Third Edition

LIGHTING

for Digital Video and Television

JOHN JACKMAN

Focal Press

Lighting for Digital Video and Television

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Third Edition

John Jackman

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Introduction

I participate in a number of Internet forums related to video production and often field questions about lighting issues. After a thread where several of us explained to a beginner why he needed to light his videos, one wag posted:

"Remember, without lighting all you have is a black picture."

Facetious, tongue-in-cheek, but true! The most common mistake beginning video shooters do is to overlook the importance of good lighting.

I've always been interested in lighting. In my earlier days it was theatrical lighting; I just loved playing with the light boards (built one myself) and figuring out dramatic lighting effects. Then I became interested in video production. That was back in the days of the Sony PortaPak®, the genesis of "guerilla video" however, and we didn't do no stinkin' lighting. Point-and-shoot was pretty much all we did outside of the studio. The PortaPaks® ran ½" reel-to-reel tape, black & white only, about 150 lines of resolution on a good day. The tape deck was about the size of a mini-tower computer today, with a shoulder strap and batteries that seemed to last about 10 minutes. Then along came ¾" U-Matic® and then ¾" SP. And then came the day when a great program I had done was rejected for network broadcast because of poor lighting in some critical interview scenes.

I got back "into" lighting with a vengeance. My earlier fascination with theatrical lighting effects was reawakened and I started to experiment. When the first 3D programs came out (anyone remember DKBTrace, the original Caligari, and Turbo Silver?) everyone else was playing with reflective surfaces—but *I* was playing with the lights! I've been playing with lights ever since.

Once you discover the difference great lighting can make, you'll be playing along with me!

—John Jackman
Lewisville, NC
Fall, 2009

CHAPTER 1

Why Is Lighting Important for Television and Video?

If you're fairly new to television, video, and digital movie production, you may not really have a sense of why lighting is so important. After all, today's cameras are so light sensitive you can often get away without any additional lighting. The only thing you don't understand is why sometimes your shots are overexposed or contrasty; and you may not be able to figure out why one shot will look like a Hollywood film and the next will look like a really bad YouTube video.

If, on the other hand, you're more experienced in television and event video production, you may understand a lot about the basic issues of controlling contrast and exposure—but would find it challenging to light a realistic night scene or simulate natural lighting in a living room for a dramatic movie. These situations are very different from flat studio lighting and a classic three-point interview setup.

Whether you're a rank beginner with a video camera or a moderately experienced video user who wants to get into the more advanced world of dramatic moviemaking, I hope this book will prove to be a helpful guide to understanding lighting and how it contributes to effective image making.

The real key to fine lighting is not only to simulate reality, but to communicate the proper mood and feeling to the viewer. You need to know more than just basic techniques or tricks; it's best to have an understanding of how certain looks will communicate to your viewers. You need to develop an artist's eye for light and shadow and color, and the techniques for reproducing them. Ultimately, great lighting is an ongoing learning experience that can graduate from craft and technique to the realm of art.

In this book, we're going to travel through the world of television, video, and digital movie lighting in a fairly methodical way, so that you build an understanding of the "why" behind the "how to." If you'll come along for the

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Like a magician, we're trying to convince the viewer of something that isn't quite true.

journey (rather than cheating and just flipping through to find a setup diagram or two), by the time we're finished you'll understand the principles behind the techniques. At that point, you'll be able to improvise, to create new techniques for unique situations, rather than having to fall back on some textbook diagrams; and it means you'll be able to do a better job at any lighting scenario.

Why is lighting so important to great video? There are a number of different reasons, some of which have to do with the camera itself and the way the imaging system translates light into an electrical signal, and others of which have to do with the fundamentals of human perception. But just as important is the fact that we're creating an illusion. Like a magician, we're trying to convince the viewer of something that isn't quite true. We're trying to make it seem as if colored plasma flickering across a flat glass screen are actually lions and tigers and bears and people, the great outdoors, the grandeur of space, and the depths of the sea. We're trying to create the illusion of depth and size in a tiny flat plane. And even more difficult, we're not really trying to capture what the eye sees. We're trying to capture the mind's *interpretation* of what the eye sees, which can be a wholly different thing. But more on that later!

FIGURE 1.1
Owen Stephens, Society of Operating Cameramen (SOC), lights an intimate lunch in Naples, Florida, with his Pampa portable fluorescent instruments.

Good lighting is important for quality video in three different ways:

- First, you have to have proper **exposure**, enough light to generate a signal from the CCDs and raise the signal to a proper level, but not exceed the limits.
- Second, you have to create the **illusion of depth** through use of highlights and shadows so that the viewers forget they are watching a 36″ × 20″ rectangle of glass with flickering plasma behind it.
- Third, you have to use tricks and illusions to create **mood and feeling** with the lighting, just as the music director will create mood and feeling with the music.

EXPOSURE AND CONTRAST

The most obvious way in which lighting is important for video is in basic **exposure**. Like the wag said, "without lighting all you have is a black picture!" You have to have enough light on your subject to excite the electrons in the camera's imaging chips to a certain level. It doesn't matter that *you* can see it—if the camera can't see it, your video is toast. You'd think this would be obvious, but it's amazing how many people will try to create a night scene by just shooting in the dark.

This is probably one of the most common "postmortems" that I do, when folks bring me their videos and ask what went wrong. The producer of an independent short brought me some raw camera footage to review a scene his crew had shot out in a field at night with a Sony VX-1000 (Figure 1.3), the first popular DV camcorder—and one that was notorious for its poor low-light performance. They had (almost) all the right equipment, but they really had no idea how to use it, and the result was dreadful. They'd shot in a field with no easily available power, so they brought a small generator and several lights. Unfortunately, they didn't bring enough "stingers" (extension cords), so when they got the generator far away enough that it wouldn't interfere with the audio, they couldn't get the lights very close to the subjects. Then, rather than concentrating the light all on one side (which might have just barely worked), they distributed them around to create a flood of weak, flat lighting. Then they turned on the AUTO EXPOSURE control on the VX1000—a true beginner's mistake. Since the VX1000 was very poor at low

FIGURE 1.2
The Sony VX1000 revolutionized digital moviemaking, but had very poor low-light characteristics.

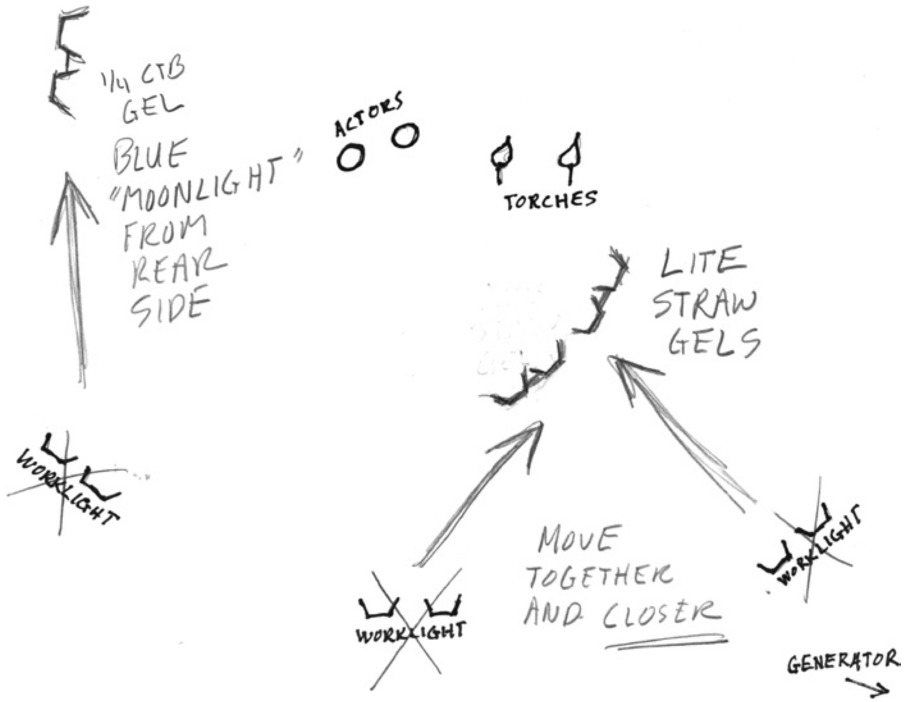

FIGURE 1.3
Lighting diagram for the VX1000 night shoot.

light situations to begin with, the AUTO circuits kicked in full gain to try and make the scene look like a fully lit room, rather than a dark night scene. With the gain all the way up to +18 db, the result was a flat, grainy picture that looked like surveillance video. The one thing it didn't look like was a night scene. "What can we *do*?" wailed the producer, who had now wasted a whole day on this scene.

I drew a diagram, using the same lights they had used but lots more stingers to bring the lights closer to the subjects. I put most of the lights in a group on one side with ¼ blue gels. I used one ungelled light as a kicker from the rear on the other side, leaving the camera side unlit. Then I showed their young shooter how to expose manually. The results were pretty good, giving a feeling of a moonlit night. I think they even gave me a credit in the roll!

But just as you must have *enough* light, *too much* light or *too much contrast* can be a problem as well. If a backlight is too intense compared to the key, the highlights will be "hot"—over the electronic definition for full white—and may "clip" so that there is no detail in that area of picture. If the camera operator stops down to expose for the backlight, then the rest of the subject will be underexposed and the picture will seem too contrasty.

Overexposing causes worse problems than underexposure because sometimes the result can't be repaired. There's a local station where I live (whose call letters shall remain anonymous) where nearly all the location news footage is grossly overexposed. I don't mean a little bit, I mean *grossly*. Large portions of the picture are clipped white, and the dark areas are medium gray. When they interview a person of color, it's not uncommon for the person to look almost Caucasian. When they interview a Caucasian, the face is a white blob with little detail. The studio (though I don't like the lighting aesthetically) is at least properly exposed, accentuating the difference in the location footage.

But once you have a basic level of exposure, what do you do with it? It's fairly easy to blast several thousand watts on a scene so that it gets the electrons in the camera hopping, and then stop down until the viewfinder's zebra indicator goes away and you're not overexposed. But it's much harder to find the nuances that will really convince the viewer's eye and mind of texture, feeling, and mood. This is where the acceptable gets separated from the great.

FIGURE 1.4
Sam Waterston, Steven Hill, and Angie Harmon in *Law and Order*, one of the best-lit dramas on television. Photo courtesy of Jessica Burstein.

BEYOND BASIC EXPOSURE

Great lighting begins with the creation of an **illusion of depth**. Keep in mind that no matter how much television is a part of our lives, the TV screen is still just a flat piece of glass with flickering colored lights. Although it has height and width, a television screen is fundamentally two-dimensional: it has no *depth*. No amount of great acting or wonderful music will create that illusion of the third dimension; it's entirely up to the lighting designer to create the feeling of depth. This is done through careful crafting of highlights and shadows, the visual cues that the brain uses to interpret depth. In fine art, the use of light and shadow to create a sense of depth is known as **chiaroscuro.** Together with the refinement of perspective, it is an essential element of great Renaissance art (Figure 1.5).

Most local news studios, talk shows, and soap opera sets are *flat lit* with loads of light and almost complete elimination of shadows. This is done for convenience and economy. The result is a very flat, two-dimensional feeling. The eye doesn't find the cues that help the brain interpret depth, so it's hard to figure out how deep the set is and how far the anchors (or actors) are from one another. We're used to the look from seeing the evening news regularly, so it doesn't bother us, but boy does it telegraph "LOCAL NEWS" to the viewer. Use that lighting scheme for a drama, and it just won't work.

FIGURE 1.5
This chiaroscuro woodcut of *The Virgin and Child* by Bartolomeo Coriolano, created between 1630 and 1655, uses light and dark lines to create the impression of dimension.

Contrast this to the realistic lighting used in many TV dramas of the last two decades, such as Dick Wolf's *Law and Order* or Aaron Sorkin's *West Wing*. These shows make very heavy use of light and shadow, often lighting close-up subjects heavily from one side with a large, diffused lighting source and leaving the other side in near darkness. The standards for television drama lighting have increased dramatically in recent years. Despite intense production schedules, the production teams on these shows work hard on their lighting to convey the feeling of depth and dimension. Light patterns on walls, mixed-color temperatures, and shadows all create a feeling of the depth of the scene—but also clearly cue the viewer as to an off-screen light source that is appropriate to the set.

While some of these shows write new rules for lighting, most films and dramatic programs borrow heavily from what I call the **Hollywood visual vernacular,** the peculiar set of visual cheats and shortcuts that have developed over the last hundred years of filmmaking. *Vernacular*, of course just refers to "common language." These tricks are part and parcel of the common visual language of movies. Many of these aren't very realistic at all, but are a type of visual shorthand that we have been indoctrinated to by years of watching Hollywood films. It's important to have a sense of these cheats and what they are associated with in the minds of viewers. Why? Because they *work*. They are much like the tried-and-true cheats of the theatre, techniques that work, techniques that the audiences are *used to* and *accept* without question.

In the live theatre, there's an expression that's quite important: "suspension of disbelief." The phrase, which originates with Coleridge* (he was talking about poetry), has come to mean the state in which the audience is fully engaged in the illusion of the drama. In practice, it is a balance whereby the actors, director, and crew use techniques and conventions to create a certain semblance of reality—and then the audience meets them halfway by "suspending disbelief" in the patent fakery. It's a delicate balance, easily broken; the audience will only go so far. If an actor drops out of character or does something utterly incongruent, the spell will be broken. The audience's attention will be focused on the fact that this is an actor *pretending* to be Romeo, not Romeo himself. If the tech crew makes a gross mistake (the phone rings long after it has been answered or the gunshot sounds before the policeman has gotten the pistol out of his holster), so too the spell will be broken. The audience will go so far, but no farther.

But those tried-and-true "cheats" that I mentioned above are, in a way, a part of the unconscious contract between audience and play actors. They are a set of conventions everyone accepts more or less willingly, cheats that the audience will accept, obvious artifices that still will not break the all-important suspension of disbelief. That's what the Hollywood visual vernacular is about—artificial devices that work without interrupting or unduly jostling the audience's suspension of disbelief.

A great example of "stock" Hollywood vernacular lighting occurs in one of Elvis's films, *G. I. Blues*. It's a bedroom scene where he sings a lullaby to Marla's baby. This room was lit pretty much in Hollywood formula fashion, effective, but certainly not breaking any new ground in lighting design. The bed and Elvis are intensely lit with thousands of watts of studio lights, while the rest of the bedroom is broken into a pattern with several blue-gelled lights with cookies. I think I even recognize the pattern of the standard Mole-Richardson cookie! This broken pattern of blue light on the walls is Hollywood code for "this is nighttime." The light level in the room is actually quite excessive for what the scene portrays, and it really doesn't actually look like any dimly lit real bedroom I've ever seen. *But with the exception of directors of photography (DPs), lighting designers, and gaffers, no one notices!* Most viewers accept the scene without question, their "suspension of disbelief" fully engaged.

*Samuel Taylor Coleridge, *Biographia Literaria* (1817), Chapter 14.

FIGURE 1.6
Filmmaker Elyse Couvillion and DP Allen Daviau ASC used light to help convey the storyline to the viewer in the independent short *Sweet.* Photo courtesy of Bruce Coughran.

As unrealistic as some of these tricks are, they are effective. The viewer will watch the scene and accept the effect and the mood without question. While it may be exciting to rewrite the rule book and create new techniques that speak to the viewer, let's face it: it's not always going to work. Sometimes it will; other times, it will flop or call such self-conscious attention to itself that it disrupts the viewer's involvement in the story. But even more to the point, most of the time you don't have the luxuries of either time or budget to mess around and experiment. It's often more effective (and realistic) to simply use the old rulebook to convey the right effect.

The real key here is to communicate the proper **mood and feeling** to the viewer. I'm always a bit bothered by the folks who seem to feel that filmmaking is some kind of personal experience that they are allowing the audience to witness. As far as I'm concerned, the art is in *creating an experience that communicates to the viewer*. If you fail to connect to the viewer, if you are so completely about your own experience or vision that you don't consciously accommodate the perceptions of the viewer, your art will likely flop. Lighting that calls attention to itself, that sets the wrong mood, or focuses the eye on the wrong part of the picture is lighting that has failed. It's like a soundtrack that uses obviously artificial sound effects, or an actor that makes the viewer turn to their neighbor and say "What wonderful acting!" Truly wonderful acting immerses the viewer so much in the character and the story that the viewer would never think to make such a comment.

Whether you use a hackneyed Hollywood trick to create that mood or come up with a new and creative technique of your own, the important point is to create an illusion that will fool the eye—or rather the mind—of the viewer. Great lighting, like great music, will reinforce the emotional or psychological impact of what is happening onscreen.

Suppose for a minute a scene of tension in which the main character is hiding in a darkened room when suddenly the door slams open and a mysterious new player enters the scene. We don't know who he is or what his intentions are; he might be an axe murderer or he might be the good guy. It could be effective to use a strong dramatic backlight, silhouetting the new player in the doorway. A bit of mist floating around makes the light beams visible, creating a sort of nimbus around the silhouetted figure. Tie this in with a dramatic chord in the background music, possibly a dolly forward, and you've got a great scene that will have the audience on edge.

Now imagine a very different scene: the first kiss of a teenage couple. Unsure of themselves, that spark has crossed like an electric shock between them as their eyes met; both move tentatively toward one another, hesitant, sensitive to any cue of withdrawal or rejection. Now apply the same lighting, the same music, the same dolly move. Yuck.

While I suppose that I can stretch my imagination to find a spikey, edgy storyline with tense characters where it *might* work, it's really not too likely. You want soft lighting; you want the rest of the scene to fade away a bit to convey the way that the young lovers' attention has collapsed until only the two of them exist.

Now, these may seem to be extreme examples, and in fact they are. The extreme example is there to make a point. You need to decide what feeling you are trying to convey, and you also need to have an understanding of how certain looks will communicate to the viewers. We are all trained by a hundred years of movies into certain perceptions. You need to think out how to create that feeling, that sense of place, mood, or circumstance before you even set up the first light. With a little practice, some tricks and techniques, and an understanding of how all this works, you'll be able to set up the proper mood quickly and with only a few instruments.

Of course, there is room for experimentation, for new effects, for lighting that breaks the rules and makes the audience uncomfortable without understanding why—rather like Hitchcock's combination of zooming in and dollying out at the same time, which created a creepy feeling that most people couldn't put their fingers on. But my message to ambitious students especially is this: *you have to learn how to do it by the rules before you can know how to break the rules!*

In the next chapters, we're going to walk through the basics, the tricks, and the techniques so that we can get to the ultimate point of the book, the creative artistry of truly fine lighting. This will give you the foundation from which you can springboard—perhaps into new lighting visions that no one else has tried!

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CHAPTER 2

Human Vision, the Camera, and Exposure

WHAT YOU SEE

The human eye is a truly astounding piece of biological engineering. It is able to pick up images both in near-darkness and in blazing sunlight. Overall, the human eye can perceive light in a range light to darkness of almost a billion to one. Unfortunately, when shooting video or film, the critical visual receptor is not your eye but the camera. And the camera perceives light differently from your eye and in a much more restricted range. The differences in this perception are critical to your understanding of how to light and expose video or film, because the camera simply can't see the extended range of light the way the human eye can.

Bear with me for a moment while we take a look at the whole system of human vision and how it differs from the camera. Light in certain wavelengths is reflected off of objects; some of this reflected light finds its way into the eye. There, the light beams are focused on a multilayered receptor called the retina, where 125 million rods and 6 million cones translate the photons into neural impulses. The rods, spread all around the retina, are responsible for dim light and peripheral perception and really do not perceive color. The cones, which are concentrated in a central area called the macula, are responsible for color perception and see in the most detail. They require a higher light level to perceive color and detail.

But the eye is not the most amazing instrument of vision; that really is the human brain—the place where the neural impulses from rods and cones in the back of the eye are assembled and interpreted. What we glibly call "vision" is an incredibly complex event that involves the entire brain and is much more than sight. There are at least 32 centers for visual processing distributed throughout the brain. And the visual experience we normally have every waking minute is a multilayered integration of two different sets of peripheral

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vision and the detailed vision of the macula, the concentration of cones near the center of the retina. The neural impulses from these two sets of rods and cones are transmitted to the brain, where they are integrated and interpreted to assemble an understanding of the objects around us. When you think this process through, this is the part that is truly amazing. The brain keeps track of position, motion, and orientation, and integrates the signals from two separate receptors to perceive depth. With the merest glance and without conscious thought, you know that the variation in reflected light is a pencil on the table, and that it is about two feet away from you. Again without conscious thought, you could reach over and pick it up—without even looking at it directly. It's really pretty amazing.

The brain uses a huge variety of very subtle details and cues to interpret and understand what the eyes are registering. And because of this, the brain is quite forgiving. It can utilize existing knowledge to fill in blanks that are poorly perceived; through depth perception and slight motion, the brain can piece together what an object is even when it is just on the edge of visibility. Slight motions of the head and eyes apparently play a huge role in supplying the brain with enough data to accurately interpret the world "out there," outside of ourselves.

This is actually quite important for our topic of study because when we translate that complex, 3D world of trees and rocks and dust bunnies under beds into a two-dimensional representation, the brain suddenly loses several of the subtle cues that it uses to interpret the world. In particular, we find that it does not fill in blanks or vague areas in the same way. So whether the two-dimensional representation is a television screen or a photographic print or a line drawing, the creator of the representation must compensate for what is missing. In short, the representation needs to be better drawn and more carefully created than the reality would have to be. The important elements must be clear and well defined. Sometimes it is effective even to blur out nonessential elements to help focus the eye (and the mind) on what is essential.

Watching a two-dimensional image, the brain loses several of the subtle cues that it uses to interpret the world.

Let me give an example of what I'm talking about here. Suppose you're sitting in a dimly lit room you are unfamiliar with. Something in the corner catches your eye; you can't quite tell what it is. So you'll move your head a little bit, giving the brain extra data about the dimly perceived object; you may squint or shield your eyes from the light source to allow you a little better dim light perception. The little bit of extra information gained from this movement may allow you to figure out what the object is. If it's not enough, you always have the option of getting up and walking over there, or of turning on another light. And if that fails, you can still *touch* the object to find out more about it!

WHAT THE AUDIENCE SEES

When you are composing a television picture, remember that your viewer has lost all those subtle controls to enhance perception. Moving the head a little won't give them additional information, since they are looking at a flat piece of glass with flickering colored lights projected on the rear. Squinting won't help. Getting up and getting closer may only reveal that the picture is actually red, green, and blue pixels. Turning on an extra light won't help, and touch will only reveal a cold, smooth surface.

The appearance of depth and texture in a television picture is entirely artificial. The only perception of depth that the viewer has in your picture is controlled by lighting and camera motion. The only way the viewer can perceive the texture of an object is through the subtle pattern of reflections, highlights, and shadows on the object's surface. Poorly lit objects may be overlooked altogether or become indecipherable blobs, even if they are clearly perceptible in actual reality. Richly textured surfaces recede into bland obscurity unless they are lit in a manner that makes the texture visible to the viewer. In creating pictures, you must be aware of how much control the viewer has lost and you, the image creator, have gained.

Add to this the fact that people are much more forgiving of reality than they are of a two-dimensional image of the same thing. If you have the opportunity of videotaping in a church or synagogue, you'll often find a perfect example of this. Most of these buildings are very poorly lit for video, and it's not uncommon to have lights shining down on the clergy person from a very high angle. The eyes are cast into shadow, glasses cast odd shapes on the cheeks, the nose casts a horrific shadow that extends over mouth and chin. Week after week, the congregation will watch the clergy person teach or read in this horrible lighting, and won't mind it a bit. They overlook the odd shadows; they don't really notice them even if their attention is called to them. Now take a videotape of the same situation and show it on a television. Right away, the same people will complain about the ugly shadows.

Realistic lighting is often not good enough for video and television!

Part of this phenomenon is in fact that the camera does exaggerate the contrast between shadow and highlight—more on that in a minute. But the part of this phenomenon I want to emphasize here is that the viewer is more demanding and critical of the two-dimensional, flickering picture. The loss of extra perceptual cues and personal control means that the brain cannot do the hoop-jumping tricks it often does to "see" through perceptual problems. What you see is what you've got. So here's a rule to engrave on your forehead: *Realistic lighting is often not good enough for video and television!*

And that's aside from the contrast issues that we now have to tackle. Remember that you have to be supplying the viewers' brains with all the visual cues they need to figure out depth and texture as well as color and placement; you also have to do it in a somewhat blunt and unequivocal way.

Add to this the very real problem that the camera doesn't see as wide a range of brightness as the eye, and the issue gets more complex. What you see with your eye isn't exactly what you are going to get. The contrast range that the camera can handle is likely to be less than a quarter of the range that the eye can perceive. The range of brightness that a camera (or film stock) can expose is known as **latitude**.

To understand this, let me go back to my earlier assertion that the eye can perceive a range of a billion to one. Actually, that wasn't quite true, since it cannot perceive the darkest object and the lightest object in that range at the same time; and it cannot perceive all light levels equally well. The eye has a number of adaptations that allow it to perceive a contrast range of between 2000:1 and 1000:1 at any given time. Changes in pupil diameter work just like the iris in a camera to physically restrict the amount of light that is admitted to the retina. Neural adaptation actually changes the activity of the neurons in the optic nerve. And there is a fundamental photochemical shift that actually gives the eye two discrete ranges of light perception.

We're all familiar with this photochemical shift. When you leave a brightly lit area and enter a darkened room, you can't see very well at first. Then, gradually, your eyes "adjust" to the lower light level, and you can begin to perceive detail in what moments earlier seemed like Stygian darkness. After a while, you can see pretty well. What has happened is much more than the change of iris size or neuron activity. In darkness, the retina regenerates a chemical called rhodopsin, which is bleached out by bright light. This chemical allows the rods in the retina to perform at much lower light levels. The entire chemical shift will typically take about seven to eight minutes, with low-light sensitivity increasing during the entire period. Of course, once the rhodopsin has reached full level, your eyes are very light sensitive, and going back out into the sunshine will be a blinding experience—until the rhodopsin is bleached out and your retina chemically "adjusts" to high-light-level mode. So the eye really can't perceive that huge range all at once, but it has an amazing ability to adjust to a wide range of lighting levels.

Note Contrast range isn't the only thing the eye does vastly better than video or film. According to most estimates, the average human eye is the equivalent of a CCD 11,000 pixels by 11,000 pixels, with pixels only 2 microns in size. That's an equivalent of about 120 megapixels—talk about "hi definition!" The best 35-mm film frame is reputed to be 3000 pixels × 3000 pixels on the best day. A standard definition ITUR-B 601 video frame is 720 × 486, or 0.35 megapixel. Full HD is 1920 × 1080, just over 2 megapixels.

This means that one of your eyes registers a picture that is about 350 times as detailed as a standard definition television picture and about 60 times as detailed as a high definition picture, with a contrast range that is six to eight times larger.

I can hear the griping now: "that's more than I ever wanted to know about eyes." "What's all this got to do with cameras and lighting and taping the evening news or a dramatic love scene?" Quite a lot, actually, because the most common basic mistake made in television and video lighting is to *assume that the camera is going to react to a scene the same as the eye*. It just ain't so, and if you don't grasp the huge difference between your camera and your eye, your lighting will never look right.

The eye is so adaptive to different light levels that we almost don't notice subtle changes in light. In fact, it's generally accepted that the light level must halve or double before it will represent a noticeable change to the human eye. That's quite a change! In fact, it is that "halving" that is behind the designation of **F-stops** on a lens. Each progressively higher stop number halves the amount of light passing through the lens and hitting the objective.

Even after you understand the subtle complexities of how human vision differs from the picture on a screen, it's essential to understand the dramatic differences in dynamic range as well. *Dynamic range* is the zone in which an instrument can operate effectively. In audio, it's the softest sound the microphone can register (above the noise floor) up to the loudest sound it can register without distortion. In video, it's the lowest reflected light that can register detail up to the highest level of reflected light that can register detail before turning to solid, blown-out white. The ratio between these two light levels is known as the **contrast ratio**.

Even if we assume conservatively that the eye can perceive a contrast ratio of 1000:1, this is still way beyond the limits of either film or video. Most film stocks can achieve contrast ratios of 250:1, and some manufacturers today are claiming 500:1 on their latest, best film stock. But remember that this is an ideal on the camera original; you'll never get a distribution print with that range! Video cameras haven't reached that far yet. A good prosumer camera like the Sony

Exposure in video cameras is measured by the F-stop. This is a measure of the exposure factor (hence the "F") of the lens and iris opening. F-stops are calibrated from the aperture of the iris; *f*/1.4 on most lenses is wide open, *f*/2 is one-half the area, *f*/2.8 is one-half the area of *f*/2, and so on.

Some lenses (usually for film) will also be marked in T-stops. T-stops will be marked in red, while F-stops will be marked in white. T-stops are actually calibrated to the measured amount of light falling on the film or CCD rather than from the area of iris opening.

It is generally accepted that the super-flexible human eye does not notice a significant change in light levels, much less than halving or doubling; that's why the system is set up the way it is.

F-Stop	Ratio
f/1.4	1:1
f/2.0	2:1
f/2.8	4:1
f/4.0	8:1
f/5.6	16:1
f/8.0	32:1
f/11	64:1
f/16	128:1

DSR-PD170 or the popular Canon GL2 may be able to reach 6 stops, or 64:1. Hi-end pro camcorders like the Sony CineAlta can hit 7 stops, or 128:1 in testing. The actual range may be much less than this in real-world situations. The new Red camera claims a fantastical 14 stops, or 16500:1—though how much of that is really usable in the real world is debatable. Out here in the irritating zone of reality, most DPs will be quick to point out that the practical usable dynamic range of any camera is dramatically less than its theoretical capacity.

Good video cameras are now performing at a contrast range similar to that of many film stocks. Much of the popular idea that "film is always better than video" is simply outdated, received wisdom from an earlier era when even broadcast TV cameras only achieved contrast ratios of 30:1. Much of that assumed gap in performance has eroded and now is nearly gone. George Spiro Dibie, six-time Emmy Award–winning Hollywood DP, says that today he can "light for my video cameras exactly the way I light for film cameras."

By the time you read this book, the latest great thing may be doing much better—but I seriously doubt that the best film stock or state-of-the-art HD camcorder custom made for George Lucas will be up to the amazing performance of the eye—partially because it is not backed up by the fantastic flexibility of the interpretive human brain.

I hope you didn't just quickly skim over those last paragraphs! Look at those figures again, comparing the human eye to a Canon prosumer unit. The likelihood is that your camcorder has a usable contrast range that is less than one-tenth that of your eye! Look at the chart in Figure 2.1 that approximates a comparison.

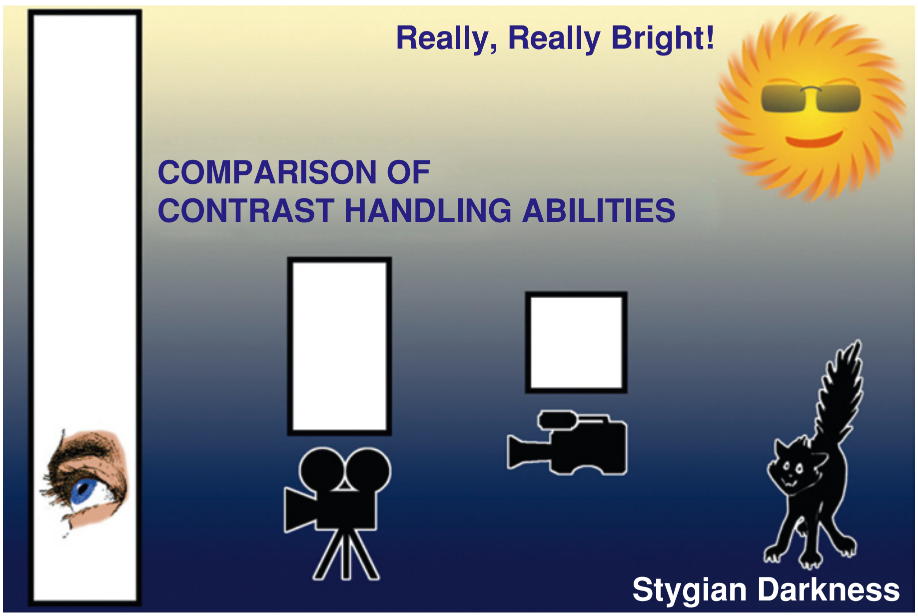

FIGURE 2.1
Comparing the relative contrast handling of the eye, film, and video.

Bear in mind that changing the exposure by opening or closing the iris doesn't expand this range at all; it just moves the "window" up and down the scale.

This issue is incredibly important if you are to do really fine lighting. It is essential that you understand how limited the contrast range of your camera is and that you learn to judge the effect of your lighting by watching the monitor. Experience will enable you to "eyeball" lighting better, but even the most experienced DP will always check the effect on the monitor because it is there that you will be "seeing" through the camera rather than your baby blues.

FITTING IN THE WINDOW

Understanding that your camera can "see" only a limited slice of what your eye can perceive and your brain interpret, we can think of this slice as if it were a window—a well-defined window of contrast range within which the camera can produce a good image. This is an incredibly important and fundamental idea for practical lighting. The size of the window doesn't change for a given camera, though we can adjust external factors (amount of light on scene, amount of fill light in shadowed areas) and internal factors (camera exposure, including iris, gain, and accessories like filters) to match the window to the scene as closely as possible. The final image created in the camera is a combination of both these internal and external factors.

Take a look at Figure 2.2, which is a graphic representation of this "window" idea. Out of the normal range of lighting levels (measured in **lux** or **footcandles**) the camera can effectively "see" (or reproduce) only a limited slice that falls within that window. Whatever light level is at the bottom of that window will be reproduced as pure black, and whatever is at the top of the window will be reproduced as pure white—no matter what your eye can see on the set! The particular position of the window is determined by camera filters (which limits light entering the lens), the camera iris (which limits the amount of light passing through the lens), and the camera's internal gain setting (which is used to artificially boost the signal coming from the imaging chips in very dark situations).

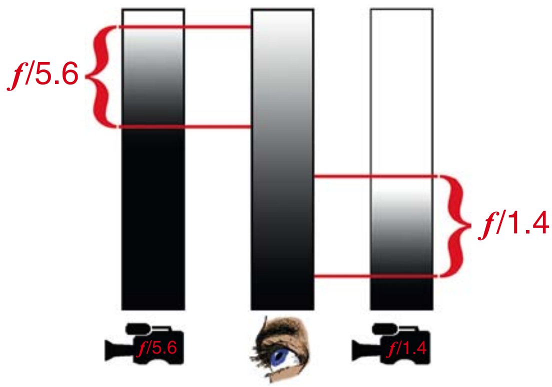

FIGURE 2.2
Opening or closing the lens does not expand the exposure range, it simply selects a different "slice" of the visible light range.

If the iris is set at *f*/1.4 (wide open) to admit the most light for a dimly lit scene, the camera will reproduce a fairly low light level—say 25 lux—as pure white. Anything lit brighter than that will appear to be the same pure white. If the iris is set to a middle range such as *f*/5.6, then the window of the camera's ability to "see" moves up the scale, and something illuminated at the same 25 lux would appear to be pure black, while a portion of the scene illuminated at 300 lux would be reproduced as pure, untinted white. If we close down the iris even more to *f*/16 (which is a tiny pinhole, almost closed) for a very bright situation such as exterior daylight, the same window will move up to the brighter part of the illumination scale. At this setting, portions of the scene that seem quite brightly lit to the eye—perhaps at 500 lux—will appear as black in the camera, while items in direct sunlight at 3000 lux will appear as pure white.

So it should be clear that the video camera needs a restricted or compressed range of lighting to reproduce a picture that accurately simulates what we would perceive with our eyes and nimble brain. There are essentially only two basic ways to do this: to control or limit the light on highly lit areas to prevent them from overexposing, and to shine extra light into dark shadowed areas to prevent them from underexposing. Actually, in most situations, we will need to do both to create the compressed lighting that will create the best video image.

SO WHAT HAPPENS IF WE DON'T?

If we don't—or can't—control the lighting in a scene, it is inevitable that portions of the scene will be overexposed and others underexposed. The picture will appear too contrasty. This is often the case with video shot outdoors in full sunlight. The camera operator exposes either for the bright sky, which will then make everything on the ground too dark, or for the foreground objects, which will cause the sky to "blow out " or overexpose.

Take a look at the images in Figure 2.3. The image on the left is exposed for the sky, and the subject in the foreground is completely underexposed. If we open the iris to expose for the foreground subject (center), the bright sky in the background becomes totally blown out. The image on the right has had light added to the foreground subject using a reflector to bring her into the same "window" of exposure as the sky—with the result that both sky and foreground can be properly exposed together.

But creating a fine picture is more than just wrestling the lightest point and darkest points into the usage exposure range of the camera. We also then have to create a pleasing distribution of tones between light and dark!

FIGURE 2.3
Exposed for the sky; exposed for foreground without fill light; fill light added to equalize exposure between foreground and background.

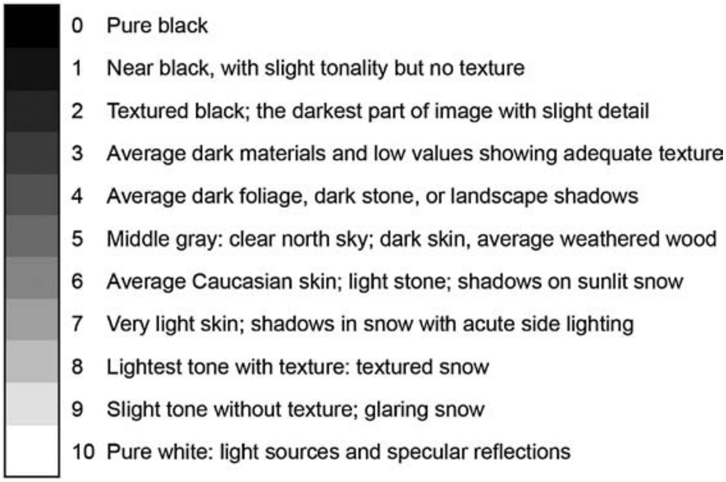

FIGURE 2.4
The Ansel Adams Zone system was devised for black and white negative photography, but is helpful in understanding exposure issues for video and motion pictures as well.

Film DPs and still film photographers are familiar with the zone system of exposure originated by Ansel Adams (see Figure 2.4). The zone system breaks the gray scale into ten zones ranging from 0 (solid black) to 9 (fully exposed white, no detail). In a properly exposed picture, values need to be distributed between zones 1–8. Adams tried to make sure that some portion of the picture fell into each zone, thus guaranteeing a full tonal scale in the picture. This is a good rule of thumb for most video pictures as well and will create a full rich tonal range—unless, of course we are intentionally going for a contrasty look as in *film noire*.

Fortunately, we have a number of tools to help us measure both the "window" we've discussed and the zones inside the window. To understand how these tools work and how to use them, we need to understand at least the basics of the video signal.

INSIDE THE LEGAL VIDEO SIGNAL

Okay, here come the video police! Actually, it's not far from it if you intend your video for broadcast or indeed for any serious distribution. *Legal video* refers to video that adheres to the accepted standards for the **National Television Standards Committee** (NTSC) or the **Phase Alternating Line** (PAL) signal in standard definition, and the accepted standards for 720p, 1080i, or 1080p in HD. It is precisely at this point where, in some of my workshops, I can actually see eyes glazing and people zoning out as I delve enthusiastically into the arcane dark world of the video signal.

So let's skip the techno-geek discussion and go directly to a basic understandable layperson's explanation of what all the technical gobbledygook means. If you want a deeper (read "geekier") explanation, check out Appendix 2 on Signal Monitoring.

The video signal is a complex engineered system that has extremely specific standards, rules, and limits. You don't actually have to know all of these to create fine video, but you need to have a vague idea of what the outside limits are and how to play inside them. In other words, you have to know how to literally color inside the lines!

Once the light from your image has gone through the lens and hit the imaging chips, the light levels for each color—Red, Green, Blue—are converted into an analog voltage level. In all newer cameras, this analog voltage is then converted into a digital value, usually from 0 to 255 for 8-bit systems.* However, the voltage levels these chips and digital conversion circuits are designed to operate with are quite rigid and narrowly defined. Remember our "window?" Well, here the visual window gets translated into rigidly specified voltage levels and digital values. Exceed those limits, and the system just won't work right. A very bright light source in a scene can cause a CCD chip to actually leak overvoltage along a vertical row of sensors, causing an unavoidable artifact called a *cascade*. In the old days of plumbicon tube cameras, pointing the camera at a light source like that would cause a "burn" on the tube that persisted long afterward.

So, to keep our video legal, we need to operate within the design limits of both the video system and the camera's engineering. In other words, voltages inside the camera do not rise above a certain limit. Black levels fall in a certain voltage range. White levels do not exceed a specific voltage, and color content (chrominance) does not exceed specs. The "video police" are the engineers at the network or station who will look at your video on a waveform monitor and assess it for technical quality. You don't want to get "busted" by these folks; your video may be rejected. But there's good reason to observe the legal standards even if you're not aiming for broadcast. These limits are the ones for which all video equipment is designed. Ignoring the standards will inevitably result in a lower quality picture on playback, and even if you hope to create something for direct-to-DVD distribution, the distributor will demand a Quality Control Check (or QC) at a video lab as part of the distribution deal. You can have your distribution deal fall apart if your lighting and exposure technique has been sloppy.

NTSC video is something of a Frankenstein's monster, cobbled together at different times by different committees trying to do different things. PAL (the video standard many other countries use) is better in color handling, but still suffers from some compromises. And guess what? The standards for HD and DTV are simply digital versions derived from the same cobbled-up analog monstrosities, though admittedly they get rid of some of the worst of the old analog world and are much more streamlined for the user. Since DTV has finally arrived and we are leaving analog in the dust, let's not even bother with the details of analog—except as they have carried forward in the way we measure

*High-end cameras such as the Red operate on a 10-bit system, which allows a much broader scale of values between "black" and "white"; the internal use of the 10-bit Cineon log format for pictures allows a significantly expanded contrast ratio, though not nearly what their PR claims in practical use!

and test video signals. We still need to understand more about the upper and lower limits of the signal, and how our creative work in lighting and exposure can impact them.

These days, more people are computer-graphics literate than they are NTSC literate, so I find it easiest to start with computer graphics. If you've created or edited a picture in Photoshop or Adobe Elements or a shareware program like Paint Shop Pro or Pixara Twisted Brush, you've had the experience of selecting colors in an 8-bit RGB digital palette. You may not have paid a lot of attention to the details. But if you did, you noticed that the specific shade of chartreuse that you selected translated into a particular set of RGB digital values—say, the ugly shade of 127,255,0. This digital value represents that glaring green on a computer monitor by indicating 50% value for Red, 100% value for Green, and 0% value for Blue. By the way, this is not a color that would be legal for digital video!

If you're not familiar with how this works, stop for a moment and go to your computer and play around with setting colors in a paint program to see how this 8-bit RGB system works. It's very similar to how colors are represented inside your digital camera, though in a slightly smaller window. Figure 2.5 shows the range of values used in computer video next to the range used for digital video. While both systems use 8 bits to represent 255 levels for RGB, broadcast legal digital video maxes out at 235,235,235. In other words, in digital video pure white is a digital value that looks light gray when viewed on a computer. This allows a slight "headroom" above legal white so that a picture that is slightly overexposed will still contain detail, which could be scaled down to legal values in post. This also explains why frames of digital video "grabbed" and then displayed on a computer often look washed out—and why computer images used in video sometimes display as too "hot."

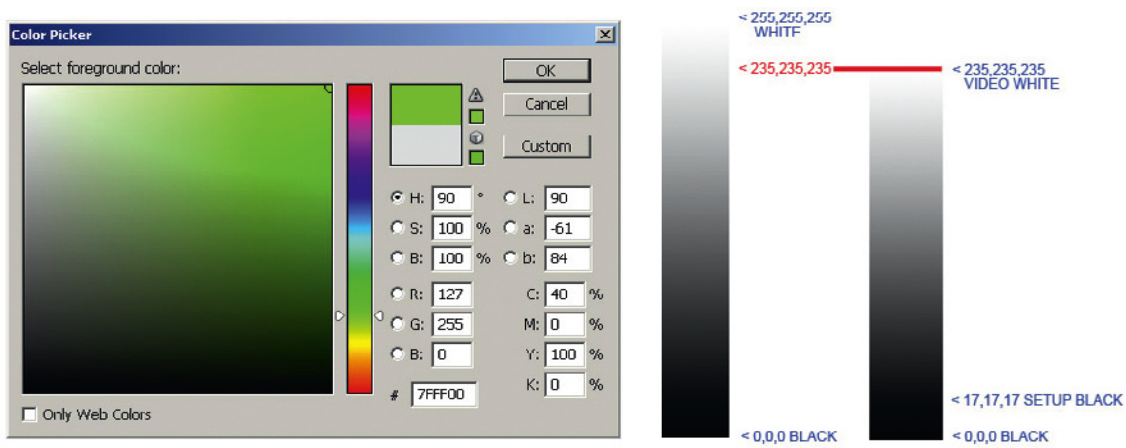

FIGURE 2.5
The familiar color picker from Adobe Photoshop allows the computer user to create colors by mixing any of 256 values for R. G, and B. This means "white" on the computer is 255,255,255. Digital video uses a slightly reduced range (right) that displays white as 235,235,235.

The video signal is measured on two devices, a **waveform monitor** and a **vectorscope**. In analog video days, these were both specialized, calibrated versions of the oscilloscope. Often, the two functions are combined in a single unit. Today's digital monitors measure the digital values we've discussed above, but still display the values in the same format inherited from the analog waveform monitors (Figure 2.6) and vectorscopes of the past. Most nonlinear editing programs (Adobe Premiere Pro, Apple Final Cut Pro, Sony Vegas) now include built-in signal monitors.

The analog waveform monitor basically measures the varying voltage of the signal across each scan line of the TV picture. This accurately equates to the signal *luminance*, or monochrome brightness. Figure 2.6 shows the trace of a waveform monitor showing SMPTE color bars; Figure 2.7 shows a waveform monitor (WFM) displaying a sample of well-exposed video. On the waveform monitor, the visual portion of the signal is measured from 0 to 100 units. This scale (traditionally known as **IRE**, after the Institute of Radio Engineers—now the Institute of Electrical and Electronic Engineers) measures the range from black to full white. Whoops, there's one little exception—a detail called **setup** or **pedestal**. In the United States and Canada and most other NTSC countries except Japan, black is not 0 but rather 7.5 units. This "setup" was added at the same time as color to prevent less than perfect picture elements from overshooting into the sync area of the analog signal.

However, digital video formats (including DV, HDV, and HD) uses 0 IRE, the Japanese standard for black level. Although this seems odd, it isn't. Digital formats generally use 0 IRE internally, with pro machines adding setup through a proc amp setting at the analog outputs. The oddity is that most prosumer DV camcorders and decks do not add setup at the analog outputs and display 0 IRE black, which means the picture on your editing setup may not look exactly as it will when properly broadcast and displayed—or when exported for DVD compression and playback.

At the top of the range, 100 IRE should represent pure white; internally, this will translate into 235,235,235 for digital formats. There is some headroom in the signal to allow for correction of overexposure in post. Older analog video formats could often display up to 120 IRE. However, digital formats will clip at 110 IRE, the maximum level defined in the digital formats; there are no numbers above 255,255,255! This is important for lighting design because it is essential to create a range of lighting (remember the limited contrast range of the camera?) that fits completely inside that compressed range. In other words, the hottest highlights in your pictures ought to just kiss the 100 IRE mark, while the deepest shadows should just descend to 7.5 IRE (0 IRE in digital), with most values falling somewhere in between. Figure 2.8 shows what you don't want: a scene with too broad a contrast range will produce clipped whites and crushed blacks. You don't want any of these "flat-line" areas at top or bottom!

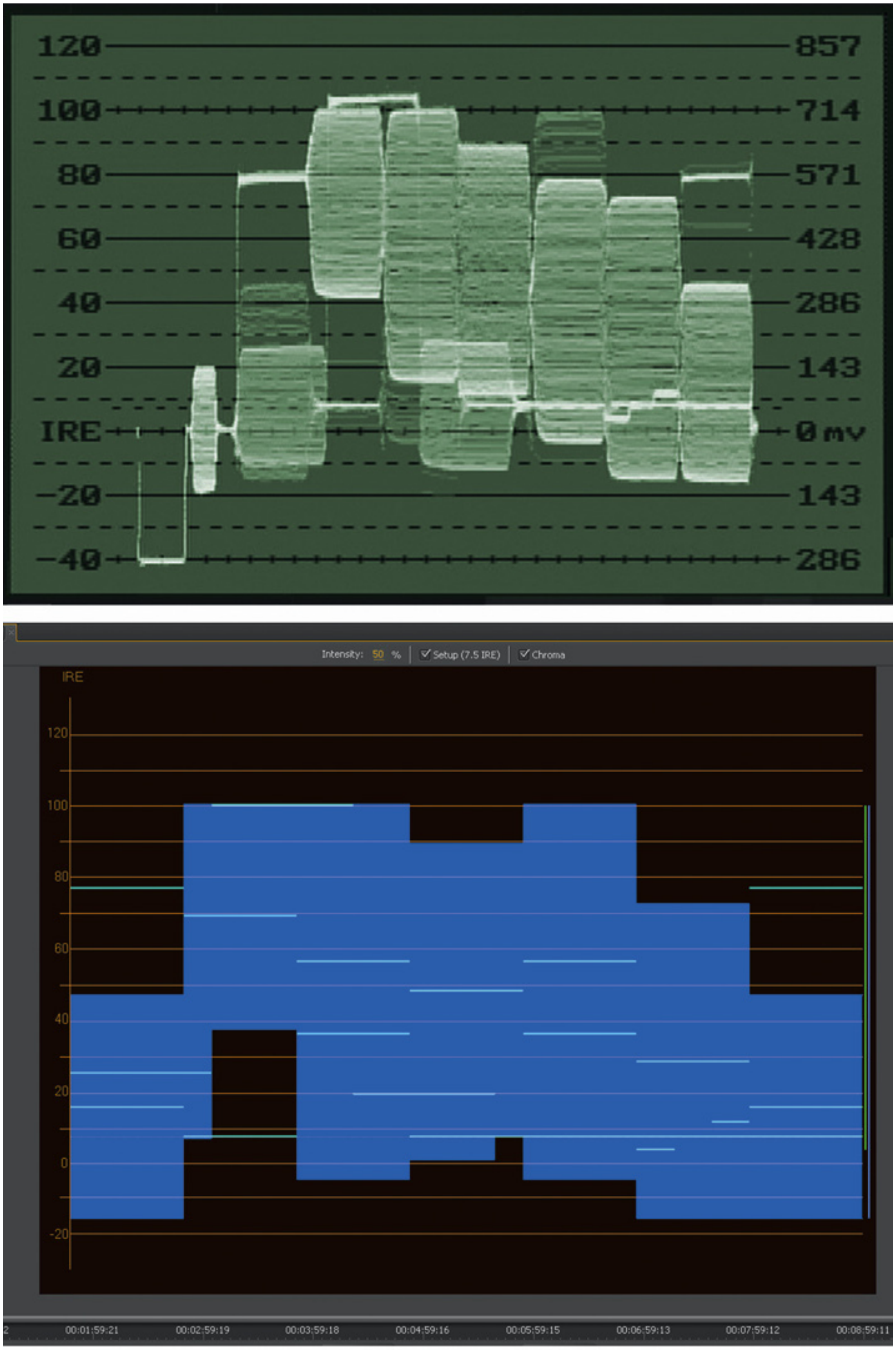

FIGURE 2.6
Analog (top) and digital (bottom) waveform monitors displaying standard Society of Motion Pictures and Television Engineers (SMPTE) color bars.

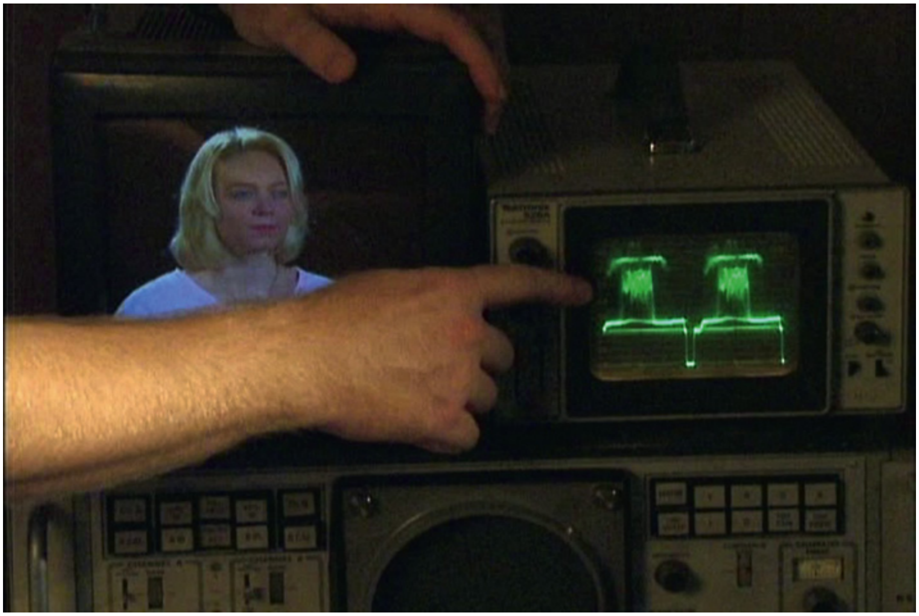

FIGURE 2.7
An analog waveform monitor displaying well-exposed video.

The vectorscope works quite differently from the waveform monitor. Color in composite analog video is defined by the *phase relationship* of the portions of the signal; and that is what the vectorscope displays. Digital vectorscopes have inherited the same display system, even though digital color works differently from analog phase color. You don't have to understand this, but it's a good idea to know what the display means. The phase of the signal is displayed by tracing *vectors* (hence the name "vectorscope") in different directions on the round display. In Figure 2.9, you'll see SMPTE color bars displayed on a vectorscope. The 75% saturation color chips draw peaks that fall within boxes known as *targets*. These are labeled (clockwise from top) Red, Magenta, Blue, Cyan, Green, and Yellow. The smaller target boxes labeled with lower-case letters are for the PAL system, which will display peaks in both boxes. You can tell that a video transmission is properly adjusted when these peaks fall in the targets of the vectorscope and the white and black levels display properly on the waveform monitor.

Reading a vectorscope is pretty simple, though for most folks it is confusing at first. It just takes a bit of getting used to. Remember that it displays color content only, *not brightness*. The more saturated (stronger) the color, the further from the center the vector trace. Washed-out, desaturated colors will be closer to the center. Any traces that go outside of the outer circle are overlimit and illegal. The one to watch most carefully is red, which will bleed terribly in analog displays. It's best to stay close to the 75% target with red, and not get too close to the outer perimeter.

The Difference between NTSC Video and Computer RGB This has absolutely nothing to do with lighting, but is an issue that comes up so much that it should be mentioned here. Since nearly all digital video will be edited on a computer, you need to be aware that there is an important difference between the digital video color space and the computer RGB color space. The 8-bit color space used by computers displays 0,0,0 as black and 255,255,255 as full-value white. This is not true of video, which uses only part of the 8-bit space. For either NTSC or PAL video, pure black is represented by the digital RGB value of 16,16,16. White is 235,235,235. These values when output to DV and displayed on a waveform monitor will register as 0 IRE and 100 IRE, respectively. Picture elements that are made up of RGB values lower than 16,16,16 will be illegal blacks; picture elements that are made up of RGB values higher than 235,235,235 will be overlimit whites.

To add to the confusion, bear in mind that while all digital video formats use 0 IRE for black, all NTSC televisions in America are designed to display 7.5 IRE as black. This "setup" or "pedestal" is not used in PAL countries or in Japan. However, when displaying DV playback on an analog monitor, if setup is not added the dark areas will appear too dark and dark colors too saturated. Fine color correction should only be undertaken on a properly adjusted NTSC monitor with setup added, or on a monitor that has a control to display 0 IRE black properly.

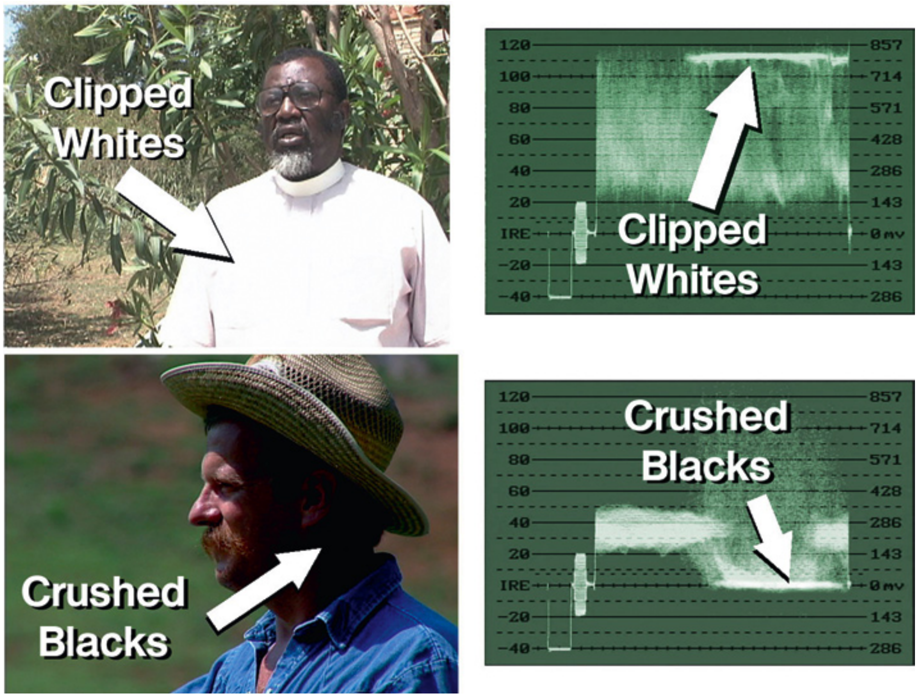

FIGURE 2.8
A waveform monitor indicating clipped whites and crushed blacks.

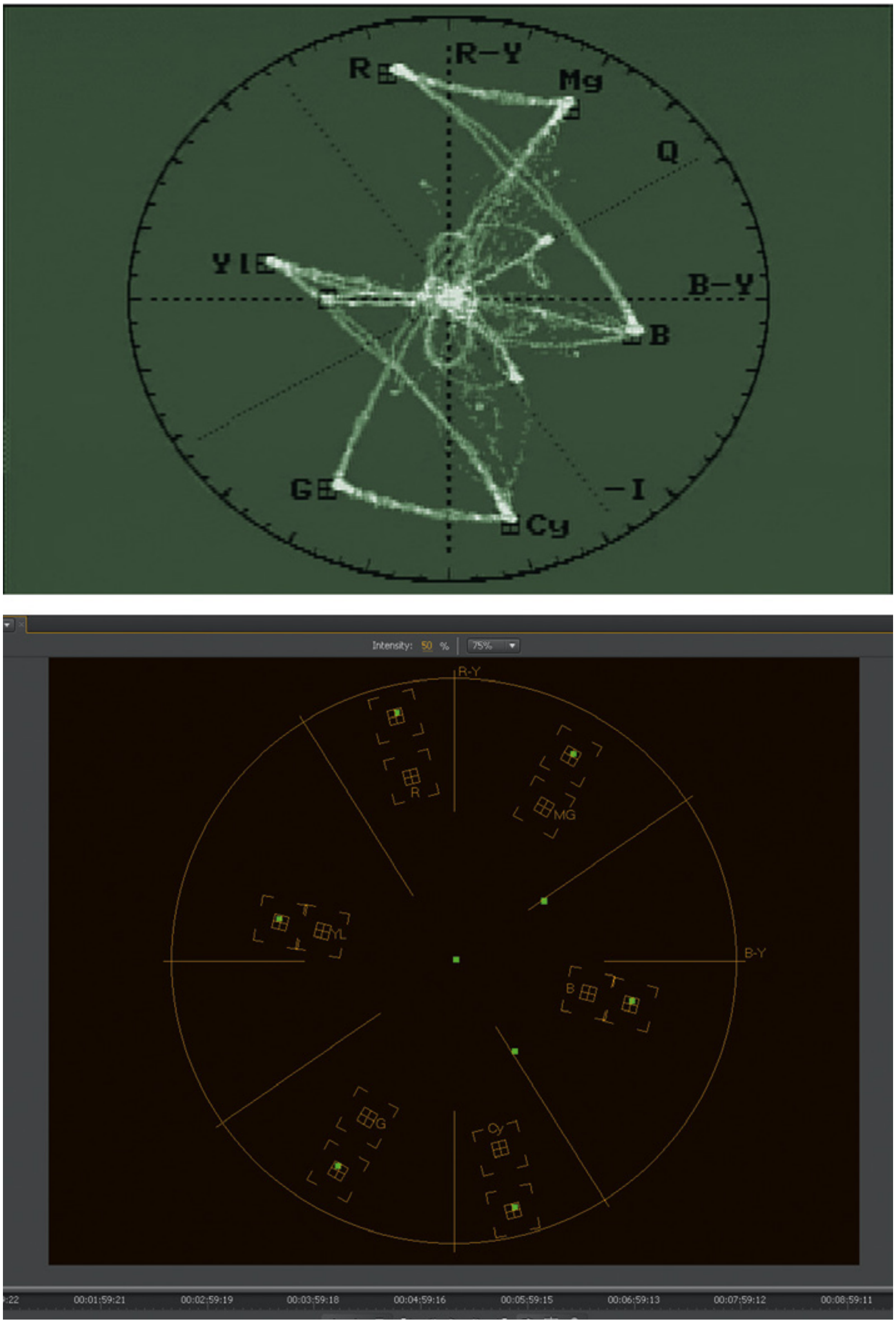

FIGURE 2.9
Analog and digital vectorscope displays of SMPTE color bars; compare to waveform display in Figure 2.6.

It's pretty rare for lighting to cause a problem with illegal colors. The two situations where you may need to watch the color content are when you are lighting a set with strong, saturated colors—the set of a children's show, for instance—or when you are using strong "party color" gels. Again, watch out for reds! Yellow can also be a problem. On the other hand, it's hard to get a blue so strong that it even approaches the limit. If you're in such a borderline situation and see that you've created an illegal color, the fix is fairly easy: either reduce the lighting level a bit (on a reflective surface) or toss in a little white light (with a strong colored light) to desaturate the color until the chroma reads legal.

For lighting, you don't really need to know much more than that! Leave the color burst and back porch measurements to the engineers. One of the great things about digital video is that we no longer have to worry about these obscure bits of the video signal; in analog days they were a great worry and deteriorated with each generation.

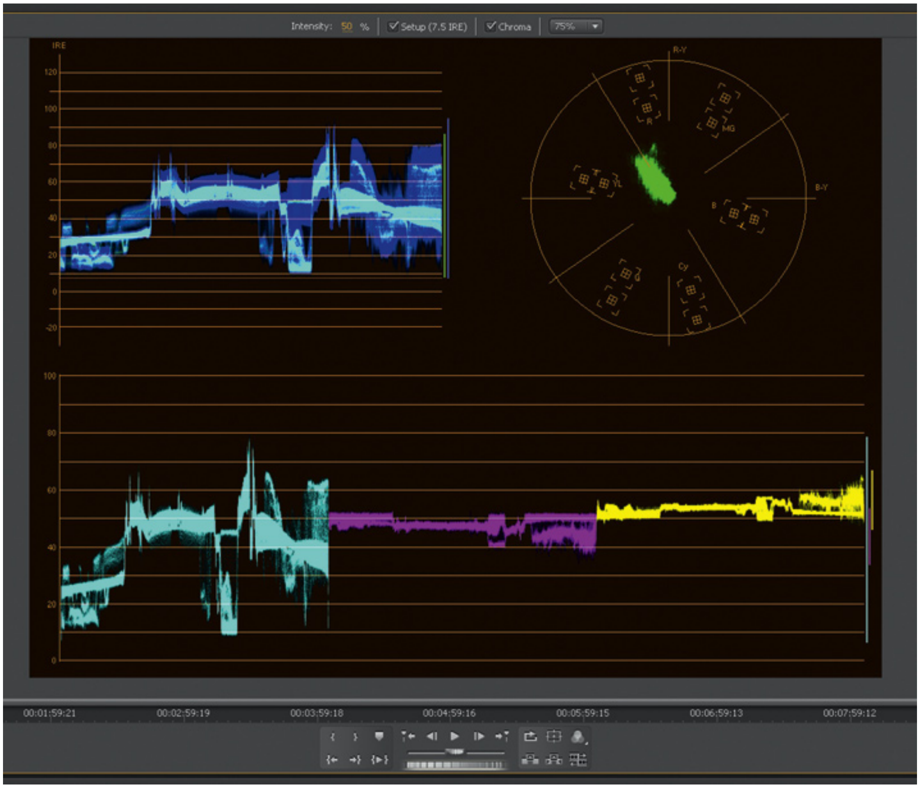

FIGURE 2.10
The built-in monitors in Adobe Premiere Pro 4.0 display a direct interpretation of the digital signal.

PROPER EXPOSURE

Before we get into the niceties of controlling contrast, we must first know how to expose the image properly in the camera, no matter what lighting level is "out there." This is how we choose where the camera's "window" will be in relationship to the available light in our scene. Film folks will be used to exposing entirely with a light meter. While you can do this for video, it is not really the recommended method. If you're a film DP who feels naked without a light meter on your belt, you can of course use the same techniques for video—with some minor modifications (see Appendix 1, Using a Light Meter for Video). A light meter and knowledge of how to use it can be quite helpful, but a meter is not a necessity for video work.

A meter is not necessary because the camera itself is a sophisticated light meter; after all, the video signal is a precise conversion of the level of light. The signal can be measured quite precisely using the **zebra display** (an exposure reading that displays in the camera viewfinder) and the waveform monitor we've already discussed. The zebra display is a feature on professional cameras (and on some "prosumer" cameras) that displays either black and white stripes or a crosshatch pattern in the viewfinder on portions of the image that exceed a certain level (see Figure 2.11). There are two types of zebra display: 100 IRE and 70–90 IRE. They work differently and are used for different applications. Some prosumer cameras have 100 IRE but may not have 70–90 IRE.

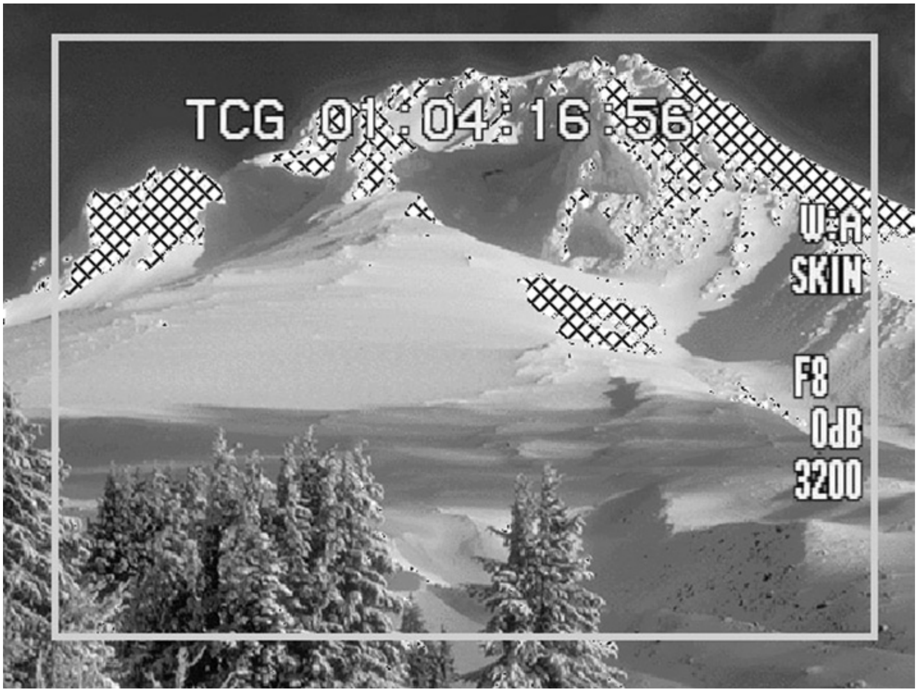

FIGURE 2.11
100 IRE zebra displays a striped or crosshatched pattern on areas of the picture that exceed 100 IRE.

On pro cameras, the type of zebra display is selectable in the menus; for many cameras, the precise bracketing of the 70–90 IRE is adjustable.

100 IRE zebra is a sort of an all-purpose "idiot light" that indicates areas of the picture that exceed 100 IRE, or full white. Remember that while the camera has the headroom to create signal above 100 IRE, that signal is technically illegal for broadcast—100 IRE is white, period. Exposure using the 100 IRE zebra display is quite simple: open up the iris until the highlights display zebra, then back off just a bit until the zebra vanishes. Your highlights are now properly exposed and legal. Of course, this does not necessarily mean that the rest of your picture is well exposed. It just means that the highlights are not overlimit. You'll still need to decide whether there is enough fill to produce proper exposure in the other areas of the picture. This is where a production monitor (rather than just the monochrome viewfinder) is essential. After you've set the exposure for highlights, you may need to add fill to achieve detail in darker portions of the image. In some situations (outdoors, or in an even setting where you can't control the lighting), you may need to make a judgment call to open up the iris and allow the highlights to go overlimit in order to expose sufficient detail in other areas. *Just keep in mind that if you overexpose too much with a digital format, you'll hit the "digital ceiling" and the highlights will clip*. Severe instances of such clipping might prevent a broadcaster from using your video.

70–90 IRE zebra is used to expose facial highlights (Figure 2.12) and is useful mainly for "talking head" shots and other shots where the primary focus is on a human face. The tool is based on the premise that properly exposed Caucasian skin will display highlights at around 80 IRE. So when using this mode of zebra, the zebra display comes "on" at 70 IRE and goes "off" at 90 IRE, allowing the camera operator to bracket exposure of the highlighted areas of the subject's face.

FIGURE 2.12
70–90 IRE zebra is useful for exposing human faces. This display will show a striped pattern on areas that register between 70 and 90 IRE—usually facial highlights such as cheekbones, forehead, and nose on a Caucasian face. On persons of color, the pattern will be much more restricted, showing up on reflected highlights. Some practice will allow a good camera operator to "eyeball" a correct exposure using this type of zebra.

A properly exposed face will typically display zebra pattern on nose, forehead, and cheekbones, but not elsewhere. Highlights that are over 90 IRE (such as the hair highlight from a backlight) will not display zebra pattern.

Obviously, there is some latitude here: darker skin tones will display a more restricted pattern of zebra highlights; extremely light skin may display much broader zebra pattern on cheeks and forehead. Some people find 70–90 IRE zebra difficult to use, but once you get used to it, you can expose faces quite accurately.

The ultimate exposure tool for video is not the light meter, but the WFM. After all, this device displays the precise voltage level of every part of the signal. Some DPs carry a small portable waveform monitor in the field; but it is more common to find them in studio usage. With most WFMs, you can actually zoom in to see the value of very small areas of a specific line—more precise than the best spot light meter.

The best way to use a WFM for monitoring exposure is with the LOW PASS filter on. This control eliminates the color component from the signal and allows you to see the luminance only. The color component, or chroma, is best monitored on a vectorscope anyway. This simplifies the display and allows you to clearly see the range of exposure.

Film DPs and still film photographers are familiar with the Ansel Adams Zone system of exposure. As noted earlier, the zone system breaks the gray scale into 10 zones ranging from 0 (solid black) to 9 (fully exposed white, no detail). In a properly exposed picture, values need to be distributed between zones 1–8. This will create a picture with full contrast, but detail in every area—both dark areas and highlight areas. It's helpful to think of the WFM display in a similar way; 7.5 IRE setup is solid black with no detail, and 100 IRE should be regarded as fully exposed white. The picture elements should distribute throughout the scale, with most of them falling between 15 IRE and 95 IRE. The hottest highlights should just reach up to "kiss" the 100 IRE line, while the darkest shadows should dip to near 7.5 IRE but never below. A very contrasty picture will display lots of values near black and near white, with few in the middle; a more normal exposure will show values distributed through the middle as well.

It does take some practice to become adept at reading a WFM, but after a little while, it becomes second nature.

CONTROLLING CONTRAST

Now let's get back to that limited contrast range. While your most basic job is to provide enough light for the camera to properly expose the picture, to get a quality picture you must also compress the range of lighting to make it fit inside the capabilities of the camera. That means that you must *lower* the level of the highlights and *raise* the light level in dark areas when compared to what our eyes would perceive as normal lighting (Figure 2.13). The effect in person is a

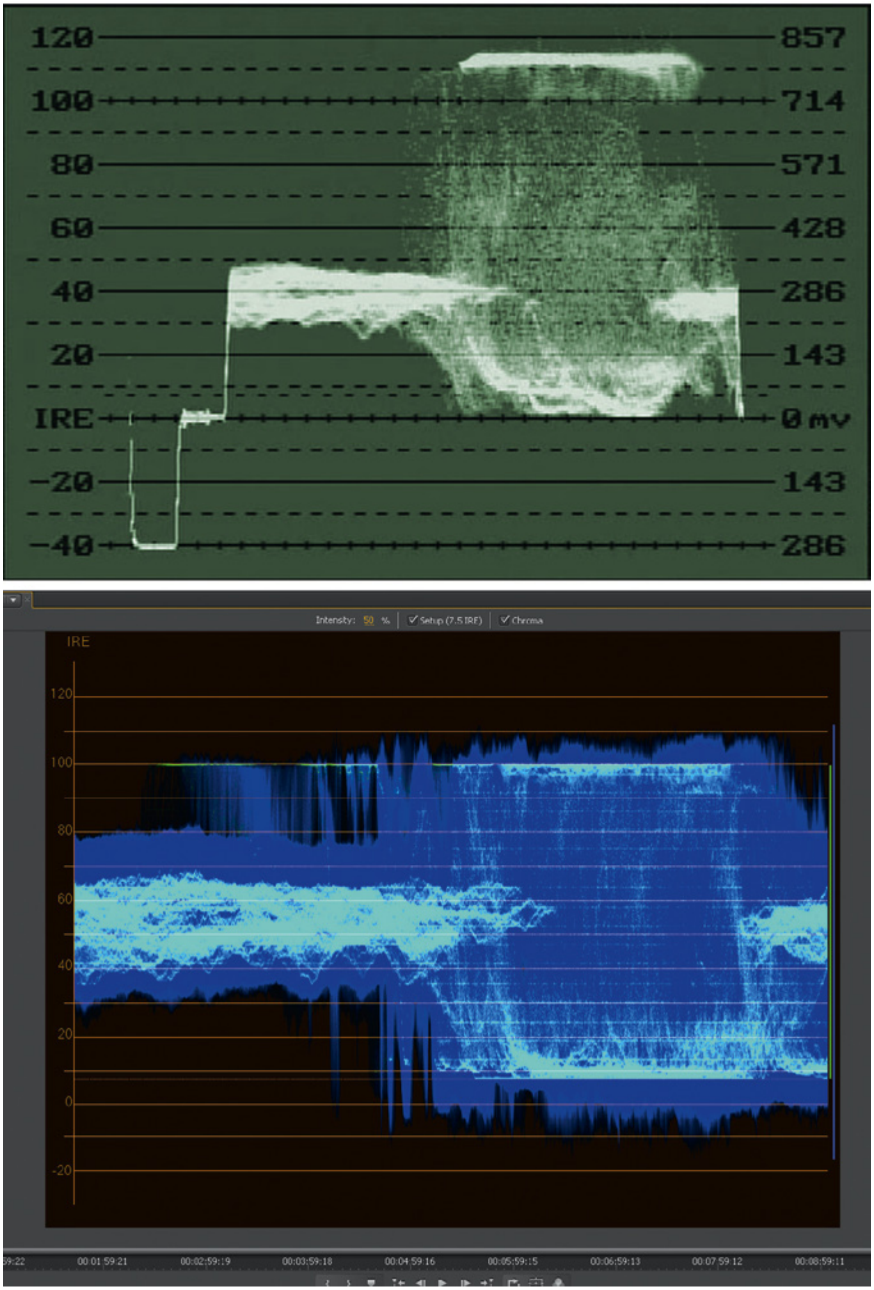

FIGURE 2.13
Controlling contrast involves adding light to dark areas and reducing light to bright areas. These WFM displays show a very contrasty picture with clipped whites and blacks. A well-exposed picture will have values distributed through the range, without exceeding the upper or lower limits.

"flatter" look than one would wish for in live performance, but it is the look on the screen that we are concerned with!

So how do you compress the contrast range? Obviously, you can do so by adding light to areas that are too dark and removing it from overly bright areas. But that's too simplistic, since the range of lighting must also relate to the sensitivity and exposure setting of the camera. The two are integrally intertwined. Film DPs, who do not have the "what you see is what you get" advantage of video, must work this blind. They'll set up the lights with a light meter and determine the camera F-stop and shutter speed from formulas. While film folks can continue this habit with video (with some important modifications—we'll get to this later), this is not the typical procedure for video.

The interrelated factors that we must work with simultaneously include:

- The level of light on the subject
- Filters on the camera lens, all of which reduce the lens's light transmission ability somewhat
- Whether the camera is single-chip or triple-chip
- The sensitivity of the camera chips
- The speed of the lens
- The F-stop setting on the lens
- The desired depth of field (DOF)*

Remember, these factors are completely interrelated, so that a minor change on any one will ripple out to affect every other on the list. In most cases, however, most of the factors will remain fixed, and we will vary only two: the level of light on the subject and the F-stop on the camera lens.

Why White Is the Enemy In controlling contrast, there are two great enemies to watch out for: a light source (such as a window or lamp) in frame and pure white objects. Either one of these will immediately cause the contrast ratio to exceed the capabilities of even the best video camera. White walls, white shirts, and white paper are the most common culprits. Ever notice that politicians all know to wear blue shirts for television interviews? This is why! The traditional rule of thumb has been "no white on a TV set!" On television, newscasters have generally worn gray or light blue shirts, their notes were typed on special light gray paper, and the walls were never, never, NEVER white. Though newer camera technologies have made this less of an issue, it's still a good rule to observe. Whenever possible, keep white objects out of the shot or protect them from key light.

*__Depth of field__, often confused with **depth of focus**, is a measure of the scene that is visually sharp. Depth of focus, on the other hand, is a technical measurement inside the camera of the depth wherein the image projected on the objective (in this case the CCD) is sharply focused; or, the distance behind the lens where the *circles of confusion* are reduced to the minimal possible size.

A typical procedure for video is to begin with the **key light**, which is usually the brightest light in the scene. This should be bright enough to allow the camera proper exposure. Set the F-stop on the camera, using the zebra display (more on this later) to prevent overexposure.

Many directors of photography prefer to use enough light to expose toward the middle of the lens's range, perhaps *f*/4 or *f*/5.6. This is because most lenses perform more accurately in this range (sometimes called the *sweet spot*) than they do at the extremes wide open or closed down. Color contrast is better, and the depth of field is greater. However, with the high sensitivity and low noise of modern digital cameras, it is possible to run lower light levels using a lower F-stop, such as *f*/2.8 or even *f*/1.4. Sometimes this is effective for achieving a limited depth of focus to throw the picture background out of focus. Conversely, if you want a large depth of field, you will want to use more light and expose at a higher F-stop.

Once you have set the key and the camera exposure, you then bring in other lights or reflectors to work with that exposure. This is the **fill light**, the light that will cast illumination into shadowed areas. A typical setup will use a fill light that is about one-half the intensity of the key. This is just a starting point, of course, because you may want a higher or lower fill level. At a minimum, you usually want enough fill to create a little detail in dark, shadowed areas rather than a flat line of solid black on the waveform monitor. Actually, you don't have to have a waveform monitor—just bring in some light until you begin to see some detail in the shadows on the production monitor.

In many situations, you will then add some variation of the **backlight**, a light from high above and to the rear that will pick out highlights that will visually separate the subject from the background. The intensity of this light can vary tremendously, from about the level of the key down to that of the fill. It all depends

"Quick-n-Dirty" Exposure Pro video camera lenses have an auto iris function. Simply using this function will often get the exposure close, but will be inconsistent due to the varying components of the picture. An on-screen practical or a dark costume will cause the auto iris to under- or over-expose some shots.

To use the auto iris for consistent "quick" setting of exposure, use a photographic gray card. These cards, available at any photo supply store, reflect 18% of the light that falls on them and are the standard for "average" exposure.

Position the card so that the key light falls on it and zoom in until the card fills the viewfinder. Activate the auto iris; usually this will have a momentary switch and a slide switch. Use the momentary switch and then revert to manual control so that the auto function doesn't "hunt" when you move off the gray card.

Now set up your shot and take careful note of the zebra display to see if there are any "hot spots" that need to be eliminated.

on the type of effect you wish to create. The one thing you *don't* want to do is load on so much light that the highlights become overexposed and clip; pay attention to the look on the production monitor and the zebra display in the camera.

This basic procedure, with variations, will generally allow you to create a lighting situation that works with the contrast range of the camera. There are many pitfalls and problems and variations, of course, which we'll get into later on in the book.

One topic that we should touch on here is the Inverse Square Law (Figure 2.14). This natural law, which describes the relationship of distance to light levels, will show up throughout later chapters as we discuss actual setups and how minor adjustments can affect exposure. Simply put, the law states that the further a light source is from the subject, the less light actually falls on the subject. Although this may seem self-evident, what is not so obvious is the amount of light dropoff as distance increases. If you double the distance from the subject, it seems common sense that the light level would be halved. Not so; the level is *quartered*. Conversely, bringing a light closer to the subject has the opposite and dramatic effect: halving the distance will increase the light level on the subject by a factor of four.

Bear in mind that a light source is really emitting photons, which will spread out radially from the source. The further the subject is from the source, the

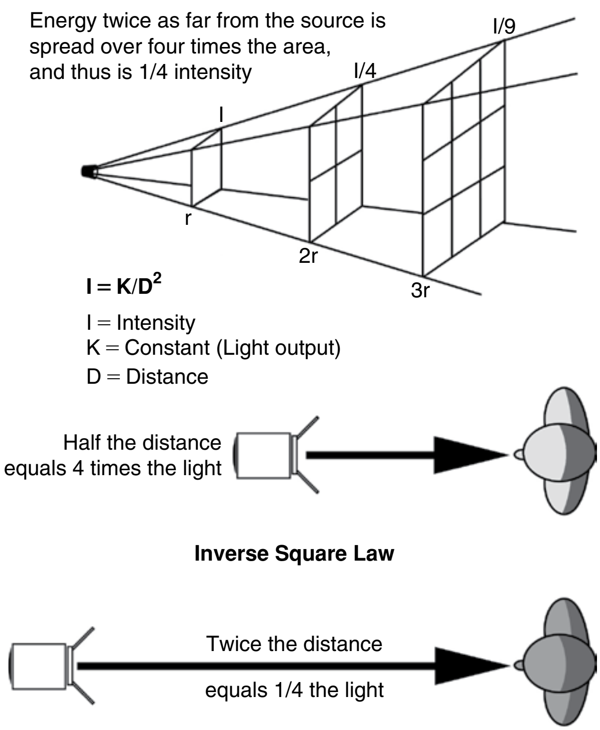

FIGURE 2.14
The Inverse Square Law indicates the light level will reduce to one-fourth if distance is doubled.

The solution: High Dynamic Range Photography There is a solution developing for the limited dynamic range of video and film: High Dynamic Range (HDR) photography. HDR is a technique whereby multiple exposures of a scene are taken and then combined to simulate a dynamic range that is much wider than the actual imaging chip can manage. HDR is already in common use for still photography. Typically, a digital camera will be mounted on a tripod and several exposures (at least three) will be taken at different exposures. This technique, which is known as "bracketing," usually involves setting the exposure normally for the overall scene, then taking a matching shot one F-stop lower and one F-stop higher.

The resulting images are combined in HDR software. Picturenaut, Essential HDR, and the oddly named Qtpfsgui are freeware HDR programs you can experiment with; of course, commercial software is available as well.

Research is underway that may make it possible to use a similar technique "on the fly" in video footage. The key will be to develop a very high-speed imaging chip that can expose two or three images of each frame, which would then be combined in hardware to create the final HDR frame. An additional problem will be compensating for subject or camera motion between successive exposures.

fewer photons will fall on that subject. A gruesome but very accurate parallel example would be found in a shotgun. The shell has a set number of pellets; when fired, they begin to spread apart. If fired at close range, the effect is devastating because the subject will receive the full impact of the entire load. But as the distance to the target increases, the load spreads in a "shot pattern" where the pellets are further and further apart. Since the target does not increase in size, the further away it is the fewer pellets will hit it—because the pellets have spread further apart.

Understanding this effect will be very important in the placement of lights for proper exposure control.

CONTROLLING COLOR

Once you've managed the contrast range of the lighting and exposure issues, you may still have to wrestle with color issues. This is another problem overlooked by the amazingly adaptive eye, for though we think of light as being "white," in fact light always has some color or tint in it, referred to as color "temperature." Another limitation of both film and video is the fact that, unlike the eye, the camera can only perceive one color frequency as "white" at any given time. If your camera is set to the wrong color temperature, the scene may seem blue or yellow or even have a green cast to it.

Take a look at Figures 2.15 and 2.16, which show the effect of improper color balance. The exterior shot, where I am taping in front of George Washington's home, Mount Vernon, looks too blue if the camera is set to 3200 K (or incandescent) color balance. When set to 5600 K (daylight), the picture on the right

FIGURE 2.15
Left, if the white balance is improperly set to 3200 K while shooting outdoors, the picture will have a blue cast. The proper daylight white balance (right) will remove the blue cast.

FIGURE 2.16
Left, if the white balance is improperly set to 5600 K when shooting indoors with tungsten lights, the picture will appear too yellow. The proper white balance (right) removes the yellow cast and makes the picture seem more natural.

appears without color cast. The reverse is true as well; when shooting indoors with tungsten or incandescent lighting, if the camera is set to 5600 K the entire scene will appear too yellow. Other color cast problems can crop up with fluorescent, light-emitting diode (LED), or arc lamps that are not specifically designed for video use.

THE KELVIN SCALE

Color temperature is a concept that was first defined by William Thomson, Lord Kelvin (1824–1907) (Figure 2.17). Thomson, an Irish-born physicist, wrote over 600 papers on the laws of motion and the dissipation of energy. He was knighted by Queen Victoria for his work on the electric motor, and he supervised the laying of the first transatlantic cable in 1866.

But Lord Kelvin's name today is most closely associated with the **Kelvin scale**, a measure of molecular activity and energy emission. The Kelvin scale begins at absolute zero, or –273.16 °C, the temperature at which all molecular motion would theoretically cease. It then describes a variety of natural phenomena as temperature on this scale. The boiling of water, for instance, is 373 K. The color emission temperatures are based on the apparent color of a black body (a material that absorbs all emissions) heated to various temperatures on the scale. A theoretical black body begins to radiate light as its temperature increases; it will glow red at 3000 K, white at 5000 K, blue-white at 8000 K, and intense blue at 60,000 K.

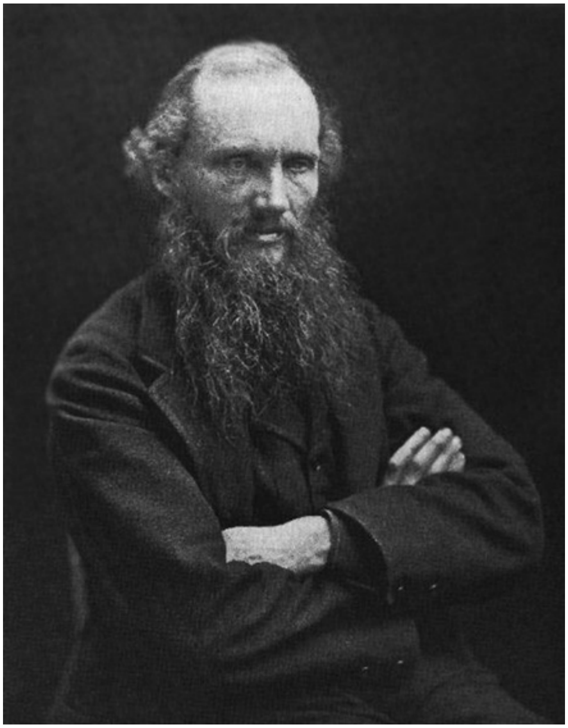

FIGURE 2.17
William Thompson, Lord Kelvin.

True black bodies exist only in theory, so to be practical, think of a piece of iron in the hands of a blacksmith. As the iron is heated, it will first begin to glow a dull red, then orange, then yellow and finally a bluish-white. Each of these radiated colors is an accurate measure of the metal's physical temperature—the activity of its molecules. We now use these color temperatures to refer to different wavelengths of light.

Interestingly, though you will often hear the phrase "degrees Kelvin" or "3200 degrees" referring to the Kelvin scale, this is incorrect. Scientists use the term "degree" as a division of an artificially devised scale. Since the Kelvin scale is based entirely on natural phenomena, it is regarded as an "absolute" scale, and temperatures on it are simply identified as "Kelvin" or "K." So the proper way to refer to the temperature of a quartz light is simply "3200 K."

While all this seems very complicated, it can be boiled down to a few shorthand notes. In film and television production, there are a few benchmark color temperatures and standard methods for converting between them. The principal two are photographic daylight (usually thought of as 5600 K) and tungsten, or quartz incandescent (3200 K). Now, right away this is a fib because real daylight can vary from 2000 K at sunrise to 7000 K on an overcast day. But let's not worry about that now. You can get an idea of the portion of the Kelvin scale that is pertinent to video and film in Figure 2.18.

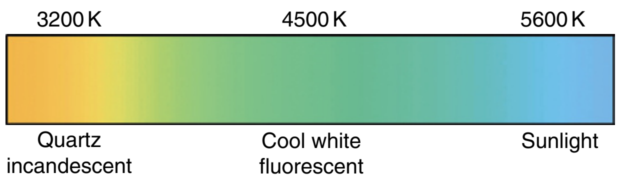

FIGURE 2.18
The portion of the Kelvin scale that is most pertinent to video and film is the range from 3200 K yellow to 5600 K blue.

If you've taken still pictures, you probably know that you have to pick the right type of film for indoor or outdoor use. Indoor film is referred to as "tungsten" balanced and is designed to register "white" at around 3000 K. Outdoor film is referred to as "daylight" balanced, and registers "white" at 5600 K. If you take a picture indoors with daylight film, everything will look yellowish-orange. Conversely, if you take a picture outdoors with tungsten film, everything will have a bluish cast.

The same is true with a video camera. While the human eye can see mixed color temperatures and register them all as "white," the cameras can only pick one or the other. That's why the camera must have the proper **white balance** for the lighting situation. In other words, you have to *tell* the camera what temperature to use as "white." And once you've "told" it that temperature by setting the white balance, you have to make sure that all the lights you use are in that same temperature range—or you have to do something to correct "off-temp" light sources.

In most cases, this is simple: you'll just use all one type of lighting instrument, for instance, all quartz **fresnels**. In other cases, if it is necessary to mix different types of sources, you will need to correct one or more of them using correction gels. More on this will be presented in the Lighting Controls chapter, Chapter 5.

While this sounds easy, and often is, you'll be astounded at how frequently it proves rather complicated. It's easiest in a studio where you have full control. But when you're shooting in a factory, or in an office where other activities must continue, you may find yourself truly challenged. Sometimes in a real-world situation you simply must live with a less-than-ideal situation and make the best of it. That's when you choose the compromise that will look the best.

There's another issue related to color that you may run into: the CRI, or **Color Rendering Index**. This is a calculated measurement of how accurately a given lamp "renders" colors. A theoretical perfect score is 100. A lamp with a high CRI (in the 90s) will make colors look rich and deep, whereas a lamp with a much lower CRI will make the same colors in a set or costume seem washed out and sickly. The index rating is a measure of the average appearance of eight standardized colors of intermediate saturation and spread throughout the range of hues. Put another way, it measures what wavelengths are missing from a theoretically perfect light source.

CRI is an especially important rating for fluorescent tubes because they are often missing significant portions of the spectrum and may have excessive spikes at certain frequencies, especially green. In other words, fluorescent tubes are a *discontinuous* light source, as a source that may be missing a chunk of red and have a huge spike in the green range. Since the Kelvin scale is based on the balanced radiation of a theoretical black body, it's technically incorrect to classify fluorescents on the Kelvin scale at all. Kelvin ratings for tubes with a low CRI will be less meaningful. Tubes with a high CRI emit a more even spectrum, and the Kelvin rating will be more meaningful.

The CRI of fluorescent tubes can range from the sublime to the ridiculous. The most common standard fluorescent tubes that used to be found in offices and factories, the "cool white" bulb, had a CRI of about 62, which is very poor for video purposes. Colors just will never look quite right under this light, no matter how many times you white balance. Manufacturers have improved color reproduction in recent years, and today most cool white bulbs have a CRI above 80—still too low for really fine video work. In contrast, a 3200-K tungsten halogen bulb has a CRI of nearly 100. If you've ever videotaped in a parking lot lit by sodium vapor lights, you won't be surprised to know that they have a CRI of about 25.

The CRI rating of fluorescent tubes is very important to how well they will work with a video camera. Some "warm white" tubes are actually worse than "cool white." Broad-spectrum "daylight" fluorescent tubes, manufactured for plant growth, are better, with a CRI of anywhere from 80 to 90, depending on the manufacturer. However, the tubes now made specifically for video and film by Kino Flo, Sylvania, and others will have a CRI of 85–95, giving excellent color rendering.

CHAPTER 3
Volts, Amps, and Watts

Before we go any further, we need to cover the basics of electricity, electrical loads, and safety when working with electricity in different conditions. Lights are pretty hefty power users, so it's essential to at least understand the rudiments even if you never intend to take apart a connector or touch a wire end. Basically, you need to have an idea about how many lights you can plug into what outlets without causing a fire or blowing breakers!

Several years ago, I had a conversation with one of the managers of a major lighting manufacturer. He related to me a phone call he had received from a customer who bought a 5000-watt fresnel and was complaining because he couldn't plug it in to a normal household outlet! (If you're new to all this, a 5 K will pull about 45 amps, more than twice what a normal household circuit can supply.) "Used to be people knew what they were about," he moaned, "now anybody with a credit card can get in the business, and you have to spoon-feed them."

This is more than a couple of older fellows reminiscing about the good old days; it's a reality. In the "old days" (only a few years back) almost everyone working in film or television had come up through apprenticeship or had attended a film school program. They had power management pounded into them as they came up, and they learned it well, or they didn't get any further. That's no longer the case. Digital video has opened up the world of filmmaking and democratized video production. And while that's good in one way, it's not so good in another. It means there are a lot more folks bumbling around with equipment they don't know how to use properly. If you're new to some of this and don't know a volt from an amp, please take some extra time with this chapter. We don't want to make a meter-totin' electrician out of you, but we do want to make sure you can pursue your craft safely!

First, let's present some basic terminology and basic abbreviations. Volts will often be abbreviated as simply V or VAC (for Voltage Alternating Current).

D.O.I.: 10.1016/B978-0-240-81227-4.00007-5

Amperage, or amps, will usually be abbreviated as A. Wattage, the usual measure of the power of a lighting instrument, will be abbreviated W. Since many of the lights we will be dealing with are high-power units, thousands of watts will be abbreviated K, which is the term the industry uses even though the proper abbreviation is KW. So a 300-watt light would be referred to as a 300-W unit; a 1000-watt fresnel might be called a 1000-W unit, but more typically will be called a 1 K, short for 1 KW, or one kilowatt. Similarly, 2000-watt and 5000-watt units will be referred to as a 2 K or a 5 K. Of course, in the convoluted parlance of the trade, they may also be called Babies and Seniors, but we'll get into that later!

When you plug something into an outlet, the electrical power you use is measured in two different ways: *voltage* and *amperage*. Voltage is a measurement most folks are familiar with. Normal household voltage in the United States is 110–120 volts AC. That's going to remain pretty much the norm for most lighting, except in those few large studio situations where 240 V is laid in for very high-powered lights. However, in Europe, Asia, Australia, and a good chunk of South America, normal household voltage is 220–240 volts.

Amperage is a measure of how much electricity is being consumed. A 100-watt household light bulb and a 1000-watt fresnel will both use 120 volts in the United States. But the first will "pull" less than 1 amp, while the second will "pull" 8.5 amps.* Plug too many 1-K fresnels into a single branch circuit, and they'll pull zero amps—because you'll blow the circuit breaker and plunge the place into darkness.

Think of the flow of electricity as if it were the flow of water in a pipe. Voltage might be thought of as the *speed* that the water is traveling, or its velocity; amperage would be the *amount* of water that is flowing at that speed. A tiny little garden hose can deliver water at the same physical velocity as a whopping great drainage pipe; but the big drainage pipe can deliver a lot more of the water at the set velocity. This isn't a perfect simile, but it will do for the moment.

You may have noticed already that the greater the wattage, the higher the amperage an instrument will use. In fact, wattage, amperage, and voltage are all closely interrelated. Wattage is in fact the product of the voltage multiplied by the amperage:

$$\text{VOLTS} \times \text{AMPS} = \text{WATTS}$$

Of course, you can reverse this equation to find out how many amps a particular wattage lamp will pull:

$$\text{AMPS} = \text{WATTS} \div \text{VOLTS}$$

This is really the more important formula for you to remember in the real world because you want to know how many 1-KW lights and 650-W lights you can

*The same 1000-watt fresnel bulbed for 240 volts European voltage will only pull about 4.3 amps.

plug into a branch circuit without blowing up the place! DP Arledge Armenaki (*Howling V*, *Blackout*, *Wesley*) uses a little mnemonic device to remember the formula: "My **A**unt lives in **W**est **V**irginia," or "My **A**unt lives in **W/V**." Silly, but it works!

So here's a practical application: you have a 1-K softbox as a key and a 650-W fresnel as a backlight and a 300-W fresnel as a fill light. Can you plug them into a single-branch outlet that runs from a 20-amp breaker? How about a 10-amp breaker in a European home?

USA	**EUROPE**
1000 + 650 + 300 = 1950 watts	1000 + 650 + 300 = 1950 watts
1950 watts ÷ 120 volts = 16.25 amps	1950 watts ÷ 240 volts = 8.125 amps

So the answer is "Yes, you can!" Provided, of course, that nothing else is plugged into the circuit. But—you need a slash of light on the wall behind the subject; could you add another 650 W to the circuit?

USA	**EUROPE**
1000 + 650 + 300 + 650 = 2600 watts	1000 + 650 + 300 + 650 = 2600 watts
2600 watts ÷ 120 volts = 21.7 amps	2600 watts ÷ 240 volts = 10.83 amps

BANG! Blown breaker, darkness. The answer is no.

Of course, you probably don't want to be hauling out a calculator every time you plug in a light. So the easy "quick-n-dirty" approach is to use 100 volts instead of 110, 115, or 120; or 200 volts in a 240-volt area of the world. This isn't right, but it makes the math easier (just move the decimal point) and ends up on the safe side:

USA	**EUROPE**
2600 watts ÷ 100 volts = 26 amps	2600 watts ÷ 200 volts = 13 amps

This is sometimes known as *paper amps* and is very useful because of the extra safety margin it provides. It's always best to err on the conservative side for amperage load, and using "paper amps" automatically does that for you.

As a quick rule of thumb, you can usually run a little over 2000 watts on a single 20-amp circuit in 120-volt countries, or on a 10-amp circuit in 240-volt countries. But how do you *know* if it's a 20-amp circuit or a 10-amp circuit—or how many (and which!) outlets are on a given circuit?

The answer is not easy because it will vary from building to building. If you're shooting in an older home, you can easily run into already overloaded

15-amp circuits with an old fuse box. Even in public buildings, the power supply may be woefully outdated and overtaxed before you show up with your hot lights.

Most buildings constructed in the past 30 to 40 years will have circuit breakers, typically supplying each branch of outlets with 20 amps. Older homes may still have limited service, meaning that the entire electrical supply to the house is rated for under 100 amps (Figure 3.1). While that may sound like a lot, it's not if you start to include a couple of window air conditioners and an electric stove and electric water heater in that 100 amps. If you like higher light levels for taping, it's not difficult to distribute your power load around various circuits and still have the main breaker blow when the water heater kicks in!

Ask to see the breaker box. You're in luck if the main breaker is rated at 200 amps or there are two 120-volt/100-amp breakers. See if the breakers are labeled. Odds are, they're not—or they are labeled in a code decipherable only to the strange fellow who owned the house 20 years ago. If they are labeled in plain, easy-to-understand English, you're in luck! Just keep your eyes open because Murphy's Law (the only constant in video production) will bite you somewhere else down the line!

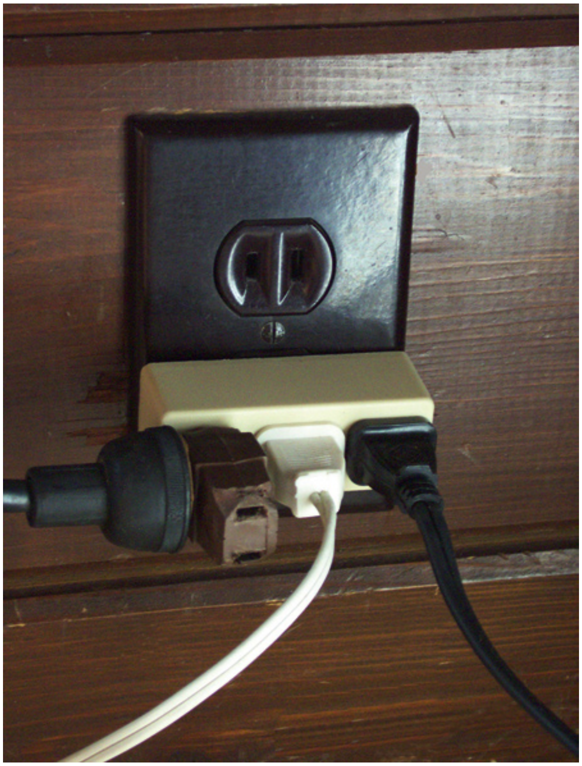

FIGURE 3.1
If you're taping in an older house and you see ungrounded outlets like this one, be extra careful to distribute your power usage widely!

In a public building, you'll find much higher service and you are more likely to find well-labeled breakers (Figure 3.2). Typically, outlets in a circuit will be grouped together along a wall (in a larger room with several circuits) or by the room. Jot down the appropriate breaker labels to help jog you memory while setting up lights. Bring enough "stingers" (extension cords) to allow you to run power from adjacent rooms easily.

It's not unusual to be running two lights from the outlets in the room you're shooting in, two lights from the next room, and a light from two doors down the hall.

Let's take a look at a real-world example. You're called on to videotape a lecture at a local civic center. You scout the location out and find the breaker box. Hallelujah, the breakers are labeled—and in English, yet! You jot down the labels of the pertinent breakers, which are labeled **MtgRm N Wall**, **MtgRm W Wall**, and **MtgRm S Wall**. This is a wonderful situation, since you will have 60 amps available in the same room, and an easy way to tell which outlets are on what circuit. You can easily distribute your lights around the room…

BAM!

No, that's not Emeril cranking it up a notch. That's the breaker blowing because some electrician's assistant 15 years ago thought it would be easy to run the outlet for the refrigerator in the Meeting Hall kitchenette off that South Wall circuit. Sorry.

Okay, so you pull a couple of lights off the South Wall and run them over to the North wall, where you are now running a 1-K Tota Lite (bounced off the ceiling for fill on the audience), a 650-W fresnel for fill on the speaker, and a 500-W

FIGURE 3.2
In a public building, you're more likely to find higher-capacity service and well-labeled breakers.

Omni to illuminate the conference banner behind the speaker. That's 2150 watts, or about 18 amps on a 120-volt circuit. You run the lights for a while to test. Everything seems fine, until halfway through the lecture when the speaker turns on an overhead projector.

BAM!

A 1000-W overhead projector that was plugged into the East Wall, a wall with a couple of outlets that are actually on the North Wall circuit! Not only did you ruin the video, but you ruined the celebrity guest's lecture. Your name is mud, and they'll never hire you again.

I'm trying to make the point that you must never get overconfident in a building you're not completely familiar with. You'll run into amazing surprises, curious fudges, and even illegal workarounds. Don't ever put full faith in breaker labels. Distribute power needs conservatively. Bear in mind anything else electrical that might come on while you're shooting: projectors, refrigerators, prototypes of miniature hand-held weather control devices the speaker is demonstrating—hey, you never know! Ask! Ask again! Because (trust me on this one) if you blow a breaker at a critical moment, you will be the one blamed.

It's a good idea to turn on all your lights early and let them run for a while. That way, if any circuit is overtaxed, the breaker will blow before the actual shoot, and you'll have a chance to redistribute the load. Bear in mind that the strongest instrument you can typically use in a normal household 15-amp Edison plug in the United States is a 1200-W light—provided there is nothing else plugged into that circuit! In a 120-volt/20-amp outlet, you can use a 2 K. In Europe and other 240-V areas, watch the values of the breakers because in some cases they will be 10-amp breakers. Thus allowing the same overall load as a 20-amp breaker on a 110-V system.

If you're shooting in a private home, distribute the load to different rooms. Just as public buildings typically use one circuit per wall, homes will often use a single circuit per room. So run a "stinger" (extension cable) to the bathroom and another one to the kitchen; run one out back to the garage if necessary!

Fortunately, as cameras have gotten more and more sensitive, lighting requirements have dropped dramatically. Where once 1-K and 2-K fresnels were basic requirements, today I typically use an Arri kit with two 650-W fresnels and a 300-W fresnel for location interviews. Many shooters are using even lower wattages. The innovation of fluorescent lights has changed the power load picture as well, since they typically draw less than half the power as an incandescent light for the same light output. Exciting innovations with LED arrays have created soft lights with even lower power demands for location taping.

Life is not quite so tough in the studio, where we hope you have laid on adequate power, and perhaps even have a lighting grid and control panel.

Before we get into the complexities of connectors, let's spend a moment on how electrical service is typically fed into a building, especially the relationship between 240-volt service and how it is used as 120-volt service at most outlets in the United States.

The service to a house or building is typically from a pole-mounted transformer that steps the transmission line voltage (perhaps 34,000 volts) down to 240 volts. This is fed into the service panel via three wires, two black and one white. The two black wires are the extreme poles of the transformer and will measure 240 volts if you connect a voltmeter to them. These are the "hot" wires. The third white wire is known as the "common" or "neutral." This is the center tap of the transformer, where the voltage is zero. If you connect a voltmeter between either of the two black wires and the white wire, it will read 120 volts. A fourth wire, the "ground," is a bar copper wire that is generally connected to a long, heavy spike driven into the ground or a metal water supply pipe—hence the term *ground*, since it literally connects to the ground around the building. In Britain, this is called the "earth," for the same obvious reason. The ground is a safety valve that provides an easy drain for power if something shorts in an appliance. The outer body of the appliance is connected to the ground; if something inside shorts to the case, the voltage will find running to the ground easier than running through *you*.

The standard household outlet uses one "side" of the 240-VAC supply by connecting one of the black wires to the "hot" terminal and the white wire to the "neutral" terminal. This supplies 120 VAC to that outlet. Every household outlet is required by law to have a ground connection as well. High-power

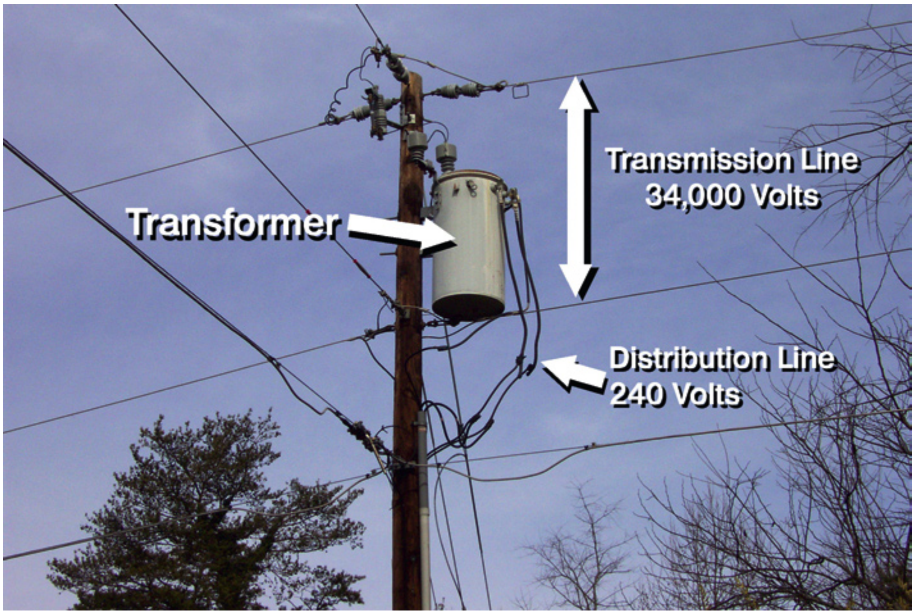

FIGURE 3.3
The line transformer steps down voltage from the transmission lines to 240 volts.

appliances such as electric dryers or electric stoves will use 240 volts by using both black wires.

Remember our formula for wattage, voltage, and amperage? If you use a 240-volt supply (doubling the voltage), you will halve the required amperage to produce the same wattage. A 1000-watt light for the European market will only pull a little over 4 amps at 240 volts, while a 1000-watt light designed for 120 volts will pull about 8.5 amps.

Oh, and while we're on the subject, lamps (or sometimes "globes" in the United States or "bulbs" or "bubbles" in the UK) are designed for specific voltages and won't perform right on the wrong voltage. Using a 240-volt globe on 120 volts will produce a dim orange glow. Using a 120-volt globe on 240 volts will produce another

BAM!

of a pretty spectacular—and dangerous—variety.

STANDARD CONNECTORS

Readers in the United States and other 120-volt countries are all familiar with the standard, three-prong connector. That's the one used on all your 120-volt appliances, computers, and of course, video lights. This connector is rated for 15 amps of load, so it would typically be found on any light up to about 1500 watts. But what about more powerful lights? Like your electric dryer, these require a different connector, one that is rated to bear the heavier load—and that is configured in such a way that you cannot accidentally plug it into a lower-rated outlet. There are also different configurations for different voltages. Add to this the different connectors used in other countries, and the specialized connectors developed for stage and industrial use, and you'll just about go nuts!

Fortunately, the real world isn't that complex, since only a few connectors are used routinely in the United States. We'll deal with international connectors and adapters separately.

In the United States, the basic specifications for electrical connectors are set by the National Electrical Manufacturers Association (NEMA). The basic, common grounded connector is rated for 125 volts, 15 amps. This is known internationally as a Type B connector. It plugs into the standard household outlet and has three connectors: hot, neutral, and ground. The hot or "live" connector is the one that is actually running from one of the black wires in the service panel. The neutral (sometimes called common) connector is run from the white center-tap wire. The ground (or "earth") is connected to that bare copper wire that ties into the earth itself somewhere, usually through a water pipe or ground spike. The plug can only be inserted in the socket one way because of the orientation of the ground pin. But even ungrounded twin-blade plugs will only insert one way because the socket is *polarized*—that is, one blade is slightly wider than the other. This is done because it is the hot wire that should be disconnected with an appliance on/off switch rather than the neutral.

Figure 3.4 shows several heavier load connectors for 120 volts in the United States: a 20-amp connector that might be used on a 2-K fresnel, a 30-amp connector that could carry 3000 watts safely, and a 50-amp connector that could be used to power a 5000-watt Molequartz 14" Senior Solarspot.

Please note that it is not just the connector that must be rated for a heavier load! The **entire circuit** from the service box must be rated for the heavier load—breaker, wire, and connector.

NEMA standard straight-blade connectors are not the only types you will see in television and video work, however. Stage lights—and very often studio lighting grids—will use a specialized curved-blade plug and socket that will lock in place with a twist. These are known as NEMA locking connectors. One of the best known brands is the Twist-Lock®, a standard feature of stage lighting systems. Twist-Lock® is a trademark of the Hubbell Company; other manufacturers have their own line of locking connectors as well, such as Leviton's Black & White connectors (Figure 3.6). The obvious advantage of these connectors is that they will not accidentally pull out during shooting, as straight-blade connectors have a habit of doing. Locking connectors are available for both wall and chassis mount (as wall outlet) or male and female inline connectors (as line cord plugs and extension ends).

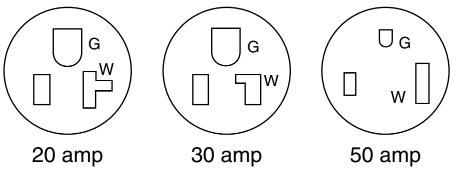

FIGURE 3.4
Pin configurations for heavier-load connectors in the United States.

FIGURE 3.5
20-amp socket and connector in the United States. Note that while a 15-amp connector will fit into the 20-amp socket, the 20-amp connector's horizontal blade prevents accidentally plugging it into a 15-amp socket.

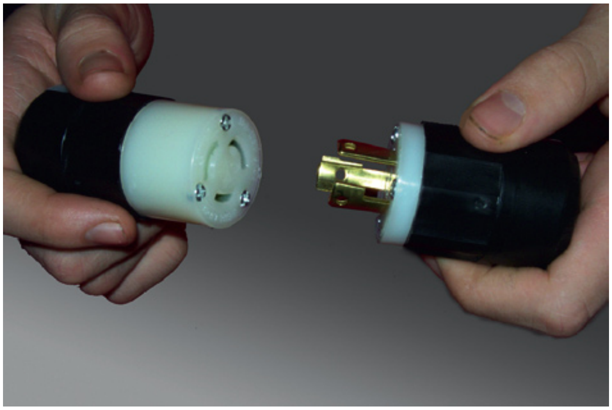

FIGURE 3.6
Leviton's Black & White locking connector, NEMA L5-15.

On larger sets, especially where higher wattage units are in use, you may also see the **Bates connector,** a flat pinned inline connector that is available in 20-, 60-, and 100-amp ratings (see Figure 3.7).

Outside the United States, there are a variety of connectors in common use (Figure 3.8). Since these connectors are generally incompatible with one another, if you are traveling between areas that use different connectors, it's best to travel also with a set of adapters—or better yet with a set of cables designed to plug directly in with the proper connector. Adapters are best with low-wattage instruments and may be unreliable and dangerous with higher-wattage instruments.

In video and television work, it's common to use "stingers" or extension cords to run power to lights rather than plugging the light directly into the wall outlet. Just as all the wiring, the breaker, and the connector in an installed wall outlet must be the proper rating, so too the stinger must be heavy enough to bear the current that will pass through it. Here, it is not just the amperage but also the distance—the length of the extension cord (or cords)—that is important. Some voltage loss occurs over a long cable, and minor voltage loss translates into an equivalent higher amperage. So you can't just look at the rating on the cheapest 25-foot cord at the hardware store, daisy-chain five of them together, and power lights close to the rated capacity.

Electrical wiring is rated by physical diameter, which is rated in "gauge." The American Wire Gauge (AWG) chart, sometimes also referred to as the Brown & Sharp or B&S gauge chart, is used in the United States and many other countries. 12AWG, for instance, is 0.808 inches, or 5/62 inches, in diameter. The English system, Imperial Standard Wire Gauge, often abbreviated SWG, is used in some European countries, while others use a metric scale. Metric gauge is determined by the actual area (in millimeters) of the cross section of the wire. Of course, the only measurement system that actually makes any sense here is the metric system, but it won't be used in the United States until long after full implementation of campaign finance reform, and the freezing over of—well, you get the idea!

FIGURE 3.7
Bates connector, available in 20-, 60-, and 100-amp ratings. Courtesy Mole-Richardson Corp.

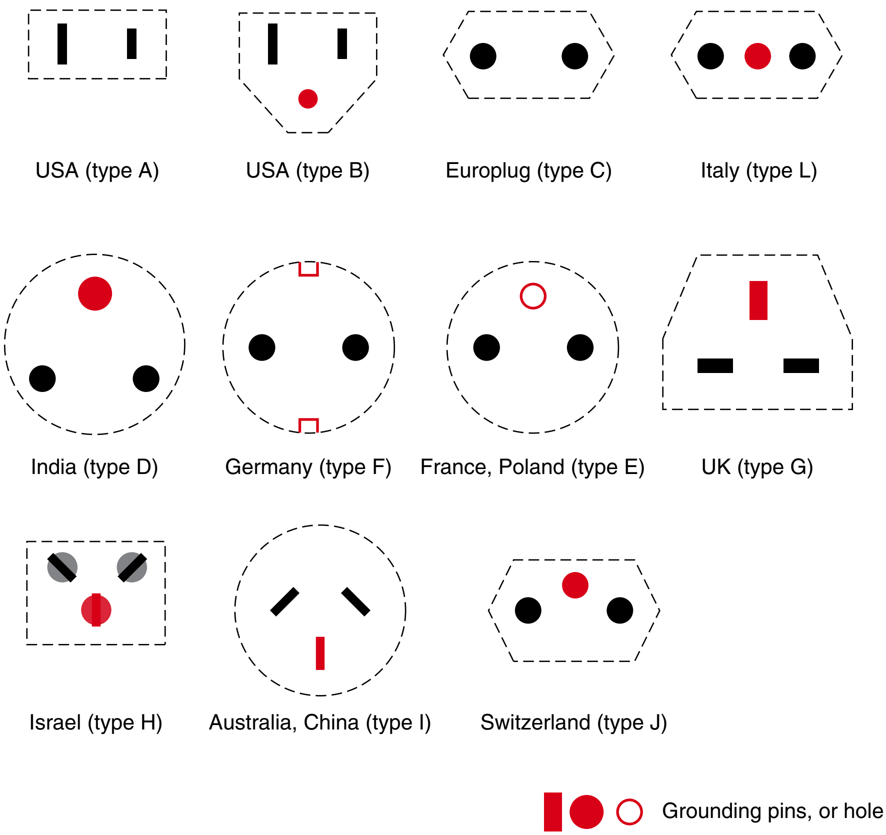

FIGURE 3.8
Connectors in common use in different countries.

Table 3.1 Amperage Ratings for Different Lengths and Gauges of Extension Cords

	Amperage		
Cord Length	**10 amps**	**12 amps**	**15 amps**
25 ft	16 ga.	14 ga.	14 ga.
50 ft	14 ga.	14 ga.	12 ga.
100 ft	12 ga.	12 ga.	10 ga.
150 ft	12 ga.	10 ga.	8 ga.
200 ft	10 ga.	8 ga.	---

Extension cords for video and television use will typically be **14 gauge** or **12 gauge**. Stay away from the "bargain basement" 16-gauge cable for any but the lightest work—practicals or small fills, for instance. For location video work where you are using a kit of 4 or 5 lights, none of which exceeds 1000 watts, you can probably get away with using 25- or 50-foot 14-gauge cables. For anything more substantial, or where you are likely to have cable runs longer that 50 feet, you should get 12-gauge cables. This is even more so if you are shooting outdoors and using a generator; in that case, you will want to use 10-gauge cable. These are often sold as "contractor" cables. For cable runs exceeding 250 to 300 feet, a very heavy 8-gauge cable may be called for. Just bring some really hefty guys to carry them, and make sure you have a deep budget, since 8-gauge cables cost as much as they weigh!

On a pro video or film set, where long runs and high wattage instruments are common, it is typical to only use 12-gauge "stingers." I know one gaffer who will often cut 14-gauge stingers in half and dump them in the nearest trash bin when he comes across them on a film set. "I just want to make sure they don't show up again," he says with a smile.

So what happens when there just isn't enough power—or worse, there's no power at all? This isn't unusual in location dramatic work. If there is power near the shoot, but insufficient distribution, then you can call an electrician to do a temporary "tie-in" (see below).

But that doesn't solve the "no-power" scenario. What happens out in the woods, or in a deserted field, where the nearest power line is thousands of feet—or even miles—away? Although smaller shoots can use battery-powered 12-V instruments, most circumstances are going to call for a generator. Noisy ones like contractors use are easily available in nearly any community. You can use these in situations where sound is not an issue, but they are very difficult to use when recording sync sound. Special sound-attenuated generators are available for film and television use; they're more expensive to rent but are worth it.

POWER TIE-INS AND CONTRACTOR CONNECTIONS

In cases where the existing building wiring is deemed insufficient for a large lighting project, such as a feature film, it may be necessary to use a tie-in. This is a special device used by gaffers to tie directly into the bus of the breaker box to provide temporary high-current branch circuits. The tie-in has its own circuit breakers and outlets. For safety, a tie-in must be installed by a gaffer who is a licensed electrician.*

Another approach for situations where insufficient power (or no power) exists is to pay the local electric company to install a temporary connection to the nearest household voltage line. These are known as ***contractor connections*** because this is how contractors supply power to a construction site before the permanent connection is made. Contractor connections must be made by the local utility for both safety and legal reasons. Call the local utility and ask for their contractor services to find out what the details are in your area and where a special permit will be required. Be sure to schedule the installation of a contractor connection well in advance, since such an installation is not an emergency and the utility will not get to it immediately.

ELECTRICAL SAFETY

We've talked about how to carefully balance load over different circuits, but now we need to talk about the larger picture of general electrical safety. Although we are all very casual about plugging in toasters and space heaters and coffeemakers, these kinds of devices and mildly damaged extension cords are among the top culprits for house fires.

High-amperage electrical supplies are not a casual thing. Despite the safety factors built into the electrical code, it is actually rather easy to electrocute yourself or someone else through a careless move. A casual shortcut on safety precautions is all it would take to burn a house or studio to the ground—with the attendant risk to the lives of all in the building.

So here are some reminders for operating your lighting setup safely. They may seem self-evident, but when one is in a rush or cutting corners due to a tight budget, it's easy to overlook a safety measure—and one time is all it takes with the wrong set of circumstances to cause death or permanent injury.

1. Don't use worn cables! Cables and connectors wear out. The extension cords (or "stingers") that you use can be subject to tremendous stresses—foot or wheel traffic over sections, kinks, bending and stress at cable ends. Inspect stingers and lighting instrument cables frequently and simply. DO NOT USE any that are questionable. If connectors are bent or get suspiciously hot in use, you can always cut a foot off the cable and put a new connector on. But don't risk using a frayed, worn, or suspicious cable. There's a reason that the firemen I know are really

*Tie-ins would rarely be used in the UK or EU countries.

critical of the use of extension cords; they've seen too many fires caused by them!

2. Electricity and water do not mix! If you are shooting outdoors and a storm comes, all stingers need to be disconnected at the outlet immediately and the lights covered with waterproof tarps. If you are running stingers over damp ground or in areas where there may be puddles, great attention needs to be paid to elevating and protecting *each* connection. If you are using a hose, spray, or other water effects, the direction of water flow needs to be carefully planned and the cables and lights need to be positioned so they will not get wet. Don't be a dummy: have the camera under protection too!
3. Don't plug or unplug high-amperage lights while they are switched on. Use the switch that is designed to disconnect the load safely and without a spark.

It's a good idea on any location to use an electrical outlet tester (commonly called a "mains checker" in the UK) on each outlet you plan to use (Figure 3.9). These simple-to-use devices test for common wiring problems, including open grounds, open hots, open neutrals, and reversed polarity.

Current electrical codes require the use of special circuit breakers for circuits that will be used outdoors or in bathrooms near water. These safety devices, known

FIGURE 3.9
An outlet tester or mains checker.

FIGURE 3.10
An EU-approved residual current device (known as a ground fault interrupter or GFI in the United States) will cut power if a leakage occurs on one side of the circuit. Note the "TEST" button.

in the United States as **ground fault interrupters (GFI) or ground fault current interrupters (GFCI)**, will disconnect power if an imbalance is detected in electrical flow on either side of the circuit or if the ground connection is faulty. In the UK and Australia these are known as **residual current devices** (RCD) (Figure 3.10). These are designed to quickly cut power if a leakage occurs on one of the sides of the circuit—say a short to your finger while you are standing on a wet bathroom floor. They work quickly enough to prevent serious damage or death. These devices all have a test button that will allow you to induce an imbalance and test the cutoff mechanism. It's always a good idea to run a test on one of these circuits before using one for your lighting.

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CHAPTER 4

Lighting Instruments

Now we're going to take a look at the variety of lighting instruments that are used in film, video, and television lighting. These are the basic tools of the trade, but they range in complexity and cost from the simple and inexpensive to the complex and very pricey.

First, here is a bit of terminology you may run into. The historical theatre term for any lighting instrument was **luminaire**, from the French term for what we would call a "luminary." Many companies still use this term, though it's not common to hear an American lighting gaffer asking for a Mole 1 K by saying "Hand *moi* that *luminaire de bébé, s'il vous plaît*. It's more likely to be "Gimme dat Baby, OK?"

Also, some folks are very averse to calling quartz halogen bulbs *bulbs*. In the trade, those glass globes or tubes with a tungsten filament inside are known as *globes*. A theatrical lighting designer told me once "If it costs less than 10 bucks, it's a bulb. If it costs more than 10 bucks, it's a globe." This is an artificial distinction if ever there was one, but in a jargon-ridden industry that refers to clothespins as C-47s and extension cords as stingers, you need to know what everyone else is talking about!

Lighting instruments fall into a few basic categories: open faced, lensed, fluorescents, **Hydrargyrum Medium-Arc Iodide** (HMI), arc lights, soft lights, LEDs, and specialty instruments. We'll take a look at each of these in turn and provide examples of each category. *Please don't assume that this is a comprehensive catalog of every available model from a manufacturer, or even that we have covered all manufacturers*.

OPEN-FACED INSTRUMENTS

The most basic lighting instruments are the open-faced units, some variation of a simple bulb and reflector. The simplest (and least expensive) of these is the photoflood reflector. These are available at any photo supply store, are inexpensive,

D.O.I.: 10.1016/B978-0-240-81227-4.00008-7

and create the right temperature of light. A 500-W 3200-K **photoflood** bulb, for instance, sells for under $5, and a clamp-on reflector will cost less than $10. The downside is that the reflector doesn't provide any method of control and the bulbs don't last very long (Figure 4.1). That 500-W bulb will only last an average of 60 hours, compared to 1500 hours for a regular household bulb and 2000 hours for a quartz tungsten bulb. They are fine until they go "POP" at the most awkward moment of an interview.

The professional television version of the photoflood and reflector is known as a **scoop,** mainly because that's usually what they look like! Scoops can be either focusing or nonfocusing, but they are primarily large spun aluminum reflectors using a large quartz globe. They project a large, soft-edged beam and are excellent for fill light or broad area lighting.

FIGURE 4.1
A standard photoflood is inexpensive but has a short bulb life.

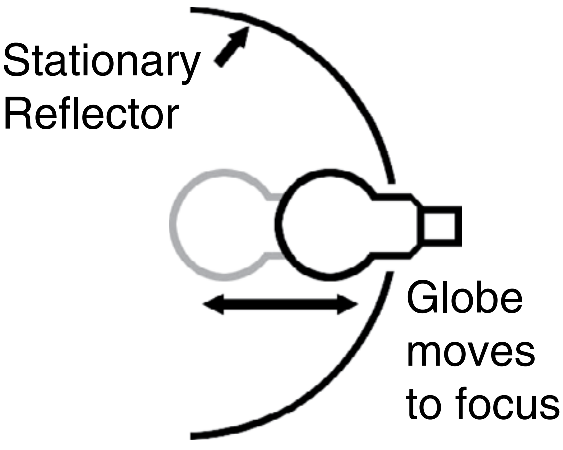


FIGURE 4.2
An open-faced instrument depends on a reflector to focus the beam.

A step up the scale would be something like the Smith-Victor 700SG or Q60-SGL. These are also simple spun reflectors, but they use the more reliable quartz bulbs and offer mounting for barn doors or other controls. Some offer basic focusing ability, though the light spread will show some unevenness. These are perfectly satisfactory entry-level units and a set of three could get you started—and maybe keep you going for a long time for basic work.

An open-faced instrument allows focusing through the simple expedient of moving the bulb backward and forward in the reflector (Figure 4.2). When positioned toward the front, the unit throws a wide beam; when positioned more toward the rear, the reflector gathers the beam into a tighter pattern. Most simple reflector units will show variations in the light pattern (especially at wide beam), since the bulb itself disrupts the light pattern at center. This effect can be mitigated through careful engineering of larger reflectors, so higher-end open-faced units will have a much more even light pattern than lower priced units. But even the best will have an uneven pattern when compared to a fresnel. Many open-faced units will also cast a slight double edge to shadows, so they may not be the best for lighting facial close-ups unless some diffusion is used. They are very useful for lighting sets and backgrounds.

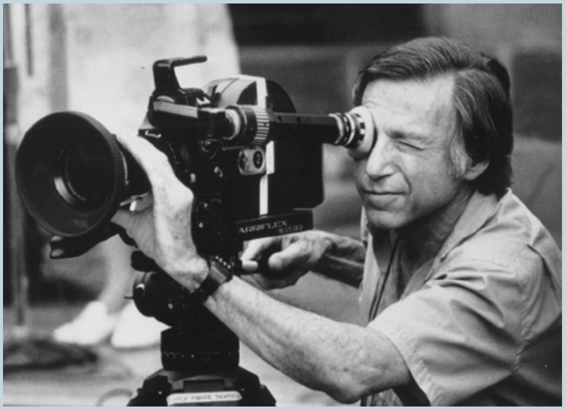
Lowel makes a wide variety of very good open-faced instruments. Their basic unit is the Tota-Lite

(Figure 4.3), a simple folding V-shaped reflector with a quartz tube. This type of lighting instrument is known in the trade as a "broad," for reasons that should be self-evident: they blast light all over the place in a very broad pattern. These are the sledgehammers of the lighting industry. They exhibit little subtlety, but they come in handy for the intended purpose! They do make excellent light sources to use inside **softbanks** like the Chimera, and they are wonderful for bounced fill light.

A more refined unit is the Lowel Omni-Light, a classic focusing reflector. This is lightweight, folds up small, and takes bulbs up to 750 watts. In addition, 12-volt bulbs are available, so the Omnis can be used in the field with battery power.

The larger and slightly more flexible Lowel DP Lite is very popular, since it allows a range of bulbs up to 1000 watts. The larger reflector allows the unit to throw a more even light pattern than the smaller Omni, and it shares the same type of clever Lowel "fold-out" barn doors. These have fold-out "ears" that create a big, trapezoidal barn door that provide excellent control. Interchangeable reflectors allow for a long-throw spot configuration. The pattern of the standard peened reflector provides a more even distribution of light at full flood than the smaller Omni.

FIGURE 4.3
The Lowel Tota-Lite (right) and the more controllable Omni-Lite (left).



Cinematographer **Ross Lowell** began experimenting with small, simple lights for location photography. He began the Lowel Light Company in 1959 out of his home. His lights were designed to be small, lightweight, and inexpensive, especially when compared with the full-blown studio lighting most of his contemporaries were using. Ideas such as collapsible barn doors and other design innovations have resulted in an Academy Award technical certificate, an SMPTE John Grierson Gold Medal, and over 20 U.S. patents.

In his classic book *Matters of Light and Depth* (Broad Street Books, Philadelphia), Ross Lowell wrote, "It is all too easy to confuse effects with effective lighting, startling images with unforgettable ones, quantity of footcandles with quality of light."

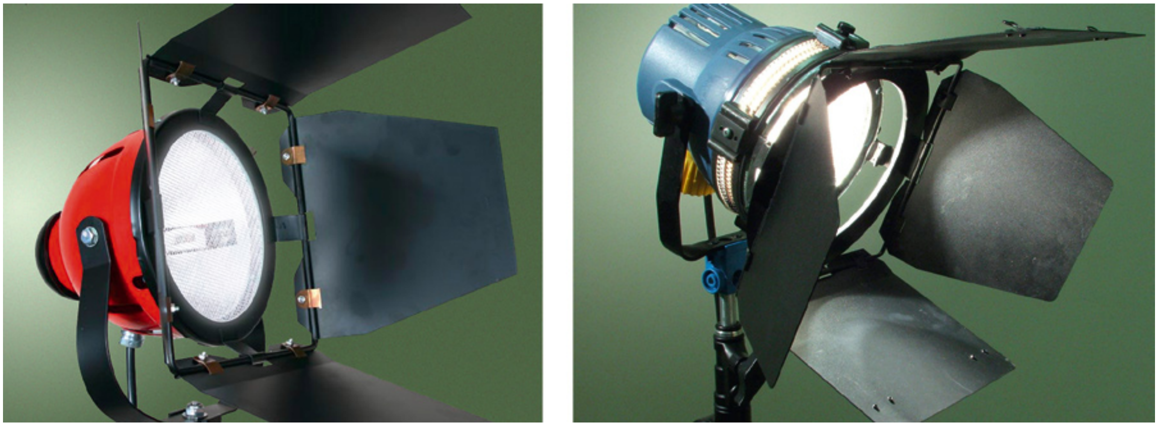


FIGURE 4.4
The Strand Redhead and the Arrilite are examples of higher-end open-faced instruments.

A step up the pricing scale, the Ianiro/Strand Redhead 650 W and 1000 W are open-faced units that are extremely popular in Europe but are less common in the United States. I've never been able to figure out why this is, because the Redhead (and the heftier 2000-W "Blonde") are very nice instruments that have an even light pattern.

Arri makes a similar and quite excellent open-faced instrument called the Arrilite, which is available in 600-W, 650-W, 1000-W, and 2000-W configurations. This is a substantially more expensive instrument than the Lowel DP Light, but is a durable professional unit with an extremely smooth light pattern. (See Figure 4.4 for examples of higher-end open-faced instruments.)

Other examples of open-faced lights generally fall into the categories called *broads* and *cyc* (cyclorama) lights. These are designed to blast light in a wide-even pattern to evenly light a large area. Nearly every manufacturer makes some version of these in various power categories. Like the smaller Lowel Tota-Light, these are mostly simple V-shaped or curved reflectors with one or more double-ended quartz tubes. Cycs are specially designed to illuminate cyclorama backgrounds evenly. Examples would be the Strand "Iris" or the Altman "Sky-Cyc." Both units can be ganged up with two, three, or four units in a single assembly.

LENSED INSTRUMENTS

Lensed instruments have a beam that is focused by a glass lens rather than just by a reflector. Usually, a reflector of some sort is used as well, but it may only play a minor role in focusing the beam (as in the fresnel or followspot) or work significantly with the lens as part of the optical design (as in the ellipsoidal or PAR can).

The fresnel lens is named in honor of its inventor, French physicist **Augustin Jean Fresnel** (1788–1827). He studied the behavior of light refracted through prisms and he worked out a number of formulas to describe refraction through multiple prisms. His theories form the basis of modern optics. He finally designed a lens composed of circular graduated prisms that acted together to focus light into a narrow beam. The prototype was a masterwork of one of the most advanced glassmakers of the day, Francois Soleil Sr. It was installed in the Cardovan Tower lighthouse on France's Gironde River in 1822. One contemporary engineer commented on the achievement: "I know of no work of art more beautifully creditable to the boldness, ardor, intelligence, and zeal of the artist."

The primary workhorse of theatrical, film, and video lighting is the **fresnel** (pronounced fruh-nel). This is named after the uniquely efficient stepped lens that it uses, which is very lightweight but has strong focusing power. Fresnels are available from nearly every manufacturer in sizes ranging from tiny units like the 100-watt, 2-inch LTM Pepper to the gigantic 24-inch Mole Solarspot that pumps out 10,000 watts. Fresnels have found huge acceptance because of their control and flexibility.

The most common fresnels in television work used to be 1-K and 2-K units, often referred to by gaffers, respectively, as a Baby and a Junior. These designations come from the Mole-Richardson line of lights, and actually refer to the physical size of the unit. Their 5-K unit is known as the Senior. The smaller 650 watt is known as a Tweenie. Mole has always been known for these somewhat quirky names, usually freely mixing the Mole brand name in somehow: the Molescent, the Molefay, or the Molegator. You ought to be at least familiar with these names, since it's pretty common to hear American gaffers talk about putting "a Junior here and a Baby over there as kicker."

As cameras have become more sensitive, the light levels necessary have decreased, and with them the power demands. Today, it is more common to see 500-watt, 650-watt, and 1000-watt units comprising the entire lighting kit for location work. You'll find the full range of lights on a well-equipped lighting truck, but it's rare to see anyone toting around a Junior or a Senior for location interview work. It's not only size, but power requirements. A Junior 2 K can technically run off a single breaker in most buildings, but they exceed the power rating of the branch circuit and typical outlet. A Senior 5 K requires a dedicated 50-amp line, which is very uncommon in most buildings except for special installations. Besides, a 1200-W HMI will pump out as much light as a 5-K quartz fresnel without making unusual demands for power. And that isn't considering the huge amount of heat generated by the power-guzzling brutes. These larger quartz fresnels are found mainly on sound stages these days.

Arri sells a very popular stock lighting kit that includes two 650-W fresnels and a 300-W fresnel. This is actually sufficient as a base kit for lots of location video

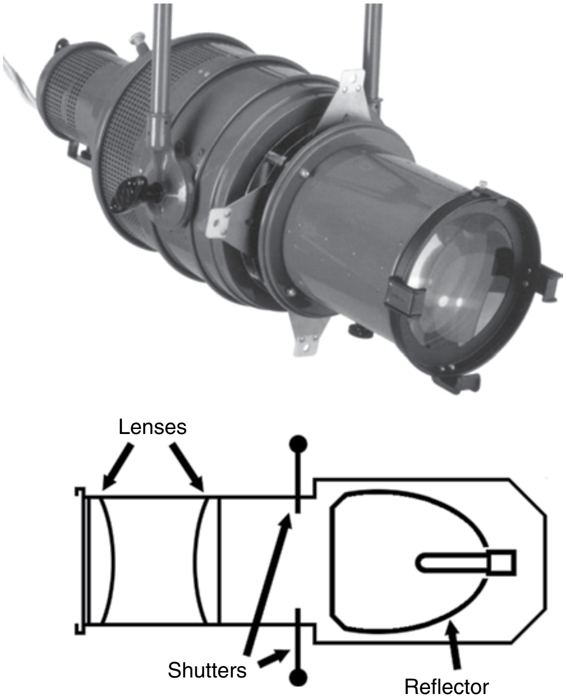


FIGURE 4.5
The ellipsoidal or profile spot uses both a specially designed reflector and a plano-convex lens to project a sharply focused beam of light.

situations. Many shooters use even less light; the popular LTM Blue Pepper Pak includes two 200-W and one 100-W fresnels.

Fresnels are not the only type of lensed instrument, of course. Another category, more commonly used in theatre than in television and video, is the **ellipsoidal**, or "**Leko**." These are known as "profile spots" or "silhouettes" in the UK because of their ability to throw a sharp-edged shadow. (See Figure 4.5.) The common name for the light comes from the shape of the carefully designed ellipsoidal reflector, which prefocuses the light before it reaches the smooth, plano-convex lens. The result is a sharp, projector-like beam with a very even light distribution. In fact, the ellipsoidal actually functions like a slide projector. Cutout patterns—or even laser-etched glass slides—can be inserted in the body to project a sharp pattern. In fact, this is the most frequent use for ellipsoidals in video and television production, rather than general subject lighting. In the theatre, ellipsoidals are often used from the ceiling above the audience because of their long throws.

A truly unique lensed instrument that has become hugely popular is the Dedolight. Though on the pricey side, location shooters love Dedolights because of their small size and beautifully even light throw. Invented by German DP Dedo Weigert, the Dedolight uses two lenses: a small meniscus lens to prefocus the light and a plano-convex lens as the main objective (Figure 4.6). The results are somewhat similar to the ellipsoidal, since both use a more sophisticated focus system than do simple single-lens instruments. The difference is that the ellipsoidal does the prefocus stage with a reflector, while the DedoLight does it with a second lens. Julio Macat (*Home Alone*, *Ace Ventura*, *The Nutty Professor*) is one DP who frequently uses a DedoLight as an eyelight.

The ellipsoidal fixture was introduced in 1933 by **Joseph Levy** and **Edward Kook**, co-founders of Century Lighting. Levy and Kook each gave half of their names to their new Lekolite or Leko. Not to be outdone, Kliegl Brothers introduced their ellipsoidal fixture known as the Klieglight. Although all ellipsoidals are frequently called Lekos in the United States, this is a brand name owned by Strand Lighting and properly refers only to their ellipsoidal reflector instruments. Hand me a Kleenex®, please—oh, any tissue will do! In the UK, on the other hand, ellipsoidals are usually referred to as "profile spots."

FIGURE 4.6
The Dedolight uses two lenses to project a sharply focused beam of light.

A very large category of lensed instrument is the **PAR,** which is an acronym for **Parabolic Aluminized Reflector.** This is an instrument that everyone is familiar with in some form. Auto headlights are PARs; so are the exterior floodlights you have outside your house, which are technically known as PAR38s. The standard PAR bulbs for theatrical or video lighting are PAR56 (7″) and PAR64 (8″). The PAR is an encapsulated unit with lens, reflector, and globe molded into a single piece. PAR bulbs typically look quite a lot like old round auto headlights and are usually mounted in a simple metal fixture known as a PAR can. They are hugely popular for live concerts and dance shows because they are cheap and durable. They also have the advantage of having a wide variety of characteristics. PARs can be designed a floods, spots, long-throw spots with oval patterns, and just about anything in between. Since the bulbs are fairly inexpensive, it's easy to keep an assortment of throw patterns on hand for different applications.

It should be clearly understood that PAR is a *configuration* rather than a particular type of globe. The basic PAR bulb is a one-piece molded unit with a quartz halogen globe enclosed. However, many HMIs (more on these later) are configured as modular PARs.

TRIVIA: The first PAR bulb was designed by Clarence Birdseye as a method of displaying his new line of flash-frozen vegetables.

FIGURE 4.7
The ETC Source Four PAR EA throws as much light as a typical 1-K PAR, but only consumes 575 watts.

Many companies have begun to produce modular PARs that can use either quartz or HMI globes. A modular unit is not molded together, but is a system where a set of interchangeable lenses and reflectors snap together with a replaceable globe.

Electronic Theatre Controls (ETC) has a very efficient series of modular PAR bulbs that are favorites of a lot of gaffers. Their Source Four series (Figure 4.7) uses a modular PAR with a 575-W HPL lamp that puts out about the same amount of light as a traditional 1000-W PAR64. Maybe this doesn't get you excited, but think back to our power management chapter. If you have to light a large set and you have a limited amount of power available, these units allow you to use half again as many instruments for the same power load. In some cases, this can be a lifesaver, and that's why some gaffers have become almost evangelical about the ETC 575-W HPL lamps.

For film productions, especially outdoors, PAR bulbs are ganged together into lighting arrays. These may include 6 to 36 bulbs arranged in an adjustable arrangement. This allows the array to be focused for a specific distance. By their very nature (multiple sources spread over an area) arrays create a somewhat soft source. In fact, some early 3D animation programs used digital "light arrays" to simulate soft shadows. Arrays are also used behind a large silk diffusion frame to create a gigantic and really, really bright soft source. If you're in a jam and you need a 6 foot by 12 foot light source that puts out 36,000 watts, the best way to do that is with a huge array! Just make sure you have a 300-amp connection handy.

When daylight balance is necessary, a special PAR globe with dichroic filter known as the FAY is used.

FLUORESCENT INSTRUMENTS

A hugely popular, and relatively new, addition to this list are fluorescent instruments. Not too long ago fluorescents and television were like oil and water: they didn't mix. The common "cool white" tubes gave everyone a sickly greenish cast that the cameras couldn't get rid of and the light would often seem to "pulse" on tape. The effect was even worse on film. If you had mentioned the word "fluorescent" to a DP 20 years ago, you would likely have produced a gibbering hysteria—or an explosive outburst. That was until the late 1980s when Kino Flo introduced high-frequency ballasts and color balanced tubes.

Today, just about every lighting manufacturer has a line of fluorescent instruments, some of which are pretty straightforward and others quite innovative. A good example is the Kino Flo 4-Lamp Bank System (Figure 4.8), which consists of a bank of color-balanced tubes operated by a remote ballast. These are fixed in a case that mounts easily on a C-Stand arm.

Fluorescents are the definition of a soft, diffused light that radiates in all directions. Like all diffused light, they have a relatively short effective throw, and thus are best used close to the subject. Since the development of color-balanced tubes, most of the earlier objections to fluorescents for film and video work have melted away. "Flos" have become hugely popular in the lighting trade for a variety of reasons. Foremost among these reasons are the lower power requirements (fluorescents typically consume a little more than half the power to produce the same light output as incandescent bulbs) and the cooler operating temperature (incandescent lights throw off a *lot* of heat).

FIGURE 4.8
John Alonzo, American Society of Cinematographers (ASC), aims the Kino Flo four lamp Diva-Lite. Photo courtesy of Kino Flo.

Let's take a closer look at those two factors. While power consumption may not be a major factor for a location videographer, it is a huge one for television studios, where the power bill makes up a major portion of their operating expense. In addition, the heat buildup from incandescent lights is substantial. Incandescent lamps are typically about 10% efficient, which means that almost 90% of the electrical energy is converted to heat rather than light. This means the studio must install a substantially larger air conditioning system, another energy hog. So installing fluorescent set lighting can result in a major cost savings for a studio. Add to this that fluorescents can now be dimmed

Fluorescents Come to Hollywood

In 1987, while working on the film ***Barfly***, DP Robby Mueller was shooting in a cramped interior with a wide lens. He didn't have the space to rig conventional set lighting. Frieder Hochheim (his gaffer) and Gary Swink (his best boy) came up with an answer. They established a base light with incandescent practicals and HMIs through windows. For fill and accent lighting, they constructed high-frequency fluorescent lights with "daylight" tubes. Through the innovation of remote ballasts, Hochheim and Swink were able to tape the tubes in nooks in the walls, behind drapes, and behind the bar. A new class of film lighting was born, and the Kino Flo Company was started. In the early 1990s, Kino Flo began manufacturing their own precisely color-matched tubes that could output 3200 K and 5600 K. Their TrueMatch™ instruments received an Academy Award®.

The new, cool, energy-efficient lights were a huge hit. They could be used as key and eye lights, and produced a very soft, diffused light. When moved off axis, Kino Flos would eliminate boom and mic shadows. Unlike standard fluorescents, their ballasts were quiet, and the light flicker free without any greenish cast. Tubes could be swapped for different color temperatures.

Gary Swink and Frieder Hochheim, founders of Kino Flo.

FIGURE 4.9
The Videssence Baselight B117339BX is a grid-hung studio fluorescent instrument.

through most of their range without appreciable change in color—unlike tungsten filament bulbs, which shift dramatically toward orange as they are dimmed.

Here's an example. When KGUN-TV in Tucson, Arizona, converted from all incandescent lighting to Kino Flo instruments, they estimated that their total power bill for lighting alone dropped by over $800 per month, or $9600 annually. And that doesn't include the savings in air conditioning costs.

So if that's the case, why is anybody still using quartz fresnels at all? Fluorescents do have a few disadvantages. First, they can't throw hard light at all. Most situations still require some hard light for accents and highlights. Even Videssence, a company built on fluorescent instruments, makes a fresnel it calls the ShadowCaster specifically for hard point and spot lighting. Second, quartz fresnels are virtually useless from any distance; don't try to light a speaker from 50 feet with "flos." And finally, they are big and bulky to transport. If you're flying somewhere, a Lowel Rifa-Lite and stand will fit in the overhead bin a lot better than a Videssence KoldLite.

The portability issue is changing, however, with the introduction of fluorescent instruments designed especially for easy transport. Lowel has an instrument called the Case-Lite, a fluorescent instrument built into a flight-ready case with barn doors that serve as the locking cover of the case. Kino Flo has a series called the Diva-Lite, which is also designed for portability and easy setup. The Diva-Lite still requires an external case for transport, however.

The flexibility of fluorescents is also changing. Where early "flos" were often big, ponderous metal cases designed for permanent mounting on a studio grid, many innovations have been made that make fluorescents useful in a wider variety of situations. The use of remote ballasts started by Kino Flo made innovative set installations possible. Remote dimmable ballast, working either off an analog voltage or DMX, have made remote control on sets easier. Smaller ballasts running a single or dual tube design have made easy-to-mount and easy to move light "wands" possible. Videssence's Modular series is a good example of a wand that can be used singly or snapped together into a bank.

DP Chris Gyoury came up with his own version of the light wand for Alton Brown's *Good Eats* series on The Food Network. The Gyoury System (Figure 4.10) is a separate dimmable ballast with remote wands that can be clamped to stands, furniture, or set pieces or mounted in a more traditional reflector.

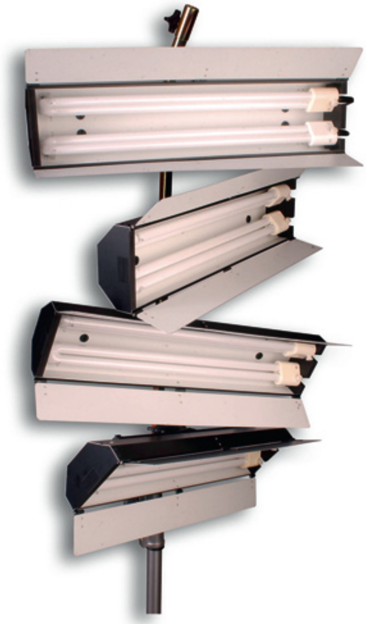


FIGURE 4.10
The Gyoury Light System uses light "wands" that snap into various holders.

Each wand uses a 55-watt Osram Sylvania high-output single-ended tube.

The tiny 4-inch, 2-watt Kino Flo KF32 T2 bulb (Figure 4.11) is also an innovation that has opened up many possibilities. These are used in car dashboards and other situations where a tiny, easily hidden soft light source is needed. It's my understanding that a certain aging national news anchor has these concealed in the front edge of his news desk, the soft light from below massaging out his wrinkles!

While fluorescent systems have proliferated and some have clear functional advantages for certain situations, it's very difficult to pronounce one line of flos as the "best." Variables such as portability, dimming requirements (local, analog, or DMX), and other factors must all be considered for a particular usage. Now that nearly all fluorescent ballasts are electronic high-frequency, the visible "pulsing" of old, 60-hz magnetic ballasts is pretty much eliminated.

One factor that is of overwhelming importance, however, is the Color Rendering Index (CRI) of the tubes that you are using. Tubes with a low CRI (less than 85) will never look right. Tubes manufactured specifically for video and film use (with a CRI of 90–95 or higher) will always render color better than consumer tubes.

FIGURE 4.11
Kino Flo T2.

HMI INSTRUMENTS

HMI (Hydrargyrum Medium-Arc Iodide) lights are a member of a class of lights known as High-Intensity Discharge (HID). This class includes the familiar bluish mercury vapor lamps used in street lights and the orange sodium vapor lights found in parking lots, as well as the HID headlights found in some newer automobiles. HMIs are in a way the modern and more portable version of the old carbon arc light and are valued because they throw off a very high light level at the same color temperature as sunlight. HMIs

FIGURE 4.12
The K5600 Joker 1200 HMI kit.

have also grown in popularity over the last few years. Don't try to remember what HMI stands for; I can't even pronounce it the same way twice in a row. HMIs are arc lights contained in a sealed capsule.

In my callow youth I had the job of running a large open carbon arc for exposing industrial screen printing emulsion. Anyone who has ever had the messy and inconvenient thrill of running a traditional arc light knows how much fun they are. They make a huge noise, they throw a pall of white ash all over the place, and it seemed as if you had to replace the electrodes every 15 minutes. Okay, I exaggerate. Today, one of the few places you'll see real carbon arcs in use are those gigantic spotlights that mark supermarket openings. Having personally operated one of the old arc lights, I can't convey to you young whippersnappers exactly how delightfully dandy HMIs are. Plug 'em in, bang, beautiful bluish-white light. No white ash, no replacing electrodes, no fiddly adjustments. Perhaps you've had the experience of watching a welder at work, or even using an electric welder yourself. This is exactly the same way that an arc light—or an HMI—works. Mole-Richardson still makes a genuine carbon arc unit, the Brute Molearc, that puts out about three times the lumens of their similar-sized 10-K "Tener" Solarspot. To put this in perspective, however, the much smaller 6-K HMI MolePar puts out about the same amount of light while consuming about one-third the electrical power.

Just like arc lights, HMIs must run off a special power supply known as a ballast. Similar to the ballast of an electric welder or a fluorescent light, the major role of the ballast is to limit the amperage that runs through the arc. Ballasts also output the correct voltage for a particular HMI globe and include special circuitry to "strike" or start the arc. These ballasts have gotten much smaller and lighter of late, too. Some even run off batteries. Just as with fluorescents, there are two types of ballasts: the less expensive magnetic ballasts (which can cause flicker problems for film or 24 fps progressive video) and the more expensive and efficient electronic square-wave ballast (known as flicker-free ballasts). Both are acceptable for video when shutter speed is set to 1/60th.

The advantage of HMIs is that they generate a very pure, intense white light that closely matches the quality of sunlight. They are available in a huge variety of sizes and wattages, ranging from the tiny Joker-Bug 150 to behemoths

FIGURE 4.13
The DigiMole 200 and 400 from Mole-Richardson are the lowest cost entry-level HMI luminaires on the market.

like the LTM Super 12/18-KW HMI with its 24-inch fresnel lens. They are available in open-faced PAR configurations with interchangeable lenses like the De Sisti Remingtons—or as more traditional fresnels such as the Mole HMI Solarspots. Portable HMI kits usually consist of a single instrument with fitted case, power supply, stand, and accessories.

Be aware that HMIs take a few minutes to reach full output. Before you measure light levels and set exposures, you need to let HMIs "burn in" to full intensity. They also pull higher than rated power during the initial strike, so you need to factor in a bit of headroom in your power requirements.

CERAMIC DISCHARGE METAL HALIDE

A relatively new class of lights that are related to the HMI are Ceramic Discharge Metal Halide (CDM) lamps. Ceramic instruments are a variation of the high-pressure mercury-vapor lamps. The discharge is contained in a ceramic tube that is filled with mercury, argon, and metal halide salts. The high temperature of the discharge partially vaporizes the metal halide salts, which in turn creates a hot plasma that emits a blue light that is very close to sunlight and has a CRI of 96 or higher.

By varying the mixture of the metal halide salts, the lamp manufacturer can also create a ceramic globe that generates a 3200-K warm light that is close to that of a quartz incandescent lamp; though these globes may have a slightly lower CRI than the 5600-K versions.

The advantage of ceramic instruments is high efficiency; they generate about five times as much light per watt than a normal incandescent bulb. The 3200-K ceramic instruments are growing in popularity in film and studio use.

FIGURE 4.14
The Desisti 3453 CST series ceramic studio instrument.

FIGURE 4.15
A simple Lowel Omni with umbrella creates a very nice, diffuse light, but is very difficult to control precisely.

SOFT LIGHTS

Soft lights are actually a broad category of lights designed to throw diffused light that creates soft-edged shadows and highlights. Soft lights can be any light source, ranging from quartz fresnels to HMI PARs to open-faced instruments. Fluorescents, of course, are soft lights by their very nature. The "hard" light sources (such as a quartz globe) in an open-faced instrument are diffused either through a large piece of diffusion material or by bouncing the light off a special reflector. The Chimera Softbank and the Photoflex Silverdome are examples of diffusion material soft lights. They are basically simple mechanisms for mounting a large sheet of diffusion material in front of a hard light source. Of course, the same effect can be achieved (though less conveniently) by hanging a sheet of diffusion material from a C-stand arm and positioning it a couple of feet in front of a fresnel.

The other class of soft light uses some sort of matte white reflector—or in a few cases, a specially engineered silver reflector—to bounce the light from a hard source. The most basic example of this is the photographer's white umbrella (Figure 4.15). One can achieve the same end, sometimes to greater effect, by simply bouncing a hard light off a piece of white **foamcore** held in a C-stand, or by bouncing off a white wall. Umbrellas and bounce cards provide a very nice diffuse light source, but allow zero control over the light. The De Sisti Wyeth or the Mole Softlite (Figure 4.16) are examples of white reflector instruments that provide higher control. These instruments use a quartz tube hidden inside the base of a large curved reflector that is painted matte white. They can use barn doors, snoots, and deep egg crates to control the light pattern quite effectively.

Most soft lights—other than fluorescents—are very inefficient. The diffusion material in a fabric softbank eats up a lot of the light; bouncing off a matte white surface transmits less than half the light. When using incandescent globes, bear in mind that they are already only 10% efficient—90% of the electricity is converted to heat—and the addition of a bounce or diffusion eating up the light reduces the efficiency even more.

One issue that is important to understand in the use of soft lights is the related impact of size and distance to the subject. Many people think that a smaller source, like the relatively small Mole 750-W Baby Softlite shown in Figure 4.16, will provide the same effect as a large Chimera. Nothing could be further from the truth. The physical size of the light source—either the diffusion panel or the reflector—has an important effect on the softness of the light. The larger the size, the softer the light. That's because instead of coming from a single point source, light is coming from the *entire surface* of the diffusion or reflector. In Figure 4.17 you can see an illustration of this effect. A large Chimera with a 54" × 72" diffusion will cast a much softer, more diffuse light than the 8" × 8" aperture of the Baby Softlite. The physical *area* of the light source is simply larger, so the photons are originating from a wider range of angles. The large area has the same effect as an array of many, many point sources. Imagine that instead of a single 1-K light source inside a softbank, you have mounted a hundred small 10-watt bulbs on a 54" × 72" piece of plywood. Light coming from the spread of sources softens the edge of shadows and highlights, and seems to "wrap" around the subject.

The other factor that affects the perceived softness of the light is distance from the subject. Remember the Inverse Square Law in Chapter 2. It applies not only to light levels, but to the effective perceived size of the light source. In other words, if you move the softlight twice as far away from the subject, the apparent size of the light source is cut to one quarter. For this reason, soft lights are best used close to the subject. This is also true because the light falloff over distance is much more severe from a diffuse source than it is from a focused point source.

FIGURE 4.16
The Mole Softlite 750.

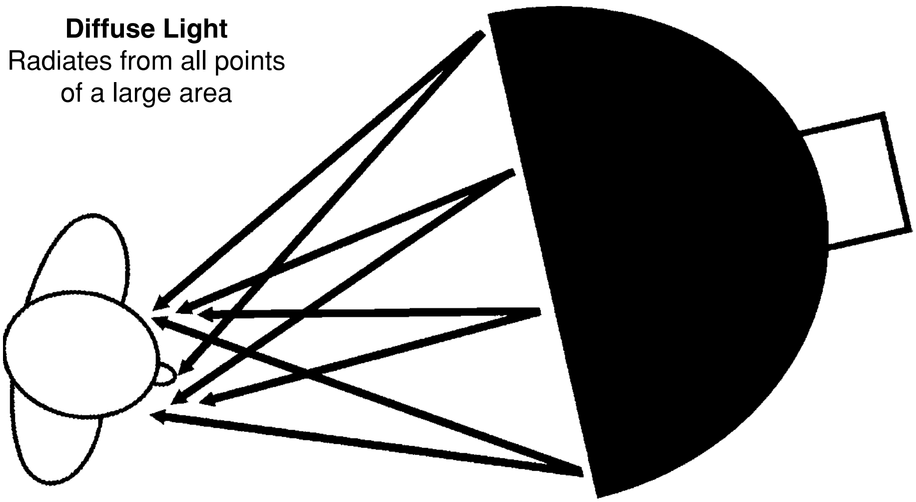


FIGURE 4.17
Light rays from a soft bank radiate from a large area rather than from a single point.

FIGURE 4.18
The type of softbank manufactured by Chimera and others, a wire frame covered with fabric and diffusion material that mounts directly on the front of an instrument, was invented by Jordan Cronenweth, ASC (*Altered States*, *Blade Runner*, *Peggy Sue Got Married*). Until commercialized, the softbank was known to many in the trade as a **Croniecone**. Gaffers often refer to these softbanks now as *baglights*.

SPECIALTY INSTRUMENTS

Specialty instruments is a whole category of instruments constructed for specific uses or effects. Since gaffers are an inventive lot, this category is always changing. It includes arrays of tiny bulbs for auto dashboards, skylights to cast even illumination over cycloramas, and the "flying moon," a large diffusion unit that is hung from a crane to provide soft illumination resembling moonlight over a large area. Many of these are instruments you'll only run into on a full-blown theatrical film production. However, I'll mention a few that find more common use in television work.

A "chicken coop" is an overhead cluster, usually using six mogul base globes in a metal reflector. These provide even overhead lighting, which is usually softened with a diffusion screen. GAM makes a large 6000-watt chicken coop known as the Toplight™. The homemade version, often constructed for specific circumstances, is known as a "coffin light" because of its shape. Chimera now manufactures a huge modular unit often used for automobile photography that serves the purpose of the custom-built coffin lights. These range up to 15' × 30' in size, which should be big enough for just about anything you can conceive!

Chinese lanterns are very useful as soft light sources. The traditional white paper lanterns are somewhat hard to find locally these days, but are still available from lighting supply houses. These can be used for soft fill and accents in many situations, and are a favorite of many DPs. Several manufacturers make "fancy" versions of the Chinese lantern using flame-resistant diffusion material and an internal cage to support the globe. They don't throw any nicer light than the cheap paper type, but they are more reliable to work with. The simple paper lantern is easily damaged and can catch fire if the globe inside touches the paper.

One intriguing use of the Chinese lantern in the last few years has been to mount the lantern on a mic "fishpole" as a portable, handheld soft light source (see Figure 4.19). In a fast-paced shoot on a complicated set, this allows a general lighting setup to be used with close-ups augmented quickly by the handheld Chinese lantern. This way, each close-up doesn't require a major alteration of fixed lights. Just like a boom mic, the "lantern-on-a-stick" can be brought in close until it is just barely out of frame.

Chris Gyoury in fact designed a fluorescent light ball for just this purpose. It uses two or four light "wands" enclosed in a wire structure of Rosco ¼ grid cloth. The unit is designed to screw onto a standard painter's pole; the remote ballast clips onto the rear of the painter's pole as a counterbalance.

FIGURE 4.19
Chinese lanterns can be used on a mic fish-pole as truly portable soft light.

Many specialty instruments have been cobbled up to mount a light source in a tiny, out-of-the-way awkward space. One is the GAM Stik-Up™, a tiny 100-watt open-faced instrument that weighs only 4 ounces. It can be mounted in a corner with gaffer tape or clipped behind an object with a C-47.

A very important category of specialty instrument is the on-camera light. These are small units that mount on the camera's accessory bracket and can be powered by external batteries or by the camera's battery. Most of them are simply holders for an MR-16 profile bulb and reflector combination—the type of bulb often used in slide projectors. However, in recent years they've gotten fancier and more versatile. Some (such as the Lowel I-Light) are focusing, while others (such as the NRG VaraLux) have a self-contained full-range dimmer. LED on-camera lights have come into wide use in the last few years as high-output daylight temperature LEDs have become more affordable. (Figure 4.20).

On-camera lights are essential in field news shooting, and other situations of "run-and-gun" shooting. When used as key light, they create the most unflattering look possible, one we're all familiar with from local news broadcasts. You should use them in this manner only out of dire necessity; I regard this use as a necessary evil for situations where no other solution is possible. On the other hand, they are quite useful and effective, even aesthetic, as fill lights or as eye lights.

FIGURE 4.20
Inexpensive on-camera LED lights such as this Bescor unit can provide needed fill that matches daylight temperature.

LED INSTRUMENTS

When the first edition of this book came out, LED lights were novelty instruments that could put a little color wash on a wall in nightclub lighting situations—but not much more than that. Since then, high-output, daylight temperature LEDs have been perfected that have created some very exciting, portable, and efficient lighting solutions.

LitePanels was one of the first companies to produce practical, on-camera LED light systems. The fact that the LitePanel could be easily battery powered and also provide daylight balanced lighting was very significant. Since that first production unit that I reviewed in 2004, the whole field of LED instruments has just taken off. FloLight, Altman, Bescor, Rosco, and other manufacturers have jumped on the LED bandwagon and created instruments for both on-camera and studio use.

Today LED instruments are very efficient and can provide reasonable light output for contemporary cameras with minimal heat and power consumption. For lower light requirements, they are becoming a preferred source because of their low heat generation and potentially long life. Since they are generally used in large arrays, they generate a pleasing, soft light source that is far more portable and efficient than older style baglights or large fluorescents.

FIGURE 4.21
The FloLight LED 500 is an easily portable soft light source that can be battery powered or AC powered and provides daylight balanced light.

COOKIES AND SNACK BOXES AREN'T FOR LUNCH

Gaffers use a whole array of specialized equipment for their craft, but more often they adapt ordinary objects for special use. Then they invariably give them funny names: snack box, cookie, C-47, trombone, meat axe. Almost more than any other field, the theatre, film, and television world loves jargon. Nearly everything has a nickname, and curiously enough it often has something to do with food. Many of these will be explained in more detail later in the book.

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CHAPTER 5

Lighting Controls and Uses

One of the key requirements of effective lighting is the ability to precisely manage the distribution and characteristics of the light that falls on the set. The implements that do this are known as lighting **controls**. The most common basic lighting control is the set of barn doors that mount on the front of an instrument. They allow simple cutting or restriction of the light beam to keep it off certain areas of the subject or the set. You might need to cut the light to keep it off a white wall, for instance; or you might wish to cast a thin slash of light across a backdrop. For location interview work, barn doors will probably supply all the control you will need.

For full production or set work, however, there are a whole variety of other controls that provide greater flexibility and precision. These include **diffusion materials** to soften the light, **scrims** and **silks** to reduce the light level to specific areas, and **flags, cookies, fingers**, and **dots** to throw creatively placed shadows just where they are needed. **Reflectors** and **bounce cards** help to redistribute existing light and provide fill. All of these have to do with controlling the distribution, intensity, and softness of the light.

GELS

Gels control the color of the light. Gels (or color filters) are thin sheets of transparent colored plastic, usually dyed polyester. There are three major gel manufacturers: Rosco in Connecticut, GAM in Hollywood, and Lee Filters in the UK. For film and video, gels break down into two categories: **color conversion** or **correction** gels and **color effect** gels

One point that is very important: not all gels have equal tolerance of heat. Cheap theatrical gels will literally shrivel under the heat of larger instruments. It's important to use gels with high-temperature tolerance known as "tough" gels.

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Color *conversion* gels are precisely calibrated to change one light color temperature to another, say to change a 3200-K quartz fresnel to 5500 K to match sunlight coming in a window. These are intended to force the color temperature of the light to match the white balance setting of the camera. Lights using color conversion gels typically will appear to be white on camera; though they are also used to create color effects in certain situations as well. Color conversion gels change light along the yellow-to-blue range.

Color *correction* gels add or subtract green component. This is necessary when dealing with typical fluorescent lights, which often have a strong green spike in their spectrum emission. If you have to shoot in an office or a factory that is lit with hundreds of "cool white" fluorescents that cannot be turned off and you need to also use a quartz key on the subject, you may need to add some green to the quartz light to match. The picture will be consistent, but will have a bit of a greenish cast since camera white balance really cannot remove the excessive green component of these lamps. You can cover the fluorescents with a magenta tone gel known as a "minus green." The simplest method is to lay large sheets of gel in the tray or grille under the tubes. Of course, covering a large number of big fluorescent fixtures with lots of minus green gel is not always practical. In that case, you can also use a camera lens filter (such as the Tiffen FL-B®) of the same magenta tone to subtract green from the entire scene. However, these often subtract so much light from the scene that they create an exposure problem in video. Another solution is to just gel the lights over the people you are actually focusing on, and let the background and other areas run a bit green.

On the other hand, color *effect* gels are intended to change the on-camera appearance of the light. These are used when a strong color tint is needed. Tints like bastard amber are known as *colorizing* gels, whereas strong primary colors are known as *party colors*. To simulate the effect of summer sunlight coming through a canopy of leaves, for instance, you might use a green gel such as Roscolux #86 (Pea Green) on the base key light and then Roscolux #07 (Pale Yellow) on an accent light with a cookie over it to create a dappled pattern. However, the camera white balance would be calibrated to 3200 K so that these colors would appear as a *color effect* on the video (if you white balance with color effect gels on the lights, the color effect will vanish or diminish). In many cases, a strong blue filter will be used to suggest moonlight. In other cases, you may want to tint a scene or part of a scene with a strong color for dramatic reasons.

Using "Party Colors" On the original ***Star Trek*** series, the set budget was very limited. Cinematographer Gerald Perry Finnerman, ASC, stretched the sets by having all the walls painted eggshell white and bathing them with "party colors" that reflected the mood of the scene. "I would cut the white light off the walls and paint my colours with the lamps," he said. "I lit the walls with the coloured lights, creating a mood for each segment (warm look for love, cold for evil, etc.). I did the same for exterior planet sets—mixing different colors for a variety of looks."

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Using color conversion gels is an essential science for video and television production. Depending on the type of video you produce, you may never (or rarely) use a “party color,” but you will certainly have to use color conversion on a regular basis. If you’re doing straightforward video work and just want a basic set of color conversion/correction gels, Rosco has a package called the Cinegel Sampler that contains what you will need.

Color conversion and correction gels primary break down into four types:

- BLUE for converting tungsten to daylight: known as Color Temperature Blue, or **CTB**
- ORANGE for converting daylight to tungsten: known as Color Temperature Orange, or **CTO**
- GREEN for correcting tungsten to fluorescent: known as **Plus Green**
- MAGENTA for fluorescent correction: known as **Minus Green**

Each type has a range of tints for different purposes. These are generally referred to by quarters—for instance, “Full Color Temperature Blue,” “¾ CTB,” “½ CTB,” or “¼ CTB.” Each tint will change color temperature a specific amount.

This can all be pretty confusing at first and the confusion is aggravated by inconsistencies between brands and even ranges within a single brand. As you may have noticed, the rules aren’t consistent through the ranges. Rosco’s Full CTB converts from 3200 K to 5500 K, while their Full CTO converts 5500 K to 2900 K. Lee and GAM use slightly different temperatures for CTB and CTO. To add to the confusion, the fractional gels aren’t linear—in other words, a double layer of Rosco ½ CTB will not be quite the same as a single layer of their Full CTB. Sorry, you just have to get used to it. It isn’t as confusing as women’s sizes in department stores, but that’s not saying much, is it?

Mired The amount you need to shift color temperature is measured in **mireds**, which is an acronym for Micro Reciprocal Degrees. Gels are rated in positive or negative mireds. Each light color temperature has an equivalent mired, which is figured by dividing 1 million by the Kelvin temperature. For instance, to find the mired rating of a typical tungsten instrument:

$$1{,}000{,}000 \div 3200 = 313 \text{ mireds}$$

The mired rating of a daylight source such as an HMI instrument would be as follows:

$$1{,}000{,}000 \div 5500 = 181 \text{ mireds}$$

The gel you need to correct from one to the other will be rated as approximately the difference between the two. In this example, the difference is 132 mireds. If you need to correct the tungsten light to daylight, you need a rating of about −132 mireds. Surprise! That’s exactly what Full Color Temperature Blue is. Rosco’s Full CTB, Cinegel #3202, is rated at 131 mireds, while Lee’s #200 is rated at −137 and GAM’s #1523 is rated at −141.

On the other hand, if you need to shift in the other direction and correct an HMI to match tungsten bulbs, you need a rating of +132 mireds, which would turn out to be a ¾ CTO., since full CTO converts 5500 K to 2900 K, or household tungsten lamp rating.

Typically, you will fall into using a few specific gels depending on what lights you use most, so it's not long until this becomes second nature. For most videographers who have a quartz light kit, the most common use will be to match sunlight coming in a window. This presents the largest variation, since the actual color temperature of sunlight varies dramatically through the year, through the day, and depending on weather conditions. To do this properly with a pro camera, perform a manual white balance on a white card illuminated only by the sunlight. The camera will display in the viewfinder what color temperature it is balanced to. For instance, on a clear day near noon it may read 4800 K. Your quartz lights will be somewhere near 3200 K, though to be sure, you might perform the same operation with the white card illuminated only by the quartz lights. This situation will call for a ¾ CTB.

Large sheets of conversion gel material are available to use over windows to convert sunlight to 3200 K. GAM makes a product called WindowGrip that has a low-tack adhesive already applied for this use. Special material to correct the daylight temperature of computer monitors and television screens is also available.

Table 5.1 Standard Color Conversion and Correction Gels

To help you out, you can find this chart as a file on the web, at www.johnjackman.com/downloads. Look in the section for Chapter 5, and the file is called Correction.xls (for Excel), Correction.doc (for Word), or Correction.txt (plain text). Print this out, laminate it, and keep it in your light kit with your gels.

Also on the web, you will find an HTML file called Cinegel.htm that will display the full range of Rosco Cinegel colors. This should be viewed in your favorite browser.

Gel Selection Software GAM GelFile is a database of technical and visual information about color. It displays and will print out the dominant wavelength, purity, and brightness of over 1300 different gels. GelFile shows what color filter is available from nine manufacturers at any location on the CIE color spectrum map.

GelFile will help you select a group of gels to form your inventory—a list of those color filters you would like to have available at your theatre or studio. You can display your inventory and all 1300+ colors available at the same time. The screen map will show which colors of the spectrum are available and which are not.

With this software, the designer can predict the colors that will mix with any selection of two or three color gels in spotlights aimed at the same surface. The answers can be viewed on the screen or can be printed out.

Light|Shop Online from Stage Research is a web-enabled, constantly updated database of photometric information on thousands of lighting fixtures, gels and filters, gobos, and gulbs from industry manufacturers.

Light|Shop data on instruments can interface with lighting layout program from Stage Research such as Light Grid and SoftPlot. These allow complex lighting designs to be laid out with accurate physic-based preview simulations.

It is a common misconception that gels add color to light, but this is the opposite of reality. It is important to understand that gels are light transmission *filters*. They do not add color to light; rather, they *subtract* it or filter it out. In other words, a green gel actually works by absorbing the opposite color (red), but freely transmitting green. The gel turns apparently white light green by removing other nongreen components. The precise manner in which a particular gel does this is plotted on a Spectral Energy Distribution (SED) curve. This displays the entire rainbow of discrete colors, and plots the filter's ability to pass or block each color.

Figure 5.1 shows two SED curves for two different Rosco gels. The first one, #389 Chroma Green, passes 80% of the energy at 500 nanometers (nm), but nearly eliminates all other frequencies. Its overall transmission rating is 40%. The second, #367 Slate Blue, has a more complex signature. It passes 460 nm (medium blue) and above 700 nm (red), but sharply curtails 600 nm (yellow) and reduces 400 nm (UV blue) to 40%. The overall light transmission is 20%. ND (neutral density) gels have a neutral tint that passes all frequencies equally, and these are used to reduce light level from an instrument or through a window, without changing its color or quality.

Gels can be used on common instruments in a couple of different ways. Most fresnels and open-faced instruments come with gel holders that can slip in behind the barn door assembly. You might want to mount a commonly used gel (for instance, a full or ½ CTB) in a gel frame for frequent use. However, in most cases, gaffers will simply clip sheets of gel onto the barn doors of an instrument using wooden clothespins, often referred to in the business as C-47s. Don't use anything but old-fashioned wooden spring clothespins—the

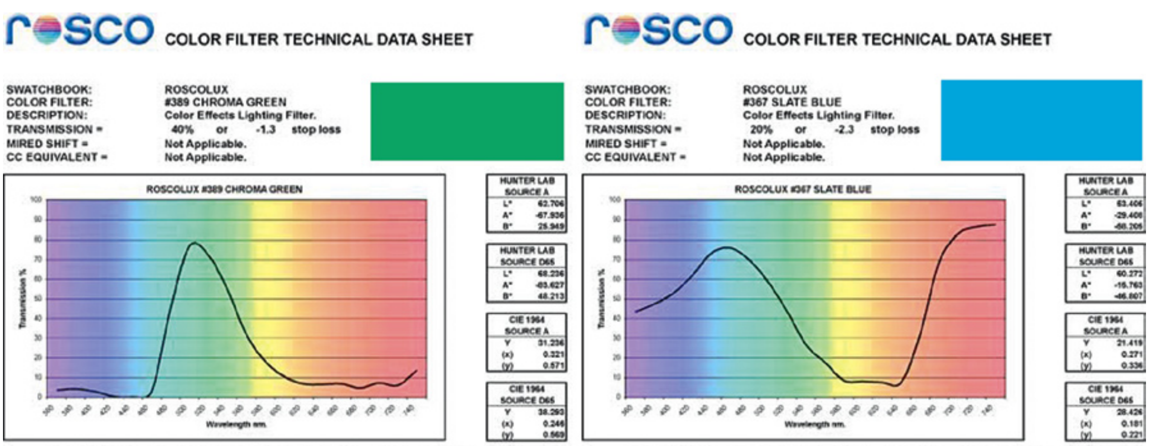

FIGURE 5.1
Spectral Energy Distribution curves graphically represent the color transmission and absorbtion of a gel.
Courtesy Rosco Laboratories, Inc.

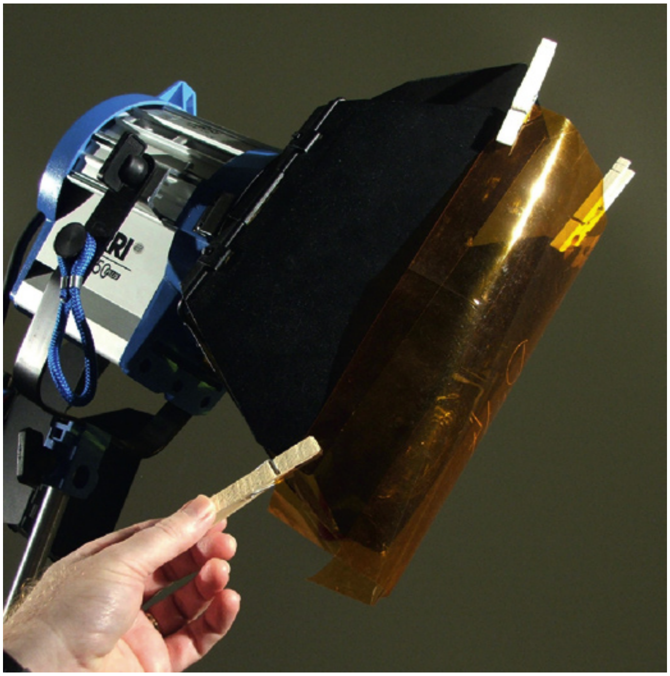

FIGURE 5.2
Gels can be mounted using a gel frame or clipped temporarily on the front of the barn doors using wooden clothespins.

plastic ones will melt in short order! Other instruments such as large softbanks may need to have a large sheet clipped inside the front diffusion material.

DIFFUSION

Diffusion material is different from gels in that it acts to soften and diffuse the light without changing its color. Diffusion changes the "quality" of the light, as opposed to its color. A whole range of diffusion materials are available, each of which has a more or less dramatic effect on the light. Typically, diffusion material breaks down into three main categories:

Grid Cloth—a waterproof woven textile that can be sewn or grommeted for attachment to large frames

Tough Spun—a nonwoven polyester fabric that reduces intensive and softens light

Frost—Sheet polyester material that is frosted to various degrees.

Rosco and Lee manufacture all three materials, whereas GAM manufactures a graduated range of polyester frost sheets. Please note that some materials are rated as flameproof and some are not. If you will be using the material close to an instrument (as in a gel holder right in front of a fresnel lens), it is important to use flameproof material.

Don't be stuck with only commercial solutions. Except when a flameproof solution is needed, just about any fabric can act as diffusion. An old white bed-sheet can diffuse sunlight coming in a window, for instance.

Nets and **silks** act to subtly reduce the light level to specific areas. They usually also provide some diffusion. These are usually thin, translucent fabrics stretched over a frame. Very large net frames are known as butterflies (Figure 5.3) and are used to knock down and diffuse strong sunlight. Smaller frames are used in front of instruments. Some frames are made as a square **U**-shape with one side open. These are called open ends and are used when the scrim must be brought in invisibly during a shot. The open side allows the scrim to be introduced seamlessly, without the visible moving shadow that a full frame would cause; or to be used to reduce light on part of the subject (a white shirt) but not another (the face) while also not creating a shadow line.

Different grades of fabric are available. Real silk, of course, is quite costly and can burn, and so synthetic substitutes are often used. The fabric may be white (known as *silk*) or black (known as *net*).Nets are used to absorb light while the white fabrics provide diffusion. These are usually graded as ¼ stop, ½ stop, and ¾ stop.

Large butterflies such as 12 × 12 or 20 × 20 can be very difficult to use if there is any wind at all. Remember, they are basically quite similar to sails and

FIGURE 5.3
A large silk, or "butterfly." Photo courtesy of Mole-Richardson, Inc.

large kites! Make sure that stands are anchored securely with sandbags or guy wires. On very windy days, they will produce a whipping sound very familiar to sailors, intruding on audio recording.

Many instruments, particularly open-faced instruments and fresnels, come with wire scrims that slip in the holder in front of the lens—just behind the barn door assembly. These are made of heatproof wire screening and usually are rated as *single* (which reduces the light by about 25%) or *double* (which cuts the light output in half). They can be stacked together to provide stronger attenuation of the light output. Confusingly, they are also available as *half singles* and *half doubles*, where the screen only covers half the light. These can be used to reduce light to a specific area of the set while keeping full intensity elsewhere.

Gels affect the color of the light; diffusion and silks affect the softness of the light by making it more diffuse; while scrims affect the intensity of the light. These are controls for the light *quality*. Now we need to control the precise light *pattern*, the shape of the beam. That is, we need to control precisely where the light falls on the scene. This is done with an assortment of opaque black objects.

The most basic and common of these controls are barn doors mounted to the front of an instrument. They provide quick and easy (if somewhat basic) control of the light pattern. They can cut the light off a white wall or keep spill

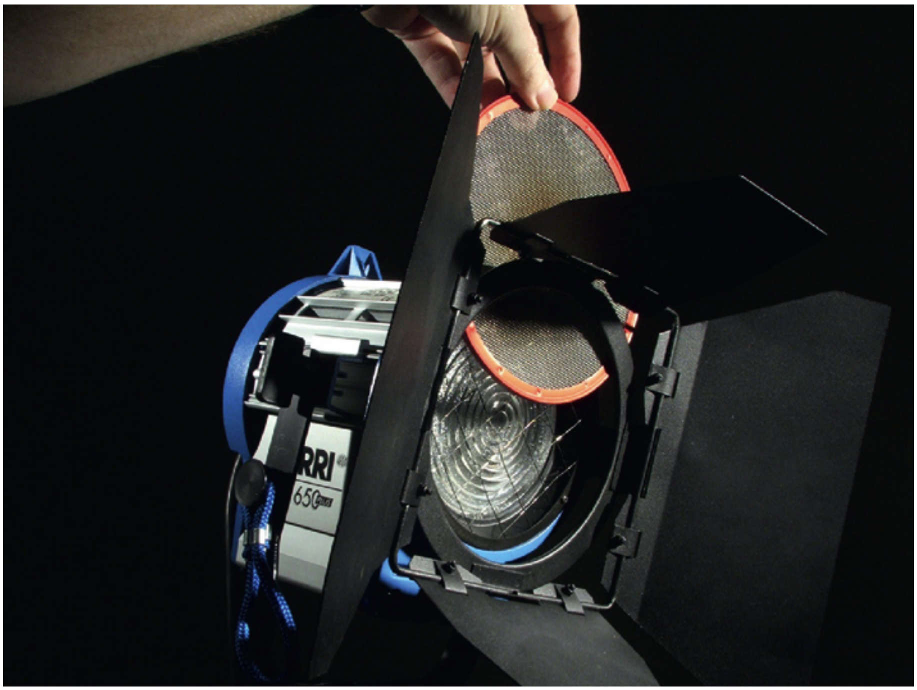

FIGURE 5.4
A wire scrim being inserted in an Arri 650 fresnel.

out of the camera lens to avoid flares. They can usually be rotated to allow the cutoff of the light pattern to be at any angle. But because they are very close to the lens, they often cast a somewhat soft edge and sometimes have too little effect on a spot pattern.

When a sharper, precisely defined shadow needs to be cast, a **flag** or **gobo** will be mounted on a separate stand a little distance from the instrument. These can be a black fabric over a wire frame, cardboard, plywood, or foamcore. Flags are wire frames covered with a black, light-absorbing fabric called **Duvetyne** or Commando Cloth. Black foamcore (¼ styrofoam sheet with paper facing on both sides) is increasingly popular for smaller applications because it is disposable and easily cut into special shapes. The boom arm of the ubiquitous C-stand is usually called a gobo arm because that's what it is most often used for (Figure 5.5). The very flexible C-stand head can mount the ⅝-inch or ⅜-inch rod that typically is used for the handle of a flag. The gobo head can also grip a piece of foamcore between its textured halves, and rotate to nearly any position.

Flags and gobos are also referred to as **cutters** and may be differentiated by position: **sider, bottomer**, or ***topper*** (also called a **teaser** after theatre parlance). Flags and cutters should not be placed too close to the instrument; a bit of distance is needed to create a defined edge to the shadow. Usually, the flag should be placed somewhere between one-fourth to one-third of the distance from the light to the

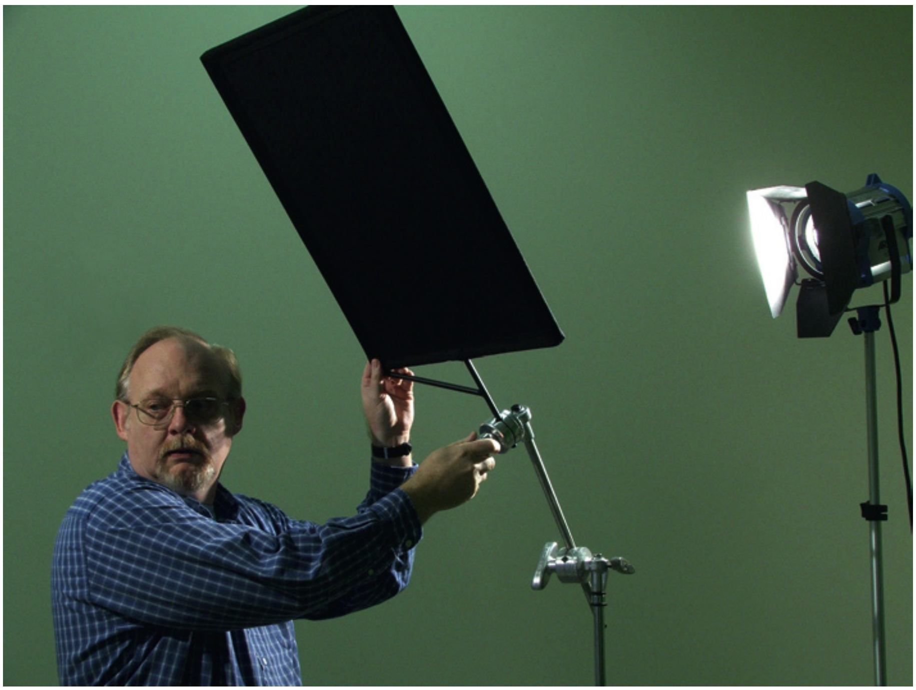

FIGURE 5.5
Using a C-stand with gobo head to mount a flag.

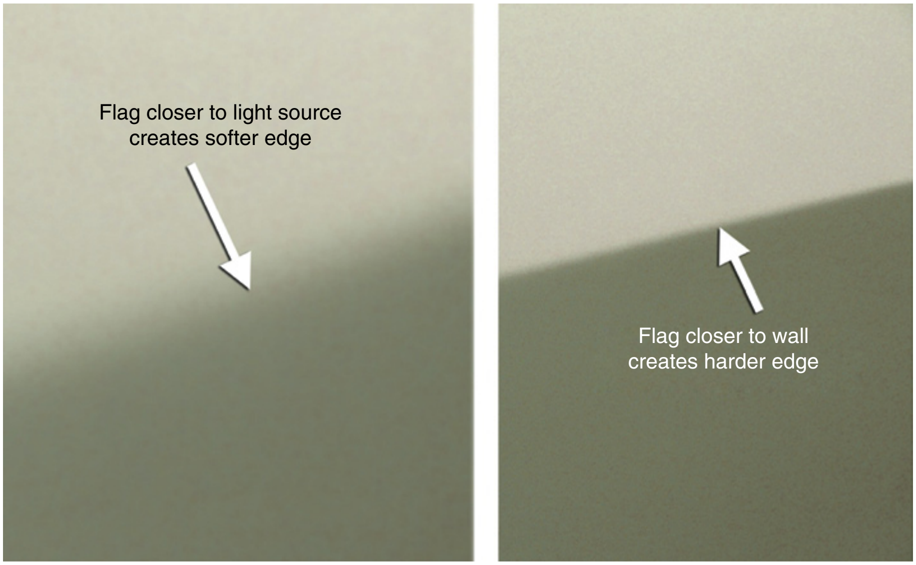

FIGURE 5.6
Here a cutter is used to create a shadow in the corner of a room. When the cutter is placed close to the light (left), the shadow is less well-defined. When it is placed closer to the set (right), the edge is sharper and more clearly defined.

subject, depending on how sharp an edge is needed on the shadow. The closer the flag is to the light source, the less well defined the edge will be; the further from the light source, the sharper the edge of the shadow. Positioning a flag is known as *setting* the flag or cutter.

Flags and other cutters allow the DP or gaffer to throw large controlled shadows on parts of the scene. But sometimes a pattern of light and shadow is needed, or more precise control of the light on a specific "hot spot" is necessary. That's when **cookies, fingers**, and **dots** come into play—or the thin aluminum cutouts Ross Lowell calls *blips*.

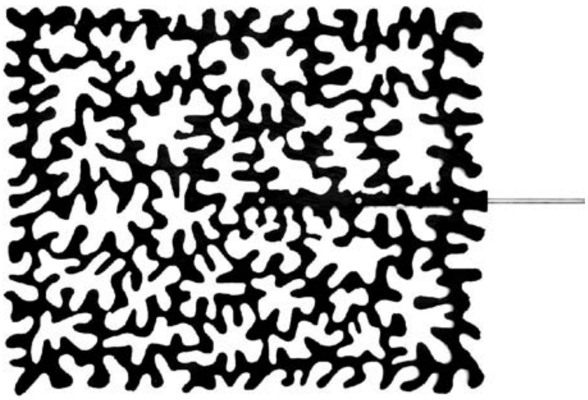

FIGURE 5.7
A cookie, or cucaloris, is a random cutout pattern, usually of thin plywood used to create a dappled lighting effect. Courtesy Mole-Richardson Co.

A **cookie**, or **cucaloris**, is a random cutout pattern that throws a dappled pattern of light and shadow (see Figure 5.7). These patterns are incredibly useful for breaking up large boring walls or for simulating the dappled light under trees. They are very frequently used in night or evening scenes. Of course, cookies aren't the only devices used to cast light patterns. Real venetian blinds can cast slatted patterns, or cutouts shaped like pane windows may be used. Chimera makes a line of large transparency patterns of windows, foliage, ferns, and so on to cast shadow patterns on backgrounds from their softbanks.

Fingers and dots (Figure 5.8) are small shapes mounted on wire much like tiny flags and nets. They are positioned carefully to throw a small

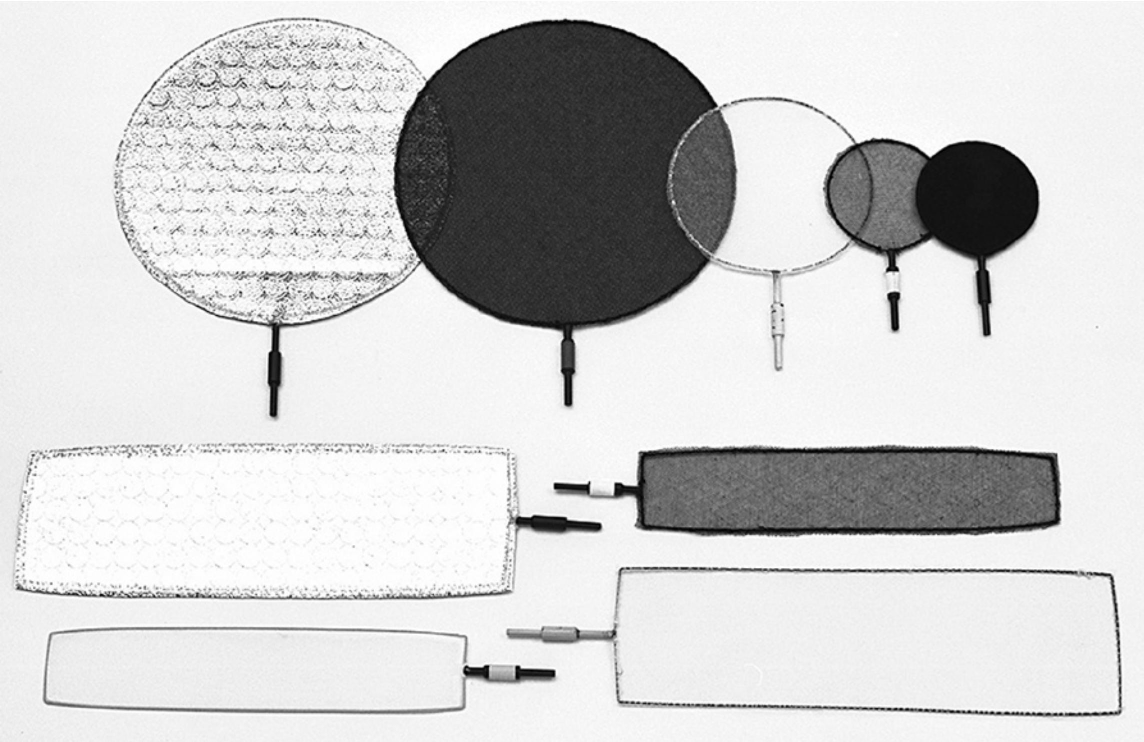

FIGURE 5.8
Fingers and dots are small patterns used to cast a small shadow on a specific area—often to kill hot spots in the picture. Courtesy of Matthews Studio Equipment, Inc.

shadow on a specific area—either a hot spot that needs to be knocked down or an area that the DP wishes to deemphasize. Fingers and dots can be opaque or use the same range of silks found in scrims. The proper grade is selected depending on how much the light needs to be reduced. These are typically most useful in close-up work or in shooting tabletops.

This category of light controls has to include the gaffer's favorite pal (no, not the tape, we'll get to that later). It's a roll of stuff called **blackwrap** (Figure 5.9). It's just heavy aluminum foil that has been anodized matte black, but boy is it great stuff! It's inexpensive and disposable, can be molded into any shape, and can be cut into shapes. A roll of blackwrap can often be all the light control you'll need. Blackwrap can replace barn doors, snoots, and a host of other accessories. You can mold a snoot to produce a precisely shaped beam of light, or cut patterns in the blackwrap. It can be used to extend barn doors when they're just not quite large enough; the most basic and common use of it is to cover the open juncture between barn doors and the instrument body to eliminate light scatter. Blackwrap is one of the "must-have" items for your Gaffer's Survival Kit!

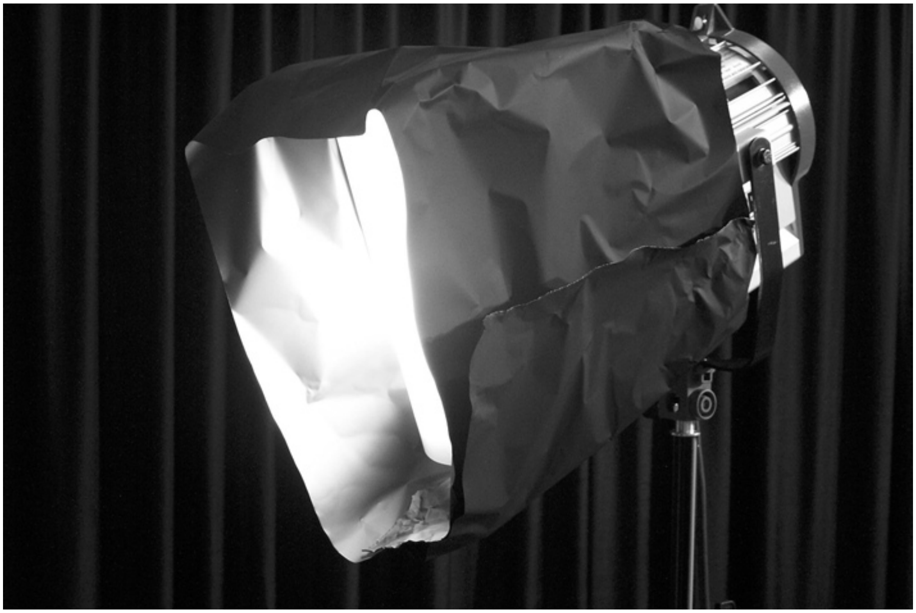

FIGURE 5.9
Blackwrap is used on a light to provide precise, custom-formed light control.

FIGURE 5.10
A reflector will provide fill in an exterior shoot.

FIGURE 5.11
Cinematographer Richard Clabaugh mounts a sheet of diffusion on a fresnel.

One very important tool that we might include in this section—because it has to do with controlling the light pattern—is the **reflector** (Figure 5.10). Many times when a little extra light is needed (especially for close-ups), you don't need to set up an extra light. There's plenty of light on the set—it just needs a little rearranging! Enter the humble reflector or bounce card. This can range from a piece of cardboard with aluminum foil on it to a snap-open treated fabric circle to a huge polished aluminum sheet. It can be a simple sheet of white foamcore or posterboard! It is simply a sheet of some material that will bounce some light into the area where it's needed.

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CHAPTER 6

Basic Lighting Techniques

Before we start with the textbook diagrams, we need to cover some basic theory of what good lighting is all about.

Obviously, lighting is necessary to provide enough excitation for the camera's charge-coupled device (CCD) to produce an image. And as we discussed in detail in Chapter 2, the contrast range needs to be compressed enough to provide some detail (engineers would say signal) in dark areas but not overexpose highlit areas. I suppose if you did no more than that, you'd be doing better than many! But this purely technical definition is pretty lacking in soul. And if that's all you do with your lighting, your pictures will lack soul, too. They'll be well exposed and the engineers will think they're great. But it would be nice to accomplish a little more than that!

Back in Chapter 2, I talked about how lighting provides subtle cues to the brain about texture and depth. These are incredibly important. Again, there's no third dimension to television or film; only height and width. The illusion of depth and dimensionality is just that: an *illusion* created by artistic lighting. It's up to you to create that illusion, and trust me, it doesn't happen by accident. Laypeople and beginners are often baffled by the amount of time it takes to light a scene properly because they don't understand the subtlety of what's going on. The compromises between the technical necessities (controlling hot spots) and the artistic potential (creating the convincing look) can take a bit of juggling to accomplish. That said, good lighting isn't always that hard or time-consuming to achieve. It's the combination of a trained eye and experience of what works that allows pros to often set up effective lighting quite quickly.

A SENSE OF DEPTH

First, we need to create a sense of depth. In the real world, of course, this is simply an automatic part of the depth perception created by our binocular vision. Lighting might dramatize our awareness of depth, but it isn't necessary.

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On television, the only tools we have to convey depth are the *shadows and highlights* created by lighting, *depth of field* (DOF), and *camera motion*. We'll leave DOF and camera motion to the camera operators right now, and fix our attention on creating shadows and highlights. This combination of highlight and shadow creates a sense of *modeling*, the illusion of depth and dimension.

Early television—just like early films—had to work at creating this sense of depth because they were monochromatic. Black and white television *couldn't* be entirely flat lit, or faces would be undifferentiated blobs. Shades of gray that were too close in value would blend together without definition. But when color was added to the signal, all that changed. When television studios discovered that the color provided additional visual definition, flat lighting was born—lots of light all over the place. It was easy, it worked, it was practical. It was easy to use in a studio setting where many people might be moving around and where multiple cameras required the lighting to work from any angle. Creative lighting was left pretty much to "the film guys" and this is part of where the film world's negative attitude about video comes from. Video just looks cheap when lit this way.

Flat lighting (also known as *high key* lighting because there's very little difference between levels of key and fill) provides very little modeling. Look at Figure 6.1. A ball that is lit from the front, as when the light is mounted on the camera, will look flat. It could in fact be just a disk rather than a ball. This sort of lighting is generally used only in location news, and then out of necessity.

Studio flat lighting, or high key lighting, is an attempt to light every bit of the studio equally. Lights on a subject will be of equal intensity from all sides.

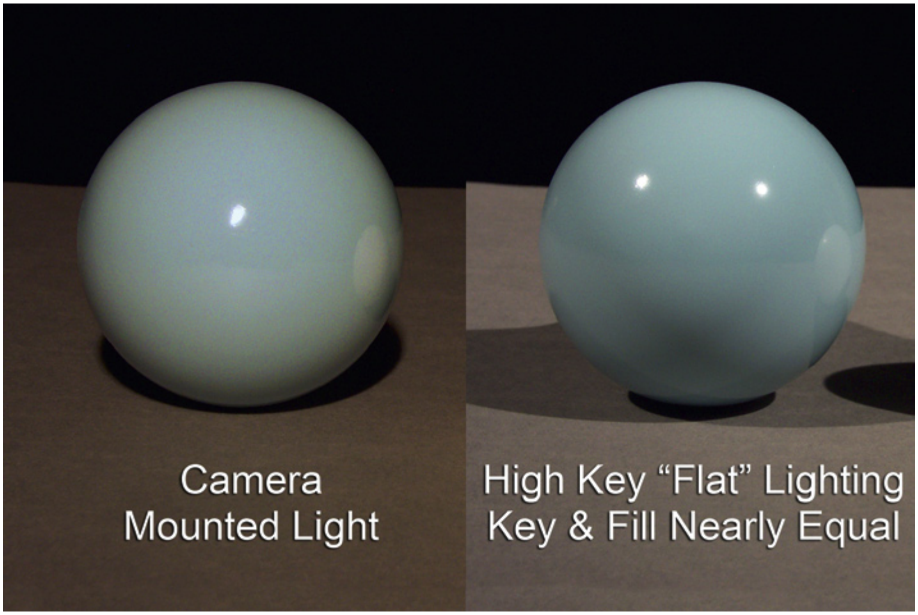

FIGURE 6.1
Left: When the light source is mounted on the camera, there is little or no modeling; the subject appears to be flat and dimensionless. Right: Studio flat lighting has some dimension, but seeks to illuminate all sides equally.

There will usually be some shadow under nose and chin, but even those can be eliminated with fill lights from below the face. One program that did this as a characteristic "look" was *Hollywood Squares* (1983–2004). Basically, a large set on which to play tic-tac-toe, the stars in the squares have fluorescents surrounding them, above, beside, and below, creating a completely shadowless—and very artificial—environment. More typical studio flat lighting will look a bit like the ball on the right in Figure 6.1. There will be some limited modeling, but not much.

Let's bypass flat lighting for the moment. It's a necessary evil, an industrial compromise that allows shows like *The Tonight Show* and *Meet the Press* to be shot in any configuration without lighting changes. You need to know how to do it (we'll cover it in the chapter on studio lighting), but it certainly isn't an artistic ideal to aspire to.

Instead, let's build some great lighting by creating a sense of shape and depth—and analyzing how your eye and brain interpret the cues we'll give them. Going back to the ball, let's turn off all the lights except one, and let's move that *off axis* from the camera. This will be the main light for our scene, known as the **key light**. Remember, if the light is too close to the camera position, there won't be much modeling. Look at the ball in Figure 6.2. Although much of the picture is in darkness, you can tell right away that the ball is spherical rather than just a flat disk. How can you tell? By the pattern of light and shadow. The position of the key light in relation to the camera is tremendously important for creating this illusion.

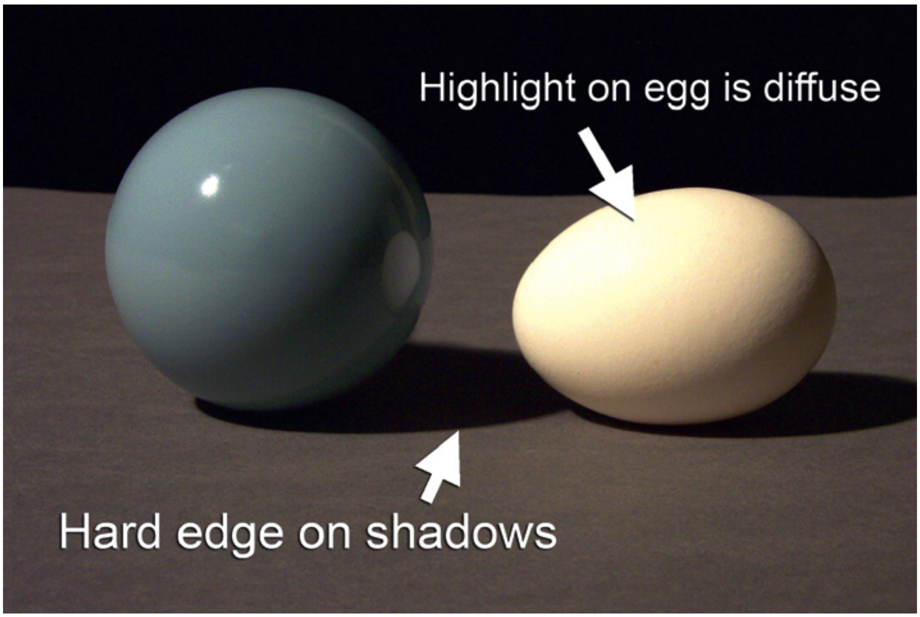

FIGURE 6.2
By moving the key light off axis from the camera, we create strong modeling that conveys a sense of depth and shape.

But what else can you tell? You can tell that the ball is shiny and that the light source is a hard light. How? By the highlight, which is actually a reflection of the light source. The tiny, sharp-edged highlight could only come from light falling on a shiny object. The sharp edge of the shadow confirms that the light is a hard source. Look at the egg. The shadow is still fairly sharp-edged from the hard light; but the highlight is less defined, spread out. You can tell from this that the surface of the egg is *not* shiny. See how these subtle cues build up? You didn't have to think consciously about either shape or texture; your mind pulls these cues together on the fly and interprets the depth and texture.

Now let's look at the same scene lit with a slightly diffused light source. This is similar to a fresnel with a light frost diffusion material or a small Mole Softlite. It is still pretty contrasty and dark, but you can tell the light source is different. How? The shadow edges are softer, and the highlight on the egg is even more diffuse (Figure 6.3).

Now let's use a really diffuse light source, like a large Chimera softbank (Figure 6.4). What a difference! Notice how the light seems to wrap around the ball and egg, and how the shadows are quite soft-edged. However, you can still tell that one object is hard and shiny and the other has a rough texture. How? Again, by the nature of the highlights. The ball shows a sharp reflection of the light source, while the highlight on the egg is so diffuse it's almost nonexistent.

The soft transition from light to shadow is known as the **transfer region**, or sometimes transfer zone. The softer the light, the larger the transfer region is at both the shadow edge and the highlight edge. But note something else; if you

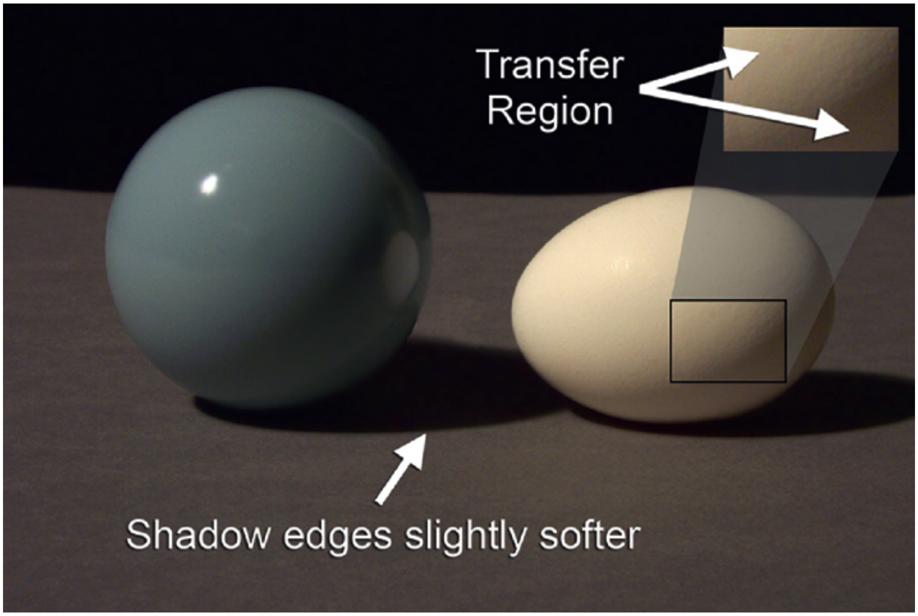

FIGURE 6.3
A slightly diffused light source creates slightly softer edged shadows, but the difference is not dramatic.

look carefully (or look at the signal on a waveform monitor), you will see that the highlight isn't just pure white, though it might look that way in a black and white rendition. When properly exposed, highlights will show a bit of the tint and texture of the underlying color of the object. This is called a **transparent highlight**. If the highlight is solid pure white, the picture is overexposed.

Now we want to relieve some of the stark darkness of the picture. We'll revert to our slightly diffused light of Figure 6.3, but we'll add some light to the opposite side to illuminate the shadowed areas a bit. This is known as a **fill light** (Figure 6.5). Now, since I dislike flat lighting, we're not going to use a fill light that is of equal or near equal intensity to the key. We'll use one that is about half the intensity. This brings out the shadowed side, allowing any details to be seen. Okay, billiard balls don't have much detail, but bear with me—most of your subjects will! But by using a lower light level for the fill, we still achieve a strong sense of modeling. The ratio between key and fill is a major factor in determining the feel of a scene. When key and fill are nearly equal, the ratio is 1:1 and the effect is flat. If the ratio is 1:32, the effect is very contrasty and dark.

Now we'll add a **backlight** to create an accent on the upper section of the egg and ball. This enhances the sense of modeling and also acts to visually separate the subject from the background. The backlight can be quite subtle or quite bold, depending on the effect you wish to create. The type of backlight depends on the position in relation to the subject and the camera. A "hair light" shines down from directly above and slightly behind the subject. A "rim light" is more behind and slightly off to the side opposite the key, creating a thin rim on the subject. A "kicker" is like a rim, behind and off to the side opposite the key—except it

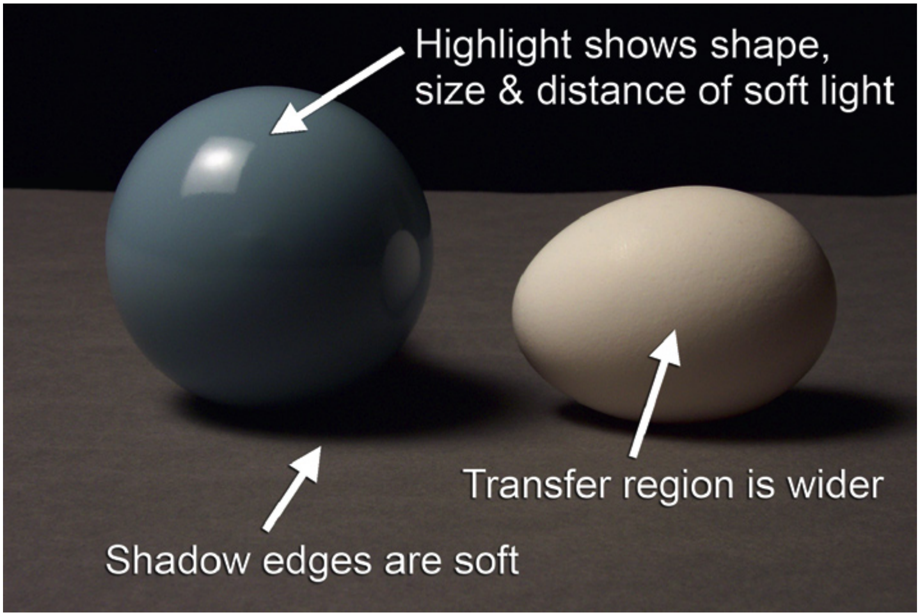

FIGURE 6.4
A really diffuse light source wraps around the subject, and shadow edges become much less distinct.

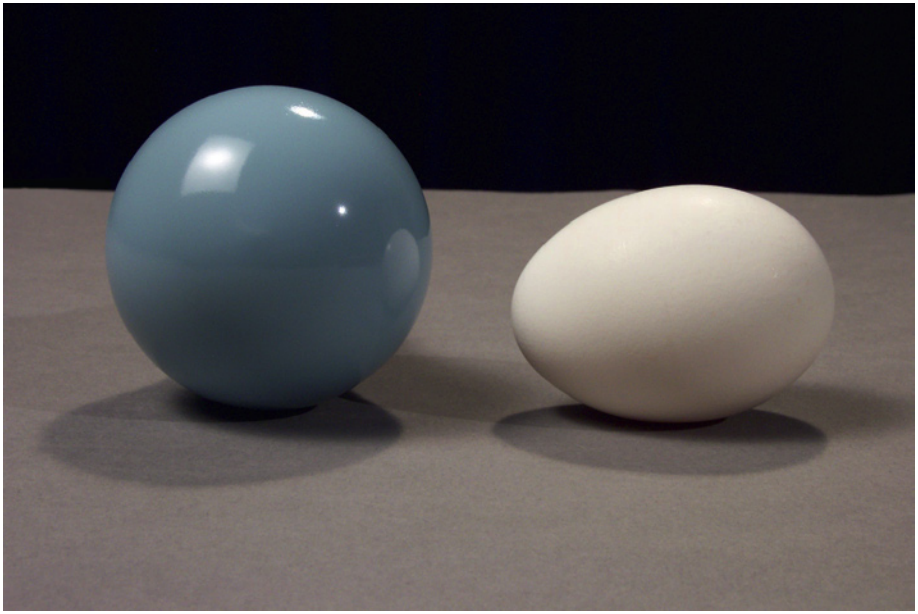

FIGURE 6.5
Fill light brings out detail in the shadows but doesn't eliminate modeling; the backlight adds an accent that can help to separate the subject from the background.

is more to the side, so that it creates specular highlights on the side of the face. One thing to note about backlight: any time you have a light pointing toward the camera (backlight, kicker, or rim) the effect is much stronger than a light pointing away from the camera. It is as if the light "skips" off the object, like a flat stone on water. So a backlight of equal intensity to the key will give a very pronounced and probably artificial effect. A backlight of about half the intensity will give a more subtle accent.

Please note that a backlight does not light the background! It shines on the subject from behind. A separate light is used to illuminate the background.

BASIC LIGHTING SETUPS

So here's the basic procedure to follow:

1. Start with the KEY.
2. Set the FILL light to illuminate shadowed areas.
3. Set a BACKLIGHT to separate the subject from the background.

Guess what? Key light, fill light, backlight—we've created the textbook three-point lighting setup! This is sort of the "formula" starting point for lots of variations (Figure 6.6). You see it on TV all the time; often a network news crew will even take the trouble to set up three-point lighting in awkward field situations.

In this situation, the key light is typically on the side near the camera, but off axis from the camera to provide some modeling. This is known as *onside key*, or lighting from the camera side. The light is positioned above the subject, but

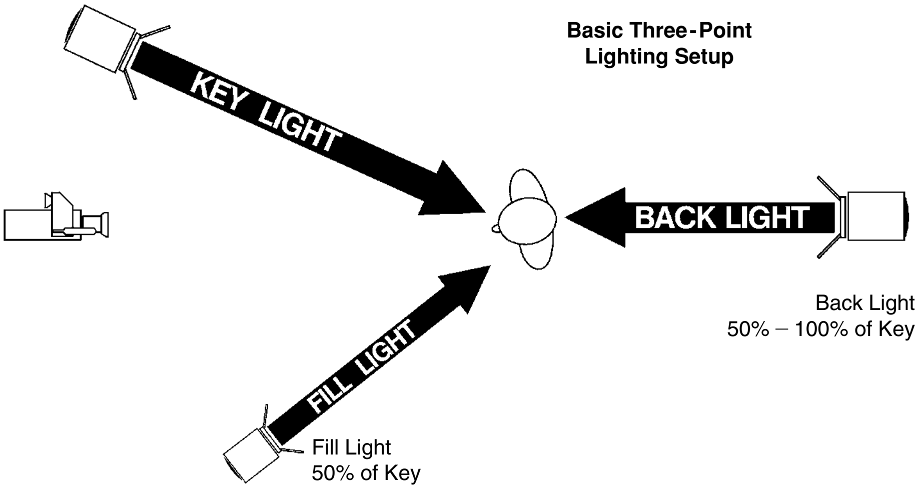

FIGURE 6.6
The three-light setup is the basic "formula" for television lighting.

not too high—it must shine *into* the face of the subject; if the angle is too steep, it will just create awkward and ugly shadows. This is what is wrong with most residential lighting when videotaping. The fill light is usually about the same height, on the side away from the camera. The backlight is directly behind and above the subject, pointed at the back of the head and shoulders.

If you learn how to do this one well, you can light interviews competently until the cows come home. But it's not the only approach out there; don't get too stuck on it. Creativity and flexibility are the key to creating great lighting in real-world situations. One problem you'll encounter right off the bat is that it's tough to have a perfect backlight—directly behind and above the subject—in location situations. In the field, you usually have to rotate the light off axis until it's more like a kicker (a light from the rear and side) in order to place the light stand for the kicker out of frame.

Each of the lights must be properly focused on the subject. In nearly every case, you want the center of the beam to be hitting the subject. The easiest way to do this with either focusing open-faced instruments or fresnels is to adjust the beam to a tight spot, aim the spotlight at the subject, and then back off to the flood setting. Now, limit the coverage of the beam with barn doors and black-wrap. The flood setting allows better shaping of the beam with these controls.

Don't get stuck on one setup! A common variation on this approach is to reverse the key and fill—position the key light on the side of the subject *away* from the camera. This is known as an *offside key.* It adds a different feel to the picture than the *onside* key. Some DPs will refer to this as *lighting from the camera side* or *lighting away from the camera side*.

Now experiment some more. What effect do you get if the key is higher? Lower? Change the height of the fill. Rotate the setup around the subject, placing the

Using Distance to Control Intensity

Remember the Inverse Square Law? The law that states that if you double the distance between the light source and the subject, the light intensity is quartered? And the reverse—that halving the distance increases the intensity by a factor of four? A very effective and simple way to control the precise intensity of the lights is to move them closer to or further away from the subject. If you add diffusion to a light, you may need to move the light closer to compensate for the reduction in intensity.

This isn't always possible, of course, owing to space restrictions. Other methods of controlling intensity are the electronic dimmer and wire scrims. The problem with using a dimmer on incandescent lights is that the color temperature will shift toward orange as the light is dimmed. Scrims, on the other hand, reduce the intensity without changing the color.

key further off axis from the camera. Try adding some diffusion to the key. How does that affect the look? Switch the diffusion to the fill, which looks a little different—though diffusion makes the biggest visual difference on the key. Adding diffusion to the light reduces its intensity, so you may need to move the light with diffusion closer to the subject to compensate.

Lighting the background can be an issue with the three-point setup. In order to focus the viewer's attention, it's generally accepted practice to have the background lit darker than the subject. A rule of thumb is that the background should be lit at least a stop lower than the subject, or half the light intensity. So you will usually want to control the key light so that it *only illuminates the subject* and doesn't spill onto the background at all. It's pretty common to open the fill light (which is about half the intensity of the key) wide open and light the background from that. However, whenever possible it's best to use a fourth light and light the background separately for complete control.

This will especially be true when you must shoot in front of a white wall. White walls are the bane of video shooters, since they will usually overexpose when the subject is properly exposed. A good rule of thumb is to keep light *completely off white walls* whenever possible, and then to use a tiny bit of bounced light to illuminate the wall. Nets or flags can also be used to protect a white wall.

The height of the light source, especially the key, is incredibly important. The principal problem with most architectural room lighting is that it falls from directly above, casting ugly shadows from the brow and nose. Television and film lighting must come from a much lower angle, shining *into the face* of the subject rather than down on top of the head. This is particularly true for interviews and close-ups. The precise angle that is used will vary. Visualizing a clock face with the subject at the center, the key may be positioned anywhere from about 2:30 up to 1:30. Much above that, the shadows become annoying; much below the level of the eyes, and the subject will look a bit like a kid at camp holding a flashlight under his face (Figure 6.8). In many situations you will violate this practice for dramatic lighting, but most of the time it's an excellent starting place.

FIGURE 6.7
The walls on this set aren't white, but we still want to keep the key light off of them. Notice how barn doors are used to keep light off the wall; the arrow points out the shadow edge cast by the barn door.

Here's a rule of thumb many shooters use for setting both the height and the angle of the key. The shadow cast by the subject's nose is known as a *nose caret*. In normal lighting, this shadow should not fall too close to the upper lip (vertical angle), and should not extend too far onto the cheek (horizontal angle). As a starting point, position the key so that the nose caret falls into the fold that runs from the side of the nose to the corner of the mouth and doesn't extend onto the cheek at all. For the anatomically minded among you, this is the juncture between the *orbicularis orbis* (the upper lip muscle) and the *levator labii* (the cheek muscle). This line is known as the *nasal-labial fold*.

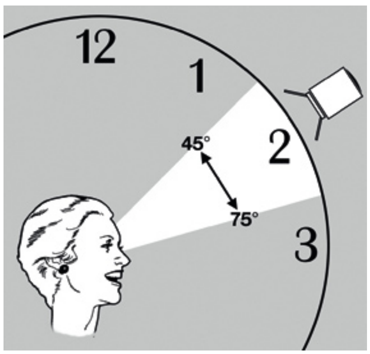

FIGURE 6.8
The key light must shine into the subject's face. If you imagine a clock face, the key should shine from about 1:30 to 2:30, or about 45° to 75°.

Now that we've had a basic introduction to the basic three-point lighting setup, let's look at some variations. Two lights and a reflector can be used quite effectively for interviews by positioning a key and kicker about 180° apart and off axis from the camera, using the reflector or bounce card for fill. A different effect will be produced if the reflector bounces the light from the kicker instead of the key. Varying the angles of this setup will create different looks. Try rotating the arrangement in the diagram to create an offside key, with the strongest illumination on the side of the subject's face *away* from the camera. The camera is now catching mainly fill on the subject, with rimmed highlights; this gives a very different feel than the original configuration.

Set Up the Shots First!

Film gaffer Craig LaVenture has a pet peeve: directors who have him light a scene before the camera is set up. Very often, when the actors are on set and the camera shot is actually finalized, the lighting must be altered to compensate for a subtlety the director didn't foresee, or the gaffers have spent hours creating a lighting effect that never shows up on camera.

His advice? "Insist that they set up the shots first." Have the actors—or stand-ins—walk through the scene, and have the DP actually rough in the camera angles and shots. This will make sure that the lighting setup is appropriate—and economical.

The best procedure is as follows.

1. Block and mark.
2. Light with actors or stand-ins.
3. Rehearse both camera and lighting.
4. Tweak lights.
5. Shoot.

It's important to have actors or stand-ins at marks when lighting the scene. As DP Arledge Armenaki always says, "I can't light air!"

Now let's lose the second instrument and drop down to a one-light setup. Using just a single instrument (preferably a large soft light) and a reflector, we can still produce a very nice situation for an interview. And while this setup might at first appear limited, a number of variations can be contrived. Again, try the softbank as both onside key and offside key. The amount of fill can be varied through the position of the bounce card. This doesn't work nearly as well with a hard light source; part of the magic for this setup comes from the diffuse light that seems to "wrap" around the subject. This setup isn't appropriate for every situation. But the advantages here are obvious: this simple, quick setup still provides a very professional look.

Okay, let's take this minimalist approach a step further! Lose the bounce card! Nothin' but a small softbank! Try this: position the subject sideways close to

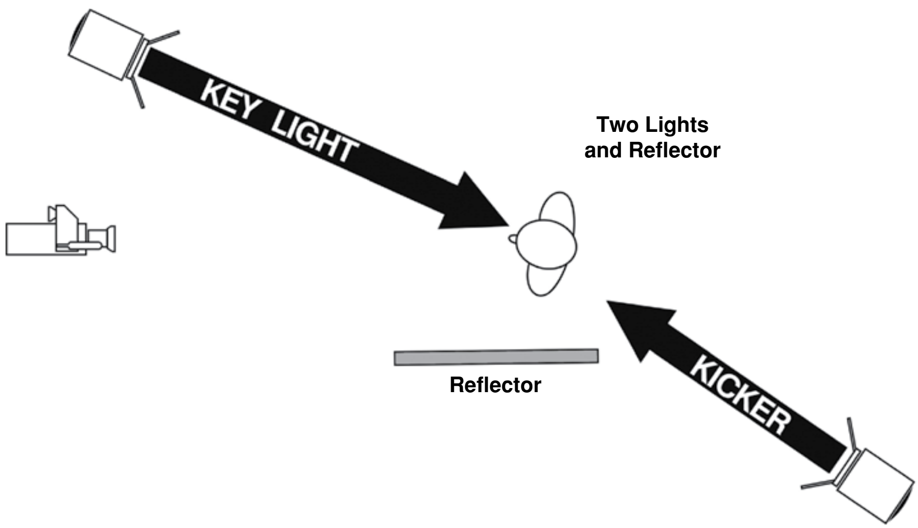

FIGURE 6.9
Two instruments and a reflector can light an interview quite effectively.

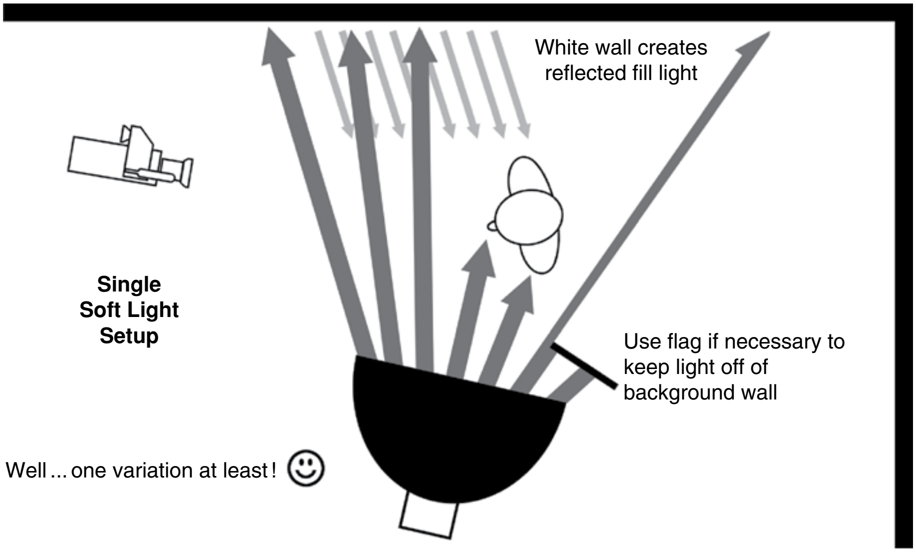

FIGURE 6.10
Used creatively, even a single instrument can produce professional results.

one of those white walls that are always intruding into your shots. Get as much space *behind* the subject as possible. Position the camera even closer to the wall, shooting a bit away from the wall. Place the softbank to the side of your subject and slightly to the front, using the wall as a huge bounce card. Keep the spill from the light from hitting the wall behind the subject, to keep it dark. Bingo! Nice lighting, nice modeling, separation from the background. One light.

LIGHTING JU-JITSU, OR THE ART OF THE REFLECTOR

Now that we've experimented with some uses of a bounce card, let's explore a little further away from brute force artificial lighting. Let's try harnessing existing light and bending its strength to fit our needs. It's a little bit like Ju-Jitsu, the Japanese martial art that uses the opponent's strength to defeat them. It is very efficient, very elegant.

There are lots of situations where you will have plenty of light—just all in the wrong places! Outdoors on a sunny day, indoors near a picture window, you

The angle of the key can be very important in revealing or concealing problem spots. Some angles may be quite flattering, whereas others will make blemishes or tiny scars stand out like a beacon. **John Alton, ASC**, used to employ a simple device, a 60-watt household bulb mounted on a wand, to find the best angle for the key. With all the other lights off, he would move the "wand" around the subject's face, observing the effect. When he found the compromise that gave him the effect he wanted and was the most flattering, he would hold the position while a gaffer set up the key to match that angle.

FIGURE 6.11
Kickers, especially softbanks or fluorescent banks, are very effective in creating modeling on a subject. Here you can see the different effects of a fresnel backlight and a fluorescent kicker.

will have lots of light. The problem is *rearranging* the light to conform to the needs of the camera and to create the sort of modeling that makes the picture seem real and three dimensional to the viewer.

Frankly, it's not unusual to see film and TV crews hauling huge HMI banks out into the field and setting up large generators to provide fill on brightly lit days. For film shoots, they may have to do this to match the lighting from another scene shot days earlier. But for many applications, it's simply not necessary. There's lots of light floating around, it just needs rearranging! And the simple, no-power tool to do that is the reflector.

Let's try an indoor interview situation. We've already done a setup with one light and no reflector; let's try one now with NO light and a single reflector! Here, we'll position the subject in a favorite armchair near a window, being careful to keep the window out of the shot. The reflector is positioned on the other side of the subject to create bounced fill. Voila, nice light, no power draw at all! The only downside to a setup like this is that the quality of light from the window may change over time, sometimes making it difficult to intercut different parts of a lengthy interview.

This type of reflector lighting may not always be practical, owing to the changing nature of natural light. But it illustrates well the efficient use of reflectors, which pros use a lot. In many cases a reflector held by a grip can quickly "fix" a lighting problem without running cables and with nearly zero setup time. It's especially effective for quick setup and short scenes where the light will not be changing.

USING A KICKER FOR MODELING

While the backlight is quite important, a subtle kicker can be even more useful for creating modeling in the subject's face. We'll have some practical examples of that later. It's not uncommon now in dramatic work to find the lighting designer using two kickers instead of a backlight. A few years ago, Jonathan Frakes invited me to visit the set of *Star Trek X: Nemesis* at Paramount, and I noticed they were using this technique. DP Jeffery Kimball (*Windtalkers, Mission Impossible II, Top Gun*) had positioned two angled Kino Flo light banks behind the seated group as dual kickers. This technique is highly effective for situations where there ought to be a lot of light—sky, large windows, and so one—behind the subject. The problem with these is preventing lens flares, since the kickers are shining toward the camera. Deep egg crates on fluorescents combined with careful positioning can be effective.

USING SOFT LIGHTS

Our last two "single-light" setups depended on use of a soft light to work well. Although they will work with a hard light source such as an undiffused fresnel, they won't be nearly as effective or seem nearly as natural as they will when using a large Chimera or Kino Flo—or shining a fresnel through a large silk (see Figure 6.12).

Soft lights have become an enormously important part of film and television lighting today. But as easy as they are to use, they are often used ineffectively. So let's take a look at the effective use of soft lights. As we do so, bear in mind that these guidelines apply to any type of soft light source: a Chimera light bank, a fluorescent instrument, a Lowel Tota with an umbrella, a fresnel with a bounce card.

FIGURE 6.12
Shining a hard light source through a large silk creates a very pleasant light source that's a little hard to describe, combining the best of harder and softer light sources. The light retains definition, but without a hard edge; and the light has a lot of "wrap." Here two 1-K Tota Lights are ganged together to shine through a silk.

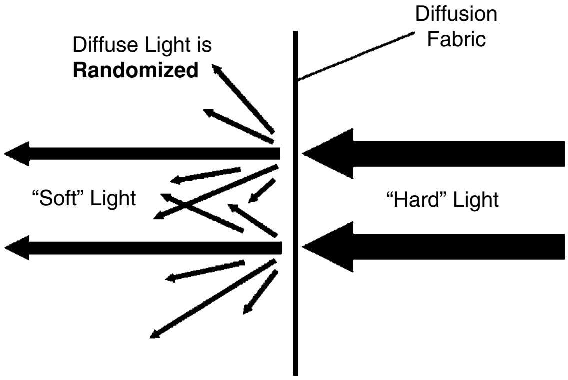

FIGURE 6.13
Hard light radiates predictably from the source; diffusion randomizes the direction of the photons.

There are two rules to bear in mind with soft lights:

1. Soft lights are best used close to the subject.
2. Soft lights are best used *close* to the subject!

Did you get the point? They really are two different points. The first rule is there because soft lights are very inefficient at any significant distance. Part of the point of diffusing light is to create a randomization of the light rays. Rather than radiating outward in a simple, predictable, and orderly fashion, the photons are bounced in all kinds of directions—they are *randomized*. This looks quite nice, but as the distance between the light source and the subject increases, a larger proportion of the photons are just wasted—spilling off somewhere else, lighting the audio guy and the PA and the camera tripod instead of the subject.

Rule number two (though you might have thought it was the same!) is there for an entirely different reason. The whole point of using a soft light is to get that nice, gradual transfer region from the shadows to the highlights. This effect is drastically reduced as the distance between the light source and the subject increases. Remember the Inverse Square Rule? It applies not only to light intensity, but to perceived *size* as well. If you take a Photoflex SilverDome softbank and position it 4 feet from your subject, you'll get a very nice soft effect. If you move the same softbank 8 feet away, the effect changes totally (Figure 6.14). First, the light level on the subject drops by more than three-quarters (remember all the random light you're losing?). Second, the apparent size of the light source drops to one-quarter of the apparent size it was in the first setup. Lighting intensity aside, this is the equivalent of switching from an 18" × 24" light source to one that is merely 4.5" × 6"—not much larger than a typical 650-W fresnel lens! It is not very soft at all. Look at the effect on the right image in Figure 6.14 You can see the dramatically reduced size of the highlight and the smaller (read "sharper") transfer region between the fully lit area and the shadowed area.

Reflectors

In the early days of film, outdoor scenes were lit entirely with reflectors. Sometimes reflectors would even be used to bounce sunlight into interior settings as the main illumination!

Reflectors of different dimensions and finishes ranging from large polished mirrors to plywood covered with gold leaf or simply painted white would provide varying qualities of "bounced" light. Rigid 4' × 4' reflectors are very useful in lighting exterior settings. A silver reflector is referred to as a *priscilla*, while a gold foil covered reflector is often called an *elvis*. Large 12' × 12' or 20' × 20' frame-stretched fabric reflectors are also used. For years the standard fabric for this use was **griff** or ***Griffolyn***, a reinforced polyethylene laminate manufactured by Reef Industries. However, in recent years Ultra Bounce and Klaykote fabrics have become more popular.

Today's small fold-up reflectors are much easier to carry but can still provide very effective light control in the field.

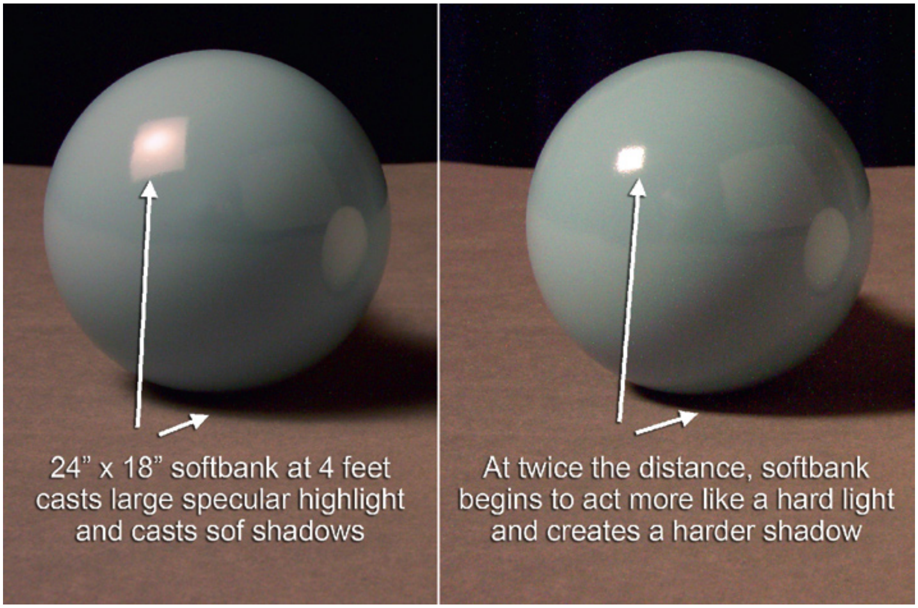

FIGURE 6.14
In the photo on the left, the softbank is 4 feet from the ball. On the right, the softbank is 8 feet away, thus cutting the apparent size and softness of the source to one-fourth that of its previous value.

HARD OR SOFT?

Earlier I mentioned that a single light setup worked best with a soft light source. Let's now take a look at the difference between soft light and hard light—and when one is more appropriate to use than the other. Many DPs have shied so far into the "super-soft" light camp that they never use hard light. As a result, everything they shoot looks like a portrait studio picture.

The first thing to understand about hard lighting is that we only see it naturally in a few settings: sunlight on a crisp, clear day, moonlight on an equally clear night, and when there is some intense and concentrated artificial light source, such as a welding torch in the scene. In nearly every other situation, the light will be somewhat diffused. After all, many days are slightly overcast and the light in our homes bounces around off of white walls and is filtered through lamp shades.

In most situations, the goal we're striving for is to create the impression of realistic lighting and a natural look. In other words, we don't want the scene to look "lit." Later on, when we cover simulating reality in greater depth, we'll delve deeper into this topic; but for now, let's just take a brief look at the appropriate situations to use soft or hard light.

The key is *observation*. Hard light is eminently necessary and desirable for some situations, especially those times when you wish to simulate intense sunlight or crisp moonlight. But for most situations, some level of diffusion is called for. Lots of Hollywood films of the 1940s and 1950s were lit entirely with hard lights and thus often lacked a feeling of natural lighting. Some diffusion (perhaps a light frost or tough spun) on that fresnel will create a little more natural effect.

Soft lights really come into their own when lighting interior scenes, where a lot of the illumination in reality would be filtered through lampshades or bounced from white walls.

But don't abandon hard lighting as a creative tool; it can be used to great effect in certain situations. An example would be the ITV-produced *Poirot* series from several years ago, starring David Suchet. Many episodes in this series, especially evening interiors, use hard light effectively to create a very particular feel.

Observation, flexibility, and imagination are the greatest tools you can have for lighting!

FIGURE 6.15
Hard and Soft Light Comparison.

Not Always Textbook

Not every great movie is a textbook on great lighting. In Franco Zeffirelli's magnificent film *Romeo and Juliet* (1968), there were certainly scenes of great lighting. The bedroom scene and the death scene in the tomb were very well done. But there were also scenes that were the worst examples of thoughtless studio lighting. In one scene, Juliet comes into a room of their castle to plead with her father. The stone room, a dank enclosed room ostensibly illuminated by a few candles and a tiny castle window, is entirely flat lit with thousands and thousands of watts of hard light. The scene looks about as realistic as a news set. Go figure.

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CHAPTER 7

Interview Setups

As you have probably gathered, my goal in this book is not only to introduce you to every aspect of lighting, but to help you understand the “why” behind the “how.” The lighting director who understands the “why” will be able to do more creative work than someone who is simply working from formulas and diagrams. But I also realize that not everyone wants to become a master of the photon; many just want to be able to shoot competent video. In the workshops I have done across the country, I invariably have someone in attendance who just wants some diagrams and instructions on how to make them work. Well, cheer up, this chapter is for you!

The most common need for almost any video shooter is the basic interview setup. It’s the core of documentary work, of legal videography, industrials, news, and so on. So here I will spell out some basic formulas for lighting interviews professionally and effectively, building on the techniques outlined in the last chapter. Except here, rather than just outlining the concept, we’ll diagram some very specific approaches that you can duplicate in many situations. These setups will allow you to create professional-looking interviews in a number of real-world circumstances.

BASIC THREE-POINT INTERVIEW SETUP

We’ll start off with the basic three-point lighting setup. This is usually a key light, a fill light, and a backlight. In the “standard formula” for television, the key and backlights usually have equal power, and the fill light is about half the power of the other two. So in Figure 7.1, the three lights could be two 650-watt fresnels with a 300-watt fresnel, or two 1-K open-faced lights (such as the Lowel DP) with a 500-watt open-faced light (such as the Lowel Omni).

All lights should be set on flood rather than spot. Use the fill light to illuminate the background and use the barn doors on the key light to keep the beam off the background; this is especially necessary when the walls are white or

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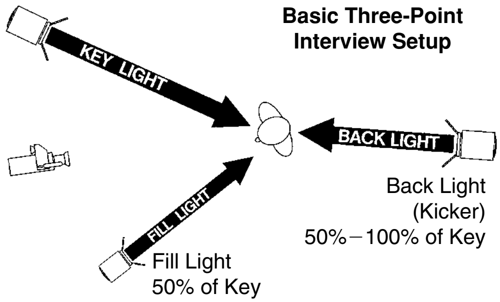

FIGURE 7.1
The basic three-point lighting setup for an interview. In this case, the key light is on the same side of the shot as the camera. This is known as an "onside" key, or "lighting from the camera side."

near-white. Use the barn doors on the backlight to make sure the light does not directly hit the glass lens of the camera, for this will create lens flares.

What problems will you find in the real world with this setup? First, it takes a fair amount of space. Although it will work in a large executive office, you'll find it tough to use in a cramped space. A variation is to use a lower power backlight, matching the fill. In many cases, this will look more natural. The strong backlight has an artificial "TV Studio" look.

Now, let me tackle the Frequently Asked Questions that always come up:

FAQ #1: How do I decide what power of lights to use? The answer depends on what you've got in your lighting kit and how hot your subject can stand to be. Once you pass a low level of lighting that allows you to expose the scene on your camera without using any gain, you've got "enough" light. What's important from that point on is not the power, but the *balance* between the lights. Two 650s and a 300 will look about the same as two 2 Ks and a 1 K; you'll just expose it differently. *This is an important concept to grasp!*

FAQ #2: How far away should the lights be from the subject? This also depends—on the size of the room, on the power of the lights, and so on. In the illustration shown here (Figure 7.2), the lights were all about 8 feet from the subject, but you may not have that much room. How far the lights are from the subject changes the angle of the light beam and thus affects how high the lights are—and so we pass to FAQ #3.

FAQ #3: How high should the lights be? Again, this depends. Are you in an office with a 7-1/2 foot drop ceiling? Obviously, the lights can't be 8 feet high! The height and distance from the subject work together to create the angle for light falling on the subject's face. Remember Figure 6.8 in the last chapter? We want the key light to be at about 1:30 to 2:30 on an imaginary clock face. The light should be shining into the subject's face, illuminating the eyes, and not casting too annoying a shadow from the nose.

FAQ #4: I don't get the clock face. How do I set the height and angle of the key light? Okay, here's another way to do it. As you move the light around, watch the shadow under the nose. This is technically known as the "nose caret." You want the key light to be high enough to cast a bit of a shadow here, but not so high (or so close—they work together!) that the shadow falls onto the lips. That would be really distracting to the viewer. You want the light off to one side enough that this shadow definitely falls one way or another, but doesn't fall on the cheek. The nose caret should stay inside the area above the upper lip, and inside the lines that run from the sides of the nose to the corners of

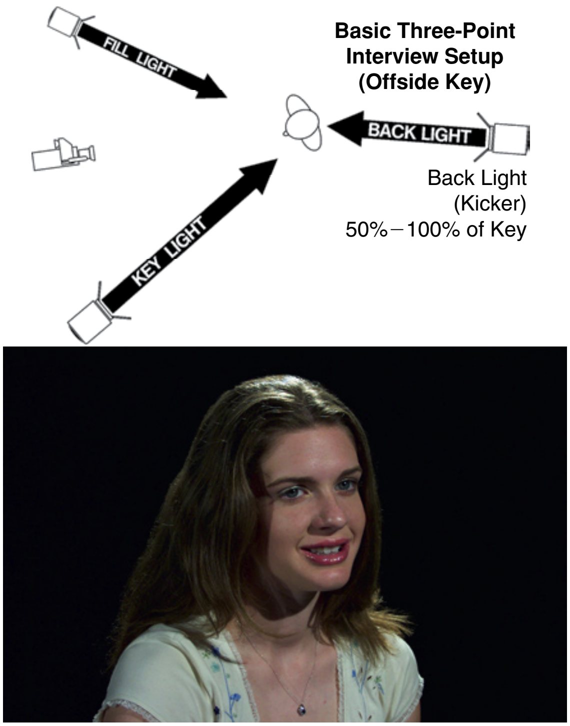

FIGURE 7.2
Here the same three-point lighting setup swaps the positions of key and fill, creating an "offside" key. This is also known as "lighting away from the camera side."

the mouth (Figure 7.4). These lines, in case you're interested, are known as the nasal-labial folds. You will be tested at the end of the book. *The position of the nose caret is particularly important when using hard light, as from a fresnel, since the shadows are obvious and are distracting or ugly if poorly placed.*

FAQ #5: How do I decide between using an "offside" or an "onside" key? Try both. Decide which you like. Use that. Ain't no rules here. More seriously, the offside key has a bit more dramatic feel than the more standard onside key, so you might pick one over the other depending on the nature of the program and interview.

FAQ #6: How do I decide between using hard light and soft light? Again, try both. Decide which you like. Use that. Ain't no rules here. But then again, lighting interviews with a softbank is easy, fast, and looks great, so see the section on using a softbank. It's a good idea to pick one common lighting style for a specific program so that interviews look consistent. If some interviews use soft key and others use hard key, they will seem visually disjointed as if they came from different sources.

FAQ #7: The office is small; I can't get the backlight right behind the subject without seeing the light stand. Move it off to one side as a "kicker." The kicker should always be placed on the side opposite the key light, not on the same side as the key light. Or if you really want that "backlight" or "hair light" look, use a boom stand or a scissors clamp that will allow you to mount the light from the ceiling.

FAQ #8: Do I really have to use a backlight? If you're going to tell folks you learned from this book, yes, you *have* to use a backlight or kicker. It is far more essential than most people realize. Even a low-powered light from the rear adds depth and detail; with only frontal lighting, the picture will seem flat, and features in the hair and outfit will become invisible. If you have to lose a light, lose the fill and use a reflector. Don't lose the backlight!

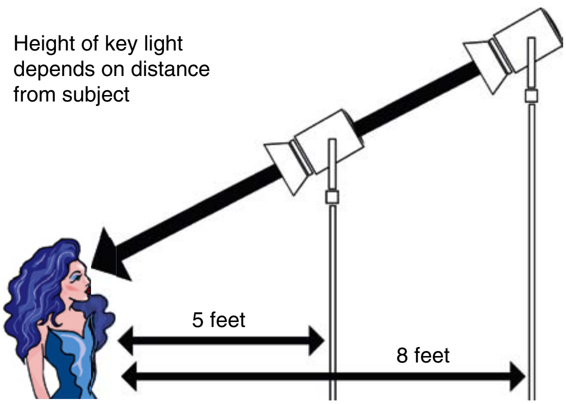

FIGURE 7.3
The angle of the light is a combination of the distance from the subject and the height of the light. A light that is positioned further away must be higher to create the same angle.

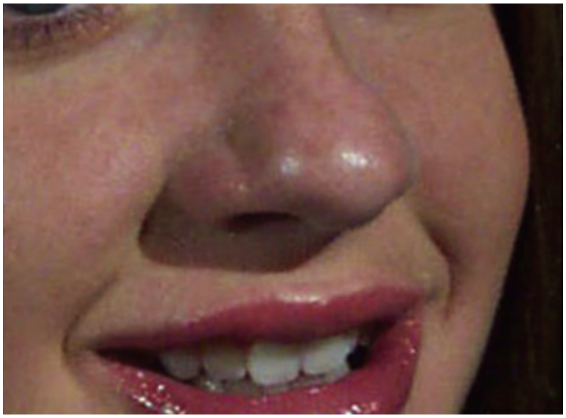

FIGURE 7.4
The nose caret (shadow) should fall somewhere between the nasal-labial folds and on the area above the upper lip. It should never touch the lips themselves, and a hard shadow is generally annoying when cast over the cheek. This rule is more flexible with soft lighting, since the shadow is less distinct and noticeable.

FAQ #9: What about the background? Our sample shots here use a black backdrop in order to focus entirely on the subject. Usually in an interview you will be in a real room with something behind the subject—bookcase, wall with picture, and so on. While you want to illuminate the background, you don't want to call attention to it; the attention should be on your subject instead. One common practice is to let the fill light illuminate the background. A more refined approach is to use a fourth light to cast some sort of pattern on the background. This can be a simple open-faced light with a homemade cutout pattern, or it can be a Source Four with a GAM pattern.

HARD OR SOFT?

Now we'll tackle the whole hard light vs. soft light issue. If you are one of those who doesn't want to become a lighting guru and you just want to learn how to set up a good-looking interview, then you should take a look at buying a soft light. There are numerous reasons for this recommendation. First, soft lights are much more forgiving than hard lights in terms of placement. Second, they are flattering to your subject, something that most folks appreciate. Third, they look more natural for most interior interviews. After all, most of the light in our homes and offices is diffused, not hard. We don't actually see hard light on faces often, with the exception of outdoor sunlight. So there's a lot to be said for using a softbank if you just want to learn a couple of basic setups for your interviews.

Now the cons, for of course nothing can be all upside. Most softbanks, or "bag lights" are much less convenient to assemble (with one notable exception); fluorescent banks are bulky and more inconvenient to transport than, say, a few Lowel DP lights. LED softbanks are the exception, though the quality of the smaller, more easily transportable units is less soft than larger, more cumbersome units. In all, however, my judgment is that the downside of using soft lights is far outweighed by the advantages. The strength of this recommendation is borne out by the fact that I haven't done an interview without using a softbank as key light for several years.

So you add a softbank to your kit—either a cloth "bag light" like a Chimera or a Photoflex or a RifaLight; or you buy any of the portable fluorescent banks that are on the market today—a Gyoury light or a Kino Diva Lite or a Lowel Caselight. Or you buy one of the growing selection of LED light banks such as the LitePanel or Flolight. This will serve as your key light. Can you get rid of the other lights? Not really, though in a minute we'll look at the simple two-light setup I often use for interviews.

Basically, you simply substitute the softbank for a key light in the basic three-light setup. The only thing that is different are the rules for positioning the softbank. Soft lights work best when they are very close to the subject. They are quite inefficient at a distance—say much more than 6 feet—and their soft quality falls off with distance. So most often you will need to place the softbank right up near your subject, perhaps 4 or 5 feet away. The height of the softbank and its angle to the front of the face will be determined by the look you want to obtain.

The vertical position of the softbank in relation to the subject is also a matter of obtaining a "look" rather than right or wrong. Since the nose caret is now very

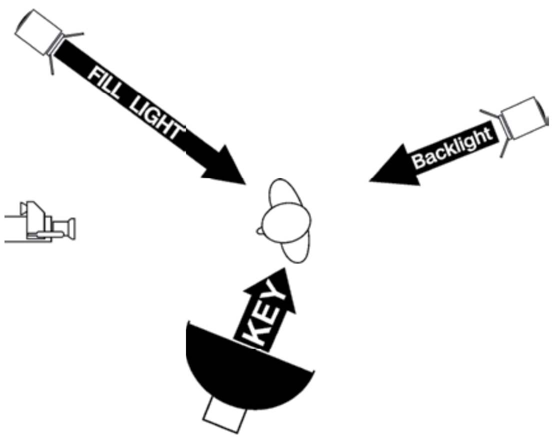

FIGURE 7.5
Using a softbank as the key creates a really pleasant look. The key light wraps around the face somewhat, and shadows are soft-edged and indistinct. Placement of the key is much less critical, being more a matter of preference of the look. The one rule to keep in mind is that the softbank should be as close in as possible, preferably less than 6 feet.

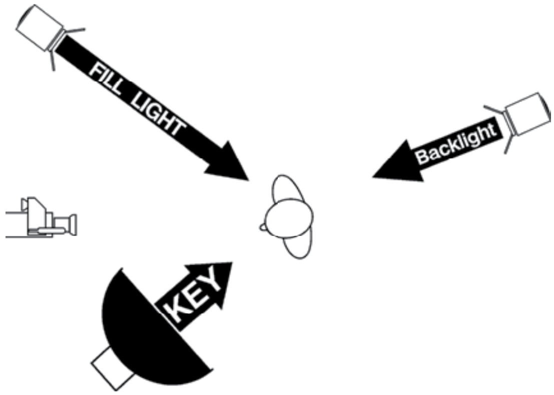

FIGURE 7.6
Moving the softbank toward the front creates a very different look for the subject with only a slight tweak of lighting position.

soft-edged and indistinct, it becomes less of an issue than it is with hard light. It's not unusual to see softbank lighting from the side where the nose caret is cast directly on the cheek. This lighting setup would be most unappealing with a hard key, but works very well with the softness created by a Chimera or similar soft light source. Typically, you still won't want to position the softbank at so steep an angle that the nose caret falls over the lips. We want to be able to see the subject's mouth!

There is still a rule of thumb, however: you don't want to position the softbank so far to one side that you lose the "eye glint" (Figure 7.7). This small detail allows your audience to better perceive the subtle eye motions that we use to judge emotion, honesty, and so on. It is this detail that separates the pros from the amateurs; a pro will always create an eye glint unless there is a strong reason not to. Even when there is dramatic motivation to have key lights in odd positions, a pro will use a small on-camera light known as an **Obie** for the sole purpose of creating an eye glint. Fortunately, because softbanks are such a large lighting source, they automatically create an eye glint from many angles. But it is possible to move the softbank so far to one side that the glint will be lost.

FIGURE 7.7
The reflection of the key light in the cornea is known variously as eye glint or eye light. For interviews, you should never position your key light so far to one side that the eye glint vanishes.

SIMPLIFYING THE SOFT LOOK

Okay, let's get minimal. I often have to fly to some distant burg to do a single interview. As airlines have become tighter on excess baggage fees, I've trimmed my kit down to two checked bags—the camera case and tripod case—that contain everything I need and each weighs just under 50 pounds. Packed around the tripod in its case are three light stands, a folded up Lowel Rifa Light, a collapsible Photoflex reflector, and power cables. In the camera case I've created a space for a Lowel Omni light with a 500-watt bulb. In my carry-on bag I have replacement bulbs and my tapes. These two specific light models are used because they pack small and set up quickly. I know several videographers that use a tiny Pro Light as a kicker instead of an Omni and they obtain great results.

Using this trimmed-down kit, I light each interview with only two lights and a reflector. Obviously, the softbank is the key light, and the Omni is generally a kicker from the opposite side. I often gel the Omni with a ¼ CTB to create the impression that the light is coming from a window off-screen. I then mount the collapsible reflector on the third light stand—using a bit of gaffer tape to keep it aimed right—and use that as a fill source. This minimalist setup has served me well for many, many interviews.

One advantage of this approach is that it can work effectively in very small spaces. How often have you had to interview a person in a tiny office or, worse yet, a cubicle? Rarely do you have elbow room to spread out and create a textbook setup. Figure 7.8 shows one tight interview I had to light. The hallway, the entry to an office suite, was only 8' × 8' with a small alcove for a table. It had white walls, and I was interviewing a person of color! By putting the kicker off in a corner and using the existing table lamp to cast a bit of yellow light on the wall, I was able to set up a workable solution. There wasn't room to breathe or move, but the resulting shot looked good!

In certain situations, I'll even forego the reflector, as in Figure 7.8. This would not work well with a person of color, especially someone with very dark skin, but it worked in this situation quite well. The trick here is to set the angle of the kicker and the softbank so that the light they cast on the subject *almost* meets.

FIGURE 7.8
The softbank/reflector/kicker arrangement can be used in some very cramped situations.

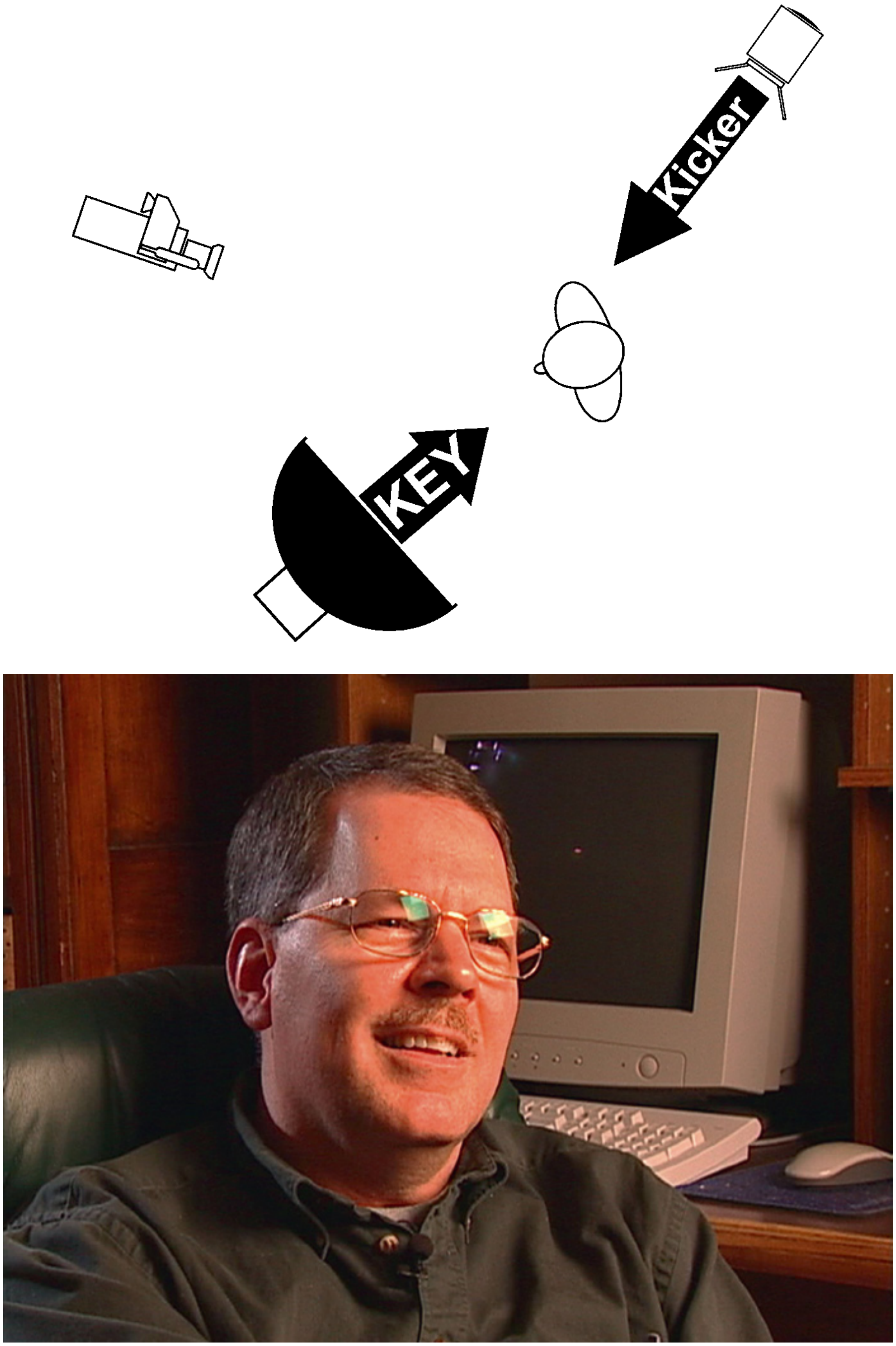

FIGURE 7.9
This interview, done in limited space in a living room, uses only a softbank and a blue-gelled kicker for illumination.

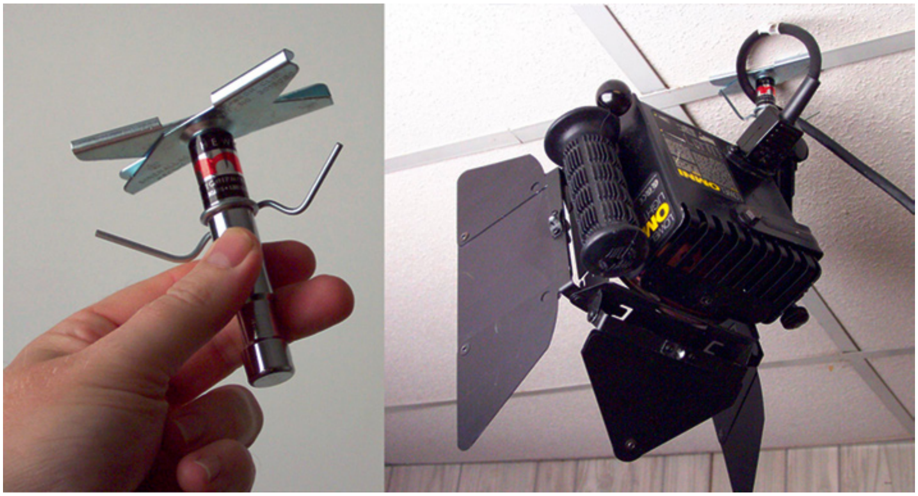

FIGURE 7.10
The scissors clamp locks onto a suspended ceiling grid, allowing a small luminaire to be mounted right from the ceiling without a stand.

BUT WAIT, THERE'S MORE!

Now I'll introduce you to the secret weapon for lighting interviews in cramped rooms—the scissors clamp. This nifty gizmo clips directly onto the metal track of a suspended ceiling grid and allows you to mount a small light such as a Lowel Omni or Pro-Light right from the ceiling—without a stand protruding into the picture! (See Figure 7.10.) This would have been a good technique for the "tight" room shown in Figure 7.8. But as ubiquitous as suspended ceilings are, the scissors clamp will come in handy in more situations than you can shake a stick at—in fact, every time you want a light without a stand protruding into the picture!

The scissors clamp is not the only problem-solving magical gizmo in the gaffer's bag of tricks. Over the year, gaffers have come up with some enormously creative solutions for hanging lights in odd corners and difficult spots. Even if you don't want to become a lighting expert, it's worth your while to take a look through the Matthews Grip Equipment or Avenger catalogs to see some of the specialty devices that are available. You may find just the gizmo to solve a weird light-mounting problem that is a regular problem for whatever you're doing!

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CHAPTER 8

Solving Common Problems

Now that we've covered some basic lighting setups, let's move on to problem solving. This is a major ingredient in real-world lighting: catching hot spots, obnoxious reflections, and potential color problems before they ruin your take. Doing this well involves an eye for detail and a real focus of attention on the picture. How well you troubleshoot lighting problems during setup will be a major factor in the quality of the final product, since many of these problems are difficult and expensive to fix in post.

HOT SPOTS: FILM FOLKS, BE VIGILANT!

One problem you need to always be watching for are hot spots in the picture. These are often reflections on shiny surfaces, which must be "killed" because they will generally produce a region of clipped white in the final video. Camera operators and DPs with a film background will already be used to watching for hot spots; but since overexposure is more obvious in video, the vigilance must be increased. In fact, in the past this was a problem area for many film DPs shooting in a digital format for the first time.

This is because film is more forgiving of overexposed areas; the gentle rolloff in the gamma curve of film means that as an area approaches overexposure, there is a soft edge to the overexposed area. In digital video, however, the overexposed area will rapidly hit the digital "ceiling" of 255, or 110 IRE. Because there are no more "bits" available to record data above that, the area will be recorded as a solid area of overlimit white with no detail. Any detail that might have been visible in that clipped area is permanently gone. This area of clipped white may be only marginally noticeable on straight playback, but may be dramatically aggravated if the video clip is broadcast and run through automatic proc amp correction. Either the proc amp will turn down the overall gain to make the hot spots legal, thus making the rest of the scene too dark; or more commonly, a limiting proc amp will simply "plane off" any values

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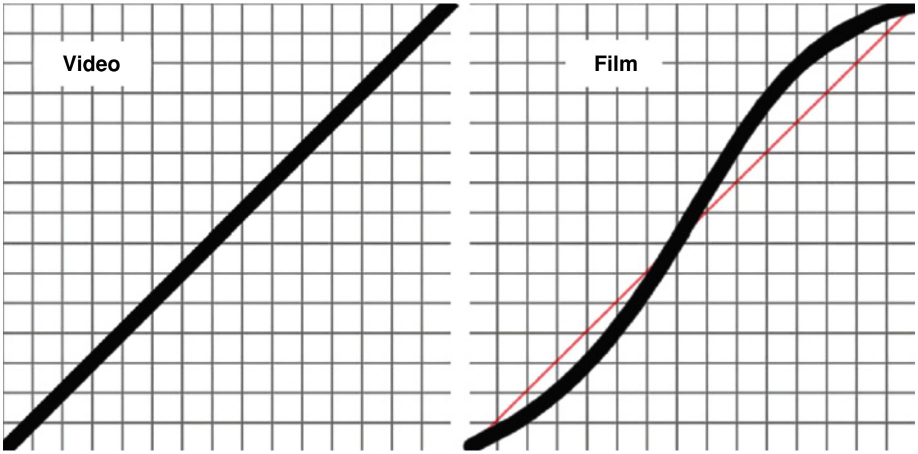

FIGURE 8.1
Film has an S- shaped gamma curve (left) that gradually rolls off response as the film nears full exposure. This is kinder and more forgiving for hot spots than the flat gamma curve of video (right). Pro cameras often have a "knee" adjustment (parallel to film "shoulder") that creates a truncated response at the top end of exposure. However, this is usually less gradual than the gentle curve of film gamma. Several higher-end HD cameras now offer adjustable gamma curves that can closely mimic that of film.

above 100 IRE, resulting in a much larger and noticeable area of clipped white with hard edges. In addition, the MPEG* compression used in digital cable and satellite tends to "posterize" the image anyway and that compression will aggravate the hard edges of a clipped area.

Obviously, there will be times that you will need to shoot with overexposed areas that are corrected in post. But an important fact to bear in mind is that the "headroom" is only 10%. Most broadcasters will allow tiny hot spots, known in video engineering terminology as *limited excursions*. But many networks will reject video that has too many areas of clipped overlimit white. PBS in particular is notorious for this.

Hot spots are most often caused by reflections of lights on glossy surfaces. They are easily spotted when using 100 IRE zebra display or when monitoring the signal on a waveform monitor. A little experience will allow the DP to spot them with the eye; often it's simply a matter of watching details like a hawk.

Offenders can range from eyeglasses and jewelry to tabletops and picture frames. With set pieces or items in a room where an interview is being conducted, the simplest solution is often to simply remove the offending piece. A minor change of camera or lighting angle can often fix the problem. In a

*MPEG is a highly compressed format devised by the Motion Picture Experts Group and now used in most satellite and cable transmission.

situation where the object really can't be moved, dulling spray is available that will create a temporary matte finish and kill the reflection. Dulling spray is specially formulated to be easily cleaned off of most surfaces; however, you should be very hesitant to use it on a piece of high value. In other words, when interviewing the Queen of England, it is not advisable to squirt dulling spray on her eighteenth-century sterling tea set! Find another solution to that particular problem. The most common uses for dulling sprays are chrome fixtures, glass in picture frames, or mirrors. In lots of cases, simply covering the offending object with a small piece of black gaffer tape will be sufficient.

Glossy tabletops can also be a problem. Since you are probably using some sort of backlight or kicker on the person sitting at the table, it's very likely that some of that light will fall on the table and bounce directly into the camera. A diffused highlight is not a problem; it's an actual direct reflection of the light source itself that must be avoided. Minor changes in the camera angle or lighting angle can often solve this problem. Don't be a slave to precise continuity of the angle of the backlight. It's often necessary to "cheat" angles between shots to fix problems like this. As long as you don't alter the general sense of the lighting too much, the audience will never notice.

Jewelry can be a particular issue since it moves with the body. An occasional glint off a ring as the subject gestures is not really something to worry about; but a brooch that causes a repeating flash, flash, flash as the subject moves must be dealt with. On a dramatic set with actors, you simply ask wardrobe to find something better; but in an interview, the subject may not be happy about removing great-grandmother's brooch. A little diplomacy is called for if you want to be invited back! Ask the subject about removing the offending piece (don't refer to it that way; something along the lines of "that stunning brooch" is more appropriate!). If they are hesitant, figure out another way around the problem. Flagging the key to keep the key light off the shiny piece works; if it's a simple piece that would be easy to clean, dulling spray will work.

EYEGLASSES

Eyeglasses are another subject altogether. Although they can be a source of problem "hot spots," the major problem with eyeglasses is actually distracting reflections that obscure the eye. In many situations, it is incredibly important for the audience to be able to see the subject's eyes; specifically the pupil and iris (see sidebar). With the wrong lighting angle, a large reflection can appear in the glasses lens right over the pupils, creating the blank stare of "mirrored" shades à la *Easy Rider*.

Unfortunately, it seems that the "wrong" lighting angle for reflections from glasses is very close to the "right" angle for overall lighting. So video shooters have had to come up with all sorts of tricks to deal with reflections in glasses.

In dramatic productions, of course, real prescription lenses are seldom used. Flat glass is used in the frames, so that the glasses will produce a single "flash"

A Glint in the Eye

William Blake referred to the eye as the "window of the soul," and in some ways that is true. There is much subtlety and unspoken communication in the language of the eyes. It's very important to be able to see the eyes of other people; that's why talking to a person with dark sunglasses can seem intimidating. Good editors will often pick a particular shot because they can "read" the eyes of the actors.

Allowing your audience to "read" the eyes of your subject is an important detail. In a drama, it may make a scene when the subtle motion of the eyes can be conveyed. In an interview, tiny cues may alert the viewer: "This man is lying," or "she feels what she's saying deeply."

The key to making the eyes "readable" in video is the tiny glint in the iris. Often, this will appear naturally if the key light is set to a low enough angle. However, it's not uncommon for DPs to use a special "eye light" specifically to create that glint. The eye light may range all the way from a stock camera-mounted light to the **inkie** often used for this purpose in films.

Watch for that glint in the eye; if you can't see it, neither can your audience. Move the lights or bring in an eye light to make it happen!

reflection as the head is turned. This gives a very realistic impression but vastly reduces the angles that will produce a reflection. It's not unusual for a near-sighted actor to wear contact lenses so that she can actually see, while wearing fake plate glasses that give the look called for in her character, or have antireflective (AR) coating applied to prescription glasses.

These relatively new coatings are pretty much the ultimate solution to problems with eyeglasses reflections. These AR coatings really work and eliminate the entire issue. There are several brands of coatings, and among the most commonly available are Zeiss Gold ET and Super ET or Crizal® from Essilor Vision. AR coatings are actually microscopically thin layers of metal and are easily scratched. But they have huge advantages for on-camera use. If you work consistently with talent that wears glasses, get their lenses treated with an AR coating. It costs anywhere from $60 to $80 for a pair, but it's worth it for many situations.

This isn't really a solution for interviews, however. For interviews you must deal with the subject's genuine prescription lenses, usually without AR coating. The curved lenses used in prescription glasses are a problem because of the curve; the lenses will reflect the light through a wide arc, with the reflection simply moving to a different part of the lens—but never going away! So here's a list of the tricks that have been devised to deal with reflections in prescription glasses.

1. Ask the subject not to wear them. Some people (especially those who are far-sighted) wear glasses part time, for reading or working on the computer. They may be quite amenable to removing them as long as they don't have to read anything close up on camera. This is less of a solution for near-sighted subjects who wear their glasses from morning till night. If no one except his spouse ever sees your subject without his glasses, he may look strange—or even unrecognizable—without them. In the absence of an antireflective coating (see sidebar), you'll need to move on to one of our other more subtle tricks.

2. In an interview setting, try seating the interviewer a little lower than the subject. This will cause the subject to look a little downward. Make sure the interviewer is not higher than the subject, which will cause the person to look up and create worse reflections. Raising the camera just a bit can help, too.
3. Raise the key light (usually the main offender) slightly. However, you don't want to raise it so much that you create dark shadows on the eyes or cause the nose caret to fall over the lips.
4. Try adjusting the angle of the glasses themselves. Tipping the temples of the glasses up a tiny bit and sliding the glasses down on the nose 1/8 inch or so can make a lot of difference. The problem with this approach is that it's not stable; the temples will tend to migrate back down, and the glasses may begin to slip down the nose. To fix this problem, I've sometimes used rubber grommets to create little "temple jacks" that raise the temples off the ears.
5. If you are lighting with softbanks, try lighting more from the sides (Figure 8.2). I learned this trick from Kelly Jones at Chimera. Moving

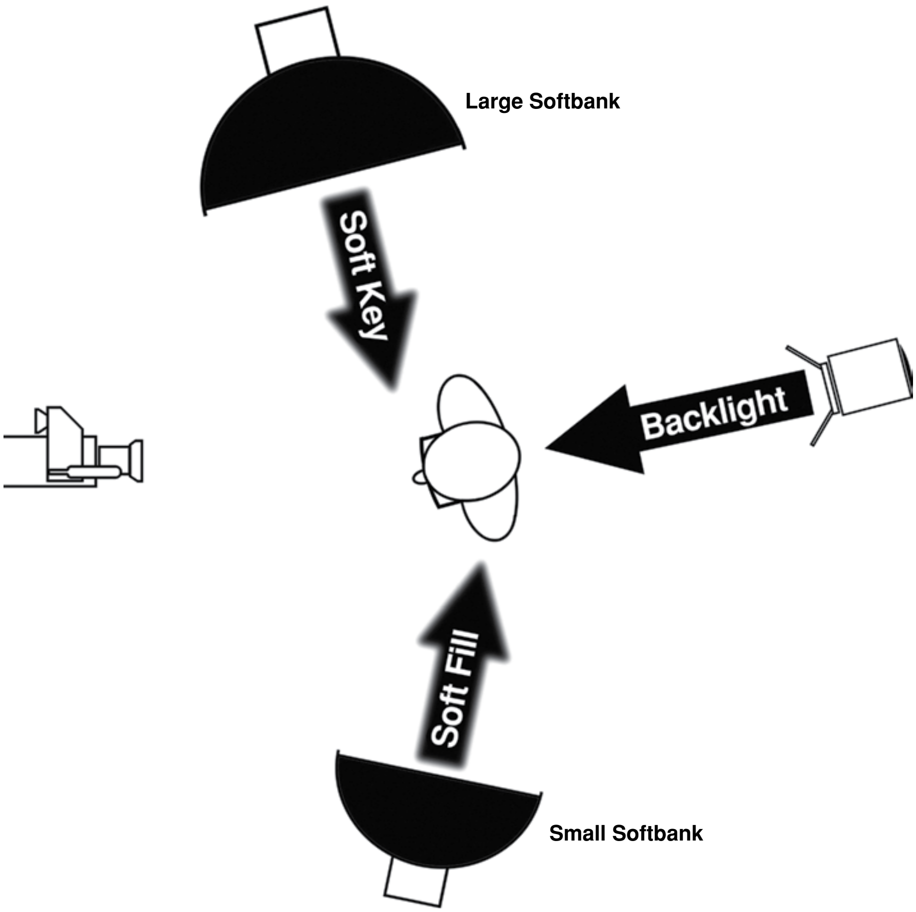

FIGURE 8.2
Lighting with two softbanks can give pleasant effect with no reflection in glasses. Position both key and fill more to the sides than in a typical three-point setup.

the key softbank more to one side will create strong modeling and will keep the reflection from appearing in the glasses. There's a position that will still create that magic "glint" in the eyeball without causing a reflection in the glasses lens. This is because the curvature of the iris is more pronounced than that of the typical eyeglass lens.

6. Here's another tip from Kelly: if you just can't quite get rid of the reflection—for instance, the subject glances around a lot—make it work for you. Use some gaffer's tape to make a cross on the front of the softbox diffusion; the occasional reflection will now look like that of a window frame!

PRACTICALS AND LIGHT SOURCES IN FRAME

One of the most common mistakes I see in amateur and event videos is the inclusion of an uncontrolled light source in frame. I'm sure you've seen videos where the camera panned around a room on AUTO EXPOSURE and when the window comes into frame the iris shuts down, reducing the subjects to silhouettes. Or grandma is interviewed next to a table lamp, which cranks the iris shut so that the room seems dark and grandma underexposed.

Light sources in frame are known as **practicals** and they can be important elements in a scene. They provide visible motivation for the lighting and enhance the natural feeling of a scene. If the lighting plan is designed well, the light will seem to come from practical sources—a table lamp, a window, a wall sconce—rather than from fresnels and scoops out of frame.

The difficulty with practicals is that they must be carefully controlled because they create a contrast range that is way outside what the camera can handle. Even if you've lit an interior quite carefully, if you show a window on a sunny day, you're going to be faced with a difficult choice: either the window will be vastly overexposed or the subject will be grossly underexposed.

When doing location interviews for news or documentary work, the most obvious and easiest solution is to pick the shot in a way that keeps the light source out of frame. When doing interviews in a home or an office, this is often the best—and simplest—choice. However, in drama you want the practicals to appear, and you need to take the trouble and time to make the contrast range work.

In those cases, the intensity of practicals must be carefully controlled to fall within the exposure limits of the rest of the scene. On a set, table lamps will be fitted with low-wattage bulbs—perhaps 25 or 40 watts, depending on the light level of the rest of the scene. In one dining room scene I directed, we had a chandelier with those 25-watt clear flame-shaped bulbs. We put the chandelier on a dimmer, and then after the scene was exposed, we turned the dimmer down until the lamps were just barely over 100 IRE.

In the real world, dimmers can also be used. A small portable dimmer made from commonly available components can be a real lifesaver. Plug the practical in, and turn it down until it exposes right with the rest of the lighting. One

FIGURE 8.3
A portable dimmer made from commonly available components can be a lifesaver in the field. Bear in mind that as incandescent lights are dimmed, their color temperature goes down—they become more yellow/orange.

caution to bear in mind is that as the voltage is reduced, incandescent lamps become more yellow/orange (Figure 8.3). However, this often looks quite acceptable with table lamps, the common problem in many settings.

Another "quick-and-dirty" solution in the field for table lamps with traditional shades is to place several layers of paper inside the shade to reduce the light that comes through the shade.

Windows are a different matter. You can't put a dimmer on the sun! The classic solution is to use a neutral density gel to reduce the light coming in. Gel manufacturers make these in large rolls that can knock the light down by 1, 2, or 3 stops. Color conversion gels can knock down the intensity of the sunlight while also converting it to tungsten temperature. GAM makes a roll ND filter just for windows that comes with a low-tack easily removable adhesive. These typically come in 58-inch-wide rolls. These are solutions for productions with a budget, however, since a single roll runs over $150. Although the rolls are reusable, they tend to get wrinkled and crumpled after a few uses.

A less expensive solution is Roscoscrim, a perforated black plastic sheet that is durable and reusable. It reduces incoming light by about 2 stops.

An even cheaper durable solution for the video shooter on a budget is a black fabric scrim material. A very economical solution that's always in my

FIGURE 8.4
On the left, the light coming in the church window makes the subject too dark. On the right, tacking black organza to the interior of the window knocks it down a full stop, allowing us to open up the iris and properly expose the subject, while not overexposing the window. This example is particularly difficult because the subject has dark skin.

"Gaffer's Survival Kit" is a 6-foot length of black organza, the stuff used to make widows' veils. You can get it at pretty much any fabric store for less than $10 a yard. If the window is near the ground, you can use gaffer's tape to fasten the fabric outside the window. If that's impractical, the fabric can be fastened to the inside of the window with tacks or tape. Although the interior fabric will be obnoxiously obvious to the eye, it will be nearly invisible to the camera.

LIGHTING DARK COMPLEXIONS

This particular example points out the contrast problem posed by darker complexions. It's sometimes hard to expose Caucasian skin tones properly if there is pure white or a light source in frame. Imagine the difficulty of controlling exposure with a very dark-skinned subject! This can become a problem even in a studio setting if you have a very light-skinned subject sitting next to someone who is extremely dark. Lighting dark-skinned subjects is an art unto itself. It's not actually that difficult, but it does involve care and observation.

The first rule of thumb is to eliminate any pure white or any light sources from the shot. This is always a good idea, but it is even more essential when attempting to capture a dark complexion. Figure 8.5 shows why: this is an example of how *not* to do it! The videographer posed the Rev. Leon Matthias in full Caribbean sunlight while he was wearing a white shirt. The result is a grossly overexposed shirt and underexposed face. Simply conducting the interview on a porch,

FIGURE 8.5
How *not* to do it! The videographer (not yours truly!) posed the Rev. Leon Matthias in full Caribbean sunlight while he was wearing a white Guyabera shirt. The result is a grossly overexposed shirt and underexposed face.

out of direct sunlight, would have helped; having the subject wear a blue or tan shirt would also have helped. If shooting under a porch overhang, a reflector could have been used to bounce light onto the face; but it would have to be flagged to keep the bounced light off the too-hot shirt. Placing the subject in front of a neutral or darker background is also helpful.

While one solution to lighting darker subjects is to pile lots more light on, we can see from this example that lots of light can cause more problems due to contrast issues. You want extra light on the face, but you may need to keep it off light clothing or light objects in the picture. And while "more light" can indeed work for medium-dark skin tones, it isn't a solution for extremely dark faces.

Subjects with coal-black or extremely dark brown skin can just soak up light in a manner that will frustrate the best frontal assaults. As we'll see later when discussing product shots, definition and modeling of dark or shiny objects come not from direct (frontal) lighting but from *reflections*. One approach that can work quite well is to use a kicker (to the rear and off to one side) to bounce light off the contours of the face. A warming gel (pink or straw) on the kicker often looks good and so can a ¼ CTB gel. Look at the underlying tone of the skin; if it is a warm brown, try an orange or a straw gel. If it is cooler black, use the blue gel. But above all, remember that large diffused sources or large reflectors work extremely well. A kicker on one side and a large softbank on the other can create

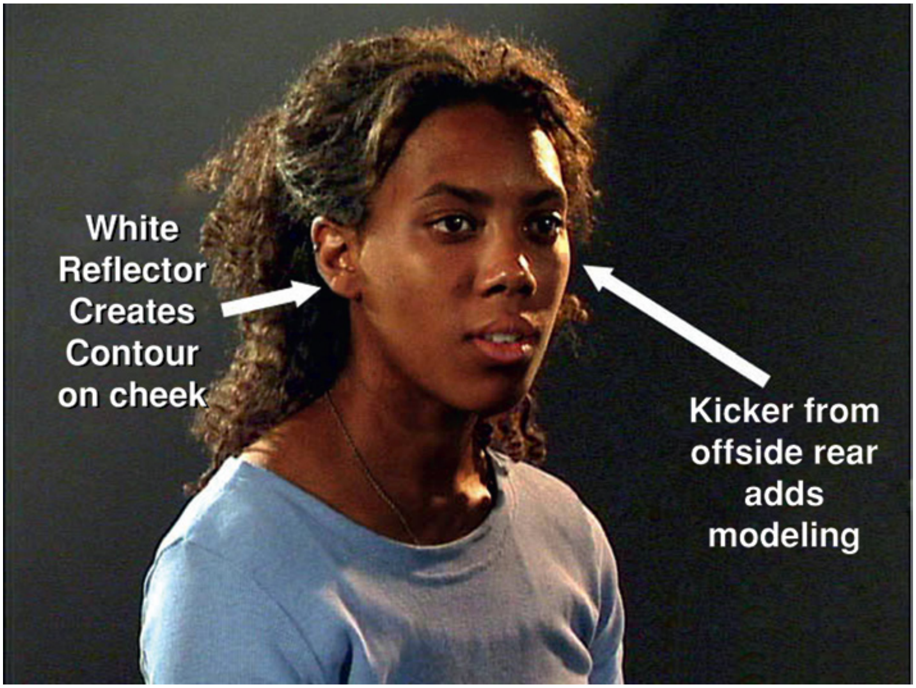

FIGURE 8.6
A "kicker" light to the rear and a large piece of foamcore help to provide reflections and modeling on extremely dark skin.

a lot of detail on a very dark face (see Figure 8.6). So, too, can a strongly illuminated large piece of white foamcore just out of shot. In both of these cases, the kicker and the foamcore are both creating areas of reflected highlights that bring out the modeling and detail of the face for the camera.

When faced with a high-contrast situation where a very dark-skinned person must be lit in the same scene with an unusually light-skinned subject, all the same rules apply. Use a kicker, a softbox, or a large white reflector to help provide definition on the darker skinned person. But use other light controls—flags, scrims, or barn doors—to limit the amount of light hitting the lighter skinned subject. Again, the situation is helped if no one wears white! A single key can be used for both subjects, with a black net cutting the intensity of the light on the pale subject (Figure 8.7). Exploit the Inverse Square Rule by seating the darker subject nearest the key and the pale-skinned subject further away. Or you can use two keys of different intensities, both flagged off with barn doors so that they only illuminate one or the other subject.

A couple of years ago, a poor fellow e-mailed me and several other lighting folks to ask for advice. He had to videotape the manager of a quarry and the client insisted that the interview be out in the quarry itself. The problem was that the manager had nearly coal-black skin, and the stone they specialized in was white marble! The sunny-day test shot was a disaster of aggravated contrast. What was he to do?

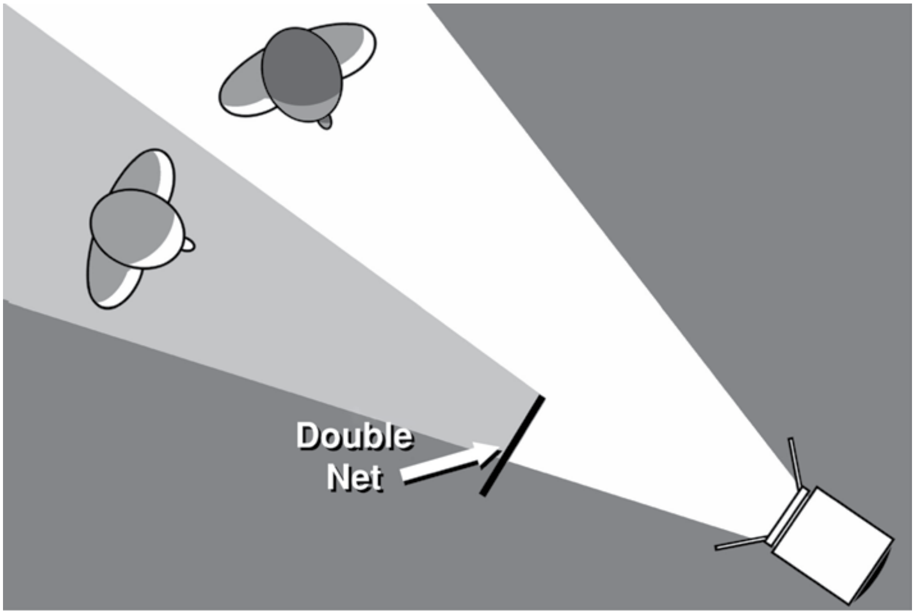

FIGURE 8.7
Use a black net to cut the intensity of the key falling on the pale subject; or use two key lights of different intensities.

"Shoot on a cloudy day," several of us suggested. "Use aluminized reflectors for key," and "use a gold reflector as a kicker." Finally, one of the other Internet advisers (I don't recall who) came up with the crowning touch: *hose down* the wall of white marble behind the subject to turn it the light gray of wet rough marble rather than the brilliant white of dry rough marble. The combination of ideas worked, the videographer was a genius with a happy client and a bonus!

But this illustrates a point: it may not be *one* "big tweak" that fixes a problem shot, but a whole collection of little tweaks all together!

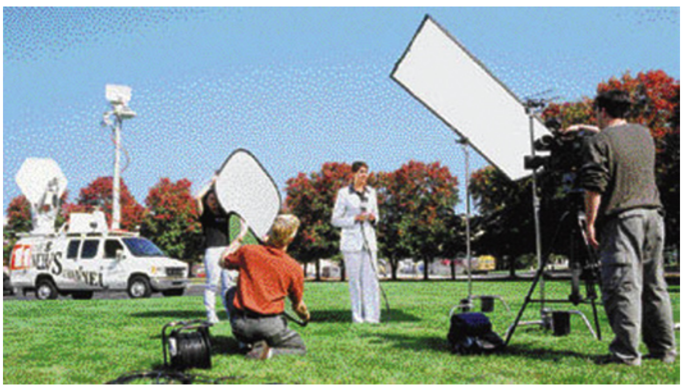

FIGURE 8.8
Here a Scrim Jim® silk is being used to diffuse the direct sunlight, with reflectors used for fill and backlight.
Photo courtesy F. J. Westcott, Inc.

FIGURE 8.9
DP Allen Daviau, ASC, and filmmaker Elyse Couvillion set a shot to take advantage of natural light in the digital short *Sweet*.

TOO MUCH LIGHT IN ALL THE WRONG PLACES!

There are many situations where (just like shooting a dark-skinned subject in front of a window) you have *too much* light—light in all the wrong places. One situation where this is common is outdoors on a clear sunny day. Especially during the middle of the day, highlights will be too hot and shadows too dark and pronounced. There are two basic approaches to fixing this situation. You can either bring in lots of lights to act as fill (the brute force approach), or you can redistribute the light you have (the more elegant approach). There are situations where each solution is appropriate, but by far the most common for video shooting is the second. Reflectors to redistribute the light and diffusing silks to take the harsh edge off the sunlight are generally more practical than truckloads of generators and HMIs.

In many cases, simply using a reflector will be sufficient to reduce the contrast and bring fill light into the shadowed areas of a subject in strong sunlight. How you orient the subject and the camera to the sun makes a difference, too. I like to use the sunlight as an offside key (illuminating the side of the subject that is away from the camera) and use the reflected fill on the camera side. Another possibility is to have the subject face away from the sun and use the direct sunlight as a backlight as in Figure 8.9. In this case, you must watch for lens flares! Probably the worst orientation is to have the subject facing into the sunlight, since that always produces an unflattering squint.

Using a large silk to diffuse the sunlight is a common solution. Silks are large frames covered with silk or nylon fabric. The silk is placed between the subject and the sun, and reflectors are then used for fill and back. Silks are quite effective but are difficult to use if there is any wind. Aerodynamically, they are not too different from a boat sail; in a breeze their most likely reaction is to fall over on the talent! Large silks will usually need to be anchored either with guy lines and stakes or with shot bags on the legs of the stand.

Generally, on any daylight outdoor shoot, reflectors should be the first-line lighting approach unless there is a strong reason to use powerful lights. Always look at the situation with an eye toward using existing light, rearranging it if necessary, rather than fighting against the forces of nature!

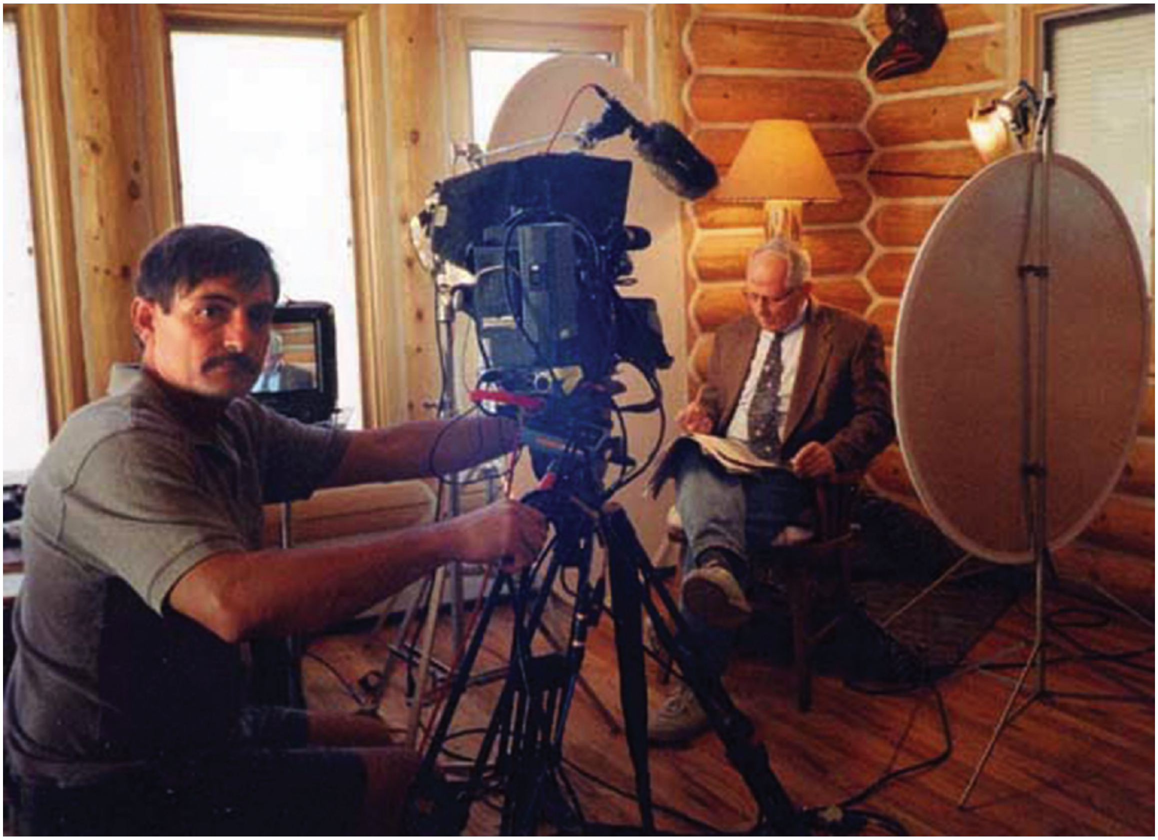

FIGURE 8.10
DP Steve Slocombe sets up a network feed with historian Stephen Ambrose. Note the use of collapsible reflectors on either side of the subject.

In the lovely independent digital short *Sweet*, filmmaker Elyse Couvillion and DP Allen Daviau (*E.T.*, *Empire of the Sun*, *The Color Purple*) did just this: surveying the apartment, the corporate board room, and the school classroom that they used as location sets to find times of day that the existing light would work in their favor rather than against them (Figure 8.10). At certain times of day, the angle of the sun coming in the windows would hit the white walls and reflect throughout the room, so that heavy additional light was unnecessary. So careful scheduling allowed them to work with nature.

Obviously, in the film and television business, you can't always do that. Schedules must be kept, and the mere progress of nature can't intrude. When you must shoot for hours with the sun apparently in the same place, you need to bring in high-powered solutions like a 24,000-watt FAY array. If you have to keep shooting into the night in a rented mansion and you need it to be sunny outside, an 18,000-watt HMI Solarspot squirted in the window will do just the trick. By the same token, these solutions cost money as well, and creativity, imagination, and careful planning may find another way to accomplish the same effect.

DIFFERENT COLOR TEMPERATURES IN THE SCENE

A basic and common problem that you will need to cope with are mixed-color temperatures in a scene. This shouldn't be an issue in a studio or stage, but it is often a problem in the "real world" where you don't control every aspect of the set and lighting. For example, you may need to grab a pan shot of a large office where efficient and happy employees crunch spreadsheets and process words and update their Facebook pages. Unfortunately, the office has sunlight coming in windows and yucky "cool white" fluorescent lighting that can't be turned off. Do you white balance to the sunlight or to the fluorescents? Or a more common problem in an office setting: when you white balance to the "warm white" fluorescents, the computer monitors all look blue. Or you may need to videotape a family (illuminated by incandescent light) watching television (which looks a washed-out intense blue).

There are several ways to approach mixed-color temperatures and the solution you choose will have to be custom tailored to the situation, the time frame, and the budget. Of course, these situations always crop up when both budget and time are tight; and the variety of situations seems almost infinite. There are certainly times when event or news shooters must simply shrug their shoulders, pick a white balance, and forge ahead!

In most situations, however, you should build in enough time (that can read "budget") to make some effective tweaks to the scene. In the large office, replacing all the fluorescents with daylight tubes might add $1000 or more to the budget in material and staff time—the most expensive solution. But if building maintenance is a few weeks away from a routine replacement of tubes anyway, it might represent nothing more than a change in maintenance scheduling and purchase of a different spec tube. Always ask the question! Just be ready to shrug your shoulders philosophically when the answer is "no."

You could also purchase ND sheet gel for all the windows; probably somewhat cheaper, but still adding a substantial sum to the budget. The typical video client will look at you like you have a blinking light on your beanie hat and bananas sticking out your ears. "Can't you just *take* the picture? This ain't a work of art, you know!"

Perhaps one should always begin with the cheaper solutions, anyway. This is a problem not only of color temperature, but also of *what quantity* of *which* color temperature. A great solution is to wait for a cloudy overcast day to shoot; balance to the fluorescents. If that's not possible, choose a time of day when strong sunlight is not streaming in the windows. If the office windows face east, then shoot in the afternoon; if the windows face west, shoot in the morning. This vastly reduces the quantity of one of the color temperatures you need to deal with and without extra budget. Balance to the ugly fluorescents, which will be around 4500 K. You might consider using a magenta filter such as Tiffen's FL-D or FL-B to eliminate the greenish spike of the "cool white" tubes. This may cut the light level so low, however, that you'll have to use gain on the camera. The exterior light will seem blue, but not excessively so, since the difference between 4500 K and 5600 K is not as pronounced as the difference between incandescent and daylight. The windows will probably still be overexposed; if so, it's advisable to eliminate them from the picture as much as possible.

The problem of conflicting color temperature from computer monitors and television screens is one that is all around us, and it is a problem that is often overlooked in the field. But there's nothing more unpleasant than to get back to the edit suite and end up with an illegible blown-out blue computer screen with a black bar rolling through it. It doesn't really capture the experience of the human eye, does it?

The problem here is not too different from the office with the windows: a combination of different color temperatures and the balance between the different colored sources. You need to regard any monitor or television as a practical: after all, it is a direct radiating light source. It is not as much as a bare 60-watt bulb, but it is a light source. And it's a light source that is generally closer to daylight. Television manufacturers discovered a long time ago that cranking up the color temperature of the cathode ray tube into the blue range made the tube seem brighter to the human eye. This use of bluer color temperatures continues with newer flat screen LCD screens, which also have color in the daylight range. So again, there are two problems to solve: the color difference and the intensity difference introduced by an on-camera practical.

Solving the color balance problem has basically three solutions. The first may not be appropriate for many situations, but will be imminently workable for some: don't solve it at all! In some situations you want to retain the blue glow of the monitor for effect: a shot of a writer working intensely on a novel late at night, for example. Balance to the incandescent table lamp and capture the blue glow on his face. Just expose so that the screen is legible and not overlimit and adjust fill light as necessary. Or you may want to capture someone watching TV alone in a dark room late at night and the blue glow is equally effective. However, for most "normal" situations, you will want to more closely match the color temperatures to simulate the experience of the super-flexible human eye.

So the second solution is to white balance to the 5600 K+ of the monitor (it may be as high as 6500 K) and gel other lights to match; or use daylight balanced lights such as daylight fluorescents, HMIs, or FAY globes, which are dichroic coated PAR bulbs. Again, expose to the monitor. It's the one light source you can't really change much, though you can of course turn down the brightness of the screen a bit. Adjust the other lights to match the monitor—don't just slap up lights, expose to them, and expect the monitor to magically match the arbitrary light level! And you ARE using clearscan to get rid

Fixing that Annoying Rolling Bar When Shooting Computer Monitors

Yes, this is a lighting book—and this is a camera operator tip. But the huge number of videos I've seen where no effort was made to deal with the "rolling black bar" problem calls for the inclusion of this note!

When videotaping a scene where a CRT computer monitor screen is visible, usually a rolling black bar will appear on the computer screen inside the video image. This is caused by the different **scanning rates** that are typically used for computer monitors. NTSC video is scanned at 29.97 hz, while it is more typical for computer monitors to use rates such as 72 or 85 hz; 24p shooters (really 23.98 hz) will see a different size and speed of rolling black bar. The black bar, which will vary in size and speed depending on the scan rate of the computer monitor, is the **blanking interval** during which the cathode ray beam retraces from the bottom of the screen to the top of the screen before beginning the next trace.

There are two methods to eliminate this problem, which must often be used together:

1. Reset scan rate of monitor.

The first and best method is to reset the scanning rate of the computer monitor to 60 hz. Please note that this is not always possible, for some monitors and SVGA adapters will not support 60 hz. However, most will. On Windows computers, right click anywhere on the desktop and select PROPERTIES. Click on the SETTINGS tab. Now click on the ADVANCED PROPERTIES button in the lower right. Usually, there will be a drop-down list of "Refresh Rate" selections at the bottom. Select 60 hz, then click OK. 24p shooters should try 100 hz, which is a commonly available refresh rate (you won't find a selection for 96 hz, which would be four times your frame rate) and is close enough to minimize the bar to a tolerable level. Windows XP will ask you to test the rate to be sure it works. Often, you will need to reboot the computer for the new rate to take effect.

After resetting the scan rate, you will find that the rolling black bar is almost entirely gone. At most, you will generally have a narrow darker or brighter bar that moves slowly on the screen. Generally, this is acceptable in many situations, and you don't need to do anything else.

Several years ago, I did special effects for a show where a bunch of computer monitors were visible on screen. All of them were set to different scan rates. The DP was frantically trying to adjust the camera clearscan control to get rid of the rolling bar on one monitor, only to find it made another monitor look worse! I went around to all the machines and changed the scan rates to 60 hz, clearing up the problem. The rest of the show, the DP treated me like a genius.

2. Use camera clearscan.

Most pro cameras have a "clearscan" feature specifically to deal with this problem. Clearscan is basically an infinitely adjustable shutter speed that allows you to match the scan rate of the computer monitor.

On Sony cameras, turn on the SHUTTER switch. Press the MENU switch/dial and highlight the SHUTTER selection. Turn the MENU dial to cycle through the normal shutter speeds until you reach the CLS (clearscan) mode. Adjust the dial up or down until the rolling bar is minimized. If the bar is black, reduce the frequency. If the bar is white, increase the frequency.

Remember: READ THE MANUAL!

Fortunately, flat-screen LCD monitors have replaced CRT monitors in most situations, but not all. The prepared shooter will need to know how to deal with CRT rolling bars for several years to come.

of that annoying rolling bar on old-fashioned cathode ray tubes, aren't you? (See Sidebar.) That's even more annoying than mixed-color temperatures—and worth some effort to get rid of! Fortunately, newer flat-screen LCD screens have nearly edged out CRTs in most situations, and they don't exhibit the dreaded rolling bar. They still have to be color-corrected, however.

The third solution is to force the monitor or television to match the color of the lights. If you're lighting with incandescent lights, you'll need to place a CTO (color temperature orange) gel over the monitor or TV screen. Cut a large sheet carefully to fit; usually, the static electricity of the screen will hold the gel in place. This looks incredibly stupid in person, but it works like magic on camera. Like the black organza mentioned earlier, the gel is invisible to the camera because of contrast. Rosco even makes a Video Monitor Correction kit specifically for this purpose, with 60" × 48" sheets of optically clear film that's just the right shade of orange for the purpose.

In all these approaches, don't adhere slavishly to a perfect match. Our eyes are used to seeing a mix of color temperatures all the time; it's just that the difference is not as pronounced as it is when seen through a camera. So there are situations where it's quite effective to correct the color difference halfway and still let one source run a little blue or the other run a little yellow. Or there may a situation where you partially correct the difference (use a ½ CTO on a computer screen rather than a full CTO, for example, or ½ CTB on the lights rather than a full CTB) and then white balance somewhere in the middle! This allows the incandescent lights to run warm yellow and the computer screen to seem a bit blue—but not the excessive difference of the "natural" situation.

As I hope you've gathered in this chapter, troubleshooting common problems for lighting and exposure involves careful observation and creativity. Often the best solutions are simple and low-tech, and frequently a variety of small fixes must be combined for the best effect.

CHAPTER 9

Studio Lighting

Much of the lighting that is covered in this book is temporary location lighting: mobile stands and stingers are used to mount instruments on location or on a temporary set. But of course many things are shot in television studios where a permanent light grid is installed, special HVAC (Heating/Ventilation/Air Conditioning) provides quiet cooling, and cameras on studio pedestals are wired into a control room. Lighting principles remain the same in a studio, but the installation is different.

Studios are a more controllable environment than locations and so are essential for situations that are more permanent, the most common local application being news sets. But just like sound stages in the film world, studios are handy for any sort of scene that doesn't actually have to be outdoors. It's easier to light sets in a studio: adequate power is available, the grid provides mounting options practically anywhere a light is needed, and sophisticated dimmer panels provide precise and easy control. Of course, other factors are more controllable as well, the major one being audio.

"Studio lighting" takes a bad rap sometimes because it is associated with local news, soap operas, and game shows. But this is unfair, since studio lighting can be pretty ordinary, but can also be done with style and artistry. Many of the best lit episodic television programs are shot on studio sets. One of the best examples in recent years has been Sidney Lumet's excellent but short-lived series *100 Centre Street*, which was shot with multiple cameras in 24p digital high-def video (Figure 9.1).

It's not required that local news be flat lit either, though lots of station managers think so. With today's computer-controlled light control boards, a good lighting designer can set up a studio for every conceivable combination of anchors, walkarounds, and other variables that afflict news sets.

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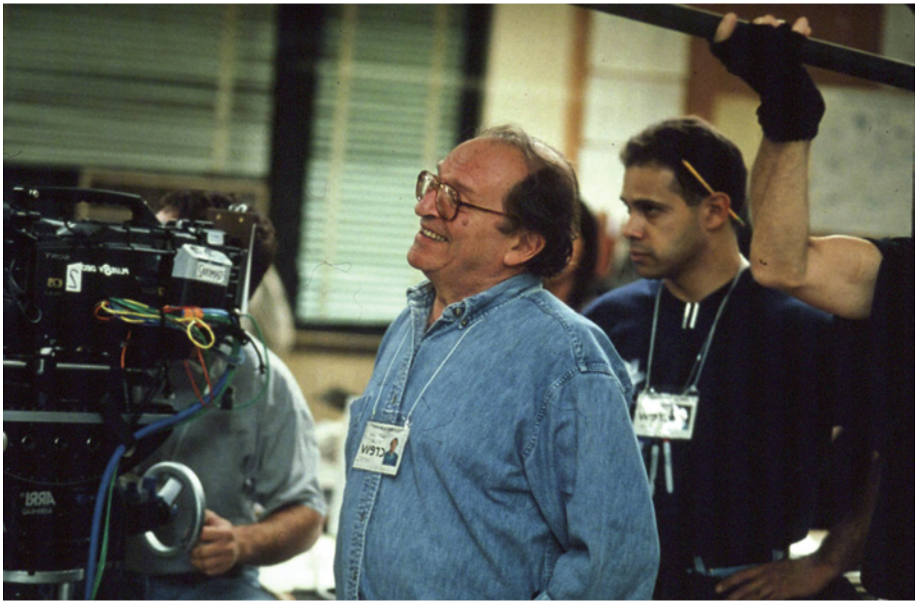


FIGURE 9.1
A&E's excellent series *100 Centre Street*, starring Alan Arkin, was a fine example of the best of studio lighting. Sidney Lumet, a veteran of the days of live TV, used the latest digital technology but resurrected the techniques of multiple cameras and live switching for the program. The show was proof of successful dramatic lighting design for multiple cameras. DP for the show was Ron Fortunato, production design by Christopher Nowak. Photo courtesy of A&E Television.

Let's take a look at designing a basic studio lighting installation and then examine typical applications.

A studio is basically a large empty room that has been soundproofed, usually has a sophisticated and very quiet air-handling system, a large smooth floor (either polished concrete, movable linoleum squares, or poured composite), and a heavy-duty, independent supply of power. A large studio usually needs to have its own line transformer from the power distribution lines; this helps to damp surges and dips in power from heavy machinery starting in another building. We won't get into the many complex details of studio design here; studio acoustic design is a whole book in itself. If you're actually building a real studio (rather than converting a warehouse or an office on a shoestring budget), it is recommended that you hire a studio designer. These folks not only understand all the interrelated complexities and problems that can crop up, but they will also be up on the latest materials and techniques. They will know the mistakes that contractors usually make and how to avoid them. We will touch on the key points that relate to lighting, however.

The first issue that crops up in studio design is the height of the ceiling. Sometimes this is dictated by other issues, but when there is a choice, the height probably ought to be several feet higher than the tallest height anyone has tossed

An Important Safety Note

Safety must not be an afterthought in the studio. Lighting instruments are heavy items; barn doors have sharp edges. In the rush to get a shot lit under time pressure, too often safety is forgotten or compromised. An instrument that has been sloppily hung can suddenly become an instrument of destruction.

A falling light can injure, maim, or even kill!

Drill safety procedures into everyone who works in a studio. Lights must be hung securely, with aircraft safety cable or chain hooked to the grid. When rigging temporary light mountings, make sure they are secure and strong enough to bear the weight. Strong cord can be used when safety cables are not available.

Make sure that fabrics are not too close to instruments; it doesn't take long for drapes to catch fire when touching the front of a 2-K fresnel!

The most common safety hazard is not lights on grids, but lights on stands. These are often extended to their extreme length and are set up quickly, thereby representing a top-heavy accident waiting to happen. Use cord or cables to anchor the stand to a set piece or wall. When you are using boom arms on C-stands, counterbalancing shot bags or sand bags *must* be used, or the entire contraption will tilt over. But even when using shot bags to counterbalance the length of the arm, don't forget that the arrangement is still quite top heavy and can tip sideways easily.

around in discussions! One of the common mistakes made in designing studios is to economize by using too low a ceiling. While it is typical in smaller studios to locate a lighting grid anywhere from 12 to 18 feet above the floor, the ceiling ought to allow *at least* another 6 to 12 feet of empty space above the grid. This is not wasted space; it is essential for handling heat. Think of each incandescent instrument on the grid as an electric space heater rather than as a light. In fact, a 1 K throws off about the same amount of heat as a 1000-watt home space heater. Disposing of this heat is a major issue in studios. It's not uncommon to be running far more light wattage than would be specified by a heating contractor for electric space heating of the same area. And of course the lights are not thermostatically controlled; the space heaters would turn off when comfortable room temperature is reached, the lights stay on!

Allowing a large space for heat to collect above the lights will keep the area below the lights more comfortable. It acts as a heat "shock absorber," an area where heat can go while the AC tries to pump it out. Decreasing the space above the grid will require a much higher rating of AC installation and AC tonnage is a *lot* more expensive than adding unfinished height!

Studios can be practically any size, depending on the intended use. They can range from tiny (20' × 30') to behemoth (100' × 140') and everything in between. Because of the characteristics of typical camera zoom lenses, a studio depth of less than 25 feet is generally not practical; even that will seem cramped. While one shouldn't overbuild, my experience has been that studios are almost always too small. In particular, it's often overlooked that there will always be lots of stuff in a studio that is not being used, but can't be in the shot. Dollies, light stands, flats, boxes, *stuff*. A large connected storage area, or just an extra 15 or 20 feet at one end, is essential.

POWER SYSTEM AND GRID

The basic ingredient of studio lighting is a sufficient power system. It's always best to be liberal here, since your needs in the future might grow. A small studio probably requires a minimum of 200 amps, whereas a larger studio may need 500 amps or more. Figure out the maximum number of instruments that you will be able to hang on the grid and add a bunch on floor-mounted stands. I know you usually won't have them all on at once—but just suppose you might need to one day! The power requirements will be lower if you use primarily fluorescent instruments; more on that later.

Do you need any 240-volt instruments—5-K fresnels, for instance? How many 240-V outlets do you need and where should they be located?

What sort of lighting control panel will you be using? Where will it be located? Today, these are typically remote controls for the actual power control modules, which are located either at a common distribution area or at remote locations around the grid.

These questions will be essential to designing your studio.

The second component of a studio lighting system is the grid. While a variety of proprietary grid systems have become available over the years, the mainstay is simple black iron pipe suspended from hangers. The pipe is usually specified as "Schedule 40 black finish steel pipe;" the size (specified in internal diameter) must be either 1-½" i.d. or 1-¼" i.d., since standard pipe hangers for instruments will not fit properly on any other sizes. The grid is formed of two layers of pipe, the first suspended at right angles to the ceiling beams. The second layer is fastened at right angles below the first with special hardware, creating a gridwork that provides numerous points for mounting instruments.

Special hardware is available to hang the pipes from the steel I-beams, C-channels, or bar joists that support the ceiling (Figure 9.2). These typically clamp onto the bottom of the beam and provide a hanger for ⅜-inch threaded rod. Clamps hang the second layer of pipe at right angles to the first. This approach is much stronger than forming a grid out of cut pieces of pipe with T-connectors.

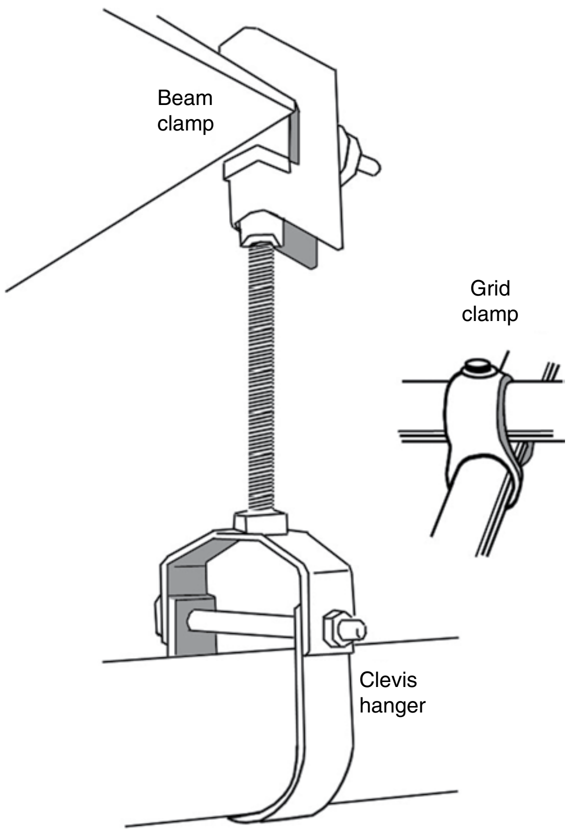


FIGURE 9.2
Special hardware is available to hang black iron pipe as a lighting grid.

Safety Note

It's important to get some engineering advice on how many hangers you will need to effectively support the weight of the grid and the lights. A heavily populated grid can weigh a lot.

Right above the grid, power connectors are hung labeled with position markers. Depending on how the control system is designed, these can be standard electrical boxes mounted on EMT* pipe, proprietary load connector strips, or rig-mounted dimmer power packs. Strand has a custom-made connector strip that is essentially an enclosed channel for wires. Short pigtails are used to connect to instruments. Rosco's Entertainment Technologies division makes a product called the Intelligent Raceway that incorporates dimmer packs and connector strip into one package.

How you control the lights depends entirely on your intended use. A very small studio might simply wire the standard outlet boxes to circuit breakers, although this is not an optimal situation. The next step up is to have a traditional electrician wire the outlet boxes to banks of standard household switches. However, basic dimmer packages are now quite affordable, so most studios will have some sort of remote control dimmer system.

In days of yore, dimmers were huge autotransformers you controlled directly with large handles. Curious mechanical interlocking systems allowed the operator (or several operators) to manipulate a group of autotransformers in tandem. Those days are gone. Today, almost all dimming systems are comprised of separate digital control systems and solid-state dimmer packs or racks. A dimmer rack is often located outside the studio in a separate machine room, wired between the breaker box and the power distribution system above the grid. Each dimming channel (which can typically range in power handling from 1200 watts to 5000 watts) is controlled discretely from a remote control board such as the one shown in Figure 9.3. Smaller systems may use dimmer packs that are mounted directly on the grid, such as the EDI SCRimmer Stik or the Dove Dimmermaster "shoebox" packs. These typically have lower ratings (four 600-watt channels or two 1200-watts channels) than rack-mounted dimmers. Smaller dimmer packs can be used in conjunction with a rack system to expand the system or provide more control.

FIGURE 9.3
The Strand 200 series is available in 12/24 channel or 24/48 channel models and features two-scene preset operation or expanded single-scene preset operation with DMX 512 operation.

Each dimmer channel is controlled by a low-voltage signal from a separate control board, which can be mounted anywhere in the studio. These control boards are now a digital ecstasy of flexibility, offering presets galore, storage of multiple programs, control outputs in every flavor including MIDI and GPI**, interface with

*Electrical metal tubing, commonly referred to as conduit.

**MIDI is the abbreviation for Musical Instrument Device Interface; GPI is short for General Purpose Interface, a protocol for connecting a wide variety of general controls to a computer.

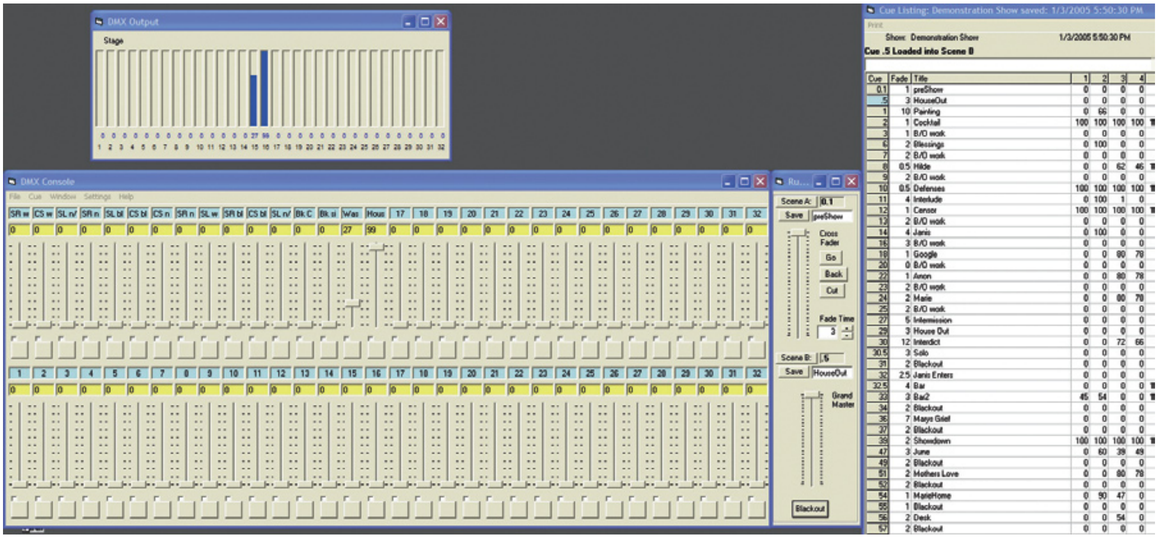


FIGURE 9.4
ChromaKinetix offers several open-source software packages for both Macs and PCs that can control common USB-DMX interfaces. This is a screenshot of their StageConsole software, a 512-channel two-scene preset light board with unlimited cue memory and manual or auto timed cross fades. Cues for a show are stored in a simple editable text file. Compatible with the Enttec OpenDMX USB widget and the Enttec USB DMX Pro.

PCs and Macs, you name it. Running the big boards is a tech task of its own; the more flexibility, the more complex the system becomes!

Of course, as time and technology have marched on, more control systems are becoming computer based. A number of software control systems combine with a hardware card or adapter of some sort to turn a standard PC into a full lighting control system such as that shown in Figure 9.4.

Dove Systems manufactures an interface called the StarPort that is available in both parallel port and USB versions; other manufacturers such as VXCO in Switzerland manufacture external boxes such as the DMXCreator1024+ that interface with the computer via either the printer port or the USB bus. Enttec makes the DMX USB Pro, which can interface with software like Stage-Research's Light Factory 2.0. Chauvet offers the X-Factor hardware combined with their ShowXpress software. Each offers proprietary control software. Rosco now offers a hardware interface and software known as Keystroke that allows your lighting board to trigger playback of computer programs such as Power-Point or a video player. Of course, like everything in the computer world, these products will be constantly changing, so you'll have to do your own research to find the state of the market when you're ready to buy!

Several interface systems allow the control panel or software to communicate to the actual hardware dimmers. The two major systems in use today are DC voltage control and DMX.

DC voltage control uses a low-level voltage, usually 0–10 vdc to precisely control the dimmer output. Each channel of the board must have a cable directly to the dimmer unit. These are often simply three-conductor XLR mic cables. On small systems (6 channels) an 8-pin DIN connector (sometimes known as a "Bleecon") is used. Not all systems are the same; Strand consoles can use either +10 vdc or −10 vdc for full "on." There are one or two renegades that formerly used lower voltages. You must make sure that all the dimmers and instruments in your system match the specs of the controller! These systems are growing less and less common, though you will still run into them in older installations.

Far more prevalent now is the DMX 512 system, which is an 8-bit digital protocol that can control up to 512 channels independently through a multiplexed signal. DMX equipment typically uses 5-pin XLR connectors, though newer equipment may be able to use CAT 5 networking cable. Each instrument on the DMX chain is assigned an individual "address" that allows the control panel to tell dimmer pack #12 from pack #3. DMX signals can run reliably over 1500 feet of cable, far more than you would need in the largest studio.

DMX is a standard developed by the United States Institute for Theatre Technology (USITT). Because of the advantages and flexibility of the digital interface, DMX is really the interface of choice today and I think you'll see the other control interfaces fade away except for the smallest six-channel systems.

DMX Control Tech Stuff

It is important to make sure all equipment is fully compliant with DMX 512 standard. Some manufacturers have used nonstandard voltages, and these can damage other DMX equipment.

Information about the standard is available online at http://www.usitt.org/DMX/DMX512.htm

Pin assignments as called out in *Section 9.02* of the DMX512/1990 standard are as follows:

PIN 1—Signal Common (Shield)

PIN 2—Dimmer Drive Complement (Data 1 −)

PIN 3—Dimmer Drive True (Data 1 +)

PIN 4—Optional Second Data Link Complement (Data 2 −)

PIN 5—Optional Second Data Link True (Data 2 +)

Section 4 of the standard requires adherence to EIA-485 with regards to all electrical characteristics, which means a maximum voltage range of −7 to +12 volts dc. The +18 to +25 volts dc used by some noncompliant instruments is outside this spec and can damage DMX-compliant gear.

Pins 4 and 5 are used to transmit data to color wheels and motion lights, sometimes known as "intelligent" instruments. Since in many studios the second data link is unused, it is fairly typical to wire DMX with three-wire cable, using only pins 1, 2, and 3 as active. By the same token, using a three-wire mic cable with an intelligent instrument will fail.

The DMX chain or "bus" must be terminated, just like a computer SCSI chain. An improperly terminated chain can exhibit bizarre misbehavior and intermittent problems. The terminator is simply a 120-Ω resistor across pins 2 and 3 in the last instrument in the chain. Some instruments terminate automatically, others have a switch for termination, and still others have no termination and a terminator will have to be created. Typically, termination issues arise when using a "twofer" or splitter where one leg is properly terminated and the other is not.

Another interface that you will run into is AMX 192, an earlier multiplex standard that also used 5-pin XLR connectors but an analog signal. Older equipment may still require AMX 192; most dimmer packs and control panels still support the standard. Because the signal was subject to ground-loops and all the other vagaries of analog transmission, it is not nearly as reliable as DMX and has mostly fallen out of use.

With all this discussion of dimmers, you may be wondering about the color shift we discussed earlier. When incandescent instruments are dimmed, they shift toward orange-yellow. So how do you handle this in a studio?

First, in many cases the dimmer panel is used as a very fancy on-off switch and the instruments are used at full power. The option of dimming is always available, but is not necessarily used. In addition, a slight yellow shift is not always a problem.

In other situations, dimming is an essential ingredient. On news desks, for instance, where different people with different skin tones are lit with the same lights, dimming presets can be a blessing. Say the morning news crew has an anchor of color with very dark skin; and the evening news crew has a blonde blue-eyed anchor with very pale skin. Carefully designed dimmer presets can be used to vary the light levels of certain instruments to compensate for the different skin tones. But again, what about the yellow shift?

The usual method to get around this is to target the white balance of the cameras on the yellow side—say 2900 K or 3000 K—and run all the lights on half intensity normally. Although this may seem wasteful, it isn't. The lights run cooler, the globes last longer, and the lighting designer has "headroom" to increase the intensity easily. From that middle range, the lighting designer can generally change the lighting level up a stop or down a stop without significantly changing the color of the light. A fudge, but it works!

FLUORESCENT INSTRUMENTS

Of course, incandescent instruments are no longer the only choice for studio lighting. In fact, they are losing ground to fluorescents all the time, for several good reasons. Yes, lighting designers like the soft light. Yes, talent likes to stay cool. But these aren't the real reasons studios are changing over. The real reason is the thing that always drives decisions in television: *money*.

Fluorescents are cheaper to run than incandescents by a huge margin. For one thing, they are more efficient: they put out more lumens per watt than any incandescent instrument. But that's just the beginning. The main savings comes because they don't generate much heat. And as we discussed above, disposing of excess heat in a studio is a major problem, involving lots and lots of air conditioning. While this may not seem to be a major factor to the average event videographer or documentarian, it's a *huge* factor if you're a studio manager. For any television studio that is in daily use, air-conditioning cost constitutes a major slice of the operating budget. Anything that will cut that bill is pure profit for the station or studio.

FIGURE 9.5
KGUN-TV in Tucson, Arizona, realized a huge savings on its power bill after changing from all-incandescent instruments to Kino Flo fluorescent lighting.

When KGUN-TV Channel 9 in Tucson, Arizona, switched from a fairly traditional incandescent lighting system (fresnels, soft lights, scoops, and cycs) to Kino Flo Image 80 and Image 40 instruments augmented with Dedolight accents, they estimated an immediate savings of nearly a quarter million kW hours per year (Figure 9.5). This translated into an annual savings of nearly $10,000 in operating costs. In addition, station manager Gregg Moss says that they received a $2500 rebate from the power company!

Many fluorescent instruments are now dimmable and others are now also DMX controllable. That makes the precise and convenient control of many "flo" instruments in a studio feasible. Each Videssence Baselight fluorescent studio instrument, for instance, is available as nondimmable, with 0–10 vdc dimming, with DMX control, or with phase-control dimming (a technique more often used for architectural light installations). Nondimming "flos" can be controlled from a DMX panel through use of a DMX relay panel, such as the ETC Sensor Dimmer Relay or the Strand CD80 Non-Dim module. Oddly, these are still known as a "dimmer," even though it's only an electronic on-off switch.

LED LIGHTING

Of course, in recent years LED instruments have made huge inroads first as on-camera lights and more recently as studio fixtures. They offer even greater power efficiency than fluorescents and are fully dimmable. A huge amount of development continues in refining the LED as a general-use lighting source and

FIGURE 9.6
The Pentagon Briefing Room uses 1 × 1 LitePanels as primary instruments. The conversion to LEDs has saved 95% in energy costs for the room when compared to the old "hot" lights.

that research will inevitably increase the efficiency and usability of LED sources in film and video production.

Numerous studio settings have begun to include LED instruments. Perhaps the most prominent is the refurbished White House and Pentagon Briefing Rooms, which now use 1 × 1 LitePanels as principal light sources (see Figure 9.6). The conversion to LEDs saved the tax payers almost 95% on the power bill for that one very visible room of the White House when compared to the old incandescent lighting.

LEDs have a peculiar advantage over fluorescents in one particular way: they can be designed with a narrow light pattern, a sort of medium spot that can be anywhere from 30° to 40°. This tight pattern is created by the tiny lens on the front of each LED, and allows a longer effective throw for a given lumen output. One instrument from LightPanels even mixes broad and narrow LEDs together so that the user can switch from a broad pattern to a tighter medium spot. This allows the studio designer to use the "punch" of concentrated light for key light in specific areas. These instruments do not throw the kind of hard, concentrated beam that a Fresnel can create, but they can sometimes have important advantages over the vague swath of light thrown by a flo bank.

DESIGNING A LIGHTING PLAN WITH FLOS OR LEDS

Soft fluorescent or LED lighting does not automatically translate into flat lighting. It can, but it can also be used to create very effective modeling. The only thing fluorescents cannot do well is generate hard light; so it is typical to still

FIGURE 9.7
Studio lighting design using flos with Fresnel accents at STV Studios Pacific Quay in Scotland. Photo courtesy of John Rossetti Lighting.

use fresnels as accents. Narrower-beam LED spot instruments can be used as accents as well. Sometimes studio lighting designers will use fluorescents to lay down a base level of illumination, but still use fresnels as harder-edged key lights. If a combination of instruments must be dimmed without changing color temperature, the trick mentioned above is used: all the flos will be populated with 3000-K tubes and the incandescents can be set up to run at about half power.

Designing light for a studio installation (Figure 9.7) is more complex than simply setting up shot-by-shot lighting. The designer has to get a good idea of every type of shot that is necessary and take into account all the variables that may crop up. The designer must anticipate problems and plan for them. When planning a new installation, you'll have to ask a lot of questions. Always overdesign, for needs will grow and you need to plan for future development.

FLAT LIGHTING

Okay, I've moaned all the way through the book about flat lighting. But no matter what style of lighting *I* prefer, *you* need to know how to do it. And there are situations where you need flat lighting. If you're trying to emulate a game show or a local news set, you'll want to use flat lighting to get the look everyone *associates* with those types of shows. If you're staging this game show inside a broader drama where most lighting is done very carefully with an eye toward realism, you may want to use the harshest, most artificial look you can come up with for the fictional game show to make it stand apart from the other scenes.

True flat lighting is when light comes equally from every direction and is fairly difficult to accomplish. It's done in certain types of product photography with a white diffusion tent, but is very hard to achieve in a studio with real people. The one show that actually came the closest is Whoopi Goldberg's incarnation of *Hollywood Squares* (1998–2004), where fluorescent tubes surround the stars in each square. Typical studio flat lighting (technically known as high key lighting, since the key and fill are equal or nearly equal) isn't actually completely flat and thus isn't quite that difficult to create. In fact, it's fairly easy—it requires lots of instruments but little expertise.

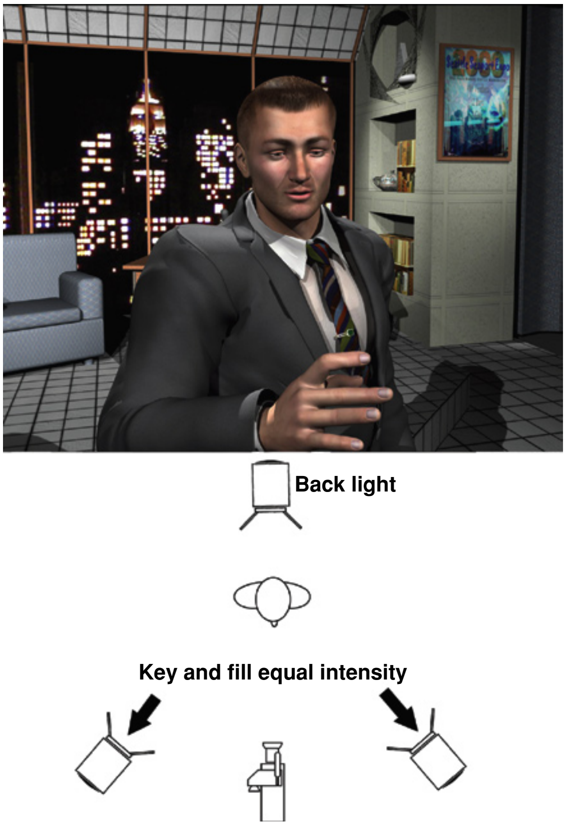


FIGURE 9.8
Flat lighting on *Conan Letterperson* on the set of his talk show. In essence, key and fill are of equal value, so there is no difference in illumination on either side of the face. Nose caret and chin shadow become inverted triangles.

While there are many variations, let's light our fictional new talk show, *The Conan Letterperson Show* (Figure 9.8). First we'll light the host. Two 1-K fresnels are hung that shine on either side of his handsome face. From the subject, they are about 45° apart and positioned equidistantly. As a result, they cast exactly the same amount of light on both sides of the host. The angle is kept low enough so that the nose caret is not too long; in fact it is minimized into a sort of triangle under his nose, rather than a nose-shaped shadow. The ubiquitous backlight is hung directly above and to the rear. This is pretty much the lighting you'll see on the *Tonight Show* or *The David Letterman Show*. Our show, of course, bears no relationship or similarity to those programs.

When the "45° key" concept is used with fluorescents, the effect is even flatter, since the soft nature of the light makes the shadows less distinct. This particular setup is so easy the weekend intern could set it up; the "flos" provide a wide, even light over the entire area. But when both instruments are of equal wattage, the look is too flat and boring for words; it needs something to punch it up.

A slightly improved variation of this setup, and one that is actually more common, is the frontal key. In this setup, a single key is used mounted above the camera, pointed directly into Mr. Letterperson's good-looking mug. Two fills are used, one on either side at about a 45° angle—much like the two keys in the setup above. Let's hope they are *not* the same intensity as the frontal key, though I'm afraid in many studios they are. Reducing them to half the value of the key does create some sense of modeling toward the sides of the face. This has a number of advantages, the major one being a reduction in the harsh triangular shadows under chin and nose (Figure 9.9).

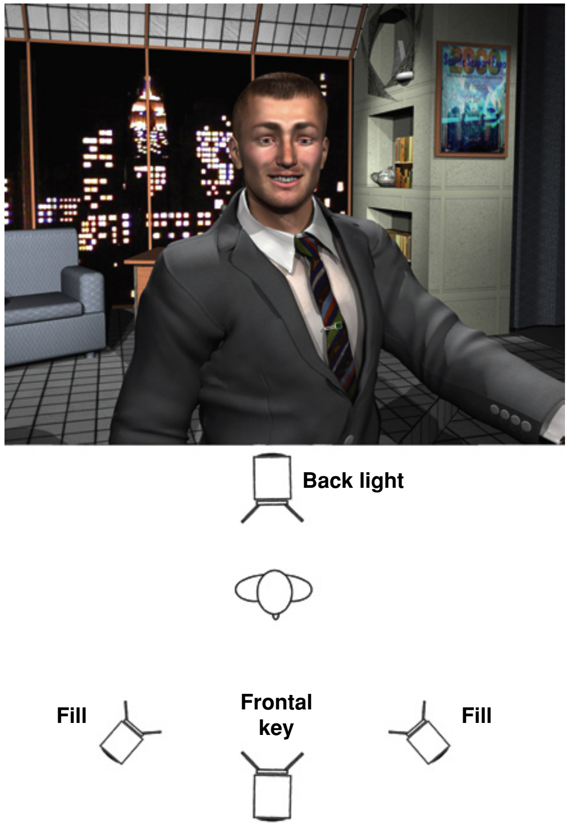


FIGURE 9.9
Frontal key lighting is an improvement, reducing the harsh shadows under the chin and nose. This setup is very commonly used on news and interview shows today. A bit of diffusion on each instrument would help the look considerably and is highly recommended.

Fine, that illuminates the host at his central mark, but what about the rest of the set? Much like basic stage lighting, we'll just clone the frontal key configuration in overlapping sets until the entire set is bathed in light (Figure 9.10). Anywhere the host or the guests walk on the set will be equally lit from both right and left. Overlapping coverage is the hardest part of setting this up with incandescent instruments. Diffusion helps significantly in blending the edges. Fluorescent instruments make this part a breeze and are really the recommended method for creating even flat lighting over a set.

Okay, how do we improve the flat lighting situation? It's actually quite simple. Remembering that modeling is created with highlights and shadows, we simply need to lower the intensity on one side and raise it a bit on the opposite side (Figure 9.11). Although it won't create stupendous lighting, the simple expedient is to reduce the level of the fill light (pick one side!) to half that of the key. This approach is quite effective when using fluorescents.

Another variation is to use a pair of "flos" much like this, combined with a small fresnel mounted in a frontal key position. This key adds the punch that was missing from the overly flat 45° fluorescent situation mentioned above. Many news sets today use fluorescents like this, combined with smaller fresnels to add punch and accents. When artfully designed, this combination can be quite pleasant and effective.

However, not every situation is a news set or a game show. Many episodic dramas, ranging from daily soaps to weekly comedies and cop shows, are shot in studios. These are more complex because of the changing demands and situations; and also because the action may move around the set in a much more random fashion than on a news or game show set.

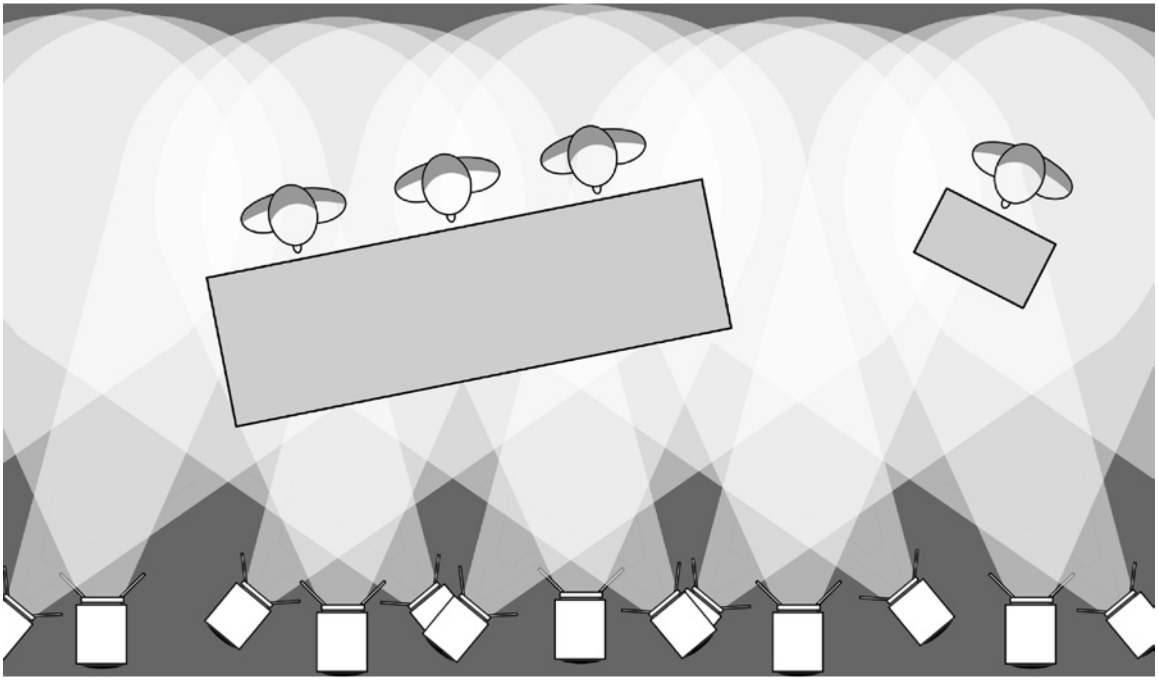
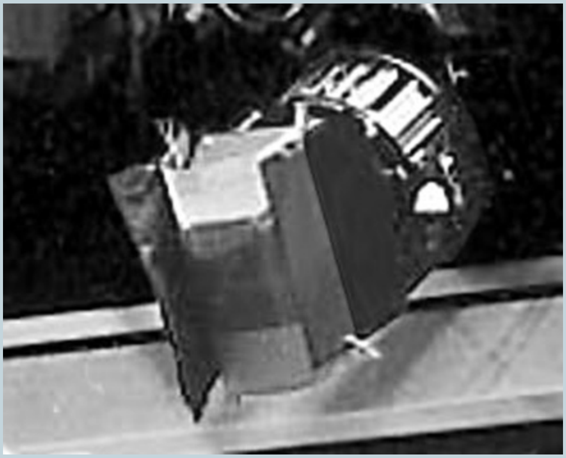


FIGURE 9.10
The frontal key arrangement is replicated across the entire set, resulting in a fairly even distribution of light wherever the contestants walk. Fluorescents are much easier to arrange than incandescents and obtain even coverage.

FIGURE 9.11
Fluorescent lighting doesn't have to be flat. Instead of lighting both sides of the face equally, reducing the intensity on one side produces a better sense of depth.

Don't Move the Mark!

Good lighting design, whether high or low key, is best when it can be *localized* and *specific*. Pick a mark for the show host, for the anchor, or for the weather person, light that



mark carefully, and then *don't move it*! Intensities for different skin colorations can be programmed into the control panel, but it's nearly impossible to light every spot in a studio equally well. Do whatever you must to convince the floor director that she must fight whims to rearrange the set to "make it look a bit different."

Control is essential when lighting a specific spot. The key should be for that mark, and that mark only, not doubling up as general fill. Use barn doors and semipermanent applications of blackwrap to give the needed effect without casting unusual shadows in the wrong places.

In this photo from the Fox News studio, note how the fresnel is controlled by barn doors, one extended with blackwrap. Diffusion material softens the light somewhat and a piece of neutral density gel is used to reduce the light level on the lower portion of the beam. This instrument makes a specific visual contribution to a specific seat in the studio.

Soaps are generally a compromise between flat lighting with a nod toward realism. They are shot on a withering schedule and tight budget. They have to crank out a show a day, allowing no pauses for great lighting or the whims of *artistes*. Also, since they shoot with multiple cameras and many different angles, the light must "work" from every direction. Flat, even lighting becomes a necessary evil. In recent years, some of the soaps have made an effort to use more accent and shadows to make the lighting more realistic, but these must always work in the basic tight parameters of the shooting realities.

Just as with news or game shows, however, it is not really necessary to have completely flat lighting. Simply picking one side of the set for stronger instruments and using lower power instruments on the other side will create some of the modeling that increases the sense of depth and reality. It will also help viewers maintain the unconscious (but very real) sense of placement in the fictional "room." The downside is that a lower key setup like this one makes it harder to pull off "cheat" shots where the shot is artificially reversed for some expedient or another.

Comedies are not known for their artistic lighting either, though they are usually better done than soaps simply because they have more time and budget to do each show. Big bright lighting is usually the fact of life.

It is in weekly dramatic shows that really fine lighting has come to the fore in recent years. Shows like *Law and Order*, *West Wing*, and *ER* have truly raised the bar for weekly episodic lighting. Of course, it's worthy of note that these shows have some of the highest budgets on television today! However, if one compares the lighting on Stephen Bochco's earlier series *Hill Street Blues* (very fine by the standards of the 1980s) with the very realistic lighting of the later episodes of *NYPD Blue* (1993–2005), it will be clear how high the standard has become over the last couple of decades. These shows are lit better than many Hollywood films, partially because of their huge budgets and careful lighting design.

A quick look at the first season of Dick Wolf's *Law and Order* reveals pretty ordinary lighting. Of course, the show was new and the budget wasn't anything like what it grew to in later seasons. The show very quickly established an extremely realistic look, with the majority of light coming from windows during the day and practicals during night shots—in other words, **motivated lighting**. The shows are a graduate course in great television lighting; they're in reruns many times a week and they're free. Watch them, deconstruct the lighting, you'll learn a lot.

A very notable example of fine television lighting was the A&E series *100 Centre Street* directed by the great Sidney Lumet (*12 Angry Men*, *Serpico*, *Dog Day Afternoon*), mentioned at the start of this chapter. The show is an important example for this chapter for several reasons. First, the show was one of the first

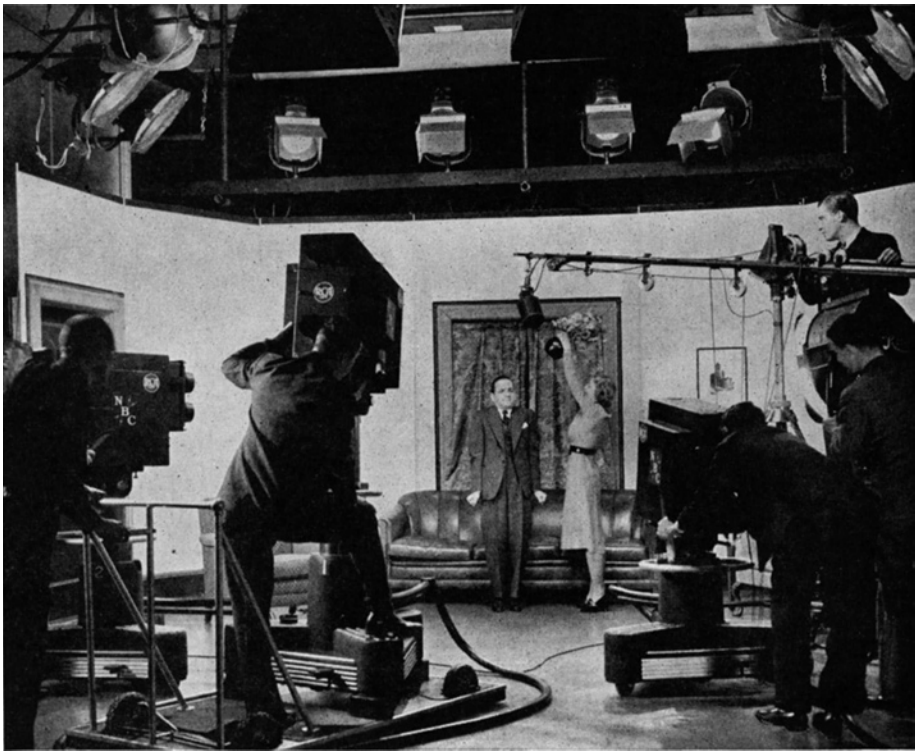


FIGURE 9.12
An early studio television program.

episodic shows to be shot digitally in 24p; second, the show was shot on a set; and third, it was shot with multiple cameras, with a rough cut done through live switching. Lumet resurrected some of the practices from his early days in live television. And guess what? They work! But what's more important here is the fact that the lighting is designed to work with those multiple cameras and with action in all areas of the set. It's a wonderful example of how well this can be done.

Whatever you are doing in a studio, I hope you can be inspired by the best rather than just meeting the minimum!

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CHAPTER 10

Advanced Lighting Setups

Now that we've covered some basic lighting setups, studio lighting, and procedures for fixing common problems, let's move on to more complex and subtle lighting. This is the type of lighting that in the past was used only in Hollywood films and thus has come to be known as "film-style" lighting.

As television and video production has become more sophisticated, and as digital moviemaking has emerged as an art, film production values have filtered down into the video world. The gulf between video and film has closed; some television series shot on video are produced with the same production values as feature films. The standards for episodic television have increased dramatically, with major hit shows like *Law and Order* setting a high standard. Today, many episodic programs are shooting episodes in hi-def 24p with very high production values using sophisticated film-style lighting style that was simply not seen in a series 20 years ago.

Film-style lighting has two major components: creating a realistic simulation of the eye's experience of the world and creating mood. It is here that lighting graduates from mere illumination to an art form that contributes as much to the experience of the viewer as music and the performance of the actors. We'll deal first with the simulation of reality.

In order to light either a set or a real location in a manner that allows the camera to capture the experience of the eye, the lighting director must have spent a lot of time observing natural lighting with an artist's eye. How do shadows fall? How does the spill from a table lamp change the color of the wall? How does the eye perceive the color variations between sunlight and incandescent light—or firelight? You can't replicate these impressions on camera if you don't know what they are. You have to have spent a lot of time in careful observation, mentally cataloging the minutiae of daily detail in the same manner as a painter or any other artist does.

D.O.I.: 10.1016/B978-0-240-81227-4.00014-2

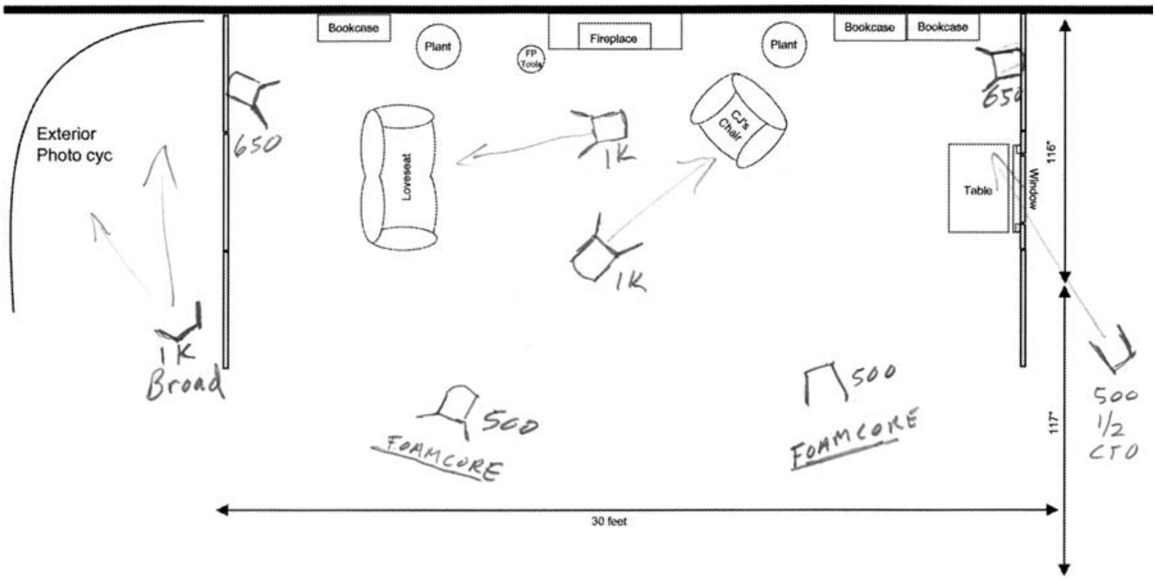

FIGURE 10.1
Establish a lighting diagram. This starts not with placement of instruments, but with a rough plan of the set and a concept of where light will be coming from—the imaginary sources that you will be simulating with real instruments. Even if this plan is very rough, it helps to maintain visual continuity.

DPs often describe their art as "painting with light," and indeed it is. But the simile falls a little short because an oil painting is static, while film and video involve motion. Great portrait lighting is fine, but may not work for a set where many people are moving around. Actors may move from light to shadow, but must remain visible to the audience in some way. In live production we also must deal with the motion of the camera, the motion of the actors, and even the passage of time. In some cases, lights will actually have to move during shots. Lighting for video or film is much more complex than lighting for a still painting or portrait.

As I mentioned in the beginning of the book, some of the methods used to simulate reality in film-style lighting are simply technique: tricks of the trade that are tried and tested. Some are not very realistic at all, but are instead gimmicky tricks that the audience accepts without question. These practical shortcuts are the "visual vernacular" of Hollywood that we've all grown up watching. Any experienced film gaffer can toss these basic effects together without much thought; we'll cover some of them in the later sections of this chapter. Really fine creative lighting will often start with the basic technique, but then find a refinement that brings it visually closer to a sense of reality.

Let's start with an overview of a typical process.

Step 1: Lay out a lighting diagram.

The first step in creating a realistic lighting scenario is to lay out the fictional and real lighting sources on the set (see Figure 10.1). They may or may not be visible in shot, but you must decide where the lights are that you are going to simulate. What's the primary light source? Where does it come from? Is it late afternoon? Do the windows face west? Then you will need golden sunlight streaming in the windows. Are there practicals in the scene? If so, are they supposed to supply significant illumination on a subject, or are they just decoration? If the main character is seated at a desk in a dark room, the desk lamp practical must seem to be providing the illumination, even if the actual light is coming from a 500-watt fresnel off camera. When shooting in the dining room, is the kitchen light on or off? It may be that a slightly cold, harsh light should stream out into the warm, candlelit atmosphere of the dining room whenever the kitchen door is opened.

Where is the main action—and where would the light come from? On a set you have to imagine the light sources. When you're shooting on location, you need to work with the existing light. Use the available light and augment it with reflectors and instruments as needed. But be sure to maintain consistency through the scene; this is very important to preserve visual continuity.

One note here: don't obsess about "motivated" lighting if there isn't an easily apparent light source. Audiences are used to seeing films that have light where the real world would be pitch black. More on that later in our section on night shots and dark rooms!

Step 2: Establish action, close-ups, and mood.

Establish the main action of the scene and frame the initial main shots. What areas of the set need to be well lit and what areas are less important? Where are the key marks that actors will stop? What close-ups will be required? Is the lighting "straight" or is there a particular mood the director wants to capture? What other shots might be needed? There are lots of questions you need to ask before moving lights; otherwise you'll have to move the lights a second time! Start setting up the key lights with actors (or stand-ins) in place so that you can judge the effects on the production monitor.

Step 3: Establish exposure.

Very often you will need to decide on a target exposure and light to that. If you want a shallow depth of field, you will need to run a very low F-stop (see the accompanying sidebar). However, many DPs like to pick a stop nearer the middle of the range because it is there that the lens performs best for image accuracy. Set the exposure on the camera and light to that exposure. Obviously, compromises are often needed here, but it's best to work toward a target rather than being haphazard about it.

Step 4: Begin setting key lights.

Since you have already established the camera shot and the critical areas you're lighting, you can focus on them first. Go back to your mental

Achieving Shallow Depth-of-Field in Video

35 mm film DPs are often frustrated by the available DOF of video cameras. Having a shallow DOF, where the subject is in focus and the background is either soft or definitely out of focus, is often a useful effect. However, it is harder to achieve in video.

The basic physics of DOF relate to the physical size of the image at the focus plane, in other words the size of the film frame or CCD that the lens projects an image on. The larger the area of the target, the easier it is to achieve a shallow DOF. Current video imaging chips are physically much smaller than film frames, so offer less natural ability to create shallow DOF. For example, a ⅔" CDD will typically have an imaging surface that is about 8.8 mm wide × 6.6 mm tall (the ⅔" designation refers to the outer case, not the active imaging area). This is roughly similar to a 16 mm film frame, which is about ⅓ the size of a 35 mm frame. Obviously, ½" CCDs will have less natural ability to create shallow DOF than ⅔" CCDs. With the tiny ¼" CCDs used in consumer DV cameras, it is almost impossible to achieve anything resembling shallow DOF. In fact, those cameras are in sharp focus over such a deep range that many lens filters will not work on them.

DOF is affected by lens aperture; smaller apertures create deeper DOF. Wider apertures offer shallower DOF.

DOF is also affected by the length of the lens; a wide angle lens will have a deeper focus at the same F-stop than a telephoto lens.

Combining these two factors, it is possible to create film-like DOF for particular shots using video. First, shoot with the zoom lens partially zoomed in, at least in the middle of its range. Next, light for a nearly wide-open lens—2.8 or 1.4. Either use less light or put a neutral density (ND) filter on the lens. Together, these will allow most cameras to create the shot you are looking for.

The following fixes will create an acceptable shallow DOF on video cameras:

⅔-inch video (14 mm lens) focused at 1.5 meters (5 feet)
f/2.8: 1.2–2.1 m (3.8–6.9 ft)
f/4: 1.1–2.6 m (3.5–8.4 ft)
f/5.6: 0.9–3.6 m (3.1–11.7 ft)

⅓-inch video (7 mm lens) focused at 1.5 meters (5 feet)
f/2.8: 0.9–3.6 m (3.1–11.8 ft)
f/4: 0.8 m–infinity (2.6 ft–infinity)
f/5.6: 0.7 m–infinity (2.3 ft–infinity)

Since shallow DOF is most commonly used in medium closeups and closeups, this technique will work well. However, it is usually less practical for creating shallow DOF in wider shots.

In recent years, a number of different adapters have been created that allow the use of a 35 mm film (or still) lens on a smaller-target video camera. Some of these are quite awkward to use, some are less so. The best adapter/camera combinations can in fact produce stunning images with precisely the same DOF as 35 mm film.

diagram of the main lighting sources in the "room" and set keys from directions that will simulate those light sources. In other words, if the room is lit from a central chandelier, keys to different areas should radiate out from that central area. On the other hand, if the room is dimly lit by a floor lamp and a table lamp, keys should seem to come from them. If the room is lit by sunlight coming in the window, then keys will need to come from the direction of the window. These instructions seem obvious, but I've seen lots of expensive television where a key came from the opposite side from the dramatic lighting source!

Step 5: Watch for problem shadows.

One problem that constantly plagues television lighting involves handling shadows that will draw the viewer's eye in a distracting way or will seem unnatural. The most common example is the shadow of an actor on a light-colored wall. Other problem shadows might be caused by plants or flowers or other set pieces that will cast oddly shaped shadows. It's best to keep actors as far away from walls as possible unless otherwise required by the script. This will keep shadow problems to a minimum.

Step 6: Create accent lighting

Accent lighting can be anything ranging from "sunlight" streaming through a mullioned window or venetian blind and casting a pattern on the wall and floor to splashes of light on set walls from table lamps. In short, lighting accents are anything that breaks up the flat, featureless feel and adds realistic lighting texture. Some gaffers call these accents "sprinkles." If there's a fire in the fireplace, obviously you need a simulated flickering accent; but it's also not unusual to have unexplained splashes or slashes of light that are there just to break up a monotonous wall.

Step 7: Bring in fill.

Now add fill light. Depending on the look you're going for, this might be a lot, so that shadows are only a couple of stops down from highlights, or they might be a little, where you want a dramatic low key look but want to see details in the shadows. At a bare minimum, there should be some signal above "flatline" 7.5 IRE black in every area of the picture. Don't get trapped in the amateur idea that fill ought to be consistent across a set. In real rooms, the light level varies in different parts of the room. You can leave one section darker or more shadowy and have lower contrast in other sections. Just make sure that the variation bears some logical relation to the imaginary lighting plan. In other words, you don't want dark shadowy areas in areas that ought to be fully lit. But don't feel slavishly bound by duplicating reality either. Just as music and shot direction are for the director, shadows and quality of light are part of the

Focusing the Instrument

Properly focusing a light involves a little more than pointing it in the general direction of the talent. To properly set a focusing instrument (fresnel, Redhead, Arri Light, and so on), set the focus to tight spot and then adjust the instrument to illuminate the talent or stand-in. Then in most cases you will back off the focus to the broad setting, where lighting controls like barn doors or cutters will have a more defined effect. However, by doing this you will make sure that the talent is in the center of the beam rather than off to one side.

FIGURE 10.2
The simulated sunlight through window panes is an example of accent lighting; the angled shadow near the top of the wall was created with a cutter.

gaffer's bag of tricks to establish mood. It's not uncommon to enhance or exaggerate lighting differences to direct the eye: to make dark areas darker than they would be naturally and accentuate dramatic focus with higher lighting levels.

Step 8: Add shadows.

Now you may wish to add shadows with flags and nets or other lighting controls. Shadows are used to direct the eye toward brighter areas of the picture—often the human face. Or more accurately, they are used to *not* draw attention to an area of the picture. They are also used to enhance the realism of the lighting. One common technique is to use angled cutters to throw a shadow on the upper area of flat walls (see Figure 10.2). Not only does this break up large areas of blank featureless wall, but it also simulates the sort of lighting pattern that actually occurs in many real rooms. These shadows also aid the viewer's sense of depth and enhance the illusion of reality.

Step 9: Control hot spots.

Now you need to find those pesky hot spots and knock them down. Because actors aren't static on a set, you may find that lighting that works fine for most of the scene becomes a problem as people move about. As an actor moves toward an instrument, the Inverse Square Law comes into effect, and suddenly the light is too hot. This can be solved by using strategically positioned nets (Figure 10.3) or by backing the light off for the scene where the actor moves.

Setting Flags and Cutters

Flags and cutters are enormously important to lighting control. While their use may seem to be simple, in fact the beginner can make many mistakes in using them—and consequently fail to achieve the desired effect. When using flags, the lighting instrument itself usually needs to be set to **broad** or **wide pattern**. Controls will have only a vague effect on tighter spot patterns. The exact position for setting the flag depends upon how sharply defined (or soft) you want the shadow edge to be. The further the flag or cutter is from the instrument (and thus closer to the set/subject) the sharper the shadow edge will be. The closer the cutter is to the instrument, the softer the edge will be. Typically, in realistic lighting you will want an edge that is not razor-sharp; but certainly there will be instances when a slash of light needs that hard edge. Accomplishing that will require setting the flag or cutter very near to the subject and far from the instrument.

A similar problem exists for any light that is shining across a set. The furniture and floor near the instrument may be too hot; this can be solved with ½ scrims inserted in the holder behind the barn doors.

You may come up with your own variation on this basic procedure, but the general outline covers the bases. Whether you set the fill first or the keys first isn't an essential consideration, as long as the end result works.

ESTABLISHING MOOD

I mentioned a moment ago that lighting is part of the director's bag of tricks. It is no less important than music or the emotion of an actor in conveying mood to the viewer. So actively using light design to convey mood is an important part of the lighting craft.

FIGURE 10.3
A net (left) can be used to reduce light levels as a moving subject gets closer to the instrument. Often two nets are used to provide a gradual reduction in light (right). The fact that the net has one open side means that there is no hard shadow from the frame to call attention to the transition. The slang expression for the act of floating a net in and out in front of an instrument is "to Hollywood the net."

What's the mood the director wants to convey? Joy? In love? Depressed? Ominous? Together, the DP and the lighting designer can create subtle variations that will help convey that mood. The possibilities here are so complex that I can only supply a few examples.

- The young lovers walking in a wood in springtime may need a base key of warm, slightly amber light with lots of diffusion. Spots of dappled sunlight—harder light through a cookie—accent the scene. In the past, the DP might have used a silk stocking on the rear of the lens to soften the scene, but these days a diffusion filter is the choice.
- The murderer is stalking our hero in a warehouse. Where is he? Most of the warehouse is dark, with areas of very dim light. Small pools and slashes of light are here and there, from a door, from a tiny window. There is just enough light for the audience to catch a glimpse of the killer behind the hero. But when the hero whirls around, nothing is visible. The addition of sharp-edged music and carefully chosen shots can build high levels of tension.
- The protagonist is introspective, reflecting on the events of the day. Here a dark set is also effective, lit with a table lamp or a reading lamp—or in a period drama, a candlestick. Perhaps there is a fireplace, with a flicker effect from an orange or amber light to the other side of the key light.
- A woman in turmoil stops in a church to pray, to find reassurance. As she enters the church, she relaxes. Lovely colored light streams in the stained glass windows; a bit of fog in the air makes the colored light almost a physical part of the scene. We see that something has resolved for her; a sunbeam breaks through the rose window and falls on the altar. Gotta have some organ music too.
- The same woman gets up the next morning filled with hope and optimism. Sunlight floods into her bedroom; the room is filled with light. Again a bit of fog or diffusion spray in the air catches the sunbeams and makes them a physical part of the scene. As she looks out the window, she is close to overexposure and there is a glowiness to the scene from a diffusion filter on the lens.
- The hostage is tied to a chair in a dark room. A lamp hangs over him, casting a pool of light. A streetlight outside shines through the single window, casting a distorted shadow of the window frame across the door. The door opens and someone is standing there backlit, completely silhouetted. The hostage catches his breath, expecting the worse. The figure takes a step forward into the room—and into the light from the window, revealing his face. It is the hero: the hostage is safe, everything is great!

These are just a few examples; perhaps they are not the most subtle, but they give the idea. In every case, the lighting is used to manipulate the feeling of the scene. In some cases, light and shadow—and particularly those conveniently placed slashes or pools of light—are used as a staging tool to conceal or reveal as the action transpires. The light is more than just illumination; it is a player in the scene.

Of course, in many cases the light isn't quite as active a player. Most of the time, you just want to get the scene illuminated realistically. The only thing you want to convey is "real room, real light."

LIGHTING DARKNESS: INTERIORS

Now it's time to take a moment to talk about lighting dark scenes, especially since I just postulated a few of them above. The concept of lighting darkness seems to be one of the most difficult for beginners to get their minds around. This topic has to be my top "Frequently Asked Question" in the DV.com Craft of Lighting Forum.

Darkness in video and film is simulated, just as everything else is. The set may actually seem quite brightly lit in person. You can't shoot in darkness because if you did all you'd get is a black picture. If you're going to do that, why bother with sets and location? Just shoot with the lens cap on! The simulation is often referred to as "film dark" or "movie dark." It's really not that hard to do; it just involves letting go of some preconceptions. It's largely a concept of using shadows and dim lighting as positive elements of the scene just as you might use lighting accents and kickers.

Plan the mood; establish the action. What essential parts of the action do you want to be visible? Which parts of the action could pass into shadow? Slashes and pools of light, areas of shadow—these need to work together to make the scene work. You don't usually want large areas of flatline black. There needs to be just enough fill to cause most areas of the room to "read." You may not want the detail to be distinguishable, but you do want the viewer to perceive the sense of the room—just as you would in a dark room after your eyes adjusted to the darkness. Vague shapes and shadows are fine. In areas where the action can pass into shadow, you might want a spot or slash of light on the wall *behind* the action so that the actor will become a distinct silhouette.

Several techniques can be used for lighting the principal action in a dark room. The particular one you pick depends on the look and feel you're trying to create.

The first technique is to create "motivated" areas of illumination at key points in the set.: light coming in through a door, moonlight through a window, a single practical that leaves most of the room in darkness, even unexplained slashes of light. Key points in the action are tied to these illuminated areas. There's a great example in Hitchcock's classic *Rear Window* (Figure 10.4). At the beginning of the famous "flashbulb" scene, the villain (played by Raymond Burr) enters Jimmy Stewart's darkened apartment. Burr appears as a silhouette in the door; then his movement is silhouetted against a slash of light on the wall. He takes a single step forward and pauses. His face is in the slash of light, Stewart can

FIGURE 10.4
In a scene similar to Hitchcock's *Rear Window*, the author pauses, his face clearly illuminated by a slash of light. Please note that the author weighs much less than Raymond Burr.

see for certain that it is Burr! If you think for a moment that move was a happy accident, you don't know much about Hitchcock. Having a principal in a scene move from shadow to light can be very effective, especially when the mood is one of suspense or fear. At one moment the figure is a moving silhouette; then the actor is clearly illuminated for a fleeting moment.

A second method, which works very well when the eyes of features of the principal don't need to be visible, is to use a backlight or kicker. A frequent trick is to use that old blue moonlight as a kicker for the whole scene. Not *too* blue, please! It's often used at low level throughout the room with no effort at realism and is accepted by the audience. To make it a touch more realistic, you'll want to rig the moonlight streaming in the windows, with mullion shadows and areas of darkness. A variation is to have blue moonlight as a kicker from one side and warm light as a kicker from the other side. Maybe it's a streetlight that shines in the window—who knows? The audience really doesn't care; they'll accept the fake without asking any questions.

Combining the "slashes of light" approach above with the "moonlight kicker" approach can be very effective.

A third method, which is probably used far more often than you might realize, is to abandon realism and illuminate the principal in the scene fully, while creating a sense of darkness in the surrounding area. In Chapter 1, I mentioned a scene from the Elvis movie *G.I. Blues*. The central area of the room is lit fully. The rest of the room is lit in that old "moonlight blue" cast through cookies to

FIGURE 10.5
In this bedroom scene the bed is fully illuminated, while the rest of the room is dimly lit with a cucaloris pattern.

break up the light into a dappled pattern (see Figure 10.5). It's not realistic, but it works. It's just part of the Hollywood vernacular; we're all accustomed to it.

In many cases, you will need to create a "dark room" look with an onscreen practical illuminating the main subject. This can range from a reading lamp (as in Figure 10.6) to a candle or lantern in the subject's hand. If the practical is properly exposed, then it will not cast enough light to illuminate the subject

FIGURE 10.6
Here a softbox is used to simulate the light from a reading lamp (left). Depending on the level of light you want to fall on surrounding walls, an egg crate may be necessary to control spill. Right: The technique in action. Although it seems on camera that the table lamp provides illumination for the actor's face, in fact it is coming from a softbox off camera. From the author's film *Windsor Knot*.

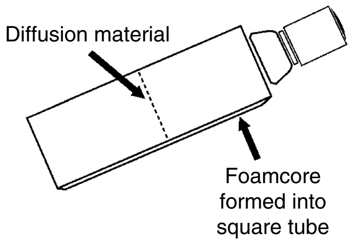

FIGURE 10.7
A square tube snoot formed out of scored foamcore can provide a controllable pool of soft light. Tape a piece of diffusion material partway into the snoot and mount it in front of a fresnel.

well; the subject must be separately lit with a key that simulates light from the practical. This will often be a fresnel placed off camera at the approximate angle of light from the practical. There is lots of "fudge room" here. The usual practice is to cheat the instrument forward, aiming the beam in front of the practical to avoid tell-tale shadows. The instrument is often raised a little above the actual level of the practical as well.

LIGHTING DARKNESS: EXTERIORS

The "unmotivated full lighting" approach is often used in exterior shots as well. Just start watching movies with that "lighting eye" and very soon you'll be amazed at how much hokey lighting and fake tricks you swallowed without question!

Lighting dark exteriors isn't that different from lighting dark interiors; much of the concept is the same. But it will require more light power and different execution because of the larger areas you'll need to fill.

Generally, you will want enough fill light to make everything in the background just visible; then you want to light the main action in a manner that conveys the impression of the situation. Let's take a couple of common examples.

The main characters are walking down the street at night. They pass through pools of light cast by streetlamps and light streams out from the windows of the few businesses that are still open. If you expose to the streetlights (they're large practicals) and then put broads inside a window or two gelled with bastard amber, then all the rest of the scene will be a flatline black. To add detail to the rest of the scene, and allow the characters to be visible while they are between pools of light, you'll need to add a blue source to simulate moonlight over the entire scene. Usually, this will be done with an HMI; with the camera white balanced to quartz, the HMI will run blue on tape. You'll probably need to enhance the pools of light from the streetlamps with fresnels, too!

A similar scene might be a car with headlights on, driving slowly on a deserted road; the headlights sweep across the scene as the car rounds a bend, revealing a person walking by the side of the road. Just as in the previous scene, if you don't light the scene, all the viewer will see is the cones of the headlights. You won't see the car itself or have any perception of the surroundings. Again, an HMI can seem like moonlight, casting just enough illumination to bring out a vague perception of the surroundings, making the car visible. You may be surprised how much illumination is needed to do this! If the car headlights point toward the camera at any time, you may have even more of a problem providing enough light for the scene to "read." Often it is helpful—particularly in street scenes—to position the HMI pointing toward the camera. Just as with backlights and kickers, the light "skips" off the pavement and into the camera. A lower powered instrument can light an amazing area this way.


FIGURE 10.8
What the camera sees vs. what your eyes see: this exterior scene (left) uses low-level illumination of the background, with the subject lit almost at full levels. Where is the light coming from? Who cares? In person, the scene seems to be very brightly lit (right), but the end result on camera is quite effective.

Another very common method of "maximizing" light for a night shoot is the use of smoke or mist. A very light fog will render the HMI "moonlight" as a blue haze, bumping up the general light level while maintaining the sense of night time. A heavier fog or smoke will give the light an almost physical presence in the frame and can be very effective. Several methods can be used to create smoke (aside from a fire!) or fog; the main ones in use today are glycol-based foggers like the Rosco fogger and oil "cracker" smoke. For more limited effects,


FIGURE 10.9
What the camera sees vs. what your eyes see: walking through the haunted woods! Mist from a glycol fogger is used to catch the light from the offscreen HMI and give "body" to the scene (left). A softbox from the opposite side provides just enough fill to allow the shadowed side of the subject's face to "read." In person (right), the scene looks very different from the final camera image.

a canned mist spray is available that will just put a hint of "body" into the air to catch the light.

Here's a classic example of a simple night scene: Romeo is delivering his famous lines to Juliet in the balcony. A tightly focused fresnel gelled amber or slightly orange (¼ CTO) illuminates his face looking up to the balcony. A broad is used from the rear with a ½ CTB gel to simulate moonlight on the castle wall and on Romeo's back (Figure 10.10). As a refinement, you might use two blue-gelled lights; use the first as fill and then shoot the second through a cucaloris to create the dappled effect of moonlight coming through leaves.

As you may have noticed, when rolling tape or film, the "moon" will always be out. Period. Blue light is simply one of those things from the Hollywood vernacular that we accept as "night." It has often been the practice to use very blue light (full CTB gel) to do this; but as more realistic lighting has prevailed, many lighting directors have tended toward a more subtle effect. When balancing to a quartz source, a ¼ CTB or ½ CTB is plenty.

One very effective fake for moonlight is a daylight source inside a large China ball hoisted on a crane. Many directors now use a source inside a white helium balloon, which is tethered to float 40 feet or so in the air. The effect is quite convincing. Several companies, such as Airstar Space Lighting, make balloons just for this purpose.

I frequently get e-mail from young producers who are doing extremely low-budget films—you know, the type where they shoot every Saturday and the

FIGURE 10.10 The author hams it up as Romeo Schwarzkopf in that famed production "Basic Lighting for DV." Note how every part of the scene is exposed; there are few areas of solid black. The only thing not visible is his friend Cyrano de Burgerbun off camera feeding him his lines.

New filmmakers aren't the only ones that have a tough time grasping the concept of "lighting" darkness. **Ron Garcia, ASC** has a great story about a shoot in a dark forest:

> During the filming of ***Twin Peaks: Fire Walk with Me***, we had to shoot a night scene between Laura and Bobby while they were waiting to do a dope deal in the woods. David Lynch did not want to use any movie lights at all! He wanted the kids to use a flashlight (just one). I explained about photographic darkness, but this was David Lynch, King of Blackness in Sprit and Photography—he was adamant about the scene not looking as though it was lit. He asked, if I used motion picture lights, where the light would come from naturally in the middle of the forest? I said the light would come from the same place the music comes from—he didn't laugh!
>
> Ultimately I talked him into using a small hand-held Xenon light and instructed the actor (Bobby) to always try to light himself and the other actor while they were talking. Then I told David I'd kill myself if I couldn't at least bounce a 1.2 K HMI par into the overhead pine trees (he thought the bead board was to bright). He finally agreed and we shot the scene.
>
> — Ron Garcia, ASC

pay is pizza if everyone is lucky! The scenes they want to create are similar to some of those covered above, but the "bottom line" of their question is always "we don't have a budget, how can I do this with Home Depot work lights and a flashlight?" Good lighting doesn't have to cost big bucks; it's more in the concept and artistry than the instruments. That said, here are a few real suggestions for "cheap" lighting exterior dark scenes, right from the DV.com Lighting Forum:

BL writes: Can anyone give me any suggestions for lighting ideas for a NO budget project. We are shooting half interior and half exterior at night. We have no budget at all. … Are there any good guerrilla tactics to use for lighting? Any help would be appreciated.

Jackman responds: Lighting doesn't actually have to cost much. The best work comes from the imagination and observation, not expensive instruments. The two main rules are to make sure that the image is properly exposed—not overlimit and with enough light that the camera doesn't have to go into "gain up." This last is especially true if you are using a Sony VX1000.

Beg or borrow a couple of worklights or those clamp-on reflectors. Eat one less pizza and buy some photoflood bulbs at the photo store. Get some aluminum foil to control the spread of the light.

Night shoots are a favorite topic of mine and a trick that lots of folks seem to have trouble grasping. You have to *light* the night shoot! Please go watch a few movies with night scenes and deconstruct how they are lit—usually from the side or toward the rear, creating a few fully lit areas and lots of dark shadowy areas. Moonlight seems blue, so the convention is to use blue gels on the lights. If you're too poor to buy gels, then point the camera at a pastel yellow card (rather than white) and do a manual white balance; this will shift the camera image toward blue.

E.L. writes: I will be shooting a short film soon and it involves four persons, in a car on a deserted road, in the middle of the night. I will (probably) be shooting on a mini-DV camera (and for sure) in black & white.

1. What is the best way to light the interior of the car? (a small, not so big, European car).
2. Can I get enough light off of the main headlights of the car? I'm not in the position to transfer heavy lighting equipment to the "set"—this is because they will be wandering around the car and close to it, terrified of what might be hiding in the dark.

Good suggestions from other forum members included the following:

- Try using day-for-night (see later in this chapter!)
- Use Kino Flo T5 bulbs to illuminate the car interior
- Use a flashlight bounced off a small white card to illuminate the car interior
- Use a Lowel Omni light with 250-w 12 VDC bulb.

Jackman responds: Okay, these are good ideas—but here's the rub most folks don't foresee: "*....in a car on a deserted road, in the middle of the night*."

Is your intent to have absolute inky blackness around the car? That's what you'll get. The audience won't really perceive "deserted road" at all, the shot could be done in a driveway. In order to expose to headlights and also allow the camera to "read" the surroundings at all, you need some low-level general fill. Usually, this would be done by bouncing an HMI off a reflector, but that doesn't sound like an option.

Try this: use a second car off camera and bounce the headlights off a white bedsheet stretched out and held at 45° to front of car. Just enough fill to barely see detail, to understand the setting. You DON'T typically want inky black, even in scenes that are supposed to be in pitch dark.

And this: tape ½ CTO gels (color to orange) over the on-camera car headlights and white balance to those. This will reduce the light output somewhat and also force the camera to see the bounced fill from the other car shifted to blue. The colors won't matter if you're ending up in black and white.

As to the car interior, yes the Kino T2 or T5 is great, but on a low budget I'd opt for a cheap-o 12-v map light or trouble light from the auto store. Just gaffer tape it to the instrument cluster, shining up into driver's face.

NOW—have a THIRD car there with jumper cables so you can jump the other two and get home!!!!!!

DF writes: So, I'm getting ready for my first project. VERY short film. Part of it will be in the desert at night, so we'll need to light it. The problem being.... where do we plug the lights in? Keep in mind, this is VERY low budget here.

I've been doing some homework. The first idea that came to mind was we could try an adapter for a car lighter! I found some adapters. But they seem to be $70 or more. For not too much more, I ran across this "portable power" battery that will run 250 watts. But I'm not sure how long the lighting will last on that thing.

Not to mention I'm still looking into how many and what kind of lights I'll need (feel free to suggest anything for that… I'm filming in MiniDV, BTW).

Am I missing any other/better option for power? Thanks for any feedback!

Jackman responds: If you're really tight on $$, why don't you try rigging up some 12 V lights and running them right off the car battery? Buy a hi-beam bulb for a four-light older car and mount it on as high a stand as you can, best at least 12' or higher—run wires right to a battery. Or use one of those "million candlepower" spots you can get pretty cheap at Pep Boys.

Do a manual white balance pointing cam at a PASTEL YELLOW card (maybe yellow legal pad) to make the WB skew blue. Make it look like moonlight.

You could then use the "portable power" battery to jump-start the car so you can get home!

DO NOT under any circumstances shoot with the camera exposure on AUTO or I will come to your house and personally revoke your independent filmmakers license!

These are just a few examples, but maybe they'll stir the low-budget creative thinking!

DAYTIME EXTERIOR CONTRAST MANAGEMENT

Taping outdoors involves a number of challenges. You can't control either the weather or the motion of the big main key light 93 million miles away! Clear sunny days are too contrasty and heavily overcast days don't provide enough contrast. For news, documentary, or incidental shots, these are fairly easily solved. For dramatic work where specific weather is called for and you need lighting consistency for long periods of time, the difficulties are more complex.

Bright sunny days present contrast issues, the nicer the weather, the more of a problem. The sun will act as a hard light source with no diffusion, casting harsh and ugly shadows on faces. The effect will be worse toward midday due to the inherent ugliness of direct overhead lighting. It's actually a lot easier to capture nice video on slightly overcast days, when the sunlight is already diffused; the contrast range is naturally compressed and often you end up with slightly more vivid colors, especially greens. The problem is that you may not want to shoot with an obviously overcast or cloudy sky as a backdrop. If the glorious blue sky is what you want behind your subject, you'll have to do some work to get the best end result.

There are several solutions to this problem, which often need to be used together. Anytime the problem is too much light in all the wrong places, the solution of

FIGURE 10.11
A butterfly diffuses the direct sunlight and knocks it down ½ stop; a silver reflector acts as a kicker, while a white bounce card provides fill.

choice is bounce cards and reflectors. On a bright day, these can function as active lighting elements just as well as standard instruments—but they have the advantage of requiring no power! Mirror and silver reflectors can act as keys from different angles and can bounce intense light into areas the sun isn't reaching. Gold reflectors can simulate "golden hour" at 10, 2, and 4—and hold the simulation for longer than the 30 to 40 minutes of perfect shooting time the actual golden hour provides. Beadboard and white cards can act as kickers, backlights, and fill. Bear in mind that many early films were lit entirely with reflectors.

Although reflectors can rearrange the light, they cannot change the basic hard quality of direct sunlight. For this reason, a light diffusion fabric will often be used over the subject in addition to reflectors. This can range from a 30" × 36" scrim (just enough to diffuse light on a face) to a 6' × 6' or 12' × 12' butterfly (Figure 10.11).

Exactly the opposite problem crops up on a very heavily overcast day. Gray light seems to come from everywhere (in fact, it almost does) and the lighting is "stale, flat, and unprofitable!" Some intervention is required to punch up the contrast to create some modeling on the subject's face. The two methods of doing this are to add light to one side or take it away from the other.

The first approach is fairly obvious. A silver reflector may be used as a key to bounce additional light from one side of the subject. Live instruments may be used—usually an HMI—to provide key, using the ambient light as fill.

The second approach, taking light away, may not be so obvious to the newcomer. It's a technique that is actually known as "negative light" or "negative fill" (Figure 10.12). Despite the science fiction sound of the term, it's actually fairly simple. A large flat black object—a flag or gobo or butterfly—is placed on one side of the subject just out of camera range. The black flag seems to magically "suck" light away from one side of the face, deepening the shadows—hence the mysterious-sounding name.

In reality, negative light isn't all that magical. On a heavily overcast day, light really does come from everywhere—the cloud cover acts as a single huge light source. What the black flag does is block the light from one direction, thereby casting a shadow, while also absorbing (not reflecting) light coming from the other direction.

Dealing with outdoor lighting for drama can be quite a bit more complex. Taping a single scene may take all day, but the component shots will need to intercut with a cohesive look. The light can't shift from obvious morning to noon, back to morning, then late afternoon! Both careful planning and lighting control are required.

Planning is essential for efficient outdoor shoots. Sunrise and sunset data, careful orientation of shot planning (you *did* take a compass when scouting, didn't

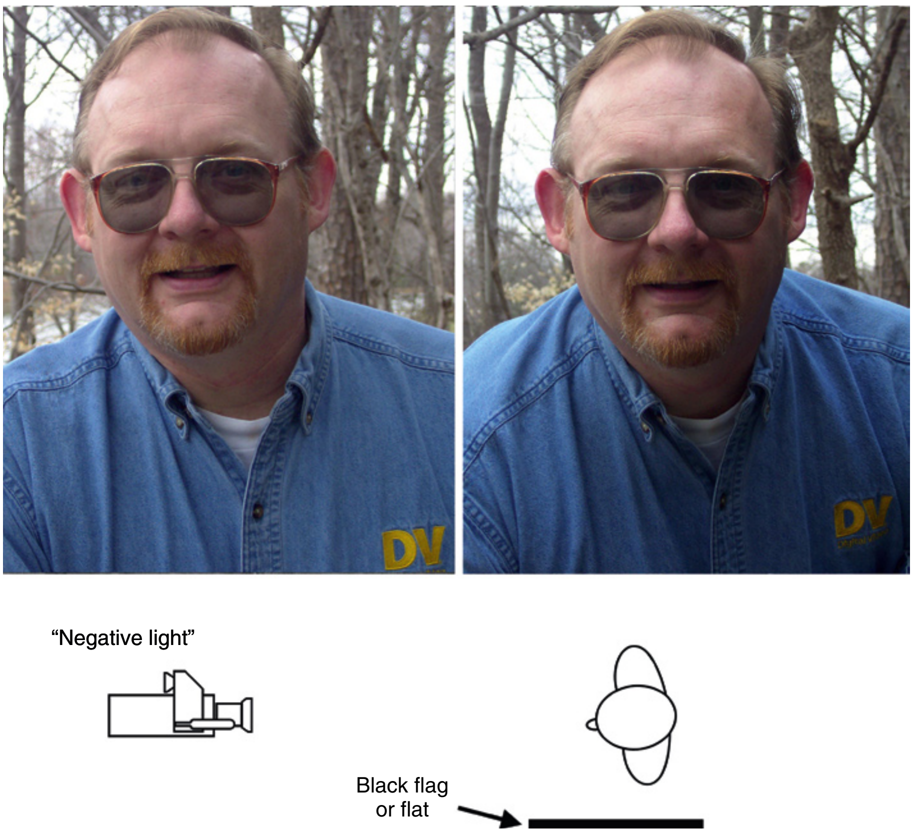

FIGURE 10.12
A large black flag placed just out of frame can increase contrast on a bleary day. The technique is known as "negative light" or "negative fill."

FIGURE 10.13
A drizzly day on the set of *Providence*, which ran on NBC from 1999 to 2002 A 12' × 18' butterfly provides negative fill to punch up the contrast a bit. Courtesy Red Herring Motion Picture Lighting.

you?), must be combined with up-to-date weather reports. Since it is easier and cheaper to control lighting for close-ups, wide shots are the ones that must be planned for optimal lighting conditions. This is especially true if the weather will be changing during the day.

Sometimes the best planning just doesn't do it, however, or the weather doesn't cooperate with your schedule. That's when brute force must be used, when 36,000-watt FAY arrays or 12,000-watt HMI fresnels substitute for the sun. But the brute force method is expensive. If your budget doesn't reach to include a full lighting truck, then you'll have to make your schedule fit the weather, rather than the other way around!

LIGHT SURGERY

I've mentioned several times now the uses of shadows as a technique to direct the attention of the viewer away from the shadowed area and toward the strongly lit area. Light intensity is very powerful in doing this. Shadows, or reduction in light intensity, combined with diffusion can also seem to reshape problem spots, or at least avoid drawing attention to them! Classic problem areas in close-ups include protruding ears, double chins, wattley necks, puffy cheeks, acne scars, and of course the facial wrinkles that the ladies are so sensitive about. Let's look at a couple of examples.

A tight "head-on" close-up of a subject with protruding ears or fat cheeks can look very different from longer shots. The cheeks and ears catch the key light

FIGURE 10.14 The author has always been blessed with large ears—the better to hear you with, my dear! These can be a problem in tight close-ups. The use of two single (or double) fingers can reduce the light only to the problem areas, preventing the viewer's eye from being drawn to them.

and seem more obtrusive than in longer shots, and the viewer's eye is drawn to them. If the head-on shot is necessary, then we can perform "light surgery." Two single fingers mounted in a "V" formation can be used to drop the light level hitting the problem areas, preventing the eye from being drawn to them. The ears are still big, the cheeks still fat, but they are no longer accentuated. They're no longer problems. It's also possible to use neutral density gels, cut to shape and taped to a wire to do this. Similar techniques can be used to direct attention away from wattley necks or double chins.

Wrinkles and acne scars are more difficult to deal with, but can become a critical issue. If shooting techniques mask these subtle flaws for most shots, it can be jarring to the viewer to suddenly have a close-up that reveals age or scars. Here a combination of techniques is necessary. First, avoid any hard kicker light that will accentuate the flaws. An ounce of prevention is worth a pound of cure! Second, use heavily diffused key; a soft box is best. Find the most flattering angle for the key; a little experimentation will show that some angles are much better than others.

Legendary DP John Alton would use a 60-watt household bulb mounted on a threaded "wand" to find the best angle for a key in tight close-ups. With all other lights out, he would move the wand-mounted bulb around and in front of the subject's face, noting the effects. It allowed him to experiment with a variety of angles quickly and efficiently before moving heavy instruments. After finding the most flattering angle for the soft key, soft fill may help eliminate any remaining problem areas.

A small amount of soft fill from below may work miracles. It's my understanding that this technique is used for the aging Dan Rather, whose news anchor desk incorporates tiny T2 Kino Flo bulbs that shine up into his face, filling in the wrinkles. If you watch carefully, you'll notice that he *slides* his script pages—picking them up to turn them over would cast a shadow on his face, exposing the gaff!

Some work on the camera side may still be necessary. The classic solution is stocking on the rear of the lens. Many DPs have found a special relationship with a specific brand of stocking for this purpose—and they can be most particular about it! Diffusion filters on the front of the lens can also minimize remaining imperfections. Popular choices include Tiffen's Soft/FX, Pro-Mist and Black Pro-Mist, or Schneider's Classic Soft and Black Frost filters.

Today's cameras also provide electronic fixes for skin flaws. Most professional cameras provide separate control for skin detail; this allows a softening of detail in areas of the picture that match a user-selectable skin tone. Since this control does not reduce edge sharpness, it doesn't make the picture seem blurry, but just smooths over those wrinkles and other blemishes. The combination reduced skin tone with soft light and a mild diffusion filter can have an amazing impact on blemishes in a close-up.

CHAPTER 11

Lighting Low-Budget Locations

If you're reading this book, the chances are you're not working on a high-budget film at a major studio. Odds are much higher that you're dreaming of doing a low-budget film or even a "no-budget" film. So here we're going to tackle the concepts you need for lighting at the low-end of the budget curve, usually in existing locations rather than sets or soundstages.

In this chapter, I'll be building on the concepts spelled out in the last chapter, so I hope you read that chapter well. No? Then go back now and do your homework before reading this chapter. No dessert for you until you've finished your vegetables.

Low-budget filmmaking almost always utilizes existing locations—real houses, offices, and so on. It's usually lots cheaper to find a workable location than to build a set. But these locations often come with a downside. They're sometimes cramped, they may not have enough power available, and often the time schedule is limited. The budget itself presents limitations. You may not have anywhere near the number or types of lights you would need in an ideal situation. The budget cramps the schedule as well; you can't always take the time to light a scene with the care and detail that might be taken in the best of possible worlds. So low-budget filmmaking always ends up being a compromise between numerous factors. Those who are successful at low-budget filmmaking are the people who are good at making these compromises in a way that "works" on screen.

Herein lies a dilemma: so many variables are involved in location, mood, finances, and skill levels that it's pretty near impossible for me to put together a set of lighting diagrams that you can copy to use for your film. Instead, we need to cover the concepts in a way that will allow you to create a lighting compromise that helps to sell the scene to the viewer.

But first, let's think about the locations you'll use before we talk about lighting them.

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MAKE LOCATION LEMONADE

When life hands you lemons, make lemonade, the saying goes. Nowhere is this more true than in low-budget filmmaking. Don't get too locked into a single option. If your Uncle Fred is going to Europe and says you can use his house for your film, but it's nothing like the house you had envisioned in the script, don't be a moron! Change the script! A free location is worth a lot. So what if you get into the location and you find the lighting you had in mind simply doesn't work? Change the lighting. Don't ever get so locked into a single approach or concept that you can't be flexible.

The fact of the matter is that you always have more options than you think. In watching numerous films, both low-budget and high-budget, over the last several years, I've noticed that editors and directors have a strong preference for close-ups, far more so than in earlier films. Close-ups are great for low-budget work; they can be shot practically anywhere. You don't have to show the entire living room; you just have to show enough of it so that the audience knows where the character is.

Analyze what is actually going to be seen in the shot. If it's not necessary to the shot, and it costs money, why bother? My favorite story about this is the 1982 production of *Annie*, directed by John Huston. There's a scene where Daddy Warbucks has a circus at his mansion. Huston had a real circus on the set for the shoot. But the shots that ended up in the movie hardly show any of the circus at all and could have been faked cheaply without having all those animals and trapeze artists on call for weeks.

You're not John Huston, and you're not Daddy Warbucks either, so chop the expensive stuff *in the planning stage* rather than in the editing room. Do you really need a wide shot of a fabulous ballroom filled with a hundred costumed extras? Cut the scene—or fake it. A church fellowship hall can be made to look pretty decent; fake up a great-looking refreshment table, stick a borrowed landscape painting on the wall with candle sconces on either side, and fake the ballroom with sound effects or conversation and dancing. Narrow the shot: the two principals getting a refill from the punch bowl while one or two couples waltz by in front of the camera to "sell" the idea that there are 50 more couples cutting the rug on the dance floor. Bingo, you have your scene but you've brought the cost down from Daddy Warbucks to starving student level. You've eliminated the rent on the fabulous ballroom, you've eliminated the need for 96 extras, 96 costumes, and—here's where it gets relevant—you've cut the lighting requirements from a full lighting truck down to a few fresnels and a soft bank. You get the idea. Tightwad planning and imagination are sometimes worth a lot more than a big budget.

Oh, and before I proceed to lighting exclusively, let me mention again the budgetary miracles of sound effects. Sound effects can create big-budget feel and convincing fakes that visuals can't. As much of a visual guy as I am, I have learned through long experience that it is often the sound effect that will "sell" a fake to the audience.

FIGURE 11.1
In this shot, from the ultra-low budget short *Windsor Knot*, the key light is actually a window. The addition of 3200-K fill light from the room side rounds out a very natural feeling.

LOW-BUDGET LIGHTING PRINCIPLES

Okay, now that you've found free or cheap locations and a good sound effects person, you're getting ready to shoot. How do you light the freebie locations you've been able to scrounge? What do you really need for lighting? Let's go over Jackman's Seven Steps to Low-Budget Lighting Success:

1. **Less is more.** Many scenes in films are significantly overlit, which requires lots of high-power instruments, and then in turn requires even more lighting for accent and highlights. Establish a low-level base fill for the room and then concentrate on lighting the actors, or the main area of action in the scene. Most living rooms are not garishly lit with thousands of watts of light; rather, they are lit by a few table lamps.
2. **Less is enough.** Cameras today are far more light-sensitive and so don't need the high levels of light that were once necessary. Instead of 1 Ks and 2 Ks, today you can use 500 watts and 1 Ks, or even less.
3. **Less is effective.** Keep it simple; a simple lighting plan can be quite effective and (surprise) uses far fewer instruments. Every light you add to a scene will increase the likelihood you will need another light to either even out the effect or counteract it.
4. **Make walls interesting.** Don't put a lot of light onto walls, but put effort into lighting accents that make the walls interesting: table lamps that cast a fan of light on the wall, light through Venetian blinds at an angle, light through a cookie to cast a pattern. If the wall is fairly well lit, use a cutter (this can be just black foamcore or cardboard) to cast an angled shadow in the upper corners.

5. **Don't be afraid of shadows.** One reason I think many scenes are overlit is that some DPs are afraid of shadows. Well, shoot, Margaret, the real world is just packed with shadows that make the light more interesting. Don't be afraid to let your actors walk through shadows. Just don't have them deliver important lines there.
6. **Make use of natural light.** In a borrowed living room, there will be windows and real light coming in through them (Figure 11.1). If you add some fill and rearrange it a little, it looks really natural … because it is! Why not build your lighting plan using the window for backlight or even key in some shots?
7. **Balance is everything.** Remember, it's not so much the amount of light as the balance between light sources that is important for video.

One final tip that may help in setting overall light levels for a location: you want a level of illumination that will allow you to expose toward the middle of the iris, say *f*/4 or *f*/5.6. Even *f*/2.8 is fine, but if you're exposing at *f*/8 or *f*/11, you have too much light. The two exceptions to this general rule are times when you are compensating for light coming in a window (as in the example below) or situations where you need to create a shallow depth of field (see the first sidebar in Chapter 10, "Achieving Shallow Depth of Field in Video").

LOW-BUDGET LIGHTING PROCESS

Keeping these principles in mind, let's walk through the process of lighting an imaginary living room. Okay, it's a real living/dining room combination I've been in but have not used as a set, so I'm beginning from scratch just like you are. It's a fairly traditional living room with a picture window, a fireplace, and a dining room area in the L-shaped room. We want to use the living room for both day and night scenes, and the dining room for a night scene. I'll assume that we have a minimal lighting kit, three fresnels (two 650 W and one 300 W), a couple of open-faced lights (a 1 K and a 500 W), gels, and reflectors. There are no HMIs or fluorescent banks.

First, for the day scene we need to have two people talking—one on the sofa under the window and one in the nearby armchair. The first decision that must be made is what to do with the picture window. Are we going to leave it open? What does the exterior look like? If it looks good enough to include, let's leave the window open. But shooting the person on the sofa now becomes a contrast problem. So let's go out and pick up some cheap sheers—thin gauzy curtains. You may have to spend $20 to $30 on these; or you can just buy a few yards of white organza at the fabric store and tack it over the window. This has three important effects: (1) it diffuses the sunlight and creates fill for the room; (2) it knocks down the intensity of the direct sunlight by about half a stop; and (3) it makes the exterior less distinct so that attention is more focused on the actor sitting on the sofa.

Now, if we set up the shot of the actor on the sofa and expose so that the window is bright but not blown out (you can still see details outdoors), we'll find that the actor is way too dark, almost a silhouette. The gauzy sheer curtains have helped, but we still have a contrast issue. However, the great big softbank we've created does wrap some fill light around him pretty well, so we need to add a key light and he'll look great. But the lights we have are quartz 3200 K, not sunlight temperature. And we haven't got an HMI! So we'll take a 650-watt fresnel and put a ½ CTB gel on it. Why not a full CTB? Because we want the interior light to seem a bit orange—just not too orange. He'll still look a bit dark in front of the window, but we're going to make this a bit "arty." Now, we'll set the camera white balance to 5600 K daylight and put a gentle diffusion filter—perhaps a Tiffen Pro Mist or a Schneider White Frost filter—on the camera. This will give a bit of glow to the backlight and reduce the contrast of the picture. It will seem to add light to the darker areas of the actor's face.

Now, for the actor in the armchair, we'll add key and backlight. The window is supplying all the fill we need and is lighting up the walls as much as we need (Figure 11.2). Again, we'll use a 650-watt fresnel with a ½ CTB gel as key. The

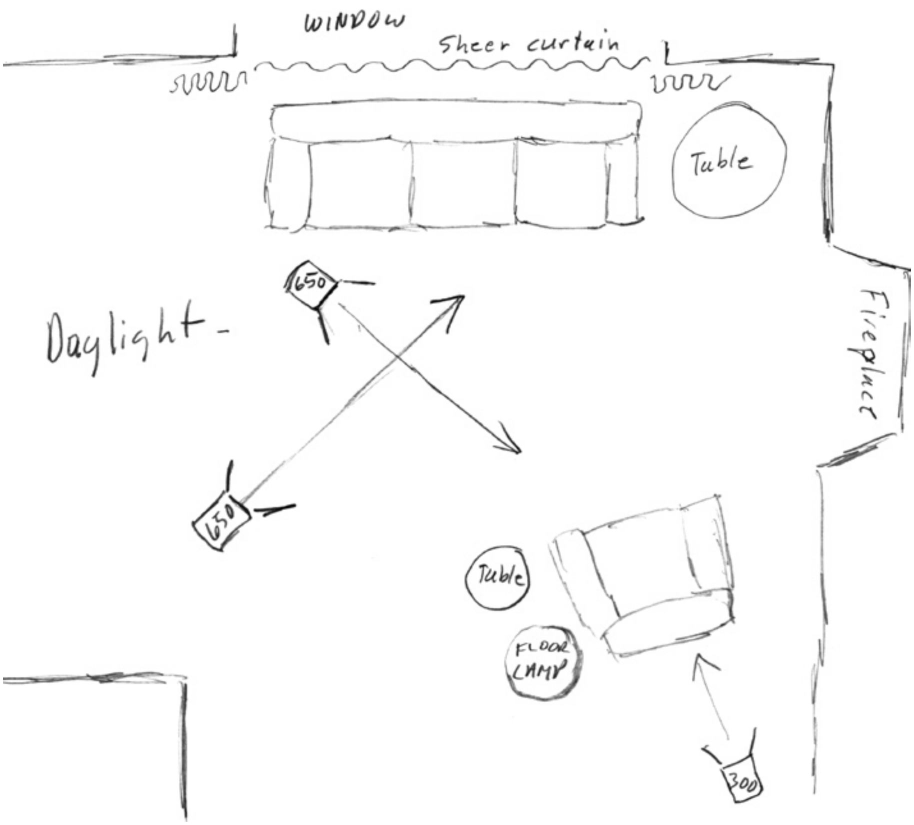

FIGURE 11.2
In my quick sketch diagram of the living room, three lights are all that are needed to light this scene because we've utilized diffused light from the picture window as fill.

barn doors will be used to cut the light at an angle across the fireplace and bookshelf, providing a little variation of lighting on the walls. The backlight will be a 300-watt fresnel with a piece of diffusion but no gel, so that the backlight will be distinctly orange.

Now, we're set up for a wide shot and for close-ups of the actor in the chair. The only extra bit we have to add for close-ups of the actor on the sofa is some way to add an eye light. We can do this in two ways: a small on-camera light or a reflector held off to the side of the camera. Either will work fine. By the way, the actor in the chair doesn't need help this way—the window will take care of eye glints.

Bingo, $30 worth of curtains and three lights, and you're set. Are there other ways to light this room? Sure, there's a bunch of them. Why not come up with a couple of different ways on paper just to get some practice?

Now we need the night scene (see Figure 11.3): reading a book with the floor lamp while there's a fire in the fireplace. First, we'll take the Pro Mist filter off the

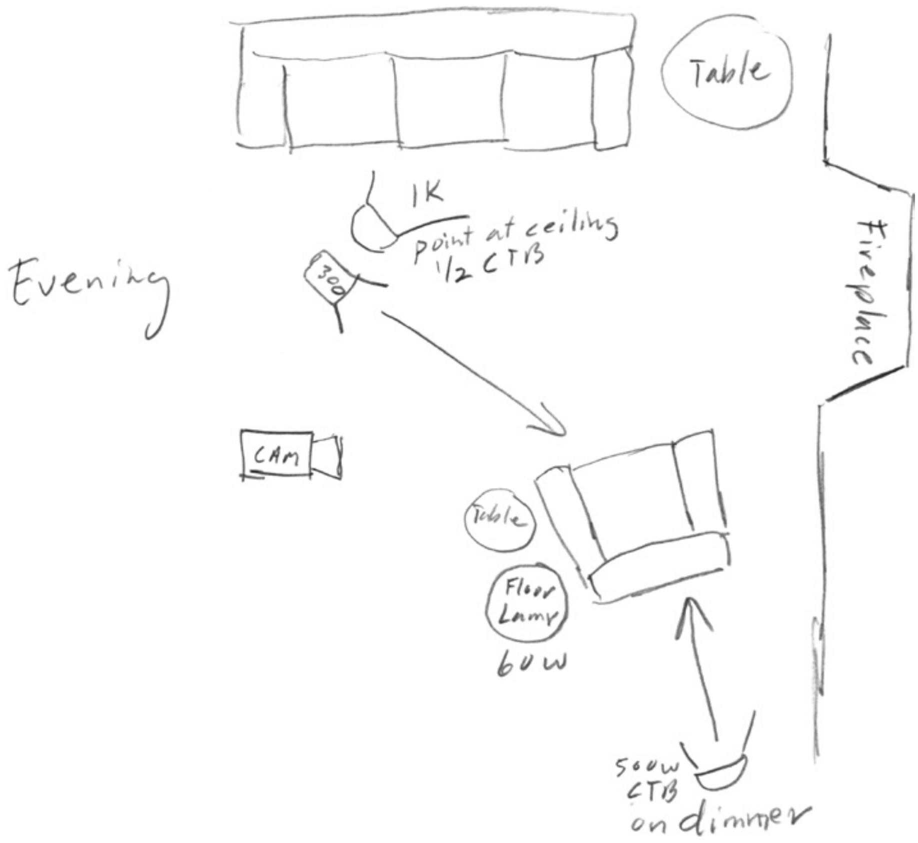

FIGURE 11.3
For our night scene, the 300-W fresnel supplies key light that appears to come from the floor lamp.

camera and set it to 3200 K white balance. Now, we'll use the 300-watt fresnel to simulate light from the floor lamp. The beam passes in front of the floor lamp so as not to cast any shadow that would give the cheat away. Experiment a bit with the settings: run it partially toward spot setting to create a nice round pool of light that appears to be coming from the floor lamp. Put a reasonably low-wattage bulb in the floor lamp, perhaps 60 watts. Now take a 1-K open-faced light and put a ½ CTB gel on it and point it at the ceiling near the sofa. This will provide gentle blue fill for the room, capitalizing on a long-standing tradition for representing moonlight. This by itself might do, but I suspect that a little backlight will be necessary to put detail into the actor's hair. I don't want too much to be obviously fake, so gel the 500-W open-faced light with a full CTB gel and put it on a dimmer. Now while watching in the monitor, bring the backlight up until it just gives some glint and detail to that actor's hair, but doesn't call attention to itself. Light a fire in the fireplace and you're done.

Now, let's move to the family scene around the dinner table. I picked this especially as a challenge, since these 360° scenes are notoriously hard to light and direct—and there isn't much room! Typically, we want the family around the table to be lit from the center—as if from a chandelier. In a studio with a lighting grid, this is achieved with crossed keys suspended from the grid, but here you must contend with light stands that may show up in the shot.

There are two ways I can think of to do this. One is to place a fresnel on a stand in one corner of the room and set up camera shots to avoid that corner. The other fresnel would be set at the opposite corner, partway into the living room. Each fresnel would be set to illuminate the faces on the opposite side of the table (Figure 11.4). To keep the light from overexposing the backs of heads, a half-double scrim must be used. If you don't have a half-double scrim, a neutral density gel clipped over the lower half of the light would work as well. A third light bounced off the ceiling can provide fill for the room walls.

However, this is not the method I would choose for my low-budget dinner party. A better "spit-and-gaffer tape" solution for this limited-space situation is to rig a light in the center of the table. Run down to the local photo supply store and get a clamp-on light reflector—the type that looks like a salad bowl—and a 500-watt photoflood bulb. Using gaffer tape, mount blackwrap (or black posterboard) around the lip of the reflector bowl to create a 4"–5" deep skirt. Now hang your photoflood about 4 feet above the center of the table, using copious amounts of gaffer tape on the ceiling. This will illuminate the faces from the center of the table. The blackwrap skirt will keep the light from hitting the camera lens directly and creating flares. Watch out for reflected hot spots on the table top.

Now that we've provided a central key light, we need fill for the faces and for the rest of the room. Take the open-faced lights and position them out in the living room, aimed up at the ceiling in the dining room—one on either side of the table. Set them on spot or use barn doors to keep the light from hitting

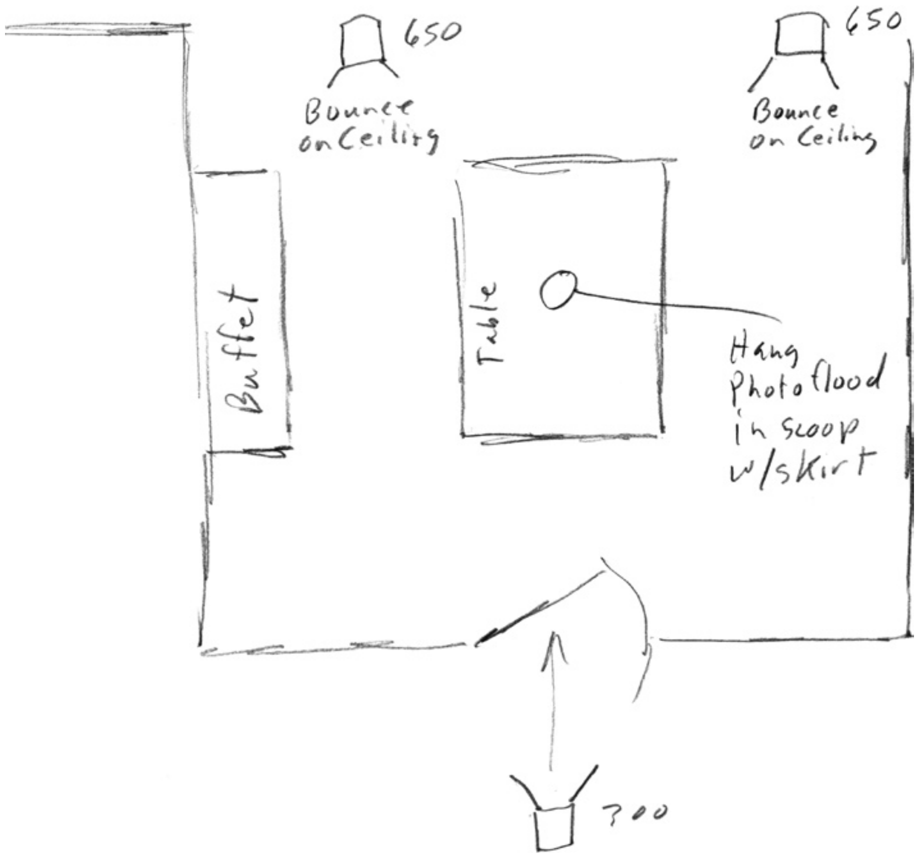

FIGURE 11.4
A hooded photoflood above the center of the table illuminates the family's faces while lights bounced off the ceiling provide fill.

the walls directly: you want bounced light, not direct light from these. I'd really like some interesting light accents on the walls, so find a table lamp for the sideboard. For one final touch of motivated lighting, place a 650-watt fresnel out in the kitchen shining directly through the door. Now, when Momma brings in the dessert, a patch of light will shine on the family as she opens the kitchen door.

This setup places the light stands at one end of the area, actually in the living room. This frees up all other angles so that we can shoot any direction except a wide shot back into the living room. However, we can still get several angles on the person seated at that end of the table without showing the light stands.

Now, in fact, there are lots of other ways to light those rooms with a few lights. But I hope that walking through the process step by step helps you understand how to do it yourself. Now let's take a look at a few real situations and how they were lit.

The first situation was a hastily shot reenactment scene for a documentary. It was lit with only two 650-watt fresnels. One is used as a key light with a piece of Tough Frost diffusion clipped on the barn doors to soften the light. The barn doors are set to cut the light from the walls. The other fresnel was set on wide beam and bounced off the ceiling to provide a low level of fill for the entire room (see Figure 11.5). This is one case where I didn't bother with a backlight; the white caps on the lady and the girl made it unnecessary. If they hadn't been wearing those caps and also had dark hair, a backlight would have been essential to pick out some definition in their hair and prevent them from getting lost in the background.

The second scene we'll look at is a scene from an historical drama, *An Uncommon Union*. Shot on location in a historic 1710 house in Connecticut, we were using actual museum artifacts as props and furniture (Figure 11.6). I do a lot of this type of historical work using authentic locations. You have to take enormous care with everything: plastic pads on the feet of the tripod, layout board to protect floors, extreme caution moving light stands. Some artifacts must be moved only by a museum staff person wearing white cotton gloves. You don't want to drop a plate or scratch the 300-year-old floorboards in a setting like this. The bill will be thousands of dollars and a severe dent in your reputation in museum circles.

In this scene the main character, Sarah Edwards, has just learned that her granddaughter has died and is weeping with her daughter. The scene is set in the kitchen of the house. We set the shot to include the window with its old colonial-style diamond-paned glass. This meant that the exposure had to be set to accommodate the window, and then the lighting in the room set to match that exposure. The scene had to be shot at *f*/8 to expose the window correctly. A Tiffen ProMist filter was used to give highlights a glow and reduce contrast. Since the scene is a flashback, a slight vignette effect was added in post.

A single 300-W fresnel with ¼ CTO gel was used as key. The light was set to illuminate the two subjects but not to hit the white walls at all. A 500-W open-faced light with ½ CTB gel was shot through a cookie to create angled slashes of light on the wall. This gives the impression of sunbeams coming in through the window. Since the effect was too intense, we mounted the 500-W on a dimmer to "dial in" just the amount we wanted. A 19-W daylight compact fluorescent mounted in a clamp-on reflector provides some blue modeling from the opposite side of the key. That's it, nothing else!

Figure 11.7 shows a "behind-the-scenes" view as we set up another shot in the same room. Here Sarah is talking to her husband, Jonathan Edwards, by the fireplace. The 300-W fresnel with ¼ CTO is bounced off the ceiling as fill. A small worklight with a full CTO gel is placed in the fireplace on the floor.

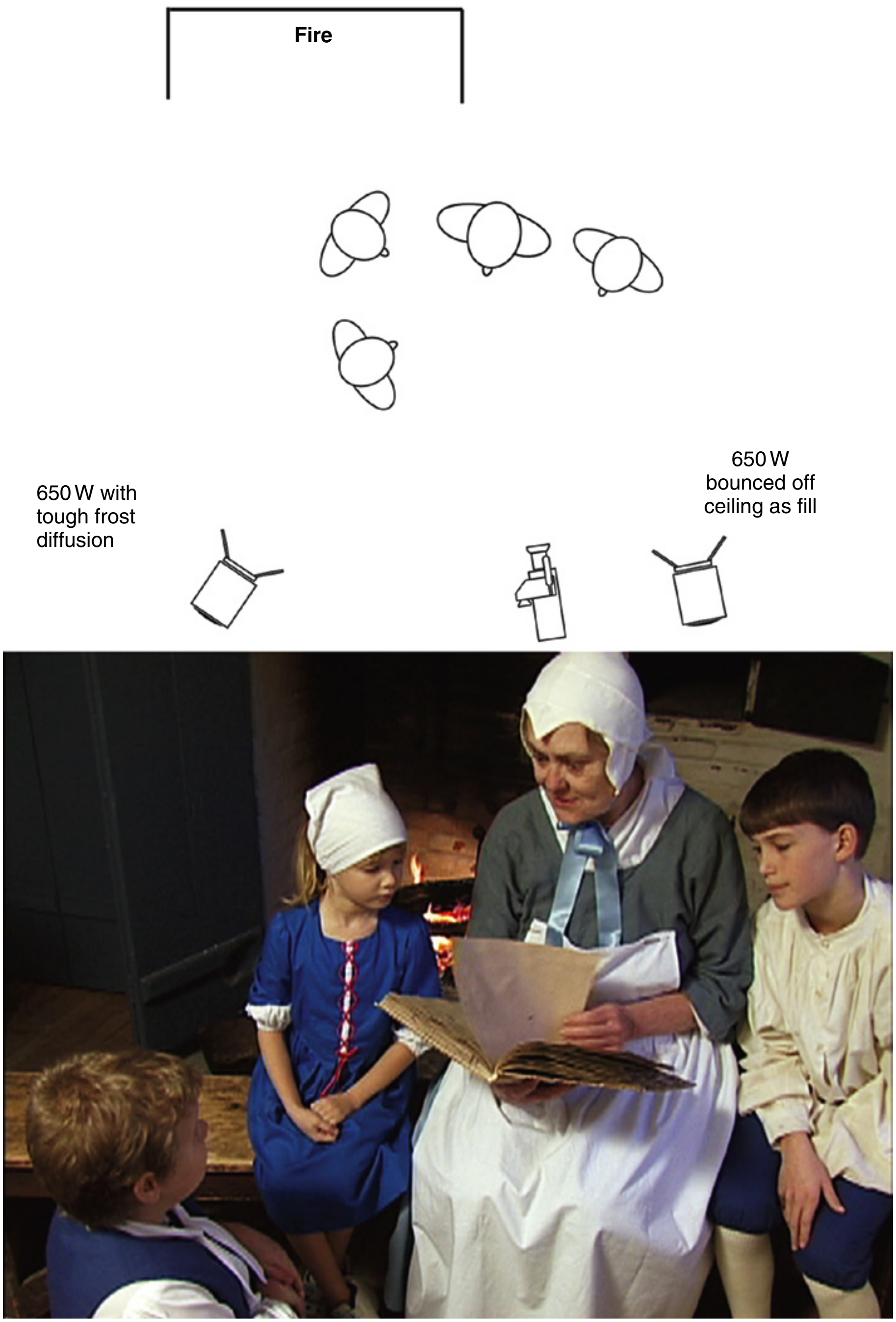

FIGURE 11.5
Reading to the children at the historic Burnside Plantation in Bethlehem, Pennsylvania. This scene was lit with two fresnels, one of which was bounced off the ceiling to supply fill.

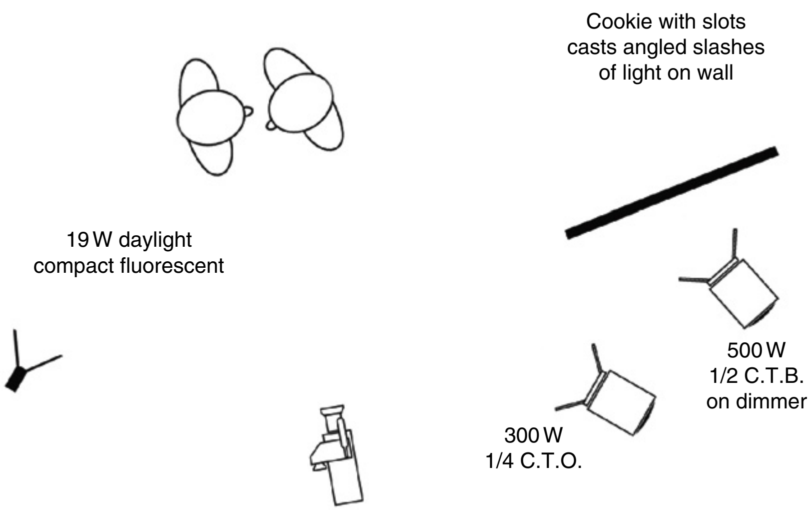

FIGURE 11.6
We are shooting very, very carefully in the 1710 Buttolph-Williams House museum in Wethersfield, Connecticut, for the film *An Uncommon Union*. Three low-power lights are used to light this scene. Still courtesy of Christian History Institute.

It is controlled from a dimmer to create an irregular flicker. This simulates the flickering firelight on their faces. We had a production assistant hold a piece of black foamcore in front of the light to create an angled shadow on the back of the settle they are sitting on. Quick and dirty, yes, but we had the scene in the can in a matter of minutes and were on to the next setup!

FIGURE 11.7
In the same historic house, we set up a shoot of the actors talking by the fireplace. A small worklight on the floor run from a dimmer provides the flickering "firelight" in their faces. Photo courtesy of Mark Pleppis.

USING EXISTING LIGHT AND IMPROVISED CHEAP LIGHTING

Several of these setups work because we have made heavy use of existing light and have improvised a couple of light sources for the situation. These approaches are very important for low-budget filmmaking. Sunlight coming through a window is free. It may need some control and rearranging, but at a minimum it can supply fill light or backlight for your subjects. Scout the location at different times of day to see what the natural light is like in the morning, afternoon, and before sunset. Depending on the type of look you want, you may need to shoot only at a particular time of day.

Rather than fighting strong sunlight with incandescents, use reflectors or mirrors to rearrange the sunlight. A room that has several windows with direct sunlight streaming in can be used if the light from one of the off-camera windows is reflected to the ceiling with a large mirror. This bounced sunlight adds fill to the room. A bit of diffusion mist in the air and a mild diffusion filter on the lens will make the effect atmospheric.

One of the greatest innovations for quick close-ups is the use of a Chinese lantern mounted on a fishpole (see Figure 4.19). Although it may have been in use

FIGURE 11.8
A full-spectrum, daylight temperature compact fluorescent tube can be used in a small reflector to provide blue fill light or backlight.

elsewhere, I've heard that the technique came into major play on *NYPD Blue*. It's a technique that offers a lot to the low-budget filmmaker. The Chinese ball may be anything from the traditional paper ball with a photoflood hanging in it (watch out, it's a bit of a fire hazard!) to the Gyoury fluorescent version. With the ball mounted on a mic fishpole or painter's stick, a production assistant or best boy can run in and hang the soft light just out of shot for a close-up, punching up the light on the face and placing those all-important glints in the eyes. Quick, dirty, cheap—and effective.

There are lots of options for cheap improvised lighting out there for the low-budget filmmaker, too—many more than in the past. In many of the setups described in this chapter, I've bounced a light off a ceiling (sometimes it's off a white wall) to provide diffused fill. Cheap worklights work well for this, though they are hard to control for some other uses. You can pick up a fluorescent worklight with electronic ballast for under $30 and mount full-spectrum daylight tubes in it; these work quite well, though they are not durable and are hard to mount. But it may be just the trick for your low-budget film.

In recent years, we've seen a lot of compact fluorescent tubes with a built-in ballast that screw into a regular light socket. Most of these are of the "warm white" variety that have a pretty huge green spike in the color content, and so weren't the best for video. However, lately many manufacturers have been making these available in full-spectrum daylight temperature. These are great for video; I used one of them in the scene shown in Figure 11.6. These can be used in a scoop reflector to provide fill light for a subject lit by sunlight from a window. The 19-watt tubes that I've used put out about the same amount of light as a 75-watt incandescent bulb, but it is that pure blue of sunlight (Figure 11.8). Since a full CTB gel eats up nearly three-fourths of the light from an incandescent bulb, think of it as a 300-watt quartz instrument with a full CTB gel—except it generates very little heat! And they're cheap to boot.

Now, you may never use any of these ideas exactly as they are outlined here. But my hope is that this chapter helped get you into the "spit and gaffer tape" mode that allows folks on a tight budget to still do creative quality lighting!

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CHAPTER 12
Specialized Lighting

Now we'll take a look at a few specialized situations. While the general principals of lighting don't change, there are certain setups that call for very specific techniques. One area that you'll probably run into frequently is that of product and food shots.

PRODUCT SHOTS

Product shots call for special care and handling for several reasons. First, the client wants you to make their (sometimes unsightly and hard-to-photograph) product look dramatic, attractive, and exciting. Unlike the still photographer, you may need to have the product or the camera in motion, or both! You may have a black product with lights on it that is a contrast challenge. Or you may have a product that looks like white blob from many angles, without distinguishing features to help the viewer understand what it is. Whatever the product is, it's your job to figure out a way to light it and make it attractive.

Let's take a case study—a home VCR or DVD player. This is basically a black box with black buttons that have black letters. The only distinguishing features are bright red LED indicators and green digital display. Right away we have a dual problem. We need the LED display to "read" on camera at the same time as giving some shape and texture to this featureless dull black box.

The first lesson here—one that is very important for many product shots—is that dark objects are given shape and texture by what they reflect. This is true even for objects with a very flat texture. Remember, black absorbs all light frequencies, so simply dumping lots of light on the black object doesn't work. You have to give it something to reflect.

This is even more true of shiny surfaces of almost any color. And there are a lot of products out there with shiny surfaces! In many ways, no matter what the object, color, or texture, product photography often boils down to creating and managing reflections.

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So we want to give the black box something to reflect, preferably several things to reflect. Each surface of the VCR must be treated separately. But before working the actual setup, we have to establish an exposure range—remember the LED display?

Those LEDs are an on-screen practical and represent a fixed light value. So we must first set the camera aperture to expose those LEDs correctly—and then light to that exposure. Establish the actual shot and decide on any motion. Does the VCR rotate slightly? Does the camera move in relation to the VCR?

We'll move the camera in this setup, using a boom arm to start at a low dramatic angle, looking up at the control panel and LED display, then pulling out and up until we can see the whole VCR from slightly above.

A large softbank can be used on the side opposite the camera to illuminate the front panel. This gives a large white light source for the semigloss black plastic to reflect and creates highlights and shadows on the lettering and buttons. Again, the intensity of the softbank must be varied to stay in line with the exposure already set to capture the LEDs. But you don't want to vary the intensity of the softbank by using distance; you want the softbank as close to the VCR as the shot will allow. You may have to change out the bulb for a different wattage, use a dimmer (remember to white balance to the dimmed color temperature!), or use black silk or organza on the front of the softbank. But when the balance is right, the highlights will glisten and the LEDs will just pop!

Now, that takes care of the opening shot, but now we need to look at the end of the shot, where the entire unit is visible. We need some white cards for the

FIGURE 12.1
White cards and a colored backlight create shape and texture on this featureless black VCR.

black sides of the unit to reflect. Position a white foam core off the side of the unit; it will catch enough light from the softbank to do the trick. But now we need to make the black expanse of top interesting.

Let's position a white foamcore off on the other side and light it with slash from a small instrument to create a sort of splash of reflection on the flat top. Then we'll add a touch of color in a red-gelled backlight that is positioned to create a color splash highlight on the rear corner of the VCR. Here the slight rough texture of the painted metal top catches the colored light and diffuses it. Voila, shape and texture where once we had a featureless black box!

Let's jump to the other extreme and shoot a featureless white box—a computer and monitor. Many of the same lessons apply. The monitor next to the bland putty-colored box is a fixed light source. First, we have to expose that properly (you *have* used camera controls to get rid of the rolling bar on the CRT monitor, right?) and then set the other lights to that exposure. Now we need to create reflections and highlights on the computer case, and create shadows. We need to pick a side of the box to be shadowed and with most shots there isn't much choice—it will be the side near the camera. Position the key light, preferably a large softbank or fluorescent instrument, on the side away from the camera and experiment with the height. Don't make it high enough to make the top of the box hot; we'll handle that separately later. Make the angle oblique enough to create shadows on the front panel. Fill light from the opposite side probably can be of very low intensity, or even just a bounce card. Remember, we're dealing with white objects here! They'll catch light in ways you didn't intend.

FIGURE 12.2
A putty-colored box. Managing the light and reflections on each side separately allows us to create some visual dimension to the featureless box.

Now let's create something slightly interesting on the top panel. Just like with the black VCR, a colored kicker will help shape the box. Let's use a ¼ CTB gel and focus the kicker on the rear camera side corner (Figure 12.2). The resulting bounced light from the kicker is again diffused by the texture of the case; but concentrates on the corner, leaving the front offside corner a darker value.

A final refinement might be a little splash or slash of light on the shadowed side toward the camera.

Let's move to the other end of the spectrum, a clear glass object. The object we'll play with as an example is an Isis Award, a prize awarded for exceptional marketing events (Figure 12.3). One of my company's clients had received an Isis and needed good shots of the award, which is a hand-blown glass sculpture.

Shining direct light on a glass object just doesn't do much. Just like the black VCR above, we have to create and control reflections that allow the eye to interpret the shape of the object. The simplest way to do this is to provide two large white surfaces off either side of the camera to reflect. In this case, we'll use a softbank to camera right, providing the main illumination to the scene and also providing a large white surface to reflect. On the opposite side, we'll mount a large white foamcore that catches the light from the softbox. This creates contour on the other side of the sculpture. Finally, experiment with a hard backlight shined through the award. This will catch on the engraving and ad a sparkle here and there, though it will do little to light the overall object. The backlight can sometimes be very effective with a touch of color—a shade of blue or magenta, for instance.

When shooting an object like this glass award, try using a star filter on the camera lens; a cliché, but highly effective. Adding a diffusion filter will also cause the reflected highlights to glow just a bit. Finally, motion will allow the

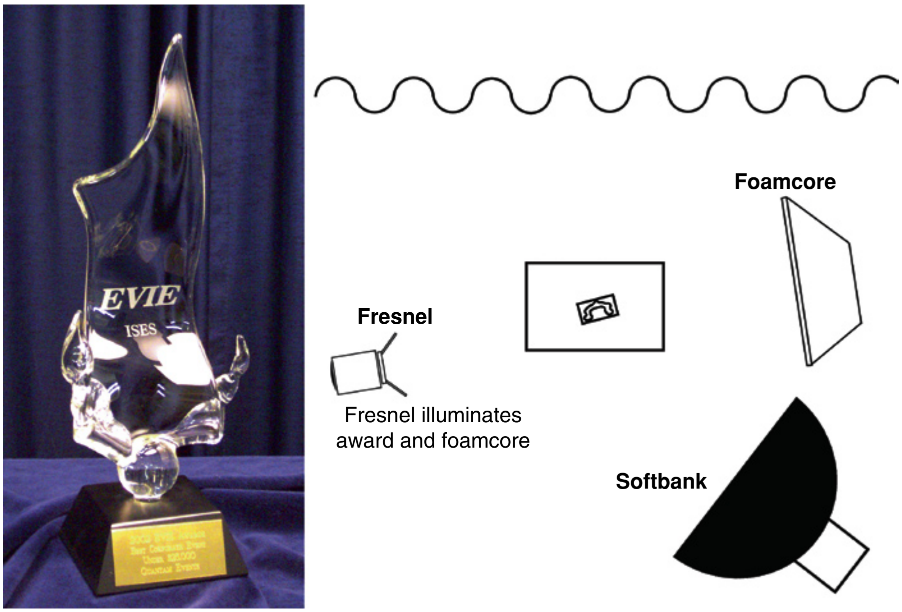

FIGURE 12.3
Lighting clear glass is mainly a matter of creating reflections that will reveal the shape of the object. With a curved or irregular object like this Isis Award, rotation is very effective.

audience to perceive the object in different ways. The best motion for this object isn't the camera, but rotation of the object under the lights so that different angles catch the lights in different ways, causing dynamically moving reflections. A turntable makes this simple.

These basic tricks will work for most types of products. You may want to use huge softbanks for larger objects or large silks. For chrome objects, you may want to fake up a bit of real world for the object to reflect, just as 3D animators do with reflection maps. Try using a large travel poster positioned at just the right angle to reflect in the chrome surface. Abstracts can be nice, too. For shiny objects, rotation or other motion that changes the relationship between the lights, the object, and the camera gives the eye interpretive information—and looks cool!

FOOD SHOTS

Taking pictures of food and making it look appetizing is just as much an art as making a featureless black box look interesting. The general techniques are not too different from those outlined earlier for product photography, but there is the added challenge of the time factor. In some cases, you will need to set up the lighting and the shot, and then shoot with fresh hot (or cold) food during the limited period while it still looks appetizing. In other cases, you'll need to resort to the many fakeries (mashed potatoes for ice cream and so on) that allow you to work longer. In any case, you'll need the services of a food stylist or you'll need to learn some of their tricks (see sidebar).

Some folks feel that fakery is the best route; it certainly helps with the time factor. Others feel it a point of honor to use the real thing. In fact, the client may insist upon it. When shooting the real thing, you will need to be ready to work with great efficiency. Set the shot and lighting with "stand-ins" and then plan on substituting a freshly cooked plate just before rolling tape.

Tricks of the Food Stylists

Here's a few of the basics that food stylists use:

- Nonstick cooking spray is used to make food appear moist.
- Acrylic "ice cubes" don't melt and refract light better than the real thing.
- Table salt in beer or soda will precipitate a dandy fizz.
- Nearly all food, especially vegetables and meat, must be undercooked.
- Grill lines are artificially created with a hot skewer.
- Random items such as sesame seeds on a bun must often be "doctored" by gluing extras in spots that seem bare.
- Substitute items often look better than the real thing. Real coffee just looks black but a dilution of Gravy Master® can look dandy.

A faked plume of steam is essential above hot foods or cups of coffee. This is usually accomplished with a smoker under the table and a tube immediately behind the "hot" item. If the object is large enough, a small incense burner right behind it can do the trick.

In many cases, what the food stylist does boils down to carefully selecting the perfect bun, the perfect lettuce leaf, and arranging the food with an eye for detail.

The late veteran DP Bob Collins once did a shoot for a famous pancake house and had to photograph every item on the menu. He created a jig that would hold each plate in the identical position. A chef created a kitchen right there in the studio and a production line was set up. The chef would flip the griddlecakes, which would be passed to the food stylist for quick arrangements and decoration. Then the hot plate was placed in the jig to be photographed while the chef was flipping the next set of flapjacks and warming up the waffle iron.

So how do you light food? Just as with most products, you have to give the surface of the food something to reflect. If there is a "stock setup" for food that will work in nearly all situations, it would be to start with a large softbox above and to the rear (Figure 12.4). A huge number of the food shots I have seen lately are done with this setup. The diffusion on the softbox gives the food something to reflect and creates lovely transparent highlights on tomatoes, apples, and so on. The effect on nonshiny foods such as bread is also appealing.

Soup and other liquids require careful placement of lights. You need to create enough of a highlight on the surface to make it look shiny, but not so much as to obscure the color of the basic liquid.

Clear liquids in clear containers—beer in a glass or soda in a bottle—can be a special challenge at times. If the beverage has an interesting color, such as beer, you can fire a light through the liquid in order to cast a colored shadow on the tablecloth, edge of plate, or another piece of food. However, shooting against a dark background can be quite difficult. Try cutting a piece of paper to the shape of the bottle or glass and mount it on the rear; this will allow light from the

FIGURE 12.4
A basic starting point for most food lighting situations is a large softbox mounted above and behind the food.

FIGURE 12.5
To capture the color of tea in a cup, the light has to come from above, hit the bottom of the china teacup, and bounce back up through the liquid. From the short film *Windsor Knot*.

front to reflect back to the camera. If the fake is too obvious, try the same thing with translucent diffusion material.

And remember: you'll have an easier time exposing and lighting the food the way you want if the tablecloth and plates are not pure snow white. Off-white or light gray will give you that extra latitude in exposure you're looking for!

LIGHTNING AND FIRE

Two lighting effects that are often needed in dramatic work are those of lightning and the flickering glow of fire. Both can be simulated in several ways, some of which are more convincing than others.

Lightning is easy to simulate poorly but a bit more difficult to do right. The "plain vanilla" method is to simply flash a blue light; but this doesn't quite work because of the slow risetime and falltime of standard incandescent globes. This means that when the instrument is powered up, there is a visible (if short) ramping up of the light from zero intensity to full intensity and a similar—usually slower—ramp back down. Real lightning, on the other hand, has a very sharp risetime, may pulse a bit, and then undergo a very rapid falloff. While the audience may accept the flashed instrument as lightning, it's only by grace and goodwill, because it really looks fake. There's some part of the mind that will register "that was a stage light" instead of staying fully immersed in the illusion of reality.

So what are the characteristics of real lightning? First, it is blue in color, often more blue than sunlight. Second, it has a very sharp risetime and a rapid decay. It may be a sharp single flash or a pulsing multiple bolt. Often several bolts will occur at *almost* the same time at different places. Then there is so-called heat lighting, which can be simply over the horizon or bolts between clouds, and is a bit more atmospheric and lower in intensity.

Film productions often use a variation on the old-fashioned arc lamp with a special controller that will strike the arc but then not sustain it. The best of these units is made by Lightning Strikes! (Figure 12.6). Their units are available in 70-KW and 250-KW models with advanced pulsing controllers. David Pringle and Yan Zhong-Fang won a technical Oscar in 1995 for the invention of these units. However, they are quite expensive and probably beyond the range of many video and television budgets.

Veteran DP Arledge Armenaki suggests a low-budget version of the arc lamp—the local welder! He's had good results paying a welder to bring his electric arc welder out on the set and simply striking an arc or two on cue. The welder is usually thrilled to "be in a movie" and will do it for far less than a high-end rental would be. Just be sure to warn cast and crew not to look directly at the intensely bright arc; there's a reason the welder wears that mask or goggles!

FIGURE 12.6
The Oscar award winning 70,000 watt Lightning Strikes! unit. Photo courtesy of Lighting Strikes!

It used to be that the most effective "cheap" lightning effects were photo flashbulbs. The Sylvania Press 25b and 40b bulbs worked really well. It may surprise you to find that stocks of these are still available from suppliers that service old camera enthusiasts. The best known of these is Crest Camera in Wayne, New Jersey. Flash cubes (remember them??) and M2B bulbs are still available from large photo suppliers such as Porter's Camera.

But it may surprise you even more to know that flashbulbs are still being manufactured! A company in Ireland, Meggaflash, continues to make specialty high-powered flashbulbs. One of their markets is the theatrical special effects. The best Meggaflash for lightning is the PF300, which has a slow peak (for a flashbulb) and sustains long enough to produce an effective "lightning strike." For video, you may need to use a ¼ or ½ CTB gel on these. They have a color temperature of around 3800 K. They mount in normal medium-base screw sockets and can be triggered with anything from a 9-volt battery to 125-volt household current. If you like the look of flashbulbs, I'd go with the new units rather than eating up increasingly rare collector bulbs at ever-higher prices.

A more convenient solution that springs immediately to mind is the photographic strobe light. These can work, but many models simply don't provide a long enough flash to be effective in video. Most cheap photo strobes have a very short duration, on the order of 1/1000th second, or a single millisecond. By contrast, the Meggaflash PF300 flashbulb mentioned a moment ago has a peak at 30 milliseconds, with an effective duration of almost 60 millseconds—or 1/60th of a second, long enough to expose a full frame of NTSC video. Even the lowly flashcubes sustained for nearly 30 ms. But a cheap photoflash may discharge so quickly that the effect only appears in a small portion of a single video field. The flash might appear in the upper half of the picture only, or as a band in the middle. A strange look indeed!

Of course, there are strobes that are designed specifically to offer longer duration times. Some are designed for photographic uses, such as the DLI Varioflash, which has a duration of up to 10 ms. Others are designed for the theatrical and music/DJ market. Several of these offer DMX control and thus work well with DMX-based lighting controllers. The Botex DMX strobe controller from NCW offers user control of flash duration; other integrated units such as the Diversitronics 5000-DMX do not have variable duration, but have a 5.5-ms duration and high flash rate. These units can be set to the highest flash rate and fired in rapid brief bursts.

One aspect of lightning that is usually missed is the effect of multiple strikes. Often there will be more than one flash, originating from different points at slightly different times. This can be effectively simulated with two flashes at different locations, triggered in quick succession. For example, if flashbulbs are used, have one set up behind the actors and the other off to camera right, each triggered by different people. If the second person is to trigger the flash effect instantly upon seeing the first flash, the delay will be just enough to give that "real feel" to the effect. When combined with a really fine, properly paced sound effect and an appropriate startle response from the actors, this effect can look quite convincing.

Fire is a completely different effect. Any time you show an actor near a fire, whether outdoors or in front of an interior fireplace, it is necessary to create a random flickering glow. There are a number of ways to simulate the flicker of fire, most of which work to one degree or another. The simplest method is to use an amber or orange-gelled instrument on a manual dimmer and have someone with an artistic touch creating a random dimming pattern (Figure 12.7).

A second simple setup is to use the same orange-gelled instrument, combined with a darker orange or red instrument. Both are placed at floor level, a little apart, shining up into the face of the actor. Typically, the key light will be from the opposite side, so that the "fire effect" lamps are illuminating the shadowed side of the face. Now, a cookie is waved in a random pattern in front of the lighter-gelled instrument, creating the random flickering effect.

Of course, there are mechanical wheels that will rotate in front of the instrument to do the same thing; but since these create a constantly repeated pattern, the fake will call attention to itself in longer scenes. The human element of control allows some randomness, and this will help "sell" the effect.

Of course, in this age of electronics, there are black boxes for everything, and fire flicker is one of them. Magic Gadgets makes several different flicker generators for film and television use. The simplest, their "Flicker 2D," creates a random pattern with several different intensities (Figure 12.8). In other words, the light doesn't just flicker on and off in a random pattern, but does so with random level changes. The upper and lower limit to the level range can be independently set, as can the flicker rate.

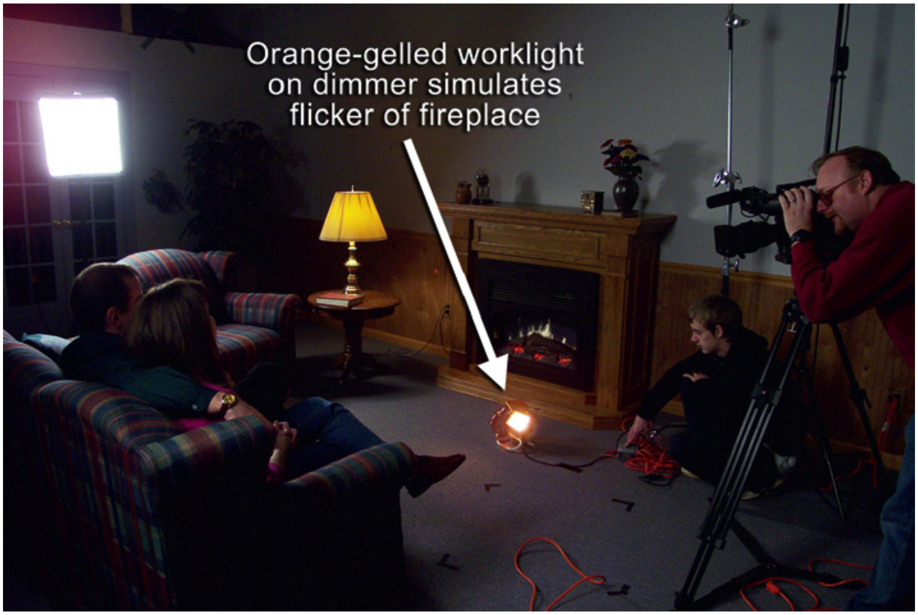

FIGURE 12.7
The simplest setup for the effect of flickering fire is to have an orange-gelled instrument on the floor run by a manual dimmer.

Smoke and Fog

Where there's fire, there often needs to be smoke. Fog and smoke are known as "atmospheric effects" and are accomplished in a huge variety of ways. Several pyrotechnic devices (pellets and powder) can be used to produce white, billowing smoke and are extremely effective. These devices should be handled by someone with a pyrotechnic license.

Fog can be produced by an old-fashioned oil cracker (atomizer) or more often by a glycol-based fogger, the type that is common in clubs, spook houses, and theatres. These devices were invented by Rosco to avoid the health issues related to burning oil and other solutions that used to be common. The glycol fogger can be used for many smoke effects as well; the fog can easily be piped through 2-inch flex hose to control point of emission.

The Curtis Dyna-Fog (actually designed as a mosquito fogger) can be used to create ground fog effects. High-volume steam generators are sometimes used to create actual steam effects for saunas, and so on.

Although the Rosco glycol fogger received a technical Emmy® award for its safety, many folks continue to be concerned about breathing artificial fog. It's best to be safe, since breathing any fine aerosol deep into the lungs for an extended period can be a problem, especially for allergic or sensitive people. Crew should wear protective masks, and actors can move out of the fog zone or wear masks when they are not actually performing.

FIGURE 12.8
Magic Gadgets Flicker 2D flicker generator creates a random pattern of flicker at several different light levels. Photo courtesy of McIntire Enterprises/Magic Gadgets.

The more advanced Flicker 3D adds another dimension by flickering more than one light at slightly different locations; the unit can create the moving shadows that are typical of a real fire. Of course, this effect can also be created manually by doubling up either of the manual setups described earlier. This "dancing shadows" effect is really important when there is very little other light in the scene; it is a touch that makes the effect work.

Tip: Take the CTO gel off the flickering instrument, substitute a ½ CTB gel, mount the instrument about 3 feet off the floor shining directly into the actor's face—and voila! Instant "watching television in the dark room" effect!

AUTOMOBILE INTERIORS

Automobile, truck, and minivan interiors are an important factor in dramatic work. Just like anything else, they have to be lit. The problem is that very compact instruments must be used, often quite close to the subject's face. So low intensity is the key here; subtlety should win out over lumens. You don't want the actor to look "lit," but you want to bring enough illumination to the face to help the camera read the eyes and reduce the contrast with the bright sunlight outside the vehicle.

In certain situations you can use external instruments mounted outside the car. If the car is still or the motion is simulated, it's easy to just place instruments around the car shining into the windows at low angles. This is not so easy if the car is moving! However, if you're using a hood mount kit for the camera, for instance, a fresnel key can be fastened to the hood mount kit as well, shining into the face of the driver or passenger.

More often today, moving cars are being lit with small instrument mounts inside the vehicle itself. For daytime shots, this is usually a small fluorescent tube mounted on the visor. The idea is not to call attention to the lighting, but just to bring enough lumens onto the actor's face to make the lighting balance work. Of course, low-power incandescents can work as well, but the extra heat means there is a fire hazard in close contact with the headliner or visor material.

If the scene calls for a car interior at nighttime, the approach is inverted (see Figure 12.10). Rather than mounting the light above the driver on the visor or outside the car, the usual practice is to simulate light coming from the instrument cluster. So the instrument, which can range from a tiny T2 flo to a Gyoury wand as in Figure 12.9, is mounted below the face shining up. Of course, instrument clusters don't really cast much illumination, so you'll need to be careful about overlighting. Also, most instruments today cast either a red or (more typically) a green glow, so you may wish to gel that color. Some of the newer fluorescent or LED 12-V auto worklights can also be used effectively and are quite cheap.

The most effective auto interior lighting at night is very low intensity, just enough to "read" when everything else is dark—but then make liberal use of transitory light sources outside the car. If the car is actually moving, plan several fresnels gelled with amber that will illuminate the interior as the car passes by them. Oh, and don't forget that old moonlight effect! A general blue fill around the car that also partially illuminates the driver or passenger can be very effective.

Close-ups where eyes and expressions need to be visible can be effectively lit with a careful combination of moonlight and "instrument panel." Of course, just as with general night shots, many DPs simply abandon realism and light the subjects at a much higher level than could be rationally explained. This is a perfectly honorable part of that "Hollywood vernacular" tradition and the audience will accept it. But it's best to pick one look and stick with it. Switching back and forth will call attention to the fakery of the "fully lit" approach.

FIGURE 12.9
The author mounts a Gyoury light wand on the visor in a minivan. The wand is then dimmed until the right light level is found.

FIGURE 12.10
The same Gyoury light wand for night use. It is mounted on the instrument cluster, shining up into the face of the driver. The dimming ballast allows adjustment to an effective light level.

BLUE- AND GREENSCREEN

After the question of how to light night shots, the second most frequent inquiry I get is how to light green- or bluescreen shots. Greenscreen is pretty fascinating, after all, since it opens the way up to imaginary imagery and creating impossible shots. The typical misconception is that greenscreen shots must be flat lit. This misunderstanding arises from the need to light the background evenly. But the foreground ought to be very carefully lit in a manner that will match the composited background. In fact, inconsistency between the foreground and background lighting is that major visual cue that will give away a composited greenscreen shot! Consider these examples:

- You've built a set of the deck of a ship and need to composite sky and ocean behind the actors. The actors need to be lit as if in strong sunlight, with a strong key from a specific location in the "sky." Kickers need to be used to simulate the highlights of wide-open sky reflected in the skin. Low-contrast lighting will make this scene look as phony as a three-dollar bill.
- Spaceman Billy is in his space suit desperately trying to fix the flipper-flummy regulator on the underside of the XK-7 space shuttle. Behind him, we're going to key the whole universe. Here very hard, high-contrast lighting is needed, with hardly any fill—the harsh light of the sun in space, where no clouds or atmosphere diffuse the light.

FIGURE 12.11
A gymnasium converted into a bluescreen studio for our ship deck set. From the set of the feature film *Wesley*. Photo courtesy of Matt Scala.

- Our hero, Konan the Librarian, has just succeeded in collecting a record number of overdue books. There is one left to retrieve, checked out 17 years ago by a hermit who lives atop an inaccessible rocky crag. In the final scene, Konan holds the book victoriously aloft as he stands on the impossibly high peak, surrounded by precipitous cliffs, as the sun sets behind him. The actor needs to be strongly lit by amber-gelled kickers on either side and above, with a very low frontal fill. Again, even lighting would just blow this scene.

Bear in mind that for bluescreen there are two lighting setups, one for the background and one for the subject in the foreground. The best practice is to avoid having these interfere with each other whenever possible. Both setups are critical to the effectiveness of the final product—the background lighting for a successful composite and the foreground lighting to "sell" the integration of the subject with the composited background. Both composited background and foreground need to use the same lighting angles and have the same perspective. If either one is off, no matter how clean the key is the viewer will feel that something is "off" in the scene.

There are lots of greenscreen composites that are just fake and not intended to simulate reality. "Weatherman"-style shots where informational graphics appear behind the host really can be lit any way you want! But for realistic shots, you need to know what the composited background will be and how the

FIGURE 12.12
A large studio with a hard cyc is not necessary for basic greenscreen work. Here, the author has converted part of an office with green fabric. Ordinary fluorescent worklights (with electronic ballasts) are used to illuminate the background, while the subject is illuminated with a softbox and Lowel Omni as backlight.

Tip: When using proprietary keying hardware or software, always check with the manufacturer for specific guidance on lighting the background. In other words, read the manual!

lights fall in it. Attention to detail is what will make the shot believable.

So let's start with the basics: lighting the background. Here there are two distinct courses; the one you pick will depend on the keying hardware/ software you are using. Plain chromakey will be best lit differently from Ultimatte® and other proprietary keying software.

The difference here is spill—reflected green or blue light from the background that appears on the foreground subject. This is the great bugbear of simple chromakey and must be reduced on the set through lighting techniques. Ultimatte®, on the other hand, has a proprietary spill-removal algorithm that automatically filters out the problem. So Ultimatte® greenscreens can be lit almost without regard for spill. In fact, the techniques used to kill spill on a chromakey set will cause problems in an Ultimatte® composite.

So let's tackle each method in turn. First, we'll deal with simple chromakey, which is the technique of identifying a specific range of color and rendering it transparent. When an actors is standing in front of a large intensely lit blue- or greenscreen, two factors will come into play to create spill. One is radiosity, the actual green or blue light that radiates off the screen onto nearby objects or people. The second is actual reflection on the skin or other surface, where the screen acts in the same way as a large reflecting card.

Both of these problems are minimized by the application of the Inverse Square Law: create some distance between the subject and the screen! This is a good idea generally because it is easier to light the foreground subject if there is some distance between subject and background. Radiosity drops off rapidly and usually is completely insignificant on a subject 8 or 10 feet away from the background. Reflections aren't as affected by distance, however, so other methods must also be used. A very simple technique is to light the background at a lower level than the foreground. Remember that the more lumens you put on the background, the more the color will reflect on the subject's face, hair, and clothing. Many

FIGURE 12.13
The Strand Orion is an example of an incandescent cyc light, which is used above and below a cyclorama for even lighting. Courtesy of Strand Lighting.

folks resist this suggestion because they've always heard that greenscreens must be brightly lit. This is simply not so. The hardware (or software) can typically key out any color and range you specify, and can remove dark green as easily as bright green. So, for classic chromakey usage, I recommend lighting the background to a value of less than 50 IRE when viewed on a waveform monitor. If you're using a light meter, the light on the background should be about half of what you'll use as key on the foreground.

Although intense bright lighting is not necessary, *even* lighting is. The more even the lighting on the background, the less latitude is needed in the software while pulling the matte. The less latitude needed, the less likely you are to encounter problems with blue halos or vanishing ears. The theoretical ideal key would have a perfectly even color in the background, with none of that color appearing in the foreground. The closer you can get to this ideal through careful, even lighting, the better the end result will be. This is where fluorescent instruments really excel and beat incandescents hands down every time.

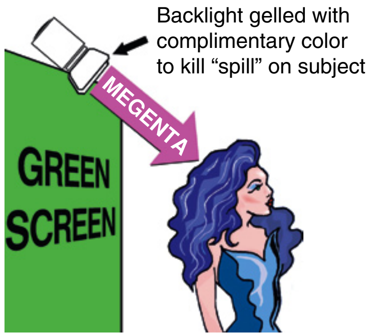

FIGURE 12.14
A backlight gelled with a complementary color can help eliminate or reduce spill. Choose a gel that is opposite the key color on a color wheel.

Typically, you'll still have some spill to deal with, usually on shoulders and hair. The classic approach—one that works when set up correctly—is to use backlight gelled to a color opposite to the color used for the background (Figure 12.14). For a blue background, this will be straw; for green it will be magenta. Doing this just right is a bit of an art, since to the eye the colored light will be quite noticeable, while on camera the right setup of intensity and color will virtually eliminate the spill without seeming to be magenta or straw. It's best to watch the effect of the colored backlight on camera rather than with the eye.

Chromakey Trick

Technically, the best key with the cleanest and most accurate edges will always happen off the camera signal rather than off a recorded format. The standard definition (SD) camera signal may have a horizontal resolution of 600–800 lines, while most digital SD formats don't go far above 500. Many HD cameras put out a signal in excess of 1000 TV lines. But the crux of the issue (the "key" if you will!) is the fact that nearly all digital recording formats decimate the color sample to half that of the luminance. That's what 4:2:2 refers to.

If you are shooting in a studio that has a hardware chromakey (most switchers/SEGs have them), you should try to pull the key live if at all possible, while also recording the raw greenscreen footage as safety in case there's a problem. But in many cases, this isn't feasible for any number of reasons and the final composite must be created in post. Even then, you can use the hardware keyer to spot and correct problems with the lighting of the background.

Try this trick. Switchers can generate color backgrounds. Set up a color background in the keyer that is about the same green or blue as the set background. Now run the camera signal through the keyer, and key this perfectly even, flat color behind the subject; and record the keyed composite. Record the live footage as safety, too! Now, when you get to pulling a matte in post, the software has a near-perfect clean background to deal with; the only fudge factor will be the tiny latitude needed right at the edges of the subject.

FIGURE 12.15
Applying amber gels to the backlights on the set of the feature film *Wesley*.

Lighting for Ultimatte® is quite different because of the spill removal. Ultimatte® uses a sophisticated process to subtract the selected key color from the foreground. It does an extremely good job in most situations, sometimes at the expense of a slight color shift in clothing. Selecting wardrobe that has no slight green or blue component will prevent this but is somewhat difficult.

Because the spill removal works so well, Ultimatte® recommends lighting the background brightly—at the same level as the key for the foreground. It is still advisable to have a good bit of distance between the foreground subject and the background to allow for flexibility in lighting.

A number of problems can crop up in lighting a green- or bluescreen shot. Set objects can cause particular problems, especially if they have shiny surfaces. A table with a varnished top can reflect the green background so that the top literally vanishes in the composite, leaving teacups and saucers floating in air. Even many tablecloths will have a shiny enough surface to cause the problem, though usually to a lesser degree. Shiny objects of any sort can cause this problem. When possible, use very flat finishes for bluescreen shots.

Often, green invisible set pieces will be included, especially when you are using the newer virtual sets. A plywood cube of the proper height painted green can allow the actor to set objects down on a virtual surface. However, these set pieces present peculiar problems since they are difficult to light evenly—and they are actually in the foreground zone, where we might be using a contrasty lighting scheme. The top will catch more light and the object itself will cast shadows that must be eliminated either live or in post. One solution is to use a darker shade of the key color on the top of the set piece than on the sides. Another is to use traditional lighting controls—flags or scrims—to control the amount of light on the top of the set piece.

Tip: Check the Ultimatte® website ate www.ultimatte.com for updated tips on lighting for their product.

When the blue floor must be visible (or rather *in*visible in the composite), it must be lit carefully to preserve the even color, while interfering as little as possible with the lighting of the subject. It is especially important that lights not be pointed straight down or angled toward the camera from a rear position,

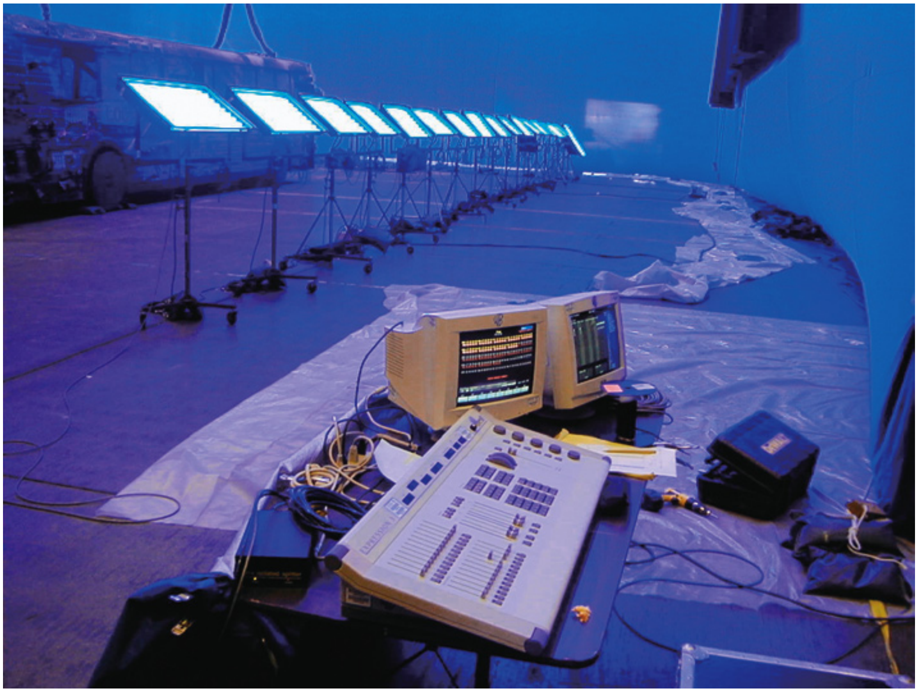

FIGURE 12.16
Banks of Kino Flo Image 80s (controlled by a DMX dimmer) are used to evenly light a bluescreen in a large studio.

since this will create specular highlights on the floor that will appear in the composite as "veiling," blue or green tinted areas. Lights for the floor should be nearer the camera so that light must be bounced back to the camera without the potential for hot specular highlights.

In some cases, backlighting the subject is essential, which will create those pesky hot spots on the floor. When this effect is inescapable, a polarizing filter on the camera can be used to eliminate the glare from the floor.

If you're starting to sense that lighting a greenscreen shot is a battle of conflicting problems, well, you're starting to get the idea!

A similar trick that is sometimes used in film but that works just fine in video as well is the use of a beamsplitter (Figure 12.17) and a glass bead reflective material such as 3M Scotchlite® or Reflec Chromatte™. A half-silvered mirror is mounted at a 45° angle in front of the camera lens, and a green or blue light is reflected from it toward the reflective material. The end result is quite good. Reflec sells a special chromakey setup with their fabric that works much like this by using a ring of high-brightness blue LEDs that fits around the camera lens.

Green- and Bluescreen Tips

- Personally supervise the selection of wardrobe for your talent. Whether you are using blue or green for your key color, the wardrobe must stay far away from that color. In one virtual set show, where we used a greenscreen, I warned the director to select only clothing that had no green in it. Halfway through the live shoots, I discovered that one of the principals was wearing an aqua-colored blouse. It looked blue to most folks, but it actually contained a lot of green. That minor mistake caused a lot of trouble in post, where I had to hand paint many mattes to fix digital "holes" in the offending garment.
- Is green or blue better? The real issue is, what color do you need to have in the foreground? If the subject needs to wear a blue shirt, use green. If green needs to appear in the foreground, use blue. Many folks feel that blonde hair keys better against blue than against green. When all else fails, use any other color that isn't needed in the foreground. Blue and green are the favorites because they do not appear in human skin tones, a color you can't change very easily. However, virtually any color can be used, including red and yellow. Dick van Dyke tells me that *Mary Poppins* was shot against yellow backgrounds!
- Take more time setting up, reshoot when necessary, avoid using those dread words "we'll fix it in post." Not until you've had to hand paint a mistake in hundreds of matte frames do you understand how costly those words are!

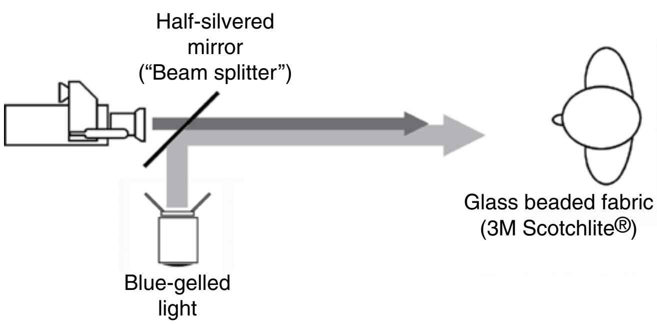

FIGURE 12.17
A beamsplitter allows a colored light to be shined exactly along the camera's axis. This can be used to place intense even blue light on selective material or for other special effects, such as red glowing specular highlights in a monster's eyes!

Note: If you are really interested in pursuing production of bluescreen footage, consider picking up a copy of the author's much more comprehensive book *Bluescreen Compositing*, also from Focal Press.

CHURCH AND WEDDING LIGHTING

One area of videography that has exploded in the last two decades has been wedding videography and, more recently, telecasting and webcasting of church services. These can be a real challenge for a couple of reasons. First, churches and synagogues have generally been designed without a thought for the lighting needed for video. Second, videotaping requirements are secondary to the integrity of the service itself. Clergy are not too friendly to a videographer interrupting the service for a second take!

Although these topics really require a book of their own, let me touch the principal points to keep in mind for weddings and general service taping.

Weddings

Generally, lighting in churches and synagogues is very unfriendly to video. The potential for creative camerawork is further limited by (usually) being restricted to the rear of the sanctuary or the balcony. In most cases, you simply must make do with what's there. In other cases, you can negotiate using a light or two to augment the existing lighting.

The first thing to do is call the church well in advance. Do not leave this till the last minute! Ask what the rules are for videotaping a service. Ask politely if you can bring in an extra light, emphasizing that you will set it up in a manner that will not distract or detract from the service. If the rules say no, don't whine or beg. It looks bad and generally won't get you anywhere!

If you can set up an extra light or two, the best bet is usually a good fresnel set on a tight spot. Mount it in the balcony if there is one or in the back of the sanctuary in an area that is not going to be actively used during the service. Another option is a PAR can with a long-throw bulb. I have a couple of 1-K PAR bulbs that are designed to throw an oval fan or a round pattern a fairly long distance. These work really well in most churches, either from the balcony or from a triple riser stand in the back.

Keep safety in mind at all times. Especially if your light is in the back of the sanctuary, you may need to block it off to make sure no one trips over the stand. Tape all cables, especially in traffic areas. When using a triple riser stand, a twine tie-down or gaffer tape to a nearby surface will be an extra safety to keep the whole shebang from toppling over and mortally wounding Aunt Fanny.

Remember that the clergy almost always poses close-ups for the still photographer after the reception line is done. This is your chance to get close-ups of the rings, shots that you could never get during the service.

Remember, the clergyperson is a professional trying to do a job. He or she will put as much time as you (or more) into the service and will get paid a tiny fraction of what you will receive. And despite the way we are depicted in movies and television, most clergy are hard-working reasonable people. We will work with you if you will work with us. Bear in mind that most of us are struggling to keep the spiritual nature of the ceremony intact against many pressures from family, friends, and social planners. After patiently explaining to the bride why she can't have a Kurt Cobain song as the processional, the clergyperson may not be in a mood to argue with you about camera placement! If you respect the rules of the congregation, respect the ceremony itself, and do a professional

The "Golden Rules" of Wedding Videography

Jackman's "Golden Rules" have appeared in many video magazines over the years:

1. Contact the pastor, priest, or rabbi by phone well in advance of the service. Introduce yourself, and ask what guidelines the congregation has for videotaping weddings. Larger congregations may have these clearly spelled out on paper. Ask if they could send you a copy. Assure the clergyperson that you will respect these guidelines and will not intrude into the service itself.
2. Attend the rehearsal, which is usually held the night before the ceremony. It's a good idea to bring your equipment then. Use the rehearsal as an opportunity to set up and establish good camera angles. Remember, you won't be able to stop the actual ceremony to get a better shot!
3. Bear in mind that the congregation will stand at certain points in most ceremonies and plan your shots to compensate. Ask the clergyperson about this. In buildings without a rear balcony, you'll have to plan a way to raise the camera to shoot over the heads of the crowd.
4. If you don't own a second camera, consider renting one. You can more than make up for the rental with your "deluxe two-camera wedding" price. While the majority of congregations and clergy will not allow a cameraperson up front during the ceremony, many will permit an unattended stationary camera. You can set this camera up during the rehearsal to shoot the bride and groom during the ceremony. Position the camera as unobtrusively as possible. If the clergyperson is reluctant to agree to this, emphasize that this is your method of providing an excellent video while at the same time respecting the sanctity of the service.
5. A pair of good FM mikes will really pay off. Remember, the father of the bride (who is probably paying your bill) really wants to hear the whispered "I do." You'll never pick that up on a camera mike. Have the groom, who closely resembles a penguin, wear the wire. The mike will not show up against a black tuxedo and will pick up groom, bride, and clergy quite well. If you are using two cameras, use two mikes as well. Send the signal from the groom's mike to the unattended front camera; mike the clergyperson and send that signal to the rear camera. This will prevent any difficulties with lip sync.
6. Think creatively about lighting. Most churches are lit like the Batcave and clergy are reluctant to let you spoil the visual appeal of the sanctuary with studio floods and fresnels. A single very strong flood from the balcony or rear may be acceptable. In my experience, there is more objection to lights being turned on or off during the ceremony than anything else. If your light is on all the time, it will seem like a part of the ceremony rather than an interruption.
7. Take a cue from the pro still photographers. They always pose 10,000 or 20,000 formal shots and close-ups (at least it seems like that many) after the service. In the past 20 years, I've never seen a videographer take advantage of this; they're usually breaking down equipment while the photographer is posing shots. Wouldn't it be great to get a tight close-up of the ring being placed on the bride's finger? Get posed close-ups, and grab shots of the various formal poses with family. Clergy generally don't care what you do during these posing sessions!
8. Finally, dress for the ceremony! You may do most shoots in baseball cap and T-shirt, but when taping a wedding, you should be dressed as if you were a guest. Still photography pros know this, and invest in a comfortable but respectable suit specifically for weddings.

job, that clergyperson will be kindly disposed to having you back—and to referring business your way!

Videotaping Church Services

Taping regular services for the congregation itself is not too different from taping a wedding, with the exception that since you are working for the church itself, there may be some greater flexibility and a chance to develop lighting that works better than an improvised "patch." Many congregations tape services for shut-ins, for local cablecast, and increasingly for webcast. Usually, the camera operators are volunteers from the congregation who may have had little or no training. In larger congregations, a staff person with some experience (usually event videography or local cable) will be appointed to supervise the video ministry of the church.

I must say, I have yet to visit a church (including those designed for contemporary worship) that has video-friendly lighting. Architects just don't understand what's needed; if a specialized lighting consultant who is knowledgeable about video hasn't been involved in the planning, assume that you will need to make alterations to the lighting scheme. Even when lighting consultants have been involved (usually in a contemporary worship setting), they are typically folks experienced with concert lighting who haven't a clue about the needs of television.

The two problems that generally must be overcome involve (1) the steep angle of principal lighting and (2) the uneven nature of the lighting.

Most architect-designed lighting is installed at far too steep an angle and casts harsh ugly shadows over eye sockets and lips (Figure 12.18). Key lights for pulpit area and choir need to be at an angle that shines into the face. Generally it

FIGURE 12.18
Most church lighting is set at far too steep an angle and casts ugly shadows (left). Added lighting that shines into the face produces a more pleasing picture (right).

is simpler to add new lights than to move existing lights, which may not be the best quality anyway.

Uneven lighting means that the camera operator can't pan across the chancel without changing the iris constantly. Areas of focus (choir, chancel) should be lit at similar levels so that constant exposure can be maintained.

If a projection screen is used in the front of the church, this presents its own exposure and color problem. Video projectors operate near daylight temperature (5600 K), and the rest of the lighting is probably quartz (3200 K). It's quite an involved task to get the lighting to match the screen or vice versa. If you don't mind having the projection screen look blue, it's much easier. As with any onscreen practical light source, you have to set the camera exposure to the practical (in this case the projection screen), and then adjust all other lights to provide good exposure at that iris setting.

Since this process often involves some expenditure and requires specialized knowledge to achieve the best results, I usually recommend that the church hire a lighting consultant to design lighting for the sanctuary that will work for videotaping. It's a one-time expense that is well worth it in the long run.

LIVE THEATRE TAPING

Stage shows (both plays and concerts) pose similar problems for videotaping. The lighting is designed for the eye, not for the camera, and so is often significantly too contrasty for video. Newer cameras with digital signal processing (DSP) have made it much easier to tape these shows, but it can still be quite a challenge.

If you are taping the show (Figure 12.19) casually and can't ask for any changes to the lighting, then your best bet is to set the camera on completely manual

FIGURE 12.19
A shot from the live stage show, *Hymns of Praise*, lit specifically for videotaping.

mode (don't ever use auto exposure for a stage show!) and attend a rehearsal to try and find the best compromise exposure. You're better off letting highlight go just a little hot, but not opening up wide to see into the shadows. Generally the lighting director will light the areas of interest in a scene, and the shadowed areas are not as significant.

If you are taping the program more seriously—for instance, for cablecast or as a professional video that the theatre company will sell—then you should politely insist on a special showing with lights altered for video. Patiently explain to those in charge why this is necessary. They want their video to look nice! Be extremely kind and understanding to the lighting director, who may be quite an expert onstage but may have little understanding of video. You're stepping on his or her toes, messing with their artistic vision. Make clear that what you're really trying to do is make sure you capture their intended vision on tape!

Sit through an entire showing—or two—with your camera and make detailed notes of scenes that are too murky or too bright. Run through the entire show with the lighting director to see if it is possible to turn a light down here and bring a little fill in there. Since most shows are run from computer controls these days, it's much easier than it used to be. They can save a tweaked "video" version of the computer file just for the special showing. Do a few tests with actors on stage (remember you can't light air!) and let the lighting director see the playback to make sure that it looks right on the video. Lots of respect here goes a long way!

If you are lighting a show specifically for videotaping, then you'll find that a combination of stage and studio lighting techniques will be necessary. Lights must be out of the view of the audience and can't be cluttering up the stage. On the other hand, basic studio techniques can usually be adapted to do this and provide effective stage lighting that also works for the eye of the live audience.

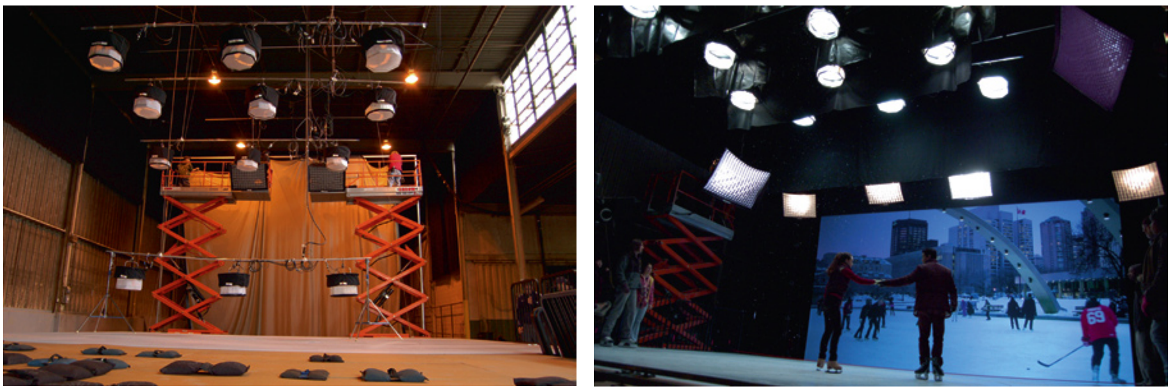

FIGURE 12.20
How do you create and light a skating rink in a studio? The rigging (left) is fairly complex to produce a seemingly simple and realistic shot that uses rear projection (right). Photos courtesy of Chase Livengood.

These are just a few of the most common "specialty" lighting situations you'll encounter. In point of fact, keep in mind that *every setup is a specialty situation!* You should regard each setup as a new and unique challenge, so try different looks, new solutions all the time. How would you light an outdoor skating rink at night? (See Figure 12.20.) How about if you had to stage it in a studio with rear projection? Every situation is different and requires a full bag of tricks, careful thought, and lots of ingenuity! While you'll find basic solutions that work well, you need to avoid falling into the rut of lighting every interview exactly the same way and every product just like the one before.

CHAPTER 13

Imagination and Invention

I hope that this book has shown you that really fine lighting is a combination of observation, imagination, and inventiveness. While almost any camera-toter can learn a basic lighting setup or two and put together some nice-looking interviews, to reach beyond that you need to spend a great deal of time observing the detail of the real world with an artist's eye. After all, you can't create realistic lighting without a solid sense of what "realistic" looks like.

But "reality" encompasses a really huge range, doesn't it? Day and night, dusk and dawn, cold winter light streaming in through dusty factory windows, the natural glow of a crackling fire, and the artificial glow of neon lights at night. Streetlights and spotlights and flashlights and candles, the "looks" that you will find in the real world are nearly infinite in variation.

Learning to create innovative looks often requires learning from the giants who have gone before us. Great cinematographers often talk about "painting with light" and many of them will talk fluently about the techniques of classical painters for capturing light and creating a sense of depth through the use of light and dark, known as *chirascuro*.

Chiaroscuro (kiarə′skyūrō)

> Italian for *light-dark* is a term in art for using contrast between light and dark to convey perspective and lighting that achieves a sense of the third dimension in a two-dimensional medium.

The Renaissance masters, particularly Caravaggio, Vermeer (Figure 13.1), and Rembrandt, became masters at portraying natural light from windows and candles and lanterns, and creating a sense of depth in the fundamentally two-dimensional medium of the canvas.

Looking at these old masters with an observant eye is powerfully instructive. How did they capture the look of light in the artificial medium of oil on canvas? What real-world observations drove their selection of pigments, their

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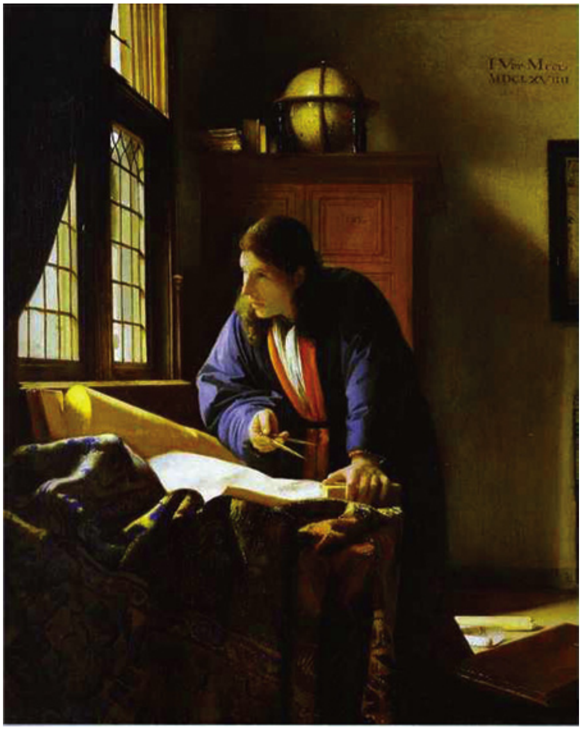

FIGURE 13.1
Jan Vermeer (1632–1675) captured realistic light from a window effectively using oil on canvas in *De Geograaf* ("The Geographer"), c. 1668–1669. The painting is currently at the Städelsches Kunstinstitut, Frankfurt am Main.

brushstrokes? Apply this real-world observation to situations you encounter and you will begin to accumulate an understanding of how light behaves in nature, how it appears on shiny surfaces, on skin, on rough wood, how it flows through windows, how it is attenuated by fabric, how it bounces off of rough plaster. These observations combine to give you an ability to replicate this reality, to paint with both light and pixels in our medium, which is just as artificial as oil and canvas.

This is also where the cinematographer who has learned all the "rules" can know where to break them. When trying to replicate reality, we are often presented with situations that are not fully lit and would seem markedly artificial with too much light. Scenes lit by candlelight or lanterns or firelight are classic examples. In trying to re-create a realistic look for the passengers belowdecks as the HMS *Simmonds* (Figure 13.3) confronted a terrible storm, we couldn't follow the rule of making sure that exposure fell into every part of the Adams Zone System. The only light belowdecks would have been a few guttering lanterns, so lighting had to skew amber and exposure was low. Yet we also had to have enough light to expose water

FIGURE 13.2
Actor Mark Scarborough portrays General Oglethorpe in the feature film *Wesley.* The scene parallels Vermeer's "Geographer" in naturalistic use of light from the window as the key light for the scene. In fact, the sunshine through the window was inadequate and had to be augmented with a 2.5-K HMI.

FIGURE 13.3
Belowdecks on the HMS *Simmonds* in the feature film *Wesley*. Exposure levels are far below the norm, gels skew all the light's amber to make it seem like they come from the guttering lanterns.

streaming through the leaky deck above the passengers. The result is very dark, but very realistic, especially when the sound effects of groaning timbers and wave impacts are added.

Combine the complexity of the real world with the unique needs of the television camera, as well as the difficulties of simulating a subtle look so that it really works on the television screen, and you have a real challenge for the creative imagination. That's where the last element—invention—comes into play. A good lighting director or gaffer needs to have a streak of experimenter and inventor—a drop of Thomas Edison to balance out the Rembrandt and Caravaggio. This is true at several levels.

The look of television and video lighting is advancing all the time. Imagining new looks and envisioning the next level is the art of the individual imagination. It usually comes into reality as an inventive team effort; but the payoff is a new look, a distinctive feel that captures exactly what you had envisioned.

Television shows with a unique "look" that stands apart from every other show on TV don't happen accidentally. A show such as *Star Trek: Deep Space 9* (1993–1999) with its heavy use of industrial grillework shadows has an immediate visual identity that is completely in keeping with the feel and premise of the show. It is also visually different from all the other *Star Trek* series that Paramount was cranking out at the time. That wasn't happenstance. Some very hard work and thought, together with classy light design, went into that show. Similarly, the *CSI* variations are recognizable just from the dark and somber strong blue lighting used in the labs, a look that was carefully designed to enhance the premise of the show. A good lighting director is going to spend some time getting the concept and feel of the show, and then will try to capture it in a new look that is just a bit different from every other show out there.

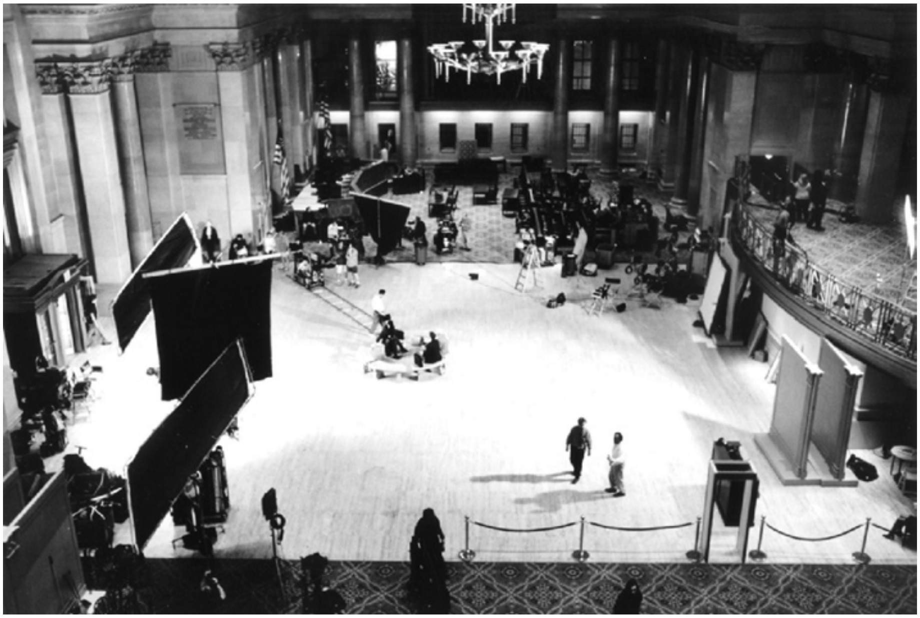

FIGURE 13.4
The crew of *Law and Order* has turned this building into the Supreme Court for an episode. Note the 12' × 12' butterflies in the foreground. Courtesy of Jessica Burstein.

Once a concept has been developed, the imagined look has to be translated into reality. Fortunately, gaffers are an inventive bunch! Almost every gaffer I know has a streak of Thomas Edison and the best ones are always fiddling around with lights and colored glass and tree branches and foamcore and crumpled aluminum foil to see how it looks. But they don't stop there; they're always envisioning some new gizmo, or a new use for an old one, that will allow them to mount a light in a new or different way. How do you think Hollywood came up with all the weird implements ranging from "meat axes" to "trombones?" Good gaffers don't just learn to *use* the tools of the trade, they *improve* on them. The innovators are sometimes memorialized in slang, but more often are forgotten as their innovation is passed around from gaffer to gaffer through the trade.

In the same manner, gaffers are always inventing new instruments. Sometimes these instruments do something new, like the first Kino Flo lights did. Other times they provide a new and more convenient way to accomplish something everyone was already doing, like the "Croniecone," the prototype of the now-common softbox. Gaffers had been shining lights through large pieces of diffusion material for years, Jordan Cronenweth just came up with a method of attaching the diffusion to the instrument itself.

Innovation in instruments is sometimes technical (like the development of lower-cost electronic ballast for HMIs or more color-accurate fluorescent tubes or high-intensity LEDs) but is more often just inventive use of components in a new way. Small instruments that can be gaffer-taped in a corner like the GAM

FIGURE 13.5
The GAM Stik-Up is a tiny incandescent fixture that can be mounted with gaffer tape or a clothespin in out-of-the-way spots on a set.

Stik-Up (Figure 13.5) aren't the cure for the common cold or a work of genius, but they sure are handy! The Gyoury Light isn't Nobel Prize material, but the innovation of viewing the tube itself as an independent instrument (rather than the box it fits in) makes some new and clever uses possible.

I've always been impressed by the low-cost inventiveness of Ross Lowell. He often just struck out on his own and reinvented the wheel, though a little more affordably. Whether you are a newcomer saving up to buy your first Lowel Light kit or a seasoned Hollywood professional used to big-bucks productions and fully equipped light trucks, you *must* have a copy of the Lowel catalog. Take a look at his "Blips" and the "Hollywood Strip" for ideas on casting odd-shaped shadows!

Don't be afraid to tinker with your lights or to take the time to mess around with unusual materials that modify the light. Washing a featureless wall by shining a fresnel through a piece of textured glass or a piece of interesting antique ornamental grillework will create a stunning texture that no purchased professional pattern will create. If the big lighting house doesn't make a pattern you need, get out your art knife and black foamcore!

I hope this book has helped you with the basics, but more importantly has focused your eyes and mind in a way that will help you create those new looks—and create the new instruments that will make new looks possible!

Happy lighting!

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USING A LIGHT METER FOR VIDEO

If you come from a film background, you probably never leave the house without your trusty Polaris or Sekonic strapped to your hip. Then you enter the world of video and everything is different. Manufacturers don't bother to give you an ASA/ISO equivalent exposure index for the cameras! How inconsiderate. You can't really use a meter without an exposure index, which is a measure of light sensitivity.

For you folks, here are two simple procedures to figure out the exposure index (or EI) of a specific video camera.

The first method uses a photographic gray card. Illuminate the card evenly and zoom in on it so that it fills the entire picture. Make sure that the Shutter Speed is OFF, which will set the speed of an NTSC camera to 1/60th (1/50th in PAL); or set the camera to 24p if it has that option and you will be shooting at that shutter speed. Also make sure the camera is set to no gain. Now press the AUTO IRIS button on the lens (pro cameras) or switch on the AUTO EXPOSURE function (prosumer cameras). Now switch back to manual so that the iris stays at that setting. Take note of the F-stop number the camera has chosen for exposure.

Now take an incident light meter reading, with the meter at the gray card and the photosphere pointed toward the camera. If you are using a film-style meter, set the cine speed to 30. The shutter speed is 1/60th; or set it to 24, with a shutter speed of 1/48th if you are shooting in 24p. As a starting point, set the meter to an EI of 100. Now compare the F-stop reading on the meter with the F-stop the camera auto iris chose. Change the EI setting on the meter until the meter suggests the same F-stop that the camera chose. Bingo, that's the EI of your camera!

The second method, which is a tiny bit more accurate, uses a chip chart and a waveform monitor. Open the iris on the camera until the white chip measures precisely 100 IRE or the crossover chip measures 55 IRE. Now follow the same trial-and-error procedure outlined above to ascertain the EI of the camera.

Once you have established the EI of the camera, you can use your "film-style" metering habits for setting exposure. Two caveats, however. First, bear in mind that using any of the gain up settings on the camera will result in an entirely different EI. If you must use gain up, you'll need to repeat the procedure in each gain setting to measure the EI in that specific mode.

FIGURE A1.1
Sekonic L-608 light meter. Photo courtesy of Sekonic, Inc.

Second, watch out for those hot spots! Always double check your exposure, with zebra display set on 100 IRE as an overlimit idiot light. If I didn't hammer on this enough in Chapter 7, I'll hit on it again now. A common mistake that film shooters make on video is to allow hot spots to run too high; then they complain that video "can't handle highlights." Remember that video has a flat gamma curve, rather than the gentle rolloff at the top end that most film stocks have. The format is stupid; the camera just does what it's told. It's just a tool. It's up to the tool user, the entity with brains (that's you!) to fit the scene into the latitude of the format.

LIGHT METER BASICS

For those who do not already know how to use a light meter, there are two types of meters: the *Incident* meter and the *Reflected Light* (or "Spot") meter. The Incident meter measures light before it is reflected off an object. The Spot meter measures light after it is reflected off an object. So a video camera is in a way a very sophisticated spot meter that can measure every pixel in the frame.

The first step in using either type of meter is to set the shutter speed to match that used by the camera. For NTSC video or standard HD formats, this will almost always be 1/60th (1/50th for PAL); for 24p it will be 1/48th. This is because the shutter speed affects the amount of light that is admitted to the camera. Well, in the case of video cameras, it affects the amount of time that the CCDs are energized to absorb light. Same thing in practice.

Next, you need to set the meter to the ISO of your film stock or ISO equivalent of the video camera—the EI that we determined above. Now, the meter can correlate the shutter speed and the EI with the amount of light measured to tell you an F-stop for proper exposure.

To measure incident light, the meter uses a white plastic diffusion dome over the sensor. The meter is placed in front of the subject (or about where the subject will be) with the dome pointed toward the light source. The meter will then indicate an F-stop for proper exposure.

The incident meter is best used to measure areas of a set in order to make sure lighting levels are consistent where needed. However, incident metering doesn't help with bright areas such as practical lights, televisions, or windows.

That's where you need to switch to spot mode or reflected light metering. This style of metering focuses on a small area of the set and measures how much light is reflected (or transmitted) from it. Hold the meter near the camera lens, and aim it at the area you want to measure. Simple, right?

No, it's not simple. The light meter is dumb. It has no idea whether the item you've pointed it at has Caucasian skin or is a dark blue sofa. The F-stop it reads out is the iris setting necessary to reproduce that tone as 18% midtone gray. But hey, we want highlights and shadows! It's up to the operator to convert the reading to an appropriate iris. When metering a Caucasian face, for instance, you will need to open up one stop from the reading the meter gives. If you were metering the dark blue sofa, an F-stop two stops down might be appropriate.

For more tips on using light meters, visit the Sekonic site at <http://www.sekonic.com/IncidentVsReflect.html>

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Appendix 2

BASIC PRIMER IN SIGNAL MONITORING

Reading a waveform monitor (WFM) is largely a matter of experience; it's something you get used to as you do it. Video engineers can use WFMs to measure a number of aspects of the signal, including frequency response, subcarrier phase, and so on. For now, however, I am mainly concerned with basic monitoring of the signal to make sure that exposure and color values are within legal limits (Figure A2.1).

FIGURE A2.1
A studio technician monitors the video signal.

You may have two dedicated monitors, one a waveform monitor and the other a vectorscope. However, many models are available that incorporate both in a single combined unit. All professional nonlinear editors (NLEs) now have software-based monitors built in.

WAVEFORM MONITOR

WFMs have several settings that affect the display. PARADE mode will display both fields next to each other. The WFM screen shots in this book all display a single frame with the fields combined. Some units refer to this as 1H/2H

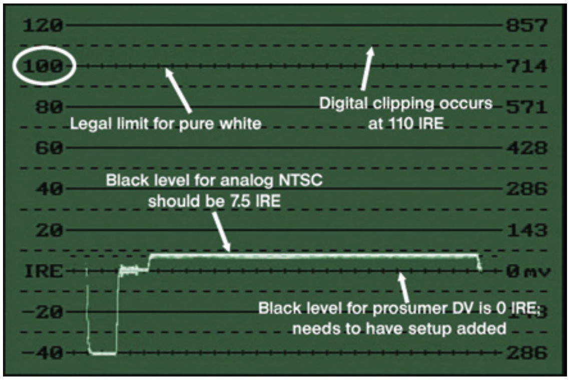

FIGURE A2.2
The waveform monitor displays the amplitude of the video signal, which is directly related to exposure.

display. Which you use is a matter of preference. A second setting you need to know about is the FLAT/LOW PASS. When this control is set on FLAT, color information is included in the signal and you will be able to view the color burst—the calibrating 3.579545 Mhz frequency that occurs right after the sync pulse and locks the color of the picture. The color component is also present in the picture waveform, which results in a vertical spread to the reading. This is useful for some measurements, but confusing for our purposes, so I recommend monitoring in LOW-PASS mode. This strips the color subcarrier out of the signal and allows you to monitor luminance, or brightness. The WFM screen shots in this book all display LOW-PASS mode. Some units refer to the low-pass filter as the IRE Filter.

When viewing a signal on the WFM, properly exposed video will fall between 7.5 IRE and 100 IRE, with good distribution across the range. Facial highlights for Caucasian skin tones should fall between 75 and 80 IRE. Hot spots should not exceed 100 IRE except for very brief excursions, typically practical light sources such as a chandelier bulb or candle flame. Hot spots should never exceed 110 IRE, which is the clipping level for digital formats. *Be aware that the live camera signal—which is analog—can contain values above 110 IRE*. These will be clipped in the A-to-D conversion and compression when the digital signal is recorded to tape, and the data will be lost.

If you are monitoring DV off a prosumer camera/deck (or even a low-end pro deck) you will notice that the black level is at 0 IRE, not 7.5 IRE. This can be very confusing. All digital formats use 0 IRE black internally; but setup (also called pedestal) should properly be added when the signal is output as analog.

VECTORSCOPE

When viewing a vectorscope, you are seeing the phase relationship of the various components of the video signal. This phase relationship is what determines the color. The phase, or hue, of the signal is displayed rotationally on the vectorscope. In other words, if you visualize the vectorscope as a clock face, pure red would read at about 11:30, whereas blue will display at about 3:30. The saturation of the color content, or the chroma level, is measured radially, or outward from the center. It is important to bear in mind that the vectorscope has nothing to do with brightness, exposure, or luminance level. It only displays hue and color intensity, so that pure white and pure black both appear identical on the vectorscope—both have zero hue and chroma—while they appear radically different on the WFM. (See Figure A2.3.)

Seventy-five percent saturation full-field color bars, or the SMPTE standard color bar chart, lets you check the hue and chroma of the signal. Properly adjusted, the color peaks fall inside the designated targets (see Figure 2.9 for a picture of color bars displayed on a vectorscope). If they are rotated either way, the phase of the signal will need to be adjusted with a proc amp. If they are far outside the targets radially or fall well within the targets, then the chroma level will need to be adjusted with a proc amp. This is how a dub house will calibrate its system to match your video—always assuming that your video matches the standard set by the color bars at the head of your tape. This calibration is mostly a nonissue with digital formats but is still very important when working with analog signals.

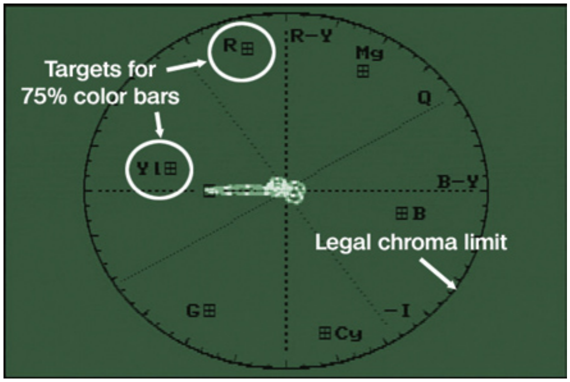

FIGURE A2.3 The vectorscope displays the color content and intensity of the video signal.

In production, the vectorscope is less important for lighting issues than the WFM. If you are using strongly saturated colors on the set or party color gels on your lights, the vectorscope will show you when your chroma is too hot. The outer circle on the vectorscope display (known as the graticule) shows the absolute legal limit for chroma. However, it's a good idea to stay well within this limit! NTSC video does not always handle strongly saturated colors well; watch out especially for saturated reds and yellows. PAL video handles high saturation better. Fortunately, with DVDs and Blu-Ray disks we have now moved beyond the lowest common denominator of video, the VHS tape, which handled saturated colors abysmally.

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ARRI Inc.
Burbank Office
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Burbank, CA 91502-1639
Phone: (818) 841-7070
Fax: (818) 848-4028
www.arri.com

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www.bogenphoto.com

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Boulder, CO 80301
Phone: (303) 444-8000
Toll Free: (888) 444-1812
Fax: (303) 444-8303
www.chimeralighting.com

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412 Calle San Pablo #200
Camarillo, CA 93012
Phone: (805) 482-4820
Fax: (805) 482-0736
www.cool-lux.com

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Albano Laziale (Roma) - Italy
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Fax: ++39/06/93.43.489
www.desisti.it

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www.dedolight.com

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Fax: (323) 461-4308
www.gamonline.com/i

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Fax: (770) 993-8837
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Grants Pass, OR 97527
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Glossary

AC Alternating current.

Accent light Instrument that focuses attention on an area. Can be in any position, key, kicker, or back.

Ampere Unit of measuring electrical flow or quantity. Usually shortened to "amp."

AMX Short for Analog Multiplexing, an older standard for lighting control. Now superseded by DMX.

Aperture The open area of the iris, the variable opening behind the lens that controls the amount of light admitted to the camera.

Apple boxes Sturdy pine boxes of graduated heights for a camera operator to stand on. The origin of the name is obvious. You can buy them from a studio supply store for an outrageous price or make them yourself.

Arc An instrument that creates light from an electrical arc flowing across the gap between two carbon electrodes.

ASA Rated speed of film, from the now defunct American Standard Association. Now known as ISO (International Standards Organization) or EI (exposure index). ASA and ISO technically only apply to film stock; the proper measure of a video camera's response to light is Exposure Index.

ASC American Society of Cinematographers. A DP who has been elected as a member of the ASC has been recognized for his or her contribution to the art.

Atlas fitting A rectangular open-faced light used for wide fill. Known in the United States as a "broad."

Backlight An instrument positioned directly behind and above the subject, aimed at the subject's back. Care must be taken not to have the backlight shine into the lens of the camera, as this will create flares.

Bail Also known as the yoke, this is the **U**-shaped bracket that holds an instrument, either hanging from a pipe clamp or on a stand connector.

Ballast Similar to a transformer, except designed to limit amperage to a specific level. Fluorescent tubes and arc lamps (both simple arcs and HMIs) must operate from a ballast. The inexpensive ballasts are magnetic; these may hum and create flicker problems at certain shutter speeds. High-frequency electronic ballasts are preferred for film and television work.

Barndoors Hinged black metal flaps that attach to the front of an instrument to control beam spread.

Bates connector 3-pin high-amperage connectors.

Beadboard A type of housing insulation made of polysterene beads formed into a flat board. Used to create soft, diffused bounce. Known in the UK as "poly."

Best boy The gaffer's assistant, a "best boy" can be a woman or an elderly man. It's just what they call it. It's got more to do with "best" than with "boy."

Black balance Procedure to set black level of camera.

Black bolton Heavy black cloth used for flags and teasers. Usually treated with fire retardant. Known in the United States as "duvetyne."

Blackwrap Heavy aluminum foil that has been anodized flat black. Next to gaffer tape, the gaffer's best friend. Used to extend barn doors, cut spill, form snoots, and wrap leftover lunch. No, scratch the last, that's the silver type.

Blocking Plan for basic action on the set. Critical points in the action are "marks."

Blonde An open-faced 2K by Ianaro/Strand, the big sibling of the Redhead. Sometimes called a "mighty."

Booster light An HMI or FAY cluster used to augment exterior daylight.

Bottomer A large flag used to cut light to the bottom of the frame. Known in the UK as a "Bottom Chopper".

Box money In the UK, fee paid to gaffer (or "spark") for use of consumable items.

Branchaloris A real branch used to break up light *a la* cukaloris. Yes, gaffers have a silly name for everything. Gaffers in the UK are just as silly; they call this a "dingle."

Broad A rectangular open-faced light used for wide fill. Known in the UK as an "Atlas Fitting."

Brute 225-amp carbon arc lamp with 24-inch fresnel lens. Close to as big and bright as it gets until you get those truck-mounted arcs they use for shopping center openings.

BSC British Society of Cinematographers. A DP who has been elected to the BSC has been recognized for his or her contribution to the art.

Butterflies (US) or **butterfly frames** (UK) Large frames that have silk or other scrim material stretched over it. These are used in outdoor shots to cut down the intensity of the sun and provide some diffusion. A "butterfly" can also be an arrangement where two instruments are hung next to one another but are facing opposite directions, often to act as key lights for subjects facing one another.

C-47s Specialized, heat-resistant miniature clamps that will hold gels or diffusion material to hot barn doors and serve a variety of other utility-holding purposes. They're actually just wooden-spring clothespins like your grandmother used before they had electric dryers. There are two main theories about the origin of the unusual designation. Airplane buffs say the term comes from the Douglas C-47, the World War II era "Gooneybird" plane

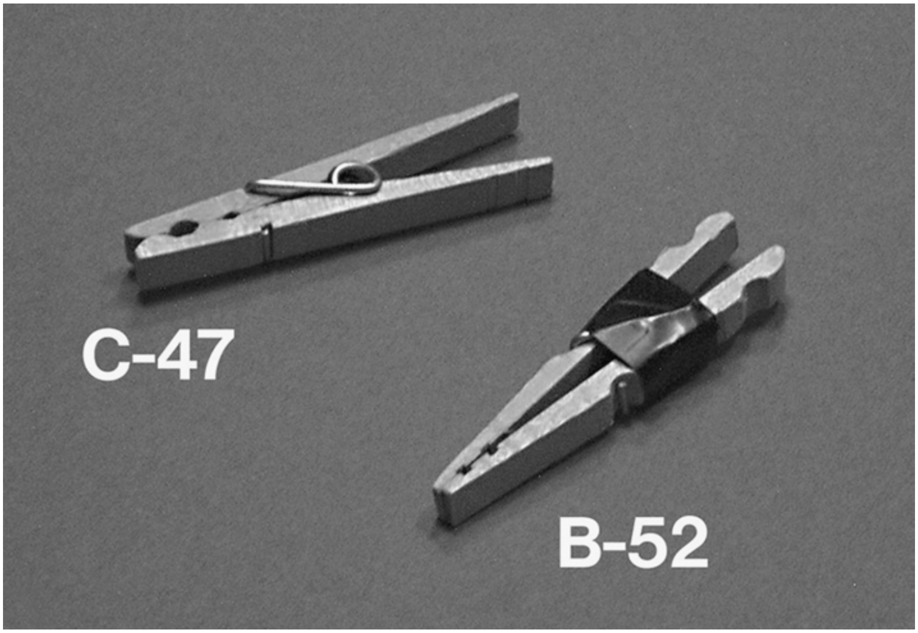

FIGURE G.1
Left: The plain ol' wooden spring clothespin, AKA "C-47" or "peg." Right: A new variant, the "B-52." The wooden paddles are reversed in the spring, and electrical tape wrapped around the spring.

that could do just about anything. Others suggest that the designation was the original part number in the old Century Lighting catalog. I personally believe the latter is the case; witness the "C-Stand" below! Younger gaffers are now calling these "pegs." Sparks in the UK call them "Croc clips."

It used to be common practice for gaffers to harass the new kid on the set by seeing how many C-47s they could clip on the back of his (or her) shirt before the newbie would notice. Watch your back!

Many gaffers disassemble the clothespins and reassemble them backwards to create a new clip that some are calling a B-52. That might support the airplane theory, but it's hindsight.

C-Stand A special, highly adaptable lighting stand. It is short for Century Stand®, which is now a registered trademark of the Matthews Studio Equipment Company. Other companies make these stands, of course, notably the Bogen Avenger line and Mole-Richardson. The C-stand has staggered folding legs that provide a horizontal area for sand or shot bags. The special dual-plate head can mount a boom arm, a light mount, or clamp flat material such as a large piece of cardboard or foamcore. This incredibly flexible stand is an essential on the set. The boom arm is generally called a gobo arm.

Cable crossing A heavy plastic ramp that covers and protects cable in a traffic area.

Cable stretcher A mythological device that gaffers would send the new kid out looking for, with the stern admonition "and you'd better not come back without one!" See also *Snipe Hunt*. Guess what—they make 'em now. The

FIGURE G.2
A Century Stand®. Courtesy Matthews Studio Equipment, Inc.

TecNec® CableStretcher™ is a multiconducter line amplifier for camera cable runs up to 300 feet.

Cam-Lok® A positive clocking cable connector for high-amperage feed.

Candela A unit of light intensity, equivalent in a sense to one candle. Actually, it's an international standard set by the sixteenth General Conference on Weights and Measures in 1979. As a scientific definition, it is based on the luminous intensity of a black body at the temperature that platinum solidifies (2047 K). The formula is mind-numbing; it's easier to just think of it as a scientifically standardized candle. A candela is measured in one direction only, as opposed to a lumen, which measures the entire spread of the light.

Celo A semitransparent cookie made with wire mesh with a plastic coating. Gives a more subtle pattern to light than a plywood or foamcore cookie.

Chain ViseGrip A ViseGrip® tool modified with a chain between the jaws; useful for clamping odd shapes.

Cheater An adapter that converts a standard 15-amp grounded connector to work in an older two-prong ungrounded outlet. Also known as a "ground lifter."

Chicken coop A light box, usually with six silvered globes that bounce a soft shadowless light directly from above.

Chief lighting technician In the UK, the lighting designer or head lighting technician. In the United States, the "gaffer."

Chinese lantern A collapsible wire and paper ball that has a lamp suspended in the middle. Provides a soft light source. Also known as "Japanese lantern." Many manufacturers now make a Chinese lantern specifically for the film and TV trade, with gridcloth diffusion and a spring wire frame. These have a bracket to hold the internal globe away from the diffusion material to prevent fire.

Chroma Color content of the video signal.

Circle of confusion The diameter of a point of light when focused on the target inside the camera. The less sharp the focus, the larger the circle of confusion. Could also be a group of baffled executive producers.

Clipped white In video, a portion of overlimit signal that actually exceeds the format's ability to record. The resulting overexposed area has no detail. In digital formats, there is a 10% headroom above the legal limit of 100 IRE for pure white; above that, there are no bits available to store information. In DV, that limit is 255,255,255.

Clothespin Your mom's term for a C-47.

Coffin light An overhead box with diffusion and a black fabric skirt to control spread. Provides soft, even overhead light for a limited area. Or it could be Vladimir's reading lamp.

Color conversion gel Used to convert a light source from one color temperature to another.

Color correction gel Adds or subtracts green to light source. In both the United States and UK, also referred to as "Plus green" or "Minus green."

Color temperature The color of light, measured on the Kelvin scale. Incandescent light is yellow, ranging from 2800 to 3200 K, while sunlight is in the blue range, around 5600 K.

Colorizing gel A gel that is intended to produce a color effect, such as warming or cooling. This is different from a *color conversion gel*. Known in the UK as a "colour gel."

Colour Gel UK term for a colorizing gel intended to produce a color effect.

Complementary colors Colors at opposite sides of the color wheel: red and green, yellow and blue.

Consumables In the UK, supplies that are used up in production such as gaffer tape, gels, and blackwraps. Known in the United States as "Expendables."

Contrast Ratio between the lightest and the darkest area of the scene (or picture). Video lighting must fit the contrast of the set into the defined contrast of the picture.

Cookie Nothing to do with chocolate chips. It's a cutout pattern that is used to break up the light into a dappled pattern. It is not to be confused with a gobo, though most folks use the terms interchangeably or backwards from their historic definitions. Useful to simulate dappled light under trees or often used in night scenes. The name is short for *cucaloris*. The British refer to these as "ulcers" for reasons that are as obscure as the origin of the term *cucaloris*.

CRI Color Rendering Index. This is a measure of the spectrum content of the light source, and thus its ability to render colors accurately. Fluorescent tubes and other gas discharge globes are usually *discontinuous spectrum* light sources, meaning that there may be gaps and spikes in the spectrum.

Croc clip British term for a spring wooden clothespin, otherwise known as a C-47 or a peg or any other term that someone has made up by the time this book gets off the press.

Croniecone The original softbox, invented by Jordan Cronenweth, ASC. A cone of foamcore or other material that holds a large sheet of diffusion material in front of an instrument while preventing spill from the sides.

Crowder clamp Designed to hang an instrument from a 2 × 4 or 2 × 6 board.

CTB Color temperature blue gel, available in several grades to convert incandescent light to match sunlight.

CTO Color temperature orange gel, available in several grades to convert sunlight to match incandescent light.

Cucaloris A cutout pattern that is used to break up the light into a dappled pattern. Useful for simulating dappled light under trees or often used in night scenes. Shorter nickname is *cookie*. The term *cucaloris* has been in use since most of the last century. However, the derivation of that term is a mystery. Most authoritative theatrical texts comment that it is the ancient Greek word for "breaking or shattering light," which sounds great except it isn't true. I took ancient Greek in college and have double-checked with several Greek scholars; it isn't a Greek word at all. "Breaking light" would be σπαζωφοσ, ("spadzophos") anyway. What I wonder is who the pompous ass was (a theatre or film production professor maybe?) who first told his class "Ahh, yas, that's from the ancient Greek," knowing full well he hadn't a clue! The British refer to these handy devices as "ulcers," an equally baffling term.

Cue A word or phrase in the script that acts to trigger another action; anything from another actor's line or entrance to a change in lighting or playing of music or sound effect.

Current A measure of total volume of electricity, measured in *amperes*.

Cyclorama or **cyc** A smooth, seamless wall, usually with curved corners. May be fabric or plaster. Used as a featureless background.

Day rate Wages for days' work, usually based on a 10-hour day.

DC Direct current, where current always flows in the same direction across the circuit. Batteries supply DC.

Depth of field The range of distance from the lens where objects are in focus.

Depth of focus The range behind the lens where the image is in focus; ideally the precise plane of the target.

Dimmer Device for varying voltage supplied to an instrument.

Dingle Another silly name for a *branchaloris*, a tree branch used to break up light. A small branch is a 1-K dingle and a larger one is a 2-K dingle. Believe it or not. Gaffers have absolutely no sense of embarrassment.

Distribution In lighting, the electrical supply system.

DMX Short for Digital Multiplexing; a digital standard for lighting control set by USITT.

Dog collar Safety cable used to attach instruments to grid. Known in the UK as a "safety wire."

Dolly grip A grip who operates the camera dolly.

Doorway dolly A narrow, steerable dolly that will fit through a standard-width doorway.

Dots Small round nets or flags used to kill hot spots.

Double 1. A scrim that reduces the light by a full stop. 2. A net that reduces the light by a full stop.

Duvetyne Heavy black cloth used for flags and teasers. Usually treated with fire retardant. Known in the UK as "black bolton."

Edison plug Standard household electrical plug. The UK version is a 13-amp plug.

Egg Crate A deep grate that allows soft light to be controlled into a directional beam rather than spreading all over the place. The deeper the egg crate is, the more control it provides. So-called because it looks like partitions that hold eggs.

Electronic ballast A solid-state high-frequency ballast for fluorescent tubes or HMI lights, as opposed to the cheaper magnetic ballast.

Ellipsoidal A lensed instrument based on an ellipsoidal reflector. It throws a hard, even beam and can be used as a sort of projector for patterns. Known in the UK as a "silhouette," a "sill," or sometimes a "profile spot."

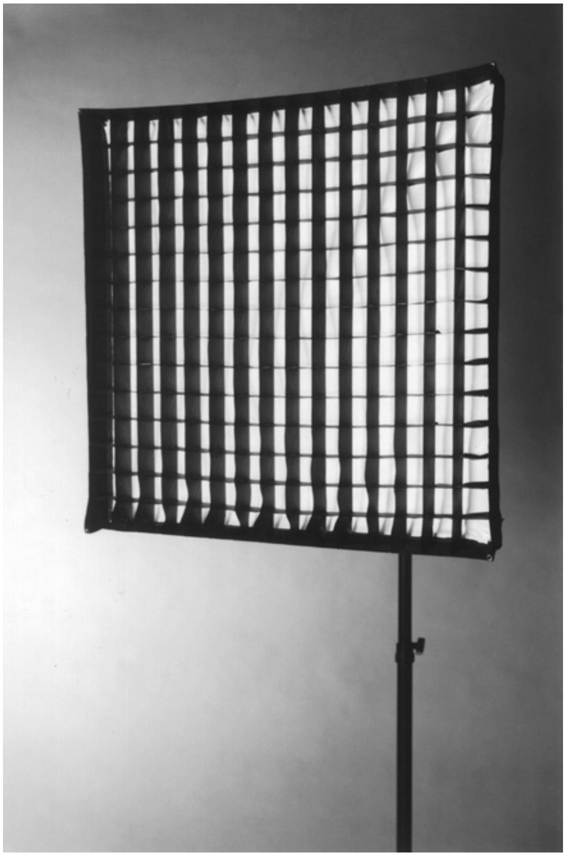

FIGURE G.3
A soft bank with egg crate to create a tighter beam of soft light. Courtesy Lowel Lighting, Inc.

Expendables Supplies that are used up in production such as gaffer tape, gels, and blackwraps. Known in the UK as "consumables."

Eye light A small instrument positioned to create a glint in the subject's eye.

F-stop A measure of the lens's light transmission. F-stop is calculated based on the diameter of the aperture. High-end lenses will also have a T-stop rating, which is based on an actual measurement of the lens's performance at different apertures.

FAY Designation for a type of PAR lamp with dichroic coating on the lens. FAY lamps emit blue light in the 5600-K range.

Feeder Heavy power supply cable. In the UK, a "Point One" or 32-amp feed, or a "Point Two" or 64-amp feed.

Fill Light used opposite the key to provide lower level illumination in shadowed areas.

Finger Small rectangular nets or flags used to control hot spots.

Flag An opaque rectangle, usually black cloth stretched over a wire frame, that is used to block light to a certain area. Same as a gobo or a cutter. These are sometimes made out of thin plywood painted black, but more and more you'll see black foamcore used as a disposable, easily reshaped flag.

Flex arm A jointed arm that can hold a flag or small instrument.

Floater A flag, net, or instrument that is moved during the shot. Floating a net in front of an instrument when an actor passes too close is also known as "Hollywooding." Ah, the verbification of the language!

Flood Wide-angle setting of a focusing instrument or any light that throws a wide pattern, such as a broad or a scoop.

Fluorescent Tubular lamp that creates light by exciting mercury vapor gas, which then emits ultraviolet radiation. The interior of the tube is coated with a special phospor that emits visible spectrum light outward when excited by the internal UV radiation. Special phosphors have been developed to give wide-spectrum light output and specific color temperatures.

Foamcore ¼-inch polystyrene sheet sandwiched between paper. Easy to cut; is stiff and handy. Available in white, black, and colors. Used as bounce cards, impromptu flags, and cookies.

Focal length Distance between the optical center of the lens to the target when the lens is focused on infinity.

Footcandle Older standard measure of illumination; one lumen per square foot.

Footlambert Unit of luminance equal to $1/\pi$ candela per square foot.

Four by four A flag that is (surprise!) 4 feet by 4 feet.

Fresnel 1. Stepped lens designed by Augustin Fresnel. 2. Focusing lensed instrument based on the fresnel lens. Most common and flexible instrument in film and television use.

Frog An arrangment whereby light is bounced off a bounce card held at an angle. Known in the UK as a "poly bounce" or as a "bounce."

Frost Diffusion material made of frosty sheet plastic. Available in several grades. May also be referred to as "diff," "diffusion," "paper," or "trace."

Fuse A link of metal that melts when too much current passes through it.

Gaffer Lighting designer or head lighting technician. In the UK, "chief lighting technician."

Gaffer tape Duct tape on steroids. 2-inch-wide fabric tape with adhesive that is strong enough to hold well but will not pull paint off walls when used carefully. Available in many colors, including chroma key green and blue.

Gamma Measure of the midrange contrast of a picture.

Gang box Electrical distribution box that breaks a 60- or 100-amp supply into four 20-amp sockets. In the UK, a "distribution box."

FIGURE G.4
A frog is an arrangement where a bounce card (here white foamcore) is angled above an instrument.

Gel Clear colored plastic sheet, usually polyethelene, used to change the color of light. Term originates from very early theatre, when the sheets were made of colored gelatin.

Glow light A weak light source that creates a bit of a glow on the actor's face.

Gobo A large flag, cutter, or even full-sized flat used to cast a shadow on part of the set. The best guess as to its origin was in the early film days, when the director would call to "GO Black Out" a portion of the set. This got abbreviated on the production notes as "GO B. O." or eventually just "gobo."

Golden hour I wish it *was* an hour. The 15 minutes or so right before the sun sets, when the quality of the light takes on a soft, glowing golden tone. Wonderful for shots of buildings, cars—just about anything. The actual length of time varies depending on the time of year.

Gray scale (or **Grey scale**) A chart with gray chips from black to white.

Grid Pipe system above soundstage where lights are hung.

Grid clamp Also known as a pipe clamp, the clamp used to suspend lighting instrument from the grid.

Griffolyn Polyethylene laminate with stranded reinforcement. Popular as large reflector or flag material for 12 × 12 or 20 × 20 frames. Originally a reinforced plastic tarp material for the farming industry. Griffolyn® is a registered trademark of Reef Industries, Inc.; often shortened to "griff."

Grip Person who handles set rigging, camera support, and sometimes flags, nets, and silks. In the UK and most of Europe, the grips are dolly or crane grips only, and the sparks (electricians) manage textiles and set flags.

Ground fault interrupter (GFI) also **ground fault current interrupter (GFCI)** Safety device designed to protect from electrical shock by interrupting a household circuit when there is a difference in the currents in the "hot" and neutral wires. Known in the EU and UK as a "residual current device" or RFD. In Italy, it is called "salvavita" (life saver), probably the best term yet.

Ground lifter A cheater. Adapter for nongrounded Edison plug (United States only).

Ground row Row of cyc lights on the floor (ground) shining up on cyclorama or backdrop.

Hair light Backlight positioned above and just slightly behind subject to create highlight on the hair.

Halogen Class of inert gas used in many tungsten filament incandescent globes; may include astatine, bromine, chlorine, fluorine, or iodine.

Hertz Measure of frequency in cycles per second. Named after nineteenth-century physicist Heinrich Rudolf Hertz, who proved that energy is transmitted through a vacuum by electromagnetic waves.

High key Lighting scheme where the ratio of key to fill is nearly 1:1.

HMI A modern arc instrument where the arc is enclosed in a replaceable globe. Technically, HMI is short for Hydrargyrum Medium-arc Iodide, a variety of short-arc metal halide lamp.

Hollywood (noun) Originally "Hollywoodland," a housing development outside of Los Angeles that made good by becoming accidentally associated with the filmmaking industry.

Hollywood (verb) Floating a net in front of a light during a shot, usually when a subject must walk closer to the instrument and the light level needs to be reduced.

Honeycomb A shallower version of the egg crate; a crosshatch grid that prevents the spread of diffused light source.

Hot spot An overexposed reflection or highlight that exceeds the latitude of the camera.

House lights The existing lights in a location.

Hue Technical term for color.

Incandescent Lamp type perfected by Thomas Edison; creates light by passing electrical current through a thin filament, which then glows or incandesces.

Incident Light falling on a subject, as opposed to light reflected from the subject. When using a light meter to measure incident light, the meter is pointed toward the light source rather than toward the subject.

Inkie A small fresnel, usually 250 watts or less. Short for inkie-dink.

IRE Colloquial term for measurement of the amplitude of the video signal. The visible luminance of the video signal is divided into 100 units, or "IRE," with 100 IRE being maximum for legal white. IRE is the abbreviation of the Institute of Radio Engineers, a name long since changed to the Institute of Electrical and Electronic Engineers, or IEEE. But everyone still refers to signal units as "IRE" anyway. At least it has an historical derivation, makes more sense than a "2 K dingle."

Iris The adjustable opening behind the lens that controls the amount of light admitted to the camera.

Japanese lantern A wire and paper ball with a lamp inside. Also known as a Chinese lantern. Useful for soft diffused light.

Junior Hollywood term for a 2-K fresnel. Elsewhere, just a "2 K."

Kelvin An absolute unit of temperature and light color. Based on the color emission of a theoretical black body at different temperatures measured from absolute zero. Named after its inventor, nineteenth-century physicist William Thomson, Lord Kelvin.

Key light The main light source for a scene.

Kicker A light positioned behind the subject and off to the side opposite the key.

Kit rental Fee added to day rate when using the gaffer's lights.

Lamp Can refer to the bulb (globe) or to the entire lighting instrument.

Latitude The contrast handling of a camera, the range between overexposure and underexposure.

Lavender A specific grade of silk that has a light purple tint. Provides both light diffusion and a reduction of intensity.

Layout board Sheets of very heavy cardboard laid down on a location floor to avoid damage from dollies and grip equipment. In the UK, this is known as "airtex" or simply as "floor protection."

Leko Original brand name for ellipsoidal instrument. Short for the inventors Joseph Levy and Edward Kook, co-owners of Century Lighting.

Limbo A seamless backdrop, often roll paper.

Louvers Shutters that control the spread and direction of light.

Low-contrast (LC) filter A camera lens filter that effectively reduces the contrast of the picture.

Low key Lighting scheme in which there is a large difference between the intensity of the key and fill lights. The *film noire* genre uses a very low key lighting scheme, creating a shadowy, contrasty look.

Lumen Measure of light intensity, over the entire spread of the light beam. Candelas measure only one direction of emission, whereas lumens are a rating of the candela multiplied by the entire spread of the beam, taking into account varying intensity at the middle and edges of the beam.

Luminaire European term for lighting instrument, used more in the theatre than in television or film.

Lux Similar to a footcandle, except metric. One lumen over one square meter.

Macro Shooting in extreme close-up.

Magic hour The 15 minutes or so right after Golden Hour, immediately after the sun has gone past the horizon. Only an hour in a DP's wildest dreams.

Master shot The wide establishing shot that shows the position of all the characters on the set and in relation to one another.

Meat axe An adjustable boom pole or gobo arm swivel mounted to a C-clamp that can grip a pipe, such as the handrail of a catwalk. Don't ask, I haven't a clue. It doesn't look like a meat axe at all. Can also refer to a "topper" or "top chopper" flag.

Minus green Magenta gel that filters green from a light source. May be used to remove green from a fluorescent source to match an incandescent light, for instance. Available in various grades.

Mired Acronym for "Micro Reciprocal Degrees," a method of calculating the compensating difference between Kelvin ratings.

MOS Taping or filming without live sound. The best story I've heard for the origin refers back to the accent of the German directors of the early film industry, "Mit Out Sound." Or it could be "Missing Optical Sound" or "Motion Omit Sound." Nobody knows.

Motivated lighting Light that seems to come from existing light sources in the scene. They can be on-screen (practicals) or off-screen (sun, moon, window, firelight).

Musco light An array of HMIs mounted on a crane.

Negative light or **negative fill** Simply placing a large black flag or flat near a subject on an overcast day to cast a shadow on one side of the face and thus create contrast. This nifty term sounds like something only a physicist could explain. Fire up the Heisenberg Compensator, Scotty, we need some negative light on this starship set.

Nets Bobbinet or black net fabric on a frame. Used to reduce light intensity, nets are available in single (half-stop) or double (full stop).

Neutral density (ND) Gel or lens filter that reduces light transmission without coloring the light.

Nook A small open-faced instrument.

NTSC National Television Standards Committee. Also refers to the television signal standard set by that committee and used in the United States, Canada, Japan, and some other countries in the Western Hemisphere.

Obie A camera-mounted eye light, named after actress Merle Oberon.

Opacity The measure of light transmitted through a gel or filter.

Open face 1. An instrument that does not use a lens to focus light. An open-faced light can in fact have a glass shield or scrim over the reflector as a safety. 2. The opposite of "poker face."

PAL Phase Alternating Line, the television standard used in most of Europe and countries formerly under European control.

Pan Horizontal move of the camera on the tripod.

PAR A lamp that incorporates bulb, reflector, and lens into a single unit. Short for Parabolic Aluminized Reflector. Old-fashioned auto headlights are PAR globes; so are the floodlights for your yard. Some newer PARs are not solid units but rather systems of interchangeable lenses and reflectors that snap together.

Party colors Gels of intense primary colors.

Pattern A metal disk with cutout shapes designed to be used in an ellipsoidal light to project a sharp, defined pattern. Often called a gobo.

Pedestal Video black level set at 7.5 IRE; used in most NTSC countries except Japan, which uses 0 IRE black. Also known as *setup*. PAL does not use pedestal.

Phase 1. In electrical power, one leg of AC power. 2. In the television signal, the relationship between the signal frequencies that control hue.

Photoflood A high-output bulb for photographic use. Available in 3200-K and 5600-K color temperatures. Being short-lived, it is better for still photography than for video or film use.

Plate Shot or graphic to be used as background in a composited process shot.

Plus green A green gel used to add green to a light source. May be used to match an incandescent instrument to fluorescent light. Available in several grades.

Polarity Direction of DC current, positive to negative. Don't mix up the + and the − please!

Poly A type of housing insulation made of polysterene beads formed into a flat board. Used to create soft, diffused bounce. Known in the United States as "beadboard."

Poultry Bracket A light mount that straps onto a tree or telephone pole. Don't ask me about origin of this name. Unless maybe pigeons like to sit on it?

Practical A light source that appears in the shot. Generally, must be lower intensity than the real thing would be in normal life.

Process shot A shot that will be composited with another background, as in the subject shot in front of a greenscreen or bluescreen.

Profile spot British term for a lensed instrument based on an ellipsoidal reflector. Throws a hard, even beam and can be used as a sort of projector for patterns. Known in the United States as a "Leko" or as an "ellipsoidal."

Punch The ability to throw light. Diffused light has little punch, while a fresnel set on spot has a lot of punch. Technically, an unscientific assessment of specular collimation—how closely parallel the photons travel.

Quality Refers to the overall effect of the light source. The light may be hard or soft, have a lot of wrap or little wrap.

Quartz bulb A tungsten-halogen globe. The term comes from the heat-resistant quartz glass used in these bulbs.

Rags see *Silk, lavender, and scrim*. Obvious origin.

Redhead An open-faced 1 K by Ianaro/Strand, the little sibling of the Blonde. Sometimes called a "mickey."

Reflector Any shiny surface used to bounce light. Often a foil-covered board. Collapsible fabric reflectors are very handy for location shoots.

Residual current device (RCD) Safety device designed to protect from electrical shock by interrupting a household circuit when there is a difference in the currents in the "hot" and neutral wires. Known in the United States as a "ground fault interrupter" (GFI) or "ground fault circuit interrupter" (GCFI). In Italy, it is called "salvavita" (life saver).

Riser The portion of the light stand or C-stand that is adjustable; also a platform to raise the lights or camera.

Rough-in First placement of the lights, before fine tuning.

Safety wire Safety cable used to attach instruments to grid. Sometimes known in the United States as a "dog collar."

SCR dimmer Solid-state dimmer based on Silicon Controlled Rectifier. All modern dimmers are based on the SCR. Older dimmers were variable transformers.

Scoop An open-faced instrument that uses a large, hemispherical reflector.

Scrim 1. Metal screen that acts to cut down the light without changing its color temperature. Light scrims are circular pieces of metal screen that slip into the gel holder on the front of an instrument. A "single" reduces the light output by half (a full stop), while a "double" reduces the light by two stops. A "half double," however, isn't the same as a single; it's a scrim with an open upper half and screen across the lower half. 2. Gauzy fabric that is used in set construction.

SECAM A version of the PAL video standard that is used for signal transmission in France and some countries formerly controlled by France. The French must always be different. *Vive la France*!

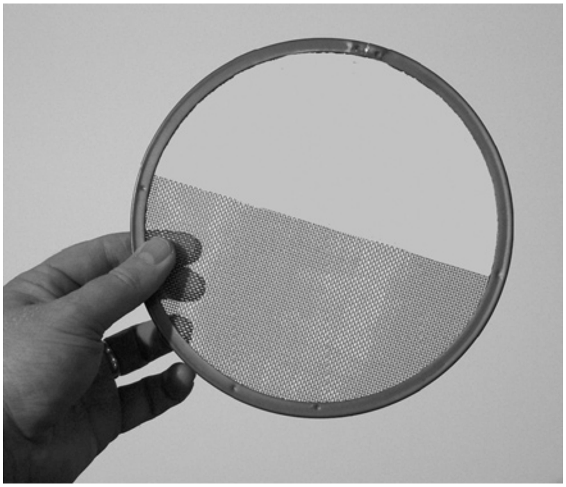

FIGURE G.5
Half double scrim.

Senior Hollywoodese for a 5-K fresnel. Elsewhere, just a "5 K."

Senior stand A braced stand that is strong enough to hold a large heavy instrument.

Setup Video black level set at 7.5 IRE; used in most NTSC countries except Japan, which uses 0 IRE black. Also known as *pedestal*. PAL does not use pedestal.

Shiny board A reflector, usually foil-covered board.

Sider A flag that cuts light to one side of the set.

Silhouette or **sill** British term for a lensed instrument based on an ellipsoidal reflector. Throws a hard, even beam and can be used as a sort of projector for patterns. Known in the United States as a "Leko" or as an "ellipsoidal."

Silk, lavender, and scrim Terms for different weights and types of light diffusion fabric. Originally made of silk, now synthetic. May be either white (providing some light reduction and diffusion) or black (providing much more dramatic light reduction). The lavender is named because of its actual color.

Single 1. A stinger or an extension cord. 2. A scrim that reduces the light by ½ stop. 3. A net that reduces the light by ½ stop. 4. What you wuz before you said "I do."

Skypan A flat, open instrument that uses a high-power (10-K) bulb to provide flat illumination of a large area such as a backdrop or cyc.

SMPTE Society of Motion Picture and Television Engineers.

Snack Box A temporary power breakout box. Usually connects to a 60- or 100-amp supply and provides several 20-amp outlets. A squarish box with a handle on top; if it had a picture of Batman on the side you could take it to school for lunch.

Snoot A tubular attachment that controls the spread of light.

SOC Society of Operating Cameramen. Ladies can join too, but not best boys unless they know how to work a camera.

Softbox A cloth and wire umbrella-like contraption that holds a large sheet of diffusion material in front of an instrument. A more convenient commercial version of the croniecone.

Soft light A type of open-faced light where the globe (usually a quartz tube) is hidden in the base and bounces outward off a curved white reflector.

Solid An opaque duvetyne flag

Specular 1. Mirror-like reflective object. 2. Hard light.

Specular reflection Reflection of light source on subject.

Speed 1. Shutter duration. 2. Light transmission of lens. 3. Light sensitivity of film or (I suppose) calculated exposure index of a video camera.

Spill Light that squirts where you don't want it. Often fugitive photons from the sides of the barn door frame.

Spot 1. In a focusing instrument, the setting where the beam is narrow and highly collimated. 2. An instrument with a narrow beam and long throw, such as a followspot.

Spun glass or **spun** Diffusion material made of a mat of glass fibers.

Staging area Temporary location for storage of equipment.

Stinger A heavy-duty extension cord, usually 12 gauge. Safety orange proliferates, but it's a good idea to have several black ones—they're easier to conceal in a set.

Taco cart A heavy duty wheeled cart that has shelves and compartments to hold bounce boards, rolls of gel, small to medium lights, and other grip equipment.

Storyboard A cartoon drawing of each shot in the script.

Target Whether film frame or CCD, the place where the lens focuses the image inside the camera.

Teaser Large black cloth that is hung to block light.

Teching down Reducing the reflective value of white fabric in costumes. From the original Technicolor process, when white shirts would be soaked in tea.

Tenner A studio10-K fresnel. In the UK, "10 K."

Three-phase AC power as it comes from the generator. Each of the three "legs" is a single-phase sine wave offset from the next by 120°. The fourth wire in three-phase power is the ground.

Tie-in Temporary hookup to main service. Should be done by licensed electrician and may be illegal in some areas.

Tilt Vertical rotation of camera on tripod; as in "tilt up." You would never "pan up."

Top chop A cutter that throws a shadow on the top portion of the picture; same as a topper.

Top light A light that shines directly down on the subject.

Topper A cutter that throws a shadow on the top portion of the picture.

Tough gel Gel designed for use in high-heat situations. Basic theatrical gels will burn when used near the front of hot studio lights; so for film and video only tough gels should be used.

Tough spun Fibrous diffusion material designed to withstand the heat of studio lights.

Transfer region The transition edge of a cast shadow. Hard light will have a sharply defined transfer region, while soft light will have a more gradual transition from shadow to light. Also known as "transfer zone."

Translucent Semitransparent object that transmits light with some diffusion effect.

Transparent highlight Specular reflection that allows the color and texture of the underlying surface to be visible. If overexposed, the highlight becomes clipped and is no longer transparent.

Trombone A telescoping contrivance that hangs from the top of a set wall to provide a light support 2 to 4 feet from the top of the wall. Presumably derives its name from the telescoping section, which acts like a slide trombone. Does not play any notes.

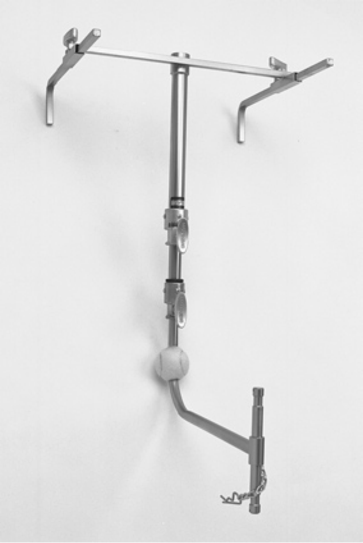

FIGURE G.6
A "trombone" is used to hang a light from a set flat. Courtesy Matthews Studio Equipment, Inc.

Truss An engineered reinforced beam used for hanging lights. Usually tubular construction welded in triangular form.

Tungsten 1. Lamp that uses a tungsten filament. 2. Material used in the filament of most incandescent bulbs.

Turnaround 1. A double-ended connector. 2. The amount of time between wrap and call next day, generally 10 hours. 3. Reverse angle of basic shots of a scene.

Turtle A floor mount for an instrument.

Ulcers A cutout pattern that is used to break up the light into a dappled pattern. Useful for simulating dappled light under trees or often used in night scenes. Known in the United States as a "cookie" or "cucaloris." Also what DPs and gaffers get from overbearing know-it-all producers.

Ultraviolet Just beyond the top end of the visible spectrum. UV light can make certain pigments fluoresce and so can be used for some types of special effects. Those around in the 1960s and early 1970s would know all about UV or "black" lights and psychedelic posters.

USITT United States Institute for Theatre Technology.

Variac A variable transformer.

Vectorscope An oscilloscope calibrated to measure the chroma and hue of the video signal.

Volt Measure of electrical energy. While amperage measures the quantity of flow, voltage describes the electrical potential or difference between positive and negative. The name derives from Allessandro Volta, the inventor of the battery.

Waveform monitor An oscilloscope calibrated to measure the luminance of the video signal, as well as display the sync and color burst.

Western dolly A wooden dolly with pneumatic rubber tires.

White balance Procedure for adjusting a video camera to recognize a specific color temperature as "white." This is done by electronically adjusting the gain of the Red, Green, and Blue CCDs while the camera is aimed at a white card illuminated by the main light source in a scene.

Xenon High-intensity gas discharge lamp usually used in strobes.

Zebra display Special indicator that appears in a camera viewfinder to indicate exposure levels in picture.

Zip cord 2-connector molded wire; also called lamp cord.

Zip light Compact 1-K or 2-K soft light. In the UK, these are known as "Zap lights."

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