

June 2000



# A Digital Video Primer

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from the Adobe |  
Dynamic Media Group

## Introduction

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There's a lot to know about the technology involved in video. There are entire industries focused on the nuances of professional video including cameras, storage, and transmission. But there's no need to be intimidated by all this technology. As video has migrated to the desktop, it has gotten increasingly easier to produce high quality work with a minimum of underlying technical know-how. This paper isn't going to tell you everything, but it will give you a brief overview of the basics.

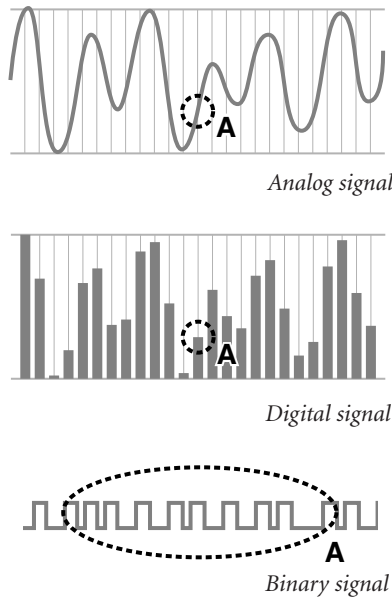
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## VIDEO BASICS

Figure 1: Video signals



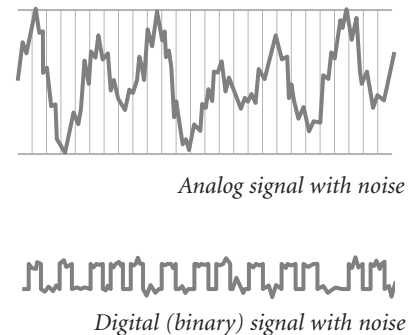
### Analog Versus Digital Video

One of the first things you should understand is the difference between **analog** and **digital** video. Your television (the video display with which we are all most familiar) is an analog device. The video it displays is transmitted to it as an analog signal, via the air or a cable. **Analog signals** are made up of continuously varying waveforms. In other words, the value of the signal, at any given time, can be anywhere in the range between the minimum and maximum allowed. **Digital signals**, by contrast, are transmitted only as precise points selected at intervals on the curve. The type of digital signal that can be used by your computer is **binary**, describing these points as a series of minimum or maximum values -- the minimum value represents zero; the maximum value represents one. These series of zeroes and ones can then be interpreted at the receiving end as the numbers representing the original information. (Figure 1).

There are several benefits to digital signals. One of the most important is the very high fidelity of the transmission, as opposed to analog. With an analog signal, there is no way for the receiving end to distinguish between the original signal and any **noise** that may be introduced during transmission. And with each repeated transmission or duplication, there is inevitably more noise accumulated, resulting in the poor fidelity that is attributable to generation loss. With a digital signal, it is much easier to distinguish the original information from the noise. So a digital signal can be transmitted and duplicated as often as we wish with no loss in fidelity. (Figure 2).

The world of video is in the middle of a massive transition from analog to digital. This transition is happening at every level of the industry. In broadcasting, standards have been set and stations are moving towards digital television (DTV). Many homes already receive digital cable or digital satellite signals. Video editing has moved from the world of analog tape-to-tape editing and into the world of digital **non-linear editing** (NLE). Home viewers watch crystal clear video on digital versatile disk (DVD) players. In consumer electronics, digital video cameras (DV) have introduced impressive quality at an affordable price.

Figure 2: Noise




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*Desktop video... enables you to work with moving images in much the same way you write with a word processor. Your movie "document" can quickly and easily be edited and re-edited to your heart's content...*

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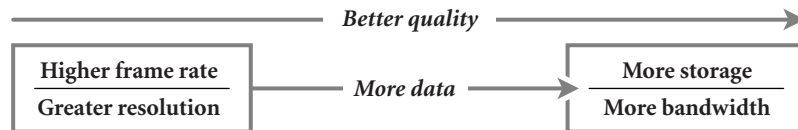
The advantages of using a computer for video production activities such as non-linear editing are enormous. Traditional tape-to-tape editing was like writing a letter with a typewriter. If you wanted to insert video at the beginning of a project, you had to start from scratch. Desktop video, however, enables you to work with moving images in much the same way you write with a word processor. Your movie "document" can quickly and easily be edited and re-edited to your heart's content, including adding music, titles, and special effects.

### Frame Rates and Resolution

When a series of sequential pictures is shown to the human eye, an amazing thing happens. If the pictures are being shown rapidly enough, instead of seeing each separate image, we perceive a smoothly moving animation. This is the basis for film and video. The number of pictures being shown per second is called the **frame rate**. It takes a frame rate of about 10 frames per second for us to perceive smooth motion. Below that speed, we notice jerkiness. *Higher frame rates make for smoother playback.* The movies you see in a theatre are filmed and projected at a rate of 24 frames per second. The movies you see on television are projected at about 30 frames per second, depending on the country in which you live and the video standard in use there.

The quality of the movies you watch is not only dependent upon frame rate, however. The amount of information in each frame is also a factor. This is known as the **resolution** of the image. Resolution is normally represented by the number of individual picture elements (**pixels**) that are on the screen, and is expressed as a number of horizontal pixels times the number of vertical pixels (e.g. 640x480 or 720x480). All other things being equal, a *higher resolution will result in a better quality image*.

You may find yourself working with a wide variety of frame rates and resolutions. For example, if you are producing a video that is going to be shown on VHS tape, CD-ROM, and the Web, then you are going to be producing videos in three different resolutions and at three different frame rates. The frame rate and the resolution are very important in digital video, because they determine how much data needs to be transmitted and stored in order to view your video. *There will often be trade-offs between the desire for great quality video and the requirements imposed by storage and bandwidth limitations.*



## Interlaced and Non-interlaced Video

If your video is intended to be displayed on a standard television set (as opposed to a digital tv or a computer monitor), then there is one more thing you should know about video frame rates. Standard (non-digital) televisions display **interlaced** video. An electron beam scans across the inside of the screen, striking a **phosphor** coating. The phosphors then give off light we can see. The intensity of the beam controls the intensity of the released light. It takes a certain amount of time for the electron beam to scan across each line of the television set before it reaches the bottom and returns to begin again. When televisions were first invented, the phosphors available had a very short persistence (i.e., the amount of time they would remain illuminated). Consequently, in the time it took the electron beam to scan to the bottom of the screen, the phosphors at the top were already going dark. To combat this, the early television engineers designed an interlaced system. This meant that the electron beam would only scan every other line the first time, and then return to the top and scan the intermediate lines. These two alternating sets of lines are known as the “upper” (or “odd”) and “lower” (or “even”) **fields** in the television signal. Therefore a television that is displaying 30 frames per second is really displaying 60 fields per second.

Why is the frame/field issue of importance? Imagine that you are watching a video of a ball flying across the screen. In the first 1/60th of a second, the TV paints all of the even lines in the screen and shows the ball in its position at that instant. Because the ball continues to move, the odd lines in the TV that are painted in the next 1/60th of a second will show the ball in a slightly different position. If you are using a computer to create animations or moving text, then your software must calculate images for the *two* sets of fields, for *each* frame of video, in order to achieve the smoothest motion. Software like **Adobe® Premiere®** and **Adobe® After Effects®** handle this correctly. The frames/fields issue is generally only of concern for video which will be displayed on televisions. If your video is going to be displayed only on computers, there is no issue, since computer monitors use non-interlaced video signals.

## RGB and YCC Color

Most of us are familiar with the concept of **RGB** color. What this stands for is the Red, Green, and Blue components of a color. Our computer monitors display RGB color. Each pixel we see is actually the product of the light coming from a red, a green, and a blue phosphor placed very close together. Because these phosphors are so close together, our eyes blend the primary light colors so that we perceive a single colored dot. The three different color components — Red, Green, and Blue — are often referred to as the **channels** of a computer image.

Computers store and transmit color with 8 bits of information for each of the Red, Green, and Blue components. With these 24 bits of information, over a million different variations of color can be represented for each pixel (that is 2 raised to the 24th power). This type of representation is known as **24-bit color**.

Televisions also display video using the red, green, and blue phosphors described above. Television signals are not transmitted or stored in RGB, however. Why not?

When television was first invented, it worked only in black and white. The term “black and white” is actually something of a misnomer, because what you really see are the shades of gray between black and white. That means that the only piece of information being sent is the brightness (known as the **luminance**) for each dot.

When color television was being developed, it was imperative that color broadcasts could be viewed on black and white televisions, so that millions of people didn’t have to throw out the sets they already owned. Rather, there could be a gradual transition to the new technology. So, instead of transmitting the new color broadcasts in RGB, they were (and still are) transmitted in something called YCC. The “Y” was the same old luminance signal that was used by black and white televisions, while the “C’s” stood for the color components. The two color components would determine the hue of a pixel, while the luminance signal would determine its brightness. Thus both color transmission and black and white compatibility were maintained.

Should you care about the differences between RGB and YCC color? For most applications, you probably won’t ever need to think about it. Products like *Adobe Premiere* and *Adobe After Effects* can mix and match video in the different formats without a problem. It is good to understand the differences, however, when you have honed your basic skills and are ready to tackle more sophisticated technical challenges like color sampling and compositing.

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*At some point almost all video will be digital... but it doesn't mean that you can ignore the analog video world.*

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## Analog Video Formats

At some point almost all video will be digital, in the same way that most music today is mastered, edited and distributed (via CD or the Web) in a digital form. These changes are happening, but it doesn’t mean that you can ignore the analog video world. Many professional video devices are still analog, as well as tens of millions of consumer cameras and tape machines. You should understand the basics of analog video.

Because of the noise concerns discussed earlier, *in analog video the type of connection between devices is extremely important*. There are three basic types of analog video connections.

**Composite:** The simplest type of analog connection is the composite cable. This cable uses a single wire to transmit the video signal. The luminance and color signal are composited together and transmitted simultaneously. This is the lowest quality connection because of the merging of the two signals.

**S-Video:** The next higher quality analog connection is called S-Video. This cable separates the luminance signal onto one wire and the combined color signals onto another wire. The separate wires are encased in a single cable.

**Component:** The best type of analog connection is the component video system, where each of the YCC signals is given its own cable.

How do you know which type of connection to use? Typically, *the higher the quality of the recording format, the higher the quality of the connection type*. The chart on the next page outlines the basic analog video formats and their typical connections.

### *The basic analog video formats and their typical connections*

Tape Format	Video Format	Quality	Appropriate Application
VHS	Composite	Good	home video
S-VHS, Hi-8	S-Video	Better	prosumer, industrial video
BetaSP	Component	Best	industrial video, broadcast

## Broadcast Standards

There are three television standards in use around the world. These are known by the acronyms **NTSC**, **PAL**, and **SECAM**. Most of us never have to worry about these different standards. The cameras, televisions, and video peripherals that you buy in your own country will conform to the standards of that country. It will become a concern for you, however, if you begin producing content for international consumption, or if you wish to incorporate foreign content into your production. You can translate between the various standards, but quality can be an issue because of differences in frame rate and resolution. The multiple video standards exist for both technical and political reasons. The table below gives you the basic information on the major standards in use today around the world.

### *Broadcast standards*

Broadcast Format	Countries	Horizontal Lines	Frame Rate
NTSC	USA, Canada, Japan, Korea, Mexico	525 lines	29.97 frames/sec
PAL	Australia, China, Most of Europe, South America	625 lines	25 frames/sec
SECAM	France, Middle East, much of Africa	625 lines	25 frames/sec

The SECAM format is only used for broadcasting. In countries employing the SECAM standard, PAL format cameras and decks are used. Remember that the video standard is different from the videotape format. For example, a VHS format video can have either NTSC or PAL video recorded on it.

## Getting Video Into Your Computer

Since your computer only “understands” digital (binary) information, any video with which you would like to work will have to be in, or be converted to, a digital format.

**Analog:** Traditional (analog) video camcorders “record” what they “see and hear” in the real world in analog format. So, if you are working with an analog video camera or other analog source material (such as videotape), *then you will need a video **capture** device that can “digitize” the analog video.* This will usually be a **video capture card** that you install in your computer. A wide variety of analog video capture cards are available. The differences between them include the type of video signal that can be digitized (e.g. composite or component), as well as the quality of the digitized video. The digitization process may be driven by software such as **Adobe Premiere**. Once the video has been digitized, it can be manipulated in your computer with **Adobe Premiere** and **Adobe After Effects**, or other software. After you are done editing, you can then output your video for distribution. This output might be in a digital format for the Web, or you might output back to an analog format like VHS or Beta-SP.

**Digital:** Recently, digital video camcorders have become widely available and affordable. Digital camcorders “translate” what they record into digital format *right inside the camera*. So your computer can work with this digital information as it is fed straight from the camera. The most popular digital video camcorders use a format called **DV**. To get DV from the camera into the computer is a simpler process than for analog video because the video has already been digitized. Therefore the camera just needs a way

to communicate with your computer (and vice versa). The most common form of connection is known as the **IEEE 1394** interface. This is covered in more detail in a later section.

## Video Compression

Whether you use a capture card or a digital camcorder, in most cases, *when your video is digitized it will also be compressed*. **Compression** is necessary because of the enormous amount of data that comprises uncompressed video.

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*It would take over 1.5 GB  
(gigabytes) to hold a minute  
of uncompressed video!*

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A single frame of uncompressed video takes about 1 megabyte (MB) of space to store. You can calculate this by multiplying the horizontal resolution (720 pixels) by the vertical resolution (486 pixels), and then multiplying by 3 bytes for the RGB color information. At the standard video rate of 29.97 frames per second, this would result in around 30 MB of storage required for each and every second of uncompressed video! It would take over 1.5 gigabytes (GB) to hold a minute of uncompressed video! In order to view and work with uncompressed video, you would need an extremely fast and expensive disk array, capable of delivering that much data to your computer processor rapidly enough.

*The goal of compression is to reduce the data rate while still keeping the image quality high.* The amount of compression used depends on how the video will be used. The DV format compresses at a 5:1 ratio (i.e. the video is compressed to one-fifth of its original size). Video you access on the Web might be compressed at 50:1 or even more.

## Types of Compression

There are many different ways of compressing video. One method is to simply *reduce the size of each video frame*. A 320x240 image has only one-fourth the number of pixels as a 640x480 image. Or we could *reduce the frame rate of the video*. A 15 frame-per-second video has only half the data of a 30 frame-per-second video. These simple compression schemes won't work, however, if we want our video to be displayed on a television monitor at full resolution and frame-rate. What we need is another way of approaching the compression problem...

It turns out that the human eye is much more sensitive to changes in the *luminance* of an image than to changes in the *color*. Almost all video compression schemes take advantage of this characteristic of human perception. These schemes work by discarding much of the color information in the picture. As long as this type of compression is not too severe, it is generally unnoticeable. In fact, in even the highest quality "uncompressed" video used by broadcasters, some of the original color information has been discarded.

When each frame is compressed separately, it is known as "*intra-frame*" compression. But some video compression systems utilize what is known as "*inter-frame*" compression. Inter-frame compression takes advantage of the fact that any given frame of video is probably very similar to the frames around it. So, instead of storing the entire frame, we can store just the *differences* between it and the frame that came before.

The compression and decompression of video is handled by something called a **codec**. Codecs may be found in hardware — for example, in DV camcorders or capture cards — or in software. Some codecs have a fixed compression ratio and therefore a fixed data rate. Others can compress each frame a different amount depending on its content, resulting in a data rate that can vary over time. Some codecs allow you to choose a quality setting that controls the data rate. Such adjustable settings can be useful in editing. For example, you may wish to capture a large quantity of video at a low quality setting in order to generate a rough edit of your program, and then recapture just the bits you want to use at a high quality setting. This allows you to edit large quantities of video without needing a drive large enough to hold the entire set at high-quality. The chart on the next page lists some sample types of video codecs and their typical applications.

*Sample video codecs and typical applications*

<b>Format</b>	<b>Resolution</b>	<b>Compression Type</b>	<b>Data Rate</b>	<b>Applications</b>
MJPEG	720x486	Intra-frame	0.5 – 25 MB/sec	General
MPEG-1	352x240	Intra-frame	.01-.06 MB/sec	CD-Rom, Web
MPEG-2	720 x 480	Intra- and Inter-frame	.01- 2 MB/sec	DVD, Satellite TV
DV	720x480	Intra-frame	3.5 MB/sec	Consumer, Industrial, Broadcast
D1	720 x 486	none	25 MB/sec	Broadcast



## DV TECHNOLOGY

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### What is DV?

One of the most exciting changes in the world of video has been the arrival of the DV camcorder. What is DV and why is it so important? The term “DV” is commonly applied to a variety of different things.

**DV Tape:** First, the DV designation is used for a special type of tape cartridge used in DV camcorders and DV tape decks. A DV tape is about the size of a typical audio cassette. Most of us are actually more familiar with the *mini-DV* tape, which is smaller than the basic DV tape -- about half the size of an audio cassette.

**DV Compression:** DV also connotes the type of compression used by DV systems. Video that has been compressed into the DV format can actually be stored on any digital storage device, such as a hard drive or a CD-ROM. The most common form of DV compression uses a fixed data rate of 25 megabits/sec for video. This compression is called “DV25.”

**DV Camcorders (Cameras):** Finally, DV is applied to camcorders that employ the DV format. When someone refers to a “standard” DV camcorder, they are talking about a video camcorder that uses mini-DV tape, compresses the video using the DV25 standard, and has a port for connecting to a desktop computer. Today, such DV camcorders are in use by both consumers and professionals.

### Benefits of DV

There are many benefits to DV, particularly when compared to analog devices like VHS decks or Hi-8 cameras.

**Superior images and sound:** A DV camcorder can capture much higher quality video than other consumer video devices. DV video provides 500 lines of vertical resolution (compared to about 250 for VHS), resulting in a much crisper and more attractive image. Not only is the video resolution better, but so is the color accuracy of the DV image. DV sound, too, is of much higher quality. Instead of analog audio, DV provides CD-quality sound recorded at 48Khz with a resolution of 16 bits.

**No generation loss:** Since the connection to your computer is digital, there is no generation loss when transferring DV. You can make a copy of a copy of a copy of a DV tape and it will still be as good as the original.

**No need for a video capture card:** Because digitization occurs in the camera, there is no need for an analog-to-digital video capture card in your computer.

**Better engineering:** The quality of the DV videotape is better than for analog devices. Plus, the smaller size and smoother transport mechanism of the tape means DV cameras can be smaller and have more battery life than their analog counterparts.

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### IEEE 1394

*IEEE 1394 is also known as  
“FireWire” and “i.LINK”*

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You can directly transfer digital information back and forth between a DV camcorder and your computer. The ports and cables that enable this direct transfer use the **IEEE 1394** standard. Originally developed by Apple Computer, this standard is also known by the trade names **FireWire®** (Apple Computer) and **i.LINK** (Sony Corporation). This high-speed serial interface currently allows up to 400 million bits per second to be transferred (and higher speeds are coming soon). If your computer does not come with this interface built in, then you will need to purchase an inexpensive card that provides the correct port.

The single IEEE 1394 cable transmits all of the information including video, audio, time code, and device control (allowing you to control the camera from the computer). IEEE 1394 is not exclusively used for video transfer; it is a general purpose digital interface that can also be used for other connections, such as to hard drives or networks.

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...each 60-minute mini-DV cassette is actually 13 GB of offline storage!

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## DV25 Compression

As previously mentioned, the DV25 codec provides 25 million bits per second of video data. DV25 is compressed at a fixed rate of 5:1. There is also audio and control information being transmitted, so that the total data rate is about 3.6 million bytes (MB) per second. This means that one hour of DV compressed footage will require about 13 billion bytes (gigabytes = GB) of storage. It is impressive to realize that *each 60-minute mini-DV cassette is actually 13 GB of offline storage!*

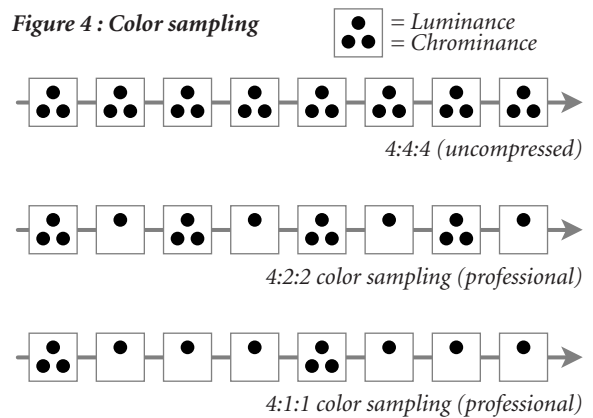
DV25 compression uses a reduced color sampling method known as 4:1:1 color, which is explained in the next section. The audio is uncompressed, and there are two stereo audio pairs. The audio can be digitized at either 12 bits at a sampling rate of 32kHz or 16 bits at a sampling rate of 44kHz or 48kHz. You should generally use the highest quality (16 bit, 48kHz) setting.

### 4:1:1 Color Sampling

When working with RGB images, we use exactly the same number of bits to store the three color components. When working with YCC video, however, we take advantage of the peculiarity of human perception previously mentioned – the eye is much more sensitive to changes in the *luminance* of an image than to the *color* (known as **chrominance**). So, instead of storing the same amount of information for each of the YCC components, professional video

only needs to store half as much color information as it does luminance information. This is also known as **4:2:2 color**, which means that for every 4 samples of luminance values, there are only 2 samples of each color signal. (*Figure 4*) This helps save bandwidth during analog transmission, as well as storage space in the digital realm. YCC can be reduced even further to what is known as **4:1:1 color**. DV cameras save video in the 4:1:1 space in order to reduce storage needs. This is not a problem for most applications, but it can cause issues during sophisticated operations such as compositing a person shot against a blue background into a new scene. The reduced color information may cause some visual **artifacts** around the composited image.

Figure 4 : Color sampling



### DV Variations

There are a number of variations to the DV format:

**Digital8:** A consumer-targeted variation on the DV25 theme is called Digital8. The Digital8 camcorder is designed to accommodate those customers who want to move up to digital video, but who might have a significant investment in Hi-8 movies. The Digital8 camera records DV25 video exactly like a DV camera does, but it records it on a Hi-8 tape. The Digital8 camera records digitally, but it can also play back analog Hi-8.

**DVCAM and DVPRO:** The basic DV format was designed for the consumer marketplace. Sony has introduced a professional variant known as DVCAM, which uses the same compression and tape as DV, but records less video on each tape. Recording is accomplished by magnetizing very small sections of videotape with differing polarities. The closer these small areas are to each other, the more likely there can be some interference. Remember, even though the data being recorded is digital, the medium itself is analog and subject to noise. Putting less data on the tape makes the recording more durable and

facilitates better interchange between devices. Both the DVCAM and DVCPRO systems are designed with the professional in mind and each offers distinct benefits for a particular customer type.

**DV50 and DV100:** In addition to the DV25 standard, there are also emerging standards known as DV50 and DV100. Since DV25 indicates 25 Mbits/sec of video, DV50 indicates 50 Mbits/sec and DV100 represents 100 Mbits/sec. The DV50 standard uses 4:2:2 color sampling and a lower compression of 3:3:1. The video quality of this standard is extremely high, and is suitable for the most demanding professional broadcast purposes. The DV100 format will be used for HDTV (high definition television) recording.

## Is DV Perfect?

The image quality of the DV format has been tested by both human and mechanical means. This testing ranks DV quality on par with Beta-SP, which has been the mainstay for professional video production for decades. But DV is not perfect.

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*While DV isn't perfect, it is certainly the highest-quality, most cost-effective video format ever made available to the average consumer.*

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Because the video is compressed, it is possible for there to be visible degradations—known as compression **artifacts**. These artifacts result from the color compression, and will be most noticeable around sharp color boundaries like white text on a black background. The 4:1:1 reduced color sampling in DV compression can also cause issues when performing professional compositing.

Additionally, compression does add noise to the picture. If DV is repeatedly decompressed and then recompressed, it will begin to degrade. This is different from just *transmitting* DV from generation to generation, which *is* lossless. Technology is advancing rapidly, and even now there are video boards available that make it possible to edit and composite uncompressed video on the desktop. But, for most editing uses, you won't do many compression/decompression cycles and so any degradation that may result from DV compression will be unnoticeable.

While DV isn't perfect, it is certainly the highest-quality, most cost-effective video format ever made available to the average consumer and to many professionals. The entire video industry is being transformed by the low cost and high quality of the DV solution.

## What is MPEG-2?

**MPEG** stands for the Motion Pictures Expert Group, an organization of film and video professionals involved in establishing industry standards; -2 refers to "compression standard version 2." This standard has gained wide acceptance in the marketplace. It is the format recorded onto DVD disks, the format received by home satellite dishes, and the format to which all television broadcast in the United States will ultimately convert. The principal feature of the MPEG-2 format is that it can provide extremely high-quality video with a data rate of around 1 MB/sec. This is almost one quarter of the data rate needed for DV video. So why isn't everything in MPEG-2?

While MPEG-2 is an excellent distribution format, it is less useful for direct recording and editing of video. The MPEG-2 compression scheme performs both intra-frame and inter-frame compression. The type of inter-frame compression that MPEG-2 employs involves estimating the motion of different parts of the image and then recording that motion rather than the actual pixels. This is both sophisticated and time-consuming. Most MPEG-2 schemes take much longer to compress video than they do to decompress it. Additionally, an MPEG-2 codec must have many frames of video to work with at once in order to perform the calculations. So, from a video editing standpoint, it can be difficult to work with MPEG-2. For example, say that you wanted to edit frame number 128 of your video. Instead of

just reading frame 128 from a disk, the editing system might have to read frames 124, 125, 126, and 127 in order to compute what frame 128 actually looks like.

There are three different frame types in MPEG-2. These are known as the *I*, *P*, and *B* frames. *I* stands for “intraframe” encoding and works just like a DV frame of video. The *P* frame is a “predicted” frame. It is computed from the frames previous to it. *B* is for “bi-directional” frame. This means that not only is the *B* frame computed from previous frames, it can also use frames that come after it. More data must be preserved to describe *I* frames, making them the “largest,” whereas *P* frames can be less than a tenth of that size. *B* frames are the smallest. Because the *P* and *B* frames are calculated from the *I* frames, you can’t just have one *I* frame and the rest *P*’s and *B*’s. There must be *I* frames interspersed or else the accumulated error becomes too great and the image quality suffers. A typical MPEG-2 sequence might look something like:

*I-P-P-P-B-B-B-P-B-B-B-P-I-P-P-P-B-B-B-P-I-P-P-P-B-B*

MPEG-2 is a very flexible format, making it possible to capture and edit video using only *I* frame encoding. Once editing is completed, the video can be recompressed to IPB format in order to reduce the overall size for distribution. The popularity of MPEG-2 will lead to MPEG-2 cameras, although these will primarily be for home use only. DV cameras will generally provide better quality video for most prosumer and professional applications.

## CONFIGURING YOUR SYSTEM

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*The boundaries between “professional” and “desktop” continue to blur. The differences between results are ultimately becoming a matter of the artist’s ability and not the cost of the system they use.*

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One of the most common questions is “*How do I configure my video editing system?*” Your answer to this question begins by asking yourself “*What are my intended uses?*” Are you interested in editing home videos on a budget? Or are you going into business as a professional? Your answers to these questions will help dictate the kind of hardware and software you should be considering. You also want to ensure that the system you are getting meets both your current and your probable future needs. Here are a few more questions you should ask yourself:

“*What kind of video will I be putting into the computer?*” Will you only be working with DV footage? Or do you need to be able to edit footage captured in component or composite video? For example, many industrial and broadcast users need to be able to capture and record video in the component format for use with Beta-SP

decks, in addition to DV. It would make little sense for such a user to have a DV-only system.

“*How will I distribute my finished video?*” Do you intend to distribute on DV, VHS, DVD, the Web? The answer to this question might dictate your selection of a video card. For example, if your business will entail creating industrial videos on recordable DVDs, then you would want a video card that could compress your video into the MPEG-2 format used on DVDs.

“*How time-critical will my productions be?*” When you add effects like transitions and titles to video, they usually have to be rendered by the computer into their final form. This can take anywhere from minutes to hours depending upon the complexity of your productions. If you are producing home videos, then this isn’t much of a problem. But, if you have clients looking over your shoulder asking for changes, then you might find it well worth your while to purchase a system which can produce these effects instantly.

“*How much video will I be working with?*” Remember that one hour of DV video takes about 13 GB of disk storage. If you are producing a 1-hour documentary, then you’ll want at least enough storage for several hours of raw footage. You will often find yourself working with four or five times as much raw footage as you will eventually use. If you are doing professional editing, you could be working with 20 or even 50 times the amount of final footage! Of course, you don’t need to have all of it available at all times, but you will need to think about this when configuring your storage.

### Video Capture Cards

There are several different types of video capture cards (also termed “boards”) available on the market today. In fact, many computer systems now ship with the IEEE 1394 interface as a standard feature. Your card choice will depend upon how you answered the questions posed above. In many cases, once you have determined your card, that will also determine your computer. This is because many types of cards are only available for one type of computer platform. There are six basic features that define video cards. These are:

1. Types of *analog* video input/output supported
2. Types of *digital* video input/output supported
3. Types of video *compression* supported
4. Types of special *processing* supported
5. Types of *software* included
6. Types of *audio* supported

## IEEE 1394 Cards

The simplest kind of card available is the IEEE 1394 interface card. This card is used to add the IEEE 1394 interface to computers that did not ship with one. This card does not support any analog video I/O, compression, or special processing. In fact, it does not really “capture” video, it merely enables the “transfer” of digital video into your computer. The IEEE 1394 interface can be used for many other connections as well, such as hard drives, scanners, and networking. Although the digital video being transmitted by the IEEE 1394 card is compressed, the card itself does not do any compression or decompression. The camera and the computer handle the compression and decompression tasks. If you purchase an IEEE 1394 card, you will want to be sure that the appropriate drivers are available to support your NLE software, such as *Adobe Premiere*.

## Analog Capture Cards

Unlike the basic IEEE 1394 cards, analog capture cards actually perform the task of converting analog video to and from digital video. There are many different sources of analog video, including VHS tapes, Hi-8 cameras, Beta-SP tapes, etc. These cards vary in price depending upon the type of analog interface supported. Composite video, from a VHS deck for example, is the least expensive. Component video, such as from a Beta-SP deck, is the most expensive. The reason for the cost difference is the complexity and cost of the components required to perform the conversion.

In addition to the type of analog input supported, you should also be aware of the type of compression being used. For many years, the MJPEG compression format has been a standard for both consumer and professional video. Recently, newer formats like DV and MPEG-2 have gained in popularity. Some of the newer cards allow you to easily convert from one format to another. That makes it possible, for example, to edit in DV and then to transcode to MPEG-2 for distribution.

## Real-Time Cards

One of the major differences (besides the price) between desktop products like *Adobe Premiere* and costly proprietary editing systems used to be performance. If you wanted a special effect like a transition, the desktop system would make you wait while it calculated the effect, whereas the high-end system included specialized hardware to create it instantly. Sometimes the calculation of the effect (called **rendering**) on the desktop system could take minutes or even hours, which would slow production to a crawl. This productivity barrier between the high-end and the desktop has now been shattered by a variety of newly introduced video cards. These boards work with *Adobe Premiere* and have specialized processors to handle the enormous number of calculations required for video effects. Prices for such “real-time” cards begin at around \$1,000 and offer performance similar to high-end systems for a significantly smaller investment. Such real-time boards provide a phenomenal productivity increase for *Adobe Premiere* users.

*Why are video effects so processing-intensive?* It’s because of the massive data rates involved. Each frame of video contains about 1 MB of data, and these data-heavy frames are arriving at around 30 frames-per-second. An effect, such as a transition, is the result of mathematically blending two video streams to create a new piece of video. That means that even the simplest effect requires about 60 million calculations per second to create the new bit of video.

*What kind of effects can be done in real-time?* That depends on the board being used. One of the strengths of *Adobe Premiere* is its wide range of effects. These include transitions, video filters (e.g., adding camera blur or changing a color image to black and white), keying (e.g. putting an actor shot against a blue-screen into another scene), transparency, scaling, adding titles, and motion. Most real-time cards are capable of handling the most common types of effects such as transitions and titles. Some boards can handle a much wider array of effects, even including the capability to “fly” your video around in 3D in real-time. Other differences between real-time video cards include the compression type (MJPEG, DV, MPEG-2, uncompressed, etc.) as well as the input/output options (composite, component, 1394, SDI, etc.).

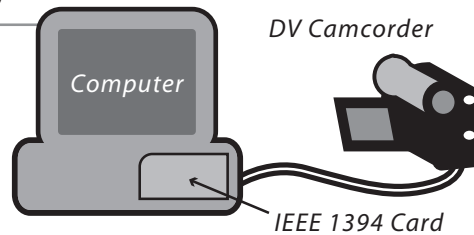
## Example Video Cards

Example	Analog Inputs	Digital Inputs	Compression Types	Real-Time Effects	Audio I/O	Approx. U.S. Cost
ADS Pyro	None	IEEE 1394	None	None	1394	\$100
Pinnacle DC-30	Composite, S-Video	None	MJPEG	None	RCA	\$500
Pinnacle DV500	Composite, S-Video	IEEE 1394	DV, MPEG-2	Transitions, titles, color correction	IEEE 1394, RCA	\$800
Matrox RT2000	Composite, S-Video	IEEE 1394	DV, MPEG-2	Transitions, titles, 3D FX, DVE	IEEE 1394, RCA	\$1,200
Pinnacle DC-1000	Composite, S-Video, Component option	IEEE 1394 option	MPEG-2	Transitions, titles, color correction	RCA (via balanced XLR w/ Break Out Kit)	\$1,699
Matrox Digisuite LE	Composite, S-Video, Component	IEEE 1394 option	MJPEG	Transitions, titles, motion, color correction, DVE	Balanced XLR (via balanced XLR and AES/EBU)	\$3,500

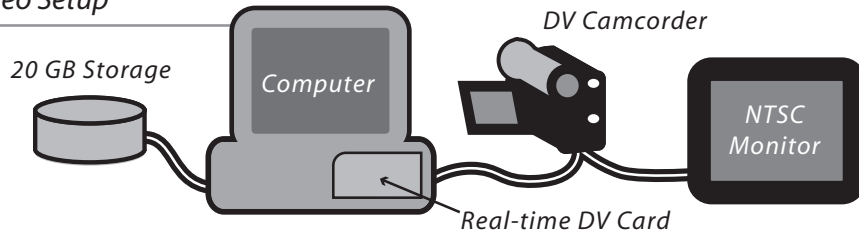
*Disclaimer: The information provided in the table above is for general information purposes only. It is not intended to be an endorsement of particular products or a complete list of products, features or pricing and it should not be relied upon as such. Please contact the relevant manufacturers for details of the individual products.*

## Example Configurations

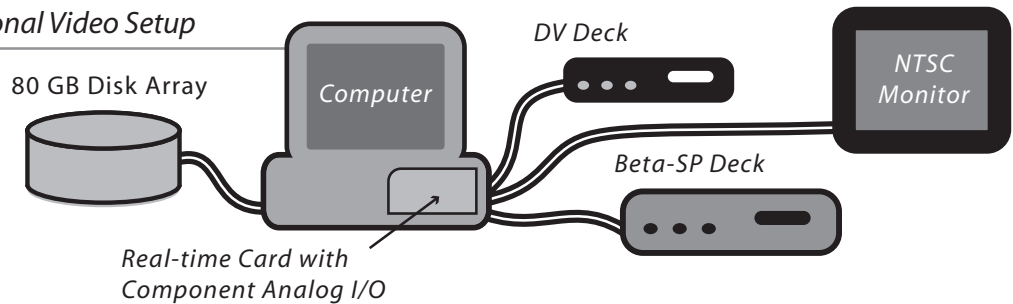
### Consumer Home Video Setup



### Prosumer Video Setup



### Professional Video Setup



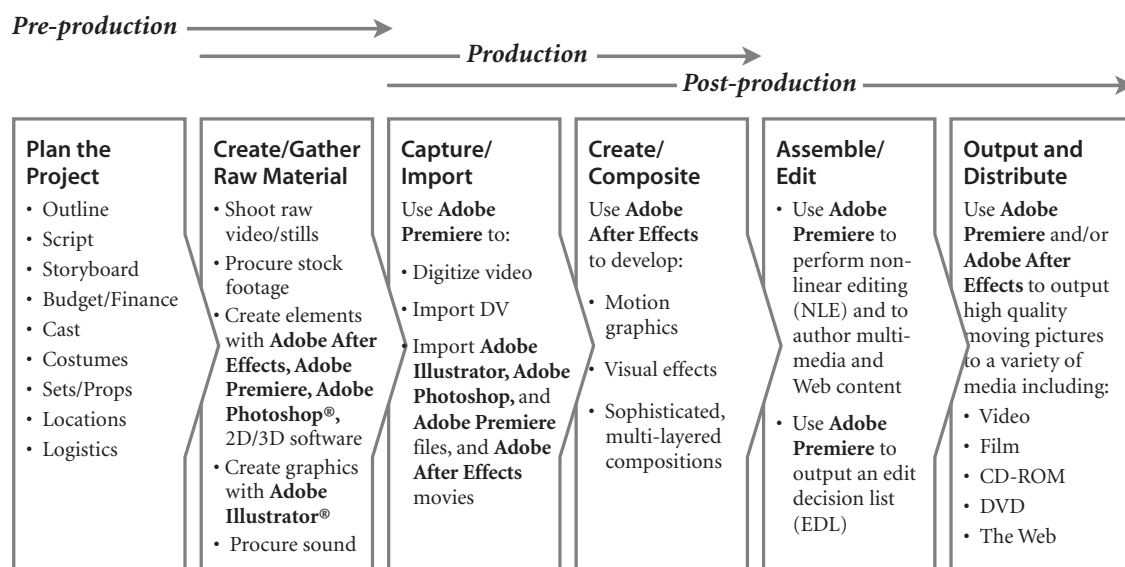


# THE CREATIVE PROCESS

## An Overview of Movie-Making

Let's assume you have a story to tell. It might be "Jonathan and Jennifer's Wedding" or "The Hometown Bank's Loan Officer Training Guide" or "Emma's Big Adventure: A Film About My Cat" or "How to Assemble the Waldo Widget." Whether you are making a very short video for the Web, an industrial or training presentation, a television commercial, a feature film, or just doing a personal project, the process is virtually the same. This section describes the key steps.

As you can see from the following chart, sometimes stages will overlap. You'll end up tailoring your own process to fit the project, or to your own, individual working style. Depending upon your personal working preferences, you might want to shoot, create and/or gather all your clips before you begin the assembly process. Or, you might prefer to work back and forth on production and post production tasks (or, if you have a team, concurrently). With digital video, your movie making tasks can flow over and around one another in an extremely fluid manner.



### Pre-Production

**Pre-production** is the planning stage. Typically, it includes steps to take before you begin "production" (shooting film or video). But this is a flexible process and the non-linear editing methods made possible by the advent of digital video make it even more so. When you begin your project, you may have already shot some or all of the video you'll need. You may be "re-purposing" content that includes existing video, still photography, charts, graphs, illustrations and/or animations. Or you may be starting with a blank slate. The "pre-production" phase should include all the steps you need to take to be sure that you are prepared to move from concept to completion.

**Outline:** No matter how "simple" (and this is, of course, a relative term!) you intend your project to be, begin with an outline. An outline helps you plan. It can be shared with coworkers or clients, to make sure everyone is "watching the same t.v. show" in terms of their expectations. Your outline will help you identify what materials you need to create, assemble, and/or acquire in order to get your process underway. You can also use your outline to plan the budget for your project.

**Script:** An outline may be enough for you to work from, or you may want a more formal script that includes dialogue, narration, notes about the locations or settings, the action, the lighting, the camera angles and movements, the edits, as well as the visual and sound effects.

**Storyboards:** You may also choose to do storyboards – sketches of key moments in the action – like a comic strip – labeled with notes about the action, sound, camera angles or motion, etc. Sometimes storyboards are even translated into motion to create **animatics**, using a tool like **Adobe Premiere** or



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“...When it comes to pre-visualization, it just makes sense for me to use Adobe Premiere. It’s cost-effective and a way to be very spontaneous when you’re being creative. You’ve got 900 frames to tell a story [for a 30-second commercial spot] and you better use every one of those frames very judiciously...”

—Fred Raimondi, *Digital Domain*

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**After Effects.** This is called **pre-visualization**, and may be used to help work out notions for a sequence, share an idea with coworkers, or “sell” a concept to a client.

**Budgeting:** Whether you are doing a personal or a professional project, it is definitely a good idea to add a budget to your outline as early as possible. For professionals, you’ll need a budget to secure financing. Your budget should include wages for yourself, your coworkers, actors and other talent (e.g., effects specialists, graphic designers, musicians, narrator, animal trainers...) as well as costs for location fees, costumes, props, equipment rentals, catering—and anything else you can think of: videotape or DV cassettes, lunch...

**Casting, Locations, Props, Costumes, Equipment Rentals, Catering, etc.:** Every project is different. Plan adequately for yours. **Do** sweat the details! Here’s a very brief list of tips to get you started thinking about some of those details:

- Take the time to test your cast, to make sure they work well together. For example, a conversation between a very tall and a very short person might not work well on camera.
- If you are shooting “real people” be sure to give them guidance about what to wear. For example, white shirts generally don’t photograph well, as they may glare under artificial light; stripes and small patterns might be problematic, etc. “Real” people should be reminded to pay special attention to grooming (hair and makeup) if they are going to be in your video, or you might want to have professional help on hand.
- If necessary, get permission to use locations.
- Be sure your costumes, sets, and props will be ready when you need to shoot.
- Make sure you have all the rental equipment you need, that it all functions, and that you know how to use it—before you head out for a location.

## Production

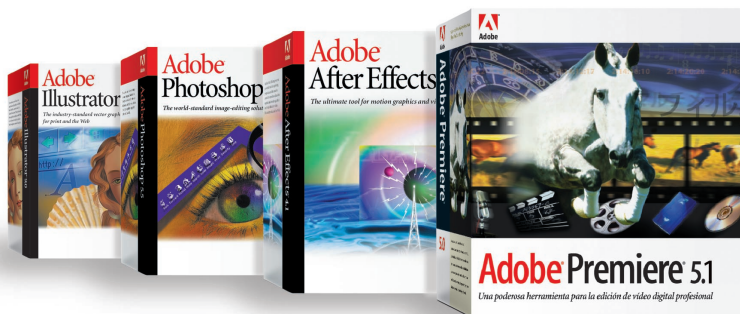
“Quiet on the set! Action! Roll ‘em!” Capturing live or animated action and sound on film, videotape, or DV—shooting or creating raw footage—is called **production**. During production, your concerns will include: lighting, “blocking” (where and how your actors or subjects move), and shooting (how the camera moves and from what angles your scenes are viewed). There are many good learning references available regarding production—books, Web sites, classes, and more.

## Post Production

What comes out of production is a collection of clips – i.e., different scenes shot in different places at different times. To actually develop your “story,” you need to edit and assemble your clips and, perhaps,

add visual effects, graphics, titles, and a sound track. This part of the process is called **post-production**. And this is where we at Adobe think the process really gets interesting. That’s why we continue to augment the *Adobe Dynamic Media Collection*. It includes two of the industry’s leading software solutions specifically designed for post-production: *Adobe Premiere*, a powerful non-linear editing tool, and *Adobe After Effects*, the ultimate tool for motion graphics and visual effects. While both of these award-winning

products are easy for the novice to learn and use, they are also the choice of a great many professionals. In addition, the *Adobe Dynamic Media Collection* includes two powerful software applications that have set the standard for graphic arts professionals worldwide and are enormously useful for creating and enhancing elements during the post-production process—*Adobe Photoshop* and *Adobe Illustrator*.



## CAPTURING YOUR CLIPS

You have configured your system. You have shot or acquired some video. And you are eager to begin post production. But first you need to gather all of your raw material together, on your computer.

### From Camera to Computer

If you shot DV, it's as easy as "plug 'n play"—just connect your DV camcorder to your computer via an IEEE 1394 connection and you're ready to edit.

#### Know Your Cables and Connectors



XLR



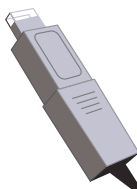
RCA



BNC



S-Video



IEEE 1394

*If you are new to video, figuring out all of those audio and video cables and connectors can be as difficult as untangling a bowl of spaghetti one noodle at a time. This chart is intended to help.*

*Pictured (top to bottom) are two audio connectors: XLR and RCA; and three video connectors: BNC, S-Video and IEEE 1394. The depicted connectors are all male, although female counterparts also exist.*

*XLR connectors are used to connect microphones and other balanced audio devices and for the AES/EBU digital audio connection. An RCA connector is also called a phono plug and is often used to connect consumer audio and video equipment like VCRs, tuners and CD players.*

*BNC, which stands for baby "N" connector is used to connect various video sources, including analog composite, analog component, and serial digital video interface (SDI).*

*BNC connectors are also used for other signals like genlock. The S-Video connector connects S-Video equipment, like S-VHS camcorders and video disks. In video, the IEEE 1394 connector is used to connect a DV camera to a computer IEEE 1394 port.*

If you have material on traditional videotape, you need to digitize and compress it. **Adobe Premiere** software makes it easy for you to control that process. With support for more than 45 video capture cards, and a wide range of compression options, **Adobe Premiere** software is the most broadly compatible NLE on the market today.

### Batch Capture

**Adobe Premiere** also provides support for controlling various kinds of tape devices, so you can perform batch captures. Batch capturing references time code and automates the digitization of any number of clips from multiple tape sources. It is useful in a professional production environment and especially helpful when you need to return to a project that was finished some time ago. Batch capture will let you recreate your video project from the original tape source.

### From Computer to Computer

Support for input and output formats in **Adobe Premiere** is extensive, and the software offers a high degree of cross-platform compatibility. So, if your material includes digital animations or computer graphics or previously digitized clips or digital sound, you can import or export many different video, audio and image formats. Users can transfer project files, titles, motion graphics, storyboards, filters, batch lists, EDLs, libraries and other files between Windows and Macintosh systems. If support for the format you want is not built into **Adobe Premiere**, chances are a third party plug-in will provide it. Just a few of the built-in formats include AVI, QuickTime, WAV, AIFF, TGA, TIFF, PICT, FLC, FLI, BMP, and animated GIF. Of course, **Adobe Premiere** also integrates seamlessly with other Adobe products, especially those in the **Adobe Dynamic Media Collection**. Naturally, **Adobe Premiere** imports **Photoshop** files, and **Illustrator** EPS files are automatically rasterized when imported. For even more enhanced integration, **Adobe After Effects** imports **Photoshop** files preserving the layers, blend modes, layer effects, and adjustment layers, and allows you to continuously rasterize **Adobe Illustrator** files during animation operations, so text and graphics will be perfectly rendered at any scale.

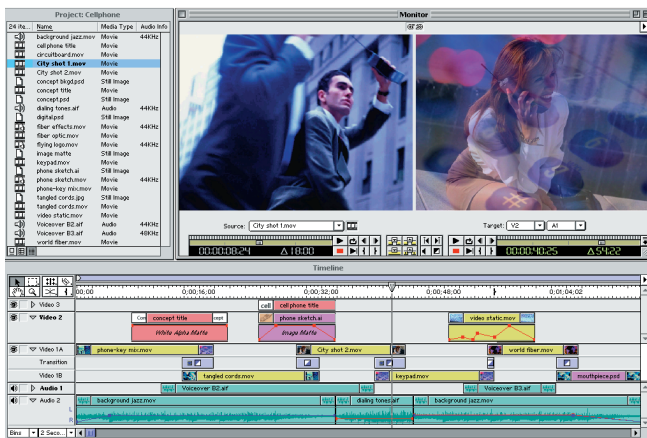
## NON-LINEAR EDITING

Yes, it's finally time to put it all together. And post production has never been easier... Non-linear editing (NLE) makes editing and assembling your production as easy and as flexible as word processing. Once your raw materials are in your computer, you can edit, alter, adjust, and reconfigure them—over and over again—with a few mouse clicks. If you make a mistake, NLE with **Adobe Premiere** offers 32 levels of undo. It also automatically creates archives of your projects at user-defined intervals. So, if you head down a creative alley that doesn't work out, you can easily return to a previous stage in your project.

### More Good Reasons to Choose Adobe Premiere

For beginners shooting home video to broadcast professionals editing a television commercial, **Adobe Premiere** is an excellent nonlinear editor (NLE) to choose. **Adobe Premiere** provides users with the tools video editors need, and a powerful, easy-to-use interface. It offers an impressive list of features, including up to 99 layers of video and audio, video transitions, special effects filters, audio effects, video motion, titling, keying and more. Due to its popularity, a large number of third-party software plug-ins are also available to enhance its functionality. **Adobe Premiere** is available for Microsoft® Windows® 95, 98 and Windows® NT, as well as Apple® Mac® OS. Because **Adobe Premiere** is an open-architecture application, it is supported by more video capture cards than any other NLE

on the market. This includes everything from inexpensive cards for the home user all the way up to broadcast systems with real-time special effects. Of course, **Adobe Premiere** integrates well with products like **Adobe After Effects**, **Photoshop**, and **Illustrator**. So, whether you're a seasoned editor or assembling video for the first time, **Adobe Premiere** offers the interface, features and support you'll need to easily and creatively tell your story.



*The Adobe Premiere user interface revolves around the Project, Monitor, and Timeline windows. Clips can be chosen from the Project window and inserted into the Timeline. Clips and finished work are viewed in the Monitor window.*

### Working with the Premiere Interface

The **Adobe Premiere** interface conforms to industry standards and expectations, while also breaking new ground with innovative features. The interface is highly customizable, so users can adapt **Adobe Premiere** to their specific use and experience. The **Adobe Premiere** interface is cleanly divided into three key areas: the **Project Window**, where content is managed; the **Monitor Window**, where video being edited is viewed; and the **Timeline**, where video pieces are organized over time.

Additional features like transitions and navigation tools are available in pop-up palettes that are visible when needed but hide easily to conserve screen real estate.

**The Project Window:** The Project Window manages all content, including video, audio, stills and titles. You organize your content into folders called “bins.” Bins can be given custom names (e.g. “Scene 12,” “Voiceovers,” etc.), which helps manage larger projects. The Project Window provides basic database functions, so you can sort or search through your content, as well as add custom fields of information. You can also create library collections of commonly used clips.

**The Monitor Window:** Much of your editing will take place using the Monitor Window. The Monitor Window has two smaller windows inside it:

- **The Source Monitor:** Where you view your individual video clips and select the pieces you want to use
- **The Program Monitor:** Where you will view the video you are constructing

The Monitor Window



- A: Source Monitor
- B: Source Menu
- C: Source Monitor Play/Edit controls
- D: Insert footage on Timeline
- E: Delete footage from Timeline
- F: Set Volume, Add Default Transition, Move to another clip
- G: View/Edit Program as laid out on the Timeline
- H: Detach Controllers from Monitor Window
- I: Target track for inserted clip
- J: Program Monitor
- K: Change what is displayed on Monitor Window
- L: Synchronize playback of Source and Program Monitors

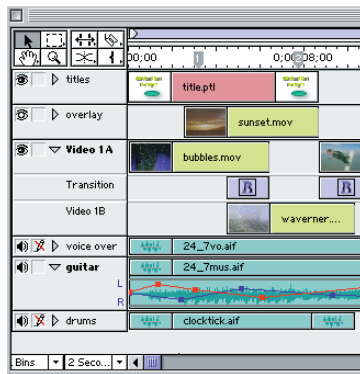
The Source/Program Monitor approach closely matches the monitor setup that is the industry standard in professional editing bays. However, if you want your video clips open in individual windows (like in older versions of Adobe Premiere), you still have that option.

To get started, simply drag clips from your Project Window to the Source Monitor in the Monitor Window. Now you can play and quickly move between the various source clips. Precisely mark in and out points as the video plays back by clicking on the mark-in and mark-out icons on the tool bar or by using the keyboard equivalents. Once you've selected the range of video you want, click on an icon and that video segment is inserted into your Timeline. Or, you can replace existing video in the Timeline with newly selected material by choosing the overlay icon. Whenever you want to view your current creation, just click on the Program Monitor side and hit the play button. As you learn the keyboard shortcuts for these operations, editing speed increases. You can even edit without touching your mouse.

## Using the Timeline

While the Monitor Window is powerful enough to control all of your editing, you'll want to use the Timeline to really extend your capabilities. The *Adobe Premiere* Timeline is easy to use, understand and manage. Clips of audio, video and graphics are dropped onto tracks in the Timeline, and can be moved, trimmed and adjusted with simple mouse clicks or keyboard commands. Up to 99 audio and 99 video tracks can be created for your program. Each track can be given a descriptive ID. Tracks also can be hidden to reduce screen clutter or locked to avoid accidental changes.

Each track in *Adobe Premiere* is collapsible, which means that there is more information available by clicking and "twirling down" a track. This saves screen space but keeps critical controls handy.



*Adobe Premiere software's collapsible Timeline can display up to 99 audio and 99 video tracks.*

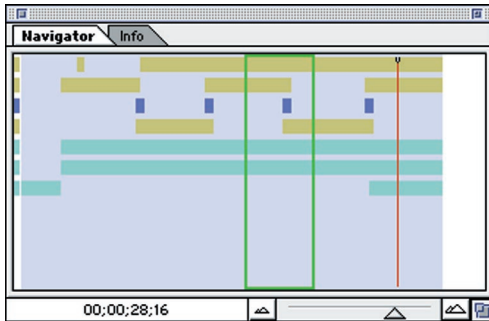
For example, opening up an audio track gives you controls for setting the gain and stereo pan of that track. It also gives you an audio waveform that allows you to easily set video edits to match audio changes. You also can uncollapse tracks to make precise adjustments to transitions between video clips.

The Timeline provides professional tools like **slip**, **slide**, and **rate adjust**. When editing, you sometimes wish to preserve the duration of a given clip and the duration of the overall movie, but change the clip's in and out points. For example, you are editing to music and you need to use just 2 seconds of a 20 second clip. You do a rough cut so that the clip starts and stops on the music beats. Now you want to refine the edit so that the 2 seconds being shown are the perfect 2 seconds out of the 20 second clip. *Adobe Premiere* offers you a slip tool to do precisely that. The slip tool lets editors adjust the in and the out points of a clip without affecting the clips that are adjacent to it. The slide tool in *Adobe Premiere* is similar, only in this

case the selected clip stays unchanged but the clips around it are adjusted as it is shifted in time. The rate adjust tool lets you control how fast or slow a particular clip will play.

To assist in moving around in the Timeline, *Adobe Premiere* offers the **Navigator Palette**. With the Navigator Palette, editors can quickly find the point they are searching for on the Timeline. The palette displays a miniature representation of the entire Timeline to assist in navigation. By simply dragging a bright-green rectangle to a different position on the miniature Timeline, editors can quickly glide





The Navigator Palette lets editors quickly and easily move from point to point in their program.

through their program. The Navigator Palette is also useful for zooming in and out of the Timeline. Entering a time code number in the palette moves the edit line to that precise location in the Timeline, and by pressing the Shift key and dragging the edit line, users can **scrub** through their program.

## Three Point Editing

The Monitor Window also lets you lift or extract footage from an edited sequence and perform professional **three-point edits**. Lifting footage from the Timeline leaves a hole that can be filled later.

Extracting footage ripples subsequent footage back to fill the hole left in your program.

Three-point editing is a powerful tool traditionally associated with very expensive editing programs. Normally, four points must be specified in order to perform a specific edit. Those four are the in/out points of the source clip (“what segment are you taking”) and the in/out for the program (“where are you putting it”). With three-point editing in Adobe Premiere, editors only need specify any three of these four in and out points. The program then automatically calculates the fourth point and ensures a proper edit. Monitor Window controls and keyboard shortcuts make three-point editing quick and easy.

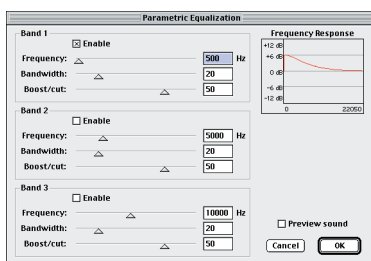
The Monitor Window also has a Trim mode, where you can precisely control individual edits. In Trim mode, you can simultaneously adjust both the out point of the previous segment and the in point of the current segment to make precise edits.

## Use More Sophisticated Features to Enhance Your Productions

Whether you are new to editing or a seasoned professional, it’s clear that there’s more to video editing than assembling clip after clip of video. You must deal with numerous details, such as setting up transitions between clips, inserting special effects, sweetening audio and generating titles. **Adobe Premiere** ships with 75 different video transitions, 60 video effects filters, and 21 audio effects filters. These filters are **keyframeable**, which gives you control over how they change over time. Third-party developers have added even more transitions and filters.

**Adobe Premiere** lets users create motion, picture-in-picture and keying effects. The **motion control** interface lets you create smooth keyframed animations of flying video, and includes controls for such parameters as rotation, scale and distortion. For even more advanced control, **Adobe After Effects** expands your tool set with full spline-based manipulation of object motion. Chroma, luminance and alpha keying are also supported in **Adobe Premiere**. You can even use **Adobe Photoshop** images as mattes for your video keying.

Professional editors looking for a powerful, affordable off-line editor will appreciate the way **Adobe Premiere** software facilitates quickly building an off-line edit and exporting an edit decision list (EDL) for conforming online. EDLs can be exported in industry standard formats compatible with all leading edit controllers, such as the Sony BVE 9000 and BVE 9100, as well as CMX.

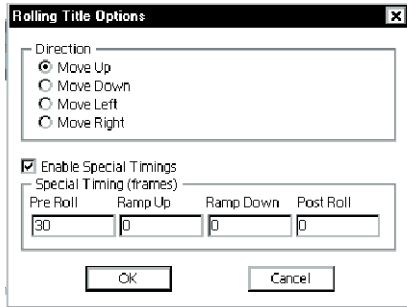


Tweak specific audio frequencies with Adobe Premiere’s parametric equalizer.

## Sweetening the Sound

Whether you’re creating a 30-second spot or a 2-hour movie, **Adobe Premiere** can deliver excellent audio and video synchronization. Twenty-one built-in controls let you produce studio-quality sound on the desktop. A compressor/expander filter fine tunes the dynamic range of audio clips. A notch/hum filter removes distracting hum. Multitap delay controls the delay of effects precisely, and a parametric equalizer filter lets editors tweak specific frequency ranges. The reverb filter in **Adobe Premiere** acoustically simulates a live interior. All audio filters can be keyframed so that they change over time, and you can add multiple effects to a single audio clip.

*Adobe Premiere* software also offers full control over the quality and data rate of output audio. Size-sensitive tasks like web audio files can be downsampled by an exact amount to assure high-quality, low-data-rate playback. Audio can be created at between 2- and 48kHz, depending upon your needs, and *Adobe Premiere* facilitates audio compression using built-in or third-party codecs.



*Adobe Premiere* software lets editors quickly and easily add titles to their programs.

## Adding Creative Titles

Adding titles can be fast and easy in *Adobe Premiere*. Simply open the **Title Window** and type in your text. *Adobe Premiere* software offers you control over the parameters of each character, including size, color, font and orientation. You can also create animated titles using roll and crawl controls. Other character controls include transparency, exact placement of ease-in and ease-out points for titles and title masking to allow characters to appear and disappear from specific points. To ensure proper placement of titles, you can import clips into the Title Window for reference. *Adobe Premiere* allows you to key your titles cleanly over your program. You can even use *Adobe Premiere* with third-party **character generators**, such as TitleDeko from Pinnacle Systems and Inscriber CG from Inscriber.

## CREATE STUNNING VISUAL EFFECTS AND MOTION GRAPHICS

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### Do I Really Need Effects and Animation Tools?

Maybe... or maybe not yet. It is more than likely that, as you progress rapidly up the movie-making learning curve, you will want to include more sophisticated elements in your productions. While *Adobe Premiere* provides a wide range of **transitions** (effects used to “transition” between two clips, such as fade-in/fade-out), as well as titling controls, filters, and some motion graphics capabilities, you may also soon want a specialized tool kit. *Adobe After Effects*, allows you to do more involved tasks including sophisticated compositing of moving imagery and very precisely controlled 2D animations.

### Leverage Graphics Experience Into New Opportunities

If you are a graphic designer, you are probably acutely aware of the way in which motion is finding its way into your world—in everything from animated Web banners to business presentations. Your experience with *Adobe Illustrator* and *Photoshop* will make it easy for you to migrate to the world of motion graphics, expanding your creative and business potential. *Adobe After Effects* lets you directly animate layered media from *Illustrator* and *Photoshop*. Plus, the layering and compositing methodologies in *After Effects* build on similar functionality in the *Adobe* software applications you already know. By adding *Adobe After Effects* to their tool kits, many graphic designers have found new markets for their talents in work ranging from the Web to the world of music videos and even film titles.

### Why Choose Adobe After Effects?

*Adobe After Effects* is the ultimate tool for motion graphics and visual effects. At almost any time, the work of *After Effects* artists can be seen on broadcast, cable, and satellite programming in every part of the world. The list of major motion pictures which have been created in part with the help of *Adobe After Effects* is extensive, including effects-heavy films such as *Star Wars, Episode I, Phantom Menace; Titanic; Starship Troopers; Lost In Space; The Matrix; Mission Impossible 2; and Titan A.E.*

*Adobe After Effects* offers the speed, precision, and creative control you need to produce superb motion graphics and visual effects for film, video, multimedia, or the Web. With its professional compositing tools, keyframe-based 2D animation system, and extremely fine-tuned timeline, as well as an extensive selection of visual effects filters, *After Effects* delivers an unparalleled set of powerful production tools for generating dynamic openers, bumpers, titles, games, Web animations, and more. *Adobe After Effects* has also spawned an entire category of third-party software and training support products.

### Facilitate Workflow with Complete Media Integration

*Adobe After Effects* works beautifully with *Adobe Photoshop*, *Adobe Illustrator*, and *Adobe Premiere* software. So, if you are already using these familiar tools, *Adobe After Effects* is the logical choice. As part of the *Adobe Dynamic Media Collection*, *After Effects* has been designed to play an important complementary role as “media integrator.” *After Effects* is a flexible environment for combining graphic images from *Photoshop* and *Illustrator* with video projects and footage from *Premiere*. *After Effects* preserves the alpha channels, adjustment layers, transfer modes and more in *Photoshop* files. Layered *Illustrator* files can be imported as layered compositions and continually rasterized within *After Effects*, delivering pristine, resolution-independent scaling and warping of vector graphics in an animation. When you import *Adobe Premiere* projects as compositions, edited clips come in as layers arranged in the appropriate time sequence, ready for further treatment or embellishment. Plus, *After Effects* even handles 3D image files, including RLA, Softimage PIC/ZPIC, and ElectricImage EI/EIZ files.

## Get the Version Designed for You

*Adobe After Effects* comes in two versions to meet the needs of different users:

- the *Standard* version provides the core compositing, 2D animation, and visual effects tools that motion graphics and effects designers need;
- the *Production Bundle* version includes all of these tools plus more sophisticated keying, **motion control**, distortion, and audio effects for visual effects artists and motion graphics designers needing the most exacting control.

You might want to start out with the *Standard* version, then upgrade to the *Production Bundle* version as your work expands in scope or complexity.

## Increase Your Productivity with Unparalleled Professional Features

*Adobe After Effects* provides a high-quality, professional working environment, with features designed to streamline the most demanding work flow:

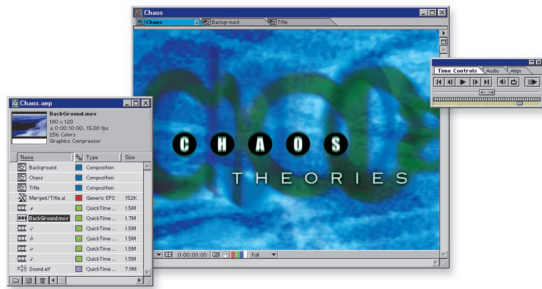
**Project and Media Management:** The organization and ongoing tracking of media elements, known as “assets,” is crucial for any production environment, especially when dealing with the diverse types of media supported by *After Effects*. The ability to arrange the Project Window based on media type, name, file size, and other attributes, as well as folder hierarchies and color coding for organizing large projects, is critical to any production flow and is unique to *After Effects*.

**Timeline Implementation:** Animation revolves around the concept of elements changing over time. The ability to selectively display control curves with linear keyframe information directly inside the Timeline Window lets you fine tune timings of multiple elements. The Time Layout Window offers flexibility for viewing and editing all object parameters.

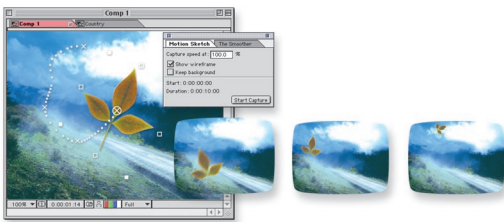
**Keyframe Control:** Keyframes are the heart and soul of moving objects, and *After Effects* provides precise control over keyframe type, generation, placement, and all other aspects of keyframe functionality. Full curve-based editing of keyframe data delivers the ability to exactly tweak motion and animation data to fit a desired requirement for all aspects of motion and effects over time. You can also draw animation paths as easily as sketching with a pencil on paper using the Motion Sketch tool. Simply select the tool and draw the animation path on-screen. Adjust your drawing speed to vary the velocity of the path. *After Effects* automatically creates the keyframes for you. Then use the Smoother tool to smooth the shape of the path and fine-tune it until the

animation moves exactly the way you want.

**Compositing and Keying:** Combining diverse types of media elements is what *Adobe After Effects* is best known for. *After Effects* is the optimal program for layering media because of its extensive transfer mode support—just like *Photoshop*—and its rich support for masking (up to 128 animatable bezier masks per layer). *After Effects* also offers a large selection of keying methodologies which, together with the transfer mode and masking support, make it capable of handling virtually any compositing task.



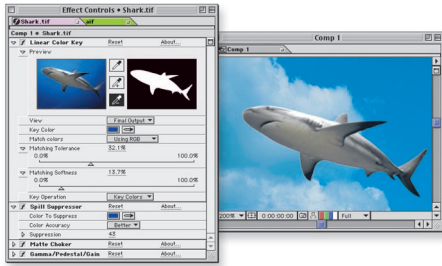
*Adobe After Effects streamlines compositing with efficient and flexible asset management*



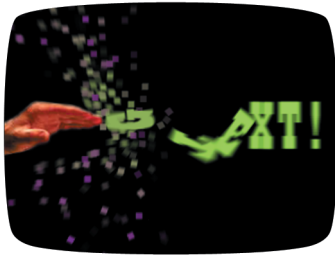
*Motion Sketch lets you draw animation paths as easily as sketching with a pencil.*



**Advanced Animation Functionality:** Making things move is only one aspect of the process of creating dynamic media—so much more is involved in the successful production of animation and video. *Adobe After Effects* Production Bundle features such as the Motion Tracking and Motion Stabilizer tools are vital to the task of compositing live action with computer-generated imagery. Motion Math (Production Bundle) allows you an unprecedented level of control over how any aspect of an object changes over time, including predefined scripts for physical simulations of gravity, springs, parabolic motion, and many other effects not found in most other 2D animation software. *After Effects* also offers an adjustable camera shutter for motion blur.



*Adobe After Effects facilitates an unparalleled range of visual effects.*



*The Particle Playground (Production Bundle)*

**Visual Effects:** *Adobe After Effects* is unmatched in the sheer variety and control of its visual effects filters and tools—from the most utilitarian color correction and visual processing features to extremely sophisticated distortion and time remapping tools. The Particle Playground (Production Bundle), with its unique ability to use any layer or text as particles, offers a myriad of creative possibilities from swarming bees to fireworks to text effects like in the opening of *The Matrix*. An extensive selection of third party visual effects filters is continually being enlarged.

**Text/Character Generation:** Words are the ultimate complement to pictures and video in the realm of communications and *Adobe After Effects* provides a comprehensive set of type animation features which, naturally, integrate tightly with *Adobe Illustrator*, the industry-leading type design tool. The ability to create animated leading and tracking effects is incredibly useful for professional titling work. It offers text animation along a path, automatic randomization/jitter effects for many character attributes such as scaling and rotation and a wide variety of other automatic text effects.

**Audio Support:** Audio effects expand your creative possibilities by merging the worlds of sound and images. *Adobe After Effects* delivers comprehensive audio-processing and effects capabilities. For example, it can synchronize animation elements to audio amplitude and drive video effects using audio data. *After Effects* also includes a rich set of audio effect filters for processing professional quality sound.

## Conclusion

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We hope this Digital Video Primer has answered enough of your questions to encourage you to get started. We know that once you do, you and your audience will be thrilled with the rewards upon the screening of your first motion picture project—whether personal or professional. If you still feel somewhat confused and hesitant, however, it's not surprising—there *is* a lot to know about video. But the best thing to do is to jump right in and learn as you go. The *Adobe Dynamic Media Collection* can help, with a comprehensive set of easy to learn and use tools that include features to grow with.

## How to Purchase Adobe Dynamic Media Products

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Via Web:

<http://www.adobe.com/store>

Via Phone:

*Adobe After Effects Hotline:* (800) 685-3504

*Adobe Premiere Hotline:* (888) 724-4507

Free Tryouts:

*Adobe After Effects:* <http://www.adobe.com/products/aftereffects/tryreg.html>

*Adobe Premiere:* <http://www.adobe.com/products/premiere/tryreg.html>

To find the reseller nearest you, visit:

<http://www.adobe.com/store/otherplaces/uscanada/main.html>

## For More Information

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There are a variety of resources available for obtaining technical information about *Adobe Dynamic Media Collection* products. There also is an abundance of places to share your experiences with other users. For a complete list of these resources go to <http://www.adobe.com>. Additionally, the following resources may be helpful:

### VIDEO CAPTURE CARDS:

To find a video capture card that suits your needs and is certified with Adobe Premiere, go to [www.adobe.com/premiere](http://www.adobe.com/premiere); click on the "Capture Cards" link.

### BOOKS ON DIGITAL VIDEO:

Adobe Products "**Classroom in a Book**" by Adobe Press (800) 428-5331 [www.adobe.com/products/adobepress](http://www.adobe.com/products/adobepress)

**Digital Video for Dummies** by Martin Doucette, published by IDG Books Worldwide, Inc., 1999

**Real World After Effects** by Sherry London and Eric Reinfeld, published by Peachpit Press, Inc.

**Creating Motion Graphics with After Effects: High Impact Animation for Video and Film** by Trish Meyer and Chris Meyer, published by Miller Freeman Books

### DIGITAL VIDEO CONFERENCES:

**BDA (Broadcast Designers Association)**  
[www.bdaweb.com](http://www.bdaweb.com)

**DV Expo**  
T: (415) 278-5300/F: (415) 278-5200  
[www.dvexpo.com](http://www.dvexpo.com)

**IBC (International Broadcasting Convention)**  
[www.ibt.org.uk/](http://www.ibt.org.uk/)

**NAB (National Association of Broadcasters)**  
T: (202) 429-5300/F: (202) 429-5343  
[www.nab.org](http://www.nab.org)

**newMedia**  
[www.newmedia.ca/](http://www.newmedia.ca/)

**SIGGRAPH**  
T: (312) 321-6830/F: (312) 321-6876  
[www.siggraph.org](http://www.siggraph.org)

**WEVA (Wedding & Event Videographers Association)**  
[www.weva.com](http://www.weva.com)

### DIGITAL VIDEO TRAINING:

**Adobe Certified Training Program**  
Adobe certified trainers listing  
[www.adobe.com/products/partnerfinder/searchtraining.html](http://www.adobe.com/products/partnerfinder/searchtraining.html)

**Total Training Inc.**  
Video training (760) 944-3900  
[www.totaltraining.com](http://www.totaltraining.com)

**Digital Institute of Video Arts**  
Video training (510) 932-2282  
[www.knowpath.com](http://www.knowpath.com)

**Mac/Windows Academy**  
Training on video cassette (800) 527-1914/(904) 677-1918  
[www.macacademy.com](http://www.macacademy.com)

**Payne Media Inc.**  
Video: "Up and Running with Digital Video" (425) 455-1025  
[www.paynemedias.com](http://www.paynemedias.com)

**Straight Scoop Enterprises**  
CD: "Secrets of Adobe Premiere 5" (503) 643-3976  
[www.straight-scoop.com](http://www.straight-scoop.com)

**Virtual Training Company (VTC)**  
CD-based training for Adobe Premiere (888) TRAIN-CD/(408) 492-1051  
[www.vtco.com](http://www.vtco.com)

**VideoSynchasies: The Motion Graphics Problem Solver**  
Videotapes by Trish and Chris Meyer  
[www.deskimages.com/ae.shtm](http://www.deskimages.com/ae.shtm)

### DIGITAL VIDEO WEB BASED FORUMS:

**Adobe User to User Forums**  
[www.adobe.com/support/forums/main.html](http://www.adobe.com/support/forums/main.html)

**Helptalk Online**  
[www.helptalk.net/audiovideo](http://www.helptalk.net/audiovideo)

**Digital Editor Online**  
[www.digitaleditor.com](http://www.digitaleditor.com)

**The World Wide Users Group Forums for After Effects Users**  
[www.wwug.com/forums/adobe\\_aftereffect/index.htm](http://www.wwug.com/forums/adobe_aftereffect/index.htm)

**The World Wide Users Group Forums for Premiere Users**  
[www.wwug.com/forums/adobe\\_premiere/index.htm](http://www.wwug.com/forums/adobe_premiere/index.htm)

### LIST-SERVERS:

**Adobe After Effects List-server**  
[www.fido.se/Pages/maillist.html](http://www.fido.se/Pages/maillist.html)

**Adobe Premiere List-server**  
[www.wwug.com](http://www.wwug.com)

**The DV-L List Server**  
[www.dvcentral.org](http://www.dvcentral.org)

**After Effects Mail Group**  
[www.softmotion.com/Pages/start.html](http://www.softmotion.com/Pages/start.html); Click on Mailists link; click on Info button for After Effects list

### DIGITAL VIDEO NEWSGROUPS:

**rec.video.desktop**

**rec.video.production**

**rec.video.professional**

### ADOBE SYSTEMS

#### DIGITAL VIDEO RESOURCES:

**Adobe Systems Incorporated**  
345 Park Avenue San Jose, CA 95110  
T: 408-536-6000/F: 408-537-7000

**Adobe After Effects Customer Service**  
800-685-3504

**Adobe Premiere Customer Service**  
888-724-4507

**Adobe After Effects for Mac OS Technical Support**  
206-675-6210

**Adobe After Effects for Windows Technical Support**  
206-675-6310

**Adobe Premiere for Mac OS Technical Support**  
206-675-6205

**Adobe Premiere for Windows Technical Support**  
206-675-6305

**Adobe Premiere for SGI Technical Support**  
206-675-6405/[www.adobe.com](http://www.adobe.com)

**Main Customer Support Website**  
[www.adobe.com/support/main.html](http://www.adobe.com/support/main.html)

**Searchable Support Databases Website**  
[www.adobe.com/support/database.html](http://www.adobe.com/support/database.html)

**Techdocs e-mail (automated system)**  
[techdocs@adobe.com](mailto:techdocs@adobe.com)

**Index of Adobe Premiere and Adobe After Effects documents**  
310099

**Index of all available documents:**  
100099

## Glossary

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**analog:** The principal feature of analog representations is that they are *continuous*. For example, clocks with hands are analog—the hands move continuously around the clock face. As the minute hand goes around, it not only touches the numbers 1 through 12, but also the infinite number of points in between. Similarly, our experience of the world, perceived in sight and sound, is analog. We perceive infinitely smooth gradations of light and shadow; infinitely smooth modulations of sound. Traditional (non-digital) video is analog.

**animatic:** A limited animation used to work out film or video sequences. It consists of artwork shot on film or videotape and edited to serve as an on-screen storyboard. Animatics are often used to plan out film sequences without incurring the expense of the actual shoot.

**aliasing:** A term used to describe the unpleasant jaggy appearance of unfiltered angled lines. Aliasing is the “beating” effects caused by sampling frequencies being too low to faithfully reproduce an image. There are several types of aliasing that can affect a video image which include temporal aliasing (e.g., wagon wheel spokes apparently reversing) and raster scan aliasing (e.g., flickering effects on sharp horizontal lines).

**anti-aliasing:** The manipulation of the edges of an image, graphic, or text to make them appear smoother to the eye. On zoomed inspection, anti-aliased edges appear blurred, but at normal viewing distance, the apparent smoothing is dramatic. Anti-aliasing is important when working with high quality graphics for broadcast use.

**architecture:** The term “architecture” in digital video (sometimes also known as format) refers to the structure of the software responsible for creating, storing, and displaying video content. An architecture may include such things such as compression support, system extensions and browser plug-ins. Different multimedia architectures offer different features and compression options, and store video data in different file formats. *QuickTime*, *RealVideo*, and *MPEG* are examples of video architectures (although *MPEG* is also a type of compression).

**artifact:** Visible degradations of an image resulting from any of a variety of processes. In digital video, artifacts usually result from color compression and are most noticeable around sharply contrasting color boundaries such as black next to white.

**aspect ratio:** The ratio of an image’s width to its height. For example, a standard video display has an aspect ratio of 4:3.

**AVI:** Defined by Microsoft, “AVI” stands for *Audio Video Interleave*. AVI is the file format for video on the Microsoft® Windows® platform.

**BNC connector:** A connector typically used with professional video equipment for connecting cables that carry the video signal.

**batch capturing:** Automated process of grabbing a series of clips from an analog videotape player for computer digitization.

**binary:** A type of *digital* system used to represent computer code in which numerical places can be held only by ‘zero’ or ‘one’ (on or off).

**CG:** Acronym for Character Generator (see *character generator*).

**CGI:** Acronym for Computer Graphic Imagery

**camcorder:** A video camera, i.e., a device that records continuous pictures and generates a signal for display or recording. To avoid confusion, it is recommended that the term “camcorder” be used rather than “camera”—in contrast, a digital camera records *still* images, while a digital camcorder records *continuous video* images.

**capturing:** Act of converting source video, usually analog, to digital video for use on a computer. Capturing usually entails both *digitization* and *compression*.

**channel:** Each component color defining a computer graphic image—Red, Green, and Blue—is carried in a separate “channel,” so that each may be adjusted independently. Channels may also be added to a computer graphic file to define masks.

**character generator:** Stand-alone device or software program running on a computer used to create text for display over video.

**chrominance:** The color portion of a video signal.

**clip:** A digitized portion of video.

**codec:** Short for *compressor/decompressor*; comprised of algorithms that handle the compression of video to make it easier to work with and store, as well as the decompression of video for playback.

**color sampling:** A method of *compression* that reduces the amount of color information (*chrominance*) while maintaining the amount of intensity information (*luminance*) in images.

**component video:** A video signal with three separate signals, “Y” for *luminance*, “Cr” for Chroma and red, and “Cb” for Chroma and blue. Component signals offer the maximum luminance and chrominance bandwidth. Some component video, like Betacam and BetacamSP, is analog; other component video, like D1, is digital.

**composite video:** A video signal where *chrominance* and *luminance* are combined in the same signal.

**compositing:** The process of combining two or more images to yield a resulting, or “composite” image.

**compression:** Algorithms used by a computer to reduce the total amount of data in a digitized frame or series of frames of video and/or audio.

**compression ratio:** Degree of reduction of digital picture information as compared to an uncompressed digital video image.

**DirectShow:** Microsoft® DirectShow® is an application programming interface (API) for client-side playback, transformation, and capture of a wide variety of data formats. DirectShow is the successor to Microsoft® Video for Windows® and Microsoft® ActiveMovie™ significantly improving on these older technologies.

**DTV:** Digital television (and occasionally, the abbreviation “DTV” is also used to connote “desktop video”)

**DV:** Generally refers to *digital video*, but current usage suggests a variety of nuances. DV can connote the type of *compression* used by DV systems or a format that incorporates DV compression. DV *camcorders* employ a DV format; more specifically, a standard consumer DV camcorder uses mini-DV tape, compresses the video using the *DV25* standard, and has a port for connecting to a desktop computer. The DV designation is also used to for a special type of tape cartridge used in DV camcorders and DV tape decks.

**DVD:** Abbreviation for *Digital Versatile Disc*, DVDs look like CDs but have a much higher storage capacity, —more than enough for a feature length film compressed with *MPEG-2*. DVDs require special hardware for playback.

**DV25:** The most common form of DV *compression*, using a fixed data rate of 25 megabits/sec.

**data rate:** Amount of data moved over a period of time, such as 10MB per second. Often used to describe a hard drive’s ability to retrieve and deliver information.

**digital:** In contrast to *analog*, digital representations consist of values measured at discrete intervals. Digital clocks go from one value to the next without displaying all intermediate values. Computers are digital machines employing a *binary* system, i.e., at their most basic level they can distinguish between just two values, 0 and 1 (off and on); there is no simple way to represent all the values in between, such as 0.25. All data that a computer processes must be digital, encoded as a series of zeroes and ones. Digital representations are approximations of analog events. They are useful because they are relatively easy to store and manipulate electronically.

**digitizing:** Act of converting an analog audio or video signal to digital information.

**dissolve:** A fade from one *clip* to another.

**EDL:** *Edit Decision List*—master list of all edit in and out points, plus any transitions, titles, and effects used in a film or video production. The EDL can be input to an edit controller which interprets the list of edits and controls the decks or other gear in the system to recreate the program from master sources.

**effect:** Distortion of a frame or frames of video to change its appearance.

**FPS:** Frames per second; a method for describing *frame rate*.

**fields:** The sets of upper (odd) and lower (even) lines drawn by the electron gun when illuminating the *phosphors* on the inside of a standard television screen, thereby resulting in displaying an *interlaced* image. In the *NTSC* standard, one complete vertical scan of the picture—or *field*—contains 262.5 lines. Two fields make up a complete television *frame*—the lines of field 1 are vertically interlaced with field 2 for 525 lines of resolution.

**FireWire:** The Apple Computer trade name for *IEEE 1394*

**frame:** A single still image in a sequence of images which, when displayed in rapid succession, creates the

illusion of motion—the more frames per second (*FPS*), the smoother the motion appears.

**frame rate:** The number of images (video frames) shown within a specified time period; often represented as *FPS* (frames per second). A complete *NTSC* TV picture consisting of two fields, a total scanning of all 525 lines of the raster area, occurs every 1/30 of a second. In countries where *PAL* and *SECAM* are the video standard, a *frame* consists of 625 lines at 25 frames/sec.

**generation loss:** Incremental reduction in image and/or sound quality due to repeated copying of analog video or audio information and usually caused by *noise* introduced during transmission. Generation loss does not occur when copying digital video unless it is repeatedly compressed and decompressed.

**IEEE 1394:** The interface standard that enables the direct transfer of DV between devices such as a DV camcorder and a computer; also used to describe the cables and connectors utilizing this standard.

**i.LINK:** The Sony trade name for *IEEE 1394*.

**insert edit:** An edit in which a series of frames is added, lengthening the duration of the overall program.

**inter-frame compression:** Reduces the amount of video information by storing only the *differences* between a frame and those that precede it.

**interlacing:** System developed for early television and still in use in standard television displays. To compensate for limited *persistence*, the electron gun used to illuminate the *phosphors* coating the inside of the screen alternately draws even, then odd horizontal lines. By the time the even lines are dimming, the odd lines are illuminated. We perceive these “interlaced” *fields* of lines as complete pictures.

**intra-frame compression:** Reduces the amount of video information in each frame, on an individual basis.

**JPEG:** File format defined by the *Joint Photographic Experts Group* of the International Organization for Standardization (ISO) that sets a standard for compressing still computer images. Because video is a sequence of still computer images played one after another, JPEG compression can be used to compress video (see *MJPEG*).

**keyframing:** The process of creating an animated clip by selecting a beginning image and an ending image whereby the software automatically generates the frames in between (similar to “tweening”).

**log:** A list of shots described with information pertinent to content or other attributes.

**lossy:** Generally refers to a compression scheme or other process, such as duplication, that causes degradation of signal fidelity.

**lossless:** A process that does not affect signal fidelity; e.g. the transfer of DV via an *IEEE 1394* connection.

**luminance:** Brightness portion of a video signal.

**MJPEG:** Motion *JPEG*.

**MPEG:** *Motion Pictures Expert Group* of the International Organization for Standardization (ISO) has defined multiple standards for compressing audio and video sequences. Setting it apart from *JPEG* which

compresses individual frames, MPEG compression uses a technique where the *differences* in what has changed between one frame and its predecessor are calculated and encoded. MPEG is both a type of *compression* and a video *format*. “MPEG-1” was initially designed to deliver near-broadcast quality video through a standard speed CD-ROM. Playback of MPEG-1 video requires either a software decoder coupled with a high-end machine, or a hardware decoder. “MPEG-2” is the broadcast quality video found on DVD’s. It requires a hardware decoder (e.g.; a DVD-ROM player) for playback.

**motion control photography:** A system for using computers to precisely control camera movements so that different elements of a shot can later be composited in a natural and believable way.

**motion effect:** Speeding up, slowing down or strobing of video.

**noise:** Distortions of the pure audio or video signal that would represent the original sounds and images recorded, usually caused by interference

**nonlinear editing:** Random-access editing of video and audio on a computer, allowing for edits to be processed and re-processed at any point in the *timeline*, at any time. Traditional videotape editors are *linear* because they require editing video sequentially, from beginning to end.

**NLE:** A *nonlinear editing* computer system.

**NTSC:** *National Television Standards Committee* standard for color television transmission used in the United States, Japan and elsewhere. NTSC incorporates an *interlaced* display with 60 *fields* per second, 29.97 *frames per second*.

**PAL:** *Phase-alternating line* television standard popular in most European and South American countries. PAL uses an *interlaced* display with 50 *fields* per second, 25 *frames per second*.

**phosphor:** A luminescent substance, used to coat the inside of a television or computer display, that is illuminated by an electron gun in a pattern of graphical images as the display is scanned.

**pixel:** An abbreviation for *picture element*. The minimum computer display element, represented as a point with a specified color and intensity level. One way to measure image *resolution* is by the number of pixels used to create the image.

**post-production:** The phase of a film or video project that involves editing and assembling footage and adding effects, graphics, titles, and sound.

**pre-production:** The planning phase of a film or video project—usually completed prior to commencing production.

**pre-visualization:** A method of communicating a project concept by creating storyboards and/or rough animations or edits.

**print to tape:** Outputting a digital video file for recording on a videotape.

**production:** The phase of a film or video project comprised of shooting or recording raw footage.

**program monitor:** Window on the *Adobe Premiere* interface that displays the edited program.

**project:** File with all information pertaining to a job, including settings and source material.

**QuickTime:** Apple’s multi-platform, industry-standard, multimedia software *architecture*; used by software developers, hardware manufacturers, and content creators to author and publish synchronized graphics, sound, video, text, music, VR, and 3D media. “QuickTime 4” includes strong support for “real” (RTSP) *streaming*.

**RCA connector:** A connector typically used for cabling in both audio and video applications.

**RGB:** *Red-Green-Blue*—a way of describing images by breaking a color down in terms of the amounts of the three primary colors (in the additive color system) which must be combined to display that color on a computer monitor.

**RealMedia:** Architecture designed specifically for the web, featuring streaming and low data-rate compression options; works with or without a “RealMedia server.”

**real-time:** In computing, refers to an operating mode under which data is received, processed and the results returned so quickly as to seem instantaneous. In an *NLE*, refers to effects and transitions happening without an interruption for *rendering*.

**rendering:** The process of mathematically calculating the result of a transformation effect on a frame of video (e.g. resizing, effects, motion).

**resolution:** The amount of information in each frame of video, normally represented by the number of horizontal *pixels* times the number of vertical pixels (e.g. 640 x 480). All other things being equal, a higher resolution will result in a better quality image.

**ripple:** Automatic forward or backward movement of program material in relationship to an inserted or extracted clip.

**S-Video:** Short for *Super-Video*, a technology for transmitting video signals over a cable by dividing the video information into two separate signals: one for *luminance* and the other *chrominance*. (S-Video is synonymous with Y/C video).

**SECAM:** Similar to *PAL* at 25 FPS, the SECAM format is employed primarily in France, the Middle East, and Africa. It is only used for broadcasting. In countries employing the SECAM standard, PAL format cameras and decks are used.

**scrubbing:** Variable-rate backward or forward movement through audio or video material via a mouse, keyboard or other device.

**slide:** An editing feature that adjusts the previous clip’s out point, and the next clip’s in point without affecting the clip being slid or the overall program duration.

**slip:** An editing feature that adjusts the in and out points of a clip without affecting the adjacent clips or affecting overall program duration.

**source monitor:** An *Adobe Premiere* interface window that displays clips to be edited.



**streaming:** Process of sending video over the web or other network, allowing playback on the desktop as the video is received, rather than requiring that the entire file be downloaded prior to playback.

**titler:** See *character generator*.

**three-point editing:** In *Adobe Premiere*, an editing feature that lets editors insert a clip into an existing program where only three of the four in and out points of the clip to be inserted, and the portion of the program where the clip is being inserted, are known.

**time code:** Time reference added to video that allows for extremely accurate editing; may be thought of as the “address” on a tape that pinpoints where the clip begins (in) and ends (out).

**timeline:** On an *NLE* interface, the graphical representation of program length onto which video, audio and graphics clips are arranged.

**transition:** A change in video from one clip to another. Often these visual changes involve *effects* where elements of one clip are blended with another.

**transparency:** Percentage of opacity of a video clip or element.

**trimming:** Editing a clip on a frame-by-frame basis or editing clips in relationship to one another.

**24-bit color:** Type of color representation used by current computers. For each of the Red, Green, and Blue components, 8 bits of information are stored and transmitted—24 bits in total. With these 24 bits of information, over a million different variations of color can be represented.

**uncompressed:** Raw digitized video displayed or stored in its native size.

**video capture card (or board):** Installed inside a computer, adds the functionality needed to *digitize* analog video for use by the computer. Using a hardware or software *codec*, the capture card also compresses video in and decompresses video out for display on a television monitor.

**XLR connector:** A connector with three conductors used in professional audio applications, typically with a balanced signal.

**Y/C video:** A video signal where the *chrominance* and *luminance* are physically separated to provide superior images (synonymous with *S-Video*).

**YCC:** A video signal comprised of the *luminance*—the “Y”—component and two *chrominance* (color)—“C”—components.