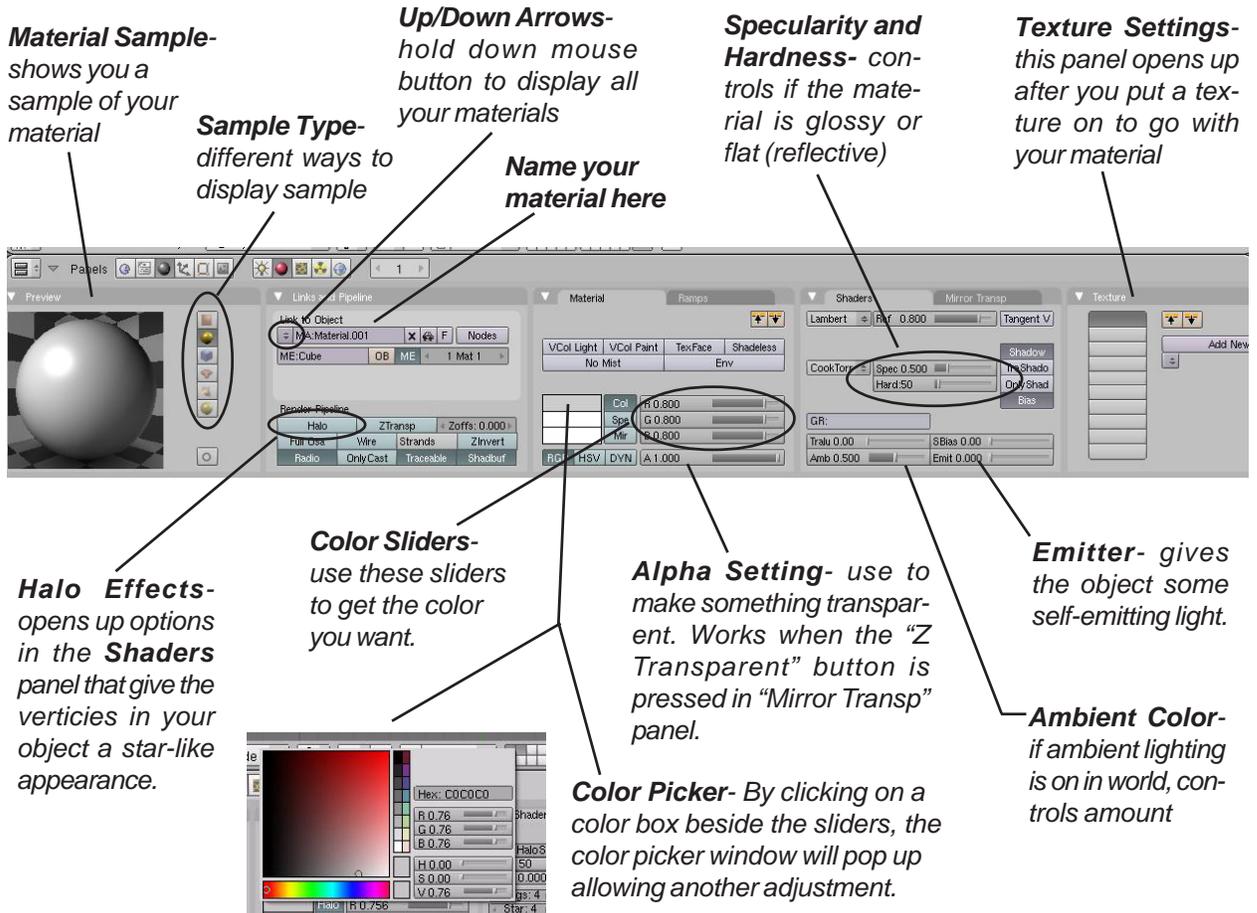
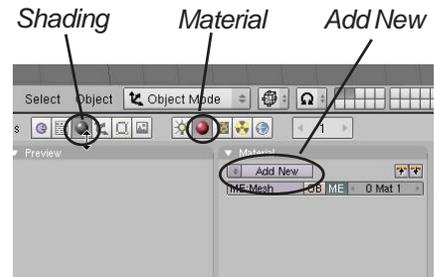


# Chapter 5- Materials and Textures

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.

## Basic Material Settings

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 object's color. Here is where you also set other properties like:



**Material Sample**- shows you a sample of your material

**Sample Type**- different ways to display sample

**Up/Down Arrows**- hold down mouse button to display all your materials

**Name your material here**

**Specularity and Hardness**- controls if the material is glossy or flat (reflective)

**Texture Settings**- this panel opens up after you put a texture on to go with your material

**Halo Effects**- opens up options in the **Shaders** panel that give the verticies in your object a star-like appearance.

**Color Sliders**- use these sliders to get the color you want.

**Alpha Setting**- use to make something transparent. Works when the "Z Transparent" button is pressed in "Mirror Transp" panel.

**Emitter**- gives the object some self-emitting light.

**Ambient Color**- if ambient lighting is on in world, controls amount

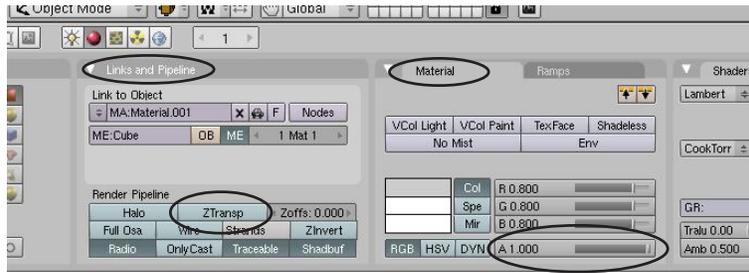
**Color Picker**- By clicking on a color box beside the sliders, the color picker window will pop up allowing another adjustment.

These are the settings 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.

# Chapter 5- Materials and Textures

## Transparency Using Z-Transparent

The easiest way to make something transparent in Blender while still maintaining a fast render speed is to use the **Z-Transparent** feature and controlling the **Alpha** setting. In the **Links and Pipeline** panel, select the **ZTransp** button, then slide the **Alpha** control down. Press the F12 button to render an image. If you need features like distortion (refraction), then you will need to use **Ray Transparent**. Refraction is the effect you get like looking through a magnifying glass or a crystal. Avoid using Ray features at this time. They are discussed in a later chapter.



## Halo Settings:

By using Halos on objects, you are basically only making the vertices 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 vertices 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 Sample*

*Material Color*

*Halo Size- used to determine the size of your halo effect.*

*Rings, Lines, Stars- add different features to your halo effect*

*Turn on the Halo effect under "Render Pipeline".*

*You can control the Halo, Line and Ring colors individually*

*Numbers of Rings, Lines, and Stars*

*Seed Pattern- used to generate a different pattern of effects*

### Different Halo Settings:

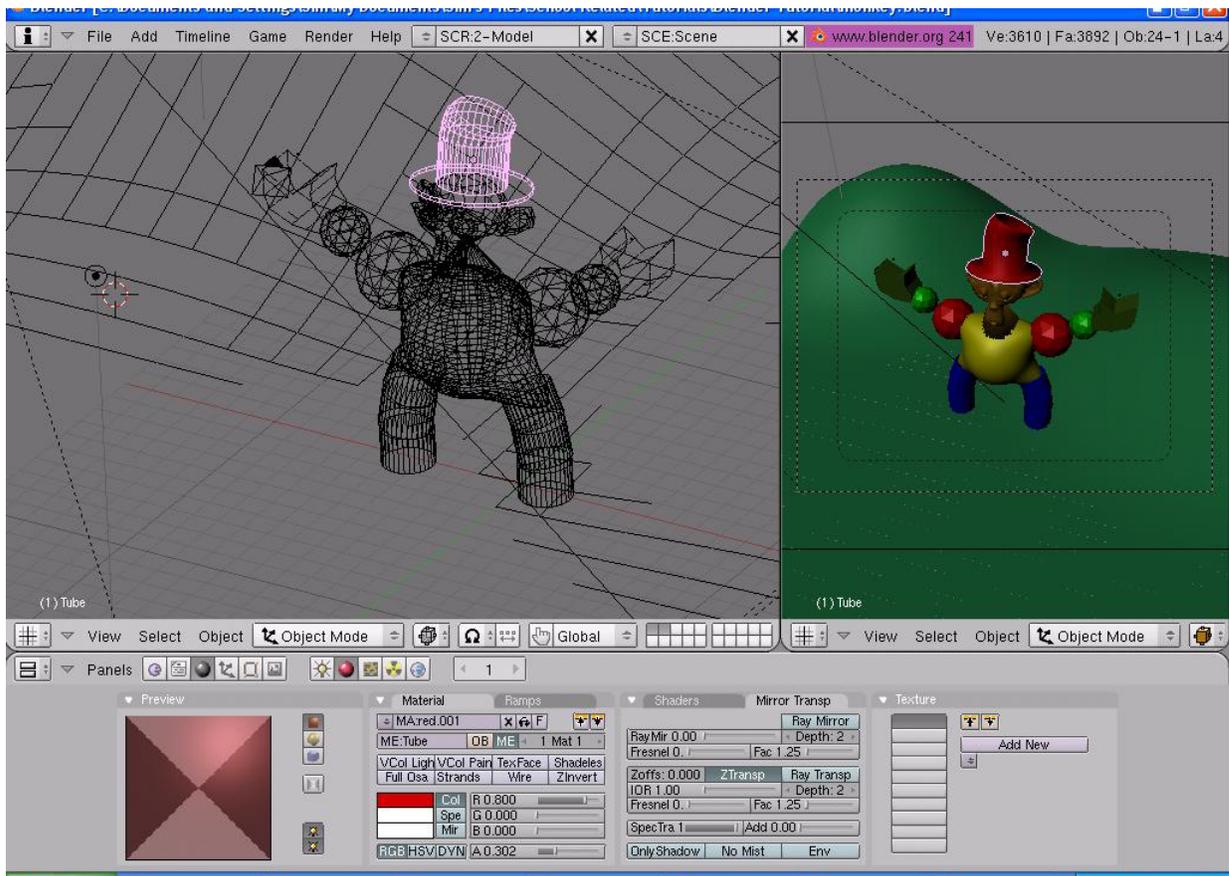
Rings Only   Lines Only   Star Only   Rings, Lines and Star turned on



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.

## Applying Materials Practice Exercise

Open your *Sculpture* file and add materials to all of your objects. Add at least one **Z-Transparent** material ( using the ZTrans button and the Alpha slider) and one material using a **Halo**. You may create a new object (a plane with only one vertex, for example) for the halo material. **For practice, name all of the materials you create so they could easily be used for other objects.** When finished, press **F12** to render out a camera view.



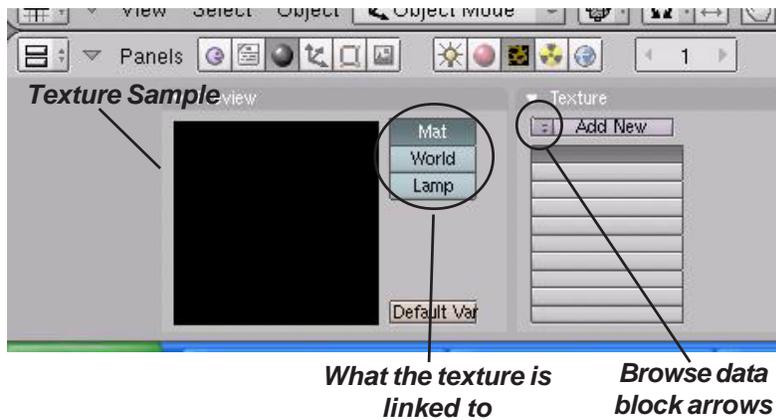
**\*\* Call the instructor when finished\*\***

# Chapter 5- Materials and Textures

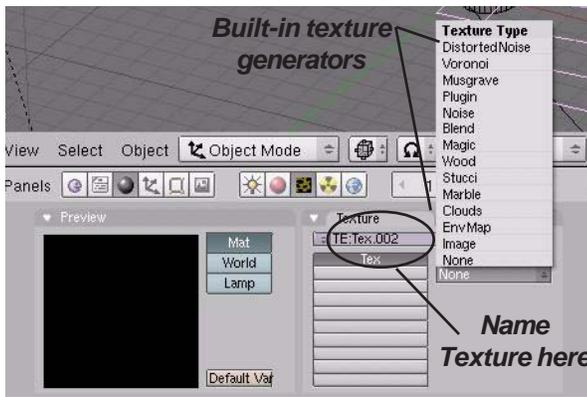
## Basic Textures Settings

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.

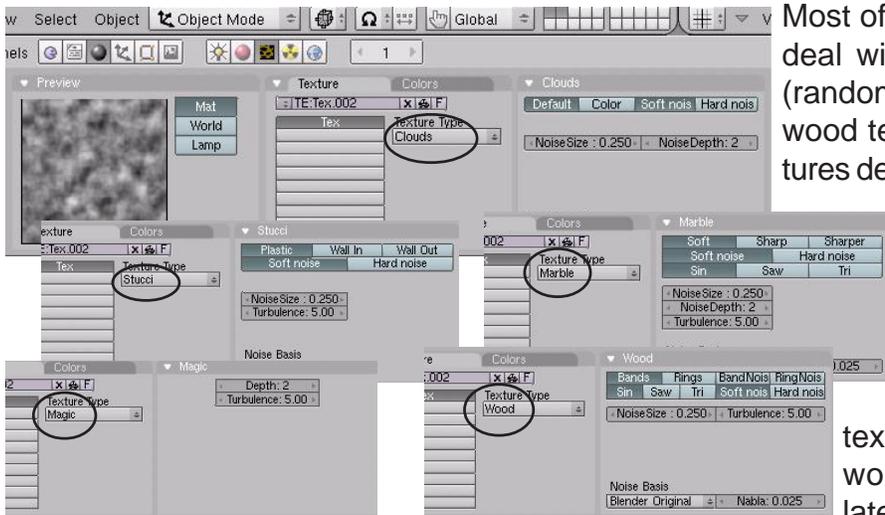


**Quick Tip:** You can't add a texture unless you've already added a material. Material and Texture properties work together!



### 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 **Clouds, 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:



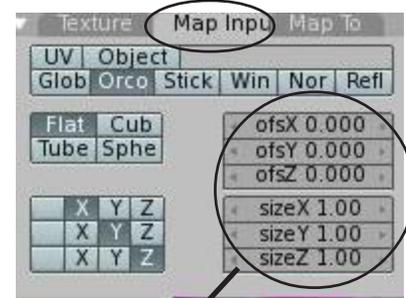
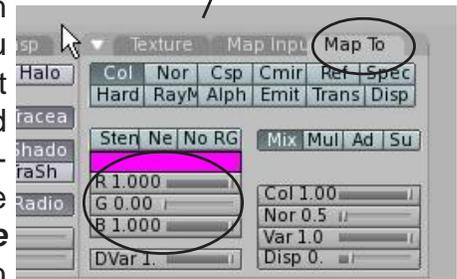
Most of Blender's texture options deal with turbulence and noise (randomness of the pattern) The wood texture also has some features dealing with the pattern of the wood grain (bands and rings). After you place the texture, you still need to go back to the Materials Buttons to fine tune the look on your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

## Chapter 5- Materials and Textures

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:



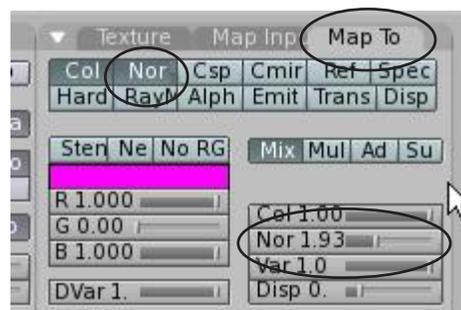
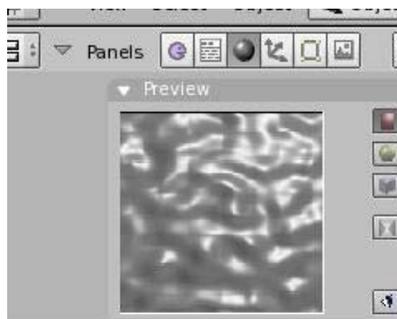
Wow- the sample block looks nice, but I don't often see much purple and gray marble around. Time to set the colors. You can set the base color in the material color sliders. To get rid of the purple, you need to select the "**Map To**" tab and adjust the sliders. Now you need to set the **size** of the 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.



**Quick Tip: Hold down "Shift" and LMB click in any number box to type a number**

### Stucci Texture:

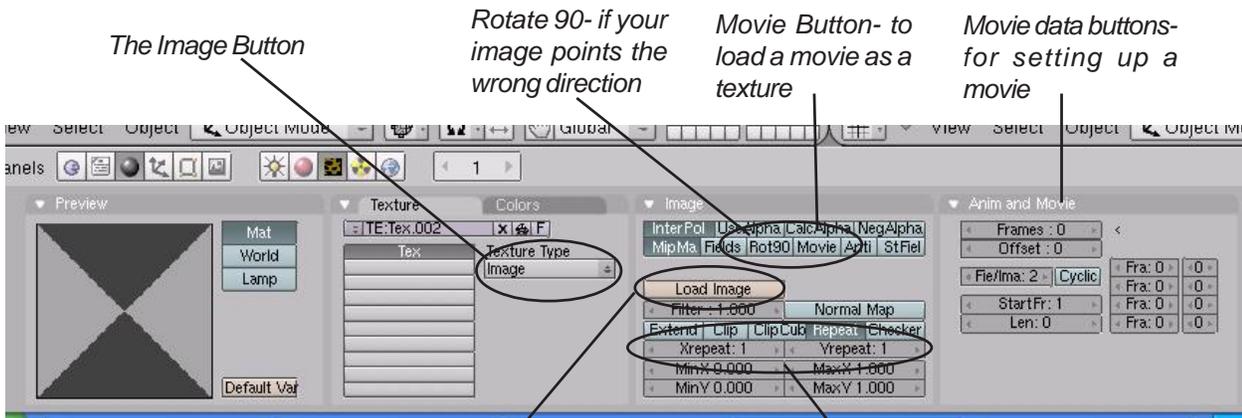
The stucci texture provides interesting effect on the surface of your object. In the **Texture Buttons**, select it as you do for any of the other texture generators and adjust the settings. Next, go back to the material buttons and click the "**Map To**" tab, click the "**Nor**" button for **normal**. 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.



# Chapter 5- Materials and Textures

## Using JPEG (.jpg) Images as Textures

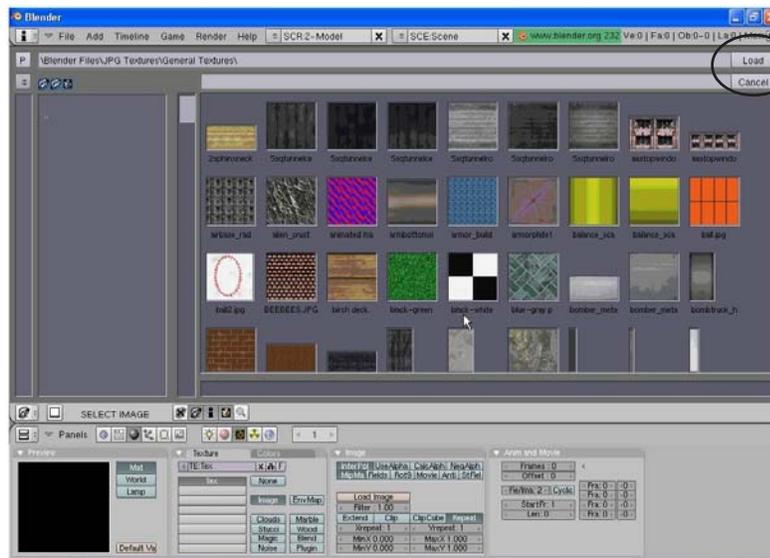
The basic texture generators are nice, but not complete. Most of the time you need to place textures like grass, brick, metal, fabrics and such into your model. **Anything that can be saved as a JPEG image can be used as a texture in Blender.** If you want to put a picture of your face on an object- 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:



*Load Image Button- hold down the “**Ctrl**” key and click button to bring up the image window (thumbnails of images). Just clicking the button without the control key will only bring up a text list- no pictures.*

*X and Y repeat- used to duplicate your image into a pattern*

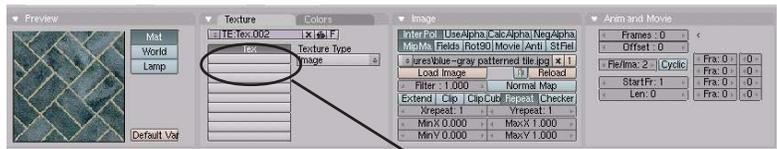
By using the **Control** key and clicking the **Load Image** button, you see a list of thumbnail images at the current folder. *Without holding the control key and just pressing the Load Image button, you will only see a list of file names without the thumbnails.* Browse through your folders to get to your images. Blender can be set to always look to the same folder when you click the load image button (see page 8).



Select Image, then click the “Load” Button

# Chapter 5- Materials and Textures

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:

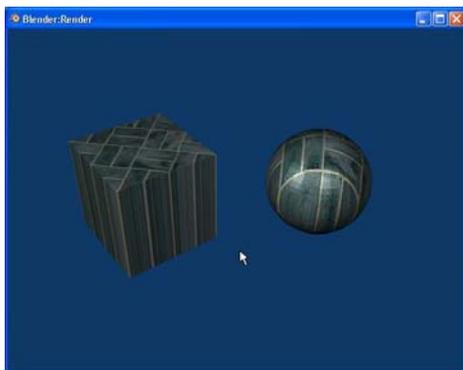


**Specularity, Hardness and Emit**- settings discussed before, will effect your end results

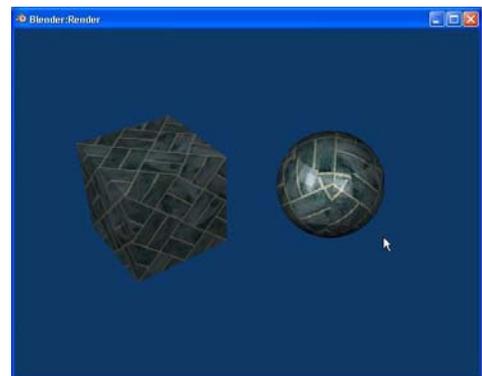


Different ways to wrap the texture around your object. Watch the sample as you try it.

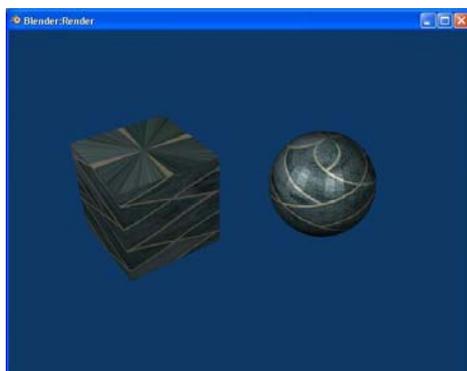
**Offset and Size** adjustments as discussed before effect your image



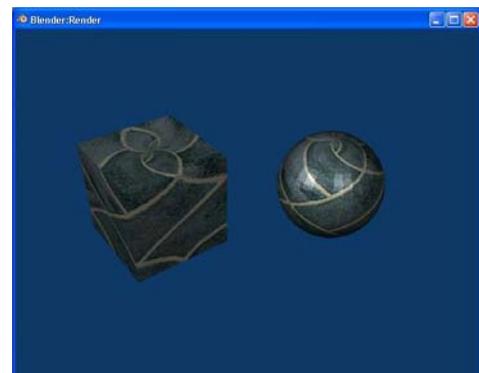
Mapped Flat



Mapped Cube



Mapped Tube

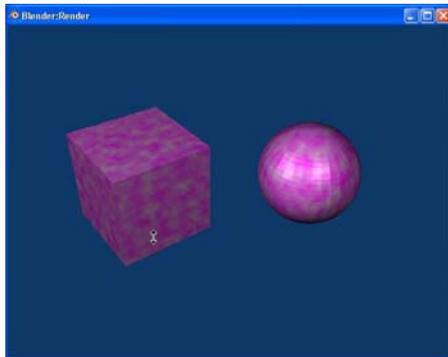
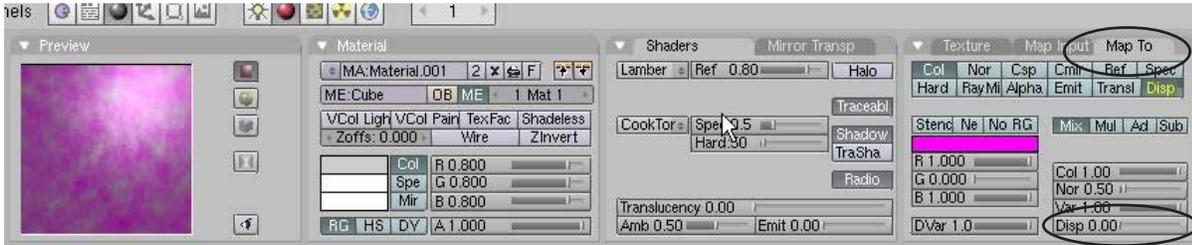


Mapped Sphere

# Chapter 5- Materials and Textures

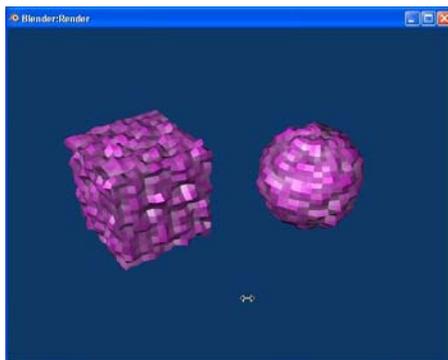
## Displacement Mapping:

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 vertices 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 vertices**, press the “W” key to get the **Specials Menu**, and **subdivide** a few times. Displacement works off of vertices 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:



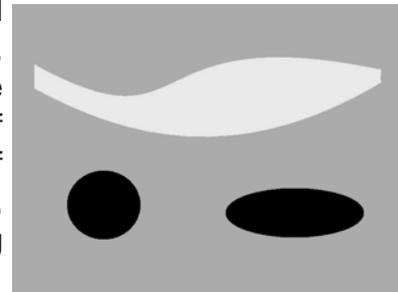
Displacement Off

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 basically works on varying colors in the texture. This is also controllable.



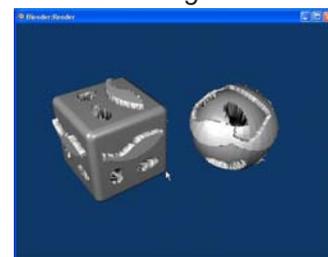
Displacement On

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 subdivisions (lots of vertices), 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 (vertices) on the mesh.



## Applying Textures Practice Exercise

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

1. Keep at least one straight material without a 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 an **Image** loaded as a texture (if you already have a color on the object from the previous exercise, the loaded texture will over ride the color setting).

*Render the image with F12 when finished*

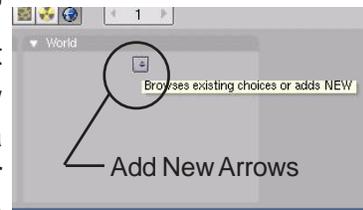


**\*\* Call the instructor when finished\*\***

## Chapter 6- Setting Up a World

### Using Color, Stars and Mist

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 releases 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:

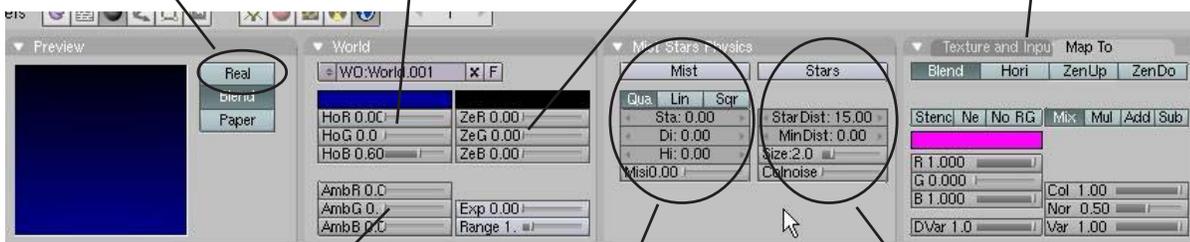


Use the **Real** button to give you movement when the camera moves

**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

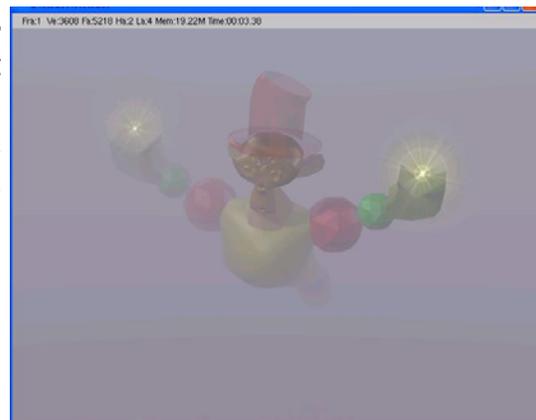
**Mist Settings**- gives you a fog effect. Can be used as a consistent fog or one that fades from ground

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

### Mist

When using Mist, You will need to set both the **Zenith and Horizon Sliders** to the color of the mist you desire (middle gray for a real fog), turn on the mist button, then adjust the **Sta** (start from camera distance) and **Di** (depth of mist). You also have a **High** setting to vary fog height.

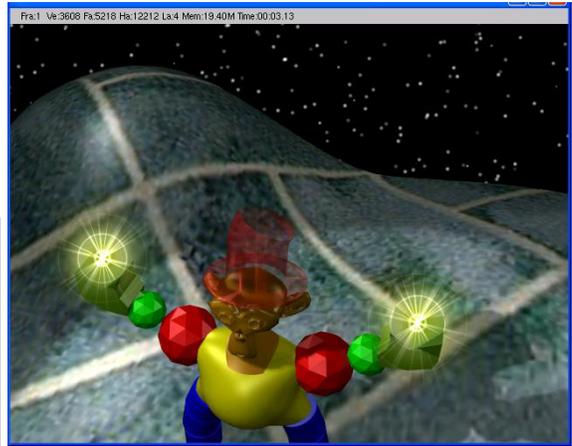
**Quick Tip:** If you apply a mist and render a blank image with the F12 button, the Di setting needs to be higher. The fog is too thick to see through!



## Stars

When using Stars, you will need to set both the **Zenith and Horizon Sliders** to black (for a space scene). Turn on the **Star** button and adjust the **Star Dist** (distance between stars) and the **Min Dist** (starting distance from camera). You can also set **Star Size** and **Color Noise**.

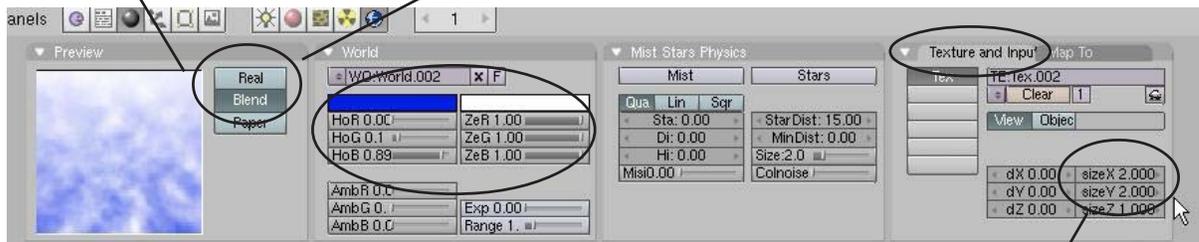
**Quick Tip:** Remember that you are creating an infinite 3D star field. If you change the Camera's distance or set the distance between stars too low, you may slow the computer to a crawl by making it try to calculate too many stars!



## Creating a 3D Cloud Background

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"** (you will notice that the texture will be linking to the world and not a material- if not, press the **World** button) 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. You will also want to make sure the **"Blend"** button is pressed.

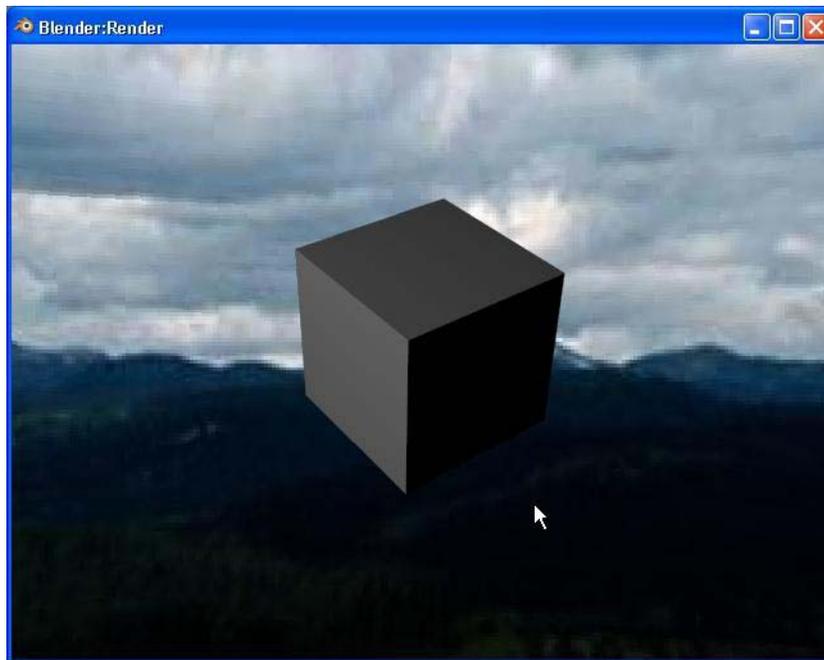
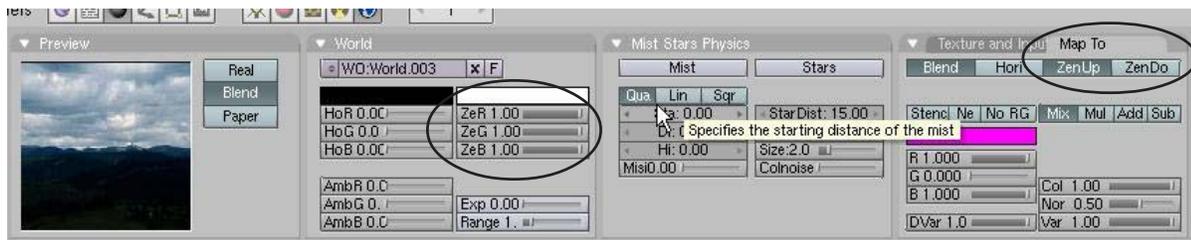


Size X and Y

## Chapter 6- Setting Up a World

### Using an Image in the Background

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, then 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. In Blender version before 2.4, 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. In the newest version of Blender, it looks like this feature has changes and you may need to press the “**Zen Do**” button also.



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.



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

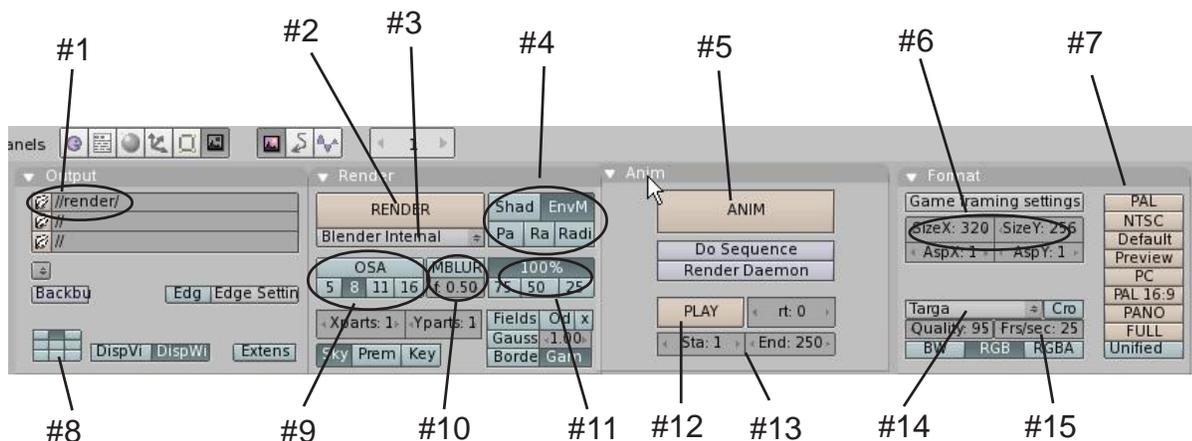
## Chapter 7- Render Window Settings

### Basic Setup Options

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 you're 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.*

## Chapter 7- Render Window Settings

- #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 “NTSC” size which sets the image to 720 x 480 pixels. This is considered US and Japan DVD quality.*
- #8. **Render Window Location**- These buttons determine where the render window is displayed on the screen when you hit “Render” or “F12”. If you wish to change the location, close the render window, then change location. When you render again, it should be displayed at the new location.
- #9. **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.
- #10. **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.
- #11. **Output Percentage**- We normally don’t mess with these, but if your image doesn’t seem to be the right size, check to make sure you didn’t take it off of 100%. The *Preview* button in the preset sizes will change the percentage for quicker renders.
- #12. **Play Button**- After you animate something, you can watch it in Blender by pressing this.
- #13. **“Start” and “End” Frames**- This is how you control which frames render in a movie.
- #14. **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%. You also have several other types of output files available, but these are the two we use most.
- #15. **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.

***Quick Tip: 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.***

### Rendering a JPEG (.jpg) 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 render window. With the render window up, Press “F3”. This will open the file save window. Here is where you give your file a name and set the location. **Remember to type .jpg after the name of the file so it saves properly. Windows will not know what to do with the file if the .jpg extension is missing and Blender may not put it on for you.**

## Chapter 7- Render Window Settings

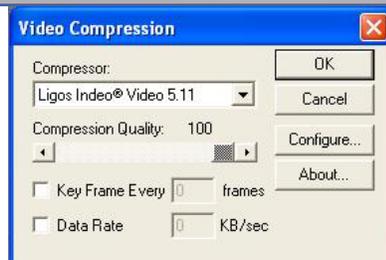
### Creating an AVI Movie File

In chapter 9, you will be creating your first computer animation. After you create all of your objects, apply materials and textures, and create your animations, you will be ready to make a movie file of your scene. Here are the steps to saving that movie file:

#### Seven Easy Steps to Create an AVI Movie File: (our settings)

1. Select “**NTSC**” (or whatever your output choice) in the **Format** Panel.
2. Change the file type from JPEG to **AVI CODEC**. Choose **Indeo 5.1** as the CODEC and set the quality to **100**.
3. Make sure that **OSA** is **ON**.
4. In the **OUTPUT** panel, click on the top file folder and set the path and name of the movie file. *Remember to type “.avi” at the end of the name or Blender will put a bunch of numbers on the end of the file (the frames rendered).*
5. Check the “**Sta**” and “**End**” frames for the length of the animation. Also check the **frames per second** setting.
6. Check to make sure the **Shadow** and **Ray** buttons are on or off (depending on your output wishes).
7. Finally, hit the **ANIM** button to animate your movie.

Now just sit back and relax. The movie may take a while to compile (minutes, hours, days depending on complexity and computer speed) since it needs to render each and every frame of the movie.



## Rendering an Image 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 different file name. You will see your scene within the scene!



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

## Chapter 8- 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- see previous chapter). 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.



### Reflection (mirror) and Refraction (transparency and distortion)

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.

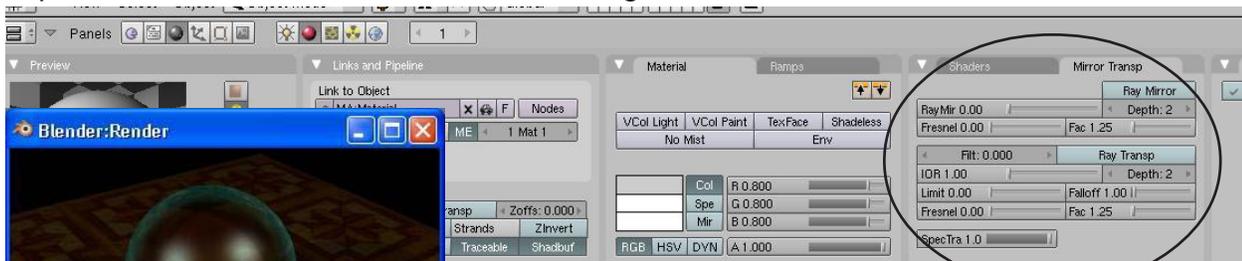


Image rendered with ray mirror on the floor and ray transparency on the ball. The lights have also been set with ray shadow.

## 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\*\***

## Chapter 9- Animation Basics

### Timing, Moving, Rotating and Scaling

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.*

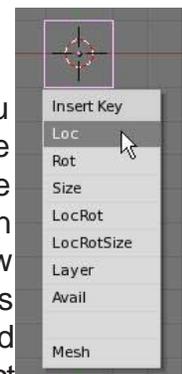


*Frames Per Second (fps)- set this to an adequate number. The default is 25 fps.*

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.

### 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**.



## Chapter 9- Animation Basics

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.

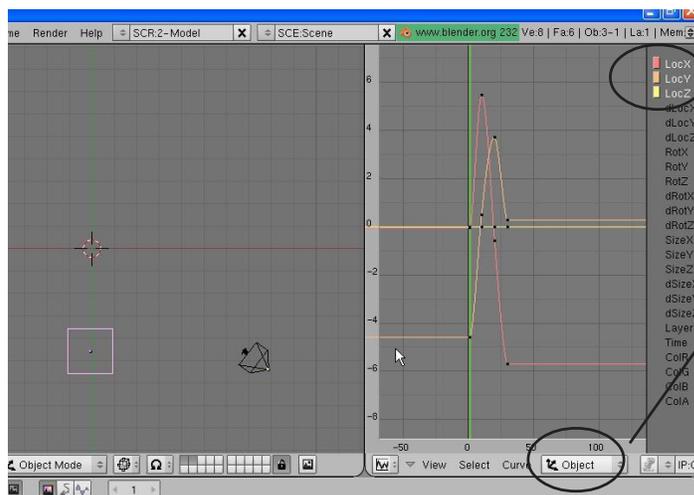
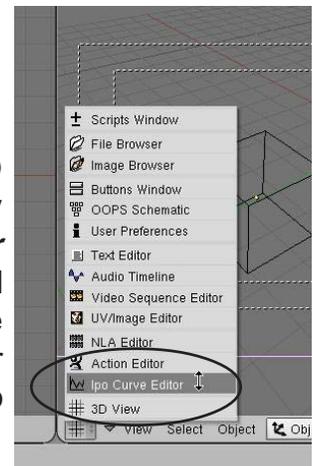
### Viewing Your Animation:

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. Blender will attempt to display the movie at the correct *frames-per-second*, but may be unable to do so due to scene complexity or image settings (solid or wireframe -Z key).

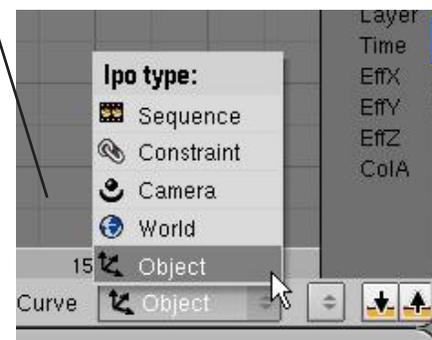
Movement may not be exactly how you planned it. Blender automatically defaults to trying to create a smooth flow through the keys you've placed. This can be changed and will be discussed later.

### 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 **IPO 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.

## Chapter 9- Animation Basics

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

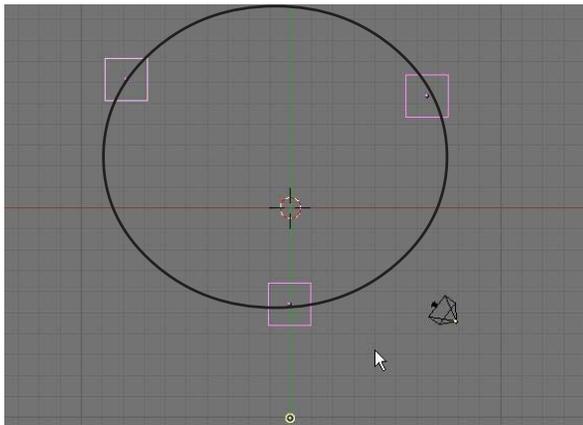
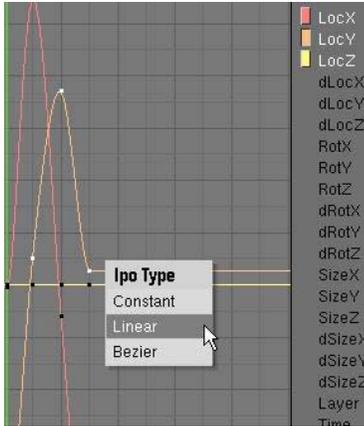
and, with the cursor in the IPO window, type “T” for type. You have 3 options:

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

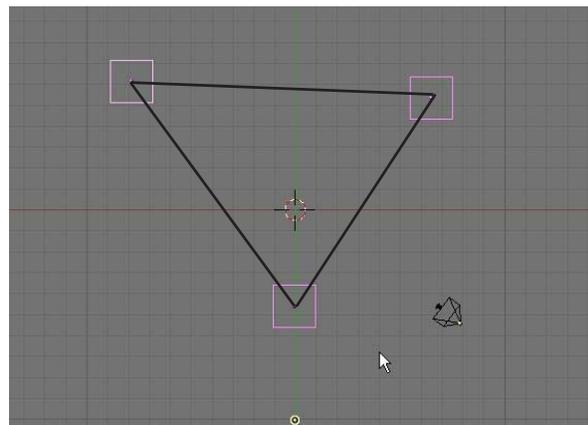
**Linear**- takes a straight path from point “A” to point “B”. Solves problems of animations swinging way out of where you want it to go, but jerky motion at key points

**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.**

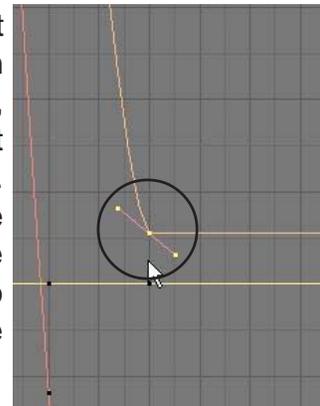


Animation path of a cube with 3 keys placed at shown locations with **Bezier** path type selected. Path is smooth, but curves way out.



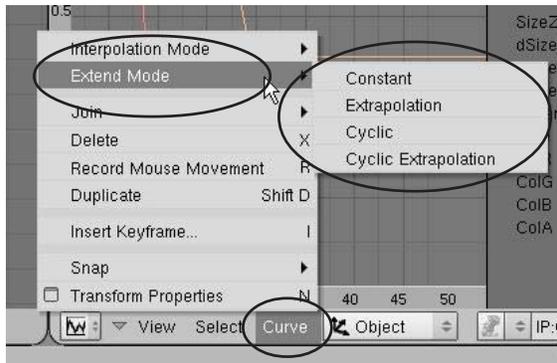
Animation path of a cube with 3 keys placed at shown locations with **Linear** path type selected. Path is straight, but jerky at key points.

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 vertices 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.)



**Quick Tip:** If you ever need to start over with an animation, you can erase all the animation tracks in the lpo window and start over. To select all tracks, hit the “A” key once or twice (once to deselect, once to select).

### 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, 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 “**Action and 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 beginning and hit “**Alt-A**” to see the animation. The difference between **Action and Object**, as displayed on the button, deals with what is being animated. **Actions** tend to deal with things like armatures (bones) while **Objects** deal with things like your meshes.



***Quick Tip: Remember to turn off Auto Keyframing when you do not need it on. It's too easy to mess up your animation! Also, remember that Blender now has a general Undo command (Alt-U), but Blender will not remind you to save your work. 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.

## Chapter 9- Animation Basics

### 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.
- All Mapping-** Use this to set all possible adjustments in one step.

#### 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.

**Quick Tip:** Remember that animations can be seen in the lpo window by changing what types of lpos are seen in the window!

## Creating an Animation

Open your *Sculpture* file and animate a variety of objects. Your movie will be 250 frames long, running at 25 fps. You can also animate 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 250; Frames/second 25 (a 10 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.



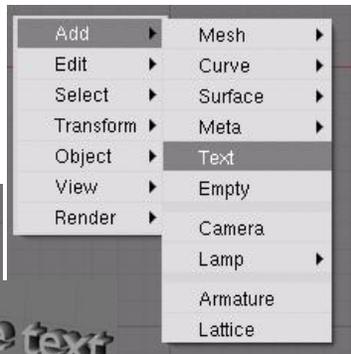
**\*\* Call the instructor when finished\*\***

## Chapter 10- Adding 3D Text

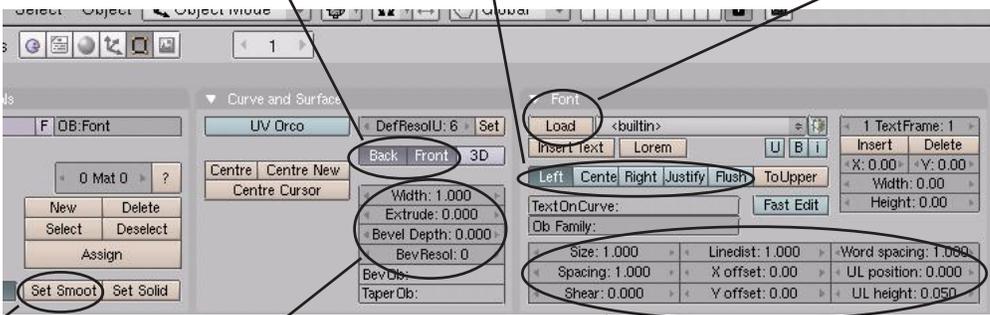
We've discussed creating a lot of objects so far, but 3D text can be considered a very important element to add. There are 2 ways to create text for Blender scenes. One way is to use the built-in text generator. The other method is to use an external program to generate the text and import it into Blender. Each method has its benefits and disadvantages. Text made in Blender can be easily changed 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 vertices that can be adjusted and used with effects like *Wave* (discussed later) better than Blender text.

### Blender 3D Text Settings

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.



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

A screenshot of the Blender Text Properties panel. The panel is divided into several sections. The 'Font' section at the top has a 'Load' button and a dropdown menu showing '<builtin>'. Below it are buttons for 'Insert text' and 'Lorem', and a text input field. The 'Justification' section has buttons for 'Left', 'Centre', 'Right', 'Justify', 'Flush', and 'To Upper'. The 'Text On Curve' section has a 'Fast Edit' button. The 'Obj Family' section has a dropdown menu. The 'Style Options' section has several sliders and buttons for 'Size', 'Linedist', 'Word spacing', 'Spacing', 'X offset', 'Y offset', 'UL position', 'UL height', 'Shear', and 'Y offset'. The '3D Features' section has buttons for 'Back', 'Front', and '3D', and sliders for 'Width', 'Extrude', 'Bevel Depth', 'Bev Resol', 'Bev Dis', and 'Taper Ob'. The 'Closed or Open Shape (Front/Back)' section has buttons for 'New', 'Delete', 'Select', 'Deselect', 'Assign', 'Set Smooth', and 'Set Solid'. Annotations with arrows point to various parts of the panel: 'Closed or Open Shape (Front/Back)' points to the 'Set Smooth' button; '3D Features-' points to the '3D' button; 'Justification' points to the 'Justify' button; 'Load Font-' points to the 'Load' button; 'Style Options-' points to the 'Size' slider; and 'Set Smooth Button' points to the 'Set Smooth' button.

**Closed or Open Shape (Front/Back)**

**Justification**

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

**Set Smooth Button**

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

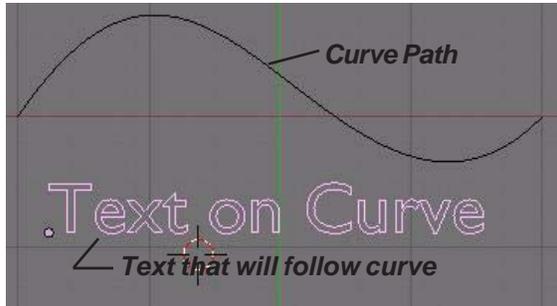
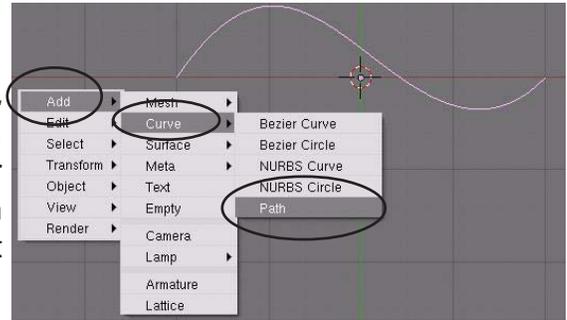
**Style Options-** Size and Letter Spacing, Shear (italic), Linedist (spacing between lines) X, Y Offset (moves text up/down left/right of center point)

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 there called **Fonts**. You will only be able to use fonts that are marked with a small square. *Some of these fonts may become distorted when extruded into a 3D shape.*

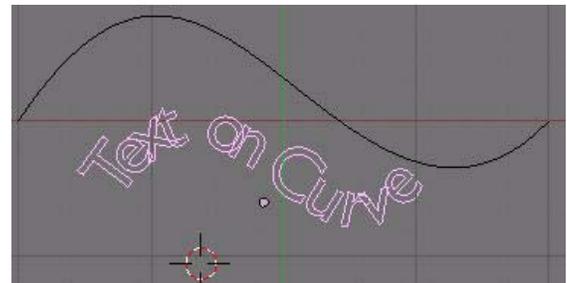
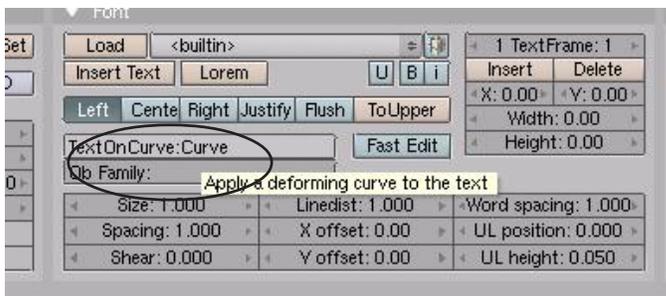
|             |         |
|-------------|---------|
| app02.fon   | 30 600  |
| app855.fon  | 37 296  |
| app857.fon  | 36 672  |
| app866.fon  | 37 472  |
| ARBLI_.TTF  | 65 544  |
| arial.ttf   | 296 712 |
| arialbd.ttf | 288 496 |
| arialbi.ttf | 226 748 |
| ariali.ttf  | 207 808 |
| ARIALN.TTF  | 134 188 |
| ARIALNB.TTF | 139 056 |

## Creating Text on a Curve

Blender text has the ability to follow a **Curved Path**. In order to create curved text, hit the **Space Bar**, select “**Add**”, “**Curve**”, then “**Path**” (or any other curve shape). The curve will come into the scene in edit mode. Shape the curve as desired, then hit **Tab** to exit edit mode.



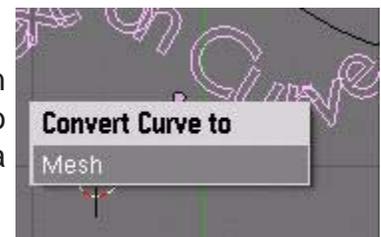
After you create the text, go to the **Edit Buttons** and find the box “**Text On Curve**”. Type the name of the curve (found in the lower-left corner of the viewport when the curve is selected- remember that names are case sensitive). The text will take the shape of the curve. You may need to change the spacing of the text so it flows properly.



**Quick Tip:** When extruding text for normal titles and labels, be careful not to extrude the text too thick. It may effect how well the text can be read.

## Converting Text Into a Mesh

At times you may need to convert text into a mesh for certain purposes (i.e. using a Build Effect discussed in chapter 12). To convert text into a mesh, press “**Alt-C**” to convert it first into a **Curve**, then “**Alt-C**” again to convert it into a **mesh**.



At times, you may feel limited with Blender text (although it seems to improve with each new release). In these cases, you may wish to use an external 3D text program like **Elefont** which saves files in standard DXF format, then import them into your Blender file.

## Chapter 10- Adding 3D Text

### Using Elefont for 3D Text (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](http://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.

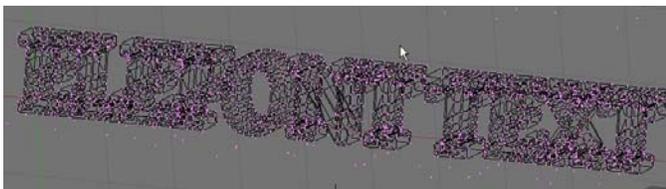
**S**- Bevel Scale (size of bevel) (hold down LMB on button, drag left/right)

**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 vertices are shown

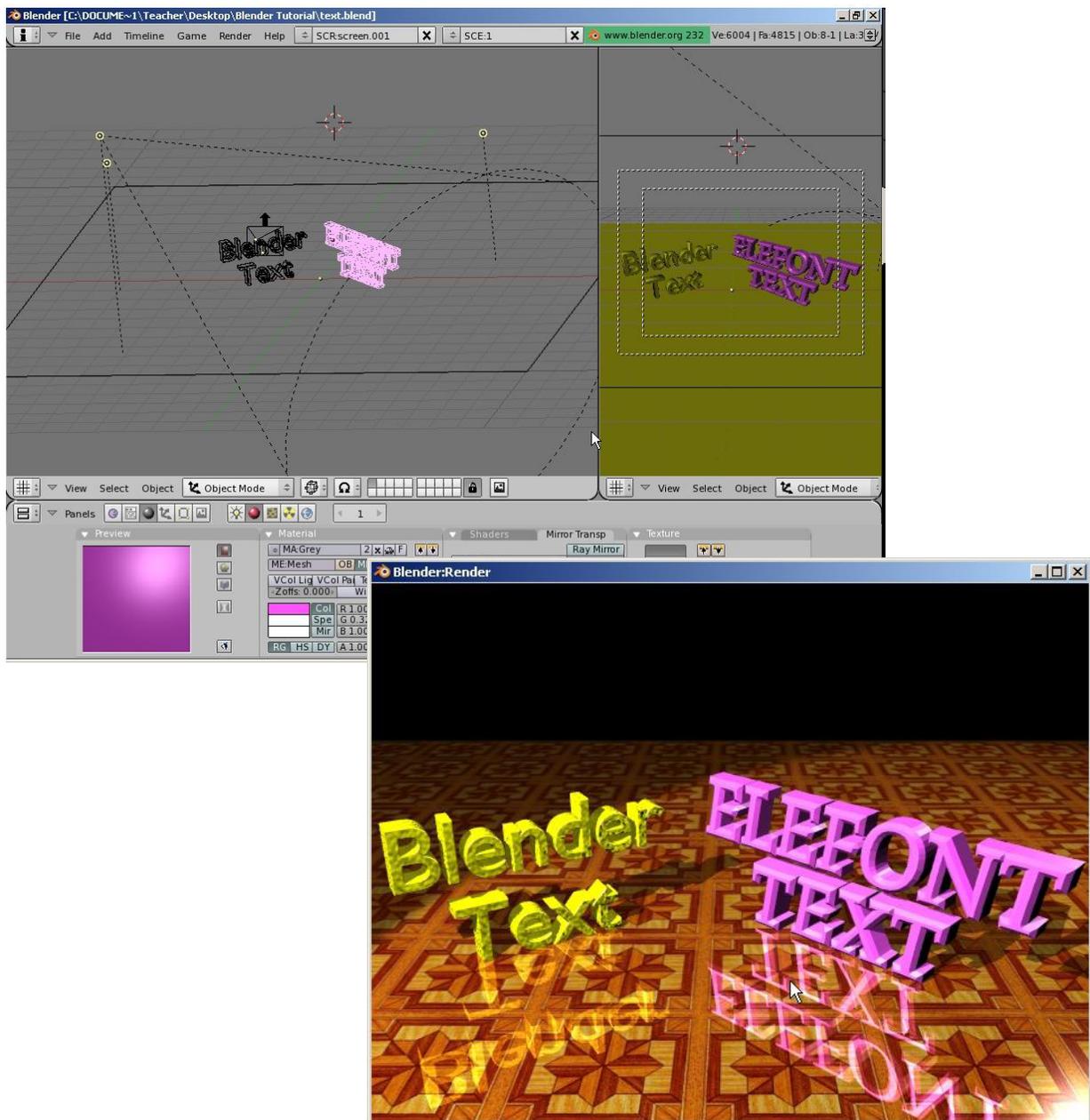
EleFont text in Blender with “Z” toggled to show a shaded view.



## Creating 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.



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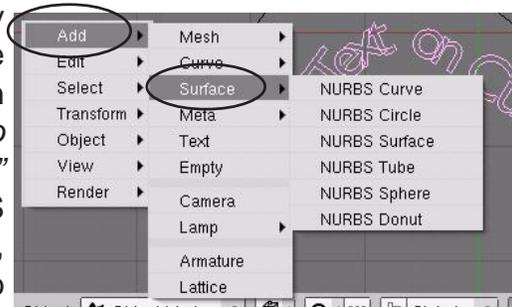
**\*\* Call the instructor when finished\*\***

## Chapter 11- 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.

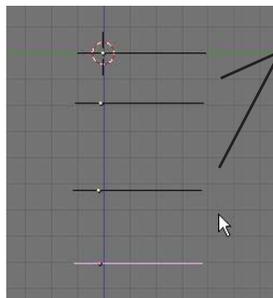
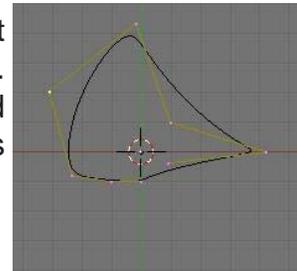
### Using NURBS to Create Lofted Shapes (surfaces)

If you look at the **Surface** menu, you will see a variety of shapes that can be created. These shapes can be used as they are or converted to meshes so you can work with traditional vertices. *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.

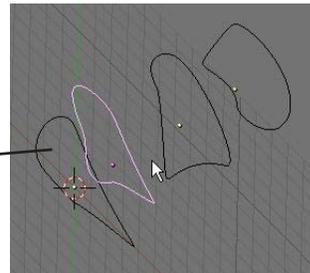


### Creating a Lofted Tunnel

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.

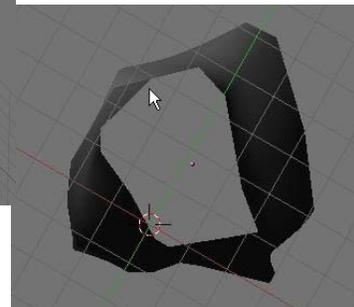
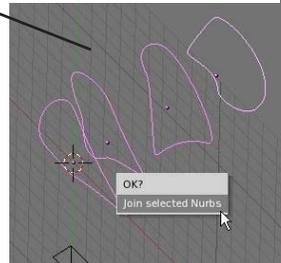


Change your view so you are looking down on the circle. Use the “**Shift-D**” keys to duplicate the circle several times. Then rotate your view so you can select each circle and edit the shapes in **edit mode** (Tab key).



After shaping the circles, Select them all by RMB clicking on them while holding the “**Shift**” key. To join them together, press “**Ctrl**” and “**J**”.

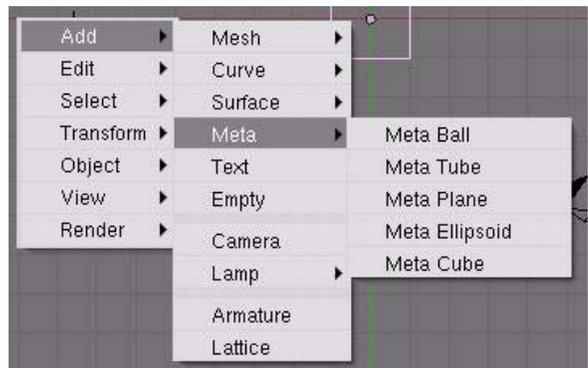
For the final step, press “**Tab**” for edit mode, “**A**” for all vertices, the “**F**” for face. Your result should be a lofted object. If you need it to be a mesh, press “**Alt**” and “**C**”.



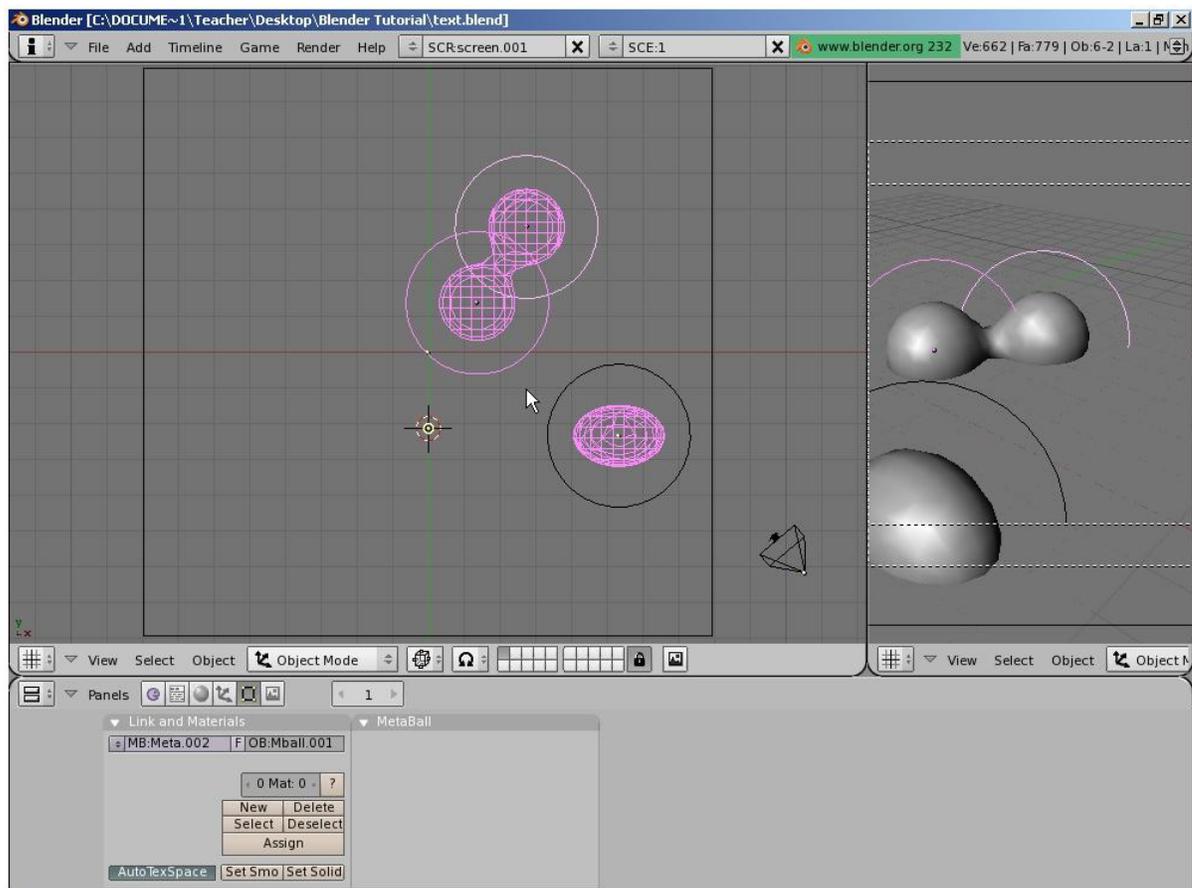
## Chapter 11- NURBS and Meta Shape Basics

### Liquid and Droplet Effects Using Meta Shapes

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.



***Quick Tip: 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 Shapes Practice Exercise

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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 mirror and transparency effect.

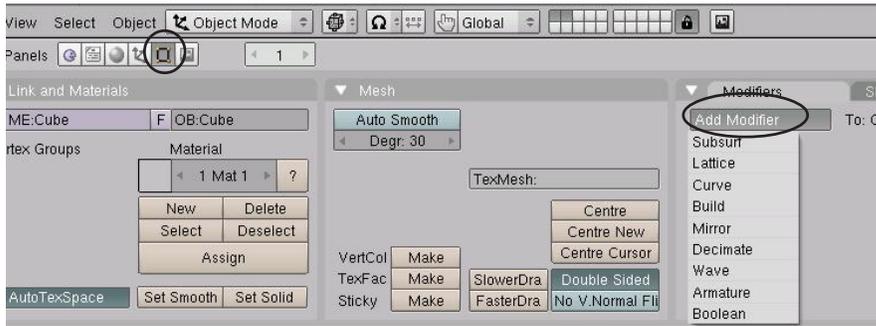
When you finish setting up your scene, render a JPEG image and save it to your directory. Feel free to create an animation also.



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

# Chapter 12- Modifiers

With the release of version 2.4, some essential items in Blender have been completely reorganized. Some of that reorganizing has occurred with the **Modifiers** used in Blender. They have all been placed in a common area to make things easier. To access the Modifiers, select the object you wish to add a modifier, then go to the **Edit buttons**. Under the **Modifiers Panel**, select “Add Modifier”.

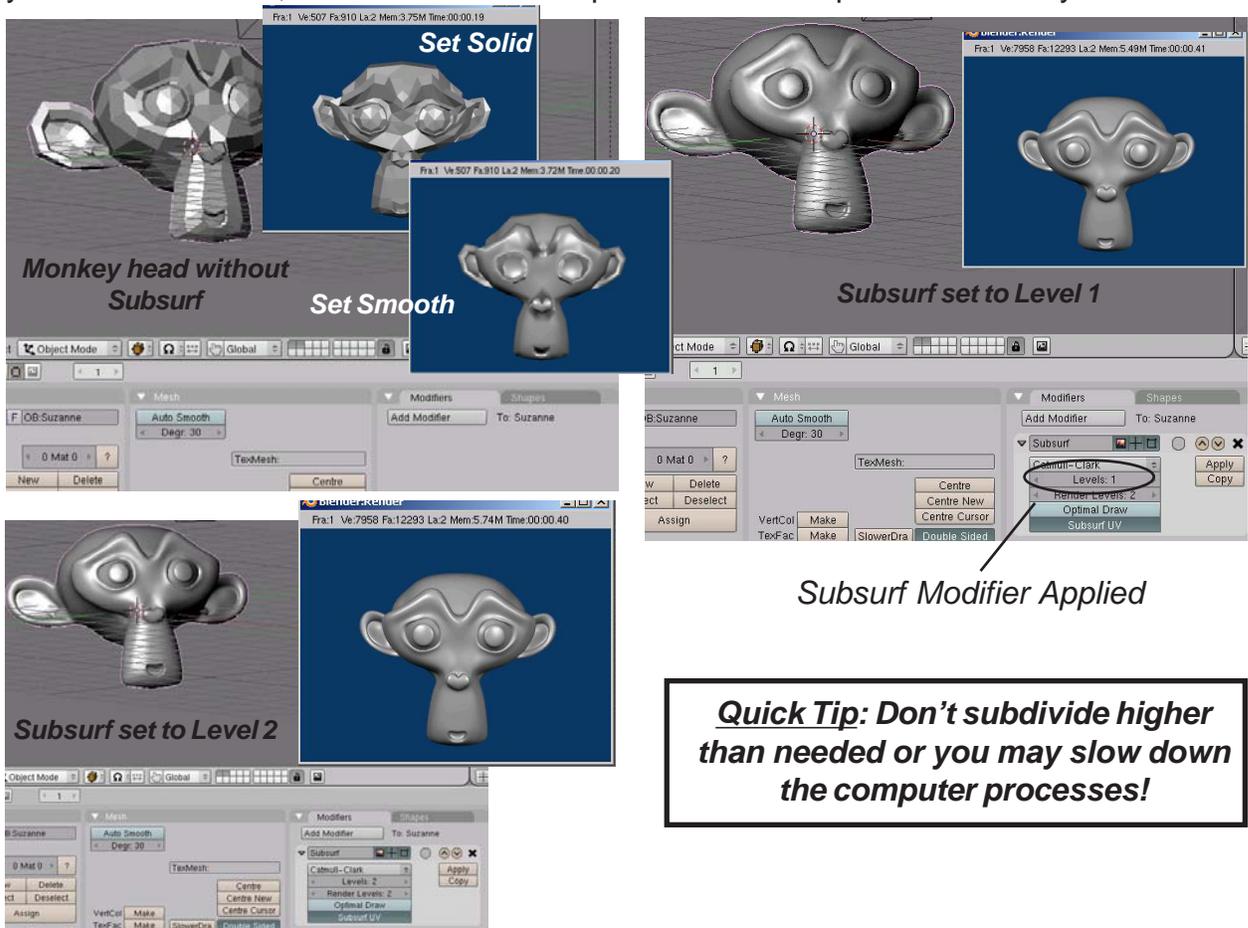


The Modifiers we plan to look at in this chapter are:

- Subsurf
- Build
- Mirror
- Wave
- Boolean

## Subsurf (mesh smoothing)

Subsurf is used when you would like to smooth out a mesh more than the “Set Smooth” button or the “Auto Smooth” will do without having to subdivide the mesh more. Subsurf will split your mesh faces a number of times, but will not add more vertices to the mesh. This means when you enter Edit mode, the mesh remains simple. See the example of the monkey head below:

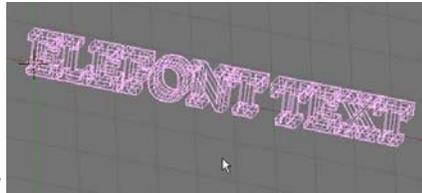


## Chapter 12- Modifiers

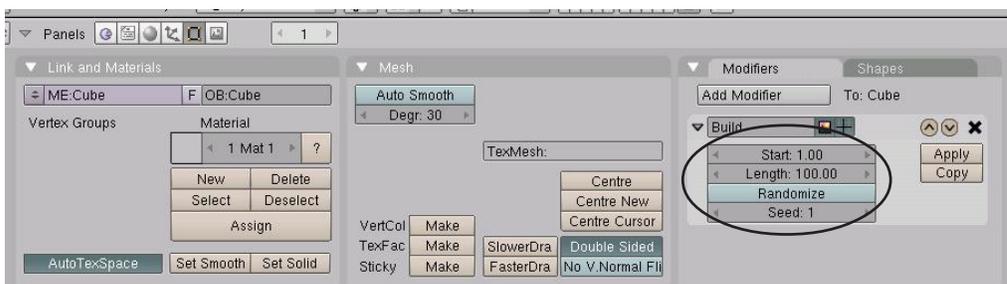
### Build Effect

The build effect is nice for simulating something building linearly along time in an animation. Text is a good example of something you may want to use with a build effect. Blender generated text cannot be built unless it has been converted into a mesh (see page 59), and even then, it may not build correctly. Elefont text may be a better option to use.

The first step in creating a build effect is to have a mesh that you would like to build. For this example, we will use this EleFont text. **A high vertex count is usually needed for a nice effect.** Notice the location of the object's "center" point. You may need to move this to get the effect you desire depending on what you plan to do with the object (*discussed in the basic editing chapter*). When bringing text into Blender from EleFont, the letters will all be separate objects. Be careful when joining them together. You need to join them together in a straight sequence (hold down the shift key and start at one end and select the letters in sequence-don't jump around). After all letters are selected, press "**Ctrl**" and "**J**" to join them. *Jumping around when selecting them to join will cause it to build oddly.* You may need to experiment with this a few times to get a good effect.



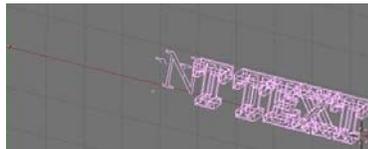
With the object selected, go to the **Edit** buttons, select the **Add Modifiers** tab and select the **Build** option from the list. You will have 2 things to set- the **Length** and the **Start Frame** (how long do you want it to take to build and when in the animation do you want it to start). You have another option dealing with **Randomized** settings you can experiment with.



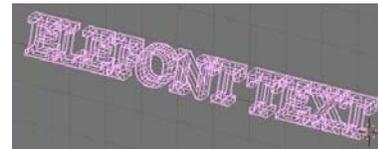
**Quick Tip: Don't be alarmed if the object disappears when you select build. You will only see the amount of it that should be there on your current frame. Press "Alt" and "A" to see it animated on the screen.**



Build at frame 1



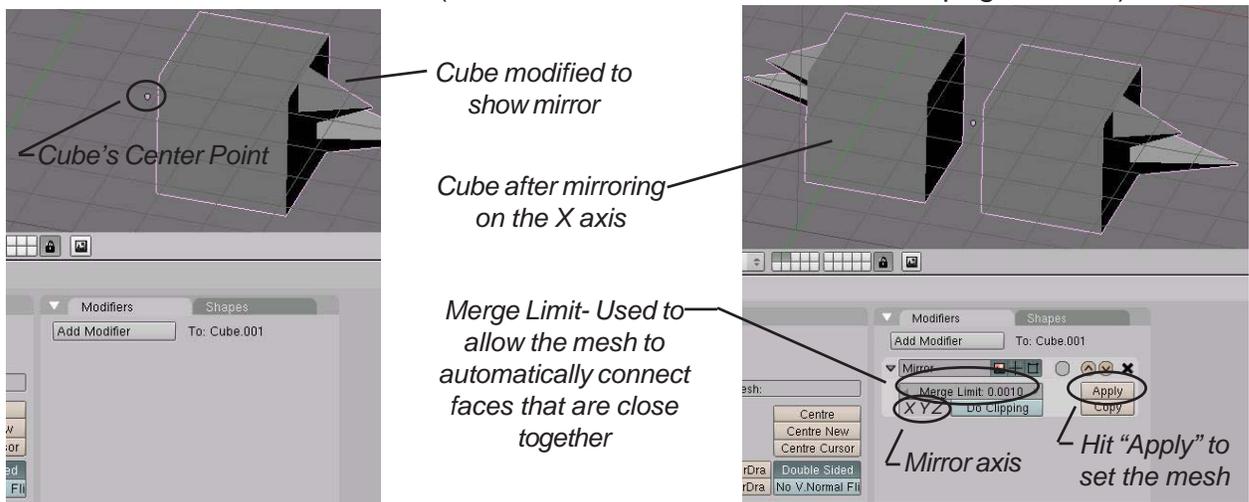
Build at frame 50



Build at frame 100

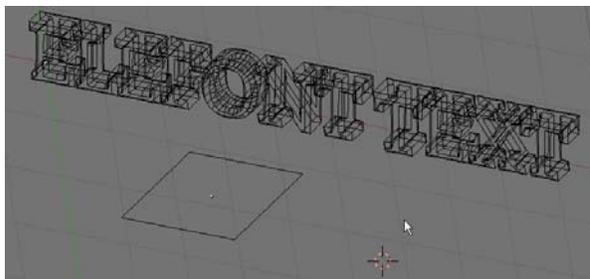
## Mesh Mirroring

Blender has a new mirror command under Modifiers. You can still mirror using “**M**” in **Edit Mode**, but now you have another option. For an example, below is a cube we will use for mirror. The cube was **Subdivided** in **Edit Mode**, modified with a few points, and the **Center Point** of the object moved to outside of the shape. *The mirrored object will use the object’s center as the axis of revolution* (These features can be reviewed on pages 22-24).

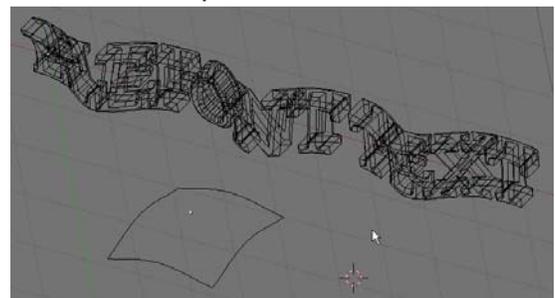


## Wave Effect

The wave effect can be used to make something look like it’s swimming like a fish or blowing in the breeze among other things. Again, you need to start with something that has a good vertex count. For this discussion, I will use the Elefont text and a plane. The text already has a high number of vertices, but the plane does not. With the plane selected, enter **edit mode** (**Tab** key) and select all vertices (“**A**” key). In the Edit buttons find “**Subdivide**” and press it about 3 times. You can also subdivide while in edit mode by pressing the “**W**” key and selecting **Subdivide** from the menu. Exit edit mode (**Tab** key). Here’s what we have so far:

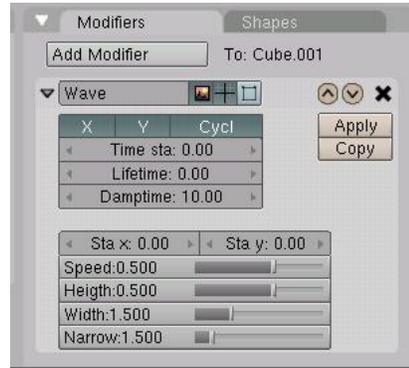


Once again, with the object selected, go to the **Edit** buttons, **Add Modifier**, then click the “**Wave**” button. Place your cursor in the 3D window and press “**Alt and A**” to see your animated wave effect. Hit escape to exit. Here’s the basic wave effect on the text and plane:

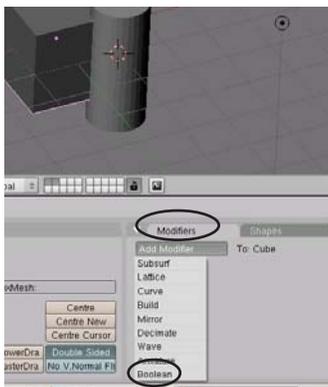


# Chapter 12- Modifiers

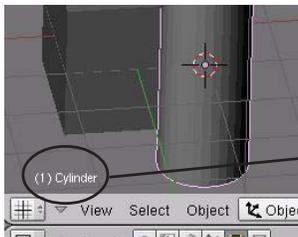
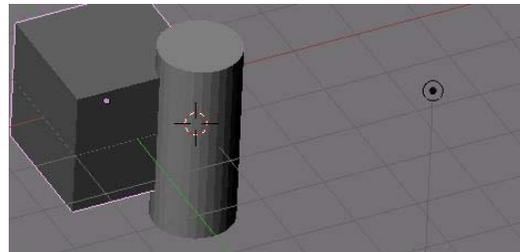
The basic wave settings have the object in *Cyclic* mode and waving on the X axis and Y axis. These can be set to achieve different effects along with the height and width, start time and length of effect. You can also control the starting time and length of animation.



## Boolean Operations (cutting and adding)



New for this release of Blender is the Boolean modifier panel. This is just another way creating a *Difference*, *Union* or *Intersect*. We briefly discussed this operation back on page 27. To add a modifier, select the object you wish to modify, then go to the **Edit buttons**, **Modifier Panel**, then select **Boolean**. In the modifier panel, type the name of the other mesh, select *Difference*, *Union* or *Intersect* and hit **Apply**. The mesh should show the operation.



To find the name of a mesh, select the mesh. The name will be displayed in the lower left of the viewport. **Names are Case Sensitive!**



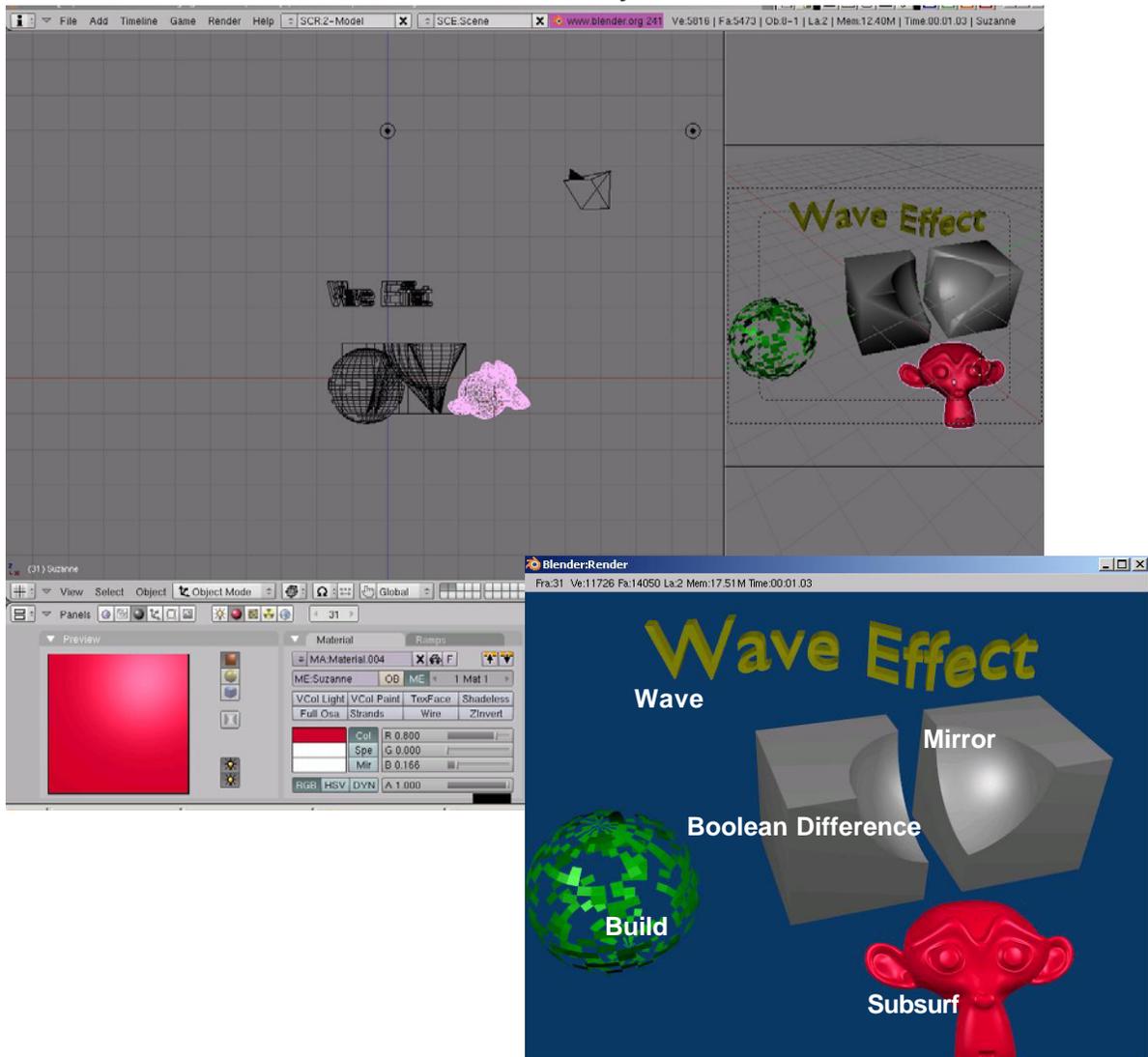
Boolean operations became important to Blender as a better way to modify a mesh with another mesh. Like other 3D programs, if you wish to drill a hole in an object, you create a cylinder to subtract from the mesh. The old Boolean operations create a massive amount of new faces and vertices. The newer code does a nicer job with this aspect.

## Using Modifiers Practice Exercise

Create a new file and call it *Modifiers*. Create a scene using any objects and materials you wish. Place at least one of each of the following modifiers in your scene.

- Subsurf
- Build Effect
- Mesh Mirroring
- Wave Effect
- Boolean Operation

Render a 200 frame movie of your scene when finished.



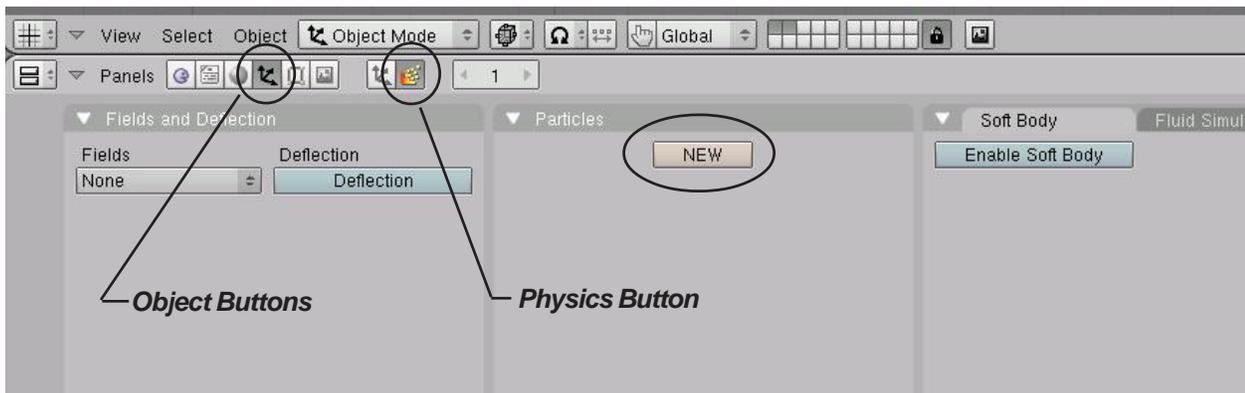
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**\*\* Call the instructor when finished\*\***

## Chapter 13- Particle Systems and Interactions

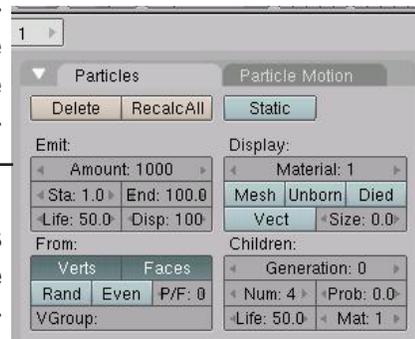
This is probably the nicest and most flexible of the effects. When you turn an object into particles, it can be used to simulate *snow, fire, smoke, clouds, sparks and much, much more*. When an object is turned into particles, it no longer exists as a solid shape and releases particles as per the settings you used on it. With particles, you can set the size (using halo), texture, color and transparency through the material buttons. You can set the particles to come off the object in a **sequence or randomly** by using **Hash** in the **Edit** buttons. Particles can be set to be pulled using X, Y, and Z forces. You can control the number of particles, how long the particles live, when to start and end, if they have a starting speed and much more than we will describe in this chapter. **Particles use to be in the same section as the Build and Wave modifiers, but has been pulled out into a new panel due to it's development.** Like all of the other features we've discussed, experimentation beyond this chapter is the best way to learn.

### Particle Settings and Material Influences



For our example, let's create a **UVSphere** and keep the segments and rings at 32. With the object selected, go to the **Object** buttons, Then select the **Physics Buttons**, click the "New" button under the **Particles Panel**. A new particle system will open in the panel and look like this: \_\_\_\_\_

For those of us that have been using Blender for years, this is a big change. The particle settings were once in one large panel. Now they have been split up into 2 separate panels- **Particles and Particle Motion**.



Particles can now be deflected off other objects, be blown by the wind, be displayed before they are built and many more options. Our next step is to examine the settings available in the particle panels. *We will only be working with the basic options in this chapter.* Remember that more information and tutorials can be found at [www.blender.org](http://www.blender.org).

# Chapter 13- Particle Systems and Interactions

## Particle Panel

This panel basically displays all options relating to how the particles are displayed. Here's what we are interested in at this time:

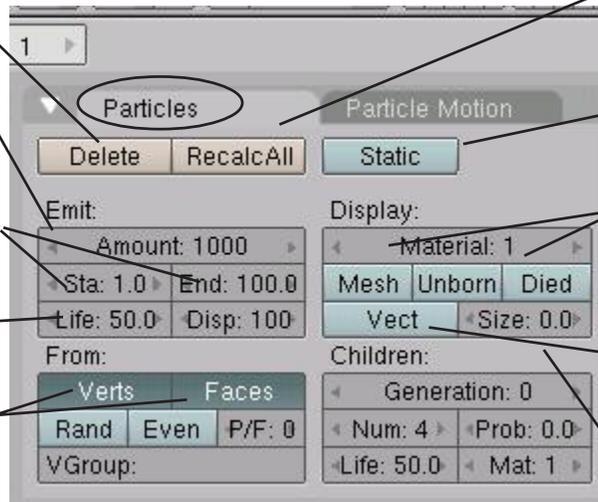
**Delete-** Start over if needed

**Amount-** Total number of particles in the entire animation

**Start and End-** When do you want the effect to start and end.

**Life-** Sets how long each particle should live after it is created.

**Verts/Faces-** Sets where the particles will be emitted from



**Recalc-** Sometimes after making changes to the setting, you need to hit this to update the animation

**Static-** Use this to make the particles "stick" and not be animated- Good for clouds

**Visible-** If particles are displayed before they are "born" or after they have "died" and if "mesh" should be displayed/

**Vect-** Gives the particles a vector (draws as a line (like a spark trail)

**Vect Size-** Controls the size of the vector trail.

## Particle Motion Panel

This panel displays the features you can use to provide animation to the particle system. Here's what we are interested in at this time:

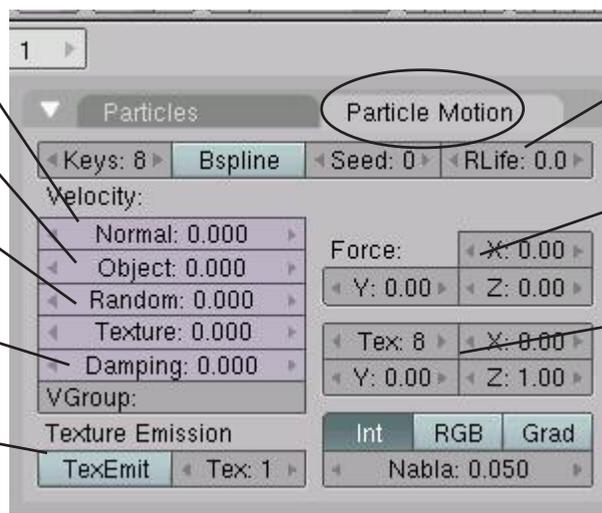
**Normal-** Gives the particles a starting speed (blasts outward)

**Object-** If the object is animated, the object can effect the starting speed

**Random-** This can give the starting speed a random variation

**Damping-** motion can be dampened with this setting.

**Texture Emit-** Use a texture to define how particles are emitted.



**Random Life** Use this to slightly vary when particles die.

**Force X, Y, Z-** Push or pull the particles in a given direction

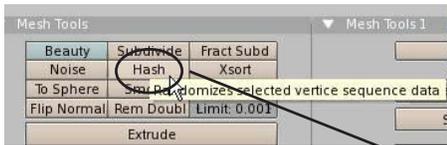
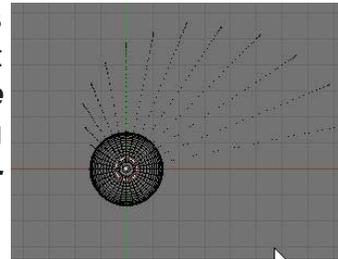
**Texture Force X, Y, Z-** Push or pull the particles in a given direction as directed by the texture

It may seem a bit overwhelming when you first look at all these setting, but with time and practice, it will begin to make sense.

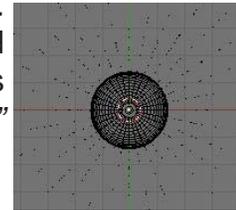
**Quick Tip:** To change the text in any given text box, you can click on the arrows in the box, hold down the LMB and drag left and right, or for more precision, hold down the "Shift" key and click in the box. You will then get a cursor to type in a number.

## Chapter 13- Particle Systems and Interactions

Let's work with our example. Make sure the sphere we created is **not** in edit mode (**Tab** key) and is selected. Add a particles effect and change the **Normal** setting to about 0.2 or 0.3 in the **Particle Motion** panel. This will give the particles a starting speed causing them to "blast out". Move your cursor to the 3D window and hit "**Alt-A**" to see the animation. It should look something like this:



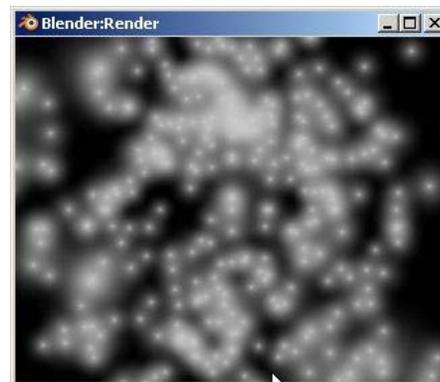
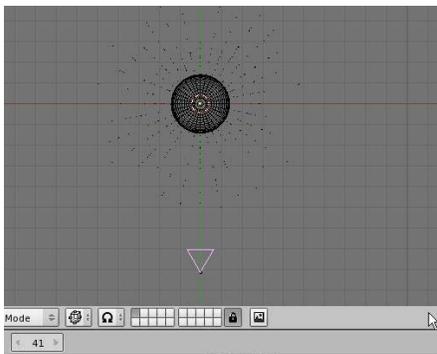
The particles come off in a pattern. This may be what you desire, but if you're making a flame or explosion effect, you need a more random release of particles. To do this, enter edit mode (**Tab** key) and select all vertices ("**A**" key). Go to the edit button and select "**Hash**". This will randomize the vertex sequence. Re-animate the window with "**Alt-A**" again and see the effect.



### Material Influence on Particles:

Particles emit their own light so it isn't necessary to have lamps in the scene to see them when rendered, however, you will need to add a material to them to give them color and to control their size and transparency.

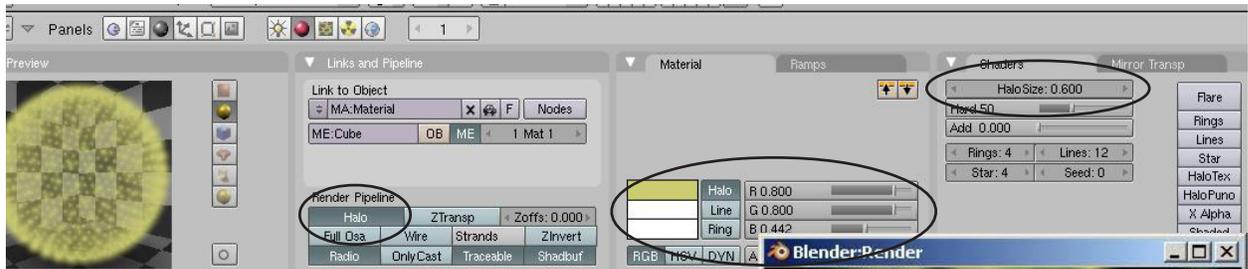
If you look at the scene we created so far, we have a camera and a sphere with a particle effect. The vertices have been randomized with the *Hash* command. If we change our current frame to a higher number like **frame 50** and press the "**F12**" key to render, this is what we see:



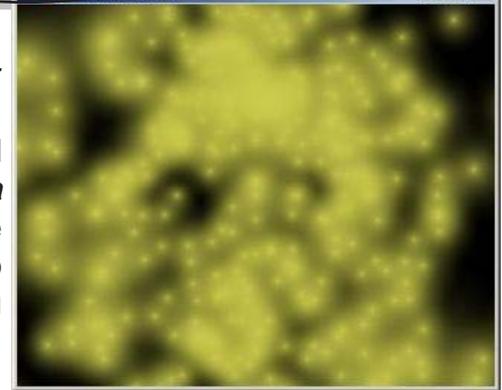
We see a randomized particle system without a material added to it. The particle size may be adequate for your needs, but in order to control size, *we need to add a material and use the halo effect*. You may also need to select "**Z Transparent**" and adjust the "**Alpha**" to set a transparency effect for the particles. The transparency effect is ideal for flame effects where you use multiple objects with particles on them and add different colors to get a realistic looking flame.

## Chapter 13- Particle Systems and Interactions

Here, I've taken the sphere and placed a material on it. With the “Halo” button pressed, change the halo size to affect the size of the particles. Color can also be adjusted.

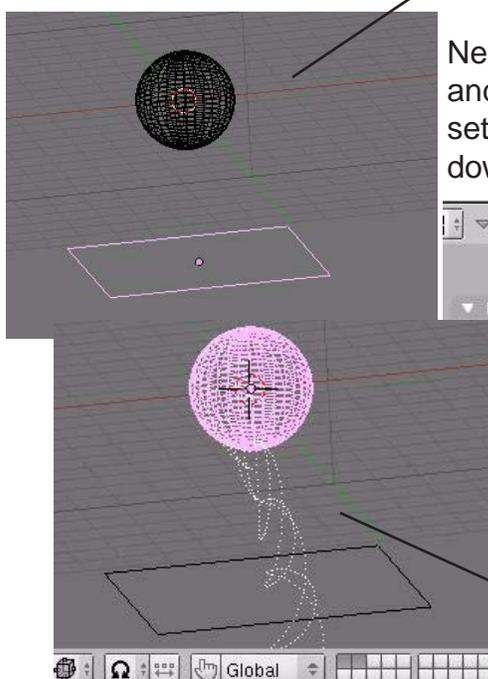


The **halo size** needs to be adjusted for the size of your scene and what you are using the particles to simulate. For example, smoke needs a smaller particle count and a larger **halo setting** and a **Z Transparent and Alpha** setting very low so the smoke looks transparent. Fire may need a higher particle count and a smaller halo setting to look good. Depending on what you want, you can turn on the rings, stars and lines in the halo settings. For a review of Halo settings, refer to page 34.

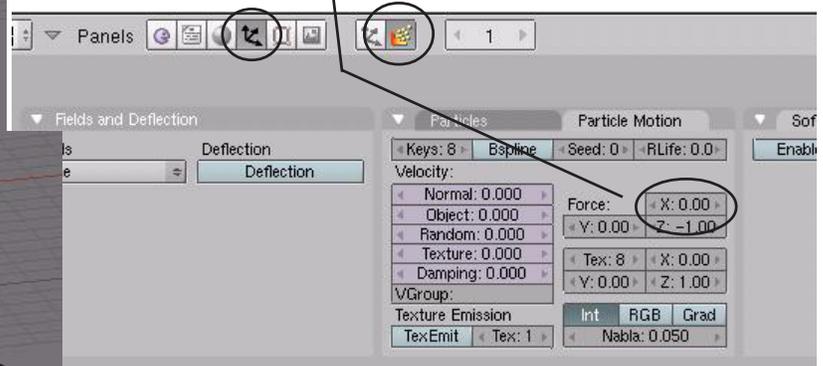


### Particle Interaction With Objects and Forces

There has recently been a lot of development in how particles can react with other objects and forces like wind. Particles can now “*bounce*” off of other objects and act like sparks or droplets. To show how these features work, we will create a scene with a **Sphere** and a **Plane** with the sphere above a scaled up plane as shown below:



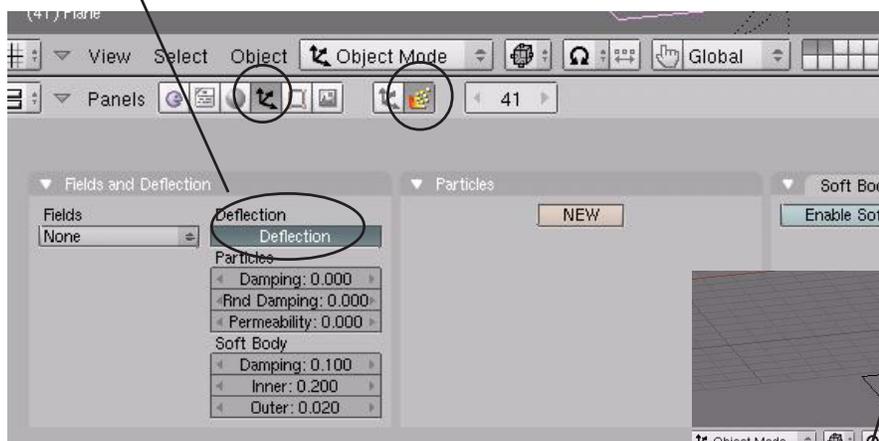
Next, with the **Sphere** selected, Go to the **Object** buttons and add a **Particle System**. In the **Particle Motion** panel, set the **Z Force** to **-1.00**. This will “*pull*” the particles in a downward direction.



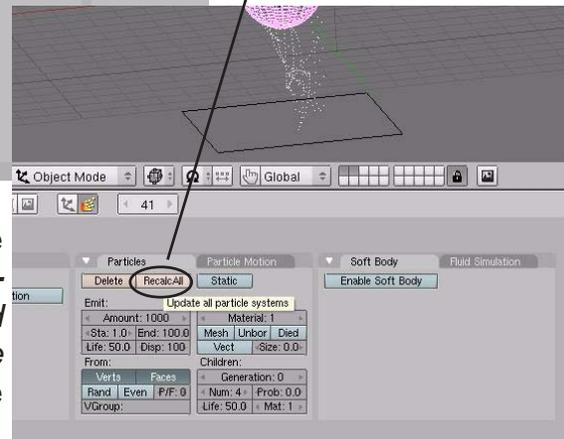
Place your cursor in the 3D window and press “**Alt**”-“**A**” to see the animation. You should see particles drop from the sphere and fall through the plane.

## Chapter 13- Particle Systems and Interactions

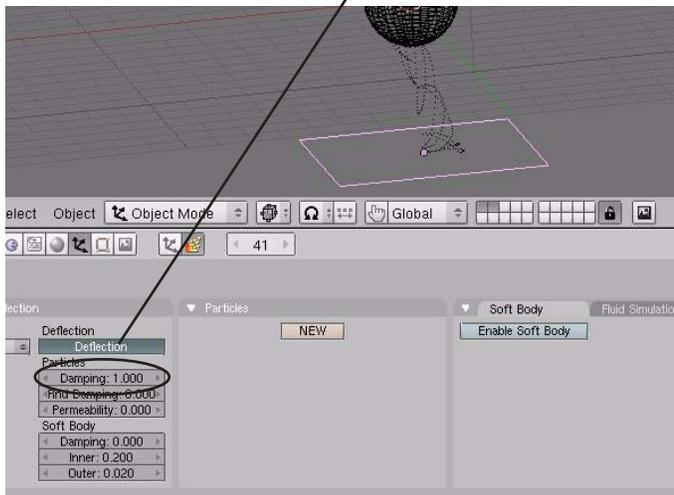
The next step is to stop the particles from falling through the plane. Now, select the **Plane** and hit the **Deflection** button in the **Object buttons**. Press “**Alt-A**” in the 3D window- you will



notice that nothing has changed! You need to select the **Sphere** once again and go to the **Particles** panel to hit the **RecalcAll** button to recalculate the particles.



After recalculating the particles, you should be able to see a change in the animation by pressing “**Alt-A**” again in the 3D window. *The particles should not pass through the plane anymore, but bounce rather high.* To minimize the bouncing, select the plane again and take the **Dampening** up to **1.00**.

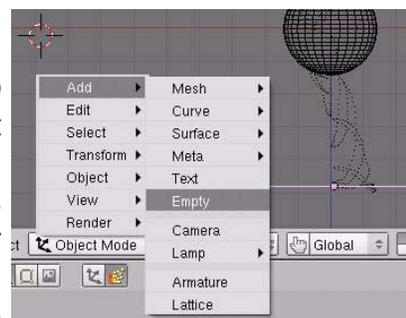
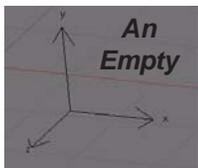


Again, you will need to select the **Sphere** once more and **RecalcAll** to see the correct physics. Now the particles stop at the plane and don't bounce anymore. Experiment with these settings for other effects.

By experimenting with the other particle settings like **Random Life, Normal, Vector, Total Particles, Life** and by applying a material with **Halo Lines and Stars**, you can simulate sparks bouncing off an object with high quality results.

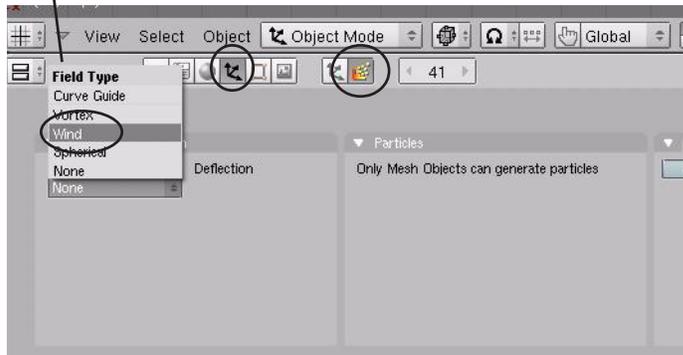
### Wind

Blender now allows for particles to be influenced by **Wind**. To create a wind effect, you need to create an object that will act like the wind. An **Empty** is a great object to use for that. An empty is displayed on the screen as a 3-axis icon that does not render as an object. It is great for a number of tasks that will be discussed in later chapters. To create an empty, place the 3D cursor where you would like the wind to come from, press the **Space Bar** and “**Add**” and add an “**Empty**”.

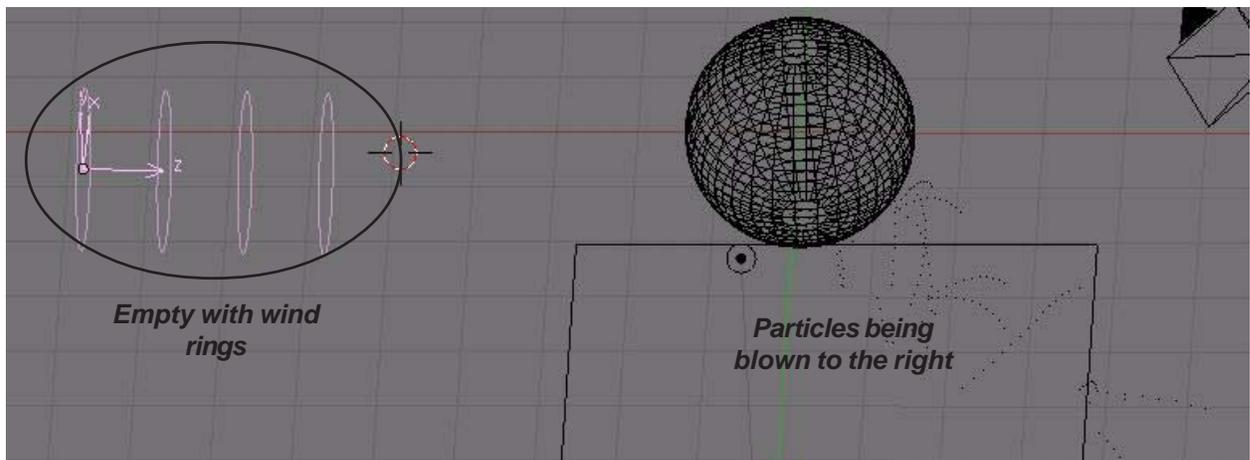


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Select the **Empty**, then, in the **Object buttons** in the **Fields and Deflection** panel, select "**Wind**". You will see some setting in the wind button to control the effect. Change the **Strength**



setting to about **20.00**. After you do this, the empty will have some circles displayed on it to represent the wind flow. You may need to rotate the empty so the wind blows toward the particles. As you rotate the empty, you may or may not immediately see the effect of the wind on the particles. Again, you may need to hit the **RecalcAll** button for the sphere.



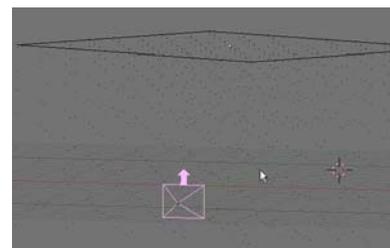
### Sample Particle Settings

Here are some sample settings for various uses for particle systems. These settings demonstrate objects that have not been scaled up or down. The numbers given in these examples are based on a 100 frame animation. If you lengthen the animation or change the size of the objects, you will need to adjust things like the total number of particles, forces and starting speeds. These settings can be "tweaked" to your own personal preferences. They are just intended to get you to a starting point.

#### Snow

*Subdivide* a plane 3-4 times (or more) and "*Hash*" the vertices. Snow will need to fall slowly so we show a small negative Z force. Place a material with a Halo on the plane and adjust the size of the Halo. Change the following settings:

|                         |                       |
|-------------------------|-----------------------|
| Tot Frames: <b>1000</b> | Random Life: 0        |
| Sta frame: <b>1</b>     | Normal: 0             |
| End Frame: <b>100</b>   | Force Z: <b>-0.05</b> |
| Life: <b>75</b>         | Vector: Off           |

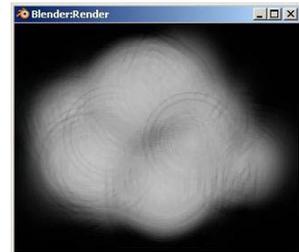
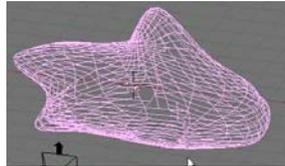


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### Clouds

Create a *UVSphere* and shape it with *Proportional Vertex Editing*. Pull the shape around to try to look like a cloud. *Hash* the vertices and put a material on it. Hit *ZTransparent* and take *Alpha* down very low (.1-.2). Set the *Halo Size* to about 4.00. Review the *Materials Chapter* for details. To give the clouds a “puffy” look, press the **Static** button to force the particles to the *Normal* setting

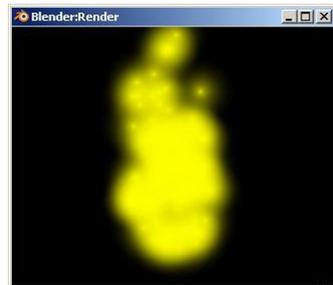
Tot Frames: **100**      Random Life: 0  
Sta frame: ---      Normal: **0.03**  
End Frame: ---      Force : 0 for all  
Life: ---      Vector: Off



### Fire

This is the best use of particles. Start with a *UVSphere*, *Hash* and put a material on it. Go with a yellow or red color. Add a *Halo* effect and set the *Halo Size* to 1.2. We are using a positive *Z* force this time to lift the particles upward. Random life also gives the flame a bit more randomness. For a good fire effect, add several objects with particles on them and give them different colors of red, blue and yellow. You may even want to use *Transparency* on them.

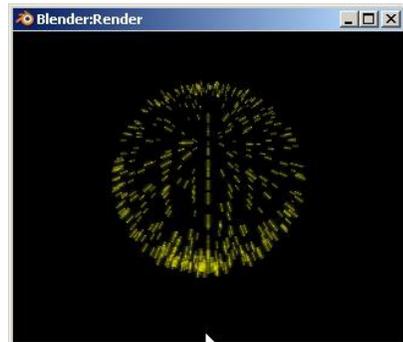
Tot Frames: **500**      Random Life: **0.5**  
Sta frame: 1      Normal: 0  
End Frame: **100**      Force Z: **0.3**  
Life: **25**      Vector: Off



### Fireworks

Start with a *UVSphere*, *Hash* and put a material on it. Go with a yellow or red color. Add a *Halo* effect and set the *Halo Size* to 0.5. You may even want to experiment with *Halo Lines and Stars*. For a good final result, you may even want to scale the sphere down in size. We “blast” all of the particles out in 1-2 frames with a high random life, use the *Normal* to throw the particles outward and *-Z* force to pull them down. The *Vector* setting also adds a nice touch.

Tot Frames: **500**      Random Life: **2**  
Sta frame: 1      Normal: **0.1**  
End Frame: **2**      Force Z: **-0.3**  
Life: 30      Vector: **On- Vect.Size-1**



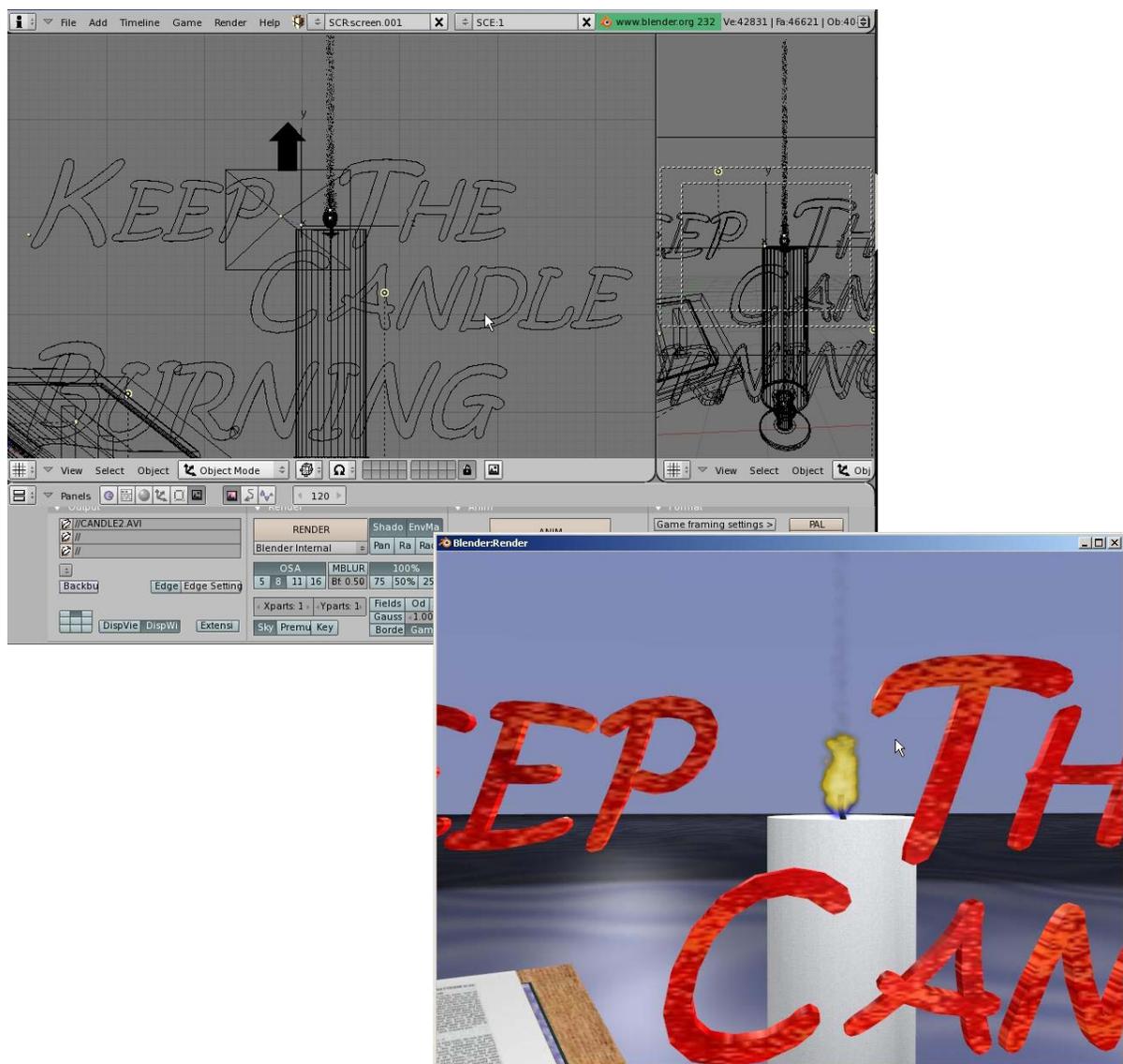
**Quick Tip: Practice using these setting to become comfortable with them!**

## Particle Systems Practice Exercise

Create a new Blender scene and set up the views any way you wish. Create a candle using cylinders (candle and wick) and add **3 UV Spheres** at the wick to use as particle systems. **Create a red flame, yellow flame and smoke trail.** Use **ZTransparent** and **Alpha** to cause a mixing of the red and yellow components of the flame and a rising smoke trail. Set all animation lengths to 100 frames and create an animation of your scene using AVI Codec and Indeo Video 5.1 settings. The scene below shows some other elements. It is up to you if you wish to create anything other than the candle.

### Challenge exercise:

If time permits, add a fireworks effect in the background. You can also add more effects to your flame for more realism or try to create a shooting star across the sky.



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