Blender Basics
Classroom Tutorial Book
3rd Edition

For Blender Version 2.49

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<u>About Blender</u>

How can Blender be free?

People usually associate freeware software with the terms "bad", "with limited features" or just a "demo". <u>Blender is fully functional.</u> It works as an open-sourced, community development program where people from around the world contribute to its success. Blender is a rendering\animation\game development open-sourced freeware program maintained by the Blender Foundation and can be downloaded, free of charge, from <u>www.blender.org</u>. The goal of the foundation can be summarized as follows:

"The Blender Foundation is an independent organization (a Dutch "stichting"), acting as a non-profit public benefit corporation, with the following goals:

- To organize a fund raising campaign in order to finance the €100,000 one time license fee
- To give the worldwide Internet community access to 3D technology in general, with Blender as a core
- To establish services for active users and developers of Blender
- To maintain and improve the current Blender product via a public accessible source code system under the GNU GPL license
- To establish funding or revenue mechanisms that serve the foundation's goals and cover the foundation's expenses"

Blender website (blender.org)

Blender can be a difficult program to learn with limitless possibilities. What do you teach in the time you have to teach? That's a tough question because you can't teach it all. This tutorial book is designed to get you up and running in the basics of creating objects and scenes and animating. The best advice I can give you about learning this program is *Don't Give Up*! Any rendering and animation program has a tough learning curve and Blender is no exception. After a few weeks, things get easier. This tutorial has been developed to be used in conjunction with daily lesson planning and demonstrations. Because of this, some areas of Blender have not been described as fully as they could be. If you are using this guide as a stand-alone teaching or "self-help" tool, you may need to seek additional help from reputable places like www.blender.org and www.blenderartists.org to make sense of things. These sites give you access to help forums and tutorials. *There are literally thousands of Blender users world-wide that browse the forums to give and get advice*. Make use of that vast knowledge base!

Version Information:

The current release at the time of this printing is **version 2.49**. Since Blender is developed by a worldwide pool of individuals giving freely of their time, releases can happen in as little as 4 months and as much as 1 year. Because of such a large number individuals contributing to Blender, major changes can occur between releases showing substantial improvements.

Rendering and Animation

Rendering and Animation Basics

RENDERING:

A rendering is a pictorial output of a 3D scene or object. Features like materials, lighting, oversampling and shadows control the effects and quality of the rendering. The more of these features you add, the more realistic your scene become, but also lengthens rendering times.

Materials and Textures:

You can control the way an object appears by applying color and textures. Materials provide realism with added effects. You an control glossiness (specularity), self-emitting lighting characteristics, transparency and pattern repetition. Raytracing can provide reflection (mirror) and refraction(transparency) effects. Textures can be made from any scanned photograph or drawn object in an image-editing or painting-type program. Images in almost any format (jpeg, bitmap, png) can be used. Blender also has many built-in texture generators that can simulate a variety of surface characteristics such as wood, marble, clouds, waves and surface roughness.

Lighting:

Lighting provides the realism to your scene through reflections and shadows. You can control the type of light, intensity and color. Some lights can give a "fog" or "dusty" look with a halo or volume lighting effect. Illumination distances can also be set.

Cameras:

Your camera is your point-of-view for the scene. Just like a real camera, you can control lens length to achieve close-ups or wide angles. Clipping distance can also be set to control how far and near the camera sees. Depth-of-field can now be controlled using nodes.

ANIMATION:

An animation is a series of rendered images that form a movie. The quality of your movie is controlled by all of the above mentioned features including frames per second (fps), output size, file type and compression. The most common method of animation is called *keyframing.* Key frames are created at various points in the animation while the computer generates all of the transition frames between the two keys. Basic animation options include changing size, rotation and location of objects.

Time Factors:

In order to animate, you must first set the length of your animation in frames and your frames per second (fps). The length in time can be calculated from these.
<u>Frame Rate Options:</u>
      NTSC- U.S. and Japan video standard of 30 fps
      Film- Movie standard of 24 fps
      PAL- European video standard of 25 fps
      Custom- set your own fps
*We typically use a frame rate of 25-30 fps depending on computer speed or if we plan to save the file to DVD. Hit the "PAL" or "NTSC" setting buttons for these.

Creating Keys:

A key is placed at the beginning and end of a desired move, size change or rotation of an object. Think in terms of how long you want a change to occur and relate it to your fps. For example, if you want an object to move from point A to point B in 2 seconds and you have 30 fps, place 2 keys 60 frames apart.

Following Paths and Objects:

In most animation programs, a camera can follow a path or object (or both) as it moves. This feature saves a lot of animation time and reduces the number of keys needed.

Output Options:

We typically save our movies in MPEG format for Windows. This type of file plays easily on most media players and at a high quality. Depending on how you plan to use your movie (i.e. on the web, saved to DVD, played in a presentation), you may wish to use different formats. Examples include Apple Quicktime and Windows AVI formats. Different formats also allow you to adjust the quality settings. For example, AVI formats can be compressed using a variety of compressors called CODECs.

Real-Time Animation (Blender only):

Real-time animation allows you to add physical properties to your objects and use the keyboard and other features to control them. You can create actors, change masses, control dampening (friction), set force and torque in x, y, and z planes and create relationships with other objects within the scene. With time and practice, interesting 3D games and real-time architectural walk-throughs can be created.

Blender allow you to use the physics engine to create animation tracks. You can now use the physics to create realistic falling, rolling, etc. animations and use them in movies.
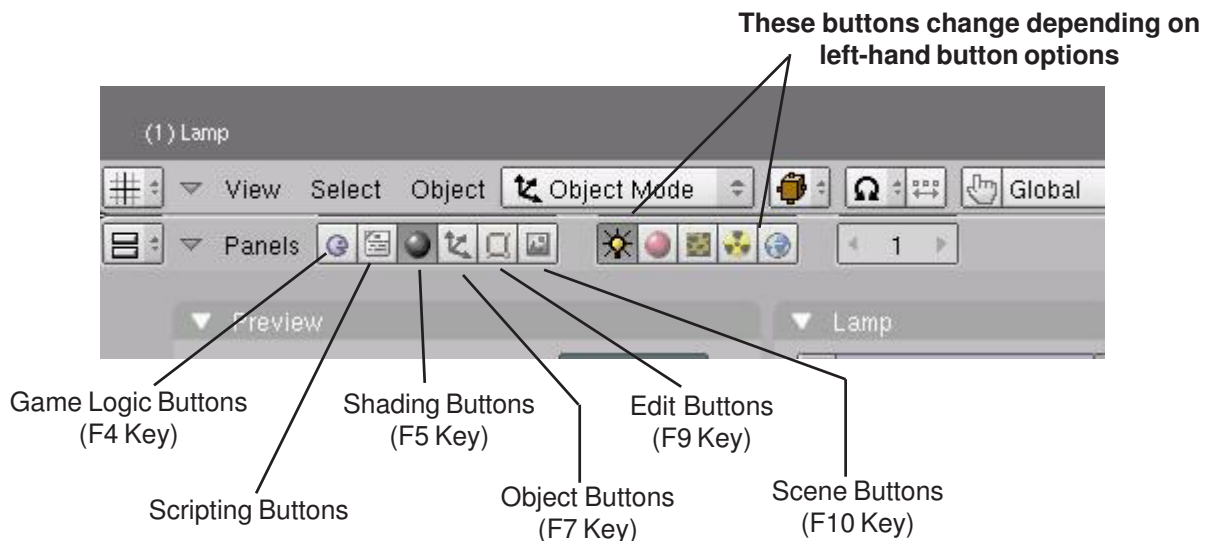
Basic Key Commands

Basic Blender Commands

This is just a partial list of Blender commands. Please visit the Blender.org website for more details.

TAB key- Toggles between **edit mode (vertex editing) and object select mode**. If you're in edit mode when you create a new object, it will be joined to the selected object.

Ctrl "Z" The **global UNDO command**. With each press, one step will be undone (up to 32 steps possible by default). If in *edit* mode, it will only undo editing steps on the selected object.

Alt "U" Brings up a **list of Global UNDO steps** to choose from (default- last 32 steps you've done).

"Z" key- Toggles view from **wireframe to solid**.

Alt "Z"- Toggles a **texture/shaded view**.

"R" key- **Rotates** an object or selected vertices.

"S" key- **Scales** a selected object or vertices.

"G" key- **Grabs or moves** the object or selected vertices.

"A" key- While in edit mode it's good for **selecting all vertices** for commands like remove doubles and subdivide. "A" twice will clear selected and reselect.

Alt "A" **Plays animation** in selected window. Your cursor must be in that window for it to play.

Ctrl "A"- After an object has been resized and/or rotated, this can **reset the object's data** to 1 and 0.

"W" key- Brings up a "**Specials**" menu while in edit mode of **specific edit mode options**.

Shift-"D"- **Duplicates or copies** selected objects or selected vertices.

"E" key- While in edit mode, selected vertices can be **extruded** by pressing E.

"O" key- The "O" key (not zero) will put you into **proportional vertex editing** while in edit mode.

"B" key- Gives you a **box (window drag) to select multiple objects**. In edit mode, works the same to select multiple vertices, but hitting "B" twice gives you a **circle select** that can be sized by scrolling the mouse wheel. Press LMB to select, press wheel to deselect.

Space Bar- Brings up the **tools menu** where you can add meshes, cameras, lights, etc.

Number Pad- **Controls your views**. "7" top, "1" front, "3" side, "0" camera, "5" perspective, "." Zooms on selected object, "+ and –" zoom in and out. The + - buttons also control affected vertices size in proportional vertex editing.

Mouse- Left to manipulate (**LMB**), right to select (**RMB**), center wheel to zoom and rotate view. If you hold down "shift" and center wheel you can pan around on the screen.

Shift Key- Hold down the shift key to **make multiple selections** with the right mouse button. Holding down the Shift key while clicking in a text box allows for **easier keyboard entry of numbers**.

Arrow Keys- Used to **advance frames in animation**. Left/right goes 1 frame at a time, up/down goes 10 frames at a time.

"P" key- While in *edit* mode, pressing P will **seperate selected verticies**. In *object* mode, pressing P will cause you to enter into the **game (real-time) mode**. Press *Esc* to exit game mode.

ATL/CTRL "P"-Creates or breaks **child/parent relationships**. To create C/P relationships, hold down shift key and select *child* first, then *parent*. Hit Ctrl P. To clear a relationship, do the same except hit Alt P.

"U" key- In Object Mode, brings up the **Single-User menu to unlink materials, animations (IPOs)**, etc. for linked or copied objects.

"M" key- **Moves selected objects to other layers**. **Mirror in edit mode**, "M" will give you a mirror command (all verticies selected, then press x,y,z for axis of mirror).

"N" key- Brings up the **numeric info. on a selected object** (location, rotation and size). Info. can then be changed in the window.

Ctrl "J"- **Joins selected objects** together.

"F" key- **Makes a face in edit mode** of the selected vertices. You can only select 3-4 vertices at a time to make a face. By selecting 2 verticies and pressing F will close shape.

Shift-"F"- **Makes all faces** on a selection of closed verticies (as opposed to only one face with F).

Ctrl "F"- Brings up a **"Face Specials" menu** with other face options.

"X" or Delete- **Delete** selected objects, vertices or faces.

"K" Key In *edit* mode, K will bring up the **Knife tool menu** with specific options for slicing faces.

Shift- "S" In both *edit* and *object* modes, this will give you options to **locate objects or the cursor** to assist in precise placement.

Function Keys- F1-Load File; F2-Save File; F3-Save Image; F4-Lamp Buttons; F5-Material Buttons; F6-Texture Buttons; F7-Animation Buttons; F8-Real Time Buttons; F9-Edit Buttons; F10-Display Buttons; F11-Last Render; F12-Render

"I" Key- The "I" key is used to **insert animation keys** for various things. Objects can be animated with basic Rotation, Location and Size keys and combinations there of. If your cursor is down in the buttons portion of the screen, animation keys can be added to lights, materials and world settings.

Ctrl "T"- Used to create a **Track To Constraint** to make one object follow another (like a camera with a target).

Ctrl "S"- Used to **Save** your Blender file

Alt "C"- Used to **convert meshes, text and curves.** For example, text can be converted into a mesh for other transform options.

"Shift" "Space" Toggles between **multiple screens to full screen** of active viewport.

Ctrl "0"- If using multiple cameras, this will **switch to the selected camera**. (Number pad "0")

Armatures- Meshes can be controlled by "bones" or armatures. Create a mesh with vertices at the joint locations, then create an armature string within it. Child/Parent the mesh to the armature using the armature option. You can then animate the armature in Pose Mode.

Ctrl-Tab- Puts you into **Pose mode** for manipulating armatures.

Import/Export- Blender accepts .DXF and VRML(.wrl) files. Just use the OPEN option from the file menu to insert these types of files into an already existing scene. When inserting other Blender files or objects into another scene, use the APPEND option from the file menu and select the appropriate options. Multiple objects can be selected with Shift-Right mouse button.

Springs/Screw-Blender can create these objects in the edit buttons. You need a profile of the object, the cursor at the center of revolution, and 2 vertices to show the length of the revolution. The profile and the length vertices need to be in the same object. All vertices need to be selected when performing the operation. You will also need to be in the front view. There are several tutorials to help with this operation. Results are great!

Multiple Viewports- To create multiple viewports, move your cursor over the edge of the viewport (to start, you only have the drawing window and the button window-move your cursor to the break between them). Right click on the break and select split area.

Basic Button Panels

These buttons change depending on left-hand button options

(1) Lamp

View Select Object Object Mode Global

Panels 1

Preview Lamp

Game Logic Buttons (F4 Key)

Shading Buttons (F5 Key)

Edit Buttons (F9 Key)

Scripting Buttons

Object Buttons (F7 Key)

Scene Buttons (F10 Key)

The Blender Screen

When I first looked at Blender and read some tutorials I thought that this looked easy and made sense. After taking the program for a test run, I decided to forget about it for a while because I couldn't make anything. The interface is different than any other programs I've experienced before. I thought I'd try again and after a few week however, things began to make sense and I realized the potential of the program. Here's what you are looking at when you open the program:
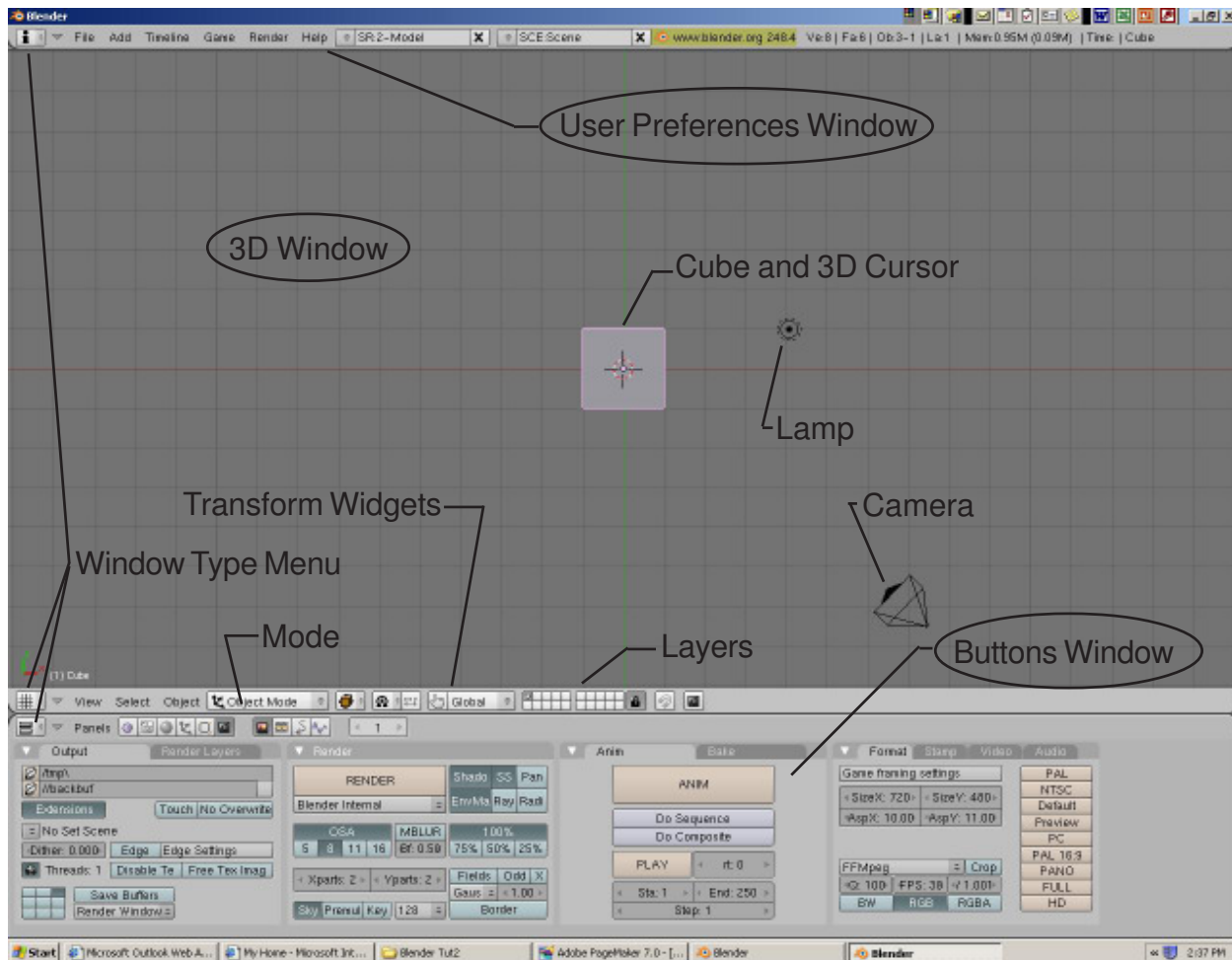
You are looking down at a scene consisting of a cube, lamp and a camera (top view). The cube is a basic mesh object to give you something to look at, a lamp to illuminate the scene, and a camera to show the scene. Older versions of Blender may open with different scenes (a plane instead of a cube and a light), but the idea stays the same. The 3D cursor in the middle of the cube is used to locate where new items will be placed. It can be moved around on the screen by clicking the Left Mouse Button (LMB). Along with familiar pull-down menus like other programs, you have a viewport along the bottom that changes every time you select a different button. This "Buttons Window" can be changed around, but for now, lets keep it where it's at.

3D Cursor
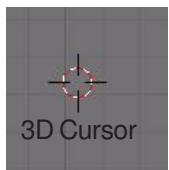
Blender works with layers much like other programs where objects can be placed in different layers and displayed as needed. It's a good idea to get comfortable with layers because as

your scenes get bigger, turning layers on and off help with the speed of your work and being able to see things better. To change things between layers, select the object with the **Right Mouse Button (RMB) and type "M" for move**. Try it with the cube and change layers. By the way, if you put it in a layer that's turned off, it will disappear. To turn that layer visible, click on that button. To turn on multiple layers, hold down "Shift" and click on the buttons. Layers containing objects will display a dot.
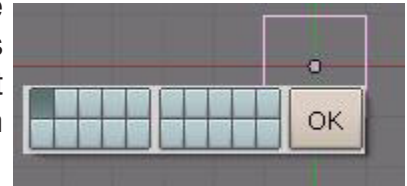
RoboDude Asks:
"How do I select multiple objects in Blender?"
Hold down the "shift" key while using the RMB (Right Mouse Button).

Window Types

Blender has a variety of different window types and every window can be set to any type. For example, your initial screen has 3 windows, the top one with the toolbars, the 3D window, and the bottom buttons window. You can set all 3 of them to display the buttons if you like (but I'm not sure why you would want to). The various window types are as follows:

Window type:
- Scripts Window
- File Browser
- Image Browser
- Node Editor
- Buttons Window
- Outliner
- User Preferences
- Text Editor
- Audio Window
- Timeline
- Video Sequence Editor
- UV/Image Editor
- NLA Editor
- Action Editor
- Ipo Curve Editor
- 3D View
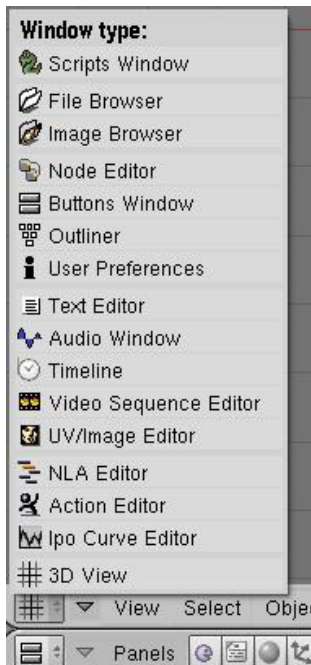
The window types that we are most interested in right now are:

• File/Image Browsers- comes up automatically on demand in most cases
• Node Editor- applies render effects
• Buttons Window- for commands
• User Preferences- menus and options
• Video Sequence Editor- join movies and effects
• UV/Image Editor- for applying game textures
• Action Editor- for animations
• Ipo Curve Editor- also for animations
• 3D View- to see our work and model items

The User Preferences Window

If you place your mouse on the line between the 3D window and the User Preferences Window (at the top), hold down the Left Mouse Button (LMB) and drag down, you will expose a number of setting options at the top of the screen:
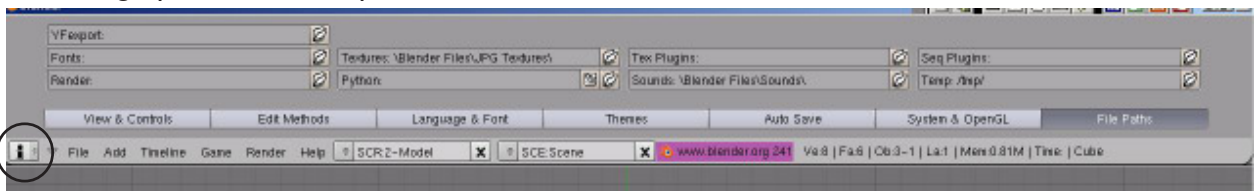
Settings of interest to us at this time in the **User Preferences** window-

- View and Controls- tool tips and mouse settings
- Edit Methods- how things are linked and duplicated, undo settings
- Language and Fonts- text style and sizes
- System and OpenGL- change some system settings
- File Paths- tells Blender where to look for certain things
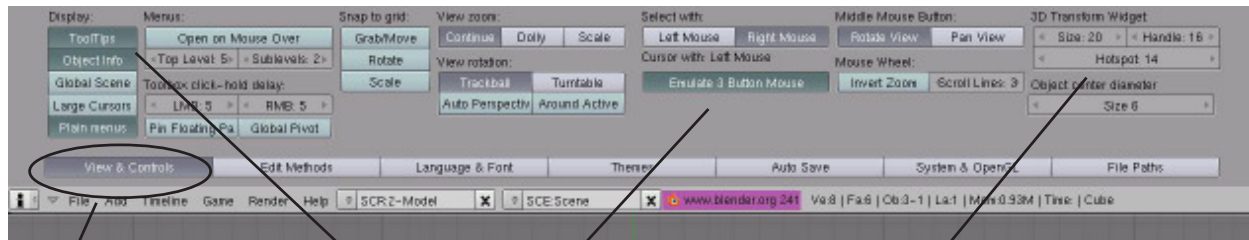
ToolTips   Mouse Operations   Widget Controls
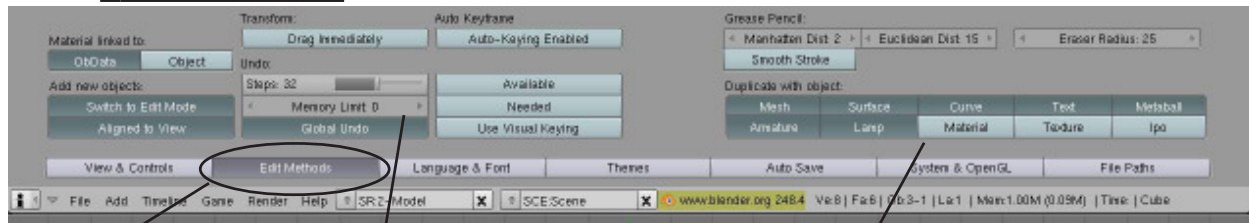
View & Controls

Global Undo (Alt-"U" keys)   Linked Data

Edit Methods
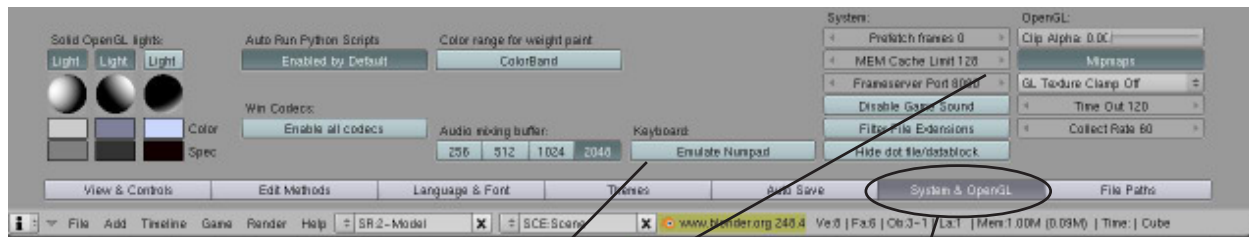
Keyboard Options
(for laptops)   Game Settings   ***System & OpenGL***
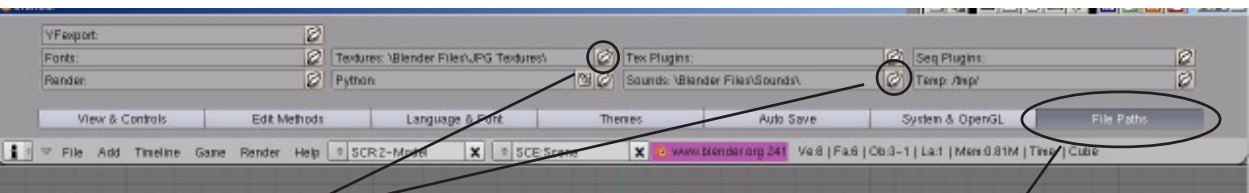
Click on folders to set paths-   ***File Paths***
This will help later so Blender goes straight to these folders when needed.

If you would like these changes to always be in place whenever you start Blender, press the **Ctrl- "U"** keys and save as **User Defaults**. You will need to use the LMB and click on the actual words "Save User Defaults" for the save to occur.

Be careful to only use this setting at the beginning of a drawing session and on your own personal machine (not school computers). If a drawing is open at the time, that drawing will automatically open every time you use Blender. It will become the default scene and replace the cube, lamp and camera basic setup!

Open, Saving and Appending Files
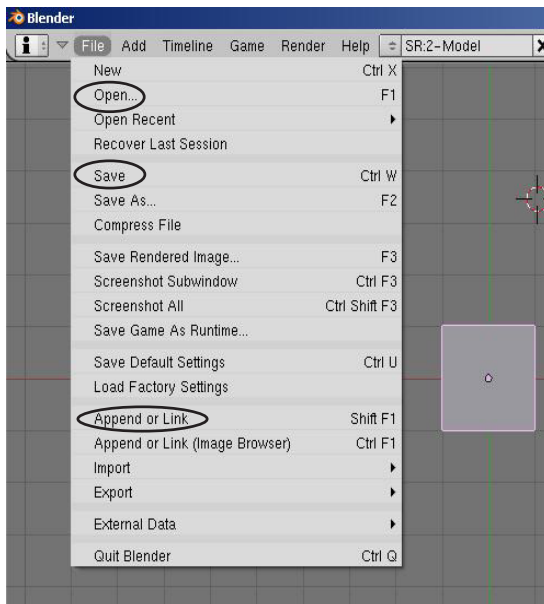
Blender utilizes commands similar to other programs when it comes to saving and opening your work with a few exceptions. Blender can use the "**Open**" command to open Blender (.blend) files and the "**Append or Link**" command to bring in elements from other Blender files into another Blender file. The open command can be used to import VRML (.wrl) and .DXF files from other programs. These are generic file interchange extentions that most programs can work with. Blender also has extensive **Import** and **Export** options in the file menu.

The Save Command

When you first start working with Blender, it seems almost impossible to figure out how to save your work. The file interface almost resembles old MS-DOS. Also, every time you save over an existing file, your previous save becomes a back-up file and is saved with a new extension (**.blend1**). This always gives you a back-up if a problem occurs.
Here's what you see when you hit the save command:

Path where work will be saved
File name typed here
"P" takes you back to the parent directory (back 1 folder)
Hold down mouse (LMB) to view all drives for this computer
After you type the file name, & hit enter, hit save
Files and folders at the current location
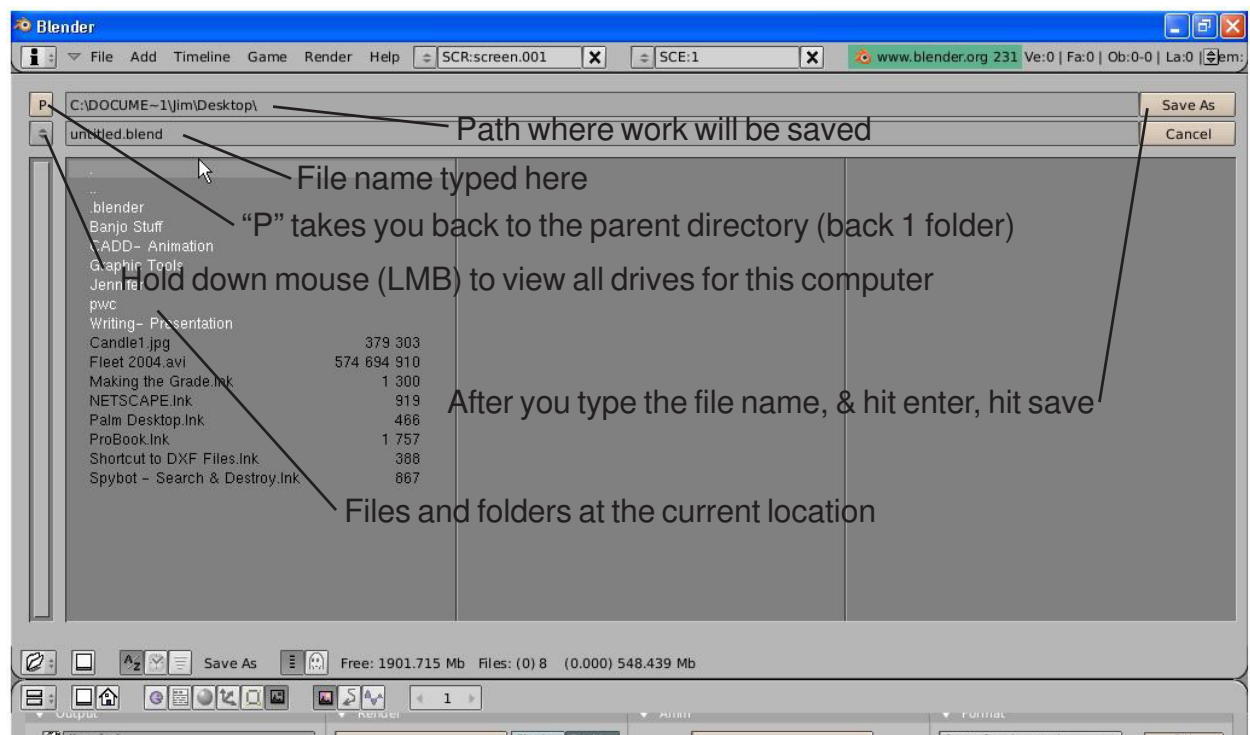
The Append or Link Command

When you need to insert elements from one Blender (.blend) file into another one, you need to use the **Append or Link** command from the file pull-down menu. While in Append, you need to navigate to the Blender file you wish to insert from, then select what you want to append into the open file. You can append anything from cameras, lights meshes, materials, textures, scenes and objects. For most purposes, use the **Object** option. By appending objects, any materials, textures and animations that are linked to that object will automatically come in with it. Right Mouse Button (RMB) clicking on objects will select\deselect them. Typing "A" will select them all. After you select all objects to append, click the "Load Library" button in the upper right corner of the screen.
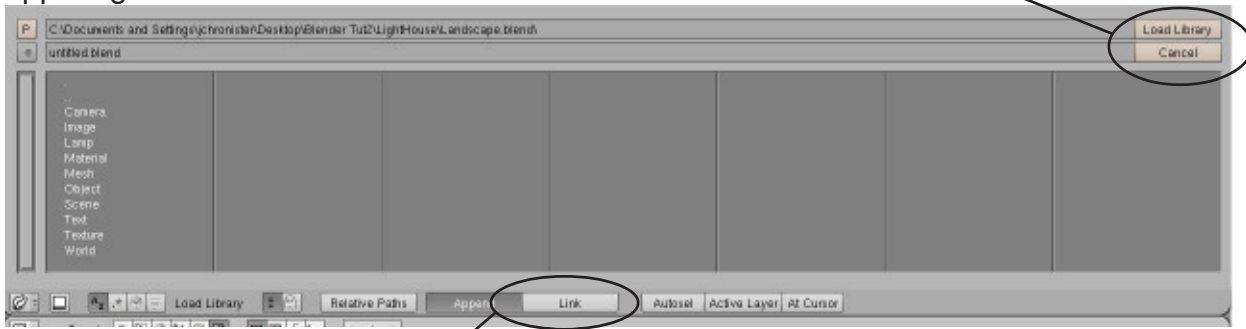
The Link option allows you to link to another Blender file rather than inserting it into the open file. This option allows for changes to the linked file that will be automatically updated when the other file is opened.

Packing Data

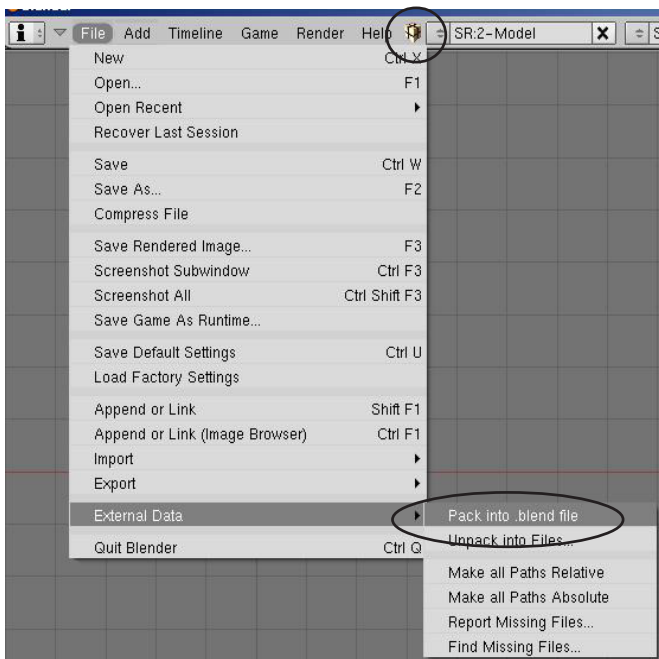If you plan to open this file on other computers, you will need to select the "**Pack into .blend file**" option in the file menu under **"External Data"**. Textures and sounds are not automatically included in your Blender file in order to keep the file size down. Every time your file opens, it looks for the textures and sounds and places them into your model. If it can't find the files, you won't have any textures and sounds. If you pack data, those files are included with the .blend file so they can be opened anywhere, however, your file size may explode. *When data is packed, a small package shows up on the top of your screen letting you know that the file is packed.* You can also unpack data to bring the file size back down.

Importing Objects

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

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

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

To save a file as one of these types from another program, you will need to find an *export* command or a "*save as*" option. This will vary dependig on the program you are using. Refer to that program's help files. To import a VRML or DXF file into a Blender scene, open a new drawing or one you wish to insert the object(s) into. You will simply need to use the *Open* command in the *File* pull-down menu. The program knows that you are trying to open something other than a .blend file and will insert it into your current scene. Now you need to find the object(s) you just inserted. Depending on how that object was drawn, it may need to be resized or rotated.
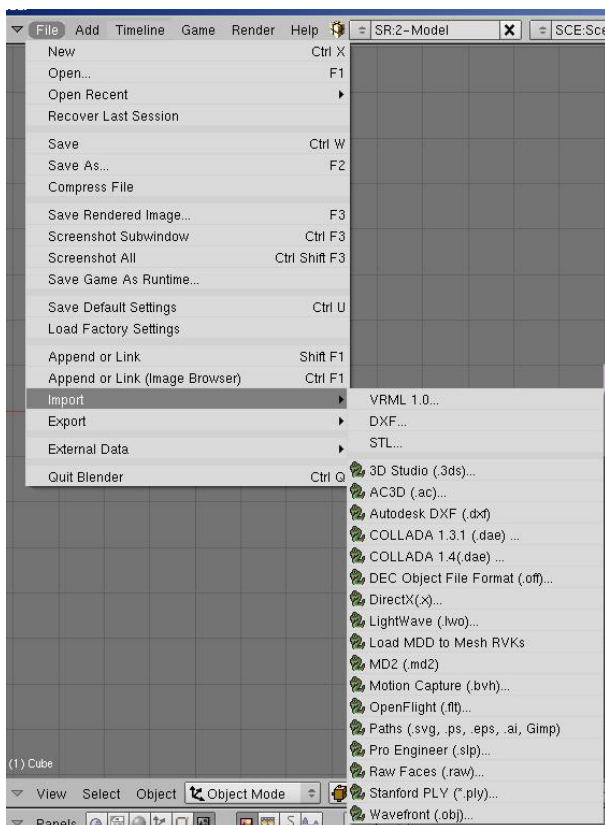
With every new release of Blender, the import/ export format options list grows. This makes Blender much more compatible with a variety of other 3D modeling and animation software programs. You should be able to find a format in the list that will work with your other programs.

When importing Blender files into other Blender files, remember to use the **Append** command instead of import. In the Append command, select the file, then select what you would like to bring into the current file. You will usually want the "Objects" option.

Creating Viewports (also called windows)

Most times, you need more than one 3D window to work with since you're trying to locate objects in three dimensions. Most rendering and animations programs allow for multiple viewports along with graphical views of various data. Blender allows the same. Remember that Blender starts with 3 viewports that are set to User Preferences, 3D Window and the Buttons Window. You can change the size of any of these windows by using the LMB and draging on the line between the viewports. You will notice the arrow pointer changes to a double headed arrow while over the line. **In order to split the screen and create another viewport, while the cursor is over the line, Right Click (RMB) and select "Split Area"**. Drag the line to a desired location and size. By moving the mouse to either side of the viewport line, you select the side to split. Joining viewports together works the same way. There's no limit to the number of times you can split your windows. I like to traditionally work with 2 views like the example shown below. I use the left view to flip between my principle views (top, front, side) and the right view for camera view and animation tracks (which we'll discuss later).
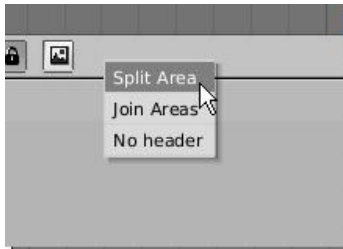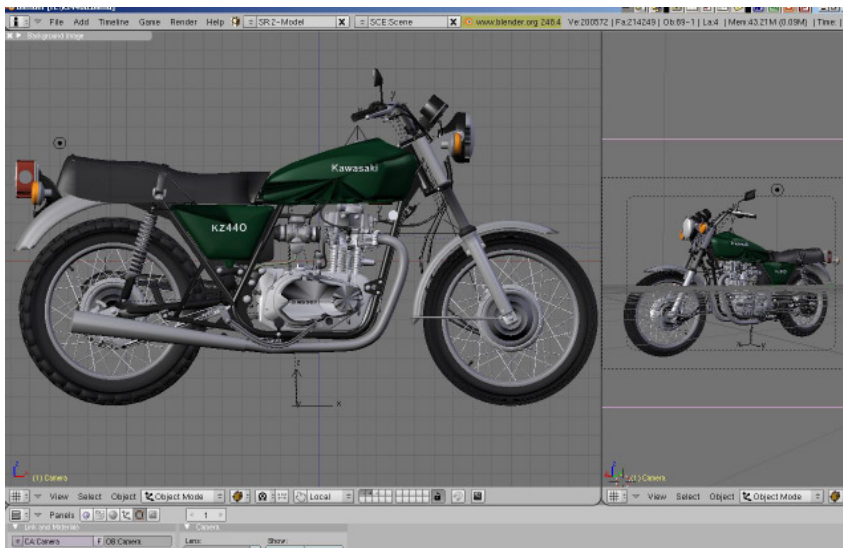
Windows can also be split along a vertical line. Some 3D programs traditionally give you 4 viewports that are set-up as front, top, right side, and perspective or camera views. Basically, it is up to what you want to work with.
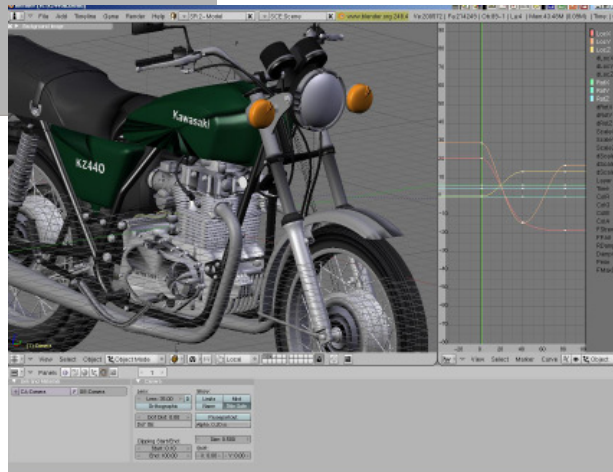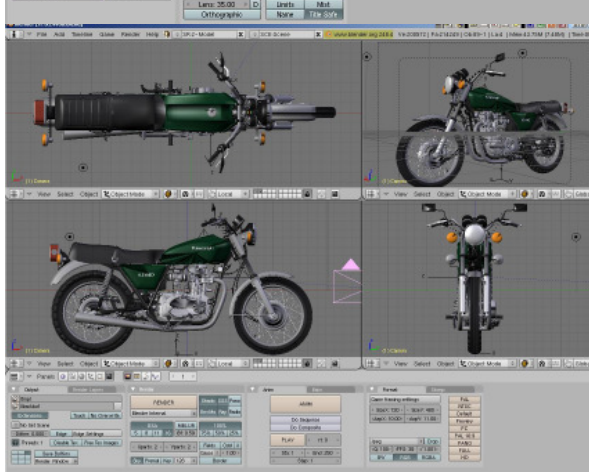
Changing Window Types

Now that you've added some viewports, remember that the viewport can be changed to a different type (refer to page 7). As you become more familiar with Blender, you will need to use the IPO, Action Editor windows and more.

The Buttons Window Option:

Traditionally, Blender has placed the Buttons Window at the bottom of the screen, but has recently given us an option to arrange them vertically on the side like some other 3D programs out there. This has been done in an effort to make learning the program easier for new users. You first need to split your 3D window in half, then select the Buttons Window type from the menu.
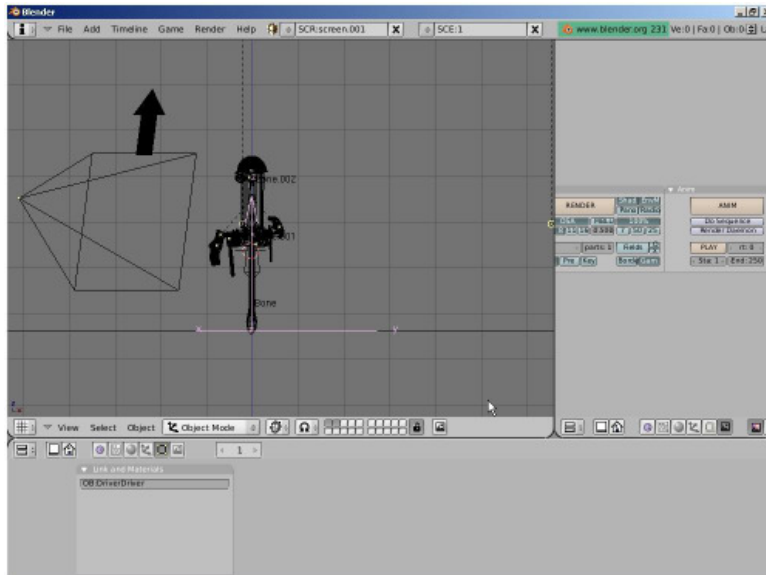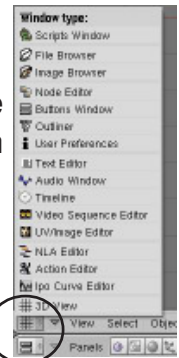
Looks good, but needs some adjustment. The buttons are arranged horizontally and off the screen. To change the arrangement, Right Click (RMB) in the window and select "Vertical". Adjust the windows to a desired size and use the plus and minus keys on the number pad to zoom in and out on the buttons to get them sized to fill the screen. Hold down the mouse wheel (don't scroll) to move the buttons around. The only problem with this method is that the buttons at the bottom of the window are still off the screen. In order to access those buttons, you need to hold down the center wheel on the buttons and drag the buttons around. I still prefer the buttons window at the bottom of the screen, but this is another option available.
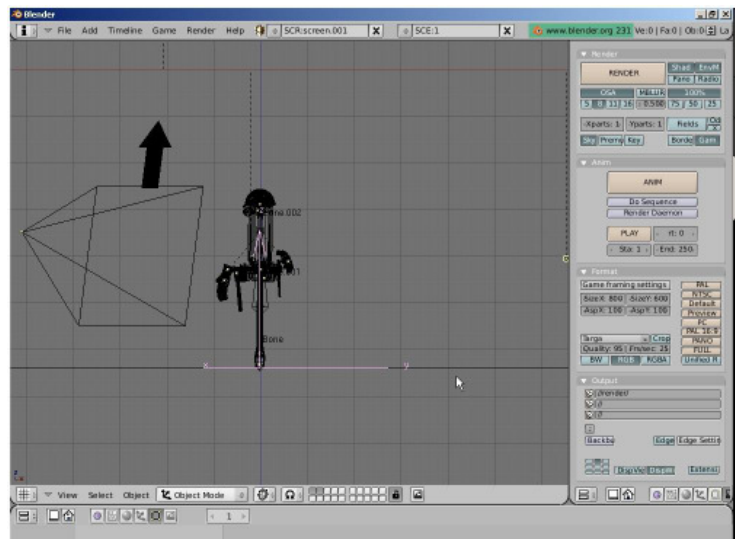
Moving Around in 3D Space:

In a 3D program, not only do you have to worry about where you are in 2 dimensions (height and width), but you also need to consider depth (how close or far away). Before you can work in 3D space, you should have some skills in 2D drawing and layout. **Moving around in the 3D window is controlled by the mouse and the keyboard number pad**. Think of a standard 3-view orthographic drawing- top, front and right side views. These views match up with the number pad **7,1 and 3 keys** (look at their arrangement on the keyboard- just like the views). Put your cursor in the 3D window and try typing those numbers. Typing "0" will put you into camera view (what the camera sees).

limits of what the camera sees
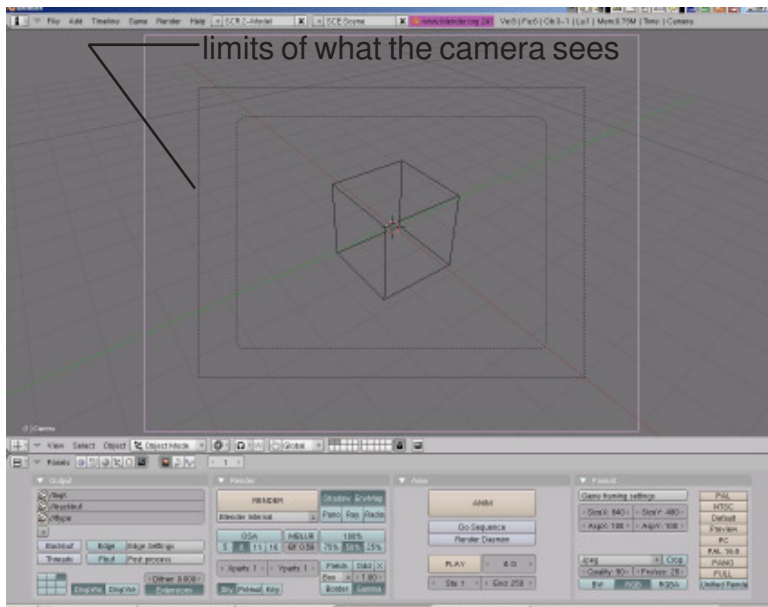
The camera is represented by 3 lines. The outer solid line is what you can click to select the camera. The outer dashed line represents the limits of what the camera can see. The inner dashed line helps with centering your scene. If you do not see the inner dashed line box, you can change this in the *edit* buttons that will be discussed later.

The number pad 5 key will toggle you between perspective and orthographic views. The number pad arrow keys (2,4,6,8) will rotate you around in 3D space. The "+" and "-" keys on the number pad will zoom in and out. The number pad "." (period) key will center your view up on the selected object on your screen.

The mouse serves a number of functions. The Left Mouse Button (LMB) will move the 3D cursor around on the screen and for dragging windows for selecting objects. *Wherever the 3D cursor is located is where the next item you create will be placed.* The 3D cursor serves other purposes that we will discuss later. The Right Mouse Button (RMB) is used to select object or vertices (in edit mode). The mouse wheel serves 2 purposes. Scrolling the wheel zooms in and out (like the + and - keys). Holding down the mouse wheel will let you rotate the view. Holding down *Shift and Mouse Wheel* will let you pan around on the screen.

> *RoboDude Says: **Practice using these controls before moving on to other lessons. Without getting a grasp on working in 3D space, you will have a difficult time creating and modifying objects.***

Now that you know what you're looking at and how to move around on the screen, we can begin making objects in Blender!

Typical Views and Buttons:

Here are some typical views used to model in 3D and the buttons on the number pad to go along with them. In order to make them work, you need to have the "Num Lock" button pressed. Get use to working with the principle views (top, front, side) in orthographic mode when locating the 3D cursor. You will usually need to check the location of the cursor in at least 2 views when placing objects.

Top View
(7 key)

Free-rotation
orthographic view

Front View
(1 key)

Side View
(3 key)

Camera View
(0 key)

Perspective Views
(5 key toggles between
orthographic and
perspective views)
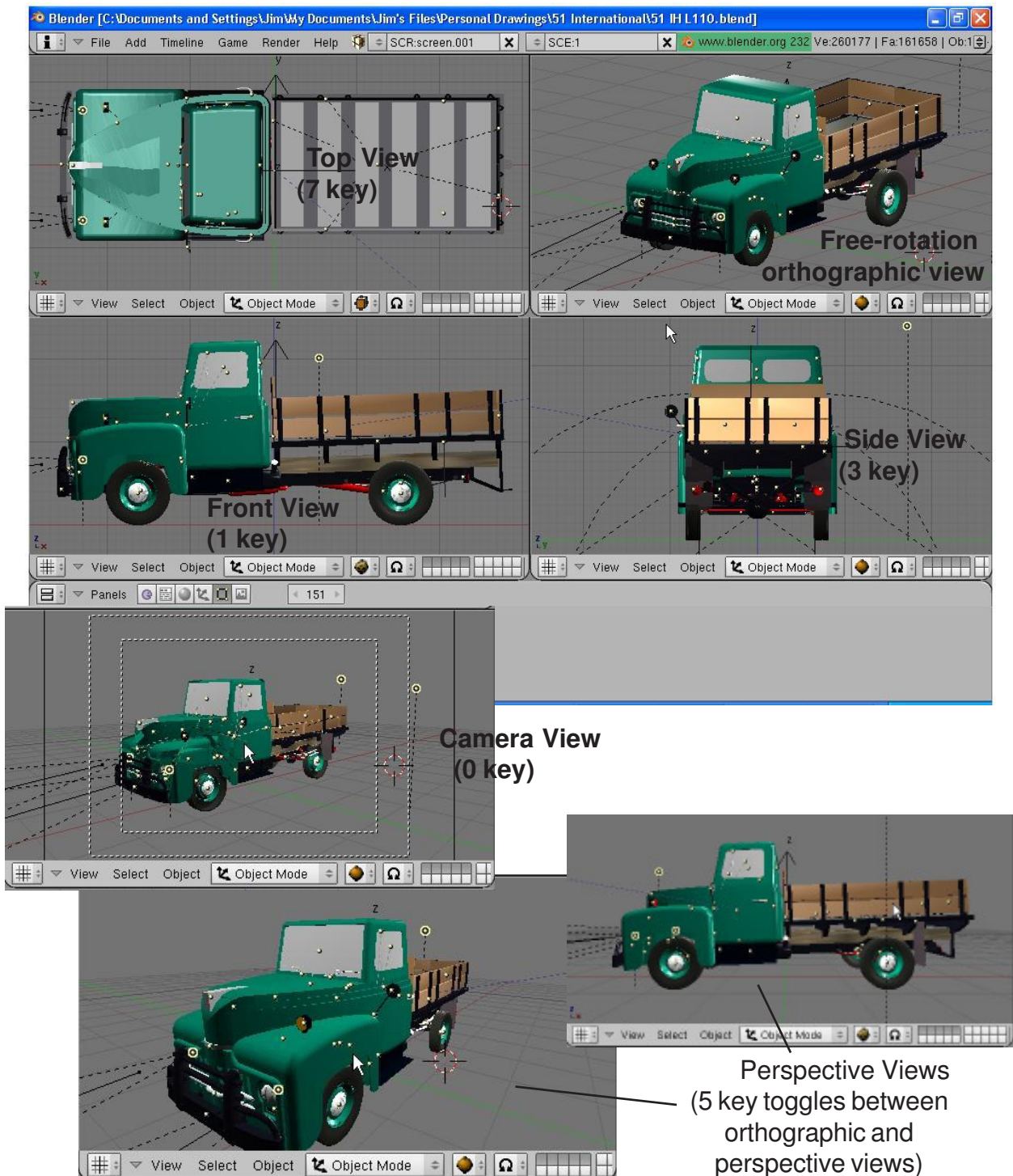
Viewports Practice Exercise

In order to get some experience with these commands, set up a screen with four viewports using a top, front, side and camera or perspective views as displayed below:
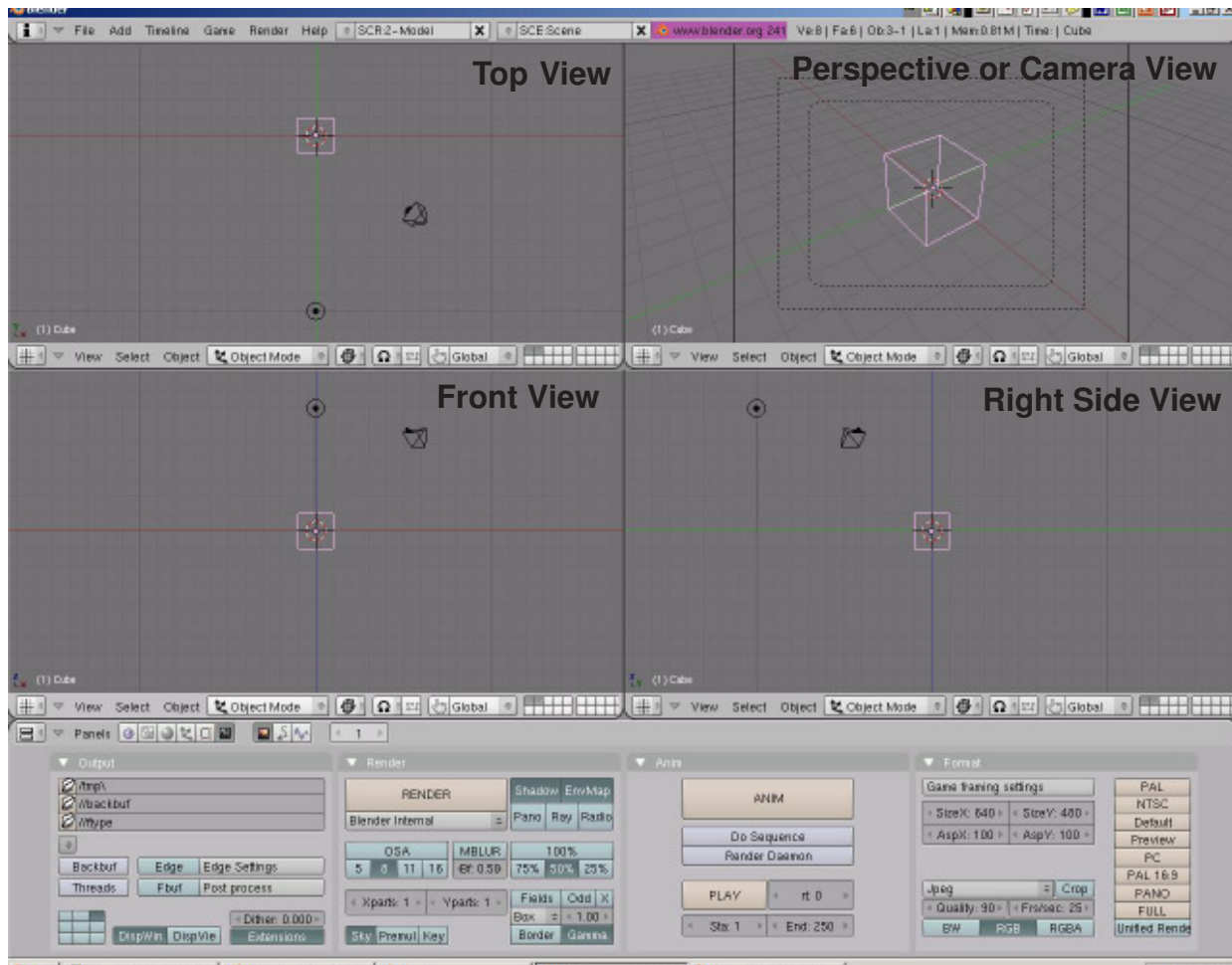
Be prepared to be able to demonstrate the following techniques to the instructor when asked:

- *Panning around on the screen*
- *Zooming*
- *Changing window types*
- *Centering the view on a certain object*
- *Switching views (top, front, side, camera, free-rotate)*

** Call the instructor when finished**

Working with Basic Meshes

Now that we know how to move around in Blender, let's start doing some basic building and shaping. In this chapter we will talk about creating basic shapes and using modifiers to form them. There are a lot of different types of things to draw in Blender. Right now we will only discuss *Meshes.*

Start a new drawing in Blender and save it in your "My Documents" directory. Call it *Sculpture.* In Windows XP, in order to get to your "My Documents" folder, do the following:
1.   Go to File- Save
2.   Select the C: drive (see page 9 in Open, Save, and Append section)
3.   Click on the "Documents and Settings" folder, find your login folder.
4.   In your folder you will find "My Documents"
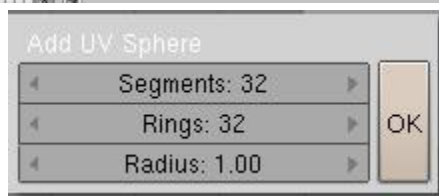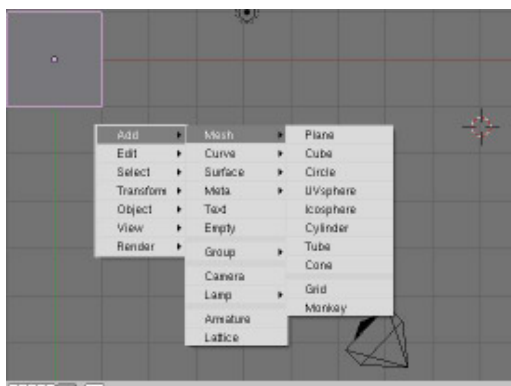5.   Type in the file name (Sculpture), hit enter, then "Save"

> ***RoboDude Asks:** **Why do I keep losing my work?***
> *Blender will not prompt you to save you file when exiting the program.*
> ***Remember to always save your work often!***

Placing Objects On Your Screen

The 3D Cursor (bullseye) location is used to place new objects. Use the left mouse button to move the cursor in 3D space When you have it in a good location, press the **Space Bar** to bring up the insert menu. Select **Add**, then **Mesh** and select **UV Sphere**. You will then be asked how many segments and rings you want. You can change these by draging the mouse in the block or by holding down the **Shift** key and clicking in the box. This will allow you to type in a number. You can keep it at 32 for now. After that, your sphere will be displayed on the screen.
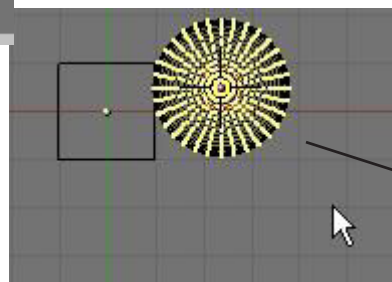
Edit Mode

Object Mode

When you place an object in Blender, it comes into the scene in ***Edit Mode.*** There are basically 2 states in Blender- ***Edit Mode*** and ***Object Mode.*** Edit mode is intended for modifying the shape of the object by selecting vertices on the object. Object mode affects the object as a whole. The ***Tab*** button toggles you between the two. ***After inserting an object into your scene, press the Tab key to exit edit mode. Otherwise, the next object you create will be joined to that mesh!***
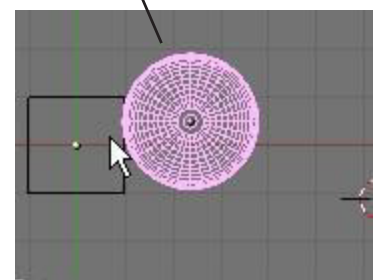
Another way to switch between **Edit** and **Object** mode besides using the **Tab** key is to use the **Mode menu** at the bottom of the 3D screen. Notice that there are a few more modes than just Edit and Object. Some of these will be dicussed in later chapters.

Precise 3D Cursor Placement

To precisely place the 3D cursor, use the "**Shift-S"** keys for options to move the cursor to objects, grid, and vice-versa.
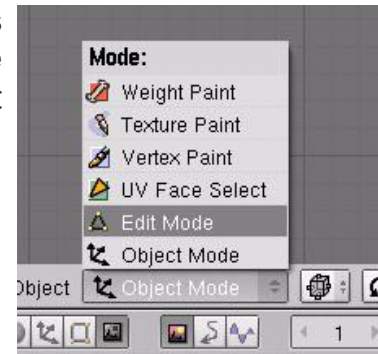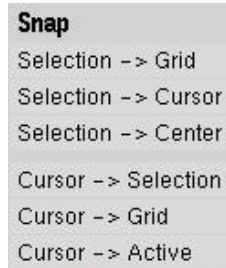
Mesh Types

When pressing the space bar and choosing to add a mesh, you will notice several mesh types (often called primitives) available. They are:

Plane- A simple two-dimensional shape. Can be sub divided and used with proportional vertex editing to make nice hilly terrain or shaped.

Cube- Basic 3D shape. Nice object to start with to shape into rectangles and other shapes.

Circle- Won't display as a 3D object unless filled, but can be extruded and shaped.

UV Sphere- A sphere generated with rings and segments, like the latitude and longitude of the earth.

Icosphere- A sphere generated with triangular shapes. Like Epcot Center

Cylinder- Like a can, with ends closed, but if you leave the ends off, it is a tube

Cone- Basic closed cone shape.

Grid- Can be used and extruded like the plane.

Monkey- A fun shape that someone decided to include in the mesh list.

Empty Mesh- A mesh without any visible verticies, edges or faces

Torus- A donut shape.

RoboDude Asks: *Why are all my meshes joined together?* Remember that whenever you create something new, it enters your scene in Edit Mode. ***Any new objects you create while in edit mode for the previously selected object will be joined to that object.*** After you create a new object, remember to hit the "Tab" key to exit edit mode. Also, remember that a new object will be created where the 3D cursor is located.

Using Main Modifiers to Manipulate Meshes

Before we look at actually changing the shape of the meshes and turning them into other shapes, we should become comfortable with creating, moving, rotating and scaling basic meshes. The three main modifying commands used in Blender (in Object mode) are:

> **"G" key- move or grab and object**
> **"S" key- sizing or scaling an object**
> **"R" key- rotating an object**

If you would like to do any of these operations through an exact number (i.e. rotate 90 degrees on the X axis or size something to a specific number), type the "**N**" key to bring up the **Numeric Window** *(Transform Properties)*.
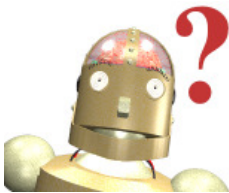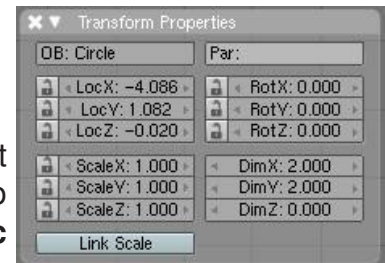
> *RoboDude Says: If you would like to move something along a straight axis line (X,Y,Z), enter the Move command and drag the object the direction you wish to go. Press the mouse wheel (don't scroll, press it like a button). The object will lock on a straight line. In the Move command, you can also type X,Y, or Z.*

Using the Transform Widgets

A relatively new feature to the program is the transform widget menu. Rather than typing R,S or G to manipulate an object, you can turn on the widget feature and simply grab the axis you wish to change. You can also change the motions to reflect Global (normal X,Y,Z planes) or Local (X,Y,Z planes in relation to the object) movement.

Grab directional lines with LMB to manipulate

Move Button   **Rotate Button**   **Scale Button**

Global/Local Setting   **Widget On/Off**
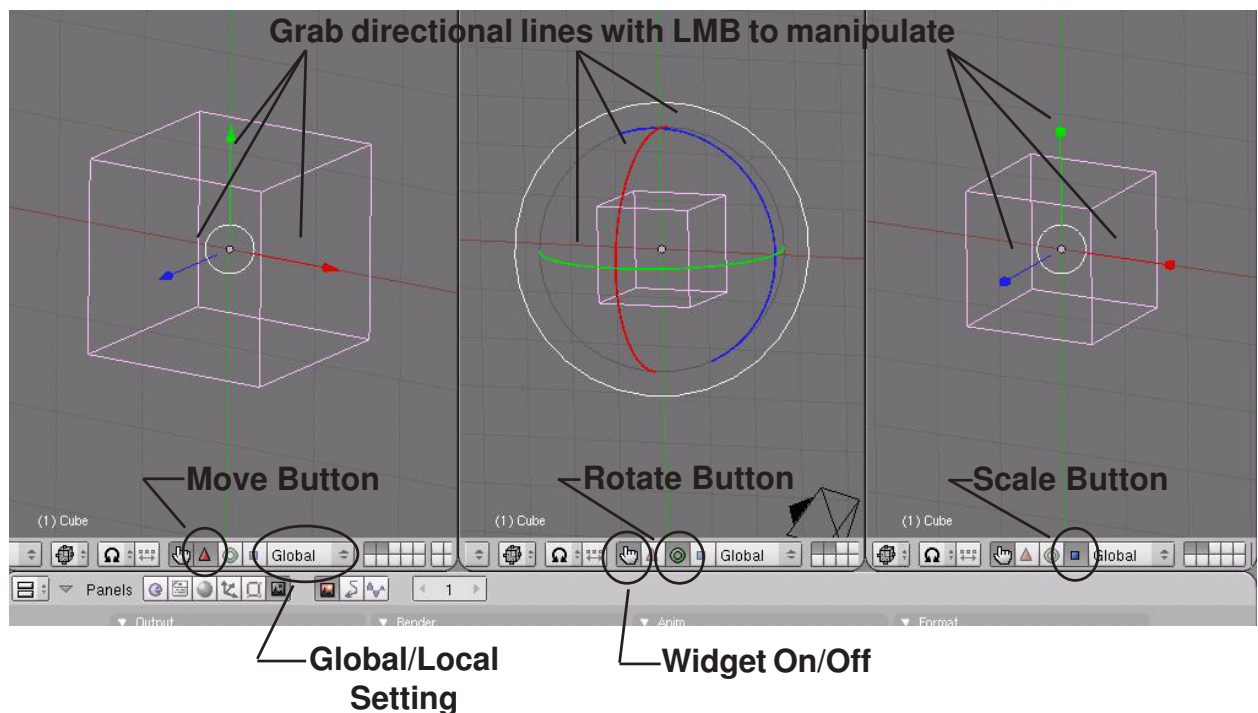
Create a sculpture using at least 1 of every type of mesh found in the Add-Mesh menu **(do not use grid or circle)**. *Remember to exit edit mode (Tab key) after every object you create.* Use a plane for the ground and scale it large. Divide your 3D window into two so you can have one working view and one camera view. Use the RMB to select objects on the screen. Experiment with sizing and rotating objects. New commands:

Size	("S" key)- to change the size/scale of the object.
Rotate	("R" key)- to rotate the object.
Move	("G" key)- to change the location of objects.
Shaded	("Z" key)- used to toggle the window from wireframe to shaded view.

Remember to make use of the number keys 1,3 and 7 to change your principle views! Also play with the camera location and angle to get a nice view!

** You do not have to make a monkey-this is just an example of using the meshes! **
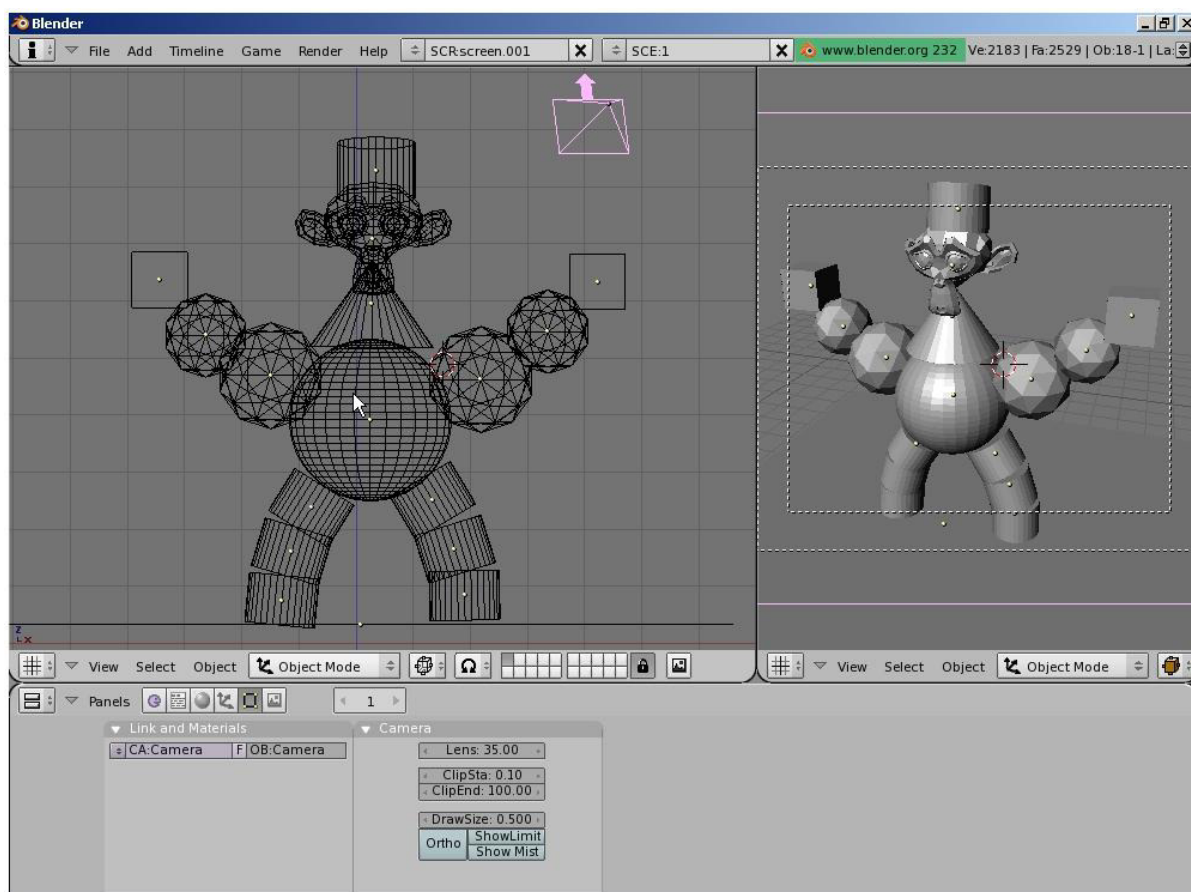
** Call the instructor when finished**

Edit Mode- Mesh Vertex Editing

After you have created a mesh, you can go into **Edit mode** (Tab key) and change its shape. In edit mode, you can work with the shape's individual verticies (mesh intersections) to create the shape you want. You know you're in edit mode when you see pink or yellow dots on the selected object. **Pink dots** are unselected verticies while **yellow dots** are selected verticies.

Edit Mode for Sphere

> **RoboDude Asks: How Do I UNDO a mistake?**
> *Pressing CTRL-Z will take you back 1 step at a time (edit or object modes). ALT-U will show you a list of steps.*
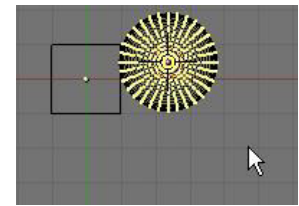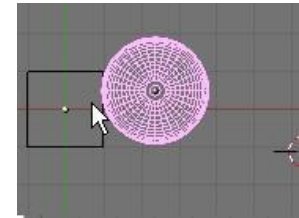
Object Mode for Sphere

Selecting Verticies:

While in edit mode, to select a single vertex, RMB click on the vertex. To select multiple verticies, hold down the **Shift** key while RMB clicking on them. To drag a window around verticies, type "**B**" key and drag a window to select. Typing the **"B" key twice** will bring up a circular selection tool that can be sized by pressing the "+ or -" keys on the number pad. Scrolling the center mouse wheel will do the same as "+ and -" keys. Pressing "**Esc**" will get you out of the circular selection tool. **In order to select *all* verticies or deselect currently selected ones, hit the "A" key (for all) once or twice**.

Edit Mode Selection Options:

By default, you are selecting verticies, but you can also select edges and faces. You can find these options at the bottom of the 3D window while in edit mode.
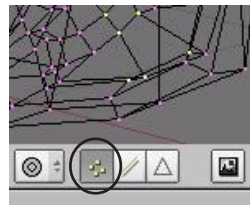
Vertex Select   Edge Select   Face Select
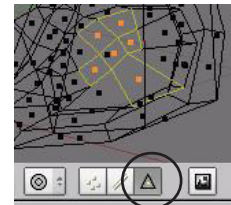
Basic Modifiers:
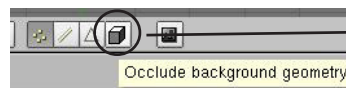
In solid view mode, this button will hide back faces

After selecting the verticies, you can use the same basic modifiers we talked about in the previous exercise ("**G**"-grab or move, "**S**"-scale, "**R**"-rotate).

Creating More Verticies:

Sometimes you need to add more verticies to some or all of the mesh in order to manipulate it to your desired detail. To do this, you must first select all the verticies you wish to split, then look at the bottom **Buttons Window** and find the edit button (looks like a plane in edit mode).   Find the **Subdivide** button and click it as many times as you need to.
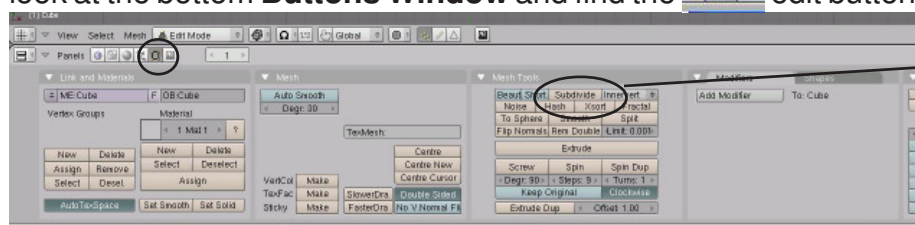
Specials
Subdivide
Subdivide Multi
Subdivide Multi Fractal
Subdivide Smooth
Merge
Remove Doubles
Hide
Reveal
Select Swap
Flip Normals
Smooth
Bevel
Set Smooth
Set Solid
Blend From Shape
Propagate To All Shapes
Select Vertex Path

Specials Menu:

In <u>edit mode</u>, pressing the "**W**" key will bring up a shortcut menu that will give you a variety of editing options. Most of these options can also be selected in the edit buttons as discussed on the previous page.

Center Points:

Every object you create in Blender has a small dot somewhere in the object (by default, usually in the center of that object). This is the **object's center**, or pivot point. Beginners in Blender often get these center points moved around to points other than where they want them. This happens because they move all the verticies of the object in edit mode, but the center point fails to move. **If you want to move an entire object, hit tab to get out of edit mode and into object select mode**. Using the "G" key to move the object in this mode will move the center point along with the object. If you ever need to relocate an object's center point, move the 3D cursor to the desired center location, then find the "**Center Cursor**" button in the edit buttons. This will change the object's center location. If you select "**Center**", The object's data (points and faces) will move to center around the object's center. If you select "**Center New**" , the program will move the center point to the object data's mathematical center.
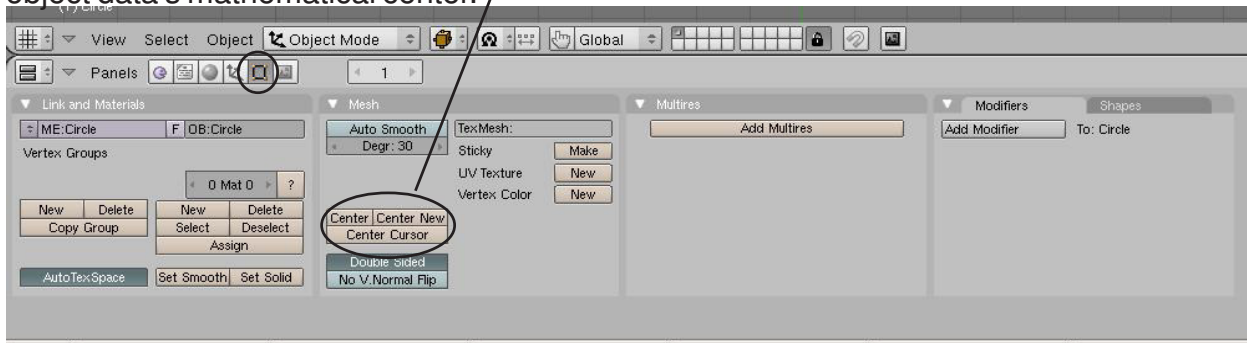
Viewport Shading

Usually by default, the viewport is set to **Solid** shading. Many times, you will need to work with your objects in **Wireframe** mode. All shading does is changing the way you see your objects. Shading also affects the way you can select verticies in edit mode. In solid shading, only visible verticies can be selected. In Wireframe, all verticies can be selected. **To change between Solid and Wire modes, press the "Z" key or select the shading mode from the toolbar.**

Wire

Solid

Draw type:
- Textured
- Shaded
- Solid
- Wireframe
- Bounding Box
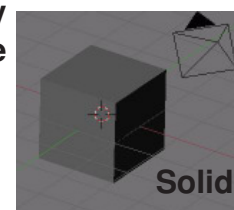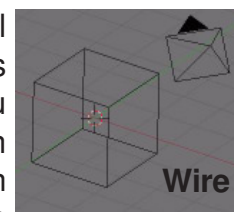
You will notice several other shading options in the menu. Experiment with the other options.

Using the Set Smooth-Set Solid Options and Auto Smooth

As you add objects and view them in *Solid* shading, you will notice that circular objects are not being displayed smooth. In the *Edit buttons*, you will see two buttons labeled **Set Smooth** and **Set Solid**. These 2 buttons not only effect the way things look on the screen, but how they will be rendered in a final image. **Be aware that the appearance of objects on the screen are not displayed at the same quality as a final rendered image.** The computer needs to conserve memory because 3D applications can be very memory intensive on your computer. There are other smoothing options available in the Edit panel, but they will be discussed in a later chapter. **Auto Smooth** is used to smooth objects when faces meet at a certain degree or less. This is a great feature when *Set Smooth* does not work properly alone. To use **Auto Smooth** on an entire object, hit the Auto Smooth button. To smooth just a selected area, enter *edit mode*, select the verticies you wish to smooth, then hit Auto Smooth.
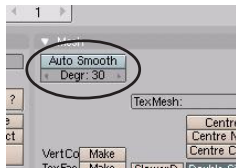
Extruding shapes:

Shapes can be lengthened by selecting a group of verticies, then by pressing the "**E**" key and confirming by clicking "ok", you will make a duplicate of those verticies. They can then be "G" (moved), "S" (scaled), and "R" (rotated). Blender has added a few more options to the extrude menu. Feel free to experiment with them. The one that you will usually want to use is the **Region** option. When you select the region option, the verticies will be extruded along a locked axis. To free the verticies so you can move them in any direction you wish, **click the Center Mouse Wheel** once or twice (don't scroll, press the wheel like it's a button). Below is an example of a cube, extruded from the right side several times using scale and rotate.

Basic Cube
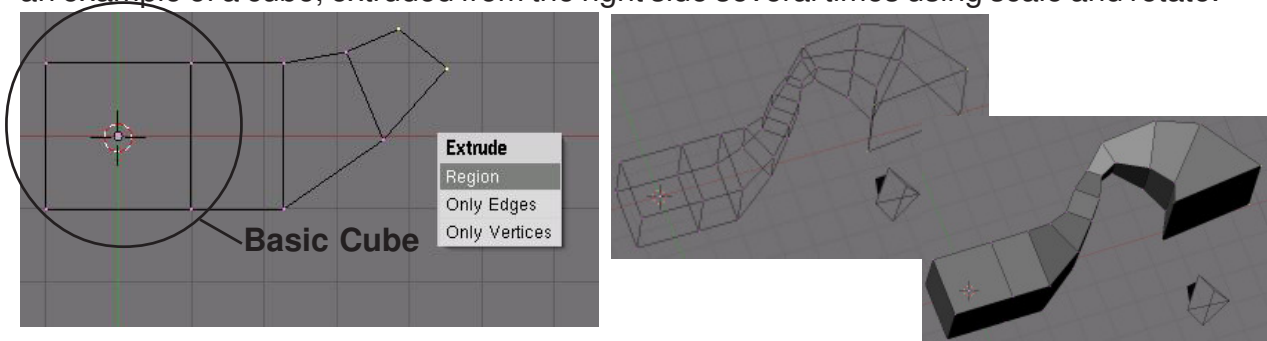
Extrude is a great command for making long tubes and tunnels. It is also good when you don't want to subdivide an object too much in order to add detail.

Proportional Vertex Editing:
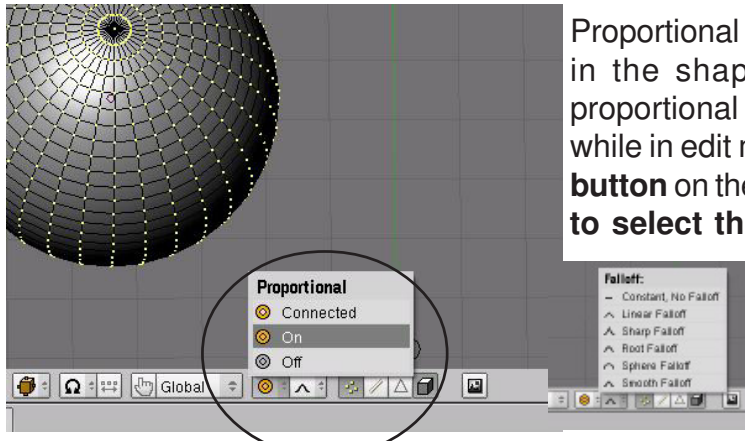
Proportional Vertex Editing is used to create a flow in the shape when editing vertices. To turn proportional vertex editing on, press the "**O**" key while in edit mode or by selecting the **small circle button** on the toolbar. **Note: you will only be able to select this option while in edit mode.** You have several options for effecting verticies in proportional editing. We usually use **Sharp** or **Smooth** falloff, but feel free free to experiment with the other options.
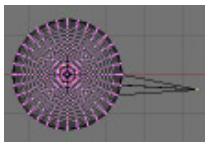
Proportional Vertex Editing "Off"   *Proportional Vertex Editing "On"*   *Sharp Falloff*   *Smooth Falloff*   *Small Area*   *Large Area*
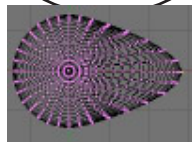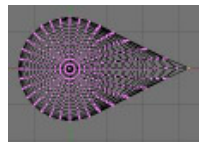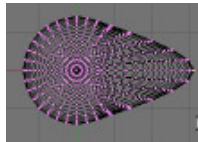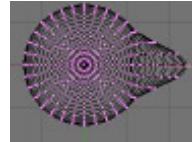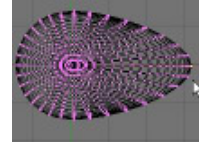
RoboDude Asks: How do I control the number of verticies affected?
By pressing the "+ and -" arrows on the number pad or by scrolling the center mouse wheel.

Knife Tool:
The **Knife Tool** allows you to split edges differently than the subdivide command. To use the knife tool, type "**K**", choose your option, draw your line and then hit "**Enter**" on the keyboard to create the cut.
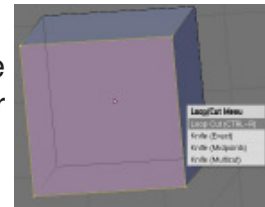
Creating Ground:

You can use proportional vertex editing to create flowing landscape easily. The first thing you need to do is create a plane in the top view (**7 key**). While in edit mode, make sure all verticies are selected (verticies are yellow). You can use the "**A**" key to select them all. Press "**W**" key for specials menu, then select "**Subdivide**". Do this a few times. Select a single vertex somewhere near center.
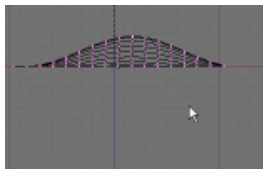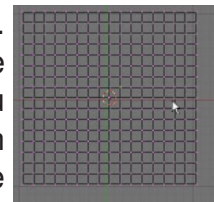
Next, switch to a front view ("**1**" key on number pad) and press the "**O**" key to enter proportional vertex editing mode. Select sharp or smooth falloff depending on what effect you want. Type "**G**" to grab (move) the vertex. Use the **"+ -" keys** on number pad or scroll mouse wheel to change the size of the selection.

Experiment with different size selections and different falloffs. To see your final work in a smooth display, exit edit mode ("**Tab**" key) and ,with the object selected, go to the edit buttons and find the "**Set Smooth**" button. This will smooth the mesh in display and final output. Finally, hit the "**Z**" key to shade your view.
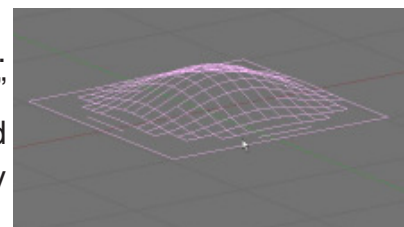
Over the next several chapters, we will be developing a nice landscape scene in an effort to build your Blender skills while you become more comfortable with the program. Below is an example of what we will be completing:
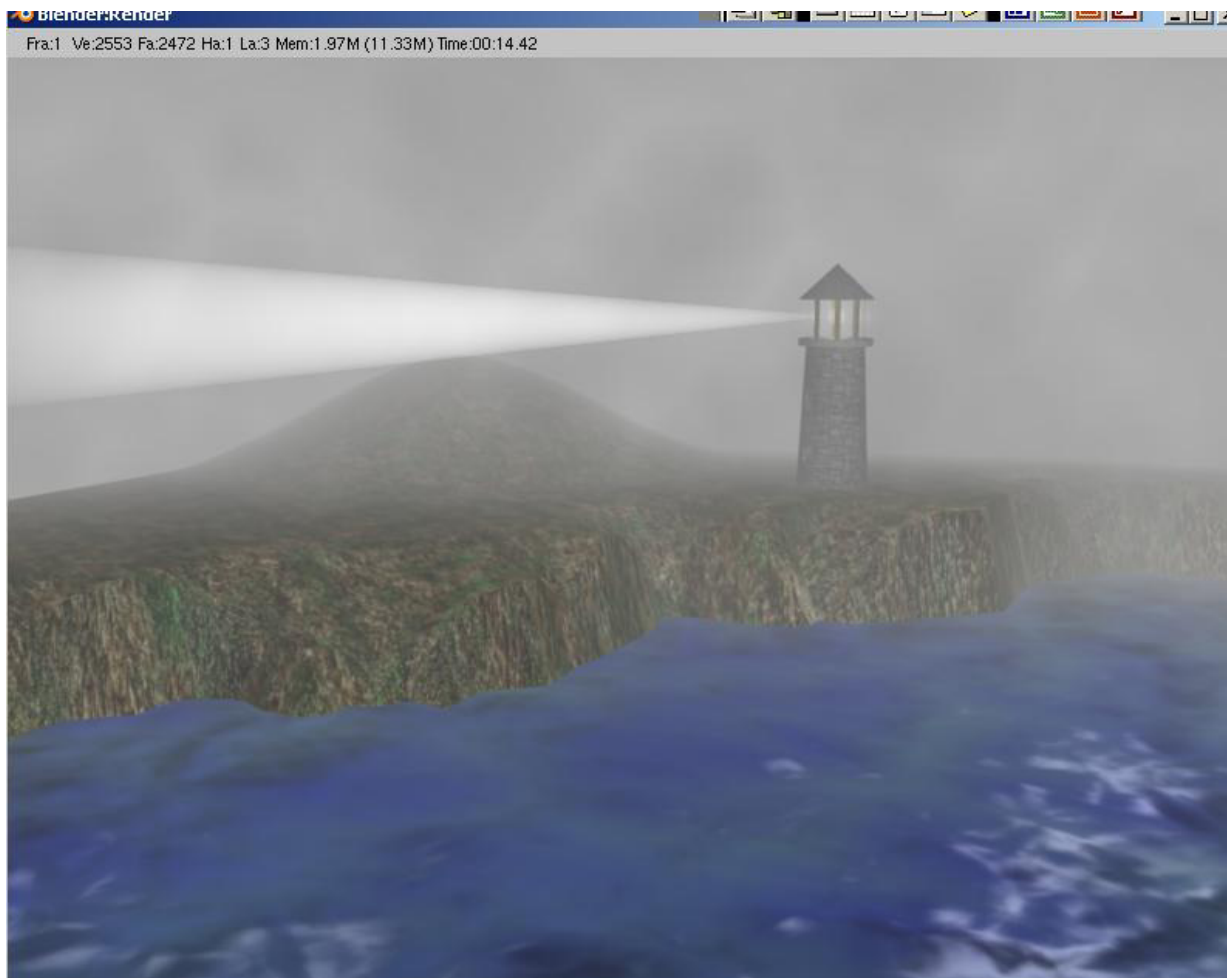
This is the basic scene, but as you work through the chapters, you will be encouraged to add more elements and details to your lighthouse and landscape to make it your own. We will eventually add rain to our "stormy night at sea" scene and animate the water, light and camera.

The first thing we need to do is create a new Blender scene and save it as "**_Landscape Scene_**". Again, we will be using this file for the next several chapters, so keep it safe and _save often_! Split the workspace into 2 viewports as shown on the next page. We will use the left viewport for working in and the right one for camera and 3D views.

While in the **top view** (_number pad 7_) erase the initial cube from the scene, then add a plane from the mesh menu (_space bar- add- mesh- plane)._
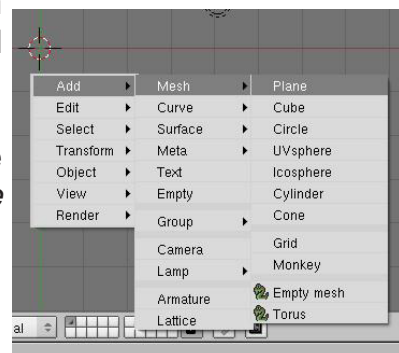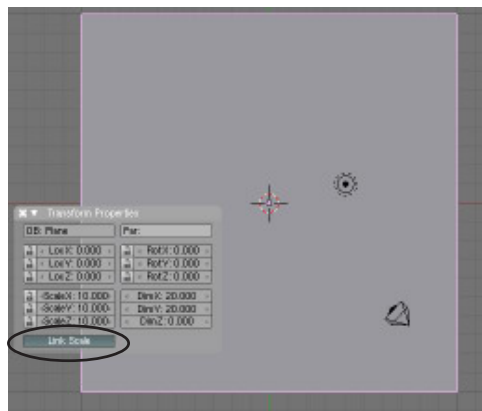
This plane will be used for our ground. Our next step is to scale it up a bit. To do this precisely, we will use the **numeric input window** (transform properties). With the plane selected and <u>out</u> of edit mode (tab), press "**N**" to bring up the transform window. Press the "**Link Scale**" button and set the <u>Scale X</u> number to 10.000. The Link Scale button will change them all. Close the Transform window (x).
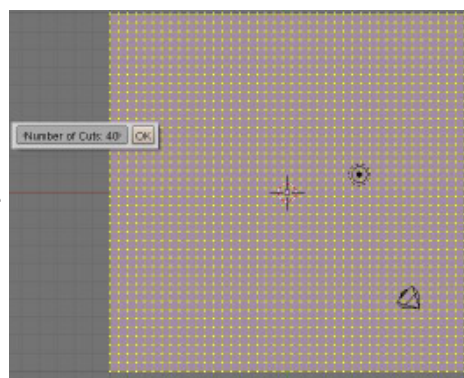
Next, go back into *edit mode* (tab) and make sure all verticies are selected. Press the "**W**" key for the *Specials* menu. Select "**Subdivide Multi**" and set the number to 40. Your plane should have 40 subdivisions.

Selected
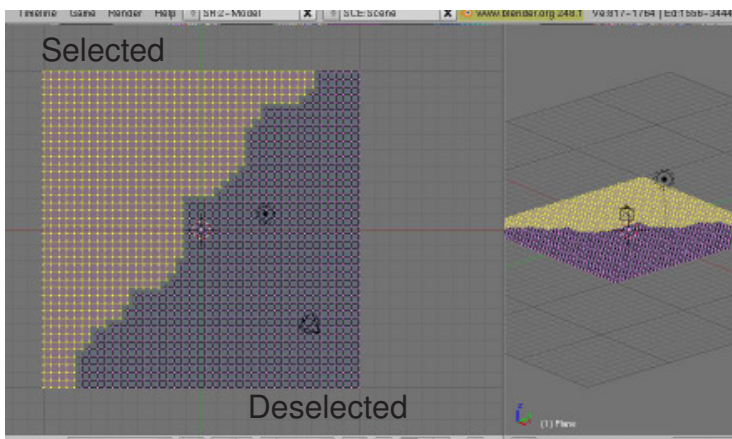
Deselected

Deselect all verticies using "**A**" and press "**B**" twice for the circular selection tool. While holding down the LMB, select half the verticies as shown. Keep the edge random similar to what is shown so it looks like a rough shoreline. If you select too many verticies, remember that by holding down the mouse wheel, you can deselect verticies.

Now switch to the **front view** (*number pad 1*). Your plane will now just look like a line. Type "**G**" to grab and move the selected verticies. Move them up about 2 Blender grid blocks. You may want to type "**Z**" to keep the move locked to the verticle axis. Use your right side viewport to spin around and get a nice look at the landscape.
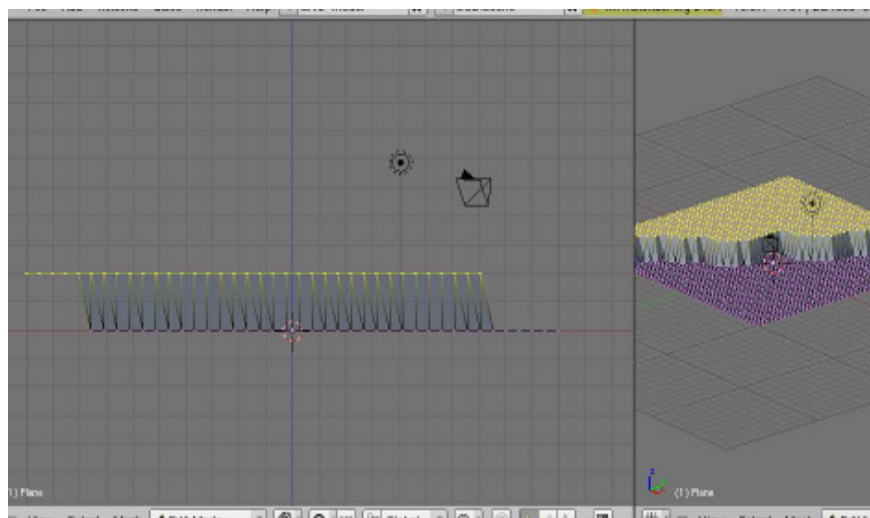
Now it's time to make some fine adjustmenst to the mesh to make the cliff edge a bit more random. Turn on the *proportional editing* button (only visible in edit mode- small bull's eye) and experiment with different types of falloff. Select single verticies, "G" to grab and scroll the mouse wheel to change the affected areas while moving.
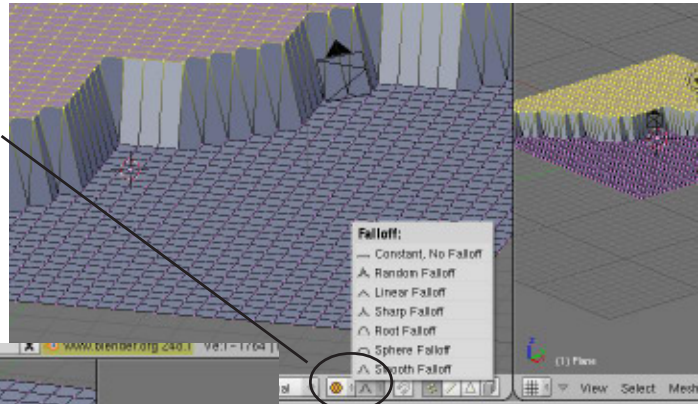
Randomly pull the edges of the cliff up and down to different levels. You may even want to do some of this with proportional editing off. Try selecting a few verticies back on the high flat land and create some hills. *Leave a flat area close to the cliff to place the lighthouse later.*
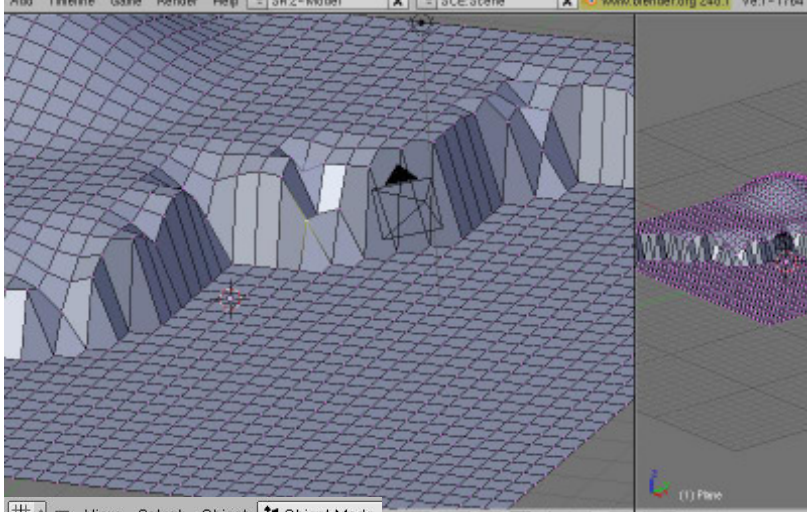
The scene's looking better, but a bit angular. Exit *edit mode* (tab) and go to the edit buttons. There you will find the "**Set Smooth**" button. Press it and you should see a much better looking landscape (you must be in object mode to see the smoothing).

Now it's time to set up the camera. We will start by adding an Empty object. An Empty is basically used for targeting purposes and does not render as a visible object. Press *Space Bar- Add- Empty*.
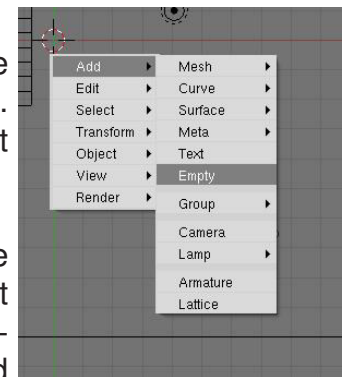
After adding the Empty, RMB click on the camera to select it. We will now add a *Tracking* constraint to the camera to always point toward the Empty. With the camera selected first, hold down the Shift key and RMB click on the Empty. Both objects will be highlighted. Press **Ctrl-T** and add a "**TrackTo Constraint**". You will notice a dashed line between the two objects indicating the link. RMB click on the camera so only the camera is selected. Type "**G**" to move the camera. It should always be pointed toward the Empty. If the link appears to work backwards, it means you had the Empty selected first. Use the UNDO command to back up and try again.
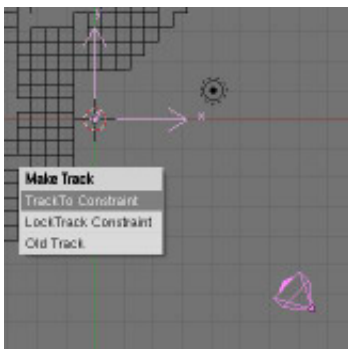
Basic Editing- Landscape and Lighthouse

It's time to place the camera and Empty into good rendering locations. You will need to use the move command ("G" key) and place the Empty and camera using your principle views of Top (#7), Front (#1), and Side (#3). Try to get the camera low so it looks as though you are viewing the shore line from a boat. Place the Empty on the cliff line. Use the picture below to frame up your view. You do not want to see any edges on your rendering. Use the "**F12**" key to render out a picture.

Use Shift "D" to duplicate the light if your scene seems dark when rendered

Camera View
(0 on the number pad)

(1) Empty
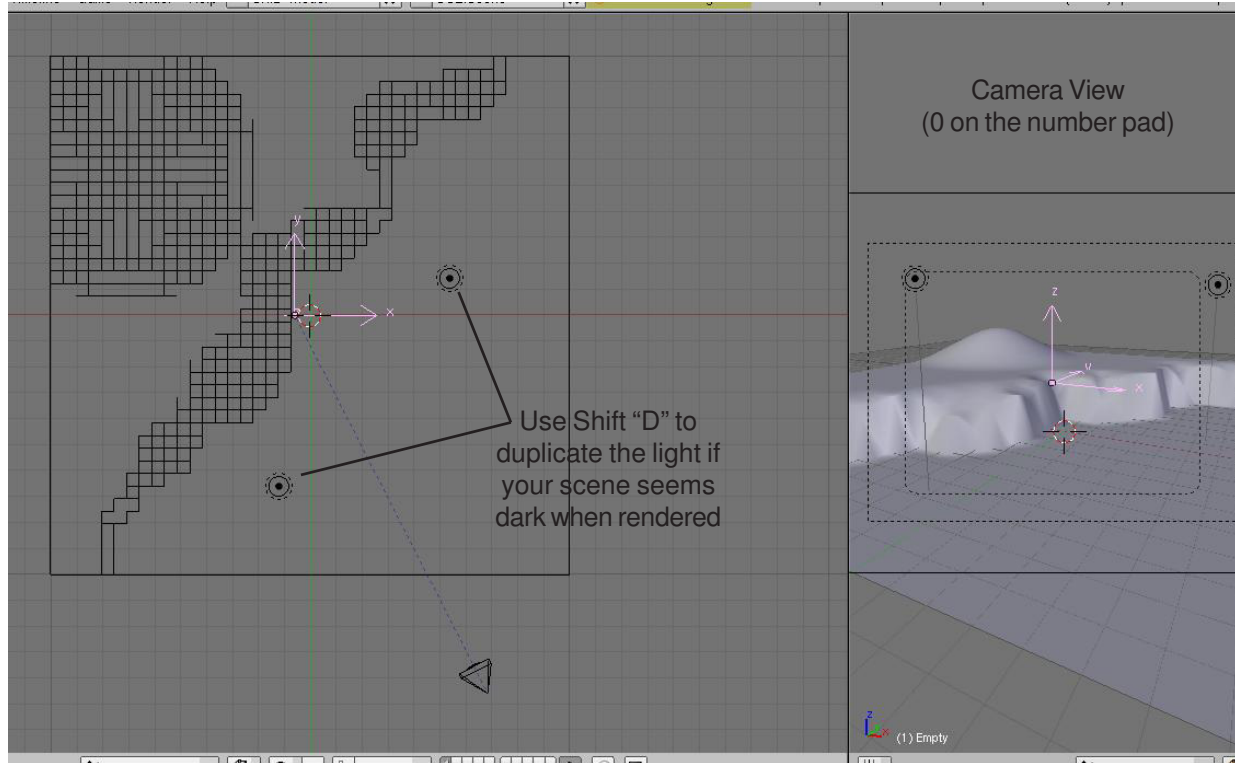
Here is the final render. We're still missing water, textures and a few other things, but it's a good start. Feel free to develop and refine the landscape contour any way you wish. The more time you spend with it, the quicker you will become comfortable with the program and the more realistic it will become.

Save the scene and start a new Blender file (I hope you've been saving every few minutes anyways). We are finished with the landscape for now and will now begin developing the lighthouse as a separate scene that we'll add to the landscape at a later time. Save this new Blender file as "***Lighthouse***".
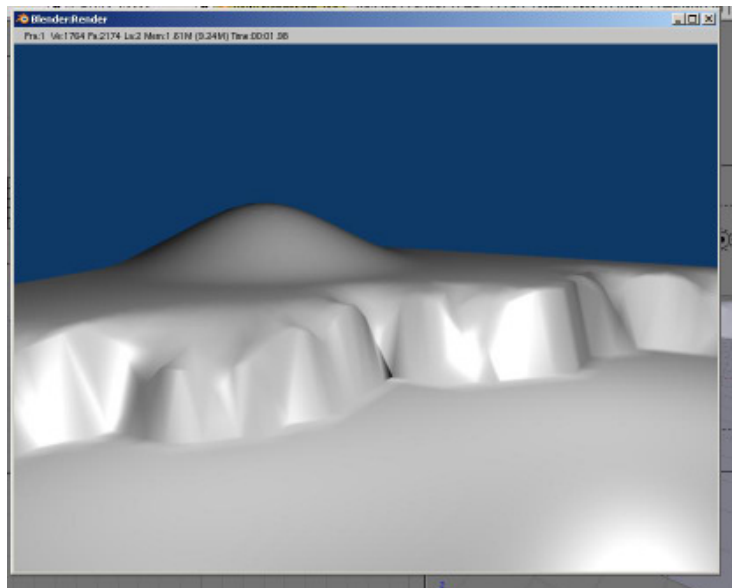
Now it's time to start shaping a lighthouse using the **Extrude** and **Scale** commands. Begin by deleting the default cube and add a **Circle** (*Space Bar- Add- Mesh- Circle*) in the *Top View* (#7). Use the default setting of 32 verticies, radius of 1, and Fill off. These setting will be fine for what we are making. Depending on what you are making and what it will be used for, you may require more or less verticies.
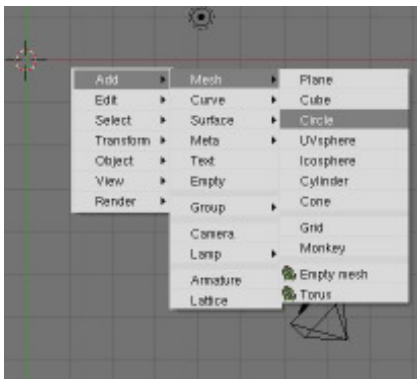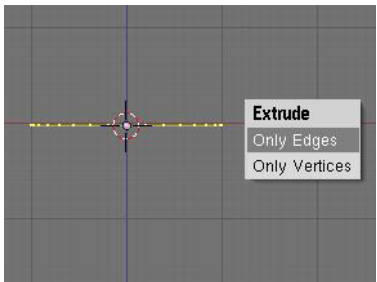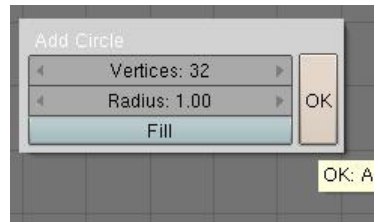
You will now need to switch to the _Front View_ (#1) so the circle appears as a line. Make sure all verticies are selected (yellow) and press "**E**" to *Extrude*, selecting the "**Only Edges**" option. As you extrude, you will need to press the "**Z**" key to lock your movement verticle. Extrude the lighthouse 2-4 Blender grid blocks high and LMB click to place them. Hit "**S**" to *Scale* them in slightly. This is your lighthouse- feel free to adjust sizes as desired. Remember to stay in the front view throughout this process! Rotated views will cause a distored lighthouse.
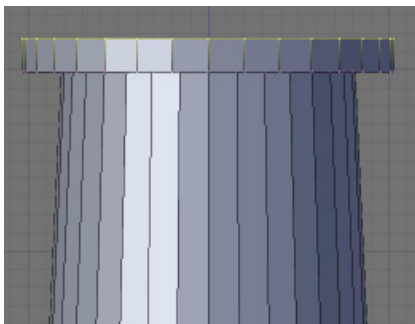
It is now time to make the small walkway around the top. Press "**E**" to extrude again, then "**S**" to scale immediately (no LMB click in between). Pull your mouse away from the lighthouse and scale the walkway outward as desired. LMB click when you have a good size. Remember, you can always UNDO if it doesn't seem right. Extrude again to give the walkway some height. You will then Extrude and Scale again to reduce the size back inward.

Continue extruding and shaping to get the light area and the roof. The point of the roof will actually have 32 verticies which you could scale very small so that it appears to be a single point, but we will use a *Specials* command in the next step to correct this.
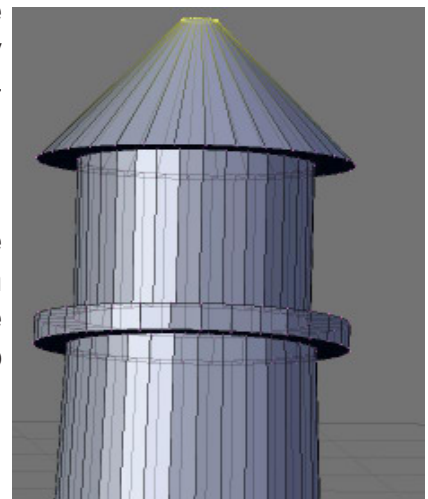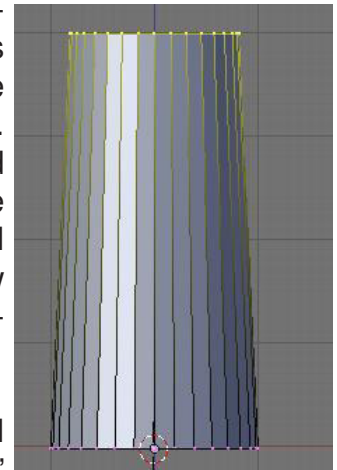
Basic Editing- Landscape and Lighthouse

You now need to turn the top into a point. With the top 32 verticies selects, press "**W**" to bring up the editing short-cut "*Specials*" menu. Select the "**Merge**" option and "**At Center**". It will tell you that 31 verticies are being removed, leaving only one.

Move your camera to a location that displays the lighthouse well and press "**F12**" to render an image. The lighthouse looks good, but angular. It will take more than *Set Smooth* to make it look good. Some edges actually need to stay sharp. This is where *Auto Smooth* becomes important.
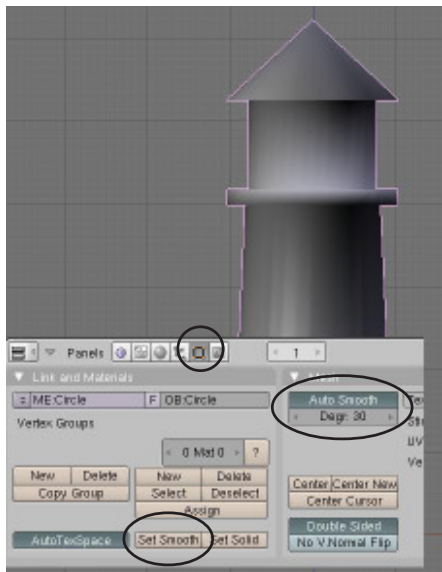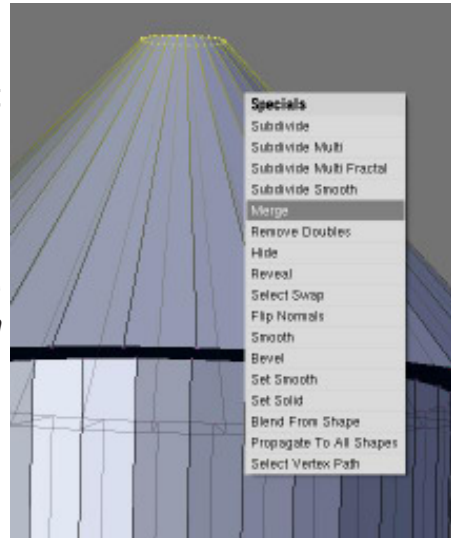
Exit edit mode (tab key). In the Edit Buttons, press the "**Auto Smooth**" button, then the "**Set Smooth**" button. Ignore how the lighthouse look on the screen. Render a picture with "F12" to see the results. You will notice a degree angle below the Auto Smooth button. Leaving it a the default of 30 degrees should work well, but feel free to experiment with other setting. Basically, this setting determines which faces are smoothed and which ones are kept sharp.

Finally, press "F12" to render a picture and check your results. If you haven't saved your file, do so now and remember to save often. We are finished with our lighthouse for now. If you have the time, feel free to modify the lighthouse, change the style, add more features, etc.
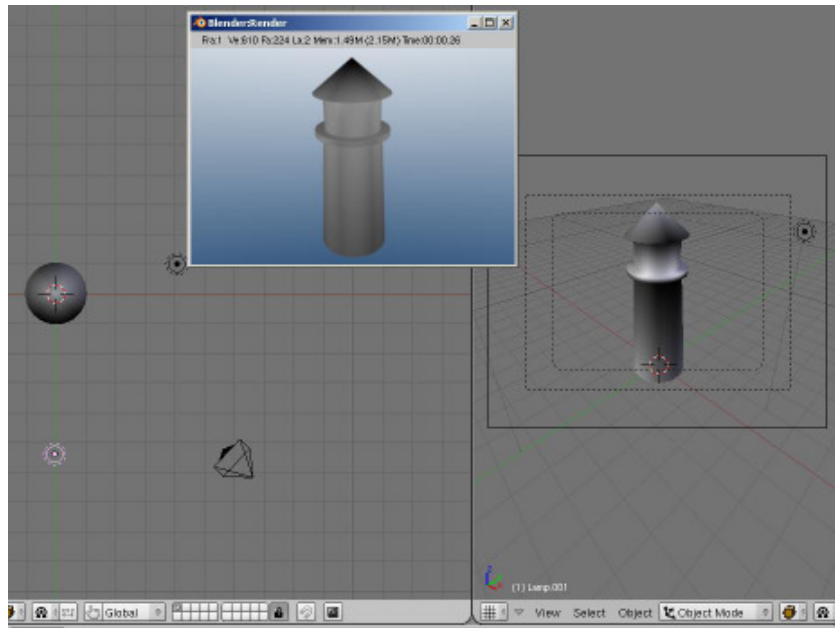
*** Call the instructor when finished****

Joining/Separating Meshes and Boolean Operations

Now that you have some experience with basic editing, here's a few more options:

Joining Meshes:

To join 2 or more meshes together, Hold down the "**Shift**" key to select them, then press "**Ctrl**" and "**J**" to join them. They will retain any materials you have placed on them, but will be one object.
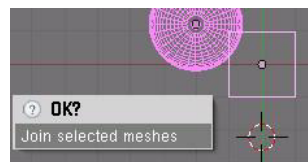
Separating Meshes:
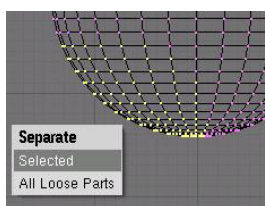
In order to break up a mesh, you need to be in edit mode (**Tab** Key) and select the verticies you wish to separate from the rest of the mesh. With verticies selected, type the "**P**" key (I like to think of it as *partition*) and select your option. You also an option to separate *all loose parts*.

Deleting Vertices/Edges/Faces:

If you want to make a hole in a mesh, select the verticies, edges, or faces you wish to remove, then hit the "**Delete**" key.

Adding Faces:
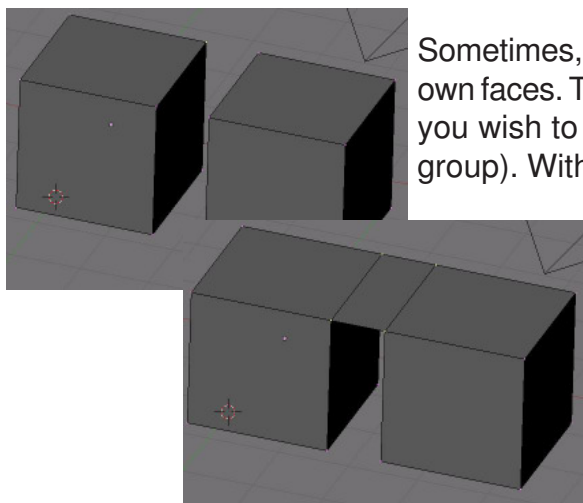
Sometimes, you need to fill in holes in a mesh by creating your own faces. To do this, go into edit mode and select the verticies you wish to face together (you are limited to 4 verticies in a group). With verticies selected, hit the "**F**" key. A face will be formed. Here is an example of 2 cubes joined together with a space that needs filled between them. In edit mode, select the 4 verticies (hold down **shift** key and **right click** on them), then type **F**. A face will be created. If a shape or area is closed, you can select more than 4 verticies and use the **Shift-F** option to auto-face the area. **Ctrl-F** will give a *Face Specials* menu of options.

Bevel Command:

In edit mode, bevels (chamfers) can be applied to an object by bringing up the shortcut menu (**W key**) and selecting bevel. Bevel may not work on complex objects however.
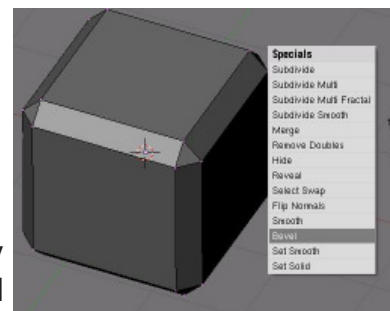
Boolean Operations:

Boolean operations allow you to cut or join meshes by using other meshes. There are 2 ways to do this in Blender. The first method is older and less reliable. This is done by selecting the 2 meshes (not in edit mode), then typing the "**W**" key. You will see the options "***Intersection, Union, and Difference***". You will also see 3 **Modifier** options which will allow you to keep the 2 original objects, but will modify their shapes according to how they intersect each other. Below, you will see the results of each:
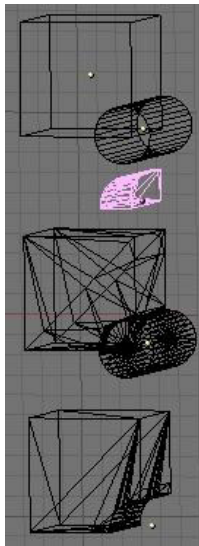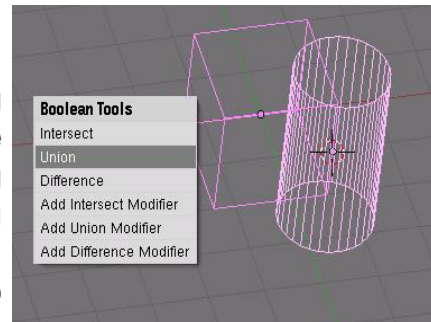
Basic shapes (before boolean operation)- Cube selected 1st

Intersection Option

Union Option
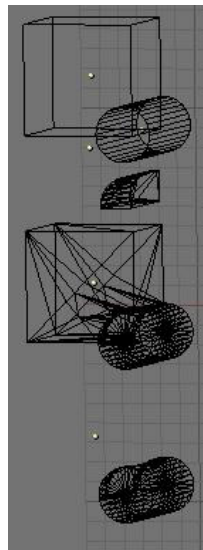
Difference option

Basic shapes (before boolean operation)- Cylinder selected 1st

Intersection Option

Union Option

Difference option

___**RoboDude Says:** **When using the older Boolean operations, a new object is created while the original shapes are retained. You will need to delete or move the original shapes to view the newly created shape.**___

Boolean Modifier Option

The newer, more reliable method is the Boolean modifier panel. This is just another way of creating a *Difference, Union or Intersect*. 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!***

To begin this exercise, start by opening up your **_Lighthouse_** file from the last exercise. We are going to use Boolean operations to cut some simple windows in your lighthouse.

Begin by adding a **cube** (*Space Bar-Add-Mesh-Cube*) to your scene, exit *edit mode*, and scale it to an appropriate size and shape. Using your principle views of #1,#3, and #7, place the cube in a good location for a window. With the cube still selected, make note of the cubes name, displayed in the lower left corner of the viewport. We will need to know that name later (*case sensitive-so note capital letters*).
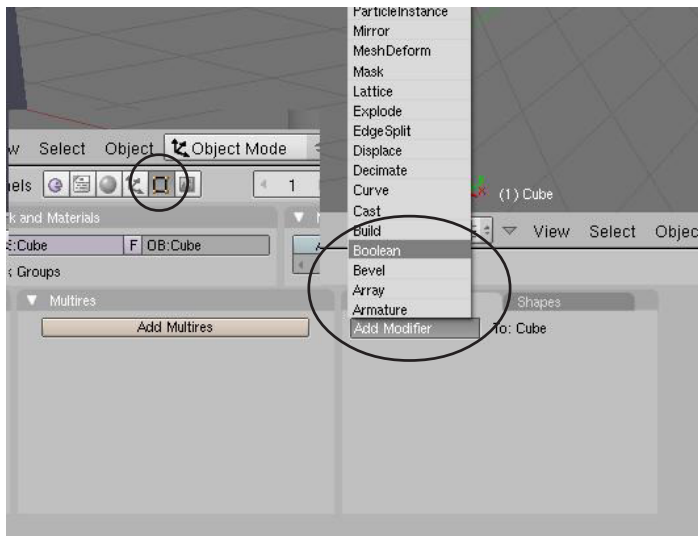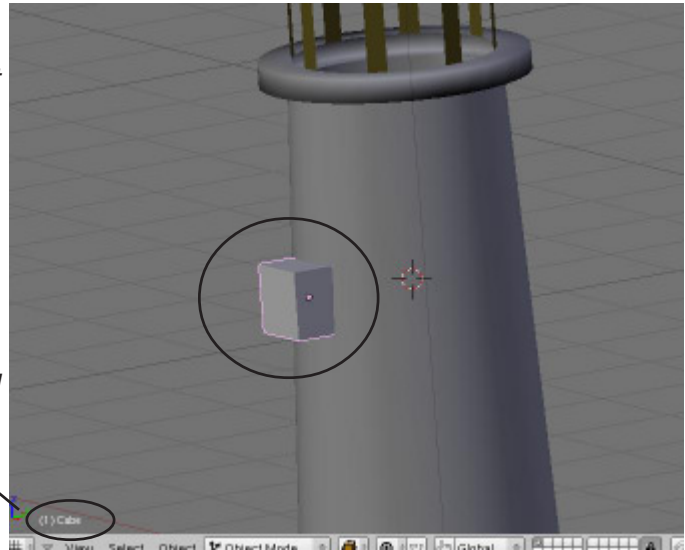
Now select the *Lighthouse* and go to the *edit buttons*. Find the **Modifiers** panel and **Add** a **Boolean** modifier.

Remember that there are two methods for Boolean operations in Blender. We are using the newer method of adding a modifier since it has received the most recent amount of work and upgrades.

Boolean Editing - Lighthouse Windows

P
R
A
C
T
I
C
E

E
X
E
R
C
I
S
E

Below, you will see the information needed to complete the Boolean operation. You first need to type the name of the mesh you are cutting out in the **Ob:** box. The default option above that block is *Intersection* which will probably give you something you don't want. It will remove everything not shared by the two shapes. Don't worry- you can continue to make changes before you hit the "*Apply*" button. Try all three Boolean options to see the results. The one

you probably want is "**Difference**". You should notice the mesh change to reflect the cut-out of the cube. If the mesh appears correct, hit the "**Apply**" button which sets the mesh permanently to that shape and removes the modifier from the list. Move the cube from the lighthouse and render (F12) a picture to see your results.
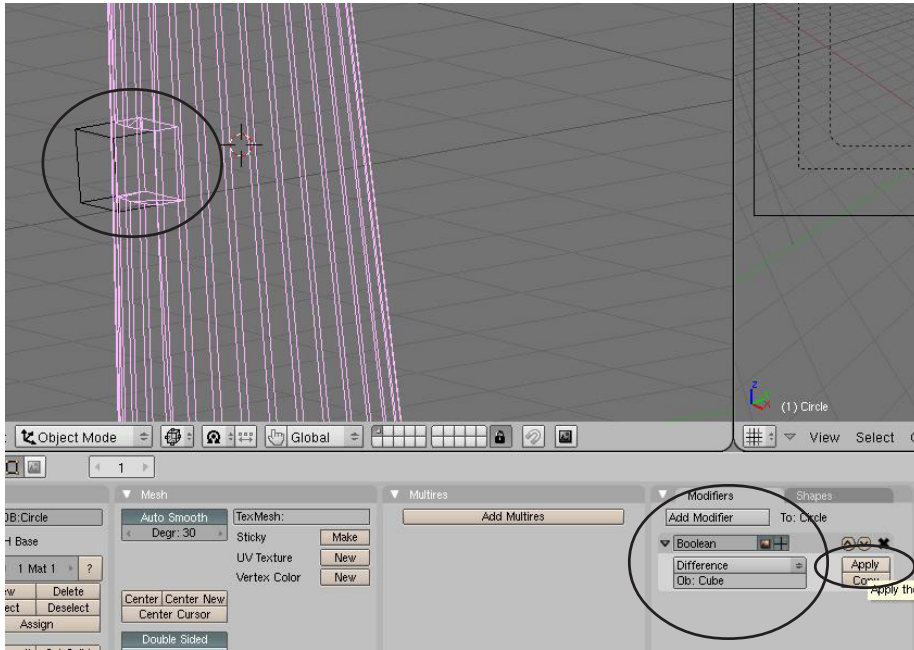
RoboDude Asks: Why can't I enter the mesh name in the OB: block?
Reason #1- Check to see if you need capital letters. Reason #2- you forgot to select the lighthouse and still have the cube selected.

After completing the first window, move the cube around to other points of the lighthouse and cut a few more windows. You can even try creating other window shape besides cubes for your model.
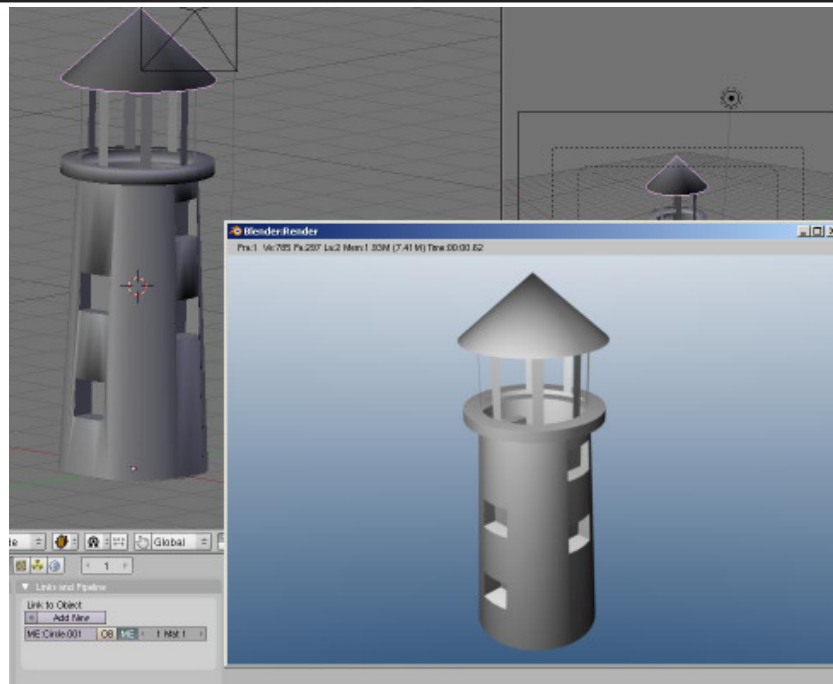
*** Call the instructor when finished***

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

Shading   *Material*   *Add New*

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. The panels can float around so they may not be in this order, but here is where you also set other properties like:

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

Panel Visibility- click on the smal triangle to collapse/expand a panel.

Material Sample- shows you a sample of your material

Sample Type- different ways to display sample

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 the "Links and Pipeline" panel.

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

Emitter- gives the object some self-emitting light.

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

These are the setting most used under the basic materials panel. There are several we haven't discussed here, but feel free to experiment with them to see what they do. There are also *raytracing* settings in this panel that will be discussed in a later chapter.

RoboDude Asks: How can I see all the panels on the screen?
At times, you will notice that the button panels are wider than the screen. Zoom in and out by pressing +/- on the number pad with cursor in window.

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

Halo Sample

Material Color

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

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

You can control the Halo, Line and Ring colors individually

Turn on the Halo effect under "Render Pipeline".

Numbers of Rings, Lines, and Stars

Seed Pattern- used to generate a different pattern of effects
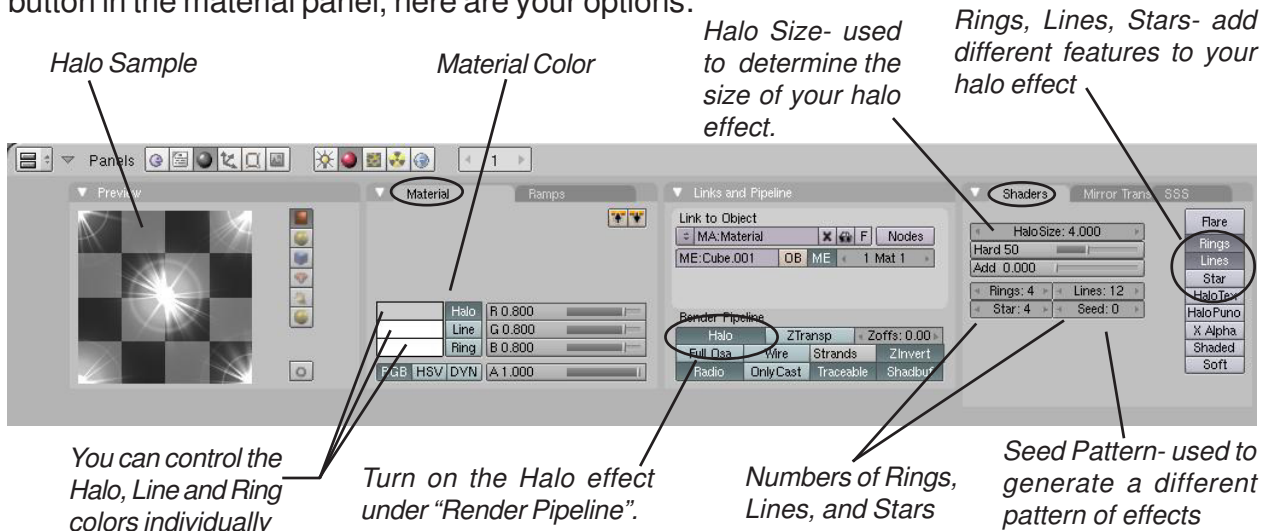
Different Halo Settings:

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.

It's now time to add some color and water to you project. Open your "***Landscape Scene***" model that you created in the *Basic Editing* chapter. Render a picture with "F12" and it should look something like this:
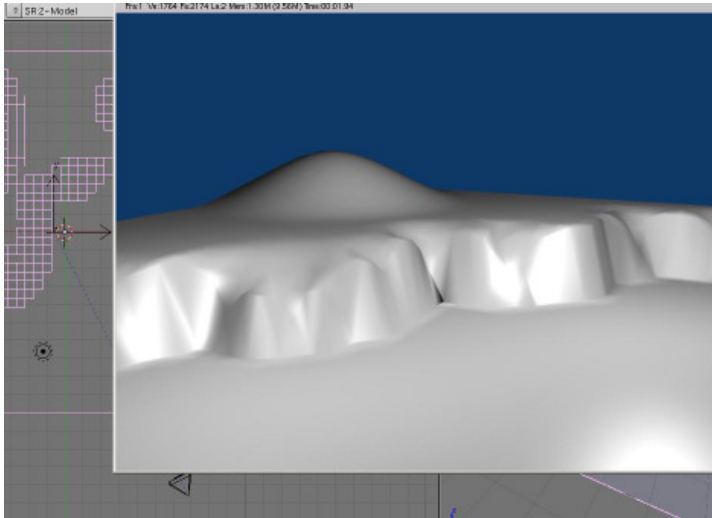
Lots of gray.... In this exercise, we are just planning to experiment with material colors and settings. We will also add a plane to the scene to act as the water. In the next activity, we will add some texture to it.

With the landscape plane selected, go to the *Material Buttons* and select "**Add New**". It is good to get into the habit of naming your materials in the **MA:** block in the "*Links and Pipeline*" panel. By default, it will be "*Material*", probably with some zeros and numbers after it. Create an appropriate name.
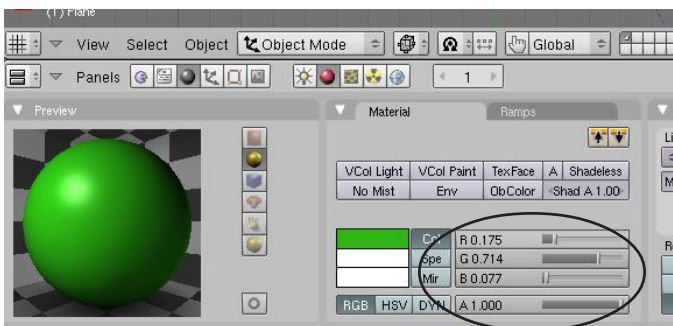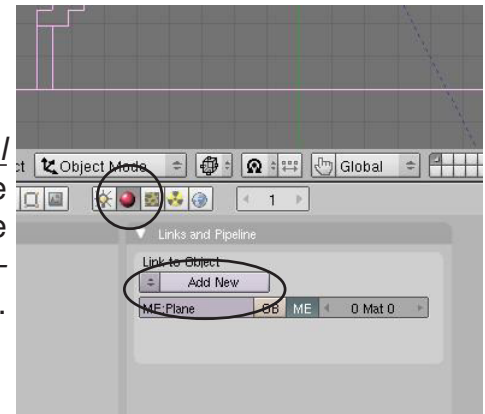
Find the RGB sliders and adjust them to a shade of green. I know this doesn't look too realistic at this point, but we will apply a nice soil/grass texture in the next exercise. For now, you're just working with material basics.

Another way to adjust the color is to use the "*Color Picker*" discussed previously. Click on the color swatch to the left of the "**Col**" block (*to the left of the red slider*). Since ground usually isn't glossy, Take the "**Spec**" (*Specularity*) down to zero (or almost zero) under "*Shaders*".
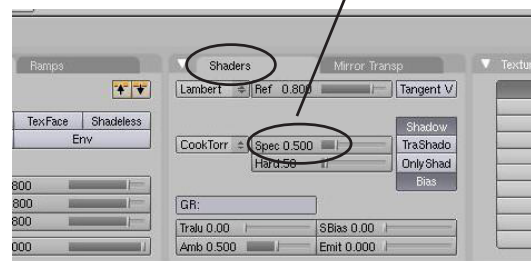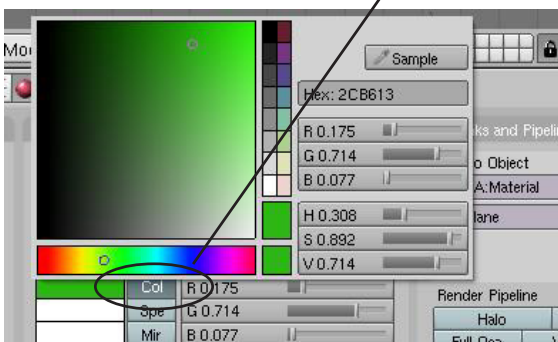
Applying Materials-Landscape

Now that you've adjusted the color and specularity in the materials panel, Press "F12" to render a new image.

Rs:1 Ve:1764 Fs:2174 La:2 Mem:1.63M (9.64M) Time:00:01.87
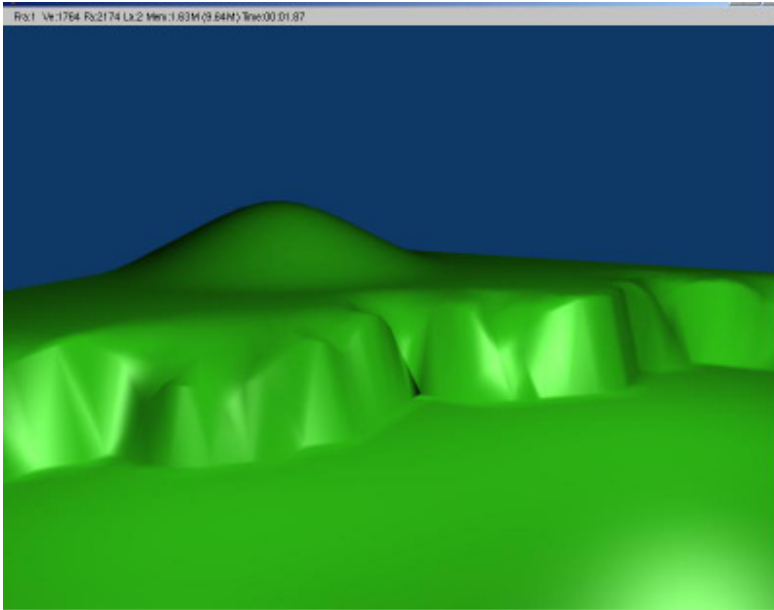
Looks better than gray, but still needs more work. We will apply a texture to the mesh in the next exercise. *Remember that you always need to place a material on an object before you can add a texture.* For future reference, if we were planning to apply an image (picture) as a texture, you would not need to adjust the color. However, you would still need to adjust specularity as needed.

We're now ready to add some water to our scene. For this we need to add a *Plane* from the *Top View* (#7) (*Space Bar- Add- Mesh- Plane*).

After adding the plane, exit *edit mode* (tab) and **Scale** the plane to about the size of your ground.

Switch to the *Front View* (#1) and move the plane to a location somewhere between the top and bottom of your landscape rise. Press F12 to render an image and check for appearance. Make sure that you do not see the edge of the plane in camera view.

Add ▸   Mesh ▸   Plane
Edit ▸   Curve ▸   Cube
Select ▸ Surface ▸ Circle
Transform ▸ Meta ▸   UVsphere
Object ▸ Text ▸   Icosphere
View ▸   Empty ▸   Cylinder
Render ▸ Group ▸   Cone
         Camera   Grid
         Lamp   Monkey
         Armature   Empty mesh
         Lattice   Torus

—Water Plane

Now it's time to add a new material to the water plane exactly as we did for the landscape. Add a new material, name the material and adjust the sliders for a shade of blue. Keep *Specularity* up for this material since water should have a gloss.
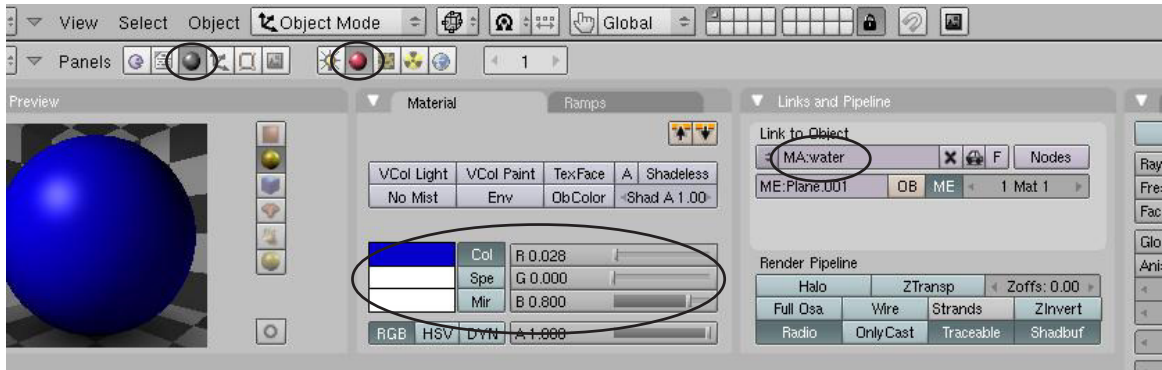
Finally, render a picture using "F12". Your sceen should now look similar to the one below. A green landscape with blue water.
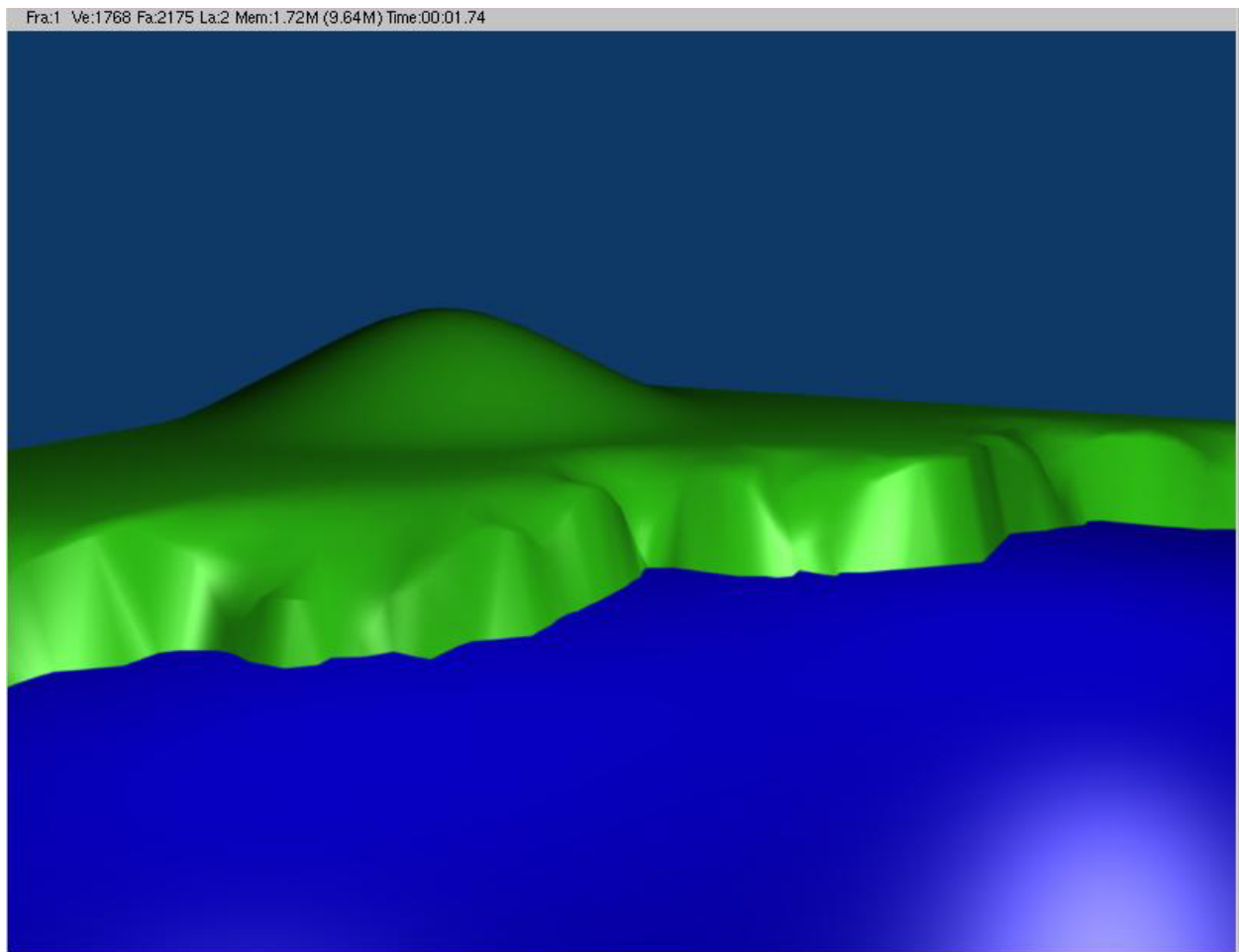
*** Call the instructor when finished***

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.

Texture Sample

What the texture is linked to

Browse data block arrows
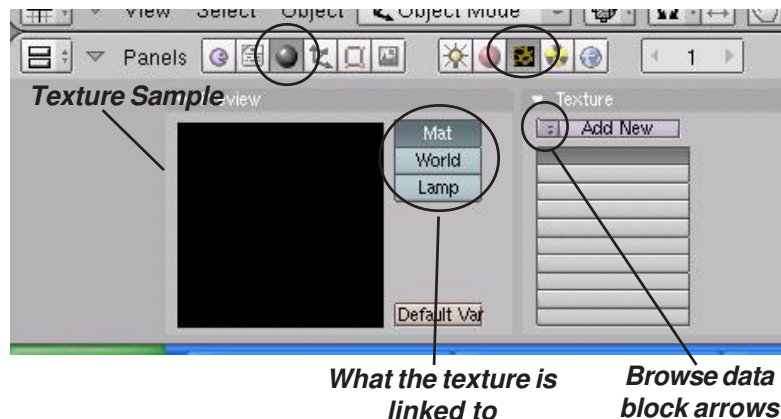
RoboDude Says: *You can't add a texture unless you've already added a material. Material and Texture properties work together!*

Built-in texture generators

Name Texture here
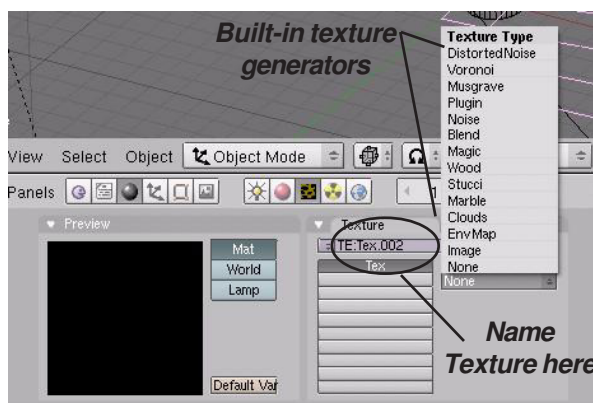
Blender's Built-In Textures:

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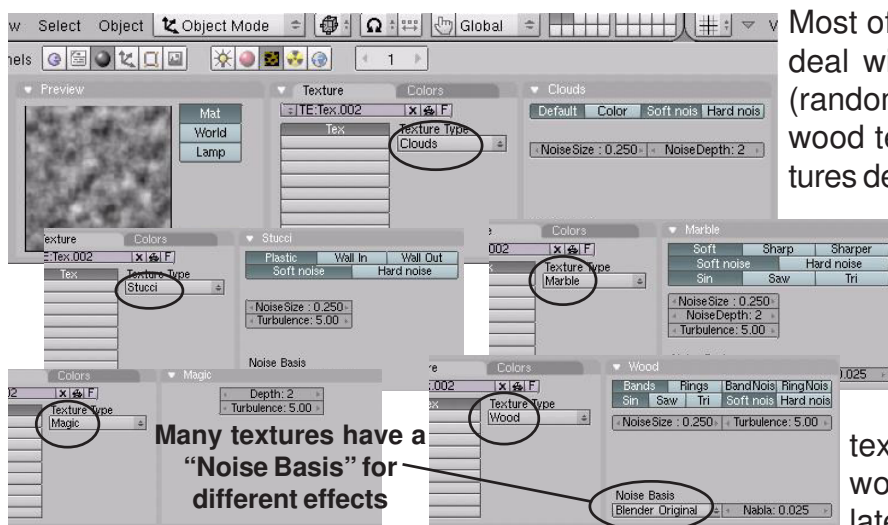
Most of Blender's texture options deal with turbulence and noise (randomness of the pattern) The wood texture also has some features dealing with the pattern of the wood grain (bands and rings). After you place the texture, you still need to go back to the Materials Buttons to fine tune the look on your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

Many textures have a "Noise Basis" for different effects

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:
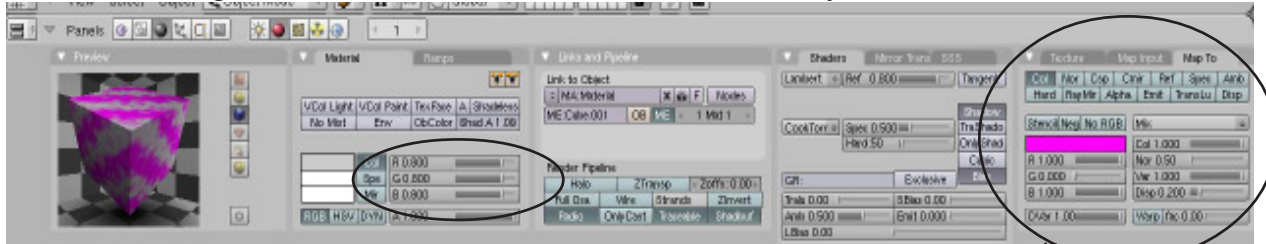
Wow- the sample block looks nice, but I don't often see much purple and gray marble around. Time to set the colors. You can set the base color in the material color sliders. To get rid of the purple, you need to select the "*Map To*" tab and adjust the sliders. Now you need to set the *size* of the texture. 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 default is 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.
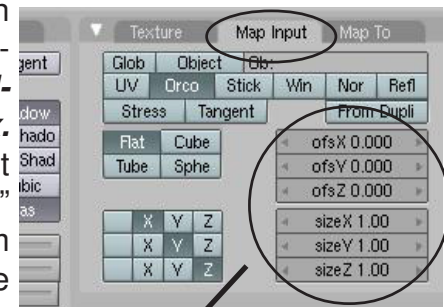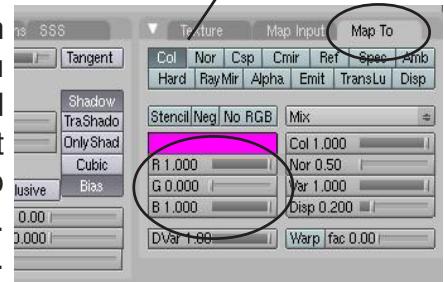
> *RoboDude Says: Hold down "Shift" and LMB click in any number box to type a number. This is the easiest way to access the number.*

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.
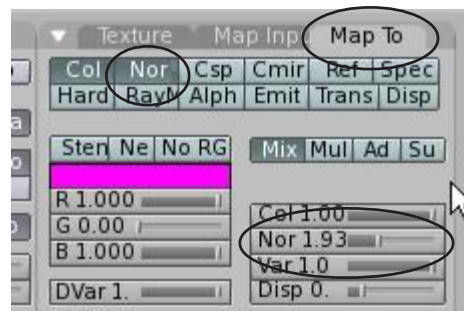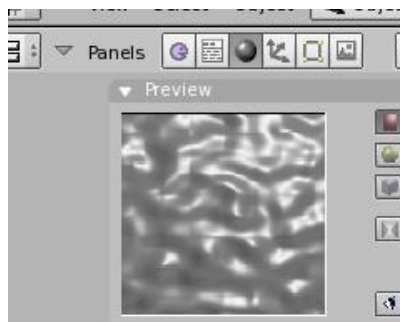
Using JPEG (.jpg) Images as Textures

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! 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:

The Image Button

Rotate 90- if your image points the wrong direction

After loading an image or movie, you will see more options in this panel

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

*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.*

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 this "Select Image" button

When loading an image or movie, the *Image* panel will display this:

Type of image or movie selected

Delete, reload or load another image

Set the number of frames to play of the movie. The small arrow will load all frames.

Tweak the movie with offset and start frame.

Make the movie play in a continuous loop.
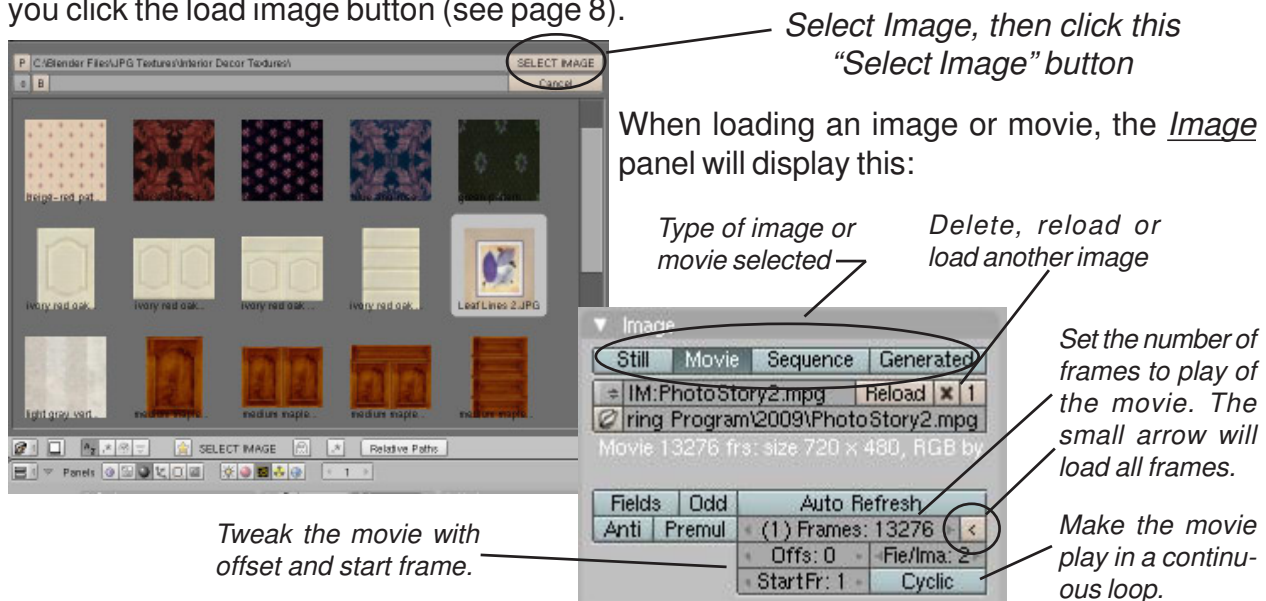
Once you've loaded the image, adjust your setting. There you can make additional corrections to the image. Other textures can be loaded onto your object for combined effects (i.e. Stucci with a loaded jpeg image) by clicking on an empty texture channel in the list, then clicking the "***Add New***" button. 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:
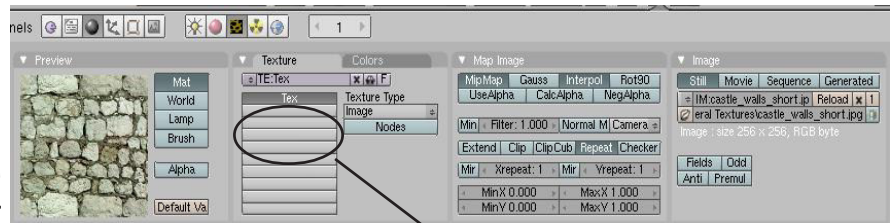
Specularity, Hardness and Emit- *settings discussed before, will effect your end results*

Different ways to wrap the texture around your object. Watch the sample as you try it. ***Flat, Cube, Tube, Sphere***

Important Stuff !

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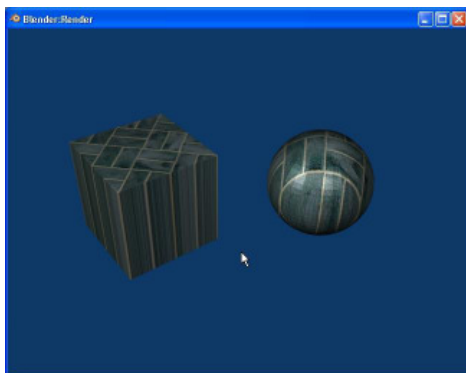
Mapped Flat

Mapped Flat *will cause the image to map on the top of the object and stretch down the sides*

Mapped Cube *will cause the image to map on every face (even if it is circular)*
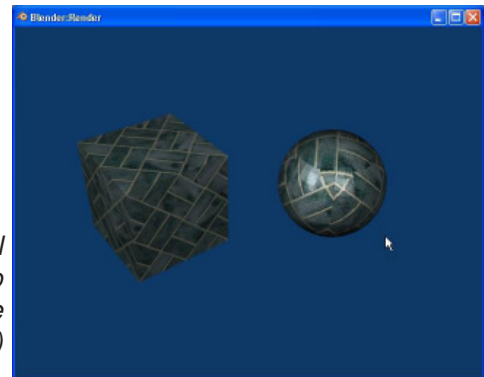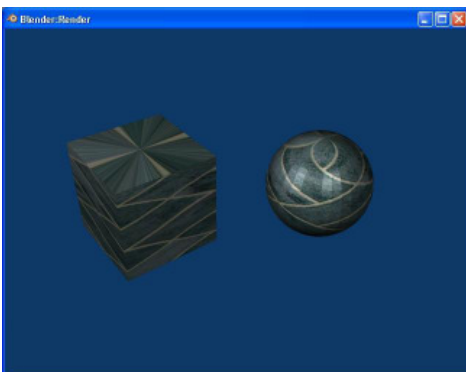
Mapped Cube

Mapped Tube *will cause the image to map around the object and stretch on the top and bottom.*

Mapped Sphere *will cause the image to compress at the top and the bottom as the sphere circumference shrinks.*

Mapped Tube
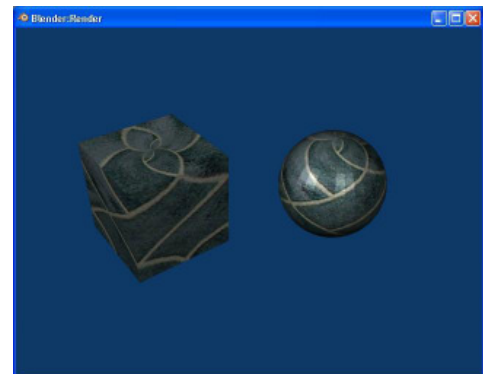
Mapped Sphere

Displacement Mapping:

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

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 Off

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

Paint Image

Displacement On

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

 RoboDude Aks: I've worked with all these settings, but the texture still won't map correctly- what's wrong? *Textures can be affected by rotation and scaling of objects. Try pressing* **Ctrl**-*"A" to reset scale and rotation.*

Let's start by texturing your lighthouse. Open your "**Lighthouse**" model, switch to a *front view* (#1), and enter *edit mode* (tab). Make sure you are in *wireframe* view (*"Z" key*). Deselect all verticies using the "**A**" key (*remember- deselected verticies are pink, selected verticies are yellow*). Zoom in on the top portion of your lighthouse.
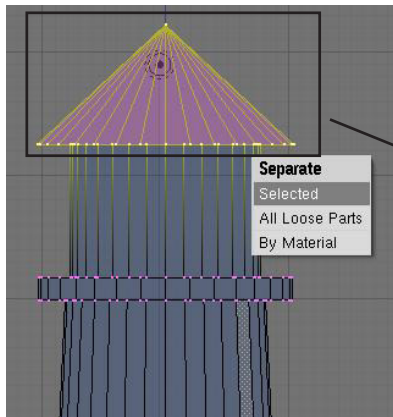
Begin by box selecting ("**B**" key) the top of the lighthouse (*roof only*) as shown. We will seperate these verticies from the rest of the mesh, making it easier to apply a different material and texture to that part of the lighthouse. Press the "**P**" key to partition (*seperate*) and choose the "*Selected*" option. The top of the lighthouse is now a seperate mesh.
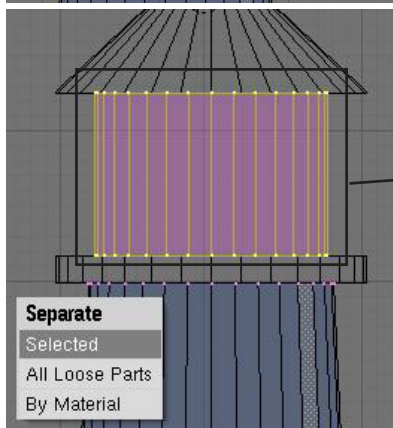
Now select all the verticies that form the walkway with box selection and seperate them using "P".
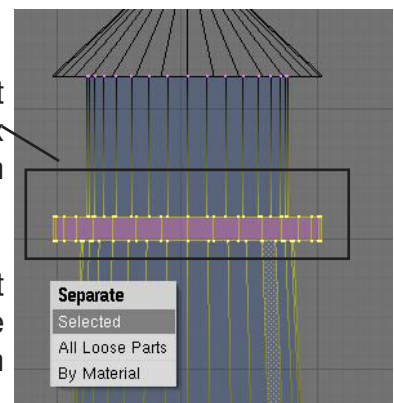
Lastly, select all the verticies that form the lighted area of the lighthouse and seperate them using "P".
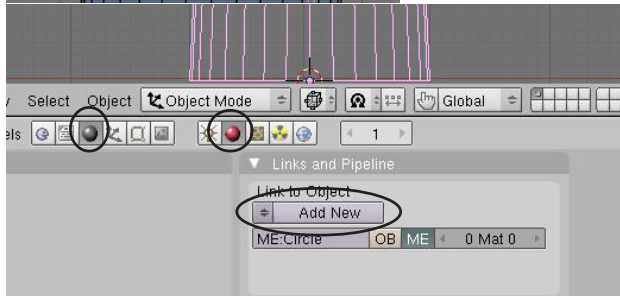
Exit *edit mode* (*tab*) and zoom out to see the entire lighthouse. The base of the lighthouse should be selected. Go to the *Shading* and *Material* buttons. Select "*Add New*". In the "*Links and Pipeline*" panel, name the material **LH Base**. Take the "*Spec*" (*specularity*) setting down to **0.1**. This will keep the gloss down. We do not need to set a color in the RGB sliders since we will be applying an image texture to the mesh.
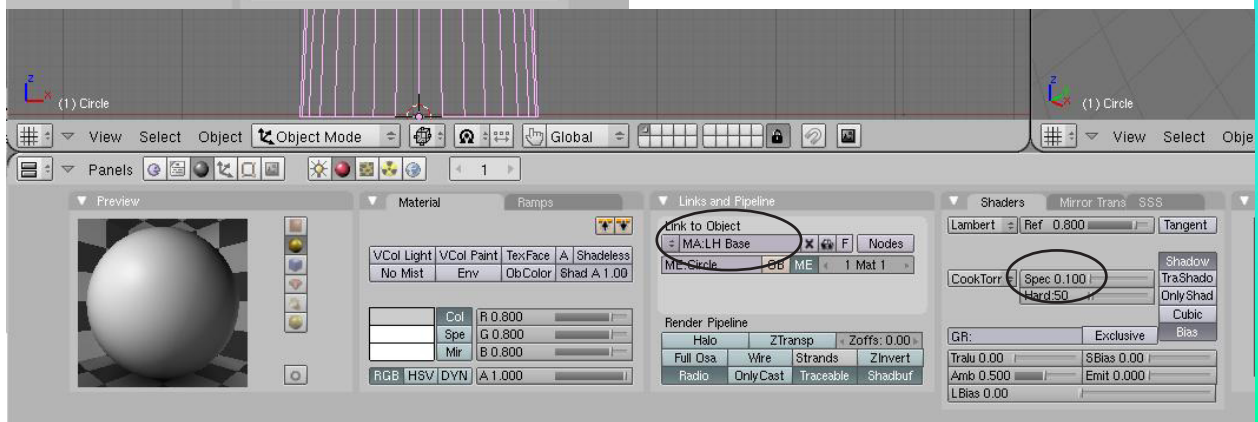
PRACTICE EXERCISE
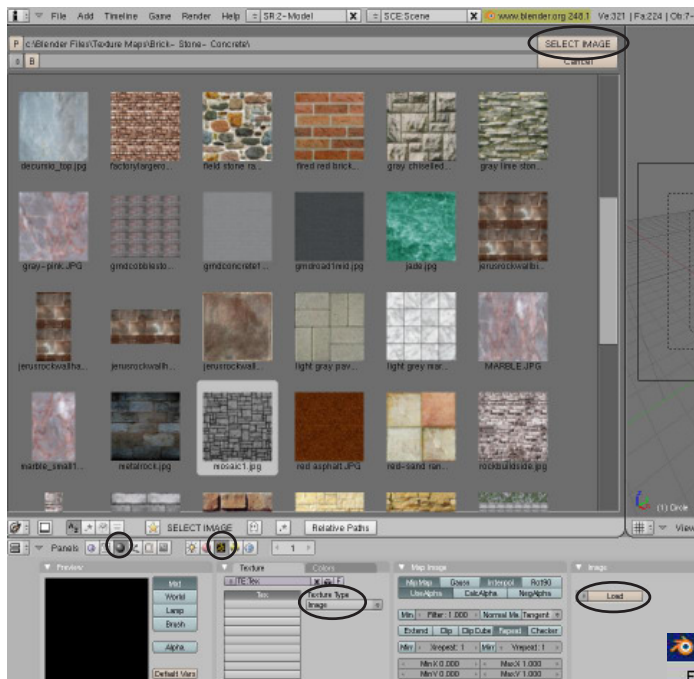
Now it's time to add a stone image in the texture buttons. You will need to find a texture to use. You can search the internet for free stone textures, look through the Blender websites, or go to *http://www.cdschools.org/cdhs/site/default.asp* and look under "Academics" and "Drafting and Design Technology" for a compiled zip file. Once you have some saved images, go to the *Texture* buttons and select the *Image* option. To see thumbnails, hold the **Ctrl** key while clicking the "*Load*" button. Pick your image and hit the "*Select Image*" button at the top. Hit **F12** to render an image like the one below:

Looks a bit distorted. Since *Materials* and *Textures* work together, let's go back to the *Materials* buttons to make some changes. Under the "*Map Input*" tab, change the mapping from **Flat** to **Tube**. Render another picture and you should see an improvement.
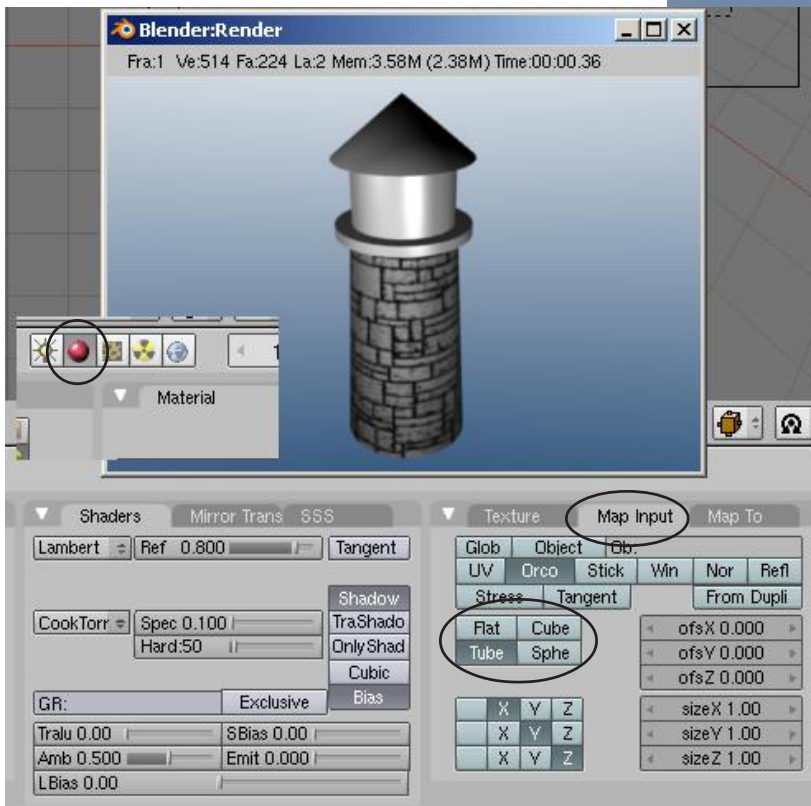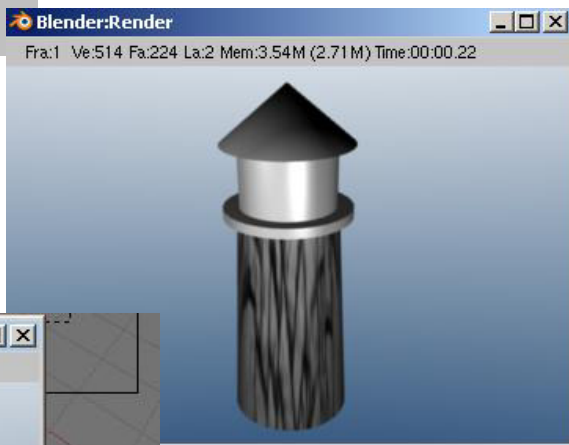
The image should now wrap around the lighthouse nicely, but the stones may be a bit large. The image may also look a bit flat. It would be nice to simulate some depth to that stone texture.

Go back to the *Texture* buttons and find the **Xrepeat** and **Yrepeat** settings. Change them from 1 to a higher number. For this example, we used 3 for each, but depending on the texture you used, it may be different. If your image shows a bad line at the seams, try clicking the **Mir** buttons by each repeat setting. This will *mirror* the image to minimize repeats.
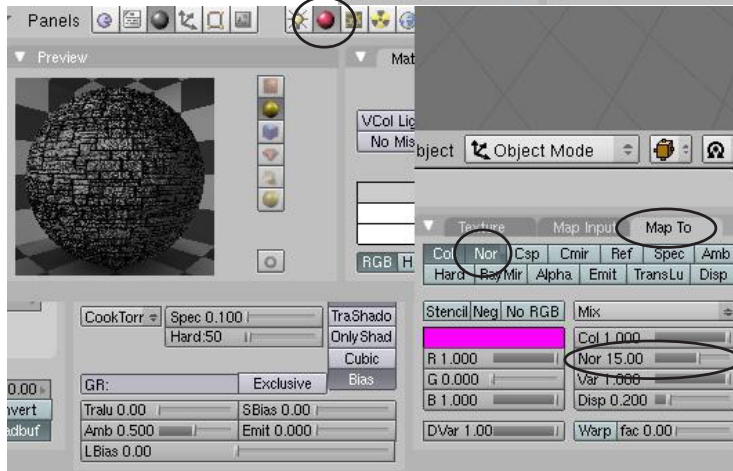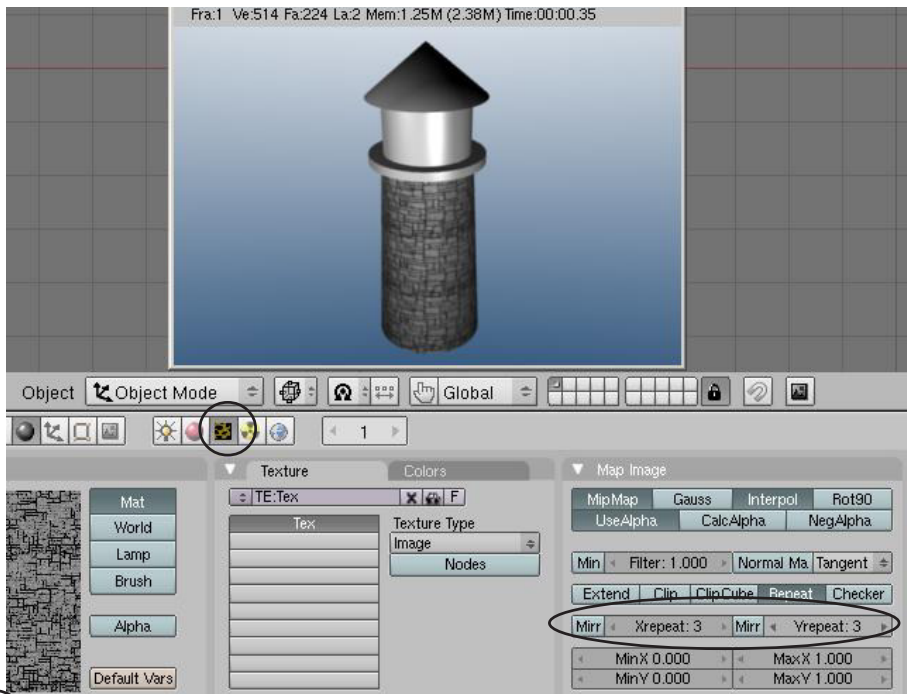
Now it's time to try to give the texture some depth. Go back to the *Materials* buttons and click on the "**Map To**" tab. Find the **Nor** (*normals*) button and the **Nor** slider. Turn on *Nor* and watch the preview panel as you adjust the *Nor* slider. You will notice simulated depth. Some images work better than others. Render an image and adjust as desired.

Continue texturing all other parts as desired following these steps. It's your lighthouse so use your imagination. After all parts are textures, it is time to cut some windows around the top so the lighthouse beam can shine out. We will do this easily by deleting faces in *edit mode*.

delete groups of 3 faces
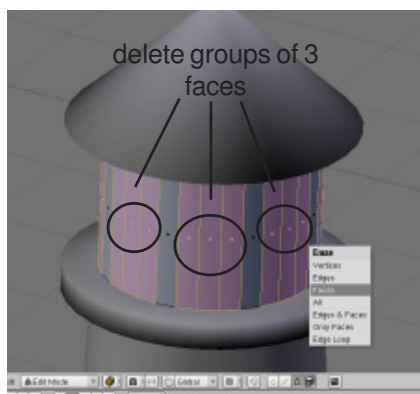
First, select the tube mesh and enter *edit mode* (*tab*). Change from selecting *verticies* to *faces*. (see page 21). You will need to select every 3 faces and delete "*faces*". You will leave 1 face (as the post between the windows), and delete the next 3 faces. Continue all the way around. Since there are 32 divisions, it should work out perfectly all the way around.

Applying Textures-Landscape and Lighthouse

With the faces deleted, exit *edit mode* and render a picture. Your lighthouse should look something like the picture to the right.

Now that we're done texturing and editing the lighthouse, it's time to join the meshes back together. In *object mode*, select all the meshes by RMB (right-mouse-button) clicking on them while holding down the **Shift** key. Hit **Ctrl-J** and confirm the operation. The lighthouse should once again be a single mesh. You should also have a final rendered view, fully textured!
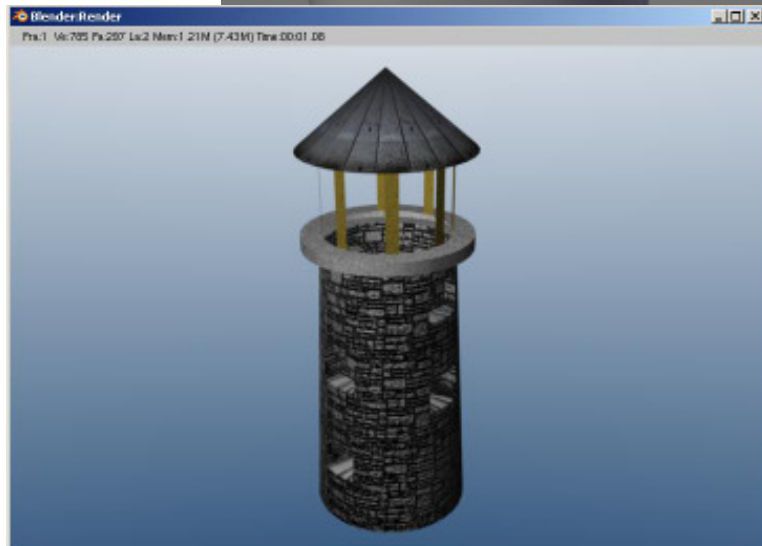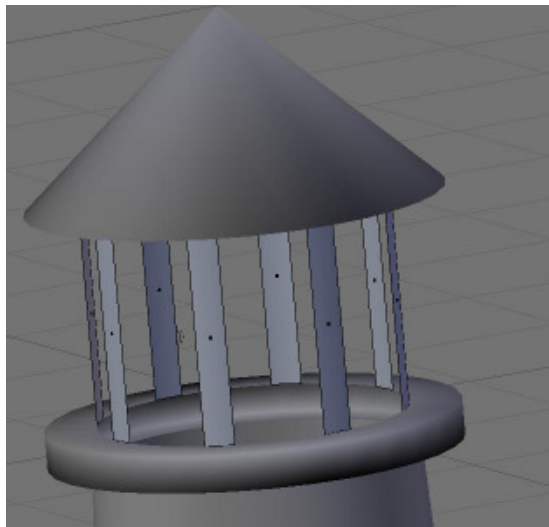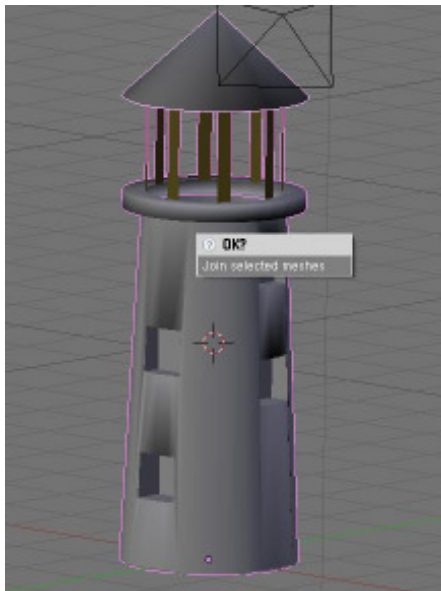
Now it's time to save the "***Lighthouse***" file and bring up the "***Landscape Scene***". It's now time to find a nice grass/dirt texture to use on our ground and repeat the same process we used for the lighthouse. Since we already have a material from the previous lesson, we can use it. Take *Specularity* down since it shouldn't be shiny. Add a new texture and load an image of your choice. Use the *X and Y repeat* setting as needed and apply *Nor* (normal) to show depth. You may want to keep this image *Mapped Flat*. Here's the final result:

Let's work on the water now. Select the plane representing the water. Again, use the material we previously created. Keep *Specularity* high since water is glossy. We will be using Blender's built in cloud generator instead of an image for this one. Go to the *Texture* buttons and add a *Cloud* texture. If you render a picture, you will see the original blue and the pink color. Go back to the *Materials* buttons and change the secondary color in the *Map To* panel to a slightly different shade of blue/gray.

Remember that our goal is to have a stormy night so pick colors that would reflect that type of scene. Adjust both colors for the best effect. Adjust the *Nor* (normal) setting to show waves and render an image to check.
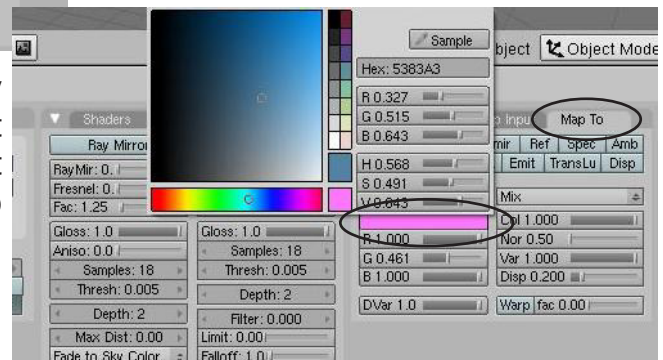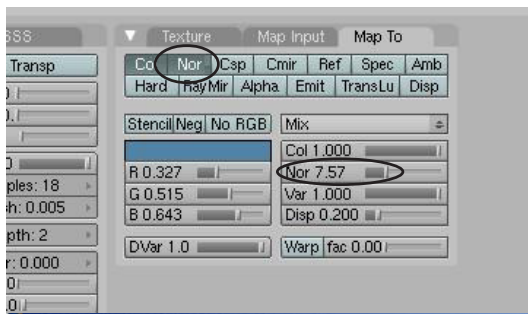
Go back over to the *Texture* buttons and experiment with different "*Noise Basis*" options to get a desired look for your waves. Some will look better than others.
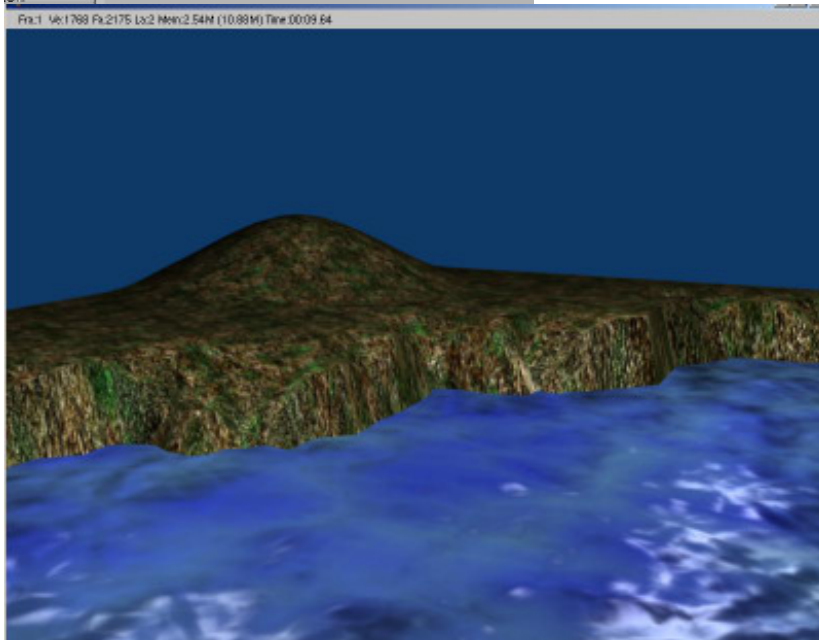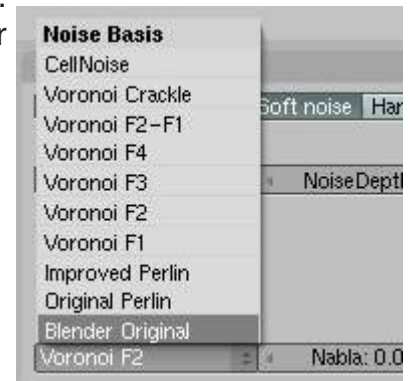
That's it for now, The rendered image should look like a fair water texture for simple settings. We will come back in a later chapter and animate some waves. Remember to SAVE !

*** Call the instructor when finished***

Using Color, Stars and Mist

You've created a nice scene for your lighthouse, 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:

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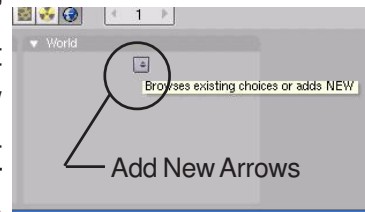
Use the **Real** button to give you movement when the camera moves

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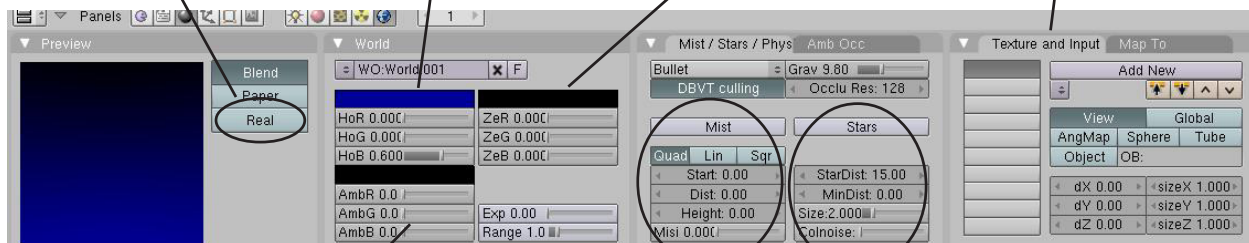
Ambient Color- gives you an overall lighting effect. Good if you have only a few lights and still want everything to be illuminated

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 **Start** (start from camera distance) and **Dist** (depth of mist). You also have a **Height** setting to vary fog height. The Misi slide can adjust intensity.
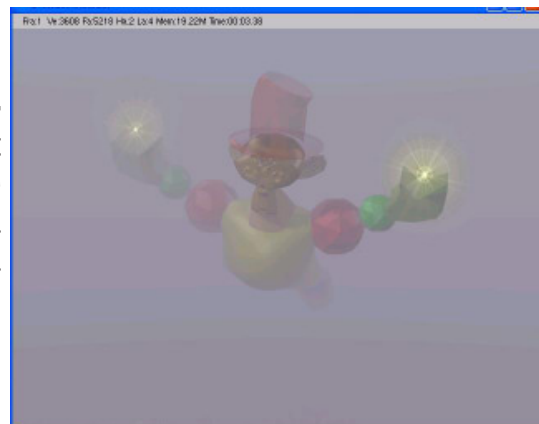
RoboDude Asks: I put a Mist in my scene, but when I render, I can't see anything-Why? If you render a blank image with the F12 button, the Dist. setting needs to be higher. The fog is too thick to see through!

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**.

> **RoboDude Says: 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!**
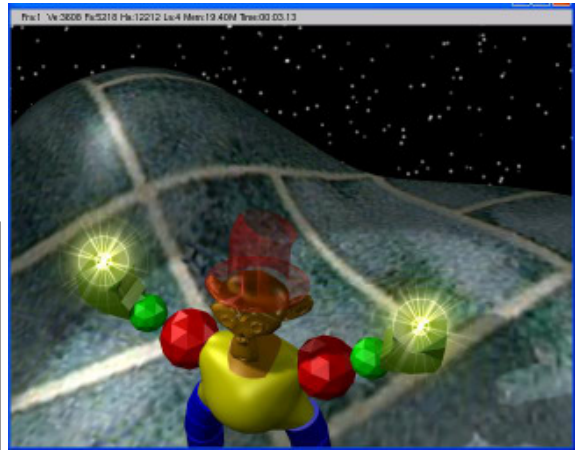
*Try a different **Noise Basis** for different looking clouds. The Voronoi F2-F1 looks nice.*

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.
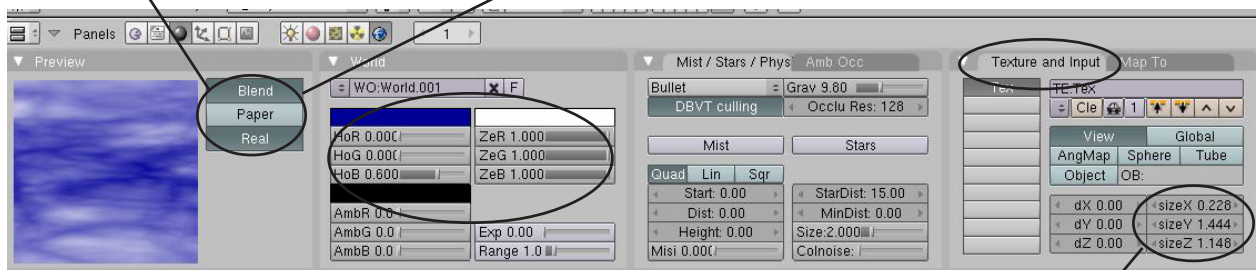
Size X and Y- Adjusting these can stretch out the clouds for a more realistic look.

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***". You may also want to hit "***Paper***" by the preview. 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.
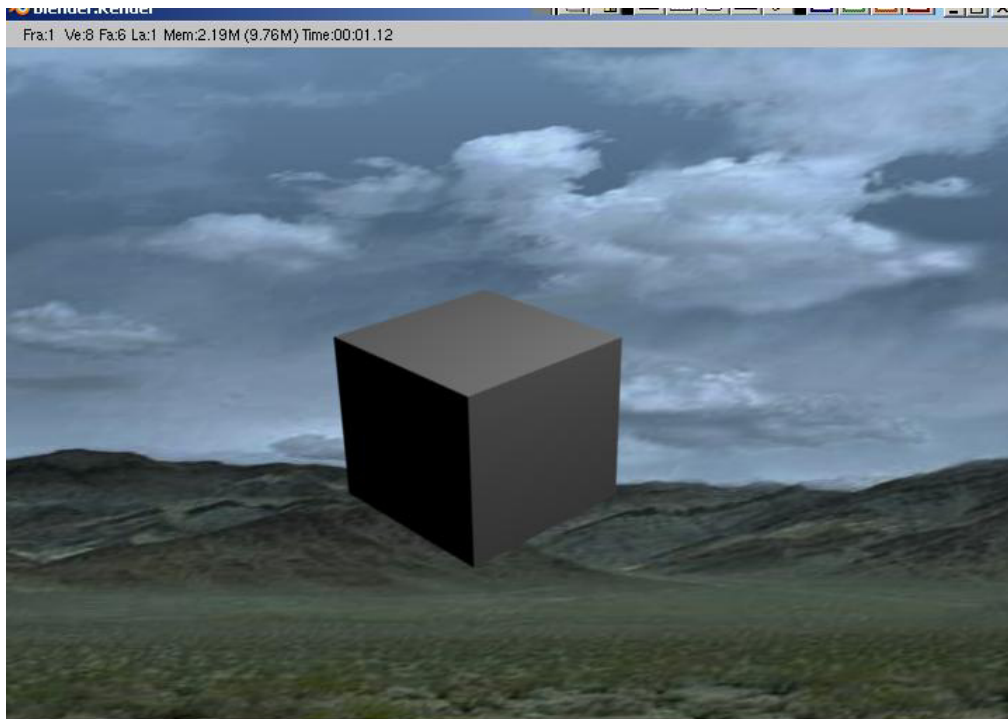
Final rendering with an image in the world.

Open your *"**Landscape Scene**".* Before we add a world to your scene, we need to **Append** your lighthouse into the scene. Append was discussed back in Chapter 1 (*page 10*) and is used to bring elements from one Blender file into another one. With the *Landscape Scene* open, go to "**File**" and "**Append or Link**".
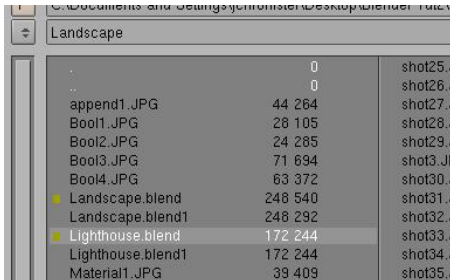
Find and select your "*Lighthouse*" file.
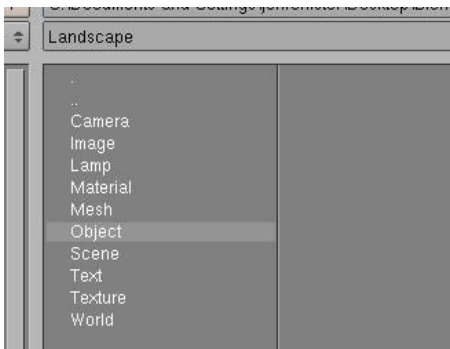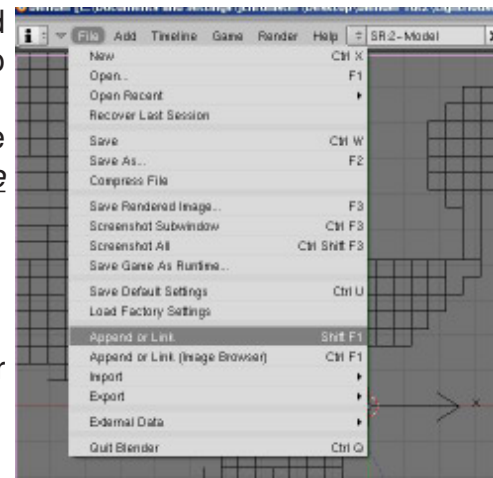
In the append window, select "**Objects**" which will take you to all of the objects in the lighthouse file. You should only see a camera, a few lamps and the circle object that represents the lighthouse. If you see more than one object, you might have forgotten to join the meshes back together. Go back into the lighthouse file and do that before you append. RMB click on the mesh *Circle* that represents your lighthouse to select it, then click the "**Load Library**" button.

Your lighthouse will now be in your landscape scene. It will probably need to be scaled and moved to a good location. Always work in your 3 principle views (#1,3,7) to get it accurately moved and scaled. Try for something like this final rendering.
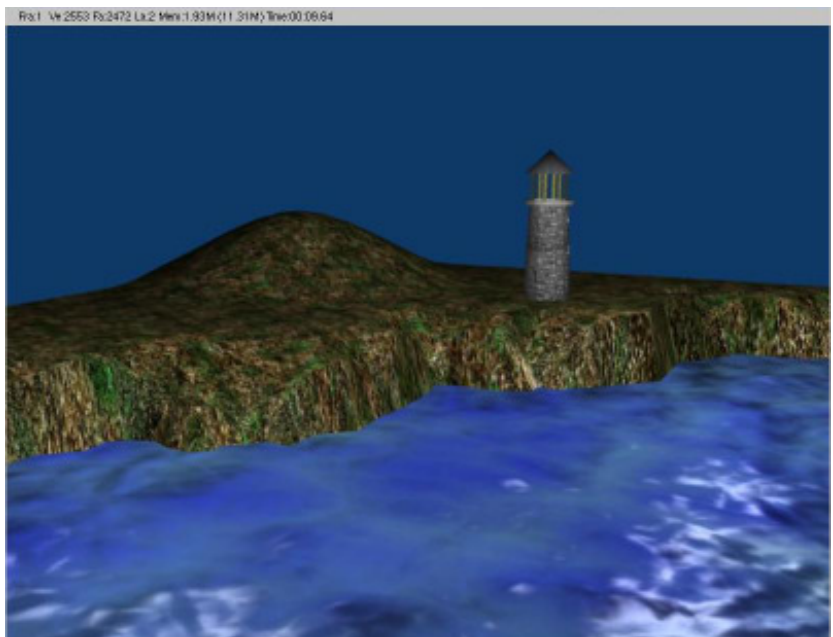
Adding a World to Your Landscape

It's time to add a world to our scene. Feel free to experiment with any of the settings, but we are actually looking for a "dark and stormy night", say, at late day or dusk. I imaging it being foggy, with a billowing effect.

Start by going to the *World* buttons and delete the default world by hitting the "X" by the name block, then "***Add New***".

Since we want a fog, set the *Horizon* and *Zenith* colors to 2 slightly different shades of gray. To do this, you cna click on the color swatches and pick the gray from the menu blocks.

Turn on the **Mist** button and start with a *Dist* setting of about **25**. Render the image and make adjustments as needed. Your goal is to be able to see the lighthouse, but a bit foggy.
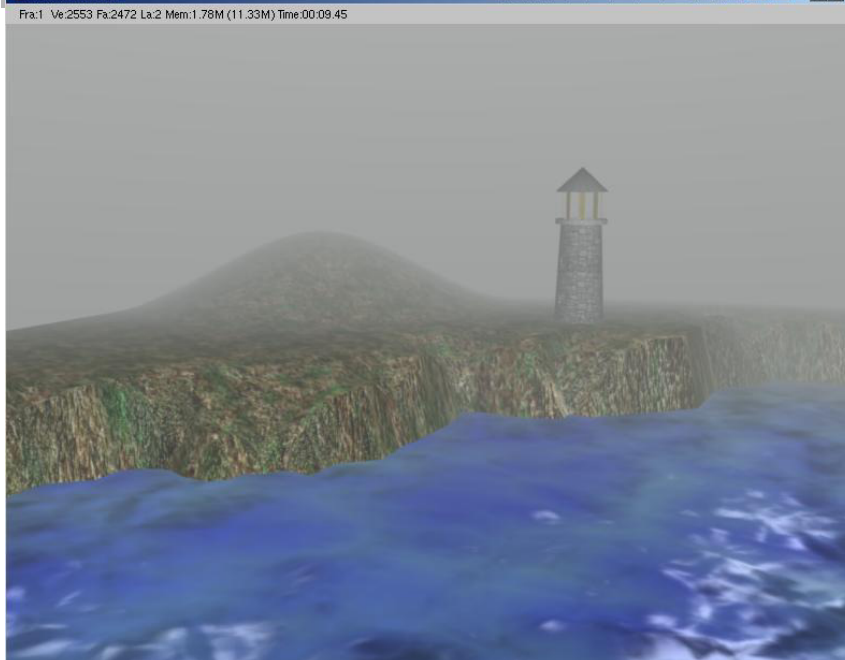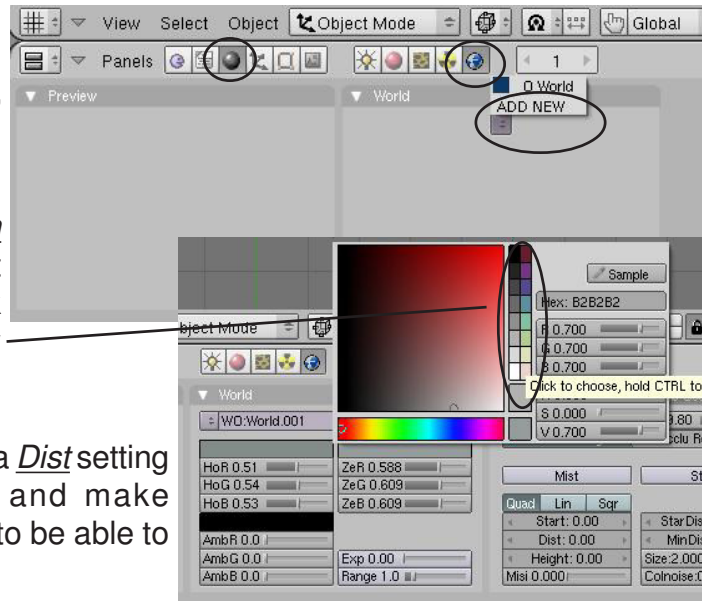
You should get a render that looks something like this.

This foggy scene looks good, but it would be nice to see some depth. Many times, a fog can appear "billowy" with varying density. For this, we will add a *Cloud Texture*. Go to the *Texture* buttons and add a *Cloud* texture. Make sure *World* is selected by the preview. Try different *Noise Basis* settings to get the look you want.
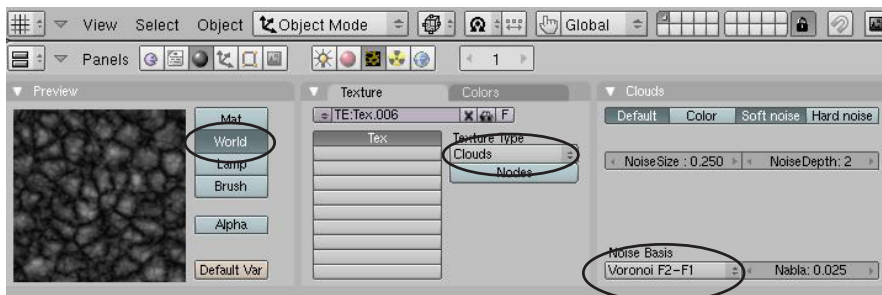
At this point, go back to the *World* buttons, render an image and make adjustments as needed. You can adjust the sizes of the cloud texture, adjust the colors, work with the mist settings (*Dist, Misi*). You may also want to go back to the texture settings and adjust the Noise Basis. We will animate this fog rolling by in a later chapter.

*** Call the instructor when finished**

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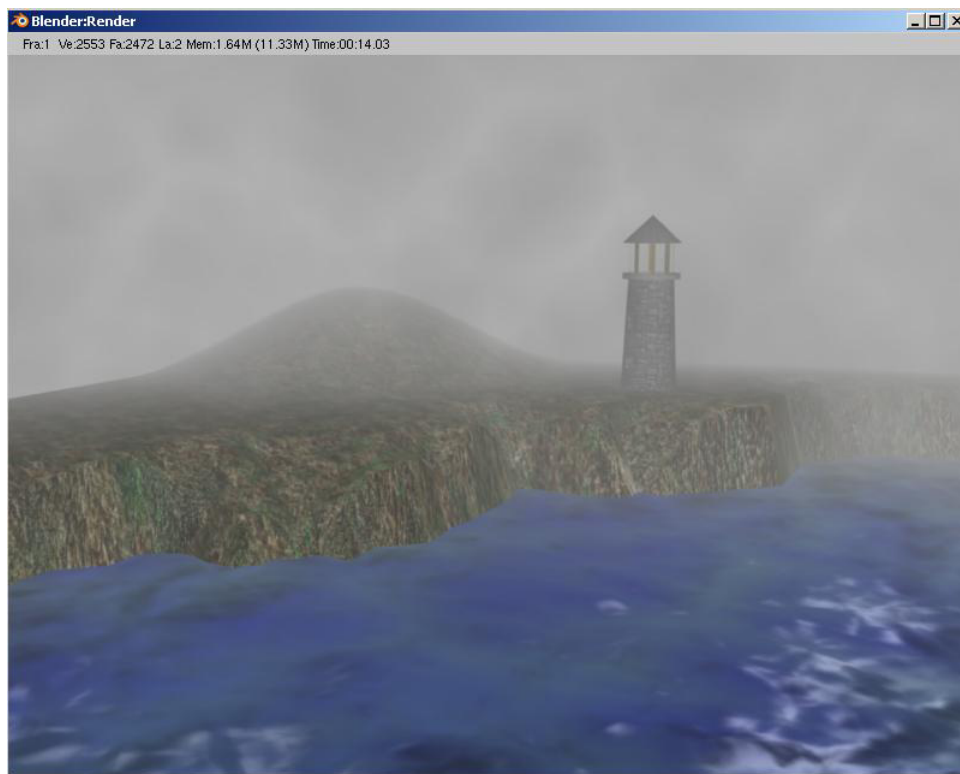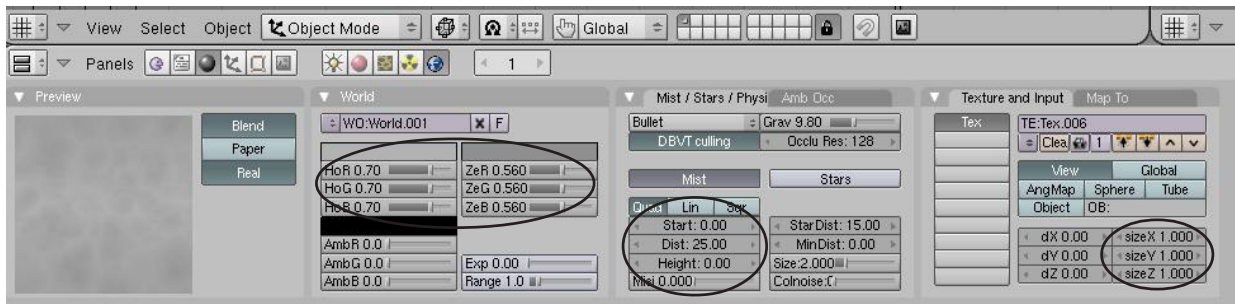
Lighting Types and Settings

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

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

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

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

<u>Lamp Settings:</u>

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

> ***RoboDude Says: Instead of adding too many lights, experiment with the Distance and Energy settings!***

Lamp Types-choose the style

Distance and Energy Setting- how bright and how far the lamp shines

Lamp Name   Lamp Color   Shadow and Spotlight Settings
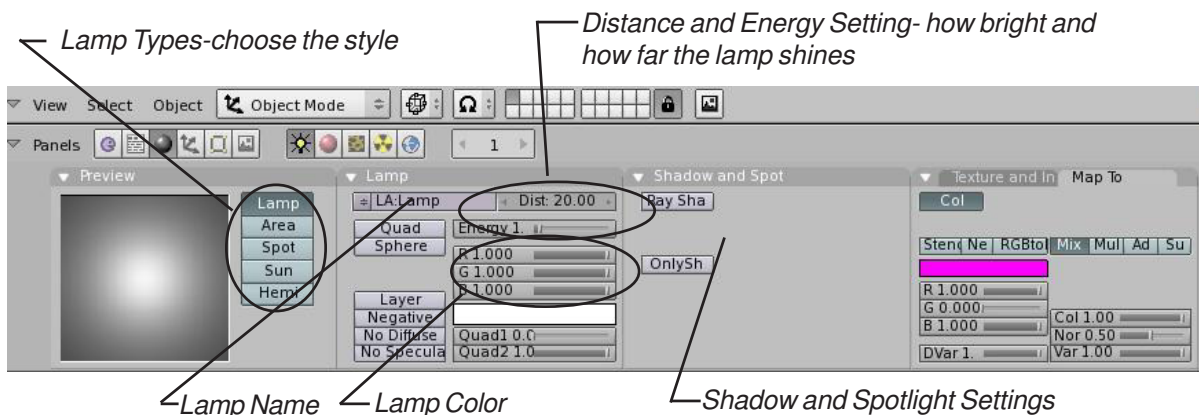
There are other lamp setting available, but for now, these are the basics.

Spotlight Settings:

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

Select Buffer Shadow- traditional, faster spotlight settings

Samples and Steps control quality and effects

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

Lamp Color, Distance, and Energy as before

Halo and Halo Intensity- gives and controls a smokey effect

Buffer Size-higher numbers mean smoother shadows

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

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

and find the **Shadows** button. If **Ray** is turned on, turn it off at this time.

RoboDude Asks: *I have Buffer Shadows on and set to render, but why do my shadows look bad?*
If your shadows do not render well, experiment with the Clip Start, Clip End and Shadow Buffer settings.

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

Cameras:

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

Like all other objects in Blender, you can adjust the camera settings as well. *With the camera selected,* click on the **edit button.** Here are some of the settings options you have:
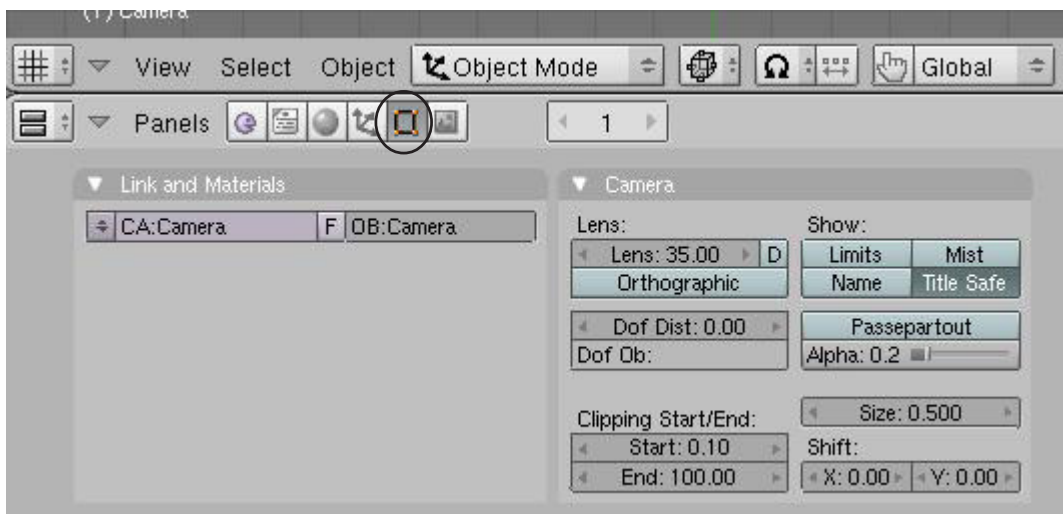
Lens-	Set-up a lens length much like a real camera. 35mm is a good, safe setting, but wide and tight angle setting work for different needs.
Clip Start-	How close an object can get to the camera and still be seen.
Clip End-	How far away objects can be seen by the camera. In very large scenes, this needs to be set higher or things "disappear" from view.
Size-	How big to draw the camera on the screen. You can also control size with scale.
Ortho-	Used to set the camera from showing a true-life perspective view to an orthographic view.
Show Mist-	Used to give you a visual display of how far the camera sees if using Mist (discussed in Chapter 6).
Limits-	Draws a line in the scene to help you visualize the camera's range
Name-	With all objects, the name of the object or camera can be displayed on the screen, but this will display the name in the camera view.
Title Safe-	Displays the inner dashed box to help with placement of objects and text.
Passepartout-	Shades the area on the screen outside of the camera's view. You can control the darkness of the shaded area with the **Alpha** slider.
Shift-	Pushes the camera's view in a direction, without changing perspective.
Dof-	(Depth-of-field)- Used with nodes to blur foreground and background objects. This will be discussed in the "*Working with Nodes*" chapter.

What is a lighthouse scene without a light shining out through the fog? Open your "**_Lighthouse Scene_**" and place the 3D cursor directly in the middle of the lighthouse where the spotlight should shine. Use your 3 principle views (#1,3,7) to place the cursor in a good location. After the cursor is located, check to see if you are in the _front view_ (#1) and add a **Spot Lamp** (_Space Bar-Add-Lamp-Spot_).
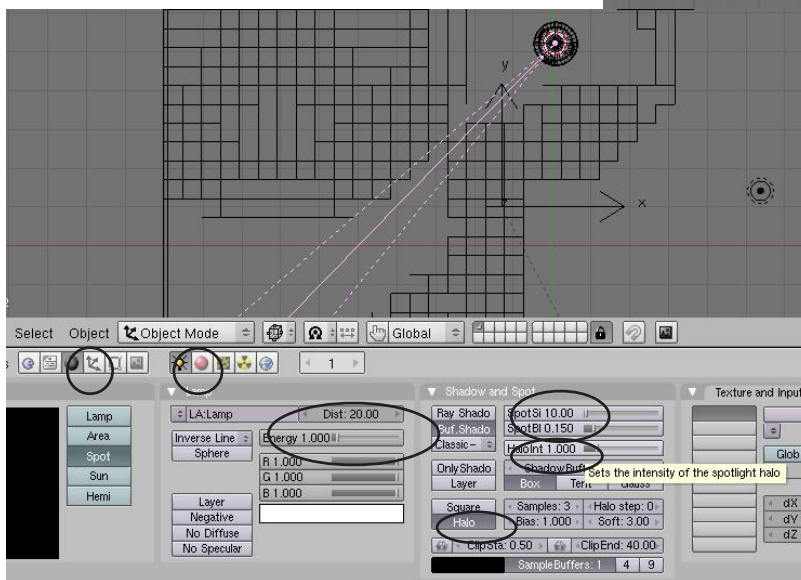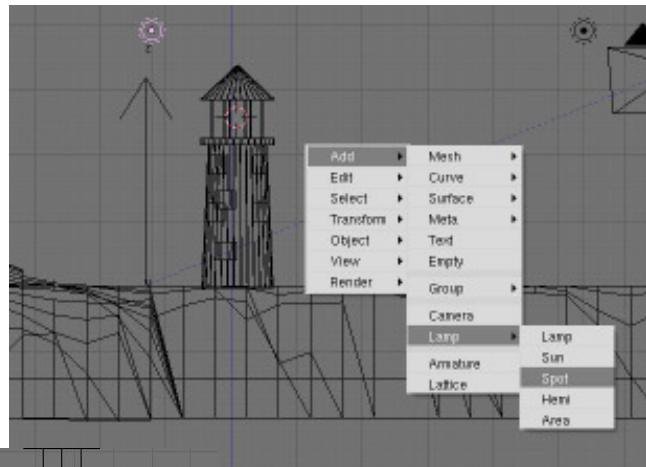
After the lamp is added, go to the _Lamp buttons_ (_Shading-Lamp_) and adjust the **Spot Si** slider to about **10**. This will give you a narrow beam that is about 10 degrees wide. In the _top view_, rotate the lamp to point to the left to give you a nice rendered view. Also turn on the **Halo** button. Render an image. Fine tune the spot light with _Distance_ and _Energy_ setting and the _Halo Intensity_ slider.

Your final rendering should look something like the image on the right. Looks good, but something is missing. There should be something in the middle of the lighthouse emitting that light. We'll do something simple, but effective for that next.
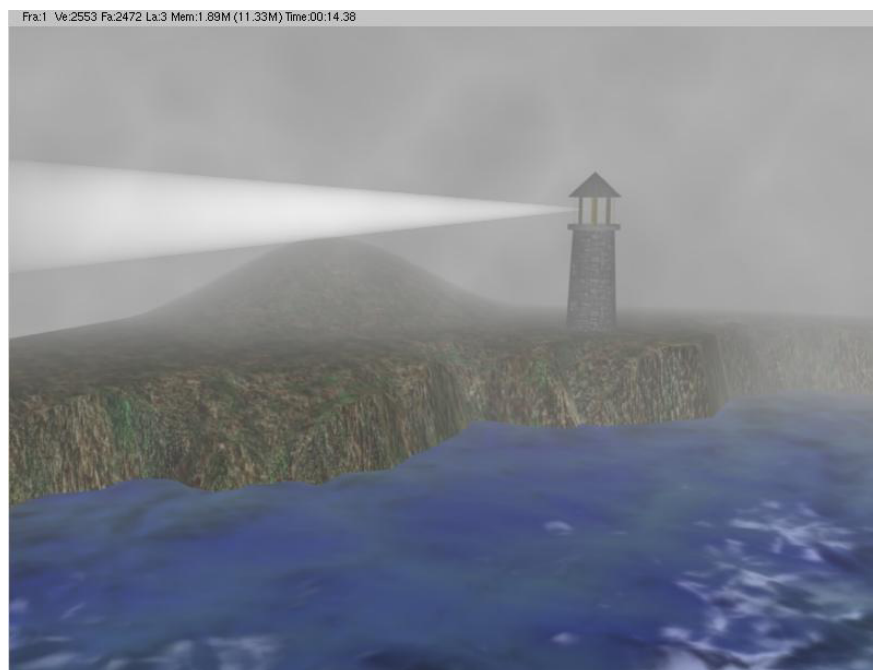
Lighting Up Your Landscape

Now it's time to add something in the middle of that lighthouse. Basically, we're going to add a mesh with a single vertex and place a *Halo Material* on it.

keep and move to center

erase

Erase
Vertices
Edges
Faces
All
Edges & Faces
Only Faces
Edge Loop
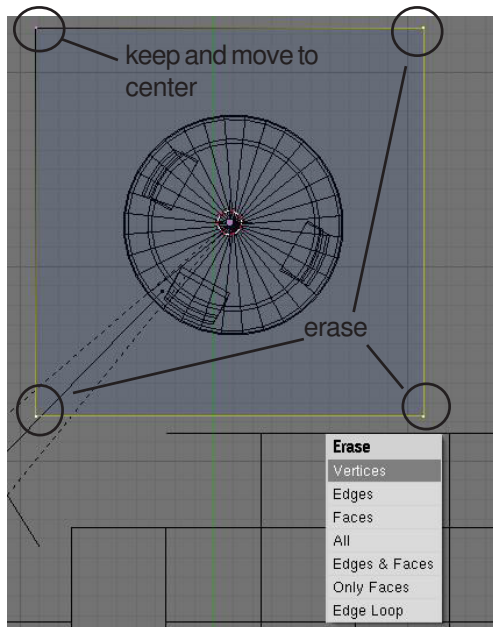
Start by making sure the 3D cursor is still in the middle of the lighthouse top. If it isn't, an easy way to get it there is to select the spotlight and hit "**Shift-S**" and select the option "**Cursor to Selection**". This is a great command to use and use often. In the *top view*, add a *plane*. Delete *all* but one verticie. Move that remaining verticie to the center of the lighthouse. After you move the one verticie, exit edit mode.

Now go to the *Materials* buttons and *Add* a new material. Press the *Halo* button and go to the *Shaders* panel. Here, you will see some Halo settings. Adjust the *Halo Size* (try 1.0 or more), turn on *Rings* and *Star*, and try adding more Rings and Stars. You may want to try adjusting the *Hardness* and *Add* sliders.
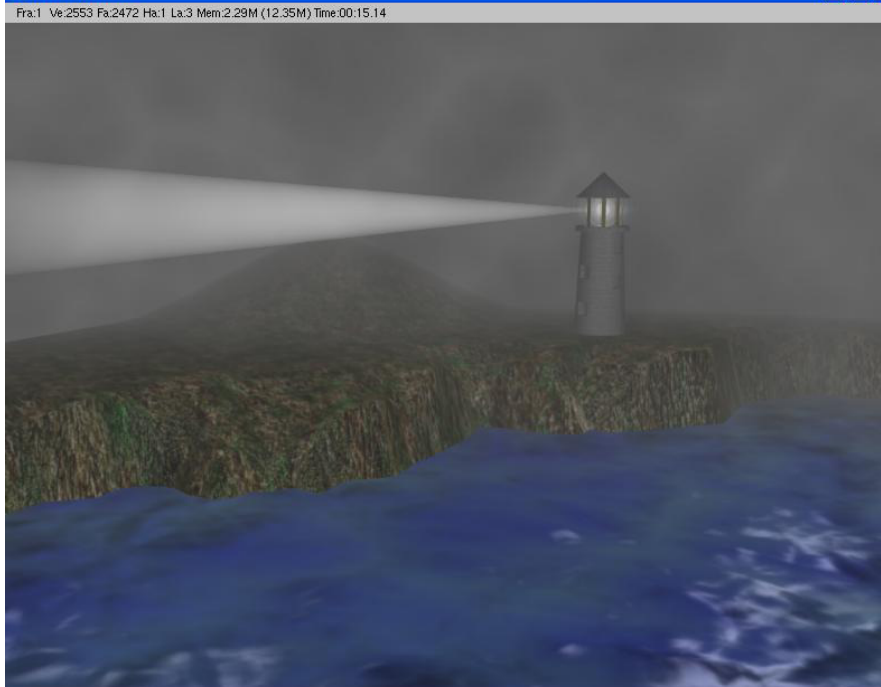
Your end result should look something like this with a ring and star in the center of the lighthouse. You may need to darken your world setting a bit to get the best effect.

Call the instructor when finished

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 (.mpg) movie format. Be aware that other options exist and more are added every few releases.
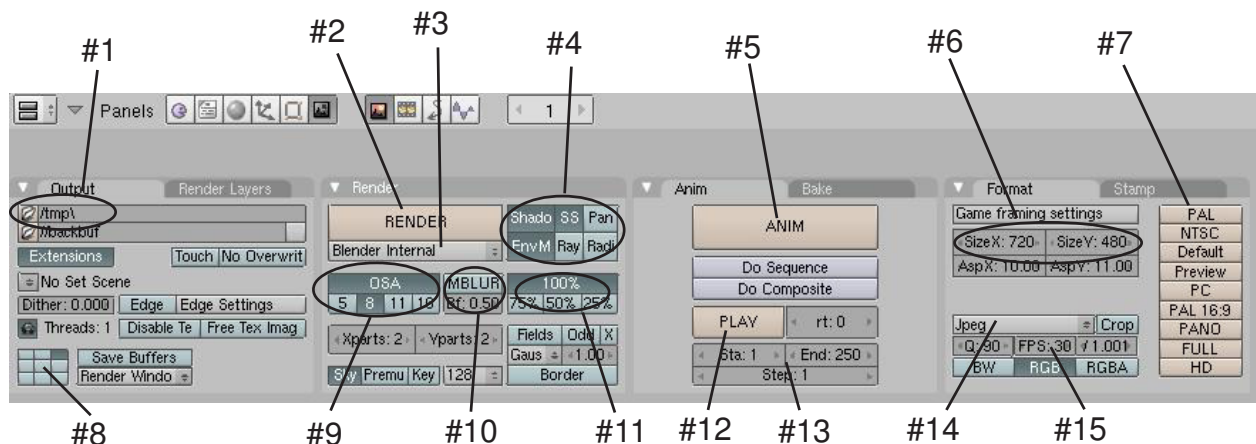
#1.   ***File name and saving location***- Click on the small file folder icon to create a file name and select a save location. It's a good idea to type the *.mpg* (movie file) and *.jpg* (image file) after the name you give the file. This keeps Blender from adding numbers after your file. (Blender does this to show which frames were rendered)
#2.   ***Render Button***- This is the same as pressing "F12" to bring up the render window.
#3.   ***Render Engine***- Blender is creating support for other external renderers. Keep this set to *"Blender Internal"* to use Blender's internal renderer.
#4.   ***Additional Settings***- Right now we are only interested in the "*Shadows*" button and the "*Ray*" buttons. Use the shadows button if you've used lights that cast shadows (spotlights). The Raytracing button will be discussed in the next chapter.
#5.   ***Animate Button***- Press this button to actually make the movie or sample files of your animation. Get ready to sit for a while because this is what takes some time depending on the size of your animation. *Use this after all your other settings are complete.*

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

#7. **Preset Rendering Sizes**- Pressing these buttons will set up #6 for you. *We usually select the "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 "*FFMPEG*" for a movie. If you select a JPEG, then set the quality option under the box. If you are selecting an FFMPEG, you are creating an MPEG2 file by default, but can change to others. 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). Hitting the NTSC button will automatically change this to 30fps. New animators often have trouble animating things at a normal speed. Either things happen too fast or too slow. This gets better with practice.

> **RoboDude Says: Experiment with these settings to become comfortable with them. It's sometimes best to work and model with small output sizes, then render at higher 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.**

Creating an MPEG Movie File

In chapter 9, you will be creating your first computer animation. After you create all of you 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 MPEG Movie File:
(our settings)

1. Select "**NTSC**" (or whatever your output choice) in the **Format** Panel.

2. Change the file type from JPEG to **FFMpeg.**

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 ".mpg" 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 you 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.
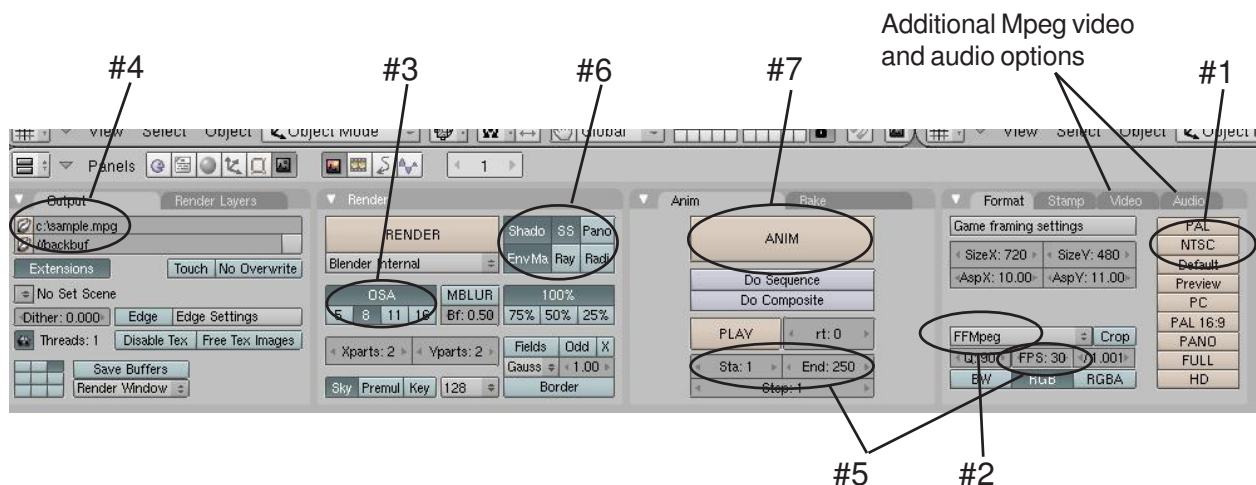
Rendering- Saving a Picture of the Landscape

Open your **_Landscape_** 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 NTSC button to render an image at 720 x 480.*
5. Name your file: *Landscape Image.jpg*

Double check all other settings as per the chapter descriptions, render image (F12) and save the image (F3). *Don't forget to add .jpg to the end of the file name!* 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.

Additional Exercise:
Render your landscape at the "**FULL**" size setting in the preset rendering size options. After you save it, open the picture in a program that allows you to set it as your desktop background (*i.e. Windows Picture and Fax Viewer*).
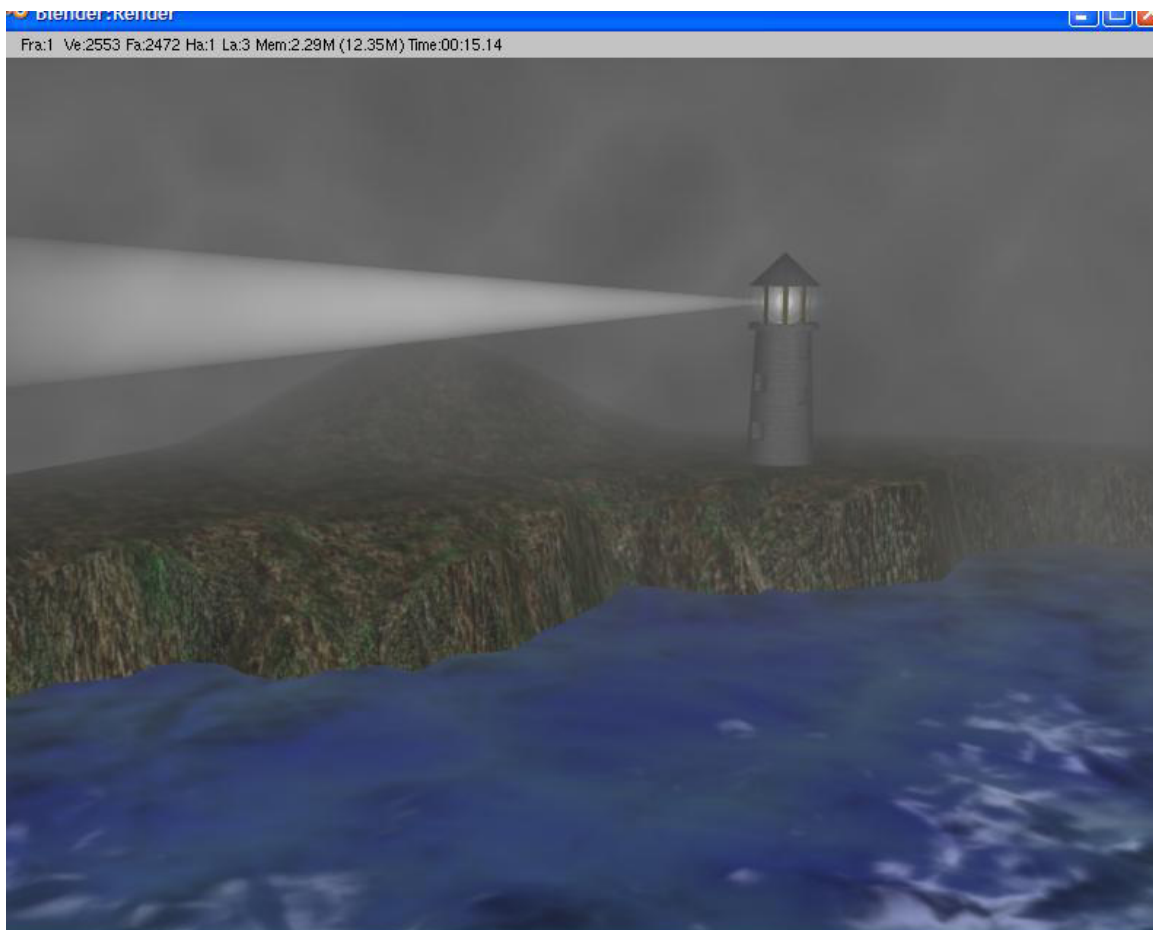
*** Call the instructor when finished ***

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.

When you activate ray shadow, you will see a few setting for most of the lamp types. You will see "*Soft Size*" settings for edge softness and "*Samples*" for improved quality.
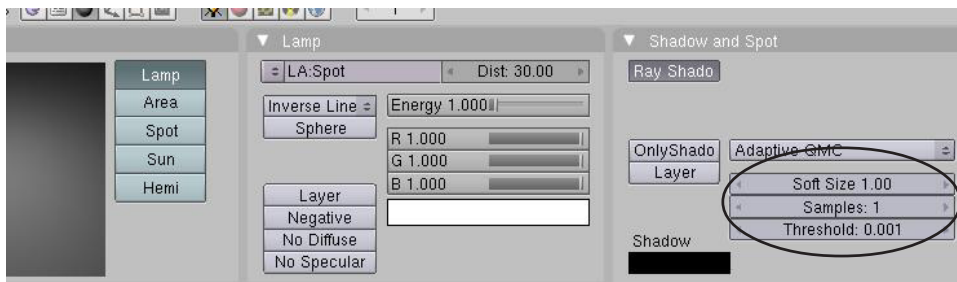
You will notice a few extra setting options for a ray spotlight. *Spotlight Si*, *Spotlight Bl*, and *Halo Int* work the same as they do for a buffer shadow spotlight.
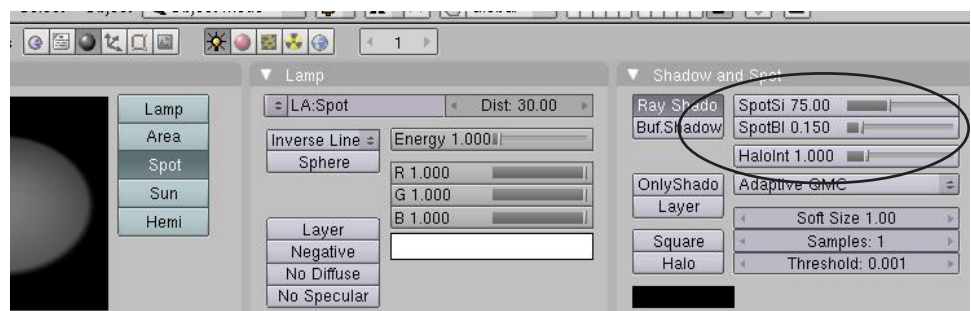
Reflection (mirror) and Refraction (transparency and distortion)

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. The **Ray Mir** slider controls the amount of mirror. A full slider would be a perfect mirror.

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.

Mirror Settings: _Transparency Settings:_

Turn mirror on/off ———————————   Turn transparency on/off

RayMir- sets the degree of   IOR- (index of refraction)- used
mirror   to provide distortion through a
                                                                                                transparent object
Fresnel- controls degree of
mirror   Fresnel- set how transparent
                                                                                                the object is
Depth- controls quality

Max Dist- controls how far away   Depth- controls quality. If you
things reflect in the surface.   are looking through a multiple
                                                                                                layed object (like a drinking
What the mirror should fade to   glass), this will help with real-
pas the Max Dist.   istic transparency.

High mirror setting to make   Transparency with IOR for
the monkey look like chrome   refraction

Ray shadow on light

Light mirror setting on
the floor
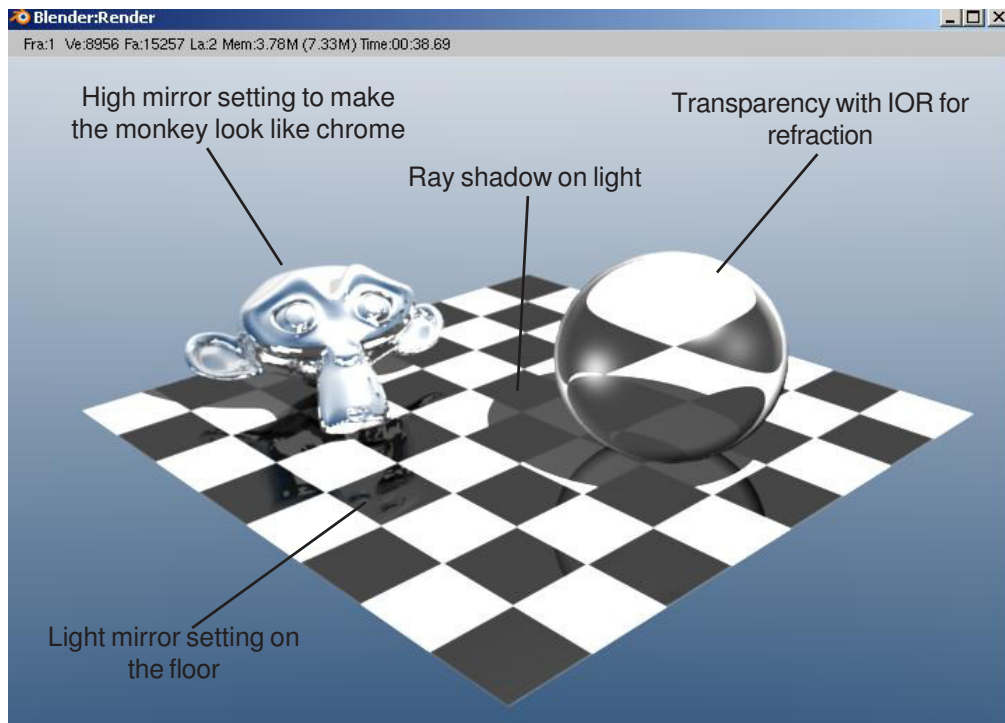
Since we don't have many objects that would work well with mirror/transparency in our lighthouse scene (except the water, which would create a slow rendering), we will create a new scene for our raytracing exercise. Create any model you like using any meshes you wish and apply materials and textures. The scene must contain:

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.
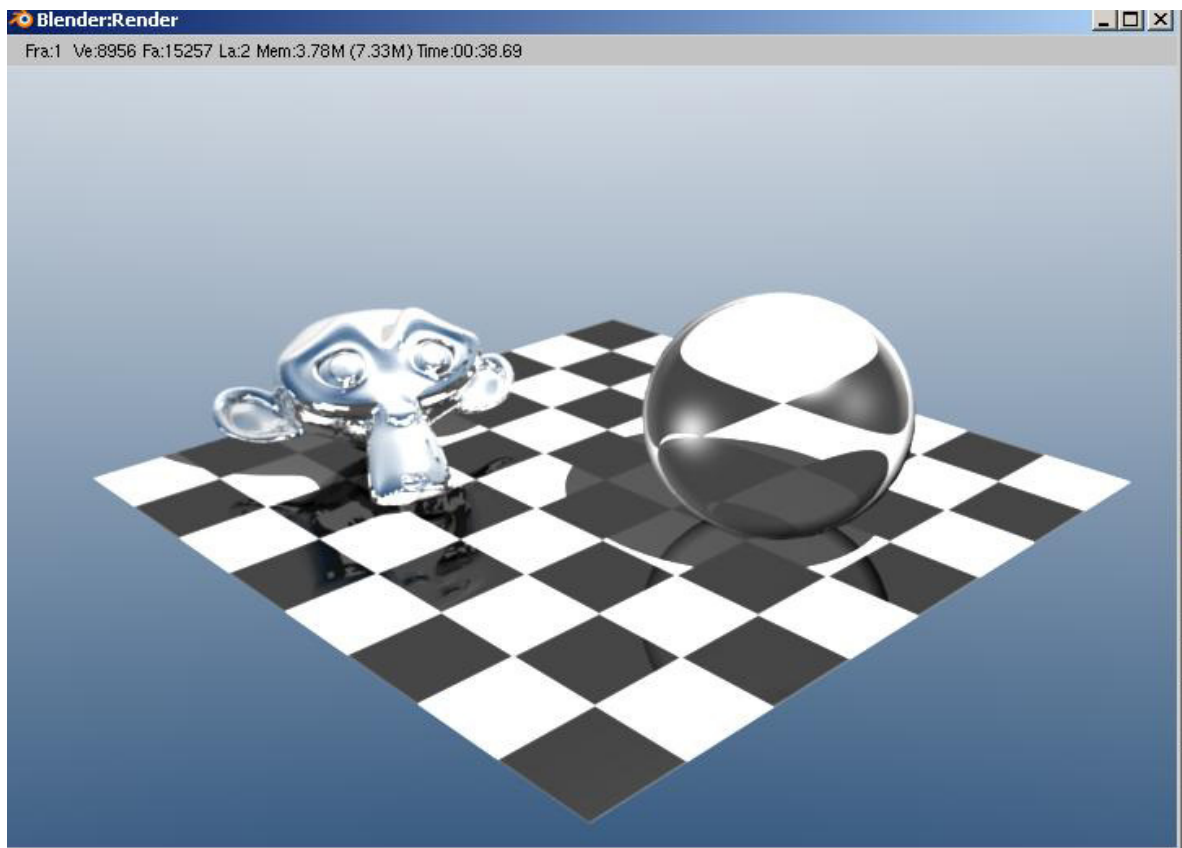
** Call the instructor when finished**

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. NTSCis 30 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.

> **RoboDude Says:**
> If an object doesn't seem like it rotates properly with animation keys, try pressing **Ctrl-A** to reset the object's scale and rotation.

Moving, Rotating and Scaling:

These are the 3 basic modifiers to use on an object in animation. When you create keyframes in Blender with these modifiers, Blender will figure out all the *inbetween* locations on the other frames. To insert a key on an object, go to the frame where you wish to place the key, move, rotate or scale the object, then press the "***I*' key** to "***Insert Key*'". Make sure your cursor is in the 3D window when you push the "I" key. The menu to the right pops up. You have 3 main options for now- *Loc* (location), *Rot* (rotation) and *Size* (size or scale) and combinations of these. We'll talk about the *Mesh* option in a later chapter. Select the key option of what you've done to the object. Now, advance to the next frame where you want to put a key (i.e. frame 25 if you want a movement to occur after 1 second), move, rotate or size the object, then press "***I*' to insert another key**.
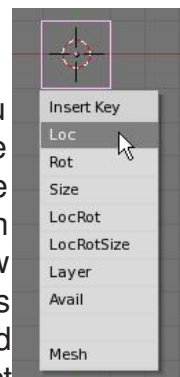
Continue placing keys along your timeline to create your animation. For the most part, location and size keys work flawlessly, **but care needs to be given to rotation keys**. If you try to rotate an object too far in one set of keys, the object may not rotate in the exact direction you want it to. It may rotate oddly. Try small angular steps while animating rotation keys. There are ways to control this better and tools to simplify this process that will be discussed later.

Viewing Your Animation:

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

Working With The IPO Window:

Animation is difficult to do without some basic knowledge of the **IPO Window**. If you are working in a split 3D window screen (as previously discussed), change the right hand viewport to the **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.
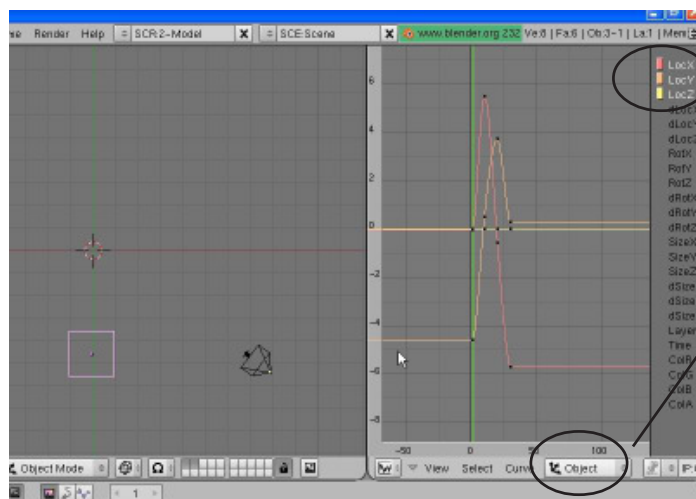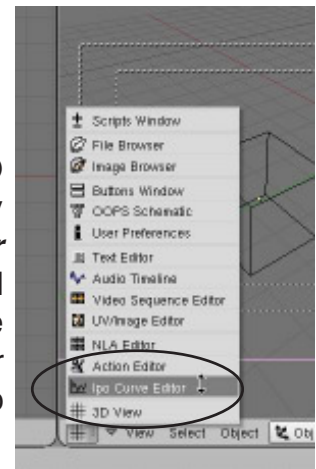
Right now, you are looking at the **Object's** animation keys, but you can animate a lot of different things in Blender, including materials and world settings. To view the different types of animation tracks, select the *"Ipo type"* window.
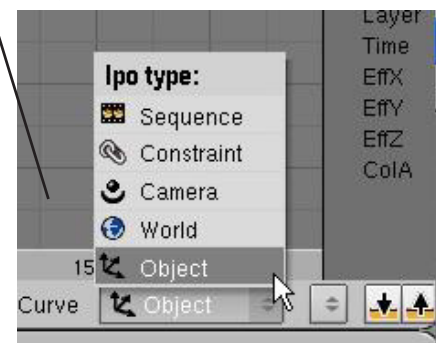
To animate material and world settings, place your cursor down in the buttons window while in the world or material settings. Press **"*I"*** to insert keys. You will see a variety of options available to you.

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

> *Constant*- Gives a square waveform, like turning it on and off. No smooth flow.
>
> *Linear*- takes a straight path from point "A" to point "B". Solves problems of animations swinging way out of where you want it to go, but jerky motion at key points
>
> *Bezier*- The default type which tries to make the motion through the points smooth.
>
> *Every application may require a different type and can be frustrating to work with until you get some practice.*
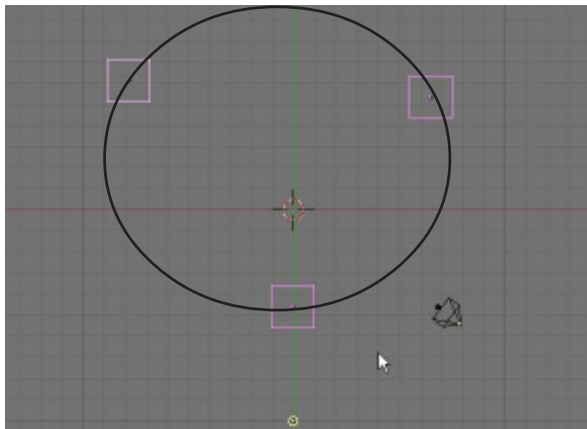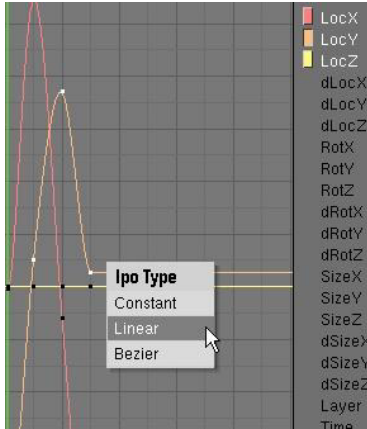
*Animation path of a cube with 3 keys placed at shown locations with **Bezier** path type selected. Path is smooth, but curves way out.*
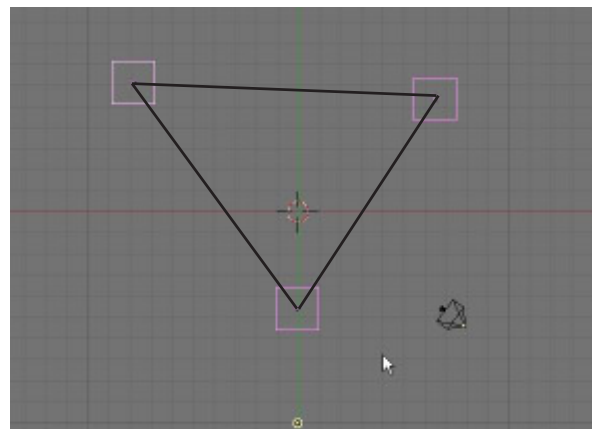
*Animation path of a cube with 3 keys placed at shown locations with **Linear** path type selected. Path is straight, but jerky at key points.*

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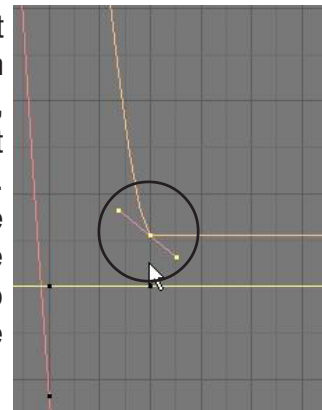
RoboDude Says: If you ever need to start over with an animation, you can erase all the animation tracks in the Ipo window and start over. To select all tracks, hit the "A" key once or twice.

Extended Modes:
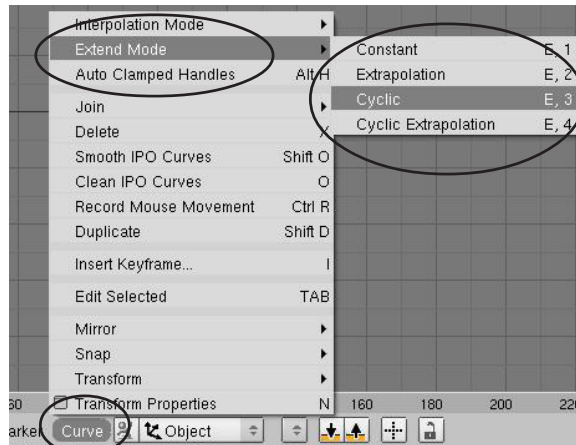
When you need to animate something with repetitive motion (wheel spinning, person walking, etc.), you do not need to keep adding keys along the path. All you need to do is create one cycle of the motion you want to duplicate, find the animation path in the Ipo window you wish to duplicate, then select "**Curve**" from the menu. In the flyout menu, find "**Extend 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:

I have noticed problems in the last two releases with the Auto Keyframing option in the top "User Preferences " menu. The alternate method for activating Auto Keyframing is to create an additional viewport somewhere on your screen and change the *Window Type* to *Timeline*. In this viewport, you will see standard play, rewind, fast-forward buttons along with a **Red, Record** button. By pressing the red button and selecting "*Add/Replace Keys*", every movement will be recorded to an IPO. You will not need to press the "I" key. 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.
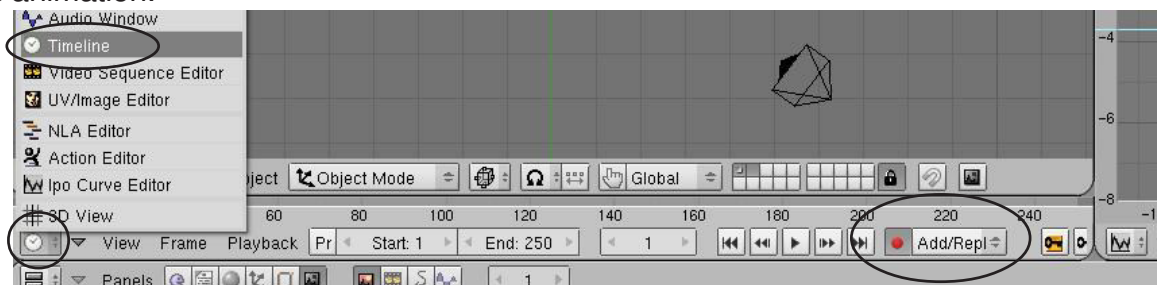
RoboDude Says: Remember to turn off Auto Keyframing when you don't need it on. It's too easy to mess up your animation! Also, re member that Blender can UNDO (Ctrl-Z), but Blender will not remind you to save your work. Save your file and save often!

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.

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.

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

Open your "**Landscape Scene**" file and go to your scene buttons. It's time to animate our "dark and stormy night". We will start by making the correct setting to do a movie. First, review the "*7 Easy Steps to Creating a Movie*" found on page 63. Follow those steps and name the output movie file as "**Stormy Night.mpg**". Also set the **End** frame to **200**. Our movie will be 200 frames long, or 6.6 seconds at 30 fps.


The first thing we plan to animate is the camera. We will do a short, simple movement of the camera coming closer to the shore. In the *top view*, select the Camera. Make sure the camera

is at a good location and does not render any edges of your planes. At **frame 1**, hit "**I**" to insert a **Loc** (*location*) key.
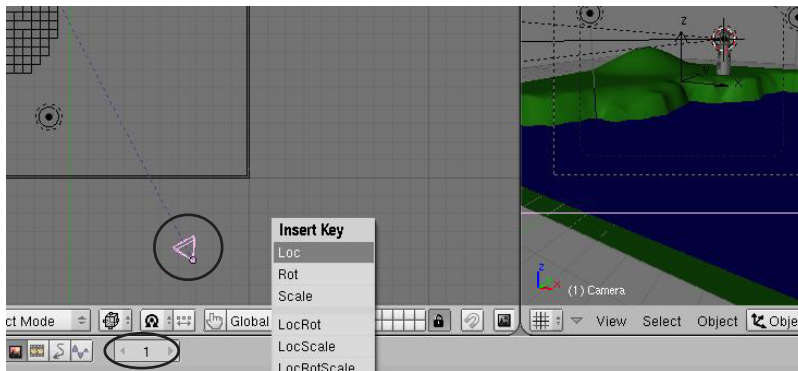
Now use your arrow keys to move to **frame 200**. Move the camera closer to shore, hit "**I**" to insert another location key.
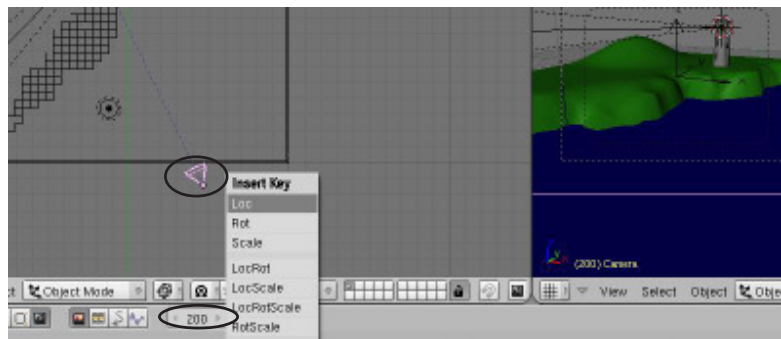
The motion doesn't need to be much. we don't want the boat moving too fast! Go back to frame 1 and hit **Alt-A** while your cursor is in the *camera viewport*. You should see the camera animated. Press **Esc** to stop playing the animation. Save your file.
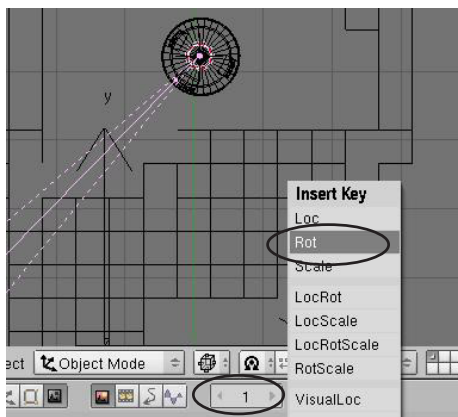
Now we're going to animate the spotlight rotating in the lighthouse. In the *top view*, select the spotlight. At frame 1, press "**I**" to insert a **Rot** (*rotation*) key. It doesn't matter at what angle the spotlight is starting at in the animation.

**P
R
A
C
T
I
C
E**

**E
X
E
R
C
I
S
E**
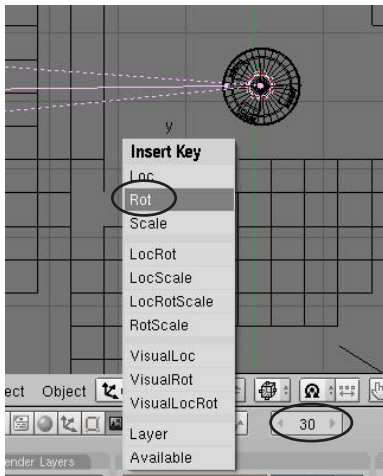
Go to frame **30** (*one second*) and <u>rotate</u> the spotlight <u>45 degrees</u>. To do this, type "**R**" to rotate, then type **45** on the keyboard. Press "**Enter**" or **LMB** click. The lamp will have rotated exactly 45 degrees. If you want the lamp to spin the *opposite* direction, type - after the 45. Use your left arrow key to go back to frame 1. You should see the lamp spin back to it's original position.

In order to keep the lamp spinning consistently the entire animation, we could attempt to continue along the time line, inserting keys every 45 degrees and 30 frames, but that would get boring very fast. Instead, we will use an <u>Extend</u> mode in the <u>IPO Curve</u> window.
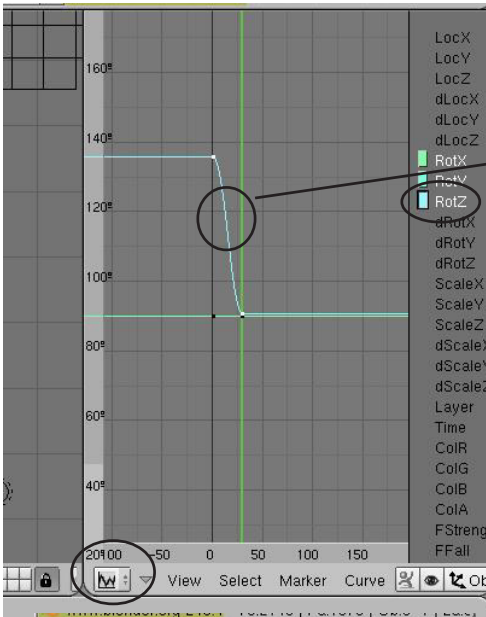
Change the right side window to the **_IPO Curve_** window and find the animation track that shows change over time (*should be the <u>Rot Z curve</u>*). RMB click on the curve to select it. In the **_Curve_** menu, select **_Extend Mode_** and **_Extrapolation_**.
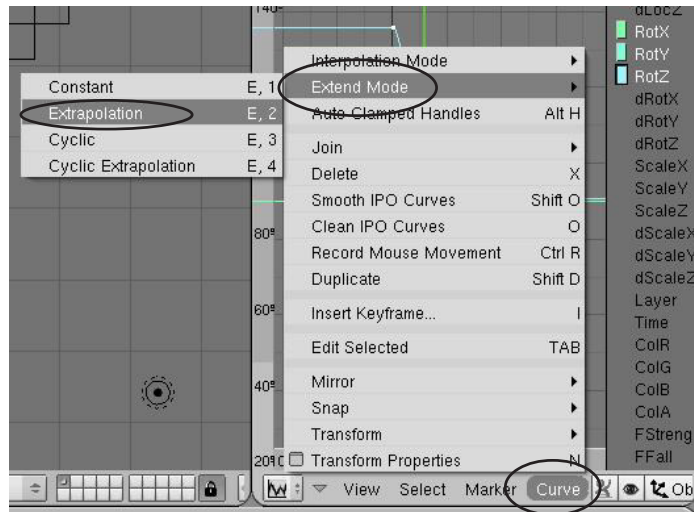
This will cause the curve to extend infinitely in both direction, rotating constantly at that speed. Change this window back to the **_3D View_** window type and press **_Alt-A_** to see the animation. The lamp should spin the entire time.

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Now it's time to animate the water. We want to create some rolling waves, not too fast or slow. This is a little trial-and-error. I've tried to take some guess work out of the process. To begin, select the **_Water Plane_** and go to your _Materials_ buttons. Go to the _Map Input_ tab and find the **_Ofs_** (_offset_) keys for the texture. We will animate the **_Ofs Z_** number. Because we used a 3D texture and not an image to create the water effect, it can be animated to give the illusion of motion.

At **_frame 1_**, and with your cursor in the materials button area, press "**I**" and insert an **_Ofs_** (_Offset_) key. This will set the animated offset to zero at frame 1.
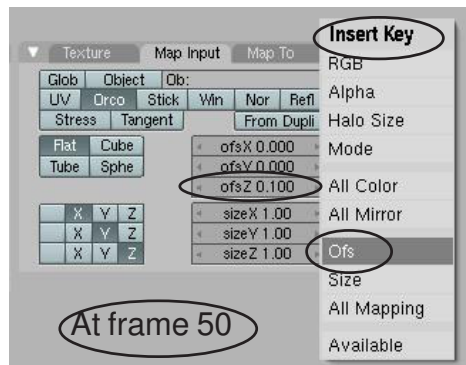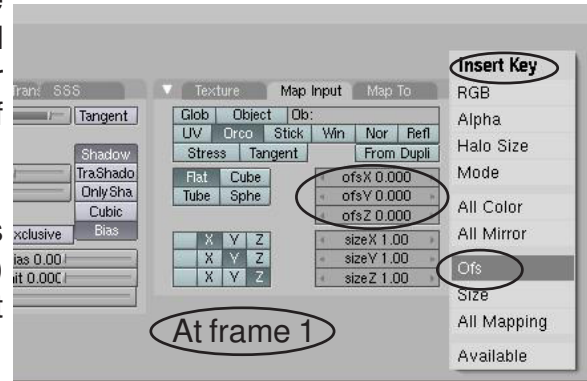
At frame 1

Now advance to **_frame 50_** and change the **_Z Ofs_** number to **0.1**. This will cause the water to "roll" up slightly. Again, with your cursor in the buttons window area, press "**I**" and insert an **_Ofs_** (_Offset_) key. This will cause the texture offset to roll from frame 1 to 50. Since we can't really hit _Alt-A_ to see the animated texture in the window, we have to wait until we animate a movie to see the speed and effect. If you place your cursor in the buttons window area and hit "_Alt-A_" you will see the number changing in the "Ofs Z" block.

At frame 50

Now we need to go to the _IPO Curve_ window to _Extrapolate_ the curve over time. In order to see the material animation curves, we need to change the view of the IPO type from **Object** to **Material**. Find the aimated curve and select it (_should be the Ofs Z curve_). Go to the **Curve** menu, **Extend Mode** and select **Extrapolation**. This should extent the curve, just like we did for the lamp.
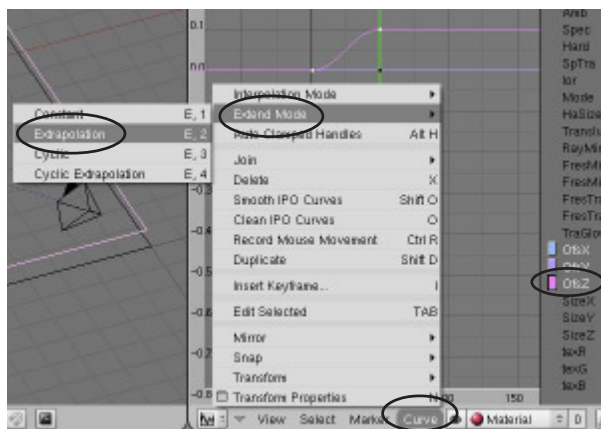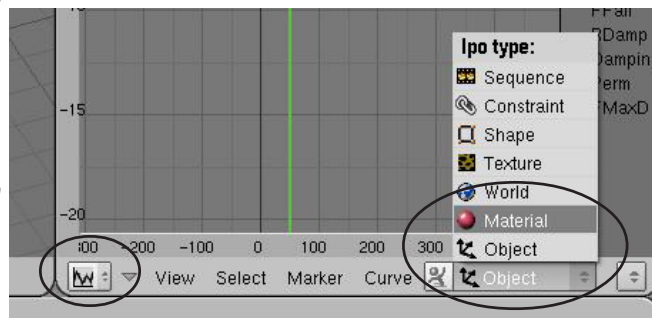
That's it for animation for now. We have animated the camera moving, the lamp spinning and the waves rolling. Later, we will add some rain using particles. You can always change to a preview size to animate faster and check your wave effects. Check your movie setting and press Animate in the Scene buttons. Sit back and wait for your movie to animate.
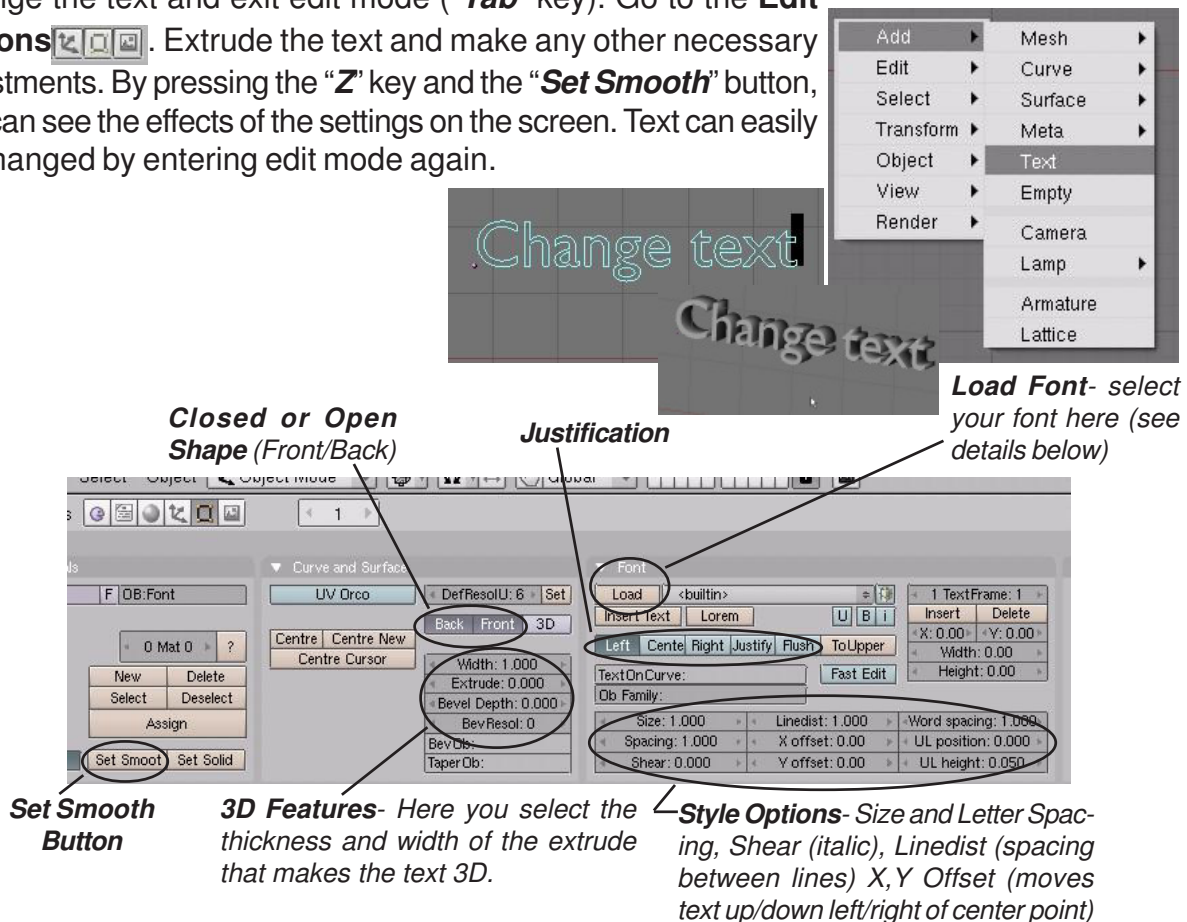
** Call the instructor when finished**

P R A C T I C E   E X E R C I S E

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 changes by entering edit mode ("**Tab**" key) and 3D features can be changed by making adjustments in the edit buttons. Text made in an external program like **Elefont** may give you additional options and different fonts.

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.

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.*

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.

Curve Path

Text that will follow curve
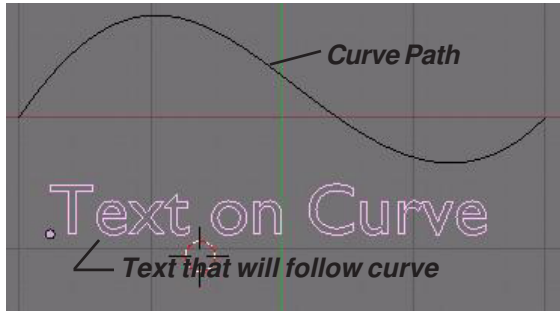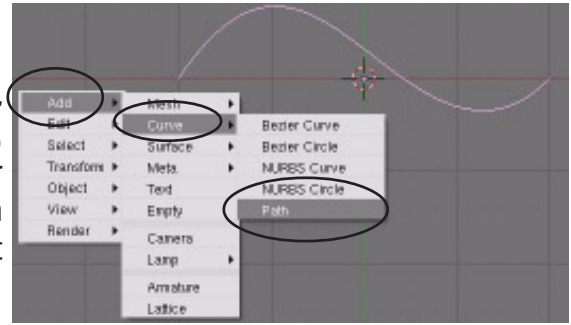
After you create the text, go to the **Edit Buttons**
and find the box "**Text On Curve**". Type the name
of the curve (found in the lower-left corner of the
viewport when the curve is selected- remember that
names are case sensitive). The text will take the
shape of the curve. You may need to change the
spacing of the text so it flows properly.
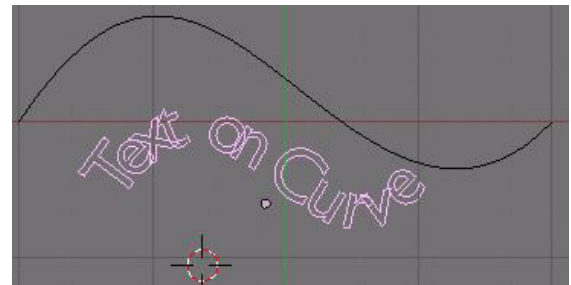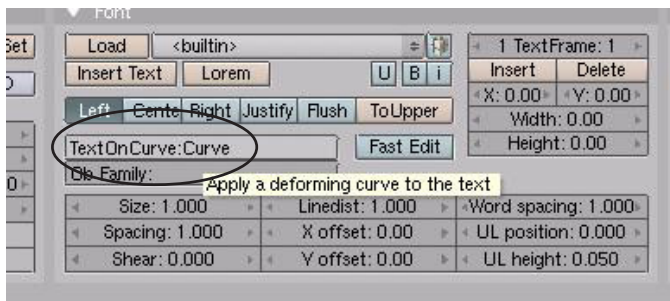
*RoboDude Says: When extruding text for normal titles and labels, be
careful not to extrude the text too thick. It may effect how well the text
can be read.*

Converting Text Into a Mesh

At times you may need to convert text into a mesh for certain pur-
poses (i.e. using a Build Effect discussed in chapter 12). To con-
vert text into a mesh, press "**Alt-C**" to convert it first into a **Curve** or
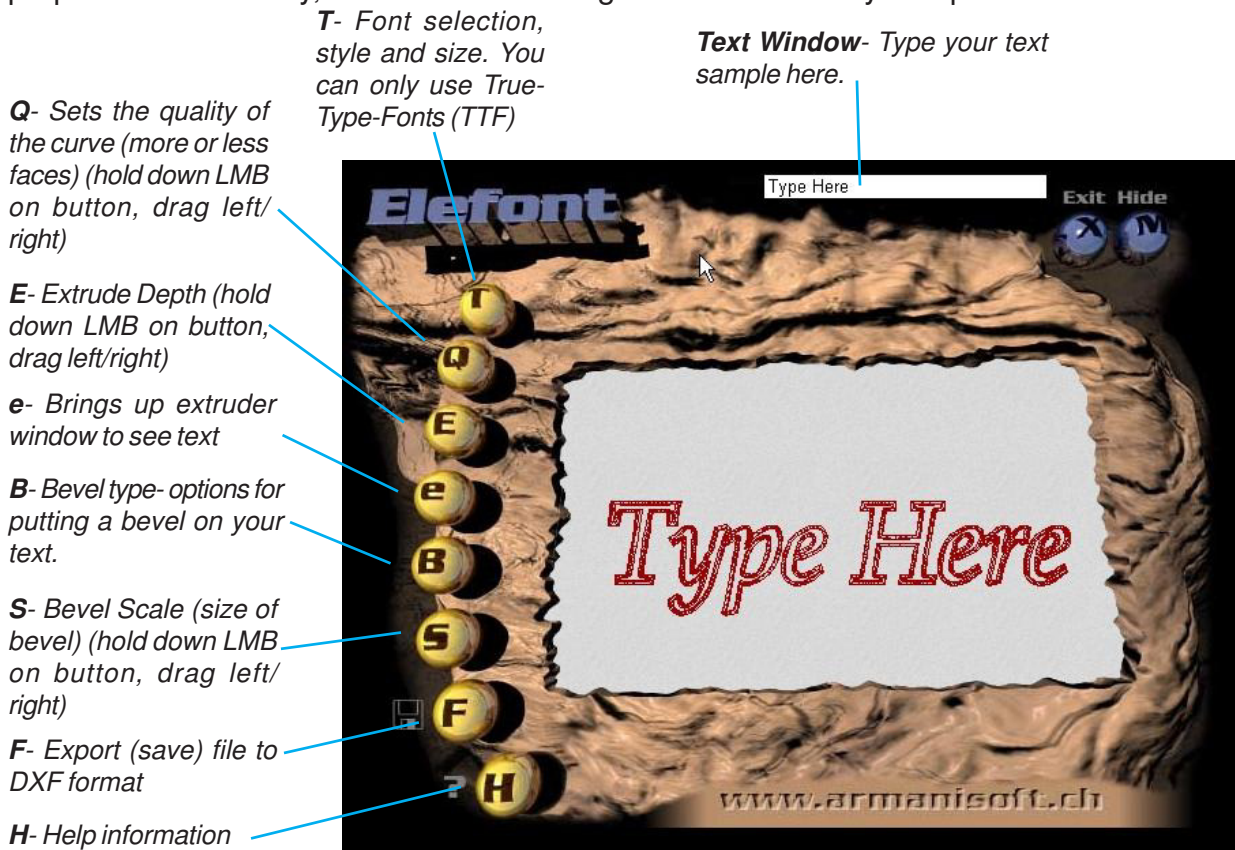**Mesh**. In edit mode, the text will now display with verticies.

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**. This is a simple-to-use program that saves the file as a .DXF format. Any program that can export 3D text files as .DXF should also work fine. Remember that Blender accepts files that are saved as .DXF and VRML(.wrl). For the purpose of this activity, we will be discussing Elefont. Here are your options in Elefont:

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

Text Window- Type your text sample here.

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

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

e- Brings up extruder window to see text

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

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

F- Export (save) file to DXF format

H- Help information

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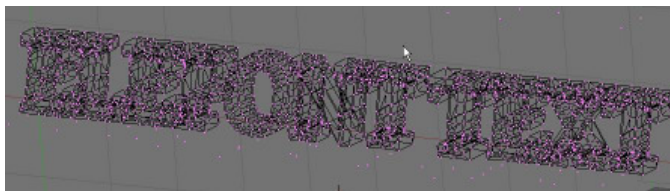
*EleFont text in Blender in Edit Mode where verticies are shown*

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

Create a new Blender scene and set up the views any way you wish. You will be creating a company logo of your choice with text. Keep it simple and utilize meshes, textures, lighting effects and raytracing to enhance your scene.

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

Note: The text you see in the scene below was placed on a Bezier Circle Curve. If you leave the circle in the scene it will render faced. The text was converted into a mesh, then the curve deleted. The water was created the same way we did the water in the lighthouse scene (with much less Normal) with ray mirror added.
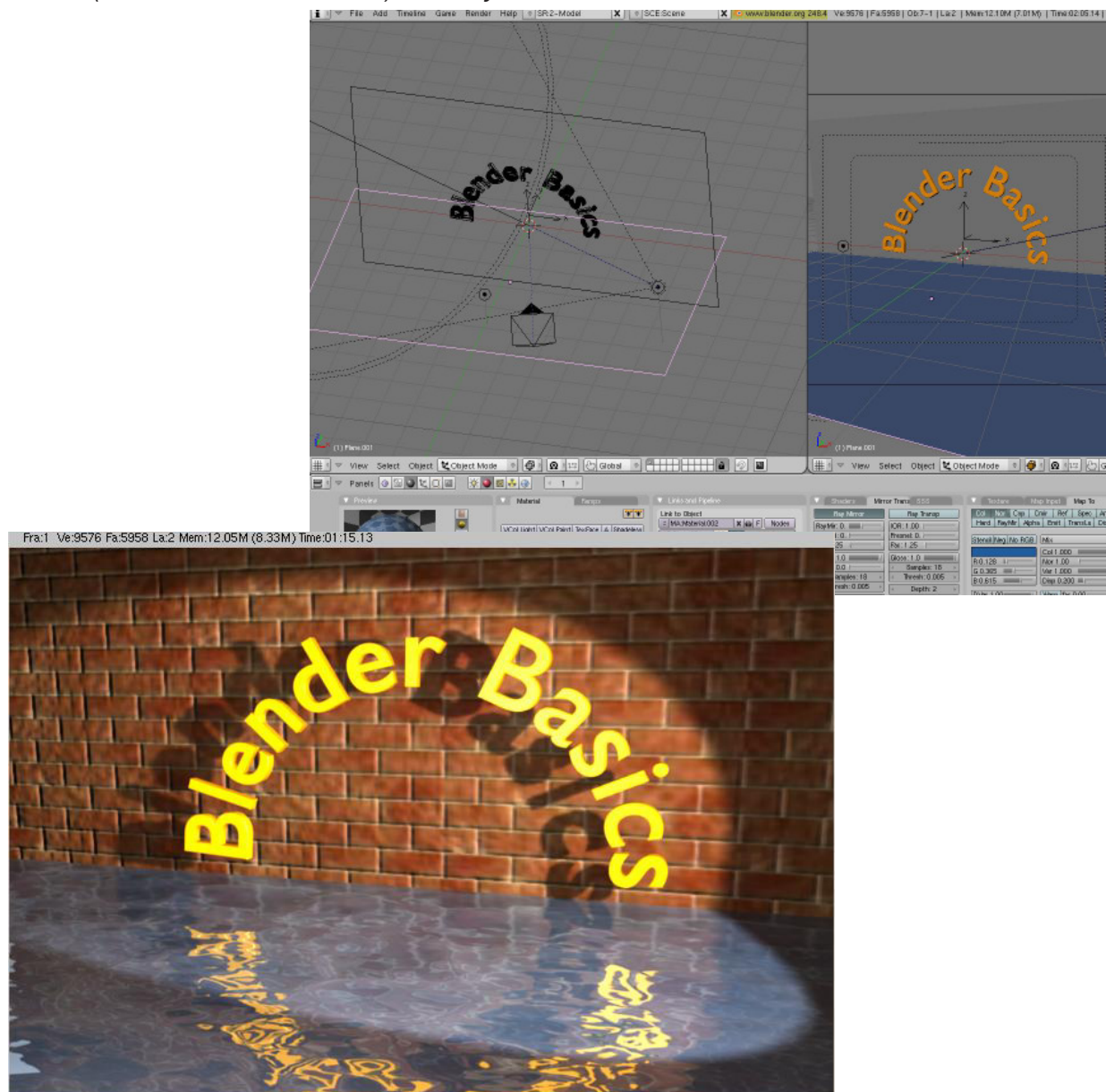

** Call the instructor when finished**

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 use as they are or converted to meshes so you can work with traditional verticies. *To convert a surface into a mesh, select the object and press the "Alt" and "C" keys. Click on "Mesh".* You can do a lot with NURBS and there are several tutorials on-line describing them, but for now, we will just work with a *NURBS Circle* to create an interesting looking tunnel.
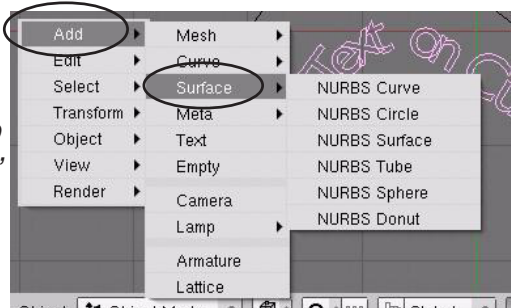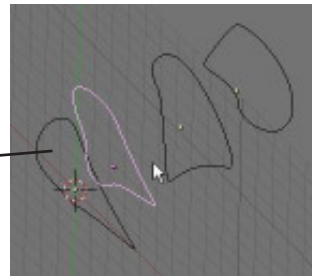
Creating a Lofted Tunnel

This process will take several profiles of a NURBS Circle and connect them together. First thing you need to do is create a **NURBS Circle**. To do this, press the "*Space Bar*", select "*Add*", then "*Surface*" and "*NURBS Circle*". The circle comes in in edit mode. Select the points and shape the circle a bit. After shaping, exit edit mode.
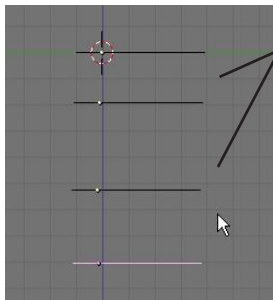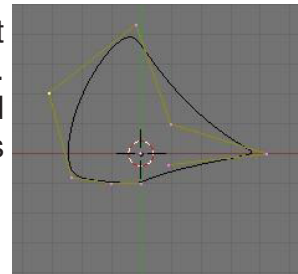
Change your view so you are looking down on the circle. Use the "*Shift-D*" keys to duplicate the circle several times. Then rotate your view so you can select each circle and edit the shapes in **edit mode** (Tab key). After shaping the circles, exit edit mode and select them all by RMB clicking on 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 verticies, then "*F*" for face. Your result should be a lofted object. If you need it to be a mesh, press "*Atl*" and "*C*".
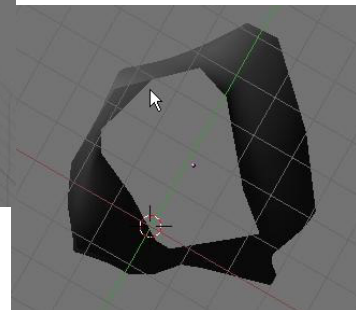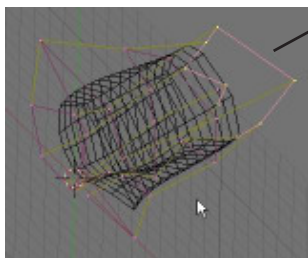
Liquid and Droplet Effects Using Meta Shapes

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.
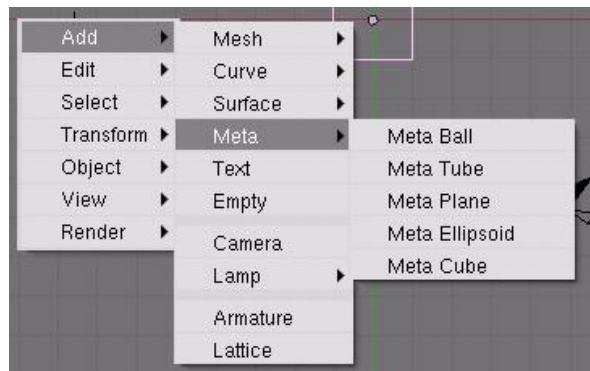
> **RoboDude Asks: Why are all my Meta Shapes joined together?**
> *Remember to exit edit mode after the creation of each meta shape (Tab key). Otherwise, all shapes will be joined together.*
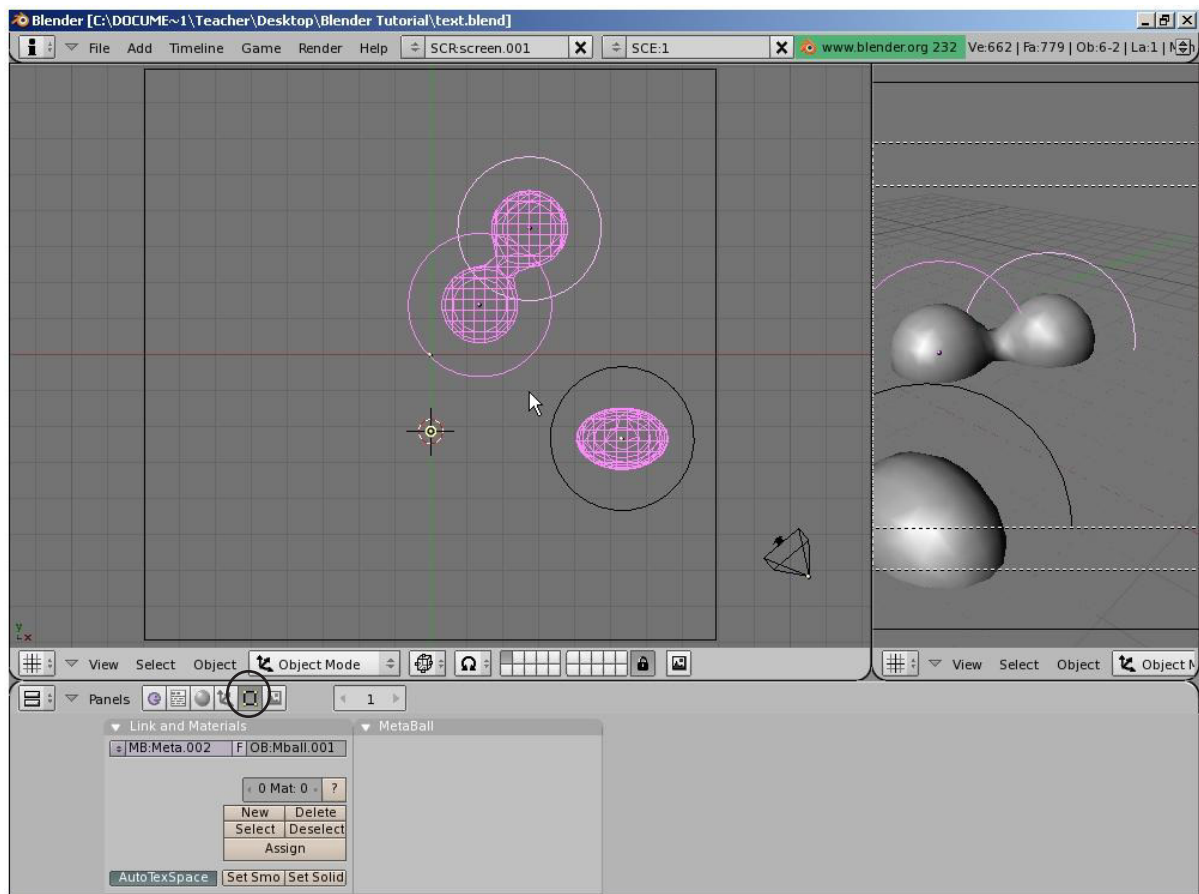
There are a few options for Meta shapes that can be controlled in the edit buttons. Experiment with them and try to make some renderings and animations.

Meta Shapes Practice Exercise

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

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

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

With the release of version 2.4, some essential items in Blender have been completely reorganized. Some of that reoganizing 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**".
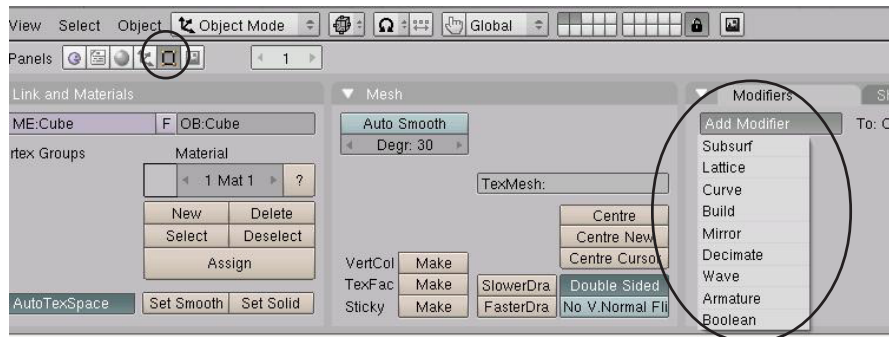

The Modifiers we plan to look at in this chapter are:
  -Subsurf
  -Build
  -Mirror
  -Wave
  -Boolean

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 verticies to the mesh. This means when you enter Edit mode, the mesh remains simple. See the example of the monkey head below:


Set Solid

Set Smooth

Monkey head without Subsurf

Subsurf set to Level 1

Subsurf set to Level 2
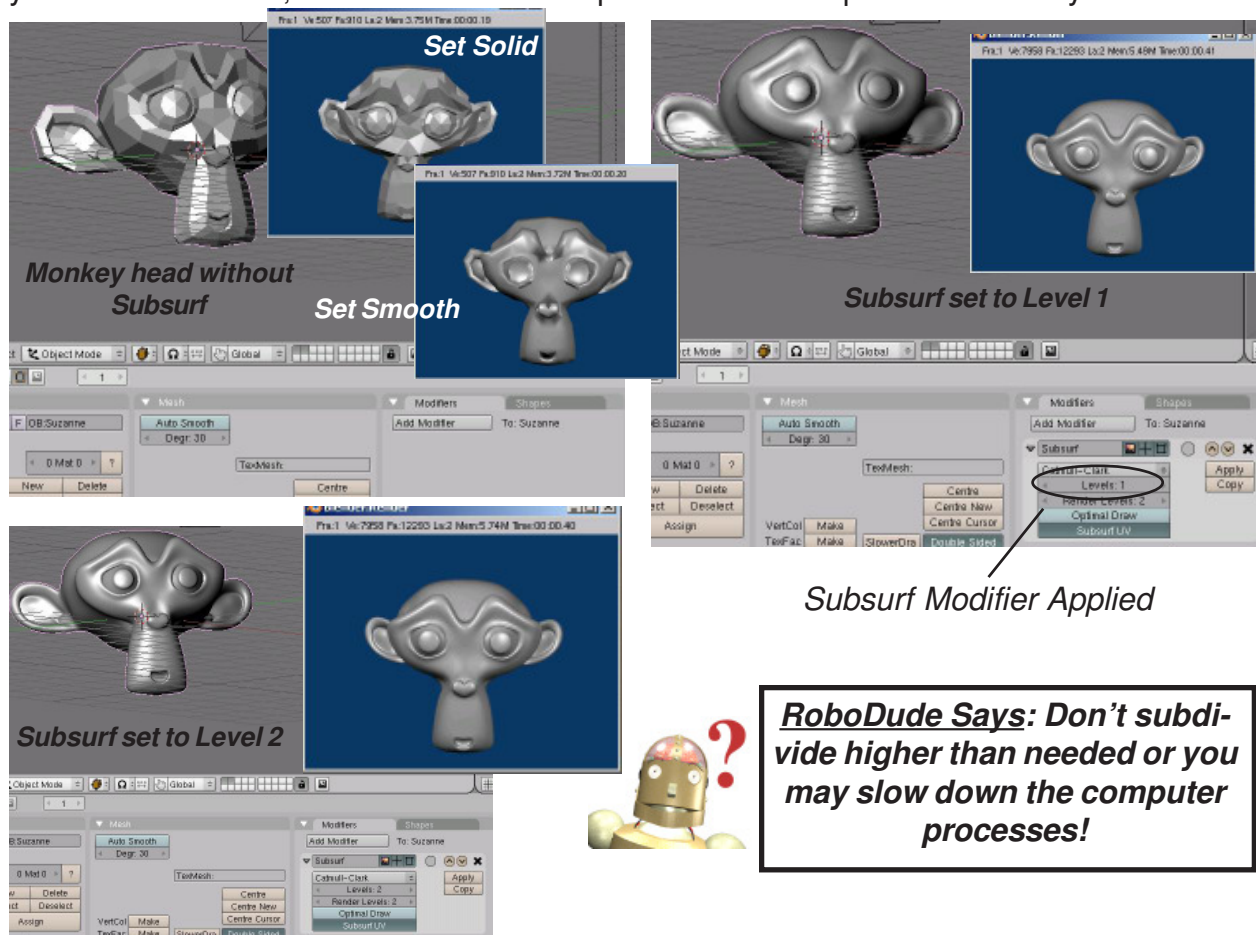
Subsurf Modifier Applied

RoboDude Says: Don't subdivide higher than needed or you may slow down the computer processes!

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.
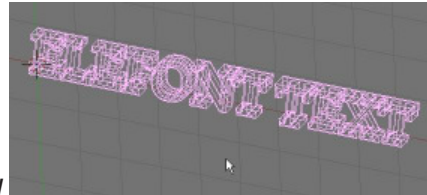
With the object selected, go to the **Edit** buttons, select the **Add Modifiers** tab and select the **Build** option from the list. You will have 2 things to set- the **Length** and the **Start Frame** (*how long do you want it to take to build and when in the animation do you want it to start*). You have another option dealing with **Randomized** settings you can experiment with.
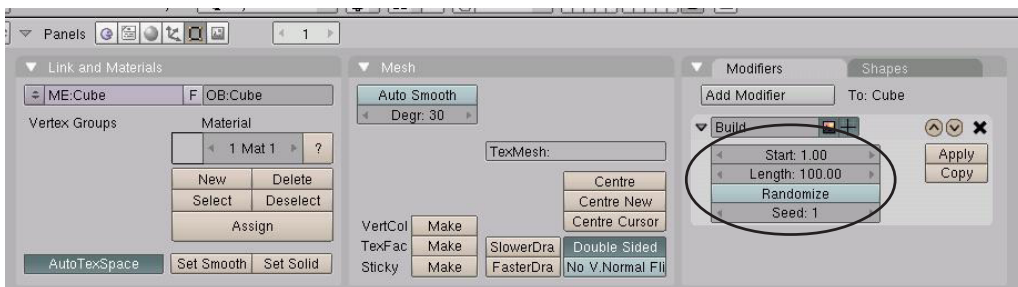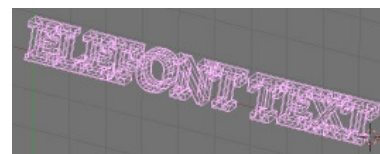
RoboDude Says: *Don't be alarmed if the object disappears when you select build. You will only see the amount of it that should be there on your current frame. Press "Alt" and "A" to see it animated on the screen.*
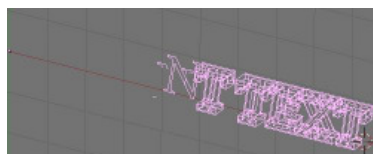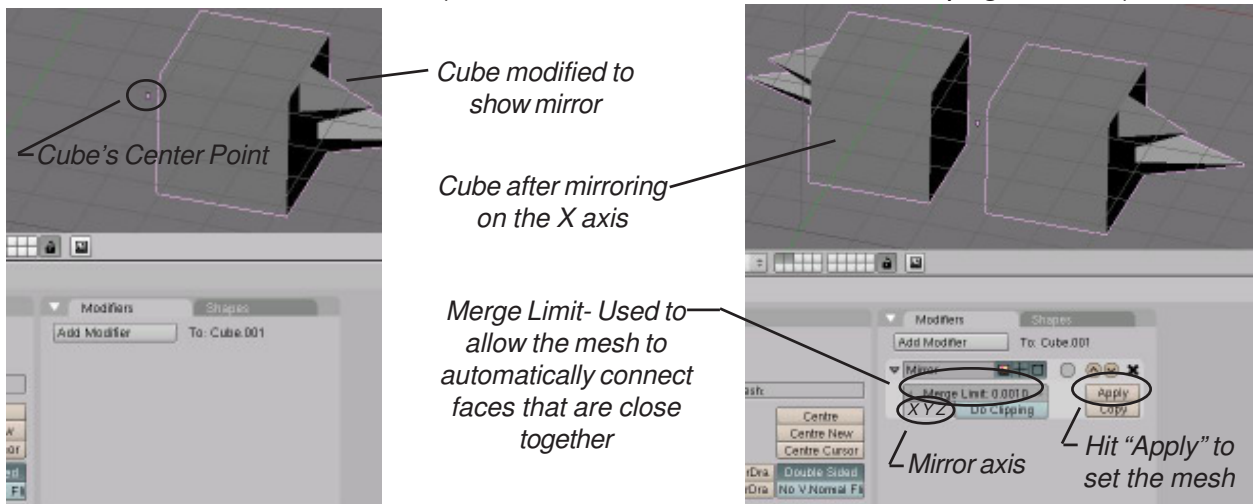
| Build at frame 1 | Build at frame 50 | Build at frame 100 |

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).

Cube's Center Point

Cube modified to show mirror

Cube after mirroring on the X axis

Merge Limit- Used to allow the mesh to automatically connect faces that are close together

Mirror axis

Hit "Apply" to set the mesh

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 verticies, but the plane does not. With the plane selected, enter **edit mode** (**Tab** key) and select all verticies ("**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:
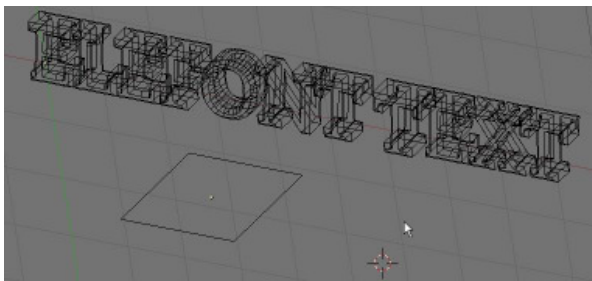
Once again, with the object selected, go to the **Edit** buttons, **Add Modifier**, then click the "**Wave**" button. Place your cursor in the 3D window and press *"Alt and "A"* to see your animated wave effect. Hit escape to exit. Here's the basic wave effect on the text and plane:
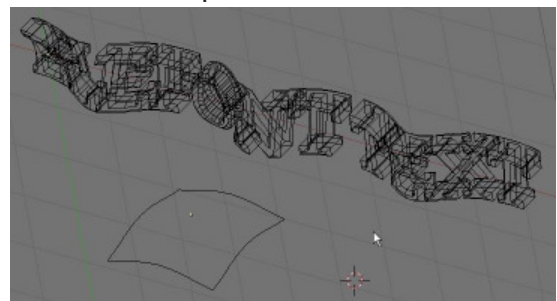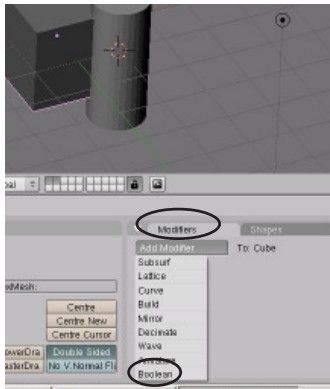
The basic wave settings have the object in *Cyclic* mode and waving on the X axis and Y axis.These can be set to achieve different effects along with the height and width, start time and length of effect. You can also control the starting time and length of animation.
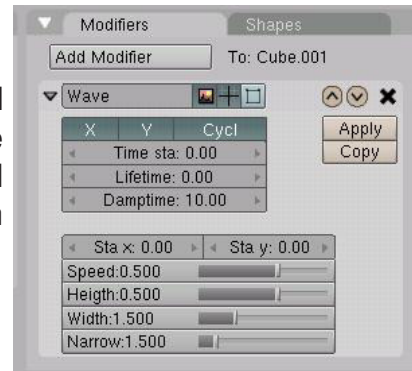
Boolean Operations (cutting and adding)

Discussed earlier is the Boolean modifier panel. This is just another way creating a *Difference, Union or Intersect*. We briefly discussed this operation back on page 32. 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.
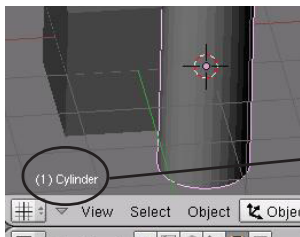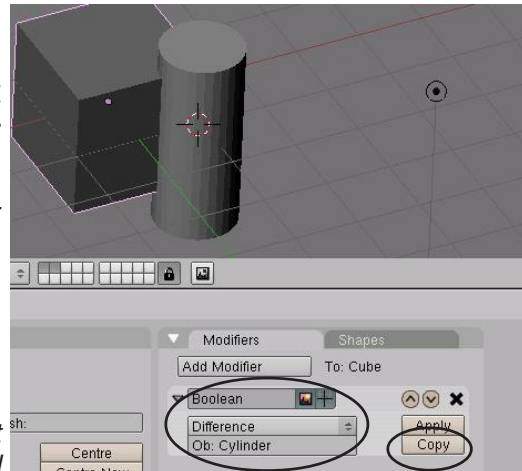
To find the name of a mesh, select the mesh. The name will be displayed in the lower left of the viewport. **Names are Case Sensitive!**

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 verticies. The newer code does a nicer job with this aspect.

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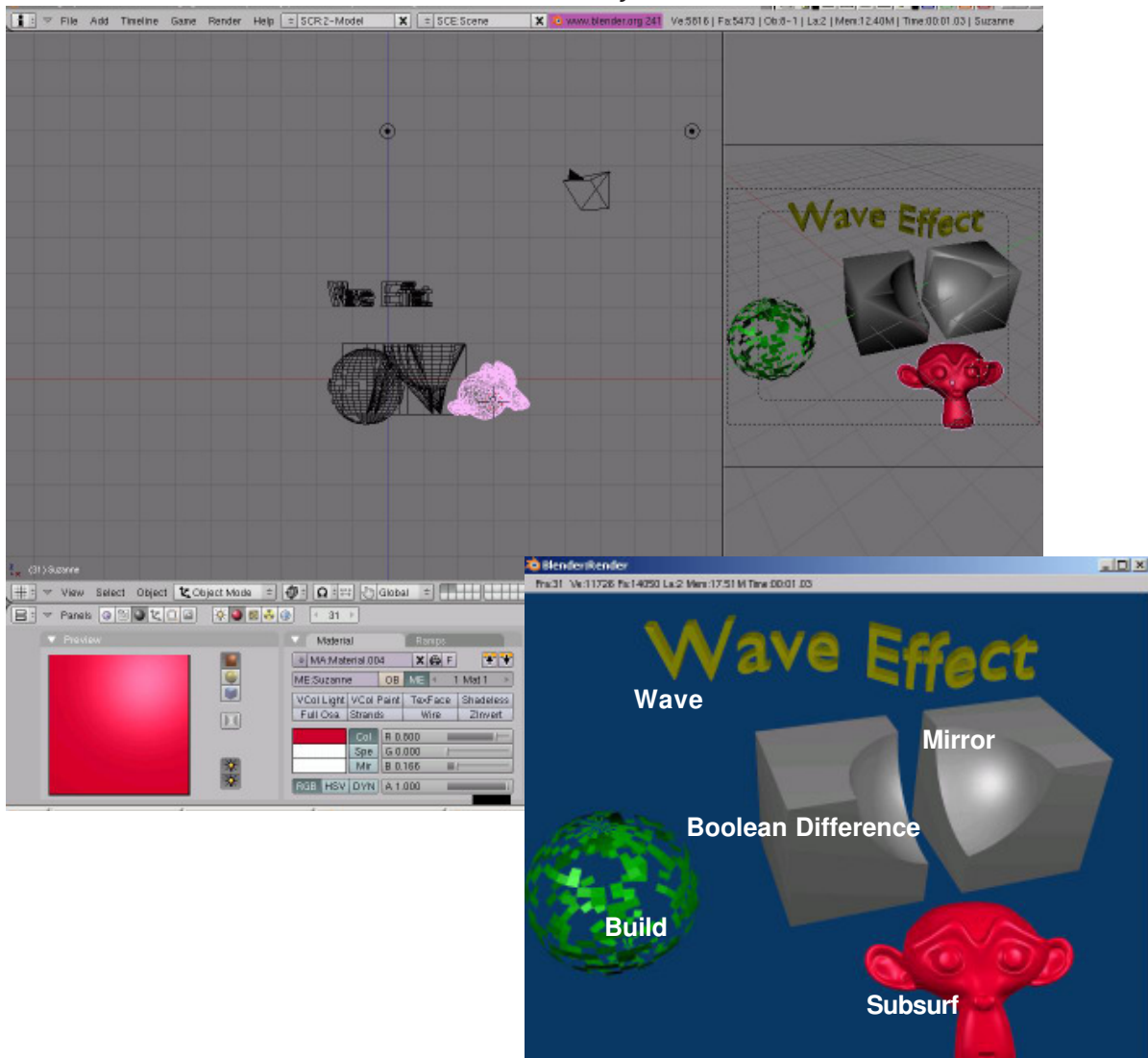
*** Call the instructor when finished***

Chapter 13- Particle Systems and Interactions

Particles have received a lot of attention in recent releases. 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, hair 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 **random** setting in the particle panel. 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. 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 **Particle Buttons**, click the "**Add New**" button in the **Particle System** Panel. A new particle system will open in the panel and look like this:
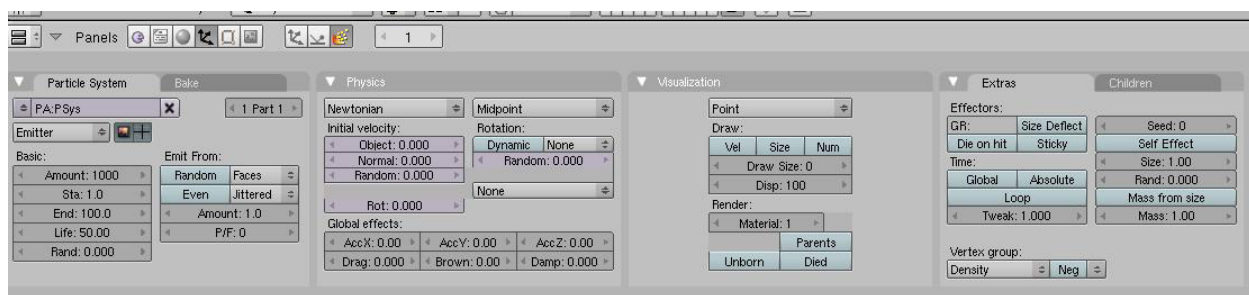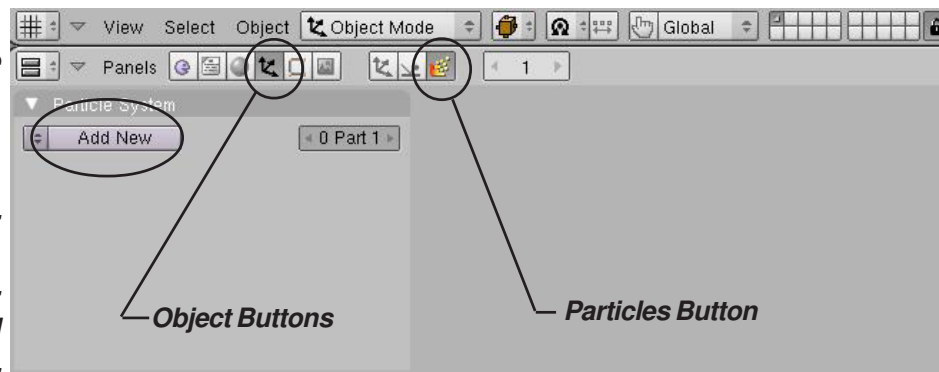
For those of us that have been using Blender for years, this is a big change. The particle settings were once in one large panel. Now they have been split up into several seperate panels- **Particle System, Physics, Visualization, Extras/Children**.

Particles can 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*.
More detailed information about particles can be found here:
http://wiki.blender.org/index.php/Doc:Manual/Physics/Particles

Particle System Panel

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

Name- *Name particle systems, like materials*

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.*
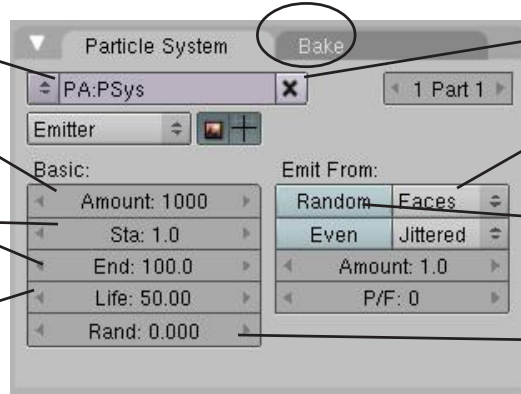
Delete- *Start over if needed*

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

Random- *This will randomize how particles are emitted*

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

You will notice a tab called "***Bake***". This is where you can tell Blender to save the effects when you animated. When hitting Alt-A (*must be on frame 1*), the animation is saved as a *Cache (meaning, saved to memory)* and "***Bake***" will save the animation to a folder that will remain unless the particle system is changed.
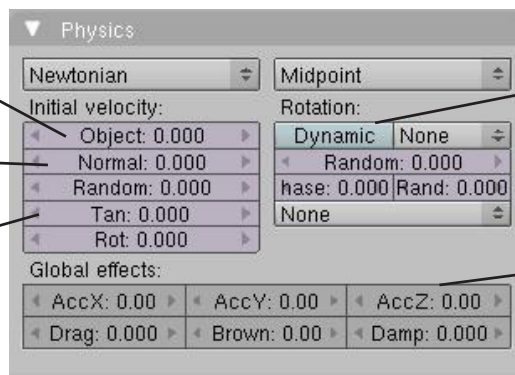
Physics Panel

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

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

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

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

Rotation- *Dynamic motion of particles*

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

Visualization Panel

This panel let's you control how the particles appear on the screen. Are they a point, line, or other object? You can also control if you see the mesh (not just particles, but the original mesh), and particles that have died or not yet "born". Needless to say, there are a lot of options and people have come up with interesting ways to use particles. You can find some nice tutorials on line.
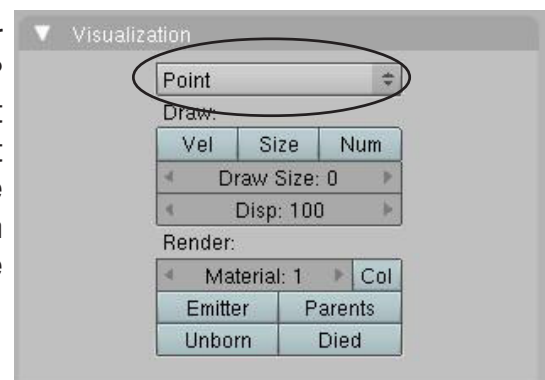
Chapter 13- Particle Systems and Interactions

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 (*Physics Panel*) to about **2.0**. 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. (*make sure you are on frame 1*)It should look something like this:
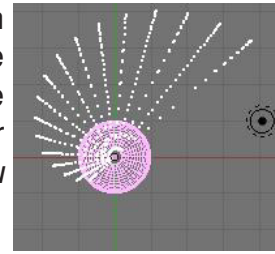
The particles come off in a pattern. This may be what you desire, but if you're making a flame or explosion effect, you need a more random release of particles. To do this, press the "**Random**" button in the *Particle System* panel. This will reandomize the sequence and when re-animated with "**Alt-A**", it will look like this example:
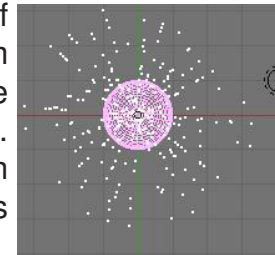
Material Influence on Particles:

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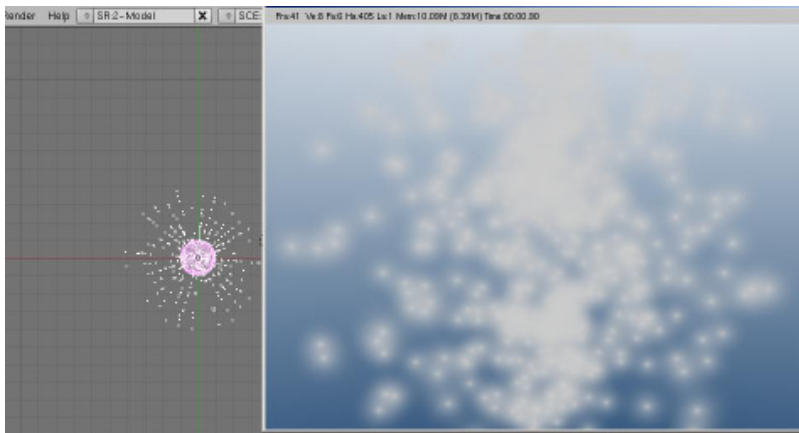
If you look at the scene we created so far, we have a camera and a sphere with a particle effect and the sequence has been randomized. If we change our current frame to a higher number like **frame 50** and press the *"F12"* key to render, this is what we see:

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. You can also create other effects with lines, rings and stars in the particle settings.

> **RoboDude Asks: Why can't I see any particles when I use the arrow keys and render an image?** If you've made changes to your settings, you need to go back to *frame 1* and hit "**Alt-A**" to recalculate to the cache. You can also "**Bake**" the animation.

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, lines, and stars can also be adjusted.
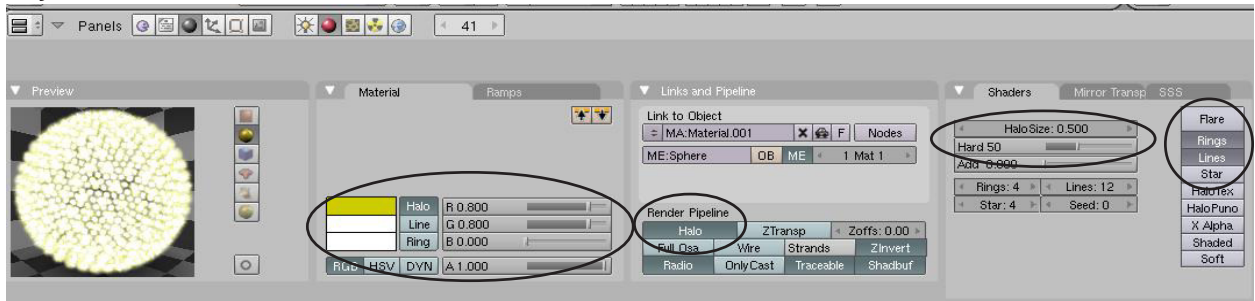

The **halo size** needs to be adjusted for the size of your scene and what you are using the particles to simulate. For example, smoke needs a smaller particle count and a larger **halo setting** and a **Z Transparent and Alpha** setting very low so the smoke looks transparent. Fire may need a higher 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 36.


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:
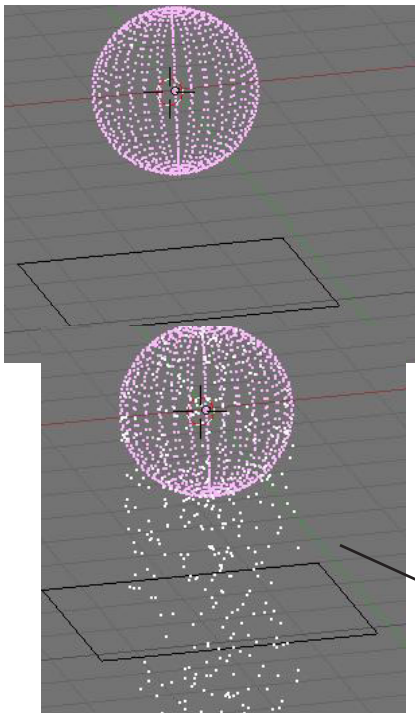
Next, with the **Sphere** selected, Go to the **Object** buttons and add a **Particle System.** In the **Physics** panel, set the **AccZ Force** to **-3.00**. This will "*pull*" the particles in a downward direction.
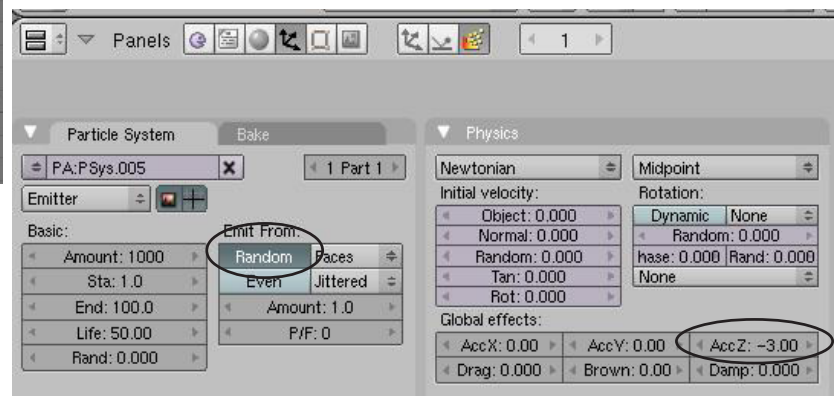

Place your cursor in the 3D window and press *"Alt"-"A"* to see the animation. You should see particles drop from the sphere and fall through the plane.

The next step is to stop the particles from falling through the plane. Now, select the **Plane** and hit the **Physics Button** *(beside the Particles button). Find the "Collision" tab and press the "Collision" button.* Place your cursor back up into the 3D window and press "**Alt-A**" to see

the effects of collision (*remember- you must be on frame 1*) *The particles should not pass through the plane anymore, but bounce rather high.*

Physics Buttons
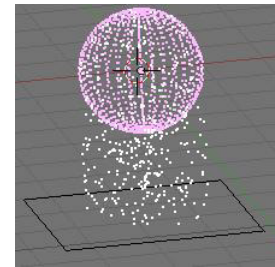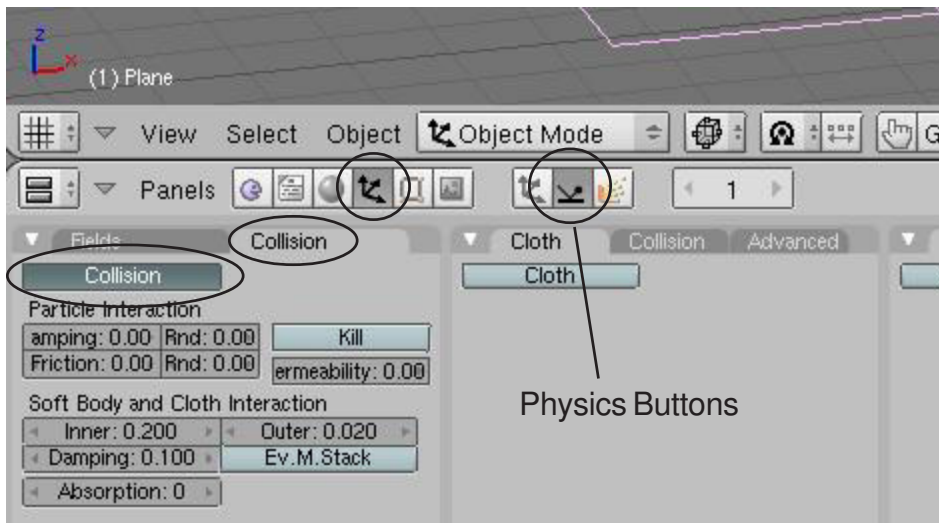
To minimize the bouncing, select the *plane* again and take the **Dampening** up to **1.00**.
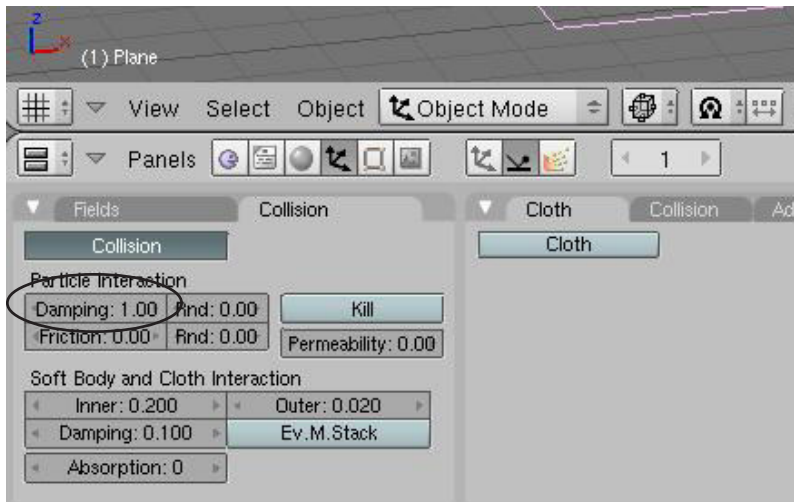
Again, you will need tgo back to the 3D window and press "**Alt-A**" again to recalculate the animation to see the correct physics. Now the particles stop at the plane and don't bounce anymore. Experiment with these settings for other effects.

By experimenting with the other particle and collision settings and by applying a material with **Halo Lines and Stars**, you can simulate sparks bouncing off an object with high quality results.

Wind

Blender 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 ren-

An Empty

der 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**".
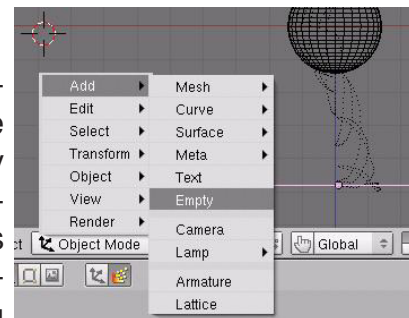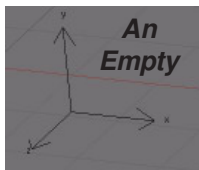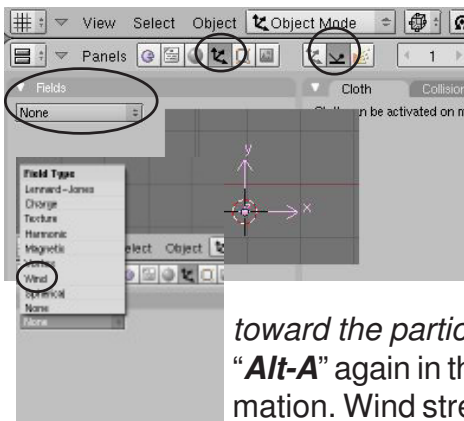
Select the **Empty**, then, in the **Object** and **Physics** buttons, select "**Wind**" in the drop-down options under the "**Fields**" panel.. You will see some setting in the wind button to control the effect. Change the **Strength** setting to about **20.00**. After you do this, the empty will have some circles displayed on it to represent the wind flow. *You may need to rotate the empty so the wind blows toward the particles*. After rotating the empty, press "**Alt-A**" again in the 3D window to recalculate the animation. Wind strength can be animated. That will be discussed in "*Chapter18- Object Physics*".

Empty with wind rings

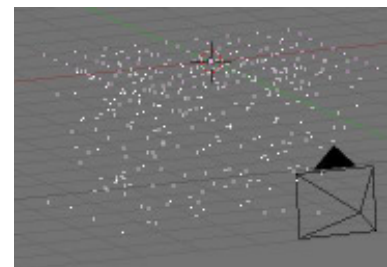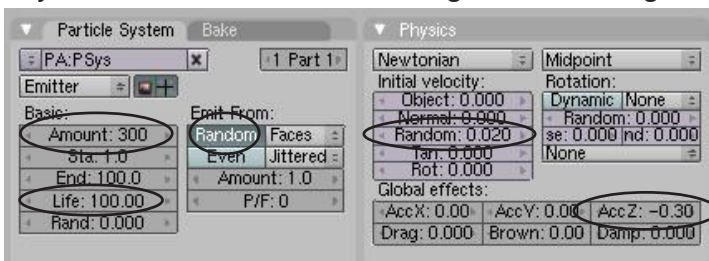**Particles being blown to the right**
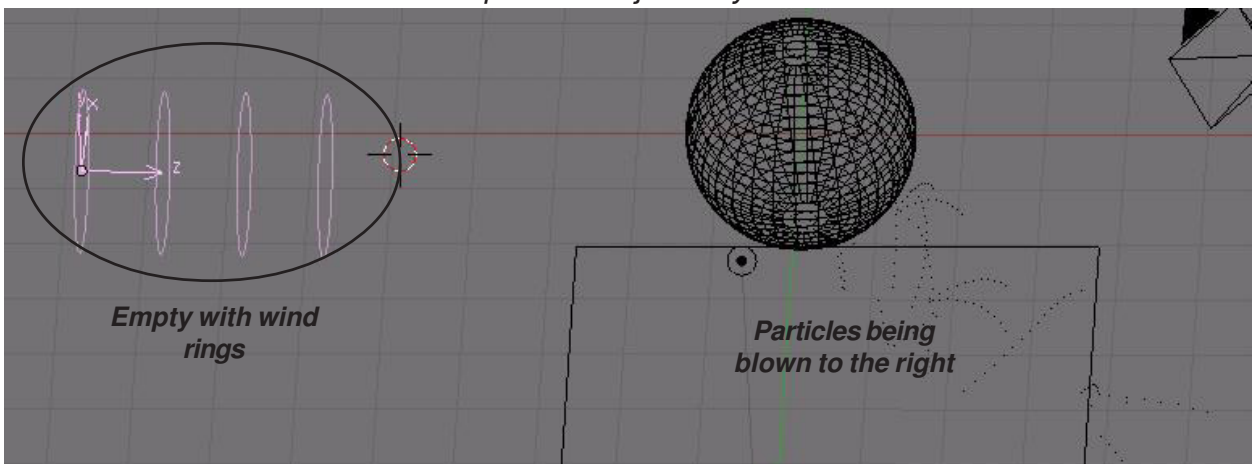
Sample Particle Settings

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 "tweeked" to your own personal preferences. They are just intended to get you to a starting point. You can also find some nice tutorials for even more detailed effects on line.

Snow

Subdivide a plane 3-4 times (or more) and "*Randomize*" the verticies. 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:
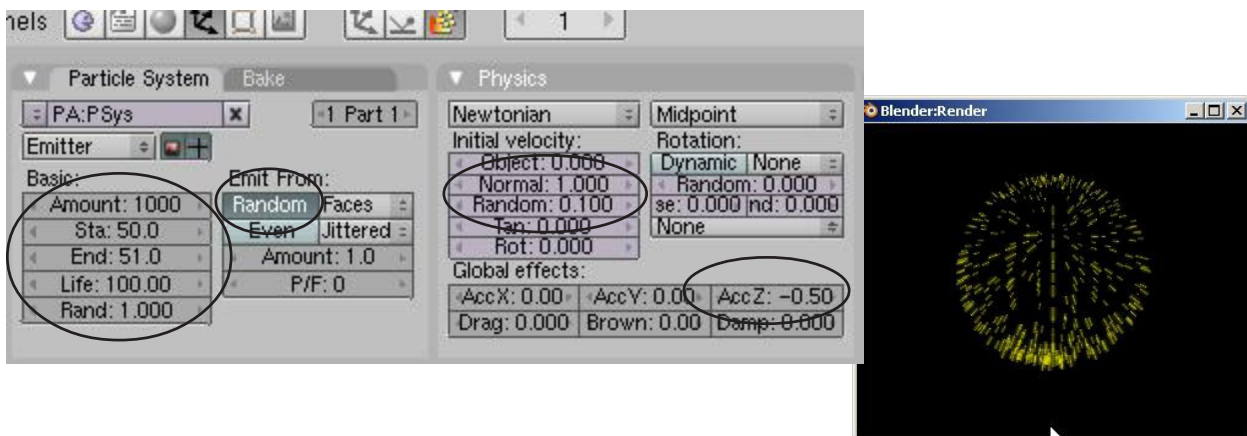
Fire

This is the best use of particles. Start with a *UVSphere* 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
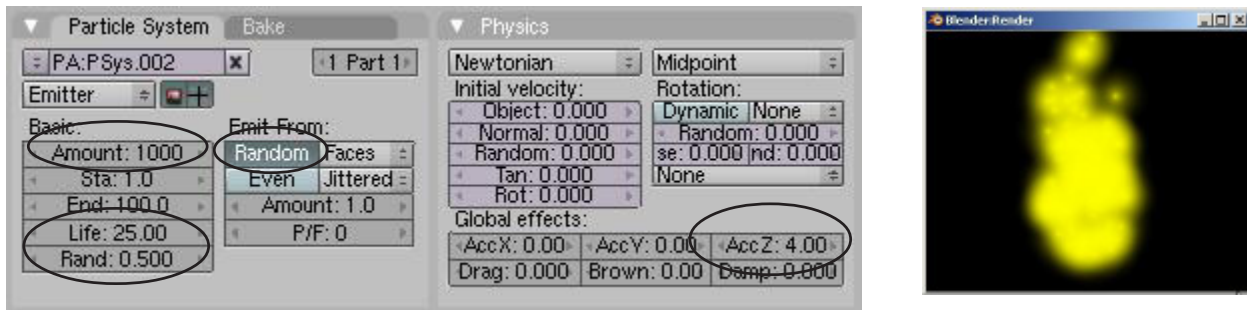
Simple Fireworks

Start with a *UVSphere* and 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.

As long as the link is good, here is a nice tutorial on making a more realistic display:
http://en.wikibooks.org/wiki/Blender_3D:_Noob_to_Pro/Fireworks. You can also search for some good tutorials.


RoboDude Says: ***Practice using these setting to become comfortable with them!***

Using Particles for Hair

Particles can be used to produce hair with great results. To start, lets add a *monkey* head from the meshes menu. So we don't produce hair on the entire monkey head, let's create a vertex group of the top faces of the monkey head (we'll make a mohawk). Go into "*edit mode*" and switch from "*Vertex*" selection to "*Face*" selection. Select the faces for the hair, add a "*New*" vertex group, name it "hair" and hit the "*Assign*" button. This will assign those faces to the group. Exit edit mode and add a particle system to the monkey. Switch the type from "**Emitter**" to "**Hair**". Make the adjustments shown below:
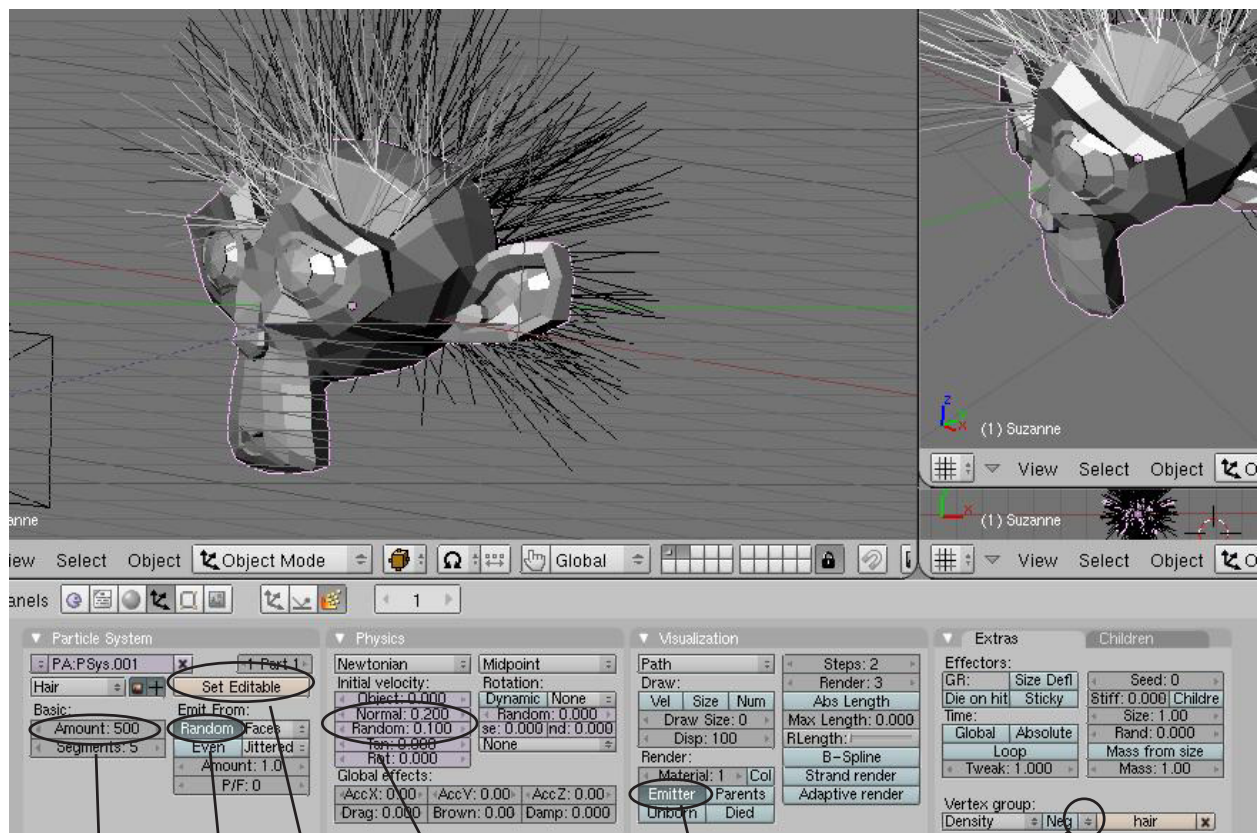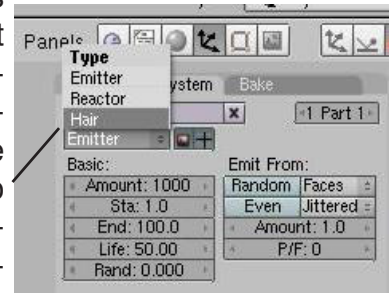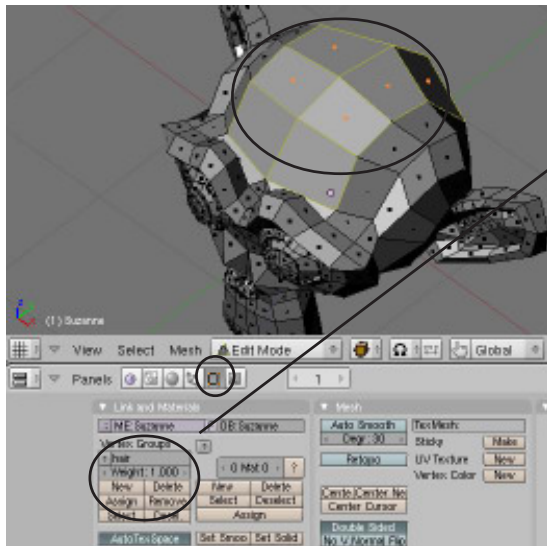
Amount to 500
Random On

*Click "**Set Editable**" so we can shape the hair later*

*Normal to 0.2*
Random to 0.1

Emitter on to see monkey head

Arrows to select the vertix group

We have some hair, but it doesn't look very good at this point. Lets shape it up a bit.

Chapter 13- Particle Systems and Interactions

Let's shape up the hair a bit, but first, lets smooth out the monkey head. Hit "**Set Smooth**" in the _Edit_ buttons and add a "_Subsurf_" Modifier. You will also see a "_Particle_" modifier automatically added for you. Now it's time to shape the hair. If you didn't press the "_Set Editable_"
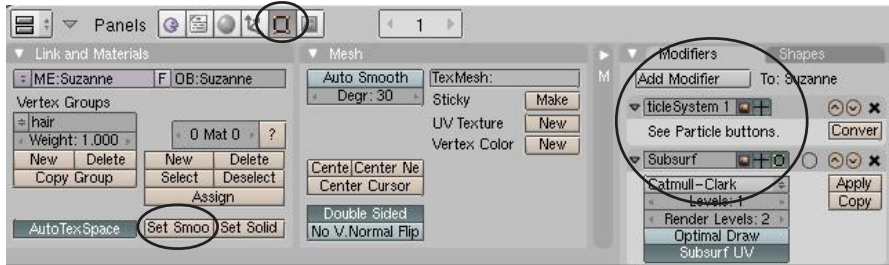
button in the particle buttons before, do it now. At the bottom of your 3D viewport, change from _Object Mode to Particle Mode_. You will see your hair with point on the ends.

It is important that you keep these verticies selected during the shaping process (use "**A**" for all). To see your shaping tools, Press "**N**' to bring up the panel. Play with the different options and strength.size sliders. Use your mouse to shape the hair.

Change from Object Mode to Particle Mode
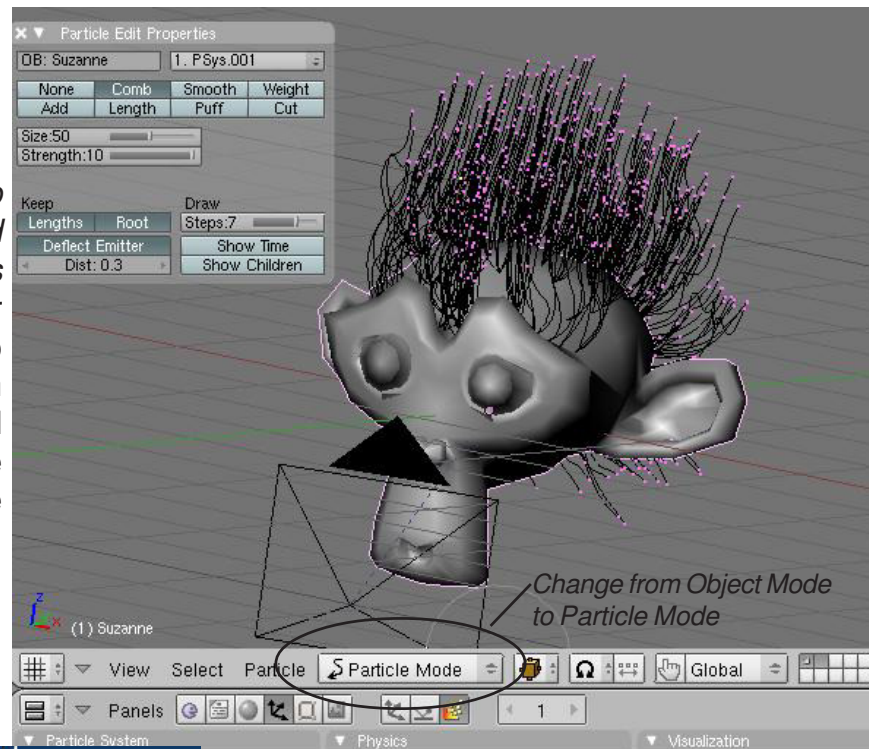
Play around with your material setting and look for the "_Strand_" setting where you can change the width and other features of the hair. Remember that hair can be effected by wind and gravity setting.

Now it's time to add some rain to your stormy night. Open up your "**Landscape Scene**". Start by adding a *plane* in the top view and *scale* it up a bit larger than your ground. Move it up high enough so it is not visible in the camera view. While in edit mode, press "**W**" and select "**Subdivide Multi**". Set the number to **20**. Your scene should look something like this:
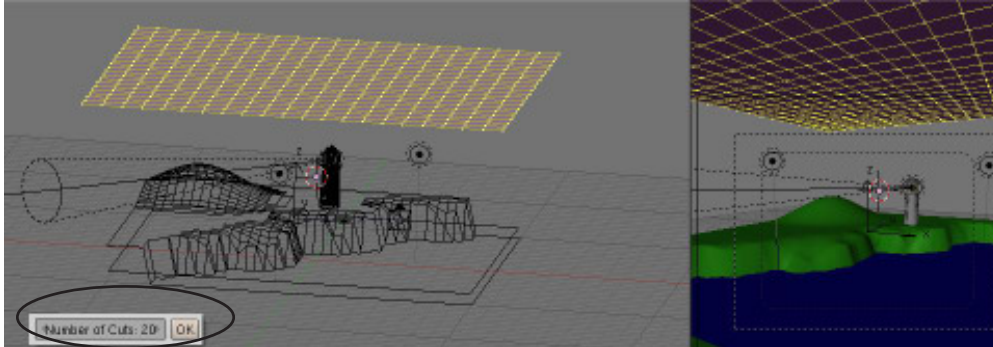
Now it's time to add a "Particle System" to make it rain. Since we want it to be raining at *frame 1*, we need to start the rain at some point before that (*-100*). We also want the rain drops to last the entire animation, be random, and appear to be effected by the wind. Try these setting. Press "**Alt-A**" often to check your results (*remembering to always be on frame 1*).
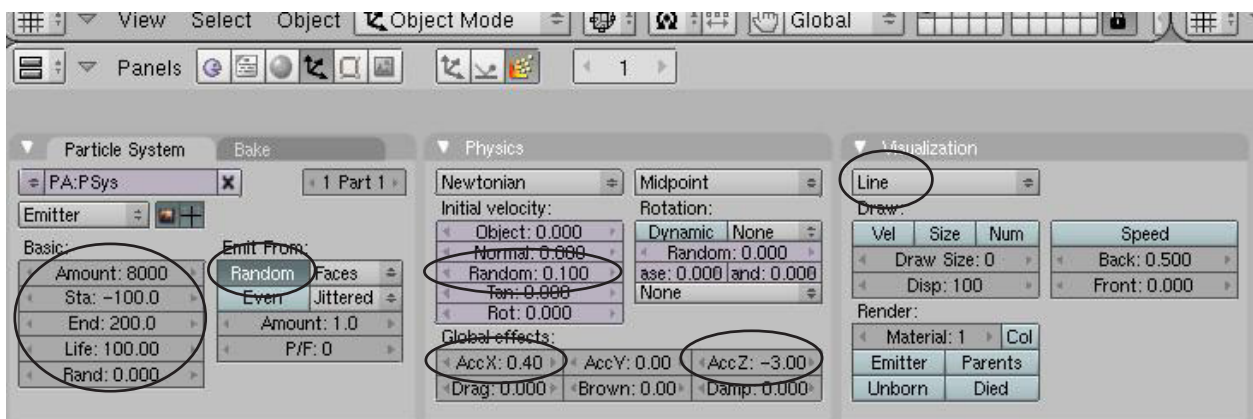
This is a pretty simple rain effect, but quick and easy for our scene and works well. Experiment with material setting for a nicer look.

When finished, render an image and save it as a jpeg. If time permits, feel free to animate your scene.

*** Call the instructor when finished ***

Chapter 14- Child-Parent Relationships

So far, we've talked about making and editing objects, making them look good and how to render and animate them, but how do we make things like humans or robots or anything else move about that have *several parts connected together*? This is where **child-parent relationships** become useful. It allows us to link things together without actually joining them. This allows the individual parts to move about, but still follow a "master" object.

The concept of child-parent relationships is used in all animation programs and it involves an object assigned the role of a **child** and an object assigned the role of a **parent**. If the ***parent*** moves, rotates or scales, the ***child*** must do so too. **On the other end, a child can move, rotate or scale without affecting the parent.** An example would be: a *hand* is the child of the forearm while the *forearm* is the child of the upper arm and the upper arm is the child of the torso. Therefore, if the forearm moves or rotates, the hand must follow and if the upper arm rotates, the forearm *and* hand both must follow. If the torso moves, the entire arm must go with it. This is how you keep a body or machine from going to pieces!

In order to make child-parent relationships in Blender, you need to hold down the "***Shift***" key to select multiple objects. ***Select the child object FIRST, then select the PARENT object.*** The child object is always selected first. If you have a string of objects that need to be child-parented together (like the arm example), *you can only do 2 parts at a time so start at the end of the chain and do the hand and forearm first, then forearm to upper arm and so on*. After selecting the 2 objects, press *"Ctrl-P"* to make parent. You will see a dashed line drawn between the pivot points of the 2 objects. This shows a child-parent relationship.

Child Object- selected first

Parent Object- selected second
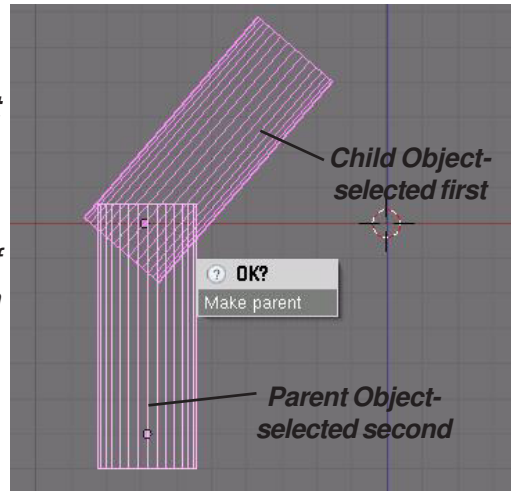
> ***RoboDude Asks: I did the Child and Parent selection backwards- How do I undo them?*** *In order to delete a child-parent relationship, select both objects and press "**Alt**" and "**P**" to clear parent. This is good when you make a mistake!*

Look at the example on the next page. If we want to child-parent a few cylinders together to make a robot arm, create a cylinder and stretch it out in edit mode by moving one end of verticies. ***Remember to pay close attention to the object's pivot point***. If the object needs to pivot like an arm, you will need to keep the point at one end of the cylinder. *Always pay close attention to the object's pivot point in any case. It's easy to forget about it when moving verticies around in edit mode.* You can use the *"Center Cursor"* option in the edit button to locate the pivot to the 3D cursor's location. After you shape one cylinder, exit edit mode and press *"Shift-D"* to duplicate it several times. Locate the cylinders and double check their pivot points. ***Moving the pivots after child-parenting them together may cause the objects to move.*** Start at the end and select the first 2 objects. Press *"Ctrl-P"* to make the relationship. Check it out to see if it's correct and go to the next set. In the next set, the previous ***Parent*** object now becomes the ***Child*** object. Make a simple animation to check the function.

Parent Object

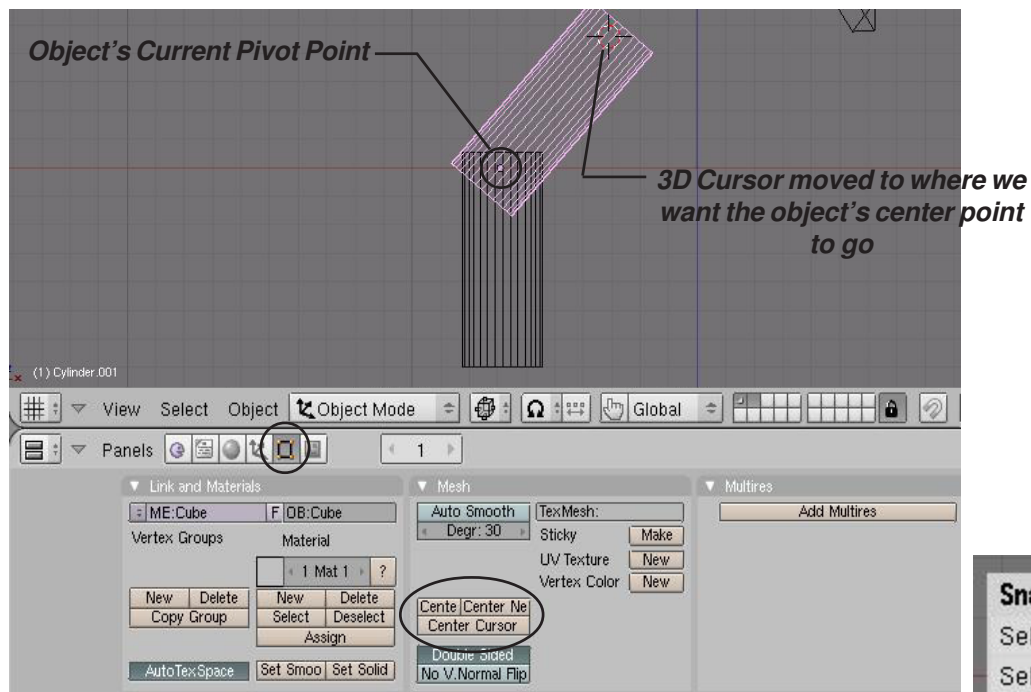*Child Object*

Object Pivot Points
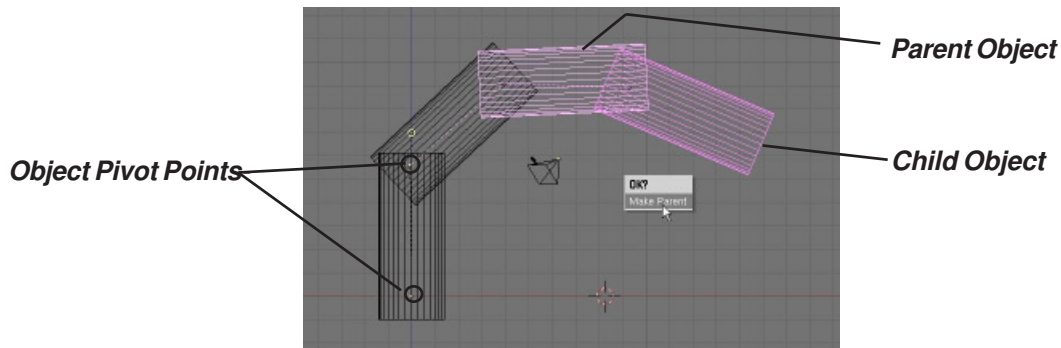
RoboDude Says: You can child-parent almost any object including cameras, empties and lamps.

Review of Moving Object Center Points

In the basic editing chapter, we discussed how to move center points of objects. You were also cautioned about moving an object while in edit mode because the verticies will move, *but not the object's center point*. To move the center point of an object, **select the object**, place the **3D cursor** in the location you want the center point to go, and press the **Center Cursor** button in the **Edit Buttons**.

Object's Current Pivot Point

3D Cursor moved to where we want the object's center point to go

Snap

Selection -> Grid

Selection -> Cursor

Selection -> Center

Cursor -> Selection

Cursor -> Grid

Cursor -> Active

Don't forget about the "Shift-S" command. It is useful for finding exact locations of object or selected verticies. Also useful for moving things around.

Creating a Robot Arm Practice Exercise

Create a new Blender scene and set up the views any way you wish. ***Your job is to design a robotic arm that is child-parented together and animated***. Create all components using planes, cubes, spheres and cylinders. Place materials on all objects and develop a good scene with plenty of lighting.

After you create your scene, develop a 150 frame animation of your robotic arm moving in all directions.

Challenge exercise:
Try to make your robot arm pick something up off the plane!
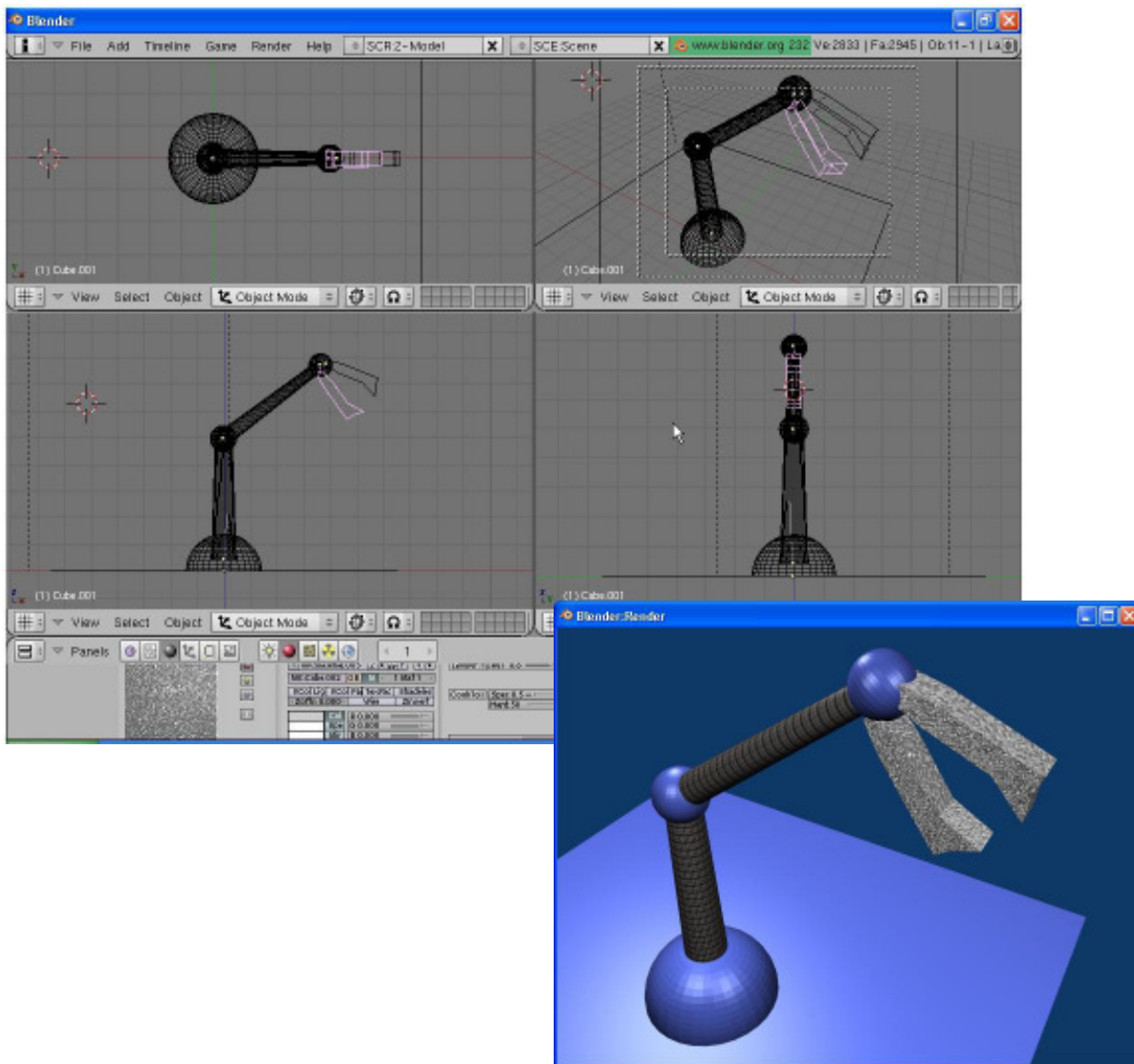
***** Call the instructor when finished *****

Tracking To An Object

There are times you want to "*constrain*" or "*follow*" a certain object in your scene. New constraints are being developed in Blender, but for now, we will just be talking about the most common one used to keep the camera focused on an object- *the "Track To" constraint*. The tracking constrain is useful in animating by saving you a lot of time and frustration trying to place location and rotation keys on the camera in an effort to try to keep your target centered. When used in conjunction with **Paths** (discussed in this chapter), you can create very smooth animation paths. ***Objects besides cameras can also be used with tracking.***

To set up a simple camera tracking constraint, Select the <u>camera</u> first, then the <u>target</u> while holding down "<u>Shift</u>". Press "**Ctrl-T**" and select "**TrackTo Contraint**". Sometimes it's convenient to target an **Empty** object (created in the *Add* menu, like we used in the lighthouse scene). This allows you to move your target around in your scene so the camera can focus on one object for a while, then move to something else by moving the target in that direction. You also have an **influence** option where the camera will track solidly to the object or allow some flowing of the camera.
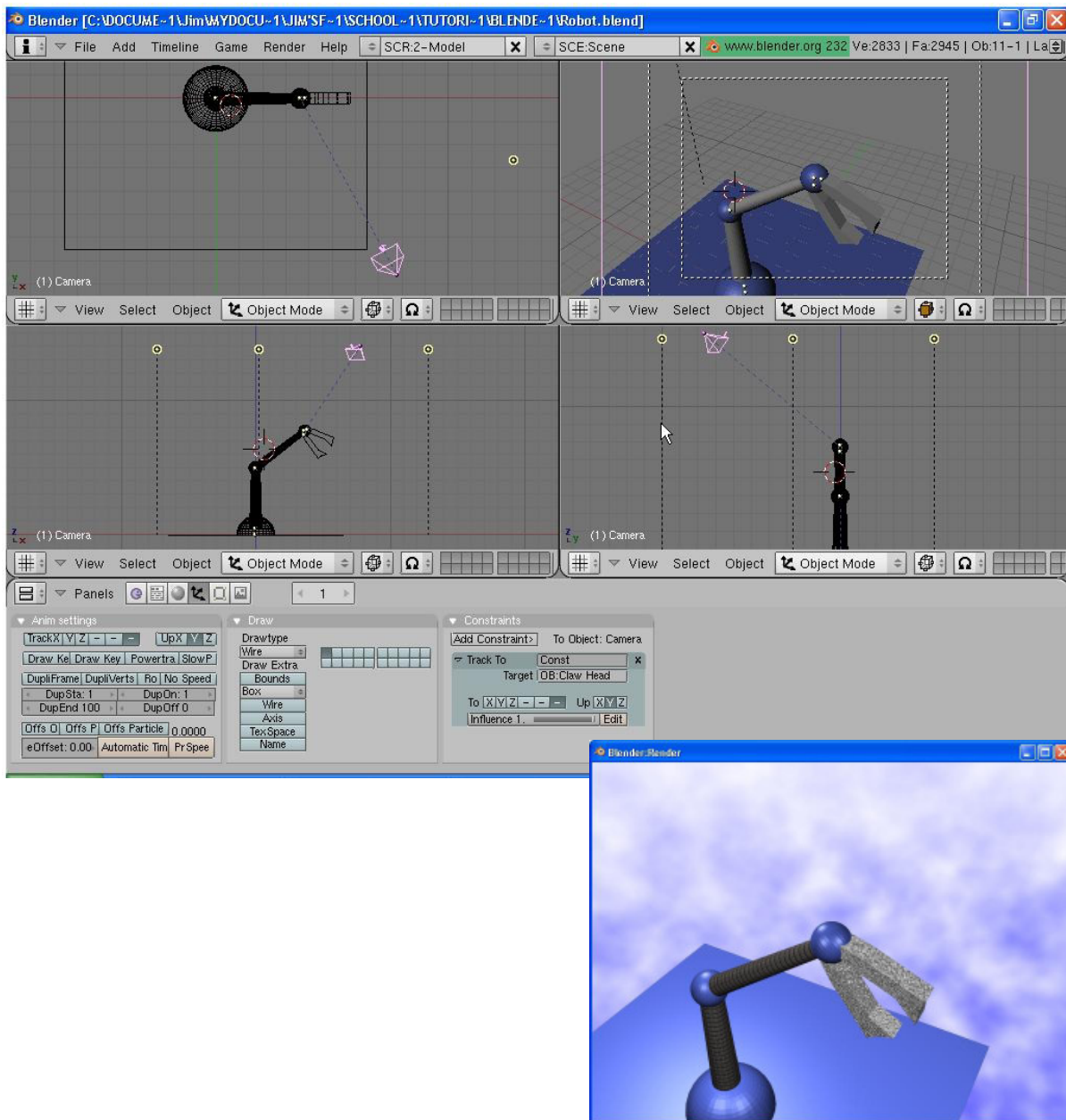
Constraints Menu

In the <u>Object</u> buttons you will see a panel marked "Constraints". This menu continues to grow with each release and gives you a variety of constraints and limitations for objects. Depending on what you need in your scene, you can do a variety of contraints. Experimentation and internet research will help you with those specific needs.
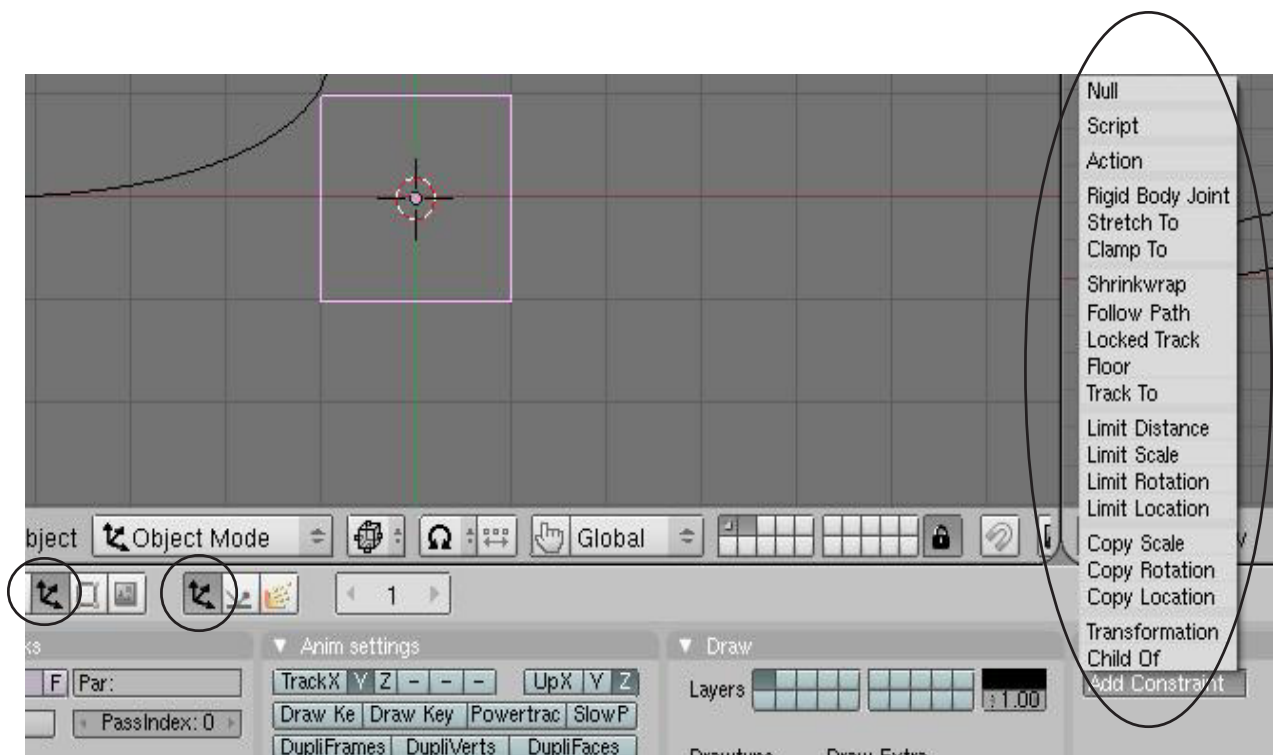
Camera Constraints Practice Exercise

Open the Robot Arm scene you made in the last exercise and add a camera constraint. You may target any part of the robot arm you like or create an Empty and target the camera to that. In the scene below, the camera was targeted to the gripper head.

After you create your scene, develop a 150 frame animation of your robotic arm moving in all directions with the camera also doing some movement.


*** Call the instructor when finished***

Following Paths and Curves

Sometimes you need to have an object flow along a smooth path in an animation. For example, it would be easier to have a spaceship flow along a line and angle and bank along that line then it would be for you to insert location and rotation keys throughout the animation. **Paths and Curves** are found in the same **Add** menu and can not only be used to create animation paths as discussed above, but can also be used to create extrusions. To create 3D extruded objects, you need to create a 2D sketch of a profile and a path for that shape to follow along. In this chapter, we will be working with both.

Following Paths
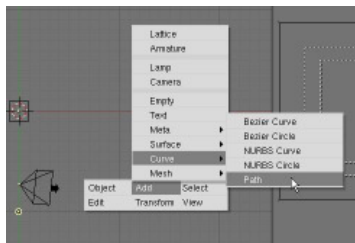
Your first step is to create a **path**. Any type of **Curve** in the **Add** menu can be used as a path, but let's use the **Path** option. Hit the **Space Bar**, select **Add, Curve**, then **Path**. You will then get a path on the screen in *Edit mode* with several points. Shape the path as desired, add more verticies through **Subdivide** if necessary and exit *Edit* mode.
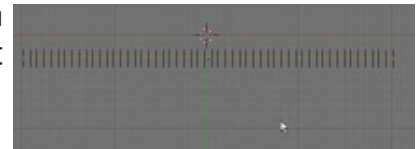
There are several ways to get the camera, object or lamp to follow the path. For now, we'll stick to the traditional way by creating a **child-parent relationship**. Select the object first, then the path (the parent). With both objects selected, press **"Ctrl-P"** to make a parent. You'll have 2 options: *"Normal Parent"* and *"Follow Path"*- select the *"Follow Path"* option. You will see a dashed line between the 2 objects. Press *"Alt-A"* to see the animation along the path. In order to get the object exactly placed on the line, move the object and place it. Right now the object's animation is exactly 100 frames long and doesn't turn to follow the path. To correct this, make sure the path is selected and go to the **Edit** buttons. here's what you see:
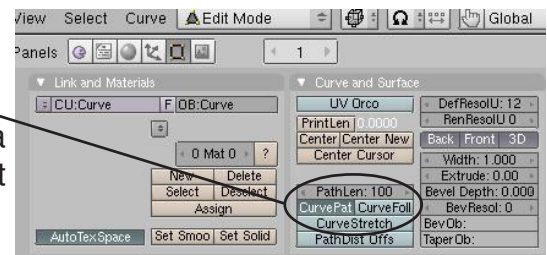
You basically have 3 options for the object following along this path. They are:
Path Length- frames it take to travel
Curve Path- will the object follow the path
Curve Follow- object curves along the path.
After you press the **Path Follow** button, the camera needs to be rotated and adjusted to the correct direction. After that, it will follow the path.

If you adjust the path length and hit *"Alt-"A"* again, you would expect the animation to change it's length, but it doesn't. There's a hidden "**Speed**" path that is hard to find the first time you try this. With the path selected, change the window type to the **IPO window**. You will then need to change the **IPO type** to **Path**. Delete the **Speed** track. See the next page:
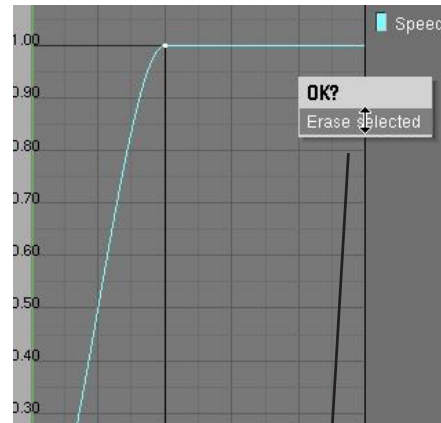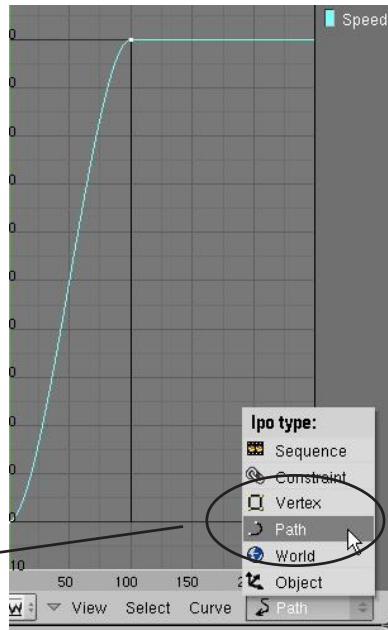
RoboDude Says: You can <u>close a path</u> by typing "C" in edit mode. You can <u>switch the direction</u> of the path by pressing "W" while in edit mode.
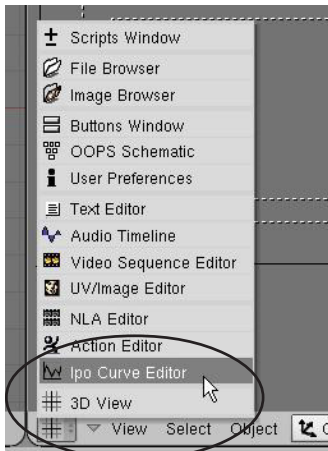
You will see the "**Speed**" track after you switch the **IPO type to Path**.

After you select and delete the speed path, the path length option will work in the Edit buttons.

Sometimes you don't want the camera to follow along the path, but look at an object as it flows along the path. **This is where you would want to use the *Curve Path*, but not *Curve Follow.*** Instead, you would put a ***Track To*** constraint on the camera so it looks toward an object as it moves along the path.

Other **Curve** objects can be used as paths also. For example, if you want a circular path, select the ***Bezier Circle*** option from the *Curve* menu. **The *Curve Path* button is not automatically pressed when you child-parent the object to the circle though, you must go into the edit button and do it manually.**
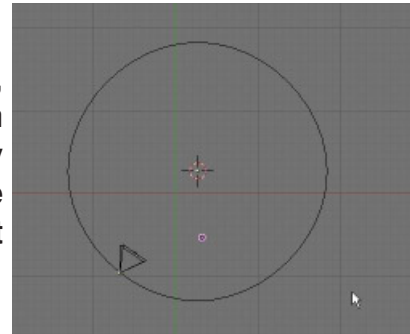
Using Curves for Extrusions

You can create a shape and extrude it along a path in Blender. For our example, we will shape a ***Bezier Circle*** and extrude it along a ***Bezier Curve***. First, create a ***Bezier Circle*** from the ***Add-Curves*** menu and shape it into an interesting object. Feel free to add more points with the *Subdivide* command. Second, create a ***Bezier Curve*** and shape it into some shape. Bezier shapes form differently and use spline points. Experiment with them to get the feel of working with them. Go to the *Edit* buttons and name both objects in the ***OB:*** block. Finally, select the ***Bezier Curve*** and go to the *Edit* buttons. You will see a **BevOb:** box. Type the name of the circle there. You will see the shape extruded along the curve! You can still shape the circle and the curve (*in edit mode*) and scale the objects.

*You can convert the new shape into a mesh to make it easier to work with by pressing the "Alt-C" keys*
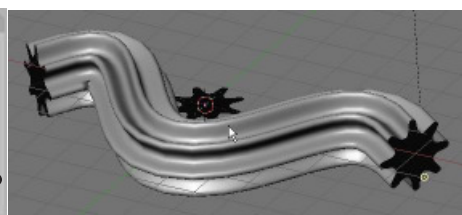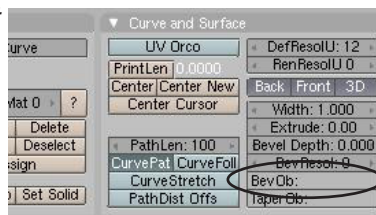
Create a new Blender file and name it **Paths**. Develop a path for your camera that goes around a shape that you extruded along a curve. Use the extruded shape as the target for the camera so that as the camera flows along its path, it is always focused on the object. *You may need to adjust the object's center point in order for the camera to properly focus on the object. (refer to the basic editing chapter)*. Add materials to all objects. If you would like to close your extruded shape (not open on the ends) try this: Convert the extrusion into a mesh ("Alt-C"), go into Edit mode and select the end verticies. Type "**E**" to extrude, then immediately type "**S**" to scale. Scale the new verticies to close off the end (*You can also type "W" and select "Merge at Center")*. . If you would like it to look like a pipe with some wall thickness, enter Edit mode and select all verticies. Press "**E**" to extrude and "**S**" to scale slightly.

Save a 100 frame animation when finished.

Challenge exercise:
After you do the required exercise, make a new one. Before you extrude your shape along it's curve, duplicated the curve and use it for the camera path. Place the path directly in the middle of the extruded shape to make the camera flow through the "tube".
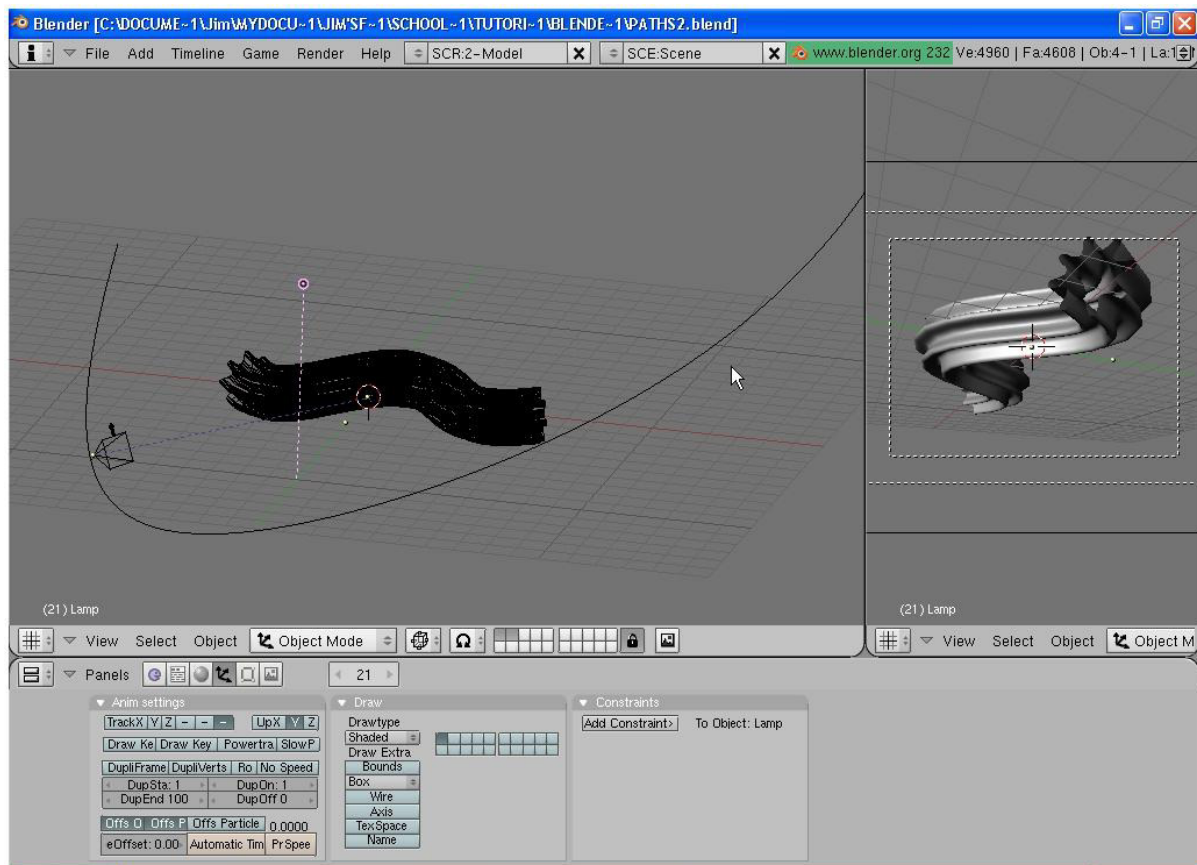

*** Call the instructor when finished***

Using Armatures to Deform Meshes

Blender's animation capabilities are great for most object animation except when you want to animate something bending like a person in motion or a tree bending in the breeze. This calls for a mesh to deform which can't be done with traditional modifiers. We can deform a mesh in 2 ways in Blender. One way is to create a skeleton and have it deform a mesh *(armatures)* and the other method is to move the mesh verticies in edit mode and create sliders that deform the mesh *(relative vertex keys)*. This chapter deals with creating armatures. The armature feature in Blender is constantly under development. For this discussion, I will stick with the fundamentals. More information can be found at www.blender.org or at www.blenderartists.com.

The first thing you need to do is create a mesh that has a few groups of verticies where you would like the object to bend. Any mesh will work and to get additional verticies you can either **extrude or subdivide**. *Be careful not to create too many verticies*. It may slow your model down considerable. Let's use a cylinder to create an arm. I will use a cylinder set at the default divisions of 32. Next, I will change to a front view and box select the top set of verticies and *Extrude* them up. I prefer to use extrude rather than subdivide to keep the vertex count down as low as possible. As I extrude the verticies, I am also using *Scale* to shape them.
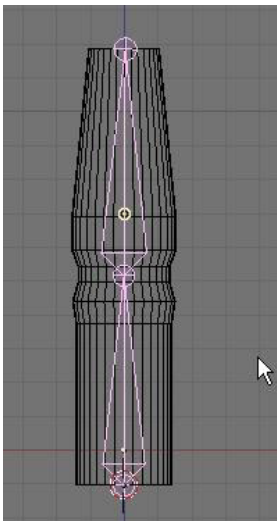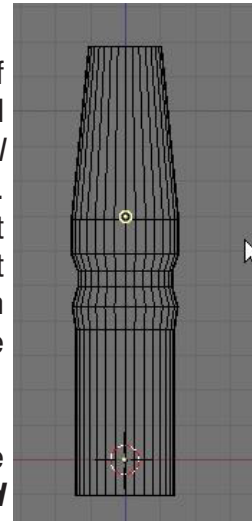
Next, place the 3D cursor directly at the bottom of the shape you just made. Hit the **Space Bar**, then **Add** followed by **Armature**. You will immediately see a bone begin to form at the cursor location. Type "**G**" to *grab* the top of the bone and lengthen it to a desired size. Move your cursor up to lengthen the bone and click where you would like the joint to be.To create another bone at the top of the first one, press "**E**" to *extrude* another bone from the first one. If you run out of room to drag the mouse up, just click wherever and hit *"Esc"* to stop making bones. As like all other objects you create, you are in edit mode. To adjust the top bone to get it in the correct position, RMB click on the top of the bone. The small circle highlights. Press *"G"* for grab to move it. When finished, press *"Tab"* to exit edit mode. Double check the armature to make sure that the ends and joint are well aligned. To add more bones, hit **Tab** to enter edit mode again and **Add Bones** with the **Space Bar**.
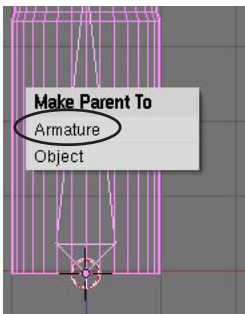
Your next step is to create a **child-parent** relationship between the mesh and the armature with the mesh being the **child** and the armature being the **parent**. Hold down the *"shift"* key and select the mesh first, then the armature. Press *"Ctrl-P"* to make parent. Select the option to *"Parent to Armature"* since the armature is both of the bones together. You will then get some options as to how to create the vertex groups that will move with each bone. For now, use the *"Name Groups"* so the computer will figure it

out and give vertex group names. Sometimes this will not work if verticies are close together (like several fingers on a hand). Verticies from one finger may get grouped with bones from the finger beside it- not a good effect! We will discuss changing your vertex groups later. That's it! Time to test your model!
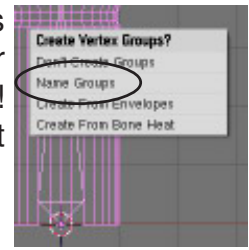
To create entire skeletons or other complex armature structures, you can do the following:

Join meshes together to form one mesh for an entire body. This can be done using the boolean *"W"* key or by just selecting them all and pressing *"J"* to join. Make sure they are all set up with materials and textures before you do this and some of the textures may need readjusting. **This must also be done before you child-parent any of the meshes to an armature.**

Create all of your individual armature sets and join them together as you do meshes or work with child-parent relationship with the bones.

To animate you armature:
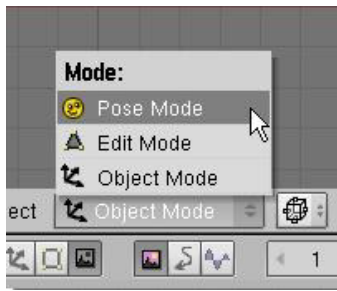
It's time to animate our "arm" model. To do this we must get into *"Pose Mode"*. Change the Mode option from **Object Mode** to **Pose Mode**. This can also be done by pressing *"Ctrl" and "Tab"* together. Select a bone to work with by RMB clicking on it. Type "**R**" to rotate it. If everything went well, the mesh should move with the bone. Place animation keys in the various frames as before to create an animation.
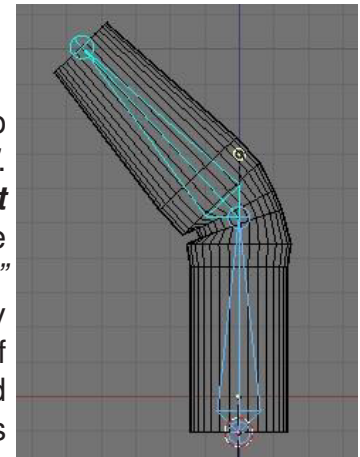
Automatic Keyframing with Armatures:

Placing animation keys on a complex armature system can be time consuming and very easy to miss a bone in a frame when you need to place a rotation key on 20 bones. That's why there's an automatic keyframe option in the top **User Preferences** window. Pull down the top menubar to expose the setting. Select *"Edit Methods"* and turn on the **Auto Keyframing button**, *"Action and Object"*. This will automatically place keys on every bone that has been moved in a particular frame. *Remember to turn it off when finished or it can cause some major problems. If this is still inoperable, refer to page 71 on Auto Keyframing.*
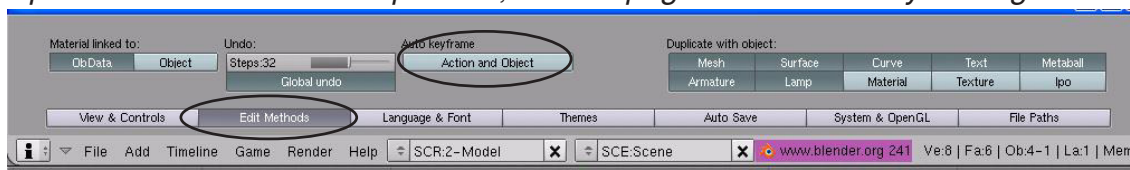
RoboDude Says: *Even if a bone isn't moving on a particular frame, move it slightly so the automatic keyframing places a key on it. Otherwise, it may move when you don't expect it to because it was missing a key. Experiment with the features to become familiar with them.*
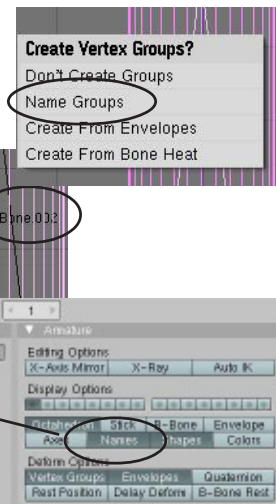
Creating Vertex Groups:

As mentioned before, sometimes when verticies are close together, Blender may have a dificult time creating clean vertex groups automatically. You will need to define the vertex groups manually. First, create your mesh and armature, then **child-parent** them to *"Use Armature"* as before, and again, select "**Name Groups**". The computer will name the groups for you and also try to assign verticies to bones. For now, we will discuss naming and making your own groups.

For this example, I've created a mesh we'll call *Finger*. I then created an armature and duplicated both to create 2 fingers. The next step is to **Join** (*"Ctrl" and "J"*) the 2 armatures together, then do the same for both meshes. **Child-parent** the mesh to the armature, select the *"Name Groups"* option.

Now we need to see the names of each bone in the armature so we can assign verticies to them. Select the armature, then go to the *edit buttons* and find the "**Names**" button. Pressing it will cause the names of each bone to be displayed on the screen. The will most likely show up as Bone, Bone.001, Bone.002, and so on. You will need to place these names exactly as shown.

Now select the **mesh** and go into **Edit Mode** (*tab* key). In the **edit buttons**, you will notice a group of buttons for creating/ assigning **Vertex Groups** (this block of buttons will only be displayed if you're in edit mode). Select the *group name* for the bone you are working with. If you ever need to create a new group, press "*New*". Remember that each bone will need a group and the group name **must** match the bone   (i.e.Bone.001, Bone.002).
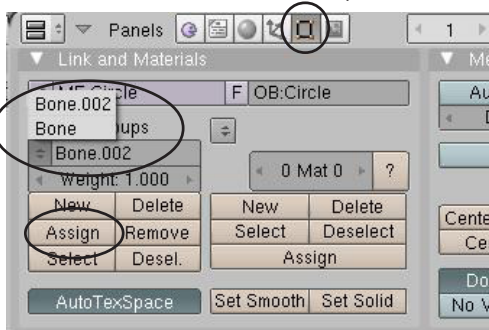
Our next step is to select the verticies that need to be assigned to that bone. *If a group of verticies is right at the joint, they need to be selected for both bones.* After selecting all the verticies that belong to that bone, press the "**Assign**" button. You've now made a vertex group

for that bone. Do this for all bones. When finished, exit edit mode and select the armature. Press "**Crtl**"-"**Tab**" to enter **Pose Mode** and test out the armature. If you need to modify any groups, you can go back into edit mode on the mesh to make corrections.

Remember we discussed the benefit of selecting the "**Name Groups**" option when parenting the mesh to the armature? It will save us a step in naming all of the vertex groups.
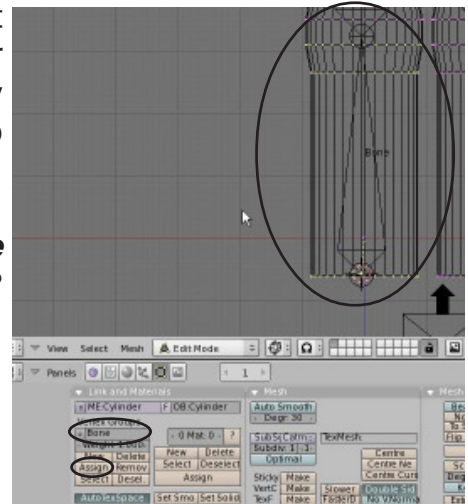
Using Inverse Kinomatics (IK)

Inverse Kinomatics is used when you wish to manipulate a skeleton by simply grabbing (**G** key) the end bone of a chain and moving it with all of the connected bones following along. Inverse Kinomatics is constantly under development and has a lot of options available depending on what you want them to do. *Visit www.blender.org for more details.*
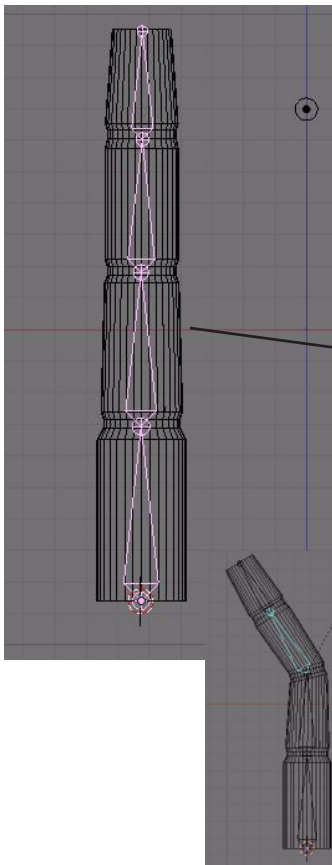
For our example, make a **Cylinder** in the *top view*, switch to the *front view* and **Extrude and Scale** the object several times to look like the example.

Next, move the cursor to the bottom of the mesh and **Add** an **Armature**. Use "**G**" to grab the top of the bone and move it to the first joint. Press "**E**" to extrude another bone to the second joint. *Repeat two more times to create a 4 bone armature*.

Child-Parent the mesh to the armature with **"Crtl-P"** and select the "**Name Groups**" vertex group option.

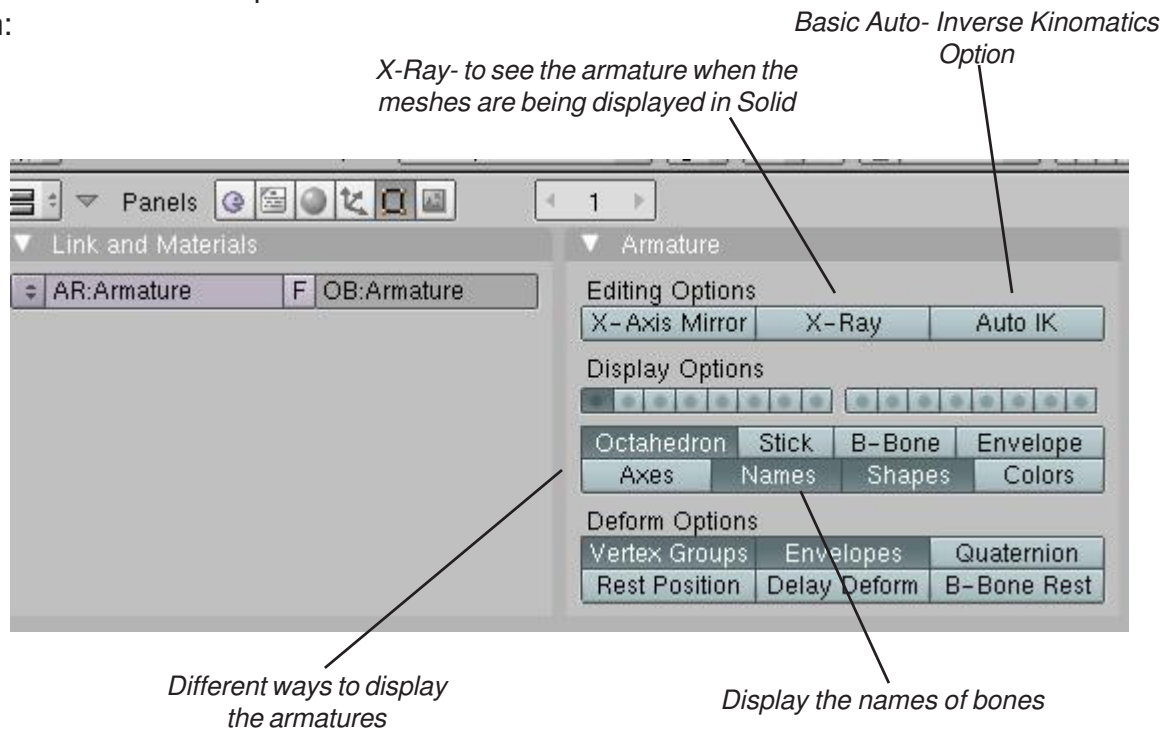Go into **Pose Mode** and rotate the bones to check the vertex groups to make sure they were assigned properly.
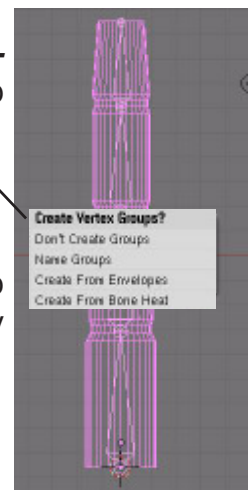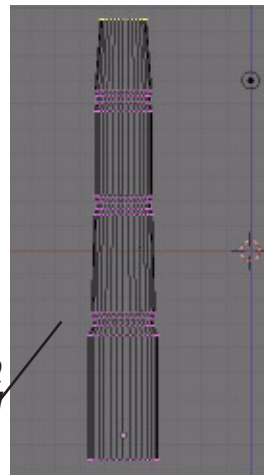
If everything checks out with pose mode, keep the *last bone selected* and go to the *Object buttons*. Find the *Constraint* panel. Under "*Add Constraint*" you will see a variety of options that apply to armatures. You can limit bone rotation/location and scale, track it, stretch it, etc. For this example, select the "***IK Solver***" constraint. Try moving the end bone. You should see it deform all the bones in the chain. You can also lock the bone to an object that will deform the entire chain.
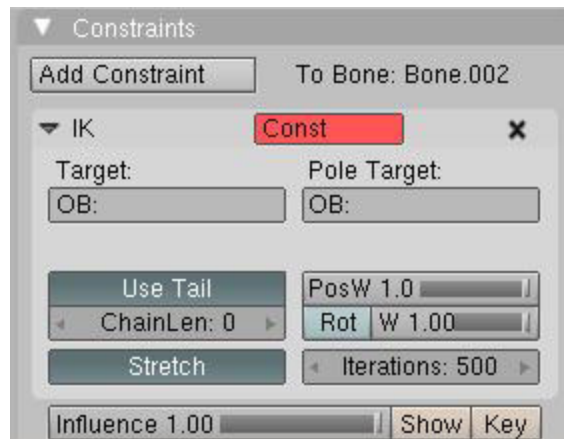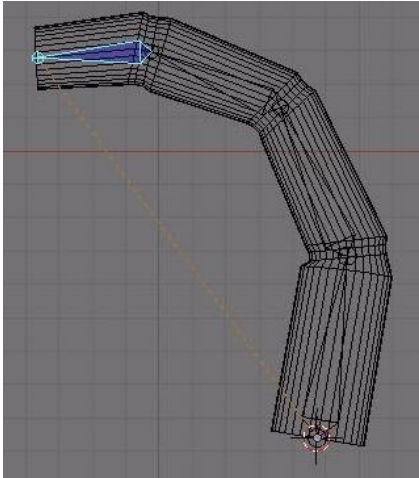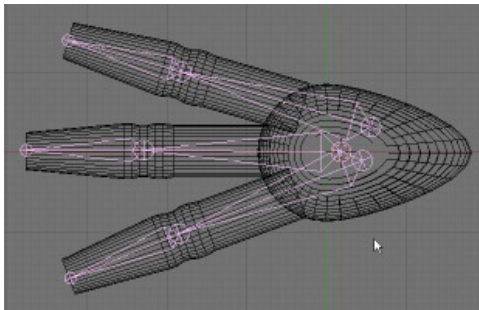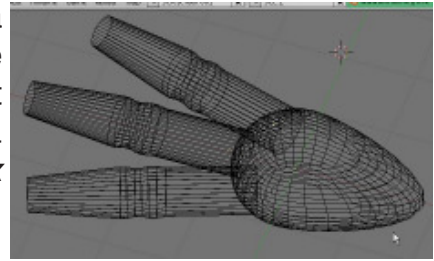
Additional Armature Settings:

Here are a few more options that have been added to make armatures a little easier to work with:

Basic Auto- Inverse Kinomatics Option

X-Ray- to see the armature when the meshes are being displayed in Solid

*Different ways to display the armatures*

Display the names of bones

Create a new Blender file and name it *Hand*. Create a UV Sphere for the hand and a cylinder for the finger. Use **Extrude** to lengthen the finger and provide verticies at the joint (*one joint only*). **Duplicate** the finger to make a total of 3. Shape the sphere with **Proportional Vertex Editing** *("O" key)*. Join all meshes together. Create a 2-bone armature for each finger and **Join** them together. Child-parent the mesh to the armature set and create vertex groups (you may or may not be able to use the automatic setting). Place a material on the mesh. **Add lighting and create a 100 frame animation of your scene.**

Challenge exercise:
Try to use armatures to animate some other object. Try a simple body that walks.
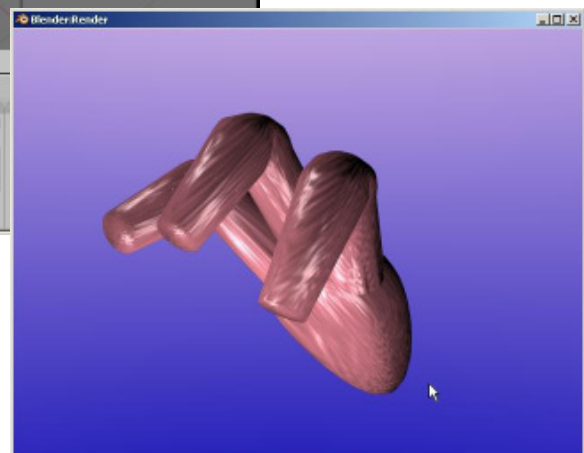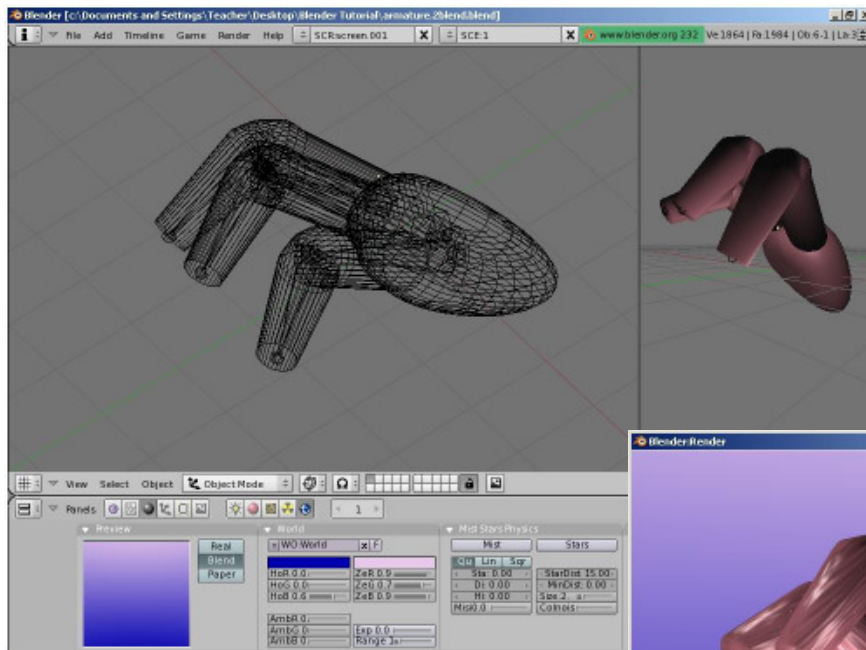
**** Call the instructor when finished****

Creating Mesh Keys

We've discussed deforming a mesh with an armature, but what if you want to deform a mesh in other ways like have it flatten, move a mouth, blink an eye, etc. and have a way of repeating that motion whenever needed? Some of these things can be done with armatures, but sometimes it's easier to set up a **slider** that at one end, represents the mesh in one form, and at the other end of the slider, shows the mesh fully deformed. See the example below:

*Action Editor
Window*
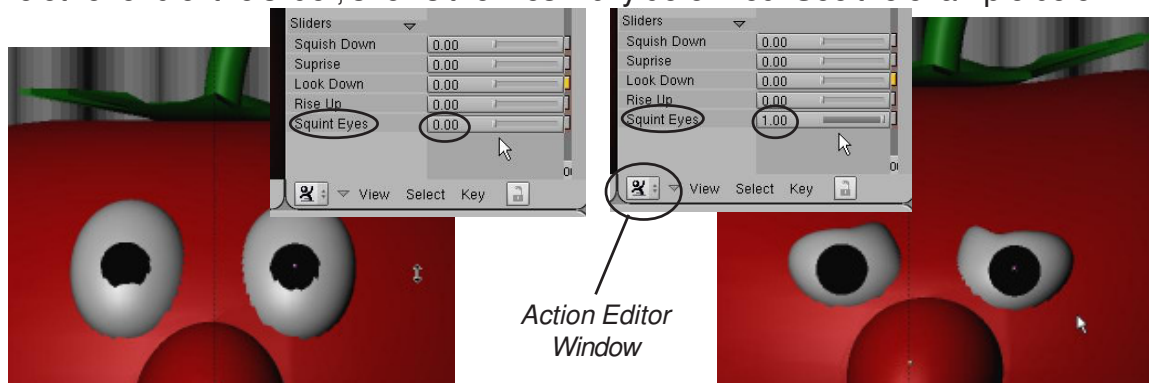
Mesh deformation using *Sliders* in the **Action Editor Window** can be a difficult process because it requires you to shape your mesh in edit mode moving verticies. With practice, this can become a worthwhile tool that will enable you to make quick and high-quality animation like the professionals do. If you notice in the above example, there are several sliders that cause different motions. By using combinations of them, a wide variety of motions can be produced *(for example, surprise and squint will combine the motions)*. These are great tools for making a character speak, blink and show expression.

The first step in creating **Relative Vertex Keys (RTVs)** is to start with a mesh you wish to deform. For our case, we'll create a **UV Sphere** set at the default segments and rings of 32. Split the 3D window into 2 viewports and set the right-hand viewport to the **Action Editor Window.** This is another type of animation control window where animation keys you create are shown as marks on the timeline. Keys can be duplicated and moved here. When we create our RVKs, they will be shown here as slider bars.
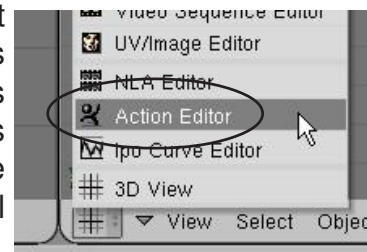
Let's go back to the left-hand viewport (still set to the 3D view window) and begin creating RVKs. **Unlike normal animation that requires you to move to different frames along the timeline, we will be creating all our different sliders and mesh deforms on frame one**. After the sliders are all created for our mesh, then we will use them in the Action Editor window along the timeline. With the sphere selected, make sure you're **NOT** in edit mode, but in *object* select mode. (*Tab* key). Hit the *"I"* key to insert a **Mesh** key. In older versions of Blender, the first time you hit the **Mesh** key for that object, you will get an option for **Relative Keys** or **Absolute Keys**. Select the **Relative Keys** option. **You won't get this option in 2.41 and up. You will automatially be making Relative Vertex Keys.**
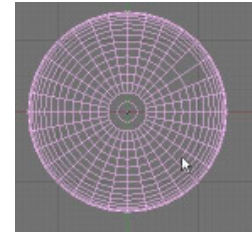
Using Action Editor Sliders

Once you hit the Mesh Keys button, the word **Sliders** is added in the **Action Editor** window after you change the **Editor Mode** to "**ShapeKey Editor**". However, no sliders have been added to the list as of yet. Now, with your cursor in the 3D window, press **"I"** to insert again a **second time** and select *"Mesh"* again. A *"Key 1"* (*or may display no name*)slider show up in the list. It's now time to define that slider. Now, go into **Edit Mode** ("*Tab*" key) and modify the verticies however you want. When you exit edit mode, the slider will now deform the mesh. **To create another slider, Insert another mesh key while NOT in edit mode**, then hit "**Tab**" to enter edit mode and modify the mesh. When you again exit edit mode, the slider will be set. Here's an example:
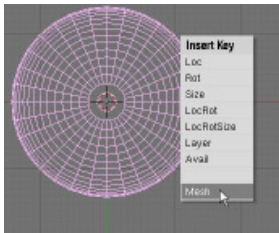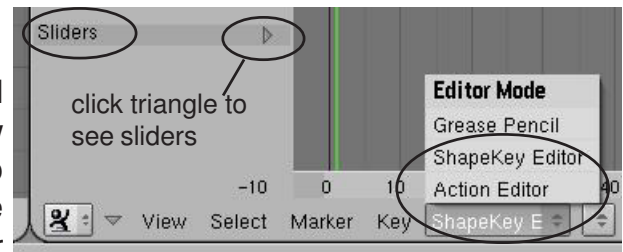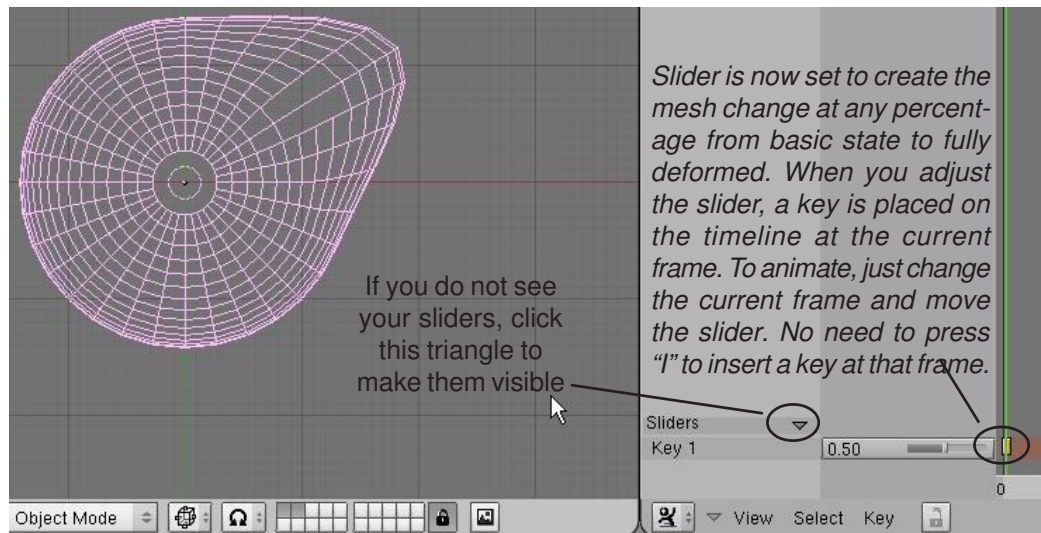
In object mode, press "I" to insert a Mesh key
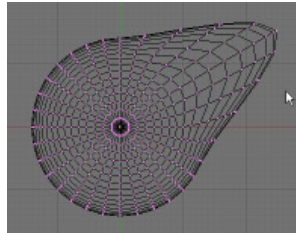
Enter edit mode (Tab) and modify mesh

Exit edit mode (Tab), mesh goes back to basic state, slider now functional.

If you do not see your sliders, click this triangle to make them visible

Slider is now set to create the mesh change at any percentage from basic state to fully deformed. When you adjust the slider, a key is placed on the timeline at the current frame. To animate, just change the current frame and move the slider. No need to press "I" to insert a key at that frame.

The basic thing to remember about RVKs is that in order to create the slider, **You must insert the key in object selection mode, then enter edit mode (Tab) to modify the mesh.** When you exit edit mode, the slider is set. Repeat the process to create all your sliders.

In order to name your RVK sliders, place your cursor over the name of the key you wish to change and press "**N**" for name (*or click on the slider*). This window comes up where you can name your slider. You can also adjust the min. and max. of your slider.
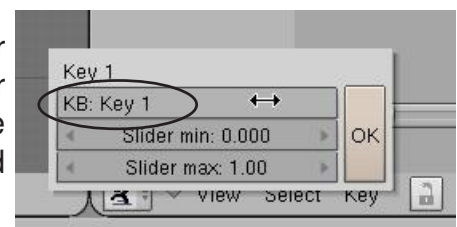
New RVK Creation Panel for 2.40

With the release of version 2.40, you have a new way to create *Relative Vertex Keys* in the *Edit* buttons. Instead of pressing the **"I"** key to create a mesh key, follow these steps:

Select the mesh you wish to apply RVKs to, then, in the **Edit** buttons, find the **Shapes** panel. Click the "**Add Shape Key**". *This is the same as you hitting the "I", then mesh key the first time, but not creating any sliders in the previously discussed process.*
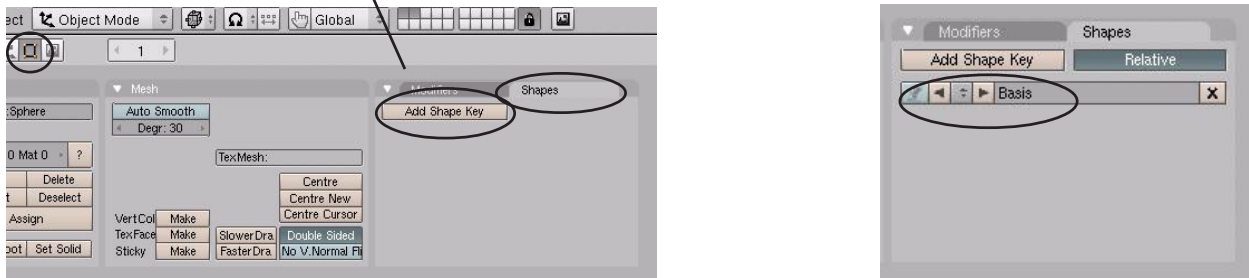
Now press the "**Add Shape Key**" again. The first RVK Slider will be displayed. At this point, enter **edit** mode and modify the mesh. When finished moving verticies, **exit edit mode** (*the verticies will return to their original positions*) and the slider will now be operational. They will also be displayed in the **Action Editor** window.
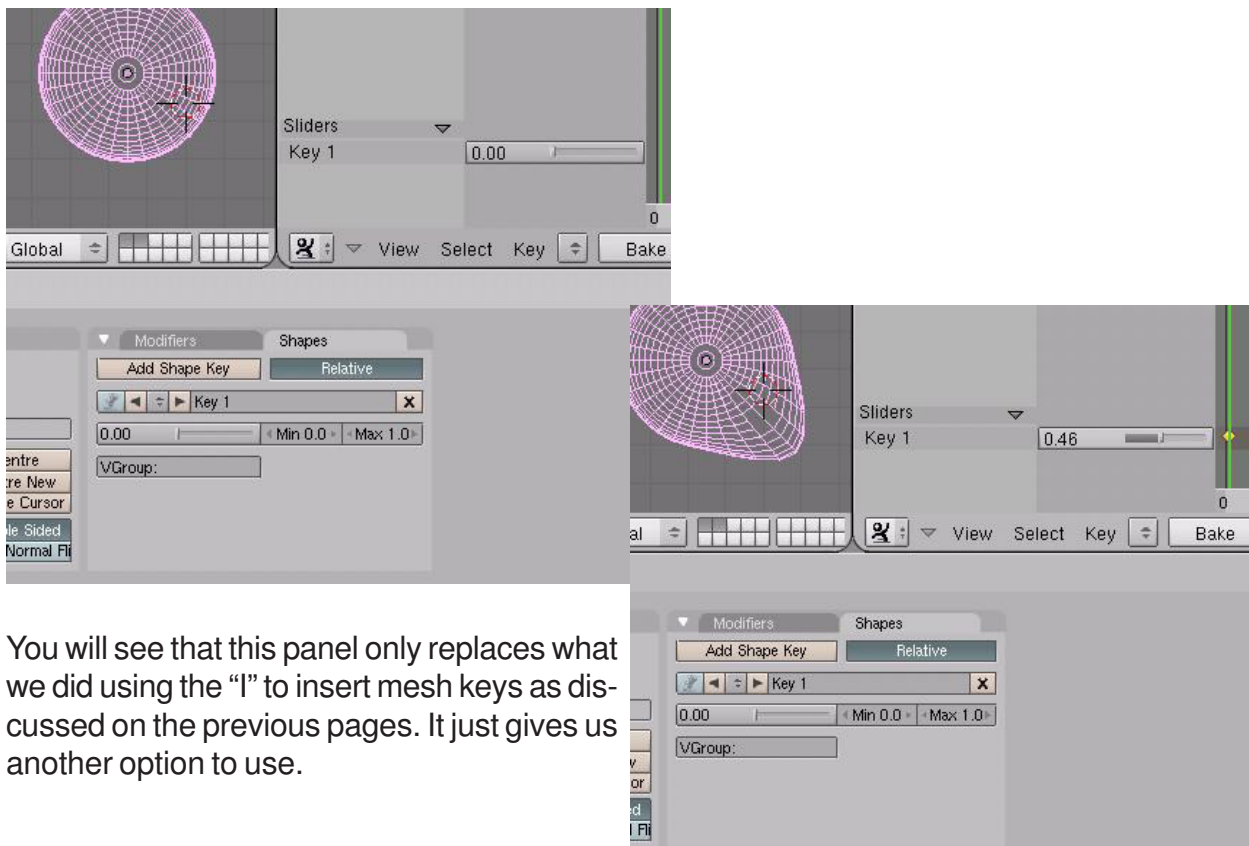

You will see that this panel only replaces what we did using the "I" to insert mesh keys as discussed on the previous pages. It just gives us another option to use.

To test your mesh key and facial expression skills, we are going to animate the monkey talking and making expressions. Start a new file and call it "**Mesh Keys**". Switch to a *front view*, delete the initial cube, then add a *monkey head*. Add a *SubSurf* modifier (*from the edit buttons*) and press "*Set Smooth*". Split your screen into 2 windows and set the right side up as an *Action Editor* window and change the display type to *ShapeKey Editor*.

Let's add a shape key to the monkey's eyes. We're going to make him look surprised. Start by pressing "**I**" to Insert a *Mesh Key*. Remember to click the small arrow by *Sliders* to see the keys we are about to make. Press "**I**" again to make the first slider, then enter *edit mode* to shape the eyes. Select only *one vertex above each eye* and turn on **Proportional Editing**. Scroll the mouse wheel to changed the effected area as you move the verticies up. After shaping the monkey, hit Tab to exit edit mode. the Monkey should return to normal shape and the slider should change his expression.

Two selected verticies

*Click triangle to see sliders*

Proportional Editing
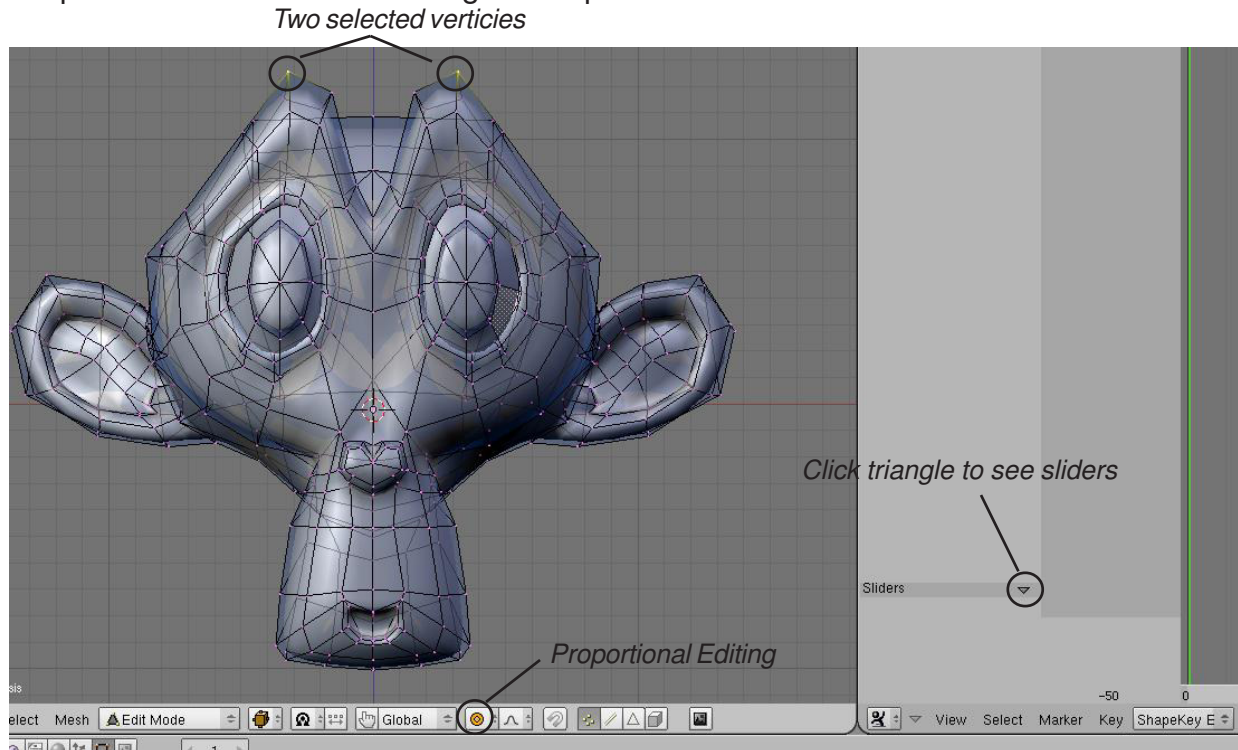
Continue adding mesh keys to bring the monkey to life using proportional editing. Add another slider to the eyes making him squint. Add a slider to move the ears. Add one to his mouth. When you are finished, animate a short movie making making expressions.

** Call the instructor when finished**

Creating Fabric and Wave Effects

One of the newest and best features added to Blender in recent releases is Soft Bodies. Soft Bodies are used to simulate fabric, "jello", and water. A mesh can deform a soft body mesh (clothing on a model or a boat in the waves). The **Soft Body, Cloth, and Fluid Simulation** features are found in the **Object** and **Physics** buttons.
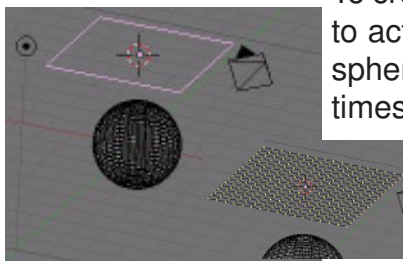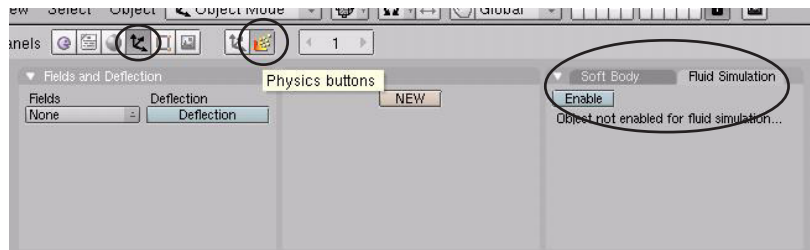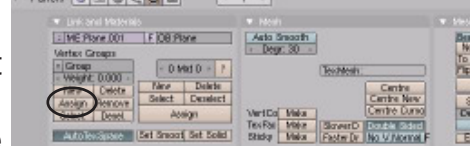
To create a simple animation of a plane with *Soft Body* applied to it to act like a sheet deforming to a sphere, create a plane above a sphere as shown to the left. In **edit mode**, subdivide the plane **4-5** times. Soft Body shapes need a lot of verticies to look good. While still in *edit mode*, select all of the verticies and, in the **Edit** buttons, create a new vertex group (*keep the name as just* **Group**). Set the weight to **0** and hit **Assign**. This will give all of the verticies a weight of 0 meaning they will not be anchored and be able to fall. Now deselect all of the verticies except the **2 left-hand outer verticies**. Take the Weight up to **1** and hit **assign**. This will anchor these verticies (like the corners of a flag). *Exit edit mode*. It's now time to go to the **Object** and **Physics** buttons and hit the **Enable Soft Body** button as displayed below.
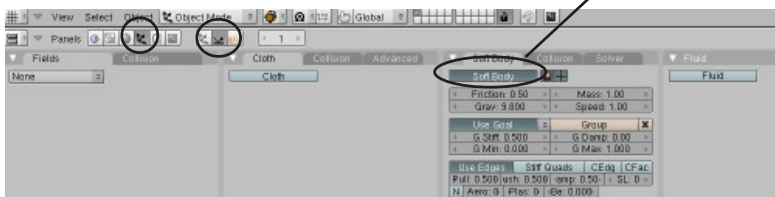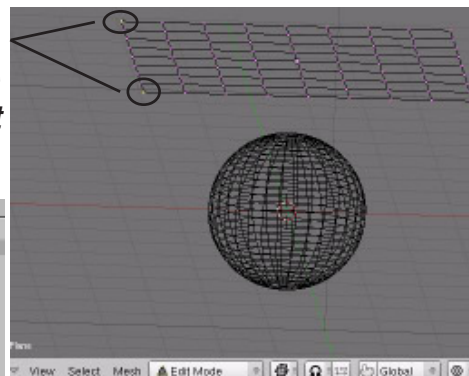
You now need to set a few things to see some animation. First, set **Gravity** to about **9.8** (earth settings) and select the vertex group: **Group** under the "**Use Goal**" setting. You are now ready to see 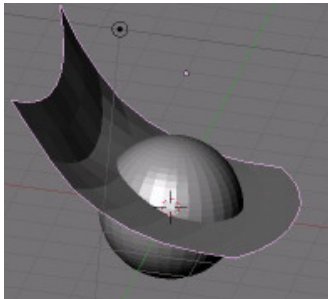the Soft Body in action! Place your cursor in the 3D window and hit "**Alt-A**" to view the animation. (you may want to shade the view) The plane should fall through the sphere and stretch quite a bit from the 2 anchor points. Not quite what what we want, but a start.
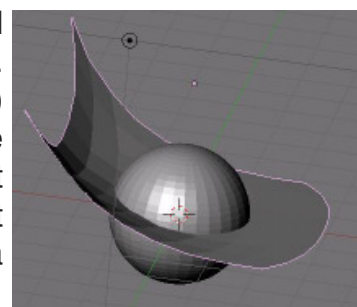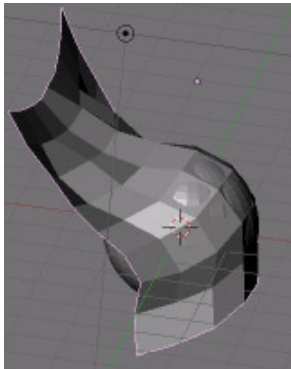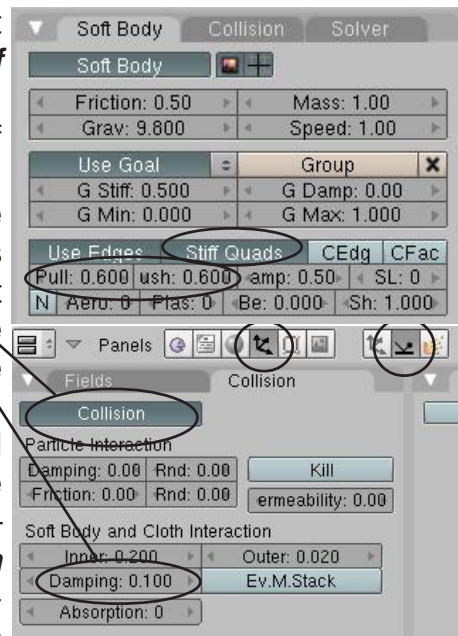
We now need to "*stiffen*" the fabric so it doesn't stretch out of shape. Under "**Use Edge**", click the box called "**Stiff Quads**" which sets the "spring" or elasticity of the verticies. If this number is taken to **0**, the shape will *stretch* out of control (try it). We want to set this at about .**60 for both Pull and Push** so it does not stretch much. Try to animate the window again. You should see a difference. Now it is time to cause the fabric to interact with the sphere. Select the Sphere and turn on **Deflection** in the **Fields and Deflections** panel. Take **Dampening** up to **1**. This will cause the plane to react with the sphere. *This will slow the computer down considerable when hitting "Alt-A"*, but look at the example to the left. In order to see the animation correctly, you will probably need to select the plane again and go to the softbody panel and hit "**Free Cache**" to clear the memory.

It looks good, but still passes through the object slightly. **To improve this, you can Subdivide the Plane more and/or use a Subsurf modifier on the plane**. Experime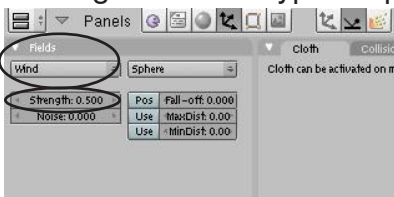nt with the settings to get a good result. You can also speed up the process by using a sphere with fewer verticies. Once you have an effect you like and want to save the process, you will need to "**Bake**" the animation settings. To do this, select the **Plane**, then go to the Collison panel. Set the **Start** and **End** frames you wish to bake and hit the "**Bake**" button. When it finishes running through all the frames, hitting the "Alt-A" button will be faster plus you will be able to cycle through all frames and see the animation. If you need to make changes, you will need to "**Free Bake**" the animation, make the changes, and "**Bake**" again.

Using Forces to Manipulate Soft Bodies

Besides collision detection with other objects, Soft Bodies can be manipulated by forces like wind. To demonstrate this process, delete the **sphere** from the scene (to speed things up) and add an **Empty** to the left of the plane. We will be using the Empty to act as the wind. Remember that an empty will not render as an object and works great for this type of application. With the **Empty** selected, go to the **Fields** panel and change the Fields to "**Wind**". Set the **Strength** to about **1.0**.
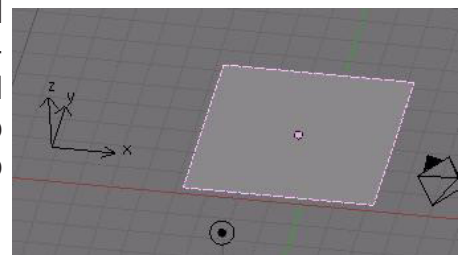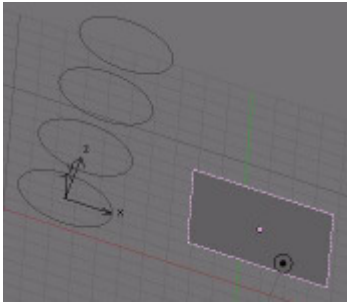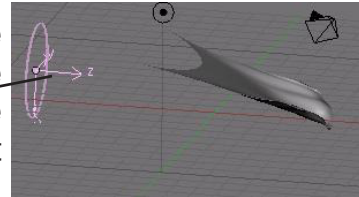
The wind may not be pointing in the right direction and may need rotating to point to the plane. Do that at this time. Hit "Alt-A" to animate the view. The wind is probably so strong that it almost blows the plane away. Try changing the *Strength* of the wind to about **0.4** and re-animate. The effect should look much better. If you let the animation run long enough, you will start to see the plane slow down in movement and just stay blown out to the right. To fix this, you will need to animate the *Strength* of the wind or add animation keys to the *Empty* to change it's direction. To add animation keys to the strength, *you will need to create a curve in the IPO window.*

To Create A Strength Curve In The IPO Window

Split your screen and turn one into the **IPO Window**. With the Empty selected, find the *FStrength* IPO track and select it. To put a track on it, Hold down the **Ctrl** key while **LMB** clicking at the desired point on the graph *(frame 1 at zero strength, frame 100 at about .2 strength)*. Change the curve type to *Linear* (**T** key) and add more points with the **Ctrl-LMB**. Move the points around to vary wind strength. Re-render your scene to see the effect.
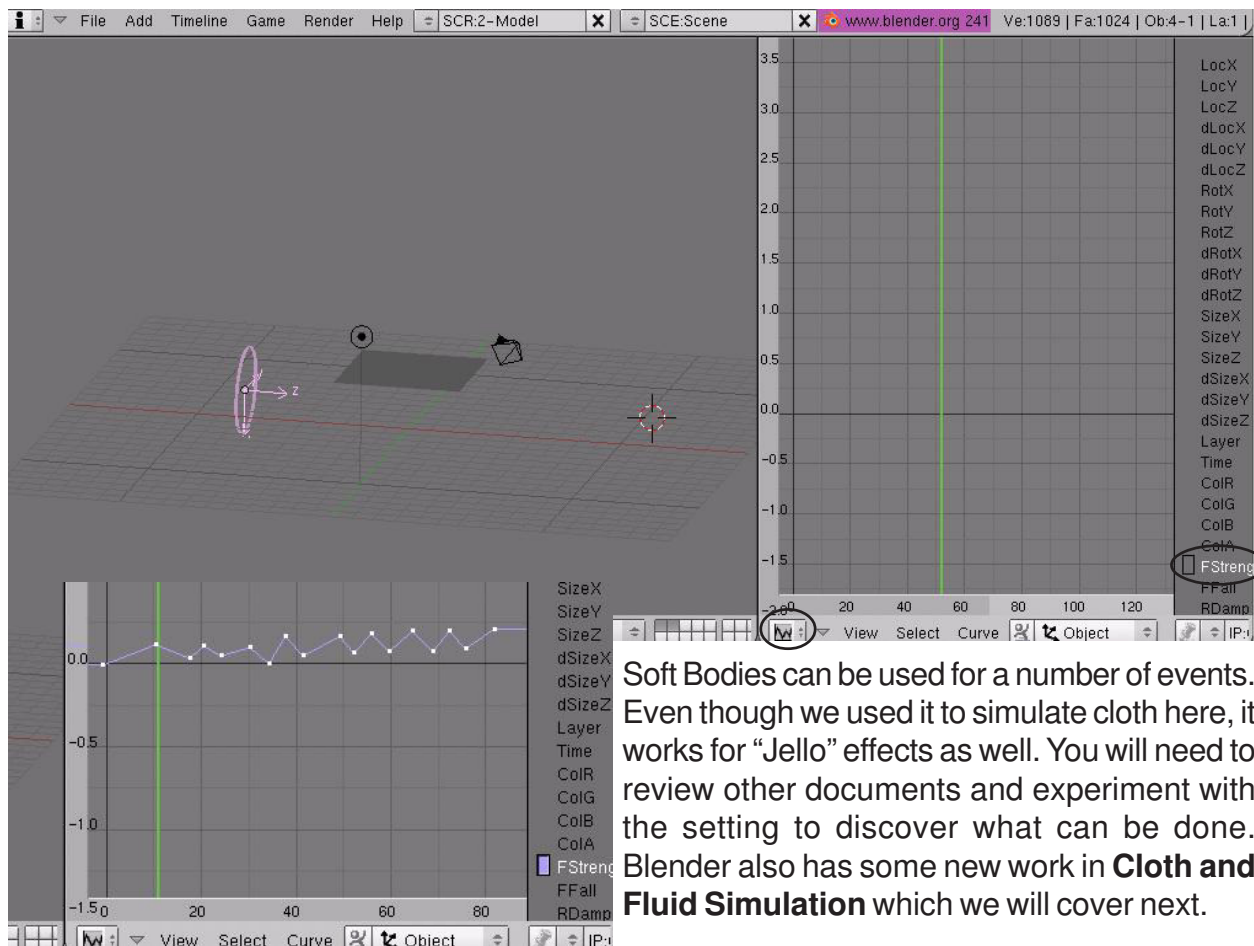
Soft Bodies can be used for a number of events. Even though we used it to simulate cloth here, it works for "Jello" effects as well. You will need to review other documents and experiment with the setting to discover what can be done. Blender also has some new work in **Cloth and Fluid Simulation** which we will cover next.

Create a new file and call it *Flag.* Create a cylinder and sphere for the flagpole and a plane for the flag. Create a vertex group for the flag with all verticies (except the 2 that contact the pole) to a zero weight. The two corner verticies at the pole should be set to a weight of one. Setup a Soft Body effect for the plane as discussed and add a wind effect. Vary the wind with an IPO curve on the FStrength track. Place materials and textures on all objects.

When finished, create a 200 frame animation of your scene.

Wind Empty
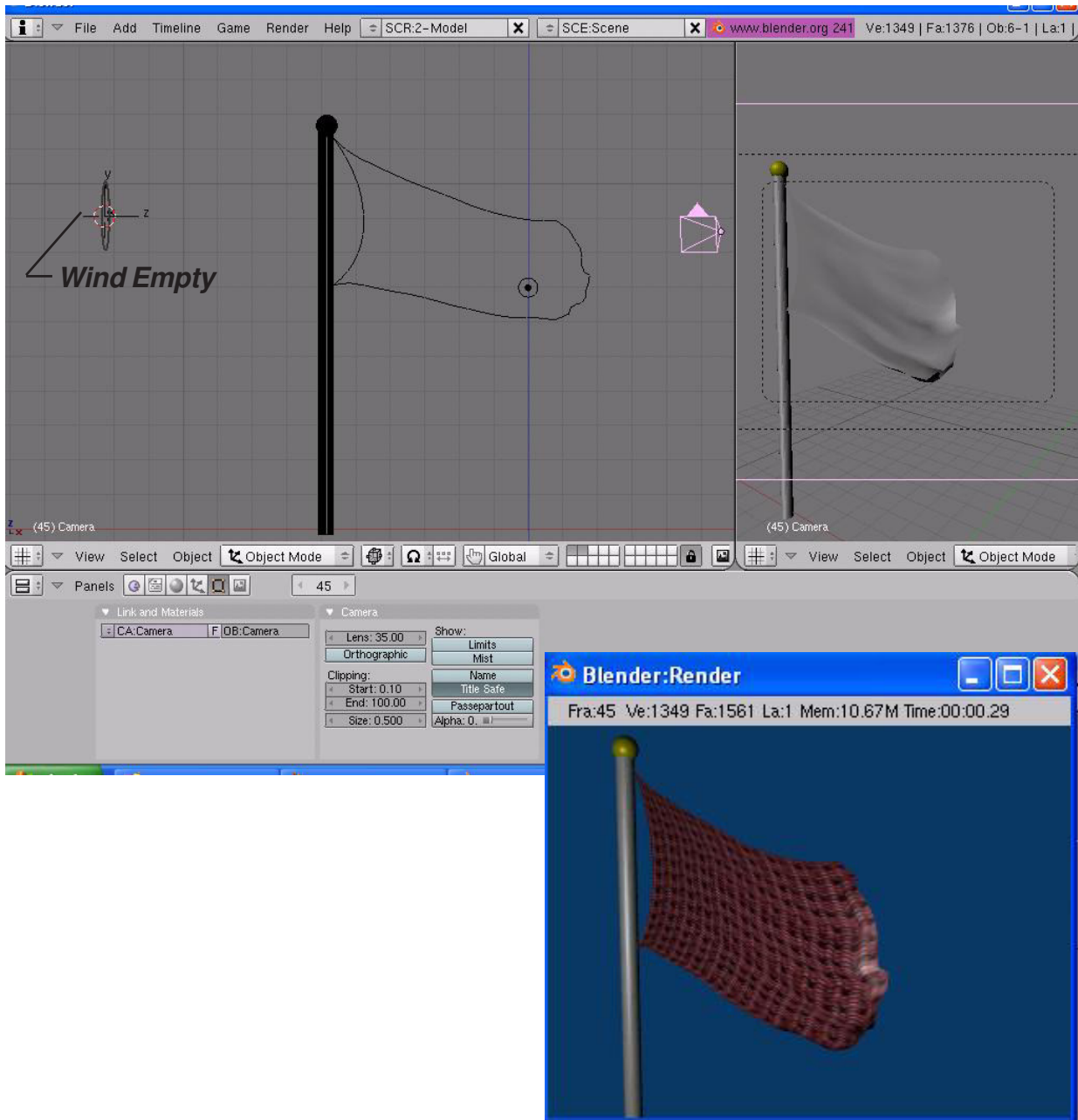
** Call the instructor when finished**

Cloth Effects

Cloth settings work similar to Softbody setting. We did a flag as a Softbody where cloth could have been used. The major difference is that there are several preset materials to choose from, or you can set your own. These effects allow you to add clothing to a model and have it react to movement. The trade-off is time. These effects can add a great deal of time to your renders. A detailed discussion can be found at the Blender Wiki.

Fluid Effects

Fluids have received a lot of attention in the past few releases of Blender. To create a fluids scene, you need a few basic elements (and some not necessary):

   The Domain- the part of you scene that will actually contain the fluid simulation. Usually a box (cube).
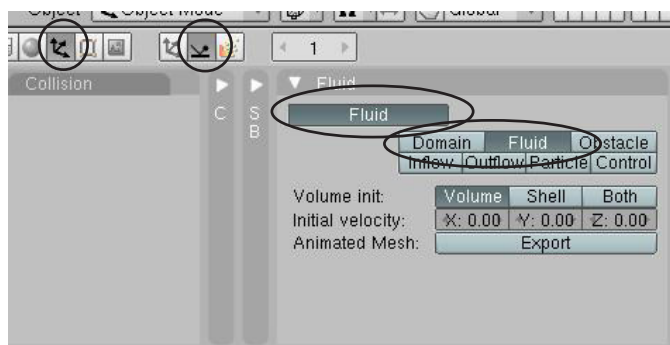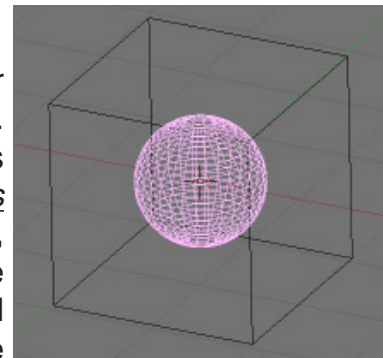   **The Fluid**- The object that represents the actual liquid.
   An Inlet- the element in the scene that supplies the water (like a faucet).
   An Outlet- not necessary, but allows the fluids to drain and limits fill.
   **Obstacles**- Things that get in the way. An object that the fluid reacts with.

Let's start by modeling a simple fluid scene. Start a new Blender file and add a *UV sphere* (*keep the default settings*) to the scene. *Scale* the sphere down a bit so it fits completely in the cube as shown. With the *sphere* selected, go to the *Object* and *Physics* buttons and enable **Fluids** and use the sphere as the **Fluid**. Next, Select the *cube* and make it the **Domain**. Remember the domain holds the fluids in the animation and all fluid animation must occur in the domain. Before we Bake the settings, go to your *Scene* buttons and shorten the animation so it runs about *70 frames instead of 250*.
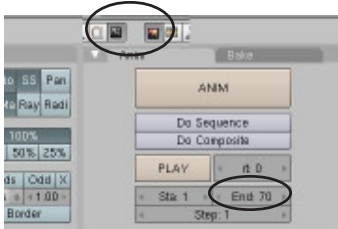
Now, with your animations shortened to 70 frames, go back to your fluid buttons, select the cube and hit "**Bake**". Blender will probably appear to freeze, then the animation will begin to calculate (*this is why we only went with 70 frames*). In your top menu bar, you will see a status bar going and the frames that are completed. When the animation is complete, you should be able to hit "Alt-A" to see the animation play through. Your model should look something like the one shown below. The rendering looks pretty good, but could be smoother. by hitting "**Set Smooth**" in the *Edit* buttons and applying a "**SubSurf**" modifier, it begins to really look good.
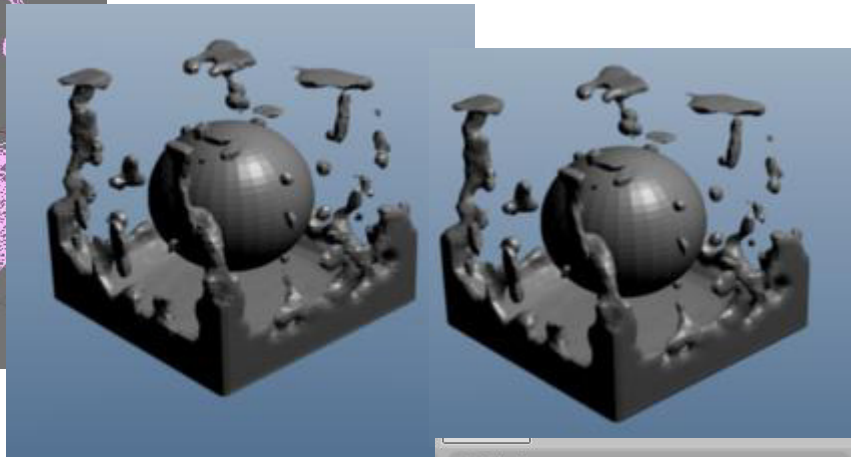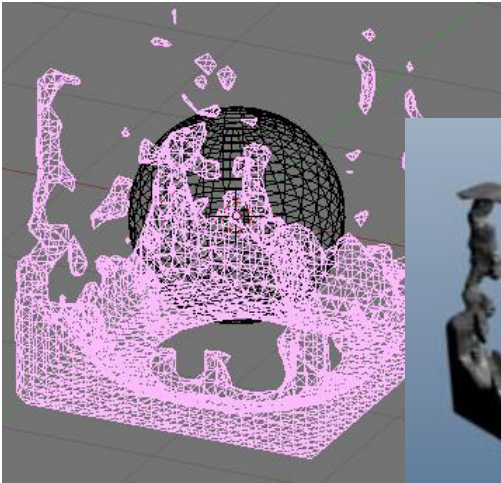
The next thing you may want to do is get rid of the sphere, but rather than erase it, select it, hit "**M**" and move it to a layer you're not using. As you work with your animation, you may want to note where the Bake function is saving your animation frames and clear that folder out from time to time.
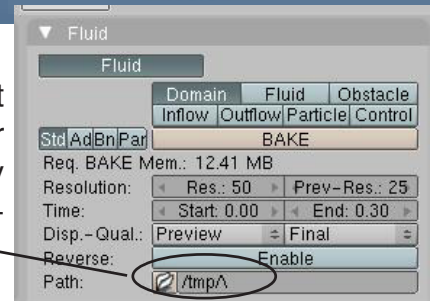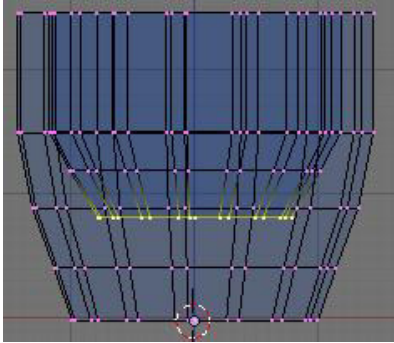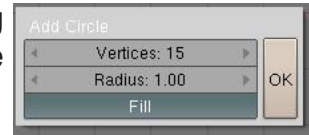
Finally, Add a nice material to your fluid. Try some texture, transparency, and mirror settings.

Fluids Practice Exercise-Splash!

Let's make a new Blender file and call it "**Splash**". Start by deleting the initial cube in the *top view* and adding a **circle**. Set the circle settings to *15 verticies* and click the "*Fill*" button.

Switch to a *front view* and begin extruding and scaling the circle to shape a simple cup. When you reach the top, scale the verticies inward and shape the interior of the cup. Again, keep the cup simple so our fluids simulation remains relatively manageable. After you model the cup, g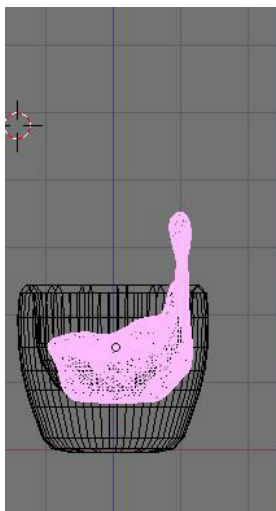o to the *edit buttons* and add a **SubSurf** modifier, also hit "**Set Smooth**". The cup should now look something like this rendered:
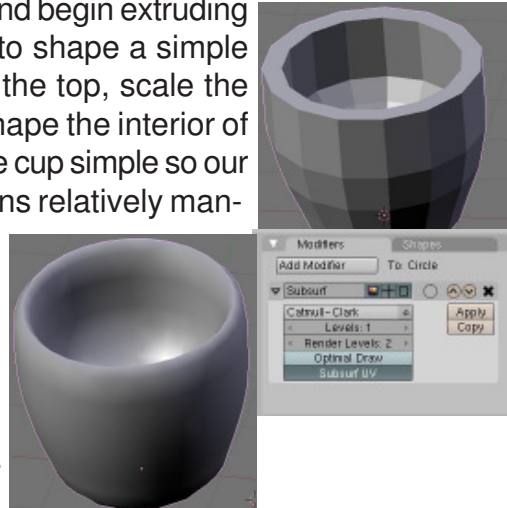
Now it's time to add a cube and scale it to *4.00 units* using the "**N**" key. Center the cube up around the cup. After adding the cube, add another *UV Sphere* and place it above the cup, *but still within the cube*. Remember, all animation must remain within the domain (cube). Check all views to make sure the sphere is contained in the cube and over the cup.
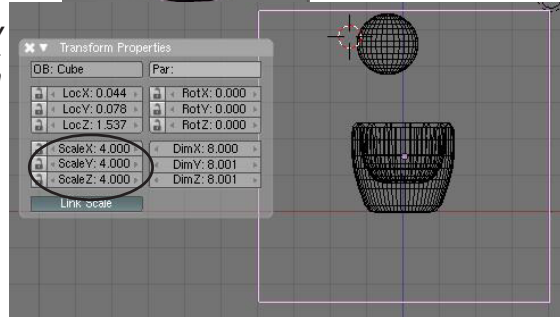
Before we animate, go to the *Scene* buttons and change the *End Frames* of the animation from **250** to **70**. Now, go to the *Object* buttons, *Physics* panel and enable *Fluids*. Set the *Cup* as an **Obstacle**, the *Sphere* as the **Fluid**, and the *Cube* as the **Domain**. With the cube selected, press the "**Bake**" button and wait for the animation to calculate. After calculations, press "Alt-A" to check the animation. If it doesn't work well, hit "Ctrl-Z" to get back to the point where you see the cube again and experiment with some of your settings. If everything worked well, add some nice materials to your objects. Place the sphere into an unused layer and Subsurf the water.

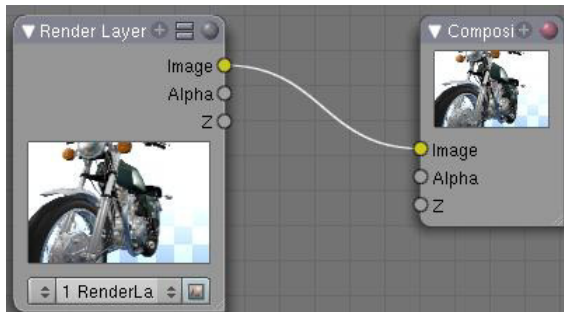****Call the instructor when finished****

Nodes are relatively new to Blender and open the door to new rendering and post-production possibilities. Nodes are used as a way to add effects to your materials and renders in the final output. Nodes are changing quickly. For the most up-to-date information and detailed discussions of nodes, review the information at blender.org on the wiki.

Accessing Nodes

In order to use nodes, you need to first set a window to the _Node Editor_ window type. To see your results when you render an image, you will also need to press the "_Do Composite_" button under animation in the _Render buttons_. At this point, you will see a big blank area in the nodes window. To turn nodes on, click on the "Composite Nodes" button and "Use Nodes" at the bottom of the window.
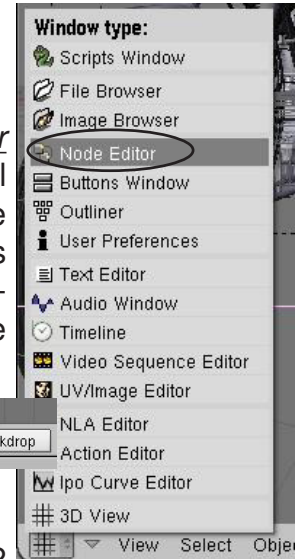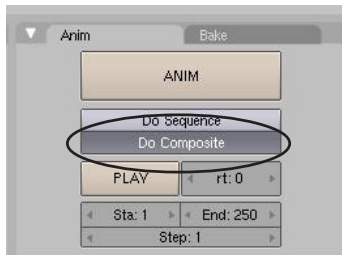
If you have rendered a picture (**F12**-if not, do so now), you will see 2 boxes displayed in the window. A _Render Layer_ block and a _Composite_ block with a line connecting the two. This is showing how the render connects to the composite output. Right now, you won't see any difference because we haven't done anything yet. The job is to add blocks between the two, modifying the output to what you desire. _The options are limitless so here we will just review some basics._

RoboDude Asks: How do I erase the connection lines between blocks? _Just use your mouse to drag a window over the line and it will erase._

If you press the "Add" button at the bottom of the Nodes window, you will see several catagories of nodes that can be placed in the sequence. They are:
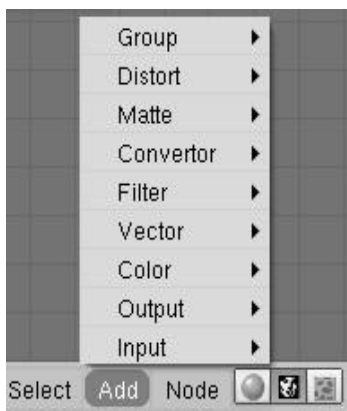
Group- user-defined blocks of nodes
Distort- changing the shape of the image
Matte- mattes that can mask off image areas
Convertor- cahange formats, seperates colors
Filter- enhance or blur images
Vector- changes intensity and reflections
Color- color, brightness, contrast, transparency settings
Output- displays results as a small image
Input- adds an image or a value to the node map.

New nodes are being added with every new release with greater potential for quality renderings.

Chapter 19- Working With Nodes

Before we begin making changes, you will see several "*connection*" points on the blocks. The basic output connections on the render layer block are:
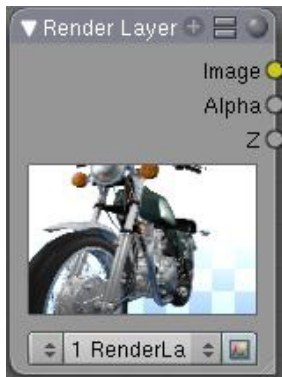
Image- this is the output connection from the renderer to the node composite.

Alpha- represents the transparency settings of the rendered.

Z- represents depth of pixels from the camera.

This is a basic rendered view. Below are some sample composite images:

Black and White output using an **RGB to BW** *Convertor* Node.
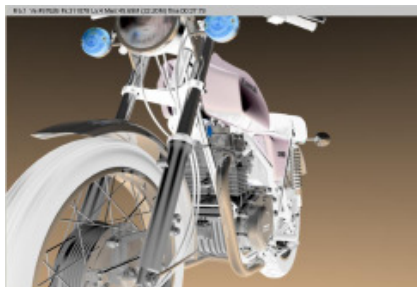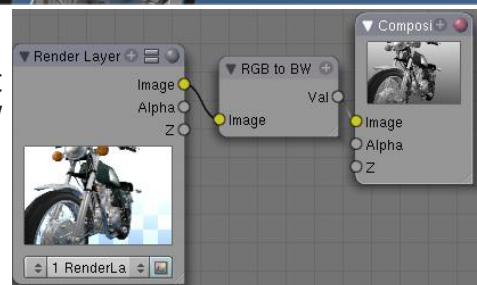
Inverted output using an **Invert** *Color* Node.
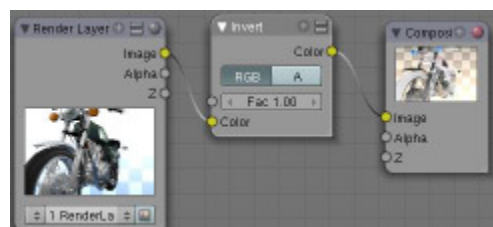
Camera lens output using a **Lens Distortion** *Distort* Node.

The possibilities are limitless using nodes. You can also create material effects with nodes. Search for some creative tutorials using nodes on the web.

In my opinion, simulating depth-of-field using nodes is one of the nices additions to Blender. Depth-of-field is the blurring that occurs from camera setting where objects in front of, and behind, the focal object are out-of-focus. Open your "***Landscape Scene***" file for this exercise. Although we won't be seeing much blur in this scene, it will add a nicer effec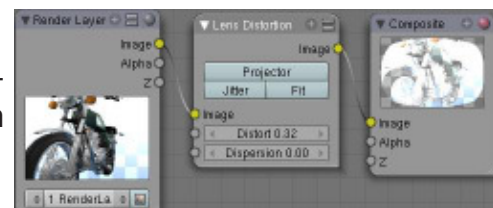t to the rain. It will also show you how to set up blur for future projects. First thing we need to do is work in the *top view*, shading to *wireframe*, and *camera* selected. With the camera selected, go to the *edit buttons*. Here, we will make a few adjustments to the settings. Let's make the *lighthouse* be the depth-of-field focus throughout the animation. The other option is to set an actual distance, but since our camera is animated, that would cause the lighthouse to go out of focus. To focus on the lighthouse, you will need to know the *Name* of the lighthouse. Select the lighthouse to see the name displayed in the *lower-left corner* of the screen. Now select the *camera* again and type the name (case sensitive) in the **Dof Ob:** box. The name of my lighthouse is *Circle.001*. You will also want to show the "***Limits***" of the camera. This will give you a line showing the camera's limits along with a small "Plus" marking the camera's focal point.
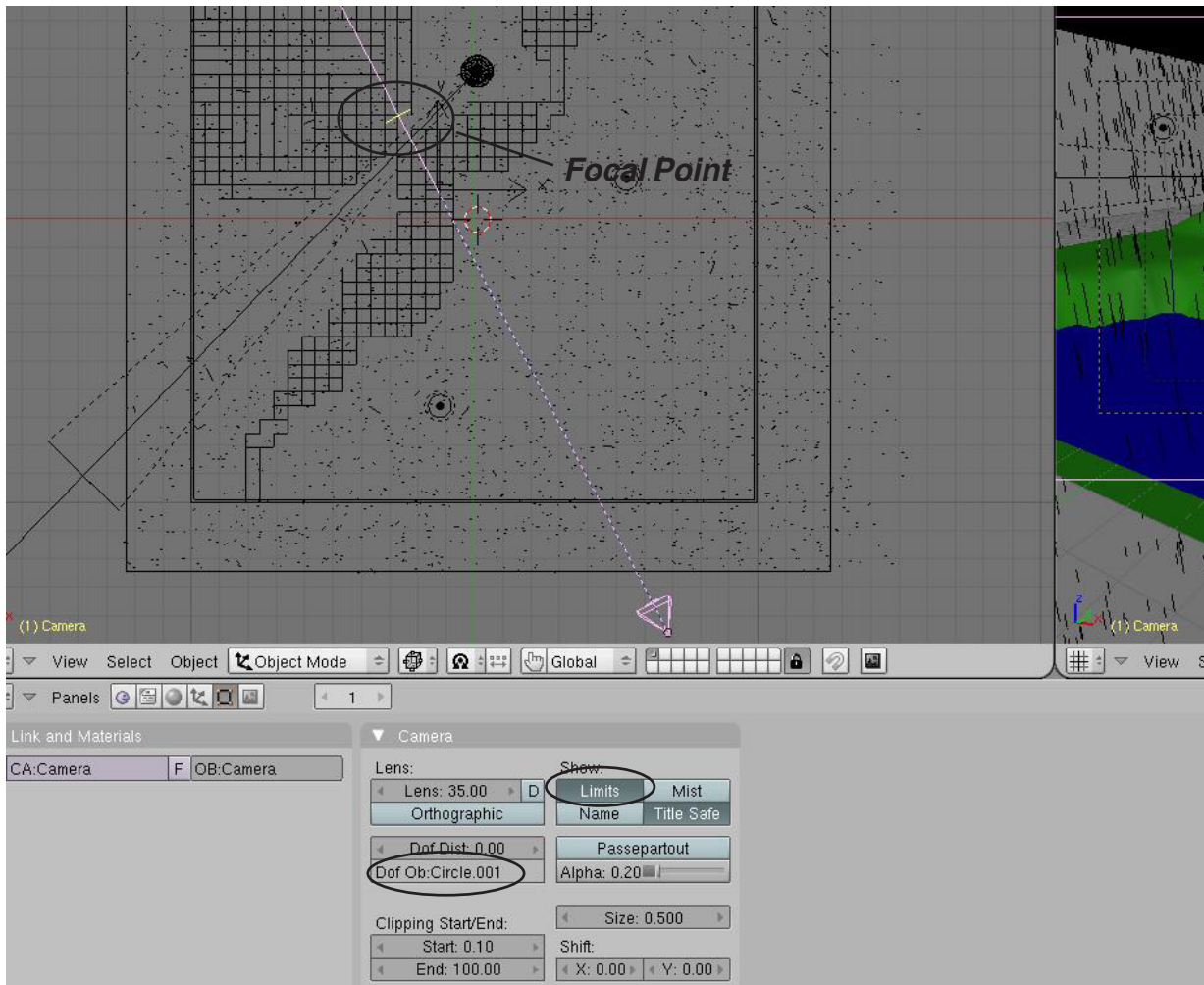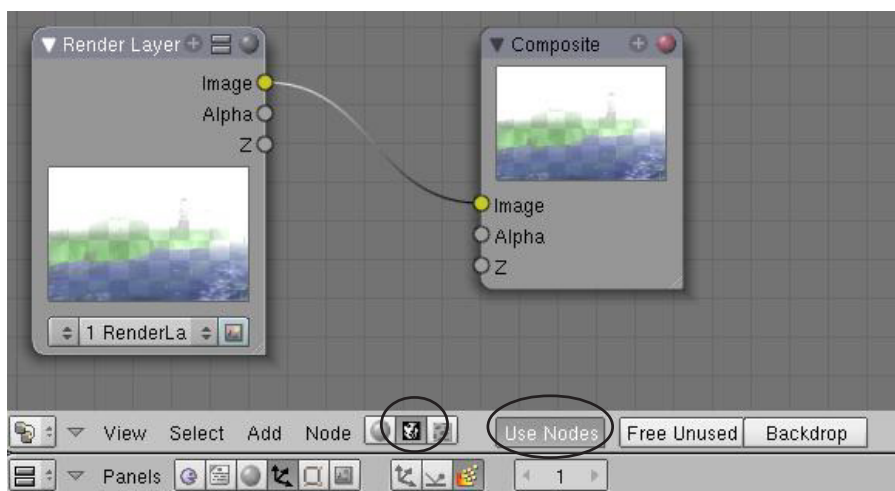

It's now time to set up the nodes to render the depth-of-field.

Depth-of-Field Practice Exercise

It's time to change your viewport to the *Node Editor* window. Then, click the "*Composite Nodes*" button and "*Use Nodes*". Don't forget to hit the "*Do Composite*" button in the Render buttons. Render an image. Your screen should look something like this:

Delete the connection between the 2 panels and set up the following node set:
Add a "**Map Value**" panel from the *Vector* node set.
Add a "**Defocus**" panel from the *Filter* node set.
Adjust your setting to match these:

Click "No zbuffer button so fStop option displays
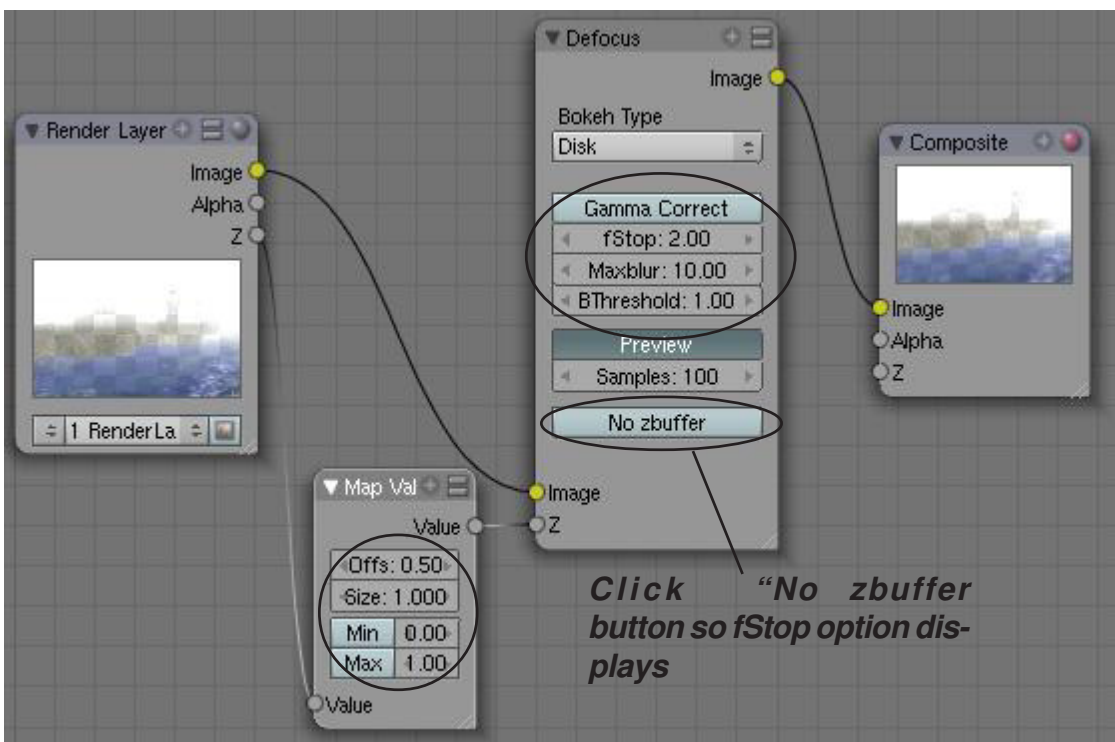
The "Map Value" panel is used to adjust the pixels related to distance from camera and connects to the "Z" on the *Render Layer* panel and *Defocus* panel. The image Out/Ins connect as shown. Adjust the **fStop** to a low number. Like a camera, a low fStop means little is in focus beyond the target. A larger number will give a larger focus range. **MaxBlur** sets the amount of blurring while a high **Samples** setting will give you a better quality image. Feel free to experiment with different setting. When you are finished, render an image and save it. If you have time, try an animation.

Here are the before and after pictures of the landscape scene.
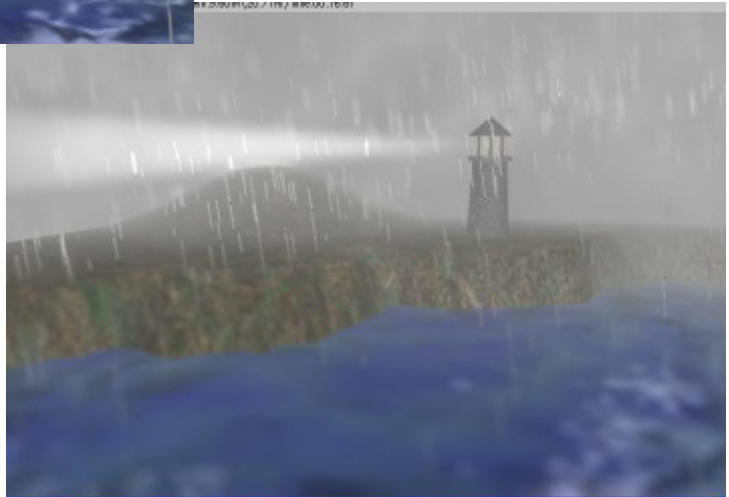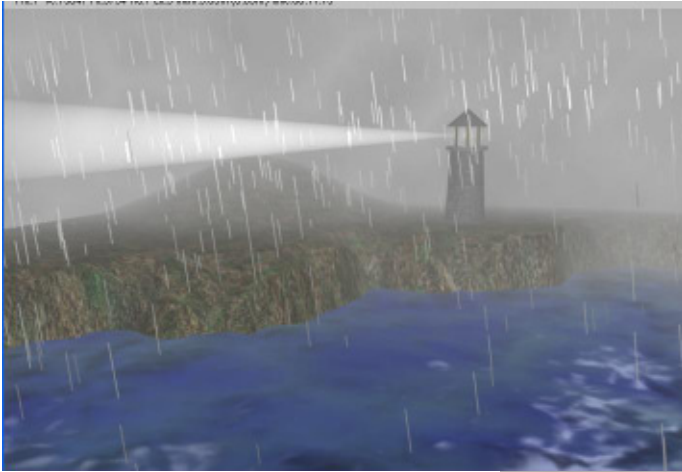
Here is the motorcycle scene used earlier with depth-of-field applied using nodes. The MaxBlur was set to 20 with the focal point of the camera at the headlight.

Call the instructor when finished

Duplicating Meshes to Create Screws and Gears

So far, we see that Blender has many features that are found in almost all 3D computer programs like the ability to extrude along paths,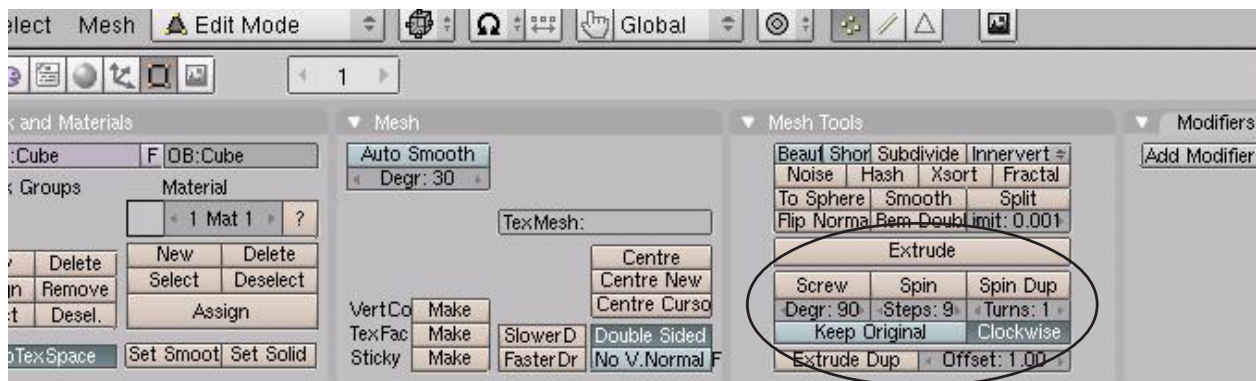 subtract and add meshes through boolean expressions and now we will examine *revolving-type* commands. The commands used for these effects are found in the _Edit Buttons_ and are visible when in _Edit Mode_. The process to get them to work can be confusing to beginners. Here's what you see:
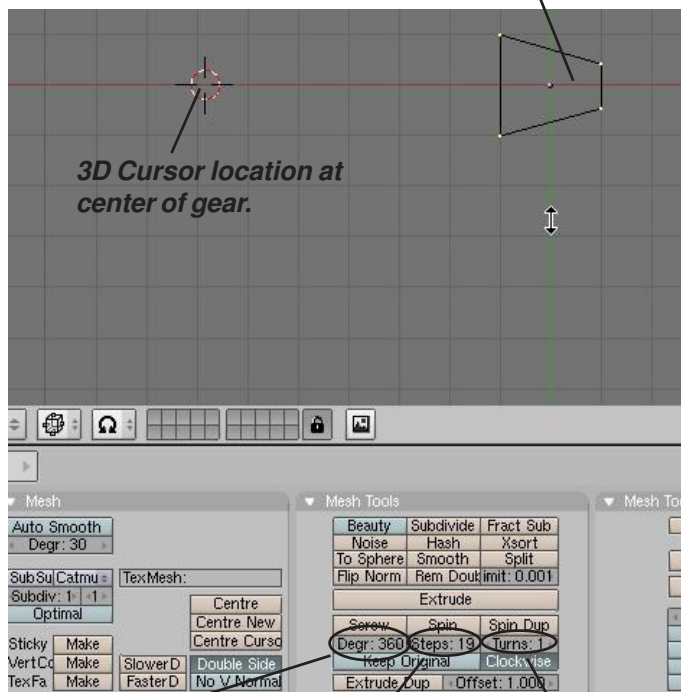

Spin Duplicate

Spin Duplicate will take a group of verticies and copy them around the _3D Cursor_ location. For our example, I will use a modified cube to make a gear. Step 1 is to shape a cube into a simple gear tooth in edit mode. While in edit mode, select all verticies and review the following settings:

Cube shaped into simplified gear tooth

3D Cursor location at center of gear.

> At time, you will get a question mark by your cursor when you use these commands. Just click in the 3D window to see the results.

With all verticies selected and everything set to these numbers, hit the "**Spin Dup**" button and see the results. You will need to experiment with sizes and number of steps to get a good gear without any overlaps. Remember that edit mode has an **Undo command**. If it isn't right, just hit "**Ctrl-Z**" and it will go back to your one gear tooth. Make sure all verticies are still selected and try again with some different settings. To fill in the gear and make it look realistic, add some cylinders to fill it in. You can also add a nice touch by using **Boolean Difference** to cut holes in the body of the gear.
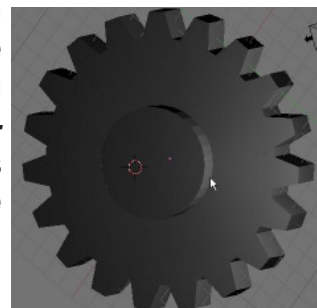
Degrees to go around- set to 360 for a full circle

Steps- number of instances. In our case number of gear teeth.

**Turns**- how many times to go around. We only want 1 turn for a gear.

Spin

The *Spin* command operates similar to the *Spin Duplicate* command, except that it works more like a **revolve-extrude** command. You can take a plane or a circle, shape it, then revolve it around the *3D Cursor location*. For our example, we started with a **Mesh Circle** in the **Top View**, then we placed the 3D Cursor at a desired location. Enter *edit mode* and select all verticies. Switch to the **Front View** and select the **"Spin"** command in the edit buttons. Notice how far it extrudes and the number of steps. **Undo** ("Ctrl-Z") the spin so you're back to your basic shape again and change **degrees to 360 and steps to 30**. Make sure all verticies are selected and try again. Here's our results:
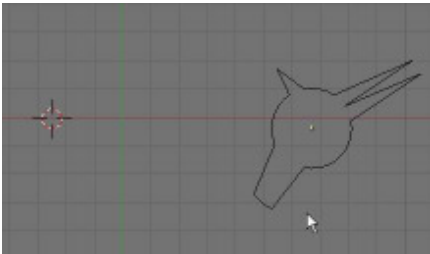
Circle that has been shaped in edit mode. 3D Cursor to left of shape for center point.
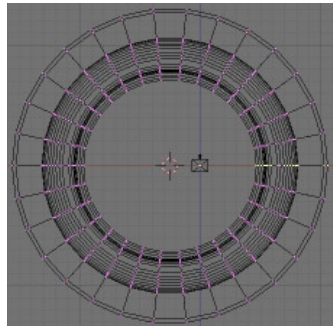
All verticies selected, switched to frontal view and spin command used.
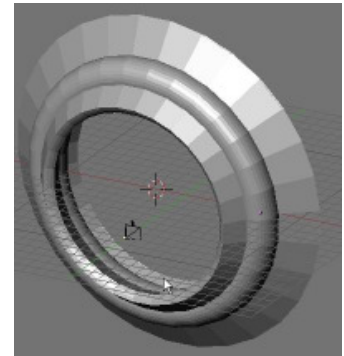
Final results of Spin command

Using Mesh Editing to Create Helix Shapes

This is the most complex of the 3 tools. This tool can be used to represent any type of **helix object**. Springs, threads on a bolt, worm gears, etc. can be done with a little work once you know how to use it. The Screw command only works in the **Front View** (number pad 1) so switch to the front view to develop a spring.

In order to create a spring, you need to start with a **Mesh Circle** in the front view. Like the other spin tools, you need to place the *3D Cursor* in the location where you want the center to be located. **Now you need to create a line that will represent the spacing in the turns** (for threads on a bolt, the line is short so the threads are close together, for a spring with a large space between loops, draw a longer line). To create the line, add a **Mesh Plane** to your scene and delete 2 of the verticies. Size the line that is left to what you need for your model. **Join the line and the circle together so that it is one object.** For the best results, *place the line you created in the center of the revolved mesh* (beside your 3D Cursor). The verticies can be moved or adjusted in edit mode. Here's an example of your model:

Here are the 2 verticies that form the line to controls spacing
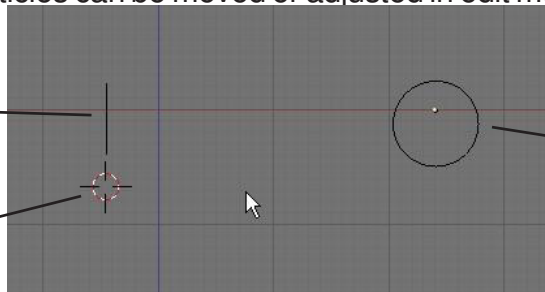
Circle that forms profile of the spring. Any shape can be used.

3D Cursor location

Chapter 20- Creating Springs, Screws and Gears

Set the **Degrees** to 360, **Steps to 16 or higher** (depending on the smoothness you want) and **Turns** to how many loops you want (I'll set it to 8). Select **All** verticies (including the 2 that form the line) and select the **Screw** button. You should see a spring on your screen. If something needs adjusting, press "**Ctrl-Z**" to undo in edit mode to go back to your basic shape and try again. Here's our results:
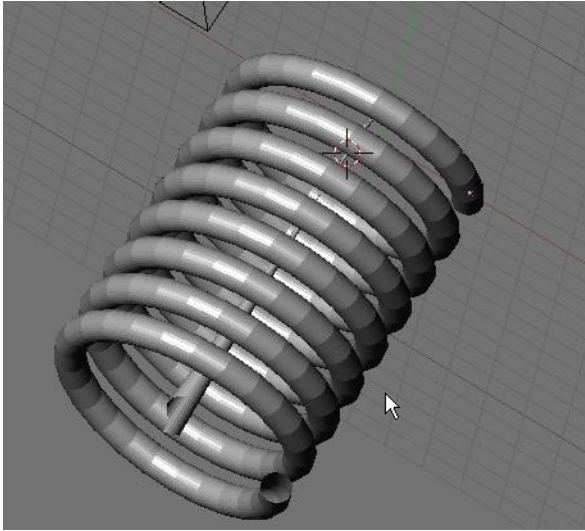
You will notice a shape in the middle of your spring. That shape is created from the verticies you used to designate the length of each loop. You placed this shape in the middle so it is easier for you to select these verticies in edit mode and erase them. Switch to a top view and enter edit mode. Select the verticies and hit "*Delete*". Now you'll just have your spring on the screen.

Other Shapes:

Here's how you can create some other things:
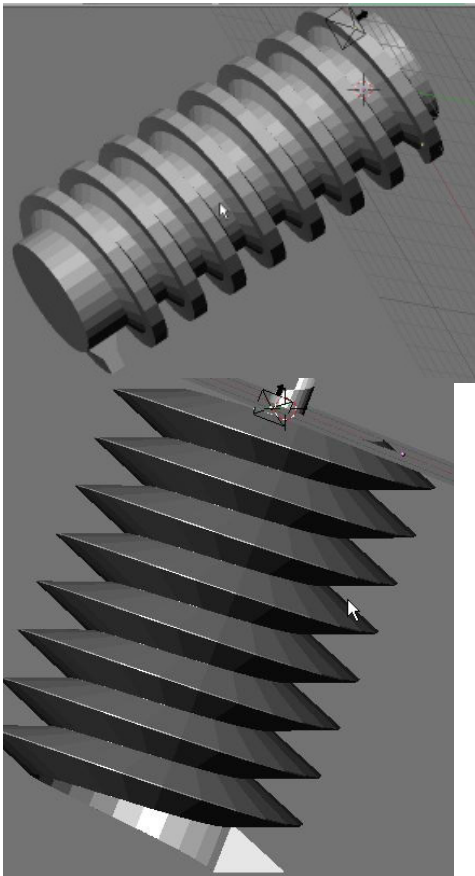
A Worm Gear created using a subdivided plane as the profile and the line set to equal twice the height of the gear profile. A cylinder has been added through the center to give it a solid appearence.
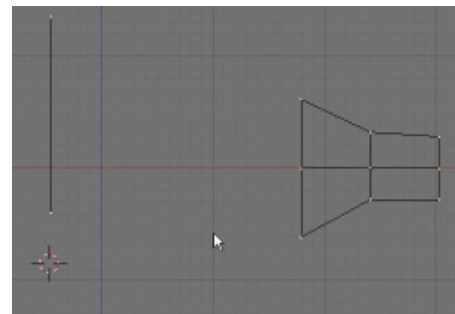
Bolt and screw threads can be created with a plane shaped into a triangle and the line for spacing set to exactly the same length as the base of the triangle. To make a pointed screw, grab the end thread verticies and scale it with proportional vertex editing ("O") for a nice look.
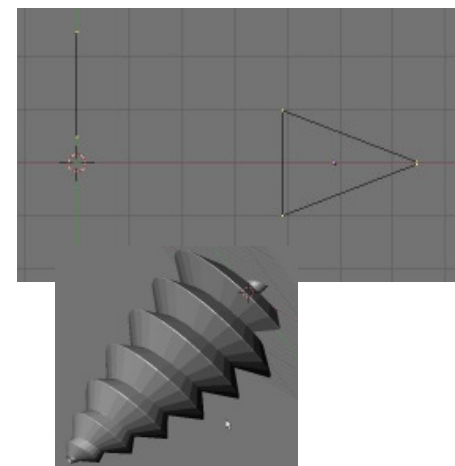
Create a worm gear and a spur gear to mesh with each other using the information discussed in this chapter. Add materials, textures and appropriate lighting. ***Make a 200 frame animation of the grears turning***. *Try to make them mesh perfectly!* Remember the Extend Mode options available in the ***IPO Window***. All you need to do is create a small section of the animation and let the computer do the rest!
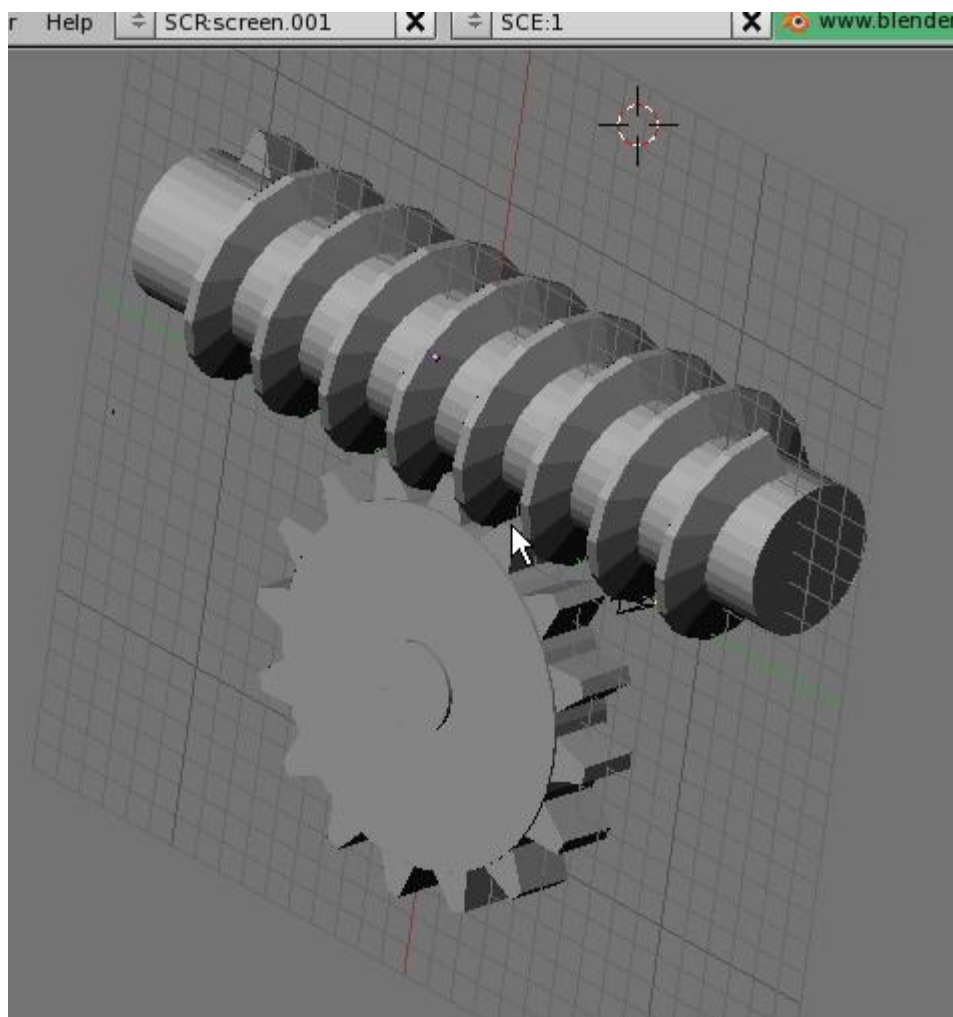
** Call the instructor when finished*

Chapter 21- Game Engine Basics

We've seen that Blender is a powerful 3D rendering and animation program up to this point, but so far, all of the commands that we've looked at are in most high-power animation programs. The big difference is in the cost of the program and some features. One thing (besides price) that makes Blender stand out from the others is its integrated **Real-Time animation features** (aka. the Game Engine). The program integrates real-time motion with physics and logic blocks. For example, you can set your gravity in the world buttons, add friction and force settings to your materials, turn objects into actors and move them around, then have them react to other objects in the scene.

You can create games that look as good as professionally produced 3D games and real-time architectural walk throughs where doors can open and close as you approach them. The best part of this is that it can all be done *without computer programming skills.* There are other freeware game creation programs out there, but most require some programming knowledge. Programming skills in Python scripting are helpful in Blender, but not necessary.

This chapter cannot hope to cover everything you need to know about the game engine. We will only look at how to texture your models and describe the interface and logic. We will also look at the game engine's ability to be written to an animation IPO curve. *For a more detailed description, review the Blender downloaded tutorial on the game engine.* It is well-written and describes all of the basic command options.

The Blender game engine has seen a great deal of development over the past few releases. The most recent has been a complete reworking of the texturing system. It is now more confusing, but gives much more flexibility. The original game engine physics module is called **Sumo**, which is still available for selection, but all recent work uses the new module , **Bullet.** Bullet is showing a great deal of promise with accuracy and the ability to be used to create **animation IPO tracks** from the action.

Setting Up the Physics Engine

The first step to using the game engine is to set it up. To do this, go to the **Shading** and **World** buttons. Under the *Mist/Stars/Physics* tab you will set the engine to **Bullet**. You can also set the **Gravity** at this time. Most likely, these setting will already be selected for you.

Using Logic Blocks

Let's make a simple scene consisting of a **plane** and a **sphere** and set the sphere above the plane. Modify the sphere by pulling one vertex out to form a *nose*. This will let us know which way is forward when we move it around. Add a material to each one and feel free to set colors for each. We will use a different process for setting textures on the objects than we do for rendering. We are adding materials for **physical properties (friction, elasticity)**. Here's what we have so far:
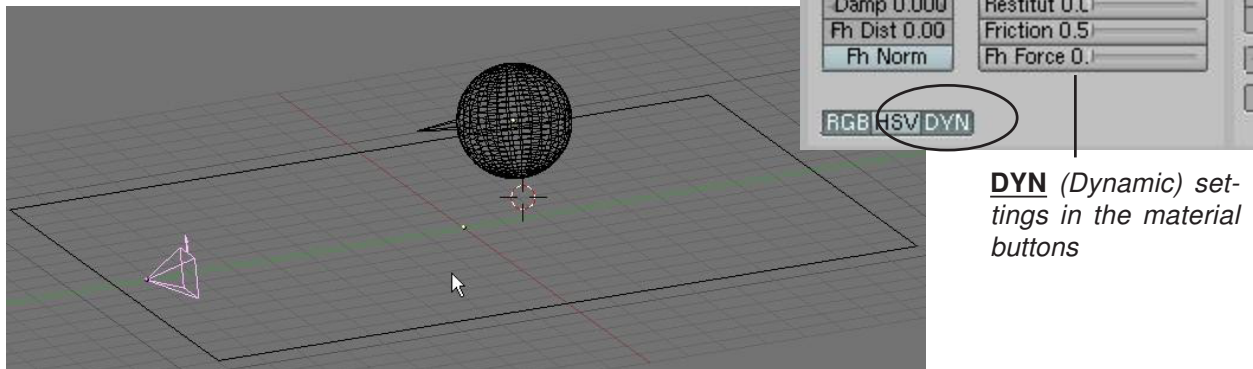
DYN (Dynamic) settings in the material buttons

Select the sphere and go to the Game Buttons ▢ (little purple pacman button). Here's what you see in the buttons window:

Actor Button- to turn the object into "live" actor.
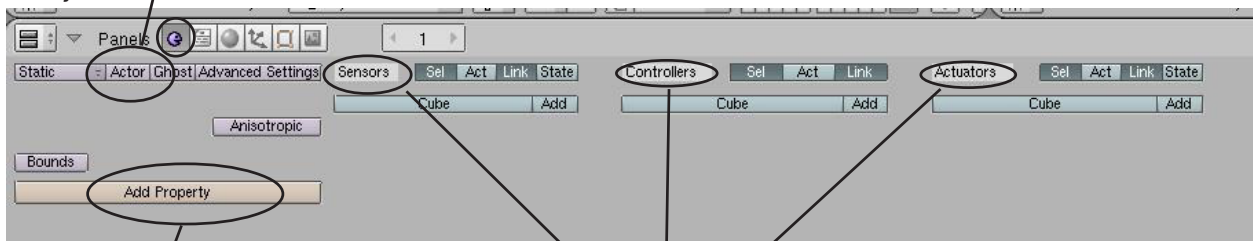
Add Property- *used when you want something to happen in your scene. Soomething will happen when it senses this property.*

Sensors, Controllers and Actuators- *The "brains" of the game engine. Think of it as Input-Process-Output where data is fed in, the computer processes it and something happens. There are a lot of options in these commands.*

Let's turn our sphere into an ***Actor***. Click on the ***Actor*** button and choose ***Dynamic***. Look at the important options now available:

Damp: *motion dampening- keeps the object from continuing forever when you stop applyiing force. I like to set this to around 0.4*

Bounds- *changes the shape of the actor from sphere (from radius) to other shapes.*
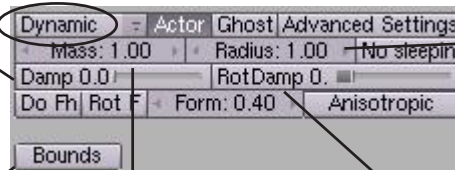
Mass- *how heavy you actor is.*

Actor Size (Radius)- *You will notice a dashed line circle around the shere when you change this. This is the actor size.*

RotDamp: *rotational dampening- keeps the actor from spinning forever. I like to set this to about 0.8*

Move your cursor into the 3D window and press "**P**" for play. If the sphere is above the plane, ***it will fall to the plane showing you that it is now an actor***. Click the "**Ad**d" buttons under ***Sensors, Controllers and Actuators***. By holding the **LMB** down on each block, you can change it's type. Change the sensor block from ***Always* to *Keyboard***.

Next, connect the blocks together. Once you change the sensor to keyboard, you will see a block for **Key**. click in that box and type the key you want to use. For our case, we'll use the "***Up Arrow***". We will tie a force to the up arrow so that when we press it, the sphere will move forward.
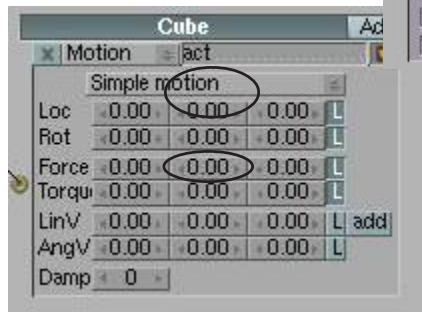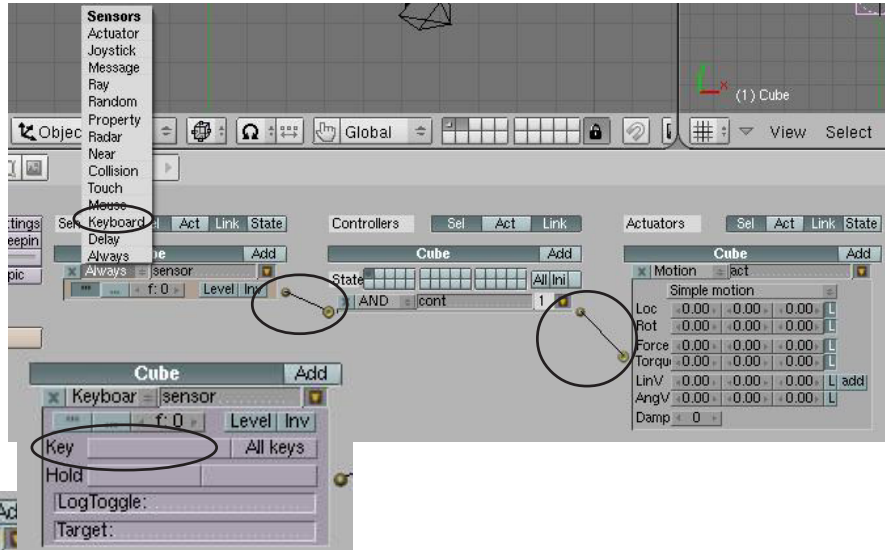
Now we'll apply a ***force*** to the actor. You will see three columns in the ***Motion*** block. They represent ***X, Y, and Z***. The best way to change numbers in these blocks is to hold down "*Shift" and click in the box*. In the ***Force*** block, Let's change the **Y** number to **10**. This is where you need to experiment with numbers. *If a block doesn't move it in the direction you desire, change it back to zero and try a different one*. If it moves on the right axis, but the wrong direction, try a *negative number*. Once you get this motion right, add another row of block under the *Sensors, Controllers and Actuators,* connect them and adjust your setting to go backwards. To make the object turn left and right, work with the ***Torque*** settings and use the left/right arrow keys. There are a lot of options in these buttons. To get a more detailed description of them, refer to the *Blender Game Engine* documentation available to download from the Blender website.

Applying Materials

RoboDude Says: *If you want to move something that isn't an actor, use Loc and Rot numbers. If it's an actor, use Force and Torque.*

Before the release of version 2.48, game texturing was a pretty easy process. Materials and textures used in rendering and animation were basically different from *UV texturing* used in the game engine. With the introduction of new features and more crossing over between rendering and game texturing, the developers have pulled many of the features together which, in my opinion, have caused some confusion. The reason for treating game texturing differently stems from the concept that things in a game need to be kept simple in order for the game to run smoothly and many feature in normal render texturing can slow game play down considerably. UV textures can basically be "mapped" onto the mesh faces which minimize texture calculations while in game play. While traditional textures can be used in the game engine to some degree, I will focus on the more traditional UV mapping process here.

You already know that you can apply a material to an object and it will display in the game engine First, start by making sure you are in Textured Draw type (**Alt-Z** will also get you there). For my scene, I will be using a basic cube to demonstrate UV texturing. Place a *material* on the cube.
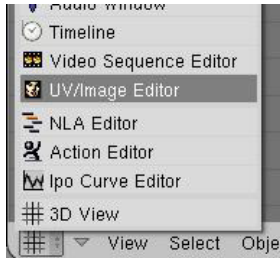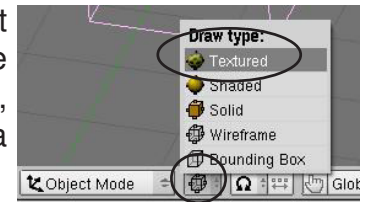
In textured mode and the cube selected, set one of your viewports to the *UV/Image Editor* window. At the bottom of that window you will see some options- *View*, I*mage* and some *up/down arrows*. The arrows are used to browse the list of already opened images in the scene. Use the *Image* menu and *Open* a texture that you would like to use. I will select a brick texture to use for the cube. Now go into edit mode and switch the selection type from *verticies* to *faces*. Hit "**A**" once or twice to select **ALL** faces. It's time to apply the UV mapping by pressing "**U**" in the 3D window for the *UV Mapping* option menu. For this example, I will select **Cube Projection**. Since we had selected the texture beforehand, it will automatically display on all faces (*or you can hit the arrows and choose from a list*). In the UV window, you will notice faces and verticies show up on the texture sample. These can be moved, scaled, etc. to change the way the texture maps. Instead of selecting all faces, we could have just selected one and applied the texture to just that face (*a difference between rendering materials and UV texturing*).
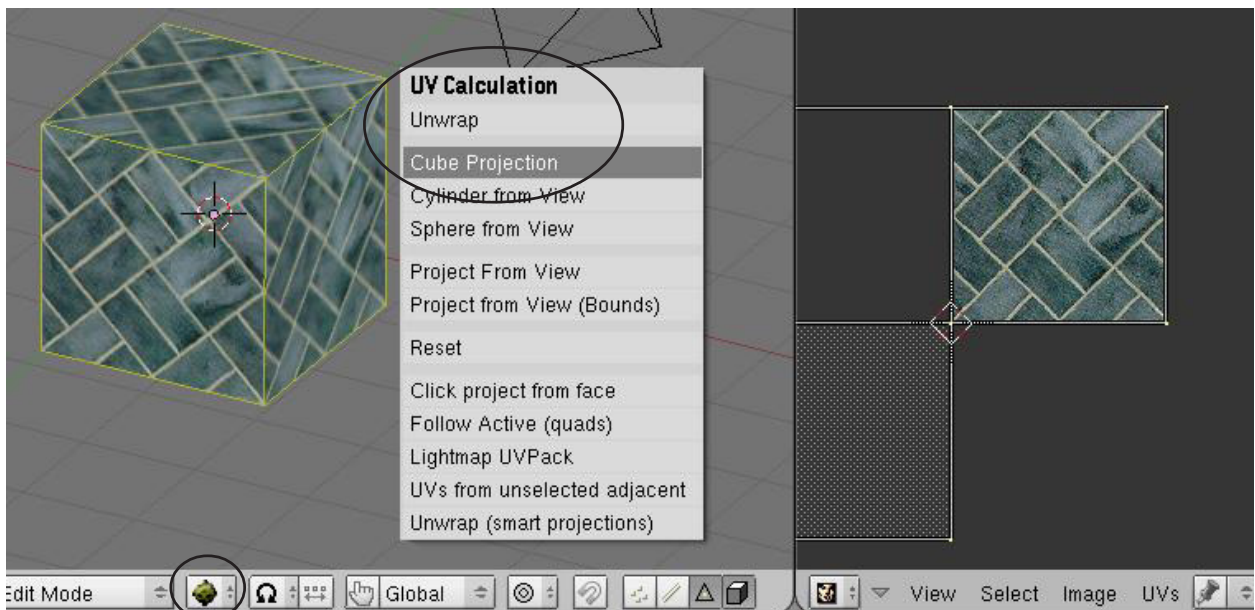
Now exit *edit mode* and press "**P**" to see how your cube looks in the game engine while running. When done, press **Esc** to exit play.

RoboDude Says: To keep your game as streamlined as possible, always keep your meshes as simple as possible with the fewest number of verticies and faces. Use textures to show detail when possible instead of modeling that detail into the mesh. (i.e. windows in a building, signs on a wall)

The cube looks good, but we have some more options. Go to the edit buttons and find the **UV Calculations** and **Texture Face** panels. The texture Face panel will only be visible after hitting the "**U**" key to apply *UV Mapping*. **Both panels are only visible in edit mode.**
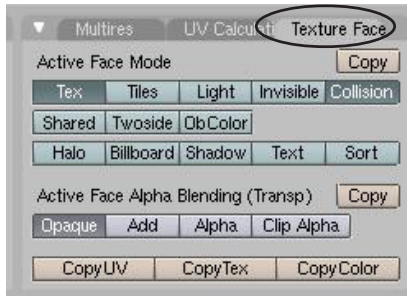
Copy- At times, press these for effects to be applied.
Light- Selected faces will reflect light for better scenes.
Invisible- Selected faces will not be seen in the game.
Collision- Actors will not be able to pass through these faces.
Two-Sided- Faces will display textures on both sides of the face (if only one-sided, face is invisible from opposite side.
Add- Textures with dark/black areas will display those areas as transparent. Great for text on a black background.
Alpha- textures with a transparency channel will display this.

UV Calculations are used to display the texture on a face in various ways. For example, if you change "*Cube Size*", place your cursor back in the 3D window and press "*U*" again , select "*Cube Projection*" and the texture will reflect the changes.

There are a lot of other things that can be done beyond this discussion. Look to blender.org and the forums for more help. *Don't be afraid to experiment!*

Using Game Physics in Animation

It is possible to use the game engine physics to record an animation (IPO) curve. Now, instead of trying to insert location and rotation keys for a falling (moving) object in the IPO and 3D window, you can set up a **Bullet** model and tell Blender to record the action to an IPO curve for animation. No more frustration trying to make something look like it's moving correctly in a fall/fly/bounce. Blender will do it for you! To start out, you need to set up your game logic to do what you want. Set up your actor to be a **Rigid Body** actor intead of **Dynamic**. Dynamic actors will not just slide around, but roll or angle when needed automatically. You may want to set **Bounds** also.

When you have the action correct, go to the "Game" pull-down menu and select the "*Record Game Physics to IPO*" option. Hit the "**P**" button to run the action. When finished, hit the "**Esc**" key. The action will be written to an IPO curve for the object and will now work with "Alt-A" and animate! Apply materials and textures as normal and make your movie.

RoboDude Says: *Remember to turn off the Record Game to IPO button when finished. It will make a new curve everytime you hit Play!*
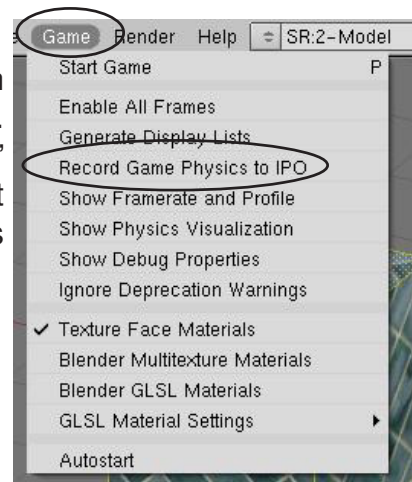
Create a scene similar to the one discussed in this chapter. It should include one actor and a plane, both textured for game mode. Apply physics to the actor (*Dynamic*) so that he can move forward and back, turn left and right. Create a brick (cube) and make it a *Rigid Body* and apply a *Box* under *Bounds* setting to it. Duplicate it several times (Shift-D) and stack them up. Drive your actor through them so they fall. When finished, create an IPO curve of your action so a movie can be rendered from the scene.

PRACTICE EXERCISE

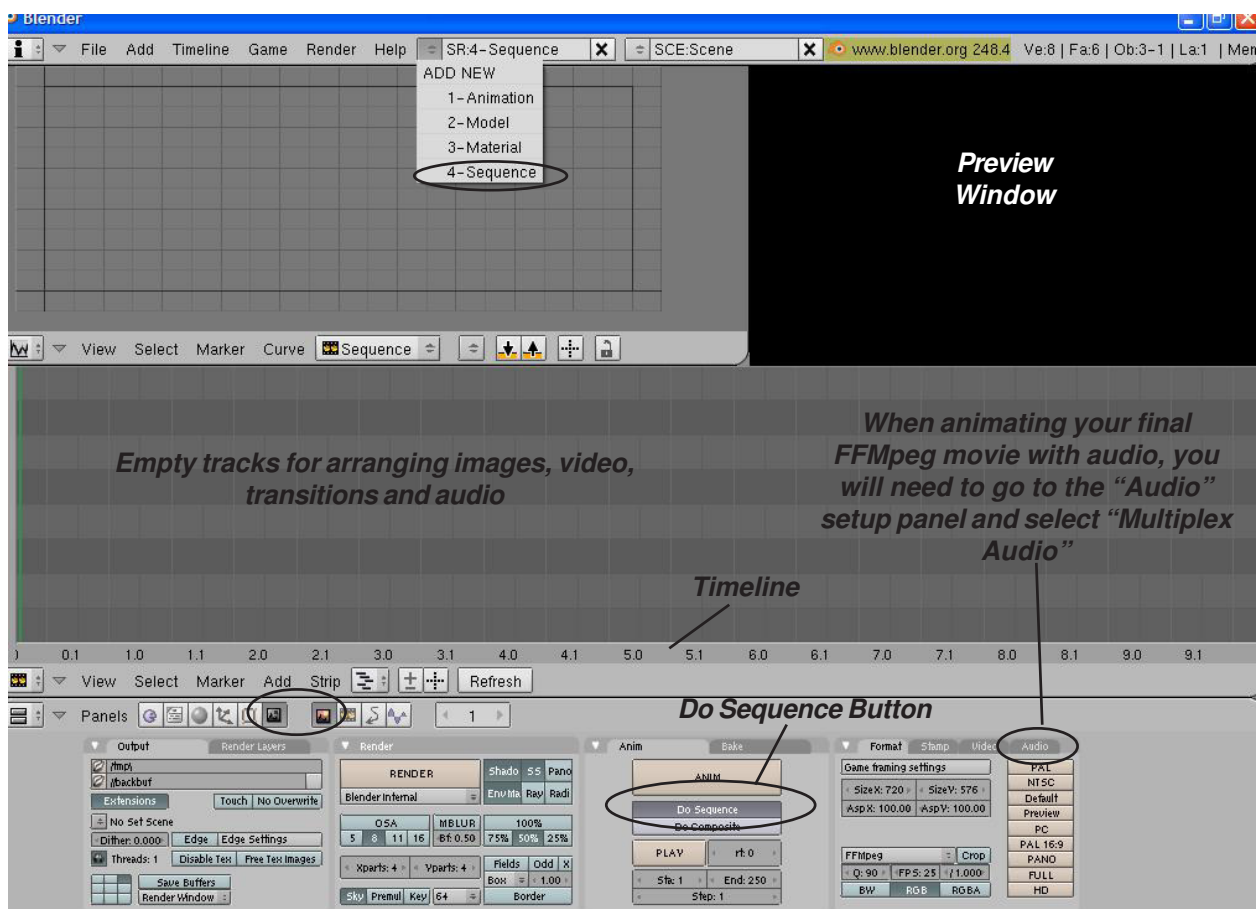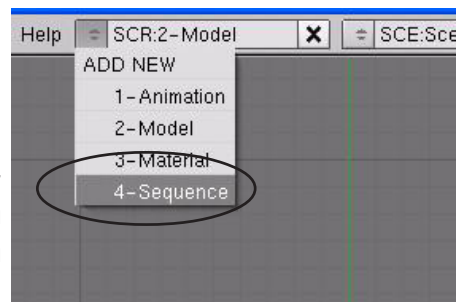*** Call the instructor when finished***

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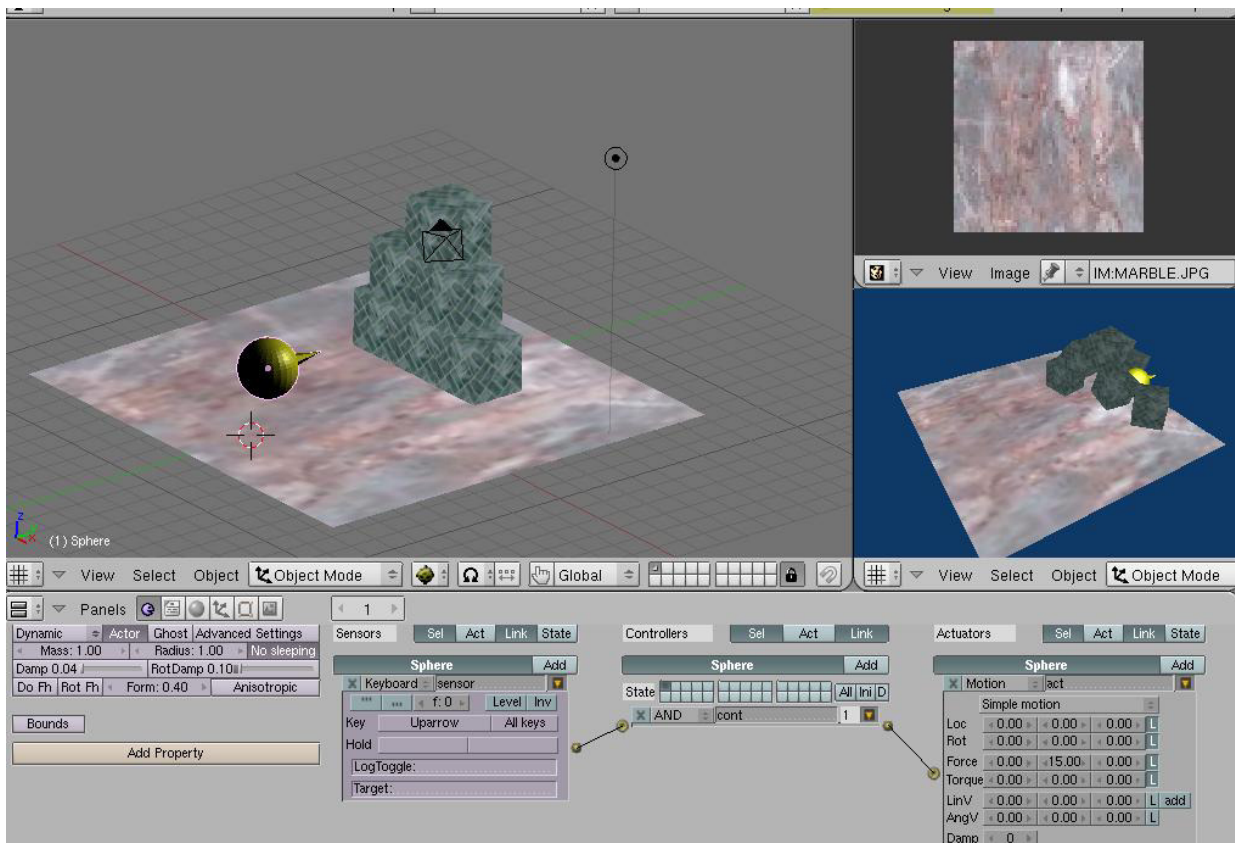
Chapter 22- Video Sequence Editor

Producing a Movie From Individual Clips

Movies are never produced from one continuous camer shot. A movie is made up of short clips and images combined together with sound and effects to give us an end production. Blender has the capability of doing much of this production work. Blender can combine video and audio together in the form of an MPEG movie, capable of being played on any media player of saved to DVD through other programs.

Setting Up the Sequence Editor Screen

Blender has a preset screen for *Sequence Editing*. To access it, go to the top toolbar and select the bottom screen option "*4-Sequence*". When you select this, your screen will look like this:

Preview Window

Empty tracks for arranging images, video, transitions and audio

When animating your final FFMpeg movie with audio, you will need to go to the "Audio" setup panel and select "Multiplex Audio"

Timeline

Do Sequence Button

If you are familiar with programs like Premiere, this will seem familiar, if not, the process is simple. First, set up your output options in the render buttons for what you want your final movie to be. Press the "*Do Sequence*" button so you render the sequence and not the 3D window (*what the camera sees*).

Next, select the "Add" button above the buttons window. We are interested in the **Effect** (transitions), **Audio**, **Images** and **Movie** options. Select a movie or image from your files to add to the timeline. Pay close attention to the frame markers at the ends of the file you are inserting. Images can be lengthened or shortened by **RMB clicking** on the end and using the "**G**" key to grab it. *Movies can only be shortened*. If you would like to add an **Effect** between the two files (*like a cross-fade*), overlap the files a second or two as shown below. *I like to leave a space between the files as*
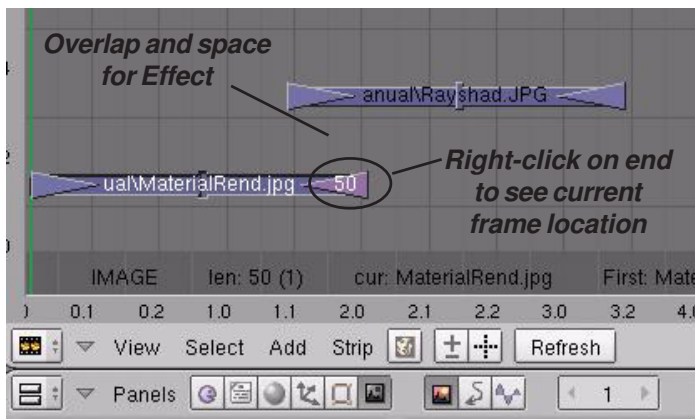
shown to in-sert the Effect later. Continue adding images and movies as needed. When you are ready to insert the **Effects**, you need to hold down the "**Shift**" key, then select the **first** file in the sequence, then the **second** one of the transition. *Selecting them backwards will cause the Effect to not function properly!* Go to the "**Add**" menu and select "**Effect**" and the effect you want to use. A simple *"Cross"* dissolve works well for most things. Place the effect between the files. To view a sample of the move, Place your cursor up in the **Pre-view** window and press "**Atl-A**". Continue down the timeline and insert all transitions. If you do not wish to use transitions, but go straight from one image to another, simply "butt" the tracks to one another being careful not to overlap them. To create the final movie, **RMB click on the last image in the movie to find out the final frame.** Set this in your **End** frame movie output. Press the "**Animate**" button in the button window. *Rendering time will be faster since you are only compiling already created images.*
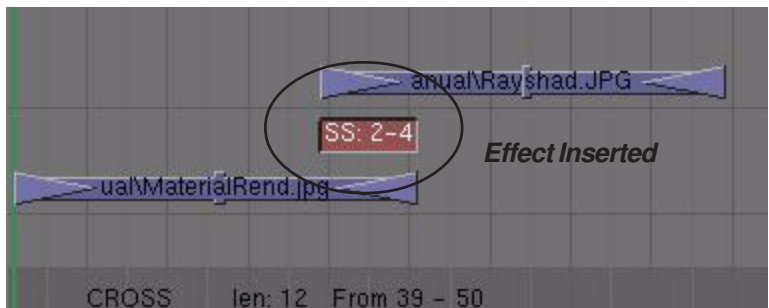
Adding an Audio Track

Do the same thing with your audio track. Be aware that some audio formats will not be supported and that you will need to experiment with them. Wave (.wav) files work best, but others are always being added. for more consistent results, use "*Audio HD"* rather then *"Audio RAM"*. To fade an audio track, select it, then go up into the IPO window in the upper-left corner. Hold down the **Ctrl** key and click in the timeline to insert a *key* at the appropriate frame.
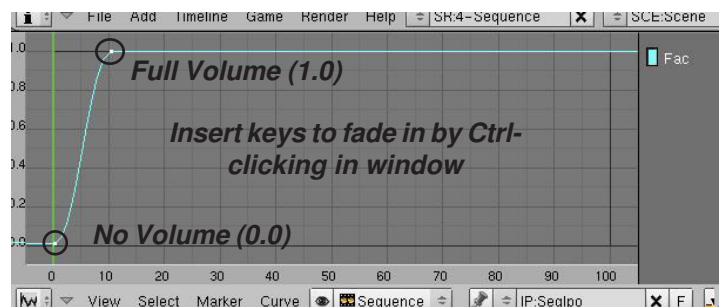
Movie Producer Practice Exercise

This is a great exercise to end the book with. Your job is to take all of the images and movies you have created through these exercises and produce a compiled movie. I recommend making a **Black JPEG image** to use for your **first** and **last** image (*start and end in black*). Images should be diplayed for approx. 3-5 seconds with 1 second transitions.

> **RoboDude Says: It is best to work with movie files that have all been rendered at the same size and frames-per-second. Problems may occur when Blender tries to convert files that are different from the output you have selected.**

I hope that this manual has been helpful in learning this difficult, yet powerful program. The projects that you can create in it are limited to only what you can imagine and are willing to learn. We have covered a lot of information, but it is only a fraction of what Blender can do. Visit the Blender forums, Blendernation.com, and Blender.org often.
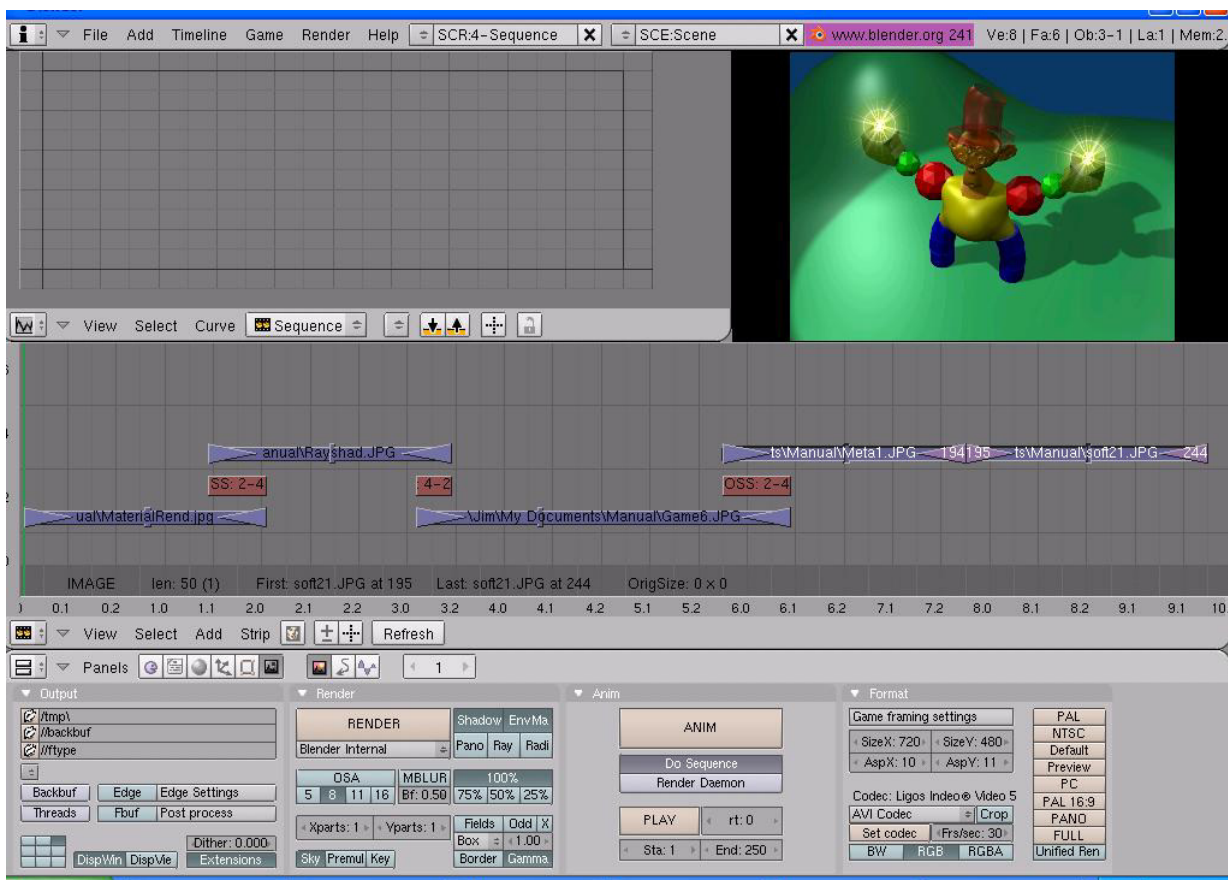
** Call the instructor when finished**

Happy Blending!