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 separate 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.
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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 emitted 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 system. Here’s what we are interested in at this time:

- **Object**: If the object is animated, the object can affect the starting speed
- **Normal**: Gives the particles a starting speed (blasts outward)
- **Texture Emit**: Use a texture to define how particles are emitted.
- **Rotation**: Dynamic motion of particles
- **Force X, Y, Z**: Push or pull the particles in a given direction

Visualization Panel

This panel lets 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.
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 reanimate 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.
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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.
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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.

To minimize the bouncing, select the plane again and take the Dampening up to 1.00.

Again, you will need to go 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 render as an object. It is great for a number of tasks that will be discussed in later chapters. To create an empty, place the 3D cursor where you would like the wind to come from, press the Space Bar and “Add” and add an Empty.
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 “Chapter 18- Object Physics”.

Sample Particle Settings

Here are some sample settings for various uses for particle systems. These settings demonstrate objects that have not been scaled up or down. The numbers given in these examples are based on a 100 frame animation. If you lengthen the animation or change the size of the objects, you will need to adjust things like the total number of particles, forces and starting speeds. These settings can be “tweaked” to your own personal preferences. They are just intended to get you to a starting point. 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 vertices. Snow will need to fall slowly so we show a small negative Z force. Place a material with a Halo on the plane and adjust the size of the Halo. Change the following settings:
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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

![Particle System and Physics settings]

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.

![Particle System and Physics settings]

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](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, let’s 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:

We have some hair, but it doesn’t look very good at this point. Let’s shape it up a bit.
Let’s shape up the hair a bit, but first, let’s 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 points on the ends. It is important that you keep these vertices 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.

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 affected by wind and gravity setting.
Particle Systems- Rain in 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, 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.

**Submit to the instructor when finished**