CIS 5660 - Procedural Computer Graphics
LAB 7 - VFX

In this short lesson, you will learn how to create a simple VFX disintegration effect in Houdini.

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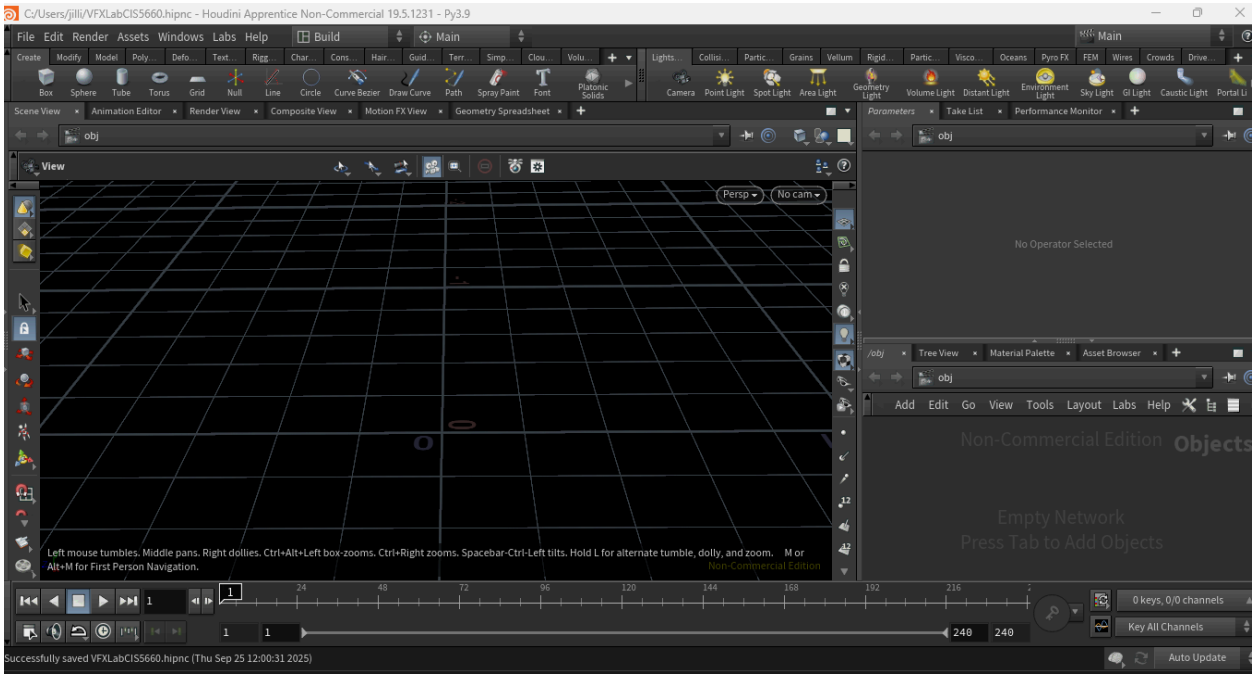
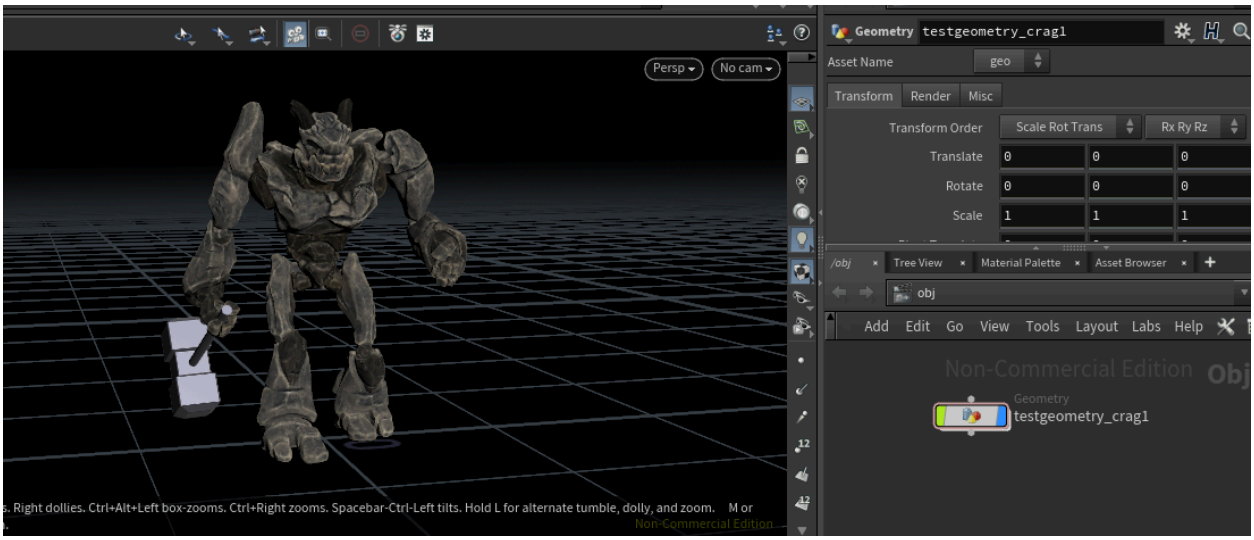
SET UP PROJECT + MODEL:

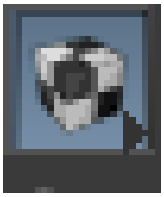
1) Open Houdini, you should be greeted with a blank workspace. Save the project to your computer and give it a name.



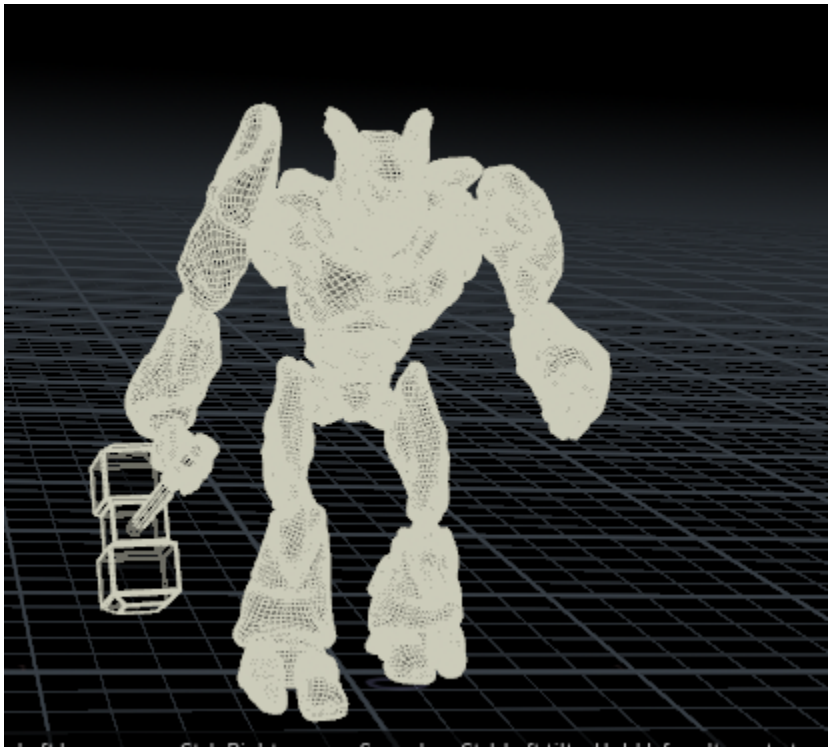
2) Place a Geometry node in the workspace editor by clicking TAB>Geometry, then double click to enter the node.
3) Place a Geometry Test node in the workspace editor by clicking TAB > Test Geometry, then selecting one of the geometric models provided. You can also import your own geometry if you wish, but for this tutorial, I will use the Test Geometry named “Crag”, but also recommend using the Test Geometry “Squab”.



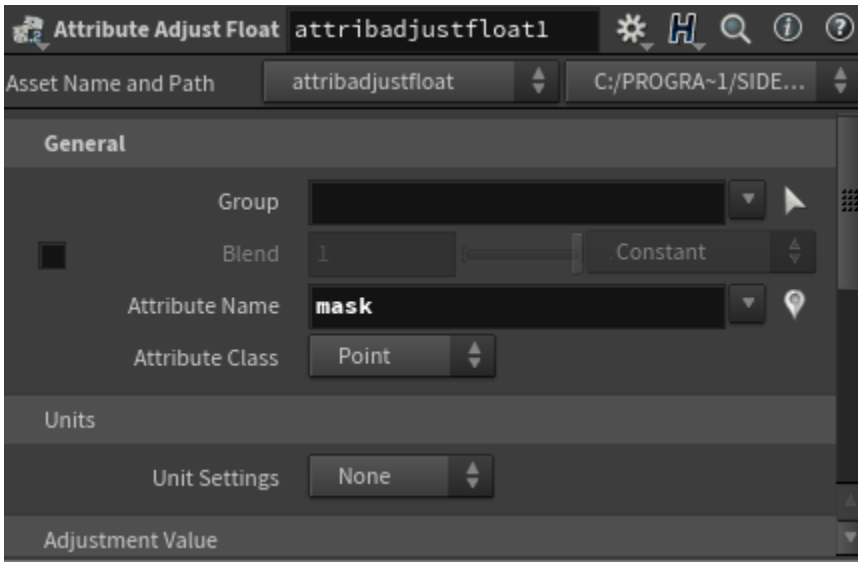
4) We want to make sure the model has enough subdivisions, so to remove the texture of your model, unselect the Display Materials button on the toolbar to the right of the viewport.



To access the wireframe of the model, click Shift+W.

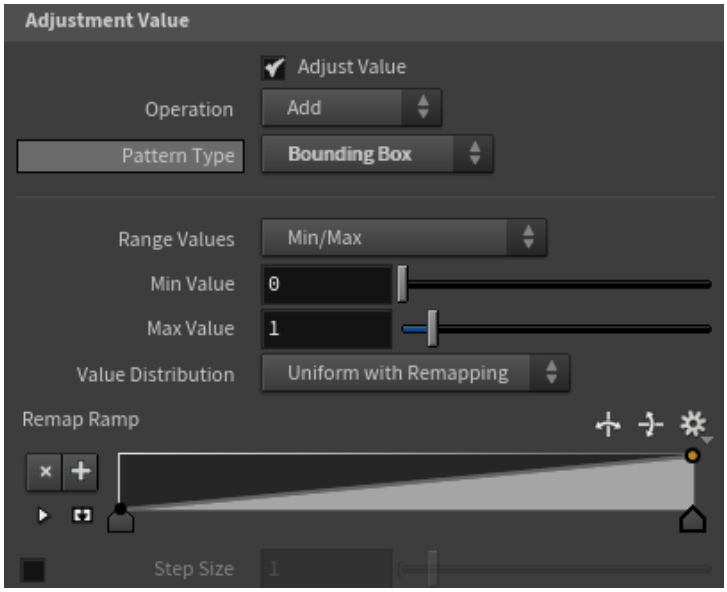


5) Within the inspector window of the “Remesh” node, set the “Smoothing” value to 1, the Iterations value to 10, and uncheck the “Recompute Normals” box. A;so change the “Target Size” under Element Sizing to 0.01



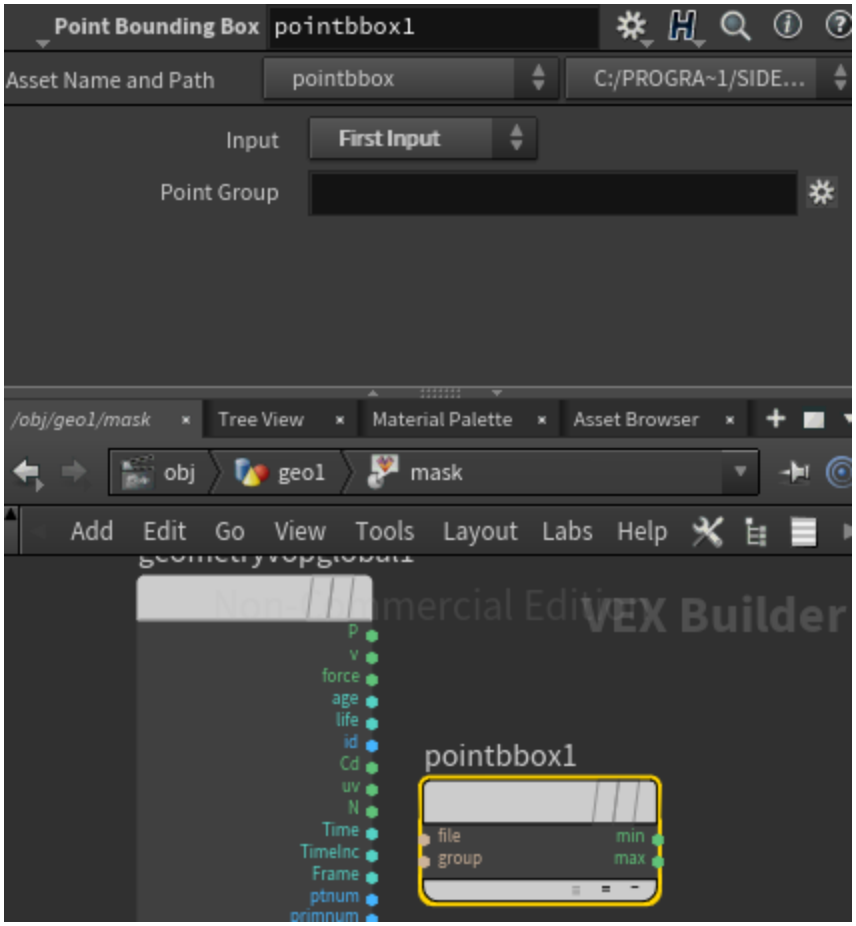
6) Next, let’s add a mask to our model. Do this by selecting TAB > Attribute > Attribute Adjust Float. Attach that node to the Remesh Node.
Within the Inspector window for the Attribute Adjust Float, change the “Attribute Name” from “pscale” to “mask”.

7) Still in the Inspector Window, scroll until you see the section labeled “Adjustment Value” and find the “Pattern Type” selection box. From the dropdown menu, choose “Bounding Box”. This will populate range values and a remap ramp.

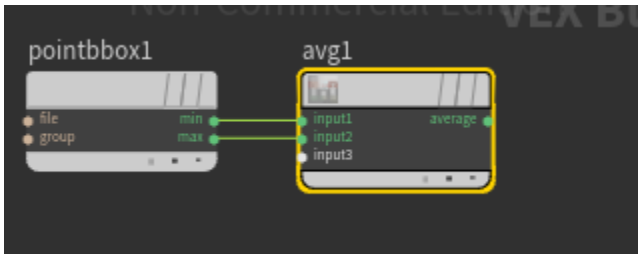


MASK CREATION:

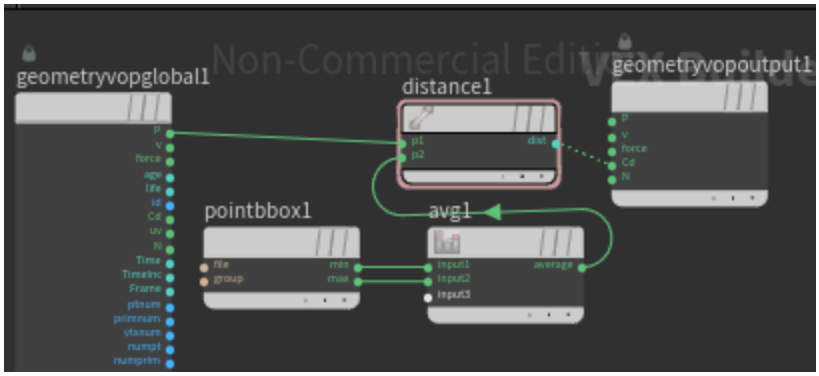
1) In between the “Remesh” and “Attribute Adjust Float” nodes, place an”Attribute Point VOP” node. You can find this by pressing TAB then searching “Point VOP”.
2) Rename the “Point VOP” node to “mask”, then double click on it to go inside the node.
3) The first thing we want to do is get the distance from the middle of the geometry, so within the Point VOP node, click TAB then search for the “Point Bounding Box” node. Select it for it to be added to the node workspace.
   Under the Inspector window for the Point Bounding Box, change the Input from File to First Input. This ensures that the input to our system is our remeshed model.



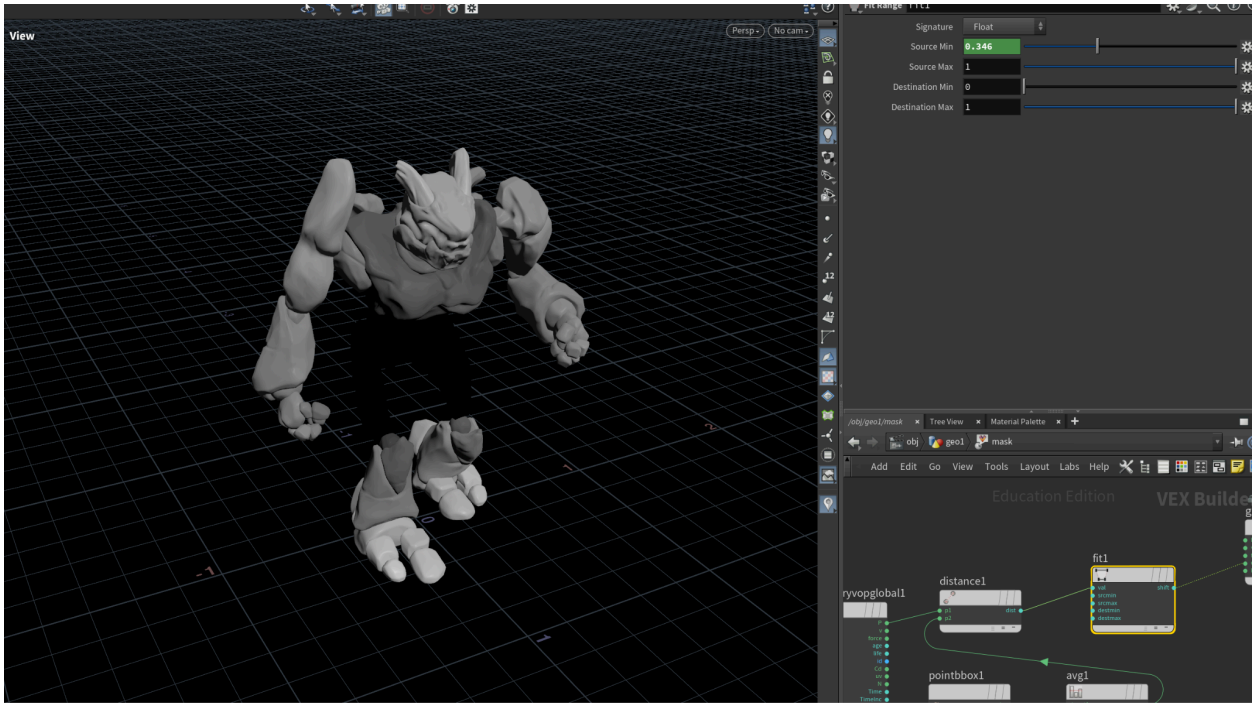
4) Next to the Point Bounding Box node, create an Average node. This can be found by pressing TAB and then searching for Average. Once spawned, connect the min and max of the Point Bounding Box node to input1 and input2 respectively on the Average node.



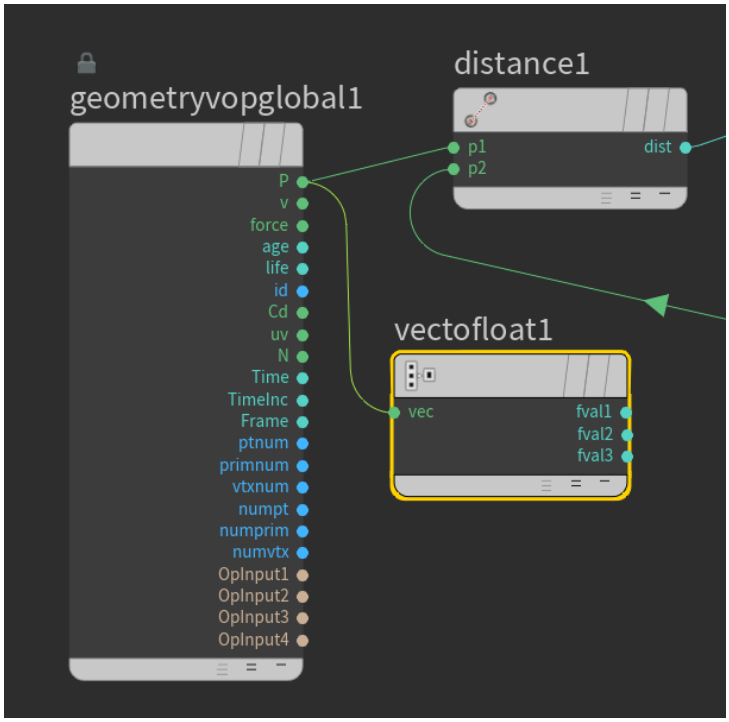
5) Next, create a Distance node, then connect the P section from the Geometry node to the p1 in the Distance node, the average output from the Average node to the p2 in the Distance node, and then the dist output node from the Distance node to the Cd input in the Geometry Output node.



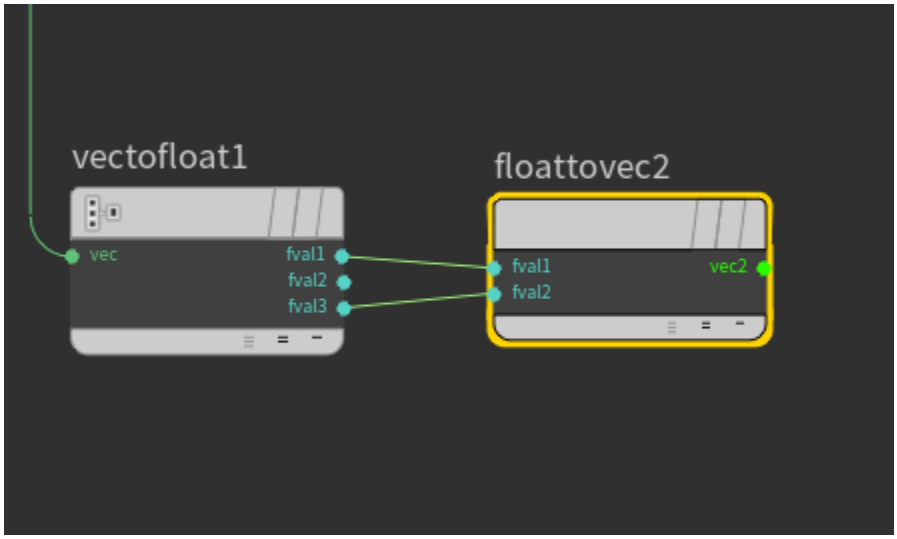
6) Create a Fit Range node and place it between the Distance and Geometry Output nodes. This will help us constrain the box to just the center of our model. In the Inspector window of the Fit Range node, change the value of the Source Min so that the center of the model is highlighted in black. In my case, the value is about 0.35



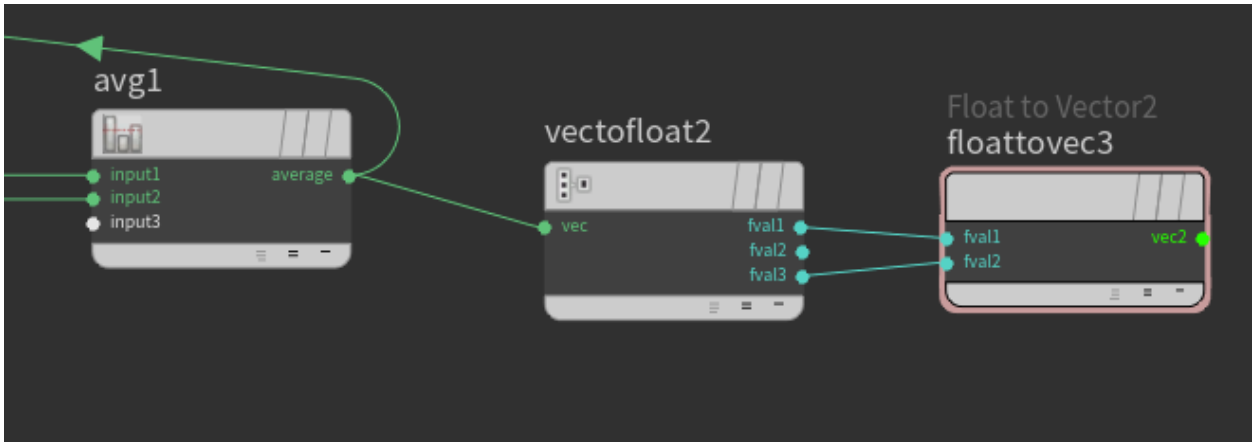
7) We are basically finding the centroid of the model so it disintegrates from the center first. This also means that to have the proper effect, we want the disintegration effect to go along the x and z axes, not up on the y. To locate the x and z axes, attach a “Vector to Float” node to the P value from the long GeometryVOPGlobal node.



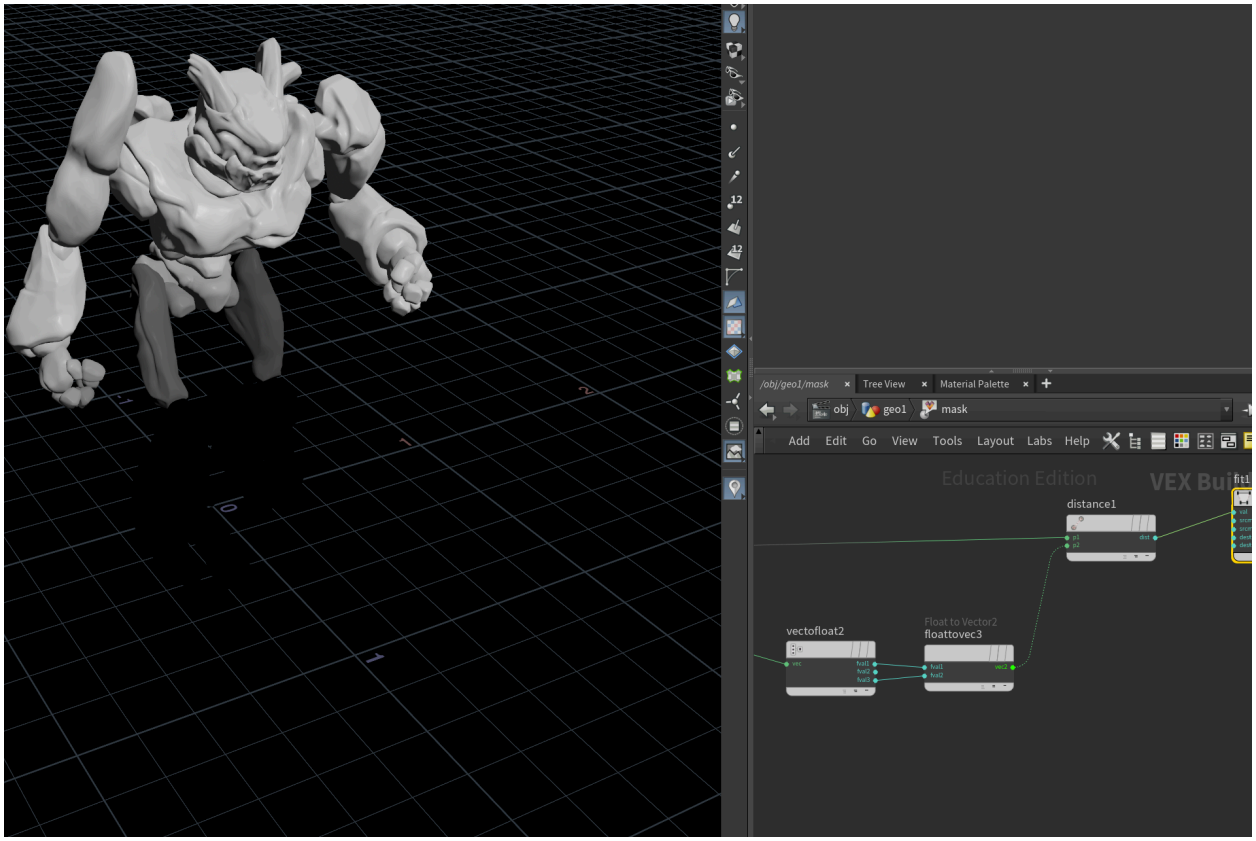
8) If you look at the Vector to Float node, you will see fval1 - 3. These each represent the three axes. Because we only want to focus on the x and z axes, we will now create a "Float to Vector 2" node and attach the fval1 and fval3 from Vector to Float to the Float to Vector inputs.



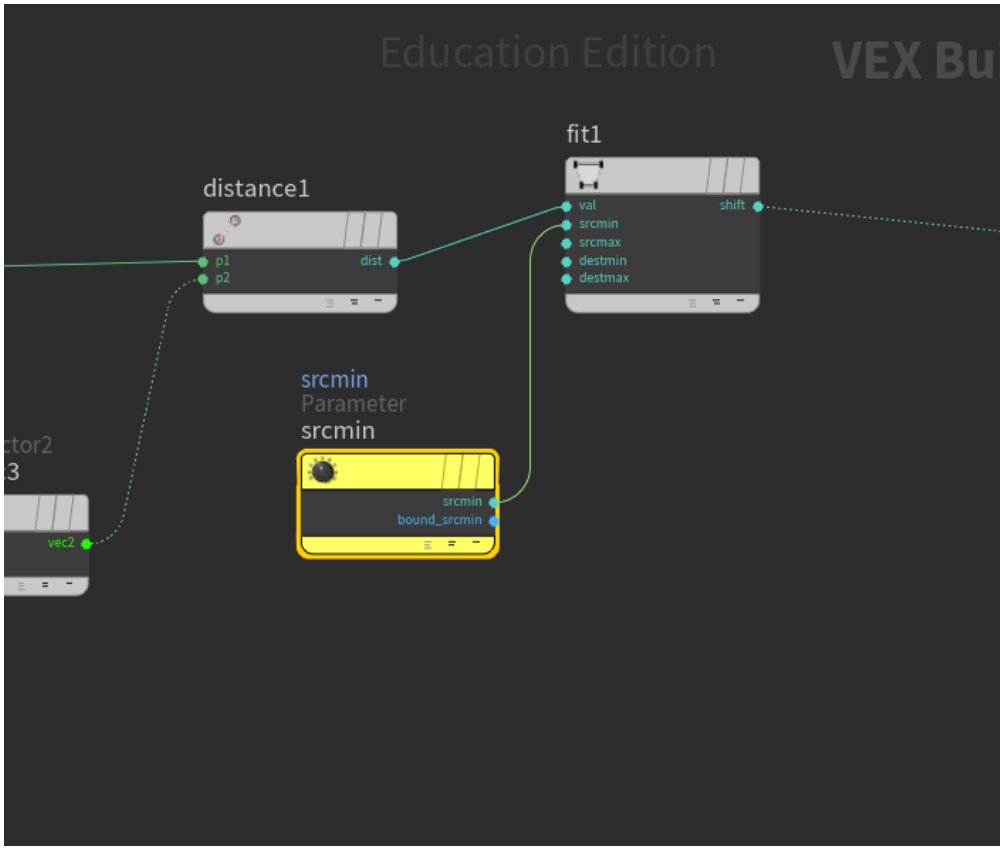
9) We also want to copy these two nodes and paste them next to our Average node, connecting them.



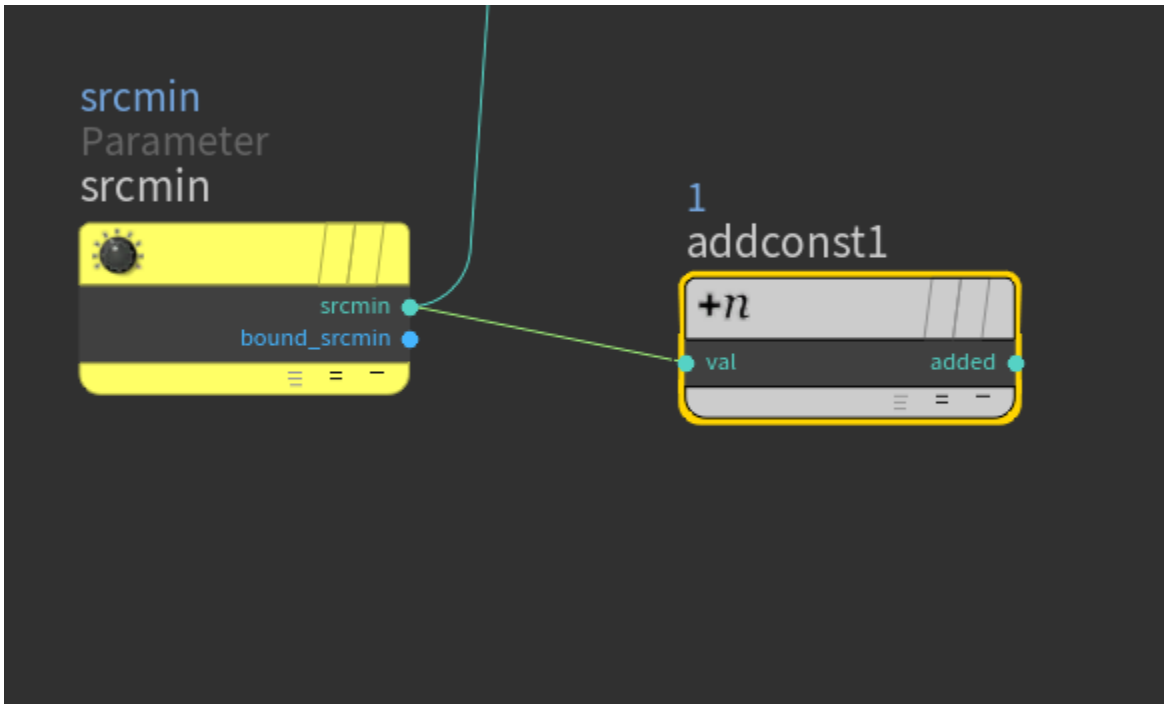
10) Now, drag the Distance and Output nodes and connect the p2 value from the Distance node to the vec2 output from the Float to Vector2 node we just attached to the Average node. This will locate the centroid of your model. Don't worry if it is not directly in the center.



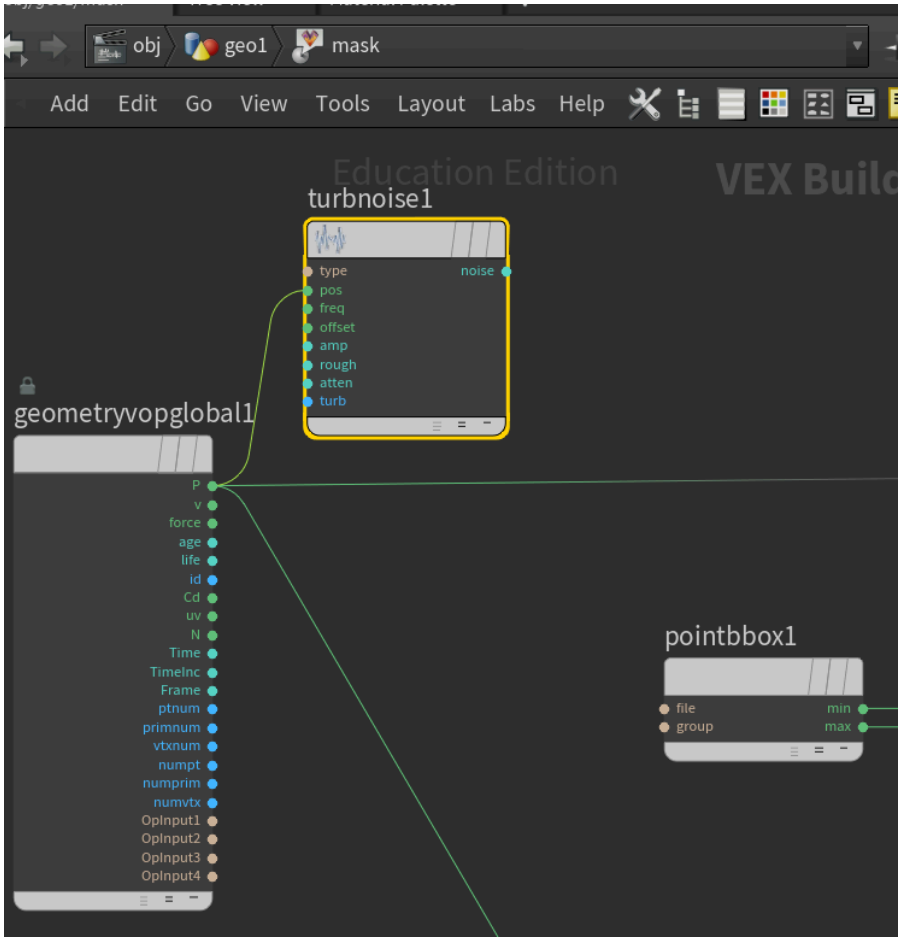
11) In your Fit Range node, change the Source Min back to 0. On the Fit Range node, click on the srcmin input option with your mouse wheel, and select "Promote Parameter" this will add a small line to the srcmin input. Click on it, and it will open the parameter as its own node.



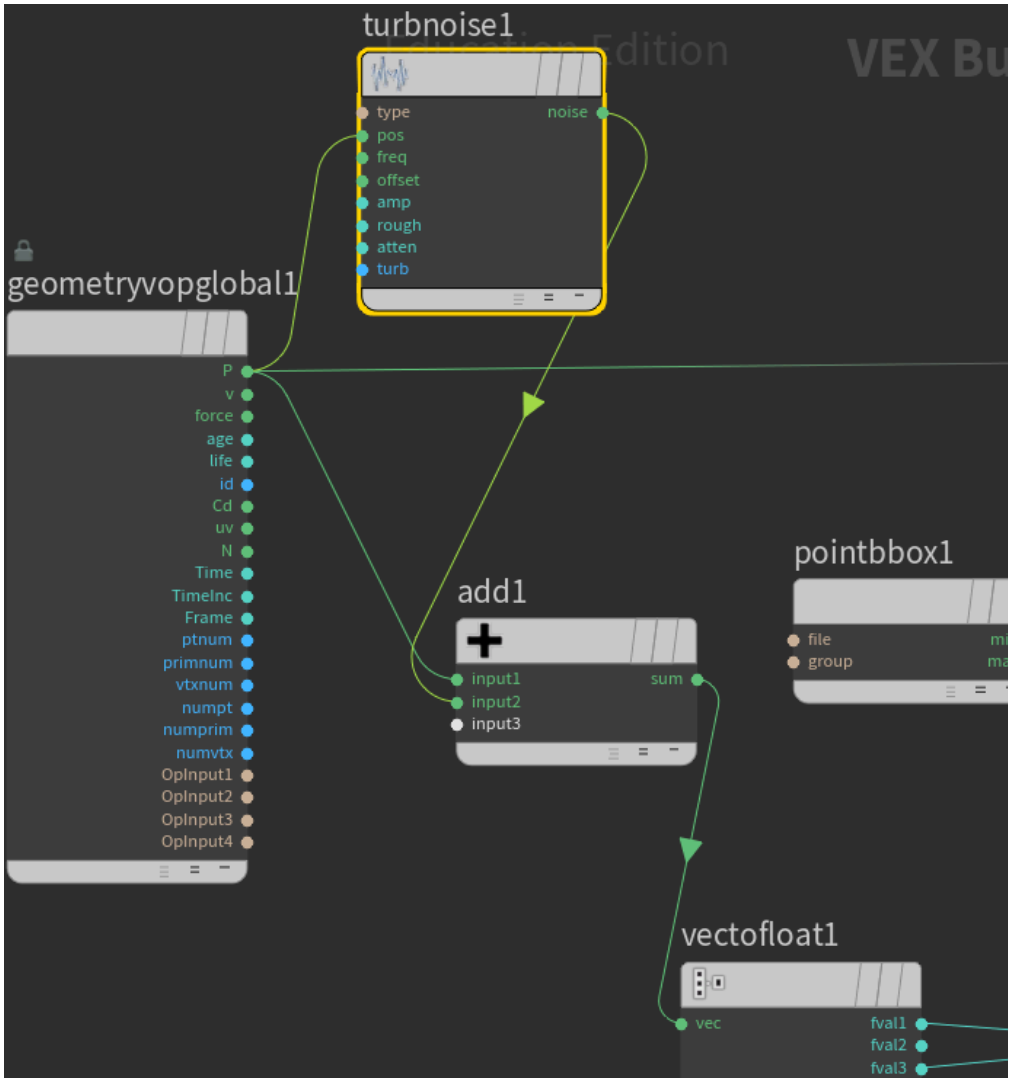
12) Since we always want this value to be the same, create an “Add Constant” node and connect it to the srcmin node.



13) In the Inspector window of the Add Constant node, change the Add value to something like 0.3 and then connect the output of the node to the srcmax input of the Fit Range Node.
14) Now, if you exit out of the VOP node back to the normal Geometry node area, you can change the Minimum Value in Source Range. This will mask a portion of your model in black. However, it is pretty linear and lacking in variation. Let's change that!
Go back into the VOP. Add a "Turbulent Noise" node, and connect it's pos input to the P value in the GeometryVOPGlobal node.



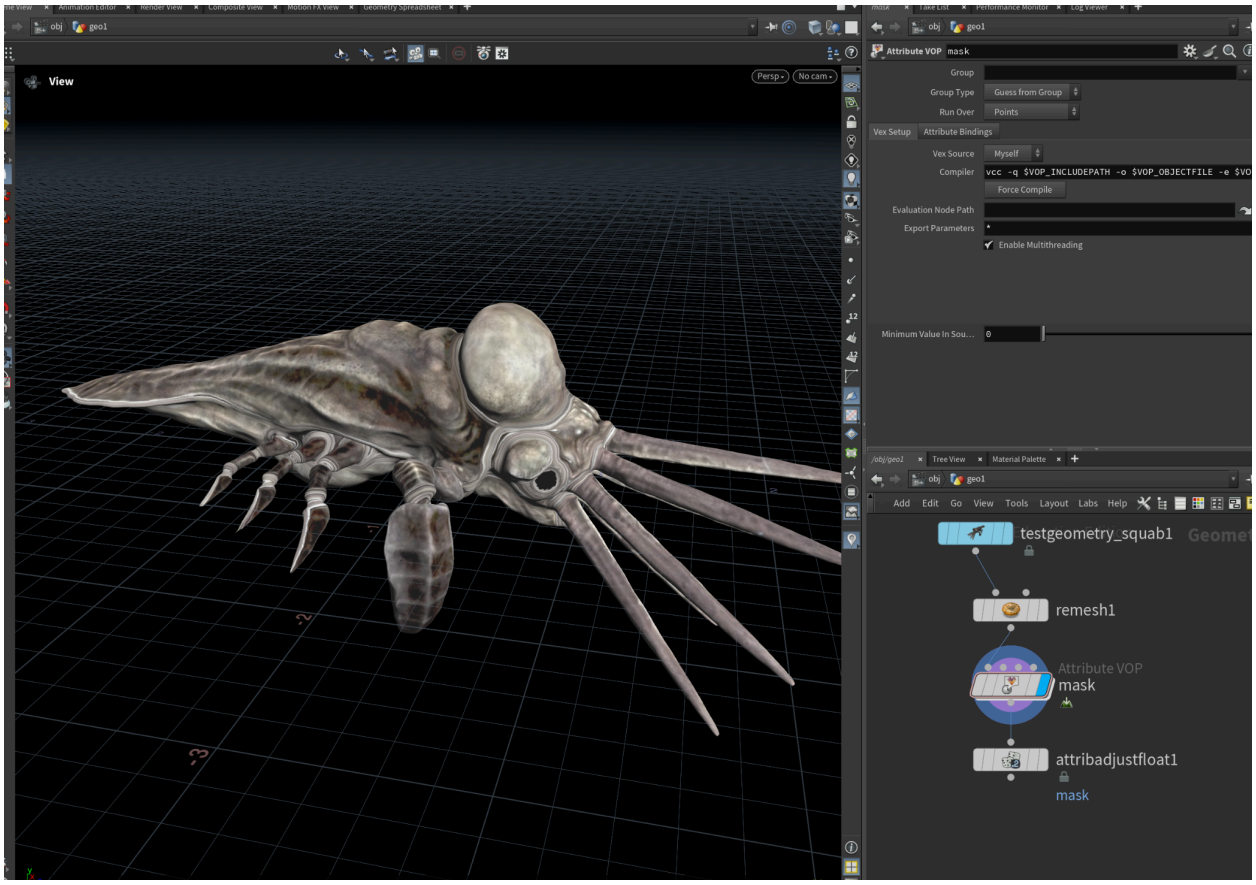
15) In the Inspector window for the Turbulent Noise node, change the Noise Type setting to "Sparse Convolution Noise", and the Signature from 1D to 3D Noise.
Add an "Add" node between the GeometryVOPGlobal node and the Vector to Float node it is connected to, then connect the Turbulent Noise output to the input2 in the Add node.



16) Play around with the settings in the Turbulence Noise node to find a noise pattern you like. This finishes our mask set up.

ANIMATING THE MASK:

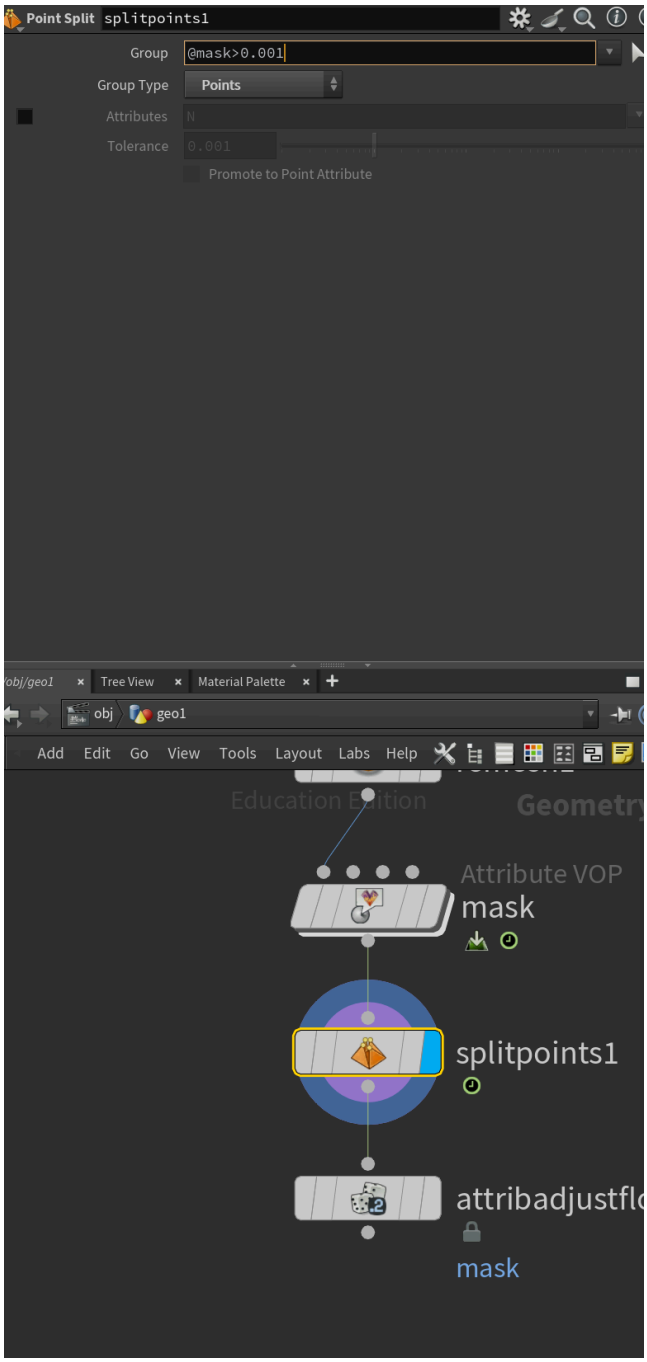
1) Now let's animate our mask. We can do this by exiting out of our VOP and setting the Minimum Value in Source Range input to 0 in the inspector window.



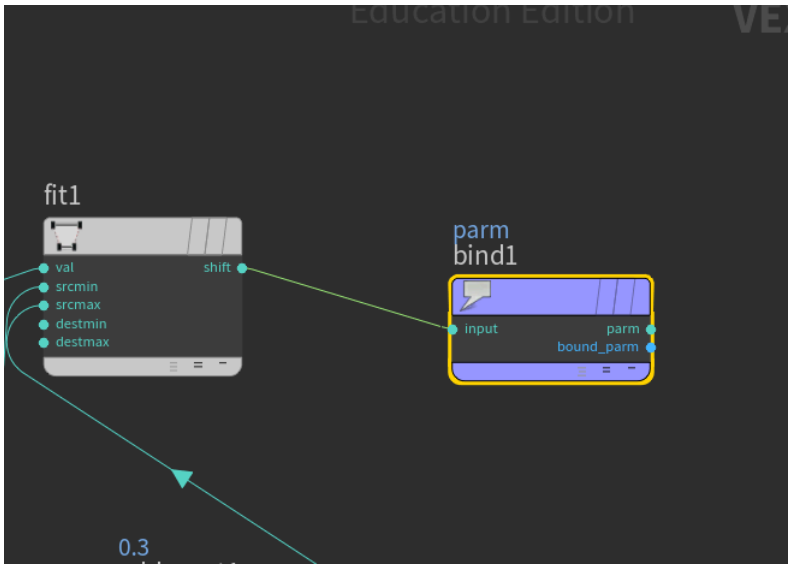
2) Click on your Minimum Value in Source input parameter and press alt. This will set a key. Then move the key frame slider to something later, maybe around frame 75, then increase the Minimum Value in Source node until the entire model is covered in the mask. Then, press alt while clicking on the parameter. The order of this procedure is important for animating properly. If you play back the animation, you should see the mask covering the model.

DISINTEGRATION:

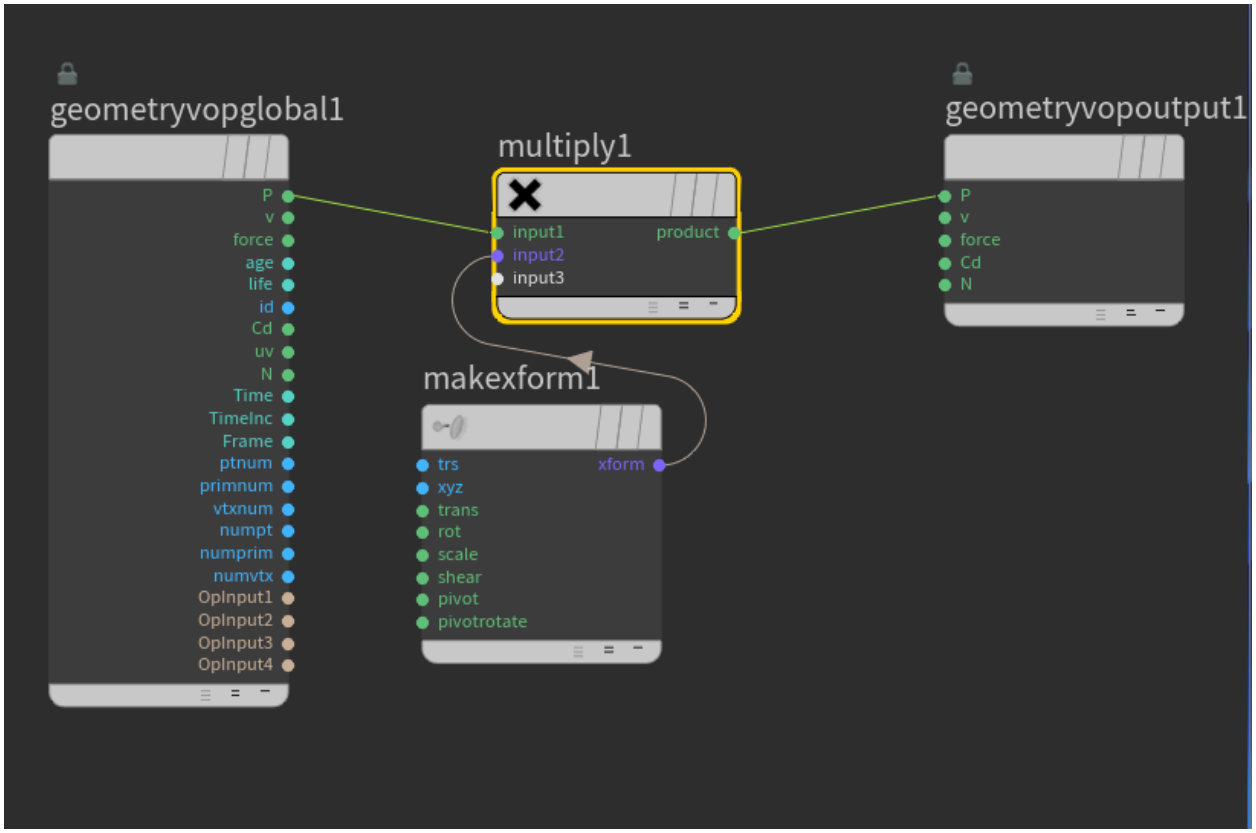
1) We want our triangles on the outside of our mask to get smaller as the mask moves across them to effectively create the disintegrating effect. We can do this by adding a “Point Split” node after the mask VOP node. This breaks each triangle down into smaller ones based on the points they are attached to.
2) In the Inspector window for the Points Split node, change the Group Type to “Points” and write the reference to our mask “@mask>0.001” in the Group field.



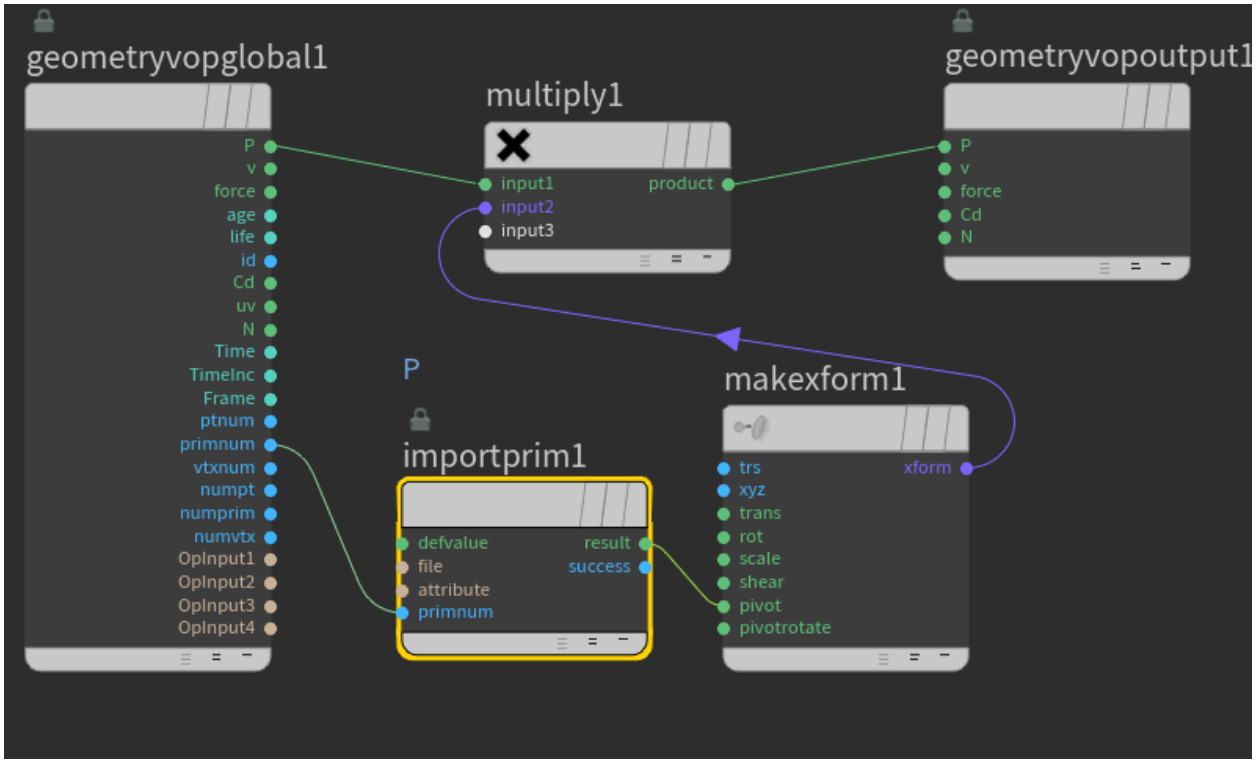
3) Let's now export our mask attribute. We can do this by first going into the VOP node, severing the connection between the Fit Range node and the Geometry Output node, and instead adding a "Bind Export" node, connecting it to the output of the Fit Range node.



4) Change the name in the Bind Export Inspector window to “mask” and exit out of the VOP.
5) Add a “Point VOP” node after the Point Split node. Rename it to “scale_down_prims”. Double click the node to enter it.
6) Connect the two default Geometry nodes (the P from the GeometryVOPGlobal to the P from GeometryVOPOutput) and add a “Multiply” node between them.
7) Add a “Make Transform” node and attach it to input2 in the Multiply node.



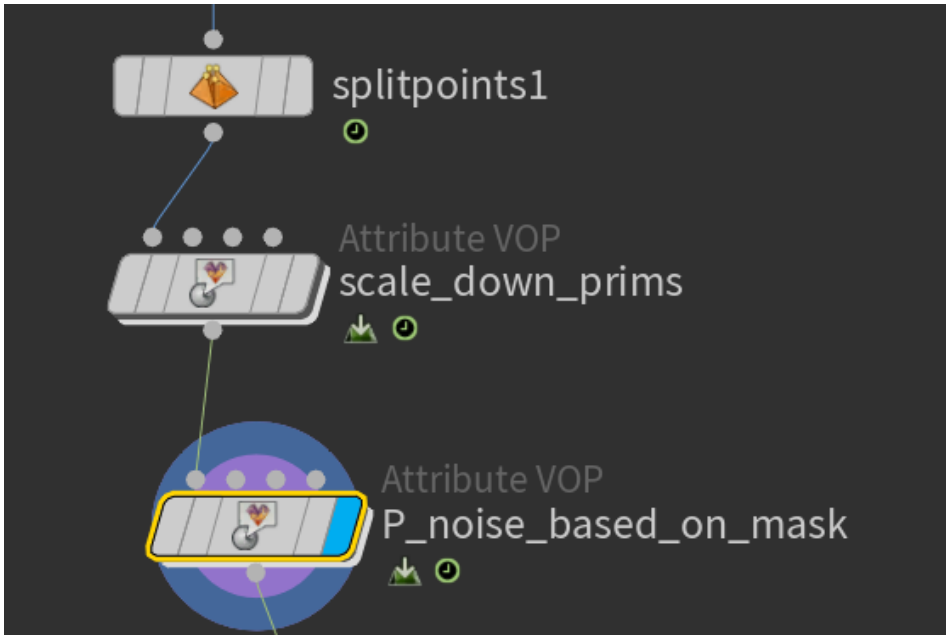
8) Right now if we were to change the scale in the Make Transform node, it would change the size of the entire model. We just want to change the sizes of the primitives based on their pivot. If you look at the Make Transform node, you'll notice that it has a pivot input, so we need to attach a vector value to it. The easiest way to do this is to attach the "primnum" output from the GeometryVOPGlobal node to an "Import Primitive Attribute" node. In this new Inspector window, change the Input to "First Input". Connect the result output from the Import Primitive Attribute node to the pivot input of the Make Transform node.



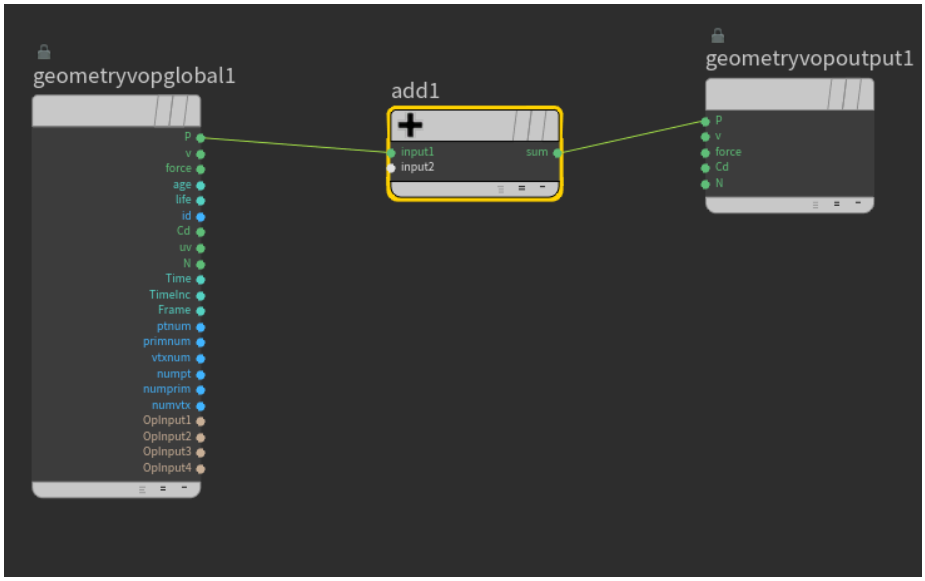
9) Just to test, if you now change the scale of the Make Transform node, you will see the individual primitives shrink. Remember to reset them to 1 though because we want the primitives to shrink relative to where our mask is.
10) To do this, create a "Bind" node, and write "mask" in the Name area of its Inspector window. Then, connect the mask output from the to the scale input of the Make Transform node.
11) Add a "Fit Range" node between the Bind and Make Transform nodes. In the Inspector window, change the Destination Min to 1 and the Destination Max to 0. This reverses our disintegration, beginning invisible and then populating onscreen. This looks cool, but if you would like the opposite effect, go to the Fit Range node in the Mask VOP and change the Destination Min to 1 and the Destination Max to 0.

MAKE IT COOL:

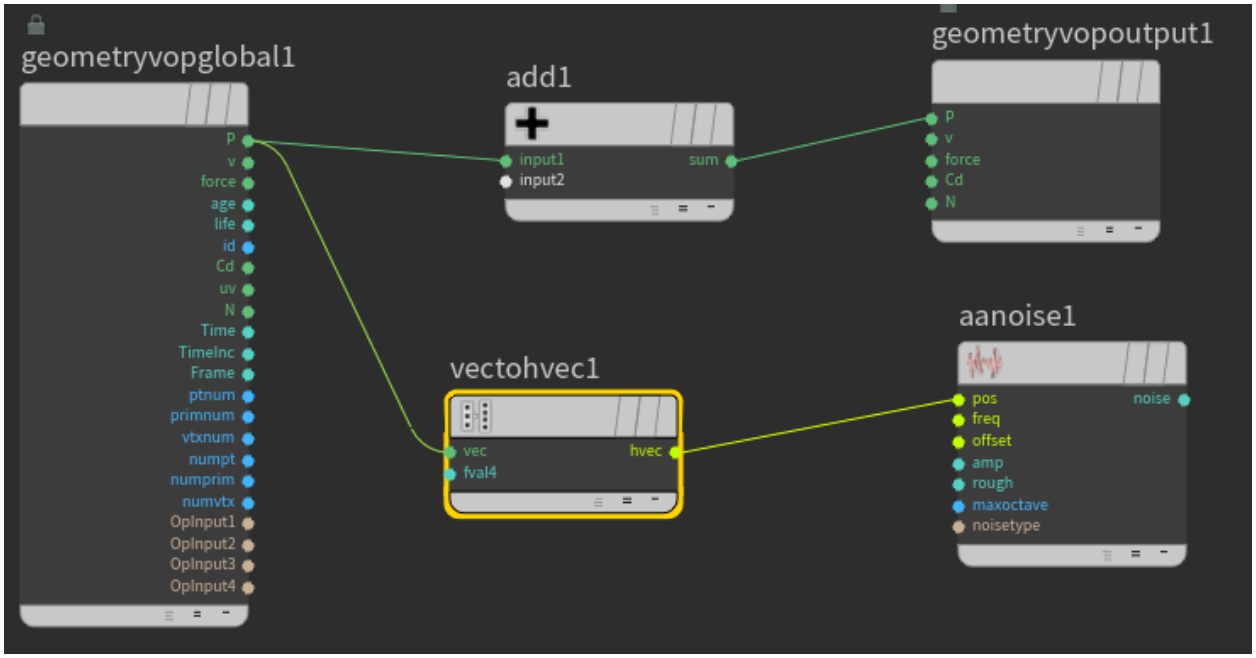
1) To add some more noise and make the disintegration more interesting, we can exit the scale_down_prims VOP and add another Point VOP after, renaming it to "P_noise_based_on_mask".



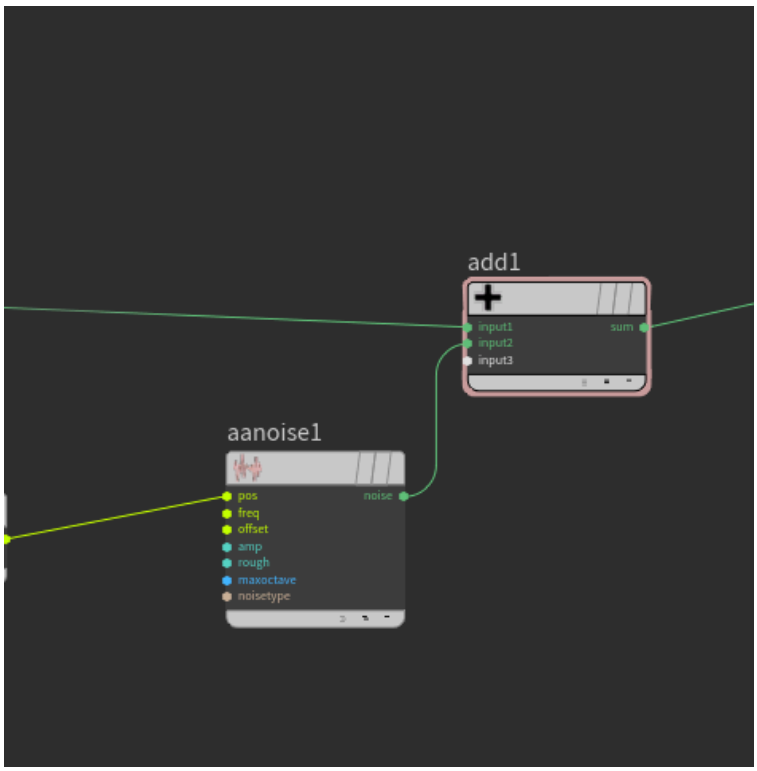
2) Double click on the P_noise VOP to go into it and connect the P values of the default Geometry nodes. Then, add an "Add" node between them.



3) Create an "Anti Aliased Noise" node and connect its pos input to the P output of the GeometryVOPGlobal node.
4) We want to add a 4D vector so create a "Vector to Vector4" node, and place it between the GeometryVOPGlobal and Anti Aliased Noise nodes.



5) If you notice on the Vector to Vector 4 node, the fval4 is still open. Let's connect that to the Time input on the GeometryVOPGlobal node. This ensures the noise changes based on time.
6) In the Anti Aliased Noise node Inspector window, change the Signature to 4D Input, 3D Noise, then connect it to the Add node. You should see some interesting changes in your viewport.



7) Add a “Multiply” node between the Anti Aliased Noise node and the Add node, and then make these deformations happen based on where the mask is, so you also want to add a “Bind” node, changing its name to “mask”, and then attaching it to the second input in the Multiply node.
8) With this Disintegration Effect in place, you now have the opportunity to expand and add onto your project! Here are some ideas to spice it up:
    a) Add multiple disintegrations at different points using the Range node, and play around with the animation to make it disintegrate at different times.
    b) Make the disintegration more volatile (more like an explosion!) by adding a transformation to the mask, so that the parts of the model expand as they disintegrate.
    c) Convert the disintegrating points into particles that emit as the mesh dissolves by using a POP network and the mask attribute to control emission rate. You can also add wind or turbulence, or change the colors of the particles too!
    d) Make the disintegration more cinematic by adding Fire or Smoke effects. This can be done by using the masked area as the Fuel Source in a Pyro Solver. Add temperature and density fields based on the mask animation, and you have a great “burn away” effect!

RENDERING:

1) To render your animation, go to the top bar, and go to Render>Create Render Node>Karma. Also create a Camera from wherever your Viewport is so you can position it how you want.
2) In the animation timeline, change the frame range from 1-80 so it will automatically update in the render settings.
3) When ready to render, click “Render to MPlay”, and wait for it to finish rendering.
4) When finished rendering, go to File>Export>FFmpeg and save your video as an avi format
5) Upload and submit your .hip file and render video.