Introduction

W hen the definitive history of personal computing is finally written, 1992 will undoubtedly be described as "The Year of Multimedia." Multimedia technology, combining computer-generated graphic images with sound, had been implemented on personal computers prior to 1990—first on Commodore Atari and later on Apple Macintosh computers. Microsoft Corporation introduced *Windows 3.0 with Multimedia Extensions* and the *Multimedia PC Specification 1.0* in the fall of 1991. IBM simultaneously unveiled its *Ultimedia* product line. More than 100 firms announced plans to provide hardware and software to support Microsoft's Multimedia PC standard. Microsoft announced in early 1992 that Windows 3.1 would include the audio subset of the Multimedia Extensions, eliminating the requirement for a CD-ROM drive to explore multimedia techniques with the PC. Windows 3.1 was released in April, 1992, and the multimedia market began its upward spiral.

Why a Book on Multimedia

Multimedia is not a product, it's an enabling technology. Multimedia enables you to combine sound and graphic images—still, animated, and video—with your computer. Exploring multimedia techniques is fun, and it's not expensive. You can add basic sound and music capability to your PC with a $100 adapter card. Doubling your investment to $200 or so enables you to record and reproduce stereo sound with audio-CD fidelity. Easy-to-use musical composition and printing applications for Windows cost $100 or less. Never in the history of digital computing has the entry cost of an important new technology been so low.

Another $300 to $400 opens the door to multimedia CD-ROMs (Compact Disc Read-Only Memory) that can hold over 600 megabytes of images and sound on a single 5-inch disc—the equivalent of 100 million words or so. New *titles*, the name given to commercial CD-ROMs, are issued daily. These titles create an electronic library of interactive text, graphics, and sounds pertinent to almost any topic in which you might have an interest. The federal government is one of the largest CD-ROM producers in the world, providing census data, detailed maps of the entire U.S., and Government Printing Office catalogs on CD-ROMs. Book publishers have converted many of their popular encyclopedic products to CD-ROM and are now beginning to issue original works on CDs.

If you own a camcorder, market research shows that you are very likely to have your own PC at home. Video-in-a-Window cards, now available in the $400 range, enable you to watch color television images on your video display. You can capture video frames as still images and save them to disk files with just a few mouse clicks. Add a $250 video output card or plug a video adapter between your VGA adapter card and display, and you have the basic equipment necessary to record your computer-generated images on videotape. The ability to display, edit, and record full-motion video using conventional VCRs and camcorders is creating a new industry—desktop video (DTV), which is the multimedia equivalent of desktop publishing.

One of Microsoft's major contributions to multimedia technology is Windows itself. The Windows graphical environment provides the foundation for displaying still, animated, and video images. The audio multimedia extensions of Windows 3.1 enable you to synchronize sound with images. Microsoft projects that 10 to 15 million copies of Windows 3.1 will be installed by the end of 1993. Every user of Windows 3.1 is a prospective customer for a sound card and a CD-ROM drive. The economics of production scale and suppliers' attempts to capture market share will keep the cost of PC multimedia technology low.

Just a few of the present applications for Windows-based multimedia presentations and CD-ROM titles include the following:

■ *Education and curriculum development.* K-12 textbook publishers offer a wide range of interactive instructional material on CD-ROMs. Children tend to learn faster and retain more content with interactive, rather than passive, presentations. IBM's Illuminated Books and Manuscripts series is one of the best examples of this genre. Multimedia techniques are especially suited to adult literacy and English as a Second Language (ESL) courses.

■ *Industrial and Commercial Training.* A mini-industry has developed that creates generic multimedia CDs to train workers in safety practices and other industrial operations such as soldering. Interactive

training CD-ROMs have been developed for specialized assembly-line operations and even telephone etiquette. American Airlines, for example, plans to provide mechanics with aircraft maintenance manuals on CD-ROMs.

■ *Desktop Video Publishing.* Multimedia techniques, combined with videographic adapter cards, enable you to create videotape productions on your computer in the same way conventional desktop publishing applications, such as Aldus PageMaker, enable you to create your own professional-appearing print publications.

■ *On-line Help for Windows Applications.* Microsoft's Multimedia Works for Windows and Lotus Development's Multimedia SmartHelp for Lotus 1-2-3 for Windows are harbingers of a new type of entertaining, interactive help system for mainstream applications.

■ *Informational kiosks.* Tourist bureaus install booths with touch-screen displays to show animated views of points of interest, together with "how to get there" maps. Advertising firms use similar techniques to create animated mini-billboards with multilingual narration.

■ *Point-of-sale product showcases.* Video rental stores use touch-screen displays to let browsers see the trailers of popular new videotape releases. Department stores display products on special sale with illustrations and voice-over narration.

■ *Interactive product catalogs.* Office furniture manufacturers use multimedia to provide three-dimensional views of their products in typical settings. Additional files enable interior designers to import scaled images into their own computer-aided designs. Fashion designers issue CD-ROMs with video clips and still images of their new lines so that buyers can review them at their leisure.

■ *Product operating manuals.* Microsoft Multimedia Works and Multimedia SmartHelp for Lotus 1-2-3 for Windows use CD-ROMs that expand traditional help files to entertaining explanations of the use of these applications. You can expect other Windows applications to adopt this new approach.

■ *Sales presentations.* Real-estate developers and brokers use Kodak's low-cost Photo CDs to provide clients with full-color interior and exterior snapshots of listed properties. Soon, photo finishers will be able to add narration to the presentation.

■ *Architectural and engineering proposals.* A&E firms are using Virtual Reality (VR) multimedia techniques to create animated three-dimensional walk-throughs in design proposals. Developers use multimedia productions to entice prospective lessors to acquire space in office buildings and retail malls.

■ *Maps and geographic information systems.* World atlases are published on CD-ROM, together with the national anthems of each country and brief examples of the languages spoken. A complete U.S. atlas with almost every street and address in the country retails for less than $100.00.

■ *Home education.* Titles in CD-ROM formats for those with multi-media-equipped PCs provide children and adults alike an engaging technique to expand their intellectual horizons. Microsoft's *Beethoven* CD-ROM plays the Ninth Symphony in high-fidelity audio and enables you to follow the score during the performance. Software Toolworks' low-cost *Miracle Piano* teaches you how to play by a widely acclaimed multimedia approach to musical instruction.

■ *Personal entertainment.* Computer games with a new level of realism and detail have been created especially for multimedia-equipped PCs. The addition of background music and actors' voices adds to the enjoyment of these products. You can expect a new level of sophistication in computer games, similar to that employed in advanced board games, now that multimedia has arrived.

All of the application categories in this list, except videotape production, share a common characteristic: they require user interaction. An active user role in determining the content and sequence of the presentation of the images and sound distinguishes multimedia from the passive viewing of motion pictures and television. A CD-ROM title that involves no user interaction at all is possible, but such a product would be only a high-cost substitute for a video cassette or a video laserdisc. VCRs and laserdisc players are far less expensive than the PCs required for reproducing multimedia titles. Interaction is what justifies the additional cost of the computer. When you see the word *multimedia*, mentally precede it with *interactive*. Interactive multimedia is what this book is about.

There is no question that multimedia is an effective medium for CD-ROM titles that entertain and enlighten. Multimedia undoubtedly will prove an effective marketing tool for many types of industrial, commercial, and consumer products and services. Whether interactive multimedia productions can be created that will truly enrich the human experience in a manner similar to that of great literary works remains an unsettled question. Authors of fiction, for instance, may not want to relinquish control over the form and sequence of their works to the user. Even if the answer to the enrichment question is ultimately "no," desktop multimedia can and undoubtedly will thrive on its education and amusement values alone.

Hundreds, perhaps thousands, of pages in computer magazines and newsletters have been devoted to explaining what multimedia is about, analyzing whether multimedia is a "real" technology, and reviewing the

rash of PC hardware products and software applications that incorporate "multimedia" in their names or descriptions. Multimedia is a "hot topic," and magazine editors need hot topics to break the monotony of those never-ending series of reviews of 80x86 clones, adapter cards, and peripherals. Some writers decry multimedia as nothing but hyper-technology without purpose. Others are enthusiastic proponents. Seldom do two articles share a common definition of the word "multimedia."

Discover Windows 3.1 Multimedia is designed to bring order to the chaos of print and televised material on the subject. A multimedia production on a CD-ROM may be a better method to introduce you to this relatively new technology, but you couldn't realize its content without owning a CD-ROM player. If you purchase a CD-ROM player without understanding the differences between CD-DA and CD-ROM XA, you are very likely to purchase a CD-ROM that will become obsolete quite soon. If you buy a low-cost audio adapter card to go with your CD-ROM player, you may be very disappointed in its fidelity, especially if you are a musician. A bit of study before committing the $200 or thereabouts for a quality MPC sound card and the additional $300 or more for CD-ROM capability will pay handsome dividends.

System Requirements for Multimedia Applications

You can add high-fidelity audio capability to any computer that is capable of running Windows and has one open adapter card slot. Even an 8-MHz 80286 computer can be used. Windows and its applications will run slowly, but sound cards will perform all of their functions—except digital audio recording and reproduction at the higher sampling rates.

Prior to the introduction of Windows 3.1, a CD-ROM drive was required to obtain access to Windows' Multimedia Extensions. This was because Windows with Multimedia (the name later given to Windows 3.0 with Multimedia Extensions 1.0) was supplied only on a CD-ROM. Windows 3.1 now includes the majority of Version 1.0 of the Microsoft Multimedia Extensions (MMEs). Applications that need the MMEs and multimedia applets omitted from Windows 3.1 come with the Microsoft versions or proprietary duplicates on floppy disk.

If you want to take full advantage of PC multimedia, with its capability to combine sound and animated graphics, you need a computer and peripheral hardware that meet at least a minimum set of standards originally established by Microsoft but now maintained by a PC industry organization, known as the Multimedia PC Marketing Council.

The Multimedia PC Marketing Council's Specification 1.0, last modified in December, 1991, requires at least a 16-MHz 80386SX computer with 2M of RAM, a standard VGA display, and a 30M hard disk drive. An audio adapter card and CD-ROM drive completes the minimum package for a Multimedia PC (MPC). This configuration will provide adequate performance with waveform audio and still graphics or simple animation, but not real-time digital video. All requirements of the MPC Specification 1.0 are provided in Appendix A.

The purpose of the MPC Specification is to ensure interoperability of the computer, audio adapter card, and CD-ROM drive. You can purchase an MPC-labeled computer from dealers or by mail order and be assured that it will *probably* meet the MPC basic specifications. These combinations, however, are generally priced somewhat higher than a similar system of equivalent capability purchased from your local PC-clone dealer, and are not necessarily the optimum system for your intended uses. Recommendations for specific computer hardware to meet the needs of multimedia production appear at the end of Chapter 1.

Who Should Read This Book

You do not need to be a computer "expert" or programmer to use this book effectively. *Discover Windows 3.1 Multimedia* is expressly designed for readers who:

- Own a Sound Blaster or Thunder Board card and want to use it with Windows applications.

- Have decided that multimedia may be the reason to make the plunge into personal computing or buy a new and faster PC, and want to know if they should purchase an MPC-labeled product or choose their own components.

- Are considering upgrading their existing PC to add multimedia sound and graphics capabilities and need to know what they should purchase.

- Have already purchased a Multimedia Upgrade Kit, a CD-ROM drive, or an MPC audio adapter card and want to learn to use it more effectively.

- Are thinking of ways to improve the impact of their presentations on management or potential customers for their products.

- Need to consider multimedia as a dynamic new form of product brochure.

- Are photographers seeking new markets for their work through technologies such as Kodak's Photo CD system.

- Want to see what's involved in creating a multimedia training or instructional title and how much it might cost to produce one or more.

- Are musicians or composers who want to learn how MIDI techniques are used in multimedia applications, or choreographers who want to try combining music and animation to design new routines.

- Want to expand their graphic arts consulting practice to include multimedia productions.

- Own a camcorder and would like to use a PC for titling and editing personal or business videotapes.

- Are system integrators or value-added resellers who want to provide their clients with networked multimedia systems based on the MPC standard.

Although multimedia involves computer technology, it also is an art form. Therefore, *Discover Windows 3.1 Multimedia* includes more subjective matter than is common in computer-related books. Readers are encouraged to verify these subjective observations for themselves, especially when they involve the expenditure of funds.

Discover Windows 3.1 Multimedia makes the assumption that you have Windows installed on your computer and that you are familiar with its operations. This book is intended for those who are familiar with Windows and are motivated to learn about multimedia sound and graphics.

Why You Should Use This Book

Discover Windows 3.1 Multimedia is a comprehensive guide to understanding the elements of sound and visual images that comprise multimedia productions within the Windows environment. This book is designed as a tutorial and a reference work to supplement the very limited sound-related content of the *User's Guide* included with Microsoft Windows 3.1. As its title suggests, this book shows you how to use multimedia. This book is written from the viewpoint of a musician and graphic artist, not from that of a programmer.

This book includes a description of the hardware required to create high-fidelity sound with your PC and explains how MPC audio adapter card specifications relate to real-world perception of audio quality. Current and emerging standards for CD-ROM drives are covered in detail.

Discover Windows 3.1 Multimedia explains how to set up the required multimedia drivers for your PC using the Drivers function in Program Manager's Control Panel and how to use the MIDI Mapper applet with

your sound card. This book covers the hardware and software you need to view and hear commercial CD-ROMs. You learn how you can make your own Windows-based multimedia presentations and even create multimedia titles for commercial distribution on CD-ROMs.

Musical Instrument Digital Interface (MIDI) techniques, plus MIDI hardware and software, are covered in depth. You learn about recent multimedia technologies, such as real-time, compressed digital video. This book includes a complete glossary of multimedia terminology newly added to "computerese," like CD-ROM XA, CD-I, Red Book audio, and MIDI system-exclusive messages.

This book provides the background you need to use the Windows Media Control Interface (MCI) commands with other programming languages for Windows, such as Visual Basic, Turbo Pascal for Windows, C, or C++. Extensive coverage is given to the Media Control Interface's high-level mciSendString() function, together with sample code that uses this function in Visual Basic.

Although *Discover Windows 3.1 Multimedia* is aimed primarily at audio and video hardware and software designed for use under Windows 3.1, other related products are also covered.

How This Book Is Organized

Discover Windows 3.1 Multimedia is divided into seven parts. Each part covers a major element in the development of multimedia productions, whether for your own entertainment or for commercial distribution. This book begins with the basics of the new sound capabilities built into Windows 3.1. You then proceed to the use of still and animated graphics in multimedia. The emerging field of desktop video production is covered with chapters describing the hardware and applications you need to record multimedia productions on videotape. The book concludes with a section on programming multimedia applications and what you can expect from multimedia in the future.

Part I: The Multimedia Functions of Windows 3.1

Part I introduces you to the basic capabilities of the audio extensions of Windows 3.1 that build the foundation for multimedia sound. You learn how to install and use audio adapter cards and CD-ROM drives in the Windows 3.1 environment.

Chapter 1, "What is Windows Multimedia?," introduces the Multimedia Personal Computer (MPC) and explains the significance of the Multimedia PC Specification 1.0 that establishes the minimum standards that a PC must meet to be considered an MPC-compliant system.

Chapter 2, "Understanding Audio Adapter Cards," describes how sound cards record and play back digitally sampled sound and synthesized music, and presents a brief history of pre-MPC sound on the PC. Descriptions of the different types of MPC- and non-MPC compliant audio adapter cards and devices available today are included, together with suggestions for choosing an audio adapter card.

Chapter 3, "Understanding CD-ROM Drives and Adapters," tells how the CD-ROM was developed, describes the basic CD-ROM required by the MPC specification, and then goes on to explain the differences between types of CD-ROM drives as well as other popular CD formats.

Chapter 4, "Preparing Your System for Multimedia," describes how to install a typical audio adapter card and how to avoid problems that arise when audio adapter cards conflict with cards already installed in your computer.

Chapter 5, "Preparing Windows for Multimedia," explains how you set up and use drivers supplied with Windows 3.1 and by audio adapter card manufacturers to link your card to Windows applications.

Part II: Using Sound in Windows

Part II introduces you to the applets supplied with Windows 3.1 to control audio adapter cards and shows you how to add sound to popular Windows applications.

Chapter 6, "Playing and Recording Waveform Audio Files," uses Windows 3.1's Sound Recorder to record and reproduce digitally sampled sound, and explains Media Player's digital sound playback capability.

Chapter 7, "Playing MIDI Files," uses Media Player to demonstrate your audio adapter card's synthesized sound capabilities and demystifies the MIDI Mapper function of Windows' Control Panel.

Chapter 8, "Incorporating Sound in Windows Applications," describes how the object linking and embedding (OLE) features of Windows 3.1 enable you to embed or link sounds to documents created by Windows word processing and spreadsheet applications.

Part III: Musical Synthesis and MIDI

Part III comprises chapters that are devoted to the Musical Instrument Digital Interface (MIDI), an industry standard that predates the MPC by several years.

Chapter 9, "Music Synthesizers," explains how audio adapter cards create synthesized music by digital FM synthesis and by reproducing samples of the actual sounds of musical instruments.

Chapter 10, "The MIDI Standard and Windows 3.1," describes the original MIDI specification that is the backbone of the electronic musical instrument industry today, and the General MIDI (GM) specification incorporated in MPC Specification 1.0.

Chapter 11, "Accessories for MIDI Systems," gives examples of the more common types of MIDI devices, such as piano-style keyboards, that you can connect to the MIDI OUT connection of your audio adapter card.

Chapter 12, "MIDI Applications for Windows," provides examples of the new sequencer applications written for Windows that you can use to record, compose, or edit MIDI music.

Part IV: Digital Audio Techniques

Part IV delves into some of the technical aspects of sampled digital sound and explains how to record professional-quality sound for multimedia presentations.

Chapter 13, "Digital Audio Sampling, Reproduction, and Compression," describes how sound waves are converted to digital data that you can store on a hard disk and then play back through your audio adapter card. Compression techniques to save disk space also are discussed.

Chapter 14, "Editing and Converting Waveform Audio Files," shows you how to use Sound Recorder and commercial sound editing applications to modify your recorded sound files in a variety of ways.

Chapter 15, "Waveform Audio Recording Techniques," aids you in selecting and using the microphones and other audio components you need to record professional-sounding narration and sound effects for multimedia productions.

Part V: Adding Multimedia Graphics

Part V changes the emphasis from sound to vision. Part V covers the hardware and software you need to manipulate still, animated, and video images in the multimedia environment.

Chapter 16, "Graphic Displays and Adapter Cards for Windows," describes how display adapters and video display units work and the VGA and Super-VGA standards that determine your computers graphics capabilities.

Chapter 17, "Image Acquisition, Editing, Interchange, and Compression," covers the use of still graphic images in multimedia applications and discusses the many formats and compression methods used by drawing and image editing applications, including Kodak's new Photo CD technology.

Chapter 18, "Presentation Graphics and Animation Techniques," gives examples of some of the new Windows applications specifically designed for creating multimedia presentations using both still and animated graphics.

Chapter 19, "Incorporating Digital Video," introduces you to the adapter cards you need to view full-motion television in a sizable window and the adapters required to convert your VGA or SVGA adapter card's output to a standard television signal you can record with a VCR.

Part VI: Authoring Multimedia Productions

Part VI covers the techniques used to produce commercial multimedia titles on CD-ROMs and how to create your own multimedia productions on videotape.

Chapter 20, "The Multimedia Production Process," describes how multimedia titles are developed, from the original concept through duplicating the CD-ROM in production quantities. Recommendations for the computer hardware you need to author multimedia productions are included.

Chapter 21, "Advanced MIDI and Waveform Audio Techniques," discusses synchronization of sound and images, including video synchronization with the SMPTE time code. Explanations of how to incorporate digitally sampled sound as a MIDI Meta Event—using MIDI System Exclusive Messages—and the special structures of Windows' multimedia RIFF files are included.

Chapter 22, "Desktop Video Production," introduces you to the new techniques and applications that enable you to create video productions with your PC. The chapter provides detailed information on video recording standards, the video equipment you need, and the new applications for computer-based editing of video productions.

Part VII: Multimedia Programming Techniques

Part VII describes the Windows 3.1 media control interface and how the functions it provides can be used with other applications and programming languages to control the operation of multimedia devices.

Chapter 23, "The High-Level MCI Commands of Windows 3.1," covers the syntax of the media control interface's mciSendString() command that you insert in Windows applications, such as MIDI sequencers, or incorporate code you write in programming languages for Windows.

Chapter 24, "Programming with MCI Commands," gives examples of the use of the MCI command strings described in Chapter 23 in Visual Basic programs and with MIDI sequencers.

Chapter 25, "Multimedia in the Future," concludes the book with projections of the new developments you can expect in multimedia hardware and applications in the next two years or so.

Appendixes

A complete glossary includes terms that may be unfamiliar to readers new to multimedia or to the audio and video technologies Windows 3.1 multimedia introduces to the PC.

The appendixes provide multimedia reference material. Appendix A extracts information from the "Multimedia Personal Computer Specification 1.0" and provides additional recommendations for the hardware required to make your PC multimedia-compliant. Appendix B describes the command-line parameters for MSCDEX.EXE, the application that lets DOS and Windows communicate with CD-ROM drives. Appendix C lists the standard melodic and percussive voices for the synthesized sound functions of your MPC-compliant audio adapter card. Appendix D provides tables that list the specific components of MCI command strings for a variety of multimedia devices. Appendix E explains the binary and hexadecimal arithmetic that is used in many MIDI messages. Appendix F consists of a list of suppliers of multimedia hardware and applications, with addresses and telephone numbers. Appendix G describes the CompuServe forums specifically devoted to multimedia or related technologies and how to download multimedia files to your computer. Appendix H describes how to obtain updated multimedia drivers for audio adapter cards and other multimedia-related hardware.
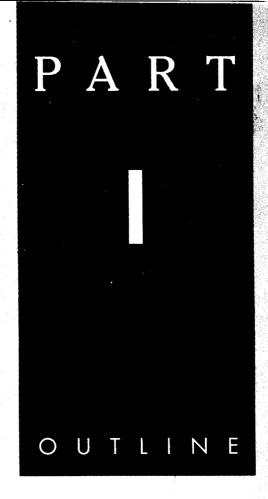
This book includes a music-oriented companion disk. The inside front cover describes the software included on this disk. The last page of this book provides installation instructions for the companion disk.

How To Use This Book

A somewhat unorthodox style is required to accomplish this book's objective of being both a tutorial and a reference for multimedia PC audio and graphics applications. Major topics, such as MPC sound, start with a brief description of the technology involved and the computer hardware and software required to use it within the Windows environment. A description of representative commercial products, available at the time this book was written, follows. Next come step-by-step instructions for installing and using typical hardware products. Complex subtopics, such as CD-ROMs and MIDI systems, are then detailed in entire parts or chapters of their own.

If sound on the PC is a new subject for you, start at the beginning of the book. If you already have a Sound Blaster or another audio adapter card installed and operating under DOS, jump to Chapter 5 and learn how to install the drivers you need to make the card compatible with Windows 3.1. Those readers who are musicians experienced with MIDI applications running under DOS may want to begin with Chapter 7, "Playing MIDI Files," check out the new Windows sequencer applications described in Chapter 12, and then skip to Chapter 21, which explains MIDI synchronization techniques used with Windows multimedia.

The Multimedia Functions of Windows 3.1

PART

1

OUTLINE

What Is Windows Multimedia?

Understanding Audio Adapter Cards

Understanding CD-ROM Drives and Adapters

Preparing Your System for Multimedia

Preparing Windows for Multimedia

What Is Windows Multimedia?

This chapter introduces you to multimedia in the Microsoft Windows environment, providing an overview of the detailed information contained in the following chapters. This chapter begins with a description of the crucial contribution of quality sound to multimedia technology. You learn about the common denominator of multimedia—audio adapter cards—and learn how these cards are used in multimedia Windows applications to synchronize sound with graphic images.

This chapter also touches on the emerging field of full-motion video technology for multimedia and explains how audio adapter cards relate to video production. If you haven't purchased an audio adapter card for your PC yet, you probably will want one by the time you finish reading Chapter 2, which describes PC audio adapter cards in detail.

The Advent of Sound

When *The Jazz Singer* ushered in the age of talking pictures in October 1927, it revolutionized the entertainment industry. Silent films became obsolete overnight, and the ubiquitous movie-house piano players began to join the ranks of the unemployed. So, too, will the mute PC ultimately become a thing of the past. Windows 3.1 ushers in the age of sound on the PC.