

# 17 Multimedia

**From Wall Street to Hollywood Boulevard**, from Cannes to Katmandu, multimedia is raising both artistic spirits and investor dollars. Widely available and inexpensive computers that can smoothly blend text, sound, graphics, and video have transformed the worlds of business, government, education, and home entertainment. Quarterly business reports come on CD-ROM; automobile companies sell cars with mouse clicks; the Library of Congress distributes its archival movie collection on-line; encyclopedias include interactive multimedia presentations; rock and rollers put interactive videos and games directly on their latest albums—even family photo albums now end up on disk accompanied by Aunt Emily’s eloquent audio reminiscences.

The conventional wisdom about multimedia production was once “Don’t try this at home.” That is no longer true: Making multimedia now requires nothing more complicated than using what comes built-in to nearly every one of today’s Macintosh computers. It is also one of the most exciting and satisfying things you can do with your Mac.

In this chapter, we’ll look at the ingredients of multimedia and how they fit into the blend, and then look at how to blend those ingredients together into something rich and wonderful.

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## How Did We Get Here?

(MEC)

When I was in elementary school, we had a special room called the “multimedia” room. This was a room stocked with a bunch of folding chairs, a small stage, and a big closet. Inside that closet was the magic: a clattering and temperamental 16mm film projector, a record player, a filmstrip projector, a portable movie screen, and an overhead projector.

The filmstrip projector and record player were a true interactive multimedia combination: The projector might show a scratched and washed-out picture of cattle grazing in a field, while the record player would crackle, “This is the heart of the Wisconsin dairy industry.” Then the record player would make a “bing!” noise (much like the sound the first Macs made when they started up), and one lucky kid would get to turn the knob on the filmstrip projector and show us the next slide. Okay, it wasn’t interactive multimedia for the rest of us, but it was for that lucky kid who got to control the show. (I was once chosen to be that lucky kid: I got excited and missed a couple of cues and was never chosen again. But I never forgot the thrill....)

Today, that multimedia room is a little box or two sitting on your desk. We call it a Macintosh.

### **If There Were No Macintosh, It Would Be Necessary to Invent One**

Q: Did the Mac create multimedia, or did multimedia create the Mac?

A: Yes.

Multimedia is certainly much older than the Mac or even the computer industry—in fact, a scholar I know says that multimedia is thousands of years old. It is certainly true that artists have been blending together materials from different media for a long time. But when the Mac came along, it was able to provide a single *medium* ideally suited for combining all the stuff that used to be on separate media (such as a filmstrip projector, a movie screen, and a record player). So you can think of your Mac as a tool that was designed to help create a lot of different media, and you can think of it as the place where all those different media can be blended together into something new. As a result, you can now listen to a Beethoven symphony with interactive commentary that appears in time to the music; you can read a real estate catalog that lets you take a tour of a new home entirely on your computer screen; your school-aged children can write reports on the Civil War complete with pictures, maps, and marching songs.

## It's the Hardware; It's the Software

The very first Macs of 1984 were capable of showing text, playing sounds, displaying pictures, and performing animations. What they didn't have was the software needed to combine them into a single presentation (those very first Macs didn't have much software at all, come to think of it). It took a few years for things to change, but they changed quickly: Over the course of a few months in 1987, Apple released both its first CD-ROM player (which could also play *audio* CDs—very cool!) and HyperCard. From that marriage the multimedia industry was born.

Apple has continued refining and improving the Macintosh hardware. Most Macs now have microphones that let you record sounds directly; many have video inputs that let you transfer video from your camcorder directly to your hard disk; and most have built-in CD-ROM players as standard equipment that are four times as fast as the first ones.

The software has gotten better, too. Where once there was only HyperCard, there are now dozens of software packages for making multimedia. And nearly all that commercially available multimedia software relies on what is probably Apple's most important addition to the Mac System Folder to date: QuickTime.

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## QuickTime: the Soul of the Multimedia Machine

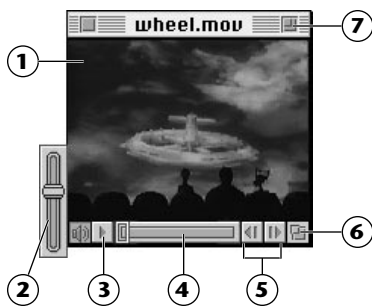
(MEC)

QuickTime has become increasingly central to Apple's multimedia strategy over the last few years, which is not surprising when you consider that the QuickTime system extension underlies much of the Mac's multimedia power. The QuickTime extension is most famous, of course, for letting the Mac do video, but the latest version also does digital audio, MIDI (see [“What is MIDI?”](#) and [“General MIDI on the Mac”](#) later in this chapter), animation, virtual reality, still image compression, and text display.

## The QuickTime Extension and Friends

(MEC)

QuickTime currently consists of three parts: the QuickTime extension itself (version 2.1 as of this writing, though version 2.5 should be out by the time this goes into print), the QuickTime Musical Instruments extension (which allows QuickTime to play back MIDI using sound samples licensed from Roland), and the QuickTime Powerplug (required only for Power Macs). All Macs sold today come with QuickTime preinstalled.



1. Movie frame

2. To adjust a movie's volume, click and hold the Volume Control button to bring up the Volume Slider.

3. Play/Pause button

4. The Slider indicates where you are in a movie. Drag its thumb to move around in the movie, or click a spot on the Slider to jump to that point in the movie.

5. Step Backward and Step Forward buttons. Control-click either button and a shuttle control will appear that lets you play a movie backward or forward at just about any speed. Dragging the shuttle's thumb adjusts the speed of playback as well as the direction.

6. The Resize Window button lets you click and drag to resize the movie frame. For optimum playback, use a multiple of the original frame size—twice as big, for example, or half the size. The frame automatically resizes in the appropriate increments if you hold down **(Option)** while dragging the button.

7. To restore a movie's original frame dimensions, click the Zoom box.

The Standard Controller provides a VCR-like interface for playing QuickTime movies.



In addition to the QuickTime software that goes into the System Folder, you almost certainly want to acquire Apple's free **MoviePlayer** program. MoviePlayer lets you open up, edit, and save QuickTime movies. It also lets you convert audio tracks from an audio CD into AIFF files on your hard disk (see [“Digitizing Sound”](#) later in this chapter), as well as convert and play MIDI files. MoviePlayer can be obtained from Apple's Web site and from user groups. It is also available on the QuickTime Developer's Kit CD (see [“The QuickTime Developer's Kit and the Apple Multimedia Program”](#) later in this chapter).

## QuickTime and Video

(MEC)

QuickTime provides standard formats for storing and playing back video at acceptable speeds (hence the name *QuickTime*), it supplies a reliable timing system to allow pictures and sound to synchronize (hence the name *QuickTime*), and does it all at the system software level, which means that an ever-increasing number of programs can now incorporate video and sound—even word processors and spreadsheets. Whatever program you use to get video into the Mac (a process called *capturing* or *digitizing*) will almost certainly use QuickTime, and whatever program you use to edit your video will use QuickTime, too. Not only that, the programs you use to view the video will also use QuickTime.



Because digital video and QuickTime are fast-changing technologies, you may want to periodically check out the QuickTime FAQ (frequently asked questions) by Charles Wiltgen, which is available on the Internet at <http://www.onshore.com/quicktime/>. This work, a labor of love by its author, compiles the latest tricks, tips, and techniques for dealing with QuickTime video on the Mac.

## QuickTime and Audio

(FB)

Aside from QuickTime's ability to synchronize events on a computer (which obviously has important ramifications for multimedia), the latest versions of QuickTime support *IMA compression*, a multimedia industry standard which allows relatively high-quality sound to take up much less disk space (IMA is the Interactive Multimedia Association). IMA compression, while not perfect, sounds much better than any compression previously available on the Mac. You can find out more about QuickTime's ability to compress audio and synchronize it with other media in "Using QuickTime For Compression and Synchronization" later in this chapter.

## QuickTime VR

(MEC)

QuickTime VR is Apple's neat technique for creating *virtual reality* experiences (hence the VR in its name). It makes it possible to use a QuickTime window as a view into a space, letting you turn around, move in more closely on objects, and so on, merely by clicking in the window. It does this using specially prepared QuickTime sequences, usually made from a 360-degree photographic panorama of an area, that are put together with a "stitcher" application (actually, a HyperCard stack) that Apple provides. QuickTime VR can also use sequences made from rendered 3-D images, making possible tours of spaces that never existed in the real world. This technology is still evolving, but it is already useful for games, simulations, and tours of real places. Licensing and development tools for QuickTime VR are available from Apple.

### QuickTime Controller Shortcuts

(MM)

The Standard Controller has several shortcuts for movie playback:

Play	Press <b>Spacebar</b> or <b>Return</b> , or double-click in the frame
Pause	Press <b>Spacebar</b> or <b>Return</b> , or click once in the frame
Mute the sound	Press <b>Option</b> while clicking the Volume Control button
Step forward	<b>→</b>
Step backward	<b>←</b>
Jump to end	Press <b>Option</b> while clicking the Step Forward button
Jump to beginning	Press <b>Option</b> while clicking the Step Backward button
Play in reverse	Press <b>⌘</b> while clicking the Step Backward button, or Shift-double-click in the frame
Play every frame	Hold down <b>Option</b> and begin playback

## The QuickTime Developer's Kit and the Apple Multimedia Program

(MEC)

If you are at all serious about Macintosh multimedia, you should obtain Apple's **QuickTime Developer's Kit** CD, which contains the latest versions of QuickTime, documentation, tools, and sample code. You can get the disk from Apple's Developer Catalog for \$99. The catalog is available on-line at <http://devcatalog.apple.com>.

If you are really serious about multimedia development, you should also think about joining the Apple Multimedia Program. Registration is currently \$300 a year, and it includes developer CDs (including the QuickTime Developer's Kit CD), marketing information, access to Apple's Third Party Compatibility Lab, conference invitations, and referral services. More information on this program is available by calling 408/974-4897 or by checking out Apple's Web site at <http://www.amp.apple.com>.

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## Ingredients of Multimedia

(MEC)

To make multimedia, you need media—all sorts of media, and usually lots of it. You should also have good reasons for combining all this stuff together (note: impressing your friends or making money are good, or, at least, compelling *motives*, but they aren't *reasons*). In other words, you need to know which kinds of media are best for which purposes, and you have to figure out the best ways to blend them to get the response you want (e.g., the respect and admiration of your friends and associates, and tons of money from satisfied purchasers of your multimedia creation).

### Text

While at first glance, text may seem to be boring and low-tech, it can actually be a powerful addition to a multimedia work. Text is good for lots of things in multimedia, and has at least one powerful advantage over some other forms of media: It is very compact. For instance, the text of an entire book takes up less room than, say, a medium-fidelity rendition of one top-40 song.

You can search text very easily, and you can use it to navigate through your work: Not only can a button with a text caption be more informative to your audience than a similar button that relies upon nontextual artwork, but many multimedia programs support “hot text” that can bring up pictures, play sounds, or display a different piece



of text (such as a footnote or a sidebar). Although often overlooked by those who promote and review multimedia, there are few multimedia titles that don't have at least *some* text in them.

Unfortunately, the creators of many multimedia authoring programs have been rather backward in providing good text formatting and searching capabilities in their products. For example, Macromedia's Director, perhaps the authoring program most widely used by multimedia professionals, has only recently begun to provide sophisticated text support with its latest release, version 5. Even HyperCard, which began life as a sort of filing system that let users mix text and pictures on a virtual stack of cards, still only supports limited text formatting, though its abilities to search through text have rarely been surpassed. You should also know that producing good-looking text requires good-looking fonts; however, licensing and distributing fonts with your work can become costly, and often involves users in an installation process that can become cumbersome.

**HOT TIP**

Still, when you design your multimedia title, remember that text can help explain some things better than any other medium, takes up less disk space, and provides additional ways for the user to navigate beyond pointing and clicking on graphic buttons.

## Graphics

Multimedia titles usually rely very heavily on graphics, using them as background "frames," user-interface elements (such as buttons, sliders, and scroll bars), illustrations of subject matter, or even *as* the subject matter. As a result, there are often several graphics on the screen at any one time. But, like sound, graphics take up disk space: The larger the picture and the more colors it requires, the more space it takes up. Furthermore, pictures take up available RAM as well as disk storage, since pictures have to be held in memory as long as they are visible. A 640-by-480 picture shown in 256 colors takes up about 300K of RAM while it is on the screen; the more pictures your

### ***Is a Picture Really Worth a Thousand Words?***

(MEC)

As far as your Mac's memory and disk space are concerned, it's usually worth more. One letter in a text file usually requires a single *byte* of storage. In this chapter the average word is about six characters long, which means that a thousand words takes up about 6,000 bytes, or 6K. A black-and-white picture that would fill the screen on the first 128K Mac requires about 22K to store, which is a little more than the amount of space that 3,500 words of text would take. Color pictures require much more storage space: If you display that same picture in 256 colors (also called 8-bit color), it takes about 175K, which makes it worth more than 29,000 words (about one-third the size of an average novel).

title displays at one time, the more RAM your multimedia title will require in order to run. There are many different types of graphics that the Mac handles; [see Chapter 15](#) for more details about graphic formats.

## Sound

From the very beginning, Macintoshes have been able to produce relatively high-quality sound, and as the years have gone by each generation of Mac has gained even more sound capabilities. Today's Macs can record as well as play back sound; they can both talk and respond to spoken commands using Apple's Speech Manager and PlainTalk software ([see "PlainTalk"](#) in Chapter 3); they can play MIDI music without the addition of an external MIDI interface, courtesy of QuickTime ([see "What is MIDI?"](#) and ["QuickTime"](#) in this chapter); they can play audio CDs if a CD-ROM drive is attached; and even (again, courtesy of QuickTime) copy sounds from those CDs to standard Macintosh file formats. Right out of the box, the newest Macs are close to being a combination recording studio and hi-fi system.

You can use sound in a variety of ways and in a variety of resolutions in your multimedia title, from simple sound effects to high-fidelity music. For example, you can use sound to provide simple audible feedback to user actions (such as a click noise when the user presses a button), pronunciations (e.g., in a glossary), narrations, musical accompaniment to a picture presentation, and much more. Remember, though, that a sound effect can go from interesting to boring to downright annoying the more times the user hears it: You should only use sound effects when you *need* to use them, and not just because you *can* use them.



Sound does take up considerable amounts of storage room on your hard disk or CD-ROM, and the better the sound quality, the more room it takes. You also need to know that different models of Mac produce different quality sound. Although the newest Macs can produce stereo sound that has the same quality as sound from an audio CD, older Macs can only produce monaural sound of much lower quality (lower, that is, to the audiophile—even the oldest Mac can produce sound that is quite acceptable for many multimedia uses).

## Video and Animation

Video is really just a sequence of still pictures that, when shown one after another, creates the illusion of motion. The first Macs could do that much, although making pictures move on those early machines took some very tricky programming. Today, thanks to QuickTime, video is something that the Mac does very easily and very well.

Video can liven up almost any presentation. There is something about a moving image that attracts and focuses attention: Although video may not have completely killed the radio star, a talking head really does get noticed more than a disembodied voice. Video is especially good for showing processes (it is one thing to read about how to bone a chicken, but it is quite another to see Julia Child wielding her knife).

But video does have its drawbacks: It is expensive to produce, it takes up lots of disk space, and even with QuickTime's sophisticated assistance, it can still task the processing speed of many machines. On the other hand, it is one heck of a lot of fun to make and use. Don't we all really want to direct?

## Rights and Wrongs: Using Copyrighted Media

No matter what mix of media you put into your title, there is one important area that you really must consider: Who owns the sound, pictures, images, text, and movies you are using? This is not critical if you are only making something for your own amusement, but if you plan to show your work in the classroom or boardroom, or if you plan to distribute your title to others, it is very important. People who produce original material have a long-standing legal right not to have their work used without permission, and they also have the right to be paid for any use of their work.



Just because you have bought an album or a book, for example, does not mean that you have the right to reuse that material without permission. As the multimedia industry grows, "content providers" (those folk who used to be called publishers, or writers, or recording artists, or directors) are becoming increasingly savvy about copyright. So should you.

How do you get permission to use copyrighted media? It depends. You can get clip art collections, for example, that give you the right to use the artwork they contain, sometimes with limits, sometimes without. There are also clip collections of sounds, and even video, that allow the same permission to reuse their contents. But in many cases, you have to ask permission of the individual publishers, record companies, museums, and studios that have produced or that own the material you wish to use—this is a slow process, and sometimes expensive, but you cannot shirk this responsibility. The world is full of lawyers, and you don't want to find yourself on the short end of a copyright infringement suit.



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## Macs for Playing and Making Multimedia

(MEC)

Although other computer companies tout their specialized “multimedia PCs,” nearly *all* of Apple’s Macs do multimedia. This does not mean that every Mac is suitable for every multimedia task, though. Here we’ll look at what you’ll need in your Mac to play and to make multimedia.

### Playing Multimedia

If you are planning to use your Mac to look at multimedia, you need a Mac that is almost unbelievably more powerful than the first little toaster box that came out in 1984. To run most multimedia titles you need a machine with at least 8MB of RAM (64 times the amount of RAM in the first Mac!), a color monitor that displays at least 640 by 480 pixels at once and can show 256 or more colors, at least a double-speed CD-ROM drive, and some very powerful software installed in the System Folder; in other words, a standard desktop Mac. Apple has come to realize that multimedia is one of its core businesses, so you can expect that most of the desktop machines that they sell from now on, as well as an increasing number of their notebook machines, will be ready for multimedia right out of the box.

### **Doubled RAM Isn’t Multimedia RAM**

(MEC)

Many people today use commercial products such as RAM Doubler or system features such as *virtual memory* to make their Macs act like they have more RAM than they really do (see [Chapter 4](#) for definitions of virtual memory and RAM). After all, RAM chips are expensive, and you can do a lot with a RAM-doubled Mac or with a Mac running virtual memory. These RAM-stretching tricks, however, tend to give multimedia titles fits—as in fits and starts.

Playing audio or video requires the constant attention of your Mac’s CPU. Utilities such as RAM Doubler, however, use compression schemes to pack temporarily inactive portions of your Mac’s memory into smaller spaces, and compressing and decompressing memory takes the CPU time to accomplish. While your Mac is busy doing that, it can’t also be decompressing the video playing from your CD-ROM. Virtual memory also ties up the CPU, and then aggravates the problem by involving the Mac’s hard disk: With virtual memory, your Mac copies temporarily dormant portions of memory to a hard disk, and reads those portions back into RAM when they become active again. Hard disks are a *lot* slower to access than RAM, and when the swapping is going on, your ordinarily fleet machine grinds away like a glacier on an Arctic night.

If you bought a new Mac within the last year, you are probably already set up to view the majority of current multimedia titles. If you have an older machine with a 68020 processor or better, you can probably upgrade your system to meet multimedia requirements as well. However if you're one of those folk with an old trusty Mac SE or Plus or Classic you are out of luck as far as multimedia is concerned—though your machine is still certainly a useful machine, today's multimedia titles demand performance and capabilities that will be forever beyond those brave little toasters.

## Making Multimedia

(MEC)

Making multimedia tends to require considerably more computing power and resources than does playing it back. Image-editing programs, for example, benefit from lots of RAM and fast CPUs. Video and audio editing are virtually impossible without copious disk storage as well. If you plan to make multimedia titles on a regular or even semi-regular basis, you will want some serious computing horsepower.

**Memory** (MEC). The bare minimum is really 24MB of RAM, and more is better (I get by with a 40MB machine, and I still occasionally feel the need for even more RAM). To hold that memory, you will want a fast machine; look at a Mac that has a fast PowerPC 601 CPU (by “fast,” I mean a chip that runs at a speed of at least 100 MHz) or one of the newer, faster PowerPC 604 CPUs. For more details on memory, [see Chapter 4](#).

**Hard disk storage** (MEC). If you are planning to create a CD-ROM title, you will want fast hard disk storage and lots of it: at least two gigabytes of hard disk storage, and probably more. In my experience, you want to have from four to six times the amount of storage that your final product will take up, just to hold the assets for your project and to give you room to manipulate them. If you are going to digitize your own video, you will need much more disk storage: Raw, uncompressed video takes up huge amounts of room; you can easily fill up a gigabyte with just a few minutes of it. For video capture, you probably want to have very fast *RAID* disks (*RAID* stands for “Redundant Array of Inexpensive Disks,” and is a way of increasing storage speed and reliability), or at least, fast disks designed for video capture—not all hard disks are up to the challenge. For more information about your storage options, [see Chapter 5](#).

**Slots** (MEC). You also want a machine with slots, because chances are you will want to add in some special boards for video digitizing or sound sampling. Until recently, *slots* meant NuBus slots, a special board interface that hardly anyone in the computer industry other than Apple used. The newest Macs, though, use the industry standard PCI slot: Most board manufacturers for the Mac are now issuing their products in

PCI format, and many of the high-end video and audio PCI boards used in the Windows world are now becoming available for the Mac as well. You can expect NuBus boards to become rarer in years to come, so plan on getting a Mac with PCI slots if you are buying a new machine for making multimedia.

**CD-ROM drive** (MEC). A CD-ROM drive is something you must have for both playing and making multimedia, and you want a fast one. Apple currently sells *quad-speed* drives (that is, drives that are four times as fast as the first CD-ROM drives) and other manufacturers make even faster ones. If your production process requires you to access a lot of material from a variety of CD-ROM sources, it may even be worth your while to investigate some of the multiple disk CD-ROM drives (often known as CD-ROM jukeboxes).

**CD-R** (MEC). A CD-R device (that is, a device for making single CD-ROMs; it means “CD-Recordable”) is almost essential for the serious multimedia developer. The price of CD-R “burners” has fallen rather quickly over the last few years, and you can get one capable of making a CD in about an hour for about \$1,000. Blank recordable CDs cost about \$10. With a CD-R and some blank media, you have a good way to produce CDs for testing and archive purposes. Make sure that the CD-R mastering software

### **AV Macs for Making Multimedia**

(MEC)

Apple has manufactured a number of Macintoshes in recent years that are specialized for creating multimedia: the AV Macintoshes (AV, of course, stands for Audio-Video). The first two machines of this type, the 660AV and the 840AV, used the Motorola 68040 CPU and incorporated special chips, called DSPs (for Digital Signal Processing), to give them a speed boost when processing the huge amounts of digital information that multimedia—particularly video—requires.

The more recent AV machines use the PowerPC processor and lack the specialized DSP chips used in the 660AV and the 840AV. Apple figures that the PowerPC is fast enough to handle most digital signal processing tasks without any assistance, and it makes the machines less complicated, and therefore cheaper, to construct.

Today, what makes a Mac an AV Mac is simply the addition of ports for inputting and outputting video and high-quality stereo audio. For relatively small projects, these machines can serve your needs rather well. However, the video *throughput* (that is, the number of megabytes of video information per second) these machines can handle unassisted does not meet most professional production needs, being limited to quarter-screen size (i.e., 320 by 240 pixels) and half the number of frames per second of normal television (i.e. 15 frames rather than 30).

## **Not Just Multimedia Software**

(MEC)

Aside from the software discussed in this chapter, there are other types of tools you want to have for making multimedia, including such things as a good database and a spreadsheet.

Sure, these are more the tools of the business world than the artistic world, but they are very useful nonetheless in multimedia production. Most multimedia projects involve lots of *assets*: image files, sound files, MIDI files, video files, text files, and so on. Keeping track of all of your assets can become a nightmare unless you get organized early and stay organized, and a good database program can help you do that.

Even though a CD-ROM can hold a lot, it can't hold everything. You'll also want to keep track of how much room each asset takes, and you might want to try juggling different sets of assets to make things fit. A spreadsheet can help you with this. You don't need anything super-sophisticated, though; an integrated program such as **ClarisWorks** is all you need: It is a word processor, database, and spreadsheet program rolled into one—it even serves as a competent drawing and painting program, and can also do slide show presentations! ClarisWorks is covered more fully in Chapter 12, and information about other spreadsheet and database programs can be found in Chapters 9 and 11.

you get for your CD-R is capable of producing *hybrid* disks, that is, CDs that can be read on both the Mac and Windows. If it is also capable of creating “Red Book” CDs (i.e. audio CDs) that's even better. You will want to get as flexible a system as you can.

**Tape backup** (MEC). A tape backup system of some sort is crucial. The amounts of data involved in most multimedia projects make floppy-disk backup completely impractical (heck, for most Mac users, floppy backup is becoming increasingly impractical). A DAT backup drive, on the other hand, can usually back up a gigabyte of data in less than an hour on a single \$15 tape. [See Chapter 5](#) for details on backup alternatives and strategies.

**Monitor** (MEC). No multimedia developer should be without a good large-screen monitor. This is not just because you deserve the very best (although, of course, you do), but because it is worth it in time and trouble saved. With a large-screen monitor, you can view both the work you are developing and the tools you are using to build it. Because most multimedia titles are designed for a 640-by-480 display, you should get a screen that can show more than that: 832-by-624 (the resolution of a 17-inch monitor) at least, and preferably more. A *multiscan* monitor, capable of multiple resolutions is a very good choice. With it, you can switch between various resolutions without rebooting, allowing you to see your title in 640-by-480 resolution (as your audience will), and then switching back to higher resolution as you do your development work.

And make sure to get the *VRAM* (that is, Video RAM) to support at least thousands of colors (16-bit color) at the highest resolution; the serious professional will want millions of colors (24-bit color) at all screen resolutions ([see Chapter 4](#) for details about VRAM).

**Speakers** (FB). Let's face it folks, that little speaker on your Mac just doesn't cut it. To appreciate the output your Mac is capable of, you need a set of decent speakers. Apple sells a nice, inexpensive pair of speakers specifically designed to be hooked up to your Mac. These are self-powered speakers, which means that they don't need an amplifier to power them, they plug into the speaker output of the Mac, and provide decent quality stereo sound. They actually seem to take the edge off 8-bit sound, which is quite a feat indeed. There are many other multimedia speakers available on the market now and all will work on your Mac. My only recommendation is to listen before buying because they range greatly in quality.

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## Graphics for Multimedia

(MEC)

Although Chapter 15 covers Macintosh graphics in considerable detail, a few words need to be said here about graphics as they relate to multimedia.

The most important point to remember is that your graphics are all destined to end up on the screen. You don't need to worry about bleeds, trapping, Pantone colors, or all the other arcana associated with producing print graphics digitally. What you do need to worry about are bit depths, color palettes, and graphic formats. You also need a passing familiarity with a couple of drawing and painting programs.

### Bit Depths

The *bit depth* of a graphic refers to how many bits of storage are required to show each pixel in the graphic. The deeper the bit depth, the more memory is required to show the graphic and the more colors the graphic can show. The first Macs had only one bit depth: Because the bit representing each pixel could be either 1 or 0, it meant the picture could only show two colors; by convention, these two colors were black and white. The more bits used per pixel, the more colors (or shades of gray) are possible. Some PowerBooks, for example, can only handle bit depths of 4, which, in turn, means 16 colors or shades of gray, since you can arrange 4 bits in 16 possible combinations.

Most multimedia titles require a minimum bit depth of 8: that is, 256 possible colors. While that is a lot of colors, it is by no means enough to represent what the eye can see. It takes at least 16 bits (which can show thousands of colors) or more before the



number of colors available is sufficient to rival photographic quality, and, although some Macs are capable of showing that many colors, many are not. Multimedia authors want to reach the widest possible audience, and, for now, staying with a 256-color limit is the best means for reaching that audience.

Multimedia developers cope with the 256-color limit by using two techniques to make 8-bit pictures seem to show more colors than they can. The first method is called *dithering*, which reduces the resolution of the picture by using more than one actual pixel to represent a single point in the picture. For example, a bluish pixel and an adjacent reddish pixel will be blended by the eye to form a larger, purplish pixel. Dithering can fool the eye to some extent, but at the cost of making the picture look less sharp. The second method is to choose the right set of 256 colors that best shows the picture: This is called using a *custom color palette*.

## Color Palettes

The Mac uses a standardized set of 256 colors (called the *standard color palette*) when it is set to a bit depth of 8. When it has to show a picture that has a different set of 256 colors associated with it, one of two things will happen: Either the Mac will dither the picture to match its standard color palette, reducing the picture's resolution and fidelity, or it will use the color palette attached to the picture, which will change the colors on all the other parts of the screen. If the Mac uses this second method, it usually causes the screen to flash unattractively as the color palette changes. Most multimedia titles use a combination of dithering and custom color palettes: A few palettes are chosen that are the best for the bulk of the pictures in the program, and the rest are dithered to look as good as possible in that set of colors. Titles that do this also tend to take over the entire screen so that no color changes will be noticed on the desktop.

## Graphic Formats and Image Conversion Software

The world of graphics program developers has spawned a menagerie of special file formats for graphics, each one tailored to suit a specific need. The standard format for all Macintosh graphics onscreen, however, is the PICT format. Because of the plethora of picture formats, and the large number of possible palettes for 256-color PICTs, converting graphics to the right format and set of colors you need for your project can often be frustrating. But every need carves a niche, and the graphics-conversion niche holds some remedies for this mess. One tool, **DeBabelizer** (\$270, Equilibrium), is famous among digital graphic artists for its power (and infamous for its confusing user interface). This program excels in converting batches of graphics from one format to another, from one size to another, from one color depth to another, and from one color palette to another. You won't need this product every day,

most likely, but when you need it, you will really need it. DeBabelizer is covered more fully in Chapter 25. Another useful package in this niche is Adobe's recently released ScreenReady, which converts graphics intended for print output, such as PostScript line art (for example, EPS files), into attractive screen-ready PICTs.

## Painting Software

You should have at least one high-quality painting program in your suite of tools. Adobe's Photoshop is nearly a standard among those who create and manipulate images on the Mac for a living, and Fractal Painter is much loved by artists who like its abilities to create digital art that looks like it was created with real-world media. There are other programs that might suit your needs just as well, though, and you can find out all about them in Chapter 15.

## Drawing Software

A good drawing (as opposed to painting) program is also a handy tool in the multimedia development environment. Although such tools are really optimized for print needs where the resolution is much higher, they can also produce output that looks good onscreen. If you need line art or specialized text treatments, you might want to look at Adobe Illustrator or Macromedia FreeHand. These and other drawing tools you might find useful are also discussed in Chapter 15.

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# Digital Audio on the Macintosh (FB)

You can produce audio on the Macintosh in one of two ways, either through the use of MIDI (see [“Music \(MIDI\)”](#) later in this chapter), or through the use of digital audio. *Digital audio* is recorded audio waveforms that are stored as bits and bytes like all other forms of digital media. There are two basic concepts that are important for understanding how digital audio works—the bit rate and the sample rate.

## Bit Rates

Digital audio is commonly found in either 8- or 16-bit formats. The *bit rate* refers to the number of possible values used to describe the *dynamic range* of an audio file (that is, the range between the loudest and softest sound). The 8-bit files have 256 possible values whereas 16-bit files have 65,536 possible values, which results in a marked difference in sound quality between 8-bit and 16-bit sound files. Also, 8-bit files tend to have a grainy quality with a lot of noise and, as one would imagine, don't handle

dynamic ranges well, whereas 16-bit files are the standard for high-quality audio and are used for audio CDs.

So now you are asking yourself, “why would anyone use 8-bit files?” As always in the world of computer multimedia, the issue comes down to CPU overhead and what the hardware is capable of playing. The 16-bit files are twice as large as 8-bit files and 68K Macintoshes (non-AV) that are not running Sound Manager 3 (or later) cannot play them without additional hardware. (Sound Manager is the system extension which controls how sound is played back, recorded, and routed on a Mac.) Sound Manager 3 can interpret 16-bit files and play them back in 8-bit format on 68K (non-AV) Macs. Sound designers don’t use 8-bit files because they like the way they sound, they use them because they will play back on every Macintosh and are small enough not to grind your presentation down to an untenable crawl while the computer attempts to play back the music along with it.

This is not as much of an issue if you are creating a project that is designed to run solely on a higher-end Power Mac. The Power Mac and AV Macs have the capability of playing back 16-bit audio in true 16-bit mode. If your project is designed to be played back solely on a high-end Power Mac, go nuts and use the best quality audio you can. The sad reality is that if your project must run on everything from an IIx to a Power Mac you will probably have to use 8-bit sound.



## Sample Rates

The process of recording sound onto a computer is often referred to as *sampling* (digital files are sometimes called *samples*) because when you record audio onto a computer it samples that audio signal thousands of times per second to re-create the waveform digitally. The sample rate determines the frequency range at which the digitized audio can be reproduced. For example, audio CDs are sampled 44,100 times per second or at 44.1 KHz. Due to something called the *nyquist average*, digital audio plays back a maximum frequency that is half the sample rate. In other words, audio that has been sampled at 44.1 KHz plays back at a maximum frequency of 22.050 KHz, which is well beyond the range of human hearing.

All this really isn’t as complicated as it sounds so long as you remember the basic rule that the playback rate of digital audio is half the sample rate. Much as we would all like to have CD quality audio on our multimedia projects, the cold harsh reality is that it takes far too much computer overhead to play 16-bit, 44.1 KHz audio while playing an animation or displaying a high-resolution graphic file. In fact, Macintoshes of the 68K (non-AV) variety can’t play 16-bit, 44.1 KHz audio without additional hardware even if the computer isn’t doing anything else.



Having said all of this, I must put in my plug for high-quality sound. There are few things that can make a multimedia presentation shine as much as good quality audio. Good sound will smooth out the rough edges of a mediocre animation and make the whole show seem that much livelier. Multimedia producers often forget, in their zeal for beautiful graphics, how important audio is to the perceived quality of a project. Often it is worth opting for 256-color images if it means the sound won't suffer for it. Whew, had to get that out of the way. Now we can move on to other things.

## Audio Formats

Like text or graphics, audio can come in a variety of different formats which allow a user to move files back and forth between various applications and platforms. The most common generic *audio format* on the Mac is *AIFF* or Audio Interchange File Format. On the PC, the most common format is Microsoft's *Wave* or *.WAV*. On the Internet, it is common to see audio files in Sun Microsystems's *uLaw* format. The main thing to remember is that when you are using audio files across different platforms you should save the file in a format the platform can read. Most audio programs can now save audio files in a wide variety of formats and there are plenty of shareware programs available on the Internet such as Balthasar and Brian's Sound Tool that can do this.

## Mixers

For those who wish to get into serious multimedia audio production, you probably want to buy an external mixer so that you can mix your different sources of audio. A *mixer* is a piece of hardware that allows you to mix multiple audio sources. Mackie Designs makes an excellent mixer that it is gearing toward the multimedia market, called the MS1202-VLZ. It features 12 channels, balanced inputs and outputs, and excellent sound quality.

### **Why Can't I Hear the Audio From My CD on My External CD-ROM Drive?**

(FB)

Macs that come with internal CD-ROM drives make it easy for the user. You put in an audio CD, you play it using the AppleCD Audio application and you hear it coming out of your Mac speaker. This is because the CD's output is routed to the same output as the Mac audio chip. If you have an external CD-ROM, it can be a little confusing because you won't hear an audio CD's output coming through your Mac. An external CD-ROM drive has two RCA jacks on the back of the unit. These are the same kind of jacks that you find on your home stereo and, not surprising, require the same kind of cables which can be found at any store that sells stereo equipment. When you play an audio CD in an external CD-ROM, you will either need to hook the RCA cables up to external speakers or listen through headphones connected to the CD-ROM drive itself. The headphone jack is almost always found on the front of the unit.

## The Miniplug

(FB)

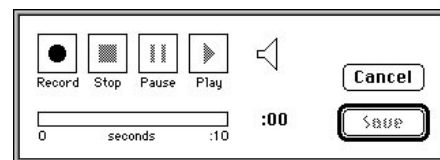
When you are connecting external speakers or a mixer to your Mac you need to be aware of the kind of cable that is required. The Mac output uses something called a *miniplug*. The miniplug is an 1/8-inch jack that outputs a stereo signal. You can tell that the jack is stereo if it has two rings around the end. Most multimedia speakers include a cable when you buy them but if you go the mixer route you will need to purchase a cable that has a miniplug on one end and two male RCA plugs on the other end. If you buy a mixer such as the Mackie, it will probably have 1/4-inch inputs. In that case, you will need to get 1/4-inch-to-RCA adapters to get all your cables to plug in properly. All of these can be found at Radio Shack, which is an excellent place to find solutions to your cabling nightmares.

If you decide to go with a mixer, you will probably want to get a decent amplifier and pair of speakers. There are many amplifiers and speakers out on the market so we won't mention anything specifically except to say that the speakers that 90 percent of the studios in the world use are the Yamaha NS10. This is not because they are the best (sort of like Windows), but because they are considered representative of the kind of speakers most people listen to music on.

## Digitizing Sound

Most Macs sold nowadays come with a microphone which plugs into the microphone input on the back of the computer. The 68K Macs support 8-bit audio input while the Power Mac and AV machines support both 8- and 16-bit input. The Mac also comes with a cable that has female RCA plugs on it allowing you to digitize a *line level* source such as a tape deck or VCR. For those of you who need to record and edit 16-bit sound on a 68K (non-AV) Mac, you will need to purchase a NuBus card designed for this purpose. Digidesign's Audiomedia II card features a higher *signal-to-noise ratio* than the Power Mac or AV Macs (meaning it's less noisy) and has digital inputs and outputs.

You can digitize sound using the Mac's internal *DAC* (digital to analog converter) by going into the Sound control panel, choosing Alert Sounds from the pop-up menu, and clicking the Add button. You then will be prompted with an interface that looks a bit like the buttons on a standard tape deck. Simply click on the Record button and begin speaking into the microphone or playing your line level source. You can then save



You can record short sounds using the Sound control panel's Add function. Sounds are saved in the System file, but you can double-click on the System file to open it up and drag the sounds out.

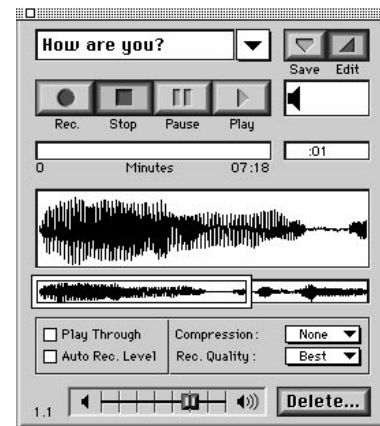
your sound as a System 7 sound and it will be added to alert sounds in the System file. A System 7 sound can be played by double-clicking on it right from the desktop.

HyperCard's Audio palette has a similar interface to the Sound control panel for adding sounds to a HyperCard stack. The Audio palette can be found under Audio in the Edit menu. This brings up an interface which works much the same way as the previous example. The Audio palette has the added benefit of allowing you to edit the sound.

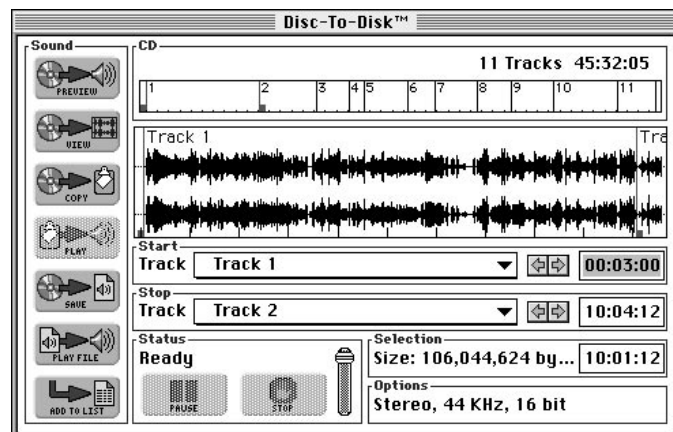


One of the best ways of adding sound to a presentation is to digitize it directly from a CD. (Of course, if you plan to sell your multimedia presentation, you *must* make sure that you have licensed the right to use the audio you pull from the CD.) To digitize directly from a CD, you must have QuickTime installed on your Mac. Using MoviePlayer (see [“The QuickTime Extension and Friends”](#) earlier in this chapter), choose Import from the File menu and highlight the track from the CD that you wish to digitize. Click on the Options button to choose the bit- and sample-rate and to home in on the exact portion of the track that you wish to save. Finally, name your file and click on the Convert button. MoviePlayer will save the track as a QuickTime movie file, which you can then save again as an AIFF file by choosing Export from the File menu. Other programs such as Opcode's Audioshop and version 2 of Macromedia's SoundEdit 16 will also allow you to digitize tracks directly from an audio CD.

**Disc-To-Disk** (\$199, Optical Media International) is a must-have application if you are going to do a lot of digitizing from CDs. It allows you to add small portions of individual CD tracks to a list and then save the items on the list directly to audio files so that you can edit them in your favorite sound editor. You can also see previews of the waveforms for fine-tuning your edit points when saving.



The HyperCard Audio palette lets you edit sounds as well as record them. Sounds are saved as resources in the HyperCard stack, so you will need to use ResEdit to move them elsewhere (see [Chapter 13](#) for more information about ResEdit and other resource editing tools).



Disc-to-Disk enables you to save portions of audio CDs to your hard disk.

## Sound Manager 3.0 and 3.1

(FB)

The audio world breathed a collective sigh of relief when Apple released Sound Manager 3.0 as an addition to the Mac's system software. With Sound Manager 3.0, 68K (non-AV) Macs can now play 16-bit stereo sound files, albeit converted to 8-bit mono. In addition, Sound Manager 3.0 allows the user to route Mac sound through 16-bit sound cards such as the Audiomedia II and increases QuickTime performance by taking over many of the audio chores. Sound Manager 3.1 adds support for IMA compression (see ["Using QuickTime For Compression and Synchronization"](#)), as well as increasing performance on Power Macs.

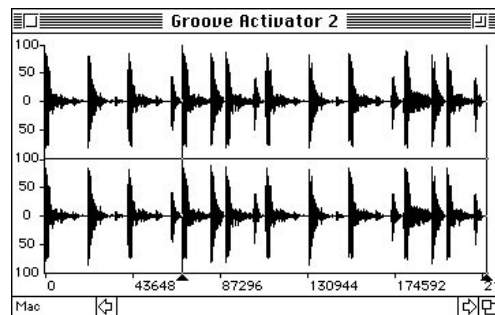
## Sound Editors

As you start getting into editing sound, you'll probably find it worthwhile to buy a dedicated sound editing program. Sound editors all show audio in a similar way so you won't have to relearn everything when going from one program to another. The horizontal axis always represents time moving from left to right while the vertical axis represents amplitude or volume.

**SoundEdit 16** version 2 (\$280, Macromedia) is a fairly complete 8- and 16-bit sound editor that lets you apply a number of audio effects such as reverb and echo to a sound file (though these effects are not of professional quality). With SoundEdit 16 you can save files in a number of formats (including the Windows .WAV) and it lets you convert a number of files between different file formats, sample- and bit-rates all at once (known as *batch processing*). You can also digitize directly from an audio CD.

**Audioshop** (\$150, Opcode Systems) is a nice, inexpensive sound editor that sports several unique and, frankly, nifty features. In addition to the standard audio editing functions, it allows you to play CDs and digitize directly from them. One of my favorite features is Audioshop's ability to make a list of any audio files you may have on your drive and play them back with a click of a button. This is an excellent feature if you need to compare volume levels between files or are just trying to find a sound file whose name you forgot.

**Sound Designer II** (\$495, Digidesign) is a professional quality sound editing package that comes bundled with Digidesign's Audiomedia II card; it requires the Digidesign card to work. The program is designed to work with 16-bit sound files,



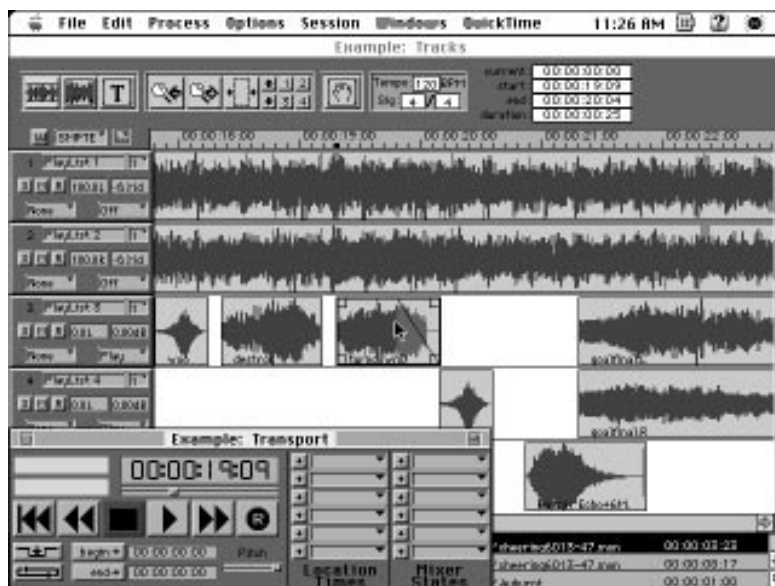
Most sound editors show audio waveforms the same way: The horizontal axis measures time and the vertical axis measures volume.



and is a must-have for anyone who is serious about sound design. One of its nice features is the ability to digitize from a DAT tape entirely in the digital realm through an *S/PDIF* or *AES/EBU* connection (these are digital connection formats used in professional sound studios). Sound Designer II can apply serious *DSP* (digital signal processing) functions to a sound file, such as equalization and time-compression, with professional quality results. It also supports third-party plug-in applications such as the L1 Maximizer from Waves Software, which is the best 16- to 8-bit sound converter available on the market.

**Alchemy** (\$300, Passport Designs) is worth mentioning because it has many of the features of Sound Designer II, but it doesn't require the Digidesign hardware in order to work. Alchemy is one of the best pieces of software available for looping sound files. It also does an excellent job of sample rate conversion, allowing you to specify any sample rate between 1 KHz and 48 KHz (most programs only allow conversions from and to a limited selection of sample rates). The program does require a lot of RAM, however, because it loads the entire sound file into RAM for editing.

**Deck II** (\$329, Macromedia) isn't really a sound editor: it is a 16-bit *multitrack* recorder and editor that lets you mix multiple audio tracks together. You are only limited by the number of tracks your computer will support; for example, the faster PowerPCs can support up to 16 tracks for editing and playback. It also sports professional features such as syncing to SMPTE (a time-code system used in the movie and television industries), *nondestructive* editing (which leaves the original files intact until you save), and *automated mixdown* (which lets you specify a number of mixing options



Deck II lets you mix multiple audio tracks together and synchronize sound effects to QuickTime videos.



and run them automatically). It is particularly useful for synchronizing music and sound effects to QuickTime videos, because it allows the user to import QuickTime movies and edit them.

**Session** (\$250, Avid) is an affordable multitrack editor which has many features similar to those found in Deck II.

**Pro Tools III** (\$7,000, Digidesign) is the cream of the crop among multitrack audio editors, and is used in many professional recording studios. Like Sound Designer II, it comes with its own hardware. It features software-based professional-quality audio effects as well as automated mixdown and nondestructive editing. Though even the base-level system is beyond the price range of most low-end multimedia producers, it is worth mentioning because soon after this book is published Digidesign will introduce a version of the Pro Tools software that will run on PowerPC Macs without requiring additional hardware.

## Using QuickTime For Compression and Synchronization

Although most people think of video when they think of QuickTime, this system extension offers a lot to anyone working with digital audio.

First off, QuickTime 2.1 supports IMA compression of audio files. IMA compression yields 4 to 1 results on 16-bit files, which means that your 16-bit, 22 KHz stereo file will compress down to the same size as an 8-bit, 11 KHz monaural file. It doesn't work well with every piece of music, so you'll have to experiment with it. Apple's SoundConverter and Macromedia's SoundEdit 16 are two programs that allow you to save files using IMA compression. Sound Manager 3.1 now supports IMA compression as well, so almost any program can play back IMA compressed audio if Sound Manager 3.1 is installed (previously, you had to use a QuickTime player to hear IMA compressed audio).



One of the wonderful things about QuickTime is that it allows audio and visual data to play back in synchronization. That may not seem like a big deal, but it has been problematic in the past to get visual and audio events to play back in sync. For example, in Director, if you have a sprite dance across the screen while you play an audio file at the same time, the sprite will probably dance at a different speed on a Power Mac 8100 than on a Mac LC III. The audio, however, *will* play back at the same speed on the two computers. This presents a major problem if you want the music to reach a climax at a certain point in the animation. QuickTime helps solve this problem because it keeps the different events running in sync, no matter what Mac it is playing back on.



A quick way of adding an audio soundtrack to a movie is to use Apple's free MoviePlayer program. Open both the movie to which you want to add the soundtrack and the AIFF file you want to add. Make the AIFF file's window active, choose Select All from the Edit menu, and copy the sound to the clipboard. Bring the movie's window to the front and, while holding down (Option), choose Add from the Edit menu (when (Option) is held down, the Paste command changes to Add). This will add your soundtrack to the movie.

The best tools for synchronizing sound and video are Deck II (see "Sound Editors" earlier in this chapter) and Adobe Premiere (see "Editing Video" later in this chapter). Both yield similar results although the two programs have rather different emphases. Deck II is first and foremost a multitrack editor. It has no video editing capabilities but is a very powerful audio editor and is very good for fine-tuning frame-accurate sound effects. Premiere is first and foremost a video editor, but it also can accurately synchronize sound effects. With Premiere, you synchronize audio and video by lining up the audio visually to the video frame, whereas Deck II gives you a SMPTE time-code readout to go by.

## Future Possibilities

An increasingly important center for multimedia activity is the World Wide Web, and audio is just beginning to become very important on it. At many sites on the Web, audio files are available for the user to download and then play back later. But, as *helper* applications such as RealAudio and programming languages such as Java become more common, and as the Internet begins to support faster connections and increased bandwidth for the average Mac user, you will see an increasing use of real-time audio across the Net. See Chapter 23 for more about the Internet and the World Wide Web.

### Audio File Sizes for One-Minute Audio Files

Sample size, sample rate, and the number of channels all affect the amount of disk space that audio data takes up. This table can help you figure out what the best combination is for your project.

Sample Size	Sample Rate	Channels	File Size
16-bit	44.1 KHz	Stereo	10.59MB
16-bit	44.1 KHz	Mono	5.3MB
16-bit	22.254 KHz	Stereo	5.34MB
16-bit	22.050 KHz	Stereo	5.3MB
16-bit	22.254 KHz	Mono	2.67MB
16-bit	22.050 KHz	Mono	2.65MB
16-bit	11.127 KHz	Stereo	2.67MB
16-bit	11.025 KHz	Stereo	2.65MB
16-bit	11.127 KHz	Mono	1.34MB
16-bit	11.025 KHz	Mono	1.32MB
8-bit	44.1 KHz	Stereo	5.3MB
8-bit	44.1 KHz	Mono	2.65MB
8-bit	22.254 KHz	Stereo	2.67MB
8-bit	22.050 KHz	Stereo	2.65MB
8-bit	22.254 KHz	Mono	1.34MB
8-bit	22.050 KHz	Mono	1.32MB
8-bit	11.127 KHz	Stereo	1.34MB
8-bit	11.025 KHz	Stereo	1.32MB
8-bit	11.127 KHz	Mono	0.67MB
8-bit	11.025 KHz	Mono	0.66MB

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## Music (MIDI)

(FB)

### What is MIDI?

If you've been involved with computers for awhile or if you've thumbed through any of the multimedia magazines that are now available at your local newsstand, you've probably seen the term "MIDI" bandied about. *MIDI* stands for Musical Instrument Digital Interface; it's a protocol which is used for passing digital musical data between electronic musical devices. With the right hardware and software, computers can also understand MIDI data. On computers, MIDI is typically used to play music back. Rather than storing a digital recording of music, you use the MIDI protocol to store information about the musical *performance* and let the playback device, usually a synthesizer or sound card, take care of producing the actual sounds. In other words, MIDI handles which notes are played, when they are played, how loud they are played, and for how long they are played. Because MIDI is only sending performance data, it takes very little CPU overhead.

MIDI was designed for musicians to use as a means of making music. Musicians use programs called *MIDI sequencers* to write music using the MIDI protocol. A song played back using MIDI is referred to as a *sequence*. MIDI uses the serial port on a computer to transmit MIDI data to synthesizers, which then play back the data they receive using their own internally generated sounds. There are 16 *MIDI channels* per serial port; a channel supports a single musical part with a unique musical voice. That means that you can get up to 16 individual musical parts per serial port. On a Macintosh, without using additional hardware, you can get 32 channels of MIDI if you use both serial ports.

In addition to specifying the notes that are played, MIDI data also contains information about what sound or *patch* that synthesizer should play. By convention, patches are numbered from 0 to 127. Patches, however, vary from synthesizer to synthesizer, and the MIDI protocol does not specify which patches are available on any specific synthesizer. All it can do is carry *program change* messages that tell the synthesizer which sound to use based on the number the sound is located at in the synthesizer's internal bank. The MIDI protocol also allows for *continuous controllers* which are messages that musicians use to enhance the performance of a piece of music. For example, Controller 7 controls volume. A musician can send a Controller 7 message that causes a musical phrase to rise or fall in volume in time with the music. There are many other MIDI messages which allow for a great deal of control over a sequence and, through something called *System Exclusive* data, control over features unique to individual synthesizers.

How a synthesizer interprets System Exclusive (or *SYSEX*) data depends on the individual synthesizer, and the same *SYSEX* message will probably mean very different things to two different synthesizers from two different manufacturers.

You should realize that MIDI isn't only used for music. Because it is merely a protocol for sending data, MIDI can be used for other, nonmusical purposes. For example, MIDI is often used to synchronize sound effects to a video source. A sound designer might load her *sampler* with sound effects (a sampler is a device that has RAM to store snippets of digital audio that it can play back in response to MIDI commands), and then use a MIDI sequencer to line up the sound effects with a video. When she plays a key on her keyboard, the resulting sound might be an explosion or a footstep, depending upon how she has mapped her sound samples to the keyboard. MIDI can also be used to control lights in theaters using a variation of the MIDI protocol called *MIDI Show Control*. If you are interested in exploring MIDI, there are many good books available that go into it in much more detail than I have room for here.

## General MIDI

The original MIDI specification let each musician decide which sounds he could use for which program numbers. Unfortunately, if a musician wanted to give someone a MIDI sequence, he would have to tell that person which kind of sound should be heard on each track in order to get the sequence to sound right. *General MIDI* was created to address this issue and to make it possible for musicians to create sequences that would sound the same on different systems. *General MIDI* defines a standard *instrument bank* so that if a sequence sends out a program change message the instrument that is chosen is predefined. For example, General MIDI specifies that program 0 is a piano, program 12 is a vibraphone, and that MIDI channel 10 is reserved for a drum kit in which specific notes are reserved for different percussion sounds ([see the table, "General MIDI Programs"](#)). In order for a General MIDI sequence to play correctly, the synthesizer that plays it back must support the General MIDI standard.

### **General MIDI Program Names**

(FB)

Many synthesizer manufacturers now sell inexpensive synthesizers that are designed specifically for General MIDI. One of the most popular is the Sound Canvas series made by Roland. General MIDI pieces will probably sound best when played back on a Sound Canvas, since it was the first General MIDI device available on the market and, as a result, has become the de facto standard on which composers create General MIDI sequences. The Sound Canvas even comes with a port to connect it directly to a Mac via a serial cable (normally you'd have to get a MIDI interface in order to connect a synthesizer to your Mac).

## General MIDI Programs

The General MIDI standard specifies 128 different instruments, or *programs*, that all MIDI-savvy devices should understand. You may not need all of the instruments in this list, but isn't it nice to know that they are there?

1	Acoustic Grand Piano	44	Contrabass	87	Lead 7 (fifths)
2	Bright Acoustic Piano	45	Tremelo Strings	88	Lead 8 (bass and lead)
3	Electric Grand Piano	46	Pizzicato Strings	89	Pad 1 (new age)
4	Honky-Tonk Piano	47	Harp	90	Pad 2 (warm)
5	Electric Piano 1	48	Timpani	91	Pad 3 (polysynth)
6	Electric Piano 2	49	String Ensemble 1	92	Pad 4 (choir)
7	Harpichord	50	String Ensemble 2	93	Pad 5 (bowed)
8	Clav	51	Synth Strings 1	94	Pad 6 (metallic)
9	Celesta	52	Synth Strings 2	95	Pad 7 (halo)
10	Glockenspiel	53	Choir Aahs	96	Pad 8 (sweep)
11	Music Box	54	Voice Oohs	97	FX 1 (rain)
12	Vibraphone	55	Synth Voice	98	FX 2 (soundtrack)
13	Marimba	56	Orchestra Hit	99	FX 3 (crystal)
14	Xylophone	57	Trumpet	100	FX 4 (atmosphere)
15	Tubular Bells	58	Trombone	101	FX 5 (brightness)
16	Dulcimer	59	Tuba	102	FX 6 (goblins)
17	Drawbar Organ	60	Muted Trumpet	103	FX 7 (echoes)
18	Percussive Organ	61	French Horn	104	FX 8 (sci-fi)
19	Rock Organ	62	Brass Section	105	Sitar
20	Church Organ	63	Synth Brass 1	106	Banjo
21	Reed Organ	64	Synth Brass 2	107	Shamisen
22	Accordion	65	Soprano Sax	108	Koto
23	Harmonica	66	Alto Sax	109	Kalimba
24	Tango Accordion	67	Tenor Sax	110	Bagpipe
25	Acoustic Guitar (nylon)	68	Baritone Sax	111	Fiddle
26	Acoustic Guitar (steel)	69	Oboe	112	Shanai
27	Electric Guitar (jazz)	70	English Horn	113	Tinkle Bell
28	Electric Guitar (clean)	71	Bassoon	114	Agogo
29	Electric Guitar (muted)	72	Clarinet	115	Steel Drums
30	Overdriven Guitar	73	Piccolo	116	Woodblock
31	Distortion Guitar	74	Flute	117	Taiko Drum
32	Guitar Harmonics	75	Recorder	118	Melodic Tom
33	Acoustic Bass	76	Pan Flute	119	Synth Drum
34	Electric Bass (finger)	77	Blown Flute	120	Reverse Cymbal
35	Electric Bass (pick)	78	Shakuhachi	121	Guitar Fret Noise
36	Fretless Bass	79	Whistle	122	Breath Noise
37	Slap Bass 1	80	Ocarina	123	Seashore
38	Slap Bass 2	81	Lead 1 (square)	124	Bird Tweet
39	Synth Bass 1	82	Lead 2 (sawtooth)	125	Telephone Ring
40	Synth Bass 2	83	Lead 3 (calliope)	126	Helicopter
41	Violin	84	Lead 4 (chiff)	127	Applause
42	Viola	85	Lead 5 (charang)	128	Gunshot
43	Cello	86	Lead 6 (voice)		

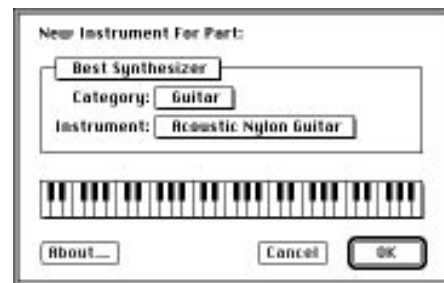
General MIDI has become very popular in the PC world for game and multimedia applications because just about every PC sound card currently sold supports General MIDI. Because MIDI data takes so little CPU power, it is very appealing to developers, although it is not used nearly as commonly on the Mac as digital audio.

## General MIDI on the Mac

Although PC users must have sound cards installed in order to play General MIDI data, General MIDI data can be played back on the Mac using QuickTime. In order to do this, you need the QuickTime Musical Instruments extension, which comes with QuickTime 2.1. The Musical Instruments extension contains the sound samples you need to play back a General MIDI sequence. If you simply want to hear a General MIDI sequence you must convert it into a QuickTime movie (although some programs are now beginning to appear that use QuickTime's MIDI capabilities directly).



An easy way to convert a General MIDI file into a movie is to use MoviePlayer. Choose Open from the File menu and select the General MIDI sequence file you wish to hear. (There are many General MIDI sequences available both commercially and on the Internet.) Highlight the MIDI sequence and the Open button will change to Convert; click to convert the sequence to a QuickTime movie. You can then play the sequence back as a QuickTime movie in MoviePlayer. If you choose Options before converting, you can change the instruments that play on the different tracks. Once a sequence is converted, you can still change the instruments using MoviePlayer: Choose Get Info from the Movie menu, select the music track and instruments, and then double-click the instrument you wish to change. This will bring up the same dialog box as when you choose Options during the conversion process. Note, however, that MoviePlayer will only convert sequences whose file type is "Midi" which is how most Mac sequencing programs save MIDI files—if it isn't, which might be the case for files that come from a PC or from the Internet, you must first change the file type with a utility such as ResEdit (see Chapter 13 for more about ResEdit). Luckily, there is an even easier way to convert a MIDI sequence using the freeware program **All MIDI** by Paul C.H. Ho: Just drop the MIDI sequence on All MIDI and the file will be instantly converted.



The standard QuickTime Musical Instruments dialog box lets you change the instruments used in a QuickTime MIDI movie.

You may be disappointed with the way your movie sounds. The QuickTime Musical Instruments are a limited sound set and don't actually contain the full set of General MIDI programs. For example, QuickTime Musical Instruments will substitute a

single trumpet for a brass section. Unfortunately, all the instruments must be stored as sound samples in memory and it would take more memory than most users are willing to sacrifice to fit all the General MIDI instruments into RAM. QuickTime General MIDI tends to sound best on pieces that aren't heavily orchestrated, such as a Bach piece for solo harpsichord. To get the best sound out of General MIDI, I recommend getting a dedicated General MIDI box such as the Roland Sound Canvas.



## Creating MIDI With Your Mac

General MIDI is a great way to get started writing music on your Mac. General MIDI synthesizers don't tend to be as expensive as professional quality synthesizers and they allow the beginner to dissect sequences others have created. So what do you need to start creating your own music? In addition to your Mac, you will need a MIDI sequencing program, a MIDI interface to connect your Mac to your synthesizer, a synthesizer (this doesn't have to be General MIDI-compatible), and a MIDI controller, which usually takes the form of a piano-like keyboard. The last two items can be found as a single entity.

There are many manufacturers of MIDI hardware; *Keyboard* and *Electronic Musician* magazines often have good articles about buying synthesizers, so I recommend looking there as a place to start. Your local music store should also be able to help you select a suitable synthesizer.

As for software, there are several manufacturers of MIDI software that address the needs of musicians at all levels. Opcode Systems makes a good starter kit for the burgeoning electronic musician called the **Easy Music Starter Kit** (\$299). It includes **Musicshop** (\$100), their entry level sequencing and notation program, the **MIDI Translator II** (\$45) MIDI interface, and **Band In a Box**, an auto accompaniment program.

Mark of the Unicorn has an entry level sequencing program called **Freestyle** (\$200) which features a unique interface designed to be more intuitive for those who are less technically oriented. It also has notation features. Two other entry level sequencing programs are Emagic's **MicroLogic** (\$159) and Steinberg-Jones' **Cubasis** (\$99).

On the professional end, there are several high-end sequencing programs that address most composers' needs. These include **Vision** (\$495, Opcode), **Performer** (\$495, Mark of the Unicorn), **Cubase** (\$799, Steinberg-Jones), **MasterTracks Pro** (\$80, Passport), and **Logic** (\$799, Emagic). Most of these manufacturers also make a version of their sequencer that allows the user to record digital audio along with MIDI.

Another area for MIDI software is applications that are designed for music notation. While many sequencers have notation features, composers who wish to write complicated music scores need to explore programs that are designed for that purpose. **Finale** (\$550, Coda) is considered by many to be the final word in notation programs. It supports almost every conceivable type of notation but has a steep learning curve. **Encore** (\$350, Passport) would probably suit the needs of most composers. Its interface is more intuitive than Finale's but it doesn't support some obscure forms of notation.

For those who wish to edit the sounds on their synthesizers, there are editor/librarian programs to help with the job. Opcode makes **Galaxy Plus Editors** (\$399) which has been the premiere patch editor/librarian program for some years. To edit a sound for your particular synthesizer, you need to purchase the appropriate editor from Opcode (some of the more popular synthesizers are included when you buy the program) as a plug-in module. This allows you to edit the parameters of the synthesizer's sounds on your computer screen and save your sounds in a library for easy accessibility. Patch editors use system-exclusive data to edit the parameters of a synthesizer. Mark of the Unicorn's **Unisyn** (\$395) is another editor/librarian with similar features.

A unique piece of software is **Max** (\$495, Opcode). Max is a MIDI construction kit that allows the user to create their own MIDI programs by patching together icons that control MIDI parameters. Max is a very powerful development environment that can be used for everything from algorithmic composition to creating your own patch editors.

## MIDI in Multimedia Applications

Although one could argue that every piece of software that has been mentioned in this section is a multimedia application, there has been scant support in multimedia development environments for MIDI on the Macintosh. Macromedia's **Director** (\$1,195) dropped MIDI support in version 4 and HyperCard has little for the MIDI enthusiast that's readily available. **HyperMIDI** is a HyperCard stack that is an exception to that. It provides a bit of everything—SYSEX dumps, recording, analysis, keyboard play, and a programmable patch editor. This is your best bet for complex MIDI implementation within a HyperCard stack. Version 1 is available as shareware on the Net, but it is about eight years old. If you are interested in the latest version, it is available for \$125 from the author, Nigel Redmond. It may be possible to use HyperMIDI's XCMDs in Director, though I haven't tried it so I can only speculate.

Your best bet for MIDI in multimedia is to use QuickTime. At present, you can play General MIDI sequences back without the use of an external synthesizer. QuickTime 2.5 (which should be available by the time you read this) will add many enhancements



to its MIDI capabilities. Version 2.5 will give synthesizer developers the capability of creating custom software synthesizers and instruments which should greatly improve the sound quality of QuickTime MIDI scores. It will also allow you to route musical information to external MIDI devices. With these sorts of enhancements, QuickTime will become an increasingly viable option for creating music on a Macintosh.

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## Digital Video

(MEC)

How times change: A few years ago people would say that adding video to computer-based multimedia was a thankless, nearly impossible task. Today, video is almost *required* for a multimedia title to get any attention. To use video, you need to know two things: how to get the video into the Mac, and how to manipulate it once you do.

### Digitizing (a.k.a. Capturing)

Capturing video is a task that requires more computing speed and storage than almost any other task you may do on your Mac. You'll either want a Mac that is "video-ready" or one that you can make video-ready.

**AV Macs and digitizing boards.** The Macs that Apple labels with "AV" are set up to do basic video capturing right out of the box. Some other Macs (for example, most Power Macs) can be made video-ready by installing Apple's **Power Macintosh AV** card (\$530). A few consumer-level Macs (such as the Power Mac 5200/75, LC, or the Performa 630) can use Apple's **Video System** card (\$120), which is cheaper, but which can't handle very large frame sizes or frame rates (that is, the number of frames of video it can capture per second). Fast Macs with NuBus slots might also be able to use a **Spigot II Tape** (\$750, Radius) digitizing card. Any of these solutions will enable you to create credible video for most multimedia purposes. If, however, you want to capture professional quality, full-screen, full-motion video, you will need additional help in the form of a proprietary third-party capture board, and you should be prepared to spend a few thousand dollars and a lot of time reading professional video magazines and journals—this field is changing so rapidly that any recommendations I might make here will be obsolete by the time you read this.

**Video sources.** Getting the Mac set up to capture video is one thing; getting the video to capture is quite another. (Note: unless you are doing all this merely for your own amusement, you don't want to capture video from commercially produced videotapes, television broadcasts, cablecasts, or laser disks—you'll be violating copyright laws and leaving yourself open to a very expensive legal education.) Your video source will



probably be some sort of videotape: VHS, Hi-8, or, if you are verging on the professional, Beta-SP. Whatever your source, make sure that it is the highest quality possible; the more video “noise” in your original, the harder it will be to compress well. Furthermore, as the Mac’s video capabilities improve, you may eventually want to recapture your video, and you will be grateful for a high-quality original when you do.

**Making the capture.** A number of video editing programs support video capturing, which is not surprising, since the bulk of the work of capturing is handled by QuickTime itself. In most cases, the process is no more elaborate than choosing “Record” or “Capture” from a menu or dialog box. Before you do, though, you should set your frame rate and compression choices from QuickTime’s standard dialog box. The menu which brings up the box is not standard; it will vary from program to program. You also want to set the capture window size. Once you have these things set, you can start capturing. After that, sit back, relax, and watch the free space on your hard disk start to disappear!



## Tips For Capturing Video

(MEC)

- *Capture your video without any compression if your hardware supports it and you have the room.* Most codecs (compressor/decompressor; see “[Compressing Video](#)”) are just too slow to compress video in real time, and besides, you will want to play around with compression settings to get the best possible results.
- *Capture video in short segments.* The longer the segment, the longer it will take to compress, the more disk space it will take up, and the more chance that something will go wrong in the process, forcing you to recapture.
- *Defragment your hard disk before you capture video.* If your Mac has to search all over your hard disk looking for empty sectors, it takes precious processing time away from the video capture, and will almost certainly result in your losing some frames.
- *Turn off CPU-hungry extensions and network connections.* Some extensions work continually in the background, taking small chunks of processing time away from the capture process. Also, if you have AppleTalk turned on, the Mac will be checking the network periodically and, while it is doing that, it won’t be working on your video. (Some programs, such as **Adobe Premiere** will even offer to turn AppleTalk off for you before it starts to capture.)
- *Capture your video at the final frame size you wish to use.* If you are planning to show your video in a 180-by-120 window, for instance, it doesn’t make sense to capture it at a larger size: This will merely consume disk space and processing time. Worse, if you plan to show your video in, say, a 320-by-240 window and you capture it at 180-by-120, it will look terrible when scaled up.

## Video Connectors

(MEC)

Attaching a video source to your Mac requires some sort of cable and connector (attaching the audio source requires a different cable and connector and is explained in “The Miniplug” earlier in this chapter). There are two different connector types for video connections: a high-quality *S-Video connector* (which looks a lot like an ADB connector) and a *composite video connector* (which looks like the RCA connectors on the backs of most stereo amplifiers). The 840AV has both sorts of connectors; the AV Power Macs have only an S-Video connector, but come with an adapter cable that converts a composite connector to S-Video. The Apple Video System card for consumer Macs has only composite video connectors.



- *Capture your video at the final frame rate you wish to use.* The television standard in America (NTSC) shows frames at about 30 per second (actually, it is 29.97 frames per second...go figure). You should capture video at some even fraction of this rate for the best playback: 15 frames per second is usually a good choice. Capturing at an uneven fraction of the standard rate can result in jerky motion, dropped frames, and other oddities.
- *Put a floppy disk in your floppy disk drive (and a CD in the CD drive, and a cartridge in your cartridge drive).* Seriously. Every so often your Mac likes to check all attached drives to see if something has been put in them. This check takes a little time, and time is something you don't have to spare when capturing video. Once a disk is in a drive, the Mac doesn't check anymore until the disk is removed.

## Compressing Video

The still pictures that make up a video take up a lot of room: A single picture measuring 320 by 240 pixels at a bit depth of 16 takes up over 150K. If you wanted to show 30 pictures like that a second (about the same rate as television), a minute of video would take up over 250MB! Luckily, there are ways to compress that same video so that it might only take up 1MB...a significant savings.

There are a lot of different methods for compressing video. The most practical ones are called “lossy” compression schemes; that is, they deliberately discard some of the video information, which reduces the picture quality of each frame. A good lossy compression scheme must choose the information to throw away that least reduces the picture quality. Video compression schemes must also allow the compressed video to be decompressed quickly enough to be shown on screen.

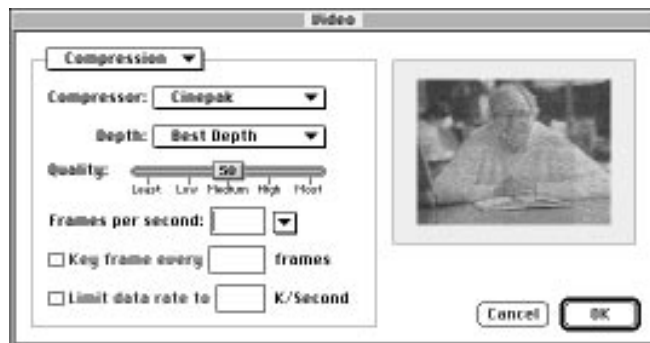
One type of lossy scheme uses something called *frame differencing*. In this scheme, *key frames* are chosen and stored periodically. Non-key frames only contain those pixels

that differ significantly from those in the key frame. This sort of compression works well for video that doesn't contain a lot of motion; a field of wheat rippling in the wind, for example, would not work well with frame differencing. Another scheme reduces the number of pixels stored in each frame by collecting adjacent pixels of similar color and making them all the same color. This scheme can make the picture look blocky and less distinct. In practice, both schemes are usually used when compressing video. It takes a certain amount of experience and experimentation to balance these different compression methods for the best results.

One of QuickTime's jobs is to manage video compression. It does this through software packages called *codecs*, which stands for "Compressor/Decompressor." Codecs are little chunks of software that handle the compression and decompression of video, graphical, and audio data. Some codecs are built into the QuickTime extension in your Extensions folder; while other, more specialized, codecs are dropped into that folder separately. QuickTime manages them all, even codecs that are designed to work only with special hardware add-ons to your Mac.

The standard QuickTime Compression dialog box includes a pop-up menu that lets you choose which codec to use. Here are some of QuickTime's built-in codecs that appear on this menu.

- **None**—As its name implies, this codec actually does no compression at all. But it is not worthless; using this codec you can convert video from one bit depth to another. You may also want to use this codec for capturing video that you want to compress later, since uncompressed video is usually the highest quality you can get—but you'll only do this if you have very fast hardware and lots of disk space.
- **Animation**—You should choose this codec for material that is made up of images generated on the Mac, such as computer-generated video or sequences of screen shots—in other words, animations as opposed to camera work. If you choose Most quality from the Compressor dialog, it supports lossless compression. The codec is very sensitive to changes between images, so even the subtlest video noise will reduce its effectiveness.



The QuickTime Compression dialog box lets you adjust a variety of compression settings. Because it is a standard part of QuickTime, this dialog box will appear in most digitizing programs.

## Choosing Video Compression Settings

(MEC)

Aside from letting you choose a compressor, the standard compression dialog offers you other choices. Cinepak, the typical compressor for live-action video, offers you a number of things you can set. Unfortunately, it is not always clear what effect a particular combina-



The shareware program *MovieCleaner Lite* provides software smarts to help you deal with the complexities of video compression.

you with informed compression choices. The latest version of Adobe Premiere also has a number of customized batch compression settings designed to help you make informed compression choices.

tion of settings will have on the final product. The “Quality” slider is rather difficult to interpret because it actually controls a number of low-level compression features (e.g. balancing “spatial” versus “temporal” compression techniques).

**MovieCleaner Lite**, an excellent shareware package, eliminates this confusion. This program (which also comes in a more full-featured commercial version) distills the experience of digital video experts, and presents

- **Apple Video**—This was the very first video codec that came with QuickTime 1.0 (during development it was known as “Road Pizza,” a sobriquet it still wears among digital video veterans). This codec provides fast enough decompression for many video playback needs, and the compression is a good deal faster than Cinepak’s (see below), taking about seven times as long to compress video as to decompress and play it back. The (relatively) fast compression speed makes it useful for doing editing experiments before final editing and compression. In addition, this codec can compress video as much as 25 to 1 with the right settings.
- **Cinepak**—This codec is most commonly used for video in multimedia titles. It compresses even more tightly than Apple Video and decompresses much faster. Furthermore, it lets you specify the data rate for your video (that is, how much data is processed each second); this is particularly useful for video that will play from a CD-ROM, where the maximum data transfer rate may be relatively low. Cinepak, however, offers these features at a price: Compression is very slow, often taking the better part of an hour to compress a mere 30 seconds of video.

## Editing Video

The field of video editing packages runs the price gamut from free to extremely costly. Nearly all video editors have certain interface elements in common: a time line that lets you select portions of the movie and places to insert clips, a Clip palette that lets you choose from the unedited clips you wish to use, and a window to play back the current state of your movie.

**MoviePlayer 2.1**, Apple's free video viewer (you can get it from their Web site) does not have a real editing interface, but you can do rudimentary video editing with it by using the traditional cut, copy, and paste commands that are standard on the Macintosh. You simply hold down the **(Shift)** key as you move the slider to select part of the movie, then choose Cut, Copy, or Clear from the Edit menu. When you finish editing, choose Save As... from the file menu and make sure to select the Make Movie Self-contained option from the Save dialog; otherwise, it will simply save a tiny file that points to the original movie, and if you move that file to a different disk, you will lose your edits.



*The utilitarian MoviePlayer from Apple lets you select, cut, copy, and paste QuickTime video. It does a whole lot more, too, and the price is right: it's free.*

**QuickFlix** (\$150, Radius) is a low-cost way to do real video editing. It provides some rudimentary effects and transitions that you can apply to your clips, and it supports direct video capture.

**Videoshop** (\$260, Avid) has more features than the first two editing packages. You can trim individual clips and layer multiple video tracks. Videoshop has a storyboard as well as a time line so you can see which clips, in which order, are currently in your movie, and it has a more robust set of effects, transitions, fades, and filters.

**Premiere** (\$500, Adobe) is probably the standard of multimedia video editing professionals, as well as having a place in the world of broadcast video editing. It has a huge number of standard transitions and effects, supports batch compression, lets you “matte” one video onto another, and much more. Its weakest feature may be its manual, which is skimpy and sometimes misleading, but if you can afford to buy it, you should have it.



*Adobe Premiere's Construction Window is typical of video editing programs, showing the movie and the soundtrack as separate time lines that can be adjusted and edited.*

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## Animation

(JK)

The word *animate* literally means “to make alive,” and because most Mac owners tend to think of their machines as living, breathing things anyway, it’s only natural that they use their Macs for creating animations. Actually, one of the biggest reasons why the Mac is the machine of choice for most multimedia developers is the availability of animation tools, as well as image manipulation and sound editing software for the Mac. All of these programs work hand-in-hand to create successful animations, animations that can range from a simple button that comes alive when you click it to talking, walking, lifelike ’toons in an interactive children’s book.

Most computer animation falls into one of two categories—two-dimensional or *cel* animation (2-D) and three-dimensional (3-D) animation. Each has its specific place in the multimedia world, and each has an extensive set of tools available on the Mac. The biggest difference between 2-D and 3-D animation is how they are made.

No matter which type of animation you intend to make, the process usually starts with recording the soundtracks: It is almost always easier to synchronize an animation to a soundtrack than the other way around. The soundtracks are mixed down to *DAT* (digital audio tape) and then digitized and edited using programs such as Sound Designer or SoundEdit 16 (see [“Digital Audio”](#) earlier in this chapter). The real work starts after you finish the soundtracks.

### 2-D Animation

In 2-D animation, you draw the parts of the image that will move: Some animators use illustration programs such as Adobe Illustrator or Macromedia Freehand, but most animation artists still prefer to draw the old-fashioned way. Whether you do your drawing on screen or on paper though, you’ll need to create at least ten separate drawings for each second of animation if you want it to look smooth. At the same time, you’ll need to create the background art over which the moving image will appear. If you’ve been doing your drawings on paper, you’ll then scan and colorize them using a flatbed color scanner and a 2-D image manipulation program such as Adobe Photoshop. The whole process is not too different from the way animation has been done since the Road Runner was an egg.

Even with your Mac’s help in reducing some of the drudgery of making all those pictures, 2-D animation is still a lot of work. That’s why most 2-D animation projects require a small team of artists. If your project will require more than just a few

seconds of animation, you'll probably want to farm out that work to a company that specializes in animation. Still, trying your hand at this venerable form can be a lot of fun, too, and the buy-in price is right: The inexpensive **Dabbler** (\$70, Fractal Design), lets you create animations and even provides interactive multimedia tutoring on the art of cartooning.

### 3-D Animation

Although most 2-D animation work still starts with pencil and paper drawings, 3-D animation is almost completely created on the computer. The two main stages in creating 3-D art are *modeling* and *rendering*.

In the modeling stage, you start by making *wireframe* images on the screen (so called because the pictures are made up of a series of lines that look like wire frames, which require much less processing time than generating a filled-in image), and fine tuning them to simulate real-life characteristics and movements. Once you've made your wireframe images, you'll apply surfaces, textures, and lighting effects to them, often using the same software that you used to generate the wireframe images. The character or scene can be modeled from various viewing angles, allowing you to create different versions of the same image. You'll also specify movements of the image over time in this stage.

The rendering process takes the choices you've made about surfaces, textures, motions, and lighting effects and turns them into a finished 3-D image. The rendering process also saves your images on disk, using one of the standard file formats (such as PICT, PICS, or QuickTime) that multimedia applications will be able to use. Rendering, however, can take a long time and it requires your Mac to do a lot of highly complex math work, so you really should use the fastest Power Mac that money can buy. In other words, your good old Mac IIsi would probably not be a wise choice for 3-D rendering, unless you have a couple of days to kill.



3-D packages range vastly in price and sophistication. On the lower end of the spectrum, many developers use **StudioPro** (\$1,500, Strata) or **Infini-D** (\$900, Specular). Macromedia recently released a good 3-D product, called **Extreme 3D** (\$500), which offers time-based 3-D animation capabilities in addition to good 3-D modeling and rendering. On the higher end, **Electric Image** (\$7,500, Electric Image) is the program of choice for the serious 3-D artist.



## Integrating Animation into Multimedia

How you integrate your animation into your multimedia project depends very much on the multimedia authoring program that you use. In many cases, you'll want to save your animation as a QuickTime movie, since nearly all multimedia authoring programs can use it. Some programs, however, let you do more than just plop a QuickTime animation onto the screen.

Macromedia Director (see [“Interactive Multimedia Authoring”](#) later in this chapter) is one of the most frequently used tools for constructing animations because it uses a time-based metaphor, and also has its own programming language called “Lingo” for developing interactivity. With it, you can make animated sequences come and go when you choose and interact with other objects on the screen.

Some developers have recently started using mFactory's mTropolis (see [“Interactive Multimedia Authoring”](#) later in this chapter) as their authoring tool, because of its ability to efficiently animate numerous objects simultaneously, and because it uses a more object-oriented authoring environment than Director's (something the programmers you work with might appreciate). mTropolis also allows you to create something called *mToons*, which are animation files used exclusively for titles developed in mTropolis. mToons are similar to QuickTime movies, since they can use the same types of compression used in QuickTime.

Of course, standard authoring and animation tools don't always meet the needs of high-end multimedia developers, some of whom develop their animated titles using proprietary software created by their own in-house programmers (who probably don't get very much sleep). Luckily, most high-end in-house proprietary tools usually find their way onto the market sooner or later. As it is, there are numerous possibilities available for creating animations on the Mac, whether you're a seasoned animator with a big budget, or a weekend hacker with some “off the shelf” software and a good machine.



## Presentations

(AA)

If multimedia is defined as the blending of different types of media, then presentation software is its very essence. That's right: Those slide-making programs that marketing and business folks use everyday for sales, education, and training are actually powerful multimedia tools. With a presentation program, you can combine text, charts, and illustrations—and, if you wish, animation, video, and sound—into eye-opening visuals that keep the audience awake and get your points across in style.

You can choose from a variety of output options, including on-screen presentations, 35mm slides, overhead transparencies, audience handouts, and videotape.

## What to Look For

(SC)

Presentation software comes in two basic flavors. *Traditional presentation programs*, such as PowerPoint and Persuasion, are essentially slide-making tools for business presentations chock full of charts and bullet points. If you're doing an on-screen slide show, you can add QuickTime movies and sounds.

*Multimedia presentation programs* output only to the screen (or videotape), but they offer more pizzazz. Not only can you combine elements from a variety of sources—including sounds and movies—but you can also define precisely when and how they will come and go over time. For example, you could have a pie chart roll onto the screen and break apart. Then each slice could tumble off the screen in a different direction while theme music pounds in the background. Two seconds later, the company logo fades in while a narrator adds a pithy comment. Most multimedia programs also offer rudimentary interactivity, allowing you (or a client) to jump to different points in the presentation at will.

Whether you opt for an old-fashioned or newfangled presentation program, here are some key features to look for.

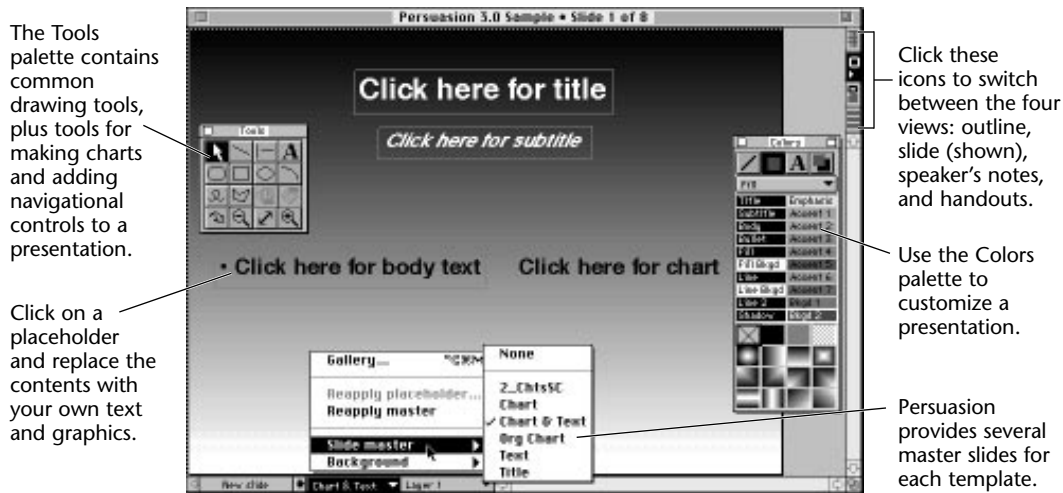
**Import capabilities.** You'll probably create most of your media elements elsewhere, so be sure the program imports the file formats you need for text, graphics, animation, video, and sound. Typically, traditional programs offer better support for spreadsheet data, while multimedia programs can handle more sound and animation formats.

**Media creation and editing.** You don't want to import everything, so look for text-formatting features (including a spelling checker!) and basic drawing tools. Traditional programs can create graphs from scratch, while some multimedia presenters have sound editors. But if, for example, you require a truly sophisticated chart, you'll have to produce it in a dedicated program such as DeltaGraph Pro ([see Chapter 15](#)).

**Run-time player.** This is critical if you want to hand out copies of presentations. A run-time player is a limited version of the program that plays back presentations but can't create them. You can freely distribute it with your presentations, so that clients can view them without the full program installed on their computer.

Don't forget to include external source files (such as QuickTime movies) when you distribute the presentation. And stick to core fonts such as Helvetica and Times so the text will look good on everyone's Mac.

**HOT TIP**



Presentation programs such as Persuasion provide a variety of templates—predesigned slides with color-coordinated backgrounds and formatted text.

**Templates.** A healthy selection of predesigned slides or scenes makes creating consistent, professional-looking presentations faster and easier. The backgrounds, color schemes, text placement and formatting, charts and graphics, and (in some cases) animation are already in place. Just substitute your material for the placeholders, and away you go.

**Transition effects.** For on-screen presentations, you can vary the way one slide or scene is replaced by another. Wipes, fades, and dissolves can add subtle interest. Some programs offer funkier effects such as checkerboards and vertical blinds.

Use a program's build feature to reveal bullet points or chart elements one slide at a time; it adds drama and helps ensure that the audience will be listening to you instead of studying the slide.



**Cross-platform compatibility.** If you work in a mixed-platform environment, look for programs with Windows versions that allow users to open and edit presentations created on the Macintosh, and vice versa. Most slide-based presentations should convert with only minor changes, such as text reformatting (due to font differences).

**Traditional tools.** Slide-making programs have a few other key features:

- *The outliner*—a defining feature of these programs—lets you quickly enter or import text. Outline entries should be linked directly to slides, so that any text changes you make show up in the slide, and vice versa. It also should be easy to change the order and hierarchy of items in the outline.

- *A master slide* acts as a guide for individual presentation slides. Backgrounds, text placeholders, and graphics (such as a company logo) that you put on a master slide appear on any slide tied to that master. This lets you quickly format a large number of slides and ensure a consistent look for the presentation.
- *A slide sorter* lets you quickly rearrange a presentation by clicking and dragging thumbnails.
- *Audience handouts and speaker's notes* often contain thumbnails of the slides along with explanatory text.

**Multimedia tools.** Multimedia programs have specialties of their own:

- *A time line* lets you control the comings and goings of each element in the presentation—logos, movies, sounds, and so on—by specifying start and end times.
- *Slide-import capabilities* let you convert a traditional slide presentation into a multimedia extravaganza.
- *Basic animation tools* let you add motion to text and graphics. For example, you could direct a circular corporate logo to bounce around a scene, then come to rest on top of an *i*.
- *Interactivity* means you can add buttons that let you (or another viewer) decide where to go in a presentation or when to play a QuickTime movie. This makes multimedia programs good choices for producing training materials and kiosk displays.

## Presentation Programs

(SC)

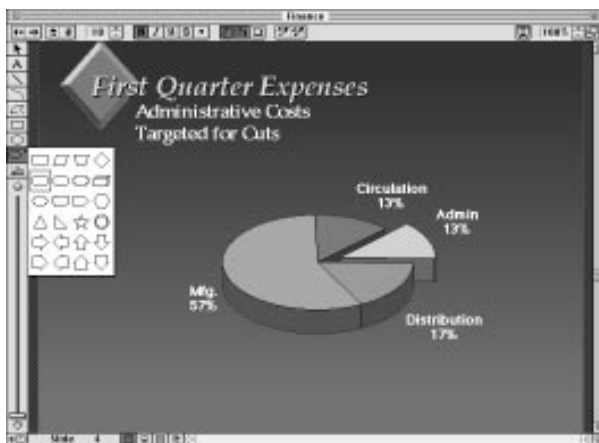
Slide-making applications are the workhorses of business presentations, meeting the needs of most of the people most of the time. You can't go wrong with either Persuasion or PowerPoint. Both offer good outliners and text handling, drawing tools, robust charting capabilities, numerous templates and transitions, a run-time viewer, and hot links to other programs—which means you could, for example, double-click on a table imported from Excel to open it directly into Excel for editing.

**Persuasion.** After a couple of years in PowerPoint's shadow, **Persuasion** (\$260, Adobe) is again king of the hill, at least temporarily. Version 3 is easier to use, with floating palettes and better navigation icons, and its improved color handling ensures that color slides convert nicely to grayscale or black and white, so that audience handouts are legible. Beefed-up options for on-screen presentations include bare-bones

animation; more control over transitions; and an autojump feature that lets you branch to other slides, presentations, or programs. And, unlike PowerPoint, Persuasion can juggle several master slides in a single presentation. For example, you could use one master for bullet-point slides, another for charts, and a third for titles. Persuasion's biggest drawback is its clumsiness in exchanging presentations with the Windows version.



**PowerPoint.** The original presentation program has that familiar Microsoft look and feel: a handy toolbar up top and hot links to other programs. **PowerPoint 3** (\$295) has



*PowerPoint is a full-featured traditional slide-making program with a variety of tools neatly arranged around the window. It offers excellent graphing capabilities, and a handy shape tool (left) helps you draw perfect polygons.*

only a single master slide, but the ability to format slide text in outline view is a real time-saver. A versatile shape tool lets you quickly draw perfect stars, arrows, and triangles, and the artistically challenged will appreciate the color coach, which helps you select coordinated colors for your presentations. PowerPoint's near-flawless ability to transfer presentations to and from its Windows version is a definite advantage over Persuasion. Version 4 sports more production aids and design features, such as improved toolbars, easier creation of organizational charts, and limited interactivity.



**Astound.** You don't have to choose between a traditional slide show and multimedia presentation program: Get **Astound** (\$170, Gold Disk), the only program that offers the best of both worlds. Like traditional programs, it uses a slide-based approach and supports outlines, 35mm slides, overheads, and speaker's notes. You can even create charts and edit text (including spelling checks). Yet Astound also provides a full range of multimedia tools, including a timeline, rudimentary animation tools, interactive buttons, and a sound editor. To top it off, Astound has a well-designed interface that's relatively easy to use, and its transition effects are positively stunning.



If you're presenting mostly charts and graphs, also consider **DeltaGraph Pro**, a super graphing program with decent presentation features to boot.



## Presentation Tips

**Keep it simple** (AA). Transitions, animations, movies, and sounds liven things up, no doubt about it, but too many will distract, instead of impress, your audience. Too much activity may also overstress your Mac, causing the presentation to become slow and jerky. Try using just one or two eye-catching effects to guide the audience to specific points.

**Color concerns** (AA). Use 8-bit color whenever possible, because the Mac can process it much faster than 24-bit color. For instance, create 8-bit animations and save them with the QuickTime animation compressor set at highest quality (this also reduces file sizes). (For more on QuickTime compressors, [see “Compressing Video”](#) earlier in this chapter.)

**File management** (AA). Keep all the source files in the same folder with the presentation so they’ll be available when you run it. This is important because many programs create a link to movies, sounds, and graphics instead of importing them. If you’re distributing the presentation, keep in mind the space limitations of floppy disks and don’t forget the run-time player!

**Presentations to go** (SC). If you plan to take your show on the road with a PowerBook, here are a few tips:

- Several programs provide templates specially designed to look good on a PowerBook screen.
- Keep it simple. QuickTime movies, jazzy sounds, and intricate drawings won’t cut it on most PowerBooks.
- If you don’t have a color PowerBook, test-drive the presentation in black and white or grayscale to be sure contrasting colors and text show up well. (Persuasion 3 has a built-in grayscale preview.)
- Stick to core fonts ([see “The LaserWriter 35: Fonts Almost Everyone Has” in Chapter 14](#)). You’ll save hard disk space and, in an emergency, won’t have problems running the presentation on someone else’s Mac.
- Bring backup—PowerBook batteries and floppies with an extra copy of your presentation and the run-time player.
- A PowerBook screen works only for a handful of viewers. For larger groups, hook up an external monitor, video projector, or LCD projection panel.

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## Interactive Multimedia Authoring (MEC)

Presentations that simply combine text, video, audio, and graphics can do a lot, but sometimes you need your Mac to do even more. When you really need to *involve* your audience, to put them in control of the material you've assembled, you no longer have just a presentation: You have an interactive multimedia experience.

### Stacks, Stages, and Scripts

Considering all the material that goes into a typical multimedia title, it helps to have some overall structure to arrange and contain it. Many interactive multimedia authoring packages choose one of two metaphors to provide that structure: the *stack* metaphor, or the *stage* metaphor.

The stack metaphor arranges the title as though it were a stack of index cards. You can flip through these cards like the pages in a book, but, more importantly, you can sort them in different orders. In this metaphor, each card contains information: pictures, text, buttons, and so on. The card metaphor is particularly good for titles that are more like books or databases than like movies, such as an interactive cookbook, or an encyclopedia.

The stage metaphor arranges the title as a collection of various movies. The screen is a stage upon which objects appear, move, interact, and disappear. This metaphor is particularly good for titles that are time-oriented and have stories to tell. Interactive fiction, games, and simulations often use the stage metaphor.

The distinction however, between stage and card is not clear: The cards in card-based programs can act a lot like stages, and the stage in stage-based programs can be made to look and act a lot like a card.

Whatever metaphor you choose, you may find yourself severely limited in the sorts of interactivity you can provide if the package does not provide some sort of *scriptability* (that is, the ability to do custom programming using the package's *scripting language*). Clever scripts can often lift the products you make with an authoring package far above what the package's creators thought possible, as well as allowing you to work around some of the package's limitations. As a simple example, most authoring programs let you create buttons that, when clicked, take you someplace, or play a sound, or show a video. But a program that lets you customize a button's actions with a script can let you do things such as detect whether the user clicked near the left or right side of the button and then use that information to control the speed of a video or the direction in which it plays.

## Authoring Packages

(SE)

**HyperCard** (\$100, Apple). This is the original easy-to-use multimedia authoring tool. First released by Apple in 1987, it has traveled through many versions (and software companies) since then. HyperCard is at version 2.3 as of this writing, and has been accelerated for Power Macintosh, though you can use HyperCard with practically any 68000-series Macintosh that has at least 2MB of RAM and a hard disk.

HyperCard uses the stack metaphor for creating multimedia. To build a program, you create cards containing data to be viewed (or heard) and interactive elements (such as buttons that may take the user from one card to the next). HyperCard has built-in tools for making or entering text, graphics, buttons, user-input fields, time-based events, or location-based events. HyperCard's automated button tasks make it easy to create jumps between cards or trigger multimedia events such as playing back audio files or QuickTime movies. HyperCard also supports AppleScript (see Chapter 3) so that you can run Apple events from within your stack. And if all the ready-to-use tools don't accomplish what you need, you (and your favorite programmer) can use the

HyperTalk scripting language to accomplish practically anything you can dream up.



*HyperCard's new button tasks automate a number of multimedia tasks that used to require scripting in earlier versions.*

Over the years, HyperCard has incorporated support tools that it now ships as part of the package. For example, a 24-bit painting program is built-in so you can create and edit your graphics directly in HyperCard. Similarly, HyperCard's QuickTime movie tools are a boon for anyone who needs to do some quick movie editing.

Although the program has fallen out of favor with many commercial developers, HyperCard is still widely used by the rest of us to create elegant and effective multimedia applications. Its card-and-stack metaphor makes it simple for school kids to visualize and create their projects using real-world index cards while it helps them acquire important logical skills (that will come in handy when they need to build that corporate presentation that is due Monday morning). HyperCard is an excellent authoring platform for interactive kiosks, computer-based training programs, presentations, and multimedia databases.



If you expect to distribute your product, HyperCard is also an economical choice. HyperCard stacks can be compiled into self-running applications that you can distribute royalty-free. (Note: Always be sure to check with Apple before distributing a HyperCard product for retail sale as the rules regarding royalty and credit are subject to change.)



**SuperCard** (\$400, Allegiant). This authoring package has been around almost as long as HyperCard, and likewise has gone through some tough times. Like HyperCard, it has been sold and bought by a number of software companies; luckily, it is now owned by Allegiant, a small company that doesn't see it as just another inventory item. At this writing, SuperCard is at version 2.5. It requires System 7, a hard disk, and 2MB to 4MB of RAM to get started.

SuperCard also uses a stack approach like HyperCard, but relies more heavily on scripting to add sophisticated interactivity. Although most work is done using the SuperTalk scripting language, don't let this put you off. SuperCard includes a lot of support for scriptwriting, including a help system that inserts the correct syntax for any script command. With SuperTalk, you can create the exact environment you need to meet your project needs, easily controlling the contents of menus, interactivity with QuickTime movies, and sound playback.

You can give your applications a professional look by adding a backdrop window to your application: This will blot out the desktop, regardless of monitor size. *A backdrop window* can save you from the chuckles that will accompany your presentation if your hard disk named "Snuggles" is floating at the upper right of that large screen you weren't expecting to use. Better still, when creating computer simulations, you can be sure the simulation window is the only thing visible onscreen.



SuperCard is an efficient user of system memory, so if your users are on less robust machines, your application won't drag along like it is in need of stimulants. SuperCard also uses a *player* approach to running stand-alone versions: Your application contains just the data and scripts and the SuperCard Player contains the kernel of software necessary to make your application run. This is particularly useful when you are putting a number of applications on a single computer—instead of duplicating the kernel with each application (taking up precious hard disk space), you only need one copy of SuperCard Player.

You'll find that SuperCard is a good, professional tool and a real workhorse. Its reliance on scripting means you will need to make an investment of time to become an expert user, but you will be well-rewarded for that effort. With SuperCard, you will be able to create sophisticated computer simulations or other specialized interactive environments in addition to more run-of-the-mill applications such as multimedia databases, presentations, and kiosks. It can even be used as a prototyping tool.

Because you will need to distribute a copy of SuperCard Player with your project, you should check with Allegiant Technologies for their current royalty and credit requirements.

**Oracle Media Objects** (\$100 introductory price, Oracle). This software was introduced as part of Oracle's interactive multimedia suite in 1995. Part of a grand design that includes client/server software, a custom extensions development kit, and players for a variety of platforms, Oracle is worth considering if you will be delivering time-sensitive data over a local network or interactive television.

Oracle Media Objects uses the stack metaphor. In this case, though, the metaphor presumes that content will be created separately from interactivity, and that the author will simply glue data and interactive objects into stacks to create applications (although those who have developed interactive titles know this isn't always the case). You'll probably want to brush up on your object-oriented programming skills to make efficient use of this metaphor (or defer to a programmer-author). Oracle also includes a scripting language, Oracle Media Talk, that will look familiar to anyone who has ever used HyperTalk or SuperTalk. For those brave enough to create their own object classes, a Custom Extensions Standard Developers Kit (SDK) is available.

Oracle's object-oriented approach makes it possible to build links to content files as well as embed data within a stack. Linked objects are easy to edit during development (you can change the contents of the linked object without modifying your stack), and they make it possible to establish dynamic links to live data sources such as media servers. Dynamism plays another role in the Oracle Media Objects world. Even after you create a stand-alone application, it can be modified as the user runs it. When this is combined with the ability to pull in live data, you've got the makings of an application that never goes out of date.

Although too new to have a long list of finished products to its name, Oracle Media Objects provides an interesting combination of abilities. Its stack metaphor makes it useful for simple presentations and interactive titles. But its ability to work in a client/server model and its strong object orientation make it extremely useful in corporate environments as a front-end for media databases. By integrating tightly with Oracle's own server architecture, it could even be possible to build on-demand titles such as interactive television and Web sites.

Media Objects' biggest shortcoming currently is a less-than-robust way of handling text, and the lack of any text searching abilities. This is expected to change, however.

Oracle sells run-time player applications for a variety of platforms. Contact them directly regarding royalties and credits for commercially distributed products.

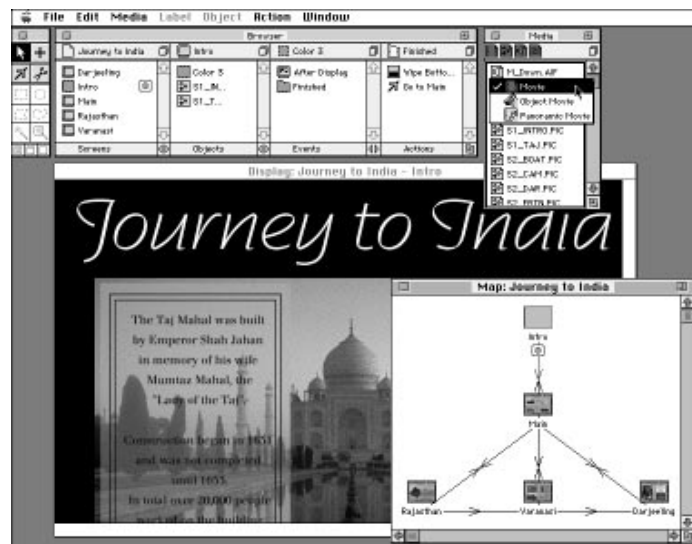
**Apple Media Tool** (\$475). Apple released **Media Tool** several years ago as a simple solution for those who wanted to create simple multimedia presentations quickly and without programming. Although never heavily promoted, reviewers have begun to notice that the Apple Media Tool is, as intended, a very good choice for authors who

want to get a simple cross-platform multimedia product up and running quickly. The current version is 2.0.

The Media Tool is built upon the concept of a map. You create locations (which represent a screen) on this map by clicking on the map window with a + tool, and then dragging and dropping media elements and interactive elements onto those locations. Each of these screens is like a cross between a Director stage and a HyperCard card.

Each screen has its own Objects window, which lists all the objects in that screen. Unlike some authoring programs that import the media into the title that is being developed, the media in a Media Tool title remains separate from the title itself: Pictures remain in graphic files, sound in sound files, and so on. This way, you can build a production using placeholder media, and substitute the final versions at a later time.

Interactivity is provided by adding “actions” to objects on a screen: Actions are listed in an Action window, which changes its contents depending upon the selected object. To add an action to an object, you simply drag the object from the Objects window and drop it onto an action. The built-in actions that the Media Tool supports are well chosen for those who wish to create a basic point-and-click interface. It does not, however, allow you to create things such as forms, or in fact, any part of a presentation that involves typed-in text.

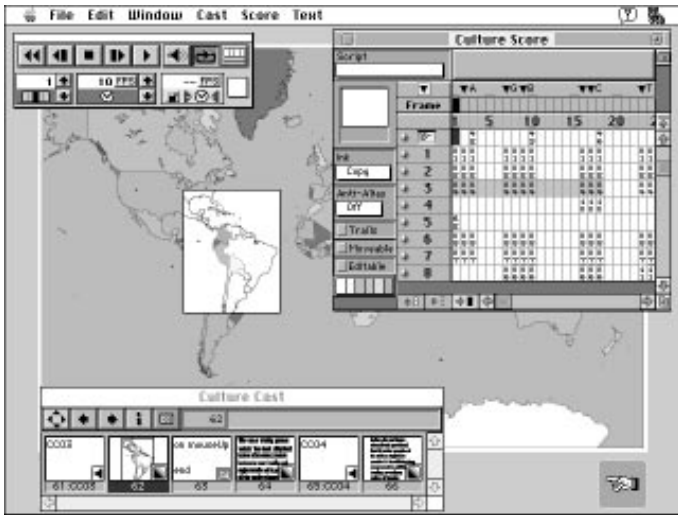


Apple's Media Tool features a map-based, drag-and-drop authoring interface.

Media Tool's capabilities can be enhanced, albeit at substantial cost and complexity, through the **Media Tool Programming Environment** (\$995). The Programming Environment is for serious programmers. With it, programmers export Media Tool titles as text files that are in the Apple Media Language, and then add the custom enhancements that are required. The Media Tool is available in a Power Mac native version, and it can create cross-platform titles.

Licensing fees vary depending upon the use: Fees can be waived for educational and non-profit uses, but for commercial uses (such as a for-sale CD-ROM, or in-house corporate training productions created with Media Tool), Apple charges a \$500 per title licensing fee.

**Director** (\$1,200, Macromedia). Ah, **Director**, the authoring tool everyone loves to hate. Director has been the flagship of Macromedia for many years, and has kept well in tune with regular and significant upgrades. Currently at version 5, you need a high-octane Macintosh to run Director at a comfortable speed. A 68030 Macintosh running System 7, a 13-inch or larger monitor, at least 8MB RAM, and up to 32 MB free hard disk space will allow you to open the program, but you will probably want



*Director's stage-based, score-driven interface is especially well-suited for animations and simulations.*

to invest in a Power Mac with at least 32MB RAM if you don't want to spend a lot of time watching the watch. Director uses a stage approach to authoring, which means that you have to remember that you can only occupy one physical space in the universe at any one time (although you may have placed copies of yourself at strategic locations all over, just in case). A background in theater also makes the Director metaphor a bit easier to understand. In Director, you create “movies” that comprise cohesive units of your application. A Director movie contains cast members that can be controllers, graphics, text, QuickTime, or sound. By physically locating cast members on your screen and controlling them through scripts, you create interactivity. Director's scripting language is called Lingo, and like any programming language, what you do with it can be as simple or as complex as your imagination allows (and a programmer can code).

Director includes a paint program and palette editor to speed your work with graphics. With 50 transitions available, you can get from screen to screen in a variety of ways that range from elegant to obnoxious.

Director has made great strides in creating a cross-platform tool for both development and delivery. This means that you need only author your application once. Then, with a bit of tweaking to accommodate for differences such as XObjects (custom code chunks for the Mac that programmers write) and DLLs (custom code chunks for Windows), you can export a version that will run under Windows, on the Internet ([see the sidebar, “On the Horizon”](#) later in this chapter), or with a 3DO set-top system. Should you be courageous enough to try this, be sure to carefully plan things such as filenames and file types beforehand, to accommodate the weird rules that apply to the various platforms.

Director's major drawback has always been that it doesn't handle text very well. For years, it has viewed text as just another form of graphic, which means that things such as full-text search or true text hyperlinks were practically impossible to achieve. Version 5 corrects some of that, with new features that support paragraph styles, line spacing, and automatic anti-aliasing of large type.

Director is great for controlling objects in motion over time. You can easily create presentations, interactive products, simulations, and kiosks with Director. If you check the credits of your favorite CD-ROM product, you'll probably find that it was created with Director. Director's cross-platform portability makes it a natural choice if you need to present your application on both the Mac OS and Windows.

**Authorware** (\$5,000, Macromedia). This authoring tool has its roots in training and education, and it shows. Bought by Macromedia a few years ago, Authorware provided a cross-platform tool when few were available. Currently at version 3, Authorware includes a complete toolbox (including sound and video editors, 3-D modeler, and clip art library), and compatibility with Macromedia's more famous authoring tool, Director. Its high price does make Authorware a significant investment.

Using a flowchart approach that has its roots in computer-based training development, Authorware employs icons to represent data types, individual screens, and user input, and it lets you connect them in charts that specify all the possible paths through your application. To work on your application, you open an icon on the flowchart to manipulate its contents or specify its settings.

The program includes a number of interactivity templates where all you have to do is arrange them in order and add data. This makes developing standard applications (such as a presentation or quiz) a breeze.

Authorware understands that words are still the basis of most communication. You can import text files in *RTF* format (Microsoft's standard Rich Text Format which most word processors can import and export) and instantly create a series of screens based on the page breaks in the document. You can identify a word or phrase as a hyperlink, and you can easily implement full-text and keyword-search features for your users.

If you need to gather feedback from your users or score correct results, Authorware will save you days of programming. You can easily track a user's progress through your application or present remedial information if a user answers a quiz incorrectly.

Although its own animation tools are pretty rudimentary, you can create animations in Director and play them back in your Authorware application. As of this edition, the Authorware application even includes a copy of Director.



This package is the Cadillac of computer-based training development tools, and its price tag makes it clear that its market is the Information System Development departments of major corporations. You will also find many copies in the halls of academe (thanks to a reasonably-priced academic version). Kiosks, videodisk training systems, and database query tools will benefit from Authorware's flowchart metaphor. Templates make it possible to create lecture presentations, quizzes, and computer-based training courses that look good and work.

You can save your Authorware application as a stand-alone that will run under either the Mac OS or Windows. Although royalty-free as of this edition, if you are distributing your product commercially, check with Macromedia regarding their current requirements for credit and royalties.

**mTropolis** (\$5,000, mFactory). A new arrival on the scene, mTropolis heralds what is likely to be a wave of products that create a new, object-oriented development approach to multimedia authoring. First released in late 1995, mTropolis requires a Macintosh 68040 or Power Mac with a double-speed CD-ROM drive and at least 8MB RAM. Far from being for the rest of us, this is a serious tool for serious developers.

The mTropolis approach is object-oriented which means you will spend as much time defining the vehicles that deliver your content as the content itself. Object orientation best suits those who like building models. The approach really makes sense for applications that explore multimedia worlds because you won't have to re-create the sound of planetary dust under each footstep or that neat visual effect each time a new door opens. A footstep object would include its sound, a door object would include its open and close effects (and the accompanying sounds). You keep track of your store of objects using a palette, picking up copies and positioning them as needed on the screen.

mTropolis promises to port your application effortlessly to the many flavors of Windows platforms available today. It is also positioned to handle the new on-line delivery by implementing streaming of your application (so it can be fed in bite-size pieces to a Web browser).

Given its set of features, the package appears to have been created by the programmers and graphic artists who create leading-edge interactive fiction and action/adventure applications. It is definitely the tool to use to create new worlds and new visions, but its support of text is quite limited. *[But now that Adobe owns a piece of the company, this*

## ***On the Horizon***

(MEC)

**Java.** While billed as an Internet tool (and cooed over by Wall Street analysts as the biggest thing to happen to computing since the bit), this complex programming language from Sun Microsystems has the potential to turn Internet web browsers into multimedia applications. Java programs are cross-platform “applets” that you download from an Internet server and then run on your machine. Some applets will certainly be designed to do multimedia tasks directly in your Web browser.

**Shockwave.** This technology from Macromedia allows Director movies to be viewed on the Internet. Using Shockwave’s compression utility, called Afterburner, animations and simulations can be downloaded and run at acceptable rates for those with relatively slow Internet connections. Shockwave should provide yet another niche for multimedia developers to exploit.

**OpenDoc.** OpenDoc is a system that sees documents, rather than applications, as the center of the computing experience. Rather than using a word processor, for example, you create a document from stationery and use an “editing part” to create your text, a “spell-checking part” to check it, and so on. OpenDoc should make it possible to create multimedia experiences in nearly any sort of document by using a combination of small multimedia parts to manage and display the media. OpenDoc should become a standard part of the Mac OS by the time you read this.

*shortcoming may disappear in subsequent releases.—MEC]* Although too new to boast a long list of released titles (such as Director), we can expect to see more mTropolis-developed titles in the next couple of years.

mTropolis creates a stand-alone application for the platform of your choice. If you are distributing your application commercially, be sure to check with mFactory for current royalty and credit requirements.

## **Editors' Poll:** **What Does Multimedia Mean to You?**

**JH:** Games! Okay, also the Web. Past those two, I haven't had any use or need for multimedia.

**ML:** It is the communication of information and ideas in a format far more interesting than any single medium.

**SZA:** Multimedia is for presenting information in a way that engages more than a single one of our senses so that it's more interesting, effective, and memorable.

**TL:** Games (including "edutainment"), demos, and presentations mostly, at least so far as I have seen. Also, the WWW looks like fertile ground for multimedia to explode (witness Shockwave, JAVA, RealAudio, and so on).

**BW:** At its best it's for letting a viewer choose their own points of entry into a given subject and perhaps come away with better comprehension. At its worst it's for selling "information" to folks whose lives revolve around the TV.

**KT:** Multimedia is a term, still being defined, for the general class of communication based on stimulation of more than one sense—often sight and sound, but at least in theory also potentially including touch, smell, motion, and others. It usually draws on multiple techniques or styles—moving as well as still image, and spoken as well as written text, for example. It tends to be expressive rather than objective and is warm rather than cool.

**JC:** For me multimedia is the integration of sound and pictures (moving or still) that can be used in a number of ways. For example, using a Mac's multimedia capabilities for presentation purposes (a way to liven up a dull sales presentation). Or, to educate by involving the user in an interactive manner. To be creative—making QuickTime movies and animation—creating and editing sound or music. To have some fun!

**SS:** When used effectively, video and sound can present information that can't be handled by text and static pictures. However, at this writing, its effective use is severely limited by our inadequate computer hardware and video's massive storage requirements. Consumers are led to expect full-screen, movie-quality video. Instead they get small, choppy QuickTime clips. Until we move beyond the inadequate speed and storage capacity of today's CDs, multimedia (at least so far as video is concerned) will remain only a mildly interesting, content-poor phenomenon.

