HOUDINI FUNDAMENTALS

NODES, NETWORKS AND DIGITAL ASSETS

A great way to understand Houdini's node-based workflow is to explore it in the context of a project. It is important to start learning how to think and work procedurally. In this lesson, you will learn how to create your own custom **brickify** tool using procedural nodes and networks to define its function and interface.

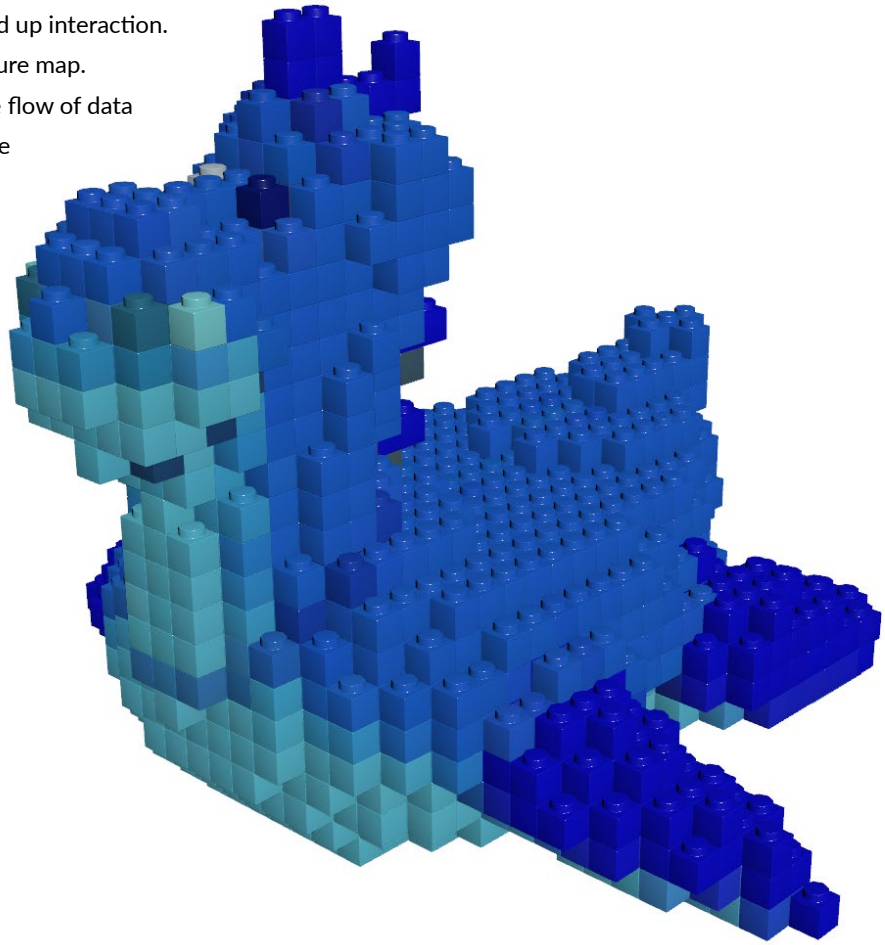
Along the way you will get to use different aspects of Houdini's workspace. Be sure to refer to the overviews in the introduction to remind yourself of how these UI elements work together. The lessons will then give you a chance to put your ideas into practice, which is one of the best ways to learn.

LESSON GOAL

- *To create a custom tool that turns any given 3D shape into toy bricks.*

WHAT YOU WILL LEARN

- How to model a plastic interlocking brick
- How to break down a default rubber toy shape into a grid of points.
- How to use packed primitives and instancing to speed up interaction.
- How to use attributes to color the bricks using a texture map.
- How to work with nodes and networks to control the flow of data
- How to create a Digital Asset to package up and share your solution with others.
- How to animate the bricks appearing over time.



LESSON COMPATIBILITY

Written for the features in Houdini 19.0+

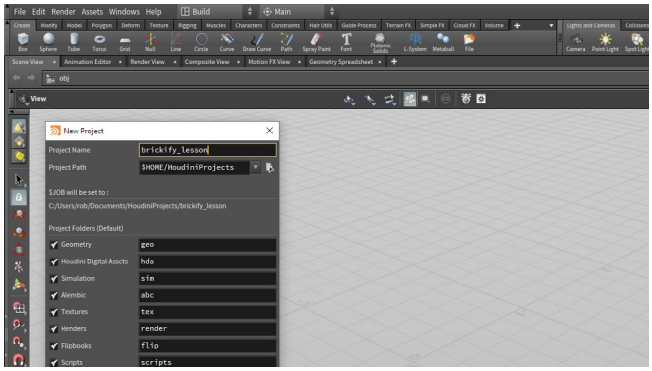
The steps in this lesson can be completed using the following Houdini Products:

Houdini Core	✔
Houdini FX	✔
Houdini Indie	✔
Houdini Apprentice	✔
Houdini Education	✔

Document Version 2.0 | October 2021

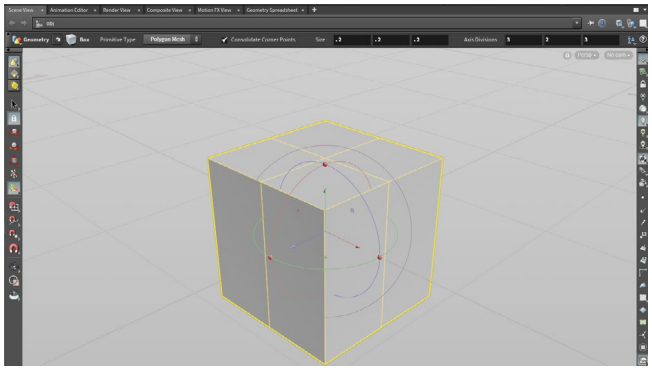
PART ONE:
Create a Single Brick

To get started, you will build a single brick model that you will later copy onto points to create the brickified shape. You will create this shape using a combination of polygon modelling tools. Along the way you will see how each action you take creates a node in Houdini that creates a recipe of the steps taken to create the geometry.



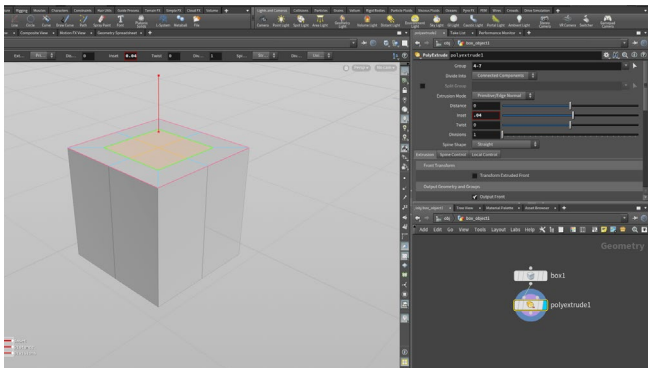
01 Select **File > New Project.** Change the **Project Name** to *brickify_lesson* and press **Accept**. This creates a project directory with subfolders for all the files associated with this shot.

Select **File > Save As...** You should be looking into the new *brickify_lesson* directory. Set the file name to *bricks_01.hip* and click **Accept** to save.



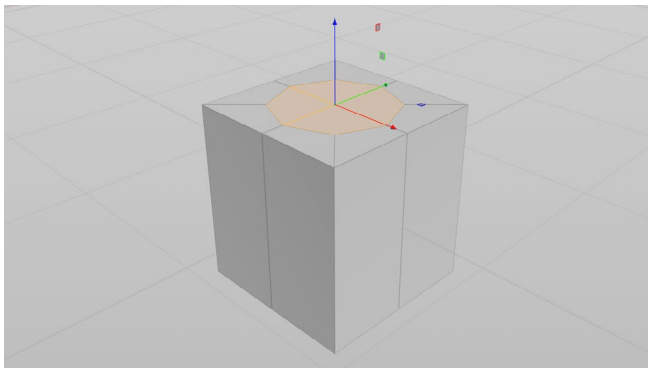
02 In the viewport, **press c** to bring up a radial menu. From this menu, choose **Create > Geometry > Box**. Your cursor now shows the outline of a box waiting to be placed in the scene. **Press Enter** to place it at the origin. In the **Operation Controls** bar, set **Size** to **0.2, 0.2, 0.2** and **Axis Divisions** to **3, 2, 3**.

You can see that there is a *box_object* in the Network view. This object level node contains the transformation information for this shape. The **Operation Controls** show you parameters from another *box* node one level down.



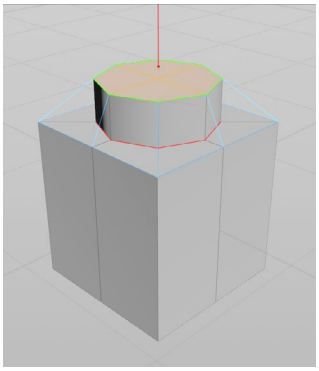
03 Click on the **Select** tool then **Press 4** to go to primitive selection mode. Select the top four faces on the box. **Press c** to bring up a radial menu and choose **Model > Polygons > PolyExtrude**. In the Network view you can see the *box* node feeding into a *polyextrude* node.

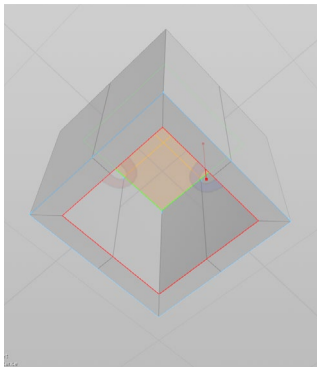
In the Parameter pane, use the slider to set **Inset** to **0.04** which creates new polygons on the top surface of the box. Each node contains parameters relevant to the purpose of that node. These are geometry nodes that are otherwise known as surface operators or SOPs.



04 Next, press the T key to call up the Move tool. This adds an *edit* SOP node into the network. In the viewport **RMB-click** in empty space to bring up a menu and select **Make Circle** to round out the selected polygons.

This menu is associated with the *edit* node. Every node has its own interface that you can access as long as a relevant tool is active. In this case, the Move tool gives you access to the handle. In other cases the **Handle** tool would be used to access the interactive handles for a node.





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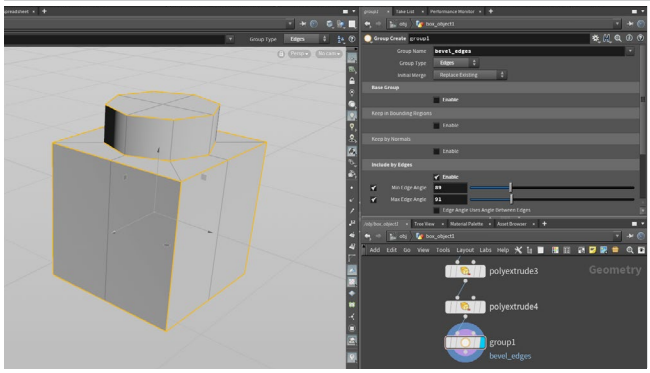
Press c to bring up a radial menu and choose **Model > Polygons > PolyExtrude**. In the Scene View pane, use the handle to drag up the polygons and set **Distance** to **0.05.**

Tumble around and **press s** to go into select mode then select the bottom four polygons of the box. **Press q** to repeat the **PolyExtrude** tool. In the Parameter pane, use the slider to set **Inset** to **0.025.**

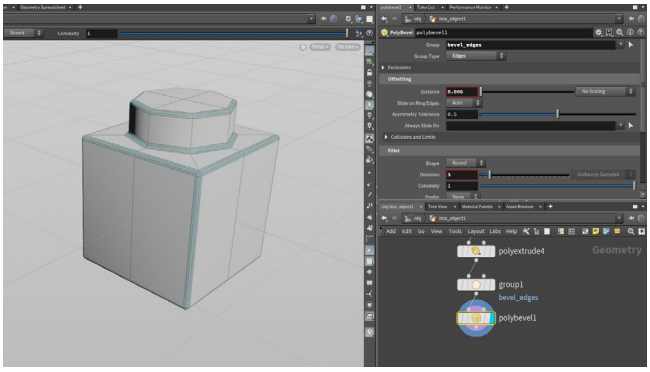
Press q to repeat that tool and set a **Distance** of **-0.175.** When you finish, tumble back to see the top of the brick.



06

Press 3 to go to edge selection and press n to select all the Edges. In the Scene view press tab and start typing **Group...** Select **Group** and in the Parameter pane, set the **Group Name** to *bevel_edges*.

Next, set **Enable** to **OFF** under **Base Group** and then set Enable to ON in the **Include by Edges** section. Turn on **Min Edge Angle** and set it to **89** and then turn on **Max Edge Angle** and set it to **91**.



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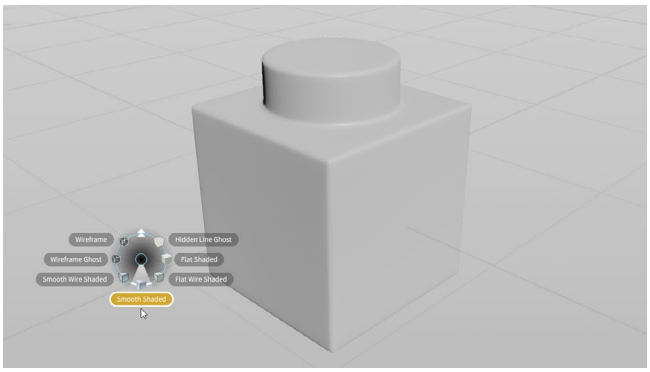
Press s to go to the **Select** tool. **Press 9** to turn on the "**Select Groups**" option. In the popup window, click on the *bevel_edges* group.

In the viewport, **press c** to bring up a radial menu. From this menu, choose **Model > Polygons > PolyBevel**. This adds a polybevel node and automatically fills in the **Group** field with *bevel_edges*.

Now set the **Bevel Offset** to **0.006**. Under **Fillet**, set **Shape** to **Round** and **Divisions** to **3**.



08

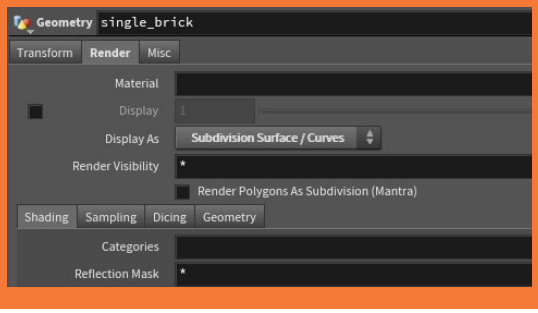
Go to the object level and in the Network view, rename the object to *single_brick*. With the brick selected, press **Shift +** to turn on subdivision surface display for this shape. Deselect the brick to see the model subdivided. If you see wire lines on your object, **press v** and from the radial menu, choose **Shading > Smooth Shading** to hide them.

Save your work.

SUBDIVISION DISPLAY

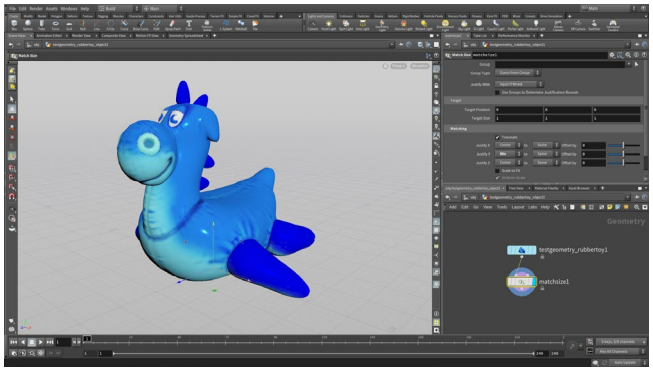
You can use **Shift +** and **Shift -** to turn subdivision display on and off on selected polygonal objects. This creates a viewport subdivide that lets you see what the shape would look like subdivided. These hotkeys set the **Display As** parameter which can be found at the object level on the object's **Render** tab.

Your object will not render with subdivisions unless you turn on **Render Polygons As Subdivision Surfaces** on the same tab.



PART TWO:
Copy Bricks to a Point Cloud

You are now going to create a cloud of points that match the shape of a particular piece of geometry. You are then going to instance the bricks to the 3D grid to create a brickified version. The instancing is generated by packing the brick geometry then instancing them to the points.

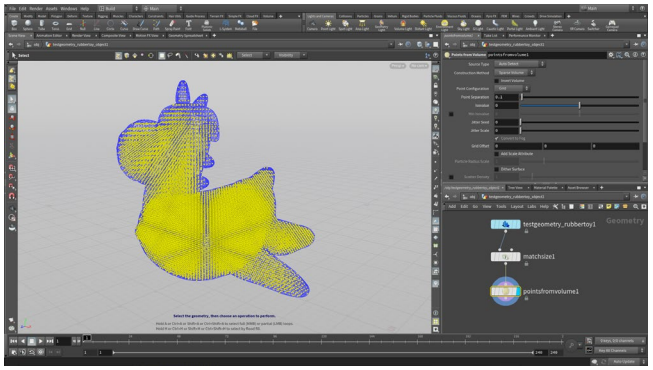


01 In the Scene View, press tab and start typing **Test...** then choose **Test Geometry: Rubber Toy.** Press **Enter** to place it at the origin.

Press i to dive into the *test geometry* object. Set the following:

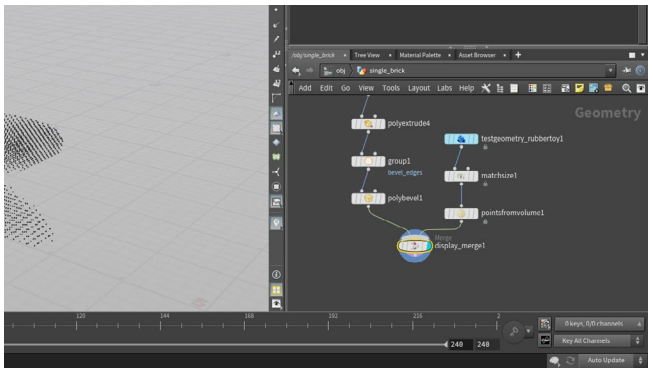
- **Uniform Scale** to **3**

Now add a Match Size node and set **Justify Y** to **Min**. This raises the toy so that it sits on the ground.



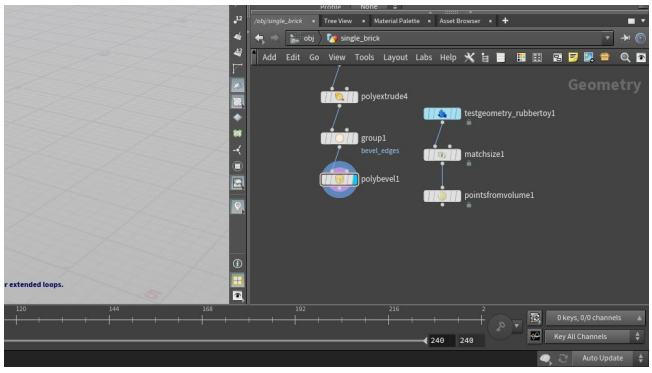
02 In the Network editor, **RMB-click** on the output of the *matchsize* node and type **Points...** then select **Points from Volumes** and place it's node in the network. Now set its **Display flag** to focus on the output of this new node.

Press s to go to the select tool and **press 2** to get point selection and then **press n** to select all the points which will highlight in yellow. You will copy the bricks to these points.

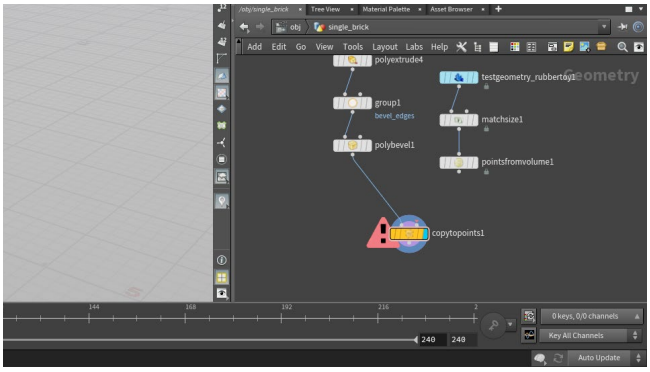


03 Press **u** to go back to the Object level and shorten the name of the rubber toy to *rubbertoy*. In the Network view, press the **shift** key and click on the *rubbertoy* and then the *single_brick*.

From the **Modify** shelf tab, select **Combine** to bring these objects together. You are taken to the geometry level and the nodes are feeding into a merge node.



04 In the Network view, select the *display_merge* node and press the **delete** key. Now the *polybevel* node chain is displayed and the other chain is not. Houdini lets you choose which node you want to display which would be the node that will be visible when you go back to the object level.

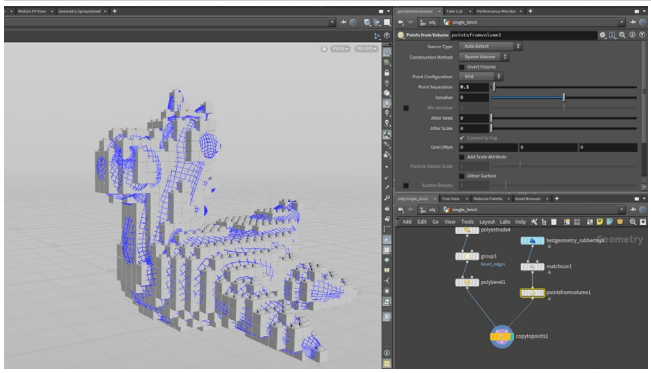


05

RMB-click on the output of the *polybevel* nod, start typing **copy...** and select **Copy to Points** node. Click to place the node below the two chains and set its **Display Flag**.

Turn on the **Pack and Instance** option. This is important because it will display the copied bricks much faster than if this option is off.

At this point there is an error on the node because we haven't connected the second input.

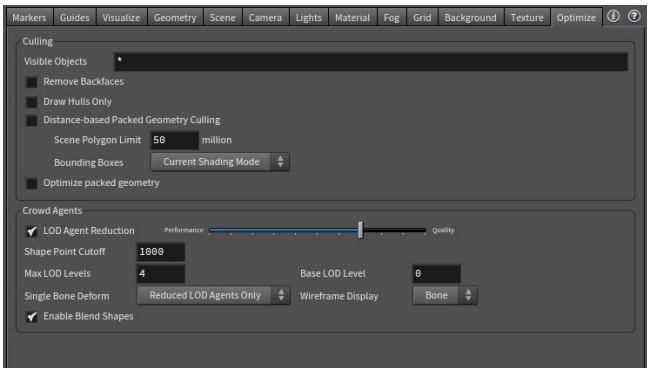


06

Click on the dot under the *pointsfromvolume* node then connect it to the second input on the *copytopoints* node.

The bricks appear to be overlapping. Go back to the *pointsfromvolume* node and set **Point Separation** to **0.2.**

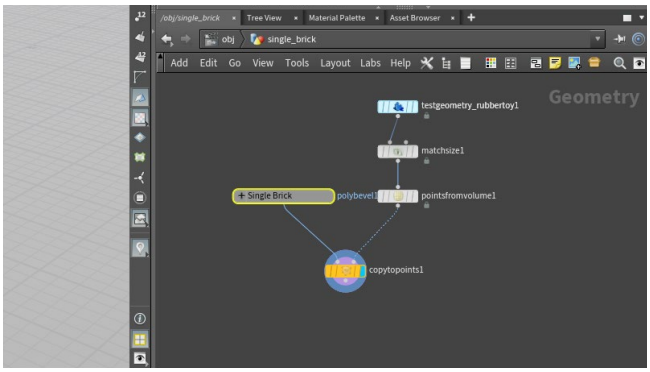
Now you are copying bricks to the points of the grid.



07

Click on the *copytopoints* node. Some of the bricks may appear dark grey and don't display the proper brick. This is because of geometry culling in the viewport. You can fix this with a display setting.

In the Scene View, press **spacebar-d** to bring up the **Display Options.** Click on the **Optimize** tab and either set **Scene Polygon Limit** to a number higher than **50 million** or set **Distance-based Packed Geometry Culling** to **OFF**. Close the floating panel. Now you can see all of the bricks being copied to the points as Packed Instances.



08

Before saving your work, let's Organize the network. Select the nodes that make up the single brick and press **Shift-O** to create a network box around them. Click on the title bar of the box and enter *single brick*. You can then collapse the box and move it down to de clutter the network a bit.

Save your work so far.

PACKED INSTANCES

If you leave **Pack and Instance** setting **OFF** on the copy to points node then you will end up with a large model with over a million points and primitives. This would make it very slow to manipulate in the Viewport because instancing is not being used.

If you turn it **ON** then the **338 points** on the brick model are packed up and instanced which leaves a much more efficient point count for the copy to points node.

Points	1,024,816	Center	0, 2.025, 0
Primitives	1,018,752	Min	-3.1, -0.5, -2.7
Vertices	4,075,008	Max	3.1, 4.55, 2.7
Polygons	1,018,752	Size	6.2, 5.05, 5.4

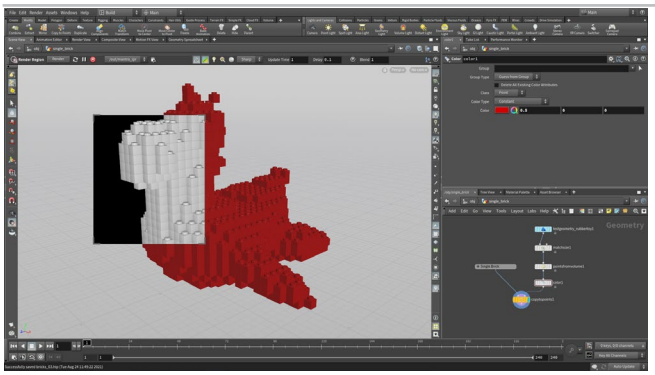
PACK AND INSTANCE | OFF

Points	3,032	Center	0, 2.025, 0
Primitives	3,032	Min	-3.1, -0.5, -2.7
Vertices	3,032	Max	3.1, 4.55, 2.7
Packed Geos	3,032	Size	6.2, 5.05, 5.4

PACK AND INSTANCE | ON

PART THREE:
Add Color and Switch to a Teapot

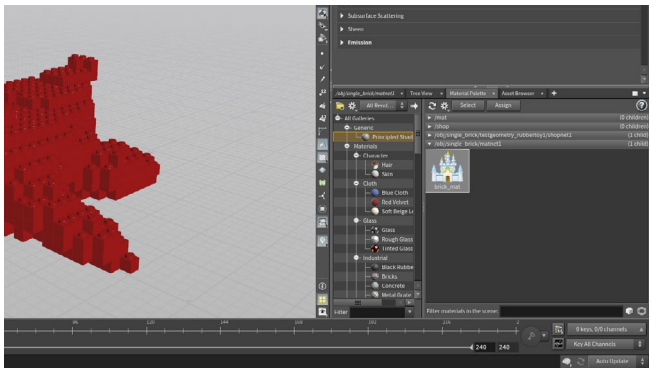
You are now going to add color to the points which will then be picked up by the instanced bricks. At first this transfer of color only applies in the viewport but setting up a proper material lets you set up the point colors for rendering the bricks. You will then set up a switch between the rubber toy and a teapot to make sure that your network works with different shapes.



01 Add a *color* node between the *pointsfromvolume* node and the *copytopoints* node. This will add color to the points which will get copied to the bricks. Change the **color** to **red** to help the bricks stand out against the background.

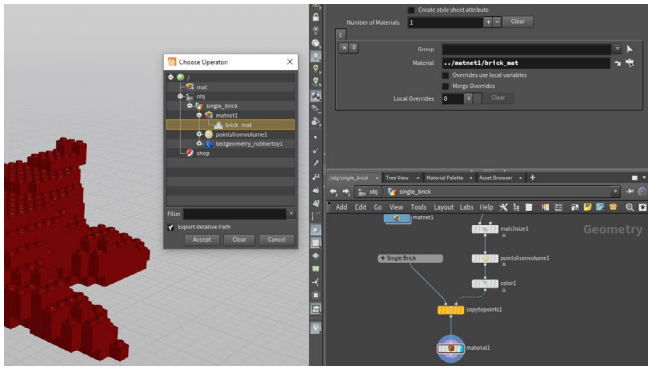
Click on the **Render Region** tool and drag a bounding box over the rubber toy. This kicks off a test Render and you can see that the bricks are not rendering as red. You need a material assigned that picks up the color.

Click the **x** button in the top right of the render region to close it.



02 Press **tab** in the Network view and type **Mat...** Choose the **Material Network** tool and click to place the node down in the network.

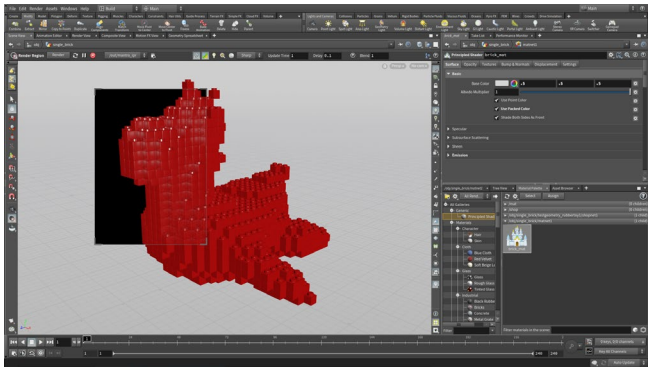
Go to the **Material Palette** and close */mat* and open up */matnet*. Drag a principled shader down into the *matnet*. Name it *brick_mat*.



03 Go back to the geometry network using the back button in the Network view. **RMB-click** on the output of the *copytopoints* node and type **Material...** Select **material** and place it's node in the network and set its **display flag**.

Click on the **Operator Chooser** button on the far right of the **Material** parameter. From the pop-up window, navigate to and highlight *brick-material*. Turn on the **Export Relative Path Option** and click **Accept**.

The material is assigned but the bricks still don't render.

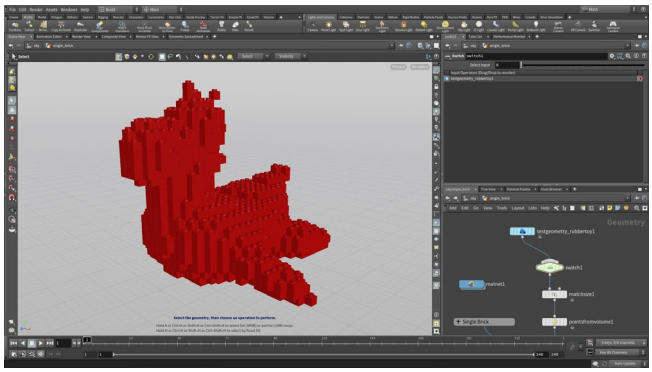


04 Go back to the Material Palette and select the *brick_material*. Click on the **Surface** tab then set the **Base Color** to **0.5, 0.5, 0.5** and turn **ON** the **Use Packed Color** option.

Click on the **Render Region** tool and drag a bounding box over the rubber toy. The rendered bricks should now be red.

If not then click **Render** in the top bar of the Scene view to make sure the changes have been applied.

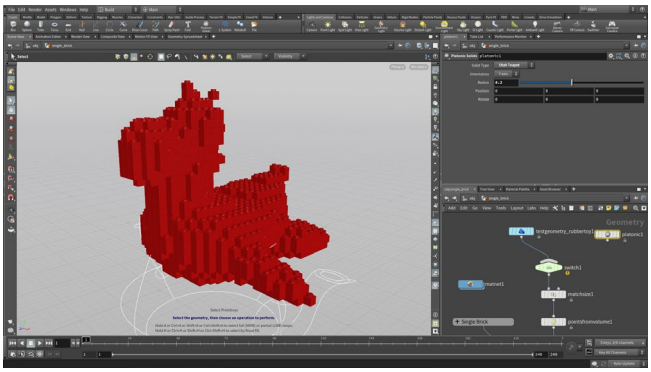
Save your work so far. Click the **x** button in the top right of the render region to close it.



05 Go back to the geometry network using the back button in the Network view. **Press s** to go to the select tool. In the Network view, press **tab** and type the word **Switch** then from the **Sourcing** folder drag it into the Network view.

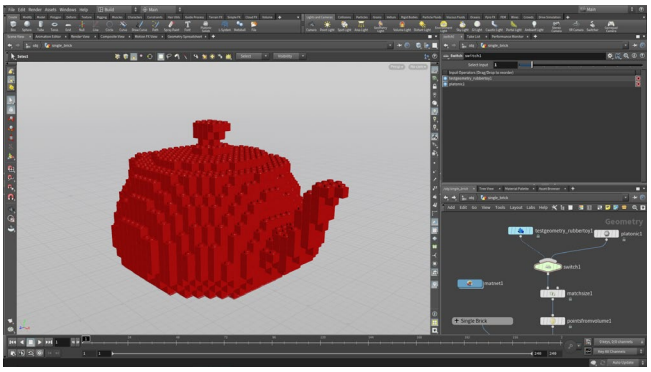
Next, drag it over the line connecting the *rubbertoy* node to the *matchsize* node. This inserts it into the network between the two nodes.

This node will make it easier to switch between different incoming shapes.



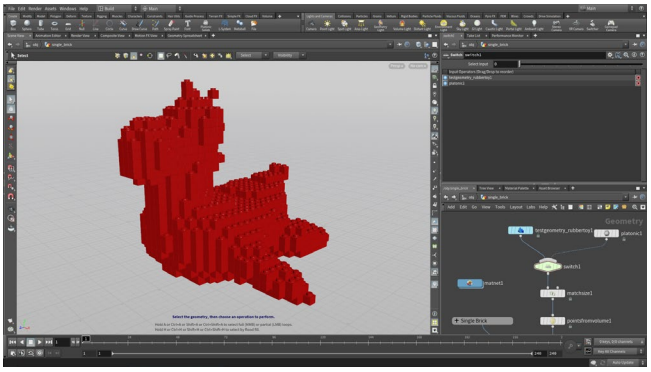
06 In the tool shelf, go to the **Create** menu and drag the **Platonic** tool down to the network view. This places a platonic node at the geometry level. Tools can be dragged into the network view as long as the node type makes sense for your current network level.

Set the platonic node's **Solid Type** to **Utah Teapot**. Set **Radius** to **4.2**. The volume from points node updates the points to match the volume and we have a new configuration of bricks.



07 Connect the output of the *platonic* node to the input of the *switch* node. Now you can select the *switch* node and change its **Select Input** to **1**. The platonic shape has been cubified using the same setup as the rubber toy.

This is one of the big benefits of a procedural system. Later you will package up this network into a custom tool called a digital asset. As a **digital asset**, it will be easier to share the network with others and to manage the tool as it gets deployed in a studio environment where changes and updates are inevitable as the tool evolves.



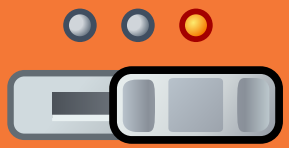
08 Use the *switch* node and set the **Select Input** to **0** to go back to the *rubbertoy*. You can now go back and forth between these two shapes and even add more shapes to see them brickified.

Save your work.

SWITCH NODE

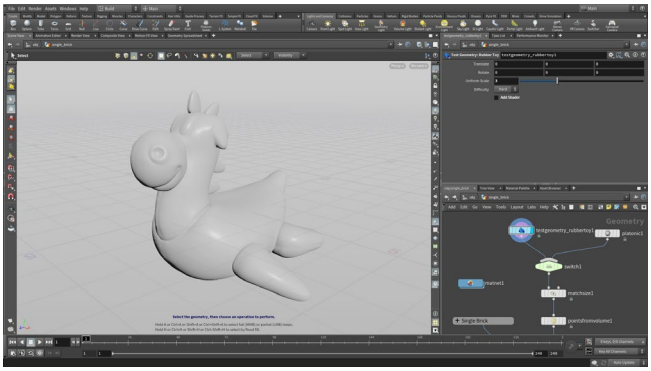
The **Switch** node is a great tool for providing options within a node network. This node lets you quickly explore multiple options without the need to wire and unwire different chains.

This node is also very useful when you wrap up your network into a **Digital Asset** because you can promote the switch to the asset as either a menu or a slider for quick access to different options.



PART FOUR:
Color the Points using a Texture

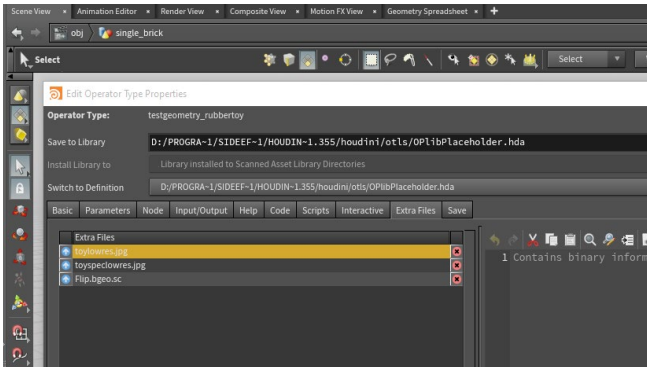
Earlier you added a color attribute to the points which affects the coloring of the bricks instances. Instead of using a single color, you are now going to use a texture map to create a more interesting look for the bricks. This will involve some special nodes to turn the texture into point colors.



01 Turn on the **Display Flag** on the *testgeometry_rubbertoy*. Select the *rubbertoy* node and in the Parameter pane turn **Off** the **Add Shader** parameter.

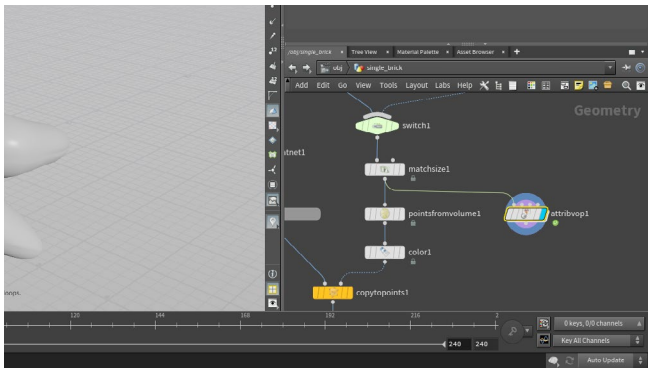
To hide the UV display in the perspective view, got to the **Display Options** bar and turn **Off** the **Show UV Texture when UV's Present** button.

You will bring back the color on the bricks using a different method that involves pulling the color from a Texture Map on disk.



02 From the **Asset** menu, choose **Edit Asset Properties > Rubber Toy**. In the **Properties** window, click on the **Extra Files** tab and select *toylowres.jpg*.

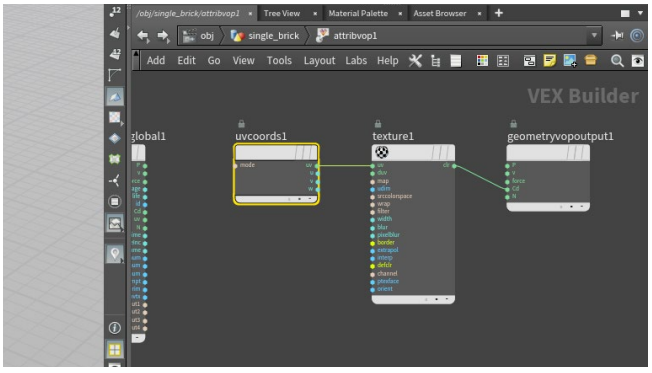
Click the **Save as File** button and save it into the *tex* folder. The texture was stored in the digital asset so that it could be shared along with the asset. You will use the texture on disk to add color to the bricks.



03 In the Network view, press **tab** and start typing **Attribute...** Select the **Attribute VOP** node and place it into the network beside the *pointsfromvolume* node.

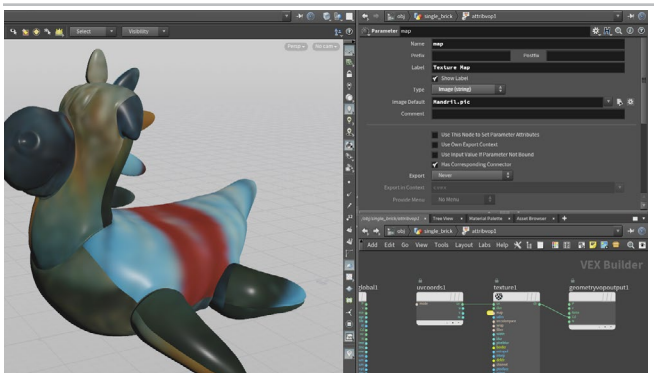
Feed the output of the *matchsize* node into the first input of the *attributevop* node. Set the **Display Flag** on this new node.

In the Parameter pane, set **Run Over** to **vertices**.



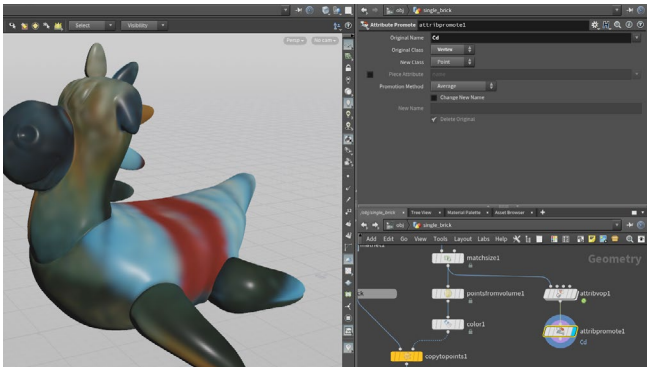
04 **Double-click** on the *attributevop* node to dive down and use the **tab** key to add a **Texture VOP**. Feed it into the **Cd** input of the *geometryvopoutput* node.

Add a **UV coordinate** node and feed it into the **UV** input on the *texture* node.



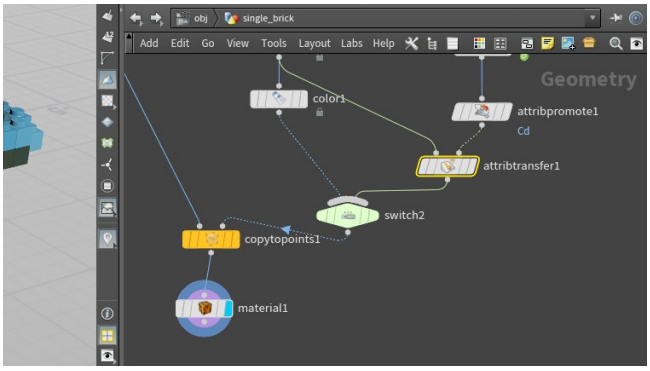
05 Select the *texture* node. Click on the **Gear** ⚙ icon on the far right of the **Texture Map** parameter and from the menu, select **Promote Parameter**. This will add this parameter to the upper level of this node.

Click on the little knob that appears next to map. In the parameter pane, change the **Label** to **Texture Map.**



06 **Press u** to go up one level. You can see the **Texture Map** parameter. Leave it set to the default **Mandril.pic** texture for now. You will add the *toylowres* texture map at the end.

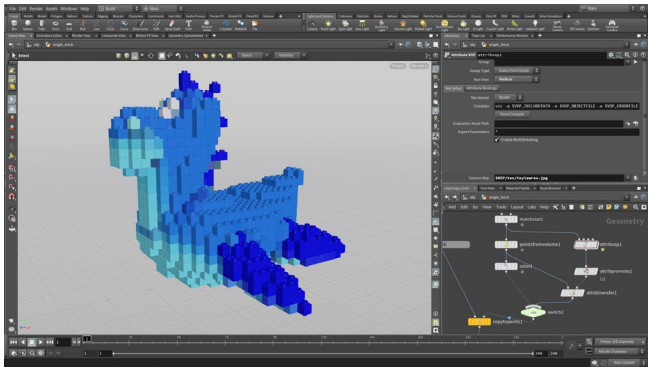
Add an **Attribute Promote** to the end of this chain. Set **Original Name** to **Cd** and **Original Class** to **vertex**. Leave **New class** set to **Point**.



07 Add an **Attribute Transfer** node. Wire the *pointsfromvolume* into the first input and *attribpromote* into the second. In the **Attributes** tab click on arrow on the right side of the **Points** field and choose **Cd**.

Add a switch node after the *color* node and wire the *attribtransfer* node into the switch. Rename this node *texture_switch*.

Set the **Switch** to **1**. Set the **Display Flag** on the *copytopoints* node. Now you can see the colors from the texture map being transferred to the copied points and therefore to the copied bricks. Set the **Display Flag** on the *material* node.



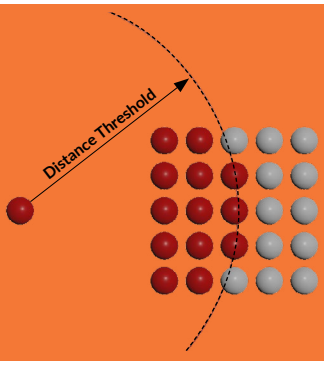
08 Select the *attribvop* node and click on the **File** button on the far right of the **Texture Map** parameter and navigate to the *toylowres.jpg* texture and click **Accept**. You can see that the texture map colors are now being assigned to the vertices.

Save your work.

ATTRIBUTE TRANSFER

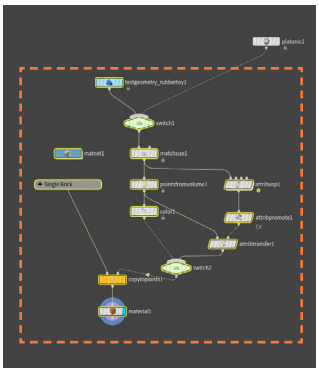
When you want to get attributes from one piece of geometry to another, you can use Attribute Transfer which uses a **Distance Threshold** along with other parameters to get the attributes copied over.

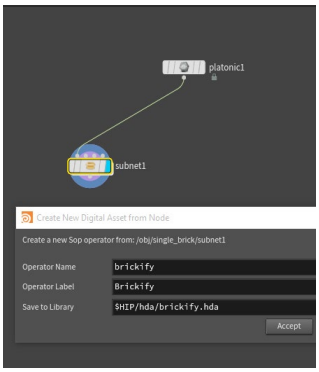
In the case of the rubber toy, you are transferring the **Cd** attribute from the points on the geometry to the point cloud that is used to copy the bricks. You could also copy attributes such as UVs or Capture Weights.



PART FIVE:
Create a Brickify Digital Asset

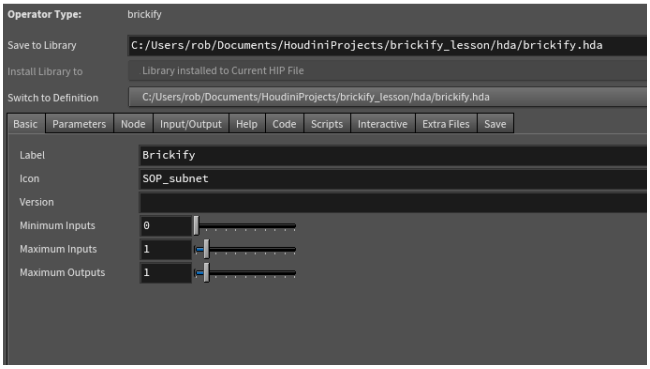
Now that the brickify recipe is working and the nodes are wired together properly, you are going to wrap up some of the nodes to create a single Houdini Digital Asset [HDA] node. Now you can share the network with parameters from inside the asset promoted to the top level to create an interface that can generate unique results each time the asset is used.





01 In the Network view, drag the *platonic* node off to the side. Select all the other nodes in the network and from the **Assets** menu, select **New Digital Asset From Selection...**. This will collapse them into a single node.

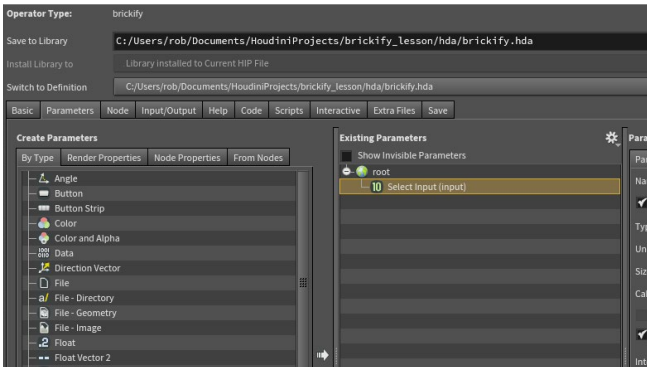
Set the **Operator Name** to *brickify* which in turn changes the **Operator Label** to *Brickify*. Click on the button on the far right of **Save to Library**. Select $HIP in the Location sidebar and then double click on the *HDA* directory. Press **Accept** then click **Accept** again in the **Create New Digital Asset** dialog.



02 This brings up the **Type Properties** window and make sure the **Basic** tab is visible. Set **Minimum Input** to **0** so that you don't "require" an input for the asset to work. The **Maximum Inputs** parameter is set to 1 which defines how many inputs nodes you will allow.

This is the input that is currently connected to the platonic node. When you use this digital asset later, you will use this input to point it to a different shape.

Press **Apply**. **DON'T** press **Accept** because it will close the window.



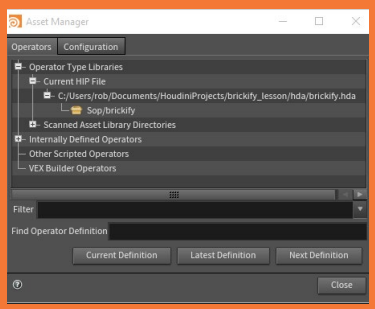
03 In the Network view, **rename** the new asset node *brickify_asset* and **double-click** to dive into it. Click on the *switch* node that is switching between the *testgeometry_rubbertoy* and the *Subnetwork Input* node. The input node is bringing in the platonic teapot shape from the level above.

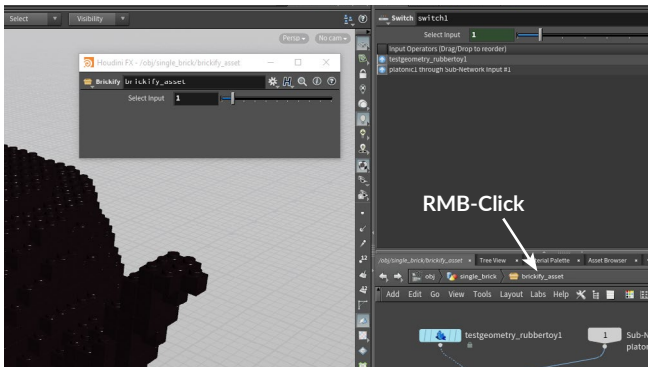
In the **Type Properties** window, click on the **Parameters** tab. Click on the **Select Input** parameter name and **LMB-drag** it to the **Existing Parameters** list in the **Type Properties** window. Drop it on the root to add it to the UI. Click **Apply** which adds the parameter but doesn't close the Type Properties window.

WHAT IS AN .HDA FILE?

When you saved your asset, it creates a **.hda** file on disk. HDA stands for **Houdini Digital Asset** and the asset definition is stored in this file then referenced into your scene. This file contains information about the nodes, the promoted parameters, UI elements and more. This file can be referenced by multiple people into different shots for a shared experience.

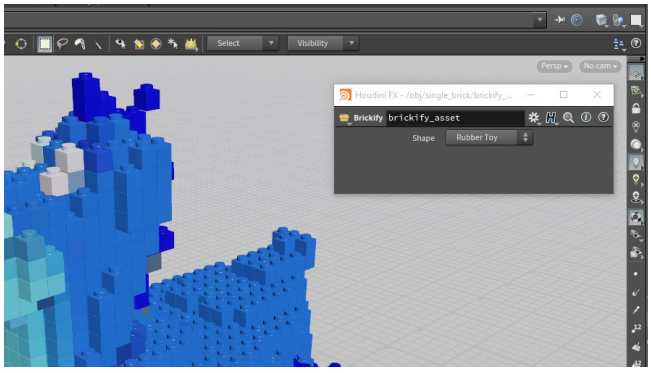
The assets being referenced into your scene can be managed by going to the **Assets** menu, selecting **Asset Manager...** and opening **Current HIP File** .





04 **RMB-click** on *brickify_asset* in the Network View's path bar and choose **Parameter and Channels > Parameters**. Now you have a floating Parameter window with the two *brickify* asset parameters. These are the parameters that will be available to anyone who uses this asset. Let's add some more.

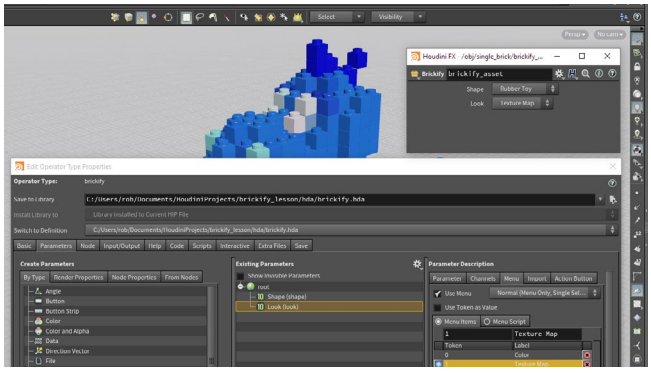
The *brickify* node has a new parameter. Change its value from **0 to 1** and back to see how it affects your scene. The problem is the name isn't very appropriate and a menu would work much better than a slider in this case, so you are going to refine the UI using the Type Properties.



05 In the parameter list, click on the *Select Input* parameter. To the left are options for refining how people see it. Change its **Name** to *shape* and its **Label** to *Shape*.

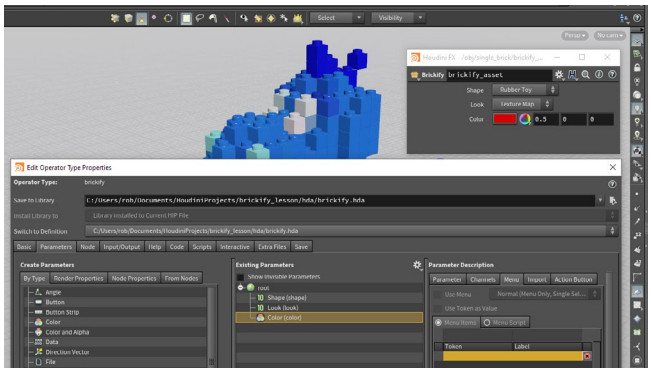
Now click on the **Menu** tab and turn on **Use Menu**. Now under menu items, type **0** under **Token** and *Rubber Toy* under **Label** then press enter. Next type **1** under **Token** and *Custom Shape* under **Label**. Press **Apply**.

Now in the floating parameter pane, you see a **Shape** parameter with a menu. Try it out to see how it works.



06 Select the second *switch* node that sits just under the *color* and *attributetransfer* nodes and promote the **Select Input** parameter to the parameter list. Change its **Name** to *look* and its **Label** to *Look*.

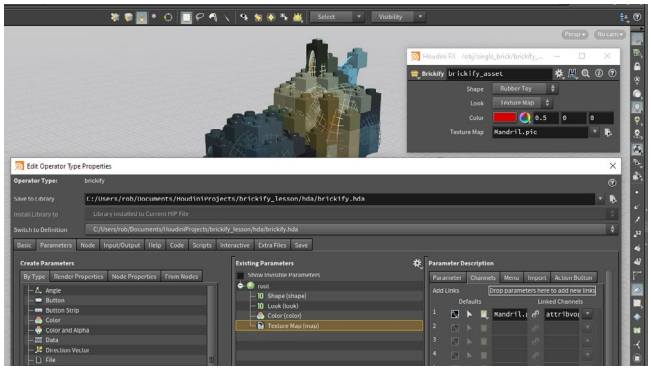
Now click on the **Menu** tab and turn on **Use Menu**. Now under menu items, type **0** under **Token** and *Color* under **Label** then press enter. Next type **1** under **Token** and *Texture Map* under **Label**. Press **Apply**.



07 Now select the *color* node in the network and promote the **Color** parameter to the parameter list. This brings over the color widget and the color wheel as well as the RGB fields.

Press **Apply** in the Type Properties window to see what this parameter looks like in the *brickify_asset* parameter interface.

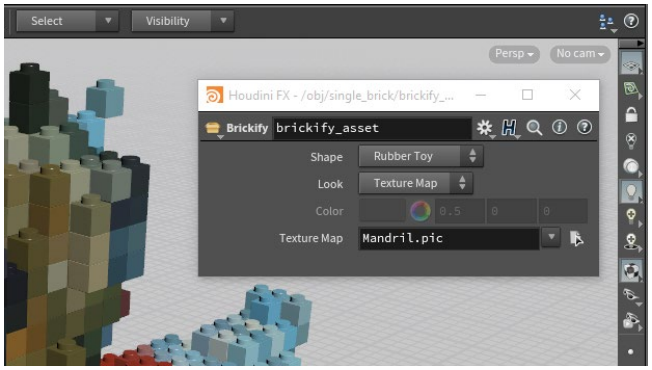
Note: If you press **Accept** by mistake the new parameter is saved to the asset but you will need to use the **Asset** menu and choose Open **Edit Asset Properties... > brickify** to reopen it.



08 Now select the *attributevop* node and promote the **Texture Map** parameter to the parameter list.

In the Parameter description section, click on the **Channels** tab and change the **default** value to **Mandril.pic**. This is a default texture map that doesn't require a path to load and is a more reliable default. Later you will reload the *toylowres.jpg* texture map.

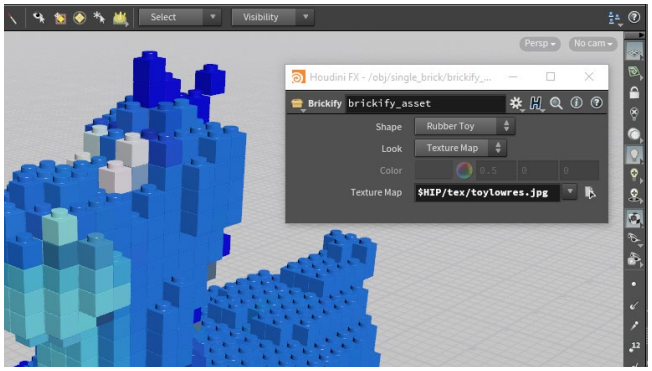
Press **Apply** in the Type Properties window and you will see this parameter in the *brickify_asset* parameter interface and the Mandril texture map is now coloring the bricks.



09 To make it clear which parameters are associated with which shape, you can disable and enable them based on the menu choice. Click on the **Color** parameter and in the **Disable When** field, enter `{ look != 0 }`.

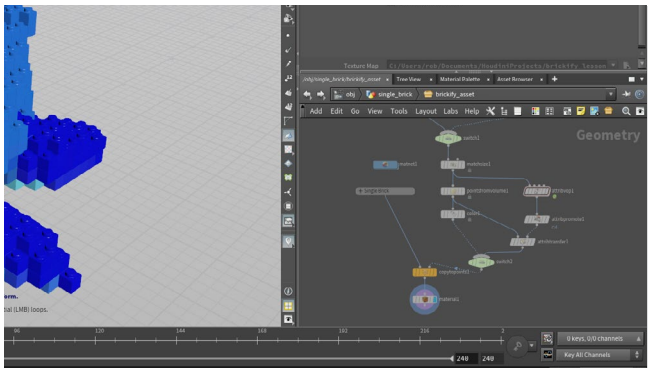
This tells this parameter to disable whenever **Color** has not been chosen in the Look menu. Next, click on **Texture Map** and in the **Disable When** field enter `{ look != 1 }`.

Press **Apply** and test the results using the **Shape** menu. You can see the parameters disabling when they are not needed. You could also hide them with the **Hide When** option but disabling is fine for now.



10 The *brickify_asset* **texture map** parameter now defaults to **Mandril.pic** which is a more versatile default because it is a texture map that will always be available. To go back to the toy map, you can click on the file selector next to **Texture Map** and again click on *$HIP* then dive into the *tex* directory and select the *toylowres.jpg* file.

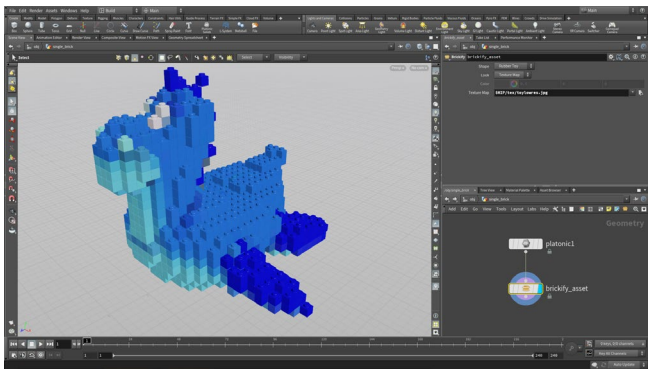
The asset is now using this texture map while *Mandril.pic* is still the default. You can tell it isn't the default because the text is bolded. The Mandril is still the default but now you are using a different map for this instance of the asset.



11 Now press **Accept** to save the changes to your asset and close the Type Properties panel.

In the Network view, **press u** to go back up one level. With the *brickify_asset* node selected, choose **Assets > Lock Asset > Brickify** from the main menu. Press **Save Changes i**f prompted.

If you **double-click** on the *brickify_asset* node to dive down, you can see that the network is greyed out and these nodes are protected. You can only manipulate this asset using its parameters. You will have to unlock the asset to make changes to its inner workings.



12 Go to the Object level. Now **Save** your scene file to preserve the work you have done so far.

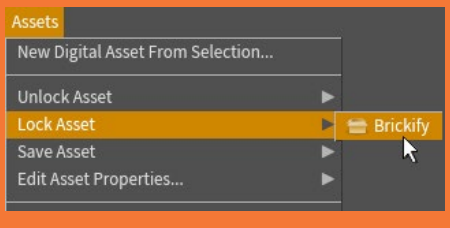
You now have the scene file and the .hda file which is being referenced into your scene to create the asset. You can use this library to create other instances of the asset in this scene or to add the asset to another scene.

In the next section, you will test out your asset and find out if it is working properly. It is always good to have one working asset and one for testing to make sure it is doing what you want it to do.

LOCKING AND UNLOCKING ASSETS

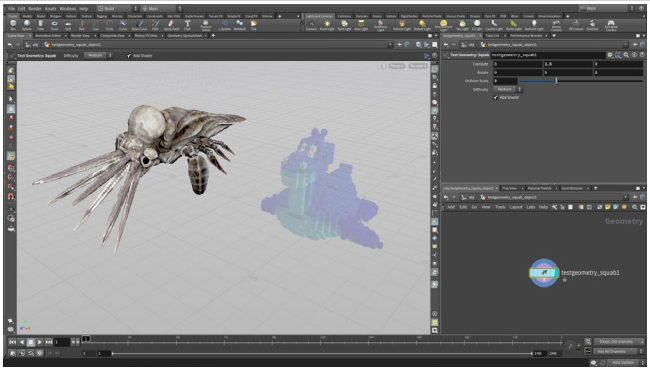
You can lock and unlock selected assets using the **Assets** menu. When the asset is **locked**, it references the HDA file to determine how the asset behaves. If the asset is **unlocked** the active definition is in your scene file. When you lock it you will be prompted to save if there are changes.

If you **RMB-click** on the asset node you can **Allow Editing of Contents** to unlock the asset or **Match Current Definition** to lock the asset but be careful because there is no prompt to save and changes might be lost.



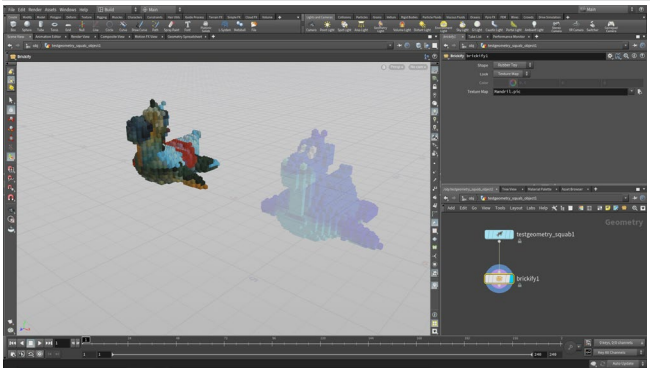
PART SIX:
Test the Digital Asset

A Digital Asset can be instantiated more than once in a single scene file. You are going to use this asset on a different piece of geometry to test how it works. It is always good to have a test version available so that changes set to the first asset can be quickly verified. The asset can also be used in other scene files once you have it working properly.



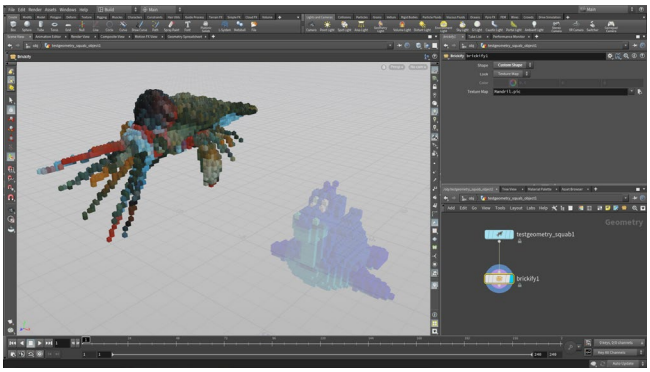
01 Use the **tab** key to get the **Squab Test Geometry**. Press **Enter** to place it at the origin then use the handle to move it to the side away from the rubber toy.

Double-click on the new object node to dive down to the geometry level. Select the node and set **Scale** to **3** and **Translate Y** to **1.5**. This will make the Squab a bit bigger than the rubber toy.



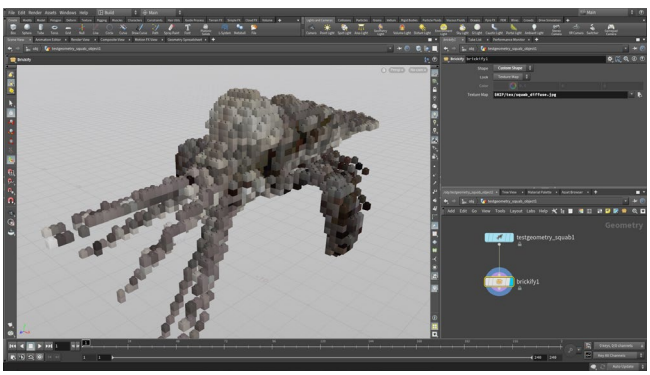
02 **RMB-click** on the output of the test geometry node and start typing **brickify...** then select the **brickify** asset from the menu. This places the asset into this new network.

Set its **display flag** and you will see another Rubber Toy colored by the **Mandril** texture map. This is because these are the defaults for this asset.



03 On the *brickify* asset node, set the **Shape** parameter to **Custom Shape** and how the squab is being brickified. The new shape is running through the node network inside the asset to create a unique result. The shape will be lifted above the ground some more because of the **Match Size** node inside the asset.

This is how digital assets become tools that you can put into your pipeline to package up multiple actions into a single node. This is an approach that speeds up your workflow and helps you achieve more consistent results.



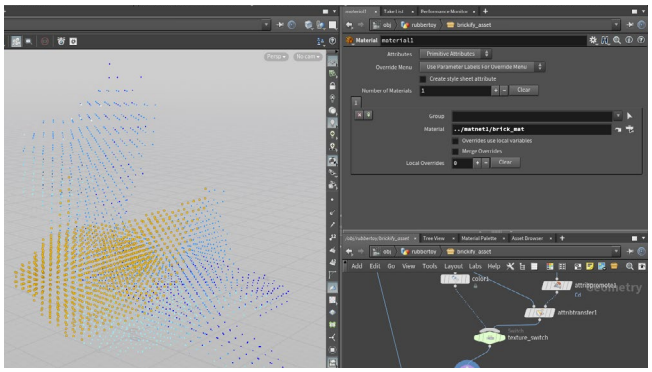
04 Select the *testgeometry_squab* node. From the **Asset** menu, choose **Edit Asset Properties > Squab**. In the **Properties** window, click on the **Extra Files** tab and select *squab_diffuse.jpg*. Click the **Save as File** button and save it into the *tex* folder. The texture was stored in the digital asset so that it could be shared along with the asset.

Now use this texture on disk to add color to the bricks using the *brickify* node's **Texture Map** parameter.

When you are finished, go to the object level and **name** this object *squab* and the other one *rubbertoy*. **Save** your work.

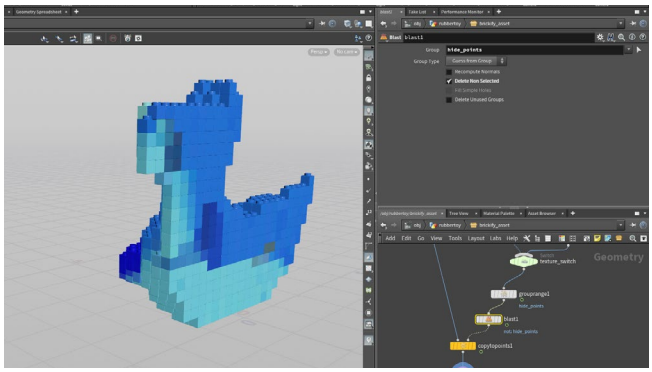
PART SEVEN:
Animating the Bricks

It is possible to continue adding features to the asset and you will create an automating build-up animation for the bricks. This will involve adding more nodes to our network to make sure the asset has this new functionality. Once the results are saved into the .hda file, the features will be available for use by anyone using this asset in their work.



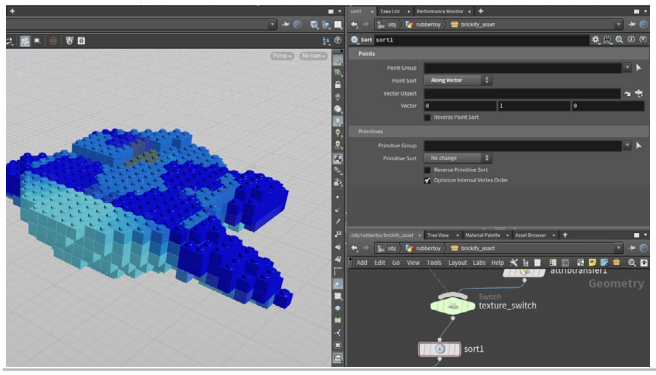
01 Hide the *Squab* object and dive into the *rubbertoy* object. Select *brickify_asset* and choose **Assets > Unlock Asset > Brickify**. **Double-click** on *brickify_asset* node then **RMB-click** on the output of *texture_switch* and select **Group by Range**. Place the node and set its **Display flag** then set the following parameters:

- **Group Name** to *hide_points*
- **Group Type** to **Points**
- **Range Type** to **Start and Length**
- **Length** to *($F-1)*20*
- Under **Range Filter**, leave **Select** to **1** and **Of** to **1**



02 **RMB-click** on the output of the *grouprange* node and select **Polygon > Blast.** Place this node down then using the arrow next to **Group**, select the *hide_points* group. Now turn on **Delete Non Selected** to delete points outside the group. Set the **Display flag** on the *blast* node.

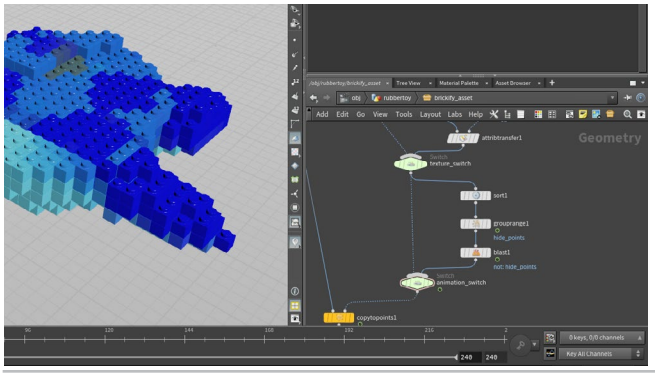
Press play to watch as the points grow with every frame. Now set the **Display flag** back to the *material* node at the end of the chain and watch the bricks grow over time.



03 Right now the bricks are coming in from one side instead of from the ground. This is because the points are appearing based on their point numbers. To control this, you need to reorder the points to create the look you want.

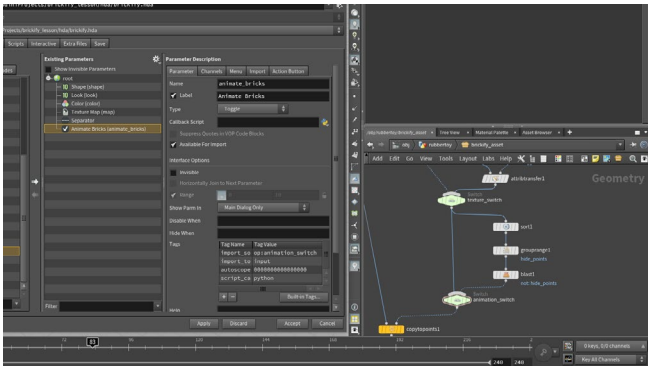
RMB-click on the output of the *texture_switch* node and type **Sort...** then select the **Sort tool.** Place this node down and change **Point Sort** to **Along Vector**. With this set to **0, 1, 0**, the points start at the bottom and go up.

Playback to see this result. Test out different vectors to see how it affects the animation.



04 To let you choose whether you want to animate the brickify effect, you can add another switch node. In the Network view, **Press tab** and start typing **Switch...** Choose **Switch** and place the node down. Rename it *animation_switch*.

Click on the output of the *texture_switch* node and feed it into the input of the *switch* node. Repeat for the *blast* node. This makes the original shape the first option and the animated effect the second option. Changing **Select Input** to **1** will reveal the animated bricks but for now keep it at **0**.



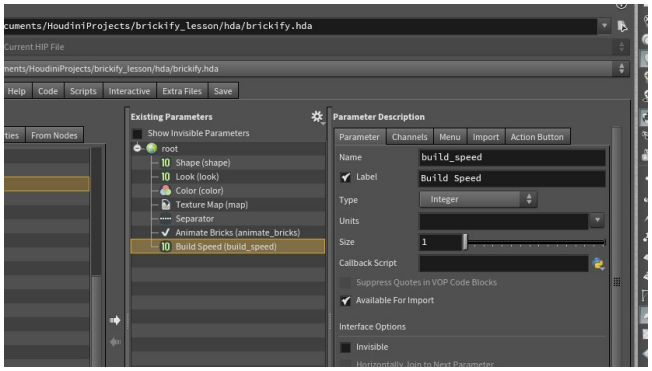
05

From the **Assets** menu, select **Edit Asset Properties > Brickify.** Go to the **Parameters** tab and drag a **separator** from the **Create Parameters** section to the bottom of the list.

Next, drag the *animation_switch* node's **Select Input** from the Parameter pane to just under the new separator. Set its **Name** to *animate_bricks* and its **Label** to *Animate Bricks*. Next, change its **Type** to **Toggle** which limits to you an **on[0]/off[1]** setting.

In the **Parameter Description** section, click on the **Channels** tab and set the default value to **0 [off]**.

Click **Apply** to save changes.



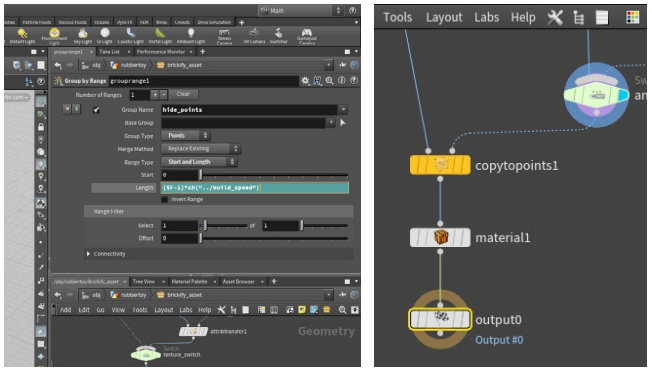
06

From the **Create Parameters** section in Type Properties, drag an **Integer** parameter under the *animate_bricks* parameter. Set its **Name** to *build_speed* and its **Label** to *Build Speed*.

Turn on the **Range** option then set the first value to **1** and the second value to **20**. Click on the **lock** next to 1 to make sure the number never gets smaller than 1.

In the **Parameter Description** section, click on the **Channels** tab and set the default value to **1**.

Press **Accept** to save and close the window.

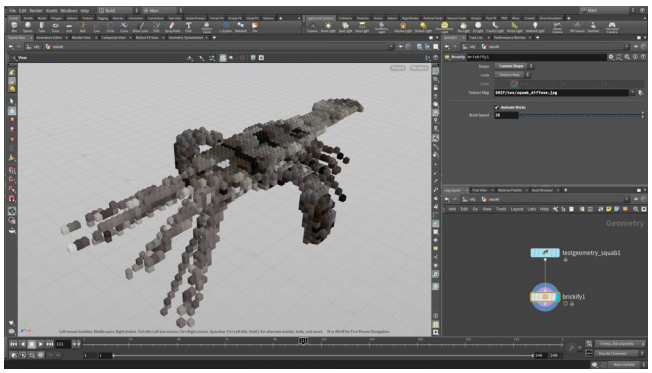


07

This parameter isn't attached to anything yet but you will now use it to drive the *grouprange* node's **Length** expression. Select the new *grouprange* node and change the **Length** expression to: `($F-1)*ch("../build_speed")`

Go to the end of the network and add an **output** node after the *material* node. This will ensure that you get the right output for your asset even if the **Display flag** is on another node in the network.

With the *brickify_asset* node selected, choose **Assets > Save Asset > Brickify** from the main menu. This lets you save this expression to the .hda file without re-opening the Type Properties window.



08

With the *brickify_asset* node selected, choose **Assets > Lock Asset > Brickify** from the main menu. You now have the brickify effect wrapped up into a custom tool which can be used on different shots by different artists.

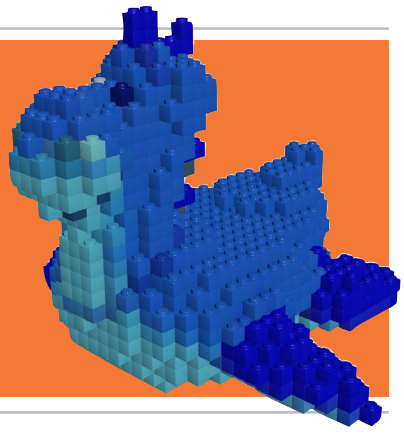
Go to the Squab network where the new features are available on the *brickify* node. Turn on the **Animate Bricks** toggle and set the **Build Speed** which might need to be set to around **25** because of the large number of bricks in this shape.

Playback to see the results.

CONCLUSION

You have now created a shareable tool which was built without writing scripts using a node-based workflow which is easily accessible to artists. By saving the HDA to disk, it becomes an asset on disk that can be referencing into multiple shots.

Houdini Digital Assets offer a powerful way for artists to share these kinds of tools in support of a studio-level production. These procedural assets make it easy to automate repetitive tasks and to stay focused on the creative needs of your project.



HOUDINI ENGINE
Loading HDAs into other Apps

Once you have a Houdini Digital Asset [HDA] saved on disk, it is possible to load that asset into a host application using the Houdini Engine plug-ins. These let you share assets with colleagues who can load them directly into 3D apps such as Autodesk Maya or 3DS Max or into game editors such as Unity or Unreal Engine.

01 To use the Houdini Engine in any of these applications, you need to first install the plug-ins using the Houdini installer. This will make the plug-ins available but you may need to take further steps to make the Houdini Engine available within your session.

Visit the following page for details:

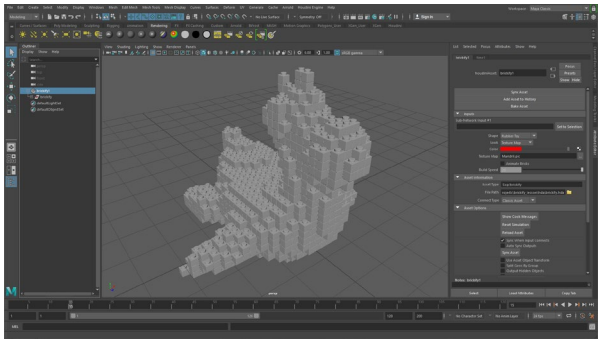
SideFX.com/engine

Click on the Engine Plug-ins tab and then click on the desired plug-in for more information.

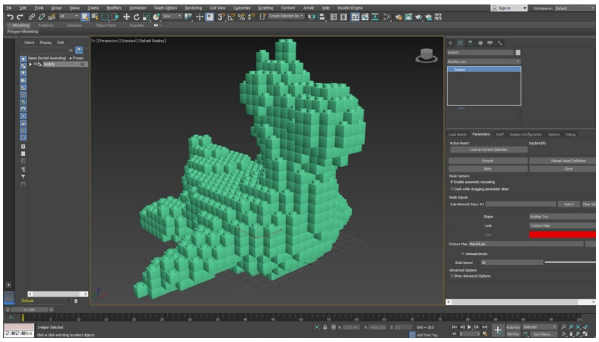
02 Once you have the plug-in installed you can load the asset using either the Houdini Engine menu or in UE4, the Import button. This will bring the brickify asset into the viewport while the asset parameters become available for manipulation.

You can also set **Shape** to **Custom Shape** and connect the asset to geometry within the host application and the brickification will be applied to that object.

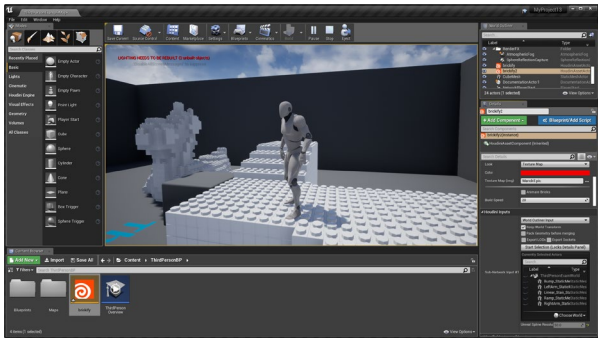
You can also turn on animation for Maya or 3ds Max and play it the sequence using the timeline.



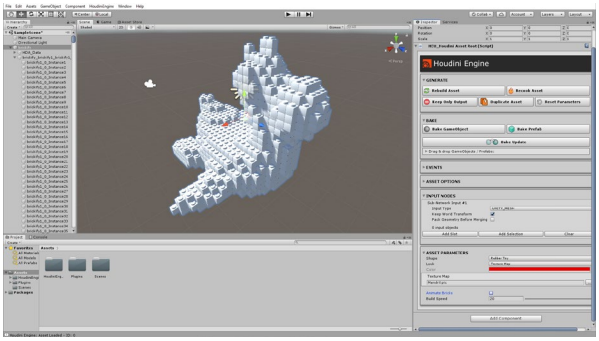
Autodesk Maya



Autodesk 3ds Max



Unreal Engine



Unity

WHAT HAPPENED TO THE BRICK COLORS?

You may notice that none of the brickified shapes are showing the brick colors within the various host applications. This is because the plug-ins don't always process information the same way as Houdini would. The point colors are still part of the asset but the host application is not receiving this information.

And while the animation works in Maya and 3ds Max, it would not make sense in Unity and Unreal Engine because Houdini assets can not become part of the runtime experience of a game therefore the built-in animation would be ignored. It is important to tailor your assets for the capabilities of the host application.