

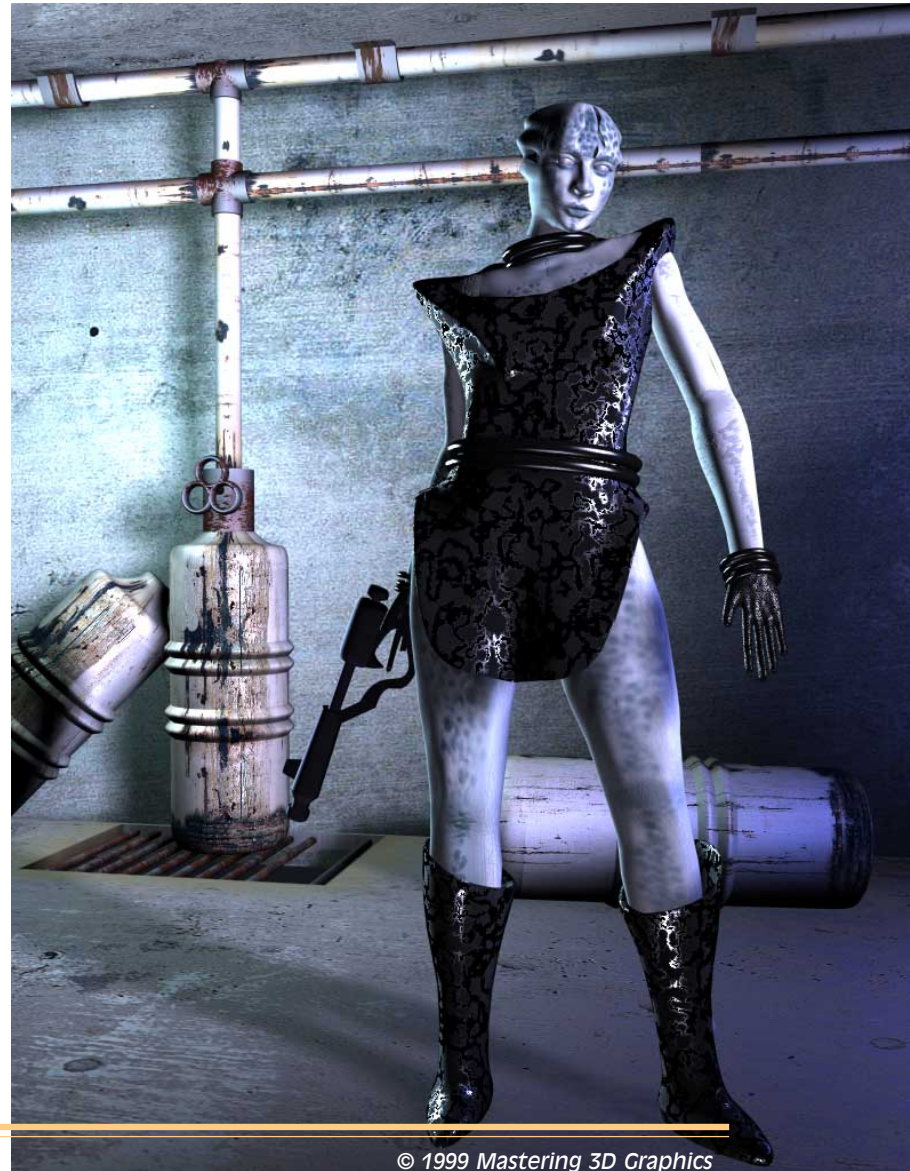
Compositional lighting arrangements for 3D illustration

(3D Studio MAX)

~ Brian Michael Nestor

Preface

Compositional Lighting Arrangements for 3D Illustration is a tutorial designed to give you a basic understanding of compositional staging principles and lighting fundamentals for 3D graphics. It should be noted that this tutorial doesn't fully follow a conventional step by step format due to the fact that there is no one correct process in going about deciding how to set up lighting. I am writing this more as a conceptual article that you can apply to whatever process is comfortable to you. On another note, although the article and example figures are geared towards 3D Studio MAX, most of the software tools and processes are universal and every effort is made to emphasize this in the tutorial.



1) Preface

2) Introduction

3) Conceptual Lighting Background

A. Hollywood Triangle Setup

1. Key lights
2. Fill Lights
3. Backlighting (rimming)
 - a) Separate Foreground/Background Elements
 - b) As Line Art

B. Basic Lighting Motifs

1. Frontal Lighting
2. Side Lighting
3. Back and silhouette Lighting
4. High Contrast Lighting

C. Underlying Patterns in Composition

1. Staging

4) Practical Examples with Software

A. Basic Types of Lights

1. Spot/Free Spot
2. Omni-directional (point lights)

3. Directional

4. Ambient

B. Light Attributes

1. Multiplier (intensity)
2. Attenuation
3. Contrast, Soften Diffuse Edge
4. Shadows
 - a. Map Bias
 - b. Map Size
 - c. Sample Range
5. Include/Exclude

C. Include/Exclude Methodology

D. Simulating Bounced Light Effectively

1. Tracing the Ray of Light
2. Proper Intensities and Hues

E. Putting It All to Use: Creative Lighting Process Used for *Femalien*

5) Conclusion, Further Experimentation

6) Biography

Introduction

Lighting is an extremely important aspect to consider when creating realistic or stylized images. It is not just a way to illuminate your models. It sets atmosphere and is one of the key ingredients in determining the underlying aesthetic quality and composition of an image. Unfortunately, it is also one of the most highly neglected aspects in the 3D graphics creation process. I find that many people don't invest more than a few thoughts as to how to strategically place lights to heighten or even exaggerate their pictures and animations. They just toss in a few spot-lights and trust the computer's rendering engine to accurately calculate all the shading gradations and shadows on their models. Mathematically accurate gradations and shadows are NOT the key aspects of making a picture interesting to look at. That is, in a sense, like allowing the software engineer to draw your pictures. How your lights are arranged and the underlying compositional staging that takes place plays a larger role in aesthetics than precise, calculated shading. In

many cases mathematically precise shading is not the best way to approach an image so steps should be taken within the software to “cheat”, or augment lighting arrangements. Artists in large budget production houses know this, and so should you.

Conceptual lighting background

Hollywood triangle setup

There is an important method of lighting used in the entertainment industry that forms the basis of developing complex lighting arrangements within 3D environments – the *triangle arrangement* [Figure 1]. A triangle arrangement's most common use is in lighting standalone char-

acters and objects and provides a convenient way for the artist to adjust his or her lighting composition. As you can see from figure 1, the triangle arrangement in its simplest form consists of three lights illuminating an object – a key light, fill light (also known as filler) and a back light – each of which serves a specific purpose.

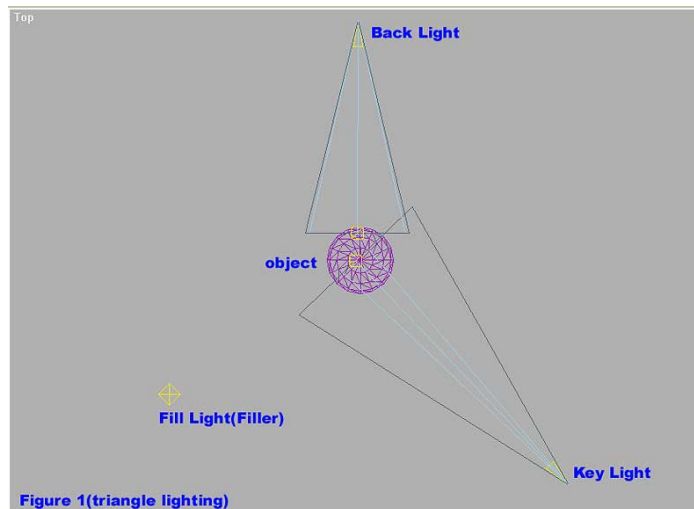


Figure 1: Triangle lighting.

Key lights

The key light [Figure 2] is the primary light of emphasis in a scene. Its purpose is to reveal the forms, texture and contour of whatever surfaces it strikes. Its position is commonly located anywhere from 10 to 50 degrees off the camera's central axis and is generally the first light you will want to set up in a scene.

Fill lights

The second light used in a basic triangle arrangement is known as a fill light [Figure 3]. One of the main roles of a fill light is to reduce contrast by bringing out some detail in the shadows of an object or person. Fill lights generally serve best when they have a soft look to them and are 30 to 70 degrees opposite the camera's axis of key lights.

Backlighting (rimming)

Back lights, or rim

lights [Figure 4] are the third type of light used in a triangle arrangement and have two main purposes. Back lights help add depth to a scene by separating a foreground object from the background – an important technique when backgrounds gets overly complex. Background lights are also effectively used as an artistic line tool adding an illustrative context to a lighting composition by emphasizing an outline or contour around objects. Back lights are commonly utilized directly behind and above the object and pointed towards the camera. They also are generally more intense than the fill and keys.

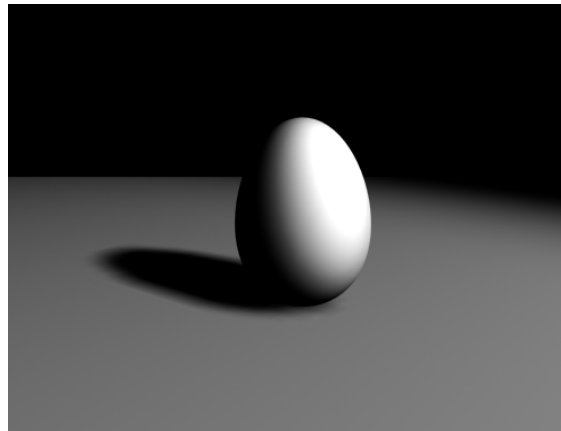


Figure 2: Key light.

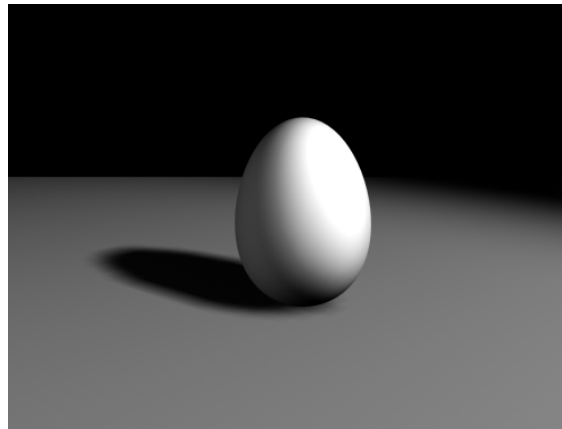


Figure 3: Fill light.

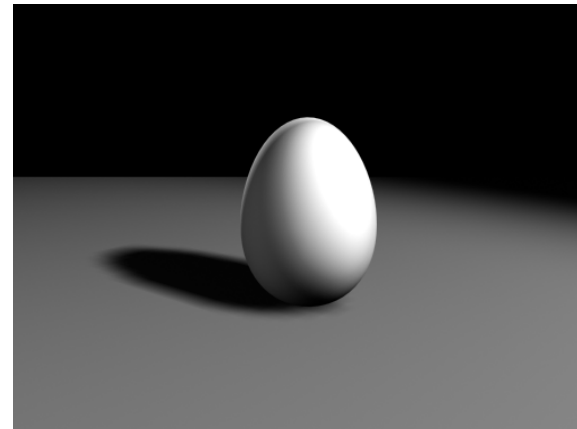


Figure 4: Back light.

Basic lighting motifs

These three lights are at the core of a triangle arrangement and serve as the basis for creating compositional setups. It should be understood that there is no one correct way to position these lights in a scene. Key lights don't necessarily have to be the main light of emphasis to create a good composition nor are fill lights or back lights needed for everything. The standard triangle is just a *basis* for creating more sophisticated compositional lighting setups. Several if not infinite variations exist that are offshoots of the triangle method. Some of the more common lighting variations are frontal, side, back/silhouette and high contrast compositions.

Frontal lighting

Frontal lighting arrangements [Figure 5] are common and very similar to the basic triangle arrangement. They involve the main focus of a composition, such as my “egg” model, being lit from a light source coming either from the direction directly in front of, or

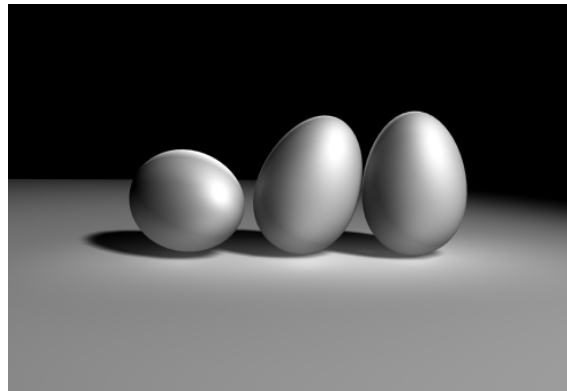


Figure 5: Frontal lighting.

slightly off-angle from the camera. If direct frontal arrangements are used, there is a possibility that they may flatten an image out due to the small amount of light to dark gradation that occurs across an object. So it is usually better to place them at slight angle from camera's central axis.

Side lighting

Side lighting [Figure 6] is a method that involves placing your primary light source, or key light, to the left or right of your object (approximately perpendicular to the camera's central axis). It puts a strong emphasis on the contoured shape of the objects in your scene and must be used carefully to avoid any compositional lopsidedness that might occur if everything in your scene were lit in the same direction.

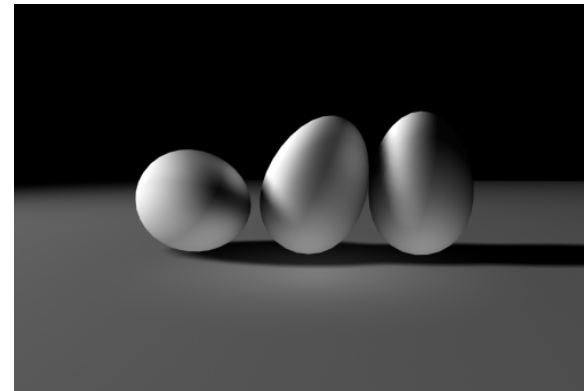


Figure 6: Side lighting.

Back lighting & silhouette lighting

Back lighting and silhouette lighting motifs [Figure 7] differ greatly from the conventional frontal and side lighting arrangements mentioned above. While front and side lighting place emphasis on an object's texture and volume, back lighting and silhouette compositions put strong emphasis on the object's contour and shape – possibly creating a powerful flattening effect in your image. Images, especially characters that are lit in a silhouette fashion, often take on a mysterious or scary personality – as with anything you can't see as well as you would like to.

High contrast lighting

High contrast lighting [Figure 8] is a less often utilized arrangement but an interesting one nonetheless. This technique deserves its name due to the toning down or omission of fill lights that in turn amplify the contrast between the highlighted areas of a scene and the shadows. Many examples such as Figure 8 use a sharp gradation falloff on an object and emphasize the opposite side with a line or rim.

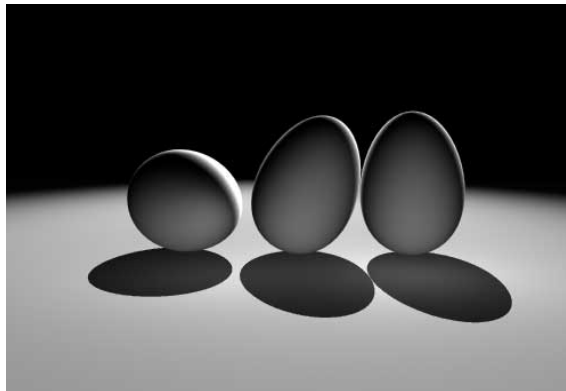


Figure 7: Back lighting.

High contrast compositions are one of my personal favorite styles due to their emphasis on line patterns, and positive negative shapes.

Underlying patterns in composition

There are many more variations to take into consideration that can easily be found through heavy use of experimentation. The arrangement you wish to use depends on personal taste, the mood you wish to convey, and what is necessary for the creation of readable shadow shapes on your objects such as an eye socket shadow on a character's face. This generally requires good modeling ability – the better your models, the better the shading the light will perform. If you model a face with a disfigured eye socket or nose, then there isn't much a rendering engine can do to correct its proportions. Good models are needed

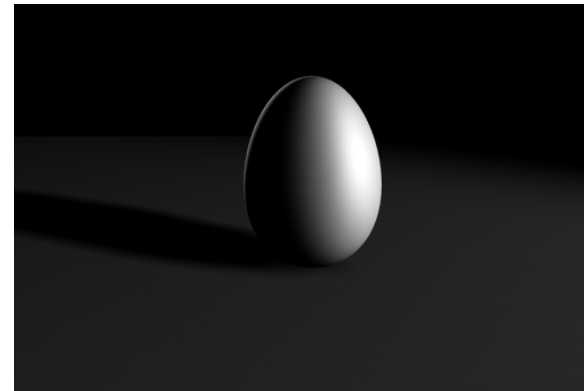


Figure 8: High contrast lighting.

in the majority of situations if you are to have good shapes drawn by the rendering engine.

Staging

One extremely important issue to consider when setting up your lights in a scene is the arrangement, or staging, of your underlying light and dark shapes and patterns. The underlying shapes [Figure 9a] are not always too apparent when viewing an illustration but they are always there nonetheless. They are the abstractive, almost subliminal, quality in a composition that an artist uses (intentionally or not) to help balance out his or her image. If an image you are looking at is confusing or uninteresting, chances are the underlying shape (or color) patterns are confusing and/or uninteresting also! These things are abstract qualities of your images and abstract elements such as shape, line, pattern, and hue are what separates an interesting picture from a boring one. Underlying elements are what keep your eyes moving the right way around a composition [Figure 9b]. Take a look at Figure 9b for instance. Just by glancing at this image, you can easily

see the underlying shape composition that Rembrandt Van Rijn used. The shapes are very dynamic suggesting a sort of swirl pattern that keeps your eyes moving actively around the picture. While the underlying shapes such as hue or value (as in this example) in an illustration don't have to be quite as apparent as the one in Figure 9b, they should be staged, or positioned clearly. This is done by making sure the shapes are relatively simple and any patterns (repeated shapes) obvious.

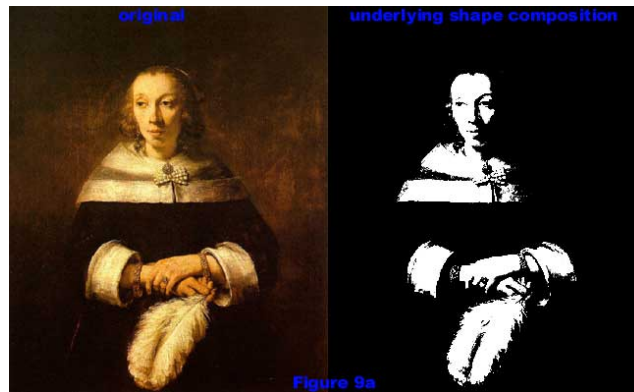


Figure 9a: Original (left) and underlying shape composition (right).



Figure 9b: Original (above) and underlying shape composition (below).

Practical examples with software

Although painters and photographers understand staging principles and basic lighting arrangements and methodologies, how do artists using 3D software go about applying these to their images and animations? 3D artists must learn how to master their tool, 3D software, to the same level as an experienced painter, sculptor, or photographer. This means understanding the medium's capabilities, advantages, and disadvantages thoroughly. A good oil painter knows which brush to use or the amount of liquid to apply for the required circumstance. Similarly, a 3D artist must know which tools are available for his or her program as well as the best situation to use them in. Most importantly, a 3D artist must understand how to gain complete control from the rendering engine as to the appearance of his or her render. If a painter wants to place a rimmed light contouring the shape of a character's arm, all he or she has to do is paint it. It will appear exactly the way he or she wants it to because it is a direct process – from their mind to their hand to the canvas. 3D illustrations on the other hand are a bit more difficult because the process is indirect – from the mind to the model viewport to the rendering engine, the last of which gets the final say. To control how light is drawn in a program, you must learn the basics of the lighting tools it has to offer.

Basic types of light

3D Studio MAX and just about every other software application have the same four basic types of lights – spotlights, omnidirectional lights (point lighting), directional, and ambient lighting. These four basic lights provide enough versatility for almost any effect you can imagine and have unique characteristics that help distinguish each from one another.

Spot/Free spot

Spotlights [Figure 10a] are the main types of light used in Max and just about every other program. They cast a beam of light from a source specified by you towards an object in a cone-like shape. The farther away your spotlight, the larger area of your scene it will illuminate. The closer the spotlight, the larger the flare on the

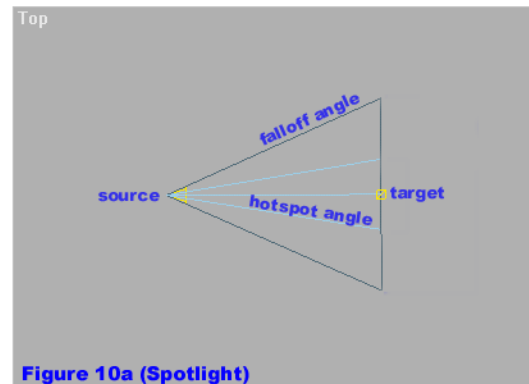


Figure 10a: Spotlight.

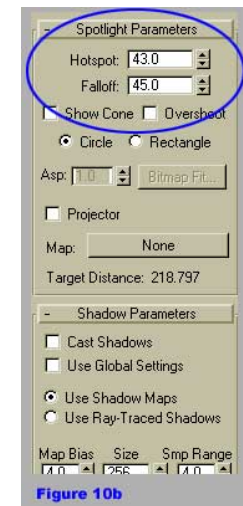


Figure: 10b.

shadows it will cast. The beam consists of an inner hotspot, the brightest part, and will falloff to darkness at the edges, also known as a penumbra. A spotlight's hotspot and penumbra angle can be controlled with the hotspot and falloff attributes in the light modifier panel of 3ds Max [Figure 10b]. Other programs have similar features.

Omni-directional (point lights)

An Omni light [Figure 11], also known by some software as a point light is another very common type of light. It is short for omnidirectional, meaning the rays of light project outwards in all directions from its source like a light bulb and are useful for lighting scenes in that fashion. Since omni lights don't project light out in a cone-like fashion, they don't have hotspot and falloff attributes like those of the spotlights. Omnidirectionals can be very useful for fill lights.

Directional

Directional lights [Figure 12] are similar to spotlight lights in that they

have a hotspot and penumbra but cast rays in a more parallel manner – giving you parallel shadows on all your surfaces no matter how close to the objects they are.

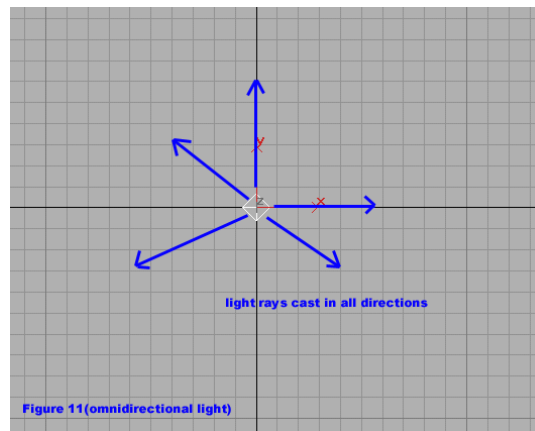


Figure 11: Omni-directional light.

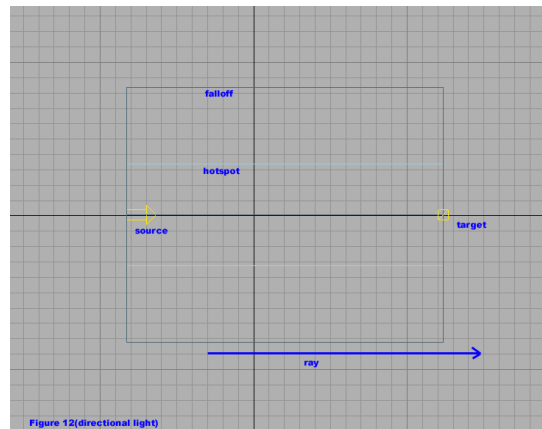


Figure 12: Directional light.

Ambient

Ambient lighting [Figure 13] is different to the other three types and must be approached with a different methodology. Ambient lights are generally used in an attempt to simulate the actual way ambient light works in the real world. Ambient lighting in Max isn't an actual object you place in a scene. It is an attribute applied to the rendering engine

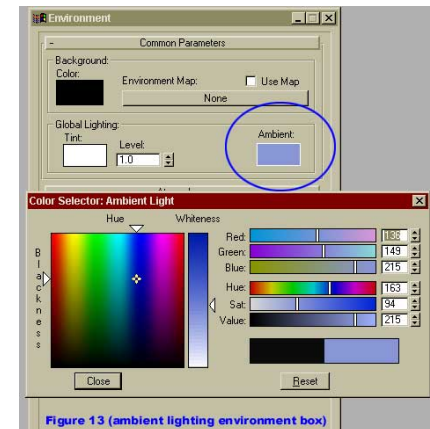


Figure 13: Ambient lighting.

at the time of rendering. Ambient light changes the overall brightness and hue in a scene. For example, in an outdoor illustration, ambient light would be fairly bright and have a blue-ish tint to it so you would apply that to your ambient value in the environment settings.

Light Attributes

While the effects of these four lights are different, the parameters used to control their look are pretty much universal. The attributes of intensity, attenuation, and shadow parameters all serve to tweak your rendered output in any way you so desire.

Multiplier (Intensity)

Intensity [Figure 14] is probably one of the most useful features that 3D Studio MAX (and every other program) has. Intensity allows you to adjust the power or brightness of your lights in the 3D scene, thus adding more or less contrast to your model. Intensities are the best tool for tweaking down your fill lights or powering up your rim lights to give a bolder or brighter line.

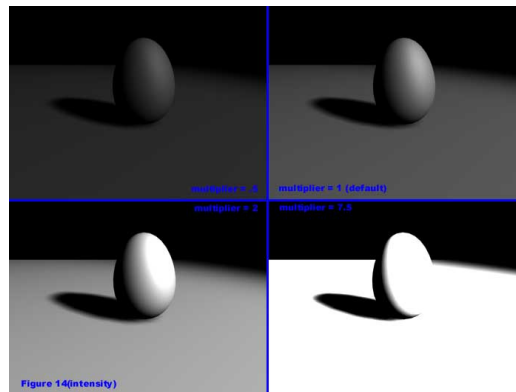


Figure 14: Intensity.

Attenuation

Attenuation [Figure 15a] is another powerful lighting tool. In real life, an object that is far away from a light source won't be lit as strongly as if it were up close. Most programs' lights including Max's don't utilize this phenomenon by default. The attenuation must be turned on and adjusted manually in the modify panel. The near and far boxes are used to adjust the falloff distance. Attenuation is used well for omnidirectional lights and helps control the area they affect.

Contrast, Soften and Diffuses edge

Contrast and Soften Diffuse edge [Figure 15b] commands are two more lighting tools that assist in how the gradations across your surfaces look. Contrast helps increase

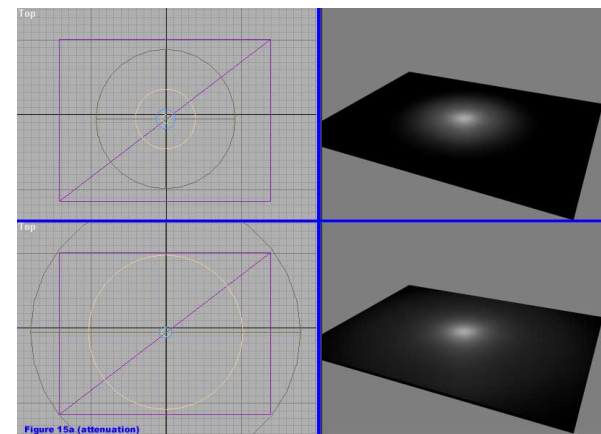


Figure 15a: Attenuation.

the values between the highlights and shaded areas of a model and Soften Diffuse Edge adds a softer look to where those gradations join at an edge. Mixing and matching between these two attributes can greatly add to an image or lighting effect.

Shadows

There are two main ways you can create shadows with 3D graphics – raytracing and shadow mapping. Raytracers draw shadows by calculating the angle of light during the rendering pass while shadow mapping performs a sort of cheat by calculating shadows first and then applying them to your objects as an actual image map, or texture. The properties of this shadow image file can be adjusted with the map size, bias and sample range parameters.

Map size [Figure 15c] determines the resolution size of your shadow maps. The larger the size you use the less pixelization your shadows will have during rendering. Larger sizes use up considerably more memory and time.

Map bias adjusts how close the shadow cast is to the object casting it. Generally lower values are needed to get the shadow “underneath” or grounded on the object. Map Bias allows for you to tweak the positioning of the shadow map on objects it is applied to.

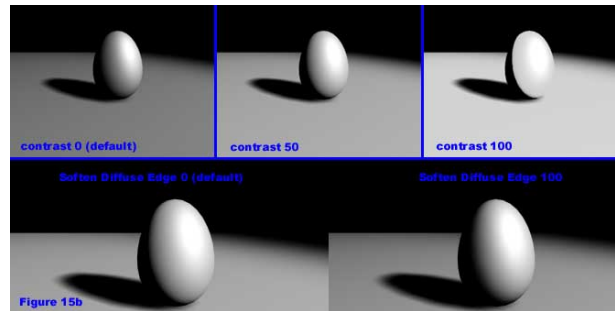


Figure 15b: Contrast, soften and diffuse.

The Sample Range [Figure 15d] attribute adjusts how soft, or blurry the edge of a shadow is. Higher values give a softer effect to the edges.

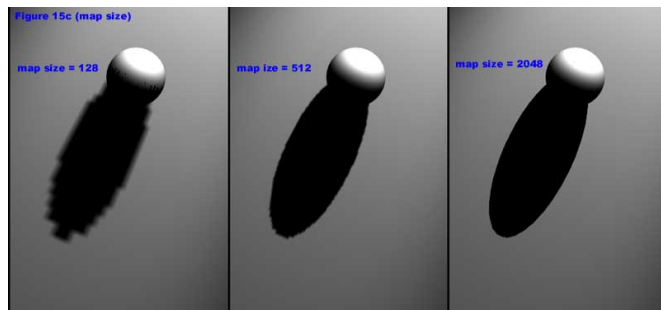


Figure 15c Map size.

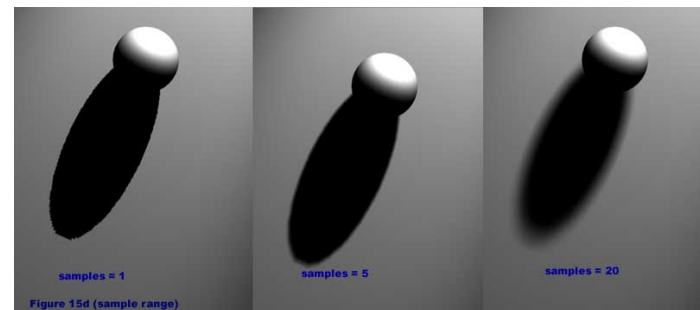


Figure 15d Sample range.

Include/Exclude

Include and exclude parameters [Figure 15e] are extremely important tools to utilize in rendering engines. Excluding an object with a light prevents that light from having any effect on the object selected by not highlighting it, casting its shadows, or both. The dialogue box contains two windows. The left window shows a listing of all objects within your loaded scene. The right window shows which objects from your scene are affected by the exclude and include feature.

Include/Exclude methodology

The include and exclude attributes form the basis of proper lighting habits for your illustrations. These tools setup the fundamental system of *grouping* that allows for you to control the lighting of each object in your scene independently from one another. Light grouping is an extremely important technique and is the one utilized most in high-end production studios – although not necessarily with Max. So just how important is it to independently group your lights in a 3D graphics program? Here's an example. Let us say you show your art director a picture of some eggs you

have rendered for a project [Figure 16a]. You have decided on a silhouette-based composition and have used a backlight to rim in the upper contour of the eggs with the purpose of making them stand out against the dark background. What if the art director doesn't like the way the rendering engine draws those outlines? What if the art director wants the outlines to be thicker, brighter and drawn around a larger portion of the egg? You can increase the intensity of the backlight with the multiplier but although the rim lines will be brighter so will the rest of your scene. The floor washes out more and the rim line shapes haven't changed at all [Figure 16b]! This is where the exclude or include attribute comes in handy. By reconfiguring the light to illuminate only the eggs, you can adjust it whichever way you want without worrying about the

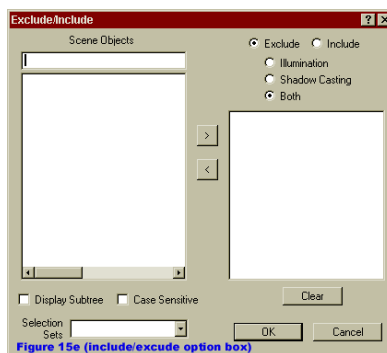


Figure 15e: Include/exclude box.

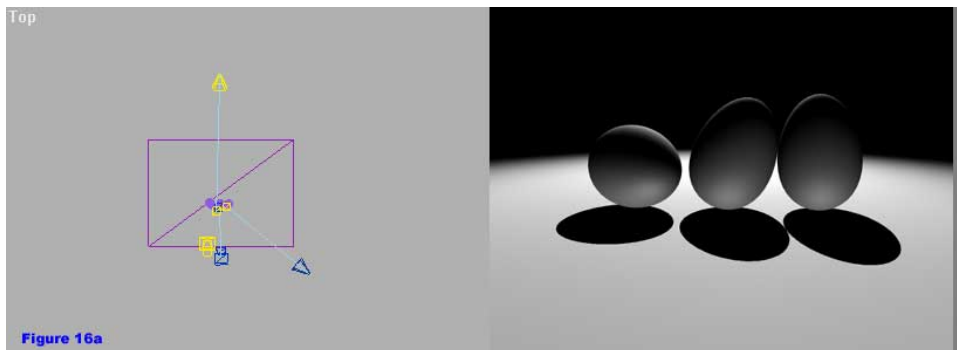


Figure 16a

Figure: 16a.

byproducts that occur on the floor or other objects in your scene. Sometimes, as in this example, you can't get the rendering engine to draw the line more solidly around the object with just one spotlight light. To get the rim lines on the eggs more evenly distributed two spotlights are needed – one for each side of the eggs to be illuminated [Figure 16c]. Since the second light duplicated is just for getting the rims of the eggs to illuminate more effectively, and thus is excluding the floor, a third light will be needed to light the floor and cast the egg's shadows. Getting the third light to ignore the eggs yet cast the eggs' shadows on the floor requires excluding the egg's illumination only by checking the illumination circle under the exclude category [Figure 16d]. This third light placed above and behind the eggs will only highlight the floor but will also give the illusion of highlighting the backs of the eggs due to the fact that it still casts the eggs shadows on the ground! Now you can tweak the egg's two rim lights to get the desired results with no problem [Figure 16e].

This process of assigning groups of lights to individual objects assures op-

timum control over how each object looks without having to worry about how the lights affect other surfaces. This is in a sense “cheating” the rendering engine to produce the results you want – not what is mathematically accurate. You are in reality drawing the lines on the eggs by manually moving the lights around in your 3D environment rather than just letting the rendering engine decide on the best way to draw them. A painter has the ability to

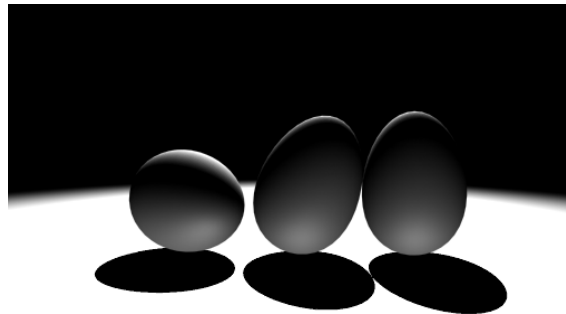


Figure: 16b.

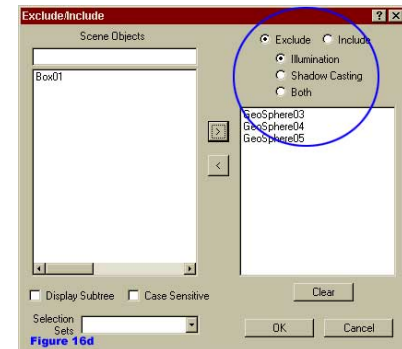


Figure: 16d.

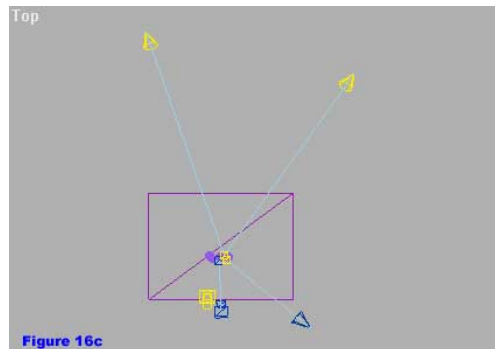


Figure 16c

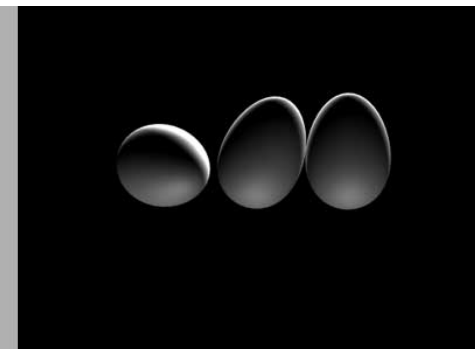


Figure: 16c.

draw lines and shapes exactly the way he or she wants to, so a 3D artist should not be any different.

Simulating bounced light effectively

Once an artist understands the advantage of grouping lights to individual objects, they can utilize it in much more sophisticated lighting arrangements such as the simulation of spill light. Spill lighting, or bounce lighting is an extremely important technique to master – especially if you are going for realism in 3D pictures. This is because rendering engines, with the exception of radiosity rendering engines, don't accurately calculate the behavior of light. With most rendering engines such as Max's, a ray of light is stopped after being drawn from the lightsource to an object in its path (or vice versa). In reality the ray of light continues on, bouncing off of the intended object and spilling onto another almost as though it was liquid –

much in the way Rembrandt Van Rijn has shown with the light on the man's collar and left hand [Figure 17]. The ray of light keeps bouncing on and off surfaces being absorbed and losing intensity and clarity until it “dissipates” into the atmosphere – adding to the ambient light.

Tracing the Ray of Light

To accurately portray spill lighting you must learn to visually trace where and how it should look. For an example, two spheres have been created in 3D Studio MAX that

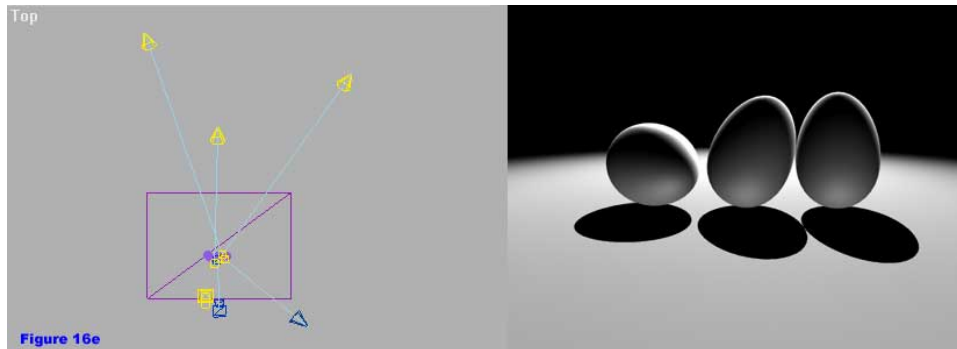


Figure: 16e.



Figure 17: Light spills.

we want to light [Figure 18a]. I have decided to go with a side lighting compositional motif and have placed a key spotlight to the left side of the scene – turning on shadows and raising the multiplier from 1.0 to 2.9 to give it more intensity and better scene contrast [Figure 18b]. Next, I added a fill light to the right in order to bring out the shadow areas better [Figure 18c]. In this example, we are not going to worry about a backlight because I want you to focus your attention on just these two lights. As we can see, the rendering engine has drawn us a picture only by calculating the rays of light from the key and fill hitting the spheres.

While these results might be satisfactory for the purpose, you can add even more realism by including some of the subtle spilling that would have occurred if this scene were in real life. In order to do this you must examine your lights and think about how the ray would trace off of the main object and onto any secondary objects that would be in close proximity.

You can think of it as though any part of an object with light striking it becomes, in itself, a light source. As we can see with ball B in Figure 18c, the key light creates a patch of light on its left side. This light should then bounce back off towards the opposite direction striking the right side of ball A – creating a subtle highlight [Figure 18d]. Creating an omni light on the upper right side of ball A and excluding its affect on ball B and the floor will make

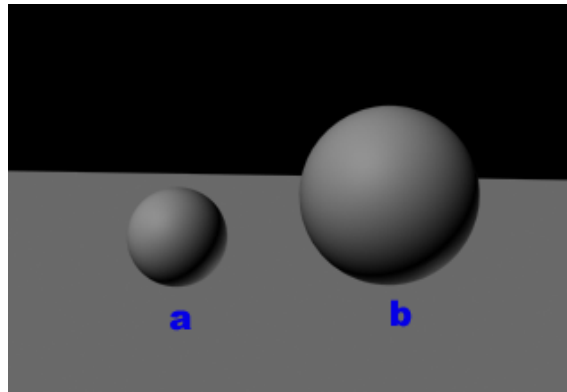


Figure 18a: Default lighting.

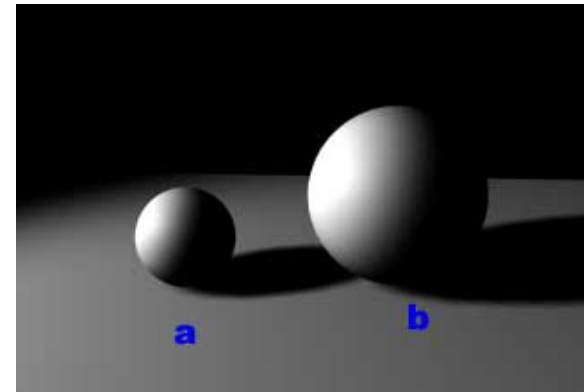


Figure: 18b.

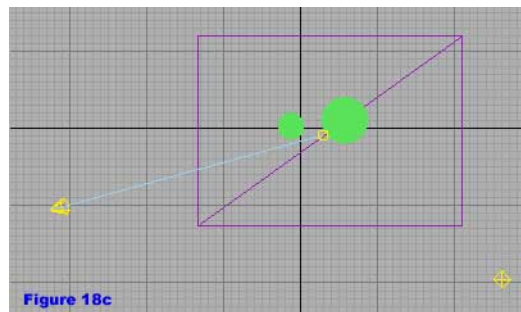


Figure 18c

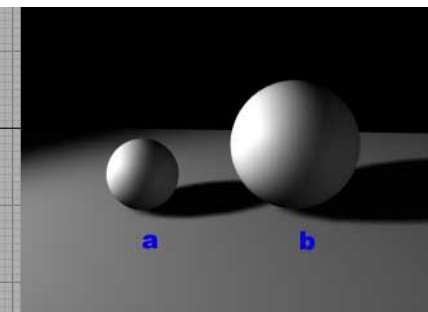


Figure: 18c.

this work. Where else might spill light be occurring from? The floor! Rays of light would bounce up from the floor and strike the undersides of the two balls [Figure 18e]. You can create this effect a number of ways such as placing individual omni lights underneath each ball excluding the floor or maybe one big spotlight (also excluding the floor) positioned somewhat underneath the spheres.

Proper intensities and hues

Lets take a look at the shadows cast by the two balls. Would they really be truly as black as the render engine has drawn them – knowing that pure black represents the complete absence of light? If you think about all the light bouncing back and forth between balls A and B, surely some of those rays would strike the floor between them. If that were to happen there should be subtle light filling out the shadow area between the two balls [Figure 18f]. This was done by creating another omni light slightly above the shadow area and excluding everything but the floor so as not to create unwanted effects on the two spheres. If your omni lights are too strong

you can use attenuation to limit their range. Another omni light was created to subtly illuminate the shadow cast by ball B to simulate rays bouncing off of the right side of the ball from the fill light to the right of the screen [Figure 18g]. You could also turn up the ambient lighting if you want to lighten your shadows but the brightness would be evenly distributed across the entire thing. Realistically, at least with this example, that probably wouldn't happen.

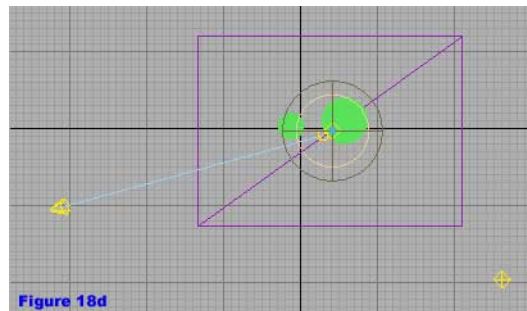


Figure: 18d.

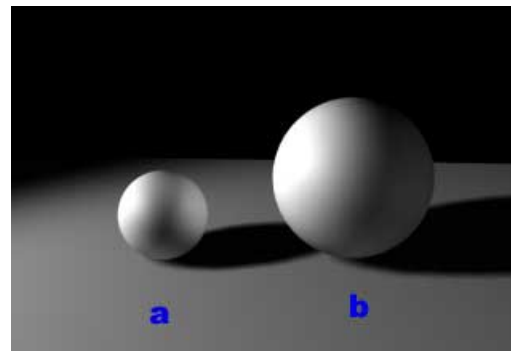


Figure: 18e.

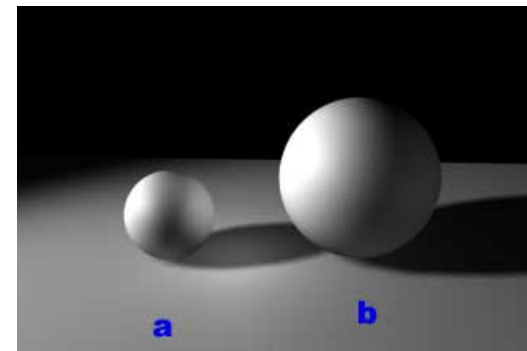


Figure: 18f.

In all we have a total of seven lights, with five used to simulate the secondary effects of the main two – the key light and the fill light. It is also important to keep in mind that the color of your fill light is generally the same color as the surface it is reflected off [Figure 18h]. In figure 18h, I made ball B a green material and placed a red sheet underneath ball A. The red sheet underneath ball A bounces red light onto the bottom of the ball. Similarly

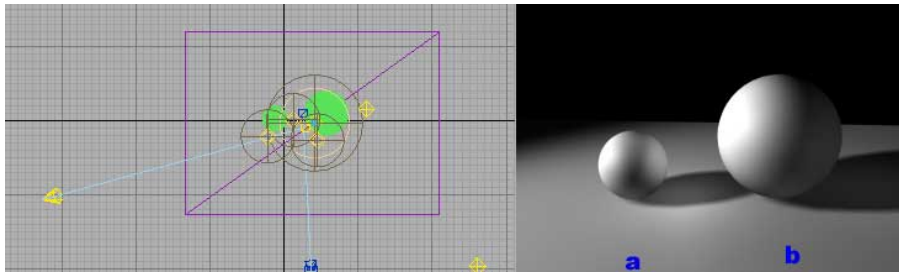


Figure: 18g.

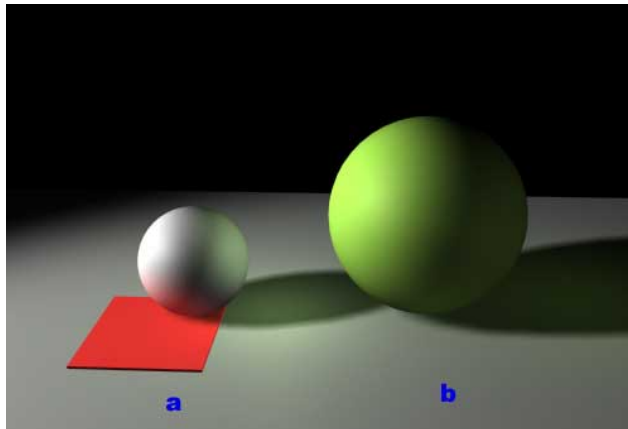


Figure: 18h.

the green ball would reflect green light back at the right side of ball A and would spill over onto the shadow area. The shadow cast by ball B was also given a very subtle green spill light to suggest light bouncing off its right side from the scene's fill light. These spills were created simply by changing the color of the bounce light to that of the surface bouncing them. They were also further tweaked by adding or removing saturation and intensity.

This practice of tracing bounce light can be a good alternative to radiosity renders (and much quicker too). Just keep in mind that even the most minuscule details such as these can greatly enhance a picture if you use them properly. They can make a good picture a great picture or help make a great picture an awesome picture.

Putting it all to use

Creative lighting process used for *Femalien*

All of these examples, while simple, should give you a good understanding of the processes needed to produce good lighting results within your 3D program. Much attention should be paid to the overall compositional staging of your scene before adding in the little extras such as spill lighting. Let us take a look at an image I have produced within 3D Studio MAX to show you a few of the above examples applied to a slightly more sophisticated illustration. Figure 19a shows you the scene I modeled (in

Rhinoceros 3D beta) when rendered with Max's default lighting arrangement. As you can see from this image, Max's default lighting doesn't do a good job of staging my model's shapes. The underlying shapes of the scene (especially the character's face and knee area) are quite confusing [Figure 19b]. To fix this I create a blue-ish colored key light (multiplier set to 1.6) pointing at her and position it around the scene until I found a place that renders out her shadow areas more clearly [Figure 19c]. Figure 19c shows two positions that I like with the one on the right being my final decision due to the fact that the shadow she cast was more dynamic – keeping the eye flowing to the background barrels, up the pipes, to the character, and back to the shadow. The key light position I chose

cast light from the upper right quadrant towards my character and provided a much better staging situation than the default lights Max started me with [Figure 19d]. As you can see from the side by side comparison in figure 19d, the underlying staging of the key light I placed is much more readable than the default Max lighting on the left – especially on her face.

Once I was satisfied with my key light, I decided to add some fill lighting in order to reduce the contrast on the character [Figure 19e]. I Set the multiplier to 0.5 which is approximately half the default intensity level simply because I thought it looked the best. Neither the fill light nor the key light excluded any objects in the scene because I



Figure: 19a.



Figure: 19b.



Figure: 19c.

didn't see any complication arise from the current renders so far.

So far so good but the whole composition feels a bit dull and my character, especially her left and right boots, are still a bit lost in the background. Since I wanted a black outfit, I decided the best way to make my character and her boots readable was to emphasize her silhouette a little stronger. This serves at least two purposes well – it makes very dark objects, such as her clothing and gun more readable by emphasizing contour, and gives the whole composition a much more dramatic, if not mysterious undertone. I placed an omni light (multiplier 1.2)

behind the character and to her left side and rendered the image out [Figure 19f]. As you can see in figure 19f, the new light brightened my back wall and floor effectively silhouetting her body and making her boots much less confusing to look at due to the better staging of their underlying shapes. The omni light also brought out my spec/shininess maps in the concrete more effectively and provided better contrast between light and dark areas of my scene. Another slightly blue omni light was placed behind the character and to her right to bring out the barrel and her left boot and hand a little more effectively [Figure 19g]. The second omni light also brings out more of my material shader patterns and gives her a splash of blue on her right side.

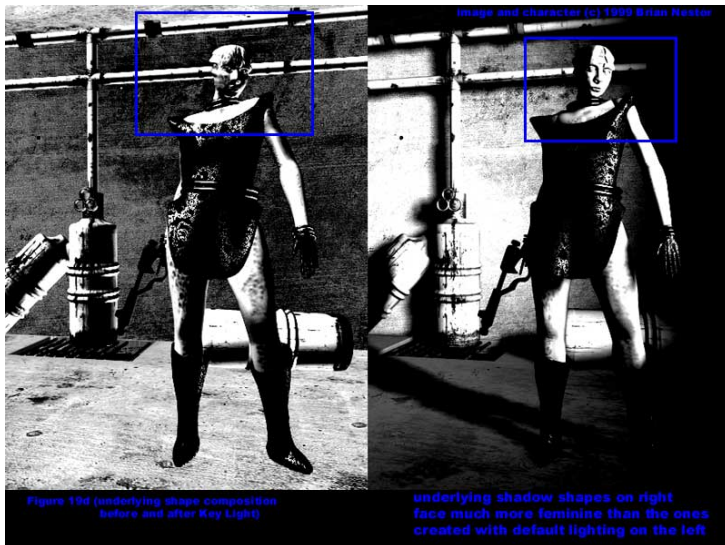


Figure: 19d.



Figure: 19e.



Figure: 19f.

Lastly I added rim lighting to her to exaggerate the effect of spill light bouncing off the back wall. This was done by placing an intense spotlight (multiplier set to 2 to really bring out the rim lines) behind and to the left of the character and rendering out the image [Figure 19h]. As you can see from figure 19h, the rim has appeared on my character but so has an unwanted patch of light on the floor. Since I preferred the floor the way it was originally, I excluded it from the rim light I just placed in the scene to correct the unwanted artifact [Figure 19i]. The rim lighting gives the whole image a more illustrative feel and helps to further separate image components such as her right thigh from her hand and gun.

There are other things I could do with the lighting in this illustration, such as putting extra spills on her boots from the floor and such, but in this case, I am pretty satisfied with the results. My finished scene contains only five lights [Figure 19j] – a key, fill, rim light, and two omni



Figure: 19g.



Figure: 19h.



Figure: 19i.

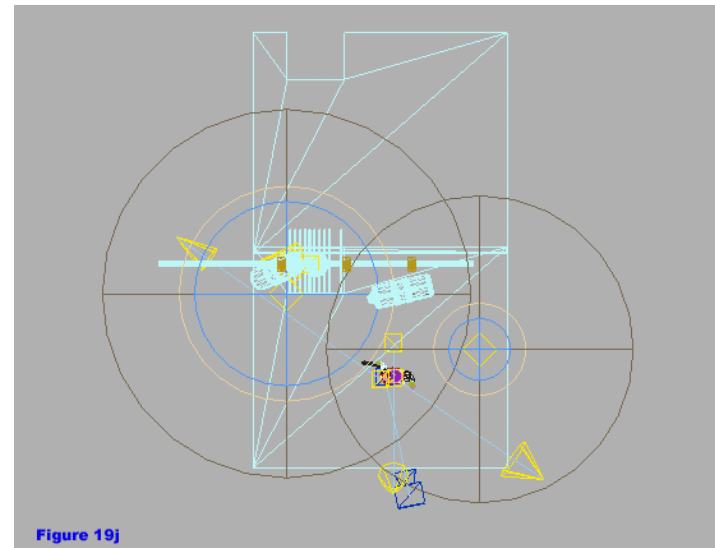


Figure: 19j.

lights used to brighten the background. Only the rim light in this scene needed to use exclusion – the rest were very well behaved.

Conclusion, further experimentation

The concepts and techniques I have described in this article have proven extremely effective for me and I hope you also benefit from them. While many of these techniques such as triangle arrangements are valuable, never be afraid to experiment with new styles or ways to ap-

proach things. Experimentation will inevitably lead to more innovative techniques and compositions – benefiting all of us in the future.

Biography

Brian Michael Nestor is a college senior studying multimedia in northern California. He may be reached for questions and comments at briannestor@hotmail.com or you can visit his online art gallery at www.geocities.com/Paris/2514/.



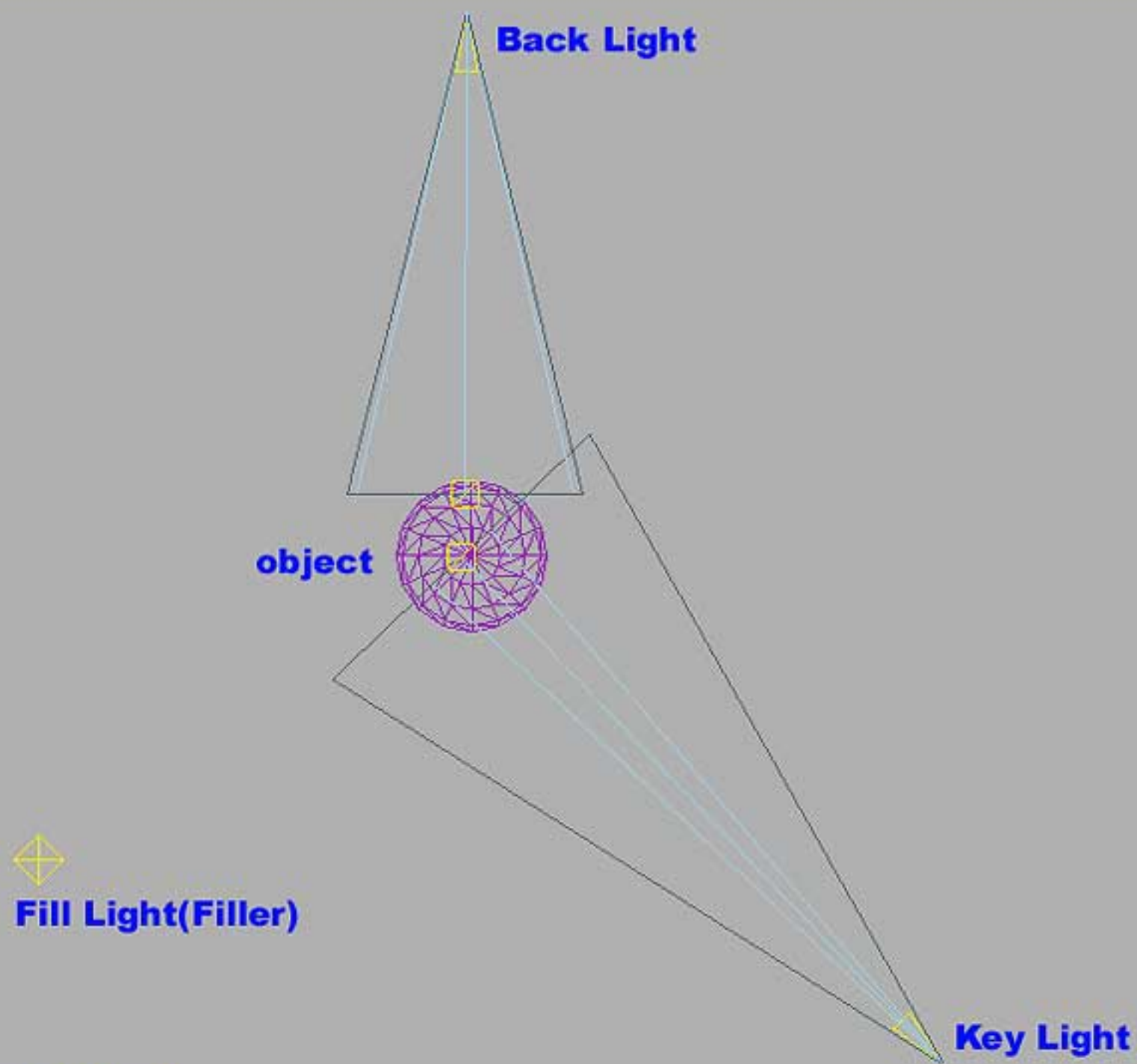


Figure 1(triangle lighting)

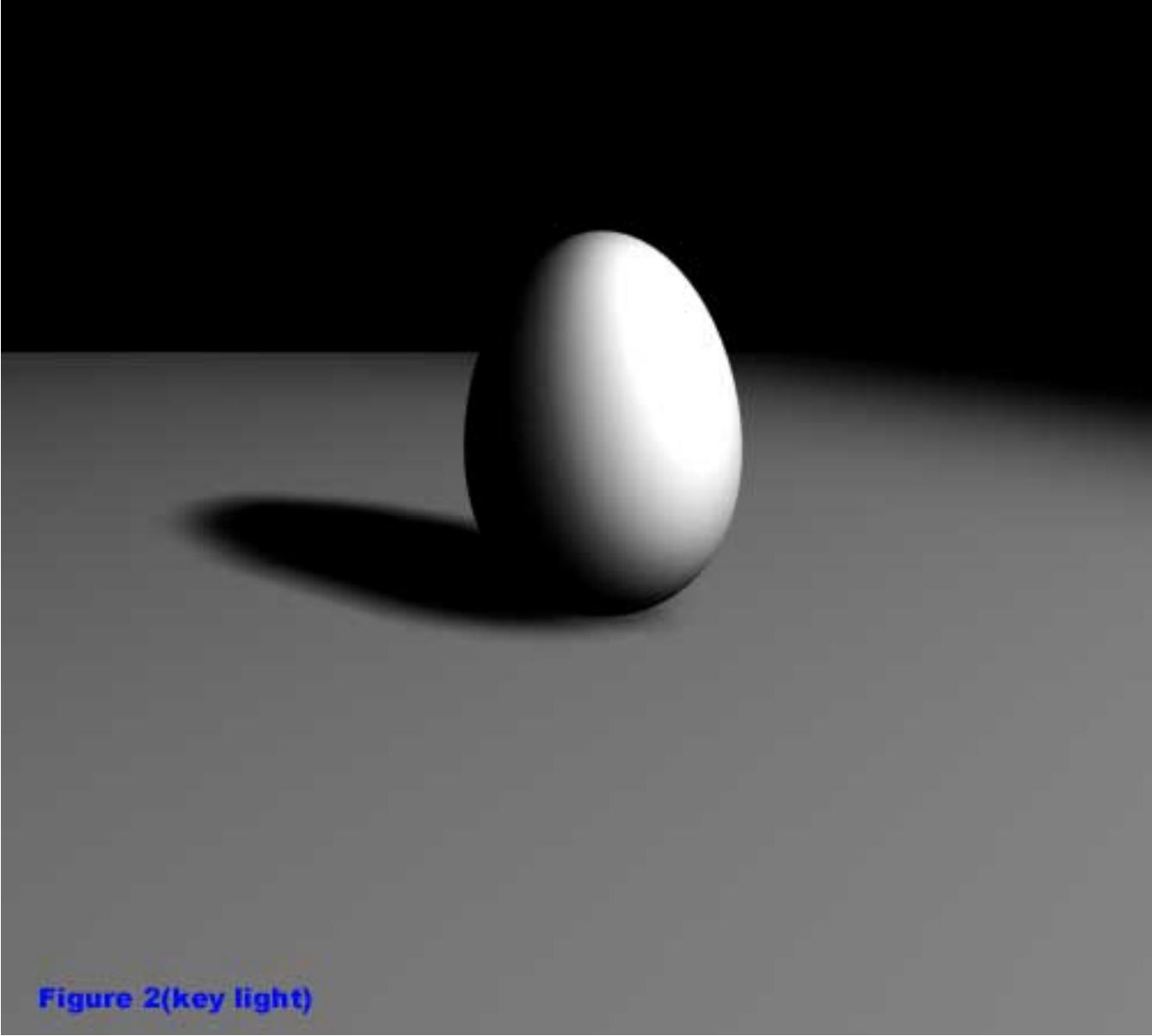


Figure 2(key light)

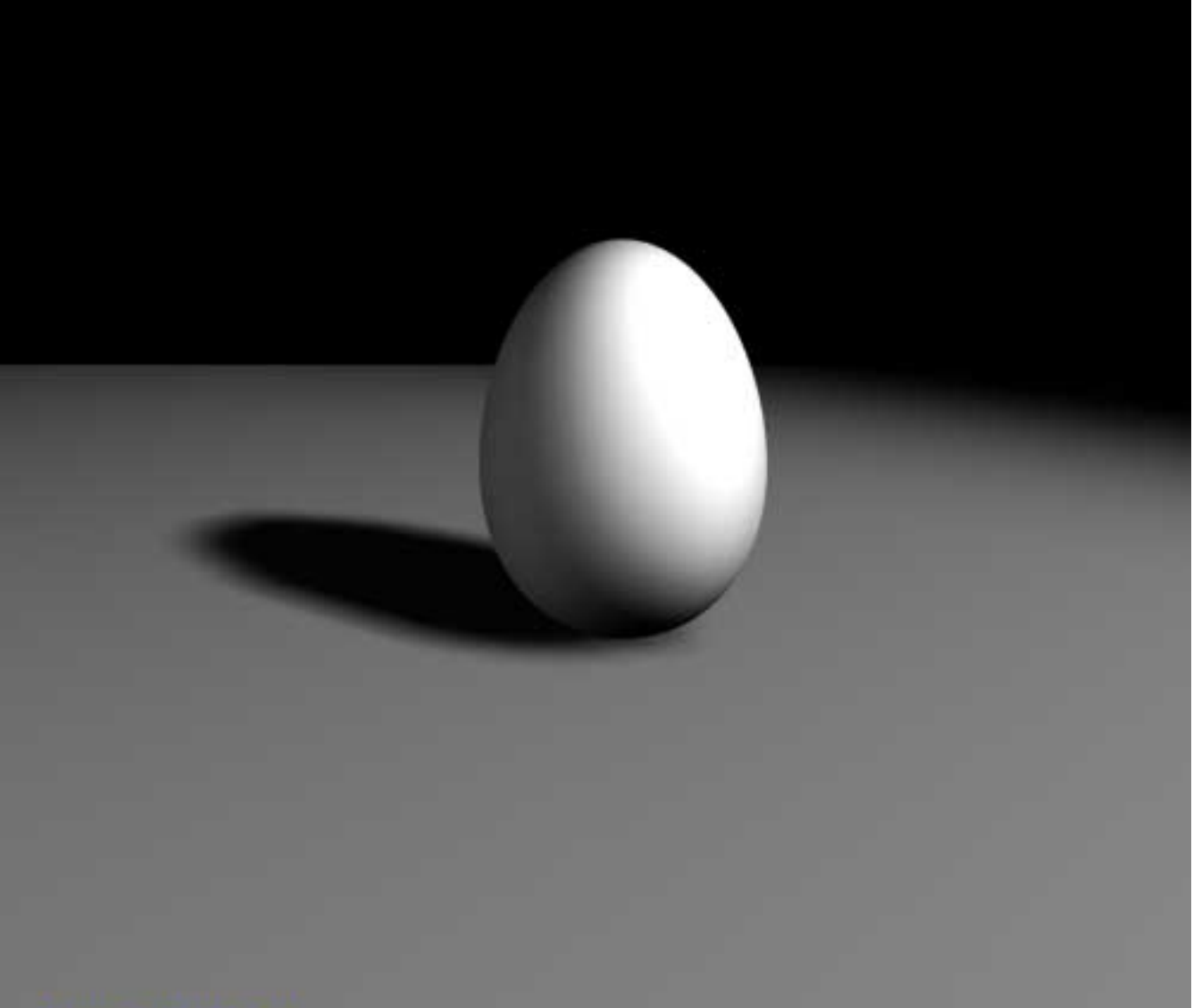


Figure 3(fill light)

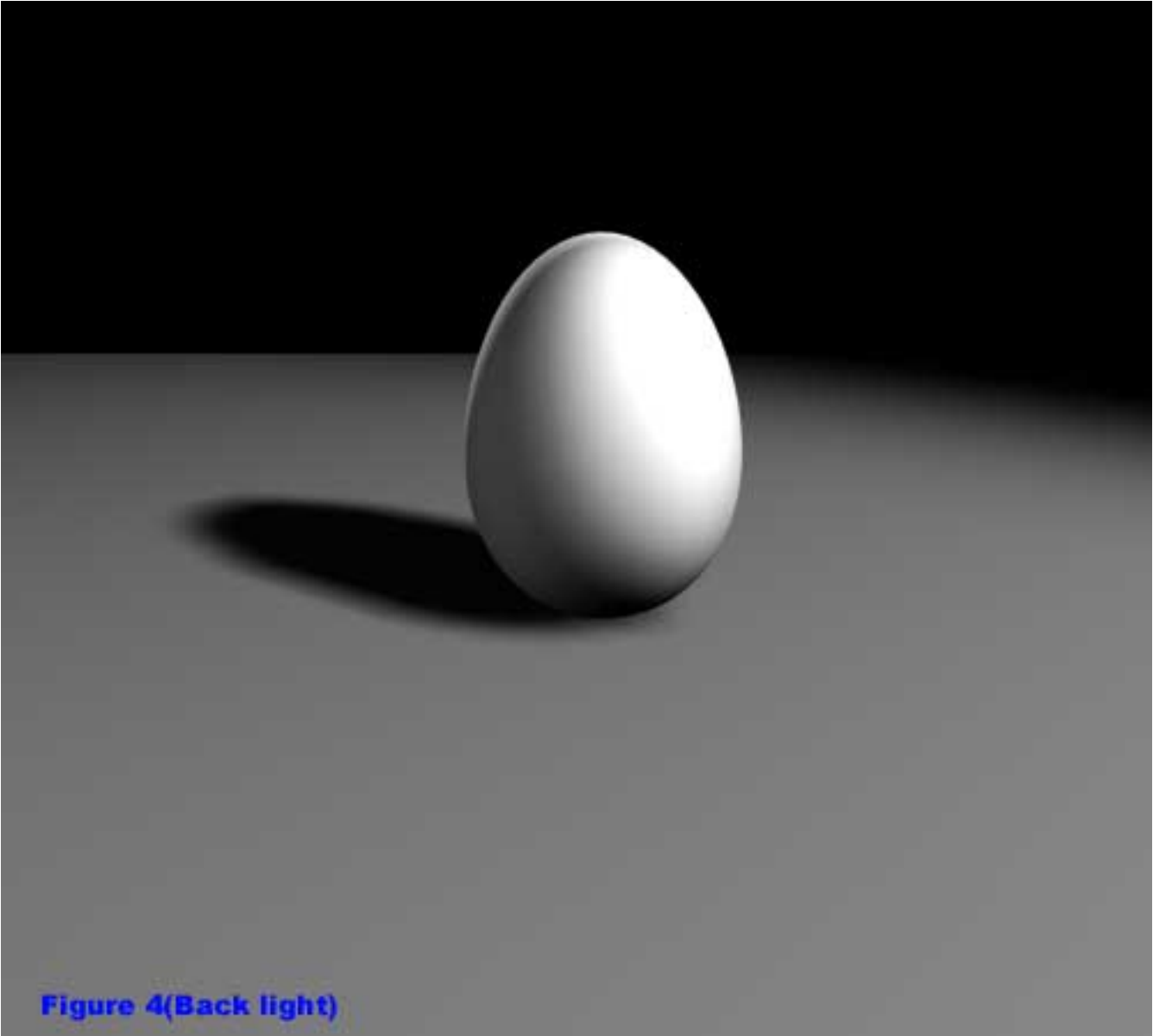


Figure 4(Back light)

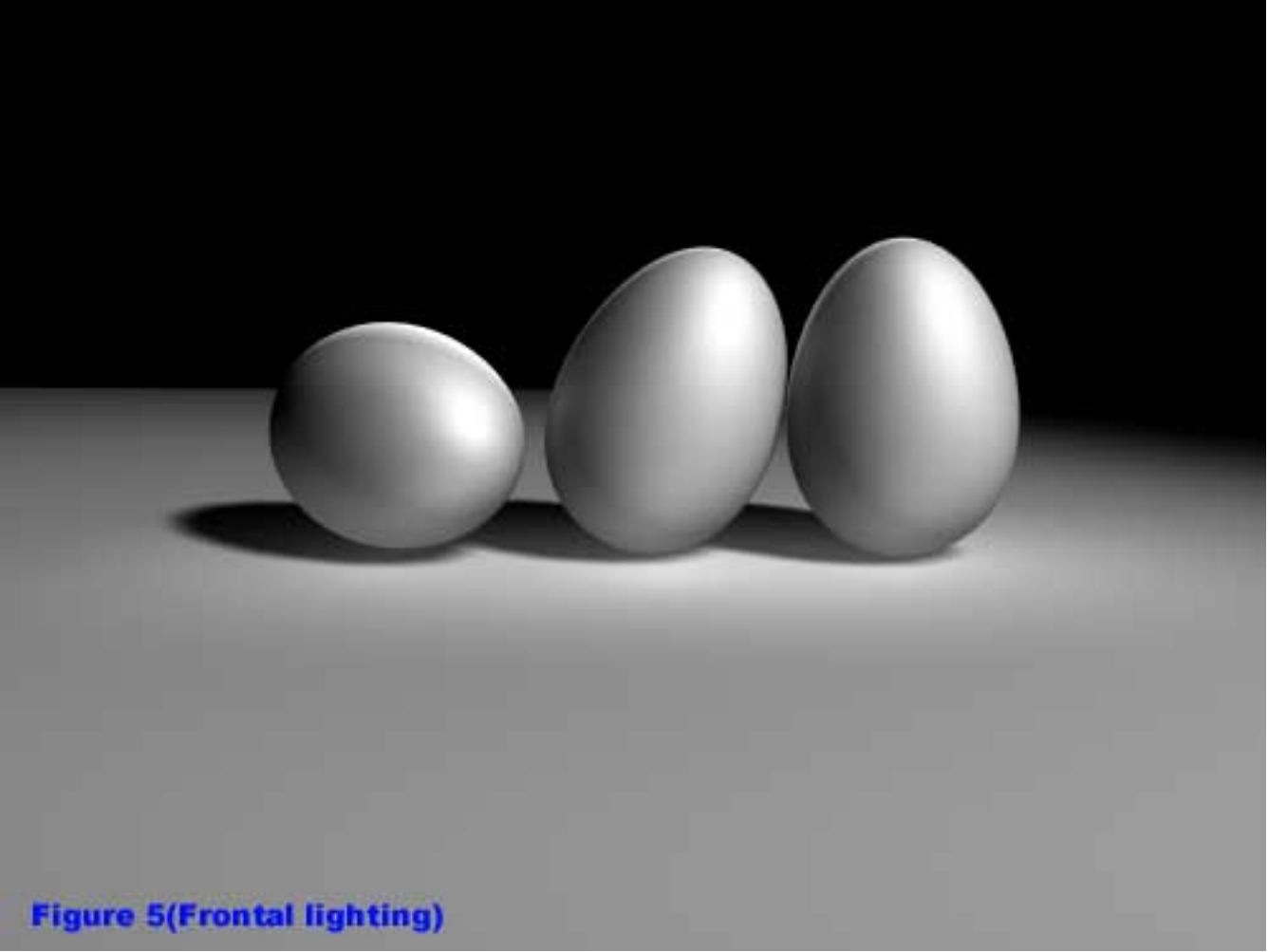


Figure 5(Frontal lighting)

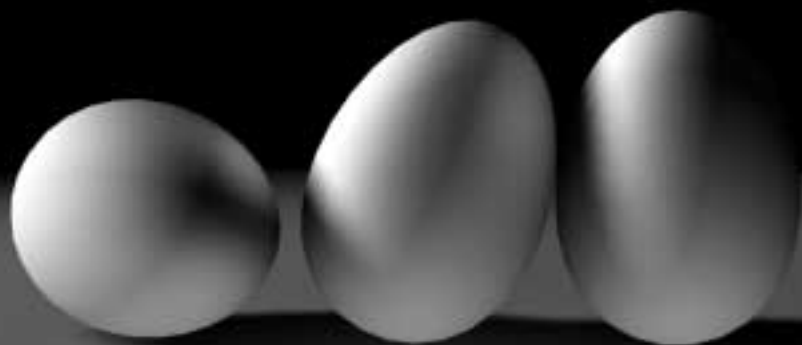


Figure 6(side lighting)

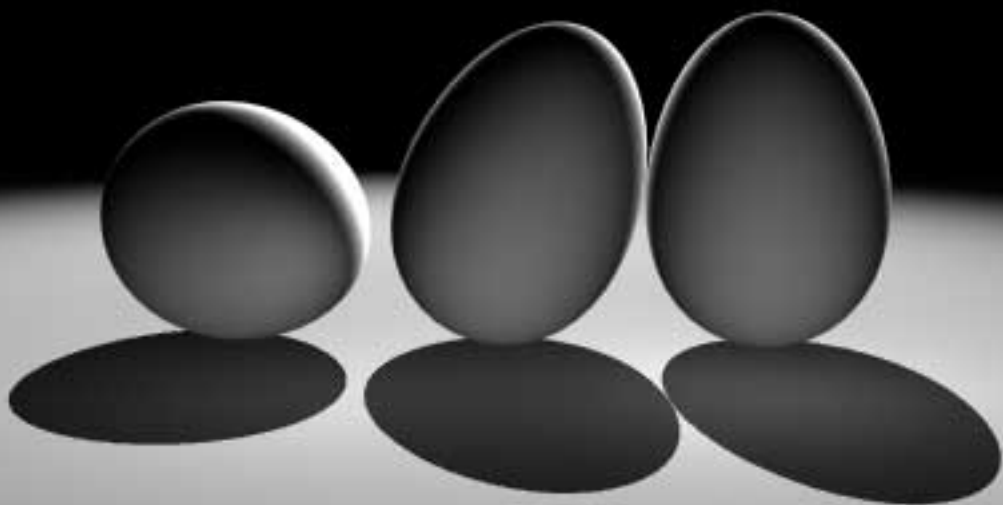


Figure 7(back lighting)

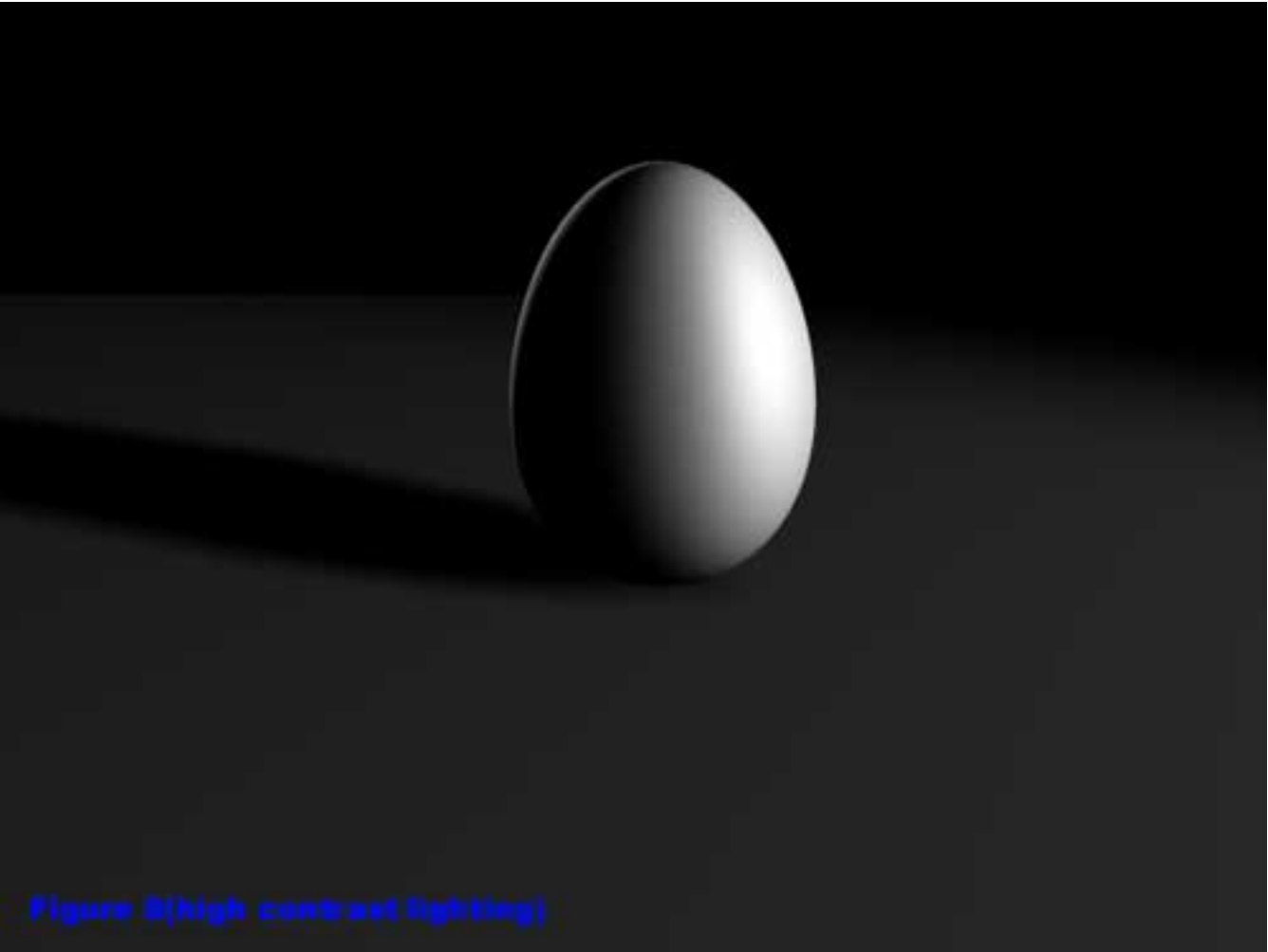


Figure 3 (high contrast lighting)

original



underlying shape composition



Figure 9a

original



underlying shape composition

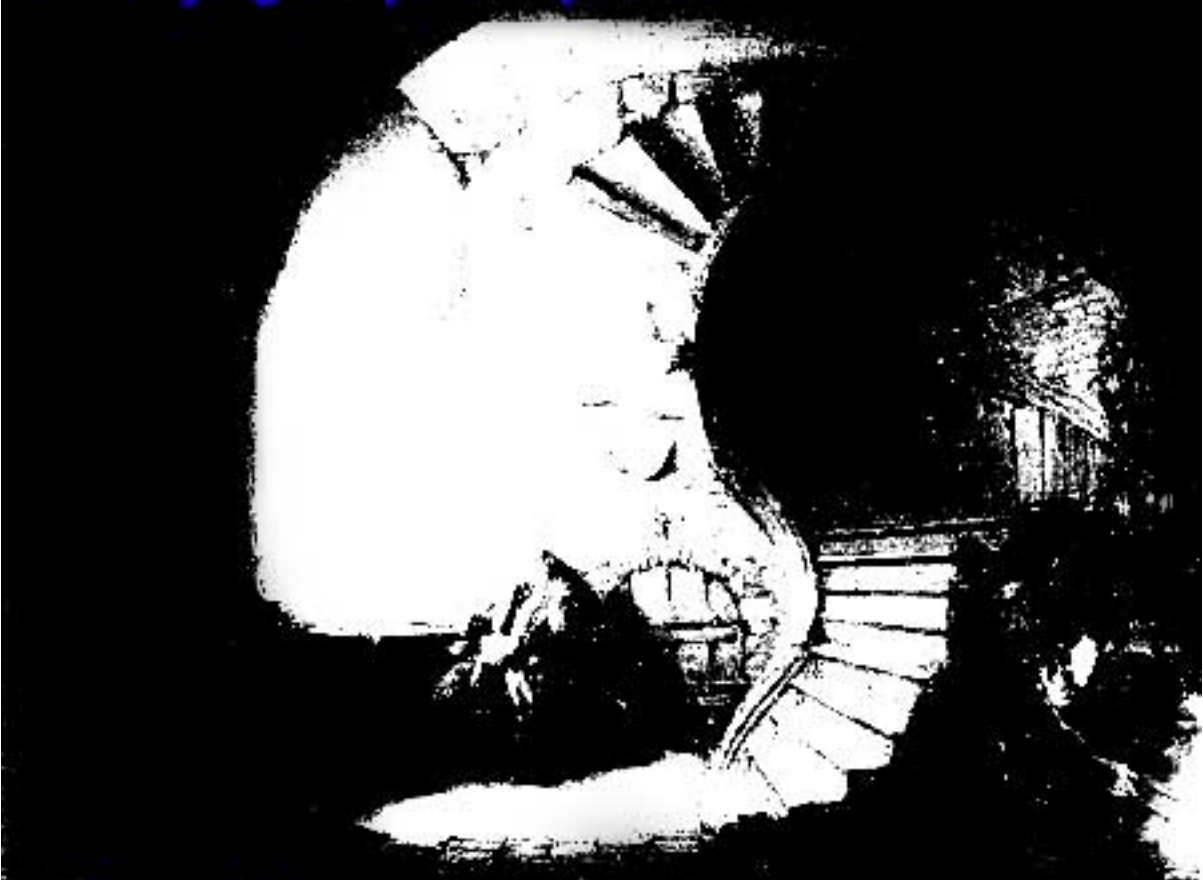


Figure 9b

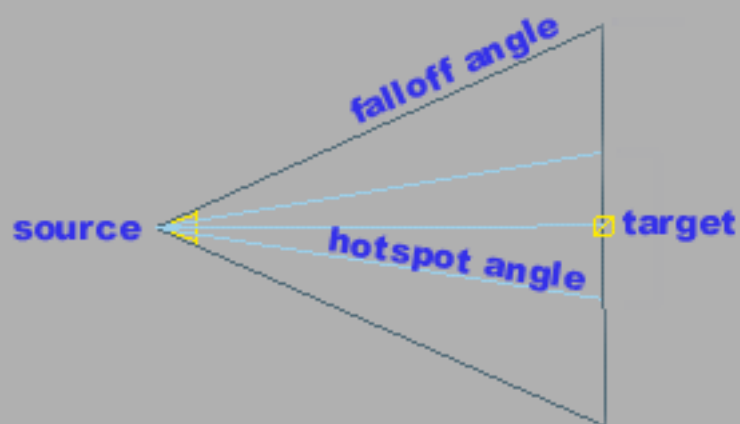


Figure 10a (Spotlight)

- Spotlight Parameters

Hotspot: 43.0

Falloff: 45.0

☐ Show Cone ☐ Overshoot

☒ Circle ☐ Rectangle

Asp: 1.0 [Bitmap Fit...](#)

☐ Projector

Map: None

Target Distance: 218.797

- Shadow Parameters

☐ Cast Shadows

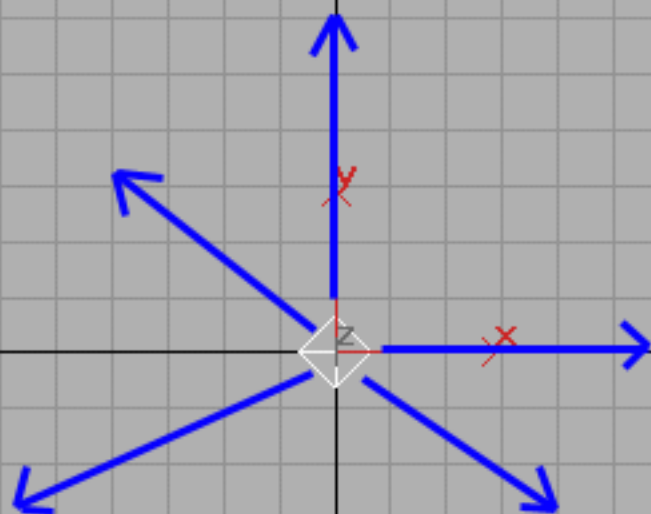
☐ Use Global Settings

☒ Use Shadow Maps

☐ Use Ray-Traced Shadows

Map Bias	Size	Smp Range
1.0	256	1.0

Figure 10b



light rays cast in all directions

Figure 11(omnidirectional light)

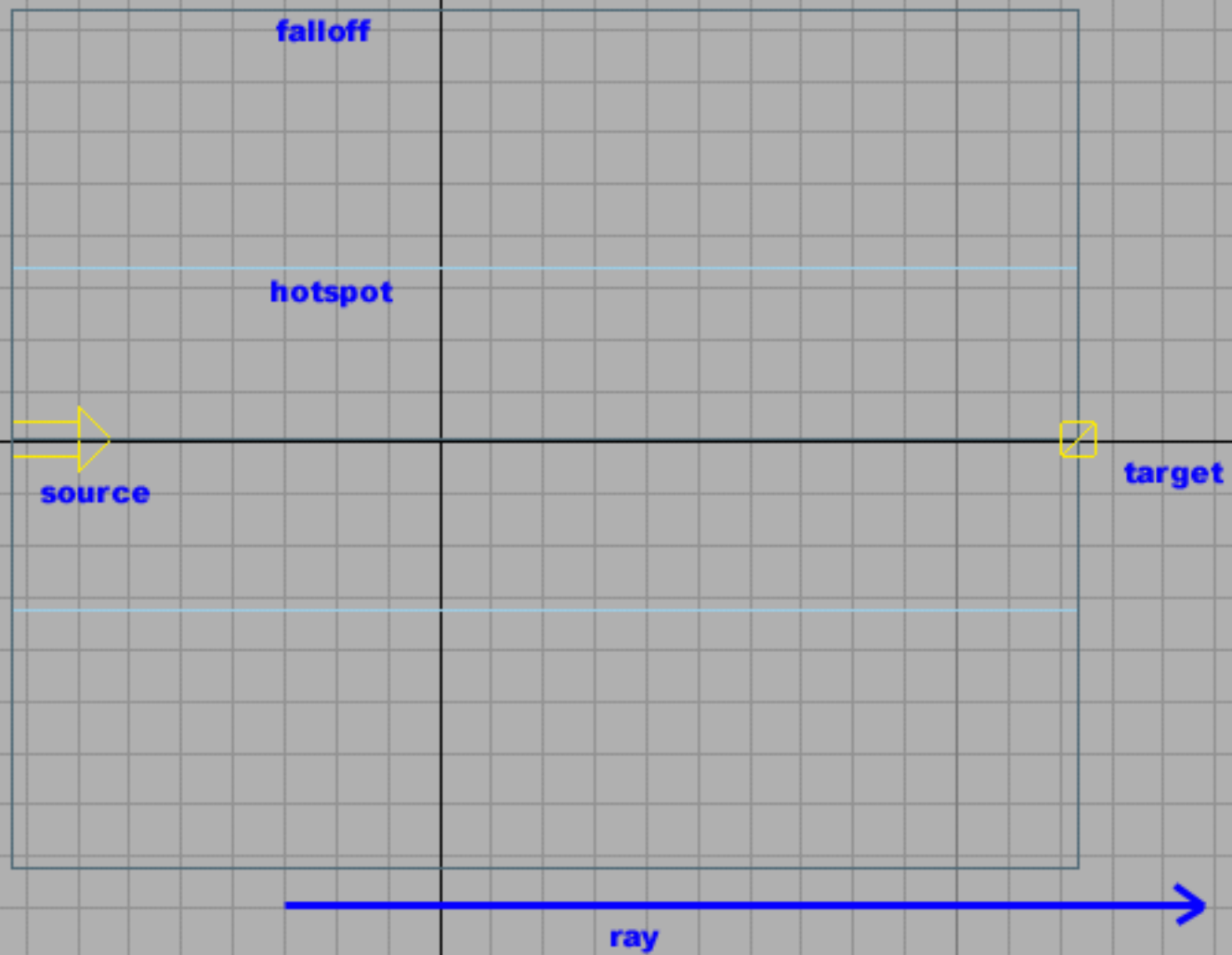


Figure 12(directional light)

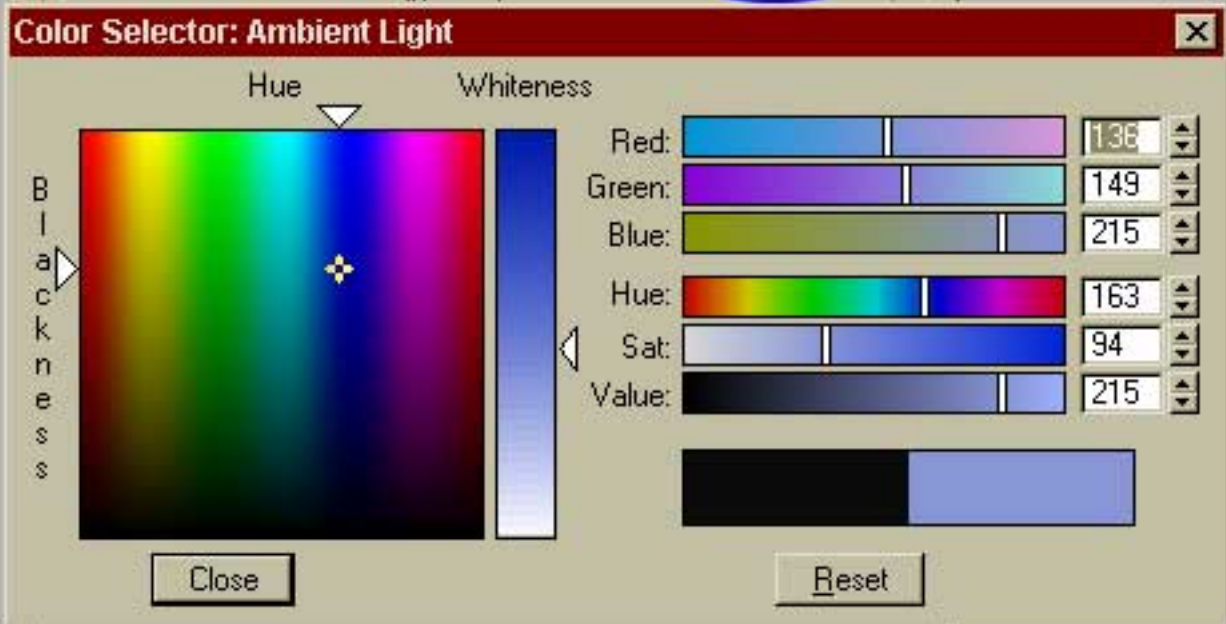
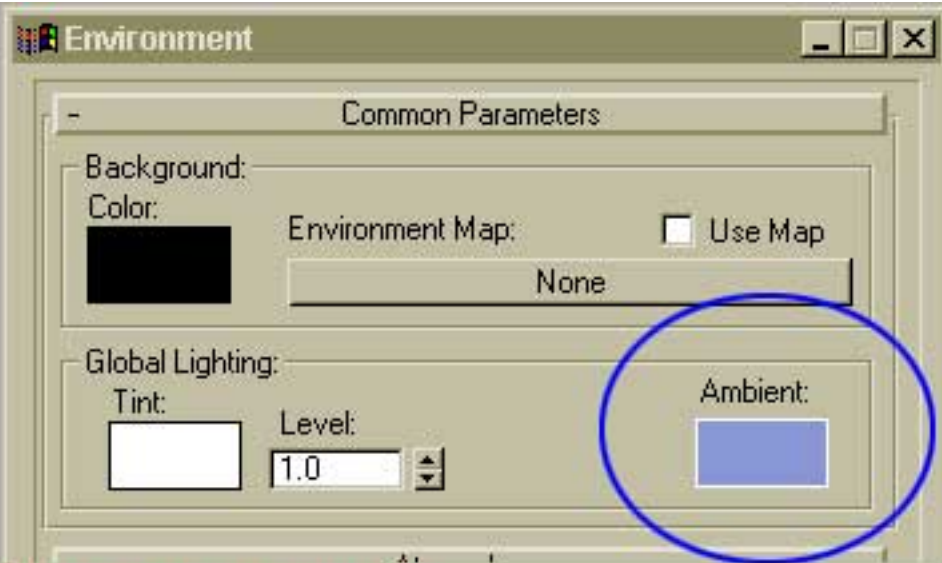
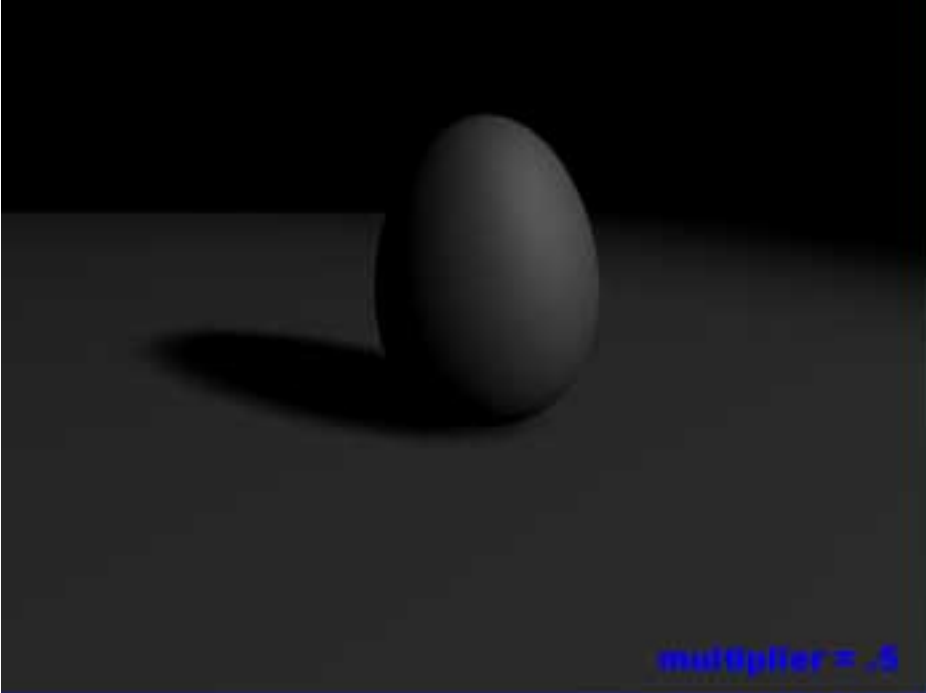
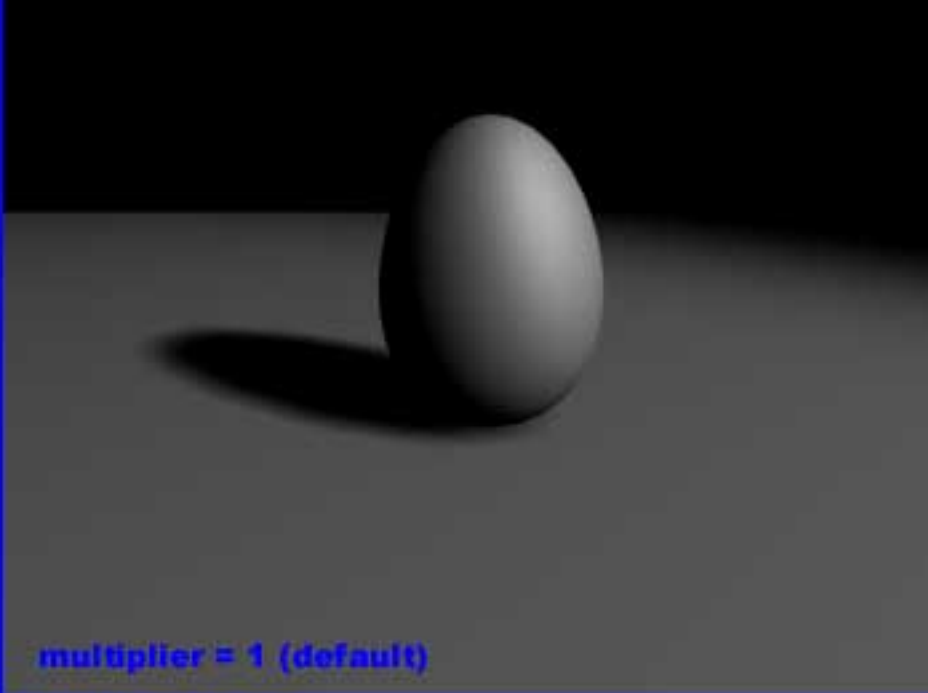


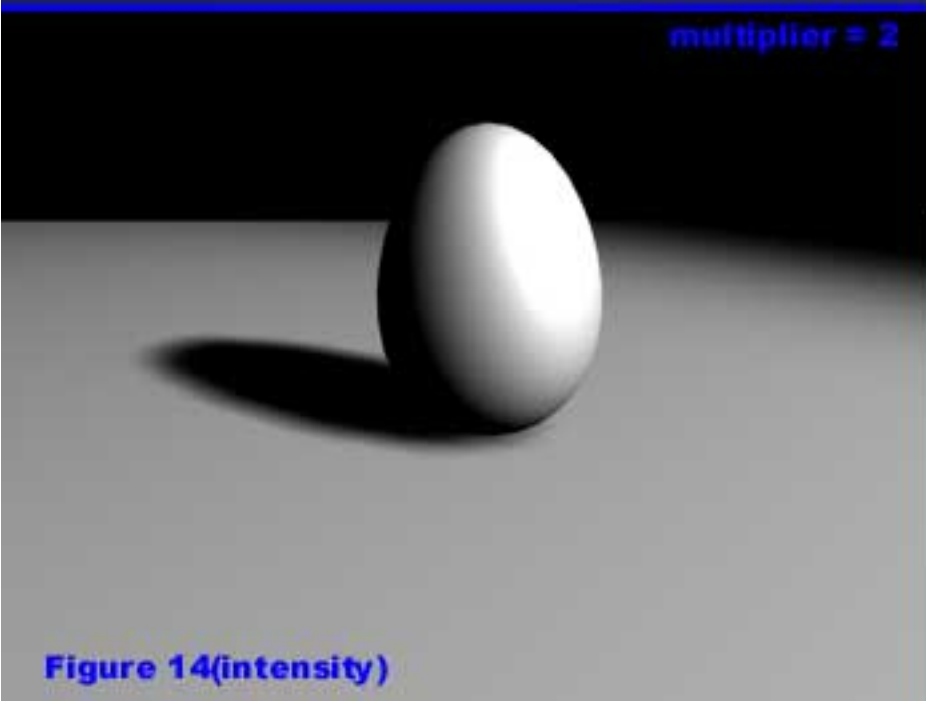
Figure 13 (ambient lighting environment box)



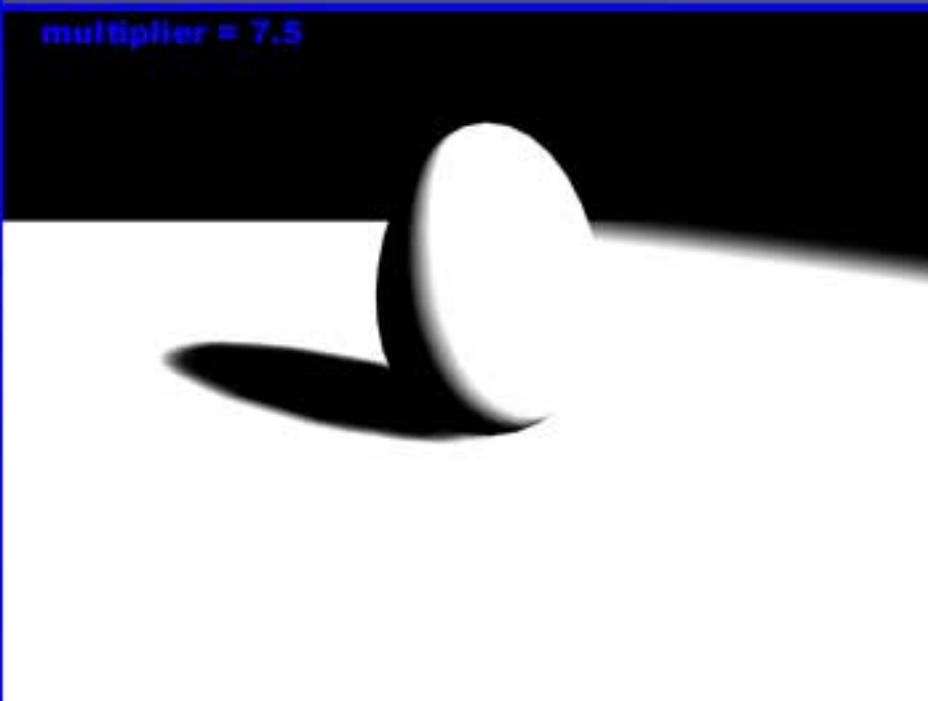
multiplier = .5



multiplier = 1 (default)



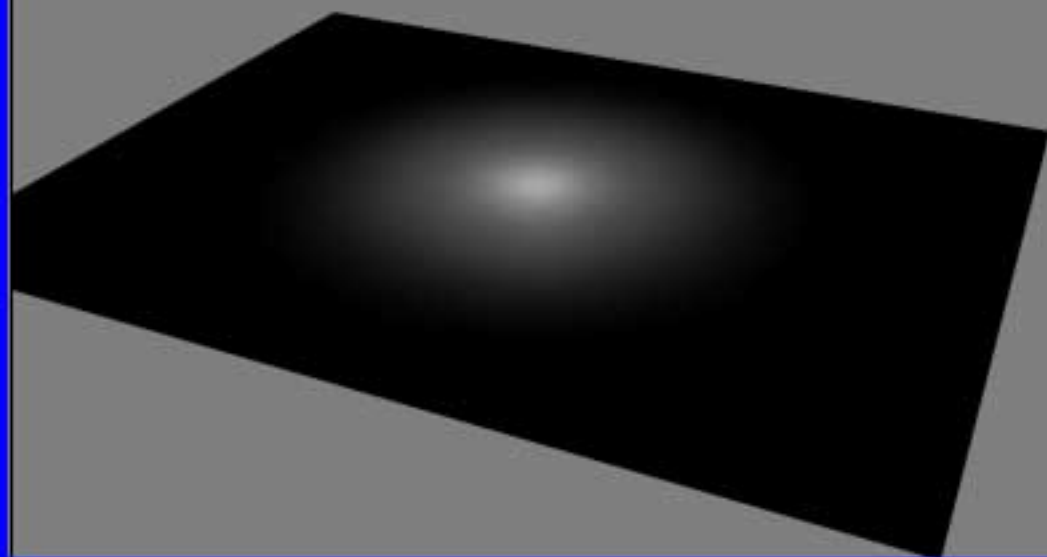
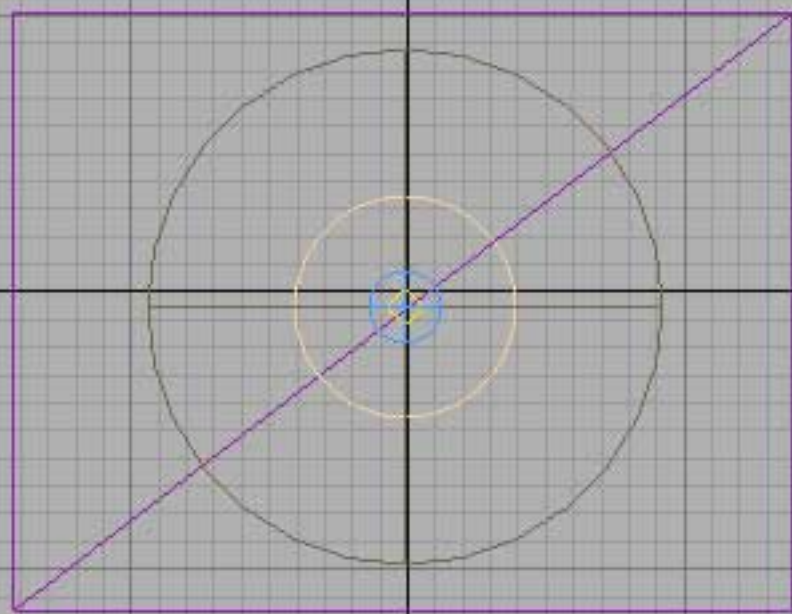
multiplier = 2



multiplier = 7.5

Figure 14(intensity)

Top



Top

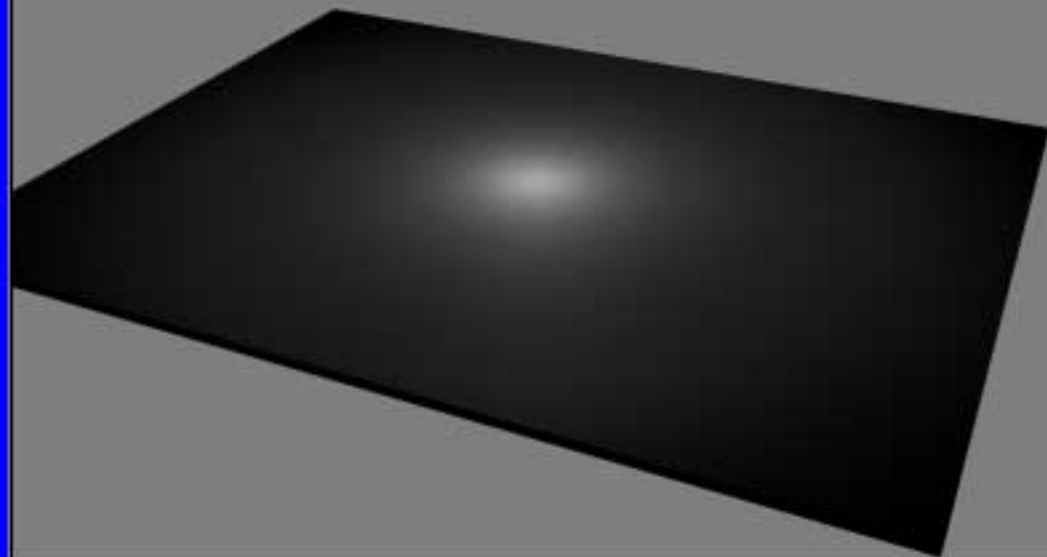
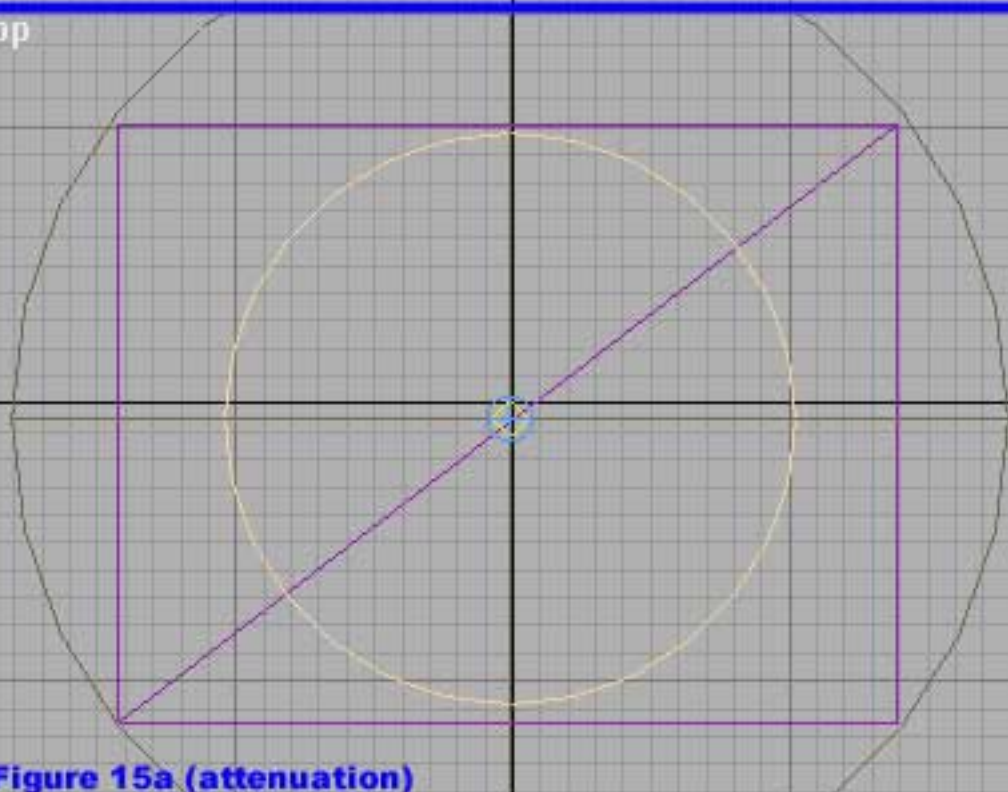


Figure 15a (attenuation)

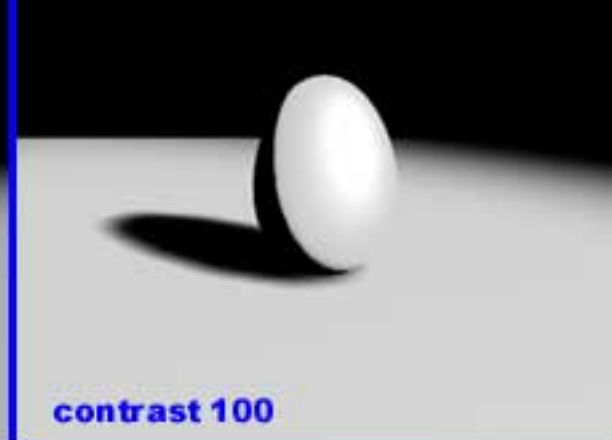
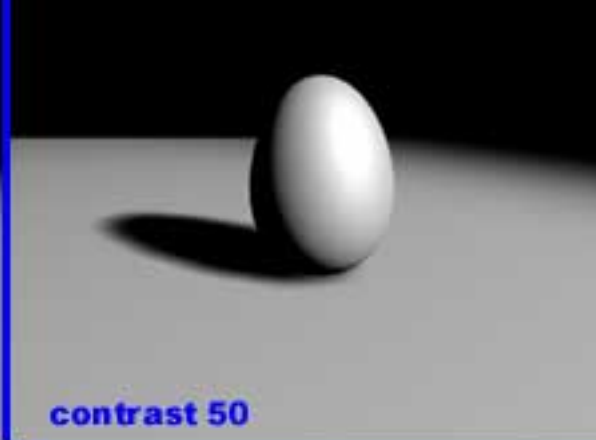
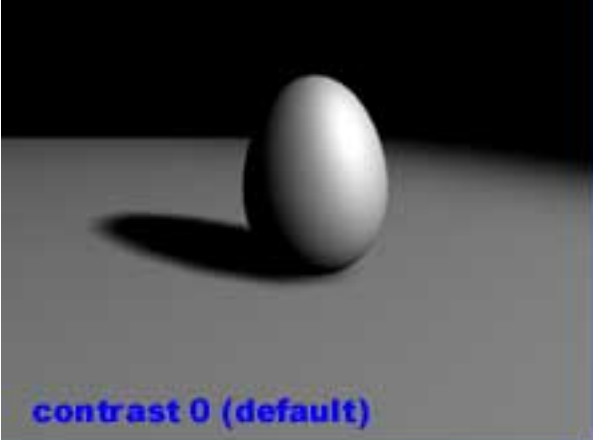


Figure 15c (map size)

map size = 128



map ize = 512



map size = 2048





samples = 1



samples = 5



samples = 20

Figure 15d (sample range)

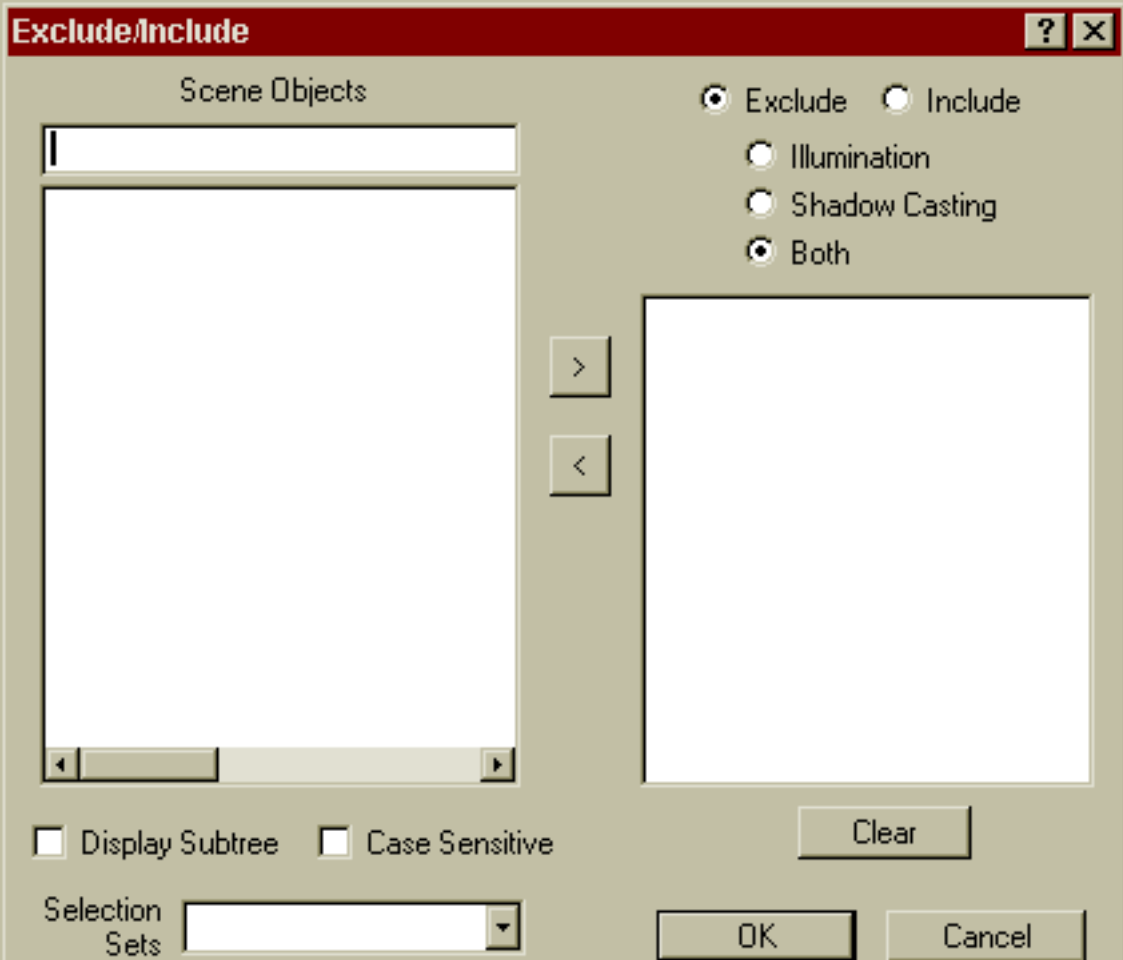
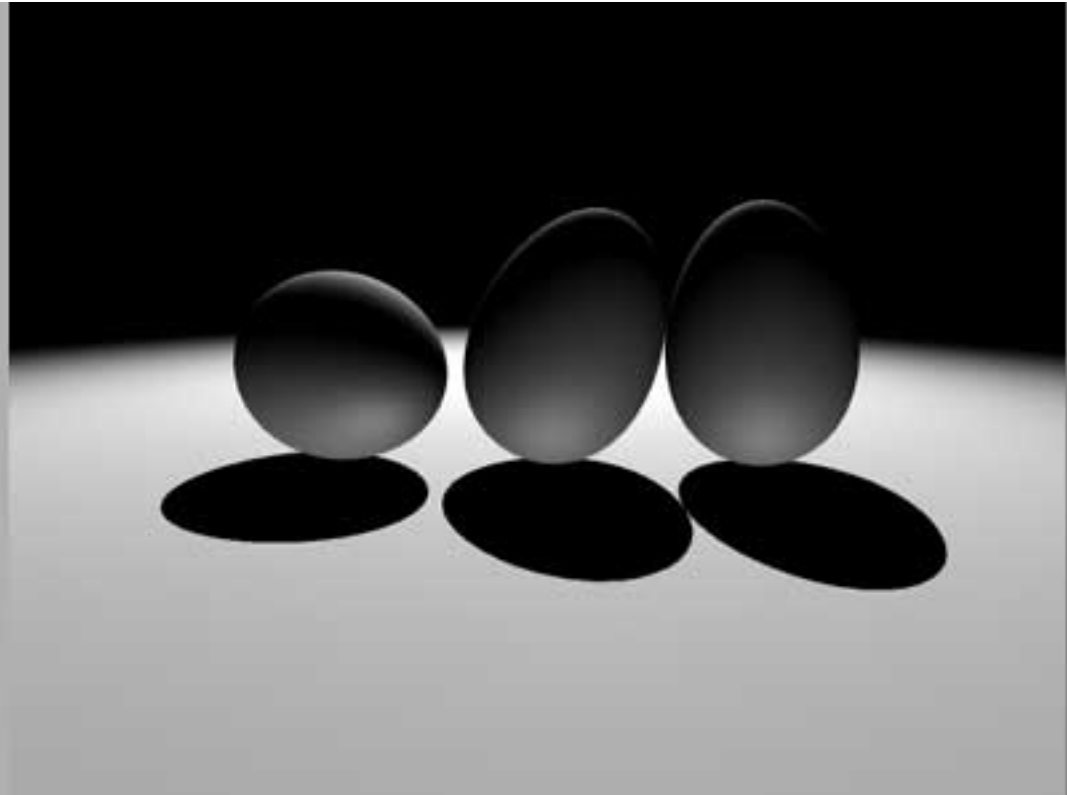
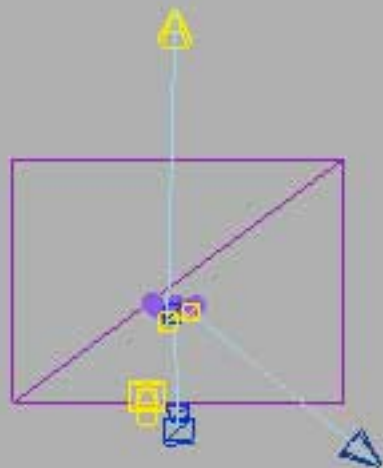


Figure 15e (include/exclude option box)

**Figure 16a**

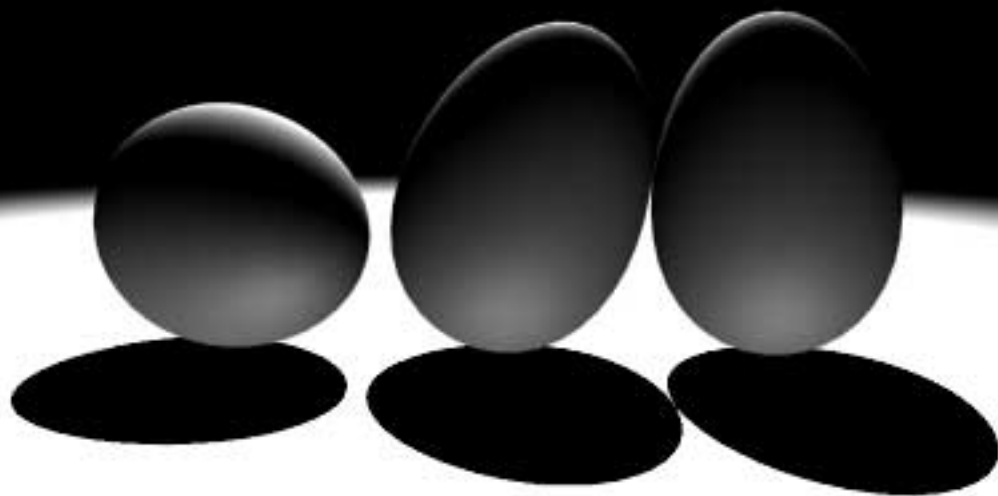


Figure 16b

Top

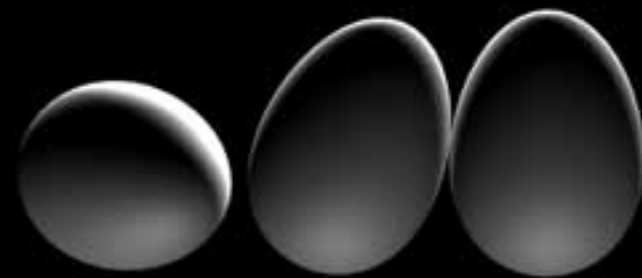
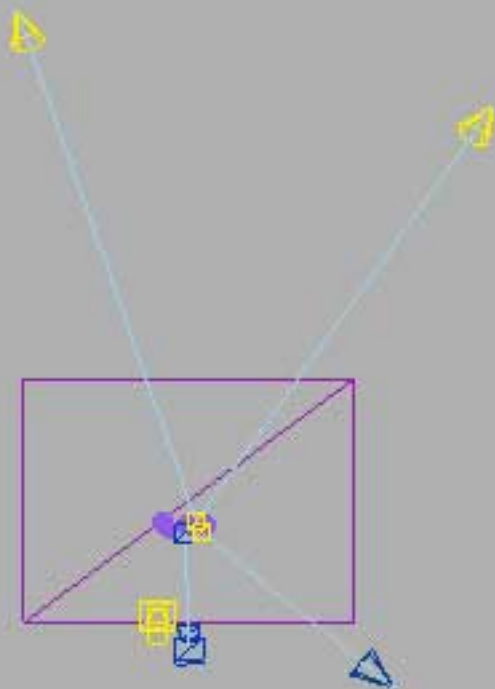


Figure 16c

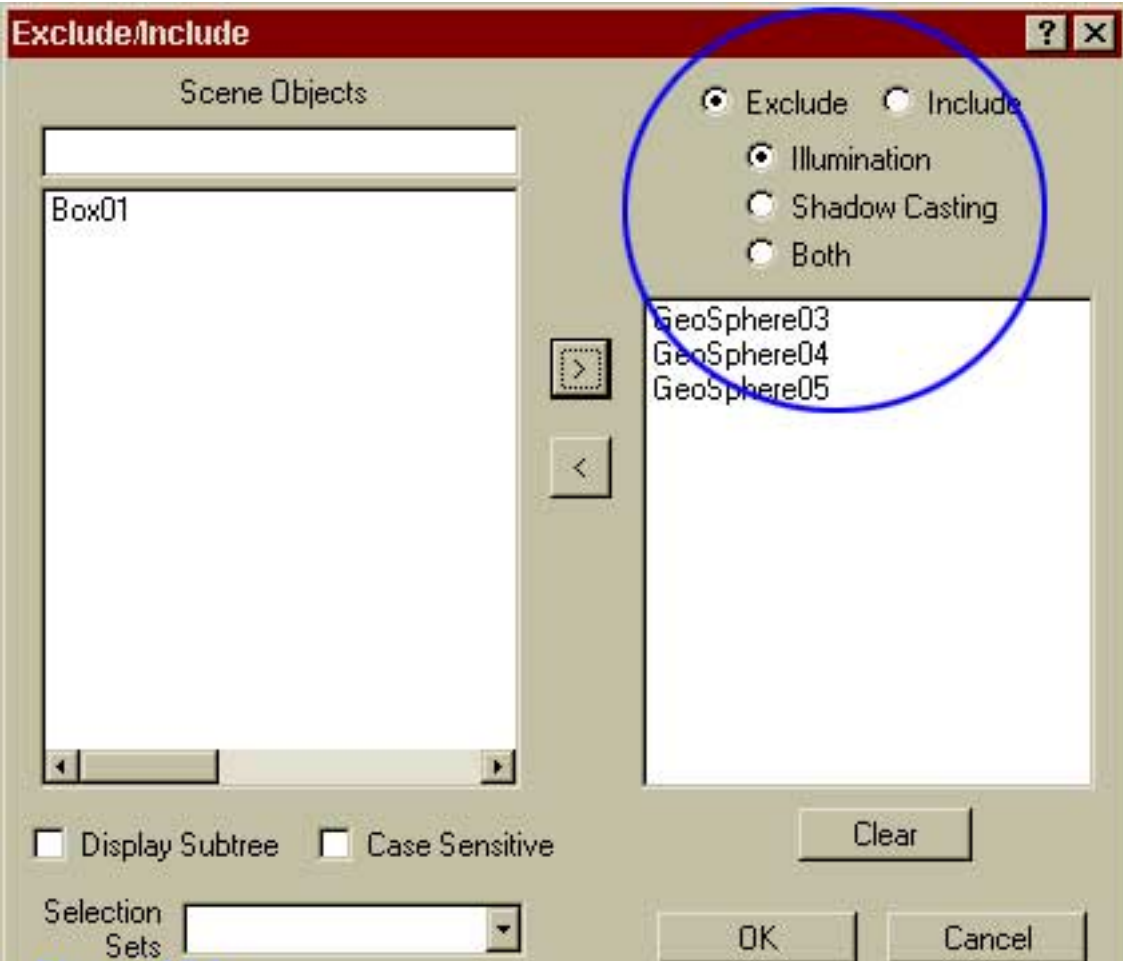


Figure 16d

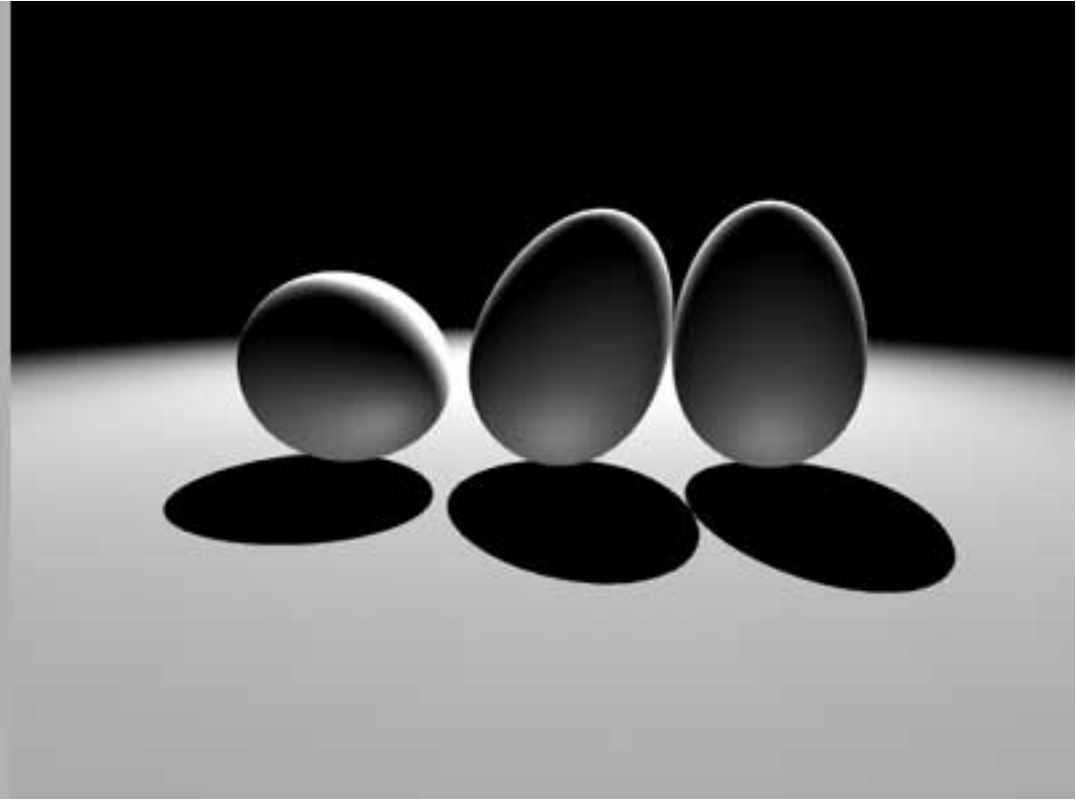
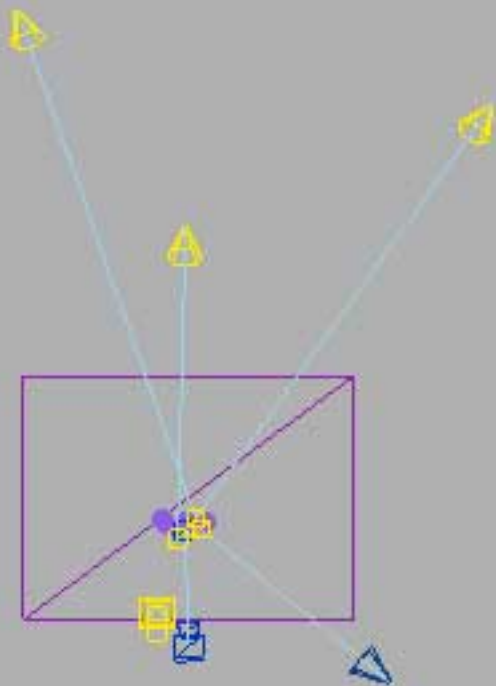


Figure 16e



Light spill on
cheek from collar

light spill on back of hand
due to bounce light
from wall

Figure 17 (Light Spills)

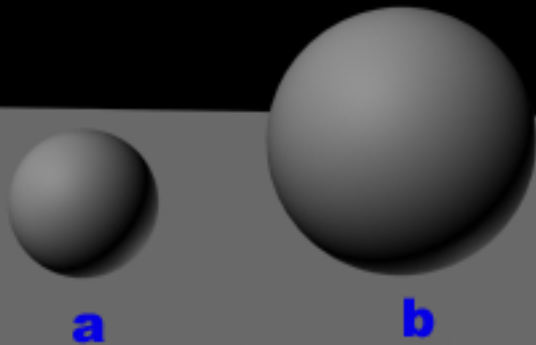
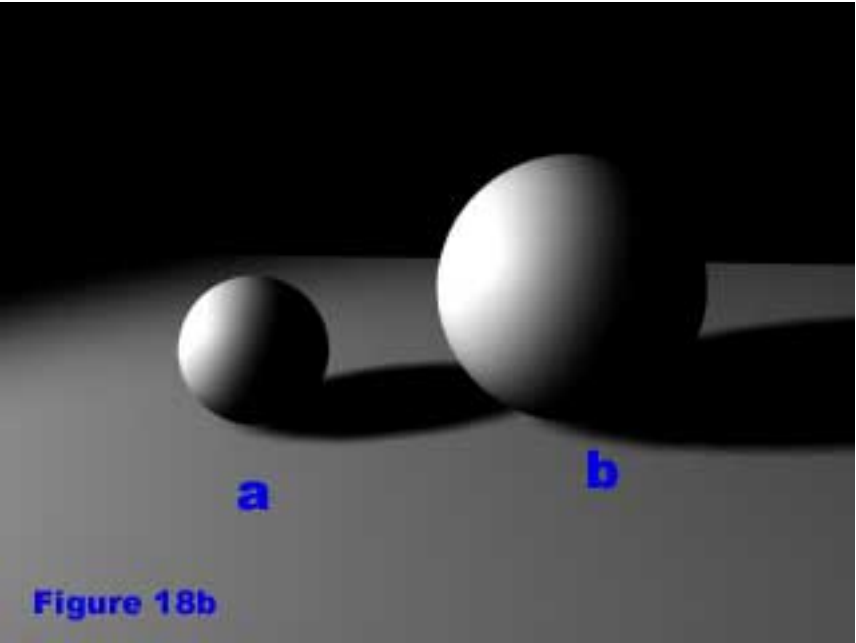


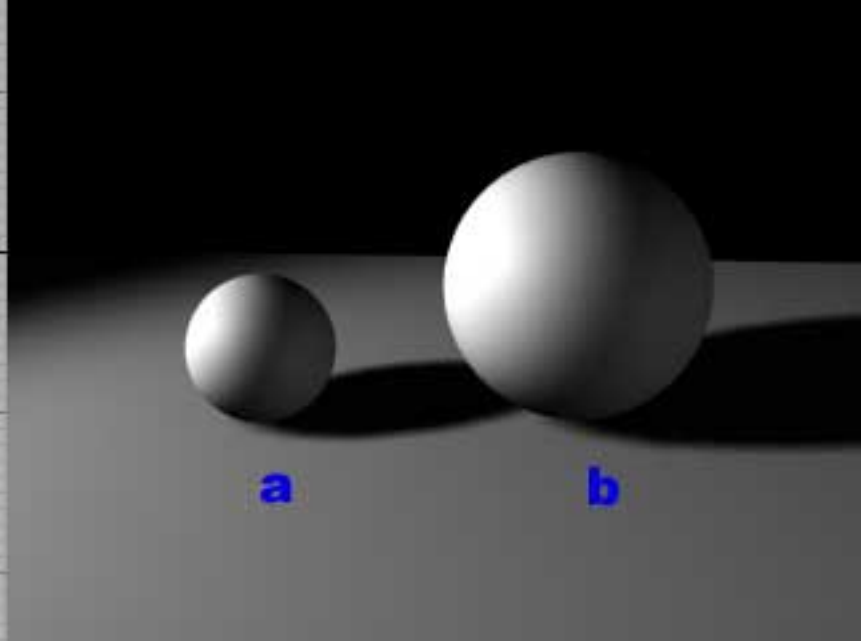
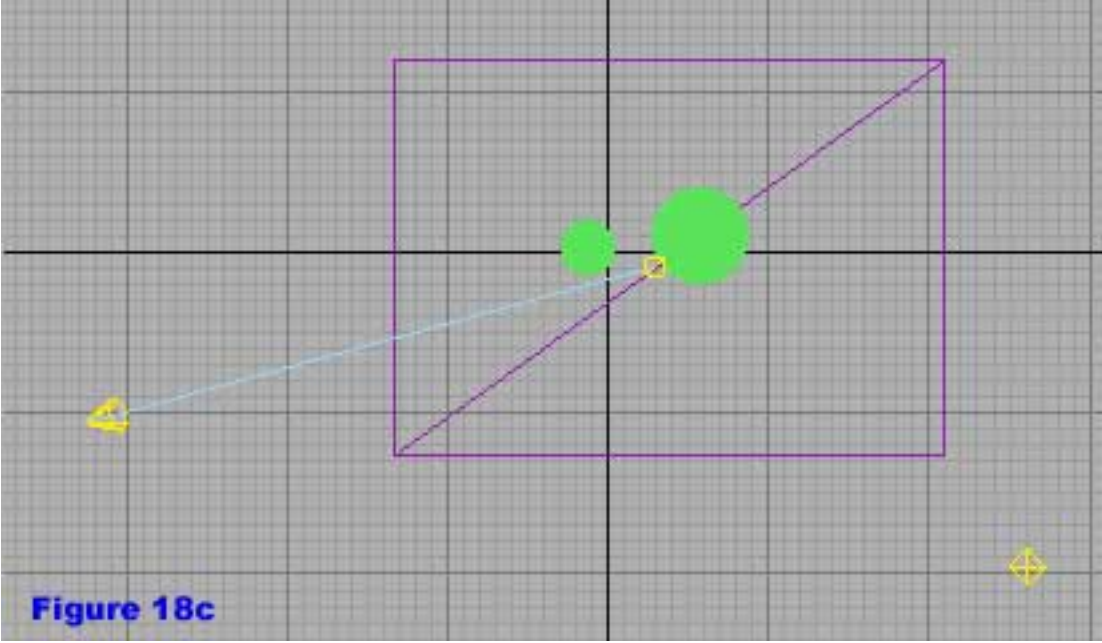
Figure 18a (default lighting)



a

b

Figure 18b



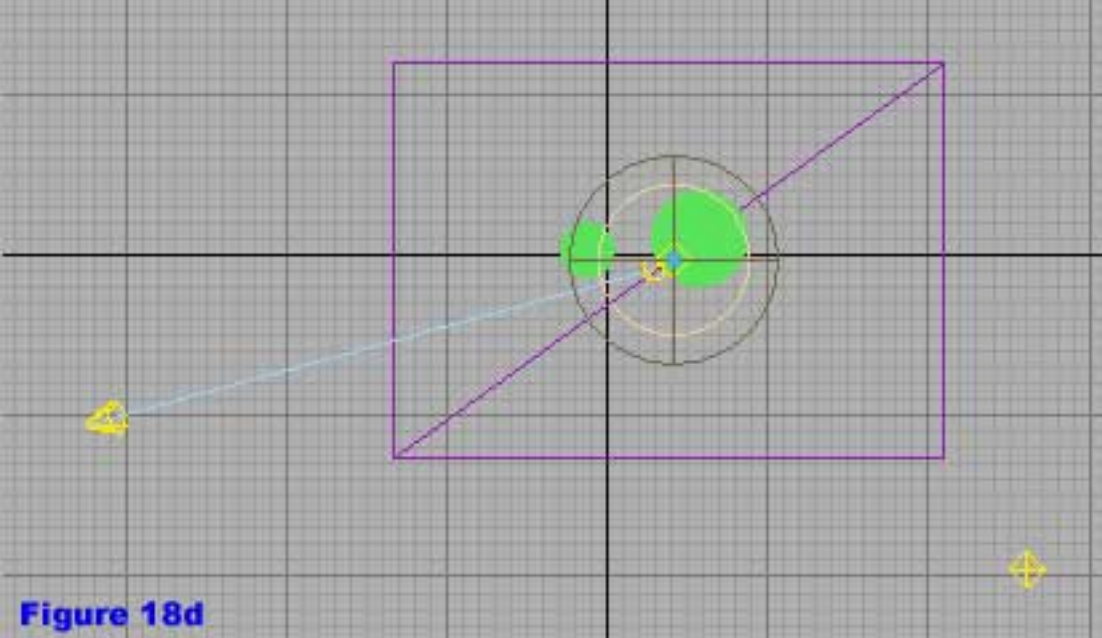
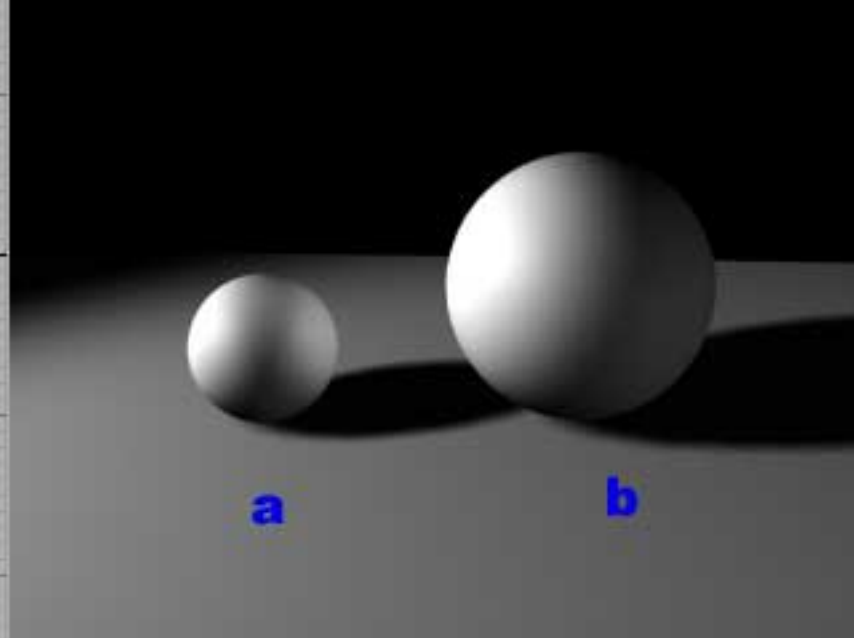


Figure 18d



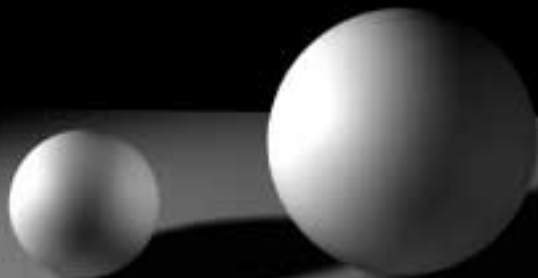
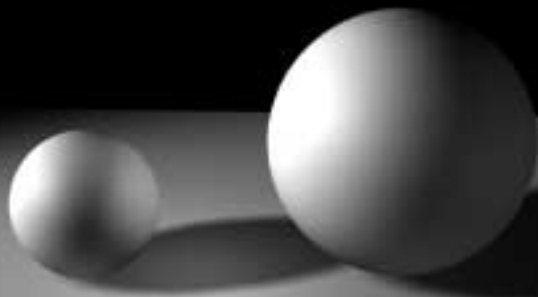


Figure 18e



a

b

Figure 18f

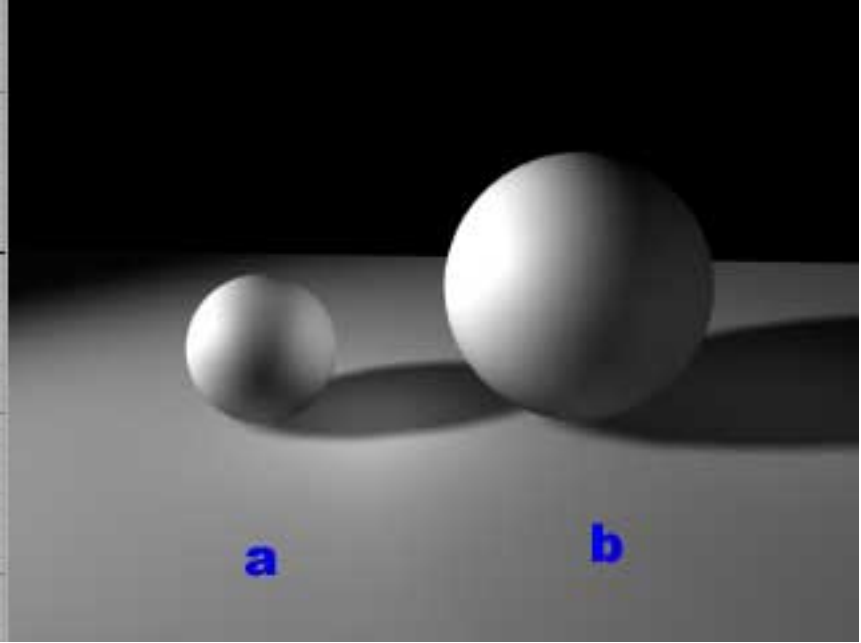
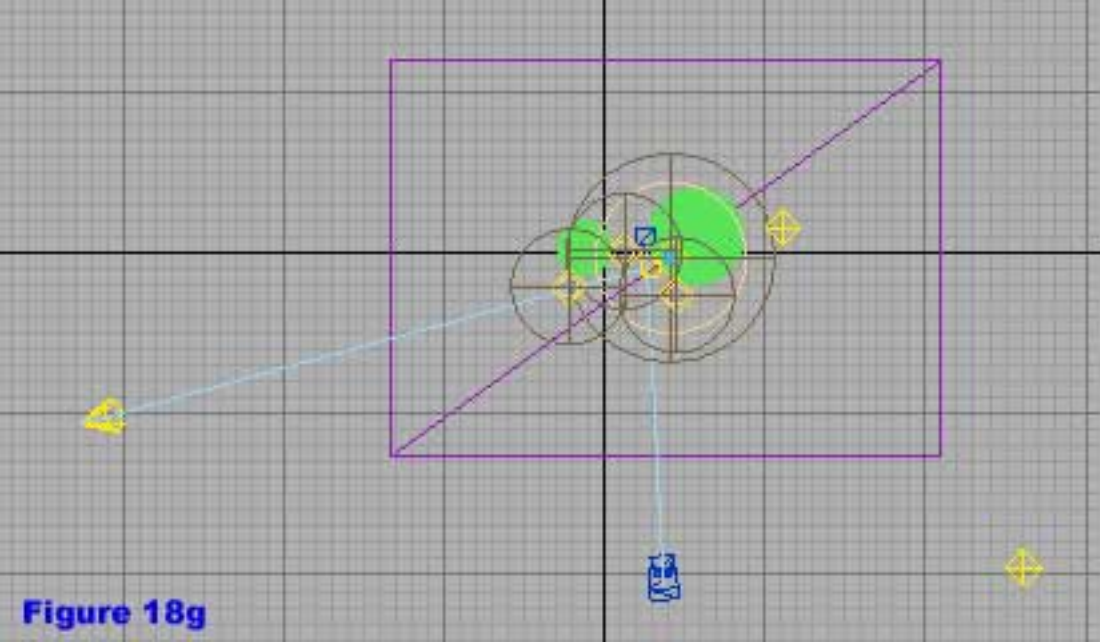


Figure 18g

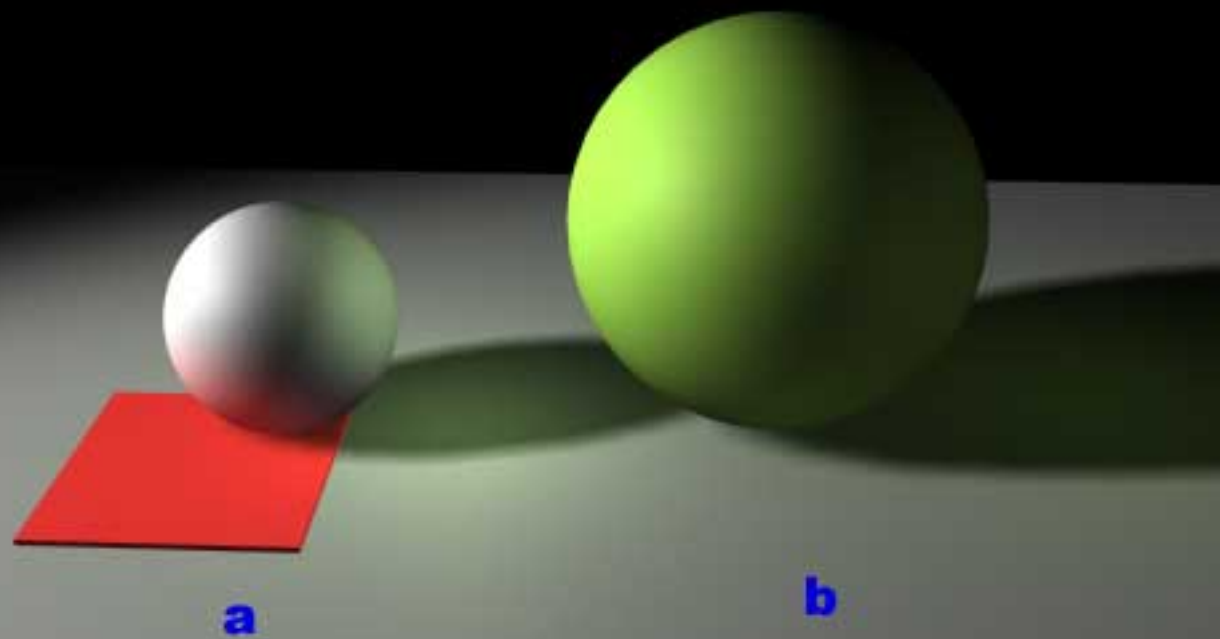


Figure 18h



Figure 19a

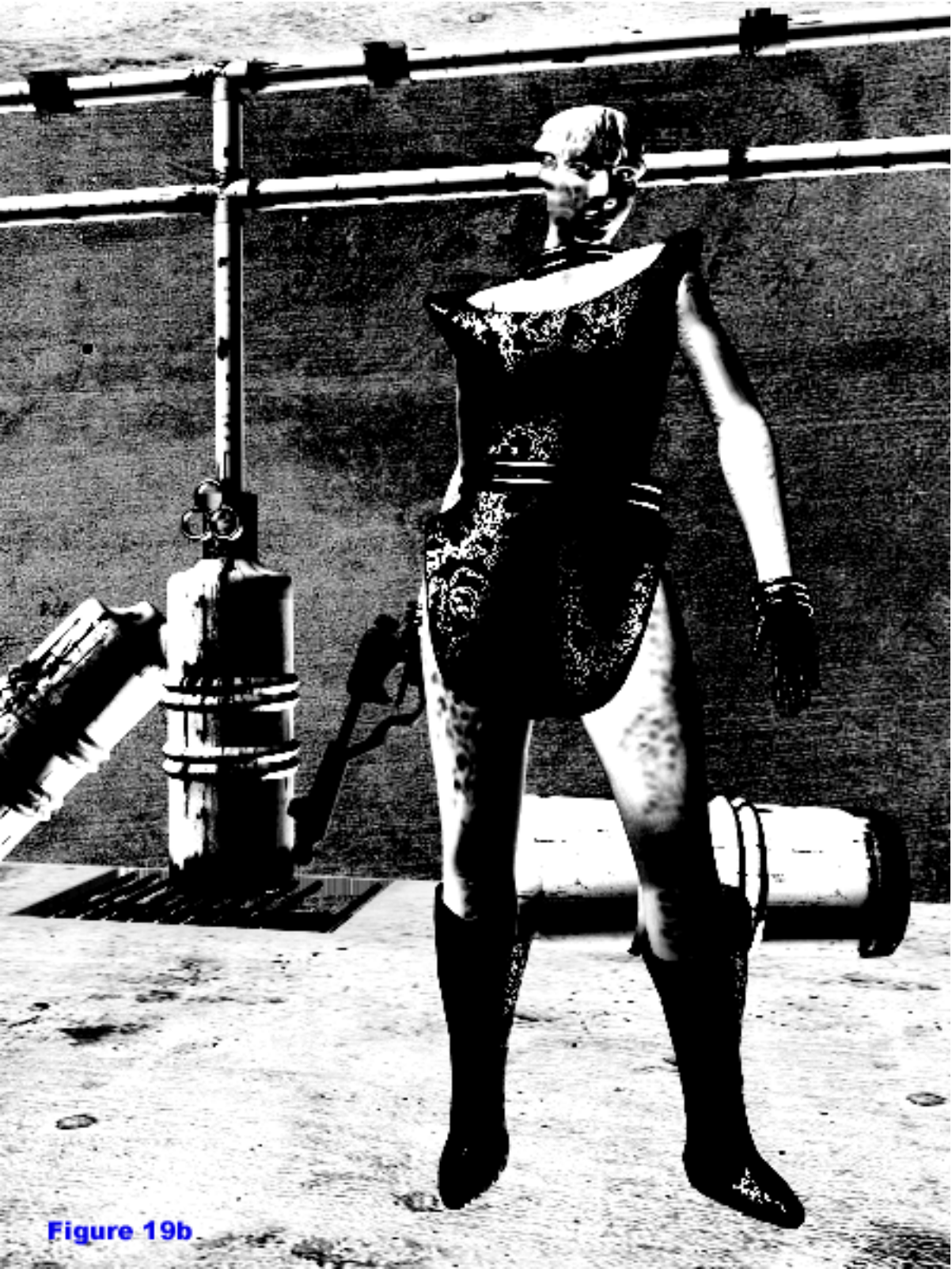


Figure 19b



Figure 19c

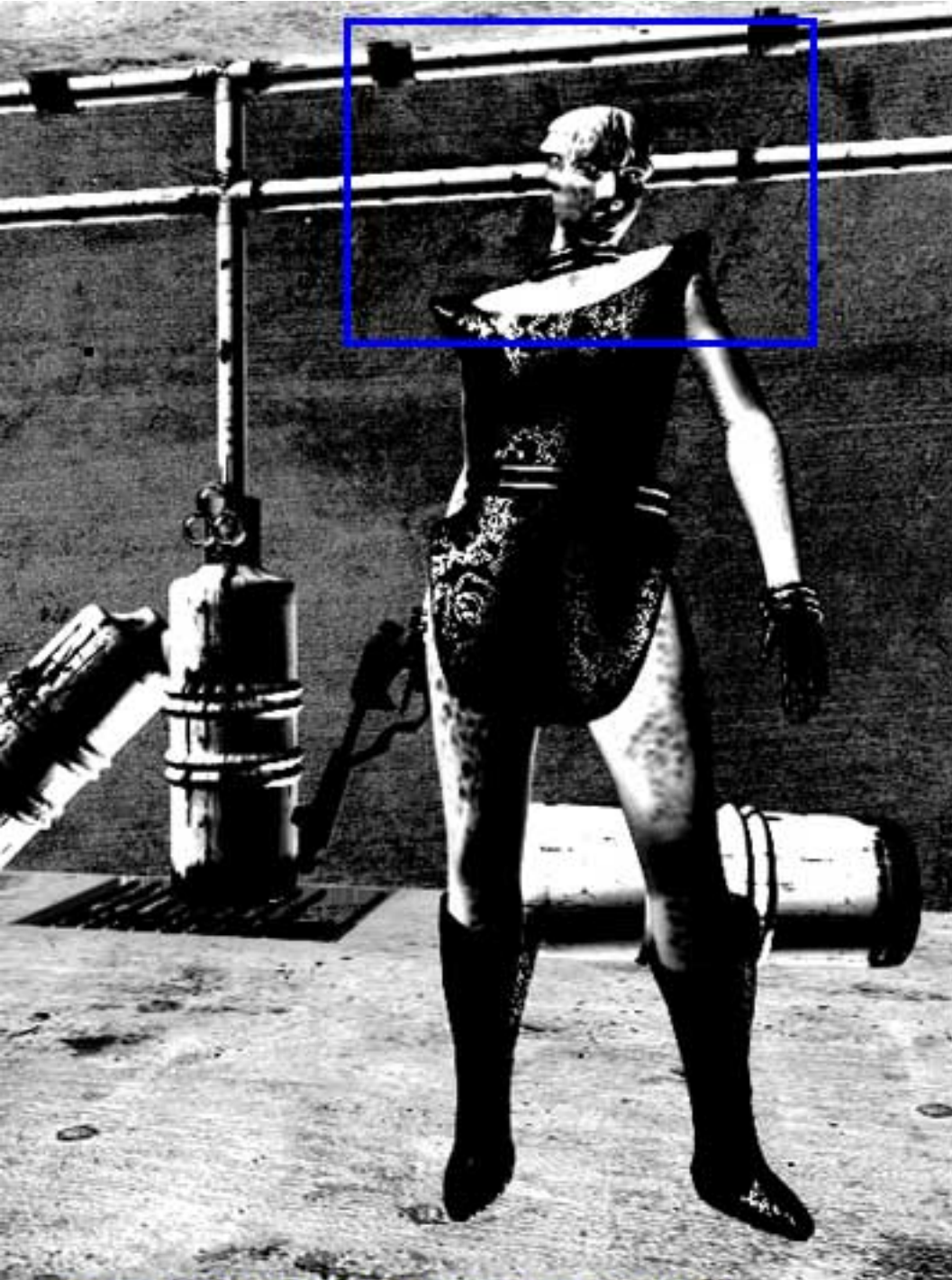


Figure 19d (underlying shape composition
before and after Key Light)



underlying shadow shapes on right
face much more feminine than the ones
created with default lighting on the left





Figure 108

(c) 1999 Brian Kottor



Figure 19g (c)1999 Brian Nestor



Figure 19h (c) 1999 Brian Nestor



Figure 19i (c) 1999 Brian Nestor

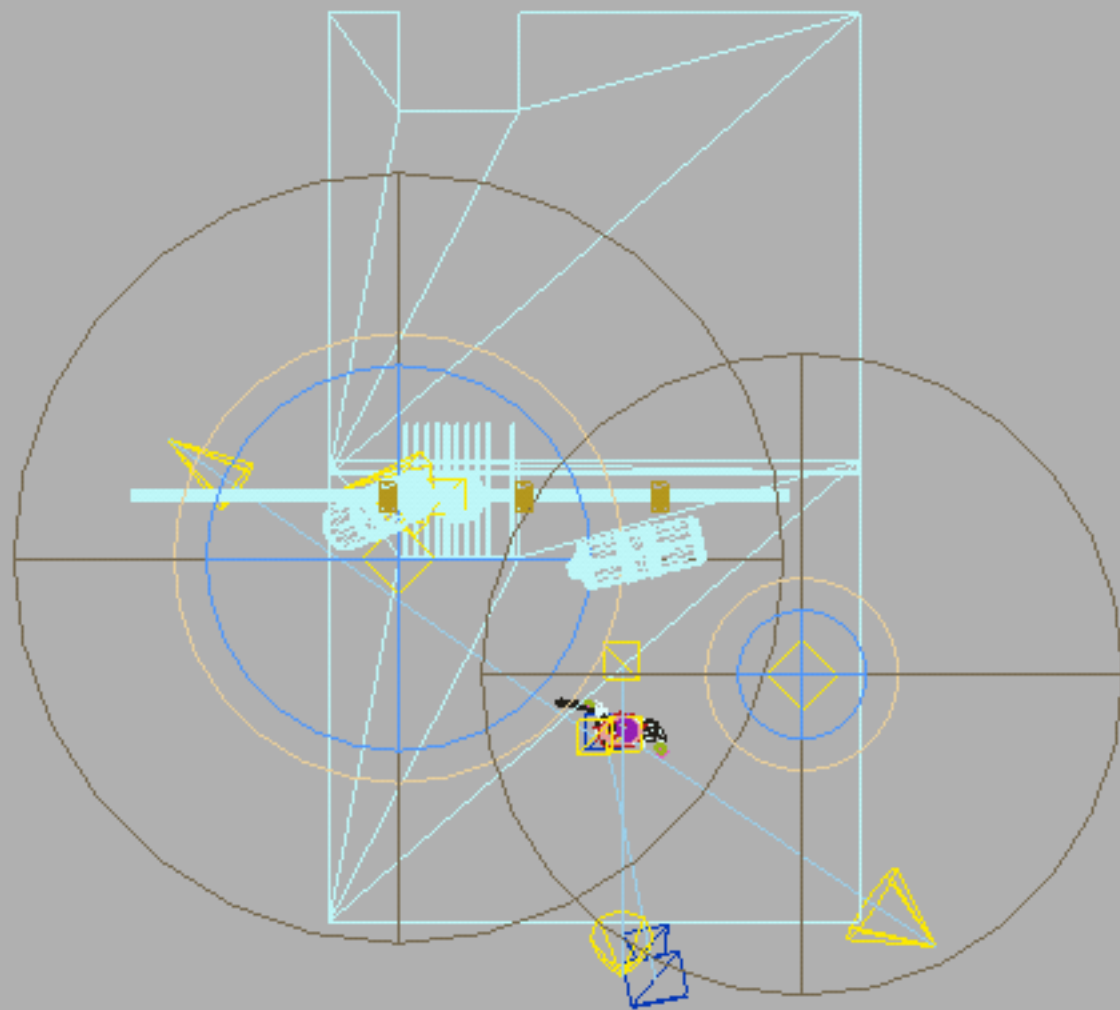


Figure 19j