Lighting and Cameras

When you create a scene in Blender, you start with a few basic elements that will include a camera, but may or may not include a light. Remember that what the camera sees is what will render out as a picture or movie depending on what you tell the program you want as a final output. To get a simple rendered view, press the "F12" key. This will open a window that will display the rendered output of what the camera is focused on. If the picture is black, you do not have a lamp or the lamp settings or placement in incorrect. To exit the render window, press the "*Esc*" key.

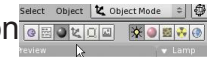
Lighting

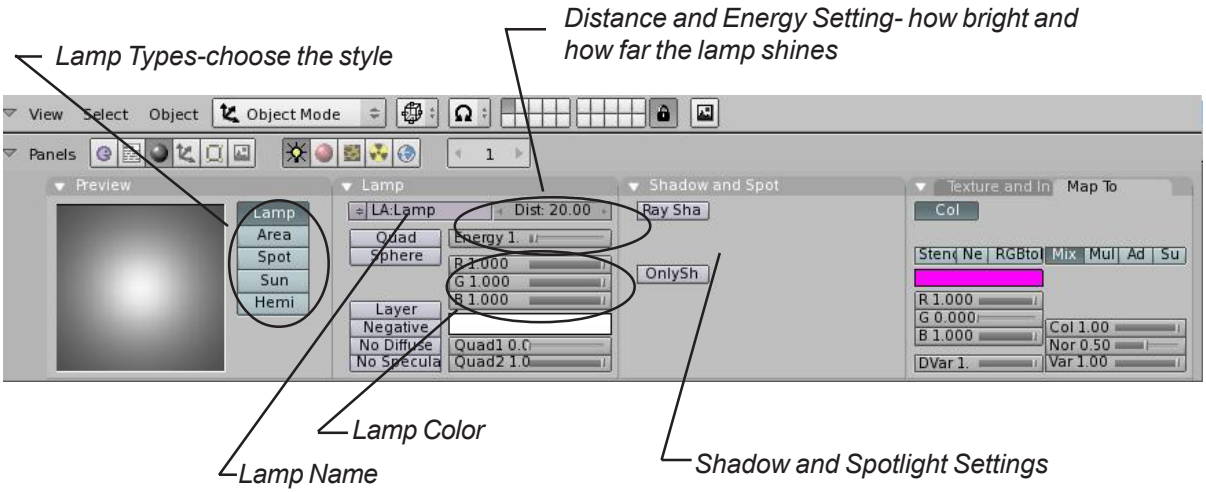
In most cases, you will need more than one lamp in order to properly illuminate your scene. Most scenes usually require 3-4 lamps. *Be careful not to use too many lamps!* The different types of lamps available for you to use are as follows:

Lamp-	Basic Blender Lamp- shines all directions
Area-	New lamp type- provides large area lighting (like a classroom)
Spot-	Shines a direct angle of light
Sun-	Provides an even angle of light, regardless of placement from objects.
Hemi-	A wider light, much like area lights.

In traditional Blender rendering, only spotlights are able to cast shadows. However, with the introduction of Raytracing (discussed in a later chapter) all lamps can cast shadows.

Lamp Settings:

To create a lamp, position the 3D cursor in a desired location and press the "*Space Bar*" and select *Lamp.* The lamp will be placed on the screen. You now have several options to select. With the lamp selected, click the *Shader* button and *Lamp* button  to bring up the adjusting options. Here's what you see:



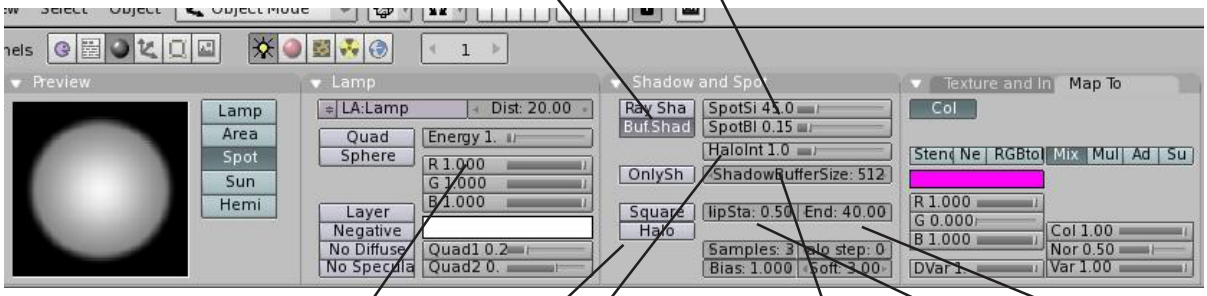
There are other lamp setting available, but for now, these are the basics.

Spotlight Settings:

Spotlights are unique in that you can simulate a foggy scene with them and cast shadows in the traditional Blender program. Raytracing (discussd in a later chapter) can cast shadows for all lamp types, but because of the more complex rendering calculations that need to be performed, renders much slower. If you watch professionally made animations on T.V., you will see that raytracing with reflections is not always used because of the rendering time. It is only used when needed. You can do the same thing. Here are your spotlight settings:

Spotlight Si and Bl- sets the spotlight beam angle and edge softness

Select Buffer Shadow- traditional, faster spotlight settings



Lamp Color, Distance, and Energy as before

Halo and Halo Intensity- gives and controls a smokey effect

Buffer Size-higher numbers mean smoother shadows

Clip Start and End- These need to be set to just include the objects that need to cast shadows. If clip start is too far above the objects or if clip end it too far away, shadows won't work.

In order for the shadows to display in your render window (*F12*), you need to tell the program to render shadows if it isn't set to do so already. Click on the *Scene* and *Render* buttons found in the bottom  and find the *Shadows* button:

Experiment with the different types of lights you have available. Different lights can be used to get different effects. As mentioned before, try not to add too many lights to your scene. It is better to keep it down to 3-4 and play with their locations and setting, rather than flood the scene in light. Think of it in terms of real lighting situations.

Cameras:

By default, your scene already has one camera and that is usually all you need, but on occasion you may wish to add more cameras. You add more cameras by hitting the *Space Bar,* like creating all other objects discussed up until now. *To change which camera is active, you need to select that camera and press "Ctrl" and number pad "0".* This changes the active camera.

Like all other objects in Blender, you can adjust the camera settings as well. With the camera selected, click on the edit button. Here are some of the settings options you have:

Lens- Set-up a lens length much like a real camera. 35mm is a good, safe setting, but wide and tight angle setting work for different needs.

Clip Start- How close an object can get to the camera and still be seen.

Clip End- How far away objects can be seen by the camera. In very large scenes, this needs to be set higher or things "disappear" from view.

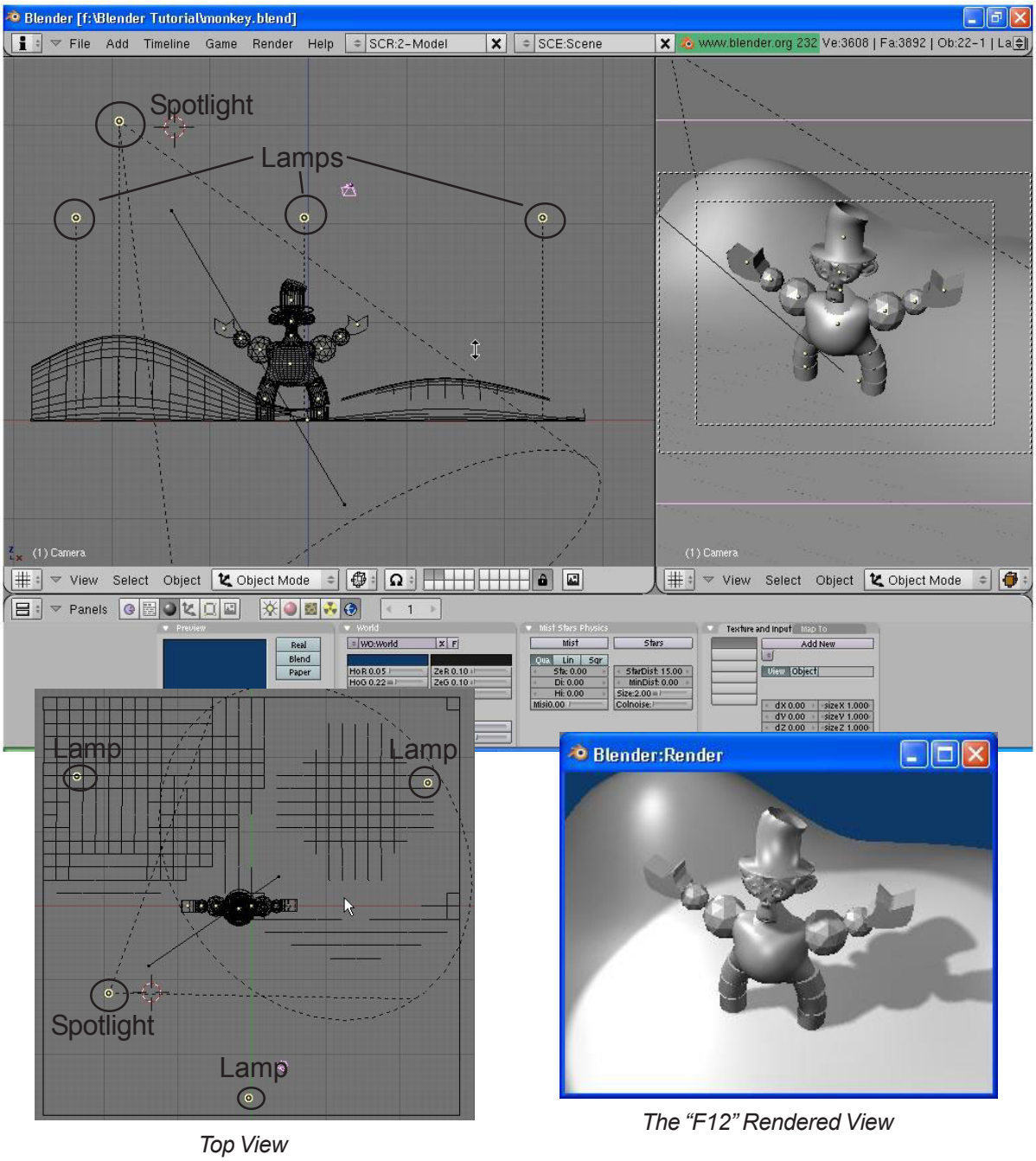
Draw Size- How big to draw the camera on the screen.

Ortho- Used to set the camera from showing a true-life perspective view to an orthographic view.

Show Mist/-Limits- Used to give you a visual display of how far the camera sees.

Lighting and Camera Practice Exercise

Open your *Sculpture* file and add lighting and set the camera for a nicely rendered view. Create 3-4 lights for your scene and feel free to experiment with different types of lamps. Use at least one spotlight and enable shadows in the render settings (see page 25 for details). Practice placing lamps for good illumination on all sides. The example below could be used as a model.



Top View

The "F12" Rendered View

***** Call the instructor when finished*****

Importing Objects

One of Blender's strong points is the program's ability to accept several generic types of 3D files from other programs. The most popular used are:

VRML (.wrl) files- Many programs are able to export their files as VRMLs. SolidWorks is a good example that we use. These files import into Blender without any problems in most cases.

.DXF files- A very popular file format for exporting and sharing. AutoCAD and SoftPlan architectural software traditionally exports with .dxf formats. Again, Blender usually accepts these files flawlessly.

To save a file as one of these types from another program, you will need to find an *export* command or a "*save as*" option. This will vary dependig on the program you are using. Refer to that programs help files. To import a VRML or DXF file into a Blender scene, open a new drawing or one you wish to insert the object(s) into. Blender does not have an import command, you just use the *Open* command in the *File* pull-down menu. The program knows that you are trying to open something other than a .blend file and will insert it into your current scene. Now you need to find the object(s) you just inserted. Depending on how that object was drawn, it may need to be resized or rotated.

Appending Other Blender (.blend) Files:

If you wish to insert elements from one Blender file into another one, you need to use the *Append* command in the file pull-down menu. The append command was discussed on page 9, but here's the details again. You can insert lamps, cameras, scenes, objects, etc. from one file into another. The best thing to do if you want to insert an object with its materials and animations, select the "*Object*" option. All data for that object will be inserted into the open file with that object. While in the objects menu, *right click* on all objects you wish to insert, or type "A" for all to select all objects. Usually, you don't insert any lamps and cameras into a scene unless you need them. This would be a good time to discuss the benefits of naming your objects as you create them. It makes it easier to find them later on when they have relevent names.

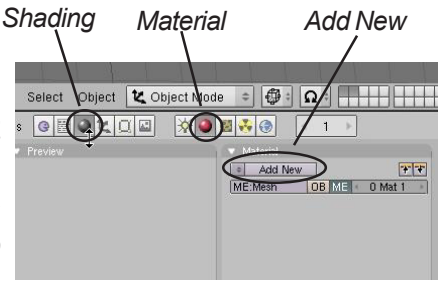
Naming Objects:

Naming objects is an easy task. With an object selected, go to the "*Edit*" Buttons and find the "OB:" box. Type the name of the object here. Remember that it is case sensitive. You've now given your object a name.

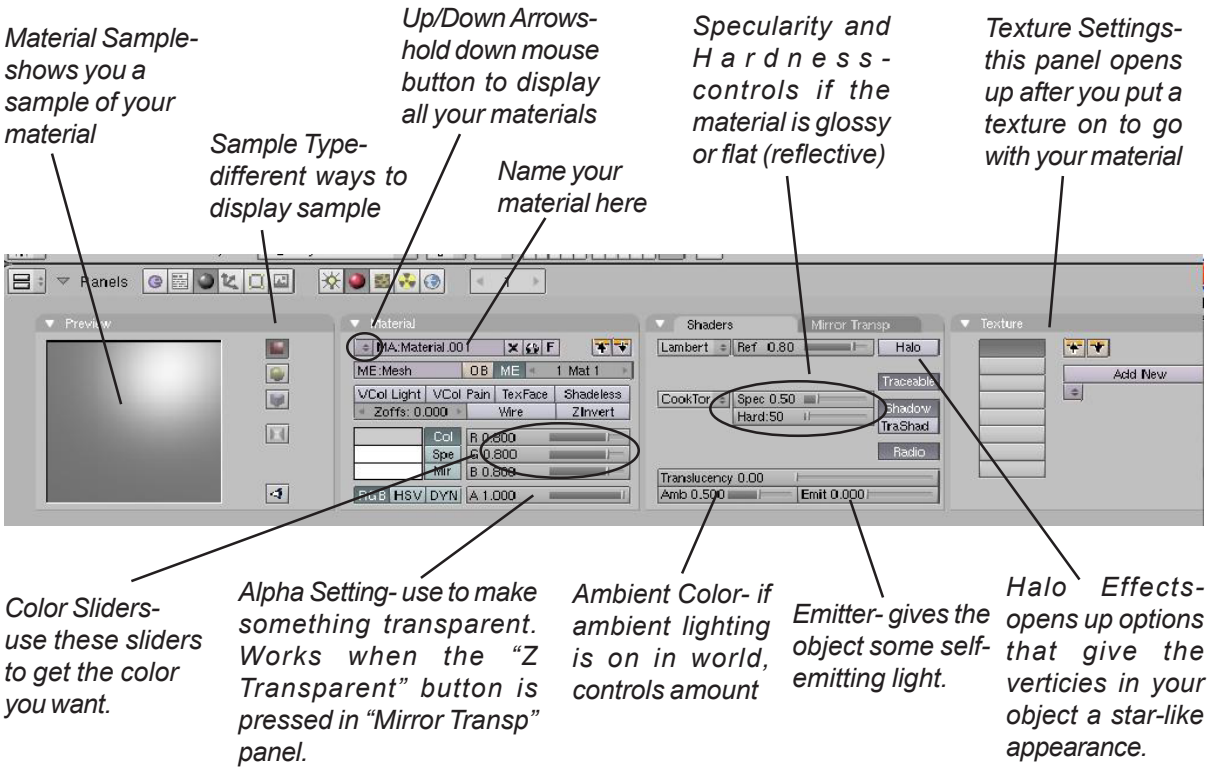
Materials and Textures

Materials and textures are what change your model from being gray to brilliant. You can add color, make things glow, become transparent like glass or make them look like brick, grass, stone, metal, fabric, wallpaper, etc. There's a lot to cover in this chapter so let's get started.

Materials



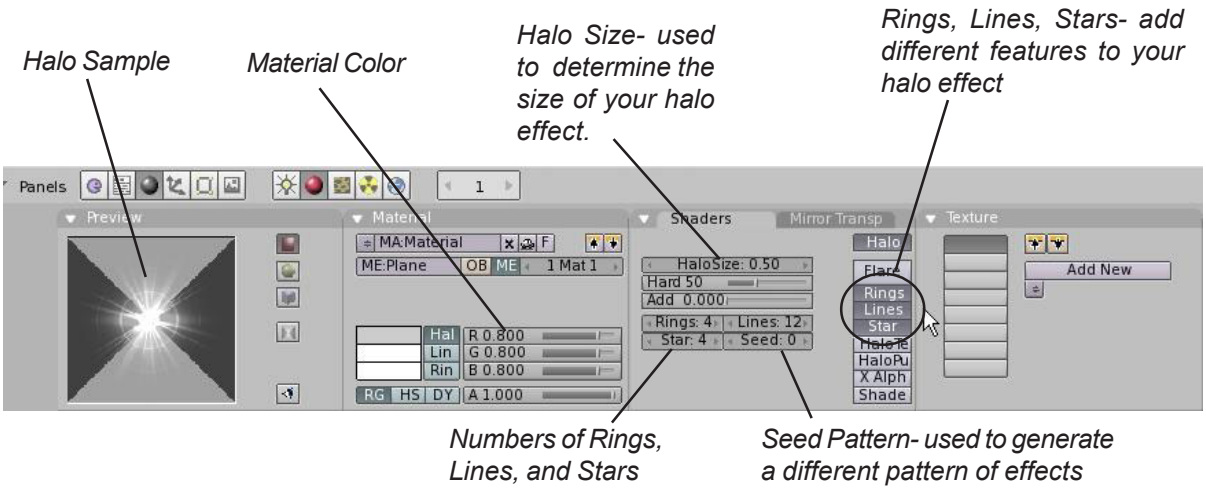
You must *always* add a material before you can add a texture. To add a material, first select the object you want to work with. Then click the "*Shading*" button and then "*Material*". Then click the "*Add New*" button. You will see more options open up. The material block is used to change some of the physical properties of the object in how it looks. If you plan on using just straight color and no texture, this is where you set the objects color. Here is where you also set other properties like:



These are the setting most used under the basic materials panel. There are several we haven't discussed here, but feel free to experiment with them to see what they do. There are also raytracing settings in this panel that will be discussed in a later chapter. Raytracing gives you better reflections and transparency setting, but at a cost of render time. Even in professional setting, raytracing is often only used where needed and not for an entire video. You can achieve good results without reflections at a fraction of the time it takes to render.

Halo Settings:

By using Halos on objects, you are basically only making the verticies visible when rendered. Halo effects give you a star-like image on every vertex. Sometimes, it adds a nice effect to take a plane and delete all verticies except for one. This one vertex can be used like a shooting star or a “Tinkerbell” effect in an animation. Tie it to a particle effect (discussed in a later chapter) and you can produce some interesting results. When you press the “*Halo*” button in the material panel, here are your options:



Halo sizes can also be animated to give the effect of growing or shrinking. Animation basics are discussed in a later chapter. There are also some other options with halos not discussed. Halos are also used to control the size and appearance of particles in smoke and fire effects. These will also be discussed in a later chapter. Feel free to experiment with other features.

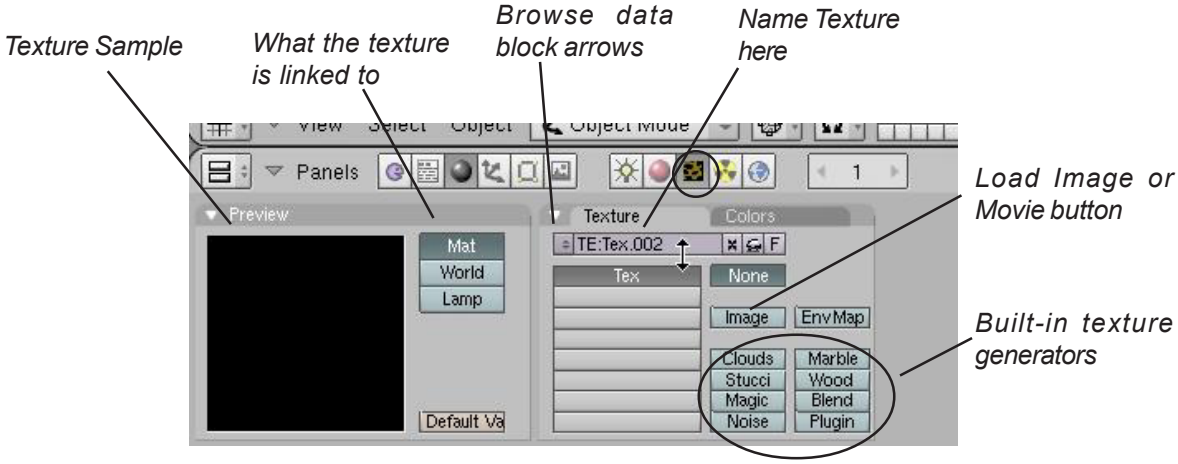
Different Halo Settings:

Rings Only *Lines Only* *Star Only* *Rings, Lines and Star turned on*

Textures

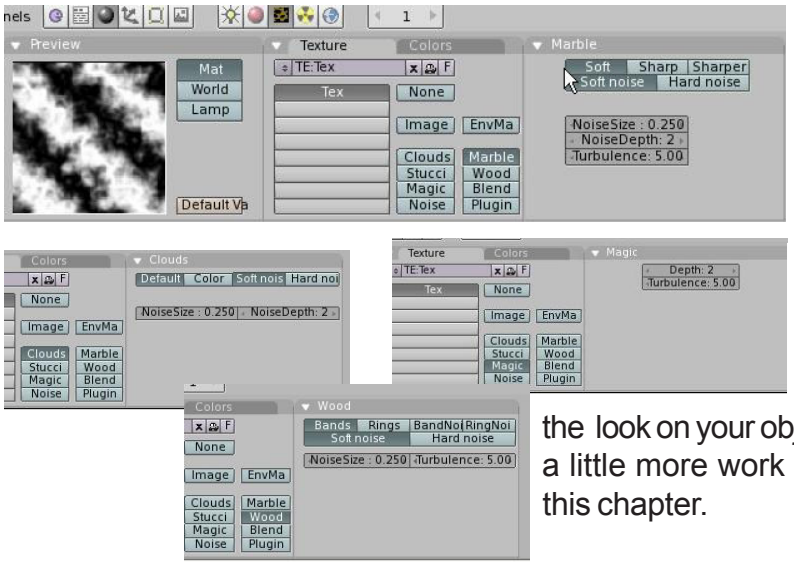
After you create a material and would like to add some kind of texture to the object (i.e. brick, carpet, woodgrain, etc), you then click on the texture button beside the material button.  After you click the "*Add New*" button, you have some choices in the texture buttons. First, you need to decide if you wish to use one of Blender's preloaded texture generators or provide your own JPEG image as a texture. Blender is capable of using any JPEG (.jpg) image whether created in a paint program or is a photographic image. Blender can even place a movie on an object as a material!. This is a good effect if you want to add animation *within* your animation.

Here's what you see after you hit the "*Add New*" button:



Blender's Built-In Textures:

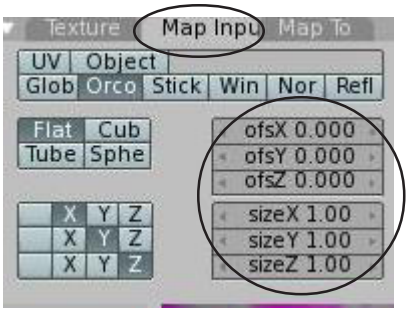
Let's say you want to use one of Blender's built-in textures. For now, we just want to look at *Clounds, Stucci, Magic, Marble and Wood*. These can produce some interesting effects with a little practice. When you click one, another panel opens to the right with more settings. Each texture has different tools available to work with, but some similarities are present in most:



Most of Blender's texture options deal with turbulence and noise (randomness of the pattern) The wood texture also has some features dealing with the pattern of the wood grain (bands and rings). After you place the texture, you still need to go back to the Materials Buttons to fine tune the look on your object. The *Stucci* texture involves a little more work and will be discussed later in this chapter.

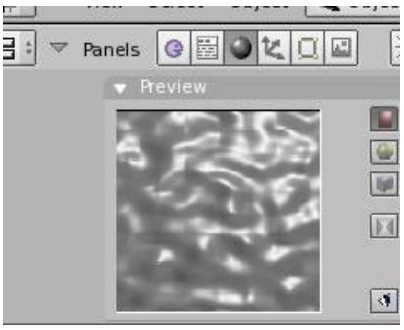
After you place a texture on your object, you need to go back to the *Material Buttons* to adjust the texture. For demonstration purposes, let's use the *Marble* texture. After you put the texture on and go back to the Materials Buttons, this is what you see:

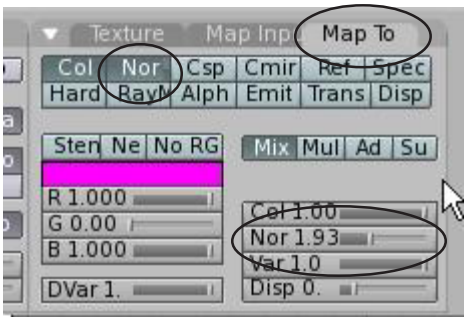
Wow- the sample block looks nice, but I don't often see much purple and gray marble around. Time to set the colors. You can set the base color in the material color sliders. To get rid of the purple, you need to select the "*Map To*" tab and adjust the sliders. Now you need to set the *size* of the texture. To do this, click on the "*Map Input*" tab (beside the "*Map To*" tab). In there, you will find *Offset* (Ofs) and *Size* X,Y, and Z sliders. The Offset sliders will move the texture in different directions on your object. The size keys defaults to 1 (100%). You can adjust the sliders to increase or decrease the size of the texture. *To keyboard in exact numbers for the slider values, hold down the "shift" key and LMB click in the box. This works for all Blender key entry boxes.* For most cases, adjusting the X and Y sliders is sufficient. Press "F12" to see your rendered scene and make adjustments from there. With practice and patience, you will be able to make adjustments easily.



Stucci Texture:

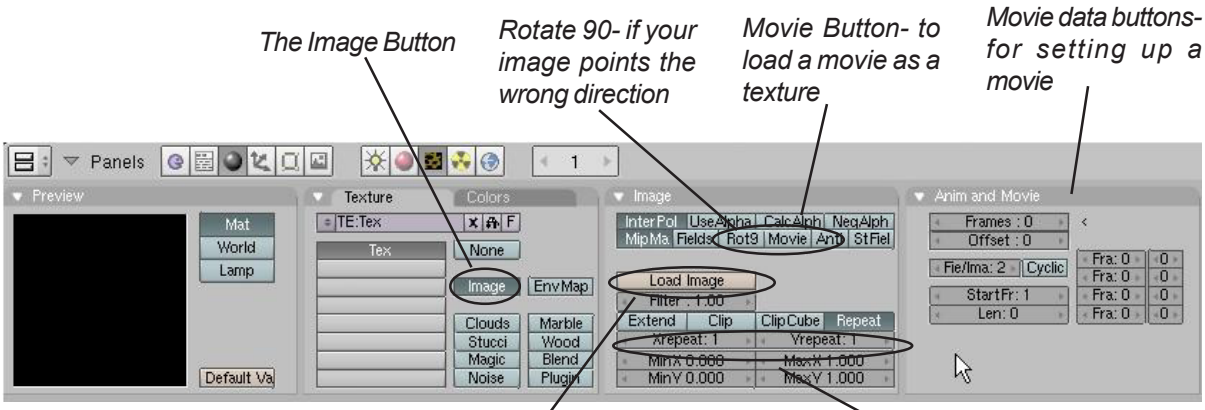
The stucci texture provides interesting effect on the surface of your object. In the *Texture Buttons*, select it as you do for any of the other texture generators and adjust the settings. Next, go back to the material buttons and click the "*Map To*" tab, click the "*Nor*" button for *normal.* You will see a "*Nor*" slider that will adjust the amount of the effect. Play with the setting to get a bumpy effect. Turning the setting way down can also give you a grainy effect.



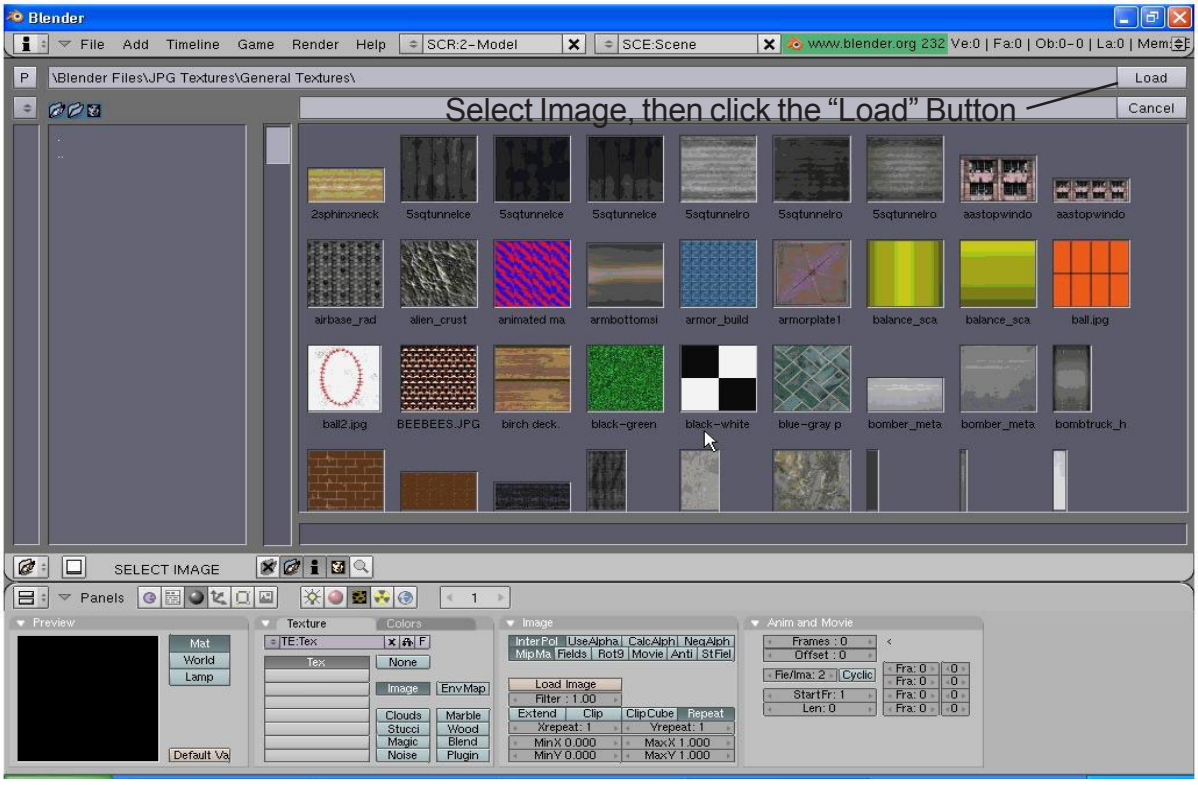


Working With JPEG (.jpg) Images:

The basic texture generators are nice, but not complete. Most of the time you need to place textures like grass, brick, metal, fabrics and such into your model. *Anything that can be saved as a JPEG image can be used as a texture in Blender.* If you want to put a picture of your face on an object- you can! AVI movie files can also be placed on an object as a material. To use a JPEG as a texture, add a material as before, go to the texture buttons and select the "*Image*" option. When you select this, another panel opens that looks like this and the options we want to look at:



By using the *Control* key and clicking the *Load Image* button, you see a list of images at the current folder. Browse through your folders to get to your images. Blender can be set to always look to the same folder when you click the load image button (see page 7).

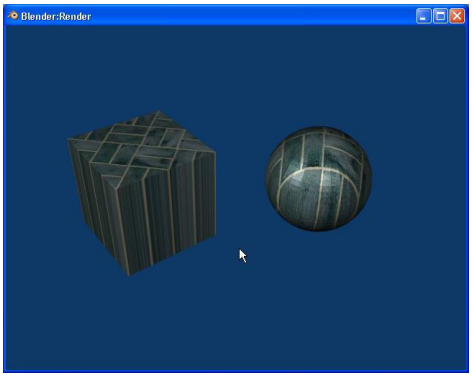


Once you've loaded the image, adjust your setting. There you can make additional corrections to the image. Other textures can be loaded onto your object for combined effects (i.e. Stucci with a loaded jpeg image) by clicking on an empty texture channel in the list, then clicking the "*Add New*" button. When you finish in the texture buttons, go back to your *Material* buttons to make additional adjustments. Switch to the "*Map Input*" tab and look at the following settings:

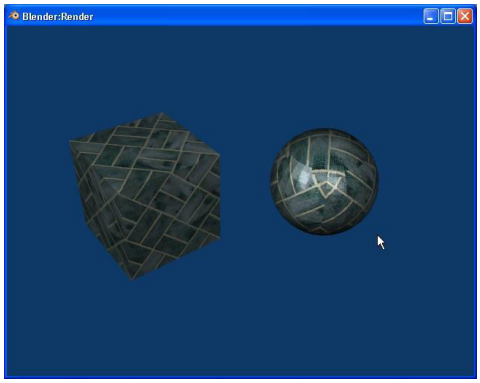
Secularity, Hardness and Emit-settings discussed before, will effect your end results

Different ways to wrap the texture around your object. Watch the sample as you try it.

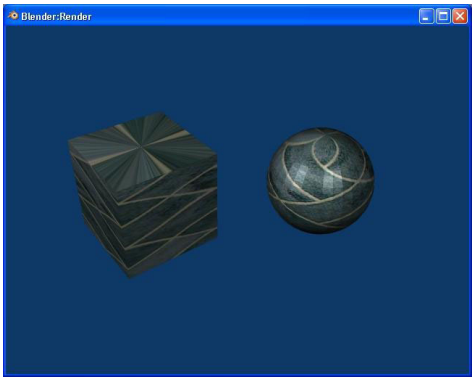
Offset and Size adjustments as discussed before effect your image



Mapped Flat



Mapped Cube

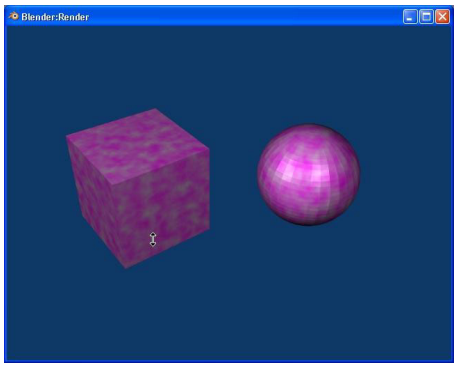


Mapped Tube

Mapped Sphere

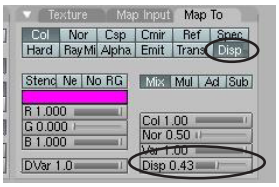
Displacement Mapping:

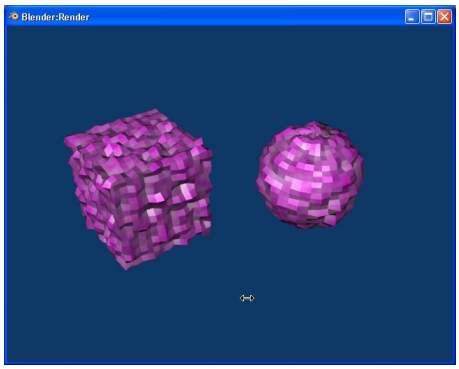
Displacement Mapping is a new effect in Blender with the release of version 2.32. What displacement mapping does is to use a texture effect to deform the mesh. Basically, you can make a cube, sphere, etc. look wrinkled without having to move verticies around to do it. To work with displacement mapping, create a cube or sphere. If you start with a cube, go into *Edit Mode* (tab) and select *all verticies*, press the "W" ket to get the *Specials Menu*, and subdivide a few times. Displacement works off of verticies so if you don't have it subdivided a few times, you won't get a good effect. Next, put a material and a texture on the object. I used the cloud texture in Blender. Go back to the Material Buttons and render a sample (F12). This is what I get:



Displacement Off

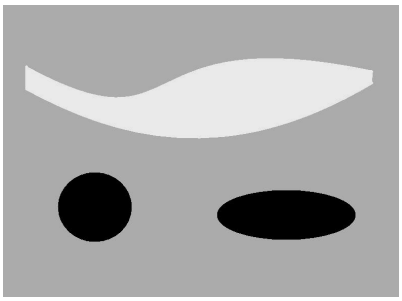
Nothing that we haven't already experienced in this chapter so far. Now, go to the "*Map To*" panel and find the "*Disp*" button to turn on Displacement. You will find a slider at the bottom of the panel called "*Disp*". Change the setting and re-render (F12). Displacement basic works on varying colors in the texture. This is also controllable.



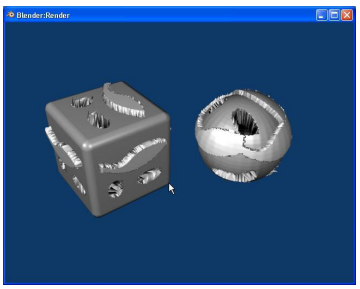


Displacement On

Now you can see the effect of displacement. If you create an image using only *gray, white and black* in a program like paint, you can control where the image is distorted. Gray is the base color, white extends out, black cuts in. If you use a mesh with a lot of sudivides (lots of verticies), you can get an interesting model.



Paint Image



Here are the effects of the paint image on the objects mapped with the *Cube* wrap. The quality of the cuts and extrudes is determined by the subdivision (verticies) on the mesh.

Materials and Textures Practice Exercise

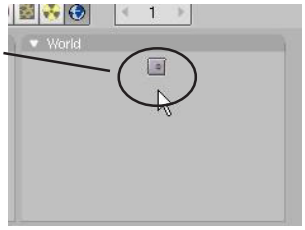
Open your *Sculpture* file and add materials and textures to all of the objects in your scene. Use at least one of each of the following:

1. A straight material without texture on an object.
2. A material with or without texture using *Transparency* (alpha with Z Transparent) on an object.
3. A material with a *stucci* texture on an object.
4. A material with a *Cloud or Mable* texture on an object.
5. A material with a *Wood* texture on an object.
6. A material with a *Halo* effect on an object. (you may create a new object for this-i.e. sun)

***** Call the instructor when finished*****

World Settings

You've created a nice scene with your sculpture, but we're missing a really nice background. Depending on which release of Blender you're running, you will either have a black background or a blue background. This is due to the fact that some release do not start with a world set-up initially (black) and newer releases start with a blue background (a basic world set-up). Blender gives you some basic options in the *World* settings. You can control the colors of the top and bottom (*Zenith and Horizon*), stars, fog or mist, clouds and, of course, loading JPEG images. In order to create a new world, select the "*Shading*" button, then "*World*".  If a world has not already been placed in your scene, click and hold on the arrow keys and select "*Add New*". This will give you a basic world with a blue horizon and a black zenith. Press the "F12" button to render your scene. You have some basic options that you can set in the world buttons. Here's what you see:

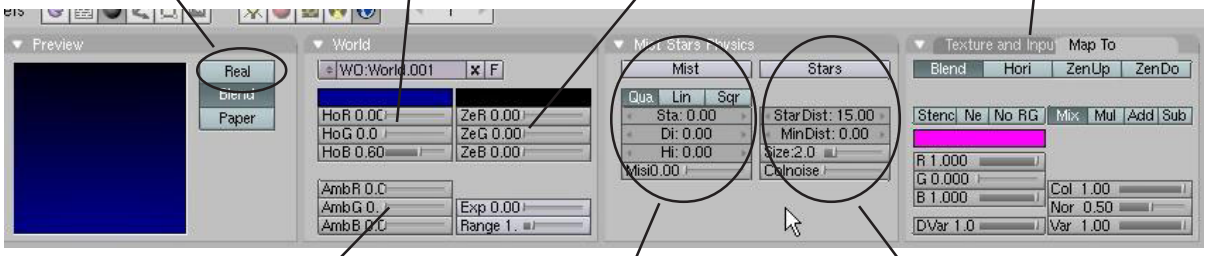


Use the Real button to give you movement when the camera moves

Horizon Color- sets the color of the bottom of the scene

Zenith Color- sets the color of the top of the scene (the middle blends)

Texture Setting- some options to use when placing texture images.



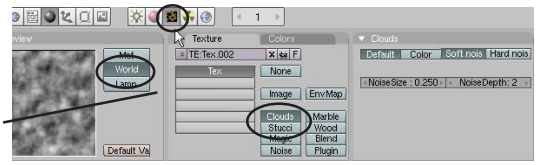
Ambient Color- gives you an overall lighting effect. Good if you have only a few lights and still want everything to be illuminated

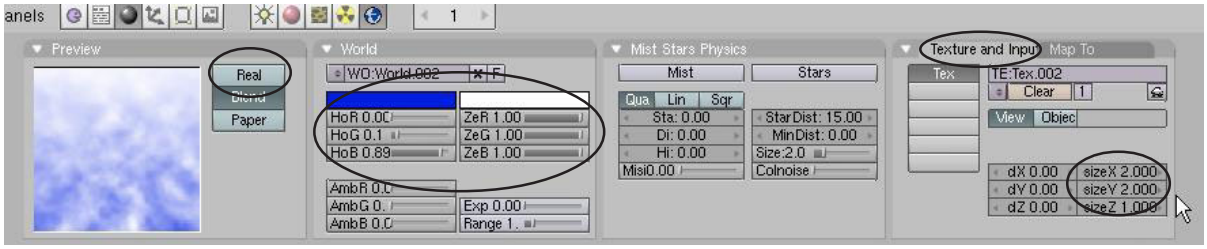
Mist Settings- gives you a fog effect. Can be used as a consistent fog or one that fades from ground

Star Settings- used to create a space scene. Can control distances and size.

Creating a Cloud Scene:

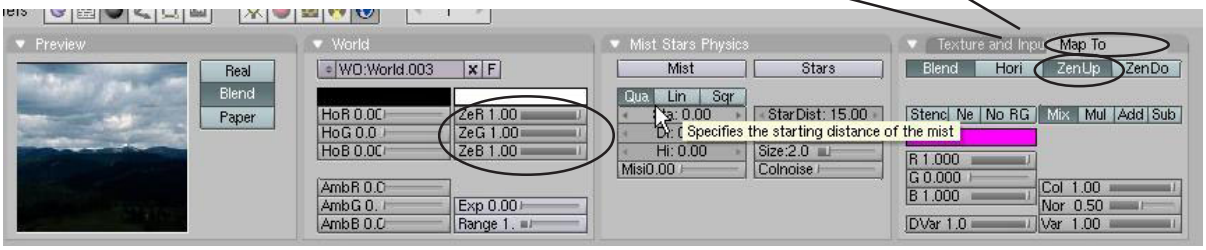
To set up a scene with clouds, create a world as described above. Set all of the *Zenith* sliders to one (all the way to the right). Keep the *Horizon* at a blue color. Now, go to the texture buttons and create a new texture using *"Clouds".* Go back to the *World* buttons, go to the "*Texture and Input*" panel and adjust the *Size X and Y* sliders to get the effects that you want. If you plan on moving the camera in your scene, you may want to hit the "*Real*" button.

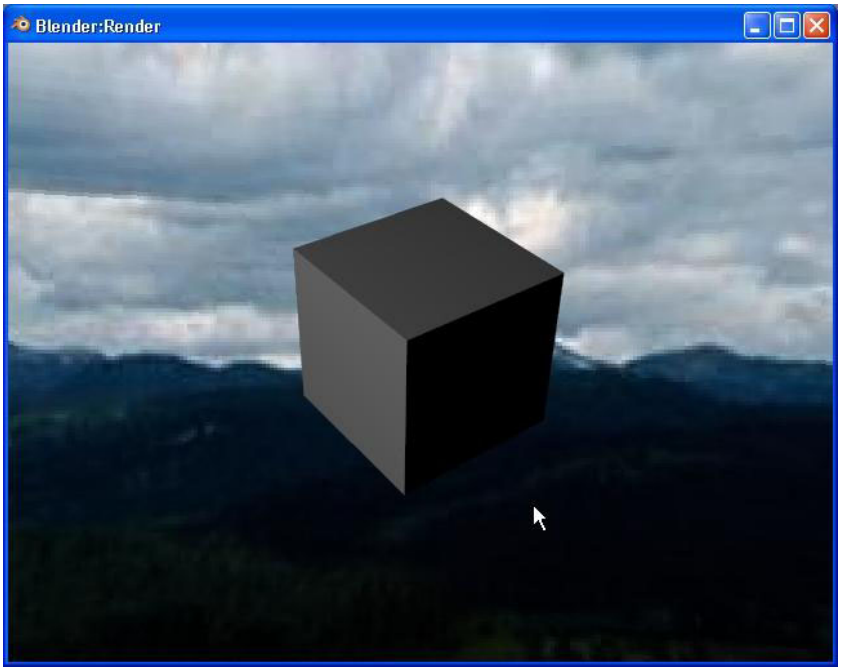




Using a JPEG Image in a World:

If you plan to use an image in your world settings, use one that is large and high quality. Low resolution images have a tendency to be grainy and unrealistic. To use an image, create a world as described before, the go to the texture buttons. This time, select the "*Image-Load Image*" options to select your image (described in the *Materials and Textures* chapter). Go back to the world settings. The sample will look horrible! Take your *Zenith* color sliders all up to 1(white). After you do this it should look much better. If you hit "F12", the background image shows up, but may look like a black-and-white image. In order to correct this you need to go to the "*Map To*" panel and select "*Zen Up*". This should correct the problem and display the proper colors.





Final rendering with an image in the world.

Adding a World Practice Exercise

Open your *Sculpture* file and add a world to your scene. Experiment with adding color, stars, mist and images. You do not need to use them all in your sculpture, but practice using them so you know how they work. When you settle on an effect to use in your world, place it into your scene.

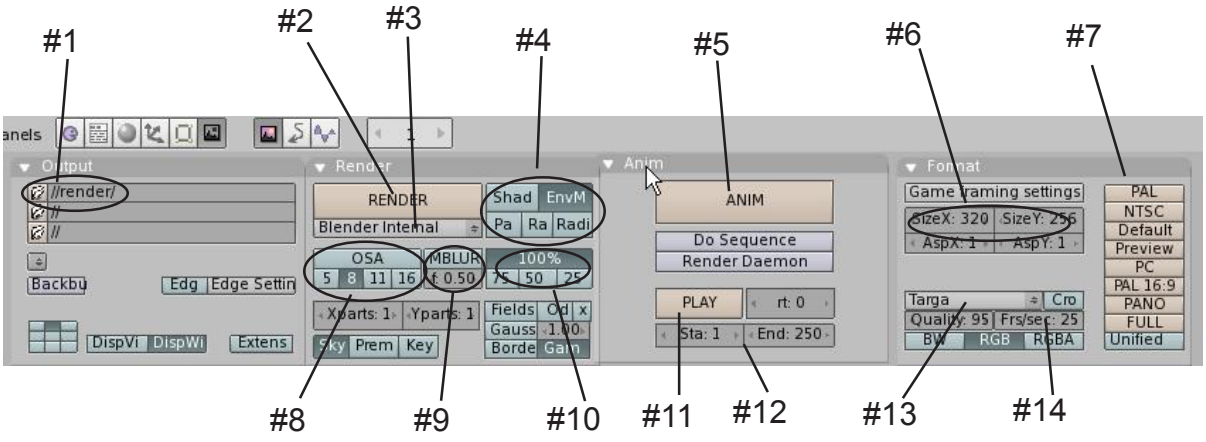
***** Call the instructor when finished*****

Render Window Settings

The render window is where you tell the program what you want as an output for your scene. Do you want a JPEG picture image or a movie? What size do you want the output to be? Do you want a high quality output or a draft style format? Do you want shadows or Raytracing effects? How about motion Blur? If your doing a movie, how many frames-per-second do you want the movie to run? Last, but not least, where do you want to save the file? All of these issues are addressed in the *Render Buttons*. Obviously, the higher the quality of the output, the slower it will render and the larger the file size will be when finished. For a review of rendering and animation basic, refer back to pages 2 and 3 in the manual. Now, click on the "*Scene*" and "*Render*" buttons so we can get started.

The Rendering Interface and Settings:

There are many options that need to be addressed in order to save your work as an image or movie. Some of these feature will be discussed in more detail in later chapters. For now, we are just interested in saving basic images in JPEG (.jpg) format and movies in the Windows (.avi) movie format. Be aware that other options exist and more are added every few releases.



#1. *File name and saving location*- Click on the small file folder icon to create a file name and select a saving location. It's a good idea to type the *.avi* (movie file) and *.jpg* (image file) after the name you give the file. This keeps Blender from adding numbers after your file. (Blender does this to show which frames were rendered)

#2. *Render Button*- This is the same as pressing "F12" to bring up the render window.

#3. *Render Engine*- Blender is creating support for other external renderers. Keep this set to *"Blender Internal"* to use Blender's internal renderer.

#4. *Additional Settings*- Right now we are only interested in the "*Shadows*" button and the "*Ray*" buttons. Use the shadows button if you've used lights that cast shadows (spotlights). The Raytracing button will be discussed in the next chapter.

#5. *Animate Button*- Press this button to actually make the movie or sample files of your animation. Get ready to sit for a while because this is what takes some time depending on the size of your animation. *Use this after all your other settings are complete.*

#6. *Size X and Y*- This is the final size of your rendering or animation in pixels. You can set them manually here or select a preset size.

#7. *Preset Rendering Sizes*- Pressing these buttons will set up #6 for you. *We usually select the "PC" size which sets the image to 640 x 480 pixels. This is considered computer low-resolution.*

#8. *OSA (Oversampling)*- Oversampling improves the quality of your output. We normally turn it on and set it to "8". This gives you a nice output without much loss in rendering time.

#9. *Motion Blur*- Use this if you have something moving fast and want to simulate a blur effect. Don't forget to play with the settings.

#10. *Output Percentage*- We normally don't mess with these, but if you image doesn't seem to be the right size, check to make sure you didn't take it off of 100%.

#11. *Play Button*- After you animate something, you can watch it in Blender by pressing this.

#12. *"Start" and "End" Frames*- This is how you control which frames render in a movie.

#13. *File Type Menu*- This is where you select the type of file you want for your output. Select a "*JPEG*" if you want a single image and "*AVI Codec*" for a movie. If you select a JPEG, then set the quality option under the box. If you are selecting an AVI Codec, a compressor selection box will pop up for you to select a Codec. We normally use "*Indeo video 5.1*" set at 100%.

#14. *Frames Per Second*- This is an important one to set at the very beginning when you begin animating. Frame rates between 15 and 30 work well with the standards being 25 and 30 (see page 3). New animators often have trouble animating things at a normal speed. Either things happen too fast or too slow. This gets better with practice.

Experiment with these settings to become comfortable with them. It's sometimes best to work and model with small output sizes and OSA turned off for speed purposes, then render at high settings.

Creating a JPEG Image:

In order to render a simple JPEG image, set up all of the options previously discussed. It is important that the file type is set to *JPEG.* For single pictures, it's nice to have a high quality image because time isn't as important when you're rendering a single image as it is when rendering a movie. Press the "*F12*" button or "*Render*" button to bring up the reder window. With the render window up, Press "*F3*". This will open the file save window. Here is where you give yor file a name and set the location. Remember to type *.jpg* after the name of the file so it saves without any extra stuff in the title.

Rendering Practice Exercise

Open your *Sculpture* file and set up a good view for rendering to a JPEG file. Set your render options for the following:

1. Select file output type as JPEG, set quality to 100%
2. *Turn on shadows*
3. *Turn on OSA and set to 8*
4. *Click the PC button to set size to 640 x 480 pixels*
5. Name your file: *Sculpture Image.jpg*

Double check all other settings as per the chapter descriptions, render image and save. We will soon be using the animation setting so begin to become familiar with those adjustments. We will be using them within the next few exercises.

Challenge exercise:
Render an image and save it as a JPEG. Then, add another object in your scene and use that image as a texture on that object. Render your new scene again as a diferent file name. You will see your scene within the scene!

***** Call the instructor when finished*****

Raytracing

Raytracing is new to Blender and has opened new horizons in rendered images. Raytracing is such an important addition to Blender that it has been placed in its own chapter. Raytracing is used to produce mirrored and reflective surfaces. It is also being used to create transparency and refraction (bending of images through transparent surfaces- like a magnifying glass or a lens). With raytracing, all Blender lights can cast shadows if you desire. raytracing can produce some stunning effect, but can come at a high cost in rendering times. *Use it only where needed.* Don't try to raytrace everything. The professionals don't even do that. Watch any 3D show on T.V. and you will see it being used selectively. You can get some great shadow and texture effects with Blender's traditional spotlights and material settings at a fraction of the render times.

To get raytracing to work, you need to go to the *Render Buttons* and turn on "*Ray"* (for Raytracing). Now you are ready to apply some of the raytracing features to your objects. Until you do that you won't see any difference in your renders.

Lighting and Shadows:

To get a ray shadow for a lamp, select the lamp you want to cast shadows (all types work with raytracing), go to the *Shading* and *Lamp* buttons, find the "Ray Shadow" button and activate it. That's it! Render out a test of your scene.

Ray Mirror and Transparency:

To create a mirror, or reflective surface on an object, select that object and add a material. You can also add textures to an object and have a mirror surface. In the material buttons, you will find a panel called "*Mirror Transp*". All of the raytracing features are found in that panel. Press the "*Ray Mirror*" button and experiment with the reflection settings.

For transparency, press the "*Ray Transp*" button to activate it. Two main adjustments are *IOR* (Index of Refraction) is used to create the Lens effect and bends light. *Fresnel* is used to control the amount of transparency. There are some other setting that you may feel free to experiment with, but these are the main settings.

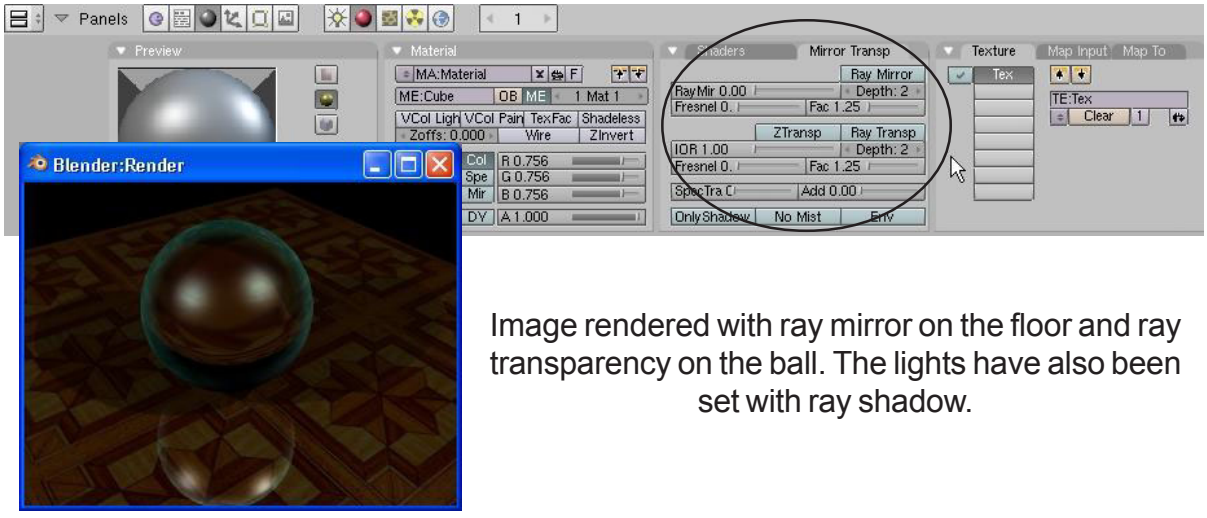


Image rendered with ray mirror on the floor and ray transparency on the ball. The lights have also been set with ray shadow.

Raytracing Practice Exercise

Open your *Sculpture* file and set up a good view for rendering to a JPEG file. Place the following raytrace settings on at least one item as follows:

1. At least one lamp with *Ray Shadows.*
2. At least one object with *Ray Transparency*.
3. At least one object with *Ray Mirror*.

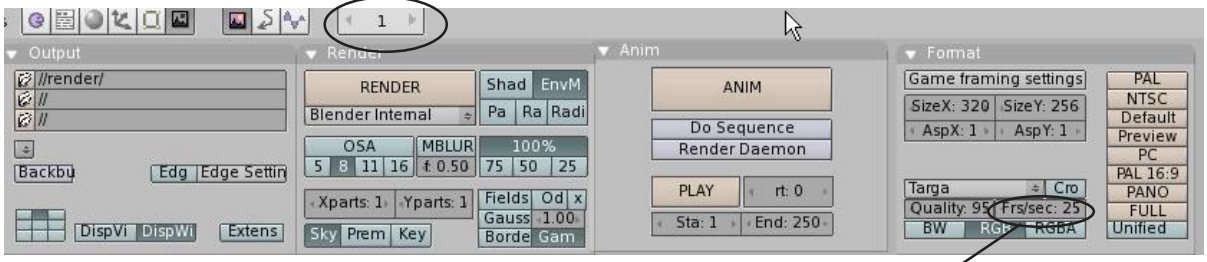
When finished, render an image and save it as a JPEG image.

***** Call the instructor when finished*****

Animation Basics

Now that we know how to make stuff and make it look good, it's time to figure out how to move it around in your scene. Another name for an animation is ***Interpolation*** *(**Ipo**)*. Remember this term because Blender uses the *Ipo* name in many different window areas to relate to animation features. This is a big area with lots of things we can do and talk about. Many of the features available will become understandable with practice and by getting beyond the basics. This is a highly developed area in Blender therefore new features will more than likely be available before this document can ever be printed. For this reason, we will deal with the basics. The first thing we need to do is go back and re-read the section on *Rendering and Animation Basics (pages 2-3).*

Current Frame- You can change the current frame by Holding down the "Shift" key and LMB clicking in the box. You can then type in a new number and will go to that frame. You can also use the "Arrow Keys" to move along the timeline. Up/Down arrows move 10 frames at a time, Left/Right arrows move 1 frame at a time.

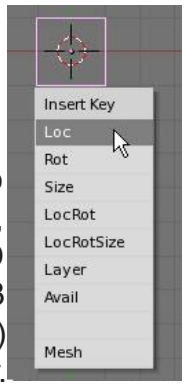


Frames Per Second (fps)- set this to an adequate number. The default is 25 fps.

After you set up your scene and set the *Frames/Second* in the render button area, consider what you want your "actors" to do and how long they should take to do it. One of the problems that beginner animators experience is making the motions occur in an appropriate time. Remember to look at your frames/second when animating and relate it to time. For example, if you want something to take 3 seconds to make a complete "walk around circle" on the screen and you are running at 25 fps, you need to complete the animation in a total of 75 frames.

Object Animation

Moving, Rotating and Scaling:



These are the 3 basic modifiers to use on an object in animation. When you create keyframes in Blender with these modifiers, Blender will figure out all the *inbetween* locations on the other frames. To insert a key on an object, go to the frame where you wish to place the key, move, rotate or scale the object, then press the "*I*" key to "*Insert key*". Make sure your cursor is in the 3D window when you push the "I" key. The menu to the right pops up. You have 3 main options for now- *Loc* (location), *Rot* (rotation) and *Size* (size or scale) and combinations of these. We'll talk about the *Mesh* option in a later chapter. Select the key option of what you've done to the object. Now, advance to the next frame where you want to put a key (i.e. frame 25 if you want a movement to occur after 1 second), move, rotate or size the object, then press "*I*" to insert another key.

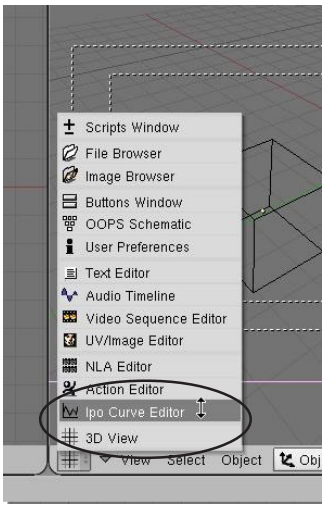
Continue placing keys along your timeline to create your animation. For the most part, location and size keys work flawlessly, but care needs to be given to rotation keys. If you try to rotate an object too far in one set of keys, the object may not rotate in the exact direction you want it to. It may rotate oddly. Try small angular steps while animating rotation keys. There are ways to control this better and tools to simplify this process that will be discussed later.

Viewing Your Animation:

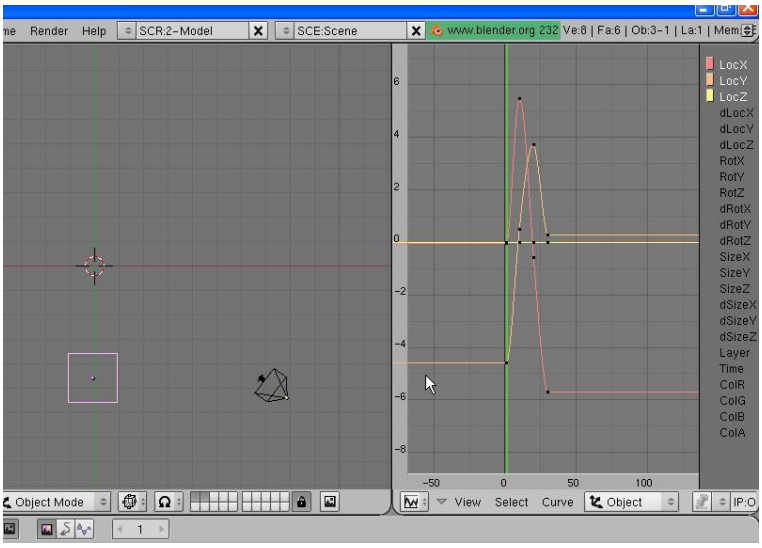
There is a simple way to view your animation without having to render out a movie. Take the *current frame number* to the place where you want to start viewing the animation.Place your cursor in the 3D window you wish to view your animation and press the "*Alt*" and "*A*" keys together. The animation will play in the 3D window where your cursor is located.

Movement may not be exactly how you planned it. Blender automatically defaults to trying to create a smooth flow through the keys you've place. This can be changed and will be discussed later.

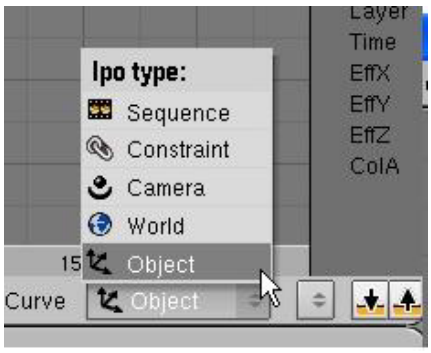
Working With The IPO Window:



Animation is difficult to do without some basic knowledge of the IPO Window. If you are working in a split 3D window screen (as previously discussed), change the right hand viewport to the I*PO Curve Editor* Window Type. In this window you will see your animation represented in a graphical form. Location, Rotation and Size X,Y, Z tracks are displayed. You can zoom in/out and pan in this window with the center mouse wheel. You can also select a track and press the "Tab" key to edit individual keys on the timeline.

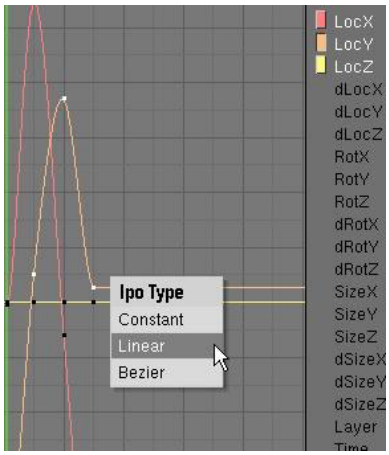


Right now, you are looking at the *Object's* animation keys, but you can animate a lot of different things in Blender including materials and world settings. To view the different types of animation tracks, select the *"Ipo type"* window.



To animate material and world settings, place your cursor down in the buttons window while in the world or material settings. Press "*I*" to insert keys. You will see a variety of options available to you.

As mentioned before, when you create an animation for an object, Blender automatically tries to "smooth" the path of animation through your key points. You have ways of controlling the results of the path. One way is to click on the path(s) you want to modify in the IPO window and, with the cursor in the IPO window, type *"T"* for type. You have 3 options:

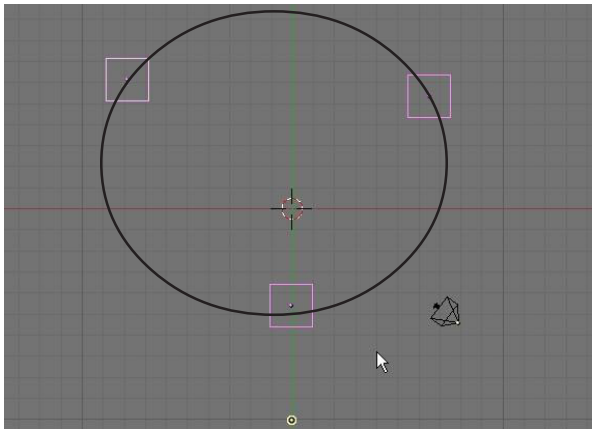


Constant- Gives a square waveform, like turning it on and off. No smooth flow.

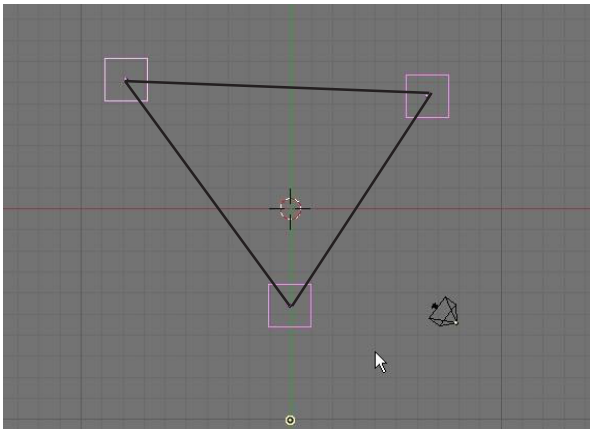
Linear- takes a straight path from point "A" to point "B". Solves problems of animations swinging way out of where you want it to go, but jerky motion at key points

Bezier- The default type which tries to make the motion through the points smooth.

Every application may require a different type and can be frustrating to work with until you get some practice.

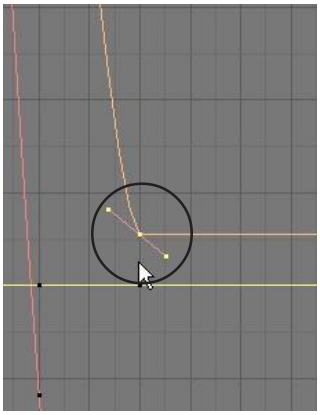


Animation path of a cube with 3 keys placed at shown locations with Bezier path type selected. Path is smooth, but curves way out.



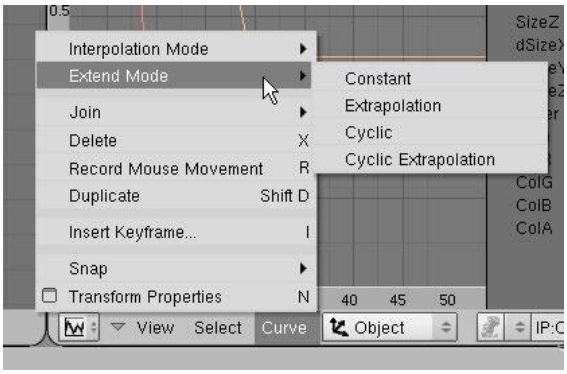
Animation path of a cube with 3 keys placed at shown locations with Linear path type selected. Path is straight, but jerky at key points.

There is another way to keep the bezier type, but control the flow. It requires you to go into the track in edit mode and adjust verticies on the graph individually. first, select the track you wish to modify (Loc, Rot, Size- X, Y, or Z) and press the "*Tab*" key to go into track edit mode. When you do that, each key will be displayed as 3 points. By grabbing ("*G*" key) an end of the "3-point spline", you can move and size it to get a different flow through that point. This technique requires some skill and practice. Key points can also be moves to different locations using this method (change a key from one frame to another.)



If you ever need to start over with an animation, you can erase all the animation tracks in the Ipo window and start over.

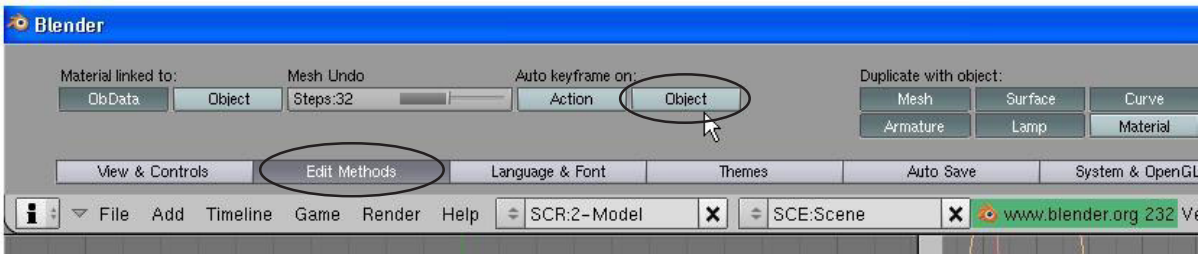
Extended Modes:



When you need to animate something with repetitive motion (wheel spinning, person walking, etc.), you do not need to keep adding keys along the path. All you need to do is create one cycle of the motion you want to duplicate, find the animation path in the Ipo window you wish to duplicate, then select "*Curve*" from the menu. In the flyout menu, find "*Extended Mode"* and select the type you want. It will then duplicate the motion along the path. Again, experiment with the various types. Use "*Extrapolation*" to show circular motion like a wheel turning. "*Cyclic*" would be good for a walking or swinging motion.

Automatic Object Keyframing:

There is a way to avoid having to press the "I" key everytime you want to add a key. The automatic object keyframing option can be turned on by pulling down the top window box to expose the "User Preferences". Click "*Edit Methods"* and turn on "*Object"* under "Auto keyframing". Start by moving, rotating or sizing in frame 1 (or wherever you want the animation to start), change to your next keyframe location and move, rotate or size again. continue down the timeline as needed. Go back to the begining and hit "Alt-A" to see the animation.



A Word of Caution! Remember to turn off Auto Object Keyframing when you do not need it on. It's too easy to mess up your animation! Also, remember that Blender doesn't have a general undo command so when you get an animation you like, Save your file and save often!

This section dealt with basic object animation. Deforming meshes, following paths, creating bone structures (armatures) and creating child-parent relationships will be discussed later. Animation can be a frustrating thing to perfect. Practice is the best way to learn it and by asking questions.

Animating Materials, Lamps and World Settings

Now that you know the basics of animating objects, we can now look at some of the things we can animate in materials, lamps and worlds. First, we select the object or lamp we want to create an animation effect on, then go to the appropriate lamp or material buttons, with the cursor in the buttons window, press "I" to insert key, and select our option.

Material Animation Options:

RGB- Color can be animated to change .
Alpha- Transparency of an object can be animated.
Halo Size- A halo can grow or shrink in an animation. Setting a Halo to zero will make it fade out or in completely.
Offset- If a texture has been applied, it can appear to move on the object in an X, Y and\or Z direction.
Size- The X,Y,Z size of a texture on the object can be animated.

Lamp Animation Options:

RGB- Color can be animated to change .
Energy- The intensity of the lamp can be changed and even set to zero to go on or off.
Spotlight Size- The angle of the spotlight beam can be sized during animation. Go from wide to narrow beam or vice-versa.
Offset- If a texture has been applied to the lamp (yes, an image or movie can be projected), it can appear to move on the beam in an X, Y and\or Z direction.
Size- The X,Y,Z size of a texture on the lamp can be animated.

World Animation Options:

Zenith RGB- Color of the zenith (top) can be animated. Great for simulating sunsets.
Horizon RGB- Color of the horizon (bottom) can be animated. Again, great for simulating sunsets night scenes.
Mist- Fog effects can be animated for interesting effects.
Stars- Star effects can be animated.
Offset- If a texture has been applied to the world, it can appear to move on an X, Y and\or Z direction. Great to show cloud movement.
Size- The X,Y,Z size of a texture on the world can be animated.

Remember that animations can be seen in the Ipo window by changing what types of Ipos are seen in the window!

Animation Basics Practice Exercise

Open your *Sculpture* file and animate a variety of objects. This can include the camera. In addition to animating objects with location, rotation and size keys, animate the following objects:

1. Animate the material on the ground (size and/or offset).
2. Animate at least one lamp size and/or color.
3. Animate the world with mist, stars or texture keys.

After you have your scene ready to animate, you will make an AVI file of your work. Set up the following Render Window settings:

1. Start Frame-1; End Frame 300; Frames/second 25 (a 12 second movie)
2. OSA turned on, set to 8
3. Render Size- PC (640x480)
4. File Type- AVI Codec; Indeo Video 5.1 Codec at 100%
5. Save movie in your document as Animation1.avi
6. Remember to have shadows on if you have any spotlights.
7. Finally, hit the Animate key to make the move.

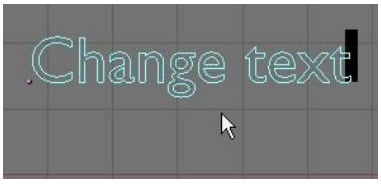
***** Call the instructor when finished*****

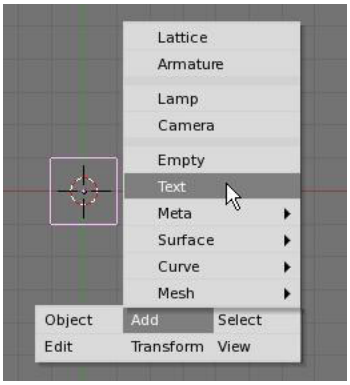
Adding 3D Text

We've discussed creating a lot of objects so far, but 3D text can be considered a very important element to add. There are 2 ways to create text for Blender scenes. One way is to use the built-in text generator. The other method is to use an external program to generate the text and import it into Blender. Each method has its benefits and disadvantages. Text made in Blender can be easily changes by entering edit mode ("Tab" key) and 3D features can be changed by making adjustments in the edit buttons. Text made in an external program like Elefont may give you additional options and import into Blender like a mesh with verticies that can be adjusted and used with effects like *Wave* (discussed later).

Creating 3D text in Blender:

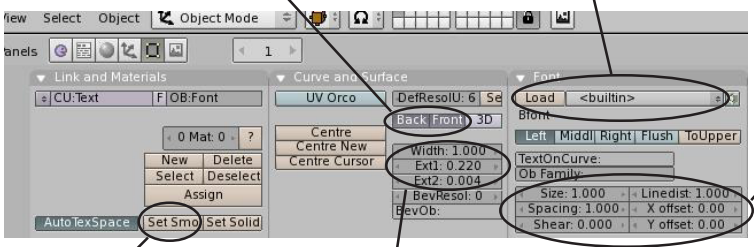
To create text in Blender, select the location of your text with the 3D cursor, then press the *"Space Bar"* to *"Add"*. Select *"Text"*. The word "Text" appears on the screen in edit mode. Change the text and exit edit mode ("*Tab*" key). Go to the Edit Buttons  . Extrude the text and make any other necessary adjustments. By pressing the "*Z*" key and the "*Set Smooth*" button, you can see the effects of the settings on the screen. Text can easily be changed by entering edit mode again.





Closed or Open Shape (Front/Back)

Load Font- select your font here (see details below)

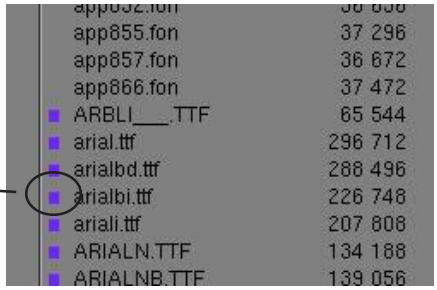


Style Options- Size and Letter Spacing, Shear (italic), Linedist (spacing between lines) X,Y Offset (moves text up/down left/right of center point)

Set Smooth Button

3D Features- Here you select the thickness and width of the extrude that makes the text 3D.

Blender will use the fonts that you have loaded with your system. If you are using a Windows computer, fonts will be found on the C: drive in the *Windows* folder. You should see a folder their called *Fonts*. You will only be able to use fonts that are marked with a small square.



Creating 3D Text in an External Program:

A popular program to use for creating 3D text for Blender models is a freeware program called *EleFont* available at *www.armanisoft.ch*. This is a simple-to-use program that saves the file as a .DXF format. Any program that can export 3D text files as .DXF should also work fine. Remember that Blender accepts files that are saved as .DXF and VRML(.wrl). For the purpose of this activity, we will be discussing EleFont. Here are your options in EleFont:

T- *Font selection, style and size. You can only use True-Type-Fonts (TTF)*

Text Window- *Type your text sample here.*

Q- *Sets the quality of the curve (more or less faces) (hold down LMB on button, drag left/ right)*

E- *Extrude Depth (hold down LMB on button, drag left/right)*

e- *Brings up extruder window to see text*

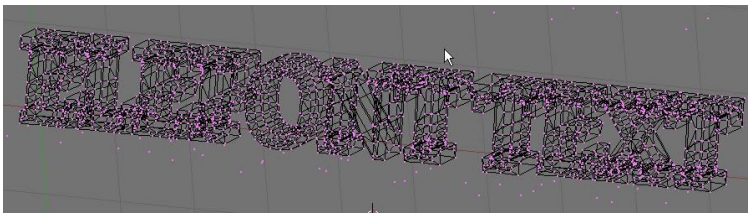
B- *Bevel type- options for putting a bevel on your text.*

S- *Bevel Scale (size of bevel) (hold down LMB on button, drag left/ right)*

F- *Export (save) file to DXF format*

H- *Help information*

After you create and save your 3D text, open Blender and go to the "*File*" pull down menu. Select "*Open*". This acts like an import command for non-Blender files. Find your file and open it into your Blender scene. This text acts like any other mesh in your scene. Add materials and textures and modifiers as needed. If you need all the letters connected together, select them all by clicking on them while holding down the "*Shift*" key. Once all the letters are selected, Press "*Ctrl*" and "*J*" to join them.



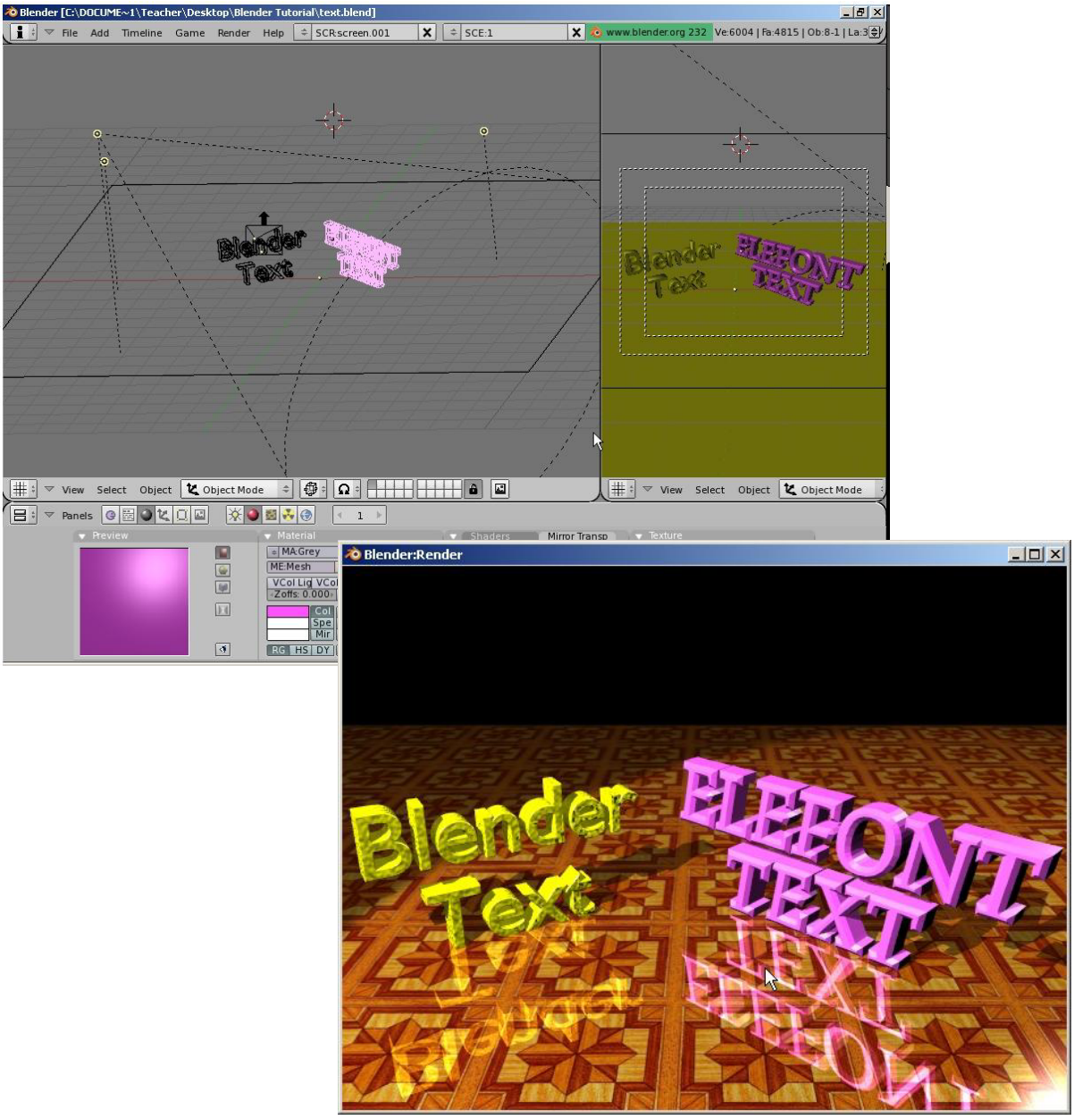
EleFont text in Blender in Edit Mode where verticies are shown

EleFont text in Blender with "Z" toggled to show a shaded view.

3D Text Practice Exercise

Create a new Blender scene and set up the views any way you wish. Create some 3D text using both the internal Blender text command and Elefont. Place both text samples on a plane and add lighting with shadows. Place a Raytrace mirror setting on the ground plane. Put materials and textures on everything.

When you finish setting up your scene, render a JPEG image and save it to your directory.

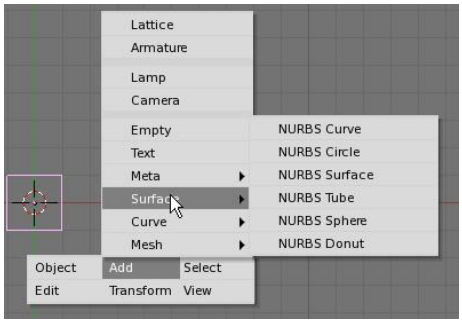


***** Call the instructor when finished*****

NURBS and Meta Shape Basics

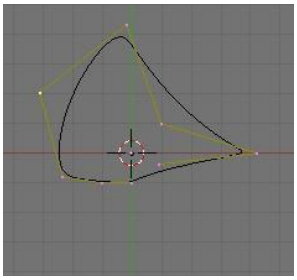
When you press the "*Space Bar*" and select "*Add*", you will notice other object types beside meshes, cameras and lights that can be created. Two types of objects that can be created are *Surfaces* (NURBS) and *Meta Objects*. A lot can be said about surfaces, but for this tutorial, I want you just to become aware that they are there and describe some basics about them. Meta objects have been expanded to a variety of shapes and can be used to give you a "liquid metal" effect where the objects "pull" together as they become close to each other.

Surfaces (NURB objects)

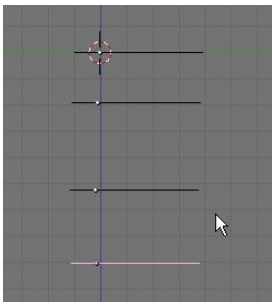


If you look at the *Surface* menu, you will see a variety of shapes that can be created. These shapes can be use as they are or converted to meshes so you can work with traditional verticies. *To convert a surface into a mesh, select the object and press the "Alt" and "C" keys. Click on "Mesh".* You can do a lot with NURBS and there are several tutorials on-line describing them, but for now, we will just work with a *NURBS Circle* to create an interesting looking tunnel.

Creating a Lofted Tunnel:

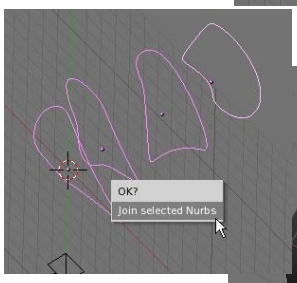


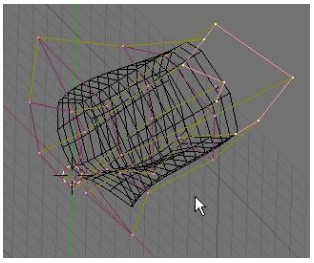
This process will take several profiles of a NURBS Circle and connect them together. First thing you need to do is create a NURBS Circle. To do this, press the "*Space Bar*", select "*Add*", then "*Surface*" and "*NURBS Circle*". The circle comes in in edit mode. Select the points and shape the circle a bit.

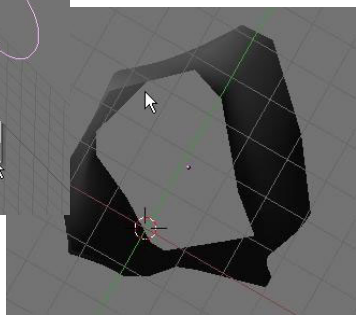


Change your view so you are looking down on the circle. Use the "*Shift-D*" keys to duplicate the circle several times. Then rotate your view so you can select each circle and edit the shapes in edit mode (Tab key).

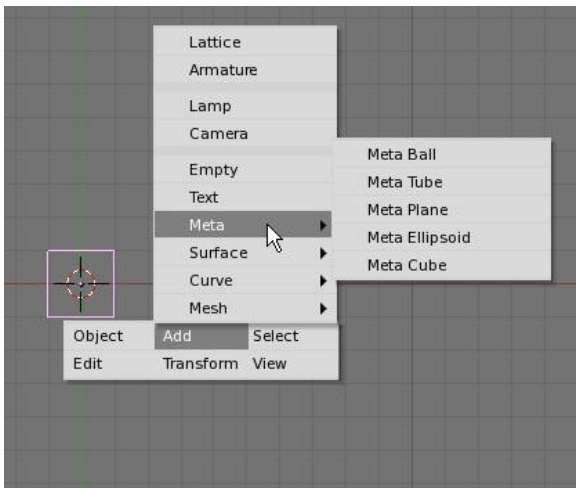
After shaping the circles, Select them all by clicking on them while holding the "*Shift*" key. To join them together, press "*Ctrl*" and "*J*". For the final step, press "*Tab*" for edit mode, "*A*" for all verticies, the "*F*" for face. Your result should be a lofted object. If you need it to be a mesh, press "*Atl*" and "*C*".





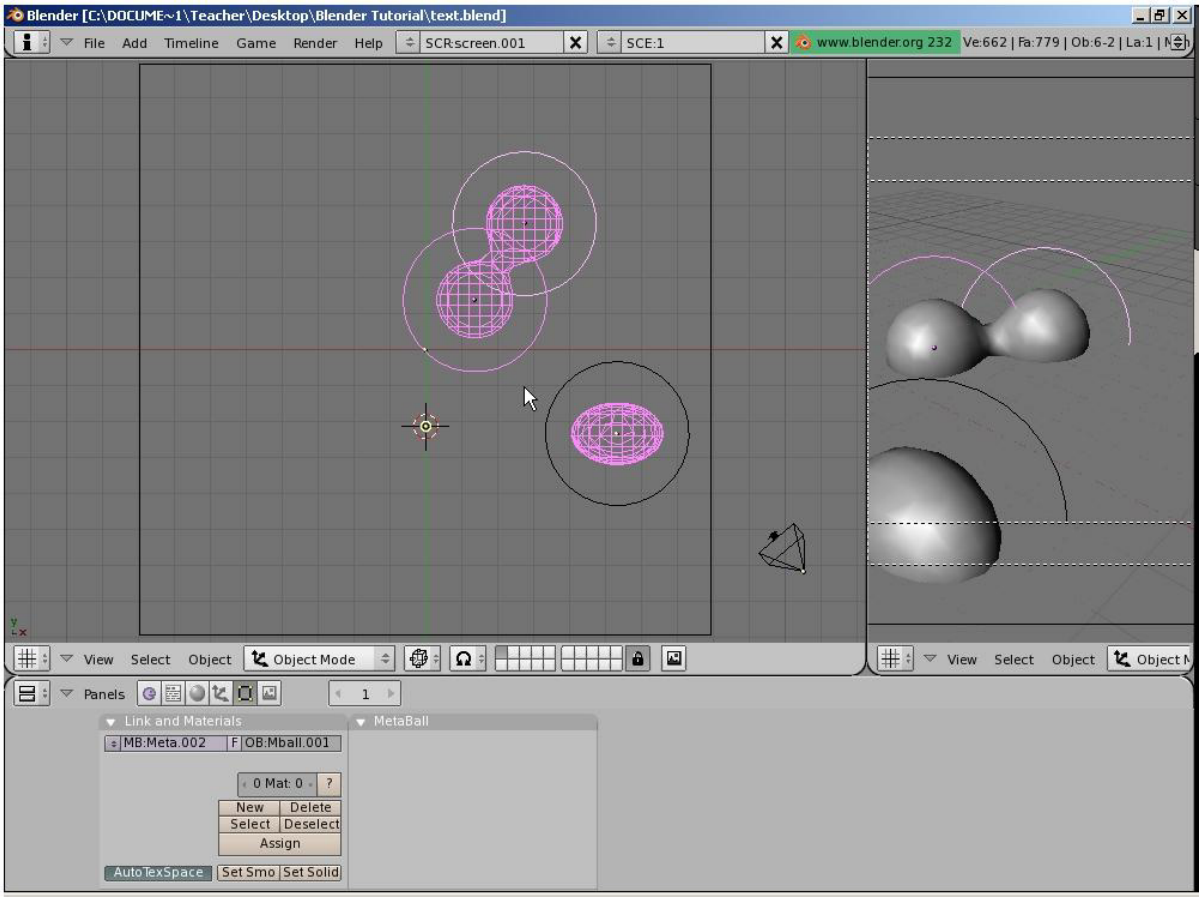


Meta Objects



Up until a few releases ago, Blender only had the capability to make one Meta shape- a ball. Interest grew, programmers added other shapes and cleaned-up the code. You can now make several different meta shapes in Blender. They all work with the same principle. As the shapes get close to one another, they begin to "pull" and flow together. Meta shapes can be animated like other objects and can be textured. Raytracing settings like reflection and transparency can also create some stunning effects. Meta shapes are created like other objects, except that the first shape acts like a parent to the other shapes. As that shape is moved, the others display a rotation.

Remember to exit edit mode after the creation of each meta shape (Tab key). Otherwise, all shapes will be joined together.



There are a few options for Meta shapes that can be controlled in the edit buttons. Experiment with them and try to make some renderings and animations.

Meta Shape Practice Exercise

Create a new Blender scene and set up the views any way you wish. Create a plane and some Meta Shapes. Place materials and textures on the plane and Meta Shapes. Experiment with the raytracing features and apply a miror and transparency effect.

When you finish setting up your scene, render a JPEG image and save it to your directory. Feel free to create an animation also.

***** Call the instructor when finished*****