Generating and Rendering Smoke
Dark Scarab Tutorials -- Blender 2.5

NOTE: In this tutorial, just like nearly all of my tutorials, I have provided what I call keystrokes lines. These are highlighted throughout the tutorial and are meant to allow you to see the actual keystrokes that I went through in order to get the results I get in the tutorial. More advanced users should be able to go through a tutorial without the keystrokes lines assuming I have explained myself sufficiently.

Recently I have finally figured out how the smoke works. Basically, generating smoke is pretty easy, I got that down the first try because it is so similar to fluid simulation. Rendering on the other hand is difficult because there are so many settings to change to get it the way it is supposed to be. It's not intuitive at all. I have also found (as I am writing this) that all of the tutorials are videos and I know many people would rather have the text. So, I thought I would do that for you guys.

Generating Smoke

First we have to actually generate the smoke in Blender. Similar to the fluid system, the smoke simulator requires a domain in which all of the smoke will be contained in and the flow which emits the smoke. To get started, open up Blender. Select the default cube (add a cube if you don't have it) and scale it up by a factor of 5. This is going to be our domain. After that, add a UV sphere to your scene. You probably will not be able to see it since it is going to be inside of the cube. That is okay, we do not have to worry about that now.

Select the Cube, $S$, 5, Add-->Mesh-->UV Sphere
With that, we have all of the necessary objects to create smoke in our scene. The next thing we have to do is assign our two objects their respective roles for the smoke simulation. Select the cube we have added to the scene. In the Physics settings there is a smoke panel. Click on Add in that panel and change the setting to Domain. You should see that the cube changed from solid to see-through. For now, we don't need to change any of the settings. This will be what our smoke is going to be contained in.

Select the Cube, Go to Physics Settings, Click Add in the Smoke Panel, Select Domain

Up next we have the sphere, which will act as the flow for our smoke. In order to have smoke we need to use particles. Particles are what the smoke will actually be emitting out of, not the sphere itself. While I will not be doing it in this tutorial, this can give you control on how the smoke moves initially or even throughout your animation. With the sphere selected, go to the particle system settings and add the particle system. After that, head back over to the Physics settings and in the smoke panel click Add. This time we need to select Flow. Even though we have added a particle system and made the sphere a flow object for the smoke simulation, Blender cannot connect the dots. Under the particle system field that appeared when we selected Flow, select the particle system we just added.

Select the Sphere, Go to the Particle Settings, Click the plus button, Go to the Physics settings, Click add in the smoke panel, change to Flow, Select the Particle System

If you test your animation out now, you should be able to see the particles falling out of the sphere and the smoke emitting from those particles creating a tower of smoke. When the smoke is emitted, it floats up to the top of the domain. Changing the way the particles move will change where the smoke is emitted from. You can always change the size of the domain to make more room. Unlike the fluid system, I do not think the size of the domain affects how quickly the smoke will bake, however, more smoke will take longer to bake. Since we have generated the smoke, we can move on to rendering it.
Rendering Your Smoke

This part is significantly harder to get right. Before we begin changing settings, let’s go through all of the initial problems we have when rendering using the image below. The first and most obvious problem is that the domain is in the way of our smoke. We will also notice that we can see the particles in our scene. Other than that, so far at least, we seem to be in good shape.

To fix the domain problem we will need to add a material to it. Select the domain and go to the material settings. The first setting we really need to change here is how the domain is rendered. Right now it is rendered as a surface, we need to change this to volume. When you have done that, you should see a smoky sphere in the preview image. Keep in mind that this is domain and we do not want to see it and leaving it as is won't allow us to see the smoke at all. Changing the Density setting to zero solves this new problem.

With our domain problem solved we now want to hide those pesky particles. Select the sphere and go into the particle settings. Somewhere in there you should be able to find a panel labeled Render. There are two things we will need to change here. The first is to change the setting that is currently at Halo to None. Before we move on, you may notice that the emitter is being rendered as well. If you just want the smoke by itself, turn this off, otherwise feel free to have a smoking sphere.

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To make a suggestion go to http://www.forum.darkscarab.com
Select the Sphere, Go to the Particle Settings, Go to Render Panel, Change Halo to None, Uncheck Emitter

Before we leave we may want to change one more setting. If you remember, our render turned out to be a big tower of smoke. If we want our sphere to be smoking, we won't want to see the smoke beneath the sphere. To just have the smoke float up without going below, just change the lifetime of our particles to 1.000. This kills the particles before they really have a chance to go anywhere, so the smoke look like it is just being emitted from the sphere.

Alright, things are looking good so far. While intuitively, you may think that we need to change the materials settings of the emitter to change the way the smoke looks, this is not true in reality. What we actually have to do is go to the texture settings and add a texture with the domain still selected. After that, change the type to Voxel Data. By default this texture type is set for smoke, so the only setting we need to define is the Domain object setting. In this case, our domain is just named Cube. When you do that, you should see a few smoky blobs appear in the preview. There is one last thing we need to do, which is something that I still forget on occasion. Down in the Influence Panel we need to turn on Density. Without this checked you will never see any smoke when you render.

Select the Domain, Go to the Texture Settings, Add A Texture, Change Type to Voxel Data, Select the Cube as the Domain Object, Go to Influence Panel, Check Density

All of our settings have been changed and the previews are looking good. Let's render our smoke. See anything? Right, didn't think so. When I got this far I could faintly see the smoke. I mean, it was so faint I wasn't sure whether it was smoke or a conveniently placed smudge on my screen. My first attempt to fix it was to just start wildly flipping settings on and off, up and down. At some point I changed the background to black and there it was! After that I found a way to finally make it appear with the grey background.

To do this, go select the domain and go to the materials settings. In the Shading panel there are a bunch of different setting. The one that I found that made the smoke's color editable with the Emission setting. By changing the Emission value to 5.000 the smoke turned white.

Select the Domain, Go to the Materials Settings, Go to the Shading Panel, Change Emission to 5.000
But hang on a second...what if I want black smoke? You can't do that with Emission. Eventually I discovered that I could change the Scattering to get the smoke to be more visible without having to use the emission setting. If you turn Emission back down to zero and change the scattering to 10, you should see the smoke getting darker. Playing with the Asymmetry value also helped with this, changing that to 0.500 got me some nice dark results.

Change Emission to 0.000, Change Scattering to 10.000, Change Asymmetry to 0.500

Basically, fiddling with those settings will be able to get you any color between black and white.
**Tweaking our Render**

Ok, so we have gone over the basics, here I am just going to do some quick changes, each with a small explanation and a render to show the changes.

**High Res Smoke:** If you look at the renders now, the quality isn't the greatest. It's actually quite blurry. What we want are the highly detailed ones that we see in some videos we find online. There is a simple fix to this, just select the domain, go to the Physics settings, and check the Smoke High Resolution. If you look at the image below, you will see that gives great results. Even though the baking is much slower, I think it is well worth it.

Sharper Smoke: Another thing we may find is that the smoke can be real blurry, especially around the edges. Obviously, one thing you can do is zoom out. However, this isn't what I want to do every time I want higher resolution. Basically, all we have to do is change the divisions settings in the physics settings in either one or both of the Smoke and Smoke High Resolution panels. For the image below, I changed the Smoke Panel's Divisions setting to 50 and the High Resolution Divisions setting to 2. This made a much clearer image for us.
Thick Smoke: Now we may find ourselves wanting thin or thick smoke. To get thicker smoke all we need to do is go to the materials settings of the domain. Within the density panel you will find the Density Scale setting. Make that setting higher to make thicker smoke and lower to get thinner smoke. The good thing about this is that you do not have to re-bake the smoke after you change the setting.