

CREATING DENSE SMOKE IN BLENDER

Blender Dense Smoke Tutorial

Dedicated to Burns for correctly identifying my homage to Rustboy by Brian Taylor. www.rustboy.com

Dense Smoke Creation in Blender 2.36 By COG aka Colin Litster



CREATING DENSE SMOKE IN BLENDER

Areas Covered

This tutorial will show how to simply create dense smoke in Blender. It utilises the Blender particle system but in a relatively straight forward way.

Prerequisites

As with all my tutorials you should have a minimum understanding of creating, scaling moving and rotating objects in Blender. How to create a Material and add textures. The Blender 2.3 manual, or the online documentation, is the best place to learn these fundamental skills. You should understand IPOs at least how to select an IPO selection and set a point on an IPO curve. Here we will utilize a material IPO and a time IPO to help create thick pyroclastic like smoke. The kind of thing that would come out of a steam train or for my needs a steam Tug. I would recommend that you use the latest version of Blender (v2.36) to try this effect although I suspect you could achieve the same effect in versions back to 2.30.

Researching Inspiration

It is always worthwhile doing some visual research to save you time in the creative process. Fortunately there are numerous images of dense smoke available on the internet. I regularly use the Google image search for my inspirational ideas so I can highly recommend it. Study any reference images for colour, texture, and lighting as it will save you time when you come to duplicate the type of smoke required. If its possible see if you can find a movie of the type of dense smoke you are trying to recreate. One of the most important features of smoke coming from a chimney is its speed and how its texture changes over time. It can show how the smoke dissipates and the effect of wind on its movement. For this example we are going to generate a simple dense and dirty steam like smoke, in a reasonable breeze, along a single axis.

Lets get started

Rather than give you the precise location of camera and lighting, or indeed the size of objects such as the chimney, I will assume that you are able to work these out for yourself. I have kept these things as arbitrary as possible so that the technique is not confined to a particular camera or 'scene lighting' position. However, the particle setup is important and its settings can radically change the look of the smoke. I will therefore give detailed settings for these critical items.

OK create a new Blender scene.

As in previous tutorials its best to save the new scene immediately with a relevant name such as **funnel-01.blend**

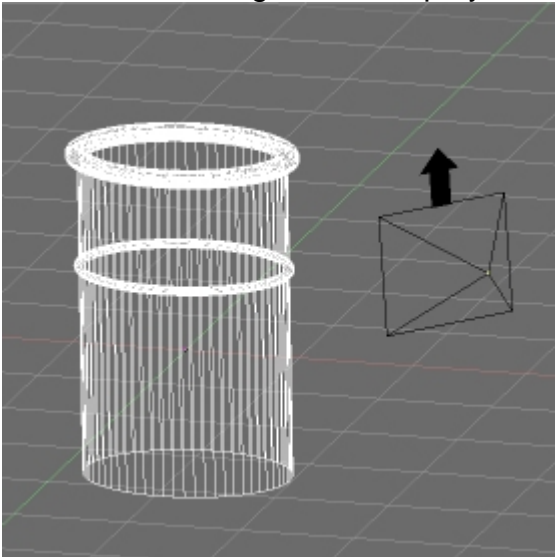
CREATING DENSE SMOKE IN BLENDER

We will handle the creation in a particular order to aid your understanding and also to show the problems and solutions that can arise in making a convincing particle system in Blender. Therefore we will proceed in the following order:-

- Create a simple funnel with appropriate lighting and camera placement.
- Create the particle emitter.
 - Setup the particle actions such as wind direction and force.
 - Setup the particle texture.
- Light the created smoke to emphasis its density.
- Modify the alpha of the smoke so that it smoothly starts and dissipates through its life.
- Modify the speed of the particle system so that its movement looks real.

Creating the Funnel

The funnel, chimney, or whatever the object is, can be made with the simple tools available from within Blender. A tube works quite well because it doesn't have a cap like the column mesh. I used a curve profile that I spun through 360° to create my funnel mesh. However, let's make this simple at the moment and just create a tube in the centre of the scene. Scale the tube to give the shape you want. You can if you want just copy the one I've created.



CREATING DENSE SMOKE IN BLENDER

Now place a camera and a couple of lights to illuminate your funnel. The lights can be simple lamps with standard settings. We will later be creating specific lights to illuminate the smoke.

Save your work as **funnel-02.blend** by pressing **F2** and modifying the name appropriately.

NOTE: You can if you want create a material for your funnel although it's not necessary for the tutorial.

Create the particle emitter

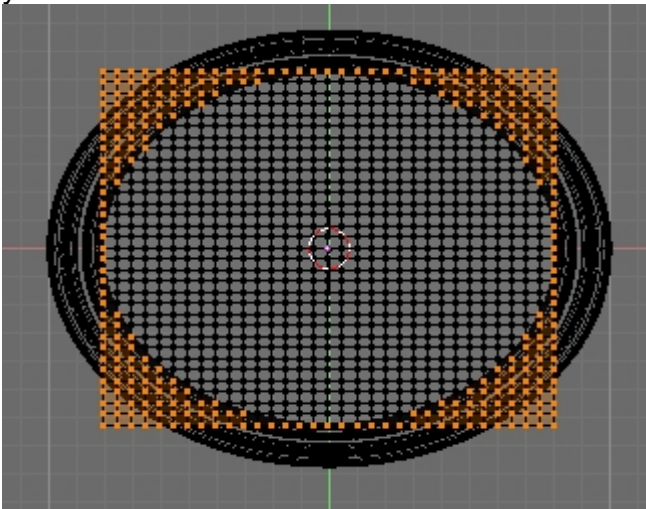
Time to create the smoke emitter. What we need is a particle emitter that sits at the top of the funnel. As you probably know any mesh object can be made into a particle emitter. However, as we want the smoke to go upwards, out of the funnel, its best to use just a simple plane mesh. Particles emanate along the normals of the vertices and therefore a sphere or other complex mesh would have particles emanating in all directions which would be difficult to control.

A plane simplifies the process. Therefore let's create a simple plane centred on the top of the funnel. Do this from the **TOP** view. Scale the plane so that it covers the inside of the funnel. Don't worry at this stage about the corners projecting outside.

Switch to edit mode **TAB** and sub-divide **W** the plane at least 5 times. This will produce enough vertices to make a reasonable emitter.

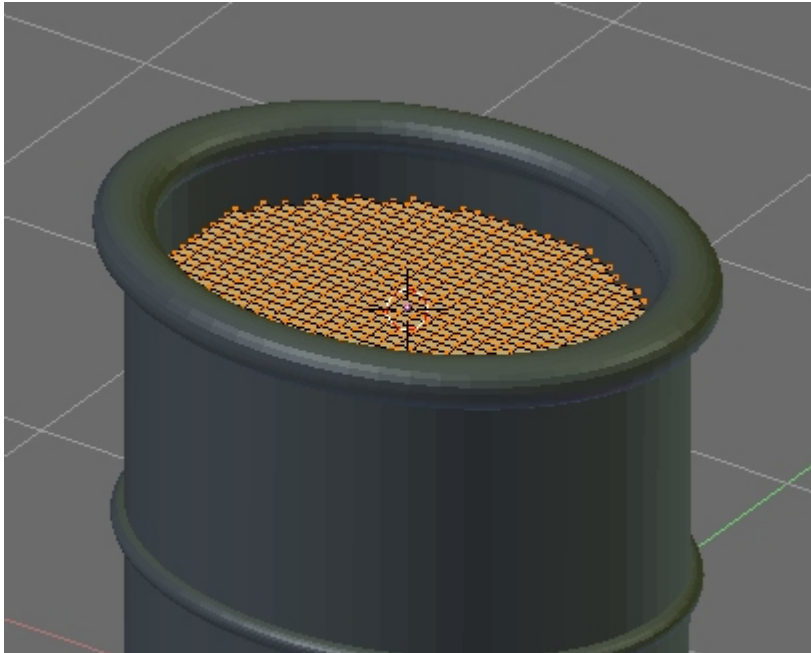
Let's remove the corners outside of the funnel.

Press **A** until all the vertices are deselected. Then use the **Border Select** command **BB** to select those vertices that are outside of your funnel. See the illustration below:-



Delete these vertices **X** key and you should have an emitter similar to that shown below:-

CREATING DENSE SMOKE IN BLENDER



It's always a good idea to randomize the order of the vertices to avoid unwanted patterns in the particle emissions.

Press **A**KEY in edit mode until all the vertices are selected.

Press **F6** for the editing panel and from **Mesh Tools** tab select **Hash**. This will randomize the sequence data of the selected vertices.



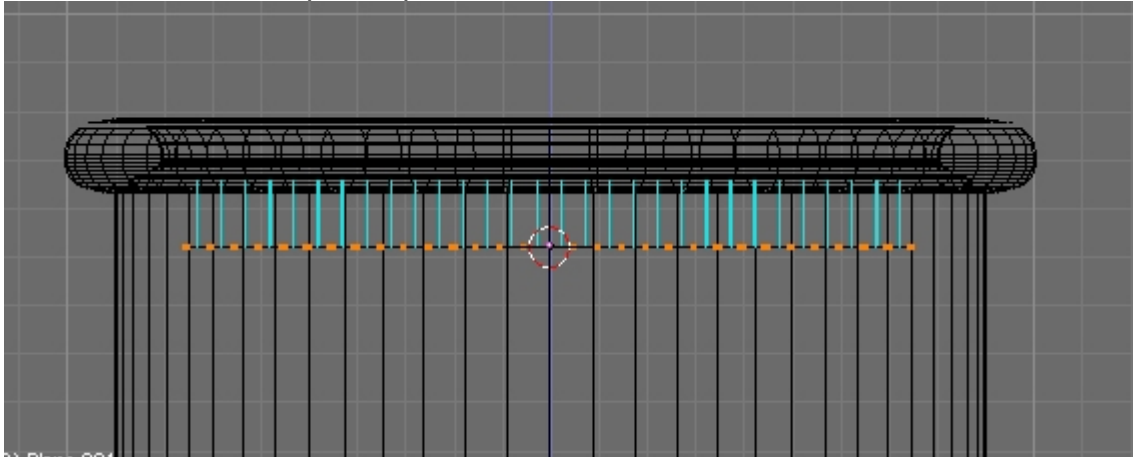
Particles will follow the normals of each vertex so it's important to ensure that they point upwards in our example or the smoke will travel down the chimney. If you have constructed the plane in the top view the normals of the mesh should point upwards. In edit

CREATING DENSE SMOKE IN BLENDER

mode you can check this by selecting the **Draw Normals** setting in the **Mesh Tools 1** tab of the **Editing menu F9**.



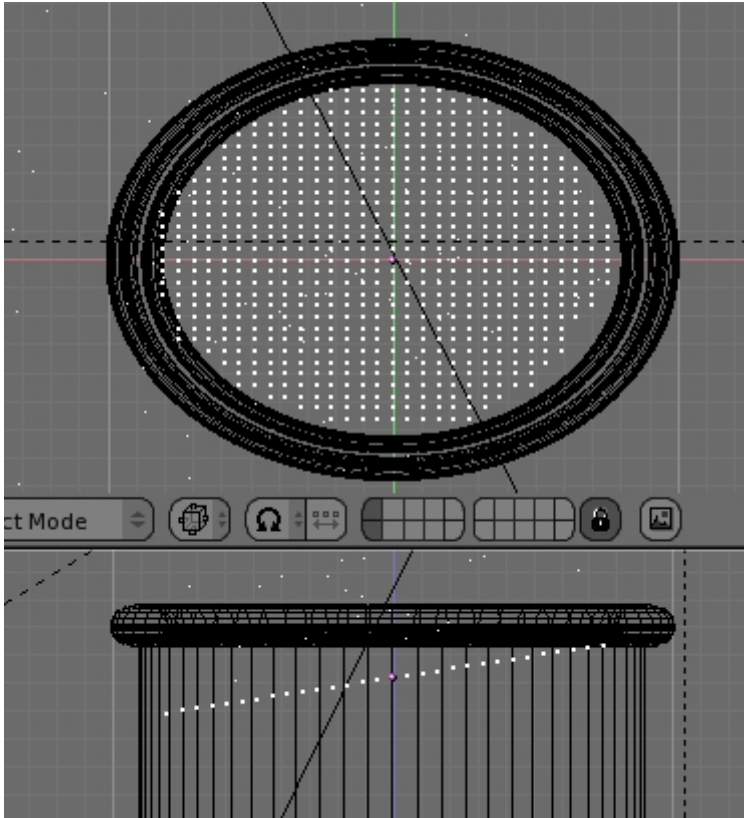
Your normals should point upwards as shown below.



If they do not press either **Ctrl-N** for recalculate normals to outside, or **Ctrl-ALT-N** for Recalculate normals to inside. Now get out of edit mode by pressing the **TABKEY**.

In my concept I also rotated the emitter mesh slightly as shown below.

CREATING DENSE SMOKE IN BLENDER



Save your work again at this point by pressing **F2** and alter the name to **funnel-03.blend**

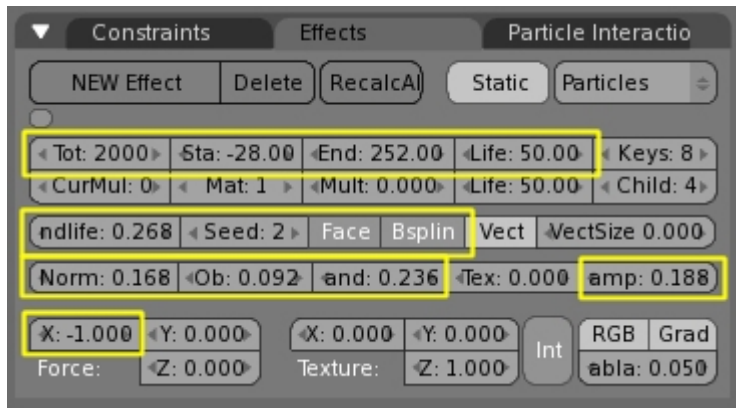
Setup the particle actions such as wind direction and force

Time now to create the particle system for the smoke on this emitter mesh. Make sure the emitter mesh is selected and then press **F7** for object mode.

Now from the Effects tab select **NEW Effect** and **Particles** from the 3 choices offered.

Setup the effect using the following settings:-

CREATING DENSE SMOKE IN BLENDER



Nothing very special in any of these settings but a little explanation may help your understanding.

- **Tot: 2000** is the total number of particles that are generated. This is normally as high as I go with particles because the render times increase exponentially with greater numbers of particles.
- **Sta: -28** means that the particle emission will start at frame -28. That ensures that the particles will be going when the animation begins.
- **End: 252** is an arbitrary end point for the particle emission. In my concept the length of the animation was just over 250 frames.
- **Life: 50** is the life of each particle. The higher this value the longer the particle will be visible.
- The **Randlife** and **Seed** values add a little variety to the particles created. You will notice that the randlife setting is quite low. This ensures that the particles look like they are reacting to the heat from the chimney. Any higher and the effect would be far too random to represent the kind of dense smoke we are trying to emulate.
- **Face** and **Bspline** have also been set. **Face** will give particles at both the vectors and also the faces of the mesh. **Bspline** ensures a smoother particle generation based on B spline interpolation.
- **Norm: 0.168** gives the initial speed of the particles which as you notice is quite small. I find that this setting should be on the low side most of the time or the particles will appear too fast.
- **Ob: 0.092** This will vary the starting speed based on the mesh object. It has also been set very low.
- **Rand: 0.236** This will give a random variation to the starting speed of each particle. Also set very low.
- **Damp: 0.188** This applies a damping factor to the particles. You can think of it as a kind of gravity or speed inhibitor over time. It ensures that a particle has a natural reaction slowing in its later life rather than carrying on in the same direction and speed over its life. Notice this is also set quite low.

Later you might want to tweak these settings. Just remember to make small changes and render short animations to check if it's what you expect.

CREATING DENSE SMOKE IN BLENDER

Time to create the wind working on our dense smoke.

You will notice that there is one further setting in the bottom left corner of the particle window. These settings are called **Force:** and apply a movement in **X**, **Y** or **Z** directions. In my concept I have used a negative **X** value of **-1.0**. This will force the smoke along the X axis away from the camera. However, you have total freedom here so don't be worried about trying combinations of force and different values.

Save your work again by pressing **F2** and changing the name to **funnel-04.blend**

Setup the particle texture

Currently the particles have no texture and a render would give a very disappointing representation of smoke. Time to create the magic that will transform our particles into smoke. Create a new material with the particle emitter selected. **F5 Shading.**

Create a new material with the particle emitter selected. **F5 Shading.**



Notice that this is a **Halo** material and that **HaloTex**, **X Alpha**, and **Shaded** are set.

- **Halo Tex** will allow us to add and use a texture on the halo.
- **X Alpha** makes the alpha effect more extreme.
- **Shaded** is one of the most important settings here as it allows the particle material to both, receive light, and shadows.

You will also notice that the **HaloSize** is set to **1.100**. This is a little bigger than the default and a size setting I have found to be more appropriate for many of my particle experiments.

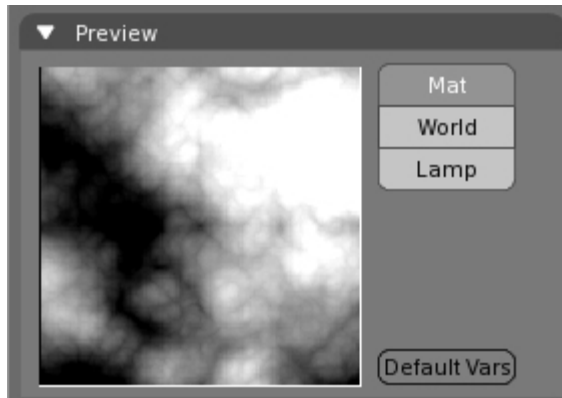
The colour is set to a light grey although again this is arbitrary. We will be adding some dirt to the smoke a little later.

One further setting is the Alpha or **A**: It's showing as 0 because of another setting we will look at shortly so don't worry about this now.

CREATING DENSE SMOKE IN BLENDER

Let's add a texture to make our smoke a little more realistic.

Press **F6** for the Texture Button.



Create a cloud texture with the following settings



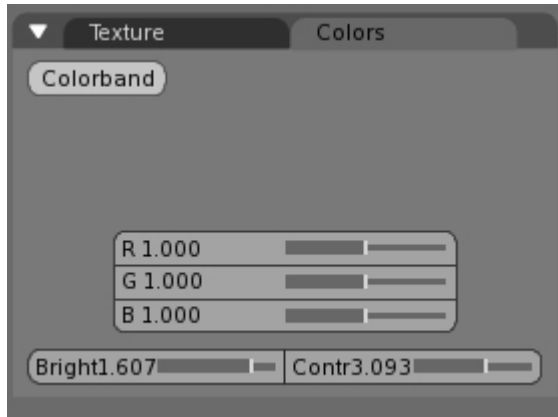
From the Colors tab alter the **bright** and **contrast** as follows.

Bright 1.607

Contrast 3.093

CREATING DENSE SMOKE IN BLENDER

These will ensure that the smoke has plenty of contrast which will help it appear dense.



Save your work again. **F2** and change the name to **funnel-05.blend**.

You could do a test render at this point although there is still a lot of work to-do to make our smoke believable.

Light the created smoke to emphasis its density.

I mentioned earlier that the shaded setting in the halo materials setting was important in that it allows the particles to receive light and shadows. Without this setting the particles would be illuminated even without lights, which is rather unrealistic. Dense smoke has the characteristic that it blocks light as well as receive it. That means that usually one side of the smoke will be well illuminated whilst the opposite would be in shadow. Frequently that would be strong light from the sky or sun with deep shadow underneath the smoke. We can emulate this by creating 2 lights. One to add a kind of highlight and another negative light to darken the shadow below the smoke. It's best to use spotlights because they generate shadows.

Create 2 spotlights one under the smoke pointing upwards and another above the smoke at a slight angle.

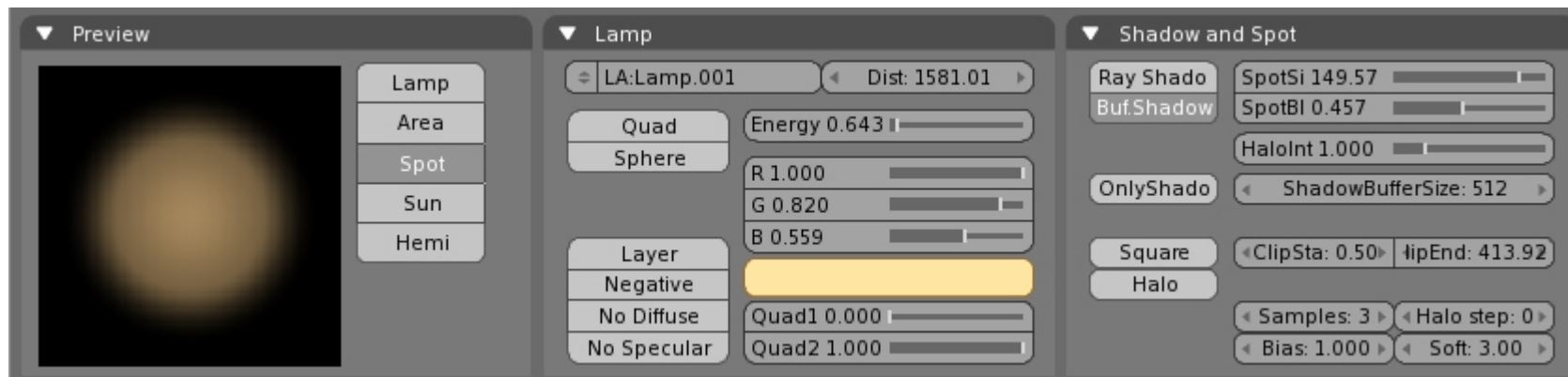
Modify each lamp to the following settings.

CREATING DENSE SMOKE IN BLENDER

SMOKE SHADOW LIGHT



SMOKE HIGHLIGHT LIGHT



You will notice that the highlight light has a slight colour to it. This is so that it adds that dirty yellow like discolouration often seen in older steam engines. Notice also that the **Energy** values have been set lower than the defaults. These settings are adjustable depending on the time of day or amount of dirt one is trying to add in the smoke. Adjust as you see fit.

The other lights in the scene will also illuminate the smoke they will not however add shadows themselves.

Save your work once more. **F2** as **funnel-06.blend**.

CREATING DENSE SMOKE IN BLENDER

You could render an animation at this point although you will probably find that the particles pop onto the scene and suddenly vanish at the end of their life. We can change this so that each particle gradually appears and fades to nothing by the end of their life. (Goodness I think I've discovered the meaning of life.)

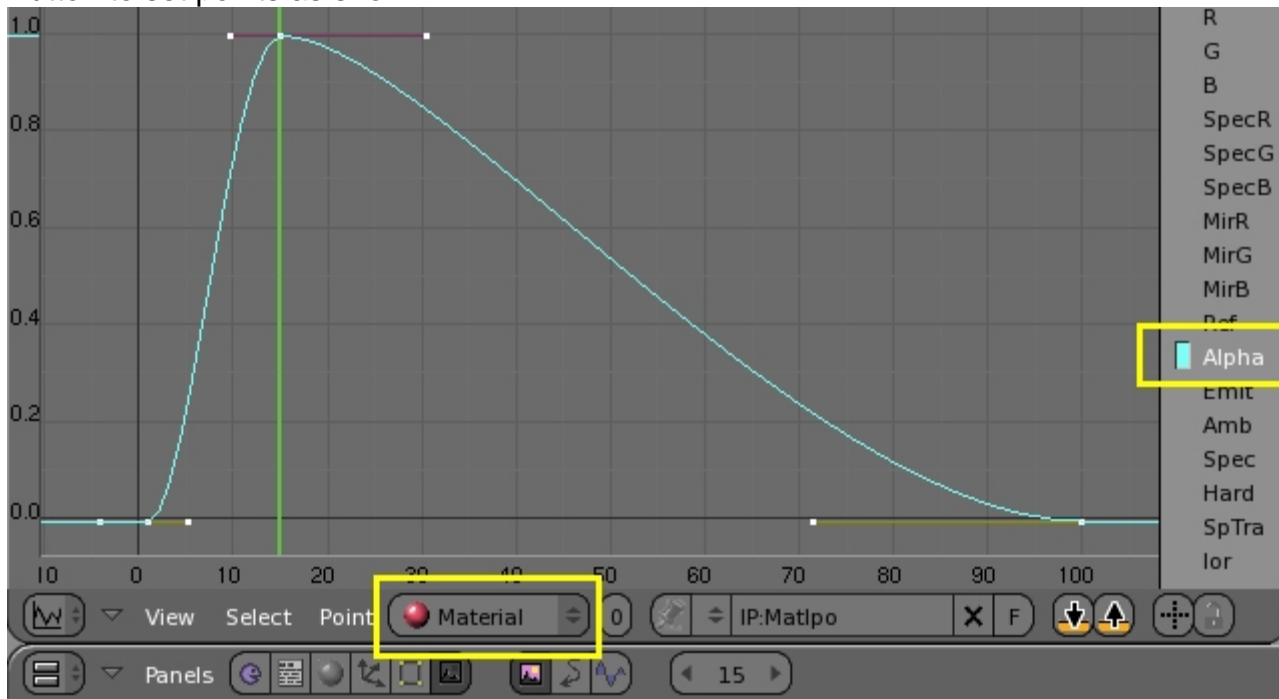
Modify the alpha of the smoke so that it smoothly starts and dissipates through its life

The alpha value of Halos can be modified as with any material. However, because a particle has a life (50 frames in this exercise) we want to apply an alpha variation to each particle separately so that each will fade in and out smoothly. Fortunately, those clever developers of Blender have provided a tool to do just that.

With the particle emitter selected alter one of your views in Blender to an IPO window.

Select **material** from the **Object Mode**.

Select the Alpha setting and create a curve as shown. (Use the mouse and set points using the CTRL key and the Left Mouse Button to set points as shown.)



CREATING DENSE SMOKE IN BLENDER

The settings for a particle material alpha are always over 100 frames. However, the changes will be refitted to the actual life of each particle which is 50 frames that we set earlier in the particle settings.

The alpha values chosen here were created by experimentation and for my concept worked quite well. They can be altered but beware because if the initial slope is too steep it will result in particles popping onto the screen, and if too shallow will give the effect of the smoke floating above or away from the funnel. It will always be a compromise so please adjust for your own needs.

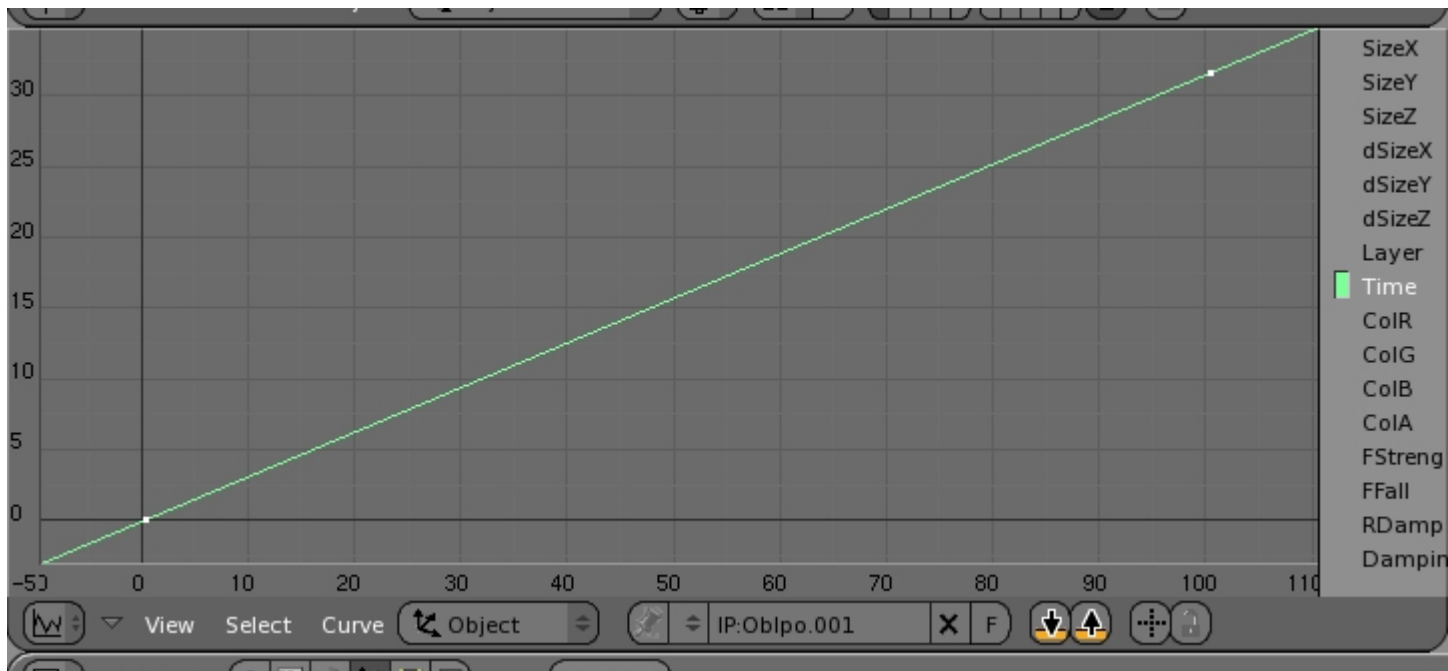
Save your work again. **F2 funnel-07.blend**

Modify the speed of the particle system so that its movement looks real.

You can if you want generate a test animation now although you may find that the smoke is still travelling too fast for the type of smoke we want to create. It is possible to alter the speed of any object, including particles, by using the **Time IPO** in Blender.

With the particle emitter selected change a view to an IPO window and select **Object Mode**.

Select the Time setting and create a straight line slope as shown.



CREATING DENSE SMOKE IN BLENDER

Again the settings are fairly arbitrary and were arrived at by experimentation. Remember if you alter the slope a steeper one will increase the speed and a shallower one will decrease the speed. If its horizontal the smoke will be frozen and if the slope is negative it will make the smoke go backwards. (H'mm that gives me an idea.....)

Wrapping things up

Hopefully you will be able to apply these techniques in some of your own animations. These tutorials are not meant to be the only solution to the design problems that constantly challenge the 3D artist. They are just the ones I have stumbled across while working with Blender.

Anyway enjoy your own Blender experimentation and I hope you will get as much enjoyment out of creating with it as I have.

COG