

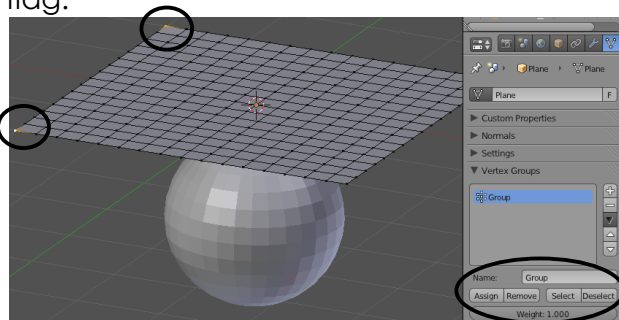
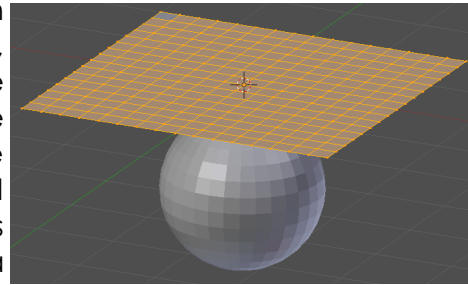
## Chapter 18- Object Physics

Trying to animate water flowing or cloth blowing in the breeze can be a difficult feature to pull off using animation techniques covered previously. Just trying to make objects fall or bounce can be difficult enough. In chapter 21 we will discuss the falling and bouncing topic. For this chapter, we will be discussing some of the other physics factors of Blender.

Blender using the *Bullet* physics engine to handle simulations. Bullet has recently been used in Hollywood blockbuster movies to simulate buildings and debris falling and I expect to see it used more often, along with Blender, with recent improvements.

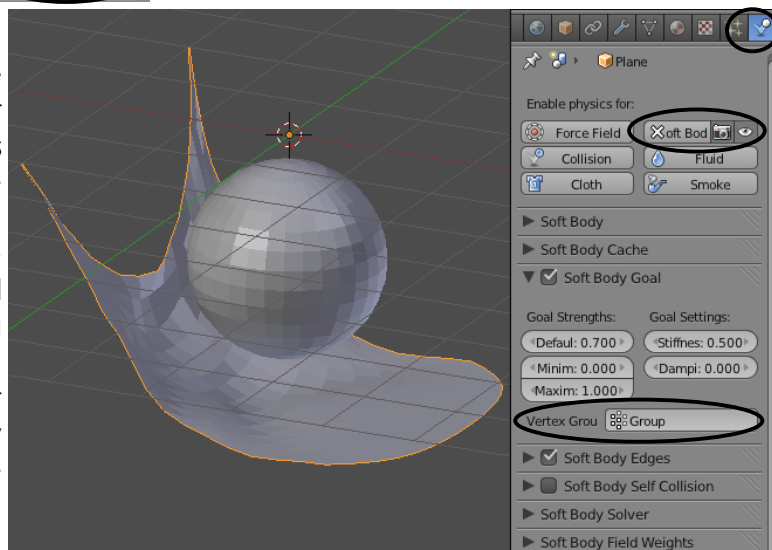
### Using Soft Bodies

*Soft Bodies* was one of Blender's first simulation features after Particles. Soft Bodies are used to simulate fabric, "jello", and water. A mesh can deform a soft body mesh (clothing on a model or a boat in the waves). Even with newer features such as cloth and fluids in Blender, *Soft Bodies* still has a place here. In order to look at the basic settings of Soft Bodies, we'll start with a simple scene of a plane placed above a UV Sphere. Scale the plane up about twice the original size and subdivide it 4 times. We will "pin" 2 corners of this plane and have it drop down over the sphere like a flag.



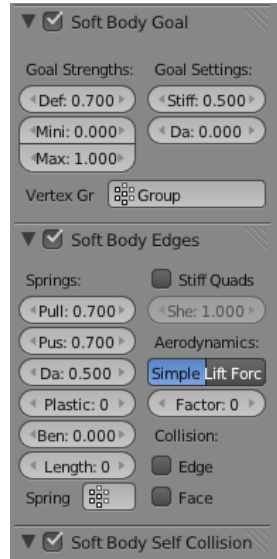
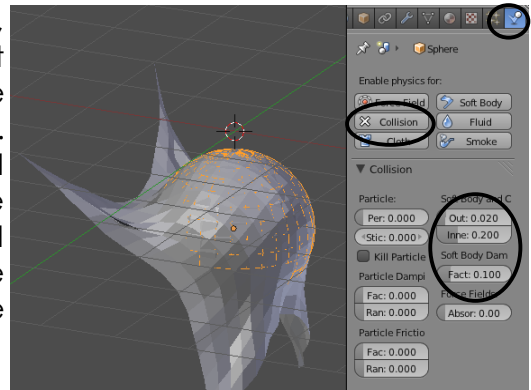
Our next step is to create a *Vertex Group* (like we did in the *Particles* chapter) in the *Object Data* panel. With all vertices selected, "*Assign*" a weight of *Zero*. Then, select only the 2 corner vertices and "*Assign*" a weight of *1.00* to them. These will be the 2 pinned corners we will use shortly. Return to *Object Mode*.

It's now time to go over the the Physics panel and enable "*Soft Body*". If you press "*Alt-A*" at this time, the plane will just bounce up and down, but if you tell it to use your vertex group in the "*Soft Body Goal*" panel and press "*Alt-A*", it should fall like a flag like shown to the right. It will fall through the sphere, but should fall. If it doesn't move, try checking to make sure you are on frame 1 when hitting "*Alt-A*".



## Chapter 18- Object Physics

In order to have the Soft Body react to the sphere, we need to apply a Collision to the sphere. Select the Sphere and press the “Collision” button in the Physics panel. Press “Alt-A” to test out the physics. The plane should now react to the sphere. You will notice that you have a few settings that can be tweaked such as simulated thickness and dampening. Other things you can do to make the reaction look better is to *Subdivide* the plane higher, *Smooth* the objects or apply a *Subdivision Surface* modifier.



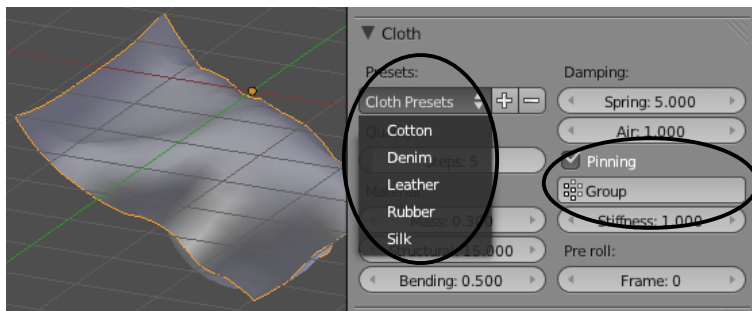
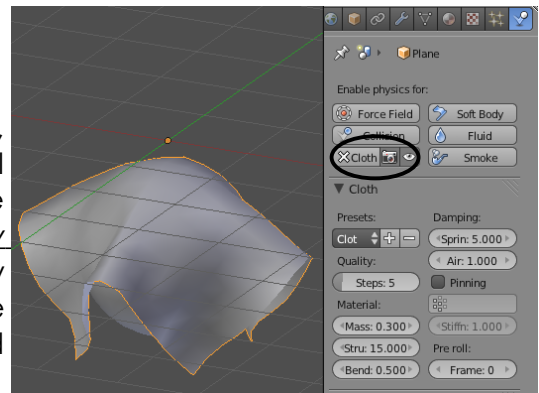
There are also many other settings that can be adjusted for the plane in the *Soft Body* panel. For example, if the plane appears too stretchy, you can adjust the *Pull*, *Push* and *Dampening* of the *Spring* settings under “*Soft Body Edges*”. Pressing the “*Stiff Quads*” button will give you some rigid effects as well.

Some other settings of interest include setting *Self-Collision* factors to prevent the mesh from intersecting itself and *Field Weights* to control gravity. If you want wind blowing the mesh, add an empty and add a *Wind Force Field* to it as discussed in the *Particles* chapter.

If you find that things are not updating for you or you would like to create a *Bake* for the physics, these issues can be addressed in the *Soft Body Cache* panel.

### Creating Cloth Effects

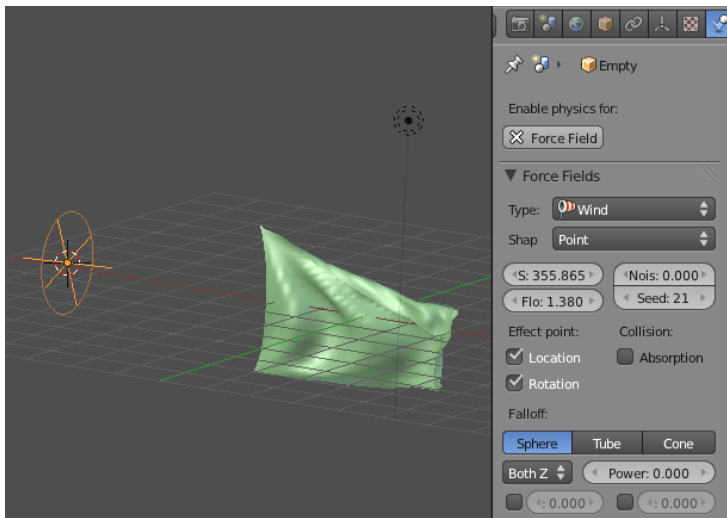
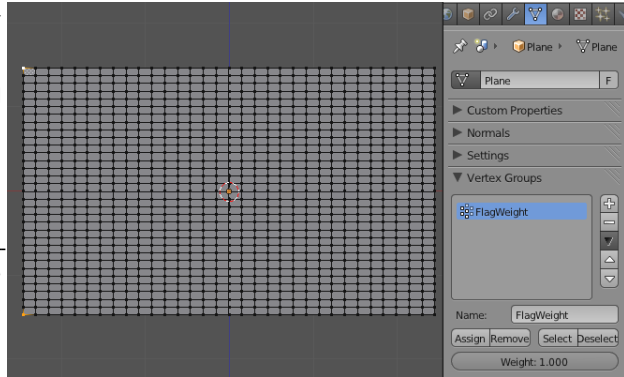
Although Soft Bodies can be used for cloth, Blender has made it easier by giving you actual cloth effects. We'll start by reusing the same object from above and removing the *Soft Body* effect and adding a *Cloth* effect. Without any vertex groups, the cloth will fall and react with the sphere (still has Collision on it) well. I've also used “*Smooth*” from the *Tool Shelf* for both objects.



You can also use groups as before by checking the “*Pinning*” box and choosing the vertex group. You can also select various material types to simulate. There are several other settings similar to what was discussed before.

## Using Physics to Make a Flag

For this exercise, you can choose to either use Soft Bodies or Cloth physics to make a flag. Start by adding a plane and rotating it to face the front view. Scale it to match an appropriate size for a flag and Subdivide it a few times to give it enough vertices to flex well. Set the plane Smooth in the Tool Shelf. Add a Vertex Group in the Object Data panel as discussed in the chapter.



Apply physics to the plane as discussed before and adjust it to get a good effect. You may want to turn on "Self-Collision". Add an Empty to your scene and apply a "Wind Force Field" to it. Adjust the Strength setting to get a good billowing flag effect. You may need a high number with a cloth simulation.

Add other details to your scene like a world background, a flagpole and anything else you wish. *Animate a short 200 frame movie when finished.*



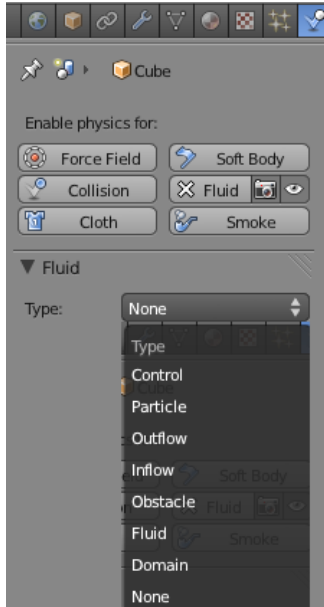
**\*\* Call the instructor when finished\*\***

## Chapter 18- Object Physics

### Creating Fluid Effects

Blender fluids have received a lot of attention in version 2.5. You have the possibility of creating realistic fluid effects with these basic setting.

With an object selected and *Fluids* enabled in the *Physics* panel, you can set it as one of the following fluid object types (by order of importance):



Domain: Needed to contain all fluid physics. All fluid simulations must occur within the domain.

Fluid: An actual object that represents the volume of the fluid.

Obstacle: An object that the water can react with.

Inflow: An object that acts like water flowing into the scene (like a faucet). Used in place of the Fluid.

Outflow: An object that acts as a drain.

Particle: Allows fluids to work as particles. More work in this area is coming in future releases.

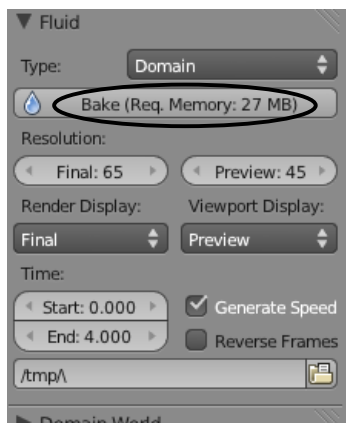
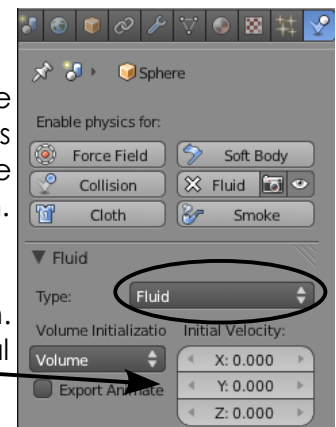
Control: Adds additional control over fluid effects.

*We will be discussing the basics in this chapter. For more details, see the Blender documentation at [www.blender.org](http://www.blender.org).*

### A Simple Splash:

Our first example will just contain a Domain and a Fluid. The scene shown contains just a *Cube*, scaled up about twice its original size, as the *Domain* and a *Sphere* that will represent the *Fluid*. The larger the sphere, the more fluid the scene will contain. It is important that the sphere is completely inside the cube.

With the *sphere* selected, make it be the Fluid in the simulation. You will see a few options including the ability to give it an initial velocity, rather than just dropping due to gravity.



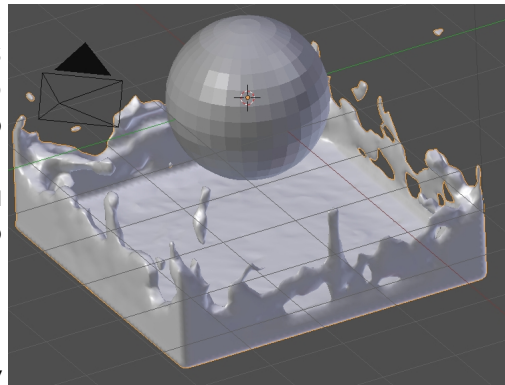
Now select the *cube* and make it the Domain. Remember that the domain contains the simulation and controls the baking of the simulation. Don't be concerned if the cube turns into a small blob due to previously cached baking. This will correct itself when you hit Bake. You can control render quality and time length in the domain. You can even specify a specific folder to save the baking into so it can be referenced later. Also, after baking, the cube is now represented by the starting fluid.

When everything is set, hit the "Bake" button and wait.

## Chapter 18- Object Physics

During the Bake, you will see a status bar at the top of the screen. You may also need to delete files from the */tmp\* folder where the bake is saved to get it to work properly. When finished, hit "Alt-A" to see your animation. To improve the appearance, hit "Smooth" in the *Tool Shelf* and apply a "Subdivision Surface" modifier. You can also experiment with the time setting in the Domain.

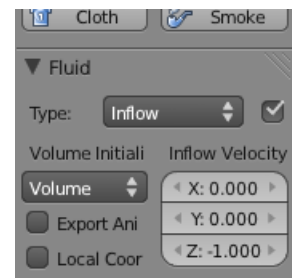
This time, we will create a scene that uses an *Obstacle* and an *Inflow* instead of a *Fluid*. Start by creating a Blender scene similar to the below. The cube has been scaled up about 3 times it's original size and used as the *Domain*, an angled plane to act as an *Obstacle*,



and a small sphere that will act as the *Inflow*. In the Physics panel, the 3 objects have been set up to reflect these items with special attention to the following:

### Sphere- Inflow Object:

Give it an *Inflow Velocity* to make it flow into the scene. I used a Z of -1.000.

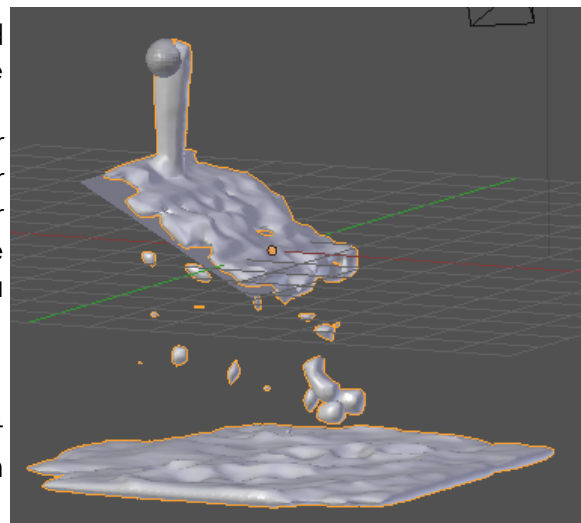


### Plane: Obstacle Object:

Experiment with the *Slip Type* for a desired effect. This adjust how much fluid slips on the object. I chose *No Slip*. Select the *Domain Cube* and *Bake* your animation. Remember to watch the status bar at the top of the screen. It may take a while to bake.



Animating fluids can be time consuming, but with practice and experimenting, you can achieve some nice result.

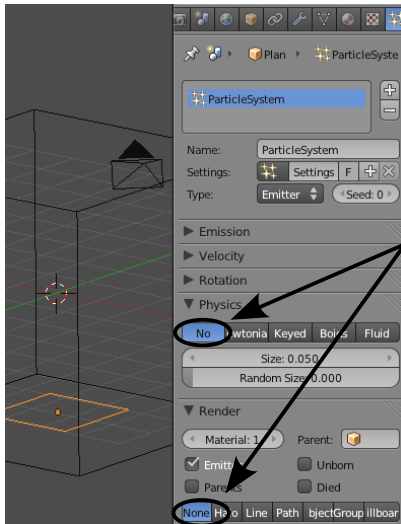
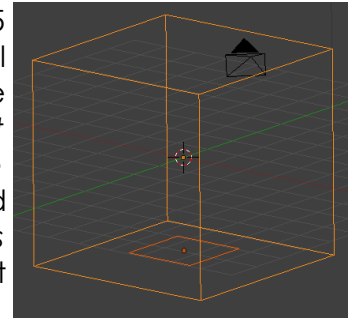


### Creating Volume Smoke

Volume smoke physics is new for the 2.5 series and still needs a lot of work. With that being said, it is still worth an introductory discussion in this edition. You can find some nice tutorials and sample videos on the internet and the feature will probably be updated before anyone gets to this chapter of the book, but here it is:

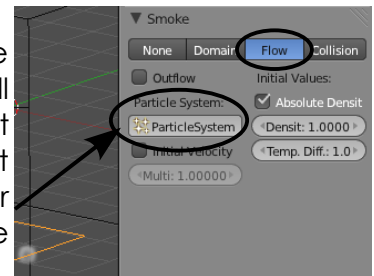
Volumetric smoke works similar to fluids where you create a Domain and an Emitter (Flow). In order to generate the smoke particles, you also need to add a Particle system and add materials and textures.

To start, we'll set up a new scene with a cube scaled to about 5 times the original size. Remember, all smoke that is created will not extend beyond the cube domain so it needs to be large enough for your scene. *It has also been recommended that you do not go into Edit mode and alter the vertices of the cube because of calculation issues.* Next add a Plane and place it to the bottom of the cube as the Flow. Make sure it is completely inside the cube! Any mesh will work for the flow, but we'll work with a plane for now.



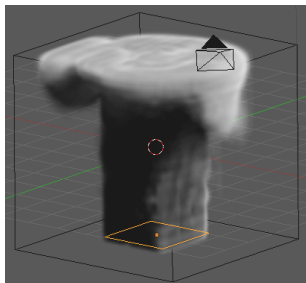
Let's now add a Particle System to the Plane. The reason for this is that the smoke is generated from the particles- not the plane. With the Plane selected, go to the Particles panel and add a Particle System. Since we want the particles to sit still and not move (just need them to emit smoke), we will turn off the Physics. Also, we won't need to see the actual particles, so turn off the Render visualization.

Time to work on the smoke physics. With the plane still selected, add Smoke Physics to it in the Physics panel and select "Flow". You will see a block for Particle Systems. Select the

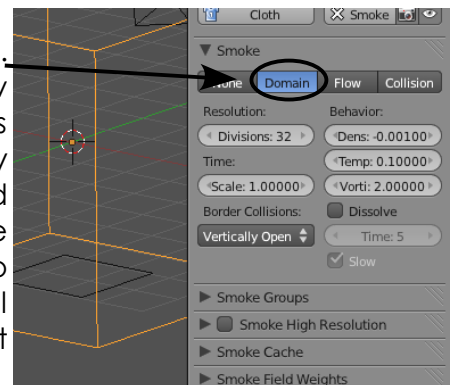


system you made if not already selected.

Now select the cube and enable Smoke Physics for it. Choose "Domain" for its property option. We're now

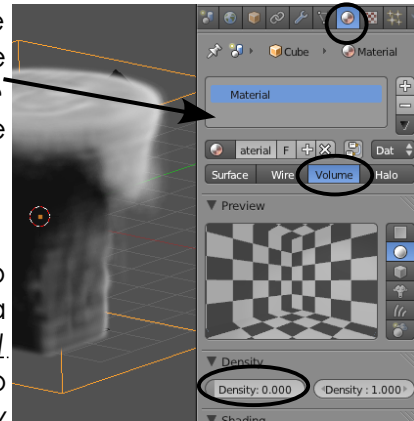


ready to take a look at our results by pressing "Alt-A". It will probably run through slowly, but you should see building smoke in the viewport window. If you try to render a picture at this point, all you will see is the cube and not the smoke. We'll fix that next.

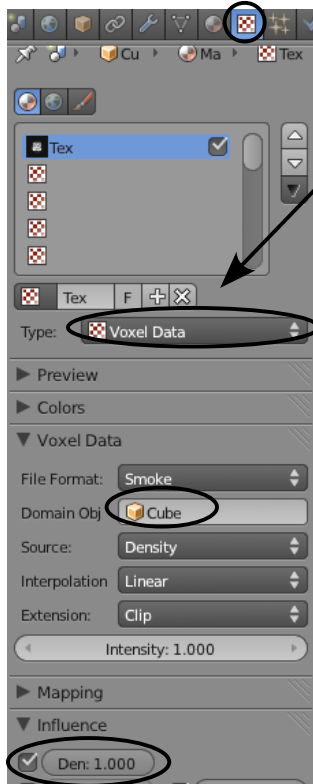


## Chapter 18- Object Physics

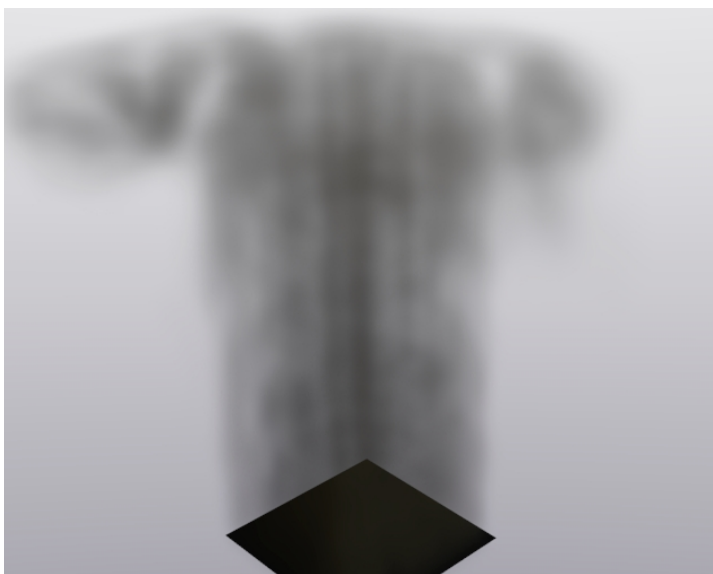
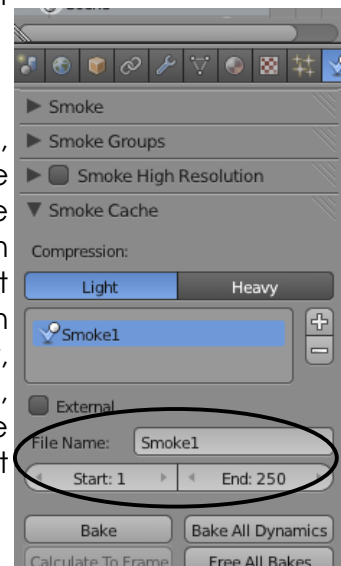
In order to get a nice render, we need to do some Material and Texture work on the Cube. With the cube selected, add a Material, set it to Volume (we're filling the cube- not putting the material on the surface), and set the Density to 0.000.



With the cube still selected, go to the Texture panel and add a texture. Change the Type to "Voxel Data", the Domain Object to "Cube" (this object), and Density under Influence checked and left at 1.000.



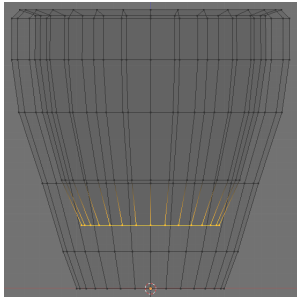
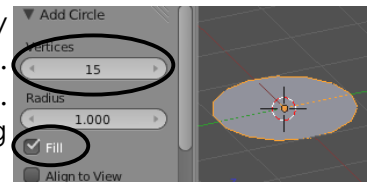
In order to animate your smoke scene, you need to Bake the data. With the cube still selected, go back to the physics panel and look at the settings in the Smoke Cache panel. You can set the frame start and end for the length and the File Name for the bake. Finally, hit "Bake" and let it run. When finished, you can create an animation using the same techniques we have in past chapters.



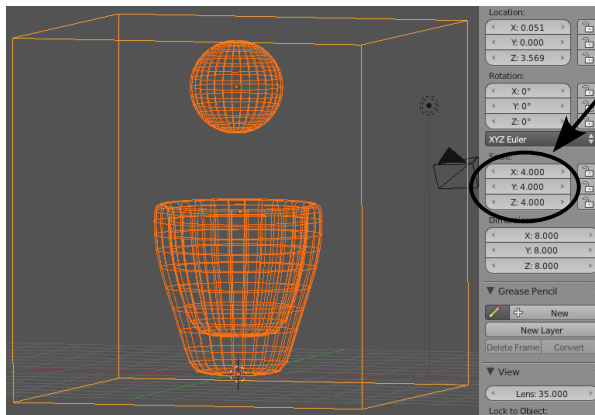
As with all other features we've covered, there are many other possible settings that can be experimented with. For example, particle settings can be adjusted in order to change density. You can also adjust the quality of the smoke resolution and field weights. Need a fire ball effect? Try child-parenting a sphere to your fire ball and use a smoke system for a nicer effect.

## Make a Splash- Fluids Practice Activity

Let's make a new Blender file and call it "**Splash**". Start by deleting the initial cube in the top view and adding a Circle. Set the circle settings to 15 vertices and click the "**Fill**" button. We will be making a small cup using this circle and keeping the mesh simple will help with the fluid physics.

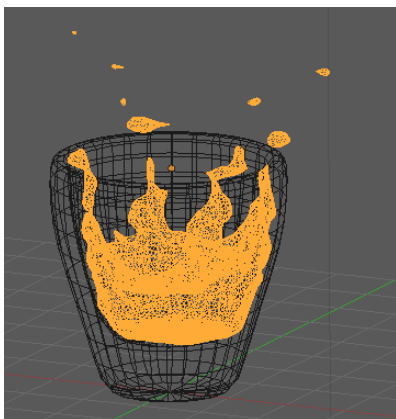


Switch to a front view and begin extruding and scaling the circle to shape a simple cup. When you reach the top, scale the vertices inward and shape the interior of the cup. Again, keep the cup simple so our fluids simulation remains relatively manageable. After you model the cup, go to the Modifiers panel and add a Subdivision Surface modifier, also hit "Smooth" in the Tool Shelf.



Now it's time to add a cube and scale it to 4.00 units using the "**N**" key. Center the cube up around the cup. After adding the cube, add another UV Sphere and place it above the cup, *but still within the cube*. Remember, all animation must remain within the domain (cube). Check all views to make sure the sphere is contained in the cube and over the cup.

Before we animate, go to the Render panel and change the End Frames of the animation from **250** to **70**. Now, go to the Physics panel and enable Fluids. Set the Cup as an **Obstacle**, the Sphere as the **Fluid**, and the Cube as the **Domain**. With the cube selected, press the "**Bake**" button and wait for the animation to calculate. After calculations, press "Alt-A" to check the animation. If it doesn't work well, hit "Ctrl-Z" to get back to the point where you see the cube again and experiment with some of your settings. If everything worked well, add some nice materials to your objects. Place the sphere into an unused layer (M key) and Subdivision Surface the water.



**\*\* Call the instructor when finished \*\***