Functions of Lights

The previous section introduced three visual functions that lights can serve, but there are more than three common light functions. In this section, we will look at several functions of lights used on characters, and how to set them up in computer graphics:

- Key

- Fill

- Bounce

- Rim

- Kicker

- Specular

To serve these visual functions, lights must be positioned relative to the camera. They are generally set up after the camera has been positioned. If you later change your mind and decide to shoot your scene from a different angle, the lighting would also have to change.

Different studios have different standards for how lights are named. Most common naming schemes start with the function, or sometimes an abbreviation for the functions. If you name your lights something like Key_Sun_ onDragon or Fill_Sky_onDragon, then anyone looking at your scene or copying your lighting rig will be able to understand the visual functions of each light.

Key Lights

As mentioned earlier, the key light is the main, brightest light in the scene, and establishes the scene's dominant angle for the illumination and shadows. Choosing an angle for your key light is one of the most important decisions in lighting your subject.

Putting the key light too close to the camera can flatten the form, as shown on the left side of Figure 5.11. Swinging the key light at least 30 degrees away from the camera will give some definition to the face you are lighting, as shown on the right side of the figure.

Figure 5.11. A centered key light can flatten the subject (left); moving it to the side adds definition (right).

We are accustomed to seeing people lit from above, so it is most normal and natural to have light coming from overhead. Light from below your subject can look unnatural or spooky, as shown on the left side of Figure 5.12. Raising the key light above the eye level of your character, as shown on the right, looks more natural.
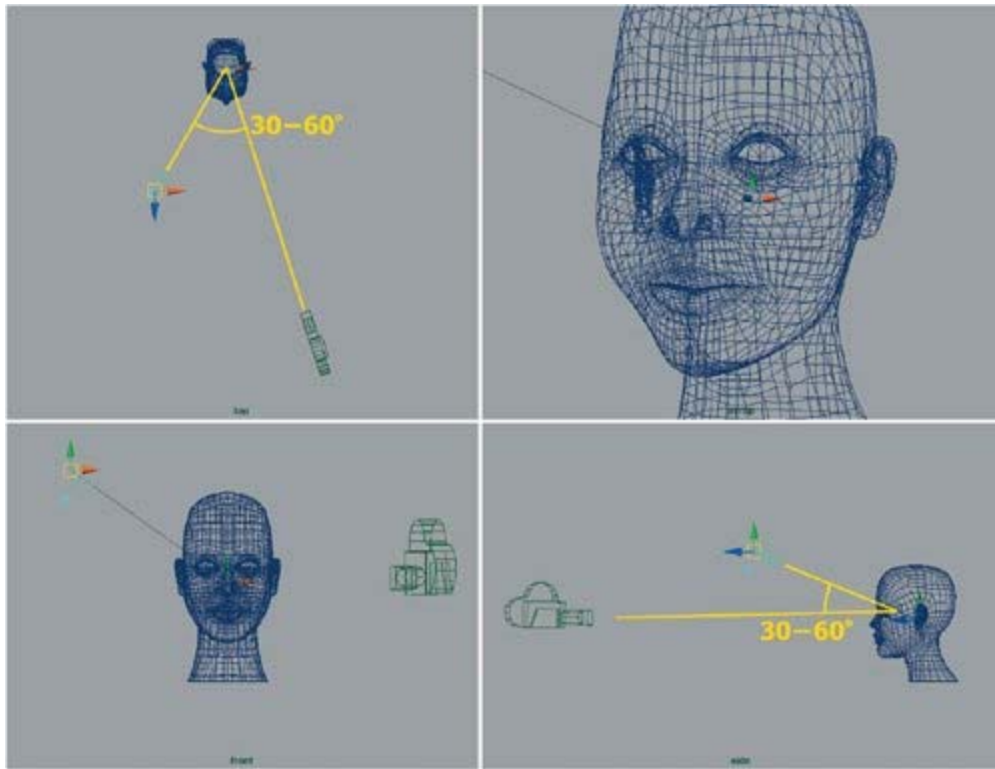
Figure 5.12. Light from a low angle looks spooky (left), while an overhead key is more normal (right).

Your key might be positioned on the left or the right, depending on what is motivated in your scene, but keys will most often be positioned above your subject by 30 to 60 degrees, and to the side by 30 to 60 degrees, as shown in Figure 5.13.

Figure 5.13. In wireframe, your key light is shown in a conventional position.

[View full size image]

Always test-render your key light in isolation, with no other lights visible in your scene. Make sure that you are happy with the illumination and shadows that your key light casts before you add any other lights.

Fill Lights

Fill lights extend the illumination beyond the key light, to make the rest of the character visible. While the key light might be motivated by the sun or a ceiling light fixture, fill light is often motivated by smaller lamps, indirect light, or the sky.

If you have already set up a key light aimed at your character and shadowing your character, then simply duplicating this light could be the quickest starting point to adding a fill. If you start with a copy of the key, be sure to rename the copy to make it clear that it is a fill light, and then swing it around to the position you want fill light to be in.
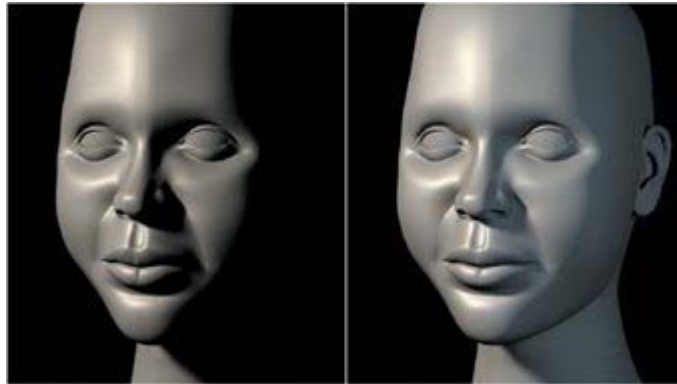
There are other things that you should adjust to make a fill light different from a key:

- Reduce the brightness of a fill light to less than half the brightness of the key.

- Give fill lights a different tint from the key. A complementary color (such as a blue fill with a yellow key) will do the most to help define the form of the character.

- The shadows cast by your fill lights should generally be softer than the shadows from the key.

Your first fill light will usually be aimed at the area in the key light's shadow. If you look at your test-render of the key by itself, as on the left side of Figure 5.14, it clearly has a black area in the areas where the key did not reach. On the right, fill light is added, continuing the illumination all
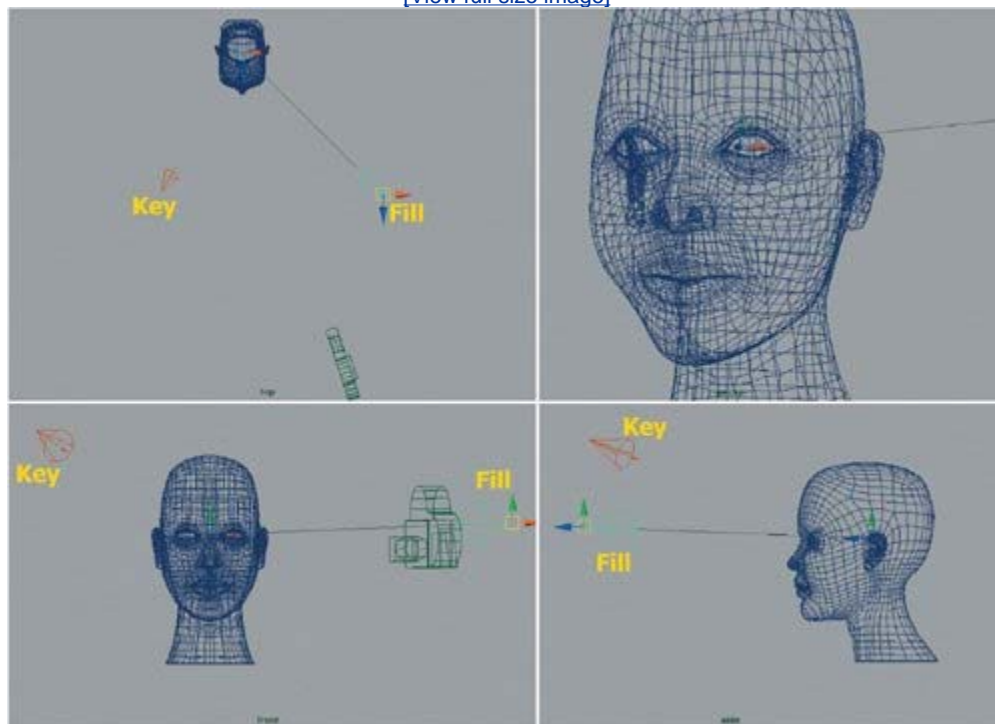
the way around the character.

Figure 5.14. A model with the key light only (left) and with a fill light added (right).

To best fill in the area the key didn't hit, fill lights are generally positioned on the opposite side of the character from the key light. You can see the position of the fill in Figure 5.15, which shows the wireframe from Figure 5.14. Often fill light comes from a lower angle than the key. If the key light is coming from a high angle, then the fill might be at about eye level to your character, or lower.

Figure 5.15. In wireframe, a fill light is added opposite from the key.

[View full size image]

You may need several fill lights to evenly light your character. Be careful that the fills don't add up to compete with the brightness of the key, which could reduce contrast and definition in the character. Very low key to fill ratios, such as 2:1 or lower, make it look like a cloudy day or a

fluorescent-lit room.

In addition to the fills that light your whole character, you can also add fill lights that use light linking to selectively light certain body parts. For example, if your character's teeth were falling into shadow, and looking too dim and yellow in comparison to the white of his eyes, you might add a dim bluish fill light, linked exclusively to the teeth and gums.

Bounce Lights

Bounce lights for characters are basically the same as bounce lights for sets, described in Chapter 4, "Lighting Environments and Architecture." Bounce lights can be considered a type of fill light; the only difference is that they simulate indirect light bounces instead of other sources of light.

To simulate light bouncing off the ground, you can aim bounce lights up through the ground. Bounce lights usually look best with a quadratic or inverse square decay, so the closer your character comes to the surface, the more the lights illuminate nearby parts of your character.

In lighting characters, you need to be especially careful that all of your bounce lights either cast shadows or are darkened by ambient occlusion, so that the inside of the mouth, nose, or other interior surfaces don't become too bright.

Also, bounce lights should not cast specular highlights. Nobody would believe that a highlight on the lower part of a character's eyeball was motivated by soft indirect light bounced off the floor.
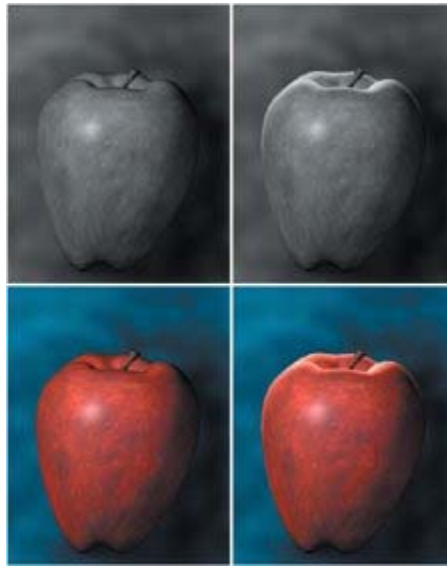
The color of a bounce light is generally based on the color of the ground, or on whichever surface the light is supposed to have bounced off. Be careful to see how this color looks on your character, however. You may want to desaturate the bounce color if it is too striking a green, for example. To help breathe a little extra life into a character, sometimes it helps to tint bounce lights on characters a warmer color than you would use on a set, to simulate indirect light from the character's skin.

Light can sometimes bounce between characters, as well. Especially if your characters are out in the sun and brightly colored, there may be times when you should add a bounce light constrained to one character to add a small amount of illumination to another.

Rim Lights

As mentioned earlier in the chapter, rim lights are aimed to create a bright line defining the edge of the character. Rim lights have their origin in black and white photography and cinematography. Figure 5.16 shows how the foreground and background in a black and white picture can be similar shades of gray (left), but adding a rim light (right) can help separate the foreground from the background. As shown on the bottom, you can use rims to add punch to color images as well.

Figure 5.16. Without rim light (left images), the apple has similar tones to the background; adding rim light (right images) makes it pop out.
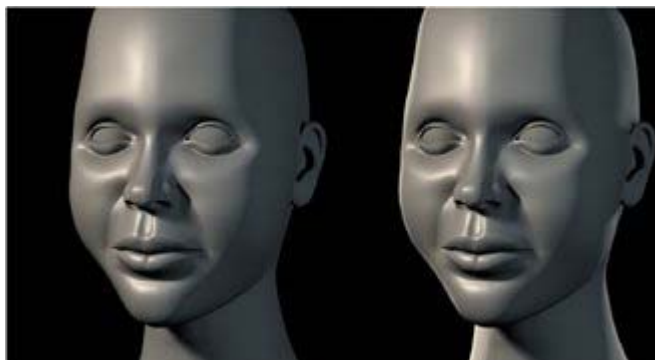
There are many uses for rim lights in CG productions:

- Visually separating characters from backgrounds, especially in darker scenes.

- Adding a sense of directionality by brightening the key side of a character.

- Drawing the audience's eye to a particular character or action you want to highlight.

- Helping to match live-action background plates. (This is because many cinematographers like shooting when the sun is low in the sky or backlighting characters.)
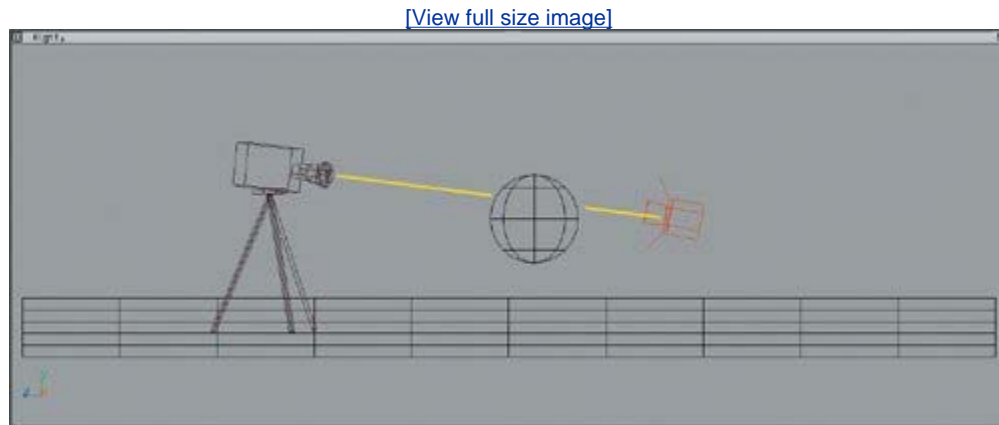
Figure 5.17 shows a character without any rim light (left), and with rim light added on the left and right (right).

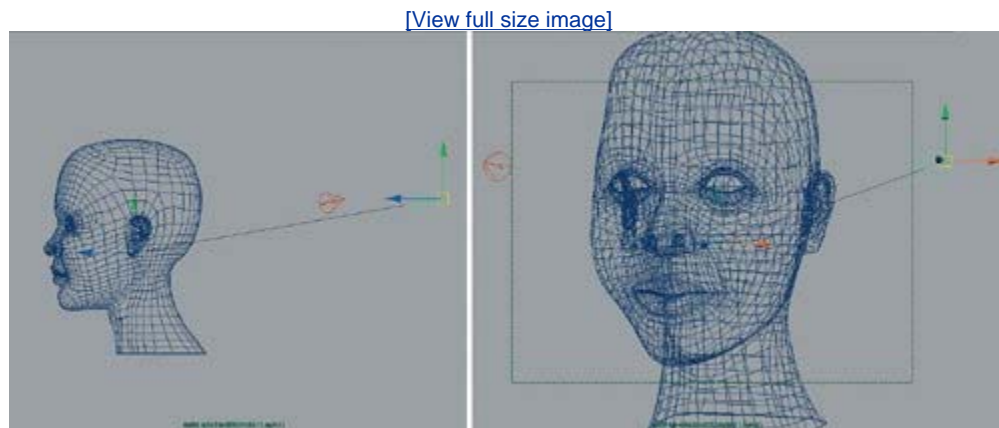### Figure 5.17. A figure without rim light (left) and with rims on both sides (right).

In live-action photography, a light directly behind a character will create a rim. In computer graphics, placing a light directly opposite an opaque object, as shown in Figure 5.18, will usually not produce any rim at all. Most often, the rim needs to be shifted above or to one side of the object, so that it is not directly behind it.

Figure 5.18. A rim light directly behind a 3D model is likely to completely disappear.

[View full size image]

To aim a rim light, start with the light positioned behind the character, and move it so that you can see the light itself when you look through the camera or perspective view of your scene. You can control where the rim light appears on your character by where the light appears in your camera view. Figure 5.19 shows the two rim lights aimed at the head. If the rim is to the right of your character in the camera view, it will add a rim to the right side of the character. If the rim is above the character in the camera view, it will add a rim to the top of the character. Looking through your camera view, you can even line rim lights up beside specific limbs or parts of the head and shoulders, and get a rim on whichever parts of the body you want.

Figure 5.19. The rim lights used in Figure 5.17 are positioned behind the subject (left) and aimed using the camera view (right).

[View full size image]

You should usually link rim lights to your character, so that they illuminate only the character and not the set. To position a rim light correctly, sometimes it will need to shine through a wall behind the character. Rim lights need to cast shadows, otherwise the mouth interior or parts of the nose or ears could receive illumination leaking through your character.

When judged through your camera view, how far away from the character you position the rim light will control how wide and visible the rim will appear. To get a thinner or more subtle rim light, move it closer to the character in the camera's view until it is almost behind the character. To

fatten up the rim and make it more visible, slide it farther away from the character, heading for the edge of the frame. To add a rim light on an especially smooth surface, sometimes you need to slide the rim slightly outside of frame.
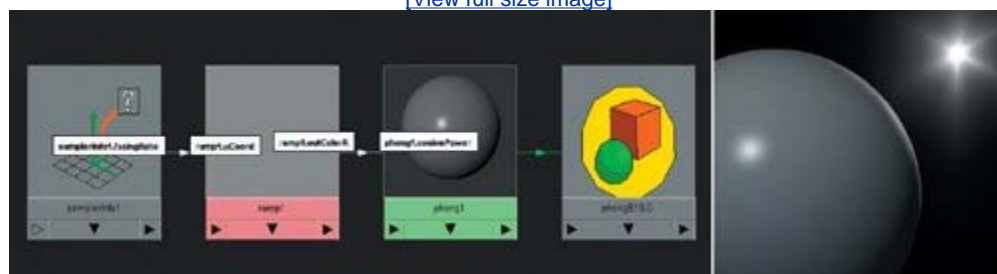
Rim light is more apparent on real people than digital objects because in real life, people and clothing are usually covered with a translucent layer of hair, dust, stubble, or other fibers. This fine outer layer picks up and transmits rim light from directly behind a person.

If you add hair or fur to an object, then rim light suddenly becomes much more apparent, as shown in Figure 5.20. Because hair adds so many translucent strands that can each catch a rim light, sometimes there's a danger that rims can be too bright on haireven if they've been properly adjusted for other parts of a character. If the hair is becoming pure white, you often need to use light linking to create a separate rim light for the character's hair, which might be dimmer or positioned more precisely behind the character.
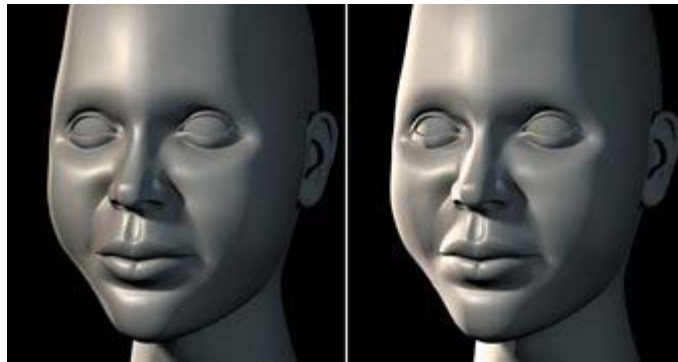
Figure 5.20. Fur responds to rim light much more readily than smooth surfaces.

Special shaders or options on lights can also help a rim light wrap farther around an object. Figure 5.21 shows one way to achieve thisby connecting the facing ratio of a surface to a shader's highlight size, giving it much broader specular response near the rim.

Figure 5.21. In Maya's Hypershade window, facing ratio is used to boost highlight size at the rim of an object.

[View full size image]

Kickers

A *kicker* is similar to a rim light, but wraps farther around the character, so that it lights one side or edge, as shown in Figure 5.22.

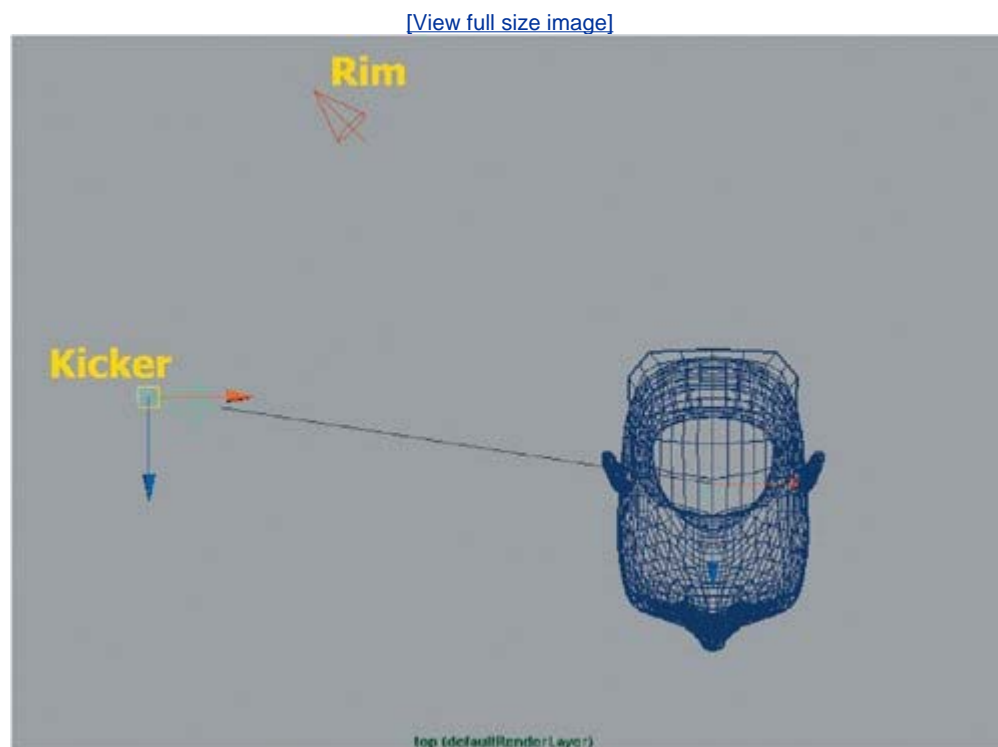### Figure 5.22. A kicker (right) lights more of the character than a rim (left).

Visually kickers can perform many of the same functions as rim lights, but are much more apparent. Kickers also can add definition to an area on one side of a character, and can help add a lot of contrast in darker scenes.

Rim lights are often cheated into scenes in places where they are stylistically needed, but not exactly motivated by any light in the scene. Kickers are usually used more sparingly, only in cases where a bright light is clearly present to one side of the character. Figure 5.23 shows the position of a kicker, more to the side of a character, compared to a rim.

Figure 5.23. While a rim is behind a character, kickers are positioned more to the side.

[View full size image]

Specular Lights

A *specular* or *spec light* is designed to add an extra specular highlight to a character. It can be any type of light source that is set not to emit diffuse illumination, but only specular.

If you are trying to make a character look wet, getting just the right highlights on his skin or hair is essential. As shown on the left side of Figure 5.24, reptile or lizard skin can look dry if it has no highlights or reflections, but adding some extra specular highlights (right) can fix that problem. To add highlights that will rake across a character's skin or hair, position the spec light roughly behind the character, much as you would a rim light.

Figure 5.24. Lacking specularity, the snake looks dry (left); a specular light adds shine to the scales (right).

As discussed below, spec lights are also ideal for adding highlights to eyes. If you want to make sure a highlight will appear in eyes, glasses, teeth, or other shiny parts of a character, position the spec light very close to the camera.

When a spec light is close enough to the camera position, you can get highlights that will remain visible no matter where a character moves during a shot.