

How Video Editing Works
by [Marshall Brain](#) and Roxanne Reid
from: howstuffworks.com

Inside This Article

Introduction to How Video Editing Works	1.
Digital Camcorders	2.
Video-Editing Computers	3.
Video Editing: Basic Concepts	4.
Running Adobe Premiere	5.
Editing a Video: Capture and Clips	6.
Editing a Video: Timeline and Transitions	7.
Background Music and Narration	8.
Split-edits	9.
Adjusting Video Sound	10.
Lots More Information	11.
	12.

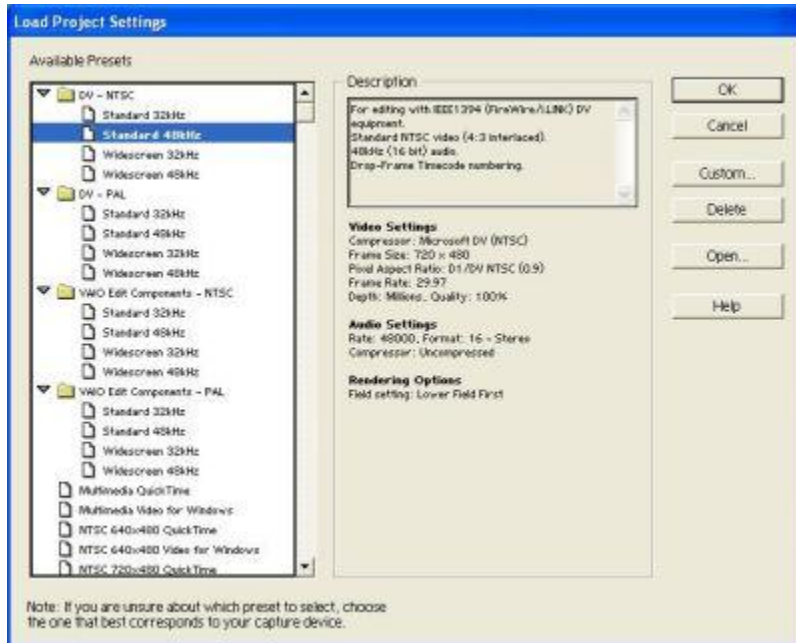
See all **Software** articles

You may have seen [TV](#) commercials and magazine articles that talk about the "dawning of the new age of personal video." It is an age in which anyone can sit down at a [home computer](#) and produce a studio-quality motion picture. All you need is a [video camera](#), the right software and a desire to create something. With today's camera and computer technology you can:

- Create a really nice rendition of your summer vacation -- far better than "home movies"
- Produce an unbelievable video presentation for work
- Create a full documentary film on any topic or issue you wish to promote

- Create your own multi-million dollar blockbuster movie, just like [The Blair Witch Project](#)

That's the idea, anyway. If you have ever tried to sit down and do it yourself, however, you know that it's not as easy as it looks. In fact, with the more advanced software packages, it can be nearly impossible to get started because they are so complicated. For example, when you open Adobe Premiere -- a [video editing software package](#) -- you are faced with this initial dialog box:



The opening dialog in Adobe Premiere is not for the faint-of-heart. See more [video-editing program screencaps](#).

If you have ever thought about producing your own high-quality videos on your computer, but haven't gotten started either because you didn't know where to start, or because it all seemed WAY too complicated, then this article is for you! In this article, we will dive deep into the world of home video editing. You will learn:

- What is possible
- What you really need -- in terms of equipment and software -- to make it happen
- The concepts you have to understand in order to use any of the popular editing packages

Plus, you will learn how to download and set up a free demo version of Adobe Premiere so that you can try out all of these concepts on your own!

At the end of the process, you will be surprised to see just how much you can do with today's technology and how easy it is to get started.

If you have a [camcorder](#), then you know that it is easy to create home video. You simply point and shoot. However, if you have ever played back what you shot and looked at it, then you know how hard it is to create *good* home video with nothing but a camera. Even if you are extremely careful when shooting, you usually end up with a lot of "junk" on the tape. When you play it back, it looks like a "home movie" -- amateurish, disjointed, confusing, lousy sound...

Because most of us watch so much television and see so many movies, we tend to have fairly high standards when we watch anything on video. We now expect the following features in almost everything we watch:

- A title at the beginning
- A set of "shots" cut together in a nice way to tell a story

A **shot** is a specific subject filmed from a specific angle. For example, if you are telling the story of your son's birthday party, different shots from the event might include:

- a shot of the cake
- a shot of the presents before they are opened
- a shot of the kids at the party sitting at the table
- a shot of your son blowing out the candles
- a shot of your son unwrapping a present

A fairly high number of shots

If you watch any regular TV show, you will see that it is rare for the camera angle to stay the same for more than 10 or 15 seconds. The director will cut between different angles to keep things interesting or to make different points. For example, the screen might show a man's face while he's talking for five seconds, and then switch to a shot of his hands holding a tissue (while the sound track continues uninterrupted with him talking) to show the emotion.

Interesting transitions between the shots

For example, some shots might fade into others, some might spin into others, and some cut very simply from one to another in a quick chain.

A decent soundtrack, often involving narration and/or background music

Perhaps static shots (like a chart or graph) mixed in with the normal video

Titles or legends on some of the shots to identify people, places and things

Slow motion or fast motion to change the tempo

Even if you are trying to present something as simple as your family trip to the zoo, it is nice to include as many of these features as possible in your rendition of it. The more features you add, the more professional your work looks and the more attractive it is to your audience.

The good news is that, with just a camera, a computer and a piece of **video editing software**, you can create video masterpieces that include all of these features.

There are a million different ways to do video editing. You can buy a complete solution from a company like [Avid](#) at the high end, and at the low end you can use your camera and a [VCR](#) to cut things together. The solution that we are going to discuss in this article involves three different parts:

- A digital camcorder that has a [FireWire](#) (IEEE 1394) connection
- A [desktop](#) or [laptop computer](#), also equipped with a FireWire connection
- A piece of video editing software

Let's look at each of these parts in turn.

Digital Camcorders

There are hundreds of [digital video cameras](#), or **camcorders**, on the market today from manufacturers like Sony, Panasonic, JVC and Canon. Most of them use what are known as **MiniDV** tapes like the one shown here:



The MiniDV tape is used in most digital camcorders.

Just about every camcorder based on the MiniDV tape format includes a [FireWire](#) (IEEE 1394) port on the camera so that you can load the video onto your computer quickly and easily. The following three cameras are typical of digital camcorders on the market today.



This is perhaps the least expensive digital camcorder on the market today. It uses Hi-8mm tapes instead of MiniDV tapes, but records on them digitally. This kind of camera is very handy if you have a lot of analog 8mm or Hi-8 tapes that you want to

load into your computer. The camera will convert an analog tape and run it out through the FireWire port on the camera, or record in digital format onto new tapes. The only problem with some of these cameras is a fairly low resolution.



©2002 HowStuffWorks

A typical MiniDV camcorder -- it has a 1-megapixel CCD that gives it great image quality. Consumer camcorders now have up to 1.5-megapixel CCDs.



© 2002 HowStuffWorks

This is an entry-level professional camcorder with three CCDs. It records onto DV-CAM or MiniDV tapes. It can produce broadcast-quality images and has professional features like XLR inputs and zebra stripes.

Whichever type of camera you pick, it needs to have a FireWire connection so you can hook it to your computer. A FireWire connection normally looks like this:



This sort of FireWire connector is common on digital camcorders. You attach a FireWire cable to this connector, and attach the other end to your computer.

Next, we'll learn about computer requirements and the software

Video-Editing Computers

You can use just about any desktop computer for video editing, as long as it has:

- A FireWire port to connect the camera to - If your computer does not have a FireWire port, you can buy a FireWire card and install it for less than \$100.
- Enough [CPU](#) power, [hard disk](#) space and bus bandwidth to handle the data flowing in on the FireWire cable

Video processing in general uses lots of CPU power and moves tons of data on and off the hard disk. There are two different places where you will most feel the benefits of a fast machine and the sluggishness of a slow one:

- When you render a movie that you have created or write it out to hard disk, you will definitely feel the speed of the machine. On a fast machine, rendering and writing can take minutes. On a slow machine it can take hours. You will learn more about rendering later in this article.
- A more important issue comes when you are reading data from or writing data to the camera. When the video data stream is coming in from the camera through the FireWire cable, the computer and hard disk **must** be able to keep up with the camera or the computer will lose frames. When sending a completed movie back to the camera, the processor must be able to stream the data quickly enough or the camera will lose frames.

I have one Pentium 3 machine running at 500 MHz, with 512 MB of [RAM](#) and a decent 20-GB hard drive. It is right on the edge of being able to handle the data stream from the FireWire connection. It can not handle it if any other applications (like an [e-mail](#) program) are running. A Pentium 4 machine or a late-model Mac with 512 MB or 1 GB of RAM and a big hard disk is a nice machine to have when you are rendering and writing files.

The Software

There are many software packages available for editing video on your computer. Windows XP even ships with software that's built into the [operating system](#). Machines from Sony and Apple have software that comes with the machines.

In this article, we will use a software package called **Adobe Premiere** to demonstrate the video editing process. We are using Adobe Premiere for two reasons:

- There is a free demo version available on the Web, and it will run on both PCs and Macs. [Click here](#) to download a copy.
- Adobe Premiere is a full-featured and well respected video editing package that can do almost anything you would want to do.

In order to use a package like Adobe Premiere, you need to understand several basic concepts. Once you understand those basic concepts, however, the whole process is remarkably easy. After you are familiar with the fundamentals, it is extremely easy to expand your repertoire to include all sorts of advanced techniques.

Next, we'll look at the four most important concepts you need to understand from the start.

Video Editing: Basic Concepts

So far, we've discussed the equipment you will need to edit video. Now let's learn the basic concepts you will need to know in order to use that equipment.

Capture

The first concept is called **capture**. You have to move all of the footage out of the camera and onto your computer's hard disk. There are three ways to do this:

1. You can capture all of the footage in a single file on your hard disk. A half hour of video footage might consume 10 gigabytes of space. (Note that some operating systems and video editing software packages limit file size to 2 gigabytes. Other packages put a 30-minute limit on file size.)
2. You could bring it in as five or 10 smaller files, which together will total 10 gigabytes but will be a little more manageable.
3. You can have a piece of software bring in the footage shot by shot. Adobe Premiere can do this manually, but a program like DVGate Motion (which comes standard on many Sony computers) can automatically scan the tape, find the beginning and end of every shot, and then bring them all in. Each shot will be in a different file when it's done. If you have access to a program like this, it makes your life very easy.

If you have just a few minutes of footage, technique #1 is the way to go. If you have an hour of footage, techniques #2 and #3 are useful.

AVI and MOV files

The capture process will create AVI (on the PC) or MOV (on the Mac) files on your hard disk. These files contain your footage, frame by frame, in the maximum resolution that your camera can produce. So these files are huge. Typically, three minutes of footage will consume about 1 gigabyte of

space. You can never have enough disk space when you do a lot of video editing. The Mac we use here at HowStuffWorks for most of our editing has almost 300 gigabytes of fast [SCSI](#) disk space, and Roxanne is always having to archive stuff off of it to make room for the new material we are working on.

Shots

Once you have all of your footage into your machine, you need a way to select the parts that you are going to use. For example, let's say that you want to include a scene in your birthday movie that shows the candles on the birthday cake being lit. You filmed this activity from three angles and have three minutes of raw footage total. But in the final movie you are going to have 15 seconds of the movie devoted to this scene, in the form of three shots:

- A 3-second shot showing a match being lit
- A 5-second shot showing a close-up of one candle on the cake being lit
- A 7-second shot of the cake with all the candles lit being carried into the room

Out of the big file of all the footage, you need a way to mark the beginning and end of these three little clips so that you can move them around as individual units and bond them together into the final scene.

You do this by looking at the raw footage and marking an IN and OUT point for the little sections that you want to use. Then you drag these little clips onto the **timeline**.

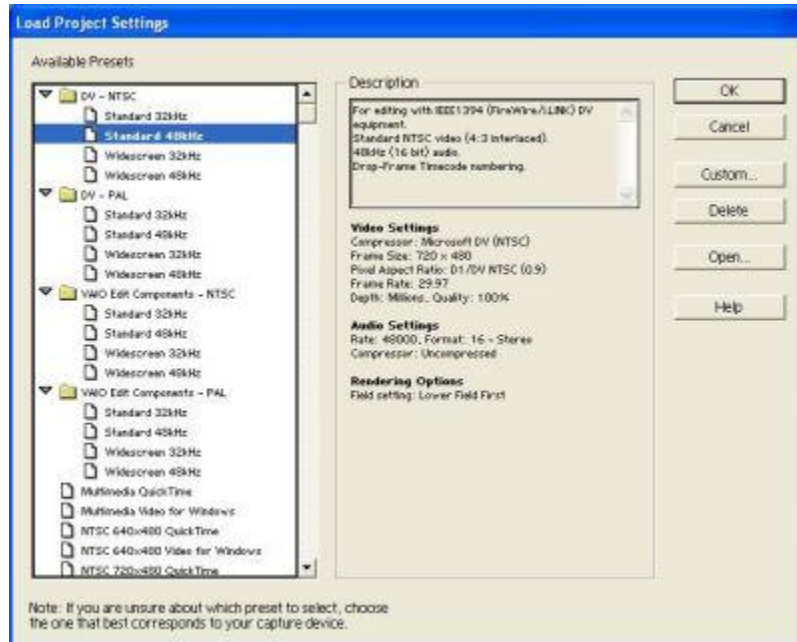
Timeline

Once you have your shots figured out, you need a place to arrange them in the proper order and hook them together. The place where you do that is called a timeline. You line the shots up in sequential order. Then you can play them as a sequence.

With just three concepts -- capture, shots and timeline -- you can make a movie. It will not be fancy, but it will be 10 times better than watching raw footage. Let's run through these steps and create a movie with them.

Running Adobe Premiere

Once you have installed Adobe Premiere on your PC or Mac, (see [this page](#) to download a free demo version), start the program. The first thing that you will see is this dialog:

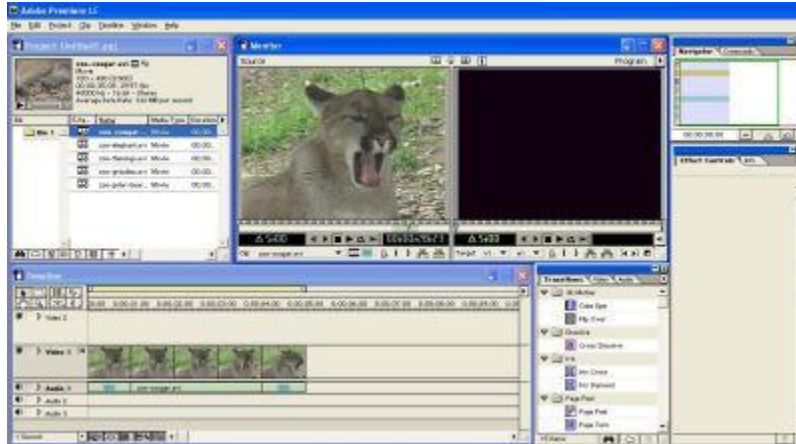


You can click OK here and move on to the next step, but if you'd like to understand what this dialog is talking about, here's a quick description:

- This dialog is a complex way of letting you tell Premiere how your camera records raw footage. There are two parts to the equation -- the **video resolution** and the **audio sampling rate**.
- If you have a camcorder that uses MiniDV or DV-CAM tapes, then your camera is taking images at 720 x 480 resolution. You would choose from one of the first two blocks (DV - NTSC or DV - PAL) depending on whether your camera is **NTSC** or **PAL**. The United States and Canada use NTSC, and Europe and Asia use PAL.
- Then you have to pick whether you shot your raw footage using **standard format** or **widescreen (16:9) format**.
- Then you have to choose the audio sampling rate. The easiest thing to do is look in your camera's manual, but 48 KHz seems to be standard for most MiniDV camcorders.

If you are using a MiniDV camera in the United States and you are shooting standard rather than widescreen, then the default that Premiere chooses is correct. Otherwise, choose an appropriate option for your situation.

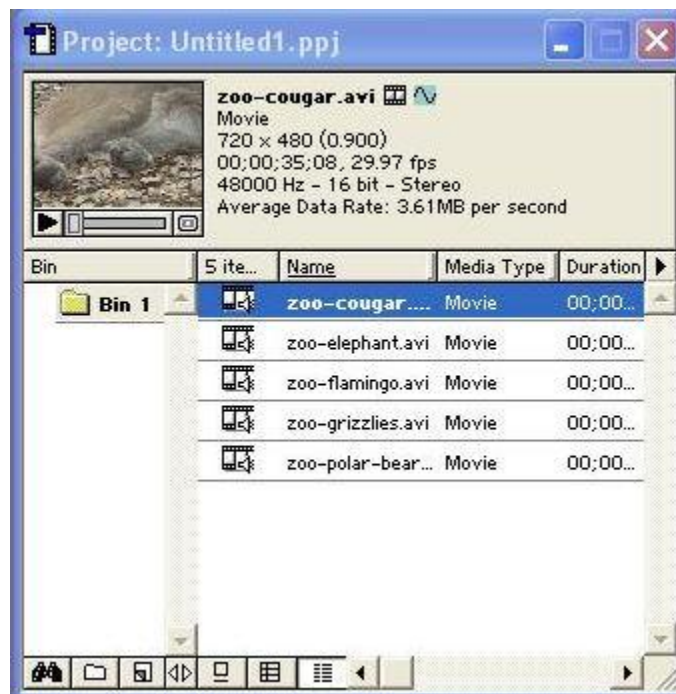
Once you get past the Project Settings dialog, you come to the main working screen of Premiere, which looks something like this:



The main working screen for Adobe Premiere

There are five different areas on the screen that are important.

- **The Project Area**



The project area

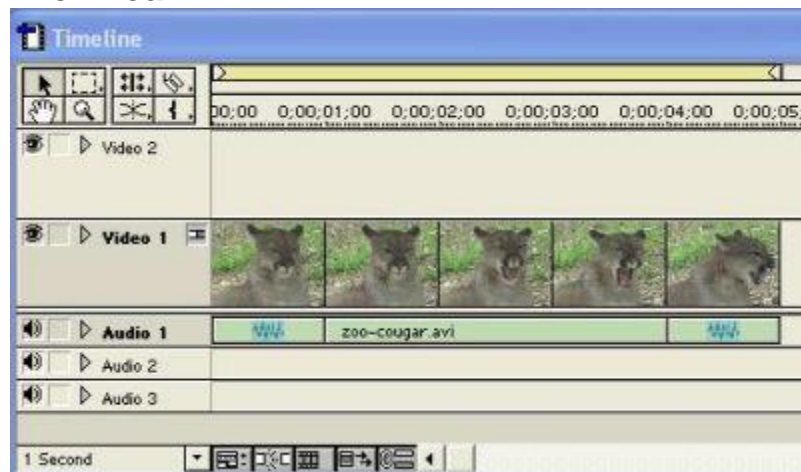
- The project area keeps track of all of the different AVI/MOV files containing the raw footage that you are using to create your movie. In this illustration, the project area has had five different files imported into one bin. Each file is a piece of raw footage: one of a cougar, one of an elephant, and so on. A bin is just like a folder -- it is a collection of things.

- **The Monitor Area**



The monitor area

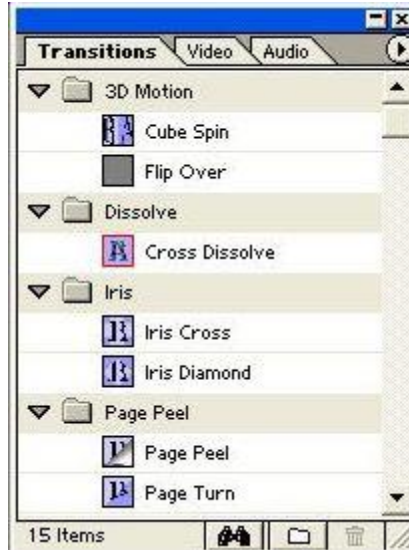
- The monitor area has two video windows. The left window, called the Source window, lets you look at different AVI files so that you can identify the IN and OUT points for the clips you want to use. The right window, called the Program window, lets you view your movie as it develops on the timeline. Both have standard controls to play, stop, repeat and so on.
- **The Timeline Area**



The timeline area: Note that your timeline view may be different. Right-click on the timeline to change the preferences.

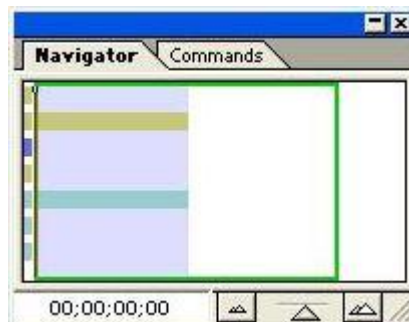
The timeline area is where you assemble audio and video clips into your final movie. This timeline initially has room for two video tracks and three audio tracks, but it can handle dozens if you like.

- **The Transitions Area**



The transitions area

- The transitions area lets you choose different transitions so you can drop them on the timeline.
- **The Navigator Area**



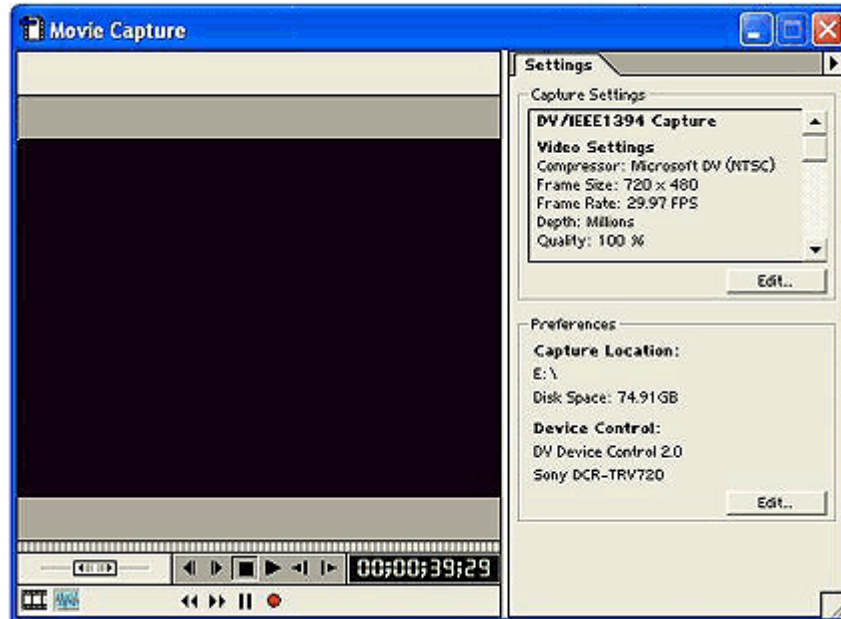
The navigator area

- The navigator area lets you see your whole project at a glance, no matter how big it gets. It also lets you set the zoom level in the timeline area.

Let's look at the process of editing a video with Adobe Premiere.

Editing a Video: Capture and Clips

After you shoot raw footage with your camera, you need to load that footage into your computer. To do this, connect your camera to your computer with a FireWire cable. Select the Capture... option in the File menu of Adobe Premiere. You will see a window like this:



The Capture dialog from Adobe Premiere

The controls at the bottom of the Capture dialog let you control your camera. You can rewind, fast forward and play. Typically, what you would do is:

- Hit the Rewind button in the dialog to rewind the tape in the camera.
- Hit the Play button in the dialog to start playing the tape.
- Hit the red Record button to start capturing the footage onto your hard disk.
- When the footage is done playing/recording, hit the Stop button. Premiere will ask you for the file name that you want to use for this footage.

You can either capture all of your footage in one big file, or you can capture it in a number of smaller files. (Note that some operating systems and video editing software packages limit file size to 2 gigabytes. Other packages limit file size to 30 minutes. You also need to make sure that you have enough free disk space to hold all the captured footage.)

Premiere will create AVI (on the PC) or MOV (on the Mac) files on your hard disk at a rate of about 1 gigabyte per three minutes of raw footage.

As an example, look at this piece of raw footage from the zoo:

- [A cougar](#)

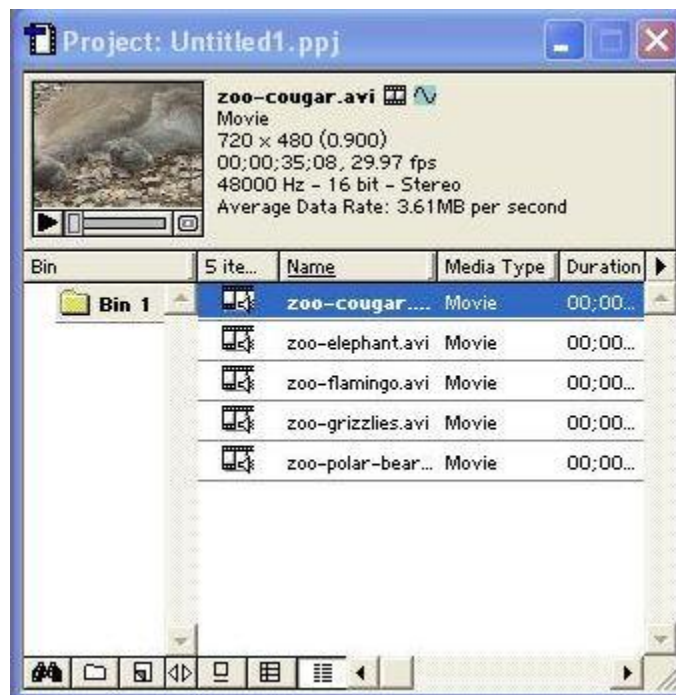
The footage is 35 seconds long, and the AVI file that Premiere created when it captured the footage is 130 megabytes. We've converted the raw footage into an MPG file so that you can view it on the Web. It is typical

"raw footage" with all sorts of debris and problems that you find in most raw footage. In the next section, we'll see how to clip out one usable piece from the raw footage.

Clipping

Let's take the shot of the cougar from the previous section as an example (look at it [here](#) if you have a high-speed connection). It's a decent shot of a cougar lying on the ground for 30 seconds. In the middle of the shot the cougar yawns. Let's say that you would like to clip out the yawn and use it in your movie. To do this, take the following steps:

- You first need to "import" the file containing the raw footage into the current **project** so that Premiere can use it. If you captured the footage in Premiere, then it was imported automatically. If not, choose Import... from the File menu and locate the AVI or MOV file you wish to add to the project. Adobe uses the concept of a "bin" to hold AVI and MOV files. A bin is like a folder -- it is just a collection of files. In complicated projects, you may have several bins that store different types of footage. Here's what you'll see after you import the footage:



This project area has had five AVI files imported into one bin. One AVI file contains a cougar, the next an elephant, and so on.

- Drag the cougar file from the Project window into the Source window.
- Play it in the Source window to see what you've got by pushing the Play button.
- Mark the IN and OUT points for a clip you want to use in the Source window.

There are several ways to mark the IN and OUT points. As you are playing the video, probably the easiest way is to hit the I and O keys on the [keyboard](#) when you see the IN and OUT points. Once you rough them in, you can fine-tune them with the mouse by dragging them.

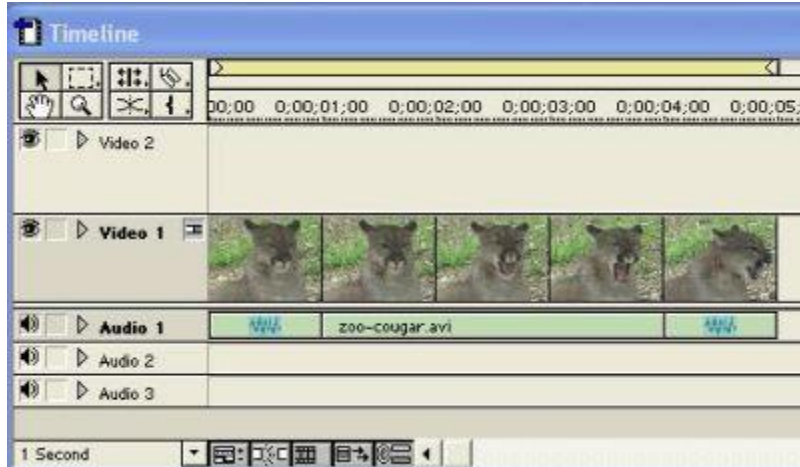


Marking IN and OUT points in the Source window: The little green bar above the time code shows you which part of the raw footage has been selected for the clip.

Now that you have selected a clip, you can add it to the timeline

Editing a Video: Timeline and Transitions

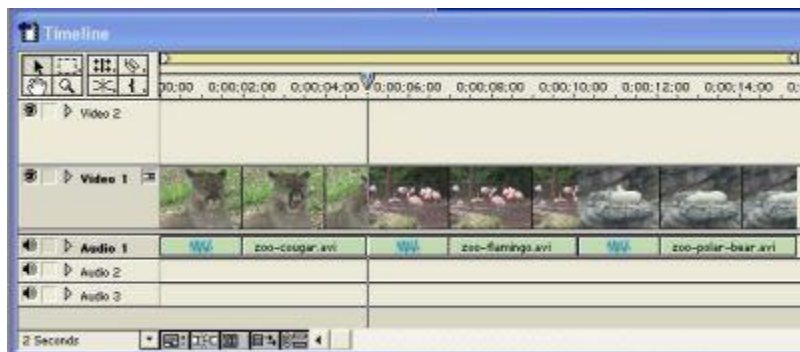
Once you have marked a clip by selecting the IN and OUT points in the Source window, you can add the clip to the timeline. Simply drag the image from the Source window down to the timeline. You will see something that looks like this:



The timeline with a single clip in it (Note that your view of the timeline may look slightly different. Right-click on the timeline and change the preferences to select your view of the timeline).

What the timeline now shows is that your movie contains one clip, about five seconds long.

Now what you can do is repeat this process and drag several more clips onto the timeline. You will end up with something like this:



The timeline with three clips in it

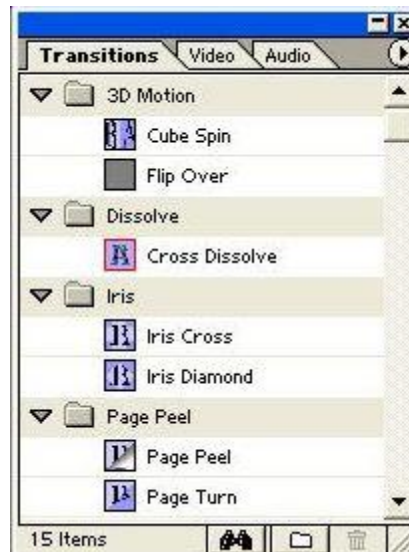
This is the simplest possible movie -- a bunch of clips strung together on a timeline. But it is a movie nonetheless, and it is 10 times better than raw footage because you have chosen the best parts of the raw footage to assemble on the timeline. To play your movie, you can click the play button on the program portion of the monitor area, or you can click in the time portion of the timeline area to move the pointer and then press the space bar to start playing from that point.

Let's say that you would like to change the length of a clip once you have it on the timeline. There are several ways to do this:

- You can drag either end of the clip on the timeline with the [mouse](#).
- You can use the razor blade (upper left corner of the timeline window) and cut a clip, and then delete either end by clicking on the end and hitting the delete key. Then you can right-click on the gap that you created and choose Ripple Delete from the menu that pops up.

Transitions

Sometimes simple cuts from one clip to the next work well, but other times you might want to use fancier transitions from scene to scene. For example, you might want to use a **dissolve**, or a **wipe** or a **fade**. Premiere has all sorts of transitions available. Simply choose one from the transitions area and drag it to a spot between two clips on the timeline:



The transitions area contains dozens of transitions for you to try.

Once in place on the timeline, right-click on the transition to adjust it if you like. The transitions will look like this on the timeline:



The timeline with a transition in place

When you play your movie, you will not be able to immediately see how the transition will actually look. That's because transitions take some extra processing to complete the effect. Premiere tells you that extra processing still needs to be done by putting a small red bar above the transition, as seen in the previous illustration. To activate the extra processing, you **Render** the timeline. From the Timeline menu, choose Render Work Area. When the processing is finished, you can play your movie to see the transition.

In the next section, we'll learn how to add music and sound effects to your movie.

Background Music and Narration

When you shoot your raw footage with your camcorder, it has a sound track. There are three reasons why you might want to supplement or replace the existing sound track:

1. Many of the TV shows and videos you see today, and almost all [movies](#), have a musical background during all or part of the action. Music can lend atmosphere and create a certain feeling. In the case of amateur production like we are talking about in this article, music can add a lot of professionalism to the finished work.
2. An additional sound track is frequently used to handle narration. Most [documentary](#) and nature films use this technique.
3. In many cases, the sound you record is unusable, or just not quite right, for the movie you are creating. For example, if a lion roars at the zoo and you capture the image, you may not be able to capture the sound because the lion is 50 feet away and you are using a

zoom lens to film him. In that case, you'll want to substitute a better roar for the one you have.

To handle **music**, you have several options:

- You can make up your own music and record it yourself. For example, I recorded [this music loop](#) using a little \$45 keyboard by connecting its headphone jack into my computer's line-in jack. I used the Sound Recorder built into Windows to record it at 48K samples per second. Obviously you can get a lot more sophisticated than that, but it shows you how easy it is.
- You can buy [CDs](#) full of royalty-free music loops and sound effects.

You can import many different types of sound files (including WAV, AIF, etc.) into a Premiere project and then position it on the timeline in Audio Track #2. Now when you play your movie, Premiere will automatically mix the original sound track of your movie with the new audio track and play it.

To handle **narration**, probably the easiest thing to do is simply read your narration into the camera, and then capture the video as you normally would. You can separate the narration sound track from the video track and use the sound track. Simply drop the raw narration footage onto the timeline, right-click on it and select "Split Video and Audio." Click on the video portion and delete it. Now you have the narration sound track that you can lay on the timeline at the proper point.

Particularly with narration, **timing** the video with the audio becomes important. Once you have the narration sound track on the timeline, you can slice it up with the razor blade tool to either add gaps or delete sections to help with timing.

In a big project, it is not unusual to be working with half a dozen sound tracks. Premiere can manage an unlimited number of audio (or video) tracks. To add a new sound track, all you need to do is right-click on the timeline and select the Track option. Select to add a new track.

Split-edits

Any TV program or movie that you see today contains **B-roll**. In the vernacular, **A-roll** is raw footage where there is a person on-screen talking. B-roll is everything else. If you were to film a high school play, the raw footage would be almost pure A-roll. On the other hand, a nature documentary can be created with nothing but B-roll, and then a narration is laid over the top of it. If you are creating a movie that explains something, it is very common to use B-roll to provide close-ups of the thing you are

explaining. You see this technique all the time in any video that HowStuffWorks creates.

The process of cutting a piece of B-roll into a piece of A-roll is often referred to as a **split-edit**. For example, earlier in this article we talked about a scene where someone is talking on camera about an emotional topic. In the middle, the director cuts to a tight shot of the person's hands holding a Kleenex. During the scene, you see the person talking, then the Kleenex, and then return to the person's face, and the sound track is uninterrupted by the B-roll.

To add B-roll and create a split-edit in Premiere, you simply add the B-roll footage to the time line using video track 2. Premiere's protocol is to use whatever video is in the highest numbered track when playing the movie. For example, let's say you set this up:



The timeline with a split-edit in it

You have the shot of the polar bear lying around. For contrast, you want to cut to a shot of two grizzly bears wrestling. You simply place the grizzlies on video track 2. When Premiere plays the movie, you will see the polar bears, then the grizzlies and then back to the polar bears.

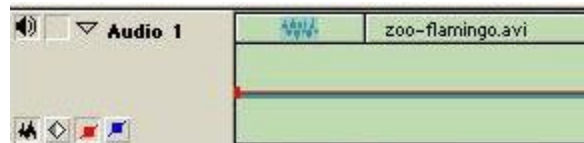
In some cases, you want to completely discard the sound track of the B-roll. Right-click on the B-roll and select "Split Video and Audio." Then click on the audio portion and delete it. Or you may want to eliminate the sound in the original footage. We'll see how to do that easily in the next section.

Adjusting Video Sound

If the visual part of a movie is perfect but the sound is not, then the movie looks amateurish. Fortunately, Premiere offers sophisticated tools for getting the sound right. We've already discussed how to add new sound

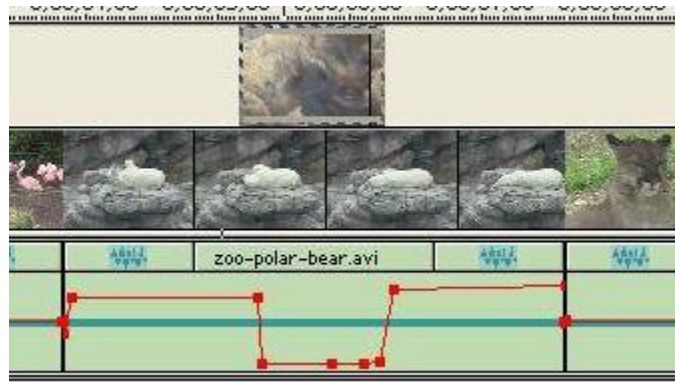
tracks to the timeline. Now you need to understand how to adjust each sound track so that everything sounds perfect.

On every sound track, there is an arrow icon. Clicking it will expand the view and make an adjustment area for the sound track available, as you can see here:



Adjustment area for an audio track

In this adjustment area, you can add new control points simply by clicking anywhere along the red line. Then you move the control points by dragging them with the mouse. The control points control the level of the sound. For example, in the following illustration, the level of the sound in video track 1 has been taken to zero so that the sound on a split-edit is used instead:



Modifying the level of an audio track

What you will normally do is listen to the sound track and "even out" or "sweeten" the sound by adjusting things so that the sound is uniform throughout your entire piece.

It is important to mention that having a good **microphone** can really help sound quality, especially when you are filming someone talking. A good lavalier microphone (the kind that you clip onto the front of the speaker's shirt) can make a huge difference. Lavalieres come in both wired and wireless versions. You will especially notice the advantages of lavalieres when you are filming indoors -- a lavalier will completely eliminate the echoes and "booming" sound that you will frequently get from recording someone indoors with the camcorder's built-in microphone. Check out [Shure's Wireless Microphone Systems](#) for details.