Particles have received a lot of attention in Blender 2.5 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, grass 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 or gravity. 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

At first glance, the particle setting in Blender can seem overwhelming! Because particles are so versatile, there are many things that can be changed for them. We will first look at the basic setting, then apply these settings to a few examples. With a mesh object selected and going to the particle settings, the first thing you need to do is press the "+" button to add a particle system. After pressing the "+", you see several panels with options. The example below displays all panels collapsed for easier viewing:
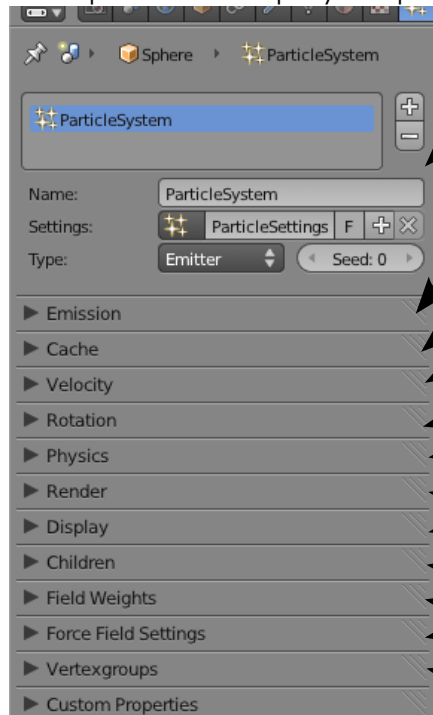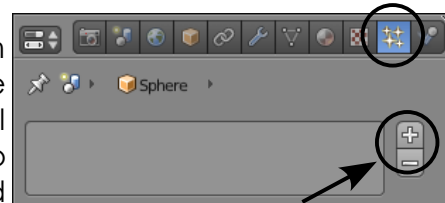
Basic Settings- This is where you name your system for easier reference, add additional systems and choose the particle type (*emitter or hair*) Hair is useful for any type of strand, like grass.

Emission- Number of particles, when they emit and how long they live when emitted.

Cache- In order to save computer processing time, you can "Bake" your particles so they are remembered.

Velocity- Sets an outward, normal (exploding) or directional force to start the particles.

Rotation- Gives your particles a spin.

Physics- Choose your physics calculation type, mass, size and drag.

Render/Display- How the particles look on screen and rendered.

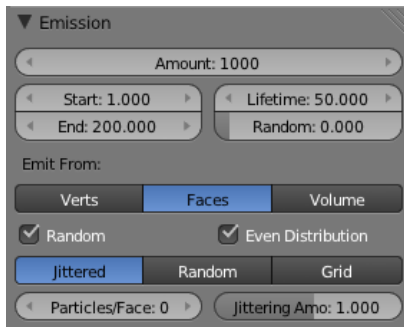**Children-** Saves render time by copying particles.

Weights and Force Fields- Controls factors like gravity, wind, turbulence, and drag

**Vertex Groups-** Setting groups to control distribution.

Particle Panel Basics

Some of the panel basic settings are explained below:

When adding a particle effect to a mesh, think of the mesh now acting like a collection of small parts, being created at various points in time, living for a while, then dying. In the **Emission** panel, you set the total amount of particles, when the particles start in time, when they end, how long each particle will live after birth and if you want some randomness to their lives. This is where you can also select _Random_ for how they are emitted from the mesh, otherwise, they may appear to come off in a sequence.

The **Cache** panel is useful for saving you particle calculations so working and rendering can run faster. Every time you make a change to your particle settings, the computer needs to recalculate those changes over time. Saving this data in a folder or file will help a lot. This is called _Baking_. When you press "Alt-A" to see an animation on screen, Blender will temporarily _Cache_ the data in memory while you work, but won't save it for a future session.
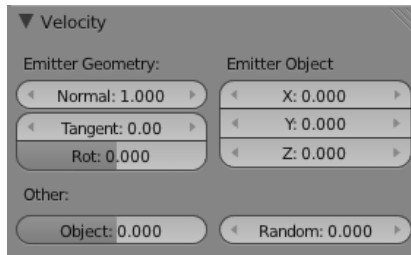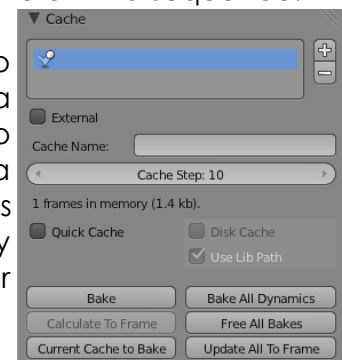
The most important settings in the **Velocity** panel are "_Normal_" and the "_X,Y,Z_" settings. Normal controls the outward force of the particles while X,Y,Z control the directional push. You also have a few other setting to adjust. The _Random_ setting is also important to make the effect look more real.

RoboDude Asks: _There are a lot of settings- how do I keep them straight?_
It is best to only make one or two changes at a time and test them out by pressing "Alt-A" to see the effects in the viewport. You can always "Ctrl-Z" to undo- and practice helps.

The **Rotation** panel gives you options related to how the particles spin when released. If you are looking at random spinning and dynamics, it's good to set these high. You can also change what effects the spin (by default it is velocity).
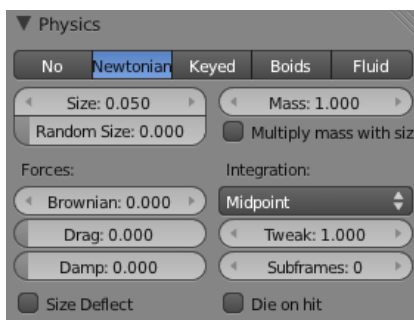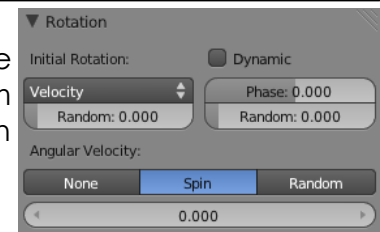
The **Physics** panel is where you can make some basic adjustments in the physics model used (default is Newtonian), size and randomness of particles, mass (when dealing with gravity and reactions) and dampening.

The **Render** panel provides setting for what the particles look like rendered (F12) or animated. If the *Emitter* button is not checked, you will see the particles and not the mesh that they are emitted from. You can also chose to see *Unborn/Died* particles. Particles can also be represented different ways such has *Halo* (material settings), *Line*, *Group*, or an actual *Mesh* Object.

The **Display** panel basically controls how your particles look on the screen. You can have them display what is actually rendered, Points, Circles, Crosses and also the percentage of the particles (helps with work flow).
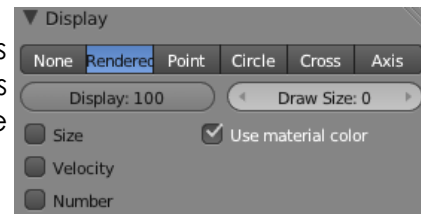
In the Emission panel, you set the amount of particles you want for your scene, but by setting the amount to a high setting (especially for hair or grass), you can greatly increase render time and slow down working on screen. The **Children** panel can help solve these problems. Basically, children are copies of a given particle so calculations only need to occur for each particle, then copies are made and grouped around that particle to make the scene more full. You can set the clumping, randomness, amount of children per particle and shape.

The **Field Weights** panel allows you to set useful features like *Gravity, Wind and Turbulence*. For example, if you are making a fire effect, You would want gravity at 0 and give "Z" an amount in the *Velocity* panel. For fireworks, only a slight gravity would be needed.
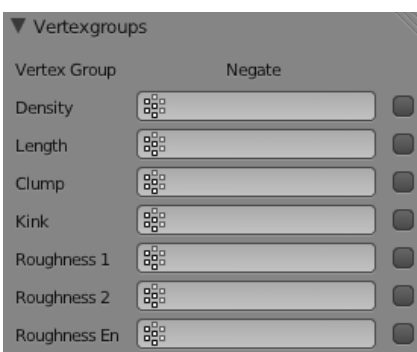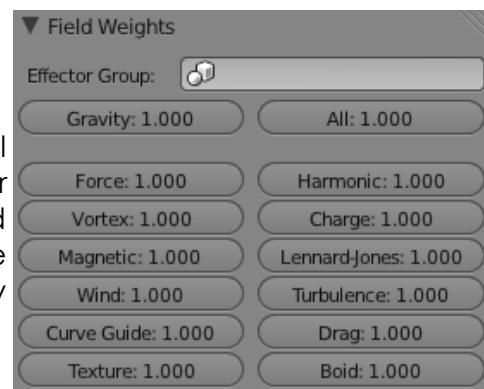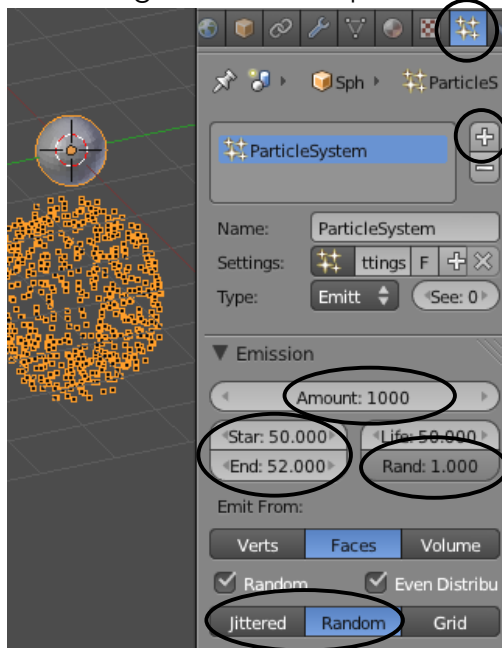
Vertex Groups can be used to control many aspects in particles. You can develop weights for density and other things. We will look at using groups later in this chapter when we use particles for hair and grass.

The **Force Field Settings** panel allows you to add additional features to your particle system. Features like Drag, Turbulence, Wind, Vortex, etc. can be added and animated.
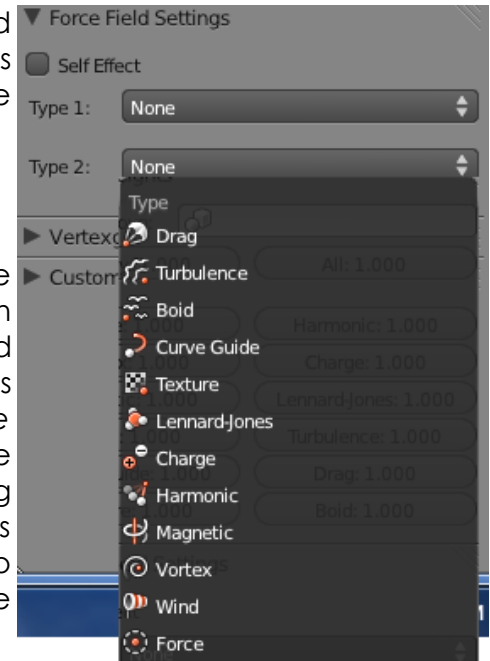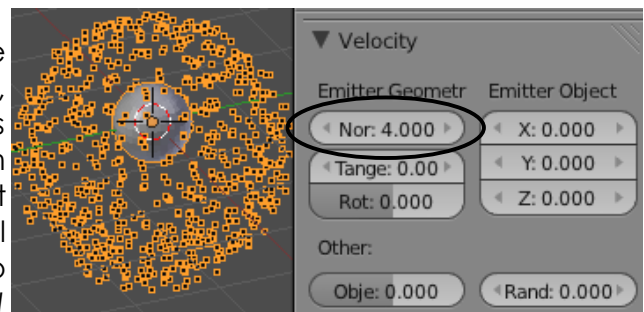
A Simple Particle Explosion (Fireworks):

Let's take some time to set up a simple particle explosion for practice using particle settings. Start with a new Blender scene, erase the initial *Cube*, then add a *UV Sphere*. *Scale* the sphere down to about ½ it's original size. In the *Properties* window, add a *Particle System* for the sphere. Press "Alt-A" to see the animated particles. You should see particles dropping off the sphere (spin your view to see the effects). Press "Esc" to exit the animation and use your arrow keys to move up in time to about frame 30. You should see something like the example below:

The particles are dropping because the gravity is set by default. We now need to make some changes to resemble a firework. First, start in the *Emission* panel and change the total *Amount* to about 300. No need for 1000 particles for a firework. Next, since a firework explodes over a short period of time, we need to change the *Start* and *End* frames to something much less. Try a *Start of 50* and an *End of 52*. This will cause all 300 particles to be release in 2 frames. Since firework particles die randomly, keep the Life at 50, but change the *Random* to full (1.000). Finally, change the Emit option from *Jittered* to *Random* to make the release of particles more random. Test it our with "Alt-A". The particles still drop so it's time to look at some other settings.

Next, in the *Velocity* panel, change the *Normal* setting to a much higher number, like 4.00. This will blast the particles outward. The gravity still pulls them downward a bit to much, so we'll fix that next. Go down to the *Field Weights* panel and set *Gravity* to about 0.40. Feel free to experiment with these setting for different effects.
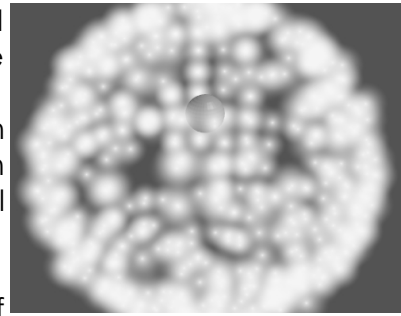
It's now time to put the camera in a good place and render an image. Advance to a frame where you see the particles well and hit "F12". You will see something like this:
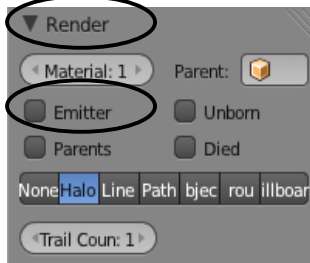
You may see the actual sphere in the center of the explosion. To turn this off, go to the _Render_ panel under particles (*if you had the camera selected from before, select the sphere again*) and turn off "_Emitter_" so the actual mesh doesn't render. You could also experiment with _Trail Counts_ for a second release. To improve the explosion, add a material and adjust the _Halo_ setting. (review chapter 4) Adjust the Diffuse Color, Halo Size and try Lines and Stars. You should end up with a nice effect.
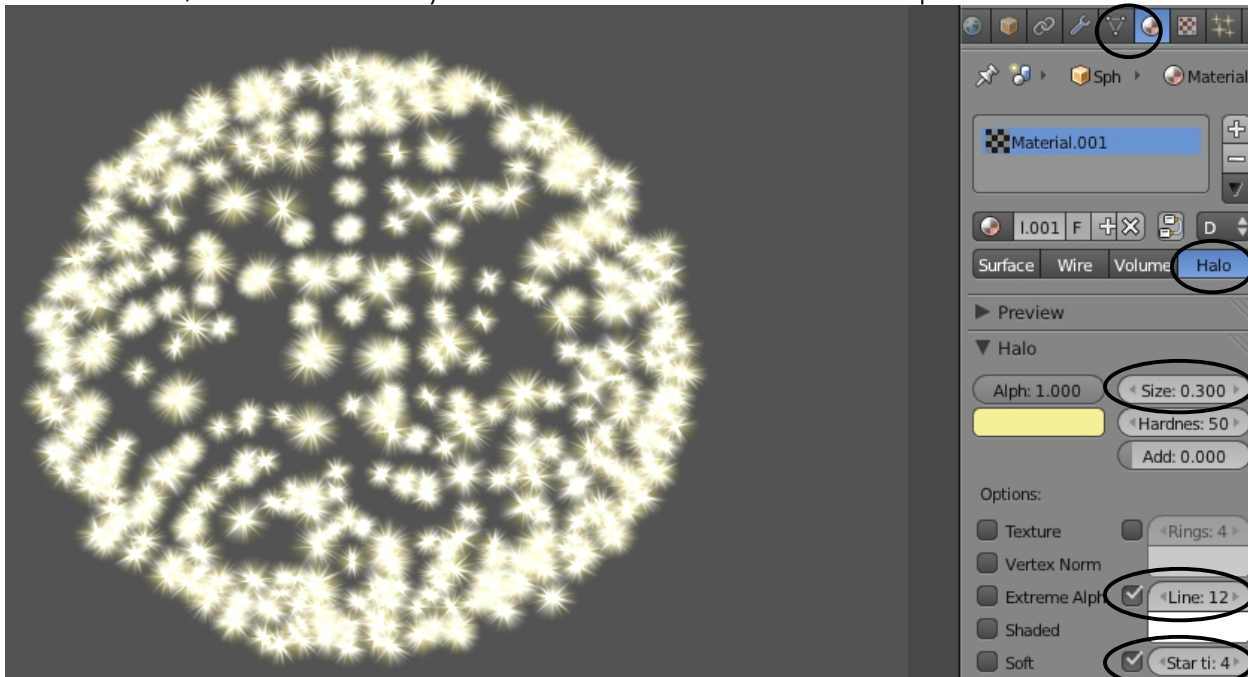

Using the Explode Modifier

The Explode modifier adds a nice touch to making something explode. We will use the firework example above to illustrate an explosion. In the _Render_ setting, turn on _Emitter_. First, turn off _Halo Lines_ and _Stars_ in the Material settings and set _Halo Size_ smaller, about 0.10. Add an _Explode_ modifier in the Modifiers panel. You may also want to check the "_Cut Edges_" box. Move to a frame where you can check the results. Also try "Alt-A". It's a nice start, but needs some work to look more believable.
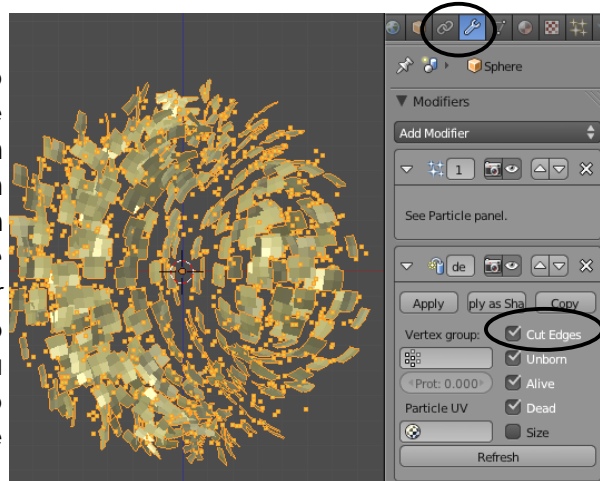
Now it's time to move back to the Particles settings panel. In the *Emission* panel, you will want to set the *Life* of the particles to 250 (length of the animation) and the Random Life slider back to 0. To set the rotation to look more random and real, set the *Rotation* and *Random* setting to numbers between 0.500 and 1.000 in the *Velocity* panel. In the *Rotation* panel, check the *Dynamic* box, add a *Random* to the *Velocity*, *Randomize Rotation Phase*, and change the *Angular Velocity* to *Random* with a number like 6.00. The key to a good explosion is setting most random settings high. Feel free to experiment with other settings, but this should give you a nice result.
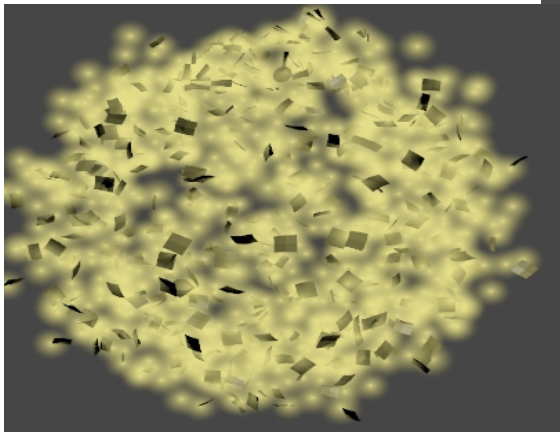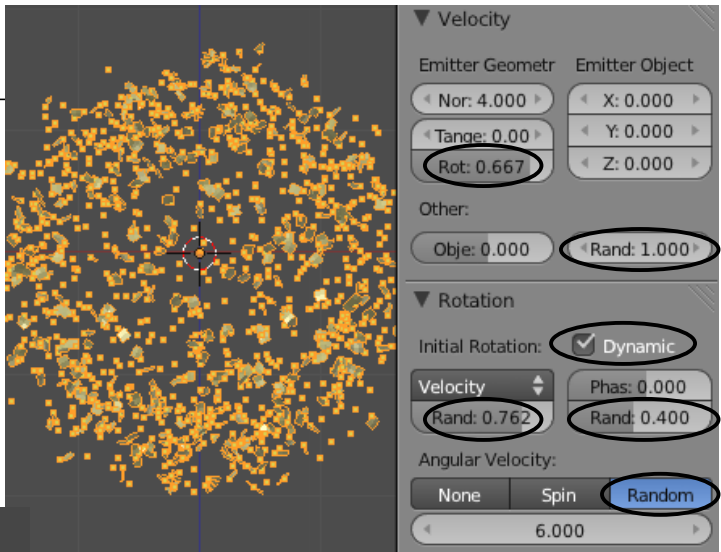
If you want an explosion without the halo particles displayed, trying setting the halo size in materials to 0. To add more depth you your animation, try adding a second mesh with a different color and particle settings. This will add levels and complexity to your scene.

Particle Interaction With Objects and Forces

So far, we've looked at basic setting to get particles moving, but how can we add interactions to them? What if we want them to bounce off other objects or have wind blowing them?

Interaction with Other Objects:
You can make particles bounce off other objects using the *Collision* setting in the **Physics** panel. For the example shown to the right, I've created a sphere with a simple particle effect applied and a plane below it. In order to get the particles to bounce when they collide with the plane, select the plane and go to the *Physics* panel. Select *Collision* and experiment with the settings under the *Particles* column. You can set them to bounce, die or partly pass through.
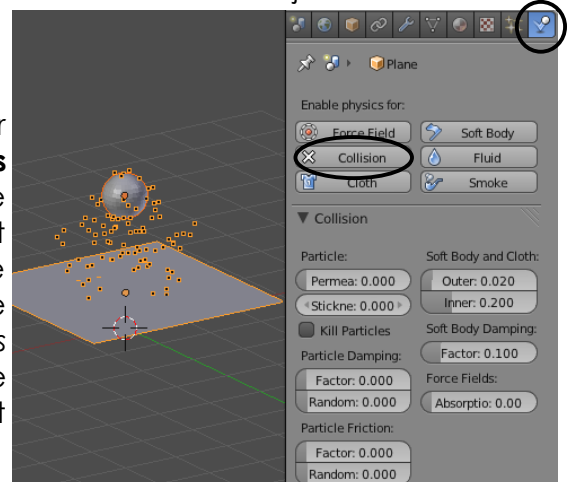
Interaction With Forces:

Particles are able to react to forces like wind. They can now be applied directly to the particle system (*see Force Field Settings panel*) or added to another object. By applying the effect to the particle system, it can effect itself or effect other particle systems. By applying a wind force to another object, it can be animated to simulate wind changing directions.

For the example to the right, we will be using an *Empty* as the wind force and a *Sphere* with a particle effect with zero gravity. The Empty's display has been changed to "*Arrows*" representation for better understanding.
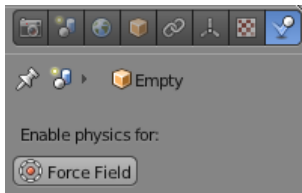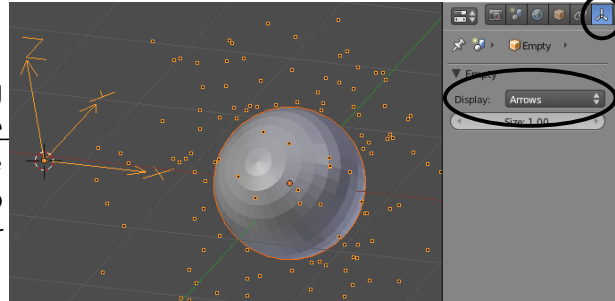
With the Empty selected, go to the *Physics* panel and enable "*Force Field*". Select wind in the "Type" option and you will see several circles form on the Empty, indicating the force and direction. By default, the force will travel in the Z-direction. Rotate the Empty to point in the direction you wish the wind to blow. You can then adjust the strength, noise and other settings. For more change, you can also animated these setting by pressing "I" over a setting and changing it over time.
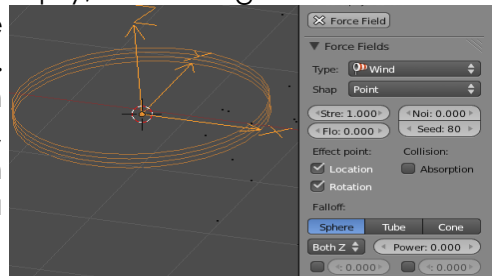
These setting are similar to many of the other forces that can be used on an object. These forces can also be used on many of the other physics features that will be discussed in a later chapter (cloth, fluids, softbodies).

## Using Particles and Vertex Groups for Hair and Grass

At the beginning of the chapter we mentioned that particles can also be used to represent hair and grass. These features can be animated to react with forces and other objects. Hair can even be combed!
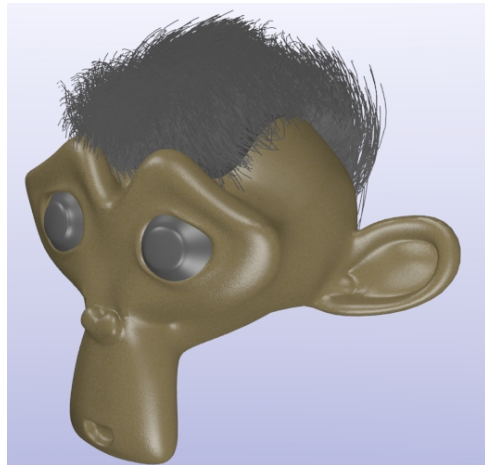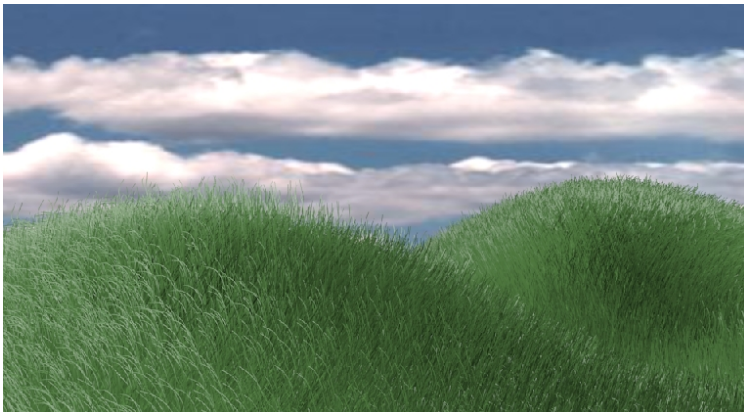
Basic Hair Settings:

For this basic setting discussion, I'll apply a particle system to a UV Sphere and switch from "Emitter" to "Hair" in the particle properties. You will probably get something like the scene below with long strand radiating out from the sphere. It's now time to adjust

the *Hair* length under the *Emission* panel. I will set this example to 1.00. We'll keep the *Amount* at 1000.
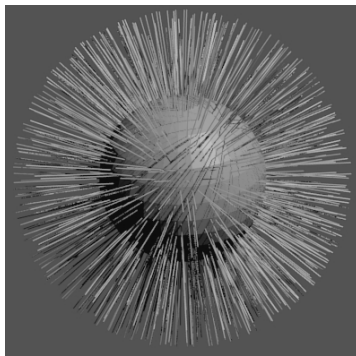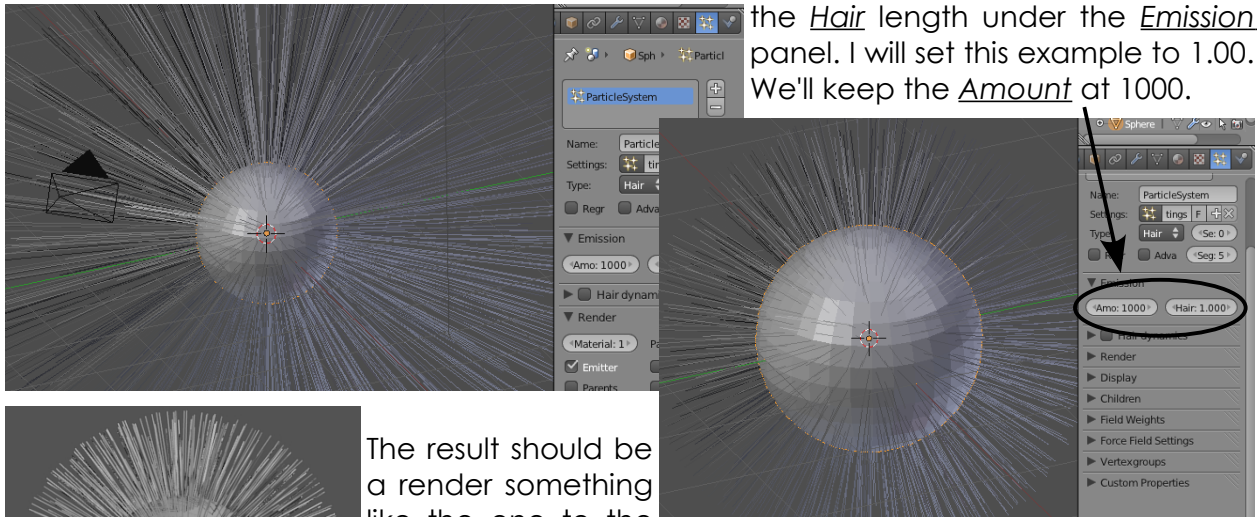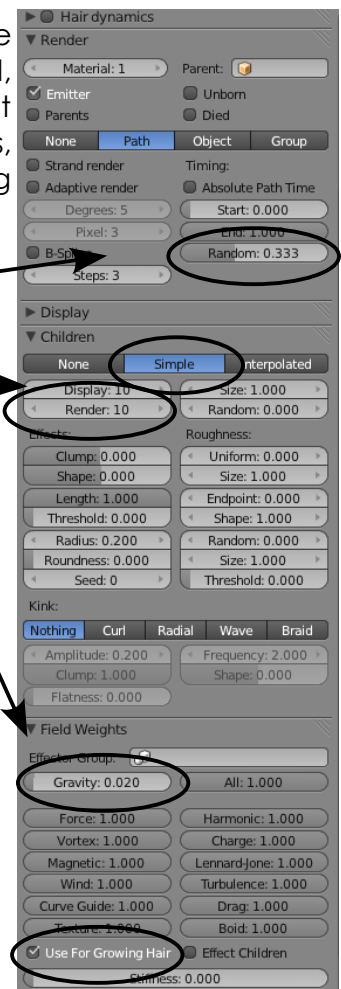

The result should be a render something like the one to the

left after reducing the length. There are many settings that can be adjusted, but let's keep it simple. In order to get something more full , random lengths, and effected by gravity, try adjusting the following settings:

Render panel- Adjust the *Random* slider to randomize the hair length.

Children panel- Select "*Simple*", then adjust the *Render* amount to something like 10 for less children. This will fill in the sphere and give more strands without adding more particle hairs to calculate. There are also many more settings for different effects.

Field Weights panel- Check the box at the bottom of the panel "*Use for Growing Hair*" and adjust the *Gravity* low (about 0.020).

These setting should give you a result something like this. Feel free to experiment with other settings.

Material Strand Settings:

The shape of the strand can be controlled in the material settings. Put a material on the sphere and open the "*Strand*" panel. Under *Size*, you will see a "*Root*" and "*Tip*" setting. The 1st example uses a Root size of 1.00 and a Tip size of 0.25. This creates a tapered strand. The 2nd example used a Root and Tip setting of 5.00.
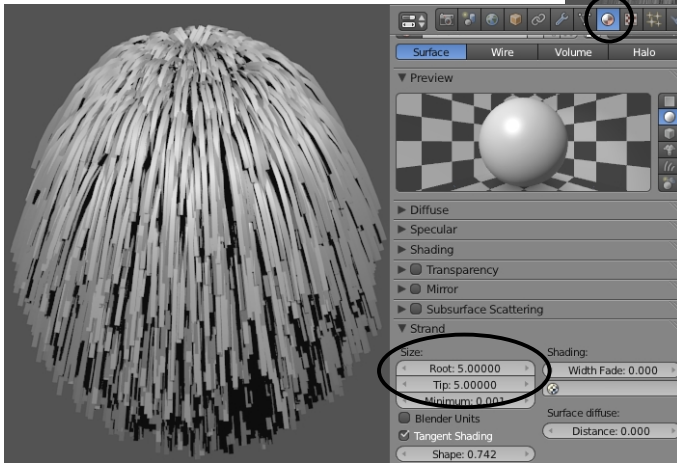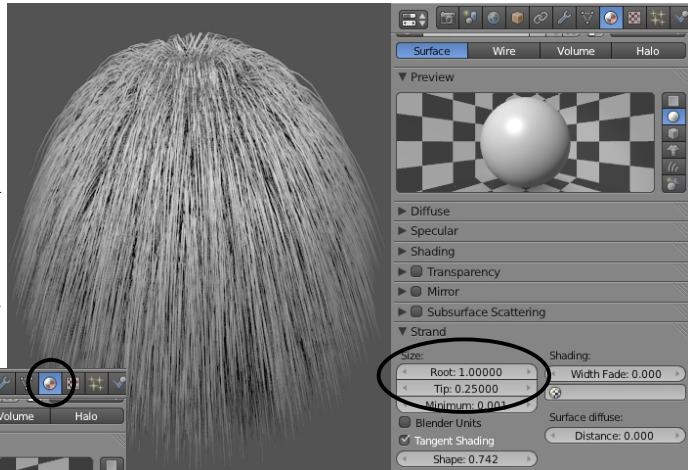
RoboDude Says:
Just like basic particles, force fields like wind can be used to move strands.

Creating and Using Vertex Groups:

Let's say you want to make an object with grass or hair, but don't want the particles distributed evenly over the entire object. We can control this with vertex groups that assign different weights to verticies. For an example, we'll start with a plane that has been scaled up a bit and subdivided about 5 times in edit mode.
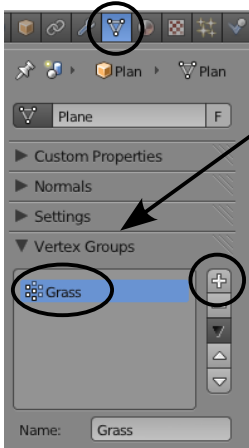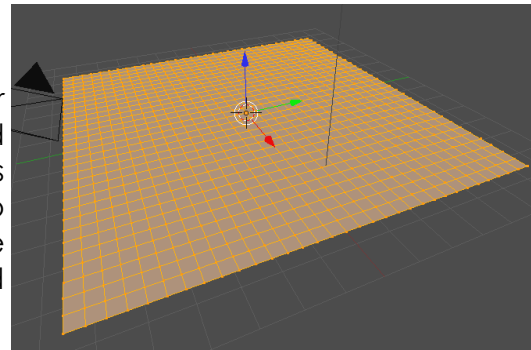
Next, well go to the *Object Data* buttons and press the "+" button in the *Vertex Groups* panel to add a vertex group. It might be helpful to change the name from "*Group*" to something more meaningful.

It's now time to assign different weights to the verticies. This can be done 2 ways:

– *Assign weights in Edit Mode*
– *Assign weights using Weight Painting*

Assigning Weights in Edit Mode:
Enter _Edit Mode_, deselect all verticies and select all those that will have the highest density of grass(_use the "B" or "C" key_). In edit mode, you will notice that a few options will show up in the Vertex Groups panel. Take the "_Weight_" slider to 1.000 and hit "_Assign_" to give the selected verticies a weight of 1, the highest density. For areas without grass, assign them a weight of zero, and areas with middle density, a weight in the middle. To see your results, you can change from _Edit_ mode to _Weight Paint_ mode (_discussed below_). Weights will display as different colors.
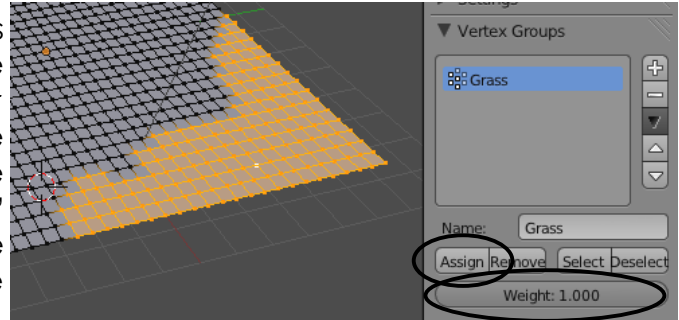
Assigning Weights in Weight Paint Mode:
Weight Painting allows you to "brush" different weights onto your object. You still need to create your vertex group as discussed on the previous page first, then change to _Weight Paint Mode_. Your plane will change to blue (_indicated everything at a weight of zero_), your cursor will be displayed as a circle, and the _Tool Shelf_ will display the Weight Painting tools. Much like assigning weights to verticies, you need to set the _Weight_ you plan to "brush" onto the mesh. You can also set the brush _Radius_ size and _Strength_. The strength determine the fade of the brush. To paint the full weight, set the strength to 1.00.
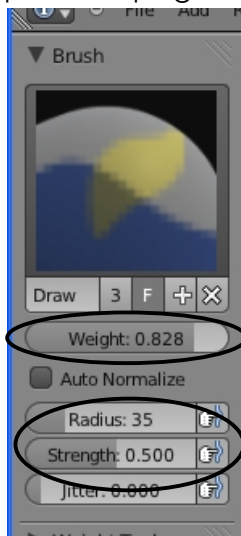
For our example, I've painted the mesh as shown to the right. Blue is a zero weight and red is a weight of 1.00.
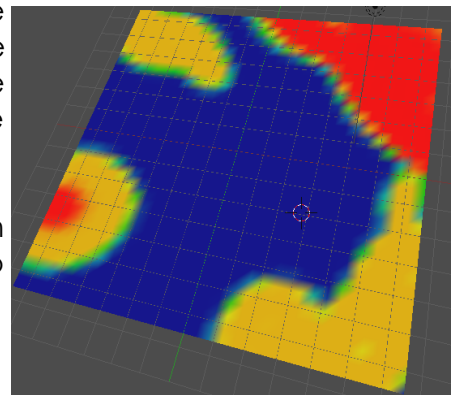
Return to _Object Mode_.
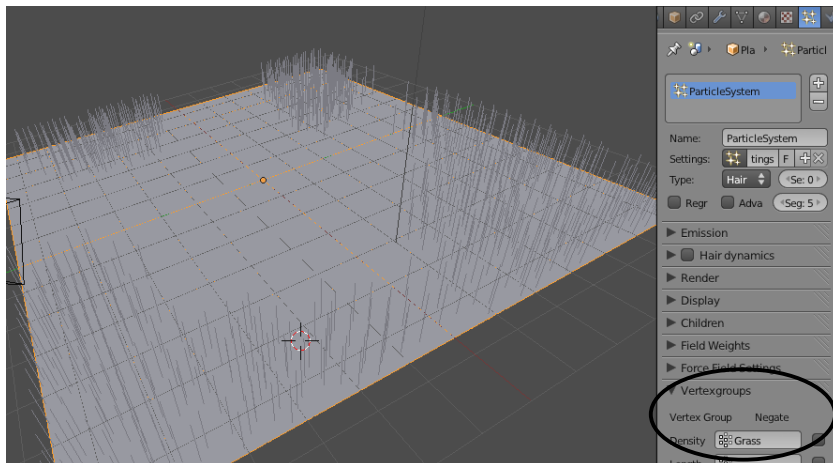
It's now time to apply a _Particle_ system and set it up for hair as discussed earlier. In order to make the particles generate using the vertex group we created, select your vertex group for "Density" in the _Vertex Groups_ panel. Vertex groups can be used for many other features in Blender.

Other Hair Effects:

We need to discuss a few other options useful for particle hair. These are shaping the hair in *Particle Mode* and assigning colors to the strands other than the main material color of the mesh. Starting with a new Blender file, We will add a Monkey head, set it smooth and apply a *Subdivision Surface* modifier to it. The next step is to add a *Vertex Group*, then enter *Weight Paint* mode and brush weighted areas where you wish the hair to grow. Painting may be difficult due to the monkey not having may verticies. My example is shown to the right with the monkey having a Goatee and a Mohawk:
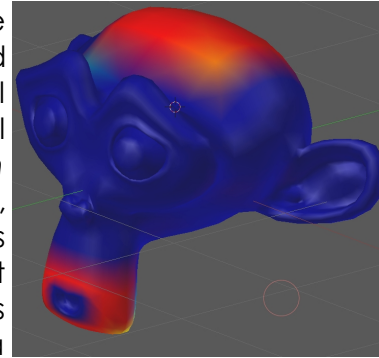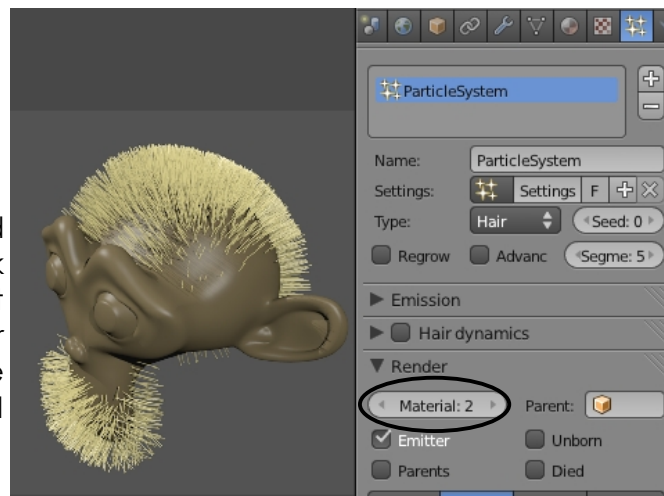
Now go to the *Materials* panel and put an appropriate color material on the monkey. I used a brown color. The next step is to apply a hair particle system as previously discussed. Set hair length, amount, and children to desired appearance. At this point, you should be able to render an image and see results similar to these.
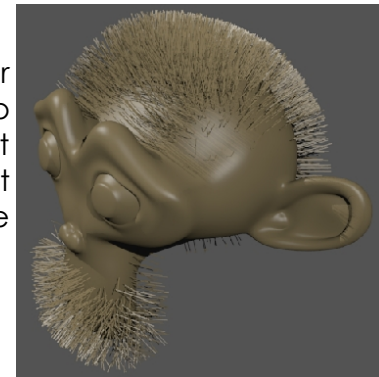
Looks good, but I would like to have the hair a different color. To do this, go back to your *Materials* panel and click the small "+" to the right of the materials list. Give it a name in the block below it and set the diffuse color. I chose a shade of yellow. The material list will show 2 materials set for this object. The 1st material channel is used for the mesh color while we will use the 2nd material channel will be used for the particles.

Now go to the *Particles* panel and find the *Render* settings. You will see a block where you set the particle material. Set it for <u>Material 2</u>. This should force Blender to use your second material for the strands. Hit F12 to render an image and you should see something like this:
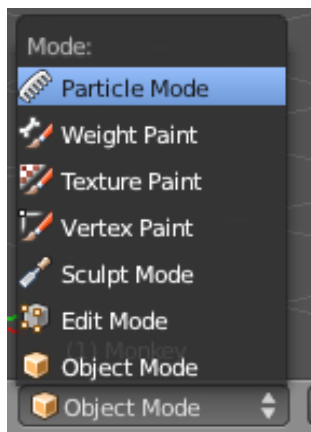
It's now time to comb and shape the monkey's hair and beard. Switch from *Object Mode* to *Particle Mode*. A new set of options will display in the Tool Shelf. By default, you may only see the original strands without the children on the screen. You can check the "*Children*" option at the bottom of the Tool Shelf. Experiment with the different options available in Particle Mode. By using the Comb, Cut, Smooth and Puff commands, you can modify the hair quite a bit.
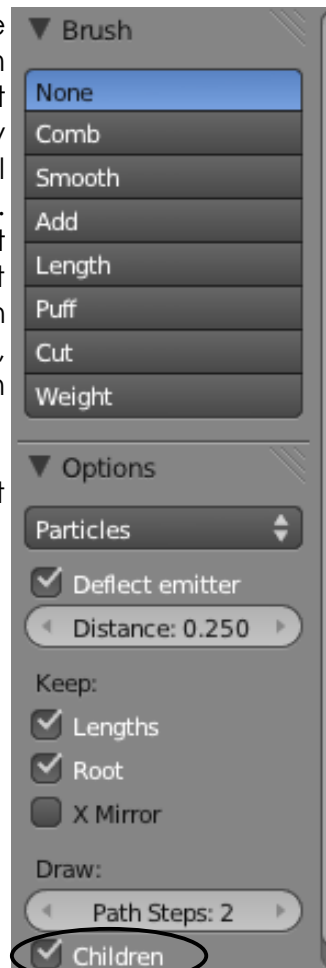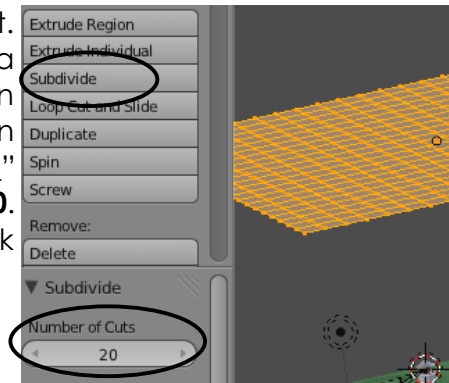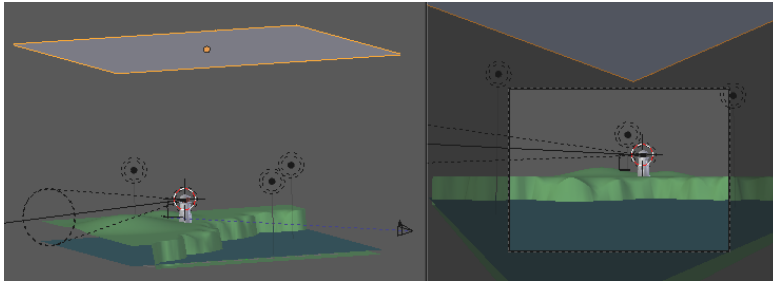
With a little practice and patience, you can create some great effects!.
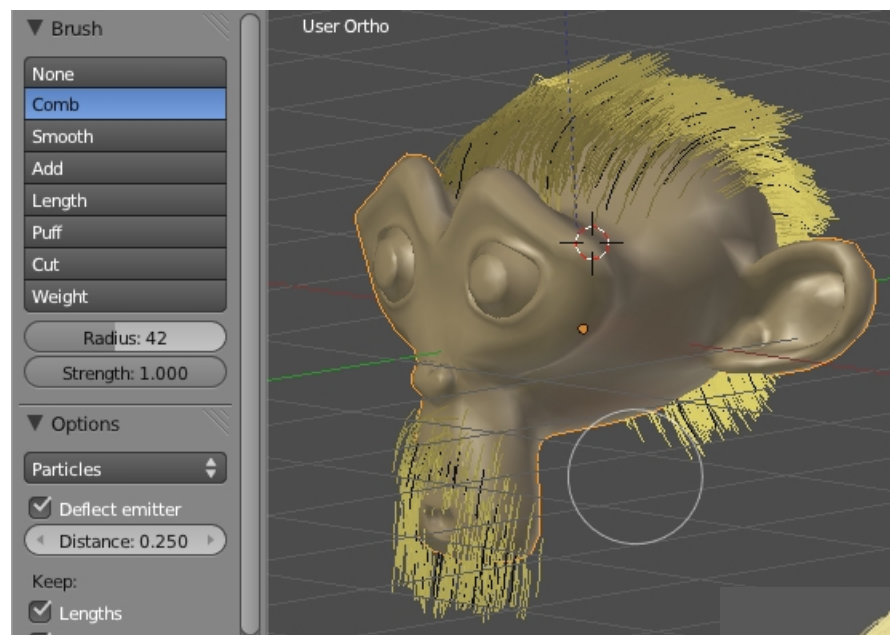
To summarize the particles unit, by adjusting the basic settings discussed here and experimenting with others, you can use particles for a variety of effects in your scenes. Need a dusty, blowing scene? A fire with flames and smoke? Grass blowing in a field? By browsing the forums, you can always find someone doing something new.

Adding Rain to Your Landscape

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, select "***Subdivide***" in the Tool Shelf and set "***Number of Cuts***" to **20**. Returning to Object mode, your scene should look something like this:

rain at some point before that (*-100*). We also want the rain drops to last the entire animation (lifetime), 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*). Place a dark gray diffused material color on it for a dark, rainy look.

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

Amount: 30000; Start: -100; End: 200; Random Distribution
In *Velocity* panel, Y: 4.000 for side movement
In *Render* panel, switch to Line. You can adjust the length of the line with the "*Back*" / "*Head*" settings.

Since your scene may be a bit different, feel free to adjust these as desired.

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.
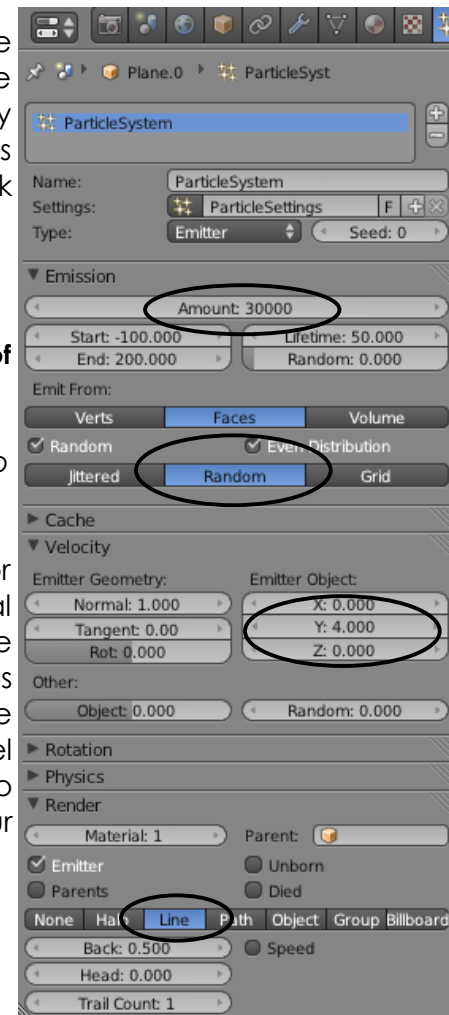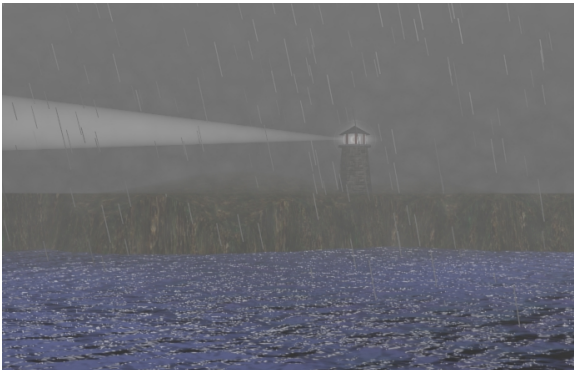
** Call the instructor when finished**