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Tony Bove and Cheryl Rhodes write books on computing, graphic arts, and desktop publishing. They publish a monthly industry report, *Bove & Rhodes Inside Report on Desktop Publishing and Multimedia*, which has provided in-depth analysis of desktop publishing and multimedia technologies and products since 1986.

Bove and Rhodes co-founded *Desktop Publishing*, the first magazine about the subject, which was renamed to *Publish!* when acquired by PCWCI, a subsidiary of the International Data Group (IDG). They have written books about Aldus PageMaker, Adobe Illustrator, Macintosh-based desktop communications and networking, desktop publishing on Macintosh and PC-compatible computers, WordStar, and CP/M and Radio Shack computers. All books were produced with desktop publishing methods.

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Introduction

The method of our time is to use not a single but multiple models for exploration.

—Marshall McLuhan, writer and futurist

If you have the opportunity to communicate an idea effectively, you can change the world, or at least your part of it. The purpose of this book is to explain and show by example how you, as an Apple Macintosh user, can create materials for multimedia projects and how you can use a Macintosh as a medium for communicating ideas.

*Medium* can mean many things, but for this book, *medium* (plural: *media*) carries two meanings: it is a means of mass communication, such as newspapers, television, and radio; and it is a type of artistic technique or means of expression determined by the materials used or the creative methods involved. *Multimedia* describes the use of several techniques or means of expression for communication. The word also is used to describe a project or application that uses text, graphics, sound, animation, and video to describe information.

The ability to create materials for printing and publishing with a desktop computer was an important first step for establishing the desktop computer as a multimedia tool. Desktop publishing was responsible for increased sales of personal computers over the last five years. The ability to create materials for presentations, information systems and kiosks, television and video projects, and a variety of other multimedia applications is now a major stimulus for personal computer sales into graphic arts, education, video production, and business markets.

Some forms of mass media, such as television and radio, do not enable you to control the medium without a great deal of capital investment, such as purchasing a television or radio station. You may think, therefore, that multimedia projects cannot be produced and performed by everyday computer users. The desktop multimedia tools described in this book, however, enable almost anyone with minimal Macintosh skills to create an effective multimedia presentation or publication. You also can use the Macintosh as a presentation device—as a *medium*. 
This book demonstrates how anyone can put together presentations and publications from the desktop and produce high-quality materials for the professional media. We provide helpful examples of real applications and suggestions about how to design multimedia presentations and publications.

Why Macintosh?

This book is based on the Macintosh desktop computer—currently the best computer for desktop publishing and multimedia applications. The highest-quality software for desktop publishing and multimedia presentations first appeared on the Macintosh because the environment is enriched for graphics applications. The common feature of publishing and multimedia programs is that information is represented with graphical icons, and the editing of information on a page is represented with appropriate graphics on-screen. The Macintosh excels at presenting screen graphics, and its system is designed to be intuitive and easily understood by graphically oriented people.

Although other computers can be used for desktop publishing and multimedia applications, the Macintosh offers the best graphics computing platform for integrating the activities of artists, writers, musicians, directors, and producers.

The Macintosh also makes the process of writing and publishing a book much easier. This book, for example, was entirely written, edited, and produced using Macintosh computers, as we describe later.

Features of This Book

This book is organized according to the activities you would engage in if you were putting together a multimedia project or publication. Beginning with tasks that require little or no specialized skills, such as text editing, working with graphics, making slide presentations, and making "live" computer presentations, the discussion moves into publishing documents, which requires some design skill but not specialized knowledge, and into printing and using presses, which requires more specialized knowledge. Electronic publishing and distribution then is introduced to prepare the reader for tackling larger multimedia projects. The scripting of interactive presen-
tations is explained in more detail for those who want to produce interactive training, education, simulation, or engineering projects. Finally, the book explains how to use the newest data types in personal computing: audio and video.

Chapter 1, “The Medium Is the Macintosh,” defines the elements of multimedia and describes the appropriate media for typical projects and how to use different media with the same electronic elements. This chapter also explains why you would want to convert information into digital form at the earliest practical stage of development.

Chapter 2, “Learning about the Macintosh,” introduces the Macintosh computer and system, the displays and adapters for color display, the application programs and utilities provided with every system, the fonts used for depicting text, and HyperCard, a multimedia tool provided free with every Macintosh.

Chapter 3, “Creating Text, Charts, and Tables,” introduces text and word processing and describes how you can use scanners to read text into a computer; how to work as a group on editing projects; and how to create textual charts, graphs, and tables.

Chapter 4, “Creating Graphics,” introduces computer graphics programs and explains the differences among painting and drawing programs that enable you to create black-and-white, gray, and color graphics and images. This chapter also explains the use of scanners and digitizers for converting paper graphics and video still images into computer graphics for use in publications and presentations.

Chapter 5, “Organizing and Storing Information,” explains how you organize different types of information—text, graphics, sound, video, and animation—so that you can find the elements you need for a project and use the same elements for different projects. This chapter also explains the differences in data storage devices such as hard disks, tape cartridges, and optical discs.

Chapter 6, “Making Slide Presentations,” introduces the tools for making slides and transparencies for business and educational presentations, including desktop film recorders for recording your own slides, and service bureaus for producing slides for you. The chapter also explains the differences among the various media options for making presentations, so that you can choose the right medium for the presentation.

Chapter 7, “Making Live Presentations,” introduces the basic concepts of a computer-based live presentation and the use of special effects such as animation and sound. This chapter also introduces the projection hardware required for such presentations.
Chapter 8, "Publishing Documents," describes the desktop publishing capabilities of Macintosh software, including the best page make-up programs. This chapter explains how you can assess your design skills, create page mock-ups and layouts, and choose an appropriate production method.

Chapter 9, "Printing," introduces the equipment for printing pages—anything from short-run publications and presentation hand-outs to master pages and proof pages for large color publishing projects. This chapter also explains how to prepare black-and-white and color photos for publication. The chapter shows how everything from in-house newsletters to fancy magazines can be printed from the desktop. Font compatibility issues are explained, and the chapter also shows how you can get the best results from a print shop and how to use desktop tools in the prepress phase (to retouch images and graphics before the actual press run).

Chapter 10, "Distributing Electronic Documents," is about electronic publishing and distribution—the dissemination of information in electronic form. You can publish and distribute information electronically with CD ROM discs, over telephone lines with facsimile devices and modems, and over a computer network.

Chapter 11, "Creating Interactive Media," explains the techniques used to create interactive media projects and how you can effectively use a Macintosh as a live presentation and publishing medium. This chapter introduces the concepts of interactive media, including the use of animation and sound elements that respond to the click of the mouse, and information that is linked to other information (known as hypertext and hypermedia). You can follow a link directly to other information without having to move sequentially through the data. This chapter explains the process of scripting, also called authoring, to create interactive multimedia presentations.

Chapter 12, "Adding Sound," introduces sound recording and playing equipment and software, so that you can add a variety of sounds to your presentations. The chapter explains the differences in quality of voice narration, sound effects, digital sound, and high-quality stereo music. This chapter also shows how you can use compact disc audio in presentations and how to use musical instruments with the Macintosh (with the Musical Instrument Digital Interface, a standard in the music world).

Chapter 13, "Using Video," explains how video works, how you can overlay text and graphics onto a moving video image, and how you can record your graphics presentations to videotape. This chapter also describes the role a Macintosh can play in professional film and video production and provides a glimpse into the future of video-based multimedia computing.
The appendix, "Information Sources," lists books and periodicals for further research and software products and companies described in this book with addresses, phone numbers, product names, and prices.

**Producing This Book**

As you begin assembling equipment suitable for desktop multimedia applications, consider what was used to produce this book: the Macintosh Plus, the Macintosh SE/30, the Macintosh II, and the Macintosh IIcx. With these computers, we used the Apple LaserWriter IINTX printer and the AST TurboLaser/PS laser printer (both are PostScript-compatible), the GCC PLP laser printer and the Apple LaserWriter IISC (QuickDraw-compatible), and the Apple Scanner. The PLP and IISC laser printers were connected to the SCSI ports of two computers, and the PostScript printers were connected to the AppleTalk-based PhoneNet network (Farallon Computer). The Scanner was connected to another computer's SCSI port. Up to six different SCSI devices (such as the PLP, the Scanner, and hard disks) can be connected in a daisy-chain method to one Macintosh. For hard disks, we used the SuperMac DataFrame XP60, the Apple HD-40 and HD-80, and the Jasmine 80, as well as the built-in drives in the SE/30 and the Macintosh II and IIcx.

To produce the final camera-ready pages, we chose the PostScript-based Linotype Linotronic 100 typesetter as the printer before resizing the screen images (MacPaint, PICT, TIFF, and EPSF graphics, described in Chapter 4). The screen images were resized for the typesetter's resolution using PageMaker's built-in scaling sizes, and the publication files were saved with the Typesetter set as the printer. For proof printing, the publication files were opened as copies (rather than opening the original files). The printer was changed to the AST TurboLaser/PS or the LaserWriter IINTX (both PostScript), and test pages were printed. The original publication files were sent (after final editing) to the service bureau for typesetting on a Linotype Linotronic 100. The service bureau was capable of fast turn-around, because the typing and editing already had been completed, and the PostScript laser printer produced the proof pages.

We used Microsoft Word to prepare text, Symantec's MORE II to prepare outlines, over 20 different graphics programs to prepare images and illustrations, and Aldus PageMaker to prepare the final pages.
PageMaker (Version 4) requires at least 1 megabyte of random-access memory (RAM) and a hard disk (with a capacity of at least 20 megabytes) for storing program and publication files. PageMaker runs on all current Macintosh models.

Producing a book is not usually the first application that comes to mind when someone mentions “multimedia,” but the various print media (newspapers, magazines, books, periodicals, manuals, and so on) still provide the widest application for taking advantage of desktop tools such as the Macintosh. By following the methods and techniques of graphical desktop publishing, you can learn the basics for producing presentations in multiple media.
The Medium is the Macintosh

We live in media, as fish live in water.

—Ted Nelson, AutoDesk Fellow, inventor of hypertext and author of *Computer Lib*, the first book about computing and media

We all are touched by media—not just the media of newspapers, radio, and television, but the media we use to express ideas, report findings, educate children, and create art. Multimedia is the use of multiple types of media—text, graphics, sound, animation, and video, in any combination—to convey information.

The Apple Macintosh computer is both a tool you can use to create materials for multiple media and a new medium for presenting information. The computer historically has played a role in assembling materials for media production, starting with publishing. The Macintosh goes further and provides a system for editing, design, and production software that is unsurpassed by conventional paste-up tools. The Macintosh system also can be linked to professional production systems, blurring the distinctions between designer and production artist, between writer and editor, between creative consultant and production, and providing a measure of control over publishing and multimedia projects that was never before possible.

Anyone with a message to convey—a small business, an organization, a corporation, or even a large institution—must ask this question: Which medium is appropriate for the message? Your choice of media for a project may depend on cost and control factors or entirely on the nature of the presentation's content. This chapter shows you how a Macintosh can be cost-effective in many different types of projects, and you will finish this chapter with a rough idea of the types of media that are appropriate for certain kinds of content.

The goal of this chapter is to introduce the different elements of multimedia information and to explain the benefits of using a Macintosh to create, design, and produce multimedia projects. You learn about multimedia from examples of projects and
descriptions of the role of software for publishing, slide presentations, "live" interactive presentations, simulations, learning tools, and reference tools. You also learn the benefits of using animation, sound, and video in multimedia projects and how the Macintosh can be used in professional audio and video studios. Finally, you learn why you should convert your information to digital form as soon as possible in the production process.

Understanding Multimedia

When Gutenberg invented moveable type for the printing press in the 15th century, many of his contemporaries doubted that the invention would amount to much—it was, after all, difficult to use. The technology of printing, however, forever changed the ways in which the public receives information. The power of publishing historically has shaped our destiny and changed the structure of society.

The desktop computer is an invention that rivals Gutenberg's in its power to change the way information is disseminated. Desktop publishing has unlocked the power of the desktop computer and laser printer, so that anyone now can produce printed information inexpensively.

The print medium, the most widely used medium in the world, has evolved to the point where the vast majority of printed material is edited and produced by computer. Desktop publishing has been a major step in the evolution of information dissemination.

The 35mm slide medium, relied upon by millions of presenters, is still largely produced by photographic methods. The use of personal computers for producing slides and for hosting presentations is rising rapidly, however, and the Macintosh is leading the way.

The Macintosh now can take us beyond desktop publishing and slide presentations into new forms of expression by using the computer display as a new medium. The live medium gives you the ability to present and interact with information, to change information on the fly, and to follow a link from one piece of information to another without moving sequentially through the presentation. Unlike a video documentary, which must be viewed from beginning to end, a multimedia documentary can be interrupted so that you can jump to a related topic by clicking on a button displayed on-screen (see fig. 1.1).
Fig. 1.1. An interactive multimedia presentation from ABC News Interactive that includes video and audio segments, linked with text and graphics, on topics hosted by Ted Koppel (courtesy of David Bohrman, executive producer).
At the heart of the live medium are two key features: *interactivity*, the ability to interrupt and take command of the computer, and *hypertext* and *hypermedia*, pieces of information linked to other pieces of information in a system that enables you to follow any link you choose.

The Macintosh can be used to present information in a way that helps to persuade others to adopt ideas and understand concepts. A quantum leap in the comprehension of ideas is occurring due to the computer’s capability to play sound and show animation and video and to provide an environment for navigating through complex information. A multimedia presentation can condense a complex subject to make it more palatable—to get over the first hump of comprehension. Imagine how difficult it would be to learn to play the guitar from only text and how much easier it is to learn from a hands-on, one-on-one session with a teacher. Interactive video and sound with animation fall somewhere in between but are much closer to the live session.

The Macintosh is used to augment the creative process and to give individuals with no prior graphics experience the ability to create commercial art. The Macintosh also is used for improvising new forms of expression: simulations, prototypes, slide shows with soundtracks, and animated storyboards. The Macintosh already has been useful in the production of commercial films—for example, animated storyboards were used to design sequences for *Star Trek V* (see fig. 1.2).

Some argue that video and animation do not provide enough depth, like a television news program compared to a newspaper. Imagine a form of interactive TV news in which you can pause Ted Koppel and delve deeply into a related subject—summoning up newspaper stories, research figures, an animated time-line of events, and other video clips with voice narration and sound. You decide where and how deep you want to go, and when you want to return to the main subject. Hypertext and hypermedia are immensely more powerful than print because they are interactive and associative.

The Macintosh is a powerful system for combining text, graphics, animation, sound, and video. Apple has placed the tools of production in the hands of creative people from all areas of business, industry, science, and communications.

For desktop publishing, the advances in technology have been most important for users who have never published. These users come from large and small businesses that want to create printed material without sending jobs out-of-house and from professional communications agencies that want to do quick and inexpensive mockups and maintain control over production. This group also includes freelance
Fig. 1.2. Scenes from the animated storyboard for the *Star Trek V* motion picture produced by Ralph Winter (designed by Lynda Weinman using MacroMind software).
writers and artists who have relied on outside organizations or services to do production work. Graphic artists now use the Macintosh to communicate ideas and prepare effective designs for published materials, and the same artists are in demand to design multimedia presentations.

The applications for desktop publishing are everywhere, in nearly every business and profession in which printed materials are essential. Graphics programs are used in a variety of business applications, from business cards and stationery to proposals, reports, and publications. Graphics, word processing, and page make-up programs are essential for publishing and presentations.

The ability to produce slides is an extension to the publishing process: the same graphics and text printed on paper or transparencies also can be placed onto photographic slides.

After you have seen one slide presentation, you have seen them all. Now you can go a step further in this evolutionary process: make the slides move and give them sound. Provide a way to interrupt the movements and sounds to branch to a different visual performance immediately. With interactive tools, therefore, presenters can provide a presentation that is customized for a particular audience.

Putting together an animated presentation is not as easy as creating a slide presentation, but the presentation is far more memorable, especially if it includes sound. An animated presentation with sound can be worked on up to the last minute and then played on a Macintosh without using any other type of media. You have no need for slides or videotape, although the latter can be the final medium for distribution. Multimedia authoring software provides tools for anyone to produce interactive, animated presentations and videos. Business people can use these tools to demonstrate ideas and assemble presentations.

The business, educational, and entertainment applications of multimedia tools are wide-ranging and include common projects, such as publications, printed materials, slide presentations, and a host of learning experiences. Multimedia tools, however, also can be applied in projects that are in the mainstream of business and education but that have never been produced by desktop computers.

For example, concept studies, simulations, and visualization experiments, such as visualizing how a product appears on a shelf or testing a prototype of a car design, used to require large and expensive engineering computers but now can be performed on a Macintosh. Information databases and job reference tools, such as employee directories, inventories, and product catalogs, can be set up with graphical
access methods including pictures displayed on-screen—you can click the mouse on a piece of office furniture in an electronic catalog, for example, and immediately display information about pricing, availability, color options, and so on.

In preparing all of these applications, Macintosh multimedia tools provide clear benefits to people who otherwise send jobs out to professionals for idea creation and final production. The multimedia tools fall into the following four general categories:

- Desktop publishing for printed and electronic publications, advertising pages, marketing literature, newsletters, architectural drawings, commercial art and graphics, and so on

- Presentation software for making 35mm slides and overhead transparencies, as well as live slide shows and storyboards on-screen, including sound and controlled by the mouse and keyboard.

- Interactive media that uses animation, sound, and often video to present information linked to other information in a system that responds to your mouse and keyboard actions and provides instant feedback and an interactive learning experience. Many kinds of simulations, engineering prototypes, job reference tools, information kiosks, games, and entertainment products can be designed using interactive media tools.

- Professional audio, video, special effects editing, and management for production studios

The benefits of desktop multimedia production are obvious in desktop publishing applications: you can get the job done quickly, cheaply, and at the last minute, while retaining control over the information.

Publishing from the Desktop

Many people are involved with publishing, whether or not they see themselves as publishers. If you produce or supervise the production of sales literature, marketing brochures, flyers, newsletters, advertisements, operating manuals, or other business communications, you may be able to save time and money—and have a great deal of control over the production process—if you use a desktop publishing system.
In an era when automation is making information workers more productive, the ability to self-publish is a valuable asset to the individual writer, working partnerships, small communications service companies, large corporations, and government organizations. If you can present and publish information in a professional style without incurring variable costs or costly delays, you are using desktop publishing for what it was intended—to make you more productive.

Examples of successful desktop publishing are everywhere in the business and professional publishing worlds. The bottom line is pure economics and control over production. ARCO, for example, produced its *AM-PM Mini Market Franchise Book*—traditionally a $67,000 job—for $13,000, including the overtime people needed to learn how to use the new desktop equipment.

Page makeup plays a central role in a desktop publishing system, and applications that perform page makeup (such as Aldus PageMaker, QuarkXPress, and Letraset's ReadySetGo! and DesignStudio) can be used as finishing tools for preparing pages for publication or on-screen presentation. Word processing and graphics programs can be used to create the text and graphics, and a sophisticated word processor or page makeup program can bring the elements together to make finished pages.

The goal of desktop publishing is to automate as many of the repetitive tasks in the production cycle as possible. A major advantage of desktop publishing is greater flexibility in design and layout. Changes are not only possible, but easy to accommodate right up to printing time, because material in electronic form can be changed without costing any paper, ink, or costly consumables.

**Printed Materials and Publications**

The desktop publishing phenomenon started with the combination of the Macintosh, the Apple LaserWriter (described in Chapter 9), and page makeup software in early 1985. The LaserWriter offered higher resolution typefaces and higher quality graphics than dot-matrix printers.

The use of different typefaces (described in Chapter 2) for text output from computers was a revolution. Before laser printers, text from computers was printed in the same monotonous letterform associated with line printers and teletype machines, or text was printed on daisy-wheel printers that emulated typewriters. The laser printer, liberated text from the doldrums of uniformly spaced typewriter text and illegible dot-matrix output. Inexpensive publishing tools, therefore, became available, which made it easier to perform publishing production tasks without resorting to typesetting.
services and graphic design houses. Now, you can get text close to the same quality, and much of the same diversity in typefaces, as you can get from professional typesetting systems.

Desktop publishing tools became useful for commercial and corporate publishing when they were made compatible with typesetters and higher resolution devices (such as film recorders and plate makers). The industry-wide acceptance of a common language of typesetting, called PostScript (developed by Adobe Systems, and first used in printers by Apple, then by Digital Equipment Corporation, IBM, Sun Microsystems, Texas Instruments, QMS, AST Research, and Wang) made it possible for desktop publishing software to produce typeset-quality text and high-quality photographs.

Control is an attractive benefit and the most important reason for our conversion to desktop publishing from traditional methods. Before acquiring our Macintosh computers, as authors we did not have control over the typesetting of our books. If we wanted to use different typefaces to explain, for example, how to use a particular piece of software on a computer, we may use This Font for the key words you must type on a keyboard and This Font for the words displayed by the computer. Imagine the frustration of watching this information be published with mistakes in font usage!

Control over a publishing project also may be important for security reasons. In 1984, a major computer manufacturer used a graphics firm to design and produce a set of manuals describing a top-secret laser printer. We were using the same firm to do typesetting for our computer magazine, and we watched as reams of "top secret" galleys were cut into sections for paste up. Although you have to use an outside press facility for big jobs, you can still minimize the use of outsiders in the production effort if security and secrecy is an issue.

Besides control and cost benefits, desktop publishing technology can be used to raise the standards of quality and substantially reduce the cost of producing printed materials. The majority of desktop publishing customers are people who have never upgraded their routine print jobs to the standards of real typesetting and have seldom used graphics in their reports and presentations.

Numerous users with no graphics or publishing experience derive benefit from desktop publishing. They usually hire a designer or graphic artist to prepare the raw materials for producing standard publications. Desktop publishing enables a designer to pass electronic designs, called templates, to a client so that the client easily can produce new versions of a publication. The benefits of desktop publishing are passed from the designer to the client.
For example, the Index Group, a consulting firm, hired Watzman Keyes Information Design to pull together a design for all of their printed materials. The Index Group recently had changed its name and services, and the firm needed to reinforce the high-quality image of its printed materials to sell higher priced services. Watzman Keyes Information Design developed a new corporate identification and graphic standards system using electronic and traditional production methods. The result is an enhanced corporate image that extends to all other printed materials and publications from the Index Group and lowers production costs. The Index Group gained effective control over the production of these materials. The firm also gained an important new sales tool that had not been considered before: an attractive newsletter.

Desktop publishing is a solution for an obvious problem: how to produce effective printed materials and publications on a budget and a tight schedule. You also can use desktop publishing methods to produce database reports, business graphics, and transparencies for presentations. Desktop publishing also enables you to enter the world of digital graphics, graphic elements converted into the electronic binary code of the computer.

**Commercial Art and Graphics**

A dramatic savings in time and cost comes with the ability to create graphics in electronic form and use the same graphics in other projects by copying the digital information. Digital graphics can be scaled in equal or unequal proportions, rotated and skewed across an axis, transformed by a variety of special effects, and placed with text on digital pages or slides. Pieces can be used to create new graphics, and almost anything from the outside world—sketches, hand drawings, photographs, and video—can be scanned and used with publications. Digital graphics also can be used in slide presentations, live interactive presentations, and multimedia projects.

An excellent example of how the Macintosh can make artists more productive is how Macintosh computers and graphics software are used in The New York Times art department. Artists use Adobe Illustrator 88 (from Adobe Systems) to prepare the daily weather map and four-day forecast. Illustrator graphics can be combined and edited to form new graphics, so that the art department can produce an image faster and still get high-quality results. The Adobe Illustrator 88 graphics files are transferred to the various daily newspapers owned by The New York Times—much like a wire service distributes news. Art director Gary Cosimini explains that his goal is "to
automate some mechanical processes so that the artist can be creative without thinking about the processes."

Macintosh painting and drawing programs are popular with free-style painting and artwork because the programs are easy to learn and very flexible, and digital graphics can be copied and altered to fit any shape or context. These programs also are used by commercial artists, designers, architects, and engineers because they offer greater precision than hand tools, perfect geometric shapes, and graphic objects that can be moved, transformed, and cloned, as well as grouped with other objects (see fig. 1.3).

Fig. 1.3. The illustration “Lucid Beginnings” by Michael Scaramozzino was sketched, rendered, and produced on the Macintosh using various painting and drawing programs (courtesy of DreamLight). Copyright © 1989 DreamLight Inc.
Rotating elements of a drawing or painting and creating mirror-image graphics is easy to do. Skewed shadow versions of graphic objects adds a touch of realism.

Photorealistic gray and color images can be retouched and prepared on the desktop for high-quality publishing projects, saving more than 50 percent of the typical charges for color preparation work, which is known as the press step. With desktop press tools, fine-tuning can be applied to color images to match the printing process, the paper stock, and the inks. Color images in electronic form can be transmitted to remote computers for design approvals and shown to others on-screen, eliminating the need for costly film and proofing materials in the design process.

**Fax and Electronic Publications**

Electronic pages created in page makeup programs can be printed on laser printers or sent to higher resolution typesetters and imagesetters for printing directly to film used to prepare plates for printing presses. These pages also can be displayed on-screen, transferred from one computer to another over networks or telephone lines, and printed onto remote fax machines. Electronic publications can be compressed and stored in electronic archives on optical discs and distributed on CD-ROM discs (compact discs used to store electronic information rather than music).

With electronic distribution methods (described in Chapter 10) and electronic pages, you can gain the benefits of remote printing. The use of fax machines as output devices is an example—you can direct the output of your page makeup program directly to the AppleFax modem or similar device connected to your Macintosh. This device transmits the information to a list of remote fax machines. Electronic information moves much faster than print, so that you can publish a newsletter or a report electronically over telephone lines much faster than traditional printing.

With electronic publishing, the information remains in a form that can be edited and changed without reducing its value or reproducible quality. Page elements remain in their original digital form in your computer, although they are turned into lower resolution images on fax machines. You can distribute the electronic information on a CD-ROM disc, for example, and users can copy the information to hard disks for editing. The most valuable feature of CD-ROM is its permanence: a disc cannot be overwritten or damaged easily. With that much permanent space available on one disc, CD-ROM is attractive for almost any type of electronic distribution and publishing project.
Chapter 1: The Medium is the Macintosh

Most Macintosh computers are connected to a local-area network, which is implemented as a cable that enables each Macintosh to share files and printers connected to the cable. You also can connect various local-area networks into a wide-area network, an internet. When you have all the recipients of information located on the same local-area network or internet, you can publish information electronically over the network or internet and get the best features of desktop publishing and communication technologies. The evolution of network publishing will help to make the electronic delivery of pages as commonplace as facsimile, with better resolution, and with pages you can edit electronically after receiving them.

**Linking Design and Production**

Electronic page makeup offers many benefits over conventional manual page makeup and design methods. Because the electronic elements can be easily moved, cut, copied, resized, edited, and repasted on the page, the elements do not get lost. You do not see cut marks where a sharp knife has slipped. You do not have to wait for images or type to be reproduced at a new size, or for the production of new typesetting galleys to replace a misspelled word found in a typeset galley. The page makeup programs enable you to adjust the design of the page when you place the elements.

Many professional publishers already have applied desktop publishing tools to improve the design process, and some have become publishers as a result of learning desktop publishing. Designer Roger Black is a good example of someone from the design world crossing into publishing and starting a new magazine. "SMART magazine would not have happened without desktop publishing," he explains. Although he approached the purchase of four Macintosh computers as if he were buying a typesetting system for the magazine, he actually also uses them as design workstations, because the benefits for design are tremendous. At the same time, he can use the computers for production, because he can obtain the production values he needs for a commercial newsstand magazine.

Design consultants and graphic artists are using desktop publishing technology to improve their clients' communications, and they are changing their roles and evolving new skills in the process. Watzman Keyes Information Design, for example, started out nine years ago as graphic artists, and now they are information specialists.

Will desktop publishing foster a renaissance in the printed word and image? Some believe that poorly designed results from desktop publishing will prove that publish-
ing should be left to the experts who have design skills. The enthusiasm for desktop publishing, however, is infectious, and people can learn design skills by reading books, consulting with experts, and taking design courses.

**Making Presentations**

Business depends on clear communication, even if your business is not communications. If you need to sell ideas, products, or services, sometimes printed brochures and publications are not enough, or are too much, and what you really need is a method of presenting information that persuades others to buy.

Media for presentations include transparencies, flip charts, 35mm slides, speaker notes, and audience hand-outs. Most of the presentation software packages can produce materials in all of these media and deliver on-screen slide presentations. With conventional slide-making so costly (nearly $100 per slide for designing and producing graphics and text), desktop presentation software is very attractive.

The benefits of using desktop presentation tools are similar to the benefits of desktop publishing: you can create better looking presentations that are more credible, and you can save time and money preparing reusable artwork with clip art or by using a professional artist to create reusable artwork.

**Slides and Transparencies**

In the past, presentations have been made with typewriters (using the Orator type element), grease pencils, and press-on type, or the jobs are sent out to services who create attractive slides using a mixture of graphics and text.

Today, you can use a Macintosh to create the graphics and text and to assemble frames (like assembling pages with a page makeup program). The frames then can be used to create 35mm slides with a desktop film recorder or a service bureau that offers slide recording from Macintosh files. The frames also can be printed on a laser printer and sent to a quick copy shop to be turned into transparencies for overhead projectors. Even color pages from a color thermal printer can be turned into transparencies. Page makeup programs also can be used to print pages to create overhead transparencies and presentation hand-outs.
You need some design skill to make slides with a professionally produced appearance. Computer users involved in publishing are often in contact with, or are themselves, graphic artists and designers. Many specialize in presentations and the design of publications and can pass on the benefits of desktop presentations to their clients, who may have little or no graphics skill. After a set of templates are defined (as with desktop publishing), a person with no graphics skill quickly can produce a unique presentation that also conforms to a set of graphics standards and uses the same corporate logo (see fig. 1.4).

Perhaps the best benefit from desktop slide presentation software is that you are free to make last-minute corrections. Parts of a presentation can be worked on by different people and assembled for final sorting in a presentation program such as Microsoft PowerPoint or Aldus Persuasion. Graphics used for printed materials can be modified and used for presentations and vice-versa.

Fig. 1.4. Different slide presentations can be prepared using the same raw materials (digital graphics and text) and the same templates. Therefore, a company can make presentations that are consistent in design and execution at a fraction of the traditional cost.
The largest users of presentation software are public relations and advertising agencies, consultants, market researchers, designers, and training companies; the next largest group are the sales, marketing, finance, project management, and planning departments of large corporations. The benefits of producing slides on the desktop also are appealing to top-level managers in large corporations, government agencies, educators, and others who communicate for a living. Film recorders such as the Mirus FilmPrinter are as simple to operate as a laser printer, and if you cannot justify the cost of a $5,000-$7,000 desktop film recorder, these devices are available at some desktop publishing service bureaus. For more information on making slide presentations, see Chapter 6.

Live Presentations

In publishing and presentations, you are concerned about quality—getting the best possible output, using an effective design, getting the point across. In publishing, however, you are filling the void with printed materials you can learn from at your own pace, and however personal you are in your tone (as in a newsletter), the information must be generalized for the widest variety of readers.

In presentations, however, you are filling the void with active information that must engage and be tailored to a specific audience. You want to establish personal contact with a finite group of people, so that you can hone the presentation down to specific answers to personal queries. The best kind of presentation is one that persuades the audience to buy into the ideas. One way to do this is to be prepared to answer any specific question with confidence. The presenter needs to control the presentation and be able to show dynamic rather than static information.

Given the choice, we prefer to show presentations on the screen rather than on slides. Even though slides are portable and useful in a variety of projection devices and slide viewers, computers are more useful for presentations in which you want to switch to a live software demo, animation, or spreadsheet and show the effects of changing data (see fig. 1.5). For example, you can jump from a bar chart on current sales figures to a spreadsheet on which you can change information about response rates and then back to the bar chart to see the effect of the new information.

A computer presentation has inherent value if you can switch from a presentation to something else on the computer, such as a spreadsheet-driven chart, a knowledge base, an outline, a prototype of a program, or an animation. You can link pieces of
information with specific processes and construct tutorials you can learn from at your own pace, simulations, and interactive video presentations. This *interaction* with the computer gives the presentation an entirely new dimension.

Fig. 1.5. Display #1 shows a “slide” of a sales chart, with a button that lets the presenter jump to a spreadsheet (display #2) to change information that also will change the chart in display #1. This is an example of using the computer screen to display “slides” and using the capability to link one display to another (and from one program to another) by means of a button.
The capability to link one screen display of information to another is inherent in HyperCard, a personal information and multimedia toolkit that ships with every Macintosh. HyperCard can be used for a variety of data-management tasks, but the program is much more than a data-management system. At the click of a mouse, the program can find information (organized onto electronic cards) and play animation, sound, and video stored on multiple media devices including laser videodiscs and CD ROM players that use compact discs to hold data.

**Animated Storyboards with Sound**

HyperCard is described in more detail later in this chapter, but to understand its power, consider the use of HyperCard to present creative ideas. Large advertising firms such as Jordan McGrath Case & Taylor, Saatchi & Saatchi, J. Walter Thompson, and D'Arcy Masius Benton & Bowles use HyperCard and ScratchPad, a program created with HyperCard by Cliff Hughes. ScratchPad can simulate television commercials with the simplest of materials: pencil sketches, text, and recorded sound.

After recording sound and narration with the MacRecorder (from Farallon Computing), the creative director scans the artists' pencil sketches with a desktop scanner (such as the Apple Scanner) and uses ScratchPad to place graphics in the proper sequence (see fig. 1.6). The sound can be adjusted with the timing of the sequence, providing a feeling for how the commercial will be produced and getting approval for the elements and sequencing of the commercial. The presentation of the idea can be further enhanced by using Macromind Director (from MacroMind) to create color animated sequences with sound and using MacroMind Player to play those sequences in HyperCard.

An important reason for an advertising agency to consider using multimedia software for prototyping commercials is the savings in time and cost to make changes to the idea. When designing a TV commercial, you need to consider many factors and anticipate others, such as the client's reaction to a certain visual element and selection of words when put together for the first time. Spending a great deal of time and money on video for a prototype commercial only to have the commercial rejected by the client can be frustrating. With desktop multimedia technology, you can make a few changes right on the desktop—changes that can make or break a presentation and be critical for gaining approvals for a project.
Chapter 1: The Medium is the Macintosh

Creating Interactive Media

A wide variety of applications exist for interactive media besides presentations. You can design *simulations*, which are demos and prototypes used to communicate or visualize an abstract idea, and you can design learning and reference tools. Examples of *learning tools* include topical videodiscs such as the Electric Cadaver project at Stanford University, which shows a graphic representation of human anatomy with video clips of surgical procedures, and interactive demonstrations such as the *Macintosh Guided Tour*.*Reference tools* are information databases such as Steelcase Furniture's "Context," an electronic catalog of office furniture.

With multimedia software, such as HyperCard and MacroMind Director, you can combine simple graphics, text, sound, and animation, with the ability to link one
piece of information to another. You can provide an invigorating rather than stifling learning environment and associate different pieces of information in a logical way so that the hyper-links attract users to new information. Models and simulations can be built that can save engineers and manufacturers millions of dollars by avoiding design flaws.

**Simulations**

Simulations are not confined to laboratories, classrooms, and research projects. A simulation can be useful in business, especially in the business of convincing others, and in public education. For example, a simulation can be used to show how a solar collector collects energy (see fig. 1.7). A simulation can cut through the abstract text

![Thermosiphon Water Heater Diagram]
descriptions and shorten the learning curve in the comprehension of the details that make up a complex subject.

Watching an animation on your business computer may seem frivolous, and you may think that producing one is expensive. Such presentations, however, can be impressive, and you can produce such a simulation on a desktop for the same or less cost than producing a typical printed annual report. A black-and-white simulation can be put together using a Macintosh Plus and HyperCard; visually stunning color animations mixed with video can be produced on a Macintosh IIcx equipped with a high-powered graphics card that offers video output and then transferred to videotape.

Imagine that you are considering an investment opportunity in a brewery. You have no prior experience with breweries or the beer industry, and you are provided with a business report printed on a laser printer in a font such as 12-point Palatino with pie charts and bar charts produced by Microsoft Excel or Cricket Graph and with pages assembled with PageMaker or Quark XPress.

You take this report home over the weekend and try to learn something about the business of producing beer. The report explains in words and graphics how the business of beer distribution works. The printed information is required reading before making a decision. The printed report is professional-looking with its fonts and graphics and is somewhat convincing, but the report does not present the entire picture.

Imagine that you are given, along with the report, a disk containing a simulation of the brewery's activities. This simulation is rich with the details of how beer goes through the stages of manufacturing, distribution, wholesale sales, and retail sales. You can click a button to play the simulation from different perspectives, such as the retailer, the distributor, or the brewery operator (see fig. 1.8). The Simulated Distribution System by Creative Interactive Media, Inc., is an example of a HyperCard-based business simulation that uses graphics, sound, and interactivity to provide self-paced learning.

By playing the simulation from different perspectives, you begin to see the interrelationships and how the communication channels work to get beer sold. For example, you can play the role of beer distributor in the simulation and solve everyday distribution problems. You cannot get this experience with a printed report. Even if the simulation is transferred to videotape, the videotape can show clips of running in automatic mode through the simulation from different perspectives.
That call from production is coming through. Click on the Phone icon to answer.

Fig. 1.8. SUDS, the brewery simulation that lets you play a role in the stages of manufacturing, distribution, wholesale sales, and retail sales in the beer business. (Courtesy of Creative Interactive Media, Inc. (CIMI))

Learning and Reference Tools

An interactive presentation provides a way to explore information in a nonlinear fashion. Interactive media can provide a method of self-paced learning without the need for supervision, and create a rich environment in which learners can become accustomed to the information.

An example of this type of learning experience is the Macintosh Guided Tour developed by Animatrix. Delivered with every Macintosh, the tour demonstrates how to use the Macintosh system and enables you to try system activities and visit different areas of the animation. You have full control over the action; you can suspend the animation and go to a new area or follow the suggestions of the animation to move the mouse, click on icons, and otherwise use the system (see fig. 1.9).

The animated presentation was produced on the Macintosh using an early version of Interactive VideoWorks, now called MacroMind Director. "It gives you the power of
Practice clicking. Click each of the closed windows. Click the forward arrow to go on.

Fig. 1.9. The *Macintosh Guided Tour*, provided with every Macintosh, provides a simulation of Macintosh operations, combining animation and sound as well as interactivity (designed by Animatrix using MacroMind's Videoworks Interactive; courtesy of Animatrix).
an entire multimedia production department on your desktop," according to Marc Canter, MacroMind's chairman and founder. "A major design goal is to make interactive presentations and animation simpler and easier than ever before."

Learning experiences can be comprised of topical video, animated brochures, and product demonstrations designed to enable users to browse through information in different ways and interrupt a particular topic presentation to jump into another topic or subtopic.

Many corporations have a need for on-going training courses as orientation for new employees or to prepare employees to use new equipment or procedures. Interactive training prepared on the desktop can be cost-effective because this type of training may not require outside help every time you need to change an element or procedure. With desktop interactive multimedia tools, such as HyperCard and MacroMind Director, training materials can be prepared by those who really know the content, rather than by outsiders, and they can be updated more quickly than printed manuals.

Interactive multimedia can go beyond the typical applications in education, training, and marketing. Corporate communications can be enhanced with applications such as reference tools. For example, Animatrix prepared an information management stack in HyperCard for Domino's Pizza (see figs. 1.10 and 1.11). Corporate headquarters uses this information facility to keep in touch with franchisees and to gather, distribute, and display information. The use of graphics makes the information system easy to understand and use and less intimidating to new users who are not comfortable with computers. These benefits can have a positive effect on productivity, morale, and on the employee learning curve.

**Animation, Sound, and Video**

Animation can be created by producing multiple frames of an image in which part of the image changes in a subtle way; when you run through the frames quickly on-screen, you see the image animated. Animation can be incorporated into almost any type of presentation using software such as MacroMind Director, Studio 1 (Electronic Arts), and SuperCard (Silicon Beach Software). You also can create simple animation in HyperCard.

Effective animated presentations are not as easy to concoct as publications—artistic skill and a sense of motion are required. Marney Morris, the founder of Animatrix, has a degree in animal physiology and in fine art and has studied motion. Morris started Animatrix by producing animated demos and presentations for the leading
companies in the computer industry, such as Adobe, Aldus, Farallon, Xerox, and Apple. Some of Animatrix's clients don't know exactly what they want but can provide some artwork or packaging ideas that Animatrix can work into an effective presentation.

Fig. 1.10. A management stack for Domino's Pizza used by franchisees to gather and distribute information. (Courtesy of Animatrix)

Fig. 1.11. Domino's Pizza franchises send data into a central network at corporate headquarters where this HyperCard stack helps users navigate through the information. (Courtesy of Animatrix)
With software tools, you can develop parts of your presentation, hire graphic artists to do some of the electronic artwork, and put the pieces together yourself. By applying existing artwork, clip art, scanned images, images captured from videotape, and clip animation (animated sequences provided by companies such as Macromedia for programs like Director and VideoWorks), non-professionals lacking artistic skill can assemble the elements of a multimedia presentation without the need to hire actors and a video crew.

Sound is a relatively new type of data for personal computers. Most PCs cannot handle sound without some kind of add-on equipment. Every Macintosh model offers a built-in capability to play sound and a mini-phone jack for connecting the computer to stereo speakers and amplifiers. You can design multimedia presentations, therefore, to include sound, and every Macintosh user can hear the presentation. The use of sound can be effective in conveying complex ideas and providing auditory feedback.

Video can be used with a Macintosh in a number of different ways. You can use prerecorded video in your presentations. With a laserdisc player and HyperCard, you can create a presentation that plays different segments of a videodisc. Commercial videodisc titles are becoming available that can be controlled from HyperCard, such as "In the Holy Land" and "Martin Luther King" by ABC News Interactive (see fig. 1.12).

You also can create your own video material to use in a computer presentation; you can record your computer presentation onto videotape for use with VCRs; or you can record the presentation onto high-quality videotape for use with industrial or commercial videos. A video signal can be brought into the Macintosh environment and displayed in a window on-screen or displayed on a separate monitor. You also can overlay graphics and text onto a video image in a computer presentation and save the result onto videotape. One frame of video can be frozen as a still image for use in presentations and publishing projects.

Video is an effective medium for many kinds of business and industrial training. With the combination of video and sound, you can present complex information simply and quickly. With a booming business in video training and an enormous installed base of VCRs, people would rather watch a video than wade through pages and pages of tutorial-style documentation.

Video, however, does not seem to work well for in-depth tutorials of computer software and computer-related subjects. Video production is expensive and technically limited for recording computer activities. Unlike live training seminars, videos cannot provide the one-on-one feedback and specific answers to user questions or adequate hand holding.
Fig. 1.12. "In the Holy Land" and "Martin Luther King" from ABC News Interactive are part of a series of interactive presentations that include videodiscs playing audio and video segments under the control of HyperCard (courtesy of David Bohman, ABC executive producer).
Video is a popular medium, and everyone is aware of high-quality video in the form of television. Anything less than high quality, and the video looks like a home movie. Amateur production conjures up the image of Dagwood falling asleep during his neighbor's vacation slide show. If you cannot get the production values of a typical TV show, you may be spending too much for something that still looks amateurish.

Animation can be more effective in some cases than video because with animation, the artists have complete control and can quickly design complex models that explain themselves. Although the need still exists for artists and designers, with desktop animation, you have no need for a costly professional video crew and no need to compromise on the quality of the presentation. For complex subjects, animation avoids the awkwardness and technical defects of videotaping, because you can control all the elements directly (such as lighting, perspective, how much detail is revealed, and so on).

The drawback with animation is the bad connotation that it is as frivolous as a Saturday morning cartoon. It is ironic that a manager may consider the time spent on animating graphics to be a waste, yet spend many thousands of dollars and hundreds of hours on professionally edited videos for the same project.

Managing Audio and Video Production

Professionals are beginning to use Macintosh computers in audio and video production studios. With appropriate software, the Macintosh can act as a control center for editing operations.

In the world of professional and amateur music, Musical Instrument Digital Interface (MIDI) is the standard way to connect synthesizers, keyboards, and other musical instruments to computers. Apple offers a MIDI interface that connects to a Macintosh and to instruments. You can purchase prerecorded MIDI music for use in presentations, and you can control the playback of various instruments. You also can publish music and studio recording sheets for musicians. The Sonata font from Adobe, used with a variety of music publishing programs, can be used to print musical scores on laser printers.

Video can be extremely entertaining and direct, capturing attention and providing much more information in a sequence of images than any other medium. The applications of desktop video are only beginning to appear, and they include all forms of training and entertainment. Professional video production studios are using Macintosh computers to assist in editing and production. Advertising firms are using
desktop video software to do rough edits of commercials to obtain approvals and make final adjustments. TV stations are using desktop video to produce transitions between programs and other special effects.

Professional-quality video is an expensive medium to produce, and the costs rise dramatically for special effects such as overlaying graphics or text on top of the video image. Desktop video technology provides the greatest benefit in this area: the use of computer graphics that can be saved on videotape. The current ABC logo is the result of using Macintosh 3-D graphics programs and saving the results on videotape.

With appropriate hardware, described in Chapter 13, you can display video with text and graphic overlays, imitating the video special effects of commercial TV broadcasts. Video information enhanced with computer graphics and text then can be saved on videotape or played back on-screen. You also can use a frame grabber to capture live video still images in digital form and use these images in publications, slide presentations, and animated simulations.

A Macintosh can be useful in virtually all of the stages of film and video production, including the pre-production and post-production steps. You can even use a Macintosh to control the editing of video and film in digital form and create the master tape or film. Nearly all of the management tasks can be aided by the use of business and word processing software on the Macintosh, and some programs expressly are designed for tasks such as budgeting.

The greatest strength of the Macintosh computer as a creative system is that the computer can be used for a variety of tasks, from idea formation to video production, from animation to budgeting, from writing and preparing scripts to communicating with remote locations. All of the desktop multimedia tools can be put to excellent use on a movie set, and the Macintosh computers on the set can be connected to the Macintosh computers in the office and to other Macintosh computers, PCs, minicomputers, and mainframes throughout the corporation.

Going Digital with Information

The Macintosh is a versatile creative tool that helps you prepare for any medium, even sculpture (especially kinetic sculpture). An artist or designer can use the Macintosh and graphics programs to work up prototypes. The computer provides a common environment for testing new ideas, so that you can maintain a unifying vision
while experimenting with the specific manifestations of that vision. This power to present mock-ups and prototypes leads to effective control over the entire creative process.

To produce a publication, presentation, simulation, or demonstration of any kind, you invariably have to go through the following steps:

1. Designing the publication, presentation, simulation, and so on

2. Creating the text, photographs, graphics, animated sequences, 3D models, video, sound, and so on

3. Assembling these elements onto pages based on a design, onto slides, on-screen, or on videotape

4. Using a production system, prepress shop, print shop, video dubbing service, or computer as the presentation device

Each type of communication—publishing on paper, slide presentations, animated presentations on the computer, interactive information systems, videotaped presentations, and so on—requires a different production method and different production values.

Upstream from the final product, however, is one common denominator: the raw material is in digital form at some point. The applications described in this book, therefore, share the same tools—graphics programs, scanners, word processors, fonts, and so on—when you are at the stage of gathering the information in digital form.

The step to digital is a crucial one: at this point, your equipment and your experience can be limiting factors on getting the quality you want. When in digital form, information can be edited, manipulated, copied without loss in quality or resolution, archived, and delivered at great speed. Interactive tours can be conducted through digital information, because you can start reading at any point. Comments and editing changes are more easily incorporated when the manuscript is stored in electronic form. Line art stored in electronic form can be precise and revisable, and electronic page makeup is faster and more revisable than the process of manual paste-up. Artwork created in digital form with a PostScript drawing program is completely independent of the resolution of the drawing device (which is the mouse and screen). With no fixed resolution, artwork can be reprinted on output devices of differing resolutions and rendered in the best manner on each device.

Text and graphics should be stored in electronic form as early in the process as possible. They may be created electronically with a computer, or the information may be converted into electronic form by using a scanner. Text and graphics can be
created on any computer, from a mainframe to a portable, and then stored in files on floppy disks, hard disks, erasable CDs, magnetic tape cartridges, and other digital storage devices. To convert paper-based information, you can scan typewritten text and hand-drawn line art with a desktop scanner that usually costs less than $4,000 and perhaps as little as $500. For more information about scanners, see Chapters 3 (for text scanners) and 4 (for graphics scanners).

Text stored in electronic form can be sent to a typesetter's system without being retyped. Graphics can be combined with text on pages without performing manual paste-up, and pieces of graphic elements can be used again in other illustrations without being redrawn. All these electronic elements can be assembled for other projects, including slides, computer presentations, videos, and so on, without having to recreate them.

Publishing and presenting activities require the gathering of text and graphics from various other efforts, such as database activities on other computers and on-going publishing efforts. Compatibility among graphics formats is the reason why the Macintosh is better than other types of computers for tasks involving communication. As discussed in the next chapter, the Macintosh provides a complete environment for managing information with graphical methods, for using devices to create digital information from the outside world, for communicating with fonts and graphics, and for linking pieces of information to other pieces. These elements are the building blocks of multimedia.

**Chapter Summary**

The Macintosh is a new medium and a tool you can use to create materials for multiple media. The Macintosh provides a system for editing, design, and production software unsurpassed by conventional tools and a measure of control over publishing and multimedia projects that was not possible before.

Your choice of media for a project may depend on cost and control factors or entirely on the nature of the presentation's content. The three major types of multimedia are print (publications and printed materials), slide (35mm slides and overhead transparencies), and live (computer presentations, simulations, learning tools, and information reference tools).

At the heart of the live medium are the key features of *interactivity*, the ability to interrupt and take command of the computer, and *hypertext* and *hypermedia*, pieces of information linked to other pieces of information in a system that enables you to follow any link you choose.
Multimedia tools fall into four general categories: desktop publishing, presentations, interactive media, and professional studio work. The benefits of multimedia are that you can get the job done quickly, cheaply, and at the last minute and still retain control over the information.

The goal of desktop publishing is to automate as many of the repetitive tasks in the production cycle as possible. A major advantage of desktop publishing is greater flexibility in design and layout. Changes are not only possible, but easy to accommodate. Desktop publishing is useful for printed materials and publications, for commercial art and graphics, and for faxed and electronic publications. Desktop publishing tools are exceptional for design, and electronic pages produced on the desktop can be used in final production. Design consultants and graphic artists are using desktop publishing technology to improve their clients' communications, and they are changing their roles and evolving new skills in the process.

The media for presentations include transparencies, flip charts, 35mm slides, speaker notes, and audience hand-outs. The benefits of using desktop presentation tools are that you can create better looking credible presentations, you can make changes up to the last minute, and you can save time and money with reusable artwork. Parts of a presentation can be worked on by different people and assembled for final sorting in a presentation program.

A live presentation can switch from a slide show to something else, such as a spreadsheet-driven chart, a knowledge base, an outline, a prototype of a program, or an animation. You can link pieces of information with specific processes and construct self-paced tutorials, simulations, and interactive video presentations. The capability to link one screen display of information to another is inherent in HyperCard, a personal information and multimedia toolkit that ships with every Macintosh.

Animated storyboards can be created for prototyping TV commercials, film sequences, plays, video productions, and so on. With multimedia tools, you can make changes quickly that can make or break a presentation and be critical for gaining approvals for a project.

Interactive media tools can be used to create presentations, simulations, prototypes, learning tools, reference tools, entertainment, and a variety of training applications. Models can be built that can save engineers and manufacturers millions of dollars by avoiding flaws in design. An interactive presentation provides a way to explore information in a nonlinear fashion. Training materials can be prepared by those who really know the content, rather than by outsiders, and they can be updated more quickly than printed manuals. Corporate communications can be enhanced with information reference tools.
Animation can be incorporated into almost any type of presentation using software such as MacroMind Director, Studio 1 (Electronic Arts), and SuperCard (Silicon Beach Software). You also can create simple animation in HyperCard. With clip art, clip animation, and scanned images or images captured from videotape, non-professionals lacking artistic skill can assemble the elements of a multimedia presentation.

Every Macintosh model offers a built-in capability to play sound and a mini-phone jack for connecting the computer to stereo speakers and amplifiers. You can design multimedia presentations, therefore, to include sound that every Macintosh owner can hear.

You can use prerecorded video in your presentations, create your own video to use in a presentation, or record a presentation onto videotape for use with VCRs. You also can record a presentation onto high-quality videotape for use with industrial or commercial videos. A video signal can be displayed in a window on-screen or on a separate monitor. You can overlay graphics and text onto a video image and save the result onto videotape.

Video is a popular medium, and everyone is aware of high-quality video in the form of television. Anything less than high quality, and the video looks like a home movie. For complex subjects, animation avoids the awkwardness and technical defects of videotaping, because you can control all the elements directly, such as lighting, perspective, and how much detail is revealed.

Professionals are using the Macintosh in audio and video production studios to perform some editing functions and to act as a control center. You can purchase prerecorded MIDI music for use in presentations, and you can control the playback of various MIDI instruments. You also can publish music and studio recording sheets for musicians.

With appropriate hardware, you can display video with text and graphic overlays, imitating the video special effects of commercial TV broadcasts. In addition, a Macintosh can be useful in virtually all of the stages of film and video production, including the pre-production and post-production steps.

To produce a publication, presentation, simulation, or demonstration of any kind, you go through the following steps: design; creating the elements (text, graphics, animation, sound, video, and so on); assembling the elements onto pages, slides, or the computer screen for display or for videotape; and using a production and delivery system (a prepress or print shop, video dubbing service, or computer as a presentation device).

When in digital form, information can be edited, manipulated, copied without loss in quality or resolution, archived, and delivered at great speed. Text and graphics should be stored in electronic form as early in the process as possible.
Learning about the Macintosh

The technicalities matter a lot, but the unifying vision matters more.

—Ted Nelson, author of Computer Lib and The Home Computer Revolution

The original Macintosh was designed in 1983 with a vision toward the future, when fonts and graphics would be commonplace and laser printers would be available to print them. By 1985, this vision was vindicated as laser printers, scanners, and desktop publishing software began to appear and to make the Macintosh computer look more attractive than other computers.

A Macintosh can make you more productive by enabling you to exchange information with many different types of computers, such as PCs and compatibles or larger computers. You can take information from these other computers and prepare a business report or commercial publication using a Macintosh.

The Macintosh is an excellent computer for sharing data because it has powerful, easy-to-learn software for making requests (the Finder). This computer also has software to help you organize information and automate typical operations (the System). Every Macintosh is supplied with the System, the Finder, utility programs such as Font/DA Mover and Disk FirstAid, and HyperCard. Each one also is supplied with built-in fonts for use with all types of printers, including laser printers. All Macintosh application programs have access to the built-in fonts and any fonts you install with the Font/DA Mover. The Finder can find any application or file on disk, and Disk First Aid can help detect any disk problems. The System controls the Macintosh and launches application programs.

The Macintosh displays an electronic desktop with icons for disks, files, and folders that hold the application programs or data files. The icons provide a form of visual feedback and a clue to the contents of the file. To launch an application program, you can double-click the icon or program name, or you can double-click a data file associated with an application program to launch the program with that data file. Data
files can contain text, graphics, sound, animation, video, or any combination of these elements (a multimedia document).

Application programs tend to look like other programs because Apple has designed a set of visual guidelines for application developers to follow. The Macintosh system provides the display of pull-down menus and the mechanism for selecting commands and options from menus. The system also provides the display of dialog boxes with settings such as Drive (to switch drives) and Eject (to eject a disk) and the OK and Cancel buttons.

Nearly all Macintosh programs use these conventions, such as having the Open, Close, and Quit commands in the drop-down File menu, so that you are not completely lost when you start up a new program for the first time. In fact, many users find that they can pick up a new program immediately and start using it because they already know how to use other Macintosh programs, and the menu choices are usually in the same place.

This chapter explains the differences among the Macintosh models and options and provides some suggestions on the type of configurations you need for multimedia applications. In this chapter, you learn what basic hardware you need for your Macintosh setup and how the supplied software, especially fonts and HyperCard, add significant value to your Macintosh. Subsequent chapters describe other hardware accessories, such as scanners and printers, and software products for specific multimedia applications.

Choosing the Right Macintosh

Any Macintosh model can be used to create, edit, and deliver multimedia presentations, although some models are better than others for specific types of projects. For example, a Macintosh with a color display is essential for presentations that use color, which leaves out the black-and-white compact models—the Macintosh Plus, SE, and Portable—that can be used to create color presentations but not to deliver them. You can create such presentations on a black-and-white display because the System and application programs can assign colors without displaying them. However, seeing the colors is always better, and most multimedia projects are assembled on the modular Macintosh II models.
Chapter 2: Learning about the Macintosh

All Macintosh computers, with or without color displays, can run presentations and simulations designed with multimedia software (as long as the computers are outfitted with enough RAM (random-access memory) for the software's needs). All Macintosh computers can run desktop publishing, presentation, and graphics software, although color paint programs cannot run well on black-and-white displays. With Macintosh, you have software compatibility from the low end of the product line to the high end, including the Macintosh Portable, although each model offers different hardware capabilities.

Every Macintosh has a set of basic connectivity options, including two serial connectors. One typically is used for a modem or printer and the other for an AppleTalk-compatible LocalTalk network that can be connected to shared printers and other Macintosh computers. Every Macintosh also has a SCSI (Small Computer System Interface) connector for connecting external hard disks and other SCSI devices (such as the Apple Scanner). Also standard for every Macintosh are several ADB (Apple Desktop Bus) connectors for attaching a keyboard, a mouse, and other input devices (such as drawing pads).

The only decisions you need to make about Macintosh computers, therefore, are which hardware configuration matches your needs and how much RAM you should have. Whatever configuration you purchase, you can run every Macintosh application program, use any SCSI hard disk or scanner, and use the same keyboard and mouse and drawing pad. Nevertheless, some models and configurations are much better than others for certain tasks.

**Reviewing Compact Models**

Apple refers to the Macintosh Plus, SE, SE/30, and Portable as compact models because these computers include the display as an integral part of the machine, which cannot be separated from the CPU (Central Processing Unit), and because you can pick up and carry them away. All of these models have black-and-white displays. The SE and SE/30 models, however, can be outfitted with an external color display and adapter from third parties such as Radius or SuperMac Technology.

The basic Macintosh Plus is supplied with 1 megabyte of RAM and can run nearly all of the software applications designed for System 6.0 and earlier. You can add another megabyte of RAM to run the largest application programs and to prepare for System 7, which will require 2 megabytes of RAM.
The most popular compact model for business use is the black-and-white Macintosh SE, which is offered with or without an internal hard disk. Several configurations are available, including one with an internal 40 megabyte hard disk and another with an internal 80 megabyte disk. Internal hard disks are not necessary, however, because you can expand the disk capacity of any Macintosh by connecting external hard disks to the computer's SCSI connector. The internal hard disk is convenient if you are moving the computer from one desk to another frequently.

The Macintosh Plus and SE have handles for carrying them, but they are heavy compared to the Macintosh Portable designed to be used while travelling. Because the Plus, SE, and Macintosh Portable are based on the 68000 processor, they are the slowest of the lot. These models are not appropriate for large-scale page makeup and color graphics activities, but they can be used as control stations for scanners and printers, as file servers for a network of other Macintosh computers, as computers for accounting and administration, and as stations for word processing and line art drawing.

The Macintosh SE and SE/30 (a compact model based on the 68030) have one slot for adding an adapter—usually a display adapter for an external color display. The cost and bulkiness of adding an external color display and adapter to a Macintosh SE or SE/30, however, is not as enticing as getting a modular Macintosh such as the Macintosh Ilcx, that accommodates up to three adapters and is a faster machine with a better processor (the 68030).

**Reviewing Modular Models**

The most popular multimedia computer is the Macintosh Ilcx that offers three expansion slots for adding any type of display, color or black and white. (You can add more than one display to the Ilcx.) All of the "modular" models offer expansion slots and do not have built-in displays.

The original Macintosh II, based on the 68020 processor, has been updated to the Macintosh Ilx, which uses a 68030 processor that is faster and capable of addressing more memory for larger application programs. The Macintosh Ilx offers six expansion slots for adding various cards. Usually, one slot is taken up with an adapter card for a color display. A high-performance version of this design is the Macintosh Ilfx that uses the fastest version of the 68030 processor and offers six slots.
Chapter 2: Learning about the Macintosh

The Macintosh IIcx and IIci, both based on the 68030 processor, offer three slots in a compact design. The IIci does not need a display adapter because it offers color display support internally.

All slots in the modular line use the NuBus architecture, which can sense the characteristics of cards designed for it, so that you don't have to understand expansion issues or use DIP switch settings—the system takes care of establishing connection.

All Macintosh II models can be expanded to have up to 8 megabytes of RAM. We recommend that you get as much RAM as you can afford, especially if you intend to create animation and use sound in presentations, because these types of information need a lot of RAM.

The modular Macintosh models are better for creating color graphics, especially if you are using scanned color images, because processing speed and disk capacity are limiting factors, and the modular Macintosh models are generally faster. The fastest machine in the product line, at the time of this writing, is the modular IIfx. The IIcx and IIci are comparable in speed, but the IIfx has a much faster architecture and faster version of the 68030 processor.

If you are planning to use a Macintosh for high-quality video production, three-dimensional graphics, photorealistic image retouching, or highly computational scientific and engineering projects, the Macintosh IIfx is the best choice. For most of us, the Macintosh IIcx usually is adequate, although this computer requires a separate color display adapter occupying one of the three slots. The IIci is a bit faster and includes basic color support without the need for a color adapter, but you have to add a more powerful color adapter to display photorealistic images, as you would with the IIcx.

Choosing a Display Adapter

An important decision to make is which kind of display adapter and monitor to purchase for a modular Macintosh. The choices are limited for the SE and SE/30, because not many users buy external displays (Radius and SuperMac Technologies offer them). The choices are virtually unlimited, however, for the modular Macintosh models.
Apple offers a complete line of display adapters and monitors that set the standard for third-party offerings. On the inexpensive side is the Apple Monochrome adapter and monitor for black-and-white display. Apple offers a variety of other monochrome display monitors, including the Full-page Monitor, and the Dual-page Monitor. These page-sized monitors can display 16 levels of gray, which is four bits of gray information per pixel and thus is called a 4-bit display.

With the capability to display 8-bit color or gray, the number of colors that can be displayed at one time are 256 out of a possible 16.7 million colors. The same adapter and monitor, when set to black and white, can display 256 levels of gray (including black). The Macintosh offers the capability to expand your color range to include all 16.7 million colors simultaneously, which requires 24 bits per pixel and is used to display photorealistic images. The Macintosh System can support up to 32 bits of color information, with 24 bits readily available and 8 bits reserved for future use.

Apple also offers a 13-inch color display and two color adapters that work with all Apple displays: the Display Card 4•8 and Display Card 8•24, NuBus cards for modular Macintosh models. A high-performance version of the 8•24, the Display Card 8•24 GC (graphics coprocessor), provides the best performance for color image retouching, color publishing, and video applications.

The Macintosh IIci offers built-in 8-bit color or gray display capabilities without the need for an adapter. Other modular Macintosh computers can display 8-bit color or gray with the Display Card 4•8 or the Display Card 8•24 (or 8•24 GC).

The 4•8 card has 512K of video memory to display 4-bit gray (16 levels) on Apple's full-page and dual-page monitors, or 8-bit color or gray (256 colors or levels of gray) on the 13-inch color monitor. This card can be upgraded to the 8•24 card that has 1 megabyte of video memory to display 8-bit gray on full-page and dual-page monitors and 24-bit color (16.7 million colors) on the 13-inch color monitor. These adapters automatically can determine which Apple display is attached and switch modes accordingly.

If you need to retouch photorealistic images or display a video signal, the 8•24 GC provides the best performance, but the 8•24 is the economical choice, providing full capabilities at a slower rate. Both cards can display images in 8-bit mode, or in slower 24-bit mode. The 8•24 GC adapter can accelerate 24-bit mode so that it is as fast as or faster than 8-bit mode. We recommend the 8•24 GC card for high-quality graphics and video applications.
The Macintosh offers complete compatibility across all models so that an image created or retouched on a high-performance color machine can be placed onto an electronic page using a black-and-white Macintosh Plus. You may not see the color, but the Macintosh saves the color information. A color display is certainly helpful in previewing color graphics, but it is not necessary—colors appear as different shades of gray on black-and-white displays.

The software technology that enables this compatibility is called 32-bit Color QuickDraw. This software technology also is responsible for displaying graphics and text in fonts on-screen. Third-party adapters for 8-bit and 24-bit color displays from companies such as RasterOps, SuperMac, and Radius, are available. These adapters are compatible with 32-bit Color QuickDraw and can be used in place of or in addition to Apple display adapters. The System manages your use of one or more displays and enables you to switch from 8-bit to 24-bit color or to black and white or levels of gray at any time.

All modular Macintosh models can support the use of third-party video frame grabbers and other types of adapters for handling video. The modular Macintosh models can display photorealistic color images with 24-bit color display adapters from SuperMac Technology, RasterOps, Radius, and other vendors. SuperMac also offers an accelerator card similar to Apple's 8•24 GC that can display 24-bit images as fast as black-and-white images.

Using the System and Finder

If you are familiar with the Macintosh Finder and System (the operating system), you already know how to prepare formatted floppy disks, copy or delete disk files, add or remove printers and other devices, print files, and run programs. The Macintosh Finder enables you to use the operating system without typing specific commands. You can perform all of these steps—you can do everything the operating system enables you to do but without having to learn commands. You operate a Macintosh by pulling down menus with a mouse and then choosing commands, options, and file names. After you learn the basics, you can quickly learn any new program because you can apply what you know. The Macintosh user interface provides basic actions that are the same from one well-designed program to another.
The Finder provides a mechanism for organizing files in folders and for launching programs. The System controls any devices (printers, scanners, disk drives, and so on) connected to your computer and the use of programs and fonts. The System also enables you to choose from several desk accessories, small programs stored in the System file and available in the Apple menu on the far left of the menu bar. You can install fonts and desk accessories with the Font/DA Mover utility for System 6.05 and earlier versions.

The System and Finder constantly are being updated by Apple Computer (to fix bugs, improve speed, add features, and so on), and updates are available from your Apple dealer. Ask your computer dealer for the latest version, System Version 6.05 when this book was written.

**Using MultiFinder**

When using MultiFinder, you can launch several applications and open several documents at the same time. Under MultiFinder, the bottom of the Apple menu includes the names of other running applications. You can switch from one application window to another or switch to MultiFinder (see fig. 2.1). You also can switch from one application window to another by clicking the icon in the top right corner of the menu bar.

The use of MultiFinder is not necessary unless you want to use several applications at the same time and transfer graphics and text from one application window to another. Remember that MultiFinder requires at least 2 megabytes (and usually more than 2.5 megabytes) of RAM to be useful.

**Using Application Programs**

When working with different application programs, the operations you use most often are the Cut, Copy, and Paste commands (found in the Edit menu of most Macintosh applications). You can use these commands to transfer text and graphics within an application and from one application to another (with Finder or MultiFinder). For example, you can use this feature to transfer a graphic image (or a piece of a graphic image) from a program such as SuperPaint (Silicon Beach) to a PageMaker page. You also can use the Macintosh Scrapbook desk accessory (or a substitute such as Solutions Inc.'s SmartScrap) to receive copied or cut elements from different applications and then cut or copy the elements one-by-one from the scrapbook file into another file.
Part of nearly every Macintosh application is the capability to undo an action. The Undo command usually is found in the Edit menu and only undoes the results of the most recent operation. You must use the Undo command immediately, before doing anything else. If, after using Undo, you decide that the original operation was correct, you can re-do the operation. (After selecting Undo, Undo is replaced by the Redo command on the Edit menu.)

Most applications also offer a Revert command on the File menu. Using this command reverts your publication file back to the last saved version. This command enables you to return to a previous version, throwing away the current version of the file. You only use this command if you really do not want to save the current version. In addition, every dialog box has a Cancel button and/or a close box (in the top left corner), so that you can back out of a command. These features are designed to make the computer experience as pleasant and non-threatening as possible.
Using Utilities and Desk Accessories

Apple includes several utility programs for managing system resources such as fonts, desk accessories, and disks. The Macintosh System has room for you to store miniprograms, called desk accessories, that perform special operations while you are running one or more programs. Desk accessories are similar to pop-up memory-resident programs on PCs, except that they occupy memory only when being used. You already may have used the Alarm Clock or Calculator desk accessory by dragging down the System menu (click the Apple logo to see the System menu) and releasing the mouse button on the accessory's name.

In addition to Alarm Clock, Calendar, Notepad, Scrapbook, Control Panel, Chooser, and others, Find File is supplied with the System file. This remarkable accessory searches folders on multiple disk drives and displays file information and the route you need to follow through disks and folders to gain access to that file. You can run Find File during an application session and find a file before using the application’s Open command to open the file.

The Macintosh has easy-to-use methods for giving you control over devices. When you use the Print command in the File menu, the system uses the application program’s print function (as long as you have the application program on disk). The Macintosh provides two desk accessories that give you control: the Chooser for choosing an output device or zone in a network and the Control Panel for controlling the characteristics of your keyboard, mouse, and display devices. Both are located in the System menu with other desk accessories.

Desk accessories and fonts can be loaded into the System or removed from the System by using the Font/DA Mover utility program supplied with the System. You can purchase fonts and desk accessories from third parties and load these items into your System anytime you need them. You only have to restart the System after loading the new fonts or desk accessories to use them.

Learning about Fonts

The terms font and typeface have recently joined the computer lexicon, but they have been in the publishing lexicon since the beginning of the publishing business. A typeface, or face, is a letterform design such as Helvetica or Times Roman. A set of faces that have a similar design—such as Times Roman, Times Italic, Times Bold, and
so on—is a typeface family (the Times family). A font is traditionally a particular instance of a typeface at a certain size, but the term also has come to be used synonymously with typeface. Today, font is used more often than typeface, and both have come to share the same meaning.

The terminology may be confusing, but the results of using fonts are not. The goal of using fonts for text is, in most cases, to improve communication—to make text easier and faster to read. In addition, the application of fonts to the text of advertisements and signs is often to capture attention or to reflect a design aesthetic (or both). The best fonts for a given project depend on individual taste and design sense and on the overall appearance and readability—qualities you may not be able to predict unless you actually see the fonts.

Seeing the fonts on-screen before making a final choice and committing the design to print, therefore, has been important in desktop publishing. The Macintosh was the first personal computer to show fonts on-screen, and its marriage to the laser printer made desktop publishing with fonts not only possible but also effective for improving the quality of publishing projects.

**Using Screen and Outline Fonts**

System 6.0 and earlier versions of the System use two types of fonts: PostScript outline fonts for printing and screen fonts, also called bit-mapped fonts, for display purposes and for printing on ImageWriter printers. PostScript is a language used to describe font information, graphics, and pages; bit-mapped graphics are composed of discrete dots (also called pixels).

PostScript fonts are higher in quality than bit-mapped screen fonts, because they are stored as outlines that can be scaled to any size and resolution (rather than bit maps that are locked into a specific resolution). PostScript fonts can be printed on high-resolution PostScript-controlled devices such as typesetters and imagesetters (with resolutions usually over 1,000 dots per inch) and on PostScript laser printers at 300 dots per inch (dpi) and up. PostScript fonts are the best fonts to use if you intend to produce the final version of your text on a PostScript printer or typesetter. These fonts are available from many different font vendors such as Adobe Systems, Agfa Compugraphic, Bitstream, and The Font Company.

Bit-mapped screen fonts are like graphics on the Macintosh screen, which are limited to 72 dpi. Bit-mapped fonts, when printed on higher resolution devices, do not have
smaller dots—you see jagged edges as if they were printed on dot-matrix printers. Some devices, such as film recorders and the non-PostScript Apple LaserWriter IIISC printer, can resize a larger bit-mapped font to make it look better on the slide or printer. Bit-mapped fonts also are better for screen presentations because they are fast. (Besides, the screen is already limited in resolution.)

In System 6.0 and earlier Systems, bit-mapped screen fonts are used for the display of PostScript fonts, largely because the earlier Systems have no provision for rendering the actual PostScript outlines for fonts on-screen. When you print the document, the actual PostScript outlines are substituted for the bit-mapped versions, and you get true PostScript output with the highest possible quality with font rendering. The font substitution is automatic, and most users don’t realize that they are using two distinct pieces of font information: bit-mapped screen fonts and PostScript outline fonts. You install the screen version in the System using Font/DA Mover, and if the PostScript outline font is not built into the printer, you drag a printer font file into the System Folder. The System takes care of the rest.

Using Adobe Type Manager

Adobe Systems (the developers of PostScript) offers a utility for Macintosh System 6.0 users called Adobe Type Manager (ATM). ATM is a System start-up document (placed in the System Folder and launched automatically when the system starts) that provides the essential scaling and display functions for PostScript outline fonts. You can control ATM’s operation from the Control Panel (see fig. 2.2).

ATM provides the convenience of having one outline for the font stored on disk. This outline can be scaled to any size for display and printing. You also can print PostScript outline fonts on non-PostScript devices, such as film recorders and the LaserWriter IIISC printer.

ATM is essential for graphic artists and designers who need to see a better match between the display and the printer and for those who use a lot of different fonts and want to save disk space.

Choosing Appropriate Fonts

Type design is an art, and designers achieve a balance in strokes of varying thickness and serifs, tiny curves at the ends of strokes. The result is beautiful, even for the most
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Agfa Compugraphic, Bitstream, and The Font Company.

Bit-mapped screen fonts are like graphics on the Macintosh screen, which are limited to 72 dpi. Bit-mapped fonts, when printed, may see jagged edges as if they were designed for non-PostScript devices and the non-PostScript font to make it look better on the presentations because they are.

In System 6.0 and earlier System Folders, largely because the early PostScript outline fonts on-screen. We substituted for the bit-mapped possibility of PostScript outline fonts. You use if the PostScript outline font is System Folder: The System table.

Using Adobe Type Manager

Adobe Systems (the developer of PostScript) called Adobe Type Manager (ATM) an Apple System Folder and launched automatically and display functions for PostScript outline fonts on non-PostScript devices, such as film recorders and the LaserWriter II SC printer.

ATM provides the convenience of having one font stored on disk. This one outline can be scaled to any size for display and printing. You also can print PostScript outline fonts on non-PostScript devices, such as film recorders and the LaserWriter IISC printer.

ATM is essential for graphic artists and designers who need to see a better match between the display and the printer and for those who use a lot of different fonts and want to save disk space.

Choosing Appropriate Fonts

Heavily used day-to-day fonts such as Times Roman. Serifs on a font are not merely for decoration—they draw your eyes into the letter and make reading more comfortable. Serif fonts, therefore, are popular for the body text of publications, or in any dense text.

The serif fonts are, for the most part, older than the sans serif (without serif) fonts that appeared in the 20th century as part of a new design trend (associated with the Bauhaus school). Sans serif fonts usually have strokes of the same width, no serifs, and no embellishments. Sans serif fonts are popular for headlines, titles, advertising copy, packaging, signs, coupons, brochures, and fine print in which the goal is to

Fig. 2.2. Adobe Type Manager displays text using the actual PostScript outlines for the fonts, resulting in a better match between the screen and the printer.
make the type compressed and hard to read. If you are unsure of the look you want for your text, consult a book on designing with type and the use of fonts or consult a designer.

If you don't have all the characters or faces you need in your current set of fonts, you can customize a font by adding symbols or create a new font.

Creating and Customizing Fonts

Fontographer (from Altsys) is the leading font creation and editing program. Its primary purpose is to create high-quality fonts, logos, and intricate PostScript artwork designed to be used as symbols. You can create graphics or enhance existing graphics or font characters, and the program offers the capability to automatically trace (create an outline around) scanned images.

You can assign a specific graphic image, symbol, or newly defined character to any key on the keyboard. After such an assignment, you can type that key to place that particular graphic image, symbol, or character in text or graphics files, and you can repeat and resize the image, symbol, or character, regardless of the application you are using (the graphic image or symbol is treated as a character of a font).

Fontographer generates the appropriate hints for obtaining perfect characters for printing at low resolutions. Fontographer offers the highest level of precision for drawing the strokes of characters, and the program offers complete control over character widths and kerning pairs (pairs of letters that should be closer together than most other pairs).

Altsys also provides a less expensive program for converting existing artwork into font characters. The Art Importer creates high-resolution PostScript fonts from Encapsulated PostScript (EPS) or PICT graphics (described later in this chapter). You can do a bit of touching-up with The Art Importer and then assign the resulting graphic image to a key as a character of a font. Because the output is PostScript, it is as precise and detailed as the original artwork, even at very small sizes (although the appearance is limited by the resolution of the printing device).

Fontographer and The Art Importer are the most popular tools for creating your own fonts and symbols. Because they can be used with existing artwork (Fontographer can be used to draw new artwork), all graphic images can be converted to a font character and used in text and graphics files as a font character. Besides technical
publishing applications that require special symbols, the most popular application of these programs is creating custom logos for stationery and presentations.

A font can be viewed as a highly detailed graphic image, and the use of fonts with graphics and icons can provide a rich set of navigation aids for moving through information. The use of fonts, icons, and graphics is exactly why the Macintosh has taken the lead in the personal management and presentation of information—and the leading program on the Macintosh to offer these capabilities is HyperCard.

**Learning about HyperCard**

Computer users always have had problems entering information that does not readily fit into categories into a database and establishing links to other pieces of information. With HyperCard, you don’t have to create a fixed, immutable structure. You place the information on an electronic card and link pieces of information as buttons that can propel you to other related cards. You can add more buttons at any time and update the database as needed.

HyperCard is the answer for the information explosion—you can correlate pieces of data without worrying about defining a logical sequence, such as an index. You, therefore, can search for anything throughout a database, and HyperCard is extremely fast in its text searches. The *stacks* (piles of cards) can be stored on any accessible disk or storage device, and the program works with videodiscs, CD-ROM, network servers, and so on.

HyperCard gives you the ability to create *buttons* that link to cards on any stacks on any medium, including a local disk, network server, videodisc player, or CD-ROM. The program provides a scripting language that controls the display of information and enables you to play sounds, perform calculations, open windows of information, link to other cards, and so on. You can use HyperCard to merge text with graphics, computer animation, video, sampled voice and sound, and computer-generated sound. Special transition effects and sounds can be set up to play as you navigate between cards, and custom buttons such as calculator functions or sounds (such as a complete clickable piano keyboard) can be designed on a card.

HyperCard compresses graphics for easy transfer over networks and for quick display, and the software unpacks an image more quickly than reading the disk. The program has very fast full-text search and retrieval capabilities, with the capability to browse
through a stack of cards and over links to other stacks. HyperCard comes with an abundance of canned graphics and sound, stack and card templates, button and arrow styles, and other special effects. It even comes with a stack called "Home" (see fig. 2.3) that provides a place for the buttons you need to go to any other stack in your HyperCard universe.

You can design applications with HyperCard that you wouldn't think of designing with other programs, such as an animated storyboard for a movie's special effects or the simulation of a brewery's operations. Training stacks developed with animation are more effective than books and manuals and more entertaining (nearly every Macintosh application package is shipped with a HyperCard tutorial on the disk). HyperCard also is useful for storing any personal information that has to be organized by association, context, and hierarchy (see fig. 2.4).

HyperCard plays a central role in Apple's desktop multimedia products. The program can be used to create interactive presentations, simulations, animated tutorials and

![HyperCard screen shot](image)

Fig. 2.3. The HyperCard 2.0 "Home" stack presents the first card you see when you run HyperCard, and from Home you can use a button to go to any other stack.
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Fig. 2.4. HyperCard is supplied with sample stacks you can customize for personal information, such as the Address stack.

storyboards, database access screens, personal information managers, calendars, diaries, clip art libraries, and so on. HyperCard can fill this role because it has a language to control events, and you can use the program to assemble digital graphics, text, and sound and control video sources, while establishing links among different types of information. HyperCard and HyperCard-compatible programs play important roles in nearly every example of desktop multimedia. The multipurpose erector set is the number one authoring system for multimedia projects.

Chapter Summary

Every Macintosh is supplied with the System, the Finder, utility programs such as Font/DA Mover and Disk FirstAid, HyperCard, and built-in fonts for use with all types of printers. All Macintosh application programs have access to the built-in fonts and
any installed fonts. The Finder can find any application or file on disk; Font/DA Mover can install fonts and desk accessories; and Disk First Aid can help detect any problems with disks. The System controls the Macintosh and launches application programs. Nearly all application programs follow the same menu conventions so that they are easy to learn.

Any Macintosh model can be used to create, edit, and deliver multimedia presentations; although some models are better than others for specific types of projects. If you are considering purchasing a new system, this chapter helped you to investigate the various models and displays offered. You also learned how you can adapt your current model for other applications.

This chapter also discussed the ways in which you can undo a recent action and the operations you use most often—Cut, Copy, and Paste. Desk accessories—miniprograms that perform special operations and give you control over devices while you are running one or more application programs—were discussed, including Font/DA Mover for loading and managing fonts.

For those new to desktop publishing, *typeface* and *font* were defined. The Macintosh currently uses two types of fonts: *outline* fonts for printing and *screen* fonts, also called bit-mapped fonts, for display purposes and for printing on ImageWriter printers. You discovered the difference and how to get the best results from the fonts you are using. You also learned about Fontographer and Art Importer, which are programs you can use to create, customize, and manage fonts.

Adobe Type Manager is a utility that provides scaling and display functions for PostScript outline fonts. PostScript is a language used to describe font information, graphics, and pages; bit-mapped graphics and fonts are composed of discrete dots (also called *pixels*).

Finally, this chapter stated the importance of HyperCard, which plays a central role in Apple's desktop multimedia products. The program can be used to create a variety of interactive presentations, simulations, animated tutorials, storyboards, and other multimedia projects. HyperCard has a scripting language to control events, and you can use it to assemble digital graphics, text, and sound, as well as control video sources, while establishing links among these different types of information.

The next chapter describes the many ways to create and assemble on the Macintosh text elements you can use for printed publications, presentations, and multimedia projects.
Creating Text, Charts, and Tables

Words challenge eternity.
—Horace, Latin poet, 2000 years ago

Despite its reputation as an excellent computer for graphics, or maybe because it has this reputation, the Macintosh is considered the easiest computer to use for creating and editing text, business charts, and tables. Although text-only PCs have been optimized for editing text, the Macintosh offers two built-in capabilities not built into standard PCs: the display of text in fonts and system support for the use of a mouse to select areas of text. Both features work with all Macintosh applications.

The display of text in fonts has an obvious advantage for users who do publishing and other forms of multimedia—what you see on-screen is what you get when you print, when you make slides, and when you make a videotape. Very little guesswork is involved in making your text look good in different media.

One not-so-obvious advantage of displaying text with fonts is that you can read the text on-screen more easily with less eye strain and can be more productive when working with text.

The ability to select sections of text with a mouse makes editing easy because you do not need to memorize a set of mnemonic commands or function keys. This selection ability works with the cut and paste metaphor so that you can move sections of text from one document to another. The same selection technique works in different application programs, so that the way you select text in a word processing program is the same as the way you select text in a charting program, a table creation program, and a page makeup program.

This chapter describes two methods for creating electronic text: using a word processing program and scanning text from paper using a desktop scanner. This chapter also describes editing text with word processing programs and sharing the editing task among members of a work group (such as an editorial staff).
In addition, this chapter explains how to create charts and graphs automatically from spreadsheets (a spreadsheet is an electronic ledger for entering numbers, formulas, and explanatory text). This chapter also describes the programs that can prepare formatted tables and text charts. You learn the strengths and weaknesses of various word processing, charting, and table creation programs, and how these programs can help you create and edit text, charts, and tables.

Learning about Word Processing

Word processing programs are designed for writing and editing text. Although some word processing programs can prepare entire pages with text and graphics, and some can merge database information with text on a page, all word processing programs are designed for the creation and editing of pure text. These operations are what they do best.

Every Macintosh word processing program offers a set of formatting functions that governs how the text appears on the printed page. Sometimes, however, producing special page effects, such as boxes around text and vertical lines (column rules) between columns, is very difficult. With most word processing programs, starting two different stories on the same page in different columns and keeping them as separate stories is impossible.

Page makeup programs, however, specialize in formatting, even if they include word processing functions. Programs such as QuarkXPress and Aldus PageMaker enable you to edit text with nearly a complete set of word processing functions. These programs, however, are designed as finishing tools and are not as fast as word processing programs for editing text. These programs give you complete control over the page layout and type spacing features and enable you to place different stories on the same page and keep them as separate stories.

Many of the same features are available in word processing and page makeup programs, but the duties of text editing and page creation usually are separate and sometimes are handled by different people. A program rarely offers the best of both worlds. Nearly every popular word processor for the Macintosh (and the PC) can create text for use with page makeup programs on the Macintosh. The word processing vendors realize that many of their customers use a word processing program for
text writing and editing and a page makeup program for layout. These types of programs, therefore, are described in separate chapters (page makeup is described in Chapter 8).

Presentation programs used to create slides and overhead transparencies are treated as finishing tools and, therefore, compliment word processing programs. You can use a word processing program to prepare text to be incorporated into a presentation—some of these programs, such as Microsoft Word, offer built-in outlining for preparing an outline. You also can use outlining programs such as MORE II (from Symantec) to create the text for slide presentations (presentation programs are described in Chapter 6).

Generally, using a word processing program is much faster than using a page makeup program or a presentation program to write more than one page of text. Using a word processing program also is more efficient if you are preparing text for use with different programs or in other publications.

### Reviewing Word Processing Programs

The leading word processing programs for the Macintosh are Microsoft Word, MacWrite II (Claris), WriteNow (T/Maker), and WordPerfect. We used Microsoft Word to write and edit this book.

Microsoft Word for the Macintosh is completely compatible with Microsoft Word for the PC, and WordPerfect is compatible with its PC version. Microsoft Works is a popular program that combines word processing with spreadsheet analysis, database entry, and communications.

### Microsoft Word

Microsoft Word, the industry leader, is the program that virtually defines what features a standard word processing program should have. The program displays text in a movable and resizeable window, with or without a ruler at the top for setting tabs, margins, and justification options (such as fully justified, ragged right, centered, and so on).
Inserting new text into existing text is easy: you can click an insertion point and start typing. You can edit text by selecting it with the mouse (by dragging over it) and typing new text. You can limit your selection to one word by double-clicking the word. You also can copy or cut and paste text in a new position in the currently open document or in another document. Word enables you to open multiple documents at the same time. You also can search for any word or combination of characters and replace them with another word or combination of characters (including spaces, tabs, and paragraph endings).

Word enables you to add graphics to the document (see fig. 3.1). You can create the graphics using any type of graphics program (described in Chapter 4). Then, you can use the Copy or Cut command in the graphics program to move the graphics into the Clipboard (a temporary holding area) and use the Paste command in Word to place the graphics on the page. Graphics are placed at the insertion point.

Fig. 3.1. Adding a graphic image to a Microsoft Word document.
Page layout features include the capability to lock an object (such as a graphic image) in an absolute position on a page and to wrap text around graphics automatically. Word offers automatic repagination so that you can see where the page breaks fall while writing or editing. Word also offers a page preview mode in which you can create and edit text as in regular text editing mode with an accurate view of how the page looks with page breaks, margins, headers, footers, and footnotes. Word automatically places each footnote at the bottom of the page containing its reference.

Word also offers stylesheets—stylesheets are a collection of styles that define the text font, size, style (italic, bold, and so on), leading (the space between lines), paragraph spacing, tab settings, indents, and color. When you change a stylesheets definition, all sections of text defined by that stylesheets change to adopt the new definition. You quickly can assign stylesheets names to paragraphs by clicking a small menu on the ruler. This menu lists predefined stylesheets names. You also can format a paragraph and define a stylesheets based on the formatting in one easy step.

Word includes outlining features that enable you to move a large section of text to another place in a document quickly by dragging the section’s heading in outline view. You can select a word or phrase and press a Command-key combination to mark the text for indexing. Creating tables in Word is a breeze, because each table element can be formatted as a spreadsheet cell.

One major innovation in Microsoft Word is the ability the program gives you to customize all menu options and Command-key equivalents. Word provides a menu option for listing all the operations and assigned keyboard equivalents, and you also can store and retrieve specific menu-keyboard assignments.

Many users flocked to Word in the past for one major feature not found in other programs: the capability to merge data from a database with text to create form letters or reports and for publishing databases. Microsoft Word displays the fields in a Microsoft File database for use with this merge-print option. Most of the other word processing programs now include this feature.

With every copy of Word, Microsoft includes the Word Finder thesaurus (Microlytics) and the QuickSwitch feature that loads Excel for an automatic data link (so that you can incorporate charts and spreadsheets in your documents and update them from Word).

The only major omission is the inability to import and export rival formats such as T/Maker's WriteNow and Symantec's MORE II (such as importing a MORE II outline into Word's outlining mode). We particularly like its relationship with PageMaker, described in Chapter 8.
MacWrite II

MacWrite II (Claris) offers a complete set of high-end word processing features, although not enough to unseat Microsoft Word as the leading word processing program. The program offers complete text editing functions, including search and replace. MacWrite II also offers automatic footnoting, separate headers for left and right pages, text in equal-width columns, and a combined preview-editing display so that what you see on-screen is a good representation of what you get on the printed page.

MacWrite II also offers a spelling checker, data-merging features similar to Microsoft Word, and a paragraph-applying ruler at the top of the document. The program conveniently opens a variety of other word processor file formats (including the MacWrite format) and saves in those formats.

Although you can define a set of styles to appear in the Style menu, MacWrite II, unlike Word, does not offer true stylesheet control over formatting. MacWrite II also lacks outlining features. However, MacWrite II offers an excellent search and replace facility that enables you to search for and replace a specific font, size, style, or a set of characters. MacWrite II is popular, but the program is quite slow on Macintosh Plus and SE computers when compared to Word or the less expensive WriteNow.

WriteNow and Others

WriteNow (T/Maker) is the most popular word processing program for users on a budget who need just about every feature of Word except stylesheets. WriteNow outperforms nearly every other word processing program and is less expensive than most.

WriteNow includes nearly every feature of MacWrite II and most of the features of Word except the capability to create an index, a table of contents, and tables and to assign stylesheet names to paragraphs. WriteNow also lacks a page preview feature. The program, however, has no limit on the number of documents that can be opened simultaneously. WriteNow is the only word processing program to offer several levels of undo so that you can undo the last few steps, not just the last step.

WordPerfect offers the same features as Word, but it differs from Microsoft Word in that it provides column-style formatting and enables you to change fonts for text and add graphics in the text body or in headers or footers. WordPerfect also hyphenates and offers manual kerning with automatic leading control.
Chapter 3: Creating Text, Charts, and Tables

FullWrite Professional (Ashton-Tate) offers all of the features of Word, MacWrite II, WriteNow, and WordPerfect, plus the capability to create and edit outlines of structured documents, so that you can move headings in an outline to move the text. The program also can produce a table of contents and an index and organize a book's footnotes and bibliographic references. FullWrite, however, performs poorly if your Macintosh has less than 2 megabytes of RAM.

FullWrite Professional offers style sheets, automatic pagination, footnotes, indexing, outlining, revision tracking, headers and footers, text in columns, graphics on the same line as text, and sidebars. FullWrite also has page layout features, such as the capability to specify column gutters with rules and wrap text around graphics.

FullWrite has typesetting features in addition to multiple-column layout and drawing functions. The program satisfies most of the requirements for a commercial book publishing tool (except for automatic kerning and word spacing controls). FullWrite, however, is not the best program for designing newsletter or magazine pages, because the methods for setting up different articles on the same page and for moving graphics into place are clumsy compared to page makeup programs.

Letraset's ReadySetGO! and Aldus PageMaker (described in detail in Chapter 8), however, are designed to be word processing programs with complete find and replace functions, a spelling checker, and fast typing response as well as page makeup programs. For using only one program to create a commercial-quality publication, such as a book, ReadySetGO! and PageMaker are preferable because they also offer higher quality type and graphics.

Any of these programs can be used to edit scanned text. The result of scanning text from printed pages usually is a text file that can be read by any of these word processing programs.

Using Scanners for Text

Desktop scanners are designed to capture an image from a piece of paper or whatever is placed on its copier-like platen and convert the image into digital information. Scanners mostly are used to scan line art and graphics, because the quality of digital information is good enough to reproduce graphics, and you can use a graphics program to retouch the results.
The scanner treats any image the same; it does not recognize text by itself. Special optical character recognition, OCR, software is required to review the image and recognize text characters.

OCR software usually is not used to scan important documents because the accuracy is not perfect. OCR software often is used to scan newspaper and magazine articles, passages in books, and other text where total accuracy is not a requirement.

**Choosing a Text Scanner**

Scanning technology is applied in different ways to accommodate a variety of raw information sources and to provide reasonably priced products. Scanners range from less than $500 for hand scanners and scanners that attach to the ImageWriter’s print head to more than $5,000 for desktop color scanners and higher resolution scanners mounted on tripods. In the middle range are desktop scanners that can sense only black and white, or up to 256 levels of gray.

The best scanners for text unfortunately are the more expensive ones, because the better resolution you can get, the easier it is for the software to recognize text characters. A $500 hand scanner such as the ScanMan (Logitech), however, can be used to scan pages for text and gets reasonable results.

For better results, you can use a scanner like the Apple Scanner with a resolution of 300 dots-per-inch (dpi) or higher and with the capability to sense different levels of gray. A scanner that senses different levels of gray eliminates noise in the image (such as a patterned background) and increases the accuracy of optical recognition software. Gray-scale scanners that can sense many different levels of gray also are better for text recognition because they can resolve the gray edges of letters to be sharp, and they make text more recognizable for OCR programs so that accuracy is higher.

The majority of desktop scanners are flat-bed devices with a glass platen on which you lay paper or objects—just like a copier. With flat-bed scanners, the paper or object (for example, a book or magazine) is stationary while a CCD (charged couple device) array and light pass under the object. Although they are more expensive, flat-bed scanners can scan a variety of items including irregularly sized pages, magazine pages, book pages, maps, fabrics, and objects. These scanners can be outfitted with automatic sheet feeders if you want to scan multiple pages as fast as possible.
Sheet-fed scanners without a platen use a roller to pull a piece of paper across a stationary CCD array. Sheet-fed scanners are designed for multiple pages—you can insert sheets of paper into them without having to align the sheets on a glass plate. Unfortunately, aligning pages so that OCR programs can recognize characters without errors is not easy. Paper tends to get caught in sheet-fed scanners. (With some scanners, pages jam inside the machine and are returned shaped like accordions.) Because you cannot trust a sheet-fed scanner to leave an original undamaged, you have to scan a copy. We recommend using flat-bed scanners with an automatic sheet feeder if you need this feature.

Using Optical Character Recognition

Text-scanning software packages that work with most desktop scanners are available for under $1,000. Although scanning text may save time and effort, today’s OCR (optical character recognition) programs are not 100 percent accurate in converting a page image to a text file and, therefore, are limited to applications that do not require 100 percent accuracy. A 97 percent accuracy rate doesn’t sound too bad, but you may get multiple errors in almost every paragraph! The accuracy rate is even lower if the page is slightly askew when placed on the scanner or if the scanned image does not yield enough contrast.

Most OCR programs are designed to read only monospaced, typewritten text (the majority of office documents), but several OCR programs can read typeset characters by the user training the software or by the software training itself.

OCR programs show best results with pages from daisywheel printers or typewriters, such as business reports and spreadsheets. Problems occur mostly with typeset text, because the characters can be almost touching and not distinctly recognizable. Some OCR programs can be trained to recognize certain fonts, but you may spend more time training the program than a fast typist could crank out the text. You can train the software to recognize one font and then scan hundreds of pages that use the same font (such as a book) with higher accuracy, but if the font appears in different sizes (such as a magazine article), you may have to train the software on each size first. Trainable OCR software is useful for reading lengthy documents that use the same font; otherwise, the time spent training is probably better spent retyping. TextPert (CTA) and Read-It (Olduvai) are examples of trainable packages that can recognize typeset fonts after you train them.
OmniPage (CAERF Corp.) can train itself to recognize typeset fonts. When the program starts recognizing, it may take a little longer than usual for the training, but then, the program flies through the material. OmniPage has the best error rate of any OCR program we have seen.

OmniPage can recognize text areas, separating them from graphics. You also can select manually the text blocks to scan and the sequence for these blocks. The price, however, is high: the standard version of OmniPage requires a 68020 or 68030 processor (Macintosh II, IIx, IIcx, IIci, IIfx, or SE/30) with at least 4 megabytes of RAM.

Some OCR programs may be able to recognize text in a database listing, but most programs have trouble with the spacing of the dots in dot-matrix output. Using a copier to copy the pages first may improve the scan by spreading the dots and filling in the white spaces. Errors can be found by using a word processor to clean up the text file—an automatic spelling checker can find many mistakes, and some OCR programs leave a character (such as an *) in place of the unrecognized character so that you can search for them. Proofreading, however, also is necessary because errors in mailing list ZIP codes and other numerical data can cause other problems. If absolute accuracy is paramount, have the same listing typed in tandem by two typists and then compare the two files.

However you plan to use OCR software, you need to set aside enough storage space for image files. If you scan many pages in one session with the intent to use OCR software later, you need about 200K of disk space for each scanned page. A better alternative is to use OCR software while scanning, because the resulting text files usually are less than 10K per page.

**Editing and Organizing Manuscripts**

In many organizations, a distinct division of labor exists between the writers, editors, page makeup artists, and so on. You don’t have to know anything about page makeup, however, to write and edit text for electronically produced pages. Editors and writers may use different computers in different offices—or even in different countries—and prepare text for the production artists who are using page makeup programs. Large manuscripts can be sent from one computer to another over the telephone or through network connections, and floppy disks are easy to exchange.
A variety of document management programs are available (such as MarkUp and Annotator, described next, and DiskTop, GOfer and CanOpener, described in Chapter 5) that make filing documents by topic, searching for documents based on their content, and adding annotations to documents easy. Most word processing programs include word counts and the capability to check spelling, an essential proofreading step that can be handled electronically. You also can perform some management tasks—such as adding comments to documents—using only your word processing program.

Annotating and Proofreading Text

One of the greatest benefits of using word processing programs is the ability to check for spelling errors and typos. Another benefit is the ease with which you can add review comments for others to read and possibly incorporate into a document.

Writers and editors can prepare text for printing from their word processing programs without paying attention to the page layout. Margins, footnotes, page numbers, headers, and footers created by word processing programs are not used by the page makeup programs. The settings for these functions can be changed without any consequence to the final page production effort. You can keep a working draft of a manuscript that constantly changes and provide versions of that manuscript for various editions of a publication.

When in electronic form, a large manuscript can be checked for spelling in just a few minutes. Words never have to be retyped, and editing changes can be added or deleted in an instant.

Some word processing programs contain built-in spelling checkers, such as Microsoft Word, Microsoft Works, MacWrite II, and WriteNow. Other word processing programs work with desk accessories such as Spelling Coach Professional (Deneba Software).

You should use a spelling checker on the final draft of a manuscript before using the text with a page makeup program, because errors make a publication look less professional.

You can add comments to a manuscript by enclosing the comments in double brackets (as in [[comment]]), and then searching for double brackets to find the comments. Another method is to use a different font, a much larger size, or boldface,
to distinguish between comments and the regular text. MacWrite II enables you to search for any words or phrases that use a particular font, size, or style. Microsoft Word enables you to type *hidden text*—displayed upon command but not printed. Hidden text does not affect the formatting of the manuscript.

If you are sharing a manuscript with a group of reviewers, these methods of annotation may be cumbersome. You can set up annotation procedures for a group by using programs designed for this purpose, as described in the following section.

**Editing in Work Groups**

*Work group* describes a working entity from two to twelve people (or more than twelve, although such a group may not be practical) that are sharing documents and data in an effort to produce something—a book or manual, a newsletter or magazine, or even an advertising campaign.

When a group is working together on a document or on articles for publication, they need to pass documents around for comments and may need to present documents to managers for approval. Several programs are available for handling the review process, such as Mainstay's MarkUp. This program enables you to create an image of a document that can be shared, commented upon, and tracked through the review process. The image of the document can be reviewed by users who don't even have MarkUp. Most importantly, no reviewer can make changes to the original document—all comments are recorded on layers, *overlays*, that are like transparent pages attached to each page of the document.

A major benefit of MarkUp is that the program does not intrude on the group's habits and does not force the group to use the same word processing and page makeup program. The program is designed strictly for managing a review process and tracking documents through that process, no matter what application is used for producing the document.

MarkUp maintains a database of documents and comment overlays with simple mechanisms for tracking jobs, controlling access, messaging other users, and keeping an audit trail of editorial activity. Because the program works with virtually every Macintosh application, including all page makeup programs, you can use MarkUp as a production tracking system (tracking PageMaker, QuarkXPress, ReadySetGO!, and word processing pages simultaneously) and as an editorial management system for collecting comments from reviewers.
You also can export documents from a MarkUp database into a file containing mini MarkUp features, so that the documents can be reviewed by users who don’t have the MarkUp application. The reviewer can double-click the file, read comments, and add more comments (all of MarkUp’s editing tools, the graphics toolbox, and proofreader’s symbols are included). You then can import the result back into a MarkUp database. This capability is impressive when you realize that you can organize an extensive review process involving a lot of reviewers, requiring only a few copies of MarkUp for viewing all the comment layers and controlling the process.

Farallon, which also offers the MacRecorder audio digitizer with a built-in microphone, is introducing a program called Annotator that offers similar markup and commenting facilities, plus the capability to include voice comments and any sounds. Members of a group can view and listen to any or all comments, which do not affect the original file. The program offers a pencil tool for drawing or writing, a straight-line tool for drawing arrows and links, a highlighting tool with six highlighting colors, and editorial marks based on the Chicago Manual of Style.

Sound in Annotator is recorded and played with a 22-kilohertz sampling rate, suitable for voice and useful for jingles and sound for presentations and storyboards. The added voice component is compelling—there are thousands of different applications. Meetings can occur without meeting rooms because participants can sit at their desks and voice-annotate documents. Engineers can explain plans and drawings to an entire company without leaving the lab. Voice identification can be used as a security precaution rather than typed passwords. Multimedia project developers can use voice annotations while reviewing presentations.

MarkUp and Annotator are excellent examples of how group-oriented software facilities can be provided for the benefit of editorial and production environments. They can operate side-by-side with project planning software, spreadsheets, and creative tools, without burdening the artists and writers with excessive procedures. They also add a measure of security to an otherwise chaotic situation for document exchange.

Creating Charts, Graphs, and Tables

One of the strengths of the Macintosh is that you can create charts, graphs, and tables automatically from data stored in spreadsheets or databases and then use those charts and graphs in other projects, such as newsletters, slide presentations, annual reports, scientific proposals, and so on.
Spreadsheet and chart/graph programs can perform calculations and produce a bar chart, a pie chart, or an x-y graph that is accurate in proportion to those calculations. Using the output of these programs, therefore, is better—at least as a template for tracing new shapes accurately. You can bring the template into a program such as Aldus FreeHand or Adobe Illustrator or directly into Persuasion and other presentation programs described in Chapters 6 and 7 and then draw your own shapes based on the template.

**Using Automatic Charting and Graphing**

As researchers and seminar leaders, we have had many an occasion to graph the results of surveys and chart the progress of the computer industry for publication and for slideshow presentation. Usually, the job requires gathering data and computing results in a spreadsheet. We use Microsoft Excel for creating the spreadsheet and the automatic charts and graphs.

A spreadsheet consists of numerical information organized in rows and columns. Each number or text element is a *cell*. Spreadsheets can have named cells, rows, and columns for easy reference. This spreadsheet data is turned into a chart or graph by a spreadsheet program such as Excel. You can save the chart or graph in a separate PICT file or copy the entire chart into the Clipboard, where it can be pasted into the Scrapbook. We use SmartScrap from Solutions, Inc., to store groups of charts and graphs in separate Scrapbook files.

Several other programs that create spreadsheets, such as Wingz (Informix) and Microsoft Works, also can create charts and graphs that can be saved as PICT files or copied to the Clipboard and then to a Scrapbook file.

You can transfer the graphics in the Scrapbook file to a graphics program (such as MacDraw II) or to a presentation program. Aldus Persuasion (a slide presentation program) also can produce charts and graphs from spreadsheet data that can be imported into its data sheet (see fig. 3.2). Persuasion can make a chart or graph look three-dimensional, and with this program, you can add legends, axes labels, colors, patterns, and other special effects (see fig. 3.3).

The original chart can be stored in the Scrapbook file unchanged for future use in other projects. You even can store the Persuasion-enhanced version in the same Scrapbook file. The built-in Clipboard enables you to transfer, via Copy and Paste, any type of graphics to and from any application.
Chapter 3: Creating Text, Charts, and Tables

Fig. 3.2. Aldus Persuasion, a slide presentation program, can import spreadsheet data into a worksheet and create automatic charts and graphs.

Fig. 3.3. An automatic chart in Persuasion, enhanced to look three-dimensional.
Another way of capturing a chart or graph from a spreadsheet or graphics program, if you intend to use it for on-screen presentations, is to use a utility such as Fkey that enables you to set up the capture key as function key F8. Capture, from Mainstay, is another utility that performs the same function but uses the print screen key rather than the F8 key. The difference is that Fkey can create a Scrapbook file holding the results of successive capture operations. Capture saves the result of one capture operation in the Clipboard (where it can be pasted into the Scrapbook in another operation) or in a PICT file.

This capture method works if all you need is a screen image as the final result. If, however, you want to use a graphic image at the highest-possible resolution of the image for printing and slide-recording, you should save the graphic image in the program's regular file format and then import the graphic image file into programs that do printing and slide recording. We describe graphics file formats in the next chapter.

Creating Tables

Spreadsheet data often needs to be printed as a table. Microsoft Word offers sophisticated table tools as part of its basic word processing toolkit, and Tycho from Macreations is a table creation program that works with any word processing or page makeup program.

In Word, and in most other table-making programs, each table element can be formatted as a spreadsheet cell, with text wrapping automatically around each line and justification options. Word offers an adjustable grid for the quick alignment of columns, and you can change the size of any selected table cell or cells by dragging ruler markers (see fig. 3.4).

Graphics and text can be mixed in tables, and table cells can be highlighted with special borders for effects such as boxed sidebars and floating or boxed graphics. Word's Table features are consistent with the rest of the program's features, and text formatting within cells is the same as ordinary text formatting. Word's QuickSwitch feature loads Microsoft Excel for an automatic data link (so that you can incorporate charts and spreadsheets in your documents and update them automatically).

Tycho resembles a spreadsheet at first, and the program uses similar terms in menus and the same shortcut keystroke combinations as Microsoft Excel, PageMaker, and programs that follow Apple's guidelines. Tycho includes a set of dingbat symbols that
Chapter 3: Creating Text, Charts, and Tables

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<table>
<thead>
<tr>
<th>Educational History</th>
<th>Location</th>
<th>Major course or subject</th>
<th>Dates attended</th>
<th>Graduated</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>School name</td>
<td>(city, state)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>The Haverford School, Haverford PA</td>
<td>English</td>
<td>9/68 to 6/72</td>
<td>9/68 x 6/72</td>
<td>High School Diploma</td>
</tr>
<tr>
<td>Technical/trade (after high school)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College (list all attended)</td>
<td>Tufts University</td>
<td>English and Philosophy</td>
<td>9/72 to 6/76</td>
<td>x</td>
<td>B.A. in English</td>
</tr>
<tr>
<td>Other education/training</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Fig. 3.4. Dragging the ruler markers in Microsoft Word to adjust the width and length of cells in a table.
complements the Zapf Dingbats font of special symbols. The dingbat font tear-off palette contains arrows and symbols, check boxes, pie portions, weather symbols, and other useful table symbols. Most users probably find the extensive set of arrows contained in the smooth Zapf Dingbats typeface more than adequate, but Tycho's arrow dingbats are in a different style, and although they are more jagged as screen fonts, they are attractive when printed.

One of Tycho's best features is the ability the program gives you to define styles for individual cells and for the entire table and to produce a report of the styles used. This information is helpful to have in a report, because Tycho enables you to apply styles to another table and offers hierarchical style formatting similar to a word processing program.

Tycho also gives you the ability to format footnotes at the ends of tables. Footnote references added to text in cells appear superscripted, are treated as graphics (the style is not affected by text style changes), and are associatively numbered to match footnote entries at the end of the table.

Although Tycho does not offer math functions, the program enables you to sort table entries, and Tycho can export a table in SYLK, comma-delimited, and tab-delimited file formats for use in spreadsheet and database management applications.

Word's table features are the easiest to learn how to use, and the program offers math functions that Tycho currently lacks. Word's intuitive approach makes the program the obvious choice for someone preparing a business report. Tycho has nifty features for those who need to create extensive tables and can be used for entering data into tables for preparing databases and spreadsheets. Both programs have features that make them attractive for creating most types of tables.

After you have created and saved the table as a PICT file, you can use it in almost any Macintosh application. The PICT format is used as a common denominator in Macintosh graphics, and you can depend on Macintosh applications to support this format.

**Chapter Summary**

In this chapter, you learned about creating and editing text with word processing programs, scanning text, organizing a manuscript review process, and programs for creating charts, graphs, and tables.
Chapter 3: Creating Text, Charts, and Tables

Word processing programs are designed for writing and editing text. Every Macintosh word processing program offers a set of formatting functions that govern how the text appears on the printed page. The leading word processing programs for the Macintosh are Microsoft Word, MacWrite II (Claris), WriteNow (T/Maker), and WordPerfect. Word virtually defines what features a standard word processing program should have. Word is the one word processing program most often recommended by software reviewers, and it is the one we use the most. MacWrite II offers an excellent search and replace facility that lets you search for and replace a specific font, size, and style, as well as a set of characters. MacWrite II is popular, but it is quite slow on Macintosh Plus and SE computers when compared to Word or the less expensive WriteNow. WriteNow is the most popular word processing program for users on a budget who need just about every feature of Word except stylesheets.

The discussion of scanners focused on the uses and the types of scanners that can recognize characters. Special optical character recognition software is required to review the image and recognize textual characters. Scanners that can sense many different levels of gray are better for text recognition, and flat-bed scanners with attached sheet feeders are recommended over sheet-fed scanners. Most OCR programs are designed to read only monospaced, typewritten text, but several scanners can read typeset characters, by the user training the software or by the software training itself.

In this chapter, you discovered that you can perform some management tasks—such as adding comments to documents—using only your word processing program. (Other document management programs, discussed in Chapter 5, make it easy to file documents by topic, to search for documents based on content, and to add annotations to documents.) Most word processing programs include word counts and the ability to check spelling, an essential proofreading step. Once in electronic form, a large manuscript can be checked for spelling in just a few minutes. Words never have to be retyped, and editing changes can be added or deleted in an instant.

If you are a member of a work group, you learned that you have several options for sharing documents and data to streamline activities. A major benefit of Mainstay’s MarkUp is that it does not intrude on the group’s habits and does not force the group to use the same word processing and page makeup program. MarkUp and Farallon’s Annotator are examples of group-oriented software that can manage editorial and production work groups.

One of the strengths of the Macintosh is that you can automatically create charts, graphs, and tables from data stored in spreadsheets or databases and then use those charts and graphs in other projects. After you create and save a table as a PICT file, you can use that table in almost all Macintosh applications. Now that you know about PICT files, turn to the next chapter to learn more about creating graphics files in PICT and other formats and using those graphics with different applications.
Creating Graphics

Space is unimaginably big.


You know that a picture is often worth more than a thousand words. Nearly all multimedia projects begin with graphics, and rarely do you find a published work that does not include graphics. When done in good taste, graphics can be compelling, entertaining, informative, and instructive.

By itself, the personal computer does not turn non-skilled people into excellent graphic artists and designers. The computer enhances creative ability and provides tools that make it easier to acquire drawing skills but does not provide a qualified critique of the drawing. Graphic design is a skill best acquired by experience and instruction. Most corporate computer users can take better advantage of desktop media by hiring an artist and designer to create original graphics and to design templates for publications and presentations. Business users, therefore, can derive the benefits of personal computer graphics without the drawback of having unskilled people drawing graphics and executing poor designs.

Painting and drawing tools for the Macintosh, however, are invaluable for bringing out the creative side of individuals who have never drawn or painted before. You can work with scanned artwork (as long as you acquire the copyrights) and create collages with little or no drawing or painting skill, although an artistic sensibility is required. An abundance of digital clip art—artwork you can use without obtaining permission—is available for use with Macintosh desktop media applications. Examples are the ClickArt series from T/Maker, SmartArt from Adobe Systems, and the DeskTop Art series from Dynamic Graphics. For example, we have produced a restaurant’s menu and a variety of party and wedding invitations that include clip art.

This chapter introduces the different types of graphics programs and explains how certain types are better than others for specific tasks. The chapter provides a detailed
description of graphics file formats, painting programs, and professional drawing programs. The discussion includes information on gray and color image retouching, photorealistic color images, professional drawing, and the production of commercial artwork. This chapter also describes how scanners can be useful and reviews the various types of scanners and scanning software. You learn which programs are best for creating technical drawings, three-dimensional graphics, special graphic effects with text, and for tracing scanned images to create professional artwork.

Comparing Painting and Drawing Programs

There are two kinds of graphic images: paint-type (bit-mapped graphics) and draw-type (object-oriented graphics). The fundamental difference between the two types is based on how they are created.

Paint-type images are created from individual dots that correspond to screen pixels. Such images are limited in resolution to the display used to create them, which is 75 dots per inch on the Apple Color Display or 72 dots per inch on the Macintosh Plus and SE displays.

Paint-type images also can be created by a scanner, which breaks down an image into a set of dots with corresponding gray or color values. Again, such images are limited to the scanner's resolution setting.

Drawn images, however, typically are drawn with mouse tools designed for drawing geometric shapes, straight lines, and curves, and contain areas of solid color, tints, or consistent patterns. Drawn images consist of a series of drawing commands that describe the image. Draw-type graphics usually are not limited to the resolution of the screen. They may look a certain way on-screen, but they invariably look better when printed with a higher resolution laser printer or imagesetter.

Painting programs, such as MacPaint, are popular with free-style painting and amateur artwork because the programs are easy to learn and very flexible (see fig. 4.1). You can touch up the dots to improve images and paint intricate patterns and shapes.

Drawing programs, such as MacDraw II, are popular with commercial artists, designers, architects, and engineers (see fig. 4.2). These programs offer precision tools, perfect geometric shapes, and graphic objects that can be moved, transformed, cloned, and grouped with other objects.
Fig. 4.1. MacPaint (Claris) creates paint-type graphics and can magnify the pixels so that you can fine-tune the artwork. Paint-type graphics are limited in resolution by the display — the pixels cannot be divided into smaller pixels.
Fig. 4.2. MacDraw II (Claris) enables you to draw objects that can be independently moved, transformed, and grouped with other objects.

Both types of programs are popular with desktop publishers, who tend to use draw-type programs for logos, line drawings, business charts, graphs, and schematics and who use painting programs to create intricate designs and free-style artwork and to edit photographic images. The highest resolution can be achieved with PostScript-drawing programs such as Adobe Illustrator 88 and Aldus FreeHand that enable you to create resolution-independent PostScript graphics (described not by screen pixels but by graphics commands).

Resolution-independent (draw-type) graphics are better for publishing applications in which a typesetter or imagesetter is used for high-resolution output (up to 2540 dots per inch, compared to the screen's 75 and the laser printer's 300). Resolution-independent graphics also are better when you are creating slides. Essentially, graphics rendered at high resolutions do not show jagged edges (dots that are too large).

Gray and color photographic images are technically paint-type graphics because they are tied to a specific resolution (usually the resolution of the scanner), but because they carry more information about grays and colors, programs can simulate grays and colors on high-resolution devices and obtain excellent results.
Chapter 4: Creating Graphics

Using Gray and Color

Many publishing applications require black-and-white graphics because graphics are essential for many forms of communication. Color graphics, however, require more expensive press runs. Graphics in black and white can be just as compelling as color graphics and are much less expensive to produce. For example, most of the multimedia presentations described in this book are in full color, but we are using black-and-white graphics that are quite effective for communication and help keep the book’s price reasonable.

Color painting and drawing programs also can be used for black-and-white painting and drawing, and in many cases, the color programs offer far more control and precision, plus special effects such as complex transformations of shapes. These programs, however, are usually more expensive than the programs that paint only in black and white. In addition, black-and-white graphics are not as complicated to produce in print and slide form.

The realism you can achieve is limited by painting or drawing in black and white, but you can create images with enough gray to make them look as good or better than black-and-white video images and almost as high-quality as black-and-white photographs.

A black-and-white image composed of display pixels looks the same as it prints—each black pixel corresponds to a black dot. An 8-bit color graphics adapter (built into the IIci, separate in other models), however, can display 256 colors or different shades of gray, including black, for each pixel. The shades of gray are called gray scales. When using such an adapter (or the IIci), a gray-scale image looks much better on-screen than when printed, because each screen pixel can show 255 different gray shades, but printed dots are only black.

To print a gray-scale image, a black-and-white continuous tone image, the software converts gray pixels into halftone cells composed of several black dots and white spaces that can simulate gray shades on a black-and-white printer. The cost of a press run is not affected by the use of gray-scale halftones because you still are using only black ink. Halftones are described in more detail in Chapter 9.

To process black-and-white continuous tone images, you need at least 40 and possibly 80 megabytes of hard disk space, a desktop scanner that can scan up to 256 levels of gray, and at least 2 megabytes of RAM (more if you intend to use MultiFinder).
Macintosh II models can be upgraded to a maximum of 8 megabytes. The extra disk space and RAM are needed because 256-level gray-scale images take up far more disk space than one-level (one-bit) black-and-white images.

The same is true of color images: 8-bit color images actually can be larger than gray-scale images, and you need a scanner that can scan gray-scale and color source materials. Photorealistic color images (with 24 bits of color per pixel) take up far more disk space and RAM than 8-bit images—approximately three times more space.

Each color (up to more than 16.7 million colors) is expressed in percentages of cyan, yellow, magenta, and black (CYMK); in red, green, and blue (RGB); or in hue, lightness, and saturation (HLS). These three different color models are used in different applications; for example, CYMK is the preferred method of specifying process colors for printing because they match process inks used in printing presses. An additional mapping system for specifying color is the Pantone Matching System (PMS), a patented method of identifying a particular color and its matching ink. Many applications support the PMS model and the RGB and CYMK models.

Essentially, three types of color images exist: scanned continuous tone color photos; created artwork that has a slightly different color for each pixel or is painted with a pixel-oriented program such as PixelPaint; and illustrations, created in a drawing program, that contain objects assigned specific colors or color blends. These different types are served by different color painting and drawing programs with overlapping features.

Continuous tone color images scanned at full 24-bit quality look like photographs on-screen, but like any continuous tone image, they have to be converted into a halftone before printing. The colors in an image also must be separated (in a process called color separation) so that the image can be output to separate films corresponding to colored inks. Color printers have built-in separation facilities, but you have to create color separations with a high-resolution imagesetter if you intend to use color images in a printing press operation.

You may decide to defer color choices until the graphics are ready to use in publishing or presentation programs. In some page makeup and presentation programs, colors can be assigned directly to objects (text, boxes, lines, or graphic images) by selecting the object and choosing a color from the color palette. You also can define colors by name for a publication in a color sheet, which is like a style sheet that
holds the names of the colors and is saved with each publication. You can copy colors from another publication and edit or remove color definitions. Your graphics therefore can be used as is or modified for use in many different projects.

Understanding Graphics File Formats

Because any graphic image can be reused in many presentations, we try to create graphics in a resolution-independent drawing program and store this version in an archive (on floppy disk) for use with high-resolution projects. To use the same graphics in lower resolution display animation, we convert the graphics and images to another graphics format in which resolution is fixed. For example, the MacPaint format is fixed to the resolution of 72 dots per inch (dpi).

The PICT format, designed for transferring graphics from one Macintosh application to another, is fixed in resolution to the original device or program that created the graphic, but this format can define graphic objects in a language called QuickDraw, the native language for Macintosh computers. PICT2 is a new version of the format that accommodates color and gray-scale information. Depending on the type of patterns used in the image, PICT and PICT2 graphics usually can be resized without distortion.

Since the invention of PICT, great strides have been made in graphics file formats, creating a common currency for transferring graphics between the Macintosh and PC worlds. The Encapsulated PostScript (EPS) file format has emerged as a standard format for line art and graphics on many different types of computers. PostScript files are coded in ASCII (American Standard Code for Information Interchange, used for text), which is easy to transfer over telephone lines with modems. Because line art and graphics are represented by algorithms, the EPS files generally are smaller than other formats for line art. We typically use Encapsulated PostScript (EPS) format for graphics and line art.

EPS graphics also are described with the PostScript language. PostScript makes the graphics independent of the display resolution (unlike QuickDraw). PostScript graphics are expressed as algorithms rather than as a series of dots, and the graphics can be resized freely. EPS graphics can be stretched or compressed with little or no distortion.
EPS can act as a super-format, carrying PostScript algorithms and a PICT version of the image for quick display operations. You can use EPS files in publishing applications that demand high resolution, therefore, and use the PICT images for displaying the graphics faster on-screen and for use in screen presentations and animations. If you are preparing graphics for screen use only, PICT-only files are generally more compact than EPS files that contain PICT images. For publishing applications, however, having the EPS format is helpful so that you can print a high-resolution version and display a lower resolution version of a graphic image.

All Macintosh drawing programs can save a PICT, PICT2, or EPS file with PICT embedded in the file, and many drawing programs can save all three types. Only EPS files, however, are independent of the recording device’s resolution. PICT and PICT2 graphics usually are set to 300 or 75 dots per inch, which are useful for printing on the LaserWriter or displaying on-screen (multiples of this resolution enable you to scale PICT graphics to high resolutions for slide recorders).

A file format for scanned images also has emerged: TIFF (Tag Image File Format), sponsored by Aldus, Microsoft, Hewlett-Packard, and a host of desktop scanner manufacturers. TIFF stores the gray-scale or color information of a continuous tone image and provides a standard format for image data so that professional-quality halftones can be produced with desktop publishing software. ImageStudio and ColorStudio (Letraset) can read and write TIFF files and enable you to adjust the gray tones or colors and retouch scanned images before using them with page makeup programs. Both programs also offer a compressed file format called RIFF (raster image file format) that occupies less disk space when storing the image.

With scanned images, higher resolution (or more gray-scale or color information) usually means larger image files. Because larger files require more processing time, you need more powerful equipment to deal with rich color and gray-scale images.

Comparing Painting Programs

The applications of painting programs include graphics for display or video animation, because resolution independence is not required, and the computer can display these images (perhaps using additional, more powerful equipment) faster than printing them. Excellent printed results also are possible with paint-type graphics, especially if the graphics consist of line art that can be resized into almost any
proportion and still look good. Painted images with tight, regular patterns, however, do not print well (they appear muddy because the fixed resolution is too coarse for printers with higher resolutions). You are better off, when creating graphics from scratch for printing, to use a drawing program such as Aldus FreeHand with drawn rather than painted patterns.

The exception, of course, is when you are using scanned gray-scale and color continuous tone images that cannot be edited by drawing programs. Professional-quality painting programs that can prepare output for high-resolution devices are available for creating gray-scale halftones and color-separated halftones for printing applications, and these programs (such as Adobe PhotoShop, PixelPaint Professional from SuperMac, and ColorStudio from Letraset) also are useful for adjusting both types of images for multimedia presentations.

**Black and White Painting**

MacPaint is one of several excellent painting programs that primarily paint in black and white. Almost all painting and drawing programs can save a MacPaint file. MacPaint format images are stored as bit maps that correspond directly to screen pixels.

For example, Stuart Sharpe used MacPaint to create the diagram for "The Mall" (an interactive presentation of the stores in a shopping center). Each shape for a store could be cloned and altered slightly to make the next store (see fig. 4.3). Stuart also created shapes with patterns that are easy to copy to the scrapbook and use with different presentations.

Because MacPaint was the first Macintosh graphics application program, it defined the features required for any painting program. MacPaint offers, for example, the ability to zoom into a drawing and see the pixels magnified so that you can make precise adjustments. The pen tool is used to turn a pixel black or white, and the brush tool enables you to paint with a wider stroke that can be customized. The program offers a rectangular selection tool and a free-style selection tool, plus a grabber ("hand") tool to move the image around the display.

Straight lines, arcs, and simple geometric shapes such as rectangles and ovals can be drawn quickly. An airbrush (spray can) tool is provided to spray black over an area, and you can fill a closed shape or any area with solid black or a pattern (30 patterns
are provided, and you can create your own patterns). MacPaint also offers an eraser tool for erasing black areas. Text can be added to artwork using all of the fonts and styles available.

Studio/1 (Electronic Arts) offers simple animation features (described in Chapter 6) and a complete set of black-and-white painting tools, including free-style, rectangle, and polygon selection tools, a grabber hand, an eraser, an airbrush, a brush that you can customize, a pencil, and tools for drawing straight lines, rounded and straight rectangles, rotated and straight ellipses, equal-sided triangles and polygons, irregular polygons, and freehand shapes. You also can draw arcs, as with MacPaint, and bezier curves—curves with control points you can drag to change their shapes.

Most of the tools work like MacPaint's tools, but in some cases, Studio/1's tools are better. For example, Studio/1 provides tool modifiers for customizing the action of certain tools. One modifier changes the way shaping tools work: you can draw shapes that are framed but not filled, or filled but not framed, or framed and filled. Another modifier changes the way selection tools work—you can modify the rectangle selection tool to shrink the selection to the smallest possible rectangle that can contain the shape.
Selection is easy with this program for another reason: you immediately can select the area you last drew or painted, and you can save a selection in a file for later recall. The program offers you the ability to transform a selection by dragging it into perspective, shearing the selection, bending the shape, resizing (freely with the mouse or by a percentage), rotating by any degree, and distorting the shape.

In Studio/1, you can define a perspective plane upon which all elements are drawn. The program offers 10 built-in orientations for the perspective plane, and you can rotate the plane around the x, y, and z axes. When you fill the document with the new perspective, any selected object fills the screen at the new perspective, leaving the original selected object and other objects unchanged.

The program enables you to create black-and-white gradients, fill patterns that change from solid black to solid white in gradually dissolving pixels. Studio/1 offers linear gradients (one end to another) or radial gradients (from a point outward). You also can choose a gradient that fills to the shape or one that fills uniformly throughout the shape. A uniform gradient fill is useful for setting a uniform fill for a background, but the gradient fill to shape option creates the appearance of depth in the object.

Studio/1 enables you to define any image or piece of an image as a brush. The text tool provides access to fonts, point sizes, styles, and alignment, and you can treat text as a bit map (on the paint layer) or as text that can be printed at higher resolutions on PostScript printers (on the text layer). The layers are independent, and you can edit text in the text layer but not in the paint layer. You can use several tools with text in the paint layer to achieve special effects such as outlined text, text with gradient fills, and the look of embossed text.

The mask feature enables you to set aside areas of an image to be unaffected by subsequent painting or special effects. You can move a selection behind the masked area so that the selection shows through transparent areas. Masking also is useful for painting next to an object without getting paint on the object.

Studio/1 is perhaps the most robust of the black-and-white painting programs. Studio/1’s animation features and its use with HyperCard stacks are described in Chapter 6.

**Gray Image Painting and Retouching**

Gray-scale images can be created by scanning photographs or by using a gray-scale painting and retouching program such as Letraset's ImageStudio and Silicon Beach
Software's Digital Darkroom. These programs can create and retouch professional-quality gray-scale halftones for printing as well as continuous-tone gray-scale images for multimedia presentations. A scanned photograph, for example, can be retouched in ImageStudio and then used in a SuperCard stack or MacroMind Director presentation, and you can produce a halftone of that same photograph using the same program (see fig. 4.4).

Fig. 4.4. A halftone of a gray-scale image, scanned with a full 256-level gray-scale scanner and then enhanced with Letraset's ImageStudio.

With ImageStudio, you can paint with gray and retouch scanned images. The program offers a wide array of versatile tools for airbrushing, water coloring, or charcoal drawing. Multimedia artist Stuart Sharpe, for example, used the program to soften the edges of black-and-white graphics and video still images (see fig. 4.5).

ImageStudio's paint brush can sketch with a soft brush stroke using a variety of attributes that enable you to change the shading as you paint. For example, you can use a pressure setting to change from a lighter pattern to a darker one as you apply pressure. The shading attributes also can be used with the pencil, rubber stamp, and charcoal tools.
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The paint brush, pen, rubber stamp (for repeating shades) and charcoal tool have an option that enables you to draw only if the spot is lighter or darker than what already is in the picture, and you draw only in the background shade to add shadows and to paint behind areas. The paint bucket tool enables you to fill an area with the same shade, with an option that enables you to fill only one pixel width border or to fill an area with a ramp (graduated shades of gray).

The pencil tool is useful for laying down thin or fat strokes of a flat gray shade and for drawing polygons with straight lines. The rubber stamp copies the current brush’s gray levels into different areas of the picture. With the rubber stamp tool, you can make new textures and use the “slide brush” to copy the shade that was under the current brush stroke. The charcoal tool works like soft-edged charcoal to make things darker and can be set to “negative charcoal” to make things lighter. You can set the charcoal tool to draw no darker than the current shade in the palette.

To soften edges, remove spots, and smooth out aliased features of the image, you can use the water drop tool (like adding water to a watercolor) and the finger tool (for smearing). The water drop averages the dots in an area and is affected by shading.
attributes—you can change the blurring effect by changing the drawing priority and the time integration settings that affect how wet the water is. The finger is useful for cleaning up an area and for smoothing out a light shading and works like the water drop tool at very light pressure settings.

ImageStudio’s Graymap Window enables you to adjust the brightness and contrast of the image with sliding buttons. You can draw a custom curve to define brightness and contrast and to select standard options like posterization (see fig. 4.6) and equalization (expanding the range of gray shades by adjusting brightness and contrast settings). The program also has built-in filters for shaping, blurring, tracing edges, resharpener, or diffusing the image.

![Fig. 4.6. An example of posterization: taking a gray-scale image and shifting mid-tone gray values to reduce the number of gray shades to black or white.](image)

ImageStudio can import graphics files in TIFF (Tag Image File Format), RIFF (a compressed raster image file format developed by Fractal Software, creators of ImageStudio), and Thunderscan, MacPaint, and FOTO formats. The program can save images in TIFF, the Encapsulated PostScript (EPS) format, RIFF (used by default), and MacPaint files.

Digital Darkroom is designed with less emphasis on painting tools and more emphasis on selection tools, with features for dissolving and blending a gray-scale image while pasting the image into another. The design goal is to enable users to make
global changes to an image quickly and to limit those changes to selected areas rather than making many changes with brush strokes.

The program’s most outstanding features are its capability to select all areas of an image that contain a certain gray-scale value, the versatility of its selection tools for selecting noncontiguous areas, and the capability to add to, subtract from, or otherwise refine a selection. Digital Darkroom also can automatically trace areas and create bezier curves, lines, and polygons for reshaping in SuperPaint or in PostScript drawing programs such as Adobe Illustrator 88 and Aldus FreeHand.

Digital Darkroom can perform effects such as blurring, sharpening, and posterization (reducing all gray dots to black or white). The program has two gray-scale maps: one for adjusting gray values and another for contrast and brightness, which can be adjusted independently. You can perform a special effect, such as posterization, and then refine the image with contrast and brightness adjustments.

The Paste If function enables you to define the gray values to paste or the gray values to paste over. A control panel enables you to decide how much of the Clipboard image is pasted into the active image area and the amount you can blend or dissolve the new image into the active image. You also can use the Paint If controls to paint over only specified gray values.

Digital Darkroom enables you to select an area of a scanned image in the shape of a polygon or circle of any size to perform special effects on and to change its gray-scale values. This procedure is useful for making silhouettes in an image. The magic wand tool selects areas with contiguous gray-scale values and provides an option to widen the selection. The scissors tool cuts out sections of a selection for further refinement, and the lightning bolt quickly “zaps” unwanted sections.

ImageStudio and Digital Darkroom have different approaches, even though they are not radically different in the effects they can produce. ImageStudio provides simulated inking and water-color tools that an artist may favor, and its paint brush can sketch with a soft brush stroke using a variety of attributes that enable you to change the shading as you paint. Digital Darkroom, however, provides a simpler set of brush tools and more selection tools with transformations that appeal to a desktop publisher who has little time and no skill in airbrushing techniques.

We prefer ImageStudio because we like to store our scanned images in compressed RIFF files, which at times can be less than one third the size of TIFF or PICT files containing the same images. Our scanned image archive contains RIFF files that can be converted to TIFF or PICT with ImageStudio. We also use Digital Darkroom for
opening TIFF files from other sources, such as PCs, and for changing the contrast and brightness for selected areas of an image.

Page makeup programs can import TIFF and PICT files, and ReadySetGO! and DesignStudio (from Letraset) can import RIFF files directly. Multimedia programs such as MacroMind Director import TIFF and PICT files, and slide presentation programs such as Aldus Persuasion and Microsoft PowerPoint also import TIFF and PICT files.

**Color Image Painting and Retouching**

To create color artwork at the pixel level and to retouch scanned color images, you can choose between 8-bit color programs (offering 256 out of a possible 16.7 million colors in each document) and 24-bit color programs (offering all 16.7 million colors at once). PixelPaint (SuperMac Technology) and Studio/8 (Electronic Arts) are examples of 8-bit programs; PhotoShop (Adobe Systems), PixelPaint Professional (SuperMac), and ColorStudio (Letraset) are examples of 24-bit color programs that also can be used as 8-bit programs.

The kind of images you want to create and the type of graphics display adapter you are using (8-bit only, or one that operates at 8 and 24/32 bits) affects your choice of an 8-bit or 24-bit program. The 24-bit image files containing continuous tone color images are huge, usually three times larger than the 8-bit files (and sometimes over 30 megabytes each file). However, 24-bit color is required for making high-quality color halftones for printing or making color slides of continuous tone images.

The use of 24-bit images is not usually necessary for most animated presentations, especially ones to be displayed with 8-bit display adapters. The majority of Macintosh color users have 8-bit adapters; and 24-bit color images take a lot of processing power and, therefore, are painted slowly on-screen compared to 8-bit images.

Most desktop media users do not need to use 24-bit images unless they are involved in the production of slick color publications such as magazines, annual reports, and so on or are working with color video images or scanned color photos.

PixelPaint (SuperMac Technology) is one of the leading 8-bit color painting programs. The professional version (PixelPaint Professional) also can run in 24-bit mode with 24-bit or 32-bit color graphics adapters.
PixellPaint offers equivalent tools to MacPaint plus an array of special color effects and painting capabilities. The paintbrush tool, for example, can use any image captured in the Clipboard as the brush shape and color. The mask feature enables you to set aside areas of an image to be unaffected by subsequent painting or special effects.

Studio/8 (Electronic Arts), another 8-bit color painting program, offers a variety of color effects such as Blend, Watercolor, Neon, Smear, Smooth, Shade, Tint, and Darken. A disk of textures such as Oak, Granite, and Silver Tile is supplied with the program. Tools can be modified for more powerful operations, and areas can be selected with the capability to shrink or expand the selection automatically to fit the contours of an image. Any selected image can become a brush.

One of the best features of Studio/8 is the ability the program gives you to define your own gradients, which can be applied to fill a shape or to fill with a uniform gradient (see fig. 4.7). Studio/8 also enables you to align a selection along a perspec-
tive (a three-dimensional plane) and to fill the perspective plane with a pattern. With this program, you mask areas of your image to protect them from subsequent paint operations. This procedure enables you to move selections behind the masked area. You also can set a mask by a certain color, so that you don't paint over or erase that color.

Studio/8 is not the only paint program that offers color cycling features for animation. MacroMind Director, a multimedia presentation program, offers a complete set of color painting features, animation, and automatic in-between features useful for creating pieces of an animated sequence.

Director's painting tools enable you to scale, rotate, flip, invert, and otherwise transform graphic objects. In addition to the standard painting tools, Director includes a lasso and a rectangular selection tool that can shrink, or tighten, the selection around an irregularly shaped object (tracing the edges).

The program offers a paint brush that paints with the currently selected color, ink effect, or fill pattern, and you can define several brush shapes to be available while painting (without having to continually change them in a dialog box). The program also offers an airbrush tool that can be modified by choosing different ink effects from a pop-up menu. You can control the airbrush tool's spray size, dot size, and flow rate, and set the brush shape. You also can define up to five different types of airbrush settings that pop up in a menu by double-clicking the tool icon.

The paint window enables you to zoom into a magnified view of the artwork, and a registration tool enables you to align graphic objects to a fixed reference point for animation. The program offers 18 different ink effects, including blend, gradient fill, and cycling (for changing colors as you paint). A gradient destination selector enables you to choose the starting and ending color of a gradient fill, and gradient fills can be set to a shape burst or sun burst and in any direction. Gradients can be made with different patterns and dithering, a technique of mixing the dots of different colors in a pattern to create a blend from one color to the other. With dithering, you can represent a 24-bit image with 8 bits for displaying with an 8-bit graphics adapter.

The reveal effect erases white areas to show the artwork in the preceding easel. You can darken and lighten colors, smooth (blur) or smear (mix colors in) existing artwork with the paint brush, pick up a specific color from the artwork with the eye dropper, and slide whatever color or pattern is currently under the paint brush across the artwork. Line
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thickness can be set in pixels, and tiles (repeating sections containing the same image) can be created from artwork as a building block for a custom pattern. You also can create custom patterns by clicking pixels on or off in the Patterns dialog box.

Transformations such as rotating (including free rotation), stretching for perspective drawing, slanting, distorting, and edge tracing can be done automatically, and cast members (elements such as artwork) can be created for each intermediate step so that the transformation can be set up as an animated sequence.

When you import a PICT image into Director, you can use the color palette (stored with the image), or you can remap a stored palette to the system palette of 256 available colors (in 8-bit color). Imported palettes can be defined by name, and every frame of animation can have a different palette. You can blend colors within a palette to create a smooth color transition, reverse the order of colors in a palette (creating a negative image), and sort colors by hue, saturation, and brightness.

The extensive transformation and painting tools in Director are designed for creating a sequence of frames for animation. Some artists prefer to work entirely within Director, which can accept scanned images and PICT and Scrapbook files, as well as sounds from popular digitizers. Because Director is used mostly for preparing animated and interactive presentations, those features are described in more detail in Chapters 7 and 11.

Many of the techniques of gray-scale image processing also apply to 24-bit color image processing. Adobe Photoshop, a 24-bit color image retouching and painting program, offers an anti-aliasing brush for softening the edges of objects and text characters, which is especially useful for text used in video presentations. The program also offers a rubber stamp tool for cloning a part of an image. Any part of an image can be a brush, and you can rotate, stretch, distort, skew, and invert parts of an image.

Photoshop processes 24-bit images and uses the remaining 8 bits (not defined by Apple) for creating masks. Selections can be added or subtracted from masks, and edges can be feathered so that they are softer. The program can convert 24-bit images to 8-bit, 4-bit, and 2-bit images, and vice-versa. The program also offers automatic traps for overlapping the borders of colors (to avoid white lines between them) when making color separations for printing. Photoshop can import TIFF, PICT2, PixelPaint, Targa, Amiga IFF, and Scitex image files and export all of these formats, plus EPS with PICT preview image for display purposes.
Photorealism in color displays will soon become the norm as new hardware for screen displays is developed. At this point, 24-bit and 32-bit Color QuickDraw add-on adapters and software are used mostly for preparing color separations of color halftones for printing (as described in Chapter 9). Color graphics that are not continuous-tone images can be created (or traced from scanned images) and then separated for printing by using color drawing programs.

**Comparing Drawing Programs**

Drawing programs give you precise tools for drawing geometric shapes and curves. Artists may find the drawing tools harder to learn than the painting tools, but learning these tools is well worth the effort because they can be used to draw commercial artwork and illustrations with no compromise in quality. They also can be used to trace scanned images, to create graphic effects with text, and to create three-dimensional graphics.

Drawing programs define shapes as objects that are distinct and separated from other pieces of the illustration. A shape such as an open-ended curve can be an object just as a closed shape is an object. Objects can be copied from one drawing to another and treated as separate pieces. Lines can be drawn straight, and curves can be precisely angled, requiring little artistic skill to drag a mouse. The program, however, is designed for professional illustrators who understand how these tools can be used to produce high-quality art and graphics.

MacDraw II (Claris), Aldus FreeHand, and Adobe Illustrator 88 are examples of drawing programs. Illustrator, FreeHand, and Claris CAD are designed for professional illustrators, and offer free-style drawing and precise drawing tools. Illustrator also offers a method for manually tracing a scanned image on-screen. MacDraw II is designed for a more general user but offers easy-to-learn tools for amateur architectural drawing. Claris CAD is designed for professional architects, engineers, and designers who specialize in computer-aided design. With these tools, the Macintosh can be turned into a professional tool for commercial artwork and illustrations in publishing and multimedia projects and for three-dimensional models, architectural drawings, and engineering designs.

**Professional Drawing and Illustrating**

The two basic types of drawing programs are ones that use QuickDraw algorithms to define drawn objects and ones that use PostScript. Nearly every type of application
can be served by both types of drawing programs; PostScript graphics can be printed on high-resolution PostScript devices but not on QuickDraw devices, and QuickDraw graphics can be printed on both but first must be converted to PostScript for PostScript devices. QuickDraw is converted to PostScript on the fly by the LaserPrep software supplied with the LaserWriter II printer driver. Chapter 9 discusses printer options in more detail.

Generally, QuickDraw drawing programs, such as MacDraw II, are designed for making slides and multimedia presentations, and PostScript drawing programs, such as Adobe Illustrator, are designed for print applications. In practice, both types of programs are used for both types of applications, because most of their features overlap. Three-dimensional graphics programs draw objects and are, for the most part, QuickDraw programs.

If you need to use PostScript devices, especially typesetters and imagesetters, use a PostScript drawing program for best results. QuickDraw drawing is best for display-oriented presentations and film recorders. If you do both, try a PostScript drawing program and copy the results through the Scrapbook to create PICT files for QuickDraw devices. PostScript drawing programs also can import PICT files from QuickDraw graphics programs.

One of the most popular QuickDraw programs is MacDraw II (Claris), the successor to the first Macintosh drawing program. MacDraw II creates graphic objects and text that can be printed at high resolutions. Objects can be scaled independently, re-shaped, grouped together with other objects, and moved and copied without affecting other areas of a drawing.

MacDraw creates layers in a drawing that can be manipulated separately (up to 500 layers with 1 megabyte RAM). Objects can be stored in libraries and retrieved when needed for a drawing. Text and drawn objects can be rotated in one-degree increments, and objects can have custom patterns. The program gives you the ability to assign colors to objects, text, and patterns.

SuperPaint 2.0 (Silicon Beach Software) has all of the features of MacPaint and most of MacDraw’s features. SuperPaint holds drawn objects on one level and painted bit maps on another, and you can overlay images with transparency or opaqueness. The LaserBits function enables you to edit enlarged areas of a bit map at 300 dpi; the edited areas become LaserBit objects that can be moved anywhere on the page and copied to other documents. Unlike other painting programs, SuperPaint’s text is printed with PostScript fonts substituted for the screen fonts, and the program offers 32 gray-scale patterns that take full advantage of the LaserWriter. SuperPaint can freely rotate text and graphic objects to any degree by dragging the mouse, and automa-
cally trace painted images to create line art in the drawing layer. The program also supports the use of color.

SuperPaint, like MacDraw, creates PICT files for black-and-white graphics. MacDraw II can create PICT2 files containing color information and can be scaled into higher resolutions for specific devices such as the Mirus Filmprinter, a film recorder for creating slides (described in Chapter 7).

The curve drawing tools of PostScript drawing programs, such as Adobe Illustrator and Aldus Freehand, can create *Bezier* curves which have control points and direction tangents that can be moved to precisely alter the shapes of the curves. Bezier curves are described by algorithm rather than by a specific number of dots, so that the curves and all other shapes based on them are independent of any resolution.

Illustrator and FreeHand enable you to draw curves by specifying a starting point and dragging in the direction of the curve. The pen tool does not draw lines—you use this tool to establish points for the program to draw with precision the line or curve segment used to connect the points. The process of drawing with the pen tool is more like a connect-the-dots puzzle. You can switch from the pen tool to the selection tool to move the points, lines, and direction pointers to change the shape of a curve and switch back to the pen and continue establishing more points. This technique can be mastered until it becomes second nature; people who are proficient can build smooth curves much faster in this manner than by drawing them with an ordinary pen on paper.

Both programs also offer free-style drawing tools that create a line or curve based on the actual movement of the mouse—you draw with the mouse as if it were a pencil or paintbrush, even though the shape of the mouse makes drawing with precision difficult (it's like drawing with a brick). Both programs enable you to adjust the freehand tool to be less sensitive to variations in your hand movement so that sketching with a mouse can be a more natural activity.

In PostScript drawing programs, such as Adobe Illustrator and Aldus Freehand, a graphic object consists of points and segments (lines or curves) connected in a *path*. A path can be one line, curve, or shape, such as a circle or rectangle, or a combination of lines, curves, and shapes. You select an entire path to perform many operations, such as resizing or rotating an object.

Adobe Illustrator offers a unique blending tool that helps you blend one shape into another—you can click the starting and ending points and specify the number of *steps*, or specific shapes, that the program should create between the starting and ending shapes (see fig. 4.8).
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Fig. 4.8. Using Adobe Illustrator to automatically create steps of blended shapes between two distinct shapes.

Illustrator also is an excellent tool for engineering and technical line art because you can draw and scale a complex graphic to any size and preserve the line weights (the lines do not get thicker when you resize the image to be larger). This feature is important for technical illustrations and architectural drawings in which line weights must be preserved regardless of the size of the printed drawing.

Anyone can become a quick map maker with drawing programs. For example, we used Aldus FreeHand to create a series of maps describing the best driving routes from San Francisco to the Mendocino coast (see fig. 4.9). FreeHand also is used by San Francisco Examiner artists and by other newspapers for various charts, graphs, and the weather map. Maps or portions of maps can be re-used for other purposes, and patterns (for example, rain and snow patterns) can be overlaid on top of a copy of the map to produce a different weather chart for each day. The benefit of using a drawing program rather than manual methods is that after a map of an area is drawn, the map never has to be drawn again—it can be scaled to any size and re-used by itself or as part of another map.

Color illustrations are created with drawing programs that offer color features. For example, Adobe Illustrator enables you to assign paths to have a percentage of black (gray) along with a percentage of each of the process colors (cyan, yellow, magenta), a specific Pantone Matching System (PMS) color, or a custom mix of process colors.
Fig. 4.9. We used Aldus FreeHand, another drawing program, to draw a series of maps in which each road, building, symbol, and so on is a separate movable object that can be copied and pasted into other maps. With FreeHand, we were able to rotate type in any angle and bind type to an irregularly shaped path.
Tracing Images

With FreeHand or Illustrator, you can trace lines, curves, and shapes using a rough image as a guide (a template). You also can draw without using a template for guidance and trace only parts of a template image.

You also can automatically turn a scanned image into a series of curves without drawing. For example, Illustrator automatically can trace a scanned image brought in as a template, so that you can start with shapes already drawn.

To make a template for tracing, you can sketch the rough image on paper and use an inexpensive desktop scanner to scan the image. For example, artist and designer Suzanne Watzman (Watzman Keyes Information Design) scanned a photo of a teapot and traced the scanned photo in Illustrator (see fig. 4.10) for use with a brochure and a multimedia presentation about the Boston SIGGRAPH computer graphics show. (The teapot logo symbolizes Boston and computer industry graphics.) The teapot was rendered half as a wire-frame object (an abstract rendition of lines and curves) and half as a solid model (solid colors or textures, with stroked lines and curves) to show the evolution of computer graphics. The teapot logo then was used on all the conference materials. Illustrator offers a Preview Illustration view that shows the solid model, and a regular view that shows only the wire-frame objects, so that you can adjust the lines and curves. The program enables you to see both views at the same time, side by side.

Because Illustrator also is a PostScript drawing program, you automatically can trace individual shapes of the scanned line art and then finish drawing the rest of the art with the same program.

Digital Darkroom, a gray-scale image retouching program, automatically can trace shapes in a scanned gray-scale image, creating bezier curves that can be edited with SuperPaint's drawing tools or with a PostScript drawing program. Digital Darkroom cannot change the bezier curves.

By converting scanned line art or images to PostScript, you can set the image free of its previous resolution. Curves can be made smoother; lines can be made finer and straight; and entire shapes can be scaled to any size without distortion. Then the image can be printed at the best possible resolution of the PostScript output device.

Publishers want to scan and trace line art because they already have invested time and money in original images. Converting an image of dots (such as a continuous
Fig. 4.10. Using Adobe Illustrator, a PostScript drawing program, to trace over a scanned image and create a resolution-independent graphic image. (Courtesy of Watzman Keyes Information Design)
tone image or a photograph) into smooth lines and curves described by algorithms, however, is still too hard to do without human intervention and editing.

Simple line art and black or solid-filled shapes usually can be traced without any image preparation, although you probably want to use the erasing tool of a painting or image editing program to erase scanner artifacts before tracing (artifacts are small imperfections from dust, scratches, or inherent flaws).

Tracing, however, is not so easy with gray-scale images of low contrast. In Digital Darkroom, you can adjust contrast and brightness and use a bit-map eraser before tracing the image. You also can use special effects such as posterization to reduce the number of gray scale levels if the shape's edges are too ambiguous.

Illustrator and Digital Darkroom offer ways to constrain the tracing so that less bumps occur in the outline (more bumps mean more curve segments, increasing the complexity of the image). You can increase or decrease the number of points in the shape, and the program retracts with the new settings. The smoother the curves, the easier reshaping them is when using a PostScript drawing program. The goal is to have the least number of points to define the shape.

Digital Darkroom can save the outline in EPS format, so that the outline can be brought into any PostScript drawing program (such as Illustrator or FreeHand). Illustrator provides sophisticated tools for adjusting points and curves, and you can sometimes drag a point over another point to join them to further reduce the number of points for defining a shape. A PostScript drawing program helps clean up the shapes and make the drawing more efficient for storage and production.

Because the process of tracing images can be time-consuming, Adobe Systems invented a utility program called Streamline that automatically traces a batch of images, without your intervention, so that you can go to lunch or have the operation performed overnight. Scanned images and painted graphics can be converted into Adobe Illustrator files or exported to other programs as PostScript artwork.

So far, none of these programs can make judgements that the human eye would routinely make when tracing, such as recognizing a complete circle or an object that is touching another object. Too many curves can be created if the image has a lot of black or gray spots, or white gaps that break up a shape into many shapes. In most cases, you want to reshape the outlines after the automatic tracing process is completed, no matter which program you use to trace the image.
Creating Graphic Effects with Text

One of the nice features of PostScript fonts is the ability to transform characters using PostScript drawing programs and still get high-resolution fonts when printing on high-resolution devices. You can distort bit-mapped fonts in painting programs, but those fonts remain fixed to the resolution of the display. When you distort PostScript outline fonts, you are actually transforming a PostScript object that retains its fill pattern, stroke width, and resolution independence.

Adobe Illustrator and Aldus FreeHand can be used to transform letters to make special headlines, logos, advertising copy, and decorative type of all sorts. FreeHand is better for text effects because the program can bind text to an arbitrary path—the type's baseline follows the shape of the path (the baseline is an imaginary horizontal line for aligning the characters).

TypeStyler (Brøderbund) is a type manipulation program that can arrange type along a path or in any shape, and apply different styles, using any Type 3 PostScript font as well as the 10 Agfa Compugraphic fonts supplied with the program. (TypeStyler does not manipulate Adobe Type 1 fonts.) The program is useful in a variety of desktop publishing and multimedia projects for designing logos, headlines, labels, signs, and fancy lettering. The results can be output directly to a PostScript printer or typesetter or saved in Encapsulated PostScript, PICT, or MacPaint formats.

TypeStyler creates two kinds of objects: type and panels. Type objects contain text, font, shape, and styling information, including color and pattern selections. Panels are used as backdrops and come in different shapes, such as stars, circles, and various polygons, and can contain color and pattern information. The program is supplied with 35 predefined shapes and 35 styles for panels and type, and you can add 35 more custom shapes to the list.

The shaper tool in TypeStyler can distort characters around arcs and circles, and between lines and bezier curves. You can independently manipulate line control points that form a shape or move top and bottom points simultaneously as if they were linked (see fig. 4.11).

TypeStyler graphics can be copied to the Clipboard and pasted into other applications. The program copies the PICT representation as well as the embedded PostScript necessary to print the image to a PostScript printer. You can paste to and print TypeStyler graphics from applications that do not otherwise import EPS (Encapsulated PostScript) graphics.
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Fig. 4.11. Using TypeStyler to reshape a type object with endpoints linked so that they move at the same time with a mirror effect.

A variety of third-party PostScript Type 3 fonts can be used with TypeStyler, including any font created using Fontographer, described in Chapter 2. TypeStyler does not support stroked fonts (fonts with open paths that can’t be filled).

If you really want to get fancy, LetraSet offers the Electronic Type Library of over 100 typefaces from LetraSet’s catalog of decorative faces, and LetraStudio, a type, logo, and headline designing program. A designer can use LetraStudio to place characters on a page with considerably more freedom to resize and rotate characters and change their shape and spacing than with any other program. The result can be saved in an Encapsulated PostScript file for use with Adobe Illustrator, Aldus FreeHand, or other PostScript drawing programs, as well as with page makeup programs.

LetraStudio offers special effects such as coloring, outlining, and precise kerning (reducing or expanding the space between two letters). The program can create drop-shadows, optical distortions (chosen from a sample palette of effects), curved baselines, and three-dimensional effects. Type forms are treated as graphic objects that can be scaled, stretched, italicized, duplicated, or manipulated by moving handles for
changing their shapes. The program enables you to color objects with specific
Pantone colors or percentages of process colors and produces color separations as
well as Encapsulated PostScript files. You can use LetraStudio graphics with
ImageStudio, combine them with scanned images, or use image processing tech-
niques (softening, diffusion, airbrush effects, and so on).

You also can use a scanned image, paint file, or PICT file as a background template
for tracing in LetraStudio. The rotation tool works on baselines and graphic objects
and is similar to Adobe Illustrator's rotate tool. LetraStudio includes a tool similar to
Adobe Illustrator's zoom tool for magnifying or reducing the view. The LetraStudio
line, arc, curve, rectangle/square, and circle/ellipse drawing tools are similar to
MacDraw tools.

With LetraStudio, an artist can work directly with the baseline and with each charac-
ter, adjusting its position, size, and shape, and rotating and slanting individual
characters. You can create a new baseline for specific characters, reverse characters
into mirror images, flip characters upside down, and move the baseline in any
direction to stretch or squeeze letter spacing. Baselines can be angled, changed into a
bezier curve, or changed into a circle or ellipse. A distortion tool provides straight-
line and curvilinear distortion of characters, including shears, stretches, proportional
scaling, flip-overs, and perspective effects. You also can distort text to look inflated,
deflated, curved to one side, and suspended in an arch.

LetraStudio is rich in the features that are not found in Adobe Illustrator or Aldus
FreeHand, which makes LetraStudio the perfect complement to these programs.
TypeStyler has more of a mass-market appeal with its canned effects, whereas
LetraStudio appeals directly to graphic artists familiar with Adobe Illustrator and Aldus
FreeHand. You can directly manipulate characters more freely in LetraStudio, which
enables you to work directly with the baseline and with each character. TypeStyler
provides more automatic results. Both programs can be used to create three-dimen-
sional text with special effects. However, to create three-dimensional graphics that
have far more detail, use a three-dimensional drawing program.

Creating 3-D Graphics

The two-dimensional images we have described so far are all that is needed in the world of
printing, but the new media for presentations and simulations—slides, videotape, and the
computer screen itself—can simulate a three-dimensional world over time. You can show
all sides of a three-dimensional object. 3-D modeling programs such as Paracomps
Swivel 3D or Silicon Beach Software's Super 3D are useful at the conceptual stage of engineering design and concept development, and also can be used in Computer-Aided Design (CAD) presentations. The output of these programs then can be rendered with textures, surfaces, one or more light sources, and shadow effects, using a rendering program such as MacroMind Three-D or Pixar's Renderman.

Swivel 3D and Super 3D provide superb three-dimensional drawing capabilities. Swivel 3D's Hidden Line feature enables you to only show lines on the front surfaces (see fig. 4.12). Swivel 3D offers an incremental animation feature called "tweening" in which you define the starting and stopping points of the animation sequence, and the program creates the intermediate steps. You then can transfer the entire sequence to MacroMind Director for inclusion in an animated presentation. Swivel 3D images can be saved in PICT (draw-type) or MacPaint (paint-type) formats and transferred via the Clipboard and scrapbook files to other applications.

Brad Pettit of Channel 6, KHQ-TV in Spokane, Washington, used Super 3D from Silicon Beach Software to create a commercial logo using bevelled surfaces (see fig. 4.13). Super 3D can display models in wire frame or solid view (with or without

![Fig. 4.12. Swivel 3D's Hidden Line feature enables you to only show lines on the front surfaces of three-dimensional objects.](image)
perspective), and the program offers an automatic view of all four sides. Objects are drawn in two dimensions using familiar drawing tools, and then transformed into 3-D objects with automatic commands. Super 3D offers "spin wheels" for rotating objects, entire models, or the "camera" (viewpoint) in all three dimensions around their respective centers. The "camera" can zoom in and out or be moved in any direction, and shading can be modified by placing up to four "light sources" and controlling their intensities. The program displays up to 16,000 simultaneous colors and provides speed advantages when used with the 68881 math co-processor (standard on all Macintosh II and SE/30 models).

Super 3D may be the easiest to learn how to use, but Swivel 3D has extra rendering capabilities including anti-aliasing for smoothing jagged edges, and the capability to have objects cast shadows on other objects. You can import 256-color painted images and apply the contents of the Clipboard to a surface.

Although some painting and drawing programs offer 3-D effects, the information stored for such graphics does not represent an object in three dimensions. True 3-D
objects can be transformed with a change in the viewing orientation, so that you can see sides of an object that were hidden. When displaying solids, 3-D modeling programs can hide areas that are underneath or behind areas rendered opaque. As an artist you are working in a three-dimensional world, defining an object that exists somewhere in a space defined by x, y, and z coordinates.

What can you do with these models? Some programs, such as Swivel 3D and Super 3D, offer animation features that enable you to move objects, light sources, and so on. You can record the movements as a sequence and export the sequence to an animation program such as MacroMind Director. You also can take an electronic “snapshot” of a perspective and export the snapshot to a presentation program to create a slide, to a graphics program for further retouching, or to a page makeup program for use on a page.

Three-dimensional modeling programs are not only useful in the creative process for designing models—they can be useful for preparing models to be rendered as final artwork. For prototype-quality rendering, you can import the 3-D model into MacroMind Three-D, adjust light sources, and create textures for the surfaces. For professional film-quality rendering, you can use Renderman from Pixar, a program that encodes 3-D graphics with an industry-standard rendering language that provides resolution-independent rendering.

The production of high-quality 3-D images can be enhanced by the use of a desktop color slide scanner or paper scanner. The texture and image used on each surface can be created on the computer in a painting program, or they can be created from scanned images, fabrics, photographs, and rough drawings.

Reviewing Scanners and Digitizers

Scanners can be useful for many different graphics applications. With a simple black-and-white scanner, you can scan hand-drawn illustrations for automatic or manual tracing with a drawing program. With gray-scale scanners you can scan photographs for use with desktop publishing software and create halftones for printing. An advertising firm (Jordan McGrath Case & Taylor) routinely scans pencil sketches for use in HyperCard stacks that are mock-ups of TV commercials (see fig. 4.14). Even in conventional publishing production settings, a desktop scanner with page layout software can be used to position elements on the page for roughs and mock-ups to aid in the creative process.
Fig. 4.14. Jordan McGrath Case & Taylor use an Apple Scanner and HyperScan software to create images for TV commercial mockups done in HyperCard.

One not-so-obvious use of a desktop scanner is to scan patterns on fabrics for use as backgrounds and textures for graphics, especially for rendering 3-D images. For example, multimedia artist Stuart Sharpe scanned different fabrics and merged them in ImageStudio (using Copy and Paste commands) to get patterns for a multimedia presentation (see fig. 4.15).

Color scanners can be useful for capturing textures and designs from fabrics—clothing designers now use them to prepare pattern examples for printing on color printers. Luca Pozzato, one of the principal designers for Benetton (an international knitwear and clothing design house in Milan, Italy), designs from scratch in Aldus FreeHand or scans and traces the image. He then prints the image, in color, on the QMS ColorScript color laser printer. Pozzato says that the color capabilities are the key to success with clothing design.

Desktop scanners can be used to capture photos for retouching. Previously reserved for the graphic arts studios, the tools of airbrushing and retouching photographs are available in ImageStudio and Digital Darkroom—all you need is the raw image and a scanner. Multimedia artists scan images and graphics in black and white, and then colorize them in programs such as PixelPaint and MacroMind Director for use in publications and presentations.
Most desktop scanners are connected to the Macintosh through the SCSI (Small Computer System Interface) port. The benefit of using the SCSI port is that up to seven different types of SCSI devices, such as hard disks, scanners, printers, and backup devices—can be connected to one Macintosh through the SCSI port by setting up a chain of SCSI devices connected to each other. Video digitizers such as the MacVision connect through the modem or printer port. Video frame grabbers, such as Personal Vision from Orange Micro, are on adapter cards that plug directly into a NuBus slot on any Macintosh II model.

Scanners range in price from less than $500 for hand scanners and scanners that attach to printers, to over $5,000 for desktop color scanners and higher resolution scanners mounted on tripods. In the middle range are desktop scanners that can sense black and white only, or up to 256 gray scales. Flat-bed scanners are best for scanning black and white or gray images for graphics applications. Flat-bed scanners can scan a variety of items including irregular-sized pages, magazine pages, book pages, maps, fabrics, and objects. Flat-bed color scanners are designed the same way, to accept any type of object on top of its platen. A slide scanner such as the BarneyScan CIS 3515 (BarneyScan Corp.) provides the best results with color photographs.
Gray-Scale Scanners

Gray-scale scanners can sense from four to eight bits per pixel of gray-scale information, resulting in 16 to 256 levels of gray. For example, the Apple Scanner can sense four bits, or 16 gray levels, which is sufficient for most applications. For preparing images for printing high-quality halftones on imagesetters, you need at least an 8-bit (256-level) gray-scale scanner, such as the Xerox Imaging Systems Datacopy Model 70 or the Microtek MSF-300G. Most scanners can create image files with 300 dots-per-inch resolution (or less), and faithfully can reproduce the grays or modify them to create black-and-white line art.

All gray-scale scanners can be set to scan black-and-white images without grays (called "line art"), and some can effectively change gray-scale information into a series of black and white dots (a process called dithering) that can simulate gray shades without using gray dots. You can use a Macintosh Plus or SE (which does not offer gray-scale display capability), therefore, with a gray-scale scanner and see dithered versions of the gray-scale images. You also can save dithered versions for use in applications such as HyperCard (see fig. 4.16).

![Image](image_url)

Fig. 4.16. The difference between a gray-scale continuous tone image (after converting from 300 dots per inch and 256 levels of gray to a halftone for printing at 2540 dots per inch) and a dithered image (limited to 300 dots per inch but also printed at 2540 dots per inch).
Although gray-scale scanners are generally better for handling the variety of scans required for desktop media applications, you can use less expensive scanners that cannot sense gray scale, or hand scanners, to scan line art and images for use in drawing programs for tracing, or in mockups, in HyperCard stacks, as "for position only" stand-ins for halftones, and in other applications in which gray scale is not necessary.

Hand Scanners

The ScanMan 32 (Logitech) is a hand-held scanner that attaches directly to the 25-pin SCSI port of a Macintosh. Operation of the device is simple, and ScanMan can sense gray scale (you can edit the gray shades in ImageStudio or Digital Darkroom). LightningScan (ThunderWare) is similar in operation but more flexible in SCSI installation (sans built-in terminator) and can save a gray-scale image with 16 levels of gray, as well as a dithered image.

Hand scanners can be carried into libraries for scanning graphics or passages of text, into laboratories to scan the results of experiments and graphs, or onto the factory floor to scan drawings, parts lists, and specifications. However, hand-held scanners require you to have a steady hand when scanning, and to be able to pull straight as you drag the scanner over the piece of paper or flat object (such as a magazine or book). If you move your hand too fast, you may cause streaks in the image and shortened sections of line art; if you move your hand too slow, the image may not be aligned properly.

Color Scanners

Color scanners are more expensive and highly sensitive; some can sense up to 24 bits of color information (more than 16.7 million different colors) at 300 dots-per-inch resolution. The Howtek Scannmaster color scanner has a glass platen for placing color pages, and the scanner comes with software that can reduce the image to 8-bit color (through a dithering process) or saves the image in full 24-bit color.

The Barneyscan color slide scanner is an electro-optical device that digitizes a 35mm slide and saves the image in various formats, including PixelPaint and TIFF. The Barneyscan uses a six-element color-corrected lens capable of 2000 lines per inch (at 80 percent contrast). Color-correcting software is supplied, and you can change the resolution of a scanned image to match output devices. If you're making color separations, scanning a slide or film transparency is better than scanning a paper-printed color image (reflective artwork).
Video Digitizers

Devices that convert video signals from video cameras into digital still images are often called digitizers or frame grabbers. Video digitizers can be connected directly to a video source, such as a VCR, or to a video camera. The MacVision (Koala Technologies) is an example of an inexpensive gray-scale video digitizer that takes a few seconds to complete a scan. For best results, this scanner requires a steady video camera, a freeze-frame function in a videodisc player, or a still image camera. We've used the scanner with a VCR set to pause, but the recorder must have a very steady pause to get anything other than a fuzzy image.

A frame grabber can digitize video faster, and can be used with a variety of video equipment. Stuart Sharpe used the Personal Vision full-color frame grabber (Orange Micro) with a hand-held video camera to capture several images in sequence of a woman turning her head (see fig. 4.17). A variety of full-color frame grabbers are available for Macintosh II models from RasterOps, SuperMac Technology, Mass Microsystems, and Computer Friends; some of these are described in Chapter 13.

Using Scanning Software

All gray-scale scanners are supplied with scanning software for controlling the brightness, contrast, and gray-scale map. Color scanners are supplied with similar controls for manipulating color information. You can use these tools to help compensate for lack of contrast or brightness in an image or to bring out or hide detail.

The Apple Scanner, for example, is supplied with the AppleScan program that can scan at different resolutions (up to 300 dpi) and different scan settings (gray-scale, halftone, and line art) and enables you to set the scanning area based on a preview scan. You even can scan an irregularly shaped area and leave out the rest.

AppleScan enables you to set the threshold level at which a gray shade is digitized as either black or white for a line-art scan. You also can change the contrast and brightness settings for continuous tone images. A high contrast emphasizes black and white, leaving few gray shades, and a low contrast emphasizes the middle gray shades. A high brightness makes an image lighter; a low brightness makes the image darker. AppleScan also provides an adaptive filter to convert gray-scale images into halftones without using traditional halftone patterns. Flesh tones in print and continu-
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Fig. 4.17. Several images in sequence of a woman turning her head were captured with the Orange Micro Personal Visionframe grabber by Stuart Sharpe for a presentation in MacroMind Director.

Oxous tone images used in display presentations on monochrome monitors sometimes look better with an adaptive filter rather than a halftone pattern.

Also supplied with the Apple Scanner is HyperScan, a HyperCard stack designed specifically for scanning images for display on-screen in multimedia presentations. HyperScan uses a unique contrast and brightness control—by moving the cursor to the left or right, you can decrease or increase the contrast; up or down increases or decreases brightness. The stack offers 30 dithering effects for displaying on-screen; diffusing provides the best results (see fig. 4.18)

ImageStudio and Digital Darkroom can be set up to scan images directly from an Apple Scanner into the program, and Studio/1 also offers this capability, so that in one step you can scan an image and perform retouching and gray-scale adjustments in the same program.

Gray-scale scanners can be set to scan line art or continuous tone images, and some can create halftones directly. Line art is an image that consists of black-and-white areas with no shades of gray, and is usually on paper. Continuous tone images (slides and 35mm prints) have shades of gray that blend into an almost continuous shade that varies without distinct separations.

Some scanner software (such as AppleScan) offers you the ability to convert the image to a halftone while bringing the image into the computer (a process similar to dithering). A halftone is an image prepared with tiny dots to give the illusion of continuous tones (halftones are described in Chapter 9). However, page makeup programs such as Aldus PageMaker offer controls for setting the line screen for halftoning images, and image editing programs such as ImageStudio enables you to modify the gray-scale information. If you are using either type of program, be sure to set the scanner software to do a gray-scale scan without dithering or halftoning, so that you can take advantage of the page makeup program's halftone settings. Otherwise your image is stuck in a dithered pattern that cannot be changed for different output devices.
Fig. 4.18. Using HyperScan to scan images with the diffusion halftone effect for on-screen presentations.
Getting the best scan of an image is often a trial-and-error process and requires some thought and preparation to get decent results. Nothing looks worse than a photo or scanned image that is too black or muddy. Use an original that is the same size or larger than the size you want the image to be on the page, because if you enlarge the image, you may make it more jagged (because you are decreasing the resolution by enlarging the image). When using slow-moving camera-based scanners such as Koala Technologies' MacVision, be sure the image and the camera are not moving or shaking while scanning.

Unless you are creating a special effect, do not scan an image that already has been printed as a halftone. When you run a halftone through the halftoning process again, you are overlaying dots upon dots which can cause a moiré effect (a wavy pattern caused by the repetition of a pattern on top of another pattern).

**Chapter Summary**

Paint-type images are created from individual dots that correspond to screen pixels. Such images are limited in resolution to the display or scanner that created them. Drawn images, on the other hand, consist of a series of drawing commands that describe the image and usually are not limited to the resolution of the screen.

Painting programs, such as MacPaint, are popular with free-style painting and amateur artwork. Drawing programs, such as MacDraw II, are popular with commercial artists, designers, architects, and engineers. Both types of programs are popular with desktop publishers, who use draw-type programs for logos, line drawings, business charts, graphs, and schematics, and use painting programs to create intricate designs and free-style artwork as well as edit gray-scale and color images.

Although gray-scale and color continuous tone images are paint-type graphics tied to the resolution of the scanner, they carry information about gray scales and colors, and programs can simulate grays and colors on high-resolution devices and obtain excellent results. To print a gray-scale continuous tone image, the software converts gray pixels into halftone cells that can be printed on devices that use black dots.

Continuous tone color images scanned at full 24-bit quality look like photographs on-screen, but like any continuous tone image, they have to be converted into halftones.
if you intend to print them. In addition, the colors in an image must be separated (in a process called a color separation) so that the image can be output to separate films.

The PICT format is designed for transferring graphics from one Macintosh application to another and is fixed in resolution to the original device or program. This format defines graphic objects in a language called QuickDraw. PICT2 accommodates color and gray-scale information.

The Encapsulated PostScript (EPS) file format has emerged as a standard format for line art and graphics on many different types of computers. EPS graphics are described in the PostScript language and are independent of the resolution of the display. EPS can act as a super-format, carrying PostScript algorithms and a PICT version of the image for quick display operations.

In addition, a file format for scanned images called TIFF (Tag Image File Format) stores the gray-scale or color information of a continuous tone image and provides a standard format for image data across different computer systems.

Generally with scanned images, higher resolution (or more gray-scale or color information) means larger image files. Because larger files require more processing time, you need more powerful equipment to deal with rich color and gray-scale images.

The applications of painting programs include graphics for display or video animation, because resolution independence is not required and the computer can display these images faster. Excellent printed results also are possible with paint-type graphics, especially if the graphics consist of line art, which can be resized into almost any proportion and size and still look good. MacPaint (Claris) is one of several excellent painting programs that primarily paint in black and white. Studio/1 (Electronic Arts) is perhaps the most robust of the black-and-white painting programs.

Gray-scale images can be created by scanning photographs or by using a gray-scale painting and retouching program such as Letraset's ImageStudio and Silicon Beach Software's Digital Darkroom.

To create color artwork and to retouch scanned color images, you can choose between 8-bit color programs (offering 256 out of a possible 16.7 million colors in each document) and 24-bit color programs (offering all 16.7 million colors at the same time). PixelPaint (SuperMac Technology) and Studio/8 (Electronic Arts) are
examples of 8-bit programs; PhotoShop (Adobe Systems), PixelPaint Professional (SuperMac), MacroMind Director (MacroMind), and ColorStudio (Letteaset) are examples of 24-bit color programs that also can be used as 8-bit programs.

Drawing programs give you precise tools for drawing geometric shapes and curves. These programs define shapes as objects that are distinct and separated from other pieces of the entire illustration. Examples of drawing programs are MacDraw II (Claris), SuperPaint (Silicon Beach Software), Aldus FreeHand, and Adobe Illustrator 88. Claris CAD is designed for professional architects, engineers, and designers who specialize in computer-aided design. With these tools the Macintosh can be turned into a professional tool for commercial artwork and illustrations in publishing and multimedia projects as well as for three-dimensional models, architectural drawings, and engineering designs.

You can use two basic types of drawing programs: ones that use QuickDraw algorithms to define drawn objects, and ones that use PostScript. Nearly every type of application can be served by both types of drawing programs; the difference is that PostScript graphics can be printed on high-resolution PostScript devices but not on QuickDraw devices, whereas QuickDraw graphics can be printed on both but must first be converted to PostScript for PostScript devices.

With FreeHand or Illustrator you can trace lines, curves, and shapes using a rough image as a template. You also can draw freely without using a template for guidance and trace only parts of a template image. In addition, you can turn a scanned image into a series of curves without any need for drawing.

One of the nice features of PostScript fonts is the ability they give you to transform characters using PostScript drawing programs and still get high-resolution fonts when printing on high-resolution devices. Examples of type manipulation programs are TypeStyler (Broderbund) and LetraStudio (Letraset). You can directly manipulate characters more freely in LetraStudio, which enables you to work directly with the baseline and with each character. TypeStyler provides more automatic results.

3-D modeling programs such as ParacomP's Swivel 3D or Silicon Beach Software's Super 3D are useful at the conceptual stage of engineering design and concept development and can be used in Computer-Aided Design (CAD) presentations. The output of these programs then can be rendered with textures, surfaces, one or more light sources, and shadow effects, using a rendering program such as MacroMind Three-D or Pixar's Renderman.
Scanners can be useful for many different graphics applications. With a simple black-and-white scanner, you can scan hand-drawn illustrations for automatic or manual tracing with a drawing program. With gray-scale scanners, you can scan photographs for use with desktop publishing software and create halftones for printing. Color scanners can be useful for capturing textures and designs from fabrics, as well as color photos and illustrations.

Flat-bed scanners can scan a variety of things including irregular-sized pages, magazine pages, book pages, maps, fabrics, and objects. Flat-bed color scanners are designed the same way, to accept any type of object on top of its platen. A slide scanner such as the Barneyscan provides the best results for color photographs that have been converted to 35mm slides or color transparencies.

Devices that convert video signals from video cameras into digital still images are called digitizers or frame grabbers. Video digitizers can be connected directly to a video source, such as a VCR, or to a video camera. A frame grabber can digitize video faster and can be used with a variety of video equipment.

All gray-scale scanners are supplied with scanning software for controlling the brightness, contrast, and gray-scale map. Color scanners are supplied with similar controls for manipulating color information. You can use these tools to help compensate for lack of contrast or brightness in an image or to bring out or hide detail.

Now that you have learned how to create many different kinds of graphics files, you will discover that graphics files can quickly fill up your storage devices. In the next chapter, you learn why it is important to organize files and maintain regular backups of these files.
Sometimes it seems that the most time-consuming task in the preparation of publications and multimedia presentations is the copying of information from disk to disk, even though the actual time spent copying is a miniscule fraction of the time spent interacting with the computer and editing material. However, finding a specific piece of information in a disk brimming with data can take too long, especially for hard-working, deadline-pressured graphic artists and publishing professionals.

The problem is increased by the fragility of today’s on-line computer storage media. Hard disks are reliable while they are operating, as long as they are not shaken or otherwise physically disturbed, but if the hard disk does not start up because of some system malfunction or missed connection or because the disk controller has been zapped by a random electronic spike, that disk is out of commission. The amount of data you can recover is limited by the backup procedures you follow; typically, you can recover only what you already have backed up.

The problem of locating files in logical places on disks is related to the problem of backing up your disks. Both depend on forethought and planning, as well as consistent follow-up. You have to organize your *files*, which are units of information, so that you and others can find them. In addition, you have to be sure to keep up-to-date backups of every file.

This chapter introduces various file organizing tools and file searching utilities, and describes how backup procedures can be set up. The differences among the best types of information storage and backup devices, from hard disks and tape cartridges to the latest in optical disc technology are explained. The chapter ends with a discussion of digital versus analog storage methods for certain types of data. At the end of
this chapter, you will know which programs are useful for organizing and searching files, which programs are useful for keeping archives, and which hardware storage devices are best for your multimedia projects.

**Organizing and Searching Files**

Even if you cultivate excellent backup habits, you still may have a major problem trying to find what you need without spending too much time searching. Because you have so many graphics, word processing, and presentation programs available to assemble elements, you may end up with many files distributed on the disk in various locations for various projects. What if you need a piece of artwork from one project in another project?

Some programs are designed to hold all elements in a single document but still allow you to export each element to separate files for use in other projects or at least copy the element through the Clipboard to another application or to a Scrapbook file. For example, Aldus PageMaker stores a publication's graphics and text elements (except graphics larger than 64K in size) in the same file, and provides an Export command to export the text into word processing files.

MacroMind Director, an interactive multimedia presentation program, can store text, graphics, animated sequences, sounds, and still video images in a single multimedia document. The program also enables you to export all these elements to separate files. Director also keeps track of every element by assigning a "cast member" identifier (see fig. 5.1), and you can browse through the cast and refer directly to members in the script of a presentation (a script controls the action in an interactive presentation, much like a movie script).

You may choose to store the "source" files that contain the original elements, as well as the resulting publications and presentations that use the elements; or you may just store the publications and presentations and throw out the source files because you always can recreate the source files by exporting the elements.

Your solution to management can be as simple as sets of files and folders and an extra backup hard disk for every hard disk in use (or sets of floppy disks for backups). The
We will begin with a successful ozone molecule and a nitrogen monoxide molecule.

\[ \text{NO} + \text{O}_3 \rightarrow \]

Fig. 5.1. MacroMind Director offers a table of information slots, called the *cast*, that can hold all of the elements (text, graphics, sounds, animated clips, images, and so on), called *cast members*, in one multimedia document rather than in separate files.

solution also can be as complex as using removable cartridges and instituting backup procedures for everyone on a network and maintaining image and text archives on optical media. But you’re in luck; the Macintosh platform has software to handle nearly every management problem.

**Using Scrapbooks**

The Cut, Copy, and Paste commands (found in the Edit menu of most Macintosh applications) enable you to transfer text and graphics within an application and from one application to another. These commands transfer information into the Clipboard, a file reserved in the System Folder for these operations.
From the Clipboard, information can be Pasted into another application or into the Scrapbook file—another reserved file in the System Folder, but this one is designed to accept as many pieces of information as you want. You can open the Scrapbook by selecting it in the list of desk accessories. The Scrapbook numbers each piece sequentially and presents you with a scroll bar to navigate through the pieces.

A better “scrapbook” desk accessory, designed to replace Scrapbook, is SmartScrap from Solutions, Inc. SmartScrap enables you to open and save individually named Scrapbook files and copy part of a Scrapbook page to the Clipboard. Included with SmartScrap is The Clipper, which can crop and scale graphics stored in the Clipboard before pasting the graphics into an application. The Clipper can be very useful if you are pasting graphics into word processing files.

We use SmartScrap to organize MacPaint graphics, PICT graphics from drawing programs, and snippets of text (such as copyright notices and other repeated items). Each Scrapbook file has a name that readily identifies its contents (such as “Icon Scraps” for our file of icons and symbols). We also use MacroMind’s ArtGrabber II desk accessory to browse a variety of clip art libraries (PICT and MacPaint formats) and select pieces of artwork. ArtGrabber II and SmartScrap together provide the rudiments of a graphical database.

When preparing graphics for animation, you can capture an image of the screen with a utility such as Mainstay’s Capture—press the Print Screen button, and Capture displays a crosshair for dragging across the screen and selecting an area to copy. Capture then places an exact copy of the entire screen or the selected area into the Clipboard, where you can Paste the selection into a Scrapbook file or application.

Another utility that performs this function is the Screen Capture Fkey supplied with MacroMind Director. This function key utility is easy to use and works like Capture, but the utility also can save a collection of captured images in a Scrapbook file you can browse with Art Grabber II.

When you use Command-Shift-3 to capture a screen image on a Macintosh Plus or SE or use various utilities (such as Capture) on a Macintosh II model, the captured screens are stored in numbered files (Screen 0, Screen 1, Screen 2, and so on, or Picture 0, Picture 1, Picture 2, and so on). However, some utilities store these files in different places (such as the current folder, the System folder, or the application’s folder). If you need to capture many screens, you run the risk of overwriting some files if you try to bring them all into one folder before renaming them.
Combining the operation of a capture utility such as Capture with a disk file rename and move operation using a utility such as DiskTop, therefore, can be useful. DiskTop is described later in this section. You alternatively may want to store these screen images in an artwork library or archive using a program such as Curator.

**Using Curator**

The Curator (Solutions, Inc.) is an art management system that can help you find a graphic image on disk without any need for reorganizing your image files. You can select any image from thumbnail sketches of each image in a folder, regardless of the file format. You also can search an entire disk for an image using keywords associated with the image, or using part of the image file's name.

The Curator can convert graphics from their original formats to other standard Macintosh formats, so that image editing can be performed with a wider variety of programs. For example, The Curator can convert a scanned image in TIFF (Tag Image File Format) to PICT or MacPaint format or an Encapsulated PostScript format (EPSF) file to TIFF or PICT.

You can associate unique keywords or phrases with each art document or one keyword or phrase for all documents in a folder. You then can use Curator to search for artwork using those keywords or phrases. The alternative would be to look for a specific artwork file and run the application program that created the artwork to see whether that artwork file is the right one. Curator saves a great deal of time by enabling you to search by keywords and displaying the artwork as you find it.

The Curator also recognizes keywords assigned to clip art by clip art vendors. You can assign keywords and phrases while browsing or use the supplied utility, The Curator’s Assistant, to catalog a large number of files at the same time. The Curator’s Assistant creates thumbnails for all artwork found in a hard disk volume, updating the Curator Catalog for that volume to include new documents and their keywords or phrases.

The Curator is supplied as two programs—a desk accessory, and an application compatible with MultiFinder—so that you can find artwork while using another application. The program shows the date the artwork was created and the date of the last modification, so that you don’t have to go back to the Finder to find this information.
Using File Search Utilities

To search for a piece of artwork in a disk filled with artwork can sometimes seem like opening a can of worms. After you get started, you can't help but try to look at numerous works of art before finding the right art and the right version. In these situations, ArtGrabber II and SmartScrap are a bit clumsy because they require too many steps and they have no search-for-caption capabilities, but CanOpener (Abbott Systems) can be handy. CanOpener helps you organize your artwork—which may be arranged in files in a variety of different formats—and enables you to add resources such as sounds and icons to other files. In certain cases, CanOpener also can retrieve data from corrupted files.

As a desk accessory or as an application under MultiFinder, CanOpener enables you to browse other files without leaving your application and transfer graphics, text, and sound from one application to another. The program also enables you to build libraries of frequently used text, graphics, and sounds (see fig. 5.2). You can search for and extract text stored in graphics files (such as chart legends, captions, PostScript code, and so on), and extract icons and sounds stored as resources. You also can install such resources in other files.

CanOpener functions like a scrapbook but can hold entire files and objects from files in its “libraries.” CanOpener can search for files containing a word or phrase and can open any file and examine its data and resource forks to extract information. The information can be stored in a library file (you can have many libraries) and copied to other applications and displayed without the need for the original application.

For searching text, GOfer (Microlytics) is a desk accessory that can find one or more words or phrases in a file, including text stored in any word processor-created files, in publication files of page makeup programs, in HyperCard files, and in MORE II (Symantec) outlines. The utility can search while you continue to use your application, whether or not you are using MultiFinder.

GOfer enables you to specify any type of search using and, or, not, and nearby operatives, which are called boolean searches. For example, you can search for “multimedia” and “Macintosh” or “Apple” nearby “MacroMind” and find only those files that contain the words “multimedia” and “Macintosh” or “Apple,” but only if they are used in context nearby the word “MacroMind.”

GOfer displays the text you are searching for in context and provides a Copy command to transfer text to the Clipboard so that you can Paste the text into any application. GOfer also provides a Copy More command to append text from different
Fig. 5.2. CanOpener enables you to build Scrapbook-like libraries of graphics, text, and sounds.
sections or different files to the current text in the Clipboard, so that you can perform one Paste command to transfer all of the text into an application.

GOfer enables you to limit searches to specific drives, folders, and files and enables you to pick specific file types (defined by creator applications) to search through. This utility is far more convenient for finding text than most other utilities. After finding the files that contain the search word or phrase, you can scroll through the files clicking the Find Next button, and the program continues finding more instances of the search word or phrase from an insertion point in a file.

CanOpener's search files function is limited for searching text files compared to GOfer's search files function, but CanOpener is faster than GOfer at specifying a search word or phrase and searching a specific folder (with the option to search folders within that folder). Unlike GOfer, CanOpener can search resource and data forks and can find the search word or phrase in files stored as other than text files.

**Using DiskTop**

You can use the DiskTop desk accessory (CE Software) to get immediate access to Finder-type functions (such as copying, renaming, and deleting files; creating folders; and running programs), folders, and files. DiskTop is most useful when you are running an application and not using MultiFinder.

DiskTop displays an information window with the contents of the current folder, the amounts of disk space (used and available), and buttons for various functions, including a Drive button for switching to other drives, and a folder pull-down menu to select the parent folders or disk. From this window, you can copy, delete, find, move, and rename files and compute the sum of the sizes of selected files and folders. DiskTop also has a pull-down menu in the application menu bar (labeled DiskTop) with functions that include the following: create a new folder, set preferences, and add programs to the menu. You also can change the default folder (used for storing work files, temporary files, and screen images from screen capture programs or Command-Shift-3 operations).

You can use DiskTop to manage files from within applications and to switch from one program to another. After selecting and adding programs to the DiskTop menu, you can switch to another program by selecting DiskTop and then selecting the name of the program. The ability to manage files without having to leave the applica-
tion (and without having to run MultiFinder) is a major advantage. In addition, DiskTop can find any file by name or search for a certain file type or for files that were created or modified after a certain date. The utility also displays the sizes of folders.

When you use DiskTop's Get Info command with any file, you get information about that file (such as its size, original application, date of creation and last modification, and any comments). You also get the opportunity to change the file's type and creator codes and attributes, such as whether the file is locked, invisible, cached, shared, busy, changed, and so on. This feature is worth the price by itself; with this feature, you can fix problems with PC files transferred to the Macintosh and change the System, InitEd, Bundle, and NoCopy attributes of Macintosh files.

We have added nearly all of our most often used programs to the DiskTop menu to facilitate switching without having to use MultiFinder. You also can shut down the system from the DiskTop menu. Nearly any kind of information storage and backup operation can be accomplished with DiskTop while you are using another application program.

**Storing and Backing Up Files**

A single scanned color image can occupy over 2 megabytes and does not fit on a floppy disk. One second of sound can occupy from 5 to 22 kilobytes, and you need at least one megabyte to hold about 45 seconds of medium-quality music.

Information takes up space, and retrieving information takes time. As you may expect, you never have enough space and time. As you add new types of information to your communications toolkit, such as sound and color images, you may be increasing your storage requirements exponentially.

First, everyone has a need to keep some large amount of disk storage *on-line*, available to the computer without anyone having to load a cartridge or insert a disk. Typically, the on-line storage medium is one or more fixed hard disks.

Second, everyone has a need to keep at least two backup copies as an archive of every document—text, graphics, sound, whatever—if that document is one stored on a volatile medium. A volatile medium is one that can be erased, written over with
new data, or damaged very easily. We consider floppy disks to be extremely volatile, while CD-ROM (compact discs that store read-only data) discs are relatively nonvolatile because you cannot write new data on them; they cannot become infected with a virus; they are rated to last more than 10 years of constant use; and they can stand to have ice cream spilled on them. Archival storage should in essence be damage-proof, and in most cases, you should keep a duplicate copy in another location (perhaps thousands of miles away).

Third, nearly everyone has a need to keep a dynamic backup of all the information available on-line at any given time, as well as the state of the system and applications (a system-wide and project-in-progress backup). This type of backup is insurance against having to reconstruct the on-line information if your on-line equipment fails catastrophically. The idea is to store everything currently on-line onto a slower, relatively nonvolatile medium that can hold the entire on-line capacity.

You may be able to solve the on-line requirement with a hard disk, the system-wide backups with another hard disk or tape cartridge backup unit, and the archive requirement with floppy disks. Your equipment choices depend entirely upon your applications, because different types of mass storage are suitable for different applications.

### Using Fixed Hard Disks

Most users want to have one and possibly more magnetic hard disk drives. These components have been in use for many years and have proven themselves worthwhile for all interactive applications but are not ideal for backup and archive, nor for distribution of information to other users, because they are bulky and must be handled with extreme care (unless they are shock-mounted).

Fixed hard disks contain the entire workings in one enclosed unit. Internal (built into the computer) drives are less expensive than external drives, but external drives (using SCSI) are transportable and can be used with other computers simply by plugging them into the SCSI port or linking them in a SCSI chain. External fixed disks are popular because you can move them from one computer to another if the computer must be serviced.

Fixed hard disks range in access rates from as slow as 60 to faster than 10 milliseconds; the faster the access rate, the better the overall performance. For use with servers on a network, the fixed hard disk is the most appropriate choice. Fixed disks are generally more reliable because they are closed systems, and dirt cannot enter
and harm the read/write mechanism (even the tiniest particle can damage a magnetic read/write disk and head).

The high-capacity hard disks are cost-competitive with all other technologies and are usually faster. The problem with hard disks is that the data is never permanent—disks can fail, and static electricity and other ambient factors can cause reliability problems. However, currently hard disks are the most effective large capacity storage devices available for on-line interactive access.

**Using Removable Hard Disks**

In theory, removable hard disks provide close to the performance of fixed hard disks plus the convenience of removing the information and using a removed disk as a backup. In practice, you can encounter compatibility and reliability problems, but many users are not affected by them.

Two forms of removable hard disks are available: removable disk cartridges and removable disk drives. The Syquest-designed removable cartridges contain disks that are removed from the drive mechanism. The 45-megabyte disk cartridges are interchangeable among different Syquest-based drives. Each drive is about $900-$2,000, and the cartridges range from $80 to $125 each. They are reliable as long as you handle them carefully but may have a shorter use cycle and may need to be reformatted (formatting destroys existing data on the disk) due to the strain of inserting and removing the disk cartridges.

Removable disk drives are similar except that you remove the entire drive assembly and disk from the chassis. However, because no standard chassis exists among different manufacturers, the removable drives are not interchangeable. Removable disk drives are much faster than removable cartridges; in fact, some removable hard disks are faster than fixed hard disks with the same capacity. Such drives are expensive at $1,000 to $3,000 per drive.

Bernoulli disk drives are a special type of removable disk; Bernoulli drives are reliable because the media rides on a cushion of air, and the read/write head never touches the media. Bernoulli drives are slow (24 to 40 milliseconds) when compared to removable Syquest-type cartridges and are more expensive. However, they are more reliable than removable cartridges. Bernoulli drives cost from $1,200 to $2,000 for the drive and $80 to $120 for each disk, providing essentially unlimited data storage (20 to 40 megabytes per disk).
Similar in concept to a Bernoulli cartridge, a mega-floppy can provide 10 to 20-megabyte storage but is even slower (60 to 70 millisecond access rates on the average). In addition, you may have trouble finding appropriate equipment to use with them if your current equipment dies or you are on the road.

**Using Tape Cartridges**

Tape backup is still the recognized standard device for backing up large-capacity hard disks. Apple offers a tape cartridge system for backing up 40-megabyte hard disks. However, tape backup devices are slow and expensive, leading many users to use another hard disk instead, or removable hard drives or cartridges, for backup. The formatting operation for a tape cartridge also is very slow.

Nevertheless, the portability of tape cartridges is a major advantage, because certain tapes can be used with different drives. The drives cost $700 to $1,200, and DC-2000 tape at 20 megabytes can cost $1.25 per megabyte and drop to $0.44 per megabyte at 80 megabytes. DC-600A tapes can cost $0.53 per megabyte at 60 megabytes, and $0.25 per megabyte at 150 megabytes. Tape cartridges also are less volatile than almost any other medium except optical.

A new form of tape used in music recording, called Digital Audio Tape (DAT), also is now used for data storage. DAT drives will soon be available for about $6,500 with high-capacity tapes costing $35-$40 each (or around $0.01 per megabyte at 1.2 gigabytes). DAT also provides much faster access and far greater capacity than tape cartridges, as well as portability. DAT can retrieve a four-megabyte file in about 47 seconds. The only stumbling block with DAT is the current price of drives, but these prices will come down in the next few years.

**Using Optical Discs**

Lasers and optics have brought us the compact disc for music, and compact discs are popular primarily because they deliver higher fidelity than any other medium and because the discs are nonvolatile—you can dump ice cream on them, wipe them off, and still use the discs.
Current examples of optical technology include CD-ROM (compact disc-read only memory), WORM (write-once, read many times) removable discs, and erasable magneto-optical discs. CD-ROM discs are useful for distributing clip art, but this medium is “read-only” and cannot be used to write new data. A WORM disc writes new data after the old—the old data cannot be erased. WORM is therefore useful for audit trails and archives but not for system-wide backup or storage of data that must be overwritten on a regular basis. Currently available WORM discs can hold from 200 to 400 megabytes each, but access times (about 150 milliseconds) and data rates (about 2 to 3 megabits per second) are much slower than hard disks.

Many institutions are switching from microfiche to WORM drives, which offer indestructible storage. Some even use a system made up of WORM platters that are selected by software and moved into place for use (as a jukebox). Unfortunately, WORM discs from one drive are not usable in another, due to a profusion of proprietary formats, and WORM drives are expensive—325-megabyte erasable magneto-optical disc drives are around $5,000, and 400-megabyte WORM drives can be $4,500. The chances that typesetting service bureaus have your specific WORM drive are pretty slim.

Erasable magneto-optical discs are attractive for backup but are still too expensive for the mass market (about $4,000 per drive and $250 per disc). Enclosed in cartridges that are about the same size as WORM discs, erasable magneto-optical discs cost about $0.75 per megabyte, and a 20-megabyte “megafloppy” is about $0.15 per megabyte. We expect to see less expensive erasable discs and drives in the next two years. Erasable discs, whether magneto-optical or completely optical, eventually will replace floppy disks as the medium of choice for backup and travel.

CD-ROM is still the medium of choice for distributing software and information content that can never be changed. The read-only nature makes CD-ROM attractive for distribution of copyrighted material, such as large databases, software, and image libraries (clip art). CD-ROM also is useful for large visual and audio presentations and for music. One example is the MacroMind CD-ROM, which contains hundreds of megabytes of “clip animation” (animation you can use in your custom presentations), clip art, sample presentations, and animated “movies” from a variety of artists.

A CD-ROM can hold about 650 megabytes and is the exact same size as an audio compact disc. Although CD-ROMs must be created at a mastering facility, they are not prohibitively expensive for distribution. Pressing 100 disks costs about $3,000, and the cost per disc drops quickly as you increase the volume.
Content developers with a need to send vast amounts of data to a CD-ROM mastering service may choose removable hard disks (as long as the service can read them) or may choose external SCSI disks for the flexibility of going to different services.

**Comparing Digital Storage Devices**

Your choices can be narrowed by deciding which type of device is useful for on-line and backup needs for your applications. We like to use fixed external hard disks for on-line storage due to their performance and the flexibility of using them with any Macintosh.

On a cost-per-megabyte basis, fixed hard disks are cost-competitive with all other alternatives for on-line storage, and they usually perform faster than the alternatives. Standard 40-megabyte fixed hard disks are about $12 per megabyte, and the price per megabyte declines rapidly as capacity increases (down to about $10 per megabyte for 80-megabyte hard disks and $8 per megabyte for 200-megabyte hard disks). By comparison, 40-megabyte removable drives are about $30-$40 per megabyte, and 200-megabyte removable drives are about $10-$13 per megabyte; 40-megabyte removable cartridges are only $3 per megabyte plus the cost of the drive (around $900-$1,500), and 20-megabyte Bernoulli cartridges are about $2.50 per megabyte plus the cost of the Bernoulli drive (around $1,200-$2,000).

We prefer to use removable cartridges for exchanging large amounts of information (such as multimedia presentations with sound) with other users and with service bureaus who have removable cartridge drives. All removable cartridges are made by Syquest and are smaller in size than removable hard disks. They also are limited to 45 megabytes. However, they are less expensive per cartridge, and you can keep files secure by removing them from being on-line.

Removable cartridges are attractive because they act as their own backup device, and data can be transported easily from one machine to another as long as both machines have Syquest-based drives. However, removable cartridges are generally slower and less reliable than fixed hard disks, and are therefore less attractive for regular, on-line storage. Besides, inadvertently contaminating or damaging a removable cartridge or the drive itself is easy when inserting or removing the cartridges from the drives.

Removable hard disks, on the other hand, are self-enclosed with the read/write mechanism and are far more reliable, although they are more costly. Removable
drives can range in access rates from as slow as 50 to as fast as 20 milliseconds. These rates are too slow for server-based on-line storage and for performance-minded users, but the removable drives provide virtually unlimited storage as long as you can afford more disks. Removable hard disks would be more attractive for system-wide backup and archive disks if different drive manufacturers made compatible chassis.

With any type of removable hard disk, you can grow your memory storage to meet your needs over time, but with removable drives, mega-floppies, and Bernoulli drives, you cannot expect to exchange information with other users or service bureaus unless they have the exact same drive.

We always have been concerned with the ability to quickly hook up a disk drive to a computer and start using the drive. SCSI-based external fixed hard disks have been more useful to us than removable drives, because any SCSI-based hard disk can be attached to a Macintosh Plus or any other Macintosh without requiring any other hardware or software. External fixed hard disks, however, can be damaged easily in travel.

Removable cartridges are excellent for archives, for system-wide backups, and for transporting information to other Macintosh users, but we do not use them on-line, nor do we rely on them solely for archives—we also keep floppies of source files. A file that cannot fit on a floppy still can be copied to multiple floppies by using the HD Backup utility supplied by Apple on the Utilities disk.

Sometimes digital media is not the most efficient method to store information, especially information already stored in an analog format, such as records, audio compact discs, videotapes, and film. To convert the information into digital form dramatically increases your storage costs, although this step also preserves the information in a pure digital form that can never degrade. The decision to go digital with certain types of information, such as high-quality music and film, depends on how well you can protect its original medium and how long that medium can be expected to last.

**Comparing Digital to Analog Storage**

Digitized stereo music, four-color continuous tone images, and full-motion color video take up precious disk space. These types of information must be in digital form for editing, modifying, and retouching, but the original source material (music, images, video) can be stored in its original analog medium—audio CD, slides, videotape, laser videotdisc, and so on.
If you have no intention of altering the sound, for example, you may consider using an audio CD for the sound controlled from HyperCard—which is exactly how Robert Winter stored the music of *Beethoven’s Ninth Symphony* for his HyperCard-based interactive presentation (see fig. 5.3). “There was no way we could fit that much music on one disc along with the software,” Robert Winter explained, “but at the same time, we needed to be able to start and stop the music instantly.”

In much the same way, laser videodiscs also can be controlled from within HyperCard to present full-motion video starting at a specific video frame. Steven Freedman of the Stanford University Medical Center used this method to provide live videos on videodisc of surgical procedures linked by HyperCard to text and graphical explanations of those procedures in the *Electric Cadaver* project.

It also makes sense for a publisher of real estate listings to keep the house photographs as prints or slides until they are needed for publication and then to use a scanner to create digital information for electronic page makeup and color separations.
The reason why these techniques work is that the original information—music, video, color photograph—is already in a compact form. However, any information that needs to be changed in any way should first be converted into digital form. With any other method you run the risk of degrading the quality of the original material. Because digital copies of digital files are exact copies, you can expect to retain the highest level of quality when the information is in digital form.

Chapter Summary

You have to organize your files, which are units of information, so that you and others can find them. In addition, you have to be sure to keep up-to-date backups of every file.

Some programs, such as page makeup and presentation programs, are designed to hold all of its elements in a single document but still enable you to export each element to separate files for use in other projects.

The Cut, Copy, and Paste commands found in most Macintosh applications enable you to transfer text and graphics elements into the Clipboard, from which they can be transferred into a Scrapbook file, which can hold a variety of different elements.

File management programs such as The Curator (Solutions, Inc.) enable you to assign keywords to documents to make searching for those documents later much easier. File search utilities such as CanOpener (Abbott Systems) and GOffer (Microlytics) provide boolean search methods as well as browsing functions. You also can use DiskTop to manage files from within applications and to switch from one program to another.

Three kinds of storage operations are required for every computer installation: on-line storage to have files available while you work in applications, backup storage for keeping an archive of important files, and a dynamic, system-wide backup of everything you are working on at a given moment, in case your on-line storage systems fail.

Fixed hard disks are best for on-line storage. Removable hard disks and cartridges can be used for on-line as well as system-wide backup storage. Cartridge tape is useful for
archives and file backups, as well as system-wide backup. Optical discs can be used for all types of backup operations but are still too slow for on-line storage.

Sometimes digital media is not the most efficient method to store information, especially sound and video information already stored in an analog format, such as records, audio compact discs, videodiscs, and film. However, information must be in digital form for editing, modifying, and retouching. Converting information into digital form may dramatically increase your storage costs, but this step also preserves the information in a pure digital form that can never degrade.

This chapter introduced file organizing tools and file searching utilities and described the best devices for implementing backup procedures. The discussion also compared various types of information storage and backup devices, from hard disks and tape cartridges to the latest in optical disc technology. You now know which storage method is better—digital or analog—for certain types of data. You also know which programs are useful for organizing and searching files, which programs are useful for keeping archives, and which hardware storage devices are best for your multimedia projects.

You now are ready to discover which programs are best for creating a presentation with 35mm slides or transparencies and printed handouts, which programs can provide special animation effects for computer screen presentations, and which hardware projection devices are appropriate for your audience.
As you learned in the previous chapter, photographic originals on 35mm slides can be stored on slides rather than converted into digital format, unless you want to retouch or otherwise modify the image, use the image in a publication, or make printed versions. If you have photos to use in a slide presentation, you can still use a Macintosh to create other slides, such as charts, bullet lists of text, and other graphics, to go along with your photos.

The goal in using the Macintosh computer to assist in a slide presentation is to express ideas in a powerful way. A good idea is only the beginning; to make the idea fly, you must be able to explain and persuade others and communicate the idea effectively. Even for the most traditional slide presentations, the Macintosh can manage the entire effort and provide snazzy visuals. Business presentations also must be attractive and timely. Information can change in an instant on the computer and be presented on-screen instantly, with high-quality slides produced and available for the carousel in just a few hours.

You can choose from a variety of methods of communicating ideas, using printed material, 35mm slides, overhead transparencies, or the Macintosh screen and speaker for live, moving pictures with sound. This chapter describes the use of 35mm slides and overhead transparencies and how you can use a Macintosh and presentation programs to create slides and manage the presentation effort. In this chapter, you learn which software is best for creating overhead transparencies for use with an inexpensive overhead projector and which software is best for creating 35mm slides. How you can prepare images with text and use a desktop film recorder to expose film for 35mm slides is explained. You also learn the benefits of using a slide service
bureau that accepts the presentation on disk or over a modem. In addition, you will understand the benefits of previewing slides on the Macintosh screen and controlling a slide show from the same software used to create the slides.

Choosing the Right Media

The most important aspect of any presentation is its effectiveness. In addition, a presentation is not just your slides or your printed handouts—a presentation is you. In other words, the presenter is the dynamic part of any presentation, and the presenter's goal is usually to establish personal contact with the audience, not unlike the goal of a stand-up comic. The best kind of medium is one that brings out the presenter's personality, so that the entire presentation becomes an extension of the presenter's personality.

Which medium you choose depends on how important your visuals are to your message and how much interactivity with the audience you want to encourage. Slides and transparencies are the most popular media for group presentations, and video is gaining in popularity as are presentations combining video with animation and sound.

Overhead transparency presentations are effective for groups of less than 40 people in a small, well-lit room. Because transparencies are relatively informal, such presentations tend to be informal and relaxed, allowing the audience to interrupt with questions and comments. The presenter can write directly on top of transparencies, encouraging group participation and using the medium interactively. Overhead projectors are commonly available in nearly every corner of the world.

The 35mm slide is the most popular medium for presentations that require high-quality stationary visuals. Slide shows are recommended for presentations that require little or no audience interaction. The room must be dark, and note-taking should not be required. Slides are considered formal, and interactivity is not encouraged because the slides must be shown in rigid sequence. 35mm slides are portable and useful in a variety of projection devices and slide viewers. Because professional-quality slides are costly to have made for you—nearly $100 per slide at a graphics service, plus a long time to wait to see results—composing slides on a Macintosh yourself and outputting
them to a service bureau makes more sense. Using this method, you pay only $12 per slide and can receive slides within 4 hours, or you can use a desktop film recorder that may cost between $4,000 and $10,000 to produce your own slides in just a couple of hours.

The Macintosh screen also can serve as a slide presentation device, without the need for 35mm slides. Such “live” presentations and the equipment and software used to deliver them are described in the next chapter.

The print medium also is useful, especially for hand-outs the audience can take with them. A variety of desktop color printers, described in Chapter 9, can reproduce slides with enough detail and quality to serve as hand-outs.

You should design your slides to fit the chosen medium, but some designs have similarities that make using the same artwork and text in presentations with different media possible. You can create the same graphics for use on printed hand-outs, slides, transparencies, and the Macintosh screen.

As a presenter, choosing a medium you are comfortable with is important. Presenting information is a personal act, and although a group effort is usually required to put together the facts and graphic elements, the presentation is still usually delivered by one person, using that person’s style. One person makes the decision about how to make the presentation and what the content should be.

Creating Transparencies

Images and text for transparencies can be assembled in graphics programs, in page makeup programs (described in more detail in Chapter 8) or in the presentation programs described later in this chapter. All three types of programs can bring diverse elements together on a single “page” or slide and print that page, and page makeup programs and slide presentation programs can prepare multiple pages. Slide presentation programs, such as Aldus Persuasion and Microsoft’s PowerPoint (described later), however, are the best to use for organizing a presentation and for preparing transparencies that are designed to resemble 35mm slides, especially if the material will be presented on transparencies and on 35mm slides.
Transparencies for overhead projectors may be as large as a standard 8.5-by-11-inch page, but the same design rules for slides apply because you are projecting the information. Use large, bold type, and allow at least 1.5-inch margins on top, bottom, and sides for the frame. Use framed transparencies to avoid the appearance of glare around the edges and to make your transparencies look professional.

Overhead projectors actually outsell 35mm slide projectors in the business market and are less expensive and therefore attractive for use in educational institutions. Most projectors have fixed lenses, and the only way to change the size and focus of an image is to move the projector closer to or away from the projection surface (usually a screen).

You can produce black-and-white transparencies (see fig. 6.1) by using a laser printer for paper masters and then using a copy service bureau or by printing directly onto copier-certified film sheets.

Fig. 6.1. Overhead transparency pages can be printed from a page makeup or slide presentation program directly onto copier-approved acetates in a laser printer, or onto laser printer masters that are converted to acetate in a copy shop.
Desktop color *thermal-transfer* printers, described in detail in Chapter 9, make excellent color transparencies. These printers use a heating element to fuse a ribbon with a film of pigment or wax to specially coated paper or transparency film. Some service bureaus that provide high-resolution imagesetting and 35mm slides also provide cameras for producing high-resolution transparencies from paper masters.

### Creating 35mm Slides

Any graphics program that saves a PICT file can create visuals for a 35mm slide. With programs that do not save PICT files, an alternative method is to "print" to a disk file that can be taken to a service bureau. SuperGlue (Solutions, Inc.) is a utility program that enables any application to "print" to a file that can be converted to PICT or other graphics formats.

The presentation programs described later in this chapter (such as Aldus Persuasion and Microsoft's PowerPoint), however, are much better for creating 35mm slides because they offer special features for organizing slide presentations and preparing them for desktop slide recorders or service bureaus. These special features include the capability to handle text outlines for organizing a presentation, tools for drawing and painting graphics, the capability to import graphics from a variety of graphics programs, and methods of saving color choices for use in multiple presentations. All of these features make designing different presentations using the same elements, such as corporate logos, and the same color schemes easy.

Color can be used to organize ideas and identify elements, milestones, or processes. Color also can bring clarity to technical illustrations and make presentations more attractive and attention-getting. But the use of some colors can produce undesirable results. For example, you should not use red for income totals, because the color red suggests that you are losing money. Nor should you use purple with Japanese audiences, because purple headbands are worn by Kabuki dancers when they are ill. Many people are color blind to red and green used together. Blue is possibly the safest color; dark blue backgrounds are used for many professional slides.

Use the following general rules for color in 35mm slide presentations: use one main color and two or three others, and use light colors on a contrasting dark background for highlighting. Too many different colors can be confusing and irritating. Use the same colors for the same type of element in the presentation, and change colors and backgrounds only if the topic is changing dramatically. A consistency in the use of color reflects professionalism.
Quality in slides is usually a measure of the resolution of the slide recorder, as well as a subjective opinion of the content. As the resolution increases, the image on the slide is clearer and its text, curves, and diagonal lines have less-jagged edges. The resolution is determined by the number of pixels and the size of the pixels. The number of pixels in a row is referred to as lines (rounded to the nearest thousand). For example, a 4,000-line resolution means that the slide has between 4,000 and 4,096 pixels per row. Because 35mm slides have a 1.5 to one ratio of width to height, the 4,000-line slide most likely has 2,700 to 2,732 rows. For Macintosh-based film recorders, the resolution depends on the capabilities of the recorder and accompanying software.

The trade off with resolution is speed: recording at 2,000 lines of resolution takes less than half the time it takes to record at 4,000 lines. More often, the sharpness of the image and text on a slide is determined by proper focusing of the projector, but pixel size (in relation to the size of the recorder's internal CRT) also can be a factor. Different film recorders offer varying degrees of image sharpness due to different pixel sizes, even when recording at the same line resolution.

These factors are important to consider when choosing a service bureau that specializes in slide-making and has a film recorder or when purchasing a desktop film recorder. The choice you make also determines the fonts you can use for the text in your slides: you can use only the fonts that are supported by your output device, a desktop film recorder or a recorder available at a service bureau. The alternative is characters of text with jagged edges that make the slides look unprofessional. No matter which program you use, your choice of fonts for text on the slides is determined by your choice of output method.

**Using Service Bureaus**

Just as desktop publishing enabled the local copy shop to provide publishing output services, desktop presentations are enabling those same copy shops and service bureaus to output slides. Infrequent presenters can go to copy shops or desktop publishing service bureaus to print slides without having to purchase or share a film recorder. These service bureaus also can recommend freelance Macintosh artists for designing graphics for use with slides.
You can find a service bureau for Macintosh slides by looking for a desktop publishing service bureau or copy shop that specializes in desktop publishing. If they don't prepare slides, they will know of a service bureau that does prepare slides. The service bureau can be anywhere in the country (or the world, for that matter), because you can transfer Macintosh files over telephone lines and use express delivery services to receive the slides.

Two important factors for comparing service bureaus is the turn-around time to make slides and deliver them and the cost per slide. In most cases, a Macintosh-oriented service bureau can process your files with no compatibility problems, except perhaps with fonts (as described earlier). The best way to find out is to try a service bureau with a small set of slides that use the font you want to use and check the quality of the resulting slides.

Most presentation programs offer a direct link, by means of a special software *driver*, to specific service bureaus. For example, Microsoft's PowerPoint offers a direct link to Genigraphics service bureaus, and the package includes Genigraphics templates specialized for their equipment with specific color schemes. Although nearly any service can produce slides from Macintosh PICT files, you may get jagged fonts due to inadequate font substitution. The best way to avoid this problem is to use the specialized drivers provided with the presentation programs or to stick with popular fonts (such as Helvetica) that are used with most service bureaus and film recorders.

At about $10-$12 per slide produced at a service bureau, you would break even with a $6,000 desktop film recorder (not counting film and processing) if you produced about 500 different slides. If you don't intend to produce 500 slides in one year, using a service bureau or copy shop is the less expensive option. Of course, even with desktop film recorders, you still need the services of a photo shop or lab to develop the film and make the slides. Most service bureaus offer film recording and film developing. Some service bureaus offer enhancements to slides, such as the addition of a corporate logo or interesting background. Some also offer 4-inch-by-5-inch or 7-inch-by-9-inch high-resolution transparencies for making color separations (described in Chapter 4).

Service bureaus typically can output film and develop slides in four hours to three days. Rush service usually commands a premium charge, but most services provide overnight service.
Service bureaus can receive Macintosh files on disk, mailed or delivered, and by modem and telecommunication software over phone lines. A variety of modems are available for the Macintosh, including the portable Apple Modem, and the Macintosh Portable includes a modem. With a modem, all you need is a telephone line with a modular jack, and telecommunication software such as Apple’s MacTerminal, Dow Jones’ Desktop Express, or Software Venture’s MicroPhone. Follow the service bureau’s instructions for sending the files. Remember that presentation files can be very large and take a considerable amount of time transferring by modem.

Comparing Film Recorders

A digital film recorder grabs the video image on the computer screen and displays the image on an internal high-resolution CRT (cathode ray tube) inside the recorder, where the image is photographed with a built-in camera. Digital recorders range in price from around $2,000 (for low resolution) and $5,000 (for at least 2,000-line resolution) to about $13,000 (for high resolution). An analog film recorder also captures the video signal but produces lower resolution images (typically 640-by-480 pixels with 256 colors, which is the resolution of the Macintosh II screen).

Desktop film recorders are attractive to graphic arts services, publishing service bureaus, copy shops, advertising agencies, PR firms, other professional communicators, and corporate presenters who need to keep their slides confidential, or need to be able to make last-minute corrections without waiting for a service bureau. If you typically want the fastest turn-around time, film recorders are more economical than service bureaus because with the service bureaus you also pay delivery charges and possibly rush charges.

Film recorders expose film, and you have to develop the film into slides, but you also can develop the film for other media, such as transparencies, color prints, posters, and whatever else your local photo shop or photo lab can produce.

The problems of font substitution and image quality with service bureaus also exists for film recorders; you should use the specialized driver software provided with the film recorder or with presentation programs. Most film recorders are supplied with driver software that can process Macintosh PICT files, but you should use the fonts supplied with that film recorder.
Chapter 6: Making Slide Presentations

Mirus Corp. offers an 8,000-line digital film recorder called the FilmPrinter. This recorder uses the same color QuickDraw instructions used to display Mac images and connects directly to a single Macintosh through the SCSI interface. The supplied software can process an image in the background of MultiFinder. The FilmPrinter driver software from Mirus is optimized for 2,000 lines of resolution, which is sufficient for many applications, but the recorder can reproduce 8,000 lines. You can choose the FilmPrinter driver by using the Chooser desk accessory then use any Macintosh application to print to the film recorder.

The FilmPrinter is an all-digital device with a high-resolution CRT, an RGB (red, green, blue) color filter wheel, and a Konica 35mm camera with a special lens. The only moving parts are the filter wheel and the film transport mechanism in the camera. The recorder processes the image sequentially through its RGB filters, producing good color saturation with a full range of colors. The FilmPrinter offers excellent color gradients (patterns that dissolve from one color to another gradually), but the recorder tends to fatten thin lines a bit. The Polaroid Bravo is nearly identical to the Mirus FilmPrinter, but is fine-tuned for Polaroid Presentation Chrome film.

The Montage FR1 (Presentation Technologies), the ProColor and SlideWriter (Agfa Matrix), and the LFR (Lasergraphics) digital recorders are similar but offer varying levels of quality. The Montage and LFR recorders handle thin lines better than the Mirus FilmPrinter, but the slides from the Montage are sometimes fuzzier when projected to very large size. The LFR offers better slide quality than the Montage and is faster than the other recorders but also is more expensive. The SlideWriter is twice as sharp as its cousin, the ProColor, and both offer good value for their prices. The LFR and the SlideWriter also perform the best with text.

Until recently, PostScript graphics could not be imaged by these recorders unless they were first converted to PICT format. Options to record PostScript graphics with film recorders are now becoming available, in the form of PostScript film recorders (such as recorders from Agfa Matrix) or in PostScript software interpreters such as Freedom of Press (Custom Applications, Inc.). A PostScript interpreter is a piece of software that operates in the device or in your computer and translates or interprets the PostScript instructions to create a high-resolution bitmap, or series of pixels, to record the slides. In PostScript devices, the interpreter usually is stored in read-only memory, or ROM, on the controller card that includes a processor, and the interpreting occurs in the device, setting free your computer to do other tasks. A software-only PostScript interpreter, on the other hand, runs in your computer and then sends the bit map of
the slide to the recorder, and your computer is occupied with the task of interpreting. Freedom of Press, a software interpreter, can interpret PostScript into a high-resolution bit map for specific film recorders (such as the Montage and LFR recorders).

PostScript recorders can provide the highest resolution for your graphics and text. Sometimes high resolution is not necessary, however, especially for slides that change often and are not expected to be high in quality. In such cases, you can get low-quality inexpensive slides from an analog film recorder rather than using a digital device.

The Addtech Film Recorder is an example of an analog film recorder, which records at the resolution of the Macintosh screen. This recorder connects to the cable from a standard Macintosh II video card and is shipped with the Polaroid PowerProcessor for developing instant slides—no film processing is necessary. No software is required because the recorder captures the video signal directly. Because the Addtech recorder is a low-resolution recorder, we recommend the recorder for informal presentations but not for high-quality slide presentations.

Color quality with any type of film recorder depends on the type of film and the quality control of the photo shop or lab. Recorder manufacturers fine-tune their recorders to work with certain types of film and recommend using only that film. Some manufacturers recommend professional film, and others recommend using Ektachrome 100 HC (available at most pharmacies). Out-of-date film may produce washed-out colors. Professional films are kept in cool storage and have emulsion batch numbers on their packages so that you can purchase a series of films and maintain a consistent quality throughout the series. You should use a professional photo lab when using professional film.

Overall quality for slides created with a desktop film recorder also depends on the type of program you use to prepare the presentation file. Although any graphics program that can save a PICT file can theoretically prepare slides, slide presentation programs are designed for this purpose, and you can usually get better results with them. Slide presentation programs also can import graphics from other programs, so that you can use the tools in a graphics program first then use a presentation program to prepare slides.

Reviewing Slide Presentation Programs

Several color slide presentation programs have been developed for the Macintosh including PowerPoint (Microsoft), StandOut! (Letraset), Persuasion (Aldus), and MORE II (Symantec). All of these products create presentations as a collection of
slides (called charts by MORE II). A slide can be the size of a regular page (for transparencies), the size of a 35mm slide, or a custom rectangular shape and size.

With all of these programs you have several output choices—including desktop film recorders and printers—and all of them can create a slide show on the Macintosh display. The programs also can print hand-outs and notes, and all are provided with templates, which are predesigned presentations that contain dummy text and graphics you can replace with your own text and graphics. Templates are designed to be used to create presentations semi-automatically without requiring you to invent a design for your slides.

Some of the slide presentation programs are designed with artists in mind: with an emphasis on graphics tools and visual organizing techniques. Others emphasize their automatic features and are pitched to the presenters, not to artists. Yet even those programs pitched to non-artists differ in what automatic features are provided; some are designed with charting and graphing features built-in, and others are designed to import charts and graphs from spreadsheet programs that can prepare such graphics. When charts and graphs depend on numeric information that changes frequently and you want to update that information in one place, you should choose a spreadsheet program that can be linked to a presentation program.

Presentation programs are more flexible for making slides than page makeup programs. They offer additional features for working from an outline and sequencing slides, and for presenting slides on the computer screen. Some presentation programs offer direct output to professional slide service bureaus. This feature is useful if you do not want to own or share an in-house film recorder.

Another useful feature of presentation programs is their capability to organize and print a storyboard, which is a set of thumbnail sketches of individual slides with comments derived from a speech outline. The presenter uses the storyboard to remember key phrases and to keep the sequence and pace of the speech intact. The storyboard contains the entire presentation in a form you can browse. Some programs offer features for creating hand-out materials as well as storyboards. Hand-out pages can be printed on a color printer and perhaps copied by means of a color copier.

The benefits of using desktop presentation programs are similar to the benefits of desktop publishing: better-looking presentations are more credible, and you can save time and money preparing your own (without artists and using clip art) or use an artist to create beautiful slide art. But perhaps the best benefit for presentations is that you are free to make last-minute corrections without incurring major production costs. Parts of a presentation can be worked on by different people and assembled in a slide presentation program for final sorting.
Microsoft's PowerPoint

PowerPoint (Microsoft) is designed specifically for producing presentations, with word processing and diagram drawing tools, and on-screen slide sorters. Microsoft includes a disk of already designed presentation layouts, and the program enables you to work on an entire presentation at one time. Professional slides and overheads can be produced from PowerPoint, as well as presentation hand-outs that include an image of each slide and accompanying text.

PowerPoint offers slide sequence views (by title, or by thumbnail display) to enable you to visually organize your presentation. The program provides a spelling checker that refers to Word's supplemental user dictionary and the capability to import graphics from a variety of sources, including EPS files.

PowerPoint can output an entire presentation to a Scrapbook file for use with other programs, such as the software supplied with desktop film recorders. Microsoft also has an agreement with Genigraphics to provide PowerPoint slides via modem to produce fast 35mm slides at Genigraphics service centers. The package includes Genigraphics templates specialized for their equipment with specific color schemes.

PowerPoint offers you the ability to add color lines, fills, shadows, and gradations that use the slide title as the center of the gradations of color. Also, when you specify the background color of a slide, the program suggests complementary colors for the text. This feature is nice for helping non-artists design colorful slides that also are readable. Microsoft offers a special palette that matches Genigraphics colors.

With PowerPoint, you can define and store color schemes for presentations and merge slides from other presentations into a new presentation, and the slides take on the color scheme of the new presentation. Additional colors can be added to the menu, and any color can be substituted for any other color automatically and globally.

PowerPoint has minimal features for previewing or presenting a slide show on the Macintosh screen, although if you memorize the Command-key shortcuts and know your slides by number, you can interrupt and resume the slide show to make an effective presentation. You also can change the color of the text and backgrounds of all the slides in one operation in order to customize the presentation for specific lighting conditions or room size at the last minute.
PowerPoint's templates are presentations you can open and then save with new file names; then you have to manually replace the text on each slide. Alternatively, you can open a template presentation file and copy elements to your presentation file. PowerPoint's master slide offers a default title position and repeating text and graphic elements, but you cannot make global changes to slides from the master slide.

PowerPoint's drawbacks are that the program does not include outlining features (although Microsoft Word, a companion product, includes outlining) and does not generate charts and graphs from spreadsheets (although Microsoft Excel, another companion product, offers charting and graphing along with spreadsheet features). PowerPoint can import MORE 1.1 outlines (Symantec's MORE 1.1 and MORE II are the most popular outliners).

PowerPoint offers the capability to define text styles for the menu so that users can select the font, the style, and the color in one action. But the real value of style sheets is not exploited: the capability to globally change the font, style, or size of a class of text objects such as the headings, level 1 subheadings, level 2 subheadings, and so on. In this regard, Microsoft Word's styles are the model to follow, but instead, the style definition in PowerPoint is merely a method of combining text settings into one menu choice. Nonetheless, PowerPoint offers high-quality results, excellent color suggestions, and direct support for Genigraphics slide service bureaus.

**Aldus Persuasion**

Aldus Persuasion offers precision drawing tools, special graphic effects, and flexible and semi-automatic charting. You can resize, stretch, and otherwise distort graphic objects, as well as flip and rotate them and use gradual fills. The standard set of geometric drawing tools are included, along with a free-hand drawing tool and a zoom tool for magnifying the display.

The program provides layers for holding different objects and for establishing a *build*, in which each layer presents part of the slide over time so that you can build up to a finish with the entire slide displayed (see fig. 6.2). Other special effects include text and object shadows, and you can specify the text shadow offset and object shadow offset separately in Preferences.
Fig. 6.2. A sequence of slides called a build, designed in Aldus Persuasion.
Persuasion offers 10 automatic chart options based on data typed into Persuasion's data sheet or imported from an external spreadsheet (and then edited in the data sheet). You also can define your own chart, and the program offers convenient methods for replotting sets and switching chart types to obtain the best chart. You then can ungroup chart elements, enhance them with special effects, and regroup them. Drag a wedge from a pie chart, for example, and move legends and other pieces. Persuasion gives you control over the x and y axes positions, the grid lines, plot range, and tick marks, and the numeric formats. You also can show depth to simulate three-dimensional charts (see fig. 6.3).

Persuasion includes 24 AutoTemplates, which open as untitled presentations (copies), so that you can save your version as a new file without danger of overwriting the template. Each AutoTemplate is a collection of six or eight master slides, and you can create new AutoTemplates.

A master slide is a model of what you want to appear on one slide or a range of slides, and a master slide contains placeholders with size, format, and location information for text and charts. You also can define the direction in which text flows within a placeholder, as well as the alignment of text within a text block. You can assign slide builds to a master slide and create separate masters for the speaker's notes and handouts.

**Financial performance update sheet**

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<td>504</td>
</tr>
</tbody>
</table>

Fig. 6.3. Three-dimensional effect, designed in Aldus Persuasion.
After choosing a set of master slides, you can apply any master to one slide or a range of slides. You also can set one master to serve as the default master when the program launches. The Gallery command enables you to preview the master slides, and you can assign a master to one or more slides in the Slide sorter view, the normal Slide view, or the Outline view.

The master slide in Persuasion holds enough information for you to change the formatting characteristics of all the text governed by that master slide in one operation. If you use several different master slides for one presentation, however, you need to change all the masters in order to change the typeface or size for handouts. In this regard, Persuasion is less flexible than MORE II, which offers global Rules for text formatting.

Persuasion offers a default palette of eight colors (including black and white) and a color grid of 200 colors, as well as access to the entire 16.7 million colors offered in the Macintosh II family and the SE/30. The program can import color graphics, but each color is converted to a matching color from the 200 colors in the color grid. You can change the color grid colors by selecting and editing one, and you can change the colors in the default palette.

You can apply different colors to the line, fill, and shadow of an object or group of objects, and to the line and fill backgrounds. The Set Colors dialog box enables you to assign colors to these classes of elements at one time for all slides in a presentation. The program offers gradual fills (also called gradients), radial fills (a gradient that radiates from a central point outward), and color-shadowed text.

Persuasion can export slides as individual PICT files or as a Scrapbook file for the entire presentation; either can be used with most desktop film recorders and slide service bureaus.

Persuasion has excellent features for presenting slide shows on the Macintosh screen. The program offers a Slide show dialog box that enables you to select a range of slides (or all slides) to show in sequence, once or continuously. Persuasion offers a full-screen presentation or a presentation inside the window, and you can set the delay between layers for builds, as well as the delay between slides during automatic advance.

As a competitor to PowerPoint, Persuasion has more features and is more convenient to use. The program combines a very robust drawing environment with an impressive set of templates, the flexibility to edit text on slides and add colors, and complete outlining facilities. In addition, Persuasion enables you to change text formatting
globally on a master slide, and you can use more than one master slide in a presentation. Persuasion is a full-featured presentation program that can produce high-quality results and is easy to learn.

**Letraset's StandOut!**

StandOut! resembles ReadySetGO! (a page makeup program), with drawing tools and style sheets for defining text elements with global reformatting capabilities. The program enables you to crop and resize images and to repeat text and graphic elements from a master slide onto every slide, similar to a master page in a page makeup program. To use a consistent design in a presentation, you can duplicate the design of the first slide and use a master slide to define repeating elements.

StandOut! enables you to change a font specification in a style sheet definition in order to apply the change to all slides for that particular class of text. StandOut! even enables you to find and replace formatting characteristics.

StandOut! offers five basic chart and graph styles that are created from a data sheet, and the program also can import Excel spreadsheets for charting and graphing. The options enable you to define the style and formatting of the chart's legend, labels, axes, grid lines, and shadows. You also can drag a slice out of a pie chart and drag elements such as the legend to new positions.

Excellent features of StandOut! are the capability to stretch and compress letters as graphic objects and to run text around graphic objects. StandOut! offers grouping, alignment, and the capability to lock objects, as well as Send Behind and Bring to Front commands for overlapping objects. You also can specify the text repel distance (for wrapping text around an object) and set a preferred line weight to use for all thin lines.

You can save any slide design, including colors, patterns, and objects, in a separate file. You then can use any of these designs in another presentation by calling up the list with the Slide Design System button; the program offers five standard designs.

The package contains 18 sample presentations that can be used as templates. First, save one as a new presentation; then you can alter the presentation as needed, but this method is not as fast as others. You also can import the text style sheets from another presentation.
StandOut! offers you the ability to create a custom color palette for a presentation, as long as you keep the palette in the same folder with the presentation. StandOut! is the only program that can import scanned image RIFF files from ImageStudio, Letraset's gray-scale painting and retouching software described in Chapter 4. (RIFF image files are much smaller than TIFF and PICT files for holding bit-mapped images.) The program's designer added a nice touch to the color palette menu—a scroll bar showing a blend of the colors in the list, so that you can quickly scroll to a certain hue.

StandOut! can export slides as individual PICT files for use with film recorders or service bureaus, and the program can print color separations. For presenting slides on the Macintosh screen, the program offers the standard features of manual and automatic advancing (same as PowerPoint) and 12 transition effects to use between individual slides, providing simple animation in your slide show. For example, you can dissolve one screen into another so that each pixel of the first slide is replaced by the corresponding pixel in the second slide—a dissolve transition—or have the second slide wipe across the first slide—a wipe transition.

StandOut! looks just like ReadySetGO! and even turns ReadySetGO! pages into slides. The program offers stylistic control over the text of all slides, and its close relationship to ReadySetGO! means that users of the latter product can make slides quickly and easily without retraining. The capability to export slides as PICT files makes getting high-quality slides produced at any service bureau or using any Macintosh-based film recorder easy.

Symantec's MORE II

Of the preceding presentation programs, MORE II has the most extensive outlining features. Graphics can be placed in an outline and thereby tied directly to an idea, rather than placed on a slide as an afterthought. MORE II also can import outlines from GrandView and from the Mac and PC versions of ThinkTank. Only Persuasion comes close to providing the outlining features of MORE II.

MORE II also stands out in the global text reformating category with its hierarchical rules. A general set of rules can define the overall text format, and rules for different classes of text inherit the general rules but override them with more specific formatting instructions. You can change a font specification for the overall text format (or for a specific class of text) to apply the change to all slides for that particular class.

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Unlike the other programs, MORE II does not include extensive drawing tools. This program has rectangle, rounded rectangle, oval, and straight line tools, accompanied by a fill and background tool, frames and frame edge styles, shadow patterns, and line endings. You can import graphics from other programs or from the MORE II libraries. MORE II offers grouping and alignment of objects, Send to Back and Bring to Front commands, and the capability to add colors, fill patterns, and shadow patterns to objects.

MORE II graphic objects are stored in the Objects Library, and clip art images (each a single object) are stored in the Graphics Library. MORE II enables you to incorporate graphics with headlines or windows in the outline, treating graphics as one object to be moved along with the headline or window. You alternatively can place the graphics on a chart (slide) or master page (master slide) and move them separately.

MORE II’s templates are stored in a Templates Library and consist of rule sets for outlines, bullet charts, and tree charts. You can create your own templates, and you can open any of the sample outlines in other libraries and borrow master slides (MORE II calls them master pages) to assign to your presentation slides. The rules that govern formatting for all slides can be tweaked or left alone, and you can get nearly automatic creation of slides from templates.

MORE II offers color pop-up menus that provide access to the color and pattern editor for creating custom colors and patterns. The program enables you to change the background and all other parts of a window, including scroll bars, rulers, and title text. The color palette holds 32 colors, that you can change by choosing Custom Color.

With MORE II, you can selectively color text in an outline if, for example, you want to set one word of a headline in a different color. You also can colorize text blocks and objects on the slides. The program enables you to customize color dithering with standard patterns and freely drawn patterns (you can edit the pixels of a pattern).

You can export an entire MORE II outline to other outline formats, such as ThinkTank (Mac and PC), MacWrite, Microsoft Word, Ready! (PC), plain text, and MORE 1.0. You also can export slides as PICT files.

MORE II has the most extensive controls for presenting slides on Macintosh displays. You can set up two or more displays—for example, one at the podium to act as a teleprompter for the presenter and one projected for the audience. The presenter’s display can show a window of notes with a miniature slide (see fig. 6.4), and the
Fig. 6.4. When using two displays, the audience can be shown a full-size slide while the presenter sees a miniaturized version of the slide with notes for the speech, and the time limit for each slide (MORE II).

The audience sees a full-size display of the slide. A control panel enables you to set a different time limit for each slide as well as a time limit for the entire presentation. As a presenter, you see a quick visual display of how much time you have left for the slide and the entire presentation. You also can use these features on one display to preview the slide show and measure how long delivering the presentation takes.

MORE II offers 24 visual transition effects between slides, and the slide show also can be controlled by the SAYETT Smart Remote control unit. A truly exciting feature is the ability the program gives you to click on a headline or text item in a slide during a Macintosh screen presentation and jump to the slide (if any) with that text as its heading. The linking power of the computer is used so that you can jump to any slide based on the context of your speech rather than the sequence of slides.
MORE II provides little in the way of drawing capabilities, assuming that you use drawing programs and import the graphics into MORE II outlines. The program offers the best controls for Macintosh-based slide shows. In fact, with its superb outlining, text editing, and computer presentation controls, MORE II may have a larger impact on the technology of desktop presentations than any of the other programs.

Chapter Summary

The goal in using the Macintosh computer to assist in a slide presentation is to express ideas in a powerful way. The Macintosh can manage the entire effort and provides snazzy visuals.

You can choose from a variety of media for communicating ideas, such as printed material, 35mm slides, overhead transparencies, or the Macintosh screen and speaker for live, moving pictures with sound. Which medium you choose depends on how important your visuals are to your message and how much interactivity with the audience you want to encourage.

Transparencies can be created in graphics programs, in page makeup programs, or in the presentation programs. Laser printers and color thermal-transfer printers can be used to print transparencies, and copy shops can convert paper masters into transparencies.

Slides are created with a film recorder on a desktop or at a service bureau. Two important factors for comparing service bureaus is the turn-around time to make slides and deliver them and the cost per slide.

Desktop film recorders are attractive to those who need to keep their slides confidential, or need to make last-minute corrections without waiting for a service bureau.

Nearly any graphics program that can save a PICT file, such as PixelPaint, Adobe Illustrator, Aldus FreeHand, Studio/8, and many others, can prepare a slide or transparency on an individual basis—one slide per PICT file. Page makeup programs also can prepare slide presentations and hold more “slides” (as pages) in a file, but these programs lack the controls for organizing and presenting slide shows.

Slide presentation programs, such as PowerPoint, Persuasion, StandOut!, and MORE II, are designed for creating slide shows, transparencies, and presentation hand-outs, and for organizing and managing efforts to create presentations.
Many other application programs, such as graphics programs, can be used to create source material, which then can be combined with other elements in slide presentation programs.

The same materials can be combined with special animation effects for Macintosh screen presentations, described in the next chapter. Multimedia authoring programs, such as HyperCard, SuperCard, MacroMind Director, and Studio/1, can act as presentation programs for combining elements and sequencing them for Macintosh screen slide shows. But they also can go much further to communicate ideas: they can combine all this information with animation and sound and provide ways for the speaker to interact with the information, making presentations that are more convenient to the speaker.
7

Making Live Presentations

Demo or die.

—Motto of the MIT Media Lab

Macintosh software brings you the power to create all of a presentation's visuals and to control the costs, the timeliness, and the quality of the visuals. But rather than using 35mm slides, you can use the Macintosh itself to present information as well as prepare visual aids. After you start to use a Macintosh for overheads and slide presentations, you may find the computer useful as a replacement for slides and overheads because the Macintosh offers new capabilities, such as animation and interactivity.

With the Macintosh as the presenting device, you can prepare an interactive presentation that enables you to navigate through the presentation through different paths and at different speeds. The presentation can play sound at the click of a mouse or jump from one topic to another or from one image to another. As a presenter, you have complete control over the sequence of slides and animated material. You also can jump from the presentation to a live software demo or spreadsheet.

Another major advantage of showing slides on the Macintosh screen is the capability to add animated transition effects between slides using programs such as MacroMind Director. For example, you can add a wipe, in which the next slide pushes the current slide off the screen smoothly, or a dissolve, in which the current slide dissolves slowly or quickly (you set the timing) into the next slide. Text can slide across the screen to make animated bullet lists. Pie chart slices can separate and dance around the rest of the pie. The possibilities are endless.

This chapter describes the benefits of using interactivity, animation, special effects, and sounds in presentations and compares various software tools for creating presentations with these elements. This chapter also describes the projection or display
hardware needed to make these presentations to large and small groups. This chapter is an introduction to the special effects you can achieve with animation and interactivity, which are explained in more detail later in Chapter 11. After reading this chapter, you will know the basics of using programs such as HyperCard and MacroMind Director, which can be used for presentations as well as for creating other types of interactive media. You also learn how to set up the appropriate projection or display equipment for group presentations and how to “publish” presentations over a network and eliminate the need for face-to-face conferences.

Displaying Live on the Macintosh

The presentation of ideas does not occur only in boardrooms and classrooms. A large category for presentations is the advertising and movie industries. For the movie Star Trek V, special effects artist Lynda Weinman put together animated sequences that serve as animatics, animated storyboards for describing scenes in the movie (see fig. 7.1). She used VideoWorks II (the predecessor of MacroMind Director) on a Macintosh II with a color monitor to present the animatics to the producer of the movie and to the special effects crew. The animatics were used only for prototyping the actual scenes, although MacroMind’s Marc Canter hopes to put the capabilities into future versions of Director to produce film-quality animated scenes entirely on a desktop Macintosh.

The Macintosh becomes the center of your creative efforts because you can arrange the same digital images and text for different types of presentations. A three-dimensional model of a product package, for example, can be presented on a color Macintosh monitor as an object that moves in any direction in three-dimensional space and have light projected from any angle. A particular sequence of these movements and lighting changes can be saved as a standard animation and then incorporated into a larger animated presentation performed on the Macintosh screen.

A particular image or single digital “frame” of a presentation can be used to create a high-quality slide and color print. The image also can be incorporated into a printed publication and eventually used for printing the graphics and text that appears on the final package.

The presentation also can be saved on videotape directly from the Macintosh using a video adapter such as Apple’s 8•24 or 8•24GC card, or a third-party equivalent product. Saving to videotape is described in Chapter 13.
Fig. 7.1. Live on the Macintosh screen: scenes from the animatics created for *Star Trek V* using VideoWorks, the predecessor to Macromind Director (courtesy of Lynda Weinman).
The Macintosh can be a presenting device as well as the creative tool. Even typical marketing and sales presentations can be effectively delivered using a Macintosh—and if you're traveling, on a Macintosh Portable. A projector or very large monitor can be used to show the screen to a larger group of people.

With the Macintosh as the presenting device, you can prepare an interactive presentation using HyperCard that enables inquisitive users to navigate through the presentation at their own pace. Sound can be played on cue from the presentation, and a user can jump from one topic to another, or one image to another, by clicking the mouse.

Using the Mac screen as the delivery system for presentations has many advantages. One is the ability to show "slides" (display frames) in any order and follow topic threads to other frames. Another is the ability to switch to a live spreadsheet for changing information. A third is the ability to demonstrate simulations and prototypes, applying new information or moving objects in simulated three-dimensional space. A fourth advantage is the ability to branch into a software demo, animation, or video clip, and incorporate prerecorded sound triggered by making selections with a mouse.

A multimedia presentation requires some preparation, if only to be sure that the audience can see and hear the presentation. The projection equipment described later in this chapter is suitable for most presentations, although the color projectors and large color monitors are relatively expensive pieces of equipment. Nevertheless, they pay for themselves by reducing or eliminating the use of slides.

If you include sound with your presentation, you need to amplify the sound. All Macintosh models have built-in stereophonic jacks for connecting to standard audio amplifiers, receivers, recorders, headphones, and portable speakers. All Macintosh units also have built-in speakers; the Macintosh Plus, SE, II, and IIX can play only one channel of stereo sound through its single built-in speaker, but the Macintosh SE/30, IICx, and IICi can play both channels. The Mitsubishi 37-inch monitors described in this chapter also have built-in speakers.

Although sound can enhance some presentations, it detracts from others. You don't need to use every feature of a multimedia system. Simple animation, combined with the capability to interact with the presentation, can be more effective than any other media combination.

For example, after using a graphics program to simulate an object such as a product package in two or three dimensions, you can use a program that offers animation features,
such as MacroMind Director, to simulate the object’s movement over time or its appearance in certain lighting conditions. A specific set of animated sequences can be prepared and presented on the Macintosh or transferred to videotape, although on videotape, you lose the interactive capabilities. Running the presentation on the Macintosh is more compelling than watching a video of the presentation. The ability to navigate through information in a non-sequential way can be invigorating and enlightening.

**Applying Animation and Interactivity**

In this age of information overload, an animated presentation can simplify a complex subject—and condense the content—to get over the first hump of comprehension. By using animation, speakers can illuminate their material in ways that extend their personalities, rather than in rigid, predictable ways. For example, you may include animated charts and graphs, attention-grabbing transitions, and talking heads (“and now, my staff will say a few words about how eager they are to serve you!”). The presentation becomes more effective the more you can customize the presentation for a particular audience.

Speakers can have many special effects at their disposal for presentations. Animated transitions between slides are simple but effective for attention-grabbing. Sound, animation, and video can be used to enhance a presentation or demonstrate a working concept. For example, Animatrix developed a self-running demonstration of the Macintosh SE/30 with videotaped and digitized images of two people, animated in MacroMind Director, to provide the illusion that they were placed inside the Mac screen (see fig. 7.2). The people’s voices were recorded and synchronized with the images so that you hear them talking and knocking on the glass of the SE/30 screen. The demo begins with the sound of a Macintosh booting, which immediately grabs the attention of passersby, and then continues with the usual “Welcome to Macintosh” startup sequence; then the demo shows the couple talking and moving inside the screen, with a narrator explaining details about the SE/30.

Sound and video take up enormous amounts of memory and disk space, by today’s standards. Multimedia methods can condense information in a manageable way by increasing the ability to initially comprehend the information, so that less raw material is required to produce excellent content.
Fig. 7.2. An animated presentation using scanned images and sound to create the illusion that the two people are inside the Macintosh looking out through the display screen (courtesy of Animatrix).
Transition effects such as builds are an example: To repeat the background and show one, then two, then three bullets of text, and so on, you would have to create a separate slide for each element of the build. With animation software, you can create the image once, then move graphics and text around a stationary background without creating any new images. You also can make sound loop continuously so that the sound plays for the duration of the presentation, yet occupies considerably less disk space.

You receive an additional benefit with scanned images and dense drawings if you design your presentations only for the Macintosh screen: because the screen is 72 dpi or 75 dpi resolution, you do not need high-resolution output, and you don't need to save the graphics in a high-resolution format. You may have continuous tone color and gray-scale images for use in publications and slides, stored in the TIFF format at 300 dpi resolution, but you can convert copies of these images to lower resolution versions for use in on-screen presentations, effectively reducing the disk storage requirement for the presentations. The Macintosh Plus and SE displays are 72 dpi, and the external Apple Color Display is 75 dpi.

Animation, sound, and graphics, when combined, offer ways to communicate that are far more effective than print and ways to mock-up and simulate ideas before producing them. Animatics are a good example. You can use a program, such as HyperCard or MacroMind Director, with original graphics to simulate a TV commercial. For Jordan McGrath Case & Taylor, a New York advertising firm, time and money are the issues. They can save time and spend less money when trying out creative ideas. What can be done in a few minutes on a computer used to take a few days in a video studio. According to Alex Ross of the firm, "If you can communicate your idea faster and less expensively, it makes all the difference."

**Presenting with HyperCard**

Jordan McGrath Case & Taylor use a HyperCard *stack*, a complete program or presentation written in HyperTalk, the scripting language of HyperCard. This stack enables them to place scanned images in a sequence with sound so that the sound can be adjusted with the timing of the sequence. This procedure provides a feeling for how the television commercial will be produced and enables the ad agency to obtain approvals from clients for the elements and sequencing of the commercial.
HyperCard is more than a software application, more than an extension of the system: HyperCard is a multimedia control program. HyperCard can be used to present a slide show, but its talents as a tool for interactive multimedia communications go much further. HyperCard and stacks created in HyperCard can run on any Macintosh.

Working with HyperCard is simple, and beginners can get started right away. In the package are many stack ideas such as a calendar, a to-do list, an address file, and an automatic phone dialer. You can build stacks using these stack ideas as starting points and using supplied button ideas and clip art stacks. The scripting language has "if/then" constructs that any BASIC user would be at home with, but you do not need to learn the scripting language. You can put together presentations without learning all the elements of the scripting language—HyperCard generates a complete program that you then can modify if you learn just a little bit of the scripting language.

HyperCard uses a card metaphor to describe a display of information. All the cards in a stack are the same size, and in Version 2, the card size can be as large as any Macintosh display; in fact, a card can be any size from a one-inch square to an 18-inch square (64 by 64 pixels to 1280 by 1280 pixels).

If the card size is bigger than the display you are using, you can scroll the display to see the rest of the card. Many stacks are designed with cards that are the size of a Macintosh Plus or SE screen so that the cards can be viewed without scrolling on the smaller displays. A stack can present multiple windows as well as cards, and color images can be displayed in a window or on a card.

Programs such as MacRecorder (Farallon Computing), MacroMind Director (MacroMind), Studio/1 (Electronic Arts), and InterFACE and HyperAnimator (Bright Star Technology) can be used to add special effects to HyperCard stacks. With MacRecorder, you can add the capability to record and play sounds; with Director or Studio/1, you can add the capability to play completed animated sequences; and with InterFACE and HyperAnimator, you can add different types of animated "talking heads" to a presentation. (MacRecorder, Director, and Studio/1 are described briefly in this chapter, and Director, InterFACE, and HyperAnimator are described in more detail in Chapter 11.)

Many of the special effects you can play from within HyperCard are supplied as XCMDs ("X" commands) and XFCNs ("X" functions), commands or functions, external to the HyperTalk programming language, that can be written in another
programming language and added to HyperCard scripts. For example, you can use an XCMD to record sound into a presentation and play it back or to start a videodisc playing a particular segment of video in a window on-screen. Stacks available from user groups and CompuServe software libraries often contain buttons that install these XCMDs and XFCNs in your stacks, so that HyperCard users who haven't learned HyperTalk can still use them without learning how to program.

Many commercial HyperCard stacks have been developed by third-party vendors and are sold through regular software outlets as well as through APDA, the Apple Programmers and Developers Association. The vast majority of the stacks are tools for creating interactive multimedia presentations and simulations (described in Chapter 11), and for adding special effects to slide show presentations performed in HyperCard.

**Adding Sound with MacRecorder**

Sound is a relatively new type of data for personal computers; in fact, most PCs cannot produce sound without some kind of add-on equipment. Every Macintosh model offers a built-in capability to play sound and a mini-phone jack for connecting the computer to stereo speakers and amplifiers. You can design multimedia presentations, therefore, to include sound with the knowledge that every Macintosh owner can hear it.

To play sound from a Macintosh, you first use a sound digitizer to record and convert the sound to a digital format. The MacRecorder (Farallon Computing) is a digitizer that connects directly to one or both serial ports (normally used for connecting to a LocalTalk or PhoneNet network and for connecting a modem). To record stereo sound, you can use two MacRecorders connected to both serial ports at the same time.

MacRecorder is supplied with the SoundEdit program for editing and mixing sounds and storing them in the Macintosh sound file format (for use with programs such as MacroMind Director). Farallon also provides two stacks called HyperSound and HyperSound Toolkit (part of the MacRecorder package) that provide a variety of options for storing sounds in HyperCard stacks (see fig. 7.3).

To digitize sound, the MacRecorder takes samples, or digital values describing the sound, at regular intervals. The higher the sampling rate, measured in kilohertz, the better the quality of the sample. The MacRecorder also can compress the sound to
Fig. 7.3. The HyperSound stack from Farallon Computing can be used to record and store sounds in digital form to be played from other HyperCard stacks.

save disk space and RAM, but as you compress at higher ratios, you lose sound quality. HyperSound can record and play mono sounds at various sampling rates and compression ratios and can copy sounds to and from stacks. HyperSound has a simple interface with an input level, an output level, a list of sounds available in a particular stack, and the capability to cut and paste sound. HyperSound is designed for anyone who uses HyperCard stacks. Chapter 12 provides a detailed explanation of how a sound digitizer works and how to get excellent results with compression and different sampling rates.

The HyperSound Toolkit, designed for multimedia stack developers, provides tools for recording and playing sounds that can be used in any stack. The toolkit is a set of HyperTalk external commands (XCMDs) and functions (XFCNs) that, when installed in HyperCard stacks, enable any user of the stack to record and play mono sampled sounds at a variety of sampling rates and compression ratios and to play uncompressed stereo sounds. You can use these XCMDs and XFCNs in your stacks and distribute them freely, without paying licensing fees. Many stacks available from user groups and public domain stack libraries are similarly free to use.
Adding Animation with Studio/1

Animation for HyperCard stacks can be created in HyperCard simply by flipping through cards quickly. You also can create animation using Studio/1 (Electronic Arts), the black-and-white younger cousin of Studio/8, the graphics program described in Chapter 4.

Studio/1 offers you the ability to create animated sequences more easily than with HyperCard itself. With Studio/1, you can paint images that differ slightly from one display card, or frame, to another, so that when you flip through them rapidly, you see animation (see fig. 7.4). Studio/1 also offers the capability to scan images directly from an Apple Scanner into the program.

To create a simple animated sequence, you set the number of frames and then paint on each frame. You can make this method convenient in a number of ways, such as setting up the frames to repeat the artwork so that you can work with the same elements without having to copy and paste them. The animation control panel, however, is the only way to see how many frames you have. You can speed up or slow down the speed of the animation, and any mouse click or key press stops the animation.

Fig. 7.4. Creating simple black-and-white animated graphics for HyperCard stacks with Studio/1.
You can attach a sound to a specific frame, as long as the sound already is digitized and stored as a resource in the Studio/1 file. (Farallon's MacRecorder stack and SoundEdit program can record and save sounds as resources in files.) After you have loaded a sound resource into a Studio/1 file, the next time you choose to attach a sound to a frame you are presented with a choice of sound resources already loaded.

A function called Anim Move enables you to define the start and end points of an animated sequence and the number of frames that complete the sequence. The program then creates the “in-between” graphics for the intermediate frames. Anim Move works in two (x and y) dimensions; for a sequence in three dimensions (including the z axis), use the program's Anim 3D option (see fig. 7.5).

![Studio/1](image)

Fig. 7.5. A simple animated sequence created by the program (Studio/1) with the Anim 3D function, which creates all the intermediate frames between the start and stop frames.

The Pickup Selection feature enables you to copy an area of the screen appearing on consecutive frames. If the area contains images in a sequence for animation, you end up with a copy of the animation, which you then can assign to the Brush tool or save in a separate file. You can use this feature to create clip animations for use in other documents.

The Pickup Selection, Anim Paint, and Brush features, when combined, provide a powerful method of creating animated sequences and saving clip animation files. For example, you can pick up a selection in an animated sequence, assign the selection to the brush, then use Anim Paint to “paint” a new version of that animation (see fig. 7.6). The Anim Paint feature
enables you to paint on-screen while the program flips from one frame to the next. Unfortunately, you have to be skilled to use this feature; if you are not quick enough to release the mouse button, animation continues to be recorded, and if you slightly move the mouse button, you have another image painted in those frames instead of a smooth-looking movement from one position to another.

Fig. 7.6. Using the Pickup Selection, Anim Paint, and Brush features in combination to "paint" an animated sequence (Studio/1).

Template files provided with Studio/1 perform automatic animated effects, such as three-dimensional cylindrical movement, zoom-in and flip, zoom-in and spin around, and so on (a total of eight 3-D movements are supplied on the program disk). The effects work on anything selected on-screen, including text frozen as a bit map (for example, painted).

The program packs five typical transition effects that can occur over multiple frames: Vertical and Horizontal Blinds, Dissolve, Zoom, and Metamorphosis. Any effect can be applied to an area of the screen. These effects have to be seen in real time to be appreciated.

The Anim 3D feature offers considerable potential for animating with 3D effects. The feature enables you to move and rotate a selection or brush in all three dimensions over a specific number of frames. This feature also presents a dialog box for typing dimensions for the x, y, and z screen axes for specifying the direction of movement and angle of rotation. After specifying a degree of rotation, the "object axes" shift with
the rotation from the screen axes, and you can further specify movement and rotation on the “object axes” or the screen axes to achieve different results.

You can specify the starting and ending *key positions* (a key position specifies an orientation and a location in three-dimensional space and can mark a beginning or an ending). You also can change a key position, but the methods are clumsy compared to “tweening” features of 3-D graphics programs that enable you to create intermediate (in-between) steps automatically. One advantage, however, to Studio/1’s key position feature is that you can specify a key ending position and work backward to create a sequence.

Ordinarily, animated sequences are linear in that they stop at the last specified frame, but you can create an animated sequence that loops back on itself by using the Chained option.

One excellent feature of Anim 3D is the ability to specify the number of frames to “Ease In” and “Ease Out” (accelerate and decelerate) the movement of a selection to make a smooth animated sequence. Another great feature is Anim Distortion, that enables you to distort a selection over a specified number of frames.

Studio/1 offers a compressed file format for saving animations, and you also can save a sequence in PICS format, which is a sequence of PICT images beginning with the first full image area and continuing with changes to that image area. PICS files can be imported into other programs that play animations, such as MacroMind Director and SuperCard (Silicon Beach Software/Aldus). You can save an entire animation (all frames) or a range of frames by first setting the frame range and then saving the range. You also can save a specific frame as a PICT, MacPaint, or TIFF file.

Studio/1 includes a HyperCard Animation Driver XCMD for playing Studio/1 animations from within HyperCard. Script commands for working with the Driver enable you to load an animation into memory, play the animation, go backward, go forward, jump to a specific frame, and release it from memory. With a combination of script commands to work this Driver and a set of animations created in Studio/1, you can create black-and-white, interactive, animated presentations.

**Presenting with MacroMind Director**

MacroMind Director is far more than a presentation program. It is a fully featured animation and multimedia authoring tool which excels in presenting slide shows mixed with animated sequences and sound on the Macintosh screen and in transferring slide shows to videotape.
Chapter 7: Making Live Presentations

The program enables you to combine text, graphics (including video stills), animation with transition effects, and prerecorded audio, all sequenced to time for presentations. Animation is as easy as a cakewalk with MacroMind Director if you have artwork and sounds ready to use. The program can create animated sequences and complete animated presentations that run by themselves or can be run from within a HyperCard stack.

MacroMind Director has a painting window for creating artwork from scratch or modifying imported artwork, a Studio window for creating animations (called movies), and an Overview window for putting together simple animated presentations.

The Overview window also can be used for playing many movies in sequence or for combining Director movies with PICT, Paint, and Glue images, accelerated movies, animated text, transition effects, and sound, into a complete presentation (see fig. 7.7). The window also can be used as a slide presentation program and to prepare 35mm slides from PICT images.

![The Joining of the Rails Overview](image_url)

Fig. 7.7. The Overview window in MacroMind Director enables you to sequence a variety of elements, including text, graphics, sound, transition effects, animated "movies" designed in the Studio window, and automatic animations created from menu choices.
As a presenting tool, the Overview window is in a class by itself, offering a control panel with icons representing standard VCR controls (play, rewind, pause, and so on) and offering you the ability to dynamically change the tempo and the background color of the screen. Slide show presenters can use Director to assemble slide shows that can be fully animated with transition effects when shown on a computer.

Director's control panels can be displayed for controlling presentations, or you can hide all panels and windows to display full-screen presentations while retaining control over them. The Overview provides a simple control panel with rewind and play buttons, and you can click above each slide to start the presentation from that slide.

The Studio window offers complete animation tools for making movies that can be accelerated with the Accelerator accessory program and played back from within HyperCard and SuperCard (with MacroMind Player, a supplied utility program). The Studio can display cast members, which are elements of a presentation, such as pieces of text and graphics. The Studio provides access to the score, a table or spreadsheet containing cast members arranged in frames, which are a measure of time. The score is used to define the action in a movie, just like a musical score defines a piece of music. The Studio also provides access to the painting and drawing tools for creating or modifying cast members.

Studio-created movies can be played by themselves or assembled in a sequence in an Overview document for playback. Other Overview documents (which are sequences of other movies and elements) can be included in an Overview document. You can assemble sets of movies and images in Overview documents, therefore, and organize the Overview documents in a final document that plays them all in sequence. In addition, MacroMind offers the Accelerator utility for converting Director movies into expanded versions that run much faster and smoother, even if the movie contains very large and intricate color images.

With Director, you can add sound directly to movies or to a sounds file for use by many movies. You can print a storyboard of scenes with comments, overlay animation, titling, and other graphics over full-motion video and save a presentation to videotape. You can use other visualization products, such as Paracomp’s Swivel 3D, to create 3-D animated sequences and bring them into Director (see fig. 7.8).

MacroMind Director’s painting tools, which are as complete as many color painting programs, are described in Chapter 4. You edit any text on the stage in the Studio window, and you can use different fonts and styles in a text block and edit text in a special text window rather than in a paint window.
MacroMind Director is the most widely used animation program on the Macintosh. Its predecessor, VideoWorks II, and Director have been used for everything from the Macintosh SE Tour (an animated presentation shipped with every Macintosh SE) to the Star Trek V animatics by Lynda Weinman and product demos for Farallon Computing (see fig. 7.9). Most of the interactive multimedia projects were constructed with the VideoWorks Interactive toolkit, which has since evolved into MacroMind Director (Version 2.0).

Using Automatic Animation

MacroMind Director includes a facility for creating animated text effects such as bullet and bar charts, zooming text, banners, and credits. These features are available in the Overview and in the Studio, along with automatic transitions between frames.

To use the auto-animate feature in the Overview, you drag the icon into position and select one type of text effect from a dialog box of choices (see fig. 7.10). You then type the words to be animated and set the text style and font. In the bullet list effects
Fig. 7.9. Product demos created in MacroMind Director for Farallon Computing, created by Animatrix (courtesy of Animatrix).
Joining of the Rails

- Central Pacific
- Union Pacific

Fig. 7.10. Animation for everyone: the auto-animate feature of MacroMind Director creates animations automatically for a variety of business and scientific presentations.
dialog box, you can set the type of bullet, the speed of the animation, the direction of the motion (for example, from the right, from the left, from below, and so on), any delays (such as an initial delay, an ending delay, a bullet delay, and so on), and the vertical spacing between elements. You then can click the Preview button to see the animation. When you click in the Preview window, a crosshair appears as the starting point for the animation, and the animation moves to whatever location you click in, so that you can place the animation exactly where you want on the screen. In the Overview, you always can change the text of the automatic animation by clicking the icon again and retyping over the old text.

MacroMind also provides this feature in the Studio window to make building complex animations with flying text and other special effects easier. The auto-animate feature in the Studio saves the resulting animation in individual frames in the score for further editing.

**Using Animation Tools**

In the score, Director uses a table metaphor of rows to represent *channels*, which are elements on the *stage* (where the animation is shown), and columns to represent *frames*, which are a measure of time. This metaphor is used consistently from the Overview window to the Studio score window.

In the Overview window, you place icons for elements such as graphics, auto-animated text, accelerated movies, transition effects, sounds, and so on, in sequential order from left to right in the top row. You can line up several elements in a column to occur at the same time, such as icons for a sound and a tempo control. You also can create a composite image of the elements (place them on-screen at the same time) by placing their icons in the same column.

The score window extends the metaphor to describe specific events with cast members. In the score window, each row is a channel that extends over time, holding information about a cast member in each cell. Each column is a frame, or unit of time, in which you can line up cast members (graphics, text, sound, color palette, and so on) to appear at the same time on the screen stage.

The Studio control panel displays a recording symbol in the appropriate channel and provides icons for turning the sound on or off and changing the background color. You can set the tempo for the entire movie in frames per second, which represents the fastest speed possible (although many things can affect speed, including the size
of images and the type of computer). On a Macintosh II display with black-and-white elements, you can set the tempo to 60 frames per second and get very close to that speed. The tempo of individual frames of the movie can be defined in the score by clicking the tempo channel and setting the tempo in a dialog box. You even can define the tempo to wait for a mouse click before jumping to the next frame, providing some interactive control. (For more interaction, use Director's scripting language, described in Chapter 11.)

Director offers several methods of animating, including the ability to assemble simple animations using only Cut and Paste in the score window. To see the results, you can drag a marker from frame to frame to move quickly through the entire animation. You can magnify the score window, display the currently selected cast member, and select choices for inking the graphics (such as matte, ghost, transparent, blend, and so on).

In addition to animation channels, the score provides channels for synchronizing sound and for defining a transition, a color palette, and a different tempo for each frame. The Set Transition dialog box enables you to define an automatic transition between frames (see fig. 7.11). You can add imported or built-in sounds in the sound window.

Fig. 7.11. Setting transitions between frames in a MacroMind Director movie's score window.
The notation in each cell can show the motion, the cast member position in the cast, the type of inking, or all of this information in an enlarged view (see fig. 7.12).

Director enables you to animate with the techniques of traditional cell animation: moving elements around a stage while leaving the background unchanged. You can drag any cast member to any position on-screen and define animated sequences frame by frame or in "real time" by dragging cast members while in frame recording mode.

The :Cast to Time feature places selected cast members in the same channel across time frames to quickly set up an animated sequence. A similar function in the score window (Space to Time) enables you to arrange several cast members in the same frame (in different channels) so that you can see all of them then moves the individual members to the same channel but places them in different frames.

The ability to do "in-betweening" (or "tweening")—creating intermediate steps automatically—and to control the smoothness and tempo of individual steps while
"in-betweening," are the hallmarks of Director. The key is the ability the program gives you to do "in-betweening" with automatic transformations and to save each step as an individual cast member. For example, you can paint an object, transform the object to another shape, and then tell Director to create all of the intermediate steps between the first and last shapes. The Auto Transform options and the painting tools make you far more productive than if you had to switch to another paint program and create the intermediate steps yourself. Director is flexible, however, so that if you want to use the "tweening" functions of another product, such as Swivel 3D, you can save the steps in that program in the Scrapbook or in a PICS file, and then import the Scrapbook or PICS file into Director's cast.

The use of Cast to Time and Space to Time, when combined with the In-Between and In-Between Special functions, enable you to easily create a sequence such as a human figure walking naturally and smoothly. The In-Between Special dialog box (see fig. 7.13) enables you to define a sharp or smooth curved path or circular path for the animation, and to decide whether or not to accelerate over the starting frames and decelerate over the ending frames.

![In-Between Special dialog box](image)

**Fig. 7.13.** The In-Between Special dialog box for automatically creating the in-between frames for an animated sequence (MacroMind Director).
frames. You can see a Preview of the sequence, fine-tune it, and save the entire sequence as a film loop in the cast for repeated usage in the score. The In-Between function also can be used to fill to the right in a score to continue an animated sequence over time.

The cast stores all elements: text, graphics, sound, color palettes, and individual *film loops* (a looping animated sequence used often in different places). Saved with each movie, cast members usually take up the bulk of the disk space occupied by the entire document. To manage the cast database, you can delete all unused cast members and move cast members into other slots for grouping them by similarity or category. To speed up animation, you can change cast members from text or PICT into bit-mapped graphics (because the screen resolution or videotape is usually the target resolution). You also can save disk space by changing the color depth of black-and-white PICT images to be one bit deep.

Every frame (step in time) can have a different color palette for displaying 256 colors at a time (eight-bit color), defined in the palette channel in the score. The program can blend between the palettes and cycle colors within a palette. Transition effects are available for palette changes so that you can, for example, fade to black before changing a palette.

You can blend colors within a palette to create a smooth color transition, reverse the order of colors in a palette (creating a negative image of a cast member that uses that palette), and sort colors by hue, saturation, and brightness (changing the color assignments in cast members that use the palette). The Select Used Colors option highlights the colors in a palette used by one or more selected cast members to make it easier to define a new palette for remapping cast members and to define color cycling within a palette.

The extensive palette management controls and painting tools are designed to make color cycling and palette cycling—two common special effects for animation—simple to create. No other painting program offers such a rich assortment of tools and effects for producing animated graphics.

**Playing Movies in HyperCard**

MacroMind Director offers an elegant method for playing movies from within HyperCard and SuperCard stacks. MacroMind Player, a utility provided with Director,
runs Director movies (and VideoWorks II and Accelerator movies) from within a stack. The program also enables you to build separate applications that consist of the movies you specify. You then can run these movies by themselves (without Director) by double-clicking them. Movies can be distributed by themselves and played on computers without any other software required.

Adding playing instructions to HyperCard and SuperCard stacks for Director movies is relatively simple. To play movies from within stacks, first you install the PlayMovie XCMD in the stack, and then use the PlayMovie command.

Director and VideoWorks II movies played within a HyperCard stack can include full-screen color images and sound (see fig. 7.14). You can see full-screen color movies on top or behind the stack background. You still can click buttons on the card to interrupt the movie and go to another card.

Fig. 7.14. From within a HyperCard stack, the MacroMind Director animation can play on top of a card, disappear underneath it, or play outside it.
With PlayMovie, you even can set the location on a card for starting the movie. You also can use PlayMovie to display the movie’s last image on-screen until HyperCard takes over and moves you to another card. Many other options are available, including preventing the movie’s sound from playing, changing the speed of the movie, and playing only a specific set of frames.

Whether you play Director movies from within HyperCard stacks or play them by themselves or with Director, the screen is the stage that must be projected or displayed on a large monitor to be seen by a group.

Using Projection Equipment

Performing a slide show on a Macintosh eliminates all of your production efforts for visuals, except for assembling the content. You need a very large monitor or a projector, however, to project the Macintosh display for presentations to groups larger than a handful.

An exception is a presentation on more than one Macintosh linked by network cabling. An application called Timbuktu (Farallon Computing) enables you to broadcast an animation presentation or slide show, although without the sound, throughout a building to every Macintosh on the network. You also can store a HyperCard, SuperCard, or Director presentation, including sound, on a network’s file server, which is a disk or computer designated to hold files to be shared. Individual users then can transfer the presentation to their Macintosh computers and run them. Until everyone carries a portable Macintosh with a cordless link to a network, however, you will need to show one display to large and small groups.

The quality of the computer presentation depends on the quality of the projection and display equipment. Large high-resolution monitors are the best choice, and video projectors offer reasonable quality although the result is usually not as sharp as a monitor. A new form of projection device—a Liquid Crystal Display (LCD) pad placed on a conventional overhead projector—is perhaps the least expensive approach, but most current LCD pads project only black-and-white images and are not suited for large groups. Portable video projectors that can display color and still fit under an airline seat offer price and performance advantages over all these methods. Choices depend mostly on the size of the audience and the room, as well as the use of color in presentations.
Understanding Macintosh Displays

The Macintosh uses a cathode-ray tube (CRT) built into the unit (as with the Macintosh Plus and SE models) or in a separate monitor (as with the Macintosh II family). The Macintosh Portable uses a reflective active-matrix liquid-crystal display (LCD) that offers one of the clearest pictures ever seen in a laptop computer (each pixel has its own transistor). These displays are monochrome (black and white only), even though some color applications can run on them (you just cannot see color).

The built-in monochrome displays (nine inches diagonal) of the Macintosh Plus and SE models offer 512 by 342 pixels for a resolution of 72 dpi (each dot is one pixel). The SE models have an extra slot for adding a video card and attaching an external monitor.

For the Macintosh II models, Apple offers the Apple Color Monitor, which is connected to the 4•8, 8•24, or 8•24GC display card from Apple, described in Chapter 2. You can connect the Color Monitor directly to a Macintosh Iici, which essentially offers the Color Card electronics on the main processor board (also called the motherboard).

The Apple Color Monitor is twelve inches diagonal and offers 640 by 480 pixels for a resolution of 80 dpi. With the 4•8, 8•24, or 8•24GC card (or with the standard Macintosh Iici), you can display 256 colors or gray-scale shades simultaneously in eight-bit mode; with appropriate software, you can pick which 256 colors to use out of a possible 16.7 million. You can switch to 24-bit mode with the 8•24 and 8•24GC cards, and with third-party cards from RasterOps, SuperMac, and others, you can display any of the 16.7 million colors, providing photorealistic color with no limitations other than the total number of pixels.

The Macintosh Portable's black-and-white LCD provides a wider display, with 512 by 342 pixels. Because the LCD has no internal illumination (the display is reflective), the LCD may be hard to read in dim light or at the wrong angle but offers excellent contrast and sharpness in a well-lit room or in sunlight.

The built-in displays and the Color Monitor are all set to landscape orientation (wider than tall). Apple also offers two large monochrome external monitors: the Apple Portrait Display (taller than wide, or portrait orientation), which displays one full page, and the Apple Two-Page Display. The monochrome Portrait and Two-Page displays are primarily useful for page makeup applications that do not require the display of color.
Generally more pixels and higher resolution provide sharper displays, but most Macintosh applications assume a resolution of 72 dpi. An inch on a program’s ruler with a 72 dpi monitor, therefore, corresponds almost exactly to an inch on paper. Monitors with higher resolution squeeze more information into an inch, and the resulting page as displayed is smaller than a piece of paper but prints at the usual size.

**Using Multiple Displays**

If you work in publishing and multimedia presentations, as we do, you can use external monochrome and color displays with the same Macintosh II at the same time (the Macintosh SE models enable only one external display in addition to the built-in display). The Macintosh II family has the inherent capability of supporting multiple displays—each one must have its own video adapter, and you can fit three adapters in a Macintosh IIcx and up to six in a Macintosh IIx or IIfx.

The System spreads the desktop over all three displays rather than duplicating the same information. You can place separate windows on the separate displays to compare them, and drag items, such as icons and windows, from one display to another, and even spread windows to appear on more than one display. Many applications support the use of multiple displays (such as MacroMind Director and MORE II) so that you can put the audience information on one display and keep the controls and notes on another display facing the speaker.

Many third-party external displays are useful for desktop presentations. At the low end, the SuperMac SuperView dual-page color display is 19 inches diagonal and connects to the SuperMac Spectrum video card, offering 1366 by 1024 pixels. This display monitor may be large enough to show a presentation to a group of 10 or 12 in a small room.

An external display monitor frequently seen at trade shows in exhibit booths is the Mitsubishi XC3710. This 37-inch monitor (with a 35-inch diagonal viewing area) can display 800 by 650 pixels and vibrant color images, due to the 30 MHz bandwidth of the supplied video amplifier. The monitor is housed in a casing with two stereo speakers, and a unit without speakers is available for wall or ceiling mounts. A line amplifier to support the Macintosh II analog signal is needed if the signal source is more than 30 feet from the monitor. Another Mitsubishi monitor that uses the same 37-inch display tube is the AM-3501R. Both monitors can adjust to the scan rate of a Macintosh II video card (they are *multiscan* monitors), and both are compatible with
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RGB analog (Macintosh II) and RGB TTL (Macintosh Plus and SE) as well as NTSC (National Television System Committee, used for American TV and videotape and described in Chapter 13). The AM-3501R accepts other types of video input but uses a lower bandwidth video amplifier and displays 720 by 520 pixels.

With both Mitsubishi monitors, text visibility is poor beyond 15 feet, and straight lines start to curve near the edges. Strong overhead lighting also can cause glare, but normally the picture is bright and clear.

The NEC DP5200S Data Projector uses a Fresnel-type screen to achieve a rich, non-reflective image. The rear-projection 52-inch monitor is housed with a forward-projection unit (the DP-1200A) in a heavy wood cabinet. The DP5200S Data Projector offers an excellent non-reflective picture as long as you are watching from directly in front—from as little as 30 degrees to the right or left of the front position, the picture appears too dark. Mount this monitor on the ceiling or high on a wall, because it must be elevated to be viewed by a large group. The monitor works best in narrow rooms or rooms longer than 30 feet. The picture is better and larger than the Mitsubishi 37-inch monitors, and the unit is compatible with nearly every type of video signal and can adjust to the scan rate of the video card.

The Macintosh Portable can be used to control an external monitor directly. The Portable is designed to be connected via the Portable Video Adapter to Apple monitors and to NTSC, PAL (a European standard), and SECAM (a French standard) video monitor inputs. The current version of the Portable, however, does not offer color output for display. For black-and-white presentations on the computer, the Macintosh Portable is attractive because you can travel with it, make changes on the fly, and rent a monitor at your destination.

**Using LCD Projection Pads**

One cost-effective alternative to video projection is the LCD (liquid-crystal display) projection pad for use with *transmissive* overhead projectors (the kind that shine light up from below the panel). This type of overhead projector commonly is used in schools, in government and educational institutions, in business, and practically everywhere else. Overhead projection is effective for small groups (under 35 people) in well-lit rooms, especially for informal presentations or if the speaker wants to encourage interaction with the audience. Because the information is on the Macintosh, you can change the presentation quickly and easily call up other graphics and programs.
The LCD pad, which is connected to the computer, is placed on top of the panel and displays the Macintosh screen image, which then is projected onto a wall or screen. Many LCD pads are on the market; the following paragraphs describe a few that are currently the best in picture quality, price, and performance.

SAYETT Technology offers the SAYETT DATASHOW HRM®, which displays 512 by 342 pixels (for a 20:1 contrast ratio). The DATASHOW can be adjusted to compensate for ambient light and presentation surfaces and offers an invert mode for displaying white text and graphics on a black background as well as a contrast control. The DATASHOW can project a clear black-and-white image without ghosting (image trails left behind by animation).

By itself, the SAYETT DATASHOW HRM can be connected to a Macintosh Plus or SE (the Macintosh Plus installation requires drilling a hole for the video cable). You need the Nutmeg LCD Video Interface to connect the DATASHOW to any Macintosh II model. This Interface is a video card for the Macintosh II and enables the LCD panel to operate as another monitor in addition to the monitor you are using with the computer. You can use any program that takes advantage of two monitors, such as MacroMind Director and MORE II, and display a full-sized presentation to the audience on the LCD pad while displaying thumbnails, menus, controls, and notes on your monitor. You also can drag items and windows from the monitor to the LCD pad and back, as if the pad were another monitor. The DATASHOW and Nutmeg Interface, however, is limited to 512 by 342 pixels, the size of the nine-inch Macintosh Plus and SE display—you must design your black-and-white presentations accordingly.

The MacViewFrame II+2 (nVIEW) connects directly to the Apple video card in a Macintosh II and displays the same image as the Apple external color monitor—a full 640 by 480 gray-scale image (not color). This pad is more useful for presentations that include gray-scale continuous tone images—the picture is clear but the contrast is not as sharp as the DATASHOW. The MacViewFrame II+2 is one of the few pads that can translate color images into eight shades of gray.

The MagniView 480 (Dukane) LCD pad can translate Macintosh II color images into 16 shades of gray and offers the highest resolution of all the pads on the market—720 by 400 pixels for text and 680 by 480 pixels for graphics. The LCD pad can be connected to the Apple video card in any Macintosh II model. Dukane also offers adapter cards for the Macintosh Plus and SE models.

The Flattop (Network Specialties) is perhaps the smallest and lightest unit (4 lbs.) on the market, which makes the Flattop the traveler's choice. This unit does not have a fan or separate power supply because it draws power from the Macintosh. The
Flattop is supplied with a padded case for protection while travelling, and the TopShell software (a Control Panel device) that offers a large cursor, a magnified screen image, and the ability to invert an image (change black to white and white to black). The Flattop, however, works only with Macintosh Plus and SE models.

When using a black-and-white projection system (such as an LCD pad) with color images, be prepared to lose some information unless the LCD pad's software can convert the color information to shades of gray. Green, blue, and brown usually project as white, and red and magenta project as black or gray. If you put green letters on a white background, you cannot read the letters. Light blue against a white background also may disappear with monochrome projection. The best approach is to test your projection equipment with color images; after you find a set of colors that work in color and monochrome projection, you should save that set as a palette (MacroMind Director, SuperCard, and all of the presentation programs described in Chapter 6 provide the capability to save custom palettes).

Using Video Projectors

A typical video projector can project in image sizes ranging from 5 to 15 feet, measured diagonally. Portable, lightweight models are available for monochrome (black-and-white) projection for around $4,000. Color projectors start at around $12,000 and can be as high as $200,000. The wide price range reflects a wide range of features, picture quality, methods of color calibration, and focusing abilities. Your choice depends upon many different factors, such as where the unit is located, how large the room is, whether the room is dark or as bright as a convention showroom, and what kind of quality you can afford.

Most color video projection units have three color guns, or projection devices, for red, green, and blue (RGB), and about a half-hour is required to synchronize them so that colors appear normal. The Macintosh II Video Card has a horizontal sweep frequency (for refreshing the image) of 32.4 kHz, and the Macintosh Plus and SE sweep at about 22.25 kHz. Unfortunately, many color video projectors sweep in the range between 15 and 27 kHz and are not useful with the Macintosh II Video Card. A simple but crude method of projecting the Macintosh display is to focus a video camera on the screen and connect the video camera to the video projector, sidestepping the signal conversion problem.

Epson America offers perhaps the best buy in portable color video projectors: the 13-pound Epson Liquid Crystal Image Projector, which can project video images up to 12
feet wide. The entire unit fits into a carrying case small enough to be stored under an airline seat. The projector uses a three-color LCD image matrix and can project images from NTSC composite video sources, digital RGB (red, green, blue) signals from computers, and analog RGB component video. The unit is easy to set up and enables you to adjust color saturation, tint, brightness, and audio levels. The picture quality is still not as good as most video projectors—ghosting occurs with animation—but the package and price is a major step in the right direction.

For traveling presenters who need the best possible picture quality, the cost-effective option is to rent from an audio-visual service specializing in projecting Macintosh screens. In some cases, you are better off using their Macintosh as well as their projector, because problems can occur when trying to connect these two devices, and it is rare to find a service that doesn't blame your equipment for the problems. You must be aware of what you are getting: our experience has shown that some rental services do not provide enough RAM in their Macintosh II models to run multimedia presentations. A minimum of four megabytes is required for most full-color presentations produced in MacroMind Director, and eight megabytes is usually required if the presentation includes sound. Expect the service to spend at least half an hour calibrating the projection equipment for a particular color adapter and for room lighting. Bring your own hard disk, because the service most likely does not have your software. We typically carry a SuperMac DataFrame XP150 (which is shock-mounted for travel) and rent everything else—the Macintosh IICx or any other member of the II family, the color monitor, and the video projector.

If each member of the audience for a presentation has a Macintosh connected to a network, presentations can be “published” for all to use at their own convenience, eliminating the need for projectors or large display monitors; in fact, eliminating the need to meet in one location at a specific time.

**Presenting over a Network**

Every Macintosh has the capability, built into the computer, to be connected to an AppleTalk-compatible LocalTalk network. The computer network itself is a medium for transmitting presentations. When you have all the recipients of information located on the same local-area network or internet, you can publish information electronically over the network or internet, including animated interactive presentations that include sound.
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An easy way to publish presentations over a network is to store them on a file server, which is a computer with hard disks acting as a repository of all shared files. Users connect with the file server and transfer the presentation file to their Macintosh computers. The presentations then can be run on their computers. Anyone connected to the network by means of cable or telephone connection can receive the presentation.

If the presentation is a Macromind Player movie, the recipients can play the movie without using Director. All sounds can be heard on the built-in Macintosh speaker. Because every user has HyperCard, you can assume that stacks can be run by everyone. SuperCard "stand alone" stacks also can play by themselves without the use of SuperCard.

Another way to show a presentation to a group of Macintosh users on a network is to use Timbuktu (Farallon Computing). Timbuktu enables you to see another Macintosh computer's display on your display and enables you to perform functions on the other computer while watching from your computer, using your mouse and keyboard. You cannot hear sound on your computer, however, because the sound is playing on the speaker of the other computer. Timbuktu is therefore useful only for presentations without sound.

Timbuktu/Remote, a companion product, enables a Macintosh to interact with a network of Macintosh computers in the same fashion by typing into the network via a modem. With Timbuktu, any Macintosh user on the network can see and participate in a computer presentation; with Timbuktu/Remote, any Macintosh user in the world can connect to a network and participate.

Timbuktu links two computers as a host and a guest, and with the host's permission, a guest can operate the host computer directly from the guest computer. Timbuktu is an interesting alternative for enabling people in small work groups to visit each other's screens without leaving their desks.

A number of training and presentation applications can be developed and provided, via network, to an entire corporation. Seminars on using programs could be offered on-line. Training movies can be played for everyone in the department at the same time, watching from their individual computers as the same movie unfolds on their screens.

The capability of adding narration offers the possibility that network management reminders and talking presentations could be viewed on several screens at the same time, transmitted by one computer over the network. The use of these applications
along with electronic mail and scheduling programs could cut down considerably the need for face-to-face meetings in conference rooms.

The network concepts are the same as for publishing documents on a network: each presentation is simply a multimedia "document" treated as any other file in the system.

Chapter Summary

With the Macintosh as the presenting device, you can prepare an interactive presentation that enables you to navigate through the presentation through different paths and at different speeds. As a presenter, you have complete control over the sequence of slides and animated material.

The advantages to using the Mac screen for presentations include the capability to show "slides" in any order, to switch to a live spreadsheet for changing information, to demonstrate simulations and prototypes, and to branch into a software demo, animation, or video clip.

Animated transitions between slides are simple but effective for attention-grabbing. Sound, animation, and video can be used to enhance a presentation or demonstrate a working concept. Live presentations offer ways to communicate that are far more effective than print and ways to mock-up and simulate ideas before producing them.

HyperCard, supplied with every Macintosh, is a multimedia control program. HyperCard uses a card metaphor to describe a display of information and a stack to hold cards. Special effects can be added to HyperCard in the form of XCMDs and XFCNs, which are commands or functions external to HyperCard that can be added to HyperCard scripts.

To play sound from a Macintosh, you first use a sound digitizer, such as Farallon's MacRecorder, to record and convert the sound to a digital format. The HyperSound Toolkit supplied with the MacRecorder provides tools for recording and playing sounds that can be used in any HyperCard stack.
Black-and-white animation for HyperCard stacks can be created in Studio/1 from Electronic Arts. Complete animated sequences in color or black and white can be created in MacroMind Director and played in Director, in HyperCard, or by themselves as individual movies.

MacroMind Director is the most widely used animation program on the Macintosh, offering cell animation features and painting tools for experienced users as well as automatic animation for beginners. You can combine movies with images, sound, and other elements in a single presentation.

For large groups, you need projection and display equipment. Large monitors offer the best picture, and video projectors offer reasonable quality although the result is not as sharp. An LCD projection pad placed on an overhead projector is the least expensive approach, but most pads project only black-and-white images. Portable video projectors that can display color and still fit under an airline seat are the best choice for traveling presenters.

If all the recipients of a presentation are connected to a network, they can receive the presentation electronically, without wasting time or travel expenses getting to the presentation room. They then can play the presentation on their computers. This is similar to publishing documents over a network.

The next chapter leads you into the world of publishing information. The same materials you gathered for slide and live presentations—the same graphic images, charts, and text—can be used again in publications.
If your organization prints reams of documents every day, you are in the publishing business, even if those documents never leave the building. Far more printed pages are produced as an incidental function of business and government than by all the book, magazine, and newspaper publishers combined.

Desktop publishing is growing up and becoming respectable. Corporations have already started doing most publishing in-house, and commercial publishers are not far behind in their acceptance of desktop publishing methods, which can be cost-effective in the production of high-quality publications.

Desktop publishing has changed the way published materials are produced. Primarily, desktop publishing has changed the way publishers prepare the camera-ready masters for the traditional printing process. This process also has changed the appearance of corporate reports and presentations that were formerly printed on daisy-wheel printers or typewriters—adding fonts and graphics where no fonts or graphics had ever appeared before.

For activities involving graphics, the Macintosh II models are the most powerful publishing systems available on a desktop—they are fast; they can display over a million colors and near-photographic-quality images; and they can prepare PostScript output for high-resolution devices connected to a network as well as QuickDraw output for inexpensive printers. No matter which form of publishing media you choose, the Macintosh II platform offers a variety of tools and can be outfitted to be a complete production environment.

The next three chapters cover nearly everything involved with publishing and help you choose a publishing medium, learn about page makeup programs, and choose a printing and distribution method to match your needs. This chapter describes the
design skills required for various publishing applications and how you can use page makeup programs to mock up the entire contents of a publication and print thumbnail sketches of the pages for rough layout. The greatest benefit with electronic page makeup is that you can go ahead and use the same program to produce the final publication. This chapter also shows how such programs can be effective for layout, planning, and design, as well as production. By the end of the chapter, you will understand the publishing process and know the comparative strengths and weaknesses of the various page makeup programs. You also learn how these programs can prepare pages for whatever medium you choose to publish in.

### Choosing a Publishing Medium

Information moves in mysterious ways, but one form of information that is here to stay is the paper publication. Paper is the best portable medium for information—you can take it anywhere and it “works” as long as you have enough light to read.

We all may feel the need to save trees, but the corporate appetite for paper is never satisfied. Paper is still the most popular distribution medium, because it is more portable than any other medium. Despite all efforts to create the paperless office, the use of paper is at an all-time high, although its use has changed from primarily a storage medium (paper files) to a transfer medium (for conveying information to readers). Recycled paper is put into use for newspapers, but not for glossy paper, which is the preferred medium for color.

The lure of laser printing has significantly increased overall paper consumption. Laser printers are revolutionary because they enable you to print on demand and use paper as a way to digest information. Laser printers are so seductive that we are all enticed to print test copies. The paperless office may someday come true, but for now, paper remains the most convenient way to communicate information.

Before the Macintosh, electronic publishing of text grew slowly because text by itself (without fonts and without graphics) was not as interesting, and because the method of distribution was not uniformly capable of reaching everyone who uses a computer. Now, electronic publishing with fonts and graphics—indeed, full pages—is not only possible, electronic publishing is preferable to the normal route of printing and distributing paper.
Electronic publishing is actually electronic *distribution* of information. Pages put together electronically for printing can be transported first, before printing. It can be far more economical and much faster to transfer the electronic version of the publication, and then print the publication at a site closest to the reader. Large newspapers and magazines transmit pages electronically to regional printing centers; this same metaphor can be applied to office documents and publications. Methods include using fax devices as remote printers, distributing documents over networks, and transmitting documents directly to computer users by modem. These electronic methods of distributing documents are described in Chapter 10. The publishing process, however, is essentially the same for all these methods of distribution.

Information can be delivered on newsprint, copier paper, offset sheets, uncoated or coated stock or sheets, and a variety of other papers. Information can be delivered through dial-up information and videotex services, or on CD-ROM, or over the telephone via data modem or fax modem, or over a network. No matter which type of paper, press, or electronic distribution method you choose, the Macintosh can be used to prepare the content in a cost-effective way. No matter which medium carries the message, you must have the design skills to present the message in its most readable form.

**Obtaining Design Skill and Support**

The ads for desktop publishing say the process is easy—you can do it yourself. Quality is no longer an issue because PostScript provides compatibility with a wide range of high-resolution typesetters and film recorders for high-quality output. That does not mean, however, that managers should buy the equipment, place it on the desks of their employees, and expect them to be instantly productive. The industry has finally recognized that training, design skills, and production know-how are all necessary ingredients for successful publishing operations.

You have many options for training in computer and design skills, and you need both types of skills in desktop publishing applications. Start with the store where you bought the equipment; the retailer may offer classes that teach basic computer use skills and introductions to a few of the best selling programs. The retailer also may offer classes in design and graphics as well as in desktop publishing. Even if you didn't buy the equipment at a particular store, the classes are usually affordable for
small businesses and entrepreneurs ($100-400 per course). Another option is continuing education offerings at colleges and universities and independent training courses provided by personal computer user groups.

Buying from a VAR (value added reseller) can be better than buying through mail order or from a retail store, simply because the VAR usually provides training, which is the "value added" to the equipment. Many VARs specialize in consulting to large corporations where in-house desktop publishing efforts need to be coordinated. The VAR should provide quality in-depth training and support for entire departments of users.

Design skills are not easy to acquire, and even if you use clip art (artwork ready for use in the public domain), you must have some design sensitivity to place elements in proper positions on the page. As laser printers proliferate in a corporation, the use of decorative or bizarre fonts and the unintentional (or intentional) departures from corporate identity standards contribute to a chaos of gaudy memos and sloppy-looking reports. Individual expression is something to cherish, but not when that expression embodies 40 different fonts on the same page. Trademark disputes can occur if corporate logos and product names are not properly reproduced throughout a company.

One solution is to use design consulting firms and communications companies, which offer a variety of services such as corporate identity programs, custom page layout templates, consulting on production, setting up internal systems, information design, package design, advertising design, and marketing support.

You may hire such a firm to standardize the design of letterhead, business cards, office forms, and in-house reports. The design firm could provide custom templates to use with page makeup programs so that you can produce your documents in-house.

The key to success with this strategy is to hire the right design firm to express the corporate identity and get the appropriate training to use custom templates. By hiring a design consultant for the design and then using desktop publishing equipment to do production in-house, a corporation can take advantage of desktop publishing without risking ineffective communications.

For some, the economical choice is to use walk-in desktop publishing service bureaus, which are popping up like mushrooms inside the familiar copy centers and print shops. One advantage to using a service bureau is one-stop shopping for production and offset printing. Some firms offer a wide range of services from design
and graphics work to computer consulting, on-site customized training, corporate
design, typesetting, imagesetting, scanning of text and graphics, and data conversion.
In addition, some even offer printing and mailing services.

Some service bureaus rent you time on desktop publishing equipment and give
discounts to those who attend the classes offered by the services. Even if you have all
the equipment you need for production in-house, you may want to go to a service
bureau for testing or using an expensive piece of equipment, such as a color slide
scanner or imagesetter, to expand your range of options. Franchise service bureaus
renowned for their desktop publishing facilities include Krishna Copy Center (San
Francisco, Calif.) and AlphaGraphics Printshops of the Future (Tucson, AZ).

No matter what production method you use, the Macintosh can form a link between
your creative efforts and production. For example, you can use a Macintosh and a
page makeup program to create a mock-up of a publication or printed piece, which
can be distributed to reviewers for approval. The same page makeup program can
turn the mock-up into the final product.

Creating and Managing Mock-Ups and Layouts

In the complex world of commercial publishing, layout artists prepare mock-ups
of page layouts to submit to an art director and managing editor for approval.
Usually the entire publication is mapped out from page to page with thumbnail
sketches of these layouts. A thumbnail sketch of a page may be only an inch
high, but the elements such as spot color and color images are indicated, so that
the art director and managing editor can make decisions about such things as the
use of color. On many printing presses, a publication is printed as a series of
signatures, which are sets of pages printed on one sheet, then folded and
trimmed to produce a set of pages in sequence. The use of particular colors on
particular pages of a signature—such as the use of color only on one side of the
sheet—influences the overall cost of the press run. Layouts with miniature page
sketches, therefore, are essential in the design process.

The currently available page makeup programs can produce thumbnails for the layout
process, and you can continue to work with the prototype layout to produce the final
camera-ready pages. Of these programs, PageMaker (Aldus) is the most flexible, but the other programs, such as XPress (Quark) and DesignStudio (Letrasel) also have advantages.

Single-page advertisements and double-page spreads may be produced by desktop or traditional methods, but mock-ups for these pages are better handled by desktop programs that can provide the flexibility for creative exploration. The same page makeup programs can be used for single-page and spread mock-ups, and specialized ad-page makeup programs, such as Multi-Ad Creator, provide even greater flexibility and tools designed for preparing page ads. You also can use the type-manipulating programs, such as LetraStudio (described in Chapter 3), and drawing programs, such as Adobe Illustrator and Aldus FreeHand (described in Chapter 4), to prepare mock-ups and final pages for advertising. Such pages then can be imported into page makeup programs for integrating them with the rest of the publication's layout.

One of the benefits of blurring the edge between design and production is the ability to take a mock-up through all the phases of design and approval, and then go through several production stages, while retaining the ability to change things. Sometimes the use of floppy disks to move the pages through the design and approval process is cumbersome, and if your Macintosh computers are linked by network, you can increase the productivity of your operations by making it easier to move designs and pages around to where you need them.

One of the best ways to organize a network used for design and production is to use a file server for the network’s users that holds all of the final versions of designs and pages. Apple offers the AppleShare file server that runs on a dedicated Macintosh and provides simple file sharing with access protection so that only authorized users can actually make changes to files.

Timbuktu (Farallon Computing) was described in Chapter 7 in the section on presenting information over a network. Timbuktu is an interesting alternative for enabling people in publishing work groups to visit each other’s screens without the use of a file server and without transferring files. Pages can be shown to others for approval, and an editor, as a guest can visit the production computer (acting as host) to make last-minute changes. Writers can go over drafts together and never leave their desks.

At this point in the creative process where you are experimenting with the look and layout of a printed piece, the most important characteristic of these tools is the
flexibility to move elements around on pages. Page makeup programs generally have an advantage over word processing and graphics programs in that they can combine columns of text from different sources on the same pages with graphics from different files. You can grab elements from other programs, throw them together on the page, and then move them around to your heart's content. Different layouts of the same information can be used to mock up different publications and to prepare presentations. Nothing is wasted, and experimentation is not expensive or otherwise prohibitive.

**Reviewing Page Makeup Programs**

Page makeup programs can combine text and graphics, including scanned images and color graphics, onto pages. They offer the most flexible and powerful tools for designing and producing pages and incorporating multiple stories and precise typesetting features optimized for the print world.

Although desktop publishing features are being added to word processing programs in order to take advantage of laser printers and graphics software, page makeup programs also are growing in sophistication to handle longer documents. Word processing programs are optimized for fast text editing. Page makeup programs, on the other hand, are optimized to bring different elements together to create a publication. Word processing programs are preferred for automated document production, but they don't offer enough flexibility for designing magazine, book, and newsletter pages.

Some graphics programs also offer presentation and page makeup features but are oriented toward single pages or dual-page spreads. Some programs are designed specifically for mocking up and producing advertising pages, such as Multi-Ad Creator (Multi-Ad Services). Addressing the page layout needs of graphic artists, Aldus FreeHand and Adobe Illustrator 88 offer minimal page layout features as part of a complete graphics toolkit. These programs are not designed to handle heavy loads of text, but may be perfect for one-page or two-page advertisements, flyers, and promotional pieces, as well as slide show and overhead presentation materials.

No single program provides enough features to completely replace all of the features offered by the variety of word processing, graphics, and page makeup applications. Not every application can be served properly by one or even two programs. This fact
escapes many who are accustomed to using one word processor, one spreadsheet program, and one database program. Page makeup methods may differ greatly from one project to another, and each program must be viewed as a finishing tool for a particular project.

A few layout features are common to all of the page makeup programs. They are: text elements and graphics can be positioned on a page directly next to each other, text is automatically hyphenated for optimal spacing, and the spacing between letters and words can be controlled for high-quality typesetting. All of them also can produce PostScript output for high-resolution PostScript typesetters and imagesetters, as well as QuickDraw output for QuickDraw printers and fax modems.

**Aldus PageMaker**

Aldus PageMaker was the first page makeup program to be successful, and this program established a level of functionality that is considered the *de facto* standard. PageMaker is still the most widely used page makeup program on the desktop, far surpassing the other programs in popularity. The current version (PageMaker 4) is the most flexible and appealing of all page makeup programs and is designed to handle any publishing task.

PageMaker's layout features mimic conventional design techniques. When placing each column of text, a paste-up artist has semi-automatic page layout and automatic typesetting features, as well as the ability to move or change any text or graphic element on an electronic version of a conventional pasteboard. This electronic pasteboard can hold columns of text that can be sized and adjusted to your heart's content. The “snap-to” ruler guides and general freedom of movement make designing any type of page possible. Graphics can be cropped and scaled, and text can be typeset with professional results.

PageMaker is by far the easiest program for quickly setting up a page format to be used on all subsequent pages. For example, you can quickly prepare a mock-up of a newsletter (see fig. 8.1). Simply move to the master page, set the number of columns and column width, and then set the type characteristics. PageMaker assumes the text areas are to be linked from column to column and page to page when you choose the Autoflow option.

You can design each page independently, with column guides that change (see fig. 8.2), or you can design the master pages to use the same ruler and column guides for each page. PageMaker displays rulers with moving tick marks for precise adjustment of text and
Fig. 8.1. Designing a mock-up of a newsletter in PageMaker by setting the column width in the master pages for the left and right pages.

Fig. 8.2. Changing the column layout for a page in the newsletter while preserving the standard layout as defined in the master pages (PageMaker). The ruler guides and column guides can be set to have text and graphic elements snap to them for quick and easy alignment.
graphics. Column and "snap-to" ruler guides are displayed at the same time, and guide positions can be locked.

When moving text and graphic elements around a page, PageMaker continually displays the element while you are dragging the mouse so that you can see the element while moving or resizing it. The program displays numbered page icons (showing two-page spreads) for navigating from page to page quickly. You can scroll up or down and right or left on the pasteboard, and zoom into a 400% enlarged view of the page or out to a view where the entire two-page spread is displayed, and out beyond that to view the pasteboard surrounding the spread as well.

A designer can start early by using PageMaker to plan the overall look of the publication. With an estimate of the amount of text and number of graphic elements necessary to convey the message and the number of pages, you can determine the page size, image area, page orientation, and perhaps even the number of columns per page. You then can print *thumbnail sketches* of the pages, using gray boxes to represent text, black boxes to represent images, and white boxes for line art. You may even produce full-size sample pages before placing manuscript text and final graphics and images. PageMaker has line-drawing, box-drawing, and circle-drawing tools, with many line styles and patterns, plus the ability to use graphics from a variety of programs.

PageMaker can pour text from a word processing file automatically, creating pages as it goes and wrapping text around graphics. You also can pour text manually, column by column, to experiment with the layout. PageMaker goes further than most other programs to define how text should be wrapped around graphics.

PageMaker's major feature is its capability to import a variety of text and graphics files, and it also can export text to Microsoft Word or WriteNow files as well as to text-only files (which can be used by any word processor). PageMaker also offers a story editor with word processing features such as search and replace, spell checking, indexing, and creating a table of contents.

You can use *style sheets*—each a "sheet" of definitions to control the formatting of a particular kind of text element, such as a subtitle—and global changes to the layout by changing a single style sheet definition. Because the Style palette can be moved to any location, attaching styles to text is easy (see fig. 8.3). You can change a style sheet definition in order to make a global formatting change, and you can copy styles into other publications. Style information includes all type specifications and paragraph settings, including indents and tabs. You also can specify colors for text.
You can define style sheets in Microsoft Word, which offers style sheet features, and import the documents with their style sheets into PageMaker. The style sheets are imported with the same names from Microsoft Word files, and PageMaker recognizes Word's definitions and settings. Writers therefore can use Microsoft Word to assign style sheet names to elements before the layout process even begins.

PageMaker offers import filters that recognize certain characteristics of text files, including embedded style information in the form of style sheet tags. These tags can be typed in advance using any word processor. Filters or tags are useful for importing any type of text file that has been previously coded for typesetting. The program also includes an export filter for Microsoft Word that can export text from PageMaker to Word files with style sheet definitions intact. A text-only ASCII filter also is supplied that can save tags as embedded codes in the text (ASCII is the American Standard Code for Information Interchange).

PageMaker's automatic hyphenation, which is based on a hyphenation dictionary and supplemental dictionary with your exception words, can be turned on or off for a selection of text. You also can set the program up to ask you how to hyphenate words when needed. Dictionary-based hyphenation can be slower but is usually accurate and not as conservative as algorithmic hyphenation (used by XPress and
ReadySetGO!, which can cause “rivers of white space” in fully-justified columns. Optional foreign language dictionaries enable hyphenation and spell checking of up to six languages at the same time, with the selection of a dictionary recorded as a paragraph style, so that different paragraphs can be checked by different dictionaries.

Columns of text are linked according to the sequence in which you placed them. You can, for example, place a column on page one and then skip to page three to place the rest of the column, leaving another column on page one and the rest of page two blank. When using the Autoflow feature, however, PageMaker assumes that you are placing each column right after the last one, page to page in succession, without arbitrary breaks.

You can replace part of the text of a story, or the entire story, with the contents of another text file. This feature enables you to easily replace a template’s dummy text, which is placed, for example, with a column on page one and the rest on page three, with real text in an automatic operation. PageMaker offers you the ability to search for and replace letters and phrases, fonts, point sizes, and paragraph styles. You can therefore make sweeping global formatting changes in a single operation.

If a page of text ends with a single word or a very short line (called an orphan) or pushes a single word or a short line less than half the width of the column onto the next page (called a widow), you may want to set the maximum number of lines allowed at the bottom or top of a column. Paragraph-level controls also include the ability to keep lines together to control breaks from column to column or page to page and to control the number of consecutive hyphens. Spacing controls also can be set for specific paragraph styles. Automatic paragraph rules can be set above or below or both and can be specified in a stylesheet.

You place graphics into PageMaker in the same manner as placing text. You can use the pointer tool to drag the corners of an image to resize the image (see fig. 8.4), and use the cropping tool to drag from corners or edges to crop the image. When resizing, you are changing the actual size of the entire image; when cropping, you are merely hiding parts of the image but leaving it the same size. Most projects require resizing and cropping. By holding down the Shift key while resizing graphics, you can constrain the operation to uniformly proportional scaling so that the image does not stretch or become distorted.

PageMaker offers the built-in percentages (when you hold down the Shift key) for resizing bit-map graphics for the different resolutions of output devices. This feature of PageMaker helps avoid jaggies (a stair-step effect on diagonal lines) and moirés,
Fig. 8.4. After placing a graphic image on the page, you can resize and crop the image (PageMaker).

which are undesirable patterns caused by overlaying two different patterns when printing bit-mapped (as in MacPaint) or scanned images.

When placing text around graphics, PageMaker displays a dotted line acting as a wrap (or "text standoff") boundary for wrapping the text around the graphic. You can adjust the boundaries and control the amount of white space by dragging the dotted line (see fig. 8.5). If you move or resize the image, the wrap boundary moves or scales with the image. You can wrap text around part of an image while overlaying text over another part and vary the amount of white space between the image and the text. No other program offers such flexibility in wrapping text around images.

The Inline graphics option enables you to place graphics directly in the text so that the graphics move with the text as editing changes are made. Inline graphics (sometimes called "anchored" graphics) can be scaled, stretched, and cropped like any other graphics, but they also can be selected as text, scaled in point size, and aligned on the type baseline. This last feature is useful for special graphical elements in the same size as the type.

PageMaker offers the most complete set of typesetting features, including two types of automatic *leading*, which is the space occupied by a single line of text. Leading can
be measured proportionately, with two-thirds of the leading value above the baseline and one third below. The baseline is an imaginary line for aligning the bottom of the body, or x-height, section of each character. The ascenders of the characters ascend above the baseline, and the descenders descend below the baseline. Leading can alternatively be specified as a measurement from the tops of the capital letters in one line to the “tops of caps” in the next line.

PageMaker also offers you the ability to set the optimal word spacing and the spacing between letters (letterspacing) for a section of text or for an entire story. You can specify the minimum and maximum as well as optimum letterspacing values, which are percentages of the suggested spaceband amount supplied by the font designer, also referred to as “a percentage of the em space.” The space between characters is measured in percentages of the font’s designed word spacing. The range of word spacing is 0 to 500 percent and of letterspacing between -200 and 200 percent. Type sizes can range from 4 to 650 points in increments of one-tenth of a point.

The program offers you the ability to rotate text in 90-degree increments and special type effects, including expanded and condensed type as well as force-justified type. Optical distortion of type (stretching and compressing) can be set as a percentage.
Kerning is adjusting the space between characters so that in certain letter pairs, the second letter is tucked under the first. Automatic kerning can be turned on for fonts above a certain point size, and manual kerning between two characters is offered in increments of 0.01 of an em space. Manual kerning also can be applied over a selection to quickly kern headlines and text.

PageMaker offers on-the-fly track kerning as found in typesetting systems—a feature that many professional publishers require. Track kerning is based on the font designer’s designated spacing information and is point-size dependent—large sizes are tracked tighter than small sizes automatically. You can select any part of a story and control how dense the information appears, tightening large type and loosening small type, in one quick operation. PageMaker offers six choices for tracking a selection of text: very loose, loose, normal, tight, very tight, and no tracking.

Separate publications can be chained together into “books” for operations such as setting up an index and table of contents, and for batch printing. Page numbering across publications can be automatic and overridden with manual page numbers. Index entries can be selected by mouse or command-key shortcut, and you can create up to three levels for each entry, with each entry up to 50 characters in length. Range options enable you to set how long the topic is discussed, so that you don’t have to continually select index entries in that range. Range options are the current page, or the number of paragraphs, or until the next occurrence of a specified style. Cross-references for all three index levels is supported, and you can even eliminate the duplicate entries caused by different spelling by selecting one version of the entry from a topic list, no matter what the spelling is in the text.

PageMaker offers the most flexible printing options, and supports specific output devices by providing APD (Adobe/Aldus Printer Description) files that work with the program and contain information such as the number of paper trays, supported page sizes, and resolution. PageMaker supports all PostScript and QuickDraw printers, and offers the same capabilities as the other programs (in printing copies, a range of pages, scaled to a percentage, with smoothing, and so on).

PageMaker prepares its own PostScript output with a print driver that differs from Apple’s print driver by offering thinner hairlines, higher resolution for MacPaint images resized in PageMaker (a smoothing function that fills in dots on jagged pieces), faster print time, an unlimited number of downloadable fonts per publication, and a separate Prep file for management by spoolers. PageMaker also offers the option of printing with the Apple print driver, for compatibility with MultiFinder and some spoolers as well as to print some PICT images correctly.
PageMaker also can print the entire publication as a PostScript file or EPS file to disk, so that the document can be transported to a PostScript service bureau without the need for PageMaker. The program offers crop marks and registration target symbols and performs automatic tiling of pages larger than the page size of the output device. Tiling is a feature that breaks a large page into smaller sections that overlap, so that you can print the sections and paste them together. PageMaker enables you manually to control the tile breaks to set the amount of overlap so that you don't break a headline or graphic.

Perhaps the most innovative feature of the newest version of PageMaker is its file management capabilities. PageMaker lists each text and graphics file imported into a publication file, indicating its file type and page in the layout. PageMaker forms a link to each imported text and graphics file so that changes to the original can optionally be passed automatically to the publication file.

You can set up a publication so that if an original file is changed, PageMaker notifies you of the change in status and replaces the text or graphics element with the new version automatically. You can keep the elements in a publication completely up to date with the original files. You also can reestablish links that have been broken (due to files being moved to other folders or being renamed), or replace a link with a new link.

Because the linked file can be stored outside the PageMaker publication file, publication files are smaller and easier to transfer to other systems, and linked files can be stored on shared disks acting as file servers. With story and graphics files, you have the choice to include the text or graphics inside the publication file or keep them stored externally.

PageMaker has evolved into a full-featured document publishing program while retaining its flexibility as a page layout program. The combination of extensive typesetting controls, manual layout, automatic pagination, word processing, index and table of contents generation, and file management makes PageMaker the most useful of all these programs for newsletters, magazines, newspapers, page advertisements, commercial books, and other applications requiring the precision of typesetting with the flexibility of moving objects around the page. The majority of desktop publishing applications fit this category, making PageMaker the most appealing.
Letraset's ReadySetGO!

Letraset's ReadySetGO! is appealing to small publishing operations on a budget because the program combines word processing, automatic page formatting, and flexible page design in one relatively inexpensive program.

The most impressive features of ReadySetGO! are the capability to open multiple publication files, the spelling checker, and the global search and replace functions. The program automatically pours text fast over many pages and wraps text around graphics (with control over the space between the text and graphics). The program also supports custom page sizes up to 99 by 99 inches.

ReadySetGO! is a full word processor as well as page makeup program. ReadySetGO! also recognizes MacWrite, Word, T/Maker's WriteNow, Microsoft Works, and text-only files. The program also can convert inch marks to open and close quotes, and double-hyphens to em dashes.

ReadySetGO! uses blocks to contain text and graphics and links between text blocks. Text blocks can be sized by typing measurements or by dragging edges. After creating pages, you can pour text faster than with any other program.

Blocks on a page can be linked in any fashion and then duplicated with global linking (page by page) or local linking (within each page only). ReadySetGO! offers you the ability to set precise dimensions for text and graphic blocks and to start with a page grid.

ReadySetGO! has more control over automatic hyphenation than PageMaker and XPress. You can specify the minimum word size before hyphenating, the minimum number of characters before and after a hyphen, and the maximum number of consecutive hyphenated lines. You also can control whether or not the program hyphenates the last word of a paragraph or capitalized words and add words to an exception dictionary.

With the search and replace options, you can search for and change text including its font, style, and point size. The case of a section of text can be converted with a wider variety of choices (all caps, all lowercase, initial caps, sentence caps, and derived small caps).
One advanced feature is the ability to place PostScript text instructions in a text block so that the program interprets the PostScript instructions rather than prints them. This feature is handy for including a complex PostScript illustration on a page if the illustration is not encoded in the EPS format, or if you are achieving a special effect with PostScript (you have to know how to use the PostScript language—see the bibliography for other sources of information).

You also can designate a text block as a comment, not to be printed—a useful feature for editors to add comments to a manuscript in production.

ReadySetGO! offers style sheet formatting and tagging, and styles can be applied in advance in another word processor by typing tag names within brackets. ReadySetGO!, however, does not recognize Microsoft Word style definitions.

The program also offers basic typesetting features, including letterspacing, although only in points. The Track feature offers semi-automatic kerning on a selection of text in increments of 1/1000 of an em space, and you can manually kern in one-point increments.

ReadySetGO! can shift text up or down from the baseline to create superscripts, subscripts, equations, and other unusual typesetting effects. The program also can expand and condense text (alter each character's width). The maximum point size of a font is 327 points.

The program provides a grabber hand tool to scroll around the page and numbered page icons like PageMaker to help navigate from page to page. ReadySetGO! also offers a window of many thumbnail pages. You can print the thumbnail pages for a mock layout or use the window to navigate from page to page. You also can cut, copy, and paste entire pages in the thumbnail window (see fig. 8.6).

After drawing or defining a picture block and placing an image from a file, you can crop the image by dragging it around inside the block (the block is like a window), or by dragging the edges of the block (like the other programs). Text automatically wraps itself around a picture block and can follow the boundary of an irregular shape or overprint the image, whichever you prefer.

Overall, ReadySetGO! is easy to learn and use, and templates are easy to set up for creating new publications. You can navigate around the page and to other pages as easily as PageMaker, and the program has more keyboard shortcuts. Because
ReadySetGO! is faster at pouring pages and reasonably fast as a word processor, the program makes an excellent book processor. You can write, edit, and produce the publications using the same program.

**QuarkXPress**

QuarkXPress has a reputation for its precision in typesetting controls, especially for kerning. The program offers full word processing, spell checking, and automatic text pouring over multiple pages, as well as automatic text wrapping around irregular shapes. QuarkXPress also provides the capability to expand or contract characters and automatic frames and frame editing.

The program uses grids and boxes for text and graphics in a similar fashion as ReadySetGO!, with a major difference: QuarkXPress offers up to 127 master pages for
a single document, and in each master page, you can set the number of columns and the width of the column gap without having to draw boxes. With the automatic linking tool, QuarkXPress is easier than ReadySetGO! for setting up the first page and for creating multiple pages, although QuarkXPress is not as fast.

The XPress pasteboard is 48 by 48 inches and can show thumbnail images of pages so that you can drag elements directly from one page to another. You also can open multiple documents and drag elements—including multiple pages—from one document to another across the pasteboard.

QuarkXPress enables you to make changes on master pages to affect existing pages already defined by those masters, and new master pages can be applied to existing pages. Master page items copied to each page can be altered on individual pages, unlike master page items used in other programs. If you use several master pages, however, a few more steps than usual are required to change the font or size of text throughout a document.

QuarkXPress can import text from Microsoft Word, MacWrite, WriteNow, and Microsoft Works documents as well as straight text files, and the program recognizes style definitions in Word files. The program offers a spelling checker and also can be used as a word processor. QuarkXPress can export to files in the MacWrite format as well as the Microsoft Word and WriteNow formats and to text-only files. Unfortunately, QuarkXPress lacks the option of automatically converting inch marks to open and close quotes and double-hyphens to em dashes.

QuarkXPress offers you the ability to set styles for paragraphs and includes widow and orphan control and the capability to keep paragraphs together. Rules can be attached to paragraphs, and graphics can be anchored to a reference in the text so that if the reference moves, the graphics move with it. You also can customize an automatic “dropped capital” (a large initial capital letter to introduce a section of text) by specifying how many lines to drop the character into and how big the character should be.

The program offers the precision of 1/1000 of an em space for kerning and fractional character widths (the same as other programs) or integral widths for use with the ImageWriter. Font point sizes can be set in 1/1000 increments of a point up to 500 points.
QuarkXPress also offers three “justification expansion methods” for adding more spaces between words and characters. You can add spaces only between words, add more space between words than between characters, or add spaces uniformly between all characters. You can alternatively specify a limit for the amount of white space between words or overall between characters (down to 1/1000 of an em space).

Automatic hyphenation affects the entire document, with two options: a smallest word setting (the program does not hyphenate a word smaller than a set number of characters) and an on/off setting for words that start with capital letters.

Templates can be filled with text automatically, even with columns linked on non-sequential pages. The visual linking in QuarkXPress—which can be very useful when preparing a mock layout—provides better feedback than the linking tool in ReadySetGO! As in ReadySetGO!, QuarkXPress uses picture blocks you can crop and resize by dragging, and you can resize an image by typing percentages.

By default, text automatically wraps itself around graphics in a picture box and can follow the boundary of a shape or overprint the image, whichever you prefer. You can control the distance between the text and the graphics by specifying a Text Outset for the picture box. You also can draw with the polygon picture box tool to create irregular shapes for text to flow around.

You can rotate text and graphic objects in degree increments of 1/1000 degrees. Objects can be grouped temporarily or permanently, and you can set a frame to be a “child” of a “parent” frame so that if you move the parent frame, the child moves with the parent. Quark has added an image library to maintain up to 2,000 separate objects for use in documents.

The Show Measurements palette displays information and enables you to edit the characteristics of a selected object or group without having to access dialog boxes. Changes are displayed instantaneously. For example, you can change the dimensions of a text block, or the size and font of the text, or the line weight of a rule, and so on, from the Show Measurements palette.

One of the best features of QuarkXPress is its capability to automatically draw a frame around a picture or text block. The program offers a frame editor so that you can design nearly any type of frame.
The program prints in the normal fashion (using the Apple print driver) but also provides direct support of several PostScript printers including the Linotype Linotronic imagesetters. This support includes the capability to print copies of the publication, a range of pages or all pages, scaled to a certain percentage, and using a proprietary smoothing algorithm for bit-mapped images. QuarkXPress offers automatic and manual tiling.

Many professional users are completely satisfied with QuarkXPress, despite the lack of file link management features (found in PageMaker), because the program does the job of typesetting and page makeup very well. Setting up a QuarkXPress document may take a bit more planning than a PageMaker document, but the ability to open multiple documents and drag elements from page to page in the thumbnail view are definite advantages.

**Letraset's DesignStudio**

DesignStudio is a high-powered page makeup program that differs from the company's ReadySetGO! program by offering a pasteboard metaphor similar to PageMaker's and advanced typesetting features. The program also offers you the ability to set a grid for the page and to align objects by snapping them to the grid lines or to guide lines. In many respects, the program resembles PageMaker with master pages, guides, and the pasteboard. ReadySetGO! also offers true tracking for typesetting.

DesignStudio can open several documents at the same time and display a thumbnail view of the pages, in which you can duplicate and delete pages as well as rearrange them.

Text can be entered into text blocks, as in ReadySetGO! and XPress, but the blocks can vary in shape as well as size—you can have rounded boxes, circles, triangles, diamonds, and parallelograms filled with text. These blocks also can be stretched or condensed, and rotated to any angle as well.

DesignStudio can import text from the popular Macintosh word processing programs including Word, MacWrite, and WriteNow, and the program can export text as an ASCII text file. Included is a spelling checker and the capability to assign styles to any sections of text, not just paragraph sections. DesignStudio imports styles from a Word
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document as new styles, not replacing existing styles set in DesignStudio. You can then edit the new style definitions to change the formatting, and you can reassign styles to text by selecting the text, but you cannot automatically apply a predefined set of DesignStudio styles by simply naming them the same as the Word styles, as you can in PageMaker.

Text flows from column to column and from page to page if you chain them together, just as in ReadySetGO!. After chaining columns together and chaining to the next page, you can extend the chain by inserting more pages that are automatically chained. Text can flow around an irregularly shaped object, which can be a graphic image or another text block, and you can specify a text repel distance to set type closer to or farther away from the border of the shape.

Automatic hyphenation, automatic kerning, and automatic tracking can be applied to any section of text, and the program supports additional languages for hyphenation. You can set the maximum number of consecutive hyphenated lines, the minimum length of word to be hyphenated, and the minimum number of characters before and after a hyphen. You also can set the program to refrain from hyphenating words in all capitals and the last word of a paragraph.

The program cautions you against overriding style definitions when trying to change words into italic or bold, for example, or when defining a fraction (using smaller point sizes for the numbers). This feature of DesignStudio is less flexible than PageMaker's style handling, which enables you to override style definitions with specific settings. In DesignStudio, you have to remove the style definition first, then make your changes. DesignStudio, however, offers excellent search and replace facilities, including the ability to specify font, size, and style for searching and replacing, and to ignore or maintain the use of capital letters when replacing. You also can search for tabs, carriage returns, fixed spaces, or any ASCII code for a special character.

DesignStudio offers two modes of justification: standard and professional. In standard justification, DesignStudio keeps all word spacing as close as possible to the minimum spacing set by the font designer and hyphenates if necessary to keep the spacing low. The program never goes any lower than the minimum and never changes letterspacing.

In professional justification, you can set the minimum and maximum space as a percentage of the designer-specified optimum space, and DesignStudio refrains from
hyphenating if spacing is within that range. You also can specify a range of letterspacing to help justify the line but not higher than 125% of the optimal spacing value set by the font designer.

DesignStudio also offers a professional ragged-right justify option that uses a percentage of the full measure of justification for alternate lines, so that lines appear more ragged if they would otherwise appear almost fully justified. You can specify the percentage of the full measure used on alternate lines.

The program offers the most extensive kerning and tracking facilities yet provided in a desktop page makeup program. You can add to and change kerned pairs, and kern individual letter pairs with the Command-left arrow key combination as well as with a numeric specification. DesignStudio offers tracking, in which the amount of space removed between characters varies with the point size and font. You can set three levels of tracking, in increments of 1/1000 of an em space, to vary the spacing according to font and size. In most cases, you would set a track to remove more space for larger sizes and to actually add space for very small sizes. You may need at least three different tracks depending on your documents—a loose track for books and manuals, a tighter track for newsletters and magazines, and a very tight track for page advertisements.

DesignStudio does not provide all the features of PageMaker, nor is the program as easy to use or as flexible, but it is more flexible in some ways than XPress and offers better tracking features. As a new program (Version 1) DesignStudio is not as stable in performance as the tried and tested versions of PageMaker (Version 4), XPress (Version 3), and ReadySetGO! (Version 4.5), but the program has an extensive set of features for a program at the starting gate, and Letraset has plenty of experience with page makeup.

**Multi-Ad Creator**

Multi-Ad Creator is designed specifically for creating mock-ups and final materials for single-page ads and spreads. When given a set of text and graphic elements, the program can automatically suggest a page layout for the ad. You also can customize any page layout and save the customized version; so, in a sense, you can make the program learn your layout preferences as you use it.
Multi-Ad Creator can track multiple page layouts for the same ad. This feature is convenient for experimenting with different layouts, testing ideas by simultaneously showing others the results of different formats, and for using the same text and graphic elements in a range of different magazine ad sizes. You can resize and move objects for each layout and reformat the text to fit. The program can display thumbnail sketches of all layouts for a particular ad.

Multi-Ad Creator uses a drawing-table metaphor that enables you to place elements on or off the actual page. You can use the area outside the page to hold rough illustrations or scans. You can freely rotate objects or groups of objects with the mouse or other pointing device or specify a rotation angle in one-degree increments.

The program offers automatic copyfitting—text can be reduced to fit within an irregular shape, and you can wrap text around irregularly shaped objects. Text is automatically wrapped when you drag another object over a text block. You also can rotate text in one-degree increments and still edit the rotated text. The program’s word processing features include the capability to search and replace fonts, styles, and sizes as well as text itself, and the capability to convert text to all upper or lower case letters.

Kerning, an important feature for page advertisement mock-ups, especially with large letters, can be applied in increments as little as 1/1000 of an em space. You also can offset type from the baseline by a percentage of the font’s height, enabling you to finely tune subscripts and superscripts or do special staircase effects with type.

Multi-Ad Creator offers a variety of drawing tools for polygons and shapes, plus special effects including custom starburst shapes, drop shadows, frame patterns, and fill patterns. Ads created as mock-ups in the program can be further refined into final pages by the same program. Color can be specified in CYMK or RGB color schemes. The program can import a variety of graphic file formats (EPS, TIFF, ImageStudio’s RIFF, PICT, and MacPaint), as well as word processing file formats for text. Completed layouts also can be exported as PICT files to be incorporated into publication files for use with PageMaker, ReadySetGO!, QuarkXPress, and other page makeup programs.

For users with CD-ROM drives, Multi-Ad Services offers a bonus CD-ROM disc with an interactive animated user’s guide that explains how to use the program and demonstrates typical ad makeup procedures. The Multi-Ad ProArt series of generic ads, which is similar to a clip art library and can be used for designing your own ads, is included on this disc.
Other Page Makeup Programs

A variety of page makeup programs are available for the Macintosh, although PageMaker, ReadySetGO!, DesignStudio, and QuarkXPress are the most popular. Less expensive programs such as Springboard Publisher and Silicon Beach Software/Aldus' Personal Press also are useful for mock-ups and layouts, although Personal Press is better equipped to carry the layout through final production.

Personal Press has impressive features for putting a publication together semi-automatically (you still need to be involved with making choices). Most of the power of the automatic processing comes from the use of "proxies" in dialog boxes. A proxy is a thumbnail image that provides direct, constant, interactive feedback. When a dialog box contains a proxy, you can see the results of specific actions before clicking the OK button. In the AutoCreate feature, for example, you can select a template and see the entire page layout in a thumbnail sketch, and then selectively place text and graphics, previewing the results before actually clicking OK to create the publication. You can even crop graphics while in this dialog box.

We prefer to use a creative tool that has full production capacity and the precision to create final pages, as long as that tool also is convenient for putting together quick mock-ups. Our preference is PageMaker for most applications because this program has the flexibility and the features we require to produce books, a newsletter, miscellaneous marketing pieces, pages for sending to remote fax machines, and electronic pages for incorporation into a CD-ROM archive of publications. We have been able to obtain excellent results even when incorporating complex elements such as black-and-white and color photos and color graphics.

Chapter Summary

The lure of laser printing has significantly increased overall paper consumption. Laser printers are revolutionary because they enable you to print on demand with good enough quality for many documents and publications.

Electronic publishing with full pages, including fonts, graphics, and images, is preferable to the normal route of printing and distributing paper. Pages put together electronically for printing can be transported to sites closer to the readers before printing. The publishing process is essentially the same for all these methods of distribution.
No matter which medium carries the message, you must have the design skills to present the message in its most readable form. You have many options for training in computer skills and design skills, and you need both types of skills in desktop publishing applications.

No matter what production method you use, the Macintosh can form a link between your creative efforts and production. Mock-ups and layouts with thumbnail pages are essential in the design process. Page makeup programs can be used in design to produce thumbnails for the layout process, and the layout can be used with the same program to produce the final pages.

Page makeup programs can combine text, graphics, scanned images, and color graphics, onto electronic pages for printing or electronic distribution. These programs offer precise typesetting and layout tools for designing and producing pages with multiple stories.

PageMaker (Aldus) is the most flexible page makeup program and has the largest set of features, but the other programs, such as XPress (Quark) and DesignStudio (Letraset) also have significant advantages, and ReadySetGO! (Letraset) and Personal Press (Silicon Beach Software/Aldus) are less expensive and can handle many jobs. Multi-Ad Creator is designed specifically for creating mock-ups and final materials for single-page advertisements and spreads.

Page makeup programs brought the power of publishing to small businesses and individuals, providing them with the ability to produce commercial-quality printed materials on demand on laser printers and to produce master pages and pages on film for press runs and high-volume printing. Long the exclusive province of typesetters, composition experts, and page strippers, full-page makeup on the desktop has unleashed a potential communications revolution that only needs an inexpensive output solution. Now you are ready for desktop printing, the subject of the next chapter.
Printing

Freedom of press is guaranteed only to those who own one.

—A. J. Liebling

Desktop publishing had a profound effect on business printing largely because black-and-white copiers and laser printers—the printing presses of the office—could effectively duplicate the pages on demand.

The Apple LaserWriter was the recognized leader in desktop publishing applications because it was the first laser printer to be supported by system software that offers standard fonts and graphics. With a higher resolution (measured in dots per inch) than the ImageWriter dot-matrix printer, laser printers provided the opportunity for Macintosh users to create professional-looking documents. The current LaserWriter II is now the recognized leader because this printer offers a level of performance and quality that other printer manufacturers try to emulate. The LaserWriters are a major factor in the success of desktop publishing.

Another important factor in the success of desktop publishing is the link from the desktop world to the professional publishing world, where higher resolution devices called imagesetters (formerly called typesetters) are used to print “camera-ready” pages on photographic paper or film, a major step in the process of creating plates for the printing press.

This link first became available with the Macintosh and LaserWriter combination, in the form of the PostScript page description language, developed by Adobe Systems and now used in laser printers from IBM, Hewlett-Packard, Texas Instruments, Digital Equipment Corporation, and many other manufacturers. PostScript laser printers are compatible with each other and with higher resolution full-page imagesetters from Linotype, Varityper, Agfa Compugraphic, and several other manufacturers.
The importance of this PostScript link is that the same page that prints on a PostScript laser printer also prints on a PostScript imagesetter, but with far better quality due to the increase in resolution. You therefore can use a laser printer for on-demand printing and for printing proof pages for high-quality print jobs without switching software. For example, you can complete a publication in PageMaker, print the document on a laser printer, and then substitute a high-resolution Linotronic 300 for the laser printer (both devices connect to an AppleTalk network the same way, requiring no extra software or hardware). Alternatively, you can send your PageMaker file to a service bureau that offers the equivalent of Linotronic output.

As a Macintosh user you can prepare pages for a variety of output devices from the inexpensive ImageWriter to high-resolution PostScript imagesetters, even if you don't have a printer of any kind. Service bureaus and some copy shops can provide laser printing, color printing, imagesetting, and film recording, so that you can experiment with the output before choosing a type of printer.

This chapter describes the various production and printing methods available for desktop printing and how to prepare publications for commercial-quality printing presses using imagesetters. The costly steps of page stripping, preparation of negatives, and electronic prepress operations can be minimized if not eliminated by using the desktop publishing software described in this chapter. After reading this chapter you will be able to choose a production method, a desktop printer, a color printer for proofing images, and a method for linking to prepress systems and print shops for high-volume printing press runs.

**Choosing a Production Method**

The volume printing process—the method by which you print mass quantities of the publication—dictates certain requirements that must be met in order to get a decent, high-quality printed publication. Will you use a copier or a laser printer to produce 10 or 20 copies? Will you need more than 200 but less than 500 copies? More than 1,000? More than 10,000? You must answer this basic question first and then plan the publication's production effort.

For example, a newsletter or business report may require a clean, polished look. Because this type of publication is inexpensively printed in small quantities (less than
500), the extra expense of production on a high-resolution (over 1,000 dots-per-inch, or dpi) imagesetter is not required—a lower resolution, 300-dpi laser printer, such as one of the Apple LaserWriter II models, can do the job.

For most printing applications, you can use a desktop laser printer (at 300 dpi) and not be concerned with using an imagesetter. Small newspapers and newsletters can be put out on a budget, foregoing color and imagesetting, because the output of a 300-dpi laser printer is usually sufficient for printing on newsprint paper. Newsprint paper is too coarse and absorbent to hold much higher resolutions. Laser printer output also is sufficient quality for offset printing and is the preferred choice for xerographic printing. Laser printer output also can be cost-effective for catalogs and magazines printed on medium-quality paper by a web press (a press that prints on a continuous web of paper rather than on cut sheets).

On the other hand, a book, a magazine, a piece of marketing literature (such as a page advertisement, flyer, or brochure), or an instruction manual may require typesetting-quality text and photographic-quality images. For such production efforts, compatibility with an imagesetter could be critical. The surest way to maintain compatibility between your laser printer and a higher resolution imagesetter is to use a PostScript-compatible laser printer. PostScript is the most popular page-description language used in both printers and high-resolution imagesetters and film recorders.

For jobs involving high-quality printing methods on medium-to-high-quality paper, you should use an imagesetter for producing full pages, to cut down on stripping charges. The Apple LaserWriter IIINT and IIINTX are PostScript-compatible printers that enable you to print proof pages before using a PostScript-compatible imagesetter. Generally, outputting complete pages rather than strips of typeset text that must be hand-pasted onto pages is better. Imagesetters, therefore, have become more important to the publishing process as complete pages with graphics are prepared on the system. They are absolutely essential if you want to obtain medium-quality and high-quality results with scanned photos and color graphics.

**Using Black-and-White Photos**

As you learned in Chapter 4, continuous tone images derived from scanned photographs or digitized video images must be converted into halftones to be printed. A
*halftone* is the result of converting a continuous tone image, which can contain gray or color dots of varying intensity, into an image consisting of only black or solid color dots of uniform intensity.

For black-and-white photographs, a halftone can simulate gray shades on a black-and-white printer because the halftone is composed of cells containing a matrix of black dots; some turned on and some turned off. The halftone *screen density*, which is the frequency of cells measured in lines per inch (lpi), determines the size of the halftone cells in the image. This size can make the difference between a muddy reproduction and a clear reproduction. Newspapers typically need a 65-line or 85-line screen. For advertisements, commercial work, and magazine pages, use screens with 120, 133, 150, or more lines per inch.

Photographically made halftones consist of negatives usually stripped into position before plates are made. In a page makeup program, you reserve a blank area of the page for the stripping operation—usually filled with a rectangle marking the exact place and size for the halftone. Photographic halftones offer the best quality because the size of each halftone cell varies to provide the illusion of gray, and you can obtain a high screen density (over 150 lines per inch) with photographic equipment.

Digital halftones consist of electronic data described in uniformly sized pixels on-screen or dots in a laser printer or imagesetter. To make the equivalent of a halftone cell with a digital device, the software combines several small dots (all of the same size) into one halftone cell dot (which can vary in size). You can raise the resolution (number of cells, or lines, per inch) of the image, but the result is a denser image with less gray levels.

To determine the number of gray levels that will be printed, divide the printer's dpi resolution (dots per inch) by the desired halftone screen lpi density (lines per inch), and raise the result to the power of two. A 300-dpi printer, therefore, can print a 50-lpi halftone with 36 (simulated) levels of gray—suitable for a newsletter or an internal document. The PostScript-compatible Linotype Linotronic 300 imagesetter (with a resolution of 2540 dpi) reproduces a commercial-quality halftone at up to 150 lpi with at least 256 levels of gray—suitable for a magazine.

Page makeup programs can crop and scale gray-scale images and turn them into halftones. For example, PageMaker offers image adjustment features that enable you to lighten, darken, or adjust the contrast of a scanned image from a gray-scale TIFF
file after the image is placed on a PageMaker page. The program offers five preset patterns for screens and enables you to vary the angle of lines and frequency of lines per inch. You also can adjust the lightness and contrast ratio for gray-scale images with a "graphic equalizer" tool.

PageMaker initially screens gray-scale images at 53 lpi, which is a density that works well with 300-dpi laser printers. With the Image control feature, you can change the screen frequency to anything that you want, such as 90 lpi or more, for printing on high-resolution devices such as the Linotronic 100 or 300. You also can lighten or darken images for a specific press run. The lightness value lightens or darkens the image, and the contrast value lightens or darkens areas of the image in relation to their surrounding backgrounds. For example, you can adjust the contrast of an image to 100 percent and reduce the lightness to zero percent to obtain a high-contrast image with no gray scales.

PageMaker does not have the painting and selection features of an image retouching program such as Letraset’s ImageStudio or Silicon Beach Software/Aldus’ Digital Darkroom, but you can import TIFF (Tag Image File Format) and PICT2 (standard Macintosh graphics) files into PageMaker and continue to perform brightness and contrast adjustments as well as adjustments to the halftone screen. Note, however, that you cannot import ImageStudio’s RIFF file directly, only indirectly by using ImageStudio to convert the image into TIFF or PICT2.

ReadySetGO! enables you to change the brightness and contrast of scanned images like the other programs and enables you to f$lop an image (turn the image into a mirror image of itself). The program supports gray-scale TIFF files from scanners, as well as EPS (encapsulated PostScript) files, PICT files, and MacPaint files. ReadySetGO! also can import a RIFF image file from ImageStudio (another Letraset product). RIFF offers more file compression than TIFF, resulting in image files that take up less disk space.

ReadySetGO! establishes a link to an image file and uses a lower resolution version for display purposes similar to PageMaker and QuarkXPress. If the program cannot find the image file when loading the document, ReadySetGO! searches the disk (other folders) for the file; the program then substitutes an empty picture block for the missing file. This is more useful than QuarkXPress but does not offer as many choices as PageMaker. Less space is taken up in the ReadySetGO! publication file by the lower resolution version, however, than in other publication files. Of all the page makeup
programs, PageMaker offers the most features and the most convenience in managing image files linked to the publication file.

The Advanced Halftoning feature of Digital Darkroom provides smoother gray scale and sharper detail than the usual output from 300 dpi laser printers. This feature works with PostScript and QuickDraw printers. The software does not construct halftone cells with printer dots in the usual fashion, but uses different resolutions (dots per inch) to represent different gray-scale values. This process works only when Digital Darkroom prints the halftone. In most cases, you would want the page makeup program you are using to print the entire page including the halftone. The Digital Darkroom program, therefore, can save its dot pattern in a TIFF file for exporting to page makeup programs.

Continuous tone color images are handled in much the same way—a halftone must be created—but more complex issues are involved due to the fact that all of the displayed colors are not reproducible on a printer or on a press.

Using Color

Color is an essential ingredient in publications, and high-quality color reproduction is the hallmark of commercial magazines, advertising pages, and brochures. Color printing, however, remains a more expensive process than black-and-white printing, and the cost of printing is a limiting factor in producing commercial and in-house publications and documents with color graphics and photos. You always need to justify the use of color in economic terms.

Nevertheless, the cost of producing color publications is coming down, and the reason is that the cost of preparing color images and color graphics has come down drastically.

The Macintosh is a major reason for this trend. Only the Macintosh offers, as a standard part of the system, the capability to use any of the 16.7 million colors at the same time, limited only by the total number of pixels in an image. You need a display adapter capable of displaying in 24-bit mode, as described in Chapter 4, in
order to see all of these colors, but the color information is stored with the image and can be processed by any Macintosh.

Color is used in several different ways on printed pages, and Macintosh page makeup programs can prepare pages with color for the following uses:

- **Spot color**, in which an area of the page, or of a graphic image, is set to a solid, consistent color with the same luminosity, hue, and saturation over the entire area. Spot colors are often used as a highlight for thick page rules and bars, in logos, and in solid two-dimensional and three-dimensional models. Pantone Matching System (PMS) colors that directly correspond to Pantone inks used in print shops are often applied as spot colors. A spot color also can be composed of a combination of process colors—cyan, yellow, magenta, and black (or red, green, and blue).

- **Color or gray tint**, in which an area has a percentage of a spot color (or of black, which produces a gray tint) less in density than a solid color. A tint is often used behind text in a boxed area, or as a shading behind an image. Tints are usually composed of percentages of PMS or process colors.

- **Color halftone** (printed version of a continuous tone image). Scanned photos and digitized video images, which consist of continuous tones of color or gray, must be converted into halftones for the printing press. Four process colors are combined to make color halftones. Color photos must be separated into layers representing percentages of each of the four process colors (cyan, yellow, magenta, and black).

To print color on a printing press, you supply color pages with the colors separated onto different pieces of film—a separate film for each colored ink. The set of films is called a **color separation**. Many publications are printed in four process colors (cyan, yellow, magenta, and black, or CYMK), with perhaps a fifth colored ink (usually a PMS [Pantone Matching System] color) per signature as an option.

Color separations are not required for printing on a color printer and then copying on a color copier. Color slide presentations as well as other color documents can be printed cost-effectively with a color printer and copier. Color printers also are useful as intermediate proofing devices for color publishing.
Spot colors, tints, and color illustrations (which are usually made up of spot colors and tints) are relatively easy to reproduce on a printing press with high quality results. Magazine-quality photos, on the other hand, are much harder to reproduce and maintain a level of quality equal to conventional methods of color halftoning. One color halftone can occupy far more disk space than several pages containing spot-colored halftones. In addition, most desktop scanners' accompanying software is not yet capable of performing as well as million-dollar prepress systems.

You can produce inexpensive color separations, however, on PostScript imagesetters, such as the Linotype Linotronic 300. PostScript-compatible color desktop printers can be used to print proofs of color images before starting the presses rolling. PostScript is the page description language that has become a standard file format for laser-printed master pages for publishing applications. PostScript also is useful for transferring computer-generated color images directly to prepress systems in an all-digital color separation process in which color PostScript printers act as proofing devices along the way.

With PageMaker and a color page printer, you can create color mock-ups, also called comps, with the color images and elements in place on the page. PageMaker's color features are designed to make overlays for spot color (such as solid color areas, color screens or tints, and colored text). The program supports three color models: CYMK (cyan, yellow, magenta, black), RGB (red, green, blue), and HLS (hue, lightness, and saturation). The CYMK values represent process color inks and can be mixed to simulate any color that can be printed. You can use any one of the three color models or choose from the PMS (Pantone Matching System) palette to specify a color.

In PageMaker, colors can be mixed to form a named color style that then can be applied to the page. The program can separate each named color onto a different layer for printing separate black overlays to make negatives and plates. PageMaker also prints alignment targets (registration marks) for aligning the overlays and enables you to specify a color for the paper.

You can choose to have the program mask, or knock-out, areas of overlays from the other overlays to have precise control and avoid mixing colors. For example, if printing on a thermal color printer using the CYMK model, to get a green object, you could knock out the object from the magenta and black overlays.
With the Aldus PrePrint utility program, you can create color separations directly from publication files. PageMaker also offers PMS (Pantone Matching System) ink colors.

ReadySetGO! enables you to specify spot colors for text and graphic elements using the Pantone Matching System (PMS). ReadySetGO! lacks the capability to specify colors using the CYMK (cyan, yellow, magenta, black) model for process color inks. The program can import a color image stored in PICT2 or the 24-bit color TIFF format but cannot separate the image.

QuarkXPress offers features similar to PageMaker for applying spot color to text and graphics and for separating the colors on output. You can specify color for text, rules, backgrounds, and frames, but not for elements or areas in the graphics.

QuarkXPress offers all three process color models—HSB (hue, saturation, brightness—also called HLS for hue, lightness, saturation), RGB (red, green, blue), and CYMK (cyan, yellow, magenta, black)—and Pantone Matching System (PMS) colors. QuarkXPress can convert a PMS color to equivalent process colors during output for color separations. You can mix custom color names that appear in the Color hierarchical menu. The program can make four separations (one for each process color) and another separation for each PMS color.

With the advent of desktop color printers at affordable prices, the explosion of desktop color publishing in the office is waiting only for an inexpensive color copier to make an appearance. Such copiers would trigger widespread use of color in documents and are only a year or two away from proliferating in the office.

**Printing Proof and Master Pages**

The quality of your results is directly related to the quality of your master pages, which are used to prepare plates for a press run or are used as the masters for making copies. One of the primary benefits of a 300 dots-per-inch (dpi) laser printer or ink-jet printer is the fact that 300 dpi is acceptable quality for a variety of office documents and publications, including newsletters. A 300-dpi printer, therefore, can be used to
print master pages for these applications and to print these publications on demand without the need for press runs or extra copying.

The other primary benefit is the printer's capability to print proof pages used for proofreading and final approvals. When applications call for higher resolutions than 300 dpi, you can still use the 300-dpi printers to print proof pages, and the process of proofing on a desktop printer can save you from the drastic expenses and time-consuming problems of correcting pages on press.

The PostScript language is used to forge a link between desktop publishing software, laser printers, imagesetters, and electronic prepress equipment. Soon PostScript also will enable you to send an electronic page directly from a personal computer to a plate making device, bypassing all photographic reproduction stages and providing direct digital proofs.

Not all Macintosh users require a link to high-resolution output devices—many would rather have less-expensive 300 dpi printers. Apple offers a line of laser printers that start with the low-cost LaserWriter II SC, which does not include PostScript but can be upgraded to the IINT, which does include PostScript. The non-PostScript printers are called QuickDraw printers because they are driven directly by the Macintosh System software using QuickDraw instructions. PostScript printers, on the other hand, are driven by a PostScript interpreter that translates the QuickDraw instructions into the PostScript language. The interpreter is usually located in the printer, so that any number of Macintosh users on a network can share one interpreter and printer. For the most part, PostScript printers are usually shared on a network, and QuickDraw printers are usually connected directly to a single Macintosh.

Page printers are cost justified by the number of pages they can print. Color printers have a different justification: the costs saved by proofing with them. PostScript offers a path so that a page with a color image can be proofed on a color printer (such as the QMS ColorScript) and then produced as a color separation on a high-resolution imagesetter or on an electronic prepress system. When color copiers become more commonplace in the office, color page printers will be even more in demand as master page printers.
Reviewing Printers

The most important difference among black-and-white printers is *resolution*, which is a measure of dots per inch (dpi). Laser printers have grown in popularity because they offer better fonts plus image printing at higher resolutions (300 dpi) compared to the fonts and resolutions offered by conventional dot-matrix (less than 150 dpi) and letter-quality printers. A dot-matrix printer such as the Apple ImageWriter II may be fine for printing rough outlines and some hand-outs, but the fonts and graphics do not look as professional as fonts and graphics printed on laser printers, due to the higher resolution of laser printers.

The most important difference among color printers besides resolution is *color depth*, which is the number of bits of color information per pixel (representing the total number of colors available per pixel). Most color printers can print at least 256 different colors on the same page (eight bits per pixel), and many can print the Macintosh's entire range of 16.7 million colors (24 bits per pixel).

Based on xerographic technology, laser printers resemble copiers and use electrostatic charges with toner, heat, and pressure to print an image. The LaserWriter II models are based on the black-and-white Canon LBP-SX printing mechanism, which offers a long life cycle, and smooth and dense black printing. The Personal LaserWriter models are based on the Canon P-110 printing mechanism, which also offers a long life cycle but is less expensive (although slower) than the LaserWriter II models.

Most laser printers, including all Apple LaserWriter models, offer resolution of 300 dpi by 300 dpi. Laser printers also can emulate daisy-wheel and dot-matrix printers at much better resolution and print quality, although some printers offer only partial-page graphics at 300-dpi resolution.

The laser printer requires a processor and memory to store the image of the entire page so that it can print the page without stopping. At least one megabyte of RAM is required in the printer to print an entire page at 300 dpi, and laser printers with additional memory tend to operate faster by storing font information in the additional RAM (a process called *font caching*). With the Apple LaserWriter IIINTX, you can expand RAM to 12 megabytes.
PostScript-compatible printers are attractive because the PostScript language can describe resolution-independent fonts and graphics. Because PostScript is a common denominator, a page can be printed on a Personal LaserWriter NT, LaserWriter IINT, or LaserWriter IINTX (at 300 dpi) and then printed with a high-resolution imagesetter (over 1200 dpi) to get a higher quality version of the same page.

Laser printers are simple to use with the Macintosh. PostScript printers are connected directly to an AppleTalk-compatible network, such as Apple's LocalTalk or Farallon Computing's PhoneNet, and are effectively shared by anyone on that network. The Apple Personal LaserWriter NT, for example, is supplied with a LocalTalk cable to connect the printer directly to another LocalTalk cable connected to a Macintosh, creating a network. As other Macintosh computers are connected to the network, they become full-fledged users of any PostScript printers also connected to the network.

Non-PostScript printers, such as the Personal LaserWriter SC and the LaserWriter IIISC, connect directly to the SCSI port of a single Macintosh and are therefore not as easy to share. Such printers are called *QuickDraw* printers because they are driven directly by the Macintosh using its native graphics language, QuickDraw. Nearly all Macintosh applications can print to QuickDraw and PostScript printers. Color graphics, however, are printed as black-and-white graphics unless you use a color printer. You can use Adobe Type Manager (ATM) to print text in Adobe PostScript fonts on QuickDraw printers, but PostScript graphics (in EPS format) will print only on PostScript printers and imagesetters.

**Apple LaserWriters**

Apple offers five black-and-white LaserWriter models: the Personal LaserWriter SC, the Personal LaserWriter NT, the LaserWriter IIISC, the LaserWriter IINT, and the LaserWriter IINTX. Apple offers the range of printers to satisfy mainstream users and high-performance users.

The Personal LaserWriter SC and NT, designed for mainstream users, are based on the compact, light-weight Canon P-110 laser xerographic print engine, which offers a performance life of 150,000 pages—equivalent to printing 200 pages a day, five days
a week, 52 weeks a year, for more than five years. These printers operate at approximately four pages per minute. The LaserWriter II models (IISC, IINT, and IIINTX) use the Canon LBP-SX engine designed for high-performance users. These models operate at eight pages per minute.

The Personal LaserWriter SC and LaserWriter IISC are QuickDraw printers that connect to a Macintosh with a SCSI cable. Both printers have a built-in 68000 processor, the same as in the Macintosh Plus. Although the Macintosh itself prepares the image in its own internal RAM, the printer also has enough RAM (one megabyte) to hold one full-page image, so that printing can take place faster. The Personal LaserWriter SC and LaserWriter IISC do not have AppleTalk ports—these printers are designed to be used with a single Macintosh and to be connected to the Macintosh's SCSI port. They are supplied with popular sizes of the screen fonts for Times, Helvetica, Courier, and Symbol typefaces. You need Adobe Type Manager to print Adobe outline fonts or other Type 1 fonts.

The Personal LaserWriter NT and the LaserWriter IINT both use the 68000 processor and a PostScript interpreter, and both models offer two megabytes of RAM (allowing room for font caching). The high-performance LaserWriter IIINTX uses the faster 68020 processor with PostScript and can be expanded to have 12 megabytes of RAM for font and image caching to increase performance. The Personal LaserWriter NT also can emulate a Hewlett-Packard LaserJet Plus. These three models can print any PostScript page and are supplied with 35 Adobe PostScript outline fonts in the following font families: Times, Helvetica, Courier, Symbol, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, Helvetica Narrow, Palatino, ITC Zapf Chancery, and ITC Zapf Dingbats.

The LaserWriter IINT and the IIINTX have SCSI ports for attaching hard disks or CD-ROM devices to hold extra fonts. Service bureaus like this feature because they need to keep a large variety of fonts available at all times. All three printers have an extra ADB (Apple Desktop Bus) port for attaching input/output devices, and the PostScript printers also sport an RS-232 port for direct connection to other types of computers (RS-232 is not offered for the IISC). In addition, the IIINTX offers Hewlett-Packard LaserJet II as well as Diablo 630 (daisy-wheel) emulation.

As a replacement for the ImageWriter, the Personal LaserWriter SC is an excellent entry offering and is less expensive than PostScript printers. The printer also can be
upgraded to the level of the Personal LaserWriter NT to support PostScript, if the need for compatibility arises later.

We prefer the economical Personal LaserWriter NT printer that offers PostScript or the LaserWriter IINT printer for high-performance printing, which can be upgraded to the IINTX for faster performance.

Other Black-and-White Printers

Many PostScript laser printers are on the market from companies such as IBM, DEC, Tektronix, Texas Instruments, Qume, QMS, NEC, GCC, Hewlett-Packard, and Xerox. Nearly all PostScript printers have a connector for attaching the printer to an AppleTalk network so that they can be shared by many users. The Macintosh is supplied with standard printer driver software that works with most of these printers (the ones not supported are supplied with their own drivers). Installing a PostScript printer is as simple as connecting the printer to a network and turning it on. A standard version of the Laserwriter file must reside in your System Folder, but this step is usually performed at the initial system installation—you can add more PostScript printers without installing new software.

PostScript printers are capable of rendering any font in the Adobe Systems font libraries and any PostScript-compatible font such as those created with Altsys Fontographer. Bitstream, Agfa Compugraphic, and The Font Company are major suppliers of PostScript outline fonts.

QuickDraw laser printers are attractive as ImageWriter replacements because they offer faster, quieter operation as well as higher resolution. QuickDraw printers cannot do everything that PostScript printers can do, such as print PostScript graphics, but for some desktop publishers, the trade-offs are worth the savings in cost, and Adobe Type Manager provides the capability to print Adobe PostScript fonts.

The GCC Personal LaserPrinter (PLP) is a QuickDraw printer that uses a six page-per-minute engine and offers excellent type quality by substituting Bitstream's outline fonts for the standard Macintosh screen fonts.
Hewlett-Packard offers a 300 dpi ink-jet QuickDraw printer for Macintosh computers called the DeskWriter. This printer represents a price and performance breakthrough as a faster and higher quality alternative to Apple ImageWriter printers. The DeskWriter prints at the rate of one to two pages a minute and uses Agfa Compugraphic's IntelliFont font scaling. This printer uses a replaceable ($19) ink and print head cartridge and is designed to run quietly.

**Color Printers**

For many presentations and publications, there is no substitute for color to communicate information, to draw distinctions, to illuminate an idea or process, or just to draw attention. The least expensive route for color in office documents is with dot-matrix (impact) printers using a multicolored ribbon (such as the Apple ImageWriter II). You can print only spot color with these devices, and text and black-and-white graphics do not print as well as with laser (non-impact) printers. For higher quality color printing, three types of printers can be used: inkjet, thermal, and laser.

An inkjet printer fires drops of colored ink onto paper from high-pressure nozzles. Inkjet printers are less expensive than thermal or laser printers and are attractive for office use. They also are lower in resolution, but the reduced resolution does not impede quality with color images as much as lower resolution impedes quality with black-and-white images and text. Many inkjet printers available today, therefore, are used for on-demand office document printing and for producing master pages for color copiers.

At the low end of the spectrum are inkjet printers such as the Hewlett-Packard PaintJet (with a resolution of 180 dpi) and the Tektronix ColorQuick (216 dpi). These printers are perfectly capable of producing hand-outs and master pages for color copiers.

The Pixelmaster (Howtek) is a 240-dpi solid inkjet printer that prints on regular copier paper and is compatible with PostScript. This printer can produce master pages for color copiers with color halftones that look very good and can print PostScript graphics and color proof pages for publishing. The Pixelmaster is slower than other
printers when printing PostScript, because it uses a software interpreter that runs as a separate program, requiring a two-step process (interpreting PostScript, then printing).

Tektronix offers a high-end inkjet printer, the Phaser CQS, which uses the same print engine as the ColorQuick, offering 216-dpi resolution but also including support for PostScript and Adobe fonts. The Phaser CQS includes a Tektronix PrintStation for controlling several color printers connected to an AppleTalk-compatible network. The PrintStation provides eight megabytes of RAM and a 40-megabyte hard disk for print spooling (lining up print jobs in a queue automatically). The Phaser CQS can print a page in two minutes and prints on regular paper or transparencies.

The ColorScript 100 Model 10 (QMS), the Phaser CPS with the PrintStation (Tektronix), and the 4693DX (Tektronix) are all examples of 300-dpi thermal-transfer printers, which use a heating element to fuse a ribbon with a film of pigment or wax to paper. Thermal-transfer printers require specially coated paper or transparencies, and are excellent for printing color overhead transparencies. They also are useful for making comprehensives (or comps) for proofing artwork before sending a color publishing job to a prepress shop. In this category, the ColorScript is more useful because it is an Adobe PostScript proof printer and can print Adobe Type 1 fonts without requiring the use of Adobe Type Manager. Non-PostScript printers cannot print text in Adobe fonts without Adobe Type Manager.

The quality of 300-dpi thermal-transfer printing is excellent—better than any other desktop color printer in the same price range—for making transparencies and master pages for use with a color copier. Color thermal-transfer printers also are slow—at least two minutes per page—but are considerably faster than the Pixelmaster, and the ColorScript is generally faster than the Phaser CPS. The paper must pass three times across a three-color ribbon (cyan, yellow, and magenta), or four times across a four-color ribbon (including black). The actual printing area on the page is smaller than the printing area of the LaserWriter. The ColorScript A-size page is actually 8.11-by-8.91 inches, leaving about an inch margin at the top and bottom of the page. Thermal paper also is more expensive than regular copier paper, but the increase in speed and overall image quality makes thermal-transfer printers worth the extra cost.

Canon U.S.A. offers the only color laser printer, which is actually the Color Laser Copier 500 outfitted with an Adobe PostScript interpreter and controller. Its resolution
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is 400 dpi, and it can print 11-by-17-inch pages at 3 to 10 pages per minute in color or black and white. The copier currently sells for $39,000 and uses plain paper. We have seen excellent quality results from this copier, including proof pages that look better than pages from any other color printer and matched closer to the ink and paper used in a printing press. Inexpensive color copiers are around the corner that can provide a desktop color press for a variety of short-run color print jobs. Although this printer/copier is still expensive, you can save a great deal of time and film consumables by using the copier for proofing color images before using an imagesetter to produce the color separation films.

Using Imagesetters

Traditional typesetting or photocomposition equipment use to be required to obtain clear, high-quality type for publishing. Yesterday's "typesetter" was in most cases a photocomposition machine driven by a computer that fed text to the machine. The machine then used a photosensitive drum combined with a CRT or similar device to create the image of the type. A roll of photographic paper would come out of this machine with type on it; this roll was called a galley, and strips of galleys were pasted manually onto the page with glue or hot wax and trimmed with an X-Acto® knife.

Today's "typesetter" is usually a photocomposition machine or a laser imagesetter. A photocomposition machine is still limited in the graphics it can reproduce, but a laser imagesetter can reproduce any image because the imagesetter is a completely digital machine, laying tiny dots onto photographic paper or film. A laser imagesetter consists of a raster image processor (essentially a dedicated computer that translates the PostScript language describing the page into a series of dots, called a bit map, corresponding to the resolution of the imagesetter) and a marking engine (a device that marks the dots on paper or film).

With a raster image processor, a full page comes out of the machine (again, on photographic paper) rather than a galley. The pages also can contain graphics and even halftones. An imagesetter can print directly onto photographic paper or onto film to produce a negative (which gives better printed results for halftones and color separations) or a positive image of the page.
The most popular imagesetters are the Linotype Linotronic 100 and 300 models, and the Agfa Compugraphic 9400, although both companies are offering higher performance models such as the Agfa Compugraphic 9800. The Linotronic 100 offers 1,270 dots-per-inch resolution, and the Linotronic 300 offers 2,540 dots-per-inch resolution. The Agfa models offer 1,200 and 2,400 dots-per-inch resolution settings.

Imagesetters are still out of most business’s price range and not suitable for the fast printing chores required in business computing applications. An imagesetter produces output of such high quality that most businesses only use it for the final step, before volume printing. Because the photographic paper used with the machine has to be developed by a chemical-based processor, a ventilated room (preferably a darkroom) for the processor is necessary. High-resolution imagesetters typically demand a temperature-controlled environment, and color separation software performs best when used with large monitors in light-controlled and specially painted rooms.

Using PostScript as a link to these devices means that you don’t have to own and maintain them yourself. Desktop publishers who need high-quality output can get the speed and the flexibility of laser printers, plus the high resolution of imagesetters, by using PostScript as the output language. You can prepare pages and print them with a PostScript laser printer for proofing before sending them to a service bureau—fully aware that the pages will not be modified or changed at the service bureau, simply “printed” on a higher-resolution device. The combination of a PostScript laser printer and an imagesetter was used to produce this book.

This compatibility among PostScript devices extends not just to graphics, but also to fonts. Because a PostScript font will print on any PostScript device, you can assign PostScript fonts in a document with the knowledge that the document will print on any PostScript device. No longer are you limited to the fonts available with a particular printer.

Font Compatibility

The Macintosh has the lead in desktop publishing for many reasons, but one is that PostScript users have access to a variety of high-quality outline fonts that can be rasterized into high-quality bit-map fonts of any point size without increasing the overhead of storing screen and printer font files on disk.
PostScript describes each character of a typeface with an outline that can be scaled into a bit map at a particular point size. Although low-resolution (72 dpi) screen fonts are used to display the text, outlines are substituted in the PostScript output stream, and the PostScript interpreter creates a high-quality bit map for each character according to the resolution of the PostScript device—a 300-dpi character for the LaserWriter IINT or a 2540-dpi character for the Linotronic 300. In the PostScript world, two kinds of fonts exist: Type 1, compact and encoded with hints for printing at low resolutions with better quality, and Type 3, described with normal PostScript instructions that can be edited.

Some QuickDraw printers print the page using screen fonts, which are normally tuned for 72-dpi screens. The LaserWriter IISC substitutes a screen font three times the size of the font you specified—a 36-point screen font for a 12-point font in the text—and scales the font down to get a higher quality 12-point font at 300 dpi (the resolution of the printer). With this clever manipulation you can use the same set of screen fonts for QuickDraw and PostScript printers.

Other QuickDraw printers substitute fonts from a different library for the standard 35 fonts shipped with every LaserWriter. For example, The GCC PLP provides Bitstream matches for the basic LaserWriter fonts—Times, Courier, Symbol, and Helvetica—and matches for the LaserWriter Plus fonts in the Fonts Plus package. Bitstream’s outline fonts are now regarded as the only reasonable alternatives to PostScript fonts because they are fine-tuned to match the PostScript fonts in character widths and spacing. The goal is to match the line endings of text so that the text falls in the same place on the page no matter which printer you use. Both the Apple and the GCC QuickDraw printers achieve this goal, and the trade-off is whether or not you want the closest match in appearance (the Apple IISC uses scaled screen fonts) or the best possible quality (the GCC PLP uses Bitstream outlines). For many users, however, a proof printer does not have to do everything a PostScript printer can do, especially if a PostScript device is available on the network as well.

Adobe Type Manager (ATM), described in Chapter 2, is a utility that enables you to render Type 1 PostScript fonts on non-PostScript devices as well as display them. With ATM, you can display and print any Adobe font or other Type 1 font on nearly every QuickDraw device on the market, including color printers and film recorders. Even the ImageWriter can be used with ATM, but the best results are obtained with 300-dpi printers or devices with higher resolutions. ATM provides the convenience of having one outline for the font stored on disk that can be scaled to any size for both display and printing.
With ATM and the QuickDraw printers, all you are missing is a way to print PostScript graphics. Many graphics programs can convert PostScript graphics into PICT files that can be printed on QuickDraw devices. Some QuickDraw printers, such as the LaserWriter IISC and the GCC PLP, can be upgraded into PostScript printers. Another alternative is to use a software-only PostScript interpreter, such as Freedom of Press (CAI), which can prepare QuickDraw output from PostScript files.

One advantage that the LaserWriter IINTX has over other PostScript and QuickDraw printers is the capability to attach a hard disk or CD-ROM drive with fonts directly to the printer. Sending fonts from the computer to the printer, which is called downloading, is one of the reasons why typesetting is time-consuming. When a program sends output that includes downloadable fonts to a high-resolution device, the program also must download the font for every page on which it appears; the program may have to download the same font several times for one page. Because AppleTalk is slower than a hard disk, storing the fonts on a disk attached to the printing device saves time.

With the SCSI ports, you can attach hard disks or CD-ROM drives acting as font servers, which contain every font everyone on the network needs, all in one place. You can customize your printers to have as many fonts as needed without using downloadable fonts—including storing logos and other often-used graphics on the font server. The expandable memory offers substantially increased performance with font and graphics caching—storing repeatedly used images in RAM.

This idea is not new—typesetters have used font-serving hard disks for several years, and all of Adobe's fonts are distributed on a hard disk in a special package for service bureaus and network users. The IINTX also has an extra slot in its circuit board for adding more resident fonts—fonts stored in ROM built into the printer. The LaserWriter IINT and IINTX printers already have 35 resident fonts.

You can get true integration of presentation and publishing products by sticking to a set of fonts that can be used in laser printers and film recorders (the 35 PostScript fonts for the LaserWriters or the Bitstream fonts used with the GCC PLP and with PostScript printers). The alternative is to change the fonts for each application, which is easy or hard depending on the application. With Adobe Type Manager, you are guaranteed that the Type 1 fonts can be used on any device you connect to your Macintosh.
Using Print Shops and Presses

Until color printers and copiers become commonplace, you will most likely use a printing press or print shop for medium-volume and high-volume print jobs. You must consider the limitations of the printing presses you are using when you start your design effort. Adjustments to images and page layouts may be required to match the specifications of a given printing press.

Paper comes in only a few standard sizes, although you can have the pages trimmed to a custom size for an additional cost. Some presses cannot print to the very edge of a standard page—the area that does print is called the image area. High-quality presses usually allow the image area to bleed off the edges and over two pages. Professional print shops offer sample pages showing what their presses can do.

Print shops will want you to provide black-and-white “camera-ready” pages with colored areas specified by an overlay page with instructions. For spot color (a single color for highlighting text or graphics), color tints (a single color or mix of colors used for a background), and four-color (full-color) images, you have to separate the color areas from the black-and-white areas by printing separate pages as overlays or masks. Page makeup programs offer you the ability to print overlays, but not the ability to separate the many colored parts of an image. For that you need a color separation utility program, such as Aldus PrePrint (which separates PageMaker files), and perhaps an image retouching program, such as ColorStudio or Adobe PhotoShop, to prepare the image for a particular type of press. The preparation of images, pages, and signatures for a press run is called the prepress step.

In the prepress step, fine-tuning is applied to color images to synchronize with the printing process. This step is a highly specialized craft performed by people with experience in certain types of presses. Because color printing is a more expensive process than black and white and involves quality control beyond the means of the desktop, you may want one vendor—usually the printing plant—to be responsible for getting the color right. A considerable amount of expertise in the specific printing press, inks, and paper stock is required.

Proofs, sometimes called comps, play a major role in prepress operations. Off-press proofs and press proofs are necessary in the color reproduction process. Press proofs are closest in showing what the color will look like on the specified paper using that
particular press and mixture of inks, but press proofs are the most expensive kind of proof, requiring the use of the actual press and printing plates or cylinders. Off-press proofs on digital printers are generally used to check the color of the corrected films before the image is transferred to plate, saving some of the “false starts” that characterize any press run.

The key to success for a digital proof printer is its capability to match the color inks used in the printing press to provide the best possible color proof. The ColorScript 100 Model 10 (QMS), the Phaser CPS with the PrintStation (Tektronix), and the 4693DX (Tektronix) are all examples of 300-dpi thermal-transfer color printers that could be used to print comps before creating color separations. The ColorScript is an Adobe PostScript printer capable of printing Type 1 fonts as well as all other PostScript fonts and graphics.

**Preparing Color Images**

A fundamental difference exists between the stages of design and production: *Design* requires experimentation, multiple choices, and obtaining final approval for the concept and design. *Production* requires a final design before starting and an attention to detail and precision in order to get the best possible result from the printing methods you have chosen. Although similar skills are required in both realms, the tasks are usually clearly divided between design and production.

Desktop publishing has placed the tools of production in the hands of the designers, enabling them to produce mock-ups, comps, and proofs from the same electronic pages that are part of the production stage. As a result of this enabling technology, the desktop has grown to accommodate a variety of powerful image editing capabilities, including the ability to prepare color photos for electronic publishing and multimedia. Even the prepress stage can be started well in advance and on the desktop.

The result is a less expensive process and a faster production cycle. Quality is not compromised by the use of desktop tools; on the contrary, quality *used* to be compromised due to time constraints and cost factors. According to Joseph Prieboy, Macintosh consultant for Home Box Office (HBO), desktop image processing saves
money. “Our printing problem is creating movie support promotions—such as posters—from inferior quality slides which have to be sent out to be color corrected and retouched. The process is very expensive,” says Priebey. “Bringing the process in-house, using the Macintosh, could save us between $2,000 and $3,000 per poster. Video design is text-oriented, so to have the capabilities of a high-resolution paint program with sophisticated text features, such as Adobe PhotoShop’s anti-aliasing, on a desktop computer is a dream come true.” Anti-aliasing is a technique of alternating the color of pixels at the edges of a graphic object, such as a text character, to simulate higher resolution.

The Macintosh can display 256 colors at the same time (out of a possible 16.7 million) in eight-bit mode with the Apple 8•24 Display Card, but this color resolution may not be enough for producing color halftones for a magazine or advertising brochure. By switching to 24-bit mode, you can use the same display and card to see any of the entire set of 16.7 million colors. Color images, therefore, can have richer, fuller colors, and these images occupy far more disk space than 8-bit images, because the files must accommodate 24 bits per pixel rather than the usual 8.

ColorStudio (Letraset) is a 32-bit color image editing program that processes 24-bit color images and uses the remaining eight bits for a mask layer and masking features. ColorStudio offers color retouching tools similar to ImageStudio’s tools for gray-scale images, including an airbrush and a variety of brush settings, selection tools, and effects (rotating, skewing, stretching, and so on). The program uses the CYMK (cyan, yellow, magenta, black) and HSB (hue, saturation, and brilliance) color models and offers Pantone Matching System (PMS) colors.

ColorStudio supports virtual memory to electronically manage the large file size requirements of high-resolution color images. This virtual memory capacity enables you to open multiple images for simultaneous viewing, manipulation, and cutting and pasting. The program also offers built-in color-correction features—an experienced color coordinator can adjust the colors for the particular printing press and for different inks and paper stock. ColorStudio is a powerful tool for color image creation and the production of comps, transparencies, and proofs.

Adobe PhotoShop (Adobe Systems) provides tools for retouching and painting, including an anti-aliasing brush and a rubber stamp tool for cloning a part of an image. PhotoShop processes 24-bit images and uses the remaining eight bits for
creating masks, similar to ColorStudio. Selections can be added or subtracted from masks, and edges can be feathered. Any part of an image can be a brush, and you can rotate, stretch, distort, skew, and invert parts of an image. The program is supplied with 22 filters for specific devices and custom filters can be added. Support for compression and custom screen angles for color separations also can be added.

Image retouching is necessary only when you need to change an image or merge two or more images into one. Correcting colors for a particular press run, however, is necessary nearly all of the time. Design programs such as ColorStudio, PhotoShop, and PixelPaint Professional offer a variety of retouching tools and also can be used to set color balancing, dot-gain compensation, and gray-component replacement.

Aldus offers PrePrint, which is meant to be a production tool in a complementary fashion to the design-oriented tools such as ColorStudio and PhotoShop. PrePrint can be used for separating color pages that include color halftones or for separating color TIFF graphics by themselves. You can improve images and make adjustments and color corrections based on typical press settings listed in the menus.

Because it is a production tool, PrePrint offers a limited set of choices that any production artist would understand (see fig. 9.1); design tools, on the other hand, offer every conceivable special effect and extremely flexible painting and airbrushing tools. PrePrint’s strengths are in the research that went into its development—the engineers at Aldus have anticipated settings for normalizing tones and gray-balancing for the majority of printing press conditions. You select which type of paper you will use in your press run—uncoated, coated, or card stock. The program then sets the proper amount of ink coverage, dot-gain compensation, and gray-component replacement.

The program can print to a variety of color page printers and make separations with PostScript imagesetters. The program also supports the Open Prepress Interface (OPI), described later in this section, which enables other applications to perform image enhancement and retouching operations to images already placed on the electronic page (which then is separated by PrePrint). With OPI, PrePrint can prepare pages for electronic prepress service bureaus.

PixelPaint Professional also offers a color separation utility that supports PMS colors and can prepare a PostScript file for inclusion in a page makeup program. The program enables you to set undercolor removal, total ink coverage, and the density range for process colors. You also can set line resolution for output on high-resolution devices. As with PrePrint, this program can print to a variety of color page printers and make separations with PostScript imagesetters.
Fig. 9.1. The Aldus PrePrint utility offers production-oriented control settings for gray-scale and color halftones stored in TIFF files, including the capability to specify a line-screen and dots-per-inch resolution and to set gray-component replacement for improving the grays in a color image.

With this method of “desktop prepress”—preparing output for PostScript imagesetters—there is no guarantee of quality unless some experience with printing is acquired. Consultants are available to set up relationships with prepress service bureaus, and there is no substitute for hard experience with printing presses and inks. (An essential reference is Computer Color [see bibliography] which shows 10,000 swatches of process colors obtained by mixing percentages of CYMK inks.) The key
to success with color publishing is the ability to predict what colors will do when they are mixed on paper with ink. Sometimes showing on a color display what those colors look like when printed is difficult. Because the color display shows subtractive colors using different color models in addition to CYMK, and the printed colors are additive colors, the display is capable of showing some colors that cannot be printed.

Matching the Display to the Printer

A CRT displays colors with light; whereas the printing process reproduces colors by mixing impure inks on paper. In fact, some colors can be displayed but not printed, and some colors you can print but you cannot display with any fidelity. Problems, therefore, can occur in matching the color you see on-screen to the color you get in print.

Tektronix has introduced TekColor, which helps you pick screen colors that can be reproduced by printers, eliminating some of the guesswork involved in matching colors on-screen to printed colors. TekColor is compatible with the CIE (Commission International de l'Eclairage) international standard for describing color. The CIE model is universally accepted as a uniform way of describing color for all kinds of devices.

TekColor is activated from the Control Panel and displays a "hue leaf" showing a range of shades for each color set. To provide consistency in the way shades are displayed in each leaf, TekColor accommodates for quirks in our perception of color, such as greater sensitivity to oranges than greens, and the perception that yellow is brighter than blue at equal levels of brightness. TekColor displays monitor and printer "leaves," and colors common to both devices appear in the overlapping area. The Control Panel software works with the Tektronix ColorQuick Inkjet Printer.

Complementing this fidelity scheme is an ADB (Apple Desktop Bus) device from Radius that helps you calibrate your Radius or Apple color display. The Precision Color Calibrator enables you to eliminate color variations between monitors and select color temperature settings and perform corrections to more closely match the display to printed samples. RasterOps goes a step further and offers a self-calibrating color monitor that uses a processor to automatically recalibrate the display every minute after you have set up the display the first time.
Leartset recently licensed the calibrated color space implementation of the CIE color model to use with ColorStudio. The CIE model makes matching colors from displays with colors on color printing presses easier. The Optronics ColorSetter 2000 is the first device to support the software and prepare color separations from ColorStudio.

**Moving from Desktop to Prepress**

You need a high-performance workstation to handle the job of rasterizing an entire page at a high resolution for a film recorder that can produce screened color halftones at 150 lines (magazine quality) or higher. You also need a lot of processing power and storage to perform transformations of a high-resolution image. A Macintosh II, IIx, IICx, IICi, or IIfx can be equipped to handle these operations with reasonable performance by installing an accelerated 32-bit Color QuickDraw adapter, such as the Apple 8•24GC, and eight megabytes of RAM for image processing. With a PostScript imagesetter, you can obtain results suitable for a medium-quality magazine or book.

To get the highest-quality color reproduction, however, nothing yet outperforms a prepress service bureau. Color reproduction is a science, but there also is a magical element to getting percentages of process colors to match a color printed on a certain press using known ink pigments. Color retouching also is a craft that seems to require expertise and experience bordering on magical powers. The prepress service bureau has a fully equipped system to process these images, but more importantly, the service bureau has the expertise with trapping, choking and spreading, undercolor removal, gray component replacement, and other effects for proper printing of type or other elements of different colors.

A hallmark of Macintosh and PostScript technology is that it can extend the capabilities of the desktop by linking them to the capabilities of the expensive prepress systems at service bureaus. The link from the desktop to the prepress system does not hide this combination of science and magic from the user—this link merely delegates the process to the expensive prepress system and its operators. You may still have to pay for an expensive color retouching process at a service bureau to get the image to look just right.

In the past, a color separation had to be stripped into the page negative by a stripping house or printer with a stripping service. If you wanted a full page output from the
prepress system, you paid more to have page layout and text manipulation performed on expensive prepress workstations.

Now the Macintosh can fulfill every role in this process and still provide a link to the expensive prepress systems and high-resolution film recorders. You can compose pages including color images on a Macintosh and then send that page file to a prepress service. The prepress service can rescan the original color artwork or photo at a higher resolution and merge the color image with the text and other black-and-white elements on the page.

Whether you use a link to a prepress service bureau, or a PostScript imagesetter such as the Linotronic 300, the result is a page with color images that do not require expensive and time-consuming film stripping. Remember, however, that the fine-tuning of color images on a color prepress system can still cost more than ten times the amount you may spend for black-and-white halftones. You should prepare your images first, on the Macintosh, and use that version of the image if possible. Rescan at the prepress service only if absolutely necessary.

Several different types of links exist to prepress systems. A two-way link using PostScript is the most flexible choice, offering ways to reduce design and production bottlenecks and use different prepress systems without compromising accuracy of placement and cropping, and without sacrificing quality. The Open Prepress Interface (OPI) is a standard way to encapsulate page geometry and image processing instructions in PostScript files so that any program can prepare elements for any prepress system. The Aldus PrePrint utility can prepare OPI-compatible PostScript files for a variety of prepress systems using a standard file format for 24-bit color images called Tag Image File Format (TIFF).

The goal of the OPI link is to provide color page geometry and image cropping and scaling information independent of any particular prepress equipment to the prepress service bureau. The service bureau can use a high-resolution scanner to scan the image from the original photo and will be able to provide a subsampled image stored in 24-bit color TIFF that you can use on a Macintosh to scale, crop, and print comps. This two-way link will offer a way to use the desktop technology for most of your work, and the expensive prepress system for just the first (the scanning) and last (the output) steps. The artists and designers can manipulate the subsample of the image on the Macintosh and communicate those changes through the link to the prepress operator, who makes the changes to the actual high-resolution image on the prepress system (see fig. 9.2). The prepress operator does not have to do anything else with the page.
Desktop Publishing System crops, scales, and places color TIFF version on page.

Prepress Service Bureau scans original, subsamples for desktop, then receives PostScript with comments from desktop.

Color-separated pages without manual stripping.

Fig. 9.2. The Open Prepress Interface provides an information link between the Macintosh desktop publishing software (such as Aldus PageMaker), which uses TIFF files for images, and the prepress system at a service bureau, which scans the original photograph into a higher resolution format for use in final production without manual stripping.

The major advantage of OPI, as compared to other links, is that information about scaling, cropping, and placement is not lost between the desktop and the prepress system, and PostScript fonts can be transferred if the prepress system can use them. The two-way link is a major step into a future where an art director can send color correction and other touch-up instructions back to the prepress system so that the scanned image is modified appropriately.

Crosfield's StudioLink enables page geometry, scanned images, text, and illustrations to be passed to the Crosfield prepress system. You can use any desktop program to produce PostScript graphics and text and use ReadySetGO! or DesignStudio, both reasonably priced desktop programs, for complete page layout.
The link from the desktop to the electronic prepress environment can be formed by network, by telecommunications, or by transfer of cartridge tape or removable hard disk. Images in 24-bit color can range from less than a megabyte to over 40 megabytes each! With compression utilities such as Stuffit (Alladin Systems), you can compress the files to be manageable. Even large-scale publishing operations can be handled this way—USA Today and the Knight-Ridder chain of newspapers, as well as The New York Times, all use Macintosh computers for graphics, and use some form of electronic distribution of graphics and pages. They are reducing costs as well as the time factor by taking advantage of desktop productivity and standard methods of transferring data.

Chapter Summary

You can prepare pages for a variety of output devices from the inexpensive ImageWriter to high-resolution PostScript imagesetters, even if you don't have a printer. The costly steps of page stripping, preparation of negatives, and electronic prepress operations can be minimized if not eliminated.

For most printing jobs, you can use a laser printer at 300 dpi, but for jobs involving high-quality printing methods on medium-to-high-quality paper, you should use a higher-resolution imagesetter for producing full pages. Imagesetters are essential for obtaining medium-quality and high-quality results with scanned photos and color graphics.

Continuous tone images derived from scanned photographs or digitized video images must be converted into halftones to be printed. The halftone screen density, which is the frequency of cells measured in lines per inch (lpi), determines the size of the halftone cells in the image. You can raise the resolution (number of cells, or lines, per inch) of the image on a digital device, but the result is a denser image with less gray levels. To determine the number of gray levels that will be printed, divide the printer's resolution (dots per inch) by the desired halftone screen density (lines per inch) and raise the result to the power of two.

Page makeup programs can crop and scale gray-scale images and turn them into halftones. They also can adjust the lightness and contrast ratio for gray-scale images.
Color often is used in several different ways: as spot color or solid color illustrations, as a tint or shadow, or as a continuous tone image to be converted into a halftone.

To print color on a printing press, you supply color pages with the colors separated onto different pieces of film—a separate film for each colored ink. Color separations are not required for printing on a color printer and then copying on a color copier.

PostScript is useful for transferring digital color images directly to prepress systems in an all-digital color separation process in which color PostScript printers act as proofing devices. You can create color mock-ups, also called comps, with the color images and elements in place on the page.

The most important difference among black-and-white printers is resolution, measured in dots per inch. The most important difference among color printers, besides resolution, is color depth, which is the number of bits of color information per pixel.

Three types of high-quality color printers can be used: inkjet, thermal-transfer, and laser. Inkjet printers are used for on-demand office document printing and for producing printed master pages for color copiers. Thermal-transfer printers require specially coated paper or transparencies and are excellent for printing color overhead transparencies. They also are useful for making comps for proofing color images. Color laser printers are just starting to appear, and when they come down in price, they will be cost-effective for all color printing applications because the quality is better than any other type of desktop color printer, and they print on plain paper.

An imagesetter is used to prepare final pages or film materials for use with a printing press. You can get the speed and flexibility of laser printers, plus the high resolution output of imagesetters, by using PostScript-compatible programs.

You can get true integration of presentation and publishing products by sticking to a set of fonts that can be used in laser printers and film recorders. With Adobe Type Manager, you are guaranteed that the Type 1 fonts you select can be used on any device.

To get the highest quality color reproduction, nothing yet outperforms a prepress service bureau. A hallmark of Macintosh and PostScript technology is that it can extend the capabilities of the desktop by linking the desktop to the capabilities of the expensive prepress systems at service bureaus.
A two-way link using PostScript, such as OPI, is a flexible choice, offering ways to reduce design and production bottlenecks and to use different prepress systems without compromising the accuracy of placement and cropping and without sacrificing quality.

The link from the desktop to electronic prepress can be formed by network, by telecommunications, or by the transfer of removable media. After you have established a means of transfer by network or telecommunications, you also have a means of electronic distribution of documents. Large newspaper publishers already use fax technology to transfer electronic pages to remote printing sites. You also can use fax, electronic mail, networks, and removable digital media such as CD-ROM for publishing electronic information. The next chapter discusses this topic in detail.
Distributing Electronic Documents

The new electronic interdependence recreates the world in the image of a global village.

—Marshall McLuhan

Information in digital form can move as fast as the speed of light. There is no comparison, no economies of scale that can describe the difference between moving digital information and moving information in any other form. Large amounts of information can be moved great distances in digital form without losing quality, as the computer-enhanced video images from Neptune proved.

New media such as compact discs, networks, and telephone lines are changing the way digital information is distributed. Electronic publishing is the distribution of information in digital form over any medium that can handle it, be it on a compact disc, over telephone wires, or through network cabling.

The largest newspapers and magazines transfer pages electronically to remote printing sites, using a high-resolution form of fax technology. But as a Macintosh user, you have better technology at your fingertips—better because it is far less expensive, much more advanced, and much more useful than fax technology alone, because pages can be transferred electronically while retaining the capabilities to be edited and reproduced on devices of varying resolutions.

You need to be aware of your distribution methods before you start a multimedia project of any kind, including a publication. Just as in the print media, where magazines, newspapers, and books are designed to be a certain size to facilitate the sales of these items in bookstores and to fit into conventional book and magazine distribution
channels, you must design your multimedia projects to fit into a practical distribution strategy. Certain types of information, such as high-quality music and video, are nearly impossible to distribute in digital form over current networks and telecommunications equipment; whereas text, graphics, animation, and voice-quality sound can be distributed in digital form with current equipment. It is important, therefore, to know about distribution methods even before designing your publication or multimedia presentation.

This chapter explains the various methods of publishing and distributing digital information without resorting to paper, except as the end result of the process—as in a fax machine or computer printer receiving the information and printing it for your convenience. You will learn not only how to distribute electronic pages with graphics and fonts, but also how to distribute "documents" that contain voice, music, and animation as well as text and graphics. After reading this chapter, you will know the details of how to use remote fax machines to print pages from your computer, while still reaping the benefits of leaving the electronic page in digital form. You also will know how to prepare pages for electronic distribution media such as compact discs. The chapter ends with a description of how to use computer networks to publish information electronically, together with sound and animation on pages that can be displayed on the Macintosh screen.

**Understanding Electronic Media**

Most information is printed simply because print is the easiest medium for transferring reading material from one person to another. However, if computer media is used, the information remains in a digital form that can be edited and changed without reducing its value or its reproducible quality.

Information can travel from the author's Macintosh to the user's Macintosh on storage media such as compact discs, over telephone lines as electronic packages, and through network connections as electronic mail. Any type of information, from large referential databases to the most interesting color presentation with music and video images, can be distributed electronically either on demand—as the reader wants it—or in an electronic "mailbox" in anticipation of the reader's interest.
Until recently, electronic publishing and distribution efforts were limited to text, and readers could read the information only if they knew how to use a modem with their computer and how to access an information service such as CompuServe. Large amounts of information were nearly impossible to receive due to the limitations of floppy disks and removable storage media.

Now, a Macintosh user can receive graphics and full pages over the same services that used to carry only text. Modems are easy to use and operate faster, and networks can transfer messages and store them in electronic mailboxes. Any fax machine can receive and print Macintosh pages with fonts and graphics. Optical storage technology has created CD-ROM (compact disc—read-only memory), which is a standard audio compact disc that holds up to 550 megabytes of digital information.

CD-ROM is emerging as an important new publishing medium for animated presentations with sound and as a distribution medium for application software. The compact discs are permanent and impervious to viruses or accidental damage. Microsoft, for example, has put all of its Macintosh applications on a single compact disc along with a HyperCard-based electronic manual that includes sound and narration. Multi-Ad Services distributes its Multi-Ad Creator application, a HyperCard-based interactive tutorial, and extensive clip art library, all on one CD-ROM. Apple provides a complete software documentation library for Macintosh developers on a CD-ROM (see fig. 10.1).

Electronic publishing not only saves paper and makes it easy for a user to search for specific information—it also opens up the possibility of using sound, animation, and a linking facility to provide a level of interactivity.

Corporations that use local-area networks (LANs) can connect them into a wide-area network (WAN) and provide the capability to publish documents electronically to the farthest regional sales office. This type of distribution can be accomplished by simply placing the publication file (which would ordinarily be printed to make masters for a press run) in a centralized area of a network—the file server. All that is needed is a copy of the page makeup application to display and print the file.

It also is easy to distribute an electronic file without the need for the original application. You can "print" an image of each page to a special file, using a utility such as SuperGlue (Solutions, Inc.) that can be displayed and printed from any Macintosh.
Fig. 10.1. The Developer CD Series: Vol. III (also known as "A Disc Called Wanda") is published by the Apple Developers Group of Apple Computer on CD-ROM and uses a HyperCard stack for navigating through and presenting the information.
MarkUp (Mainstay), an editorial commenting program, enables you to "publish" as many documents as you want in a format that can be displayed, printed, and commented upon by another Macintosh user who doesn't even need a copy of MarkUp.

You also can publish electronically via fax, effectively turning any facsimile machine in the world into a remote "printer." Apple offers the AppleFax modem and software, and Solutions, Inc., offers the BackFax software. With the AppleFax modem and either software package, you can use your Macintosh as a sending and receiving fax machine. You can use any scanner, including the Apple Scanner, to scan materials and turn them into electronic pages for faxing. This facility can be handy if you have no printer at your disposal—you can simply "print" to the AppleFax modem. Although the quality is limited to the receiving fax machine's resolution (most fax machines print at 240 dpi), Macintosh software can treat the fax as if it were a printer, and fonts are rendered as best as the software can manage. If the receiving device is a Macintosh with the AppleFax modem, it receives the actual Macintosh file rather than single, static pages. The file then can be used with applications as any other Macintosh file.

Electronic publishing raises a new set of questions: will you distribute only text, or will you include graphics? Will sound and animation fit on the disk? Will the transfer of these documents slow down the network and affect everyone's performance? New advances in technology will ultimately solve some of these problems, but for now, it is wise to forego the use of sound in documents that must traverse the network or telephone lines. CD-ROM is a more effective medium for distributing large multimedia presentations and information databases.

**Publishing on CD-ROM**

CD-ROM is a cost-effective medium for distributing data, including sound and music. Similar in nearly every respect to an audio compact disc, a CD-ROM disc can hold the equivalent of 825 floppy disks of information. CD-ROM discs are much less expensive to manufacture in large quantities compared to floppy disks—less than two cents per megabyte for CD-ROM; whereas a floppy can cost more than $1.40 per megabyte.

Along with capacity, the most valuable feature of CD-ROM is its permanence: once it is mastered, a disc cannot be overwritten (not even by a virus). Nor can it be affected by a magnetic field or damaged by dust and dirt. This permanence gives CD-ROM an advantage over all other electronic storage media for the purposes of publishing and distributing information to computer users.
With that much permanent space available on a single disc, it is attractive for almost any type of electronic distribution, limited only by the availability of a CD-ROM drive at the receiving computer. Software publishers such as Microsoft have recognized that a disc could hold a suite of application programs and templates, plus electronic manuals and miscellaneous documentation for these programs, plus some voice narration in the “help” areas. Users can search through the manuals and get information much more quickly than if they used the paper versions, and the electronic manuals are cross-referenced with hyperlinks. The installation of all this software is so much easier because it comes on one disc.

The CD-ROM distribution medium provides new opportunities to publish multimedia titles, such as magazines. For example, Michael Gosney, the publisher of *Verbum* magazine, created an interactive magazine on CD-ROM that provides instant access to a variety of different topics and multimedia products (see fig. 10.2). The interactive magazine presents text, graphics, animation, and sound, and provides facilities for ordering product information. It even includes a comic strip by multimedia artist Street Poet Ray.

![You are here... Directory](image)

Fig. 10.2. The interactive magazine *Verbum* (courtesy of Michael Gosney).
This is Verbum Interactive, an interactive magazine published on CD-ROM. It has grown out of the Verbum (Journal), a quarterly set magazine dedicated to personal computer aesthetics.

Verbum magazine has always emphasized content and presentation in its coverage of personal computer art. During the mid-80s dawn of desktop publishing, aesthetics was an important concern, and Verbum helped inspire design, awareness and creativity. Similarly, during the early evolutions of interactive multimedia, aesthetics is an essential dimension. We see an industry, now designing the tools to a new kind of media which will give people unprecedented access to information, entertainment and communications through friendly computer televisions. Verbum hopes to sit in this design process.

Following the pattern established with Verbum magazine, we're experimenting with the new media tools in the production of our publication. In this case, we're publishing on CD-ROM. Verbum interactive is about creativity in digital art, publishing and multimedia. With a focus on tools, design, content and culture, Verbum interactive is about creativity in the new media, interactive multimedia, hypermedia, contexts, topics, design, content and culture.

Verbum interactive will stimulate the existing multimedia community, and will encourage the electronic art and design community to use the new tools.

Verbum, interactive 1.0 will be available in limited quantities. Apple CD-ROM Disc in the $20-30 each. We plan to sell through formal subscriptions beginning in 1991. Contact Michael or Verbum for more.

Fig. 10.2. continued.
CD-ROM is used by a variety of publishers for such reference material as *Books in Print Plus* (Bowker Electronic Publishing), *The Electronic Encyclopedia* (Grolier Electronic Publishing), and the *MEDLINE Knowledge Finder* (Aries Systems). Standard file formats for CD-ROM information, including Apple's Hierarchical File System (HFS), the International Standards Organization (ISO 9660) format, and the High Sierra format supported by many vendors including Microsoft, are widely used by publishers and are all supported by the AppleCD SC CD player. However, to make the most use of HyperCard and the Macintosh Finder environment, Apple's HFS is the best choice for CD-ROM products destined to be used in Macintosh computers. The High Sierra format is for CD-ROM products that run in DOS and other environments.

The AppleCD SC is a SCSI-type CD-ROM player designed for use with Macintosh and Apple II computers. The player includes an audio chip set, and the CD Remote desk accessory enables normal audio compact discs to be played in the drive. A headphone jack and two RCA jacks provide access to stereo audio and enable connection to an external amplifier and speakers. You can play audio discs and work on other applications at the same time.

With the HyperCard CD Audio Toolkit (APDA), you can create HyperCard stacks that also can play the audio tracks of standard compact discs on the AppleCD SC player. Using this method, The Voyager Company put together its *Beethoven's Ninth Symphony* interactive presentation, which is comprised of several HyperCard stacks on floppy disks and the audio portion of the presentation on a conventional audio disc.

CD-ROM discs, designed specially to hold digital information rather than audio tracks, hold about 550 megabytes after formatting. The AppleCD SC transfers data at a rate of about 153.6 kilobytes per second and has an average access time of less than 600 milliseconds (maximum access time is 1.2 seconds). A 64K RAM buffer improves performance during access.

The AppleCD SC player can be connected to a file server and shared across a network. The AppleCD SC icon appears on the desktop as any other disk, and you double-click the icon to access the files if the information is in the Apple HFS format. On a file server, the player can act as a central location for retrieving (but not saving) electronic documents.

Kwickee In-House Publishing from Multi-Ad Services is one of the first applications demonstrated for the Apple CD-ROM. Updated quarterly, this subscription disc is targeted at newspapers and ad agencies. It uses a customized version of QuarkXPress to provide clip art and layouts, including color, for grocery/food ads.
Other AppleCD SC developers are targeting vertical markets. In some reference works, such as Books in Print Plus, searches can be performed on various elements (such as title, author, subject, and publishing house), plus orders can be automatically generated. Other developers are producing discs targeted for education, real estate, and music entertainment markets.

Preparing Information for CD-ROM

With the proliferation of computers that can display graphics, and the advent of CD-ROM for storing large amounts of information, electronic pages have come to resemble paper pages. You essentially can design one page for both types of distribution.

There are some advantages to preparing information for electronic publishing first, before creating a paper version. The information remains dynamic and can be updated continually until you finally “freeze” it and store it on CD-ROM, where it is as permanent as paper. Even better is the fact that photographic images should not be converted to halftones—they should be left as continuous tone images for the display until the publication is ready to be printed. The quality of the display is always better than the quality of the printed halftone. If the document always will be delivered via the Macintosh screen, as in a multimedia presentation, and never will be printed in high resolution, you can use low-resolution (72 dpi) images and save a considerable amount of disk space.

When designing an interactive presentation for CD-ROM, you must design with a read-only environment in mind. The software must be able to function without having to write anything to the original disc (because it is a read-only disc).

HyperCard is a suitable authoring environment for presenting text, graphics, animation, and sound, and providing an interactive environment in the context of a read-only stack. (The next chapter goes into more detail on how to design interactive presentations with HyperCard.) MacroMind Director and SuperCard also are suitable for authoring for a read-only environment.

If any portion of the presentation must accept new data, you can store that portion in a separate file on a separate read-write disk (or instruct users to copy a particular file to their read-write disks). With most HyperCard presentations, a Home stack must be saved on a read-write disk, and the rest of the presentation can be stored in the read-only medium of CD-ROM.
Keep in mind that CD-ROM discs are not as fast as hard disks when retrieving information. The layout of the information can be changed to optimize performance, and you can use a variety of search engines available on the market to speed up text retrieval. A search engine is a piece of software that can be used in a HyperCard stack with external commands for implementing fast searches. Another method is to create an index of the location of every important word in the presentation and store that index also on the disc or on faster media. The search engine can use the index to find words faster than by searching through the entire text.

Not every user of your information will have the same programs, although you can assume that they have HyperCard, and you can distribute a copy of MacroMind Player for MacroMind movies. It may be necessary to convert graphics and pages to the PICT file format for display purposes or to use SuperGlue (Solutions, Inc.) to prepare Glue files that can be viewed with a desk accessory that can be distributed with the files. HyperCard represents the least common denominator in this regard, because anything brought into a HyperCard stack then can be distributed in the stack to anyone with HyperCard—and HyperCard is provided free with every Macintosh. HyperCard stacks can be launched from a CD-ROM as "read-only" stacks, because CD-ROM is a read-only medium.

**Mastering CD-ROMs**

The mastering process is the most expensive process for making CD-ROM discs; the discs themselves can be manufactured cheaply (less than $2 each in large quantities), but the information put on them must be correct and complete. The key to success in the CD-ROM mastering process is to build a test disc or series of test discs, and test them until they are perfect. The process is analogous to the color proofing steps in the production process for four-color print publishing.

It is possible to simply put all your information on a large hard disk or cartridge tape and send it to a mastering facility to create a set of discs. Some companies will provide you with a disc master and 100 pressed discs for about $1,500. It is even less expensive, however, to produce one test disc (about $500), and much safer if you want to examine the product first before mass-producing it.

Testing a CD-ROM disc before going into mass production is a smart idea, because it is possible to make presentations that don’t work on the read-only media for some reason (perhaps a reference to a non-existing card in a stack). Incorrect cross-references can occur if the structure or names of the folders change from your
development version to the distributed version. Windows may open at the wrong position on smaller Macintosh screens. It makes sense to test the disc with every type of Macintosh screen, including large screens, black-and-white screens, and color screens. The purpose of all this testing is to make sure that no bugs creep into the final version, which can never be changed without mastering a new set of discs.

If your CD-ROM product will be used on non-Macintosh computers, you must take the extra step of converting your data to the ISO 9660 or High Sierra format, using Apple's extensions to ensure that Macintosh and Apple II files remain intact. This is usually done right before a step called premastering, in which the data is converted to nine-track or other type of magnetic tape format before it is transferred to disc. If you are using the Apple standard HFS (hierarchical file system) format with file icons and windows (compatible with the Finder), you don't have to create the visual interface for accessing the files. In other formats, you may have to design such a visual interface (folders, icons, windows, and so on) before premastering.

CD-quality audio tracks can be stored on the same disc with digital CD-ROM information. The HyperCard CD Audio Toolkit provides external commands for use in stack scripts to control the AppleCD SC player to play the audio portions. Scripting in HyperCard is described in the next chapter.

CD-ROM provides considerable benefits for publishing large amounts of information, but it has one drawback: the information cannot be changed. For information that changes quickly, you may want to use a medium that enables you to update the information continually without requiring any special "mastering" step and without requiring any manufacturing. Telecommunications, which is publishing and distribution by telephone lines, provides these benefits.

**Publishing by Phone**

Your phone lines are available for distributing information electronically to other computer users and to fax machines. You can even distribute information electronically to a service that will print it, fax it, or deliver it by courier.

The electronic equivalent of a bookstore is an information service such as CompuServe, MCI Mail, or AppleLink. By arrangement with such a service, you can publish information and charge an access fee or distribute it freely. Information services are the gateways to research libraries, electronic shopping and banking,
teleconferencing, airline schedules and reservations, and electronic mail with the rest of the world (not just your office or your corporation). Some also provide free programs (public domain software and shareware—software for which you pay a donation), user group bulletin boards filled with pertinent technical information, and up-to-date stock information. Some, like MCI Mail, offer services such as laser printing and fax or courier delivery of messages.

The MCI Mail electronic mail service has been in use for a long time, but until recently the capability of sending and receiving programs, spreadsheets, and other types of files besides text was extremely limited. Most MCI Mail users sent and received text messages without fonts, graphics, or special characters.

Desktop Express (Dow Jones) for the Macintosh adds the capability to send and receive any type of file, including word processing files formatted with fonts, spreadsheet files, publication files, database files, and programs. In addition, Desktop Express includes the Glue ImageSaver utility that enables you to send graphics and images of the screen. MCI Mail has installed hundreds of Apple LaserWriters across the country so that you can send an image or word processing file to anyone in the world, letting MCI Mail do the laser printing for you.

A major benefit of using an electronic mail service is the ability it gives you to compose and send one message to the service and distribute it automatically to one or more lists of recipients. You can store and retrieve distribution lists and send the message in one quick operation. The message file can be any length, and such files can contain presentations, publications, or even software programs. The modem does not discriminate in the kinds of information it can transmit and receive—anything that is in digital form can be distributed over phone lines.

**Using a Modem**

*Modems* are essential for communicating over phone lines. The modem acts as a translator, converting digital information into telephone audio tones (when it is sending) and converting the audio tones back to digital information (when it is receiving). A *fax modem* is a special type of modem that sends and receives streams of bits in the standard facsimile format to fax machines and other fax modems.
One of the benefits of using a modem is that you can transfer information from one type of computer to another (as long as the other computer also has a modem). For example, using a modem with each computer, you can transfer a text file from a Macintosh to a PC or from a PC to a Macintosh.

One essential ingredient for using a modem is the software to control the modem. Modems handle the task of making the phone line a useful connection, but it is the communication program, running on your Macintosh and the other computer, that prepares and sends information to the modem and receives information from the modem.

The features to look for in personal communication software include automatic dialing, originate and answer modes, Hayes compatibility (for use with modems that are Hayes-compatible), and the capability to use error-checking protocols in your text transfers to ensure accuracy in the transmissions.

An important consideration when buying a modem is whether the modem will function properly with other modems that are already in use. For two modems to communicate, they must be set to the same speed and transmission protocols. (A protocol is a prescribed method for one modem's telling the other modem how to communicate with it.) Most modems follow the Bell standards: the Bell 103 protocol for 300 bits-per-second (bps) modems and the Bell 212A protocol for 1200 bps modems. The Apple Personal Modem and the Hayes Smartmodem 1200 both use these protocols, as do most information services such as MCI Mail and CompuServe.

For 2400 bps modems, the standard protocol is the CCITT V.22bis protocol (created by the Consultative Committee on International Telegraph and Telephone, an advisory organization). High-speed modems offer many standards—9600 bps modems can use the CCITT V.32 protocol or a special version of the CCITT V.29 protocol, or a proprietary protocol (in which case you must use modems from the same manufacturer). High-speed modems that also can communicate at low speeds using standard protocols are a better buy than proprietary modems that do not use standard protocols, because they can communicate with more than one type of modem.

High-speed modems are attractive because multimedia documents and publication files are large, and it takes a considerable amount of time to transfer them at 2400 bps. A high-speed modem (at least 9600 bps or higher) can be too expensive to justify for
use with one computer, but it may not be too expensive if shared by a network of computers. A modem server is hardware or software that acts as a traffic controller, routing calls from different computers on a network to one or more modems, effectively sharing the modems over the network. The NetModem V1200 (Shiva Corp.) enables each user on an AppleTalk network to make calls by sharing a modem. The Shiva NetModem connects directly to the network, and users can choose the device by using the Chooser desk accessory.

Some modems are capable of handling fax transmissions and receptions as well as other modem activities. It is also possible to attach both types of modems to the Macintosh. For example, an Apple Personal Modem can be attached to the AppleFax modem, which then can be attached to the Macintosh so that the modems occupy only one modem port.

### Printing to Fax Machines

The capability to publish electronic pages to any Group 3 fax machine in the world lies in the power of Macintosh software to convert an electronic page into a fax image, and the capability to connect a fax modem to the computer. Group 3 fax machines are the international standard for facsimile.

The Macintosh converts each electronic page into the fax format, which is a bit map fixed in resolution to 200 dots per inch, with no gray-scale). The computer software provides the capability to automatically dial and connect with a distribution list of fax machines, so that you can “publish” a fax newsletter overnight to hundreds of subscribers.

Although the quality of fax output is not usually good, the quality of electronic pages printed directly to fax machines (bypassing the usual scanning step associated with normal fax) is excellent. With the AppleFax software or with BackFax (Solutions, Inc.), the quality of text in the Times, Helvetica, and Courier fonts in the fax image is superb on any fax machine, mostly because the software substitutes screen fonts that are three times larger (for example, Times 36-point is substituted for Times 12-point, and so on and is then compressed for the 200 dpi fax machine). These large screen fonts also are useful if you have an ImageWriter LQ printer. With Adobe Type Manager, you can get excellent results on fax machines with any Type 1 PostScript font.
The AppleFax modem connects to the Macintosh serial port and offers a pass-through connection for other serial devices (such as a regular modem). The BackFax program can make your AppleFax modem work in background mode for sending and receiving faxes, so that you can continue to use the Macintosh with other applications. With either BackFax or AppleFax, you can fax a document from within the application it was created with—simply by choosing the fax modem as your printer with the Chooser and using the application's Print command. The operation is the same as printing, only instead of clicking OK to print, you first supply a phone number for the receiving fax machine, and then you click OK to print. The rest of the process is handled automatically by software.

Just as it is possible to share a modem with users on a network, it also is possible to share a fax modem over a network, using software such as FaxGate (Solutions, Inc.). Any Macintosh on the same network as the Macintosh running FaxGate can send and receive fax messages through their electronic mail software, and the Macintosh running FaxGate, which is called the mail server, handles message traffic over the fax modem. This is just one method of publishing information over a network: to a fax modem connected to a mail server that serves messages to every computer on the network.

### Publishing over a Network

Where there are networks, there is file transfer, and where there is file transfer, there is electronic distribution. It can take many forms, from such simple arrangements as file sharing between computers to an organized set of local networks, each with their own set of file servers, linked into an enterprise-wide network.

Network-based electronic publishing and distribution embodies the best features of desktop publishing and communication technologies and will help to make the electronic delivery of data as commonplace as facsimile.

The same type of network used for connecting the various people working on a publishing task also can be used to distribute information. When a publishing task calls for contributions from different writers and is managed by several editors, networks are employed to link these various work groups, and electronic pages can be passed back and forth over the network. Server arrangements such as AppleShare
are set up to make the networks inherently faster, placing the fastest, largest hard
disks on the computer that is acting as a file server. Formal backup procedures and
closely integrated network functions can be managed without changing everybody's
work habits. For example, network managers can set up automated backup proced-
ures with products such as SuperMac's Network DiskFit, designed to back up file
servers while network users continue to work undisturbed.

You already can connect AppleTalk networks to large computers and use the large
computers as file and print servers (Alisa's AlisaTalk or Pacer's pcLINK for VAX minis,
Tri-Data's Netway 1000 for IBM mainframes). You also can expand network band-
width by using high-performance AppleTalk cables, such as DuPont's fiber-optic
cable, or by using the AppleTalk communication protocols over Ethernet (EtherTalk)
or IBM's Token Ring.

AppleShare from Apple provides folder-level access protection so that you can group
files into folders and restrict access to some folders. The software also has the
capability to work concurrently with electronic mail and print spooling software. The
current version requires a Macintosh to act only as a dedicated file server, but
performance is generally faster when the server is a dedicated computer. Also, with a
dedicated Macintosh as a file server, you can have department-style control over file
sharing and printing, a central location for all fonts (with no need to keep fonts on
users' system disks), systematic and organized backup procedures, and faster
throughput because you use the entire resources of a dedicated computer.

A dedicated Macintosh may be too expensive for a small work group, and you may
need more than one server. TOPS (TOPS/Sun Microsystems) and Timbuktu (Farallon
Computing) offer simpler ways to share files, without as many protection features,
but also without the need to dedicate an entire computer. This casual style of file
sharing may be a first step for many users who tend to not use the file-sharing
functions until they are ready to perform file transfers from one disk to another. In
such arrangements, it also is each user's responsibility to make secure backups and
keep sensitive files out of reach.

No matter which type of server arrangement you choose, AppleTalk networks can be
linked via routers to other AppleTalk networks and exchange information. Routers
can incorporate modems to link networks over phone lines, and entire buildings can
be wired with AppleTalk-compatible PBX and telephone lines.
These developments bring more corporate users into contact with desktop publishing software and electronic pages. The goal of any network administrator is to provide a network that enables users to share files without worrying about the management of those files and to be able to use or communicate with already existing mainframes and minicomputers. There is now enough of a variety among file servers on AppleTalk networks to please almost any type of publisher trying to manage large publishing projects, and to facilitate the publishing of information to every computer on the network.

As electronic pages zip from one place to another, never touching paper unless a print-out is required, the network "pipeline" will have to be enhanced to carry more traffic. The trend of increasing network bandwidth will make transfers of voice-annotated documents and perhaps even video documents commonplace in just a few years. Multimedia presentations to everyone on the network, by means of their Macintosh screens, will become the most common form of electronic publishing. With the power of interactivity combined with the methods of electronic distribution, it is possible to implement a lively and interactive information library of sounds and video, available to everyone on the network on a real-time basis.

Chapter Summary

Electronic publishing is the distribution of information in digital form over any medium that can handle it, be it on a compact disc, over telephone wires, or through network cabling. Pages can be transferred electronically while retaining the capabilities to be edited and reproduced on devices of varying resolutions.

It is important to know as much as you can about distribution methods even before designing your publication or multimedia presentation. If computer media is used, the information remains in a digital form that can be edited and changed without reducing its value or its reproducible quality.

CD-ROM is emerging as an important new publishing medium for animated presentations with sound and a distribution medium for application software. Designed specially to hold digital information rather than audio tracks, CD-ROM discs can hold
about 550 megabytes. The mastering process, to make the master disc, is the most expensive process; the distribution discs can be manufactured cheaply. The key to success in the CD-ROM mastering process is to build a test disc or series of test discs, and test them until they are perfect. CD-quality audio tracks can be stored on the same disc with digital CD-ROM information.

The advantages to preparing information for electronic publishing include the capability to update the information continually, the capability to use continuous tone images without converting to halftones until printing, and the capability to use lower resolution versions of images suitable for screen display.

For information that changes quickly, you may want to use the telecommunications or network media so that you can update the information continually without requiring any special "mastering" step and without requiring any manufacturing.

Your phone lines are available for distributing information electronically to other computer users and to fax machines. You can even distribute information electronically to a service that will print it, fax it, or deliver it by courier. All you need is a modem or fax modem, and software to control it.

A major benefit of using an electronic mail service is the capability to compose and send one message to the service and distribute it automatically to one or more lists of recipients. Information services can be a publishing and distribution medium for documents as well as a gateway to research libraries, electronic shopping and banking, teleconferencing, airline schedules and reservations, and electronic mail with the rest of the world.

The BackFax program, which works with the AppleFax modem, converts electronic pages into the Group 3 fax format for printing on any fax machine anywhere in the world.

The same type of network used for connecting the various people working on a publishing task also can be used to distribute information. There is now enough of a variety among file servers on AppleTalk networks to please almost any type of publisher trying to manage large publishing projects and to facilitate the publishing of information to every computer on the network.
The capability to distribute multimedia documents over a network is one of the major benefits for conducting in-house training using Macintosh computers and authoring software. The use of interactive presentations distributed to everyone on the network, by means of their Macintosh screens, will eventually become the most common form of electronic publishing. The next chapter explains by examples how interactive multimedia presentations, simulations, prototypes, and reference tools can be designed and produced on the desktop.
Creating Interactive Media

The mind is the pilot. We think of things before the body does them.

—Walt Disney

You have learned the basics about creating most of the elements of a multimedia presentation—text, graphics, recorded sound, and animation—and how to present information in a linear presentation of slides or transparencies, as well as how to use various print media. You also have been introduced to various digital storage media and file organization tools and methods of distributing information in digital form. All of this information is a prerequisite for understanding how to effectively use interactive media.

You must be grounded in the basic elements of communication (text and graphics in a linear presentation) before attempting animation. Publishing also is the arranging of information in a linear presentation, but with the assumption that a reader can browse at will and will probably try to find information first by using an index or a table of contents in a non-linear fashion. It also helps to know the limitations of digital storage and distribution methods before designing projects involving animation, sound, and large amounts of information.

However, interactive media has the potential to be far more effective than any other types of media in certain types of communication. The power lies in your ability to understand the methods of interaction, such as menu choices, dialogs, links, and browsing tools, which are used to develop learning experiences, persuasive presentations, reference tools for accessing information, demonstrations of concepts and products, entertainment, and so on. The goal of many interactive media projects is to provide a relationship between information and humans so that the humans can interact with and navigate through the information in various ways.
This chapter takes you on a tour of typical applications of interactive media and explains the design techniques you should acquire and the production methods you should adopt to become a content provider of interactive media. It explains the concepts of authoring, or scripting as it is called in HyperCard, which is an activity that is similar to directing a film but with some programming tasks to create the interactive features. It also provides an introduction to and overview of scripting in HyperCard, SuperCard, and MacroMind Director, the leading application programs for interactive media. After reading this chapter, you will be ready to start interactive media projects, and you will know what skills are required, what programs are best for the types of applications you are doing, and what to expect with the design and production process. You also will know something about what works in this new media and what doesn’t.

Learning from Examples

It may be that Buckminster Fuller, noted architect and futurist, was right in saying that it takes about 30 years for the world to collectively understand and make use of a truly new idea or invention. But there is no doubt that interactive multimedia technology is in use today and that it will have a major impact on all forms of communication tomorrow.

Today, interactive multimedia is more than simply an experiment. The U.S. Coast Guard monitored the Exxon Valdez oil spill cleanup and conducted daily briefings using an interactive information system that combines maps, graphs, and databases. The Yale University School of Medicine sponsored an interactive medical education project called “Cardiac Imaging” that makes use of color graphics and interactive access to video, digitized sound, and images to teach residents and clinical staff.

Both of these projects were created and produced on the Macintosh using Silicon Beach Software/Aldus’ SuperCard, a HyperCard-compatible application, and the latter used graphics created in Silicon Beach/Aldus’ Super 3D. Both projects were governed by tight budgets, demanding schedules, and high expectations, and both were successful.

Interactive multimedia projects are not confined to the esoteric regions of science and medicine. BellSouth commissioned artist Stuart Sharpe to design an interactive presentation of its communications products, using colorful images and original music (see fig. 11.1). Steelcase Furniture uses an interactive multimedia presentation
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**The Tradition:**
BellSouth has introduced and implemented communications choices to millions of customers by combining the most advanced technology with our unexcelled expertise.

Fig. 11.1. The opening screen, menu, and sample screen of “BellSouth” (an interactive demonstration of BellSouth's communications product line) by Stuart Sharpe (courtesy MacroMind).
and electronic catalog, "Context" (developed by Creative Interactive Media), to present their new line of modular office furniture. This presentation incorporates Super 3D models of furniture and animations to show how the office will look with the new furniture. GTE/North Telephone Operations in Indiana uses an interactive multimedia simulation for teaching field technicians how to test for leaks in pressurized cables.

Nor are such projects confined to the world of business and industrial training. "Guernica" (Robert Abel and AND Communications) is an interactive exploration of the Picasso masterpiece of the same name, with historical, cultural, political, geographical, and personal references drawn from the art. It uses a multimedia approach to convey information—text, graphics, animation, video, and sound—and a starting point, called home, that displays the entire Picasso painting and a set of active buttons representing tools you can click to navigate through the information. The tools include Interpret, Examine, Overview, Timeline, and Evolution. The project was started in HyperCard and then transferred to SuperCard, and includes film clips, additional images, critical commentary, and music.

Nor are interactive media projects simply for show and tell. The Voyager Company, distributors of hundreds of videodisc titles, has begun distribution of interactive multimedia entertainment and educational products, starting with Robert Winter's *Ludwig Van Beethoven*, *Symphony No. 9* presentation (see fig. 11.2). Warner New Media, a division of Time/Warner that focuses on developing interactive multimedia products, offers the Audio Notes Series including a presentation of Mozart's *The Magic Flute* (see fig. 11.3).

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**Fig. 11.2.** A HyperCard stack that plays and explains parts of Beethoven's Ninth Symphony in Robert Winter's *Ludwig Van Beethoven*, *Symphony No. 9* (courtesy of The Voyager Company).
Interactive multimedia has become an art form, and known and unknown artists have experimented with it. Amanda Goodenough creates interactive children's stories. Interactive fiction has been explored by a number of writers, and interactive art is flourishing. MacroMind includes a sampler of animation from artists on its CD-ROM sampler disc. *Verbum*, a journal of computer art, recently sponsored a multimedia art contest and has developed an interactive animated magazine (see fig. 11.4).
Perhaps the largest category of interactive presentations to date has been electronic "catalogs" of information, information "kiosks," and software product demonstrations. Apple Computer has produced all of these types at one time or another, including trade show maps to exhibit booths, stacks of information for developers, and self-guided tours of its computers.

One of our favorite examples is a simple, black-and-white introduction to using the Macintosh, created by Animatrix (see fig. 11.5). It is supplied with every Macintosh and explains such concepts as clicking the mouse to start programs and dragging icons to copy files. After demonstrating how to do something, it presents an opportunity for you to try doing it yourself (see fig. 11.6).

This demonstration represents the power of interactive media: providing a user with the experience of using a tool, without forcing the user to deal with the consequences of real-life action. The result, in this case, is a computing experience without the drama and hesitancy associated with actually using a computer—there is nothing to fear because it is a simulation, but there is everything to learn because the simulation is so real.

Fig. 11.5. One of the first interactive animated demonstrations is this tutorial on using the Macintosh SE computer, created by Animatrix (courtesy of Animatrix).
Practice pointing. Move the pointer so it touches each of the numbers in order.

Fig. 11.6. "SE Tour" enables you to try the activities that it has just demonstrated. The tour was created by Animatrix using an early version of Videoworks Interactive, which is now MacroMind Director (courtesy of Animatrix).

Reviewing Applications of Interactive Media

There are as many different applications of interactive media as there are different types of human experiences that need to be learned and different types of information that need to be absorbed or used in any way. Here are several types of applications for which interactive media tools can be applied:

- Learning experiences, such as topical video, animated "brochures," and product demonstrations, which are designed to enable users to browse through information in different ways and interrupt a particular topic presentation to jump into another topic or subtopic

- Reference tools, such as employee directories, product information databases, research databases, and catalogs, in which information is linked to other information through the use of hyperlinks
• Visualizations, such as simulations and prototypes, used to communicate an abstract idea or process. This category can include new kinds of simulations never done before, such as business plans that simulate business activities and computer models for manufacturing.

• Self-paced training presentations that enable trainees to explore areas of interest and try simulated exercises

• Expert systems that can demonstrate processes, explain concepts, respond to user queries, and take into account user responses

• Art and entertainment. Video is already exploited as an art form, and interactive multimedia creates new possibilities for an art form that changes with audience interaction. For entertainment, there is a constant need for new games with interesting visual and audio elements.

In all of these types of applications, interactive multimedia is unsurpassed by any other methods, and the tools provided with the Macintosh can help a content provider—someone with a mastery of the information itself—assemble an interactive system without any prior knowledge of computer programming.

Currently, most businesses rely on instructor-led training courses and published materials to communicate everything from how to use a phone system to product or support information. Such methods can be cumbersome and expensive compared to the use of interactive multimedia tools on a Macintosh. Training materials can be prepared by those who really know the content, and they can be updated more quickly than printed manuals.

Interactive multimedia can go beyond the typical applications in education, training, and marketing. Corporate communications can be enhanced with job reference tools, such as the HyperCard stack for Domino's Pizza, described in Chapter 1, for corporate headquarters to keep in touch with franchisees and to gather, distribute, and display information. The use of graphics makes the information system easy to understand and use and less intimidating to new users.

Design skills are required for making graphical presentations and animations, but these skills are not enough. Training in video techniques may help, but the most important activity is visualizing the entire presentation. Amateur animators and video editors need to first develop a vision of the actual experience you want the audience to have, before starting production. Communicate this vision with an abundance of "clip" animation and sound (copyright-free and reusable) and an inexpensive
Authoring system such as HyperCard, SuperCard, or MacroMind Director, and you can become an interactive multimedia content provider.

Designing for Interactive Media

You may remember the role computers have played in education and training so far. Traditional CBT (computer-based training) often was text-based and linear, moving from chapter to chapter or lesson to lesson with little interactivity besides the quiz at the end of each section. Not only was this type of training less stimulating than instructor-led training, it also tended to demoralize the learners and institutionalize the results. Traditional training methods implied something an authority figure does to a learner.

Interactive multimedia tools emphasize non-linear exploration, self-paced learning without any supervision, and an experience that combines text with rich graphics and sound. This type of learning implies the creation of a rich environment in which a learner interacts with the information.

For example, in the HyperCard presentation *Ludwig Van Beethoven, Symphony No. 9* of the Voyager CD Companion Series by Robert Winter (see fig. 11.7), a user has...

Fig. 11.7. *Ludwig Van Beethoven, Symphony No. 9*: A close reading of the 4th Movement, in which the user can play the entire movement, play a sample trill, read a glossary entry, read other notes, and so on (courtesy of The Voyager Company).
many choices at any given card in the stack to learn about the symphony from a variety of different angles. The user also can branch to facts about the use of certain instruments (see fig. 11.8). The presentation even includes a trivia quiz, providing a different type of stimulation for learning (see fig. 11.9).

When Robert Winter started his project (he is a professor of music at UCLA and a historian), he was a HyperCard novice. He spent nine months developing this project, becoming familiar with the Macintosh and with HyperCard along the way. He described his experience designing this interactive multimedia project as "somewhere between writing War and Peace and cartoon captions." By this he meant that, on the one hand, everything has to relate to everything else, and you cannot be sloppy in your logic. On the other hand, it is like writing cartoon captions because a well-designed card cannot have that much text on it anyway—you strive to keep your design to only one idea on a card. "It was the most challenging writing I have ever undertaken," he said, "and it also was the most rewarding."

The combination of recorded music, other sounds, graphics, carefully worded text, and hyperlinks can work together to provide a learning environment that is invigorat-

![Fig. 11.8. Ludwig Van Beethoven, Symphony No. 9: The user can branch to information about different types of instruments, including the role of percussion (courtesy of The Voyager Company).](image-url)
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Incorrect. This "hiccup" feeling is just one of the elements contributing to the overall effect I created here.

Fig. 11.9. Ludwig Van Beethoven, Symphony No. 9: Users can try the trivia quiz approach to learning and get Ludwig himself to reply (courtesy of The Voyager Company).

As a content provider, you should not overlook the importance of stimulating the user and grabbing attention. "My goal," said Professor Winter, "was to be able to interrupt the music at any time, with no perceivable delay and also be able to get to any spot in the music in five seconds." This goal made it imperative to extend the capabilities of the off-the-shelf version of HyperCard, and so the design group at Voyager developed their own extensions for handling the audio tracks of CDs. Although the initial investment in time and effort was substantial, Voyager is now able to build on what has already been developed and introduce new content.

The most compelling applications are those that incorporate techniques from the worlds of animation, film, video, graphics, typography, music, entertainment, advertising, and communications. The major difference between those applications that are successful and those that are not lies in the ability of the content provider to understand and effectively use the media. Training in video techniques may help, but the
most important activity is visualizing the entire presentation as a director may visualize a completed film. You need to develop a vision of the actual experience you want the audience to have.

In addition, you have to pick the right tools for the job. A learning application addressing technical information may be composed using HyperCard, enabling the user to zoom down into finer levels of detail, displaying related text and graphic information as needed. With MacroMind Director or Authorware Professional (Authorware), a complete simulation can be developed that enables a user to operate some equipment and see the relationship between the moving parts. Sound can be added to give a flavor of how the equipment would impact the environment. Incorporating text, sounds, images, animation, and video has a strong impact on both memory and learning.

The goal is an application that transparently facilitates the user’s relationship with the content and that is obvious and effortless to use. It’s not enough to use graphics only to enhance text or to be cute. Graphics can be used to provide a context and to create visual landmarks. A compelling application often involves a high level of meaningful interactivity and user control.

To build practical and effective presentations, you should start with a clear idea of what you want to present. In the past, computer-aided instruction projects were started by a content expert and an instructional designer who passed work to a graphic artist for enhancement and then to a programmer to put it all together. With a Macintosh-based authoring system, the development process becomes more fluid and interactive, and the people with backgrounds in content can put everything together without relying on programming techniques.

Today, an interactive multimedia project team may have members with the following skills: a “general architect” who designs the structure of the information and the navigational routes, a visual or graphic designer, a HyperCard specialist, and a writer with considerable knowledge of the content. In many cases, one person fulfills all of these roles, except perhaps graphic design.

Every project requires a detailed analysis, but before launching into it, it is important to define the problem to be solved or the question to be answered. Too often, designers and writers jump headlong into the details of a project before they have
identified the problem in broad terms. After the problem has been identified, the audience and subject matter should become clearer, as well as how that subject matter will be created or collected. You also will want to consider how the audience will use the subject matter in the real world.

After this analysis, take a broader perspective and develop a vision of the actual experience you want the user to have. Take into consideration games, television, films, books, courses, and so on, to create a rich and seductive environment. Think about real-world models that may apply to your content.

As you develop an application, think of a metaphor that will work for both the audience and the content and a plan of routes for users to navigate through the information. You can use HyperCard or another authoring tool to create a prototype, or just a thin slice, of this environment so that you can determine whether it is practical and effective from a technical standpoint and for the audience. You then will want to test this prototype with actual users. This phase of designing and testing prototypes is iterative as you change your plans based on feedback from real-world usage.

You have to present enough information to stimulate a learning experience but without overloading the users, and hide details that may confuse them while still making the details available to the curious users. Don't just create a textbook on-screen—give people tools to get at the information from different angles. Users may have a negative experience if they do not have control to leave when they want, and if the visual interface does not provide feedback on where they are at all times. Let them follow their curiosity and build knowledge within a secure and friendly learning environment.

For example, in an education project for the N.Y. Hall of Science, the designers had to push the Macintosh applications to their limits to achieve the kind of fast interaction required to keep the attention of grade-school children. Designers from NYU's Tisch School of the Arts (the Interactive Telecommunications Project) designed an educational kiosk ("Light and Color Theory") that uses animation to demonstrate the concepts of light and color theory, including sources and uses of color, the electromagnetic spectrum, and the way the human eye senses color. It was designed to be kid-proof (protected against soda spills, for example) and uses a trackball as a pointing device rather than a mouse, because the goal was to make the kiosk as user friendly and intuitive as a computer game. "We see kids rolling that trackball so
quickly, the cursor is bouncing off the walls," says John Driscoll, manager of the project. "The point is, you can't have animation and sound that can't be interrupted. Kids react fast and need very fast response times, or they lose interest."

There are several resource guides, HyperCard stacks, MacroMind movies, and SuperCard examples that can help you design your interactive multimedia applications. Apple Computer also provides interface and design guidelines for application developers. The HyperCard Stack Design Guidelines, a document that is available through APDA (Apple Programmer and Developer Association), is an example that is based on Apple's considerable research efforts in human interface design. You can apply these guidelines when preparing any type of interactive presentation or simulation in HyperCard.

**Scripting with HyperCard**

HyperCard is more than an information navigation system and more than a presentation program. It is the first of a new wave of programming systems that are designed to be used by non-technical professionals from fields other than computing: by publishers, by artists, by students, and even by poets.

A HyperCard stack user can browse through information by jumping from one card (screen image) to the next, in sequential order or any order, or simply by following references to other cards. But HyperCard has far more capabilities for customizing unlocked stacks and for creating your own stacks.

If you go beyond the Browsing and Typing levels in HyperCard (which enable you to move around and edit text, but nothing else) to the Painting level, you can use the painting tools for adding a variety of graphic effects and for selecting artwork to use in other cards. At the next level, Authoring, you can use the field and button tools as well as the painting tools, and you gain the ability to browse and edit text. A field is used to hold text or numbers you can edit, and a button is an object you click with the mouse to get some action, such as moving to another card.

A link to another card, or hyperlink, is defined as a button on a card that executes a script (in the language HyperTalk), which directs the HyperCard program to move to another card. The Scripting level offers all of the capabilities of lower levels and enables you to add or change instructions using the HyperTalk language. You can
create stacks at the scripting level and create copies that are locked at a lower level (such as Browsing, so that they cannot be changed).

Buttons can do much more than switch cards; you can add sophistication by writing more complex scripts to do things, such as play sounds and animated sequences. By adding instructions to a button’s script, which is easy to do (simply switch to “button” mode, click a button, and click the Script button to see and edit the script), you can provide more interesting features to a stack.

You can build highly graphical stacks and link information with decorative buttons without learning the HyperTalk language, because buttons are easy to define with the button tool, and backgrounds can be painted with the paint tools or imported from graphics programs.

A common way to create a new stack is to copy and use as a template a sample stack provided in the HyperCard package (or use one of hundreds of non-copyrighted sample stacks available in the public domain). Buttons can be freely copied from one stack to another (see fig. 11.10), and their scripts are copied with them; for example, a

![Readymade Buttons](image)

Fig. 11.10. At the authoring level, you can paste a button and its function from the Readymade Buttons stack into your stacks; at the scripting level, you can look at and edit the button’s script.
right-arrow button used in a stack to advance to the next card in sequence can be
copied with the button tool, then pasted into a completely different stack, and still
perform the same way—advancing to the next card—as well as look the same as the
original button in the original stack. When you borrow the object—in this case, a
button—you also borrow its properties, its looks, and its script.

This is why HyperCard is so popular as a personal information management system:
it enables you to customize the access routes and appearance of your information.
This type of programming system makes it easy to create customized "vertical"
applications that have never existed before (because programming talent has always
been expensive). Objects such as fields, buttons, cards, and backgrounds can be
copied and used in many different stacks and rearranged to fit very specific needs.

**Objects and Layers**

The HyperCard environment is an infinite universe of content and HyperTalk instruc-
tions that are combined to form six basic types of objects. These are

- Cards, each one designed to fill an entire HyperCard window
- Windows, each one displaying the cards of a particular stack
- Buttons, designed to be clicked with a mouse to instigate some action
defined by a script
- Fields, designed to hold text and numbers that can be edited
- Hot text, which are words defined to instigate some action defined by a
  script
- Backgrounds, only one per card, composed of text and graphics that fill the
  entire card

The background is like the stage in a presentation or the form in a data-entry screen.
It should display information that must be repeated in the same location on different
cards. An empty calendar is an example of a useful background image.
The background of a card exists at the very bottom layer, with all other objects on their own layers above the background. Therefore, if you create an object such as a button that is opaque (not transparent), it will obscure some part of the background. Text fields also will display on top of the background.

A variety of icons can be used for buttons (see fig. 11.11). HyperCard offers check boxes, radio buttons, and rectangular buttons with shadows. You also can define a transparent button to sit on top of any graphic image. With this technique, for example, clip art libraries can be organized to jump to another card of "noses" when you click on the lion's nose.

Fig. 11.11. A set of icons are provided for use as buttons in HyperCard.
Buttons can be placed on the background layer or on the card itself, but each new button is a new layer that obscures what is under it, unless it is set to be transparent. You can use background buttons and layering to hide functions that are not appropriate for some cards but are appropriate for many others.

Fields can be placed in the same way as buttons, and are used to provide text entry areas on cards. Typically, all the cards in a given stack will require the same entry fields, which should be placed in the background. Fields can be arranged in a particular entry order on the same card, so that the user can use the Tab key to jump from one to the next. Fields are not used for fixed text that appears on one or more cards—the painting tool palette provides a tool for that purpose. All text in HyperCard can be styled in fonts.

Buttons, fields, and cards can have *names* to make them readily identifiable in scripts. Cards also have absolute ID numbers to identify them as part of a stack. You also can refer to a card by its relative position within a stack.

**Actions and Events**

The easiest HyperTalk command to learn is the Go to command, and it also is the most widely used one. When you create a button, HyperCard enables you to establish a link automatically to another card in the current stack or to a card in another stack. A simple Go to command provides the same function and can be used in a script containing other commands. It is the simplest of actions and the most common action, but its use depends entirely upon the context.

For example, you can design a simple menu in HyperCard comprised of a graphic image as a background and a set of buttons for jumping to other stacks (see fig. 11.12). In addition, the information cards have right-arrow and left-arrow buttons for moving from one card to the next in the same stack and a “return” button (a curved arrow) that enables you to return to the main menu (see fig. 11.13).
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Fig. 11.12. The main menu card for the CD-ROM Explorer presentation, which can jump to other cards and other stacks through the use of buttons activating different Go to commands (courtesy of Apple Computer).

Fig. 11.13. Information cards in the CD-ROM Explorer presentation, which contain simple navigational buttons (courtesy of Apple Computer).
The best presentations are those that are consistent in the use of buttons for navigation and that offer a way out of the presentation quickly, as well as a shortcut to the main menu. The *Electronic Whole Earth Catalog*, designed in HyperCard (see fig. 11.14), is an excellent example of a consistent and intuitive design for navigational controls, in which you can go as deep as you want into a segment of the catalog and still reach the topic menu or the main menu with one mouse click (see fig. 11.15).

When a user clicks a button, the action creates an *event*. The event, in this case, is a mouse click, which causes a particular script to execute. HyperTalk is a language that can be written in modular form, attaching instructions to buttons and to entire cards. The language can be used in the message box and executed immediately. You can therefore try any action before writing a script.

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*Fig. 11.14. The *Electronic Whole Earth Catalog* offers several levels of menus and a consistent set of navigational controls; you can go back to the main menu (the Earth icon) or the topic menu (the topics icon) with one mouse click (courtesy of Whole Earth Catalog).*
Fig. 11.15. An explanation of some of the navigational controls for the *Electronic Whole Earth Catalog*. The First Time Help button enables you to browse the stack and learn how to navigate through it, and the "Click here first time" button provides the necessary "hand-holding" to lead the uninitiated through the help information (courtesy of Whole Earth Catalog).

The Go to command typically is used to switch to another card. For example, the following script activates when you press the Photos button on a particular card in Stack Ideas (see fig. 11.16):

```plaintext
on mouseUp
go to card id 42964
end mouseUp
```
Fig. 11.16. The main card from the Image Index, a sample stack included in the Stack Ideas folder of the HyperCard package. After switching to the button tool and double-clicking the Photos button, you can now gain access to the script.
The script means: upon the event of a `mouseUp` (a system message indicating that the mouse button has been released), advance to the card with the ID number 42964. The `end mouseUp` simply defines the set of instructions.

Another script executes when you click the “flying cards” icon:

```
on mouseUp

show all cards

end mouseUp
```

The `show all cards` command flashes all the cards in the stack in sequence. Scripts can be much more sophisticated without getting complicated, as the one associated with the Sort cards button shows:

```
on mouseUp

if the name of this stack contains "stack ideas"
then

  show card field 1 - explain why not sort here

else

  answer "Sort all cards of this stack according to:" →
  with "Number" or "Title" or "Cancel"
  if it is "Number"
  then sort by first word of first line of field "Number"
  else if it is "Title"
  then sort by first word of first line of field "Title"
  end if

end if

end mouseUp
```
The script uses an if-then-else construction that controls execution of other commands. If the name of the stack contains the phrase "stack ideas," then show the card's first field; if not, then execute the list of commands following the else keyword. This list of commands is executed in the order they appear: first it poses a question with the answer command, to be answered with the buttons Number, Title, or Cancel. Another if-then-else construction determines which sort command to use, based on the answer to the question (sort by number, by title, or cancel the sort). This sophisticated sorting tool, written in HyperTalk and attached to a button, can be copied to any stack for use as a sorter.

The HyperTalk language offers a complete set of mathematical operators (add, subtract, multiply, divide, and so on), comparison operators (greater than, less than, equal to, and so on) and logical operators (and, or, is in, is not in). It has several functions for doing things like determining the position of the pointer on-screen, sensing a key click, and rounding to the nearest integer.

HyperCard (Version 2) also offers you the ability to define text as "hot"—that is, to act like a button and instigate some action defined by a script. Three instructions—clickText, clickLine, and clickChunk—are provided for responding to a mouse click in a text field. A new style is provided, called Group, that enables the stack programmer to define the word or group of words to be used as hot text. When the programmer locks the stack, the defined hot text is hot, but while the stack is unlocked, the programmer can edit the text. The user who uses the locked stack will activate the link by clicking the mouse over the hot text. The programmer can cause a script to be activated when a user clicks a specific word or group of words or clicks a word in a specific style, such as italic, or to a particular size, and so on. For example, you could program a stack so that when the user clicks any bold word, a certain action occurs (see fig. 11.17).

HyperCard has been improved since the first version. The program now offers multiple windows for displaying more than one stack and cards of any size.

HyperCard can display color images in a window, and different parts of text can be styled differently within one field. You can print any field or card and control the position of the card on the page when you print. You can even include headers on the page with the date, the time, the stack name, and the page number. A sophisticated database-style reporting facility is provided for printing fields of a stack with special formatting and computing operations performed automatically.

HyperCard stacks run faster than before because the HyperTalk code in a stack is compiled into faster machine code when you first load the stack. This machine code
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Fig. 11.17. The Jabberwock stack provided with HyperCard 2 demonstrates how text can be “hot” and act as a button to activate a script—you can click any bold word, and a script displays an explanation of the word.

is never seen, and you can still edit HyperTalk code, which is in plain English (in the U.S. version). The functions of HyperTalk can be extended to include new functions not provided in the language, through the use of external commands and functions.

Extensions to HyperTalk

HyperTalk can be extended through the use of external commands or functions, called XCMDs and XFCNs, which can be written in another language. An XCMD is essentially a call to a routine written in another language that performs some action; an XFCN is a special type of call (a function) that returns a value to the calling routine.

External commands and functions typically are used to give HyperCard a more powerful function that it doesn’t already have. For example, as described earlier, for
the interactive kiosk titled *Light and Color Theory* for the N.Y. Hall of Science (see fig. 11.18), the designers had to devise crafty methods of knowing where the cursor is at all times, because the kiosk uses a trackball and does not rely on mouse clicks (which are the events that trigger nearly every action in HyperCard).

The designers used external commands and functions to implement memory management, to change the color palette for different screens, and to perform other tricks. The external routines are Pascal programs (Pascal is a computer programming language available for the Macintosh from Apple Computer and from other vendors such as Symantec). As designer Jeff Jones described their development effort, “We think of HyperCard not as a control program for multimedia devices but more as a way to access the Macintosh Toolbox.”

![COLOR WORKSHOP](image)

**Fig. 11.18.** External commands and functions (XCMDs and XFCNs) were used to extend the capabilities of the HyperTalk language for this interactive kiosk presentation, *Light and Color Theory*, for the N.Y. Hall of Science.
Hard disk performance can dramatically affect a multimedia presentation. The time it takes to load a scene and play it may vary and affect the timing of sound and animation. The designers of *Light and Color Theory* resorted to memory management routines (written in Pascal, called from HyperCard) to improve performance. Virtual memory—memory that is actually on disk, not in RAM, but causes data to be swapped in and out of RAM—is not useful for these types of interactive applications, because the swapping can create pauses and "hiccups" in the presentation.

It is the nature of many HyperCard extensions that after they are designed for use in a specific presentation, they can be used again in new presentations, effectively reducing the development time needed for the new presentations. You can install all of the external commands, functions, and resources you need into shared code library stacks, so that they can be shared by all other stacks on the same hard disk.

Some content providers, such as Voyager, have turned their custom toolkits into products for other content providers. There are several "developer stacks" in the public domain, available from user groups such as BMUG (see bibliography). CompuServe has rich libraries of stacks and is another excellent place to start your research.

The Apple Programmer and Developer Association (APDA), sponsored by Apple Computer, is a worldwide mail-order distribution service providing development tools, reference manuals, and books for professional software programmers and multimedia developers who join the organization. APDA provides fast access to the widest available selection of development tools and developer information. APDA is not an exclusive club—over 20,000 members have already joined, including in-house corporate software developers, university professors, students, value-added resellers, hobbyists, commercial interactive multimedia developers, graphic artists, and of course, commercial hardware and software developers.

APDA offers a large selection of tools for HyperCard developers, including such gems as the HyperCard Videodisc Toolkit, which contains all the external routines for extending HyperCard to control a videodisc player and to organize and control the display of video sequences, still images, and sounds recorded on videodiscs. The Toolkit works with any Level 3 externally controlled videodisc player and monitor.

Joining APDA is worth it if you are serious about developing HyperCard-based interactive multimedia projects. For only $20 a year ($25 in Canada and Mexico, $35 in other countries) you gain access to all of the technical information currently available about programming a Macintosh, plus a magazine and catalog.
Adding Effects to HyperCard

When Apple Computer decided to bundle HyperCard with the Macintosh, several software vendors recognized an opportunity to build upon the HyperCard environment—such as Bright Star Technology with HyperAnimator and interFACE, which are programs that can add "talking heads" to stacks, and MacroMind Player, which enables you to play MacroMind movies, even full-screen color movies, from within stacks. These vendors decided to extend HyperCard in much the same way that multimedia developers have added sets of external commands and functions to the HyperTalk language.

Several vendors also realized that HyperCard can never be all things to all people and decided to improve the set of features by offering HyperCard-compatible programs that can modify existing HyperCard stacks and add capabilities to them. An excellent example is SuperCard (Silicon Beach Software/Aldus), which can import a HyperCard stack and add features such as color backgrounds and buttons, color graphic objects, Macintosh-style menus, and the capability to edit scripts in a separate program.

You already have seen how it is possible to extend the capabilities of HyperCard with external commands and functions. Several commercial programs can be activated by external commands and functions from within HyperCard stacks, acting as extensions to HyperCard itself. MacroMind Player, Bright Star's HyperAnimator and interFACE, and Farallon's ScreenRecorder and MediaTracks all can play animation with sound without the use of HyperCard but also can play animation and sound from within HyperCard.

Complete authoring environments also are available that provide capabilities beyond the standard set by HyperCard. Some, like SuperCard (Silicon Beach Software/Aldus) and Plus (Spinnaker Software), are compatible with HyperCard for importing stacks, but for the most part do not export HyperCard stacks—you must run the new software to run the interactive presentations. For example, SuperCard applications can be run by SuperCard itself or by themselves without SuperCard—you don't use HyperCard to run them. MacroMind Director enables you to build complete interactive presentations and control multimedia devices without the need for HyperCard. All of these products extend the HyperCard concepts of linking information, providing an environment for user-oriented programming and using the Macintosh visual interface of menus and buttons.
MacroMind Player: Interactive Movies

Animation and sound are easy to add to HyperCard, because you can create them in MacroMind Director (see fig. 11.19) and use MacroMind Player to play them from within any HyperCard stack. MacroMind Player contains the "driver" software that can play Director movies.

Fig. 11.19. An interactive service manual for a remote control device, created by Grafica Multimedia, Inc. If you click the power switch on the right (a button), you activate the videocassette player animation.
Player also can be used to build *projectors*, which are separate, stand-alone interactive movies that can play without Director or HyperCard present. You specify the movies to be played and the order for playing them in a *playlist*. Projector applications (indicated by the film-projector icon) can be distributed either with playlist movies embedded within them or with the playlist movies as separate files in the same folder. Player also can play *accelerated* Director movies, which are movies converted into much faster versions by the MacroMind Accelerator utility program available with Director.

Projector applications are designed to be distributed to users with a minimum of overhead and without requiring users to purchase additional copies of Director. MacroMind has a simple licensing arrangement for developers who are distributing commercial stacks and projector applications, and a flat license fee of $250 per commercial project with no limit on distribution. Licensing is free for educational and non-commercial projects.

Because MacroMind Director movies can be extended to include interactivity through the use of the Lingo scripting language (described later in this chapter), the movies you play with MacroMind Player can be interactive presentations. It is therefore easy to create complete, stand-alone interactive presentations using just Director and MacroMind Player—these capabilities do not require the use of HyperCard or HyperTalk. HyperCard and HyperTalk compatibility also is provided because HyperCard is widely used for a variety of tasks, including personal information management, database order entry, telecommunications, and user programming, as well as interactive multimedia.

With Director and Player, you can add a host of special effects to your HyperCard stacks, including full-screen full-color animation with sound. Black-and-white and color movies can be designed to overlay on top of the HyperCard information, and you can set the location of the movie in HyperTalk coordinates. Player also gives you the ability to display any PICT graphics file in HyperCard.

Special effects with Player include leaving the last image on the screen after playing a movie, hiding the menu bar while playing a movie, clearing or not clearing the HyperCard image before playing a movie, ignoring or not ignoring a mouse click while the movie plays, and so on. You can even play just a certain range of frames from a Director movie. And you can fine-tune the presentation with features such as movie preloading for faster operation, fading to black between different color images, and changing the movie’s speed.
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To play a movie from within HyperCard, you use the PlayMovie command supplied with Player's HyperCard Manual stack. First, create the movie using Director and save its sounds either in the movie itself or in a Sounds file (using Director). Then, install the PlayMovie XCMD in the stack and use the PlayMovie command in the stack's scripts. To play a movie from a stack, the PlayMovie XCMD must be installed in the stack. Alternatively, you can install the PlayMovie XCMD in your Home stack in order to play movies from any of your stacks. If, however, you want to distribute a stack by itself, without your Home stack, you should install the PlayMovie XCMD in the stack. Installing PlayMovie is easy—simply click the Install PlayMovie button in Player's HyperCard Manual stack.

MacroMind Player must be in the same folder as your stack or the HyperCard program, and it must be named "MacroMind Player" for PlayMovie to find it. If you use a Sounds file, it also must be in the same folder as the stack or the HyperCard program.

After installing PlayMovie, you can add the PlayMovie command to any script, such as the script for a button:

```plaintext
on mouseUp
  PlayMovie "Blow Up"
end mouseUp
```

When this button is pressed, the movie called "Blow Up" (enclosed in quotes to indicate a movie title) is played. If the movie is stored in another folder, you can specify the entire path to the folder in quotes (as in "Films:Antonioni:Blow Up").

Special effects are specified in the same command line with the PlayMovie command. For example, the Hyper Mattes button in the Player HyperCard Manual stack plays a Director-created animation of trout swimming across the card (see fig. 11.20). The movie uses different matte settings so that some of the fish swim behind a menu choice and some swim in front (see fig. 11.21). The PlayMovie command to play the "Trout" movie is as follows:

```plaintext
on mouseUp
  PlayMovie "Trout", movieNoClear, movieLoop, movieClick
end mouseUp
```
Fig. 11.20. The main menu in the MacroMind Player HyperCard Manual stack has a button, Hyper Mattes, that plays a MacroMind Director animation of trout swimming in front of and behind menu choices on the cart.

Fig. 11.21. The matte effect, used in Director for the trout, makes it easy to have some pieces of the animation appear behind a HyperCard button and other pieces appear in front. (MacroMind Player with HyperCard, from the MacroMind Player HyperCard Manual stack.)
The option *movieNoClear* leaves the HyperCard card graphics in place, so that the movie's matte effects can work. The options *movieLoop* and *movieClick* cause the movie to be repeated until you click anywhere with the mouse or keyboard.

MacroMind Player is simple to use to set up a projector application. You can use Player to play any Director and Accelerator movies in real time, in any sequence. You also can set up a playlist to play specific movies in a specific sequence. The options available include repeating the sequence in a loop, changing the size of the *stage* (display area), running movies without pausing to wait for a click, and so on. Director movies can be compiled into a projector application, or you can keep the movies in separate files (and thereby include Accelerator and VideoWorks movies in the playlist). If an Accelerator movie is too large to fit into memory, Player gives you the option of playing only what fits into memory or playing the entire movie in chunks or frame-by-frame from disk.

Before MacroMind Player was developed, many of the earliest pioneers in interactive media used the original VideoWorks program and its interactive toolkit to produce interactive presentations and simulations, such as the animated SE Tour supplied with every Macintosh SE computer. These presentations were run by software known as the VideoWorks Tour Engine. Developers such as Jeff Jones of the N. Y. Hall of Science used the original VideoWorks HyperCard driver to add full-color, animated VideoWorks movies to the *Light and Color Theory* stacks created in HyperCard. MacroMind Player is the newest generation of software for replacing the Tour Engine and HyperCard driver, just as MacroMind Director is a new and extended version of the original Interactive VideoWorks program.

MacroMind Director excels at creating almost any kind of animation, and *clip animations* are available from MacroMind and independent designers, that are sequences designed to be useful in a wide variety of animated presentations, especially business presentations. There also are programs that excel at creating very specific types of animations, such as HyperAnimator and interFACE for creating "talking heads," which are animated human faces that can talk.

**HyperAnimator and interFACE: Talking Heads**

Many of the tools that are used to extend HyperCard are designed to help you create a particular type of animation or special effect rather than try to provide tools for general-purpose animation. One of the hardest tricks with animation is to create a talking head—a face that appears to be talking. HyperAnimator (Bright Star Technol-
ogy) is a set of stacks that work from within HyperCard to create animated lip-syncing human heads for HyperCard presentations. Its most famous role was for the creation and playback of the cartoon character “Albert” in “The World of Disney” TV show, “The Absent-Minded Professor.”

HyperAnimator is supplied with nine synthetic actors, each with seven talking lip positions, eight facial expressions, and one resting face, all corresponding to specific phonetic combinations (see fig. 11.22). You can record the sound of a person talking and have that speech appear to come from a synthetic actor’s mouth. You also can use the program to synthesize speech and create your own synthetic actors from original graphics such as scanned images (or alter one of the supplied actors). With the Speech Sync feature, you can synchronize digitized sound with an actor’s expressions, and save the recorded speech and actor as a single-line HyperTalk command script that can be copied and pasted into any stack.

Fig. 11.22. With HyperAnimator, you can add talking heads to your HyperCard presentation, including those you make up yourself — the program offers “face clip art” and HyperCard’s painting tools.
HyperAnimator provides a "dressing room" for painting expressions for actors' faces, and a "stage" for screen-testing your actors before using them in stacks. You can type any word or phrase and watch (and hear) your actor "say" it (see fig. 11.23). You can then save the actor in a stack. The speech is created by synthesizing words (using the MacinTalk system function).

To use HyperAnimator actors in a script, you use the RAVE external command and options, called arguments, to control your actors. A RAVE command can make an actor say whatever is enclosed within quotes or control the actor's movements. RAVE commands can be used to make an actor appear at a certain position, to make the actor move to a new position, to show different facial expressions without speaking, and to recite digitized speech. You also can synchronize digitized speech to fit a particular set of facial expressions (see fig. 11.24) and save the recorded speech and actor as a single-line RAVE command that can be copied and pasted into any stack.

Fig. 11.23. The HyperAnimator stage enables you to preview the actor's animated speech-making.
Although digitized speech takes up far more disk space and RAM than MacinTalk-synthesized speech (which is synthesized in real-time and doesn’t require extra storage), digitized speech is more life-like and higher in quality than MacinTalk speech.

With HyperAnimator and HyperCard, you can create talking actors to help guide users through your stack. Use a scanner or video camera to create your own actors from graphics or scanned images. You can scan a photo of yourself, therefore, to use in your stacks for narration. The full set of HyperCard painting tools are available, plus a library of face clip art.

Bright Star also offers interFACE, a more sophisticated program for creating talking actors. The interFACE program offers several types of actors: standard (with eight different lip positions corresponding to speech patterns), extended (15 different lip positions), and co-articulated (32 different lip positions), which is more life-like than the other two types. An actor can contain from 16 to 120 different images for animation, and the size of the image can be from very small (16 by 16 pixels square) to the dimensions of a Macintosh SE display (512 by 342 pixels).
The interFACE program also can create color or gray actors, either drawn, scanned from photos, or digitized from video images (see fig. 11.25). Multiple actors can speak at the same time, and actors can be used from within HyperCard stacks and other applications such as SuperCard. The program can use the MacRecorder (Farallon Computing) directly for recording and digitizing sound for synchronizing with an actor's facial expressions.

**ScreenRecorder and MediaTracks: Software Demos**

Another tool that is designed for a particular type of interactive multimedia application is ScreenRecorder (Farallon Computing), which records all screen activity as an animated sequence that can be played back from within HyperCard. ScreenRecorder is complemented by MediaTracks (Farallon), an editing program for putting together movies of ScreenRecorder clips with sound.

The ability to record screen activity is particularly useful for building training exercises for using software—you can demonstrate how to do specific operations by performing them and saving the performance as an animated sequence. You then can add voice narration recorded with MacRecorder.

Fig. 11.25. "Renée & Dave's Excellent Conference Ad" (featuring David Szetela and Renée Rodrigue of Apple Computer) was created with interFACE and played from within a HyperCard stack distributed with a library of software development documentation on CD-ROM.
ScreenRecorder is an excellent tool for documenting system and software procedures—let the software explain itself. A “looping tape” feature enables you to continuously record screen activity until you stop it, and an automatic-repeat feature enables you to play “tapes” (animations) repeatedly. After you have recorded a session with an application, you can save the “tape” and distribute it to others or include it in a MediaTracks movie.

ScreenRecorder is used as a desk accessory. It provides controls similar to a VCR, with record, playback, and pause buttons. You also can control the speed of the recording. To play ScreenRecorder “tapes” from a HyperCard stack, you first must install the PlayScreen XCMD in a stack and copy the PlayScreen driver to the folder containing HyperCard or to the folder containing your stack (or the System Folder). You also can install the XCMD in your Home stack in order to play “tapes” from any stack called from your Home stack.

The PlayScreen installer can automatically create a button in your stack to play any animations recorded by ScreenRecorder. The installer asks for the name of the “tape” and then automatically creates the script (with the PlayScreen command) for the button. You can preview the animated sequence from the installer and then install the PlayScreen XCMD (if you have not already done so) in the stack. Options for running “tapes” from within HyperCard include hiding the control button panel, repeating the “tape” continuously, and changing its speed.

MediaTracks enables you to synchronize an audio track to ScreenRecorder “tapes” for putting together training sequences that play on the computer. These movies can be interactive, with buttons to play other tapes, to rerun segments, to pause for a certain amount of time or wait for a mouse click, to wait for the audio track to end, and so on.

MediaTracks offers a cut and paste editing window for ScreenRecorder sequences, or “clips” (see fig. 11.26). The editing window provides tools such as microstepping (moving slowly through the sequence) and marking for determining precisely where an editing segment, or clip, should begin and end. Clips can be cut, copied, and pasted into other presentations, and moved within a presentation to a new location. You also can set up a clip to pause until the user performs some action, such as clicking a button, or to pause for a number of seconds. The playback time also can be adjusted independently of the recording time.
Sound can be recorded directly into MediaTracks or imported from SoundEdit files created by the SoundEdit program (described in Chapter 2) supplied with the MacRecorder sound digitizer (Farallon). Sound can be cut or copied from the SoundEdit editing window and pasted into the MediaTracks window. A clip plays simultaneously with any attached sound, and you can set up a clip to pause until the sound finishes before the presentation moves on to the next clip. You also can attach sound to an interactive button, so that sound plays only when the button is clicked.

MediaTracks offers extensive annotation features, including a drawing layer. You can create text labels to identify specific areas of the playback display for editing and add lines, arrows, rectangles, and ovals to show relationships between elements. Color also can be used for annotation, as in SoundEdit. Interactive buttons can be added to
control the flow of the presentation and to present options such as pause, play sound, skip back, skip forward, link to another clip, link to another tape, and so on.

Besides playing complete annotated screen animations with MediaTracks, you can save a "tape" as a stand-alone presentation that can play without the use of MediaTracks or as a "tape" that can be played from within an application (using the MediaTracks Player driver software). You also can install buttons in HyperCard stacks to play MediaTracks animations.

Stand-alone "tapes" can be mailed electronically or distributed across a network. The "tapes" can be loaded from a server, and the program automatically spools the information from the server to provide seamless performance (depending on the activity at your server) without requiring local disk storage. Unlike using Farallon's Timbuktu for network presentations, with MediaTracks, you can hear the audio portion of the presentation.

MediaTracks is ideal for putting together custom training "tapes" of how to use Macintosh applications. Microsoft, for example, will provide a button in Excel's help system to connect with MediaTracks tapes that can be custom-designed for corporate training. If you are an expert in a particular type of Excel spreadsheet in your office, you can assemble "casual training tapes" to educate your co-workers on how to use the spreadsheet. The spool-from-server feature means that one copy of a MediaTracks presentation can be presented to every user on a network.

ScreenRecorder can record any screen activity, including animation created by other programs (such as HyperCard and MacroMind Director), but ScreenRecorder "tapes" tend to occupy more space than condensed Director movies. Complex animations are better arranged in Director, but recording screen activity with a software program is better handled by ScreenRecorder. Both types of animations can be run from within HyperCard, along with HyperAnimator talking heads.

Scripting with SuperCard

The most intriguing aspect of Silicon Beach Software/Aldus' SuperCard is that it enables you to put together what appear to be real Macintosh applications, not just stacks that are limited in features by what HyperCard offers. SuperCard's scripting language is a superset of HyperTalk and provides a powerful environment and an easy upgrade path for HyperCard stack developers.
With HyperCard, you have to add XCMDs and XFCNs, which are written in a conventional programming language, in order to provide the typical features of a commercial Macintosh application. SuperCard can import HyperCard stacks with XCMDs and XFCNs and enable you to produce stand-alone applications that are more like Macintosh applications than like HyperCard stacks.

For example, The HyperMedia Group used SuperCard to produce Display Net (see fig. 11.27), an electronic catalog of nearly 10,000 different items for retailers to browse through, compare different products, and place orders electronically. SuperCard’s support for custom color palettes made it possible to display digitized color product photos sharply.

In addition, SuperCard offers you the ability to create and manipulate graphic objects. You can turn any object, tool, or section of text into a “hot” button with an associated script (a hot button is one that activates a script when you click it). You also can create custom Macintosh menus and any of the seven standard Macintosh window

![Image](Fig. 11.27. Display Net, produced by The HyperMedia Group using SuperCard, is an electronic catalog for retailers to browse over 10,000 items and be able to order them directly.)
types. "Floating" tool palettes can be moved around the screen, and multiple stacks can be displayed at the same time (each stack is displayed, one card at a time, in a window).

**Object-Oriented Drawing**

Silicon Beach added to SuperCard some of the drawing tools from SuperPaint, and the automatic tracing tool from Digital Darkroom that creates graphic objects from bit-map graphics. Selections can be made by shrinking the selection to an automatic trace from the outside with the marquee or lasso or from the inside (like a paint bucket tool).

Any painted or drawn graphic can have an associated script as well as a name, and you can write a script to move any object from any point to any point (the object remains visible while moving). Objects can be nudged in a direction by a certain number of pixels, moved along a series of points, or along the points of a polygon. These features make it possible to provide simple animation of graphic objects and titles. SuperCard also can record and play PICS files for animated sequences. (PICS files can be created from animation programs such as MacroMind Director.)

Any stack can contain up to 256 colors, and you can import color lookup tables (CLUTs) into a stack's resource (with one CLUT per card) and perform color cycling to simulate animated colors. SuperCard also can import and export sounds, XCMDs, XFCNs, icons, and cursors as resources.

**Editing Scripts**

One of SuperCard's strongest suits is the capability to edit scripts in a separate environment that does not run the scripts. SuperEdit, the editing program for writing and editing scripts, enables you to double-click the names of windows, menus, and objects to see their properties and then click the Script button to edit their scripts. The program offers pop-up menus in the script editing window containing every command, function, control structure, system message, and property in the language.
As in a presentation program's thumbnails, the editor enables you to cut and paste windows as well as script text, and you also can view menus and resources. Windows are modeless and so you can open as many script windows as you want.

The SuperEdit editor is an "under the hood view" of your stack, and scripts do not execute in the editor. The editor can incorporate all run-time functions to produce a stand-alone application that does not require SuperCard to run. Cards can be any size up to a maximum of 34 feet by 34 feet!

Several interactive multimedia projects, such as "Guernica" (Robert Abel), were started in HyperCard and then transported into the SuperCard authoring environment, where full-screen color windows and Macintosh menus could easily be added. SuperCard can add considerable zest to a HyperCard stack, and SuperCard's object-oriented drawing environment makes it possible to do animated sequences much more easily than in HyperCard.

**Scripting with MacroMind Director**

MacroMind Director is far more ambitious than any other animation program, offering 24 channels of animated sequences, eight-bit color with palette and color cycling controls, sound and transition channels, and a score window for copy/paste operations over frames. Director also offers considerable control over animated sequences and a convenient method of copying, pasting, and selecting animated sequences. Many of its animation features are described in Chapter 7.

With Director, you can selectively copy, cut, or clear 24 individual channels that could contain various cast members including painted areas, graphic objects, text, palettes, and sounds. MacroMind Director's auto-animation and text features are more extensive than any other program in its price range.

MacroMind Director (Version 2) also provides a complete authoring and animating system that includes a scripting language, called Lingo, for building interactive presentations and a set of XCMD-like structures called XObjects for controlling various devices such as videodisc players.
The precursor to Director, VideoWorks Interactive, was used to create a variety of interactive presentations such as Sartorius by Animatrix (see fig. 11.28). The demonstration shows how a simple linking facility, similar to HyperCard's, can be used to

![Diagram of animal weighing](image)

**Fig. 11.28.** Sartorius, an interactive presentation of a precision scale, was designed in VideoWorks Interactive (now called MacroMind Director) by Animatrix (courtesy of Animatrix). The user can set the animal's activity level to see the result on the scale.
demonstrate how a precision scale can be used to weigh an animal (see fig. 11.29). Interactive presentations designed in VideoWorks can be imported into Macromind Director and enhanced with new scripts.

To use the interactive features of Director, you should first become familiar with Director's techniques for creating and editing animated sequences in the Score window. All scripting for Director is accomplished in the Studio portion of Director, which offers complete animation tools for making movies and access to cast members (elements, such as pieces of text and graphics) and the Score window, as well as to the painting and drawing functions.

Fig. 11.29. The Lingo script for Sartorius appears in Director's Score window in a script pop-up menu.
Using Lingo

The linking facility in Director is similar to HyperCard, except that in Director, any object can be "hot"—that is, have a script attached to it (similar to a HyperCard button). Director also records events and actions such as mouse and key clicks, so that you can direct your scripts to perform some tasks based on these events and actions. Scripts are written in a language called Lingo, which is similar to HyperTalk but more extensive in its control of objects and events.

There are three kinds of scripts in Director: frame scripts, which are attached to a particular frame of time in the score; event scripts, which are activated by certain events or actions (such as pressing the mouse button); and sprite scripts, which are attached to a particular sprite, which is a graphic object or cast member on the stage. Frame scripts are activated automatically when the movie reaches that particular frame. A sprite script is activated only if you click the sprite with the mouse.

Fig. 11.30. Director frame scripts can be entered into any cells in the Script channel, and sprite scripts can be entered into any cells in the numbered channels. You can test the action by moving the frame marker and watching the movie, clicking sprites to activate sprite scripts.
Director extends the metaphor of a score for the movie to include script information. The script channel appears next to the tempo, palette, transition, and sound channels and is used to enter frame scripts (see fig. 11.30). Sprite scripts are entered into any cells in the numbered channels. Event scripts can be entered into cells in either type of channel but are usually attached to sprites just like sprite scripts. As you enter scripts, they are numbered sequentially, and you can see a list of the entered scripts in the Score window (see fig. 11.31).

The most often-used command in the Lingo language is the Go to command, which can be used to go directly to another frame, to start another movie, or to start playing another movie at a specific frame. The Go to command can be used with a specific frame number or with labeled markers. A marker can be dragged to a specific frame in the Score window, and you can type an identifying label for it, and use that label in a Go to command. Labels are easier to use than frame numbers because they are more descriptive, and because they stay attached to their appropriate frames even if you edit the movie's score.

![Figure 11.31](image.png)

Fig. 11.31. Using the Go to command in Director to go to a specific frame and start playing from that frame. Each script entered into a Director movie is numbered sequentially and appears in a list in the Score window.
You can try out proposed Lingo statements before making them part of a script by using the Message window, which is similar to the message window in HyperCard. A statement written in the Message window executes immediately when you press the Return key. If it doesn't work as planned, you can edit the statement in the Message window, and try it again.

Lingo offers an extensive set of commands, functions, and special effects. You can create text elements that can be edited by the user and scripts that can test the contents of editable text elements (using if-then-else or when-then constructs) and perform some action depending on the result. Director also enables you to build Macintosh-style menus and buttons that invert when you click them.

Lingo statements must be written on one line in the script entry area, but Director supports multiple-line scripts by enabling you to edit them as text cast members and assigning them a macro name. As a macro, the script can be activated by using its name alone as a Lingo statement. This design lends itself to "object-oriented" and modular programming techniques and makes it easier to read scripts, as long as you use descriptive macro names. You also can call a single macro from many different scripts, which makes your presentations easier to program.

**Sprites and Puppets**

Sprites are the basic elements of animation. Sprites are created as cast members painted in or imported into the Paint window, as text cast members typed in the Text window, or as text or graphics created with the drawing tools directly on the stage. Sprites are entered into the numbered channels in the Score window or simply dragged onto the stage. Sprites can have special properties, such as foreground and background colors, ink effects, and stretching capabilities (changing its width or height).

Some of the properties and movement of a sprite can be controlled from a script; such a sprite is called a puppet. A script can control a puppet's location on the screen, line style and pattern, color, ink effect, height, and width. You also can define a tempo, transition, or palette as a puppet to be controlled by a script. Once declared as a puppet, a sprite is no longer controlled by the score but by its attached script. A puppet is useful if you want the user of the presentation to be able to drag something, such as a graphic image, around the screen.
You can define text and graphic sprites to be *moveable* and text sprites to be *editable*. Buttons, check boxes, and radio buttons are a special type of sprite that offer choices. Moveable sprites can be constrained in their movements.

Actions and events can be tested, and the program includes a timer and a time-out function for measuring duration and taking some action. You can even test when the mouse has been moved across a location on-screen, called the rollover function (see fig. 11.32). The function is “true” if the mouse is currently over the area specified by the sprite number.

**Factories and XObjects**

Director’s Lingo language has two powerful features, *factories* and *XObjects*, for extending its capabilities to do things such as create animated objects that “play” as you move them around the screen, control videodisc players, and play the audio tracks of CDs.

![Fig. 11.32. An example of a script that uses the rollover function to test whether the mouse has rolled over a specific location and to take some action if it has (Director).](image-url)
Factories are used to create an object that is controlled by its own special set of macros, called *methods*, that define how an object moves when certain conditions are met, such as when the mouse pointer is located in a certain area of the screen. For example, in the movie *Simple Bird*, you can hold down the mouse button and actually move each of the birds to any location on the screen, and while they move, the birds also are animated—their wings go up and down (see fig. 11.33). These birds are simple *actors*, and you can create more complex actors with factories.

Fig. 11.33. In *Simple Birds*, you can move each of the animated birds around the screen by holding down the mouse and dragging each bird. This is an example of a moveable sprite, which is a graphic object that is automatically animated when you move it (Director).
XObjects are similar to XCMDs and XFCNs (external commands and functions) in HyperTalk: any software driver or segment of code can be added to the Lingo vocabulary with XObjects, which can be written in Pascal, C, or other programming language. An XObject for using HyperCard XCMDs, called XCMDGlue, is built into Lingo, and Director is supplied with a wide range of XObjects ready to use, including ones for controlling videodisc players such as the Pioneer 4200 and all Sony models.

Professional Scripting

The requirements for professional scripting (or authoring) programs include the capability to set up interactive screens with linking facilities and to control various multimedia devices, such as laser videodiscs, using a scripting language. HyperCard, MacroMind Director, and SuperCard all qualify as professional scripting programs. Authorware's Authorware Professional provides sophisticated features and a flow-chart diagram for professional scripting. MacroMind Director provides nearly all of the same features but excels in providing animation features.

As a scripting language, nothing is as extensive as MacroMind's Lingo and also easy to understand, with commands, functions, key words, constants, and operators similar to HyperCard's HyperTalk. Lingo offers a complete set of arithmetic, logical, and comparison operators for building complex expressions, and you can test for the location of sprites and for certain system properties, such as the monitor's color depth or the amount of time passed since a mouse or key click.

Lingo supports the use of variables—temporary holding places for values, used in all programming languages. In fact, Lingo offers a flexible choice of global, local, and instance variables—global variables can be referenced and changed by any script, macro, or factory; local variables can be changed only by the macro or factory that contains them; and an instance variable can be changed only from within the factory that uses it.

Director has nice features for tracing the execution of scripts (for "debugging" the presentation), including the recording of a "journal" of activity. The program offers an "object-sensitive" help facility—simply press the Shift and Option keys simultaneously and click on any object on-screen or any Lingo word in the Lingo menu, and a help message appears explaining that item.
For all of its power and flexibility, Lingo and Director provide the most accessible paradigm for developing multimedia presentations with interactivity. The Score window shows the action as it is occurring, with a symbolic representation that enables you to cut and paste animated sequences into frames and synchronize sounds and transitions to frames. Scripts are entered directly into the score or into the Text window, and macros allow you to condense complicated scripts into single-word commands.

The Lingo language can be used to make decisions based on actions, events, timing, and even the location of the mouse itself (without clicking). You can use factories to make similar objects that have their own inner logic of constrained movement. If there is any interactive multimedia authoring system that can create the illusion of human actors leading you through a labyrinth of information, it is MacroMind Director. There is no limit to the kind of interactive presentations you can create with Director.

Authorware Professional can be used to create realistic simulations, to prototype ideas, and to create interactive courseware. Authorware Professional excels in its

Fig. 11.34. Authorware Professional (Authorware) offers professional scripting features with script objects such as "Parts of a camera" containing logical branches, graphics, sound, and animation.
capabilities to integrate data from other applications and to reduce maintenance efforts with its flow-chart diagrams that can be modified quickly and easily (see fig. 11.34). Models created in Authorware Professional can be copied and pasted into multiple documents to be used with several different projects.

With data from other applications, you can set up a simulation that operates in different ways depending on the data. You can also use Authorware Professional to collect data from users and to collect performance data for multiple users for analysis and reporting.

Authorware Professional includes a Farallon MacRecorder for digitizing sound and supports a variety of laser videodisc players. It is provided with a productivity library of animations, menus, interface "gadgets" such as sliders and buttons, interactive control techniques, performance tests, graphics, and sounds. Although the commercial version of the package is expensive compared to other desktop programs (over $8,000), the price includes two days of intensive training in using the product. Authorware also distributes an academic version of the product with unbundled training. Although the program is not as easy to learn as HyperCard or MacroMind Director, it provides data-driven simulations and performance testing that are necessary for some applications, especially in engineering training and prototyping.

Chapter Summary

Interactive media can be far more effective than any other types of media in certain types of communication. Interactive media applications include learning experiences, reference tools, simulations and prototypes, self-paced training, expert systems that demonstrate processes, and art and entertainment. In all of these applications, content providers who understand the information can assemble an interactive system without any prior knowledge of computer programming.

Interactive multimedia tools emphasize non-linear exploration, self-paced learning without any supervision, and an experience that combines text with rich graphics and sound. The key ingredient is a plan that enables the multimedia content provider to associate different pieces of information in a logical way so that the hyperlinks attract users to new information.

To build practical and effective presentations, start with a clear idea of what you want to present. Every project requires a detailed analysis before launching into it. Define
the problem to be solved. After this analysis, take a broader perspective and develop a vision of the actual experience you want the user to have. As you develop an application, think of a metaphor that will work for both the audience and the content and a plan of routes for users to navigate through the information. You can use HyperCard or another authoring tool to create a prototype and then test this prototype with actual users.

There are several resource guides, HyperCard stacks, MacroMind movies, and SuperCard examples that can help you design your interactive multimedia applications.

HyperCard offers cards to present information, buttons to activate scripts, fields to hold information, and backgrounds to provide context. HyperCard's buttons can do much more than switch cards and link pieces of information. You can add sophistication by writing more complex scripts to do things, such as play sounds and animated sequences. HyperCard enables you to customize the access routes and appearance of your information.

HyperCard is more than a personal information navigation system and more than a presentation program. It is the first of a new wave of programming systems that are designed to be used by non-technical professionals from fields other than computing. HyperTalk is a language that can be written in modular form, attaching instructions to buttons and to entire cards. The Scripting level offers all of the capabilities of lower levels and enables you to add or change instructions using the HyperTalk language.

HyperTalk can be extended through the use of external commands or functions, called XCMDs and XFCNs, which can be written in another language. External commands and functions typically are used to give HyperCard a more powerful function that it doesn't already have.

Vendors are improving the set of features by offering HyperCard-compatible programs that can modify existing HyperCard stacks and add capabilities to them. Complete authoring environments also are available that provide capabilities beyond the standard set by HyperCard.

Animation and sound can be added to HyperCard stacks by creating them in MacroMind Director and using MacroMind Player. HyperAnimator and interFACE (Bright Star Technology) can be used to create animated lip-synching human heads for HyperCard presentations. You can record the sound of a person talking and have that speech appear to come
from a synthetic actor’s mouth. ScreenRecorder (Farallon Computing) records all screen activity as an animated sequence. MediaTracks (also from Farallon) is an editing program for putting together movies of ScreenRecorder clips with sound.

SuperCard enables you to put together what appear to be real Macintosh applications, not just stacks that are limited in features by what HyperCard offers. SuperCard’s scripting language is a superset of HyperTalk and provides a powerful environment and an easy upgrade path for HyperCard stack developers.

MacroMind Director is far more ambitious than any other animation program in its price range. Director also offers considerable control over animated sequences and a convenient method of editing animated sequences. Director includes a complete authoring and animating system that includes a scripting language, called Lingo, for building interactive presentations, and a set of XCMD-like structures called XObjects for controlling various devices such as videodisc players.

The linking facility in Director is similar to HyperCard, except that in Director, any object can be “hot” and activate a script, and any object’s movements can be controlled by a script. For all of its power and flexibility, Lingo and Director provide the most accessible paradigm for developing multimedia presentations with interactivity.

Authorware Professional is more sophisticated than HyperCard and provides data-driven simulations and performance testing features that are necessary for some applications, especially in engineering training and prototyping.

The authoring systems described in this chapter also can synchronize digital sound, including high-quality music, with an interactive presentation. HyperCard and MacroMind Director also offer methods of controlling the AppleCD SC player in order to play segments of recorded music on conventional audio compact discs. The next chapter describes how digital sound is recorded and how you can get the best quality
12 Adding Sound

*If music be the food of love, play on.*

—Shakespeare, *Twelfth Night*

The sound of music can be enthralling, jarring, provoking, soothing, or obnoxious, depending on how it is used and how it sounds. The reason for using sound in multimedia presentations must be clear—no one wants the equivalent of Musak in their presentations. Appropriate sound is particularly important for business communication—the listener should be able to hear the narration, other sounds, and music clearly, without interference or unnatural distortion.

Applications for sound as part of multimedia presentations are everywhere: business communications, training, education, art, and entertainment are the major categories. Applications include narration, voice-overs, music, and sound effects to go along with any kind of animated sequence or transition. Interactive presentations can be built around music as the content, or music can be used to enhance the content.

Narration is effective in all forms of training and educational application, and also can be used for electronic mail. A narrator can be effective even if the quality of the sound is “voice-quality” (a euphemism for telephone-line quality). Sometimes there is no substitute for the warm, gentle voice of an assured and experienced human being.

Sound effects also can be very useful to highlight visual aids and navigation controls in interactive presentations—such as a click when you activate a button or a simple chime that plays during transitions between cards.

This chapter describes various uses of sound in multimedia presentations, and the differences between using prerecorded sound on conventional compact discs and sound recorded in digital form and stored on digital media. It explains how digital
"sampled" sound is recorded and how you can get the best quality from sound digitizers. This chapter also describes how to measure sound and minimize distortion to get a clear recording. In addition, it shows how you can connect musical instruments directly to the Macintosh to create and play back music. After reading this chapter, you will have learned the basics of digital sound recording, and you will understand the methods and techniques for using sound with multimedia presentations.

Understanding Sound

When an application demands the use of long-playing, prerecorded high-fidelity sound, you can use off-the-shelf audio compact discs with the AppleCD SC player and a set of HyperCard or MacroMind Director external commands and functions to control the playing of the discs so that you can play any segment of sound.

For example, The Voyager Company created a HyperCard stack that plays the audio tracks of an off-the-shelf compact disc containing Beethoven’s Ninth Symphony. With this method, you can present CD-quality recorded music without overly burdening hard disks or creating pauses in your presentation. This is because you are playing the sounds from the AppleCD SC unit without using your Macintosh processor. Computer performance is not affected, and disk accesses in the computer do not cause the sounds to pause. You also can play this type of sound using the CD Remote desk accessory supplied with the AppleCD SC player.

However, because the sounds with this method are not brought into the computer, you cannot freely edit or manipulate sounds or copy the sounds without first digitizing them. Digital sound brought into the computer can be edited, altered in various ways, and copied with absolutely no loss in quality.

To create digital sound, you can record sound directly from audio equipment or with microphones and use a sound digitizer to convert it to a digital format. You also can create digital sound with musical instruments and synthesizers that use the Musical Instrument Digital Interface (MIDI).

The quality of the digital sound that the Macintosh can record depends on the digital recording device. Every Macintosh has the capability to play medium-quality digital
sounds through its speaker, and every Macintosh has a conventional stereo mini-plug for connecting speakers or an audio amplifier. The AppleCD SC has a similar mini-plug connector. The built-in Macintosh speaker does not offer stereo, and it is low quality (designed to be excellent for voice-quality narration and sound effects, but not for high-fidelity music). High-fidelity digital music can be recorded and played with professional sound processor cards for the Macintosh II models.

**Off-the-Shelf Compact Discs**

Playing prerecorded music on the audio tracks of compact discs is more convenient and cost-effective for some applications than recording and editing your own music or converting prerecorded music to digital format. The use of off-the-shelf compact discs with HyperCard and MacroMind Director presentations is fast becoming a publishing success story. Besides The Voyager Company's *Beethoven's Ninth*, another example is Mozart's *The Magic Flute* from Warner New Media (see fig. 12.1), which is a package

![A TEMPO GUIDE](image)

Fig. 12.1. Mozart's *The Magic Flute* HyperCard stack (courtesy of Warner New Media).
of three Mozart audio compact discs that play on any CD player but also can be controlled by a set of HyperCard stacks when played on the AppleCD SC player, for exploring the music interactively.

The HyperCard CD Audio Toolkit (APDA) provides a set of HyperCard XCMDs (external commands) to use in stacks for access and playback of audio tracks on compact discs used with the AppleCD SC player. With this toolkit, you can design stacks that can play segments of music on conventional discs. The extensions provide advanced control of the audio tracks to 1/75th of a second.

MacroMind Director offers XObjects for playing segments of music stored either on off-the-shelf compact discs or the audio tracks of CD-ROM discs, when played on the AppleCD SC player. The playing of music on the audio tracks of a CD-ROM disc is independent of the Macintosh, so that you can play sound while movies and presentations are loading from disk into memory.

The Voyager Company also provides a HyperCard toolkit (Voyager CD AudioStack) to access the audio tracks of compact discs. You can synchronize HyperCard events to specific music segments on any compact disc played on an AppleCD SC player. Without these techniques, it would have been impossible to provide a product such as the Beethoven’s Ninth presentation with CD-quality sound—the company would have had to deliver large-capacity hard disks to hold the sound in digital form.

Digital Sound

Digital sound is sound that is either created by the computer using synthesizer electronics, which is called synthesizer sound, or sound that is recorded in a digital format, which is called sampled sound.

A number of software products, mostly games and educational software, enable you to use the Macintosh as a synthesizer. Harmony Grid (Hip Software), for example, is an entertaining and educational program that enables you to explore harmonic relationships by moving the mouse and playing music (see fig. 12.2). It is an excellent way to learn about harmony especially if you are studying music. Professional synthesizer playing and recording is described later in this chapter with using MIDI devices.
Chapter 12: Adding Sound

An application that requires voice-quality narration or medium-fidelity music and sounds can be put together inexpensively with the MacRecorder (Farallon), or similar digital recording device. You can use one MacRecorder that connects directly to the Macintosh modem or printer ports or use two MacRecorders and connect to both serial ports for stereo sound. The MacRecorder can record sounds through its microphones or directly from an audio source, such as an amplifier/receiver, tape deck, or high-quality microphone repeater.

You can record high-fidelity sound with a professional digital audio recording adapter, such as the Audiomedia card and Deck program (Digidesign), into a high-quality digital format and store it along with the other presentation elements on digital storage media such as a hard disk, a removable disk, or CD-ROM.
To understand how sound is digitized, you first must understand how sound is measured. Sound is the transmission of energy caused by vibrating air molecules, and a *waveform* measures the speed and the distance travelled by the air molecules. As shown in figure 12.3, the *amplitude* measures the height of the wave, which is the sound's relative loudness.

![Waveform diagram](image)

**Fig. 12.3.** How sound is measured in a waveform.

The *period* is the distance between two successive peaks in a waveform and is usually expressed in seconds. The *frequency* is the number of peaks that occur in one second, and frequency is used to describe the *pitch*—the higher the frequency, the higher the pitch. A sound that has 1000 peaks per second, or cycles per second (a cycle is a section of the wave that is one period long), is written as 1000 Hertz (Hz) or 1 KiloHertz (kHz).

The *phase* of the wave shows where the wave starts (your ear uses phase information to determine the direction from which a sound is coming). The *shape* of the wave indicates the tonal quality—sweetness, harshness, and so on—of the sound. A sine wave shape sounds sweet, a square wave harsh, and a complex wave rich and full. Most sounds have complex wave shapes, but the smoother the wave is, the cleaner and sweeter it sounds.
Over time, a sound waveform changes its amplitude, frequency, and shape. The envelope is an imaginary wrapping around the entire waveform, matching its entire shape and representing the loudness at each point. A musician creates music by making sounds of different frequencies; the interval between a given frequency and twice that frequency is called an octave.

To store sound in digital form, a device such as the MacRecorder (Farallon Computing) takes samples of the waveform—it measures the exact location of the waveform—at evenly spaced intervals of time (see fig. 12.4). Each location becomes a dot, and the waveform can be re-created by connecting the dots, as long as the rate of sampling is high enough to record the waveform properly.

Fig. 12.4. A digitally sampled sound waveform displayed in Farallon's SoundEdit program, shown in both fine and coarse time increments, which can be changed by the zoom control.
For example, a 22 kHz sampling rate means that 22,000 cycles are recorded per second. This rate is the current upper limit for the standard Macintosh without requiring additional circuitry or an add-in card. Eight bits of information can be used to store each sample.

The Macintosh can play eight-bit digital sound with no additional hardware, but eight-bit sound is not as high in fidelity as 16-bit sound, which is the same quality as audio compact discs. Digidesign offers a range of 16-bit coprocessor cards for sound recording and editing and playback cards for Macintosh II models, with variable sampling rates including the compact disc standard 44.1 kHz rate.

The benefit of using a coprocessor card to play high-fidelity digital sound is that there are no pauses in the smooth playback when the disk is accessed, so that you can play longer pieces of music directly from the disk. By comparison, sound played on the Macintosh directly must be preloaded into RAM to play continuously. When you combine preloaded animation and preloaded sound, you run out of RAM very quickly, even if you have eight megabytes.

The storage requirements for digital sound are enormous: you need 22 kilobytes to store one second of 22 kHz sampled sound without compression. With the maximum amount of compression (8:1), you can reduce this requirement to 2.75 kilobytes. Still, even compressed 8:1, only 360 seconds (that's six minutes) of 22 kHz sound can be stored in one megabyte of disk space. 10 megabytes of disk space is required to store one hour of sound compressed 8:1.

There are basically two ways to reduce the amount of memory and disk space required to hold sounds sampled at 22 kHz. One method is to *downsample* the sound, or reduce the sampling rate to 11, 7, or 5 kHz. Although the sound remains stored with eight bits per sample, there are fewer samples to store—typically the sound file is reduced by half. However, downsampling reduces the frequency range (for example, the range for an 11 kHz sample is from 0 to 5 kHz).

Another method is to use a compression algorithm that reduces the number of bits per sample. For example, with 8:1 compression, the number of bits per sample is reduced to one, and the size of the sound file is reduced to one-eighth its original size. However, higher compression ratios yield lower sound quality. Picking the best
way depends on the type of sound—mono voice narration usually can be highly compressed with good results. You can use a 5 kHz sampling rate for telephone-quality sound, 7 kHz for AM radio sound, 11 kHz for television sound, 22 kHz for medium-quality sound, and 44.1 kHz for high-fidelity sound.

**Using Sampled Digital Sound**

The playback of medium-fidelity digital sound on a Macintosh requires no special equipment—only the use of headphones or speakers attached to the Macintosh stereo connector. To control a MIDI instrument, you need a simple device called a MIDI interface, available from Apple and third parties. To play high-fidelity digital sound from a Macintosh, you need a 16-bit professional sound recorder/player card such as the Audiomedia card from Digidesign, designed for any Macintosh II model.

When playing medium-fidelity sound, the Macintosh internal speaker may not be enough to convey the quality of the sound. There are many speaker systems that can be attached directly to the Macintosh via the stereo miniplug, and you also can connect the Macintosh to a conventional stereo amplifier or receiver. Cambridge SoundWorks offers the Ensemble speaker system with two subwoofers that can be hidden under a desk or table and two smaller speakers that can be placed on top of the desk or table, providing excellent high-fidelity sound.

Prerecorded compact disc sounds, sampled sounds, and MIDI sounds can be mixed in the same presentation. You may take this approach if you want to use high-quality stereo music and medium-quality narration and sound effects. These methods are often combined to gain the advantages of both: the quality of CD audio for music, and the quick turn-around time of cost-effective digital recording for narration and some sounds.

When you commission professional-quality music for a soundtrack, you can expect to pay an independent musician or composer anywhere from $1,200 to $2,800 per minute of music. To save money, you may consider using stock music from a music library. However, the cost of the minimal equipment for recording music digitally—a
Macintosh IIcx with an 80-megabyte hard disk and professional audio recording hardware and software from vendors such as Julian Systems or Digidesign—can be less than $10,000, the cost of less than 10 minutes of music. If you add in the salary for the musician (around $35,000 a year or $30 an hour), you find that you can reduce the cost of commissioning professional-quality music to around $600 to $800 per minute.

It is possible with conventional recording equipment to use a digitizer at the end of the recording process or to use a digitizer to record each track of music separately. Professional high-fidelity music can be digitized with the Audiomedia system from Digidesign, described later in this chapter. For medium-fidelity music and sound and for voice-quality narration, Farallon's MacRecorder is probably the most widely used sound recorder and digitizer.

**Recording Sound**

The quality of the sound you are recording depends first on the quality of the microphone and second on the ambient sound of the room in which you are recording. A good microphone can record sound more clearly and provide a dynamic presence that cheap microphones cannot reproduce. Remember, also, that the audio portion of a multimedia presentation can be adjusted for volume when played back. If you record at too high a level, you may introduce distortion that cannot be easily corrected.

Ambient noise in the room will most likely be picked up, as well as noise from the next room. Don't record narration in an office cubicle surrounded by office workers who are moving around, talking, using typewriters, and so on, unless you want the noises to be heard. You may want to use baffles (pieces of sound-proofing material) to stop extraneous noise from appearing in the recording. Inexpensive baffles can be made by mounting halves of cardboard egg cartons onto large pieces of cardboard.

MacRecorder has a built-in microphone for recording, and it connects directly to the modem or printer port. With two, you can record stereo music by connecting them to both the modem and printer ports.

The MacRecorder includes the SoundEdit program and the HyperSound stack (for HyperCard). Either or both can be used for editing and mixing sounds and storing them in
the Macintosh standard sound file formats: the SoundEdit data file format (for use with programs such as MacroMind Director), or as "snd" resources for installing in HyperCard and SuperCard stacks.

The HyperSound Toolkit provides HyperTalk external routines for creating stacks to record and play voice or music and to present interactive simulations with sounds. Each MacRecorder can record audio via a built-in microphone, external microphone, or line-in source. With two MacRecorders you can record in stereo. You also can use the SoundEdit software as a multichannel mixer to combine up to four channels into one.

The MacRecorder records with 22,000 samples per second frequencies up to 10 kHz. (It cuts out frequencies higher than 11 kHz that would cause aliasing, or high frequencies masquerading as low frequencies after sampling.) You can set the MacRecorder to record to a lower sampling rate for lesser quality to conserve disk space. The basic tradeoff is that you lose more high frequencies, but you can make a longer recording using the same amount of memory and disk space.

Digitized sound occupies large amounts of RAM and disk space, so that some form of file compression is necessary. SoundEdit offers four compression choices (ratios 3:1, 4:1, 6:1, and 8:1 as the highest amount of compression). When you record in compressed mode, the MacRecorder saves one bit per sample rather than one byte; therefore, a sound can be stored in one-eighth the same amount of memory or disk space. However, with compression you lose fidelity because quantization noise is increased (this is noise formed by the rounding of amplitude to the nearest integer). Compressed mode, therefore, is more useful for recording speech than for music, and you cannot use compressed mode for stereo recordings. However, without compression, a HyperCard stack or multimedia presentation that includes sound would be too large to distribute on floppy disk.

**Editing Sound**

After you have recorded the basic sounds, you may want to add special effects. Some effects can be added in the sound editing program and fine-tuned to match the sounds already recorded. For example, Farallon's SoundEdit program, supplied with the MacRecorder, enables you to mix sounds from separate channels into one channel (see fig. 12.5). You can mix up to four uncompressed sounds at the same time into one channel.
SoundEdit displays sound as a waveform, the height of which is amplitude, and the length is a period of time. The amplitude and frequency (number of peaks or cycles occurring in one second) can change over time, creating different waveform shapes. Because the frequency range of a digitized sound is limited to one-half the sampling rate, and the MacRecorder can sample music at the rate of 22 kHz, you can accurately record with the MacRecorder a frequency up to 10 kHz (the device has an anti-aliasing filter to remove frequencies above 11 kHz). You also can minimize clipping and quantization noise by adjusting the MacRecorder's input level. The optimal recording level occurs when portions of the waveform touch the top and bottom of the SoundEdit window. Adjustments can be made to the sound wave's envelope to adjust the maximum loudness (see fig. 12.6).

You can cut and paste sound segments from one SoundEdit window to another (see fig. 12.7). When you paste sound into a window at an insertion point in the middle or
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Fig. 12.6. Adjusting the envelope in SoundEdit, which changes the maximum loudness (amplitude) for the sound wave.

Fig. 12.7. Copying a sound from one window and using Paste to paste it in front of another sound in another window (SoundEdit).
at the beginning of existing sound, the new sound is inserted before the old sound. If the old sound is selected when you paste, it is replaced by the new sound. The new sound takes on the characteristics, such as the recording type and mode, of the window it is pasted into. When you select a segment, you can click the Play button to be sure that you have the segment you want.

SoundEdit provides a variety of special effects that can be applied to selected uncompressed sound segments. The echo effect repeats a selection with a decaying effect that sounds like an echo, and you can specify the echo's delay and strength. A selection of the sound waveform can be inverted along the horizontal axis and defined as a loopback (a repeated segment). The flanger effect creates the sound of a jet taking off, and the noise effect adds "white noise" to the sound. You can adjust the amplitude of a selection with the amplify effect and run selections backwards (get out those Beatles albums!).

Other effects include the bender effect, which enables you to adjust the pitch of a sound by a varying amount over time, the ping-pong effect that gradually interchanges the left and right channels of stereo sound, and the envelope effect, which enables you to adjust the overall waveform envelope by a varying amount over time.

You can colorize parts of a waveform to identify words, sounds, transitions, and so on, and use text labels to identify selections by specifying the start and end locations of each labeled selection. Labels will be important as future multimedia programs are modified to play labeled selections of sound files that are synchronized with other events, such as animation.

SoundEdit offers the capability to analyze recorded sound with the sonogram and spectrogram tools, which show a map of the relative strengths of the frequencies. Although the sonogram offers a narrow dynamic range of 24 dB (decibels) compared to the spectrogram (which has a dynamic range of 48 dB), the sonogram is useful for analyzing long periods of sound with general frequency patterns. The spectrogram is useful for analyzing shorter periods in more detail.

SoundEdit also can be used to generate sounds such as individual tones at particular frequencies, amplitudes, and shapes, and frequency-modulated signals such as the sound of sirens, buzzers, and chirping birds.
**Recording and Playing High-Fidelity Digital Sound**

The MacRecorder can handle a variety of sound recording projects, but because it records into RAM, it is limited to recording less than a minute at its highest sampling rate, which is 22 kHz. For professional music recording and playback, Digidesign's Audiomedia card is capable of real-time digital signal processing and sound synthesis, and it can record hi-fi sound directly onto disk and play it back from disk.

The Audiomedia system is compatible with MIDI devices, such as synthesizers, keyboards, and other musical equipment, and can trigger MIDI devices to play in polyphonic sound. With the additional Deck software, the system offers CD-quality multitrack recording and editing features with 16-bit digital sound samples at 44.1 kHz. The 16-bit sound can be played from within HyperCard with the Audiomedia card.

The Audiomedia card includes the Motorola 56001 digital signal processing (DSP) chip for real-time processing, compression, and expansion of compressed sounds. The Audiomedia system is optimized for a 44.1 kHz sampling rate with higher rates possible, and a frequency response of 20 Hz to 20 kHz at 44.1 kHz; its signal to noise ratio is greater than 90 dB. It can play sound directly from a hard disk, so that recording length is limited only by the amount of disk storage rather than by the amount of RAM—you could theoretically play a half-hour of stereo CD-quality digital audio from a sound file stored on a 300-megabyte hard disk. The system uses only about 50K of RAM and loads music instantly.

The Deck program, which works with the Audiomedia card, provides the capability to edit the full stereo sound waveform. You can work with entire music pieces in what is called "playlist editing"—the capability to rearrange pieces for dance mixes, film edits, and so on. With the MIDI Preview software, you can play music from disk polyphonically with any MIDI keyboard connected to the Macintosh MIDI interface.

Audiomedia also comes with Sound Access, a set of XCMDs and XFCNs (HyperTalk external commands and functions) for playing 16-bit sound from HyperCard stacks and Director movies. MacroMind offers an XObject in Director for controlling the Audiomedia card to play CD-quality digital sound from a Director presentation. The card loads music from disk in real time while playing, so that you can use lengthier segments of music than you would ordinarily be able to use.
There are several professional-level audio recording and editing systems that use a Macintosh as the control center. For example, Dyaxis, from Integrated Media Systems, features random-access, two-track recording and playback, multi-track off-line sound file assembly, and digital format conversion. At the heart of the Dyaxis system is stereo 16-bit analog-digital and digital-analog circuitry and an audio processor for recording at 48 kHz, 44.1 kHz, and other sampling rates. It is possible to outfit a Dyaxis system with up to five 320-megabyte hard disks for storing over two hours of CD-quality digital sound. Although music editing systems such as these are priced starting at above $5,000 and continuing to over $40,000 (not counting the Macintosh), they are still priced at a fraction of the cost of conventional professional digital sound editing systems, and the sound quality is as good as these conventional systems, making the Macintosh-based systems attractive for professional sound recording and audio-video sequencing.

**Using MIDI Sound**

In the world of professional and amateur music, MIDI (Musical Instrument Digital Interface) is the standard way to connect synthesizers, keyboards, and other musical instruments to computers. Apple offers a MIDI interface that connects to a Macintosh serial port and is controlled by a standard MIDI driver and MIDI Manager software (available from APDA).

If you have a synthesizer, you can purchase presequenced MIDI songs for your multimedia presentations. You can open a MIDI sequence, adjust the sequence to fit the occasion and your synthesizer's configuration, and edit the sequence. MIDI music sequences are available from a number of sources such as Golden MIDI Music, usually priced at about $10-$30 per song.

If you are playing back sequenced music, all you need is a desktop synthesizer such as the Roland CD-64 LA/PCM Sound Module, which can play both synthesized and sampled sounds. Supplied with 128 synthesized sounds and 64 sampled sounds, the desktop synthesizer (which fits underneath the Macintosh) also can read special RAM cards containing additional samples from the Roland library of sounds.

Although Apple offers a MIDI box to interface to musical instruments, there are a variety of third-party MIDI interfaces available that offer features such as more MIDI in and out ports. The Studio Plus Two MIDI Interface (Opcode Systems) provides
two MIDI INs and six MIDI OUTs; with the INs, you can sync and record at the same time as well as record two MIDI devices simultaneously. Opcode's MIDI interfaces have opto-isolated INs that can eliminate ground loops, hum, and whine.

**Music Playing and Publishing**

For MIDI music playing and recording, you can use the DeluxeRecorder (Electronic Arts), which enables you to record whatever you play on a MIDI instrument so that you can play it back, edit and refine the music, and send the music information to other MIDI instruments for playback.

DeluxeRecorder offers eleven staff types for displaying MIDI music information, and each track of music appears on a Grand Staff that resembles the grand staff of traditional music notation (see fig. 12.8). The program offers multichannel recording (up to

![Fig. 12.8. Using DeluxeRecorder (Electronic Arts) to record and play MIDI music.](image-url)
32 channels), programmable quantization and metronome, a real-time tempo generator, and a real-time editing window for manipulating MIDI music information.

To create a score, you record one part of the score at a time onto a track as you would in a studio. The program offers 16 tracks and a tempo range of 20 to 500 beats per minute. Unlike a tape recorder, DeluxeRecorder preserves the original pitch as you speed up or slow down the tempo, even while playback is in progress. Because the MIDI information is in digital form, you carefully can record a music piece at a slower pace then play it back up to tempo. DeluxeRecorder can record into a buffer or holding area, so that you can repeat the take as many times as you like until you’re satisfied, then save it on a track. The program enables you to continue to record into the buffer without writing over what is saved on the track, and you then can merge the new music into a track or replace a track.

If you are serious about using MIDI equipment and publishing original music, the Deluxe Music Construction Set (Electronic Arts) offers complete musical notation tools including triplets, quintuplets, slurs, ties, adjustable beams, octave signs, repeats, braces, brackets, and first and second endings. DeluxeMusicTranslator is a module that enables you to translate DeluxeRecorder scores into Deluxe Music Construction Set files for notation and printing.

Eight staves are available in Deluxe Music Construction Set, with two rhythmically independent tracks per staff, with treble, bass, alto, and tenor clefs. You can put multiple time signatures and key signatures anywhere in a piece of music, and customize the spacing in your scores.

The program supports MIDI IN and OUT and enables you to play the music you write in any tempo with MIDI instruments (eight MIDI channels). You can input music in step time directly into the program with a MIDI keyboard and use Opcode’s Vision for transcribing music in real time.

The program also provides complete score printing on an ImageWriter or LaserWriter and can use the Sonata music font by Adobe Systems with PostScript printers such as the LaserWriter II NT and NTX. You can produce publishing-quality scores and sheet music, therefore, while playing the music on MIDI equipment in real time.
Controlling Processes

For some beginners, the intricacies of hooking up various MIDI equipment and piping musical information into the Macintosh for processing and then out to other MIDI devices are too complex. To set up a MIDI instrument as a device to control a set of Macintosh programs is not easy without some knowledge of HyperTalk (for controlling HyperCard stacks) or MacroMind Director (for controlling animated presentations).

HookUp! from Hip Software presents an “under the hood” view of connecting MIDI devices to the Macintosh. This view uses simple predefined icons for the devices and enables you to draw connections for processing music and animation and to create your own icons to represent special effects. HookUp! can be used to compose music, to generate animation based on music, and to simulate processes involving sounds. It also is a prototype of a complete graphical programming environment, in which every object and Macintosh window has a control panel in which you can see and customize the circuitry with icons and graphics tools (see fig. 12.9). For now, users can learn how to control animation with MIDI information, and control any Macintosh process with voice or music input.

HookUp! is entirely interactive and does not require programming skill, nor does it force you to write code in an abstract way and then “compile and run” the code as a separate step to see if the code works. You can tell right away, because the connections you make are in real time (as in a performance). You can change connections while a simulation is running. You can control animated artwork from MacroMind Director, create objects that bounce, collide, and are affected by gravity, and then show how changes in the laws of physics affect the objects. You can make musical special effects generators such as custom percussion kits and sequencers, diatonic voicers, variation generators, arpeggiators, and simulation-driven music. You also can dynamically control the pipeline of MIDI data into and out of the Macintosh, performing transformations such as attenuating velocity, doubling octaves, transposing octaves, and creating counterpoints.

MIDI links the Macintosh world with the musical world. You can use a converter, such as the Timecode Machine (Opcode), to link MIDI with the world of video editing and SMPTE (The Society of Motion Picture and Television Engineers), which is a standard method of identifying video frames in order to synchronize music to video.
Fig. 12.9. Using HookUp! (Hip Software) to customize the circuitry for connecting various MIDI devices to Macintosh processes, such as animated sequences.
Chapter 12: Adding Sound

Chapter Summary

Applications for sound as part of multimedia presentations are everywhere: business communications, training, education, art, and entertainment are the major categories. Applications include narration, voice-overs, music, and sound effects to go along with any kind of animated sequence or transition.
You can use off-the-shelf audio compact discs with the AppleCD SC player and a set of HyperCard or MacroMind Director external commands and functions, to control the playing of the discs so that you can play any segment of sound from within a HyperCard stack or Director movie. With this method, you can present high-fidelity recorded music without overly burdening hard disks or creating pauses in your presentation. However, the sounds must be prerecorded onto compact disc. With this method, sounds are not stored in digital format, so that you cannot freely edit or manipulate sound or copy the sounds without causing some degradation.

Digital sound can be edited, altered, and copied with absolutely no loss in quality. You can record digital sound from audio equipment or with microphones, using a recorder and digitizer (such as the Farallon MacRecorder). You can record sound with a professional digital audio recording adapter, such as the Audiomedia card (Digidesign), into a high-quality digital format. In both cases, you are creating sampled sound that can be played on the Macintosh itself (medium-fidelity) or on a coprocessor card that processes high-fidelity sound.

The playback of medium-quality digital sound on a Macintosh requires no special equipment—only the use of headphones or speakers attached to the Macintosh stereo connector.

The benefit of using a coprocessor card to play high-fidelity digital sound is that there are no pauses in the smooth playback when the disk is accessed, so that you can play longer pieces of music directly from the disk. By comparison, sound played on the Macintosh directly must be preloaded into RAM to play continuously.

You also can create and play digital sound with musical instruments and synthesizers that use the Musical Instrument Digital Interface (MIDI). To control a MIDI instrument, you need a simple device called a MIDI connector. MIDI (Musical Instrument Digital Interface) is the standard way to connect synthesizers, keyboards, and other musical instruments to computers.

The quality of the sound you are recording depends first on the quality of the microphone and second on the ambient sound of the room in which you are recording. To understand the recording of sound, you must first understand how sound is measured.

There are two ways to reduce the memory and disk space requirement for digital sound: downsample the sound (reduce the sampling rate) or use compression to reduce the number of bits per sample. However, downsampling reduces the frequency range, and higher compression ratios yield lower sound quality. You should
use a 5 kHz sampling rate for telephone-quality sound, 7 kHz for AM radio sound, 11 kHz for television sound, 22 kHz for medium-quality sound, and 44.1 kHz for high-fidelity sound.

The compression and digitizing of sound is similar to the compression and digitizing of video, except that digital video carries far more information and requires far more memory and storage. Video can include sound, or you can record sound separately from video and play it back separately. With digital sound and digital video, you can mix and match these elements in a multimedia presentation. The next and last chapter is about video and how you can use it with the Macintosh. It also is a peek into the future of audio and video computing.
Video is an effective medium in many of the same categories as the use of sound: business communication, entertainment, art, training, and education. You can design interactive video projects in which a laser videodisc player is controlled by software, enabling users to explore the video presentation from many different angles without having to sit and watch the entire video presentation in sequence.

In addition, video often can be an excellent source of images to use in desktop publishing and presentation projects. You can bring video into the Macintosh, and display it on the Macintosh screen, and save a single frame of the video as a digital image that can be retouched, edited, and then used in a publication or presentation.

The use of video is not restricted to bringing it into the computer. You also can send video out of the computer to be recorded on videotape. For example, you may want to prepare a videotape of an animated presentation or overlay animated graphics on top of a video presentation and save that on videotape to take advantage of the enormous installed base of VCRs. In addition, you may want to record live video and synchronize it with animation or prepare it for an interactive presentation or information tool.

It is possible to work directly with the standard video signal used in television and for recording to videotape. You can display video on a separate monitor (from a source controlled by the Macintosh) or on the Macintosh display in a window.

This chapter explains how video can be incorporated into computer presentations and how to capture still images and full-motion video for displaying on the Macintosh screen. It also describes how to overlay text and graphics on a video image and display the composite image on the Macintosh screen or on another display. You will
learn about recording animated presentations to videotape and playing video in a window next to other applications. You also will understand how the Macintosh can be useful in a professional video and film production studio as well as on the set (and even on location). This chapter ends the book with a look into the future of interactive multimedia and computing and its socioeconomic impact on society.

Understanding Desktop Video

Video can be used with a Macintosh in a number of different ways and be distributed in several different forms. For example, you can use prerecorded video in your presentations, record your computer presentation onto videotape for use with consumer VCRs, or record the presentation onto high-quality videotape for use with industrial or commercial videos.

A video signal can be brought into the Macintosh environment and displayed in a window on the Macintosh screen or displayed on a separate monitor. For an interactive project, such as ABC News Interactive’s video presentation of Martin Luther King (see fig. 13.1), the video is stored on a laser videodisc and played on a videodisc player controlled by a HyperCard stack. A viewer can jump to any predefined video sequence at the click of a button.

Another use of desktop video is to overlay graphics and text on prerecorded full-motion video and save the result—a new video with graphics and text—onto videotape. In addition, a single frame of video can be captured as a digital image for use in presentations and publishing projects.

Video production technology has its own language and standards that are not well known in the computer industry and not adhered to by computer display technology. In fact, the technologies have not been used together, by the same people, until very recently.

How Video Works

The capability to place live video on the same screen as the computer’s display is called “video in a window” in this book. It is far easier to display live video on a separate monitor next to the computer’s monitor and drive both monitors from the
Fig. 13.1. ABC News Interactive produced an interactive laser videodisc of Martin Luther King video clips using a HyperCard-controlled laser videodisc player.
same computer, but unfortunately this setup requires two monitors, and most Macintosh users have only one. Thus, video in a window is an important capability that expands the audience that can view your presentation. Both methods of using video are described later in this chapter.

In the United States and Japan, the broadcast video signal is called *NTSC video*, and it differs significantly from the video signals used in other countries (such as PAL, used in Great Britain, other European countries, and Australia, and SECAM, used in France, USSR, East Germany, and the Middle East countries).

NTSC is the acronym for National Television System Committee, and describes a type of video signal defined in 1953 that encodes and transmits color television. NTSC video displays images, or *frames*, at the constant rate of 30 frames per second. Each frame has 525 lines of image information divided into two fields: one for the even-numbered lines and one for the odd-numbered lines in the image. In a process called *interlace scanning*, a beam sweeps across the picture tube displaying all the odd lines from top to bottom, then blanks out, and returns to the top to display all the even lines from top to bottom. This process happens continuously and faster than the eye can see (60 fields per second), providing the illusion of movement with images.

Synchronizing pulses (Vertical and Horizontal SYNC) are the part of the signal that locks the picture images in place. These pulses mark the transition points between elements of the picture. The Horizontal SYNC pulse occurs once for each line during the blanking interval, providing a measured interval for the beam to move from the end of a line to the beginning of the next line, so that the beginnings of each line are lined up in the same column.

The Vertical SYNC occurs in the vertical blanking interval (the black bar you see when you adjust the vertical hold on your TV set) and provides a measured interval between fields of a frame so that the beam can move from the bottom to the original top position and display the alternate field.

The standard Macintosh video display differs from a standard television or video monitor in that it uses a different scan rate and separate RGB (red, green, and blue) signals rather than one composite video signal (a composite signal includes all colors). Additional circuitry is required to combine the two different types of video information—*non-interlaced* computer display and *interlaced* television-style video—on the same display and to synchronize the signals.
A feature known as *genlocking* is required to overlay, for example, a computer image or text on top of a video signal. Genlocking is the capability to lock signals from different video equipment so that you can overlay them. The genlocking feature of video cards for the Macintosh II models makes it possible to overlay Macintosh graphics, including animation, on top of live, full-motion NTSC video.

*Keying* (also called color keying) is the capability to make a portion of a video signal transparent so that you can see another signal when genlocking. A color called the *key color* is chosen on one signal. For example, you may set the key color to be light blue, and all light blue areas of the video are replaced by another video signal. This is one method for combining, for example, a wall-sized weather map with a video image of a weather announcer standing in front of a light blue wall.

You record video onto a *master tape*, unless you are recording video directly into a digital format. This master tape is used to make duplicate copies, or *dubs*, but the quality of these copies is diminished somewhat due to the analog copying process. By contrast, digital video—video stored as a series of ones and zeros in a binary digital format—does not diminish in quality when you copy it. But do not confuse digital video, which is still in its infancy, and digital media such as the videodisc, which stores video in its usual (analog) format but with a digital storage technique that provides faster access to video segments.

## Developing a Video Project

The creation and production of an interesting and visually competent video project can be very expensive. Even the simplest marketing presentation can be more than $2,000 per minute for video shooting and editing. Although you can use video clips from other sources, including previous projects, the editing of such material can still be expensive.

How does one go about making a video piece? At minimum, a writer is required to create some form of *screenplay* and an artist to create a storyboard for the project. You also may need a musician and/or composer for creating the *soundtrack*, a narrator, and a graphic artist that knows how to create materials for video. In-house salaries for these professional categories are usually lower than salaries at video production facilities; for example, a professional graphic artist at a post-production
facility may charge $250 or more per hour. An independent producer, functioning as a writer for the project and as someone who oversees all production, can charge anywhere from $250 to over $1,000 per day.

Video production starts with the video camera, which at the low-priced end of the range is a hand-held consumer camcorder for medium-quality business and training videos and at the high end are more sophisticated television cameras for commercial-quality videos and broadcast-quality television. An example on the low end is the $1,000-$2,500 Super VHS or ED Beta format camcorder that outputs a composite video signal and provides adequate quality for industrial and corporate projects. Broadcast-quality cameras (from $3,000 to over $10,000) that output separate RGB (red, green, blue) or S-Video signals also can be used with desktop video products, yielding sharper and more colorful video images. Special types of video cameras can be used to capture images and sound in almost any situation or place—in frigid arctic temperatures, under water, in outer space, or inside the human body.

After video sequences are shot, they can be produced in several ways and be distributed on videotape or laser videodisc, or broadcast by cable, network television, or satellite. By far the most common distribution form of video in the U.S.A., besides broadcast TV, is videotape in the consumer VHS format. This format is used widely for business communications, training, research and development, and education, as well as entertainment. There are several formats for commercial video production that also are supported by Macintosh video editing products.

**Deriving Benefits from Desktop Video Production**

Professional-quality video is an expensive medium in which to produce, and the costs rise dramatically if you want to do special effects such as overlaying graphics or text on top of the video image. This is where desktop video production provides the greatest benefit: in the use of computer graphics that can be saved on videotape. For example, the ABC logo currently in use is the result of using Macintosh 3-D graphics programs and saving the results on videotape.

The video medium has been used extensively for producing animatics, which are a combination of storyboard-like still images with text and possibly narration, combined with roughly edited video sequences, used to get approvals for a video project. For example, advertising agencies, such as Farago Advertising in New York, prepare animatics for television commercials that are shown to clients to gain their approval before committing production time to the concept. The cost for producing one such
animatic (usually about 30 seconds) can be as much as $10,000. With desktop methods, the cost of the entire equipment needed to produce one animatic can be under $10,000, and subsequent animatics are virtually free of cost other than time.

Still, it is a daunting prospect to produce a commercial video, or a video with commercial-quality results, without the help of a professional studio. Sophisticated video production can be done on a Macintosh, although in many cases the professional video artists and producers already have standard video equipment that is cost-effective. The Macintosh can play a cost-effective role in the management of the editing process and in preparing the rough cuts for showing the progress of the production effort and gaining approvals.

The savings in cost for graphics work are not as dramatic in the short run, but when combined with the savings in time and increased control and flexibility, plus the capability to reuse materials in electronic form stored in-house, the savings can be dramatic but hard to measure on a job-by-job basis.

A graphic artist may spend about 12 hours creating, getting approval for, and finishing four drawings. Sequencing the images with a soundtrack may take another four hours. At a salary of about $35,000 a year for an in-house graphic artist (or about $30 an hour), the labor costs per project are less than a fifth of the cost of using a graphics or production facility. Although the initial equipment investment is high, you can expect to incur only labor costs for subsequent projects.

It makes sense to send the one-time, never-to-be-repeated video project outside to an independent multimedia developer. However, it also makes sense to hire the appropriate people and do projects in-house if these projects will be repeated and material reused again and again in different forms. The considerable benefits of desktop video equipment come into play especially when raw materials can be reassembled for other projects.

**Recording to Videotape**

Although you may build a presentation on the Macintosh, you may want to distribute a recorded version of it on videotape. A variety of applications are best served by recording presentations to videotape, even though it means the presentation will be viewed without the benefit of interactivity. Of course, anything recorded to videotape also can be used to master videodiscs, which can be used interactively.
Most of the video cards described in the next section provide the capability to output an NTSC video signal for recording onto videotape; the ones that don’t provide NTSC output work with additional devices that perform this function (such as the VIDI/O box that works with the Truevision NuVista card used for displaying full-motion video in a window). In addition, VENT offers inexpensive black-and-white cards for the Macintosh Plus and SE, and eight-bit color cards for the Macintosh SE/30 and II models, that can send out NTSC signals. Mass Microsystems offers the ColorSpace line of color video input, display, and output cards for Macintosh II models, and the ColorSpace Plus/SE device for overlaying Macintosh graphics on video signals.

The quality of the recording is affected by a variety of factors including the quality of the output signal and the capabilities of the videotape recorder. A consumer-grade VHS VCR can record animatics for showing concepts and ideas, but it is probably not good enough for industrial-quality and certainly not for broadcast-quality videos. Super VHS and ED Beta consumer decks can be used for corporate and industrial training tapes. Broadcast-quality and commercial video can be recorded only with professional decks.

**Recording Frame-by-Frame**

Although it is possible to record an animated computer graphic sequence onto videotape in real time, most applications call for faster animation or more control over the animation, and so the recording must be done frame by frame.

The precision of professional video recording equipment is required for recording frame-by-frame. MacroMind provides Director XObjects for recording frames to professional videotape recorders (such as those using Video8, 3/4 inch, and 1 inch formats) that are driven by intelligent controllers.

Diaquest offers a range of video deck controllers for recording onto videotape, including the DQ-422 (for RS-422 interfacing) and DQ-50P (for parallel interfacing), the Series II stand-alone controller (for serial port interfacing), and the DQ-Animaq (for the Macintosh). DQ-Animaq is available in a broadcast-quality model for serial machine control, and a desktop model for serial and parallel control with an RS-170A sync generator and SMPTE time code generator. SMPTE (The Society of Motion Picture and Television Engineers) time code is the standard method of identifying video frames in professional editing studios.
The DQ-Animaq provides frame-accurate recording of video animation and also can be used with a frame grabber (such as the Truevision NuVista, described later) to digitize video sequences for rotoscoping effects. Captured video scenes can be composited with computer graphics and then output frame by frame to videotape.

Diaquest offers a variety of software tools for controlling the DQ-Animaq board, including XObjects for MacroMind Director for recording frames of animation directly to videotape without having to store them on disk. The board is supplied with the Action Animator program for remote control of a VTR, frame digitizing and recording, and auto-sequencing of image files from disk, and with Video Online for animating from within other programs.

Recording frame-by-frame to videotape is the preferred method for showing animations of 24-bit photorealistic images, which are slow when run in real time on the Macintosh. When recording animation frame-by-frame, it can take many frames to record a single transition effect between frames, but the results can be startling. You also can add transition effects directly to the videotape using professional video special effects equipment.

**Designing Graphics and Text for Video**

There are a number of rules to remember when designing graphics and text for recording to videotape. One problem you may encounter is *flicker*, which occurs with very fine horizontal lines and jagged edges. You can see flicker in text and in transition areas of high contrast. Dithered patterns, fonts smaller than 18 points, and single-pixel lines are the usual suspects. Unfortunately, many clip art images are composed of dithered patterns and single-pixel lines.

The thicker the line, the less it matters, but lines that are an even number of pixels thick usually do not flicker. You also can reduce the contrast at the edges, or use a technique called *anti-aliasing*, which adds or subtracts pixels at high-contrast edges to soften or blur the edges (see fig. 13.2).

You can avoid having sharp vertical lines appear softened or repeated ("echoed") by softening the edges of the lines first (with the precision of an image editing program such as ColorStudio or Adobe Photoshop). Cross-hatched or repeating dark vertical lines also may cause a rainbow effect, or color fringing, and should be avoided.
Fig. 13.2. The text is set to "anti-aliased" in Adobe PhotoShop so that it blends into the video image and simulates higher resolution.
NTSC video is designed to be used with televisions that overscan the picture tube—the total image area is larger than the tube. The Macintosh works the opposite way, displaying an image that is slightly smaller than the display screen. When designing images on the Macintosh II display that will eventually be shown in NTSC video, leave at least 15% of the full screen on each edge blank (or without critical imagery), because the video format chops off about 15% of the full-screen Macintosh II display from each edge. A template is provided with MacroMind Director for creating animations to be stored in NTSC video format.

Design rules for video include avoiding dithered patterns; avoid lines that are composed with an odd number of pixels, especially single-pixel lines; avoid spaces between lines that are an odd number of pixels high or wide; avoid high-contrast areas, especially when white and black are adjacent to each other, such as sharp vertical lines; avoid highly saturated colors, especially vivid red and orange, and use mostly pastel colors which display well in video format; use fonts larger than 18 points; and plan your images to be within the “safe area” for video so that the images are not cut off.

**Reviewing Desktop Video Equipment**

You currently need more equipment than a standard Macintosh to support video applications. Starting with an economical Macintosh IIcx with at least four megabytes of RAM, an 80-megabyte hard disk, a color monitor, and a color video input/output card such as the Mass Microsystems ColorSpace II, you can use video from an external source (such as a video camera or laser videodisc player), and capture frames of video for use as graphic images.

However, without some form of video compression, this configuration and capacity of disk storage is not nearly enough to store even a minute of live video at full resolution. Until real-time video compression and decompression is provided (and there are several Macintosh compression products in the works as we write this), you will not be storing video in digital form in desktop computers, unless you use some of the proprietary Macintosh-based editing systems which are described later in this chapter, in the section on using the Macintosh in film and video studios.

Desktop applications for bringing video into the computer include the use of still video images, captured and digitized for use as a graphic image, and full-motion
video from one or more external sources displaying on the Macintosh. Applications for outgoing video include saving computer animation on videotape, overlaying text and graphics on full-motion video, and then saving the result on videotape.

Besides the software provided with video cards for displaying video in a window and for controlling laser videodisc players, you might use other applications with desktop video projects, such as Aldus FreeHand or Adobe Illustrator for creating graphics; LetraStudio (Letraset) for text effects; ImageStudio (Letraset) or Digital Darkroom (Silicon Beach Software/Aldus) for gray-scale image retouching; ColorStudio (Letraset), PixelPaint Professional (SuperMac), or PhotoShop (Adobe Systems) for color image painting and retouching; Super 3D (Silicon Beach Software/Aldus) for 3-D graphics; and MacroMind Director for animation and recording frame-by-frame.

Sometimes full-motion video is not necessary for an application, and in fact can be a burden if extra hardware is required to play the video. Multimedia projects designed to be used on a wide variety of Macintosh configurations can use still video images, captured from a video source such as a videocassette recorder (VCR), laser videodisc player, or camcorder.

**Using Camcorders and VCRs**

Video is recorded onto videotape using either a video camera/recorder, called a camcorder, to capture scenes from real life, or a videocassette recorder (VCR) for recording video off the airwaves, off cable, or off satellite. Consumer videocassette recorders (VCRs) are adequate for playing video to be captured by a frame grabber (described later) or video digitizer but are not useful for interactive video projects because the tape speed is too slow for random access.

Camcorders can be used for capturing raw video footage, which can be edited into a video clip. Single frames of raw footage can be captured and used as images for a presentation. The type of camcorder you choose depends on a variety of factors, such as your taste for quality, your need for portability, and your budget.

Consumer-grade camcorders fall into two major categories: 8mm and VHS (including Super VHS). Generally, the 8mm camcorders are lighter, more compact, and easier to
use while traveling. The VHS and Super VHS camcorders are usually larger and record onto VHS-format videocassettes that can be played in consumer-grade VHS-format VCRs. Both types of camcorder formats offer low-priced, medium-range, and professional models.

Features to look for in consumer-grade camcorders include a power zoom lens, multiple-speed shutter, flying erase head, rechargeable battery, and the capability to connect to a TV for playback. NTSC video output is necessary for connecting a camcorder to most frame grabbers and digitizers, although some frame grabbers (notably the RasterOps TrueCapture 324 card) offer S-Video connection.

Professional models should include SMPTE time code, which is the standard method of identifying video frames when editing video in order to synchronize music to video. SMPTE time code is recorded directly on the tape so that the tape can be used with editing decks.

The Sony CCD-TR5 8mm Camcorder is currently the smallest and lightest camcorder (just over 2 pounds with battery), and its picture quality is excellent for a consumer model. Sony offers a professional version of this camcorder that includes SMPTE time code.

**Using Laser Videodisc Players**

Video can be prerecorded and mastered onto laser videodiscs and then played on videodisc players. The major benefit of producing interactive video is that the speed of a laser videodisc is fast enough for random access. For example, the seek time (the time it takes to find any single frame of video on the disc) of a Pioneer LD-V 4200 is about 3 seconds, and higher-performance models, such as the LD-V 8000, can seek as fast as 0.5 seconds.

Laser videodiscs encoded in the standard LaserVision format can be played on players from Pioneer, Sony, Mitsubishi, and other manufacturers that support the LaserVision format. Commercial discs are encoded in the LaserVision format. Discs in proprietary formats can be played only on players designed to handle the particular format and are not useful in desktop video applications.
There are two recording formats of standard laser videodiscs: CAV (constant angular velocity) and CLV (constant linear velocity). Currently only CAV discs are useful in interactive media projects, because you can start and stop on any frame and freeze on a single frame as well as step slowly through a video frame-by-frame. CAV discs can hold up to 30 minutes of full-motion video on each side. Some players can play CAV discs backward and forward and in slow motion. CLV discs can store up to 60 minutes of full-motion video on each side but are not as accurate for stopping on a single frame or for playing in slow motion.

Laser videodisc players are not equal in features. “Level 1” players, such as the Pioneer LD-V 2000, are primarily for viewing video in sequence, not for playing interactive video. “Level 2” players have built-in intelligence for playing interactive video controlled by remote keypads, but the built-in intelligence is not useful for computer-controlled presentations and simply adds to the price tag. “Level 3” players, such as the Pioneer LD-V 4200 and 8000 and the Sony LDP 1200, have one very important distinguishing feature: an RS-232 connector for connecting the device to a computer. Thus, only “Level 3” players are useful for interactive video.

The resolution of the display from a laser videodisc player should be close to 400 horizontal lines. Some players offer multi-speed play capabilities, which can be useful if the software you are using supports it—you then can create buttons for playing the video clips in slow motion, or faster than usual, both forward and backward.

“Level 3” players are not usually sold in consumer audio and video equipment retail stores. The Voyager Company offers the “Level 3” Pioneer and Sony models, along with the special RS-232 videodisc player to Macintosh cable. Be sure to get the right cable for the player—some players use 15-pin connectors, and some use 25-pin connectors.

Laser videodisc players are controlled by a set of commands that can be generated from Macintosh software such as HyperCard or MacroMind Director (or any other authoring program that supports the control of laser videodisc players). This command set is usually in ASCII form so that the commands are readable and understandable. Be sure to select a player that uses an ASCII command set and one that is supported by the software you intend to use for authoring. For example, MacroMind Director provides XObjects for controlling the Pioneer LD-V 4200 and 8000 players and the Sony LDP 1200. Features such as character generator and overlay are convenient if you do not intend to use a genlocking card to use text and graphics created on the Macintosh; otherwise, you probably won’t use those features because Macintosh software can create better-looking text and graphics.
Capturing Still Images

A still video image is similar in format to a scanned gray-scale or color image and can be edited and retouched just like a scanned photo using image editing software such as Digital Darkroom (Silicon Beach Software/Aldus) and ImageStudio (Letraset), although a video image is usually lower in resolution than a scanned photo.

A video digitizer is used to capture video images from a video source. You can get considerable mileage today with a simple device such as the MacVision (Koala Technologies) video digitizer, which captures black-and-white images with 256 levels of gray from any NTSC source. You can mount a video camera on a sturdy tripod, capture an image in 640 by 480 pixel resolution, and colorize it in a paint program or in MacroMind Director (see fig. 13.3). In particular, we like MacVision’s capability to save in different formats, including the space-saving RIFF (Raster Image File Format) for use with Letraset’s ImageStudio.

However, MacVision’s capture speed is very slow (about one frame per second). If you try to scan an image using a consumer VCR with an ordinary pause button (which typically cycles through several frames rather than freezing on a single frame), you can get blurry images that are unusable. Digitizers like the MacVision product are designed to be used with hand-held video cameras mounted on a tripod so that they remain steady during the image capture operation. Pixelogic offers an external video digitizer, the ProViz, that can capture 24-bit color images from an RGB video source in 45-60 seconds; but again, this is too slow for a conventional VCR pause button—it is designed to be used with an RGB still camera or camcorder mounted on a tripod.

A frame grabber can “grab frames” of video at the speed of video (30 frames per second) and display each frame on the Macintosh screen, although the display may not be as fast as the speed of video. For example, the TrueCapture Frame Grabber (RasterOps) can capture frames as 24-bit images in 1/30th of a second—fast enough for any standard video signal without the need for pause (see fig. 13.4). Products that offer full-motion video in a window and frame-grabbing are described later.

The TrueCapture card accepts a video signal as separate RGB signals or a composite NTSC or PAL video signal. It also accepts an S-Video signal (composed of encoded luminance and chrominance signals), which is not as sharp as RGB but sharper than NTSC. The TrueCapture card offers a comb filter for NTSC input that reduces cross-color interference and improves resolution, especially with color images that include flesh tones, scenery, or vertical lines (it has no effect on black-and-white images).
Fig. 13.3. These images were captured with the gray-scale MacVision video digitizer using a video camera and colorized in MacroMind Director by Stuart Sharpe.
Fig. 13.4. Using the TrueCapture frame grabber (RasterOps) to capture, at 30 frames per second, single frames for use as digitized images in graphics programs and multimedia presentations.
TrueCapture captures an image in its own RAM and then transfers the image to the computer's display RAM. The size of the image depends on the signal (NTSC or PAL) and the size of the display rectangle which you can specify with the software. You also can crop an image after it is captured.

After the image is captured and placed in the Clipboard, it can be used by applications that access the Clipboard. For example, you can paste the image into a 24-bit graphics retouching program such as Letraset's ColorStudio, Avalon's PhotoMac, or Adobe PhotoShop.

A frame grabber usually contains enough RAM (about 1.5 megabytes) to store a single NTSC video image, or three megabytes to store a PAL image, using 24 bits per pixel. You can display the images using a 24-bit color graphics adapter. The TrueCapture Frame Grabber is designed to be used with the RasterOps 24-bit video cards (the ColorBoard 64 or 104). You also can use the frame grabber with the standard Apple Color Card (eight-bit) or a compatible eight-bit color video card and store images with eight bits per pixel.

Frame grabbers can display video frames on the Macintosh screen but usually not as fast as they can capture the frames, so they cannot display live full-motion video at 30 frames per second. Essentially, the NuBus bus inside the Macintosh II models is not fast enough to transfer 30 frames of video per second to the display RAM at full size in 24-bit mode. However, these frame grabbers can be used to display a video "slide show" (at a rate slower than 30 frames per second) and to capture still video images with high-quality results for use with graphics, presentation, or publishing programs.

The capability to grab frames to save as images also is included as a feature in products that can display full-motion video in a window on the Macintosh screen—at 30 frames per second. These video products are described later.

When video compression and decompression are offered with frame grabbers, you will be able to store full-motion video on disk and edit video sequences with a standard Macintosh configuration equipped with such frame grabbers.

**Controlling External Video Devices**

One straightforward way to add prerecorded full-motion video to a multimedia presentation is to use an external display monitor for the video portion of the presentation, connected
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To explore a specific body region, click on the figure to the left.
Return to the INDEX at any time by clicking on the Electric Cadaver icon in the top left corner.

Within the body, click on symbols:
- to rotate
- to zoom in
- to zoom out
- to display and hide labels
- to display and hide x-rays

Fig. 13.5. The Electric Cadaver project at Stanford University uses HyperCard to display a graphic representation of human anatomy synchronized to video clips of surgical procedures shown on a separate monitor.
directly to the video source device (usually a laser videodisc player), which is controlled from the Macintosh using special external commands in HyperCard or MacroMind Director. Steven Freedman used this method for the Electric Cadaver project at Stanford University, which is a HyperCard stack displaying a graphic representation of human anatomy on the Macintosh screen (see fig. 13.5) while simultaneously showing a video clip of a surgical procedure on another display monitor.

The Hyper Switcher (VENT) is a control unit for connecting up to four video input devices, such as camcorders, VCRs, and videodisc players, and two video output devices, such as display monitors, VCRs, or other video recording devices. VENT offers software for controlling these devices from a Macintosh, so that you can run a dual-display presentation with commands in "real time," as a performance, or by writing a script that executes a performance.

When equipped with one of the video input and output adapters described in the next section, a Macintosh can function as a video input or output device and connect to this unit.

VidClip (ATB Video Consultants) is a set of HyperCard external commands and a custom cable for controlling one or two consumer VCRs or camcorders that use the Control-L and Control-S remote control commands. The VidClip VideoTape Control Toolkit for HyperCard (APDA) provides external commands to control Sony consumer videotape players. It requires the use of a Control-L5-pin DIN remote control jack with a Sony video player. The toolkit is compatible with other videodisc toolkits available from APDA, so that you can mix videodisc and videotape control in a stack and provide more than one source for video.

MacroMind also offers external commands for its Lingo scripting language used in MacroMind Director, which are called XObjects. Some are used for controlling videodisc players such as the Pioneer 4200 and the Sony industrial players. With the external video XObjects, a multimedia presentation involving animation can be synchronized with a videodisc player.

The Voyager Company offers the Videodisc Accessory Series, a set of desk accessories that enable you to control a videodisc player while running any application. Besides still frame, search, slow, scan, fast forward, and reverse, the Videodisc Accessory Series provides the capability to overlay text (if the player supports it) and the capability to set and play repeating sequences, even in reverse. It works with the Pioneer 4200 and 4100, Pioneer 6000 Series, and all Sony industrial videodisc players.
The Voyager Company distributes a vast library of videodiscs including video images from the Voyager spacecraft's tour of the solar system, images from the National Gallery of Art, and complete movies. The Voyager Company also distributes Laserstacks, which are HyperCard-based products that include videodiscs and interactive stacks.

**Displaying External Video in a Window**

There are several hardware products currently available that can display full-motion and live video in a window on the same Macintosh display as your software. The applications for full-motion video on the same screen as software can be as simple as watching TV while working or as complex as integrating video with a multimedia presentation or overlaying text and graphics on a video image and recording the result onto videotape.

One popular application of full-motion video, with products such as RadiusTV, is business television. For example, stock traders can simultaneously display the latest stock information and a live feed from the Financial News Network on the same screen. Media watchers can display a live newscast with closed caption text and record the captions in a transcript file.

Other applications include desktop publishing and presentations, because most of these full-motion video products offer image capture and processing capabilities. Newspapers and magazines can capture video images for publication. Interactive training applications can be developed with laser videodisc players that display in a window on the Macintosh screen.

MicroTV (Aapps Corp.) displays live or prerecorded video in a window on the Macintosh screen. The MicroTV adapters for the Macintosh II and SE models include a television tuner and a digitizer that operates at the real-time speed of 30 frames per second, providing full-motion black-and-white TV in a fixed-size window on the screen.

Each card is actually a "cable-ready" TV that requires only an antenna or cable hook-up to receive TV signals. Although the SE version shows only black-and-white video, the Mac II version shows 128 different shades of gray. The TV window is 128 by 108 pixels (approximately 1.5 by 1.25 inches). The cards offer direct and composite video
input connectors and an output audio jack, as well as internal speakers (it does not use the Macintosh speaker). The software can select channels, has a timer for launching and selecting a channel, and runs under MultiFinder, enabling you to run applications while watching TV or full-motion video from any video source. MicroTV Professional provides a larger window (256 by 192 pixels) and the capability to capture a still video image for use in desktop publishing and presentations.

The MicroTV product is relatively inexpensive compared to other video solutions. A training center could outfit each Macintosh in a classroom with one card and wire the cards by coaxial cable to a video playing device, such as a videodisc or VCR, for viewing training videos side-by-side with software.

Frame grabbers are available that use special techniques to grab frames and deliver them to the Macintosh screen at speeds up to 30 frames per second, providing the capability to display live, full-motion video in a window on the Macintosh screen. With such products, it is easy to freeze one frame to capture a still image, but you also can integrate full-motion video with a multimedia presentation. For example, SCION offers the Image Capture Board that can digitize and display black-and-white video from an NTSC source at 30 frames per second on the Macintosh display. This is called real-time live video. However, the SCION board does not display or capture in color, only in 256 levels of gray.

There are some trade-offs with current products that provide full-motion video on a Macintosh screen. Although some video frame grabbers can provide up to 24 bits of color information per pixel (about 16.7 million colors), some products compromise on image size, or in color depth by providing only 8 bits (256 colors), in order to operate fast enough to display full-motion video (at 30 frames per second). Many of these cards are designed for video professionals and offer genlocking features for overlaying text and graphics onto video.

You can bring more than one video signal into the Macintosh and you can integrate all the functions of television with the Macintosh by using RadiusTV, a product that combines a video display card with an external audio and video input processor and television tuner.

RadiusTV displays full-motion video in 8-bit or 16-bit mode, and works with any NuBus video card that supports 16-bit display and block transfer of information. RadiusTV can be used with the standard Apple 13-inch color monitor controlled by
the Radius DirectColor/GX display controller. Radius offers two-page color display systems that are also compatible with RadiusTV.

RadiusTV consists of two hardware parts: the Audio/Video Input Processor (AVIP) is a separate component that prepares signals from the video source devices for display by the Video Engine Card, which can be installed in a NuBus expansion slot (such as the slots in Macintosh II models). Software supplied with RadiusTV includes RadiusTV Window, a desk accessory for displaying video in a window, and Theatrics, a program for viewing and capturing frames of video as images for use in other applications.

RadiusTV is capable of receiving live broadcasts over cable or a connected antenna using the AVIP built-in tuner. The AVIP also offers two NTSC composite video inputs and a set of RGB component video inputs for connecting camcorders, VTRs, VCRs, or laser videodisc players. It also offers two separate audio inputs. You can choose between video sources without recabling.

RadiusTV Window is as easy to use as a television (see fig. 13.6), providing controls for fine tuning, brightness and contrast, channel selection, hue and color, volume, and video source. The window can be located anywhere on the Macintosh screen and video can be displayed in the background while you use other applications. Closed caption text can be displayed and captured into a text file. Any two channels can be sampled while you watch a third channel. In addition, a video frame can be captured and saved in the Scrapbook.

Additional image capture and processing capabilities, such as automatic field alignment to improve picture quality, and tools to achieve special effects, are provided in the Theatrics program. Radius offers a developer’s toolkit of software interfaces for controlling the hardware, andMacroMind offers XObjects for controlling RadiusTV from within MacroMind Director.

Although it is more expensive than most other video frame grabbers, the NuVista card (Truevision) offers a full spate of video capture and display features with full 24-bit color images. By itself, the NuVista board can provide 32-bit color display with a variety of multiscanning monitors and capture RGB video in real time (10 frames per second, or one-third the normal speed of video). It uses a Texas Instruments TMS34010 graphics processor and 1, 2, or 4 megabytes of standard video memory, expandable to 12 megabytes.
Fig. 13.6. RadiusTV displays full-motion video in a window on the Macintosh screen, and combines a cable-ready television tuner with an external unit for connecting multiple video sources to the Macintosh. This desk accessory provides all the functions of a television including fine tuning, brightness and contrast control, and channel selection.

Although the standard NuVista board will work with the Apple Color Display, it is not recommended and will actually damage the monitor if your software tries to display full-motion video (by altering the scan rates). Multiscanning monitors with
analog RGB inputs and the capability to scan from 15 kHz to 35 kHz, therefore, are preferred (examples are the Sony CPD 1302 Multiscan monitor and the Electrohome ECM 1900 Series). The maximum resolution, in 32-bit display mode, is 1,024 by 1,024 pixels (at least four megabytes of video RAM is required for maximum resolution).

The NuVista is compatible with NTSC and PAL formats and can be connected directly to RGB cameras and studio equipment. By adding Truevision’s VIDI/O box, you can connect to consumer-grade NTSC and S-video source devices such as VCRs, handheld camcorders, and videodisc players. When capturing full-motion video at nearly full resolution (1,024 by 768 pixels) in 32-bit mode, you need at least three megabytes of disk space for each frame. Video images can be stored as PICT files and as eight-bit or 32-bit TIFF files.

Mass Microsystems provides plenty of video display features on one relatively inexpensive NuBus frame grabber and genlocking card, the ColorSpace II. Although it does not work with Apple’s Color Card, it can provide computer images to a non-interlaced RGB monitor and therefore could be used with a third-party monitor as your main Macintosh display; it also can work concurrently with the Apple Color Card and monitor if you use it to display on a second monitor. (You can then drag windows from the Apple monitor to the second monitor.) The card offers NTSC video input and output and a plug for an optional RGB monitor.

A newer version of this card, the ColorSpace III, can convert NTSC video signals into the higher rate needed to display the images on the 13-inch Apple Color Monitor and therefore can be used with that monitor. The ColorSpace III is the preferred card for Macintosh users who already own the Apple Color Monitor. The ColorSpace III offers all the features of the original ColorSpace II, plus the capability to display 24-bit color video at 30 frames per second.

Mass Microsystems also offers the ColorSpace FX full-motion video display card, which converts NTSC, PAL, and SECAM video signals into a flicker-free, 30 frames-per-second RGB signal. It offers special effects including zoom, mirror, and the capability to squeeze the picture, but it does not include a frame grabber (you use it in conjunction with the ColorSpace II or III).

Orange Micro offers the Personal Vision card, which can capture 8-, 16-, or 24-bit video images at 30 frames per second. The card accepts RGB and black-and-white NTSC video signals directly; you need another NTSC-to-RGB converter card to capture full color NTSC video. The Personal Vision card can display in any size window from 128 by 80 pixels to 645 by 484 pixels and provides zooming and panning features.
software can save video images in PICT2, color TIFF, Encapsulated PostScript, and MacPaint formats.

The Personal Vision card can display video on the Macintosh screen at 30 frames per second via direct connection to the Apple Color Card (bypassing the NuBus bus) or at 15 frames per second over the NuBus, which is half the speed of full-motion video but still useful for multimedia presentations.

BigTime TV (HyperPro) is a set of HyperCard external routines developed by HyperPro for controlling the Personal Vision card at 15 frames per second. The routines also can be used with the Mass Microsystems ColorSpace II and FX combination.

It is generally true that more expensive video cards, such as the Truevision NuVista card, provide higher quality signal processing than the less expensive cards. One major trend is toward fitting as many features as possible on one card while lowering the cost of manufacturing, but the results are usually lower than broadcast video standards. In an age where the NTSC standard for composite video is being challenged by High Definition TV and other specifications, we can only expect major changes in card pricing and quality over the next few years.

**Overlaying Text and Graphics**

One important application of desktop video is the capability to overlay text (such as titles) and graphics (particularly animation) onto the video signal, effectively mixing the two media. This process also is called *compositing*. The output of this process could be displayed on a separate video monitor or on the Macintosh monitor, depending on which display card you use, or recorded onto videotape through the use of a video output feature of the display card or a separate video input/output box. The process requires the genlocking feature to synchronize the computer and video signals.

The NuVista card, described earlier, offers genlocking so that you can overlay graphics on full-motion video, or overlay full-motion video on a graphic image as a background. With the VIDI/O box you can record onto videotape full-motion or frame-by-frame animation prepared by a program such as MacroMind Director.
MacroMind also offers an XObject with Director that can perform effects with the video image provided from a Mass Microsystems ColorSpace IIi card, including the capability to synchronize an interactive animated presentation with video. The ColorSpace II or III can genlock to a standard full color video signal and overlay graphics and text for titling. The result can be output as high-quality RGB video, or composite NTSC or PAL video. When the board is genlocked to an external signal, it provides a sharp and stable NTSC signal with minimal interface flicker. It also can digitize a full-color picture in one second (at 640 by 480 pixel resolution).

Besides these video input and output adapters, a host of products from different companies offer genlocking for use with video output units for recording onto videotape. RasterOps offers an NTSC video genlocking board with 24-bit color that works with the ColorBoard 24L display card. Computer Friends offers TV Producer, a genlock card that requires the Apple Color Card in the NuBus slot next to it (the card connects to the Apple Color Card directly). When combining a video signal with the Macintosh display signal, you can define the key color to display the video signal through the Macintosh signal.

Macintosh Plus and SE computers can be outfitted with the ColorSpace Plus/SE, a SCSI device that enables you to overlay Macintosh graphics on an NTSC or S-Video signal from an external video source. With special keying technology, the ColorSpace Plus/SE replaces black, white, and the desktop’s original gray pattern of black and white, with three colors out of a possible 256 colors. The features are adequate for creating color titles, simple graphics, and text and overlaying them on video. The device incorporates a proprietary adaptive vertical filter, which reduces the flickering that may happen with thin lines and especially with text. Two NTSC and two S-Video sources can be connected to it for display on a composite monitor.

Julian Systems offers the Genlock Converter, which also connects to the Apple Color Card and must be inserted in the slot next to it. Unlike the TV Producer and ColorSpace cards, the Julian Genlock Converter offers the capability to input a key signal that can be provided by video switchers, chroma keyers, or special-effects cards before feeding the video signal to the Converter. The Converter is designed for use with professional video equipment because it uses BNC connectors rather than consumer-type RCA connectors. Rather than using a key color for keying, the Julian Genlock Converter uses brightness, so that very bright or very dark areas of the image can be made transparent to the external video (black or white should be used in the graphics where the video signal should appear).
Video input/output conversion cards and boxes vary in features and price; the least expensive units convert the Macintosh signal into composite video before synchronizing and combining it with the video signal. Products such as the ColorSpace III transform the incoming composite signals into separate RGB components so that you can adjust them separately before mixing them with the Macintosh signal. This capability is important to professional video producers who are making industrial or broadcast-quality videos with overlayed animation and text.

**Using the Macintosh in Film and Video Studios**

A Macintosh can be useful in virtually all of the stages of film and video production, including the pre-production and post-production steps. It is even possible to use a Macintosh to control the editing of video and film in digital form and create the master tape or film.

Professional video systems and the conventional dedicated computers used in the editing room do not use a visual metaphor—they are mostly text screens with numbers for cut-in and cut-out points. The Macintosh can at least provide a visual metaphor for these types of control applications, and with some configurations and software products, the Macintosh can go a step further into production by actually displaying digitized video sequences for editing.

**Managing Pre-Production**

All film or video projects start with a pre-production phase, during which the producer must nail down a “show idea” for the project and establish the goals of the project, before hiring the talent and starting actual production. In most cases, this phase includes budgeting the entire production effort, outlining the project, choosing formats, describing segments, deciding how to build the set, deciding on special graphics and equipment, and establishing the dates and times for taping or filming. Finally the producer must secure a director and a writer for the script, and the writer must produce a first draft of the script.
Nearly all of these tasks can be aided by the use of business and word processing software on a Macintosh, and there are programs expressly designed for some of these tasks, such as budgeting. Screenplay Systems, for example, offers Movie Magic Budgeting and Scriptor, which provide facilities for budgeting and script writing that are compatible with Microsoft Word and with another Screenplay Systems product, Movie Magic Scheduling. These products are designed for entering any and all expenses you can conceive for a video or film project and consolidating them into a budget.

MacToolkit (Max3) provides budgeting and scheduling features, including a labor guide on disk that includes the union labor rates, so that the producer can include the rates for various union employees and Screen Guild actors in the budget.

Although word processors can be used for writing screenplays and scripts, most of them are too cumbersome for editing dual-column audio video scripts. In such scripts, the writer starts by writing the audio portion scene-by-scene in the double-spaced right column then fills in the video portion in the single-spaced left column. ScriptWriter (American Intellware Corp.) handles this formatting task, and a companion program called Storyboarder enables you to combine a series of drawings with text to depict the important scenes. Max3 also offers CineWriter for writing screenplays and scripts.

The use of animated storyboards may come during this phase or at the beginning of the actual production phase. The production phase includes creating the set and graphics, arranging studio time, equipment, and crew and preparing the shooting script and details of specific shots. It is during this crucial phase when expenditures can skyrocket and shots can be wasted. The post-production phase includes editing, audio overdubbing, and duplication.

In the production of the movie Star Trek V, animated storyboards were used to conceptualize some of the scenes that would involve the creation of models and the use of special effects (see fig. 1.2 in Chapter 1). “Some pre-visualization and pre-planning can avoid a lot of pitfalls that you would find if you just went ahead and built the models and executed the shots,” explained Lynda Weinman, developer of the animated storyboards (which were created with the precursor to MacroMind Director, VideoWorks). “(The animated storyboards) help show the continuity and whether you have the right number of shots to tell the story. You can show it to
someone as a sequence rather than as individual panels. The producer used a
Macintosh II to show the animated storyboards to the director and artists, so it was
easy to stop on a frame and view a particular sequence over and over. The resolution
of the screen is so much better (for this type of application) than the resolution of
videotape." Lynda Weinman also used Swivel 3D to draw the three-dimensional
graphic models used in the animation.

Editing Video and Film

In video production, editing is the process of creating a master tape by taking
segments from the work prints and compiling a final edit decision list that details the
sequence of scenes, cuts, and effects. The Macintosh can be an excellent tool in this
phase, providing a visual interface and direct access to video frames with exact time
codes. Film editing involves physically cutting and re-assembling shots by splicing the
pieces of film. The problems of dealing with hundreds of pieces of film can be
managed by viewing shots on the Macintosh screen, and you can have instant access
to any part of a film by clicking on a time line.

Videotape decks are inherently sequential-access devices, and even fast decks can
take minutes to get to a desired location. With tape decks, the master tape must be
made in a linear fashion because video material cannot be added or removed.

Two different approaches are used with new Macintosh-based editing systems that
also vary considerably in the packaging and price—the under $10,000 Midas I and
under $15,000 Midas II desktop production systems (Seehorn Technologies, distrib-
uted by Julian Systems) for high-performance Macintosh II models, and the Avid/1
Media Composer system (Avid Technologies), which includes a Macintosh IIx and
disk storage, for over $58,000.

The Midas I system offers budgeting and scripting features, and the capability to
create a storyboard using an image catalog and two Macintosh-controlled VTRs, as
well as editing functions. Midas can run on a standard Macintosh II with at least two
megabytes of RAM (four are recommended) and a 40-megabyte or higher capacity
hard disk. It can drive nearly every type of video recorder and can be used to directly
edit master tapes as a conventional edit controller.
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The Midas frame grabber stores black-and-white stills of the first and last frames of a sequence, with time codes to match the edit points. You can create a “paper cut” and a “first cut” with the basic system and upgrade to the Midas II system for creating final cuts. The system can produce a final edit decision list that is compatible with the CMX standard for broadcast-quality professional editing equipment.

Avid/1 Media Composer is a complete Macintosh IIx-based video editing system with two color monitors and up to 4.2 gigabytes of hard disk storage. The system digitizes video at 30 frames per second and stores it on the hard disk so that you can edit exactly frame-by-frame. The video is compressed by a factor of 75 to 1, which reduces image quality but still provides sufficient detail for editing. Audio is captured at CD-quality sampling rates so that it can be provided directly from the system. A one-disk system can hold about 16 minutes of video with CD-quality audio; a seven-disk system can hold over 2 hours.

With the raw footage on disk, you can build video sequences, rearrange and trim frames from any part of the entire show, and see the results immediately. The Avid/1 system captures time codes from tape while digitizing, and when you finish editing, the system can build a broadcast-quality master tape directly from your source tapes. You also can output a CMX-compatible edit decision list to floppy disk for creating the master with other equipment.

The primary benefit of the Avid/1 system is that you can assemble a rough cut and continue to edit and fine-tune the sequences without having to duplicate or transfer the footage to other formats or media, and the program length expands or contracts according to your edits. You have instant access to any part of the show by clicking on the time line, and the time codes are accurate. A log is automatically generated that can show the first frame of each shot, or the first and last frames, or all frames.

Film editing also can be enhanced by using the Avid/1. Clips are stored and listed as items in a “bin,” and you can view them simply by dragging them with the mouse into the viewing window. The clips can be listed by name and catalogued in “image mode” so that you can view the first frame or keyframe of every clip. When you start a sequence you can see it instantly, at the speed of the audio, without having to wait for the equipment to get up to speed. The audio can be played back even when you are inching forward or backward through a sequence.
Although the digital images are not suitable for broadcast-quality video, the control over the editing process is superb, and the quality of the final product is not compromised in any way. The digital audio portion is higher in quality than conventional flatbed editing machines. You can present a variety of different sequences of the same footage to a client and spend less time shuffling from one take to another. Although the system can be used for final production, advertising executive Peter Farago uses it for storyboards because “we don’t waste time, and we get the message across. We can then pass it on to production.” According to Thomas Ohanian, a professional online editor, “The flexibility and the options that the Avid/1 gives an editor will enable you to approach the edit differently and, I believe, in ways in which most of us have always wanted to work.”

As desktop technology for video production matures, more service bureaus for video production will come into existence to serve the emerging market of desktop video producers. Companies already exist that rent editing rooms for on-line editing (direct to master tapes) and off-line editing (rough cuts). The costs, however, are quite high when renting laser videodiscs and sophisticated edit controllers for non-linear, random-style access and on-line editing—from $300 to over $500 an hour. It is in this area that systems like the Avid/1 will dramatically reduce costs.

The MicroTV card from Aapps, when combined with Screen Play from VENT, are a glimpse of the video offerings to come. Screen Play enables you to reorganize video clips digitized at 5 to 10 frames per second and can create a video editing decision list to control consumer recording decks in pseudo-time code (accurate to about 10 frames per second). We expect future offerings to be supported by software that would make it easy for any of us to edit and assemble “video mail” and even medium-quality video productions using only a camcorder, a Macintosh, and VCRs to play prerecorded segments and to record the result.

**Chapter Summary**

Video is an effective medium in many applications, including business communication, entertainment, art, training, and education. You can use prerecorded video in your presentations, record your computer presentation onto videotape for use with consumer VCRs, or record the presentation onto high-quality videotape for use with industrial or commercial videos.
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The NTSC format is used in the United States and Japan and differs significantly from the video signals used in other countries such as PAL, used in Great Britain, other European countries, and Australia, and SECAM, used in France, USSR, East Germany, and the Middle East countries.

The simplest way to add prerecorded full-motion video to a multimedia presentation is to use an external display monitor connected to a video source device controlled from the Macintosh using external commands in HyperCard or MacroMind Director.

A video signal can be brought into the Macintosh and displayed in a window on-screen or on a separate display. You can overlay graphics and text on a video signal and save the result onto videotape. A single frame of video can be frozen as a still image for use in presentations and publishing projects.

A video digitizer is used to capture video images from a video source. A frame grabber can "grab frames" of video at the speed of video (30 frames per second) and display each frame. A still video image is similar to a scanned gray-scale or color image and can be edited and retouched just like a scanned photo using image editing software.

A feature known as genlocking is required to overlay, for example, a computer image or text on top of a video signal. Keying is the capability to make a portion of a video signal transparent so that you can see another signal when genlocking.

Although you can record animation on videotape in real time, most applications call for faster animation or more control over the animation, and so the recording must be done frame-by-frame.

There are a number of rules to remember when designing graphics and text for recording to videotape. Lines that are an even number of pixels thick usually do not flicker, but some horizontal lines and text may flicker. You can reduce the contrast at the edges or use a technique called anti-aliasing, which adds or subtracts pixels at high-contrast edges to soften or blur the edges. When creating images that will eventually be shown in NTSC video, leave at least 15% of the full screen on each edge blank.

Professional-quality video is an expensive medium in which to produce, and the costs rise dramatically if you want to do special effects such as overlaying graphics or text on top of the video image. This is where desktop video technology provides the greatest benefit: in the use of computer graphics that can be saved on videotape.
A Macintosh can be useful in virtually all of the stages of film and video production, including the pre-production and post-production steps. It is even possible to use a Macintosh to control the editing of video and film in digital form and create the master tape or film. Future desktop video products will offer similar features for editing video presentations using consumer-priced camcorders and VCRs, and the software will make it easy for anyone to make a video.
Looking into Future Media

The Future is Fun!
The Future is Fair!
You may already have won!
You may already BE there!

—The Firesign Theatre, *I Think We're All Bozos on This Bus*

You are watching a movie of driving down a street in Aspen, Colorado, but it also is a map of Aspen. You are using the map as a way to choose which way to drive, but it also is a movie in which you see the street and buildings and other cars. You can drive down any street, turn any corner, change the season from summer to winter, look behind you, in front, or side-to-side, stop and turn toward the entrance to a building, and walk into the building. Everything you see is a film clip, but it is not simply a movie: from start to finish, you are in control.

As described in Stewart Brand's book, *The Media Lab* (Viking Penguin), the Aspen Movie Map is an example of interactive multimedia. The map and film clips were not just selections of Aspen, but the entire town, including the insides of many buildings and restaurants (including menus). Brand writes about the public reaction to this project: "Aspen' shook people... For the first time the viewer could be thought of as an animal instead of a vegetable, active and curious instead of passive and critical."

Produced more than 10 years ago by the Architecture Machine Group at MIT (funded by the Defense Department's Advance Research Projects Agency), the Aspen Movie Map was the first major demonstration of using video in an interactive way to provide a learning experience that far surpasses the experience of imagining the streets by reading maps or watching a movie in which you have no control. We are rapidly closing the gap between the promise of interactive video exhibited by this laboratory project and the reality of a consumer market for desktop video projects. As with desktop publishing, the business applications are leading the way.
All indications for the future are that television-quality video and high-quality sound will be integrated with everyday computing activities. Indeed, the computer can already play a live video image, with sound, in a window next to an application. The next step in this evolutionary process will be the introduction of desktop video editing equipment designed for small business and home use.

However, there remains an important question about how this technology will affect the quality standards of the medium. Desktop publishing tools were at first considered to be only for graphic arts and publishing professionals because special skills are required to create well-designed publications. But this characterization proved to be one-sided. Desktop publishing may have lowered the standards of high-resolution typesetting as it lowered the required resolution to that of laser printers, but it also raised the possibility that a wider variety of content would have that “published” look. Desktop publishing moved into the mainstream and attracted anyone who could afford a laser printer, and the results are better communications within corporations, more effective marketing campaigns, a wider variety of publications, and a victory for freedom of the press even under totalitarian regimes.

Since the invention of the printing press, it has been obvious that the technology of the communications media has had a tremendous impact on society. Television has completely changed the electoral process in this country, providing viewers on the West Coast with early voter returns that may influence them before they vote, and providing candidates with an extremely effective medium for advancing propaganda and false characterizations. Television also has changed the way we experience natural disasters—nearly everyone in the country tuned to the World Series found out that San Francisco had suffered a devastating quake, even before residents of the Bay Area and California knew what was happening.

To those who say, however, that television, radio, and video technology have put too much power in the hands of government, the successful dissidents in Eastern Europe would point out that these technologies, having evolved to become desktop tools, were the decisive factors in their victories. For example, Robert Manchin, a Hungarian sociologist, became a desktop publisher with information he recorded in the Hungarian Parliament and circulated over 70,000 copies of his publication, Orszaggyulesi Tudositasok, in the months before the great reform movement.

Television may be useful for advancing political propaganda, but it is far more effective at pleasing its viewers with reruns of “I Love Lucy.” In nearly every Eastern
European country that successfully revolted against totalitarianism, the people were demanding freedom and tuning into Western broadcasts, looking for variety and entertainment.

Desktop video and audio production will someday force a major change in the power structure of broadcasting, but in today's commercial and professional studios, desktop video and audio tools are used mostly for prototyping and management, not for actual production. Desktop technology can be useful for professionals in the studio, but it is not yet high enough in quality to replace professional equipment. It took several years for professional typographers and graphic artists to start using desktop publishing tools for commercial publications; it will take even longer for professional audio and video specialists to sanction the use of desktop tools for their projects.

Those who think that video and audio production are best left to the professionals who have the skills are missing the point that desktop video and audio is mostly having an impact in the world of amateurs. Desktop audio and video production are extremely attractive to cost-cutting, security-conscious, and time-pressed businesses and training departments of large corporations. Like desktop publishing, desktop audio and video opens new vistas of opportunity for smaller businesses who could not afford the cost of professional-quality production. The technology also is enriched with design aids and prolific examples that serve as templates for integrating audio and video with interactive multimedia applications. Even though some of the capabilities, such as playing live video side-by-side with software windows on the same monitor, currently offer uneven quality at best, the capabilities by themselves are such a major leap forward that a large segment of early adopters are ready for it.

Multimedia business presentation is currently the fastest growing and largest category of personal computer applications. Desktop computers are already used in corporations to produce slide presentations, and many are used to present the slide presentations as well. The number of "electronic frames" (slides displayed on the computer rather than on slide projectors) will jump from 17 million in 1987 to 232 million in 1992 (according to Desktop Presentations, Inc.). Compared to the number of photographic slides produced on the desktop (111 million in 1987 rising to 296 million in 1992), electronic frames are rising much faster, and the addition of video and sound will make electronic presentations an even more attractive choice.

The immediate future of desktop video is real-time compression and decompression of digitally stored video, most likely based on the Joint Photographic Experts Group
(JPEG) standard proposed by the CCITT/ISO international standards committees. The first VLSI (single-chip) image compression processor based on the JPEG standard was announced recently by C-Cube Microsystems of San Jose, California. The processor compresses still images or motion video by at least a factor of 20 without visible degradation in quality (although some information is subtracted, the degradation is not visible under normal circumstances). It can compress an image for the screen with optimal results at up to 10:1 ratios, and a higher resolution image for printing at up to 25:1. The compression ratio can vary under programming control. The processor can compress or decompress a 24-bit color image in less than a second, and full-motion video at real time (30 frames per second).

For anyone who wants the capabilities for color publishing, photorealistic presentations, and full-motion video, the JPEG standard is good news. We desperately need compression to store images on disks and to pull them through the bottlenecks of networks. Defined by the same umbrella organizations (the CCITT/ISO) that brought us into the fax age and gave us Ethernet, JPEG promises to be an open standard for international data exchange and an impetus to the growth of new technology.

In addition, high-speed, broadband networks must be introduced for exchanging video information between computers. When these obstacles are overcome in the labs, there must be breakthroughs in manufacturing to lower the costs of these components and increase the quality of the video image. Pulling all these developments together will be a desktop media control architecture consisting of multimedia protocols that will enable applications to be developed that are completely compatible with each other in exchanging video and audio information.

Interactive video on the desktop will have an impact not just on presentations and training but also on publishing, graphic arts, network management, telecommunications, and database access applications.

Apple has recently proposed a document architecture and set of system resources, called QuickTime, that provides time-based actions and a way to store various types of multimedia information—text, graphics, sound, animation, and eventually full-motion video. Next year, Apple hopes to implement QuickTime so that all Macintosh applications can take advantage of system resources for manipulating multimedia information.

Word processing, the most popular activity in personal computing, will be changed radically by sound and video information. You will be listening to voice-annotated
documents and be using dictionaries that look up words you have spoken phonetically. You will be able to quickly prepare videos of yourselves to send to others, perhaps by looking at a combination display/lens unit attached to your computers and choosing a menu item to prepare “videomail.”

Personal and professional communication by video and by computer will be as radical a change for the business world as data processing itself. If the success of word processing and desktop publishing is any indication of how communication can be improved, the use of audio and video as part of communication will at first require some skill but eventually will be practiced by everyone in business using automatic tools.

The possibilities are endless if the computer industry can adapt to the mass market. The consumer may eventually get talking books, paperback movies, animated greeting cards, and the capability to make and distribute personal cartoons.

One of the factors of the rapid political restructuring of Eastern Europe was the effect of allowing new media technology to be available—specifically radio, television, and desktop publishing. The battle cry for freedom of the press has already changed to freedom of the airwaves and freedom of information access. Personal video is the next catalyst for social change, because it has the potential to break down the barrier between the creative artists and communicators and those who control the methods of production and distribution. Personal computers started the ball rolling in 1980. In another decade, we will probably look back fondly on today’s desktop multimedia equipment and consider it quite primitive but certainly a major step in the evolution of media.
Appendix

Vendors: Toolkits, Programs, and Systems

This appendix of vendors and products lists companies in alphabetical order. If you want to find a company or product and you know only the product name, look up the product using the Index at the back of this book. Go to the index-referenced page to find the company name in the text, and then use this appendix to find the company listing.

3-M Corporation:
Videodisc preproduction and manufacturing
Bldg. 223-5S, 3M Center
St. Paul, MN 55144-1000
(612) 736-4520

Aapps Corp.:
MicroTV (SE version), $295
MicroTV (II version), $395
MicroTV Professional, $595
756 N. Pastoria Avenue
Sunnyvale, CA 94086
(408) 735-8550

Abbott Systems:
CanOpener, $125
62 Mountain Road
Pleasantville, NY 10570
(914) 747-3116

Addtech Computer Systems:
Addtech Film Recorder, $5,295
601 Magnetic Drive, Unit 5
Downsview, ON M3J 3J2, Canada
(416) 736-7007

Adobe Systems:
Adobe Illustrator 88 (1.9.3), $495
Adobe Photoshop, $895
Adobe Streamline, $395
Adobe Type Manager, $99 (Font package: $198)
1585 Charleston Road
PO Box 7900
Mountain View, CA 94039-7900
(415) 961-4400

Agfa Compugraphic
9400 Imagesetter, approx. $45,000
200 Ballardvale Street
Wilmington, MA 01887
(508) 658-5600

Agfa Matrix:
ProColor, $6,495
SlideWriter, $11,795
One Ramland Road
Orangeburg, NY 10962
(914) 365-0190 or (800) 876-7543
Aldus Corp.:  
FreeHand 2.02, $495  
PageMaker 4.0, $795  
Persuasion, $495  
PrePrint, $495  
411 1st Avenue South #200  
Seattle, WA 98104  
(206) 622-5500

Alladin Systems:  
StuffIt Deluxe, $100 ($40 upgrade price for registered users of previous versions)  
Deer Park Center #25A-171  
Aptos, CA 95003-4723  
(408) 685-9175

Alisys:  
The Art Importer, $179  
Fontographer, $495  
720 Avenue F #109  
Plano, TX 75074  
(214) 424-4888

American Intelliware Corp.:  
ScriptWriter, $495  
Storyboarder, $495  
P.O. Box 6980  
Torrance, CA 90504  
(213) 533-4040

APDA:  
HyperCard CD Audio Toolkit, $75  
HyperCard Videodisc Toolkit, $40  
VidClip VideoTape Control Toolkit for HyperCard, $199  
(address: see Apple Computer)  
(800) 282-2732

Apple Computer, Inc.:  
AppleShare, $799 (AppleShare PC $149 per client node)  
CD ROM SC, $979 or $969 (depends on which SCSI cable is included)  
Display Card 4*8, $648  
Display Card 8*24, $899  
Display Card 4*8 GC, $1,999  
HyperCard, free (bundled) or $49 by itself  
ImageWriter II, $625  
LaserWriter II SC, $2,799  
LaserWriter IINT, $4,499  
LaserWriter IINTX, $5,999  
Macintosh Plus, $1,799  
Macintosh Portable, $4,799, w/40MB HD, $5,499  
Macintosh SE, $2,569  
Macintosh SE/30, $3,869  
Macintosh IIx, $5,269  
Macintosh IIcx, $4,669, w/40MB HD, $5,369, add 4MB RAM, $6,569  
Macintosh IIci, $4,269, w/40MB HD, $6,969, add 4MB RAM, $8,169  
Macintosh IIfx w/4MB RAM, $8,969, w/80MB HD, $9,869, w/120MB HD, $10,969, w/80MB HD and 4MB Parity RAM, $10,369  
MIDI Interface, $99  
Personal LaserWriter NT, approx. $3,300  
Personal LaserWriter SC, approx. $2,000  
Personal Modem, $309  
Apple Modem 2400, $499  
AppleFax Modem, $729  
Scanner, $1,799  
20525 Mariani Avenue  
Cupertino, CA 95014  
(408) 996-1010
Appendix: Vendors and Content Providers

Ashton-Tate:
  FullWrite Professional, $395
  20101 Hamilton Avenue
  Torrance, CA 90502
  (213) 329-8000

ATB Video Consultants:
  VidClip, $200
  83 Main Street
  Norfolk, MA 02056
  (508) 520-0199

Authorware, Inc.:
  Authorware Professional, approx. $8000
  8500 Normandale Lake Blvd., Ninth Floor
  Minneapolis, MN 55437
  (612) 921-8555

Avid Technology:
  Avid/1 Media Composer:
    base system w/Mac IIx and two monitors, $58,000
    w/ 4.2 gigabyte hard disk storage, $81,000
  3 Burlington Woods
  Burlington, MA 01803
  (617) 221-6789

Barney Scan Corp.:
  BarneyScan 35mm Slide Scanning System (CIS-3515), $9,495
  1125 Atlantic Avenue
  Alameda, CA 94501
  (415) 521-3388

Bright Star Technology:
  HyperAnimator, $150
  interFACE, $500
  14450 NE 29th Place #220
  Bellevue, WA 98007
  (206) 451-5697
  (206) 885-5446

Broderbund:
  TypeStyler, $199
  17 Paul Drive
  San Rafael, CA 94903
  (415) 492-3200

Caere Corp.:
  OmniPage, $795
  100 Cooper Court
  Los Gatos, CA 95030
  (408) 395-7000

Cambridge SoundWorks:
  Ensemble speaker system, $499
  154 California Street
  Newton, MA 02158
  (800) 252-4434

CE Software:
  DiskTop, $50
  1854 Fuller Road
  PO Box 65580
  Des Moines, IA 50265
  (515) 224-1995

Claris:
  MacDraw II (1.1), $399
  MacPaint 2.0, $125
  MacWrite II, $249
  5201 Patrick Henry Drive
  Santa Clara, CA 95052
  (408) 987-7000
  (408) 727-8227 (customer service)

Computer Friends:
  TV Producer NTSC card, $799
  TV Producer Pro Option, $999, with
  RGB, $1,500
  ColorSnap 32, $1,595
  14250 NW Science Park Drive
  Portland, OR 97227
  (503) 626-2291
Comstock, Inc.:
Desktop Photography:
Vol 1, $500
Vol 2 (Business Images), $195
30 Irving Place
New York, NY 10003
(212) 353-8600

CTA:
TextPert, $995
747 Third Avenue 3rd Floor
New York, NY 10017
(800) 252-1442
(800) 688-8596 (Canada)
(212) 955-2280

Custom Applications, Inc.:
Freedom of Press, $495
900 Technology Park Drive, Building 8
Billerica, MA 01821
(508) 607-8585

Deneba Software:
Spelling Coach Professional 3.1, $195
3305 NW 74th Avenue
Miami, FL 33122
(800) 622-6827
(305) 594-6965

Diaquest:
DQ-Animaq, $3,250 (broadcast model), $3,750 (desktop model)
1440 San Pablo Avenue
Berkeley, CA 94702
(415) 526-7167

Digidesign:
Audiomedia, $995
Deck, $549
1360 Willow Road, Suite 101
Menlo Park, CA 94025
(415) 327-8811

Dow Jones Software:
Desktop Express, $149
PO Box 300
Princeton, NJ 08543-0300
(609) 452-1511

Dukane:
MagniView 480, $2,199
2900 Dukane Drive
St. Charles, IL 60174
(312) 584-2300

Electronic Arts:
Deluxe Music Construction Set, $100
DeluxeRecorder, $199 (buy DeluxeRecorder and Deluxe Music Construction Set together for $199 for both)
Studio/1, $150
Studio/8 (1.0), $495
1820 Gateway Drive
San Mateo, CA 94404
(800) 245-4525
(415) 571-7171
(415) 572-ARTS (customer service)

Epson America
Epson Liquid Crystal Image Projector, $3,495
PO Box 1809
Lomita, CA 90717
(800) 782-5389

Farallon Computing:
MacRecorder 2.0 (with SoundEdit and HyperSound), $249
MediaTracks, $295
PhoneNet, $60 each node, regular config.
ScreenRecorder, $195
Timbuktu, $149
Timbuktu/Remote, $195
2000 Powell Street #600
Emeryville, CA 94608
(415) 596-9000
Appendix: Vendors and Content Providers

GCC: Personal LaserPrinter, $1699
580 Winter Street
Waltham, MA 02154
(617) 890-0880

Golden MIDI Music:
MIDI sequences, $10-$30 per sequence
330 E. 39th Street, #10A
New York, NY 10016
(212) 370-0474

Heizer Software:
RecordIt!, $49
PO Box 232019
Pleasant Hill, CA 94523
(800) 888-7667
(415) 943-7667

Hewlett-Packard:
DeskWriter, $1,195
PaintJet, $1,500
ScanJet, $1,990
ScanJet Plus, $2,190 (8-bit scanner)

Inquiries
13919 Pruneridge Avenue
Cupertino, CA 95014
(800) 752-0900

Hip Software Corp.:
Harmony Grid, $99
HookUp!, $149

117 Harvard Street 3
Cambridge, MA 02139
(617) 661-2HIP

Howtek:
Pixelmaster, $8,495
Scanmaster, $5,995
21 Park Avenue
Hudson, NH 03051
(603) 882-5200

HyperPro, Inc.:
BigTime TV, $395
465 South Mathilda Avenue
Sunnyvale, CA 94086
(408) 446-4800

Integrated Media Systems:
Dyaxis, $6,995
1522 Laurel Street
San Carlos, CA 94070
(415) 592-8055

Interactive Media Technologies:
IMTX 8000, $7,000 ($12,000 fully configured)
7320 E. Butherus, Suite 200
Scottsdale, AZ 85260
(602) 443-3093
(800) 289-4689

Julian Systems:
Genlock Converter, $999
2280 Bates Avenue #J
Concord, CA 94520
(415) 686-4400

Koala Technologies:
MacVision, $399
209 Mount Hermon Road
Scotts Valley, CA 95066-1029
(408) 438-0946

Lasergraphics, Inc.:
LFR, $9,750
17671 Cowan Avenue
Irvine, CA 92714
(714) 660-9497

Leatraset U.S.A.:
ColorStudio, $1,995
DesignStudio, $795
FontStudio, $595
ImageStudio, $495
LetraFont Type Library, $75 ea. face
LetraStudio, $495
ReadySetGO!, $495
StandOut!, $395
40 Eisenhower Drive
Paramus, NJ 07653
(201) 845-6100

Letraset U.S.A. 

40 Eisenhower Drive
Paramus, NJ 07653
(201) 845-6100

403
Linotype:
- Linotronic 100, approx. $30,000
- Linotronic 200, approx. $30,000
- Linotronic 300, approx. $60,000
425 Oser Avenue
Hauppauge, NY 11788
(516) 434-2000

Logitech:
- ScanMan 32, $499
6505 Kaiser Drive
Fremont, CA 94555
(800) 251-7717 (outside CA only)
(800) 552-8885 (CA only)

MacroReations:
- Tycho, $150
329 Horizon Way
Pacifica, CA 94044
(415) 359-7649

MacroMind:
- Art Grabber II, included in Director 2.0
- MacroMind Accelerator, $195
- MacroMind Clip Animation, $60
- MacroMind Director 2.0, $695
- MacroMind Interactive Toolkit, included in Director 2.0

410 Townsend Street #408
San Francisco, CA 94107
(415) 442-0200

Mainstay:
- Capture 2.0, $80
- MarkUp, $245-$995
5311-B Derry Avenue
Agoura Hills, CA 91301
(818) 991-6540

Mass Microsystems:
- ColorSpace II, $1,995
- ColorSpace III, $2,300
- ColorSpace FX, $3,500
- ColorSpace Plus/SE, $1,995
550 Del Rey Avenue
Sunnyvale, CA 94086
(408) 522-1200

Max3 Inc:
- CineWrite, $495
- MacToolkit, $695
3021 Airport Avenue, Suite 112
Santa Monica, CA 90405
(213) 398-5771

Microlytics:
- GOfer, $80
- Word Finder, $60
One Tobey Village Office Park #127
Pittsford, NY 14554
(716) 248-9150

Microsoft Corp.:
- Excel, $395
- PowerPoint, $395
- Word, $395
- Works, $295
16011 NE 36th Way
Redmond, WA 98073
(206) 882-8080

Microtek Lab:
- MSF-300G Scanner, $3,495
- MSF-300Z ColorGray Scanner, $2,195
680 Knox Street
Torrance, CA 90502
(213) 321-2121

Mirus Corp.:
- FilmPrinter, $5,895
4301 Great America Parkway
Santa Clara, CA 95054
(408) 980-9770

Mitsubishi Electric Sales America:
- Mitsubishi AM-3501R, $6,900
110 New England Avenue W.
Piscataway, NJ 08854
(201) 981-1414

Mitsubishi Electronics America:
- Mitsubishi XC3710, $7,599
991 Knox Street
Torrance, CA 90502
(213) 515-3993
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<td><strong>Multi-Ad Services:</strong></td>
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<tr>
<td>Multi-Ad Creator, $995</td>
<td></td>
<td>1720 W. Detweiller Drive, Peoria, IL 61615-1695 (309) 692-1530</td>
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<tr>
<td><strong>NEC:</strong></td>
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<tr>
<td>DP5200S Data Projector, $12,495</td>
<td></td>
<td>405 North Lakeview Avenue, Chelmsford, MA 01824 (508) 256-4511</td>
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<tr>
<td>Professional Systems Division</td>
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<tr>
<td>1255 Michael Drive</td>
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<tr>
<td>Wood Dale, IL 60190-1094</td>
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<tr>
<td>(312) 860-9500</td>
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<tr>
<td><strong>Network Specialties:</strong></td>
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<tr>
<td>Flattop, $1,495</td>
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<td>296 Elizabeth Street, New York, NY 10012 (212) 995-2224</td>
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<td><strong>Nutmeg Systems:</strong></td>
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<tr>
<td>LCD Video Interface, $499</td>
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<td>25 South Avenue, New Canaan, CT 06840 (203) 966-3226</td>
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<tr>
<td>LCD Video Interface w/SAYETT</td>
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<tr>
<td>DATASHOW®, $1,995</td>
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<td><strong>nVIEW Corp.:</strong></td>
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<tr>
<td>MacViewFrame II+2, $1,895, $149 for Plus/SE adapter</td>
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<td>11835 Canon Blvd., Suite C-101, Newport News, VA 23606 (804) 873-1354</td>
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<tr>
<td><strong>Olduvai Software, Inc.:</strong></td>
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<tr>
<td>Read-It!, $495</td>
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<td>7520 Red Road #A, South Miami, FL 33143 (800) 822-0772</td>
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<tr>
<td>(305) 665-4665</td>
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<td><strong>Opcode Systems:</strong></td>
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<tr>
<td>Vision (Professional Sequencing Software), $495</td>
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<td>444 Ramona Street, Palo Alto, CA 94301 (415) 321-8977</td>
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<td>Studio Plus Two MIDI Interface, $225</td>
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<td><strong>Optronics:</strong></td>
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<tr>
<td>ColorSetter 2000, approx $60,000</td>
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<td>7 Stuart Road, Chelmsford, MA 01824 (508) 256-4511</td>
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<tr>
<td>ColorGetter scanner, approx. $70,000</td>
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<td><strong>Orange Micro:</strong></td>
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<tr>
<td>Personal Vision, $2,899</td>
<td></td>
<td>14000 North Lakeview Avenue, Anaheim, CA 92807 (714) 779-2772</td>
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<tr>
<td>Converter, $799</td>
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<td><strong>Paracomp:</strong></td>
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<tr>
<td>Swivel 3D (2.0), $495</td>
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<td>123 Townsend Street, San Francisco, CA 94107 (415) 543-3848</td>
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<td><strong>Pioneer Communications of America:</strong></td>
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<td>VideoDisc preproduction and manufacturing</td>
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<tr>
<td>Industrial Division</td>
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<td>1058 East 230th Street</td>
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<tr>
<td>Carson, CA 90745</td>
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<tr>
<td>(213) 513-1016</td>
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<td><strong>Pixelogic:</strong></td>
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<tr>
<td>ProViz Color Video Digitizer, $1,695</td>
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<td>800 West Cummings Park, Suite 2900, Woburn, MA 01801 (617) 938-7711</td>
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<td><strong>Polaroid Corp.:</strong></td>
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<tr>
<td>Bravo, $5,995</td>
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<td>549 Technology Square, Cambridge, MA 02139 (617) 577-2000</td>
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<td><strong>Presentation Technologies, Inc.:</strong></td>
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<td>Montage FR1, $6,995</td>
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<tr>
<td>Montage FR1 Chooser Level Driver, $495</td>
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<td>743 North Pastoria Avenue, Sunnyvale, CA 94086 (800) 782-2543</td>
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<td><strong>Pivit:</strong></td>
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<td>Montage FR1, $6,995</td>
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<tr>
<td>Montage FR1 Chooser Level Driver, $495</td>
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QMS, Inc.:  
ColorScript 100 Model 10, $9,995  
One Magnum Pass  
Mobile, AL 36618  
(800) 631-2692  
(205) 633-4300  

Quark, Inc.:  
QuarkXPress, $795  
300 S. Jackson Street, Suite 100  
Denver, CO 80209  
(800) 543-77140  

Radius:  
DirectColor/8, $2,095  
DirectColor/16, $3,695  
DirectColor/24, $4,095  
DirectColor/GX, approx. $1,200  
Radius Color Display, $4,295  
RadiusTV, approx. $3,000  
Radius Precision Color Calibrator, $695  
QuickColor Graphics Accelerator, $795  
1710 Fortune Drive  
San Jose, CA 95131  
(408) 454-1010  

RasterOps:  
ColorBoard 64 with NTSC and genlock, $4,695  
ColorBoard 364, $1,995  
TrueColor Frame Grabber, $1,495  
RasterOps Self-Calibrating Color Monitor Systems:  
8L (8-bit), $10,695  
24L (24-bit), $12,695  
2500 Walsh Avenue  
Santa Clara, CA 95051  
(408) 562-4200  

Roland Corp.:  
CM-64 LA/PCM Sound Module, $1,395  
7200 Dominion Circle  
Los Angeles, CA 90040-3647  
(213) 685-5141  

SAYETT Technology  
SAYETT DATASHOW® HRM LCD Pad, $1,395, plus $99 for Plus/SE adaptor  
SAYETT Smart Remote, $325  
100 Kings Highway #1800  
Rochester, NY 14617  
(800) 836-7730  
(716) 324-0700  

SCION Corp.:  
SCION Image Capture Board, $1,195  
3 North Main Street  
Walkersville, MD 21793  
(301) 845-4045  

Screenplay Systems:  
Move Magic Budgeting, $595  
Movie Magic Scheduling, $695 (595 for Budgeting owners)  
Scriptor, $295  
150 E. Olive Avenue, Suite 305  
Burbank, CA 95102  
(818) 843-6557  

Seehorn Technologies:  
Midas I desktop video production system, around $10,000  
Midas II final cut system, around $15,000  
1063 Kildare Avenue  
Sunnyvale, CA 94087  
(408) 244-5382  

Shiva Corp.:  
NetModem V1200, $599  
155 Second Street  
Cambridge, MA 02141  
(800) 458-3550  
(617) 864-8500  

Silicon Beach Software/Aldus:  
Digital Darkroom, $295  
Personal Press, $299  
SuperCard, $299  
SuperPaint 2.0, $199  
Super 3D, $495  
9770 Carroll Center Road #J  
San Diego, CA 92126  
(619) 695-6956
Appendix: Vendors and Content Providers

Solutions, Inc.:
The Curator, $140
SmartScrap and The Clipper, $90
SuperGlue II, $120
30 Commerce Street
PO Box 783
Williston, VT 05495-9957
(802) 865-9220

Spinnaker Software:
Plus 2.0 for the Macintosh, $500
One Kendall Square
Cambridge, MA 02139
(617) 494-1200

Springboard:
Springboard Publisher II, $200
7808 Creekridge Circle
Minneapolis, MN 55435
(612) 944-1832

SuperMac Technology:
PixelPaint, $395
PixelPaint Professional, $699
Colorcard SE/30, $899
Spectrum video card series:
Spectrum/8 PDQ, $1,899
Spectrum/8 Series III, $1,399
Spectrum/24 PDQ, $4,999
Monochrome Display Card, $499
Color Two-Page Display (21-inch diagonal), $4,799
Platinum Two-Page Display (21-inch diagonal, black-and-white), $1,799
16-inch Trintron Display, $2,800, or $3,699 bundled with Spectrum/8 Series III card

485 Potrero Avenue
Sunnyvale, CA 94086
(408) 245-2202

Symantec Corp.:
MORE II, $395
10201 Torre Avenue
Cupertino, CA 95014-2132
(800) 441-7234
(800) 626-8847 (CA only)
(408) 252-3570

Tektronix:
ColorQuick, $2,495
4693DX, $9,450
Phaser CPS, $12,995
Phaser CQS, $9,995
TekColor, $50

Graphics Printing and Imaging Division
PO Box 1000 MS 63-447
Wilsonville, OR 97070
(800) 835-6100

T/Maker Company:
WriteNow, $195
1390 Villa Street
Mountain View, CA 94041
(415) 961-0195

Truevision:
NuVista, $5,995 (includes 4M of RAM)
NuVMX memory expansion, $1,500 to $4,500
VIDI/O box, $995
7351 Shadeland Station, Suite 100
Indianapolis, IN 46256
(317) 841-0332

VENT, Inc.:
Black-and-white cards (Plus and SE), $399
Eight-bit color cards (SE/30 and II models), $499
Hyper Switcher, $499
110 Pioneer Way
Mountain View, CA 94041
(415) 961-3671
VideoLogic, Inc.:
DVA 4000, $2,500
245 First Street
Cambridge, MA 02142
(617) 494-0530

The Voyager Company:
Voyager CD AudioStack, $100
Pioneer LVP4200, $995
LaserCables (Mac to RS-232 Disc Player), $25
The Box (connects Mac to consumer videodisc player), $150
1351 Pacific Coast Highway
Santa Monica, CA 90401
(213) 451-1383
(800) 446-2001
(800) 443-2001 (CA only)

WordPerfect Corp.:
WordPerfect, $395
1555 North Technology Way
Orem, UT 84507
(801) 225-5000

Xerox Imaging Systems:
Dataplot Model 70, $1,800
AccuText (OCR software), $799
535 Oakmead Parkway
Sunnyvale, CA 94086
(800) 248-6550

Content Providers

Broderbund Software
The Whole Earth Electronic Catalog, $150
17 Paul Drive
San Rafael, CA 94903
(415) 492-3200

Optical Data Corporation
ABC News Interactive Videodisc Series:
Martin Luther King, Jr., $395
In the Holy Land with Ted Koppel, $395
30 Technology Drive
Warren, NJ 07050
(800) 524-2481

The Voyager Company:
AmandaStories (Adventures of Inigo the cat), Vol. I-III, $25 each volume
LaserCables, $25
Pioneer 4200 laserdisc player, $995
Pioneer 8000 laserdisc player, $1995
Sony 1200 laserdisc player, $795

Voyager CD Companion Series:
Ludwig Van Beethoven, Symphony No. 9 (Robert Winter), $100
VideoDisc Accessory Series, $50
1351 Pacific Coast Highway
Santa Monica, CA 90401
(213) 451-1383
(800) 446-2001
(800) 443-2001 (CA only)

Warner New Media:
Music Discovery Series:
Audio Notes #1: Mozart's The Magic Flute, $66
3500 West Olive Avenue
Burbank, CA 91505
(818) 955-9999
Bibliography

Books


Magazines, Journals, and Newspapers

*American Printer.* 300 West Adams Street, Chicago, IL 60606. $35 per year.


*Graphic Perspective.* Ashley House, 176 Wicksteed Avenue, Toronto, Ontario, M4G 2B6 Canada. (416) 422-1446. $40 per year.


*MacWorld.* PCW Communications, 501 Second Street, San Francisco, CA 94107. (415) 546-7722. $29.90 per year.

*MacUser.* Ziff-Davis Publishing Company, 950 Tower Lane, 18th Floor, Foster City, CA 94404. $27 per year.


*Publish/PC World Communications,* 501 Second Street, San Francisco, CA 94107. (415) 546-7722. $39.90 per year.

*Step-By-Step Graphics.* Dynamic Graphics, 6000 N Forest Park Drive, P.O. Box 1901, Peoria, IL 61656-1901. (800) 255-8800. $42 per year.

*VERBUM, Journal of Personal Computer Aesthetics.* P.O. Box 15439, San Diego, CA 92115. (619) 463-9977. MCI Mail: VERBUM. $28 per year.

Newsletters

*Before and After, How to Design Cool Stuff.* PageLab Inc., 331 J Street, Suite 150, Sacramento, CA 95814-9671. (916) 443-4890. $60 per year.
Bibliography


Media Letter. The Myriad Group, P.O. Box 5199, Belmont, CA 94002-9998. (415) 821-4737. $395 per year in N. America, $495 outside.


Quick Printer’s Guide. Lambda Company, 3655 Frontier Avenue, Boulder, CO 80301. (303) 449-4827. $75 per year.

ReCAP. Boston Computer Society, Desktop Publishing User Group, One Center Plaza, Boston, MA 02108. (617) 367-8080. $28 per year.


Technical References and CD-ROMs


MacroMind CD-ROM (1989), MacroMind Inc.


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