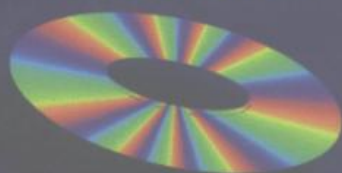


# Using Digital VIDEO

ARCH C. LUTHER



**CD-ROM  
Included**



# **Using DIGITAL VIDEO**

**ARCH C. LUTHER**



**AP PROFESSIONAL**

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# Preface

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Personal computer buyers have become used to the fact that the new computer they just bought likely will be obsolete in six months or at least by then the price will have dropped substantially below what they paid for it. They also realize that new features and capabilities for existing machines will regularly appear through new software. This constant shifting of the ground beneath the feet of PC owners is one reason why personal computers are so exciting and, at the same time, so exasperating.

One recent such movement is the growing mass-market availability of digital motion video for PCs. Now we can see and create television-style video and sound through software on any PC. It has its limitations, but they soon will fade away as the hardware industry catches up with the demands of this new software. Although I used the words “television-style,” PC video isn’t the same as television because it exists in the environment of the PC *along with everything else the PC could already do*. PC video is a new tool that creates new opportunities for those who embrace it and integrate it effectively into applications.

Unlike television, PC video is so new that the rules for the best ways to use it are not yet fully written. It is different from everything else in the PC, and it is different from other uses of video technology. At the same time, PC video has a price in terms of its required system performance and data storage capabilities. The benefits of using video must be in proportion to the price it exacts. This means that the opportunity is also a challenge.

People who create video applications today are breaking new ground, finding new applications, writing new rules. However, there is already a lot to know about PC video in both technical and nontechnical areas. This book presents that information, for either technical or artistic readers. Its purpose is to give you the background needed so you can effectively move into that elite group who are pioneering PC video, learning where it fits and where it doesn’t fit, and writing the guidelines for its use.

Although PC video is being enabled by technological developments, it will not be widely used until it is embraced by the developer community—those people who figure out what computers should be used for and how best to use them. There are developers at many levels, from those who create commercial applications for mass sale to the individuals who create applications for their own use or for use locally in their companies. The thrust of this book is more toward the latter developers than the former. My experience falls in both developer camps,

and I also have a lot of technological experience. I have focused this book on the needs of the small developer, who does not care about the technical details except where they are necessary to understand what a product can do. Technical discussions do appear, but believe me, they are things that every PC video user has to know to make sensible decisions about applications. In any case, you do not need a great technical background to read this book.

To help those who are not familiar with the terminology and jargon of the video industry, I have carefully defined every such term the first time I use it. To signify that, I italicize the term at that time. The most important terms are also included in the Glossary at the end of the book. In most cases, the Glossary definition goes a little further than the definition in the text. However, once you see an italicized term, I will expect that you will know what it means when I use it later.

I have always been disturbed by the need to use compound personal pronouns such as he/she to recognize both genders, since the English language doesn't provide a simpler approach. In this book I have adopted an approach that I hope won't disturb anyone. In odd-numbered chapters, the pronouns are male, and in even-numbered chapters they are female. So, if at any point you are upset with my use of personal pronouns, just read on to the next chapter.

The book is organized into 15 chapters, as follows: Chapters 1–4 are introductory and tutorial to acquaint you with the video industry and the technologies. Beginning with Chapter 5 and continuing to Chapter 9, I cover the basic principles of audio and video production and postproduction, which are the processes of acquiring audio and video from original sources. From Chapter 10 up to Chapter 14, I discuss the various techniques and alternatives for creating applications of motion video and audio. Chapter 15 is a look at the future of this industry. That is important because things are changing rapidly and they are likely to move even faster in the future. This chapter will help you keep your feet on the ground as the industry dashes past!

Many hardware and software products are mentioned or described in the book. The purpose of this is to teach how typical products work for specific tasks—it is not to compare products with one another. Video products are changing so rapidly that the book sticks to fundamentals; to keep up to date, you should follow the periodicals mentioned in the Bibliography.

A CD-ROM is included with this book. It contains a large number of data items and software tools for testing and evaluating digital video (and audio) systems. These can be used on Windows or OS/2 PC systems. Instructions for setting up your system to use the CD are given in Appendix C at the back of the book.

The application of motion video and audio on computers has finally come of age. It is now possible to have it on almost any PC, but it is still very much frontier country and the number of new programs being developed is mind boggling. This book will introduce you to all that and help you decide how digital video will become part of your life.



# Acknowledgments

Although this book has only one author, it not the work of one person. Many others helped me with input material, discussions, reviews, figures, software packages, and many of the other things that go into a project like this. I'll try to name as many here as possible; if I have left someone out—I'm sorry—it was not intentional. My friends and helpers include Tom Vreeland, Alan Rose, Kayle Luther (my daughter), Wayne Jerves, Les Wilson, Rickey Gold, Jim Wickizer, John Smiley, Barbara Tescher, and especially Helen Larkin (my aunt), who has had to put up with my constant alternation between California and New Jersey.

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# Introduction

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*video: electronic reproduction of images*

Television is by far the largest and oldest application of video technology, and we often equate video with television. However, the preceding definition embraces many other kinds of video, some of which are covered in this book. Returning to TV, it is a means of mass communication where a centralized source (station) broadcasts video and audio program material to many receivers (viewers). Most TV program material is motion video, where separate images (*frames*) are transmitted often enough that smooth motion is perceived by the viewer. A TV system displays a wide range of colors and provides realistic reproduction of almost any natural scene. Television is a mature technology that has a massive infrastructure in place for both the technology and the programming that supports it.

TV broadcasting uses radio frequency transmission or, in cable TV, receivers are wired directly to the source with cable or optical fiber. A viewer usually can choose from a number of sources—in fact, with cable TV, the number of available sources connected to one cable may reach into the hundreds.

From a viewer's standpoint, each source is called a *channel* and it is accessed through a selector on his TV receiving equipment. However, once a viewer chooses a channel, he can see only whatever that channel is broadcasting at the moment. It is not possible for any viewer to affect the behavior of the video source because TV is a one-to-many *one-way* communication system. The viewer's only means of interacting is to change sources (channels) or to turn off the TV. In spite of being noninteractive, TV has a powerful ability to inform, teach, or entertain.

A subset of the TV business has developed because of the explosive emergence of video recorders (VCR) in the home. An entire industry is devoted to creation, replication, and distribution of pre-recorded TV video on tape for both entertainment and information publishing.



But TV is only one of many possible applications for video technology. For example, video equipment similar to that of TV is often used for surveillance, monitoring, engineering, etc. In most of these cases, each video pickup device (camera) is connected to one or only a few receivers (*monitors*). The purpose is for someone at a remote location to view what is happening at the location of the camera. The camera may be located where it would be impractical for an observer to be physically present or it may be that the output of the camera is recorded for viewing at a later time. Other possibilities are that one viewer can observe several locations or several viewers can observe the same things. Such applications usually depend on motion video capability.

Another large application of video technology is in personal computer (PC) displays. Every PC has a video monitor that dynamically displays the current status and output of the computer. In this case, the video may or may not be motion video. In fact, most computer displays today do not show motion video, but, by the previous definition, they still qualify as video devices. But the video equipment for computer display is totally different from TV equipment—it is digital.

A digital video application that is related to PCs is the video game. These are special-purpose devices designed to provide dynamic video and audio capability at the lowest cost for interactive entertainment use. Because of their low cost, there are more video game machines in use in homes than there are PCs. Another class of video game is designed for use in arcades. Here the need for performance outweighs the need for low cost. Video game machines will not be discussed further in this book.

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## ANALOG AND DIGITAL

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Image reproduction in TV is *analog* (see Figure 1.1). That means the electrical signals for TV are continuously varying: at any time the TV video signal can have minute variations of value as long as the value stays within the available range. This analog nature allows a TV system to reproduce a wide range of colors with very fine gradation or shading wherever needed by the scene in front of the camera. (This will be discussed with much more technical exactness in Chapter 2.) Although the existing systems of TV broadcasting and cable TV work fine, analog systems have many difficulties that limit their performance. These problems are caused by the system introducing small changes into the signals that accumulate as signals are transmitted or processed. The changes may be in the form of small random fluctuations (called *noise*), amplitude changes, or other distortions. However, analog technology was the only thing that existed when