The Coolest Macintosh Extension Ever!
Roll 'Em!

Cool Mac™ QuickTime™

Steve Sanz

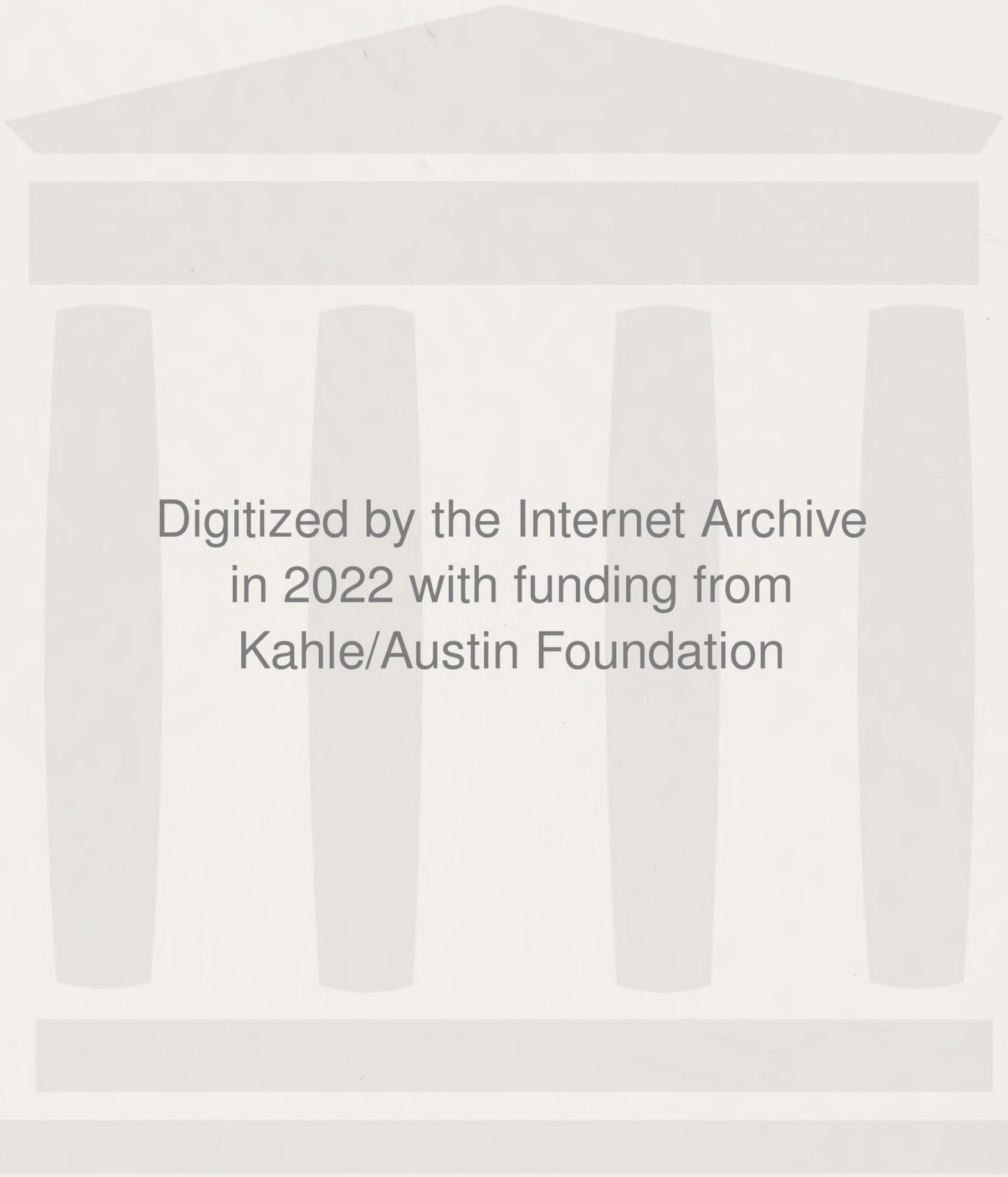
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-Eric Hoffert and
Michael Mills
Apple Computer, Inc.

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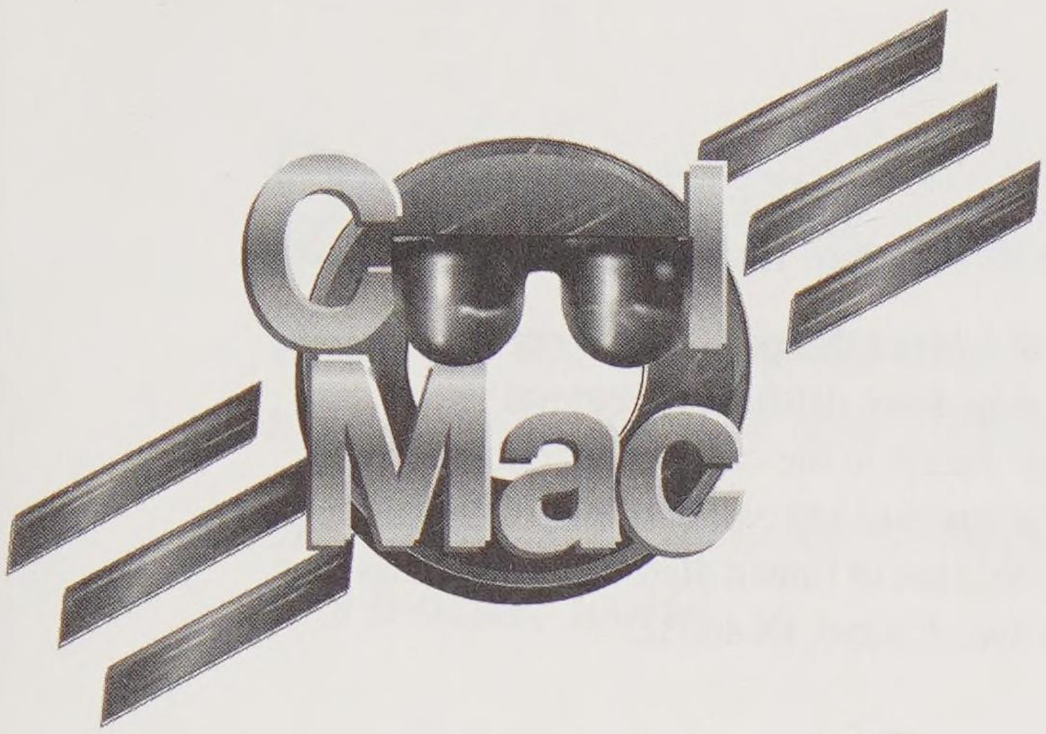


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Cool Mac® QuickTime™

Steve Sanz

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Cool Mac QuickTime

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You can use the *Cool Mac QuickTime* disk on any Macintosh computer that reads high-density (1.44M) disks. No additional hardware is required.

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Dedication

This is for the old and the new: my parents, Bill and Evie Sanz, and my children, Jennifer and Stephanie.

May technological advancements like QuickTime help them make this a better world.

About the Author

Steve Sanz

Since the late 1970s, Steve Sanz has been part of the microcomputer revolution. While at the University of Illinois, Champaign-Urbana, Steve earned Baccalaureate Distinction through his development of an Apple II-based nutritional assessment database system for medical student education. He left graduate school in computer science to plunge into the microcomputer revolution with Burtonix. Burtonix was best known as the developer of the Microsoft SoftCard for the Apple II and III computers and the first Microsoft memory card for the original IBM PC. Steve subsequently worked in the aerospace industry and with PC manufacturers. Since 1985, Steve has become a small business consultant specializing in automation and planning. Steve also has expertise in numerous aspects of chip technologies, software, networking, telecommunications, multimedia technologies, and video imaging.

Because he has been a user of technology, a developer, and a reseller throughout his career, Steve has developed a sensitivity to a broad range of people interested and involved in automation. Several years ago, Steve began sharing his knowledge through writing. He has contributed to *Macworld*, *LAN Technology*, and *Computer Reseller News*. Currently he writes a column on multimedia in *Micro Publishing News*. Steve's background and familiarity with Macs, DOS, NetWare, and OS/2 give him a unique perspective beyond that of most writers in the computer field. Steve founded and runs the Multimedia User Group of Orange County, California.

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Acknowledgments

I want to thank the Hayden staff for their support in writing this, my first book. I was excited by seeing QuickTime and I was excited for the opportunity to write this book.

QuickTime would not exist if not for Apple. They provided all of us with QuickTime; they provided me with all of the technical reference material available. Apple also supported my effort with equipment and AppleLink communiqués. Thanks to Apple's Doug Camplejohn and Eric Hoffert for their support during a very busy time.

The following Apple documents served as reference material for this book: "Capturing QuickTime Movies," *QuickTime Technical Report No. 2*, by Eric M. Hoffert, Apple Computer, Inc.; "CD-Playable QuickTime Movies," *QuickTime Technical Report No. 3*, by Eric M. Hoffert, Apple Computer, Inc.; and *QuickTime Development Documentation* was compiled and written by Doug Engfer, with contributions from Michael Arent, Jim Batson, Sean Callahan, Johnathan Cohen, George Cossey, Ken Doyle, Bill Fernandez, Angela Greene, Peter Hoddie, Eric Hoffert, Mark Krueger, Bruce Leak, Michael Mills, Steve Shaw, Chris Thorman, David Van Brink, Rich Williams, Gary Woodcock, John Worthington, and Mitch Yawitz. *The QuickTime 1.0 Developer Disk* is available from APDA at 800-282-2732.

Thanks to all the people who provided me insight with QuickTime today and the future: Ashok Jain and Klaus Allmendinger from Workstation Technologies, Christine Perey, publisher and editor of *The QuickTime Forum* newsletter, Cathy Galvin from SuperMac, Ben Jamison from Radius, Scott Rawlings from RasterOps, Toni Poper and Sheldon Linker from Linker Systems, Alpha Technologies Group, Jon Harber and Amy Limb from DiVA, Joseph Klingler from VideoLake, Michael Peirce from Peirce Software, Ed Anuff from Vision Software, Joyce Erickson from Interactive Solutions, Tracy Egan from Software Toolworks, Karen Omholt from Brøderbund Software, Windy Whitlock Cornish from Vividus, Ed Anson from Tulip Software, Richard Sink fromVirtus, Maurice Naragon from Apple, and Greg Newman.

Thanks to the stat™media team for their support and help. I would not have finished this book in time if Gary Birch and his staff had not graciously offered to accommodate my hurried schedule. Gary rose to the occasion when he heard the cry for help.

It would have been impossible to write this book without the support from my friends and family, who at times pushed me into my writing room! I thank Javad Hastroudian, Devin Doherty, Stan Trombler, Ed Hart, Jim Fitzsimmons, John Waters, Terry Larkins, Diana Duncan, Mike Schendel, Dr. Randall Busch, Dr. Mark Sanz, and my parents for their words of encouragement.

My wife, Jessica, and my daughters, Stephanie and Jennifer, suffered and helped me the most. They put up with my late nights and missed weeks, (sometimes feeding me as if I were bedridden). Writing this book has been exhilarating—and stressful. I did my best to provide you with useful and interesting information. I hope you enjoy it!

Steve Sanz
Santa Fe, New Mexico
May, 1992



Conventions Used in This Book

Text that you are instructed to type appears in a `special typeface`.

Text that appears on-screen, such as messages and menu commands, appears in **bold**.

Keystroke combinations are indicated as in the following example: "Press command-P to print." This means that you press *and hold* the command key (the key at the bottom of your keyboard with a picture of an apple and a cloverleaf on it), and then press the key labeled *P*. Release both keys simultaneously.

The following icons appear throughout this book:

Icon	*Explanation*
	Cool idea.
	Clue/hint.
	Important note.

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We at Hayden have tried our best to make this the most fun and useful Macintosh book available to the masses. However, we are (unfortunately) only human, and it is conceivable that you may encounter unusual circumstances that we did not discover in our extensive two-hour testing session. For any problems you may have, we apologize in advance. We'll do our best to make amends wherever possible (and inexpensive).

Be careful. Practice safe computing. Make backups. Try these programs out on a friend's Mac first…

Void where prohibited by law. No stopping, standing, or parking. No shirts, no shoes, no service. Place trays in the upright and locked position. This side up. Do not submerge. Curb your dog. Do not fold, spindle, or mutilate. Tape. Do not staple. Fully microwaveable. Under penalty of law, this tag may not be removed except by the consumer. Do not pass GO, do not collect $200. Have you enclosed your check? No CODs. Keep out of reach of children. Keep off the grass. If product gets in eyes, flush with warm water. No trespassing. This is not a toy. Non-negotiable. Please enclose stub with payment. Open 9 a.m. 'til closing.

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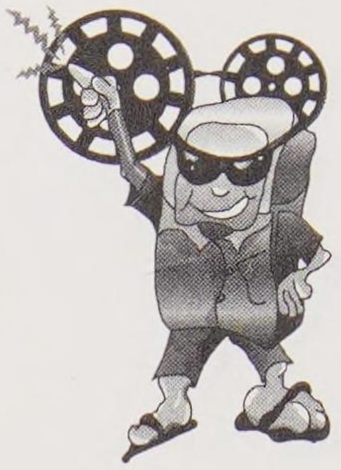
What our readers think of Hayden is crucial to our sense of well-being. If you have any comments, no matter how great or how small, we'd appreciate your taking the time to send us a note, fax us a fax, rhyme us a rhyme, etc.

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If this book has changed your life, please write and describe the euphoria you've experienced. If you have a cool book idea of your own creation, please send it (caged, of course) directly to us at Hayden. Who knows? Your creation may end up in the *Cool Mac QuickTime: The Sequel.*

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Foreword

The information is in the flow ....

J.J. Gibson

It started almost three years ago. On the surface, a number of seemingly unrelated projects taking place in different research and development departments; software designers, hackers and researchers all tinkering on the fringes of the media frontiers. Clearly, something exciting was taking place in our midst.

Each project was intriguing in its own right. One early effort was the development of an image- and video-compression method for the Mac. This video-compression technique was unique because it ran in software only—no special hardware required. That compression method was quickly improved, and the ability to playback motion video with synchronized sound was added. Suddenly, we were creating and playing back movies on the Mac. And, these movies were flexible, malleable digital representations—not the kind that you just sit back and watch passively. These were the kind of movies that allowed everyone to sit in the director's chair. At this point, we knew that life had changed. The writing on the wall read, "media for the masses."

On a different tangent, human interface researchers were exploring the possibilities for embedding video and animation into different applications, such as word processing and presentation programs. New life was breathed into supposedly static, traditional and well-defined data types. The human interface team coined the term "dynamic documents" for this new meta-medium. Electronic publishing got a jolt in the arm.

Meanwhile, others working on the next generation of system software were considering what it should mean to properly support the notion of time in a personal computer operating system. At that time, most of the work on the computer had been concerned with static objects. Now the problem of how to "cut and paste" with time-based objects had to be solved.

And, off in the wildlands, yet another group was addressing the implications of creating multimedia software where the underlying digital video, audio and telecommunications technology clearly would be changing rapidly for a number of years.

At some point, it became apparent that these independent efforts were more related than previously thought. Although each project in its own right was intriguing, it was clear that the whole was far greater than its parts.

Once this connection was made, voilá—QuickTime was born. An extremely talented group quickly was assembled and worked together in record time to bring dynamic media to the masses. Extending the boundaries of the personal computer to allow the creation, editing and playback of dynamic media was a fantastic (and fanatical) challenge. The challenge was met, and the reward laid the foundation for the creation of movies, dynamic documents, and visual experiences that could have only been dreamed of before the arrival of QuickTime. And the challenge and the fun continues!

QuickTime is an architecture where creative ideas thrive: for us, for developers, and for users. QuickTime 1.0 has hit the streets. This is just the beginning. Join us in exploring the new digital world.

Cool Mac QuickTime is a place to start, an opportunity to come up to speed on the technology underlying QuickTime, and a chance to become a QuickTime moviemaker yourself. And have as much fun using QuickTime as we do.

Eric Hoffert and Michael Mills
Apple Computer, Inc.

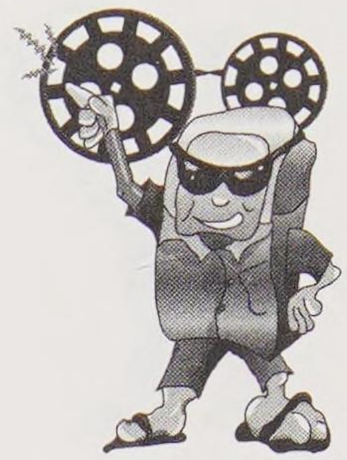


Table of Contents

Introduction

1 About This Cool Book 1

2 The QuickTime File... 9

3 Compression 25

4 Pieces and Parts 39

The Main Feature

5 Experimenting with QuickTime 43

6 Getting Digital 57

7 Sorting the Details 73

8 Where Do You Want It? 87

9 Expressions of a New Paradigm 91

The Credits

10 It's Only Just Begun 97

11 Cool Solutions to Uncool Problems 105

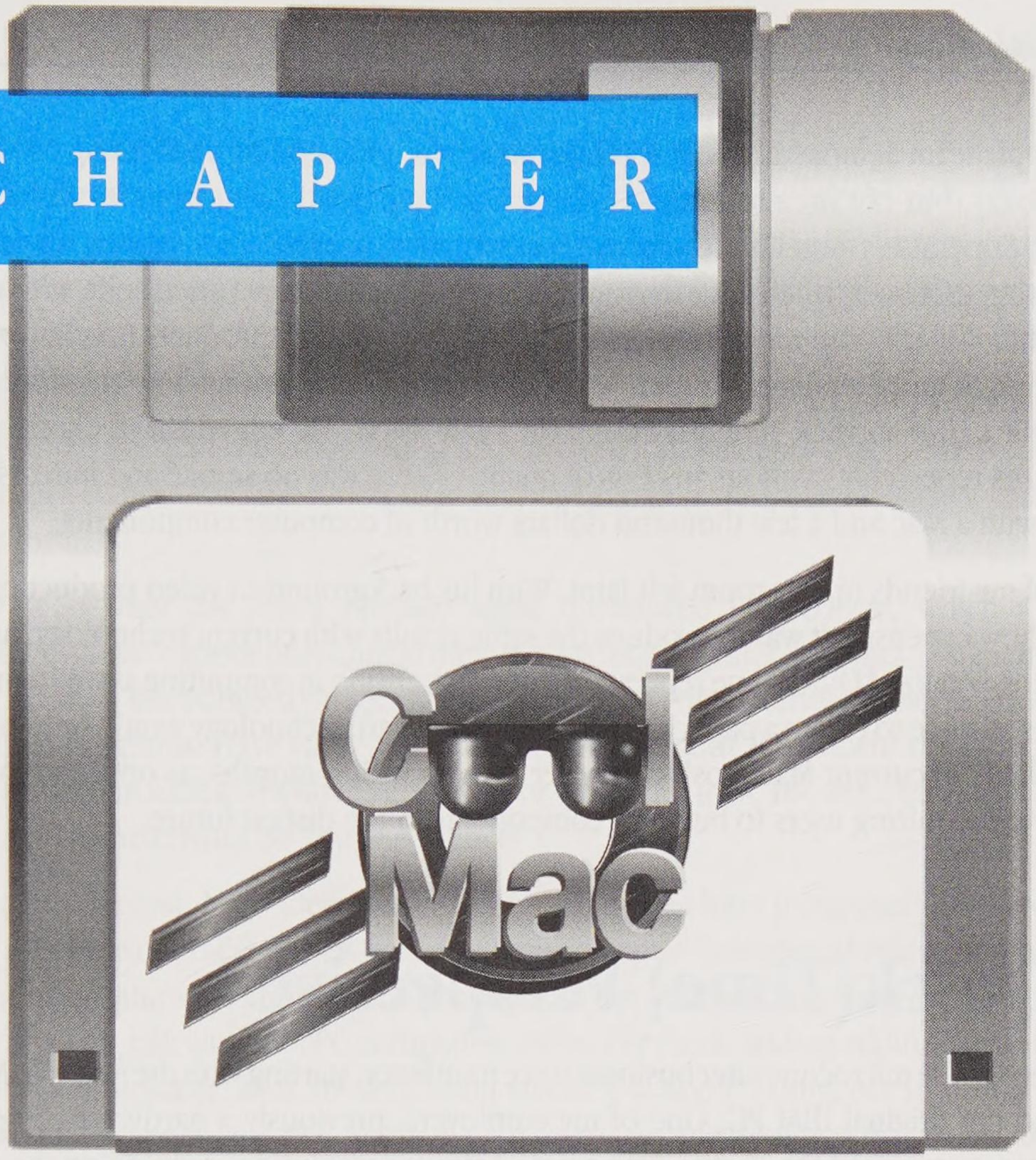
Index 109

Using the Cool Movie Disk 131

How This Book Was Created 131

What's on the Cool Movie Disk? 132





CHAPTER

1

About This Cool Book

Dateline: May 1991

Event: Apple's Worldwide Developer's Conference

Apple Computer has held Developer's Conferences for eight years, offering developers opportunities to learn about Apple's products, plans, strategies, and tools. In 1991, however, Apple introduced something more revolutionary than the Macintosh itself: QuickTime. This software addition brings new capabilities to existing Macs, creating a paradigm shift—the beginning of a new way to look at information. QuickTime supports time-based information, such as audio, video, and animation, in the natural, friendly, and interactive way that has made the Mac famous.

The Apple team demonstrated QuickTime movies to 1,500 oohing and ahhing people. It was snazzy, but not breathtaking—I hadn't seen its potential yet. Later in the week, I visited SuperMac's hotel suite where representatives were demonstrating their new technologies. Finally, the light came on! I was standing in this crowded suite with other Mac-philic friends and acquaintances for a demonstration of products now known as VideoSpigot and Premiere. A SuperMac programmer demonstrated how to import and edit QuickTime movies, then play them on a television. He edited these digital video segments repeatedly, without any loss of quality. There was no smoke and mirrors—he did it with a Mac and a few thousand dollars worth of computer components.

One of my friends in that room felt faint. With his background in video production, he knew how expensive it was to produce the same results with current technology. At that moment, I realized QuickTime represents a new dimension in computing as well as man's greatest chance to create a paperless office. This software technology would be available to millions of current Macintosh computer owners within months, as opposed to new hardware requiring users to buy new components in the distant future.

A Quick(Time) Perspective

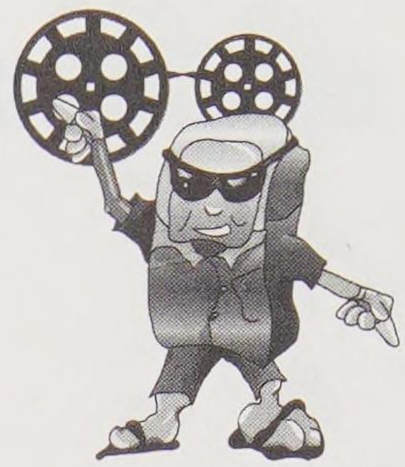
I've been in the microcomputer business since its infancy, starting with the Apple II, Apple III, and the original IBM PC. One of my employers, previously a hardware computer designer, considered the PC the next great computer revolution, succeeding the mini-computer. Research companies projected IBM and clone manufacturers would sell hundreds of thousands of units. My boss was right; the market research companies were right.

I can safely say PCs have changed the world and may represent a socioeconomic shift as great as the change from an agricultural to industrial economy. PCs have enabled millions of people to process more information than ever before. By witnessing the oppressive Tiananmen Square massacre in China and the downfall of the Soviet Union, we've seen how powerful freedom of information is. PCs offer this freedom to individuals.

What Has the Mac Done for Us?

Apple designed the Mac (and its progenitor, the Lisa) as a mass-produced graphics-based computing platform, a daring first for the computer industry. This machine, along with Apple's Human Interface Guidelines and strict programming rules, enables you to display, cut, copy, and paste any text in any type style and point size from any document to any document. Apple Computer probably educated more people about type in a shorter time than anything or anyone, ever.





You also can display, cut, copy, and paste almost any graphic image. Apple introduced a graphics file format standard called a *PICT image*. Virtually all Macintosh applications that use graphics support cutting, copying, and displaying PICT graphic images (even the ubiquitous TeachText program, a free document-viewing utility nearly every computer vendor uses), and universally accept the PICT file format as the minimum graphics standard, which is important to QuickTime's context.

Again, Apple brought the complicated and often hidden features that occur within the bowels of a computer to the forefront in an easy-to-understand, easy-to-access, and easy-to-use format.

A few years after the Mac's release, Apple introduced Q*uickDraw*, which further simplified users' experience. QuickDraw is a set of computer graphics programs that Apple strongly encouraged programmers to use rather than handling the video within their own programs. Have you ever added monitors to your Macintosh? Upgraded your video card from black and white to grayscale, or 4-bit color to 8-, 16-, or 32-bit color? Which common characteristics do you experience?

First, and foremost, Mac video is hassle-free. You do not have to reinstall programs, let alone purchase upgrades or new versions. When you purchase special video components for one application, all applications benefit from the upgraded equipment. If you think this is obvious, talk with IBM PC-compatible users. For them, adding additional monitors is almost unthinkable, as is 16- and 32-bit video. It is Apple's diligence in bringing the richest experience to the most users in an easy-to-use, pleasing way that has made our Macintosh computers so endearing.

One more concept lays the groundwork for QuickTime. Computers, as well as computer applications, are approximations of the real world. You benefit from the (usually) high degree of accuracy and repetitive tirelessness of automation assistants. Most computers are static models that are appropriate for much of what you do. Accounting is a static exercise. The numbers for expenses and taxes are fixed over a short time—for instance, the next few days—until you review them. Once created, a spreadsheet, letter, or inventory parts list is static for a few hours or a few years. Phone lists, test scores, financial projections, and much more of the data we store within computer systems are also static. However, this static information doesn't represent the bulk of our experience.

The Changing Face of Computing

Our keenest sense is sight. Our eyes are particularly acute at detecting edges, such as when people move. And, even though your mates, coworkers, and family may disagree, you hear well, too. Researchers discovered that you absorb more information when you see



color and motion, and listen to content. This is one reason entertainment and education videos are becoming increasingly popular. Does your prolific, obedient slave—the computer—speak to you or show you movies?

Until recently, the answer was "Yes, but." Computer components can add different flavors of audiovisual content to the machine. However, there is no standard to ensure that all applications have access to audiovisual information. Programmers must develop (at great expense) small program modules, called drivers, for each video card, CD-ROM drive, video disk player, VCR, etc.

Ask any mainstream DOS-based word processing application user the number of different printers the application supports. The answer usually is somewhere between a few and a hundred. If program developers have to support different media and media devices, the cost of the software increases, the availability of products supporting a common set of devices decreases, and the user must carefully manipulate this mixture of software, hardware, and cabling.

The paradox is that computing devices are becoming less expensive and more powerful. (At the same time, creating audiovisual information is becoming cheaper and more plentiful.) Can computer users ever take advantage of increasingly powerful computers along with this great communication information?

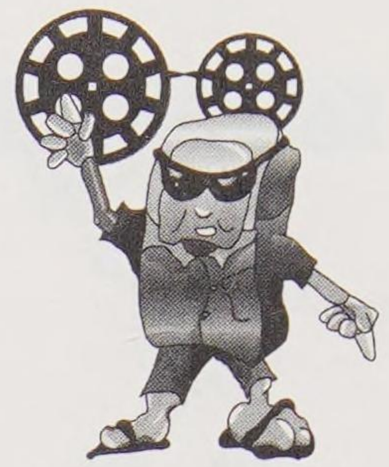
Apple never has liked the phrase *multimedia*. Instead, it talks about media integration. Remember, Macs are graphical machines, so you can put any visual element on the screen, limited only by your purchasing power to buy disk space, speed, and screen colors. Since the arrival of the Macintosh II computer, Apple arguably has added the best sound support for any personal computer platform of mass appeal. In retrospect, it makes sense for the Mac to integrate further, moving screen images and sound together.

QuickTime: The First Step

QuickTime is a system-level software technology that consistently and handily integrates dynamic, time-varying information into the applications we use daily. To support the breadth of QuickTime, integration in numerous levels is required. For example, Apple had to rewrite TeachText, the standard "READ ME" program included with every Mac. QuickTime affects the Scrapbook, also. Apple had to ensure that users can play back sound files created on any Macintosh on any other Mac.

When Apple considers adding functionality to their computers, they try to support as many of their existing and previous computers as possible. This is true with QuickTime. On January 13, 1992, Apple Computer unveiled QuickTime, which, when installed on two





million QuickTime-compatible computers worldwide, create two million digital video machines.

Some people define QuickTime as digital video running on a Macintosh computer screen. This is only one element of QuickTime. Trying to run full-size TV onscreen brings most of today's Macs to their figurative knees.

QuickTime provides a method for all computers, even non-Macs, to store and display video, animation, sounds, and still images. QuickTime defines the conversion of analog information into digital information that computers understand and compresses these digital representations onto computer storage media (see figure 1.1). Amazing? Actually, no. Telephone companies have been converting voices to digital information for years. The phone company breaks speech into thousands of digital fragments every second, routed by computers to other computers that put the fragments back together, then sent along to the listener at the other end.

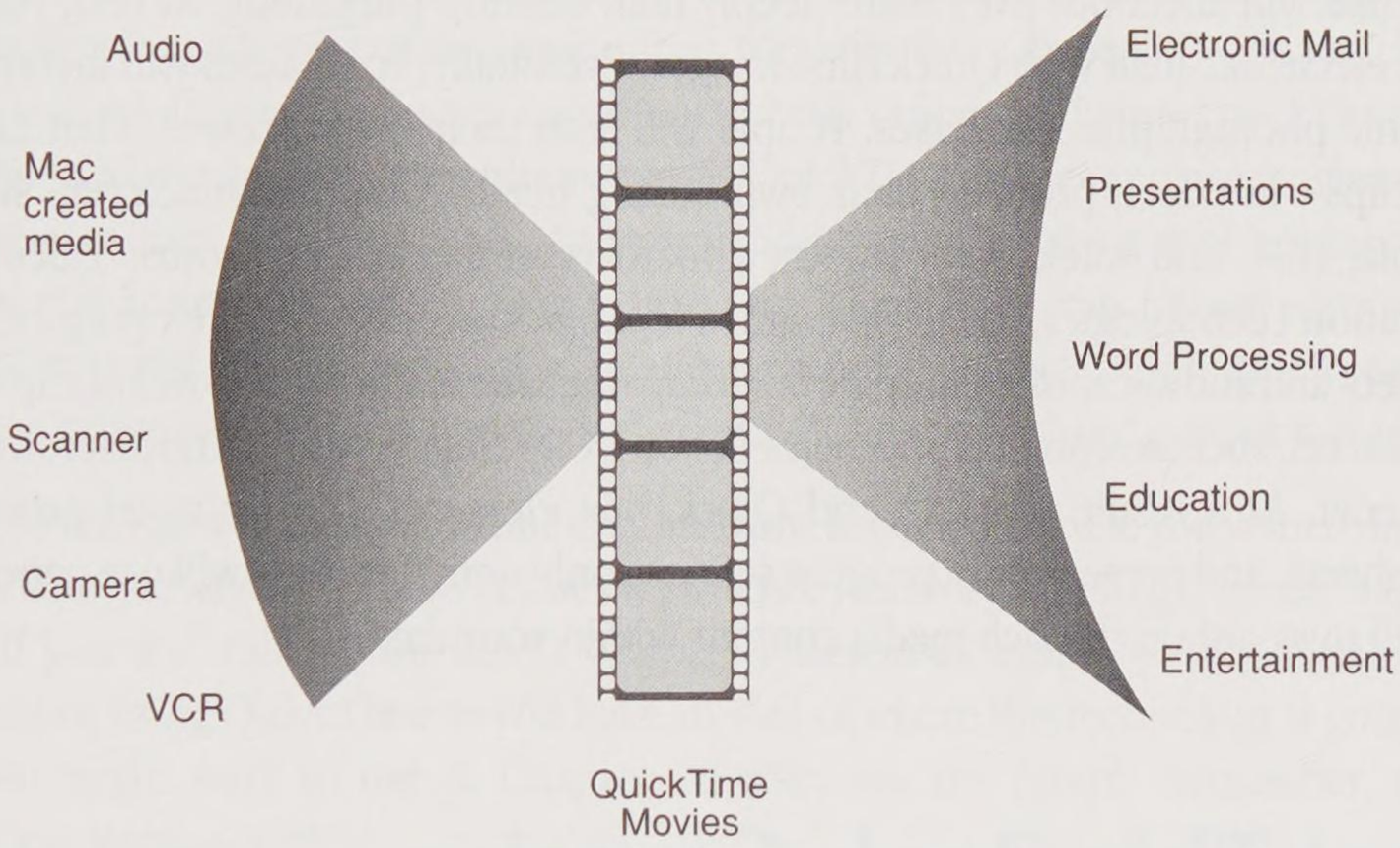


Figure 1.1
Analog and time-based media converted for use in computer applications.

The film industry uses computer technology in every frame of every movie or television broadcast. A *time-based corrector* device synchronizes images from multiple sources and corrects for color. This device captures each frame, sends it into a computer storage block and performs its corrections and synchronization at the rate of 30 times per second.

Software engineering, within the myriad of applications and standards encompassing QuickTime technology, analyzes and organizes the sub-second digital samples that compose time-varying files, whether they are sound, video, animation, or graphic images. Apple has the amazing capacity to

- Provide digital video capability across many different Macs with different capabilities



- Make this technology hardware independent so it can run on other personal computers, workstations, and mainframes
- Make the rules easy for developers to incorporate into applications
- Bring a previously unwieldy technology to the masses so they can display, cut, copy, and paste analog information

In addition, QuickTime technology provides growth without obsolescence. Applications supporting QuickTime can take advantage of new functionality as QuickTime evolves, without the need to modify their applications.

Why This Book Is for You

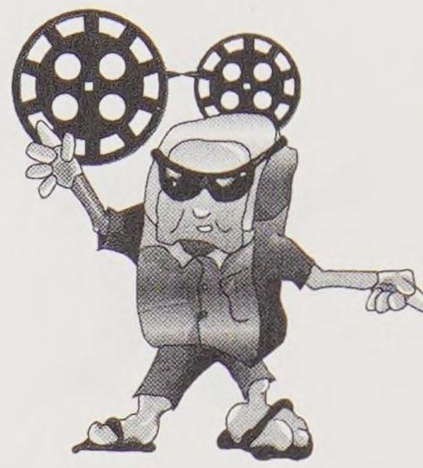
QuickTime will affect our lives more deeply than desktop publishing. At first, you may receive electronic mail with QuickTime images. Eventually, companies will incorporate electronic photographic databases. People will scan their own pictures, then capture video clips—in effect, produce their own talking heads! Chip manufacturers such as Motorola, IBM, and Intel, and computer board vendors such as Radius, VideoLogic, Workstation Technologies, RasterOps, and VideoLogic currently are developing inexpensive video- and audio-capture equipment. Companies already bring libraries of clip media to the market, such as Alpha Technologies Group's ClipTime Volume 1 and Macromedia's Clip Media. As a result, you can add QuickTime elements to your word processor, spreadsheets, and presentation programs. Soon, only non-Mac users will use paper, and they will miss out on the rich media content within your data.

What This Book Contains

Can QuickTime technology bring video into the computer? Does it use sound? What about still images? Does QuickTime have anything to do with the hard disk in my Mac? Must I buy more equipment to use QuickTime? Can I become a movie producer with my $5,000 Macintosh system?

I'm glad you asked! This book attempts to answer these questions. QuickTime enhances our ability to express ourselves as individuals and strengthen our business communications, just as in-house brochures, memos, and resumes now look more professional thanks to a conscious understanding of type, design, and layout.





How to Use This Cool Book

I organized this book to build your understanding of QuickTime technology. Chapters 2, 3, and 4 cover the concepts behind the technology and how other vendors add value and offer products that enhance QuickTime.

Chapter 5 describes what you need to get started with QuickTime. You learn the controls for QuickTime files and user-interface rules to interact with movies. The enclosed disk includes two sample movies.

Chapter 6 tells all you need to know about the analog world, or at least that part of the world you might use for digital acquisition. This chapter also contains information about converting Mac-generated data into QuickTime movies.

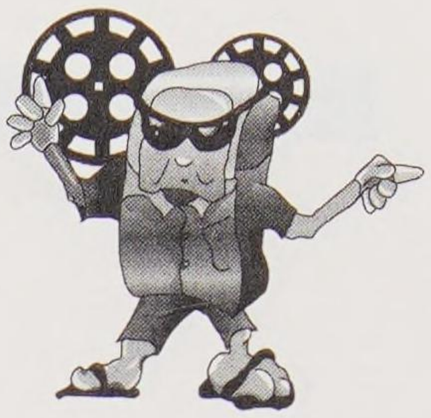
Fundamentally, QuickTime involves two different processes: creating and viewing, or pilots and passengers. Word processing or spreadsheet applications can contain QuickTime data for viewing, whereas other applications (described in Chapter 7) edit QuickTime data. Some applications offer the capability to both output and view QuickTime data; MacroMind's Director can both author (create) QuickTime movies and use movies as part of a presentation. Linker Systems' Animation Stand is an amazing tool because of its professional animation and the way it uses QuickTime. You can import movies into Animation Stand, apply layers of animation over the movies, apply the program's extensive repertoire of filters and optical effects to the movies, and output movies.

Chapter 8 tells how to use QuickTime data and how to get it there. Do you want to include a QuickTime file in your resume or sales report? Are you storyboarding the next Star Wars epic? (If you are, call me for help!) Chapter 9 describes examples of programs and applications using QuickTime so you have an idea of where this technology is going and how you might want to use it. Chapter 10 discusses the future. Remember, this is QuickTime Version 1.0!

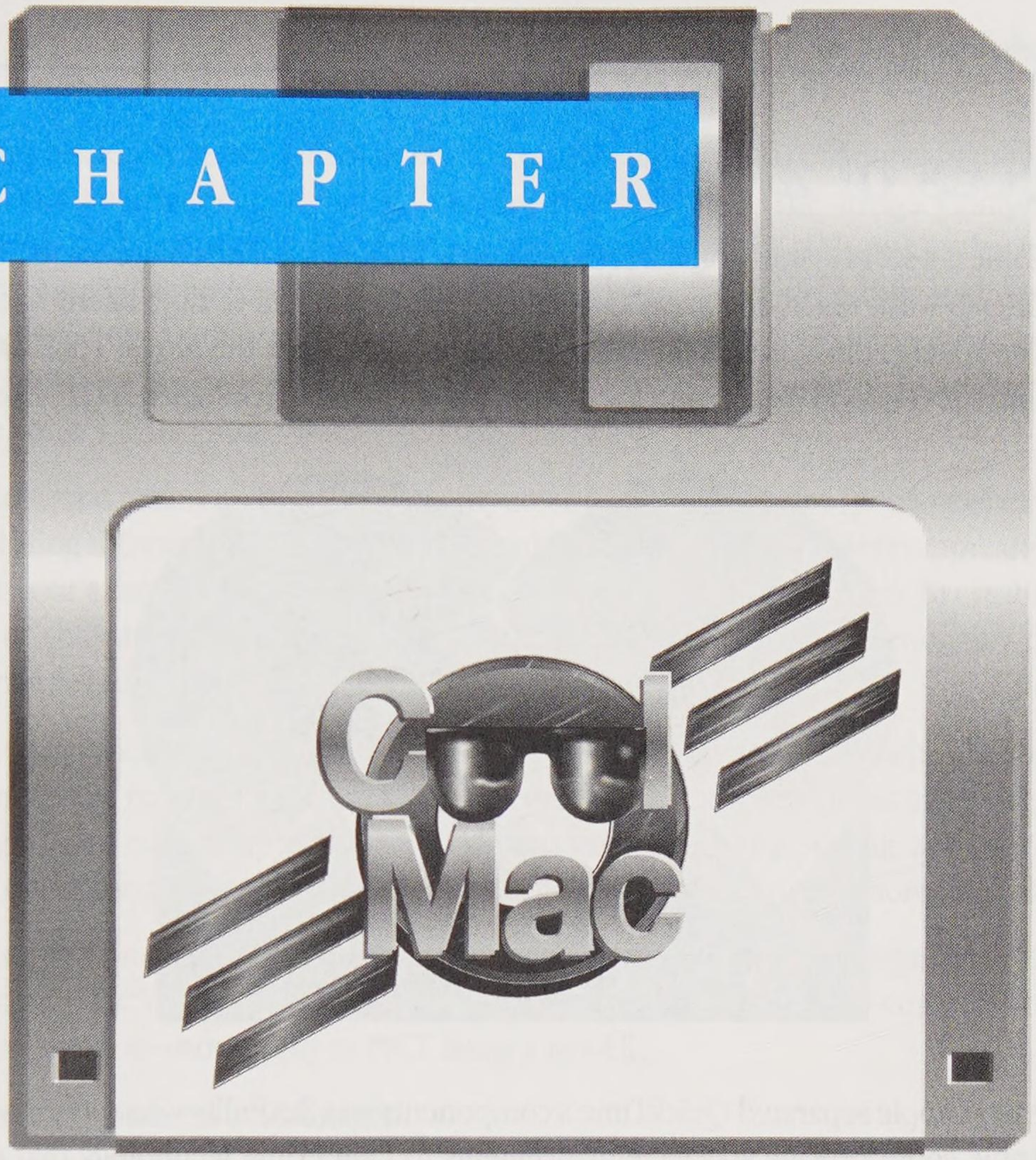
The Cool Items on The Disk

The enclosed disk contains files that enable your Macintosh to use QuickTime. The QuickTime file adds digital video support to your Mac. The Popcorn program plays the demonstration files. The two demonstration files are described and explained in Chapter 5, "Experimenting with QuickTime."





CHAPTER



2

The QuickTime File

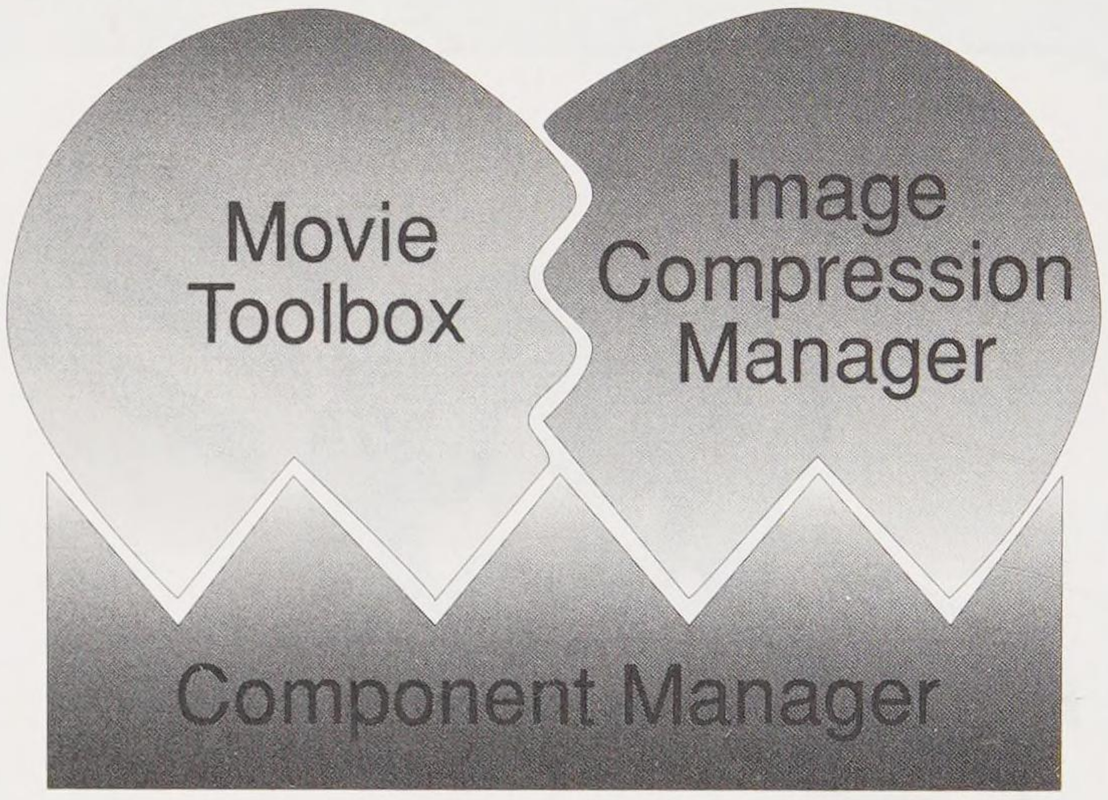
Although this is only the second chapter, it's not for the faint of heart. This chapter digs deep into how QuickTime makes its magic, so it's very technical. First, the chapter introduces QuickTime's components. Then, you learn the detailed structure of a QuickTime movie. The chapter also introduces you to many new digital video and audio terms.

QuickTime is truly a *three-dimensional technology*: it offers height, width, and time dimensions. This book, my communication medium with you, is only monomedia, (a two-dimensional world of words and pictures). Therefore, you need to follow the text closely because QuickTime's technology is more amazing than words can describe.

Pieces of a Puzzle

QuickTime is a set of system software routines, new file formats, and compressors. These components work together so applications can store and retrieve time-based information. The system software contains three distinct components: the Movie Toolbox, the Image Compression Manager, and the Component Manager (see figure 2.1).

Figure 2.1
How QuickTime fits together.



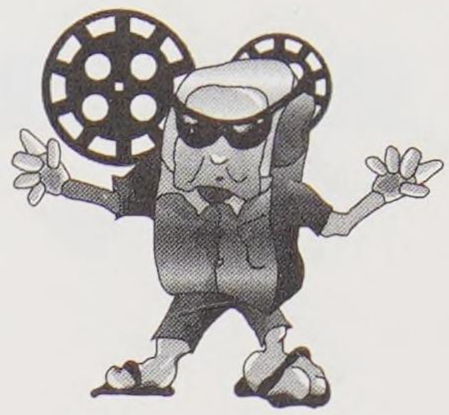
One reason Apple separated QuickTime's components was flexibility—so vendors other than Apple could provide specific enhancements to QuickTime technology that other applications could use. In addition, you can use these components anywhere you want. For example, a vendor makes a turbo-compressor to use with animations. You use the turbo-compressor, delivered as a QuickTime component (instead of inside the animation program), with other QuickTime movies you created using different applications.

Movie Toolbox

QuickTime's *Movie Toolbox* gives applications the power to record, cut, copy, paste, and play back movies as easily as applications manipulate text and graphics. The Movie Toolbox contains routines and instructions that application developers can use to access QuickTime. For example, the Movie Toolbox includes routines for setting the display region of a movie, previewing a movie, or discovering how long a movie has been playing.

Image Compression Manager

The *Image Compression Manager* (see figure 2.1 above) contains different methods to squeeze and unsqueeze data within movies. Apple supplies compression and



decompression schemes—also known as *codecs*—for video, animations, graphics, and JPEG (an international still-image compression method). The Image Compression Manager (ICM) is device-independent and driver-independent. This means that anyone can develop other codec drivers for anyone else to use. Additional codecs might include Group 3 fax (used by most fax machines in the world), and MPEG, a compression standard being developed to compress video. QuickTime currently doesn't implement either of these codecs.

Vendors who make compressors on computer boards—usually for speed—benefit most by creating software decompressors that enable anyone to view movies compressed with the vendor's computer board (the component concept discussed earlier). By creating this type of software decompressor, the vendor makes its product's functionality device-independent and encourages viewers to purchase its hardware.

In some applications, you decide which compressor you want. In others, the software automatically requests a compressor from the Image Compression Manager. The ICM also performs numerous image manipulations such as clipping, scaling, and conversion from one color depth to another. (See Chapter 3, "Compression," for more information.)

The Image Compression Manager also works with the standard still-image format for the Macintosh: PICT files. The features that make QuickTime appealing—compression and display preview—now apply to PICT images as well.

The Image Compression Manager

- Is device-independent
- Is driver-independent
- Presents a consistent interface for all codecs
- Manages codecs
- Scales and clips images
- Dithers colors
- Supports compression and decompression of PICT files

The Component Manager

The *Component Manager* is a registry of devices and resources that any application can use. For example, digitizing boards and videotape machines have a software component that describes the machines' characteristics and capabilities. You place this software component (provided with the computer board or machine), into the Mac's System folder (actually, the Extensions folder within the System folder). The Component Manager registers this new component.



An application such as Claris' Resolve (a spreadsheet program) can access a digitizer and a videotape machine to import images. The application asks the Component Manager for a video digitizer and/or a video source, then enables you to control the activation of the capture process. In this way, applications choose freely among components of a given type, with absolute confidence that each will work.

Before QuickTime, software vendors had to write custom support for each device the vendor wanted to support, and then modify support programs when hardware changed. The Component Manager provides a dispatching system so multiple applications can use the same component simultaneously.

The Component Manager

- Maintains a registry of devices and resources
- Provides programs with access to devices
- Supports multiple programs' simultaneous access to the same device or resource

Movies 101: Fundamentals

Next, you need to learn about movies (the digital kind): what they are and how they become moving magic on the screen. In time (a pun) you see how the Image CompressionManager and the Component Manager interact in a symbiotic cacophony.



QuickTime stores time-based data in a file format called a *movie*. Examples of time-based media include sounds, video, animation, dynamic bar charts, heartbeats, material stress measurements, and seismographic recordings. The continuous stream of information is one common characteristic among these media.

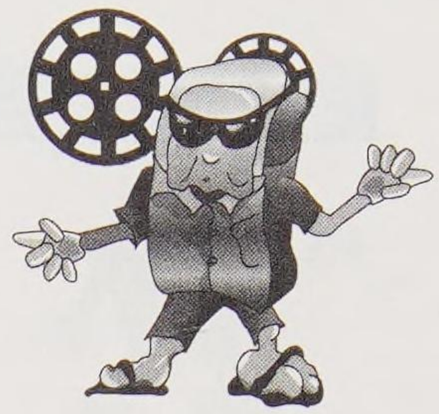
QuickTime movie files, unlike a piece of film or a cassette tape, don't need to be continuous streams of data—although they can be. Movies can contain pointers to information stored elsewhere. The type of movies appearing on QuickTime-compatible CD-ROMs reaching the market is a practical example. The actual video data might reside on the CD, although you can import the movie into your word processor. When you play the movie from within the word processor, the movie references (or points to) a CD for the data.



If you change CDs and then attempt to run the movie that the CD references, a dialog box appears, explaining that the program cannot find the movie. You have the option to search for and find the required data.

A movie can contain all its movie data, instead of pointing to the data on another media, like a CD. Self-contained movie data would be needed if you were to mail a movie on a disk.





Cinematic movies, like videotapes, have two tracks: a video track and an audio track. QuickTime movies also have these two types of tracks, but they are not confined to one video and one audio track. QuickTime movies can have multiple video and audio tracks and, in a future QuickTime version, multiple tracks of any type. However, the notion of time underlies this entire setup.

It's About Time

Time is a fundamental concept in QuickTime. Suppose you have a movie that plays perfectly on your computer, but speeds up and sounds like Mickey Mouse on your customer's machine (you can force this when playing movies). QuickTime supports different time references for the different layers in the QuickTime architecture.

Time Scales

QuickTime enables you to control time management for each movie and each type of data within a track (but not for the track itself). Why is this relevant? You measure activities in minutes, celestial activities in light years, and semiconductor circuitry events in picoseconds, nanoseconds, or microseconds. These measures are *time scales*. These are additional time scales:

Time scale	*Purpose*
1	Seconds
60	Macintosh computer ticks
1,000	Milliseconds
1,000,000	Microseconds
22254.5454	Sound sampled at 22 kHz

Time Bases

The *time base* is the translation factor from the time-coordinate system to the real world. The time base is a number that represents the number of time-scale units in the time-coordinate system you need to make one second of real time. A time base of 10 means every second of real time has 10 units in the time-coordinate system. Time bases also indicate direction. You can play QuickTime movies backward as well as forward, so a negative value indicates the movie is playing in reverse.



Duration

Duration is the length of a movie or of the media referenced by a movie. Each movie has its own time-coordinate system containing a time scale and movie segments with a duration that the time scale defines. Each movie defines what each tick unit represents in its time scale.

QuickTime uses 32-bit or 64-bit quantities to represent time values. A 32-bit time value equals 4 billion time values. A year has only 31 million seconds, so QuickTime reserves more than enough time values for any realistic movie length.

Rate of Time

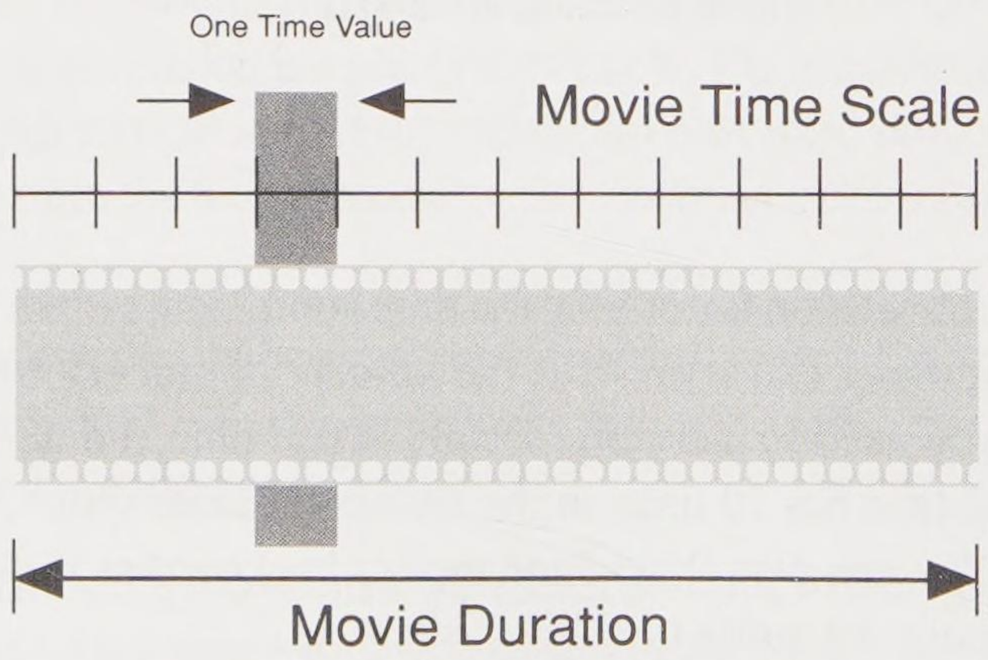


The *rate* of time is a value that specifies the speed and direction the movie plays. A movie with a negative rate moves in reverse, and a movie with a positive rate moves forward. To determine a movie's speed in seconds, multiply the rate and direction by the time scale and the time base. The time base also contains a reference to the clock that provides timing for the time base. The Component Manager manages QuickTime clocks, so different clock rates can exist for different types of data and computer systems.

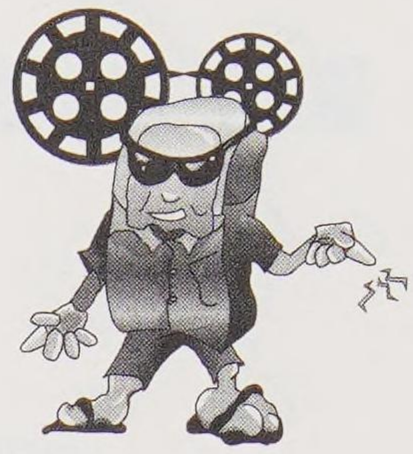
The Movie Structure

A QuickTime movie contains multiple *tracks*: for example, a video track and a sound track. QuickTime movies have their own time-coordinate system—much as a 70 mm movie reel plays at a different time reference than a Hi8 camcorder. QuickTime movies have a time dimension specified by a time-coordinate system, including a time scale and a duration. Figure 2.2 illustrates how QuickTime marks time in a movie. QuickTime synchronizes the tracks when you play the movie.

Figure 2.2
A movie's time-coordinate system.







A movie is a hierarchical arrangement of tracks; tracks are a hierarchical arrangement of media. In the analog world of movies and videotapes, the number of tracks and the purpose of each are clearly defined. Electronics are designed to operate on specific segments of the tape. The tape dedicates sections of itself for sound, video, and sometimes digital data or sound dubbing.

A QuickTime movie can have a virtually limitless number of tracks. The tracks can contain any type of data QuickTime supports now and in the future. This is a much more flexible arrangement, which is one of a computer's benefits. Software determines how to interpret a track—not fixed electronics like those found in a camcorder.

Each track in a QuickTime movie refers to a separate set of media data that a movie's time-coordinate system interprets. A track's duration may vary, and numerous tracks may start and stop at different times within the movie. There may be points along a movie's time scale where all or none of the tracks are active.

Previews

No, this section is not about upcoming Hollywood attractions! A QuickTime preview is a shortened version of a movie, analogous to the celluloid version. In this case, previews last a few seconds. Previews have a starting time, duration, and a list of tracks that comprise the preview. Some tracks within the movie may exist solely for the preview.

Posters

A QuickTime movie poster is not a 2-foot by 1-foot color poster you get free with every QuickTime movie! The QuickTime movie poster is closer to the size of a postage stamp, but bigger than the icon on a file. A poster is the static visual representation of a movie, located at a specific time value in the movie's time-coordinate system. You use the poster as a marker to indicate a movie's location on the monitor and as a visual reference to a movie's contents. Without a poster, you cannot locate a movie; the movie is hidden.

You assign specific tracks to the poster, just as you do with the preview. A specific time value in an audio track has no meaning with respect to posters.

Most posters are the first-time value of the movie. However, some programs enable you to change the poster, even if the program is not a QuickTime editor. WordPerfect 2.1 is a type of program that enables you to change the poster on any movie in the document.

Figure 2.3 shows standard video and audio tracks as well as a preview audio track. You use the video tracks for the movie, the preview, and the poster. One audio track is for the



movie, the other for the preview. QuickTime generates the poster from images located at a point in the timeline away from the video tracks.

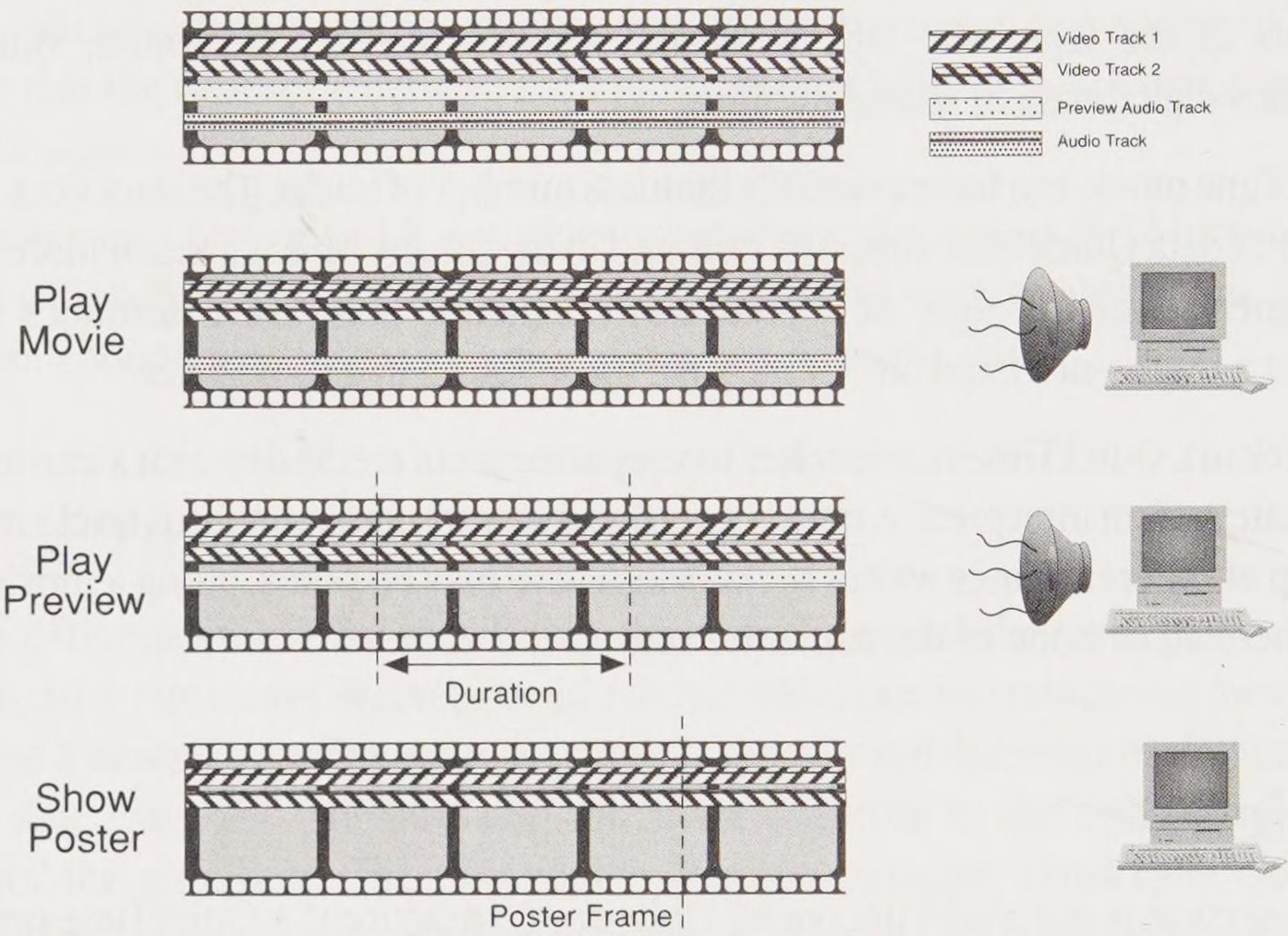


Figure 2.3
Movies, tracks, preview, and poster.

More Movie Characteristics

Every QuickTime movie contains the following information:

Movie-time information:

- Creation time
- Modification time
- Time scale
- Duration

Preview information:

- Preview time
- Preview duration

Poster information:

- Poster time



Current selection information:

- Selection time
- Selection duration
- Current time

Spatial characteristics:

- Matrix
- Movie clip

Playback settings:

- Preferred rate
- Preferred volume

User-defined data

A movie's starting time and duration defines the movie's preview, according to the movie's time scale. A movie's time value defines the movie's poster, which is equivalent to the poster's location.

The movie's current time defines its current position. If the movie currently is playing, this time value is changing. Applications can read a movie's current time. For example, an application can track the number of minutes your children watch QuickTime movies and shut off the movie after a pre-programmed amount of time. (Wouldn't that benefit parents!)



Future interactive QuickTime versions conceivably will use the current position to enable you to press any location at any time in a movie to trigger an action.

Movies have *inpoints* and *outpoints*. You may want to start a movie at a certain location after the beginning of the movie, yet still preserve the movie's absolute beginning. Some editing applications enable you to set an inpoint for this purpose. This inpoint becomes the current time value found in the movie file.

An outpoint is a point in the movie where you want to stop the action before the movie's absolute end. If you record two takes of a scene, you may want to retain both takes but display only the first. You accomplish this by assigning an outpoint at the end of the first take. The current selection becomes that segment of the movie that the inpoint and the duration specifies, spanning from the inpoint to the outpoint. A movie is equal to or greater in length than the selection.





Inpoints and outpoints may be useful for a future interactive version of QuickTime. You could use some segments of the movie as responses to a user-triggered interactive movie.

A movie may have a preferred rate for playing the movie's video portion, and a preferred volume for playing the audio portion. If possible, the computer tries to achieve these preferred settings. A QuickTime movie created on a Macintosh IIci plays at its preferred rate on a Macintosh Quadra, but probably doesn't play at its preferred on a Macintosh LC. The preferred audio volume is much easier to maintain across different computers than the video portion.



The audio volume in a movie supersedes the volume set in the Sound Control panel. If you set the Sound Control panel volume low, but a movie has a high sound volume, the movie plays loudly.

You store additional information in the movie file in the user data area. Because you can store any type of information in this area, some information may make sense only to you. Typically, you store movie copyrights and credits in the user data area. The accessibility of this information depends on the application; an application must provide access to these parts of the movie.

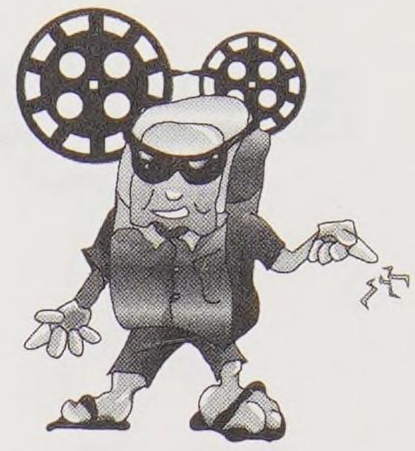
When you play a movie containing visual data, the Movie Toolbox collects information (such as its preferred rate from the tracks and from the movie), and performs numerous computations to display each image of the movie in its window. This is a complicated process, making what we've discussed so far seem easy. Transforming the bits into a movie in a window is called *spatial processing*—processing information in a space. The computer must consider the size, shape, and location of the data, the clipping region, matting, transformations, and layers of tracks. This occurs for each image brought to the screen.

Each track handles its own spatial characteristics—information about each image's size, boundaries, and shape. QuickTime combines the spatial characteristics of each track for every time value in the movie to produce the final image.

Track Characteristics

As with movies, tracks provide the control information that enables a movie to gain access to its data. A movie can contain one or more tracks. Each track represents a single stream of data in a movie, associated with a single media. Note that tracks use the movie's time-coordinate system. Each track has its own duration but not its own time scale or time base. The track control information contains:





Track-time information:

- Creation time
- Modification time
- Duration

Track ID

Alternate group

Spatial characteristics:

- Track width
- Track height
- Track clipping region
- Track matte
- Transformation matrix

Sound settings:

- Volume

Edit list table

Media

User-defined data

Multiple tracks of the same type can exist within the same movie. You group the tracks together into an alternate group or a collection of tracks of the same type. For example, you can store multiple languages as a group and choose a specific track by selecting the language you need. Another example is multiple image tracks, optimized for playback speed. You can play a different track from the alternate group list, depending on the speed of the computer you use to play the track.

The volume setting, used only for tracks that produce sound, indicates how loudly QuickTime plays. QuickTime always associates a track with one media, which defines the data for that track in the movie. The track contains a list of references to media data. Each of these references defines a portion of the media the track uses. In essence, these references are an edit list of the media. Notice how this differs from a celluloid movie.

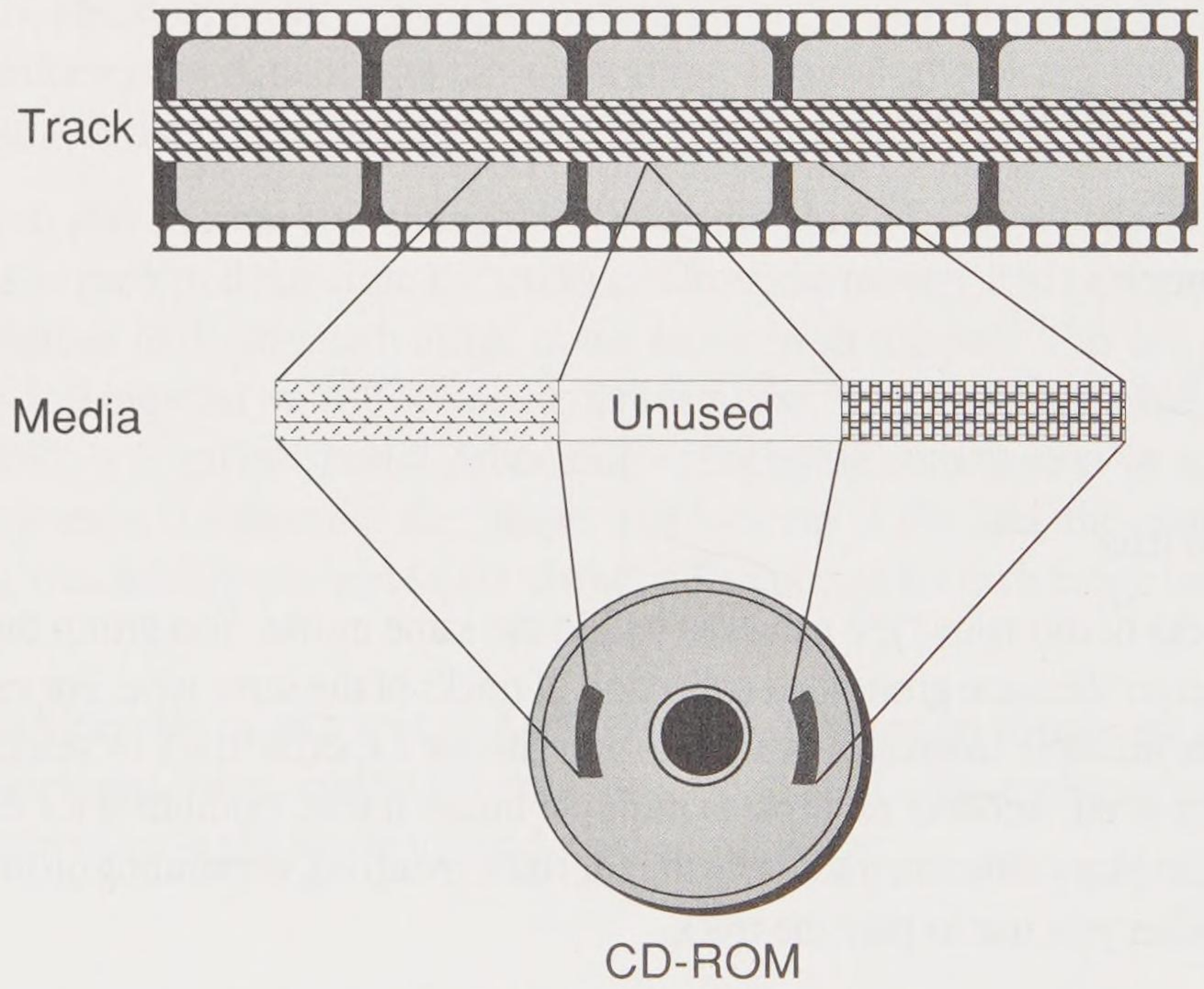
The movie itself does not always contain the actual image or audio data. The data can exist in other files on the computer or a CD-ROM. In this case, the track's media points to the data in another file on another media.

A track can play the data in any order and any number of times. Media that relates to another data format within the track differs from media data that is the actual movie data. However, because I'm explaining how an image appears, this difference is not a major concern.

The media handler is the final detail. A media handler is responsible for the details of loading, storing, and playing media data. QuickTime requires media handlers for any new types of media. If a new type of storage appears—for example, a hypothetical floptiROM—you need a media handler to plug into QuickTime. Figure 2.4 shows the relationship between a movie, a track, and the media.

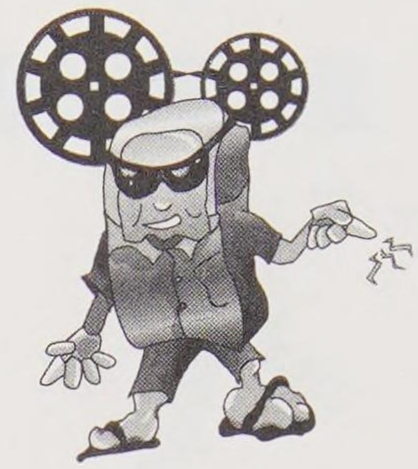
Figure 2.4

Movies, tracks, and media.



Video Tracks Become Images

When you play a movie containing visual data, the Movie Toolbox gathers the movie's data from the appropriate tracks and media, transforms and manipulates the data, and displays the results in a window. The Movie Toolbox uses only enabled tracks at any given time and only tracks that are active in the current movie mode (standard playback, poster mode, or preview mode).



This complicated process involves clipping and resizing each image from the data storage media. Each track defines its own spatial characteristics, which then become another input image within the context of the movie's spatial characteristics.

Each track defines a rectangle where the track displays its media. The Movie Toolbox clips the image from the media. A track's matte—a fill shape—filters the image further. The track image may undergo mathematical matrix operations: a graphical manipulation to rotate, move, and scale the image.

The process of reading the image from the media, then clipping, resizing, and translating the image occurs for each active track at the time of display. The movie image is the combination of track images by track order. Some tracks may clip or partially obscure tracks that are lower in the image by overlaying them.

You now have a composited movie image. Is this what is displayed? No. QuickTime clips and manipulates the movie image into the screen display boundaries again. When you resize the movie window, you change the display boundaries.

QuickTime Audio Support

As with video or image data, QuickTime movies store sound information in tracks. QuickTime movies don't require sound, not even digitized video movies. The SuperMac VideoSpigot board, which imports video into a QuickTime movie, does not support audio directly on its board. It recognizes audio input from either the built-in Macintosh sound input or the MacRecorder driver, and adds sound to QuickTime movies.



Do not expect QuickTime movies to contain sound. It's an option that you can add or remove by using any QuickTime editing program.

If you want just a QuickTime sound file, create a PICT image and merge it with your sound file using a QuickTime editor (see Chapter 7, "Sorting Out the Details," for more information); you then can see the movie when you place it in a document.

Macintosh Audio Fundamentals

There aren't many sources of information describing Macintosh audio support for non-programmers. The Mac is well-recognized as leaps and bounds ahead of sound support in DOS machines, and inferior to the NeXT computer. Because sound is part of QuickTime, this segment describes Macintosh audio fundamentals.



Inside the Macintosh operating system is the Sound Manager. This piece of software controls the types of sounds you hear from the Mac speaker, or whichever audio system you plug into the stereo audio-out port found on the back of every modern Macintosh. The Mac specifically manufactures (or synthesizes) three types of sound wave forms from digital information (see Figure 2.5). You can derive any sound from these three wave forms by using the Sound Manager's three synthesizers: the four-tone synthesizer, the sampled sound synthesizer, and the wave-table synthesizer.

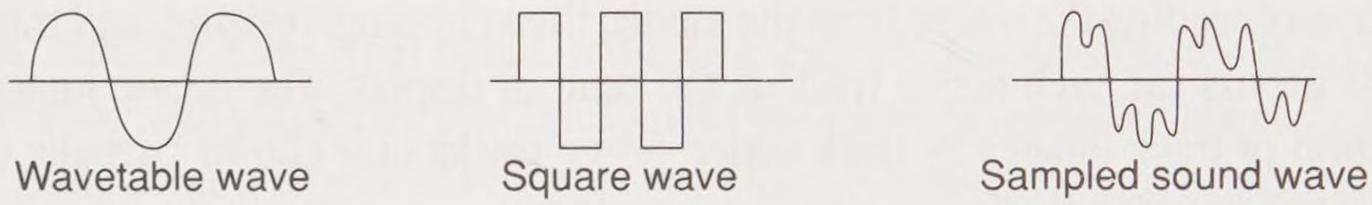


Figure 2.5
Types of wave forms Sound Manager supports.

A tuning fork generates the most recognizable wave-table wave forms. Objects that turn on and off like the beep of a horn generate square waves. Objects that vibrate and change frequency rapidly, like human speech, generate sampled sound waves, which are the most common type of waveform. A synthesizer takes numbers approximating a wave form and converts them back into a wave form that plays out the speaker. The actual component that converts the numbers to sounds is a *digital-to-analog converter*. The method of storing the points along a wave form as numbers is known as *pulse-code modulation* (PCM).

The Sound Manager supports multiple channels of sounds. For example, a Mac can play a channel containing the tone from a tuning fork and a channel of human speech. The number of channels a Macintosh can use simultaneously depends on the Mac's power. A Macintosh II machine can support several channels of high quality stereo; a Plus can support only one.

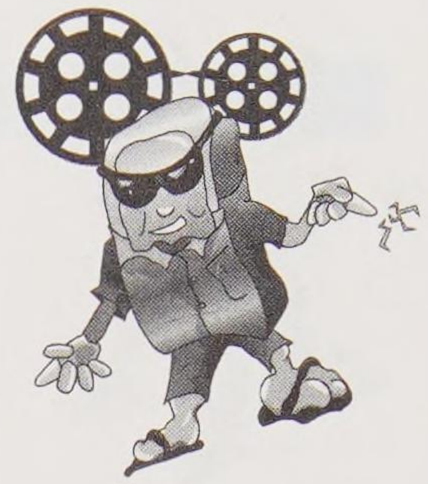
In addition to playing sounds, the Macintosh Sound Manager also supports the Macintosh Audio Compression and Expansion (MACE). One minute of single-channel, CD-quality sound can occupy 5.3 megabytes (M) of disk space. One minute of telephone line-quality sound takes more than 500 kilobytes (K) of disk space. MACE supports compression of sound data at ratios of 3:1 or 6:1. Compressing sound yields significant savings in storage and RAM space, at the cost of somewhat lower quality and higher processing requirements of the computer on playback.



The Sound Manager stores audio in three ways: SND resource, AIFF, and AIFF-C.

You embed digital audio into a file. The file known as an SND *resource* (the blank after the first three characters is significant and acts as a special identifier to the Mac and Mac programs) gives the digital audio's file a special tag. Applications and the Macintosh





operating system know the SND resource as a type of audio data. *AIFF* is an acronym for Audio Interchange File Format—a collaborative invention between Apple Computer and several interested companies. The main difference between AIFF and AIFF-C is that *AIFF-C* allows for compressed audio data.

The Sound Manager supports two techniques for encoding the *amplitude* (or loudness) values in a sample: offset-binary and twos-complement. Offset-binary encoding offers 256 values to represent a wave form. Samples in Macintosh sound resources ('snd ' resources) are stored in offset-binary form. Twos-complement encoding also offers 256 values but defines silence value differently. The AIFF stores samples in twos-complement form. You can convert the two encodings so programs such as Macro Media's SoundEdit Pro can convert between the two formats.

QuickTime Audio

QuickTime movies may have one or more sound tracks—your application enables the track(s) as appropriate. You can edit the sound tracks individually, if you have a QuickTime editing program. You then group multiple sound tracks into alternate groupings for purposes such as foreign language playback. QuickTime also mixes sound tracks together: for example, you can add a voice track onto a music background track.

QuickTime's two main sound support attributes are volume and balance.

Volume Setting



Each sound track in a movie has a volume setting. A track's volume governs its loudness relative to other tracks in the movie. Each movie has a current volume setting that controls the loudness of the entire movie's sound tracks. In addition, you can set a preferred volume setting for a movie. When you play a movie, the Movie Toolbox sets the movie's current volume to the value of its preferred volume. The preferred volume takes precedence over the system speaker volume. The movie volume setting supersedes the system speaker volume, even if you turn off the system speaker volume.

QuickTime movie volume settings range from –1.0 to +1.0. The sound volume is a 16-bit value. Negative values, from 0 to -1.0, are muted but retain the volume setting's magnitude. So, toggling off the volume retains its magnitude, similar to pressing the mute button on a television. This leaves 256 levels, or eight bits, for audio volume.



Balance Setting

Each track in a movie has its own balance setting, which controls the mix of sound between two speakers. If the sound source is monaural (one speaker), the balance setting controls each speaker's relative loudness independently. Also, when the computer has a single speaker, the balance setting has no effect on playback.

QuickTime movie balance settings also range from –1.0 to +1.0, held in a 16-bit value. Negative values weight the balance toward the left speaker; positive values emphasize the right channel. Setting the balance to 0 corresponds to a neutral setting.

QuickTime Audio Quality

Sample size, the size of the wave form, indicates the number of bits used to encode the *amplitude*. A sample's size determines the sound quality because more bits can represent more amplitude values. The basic Macintosh sound hardware supports only 8-bit samples (256 values), but the Movie Toolbox also supports 16- and 32-bit sample sizes. The Movie Toolbox plays these larger samples on 8-bit Macintosh hardware by converting the samples to 8-bit format first.



With 16-bit sampling, QuickTime is capable of storing CD-quality audio.

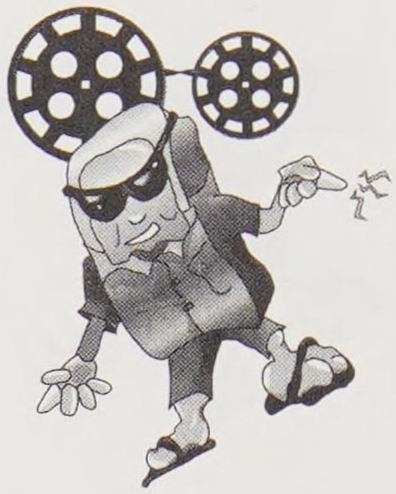
Sample rate indicates the number of samples captured per second. The sample rate also influences the sound quality because higher rates can capture the original sound wave form more accurately. The basic Macintosh hardware supports an output sampling rate of 22.2545 kHz, or approximately 22,000 samples each second. By comparison, a compact disc samples at a rate of approximately 44.1 kHz, and digital audio tape (DAT) samples at 48 kHz. The Movie Toolbox can support any rate up to 65.535 kHz; as with sample size, the Movie Toolbox converts higher sample rates to rates the Macintosh hardware can accommodate when it plays the sound.

The Movie Toolbox also supports the Sound Manager's MACE capability. This means you can compress QuickTime audio at ratios of 3:1 and 6:1. Compressing a movie's sound can yield significant savings in storage and RAM space, at the cost of somewhat lower quality and higher CPU overhead on playback.

SoundEdit Pro software offers additional compression ratios of 4:1 and 8:1, which are not QuickTime-compatible.

Hayden's *Cool Mac Sounds* discusses sampling and compression, among other sound morsels, in much greater detail. (And it also has loads of sounds you can use in your QuickTime movies!)





CHAPTER



3

Compression

This chapter describes QuickTime's Image Compression Manager (ICM). The Image Compression Manager is an element that compresses and decompresses QuickTime movie data by squeezing the data in the movie. Compression minimizes the disk space you use, yet still preserves the data's quality. Apple provides compressors for still images (or photos), graphics, animation, and video.

What Is Compression?

The simplest way to explain compression is to compare it to trash. (Don't get me wrong—I'm not saying compression is trash!) When you finish reading a newspaper, you don't

drop the pages as is into the trash because that method takes too much space. Instead, you wad (or *compress*) the pages into little balls with your hands and then toss them.

What if you need to find an article in the paper after you've compressed and thrown it into the trash? You pull out the paper and smooth the wrinkles—in other words, *decompress* the paper. The article is as legible as it was when you first read the paper. This type of compression is called *lossless compression* because you haven't lost anything; the information in the article is completely recoverable.

After that discussion, I'm hungry, so I think I'll pop a frozen meal into the microwave. Instead of tossing the used packaging whole into the trash, I tear apart the box, cut up the plastic wrap, then throw both away. I'm compressing the spent container. However, I can't finish my meal, so I need to re-package the leftovers.

To repackage my leftovers with the original materials, I need to take the packaging from the trash and tape the plastic wrap (and possibly the box) together. I lay the plastic over my uneaten food and put the entire meal in the refrigerator. I'm not able to preserve the original packaging materials because I cut them up to compress them into the trash. However, the packaging is still usable in some form.

This food example compares to losing some of the computer data's quality with compression. The packaging is not as good as the original, but it meets my need to cover the leftovers. Likewise, computer images may have a higher degree of quality than you need, so you can compress them to save space and still remain useful. Compressed computer data with partially removed information is *lossy compression*.

Uncompressed image data requires a large amount of storage space on your computer. You need as much as 1.2M to store a single 640- by 480-pixel image, the size of the standard Mac 13-inch monitor screen, in 32-bit color. With a minimally acceptable frame rate of 10 images per second, a 30-second full-screen movie requires 3,600M. Do you have a spare 3,600M on your hard disk? And this number does not reflect the additional space the audio track consumes!

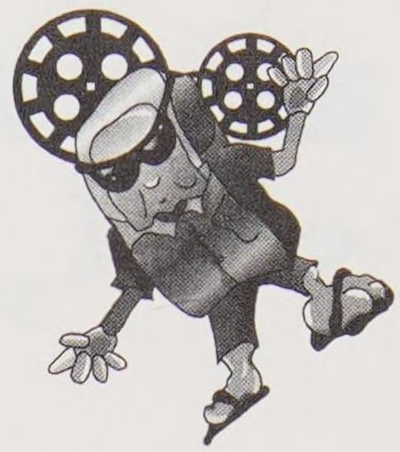
You benefit from using image compression in the computer by

- Decreasing the amount of storage needed for image data
- Decreasing the time required to move image data from the hard disk to the computer's main memory
- Decreasing the time required to exchange image data across networks.

The drawbacks of using image compression in the computer are

- An increase in time required to manipulate image data because of the extra compressing or decompressing step





- The possibility of incompatible compressors and decompressors rendering the image data unavailable.

What Is an Image?

To understand which data you can compress, you need to know how computers represent images.

How Computers Make Screen Dots

A computer screen is like a television set. Most common computer displays contain a cathode-ray tube (*CRT*). Inside the CRT, an *electron gun* shoots a controlled beam of electrons onto a screen. This screen is the computer display you see.

Color monitors contain three electron guns that display images in three primary color combinations in the CRT: red, green, and blue (RGB monitors). An adjustment of the intensity of light from the three electron guns, produces color variations onscreen. The light emitted from the three guns focuses on a tiny cluster of three dots. We call this triad a *pixel*, which stands for picture element (see figure 3.1). The pixel is the smallest element a computer can address individually.

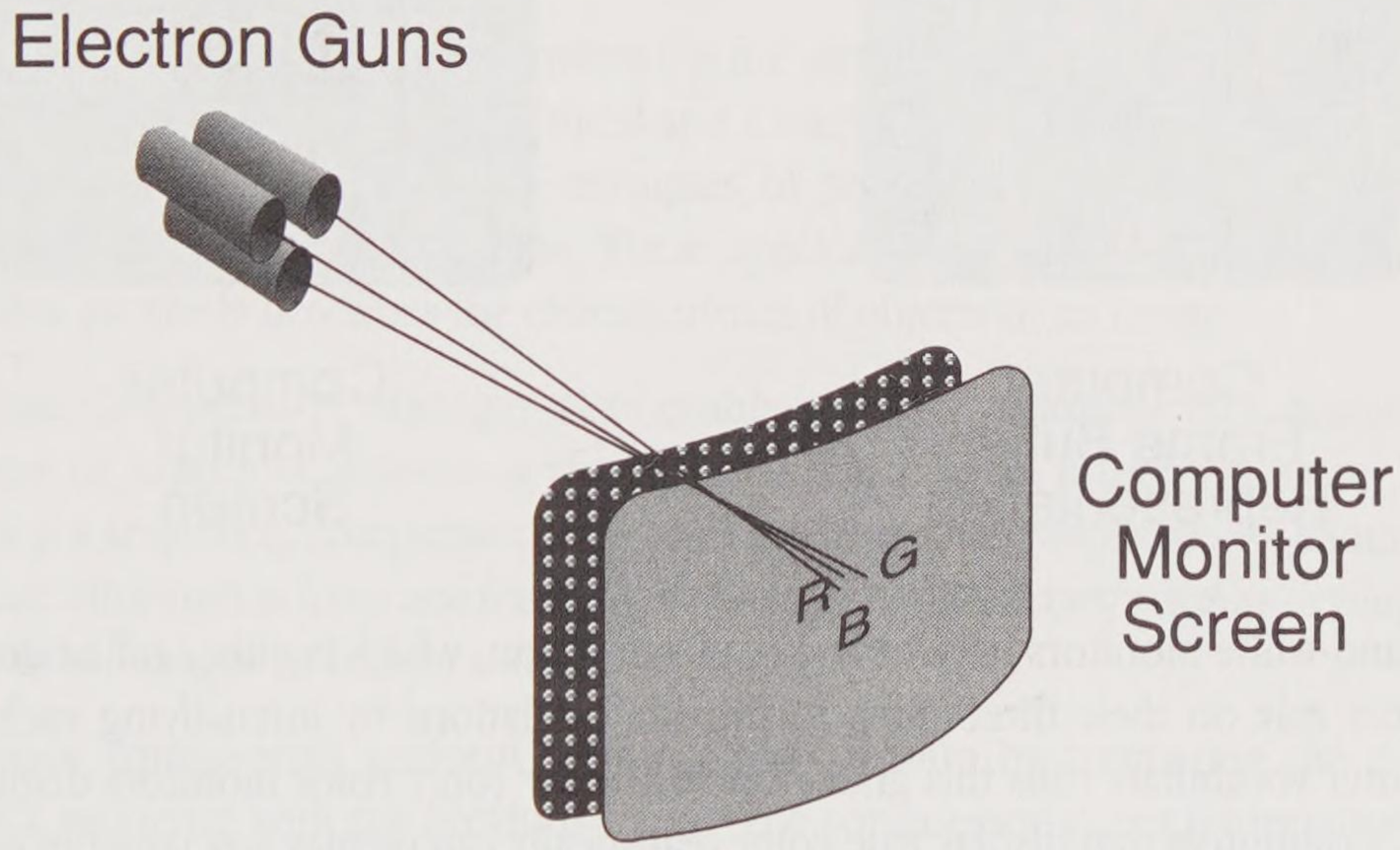


Figure 3.1
Pixel representation.

A computer groups pixels to make text characters, graphic images, and QuickTime movie images. Pixels comprise everything you see on a computer screen. An entire screen of pixels is called a *raster*—a rectangular grid of pixels. The electron gun aims the electron



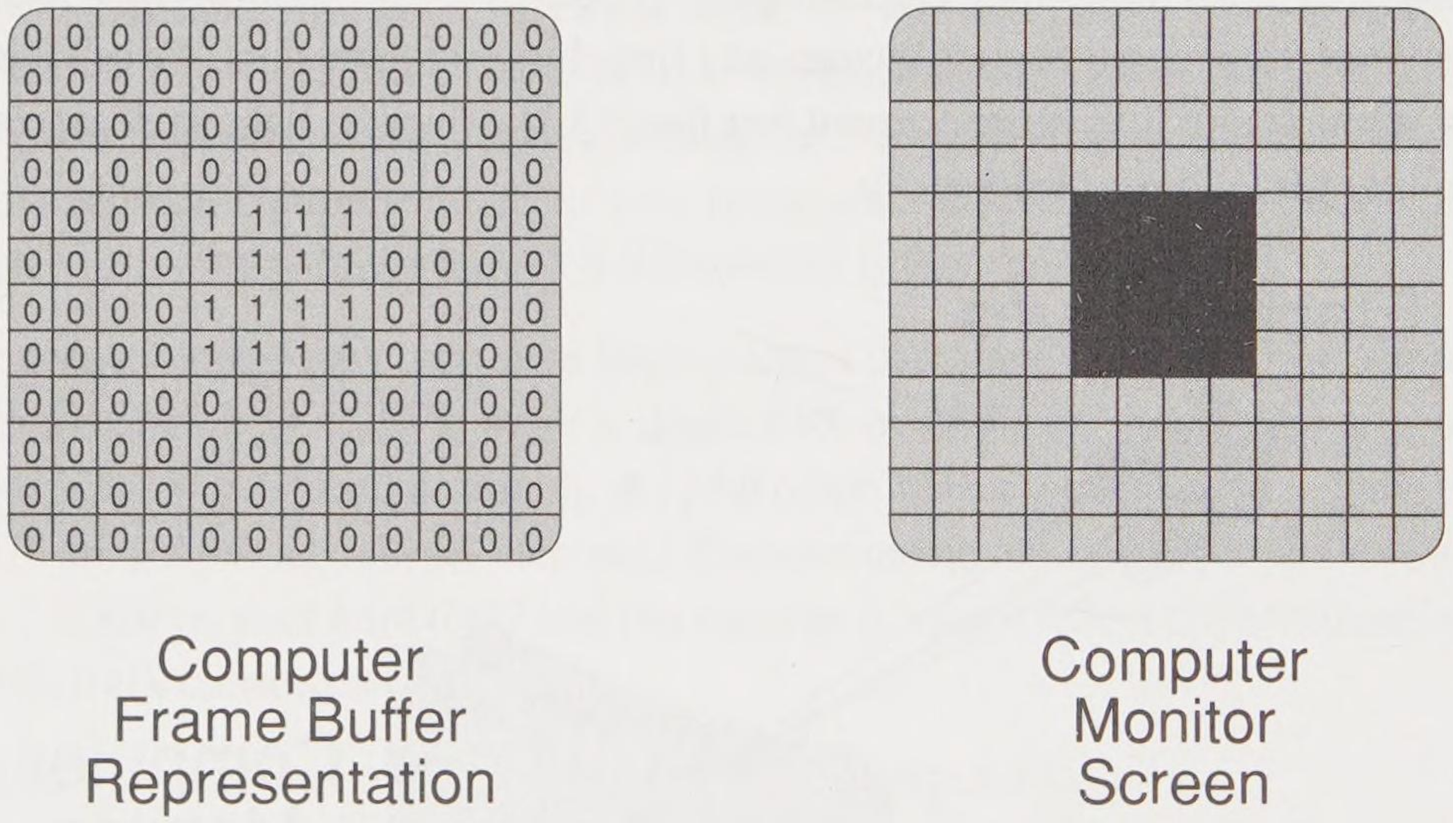
beams at a different location on the screen, starting at the top left corner and working toward the bottom right corner. The electron beam visits every pixel on the screen at least 30 times per second.

Resolution describes the number of pixels in the raster's horizontal and vertical dimensions, assuming screens of the same size. Higher resolutions produce clearer images and offer more screen space. Computer screens have a higher resolution than TV sets. The standard 13-inch Macintosh RGB monitor is 640 pixels by 480 pixels.

Representing Dots as Computer Data

To display a black, 5- by 5-pixel square onscreen, the computer stores a picture of the square in a video *frame buffer*. The frame buffer contains all pixel values that describe the picture the screen will display. The frame buffer temporarily stores (buffers) a full frame of information at once. Electronic circuitry reads the frame buffer and translates this information into on and off pulses of the electron gun as it moves from pixel to pixel in the raster (see figure 3.2).

Figure 3.2
A frame buffer's relationship to the display.



Black-and-white monitors have only one electron gun, which is either off or on. Color monitors rely on their three guns to provide gradations by intensifying each color. Computer vocabulary calls this gradation *true color* (only color monitors display true color). Computers that display true color realistically can display any tangible item.

Mathematically, you need 16.7 million colors for true color— 256 times 256 times 256. Each pixel in a true color display can create 256 greens, 256 reds, and 256 blues. Each pixel's *bit depth* (also called *color depth*) is 24 bits. True-color display systems contain 24 frame buffers—each buffer represents an intensity for each pixel in the raster. A frame buffer is a segment of computer memory; the larger the screen and the greater the bit



depth, the more computer memory you need. Color images, especially images with great color depth, also require larger disk storage and more RAM to manipulate them in applications.

What Can I Compress?

It is inefficient to store images on a disk the same way you do in RAM. A solid black object contains black for its entire color depth, across many pixels. You eliminate some of the redundancy by compressing the image. The compressed image occupies less disk storage space, too.

In addition, the visual images we humans perceive have special qualities you can exploit to further compress image data. For example, your mind fills in visual blanks between frames in a movie. Image compression algorithms use this perception to compress the data.

The Image Compression Manager

The Image Compression Manager works only with image data. You primarily use the ICM to compress pictures that have images: scanned still images, digitized video images, paint or 3D rendering applications.

There is no significant compression when the file contains data that describes shapes as opposed to the actual color image of the shape. Computer-aided design, draw programs, and 3D modeling applications are examples of programs that create and use files containing image shape descriptions. These applications create images in a compact format that precisely describes the characteristics of objects in an image.

The Image Compression Manager also enables you to compress and decompress sequences of images or *frames*—a single visual image in an image sequence. When processing a sequence, compressors may perform *temporal compression*—eliminating redundant information from one frame to the next—or *spatial compression*—compressing individual images or frames within a sequence.

Compressor components perform temporal compression by comparing the current frame in a sequence with the previous frame. The compressor stores information only about pixels that change between the two images. If adjacent images are similar, which is common in movies, temporal compression can reduce significantly the amount of data you need to describe the images in the sequence. Either you or the application program can choose the quality level for the compressed image. The compressor uses this value to determine the amount of temporal redundancy to eliminate between images.



The Image Compression Manager is available only to computer programs. The ICM provides programs with a single interface to compress and decompress images and sequences of images, independent of any compression devices and algorithms. Applications benefit from this device independence; they don't need their own compression routines, which may be incompatible with another program's routines. The Mac makes compression available to any application that wants compression, which gives you a richer set of applications.

Image Compression Characteristics

You judge image compression algorithms by three main characteristics: compression ratio, compression speed, and image quality. Other factors unrelated to the compression algorithm also affect any method's performance. Pixel depth conversion, spatial and temporal compression, key frames, and fast dithering are described also in this section.

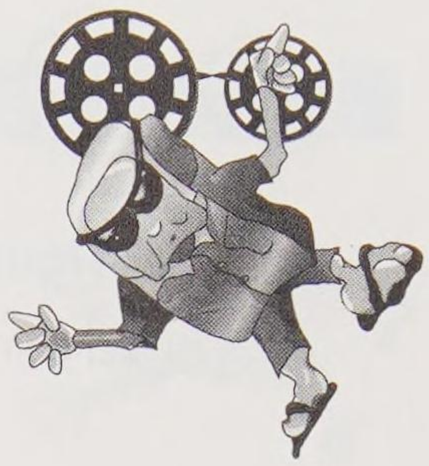
Compression Ratio

The compression ratio enables you to control the tradeoff between the amount of image compression and the quality of the resulting image. The size of the original image divided by the size of the compressed image determines the compression ratio. Most algorithms have a range of compression ratios, such as 2:1 to 20:1. Therefore, you usually want to look at an average compression ratio. Determining the best compression ratio for a compression algorithm takes many attempts and considerable time. The best compression is your subjective assessment of the image. Generally, the higher the compression ratio, the poorer the quality of the resulting image.

Some compression schemes produce compression ratios that are highly dependent on the image's content. This aspect of compression is called *data dependency*. If you use an algorithm having a high degree of data dependency, an image of a crowd at a football game (which contains much detail) may produce a very small compression ratio, whereas an image of a blue sky (which mostly consists of constant colors and intensities) may produce a very high compression ratio.

Compression Speed

The amount of time required to compress and decompress a picture defines compression time and decompression time, respectively. The time values depend on



- The compression algorithm's complexity
- The efficiency of the algorithm's software or hardware implementation
- The computer or codec hardware's speed

The faster you can perform compression and decompression, the better. A 1/2 second speed differential in compression methods can be significant. For an image with 30 seconds of images at 10 frames per second (300 images total), this translates into 150 seconds—2 1/2 minutes!

Image Quality



As I discussed earlier, you can perform two types of image compression: lossy and lossless. Lossless schemes preserve the original data precisely. Lossy schemes do not; the original image cannot be recovered after compression. However, most lossy schemes try to compress the data as much as possible without decreasing the image quality noticeably. The compression ratio affects the amount of loss that occurs in the image.

Pixel Depth Conversion

The ICM has another element called the *raw compressor* that converts images from one pixel depth to another. True color images contain 24 bits for each pixel. However, because a Mac reads in 16- or 32-bit chunks, your computer reads 32 bits of information for each pixel. The raw compressor can convert a 32-bit pixel image to a 16-bit pixel image. A true color image stores eight bits for each color. By removing the least significant three bits, the image retains its most significant color information (see figure 3.3). Three 5-bit color values, rounded to the next largest computer chunk size, yields a 16-bit-per-pixel image conversion. Converting a 32-bit image to 16-bit format achieves a 2:1 compression ratio. The raw compressor performs this conversion quickly, and the resulting image usually retains excellent image quality, in most cases.

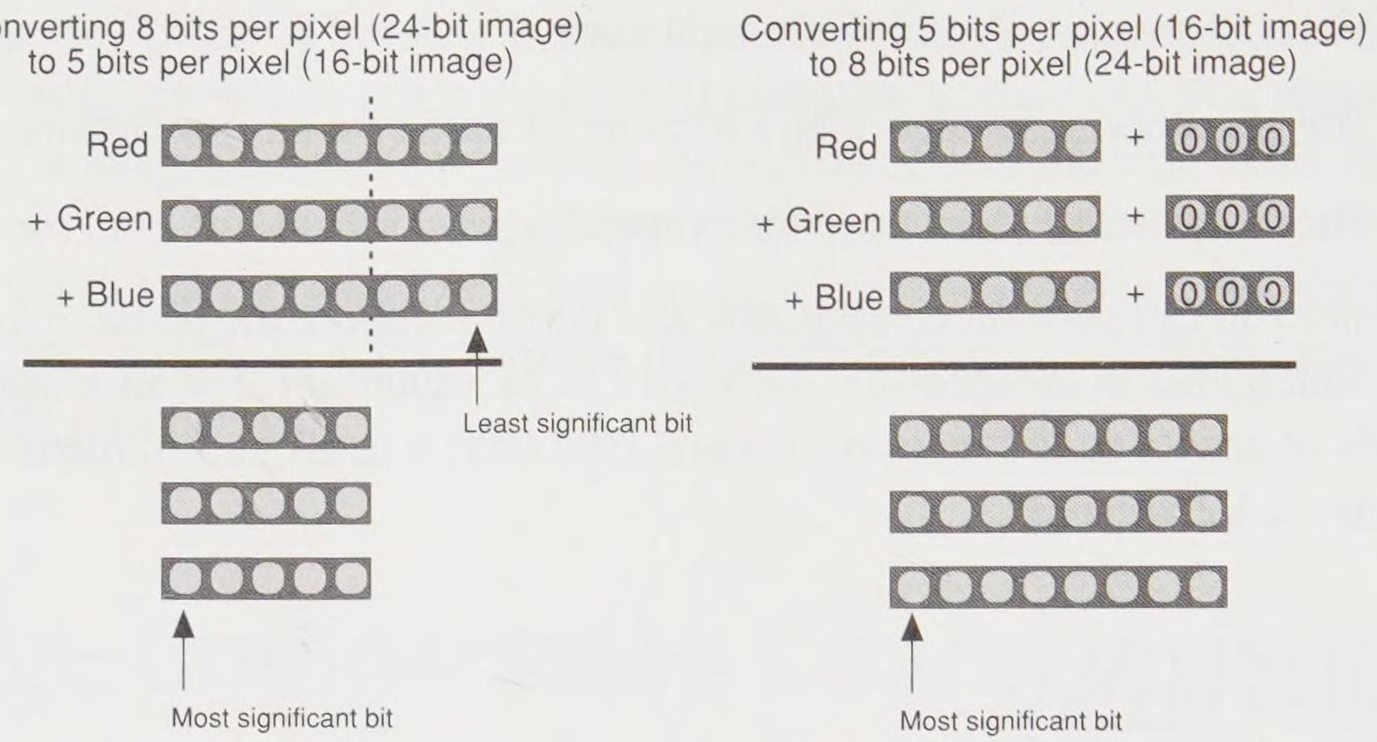
The ICM often combines the raw compressor with other compressors. For example, the photo compressor works directly with only 32-bit color images. The ICM uses the raw compressor either to convert the original image's pixel depth to 32-bit color or to convert the 32-bit decompressed image to another pixel depth for display.

The raw compressor works in both directions: 8-bit images converted to 16-bit or 32-bit images and 16-bit images converted to 32-bit images. When the ICM uses the raw compressor for this type of conversion, images generally do not lose quality because color information is padded in the least-significant values.



Figure 3.3

Pixel conversion.



Spatial and Temporal Compression

Spatial quality controls the picture quality to compression ratio within a single image or frame. Temporal quality controls picture quality to compression ratio for a sequence of images over time. You create temporal compression by removing any redundancy between adjacent frames. Compression ratios are generally inversely proportional to the quality settings.

QuickTime standardizes spatial quality settings and quality scales. A quality scale has a dynamic range of 1,024 values divided into four regions (see figure 3.4). The quality scale has five "tick marks" to represent five settings from "worst" to "best." The quality scale setting that offers any compressor average to good-quality results is "normal." Normal is the default setting for both spatial and temporal quality. You may want to adjust the quality scale whenever you produce a specific file size to fit on a floppy disk, for example.

What happens when the quality level decreases? Spatial compression can result in the following effects on an image:

- Blurriness or smudging
- Blockiness (small blocks of constant color, or blocks from previous frames)
- Streaking (lines of constant color)
- Contouring (regions of constant color).

Blocks from previous frames show through the current frame when you use temporal compression.

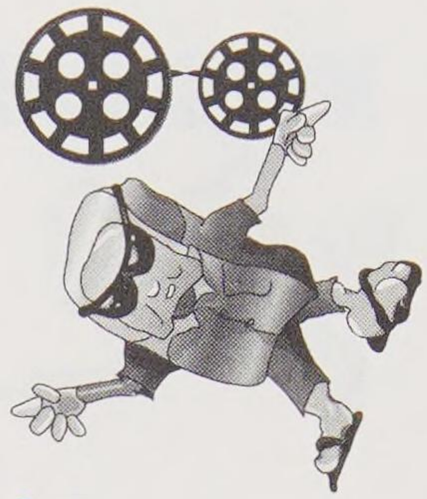
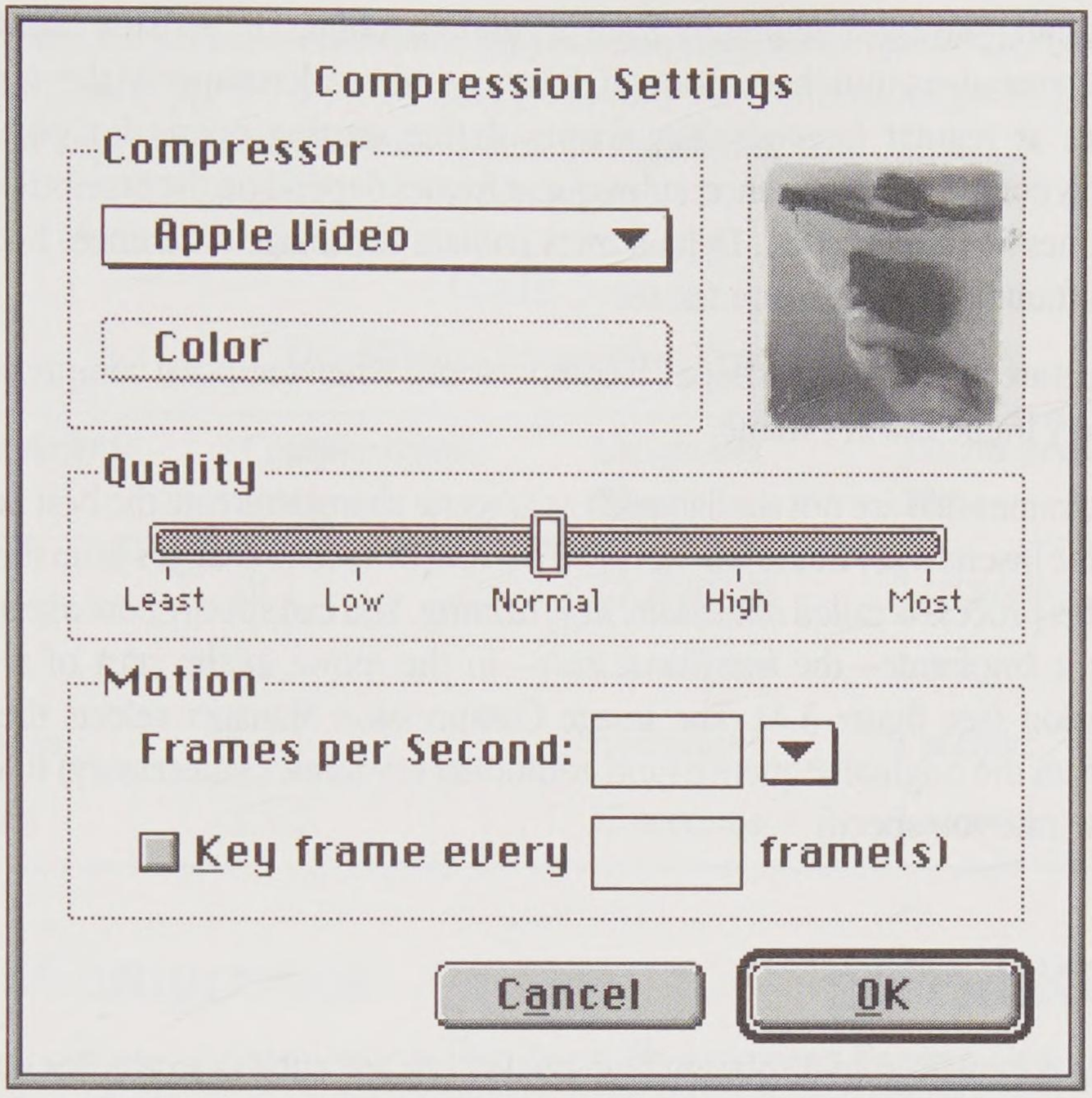


Figure 3.4

The standard QuickTime quality scale.



The Apple animation compressor performs lossless compression when you set the spatial quality setting to maximum or "best," quality



Key Frames

Key frames are used in temporal compression. Temporal compression only saves differences between frames. Key frames are full frames saved in the data stream. If you pause the movie, you see a key frame plus the accumulated frame differences from the key frame to the current point in the movie.

Key frames allow random access and reverse play modes, and synchronization with audio for temporally compressed movies. For example, in a movie where a person sits at a desk, the desk and desk features, the wall, and everything else in the room are fixed over a sequence of frames; you can temporally compress these elements.

Reconstructing an individual frame within a sequence that has been temporally compressed requires a knowledge of the previous frames. This does not present a problem if the movie always plays compressed sequences from the beginning. However, if you



need to start playing a sequence from a random point, or perhaps backward, the decompressor does not have enough information to decompress the compressed sequences at regular intervals. Key frames define starting points for portions of a temporally compressed sequence; subsequent frames depend on the previous key frame. Delta frames are also created. Delta frames contain the image differences between the previous frame and the current frame.



Key frames are not needed with spatial compression. When temporal compression is not used, every frame is a key frame.

Adjacent frames that are not similar, such as at scene changes, create the best key frames. QuickTime inserts a key frame whenever 90 percent of a scene changes from the previous frame. This process is called *automatic key framing*. You can specify how often you want to insert a key frame—the *key frame rate*—in the movie at the start of a sequence compression (see figure 3.4). The Image Compression Manager selects the best key frames from the original sequence (and additional key frames if necessary) to match the key frame rate you specify.

Fast Dithering

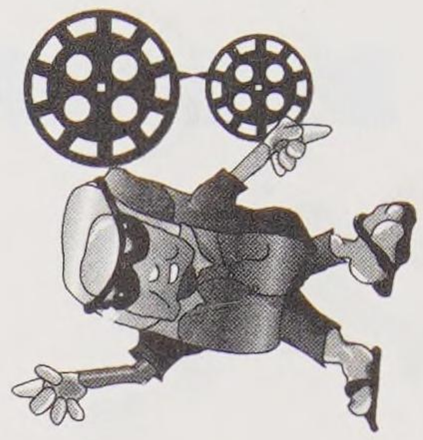
Dithering is a method of displaying high-quality images, such as true color images, at a lower pixel depth. The standard Macintosh display tool, QuickDraw, provides this capability. By dithering the destination image, QuickDraw fools your eyes into seeing colors that aren't actually on the display screen. Unfortunately, dithering takes too much time. QuickDraw's drawing delays are unacceptable when you work with movies, which must display many images each second.

QuickTime offers two dithering methods for movies: *fast dithering* and *error diffusion dithering*. Error diffusion dithering takes more time and looks better than fast dithering. Error diffusion dithering works its magic by inserting random noise over the image. Fast dithering is the technique QuickTime normally uses during the playback of movies that must be dithered in real time. This method uses look-up tables, making it the fastest dithering method.

Built-in QuickTime Compressors

Apple independently developed and supplies five compression algorithms with QuickTime. The following sections describe these compressors, the type of data they compress, and their effectiveness. Table 3.1 contains a summary of QuickTime compression methods performed on a IIsi. The table's tested image is 24 bits, at a pixel size of 640 by 480 dots.





Apple supplied the results on the chart, (Apple Computer, Inc., *Preliminary QuickTime Developer's Guide*, pp. 3.7-3.9). so the results may vary with subsequent QuickTime releases and improvements in the compression algorithms.

Table 3.1

QuickTime Compression Types

Compression Type	*Compression Ratio*	*Compress Time*	*Decompress Time*
Photo	10:1	7.5 seconds	7 seconds
Video	6.5:1	3.5 seconds	1 second
Animation	1.3:1	2 seconds	1 second
Graphics	2.5:1	17 seconds	1 second

Photo Compressor

The photo compressor implements the Joint Photographic Experts Group (JPEG) algorithm for still-image compression. JPEG is an international standard for compressing still images. The photo compressor performs best on still images that vary smoothly or don't devote a large percentage of their areas to edges and other sharp details. Therefore, the photo compressor works well with most natural scenes. The photo compressor's compression ratios range from 5:1 to 50:1 at 24 bits per pixel—compression ratios between 10:1 and 20:1 create good picture quality.

Publishing professionals have rapidly adopted JPEG compression. Because you can select JPEG compression's quality, you can preserve as much quality as you need. High-resolution images suitable for magazines require approximately 2,000 dots per inch. The computer industry considers a computer screen resolution of 72 dots per inch WYSIWYG (what you see is what you get), so a magazine-quality image has a 20 to 40 times higher image resolution. The Macintosh 13-inch screen is only 7 inches high; a magazine page is 10 inches or more high, so a full-page picture easily can use more than 30M of space. Compressing this magazine-quality image by a factor of 10 yields a 3M image.

Today, JPEG is a default name for the compression proposal, the committee defining the proposal, the file format, and the compression method. The computer industry now refers to JPEG's original acronym as Working Group 10 of the CCITT (Consultative Committee of the International Telegraph and Telephone). Once approved, the still-image compression standard will be called International Standard (IS) 10918-1.



Video Compressor

The video compressor quickly decompresses 24-bit images while maintaining reasonably good picture quality. The video compressor works best with digitized video. This compressor uses spatial and temporal compression methods. Spatial compression only yields compression ratios from 5:1 to 8:1 with reasonably good quality at 24-bit pixel depths. Spatial and temporal compression combined produce compression ratios from 5:1 to 25:1. You can use the video compressor for computer animation as well as digitized video, but you obtain higher image quality by using the animation compressor.

Animation Compressor

The animation compressor compresses sequences of screen images, so it works best with animation and computer-generated visual content. The animation compressor's algorithm first applies PICT image-compression methods to the sequences, and then applies compression across all images in the movie.

A PICT image uses lossless compression. However, the animation compressor can perform either lossless or lossy compression. The lossy method speeds the rate at which you can play back the movie. The animation compressor's performance and achieved compression ratios depend on the type of images in a scene. The animation compressor is sensitive to picture changes and works best on clean, computer-generated images: images created with paint, drawing, computer-aided design, and animation programs.

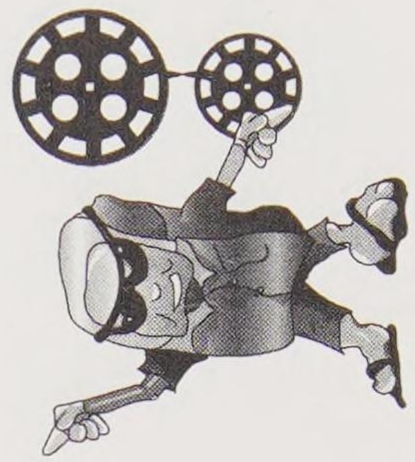
Images captured from videotape generally have considerable visual noise. The noise can corrupt the pixels' inherent similarity and make it more difficult for the animation compressor to achieve good compression.

Graphics Compressor

The graphics compressor is best suited to 8-bit still images and image sequences in applications where compression ratio is more important than decompression speed. The graphics compressor is a good alternative to the animation compressor whenever performance is less important than compression ratio.

In general, the graphics compressor generates a compressed image that is half the size of the same image compressed by the animation compressor. However, the graphics compressor can decompress the image at only half the speed of the animation compressor.





PICT Images

The PICT image format is a Macintosh standard-image format. QuickTime adds image compression support and image previews to PICT files (see Chapter 2, "The QuickTime File," for more information). You probably are curious how programs can support a new capability without modification. When you install QuickTime, QuickTime's installation program replaces the existing graphics procedure with a new graphics procedure. When an application displays an image that contains compressed image data, the new graphics procedure invokes the ICM to decompress the image transparently.

Programs rewritten to support QuickTime automatically acquire the enhanced PICT-image support and can use QuickTime's preview feature, also.

PICT images compressed with QuickTime do not open in applications if you don't install QuickTime, even if programmers rewrite the applications to support QuickTime. A dialog box appears, reminding you that you have not installed QuickTime.

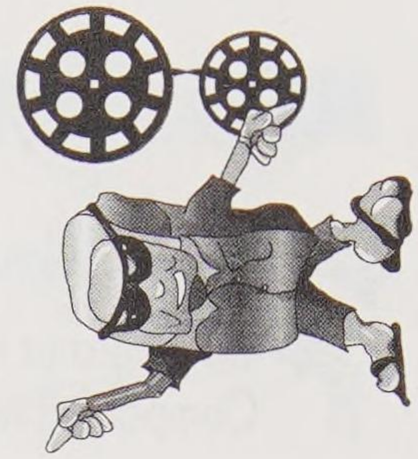


Why Learn About Compression?

Compression is the difference between enough space and no space to run QuickTime on your Mac. Without compression, you don't have enough disk space to create or save any significant QuickTime movies. With compression, you decide the tradeoff between your movies' quality and file sizes.







CHAPTER

4

Pieces and Parts

This chapter describes the Component Manager (CM), a QuickTime element that tracks QuickTime modules and QuickTime-compatible modules. Software interfaces to video digitizing boards, videotape players, and compression products are examples of QuickTime modules. Application programs use the CM to add functionality without adding more programming to the application (see figure 4.1).

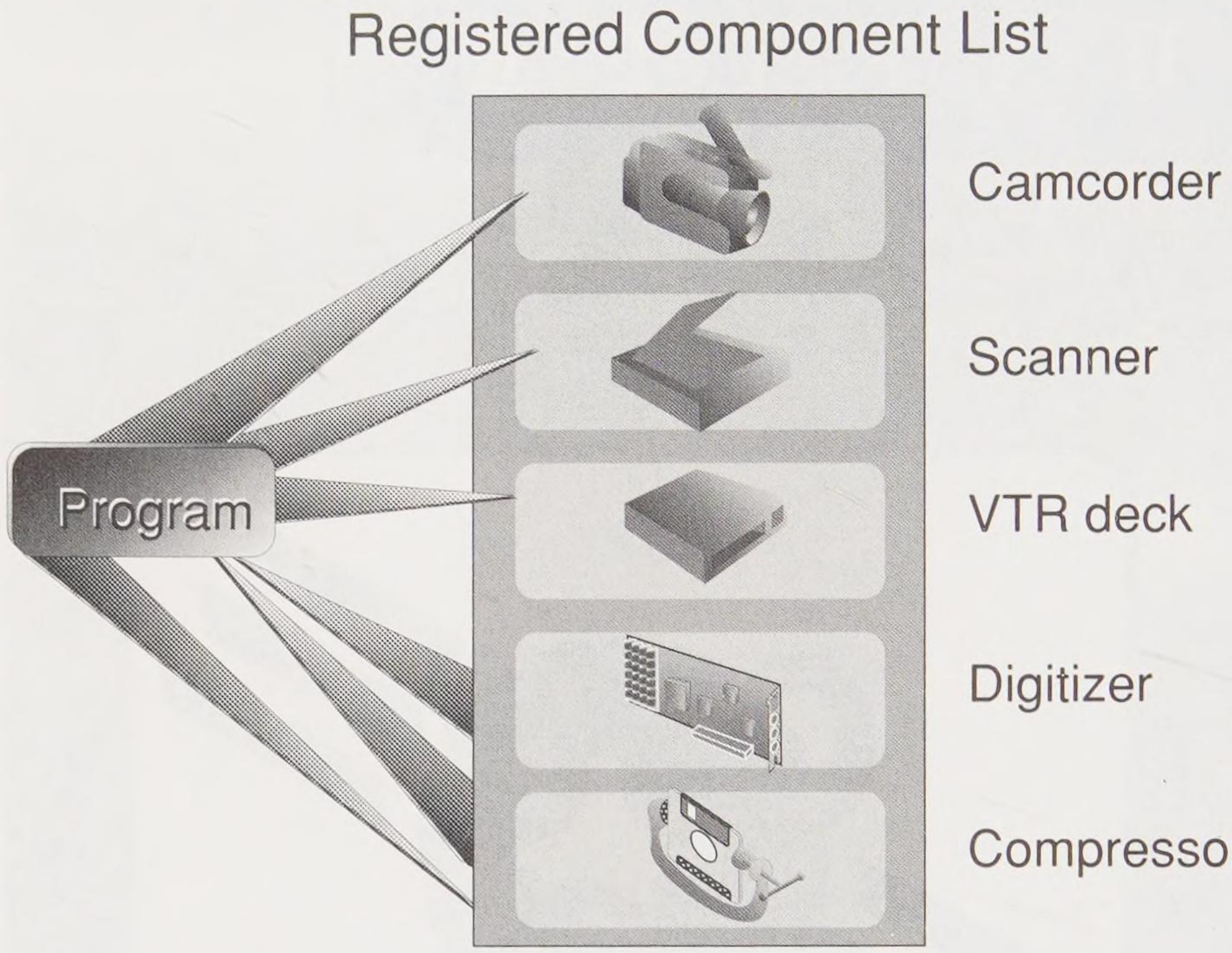


Figure 4.1
Programs using the Component Manager.

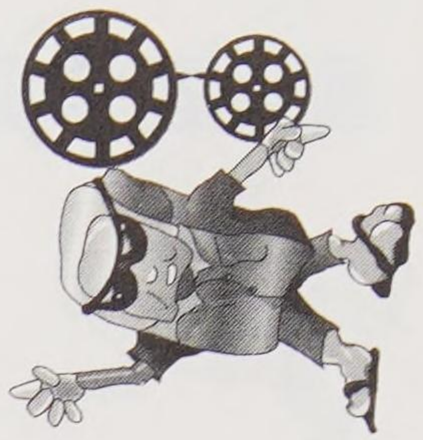
You already have learned that Apple provides QuickTime with four compression components: graphics, animation, photo, and video. Through applications, these compression choices with built-in algorithms are available to you.

The Component Manager

The Component Manager acts as a database and a dispatcher for applications that use QuickTime. An application requests a specific type of functionality, and the CM locates all components with the requested capability. The CM keeps track of each component's characteristics, such as the component's name, type, icon, and performance. For example: "imdc" code components provide image decompression information. Although you can't see the decompression information (it's part of the component's programming), the CM can find it. The Component Manager enables multiple applications to use the same component by establishing and managing that component's connection.

About Components

Components are software program fragments that provide a defined set of services to applications. Components aren't programs you run directly; components more closely resemble control panel devices (cdevs). The computer industry classifies components by



services: image compressors, image decompressors, video digitizers, timing sources, movie controllers, and sequence capturers. You can add a new component type at any time by dropping it into your System folder.



You must restart your Mac after installing new components. As the Component Manager loads, it identifies and logs the components it finds.

The Component Manager classifies components by three main criteria:

- The type of service
- The level of service
- The component manufacturer

All components in a type provide the same service. In addition, all components of a specific type must support a common application interface.

The component subtype specifies the level of service the component provides. The component subtype's value is meaningful only in the context of a specific component type. For example: Image compressor components use the component subtype value to specify which compression algorithm the component supports. All components of a given type/subtype combination support a common application interface.

How Layers Benefit You

Now, companies can add incremental functionality for QuickTime without writing complete programs. Storm Technologies excels in producing JPEG software and hardware. Storm's QuickPress JPEG compressor is both a product and a QuickTime component. By combining product and component concepts, Storm adds functionality to any program that uses and offers JPEG compression.

Another example: A digitizing card contains software that you must place in the System folder. One of the software programs you put into the System folder is a QuickTime component. By having this component available through the CM, a HyperCard stack or any program that lets you digitize directly—you don't need a separate program exclusively for digitizing.



The VideoSpigot is an exception. The VideoSpigot's system software extension isn't a component; the extension functions as a custom component to SuperMac's custom movie file format. The system extension translates VideoSpigot-generated movies into QuickTime movie file format on demand. You don't even know the translation is happening. However, because the VideoSpigot extension isn't a component, it doesn't

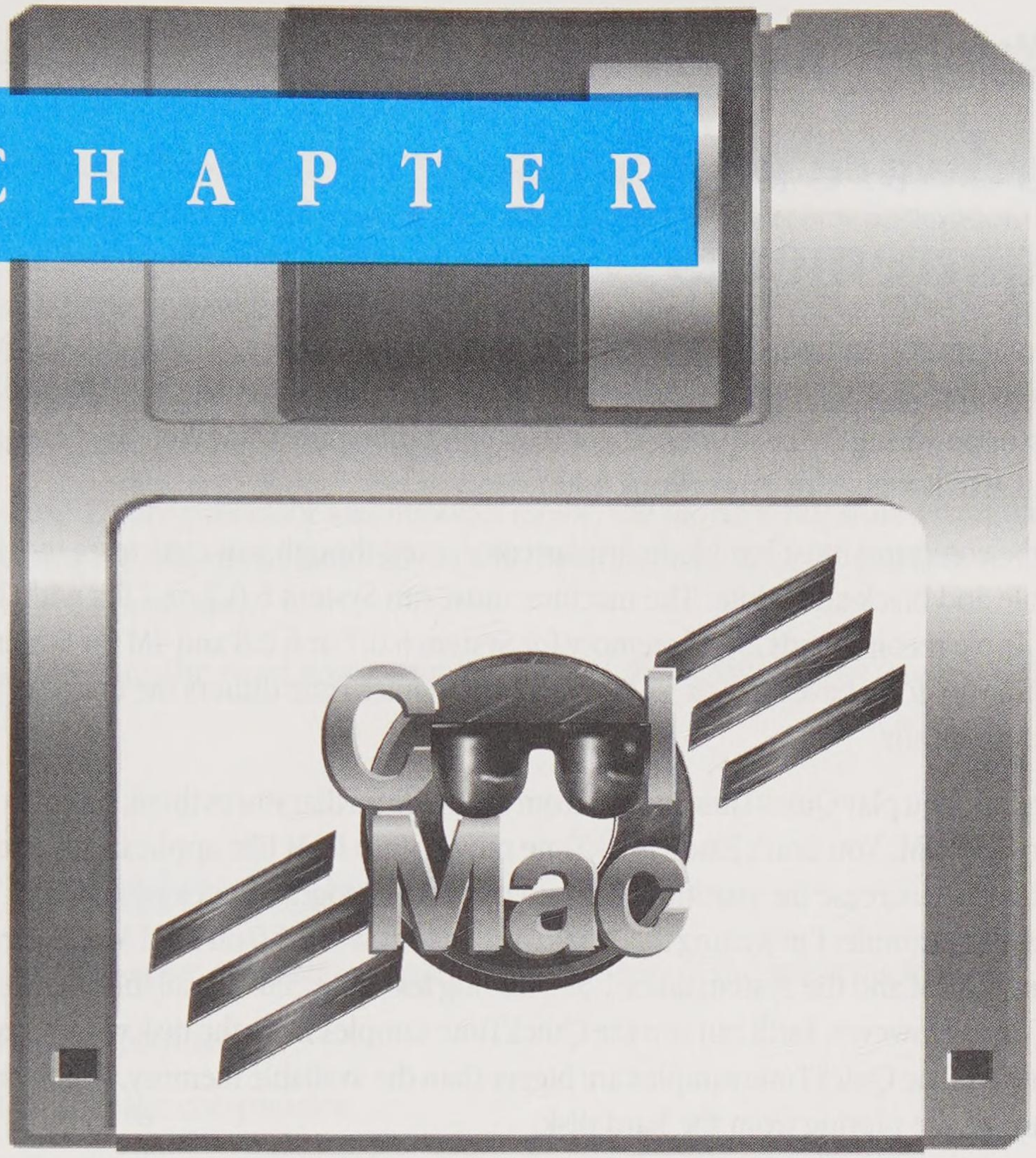


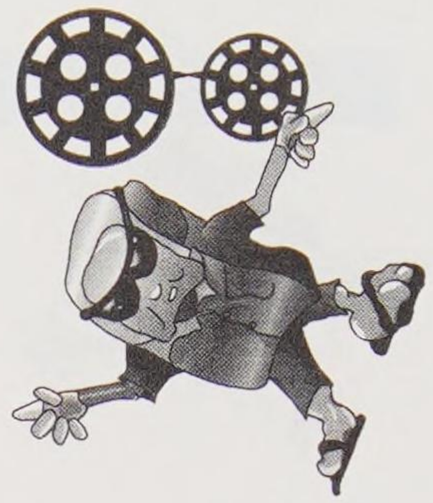
appear as an option in programs that allow you to select a digitizer component. By the time this book is in your hands, SuperMac will offer a video digitizing component for the VideoSpigot.

In Conclusion

The Component Manager is a database of QuickTime components and a manager for applications requesting component services. Adding new components is as easy as drag and drop: drag a new component from a disk and drop it into your System folder.







CHAPTER

5

Experimenting with QuickTime

If you learn best with your hands on a computer, this chapter is for you. If you've opened and viewed the Cool QuickTime samples on the enclosed disk already, this chapter explains more about what you've seen: QuickTime's hardware and software requirements, the controls to play QuickTime movies, and the named parts of QuickTime files. I also explain how I created these sample movies.

Hardware and Software Requirements

Which computers support QuickTime? To start, do you have a Mac? If not, convince Microsoft and IBM to support QuickTime. Macs must have a 68020, 68030, or 68040 processor powering the computer. This means you cannot use a Mac Plus, SE, Classic, the original Mac Portable, or PowerBook 100.

Next, the computer must be able to display color, even though you can create movies in grayscale and black-and-white. The machine must run System 6.0.7 or 7.0.x with 2M of RAM. (Apple recommends 2M of memory for System 6.0.7 or 6.0.8 and 4M for System 7.) Finally, if you don't have a 24- or 32-bit video card, QuickTime dithers the image to eight bits automatically.

Remember: You play QuickTime movies from the medium that stores them, such as a hard disk or CD-ROM. You don't load QuickTime movies into RAM like applications and you don't need to increase the partition size for your other programs because of QuickTime movies. For example: I'm writing this book in Microsoft Word 5.0 on a 4M Mac. Microsoft Word needs 2M and the System takes 1.5M, leaving less than .5M of available memory for QuickTime. However, I still can run the QuickTime samples from the disk with Microsoft Word open. The QuickTime samples are bigger than the available memory, which proves that movies are playing from the hard disk.



For movies in the looping mode, QuickTime attempts to cache the movie in memory if the application has enough memory.

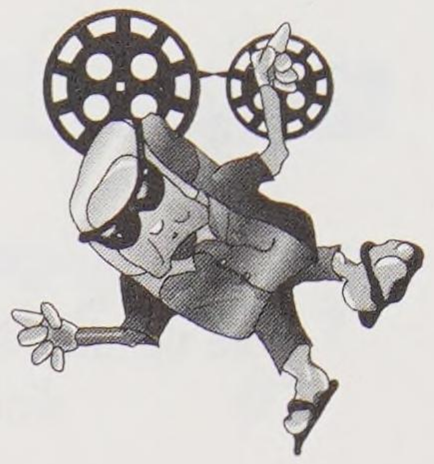
QuickTime supports 19 foreign language versions of the Macintosh system software.

QuickTime, the system software enhancement, contains only a few files. You place QuickTime (the INIT file), into the **Extensions** folder in the **System** folder. (INITs are files that add to the Macintosh operating system's functionality.) A new TeachText version available with System 7—the universal Mac text-viewing program—supports files containing QuickTime movies. You place TeachText anywhere in your Mac. I recommend you throw away any previous TeachText versions. There is also a new version of the **Scrapbook** file, a long-term repository for clippings from the Clipboard. The new **Scrapbook** goes into your **System** folder.



QuickTime is fully functional with the licensed QuickTime INIT file enclosed on *Cool Mac QuickTime's* disk. The **TeachText** and **Scrapbook** files are optional. You must get the **TeachText** and **Scrapbook** files from wherever you purchase your Macintosh system software.





The new QuickTime-savvy **Scrapbook** demonstrates how QuickTime works. How can the **Scrapbook** file contain a 5M movie if you have only a 4M Mac? The new **Scrapbook** doesn't hold the data, it only holds the movie file that points to the data (similar to System 7's Alias feature). To prove how the **Scrapbook** functions, I copied a 1.2M movie to the **Scrapbook**, but the **Scrapbook** increased in size by only 30K. I also viewed the movie in **Scrapbook** and played it from **Scrapbook**. The movie is scaled so that a large-screen movie plays within the borders created for the movie **Scrapbook** version.

If you use a word processor and import a movie, the movie is not stored with the word processing file. The movie is stored outside the word processing file and then referenced by the word processor.

If you distribute the word processing file, include the original movie when you transfer the file.



The Interface

A QuickTime-savvy application supports two or more of the following features

- Movie playback
- Still image compression
- Saving data as a QuickTime movie
- Standard **Preview** dialog box
- Cutting, copying, and pasting movie data

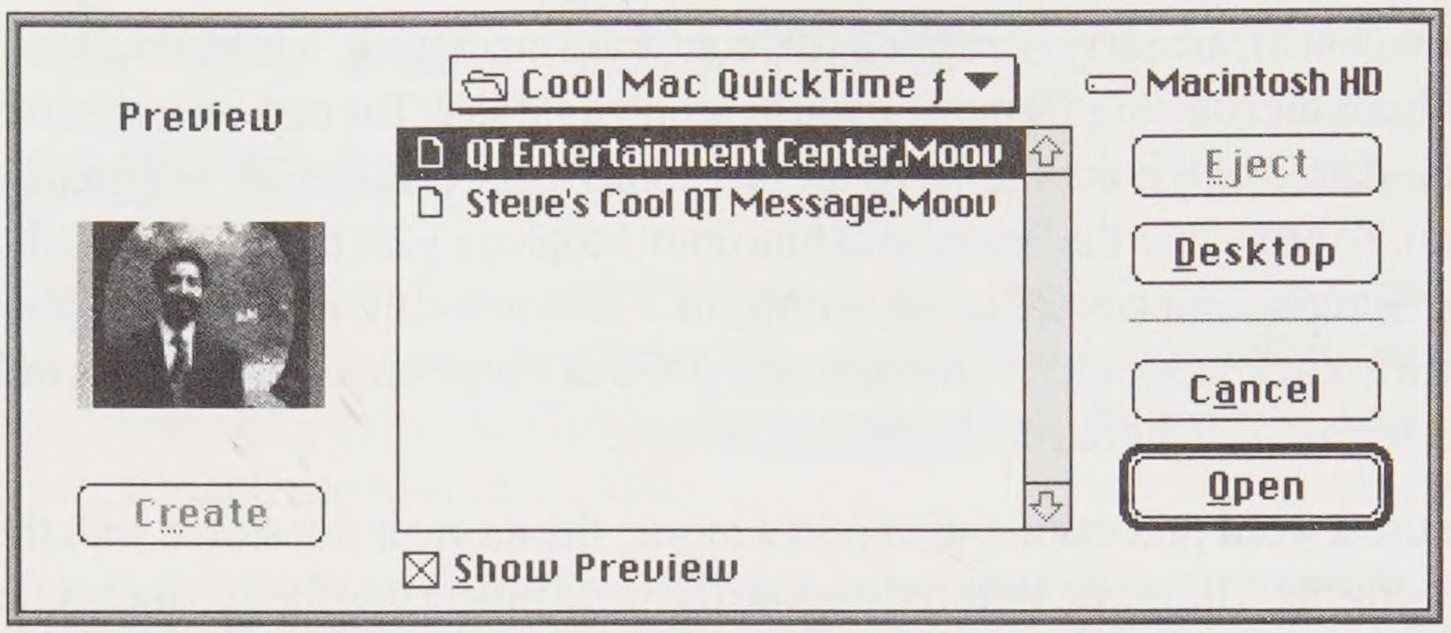
QuickTime's standard **Preview** dialog box differs from the Mac's standard **Open** dialog box. The **Preview** dialog box has a preview region on the left side. Any QuickTime file format—a movie or a PICT file—can display a preview of the file. If a movie or PICT file doesn't contain a preview, the dialog box includes an option enabling you to create a preview (see figure 5.1).

Popcorn, the QuickTime player on the enclosed disk, plays movies, displays the standard **Preview** dialog box, and cuts, copies, and pastes movie data.

Load the enclosed disk onto your computer now, following the instructions at the back of the book. After you load the files onto your hard disk, launch Popcorn by double-clicking on Popcorn's icon.



Figure 5.1
The standard **Preview** dialog box.



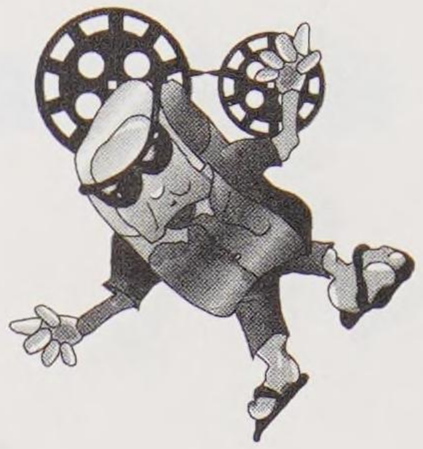
Select the **Open** command from the **File** menu to see the standard **Preview** dialog box. Select either movie from the disk by single-clicking on an icon. Figure 5.2 shows the *QT Entertainment Center.Moov* file as it appears in the Popcorn application (the movie automatically begins). This movie shows the standard movie features you will use.

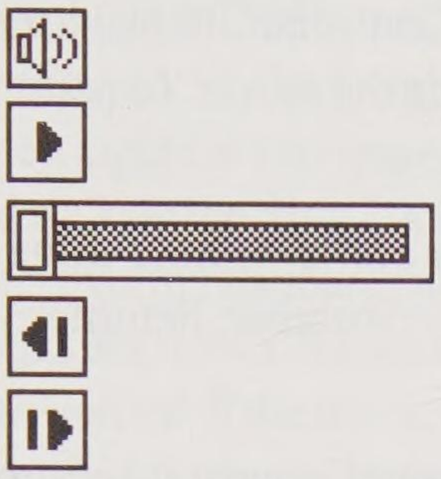
Figure 5.2
A sample QuickTime movie.



The controls closely resemble those you find on standard consumer electronics. The entire control area is called the **Standard Movie Controller**. To play the movie, single-click on the right chevron.

Now that you've experienced my fantastic cinematography, it's time to return from euphoria. The QuickTime movie controls are (from left to right in figure 5.2).





Volume control

Play button

Scroll box

Step Back button

Step Forward button

The twin rectangle icon adjusts the movie's viewing size. This icon is not part of the standard controller, but you find it in some implementations.

Volume Control

The **Volume** control enables you to adjust the sound volume. To operate:

1. Click and hold the mouse button over the speaker icon. A slider appears as you hold the mouse button. The slider lever position is the preferred volume setting you define in the Movie Control section (see Chapter 2, "The QuickTime File," for more information).
2. While holding the mouse button, move the slider to any other sound volume setting. You can adjust the sound volume whether the movie is playing or stopped. The sound waves radiating from the speaker icon diminish as the sound volume decreases.
3. To mute the sound without moving the slider, hold down the Option key and click on the speaker icon.

If a movie has no sound, the speaker icon appears with dotted lines instead of solid lines.

If you don't want to use the mouse to change the volume setting, press the Up arrow on the keyboard to increase the sound volume incrementally and the Down arrow to decrease the sound volume incrementally.

The movie volume supersedes the system speaker volume you set in the sound cdev.



Play Button

The chevron pointing to the right is the **Play** button. The **Play** button starts and stops the movie. If you click on the **Play** button, the movie starts playing and the **Play** button converts to a **Pause** button. If you click on the **Pause** button, the movie stops playing and the **Standard Movie Controller** converts the **Pause** button to a **Play** button.





You can play a movie without displaying the **Standard Movie Controller**. To play a movie without the controller, double-click on the poster representing the movie. To pause the movie without the standard controller, single-click on the movie.

Press the Spacebar or Return key on the keyboard to start a movie without using the mouse. To pause the movie without using the mouse, press the Spacebar, Return key, or Command-period while the movie is playing.

Some applications enable you to play movies in reverse by pressing Command-Left arrow. A movie playing in reverse plays as a palindrome (a word that reads the same forward and backward, like the words "mom" and "dad").

Other programs enable you to loop a movie by holding down the Shift key and clicking on the **Play** button. To play a movie in palindrome in applications that loop, hold down the Option key and click on the **Play** button.

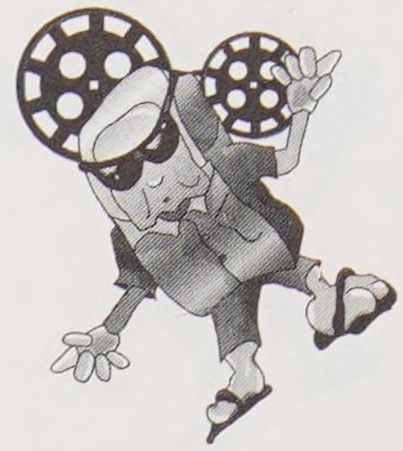
Scroll Box 

The long bar in the middle of the **Standard Movie Controller** is the **Scroll** box. The rectangle sitting on the scroll box is the slider. The slider indicates, relatively, how much of a movie you have seen to that point. The length of the scroll box represents the entire length of the movie.

If you click and hold down the mouse button over the slider, you can drag the slider to the right or left to move forward or backward, respectively, in the movie. Moving the slider with this method maintains the current frame rate; the movie only adjusts when the computer grabs information for playback. You can point and click at any position along the scroll bar and the slider jumps to that relative location within the movie. You can move the slider while the movie is playing or stopped.

Special Play Options

Each QuickTime movie has a preferred frame rate and tries to maintain that rate. If necessary, the movie skips frames to maintain the preferred rate. Some applications enable you to override QuickTime's directive and play every frame by holding down the Option key and clicking on the **Play** button. Other applications force you to adjust the frame rate in a dialog box. If you slow the frame rate, you force QuickTime to play more frames than may be possible to handle at normal speed.



One of QuickTime's really cool hidden playback features is what I call the *speed jogger* (see figure 5.3). The speed jogger enables you to modify the frame rate, and you can start the speed jogger in two ways. If the movie is not playing, you can hold down the **Control** key and click on the **Step Forward** button. This action plays the movie forward at a frame rate other than the standard rate. Generally, your first Control-click on the **Step Forward** button results in a slower-than-normal frame rate, and a second Control-click runs the movie faster than normal. If the movie has sound, the audio plays slowly and voices are deep basses. If the movie is playing faster than normal, the voices sound like Mickey Mouse. The speed jogger may not be available in all **Standard Movie Controller** implementations.





Figure 5.3
Speed jogger control.

To view the jogger control, you must hold down the Control key, and click and hold the mouse on either Step button. The white region in the center of the speed jogger scroll bar indicates no movie motion; the movie pauses. Moving the speed jogger slider to the right moves the movie forward at a frame rate you determine by moving the scroll box slider. You find the normal frame rate at approximately 1/4 the distance from the middle of the speed jogger to either end. If you position the speed jogger slide bar at a point less than the normal frame rate, the movie plays slowly. If you move the speed jogger slide bar more than 1/4 the length from the middle of the speed jogger, the movie plays faster than normal and the voices play at a higher pitch.

Step Back Button

The **Step Back** button icon is a left-pointing chevron with a vertical bar to its right. The **Step Back** button moves the movie back one frame or to the previous key frame if the movie has temporal compression.

- Single-click on the **Step Back** button; the movie goes back one frame.
- Hold the mouse button down on the **Step Back** button; the movie continually moves backward through the movie.
- To jump to the beginning of the movie, hold down the Option key and click on the **Step Back** button.



Use the Left arrow on the keyboard to move back one frame without using the mouse.

Step Forward Button

The **Step Forward** button icon is a right-pointing chevron with a vertical bar to its left. The Step Forward button moves the movie forward one frame or to the next key frame if the movie has temporal compression.

- Click once on the **Step Forward** button; the movie goes forward one frame.
- Hold the mouse button down on the **Step Forward** button; the movie continually moves forward through the movie.
- To jump to the end of the movie, hold down the Option key and click on the **Step Forward** button.



Use the Right arrow on the keyboard to move forward one frame without using the mouse.

Size Handle

The size handle is not part of the **Standard Movie controller**. In Popcorn, you can drag the size handle to increase or decrease the movie's view size, but you get less-than-desirable results in most cases. QuickTime must perform additional matrix transformations on the movie display region to accommodate your new size setting.



To resize the movie and keep the same aspect ratio, hold down the Shift key, click and hold the mouse button over the size handle, and drag.

To change the movie to an optimum viewing size, such as 160 by 120 or 120 by 90 pixels, hold down the Option key, click and hold the mouse button over the size handle, and drag. A rectangle showing the closest optimal viewing rectangle appears. Release the mouse when you see the viewing size you want.





Badges

The badge is a small filmstrip icon in the lower left corner of the movie poster. If you click on the badge, the **Standard Movie controller** appears. However, you can play movies directly, without clicking on the badge. Double-clicking on a non-badge section of the poster starts a movie; single-clicking on a non-badge section pauses the movie.

Figure 5.4 shows the badge on a movie taken from WordPerfect 2.1, the first word processor to support QuickTime. The Popcorn QuickTime player doesn't display badges. Application programs that support QuickTime movie playback as an addition display movie posters and badges.



Figure 5.4
A movie badge in WordPerfect 2.1.

Screen Sizes

Some programs that play back QuickTime movies offer menu bar choices for screen sizes. Half-size, quarter-size, normal or full-size, and full-screen are typical screen size choices. The size is relative to the original movie image size, not to your screen size. Assume the movie size is 320 by 240 pixels—1/4 of the standard 640 by 480 pixels Mac 13-inch monitor. A half-size image is 160 by 120 pixels; a quarter-size image is 80 by 60 pixels. If the original movie size is 160 by 120 pixel, a half-size image is 80 by 60.

Making QuickTime Movies

Now that I've explained QuickTime and how to play movies, I encourage you to view the movies on the enclosed disk. I created the movies so you realize the equipment and time needed. Often, books and articles describe the finished products but not the energy you need to create the products. My initial consideration in making these movies was space. How long should I make my QuickTime movies play, if I also need to put the QuickTime INIT and the Popcorn player on a 1.4M disk? (QuickTime movies take plenty of space by themselves!)

Steve's Cool QuickTime Video Movie

Steve's Cool QuickTime Message movie introduces the book you are reading and describes QuickTime in 22 seconds. I wanted to represent what you can do when capturing video in a movie and show some editing effects.

Cameraman Gary Birch and I shot several takes of my message for the QuickTime Message movie. We used the natural lighting of morning with an overcast sky, and an 8 mm tape in a Hi8 camcorder set on a tripod, with no extra lighting or microphone. In 20 minutes, we shot about two minutes worth of videotape.

I imported the video using both the SuperMac VideoSpigot and Workstation Technologies's MoonRaker. Both input devices gave me similar quality. I imported the video at 160 by 120 pixels and 320 by 240 pixels.

The MoonRaker board has complete sound input support and, using an early video input program, I recorded the audio and video together. The MoonRaker board has complete audio and video input hardware support. (However, the audio software was not functioning with the early version of the software I used.) With trial and error, I received the best recording by taping a Radio Shack lapel microphone to a headphone speaker, plugged into the camcorder's headphone jack. The lapel microphone was then plugged into the Quadra's microphone input port. ReChord, Workstation Technologies' QuickTime video record application, recognized and recorded good fidelity audio with this configuration.

The VideoSpigot doesn't have audio input, so I connected the audio out from the camcorder to the line input on a MacroMedia MacRecorder. The VideoSpigot ScreenPlay software recognizes the MacRecorder sound driver in the System Folder and records audio and video input simultaneously.

Gary and I thought the audio portion of the movie would present a problem because we picked up bird sounds and cars on the recording, which I expected to edit out in the soundtrack. However, I couldn't separate the sound track from the rest of the movie. I used Adobe Premiere to edit the movie. However, Premier basically has few audio editing capabilities and doesn't export or output the audio track in a method that any Mac audio editing tool can edit.

I rerecorded just the audio from the camcorder for use with the automation. I used the MacRecorder and Macromedia's SoundEdit Pro sound editing and recording software. I used SoundEdit Pro to filter extraneous noises, then trimmed the audio to match the video I created. I saved the edited audio track as an AIFF file format. Premiere and QuickTime understand this format.



I still had to edit the imported digital video with Premiere. I used the video digitized at 320 by 240 pixels. I chose two segments to combine. I used Premiere's clip editor to set the inpoints and outpoints for the first clip, then set the first clip into the first video channel. I cut the movie at the outpoint. Premiere adds the cut segment as another clip. I set the inpoints and outpoints for the second segment and dragged the clip into the second video channel.

Premiere has only one effects track. This means you can only apply only one special effect to the same time segment. You can get different effects at different places in the movie, but you cannot apply more than one effect at the same place. I chose to apply a PICT mask to the entire movie, so I output the movie at the highest screen size and frame rate to maximize the source material for the next movie.

I used Adobe PhotoShop to create a giant letter Q, for QuickTime. I filled in the Q's open space so you could see the movie through the letter border. I returned the newly created movie to to Premiere as input for the next Premiere movie project. In this next project, I laid out the entire movie and selected the PICT mask of the letter Q, and then stretched the mask to fit the entire length of the movie.



Because these movies are digital data, you can edit and re-edit without losing quality, if you do not change the compressor you use.

Premiere lets you preview as much of the movie as you want. After finishing the setup, I saved the setup configuration, which is called a *project*. The project file is similar to an edit decision list. It contains no data; it points to locations in the selected movies. The project file size is 4K even though the source files are megabytes in size.

I used the movie created with the VideoSpigot to create the video screen for the QuickTime Entertainment Center. I recaptured the video using the MoonRaker board. (I found that capturing at a larger window size and editing it down to a smaller size did not produce a better QuickTime movie. In fact, it seemed to cause a reduced frame rate in the edited movie. So I captured the movies at 160 by 120 pixels, as fast as I could.) The video source was digitized at 24 frames per second with no compression, thousands of colors, and 22 kHz audio. This was captured to disk—not to RAM. I didn't have enough RAM to capture the complete video segments, as small as they were. These movies were captured on a Mac Quadra with 8 M of RAM. I edited the movie exactly as described with the previous movie.

I repeated the last step in creating the movie, generating the output for the enclosed disk, numerous times. This was the critical step in creating a file size that would fit on the disk. Table 5.1 shows how varying the output parameters resulted in different file sizes. The audio output was held to 11 kHz, and the compressor selected was the video compressor. The color depth is fixed at 16 bits, which is the only choice when using the video compressor.



Table 5.1
Video movie file sizes.

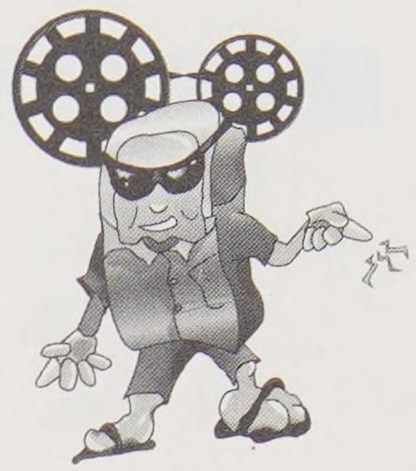
Frame rate (fps)	*Quality Setting*	*Key Frames*	*File size*
15	2	10	1,098
12	2	10	1,044
12	2	12	1,014
12	1	12	836
12	3	15	1,149
10	3	10	1,107
10	2	10	993
10	3	15	1,112

Premiere took from 4 to 6 minutes to create each movie. The final animation is just over 22 seconds long. I chose the 836 K, because, once compressed with the other material to be placed on the 1.4 M disk, this was the only movie that fit! After creating the movies, I compressed all files with Compact Pro.

The QuickTime Entertainment Center

This is the coolest movie. My goal was to give you a video, animation, and audio movie. However, the space consideration quickly ruled out a separate audio movie. So I ensured both movies had audio. This was easy for the video movie but not for the animation one. I was going to create something with Virtus's WalkThrough program. Its Snapshot option supports direct export into QuickTime movie format, with options for image size and color depth. Then, I had a way cool idea. If QuickTime is as empowering as Apple says, I should be able to import and export QuickTime movies. So I searched high and low, inside and out, and found Strata's newest version of StrataVision 3D, version 2.5. This program supports QuickTime movies as easily as PICT images—as inputs and outputs—thus ending my quest and proving Apple's assertion.

I decided to create the totally cool QuickTime Home Entertainment Center. With Jesse Morgan's StrataVision skills and my insightful creative genius, we created the room of tomorrow for you today! The room contains a monitor from Strata's shapes library. We



mapped Steve's Cool QuickTime video movie onto the monitor's screen. I created the remainder of the model as I would any 3D Strata model.

Again, I was facing the laborious part. I had to decide how large the image should be and the frame rate. StrataVision does not allow me to select the compressor. That did not matter anyway, because I had to take the final animation into Premiere to add the sound track. When StrataVision mapped the QuickTime movie, it took only the images, not the sound track. StrataVision always makes 32-bit images, nothing less.

StrataVision lets me select parameters such as anti-aliasing, surface mapping, surface glow, shadows, reflectivity, shading, refraction, transparency, radiosity, and ray tracing that control the quality of the animation. This book does not address 3-D rendering and animation, but it takes time to adjust these parameters to get the desired image. It was typical for me to render one frame. If I liked it, I set up the rendering options, the camera positions, the number of frames, and the image size. Then I waited, usually overnight but sometimes only hours. Fortunately, Apple Computer loaned me a Quadra 700, which rendered more than twice as fast as the IIfx.

After StrataVision created the QuickTime movie with the lighting, image size, and frame rate I wanted, I imported the animation into Premiere. There I added the sound and output several variations to get the file size I needed to fit on the disk (see table 5.2).

Table 5.2

Animation movie file sizes.

Movie Image Size	*Compressor*	*Frame Rate (fps)*	*Size (K)*
160 by 120	Animation	15	1,876
160 by 120	Animation	10	1,586
160 by 120	Video	10	508
120 by 90	Video	10	340

The video compressor created a smaller file than the animation compressor. I selected the 508K file for inclusion in the book. Compressing this animation with Compact Pro produced an additional 16 percent space savings.



Applause, Applause

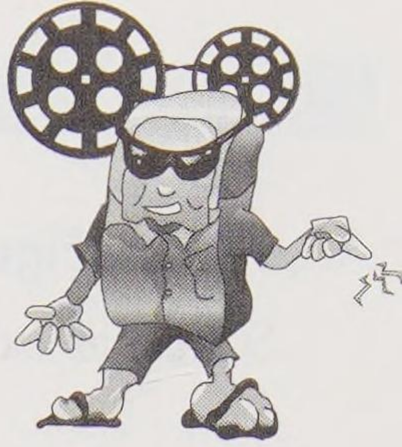
I spent approximately five full days creating the movies. The intermediate and final files occupy 64M of disk space, all for less than one minute of running video. Of course, you can create a quick and dirty movie (I'm not necessarily implying pornography here!) in almost no time. I used my camcorder to shoot my computer room, then edited the footage to fit on one 800K disk, and mailed the disk within 30 minutes.

Now that you know about QuickTime movies, the next chapter discusses how to create them.



CHAPTER





6

Getting Digital

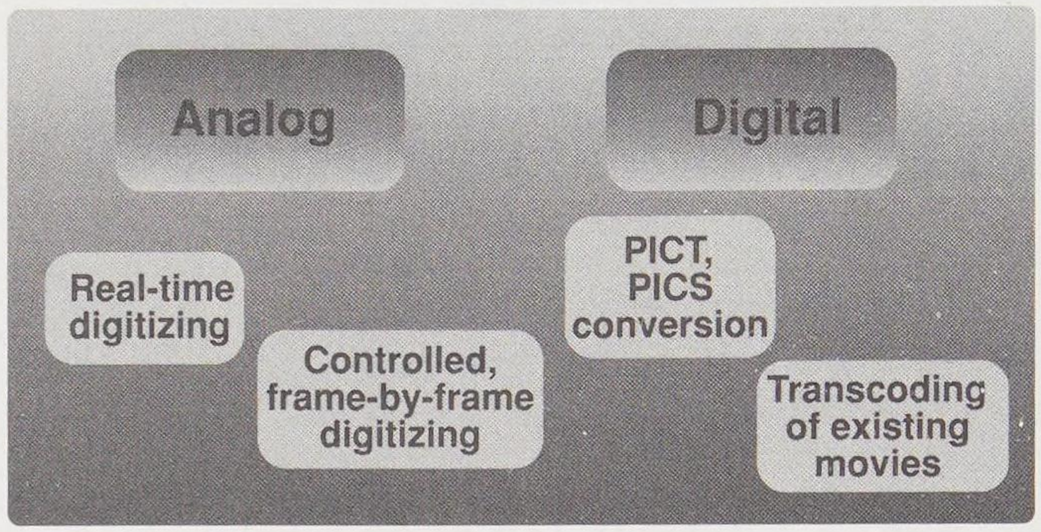
Capturing your digital movies is the most challenging aspect of QuickTime. To capture analog data such as videotape from your camcorder, you need to understand

- The analog source information
- The parameters you control when acquiring the information
- The actual recording process

When capturing digital data, you control the program generating the data and converting data from one digital form into the QuickTime movie format. Figure 6.1 illustrates four key methods you can use to make QuickTime movies.

Figure 6.1

Sources for movie files.



This chapter reviews details and issues in capturing analog and digital video, and the trade-offs in using different capture methods.

Your Target Audience

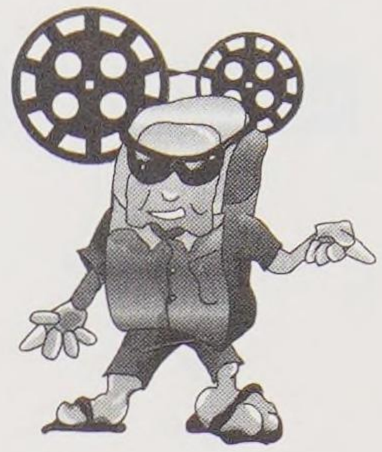
One question you inevitably ask yourself while creating your QuickTime movies is: "Is my movie good enough?" I struggled with this question myself when I created the samples on the enclosed disk. After all, you may show the created movie to a wider audience than you anticipated at first.

Consider these four types of audiences when you create movies:

- Personal: This may be for rough approximations, testing new ideas and approaches, or an archive (such as videotaping your personal assets and keeping the film on disk in case of fire damage).
- One-to-one: This may be a small, shot segment for use in electronic mail or a one-time correspondence.
- One-to-few: This may be for a small presentation.
- One-to-many: This is of the highest quality, because it has many viewers. It may be on a CD-ROM, floppy disk, or distributed over an electronic network. Considerable time and money is spent on its preparation.

Analog Audio/Video Capture

You can use a video capture board to create movies almost effortlessly and produce acceptable results. However, if you want more control in creating your QuickTime movies, analog video capture is the most exacting movie capturing process. Figure 6.2



shows an overview of the steps you take, either by default or choice, to produce a QuickTime movie from an analog video source.

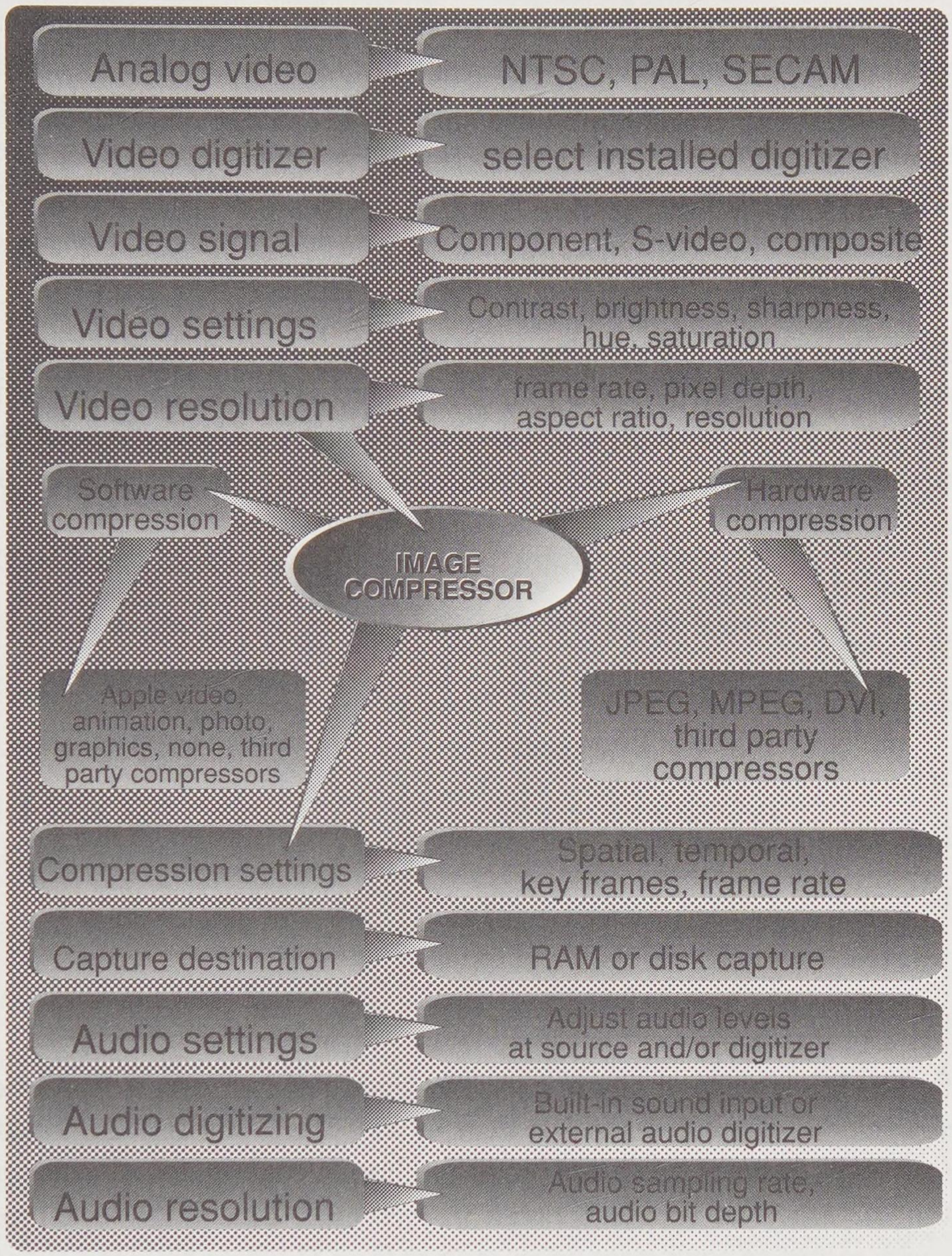


Figure 6.2
Analog video capture options.

Analog Video Considerations

Most personal computer users are familiar with TV and computer monitors. But believe me, TV and computer video are quite different, even though they look interchangeable. The source of information in an analog computer monitor starts in the digital domain and is converted to analog signals to control the electron guns, colors, and intensity of display.

Analog signals vary continuously with time. The classic sine wave is an example of an analog signal. We call watches with hands analog timepieces because the hands rotate smoothly (if you have a good one) with time. *Digital* signals contain discrete values that are constant for some amount of time and are absolutely reproducible. Digital watches have numbers that stay constant until the next minute or second. Money is digital because we have assigned it discrete values, such as 5-, 10-, and 25-cent pieces. You don't buy an item in a store for "between $5 and $8;" that's simply what you tell your spouse when you are trying to hide the item's cost!

Video Formats

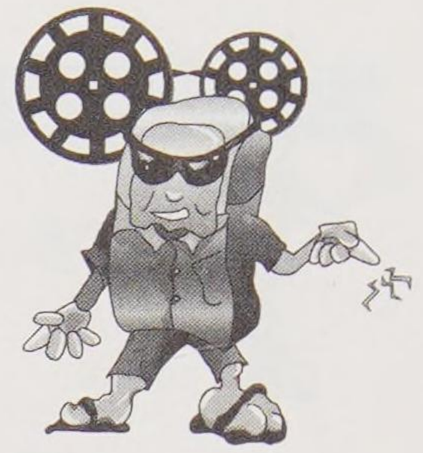
Video technology started in the analog world and largely remains there today. You can use a variety of analog video formats with differing picture quality and resolutions. For example: VHS offers approximately 200 lines of resolution; and Hi8 offers 400 lines of resolution. The following lists common video formats from lowest to highest picture quality:

- Extended play VHS
- VHS, 8mm
- S-VHS, Hi8
- 3/4-inch
- D-2
- Beta cam
- 1-inch
- D-1

Video formats below VHS and Hi8 are consumer-grade quality; the recording devices for consumer-grade quality tapes cost less than $1,000. The S-VHS and Hi8 formats are "prosumer"—professional consumer products whose recording devices cost between $1,000 and $2,500. Video formats between 3/4-inch and D-1 are professional broadcast quality, with recording equipment prices ranging from $3,000 to $100,000.

Video Standards

These tape formats exist in NTSC video signals—the video signal standard of the US and Japan—and in similar variations throughout the world. PAL and SECAM are the two other world video standards. There are a number of differences between these three mainstream standards: the number of lines of resolution and the viewing image's dimensions,



to name two. The following list details the major broadcast standards (and variations) used throughout the world:

NTSC-M (United States, Canada, Japan)

Line/Field: 525/60

Horizontal scans: 15.734 kHz

Vertical scans: 59.94 Hz

Sub carrier: 3.579545 MHz

Band width: 4.2 MHz

Sound: 4.5 MHz (FM)

PAL-I (United Kingdom)

Line/Field: 625/50

Horizontal scans: 15.625 Hz

Vertical scans: 50 Hz

Sub carrier: 4.433618 MHz

Band width: 5.5 MHz

Sound: 6 MHz (FM)

PAL-B, G, H (Continental Europe)

Line/Field: 625/50

Horizontal scans: 15.625 kHz

Vertical scans: 50 Hz

Sub carrier: 4.433618 MHz

Band width: 5 MHz

Sound: 5.5 MHz (FM)

PAL-M (Brazil)

Line/Field: 525/60

Horizontal scans: 15.75 kHz

Vertical scans: 60 Hz

Sub carrier: 3.575611 MHz

Band width: 4.2 MHz

Sound: 4.5 MHz (FM)

PAL-N (Argentina)

Line/Field: 625/50

Horizontal scans: 15.625 kHz

Vertical scans: 50 Hz

Sub carrier: 3.58 MHz

Band width: 4.2 MHz

Sound: 4.5 MHz (FM)

SECAM-L (France, USSR)

Line/Field: 625/50

Horizontal scans: 15.625 kHz

Vertical scans: 50 Hz

Sub carrier D_R: 4.40625 MHz /282 horizontal

Sub carrier D_B: 4.25 MHz /272 horizontal

Band width: 6 MHz

Sound: 6.5 MHz (AM)

Preferred Video Format

I recommend Hi8 and S-VHS video formats to create digital data source material. Hi8 and S-VHS produce the best results for the price of the video source. You generally find these two formats in widely available camcorders and videotape players.





Each time you copy an analog tape onto another tape, the quality degrades up to 30 percent per copy. This process results in *generation loss*.

Composite Vs. Component Video

Video signals carry two types of information: color and color magnitude.

The best quality representation of video, called *component audio*, transmits the video signal as three separate channels of information. Component video is transmitted as RGB: it contains individual red, green, and blue channels. The Apple 13-inch monitor is an RGB monitor. It takes video as components from the video connector. If you look at the cable that plugs into your color monitor, you see more than one pin (generally 15 pins). These pins contain reference signals and component RGB signals from the video circuitry in the Mac.

The video industry abbreviates another type of component video signal—the *color difference signal*—Y/U/V. Y equals luminance or grayscale, defined as the sum of red, green, and blue. U is red minus Y, and V is blue minus Y. (Hey, I don't assign these codes!) Video experts say Y/U/V is the ideal way to store video information.

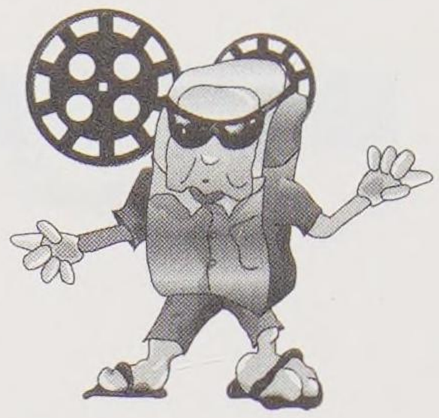
Because the eye is more sensitive to brightness than color, video signals contain more brightness information than color information. The Y/U/V representation captures a full screen of brightness information but needs only about a one-quarter screen of color information. Overall, representing video in Y/U/V means smaller data storage with greater video fidelity. However, because monitors are RGB video devices, the Y/U/V must ultimately be converted to RGB. SuperMac's VideoSpigot ScreenPlay video capture program converts a composite video source signal into digital Y/U/V. Radius' new video capture product, Lexington, also converts and manipulates video in Y/U/V.



The PhotoShop program contains a control panel device, Gamma, that enables you to correct for your RGB monitor's brightness.

S-video is one step down in fidelity from RGB and Y/U/V. S-video has only two channels of information: color (chrominance) and brightness (luminance). The next drop in fidelity brings us to the most common video format: *composite*. All signals, both color and intensity (brightness), intermix into one channel. You receive a composite signal over the airwaves and through the antenna or cable TV system. Only one wire carries this information (there is also a ground that carries no information). As a consequence, you get compaction and compression when combining the discrete red, green, and blue information into the one channel. Therefore, the composite signal's picture quality is less than S-video or component video.





You should use the highest quality signal you can get from your source. Component video minimizes the generation loss during image transfer. Some camcorders, especially Hi8 units, have both S-video and composite outputs. If your video capture card supports S-video, use it!



Don't let the S-video designation trick you into thinking you must have an S-VHS camcorder or player to get S-video output. Hi8 cameras support S-video signal format.

An S-video cable is the same cable that connects your keyboard and mouse to the Mac. If you need a keyboard extension cable, purchase an S-video cable from your local video parts store. This strategy is cheaper than purchasing a keyboard extension cable from your computer dealer.

The Mac keyboard and mouse connect to the computer over the Apple Desktop Bus (ADB). Signals carry across the ADB for at least 25 feet, so you can place your keyboard and mouse away from the computer into which the keyboard connects.

Video Digitization Considerations

Now that you understand what you are putting into the computer, let's focus on the conversion process. Three different items control the quality and size of the video capture:

- The physical connection the video capture hardware offers
- The video capture hardware's features and capabilities
- The video digitizer software component's features and capabilities

Here's how the capture and conversion process works:

Video digitizer components (the Component Manager type, not the video signal type) convert analog video input into a digitized color image. The digitized color image is split into component forms, even if the source is a composite signal, and the image usually contains eight bits per component. Next, QuickTime prepares the digitized video image for display by resizing, clipping, and possibly dithering and applying pixel depth conversions. QuickTime places the resulting image into the current frame buffer before the image appears on your computer screen.

Video Digitizer Hardware

Only a handful of QuickTime compatible video digitizers exist today. Some are designed specifically for QuickTime, others are adapted from existing video capture products, and

still other digitizers offer add-on boards to their existing video products. Each digitizer has a different feature set. The digitizer you choose depends on its intended use and the cost constraints.

Some digitizers receive only composite video signals, while others can receive composite, S-video and component RGB or Y/U/V signals. The SuperMac VideoSpigot has one composite video input. The RasterOps 24STV has one composite and one S-Video input. The Workstation Technologies MoonRaker contains two RGB components, one S-video, and one composite input.

Picture Quality

The method the digitizer uses to resize the video image, whether in hardware or software, greatly affects the picture quality. The video image is created from two fields. The field lines occupy every other line of the frame. Field 1 contributes lines 1,3, and 5; field 2 contributes lines 2,4, and 6. Video capture devices currently capture only one field per frame. A better picture would result if a device captured and averaged the two fields comprising a video frame, either in software or hardware.

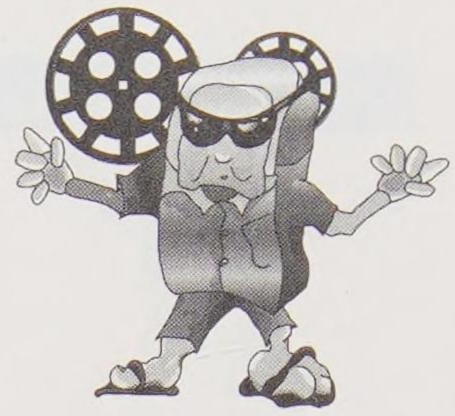
In addition to video capture devices only capturing one field of video per frame, your resolution may also suffer. If you see jagged lines instead of straight lines, you are witnessing *aliasing*. This is a result of a reduced image resolution. The best technique for minimizing resolution loss is *filtered-down sampling*. Averaging together neighboring pixels to determine the best reduced image pixel is filtered-down sampling.

Speed of Capture

Individual digitizers acquire digital video at different speeds. Some digitizers are complete parallel-processing units that capture and convert one frame in less than 1/30 of a second. Parallel processing is the fastest and therefore best method. Slower digitizers capture one frame of data and the computer must convert the image. QuickTime itself can be an obstacle in video-capture performance. Because QuickTime moves the captured digital video data at the speed of your computer, you may be limiting image size, color depth, and/or frame rate,

The MoonRaker board digitizes at 1/30 of a second no matter which processor and the image size you use. Therefore, the MoonRaker generates images at the same frame rate on a IIci or Quadra. The MoonRaker costs $1,500.

Efficient software makes the VideoSpigot work quickly. The VideoSpigot lets you choose three image capture sizes: 320 by 240 pixels, 240 by 180 pixels, and 160 by 120 pixels. The



VideoSpigot digitizes analog video into Y/U/V digital components and compresses the data to disk at 3:1. The VideoSpigot is sensitive to the processor's power. You can capture up to 26 frames per second, without audio, in a 160 by 120 window using a Mac IIci. You can capture 30 frames per second for this window size on a Quadra. If you want to capture 320 by 240 on a IIsi, you get poor frame rates.

QuickTime itself is a bottleneck to real-time frame rate capture. QuickTime stores captured frame data in two memory buffers and tells a digitizer which buffer to place a new frame of image data into. QuickTime then copies that frame of data to another memory block, and tells the digitizer to put a new frame into the second buffer.

Fast digitizers with independent processors that share access to memory can place image data into the buffers faster than QuickTime can move the data out. This speed situation can have negative effects. For example: When you use the MoonRaker, you achieve a frame rate that is less than the board's potential because QuickTime cannot move blocks fast enough. If QuickTime enabled the MoonRaker's coprocessor to move data directly to its final destination, you would benefit from the board's maximum performance capabilities.

If the video digitizer cannot digitize at 15 frames per second or better, another method—*controlled capture*—digitizes one frame at a time. Professional videographers use controlled capture. You must be able to control the video source also, and frame-controllable decks are the most expensive. If you want to capture from consumer-oriented equipment, you need a fast digitizer to achieve acceptable frame rates.



As QuickTime records, you see video in the digitizing window at a reduced frame rate. This is dependent on the digitizing hardware and software and the way QuickTime grabs each frame. If the digitizing system is fast enough, you can theoretically grab, compress, decompress, and display each frame at the selected frame capture rate. No digitizer currently does this.

Recommended Bit Depth

Most video digitizers support 24 bits per pixel: three video channels with eight bits per channel. However, 16 bits per pixel is the optimal pixel bit depth to represent video images on the computer. Sixteen bits best represent video images because of video signals' limitations. Our eyes are more sensitive to small brightness variations than color variations.

The relationship between a good video signal and interference—known as the *signal-to-noise ratio*—ranges from 20 to 35 dB. A ratio of 100 to 1 measures at 40 dB. This means the smallest discernible amount of information is less than 100 times the most discernible. You can see a plane flying over a house when you are outside, but the plane may



be too small to see in a movie. A higher signal-to-noise ratio indicates a better separation between what you want and what you don't. VHS recordings have a signal-to-noise ratio from 10 to 16 dB.

The 5-bits-per-channel, a ratio of 32 to 1, best represents the signal-to-noise ratio of video. The computer best represents 5 bits per channel as a 16-bit pixel, with the extra bit unused. Computers work in multiples of eight, 16, or 32. Macs easily grab data in 16-bit chunks. However, the next size is 32-bit, not 24-bit. To get 24-bit video, your computer has to grab twice as much information (32 bits) in the same amount of time it takes to grab 16 bits.

Frame Rate

NTSC video's frame rate is 30 frames per second (fps). PAL's frame rate is 25 fps. Most QuickTime-aware applications, whether they're capture and editing tools or support only playback like WordPerfect 2.1, enable you to determine a movie's frame rate. Ten, 12, and 15 fps are recommended playback rates. At these rates, you get an acceptable moving picture rate for the amount of data furiously pumping through your computer. Some QuickTime movies come from a CD—a slow medium—while others come from fast hard drives on Mac Quadras. The movie description (defined in Chapter 2, "The QuickTime File") contains a preferred frame rate; QuickTime strives to achieve your selected rate given the resources of your computer system.



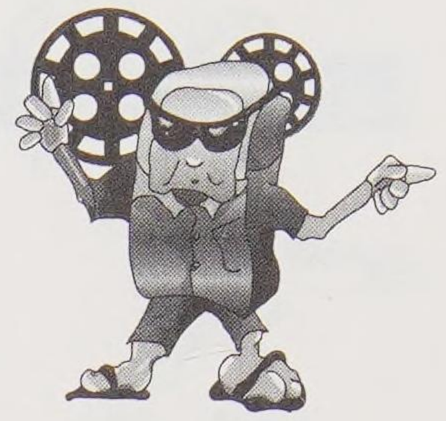
NTSC actually runs at 29.97 fps. Video equipment adjusts after 1,000 frames, similar to our adding February 29 every four years to adjust for timing variations in the solar cycle.

Aspect Ratios and Clipping

Different video sources have varying *aspect ratios*—a relationship between an image's width and height. The preferred QuickTime movie aspect ratio is 4:3. The Macintosh 13-inch color monitor is 640 pixels wide by 480 high: a 4:3 aspect ratio. Typical QuickTime movies are 320 by 240 pixels, 160 by 120 pixels, and 80 by 60 pixels (like the movies on the enclosed disk). These aspect ratios are all 4:3.

The digitizer settings may enable you to crop or resize an image to this ratio. Cropping preserves the image without stretching or shrinking but truncates an image's dimensions. Changing an image without cropping creates stretching or shrinking.





Viewing Size

Applications can control the size and location of the source video in several types of rectangles. The digitizer then converts the video signal from that rectangle (see figure 6.3). Video digitizers define four areas:

- Maximum source rectangle
- Active source rectangle
- Vertical blanking rectangle
- Digitizer rectangle

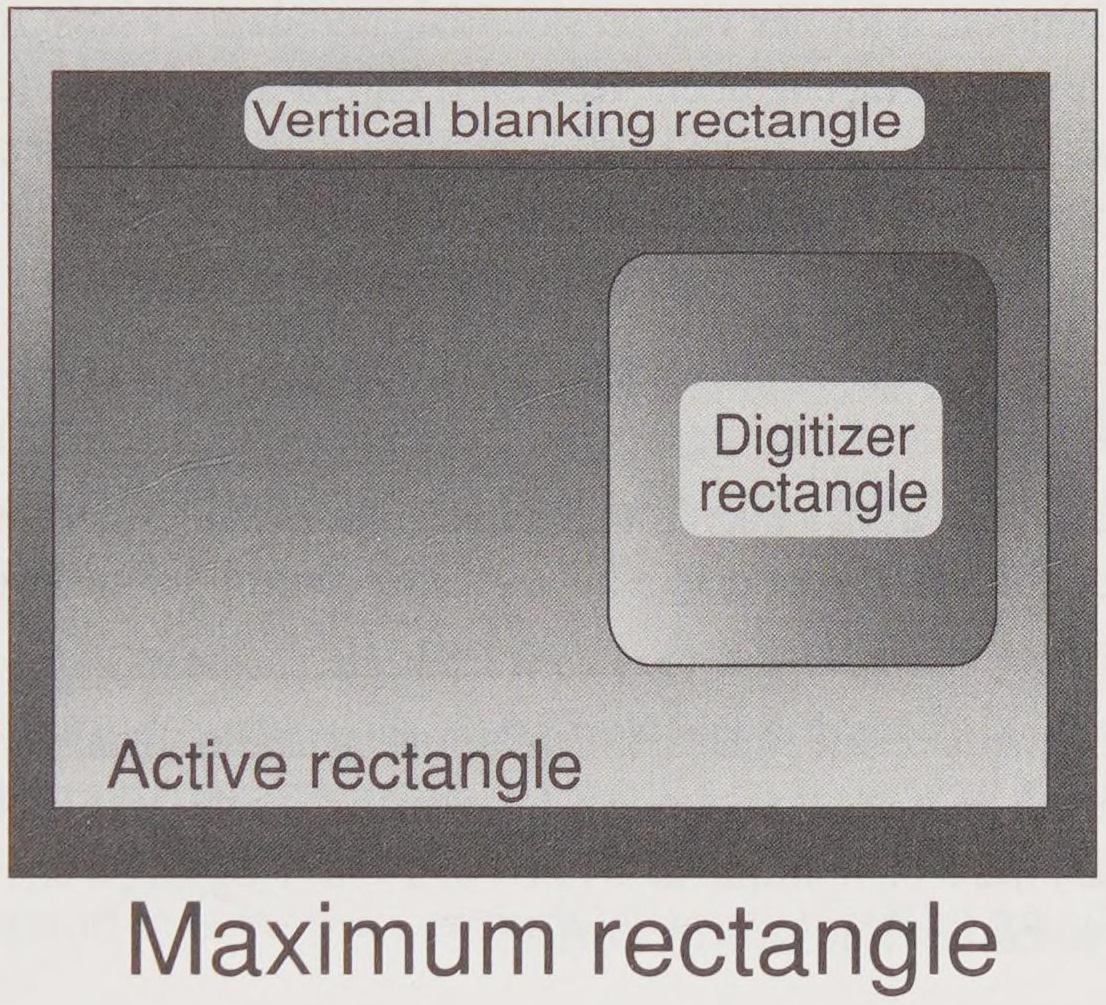
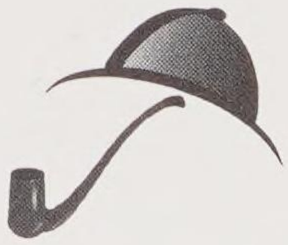


Figure 6.3
Video digitizer rectangles.

The maximum rectangle defines the maximum source area the digitizer component grabs. The active source rectangle defines which section of the maximum rectangle contains active video. The vertical blanking rectangle defines the section of the input video signal devoted to *vertical blanking*—the time period when the electron gun turns off and moves from the lower right corner of the display to the upper left corner. Vertical blanking occurs approximately 60 times per second for a non-interlaced monitor.

Broadcast video sources may use the vertical blanking portion of the input signal for closed captioning, teletext, and other non-video information. Radius TV is a product that uses closed-captioned information.



The video digitizer determines the allowable image sizes. You may select an image size in the program you use to capture video. The image size options may be one-half,



one-quarter, or full-screen. This concept can be confusing: you may think the image size refers to half the screen you are working on. Imagine capturing video on a 21-inch monitor. One digitizer may capture images at 640 by 480 pixels and reference this as full-screen. Another digitizer may capture a 160 by 120 pixel size image on the same monitor and reference this size as full-screen.

Audio Considerations

It's not always easy to digitize audio from a video analog source. This is why studios and TV stations hire professional audio engineers in addition to videographers. Paraphrasing Senator Lloyd Bentsen, a former vice-presidential candidate: "I have met a recording engineer; I am no recording engineer." However, I know a few techniques you can use to get good sound quality into your QuickTime movies. You may adjust the audio levels in one or two places, depending on the audio equipment.

Audio Source

The audio signal comes from a microphone, mixer, audio tape, videocassette machine, camcorder, laser disk, etc. If your device has a volume control, set the level so it does not distort.



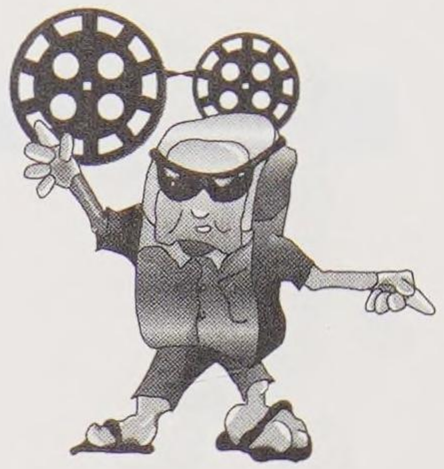
Most audio out signals are line signals, which means the audio signal's amplitude is one volt. The Macintosh built-in microphone port (available on the Mac II, the LC, Mac IIsi, and the Quadras) has an amplitude of 1/1,000 of a volt. Plugging a line signal into the microphone port causes distortion or worse!

Audio Digitizer Levels

Some video digitizing products have audio digitizing built in or offer audio digitizing as an add-on. For example, the MoonRaker digitizer has an add-on board, BoomBox, that digitizes 8-bit stereo sound from a line input source in real time at better than 22 kHz. This is in addition to, and works simultaneously with, the MoonRaker's video digitizing capability. The software the MoonRaker supplies enables you to manually adjust the volume, balance, bass, treble, and other aspects of the incoming audio. QuickTime doesn't support bass and treble control, and limits audio frequencies to 11 and 22 kHz.

The VideoSpigot doesn't have built-in audio capability. If an audio component exists, ScreenPlay recognizes it and records through the audio source while the VideoSpigot





records the video. MacroMedia's MacRecorder works with the VideoSpigot to incorporate audio in a movie. You can use the built-in Mac microphone, too. When using any audio digitizing product, you should adjust the digitizer's audio level so the resulting digital audio isn't noisy or distorted.

RasterOps' standard video and video digitizing boards don't support video. The add-on boards support many types of audio recording.

You can adjust your Mac's sound cdev to your comfort level, but don't assume the loudness coming from the Mac speaker is the recording volume. The volume setting in the sound cdev has nothing to do with the audio signal's recording level.



Audio Sampling Rate

The built-in Macintosh audio sampling rates are 8 kHz (best used with voice only), 11 kHz, and 22 kHz for music. As the sampling rate decreases (22 kHz to 8 kHz), the sound quality diminishes, but the savings in storage space increases.

The best way to get 11 or 22 kHz sound is to sample with as high a frequency as possible, even as high as CD-quality. Then use a software program that can perform filtered-down sampling (discussed earlier with respect to video digitization) from these higher sampling rates to the rate you want.



As we discussed in Chapter 2, the Mac uses only 8-bit sound. QuickTime currently supports only 8-bit audio; eventually, QuickTime will support 16-bit audio, too. Then, you'll need to use a third-party sound board (such as RasterOps' MediaTime add-on adapter) with a QuickTime component. Sixteen-bit audio will increase movie sizes because 16-bit sound contains twice as much information as 8-bit sound.

Hard Disk Tips

If you capture video to the hard disk, your hard disk's performance determines the movie's frame rate and quality. Two drive characteristics are important: the write speed and the seek time. Hard disks write data at speeds ranging from 100K per second to 4M per second. There are a few utilities that tell you your drive's write speed, but the easiest way to find out is to ask the drive's manufacturer. I recommend a write speed greater than 300K per second, but the faster the better. Remember: The faster information can get onto the drive, the higher the frame rate.

Seek time is the time the drive needs to find the information you request. Disk drive seek times range from 65 milliseconds to 9 milliseconds. Use a minimum seek time of 25



milliseconds. If you intend to purchase a disk drive, you'll discover that the larger the drive's storage capacity, the faster the seek time and write speed. Manufacturers design larger drives for performance.

Before importing QuickTime movies, defragment your drive to consolidate files on the disk. Defragmenting enables the computer to write your movie data in one continuous piece instead of spending precious time copying pieces of the movie to available spaces throughout the disk. Several applications can defragment a disk.

RAM Versus Disk Capture

You can achieve a digitizer's maximum frame rate by capturing to RAM. Capture programs such as DiVA's VideoShop enable you to choose your capture destination: RAM or disk. If you can capture movies to RAM, close other applications and minimize the disk cache size in your memory cdev. The amount of video you can capture to RAM depends on the amount of RAM in your machine and the size of the video you are capturing.

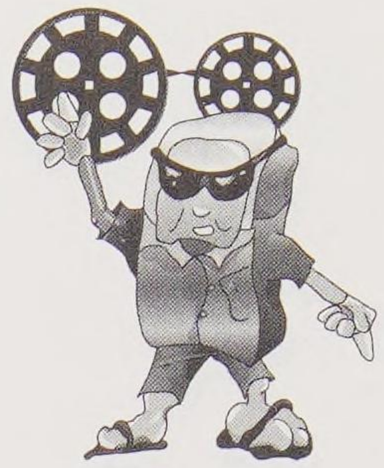
Transcoding and File Format Conversions

What big words! When you make a slide in PowerPoint, More, or Persuasion; an animation in Director or PICS images in Electric Image, StrataVision, Three-D, or Infini-D; and a product picture in Sketch! or Ray Dream Designer, you're creating one form of digital imagery. QuickTime movies contain a different form of digital imagery. How do you convert your slides, PICS, PICTs, etc., into a QuickTime movie? You *transcode* from one format to another by cropping, resizing, dithering, and/or compressing your digital source data into a QuickTime movie.

The PICT format is the standard format for Mac-based still images. The PICS format is the Mac standard for moving images. PICS files are movies without time synchronization information or sound. When you use computer-created image files for QuickTime movies, you don't need to perform many of the digitizing steps. The only conversions you may make are in image cropping and resizing, pixel depth conversion, dithering, and compression.

Some of your favorite applications soon will transcode for you. You also may find utilities such as Apple's ConvertToMovie program that will take a file format and convert it to a movie. Smoothie (see Chapter 9, "Expressions of a New Paradigm") also converts from one file type to another.





Pre-Made Movies

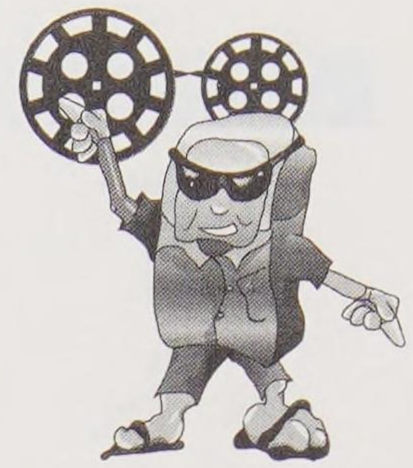
If this chapter overwhelms you, try another avenue. Instead of purchasing video digitizers and experimenting for hours to create QuickTime movies, purchase some of the hundreds of gigabytes of pre-made QuickTime materials that are appearing on the market. Programmers are creating QuickTime materials ranging from the Wayzata *SpaceTime and Art* computer models of the universe's creation to disks and CDs with readings of classic books. Most of the material being developed is royalty-free, so you don't need to pay someone if you use them.



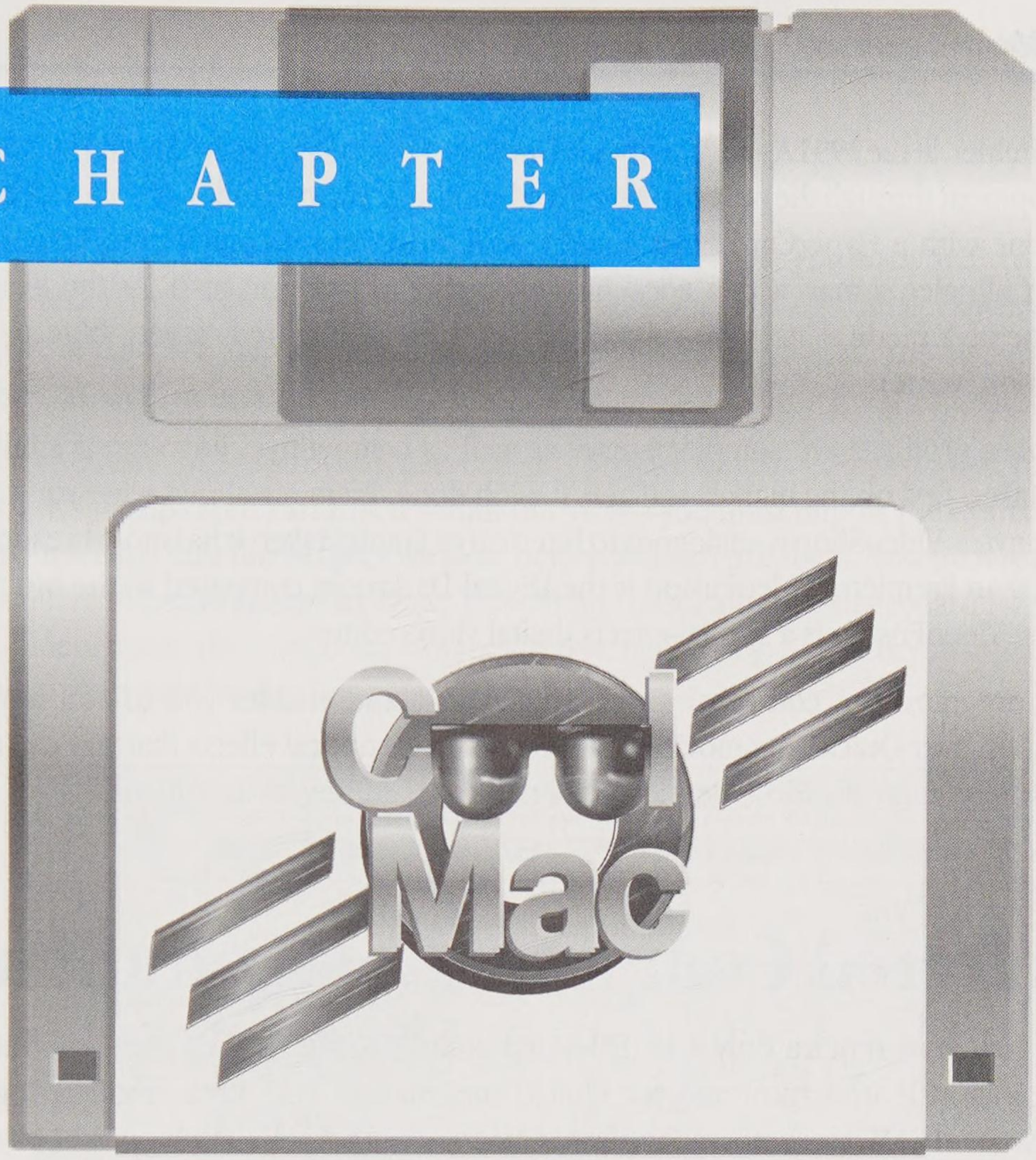
Buy carefully! Some media is for non-commercial use only. If you use it for business, you must pay someone. Media rights is one of the most controversial issues in the emerging QuickTime market.

Buying pre-made movies has two drawbacks. First, you miss the fun of creating your own movies. If you have a personal camcorder, you'll delight in videotaping that special moment, digitally capturing it, and mailing it to another Mac user somewhere in our global village. The second drawback is the limited rights you may encounter when you purchase pre-made movies. If time-based computer media is to grow without bitterness that currently exists in the audio recording industry, you must honor the laws of the media you use. By creating your own media, you aren't breaking ownership laws.





CHAPTER



7

Sorting the Details

You've created movie clips. Perhaps you've digitized video, recorded an audio track, or generated a movie file from Mac programs. Next, you want to trim the movies, possibly add special effects, or combine movies. Currently, only three QuickTime editors exist. At the least, you can open, cut, paste, manipulate, and output movies with these editors, and the editors include direct support for movie acquisition and output to video.

Adobe Premiere, DiVA VideoShop, and VideoLake VideoFusion are three QuickTime editing applications. I was exposed to the programs in this order, and was amazed at the power and innovation of the tools. In Chapter 1, "About this Cool Book," I told you I was first excited about QuickTime when I saw a ReelTime (Premiere's development name) demonstration. I also lunched with DiVA's Iván Cavero Belaúnde, a soft-spoken

programmer, at the 1991 Apple Worldwide Developer's Conference. I watched VideoShop's development through the next two MacWorld shows and marvel today at what VideoShop has done with a HyperCard environment. And VideoFusion comes from VideoLake's Joseph Klingler, a man with a good image (or should I say images?). As the technical director of a medical imaging center, he has triple vision (red, green, blue or hue, saturation, value).

The three products are complementary as well as competitive. Premiere is similar to PageMaker: first on the market and gets the job done. Premiere shows what you can do with movies. VideoShop is analogous to Interleaf or FrameMaker: it has more breadth and depth than Premiere. VideoFusion is the Digital Darkroom compared to the other two editors: VideoFusion is a special-effects digital video editor.



Other programs can edit movies too. Animation Stand enables you to add layers of animation over QuickTime movies and has numerous optical effects that you can apply to QuickTime movies. However, it's not a dedicated editing environment.

Preferred Computer Configurations

QuickTime may require only a 68020-based color Mac with 4M of memory, but that configuration is underpowered for QuickTime editing. The three editing programs suggest 8M of RAM. I recommend the fastest Mac you can get your hands on, a 24-bit video card, at least 8M of RAM for the partition size of the editing application, and *plenty* of fast hard disk space. If you set the application partition size too small, the program may warn you it cannot complete creating your movie or processing the effect you want. In some cases, the program completes creating the movie, but the finished product isn't what you requested!

Editing Basics

Movies consist of video frames and sound clips. First, open any video/audio clips you have into a sequencer and order them. Then, cut, clip, or trim the clips until you get just the frames you want for your movie. You can add digital filters and effects to enhance the frames' images. You also can add transitions— a fade from one video clip to another, for instance. After previewing your movie, define the final movie's size, compressor, frame rate, etc. Lastly, create the movie. You may print frames to paper or image out the entire movie to video, too.





Storyboards

A *storyboard* is a window where you arrange clips in the order you want them to appear for the final movie. You use the storyboard to develop the movie's concept and overview quickly, and to see the relationship between movies. Storyboards can include PICT images, movies, and sound tracks.

Premiere doesn't offer a storyboard. Premiere's **Project** window contains a list of all used clips, but the clips aren't arranged within this view—you must import the source movie and sound clips into the **Project** window before you can use them. You then sequence in Premiere's **Construction** window. VideoShop has an intuitive storyboard (see figure 7.1). VideoFusion also contains a storyboard (see figure 7.2). Both storyboards support multiple video and audio clips you can combine.

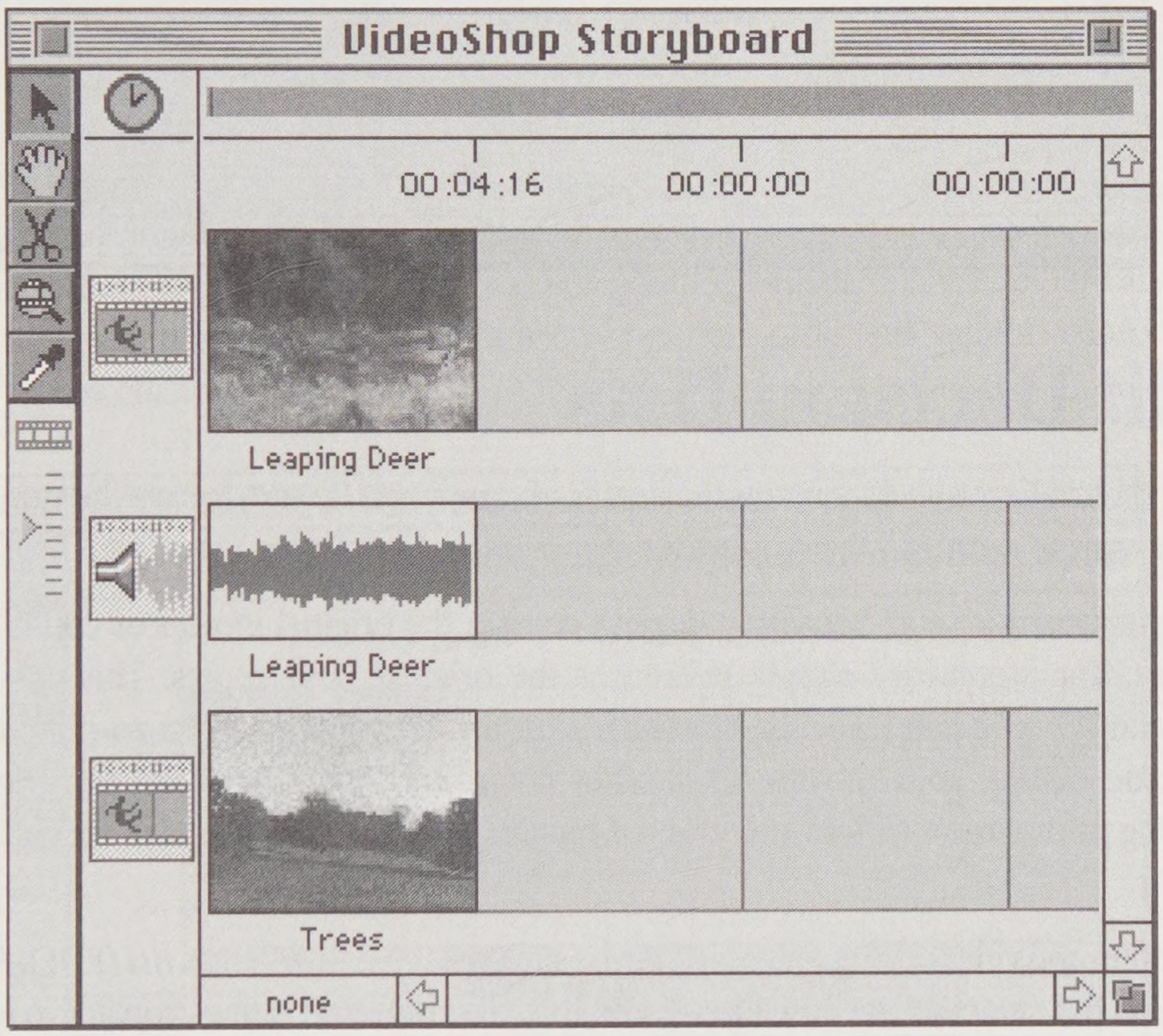


Figure 7.1
VideoShop's **Storyboard** window.

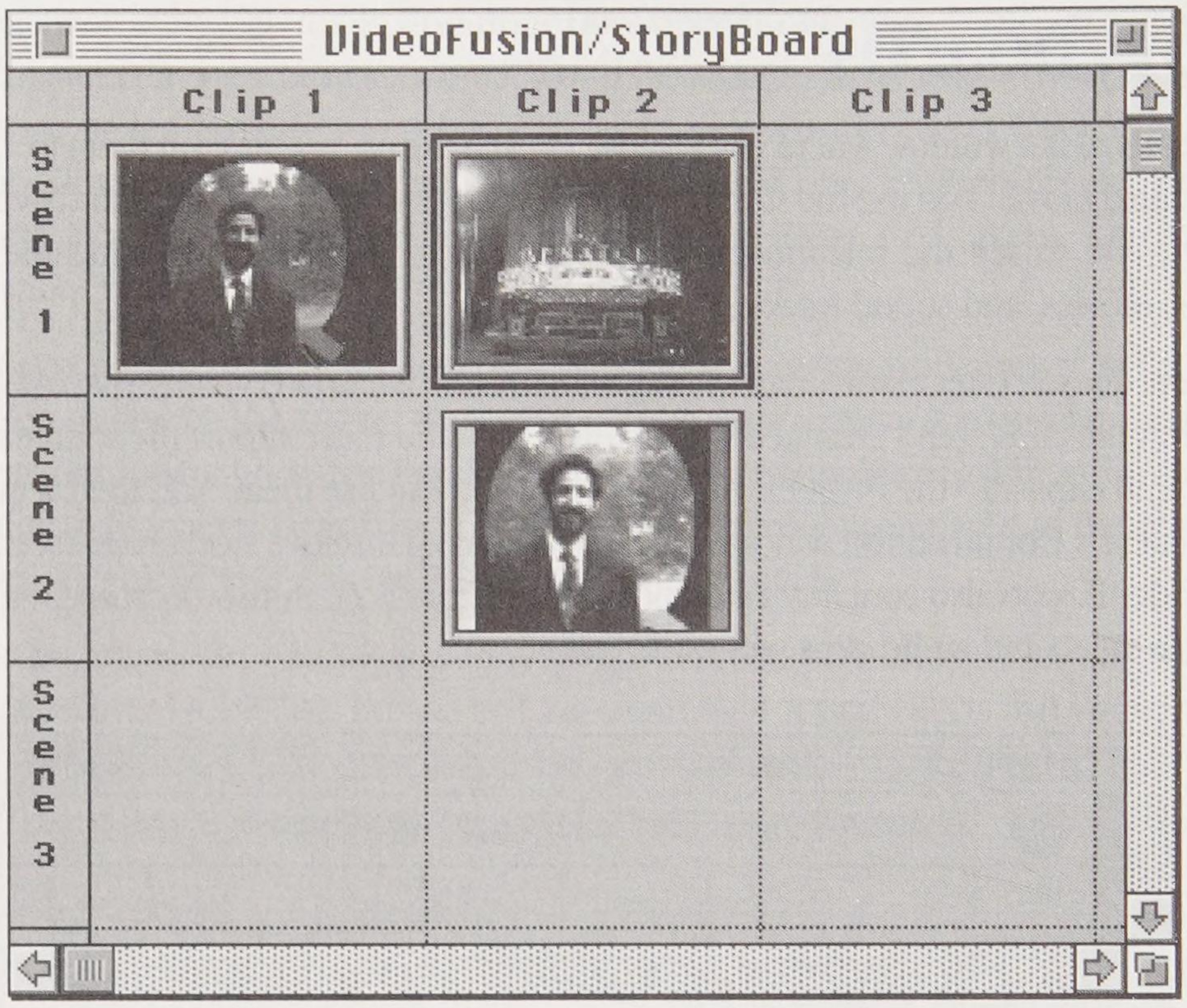


Figure 7.2
VideoFusion's **Storyboard** window.

Edit Decision Lists

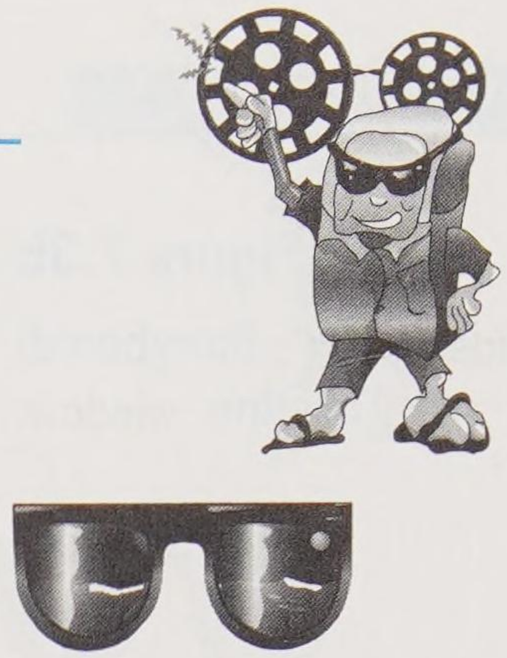
A storyboard (or project) contains the details of your work. Be sure to save the storyboard if you want to return to the current set of movies and movie organization.

The storyboard is small because it doesn't contain the original movies or copies of the movies. The storyboard simply references the originals and copies. This concept is important. You cannot put the storyboard on a diskette and expect to play back or continue editing your movies on another computer. The storyboard only contains locating information to find the original movies in the order you want the scenes to appear.

In the film and video world, the storyboard is similar to an edit *decision list* (EDL). An EDL contains the names of the film footage and the exact time and frames you are to include and exclude in the final film. The original film is a reference.

You can create an EDL using copies of an original tape. You don't need the latest and greatest equipment and effects generators to create an EDL; again, you're creating only a reference to the original tape or film. Once the EDL is complete, the EDL and the master tapes are assembled into its final form.

You create EDLs in an editing bay (costs of renting an editing bay range from $85 to $250 per hour; and it can take days to produce only minutes of video in an edit bay). One final,



"small" detail: You pay for every filter, transition, and effect you want in an edit bay. The effects are *free* with the three QuickTime editors!

Digital video editors create storyboards, timelines, and projects the equivalent of a visual EDL. Saving the movie file saves the EDL. You must select the command to make a movie to create the finished item.

Timeline View

You edit movies in the timeline view, which gives you a precise display of a movie. You can perform frame-accurate editing in the timeline view. The timeline view also enables you to trim clips, lengthen or shorten clips, filter video segments, add transitions and layer movies.

Figure 7.3 shows the editors' **Timeline/Construction** windows. (Premiere's timeline is called the **Construction** window.) VideoFusion and VideoShop enable you to work with multiple video and audio clips in the **Storyboard/Timeline** windows. Premiere supports two video channels, an effects channel, a superimposing channel, and three audio channels. (Superimposing—matting and compositing—displays one clip onto another, such as playing the credits over the movie.) The other programs support compositing between any channels.

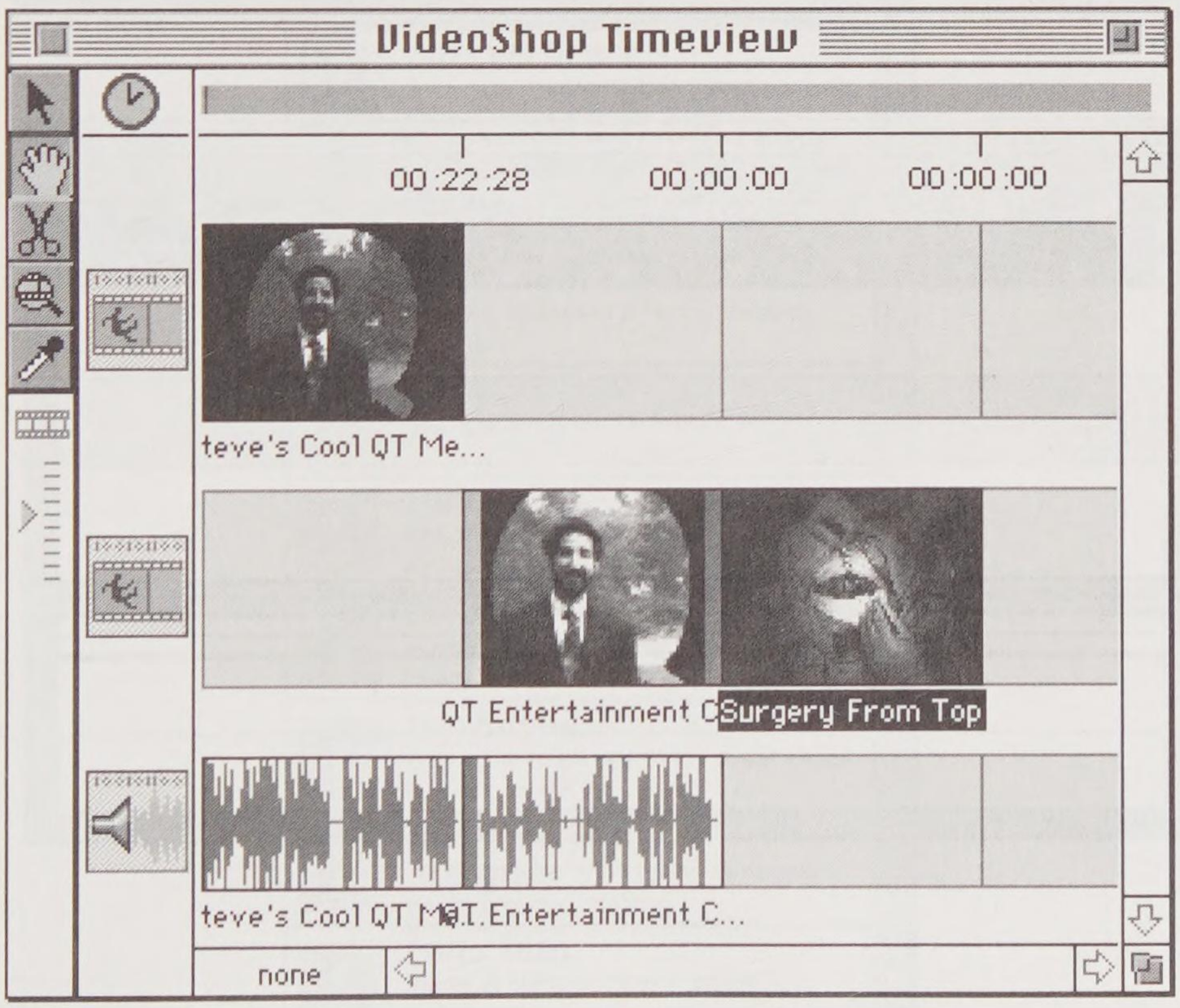


Figure 7.3a
VideoShop's **Storyboard/Timeline** window.

Figure 7.3b

VideoFusion's **Storyboard/ Timeline** window.

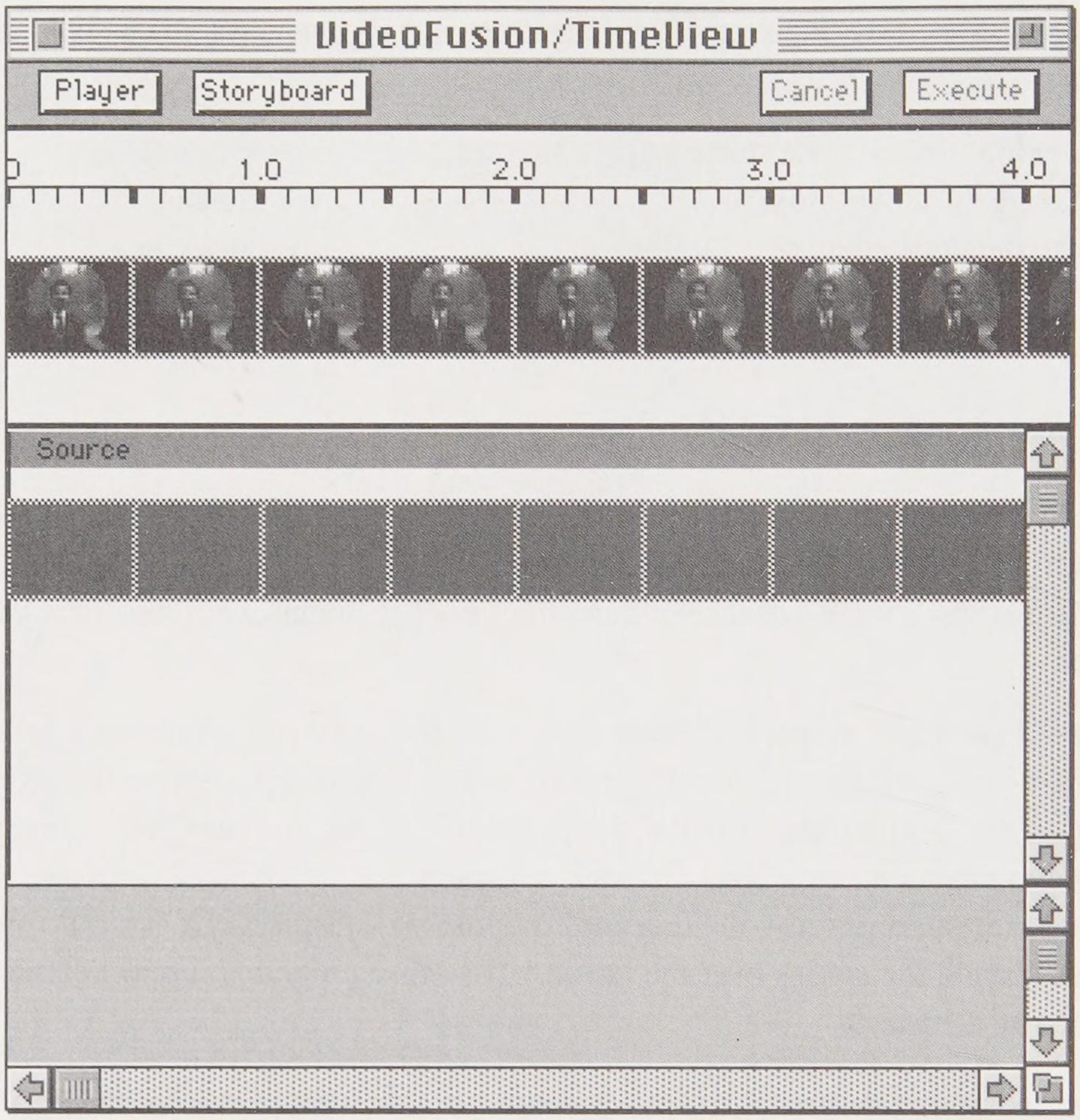
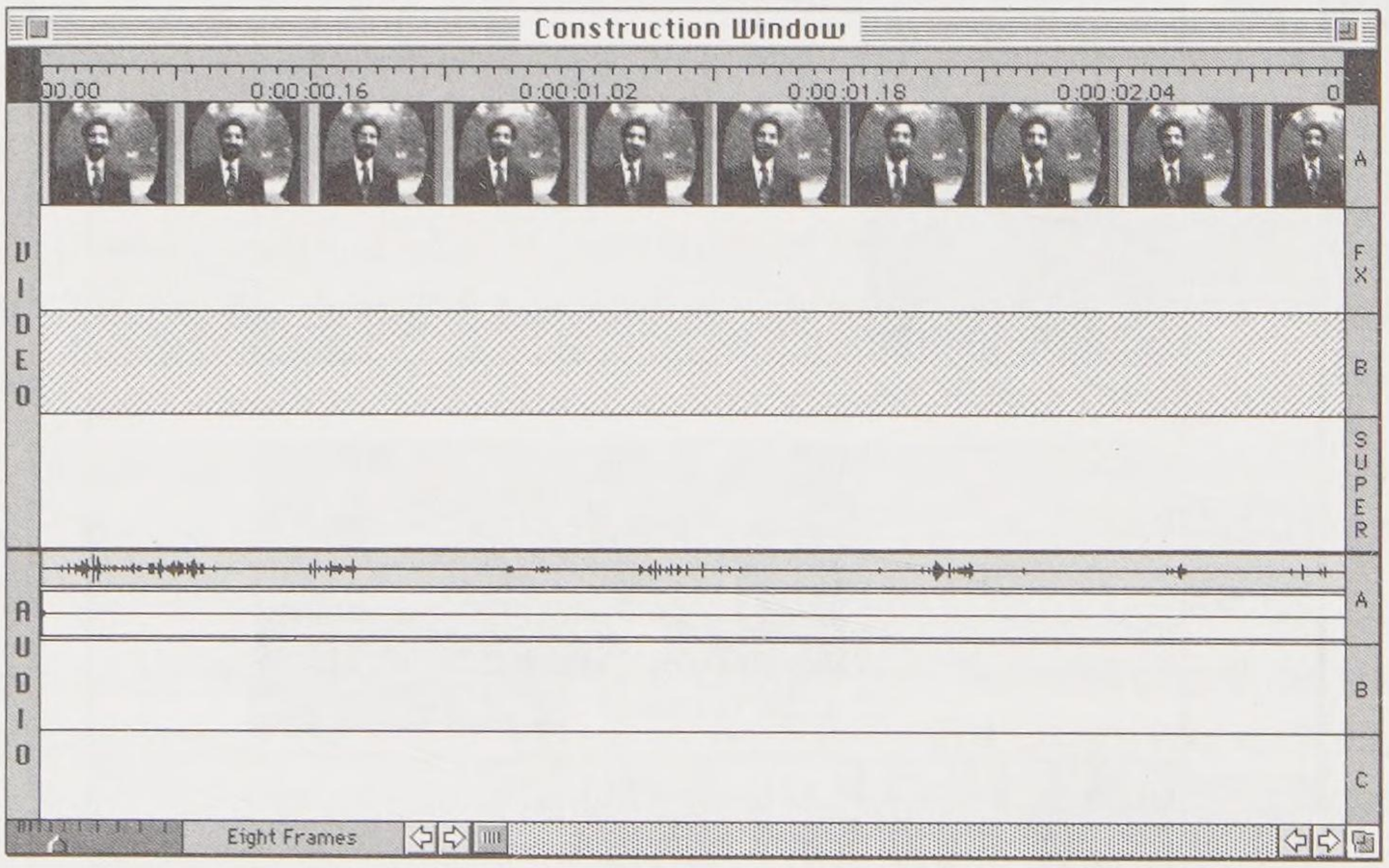


Figure 7.3c

Premiere's **Construction** window.





Digital Image Processing

Without question, digital image processing is the coolest part of digital video. Scientific workstation users in the manufacturing, aerospace, and medical fields have used digital video processing successfully for years. The arrival of digital video media on the Mac transfers technology from the entire image processing world to you.

Premiere Effects

Premiere's effects operate on two video track sources. You display and operate the effects in real time, transitioning between a pale blue and a yellow letter. You comprehend the effect without even looking at its name, making it easy for you to choose the coolest one. The 24 built-in effects include slides, wipes, dithers, dissolves, page turns, stretches, zooms, and more. You control the effect's direction, which direction the effect starts (track A or B), anti-aliasing options, and more. You can spend much time playing with the possibilities (see figure 7.4). You also can use PhotoShop filters in Premiere, if applicable. Some PhotoShop filters affect only one frame; you can apply other PhotoShop filters to multiple images, as is the case with movie files.

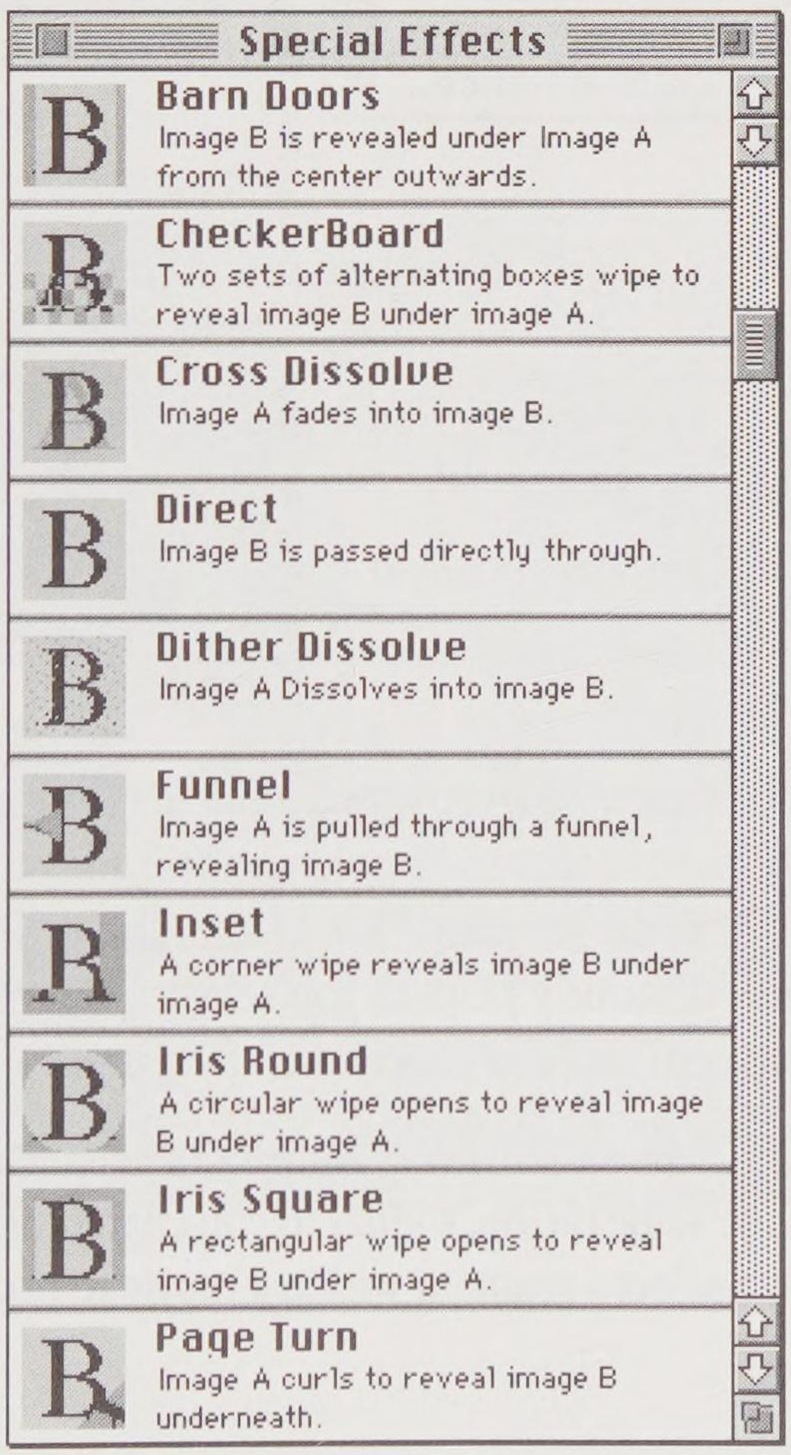


Figure 7.4

Premiere's **Special Effects** window.

You can superimpose an image over a movie, too. With alpha channel support, you need a program such as PhotoShop to create a file and store information into the upper eight bits of a 32-bit image file. Full-color images use only 24 bits; you can use the remaining eight bits of a 32-bit image file in this way: the 8-bit alpha channel acts as a 256 level filter screen (a darker filter lets less light shine through). An alpha channel determines the amount of the digital image contained in the rest of the 24 bits that can shine through.

VideoShop Effects

VideoShop operates differently from Premiere. In Premiere, you can apply multiple effects along the timeline but not on the same time segment. First, you must create the movie with one effect, then create a new movie project using the created movie as one of the new project's sources. In VideoShop, you can apply effects to any movie segment you want (see figure 7.5) as often as you want. After you apply the effect, the resulting movie becomes a new segment in the current storyboard. However, VideoShop doesn't show you the effects before you apply them as does Adobe Premiere.

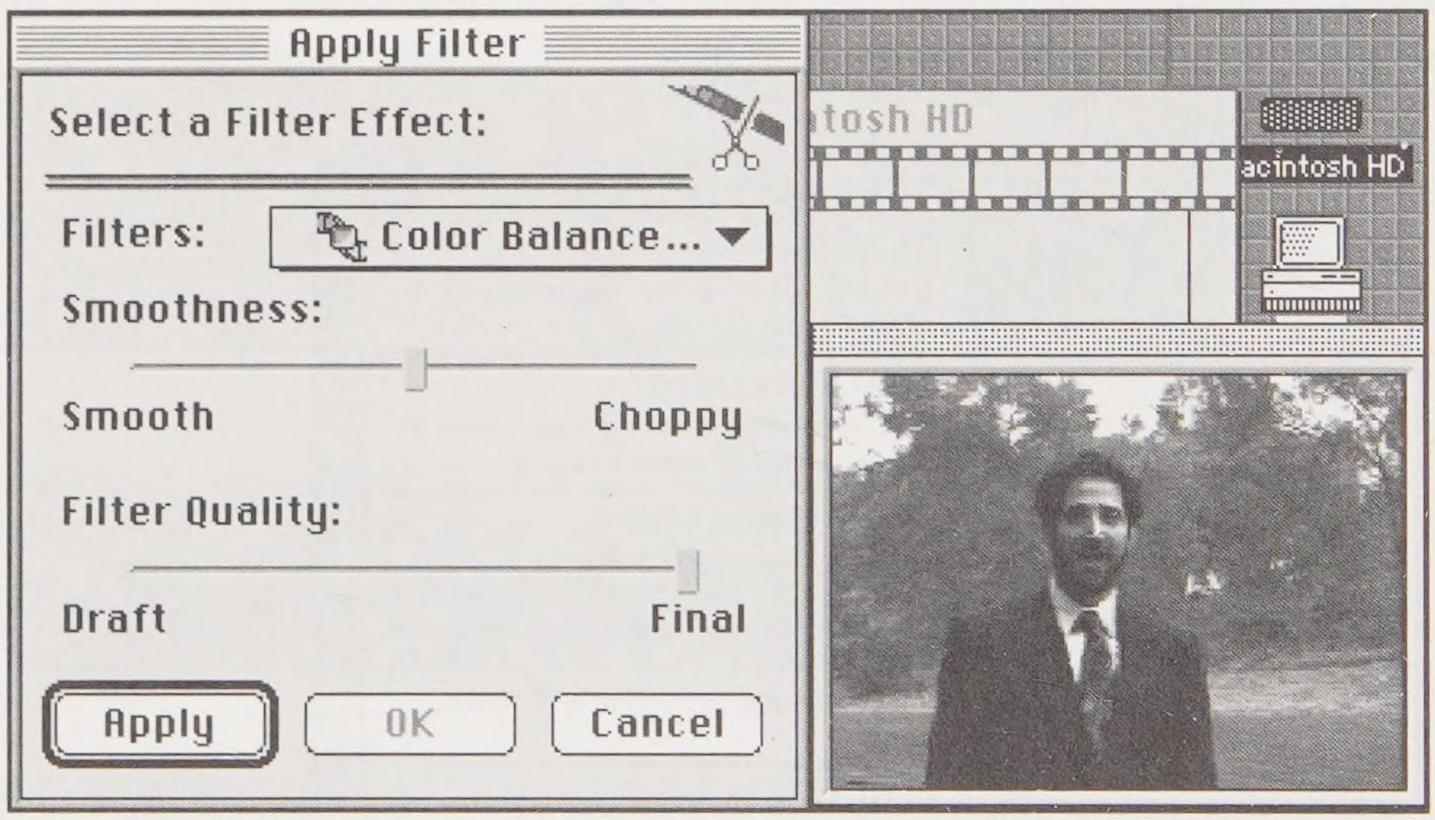


Figure 7.5
Applying VideoShop filters and transitions.

You select a segment and then an effects option from the **Sequencer** menu. VideoShop supports a plethora of effects similar to Premiere's. You adjust your effect's parameters with sliders, as you would in the standard QuickTime **Compression Settings** window. The selected segment continuously plays as you select and apply the filter. You see the effect on the video's segment and can cancel the effect if you don't like it.

VideoShop differentiates between filter and transitional effects. A filter effect applies to selected frames within the same movie, similar to you changing a block of words to italic in a word processor. You select a segment within a movie to posterize (blur). Transition



effects blend together one or more video segments, such as dissolving from one movie to another over a selected number of frames. All effects segments automatically become another part of the same storyboard sequence.

VideoShop also supports PhotoShop Plug-ins.

VideoFusion Effects

VideoFusion wins the digital effects comparison. VideoFusion claims to provide the capabilities of a well-equipped television studio including editing, chromakeying, digital effects, video blending, and compositing, and the program does. You can spend hours applying its many effects (see figure 7.6). VideoFusion supports independent channel processing for

- Blending and colorizing
- Perspective transformations for scroll, pan, zoom, and 3D fly-by effects
- Filters to highlight edges, create mosaics, and smooth and warp images
- Compositing to overlay video on video or computer graphics on video

Many of these capabilities are unique. VideoFusion also enables you to control its effects functions over time to perform fades, smooth transitions, color cycling, and dynamic geometric transformations.

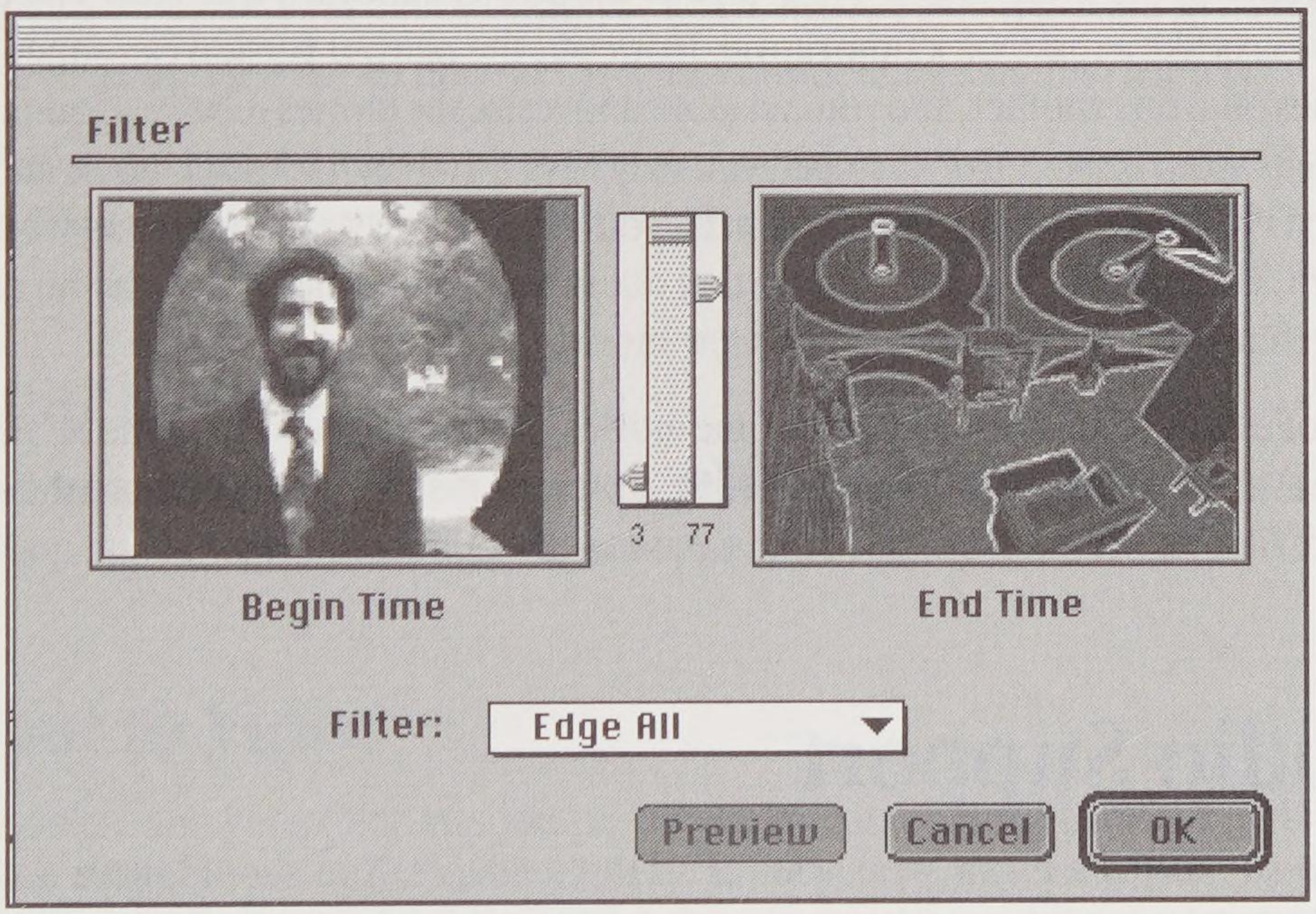


Figure 7.6
Result of a VideoFusion effect.

Many of VideoFusion's features may contain new terms for you. But these features enable you to access wonderful image processing effects with VideoFusion. For example, independent channel processing means VideoFusion can extract the red from an image. You can adjust this red channel alone—perhaps, increase the intensity of the red—then blend and composite the adjusted channel with the original.

VideoFusion works with the more familiar red, green, blue channels and the hue, saturation, value color channels. The power you have with independent channel processing is difficult to describe with words and pictures. With VideoFusion, you can extract people in the foreground of a movie and set them into another video clip, for instance. All effects create a new movie that you can add to the storyboard.

Previewing

All three editing applications enable you to preview your work at any time. In Premiere, the length of a movable yellow bar across the top of the timeline determines the length of your preview. The preview is always in an 80 by 60-pixel window that doesn't contain the standard QuickTime controls. When you select a preview, Premiere collects the frames (if you've created a new preview selection) and displays it.

VideoShop calls its **Preview** window a *playout*. The **Playout** window is DiVA's version of QuickTime's **Standard Movie Controller**, although you can select the QuickTime controller in the preferences. The **Playout** window is a movie's true size. The playout movie acts like a real QuickTime movie. However, the playout version can superimpose movies onto one another, and you can move and resize the movies relative to one another in the playout version. For example, you may have a 160- by 120-pixel movie and a full-screen PICT image as a movie backdrop. You can place the playout window anywhere over the PICT image, which is also a movie that doesn't move over time. The playout movie is more functional than a Premiere preview movie.

VideoFusion creates standard QuickTime movies, preserving the original movie size, with QuickTime's **Standard Movie Controller**. A preview is superfluous because the created QuickTime movie stays onscreen and becomes the active window.

Audio Support

Audio support is a major weakness for all three editors. You should more accurately categorize these editing applications as QuickTime video track editors.





Premiere and VideoShop enable you to adjust the sound level across time. You can mark segments, cut, copy, and paste audio, but you cannot edit the wave form as you can with SoundEdit. QuickTime's sound support is so poor, you cannot export QuickTime audio.

If you must do any audio editing, don't bring audio in through QuickTime capture products. Use another method and save the edited audio in SND resource, AIFF, or AIFF-C format. Edit the sounds, then import them into a video editing application.

Output

Obviously, Premiere, VideoShop and VideoFusion create QuickTime movies. You need to know the differences among these editors in outputting QuickTime movies.

Output to QuickTime Movies

Premiere enables you to control the size of the **Output Video** window and the compression method in the **Output Options** window (see figure 7.7). VideoShop offers significantly more (see figure 7.8). You physically can adjust the Video window size and other attributes with the **Playout** screen setup. To output a completed movie, save the playout movie.

You can save a movie as a reference movie, which points to the original video segments. You can save a movie as a stand-alone movie, which flattens it, condensing all tracks into the created movie (see the section on CD-ROM considerations in this chapter).

VideoFusion generates a movie after you apply each effect or change. VideoFusion doesn't offer as many output options as the other two programs.

Output to Paper

Premiere can print any of its windows to paper, primarily for use as storyboards. VideoShop and VideoFusion do not support printing to paper.

Output to Video

Both Premiere and VideoShop support printing to videotape (see figures 7.9 and 7.10). To print to videotape, you must have the correct hardware. Assuming you have the correct equipment, you can ask VideoShop to double the number of lines to fill the video screen.

Premiere also offers this particular line-doubling capability, if your video card contains hardware zoom. My first ReelTime viewing on a television was created using SuperMac products zoomed in 2:1.

Figure 7.7
Premiere's **Output Options** window.

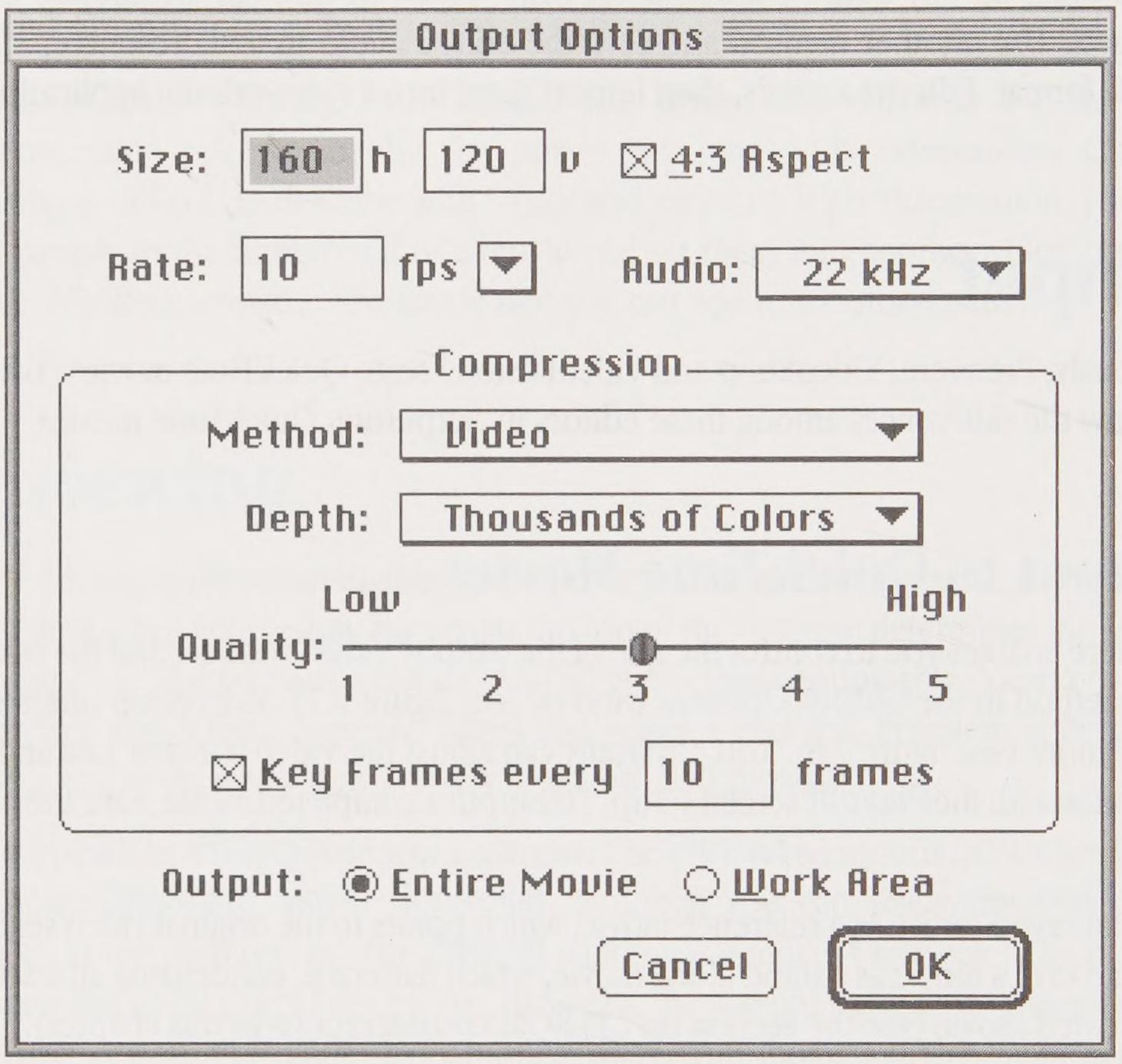
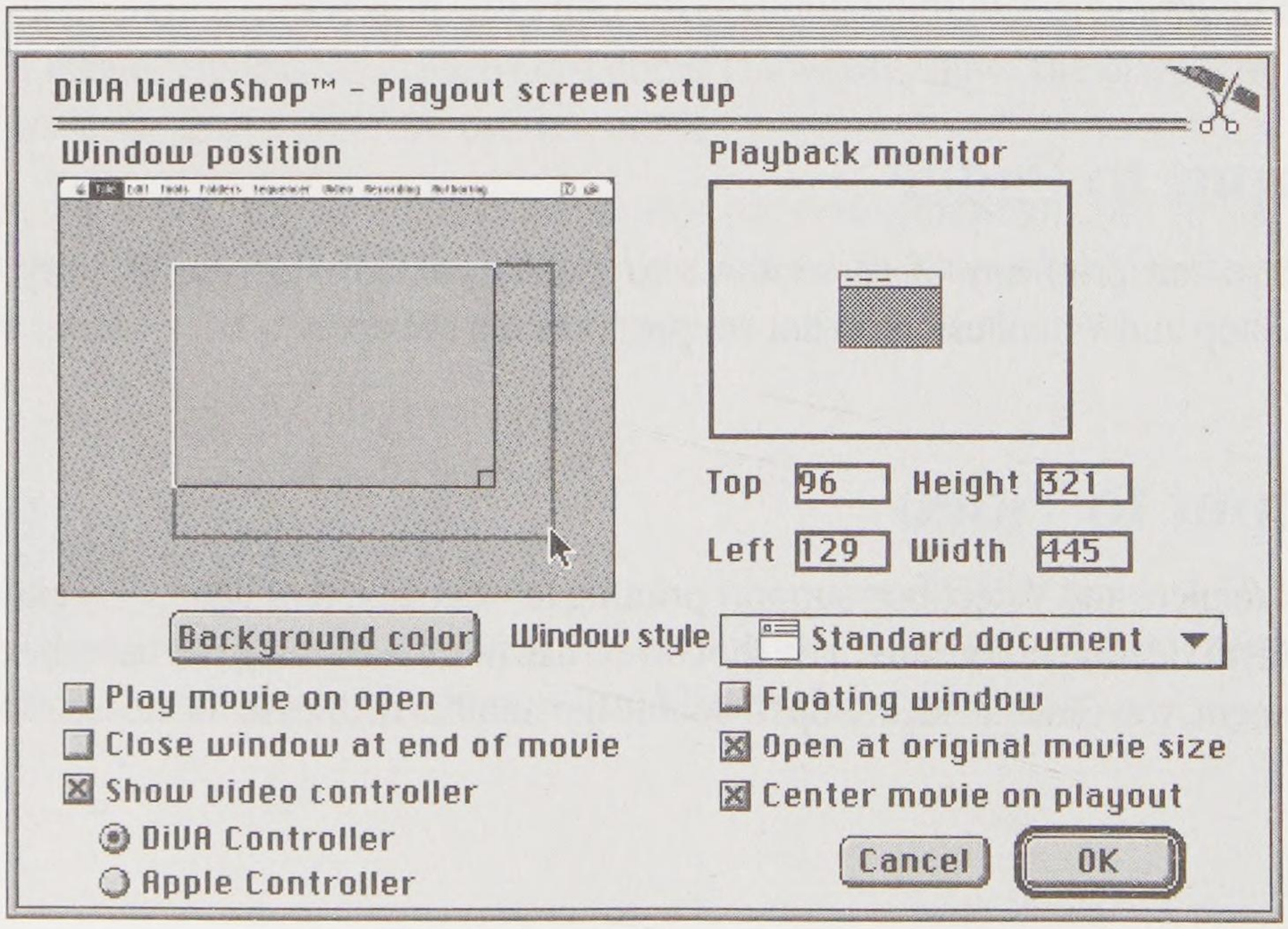


Figure 7.8
VideoShop's **Playout** screen.





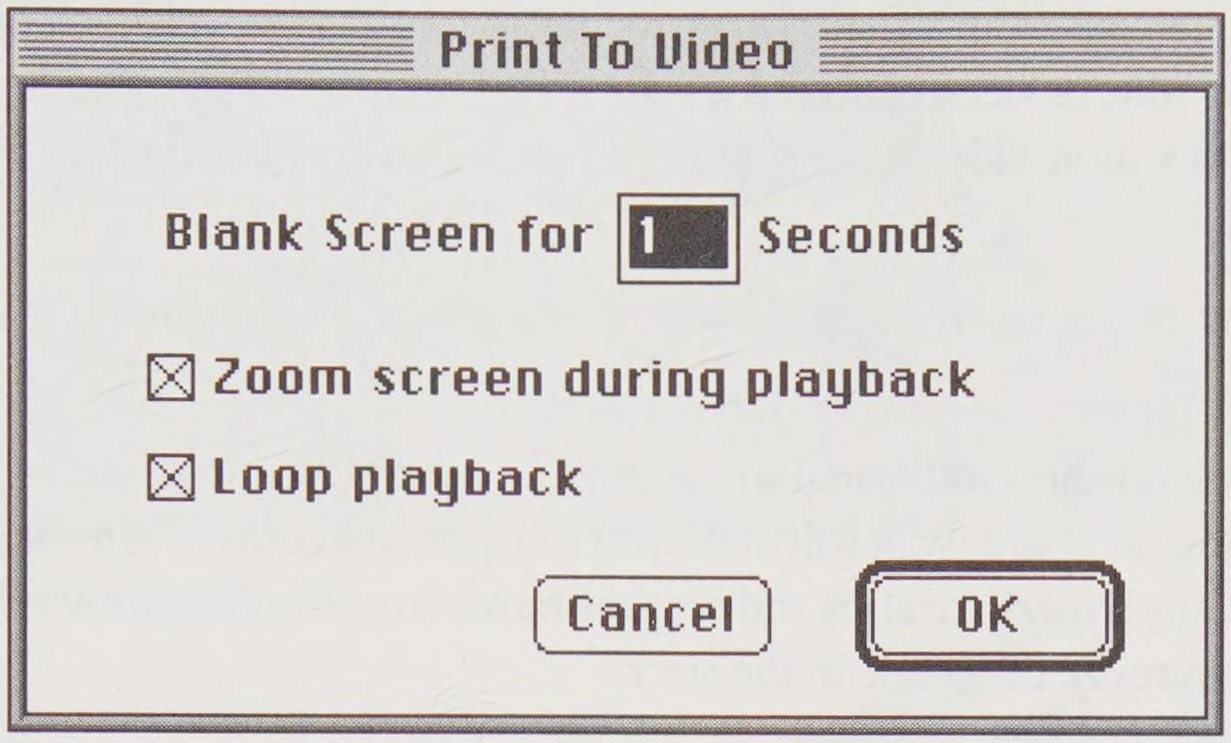


Figure 7.9
Premiere's **Print to Video** window.

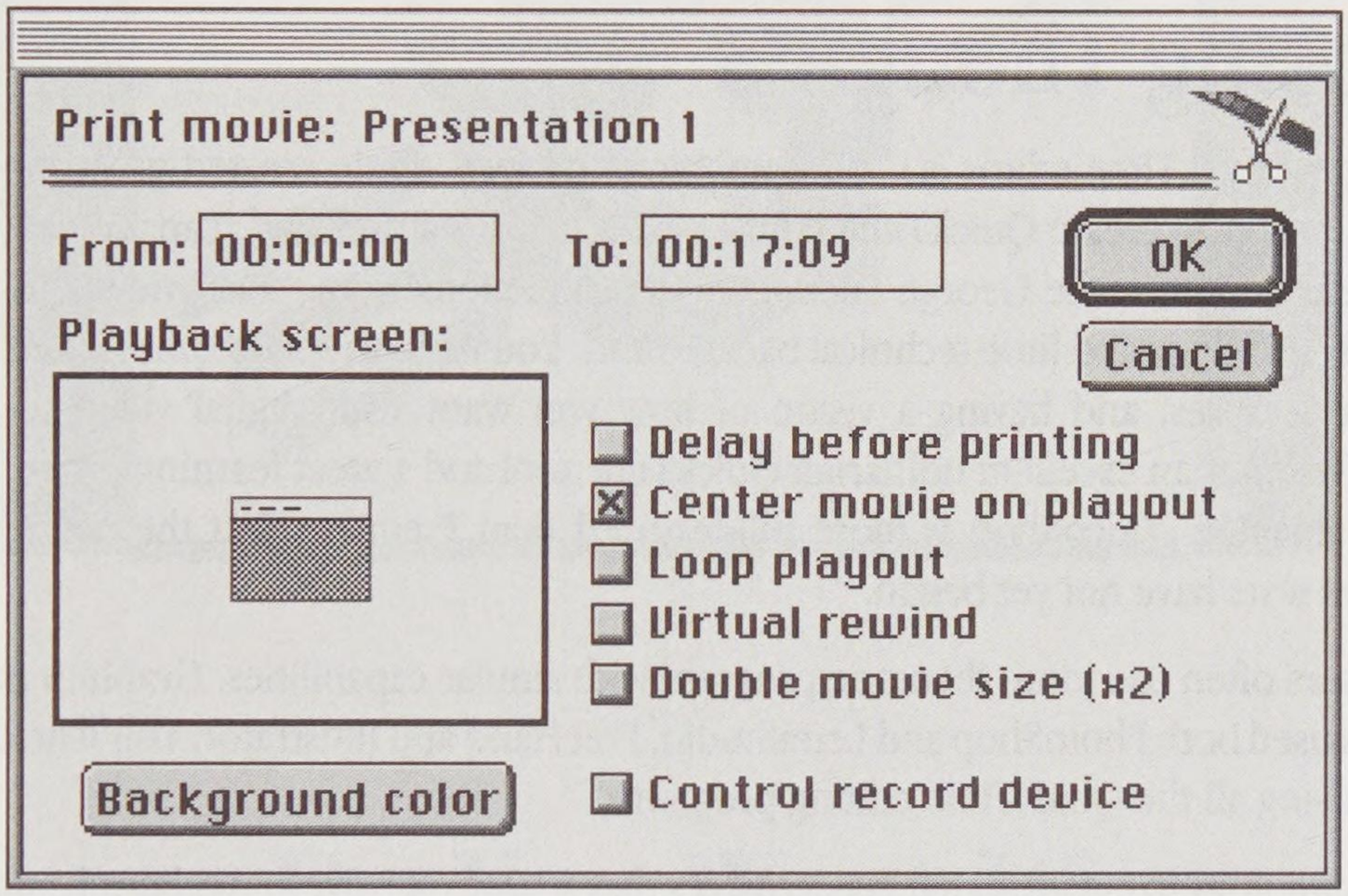


Figure 7.10
VideoShop's **Print Movie** window.

Other Impressions

VideoShop does more than edit; it converts your Mac into a QuickTime production studio. The people at DiVA have created the *visual desktop*. The visual desktop transforms your Mac Finder desktop into a similar-looking image, except everything you select on the desktop relates to QuickTime. For example: *Micons*—movie icon images—appear in folders instead of files. You don't need to remember which files are movies and which files are spreadsheets; you only see movie files. The visual desktop does a good job of emulating the Finder.

VideoShop directly supports analog video recording through the QuickTime Component Manager. Any vdig, or video digitizers you install in the System that supports QuickTime is available to you in VideoShop. You even can designate a location for all incoming digitized video.

VideoShop supports visual catalogs—HyperCard stacks that contain references to movies and sounds.

VideoShop also enables you to import any movie into any HyperCard stack directly. This importing process is so easy, it will make you a HyperCard convert. After selecting your movie, open any HyperCard stack and drag the movie from the **Playout** window into the stack. You can resize the movie in the stack.

Closing Thoughts

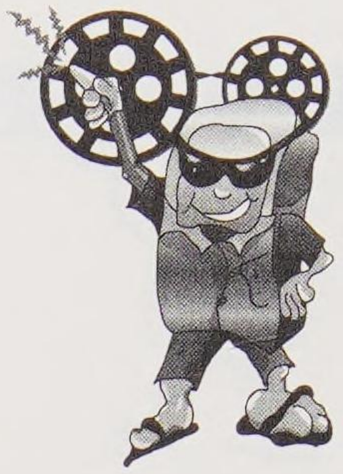
Making a QuickTime editor is a very ambitious project. Apple created great tools for programmers to create QuickTime editors, with many features and capabilities. Most people expect to make George Lucas-quality productions from "trash video," using a QuickTime editor and little technical background. You need to spend time understanding the features, and having a vision of how you want your digital video to look. VideoFusion is an excellent utilitarian QuickTime tool and a great learning program for digital imaging. VideoShop is more full-featured than Premiere, but the competitive features wars have not yet begun.

Mac users often use more than one program with similar capabilities. Graphics professionals used both PhotoShop and LetraStudio, FreeHand and Illustrator. You'll no doubt enjoy using all the QuickTime editing programs.

The technology to create digital masterpieces that are inexpensive and relatively quick to produce, without relying on others, is QuickTime's most exciting and empowering aspect. You control the quality of the material you create. You control the quality of the information you put into your computer. You control the sequencing and add the effects you want.







CHAPTER

8

Where Do You Want It?

Whether you create your own QuickTime movies or import them from across the network or across the world, you want to *output* the movies. I define output as the opposite of digital movie acquisition: using the movie within applications or printing it to videotape.

Typically, two classes of applications exist: the makers and the players. The makers are applications such as Premiere, VideoShop, Director, and StrataVision that create and edit QuickTime movies. Players are applications such as word processing documents, presentation programs, and time-varying spreadsheets enhanced by QuickTime's capabilities. Some applications are both makers and players—StrataVision 3d and MacroMedia Director to name two. (Chapter 5, "Experimenting with QuickTime," discusses StrataVision's use of QuickTime movies as mapping surfaces.)

StrataVision outputs animations as QuickTime movies. Director imports and controls movies as easily as it does PICT images. You can output entire sections or Director files as QuickTime movies, then re-import the files to use in a new Director movie. (Director files and QuickTime files are both called movies.)

More programs are adding QuickTime player support and many are adding QuickTime creation support. For example: DeltaPoint's new DeltaGraph Professional software supports the viewing of QuickTime movies alongside the charts and graphs you create within the program. Soon, you'll be able to save your charts and graphs in QuickTime format to use in other programs.

Movies in Mac Files

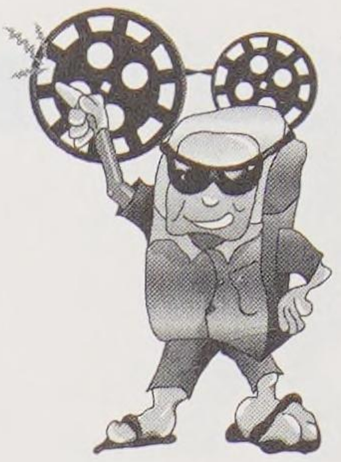
Imagine this dynamic, computerized product marketing document (the document is dynamic, although the product should be, too): You introduce the document with a movie letterhead or corporate logo. The first few paragraphs describe the product. You then use another movie showing the product in a 3D panning motion. After more words and graphs describing the market niche and market size, you show an animated graph presenting growth in sales as a function of dollars spent in advertising. You describe ideas for ads and include voice spots for radio. At the end, in addition to signing your name, you include a video of yourself and the product team. This type of document provides viewers a more comprehensible, more enlightening message than traditional marketing presentations.

Movies in Word Processing

Integrated word processing—commonly known as *living documents*—is a valuable QuickTime technology application for the masses. People using word processors don't need to create QuickTime movies but can insert the movies into documents to view alongside text. WordPerfect for the Mac Version 2.1 is the best example of an application that supports living documents. This product was released about the same time as QuickTime and provides a great example of time-based data in words and graphics. WordPerfect 2.1 also enables you to control movies.

You are only one menu selection away from using a movie in WordPerfect. Simply select from the **Tools** menu, **Movie**, then **Insert** and select which movie to insert. You grab the movie and move it anywhere in your document. The movie has a badge that clearly differentiates the movie from other graphics. To activate the movie, double-click on the





movie badge. WordPerfect even adds an extra touch: The cursor changes to a pause icon while the movie is running. If you pause the movie, the cursor changes to the play icon, indicating your next possible action.

WordPerfect enables you to adjust the settings. However, WordPerfect doesn't support some of the mouse and key combinations described in Chapter 5. Instead, you control actions such as "loop continuously" in the **Movie Settings** dialog box. You can view the movie in the **Settings** dialog box and control the frame rate and direction of play. You even can change the poster (the image representing the movie); a feature I haven't seen in any other application supporting QuickTime playback-only capabilities. WordPerfect also enables you to place captions and frames around the QuickTime movies, too.



Movies containing only sound are valid QuickTime movie types, but don't use them in WordPerfect. Because a sound-only movie doesn't have a poster, the movie doesn't appear onscreen and no one knows you have incorporated it. Use a QuickTime editing program and add a PICT image, even if the PICT image is text such as "This movie is audio only."

Eventually, you may send computer files to the person who views your documents, but today's reality dictates that you print documents instead. You can print the poster representing the QuickTime movie if you select **Grayscale** in the **Print** dialog box.

Movies for the Unaware

There are applications today that do not support QuickTime. For those unsupported applications, Apple makes Wild Magic, a program that magically adds QuickTime support, thereby becoming the engine for your QuickTime movies. However, at the time of this writing, Wild Magic is not commercially available.

Linker Systems embeds QuickTime movies in PICS files. A PICS file contains a series of PICT images and is limited to 16M. Linker Systems tricks a program into thinking it has a sequence of PICT images. QuickTime intercepts the PICT display actions and displays QuickTime movies in their place.

Video Out

Every new Mac contains built-in video so you can connect an RGB monitor. This is *video out*. If you want to print your QuickTime movies to video, do you use the same video-out port? Do you plug your VCR or camcorder into the digitizer to convert the digital video back into analog?



To print to videotape, you must convert the digital RGB signal to a PAL, NTSC, or SECAM video format, depending on the recording device. This conversion is a two-step process. The standard TV formats use an interlaced signal and the Mac uses a non-interlaced signal. After converting to an interlaced signal, you must convert the RGB to one of the video formats.

Some video display boards, such as the TrueVision NuVista+, make the conversions for you. The NuVista+ price starts at $2,000. Other boards, such as Apple's 8•24 card and the Radius DirectColor/GX, only convert the signal to interlaced and cost less than $1,000. With these less expensive boards, you must add an encoder for approximately $400. VideoLogic's Mediator box ($2,500) also converts a standard Mac video signal to NTSC or PAL. You can purchase more expensive encoders as well.

Once you buy video conversion equipment, you can output less than full-screen digital video to your VCR or camcorder. You cannot create a QuickTime video that plays smoothly and has a screen size large to look good on tape and fill the screen.

You can use boards such as the SuperMac Spectrum and Thunder boards that perform a 2:1 zoom. Then you can create and edit movies at 320 by 240 pixels. Doubling this screen size corresponds to a full-video frame, but the results appear grainy.

The recording industry is introducing new products that record QuickTime movies directly to tape well. Some of the newest Sony products contain a built-in encoder to receive the standard Mac video signal. These units also contain electronic controls so the computer can tell them when to record a frame and when to advance to the next frame for frame-by-frame accuracy.

I've discussed the significant hardware issues in recording digital video to videotape; VideoShop and Premiere software programs will print your movies to tape. (See Chapter 7, "Sorting the Details.")

Lastly...

QuickTime movies are for use on the Mac. Apple has made QuickTime simple enough for every developer to support it. Linker Systems even has found a method that makes QuickTime support non-QuickTime applications.

It's more difficult to print QuickTime movies to video. Most people don't have the necessary equipment to make even bad videos from QuickTime movies. Many people believe that with QuickTime, you can bring video into the computer, edit it, and put it back onto tape. Unfortunately, QuickTime and the Mac can't perform this feat—yet!



CHAPTER





9

Expressions of a New Paradigm

Most of this book explains QuickTime's details. This chapter offers my subjective look at cool applications, utilities, and movies related to QuickTime that I haven't described elsewhere.

Applications

Many programs have added QuickTime import and QuickTime export but remain fundamentally unchanged. QuickTime support doesn't enhance a spreadsheet, for

example. The programs I've selected in this chapter are unique programs QuickTime impacts substantially.

WalkThrough

WalkThrough is a product ahead of its time. Let's say you model a structure and define a path to walk through it. Before QuickTime, the PICS format was the best way to save and view walkthroughs. Now, you can save in QuickTime format, which enables you to save as much of a walkthrough as you want. You can define intricate and elaborate walkthroughs of the model, then edit them with a QuickTime editor.

MovieWorks

Numerous animation programs for the Mac already exist. Existing applications such as Director and Animations Works will assuredly support QuickTime. New animation programs such as Vividus' Cinemation already support QuickTime.

I single out MovieWorks from Interactive Solutions because of its interface. This animation program completely embraces a QuickTime-like user interface. MovieWorks' Time View panel—known in Director as the Score—looks like tracks in a representation of the QuickTime movie layout. The application tracks timing in hours:minutes:seconds. Even MovieWorks' playback controller looks similar to QuickTime's playback controller.

Miracle Piano

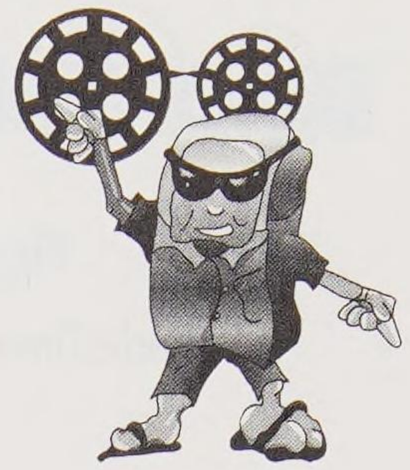
The Miracle Piano Teaching System consists of a keyboard with built-in speakers and MIDI support. The keyboard plugs into the Mac. Miracle Piano is an incredible teaching program filled with over 1,000 games and exercises—guaranteed fun. Because the program supports MIDI, the computer reads the notes you create, enabling the Mac to monitor your performance.

QuickTime functionality has enhanced Miracle Piano with animations showing where to put your hands while you play. This makes the Miracle Piano the most advanced interactive learning tools on any personal computer system.

Utilities

Whenever new software emerges, sharp-minded individuals find gaps for tools and utilities. Listed below are a few utilities I've found.





MediaTree

MediaTree, the media organizer from Tulip Software, leads off the cool utilities. MediaTree catalogs still images, sounds, text, and movies. Other programs do this, too; MediaTree's approach differentiates it from similar programs.

If you need to organize your media, you probably have plenty of material occupying disk space. Some programs similar to MediaTree enable you to enter keywords to index your media, and you need the disk files available for the index. Other programs contain an internal database that stores and compresses the files internally. But this approach doesn't work if the data you want to catalog is on a CD.

MediaTree is unique in two ways. First, it doesn't need your data files. If you select a file from a catalog that isn't mounted on your desktop, MediaTree prompts you either to insert the file or cancel. The application's outliner is the second unique attribute. With the outliner, you create a hierarchical tree that best represents your data. For example, you can create a catalog similar to this:

Buildings

    Commercial

    Industrial

    Residential

        single-family

        condominium

        apartment

You insert the media references into any level of your outline. Figure 9.1 shows a simple outline I made of the ClipTime CD to demonstrate how you can catalog a CD.

Smoothie

Peirce Software's Smoothie is the answer to a videographer's prayers. This software doesn't quite fit with the other applications and utilities. Smoothie anti-aliases object pictures, which contains drawn shapes like those you create with FreeHand, MacDraw, Persuasion, or a CAD program. However, Smoothie doesn't smooth bitmapped images such as QuickTime movies, MacPaint, or PhotoShop files.

Smoothie is a utility in the true sense of the word. You can publish a graphic using System 7's publish capability and Smoothie automatically processes the incoming edition data.

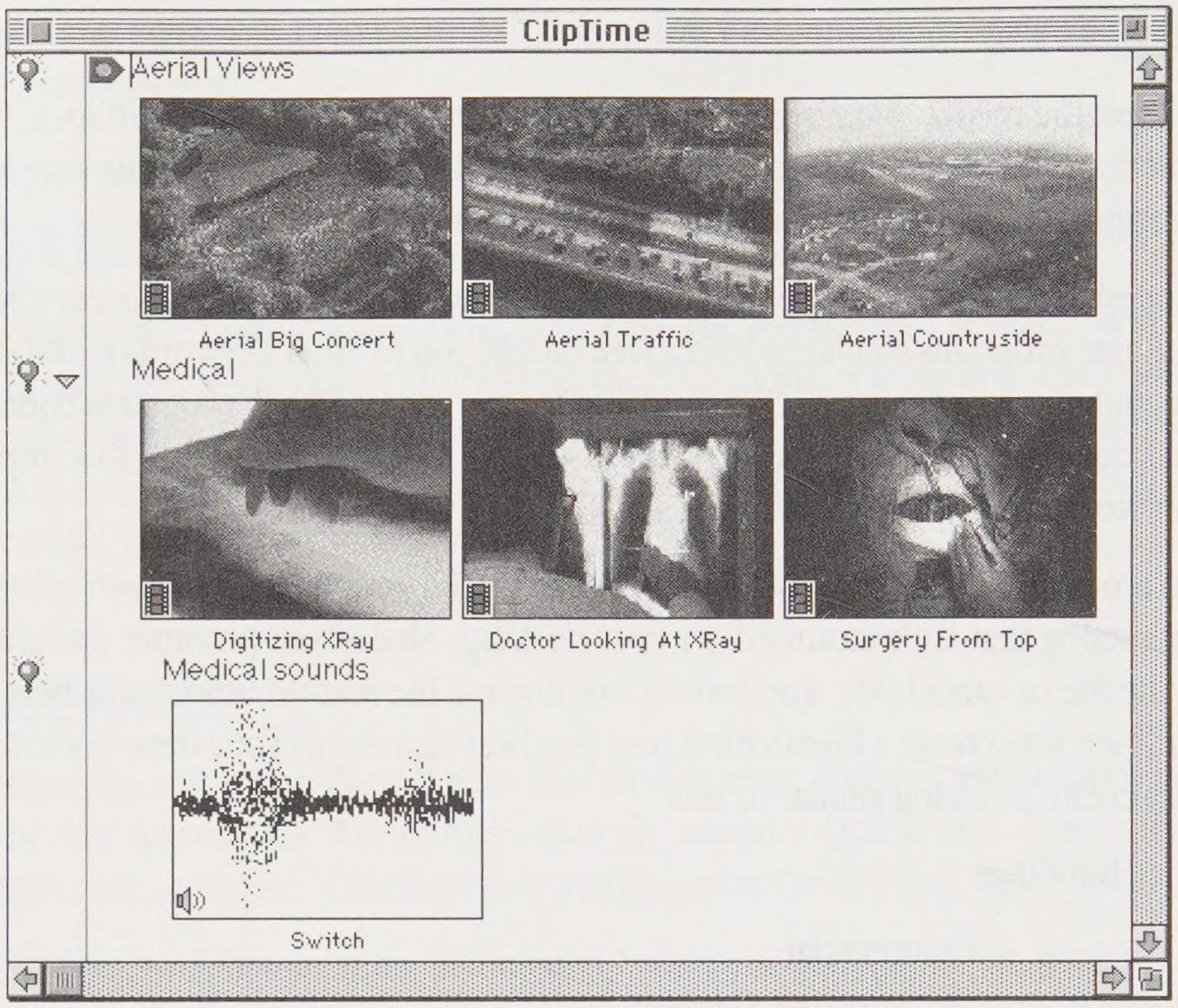


Figure 9.1

MediaTime outline of ClipTime.

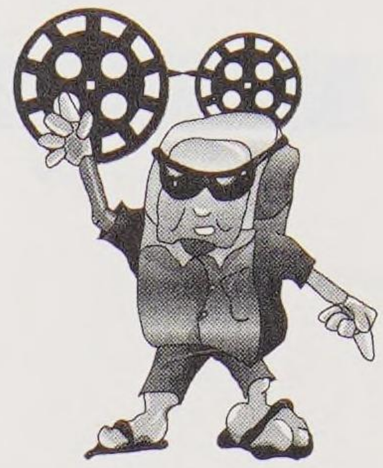
Smoothie creates smoothed bitmapped images. The application creates QuickTime movies of dithered graphics also. You can use QuickTime's compression methods when you create Smoothie QuickTime movies.

CameraMan

Smoothie may be great for some people, but CameraMan is great for anyone who's ever tried to demonstrate a technique or problem using a computer.

CameraMan, from Vision Software, is a movie-recording application that records your computer screen. With the small CameraMan INIT in your **System** folder, you can record any action you perform on your computer, such as launching and operating a program.

Think how valuable this capability is for support personnel! If you have a reproducible problem, you record all steps leading to the problem. You can open the **Control** panel and show your memory size, virtual memory settings, etc., also. CameraMan has cool features that you probably would never consider until you needed them. The program can capture smaller screen sizes than your screen, so you can play back the screen capture movie on a smaller monitor.



Movies

One key to QuickTime's success is content. As the industry creates more QuickTime media, more users will consider owning a Mac. Because QuickTime movies are large, the CD is the media of distribution for movies.

ClipTime, Volume 1

Alpha Technologies Group, Inc. is first out the door with a useful QuickTime CD sampler product. ClipTime Volume 1 contains over 250 assorted QuickTime movies. Most of ClipTime's movies don't contain sound, which means you can add your own sound when you use these movies. ClipTime's movies are approximately 160 by 120 pixels in size and approximately 10 seconds long.

ClipTime's assortment offers great enhancements for presentations, especially when you consider time you don't have to spend capturing and converting to create your own movies. ClipTime's movie categories include aerial, animals, buildings, business, education, leisure, medical, people, sports, and more. Each category contains approximately 15 movies.

Apple Intro News

I've got to give credit where credit is due. Apple invented QuickTime and released flimsy newspaper announcements. Then Apple introduced the multimedia version: the Apple Intro News and CD-ROM Titles Sampler CD.

The CD contains all the information in the paper, plus more. For example: Apple offers testimonials from third-party vendors such as WordPerfect in the Intro News. On the CD version, each person's testimonial is a QuickTime movie. You double-click to hear what the people actually say about QuickTime.

The CD also contains cool graphics and a list of forthcoming programs and products that support QuickTime. This use is an excellent demonstration of QuickTime's interactive possibilities.

Integrating with QuickTime

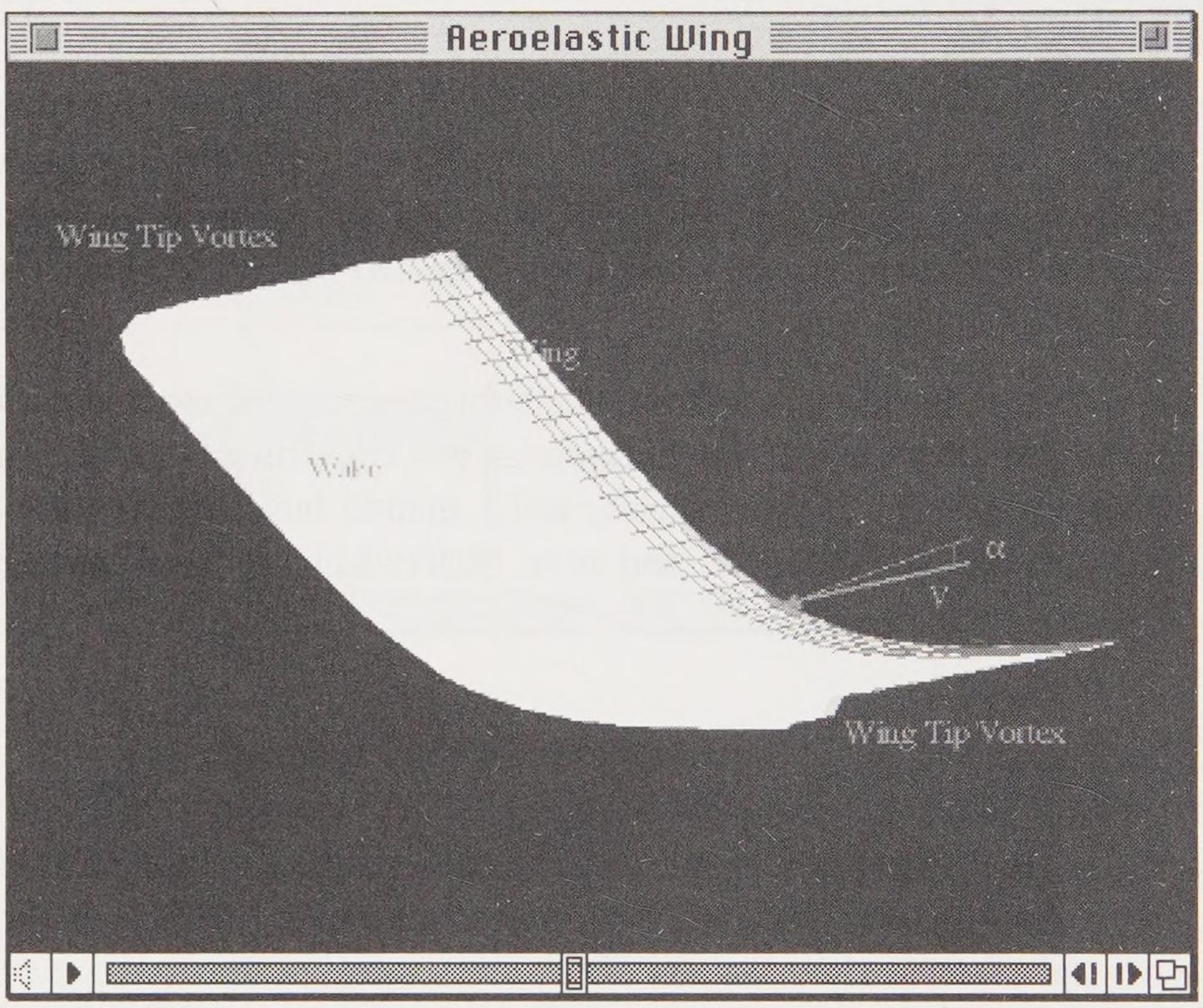
People who adopt new technology early shape the technology's direction. Gordon Miller, director of a multimedia lab at Virginia Tech, is such a person. Working with professors

and students, Gordon combines visualizations from high-powered workstations, super computers, and Macs.

Miller uses Director to create animations. SpyGlass' Format, Dicer and View tools record and analyze data. The PICS and Director movie files are converted into QuickTime movies. Figure 9.2 shows one frame of an aerolastic wing simulation, created by Alan Lutton.

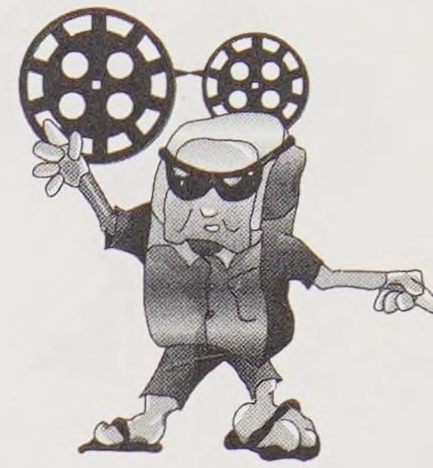
Figure 9.2

QuickTime wing simulation.



One researcher at the university used QuickTime to discover a four-line programming error in a 3,000-line program simulation that generated volumes of data. Using Spyglass' Dicer and then QuickTime, the researcher pinpointed the erroneous computer code by finding the aberration in the visualization. What could have taken a week of searching took minutes through an unconventional use of QuickTime.

This situation exemplifies the fact that we're seeing only the tip of the iceberg. QuickTime is a powerful and enabling technology.



CHAPTER



10

It's Only Just Begun

Apple publicly has proclaimed itself a software company that continues to sell Macs so Apple has hardware to support the features it wants to create. Microsoft doesn't sell computers; it works with Intel and other hardware manufacturers to implement its software strategies. Because of an increasingly competitive worldwide market, every choice Apple makes has a greater impact. QuickTime spearheads Apple's juggernaut, through business customers, to families, to children. QuickTime's changes and direction will shape Apple's future too.

Apple and Technology

Whether Apple is a hardware or software company, QuickTime is one of Apple's greatest accomplishments for you and me. Apple has a history of taking good ideas others develop, re-shaping the ideas, and integrating them into the Mac. Today's trend in the computer industry is integrating more functionality into the main computer. For example, the original Apple II computers didn't have built-in serial ports. Now all Macs have two serial ports: one for the modem, and one for the printer. Since the introduction of the Mac IIci, Apple has built color video support into every new 68030 or 68040-based machine (except the discontinued Mac IIfx).

Looking at the history of Apple's support for image data types illustrates the software side of this integration trend. Before QuickTime, there was the PICT file format for still images; then the PICS format was created (PICS files are a sequence of PICT files). However, PICS files were not as widely supported as the PICT file format. PACo emerged a short time before QuickTime. PACo, from the Company of Science and Art (CoSA), combines and synchronizes images and sounds for playback from disk. It is amazingly similar to QuickTime, but requires neither the system or QuickTime. CoSA's products today embed QuickTime or PACo files into shells that play your movies on computers running DOS Windows and even higher-powered graphics workstations.

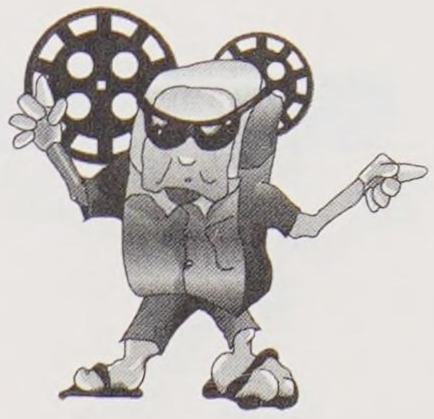
Setting the Scene

Although today's QuickTime version is exciting, it isn't good enough. People like us, early adopters of the technology, tend to overlook its limitations. QuickTime movies are too small, play too slowly, and you can't put the movies on videotape with broadcast quality. Yet QuickTime has numerous uses in presentations, education, databases, and electronic mail.

I recently described to two juvenile hall counselors how to use QuickTime for documentation. When counselors use surveillance cameras to capture an incident, they must write a report on that incident. With QuickTime, the counselors could import the video clip into the report, similar to the famous Rodney King police incident in Los Angeles in 1991. (The counselors, subsequently, must prove they didn't digitally manipulate the video.)

Creating QuickTime movies today requires a lot of hardware, both from Apple and others. You need a high-end Mac and lots of disk storage if you plan to edit movies and use capture equipment. To play back movies, you can use a low-end Mac, but this type of Mac isn't transportable. Consequently, QuickTime's future depends on lower-priced, faster QuickTime playback systems and features.





Hardware/Software Strategy

Apple's success is built on its technological lead. Apple makes money selling machines that are technologically superior and meet customer expectations, and expectations from Mac users are high. The PowerBooks are a great success because they are both technologically superior and meet the pent-up demand for Mac portable computing unmet by Apple's previous models.

Apple's next great market penetration is aimed at consumers. The PowerBook is too bulky, too fragile, and too expensive for consumers. However, QuickTime technology is just the right type of technology to stimulate consumer sales. Consumer machines supporting QuickTime movies, to be cost-effective, will only play back movies. Apple will create product configurations supporting specific market segments, such as education-only and consumer QuickTime playback-capable machines. High-end business machines and workstations will support the creation of or playback of QuickTime movies.

Consumer Macs

In 1993, you'll see consumer-oriented CD-based QuickTime players the size of a Sony DiscMan. These powerful QuickTime devices will display QuickTime movies on built-in color LCD screens or plug into televisions. With the performance of today's Mac IIfx, consumer QuickTime players will run a modified Mac operating system with complete file compatibility.

Penta Macs

To create full-screen, 30-frames-per-second QuickTime movies, you'll need a tremendously powerful computer system, beyond anything available today.

Let's look again at the information you need for QuickTime video movie playback. The disk holds compressed data. The disk sends the data in chunks to the RAM in the computer. The computer processor decompresses the data into another RAM location. (The data is full size again.) Now, the data is ready for display and must be moved to the video area—full size. At this point, after the image is decompressed, there are a lot of computer bits that have to be put into the video. A 13-inch Mac screen contains 640 by 480 pixels whether the compression method is lossless or lossy. Displaying full-frame images like the ones we see on television, 30 frames per second and 16 bits per pixel, requires the display bits to move at a blazing speed of 147 million bits per second.



The data throughput far exceeds the speed that personal computers can move information today—but not tomorrow. At some point, the bottleneck for displaying full-screen, full-motion movies becomes the band width of the computer and its speed of moving information. Neither the NuBus, which is the connection for adding more boards, nor the Mac processors currently can achieve this speed.

The Multiple Processor Approach

The Mac must move many bits and calculations to create video for each frame. RasterOps' strategy is to off-load QuickTime's processing requirements onto a video card. Using a 40 MHz RISC processor to create daughter boards, RasterOps will sell media plug-ins to give you increased performance. (*RISC* is an acronym for reduced instruction set computer.) RISC processors understand fewer commands but process the limited commands faster. RISC-based modules support faster, larger movies and higher fidelity sound. The boards directly plug into existing RasterOps video cards.

This off-load strategy minimizes the amount of data traveling across the NuBus. The data is QuickTime-compressed, so less data moves for the same size and frame rate image. The RISC board speedily decompresses the information and, because the video is attached directly, the movie data moves directly to the video memory for display. No data needs to return across the slow NuBus or travel into the slow processor.

New Video's EyeQ board also provides complete compression and display capabilities in one product. As EyeQ compression improves, the image displays will become larger and faster for the same amount of data moving through your Mac.

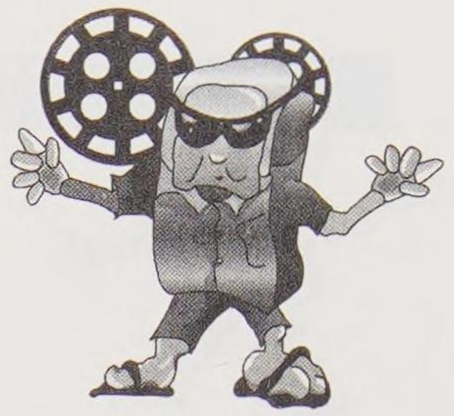
What about Digitizers?

The digitizer approach is perfect to boost QuickTime performance for existing machines, although buying video cards and the daughter boards is expensive. But products that only digitize and don't contain video display circuitry—such as the VideoSpigot and MoonRaker products—are limited to the NuBus and the power of a Mac model. Increasing the size or the frame rate overwhelms today's Macs.

Description of a Media Machine

A machine that can process compressed video must be much faster than the current Macs. If Apple puts digitizing capability into the Mac, it will bypass the NuBus' band width limitations. The video signal will go directly into chips on the main Mac board, then into





RAM on the main Mac board or to the processor on the main Mac board. The key is to avoid the NuBus—as it is defined today—and increase the speed and functionality of the circuitry on the main board.

Processing larger images requires a faster processor. Apple's alliance with IBM gives Apple access to a significantly higher performance processor. You can expect future media machines to integrate complete media processing onto the main board, speed or create a faster NuBus, and/or use faster processors.

Future Features

Higher compression is the biggest QuickTime enhancement we'll continue to see. Current compression ranges from 3:1 to 20:1. Expect to see the range reach 200:1 compression over the next few years.

Apple is open to suggestions for QuickTime enhancements. If you want to know why QuickTime doesn't perform a specific task, someone probably has discussed it with the QuickTime team already.

Photo CD

Apple already has announced QuickTime's support for Kodak's digital imaging technology, Photo CD. Photo CD produces a writable compact disc that efficiently and cost-effectively stores color images in digital format, and maintains the resolution of photographic film. You can display and use Photo CD images on a computer through CD-ROM XA-capable drives (such as the Apple CD SC Plus CD-ROM drive) or on a television through Kodak's Photo CD player or CD-I players. Photo CD photo finishing services will be available worldwide this summer. By year's end, over 100,000 photo finishing retail outlets will offer this service.

QuickTime supports any compressor that's part of Photo CD when you drop the new compressor component in your **System** folder. With Photo CD, you click on a Photo CD icon to access "thumbnail" versions of images stored on Photo CD discs. Then, you can integrate the images directly into applications that create multimedia titles, presentations, and publications that combine video, animation, and photographic-quality still images.



MIDI

MIDI is an acronym for musical instrument device interface. MIDI has established itself as the premiere interchange for computers communicating with electronic musical instruments. With MIDI, codes for musical notes take only a few bytes, so a five-minute full musical score may consume only 30K. The Mac has supported MIDI to a degree for years.



MIDI doesn't support voices, only musical notes.

I think the graphical interface displaying notes and scores onscreen is a major reason for the Mac-musician romance. However, MIDI hasn't reached the cut, copy, and paste stage like text, graphics, and QuickTime. You'll see QuickTime movies support MIDI tracks. If the audio in a movie is MIDI, QuickTime must read only a few bytes, so you have more band width for the video. You can get a larger screen size, more colors, a higher frame rate, or more movie length. MIDI support in QuickTime will increase MIDI's popularity as well.

SMPTE

SMPTE is a time code or broadcast-quality production: in other words, a timing method. QuickTime architecture is designed to support alternate time codes, and the film industry can do much to promote QuickTime. By the time Apple creates hardware capable of supporting full-screen, full-frame rate video, QuickTime will support SMPTE time code. We may see SMPTE support in QuickTime even sooner.

Interactivity

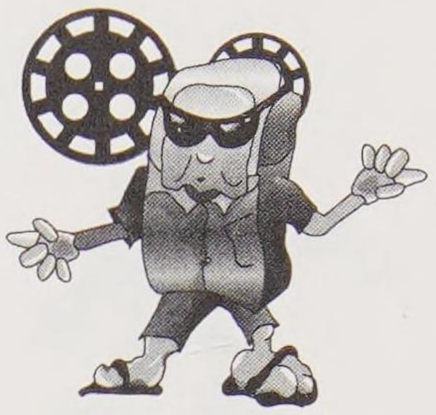
Imagine a QuickTime amusement park. The camera pans the park. You click on the ride you want: the roller coaster. You're transported to a movie that depicts riding that roller coaster.

Interactivity is QuickTime's future. You'll code regions within a screen, and when the viewer clicks on items on the screen, the appropriate code activates a movie handler to interpret that code. The handler can take you to another movie or another location in the current movie. The handler even can activate the computer-controlled chair in which you are sitting! Interactivity is almost the fourth dimension of the desktop.

The QuickTime Forum



This book cannot keep pace with QuickTime—the writing must stop, but QuickTime will evolve and grow. If you want to keep pace with QuickTime technology, subscribe to *The*



QuickTime Forum newsletter ($75 for 10 issues annually). This newsletter is a great resource for learning about QuickTime. *The QuickTime Forum* contains articles explaining technologies embedded in QuickTime, such as sound and video. The newsletter's glossary of terms is valuable in itself. Christine Perey, the editor, lists vendors and products related to QuickTime and reports on upcoming events featuring QuickTime technology. Write to: *The QuickTime Forum*, c/o Mackler Corporation, 11 Ferry Lane West, Westport, CT 06880, telephone 800-635-5537.

Copyright and Copying

I choose to end this chapter with a brief discussion of copying because the subject has become more relevant. QuickTime magnifies the importance of protecting intellectual rights.

Because QuickTime movies are digital, you can copy someone else's sounds and images easily. Using fantastic editors such as VideoFusion, you easily can modify someone's work and call it your own. We'll never have enough policing bodies to enforce the copyright infringement possibilities with QuickTime movies, so you must discipline yourself. I encourage you to find the owner of the media to get permission.

I once saw an article in a newsletter containing some Lingo scripting I wanted to use. The newsletter clearly stated that the scripting was property of the author. I called the author and explained how I wanted to use his code and he verbally granted me permission to do so without cost.

I urge you to respect others' hard work. Pay for what you use and get permission according to the authors' licensing wishes. You'll feel good, you'll see more quality material become available, and you'll make the creator feel good too.





CHAPTER



11

Cool Solutions to Uncool Problems

Manufacturers only recently have introduced products supporting QuickTime. Until QuickTime is part of every Mac and every Mac can support QuickTime, problems will exist. Because of QuickTime's modularity, you may experience problems with components, also.

Problem:

When I run a QuickTime program, I get a system bomb complaining about an unimplemented trap.

Solution:

Put the QuickTime INIT into your System folder. Most programs check to ensure you've installed QuickTime. If you haven't installed QuickTime, the program displays a dialog box telling you so. Some programs don't check first, start using the QuickTime functionality, then crash.

Problem:

I selected the video compressor, but I can't tell the compressor I want 256 or millions of colors. The compressor is stuck on thousands of colors.

Solution:

The Apple video compressor only supports 16-bit video, or thousands of colors. You can't access the other colors with Apple video compression. If you want another color depth, select a different compressor.

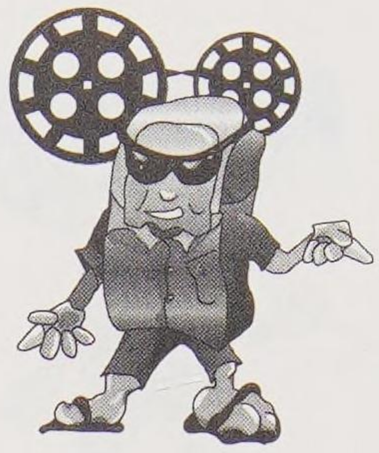
Problem:

My movie is jerky when I start it, especially if the movie plays from the CD-ROM drive.

Solution:

That's a fact of QuickTime life. QuickTime buffers movie data so it can play continuously while simultaneously grabbing more data. When starting up or moving to another point in the movie, QuickTime must flush the current buffers and reload.





Problem:

I'm running System 6.0.X and...

Solution:

STOP! First, QuickTime works only under Systems 6.0.7, 6.0.8, and 7.X. System 6 supports some QuickTime features ... and some bugs. If you have problems, install System 7 and try again.

Problem:

I'm trying to digitize video, but nothing displays on the screen.

Solution:

Make sure you've selected the correct digitizing component. If you can't select the digitizing component for your digitizer, either you never installed the digitizer or your digitizer doesn't support the QuickTime standard vdig method for digital video acquisition. The VideoSpigot has a non-QuickTime method of acquiring video.

If you've selected the correct digitizing component, check the compatibility between the digitizer and the video card you are using.

Problem:

I can't get a digitizing frame rate equal to what the digitizer's manufacturer claims.

Solution:

Try digitizing to RAM, if your digitizing software supports this situation. Digitizing to RAM is the fastest method to get video. The amount of video you can digitize is limited to the amount of RAM in your computer. If digitizing to RAM gives you the desired frame rate, purchase a *lot* more RAM.



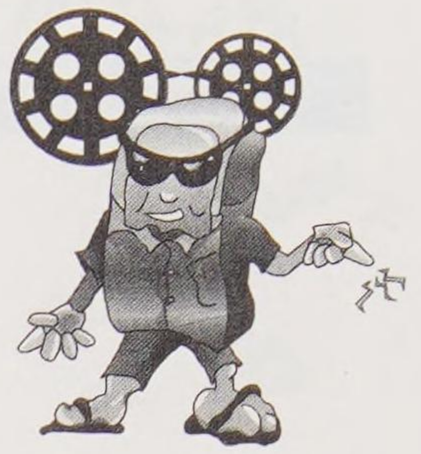
Problem:

I edited a movie, but the process took a long time and the movie looks different from the way I arranged it in the timeline.

Solution:

Increase the QuickTime editing program's partition size.





Index

A

accessing digitizers, 12
activating movies in word processing documents, 88
active source rectangle, 67
AIFF (Audio Interchange File Format), 22-23, 52
aliasing, 64, 93
amplitude, 23-24
analog signals
  audio, 58-63
  video, 58-63
animation, 92
  compressor, 36
  files, size, 55
  importing, 55
  output, 88
anti-aliasing, 55, 93
Apple Intro News, 95
aspect ratio, 50, 66
audiences, 58
audio, 21
  analog, 58-63
  clips, 74
  component, 62
  digital, embedding, 22
  digitizers, 68-70
  editing, 52
  filtering, 52
  sampling rate, 69
  signals, out, 68
  storing, 22
  support, 82-83
  tracks, 13-14, 21, 23
Audio Interchange File Format (AIFF), 23
automatic key framing, 34

B

badges icon, 51
balance, volume, 24
bit depth, 28, 65-66
bitmapped images, 93-94
blending, 81
boards
  daughter, 100
  EyeQ, 100
  RISC (reduced instruction set computer), 100
bombs, 106
buffers, frame, 28
built-in compressor, 34-36
buttons
  Pause, 47
  Play, 47-48
  Step Back, 49-50
  Step Forward, 50

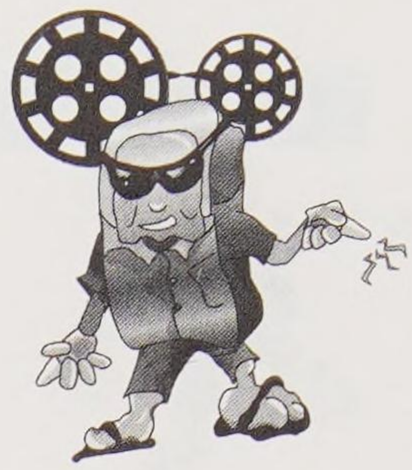
C

cables, S-video, 63
caching movies, 44
CameraMan, 94
capturing
  audio, analog, 58-63
  controlled, 65
  digital data, 57-58
  speed, 64-65
  to RAM, 70
  video
    analog, 58-63
    to hard disks, 69-70
cards, video, RasterOps, 100
cathode-ray tube (CRT), 27
CD-ROM, 12, 44
cdevs (control panel devices), 40
CDs
  photo, 101
  players, 99
channels, sound, 22
chrominance, 62

clipping
Image Compression Manager, 11
images, 21
clips
ordering, 74
sound, 74
video, 74
ClipTime, Volume 1, 95
closed captioning, 67
CM, *see* Component Manager
codecs, 11
codes, time, 102
color, 44
conversion, Image Compression Manager, 11
cycling, 81
images, digitized, 63
troubleshooting, 106
true color, 28
color difference signal, 62
colorizing, 81
component audio, 62
Component Manager (CM), 10-12, 39-41
component video, 62
components, 40-41
digitizers, video, 63
installing, 41
subtypes, 41
composite video format, 62
composite video signals, 64
compositing, 81
compression, 25-27, 101
data dependency, 30
frames, 29
lossless, 26
lossy, 26
movie data, 25
ratio, 30
spatial, 29-34
speed, 30-31
temporal, 29, 33-34
types, 35
compressors, 11
animation, 36
built-in, 34-36
graphics, 36
photo, 35
turbo, 10
video, 36, 106
configuring editing programs, 74
consolidating files, 70
control panel devices (cdevs), 40
controlled capture, 65
controls, 46
conversion, color, 11
converting
digital-to-analog, 22
numbers to sounds, 22
signals to video format, 90
copyrights, 103
creating
boards, daughter, 100
EDL (edit decision list), 76
cropping, 66
CRT (cathode-ray tube), 27

D

data dependency, 30
daughter boards, creating, 100
defragmenting drives, 70
delta frames, 34
Developer's Conferences, 1
dialog boxes
Open, 45
Preview, 45
digital image processing, 79-82
digital
audio, embedding, 22
data, capturing, 57-58
filters, 74
imagery, 70
signals, 60
digital video editors, 77
digital-to-analog convert, 22
digitizers, 100
accessing, 12
audio, 68-70
video, 63-68
bit depth, 65-66
components, 63
hardware, 63-64
digitizing
card, 41
frame rate, 107
video, 107
direction, 14
display
boundaries, 21
region, 10
displaying images, full-frame, 99



dithering, 34
documents, moving in, 88
drives, defragmenting, 70
duration, 14

E

edit decision list (EDL), 76
editing, 73-74
  audio, 52
  programs, configuring, 74
  timeline view, 77
  tracks, audio, 23
  troubleshooting, 108
  video, imported, 53
editing bay, 76
editors, 73, 77
EDL (edit decision list), 76
effects, 53
  filters, 80
  Premiere, 79-80
  tracks, 53
  transitional, 81
  VideoFusion, 81
  VideoShop, 80-81
electron gun, 27-28
electronic mail, 6
embedding digital audio, 22
enabled tracks, 20
Extensions folder, 11, 44
EyeQ board, 100

F

fades, 81
file formats
  AIFF, 52
  converting to movies, 70
  graphics, 3
  PICS, 70
  PICT, 70, 98
files
  consolidating, 70
  Macintosh, 88-89
  movies, 12, 54
  PICT, 3
  project, 53
  sizes, animation movies, 54-55
  'snd' resource, 22
fill shapes, 21
filter effects, 80
filtered-down sampling, 64
filtering
  images, 21
  sound, 52
filters, 74, 81
folders
  Extensions, 44
  System, 44
formats
  images, PICT, 37
  importing, 54
  video, 60
four-tone synthesizer, 22
frame buffer, 28
frame rate, 66
  digitizing, 107
  modifying, 49
frames, 29, 74
  capturing, 64-65
  delta, 34
  key, 33-34
full-frame images, 99

G

generation loss, 62
geometric transformations, 81
graphical manipulation, 21
graphics
  compressor, 36
  file formats, 3
grouping tracks, 19

H

handles, 50
hard disks
  seek time, 69
  video capture, 69-70
  write speed, 69
hardware
  requirements, 44-45
  video digitizers, 63-64
hierarchical tracks, 15
Home Entertainment Center, 54
Human Interface Guidelines, 2
HyperCard stacks, 86

I

ICM (Image Compression Manager), 10, 25, 30
  frames, 29
  PICT file, 11
  raw compressor, 31
icons
  badges, 51
  movies, 85
Image Compression Manager, *see* ICM
image compressors, 41

image data, uncompressed, 26
image decompres-sors, 41
images
  bitmapped, 93-94
  clipping, 21
  color, digitized, 63
  cropping, 66
  digital processing, 79-82
  filtering, 21
  formats, 37
  full-frame, 99
  graphical manipulation, 21
  moving, 21, 70
  PICT, 3
  reading from media, 21
  resizing, 21, 66
  rotating, 21
  scaling, 21
  shrinking, 66
  size, 67
  still, 70
  stretching, 66
  superimposing over movies, 80
  translating, 21
  video, digitized, 63
importing
  animation, 55
  formats, 54
  video, 52-53
indexing media, 93
inpoints, 17, 53
inserting frames, 34
installing components, 41
integrated word processing, 88
interlaced signals, 90

J–K–L

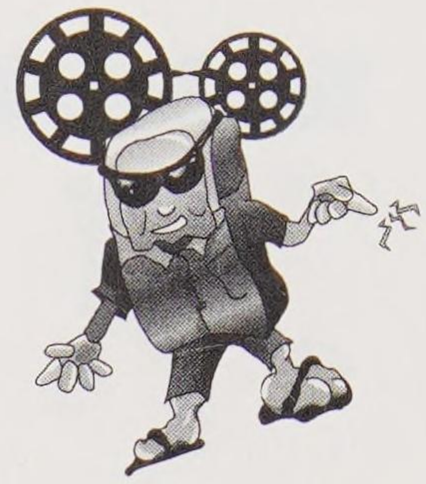
Joint Photographic Experts Group (JPEG), 11, 35, 41

key frames, 33
  automatic framing, 34
  inserting, 34
  rate, 34

languages, 19
layers, 41-42
line signals, 68
living documents, 88
loading media data, 20
location markers, 15
looping mode, 44
looping movies, 48
lossless compression, 26
lossy compression, 26
luminance, 62

M

MACE (Macintosh Audio Compression and Expansion, 22
MacRecorder, 52
markers, 15
mathematical matrix operations, 21
matte, track, 21
maximum source rectangle, 67
media
  images, reading, 21
  integration, 4
  handler, 20
media organization, 93
MediaTree, 93
micons (movie icons), 85
microphones, 52
MIDI (musical instrument device interface), 92, 102
Miracle Piano, 92
modes
  looping, 44
  poster, 20
  preview, 20
  standard playback, 20
monaural sound, 24
monitors
  additional, 3
  color, 27
  pixels, 27-28
  raster, 27
  resolution, 28
  RGB, 27
MoonRaker, 52
movie controllers, 41
Movie Toolbox, 10, 20
movies
  activating in word processing documents, 88
  CD-ROMs, 12
  compressing, 25
  converting from file formats, 70
editing, 52, 73-74, 77
files, 12
  Macintosh, 88-89
  sizes, 54
inpoints, 17
location markers, 15
MIDI tracks, 102
moving in documents, 88
outpoints, 17



output, 83, 87
posters, 15
premade, 71
previewing, 53
resizing, 50
reverse, 14
sampling, 95
sound-only, 89
stand-alone, 83
Steve's Cool QuickTime Message, 52
stopping, 17
structure, 14
time, 16
tracks, 14, 19
word processing, 88-89
MovieWorks, 92
moving
images, 21
movies in documents, 88
multimedia, 4
musical instrument device interface, *see* MIDI

N–O

negative rate of time, 14
NTSC video signals, 60
NuBus, 100
numbers, converting to sounds, 22

objects (pictures), anti-aliasing, 93
Open dialog box, 45
optimal viewing size, 50
ordering clips, 74
outpoints, 17, 53
output, 87
animation, 88
paper, 83
QuickTime Movies, 83
video, 83-84
overlaying tracks, 21

P

parallel processing, 64
partitions, 108
Pause button, 47
pausing movie, 48
PCM (pulse-code modulation), 22
personal computers (PCs), 2
perspective transformations, 81
photo CDs, 101
photo compressor, 35
PICS file format, 70
PICT
files, 11, 70, 98
images, 3, 37
mask, 53
pictures (objects), anti-aliasing, 93
pixels
bit depth, 28
color depth, 28
depth conversion, 31
raster, 27
reduced image, 64
resolution, 28
Play button, 47-48
play options, 48-49
playback, 99
reverse, 48
settings, 17
playing media data, 20
playouts, 82
points, sound, storing, 22
Popcorn, 45
ports, serial, 98
positive rate of time, 14
poster mode, 20
posters, 15-16
PowerBook, 99
preferred
rate, 18
volume, 18
premade movies, 71
Premiere, 52, 73, 79
Preview dialog box, 45
preview mode, 20
previewing, 10, 15-16, 45, 53, 82
printing to videotape, 90
processing
images, digital, 79-82
parallel, 64
spatial, 18
processors, multiple, 100
projects, 53
pulse-code modulation (PCM), 22

Q

QuickDraw, 3
QuickTime players, CD-based, 99
The QuickTime Forum newsletter, 102

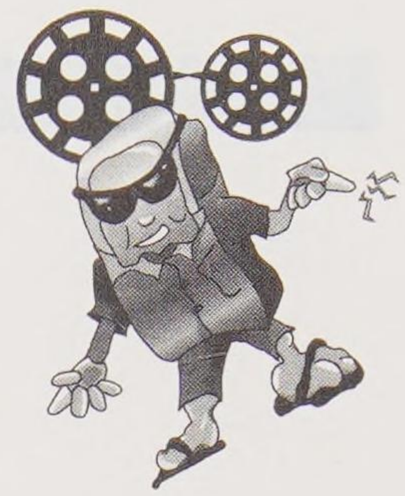
R

radiosity, 55
RAM, 99
applications, 44
capturing to, 70
random access, 33
raster, 27

RasterOps, 100
rate
  preferred, 18
  sample, 24
rate of time, 14
raw compressor, 31
ray tracing, 55
READ ME file, 4
reading images from media, 21
recording
  computer screen, 94
  Movie Toolbox, 10
rectangles
  active source, 67
  defining, 21
  maximum source, 67
  vertical blinking, 67
reduced image pixels, 64
reduced instruction set computer (RISC), 100
reflectivity, 55
refraction, 55
resizing
  images, 21
  movies, 50
resolution, 28
Resolve, 12
reverse movies, 14
reverse play mode, 33
RGB
  signals, 62
  monitors, 27
RISC (reduced instruction set computer), 100
rotating images, 21

S

S-video, 62-63
sampled sound synthesizer, 22
sampling
  audio, rate, 69
  movies, 95
  rate, 24
scales, time, 13
scaling, 11, 21
Scrapbook, 4, 44-45
screen dots, 27
screens
  recording, 94
  sizes, 51
scroll boxes, 48-49
seek time, 69
segments, 80-81
sequence capturers, 41
serial ports, 98
settings
  playback, 17
  preferred, 18
  volume, 23
shading, 55
shadows, 55
shrinking images, 66
signal-to-noise ratio, 65
signals
  analog, 59-60
  audio, out, 68
  converting to video format, 90
  digital, 60
  interlaced, 90
  line, 68
  RGB, 62
  video, 60, 64
  Y/U/V, 64
sine wave, 60
size
  files, 54-55
  sample, 24
  screens, 51
  viewing, increasing/decreasing, 50
size handle, 50
sizing images, 66
sliders, 47
Smoothie, 93-94
SMPTE, 102
'snd' resource files, 22
software requirements, 10, 44-45
sound clips, 74
Sound Manager, 22
sound track, 55
sound wave forms, 22
sound-only movies, 89
SoundEdit Pro, 52
sounds
  channels, 22
  converting numbers to, 22
spatial compression, 29, 32-34
spatial processing, 18
speaker icon, 47
special effects, *see* effects
speed, 14
  capturing, 64-65
  compression, 30-31
  determining seconds, 14
speed jogger, 49
stand-alone movies, 83
Standard Movie Controller, 46



standard playback mode, 20
start up, troubleshooting, 106
starting without mouse, 48
Step Back button, 49-50
Step Forward button, 49-50
Steve's Cool QuickTime Message, 52
stopping action, 17
storing media data, 20
storyboards, 75-76
StrataVision, 54, 88
stretching images, 66
structure, 14
superimposing images over movies, 80
surface glow, 55
surface mapping, 55
synthesizers, 22
System 6, 107
System folder, 11, 44
system software, 10

T

TeachText, 3-4, 44
teletext, 67
temporal compression, 29
  delta frames, 34
  key frames, 33-34
time, 13, 16
  bases, 13
  codes, 102
  current, 17
  rate, 14
  scales, 13
time-based corrector device, 5
time-based media, 12
time-coordinate system, 13-14
timeline view, 77
timing sources, 41
tracking modules, 39
tracks, 18-20
  audio, 13-14, 21
  editing, 23
  enabled, 20
  grouping, 19
  hierarchical, 15
  matte, 21
  multiple, 19
  overlaying, 21
  posters, 15
  rectangles, 21
  special effects, 53
  video, 13-14
transcoding, 70
transformations, geometric, 81
transition effects, 81
translating images, 21
transparency, 55
traps, 106
troubleshooting
  colors, 106
  digitizing
    frame rate, 107
    video, 107
  editing, 108
  start up, 'jerky' video, 106
  unimplemented trap, 106
true color, 28
turbo-compressor, 10

U–V

unimplemented trap, 106

vertical blanking, 67
vertical blinking rectangle, 67
video
  analog, capturing, 58-63
  capturing to hard disks, 69-70
  cards, RasterOps, 100
  clips, 74
  component, 62
  compressor, 36, 106
  digital, editors, 77
  digitizing, 107
  formats, 60, 62
  frames, 74
  images, digitized, 63
  importing, 52-53
  NTSC signal, 60
  output, 83-84
  overlaying on video, 81
  signals, 62
    composite, 64
    interference, 65
    NTSC, 60
    standards, 60-61
    tracks, 13-14
  video digitizers, 41
    bit depth, 65-66
    components, 63
    hardware, 63-64
    images
      color, 63
      resizing, 64
      size, 67
      video, 63
    picture quality, 64

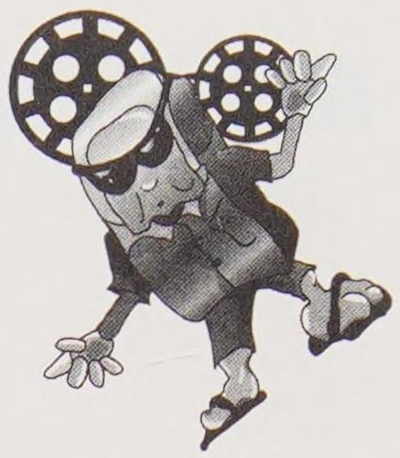
video out, 89-90
VideoFusion, 73, 81
VideoShop, 73, 80-81
VideoSpigot, 41, 52
videotape, 13, 90
viewing
    jogger control, 49
    optimal size, 50
    size, adjusting, 47, 50
views, 77
visual
    catalogs, 86
    desktop, 85
voices, 102
volume, 23
    balance, 24
    preferred, 18
volumn control, 47

W

WalkThrough, 54, 92
wave-table synthesizer, 22
word processing
    integrated, 88
    movies, 88-89
write speed, 69

X–Y–Z

Y/U/V (color difference
    signal), 62-64



Using the Cool Movie Disk

The files on this disk are compressed. You need 1.7M of hard disk space to install these files. Follow this procedure to decompress the files:

1. Insert the Cool Movie Disk into your high-density floppy drive (also known as an HDFD). All Macs capable of supporting QuickTime, except the Macintosh II, have the HDFD.

2. Double-click on the icon named "Cool Movies.**sea**" ("sea" stands for self-extracting archive). This launches the Compactor Pro application inside the archive to install the files on your hard disk.

3. Choose to install the files on your hard disk (obviously there isn't room on the floppy).

4. Click on the **Extract** button when you are satisfied as to where to place the files. A progress bar tells you how far the process has to go. You'll see five files: **Popcorn™**, **Popcorn™ Read Me**, **Steve's Cool QT Message.Moov**, **QT Entertainment Center.Moov**, and **QuickTime™**.

5. If you've already installed QuickTime™ on your computer, you can discard the QuickTime™ file. If you haven't installed QuickTime on your computer yet, drag the QuickTime™ file onto your **System** folder of your startup disk. This file will be placed into your **Extensions** folder within your **System** folder if you are running System 7.x. You must restart your Macintosh after installing QuickTime™ into the **System** folder before the Macintosh activates QuickTime™.

If you are anxious to see the QuickTime movies, you can

1. Double-click on either movie

2. Drag either movie onto the Popcorn™ program

3. Launch Popcorn™, then use the **Open** option

That's all there is to it. Have fun!

How This Book Was Created

This book is especially cool because it, along with all Hayden titles, was created entirely on the Macintosh computer. The text was written and edited in Microsoft Word 5 on a Quadra 700. The screen captures were taken with Advanced Software's QuickTools QT/Snipper control panel device. Illustrations were created with Aldus FreeHand 3.1. The



video was captured with the SuperMac VideoSpigot, Workstation Technologies MoonRaker and BoomBox, and Macromedia MacRecorder and SoundEdit. The QuickTime movies were created with Adobe Premiere and StrataVision 3D 2.5. Communications were courtesy of the phone company, Federal Express, and AppleLink.

What's on the Cool Movie Disk

Your Cool Movie Disk contains files that enable you to use QuickTime—the coolest system extension ever. The disk contains the QuickTime extension and Popcorn, an application that enables you to view QuickTime movies on your Mac. The disk also includes samples of QuickTime movies. There are a total of five files in your Cool Movie Disk. The following is a description of the files contained on the disk. Have a good time!



QuickTime. A system extension that manages multimedia. Coolest thing to happen to the Mac since the LaserWriter.



Popcorn. An engine (application) that shows QuickTime movies on your Mac. Requires QuickTime to operate.

Popcorn Read Me. This is a TeachText document with important information about Popcorn. Be sure to read it first!

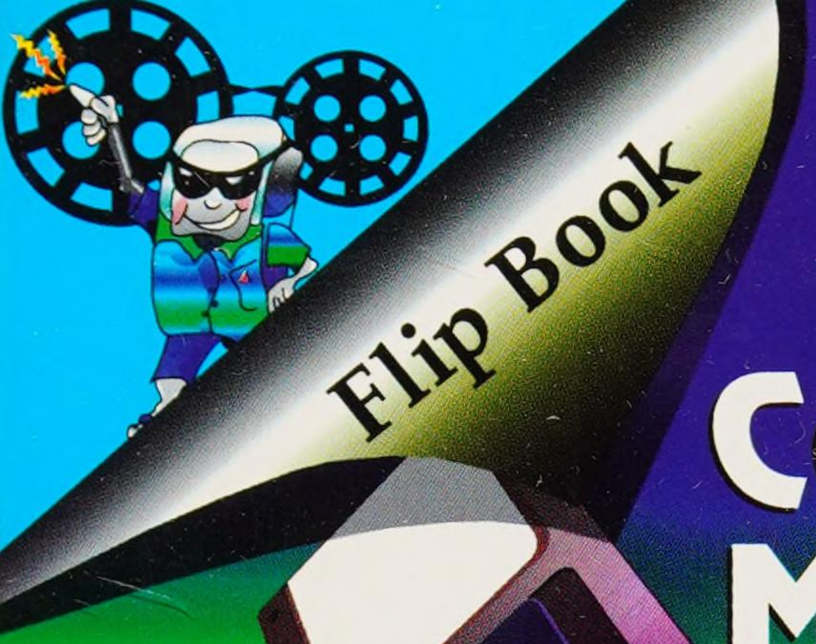
Steve's Cool QT Message.Moov. A QuickTime file introduction you to *Cool Mac QuickTime*.

QT Entertainment Center.Moov. A QuickTime movie with animated effects.

Caution: If you insert the Cool Disk (a high density disk) into an 800K (double-density) floppy drive, you may see the message `This disk is unreadable: Do you want to initialize it?` If this occurs, click **`Eject`**. Do not initialize the disk! Find a friend who has a SuperDrive. SuperDrives can read 1.4M (high-density) floppy disks. Double-density drives cannot read high-density disks.







Cool Mac™ QuickTime™

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- Popcorn™—a QuickTime player
- The exceptional QuickTime extension
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- Vital documentation

"It's a lot like something. It's right on the tip of my tongue. Yes. I've got it! It's...Rosebud!"
—Orson Yells

"Now you can really dance with the dark beneath the not-so-pale Mac light. After all, this book helps you make a movie"
—The Jokir

"I've never seen such a...a...complete resource...on uh...such...a...significant technology. And of course, I'm doing it a favor by even considering it technology..."
—Woody Yallin

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Steve Sanz

has been a promoter of the microcomputer revolution since the late 70's. Since 1985, he has been a small business consultant in automation and planning. He also has expertise in chip technologies, software, networking, telecommunications, multimedia technologies, and video imaging. Steve founded and runs the Multimedia Users Group of Orange County.

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