Nonlinear Editing Basics

Electronic Film and Video Editing

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CHAPTER 2

A Brief and Subjective History

On April 14, 1894, the first Kinetoscope parlor opened its doors in New York City. This technical marvel fascinated individuals for a while but the novelty soon wore off. Able to be seen by only one person, the profit potential was limited. This invention was improved upon and developed into a combination camera and projector that traveled the country. A single operator would set up a show in each location during the night and shoot new footage during the day. By 1898, the projected picture also had lost its novelty. Audiences were demanding different subject matter.

A film exchange appeared, where films would be rented to exhibitors for one fifth the price of purchase. In these early years, the films made mostly were nonfiction. From 1900 to 1908, the Biograph company produced 1,035 nontheatrical films, compared to 774 theatrical productions. However, after 1908, the balance shifted.

Georges Méliès, a magician and filmmaker, astounded audiences with his films, which included his *A Voyage to the Moon* made in 1902. Audiences loved these effect-filled stories. Méliès used stage tricks to achieve his film effects and keep the audience's attention. Edwin S. Porter included footage from Thomas Edison's library of fire departments in his film *The Life of an American Fireman*. By combining the footage and giving the audience a sense of time (the rescue had to be made before the family perished), he introduced two major concepts into the film lexicon.

The Great Train Robbery, Porter's next important film, introduced parallel story construction. However, because all the action took place at the same distance from the camera, there was no filmic way to emphasize particular aspects of his story. He had no close-up or wide shots. The actors were the sole method of imparting

emotion of focusing the audience's attention. When the action left the frame, the camera angle was changed.

In 1907, the director came into his own as companies (which actually owned the equipment and were trying to create material so their machines would be used) attempted to mass produce films. The director took responsibility for all aspects of the reel of film from story to editing.

Director D. W. Griffith alternated his angles and shots, not because his action went out of frame but because he chose to edit the images, following what he believed to be his audience's emotional expectations.

Russian film directors scoffed at this approach. They were not capitalists but propagandists, and their purpose was to alter people's ideas, not entertain the masses. One of these Russian directors, Pudovkin, took the stance that a director's responsibility was to manipulate the audience.

Pudovkin took a shot of a smiling actor, cut to a revolver, then cut to a terrified actor. This short scene made the actor appear to be cowardly. In contrast, he put the terrified actor first, cut to the gun, then cut to the smiling actor. This second scene reversed the audience's perception of the performer; now he was brave. Yet the performer had nothing to do with this change in perception. It was the juxtaposition of images.

In a second experiment, Pudovkin took a passive shot of an actor and placed it between shots of soup, a child playing, and a funeral. Test audiences marveled at the range of the actor!

The manipulation found in Pudovkin's experience and the emotional exploration found in D. W. Griffith's movies are the basis of commercial film making today. Effective filmic emotion coupled with manipulation of images and sound (production plus editing) makes a powerful impact on audiences around the world.

All this innovation took a large step backward in the late 1920s to accommodate a new technological revolution, sound.

At its inception, the only real advantage brought by sound was the elimination of the printed cards one had to read during the movie. Because the sound technicians ruled the set, the camera stood still, covered in a box with soundproofing. Mobility and camera angles suffered to bring the spoken word.

As the technical aspects of sound were perfected, the camera was free to move again. In 1950, a new challenge entered the film arena, television. Although the budgets were not as large as for feature films, the programs were "free" to anyone who owned a television. Black-and-white film was used in television shows while film producers scrambled to find more spectacular avenues to attract audiences out of their homes. Cinemascope and 3D movies were produced. Large budget films and musicals were made.

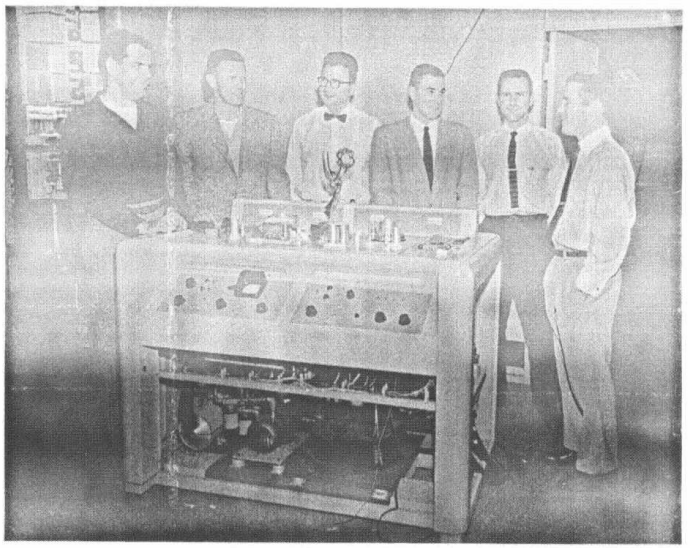


Figure 2–1 *The Ampex team that invented the original "Quad" videotape machine: from left to right, Fred Pfost, Shelly Henderson, Ray Dolby, Alex Maxey, Charles Anderson, and Charles Ginsburg. Photo courtesy of the Ampex Corporation.*

In 1956, the videotape recorder was invented (see Figure 2–1). Within a year, edits were made using this new electronic medium. The first edits were physical cuts in the two inch wide tape. By sprinkling "tracing powder" on the tape, the vertical frame line could be seen using a microscope. This type of editing was slow and technically poor. In the 1970s, CMX, a company created by CBS and Memorex, developed the CMX 600, the first electronic random access editor. Using stacks of metal discs, the system stored about half an hour of black-and-white source material. The program was cut on this off-line system. Once the editorial decisions had been made, an edit list (EDL) and a videocassette of the program were used to recreate the program using the original videotape production footage. The CMX 600 was expensive and prone to failure, but the concept of "off-line" editing was incorporated in the 1973 off-line editor, the CMX 50. The CMX 50 used three-quarter inch dubs of the master footage for its playback source. The recording tape also was a three-quarter inch tape. With two playback decks,

simple effects (wipes, dissolves, and keys) could be put into the list and the offline master. The master, however, occupied physical space. If the running time changed, the master had to either go down a generation or all the edits had to be performed, incorporating the new running time.

Film continued to be cut as it always was, by hand. Developments during the middle of the 20th century sped up the postproduction process. In the 1930s, the upright Moviola (Figure 2–2) proved to be a great help to editors. By using foot pedals, the film and sound tracks could be driven by motors, freeing the editor from hand cranked rewinds. Then came the flatbed (Figure 2–3). This film editing device allowed the viewing of multiple images and sound on a horizontal table.

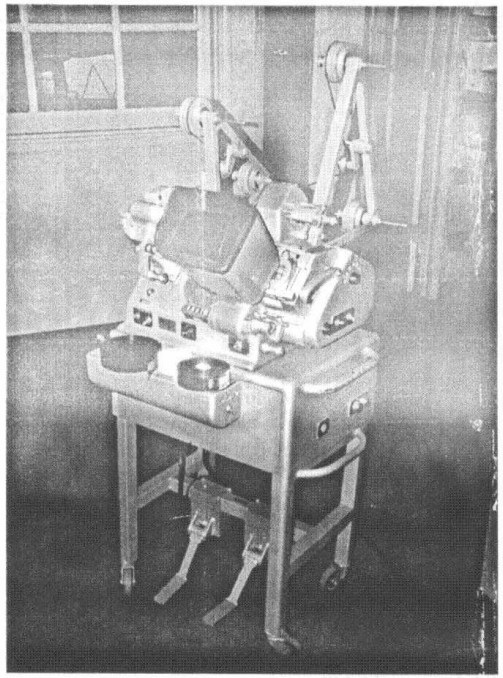


Figure 2–2 *The upright Moviola was a great technological advance for editors in its day. A few devices are in use today. Photo by Sean Sterling.*

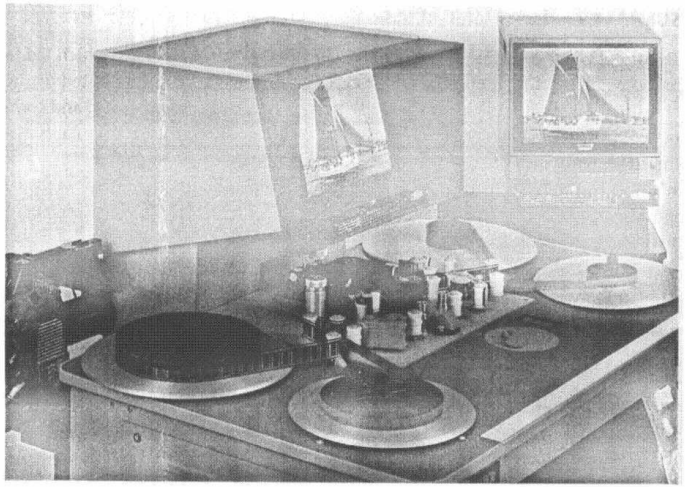


Figure 2–3 *Flatbeds can be equipped with many different configurations. This particular editing device, manufactured by W. Steenbeck & Company, can output video and sound to a tape deck and lock to the video deck for tape and film synchronizing, in addition to editing. Photo courtesy of W. Steenbeck & Co.*

By the mid 1980s video discs had been introduced. The combination of video and computers worked well. Several random access editors were introduced in the late 1980s. The Ediflex used tape; the EditDroid, Montage, and CMX 6000 used video discs. All worked on a similar principle: access to multiple copies of footage, allowing the decks access to footage quickly enough to create a continuous preview.

When computer storage and accompanying software programs became powerful enough to hold the volumes of footage required to edit a show or feature, the discs and VHS decks fell away to hard drives. Today, hard drive storage is doubling about every 28 months, and the ability to load and edit with gigabytes of material is a reality. The massive technical knowledge once needed to run the equipment is slipping away. Operating these editing systems requires only a few weeks of training.

SUMMARY

Technology will continue to change. Moviolas gave way to flatbeds, which led to random access editing. Off-line linear video editing was swiftly eliminated by the random access editor. As hard drive disk storage becomes less expensive and computers more powerful, the buttons one pushes and software that manipulates pictures no doubt will change. Even the delivery medium will be altered. But the selective process of choosing and refining the footage to be included in a visual program will still have to be done by talented people, editors who know their craft and how their choices will affect the audience.

CHAPTER 3

Beginnings

Despite the many different styles and processes of editing, there are standard methods of finishing and completing the editorial requirements of a program. In Chapter 12, we will look at some of the details in individual editorial challenges. Here, we will examine the preproduction stage and specific buzz words that need to be understood before moving into the more technical chapters.

WHERE THE NONLINEAR EDITOR FITS IN

The nonlinear editor fits neatly into the film and video work flow (see Figures 3–1 and 3–2). In feature films, the nonlinear editor does not replace the film cutting room. Basically, the film cutting room (in movie postproduction) and the video off-line editing room have been upgraded to an expensive computer system and its associated hardware. In some cases, the nonlinear editor is simply a replacement in hardware. The professional who used to cut on video or film merely has learned new equipment.

PREPRODUCTION, PRODUCTION, POSTPRODUCTION

Preproduction

All visual projects have three major areas: preproduction, production, and postproduction. Obviously, the nonlinear editor falls into the postproduction arena. However, elements of the preproduction process become very important in postproduction, even before film (or video) is shot.

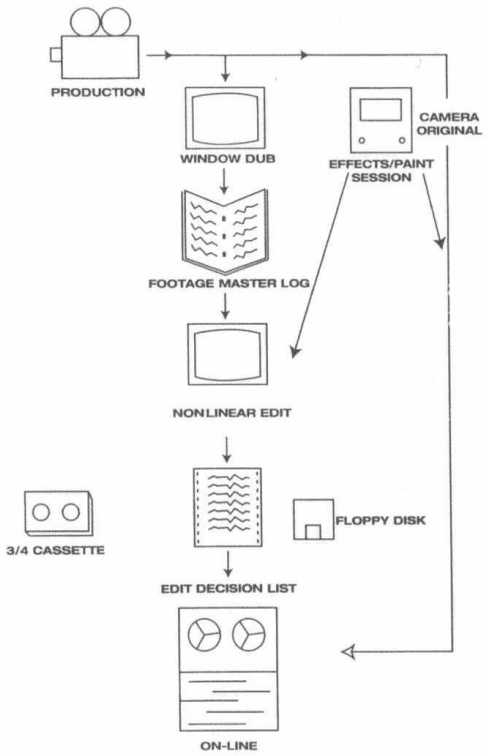


Figure 3–1 *The video work flow diagram. The nonlinear editor may have taken the creative cutting from the work print editor, but film still is conformed for theatrical test screening.*

Professional directors of great reputation and stature still (and will continue to) use storyboards to lay out their projects during the preproduction process. Why complete this time-consuming project? To examine the visuals of the story in minute detail and to look for editorial, story, or location problems. Shots that will not cut and parallel story construction can be manipulated and massaged until the optimum project can be obtained. Animated features and commercials always take shape on the storyboard. Even long-form television shows (movies of the week, miniseries, dramatic specials) often are storyboarded. In some cases, the editor is brought in to consult with the director. The storyboard not only examines the story visually, it very quickly shows other production personnel the director's vision, so that everyone working on the project knows the ultimate goal.

This process usually is bypassed for sitcoms and game shows because, for the most part, the sets are the same every week. Comedy and performance are the primary purposes of this type of programming. Documentaries, clip shows (compiled from existing footage like the home video shows), news programs, magazine programs, and concerts usually do not use storyboards either.

Another vital preparation element that is used in the postproduction process is the script. The editorial staff often utilizes two scripts. The original script is used to understand the story concept and intent of the writer. As one of the steps in preproduction, the original script (usually in a feature film, dramatic television, or long-form broadcast program) is rearranged by location and personnel avail-

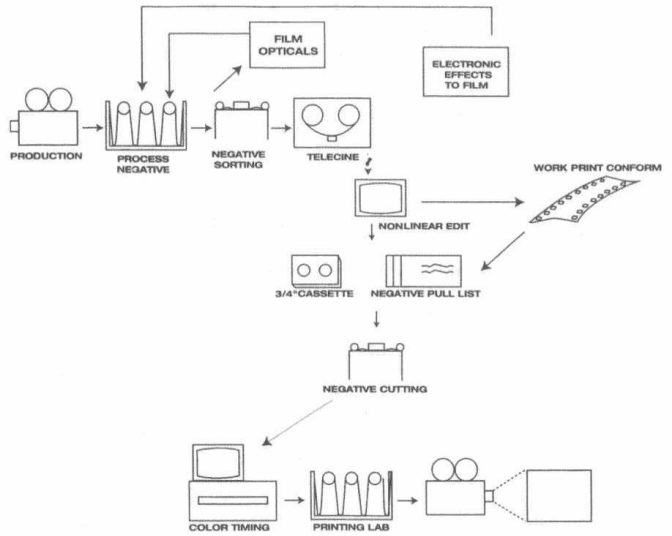


Figure 3–2 *The expanded feature film work flow diagram.*

ability. All scenes that occur in a particular location are shot at the same time. Each scene is broken down into specific shots, and each shot that has the same framing is performed at the same time. This, called the *shooting script*, will be used to keep timings, notes, and other production information as well as a reference tool in the editing room.

In television sitcoms, the script is broken down into camera angles and shots. In clip shows (usually edited and finished on videotape), the clips are edited using the nonlinear editor, then cut on-line. Once the clip timings are formalized, the script is written to describe the scenes and fill in the remaining time required for program delivery. The on-camera footage is shot, either on location or in a studio, then both the clips and on-camera footage are combined.

Production

The numerous tasks, challenges, and complications of production would take up another book. However, the footage being shot on location and on the sound stage usually arrives at the editing room within days. Interest rates (on the production company's investment) and delivery schedules (which always are too short) put pressure on the editor to finish the project as soon as possible.

Occasionally, the editorial staff becomes involved in the production: when a scene is not working, a cutaway is needed, or a particular shot would make a scene work better. But, for the most part, the editing room's job is to put the program to together.

Postproduction

Once production begins, so do the postproduction chores. Depending on the requirements and budget of the program, the following elements are set into motion.

For a feature film or filmed dramatic program,

- ADR (rereading actors' lines to production footage)
- Film-to-video transfer for electronic editing
- Foley session (creating effects while watching production footage)
- Composing music
- Visual effects
- Editing
- Audio effects
- Negative cutting
- Music recording
- Rerecording (mixing)
- Color correction
- Duplication
- Titles

For single-camera video production,

- ADR
- Foley
- Composing
- Visual effects
- Editing
- Audio effects
- On-line editing
- Music recording
- Duplication
- Titles

For a filmed sitcom,

- Visual effects
- Editing
- Film-to video-transfer for electronic editing
- Audio effects (sweetening)
- On-line editing
- Duplication
- Titles

For the video finishing of a documentary,

- Editing
- Openings and closings
- Graphics
- Audio effects
- Sweetening
- On-line editing
- Duplication

For a video sitcom,

- Visual effects
- Editing
- End titles
- Audio effects (sweetening)
- On-line editing
- Duplication

As you can see from these lists, the sitcom has fewer postproduction details than a film or single-camera video show. The reason for this is that a new half-hour program has to be created every five to seven days. Audio requirements are much less stringent than for a filmed dramatic or feature film project. These programs must be delivered quickly and on time. Single-camera dramatic programs, even those finished in the video environment, require more audio and production work; and therefore their production schedules are longer. The original production format as well as the delivery medium often determines the delivery schedule as well as the processes through which the program must pass.

In some cases, the cost of a nonlinear electronic editing system may not be justified. A game show, which has to be cut only to a finite delivery time, can be created on-line without the added expense of off-line editing.

BUZZ WORDS

All technical processes employ words and phrases that are unique to it. Here, we discuss several key words that pertain to film and videotape electronic postproduction. This is not a complete glossary, merely important words that should be known before venturing further into the world of random access editing:

- **analog** (video and audio). Encoding a signal onto a carrier wave in order to record or broadcast that signal onto a recording medium.
- **CGI** (both film and video). Computer-generated images. A computer-generated image can be as simple as a few words or as complicated as creating effects onto an existing shot or building a character from scratch. The quality of the image depends on equipment used, the talent of those using the equipment, and the quality of original production footage, if any.
- **circled takes** (both film and video). The takes deemed acceptable, both technically and aesthetically, to be printed for inclusion in a film project (see Figure 3–3).
- **code book** (film). The book that correlates the original negative key numbers with the printed code on the work print audio and picture. This book also has listings of each shot, its original film reel, and its key number.
- **component** (video). The encoding that describes a picture's color and luminance values in a single mathematically encoded signal. A component recording can be in an analog format (one inch, three-quarter inch) or a digital format (D2 and D3). The component signal was created to transmit television pictures over the airways in a single encoded signal.
- **composite** (video). The recording of an image using separate chroma and luminance signals (see Figure 3–4). In keeping separate the three color signals and single luminance signal, the picture is cleaner and offers greater flexibility in creating effects. Composites can be analog (Betacam, MII) or digital recordings (D1, D5, DIGITAL Betacam).
- **DAW** (both film and video). Digital audio workstation (see Figure 3–5). The DAW is rapidly replacing old-style audio boards, multitrack audio machines, and dubbers. The DAW often includes sophisticated equalization, compression, and automated faders. Usually, it can store several different mixes of the same material. Changes are relatively easy, and the DAW is very flexible. The DAW is the audio equivalent of the nonlinear editor.
- **digitizing** (both film and video). The process of taking a signal, electronically analyzing it, then breaking it down to ones and zeros. Unlike an analog signal, which can become distorted over multiple recordings, digital recordings easily are replicated and can withstand many multiple generations (as long as the signal remains in a digital environment). However, a poor picture that

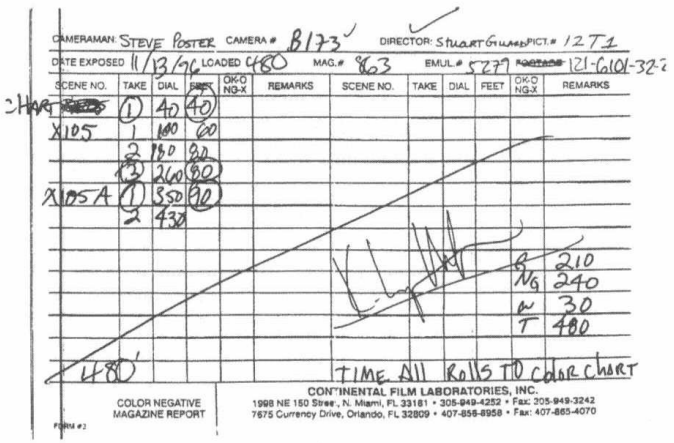


Figure 3–3 *In feature film production, all camera negative is developed but only the circled takes, indicated in the camera report, are printed to a work print. In this case, a color chart also is printed, along with the two selected takes.*

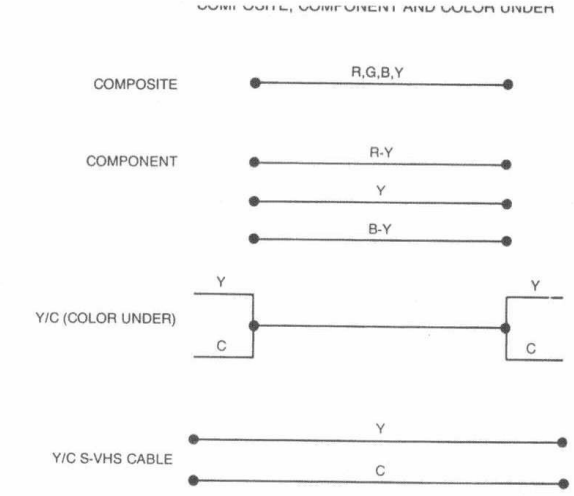


Figure 3–4 *The four types of video signal and how the signal travels.*

Figure 3–5 *A working digital audio workstation (DAW).*

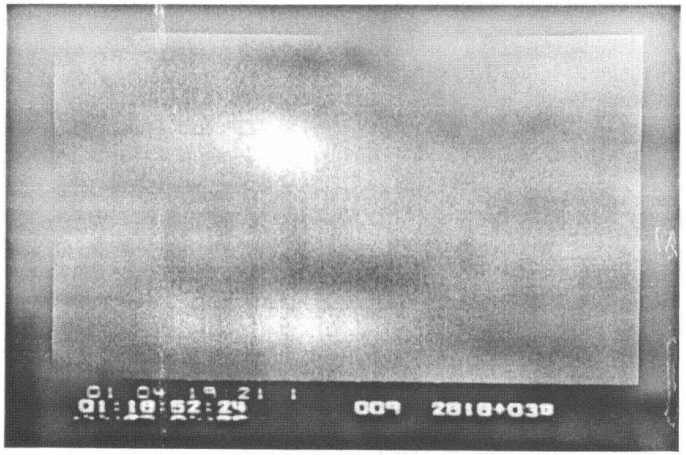
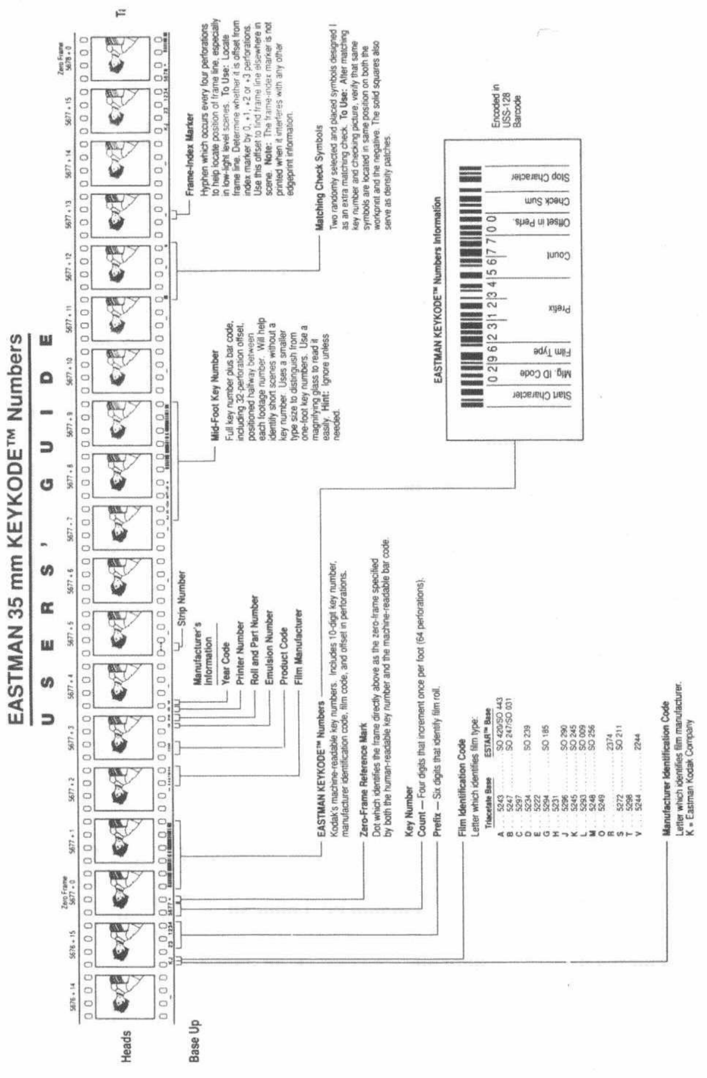


Figure 3–6 *This picture of a digitized daily reel has a time code on the left side of the screen and the footage count on the right side. The footage count at this point is 2,818 feet and 3 frames. In a videotape edit, only a time code would be burned into the picture (see window dub).*

is digitized remains a poor signal. It may not degrade further, but without extensive and expensive manipulation, it will not improve.

- **EDL** (video). The printout or disc that contains the editing information to recreate a video program. It is the equivalent to the negative cut list, yet it can have additional information, from the audio edits to effects that have been performed. The EDL can be a product of an off-line session or an on-line session. Often, editing systems have different EDL formats that include information about effects, switcher setup, and VTR motion control.
- **flat** (film). A way of shooting a movie. A flat image is shot without using an anamorphic lens to squeeze the shot. The alternative to a flat image would be a "scope" or image shot with an anamorphic lens.
- **footage count** (film). The physical length at a particular time in a film product. In many work print transfers, the key numbers and the footage count are visually "burned into" tape transfer (see Figure 3–6). This information allows an editor to relate back to previous footage and provides a reference point with which to communicate to other editors, the director, or anyone else involved in the project.

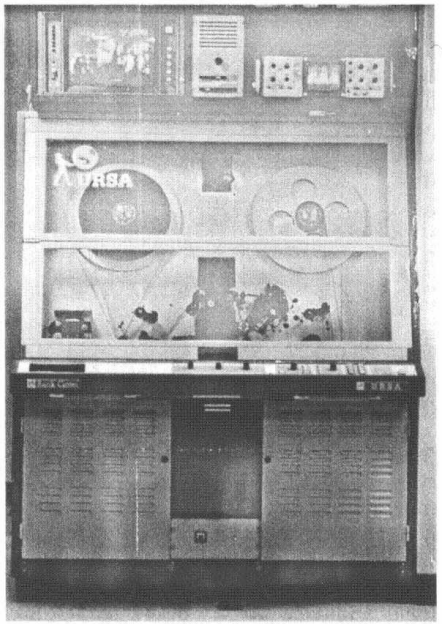


- **framing** (both film and video). The size of an image within the film or video frame. The following are common abbreviations for these framings:

  ECU—Extreme close-up
  CU—Close-up
  MCU—Medium close-up
  MS—Medium shot
  MLS—Medium long shot
  LS—Long shot
  ELS—Extreme long shot
  2S (3S)—Two shot (three shot): a shot containing two (three) characters
  OS—Over the shoulder; often further explained in the manner of "over the shoulder favoring the hero."

- **IP** (film). Interpositive. A fine-grained, low-contrast, positive, intermediate printing master film that is created from the camera negative. The same stock is used to create the dupe negative (a copy of the negative) from the interpositive. IP is used to protect the camera original during the making of film products. IP is struck from cut negative as well as uncut negative to create support programs such as coming attractions and other promotional materials.
- **Keykode.** A machine- and human-readable series of alphanumeric characters used to locate a particular piece of film footage. Keykode is an improvement of the film's frame identification system (key numbers). Keykode allows automated insertion of key numbers onto videotape (see Figure 3–7).
- **kinescope** (film). An inexpensive, low-quality filmed copy of video off a monitor. Kinescopes are used for inexpensive film audio postproduction.
- **negative** (film). The original film exposed during production. This element is extremely valuable and represents all the time and expense put into creating the image. It is stored in a protected vault and handled only by experienced personnel in specifically designed rooms.
- **negative cut list** (film). The list of key numbers delivered to the negative cutter. This list will be the basis of which footage to pull when the film is to be assembled. It is the equivalent of the video EDL.
- **off-line** (video). The creative stage of a project, often using window dubs of the original material. It is the same concept as film work print editing.

Figure 3–7 *(Opposite) All 35 millimeter film has a bar code that can be read by properly equipped telecine bays. Eastman Kodak's bar code is called Keykode. As you can see, a lot of information, in addition to frame indicators, is printed on the side of the film. Graph © Eastman Kodak Company, reprinted courtesy of Eastman Kodak Co.*



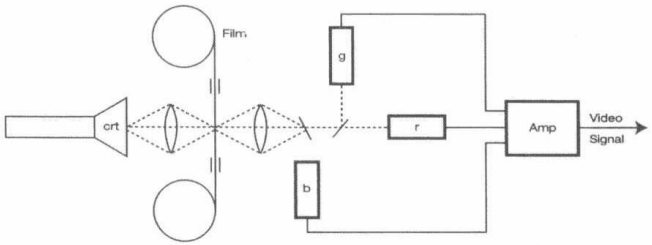


Figure 3–8 *A Rank Ursa telecine film-to-tape machine. This delicate and expensive machine transfers film images to videotape. Notice in the diagram that a cathode ray tube supplies the illumination for the transfer process, the same device that creates a television picture.*

- **on-line** (video). The session for final completion and delivery of a production. An off-line session may precede the on-line or the on-line may be the first editing session of the project.
- **one-light** (both film and video). A film-to-tape or film-to-film transfer that uses a single exposure setting throughout the reel of original film. This process is less expensive and less precise than if each shot was individually color corrected.
- **reel number** (video). The incredibly vital number assigned to a film or video reel that, with its accompanying description, is used to locate the original footage when it comes time to finish a project. Most current on-line linear systems can handle a maximum six-digit number. One should keep this in mind when assigning reel numbers during telecine or when digitizing footage.
- **scope** (film). A way of shooting a film image using an anamorphic lens, in effect squeezing the image recorded on film (see flat).
- **telecine** (both film and video). The transfer of images from film to videotape (see Figure 3–8). The telecine can be quick and (relatively) inexpensive or last days and be incredibly precise and complex. The product of the telecine session is a videotape copy of the film. The video record tape can be in almost any format, depending on the purpose of the telecine session. If the footage is going to be used in a video finish, a mastering quality tape is recorded (such as D1, D2, DIGITAL Betacam, MIII, or Betacam) and then a three-quarter inch window dub is made for the off-line editorial process.
- **time code** (both film and video). A digitally encoded signal that is recorded visually in the vertical frame line (vertical interval time code, or VITC; see window dub) or audibly (longitudinal) on videotape, identifying each frame with an arbitrary and (ideally) ascending number in the format of hours:minutes:seconds:frames (02:12:35:10). Time code can be restarted manually in the middle of a reel, causing much confusion. A video editing system makes the assumption that the higher number code is toward the end of the reel.
- **trim** (both film and video). To alter an edit, usually by taking off a number of frames: "Trim that edit by three frames." In film, the footage left over after cutting a piece of a scene and inserting it into a reel; head trims, tail trims, and just little pieces of film that are left over should be kept in boxes and carefully labeled.
- **window dub** (both film and video). A copy of a videotape with the original tape's time code burned into the picture (see Figure 3–9). Time code is a digitally encoded signal; however, it can be decoded and displayed. A window dub usually cannot be a master because the time code occupies a portion of the image. A window dub is used for viewing or to input footage into the nonlinear off-line/work print editor. The window dub usually has the same time code recorded on it as displayed in the window.

Figure 3–9 *A window dub. This is an exact copy of a video master with the original time code burned into the picture. The number in the picture is not the time code but a visual reference to the time code on the original. A window dub may or may not have a time code on it, depending on how the dub was created.*

THE DIFFERENCE BETWEEN DIGITAL AND ANALOG

The first generations of videotape machines recorded signals in an analog format. The machines encoded the images onto differing voltages, then recorded this signal on videotape. After only a few generations, these analog signals became distorted and, as a result, the picture quality degraded.

Then came digital recording. Instead of using analog signals, the digital machine converts picture and audio into a series of ones and zeros. This encoding is easily replicated and can withstand multiple generations (as long as the signal remains in a digital environment). One important aspect to remember, though, a poor picture that is digitized remains a poor signal. It may not degrade any more, but without extensive (expensive) manipulation, it will not improve.

The most promising aspect of the digital signal is that the cost of using digital equipment, whether a tape machine or computer drive, will continue to drop in price and improve in performance. However, film probably will continue to be the medium for production. It has a unique look and its resolution is much greater than videotape. However, in the future, there may well be super high-definition video cameras that, with a flip of a switch, emulate a "film look," perhaps even to replicate specific types of negative film stock.

AN OVERVIEW OF FILM VERSUS VIDEOTAPE

Briefly (the technical aspects of these two media are discussed in Chapters 4 and 5), film is very different from videotape. However, film can be recorded on videotape and videotape can be recorded on film. There are several other differences, but the most important ones are resolution and frame rate.

Film runs at 24 frames per second, video at close to 30 frames per second (29.97 frames per second to be exact). One might wonder why the difference exists. Basically, a series of images running at any rate faster than 15 frames per second will fool the eye into perceiving motion. The early film industry chose 24 frames per second for economic and image reasons. Video, arriving over a half century later, had other concerns. The electronics to run the scanning process of producing a television image needed some kind of reference clock. The 60 cycle alternating current that was (and still is) powering our homes was the obvious source of this timing signal. Because video runs at 30 frames per second but 60 fields (half a frame is a field), this was the rate chosen.

The small difference between 30 and 29.97 frames came from a slight technical adjustment in the frame rate that eliminated a flicker in the television image. This slight difference has been with the NTSC television signal since its inception and is the reason there are two types of time code formats.

Three-Two Pulldown

How do we get 24 frames of film to make 30 frames of videotape? By repeating half a field of image every other film frame (see Figure 3–10). This duplication of image creates the required six frames of video. A field is repeated every other frame. This process, called *three-two pulldown,* is not complicated but can cause confusion, as we will see in later chapters.

Video to Film

How does videotape get recorded onto film? With careful processing videotape can be exposed onto negative film stock. *Hoop Dreams* was a film made from mostly videotape footage. Some film effects and coming attractions in theaters are created on videotape. In this case, when the producers know that the final product will be projected onto a film screen, the effects are created in a high-end dig-

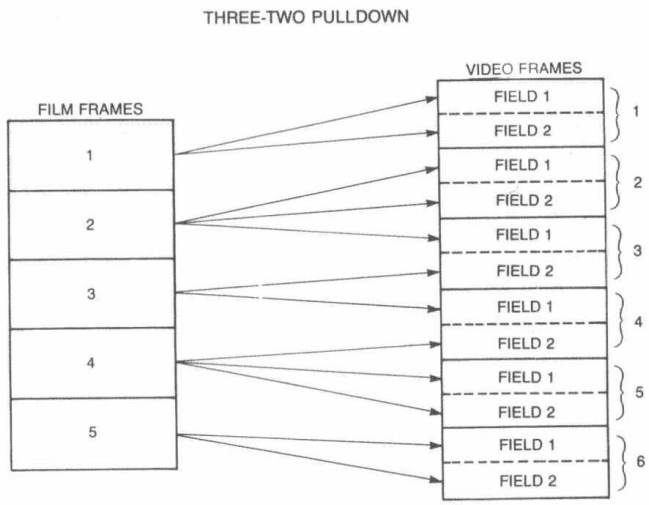


Figure 3–10 *The difference between 24 frames of film and 30 frames of videotape is made up by repeating a field of film image every other video frame. Nonlinear editors must know where these "manufactured" frames exist to create accurate film negative cut lists.*

ital environment, then produced on D1. This D1 master is then exposed, frame by frame, onto film negative.

Resolution

Currently, videotape produces 525 lines of resolution, about 460 of which reach the home viewer. HDTV (high-definition television) approximates a thousand lines of resolution. It is true that feature films have been created electronically (Disney's *Toy Story*) and certainly many effects have been created within the computer, but the cost of storing and manipulating these high-resolution images currently is prohibitive for all but those well-funded programs. As a matter of course, almost all feature film production footage originates on film.

Videotape has much lower resolution than film, even when being recorded digitally. Lower cost formats such as VHS, 8 millimeter, and three-quarter inch tape have even lower resolution and suffer greatly at each generation. However, videotape (usually three-quarter inch) is the media used to import information into the electronic editor.

It is important to know where the original footage comes from and its transfer rate. This information is entered into the nonlinear editor during the digitizing process and used to calculate where edits came from, especially in film finished programs.

Garbage In, Garbage Out

Computers are only as good as the information they receive. No matter which process is employed, one of the most crucial parts of the editorial task (in addition to the important editorial decisions) is the accurate loading (digitizing) of the footage into the electronic editor. Entering the wrong key number or reel number can send sane men and women into a frenzy when it comes time to complete a project.

Attention to detail at the beginning of the process is vital for the editorial project to be completed in a timely and cost-efficient manner.

SUMMARY

Video and filmed shows pass through several established paths. Although there are variations on these processes, the established methods probably are best followed. Film audio, effects, ADR, sound design, and mixing often are considered and budgeted more carefully than for videotape programs, although this oversight is changing.

Being familiar with the technical buzz words in both the film and videotape worlds is important. The merging of these media already is in progress. Even though the nonlinear editor seems to make the transition from one to the other transparent, one should know and understand the difference between film and videotape footage.

Knowing where particular footage originates is important, not only to the editor but to the people who ultimately will be completing the project. Keeping accurate logs of where original material comes from will save time and money in the final project.

CHAPTER 4

What Is Videotape?

Videotape consists of a Mylar® backing covered with a thin layer of ferrous oxide (see Figure 4–1). Mylar is a strong, flexible plastic material that provides a base for the oxide. This oxide is magnetized easily and stores the video and audio information. Metal tape is a highly refined videotape that uses metal particles instead of ferrous oxide to enhance recording sensitivity. Metal tape is used in D1, D2, D3, D5, DCT®, Digital Betacam®, Betacam® SP, S-VHS®, and Hi-8®. Videotape is very similar in composition to audiotape.

When videotape is purchased, whether by a production company, an editing facility, or a home user, it usually is blank. (A prerecorded tape has a signal on it.) When a blank tape is played on a video machine, the viewer sees either snow or nothing. The same condition exists after the viewer erases a recorded tape by

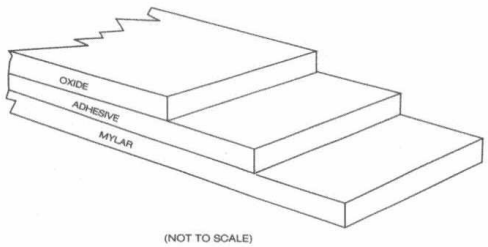


Figure 4–1 *A cross section of videotape.*

putting it next to a very strong magnetic field, which destroys the video signal on the tape. The machine that does this is called a *bulk eraser.*

Because it is the medium on which original pictures and audio are stored, buying high-quality tape is worth the extra expense.

CONTROL TRACK

Control track refers to a pulse recorded onto a track of the videotape (see Figure 4–2). Because the pulse, which is only created during an assemble recording, marks each revolution of the record drum and the beginning of each frame, it is called the *frame pulse.* The control track could be considered the electronic sprocket holes of video, because it guides the playback of the video signal.

Because the pulses on the control track are recorded in evenly spaced intervals at each revolution of the recording drum, the playback machine must maintain the same relationship to play the signal properly. If the spacing of the control track pulses is altered, the picture will roll until the spacing becomes even

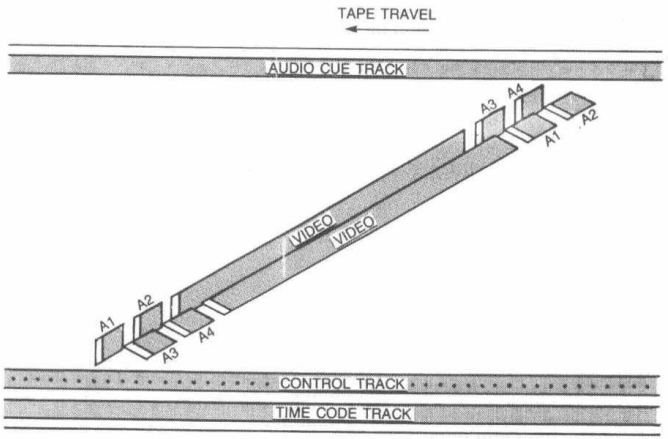


Figure 4–2 *A diagram of a D2 recording. Note the control track represented by the dotted lines. All videotape signals have control track pulses, which tell the playback machine how the original signal was recorded.*

again. During this roll, the playback machine will change the tape speed and drum rotation in an attempt to keep the control track pulses constant.

All video formats use different but similar control track signals.

TAPE RECORDING AND EDITING

Two basic types of video recording are used: assemble and insert.

Assemble Recording

Assemble recording erases everything on the tape from the beginning of the assemble edit, replacing it with the new picture, audio, and control track. This method is ineffective when it comes to editing different audio and video sources. However, it is a very effective way to make a direct copy of another videotape or to create control track in preparation for an insert editing session.

Another disadvantage of assemble recording is that the control track pulses at the edit can occur either earlier or later than the previous control track pulses (if the tape already has a recorded signal on it). This difference in spacing will cause the picture to break up or roll, as mentioned earlier. Newer machines can lock to the previous control track, producing a stable assemble edit. However, the OUT of the edit will not have exactly the same spacing as the video that follows.

These two major technical disadvantages of assemble editing and recording explain why most professional editing is done using insert recording.

Insert Recording

Insert recording can replace video, audio, or both video and audio without disturbing the tape's control track. Before an insert recording can be made, the tape must have a control track recorded on it. To do this, an assemble recording is made for the length of the videotape; this recording lays down a continuous, unbroken control track. An insert recording made on blank tape will not play back properly because the tape has no reference as to how to play the video.

Professional editing houses buy new videotape and have night shift employees assemble record them to prepare them for use. The assemble recording usually is a "black" picture with no audio, but it does have time code on it. This *black-and-coded* tape is used as a record tape for insert recordings.

To repeat, an assemble recording erases everything—all video, audio, and control track—and replaces it with totally new signals. An insert recording replaces only those tracks (video, audio, or both video and audio) selected. Insert recording is the method used by most professional editing companies.

Recording versus Editing

The words *insert* and *assemble* are used in several ways in the video industry. An *insert recording* is done according to the method just described. To insert an edit, however, means to place an edit between two other edits or to erase part of a previously recorded edit by inserting a new edit. The *insert edit* is made using an insert recording.

An *assemble recording* erases all signals on a tape and records new signals on it. *Assembly* refers to an on-line editing session using either an edit log or a computer-generated edit decision list (EDL); assembly is accomplished using insert recordings. An *A, B, C, D, E mode assembly* refers to one of two different approaches to assembling an EDL. A, B, C, D, and E mode assemblies are accomplished using insert recordings. To *auto assemble* means to have the computer editor automatically perform a series of edits in an EDL list (see Figure 4–3).

VIDEO FRAMES AND FIELDS

Recorded video signals are rather complex and so are tightly structured. The standard unit of video is a *frame*. Similar to film, video motion is created through displaying progressive images fast enough for the eye and brain to perceive continuous action. The broadcast standard in the United States and certain other countries records and displays approximately 30 frames per second (29.97 frames to be exact). This standard is called *NTSC*, after an old committee that approved the format, the National Television Standards Committee.

A frame of video is composed of two *fields*. These fields are recorded adjacent to each other on the videotape and are interlaced during the playback process to display a full frame of video.

Video images are recorded and displayed through a *scanning* process. When a video image is recorded by a camera, a beam of electrons sweeps across the recording surface in a progressive series of lines (think of fine lines running horizontally across the face of an image on a TV set). NTSC video, the North American standard, specifies a frame as containing 525 scan lines. Each field contains 262.5 lines. One of the two fields in each frame contains the odd-numbered scan lines, and the other contains the even-numbered scan lines. When they are interlaced, they create a full frame. Blank videotape has no frames, fields, or control track.

Figure 4–3 *(Opposite) A video edit list can be manipulated to record edits in varying configurations. This is an example of a single edit list arranged in increasingly effective arrangements. The edit program PrelReader, from The Software Grille in Irvine, California, was used to*

ABCDE EDIT LISTING MODES

A MODE SORTED IN ASCENDING ORDER, USING THE RECORD IN TIMES

EDIT	REEL	MODE	TYPE	P-VTR IN	P-VTR OUT	R-VTR IN	R-VTR OUT
0001	OPEN	V	C	01:00:00.00	01:00:10.00	01:00:00.00	01:00:10.00
0002	GRAFIX	V	C	02:00:12.15	02:00:14.15	01:00:10.00	01:00:12.00
0003	LOCAT1	V	C	04:15:18.12	04:15:24.12	01:00:12.00	01:00:18.00
0004	GRAFIX	V	C	02:03:22.15	02:03:25.15	01:00:18.00	01:00:21.00
0005	CAM1A	V	C	05:48:16.01	05:48:18.01	01:00:21.00	01:00:23.00
0006	GRAFIX	V	C	02:12:12.15	02:12:14.15	01:00:23.00	01:00:25.00
0007	LOCAT1	V	C	01:23:22.12	01:23:27.12	01:00:25.00	01:00:30.00
0008	CAM1A	V	C	05:44:25.01	05:44:28.01	01:00:30.00	01:00:33.00
0009	LOCAT1	V	C	01:00:22.00	01:27:37.00	01:00:33.00	01:27:48.00
0010	GRAFIX	V	C	02:10:12.15	02:10:14.15	01:27:48.00	01:27:50.00

B MODE SORTED BY PLAYBACK REEL, ASCENDING ORDER USING THE RECORD IN TIMES

EDIT	REEL	MODE	TYPE	P-VTR IN	P-VTR OUT	R-VTR IN	R-VTR OUT
0005	CAM1A	V	C	05:48:16.01	05:48:18.01	01:00:21.00	01:00:23.00
0008	CAM1A	V	C	05:44:25.01	05:44:28.01	01:00:30.00	01:00:33.00
0002	GRAFIX	V	C	02:00:12.15	02:00:14.15	01:00:10.00	01:00:12.00
0004	GRAFIX	V	C	02:03:22.15	02:03:25.15	01:00:18.00	01:00:21.00
0006	GRAFIX	V	C	02:12:12.15	02:12:14.15	01:00:23.00	01:00:25.00
0010	GRAFIX	V	C	02:10:12.15	02:10:14.15	01:27:48.00	01:27:50.00
0003	LOCAT1	V	C	04:15:18.12	04:15:24.12	01:00:12.00	01:00:18.00
0007	LOCAT1	V	C	01:23:22.12	01:23:27.12	01:00:25.00	01:00:30.00
0009	LOCAT1	V	C	01:00:22.00	01:27:37.00	01:00:33.00	01:27:48.00
0001	OPEN	V	C	01:00:00.00	01:00:10.00	01:00:00.00	01:00:10.00

C MODE SORTED BY PLAYBACK REEL, ASCENDING ORDER USING PLAYBACK IN TIMES

EDIT	REEL	MODE	TYPE	P-VTR IN	P-VTR OUT	R-VTR IN	R-VTR OUT
0008	CAM1A	V	C	05:44:25.01	05:44:28.01	01:00:30.00	01:00:33.00
0005	CAM1A	V	C	05:48:16.01	05:48:18.01	01:00:21.00	01:00:23.00
0002	GRAFIX	V	C	02:00:12.15	02:00:14.15	01:00:10.00	01:00:12.00
0004	GRAFIX	V	C	02:03:22.15	02:03:25.15	01:00:18.00	01:00:21.00
0010	GRAFIX	V	C	02:10:12.15	02:10:14.15	01:27:48.00	01:27:50.00
0006	GRAFIX	V	C	02:12:12.15	02:12:14.15	01:00:23.00	01:00:25.00
0009	LOCAT1	V	C	01:00:22.00	01:27:37.00	01:00:33.00	01:27:48.00
0007	LOCAT1	V	C	01:23:22.12	01:23:27.12	01:00:25.00	01:00:30.00
0003	LOCAT1	V	C	04:15:18.12	04:15:24.12	01:00:12.00	01:00:18.00
0001	OPEN	V	C	01:00:00.00	01:00:10.00	01:00:00.00	01:00:10.00

D MODE SORTED BY PLAYBACK REEL FOR FASTEST ASSEMBLY TIME

EDIT	REEL	MODE	TYPE	P-VTR IN	P-VTR OUT	R-VTR IN	R-VTR OUT
0008	CAM1A	V	C	05:44:25.01	05:44:28.01	01:00:30.00	01:00:33.00
0005	CAM1A	V	C	05:48:16.01	05:48:18.01	01:00:21.00	01:00:23.00
0002	GRAFIX	V	C	02:00:12.15	02:00:14.15	01:00:10.00	01:00:12.00
0004	GRAFIX	V	C	02:03:22.15	02:03:25.15	01:00:18.00	01:00:21.00
0006	GRAFIX	V	C	02:12:12.15	02:12:14.15	01:00:23.00	01:00:25.00
0010	GRAFIX	V	C	02:10:12.15	02:10:14.15	01:27:48.00	01:27:50.00
0009	LOCAT1	V	C	01:00:22.00	01:27:37.00	01:00:33.00	01:27:48.00
0007	LOCAT1	V	C	01:23:22.12	01:23:27.12	01:00:25.00	01:00:30.00
0003	LOCAT1	V	C	04:15:18.12	04:15:24.12	01:00:12.00	01:00:18.00
0001	OPEN	V	C	01:00:00.00	01:00:10.00	01:00:00.00	01:00:10.00

E MODE SORTED FOR MULTIPLE REELS, FOR FASTEST ASSEMBLY TIME

EDIT	REEL	MODE	TYPE	P-VTR IN	P-VTR OUT	R-VTR IN	R-VTR OUT
0002	GRAFIX	V	C	02:00:12.15	02:00:14.15	01:00:10.00	01:00:12.00
0005	CAM1A	V	C	05:48:16.01	05:48:18.01	01:00:21.00	01:00:23.00
0004	GRAFIX	V	C	02:03:22.15	02:03:25.15	01:00:18.00	01:00:21.00
0008	CAM1A	V	C	05:44:25.01	05:44:28.01	01:00:30.00	01:00:33.00
			**** FINISHED WITH REEL CAM1A, REPLACE WITH LOCAT1 *****				
0006	GRAFIX	V	C	02:12:12.15	02:12:14.15	01:00:23.00	01:00:25.00
0009	LOCAT1	V	C	01:00:22.00	01:27:37.00	01:00:33.00	01:27:48.00
0010	GRAFIX	V	C	02:10:12.15	02:10:14.15	01:27:48.00	01:27:50.00
			**** FINISHED WITH REEL GRAFIX, REPLACE WITH OPEN *****				
0007	LOCAT1	V	C	01:23:22.12	01:23:27.12	01:00:25.00	01:00:30.00
0001	OPEN	V	C	01:00:00.00	01:00:10.00	01:00:00.00	01:00:10.00

INTERNATIONAL TELEVISION STANDARDS

As described in the previous section, NTSC is the video standard chosen by the United States and a number of other countries. PAL and SECAM (phase alternate line and sequential color with memory) are the two other major worldwide television standards. PAL specifies a different means of encoding and transmitting color video. Both PAL and SECAM scan 625 lines per frame versus NTSC's 525 and have a rate of 25 frames per second. PAL and SECAM operate at a 50 Hz frequency versus NTSC's 60 Hz. Finally, PAL defines the black level (see Glossary) as 0, the same as the reference level for sync. In NTSC, 7.5 is the stated black level and 0 is the sync reference level.

NTSC, PAL, and SECAM are incompatible with each other. Standards converters can convert video from one standard to another. Productions intended to be broadcast or released in different video standards often are shot on film, which can be converted to any video standard with little or no loss of resolution.

TIME CODE

Time code is a labeling system that specifically identifies video frames and audio signals by referencing a 24-hour clock. Each video frame is identified by an eight-digit number in the format of hours:minutes:seconds:frames; for example, 05:15:18:23.

Time code enables each frame to be identified and accessed for editing or reference. The time code can be recorded on videotape in several places: on one of the audio tracks (called *longitudinal time code*), or in the vertical interval portion of the video signal (*vertical interval time code*, abbreviated VITC and pronounced *vit-see*), or on the address track of the tape (a special area located in certain tape formats).

In concept, the time code is very similar to the edge numbers on film. It is an arbitrary number assigned to each frame of video. The time code is arbitrary, because the important portion of the tape is not the number but the picture the code identifies. The time code always is read (by humans) in the same format. When recorded properly, time code is synchronized to the beginning of each frame. If time code is recorded by a code generator without being locked to a video source, the code may drift across the video frame, rendering it useless.

The time code has other data embedded in it: user information and sync information. The code is divided into 80 digital bits recorded across the video frame. Groups of four bits create a decimal number from 0 to 9. There are 32 bits reserved in the code for user information. With 32 bits, only the numbers 0 through 9 can be used in simple systems or the letters A through F in more com-

and A–F). This encoding method is called *hexadecimal notation*. User bits might indicate reels in a show; for example, reel 15, shot on September 20, at location 11 could be encoded 15 09 20 11. The coding equipment can be set to record the user information on each frame of video. The sync information defines the end of the frame of time code, which allows time code readers to determine the direction the tape is traveling.

In a composite video signal, the phase relationship of the color burst inverts every frame. (Component video does not require this phase reversal.) If an editor connects two frames with the same phase relationship, a horizontal picture shift occurs. When cutting to a completely new picture this shift is not noticeable. When cutting to the same image (to extend a freeze frame or graphic) this shift is very obvious. Color phase information is included in the time code signal, aiding computerized video editing systems in keeping the phase relationship of edited tapes consistent.

There are two kinds of time code: drop frame time code and non-drop frame time code. *Drop frame time code* is time accurate, meaning that one hour of time code equals one hour of videotape running in play mode. *Non-drop frame time code* is not time accurate. An hour of non-drop frame time code is equal to 1 hour and 3.6 seconds of videotape running in play mode (see Figure 4–4).

The difference between the two types of time code occurred because the NTSC decided that color television signals would run at 29.97 frames per second rather than 30 frames per second. When the time code was first introduced, however, it was designated with 30 frames per second. Over one hour, the 0.03-frame-per-second error adds up to 3.6 seconds. To compensate for this error, a system was devised to drop certain numbers from the counting.

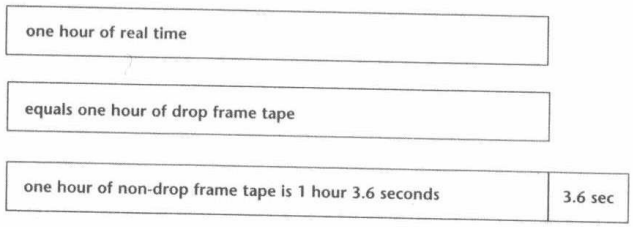


Figure 4–4 *Non-drop frame time code versus drop frame. Non-drop time code over an hour is actually 3.6 seconds longer than a true hour because video runs at 29.97 frames per second*

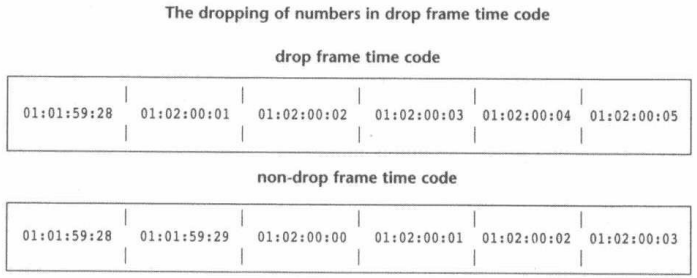


Figure 4–5 *Looking at the numbering of frames one can see where the drop frame time code eliminates time code numbers. Remember, this process drops numbers, not actual frames.*

The :00 and :01 frames are dropped at every new minute except at the 10-minute marks. These time code locations would be at 10 minutes, 20 minutes, 30 minutes, 40 minutes, 50 minutes, and at the top of the hour (see Figure 4–5). This amounts to 108 dropped numbers (3.6 seconds), which allows drop frame time code to keep accurate time and also gave it its name. Dropping these numbers does not change any video content.

Drop frame time code often is used for television programs that must be edited to meet certain time requirements. These shows must be edited to the second. Because drop frame time code is time accurate, it is used in these cases.

Non-drop frame time code is used most often to edit commercials and promotional tapes. Because commercials usually are no longer than one minute, there is no need to worry about the two frames dropped at the top of the minute. Similarly, promotional tapes usually are cut according to their content and pacing, with little concern for to-the-second timing.

Types of Time Code Recording

All three types of time code recording originate with a time code generator: audio, or longitudinal, time code; address track time code; and vertical interval time code.

Audio, or *longitudinal, time code* is encoded digitally by a time code generator and recorded onto an audio track of a tape. It can be erased or regenerated (duplicated) and then recorded onto another tape.

Audio time code can be recorded during the production phase of a show or after shooting has been completed. It can be recorded on any available audio channel. One inch videotape has a specific audio track (track 3) designed for time code. All digital formats have specific time code tracks. However, most digital formats use both audio time code and vertical interval time code (VITC). Occasionally, the two do not match. Care must be taken when recording time code on digital formats that both tracks match.

Address track time code is used only on three-quarter inch professional broadcast videotape formats. Address track time code can be recorded only on decks specifically designed to record and read address track. Address track recording occurs during the shooting phase in an assemble recording, that is, at the same time the video and audio are recorded. Although address track time code is recorded in the same location on the tape as the video, it is recorded at a different frequency. The advantage of address track time code is that it does not occupy a production audio channel.

Vertical interval time code is a picture signal recorded in the vertical interval. The advantage of this type of time code is that, unlike audio and address track time code, it is readable even when the tape is not moving. Because VITC is recorded in the vertical interval using a video channel, it does not occupy an audio channel. VITC also can indicate the particular field on which the videotape is parked.

VITC must be recorded at the same time as the picture. Recording and decoding the code requires special equipment. More expensive decks, such as D2s, come with VITC decoders built in. One should check the availability of this equipment before planning to use this type of time code.

The time code should not be copied directly tape to tape because the time code is a digital signal that degrades with a straight transfer and tape noise can render the code useless. The time code is regenerated by feeding the original time code signal into a regenerator, which creates a clean, new signal that can be recorded onto the same tape or used to create a window dub or submaster.

Working with the Time Code

As stated earlier, the time code comes from a time code generator. The operator selects drop frame or non-drop frame time code on the generator, along with the specific starting point (hour, minute, second, and frame). The time code must be in exact sync with the video, so the generator must be locked to the record deck or a common reference signal. Recording unlocked time code will result in non-synchronous code, meaning that the code for one field will fall across two video fields, making the code impossible to use in editing situations.

Some producers label videotape reels with code. For instance, reel 1 would have a one-hour time code, reel 2 a two-hour time code, and so on. Many films transferred to tape use hours to indicate film reels as they are transferred.

Another way to use time code is to record time-of-day code on the tape. This is done by setting the time code generator to a clock and having it run in drop frame. For instance, time code 04:00:00:00 would indicate that the shot was made at 4 o'clock. A producer who wants to find something that happened at a particular time of day can just search the tape for that time code.

A potential problem with the time-of-day method is that the code generator switches from 23 o'clock to 0 o'clock at midnight. If the operator has not put up a new reel before going home for the day, the time code at the end of the reel will have a lower number than the time code at the beginning. Because the computer editor will always look for the lowest number toward the beginning of the reel, one solution is to change the reels at midnight. Using time-of-day code also means that different reels could have the same numbers. A shot at time code 10:00:00:00 could be on any reel that was recording at 10 o'clock.

For edit master stock, most professionals start their time code at 00:58:00:00 or 09:58:00:00, both of which allow for two minutes of code for bars and tone, slates, and any other visual or audio information, ending two seconds before the program starts (see Figure 4–6). The program would start at either 01:00:00:00 or 10:00:00:00.

In video production, most producers record the time code on their production footage as they shoot. Others wait and code their footage after the production phase is over. Because address track time code and vertical interval time code must be recorded with the video, only audio time code can be used when the footage is coded after production.

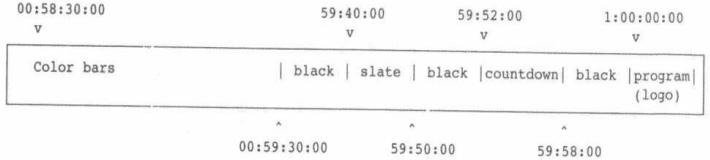
It generally is more cost effective to rent a time code generator and record the code during the production. This method also allows the producer to record identical time code on multiple videotape recorders (VTRs) during complex camera setups.

THE COLOR VIDEO SIGNAL: COMPOSITE, COMPONENT, AND Y/C

Four basic elements make up the color video signal: the luminance or brightness (white) values within the picture and the three chrominance or color values (red, green, and blue). These four elements combine to create the color signal.

As noted in Chapter 1, there are several methods of recording color, two of which are the component and composite formats. Composite video integrates

A SAMPLE BEGINNING OF A VIDEO PROGRAM



EDT	REL	MODE	TYP	T		P-VTR IN	P-VTR OUT	R-VTR IN	R-VTR OUT
0001	BARS	VA1A2	C			00:58:30.00	00:59:30.00	00:58:30.00	00:59:30.00
0002	BLK	V	C			00:00:00.00	00:00:10.00	00:59:30.00	00:59:40.00
0003	SLATE	V	C			00:00:00.00	00:00:10.00	00:59:40.00	00:59:50.00
0004	BLK	V	C			00:00:00.00	00:00:02.00	00:59:50.00	00:59:52.00
0005	COUNTD	VA1A2	C			01:00:00.00	01:00:06.00	00:59:52.00	00:59:58.00
0006	BLK	V	C			00:00:00.00	00:00:02.00	00:59:58.00	01:00:00.00
0007	BLK	V	C			00:00:00.00	00:00:00.00	01:00:00.00	01:00:00.00
0007	LOGO	V	D		00:10	01:03:39.14	01:03:41.14	01:00:00.00	01:00:02.00

Figure 4–6 *A sample of the beginning of a videotape with bars and tone for playback reference, visual slate information, and an eight second countdown, ending two seconds before the start of program.*

both luminance and chrominance portions of the signal and therefore can be transmitted from point to point along one wire.

Standard component video divides the signal into three parts and so requires three wires to travel through switchers or other electronic gear. The three signals that travel in the standard component environment are the luminance signal (denoted by the symbol Y), the red signal minus the luminance (R-Y), and the blue signal minus the luminance (W-Y). With these three signals, the color green also can be represented.

Because color information is not embedded in the component luminance signal as it is in the composite signal, the component path and recording signal are superior to those of the composite signal. However, the added cost for rewiring and purchasing component equipment deters some postproduction companies from committing to component video. Tape formats that use component video are D1, MII, Betacam SP, Betacam, and DCT.

A third type of color recording, called *Y/C,* is used to record the video signal.

recordings. Some editing systems have specific inputs to accept the separate luminance and chrominance signals. By separating the luminance from the chroma (the red, green, and blue signal), the two signals maintain a distinctness that helps to recreate the picture information during playback.

RGB is another type of video signal that provides a separate channel for output from paint systems and computers. This type of signal is of extremely high quality and, in many cases, carries much more information than a component signal. However, to record the output of a paint system or computer, the RGB signal moves with its accompanying luminance signal into a converter, where its information is transformed into a composite or component signal.

DIGITAL VIDEO

Digital technology has significantly altered the way video is shot, processed, and edited. Standard analog video signals consist of smoothly varying voltage levels that closely mirror the original image. Digital technology, on the other hand, divides a signal into tiny segments of time and measures the quantity of the signal within each segment (see Figure 4–7). The segments and their measurements are expressed in binary digits, a complex series of positive (1) and null (0) values. Binary digits are processed more easily than analog signals and can be copied without the generational loss of quality that occurs with analog signals.

Digital technology in video often depends on converting analog signals to digital signals. Analog-to-digital converters and digital-to-analog converters accomplish these functions. Graphics thus may be created in the digital domain and integrated into an analog system.

Four primary digital formats are in use. Like analog video recording, digital video can be either component or composite. The D1 recording format, developed by Sony, and Ampex's digital format, DCT, both have separate Y, R-Y, and B-Y portions (component recordings). The D2 and D3 formats, developed respectively by Ampex and Panasonic, feature composite recording (see Figures 4–8 and 4–9). Because the composite signal requires less processing, D2 and D3 are less expensive than D1. Yet D1 offers superior quality and is ideal for effects and graphics work. If all editing equipment and wiring is kept in the Dl digital domain, hundreds of generations can be performed with little signal degradation.

Compression

As digital tape formats and nonlinear editing systems took hold, a new process came into its own: compression. Digital compression takes a signal and eliminates

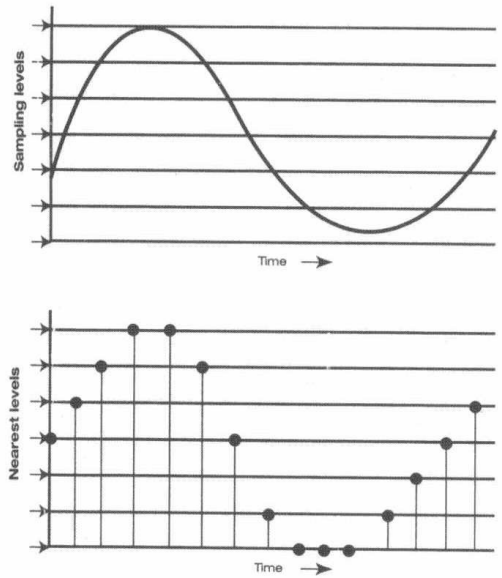


Figure 4–7 *In the digitizing process, the picture (or audio) is examined at regular intervals, then the image stored. If changes in the image occur quicker than the sampling rate, the resulting image will not accurately reflect the original material.*

certain aspects of it. Mathematical programs have come up with different types of compression. There is JPEG, MPEG, 2:1 on down the path to 30:1. Basically, compression loses information. It depends on how much is lost and how much was there to being with.

Digital Betacam is a component signal (see Figure 4–10). It is the equivalent of a D1 signal but compressed at a ratio of 2:1. This compression rate is practically invisible. Digi Beta, as it is called, is quickly becoming a de facto standard.

A D1 level picture takes up so much storage, whether it be on tape or hard disk space, that compression is used in nearly all nonlinear editing systems. A few exceptions would be Quantel's Edit Box and Discreet Logic's Fire. Both systems are pure 601 random access on-line editors.

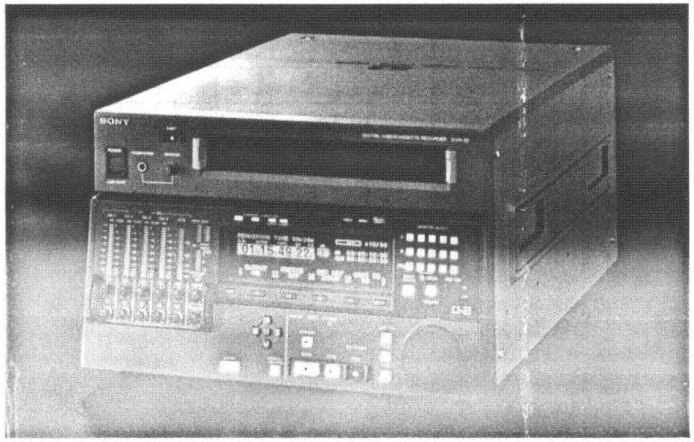


Figure 4–8 *A Sony D2 tape machine. Photo courtesy of Sony Corporation.*

If a picture is compressed too much it becomes indiscernible. Several different types of compression are possible and often many levels to the compression. MPEG, JPEG, and DVI all do the job and work well within the off-line/work print editing environment.

Why compress? To make nonlinear off-line/work print editing affordable. The cost of renting or purchasing the amount of memory required to edit a show with full picture resolution would be far too much, even for feature film budgets. So, compression is used to decrease the amount of storage.

When an off-line/work print nonlinear editing system digitizes material, it first eliminates a single frame of the image. From there, it depends on the program used for compression. And each program has different levels of compression. At each level, less space on the hard disk is used for each frame of picture. At some point the picture quality becomes too poor to use effectively.

SUMMARY

Videotape has been with us for over 40 years. It continues to adapt and change.

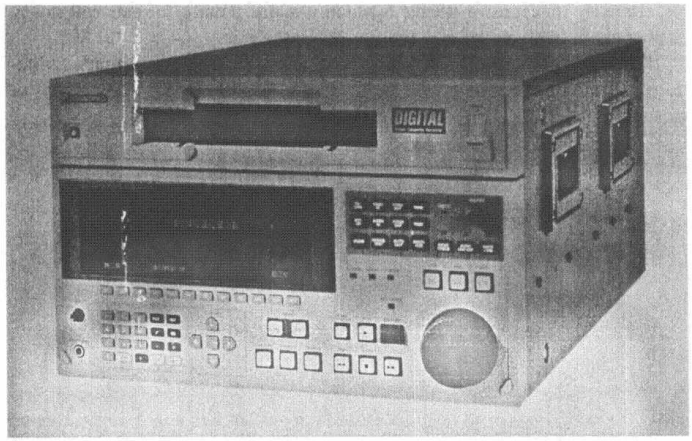


Figure 4–9 *A Panasonic D3 tape machine. Photo courtesy of the Panasonic Corporation.*

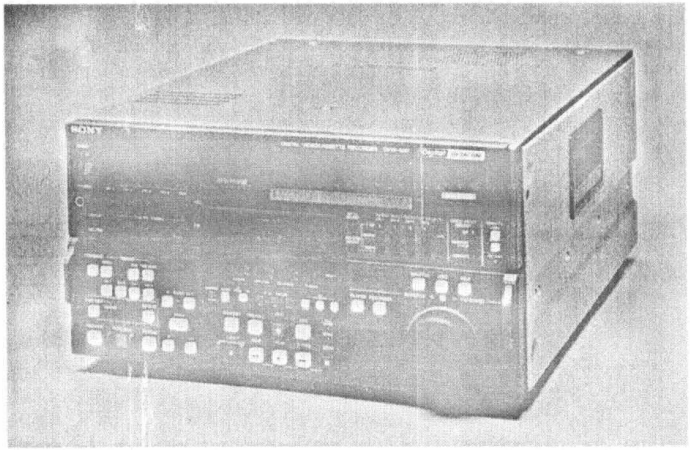


Figure 4–10 *A Sony digital Betacam editing recorder. Photo courtesy of Sony Corporation.*

ble, relatively inexpensive storage medium remains. Analog formats will slowly be phased out, with digital tape formats filling the gap.

Knowledge of control track, time code, and a particular format's limitations and capability continue to be necessary whether one is editing film or videotape.

CHAPTER 5

What Is Film?

We all have used film at one time or another. Most people's experience with film has been in using still cameras. Motion picture film basically uses the same material as in 35 millimeter still cameras.

Film is a thin flexible strip made up of several layers (see Figure 5–1). The top layer is called the *emulsion*. The emulsion is composed of light-sensitive silver salts. The emulsion rests on a strong support, called a base. The base usually is made of cellulose acetate or cellulose triacetate. Old film used cellulose nitrate, which was extremely flammable and occasionally would ignite, even while being projected.

Examining a cross section of color film reveals seven layers. First is the emulsion. Color film has three layers of emulsions with a yellow filter between the blue-sensitive emulsion and the green- and red-sensitive emulsions. Then comes the

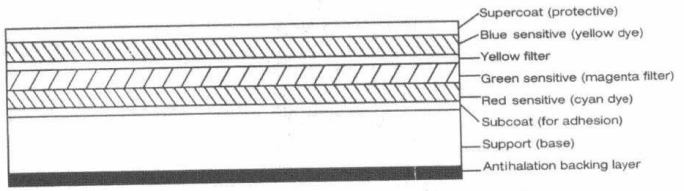


Figure 5–1 *A physical cross section of color film shows the many layers involved. Thirty-five millimeter feature film basically has the same construction as the film used in 35 millimeter still*

backing and finally an antihalation layer to prevent light that has passed through the emulsion being reflected back from the shiny base and causing a halation or halo around certain images.

The layers of light-sensitive emulsion are made of a gelatin and silver halides. When the sliver halides are exposed to light, they separate into a metallic silver deposit and halogen. In processing, the unexposed halides are washed away. The remaining metallic silver grains form the picture we see on film. Three different layers of emulsion are in color film: yellow, magenta, and cyan. It is interesting to note that these colors are the opposite of videotape, which is derived by combining the colors red, green, and blue.

The edge of film contains physical holes punched through the emulsion and base (see Figure 5–2). These sprocket holes are used to transport the film. The distance between one hole and the next is called the *pitch*. The space occupied by a single image is called the *frame*.

A claw in the camera pulls the film into position (see Figure 5–3) and a shutter opens, allowing light to hit the film. The camera's iris is adjustable. It can be opened and closed, depending on the requirements of the film stock and amount of light available on the subject being photographed.

Once a section of film has been properly exposed, the shutter closes. While the shutter blocks the light, the claw reaches up and pulls another section of film into place. This process happens 24 times a second at normal speed. For slow motion, more frames per second are exposed, but the film still is projected at 24 frames per second. For sped up action, fewer frames per second are exposed.

Film is described by its physical width. Because it is a physical medium, the larger the exposed area, the higher the resolution of the picture. Every increase in

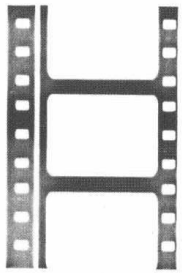


Figure 5–2 *Sprocket holes in the side of the film are used to move the film through various devices (cameras, projectors, laboratory equipment, telecine machines, etc.).*

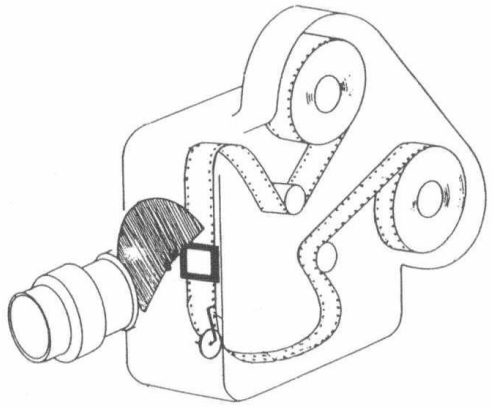


Figure 5–3 *The camera uses a claw to move the film through the gate as the shutter closes, avoiding exposure of the film while it is motion.*

size increases the picture area by the power of four, thus an unsqueezed 35 millimeter frame has 64 times the picture area of 8 millimeter film. The great advantage of film is that its formats are accepted nearly universally. A 35 millimeter film can be made in Canada and played in France. This interchangeability, coupled with film's superior image resolution, makes it an ideal choice as a production and distribution medium.

EMULSION SPEED

Film is manufactured with different emulsion speeds. This means that certain film stocks require less light to produce an image. The trade-off is in the size of the grains in the emulsion. In very "fast" film, the grains are so big that they actually can be seen, yet the film can be exposed using very little light. In this case, the images may look like they are "boiling."

The speed of a film stock is indicated by its ASA or DIN number. The higher the ASA number, the less light is required to produce a image. A wide variety of speeds can be purchased.

KEY NUMBERS

The side of the film contains a series of alphanumeric characters that identify the frames of film. This group of numbers, called *key numbers* or *edge numbers*, is used to identify frames. The film one uses in a 35 millimeter still camera has key numbers, frames, and sprocket holes, just like motion picture film.

Newer film stocks also contain a bar code, an encoded computer code that contains the key numbers of the film. With a Keykode reader, these numbers can be read off the film during a telecine session and visually inserted into the video transfer. This allows electronic editors to visually keep a record of the source of the shot. Usually in the film-to-tape transfer, key numbers, scene numbers, date of transfer, and footage count are visually recorded along with the film image. *(One should never digitize a film image without identifying images. These identifiers at the very least should be found at the head as a slate. If the footage is for off-line or work prints, the key numbers or code numbers should be burned into the picture.)*

RUBBER, INK, OR ACMADE NUMBERS

Not to be confused with key numbers, these numbers are printed on work print film in sync with audio mag to help keep the two separate strips locked during editing. In the work print stage of editing film, the production sound is transferred to audiotape that is cut in the same format as the work print, but there is no way to identify the sync point on the mag, so these numbers are printed on the mag and film work print. One machine that prints these numbers is manufactured by Acmade.

FILM FORMATS

Smaller Formats

Super 8 and 8 millimeter are ideal consumer formats for the beginning filmmaker. Some more recent super 8 cameras are very sophisticated, utilizing computer chips. However, the size of the film is small compared to 16, super 16, or 35 millimeter stock. Cost-efficient consumer videotape formats often are more desirable because of no need for laboratory processing and their affordable editing systems.

16 (mm) Millimeter

In 1923, Eastman Kodak introduced 16 millimeter film as a student film format. In 1938, the company added sound to the format. In the beginning, 16 millime-

ter film was like 8 and super 8 millimeter film are now: the cameras were less sophisticated than the professional 35 millimeter models. When Arriflex introduced a battery-operated, high-quality 16 millimeter film camera, the film industry took notice. With further refinements in film stock, 16 millimeter became a low-budget option for feature films and television production.

Super 16

The super 16 format increased the exposed frame area by eliminating the space normally occupied by the soundtrack and using only single perf (perforations are on only one side of the film, the sound track area is not necessary for production shooting on film). In making these alterations, filmmakers gained 40 percent more exposable area on the same amount of film. Many low-budget pictures have taken advantage of this stock. The footage later is blown up to a widescreen 35 millimeters for theatrical release.

35 (mm) Millimeter

This is the standard feature film format originally invented by Thomas Edison. Highly complex cameras and laboratory procedures are built around this international film standard. In addition to creating higher-resolution images with more perforations per frame, 35 millimeter film is held more precisely and steadier than the smaller formats. Many different types of film stock are manufactured for varying lighting conditions.

THE ANAMORPHIC PROCESS

A special lens developed in the 1930s was designed to visually "squeeze" the picture as it is shot (see Figure 5–4). The anamorphic process uses standard 35 millimeter film but includes more image on the same size film stock. When the image is projected, a reverse process is used to unsqueeze the picture. Several trademarked names that have become familiar use the anamorphic lens, such as Cinemascope, Techniscope, and Super-Panavision. The "normal" lens that produces a flat image is called a spherical lens. A flat film, when projected, produces a 1:33:1 aspect ratio. To make a flat film appear "scope," one blows up the image then mattes that expanded image as if it were a "scope" picture. The result appears to be a larger picture, but it is slightly blurrier because the image has not been squeezed but blown up.

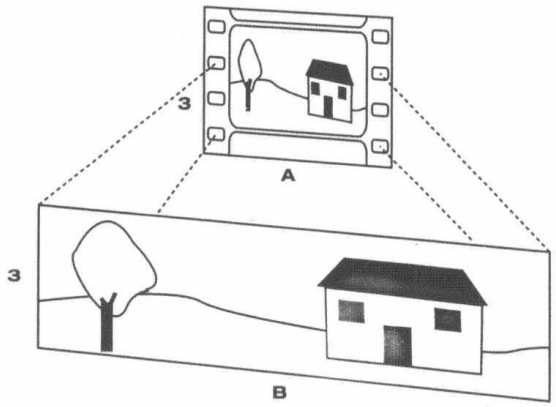


Figure 5–4 *Through the use of an anamorphic lens, a wide image can be squeezed to fit into a smaller area. Reversing the process in projection unsqueezes the image. Many productions simply blow up the film and crop it in the theater to approximate this aspect ratio to save money.*

ASPECT RATIO

The ratio of any film or video image from width to height is called an *aspect ratio.* Several standard film formats are used in production (see Figure 5–5). The academy or flat ratio is at 1:33 to 1, which by the way is the same ratio as a television picture. Spherical lenses also can produce different size aspect ratios. Some of the commonly used ones are 1:66:1, 1:75:1, 1:85:1. However, these formats are shot flat (1:33:1). This increase in aspect ratio is accomplished by blowing up the film and then matting it in the projector. As mentioned earlier, the procedure reduces the image resolution but is less expensive than shooting with an anamorphic lens.

An anamorphic lens produces various aspect ratios. Some of the standards are 2:66:1, 2:55:1, and 2:35:1. As mentioned earlier, anamorphic lenses optically squeeze the image, then the image is unsqueezed by reversing the process and projecting the image through an anamorphic lens.

Two formats expose the image on the film sideways. VistaVision exposes 35 millimeter film sideways and results in an aspect ratio of 2:21:1. Imax, a film format that is projected in special theaters, exposes 70 millimeter film horizontally. This format creates an original frame size of 70 × 46 millimeters! The interest in this format is not so much its aspect ratio but that the amount of film exposed is much larger than normal 35 millimeter film and is amazingly clear even when projected on the large Imax screens. The reason more feature films do not utilize this high-resolution format is that the cost of exposing so much film so fast is not economically feasible.

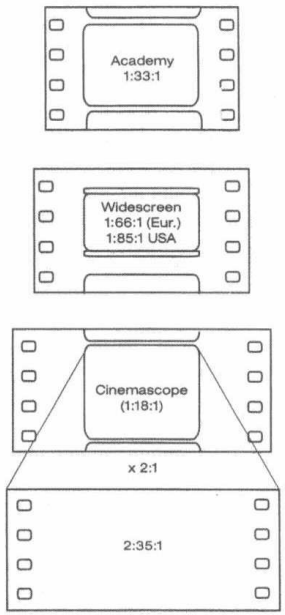


Figure 5–5 *Commonly used aspect ratios in feature film production.*

SPECIFIC TYPES OF FILM

One should be aware of some generic film images and stocks that are used in the postproduction process.

Academy Leaders

Everyone has seen this countdown footage at one time or another. Usually, it is a picture of a simple clock graphic. It counts backward every second with the last two seconds in black. This film is spliced to the head of every editing picture and negative so that the sync point (the picture of a 2) is recognizable and can be located. Foot (or tail) academy leaders used to be common but slowly have been ignored except in prints for theatrical release.

Dirty Dupe

This is an inexpensive black-and-white reversal contact print, often made from a work print. Dirty dupes are made for sound mixing or editing or as a protection for the edited work print.

Fill

Old, useless, and ready to be discarded film is cut into sound tracks to take up necessary space.

Slug

Black or opaque film is cut into a work picture to take up space where effects or missing scenes should reside. One could not use old footage for a slug because it would contain a picture.

Dupe Negative

A negative copy is derived by taking the camera original, making an interpositive, then making a negative from the interpositive. Usually, the dupe negative's purpose is to make projection prints. Rather than (eventually) damage the camera original cut negative, this dupe negative is the duplication master for a filmed show (see Figure 5–6).

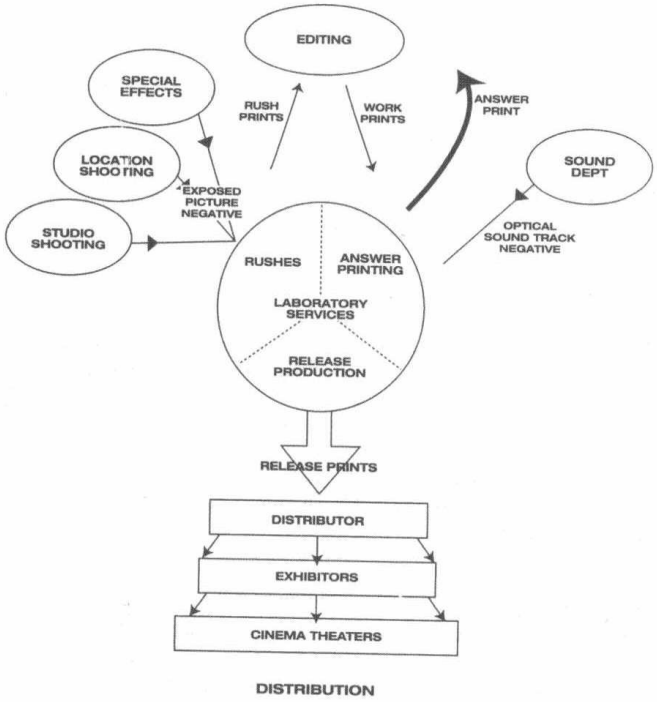


Figure 5–6 *A diagram of the central position of the film lab in feature film production. The lab is the hub of feature film postproduction. Dirty dupes, dupe negatives, internegatives, interpositives, low cons, work prints, and release prints all come from the processing services of the film lab. Broadcasters tend to rely more heavily on videotape editing and duplication companies. Still the lab is a vital part of the film process.*

High Con

A high-contrast black-and-white film is used to create special effects. This extremely sensitive black-and-white film produces a stark, extreme image that is often used for titling or holdouts for green screen effects.

Internegative

This is a negative that comes from a positive image. For instance, an internegative could be made from the work print. It usually is made from black-and-white positive film, in contrast to making a color dupe negative from interpositive film.

Interpositive

This is a low-contrast positive image that comes from the camera original master. It is used for telecine (film-to-tape) sessions or making a theatrical trailer, rather than risk using the precious camera negative, or for creating a dupe negative.

Low Con

A low-contrast positive print often is used for film-to-tape sessions rather than a projection print, although a camera original or an interpositive of the negative would be preferable.

Work Print

A color or black-and-white positive copy of the camera negative, which is used to create a working print of a film project. Originally, a work print was physically cut and recut until the exact sequence of pictures was created. Now electronic editors are used to cut the program and the work print is used for telecine transfer to video and test screenings. In smaller budgeted film projects that are going directly to videotape, a work print may not be used at all.

Release Print

This is the finished sound print for projection derived from cut negative or dupe negative. A dupe neg is created by transferring a camera negative to IP then transferring the IP to a dupe neg.

A FINAL NOTE ABOUT FILM GENERATIONS

Film is a physical medium, so multiple generations do not hold up well. Each generation away from camera negative is noticeable to the trained eye. Unlike digital video, which can withstand hundreds of generations (even though its resolution is far less than film), filmmakers try to keep as close to the camera negative as possible.

Also, because film is physical, damage can be done to the camera negative. All precautions should be made to keep this vital part of the production protected from heat, dust, and unnecessary handling. Usually, all production negatives are kept in one place, carefully labeled and stored in boxes. Careless handling of negatives eventually will result in lost or damaged footage.

SUMMARY

Production on film currently is the best method of producing high picture resolution along with international interchangeability. The global acceptance of standard film formats has produced a consistent and well-worn work path. Film most likely will continue to be the preferred method of capturing images. Understanding the basics of how this high-quality medium works is a necessity to understanding how a film project is finished, whether it is edited traditionally on film or by using a nonlinear editing system.

CHAPTER 12

Editing Pictures

There is a logic and purpose to cutting any visual program. Here, we examine some of the accepted concepts concerning the editing of picture and sound. These rules and ideas apply to any program, whether it is a big budget movie or a public access program.

The novice editor might think the professional glances at the program script, then whips out a first cut that is brilliant, approved, and sent to finish. Nothing is further from the truth. A high-caliber editor takes the time to log in the available footage. Then, after consulting with the director and the script, the methodical process of cutting a program begins. This job is neither quick nor easy. Knowing the existing footage, understanding the show's purpose, and being familiar with the script begins the editorial process.

ORGANIZATION

Creating a show cannot be a haphazard affair, or the editorial results will be equally haphazard. The thought process that includes planning an editing approach is as important as learning which button to push. The editor who takes the time to set up the nonlinear editor in a logical and easy to understand fashion will be prepared to deal with the pressures of cutting large amounts of material in a short amount of time. It is vital to know what material is available and where it is stored. Keeping an uncluttered screen and carefully categorized electronic bins are keys to successfully completing an editorial challenge.

Every program has a purpose. This purpose might be to sell a product, to train or inform, to amuse, to frighten, or to excite. The show's purpose may be to entice advertisers to financially support the program or to show the most exciting portion of a movie.

The editor cuts images and sound into a structure that specifically suits the show's purpose. This is true in feature films as well as propaganda pieces, news stories, magazine shows, comedies, dramas, and documentaries. If the editor is confused about the show's purpose, it will be evident in the final product.

THE INTENDED AUDIENCE

Each program also has an intended audience, which may be very broad or very limited. A videotape that explains the workings of a hydroelectric dam would be edited differently than a documentary on the life of the dam's designer. The editor must know the intended audience of a program to satisfy that audience's expectations.

SELECTIVE ELIMINATION

The editing process is one of selective elimination (see Figure 12–1). The production company eliminates footage for technical or aesthetic reasons by printing only circled takes. The editor views the remaining footage and eliminates those images and sounds that are inferior, using only those that serve the show's purpose and intended audience.

Viewing footage may involve taking extensive notes as well as referring to production material (script supervisor notes, camera and sound reports, reading the script) and talking with the director. Production notes often indicate which shots have the proper delivery or performance. Perhaps only a portion of a shot is usable, but if it contains the correct balance of composition, performance level, and background action, this is noted.

CHOOSE, EDIT, THEN TRIM

The chosen cuts and scenes are edited together, then trimmed (or eliminated) until they are at their optimum length. Some editors come close to a fine cut (where the edits flow correctly with little apparent interruption in continuity) if they choose shots carefully, then trim each edit and scene thoroughly.

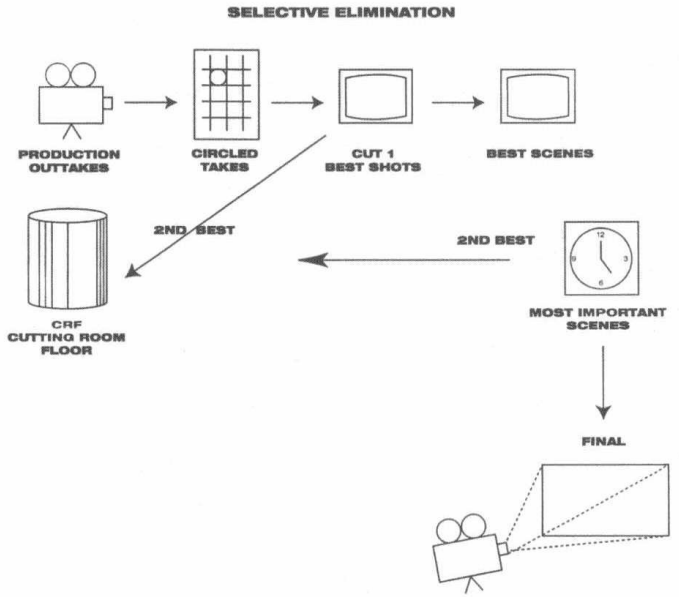


Figure 12–1 *The editing process is one of selective elimination. The production company begins the process by eliminating unwanted takes. The elimination continues through picking the best shots and angles that suit the program's purpose and intended audience.*

Usually, the first cut of a program is made without consideration of time. Politics and financial requirements eventually will alter this cut. Scenes and sequences will be changed until the program plays to everyone's satisfaction as well as meets the technical requirements. More often than not, sacrifices and compromises will be made.

SHOTS AND ANGLES

A scene usually starts with a wide or long shot (see Figure 12–2) to establish location and mood. Often, this establishing shot is underscored with music, adding time to the wide shot. From this establishing shot, the scene moves into a

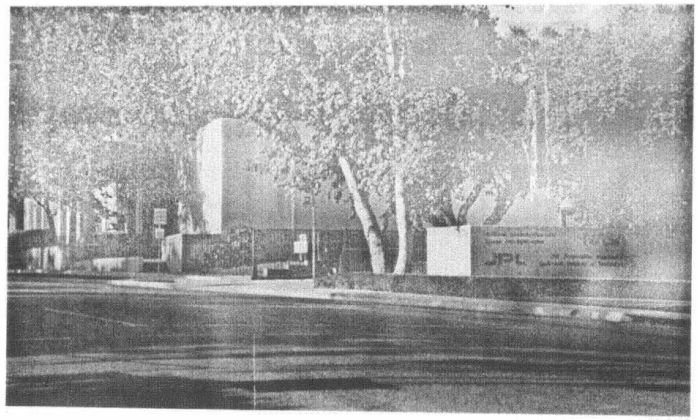


Figure 12–2 *The establishing wide shot acquaints the audience with the location and tone of the scene.*

medium shot, then alternates between close-ups and medium shots. Occasionally, this rule is broken. Cutting to a wide-eyed victim can be a powerful transition when coupled with the correct audio effect or music cue. As a rule, however, the audience wants to know where the action is taking place.

Television programs are shot quickly and without a tremendous amount of coverage. The wide to medium to close shot sequence is used over and over again. It is a good idea to break this sequence and return to either the wide or medium shot to reorient the audience. An excellent time to break the close-up to close-up sequence would be when a new player enters a scene. The shot establishes the entrance of the character and shows the viewer where the player is in relationship to the others. Ideally, the director will provide the editor with enough editorial choices to allow him or her to incorporate a variety of different shots in the program.

SHOT LENGTH

There is no proper length for a shot. In a motion picture trailer, the length of the cut almost always is shorter than in the movie. The trailer's purpose is to sell the film. The movie's purpose is to entertain.

Each cut should remain only as long as it takes to impart its information. An edit could last for seconds or minutes, depending on action, dialogue, camera movement, and the show's purpose. If a shot does need more length (for music or getting a show to a specific time), it often is better to use the material at the head of the shot. Once the internal interest of a shot has played out, it becomes boring. At the very least, extra footage at the beginning of a shot establishes the scene's mood.

CUTTING PICTURES

The essence of editing can be explored by watching almost any television commercial. The commercial must tell a story, entertain, and sell a product in a very short period of time. Commercials usually break new ground in the areas of effects and graphics as well as reflect current editorial trends. Only the most necessary pictures and audio are included. Weeks, sometimes months, will be spent making sure every frame is exactly right.

PACE

Each shot has its own internal rhythm. The connection of several shots provides the pace of a scene. The cadence of one scene juxtaposed to another creates the flow of an entire program.

Through the careful use of pace within a shot and between cuts and scenes, an editor can create emotion (tension, humor, relaxation, arousal, anger). A program must elicit several of these feelings. A comedy often will contain a dangerous or depressing scene as a change of pace and release from laughter. The entire spectrum of human emotion is available to a sensitive editor with the proper footage.

Time Compression and Expansion

One of the more powerful tools an editor employs is the ability to compress or expand time. A program about the construction of Hoover Dam would be intended to impart information about a technical process. The shots will be more than long enough to show the facts concerning the construction process. Some footage might be repeated. The pace of the program will be fairly slow, cut for maximum content absorption as well as entertainment value.

An action-adventure program that takes place on the same dam will have many more cuts with short duration for each edit. The pace will come from the movement within the frame as well as from rapid edits.

A program's pace can be controlled in several ways. The first and most obvious is the length of the cuts. An edit can have extra time at the beginning and ending portion. This added time affects how the edit "plays." For instance, one may edit a close shot of a gun being raised, then fired, as in Figure 12–3. An edit that uses the whole raising action and firing, including the moments after the firing, will be paced more slowly than the edit that starts just as the gun stops its upward motion and ends as soon as the shot is fired. The slower edit would be at least one second longer than the quick-paced edit.

A recent movie had a car chase through the hilly streets of San Francisco. The sequence was cut very quickly and worked well on the small screen of the electronic editor. However, when the work print was matched and the sequence was screened in a theater, it was impossible to tell what was happening. Each frame of the motion picture carried so much information, the viewer needed time to absorb the change in angle and react to the action. As a result, the scene had to be "opened up," allowing more time for each cut.

Another method of controlling the show's rhythm is through the number of cuts. Again, referring to the raising of a loaded gun, the same real-time shot could be used to show the gun being raised but intercut with the intended victim's face and the assailant's expression. Raising the gun would take just as long, but the added footage would alter the scene's timing.

Internally, a scene may have several "beats" or emotions. It might begin using quick cuts, with great tension, then slow down, only to speed up again as another threat or character is introduced. A show without rhythmic change is boring. This is another reason why directors shoot several angles of a scene. Multiple angles allow for flexible adjustment of the pace.

Pacing Within the Words

Dialogue plays an important part in any production. Space between sentences often is eliminated to alter a show's pace, especially in narration. This type of editing also is used to speed performers who are slow to deliver their lines (as long as it is not a dramatic moment). The "pull-up" can be accomplished by eliminating the space between words, or sentences, and covering the resulting jump cut with a cutaway.

Not every line and not every speech is sacred, and it often is necessary to remove one or more lines of dialogue and jump to a section of the script further into the scene. Entire sequences can be eliminated to improve or to shorten a scene. Naturally, the intended purpose of the program must be considered before entire lines and exchanges are eliminated.

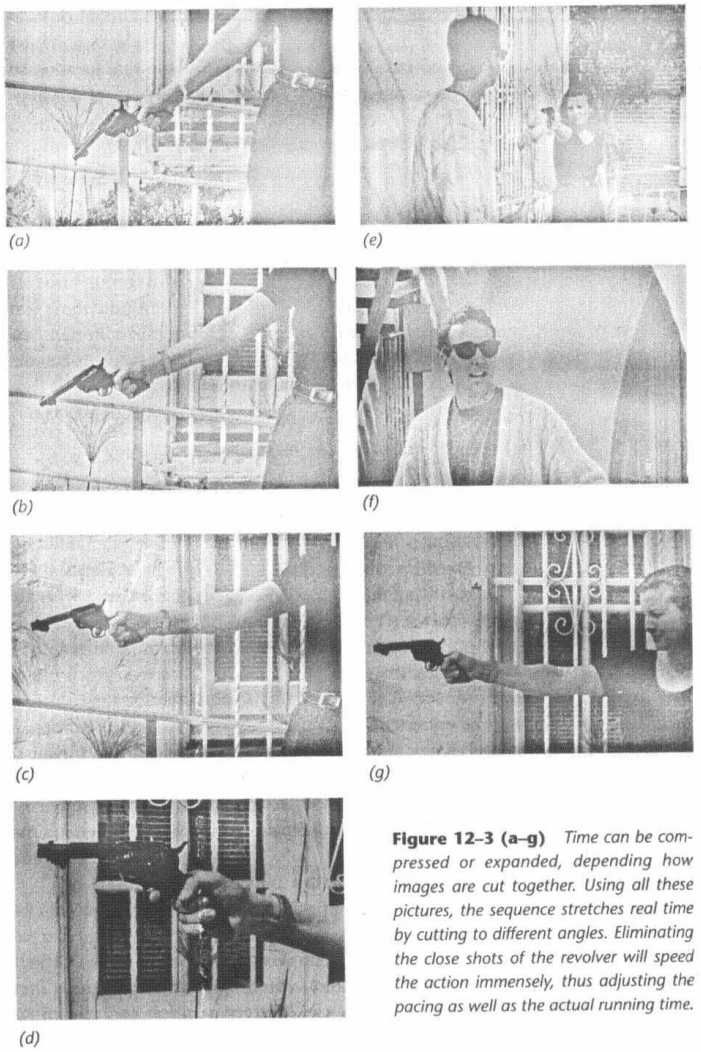


Figure 12–3 (a–g) *Time can be compressed or expanded, depending how images are cut together. Using all these pictures, the sequence stretches real time by cutting to different angles. Eliminating the close shots of the revolver will speed the action immensely, thus adjusting the pacing as well as the actual running time.*

At other times, it is necessary to add space in dialogue. Every room or location has a unique sound. There is never true silence during production. When opening up dialogue, it is important to use ambient sound from that location so the "silence" matches the rest of the audio.

WHERE TO CUT

Invisible editing is the key allowing the audience to be absorbed in the story. This puts the editor in the unusual position that his or her contributions to the project are meant to be unnoticed. How does one achieve this goal? Through careful attention to action matches, judicious dialogue choices, and continuity.

Edits can be invisible when the cut follows one of four basic editorial concepts: action, screen position, form, or idea. One exception to this rule is an edit specifically made to jar the audience, a shock cut; another is in a music montage sequence, where edits often are made on the beat, making the cuts or effects obvious.

Action Cuts

A simple gesture such as raising one's hand allows an editor to cut at numerous points during that action. An editor might cut at the start of the move, in the middle, or toward the end; but cutting during the action is one of the best ways to change the camera angle within a scene. The audience follows the action and is unaware of the change of camera angle. In larger action scenes, the change in angles can be used, again, to change the pace of the action. A car screeching around the corner can enter the intersection or be halfway into the traffic. Again, the pace of the scene will dictate the entrance and exit of the particular shot.

If the eye is led to one side of the screen, the action or character in the next shot often is located on that side as well. The purpose is to allow the eye to follow the movement between the two shots. In commercials, an image often is flipped to help an edit flow. Attention must be paid to any signs or other letters in the shot as they will be backward.

Form

A cut from a porthole to a full moon is an example of an edit using form. Cutting from a Frisbee to the sun and a dissolve from a burning match to a roaring fire are other examples. This type of edit often uses screen position and matching shape to be most effective.

Idea

Ideas are used to smooth the visual transition in edits. The idea cut is more subtle than the form or action cut and highly dependent on the production footage. However, if you think of such a transition before production stops, it might be worth mentioning to the director. Perhaps the shot can be added to the production schedule. A dissolve from a crying woman to a rain-streaked window is an example of an idea edit.

The Combination

The most powerful edits are those that use two or more of these concepts. Cutting from a high-angle shot of a diver leaping off a diving board to a side-angle shot of an ice cube landing in a glass would use action, screen position, and idea to create a unique transition.

More on Where to Cut

Some editors overlap action cuts by a few frames. In large effects shots, it is common practice to expand the time of an explosion through the use of slow motion and extensively overlapping the action. This extends the effect, maximizes the expensive production, and fulfills the show's purpose.

Another ideal time to cut is when the audience expects it. If two on-screen characters are having a discussion about the daily routine of a third individual, showing the actions of that character during the discussion would be expected and natural. Similarly, it would be a good time to show a snowbound runway while an air traffic controller describes a particularly severe snow storm.

Each edit must be motivated. Without motivation, either by concept such as a narrator's or character's line, physical action by an object or character, or change of location, the edit will seem jarring and obtrusive. Occasionally, the scene will play perfectly well in a wide shot. A general rule is to stay on the action unless there is a real purpose or motivation, then cut. When an edit occurs with motivation and on-screen action, the audience is usually unaware of the shot change.

The number of (motivated) edits will determine whether the production seems long or short to the audience. In the limited settings of television sitcoms, for example, camera angles and shots are changing constantly to give the show its quick pace. Occupying the eye with new and different images that are consistent with the intent of the show will prevent the audience from becoming bored. Of course, a quick cut during a heart-wrenching funeral scene might be totally inappropriate.

Many starting editors dwell over what material to keep and what to eliminate. A great deal of footage may seem overwhelming at first, but like climbing a mountain, the goal is reached by taking one step at a time. The editor should follow his or her first instincts, stay organized, and keep cutting. If a shot fits, use it. If it belongs on the cutting room floor, let it go. Keep in mind that the images chosen must fit the program's purpose and audience's expectations.

USING SPECIAL EFFECTS

There is a time and place for the special effect. As a rule, feature films use their effects within the frame and use cuts for transitions. Music videos seem to follow the same concept, but the effects within the frame are far from subtle. "Talking head" shows or lecture programs benefit from graphic treatments that move and digital effects that occupy the audience's eyes while being bombarded with information. The more visuals there are to support and explain the information presented, the less likely that there will be snores and eyes rolled back in. Just as each shot is selected for its contribution to the program, so should any effect be chosen to increase the overall impact of the program.

Dissolves, Wipes, and Digital Effects

The most important and powerful tool at the editor's disposal is the cut, but other effects are useful when editing a program.

In the early days of filmmaking, dissolves were used to indicate the passage of time. Today, audiences are more sophisticated; and with the proper clues, they understand a cut to another time or location without the aid of a dissolve, although the dissolve still is used to show the passage of time.

Dissolves also can be used to ease transitions. In interview programs, jump cutting to the same angle can be masked by putting a frame of white at the jump cut, then dissolving back to the speaker. Of course, just throwing a frame of white into an interview is as obtrusive as the jump cut. Putting a white flash at the beginning of the interview prepares the viewer and establishes the transition as a motif for the scene.

Digital effects can be used to give motion to still pictures or to move from one image to the next. Other uses of the DVE (digital video effects) device are to move graphics, words, and images from videotapes or character generators (see Figure 12–4). The DVE can stretch, expand, rotate, or reposition picture elements to other areas of the frame. DVE repositioning commonly is used when combining elements in effects. Creating a mirror image also is a function of the DVE.

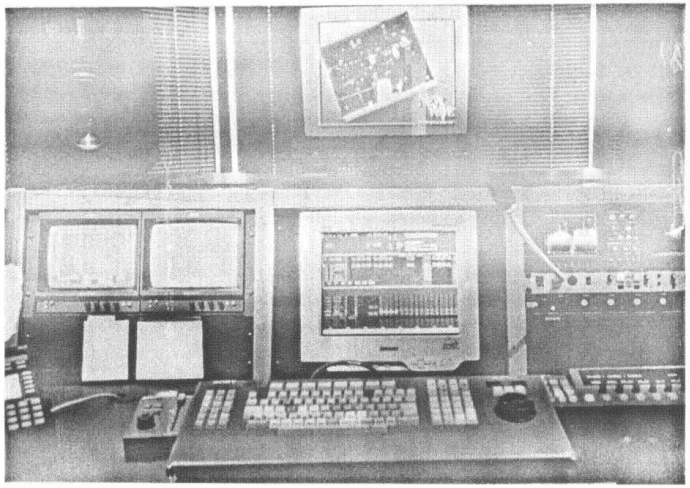


Figure 12–4 *A linear edit bay with a DVE move in progress. Lecture-type programs can benefit from graphics that move, occupying the audience's attention.*

No matter what the effect, it should fit with the concept and feel of the program. Also remember that any visual effect occupies the mind and, during the effect, the viewer usually does not recognize anything else. For instance, if audio information is given during an effect, the audience members might be distracted by what is happening on the screen. "Effect" time, therefore, should not be used to convey important information. Also, the editor must be sure that the images involved in the effect are on the screen long enough for the audience to see them. (Exceptions to the rule are the flash cuts like the ones used in music videos and some commercials.)

MORE INFORMATION EQUALS MORE INTEREST

The editor's purpose is to create a show that plays in a cohesive, understandable, and orderly fashion. The more visual and aural experiences one can present (in context with the show's purpose and the audience's expectations), the better the show will be.

Often, a production contains more than one story line. There are two methods of editing multiple story lines. The first is to tell one story, then go on to the next. This type of storytelling is called *continuity editing*. The second method is to tell the stories side by side, as they happen. This is called *parallel editing*.

For instance, if two brothers went to war and the editor wanted to show what happened during those years, he or she could tell the story of one brother, then focus on the other. That would be continuity editing. If the editor took both brothers' experiences and intercut them, that would be parallel editing.

Both methods of storytelling are effective, but in parallel editing, special care must be taken to make sure the audience knows which story is being told.

EDITORIAL PITFALLS

Finishing the Action

One should allow characters or objects to "complete" an action within a scene. This does not mean letting a character walk the entire length of a deserted road. Leave the shot when the content of the shot has played out. Cutting away without conveying the essence of the shot or scene is as ineffective as lingering on a stagnant or slow-moving shot. An exception to this rule is in editing commercials or music videos. In these programs, the intent is to catch the audience's attention. Rapid edits and unfinished action is in line with the program's purpose.

Continuity

Continuity is a major concern during production and just as important during the editing process. Having a character running left to right in one shot and then suddenly reversing direction in the next can ruin the sequence and confuse the audience. Examine shots for mismatched hats, modern watches in period pieces, out of character actors, and props that appear and disappear. If there is a problem, one can cut away to mask apparent mismatches (see Figure 12–5).

Jump Cuts and Cutaways

A jump cut occurs when two extremely similar shots are edited together. When this occurs, everything in the frame seems to jump. This effect can be used to pop people or objects in or out of a scene, but in most instances, the jump cut is annoying.

Figure 12–5 *The cutaway can mask continuity problems. Note the woman's expression is not exactly matching in the high angle cutaway nor is the man's hand position.*

Jump cuts are created purposely in the first stage of building a reporter's story. Once the narration and dialogue "bites" (small portions of audio) have been cut together, creating an audio "bed," the resulting jump cuts are covered through the use of cutaways. Some news and documentary programs use four- or five-frame soft-edged wipes or dissolves to mask jump cuts. Music videos and some commercials now purposely use the jump cut.

Mismatched action or dialogue pull-ups often are corrected through the use of the cutaway. Although the cutaway is a powerful tool, it can be very disruptive if used improperly (without audience expectation or its own mismatched action). An editor must choose cutaways carefully. As with every edit, the cutaway should be motivated.

Respect for the Character

The audience is keenly aware of a character's expressions. Editors can forget that the images in front of them will be recognized by the audience as human. Screen characters should be treated as respectfully as possible. Several specific rules about editing facial expressions and dialogue should be broken only for a specific effect.

When using a close-up for a cutaway, the subject should never appear to be talking. Ideally, the character should be reacting to the speaker. This rule also applies to a character who is about to speak. If the edit requires cutting away from the person about to speak, the cut should happen before the speech, not as the talking begins.

To expand the preceding concept, one should not cut to a character with his or her eyes closed or mouth open unless the shot is specifically designed to do so.

Careful background choices Cuts to background characters should be made as selectively as to those of the principals. Cutting to any old shot of people milling around into a scene can destroy the illusion of the program. Background performers should be dressed correctly and acting in character. Also one should make a quick check for unintentionally humorous signs or distracting background action that do not belong in the program.

The actor in character Another check is to make sure all the actors are "in character" and ready to perform. A group of actors can include one who "mentally" arrives late, after the call for action. It is important to keep the illusion of the story intact.

Options are everywhere Editorial choices can be found in the most unlikely places. Just because an obvious answer is not immediately forthcoming, do not assume that no editorial answer is hidden in the given footage. Take a short break, think about other ways to accomplish the task. As mentioned earlier, sometimes production will shoot a special shot if you absolutely need a particular dialogue line, cutaway, or establishing shot. Before requesting new footage, take a critical look at what is on hand. Pictures and sound can be edited in many ways. Think. Options are found everywhere.

Special shots One should be careful not to linger on favorite or special shots. Also, trying to force that unique composition into a scene where it does not belong can produce an obvious edit, showing the "invisible" hand of the editor.

Shot composition is another consideration, especially in dialogue scenes. Editorial choices will be limited to available footage, but it is best to keep the headroom in medium shots approximately the same.

Performance always takes precedence over (minor) technical discrepancies. An excellent line delivery or expression may be a better editorial choice than trying to keep the camera framing or motion exactly the same.

THE POLITICS OF THE EDITING ROOM

The Director

The director is responsible for the vision and creation of the visual project. This is not to say the director knows more than the editor. Sometimes, a director's explicit instructions are editorially correct. Other times, these instructions are just wrong or inaccurate (such as describing a shot that does not exist). It takes experience to know when to perform the requested task or to satisfy the request in a different manner.

Careful analysis of the problem and the political climate usually will result in a compromise or a win-win solution. The successful editor will use expertise and communication to solve political as well as technical editorial challenges.

The Client

Often, a client is involved directly in the production. Clients have varied ranges of technical expertise. They may have had extensive postproduction expertise or know little of what goes on in the cutting room. One never should assume the client is clueless for two reasons. The first is that this payer of the bills will be offended. The second reason is that the client may be right.

Even though a client may want you to follow a different path than you would choose, it is wise to examine the suggestion. There are several ways to solve any editorial challenge. Often communication can help solve the problem. Clarifying an editorial note can change a request to a discussion about how the challenge can be met.

AUDIO

Audio is one of the most underrated aspects of the visual medium and should never be given second-class status. If an audience views two visually identical programs, an audience will "perceive" the one with a superior audio track to be *visually* superior. Ambient sound, effects, and music should always be considered. If the mixing will take place during the electronic edit, even more attention needs to be taken with the audio elements.

The four elements of a sound track are narration, dialogue, music, and effects (see Figures 12–6 and 12–7).

Narration

Narration may seem to be just a voice that explains what is happening on the screen. Yet, a talented narrator can turn mediocre footage into an exciting production. When one directs a narrator, record the voice while the talent (narrator) watches the off-line or work print picture. Be careful to run machinery from a different room to avoid recording equipment noises. Reading to a picture gives the talent an opportunity to see the program and read the copy in the required time.

Before the narrator arrives, make sure all scripts are properly marked. The outgoing cue, narrator line, and incoming dialogue should be typed and duplicated. Timing and notes should be written (legibly so others can decipher the information) for each take. Alternative readings should be made if there is time during the recording session. It always helps to have these "alts" when the client or director dislikes a particular reading.

Audio Effects

Off-screen sirens and traffic in city scenes, bubbling streams, crickets, birds, far off train whistles, rain, and the like always should be considered. Sound effects can be used from other areas of the production track or from purchased sound libraries. A well-chosen sound effect can add thousands of dollars of production value to a program with one simple audio edit.

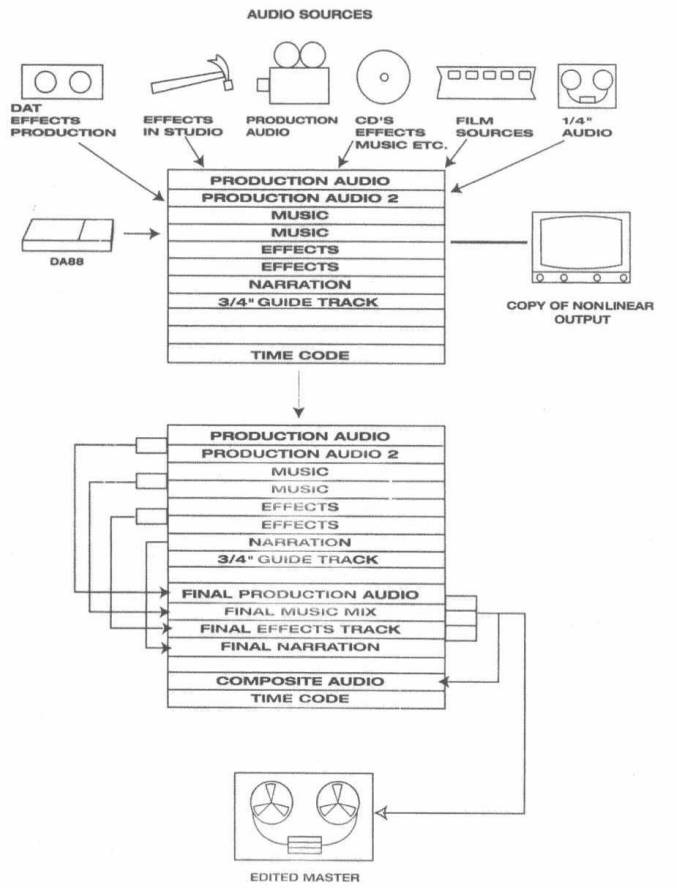


Figure 12–6 *Many audio sources are combined in the sound track. In larger productions, they are combined on separate tracks of the digital audio workstation or multitrack recorder, then mixed down to the four basic audio tracks: narration, dialogue, music, and effects.*

Figure 12–7 *A video mixing studio, where audio is mixed to the work picture. Here the four elements of the audio tracks are combined. Note the large console in front of the two men as well as the window dub being projected in the front of the room. Photo by Gil Smith.*

Music

Music has moved people's emotions for centuries. However, one must be careful with music and not too intrusive. In narrator- or dialogue-driven passages, music should be considered carefully. Lyrics that can conflict with dialogue or narration should be avoided. Obtain music rights early on. It is heartbreaking to recut a sequence that has been carefully edited to a music track.

A music editing trick that can cause problems is to hide bad transitions behind loud sound effects or production noise. When the scene needs to be changed, or replaced, the masking effect can be eliminated, leaving an ugly sounding music edit. Take the time to make the best possible music transition even if the edit is hidden.

Dialogue

Dialogue is the words spoken by a character in a scene. These words can come from production audio or audio recorded after the visual shooting has been completed.

Different takes of a particular scene are used in the construction of that scene. It takes a skilled editor to seamlessly jump from one take or camera setup to another without any apparent change in dialogue. Different takes often have distinct inflections and intonations that can be used in a scene. Words or sentences can be eliminated to smooth a scene or alter timing. Additional space between sentences can be added to affect the original dialogue pacing. Attention should be paid to the script and intended audience. All dialogue and alterations to the dialogue should be made with the show's purpose and intended audience in mind.

The dialogue track is the first track built, yet it greatly affects the others: effects, narration, and music. With careful attention, the considerate editor can improve even the best performance through the careful choice of performance and delivery of a character's dialogue.

Adding Audio to Film

If the audio input into the nonlinear editor is digitized at proper levels (and of acceptable quality), the output from the editor can be used for the final mix (see Figure 12–8). This is another reason to make those tricky audio edits perfect. An ugly audio edit can end up in the finished piece.

The Split Edit

The L cut, or split edit, is an edit in which the audio or picture leads a *both cut* (see Figure 12–9). This edit is extremely powerful, offering many possibilities for controlling dialogue and making shot transitions smoother.

The L cut can be used in any editing situation. An audio cut that precedes the picture can be used to prepare the audience for the next scene. For instance, the sound of waves might precede a picture of the stormy ocean. Alternatively, a picture leading into an audio split might be a close-up of a woman's lover as she finishes talking about him.

The L cut often is used in static dialogue scenes (in soap operas or television dramas), where there is little variation in angles.

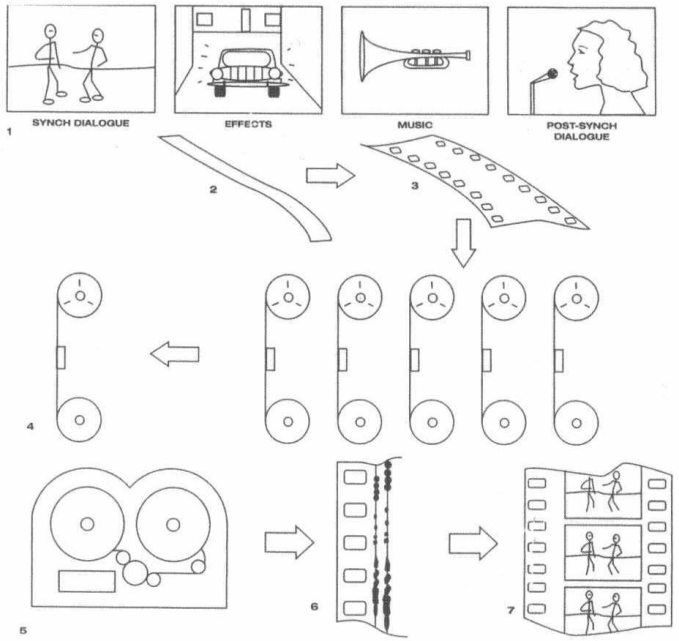


Figure 12–8 *A simplified diagram of how audio is put into a film project. (1) Multiple sources are recorded on audiotape (2). These sources are edited, then transferred to mag (3), which is audiotape cut into the size and shape of film. These reels are played back and mixed down to a single reel with multiple audio tracks (4). This composite mix is then played back (5) and an optical track (6) is created, which is then printed onto the feature film (7).*

The Value of Silence

Most audio tracks include effects, music, background sound, and dialogue. When all this stops and the track is silent—without the crickets or the bird chirp—the audience takes notice. This silence may not last long, but it is important to remember that silence can be as emotionally powerful as the best score or sound effect.

SUMMARY

Creating a show cannot be a haphazard affair or the editorial results will be equally haphazard. The editor's purpose is to cut images and sound into a structure that specifically suits the show's purpose. The editor who takes the time to become familiar with the footage, the show's formatting requirements, and the show's purpose and intended audience will be prepared to deal with the pressures of cutting large amounts of material.

Viewing footage may involve taking extensive notes as well as referring to production material (script supervisor notes, camera and sound reports, reading the script) and talking with the director.

The editing process is one of selective elimination. A cut should remain only as long as it takes to impart its information. Each shot has its own internal rhythm. The connection of several shots creates the pace of a scene. The cadence of one scene juxtaposed to another creates the pace of the entire program.

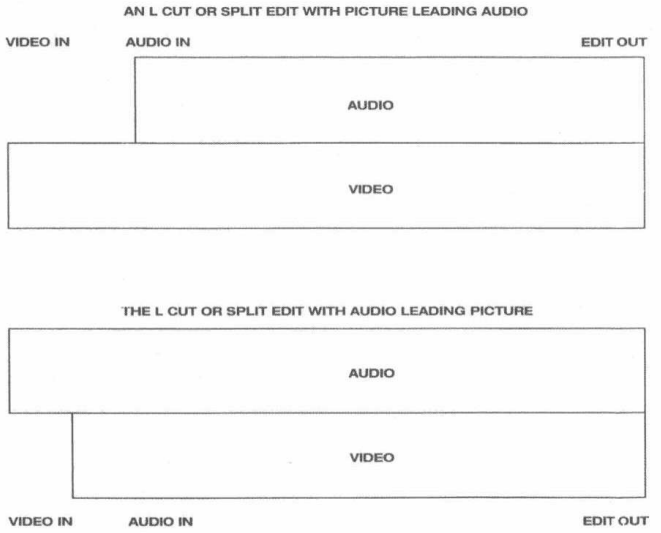


Figure 12–9 *The split edit is a powerful tool that is used several times a minute in dialogue shows.*