University of Gondar

College of Social Science and Humanities

Film and Television Production Department

Course Name:Tv Studio production

 **Television Production Overview**

**In television production, as in most of**  **today's high-tech areas, *knowledge is power.* For one thing, you may suddenly be confronted with an internship or job opportunity where this knowledge is essential. (Ever fill out a job application where they ask you to list the equipment, computer programs, etc., you are familiar with?) Camerapersons, writers, directors, producers, and even on-camera talent have found that having a solid understanding of the tools and techniques of the whole process has made a major difference in the success of productions—not to mention their own careers.**

**The person who's generally in charge of the entire production is the producer. He or she comes up with the program concept, lays out the budget for the production, and makes the major decisions. This person is the chief honcho, the team leader, the person who works with the writers, decides on the key talent, hires the director, and guides the general direction of the production.**

 **In smaller productions the producer will also take charge of more mundane things. And in small productions the *director* (to be discussed below) may also handle the producer's responsibilities. In this case the combined job title becomes** **A producer-director. Some productions may also have an associate producer who sets up schedules for the talent and crew, and who, in general, assists the producer throughout the production.**

**On a major production one of the producer's first jobs is to hire a writer so a script can be written (the document that tells everyone what to do, say, etc.). The script is sort of like a written plan or blueprint for the production. The key talent for the production will normally be the next thing considered by a producer.**

**In general, the talent includes actors, reporters, hosts, guests, and off-camera narrators—anyone whose voice is heard or who appears on camera. (With or without genuine talent, the talent is referred to as the *talent*, just in case you were wondering.)**

**Sometimes *talent* is broken down into three sub-categories: actors (who portray other people in dramatic productions), performers (who appear on camera in non-dramatic roles), and announcers (who typically don't appear on camera).**

**In a large production the producer will be responsible for hiring a director. That's the person in charge of working out preproduction (before the production) details, coordinating the activities of the production staff and on-camera talent, working out camera and talent positions, selecting the camera shots during the production, and supervising postproduction (after the production) work. In other words, the director is the front line commander in charge of taking the script to the very end of the production process.**

**Assisting a director in the control room is typically a technical director who operates the *video switcher*. (A rather elaborate version is shown on the right.) The technical director, or TD, is also responsible for coordinating the technical aspects of the production. It needs to be emphasized at this point that, depending on the production facility, the specific responsibilities of production personnel can vary widely.**

**One or more production assistants (PAs) may be hired to help the producer and director. Among other things, PAs keep notes on ongoing production needs and changes.**

**Other people who may be involved in the production include the lighting director (LD) who designs the lighting plan, arranges for the lighting equipment needed, and sets up and checks the lighting. As we'll see, lighting is a key element in the overall look of a production.**

**On some productions there will be a set designer who, along with the producer and director, will design the set and supervise its construction,painting, and installation.**

**Next, there may be a makeup person, who, with the help of makeup, hair spray, or whatever, sees that the talent looks their best (or their worst, if the script calls for that).**

**Major productions will have a wardrobe person who is responsible for seeing that the actors have clothes that are appropriate to the story and script.**

**The audio director or audio technician arranges for the audio recording equipment, sets up and checks mics (microphones), monitors audio quality during the production, and then strikes (another production-type term meaning disassembles and, if necessary, removes) the audio recording equipment and accessories after the production is over. (*Mics* stands for *microphones,* and is pronounced *mikes.*)**

**The microphone boom/grip operator watches rehearsals and decides on the proper mics and their placement for each scene. During an *on-location* (non-studio) shoot this person may need strong arms to hold the mic boom over the talent for long periods of time.**

**The videotape recorder operator arranges video recording equipment and accessories, sets up video recordings, performs recording checks, and monitors video quality. In dramatic productions the continuity secretary (CS) carefully makes notes on continuity details as each scene is shot to ensure that these details remain consistent between takes and scenes. As we will see later, this is a much more important job than you might think, especially in single-camera, on-location productions. Once production concerns are taken care of, the continuity secretary is responsible for releasing the actors after each scene or segment is shot.**

**The CG Operator (electronic character generator operator) programs (designs/types in) opening titles, subtitles, and closing credits into a computer-based device that inserts the text over the picture during the production.**

**Camera operators do more than just operate cameras. They typically set up the cameras and ensure their technical quality, work with the director, lighting director, and audio technician in blocking (setting up) and shooting each shot. On a *field* (out of the studio, or on-location) production they may also arrange for camera equipment pickup and delivery.**

**Depending upon the production there may be a floor manager or stage manager who's responsible for coordinating activities on the set. He or she may be assisted by one or more floor persons, or stagehands.**

**After shooting is completed the editors use the video recordings to blend the segments together and add music and audio effects to create the final product. The importance of editing to the success of a production is far greater than most people realize. As we will see, an editor can make or break a production. This finishes the list of people and what they do. Now for the production, itself.**

 **How the TV Process Works**

**Why do you need to know how the TV process works? Well, this is another of those "knowledge is power" things. The more you know about the TV process the easier it will be to use the tools in creative new ways—and to solve the inevitable problems that crop up during TV productions. So, let's start at the beginning with...**

 **Fields and Frames**

**When you get right down to it, both motion pictures and TV are based solidly on an illusion. Strictly speaking, there is no "motion" in TV or motion picture images** . **Early experiments with motion pictures found that if a sequence of still pictures was presented at a rate of about 16 or more per second, the individual pictures would blend together, giving the impression of a continuous, uninterrupted image.**

**It was also discovered that if the individual pictures varied slightly to reflect changes over time, the illusion of motion would be created when the pictures were presented in an uninterrupted sequence.**

**In the illustration on the left you can see how a sequence of still images can create an illusion of movement.**

**Early silent films used a frame (or picture) rate of 16 and 18 per-second, when sound was introduced this rate was increased to 24 per-second. This was primarily necessary to meet the quality needs of the sound track. Unlike broadcast television that has frame rates of 25 and 30 per second depending on the country, film has for decades maintained a worldwide, 24-frame per-second sound standard.**

**The NTSC (National Television System Committee) system of television used in the United States reproduces pictures (frames) at a rate of approximately 30 per-second. Of course, this presents a bit of a problem in converting film to TV (mathematically, 24 doesn't go into 30 very well), but we'll worry about that later.**

**A motion picture camera records a sequence of completely formed pictures on each frame of film, just like the still pictures on a roll of film in your 35mm camera. The motion picture camera just takes the individual pictures at a rate of 24 per-second.**

**Things are different in TV. In a video camera each frame is comprised of hundreds of horizontal lines. Along each of these lines there are thousands of points of brightness and color information. This information is electronically discerned by in the TV camera (and then later reproduced on a TV display) in a left-to-right, top-to-bottom, scanning sequence. This sequence is similar to the movement of your eyes as you read a section of this page.**

**To reduce flicker and brightness variations during the scanning process, each complete television picture is typically divided into two interleaved segments. The odd-numbered lines are scanned first and then the even-numbered lines are interleaved in between to create a complete picture.**

**Note the scan lines in this enlarged section of a black and white TV picture. (A color TV picture, which is a bit more complex, will be described later.)**

**The term interlacing is also used to describe the alternating, odd-even line approach to scanning the complete picture. Each of these half-frame passes (either the odd or even-numbered lines) is called a field*.* The completed (two-field) picture is called a frame, as we've previously noted.**

**Once a complete picture (frame) is scanned, the whole process starts over again. The slight changes between successive pictures are fused together by human perception, giving the illusion of continuous, uninterrupted motion.**

**Today, rather than using an interlaced approach to scanning, some video systems (including computer monitors and some of the new digital television standards) use a progressive or non-interlaced scanning approach, where the fields (odd and even lines) are combined and reproduced at the same time. This approach, which results in higher technical quality, was not technically possible until rather recently.**

**Progressive scanning has a number of advantages, including the ability to more easily interface with computer-based video equipment. At the same time, it also adds greater technical demands on the TV system.**

**As we will see in the next module, the specifications for digital and high-definition television (DTV/HDTV) allow for both progressive and interlaced scanning.**

 **Analog and Digital Signals**

**Electronic signals as they originate in microphones and cameras are analog (also spelled analogue) in form. This means that the equipment detects signals in terms of continuing variations in relative strength or amplitude. In audio this would be loudness; in video it would be the brightness component of the picture.**

**Compared to the digital signal at the bottom, an analog signal would seem to be the most accurate and ideal representation of the original signal. While this may initially be true, the problem arises in the need for constant amplification and re-amplification of the signal throughout every stage of the audio and video process.**

**Whenever a signal is reproduced and amplified, noise is inevitably introduced, which degrades the signal. In audio this can take the form of a hissing sound; in video it appears as a subtle background "snow" effect.**

**By converting the original analog signals into digital form, this noise buildup can be virtually eliminated, even though it's amplified or "copied" thousands of times. Because digital signals are limited to the form of zeros and ones (0's and 1's), no "in between" information can creep in to degrade the signal.**

**Since the digital signals are composed of 0's and 1's, they can also be manipulated in many ways. Parts of the signal can be added and subtracted, or mathematically combined with other signals, etc. This opens the door to all of the audio and video special effects that we are so used to seeing and hearing.**

**By their nature, digital signals consist of hundreds of times the information (data) of analog signals. This puts great demands on equipment. It has only been relatively recently that audio and video equipment has grown sophisticated enough to handle the huge amounts of data represented by digital signals.**

**To convert analog signals into digital information, the analog signal must constantly be *sampled* to determine its characteristics at a precise point in time. In this illustration the blue-green bars represent repeating samples taken of the original analog amplitude. Each time a sample is made its characteristics are interpreted and expressed in terms of 0's and 1's (standard computer language).**

**The faster the sampling rate and the more gradations of information sampled at one time, the higher the quality of the resulting signal.**

**Digital audio and video equipment has borrowed heavily from developments in computer technology—so heavily, in fact, that the two areas seem to be merging. It will probably not be too long until television programming is distributed to our homes in a way that strongly resembles how we now get material to our computers via the Internet.**

 **The Three Production Phases**

**The production process is commonly broken down into preproduction, production, and postproduction.**

 **The Preproduction Phase**

**There is a saying in TV production: The most important phase of production is preproduction.**

**The importance of this is often more fully appreciated after things get pretty well messed up during a production and the production people look back and wish they had adhered to this axiom from the start.**

**In preproduction the basic ideas and approaches of the production are developed and set into motion. It is in this phase that the production can be set on a proper course, or misdirected (messed up) to such an extent that no amount of time, talent, or editing expertise can save it.**

 **The Prime Directive**

***Star Trek* has its prime directive, so does TV production: Hit the target audience. In order for the program to be successful, the needs, interests, and general background of the target audience (the audience your production is designed to reach) must be studied and kept in mind throughout each production phase.**

**In order for your program to have value and a lasting effect the production must in some way affect the audience emotionally. This ends up being a major key to success, and it will take some explaining—something we'll do later.**

**During preproduction not only are key talent and production members decided, but all of the major elements are also planned. Since things such as scenic design, lighting, and audio are interrelated, they must be carefully coordinated in a series of *production meetings.***

**Once all the basic elements are in place, rehearsals can start. A simple on-location segment may only involve a quick check of talent positions so that camera moves, audio, and lighting can be checked. A complex production may require many days of rehearsals. These generally start with a table reading or dry rehearsal where the talent, along with key production personnel, sit around a table and read through the script. Often, script changes take place at this point. Finally, there's a dress rehearsal.**

 **The Production Phase**

**The production phase is where everything comes together (we can hope) in a kind of final performance. Productions can either be broadcast live or recorded. With the exception of news shows, sports remotes, and some special-event broadcasts, productions are typically *recorded* for later broadcast or distribution.**

**Recording the show or segment provides an opportunity to fix problems by either stopping the recording and redoing the segment or making changes during the postproduction editing phase.**

 **And, Finally, the Postproduction Phase**

**Tasks, such as striking (taking down) sets, dismantling and packing equipment, handling final financial obligations, and evaluating the effect of the program, are part of the postproduction phase.**

**Even though postproduction includes all of these after-the-production jobs, most people only associate postproduction with editing.**

 **As computer-controlled editing techniques and postproduction special effects have become more sophisticated, editing has gone far beyond simply joining together segments in a desired order. As we've noted, editing is now a major focus of production creativity.**

**Lenses: The Basic**

 **In actual fact, variables associated with camera lenses have a major influence on how subject matter will be seen by a viewer. The cameraperson who understands this commands a significant amount of creative power.**

**Before we investigate how some of these creative controls work, we need to look at some basic information about lenses—starting with the most basic of lens attributes: focal length. As we will see, the focal length of a lens affects the appearance of subject matter in ways.**

 **Lens Focal Length**

**Focal length is defined as the distance from the optical center of the lens to the focal plane (CCD or target) of the camera when the lens is focused at infinity. Any object in the far distance is considered to be at infinity. Since the lens-to-target distance for most lenses increases when they are not focused at infinity (see second illustration), we must specify infinity as a standard for measurement.**

**Focal length is generally measured in millimeters. In the case of lenses with fixed focal lengths, we can talk about a 10mm lens, a 20 mm lens, a 100 mm lens, etc. As we will see, this is a designation that tells a lot about how the lens will reproduce subject matter.**

**With fixed focal length or prime lenses the focal length cannot be varied. Several high-end consumer-type video cameras use VL lens mounts that accept hundreds of high-quality lenses designed for 35mm still cameras.**

 **Zoom and Prime Lenses**

**Zoom lenses came into common use in the early 1960's. Before then TV cameras had lenses of different focal lengths mounted on a turret on the front of the camera, as shown on the right. Each lens had to be rotated into position and focused when the camera was not on the air. Today, most video cameras use zoom lenses. Unlike the four lenses shown here, which each operate at only one focal length, a zoom lens can be continuously varied from a wide-angle to a telephoto perspective.**

**To do this zoom lenses have numerous glass elements, each precisely ground, polished and positioned, which can be repositioned to change the magnification of the lens. Groups of these lens elements must move at precise (and often differing) speeds as the lens is zoomed. The cutaway view of a zoom lens on the right shows the many glass elements within the lens housing.**

**It might seem that we would be taking a step backwards to use a prime lenses, or a lens that only operates at one set focal length. Not necessarily. Many professional videographers and Directors of Photography—especially those who have their roots in film where prime lenses are typically used—feel they provide greater sharpness and are more predictable in their results. Prime lenses also come in more specialized forms—super wide-angle, super telephoto, super closeup, super-fast, etc.**

**Even so, for normal work zoom lenses are much easier and faster to use. The latest of HDTV zoom lenses are extremely sharp—almost as sharp as the best prime lenses.**

 **Angle of View**

**Angle of view is directly associated with lens focal length. The longer the focal length (in millimeters) the narrower the angle of view You can see this relationship by studying the drawing on the left that shows angles of view for a camera with a 2/3rds inch CCD.**

**A telephoto lens (or a zoom lens operating at maximum focal length) has a narrow angle of view. Although there is no exact definition for a telephoto lens, the angles at the top of the drawing from about 5 to about 10 degrees would be considered in the telephoto range.**

**The wide-angle range for this lens is represented at the bottom of the drawing (from about 45 to 90 degrees).**

**The normal angle of view range lies in between telephoto and wide angle. When you double the focal length of a lens, you double the size of an image on the target; and, as you would assume, the reverse is also true. Put another way with the camera in the same position, a short focal lens creates a wide view and a long focal length creates an enlarged image in the camera. (See images below.)**

**Another concern in using different focal length lenses at different distances is the relative amount of background area you will include in the picture. The drawing below shows the major differences for telephoto, normal and wide-angle lenses (in this case 70mm, 20mm and 10mm lenses). The light blue area (not labeled) represents the angle of view of a 5mm lens.**

**A Zoom vs. a Dolly**

**Another way to alter what the camera sees is to actually move (dolly) the camera toward or away from a subject. Although it might seem that this would produce the same effect as zooming the lens in and out, that's really not true.**

**When you zoom you optically enlarge smaller and smaller parts of the picture to fill the screen. When you dolly a camera you physically move the entire camera toward or away from subject matter.**

**The latter is similar to how you would see the central and surrounding subject matter if you were to walk toward or away from it. Some directors, especially in motion pictures, prefer the more natural effect of a dolly—although it's much harder to smoothly achieve.**

**Zoom Ratio**

**Zoom ratio is used to define the focal length range for a zoom lens. If the maximum range through which a particular lens can be zoomed is 10 mm to 100 mm, it's said to have a 10:1 (ten-to-one) zoom ratio (l0 times the minimum focal length of 10mm equals 100mm).**

**That's fine, but with this designation you still don't know what the minimum and maximum focal lengths are. A10:1 zoom lens could have a 10 to 100mm, or a 100 to 1,000mm lens—and the difference would be quite dramatic.**

**To solve this problem we refer to the first zoom lens as a 10 X 10 (ten-by-ten) and the second as a 100 X 10. The first number represents the minimum focal length and the second number the multiplier. So a 12 X 20 zoom lens would have a minimum focal length of 12mm and a maximum focal length of 240mm.**

 **The zoom lenses on most handheld field cameras have ratios in the range of 10:1 to 30:1. The effect of zooming from a wide-angle position to a telephoto view with a 30:1 zoom lens is shown below.**

**Some lenses used with large, tripod-mounted field cameras can have zoom ratios that exceed 70:1. In this case a camera covering a football game could zoom out and get a wide shot of the field, and then by zooming in, fill the screen with a football sitting in the middle of the field. Of course, this type of lens would probably be bigger than the camera itself, not to mention more costly.**

**Motorized Zoom Lenses**

**Zoom lenses were originally controlled manually by push rods and hand cranks. Today, zoom lenses are typically controlled by built-in, variable-speed electric motors. These electric zooms are often referred to as servo-controlled zooms.**

**Although servo-controlled lenses can provide a smooth zoom at varying speeds, manually controlled zoom lenses are often preferred for sports coverage. A manually-controlled zoom can be adjusted much faster between shots. This can make the difference between getting to a new shot in time to see the critical action, or missing the shot.**

**Although most videographers work within the limits of the zoom lens supplied with their cameras, it's possible to modify the focal length of most lenses (both zoom and prime lenses) by using a positive or negative supplementary lens. These can increase or decrease the basic focal length of a lens. Information on these can be found here.**

**Thus far, we've assumed that varying the focal length of a lens simply affects how close the subject matter seems to be from the camera. That's true, but as we will see in the next section, focal length also affects the subject matter in a number of other important and even dramatic ways.**

**F-Stops and Creative Focus Techniques**

**Cats and owls can see in dim light better than we can, in part because the lenses of their eyes allow more light to enter. We could say that the speed of the lenses in their eyes is "faster" than our lens speed.**

**Lens speed is defined as the maximum amount of light that the lens can transmit. Like the pupil of an eye that automatically adjusts to varying light levels, camera lenses have an iris that controls the amount of light that can go through the lens. Most of us know that under very low light conditions the iris (pupil) of our eyes opens up almost completely to allow in the maximum amount of light. In the bright sunlight the pupil contracts in an effort to avoid overloading the light-sensitive rods and cones in the back of our eyes. In the same way, the amount of light falling on the light-sensitive target of a TV camera must be carefully controlled with the aid of an iris in the middle of the lens (shown above on the left). Too much light and the picture will become overexposed and washed out; too little, and detail in the darker areas of the picture will be lost.**

**Although an iris can be smoothly adjusted from a very small opening to the point of being wide open, certain specific points throughout this range are marked in terms of levels of light transmission. These numerical points are called f-stops. Contrary to what you might first assume, the smaller the f-stop *number,* the more light the lens transmits. Conversely, high f-stop numbers mean that little light is being transmitted through the lens.**

**The following illustrates this relationship.**

 **1.4, 2.0, 2.8, 4.0, 5.6, 8, 11, 16, 22**

**<=== more light** ~ **less light==>**

**Occasionally we see f-stops not illustrated above. Examples would be f/1.2, f/3.5 and f/4.5. These are midpoint settings between whole f-stops, and on some lenses they represent the maximum aperture (speed) of the lens.**

**We've noted that the speed of a lens is equal to its maximum (wide-open) f-stop. In the drawing shown above, f/l.4 would be the speed of the lens represented. When an iris setting is opened up one f-stop (from f/22 to f/16 in the drawing above, for example), it would represent a 100 percent increase in the light going through the lens. Conversely, if the lens is stopped down one stop (from f/16 to f/22, for example), the light is cut by 50 percent. Put another way, when you open up one stop you double the light; when you stop down one stop you halve the amount of light going through the lens.**

**Once the f-stop range is understood, it will be obvious which way a lens iris should be adjusted to compensate for a picture that is either too light or too dark.**

**Cameras with automatic exposure controls use a small electric motor to automatically open or close the iris in response to varying light conditions. On professional cameras the f-stop settings are visible on the lens barrel and sometimes in the camera's viewfinder display. On many consumer cameras the numbers aren't shown and exposure adjustments are automatic—which may or may not set the iris at the best setting for specific subject matter.**

**As we will see, for the savvy videographer who must use this automatic feature, there are various ways to "influence" the automatic exposure. In some circumstances this will result in much better video. In addition, it can provide control over such things as depth of field (to be discussed below).**

**A typical situation where automatic exposure adjustment will not provide the best video is illustrated here. When automatic circuitry is used, bright backgrounds, lights, and windows in a scene will generally result in dark (underexposed) video and muted color.**

 **Depth of Field**

**Depth of field is defined as the range of distance in front of the camera that is in sharp focus. Theoretically, if a camera is focused at a specific distance, only objects at that exact distance will be completely sharp, and objects in front of and behind that point will be, to varying degrees, blurry. In actual fact, areas in front of and behind the point of focus may be acceptably sharp.**

**The term *acceptably sharp* is subjective. A picture doesn't just abruptly become unacceptably blurry at a certain point in front of, or behind, the point of focus. The transition from sharp to out of focus is gradual.**

**For practical purposes the limits of sharpness are reached when details become *objectionably* indistinct (blurry). This will vary according to the medium. What is acceptably sharp in standard NTSC television (SDTV) will be much greater than what is acceptable in HDTV. In the latter case the superior clarity of the medium will more readily reveal sharpness problems.**

 **Selective Focus**

**One of the important creative tools available to a videographer or cinematographer is focus—making sure certain some things are in focus and others aren't. This ends up being an effective way of directing attention toward things that are important in a scene and away from things which can be distracting, or need to be de-emphasized or hidden.**

**The term selective focus is used to describe the process of using limited depth of field to intentionally throw areas of the picture out of focus.**

**This technique is widely used in film and is associated with the so-called "film look" that many people find desirable.**

**Consider the scene in the left. By throwing the building and the newspaper out of focus, the woman stands out clearly in the photo and is not lost in a confusion of distracting elements.**

**If the scene is brightly lit, as this one is, you may have to use a high CCD shutter speed or even a light reducing neutral density filter to reduce the amount of light going through the lens. To compensate for either of these actions the iris will have to be opened up—which minimizes depth of field and creates the selective focus effect.**

**Zoom lenses used at maximum focal length (zoomed in) can create somewhat the same effect. In either case you will need to study the effect in a high-resolution video monitor to make sure you are achieving the effect you want.**

 **Follow Focus**

**In video production we are often dealing with moving subjects. A person may quickly move outside the limits of depth of field unless the lens can be quickly refocused. Professionals know which way to turn the focus control to keep a moving subject in sharp focus.**

**(Nonprofessionals end up throwing a slightly blurry image totally out of focus for a few seconds when they first turn the focus adjustment the wrong way.) The technique of follow focus is used to subtly refocus the camera to accommodate subject movement.**

 **The Macro Lens Setting**

**Most zoom lenses have a macro setting that enables the lens to attain sharp focus on an object only a few inches or even a few millimeters from the front of the lens.**

**Although lenses differ, to reach the macro position on many zoom lenses a button or lever on the barrel of the lens is pushed to allow the zoom adjustment to travel beyond its normal stopping point. Many newer lenses are called continuous focus lenses.**

**These are internal focus lenses that can be smoothly and continuously adjusted from infinity to a few inches without manually having to shift the lens into a macro mode. Videographers often forget about the macro capability, but it offers many dramatic possibilities.**

**For example, a flower, stamp, or a portion of a drawing or snapshot can be made to fill the TV screen. A tripod or camera mount is a "must" in using the macro setting. Since depth of field extends only a few millimeters at this super-close range, focus is extremely critical.**

 **Rack Focus**

**Rack focus is similar to selective focus, only the camera operator changes focus to shift viewer attention from one part of the scene to another.**

**Note how rack focus is used in this series of photos. In the first photo on the left above we see the woman (in focus) sleeping. When the phone rings the focus shifts to the phone, (on the right, above).**

**To use this technique you have to rehearse your focus shifts so you can manually rotate the lens focus control from one predetermined point to another. Some videographers temporarily mark the points on the lens barrel with a grease pencil. After locking down the camera on a tripod, they can then shift from one focus point to another as needed.**

 **Autofocus Lenses**

**Although autofocus lenses can be a help in following moving subjects, you will encounter problems unless you fully understand their imitations.**

**Most autofocus devices assume that the area you want in sharp focus is in the center of the picture. The autofocus area is represented by the green area in this photo. Let's look at the rack focus sequence discussed above. Since the area you want to focus on does not remain in the center of the frame, autofocus would not be useful.**

**Note that in the photo below the center area is correctly focused (thanks to autofocus) but that the main subject is blurry. Of course, the object in this case was to have it the other way around.**

**To make this scene work with autofocus you would have to pan or tilt the camera to bring the main subject into the autofocus area. This would change the composition in a way that many would find undesirable.**

**Some camcorders allow you to center the subject matter in the autofocus zone and then lock the autofocus on this area. You can then can reframe the scene for the best composition.**

**One camcorder attempts to track eye movement in the viewfinder and shift focus accordingly. If you were looking at the women, the camera would focus there; but as soon as you looked at the building in the background, the camera would shift focus to this point.**

**Autofocus systems have other weaknesses. Most can be fooled by reflections, and flat, monochrome areas with no detail. Most autofocus systems also have trouble determining accurate focus when shooting through glass, wire fences, etc. And, finally, autofocus devices (especially under low light) can keep readjusting or searching for focus as you shoot, which can be quite distracting.**

**For all of these reasons professional videographers typically turn off autofocus—if it even exists on their particular video camera—and rely on their own focusing techniques.**

**The only exception would be in a chaotic situation where there is no time to manually try to keep moving subject matter in focus.**

**FramingThe frame is the border between what the filmmaker/Tv producer wants us to see and everything else the dimensions of height and width that provide the shape of the movie’s images.**

**Shots where the characters are placed at the edges of the frame and have little room to move around within the frame are considered tight.**

Framing—Shot Distances

**The closer the subject, the more potent, powerful, able to create change; the farther away, the less potent, the weaker, less able to create change.**

**11 Types of camera Shots**

* **Extreme Close up:-**
* **Big Colse up**
* **Close Up**
* **Medium close up**
* **Medium Shot**
* **Medium long shot**
* **Long Shot**
* **Very long shot**
* **Extreme long shot**
* **Two shot**
* **Over shoulder shot**

**Cameras: The Basics**

**With all that has gone before as a background we can now turn to the first in a series of Hnadouts on the camera and its associated equipment.**

**Video Resolution**

**Video resolution is a measure of the ability of a video camera to reproduce fine detail. The higher the resolution the sharper the picture will look.**

**The standard NTSC broadcast TV system can potentially produce a picture resolution equal to about 300 lines of horizontal resolution. (This is after it goes through the broadcast process, not what you might be able to see in a control room.) CATV, DVD and satellite transmissions as viewed on a home receiver can potentially reproduce somewhat more than this.**

**Three- to four-hundred lines of resolution is equal to the limits of what viewers with 20-20 vision can see when they watch a TV screen at a normal viewing distance. "Normal" in this case translates into a viewing distance of about eight times the height of the TV picture. So, if the TV screen were 40 cm (16 inches) high, a so-called 25-inch (64-centimeter) picture, the normal viewing distance would be about 2 meters (10 feet).**

**HDTV/DTV, with its significantly higher resolution, makes possible both larger screens and closer viewing distances.**

**Lines of resolution as measured by a test pattern, such as the one shown here, are not to be confused with the horizontal scanning lines in the broadcast TV process— typically 525 and 625—which we discussed earlier. Although most home TV sets are capable of only 300 or so lines of resolution (and that's on a good day!), TV cameras are capable of much higher resolutions—up to 1,000 lines or more.**

**And so this question arises: Why bother with high resolution in cameras (with their added costs) when the home TV set can't reproduce this level of sharpness?**

**Answer: As in most aspects of TV production, the better quality you can start out with the better the quality will be for the TV viewer—even with all the broadcast-related losses.**

 **Determining Resolution**

**Charts that contain squares or wedges of lines on a light background can indicate the limits of sharpness. Within a particular area of one of these resolution charts there are lines that converge, as shown on the left. Numbers such as 200, 300, etc., appear on the chart next to the corresponding line densities.**

 **Color Resolution**

**The resolution we've been discussing is based on the sharpness of the black and white (luminance) component of the TV image. It was discovered early in experiments with color TV that the human eye perceives detail primarily in terms of differences in brightness (luminance differences) and not in terms of color information.**

**When NTSC color television was developed, an ingenious and highly complex system of adding a lower-resolution color signal to the existing black-and-white signal was devised. Using this system, color information can be added to the existing monochrome signal without having to greatly expand the information carrying capacity of the original black-and-white signal.**

 **Camera Mounts**

**Using a camera tripod can make the difference between professional looking video and a video that screams "amateur at work." Although a tripod may be a hassle to carry and set up, the results can be well worth the effort. Exceptions to using a tripod are in news and sports where you must be mobile enough to follow moving subjects, documentary style production where shots are brief and rapid, and subjective camera shots that simulate what a moving subject is seeing.**

**In recent years some commercials and dramatic productions have used handheld cameras in scenes as a way of imparting a "fluid," "on-the-go" feeling. The award-winning film, *Traffic,* released in 2001, had many handheld shots designed to impart a "documentary frenzy" to some of the scenes. TV series such as *Law & Order* also use this approach.**

**In the hands of a professional director of photography this effect can work; however, when less experienced videographers attempt to handhold a camera (especially while zooming, panning and tilting) the effect can look amateurish and even make viewers a bit "seasick." If you examine most exemplary films and video productions you will find solid, steady shots—the kind that are only possible with a solid camera support.**

**On most tripods the pan and tilt head (which attaches the camera to the tripod) is not meant to be used for smooth panning and tilting while shooting—only to reposition and lock the camera between takes. And, given the fact that a cut from one scene to another is faster and generally better than panning, tilting or zooming to new subject matter, this may be just as well.**

 **The Camera Viewfinder**

**We are gradually sneaking up on the operation of the total video camera. But, before we can really use one like a professional, there are a few more things we need to cover.**

 **Viewfinder Types**

**The viewfinder of a camcorder can be a CRT, tube-type (like those used in most TV sets), or a flat, LCD type (similar to those in laptop computers). (CRT stands for cathode ray tube; LCD for liquid crystal display.)**

**Unlike studio cameras that typically use at least seven-inch displays, the viewfinders for camcorders must be much smaller. They typically use a miniature CRT with a magnifying eyepiece, or, as shown below, a small LCD screen.**

**Although many camera viewfinders provide a color image, some camera operators prefer the sharper image of a black and white image.**

**Accommodating Left and Right-Eyed People**

**With cameras that use side-mounted viewfinders, the viewfinder can often be flipped from one side of the camera to the other for operators who prefer to use their left or right eyes. When the viewfinder is flipped the image ends up being upside-down—unless a reversal switch is flipped. (This also explains why an image might inexplicably be upside down when you first look in a viewfinder.) Holding your eye to a standard viewfinder for a long period of time can be quite fatiguing. Cameras employing flat LCD viewfinders (which you can view from a distance) can help. This type of viewfinder (pictured here) is also an aid in shooting at very low or high angles.**

**LCD viewfinders can also be used to compose shots that you, yourself, want to be in. You can simply mount the camera on a tripod and then turn the viewfinder around so you can see it. The main disadvantage of the flat, LCD display is that the image loses contrast and brightness when viewed in bright light. This can make the camera hard to focus.**

**Once you get used to their operation, viewfinder goggles that resemble virtual reality goggles allow even greater flexibility. This type of viewfinder can be used to supplement a standard side-mounted viewfinder. Since the viewfinder is connected to the camera by a long cable, you can easily hold the camera over your head, as shown here, place it flat on the ground, or even shoot backwards with the camera mounted on your shoulder. For critical, professional work the best "viewfinder" is an external monitor—preferably, a bright, high-resolution color monitor. Even though this type of standalone monitor requires extra power and limits your mobility, it's the only accurate way of checking subtle lighting effects and critically evaluating things such as depth of field.**

 **Camera Safe Areas**

**Because of over scanning and other types of image loss between the camera and the home receiver, an area around the sides of the TV camera image is cut off before being seen. To compensate for this, directors must assume that about ten percent of the viewfinder picture may not be visible on the home receiver.**

**This area (framed by the red lines in the photo) is referred to by various names including safe area, and essential area. All written material should be confined to an "even safer" area, the safe title area (the area inside the blue frame).**

 **Adjusting the Viewfinder Image**

**Because the image in the camera's viewfinder is actually the image from a miniature TV screen, it's subject to brightness and contrast variations. In addition, with tube-type viewfinders there may also be an electrical focus problem and the occasional lack of proper image centering.**

**Adjusting the viewfinder image does not affect the video coming from the camera itself. But adjustments to the camera video will obviously affect the viewfinder image. Viewfinders should accurately represent the nature and quality of the video coming from the camera. To make sure that the contrast and brightness of the viewfinder are set correctly, the camera's built-in, electronically generated color bars (if they are available in the camera you are using) can be switched on and checked in the viewfinder.**

**The viewfinder brightness and contrast controls can then be adjusted until a full, continuous range of tones from pure white to solid black are visible. If the camera doesn't have a built-in test pattern, the quality of the camera video should first be verified (with the help of a test pattern and a reliable external video monitor) before the viewfinder controls are adjusted.**

 **Checking Viewfinder Accuracy**

**Although CCD-type viewfinders normally remain stable over time, the frame area accuracy of a tube-type (CRT) camera viewfinder can drift to a point of not accurately showing the output of the camera. It's relatively easy to check on this.**

**First, a video monitor has to be found that has itself been perfectly aligned with the help of a test pattern. The output of the camera in question is then hooked up to the monitor and the camera is focused on a test pattern so that the outermost edges of the test pattern just fill the viewfinder image.**

**Any discrepancy between the viewfinder image and the monitor image should then be obvious. Viewfinder alignment may have to be adjusted with the help of an engineer or technician.**

**Occasionally the electrical focus will also drift out of adjustment on a tube-type viewfinder. This will make optical focusing difficult until it is corrected, generally with the help of a test pattern and screwdriver-equipped engineer.**

**Since wearing glasses while using a camera viewfinder can present problems, many side-mounted eyepiece-type viewfinders have a control in the eyepiece to correct for variations in eyesight. This is referred to as diopter correction. If this isn't built in, eyepieces can be purchased that can eliminate the need for many types of eyeglasses while using the camera. These are normally calibrated in the same way over-the-counter reading glasses are: +1, +2, +3, and +4.**

**Status Indicators—Viewfinder Variety**

**To help you keep track of everything you need to know while shooting, video camera manufacturers have added an array of status indicators to viewfinders. There are many types. First, there are miniature colored lights around the edges of the video image. Red, yellow and green are common colors. Sometimes they even blink to capture your attention.**

**Next are the indicators that are superimposed on the viewfinder video. Boxes, bars and lines are common configurations. Some of the viewfinder messages may be superimposed over the image in plain English (or the language of your choice). For example, "tape remaining: 2 min." Finally, some camcorders have small speakers built into the sides, and announce (again, in the language of your choice) such things as "low battery," or "tape remaining: five minutes."**

***Viewfinder status indicators can include the following:***

● **a tally light indicating that tape is rolling or that camera is "on the air"**

● **a low battery warning**

● **minutes of tape remaining**

● **color balancing may be needed**

● **low light; insufficient exposure**

● **low-light boost (gain selector switch) circuit in operation**

● **indoor/outdoor filter in place**

● **zoom lens setting indicating how much further you can zoom in or out**

● **auto/manual iris status**

● **audio level meter**

● **tape footage counter**

● **a zebra pattern for setting maximum video levels**

● **superimposed masks for the safe area and the 4:3 and 16:9 aspect ratios**

● **the presence of customized camera setup profiles to accommodate specific types of subject matter**

 **Composition:**

**Composition can be defined as *the orderly arrangement of elements in a scene which, when taken as a whole, conveys intent and meaning*.**

**Television production involves both static composition and dynamic composition.**

**Static composition covers the content of fixed images such as paintings or still photos.**

**Dynamic composition goes a step further and takes into consideration the effect of time: moment-to-moment change. This change can be within a single shot (including camera or talent moves), or it can apply to the sequence of scenes created through editing.**

**By studying the most enduring and aesthetically pleasing paintings over the centuries, as well as the most effective film and video scenes during the past 50 years, certain artistic principles emerge. Why not take an afternoon and go to a good art gallery and see if you can draw some conclusions for yourself, or study some dramatic videos (movies) that have won awards for cinematography.**

**Elements of Composition:**

**1.Clearly Establish Your Objectives**

 **First, clearly establish your objectives and hold to them throughout the production. Your objectives in doing a production may be anything from doing a treatise on spiritual enlightenment to creating an experience of pure escapism.**

**Few people would start writing a sentence without any idea of what they wanted to say. Visual statements are no different. Good writers, producers, directors and editors know the purpose of each and every shot. So, before you roll tape on any shot, have two things clearly established in your mind:**

**● the specific reason for the shot**

**● the purpose of the shot within the overall production**

**2.Strive for A Feeling of Unity :- The concept of unity applies to such things as lighting, color, wardrobes, sets and settings. For example, you might decide to use muted colors throughout a production to create a certain feeling or atmosphere. Or, you may want to create an overall atmosphere by using low-key lighting together with settings that contain earthy colors and a lot of texture.**

**By deciding on certain appropriate themes such as these, you can create a consistent feeling or look that will give your production unity.**

**3.Compose Around A Single Center of Interest :- Multiple centers of interest may work in three-ring circuses where viewers are able to fully shift their interest from one event to another. But competing centers of interest within a single visual frame weaken, divide, and confuse meaning.**

**Think of each shot as a statement.**

**An effective written statement should be cast around a central idea and be swept clean of anything that does not support, explain or in some way add to that idea.**

**Consider this "sentence": "Man speaking on phone, strange painting on the wall, coat rack behind his head, interesting brass bookends on desk, sound of motorcycle going by, woman moving in background...."**

**Although we would laugh at such a "sentence," some videographers create visual statements that include such unrelated and confusing elements.**

**4. Observe Proper Subject Placement**

 **a subject is moving in a particular direction, space is provided at the side of the frame for the subject(s) to "move into." This is referred to as leading the subject.**

**Rule of Thirds**

**Except possibly for closeups of people, it's often best to place the center of interest near one of the points indicated by the rule of thirds. In the rule of thirds the total image area is divided vertically and horizontally into three equal sections.**

**Although it's often best to place the center of interest somewhere along the two horizontal and two vertical lines, generally composition is even stronger if the center of interest falls near one of the four cross-points.**

**5.Maintaining Tonal Balance :-*The tone (brightness and darkness) of objects in a scene suggests weight*. For example, against a medium background dark objects seem heavier than light objects.**

**Once you realize that brightness influences mass, you can begin to "feel" the visual weight of objects within a scene and strive for balance.**

**6.Balance Mass :- Regardless of their actual physical weight, large objects in a scene seem heavier than small ones. By objectively viewing the elements in a scene, you can learn to see their "psychological weight."**

**To do this it helps to imagine a fulcrum or balance point at the bottom center of each of your shots. Several things can be done to try to balance a shot: the camera can be panned to the left or right, a new camera angle can be selected, or the lens can be zoomed in or out to include and exclude objects. Seldom will objects actually have to be moved around.**

**7.Using Lines :- The boundaries of objects in a shot normally consist of lines: straight, curved, vertical, horizontal and diagonal.**

**Our eyes tend to travel along these lines as they move from one part of the frame to another. Knowing this, it becomes the job of the videographer to use these lines to lead the attention of viewers to the parts of the frame they wish to emphasize—especially toward the center of interest. When used in this way lines are referred to as leading lines because they are selected or arranged to lead the viewer's eyes into the frame, generally to the scene's center of interest.**

**In addition to moving our eyes around the frame, lines can suggest meaning in themselves. Straight, vertical lines suggest dignity, strength, power, formality, height and restriction.**

**Horizontal lines suggest stability and openness. Diagonal lines can impart a dynamic and exciting look. Curved lines suggest grace, beauty, elegance, movement, and sensuality.**

**The S-curve is particularly effective in gracefully leading the eye to a center of interest. (Note the photos above and on the right.) In contrast to curved lines, sharp jagged lines connote violence or destruction, and broken lines suggest discontinuity.**

**8.Frame Central Subject Matter :-**

**By putting objects at one or more edges of the picture, a shot can be framed. Framing a scene holds attention within the shot and keeps viewer attention from wandering or being distracted from the center of interest. To cite a common example, a leaning tree branch at the top of a scenic shot breaks up a bright sky and acts as a visual barrier or "stop point" for the top of the frame. Note in the photo above how framing a shot with foreground objects adds depth and dimension.**

**9.Make Use of Visual Perspective :- As noted previously, camera positions and lens focal length alter the apparent perspective in a shot, as well as the apparent distance between objects. A minimal camera-to-subject distance coupled with a short focal length lens (or a zoom lens in its widest position) exaggerates perspective.**

**Parallel lines will be wide apart in the foreground of the picture and start to converge after a short distance. By creatively controlling such things as lens focal lengths and camera distance, quite different impressions about a subject can be conveyed.**

**10:- Convey Meaning Through Colors and Tones :- The predominance of bright or dark areas carries strong psychological meaning in itself, regardless of what else is going on. Just as the selection of lighting and monochrome values in a scene suggests mood and meaning, so does the choice of color.**

**In general, bright colors add energy to composition, while lighter hues impart a serene, harmonious and stable look.**

**Color preferences vary with age, sex and race. We know that people prefer to see colors "in their place." Magenta-to-red colors may be popular—until they are brought into a kitchen setting.**

 **A particular shade of green may be an attractive color until it becomes associated with the walls of a hospital room. Surrounding colors also greatly affect color preference. When a color is used near its complement its preference rating usually rises, as long as the complementary color is subdued and is not brighter or more intense than the original color. (Recall that complementary colors are opposite each other on the color wheel.)**

**Just as people prefer a balance between mass and tone in composition, they also prefer a balance in colors, as seen on the color wheel. In particular, they prefer a balance between calming and stimulating colors. In balancing colors in a scene be aware that it will take a larger area of cool colors to balance hot colors.**

**11.Avoid Mergers**

***Tonal mergers* result when important objects in a scene appear to blend together and lose their identity. This may be because of a lack of lens sharpness, because the objects are of similar tonal or color values (note the butterfly in the photo , or because of lighting problems.**

***Dimensional Mergers :-* dimensional mergers can cause important scene elements to run together and lose meaning; at worst, they look ludicrous, such as when a lighting fixture is jetting out of a person's—in this case, the author's—head.**

**Although selective focus and the use of a backlight can alleviate this problem, the best solution is to recompose the shot by either shifting the camera angle or rearranging the elements. (Note that simply taking a couple steps to the left or right would have solved the problem above.)**

***Border Mergers :-* the border merger, occurs when subject matter is cut off by the edge of the frame—at an inappropriate point. A side view of a car showing all but the back wheels will probably give you an uncomfortable feeling that the back end of the car is just hanging in air without visible back support.**

**12.Control the Number of Prime Objects**

 **The thirteenth guideline for effective compositions is: control the number of prime objects in the scene. Generally, an odd-number of primary objects provides stronger composition than an even number.**

**13.Balance Complexity and Order :- This aspect of composition can be stated: complexity without order produces confusion; order without complexity produces boredom. A medium shot of a banana against a medium gray background will probably end up being a rather dull visual experience. Add a few apples, some grapes and an interesting fruit bowl, and you'll have a more engaging picture (with the banana still standing out from the darker colors).**

**But throw in 50 randomly arranged bananas on top of this and you'll end up with a visual muddle. Suffice it to say, the most interesting composition is a balance between order and complexity.**

**14.Movement and Meaning:- Movement from dark areas to light areas can symbolize liberation or emotional uplift. Upward motion—even something as simple as an individual getting out of a chair—catches attention because it suggests progress or advancement. Downward motion often connotes the opposite. Action that progresses toward the camera is more powerful than action that moves away from the camera. The object, itself, may be moving, or the camera shot may change through a dolly or zoom.**

**Often, televised speeches are worked out with camera operators so that the camera is zoomed in to add emphasis to a certain part of the speech. With this in mind, it's generally better (psychologically) during a speech to zoom in for emphasis and then cut (rather than zoom) back, as necessary, to a medium or wide shot.**

**Left-to-right movement is generally more engaging than right-to-left movement. The most engrossing type of movement is diagonal, especially when it's from the lower left of the frame to the upper right. Related to this concept, a canted camera shot (a tilted camera angle, also called a Dutch angle), especially from a low angle, is often used to connote energy or power.**

**Lighting:**

**Hard and Soft Light**

**The art of cinematography is the art of lighting and making that light tell the story. Lighting can emphasize important details or completely hide them. It can flatter a subject by bringing out positive attributes, and it can de-emphasize or hide less attractive attributes. Lighting can even impart a sinister and hostile look. It all depends on how you choose to use the concepts we'll be covering in the next few modules. Television is based on the medium of light; in fact, without light there could be no video. Just as sound must be skillfully controlled in audio production, light must be expertly controlled in television.**

**As video—especially HDTV/DTV—has begun to emulate the more artistic dimensions of film, there has been a greater emphasis on creative lighting. But, before you can successfully control light, you need to understand and control its three basic characteristics:**

**● coherence (quality)**

**● color temperature**

**● intensity**

 **Light Coherence**

**Coherence, often called quality, is the hardness or softness of light. Light quality is probably the least understood and the most neglected of the three variables.**

 **Hard Light**

**Light that is transmitted directly from a small point source results in relatively coherent (parallel) rays. This gives the light a hard, crisp, sharply defined appearance. The light from a clear, unfrosted light bulb, a focused spotlight, or the noonday sun in a clear sky, all represent hard light sources.**

**Hard light casts a sharp, clearly defined shadow. When hard light is used to illuminate a face, imperfections in the skin stand out. The result is less than flattering. But in other applications, such as bringing out the texture in leather, or the engraving on a piece of jewelry, this can be an advantage.**

**Note in the photo on the left how the writing stands out. Also note the clearly defined shadow of the flower at the bottom of the photo. Compare this photo with the one in the section below (with soft light) where the letters are hard to read and the shadow of the flower has all but disappeared.**

**Several types of lighting instruments are used in TV to create hard light, including the beam-spot projector and the commonly used ellipsoidal spotlight.**

**Soft Light**

**Soft (diffused) light has the opposite effect, especially when lighting angles are controlled. As shown in the photo here, soft light tends to hide surface irregularities and detail. Spun-glass diffusers are used over the front of lights to soften and diffuse their beams. At the same time, diffusers also reduce the intensity of light.**

**Soft light sources are used in production to create a broad, even area of light. In the field videographers often rely on umbrella reflectors (on the right, below) to create a soft lighting effect. As you can see, this is simply a light bounced off the inside of a silver or white, umbrella-like reflector. The illustration on the left shows a much heavier soft light that is commonly hung from the grid in studios.**

**Since soft light tends to hide lines, wrinkles and blemishes, it's desirable in doing glamour work. The photo of the model on the left was shot with soft light.**

**A soft light source placed close to the camera minimizes surface detail. The effect is commonly referred to as flat lighting.**

**Although it has certain applications, especially in extreme closeups of objects where shadows would obscure important details, flat lighting leaves subject matter somewhat "dimensionless." When used over a large area, it can impart an arid and sterile-looking appearance.**

 **Ultra-Soft Lighting**

**There are a few occasions when ultra-soft lighting is necessary to keep video equipment from compressing (losing) important detail. To create this ultra soft lighting the subject matter was surrounded by a white sheet, leaving only a small opening for the camera lens. Three lights placed at different angles lit the sides of the sheet.**

**In this module we've illustrated the two extremes: hard light and soft light. Although each has its purpose, as we'll see, most subject matter looks best when illuminated with a light source that lies somewhere between very hard and very soft light.**

**The Key Light**

**In typical lighting setups, lighting instruments serve four functions:**

● **key lights**

● **fill lights**

● **back lights**

● **background lights**

**Key Light Attributes**

**As the name implies, the key light is the main light, the light that defines and most affects the appearance of subject matter. In terms of coherence or quality, it should be in the middle of the hard-to-soft range. In the studio this generally means a Fresnel light.**

**In three-point (formula) lighting the key light is placed at an angle of between 30- and 45-degrees from either the left or the right of the camera.**

**For the sake of consistency, the 45-degree angle will be used throughout this discussion. This brings us to the rule we'll need to keep in mind, especially if multiple cameras and camera angles are involved in the production:**

**The Key's Vertical Angle**

**We have established the horizontal angle for the key light is approximately 45 degrees to the left or right of the subject in relation to the camera. One other key light angle should be considered: elevation. As shown below, this angle is also commonly 45 degrees for the key light. We'll cover the other lights shown later.**

**Some lighting directors prefer to place the key right next to the camera, or at a vertical angle of less than 30 degrees. Sometimes in limited on-location conditions this may be unavoidable.**

**Keys and Boom Mics**

**Since the key light is the brightest light on the front of a subject, it's the one that will create the darkest shadows. Shadows from boom mics (microphones suspended from long poles over the talent areas) can be minimized by positioning the boom parallel to (directly under) key lights. By not placing talent too close to a background, the boom shadow will end up on the floor rather than creating distracting shadows on the background—assuming you keep the key at the recommended height of 45 degrees.**

**The Sun As A Key**

**When shooting on location during the day the sun will normally be your key light. However, direct sunlight from a clear sky results in deep, black shadow areas with a major loss of detail. If the sun is directly overhead, a "high-noon effect" will be created, producing dark eye shadows. Put technically, in both instances you've grossly exceeded the brightness range of the video system.**

**Suffice it to say, direct sunlight, especially for closeups, can look unflattering—not only to the person in front of the camera, but for your mastery of production skills. First of all, to get around the "high noon effect," it may be best to shoot sunlit, on-location productions in midmorning or mid-afternoon when the sun is at an elevation of 30 to 45 degrees.**

**If subjects can also be oriented so that the sun (the key light) ends up being 30 to 45 degrees off to one side of the camera, lighting will be best—especially if a fill light (to be discussed in the next section) is used to slightly fill the shadows caused by the sun.**

**On an overcast day the diffused sunlight will provide a soft source of light. If the diffused sunlight is coming from behind the subject, it can provide good back lighting while the ambient light from the overcast sky furnishes soft front lighting. With the proper level of cloud cover this can result in soft, flattering lighting, as shown in this illustration.**

**The Fill, Back and Background Lights**

**The key light by itself (whether it's the sun in a clear sky or a focused quartz light in the studio) produces heavy, distracting shadows. The purpose of the fill light is to partially (but not entirely) fill in the shadows created by the horizontal and vertical angles of the key light.**

**The Fill Light**

**The fill light should be placed about 90-degrees away from the key light. This means that if you draw lines from the key to the subject and then to the fill light you'll create a right angle.**

**Although the fill can be positioned at any point from right beside the camera to 45 degrees away, it's safest to place the fill 45 degrees from the camera. By lighting a full 90-degree area, an important *margin of safety* is created in case subjects unexpectedly move and camera angles have to be changed during the production. Having to stop a production to change the position of lights can represent a time-consuming and costly delay.**

**Although the horizontal angle for the key should be about 45 degrees, the vertical angle of the fill is less critical. Generally, the fill is placed just above the camera, as shown above, which means it ends up being slightly lower than the key. In this position it can easily do what it's intended to do: *partially* fill in the shadows created by the key light.**

**The height of the fill can be lowered from the grid to the proper angle by an extension rod (pipe) or by a counterbalanced extension device shown above on the right.**

**We've suggested that the fill light should be softer than the key. A soft light source is able to subtly fill in some of the key's shadows without creating a second catchlight in the eyes.**

**Note in the photo here how the shadow from the key on the cheek is only partially removed by the fill, creating a gradual "rounding off" of the key light on the cheek. This key-fill difference provides much of the perception of three dimensions that's desirable in a medium that's limited to two dimensions.**

**Fill Light Options**

**A good choice for a studio fill light is a scoop, or a bank of color-balanced fluorescents. When doing on-location work these options are a bit unwieldy so a portable quartz stand light can be used with a diffuser. The diffuser not only softens the fill light, but it can appropriately reduce its intensity. Outside, when the sun is being used a key, a reflector board can be positioned at about 90 degrees from the sun to reflect sunlight into the shadow areas.**

**Large white Styrofoam boards are often used for closeups in ENG work. There are also folding silver reflectors available that can reflect light much greater distances. Reflector boards can be clipped to a stand as shown here, or held by an assistant. These photos illustrate a subject in harsh sunlight with and without a reflector fill.**

**If a key light puts out a wide beam of light, part of this light can be bounced off of a reflector board to act as a fill.**

 **The Back Light**

**At this point we've covered two of the three lights on the subject in formula lighting. The third point is represented by the back light. The function of the back light is to separate the subject from the background by creating a subtle rim of light around the subject.**

**The back light (sometimes called a hair light) should be placed directly behind the subject in relation to the closeup camera. From an overhead perspective you should be able to draw a straight line from the lens of the closeup camera, through the subject, directly to the back light.**

**Although the elevation of the back light is often dictated by conditions, a 45 degree angle is most desirable. If the back light is too low, it will be picked up by the camera in wide shots; if it's too high it will spill over the top of the subject's head, lighting up the tip of the nose creating "the Rudolph effect," after a well-known reindeer. Compared to the key, a smaller, lower-wattage instrument can be used for a back light for two reasons. First, back lights are often placed closer to the subject than the key light, and, second, with subjects confined to a limited area like a chair the beams of many lights can easily be "pinned down" (focused into a narrower beam) to intensify the beam.**

**By using only back lights with no front lighting a silhouette effect can be created. This canbe used for dramatic effects or to hide someone's identity.**

**In trying to successfully eliminate all front lighting—especially in an effort to hide someone's identity—watch out for reflected light from walls and the floor. Outside the studio the use of back light (generally in the form of sunlight) can add depth and separation to subject matter.**

**At the same time, strong back light without adequate front light can create an exposure problem—unless you intentionally want to achieve a silhouette effect. Remember, on many camcorders there is a *back light control* that's designed to compensate (to some degree) for this exposure problem. A careful balance between front light and back light can add a 3-D quality to scenes.**

**Background Lights**

**Background lights are used to illuminate the background area and add depth and separation between scene elements. (*Keep in mind that a back light is designed to light up the back of subjects and a background light is designed to light up the front of backgrounds.. The effect of the backlight is shown below.* Once the background light is added, the lighting setup is complete, as shown in the drawing on the right above.**

**Any type of light can be used as a background light as long as it provides fairly even illumination across the background, does not hit the central subject matter, and is at the appropriate intensity. If the background has detail or texture, you will want to put the background light on the same side as the key, as shown in the drawing above. This keeps the dominant light consistent in the scene.**

**Special Lighting Situations**

**Let's start with a simplified design that creates a softer effect than the three-point formula approach we've covered.**

**In the drawing below note that a soft front light replaces both the key and fill. The umbrella reflector shown here, or a light bounced off a large white card will provide similar results. In this case the broad area covered by the key acts as both a key and a fill.**

**Although the picture produced will not provide the same depth and dimension as with formula lighting, the softer effect may be more flattering for some subjects, especially if wrinkles and age lines are an issue. If the background is close behind a subject, this may eliminate the need for a background light. (Since you are using a diffused light source, the background will probably be softly lit and shadows on the background will be less noticeable.) A backlight is still desirable to provide needed subject-background separation.**

**Multiple Purpose of Lights**

**Occasionally you can make lights serve dual purposes and still maintain the three-point lighting effect. Here, a one-on-one interview is lit with only three lights. Note that each of the (very carefully placed) lights serves two purposes. If distances are carefully controlled, the lights will be 50 percent brighter as back lights than as keys.**

**This can work well under carefully controlled situations where you know in advance the color of each person's hair (or, possibly, lack of hair) and the color of clothes that will be worn by each person. Obviously you won't have much latitude in accommodating special needs. In this situation the chairs can't be moved without upsetting the lighting balance.**

**Bounced Light**

**For short ENG segments bounced light can be used. The drawings below show an approach for large and small rooms. Although the soft lighting effect leaves a bit to be desired, this type of approach may be adequate for short segments.**

**Bounced light creates a soft, even light throughout the entire room, an effect that is similar to what we are used to seeing with overhead fluorescent lights. If the camera is back far enough, a light mounted on top of the camcorder can be aimed at the ceiling for a bounced light effect. The camera (and attached light) should be far enough back from the subject so that the light will come down at an acceptable angle. If the light is too close to the subject, dark eye shadows will result. If the walls of the room are a light, neutral color, they will reflect part of the bounced light and more fully fill in shadow areas.**

**The second drawing assumes a smaller room. To keep the light from coming down on the subject at too steep an angle, it's aimed at the back wall. Again, this approach creates an extremely soft effect, which may or may not be desirable.**

**To help compensate for the color that the ceiling and walls add to the light, be sure to color balance the camera under the bounced (rather than the direct) light.**

 **Lighting Multiple Subjects**

**Thus far we have covered the lighting of one subject only. Life isn't always that simple. First, we'll take a look at a typical three-person interview setup. Note below that even though things appear to be much more complex, we've only just repeated the basic three-point lighting setup for each of the three people.**

**A simple news, weather and sports set is shown below. By panning to one side or the other, the two cameras can get one of the co-anchors, or the sports or weather person. Also note that the positions of the key and fill lights provide three-point lighting coverage for each of these camera positions. Background lights are not shown—and may not be needed—because of the abundance of ambient light that would be present.**

**Area Lighting**

**So far we've covered subjects conveniently confined to one place. But what if one or more subjects must be free to roam around a set while on camera? There are four ways this can be handled.**

**1. First, the entire area can be flooded with a base light, which is an overall, even light. Scoops or color-balanced fluorescents will work here, assuming the area isn't too large. Important closeup camera talent positions are then keyed with lights at twice the intensity of the base light. Small pieces of tape placed on the floor can provide marks for the talent to "hit" as they move from one major camera position to another. With this approach you will probably not want to barn off the lights any more than necessary because illuminated areas should be kept large enough to give the talent a margin of error in missing their marks.**

**2. The second approach involves keying, filing and backing the entire area (generally, a dramatic setting). Here the whole working range—assuming it's not too large—is treated as a single subject. This will require a powerful (high-wattage) key light positioned at a great enough distance to cover the entire area.**

**If the key is placed in the center of the set, 90-degrees to the back wall, the angle will be appropriate for cameras positioned at each side of the set. One or more Fresnels with diffusers placed at either side of the set can serve as fills. (Scoops or banks of color-balanced fluorescent lights will not throw light far enough to reach the back of a large area.)**

**If multiple keys are needed to achieve a high enough level of illumination over the set, they should be positioned as close together as possible to reduce the problem of multiple shadows and multiple catchlights in eyes.**

**Over a large area multiple back lights will have to be used. They should be aimed to create slightly overlapping pools of light over the whole talent area. The talent should be able to walk from one area to another without obvious variations in back light.**

**3. The third approach to lighting a large area is to divide the set into individual areas and key, fill and back each area. Often, large interior settings are divided into four or more parts for keying, filling and backing. Typically, the lights at the edge of each of these areas will just begin to merge. With this approach it's important to make sure that closeups on the talent will not be in the transition points between lighted areas. Keep in mind the sources of light that may be suggested by the setting—visible table lamps, windows, etc. Place the key lights so they will be consistent with these suggested sources of illumination. This is called *following source*.**

**4. The last approach to lighting a large area would be appropriate to simulate an interior at night. This technique would use a low key lighting ratio from 3:1 to 6:1, and the talent would move in and out of specifically defined set areas. Only important, closeup areas would be lit, leaving the rest of scene relatively dark. With this approach it's especially important to *follow source*; i.e., place keys so that they are consistent with the visible or suggested sources of light within the setting. If a person were sitting next to a reading lamp, the key would have to be angled so that the light would appear to be coming from the table light. In some cases you may want to use a low-level base light over the entire set to keep in-between areas from going too dark.**

**Using A Stand-In**

**Whatever lighting approach you use the lighting can be checked on camera by having a stand-in (a person of similar height, skin color and clothing as the talent involved). This person should slowly walk through the positions on camera as the lighting is carefully observed on a good color monitor.**

**During the show's dress rehearsal (with the actual talent) any remaining problems can be spotted and then fixed during the break between the dress rehearsal and the actual production.**

**Existing (Natural) Light**

**In news and documentary work the most "honest" approach to lighting is to make use of the existing (natural) light present at the location. This shows things as they really are (within the limitations of the video process), rather than after they have been altered or embellished by "artificial" lighting.**

**The problem is that existing light is often unsuitable. The brightness ratio can be too extreme; there can be mixed sources of light (daylight, incandescent light and fluorescent light all at the same location); or, the light level can be too low for a quality video signal.**

**There's also another consideration: people are used to seeing interviews, etc., enhanced by good lighting. Without it, it appears to many viewers that "the picture's dark," or "the picture isn't too good."**

**This is not unlike the situation photojournalism faced a few decades ago when existing light still photography was first used in publications such as *Life* magazine. Since people were used to seeing flash-on-the-camera photos, natural light photography seemed unnatural—even though it accurately showed the actual conditions being photographed. (Flash was necessary in the early days of photojournalism because of the relatively slow speed of film and lenses.)**

**Occasionally in dramatic productions you have to fake lighting to make it look real. Here, the light from a computer screen is insufficient to illuminate the child's face. So to simulate this setting, a light with a blue filter is positioned on the other side of the computer monitor.**

**Television Sound: The Basics**

**Until rather recently, far more attention was paid to video in television than to audio. "Good sound" was when you could make out what was being said; "bad sound" was when you couldn't.**

**This has changed. With the advent of stereo, surround-sound, and now digital audio with its multiple sound tracks, audiences have much greater expectations. Before we discuss some of the basic audio production concepts, sound itself must be understood.**

**Sound has two basic characteristics that must be controlled: loudness and frequency.**

**Loudness and Frequency**

Loudness

**Although sound loudness is measured in decibels (dBs), that term actually refers to two different things. First is dBSPL (for sound pressure loudness), which is a measure of acoustic power.**

**These are sounds we can directly hear with our ears.**

**These decibels go to, and beyond, 135, which is considered the threshold of pain; and, by the way, the point at which permanent ear damage can occur. (The damage, which is irreversible, often goes unnoticed, which probably explains why the average 50-year-old in somecountries has better hearing than many teenagers in the United States.) Various sound pressuredecibel levels (in dBSPL's) are shown here.**

**The second use of the term decibel*,* dBm (for the milliwatt reference level) is a unit of electrical power. These decibels are displayed on loudness meters. In audio production we are primarily interested in dBm, which represents levels of electrical power going through various pieces of audio equipment.**

**The dB level going through audio equipment must be carefully controlled. If the signal is allowed to pass through equipment at too low a level, noise can be introduced when the level is later increased to a normal amplitude (audio level).**

**If the level is too high (significantly above 0 dB or into the red areas on the VU meter), distortion will result—especially with digital audio. To ensure audio quality, you must pay constant attention to maintaining proper audio levels. The animated meter shown here indicates a sound level that is too loud. Ideally, the needle should not go deeply into the red area this often.**

Frequency

**Frequency relates to the basic pitch of a sound—how high or low it is. A frequency of 20 Hz would sound like an extremely low-pitched note on a pipe organ—almost a rumble. At the other end of the scale, 20,000 Hz would be the highest pitched sound that most people can perceive, even higher than the highest note on a violin or piccolo.**

**Frequency is measured in Hertz (Hz) or cycles per second (CPS). A person with exceptionally good hearing will be able to hear sounds from 20-20,000 Hz. (Generally, women can hear higher frequencies than men.)**

**Since both ends of the 20-20,000Hz range represent rather extreme limits, the more common range used for television production is from 50 to 15,000 Hz. Although it doesn't quite cover the full range that can be perceived by people with good hearing, this range does cover almost all naturally occurring sounds.**

**The Frequency-Loudness Relationship**

**Even though sounds of different frequencies may technically be equal in loudness (register the same on a VU meter) human hearing does not perceive them as being of equal strength. The red line on the graph (roughly) shows the frequency response of the human ear to different frequencies. Because of the reduced sensitivity of the ear to both high and low frequencies, these sounds must be louder to be perceived as being equal to other frequencies. You'll note that a good-quality microphone (the green line) is relatively "flat" in the all-important 50-15,000 Hz. range.**

**Room Acoustics**

**Sound, both as it's recorded and played back, is greatly affected by the acoustics of a room or studio. In an effort to create totally soundproof studios, early radio stations used to use thick carpets on the floors and heavy soundproofing on the walls. Although possibly successful as soundproofing, the result was a lifeless and dead effect that we're not used to hearing in a normal environment, such as in our living rooms. Two types of soundproofing material are shown on the left.**

**At the other extreme is a room with a tile floor and hard, parallel walls that reflect sound. The result is reverberation (a slight echo) that interferes with the intelligibility of speech. The ideal room for recording or listening to sound has just enough reverberation to sound realistic (similar to your living room possibly), but not enough to reduce the intelligibility of speech.**

**Microphones: Major Microphone Designs**

**There are six common microphone designs:**

● **hand held - the type held by on-camera talent or used for on-location interviews** ●**personal mic (lavaliere / clip-on mic) - Whether hung from a cord around the neck or clipped to clothing, these are all referred to as personal mics.**

● **shotgun - used for on-location production to pick up sounds a moderate distance from the camera**

● **boundary effect microphone - also called PZ or PZM mics These rely primarily on reflected sounds from a hard surface such as a table top**

● **contact mics - which pick up sound by being in direct physical contact with the sound source. These mics are generally mounted on musical instruments.**

● **studio microphones - the largest category of microphone. These include a number of application designs that we'll discuss later. These six categories include different transducer types, or approaches to converting sound waves into electrical energy. In this module we'll discuss the most popular types of mics and their characteristics, starting with...**

**Dynamic Microphones**

**The dynamic mic (also called a moving-coil microphone) is considered the most rugged professional microphone. This type of mic is a good choice for electronic newsgathering (ENG) work, where a wide variety of difficult conditions are regularly encountered (such as the ENG report on a fire).**

**In a dynamic microphone sound waves hit a diaphragm attached to a coil of fine wire. The coil is suspended in the magnetic field of a permanent magnet. When sound waves hit the diaphragm they move the coil of wire within the magnetic field. As a result a small electrical current is generated that corresponds to the original sound waves. This signal must be amplified thousands of times.**

**When small size, optimum sensitivity, and the best quality are all prime considerations, another type of mic, the condenser mic, is often preferred.**

 **Condenser/Capacitor Microphones**

**Condenser microphones (also called capacitor or electret condenser mics) are capable of top-notch audio quality. They can be made so small that they are almost invisible. However, condenser mics aren't as rugged as dynamic mics and problems can result when they are used in adverse weather conditions.**

**Condenser mics work on the principle that governs an electric condenser or capacitor. An ultra-thin metal diaphragm is stretched tightly above a piece of flat metal or ceramic. In most condenser mics a power source maintains an electrical charge between the elements.**

**Sound waves hitting the diaphragm cause fluctuations in an electrical charge, which then must be greatly amplified by a preamplifier (pre-amp). The pre-amp can be located within the microphone housing or in an outboard electronic pack.**

**Because they require a pre-amp, this means that, unlike the dynamic mics discussed earlier, most condenser mics require a *source of power*, either from an AC power supply or from batteries.**

**An AC power supply for a condenser mic is sometimes built into an audio mixer or audio board. This is referred to as a phantom power supply. When this type of power supply is used, the mic cord ends up serving two functions: it delivers the signal from the mic to the mixer and it carries power from the mixer to the pre-amp of the condenser mic.**

**Of course, using batteries to power the pre-amp of the condenser mic is more convenient (you don't have to use a special mixer or audio board connected to an AC power source). But, battery-powered condenser mics introduce a problem of their own: at the end of their life cycle the batteries can go out *without warning*.**

 **To get around any unexpected problems, especially on important productions, two miniature condenser mics are often used together. If one mic goes out, the other can immediately be switched on. This double microphone technique is called dual redundancy—a term that is somewhat redundant in itself.**

 **Ribbon Mics**

**Except possibly for an announce booth (shown here), ribbon mics are seldom used in TV production.**

**Although they can impart a deep, resonant "coloring" to sound, they are fragile and highly sensitive to moving air. This precludes their use outside the studio and on most booms—which covers most TV production applications. Ribbon mics were primary used in radio studios**

**Contact Mics**

**As the name suggests, contact mics pick up sound by being in direct physical contact with the sound source. These mics are generally mounted on musical instruments, such as the sounding board of a piano, the surface of an acoustic bass, or near the bridge of a violin.**

**Contact mics have the advantage of being able to eliminate interfering external sounds and not being influenced by sound reflections from nearby objects. Their flat sides distinguish them in appearance from small personal mics.**

**Directional Characteristics**

**Microphones have a similar attribute: their directional characteristics, or, you might say, the angle of view that they "hear." In microphones there are three basic directional categories:**

● **omnidirectional**

● **bi-directional**

● **unidirectional**

**Omnidirectional Mics :- Omnidirectional mics (also called nondirectional mics) are (more or less) equally sensitive to sounds coming from all directions. Although this attribute would have advantages in radio, where several people could stand or be seated around a single microphone, in video production it's almost always more desirable to use some form of directional mic. For one thing, this will reduce or eliminate unwanted sounds (behind-the-camera noise, ambient on-location noise, etc.) while maximizing sound coming from talent.**

**Bi-directional Mics :-In a bi-directional sensitivity pattern (bipolar pattern) the mic is primarily responsive to sounds from two directions. Note drawing above.**

**Although commonly used in radio interviews (for people sitting across from each other at a table, for example) until the advent of stereo, bi-directional (also called figure eight)sensitivity patterns had limited use in television.**

**Unidirectional Mics :-The term unidirectional simply refers to a general classification of mics that are sensitive to sounds coming primarily from one direction.**

**There are four subdivisions in this category:**

● **cardioid**

● **supercardioid**

● **hypercardioid**

● **parabolic**

**Although these terms may sound as if they belong in a medical textbook, they simply refer to how narrow the mic's pickup pattern ("angle of view") is.**

**Cardioid**

**The cardioid (pronounced car-dee-oid) pattern is named after a sensitivity pattern that vaguely resembles a heart shape. The drawing here is a highly simplified depiction of three directional patterns. Mics using a cardioid pattern are sensitive to sounds over a wide range in front of the mic, but relatively insensitive to sounds coming from behind the mic. Although this pattern might be useful for picking up a choir in a studio, the width of a cardioid pattern is too great for most TV applications. When placed two or more meters (7 or more feet) from a speaker, it tends to pick up unwanted, surrounding sound, including reverberation from walls.**

 **Supercardioid**

**The supercardioid is even more directional than the cardioid sensitivity pattern. When this type of mic is pointed toward a sound source, interfering (off-axis) sounds tend to be rejected. This polar pattern is similar to that of our ears as we turn our head toward a sound we want to hear and try to ignore interfering sounds.**

**Hypercardioid**

**Even more directional is the hypercardioid. Although this mic's narrow angle of acceptance means that off-axis sounds will be largely rejected, this also means that this type of mic has to be accurately pointed toward sound sources. Regular adjustments have to be made if the talent moves. Some highly directional shotgun mics (below) are included in the hypercardioid category.**

**Shotgun Mics**

**Shotgun mics represent one of the most widely used types of mics for on-location work. Since they are quite directional, they provide good pickup when used at a distance of 2 to 4 meters (7-13 feet) from the talent. Like other types of highly directional microphones, they tend to reject sound that would interfere with the on-camera talent.**

**The drawing below shows another way basic microphone sensitivity patterns (polar patterns) can be visualized. The light blue arrows represent the direction the mics are pointed. A top view is shown for the bi-directional mic. The blue areas represent the areas of maximum sensitivity.**

**Parabolic Mics**

**Parabolic mics represent the most highly directional type of mic application. This category refers more to how a microphone is used than to a type of mic or its basic directional pattern. It's the *parabolic reflector* that creates the polar pattern for this mic, not the mic itself. In fact, the mic used in the focus (center) of the parabola can be any general cardioid or supercardioid mic.**

**The parabolic reflector can be from 30 cm to 1 meter (1 to 3 feet) in diameter. Because of the parabolic shape of the reflector, all the sounds along a very narrow angle of acceptance will be directed into the microphone.**

**Parabolic microphones can pick up sound at distances of more than 60 meters (200 or more feet). These mics are not a practical choice for general field production work, but they are often used in sports.**

**For parabolic mics, or any type of directional mic used on location, the person controlling the mic should always be wearing a good set of padded earphones connected to the mic's output—especially if subjects are moving. A slight error in aiming a highly directional mic can make a big difference in audio quality.**

**Handheld Microphones**

**Handheld mics are often dynamic mics because they are better at handling momentary sound overload. Although they are called handheld, the term is a bit of a misnomer, because this type of mic is often mounted on a microphone stand. Because these mics are often used at close distances, some special considerations should be mentioned. First, it's best if the mic is tilted at about a 30-degree angle (as shown here) and not held perpendicular to the mouth.**

**Speaking or singing directly into a mic often creates unwanted sibilance (an exaggeration and distortion of high-frequency "S" sounds), pops from plosive sounds (words with initial "p's," and "b's") and an undesirable proximity effect (an exaggeration of low frequencies, to be discussed in more detail later).**

**Most handheld mics are designed for use at a distance of about 20-40cm (8 to 16 inches), but this distance may have to be reduced in high-noise situations. Pop filters, which are designed to reduce the pops from plosive sounds, are built into many handheld mics.**

**When a mic is used at close range, it's also wise to slip a windscreen over the end of the mic to further reduce the effect of plosive speech sounds. In addition to reducing the effect of plosives, windscreens can eliminate a major on-location sound problem: the effect of wind moving across the grille of the microphone. Even a soft breeze can create a turbulence that can drown out a voice.**

**The elaborate windscreen shown here is used in field production work. A highly directional mic is housed inside this shell. Generally, this type of mic is attached to a "fish pole" and pointed toward the talent, just out of camera range.**

**Positioning Handheld Mics**

**When a handheld mic is shared between two people, audio level differences can be avoided by holding the mic closer to the person with the weaker voice. Inexperienced interviewers have a tendency to hold the mic closer to them. The resulting problem is compounded when the announcer has a strong, confident voice and the person being interviewed is somewhat timidly replying to questions.**

**Personal Microphones**

**Personal mics are either hung from a cord around the neck (a lavaliere or lav mic) or clipped to clothing (a clip-on mic).**

**This type of mic can be either a condenser or dynamic mic. Condenser-type personal mics can be made quite small and unobtrusive—an important consideration whenever there is a need to conceal a microphone.**

**When attaching a personal mic it should not be placed near jewelry or decorative pins. When the talent moves, the mic can brush against the jewelry creating distracting noise. Beads, which have tendency to move around quite a bit, have ruined many audio pickups. Personal mics are designed to pick up sounds from about 35cm (14 inches) away. If a personal clip-on mic is attached to a coat lapel or to one side of a dress, you will need to anticipate which direction the talent's head will turn when speaking. If the person turns away from the mic, not only will the distance from mouth to mic be increased to 50cm (almost 2 feet), but the person will then be turned away from the microphone as well.**

**Headset Mics**

**The headset mic was developed to serve the needs of sports commentators. Normally, a mic with a built in pop-filter is used. The padded double earphones carry two separate signals: the program audio and the director's cues. Having the mic built into the headset assures a constant mic-to-mouth distance—even when the announcer moves from place to place.**

**Mic Connectors**

**To insure reliability, mic (and general audio) connectors must always be kept clean, dry and well aligned, without bent pins or loose pin connectors.**

**The two connectors on the left of the photo are female and male Canon or XLR connectors. These three-pin connectors are used in professional audio applications**. **To the right of the Canon connectors are the mono and stereo (with the floating center connector) miniature connectors.**

**When used on location, audio connectors must be kept dry; however, mic cables can be strung across wet grass, or even through water, without ill effects (assuming the rubber covering has not been damaged). If you must work in rain or snow in the field, moisture can be sealed out of audio connectors by wrapping them with plastic electrical tape. It should be emphasized that this applies to mic cables only. If power cords are used in the field for the camera, lights, or recorder, these cables and connectors must always be kept dry to avoid a dangerous electrical shock hazard.**

**Positioning Mic Cables**

**Running mic cables parallel to power cords often creates hum and interference problems. The solution is often as simple as moving a mic cable a meter away from any power cord. Fluorescent lights can also induce an annoying buzz in audio. Computers and certain types of medical equipment, especially if they are near audio cables or equipment, can also create undesirable noise. By carefully listening to your audio pickup with a set of high quality,padded earphones, you can generally catch these problems before it's too late.**

**Wireless Microphones**

**Wireless mics can solve many audio problems in production. They are especially useful when talent must be free to roam, such as when doing an report from the lighthouse shown above. At the same time, wireless mics can introduce problems.**

**In a wireless mic a dynamic or condenser microphone is connected to a miniature FM (frequency modulated) radio transmitter. Because the mic's audio signal is converted into a radio frequency (wireless) signal and transmitted throughout the production area, these mics are also referred to as RF mics.**

**There are two types of wireless mics: the self-contained (all-in-one) unit and the two-piece type. In the self-contained, handheld unit the mic, transmitter, battery, and antenna are all part of the microphone, as shown on the left.**

**When small, unobtrusive clip-on mics are desirable, a two-piece wireless unit is the best choice. In this case the mic is connected to a separate transmitting unit that can be clipped to the belt, put in a pocket, or hidden underneath clothing.**

**Many of the problems with interference, fading, etc., which at first plagued wireless mics have now been reduced or eliminated. Today, RF mics are widely used in both studio and on-location productions. Some camcorders have built-in receivers for wireless mics, thus eliminating the vexatious mic cable that normally connects the reporter or interviewer to the camera.**

**Microphone Booms**

**In the studio the simple fishpole moves into the much more sophisticated category of boom mics. Microphone booms range from a small giraffe (basically a fishpole mounted on a tripod) to a large perambulator boom (that weighs several hundred pounds, takes two people to operate, and can extend the mic over the set from a distance of 100 meters (more than 30 feet).**

**The largest booms have a hydraulically controlled central platform where operators sit and watch the scene on a TV monitor while controlling such things as the :-**

● **left or right movement (swing) of the boom arm**

● **boom extension (reach of the arm)**

● **left to right panning of the attached microphone**

● **vertical tilt of the microphone**

**Hanging Microphones**

**Sometimes you can get by without a boom mic, especially if the talent is confined to a limited area. In this case a mic can be suspended over a performance area by tying it to a grid pipe or fixture just above the top of the widest camera shot.**

**The disadvantage of this approach is that the mic can't be moved during the production. Both boom mics and suspended microphones should be checked with the studio lights turned on to make sure they do not create shadows on backgrounds or sets.**

**Hidden Microphones**

**It's sometimes possible to hide microphones close to where the on-camera talent will be seated or standing. This will eliminate both the need for personal or handheld mics and the problems that mic cords can introduce.**

**Sometimes several mics must be used on a set at the same time. In this case each mic not being used at a particular moment should be turned down or switched off. This not only reduces total ambient sound, but also eliminates something called....**

**Control Devices**

**Mixers**

**During a production the various sources of audio must be carefully controlled and blended. You will recall in an earlier module that we said if audio levels are allowed to run at too high a level, distortion can result; and if levels are too low, noise can be introduced when levels are, by necessity, later brought into the normal range. Beyond these basics there is a creative need to carefully control and blend audio levels for optimum effect. The control of audio signals is normally done in a TV studio or production facility with an audio board or audio console, such as the one shown here.**

**For video field production smaller units, called audio mixers, do the same thing on a smaller scale. Both audio consoles and audio mixers do five things. Below we see a simplified block diagram of an audio mixer. The input selector switches at the top of each fader can switch between such things as CD's, videocassette machines, DAT's, satellite feeds, and, of course, microphones. The selector switch at the bottom of each fader switches the output of the fader between *cue*, *audition* and *program*.**

**Cue is used for cueing up audio sources (finding the appropriate point in a musical selection on a CD, etc.). A low-quality speaker is intentionally used in many cases so cue audio is not confused with program audio.**

**Audition allows an audio source to pass through an auxiliary VU meter to high quality speakers so levels can be set and audio quality evaluated. And, of course, program sends the audio out to the master gain control to be recorded or broadcast.**

**Even though audio mixers can control numerous audio sources, these sources break down**

**into two categories:**

 ● **mic-level inputs**

 ● **line-level inputs**

**Mic-level inputs handle the extremely low voltages associated with microphones, while line-level inputs are associated with the outputs of amplified sources of audio, such as CD and tape players. Once they are inside an audio board, all audio sources become line-level and are handled the same way.**

**Using Multiple Microphones in the Studio**

**Most studio productions require several mics. Since the mics themselves may have only a 5 to 10 meter (15-30 foot) cord, mic extension cables may be needed to plug the microphone into the nearest mic connector (generally in a wall). Studio mics use cables with three-prong XLR or Canon connectors, as shown on the left.**

**Since things can get confusing with a half-dozen or more mics in use, the audio operator needs to make a note on which control on the audio board is associated with which mic.**

**There is another important reason that mics should be checked before a production: the strength of different people's voices varies greatly. During the mic check period, you can establish the levels (audio volume) of each person by having them talk naturally or count to 10 while you set or make a note of the audio level on a VU meter.**

**Of course, even after you establish an initial mic level for each person, you will need to constantly watch (and adjust) the levels of each mic once the production starts. During spirited discussions, for example, people have a tendency to get louder. (Monitoring audio gain will be discussed below.)**

**It is also good practice to have a spare mic on the set ready for quick use in case one of the regular mics suddenly goes out. Given the fragility of mics, cables, connectors, etc., this is not an unusual occurrence.**

**A traditional audio board is shown on the left. Note the standard VU meters at the top of this stereo model. As production facilities move to digital audio, boards are taking on a different appearance. Like the new digital switchers and lighting boards, the latest generation of audio boards makes use of an LCD video display. A recent model is shown below .**

**Using Multiple Mics in the Field**

**If only one mic is needed in the field, it can simply be plugged into one of the audio inputs of the camera. (Remember, the use of the internal camera mic is not recommended except for capturing background sound.)**

**When several microphones are needed and their levels must be individually controlled and mixed, a small portable audio mixer will be needed. The use of an audio mixer requires a separate audio person to watch the VU meter and maintain the proper level on each input.**

**Portable AC- or battery-powered audio mixers are available that will accept several mic (or line-level) inputs. The output of the portable mixer is then plugged into a high-level VCR audio input (as opposed to a low-level mic input).**

**Most portable mixers have from three to six input channels. Since each pot (fader control) can be switched between at least two inputs, the total number of possible audio sources ends up being more than the number of faders. Of course, the number of sources that can be**

**controlled at the same time is limited to the number of pots on the mixer. There is also a master gain control—generally on the right of the mixer—that controls the levels of all inputs simultaneously.**

**Audio Mixer Controls**

**Audio mixers and consoles use two types of controls: selector switches and faders. As the name suggests, selector switches simply allow you to select and switch a variety of audio sources into a specific audio channel Faders (volume controls) can be either linear or rotary in design. As we've noted, faders are also referred to as attenuators or gain controls. A rotary fader (as shown here) is also referred to as a pot (for potentiometer). Linear faders are also referred to as vertical faders and slide faders.**

**"Riding Gain"**

**It's important to maintain optimum levels throughout a production. This is commonly referred to as riding gain. You will recall that digital audio equipment typically requires different audio peak settings than analog equipment. Normal audio sources should reach 0dB on the VU or loudness meter (next to the 100 in the illustrations) when the vertical fader or pot is one-third to two-thirds of the way up (open).**

**Having to turn a fader up fully in order to bring the sound up to 0dB indicates that the original source of audio is coming into the console at too low a level. In this case the probability of system background noise increases.**

**Conversely, if the source of audio is too high coming into the board, opening the fader very slightly will cause the audio to immediately hit 0dB. The amount of fader control over the source will then be limited, making smooth fades impossible.**

**To reflect the various states of attenuation (resistance) the numbers on some faders are the reverse of what you might think. The numbers get higher (reflecting more resistance) as the fader is turned down. Maximum resistance is designated with an infinity symbol, which looks like an "8" turned on its side. When the fader is turned up all the way, the number on the pot or linear fader may indicate 0, for zero resistance. Even so, just as you would assume, when the pot is turned clockwise or the fader control is pushed up, volume is increased.**

**Level Control and Mixing**

**Audio mixing goes beyond watching a VU meter. The *total subjective effect* as heard through the speakers or earphones should be used to evaluate the final effect. For example, if an announcer's voice and the background music are both set at 0dB, the music will drown out the announcer's words. Using your ear as a guide, you will probably want to let the music peak at -10 dB or -20dB, and the voice peak at 0dB to provide the desired effect: dominant narration with supporting but non-interfering background music.**

**During long pauses in narration you will probably want to increase the level of the music somewhat, and then bring it down just before narration starts again. In selecting music to go behind (under) narration instrumental music is always preferred. If the music has lyrics sung by a vocalist (*definitely not recommended as background to narration*) they would have to be much lower so as not to compete with the narrator's words.**

**Using Audio From PA Systems**

**In covering musical concerts or stage productions a direct line from a professionally mixed PA (public address) system will result in decidedly better audio than using a mic to pick up sound from a PA speaker. An appropriate *line-level* output of a public address (PA) amplifier fed directly into a high-level input of a mixer can be used. *(NOTE: The regular speaker outputs from the PA amplifier cannot be used; they can severely damage the mixer.)***

**Audio Recording, Editing and Playback**

**A Quick Look Back: Turntables and Reel-to-Reel Tape Machines**

***Records and reel-to-reel tape machines used to be the primary source of prerecorded material in TV production. A reel-to-reel machine is shown on the right. Today, these have almost all been replaced by audio carts (cartridges), CDs (compact discs), and DAT (digital audio tape) machines.***

***Unlike records or vinyl, some of the newer media can be electronically cued, synchronized and precisely controlled—things that are important in precise audio work. Reel-to-reel analog 1/4-inch tape machines, which were relied upon for several decades in audio production, have now almost all been replaced—primarily by cart and DAT machines.***

**Compact Discs**

**Because of their superior audio quality, ease of control, and small size, CDs (compact discs) are now the preferred medium for prerecorded music and sound effects. Although the discs containing permanently recorded audio are most common, there are also CDR's (recordable compact discs). With these it's possible to repeatedly record and playback material on the same disc.**

**Although the overall diameter of a typical audio CD is only about five inches (12.7 centimeters) across, CD's are able to hold more information than both sides of a 12-inch (30.5cm) LP phonograph record. And, the frequency response (the audio's pitch from high to low) and dynamic range (the audio range from loud to soft that can be reproduced) are significantly better.**

**In the manufacture of a CD an image of the digital data is stamped into the surface of the CD in a process that is similar to the way LP records (with their analog signals) are produced. When a CD is played a laser beam is used to illuminate the microscopic digital pattern encoded on the surface. The reflected light (modified by the digital pattern) is read by a photoelectric cell.**

**Audio Editing Systems**

**Audio editing used to require physically cutting and splicing audiotape—an arduous process at best. Today, there are numerous computer-based editing programs available. Many are available the Internet in the form of shareware. In addition to basic editing, they provide filtering, manipulation, and an endless range of special audio effects.**

**The audio line above shows how a single channel of sound appears in an audio editor. The vertical red line indicates the cursor position. Much as a cursor is used to mark words in a word processing program to make changes as needed, the cursor in an audio time line provides a point of reference for making audio changes.**

**The display above shows how the time lines are integrated into a typical audio editor. Most programs use a computer mouse to drag-and-drop segments and special effects to the time line. Audio editing in television production is typically handled along with the video on a video editing system.**

**The hard drives on computer-based audio editing systems can also store a wide range of sound effects that can be pulled down to a time line to accompany narration and music.**

**Studio Hand Signals**

**Although the studio director can relay signals to the crew via headset (PL line) instructions, getting instructions to on-camera talent while the mics are on must be done silently through the floor director.**

**To do this the floor director uses agreed upon hand signals. In order for the talent to be able to easily and quickly see these signals, they should be given right next to the talent's camera lens.**

**Shooting Angles**

**In an interview the eyes and facial expressions communicate a great deal—often even more than what the words the person is saying.**

**Profile shots (equivalent to shooting the closeups from camera position A) often hide these important clues. A closeup of the guest from camera position B, as well as a closeup of Dr. Lee from the camera 2 position, provide much stronger shots.**

**These angles also offer more possibilities for shots. You have a strong closeup of the person talking, plus (if you zoom back slightly) an over-the-shoulder shot that can even be used to momentarily cover comments by the person whose back is toward the camera.**

**Special Effects**

**Although video switchers like the one pictured here look impossibly complex, once you understand some basics, a switcher like this isn't quite as intimidating. In this module we'll trace operations that are common to most switchers—both hardware based and software based. We'll start with a very basic switcher configuration.**

**Each button represents a source of video—even "black," which includes the technical parts of the video signal necessary to produce stable black. The bottom row of buttons (outlined in blue) is the program bus or direct-take bus.**

**Any button pressed on this row sends that video source directly to line out, the final feed being broadcast or recorded. The easiest way to instantly cut from one video source to another is simply to select it ("punch it up") on the program bus. The program bus generally handles more than 90% of video switching.**

**But what if you want to dissolve (fade) from one camera to another, or fade to black? For this you need to move to the top two rows of buttons referred to as effects or the mix/effect bus. With the use of the fader bars you can create rudimentary special effects.**

**When the fader bars are in the top position as shown here, any video source punched up on the top row of buttons is sent to the effects button on the program bus. (To see this clearly you may want to refer back to the larger illustration above.) The buttons that have been selected are shown in red. Since camera 3 was selected on the effects bus, that's the camera that's sent to program bus to the line out video monitor.**

**If we were to move the fader bars down to the lower position, the video source selected on the lower row of buttons on the effects bus (in this case camera #2) would be sent through the effects key on the program bus to the line-out monitor. In short, we've put camera #2 on the air. During the process of moving the fader bars from the top to the bottom we've seen a dissolve (and overlapping transition) from camera #3 to camera #2.**

**If we stop the fader bars midway between the move from top to bottom, we would have both sources of video on the line-out monitor at the same time—we would be superimposing one camera over the other. Although this used to be the way we displayed titles, credits, etc., on the screen, today we use an electronic keying process. As illustrated below, a key produces a much cleaner and sharper effect.**

 **Note in the drawing above that in a key one image is electronically "cut out" of the other, while in a super the two images are simply overlapped. Now, let's add a couple of new things to our basic switcher.**

**First, note in the drawing above that the fader bars have been split—each one being at the "0" (no video, or black) position. If we were to move fader bar "A" to the top position we would put camera 3 on the air; if we were move fader bar "B" to the bottom position**

**we would put camera 2 on the air. Next, note the extra row of buttons (in green) below the program bus marked "preview." With the preview bus we can set up and check an effect on a special preview monitor prior to switching it up on the program bus.**

**To see (preview) an effect we can punch up *effects* on the preview bus. When we get what we want, we can cut directly to it by punching up *effects* on the program bus.**

**Some switchers (like the one shown in the photo at the beginning of this module) have multiple effects banks. A simple version is shown below.**

**Finally, let's add some real bells and whistles. The top row of buttons in this drawing represents various types of wipes. Yellow on the buttons represents one video source, black another source. Additional patterns—some switchers have hundreds—can by selected by entering numbers on the keypad. If wipe is selected on the switcher, the button pushed (indicated in red in this drawing) shows the moving pattern (controlled by the fader bars) that takes you from one video source to another.**

**A border along the edge of the wipe—a transition border—can be used, and its hue, brightness, sharpness, width, and color saturation selected. To add even**

**more variety the edge of the wipe can also be modulated (made to move) with the pattern modulation controls. The key clip knob controls the video level of the source you are going to key into background video. This is adjusted visually on the preview monitor.**

**Downstream keyers, which are often used to key in such things as opening credits and closing titles, are external (downstream from) the basic switcher. The advantage of a downstream keyer is that it doesn't require the use a switcher effects bank for keying, which means that the bank stays free to be used for other things.**

**Although we've shown the basic configurations of special effect switchers through drawings, in "real life" the most sophisticated units look like the one pictured here. This unit combines the traditional buttons and levers with a computer display. Later, we'll talk about software-based switchers and special effect units that are based on a desktop computer.**

**Chroma Key**

**The type of key we've been discussing so far is referred to as luminance key because the keying effect is based on the brightness or luminance of the video you are keying in. But, as we saw when we discussed virtual reality sets, it's also possible to base keying on color (chroma). In chroma key a particular color is selected for removal and another video source is substituted in its place. This type of keying is commonly done during newscasts where a graphic is inserted behind a newscaster, or a weather map is keyed in behind the weather person.**

**chroma key is now used to key in (virtual reality) sets behind talent. Although any color can be used in chroma key, royal blue and a saturated green are the most commonly used. Most of the special effects we seen on television today are done with chroma key.**

**Software-Based Switchers and Effects**

**Most software-based switchers use the hardware-based switcher we've discussed as a graphical model. On the computer screen shown on the left note the familiar fader bars and the various banks of buttons. In this case, however, instead of pushing buttons, you click on the buttons with a mouse. Software based systems can be easily and regularly upgraded when new software is written—an advantage you don't have to the same degree with hardware-based equipment. It's also possible to go beyond basic switching with most of these systems and create such things as 3-D illustrations and animated effects.**