



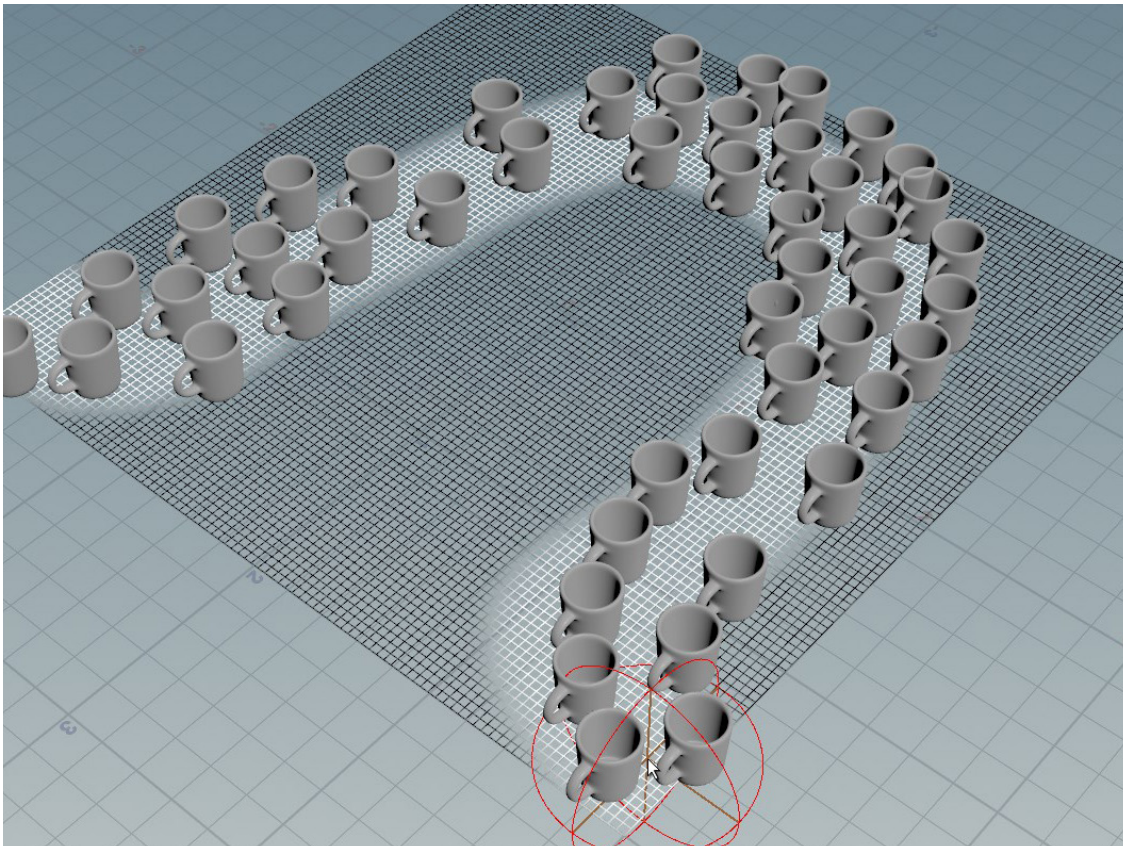
Curriculum-in-a-Box | Lesson 3 | Guided Work

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 an attribute on the source grid to influence the location 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

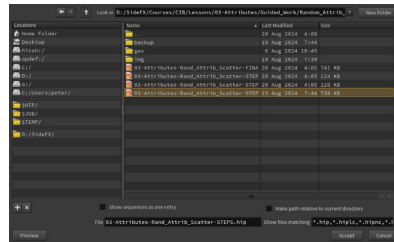
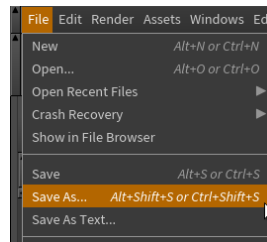
In the first exercise, you will instruct students on how to set up their project, add a grid to the scene and scatter points onto the scene. These points will be the location onto which you copy your geometry later in the lesson.

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**.

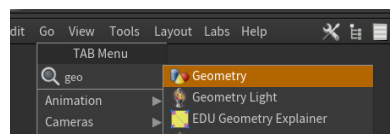
2. Save your Scene File

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

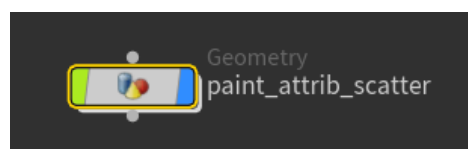


3. Set up the Geometry Network

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



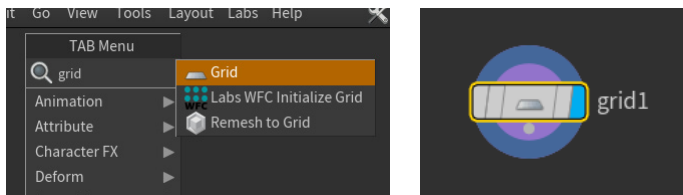
- Click in the Network View to place the node.
- Double-click the *geo1* name and change it to something like *paint_attrib_scatter*.
 - This will be a container for the geometry you create.



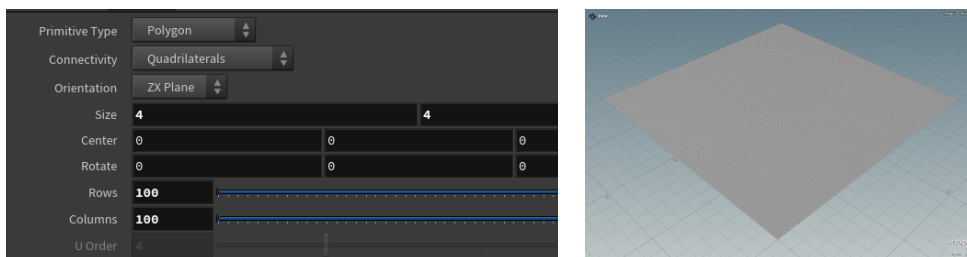
- Double-click the *paint_attrib_scatter* node to dive inside.

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.

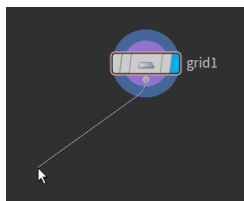


- In the Parameter Pane, change the **Size** to **4** and **4**.
- Change the **Rows** and **Columns** to **100**.

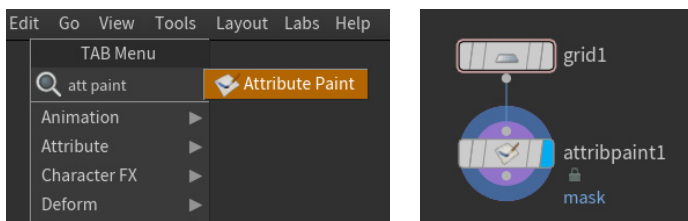


5. Add an *Attribute Paint* node

- **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**.

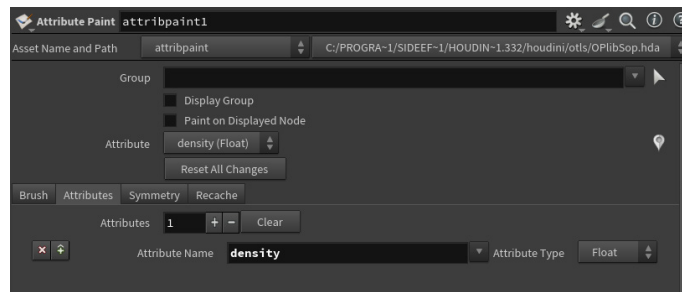


- A new *Attribute Paint* node will be placed in your Network View and will be connected to the *Grid* node.
- You can move the new node in order to keep your network organized. You should see the node snap into alignment with the positions of the other nodes that are already in the network.

- 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 *density*.
- Keep the **Attribute Type** as **Float**. This will output a decimal value between 0 and 1.



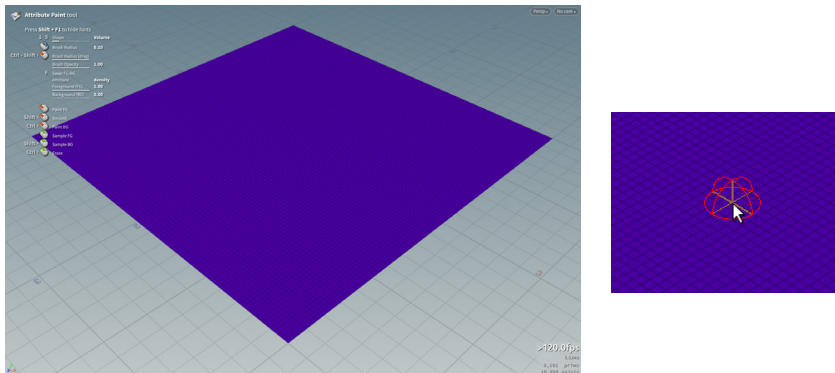
PART TWO

Paint Attribute and Scatter

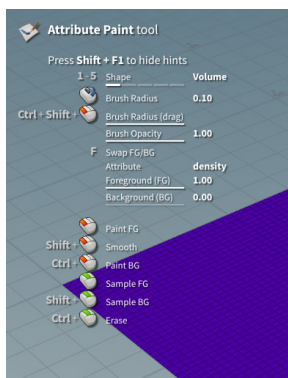
The next step in this exercise will show your students how to paint an attribute onto geometry in Houdini. The concept of writing attributes to geometry is one of the fundamental ideas of Houdini's procedural workflows. Painting these attributes will allow you to drive this proceduralism with artistic decisions.

1. Paint an attribute on the grid in the Scene View

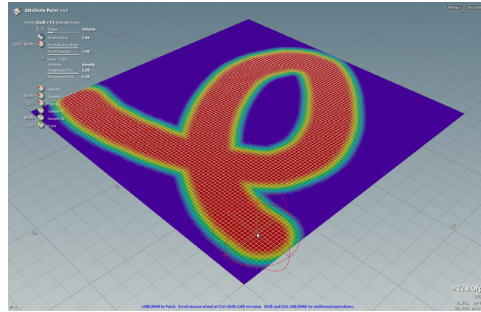
- Hover your mouse over the Scene View and press **Enter**.
 - This will enter the current tool's **Viewer State**. In this case, you will now be in a mode where you can paint on the geometry.
 - When you hover the mouse over the grid you should have a 3D sphere following your cursor.



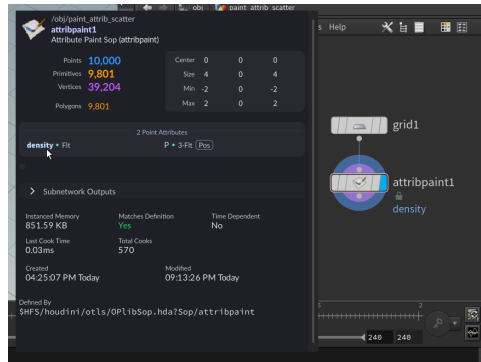
- While hovering over the Scene View, you can use your mouse's scroll-wheel to change the radius of the brush.
 - All of the tool's other controls can be seen in the top left of the Scene View.



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



- **Middle-click and Hold** on the *attribpaint1* node check the info pane to see if a *density* attribute is present.

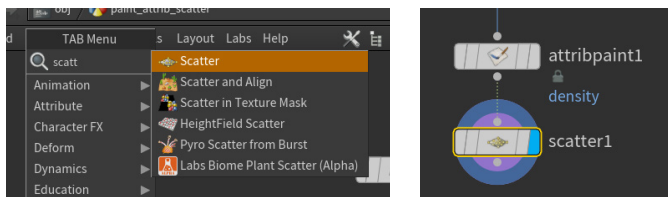


- **Left-click** on the **Geometry Spreadsheet** tab above the Scene View to see if the values are between **0** and **1**.

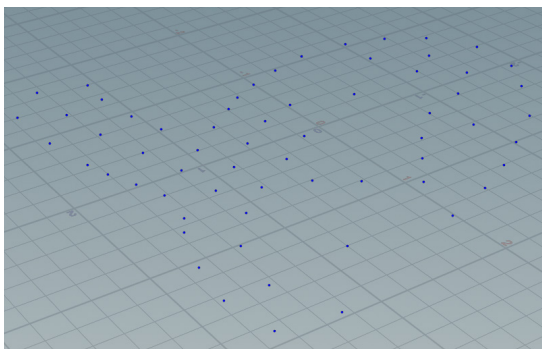
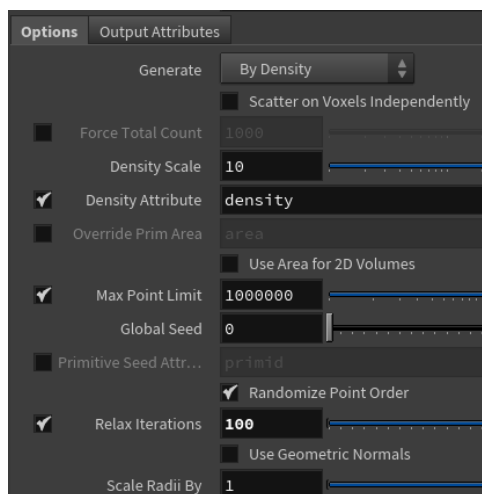
Node: attribpaint1	P[x]	P[y]	P[z]	density
S24	-1.6303	0.0	-1.79798	0.0
S25	-0.989899	0.0	-1.79798	0.0
S26	-0.949495	0.0	-1.79798	0.0
S27	-0.909091	0.0	-1.79798	0.0
S28	-0.868687	0.0	-1.79798	0.0
S29	-0.828283	0.0	-1.79798	0.0
S30	-0.787879	0.0	-1.79798	0.00588041
S31	-0.747475	0.0	-1.79798	0.0019857
S32	-0.707071	0.0	-1.79798	0.205118
S33	-0.666667	0.0	-1.79798	0.389099
S34	-0.626263	0.0	-1.79798	0.527534
S35	-0.585859	0.0	-1.79798	0.659956
S36	-0.545455	0.0	-1.79798	0.76751
S37	-0.505051	0.0	-1.79798	0.85761
S38	-0.464646	0.0	-1.79798	0.93111
S39	-0.424242	0.0	-1.79798	0.978216
S40	-0.383838	0.0	-1.79798	0.993156
S41	-0.343434	0.0	-1.79798	0.996393
S42	-0.30303	0.0	-1.79798	0.999899
S43	-0.262626	0.0	-1.79798	1.0
S44	-0.222222	0.0	-1.79798	1.0
S45	-0.181818	0.0	-1.79798	1.0

2. Add a scatter node and set it to scatter where the density attribute is painted

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



- In the Parameter Pane, **un-check** the box next to **Force Total Count**.
- Next, **check** the box next to **Density Attribute**.
- Also, change the **Relax Iterations** to **100**.
 - Activating this *density* attribute parameter will look for areas where the point attribute are over **1** and place points according to the *density* value.



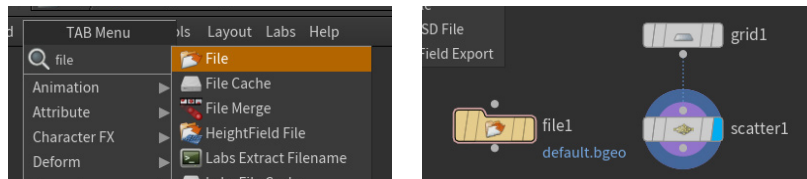
PART THREE

Import Geometry and Copy to Points

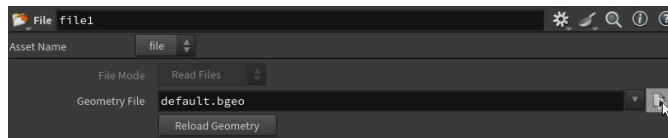
In the final part of this exercise, you will guide your students through importing a coffee cup geometry and copying it to the points you created in the last step. You will accomplish the duplication of the geometry by using the Copy to Points SOP, which is an integral part of many Houdini workflows.

1. Import the coffee cup geometry

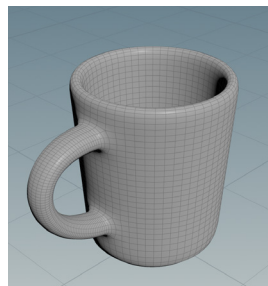
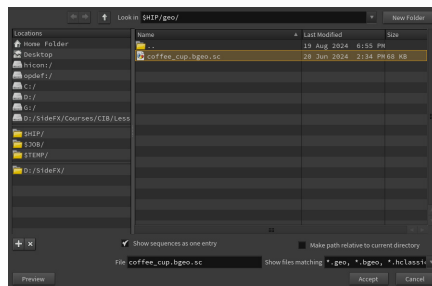
- Press **Tab** in the Network View, type *file*, and press **Enter**.
- Left-click** to place the node.



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

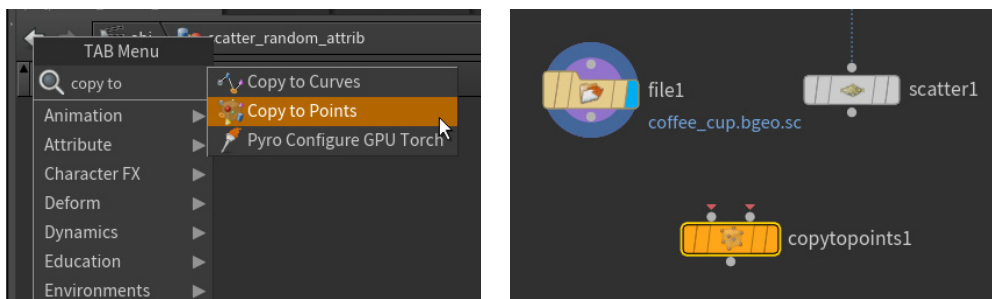


- Navigate to the supplied coffee cup geometry, select it, and press **Accept**.
 - If you move the blue Display Flag to the *File* node, you should see the cup geometry in the Scene View.

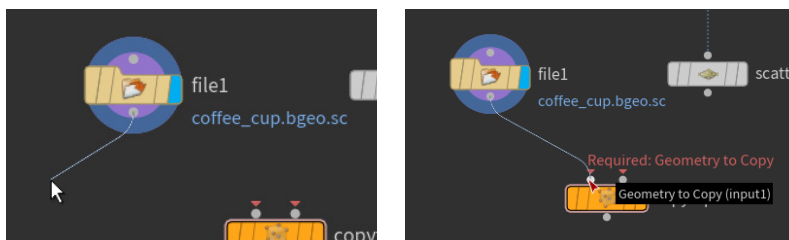


2. Copy the cup to the points

- 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.

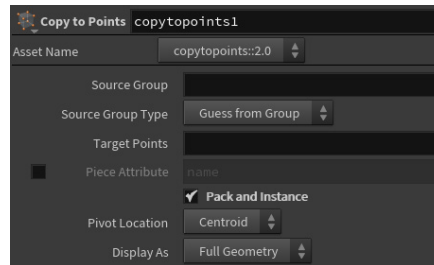


- You can see that inputs are named in the screenshot. This is especially helpful for multi-input nodes like *Copy to Points*. Here you can see that input 1 is named **Geometry to Copy**.
- Repeat the last step between the *scatter1* node and the *copytopoints1* node's second input.



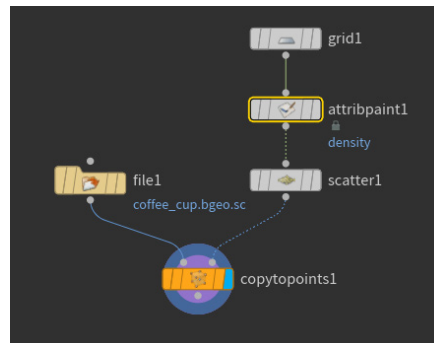
- If you move the blue Display Flag to the *Copy to Points* node, you should see the copied cups in the Scene View.

- Select the *copytopoints1* node and in the Parameter Pane **check** the box next to **Pack and Instance**.
 - This step will optimize the performance of copying your geometry to the points.

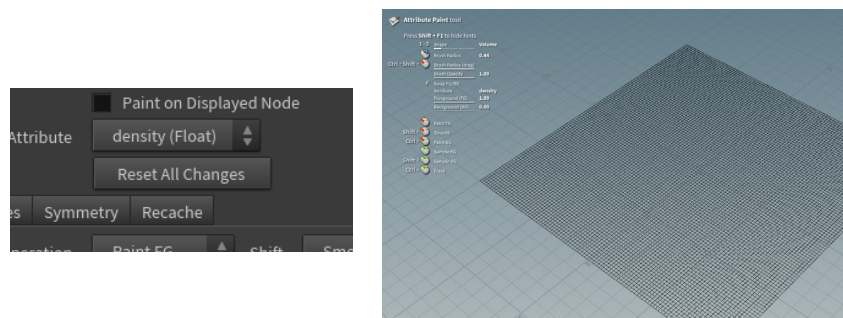


3. Modify the previous attribute painting

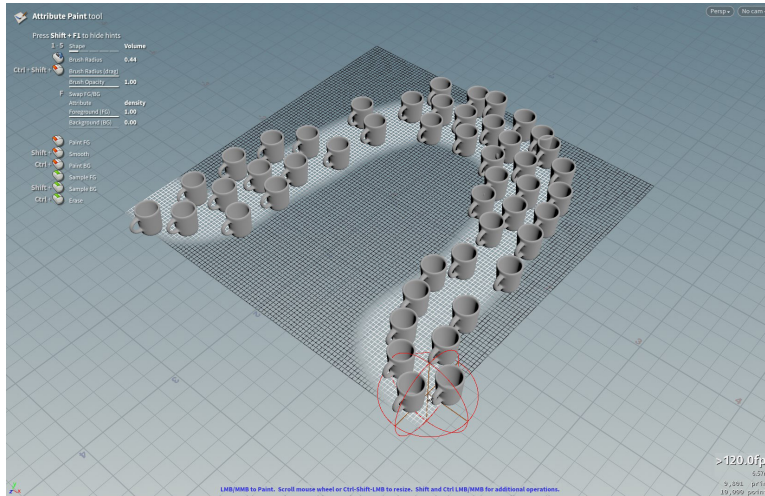
- Set the blue Display Flag to the *copytopoints1* node.
- Select *attribpaint1* in the network. It should have a yellow highlight around the node.
 - This will allow you to view the results of this entire setup after you paint on the grid again.



- In the Parameter Pane, click the **Reset All Changes** button.
- Hover your mouse over the Scene View and press **Enter**. This will activate the Attribute Paint's viewer state.



- **Left-click and drag** over the grid to see coffee cups appear where you paint on the grid.



CONGRATULATIONS

You have now completed your painted attribute scattering exercise. This has taken you through a project that began with a grid, you painted an attribute onto it, and then scattered geometry wherever a painted attribute was present.