Compton French

Professor Sheldon Schiffer

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Smokey Animation: Lingering Smoke Trail and Clouds in Blender 3.3.1

For the project of a plane simulation, the project would not look complete without a smoke trail behind the plane. In addition to the smoke trail, the project includes four different cameras and five clouds. The effects of the particles from the smoke trail and the clouds give off a similar color and look. However, they are implemented very differently to achieve their specific purpose. The project was completed in Blender 3.3.1 which led to finding a different methodology than in 2.78. Various ways were available between clouds or smoke trails which forced a decision on what would be best.

## Smoke Trail:

### Blender Implementation:

Blender 3.3.1 has an option for quick effects under the objects option in the top bar of the 3D viewport. Quick effects have the options of Fur, Explode, Smoke, and Liquid. Select a mesh object, and once you select the smoke quick effect option, a new Smoke Domain object will be created. The object selected will be the emitter of the smoke, and the Smoke Domain contains all of the smoke created within its bounds. Automatically, the smoke works in a way where the smoke will travel upwards and will be contained strictly within the bounds of that box.

### Relevant Properties and Objects:

It is important to note that the Smoke Quick Effect option can only be implemented on mesh-type objects. Otherwise, it outputs an error and does not create the effect. Many of the smoke’s emitter objects are related to the smoke itself. Density, temperature, and initial velocity affect the travel of the smoke. Under Flow Source, there are Surface Emission and Volume Emission values that can be changed to affect the amount of smoke present.

Additionally, the Smoke Domain is always a cube-type object. The cube shape can be altered in many ways such as scaling the shape as whole or specific faces and moving the vertices. The Smoke Domain also includes an Adaptive Domain under Physics Properties. Adaptive Domain is very useful in cases where you do not know the specific size of the domain that you want, or give off the effect that the smoke is not trapped. Many more options affect how the smoke reacts such as noise, density, heat, vorticity, and border collisions. However, the options in the Physics Cache tab are important to remember. The option for the smoke's frame counts can be changed from the whole animation. The option allows for the smoke to only be in effect during specific frames of the animation, or forgetting about it can leave frustration on why the smoke is not appearing. The Dissolve property is useful to control the amount of smoke present in the domain.

### Experimental Activity and Products:

To create the effect of the smoke trail, I placed the object that I wanted to create the smoke inside of the plane object and made it a child of the plane, so that it would be in the same spot during the simulation. I also made the Smoke Domain a child of the Smoke object because the emitter needs to be inside the domain to make smoke. During testing, when the domain was too far behind the emitter, no smoke would show up. I increased the smoke’s Volume Emission property to display more smoke in the render. I wanted to alter the volume property instead of the surface property, because it controls the smoke to be created more inside of the object than randomly outside of it, giving the effect of a straighter trail. For the project, I decided to have an adaptive domain because I do not want the smoke to be confined to an area where it could potentially show the bounds of the domain box. The dissolve timer was set to 8 to show an appropriate amount and not build up too much.

## Clouds:

### Blender Implementation:

To begin making a cloud, add a mesh object to the scene, and alter the mesh to get the shape of the cloud wanted. The cloud mesh can be altered in many ways using subdivisions, extrusions, and scaling. In the objects modifier, there is one called Displace that with the Cloud texture selected gives it sharp edges and a unique shape. Once happy with the shape of the cloud mesh, add a Volume Empty to the scene. Add a Mesh to Volume Modifier to the Volume object and set the object in the modifier to the cloud mesh. Hiding the cloud mesh in the viewport or render makes the solid object not appear and only shows the cloud. There are many properties to alter how defined the volume will look in comparison to the original cloud mesh. There is also a volume deform modifier called Volume Displace that is similar to the one for meshes.

### Relevant Properties and Objects:

There are many ways to alter the shape of the final cloud, altering the cloud mesh or altering the volume. Altering the cloud mesh gives so many possibilities for the base shape of the cloud. Changing any object property that alters shape will make a unique outcome such as extruding, scaling, subdividing, rotating, and many other deform modifiers that will help make the cloud shape wanted.

The properties of the volume object help change the cloud's appearance significantly. The main changes are density, exterior and interior band width, and changing the voxel size or amount. Changing the density value will change the transparency of the cloud's volume. Changing the interior or exterior band width will alter the volume inside or outside the mesh, respectively. Adjusting the voxel will make the cloud's volume appear more granular or smooth. Within the Volume displace modifier the strength can be adjusted to increase the noise and adjusting the size will show different ways the cloud will look from the base cloud mesh model.

### Experimental Activity and Products:

To make my cloud mesh, I extruded with no particular goal until I felt satisfied with the shape. Similarly, I played around with the strength, subdivision, size, and depth properties until I was done. I also jumped around the properties and their values to see how they all impacted each other, but I could not find a certain linear relationship between them. Once I added the Volume object to the cloud mesh, I moved around the voxel amount, noise and size to my liking. I knew I did not want to change the density or bandwidth because I wanted to keep the cloud defined enough to be seen easily in the render, but not too unnatural where it would not look like a cloud. I was still able to change properties in the cloud mesh after creating the volume. To create more clouds I duplicated them and changed their locations, rotations, and sizes.

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