Lesson 1: Understanding Digital Video

What you’ll learn in this lesson:
• To understand the difference between editing and delivery formats
• To understand the difference between high-definition and standard-definition video formats
• To understand the digital post-production workflow

Before you begin editing in Premiere Pro, it is beneficial to become familiar with some of the concepts and principles that define the art and craft of video editing.

Starting up
You will not need any files for this lesson.

Understanding digital Non-Linear Editing
When you watch a video or film, what you are actually watching is a series of still images displayed sequentially at a high rate of speed. Each image, called a frame, is displayed on screen for a very short period of time (anywhere between 1/24th to 1/30th of a second), creating the illusion of continuous motion. In the past, the only way to edit film or video was using a linear system. That is, an editor had to advance a film reel or tape to a specific part and cut or copy from that point forward. If she or he then wanted to edit another part of the footage, they had to advance the entire reel or tape to a new location and start again. It could be a very tedious and time-consuming process. Adobe Premiere Pro is an example of a digital NLE (Non-Linear Editor): it gives you direct and immediate access to any frame in a digital video clip at any time. In an NLE process, you use computer data instead of a physical linear medium, such as film or tape, and you can jump back and forth along your timeline at any point in the editing process. Unlike traditional graphic image processes, this is a non-destructive process because the original source footage is never lost or altered. The media links that you import or capture in Premiere Pro are only references to the original footage stored on your hard drive.

The video and audio footage that you edit in Premiere Pro can be digitized from an analog source, such as a VHS or cassette tape, or recorded directly to a digital format, as is the case with modern video cameras as well as other hard drive and compact flash-based recording devices.
Understanding video settings

In Premiere Pro, you generally work by building sequences to match the standards of the media you are going to work with instead of the intended output. There are many types of video files you can work with in Premiere Pro. The various formats, aspects ratios, codecs, and other settings used to describe video files will be explained in this book. The following terms will help you:

**Dimensions**: specifies the pixel dimensions of a video file; in other words, the number of pixels horizontally and vertically that compose an image or video frame. This value is usually written as a pair of numbers separated by an X, where the first number is the horizontal value and the second represents the vertical; for example, 720 × 480. Pixel is a conjunction of the words “picture” and “element” and is the smallest individual component in a digital image.

**Frame rate**: specifies the number of individual images that compose each second of video. Frame rate is displayed as a value of fps (frames per second).

**Pixel Aspect Ratio**: specifies the shape of the pixels that compose an image. Pixels are the smallest part of a digital image and different display devices (televisions, computer monitors, etc.) have pixels with different horizontal and vertical proportions.

**Editing vs. delivery formats**

While working through the many lessons presented in this text you are going to encounter many new concepts and terms, especially when you are dealing with video footage. When working with video in Premiere Pro you will encounter many different video formats and the codecs (compressor/decompressor) used to compress them while editing the video files throughout the lessons in this book and when working on your own. Most computer users are familiar with the term “format” used to describe files, for example, jpeg and tiff formats for images, or doc and ppt formats for Word and PowerPoint files. However, for video files, formats such as Quicktime and AVI are only containers that hold video information; much like a file folder holds paper. You can describe the relationship between formats and codecs this way: formats are the containers; codecs are the language the contents are written in.

Codec is a conjunction made from the words “compressor” and “decompressor.” Codecs are mathematical algorithms used to shrink audio and video files to manageable sizes. Video files are very large; for example, 20 minutes of NTSC DV video (from a standard definition miniDV camcorder) is over 4 GB in size, which is the capacity of one single-layer DVD. Without video codecs, you could not easily save and store archived video footage; video would also never be small enough to watch online, by email, or on a mobile device. To view an audio or video file, you must have a player compatible with the format and have on your computer the codec used to compress the video file, so you can decompress it.

Traditionally, the codecs used to capture and edit footage were uncompressed or offered very little compression, while the codecs used to deliver the final files to the viewers were far more compressed. With the proliferation of high-definition video equipment, this has changed: many cameras now use MPEG-2 or MPEG-4 codecs to reduce files to manageable sizes for storage and editing.

**Tape-based vs. tapeless formats**

Prior to the proliferation of high-definition devices, camcorders relied on physical tapes to record data. VHS, Beta-max, DigiBeta, and MiniDV are examples of tape-based formats. While the tape-based
workflow served the video industry well for many years, there were drawbacks to using it. Being a physical medium, tapes would eventually degrade with reuse, so they had a limited lifespan. Additionally, since tapes are a linear format used for transferring footage stored on a digital tape to a computer—a process known as capturing—this could only be performed in real-time. In other words, if you had one hour of video footage to capture, it took a full hour to do so. Tapeless, also called file-based formats, use hard-disk drives or flash drives to store video footage. When using a tapeless system, a new file is created whenever the camera person presses the record/pause button on the camcorder. This offers instant access to any recorded scene without the need to cue up a specific tape location.

With the expansion of the high-definition camcorder market, consumer, prosumer, and professional-level camcorders now rely almost exclusively on tapeless, file-based storage systems. These tapeless camcorders have blurred the line between editing and delivery formats, since most of them use either an MPEG-2 or MPEG-4 codec on the recorded video.

**High definition vs. standard definition**

Standard definition footage adheres to the NTSC (National Television Standards Committee) or PAL (Phase Alternating Line) standards, which are the standards for video used in the United States of America and most of the rest of the world, respectively. Standard definition footage usually has an aspect ratio of 4:3; in other words, there are four horizontal units for every three vertical units of measure. Prior to the invention of high-definition television, NTSC was the only standard for broadcast video in the United States. NTSC included settings for both 4:3 and 16:9 (widescreen) aspect ratios. In the age of Digital Television broadcasts, the NTSC has been replaced by the ATSC (Advanced Television Systems Committee) standards; however, the term NTSC is still used by most video cameras, editing, and graphics applications to refer to standard definition broadcast quality video.

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**NTSC & NTSC Widescreen:** The NTSC presets include settings for standard (4:3) and widescreen (16:9) aspect ratios. The dimensions for both are 720x480, but the pixel aspect ratio is different, which accounts for the difference in shape. Pixel aspect ratio (PAR) is the ratio or shape of the pixels that compose each individual part of a single video frame. Both versions of the NTSC standard use a frame rate of 30 fps.

**PAL & PAL Widescreen:** PAL is the standard for broadcast television used throughout Europe and much of the rest of the world. PAL differs from NTSC in several key ways; such as dimensions and frame rate. It uses a frame rate of 25 fps, which is closer to the 24fps used in film and according to some video professional produces more realistic imagery. Similar to NTSC, PAL has standard (4:3) and widescreen (16:9) settings. A frame size of 720x576 is shared by both, and the pixel aspect ratio gives each their unique frame shape.

**High Definition:** High Definition (HD) television technology has existed for decades, but it was during the early 21st century that it became popular with average American television viewers. The term HD
describes video with a higher resolution than traditional television systems, now called SD or standard definition. There are two main high definition standards for broadcast television: 720P and 1080i; many televisions and Blu-ray disk players support a third standard: 1080P.

**720P**: the 720P format has a resolution of 1280 pixels wide by 720 pixels high and supports a variety of frame rates, from the 24 fps used by film and the 30 fps that was part of the old NTSC standard, to 60 fps.

**1080P & 1080I**: the 1080 formats exist in Interlaced and Progressive versions; as with other modern digital standards, these formats support a variety of frame rates, such as 24 fps, 30 fps and beyond.

**Progressive video vs. interlaced video**

The two methods of displaying images on a video screen are Progressive display and Interlacing. When discussing video formats, the letter P or I are often stated at the end of the format. For example, 1080p or 1080i footage denote whether it is progressive or interlaced. In the United States, and before changing to a digital broadcasting system, televised images were sent as interlaced signals in which every frame of video was made by combining two half-images called fields.

Before the advent of high-definition LCD and Plasma screens, televisions were made by wrapping a plastic or wooden frame around a large, hollow glass device called a Cathode Ray Tube (CRT). These CRT television screens were composed of a series of even and odd numbered lines called scan lines, and each frame of video was displayed by illuminating these lines starting at the top of the screen. Interlacing was created to display video signals on this type of TV set and worked by illuminating one set of lines first (even or odd numbered), and then moving back to the top of the display to illuminate the other set. In this way, the display would show the second set of lines when the first set of lines began to fade; the result was a complete picture for the viewer. This process occurred 60 times a second with NTSC broadcast television. Unlike Interlacing, Progressive display illuminates the scan lines sequentially from top to bottom.

Most modern televisions can display in interlaced and progressive mode, and the ATSC includes broadcast standards for both, while all computer monitors use progressive display only. The difference between the two display methods occurs in video camera formats as well; older NTSC or PAL cameras can only shoot interlaced video, but many newer cameras let you choose between interlaced and progressive shooting modes, for example, 50i (25 fps), 60i (30 fps), 30p (30 fps), and 24p (24 fps). When working in Premiere Pro, we highly recommend that you use the sequence settings that match the settings of the footage you are working with.

**Premiere Pro presets**

In Premiere Pro, your projects are organized and arranged into Sequences. The video you are going to edit is added to these Sequences, where it can be trimmed, moved, arranged, and otherwise adjusted. Before you can edit video in Premiere Pro you must create a sequence inside your project. This sequence is your main editing and assembling environment. The application includes pre-built settings for sequences called presets. With the recent proliferation of high-definition video equipment and non-tape based recording media (cameras that store video on hard drives or flash drives instead of traditional tape) you can use a wide variety of formats and specifications. Tapeless camcorders, also known as file-based devices, usually record to hard-disks, optical media, or flash memory media, instead of to videotape, and save video and audio files using formats and codecs often specific to each device.
Tapeless formats supported by Premiere Pro include Panasonic P2 camcorders, Sony XDCAM HD and XDCAM EX camcorders, Sony CF-based HDV camcorders, and AVCHD camcorders.

In this section, you will learn about some of the common standards as they apply to working in Premiere Pro.

**DV NTSC, DV PAL, DV 24P**
The DV (Digital Video) standard comes in three varieties: NTSC, PAL, and 24P, all of which should be used in conjunction with IEEE1394 (FireWire/i.LINK) DV equipment. All three varieties of video come in standard (4:3) and widescreen (16:9) aspect ratios and have variations to support two standard rates for audio sampling: 32 and 48 kHz.

**AVCHD**
AVCHD is an acronym for Advanced Video Coding High Definition, a video format developed for the recording and playback of high-definition digital video. This tapeless format was created primarily for use in consumer and prosumer level camcorders, but it has also been adopted for use in some professional level equipment. The AVCHD presets in Premiere Pro support 720p, 1080i, and 1080p video footage, each at a variety of frame rates.

**DVCPRO & DVCPROHD**
Panasonic developed DVCPRO as a variation of the standard DV format. This tape-based format was developed to improve the standard definition DV format by increasing its robustness and feature set, and is an alternative to the DVCAM format developed by Sony. DVCPROHD was created as an enhanced version of the preceding DVCPRO format. The DVCPRO50 presets in Premiere Pro can create sequences compatible with 480i (NTSC) and 576i (PAL) video formats; the DVCPROHD presets can create sequences for footage recorded at 720p, 1080i, or 1080p in a range of frame rates from 24fps to 60fps.

**HDV**
HDV is high-definition digital video. The format can store up to 1 hour of high-definition video on a standard mini-DV tape by compressing the video using the MPEG-2 codec, which is the same type of compression used to create DVDs. The HDV presets in Premiere Pro can create sequences for footage recorded at 720p, 1080i, or 1080p. HDV tape was one of the first consumer and prosumer levels of high-definition recording and storage available to the public.

**XDCAM, XDCAM HD, XDCAM EX, XDCAM HD422**
The XDCAM format was introduced by Sony as a tapeless solution for professional level video recording and storage. The XDCAM family of products differs in everything to other formats, from recording media, frame size, and codec. The presets in Premiere Pro contain support for the range of XDCAM formats: you can work with standard definition projects using the DV NTSC sequence presets, while XDCAM HD, XDCAM EX, and XDCAM HD422 have their own presets. The XDCAM EX and XDCAM HD422 presets include support for 720p, 1080i, or 1080p footage; the XDCAM HD presets support 1080i and 1080p in a range of frame rates from 24fps to 60fps.

**Overview of the post production workflow**
Video productions are usually divided into three distinct, though interrelated, stages: Pre-production, Production, and Post-production. The video editing, graphics integration, and compositing that you perform in Premiere Pro is part of the post-production stage. Once a video project has been recorded, the
work of the post-production professionals (editors, graphic designers, composers) begins. Large studio or production companies hire different individuals or outside contractors for post-production work. Smaller post-production teams share multiple positions or have one person perform the post-production work. A general post-production workflow is shown in the following figure.

Specific post-production workflows vary depending on the production company and project.

**Media acquisition**

During media acquisition, you can add footage to the Premiere Pro project, which can come from a single source, or a variety of tape-based or tapeless sources. Footage that comes from an analog source, such as a VHS or Beta tape, must be digitized; digital tape-based sources, such as DV footage, are captured; tapeless formats are ingested. An important aspect of the media acquisition phase is the storage and organization of media assets. Video files use a lot of hard drive space and can be better stored on external devices, which allows you to become modular, thus easily transporting footage and project files from one computer to another. At the same time, we recommend you develop an intuitive and easy-to-navigate folder structure to store your footage and help you locate specific footage items when needed in the latter stages of post-production.

**Editorial development**

Editorial development is the phase when a project is assembled. The diagram above portrays this phase as a single block of time and effort, but it is a multi-stage process where you can go through the initial editing steps to develop a rough cut, submit it for client or collaborator feedback, and then refine it in a sequential process of edits and revisions that lead into the finishing phase. Often each successive revision (called a cut) refines the pacing, tone, and theme or narrative of the work leading into the next phase. During this phase, stand-in graphics and audio are added into the edit while the finished products are developed.

**Graphics development**

The graphics development phase is often concurrent with editorial development. Titles, effects shots, and compositing are integrated into a project in this portion of the workflow. This phase does not involve just one step, but a sequence of successive revisions that begin with initial concepts and rough art work and end with the development of the final graphics and effects added to the finished project.

**Audio development**

The third concurrent phase represented here is audio development. As is the case with graphics and editorial, this phase involves a sequence of successive revisions leading to the creation of finished audio tracks added into the edit. This phase can include audio refinement to clean up noise and the creation of Foley sound effects and background music beds.
Finishing
The finishing phase is where stand-in graphics and audio are replaced with the finished elements, and any final edits and transitions are added in Premiere Pro to create a final cut.

Mastering
The mastering phase involves compiling all the elements that the client needs, and assembling them into a single bundle for handoff. Depending on the required deliverables, this may be as simple as adding multiple individual sequences into a single master sequence for output to a tape or file. It could also include preparing a variety of different projects with different titles, graphics, or audio for delivery to different regions or markets.

Output and delivery
Output and Delivery is the process of creating the final, playable media for handoff to the client or audience. Depending on the scope of the project, this phase can take different forms. It may involve outputting your master sequence to a tape-based format for handoff to a broadcast television station, authoring a DVD or multimedia playback component, or compressing your source footage for streaming delivery on the Web.

Self study
1 In this lesson, you learned about some of the technical details that will affect the decisions you make when setting up and outputting your video projects. It is important to keep in mind that as new video, image, and audio formats are developed and support for them is added to Premiere Pro you will want to constantly improve your knowledge base.

2 The Adobe website (www.adobe.com) offers tutorials and white papers on technical and design issues that relate to your use of Premiere Pro and along with sites like Wikipedia (www.wikipedia.com) can be an excellent source to help further your professional development.

Review
Questions
1 What are names of the two different standards that govern video for American and European television?
2 What are the three high definition video standards?
3 What are the frames rates for American television, European television and film?

Answers
1 The ATSC (Advanced Television Systems Committee) is the name of the set of standards that govern American television and PAL (Phase Alternating Line) is the standard used in Europe. In the United States the set of standards that were in use before the age of digital television broadcasts were called the NTSC (National Television Standards Committee).

2 The three standards for high definition video are:

   720p: the 720p format has a resolution of 1280 pixels wide by 720 pixels high and supports a variety of frame rates, from the 24 fps used by film and the 30 fps that was part of the old NTSC standard, to 60 fps.

   1080p & 1080i: the 1080 formats exist in Interlaced and Progressive versions; as with other modern digital standards, these formats support a variety of frame rates between 24 to 30 fps.
American television uses a frame rate of 30 fps, while European television uses a frame rate of 25 fps and film uses a frame rate of 24 fps.