Chapter 5: Fundamentals of Lighting

The Importance of Lighting

In the “real world” we see with our eyes, and because they so readily adapt to different lighting conditions, most of us take lighting for granted. But when we make and watch television we only see what the camera lens sees, and no camera lens comes close to duplicating the capabilities of the human eye. The electronics and optics of cameras do not adjust to different lighting environments nearly as well as the human eye, and what the camera sees depends greatly on the lighting in that environment. The role of the Lighting Director, which out in the field may very well be the cameraperson, is therefore extremely important.

The Lighting Director’s Concerns

The Lighting Director has two types of concerns:

Technical Needs:
- **There must be Enough Light for the cameras to be able to reproduce a sharp, three-dimensional image.** The Studio’s 3-chip cameras give finely detailed pictures, but only under very brightly lit conditions. The much cheaper 1-Chip camcorders don’t give as detailed resolution, but they can see with much less light (lower lux).
- **The light sources should all be of the same Color Temperature.** Color Temperature describes the relative reddishness or bluishness of light, and is measured in degrees Kelvin (K). Curiously, the lower the Color Temperature, the redder or warmer the light; the higher the Temperature, the bluer or colder the light. Candlelight is about 2000 K, which is why it looks so yellow. Studio lamps are rated at 3200 K, and because they are halogens, will maintain that same temperature until they burn out. In contrast, incandescent bulbs gradually lose Color Temperature as they age. Sunlight varies depending on time of day (when is the best time to take outdoor pictures of people?), but at midday is generally rated at about 5600 K. Fluorescent lights are the worst to work with, because their temperature varies depending on the gas used, and this pulsating gas actually emits a constantly varying Color Temperature.
- **The Contrast Ratio or brightness range should be close to 20:1, i.e., the brightest spot should be 20 times more intense than the darkest spot.** You won’t be able to measure it without a light meter, but you can make good judgments just by looking at the picture in a monitor and maximizing the amount of detail you can see in both the lightest and darkest areas of the picture.
- **The lighting shouldn’t be overpowering, but rather be Comfortable for your Talent to perform well under.**
**Creative Needs:**

- **The Lighting Director's other job is to create a specific composition or Mood with the lighting.** Mood refers to the depth, contrast, and feel of a scene. The lighting can be naturalistic or highly dramatic; intimate or intense; white, colored with gels, or patterned. Intensified light levels in one part of the set and lowered levels in other parts will draw the eye to important features in the frame.

**Lighting Techniques**

**Three-Point Lighting**

In the Studio, the lighting is often done with Direct Lighting. This is possible because of the plentiful supply of electricity and air conditioning, the permanent grid full of lights, and the relatively long distance between the lights and the talent.

In a Studio and in some Remote settings, Direct Lighting starts with a Three-Point Lighting set-up. This set-up begins with the axis, an imaginary line drawn between the camera and the subject to be lit.

**Key Light:** Is the main source of illumination for the subject. It is placed at a 45 degree angle from the axis.

**Fill Light:** Is a more diffused light that reduces the contrast and softens the shadows on the subject caused by the Key Light, and adds an overall brightness to the scene. It is placed at a 45 degree angle on the other side of the axis, opposite the Key Light.

**Back Light:** The back light shines on the subject from high and behind, accenting the shoulders and head in order to give depth to the picture and separate the subject from the background. It is placed behind the subject, directly opposite the camera.

A Spotlight is usually used for the Key and Back Lights because it can be directed, whereas a Flood Light is used for the Fill Light. Most of CCTV’s spotlights are adjustable between spot- and flood-light settings; adjust them according to your needs and preferences.
When sufficient lighting fixtures are available, such as in a TV Studio, other types of lights may be added:

**Background or Set Light:** Is different from Back Light, in that its job is to illuminate the set and/or background, not the talent.

**Chin Light:** Is often needed in confined settings when the steep angle between the lights and the talent causes dark shadows under people's chins. To counter this, mount a field kit light on a low stand and point the light UP under the talent's chin. To keep the talent from going blind and getting uncomfortable, place the light stand off to the side and cover it with diffusion.

**Eye Light:** Mounted on top of the camera, this small spotlight is used for eye sparkle or to illuminate objects in dark corners of the set.

**Kicker Light:** Provides directional illumination from the back, off to one side of the subject, usually from a low angle opposite the Key Light.

*Indirect Lighting: Doing More With Less*

When you start to apply the 3-point lighting technique in the field, you quickly appreciate the advantages of working in the Studio: A grid stocked with plenty of lights, no shortage of power and air conditioning, large distances between the lights and the talent, all the lights are the same color temperature. So when you get to the field, you soon begin thinking about how to accomplish the same goal with less equipment. This is where Indirect Lighting can be your friend.

There are two ways of lighting a space, which are not mutually exclusive:

- with **Direct** Light: The light source is pointed directly at the subject.
- with **Indirect** Light: A source's light is bounced off another surface such as a white wall or a reflective umbrella and then illuminates the subject.

Because Direct Lighting can be rather harsh on the subject, Indirect Lighting is preferred in many situations. Lamps can be directed at a reflective surface, usually a white ceiling or wall, and bounced back onto the subject. This method provides less overall illumination than Direct Lighting, but is much kinder to your subject and looks more natural.
There are many advantages of working with indirect light instead of direct light; in the field, these advantages can be critical to your success. These advantages include:

- Fewer fixtures mean less gear to haul around;
- Fewer fixtures translate to fewer power cords in the way, fewer outlets needed, less draw on the electricity, less likelihood of blowing a fuse;
- Fewer fixtures means less heat and less direct light generated, which translate to more comfortable talent; and
- Indirect light is kinder to your talent, makes them look more natural.

**Introduction to Lighting Equipment**

**Types of Lighting Fixtures:**

**Spot Light:** Concentrates its beam over a limited area, and is often used as a Key or Back Light. With a Focusing Spot, the intensity of the beam and the area covered is adjustable. TV Spots are designed to remain soft at the edges of the beam, to aid in evenly blending illumination from several sources.

There are three kinds of Spotlights:

- **Fresnel:** Fresnel spotlights have a movable lens which adjusts from spot light to broad light. Even in broad setting, they create softer edges than broad lights. They are very common in Studio settings where plenty of power is available.

- **Open-Faced:** Are more common in the field, where their higher output (lumens per watt) and lower weight are important advantages.

- **Ellipsoidal or Lico:** This light consists of a lamp, reflector, framing device, and lens. This assembly holds a cut-out pattern called a Cookie, which blocks light in a stylized pattern. You may purchase more than 200 patterns.

**Broad, Flood, Scoop Lights:** Are designed for maximum area coverage rather than high central intensity. They throw a highly diffused (unfocused), even light over a wide area, and are appropriate for use as a Fill or Background Light.

**Softlight:** Is a kind of Broad Light, constructed in such a way that the light from it is not aimed directly at the subject. The Softlight's advantages over a regular Broad Light are softened shadows and the fact that the subject doesn't have to endure the harsh glare of a Direct light. For these reasons, the Softlight is preferred when only one light fixture can be used.

**Lighting Accessories:**
Barn Doors: Hinged shutters or flaps, usually 2 or 4 per light, which attach to the front of the light fixture and are used to control the shape of the light beam and to prevent light from striking unwanted areas of the set. The edges of the lit area defined by Barn Doors are usually soft.

Cookies: Metallic cut-out patterns that are used to create stylized patterns of light. They can be used to cast a patterned image on the background set (cityscapes, for example) or on the foreground talent (to simulate the appearance of light coming through a shuttered window, for example). You can purchase special spotlights (lico or ellipsoidal) and prefabricated metal cookies, or make your own heat-resistant metal cookie and place it in the gel frame of an ordinary spotlight.

Diffusers: Are used to reduce the intensity of a lamp without affecting its color. Usually mounted on the light fixture itself, diffusers come in a variety of materials, such as glass, fabric, or gel. The kind we generally use is a fabric kind called "tough spun."

Dimmer: An electrical device that variably controls the intensity of a light source.

Flags: Are also used to block out light, but they create much harder edges defining the lit area than Barn Doors. They are normally mounted on stands separately from the light fixtures; although a person holding a big posterboard near the lamp can be a very effective Flag.

Gel: Any of a wide variety of heat-resistant, plastic film-like sheets used to diffuse, reduce, or alter the color characteristics of the light fixtures to which they are attached. Gels are used to colorize a lamp's light, or to change its Color Temperature, such as from daylight or fluorescent light to Studio light. Gels are typically placed in metallic gel frames that slide in at the front of the light.

Lighting Grid: A grid of pipes suspended below the Studio ceiling used for hanging light fixtures.

Scrim: A metal screen placed in front of the lamp to reduce, diffuse, and/or soften the light.

Umbrellas: These special umbrellas have a highly reflective silver coating on the inside, and are used to turn a harsh Direct Light into a source of softer Indirect Lighting.
Camera Adjustments That Relate to Lighting

All cameras have some controls that relate to lighting. It is important to set these controls correctly for the given situation, as a poorly adjusted camera can compromise even the best lighting job. In some cases, these controls may help you get a better video signal under poor lighting conditions, but remember that there is no substitute for good lighting.

Controls for Amount of Light:

Iris: The brightness of your TV signal is going to depend on both the amount of light in the environment and how much of that light you let into the lens. The iris is the ring that adjusts how much light gets into the lens; obviously, the larger the opening the more light gets into the lens. The size of the opening is listed in f-stops, typically ranging from f1.9 to f22; curiously, the larger the f-stop number the smaller the opening and vice-versa.

Most cameras allow you to operate in either automatic or manual iris mode. You should always try to do the best lighting job you can do first; but if you’re still not happy, you can open the Iris to let in more light or close the Iris to let in less light.

Gain: If you’ve done the best lighting you can, and you’ve opened the Iris as wide as you can, and you still don’t have enough light, it’s time to use the camera’s Gain circuit, which electronically amplifies the signal. This has the effect of making the picture easier to see, but also blockier or grainier. Most cameras have several gain up settings; you should always try to use as little gain as possible. Remember, when you boost the gain, you get grain.

Controls for Color Temperature:

White Balance: White’s white, right? Think again! Ever gone to the paint store and asked for a gallon of white paint, and been handed little chip cards showing 100 different shades of white? Well, a white object will assume different shades under different lighting conditions. Our eyes adjust for these color temperature differences without our even noticing, but cameras do not. So cameras come with white balance switches that allow you to tell it what color temperature environment you’re shooting in, by trying to match something that is supposed to be white with a reference in the camera’s memory. Different cameras have different ways of setting white balance, but most give you the choice of automatic or manual white balancing.
Filter Wheels: In addition to the White Balance controls, the 3-chip cameras also have a filter wheel attached to the lens which adjusts for the three most common professional lighting situations:

#1: 3200 K Studio Lighting

#2: 5600 K + 1/8 ND Outdoors, under sunny skies (1/8 ND stands for a neutral density filter that reduces the intensity of the light without changing its color temperature)

#3: 5600 K Outdoors, under cloudy skies

**Lighting Safety Tips**

Safety is another important concern for anyone using lights, whether in the Studio or in the field. Here are some tips for handling lighting fixtures.

The most important things to appreciate is that **PROFESSIONAL LIGHTS OPERATE AT VERY HIGH TEMPERATURES** (1000-2000 watt lights are common in the Studio, 500-750 watt lights are typical for the field). Besides worrying about blowing fuses, **YOU SHOULD BE CONCERNED ABOUT THE POTENTIAL FOR SERIOUS BURNS OR EVEN FIRE**. So…

* **Lights should not be placed close to anything that will burn.** This includes ceiling tiles, walls, floors, wood, paper, and people.

* **Similarly, nothing should touch the lamp while it is lit.** Use gel frames and/or clothespins clipped to the barn doors to keep gels and diffusion a safe distance away from the lamp. If making your own cookie, make sure it can withstand intense heat.

* **Always use heat-resistant gloves while touching hot light fixtures.**

* **Turn lights off while moving them** (to prevent damage to the filament while moving, reduce the likelihood of fire if it accidentally tips over, and to keep you from shining the light in the eyes of an unsuspecting person).

* **After setting up the lights, turn them off until just before the shoot starts.** (This also prolongs the life of the lamps, which can cost $30 or more, each!)

* **Turn the lights off as soon as the shoot is over,** since they will typically take at least 10-15 minutes to cool down. Break down the rest of the shoot first, then come back and break down the lights.

* **Don’t fully close the barn doors while the lights are on, or even while they are still cooling down.** Wait until they are cool before closing the barn doors and packing them away.
Besides intense heat, professional lights also give off intense light. And if the bulb had been mishandled, it could also shatter and send pieces flying. So…

* When turning on a light, always have it pointed away from people (including bystanders).

* When working in the Studio, always be sure to have the power to the lights turned off when moving light fixtures, changing bulbs, or plugging and unplugging them. It is extremely important to have good communication between the person up near the grid and the person operating the dimming board.

* Do not touch the glass part of the bulb at any time. The naturally occurring oils in your skin will transfer to the bulb. When the light is turned on and the bulb heats up, the parts where the oil is will heat up at a different rate than the parts you didn’t touch, causing the bulb to become misshapen and possibly to shatter.

Lighting fixtures represent tripping hazards, as well. So…

* Use gaffer’s tape to tape down lighting power cables and keep people from tripping over them.

* Use heavy objects, such as the sandbags found in the Studio, to anchor the light stands. Because of their high center of gravity, floor mounted lighting fixtures can be tipped over quite easily by someone tripping over the power cord or the tripod-style supports.

When working with lights on the lighting grid…

* Keep the safety chains securely fastened around the lights and the lighting grid at all times. If you have to detach a safety chain to move a lighting fixture, make sure there is no person or thing below which they could damage if the light fixture fell. And be sure that the safety chain is the first thing you reconnect after moving a light.

* If using a ladder, make sure that one person is holding the ladder while another is on it.