



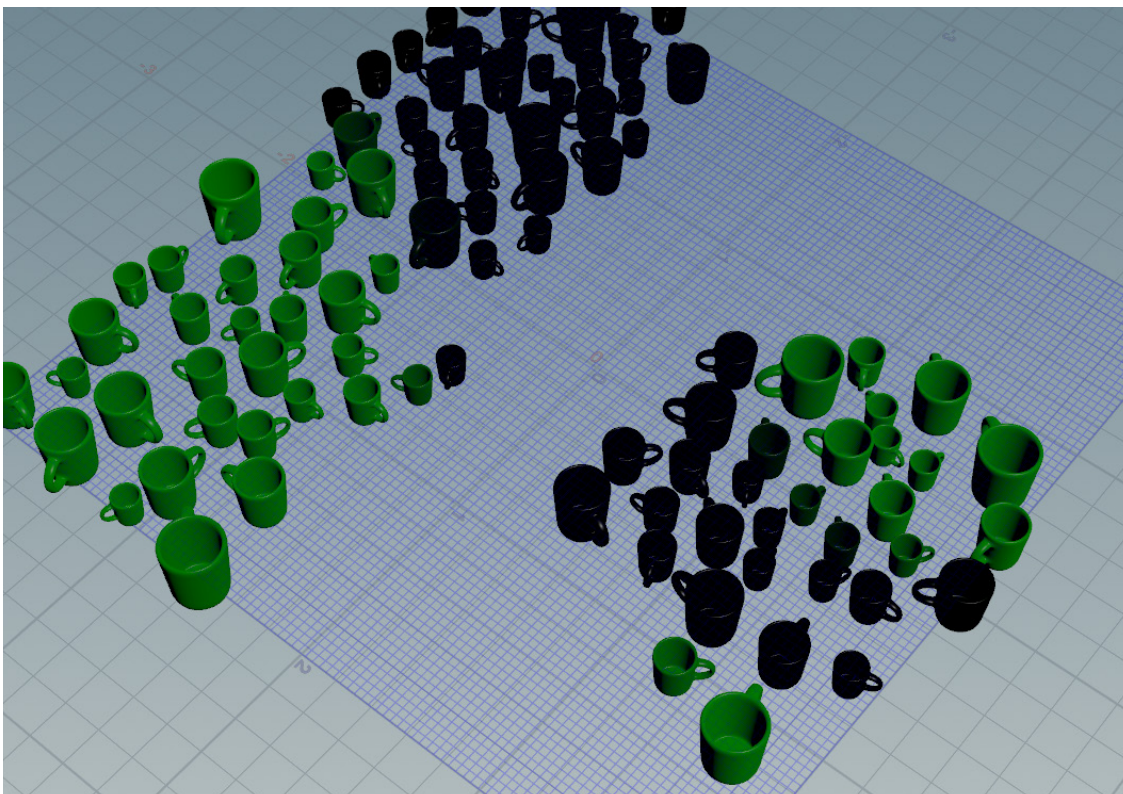
Curriculum-in-a-Box | Lesson 3 | Guided Work

MULTIPLE PAINTED ATTRIBUTES WITH SCATTERING

Students are now asked to follow-along with the teacher as they build something in Houdini. For this lesson, students will learn how to work with attributes and how to use those attributes to manipulate copies of geometry. This specific example will take a coffee cup and scatter it onto a grid. In order to achieve this, students will learn how to paint multiple attributes on the source grid to influence the location and color of the copies. Copying geometry to points is a fundamental concept for working with geometry in Houdini. Students will have a much deeper understanding of this after completing the following exercise.

WHAT STUDENTS WILL LEARN

- How to scatter points onto geometry
- How to drive the scattering with a painted attribute
- How to use the Copy to Points SOP to copy geometry



PART ONE

Grid and Scatter Setup

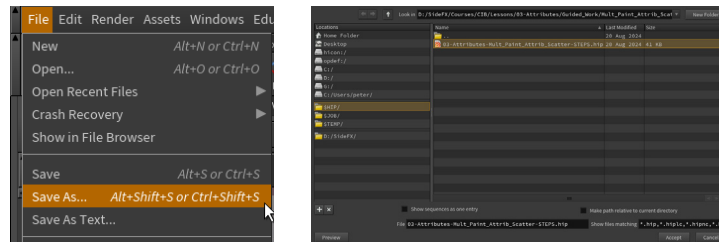
In this first part of the exercise you will show your students how to set up their project, add a grid to the scene and scatter points onto the grid. These points will be the location onto which you copy your geometry later in the lesson.

1. Set up your Project Directory

- Download the *CIB_Lesson03.zip* file and unzip it then place it in the *documents>HoudiniProjects* directory.
- Open Houdini and from the **File** menu, choose **Set Project**.
- Navigate to the *CIB_Lesson03* directory and press **Accept**.

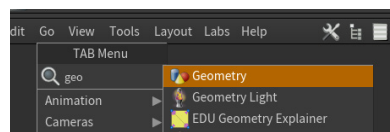
2. Save your Scene File

- From the File menu, choose **Save As**.
- Make sure you are in the *CIB_Lesson03* directory, give the **File** a name and press **Accept**.

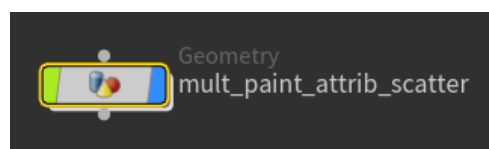


3. Set up the Geometry Network

- Press Tab in the Network View, start typing *geo* then select **Geometry**.



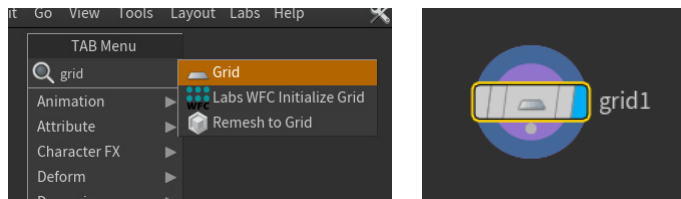
- Click in the Network View to place the node.
- Double-click the *geo1* name and change it to something like *mult_paint_attrib_scatter*.
 - This will be a container for the geometry you create.



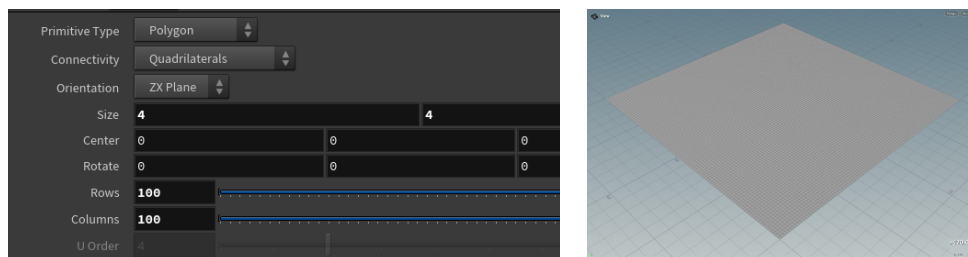
- Double-click the *mult_paint_attrib_scatter* node to dive inside.

4. Add a *Grid* node to the scene

- Press **Tab** in the Network View, type *grid*, and press **Enter**.
- **Left-click** to place the node.

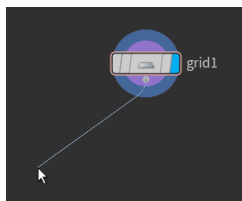


- In the Parameter Pane, change the **Size** to **4** and **4**.
- Change the **Rows** and **Columns** to **100**.

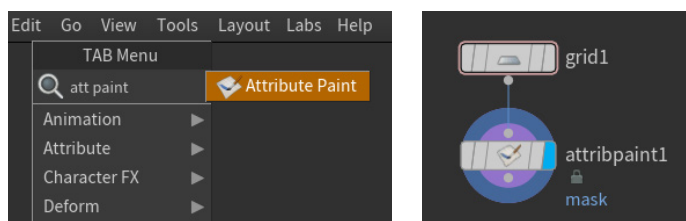


5. Add an *Attribute Paint* node

- **Left-Click** on the *Grid* node's output dot.
 - You will now have a wire that follows your cursor and is connected to the output dot.



- Press **Tab** in the Network View, type *att paint*, and press **Enter**.

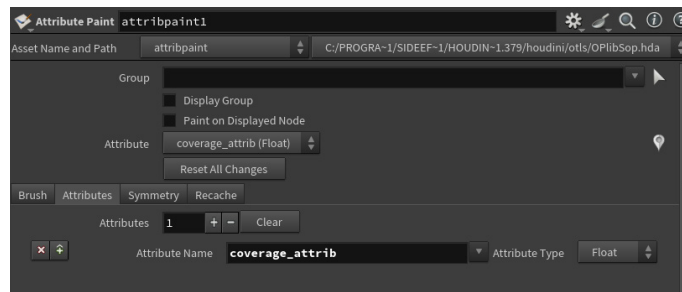


- A new *Attribute Paint* node will be placed in your Network View and will be connected to the *Grid* node.
- You can move the new node in order to keep your network organized. You should see the node snap into alignment with the positions of the other nodes that are already in the network.

- Click the right-most section of the *Attribute Paint* node to move the blue Display Flag.
 - This allows us to visualize what the *Attribute Paint* node is doing. The Display Flag is a cornerstone of using Houdini because it lets you visualize the result of all nodes that were placed before the one with the Display Flag.
 - If your *Attribute Paint* node isn't highlighted in yellow, click on the center of it in the Network View.

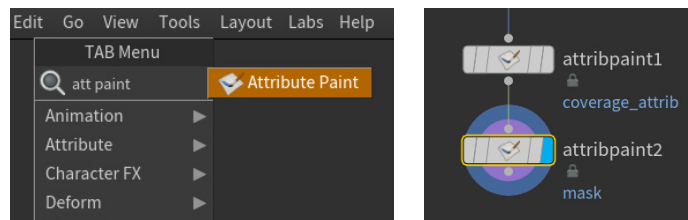
6. Change the attribute that will be painted in the Scene View

- In the Parameter Pane select the **Attributes** tab, and change the **Attribute Name** text from *mask* to *coverage_attrib*.
- Keep the **Attribute Type** as **Float**, as this will output a decimal value between 0 and 1.



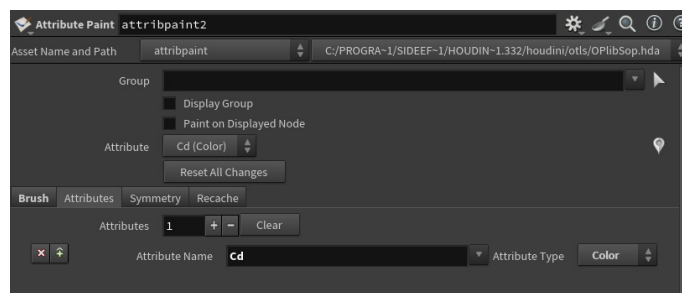
7. Add a second Attribute Paint node

- Click the output dot of the *attribpaint1* node.
- Press **Tab** in the Network View, type *att paint*, and press **Enter**.



8. Change the attribute that will be painted by this node

- In the Parameter Pane, select the **Attributes** tab, and change the **Attribute Name** text from *mask* to *Cd*.
- Change the **Attribute Type** drop-down to **Color**.



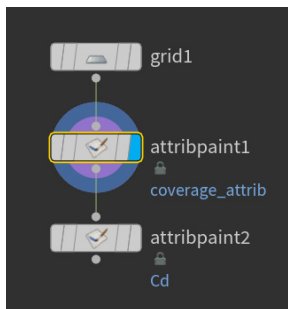
PART TWO

Paint Attributes and Scatter

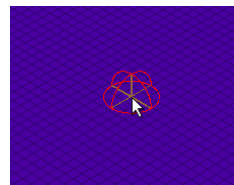
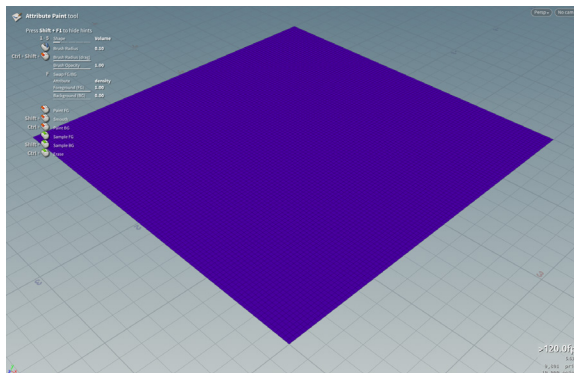
In the next step in this exercise, students will import a supplied coffee cup model and copy it to the scattered points. This part of the exercise will introduce students to the Copy to Points node, which has two inputs. Students will learn the beginning stages of how more complex scenes are created.

1. Paint an attribute on the grid using the first *Attribute Paint* Node

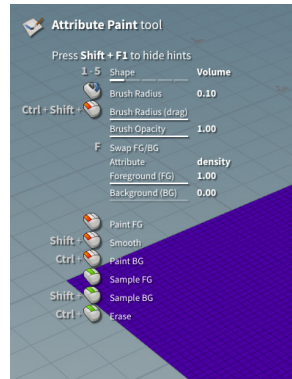
- Select the *attribpaint1* node in the Network View, and move the blue Display flag to this node.



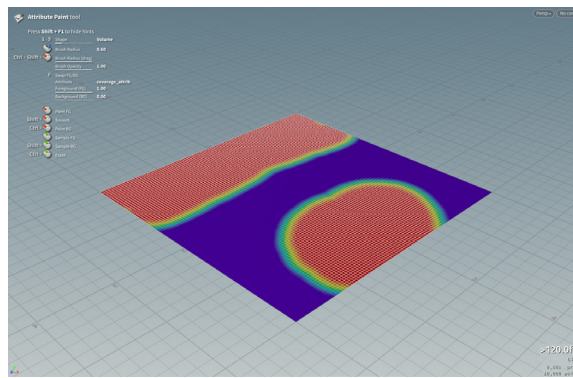
- Hover your mouse over the Scene View and press **Enter**.
 - This will enter the current tool's Viewer State. In this case, you will now be in a mode where you can paint on the geometry.
 - When you hover the mouse over the grid you should have a 3D sphere following your cursor.



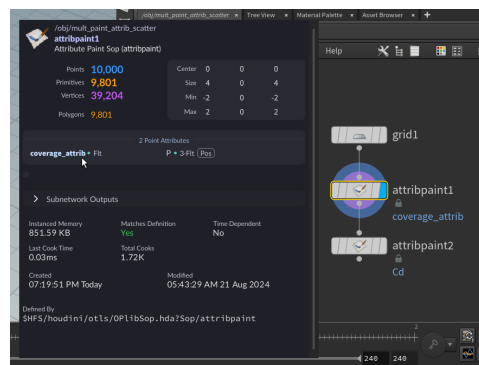
- While hovering over the Scene View, you can use your mouse's scroll-wheel to change the radius of the brush.
 - All of the tool's other controls can be seen in the top left of the Scene View.



- Left-click and drag to paint the *coverage_attrib* attribute onto the grid.
 - The red sections indicate a *coverage_attrib* of 1, and the purple indicates a *coverage_attrib* of 0. The color ramp represents the decimal values between the two numbers.



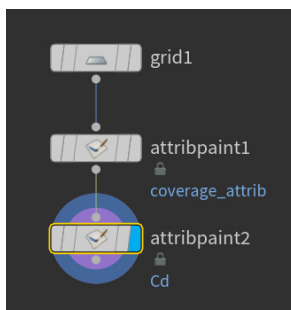
- Middle-click the *attribpaint1* node to check if a *coverage_attrib* attribute is present.
- Left-click on the **Geometry Spreadsheet** tab above the Scene View to see if the values are between 0 and 1.



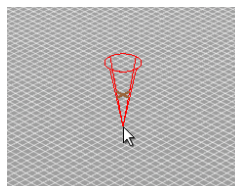
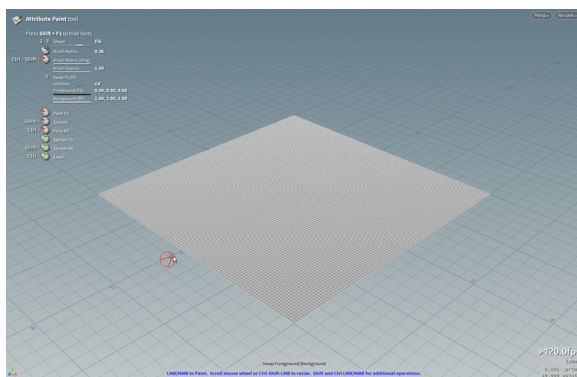
Node: attribpaint1	P[x]	P[y]	P[z]	coverage_attrib	Group:
0	-2.0	0.0	-2.0	1.0	
1	-1.9596	0.0	-2.0	1.0	
2	-1.91919	0.0	-2.0	1.0	
3	-1.87879	0.0	-2.0	1.0	
4	-1.83838	0.0	-2.0	1.0	
5	-1.79798	0.0	-2.0	1.0	
6	-1.75758	0.0	-2.0	1.0	
7	-1.71717	0.0	-2.0	1.0	
8	-1.67677	0.0	-2.0	1.0	
9	-1.63636	0.0	-2.0	1.0	
10	-1.59596	0.0	-2.0	1.0	
11	-1.55556	0.0	-2.0	0.991066	
12	-1.51515	0.0	-2.0	0.944786	
13	-1.47475	0.0	-2.0	0.861761	
14	-1.43434	0.0	-2.0	0.634662	
15	-1.39394	0.0	-2.0	0.88492	
16	-1.35354	0.0	-2.0	0.793675	
17	-1.31313	0.0	-2.0	0.980228	

2. Paint a color attribute onto the grid using the second *Attribute Paint* node

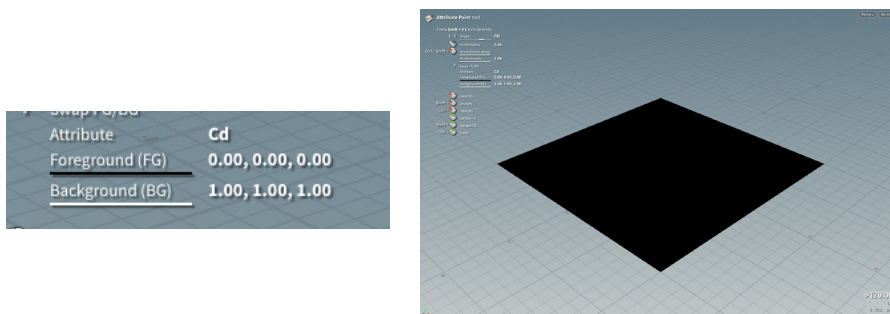
- Select the *attribpaint2* node in the Network View, and move the blue Display flag to this node.



- Hover your mouse over the Scene View and press **Enter**.
- While over the Scene View, press **4** to enter the **Fill Brush**.
 - When you hover the mouse over the grid you should have a 3D cone following your cursor.



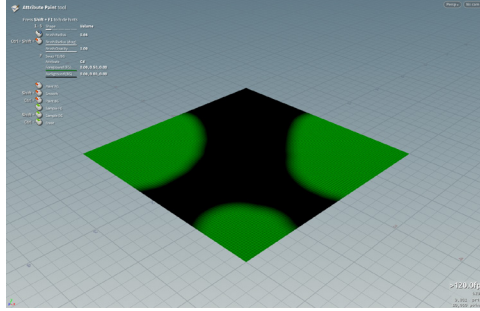
- Press **f** to swap the foreground/background colors, and use the hints in the top left of the Scene View to confirm that the foreground color is now black.
- **Left-click** on the grid.



- Over the Scene View, press **1** to change the brush back to **Default**.
- Using the bar above the Scene View, change the **Foreground Color** to something you like (you'll see green in the following examples).

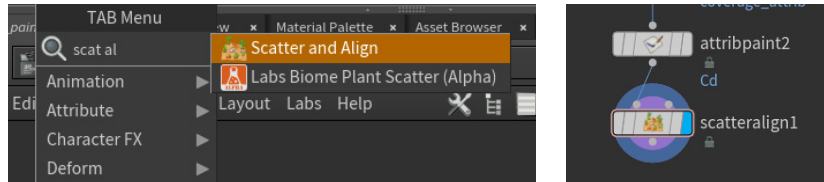


- **Left-click and Drag** on the grid to paint parts of it your selected color.

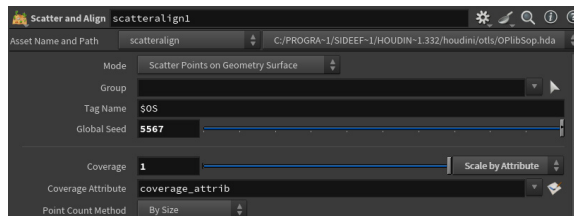


3. Add a *Scatter and Align* node and to scatter where the *coverage_attrib* attribute is painted

- Click the output dot of the *attribpaint2* node.
- Press **Tab** in the Network View, type *scatter*, and press **Enter**.



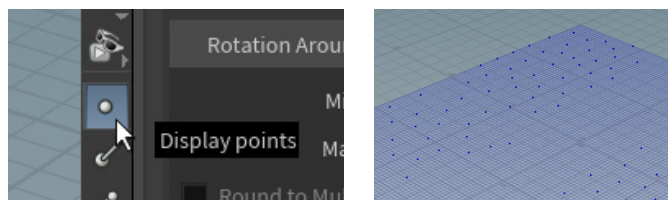
- In the Parameter Pane, set the **Coverage** to **1**, and change the **No Scaling** drop-down to **Scale by Attribute**.



- In the **Scale** section of the Parameter Pane, change **Min Radius** to **0.5**, the **Max Radius** to **1.1**, and the **Uniform Scale** to **0.2**.



- Since the points are now colored by the attribute we made before, they may be hard to see in the Scene View. Press the **Display Points** button next to the Scene View to make them more obvious.
 - After viewing the points, turn off the **Display Points** button to make the Scene View less cluttered.



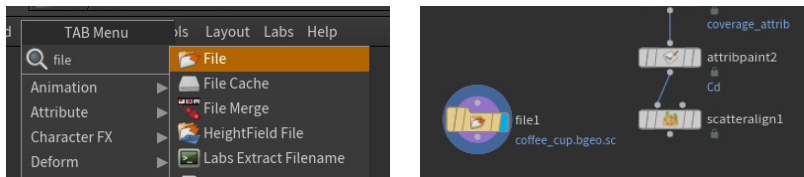
PART THREE

Import Geometry and Copy to Points

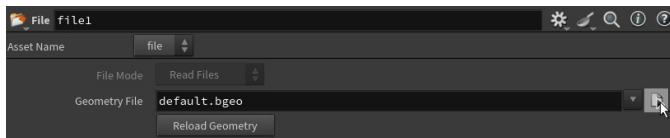
In the last step of this exercise, students will import a coffee cup geometry and copy it onto the points created in the previous step. You will accomplish the duplication of the geometry by using the Copy to Points SOP, which is an integral part of many Houdini workflows.

1. Import the coffee cup geometry

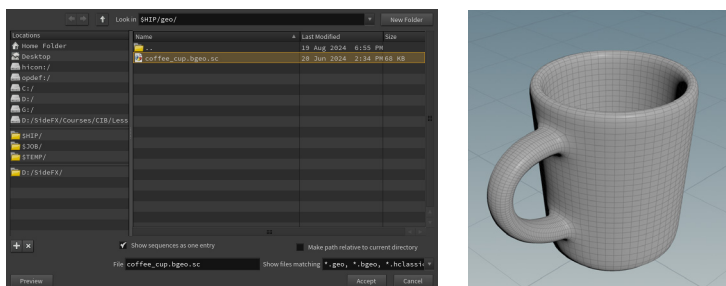
- Press **Tab** in the Network View, type *file*, and press **Enter**.
- **Left-click** to place the node.



- In the Parameter Pane, use the displayed icon next to the **Geometry File** parameter.

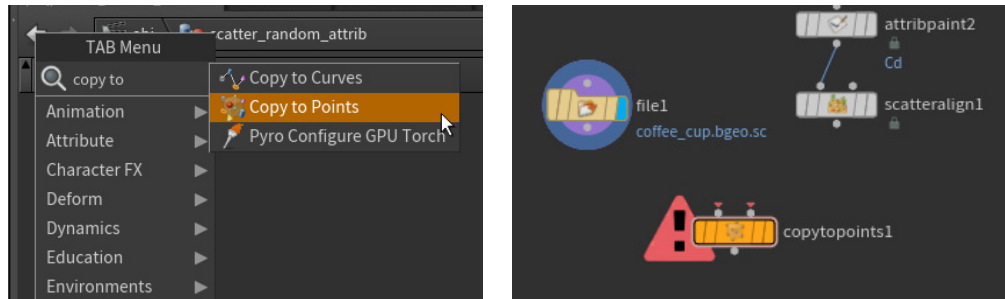


- Navigate to the supplied coffee cup geometry, select it, and press **Accept**.
 - If you move the blue Display Flag to the *File* node, you should see the cup geometry in the Scene View.

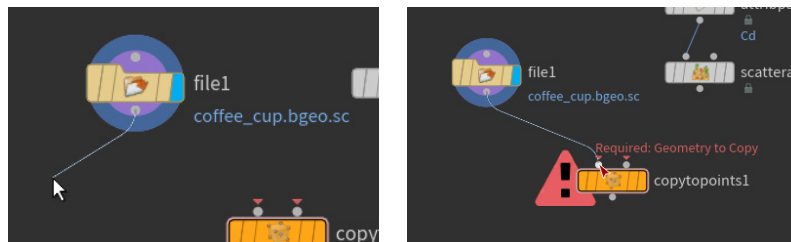


2. Copy the cup to the points

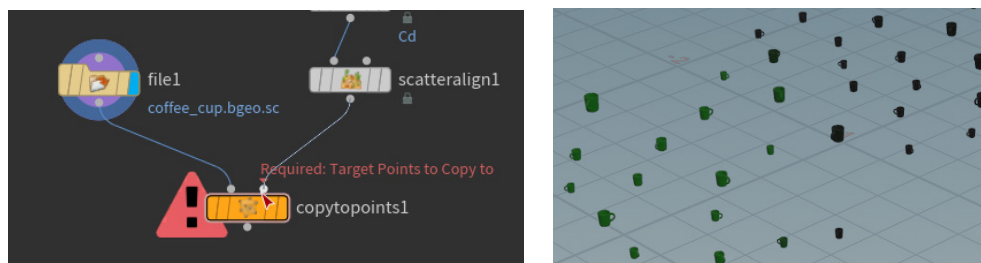
- Press **Tab** in the Network View, type *copy to*, and select **Copy to Points**.



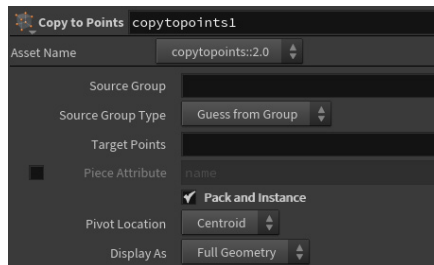
- Take care to select *Copy to Points*, and not *Copy to Curves*. The latter node comes first in the list so it might be easy to select incorrectly.
- Left-click** to place the node.
- Left-click** on the Output dot from the *file1* node, and then **Left-click** to attach the wire to the first input of the *copytopoints1* node.



- You can see that inputs are named in the screenshot. This is especially helpful for multi-input nodes like *Copy to Points*. Here you can see that input 1 is named **Geometry to Copy**.
- Repeat the last step between the *scatteralign1* node and the *copytopoints1* node's second input.
 - If you move the blue Display Flag to the *Copy to Points* node, you should see the copied cups in the Scene View.
 - You will also see that the *Cd* attribute is adjusting the color of the copied coffee cups.

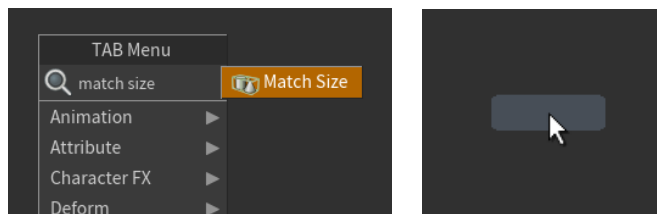


- Select the *copytopoints1* node in the Network View.
- In the Parameter Pane, **check** the box next to **Pack and Instance**.
 - These steps will optimize the performance of copying your geometry to the points.

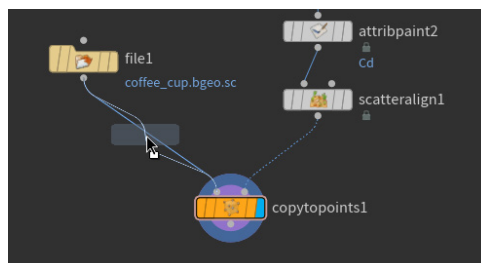


3. Adjust the scale of the coffee cup

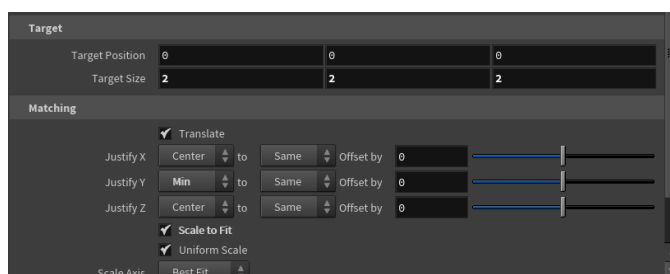
- Press **Tab** in the Network View, type *match size*, and press **Enter**.
 - You will have a ghost node attached to your pointer.



- Click to place the node between the *file1* and *copytopoints1*.

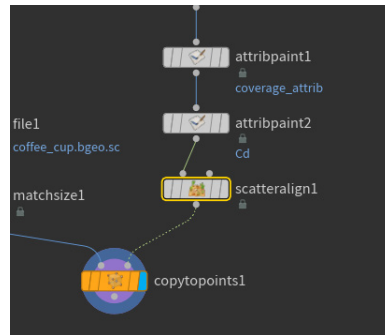


- In the Parameter Pane, change the **Target Size** to 2, 2, and 2.
- Set the **Justify Y** to **Min**, and check the box next to **Scale to Fit**.

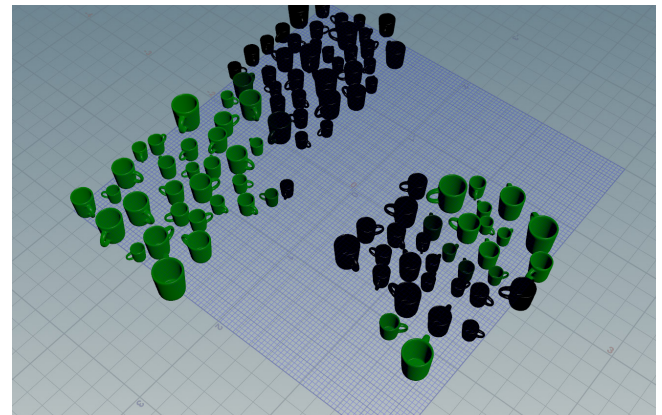
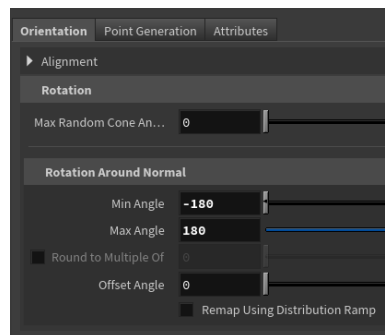


4. Randomly rotate the cups

- Select the *scatteralign1* node.



- In the Parameter Pane scroll down to the **Rotation Around Normal** under the **Orientation** tab. Set the **Min Angle** to **-180**, and the **Max Angle** to **180**.



CONGRATULATIONS

You have now completed your multiple-painted attribute scattering exercise. This exercise took you through a project that began with a grid that you painted an attribute onto, you scattered geometry on user-painted attributes and changed the geometry's color based on other painted attributes.