

THE **e**LEARNING DEVELOPERS' JOURNAL

Strategies and Techniques for Designers, Developers, and Managers of eLearning

THIS WEEK — DEVELOPMENT TECHNIQUES

Repurposing Taped Video for e-Learning, Part 1: From Tape to Hard Drive

BY STEPHEN HASKIN

You've been given an assignment: Locate your video-taped resources and convert them to a new delivery medium, such as the Internet or a CD-ROM or a DVD. A DVD? How the heck do I make a DVD out of my videotapes? How do I get them on a CD-ROM? What do I do about making them Internet-ready?

This two-part series will walk you through the hardware and software needed to do these jobs. In this week's article, I'll introduce you to the basic methods of digitizing your video, which moves it from videotape to your computer hard drive. Next week I'll show you how to convert that raw digitized video into compressed files for the Web, for burning onto a CD-ROM, or for burning onto a DVD. Both articles together provide a step-by-step tutorial, with some hints and a little enrichment here and there.

Let's begin in your tape vault, or where ever you have all that vinyl footage.

Taking stock of what you have

If your training department has created video in the past, you've done it in one of two ways: in-house or through a vendor. If you've done your video in-house, and your

video department is still using tape to dub (copy) and not doing the job digitally, you can help them understand that it's now 2003 — time to move into the new age. If you've been using a vendor (and many companies do), then you may have another problem.

Often it's not cheap to get an outside vendor to convert your tapes to digital media and then make them ready to publish online, or on a CD-ROM, or whatever. You can, however, do the digitizing and conversion yourself. In the short run, you'll probably spend less than you would by having a vendor do the job. You'll learn new skills at the same time. In the long run, you'll save lots of money. This is a good thing to discuss with your manager.

The first thing you should understand is

Continued on next page

Technology for delivering video in e-Learning programs has made great advances in the last five years. But most video is still on tape and not available to your online offerings. Here is the first part of a simple step-by-step tutorial that will get your video out of the vault!

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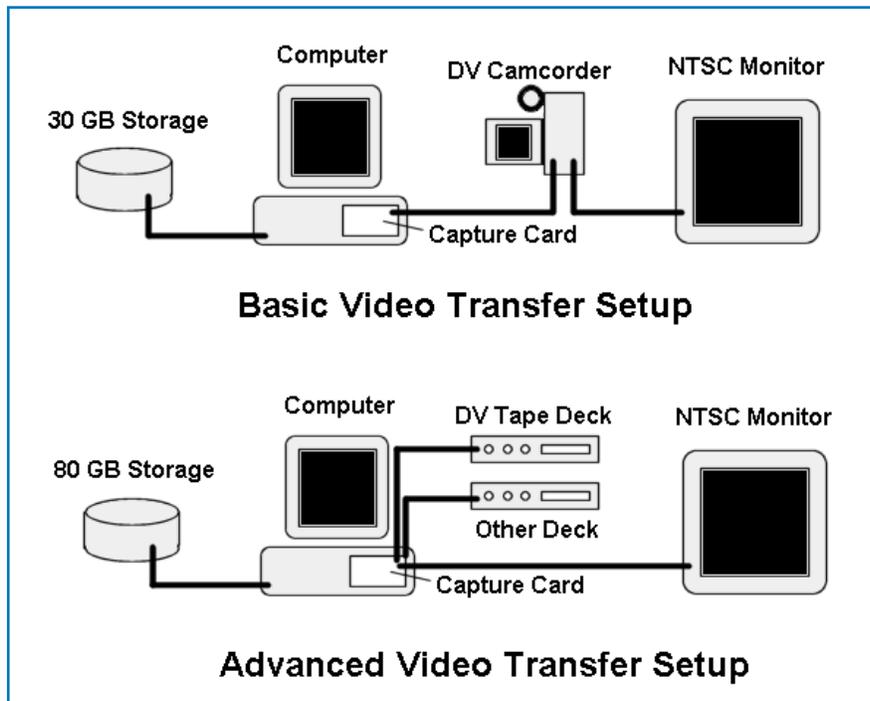


FIGURE 1 These are the two most likely system configurations for transferring video to your hard drive.

that the whole procedure isn't difficult. It does have a learning curve, but it's not that steep. You'll be an "expert," or at least expert enough to get the job done with confidence, in less than a month.

Ownership issues

The second thing you should know is that if you used a vendor to make the original videos, the original tape is yours. It belongs to you. It does not belong to the production house (sorry, production houses — I know you don't want people to know this). You employed the production house to create a work for hire. The work and the copyright belong to you. Many production houses want to retain control of your original tapes and they may tell you all manner of things to try to keep you from getting possession and control of your tapes.

The production house doesn't own the original tapes or the master edit. You do. You paid your department's hard-won budget dollars to get a tape written, produced, and edited and to get the final out to the people who need the training. You own the original media. That is, unless you signed a highly dubious contract in the first place, in which case, if you have a legal department, get them involved.

On the other hand, all those tapes you bought from vendors — the ones that have other people's copyrights on them — are

off limits for this discussion. Unless you have obtained permission in writing from the copyright owners to transfer the content to other media or to the Web, the content has to stay on the tapes. That's the law, and it's a really good idea (morally, legally, and financially) to be respectful of the copyrights of others.

Videotape formats

OK, that's out of the way. And here's why I made an issue of it: A sow's ear cannot be turned into a silk purse, no matter how hard you try. The sow's ear is a beat-up old copy of the video you spent all that time, energy and money on a few years ago. It's been seen by many learners, and what you were teaching and how it was taught is still valid. Although that old beat-up copy of your video might actually be made to look a little better with smart digitizing techniques, it won't look much better. You need to get your hands on the highest quality analog video you can get. And if you used an outside production shop, they've got it. They might charge you tape fees for your original footage after they stop kicking and screaming, but in the end, you'll get your hands on the best quality original tape.

Now you have two new things to think about: what format is the video tape, and how can you "capture" it onto your comput-

er hard drive?

So you've got the tape. The picture quality is pretty good. What kind of tape is it? VHS? S-VHS? BetaSP? Digital BetaSP? These are all different tape formats and the different formats require different tape decks. Whichever format the tape is in, you'll have to have a tape machine that will play it back. If you don't have a tape deck, buy one — except if it's a BetaSP (I've heard a lot of people call it either SP or Beta). A new SP deck can set you back a bundle (as in \$5,000-10,000). And they're still being manufactured. If you absolutely need one, you can often find them on eBay for \$1,000-2,000, but you're buying a pig in a poke there.

If you have only a few (up to a few dozen) SP tapes, a video service agency can do the conversion from SP to VHS or MiniDV for a lot less money. But beware — most video service agencies do not actively promote MiniDV. They would rather make DVCPro or something that's even more expensive than BetaSP. A good VHS or S-VHS dub from a BetaSP master is as good as it's going to get on a budget, and the dub should be almost as good as the original. Finally, very few video service agencies are willing to digitize video content because it involves their hard drives, and that can be expensive.

Most tape in your vault is probably analog. If your tape is already digital, it's still tape. Either way, the video information on the tape has to be "captured," that is, transferred to your computer's hard drive.

Overview of conversion

Assuming that you are not doing this conversion process in your spare bedroom, you are probably going to be using a setup similar to one of the two shown in Figure 1, above. (The NTSC monitor shown in the figure is only needed if you are going to output your video back to tape again, or if you are transferring video from, for example, VHS or BetaSP to DV or MiniDV as discussed in my hint later in this article.)

The factors to think about as you do your planning include:

What kind of finished product am I going for? Here are the most common e-Learning options today: video for streaming on the Web, video for distribution on CD-ROM, or a video-intensive training product for distribution on DVD. Always begin with the end in mind. This may dictate your choice of video capture

card, and it also tells you what kind(s) of software you will require.

What video format(s) am I starting with? This relates mainly to the tape deck issue just addressed. But it may also have some bearing on the process of capturing the video to your hard drive.

Here's the difference between capturing analog tape vs. digital tape. Analog tape can be captured with a capture card that has analog ports, hopefully "composite" and "S" ports. Every capture card I can think of in the market in February of 2003 that has analog ports has both flavors. You capture through these ports using the software that came with the card. There's almost always a utility (software) included to capture video when you buy one of these cards.

If the tape is digital (as in Digital Beta, or DVCAM or MiniDV) then you'll ideally capture the video through the FireWire port on your Mac (or on your PC, if it has a FireWire port). This makes life really simple because your digital tape, even though it's a long strand of tape with 1s and 0s on it, has a time code and all sorts of other information that those old fuddy duddy analog tapes don't have. So FireWire is a much easier way to capture — but you still have to capture.

And one other thing: all this capturing is done in real time. There's no way to do a high speed capture, so if your tape runs for 15 minutes, then it'll take 15 minutes to capture once you've started the process. This is true whether your tape is analog or digital.

How much video am I working with? This is critical, because it dictates the amount of disk storage you will need. We aren't going to talk much about storage in this series, but keep in mind that an hour of video on DV tape can consume 13 GB (gigabytes) of disk storage. If you aren't doing any editing, figure on needing twice that amount of storage per hour of tape. And remember that you will need to archive all these files somewhere. If you are editing tape (adding effects, combining footage), you may ultimately need between four and fifty times as much disk storage space.

Equipment for transferring analog video tape to digital formats

As noted above, transferring digital video tape to your hard drive is simplicity itself with a FireWire port. But things are a bit

different if you have analog tape (VHS for example) to start with.

By itself, converting analog to digital tape isn't hard. The biggest issue you'll have to deal with is the cost of the equipment. Let's pretend for a moment that you're past the money issue. Here's an equipment list that will take you from an analog tape to the Web or DVD, CD-ROM, or whatever form you're using to deliver your instruction.

Computer: Personally, I don't care whether I'm sitting in front of a Mac or a PC. In a corporate or educational environment where you usually have to use one or the other, it's all pretty much the same. So the computer itself doesn't matter. The minimum specification for the computer would look like this:

- Fast processor (Pentium 4 if a PC, G4 if a Mac)
- 512MB of RAM
- 80GB hard drive
- Good sound card (Creative Audigy 2 is a good choice)

• Good video card... this computer does not have to have the latest and greatest video card — those cards are for playing games. Now this terminology gets a little confusing. The video card I'm referring to only puts information on your computer screen. It has nothing to do with the video you'll capture. For that you'll need a capture card.

Capture card: Capture cards come in all flavors and prices, from \$100 to over \$5,000. That's a big variation in price and there's an enormous variation in the quality of the results these cards deliver. There's also a large variation in the way these cards will work with your editing board. Remember, you get what you pay for.

To expand on what was said earlier, capture cards aren't always necessary. But a capture card is an absolute necessity if you are going to capture analog video, and is also necessary if you are using a PC and you are capturing digital tape but don't have a FireWire port. Macs already have FireWire. Most new PCs have FireWire, but not all of them.

For most analog conversion or "repurposing" work, a \$500 capture card will do the job nicely. Capture cards in this price range are made by Pinnacle, Matrox and Canopus. All are good choices and have plenty of support. They all have analog inputs. The quality of the video they capture is also very good. Additionally, they all

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work very well inside Adobe Premiere, which is the software of choice that we will discuss in a moment.

If you must get a less expensive card, make sure it will capture 720 X 480 pixels. Those pixel dimensions translate to full screen video. Something you should remember throughout this process: the higher the quality you capture in the beginning, the better your output will be at the end.

Another caution about capture cards, especially if you are on a tight budget, has to do with IEEE 1394 (FireWire) cards. They

only enable the transfer of *digital* video into your computer. They do not really “capture” video. In particular, they do not support analog video conversion, they do not perform any compression, and they do not offer special processing options. If you are working with digital video, the camera and the computer handle the compression and decompression tasks that we will discuss later, so the card doesn’t have to do these jobs. Finally, if you are only working with digital video and you buy an IEEE 1394 card, be sure that you also get the correct

drivers to support your editing software (probably Premiere).

Software

You’ll need some sort of software to take the captured video and make it into video that can be seen on the Web or on a DVD or a CD-ROM. All analog capture cards come with a copy of Adobe Premiere or some other editing program, so you’re set in the software department. However, if you are buying your software separately, be sure that the software you choose supports the capture card you bought. Among the available programs today, Premiere probably has the shortest learning curve for basic video editing.

Budget

So how much will this cost? It’s simple. Taking the lowest end computer you should use for this, the estimated costs are:

- Computer: \$2750
- Capture card: \$500
- Software (if you need it): \$500

This makes a total of less than \$4,000 — of course you can spend more if you like. The quality will go up and the time it takes to do things will go down, but that’s a topic for another article.

In all this, I’m also saying if you are modifying an existing computer and it already has a sound card and a video card, all you have to do is get a capture card and you’ve got all of the hardware you’ll need to capture video. I’m also assuming you have at least 256Mb of memory. Memory is cheap these days, so if you don’t know how much memory you have, check with your IT people to make sure you have enough. It’s important!

If you compare these costs against the cost of remaking your video, then it’s very inexpensive. It doesn’t take much to spend this amount on video production, so this is a true bargain, even with new equipment. More money spent for a faster processor, bigger hard drive, more memory, better capture card, sound card, etc., will pay you back in the end with better quality.

Steve’s helpful hint

If you can afford a MiniDV deck (Sony calls it a Video Walkman) or MiniDV camcorder, get one. When I’m converting analog tape, instead of capturing the analog tape directly into my computer, I make a copy (dub) of the tape onto a MiniDV tape. This does several things, all of them good

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in my experience:

The most important thing is that you'll be making a digital tape copy of your analog tape. While this isn't digitizing your tape in the computer (and it adds an extra step to the process), it's a copy that will allow you to use the FireWire port on your capture card or the one built into your computer. It's far easier to capture video via FireWire than by analog ports.

Another important thing to consider is that MiniDV doesn't have the limited color bandwidth that analog NTSC (the American video standard) tape has, so the colors are even better, especially reds. Many people in the video industry jokingly say NTSC stands for Never The Same Color. (It actually stands for National Television Standards Committee.) Bottom line: If you can afford it, get the Video Walkman or a MiniDV camera (or both!) and copy your analog tapes onto digital tape.

The reason I suggest a deck instead of a camera is that if you're going to use the camcorder for both MiniDV recording and playback, you're placing a heavy burden on your camcorder's drive mechanism. Remember the tape transport is electro-mechanical, and that means at some point it will fail.

Process

Now that we have all the bits and pieces, it's time for the big picture. Converting your videotape to a digital file that can be streamed over the Web or burned onto a CD-ROM or DVD is only a two-step process. There are a few refinements possible here and there, but it's really simple as long as you aren't doing any editing.

Step 1: Capture the video to your computer's hard drive

With all of the hardware set up more or less as shown in Figure 1, you are going to use Premiere to control the capture of the video data through the capture card, and to direct the storage of the video data onto your hard drive. If your video is on DV tape, this is practically as easy as "plug and play." If the video is on analog tape, this step is not much more difficult.

As you will see in the step-by-step description, your video will be placed on something called a "Timeline." The Timeline is most important if you are going to be doing any editing, but for this article, you can think of it as a staging area. From

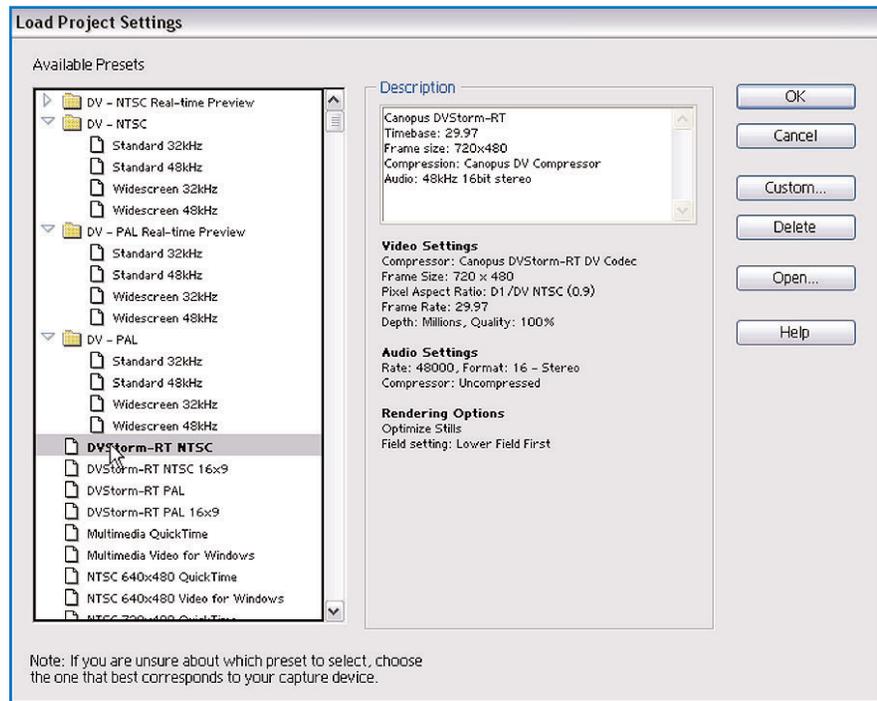


FIGURE 2 Select the editing format in Adobe Premiere.

the Premiere Timeline, you save the digitized video to your hard drive. From the Timeline, you will export the digitized video to a video file that is optimized for viewing from the Web, from CD-ROM, or from DVD.

Step 2: Render the captured video into a compressed format

Premiere also manages the export of the digitized video to that optimized video file. Essentially this process, called "rendering," consists of compressing the video in a way appropriate to the final destination. For the Web, the video file must be one that can be streamed — reducing transfer time as much as possible. For CD-ROM and DVD, the objective is to minimize the file size so that it fits in the limited space available. For DVD, you also have the option to use authoring software that will turn a plain video (all that you can do on CD-ROM) into an interactive training tool. You can also output the same video as separate versions, for example for Web viewing and for DVD. You can even put it back on tape, if you want to do that.

Exporting to digital files involves a number of steps that will be covered in the tutorial next week. These steps include making choices that affect the quality of the viewer's experience, such as the rate at which the video is played back, the frame size, and color depth. Other choices involve selecting the compression method that is

applied in order to allow the systems used by the learners to play the video.

The details for Step 1 follow in this article. Next week we'll cover Step 2, including the tricky business of balancing all those export choices.

Capturing video to your hard drive

OK. You've got the tapes. You've got the equipment. You're ready to start getting the tape digitized. How do you do it? If this were a book, I could plan for every different kind of PC and Mac out there, but it's not, so I'll have to be as generic as I can. First, I'm going to do the easy way of getting tape into your computer — FireWire, using digital tape.

Digital tape to digital file via FireWire

FireWire is a nice thing. It's what computers were designed to do, that is, do a lot of the work for you. FireWire was invented by Apple, but has been standardized as IEEE 1394 for several years and virtually every PC running Windows 2000 or XP and every Mac can use it. You don't have to shut your computer down when you plug devices in, either. The PC or Mac will see the device as say, a Sony Camcorder or Panasonic Tape deck or whatever. A Mac will mount the device on your desktop. A PC will show it in the drive section of My Computer.

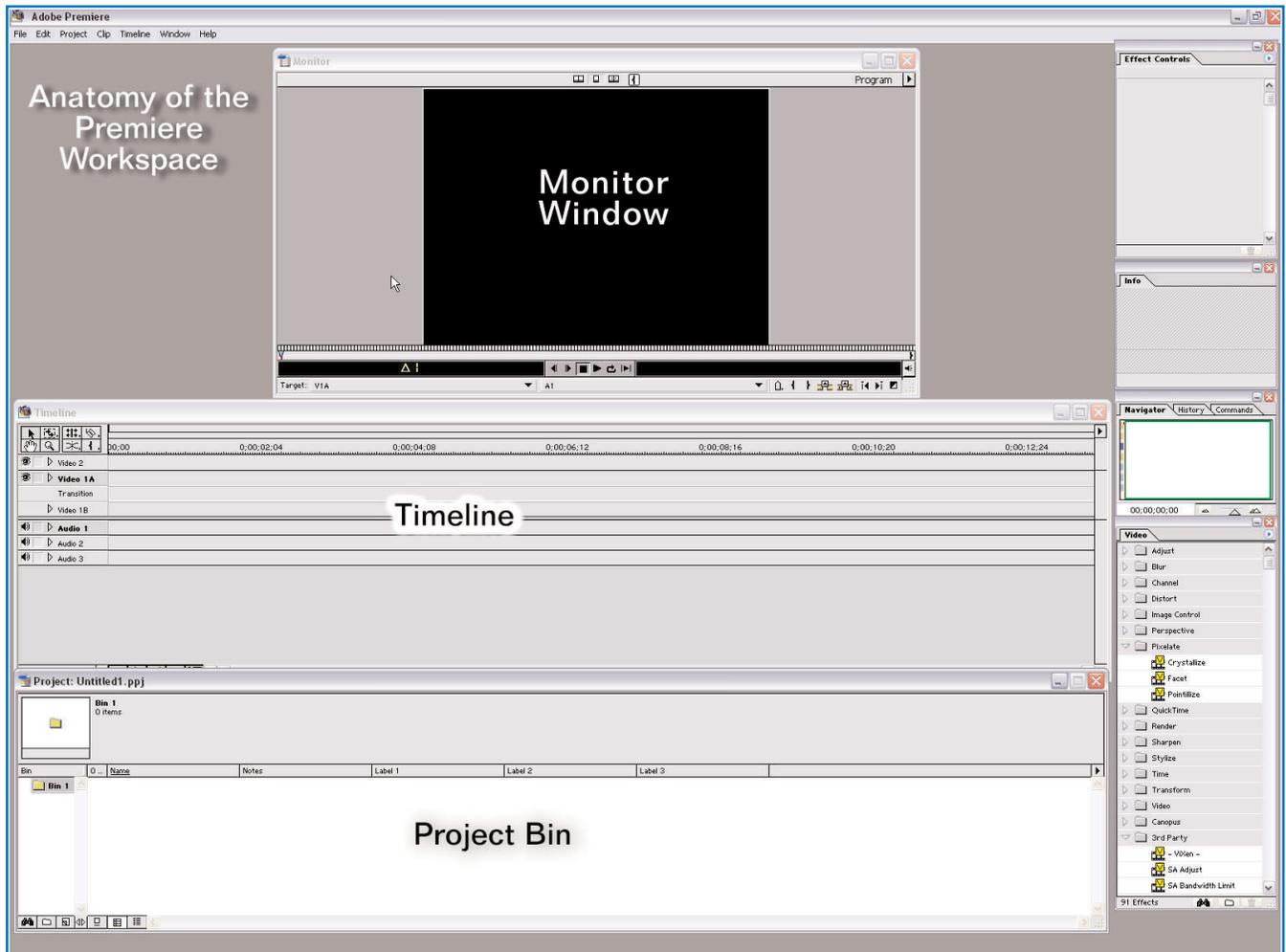


FIGURE 3 The Adobe Premiere editing screen.

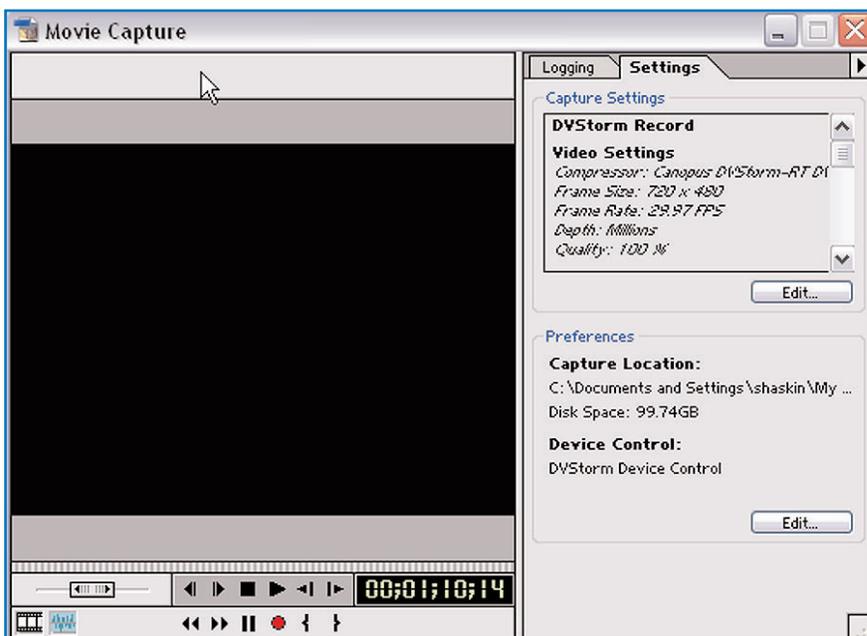


FIGURE 4 The Movie Capture window in Adobe Premiere

Some cards, such as the Pinnacle card, will have a program called DV Tools (or something like that) and others will capture through Adobe Premiere. Either way is easy, but I'm going to describe the Premiere method because you capture the video to your hard drive with the same software you'll later use to export the video to the format required by your distribution medium.

At this point I'm going to make the assumption that you've installed the capture card and software, and all appears to be working properly. So here it goes, step by step.

1. Start Adobe Premiere. After the software starts, you'll see a dialogue box that asks for the format in which you want to do your editing (which includes the process of transferring the video from the tape). (See Figure 2 on page 5.) In this case a Canopus DVStorm card is installed in this computer. Since I want the card to do some of the work for me, I've selected the

Canopus RT NTSC option. This is only for making the transfer to the hard drive. It has nothing to do with the way the video will be exported later, in Step 2 (next week).

Once I've selected the method of editing, I'm presented with a new screen. (See Figure 3 on page 6.) This is the basic editing screen and it has lots of details you'll need eventually, but not now. We'll get to these as you need them, and the callouts in the figure will help.

2. Now on the menu bar, go to File > Capture > Movie Capture and you'll see another new window. (See Figure 4 on page 6.) This is the Movie Capture window. Since in this example there is a FireWire device (for example, a camcorder or tape deck) plugged in, you'll be able to start and stop that device, plus start recording on your computer right from this dialog. It's very nice and it usually works too.

3. In the Movie Capture window, you'll see an Edit button in the Preferences section of the Settings tab. Click on this, and you'll be able to designate the directory where you will store captured movies, as well as where to store your video and audio previews. In the Capture Settings section, choose the device control, which is the capture board you are going to use. I've selected the Canopus DV Storm device control, since that's what is installed in this machine.

4. You are now ready to start capturing your video. If you click on the Play button, and then the Record button (at the bottom of the Movie Capture window), you'll hear your hard drive start to churn away. Premiere is now recording the video to your hard drive. You can watch the process with your jaw hanging a bit, or you can walk away from the computer until you've got the entire tape captured. But remember *Steve's Rule Number 1: If you walk away, something in your computer will screw up.* Better you should hang around and do other things that need to be done.

5. After the tape has faded to black, click on the Stop button and you'll be prompted to give the file a name. Call it whatever you want, but you should have some sort of naming schema in mind, even if it's only the name of the video. This way you're consistent. Your whole video is now a file on your computer, just like a Word document.

6. You're done capturing your video. That's all there is to it. Really.

GLOSSARY

Composite video: Composite video is one of two methods commonly used for sending video signals to video systems. The other method is "S" video, described below.

If a video system is to receive video correctly, it must have several pieces of information. First, it must have the picture that is to be displayed on the screen and it must know the correct colors to use in displaying the picture. These two elements are the "active video." The video system also needs information that tells it where to place each pixel (picture element). This element is called "sync." Finally, the display needs to know when to shut off the electron beam that "paints" the image onto the monitor screen, so the viewer can't see the beam retrace across the screen. This element is called "blanking." Each of these pieces could be sent individually and simultaneously over three separate connections to the video display. This would be a waste, though, because all three can be combined into a single stream or signal, sent to a single connection.

Composite video puts everything into one signal. There are two common standards for sending composite video. NTSC is the standard used in North America, and PAL is used in Europe and most of the rest of the world outside of North America.

The simultaneous transmission of all these elements limits the quality of NTSC and PAL video. A receiver, whether a television set or a VCR, runs the composite signal through filters that separate ("decode") the various pieces. The process of decoding composite video with filters tends to smooth the transitions in the waveform. This smoothing process is exhibited as edges that aren't as sharp as originally recorded, and colors that aren't as distinct.

"S" video: S-Video (as it is also known) is the other system for sending video signals. The "S" stands for "separate." Separate luma (Y) and chroma (C) video signals are used, rather than a composite video signal. By electronically adding together the Y and C signals, you reconstruct the original video signal.

S-Video is a higher quality method for delivering video signals. The quality is improved by eliminating the need for the filtering processes that degrade video output. The method is simple — don't combine the signals in the first place. If the signals are always separate, never combined, then no filtration is required. The resulting image, captured in the computer's memory, is a more precise representation of the image originally captured by the camera or recorded by the VCR.

There is only one significant disadvantage to S-Video — cost. S-Video equipment is generally more expensive than composite video equipment. Another disadvantage is that S-Video is not a broadcast standard. S-Video can only be moved through interconnecting cables.

Analog tape to digital file via capture card

Capturing analog video isn't as "pretty" as FireWire capture, but isn't different in substance. The major difference is that you push the actual physical buttons on the tape deck, camcorder or whatever device is holding your tape instead of having the computer do it for you. There's also no absolute time code on an analog video tape until you get it into the computer. The timing you see on a digital tape is absolute to the frame. The timer you can see on your VCR or other analog deck is relative, so on an analog tape you can't go to an exact place in the video by typing it into a

dialogue box. You have to start at the beginning of the tape, find the section you want to capture, and start your computer recording at that point.

That's all there is to grabbing your video. For the purposes of this series, we're assuming you are grabbing complete videos. There is no editing to be done. Maybe a fade-in or fade-out to make the change in format look a little more polished, but that's it.

Conclusion of Step 1 tutorial

This concludes the tutorial for Step 1. You now have an exact digital copy of your original videotape on your hard drive. You saved this copy with a file name that will

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AUTHOR CONTACT

Stephen Haskin has been involved in the world of digital video for education since the late 1980s and in computing since the 1970s. He has worked in the worlds of corporate education and training and film/video production. Always keenly interested in medicine and medical training, he moved to the arena of academic medicine four years ago. He currently directs the development of Internet and Intranet educational Web sites and works on video projects for the University of Michigan, Department of Surgery. Steve is also the author of several books on video production in the computer environment and wine (yes, wine). Contact Steve at shaskin@med.umich.edu



The author at work behind the camera.

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