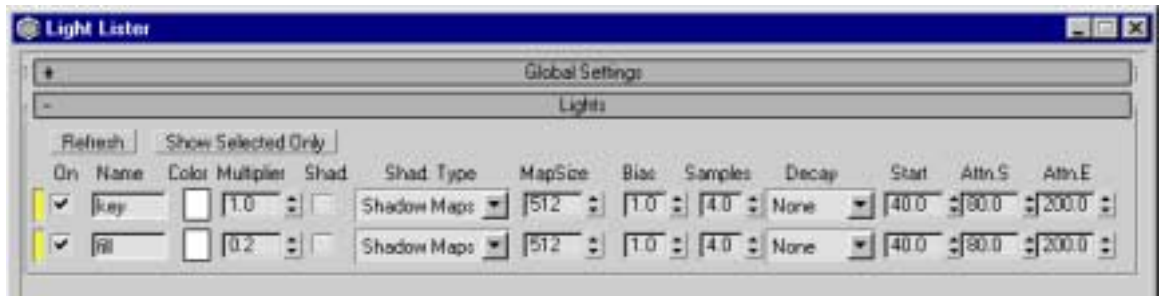
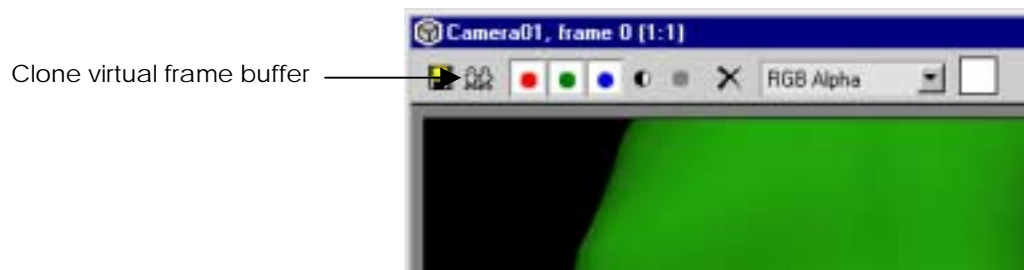


Lighting Tips

1. **Start in Darkness;** when you add a light to 3ds max - default lighting is turned off.
2. **Evaluate scene** – what type of lighting do you want; what mood?
3. **Turn off default Global Ambience:** generally robs scene of richness and variation.
4. **Add fill lights** to replace global ambience.
5. **Begin with lights and no shadows.** Use iteration instead to fake shadows.
6. **Use 3-point lighting.**
7. **Create geometry with beveled edges** (*see definition for normals*).
8. **Object materials and maps define lighting effects:** Apply appropriate specular, glow, and bump maps to objects.
9. **Isolate Lights:** (*Tools: Light Lister*) Turn off all lights then turn on one at a time and render. This way you can see which light is illuminating which part of your scene.



10. **False Colors:** Give your different lights extremely saturated colors and render. This way you can see how they interact with each other and where they blend or where they stop affecting the object.
11. **Compare renders:** render with specified lights on and off; use clone virtual frame buffer on rendered image to clone it so next render can be compared.



12. **Test your lighting for future animations:** Create an animation that revolves your camera around the object that is being lit. Check for problem spots, etc.

Lighting Terms

Global Ambience: amount of flat uniform brightness added to objects in scene. default global ambience in 3ds max is black; keep it here (*Rendering: Environment*).

Beveled edges in geometry: Geometry with beveled edges have more depth and interest because beveled edges can catch light from multiple angles.

3-point lighting: use key light and 2 fill lights to illuminate subject.

Key light: main illumination of subject and defines dominant angle of lighting (THE SUN). Usually brighter than other 2 lights. Remember we only have one sun!

Fill light: softens and extends illumination provided by key light making more of the subject visible. Also simulated reflected light and is necessary in 3d since true bounced light is not possible in 3d.

Backlight (hair light): creates defining edge to help separate background from foreground. Sometimes called hair light because glint usually comes from subject's hair.

Key to Fill Ratio: differences of intensity between brightness of fill light and brightness of key light in scene.

Shadow: the dark side of the subject generated by key to fill ration in lights.

Cast Shadow: the dark area that is cast onto other objects from the subject generated by turning on shadows for lights.

Softness: unnatural hard light most common in computer graphics. Soft light is diffused or scattered light. (kind of like a lightbulb's illumination). It is recognized as having soft edged shadows, broader, less focused highlights and shading.

Intensity: brightness of light. Consider virtual camera exposure, time of day, type of light, etc. subjective.

Multiplier: larger value = brighter light.

Color of Light: white is bright; black is dark.

Attenuation: fall off of light over distance. Brighter lights illuminate more of scene infinitely (like the sun), dimmer lights brighten only small area of scene (such as candle).

Near: Start / End: where light starts decrease in intensity from source

Far: Start / End: where a light starts to decrease in intensity at distance

Throw: pattern or shape created by illumination. Change the appearance of the scene by adding depth, invoke emotion, create realism.

Cookie: shadow-casting object placed in front of light with shadows turned on

Caustics: light thrown from mirrors, off glass near wall surfaces. Think of as dirty imperfect light that is varied and broken up from original light source usually due to what it is transmitted through (glass, water, mirror, etc.)

Specularity: the highlight of light on subject; size of specular area represents light's size.

Glossiness: represents the amount of diffusion, scatter, or spread of light on subject; defines surface of the object. Rough texture=high glossy value ; smooth texture = low.

Surface normals: renderable side of object that affects the way light illuminates object. Where normals point directly at light diffuse illumination is brightest. When surface normals are at least 90 degrees from light no illumination occurs on surface (*this is why beveling helps*).

Lighting Setups

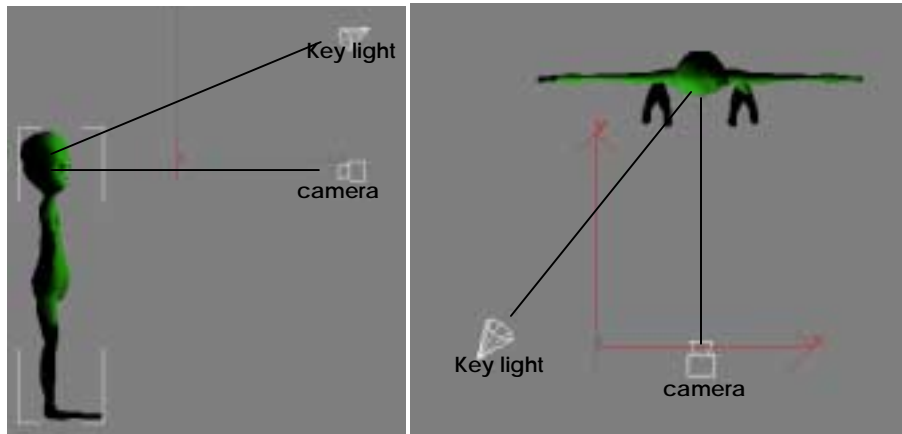
1. **ADD A SINGLE KEY LIGHT:** this represents the single main light source in scene.

Defining key light angle:

Position key light above and to side of the subject.

15 - 45° to side & above camera.

Putting key light too close to camera's angle can flatten subject. Putting key light too far to left or right of camera angle inflicts harsh distracting light and does not fully illuminate the subject.



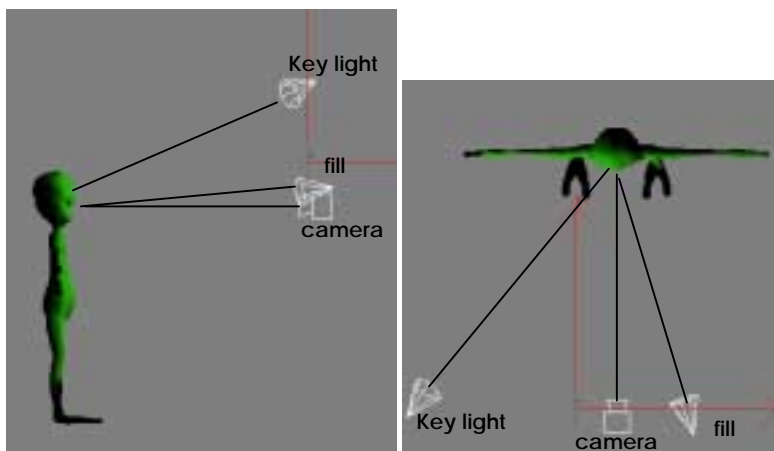
15 to 45 degrees to side of camera; 15 to 45 degrees above camera

2. **ADD FILL LIGHT(S):** Add dim fill light at opposite angle of key light. This will simulate reflected light.

Defining fill light angle:

Usually 15 - 60° to left or right of camera angle; slightly above camera angle.

Fill is lower in intensity than key light. Move closer to camera angle so areas lit by key and fill overlap (use False Colors to check overlap)



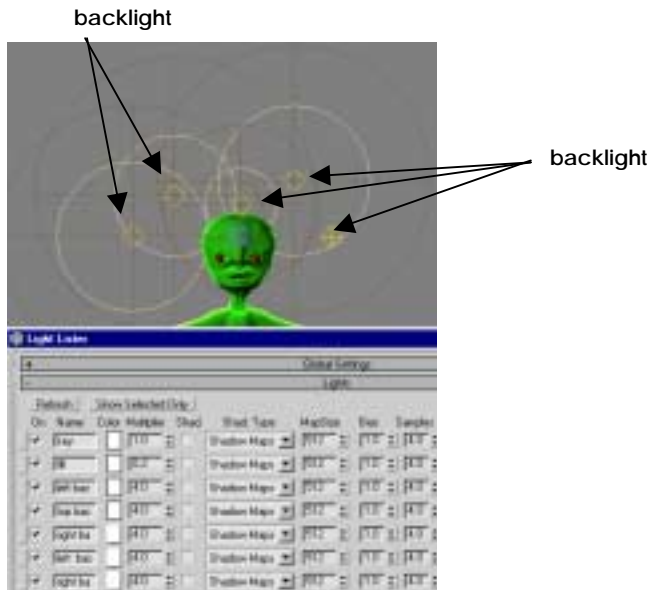
15 - 60° to left or right of camera slightly above camera- opposite direction of key light

3. **ADD A BOUNCE LIGHT:** You could also place a fill light in the same direction as a wall the subject is in front of. This light would represent the key light bouncing off the wall onto the subject.
4. **CONSIDER THE KEY:FILL RATIO:** do you have dramatic lighting or simple lighting in your scene. Look at the intensity values of all your lights when deciding.

<p>Low key to fill ratio: (2:1) Overall very bright. The fill light is half the intensity of the key. Shadows disappear or are not in the scene at all. There is little variation in tone. Good for children's stories.</p>	<p>Washed out All lights in scene have similar multiplier value and/or high multiplier value.</p>
<p>Moderate key to fill ratio: (4:1) Normal shadows with basic modeling of subjects in scene. Everything is moderately illuminated.</p>	<p>Normal shadows Key has higher multiplier value than fills lights.</p>
<p>High key to fill ratio: (8:1) Very dramatic and shadowy scenes. Dark shadows and areas of scene in pitch-blackness or close to it.</p>	<p>Dark and shadowy Key has high multiplier value and fill lights have extremely low value or no value.</p>

5. **ADD A BACKLIGHT (HAIR LIGHT):** Only add a backlight if the subject and background cannot be separated. Otherwise use attenuated lights.

Multiple backlights might be necessary to create the rim around your object since the edge of your subject will not have a true transparent edge. Attenuation must be used less the backlights will blow out your image.



Backlights directly behind object do not illuminate subject in scene!

6. TURN ON SHADOW CASTING FOR KEY LIGHT: Key light is usually the shadow light!

Shadow Casting Lights:

PROS: add contrast
holds image to ground plane
reveals alternative angles
can indicate off-screen objects

CONS: processor intensive
can clutter scene with unnecessary patterns

Raytraced verses shadow map

Ray traced	Shadow Mapped
ray traced shadows take longer to render	spot lights render better using shadow maps (omni is slower)
transparent object's ray traced shadows appear lighter	shadow maps are dependant on a set resolution (<i>Shadow Map Parameters: Size</i>)
ray traced shadows will appear crisp in scene	you can vary opacity of shadow - density settings

Softness of shadow

Shadow Map: Sample Range (bigger # = softer)

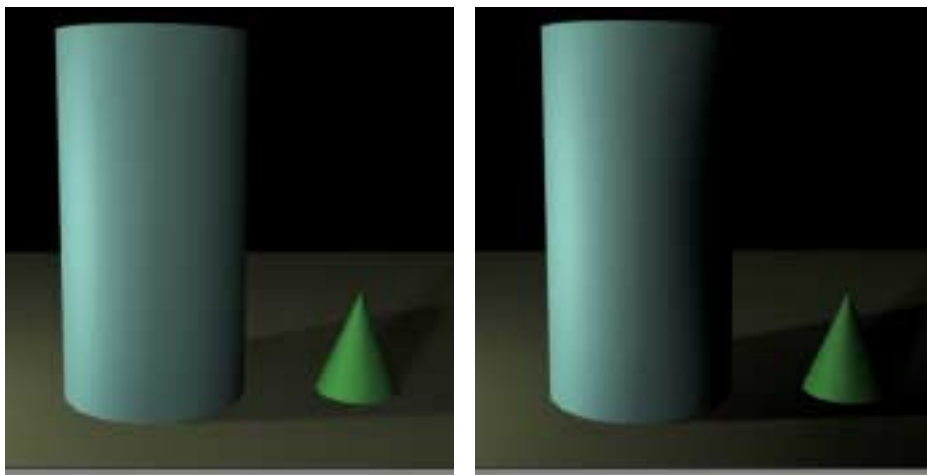
Bias: how close the shadow is to object (low # closer - higher # further away)

Raytraced Shadows: bias - same as with shadow maps; no parameters to soften shadow

How to fake shadows!

Attenuated lights (for corners of rooms)

Negative values in light multiplier (*darken shadow side of object*)

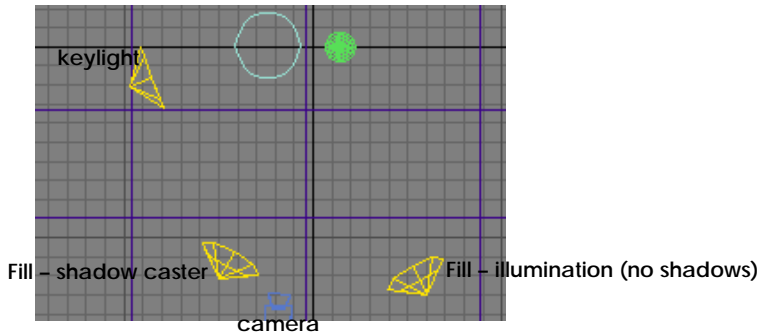


omni light added with negative multiplier of -.2 to darken right side of image

7. **INCORPORATE ADDITIONAL SHADOWS CASTERS USING FILL LIGHT:** use to add shadow to areas of scene key light does not affect (*for example an object behind another object concealed from effect of key light shadows*).

Exclude: Use shadow casting fill lights in conjunction with exclude so you can set up a fill light to add shadows to scene but not illuminate scene.

Shadow density: designate different shadow densities for key light and fill light if there are more than 1 shadow casting light in the scene. Make key light less dense than fill light so overlapping shadows can be seen where they cross.

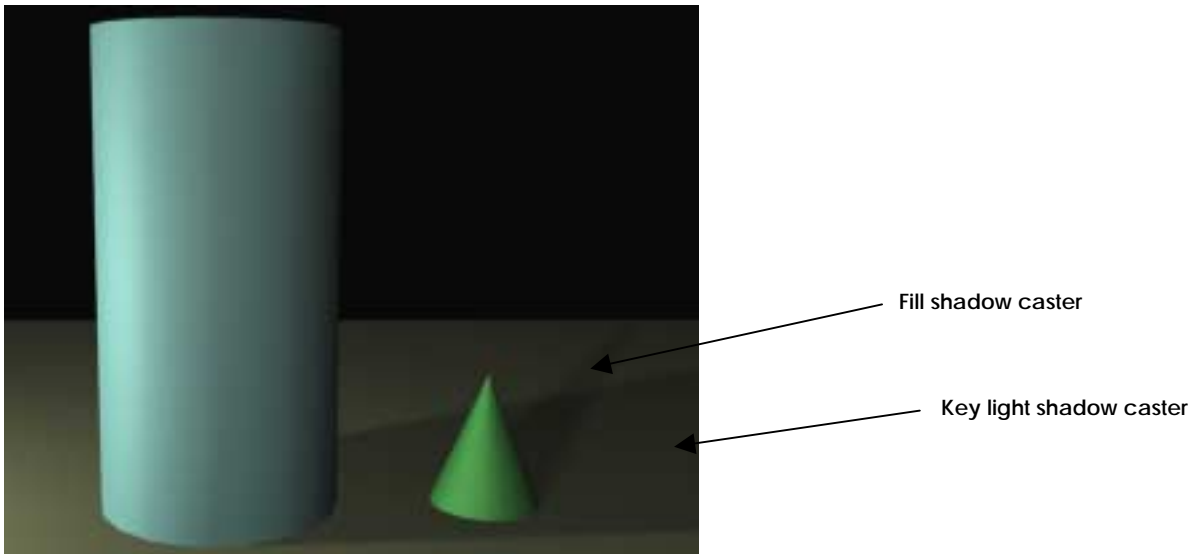


staged scene Example above:

Keylight: main shadow cast from cylinder
 does not create shadow cast from cone concealed behind cylinder
 density of keylight is half the density of fill light.

Fill - shadow caster: shadows turned on
 Shadow density set higher than key shadow density
 Excludes cylinder from shadow casting

Fill - illumination: adds illumination to side of cylinder and cone
 adds shadows but not cast shadows
 shadows turned off.



8. EVALUATE SOFTNESS OF LIGHTS AND/OR SHADOWS.

To increased softness of lights:

1. Use shadow maps and higher sample ranges
2. Lower density of shadow
3. Use 2 shadow lights to represent multiple but less intense shadows
4. Increase range between hotspot and fall off of spot
5. Turn off specular highlights on light (*uncheck box - general light parameters*)

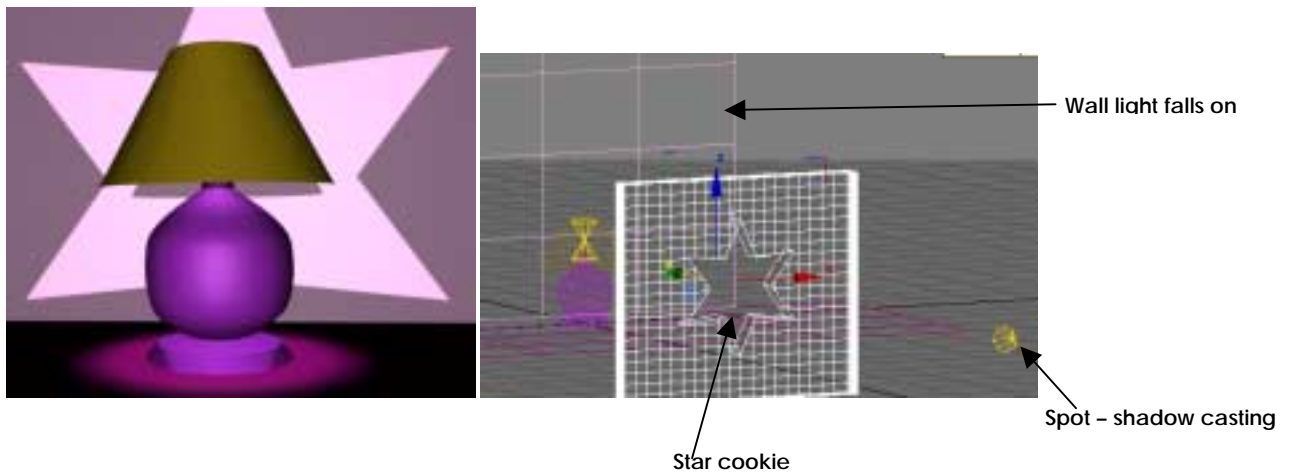
9. EVALUATE COLOR OF YOUR LIGHTS: color of light depends on type of light and film simulated.

light bulbs (tungsten light) - yellow in color

fluorescent - green in tone

sun light - generally bluer

10. ADD A THROW OR COOKIE TO YOUR SCENE TO INCREASE DEPTH OR INTEREST: Place any piece of geometry in front of shadow casting light and light reshaped.



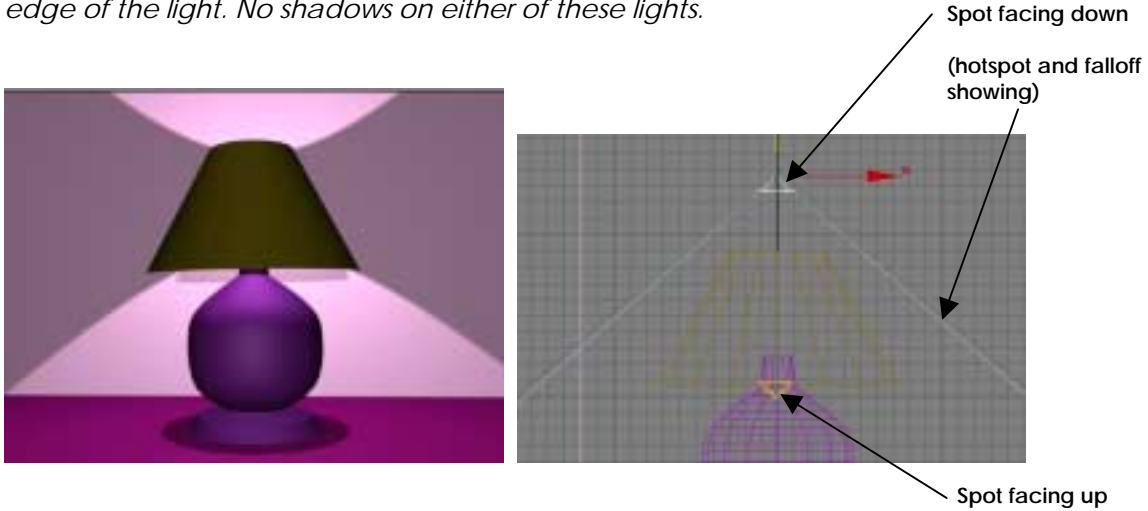
Transparent colorful objects can change the quality of light thrown on other subject in scene. (*stained glass effect*).

Caustic Lighting

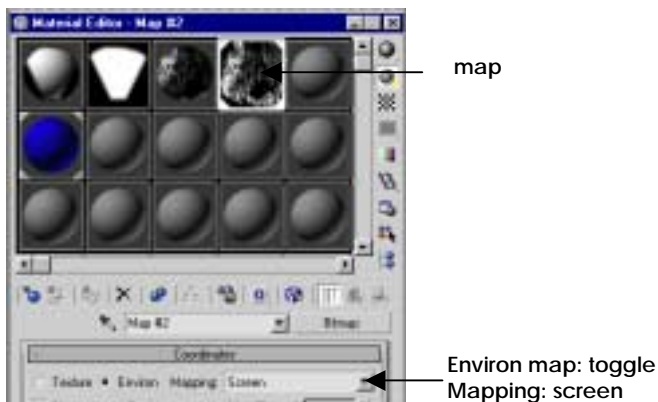
To simulate **caustic light**. Create a spot and change the color of the shadow (shadow parameters) to white. Exclude object from illumination if necessary. Add a gradient ramp map to the map button add noise to gradient ramp and tweak.

Hotspot and falloff to create shaped lights: use hotspot and fall off in spotlight to create general light shape.

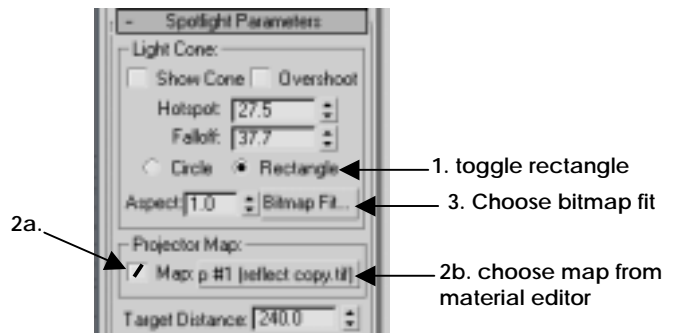
In the example below 2 spotlights are placed inside the lamp facing up and down. The hotspot is set to resemble the thrown light of the lamp and falloff is set to represent the soft edge of the light. No shadows on either of these lights.



Projector Map: create a graphic in Photoshop and assign it to a material in the material editor. Drag the bitmap over to a new slot and change mapping to environ: screen. (under coordinates pull down menu in material editor)



material editor



spotlight parameters under modify menu

1. choose rectangle as type of cone.
2. (a & b) check map box above. Choose map from material editor.
3. select bitmap fit to make the light rectangle and bitmap aspect the same.



projection light = shape of light.
Add a separate light to illuminate subject.

This could also be accomplished also by using material editor:

1. add the same map (seen above) to specular level in material editor
2. assign it to the object
3. turn off tile
4. increase/decrease size of map by increasing/decreasing tiling value.

11. **ANIMATION:** animate lights or cookies. *All lighting parameters can be animated over time.*

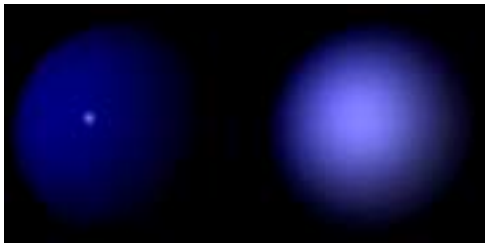
Animated lights: car headlights through window, sun traveling, police car sirens, etc. attach lights to dummy objects.

Animated cookies: light thrown by fan blades etc.

Textures and Lighting

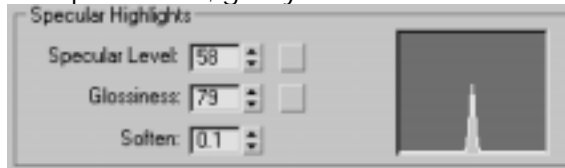
specularity and glossiness represents light size and spread.

Use self-illumination on materials to brighten objects such as eyes.

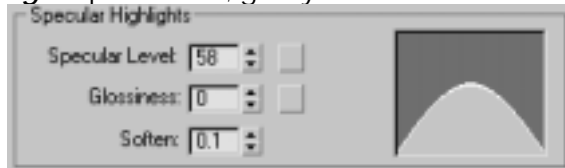


specular and glossy values

left: specular 58; glossy 79



right: specular 58; glossy 0



Specular Level Mapping: Add b/w maps to specular level and specular highlight can have specific shapes to them (*similar to projection maps*).

Reflection Mapping: Add color maps or b/w maps to reflection mapping to represent reflections off of objects.

Color (Diffuse) Mapping should have no shadows within its bitmap

Main Reference: Digital Lighting and Rendering, Jeremy Birn, New Riders