LESSON ONE

Quickstart

Welcome to the world of Houdini. This tutorial offers an introduction to this amazing software which lets you build models, animate and create visual effects using an artist-friendly node-based workflow.

In the introduction chapter, you had the chance to read about all the different ways in which Houdini is used and what toolsets are available for you to play with. Now it is time to roll up your sleeves and create your first Houdini scene.

In this lesson you will explore a variety of modeling tools as well as tools for fracturing your objects using rigid body dynamics. You will soon see that it is just as much fun smashing up objects in the virtual world as it is in the real world. Lets get started!

LESSON GOAL

To model a circular arrangement of columns then smash them up using rigid body dynamic fracturing.

WHAT YOU WILL LEARN

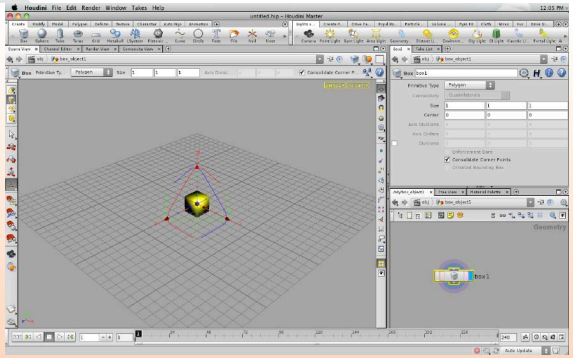
- How to add detail to a box using the polyextrude and polybevel tools.
- How to use Houdini's node-based workflow to create and refine your work.
- How to utilize rotational and axial symmetries to model efficiently.
- How to set up a rigid body dynamics simulation.
- How to make your objects breakable to create a smashing simulation.
- How to set up lights and cameras then render out your work as an image sequence or quicktime movie.

Along the way you will get to use different aspects of Houdini's user interface. Be sure to refer to the overviews and quick reference guide in the introduction to remind yourself of how these UI elements work together.

This lesson can be completed using Houdini Escape for the modeling and rendering of the columns and Houdini Master for the rigid body dynamics.

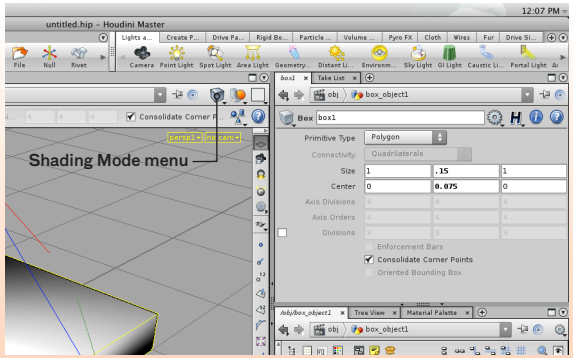
Build the Base of the Column

To create the base of the column, you will start with a simple box then use polygon tools such as polyextrude and polybevel to give it shape.



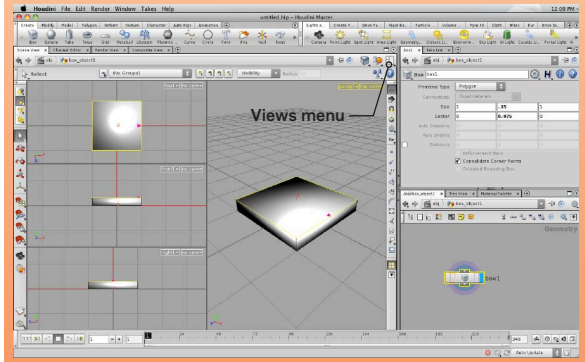
1 From the **Create** shelf, click on the **Box** tool. Move your cursor over the Scene view and press **Enter** to place it at the origin. The object appears with handles. Don't touch these handles because you want the object at the origin.

At the top left of the **Scene view** is the **Operation Controls** bar. Next to the word *Geometry*, click on the **Jump to Operator** button to dive into this object. This takes you to the **Geometry** level where you can shape your object. You can also press **i** to dive into the object.



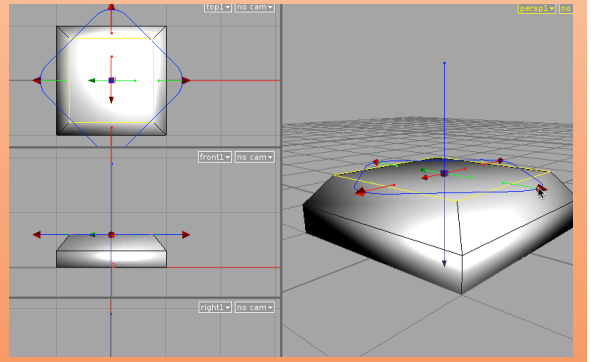
2 In the Parameter pane, change **Size Y** to **0.15** and **Center Y** to **0.075**. In the scene view, you can use **Spacebar-LMB** to tumble, **Spacebar-MMB** to track and **Spacebar-RMB** to dolly the view. When you finish, you can also press **Spacebar-g** to focus on the box.

From the Scene view's top right, change the shading to **Smooth Wire Shaded**. This will let you see all the modeling details of the surface as you work.



3 In the Views menu, [see sidebar tip] set the view layout to **Four Views Split Left**. This will show you one big 3D view, and three smaller orthogonal views. From the same menu, choose **Link Ortho Views**. You can now track and dolly in the ortho views and they all stay the same size. These views will help you as you work on the model.

Press **s** to get the **Select** tool. Click on the box's top face to select it. Its edges are highlighted in yellow to indicate that it has been selected.



4 From the **Polygon** shelf, click on **PolyExtrude.** In the side view, use the vertical line at the center of the extrude handle to extrude the face up using along the Y axis. This restricts movement to the vertical axis.

Next, in the top view, click on the handle's outer arrow to scale the face in a bit. Scaling works here since the face is square, but if it were rectangular or n-sided then it would be better to use the **Inset** parameter which brings the extrude in evenly on all sides.

TIP

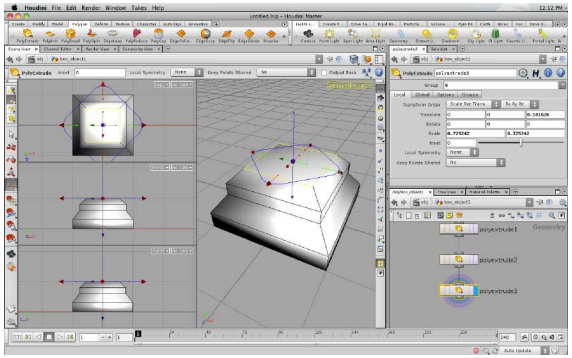
WORK WITH MULTIPLE VIEWS

When Houdini opens, you are looking through a single 3D view. You can work with this view by tumbling around to review your work.

Another option is to use the **Views** menu in the top right of the Scene view to choose a multi-view layout.

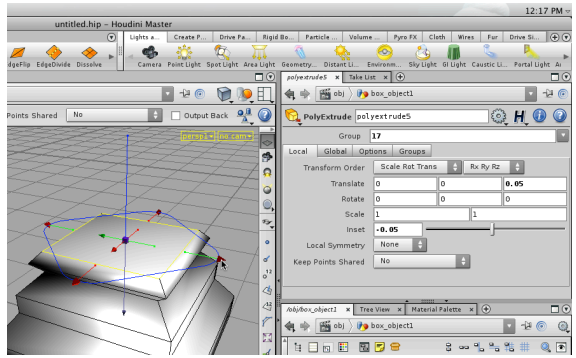
Views Menu

These views let you look at your scene from the top and sides. You can then use **spacebar-b** to toggle between single and multi views.



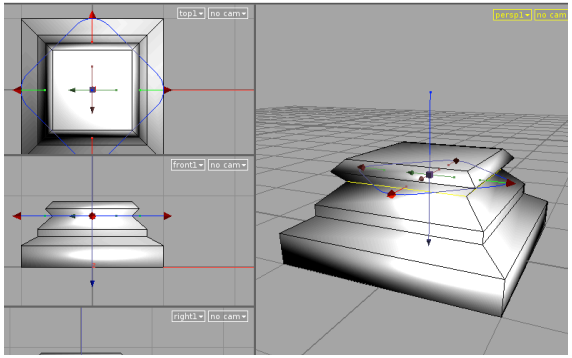
5 Press **q** to repeat the **Polyextrude**. Lift the new handle straight up to add another flat side. Press **q** again then lift and scale the new face to create another inset face. The q hotkey makes it easy to do many repetitive steps which often happens when modeling in 3D.

At this point, don't worry about matching what you see perfectly. In a couple of steps, you will use the nodes in the network to step back and tweak the results. For now you are simply putting all the parts in place.



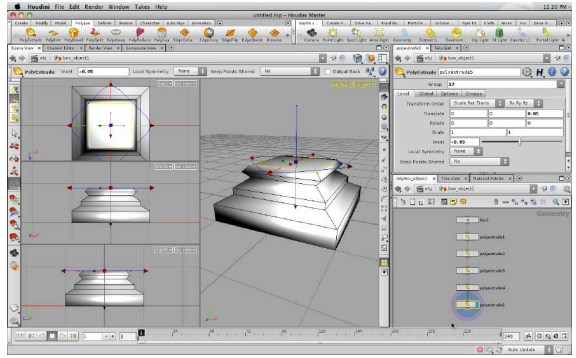
6 **PolyExtrude** again and move straight up along the Y axis by about **0.05**. **PolyExtrude** again. This time go to the Parameter pane and set the **Translate** value to exactly **0.05** and **Inset** to **0.05**. **PolyExtrude** one last time. Set **Translate** to **0.05** and **Inset** to **-0.05**.

These last two polyextrudes create the top surface of the base. By using the Parameter pane, you can input exact values to get the size and shape that you need.



7 In the Network view, you can see how each extrude creates a node. Make sure the Handle tool is active then select one of these nodes. In the Scene View, you can use the handle to refine the shape.

As you can see, your changes affect the results of subsequent nodes. You can click through the various polyextrudes and either translate or scale to change the geometry's shape. You are using the nodes to affect the construction history of the geometry.



8 Keep refining the extrudes until you get a shape that looks like the above image. You can refer to the side view to make sure that the profile matches. If you ended up with too many extrude nodes then delete any extra ones and limit your model to six *PolyExtrudes*.

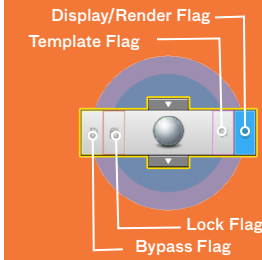
Very Important: When you are finished, be sure to select the last node before moving forward. The active node highlighted in yellow defines the working geometry in the Scene view and you need to work with the end of the chain.

NODE FLAGS AND HIGHLIGHTS

TIP

Houdini nodes have several different flags and highlight states which control how the node is viewed and how data flows through it.

The display flag puts a **small circle** around the chosen node. The **bigger circle** denotes a render flag which typically moves with the display flag. To set the render flag on a different node then use the **Alt** key.



The **lock** and **bypass** flags affect how data flows through the node. Lock ignores the nodes coming into the node and bypass ignores this node within the chain.

The currently selected node is highlighted in **yellow** indicating that it is active in the viewport even if the display node is somewhere else in the network.

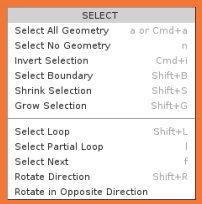
SELECTING GEOMETRY IN THE VIEWPORT

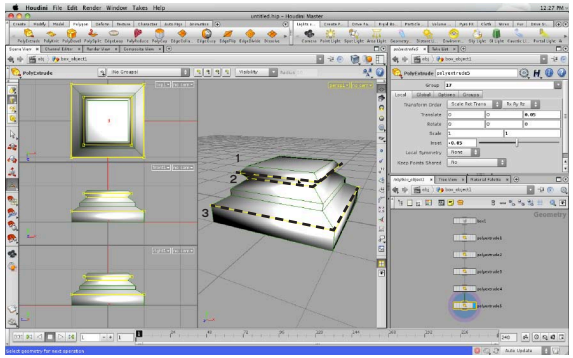
TIP

Working with geometry often involves making a selection, then acting on that selection. In Houdini, you can make the selection first and the tool will use that selection or you can start with nothing selected and the tool will prompt you.

The **Select** tool is the easiest way to make geometry selections in anticipation of another action. You can also make selections while using the transform tools and sometimes the handle tool. In these cases, you put yourself in selection mode once you start picking geometry.

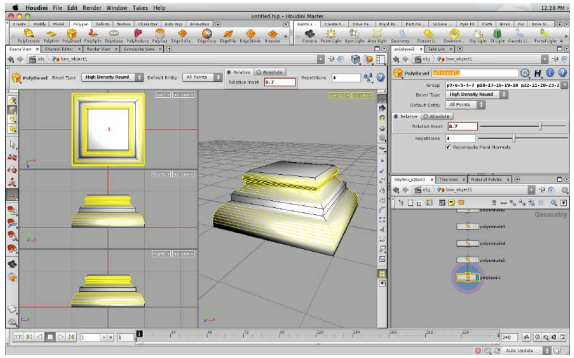
Selecting options can be found by clicking and holding on the **Select** tool, clicking and holding on the current **Selection mode** and **RMB-clicking** in empty space. The **RMB** menu gives you the select menu which offers different tools such as edge loops or growing and shrinking selections.





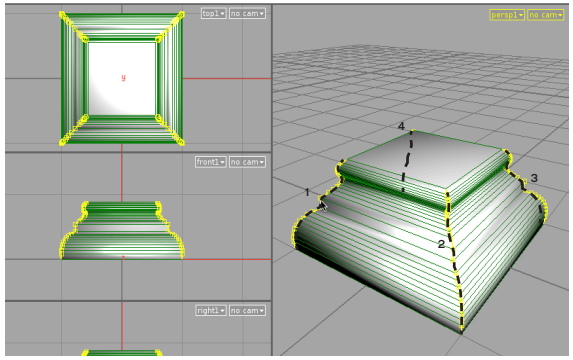
9 Make sure you select the last node in the network which makes this the working geometry. In the Scene view, press **3** to go to edge selection. Select one of the edges shown above then **RMB-click** in the Scene view and select **Select Loop** to loop the selection.

Press **Shift** to select one of the edges as shown above then press **Shift-L** to loop again. Whether you can loop around a piece of geometry will depend on its topology. Repeat for the third edge shown above.



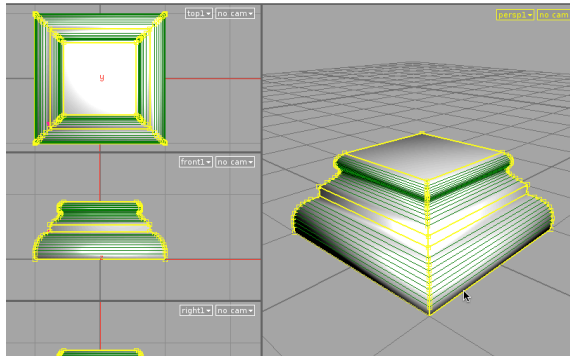
10 With the loops selected, go to the **Polygon** shelf and select **Polybevel**. Set **Bevel type** to **High Density Round**, **Relative Inset** to **0.7** and **Repetitions** to **4**. This creates nice rounded bevels which add detail to the base.

The **Relative inset** uses the overall distance from one edge to the other to determine how much to bevel. Later you will use **Absolute inset** which lets you set a specific bevel amount. Which of these you use will depend on your particular situation.



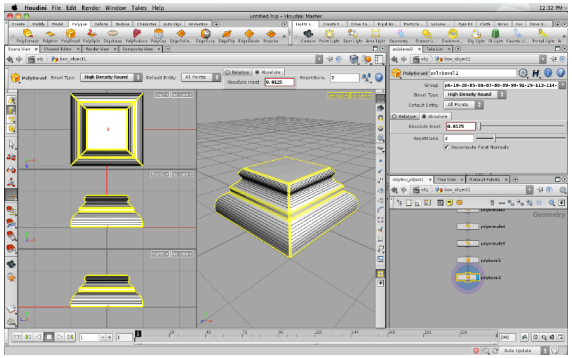
11 Select one of the edges on the side of the base then press **Shift-L** to loop from the top to the bottom. Press **Shift** and select the next side edge then **Shift-L** to loop again. You may need to zoom in to find one of the edges.

Tumble and repeat for the other two sides. Don't forget to press **Shift** as you begin adding each edge then **Shift-L** to loop. Now you have all the sides of the base selected. You are going to bevel these later after you select some horizontal edges.



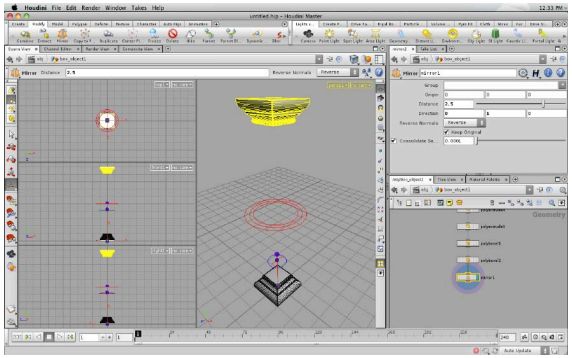
12 Press Shift to select one of the middle edges then **Shift-L** to loop. Repeat for the Edge Just above it. Now **Shift** select all the edges on the top and bottom of the base's geometry.

Since these edges are not interior edges, the looping does not work here. You will need to tumble around and **Shift** select these edges until you have them all. If you deselect by accident then you can **Edit > Undo** to go back to the selection.



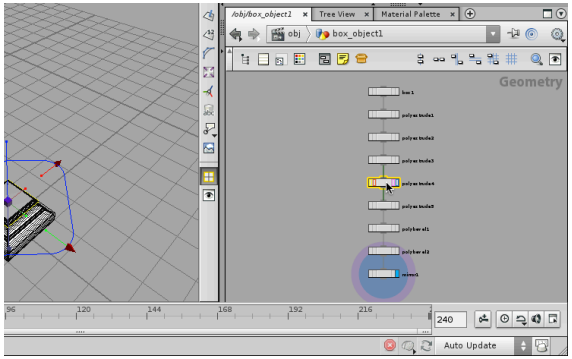
13 Again select the **Polybevel** tool. This time set **Bevel type** to **High Density Round**, **Absolute Inset to 0.0125** and **Repetitions** to **2**. By using an **Absolute Inset**, all of the selected edges bevel evenly. With **Relative Inset**, the bevel would be sized depending on the distance from the neighbouring edges.

These bevels add a little detail and create nicely rounded edges. These work really well later when you are rendering and the rounded edges provide nice specular highlights.



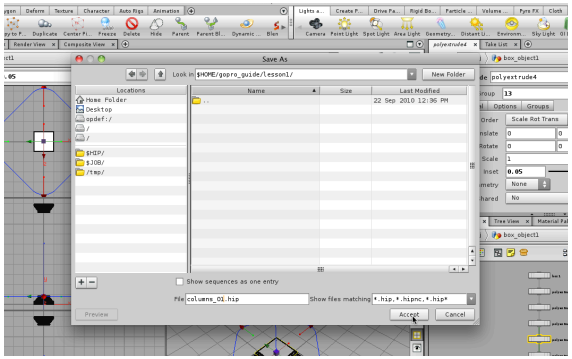
14 In the Scene view, press **4** to go to face selection then press **a** to select all the faces. From the **Modify** shelf, click on the **Mirror** tool. In the parameter pane, set the **Direction** to **0, 1, 0** and **Distance** to **2.5**.

This turns the base into a column capital which will cap off the central fluted column which you will create in the next section of this lesson. You will use these two pieces as guides to create a curve which you will revolve into the main body of the column.



15 In the Network view you now have a couple of new nodes and just like before you can step back and make changes to nodes in this chain and the whole solution will flow forward.

While this use of Houdini's nodes and networks for construction history seems familiar that is because many apps use this kind of linear approach. In the next section, you will jump around the network more and take advantage of its procedural nature.



16 Select **File > Save As...** and in the browser window, click on the *Home folder*. Find the folder called *gopro_guide* and then double-click on it to dive in. Double-click to go into the *lesson1* folder then name the file *columns_01.hip.* Click on the **Accept** button to save.

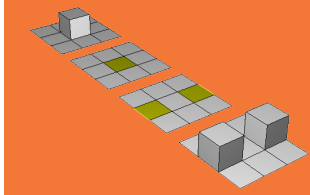
The next time you save, Houdini will copy the previously saved file into a back-up folder then over-write your scene file. This protects your work although the folder will get full and will need to be cleaned out once in a while.

TIP

HOW TO RESELECT GEOMETRY

When you use a tool in Houdini, you first make a selection then a node is placed down which specifically references that selection. If you extruded the wrong face or bevelled the wrong edge, you can fix this without using undo.

In these cases, you select the node in question, then click and hold on the **Select** tool and from the menu choose **Reselect For Current Tool**. This shows you your current selection which you can then change using the **Shift** key to add or subtract geometry from the selection.

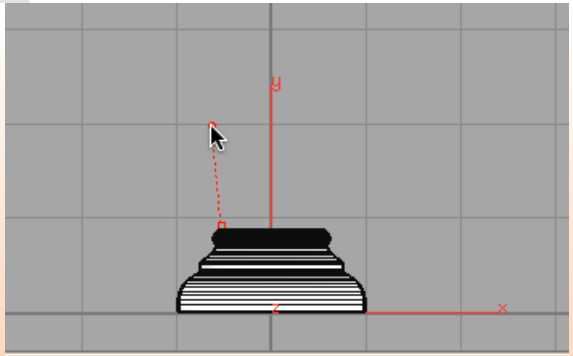


Once you are finished, press **Enter** and the node is reworked using the new selection. This skill is worth learning because it can be a real life saver while working with geometry nodes in production scenarios.

Model the Column

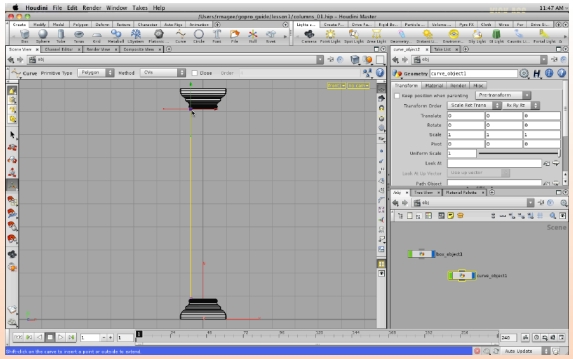
To create a fluted column between the mirrored base, you will start with a simple curve then create a partial revolve which you then rotate-duplicate to create the column shape.

You will then use more polymodeling tools such as polybevel to create the details. You will use the columns rotational symmetry.



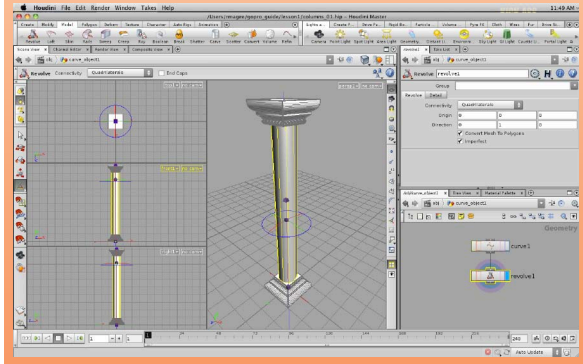
1 In the Scene view, mouse over the **right** view then press **spacebar-b** to expand this view then press **spacebar-g** to see all the geometry. This will let you focus on an orthographic view of the column base.

From the **Create** shelf, click on the **Curve** tool. In the right view, click once at the top left corner of the column base to create the first point of the curve. A new object is created and a new modeling network started with a curve node.



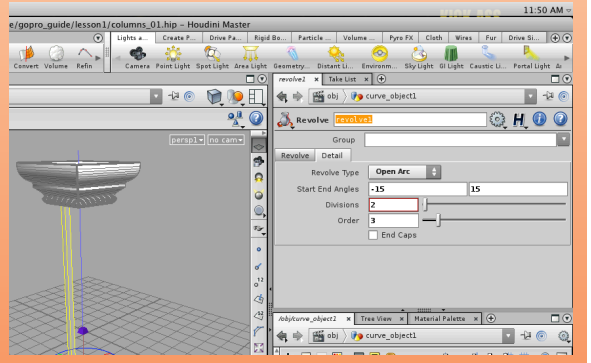
2 Click again just under the mirrored base to place a point at the top left corner of the column. Press **Enter** to finish the line then use the handle to make sure the curve is vertical. Eyeballing this will be good enough for this lesson.

With the **Curve** tool, you can click and edit any point on the curve. The one limit is that you can only edit one point at a time. If you want to edit more then you would need to select the points and use the transform tool which would add an edit node. That is not necessary for this simple curve.



3 In the Scene view, press **spacebar-b** to go back to a four view layout. From the **Model** shelf, click on the **Revolve** tool. This revolves the curve to create a complete column shape. There is a handle available if you want to change the location and direction of the revolve axis but you won't need this because you are working around the Y axis.

Now you could start adding detail to this geometry to create the fluting but it will be easier to start with a partial revolve then shape it and copy it later.



4 In the Parameter pane, click on the **Detail** tab and set the **Revolve Type** to **Open Arc**, the **Start Angle** to **-15** and the **End Angle** to **15**. This creates a partial revolve which covers 30 degrees. Later you will rotate duplicate it 12 times to recreate the column.

Next set the **Divisions** to **2** and the **Order** to **3**. This gives you just enough detail to start modeling. The **Order** helps define the spline-based revolve which is then converted into polygons which is what you need for this model.

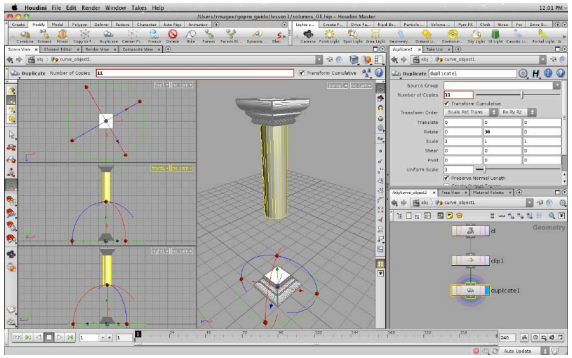
TIP

THE HANDLE TOOL

As you use tools from the shelf, you are generally placed into the **Handle** tool where you have access to a node's specific handles such as the **Revolve** node's handle shown on this page.

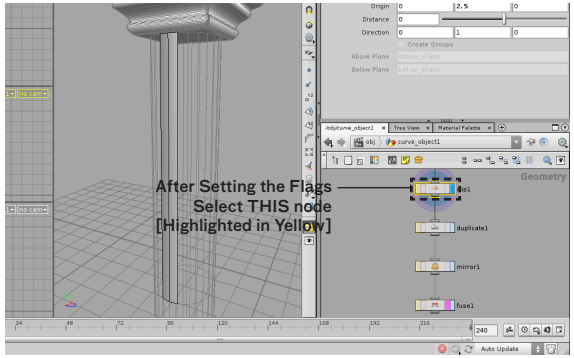
Handle Tool

If you leave the **Handle** tool then you lose this handle. To get the handles back, click on the **Handle** tool, select the node in the network and then press **Enter** in the viewport.



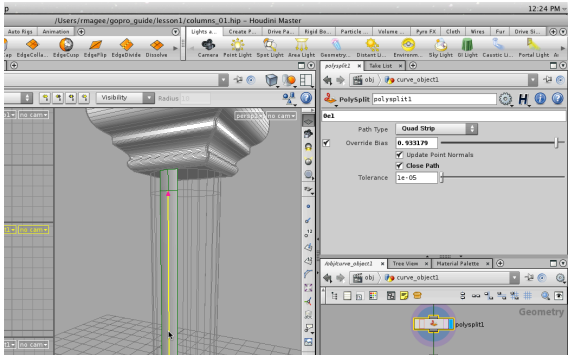
5 In the Scene view, press **a** to select all the geometry then press the **tab** key and select **Polygon > Clip**. In the Parameter pane, set the **Origin** to **0, 2.5, 0**. This cuts the geometry in half so that you can add detail to the top of the flute and then you mirror the results to the bottom.

From the **Modify** shelf, click on the **Duplicate** tool. This adds a duplicate node to the network. In the Parameter pane, set **Rotate Y** to **30** then drag the slider next to **Number of Copies** until you have **11** copies.



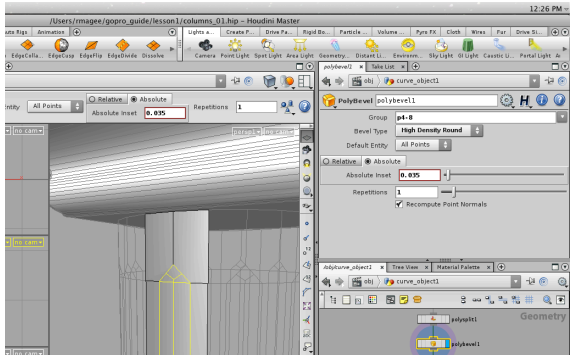
6 Press **a** to select all the geometry then go to the **Modify** shelf and click on **Mirror**. Make sure the field next to **Group** is empty then set the **Direction** to **0, 1, 0** and the **Distance** to **2.5**. In the Network view, **RMB-click** on the output of the mirror node and select **Polygon >Fuse**. Set the **Template flag** on the *fuse* node and the **Display flag** on the *clip* node.

DON'T FORGET: Make sure the *clip* node is highlighted yellow so that this geometry is your working geometry.



7 Go to the Polygon shelf, click on the **EdgeLoop** tool and cut the surface near the top. This will create the upper edge of the flute. When you finish, you can set the **Override Bias** amount to a specific value to place the loop.

Press **s** to get the Select tool. Click on the center line just under the cut you just made. You will start building the flute by working with this line.



8 Click on the Polybevel tool. Set **Bevel Type** to **High Density Round**, **Absolute Inset** to **0.035** and **Repetitions** to **1**. This defines the outer edges of the flute and creates a new centerline which you can use to add detail.

You will add this detail with another bevel but first you need to remove the detail at the top of the first bevel. For the top of the flute you will carve and shape the polygons after creating the flute.

TIP

WHY NOT DUPLICATE AND MIRROR AT THE END?

In this lesson, it might make sense to save the duplicate, mirror and fuse steps until the end of this section.

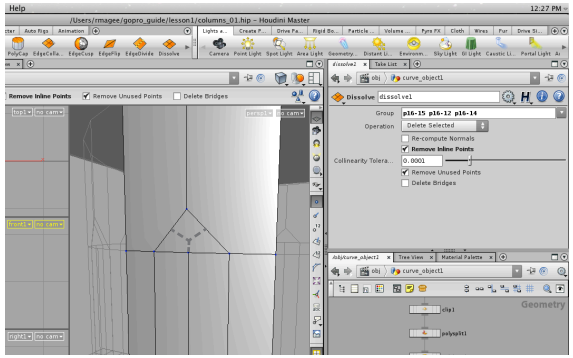
The reason you are doing it now is to take advantage of Houdini's ability to step back and work with a node earlier in the chain then watch as the flow of the network carries forward your edits. This ability to display any node and work with different parts of a network is an important skill you will use again and again with Houdini.

DISPLAY BAR

TIP

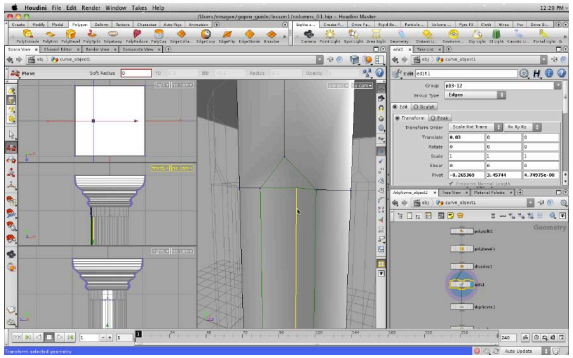
As you work with different selection modes, Houdini will show you points, edges or faces as needed. If you want to see these things even when you aren't selecting then you can use the **Display options** bar at the right side of the Viewport.

In addition to showing points, you can also show point numbers, primitive numbers, normals and more. These display options can be very helpful when analyzing the topology of a model.



9 Press **s** again then **3** to get edge selection. Select the three lines at the top of the bevel and press the **Delete** key to remove them using a *dissolve* node. This removes the edges but not the connected points. Turn on Display points in the Display Options bar found at the right side of the Scene view.

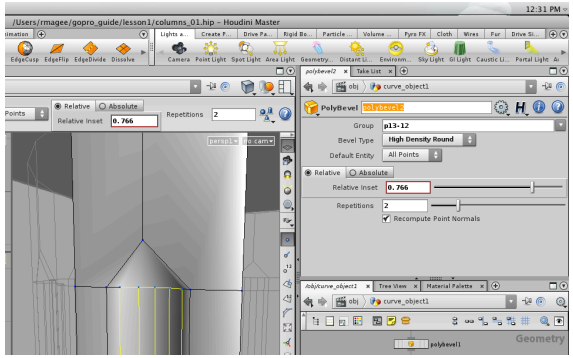
You can see that there are still points where the edges used to meet the other edges. In the Parameter pane, turn on **Remove Inline Points** to get rid of these extra points.



10 Select the new center line. Press **t** to get the translate tool and push the line along the X axis. This puts down an *edit* node. You can set **Translate X** directly if needed.

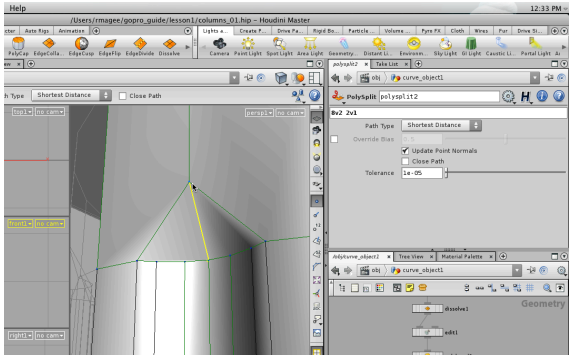
The *edit* node is used to reshape geometry. When you select geometry and use either the move, rotate or scale tools at the geometry level then an *edit* node is created.

Note: If you drew your original curve in a **Side** view then you will need to translate this line along the Z axis.



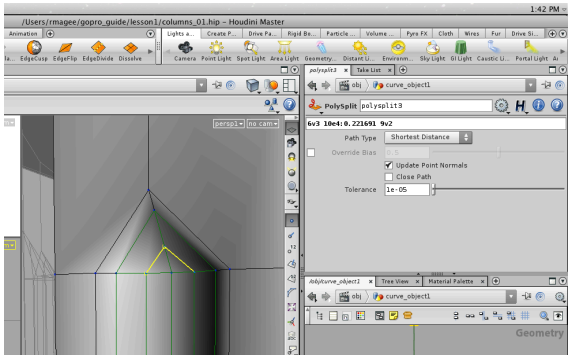
11 Now click on the **Polybevel** tool and set **Bevel Type** to **High Density Round**, **Relative Inset** to **0.766** and **Repetitions** of **2**. This gives you the basic shape of the column flute.

Tumble around to make sure you like the shape. You may want to go back to the *edit* node to tweak the position of the center line to get the exact depth you want. You can also see that the flutes are being copied to the templated geometry from the *fuse* node.



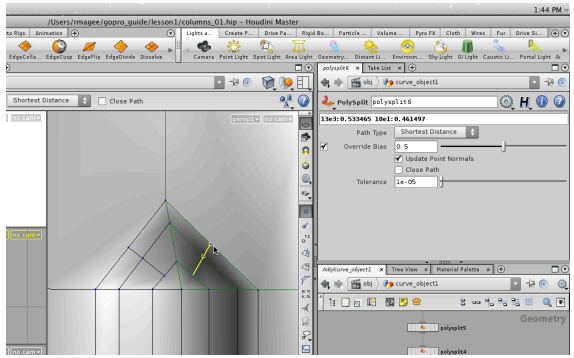
12 Dolly in and **Tumble** until you are looking at the top of the flute. From the **Polygon** shelf, click on **Polysplit**. Move your cursor to the peak of the triangle and when you see it highlighted with a little circle then click to place a point.

If you have trouble finding the circle then tumble to another view. Since this is an n-sided polygon you may not always find the point. Next go down to the top of the flute's center line and once you see the circle then click again. Press **Enter** to finish. This splits the polygon along the chosen line.



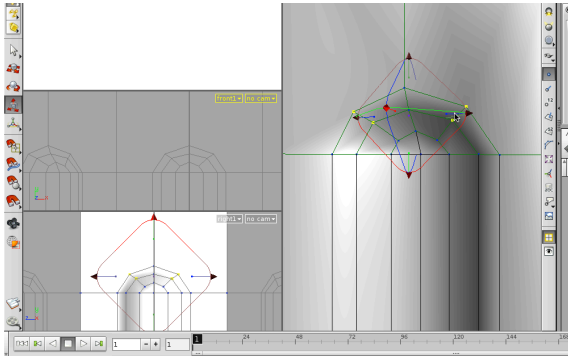
13 Press **q** then when you see a circle, click on the point at the top right edge of the flute. Next click on the centerline about a third of the way down when you see an x then at the point at the top left edge of the flute when you see a circle.

Press **Enter** then **q** to add another polysplit as shown above. Just like before you may need to tumble to find the click points. The more cuts you make the easier it is to find the points because the n-sided polygon has been broken down into more manageable parts.



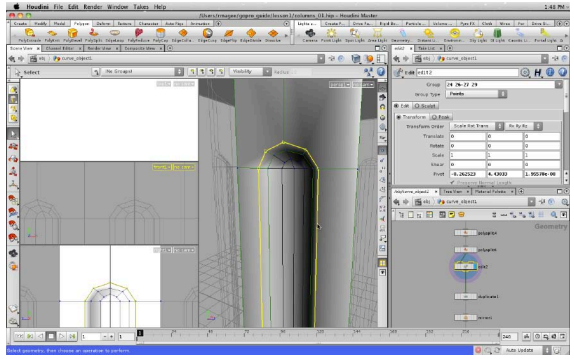
14 Press **q** to repeat and split the top of the flute on the right side. In the Parameter pane, turn on the **Override Bias** and leave it at **0.5**. Now split the left side as shown above and again turn on the **Override Bias**. This parameter lets you position the split at a specific point along the edge.

These splits add detail which will be used in subsequent steps to shape the top of the flute. Each polysplit adds to the topology and creates points which you can use to shape a nice rounded shape.



15 Press **s** to get the **Select** tool. Press **2** to get point selection. Select the points at the top of the flute and lower them down. Next, select and edit the other points to create the proper flute shape. If you select points from both sides then be sure to use the scale handle to move points in or out and the transform handle to move them up and down.

You may want to use the multiple views to see this from the front and side to make sure you are doing it right. In the end you should have the shape shown above.



16 Press **3** to get edge selection then click on the edge on the left side of the flute. Press the **Shift** key and select all the edges going around the flute.

In the next step, you will bevel this edge to create a better transition from column to flute. The bevel will also provide a nice rounded edge which will pick up specular highlights when rendered.

TIP

THE EDIT NODE

The Edit node is a special kind of node that works differently than other nodes. Where as most nodes take a very specific selection and act on that selection, the Edit node stores the results of multiple edits.

This node works this way because there are times where you just need to tweak points and shape your model and you don't want a new node for every little move you make. Therefore the edit node lets you do lots of tweaking and the results are all stored in the one node.

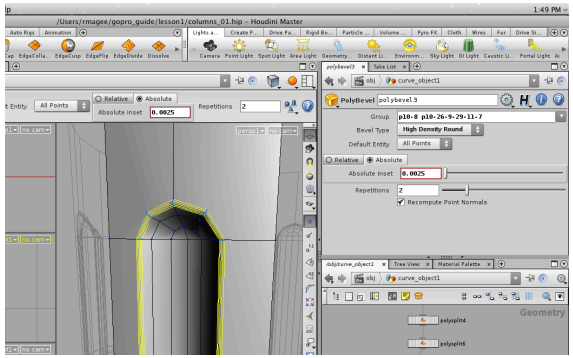
This node also has sculpting tools which let you use a brush interface to manipulate points but that is not needed in this lesson.

OBJECT LEVEL VS GEOMETRY LEVEL

TIP

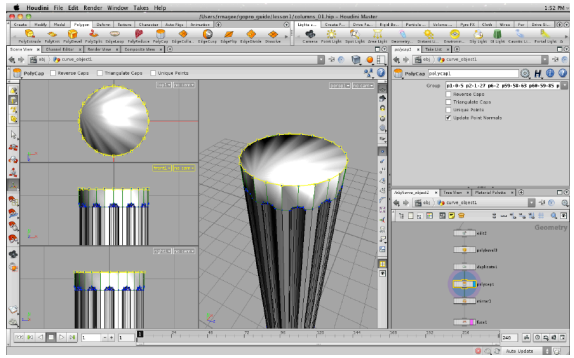
As you work, you will be jumping up and down between the object level and the geometry level. Generally you use the object level to position and orient the object and the geometry level to define its shape.

Make sure you are aware which level you are working at. The Network view labels each level with either Geometry or Scene for objects. You can also use the path above each panel to tell you where you are.



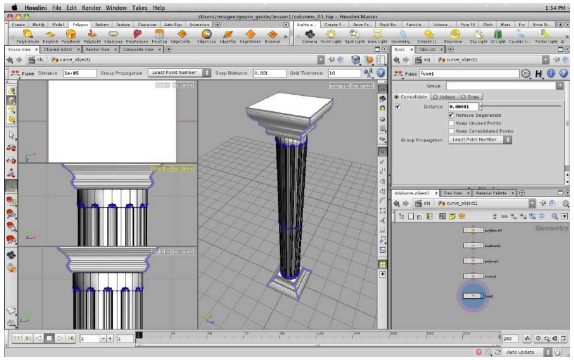
17 Click on the **Polybevel** tool. Set **Bevel Type** to **High Density Round**, **Absolute Inset** to **0.0025** and Repetitions to **2**. This creates the nice rounded transition.

Now you need to cap the top of the column but you can't see it because of the base geometry. Choose **Hide Other Objects** from the menu at the top right of the Scene view. This hides geometry belonging to other objects. Up to this point they have been ghosted.



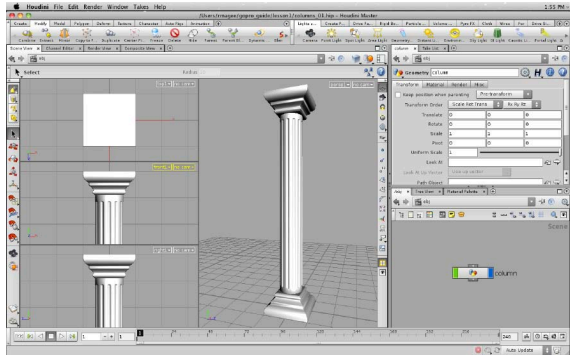
18 Turn on the **Display flag** on the *duplicate* node and select it to highlight it in yellow. Press 2 to get point selection. In the front view select the points at the top of the column. From the **Polygon** shelf, select **Polycap**.

In the Scene view dolly in to see the cap. This gives you a closed shape which is needed later when you smash the column. Go back to **Ghost Other Objects**. Dolly out to see the whole column.



19 In the Network view, turn on the Fuse node's **Display flag** and turn off its **Template flag**. If you zoom in you will see that the top of the flute may have the detail changed because of the fuse.

Select the fuse node and in the Parameter pane, set **Distance** to **0.0001**. This setting makes sure that the points on the flute aren't being fused together which would alter the nice rounded edge you set up earlier.



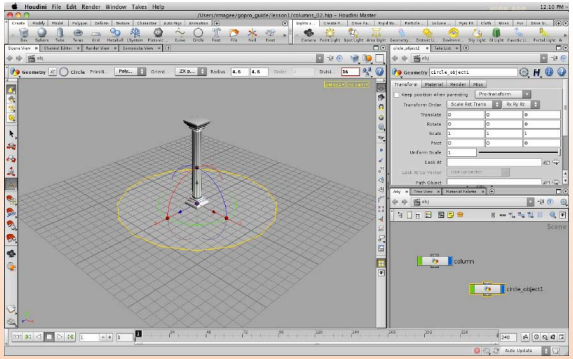
20 Click on *obj* in the path at the top of the Scene view to go to Object level. Select the objects and from the **Modify** shelf, click on the **Combine** tool. Now all the geometry is contained in a single object and the two modeling networks have been merged into one. Go back to the object level and rename the object *column*. From the **Shading** menu, select **Smooth shaded** to take a look at the finished column.

Select **File >Save As...** and call it *columns_02.hip*. Now the fun begins as you start to smash things up.

Smash the Column with Dynamics

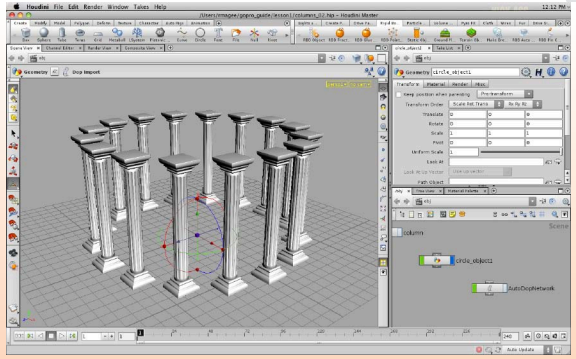
For Houdini to include objects in a dynamic simulation, they need to be tagged as dynamic objects. For the column, you are going to instance it to a circle to create an arrangement of columns. You will then add a sphere which will become the “hidden force” which tears down the columns and a ground plane to anchor everything.

As you turn these into rigid body objects, extra nodes will be added to each object’s geometry network which connect the object to a dynamics network where all the fun takes place. As you work you will jump between the object, geometry and dynamics levels to access different nodes.



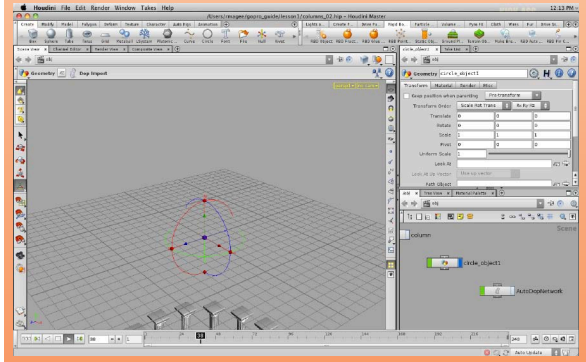
1 In the Scene view, press **Spacebar-b** over the perspective view to focus on this view then **Spacebar-h** to go to a home view. From the **Create** menu, select the **Circle** tool. Press **Enter** to place it at the origin.

Press **i** to go into this object then set **Primitive Type** to **Polygon**, **Orientation** to **ZX plane**, **Radius** to **4.6, 4.6**, and **Divisions** to **16**. You will use this to create a circular arrangement of 16 columns. Press **u** to go back up to the object level.



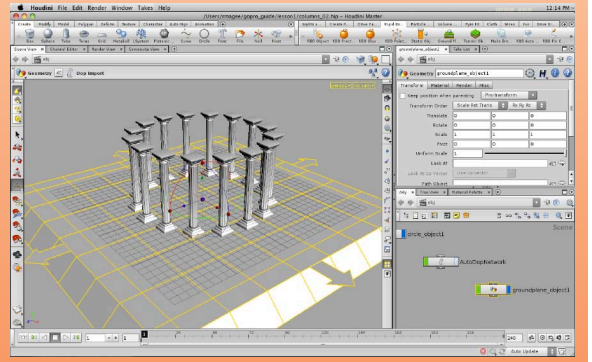
2 Make sure you are at **frame 1**. When working with dynamic tools, make sure to always adjust your scene at frame 1. With the circle selected, go to the **Rigid Bodies** shelf and click on the **RBD Point Object** tool. Select the column and press **Enter**. Now you have a ring of columns.

If you were just modeling then there are other ways to make copies of geometry such as the *copy* tool but since the goal is a rigid body simulation, this is the best tool for the job.



3 Press **Play** in the timeline and you will see the columns start to fall down. They are dynamic objects with a gravity force applied to them. You need to add a ground surface to keep them from falling down.

In the Network view, you can see that a new node has been added called *AutoDopNetwork* which is where all the dynamic nodes will be placed. Later you will navigate into this network to work with the nodes directly.



4 From the Rigid Bodies shelf, click on the **Ground Plane** tool. In the network edit, click on the **Display flag** to hide the ground plane. Even though it is hidden, it will still be used in the simulation.

The ground plane extends in all directions despite its appearance and will keep all the objects grounded. Later when you dive into the *AutoDopNetwork* you will see that the ground plane is visible at that level.

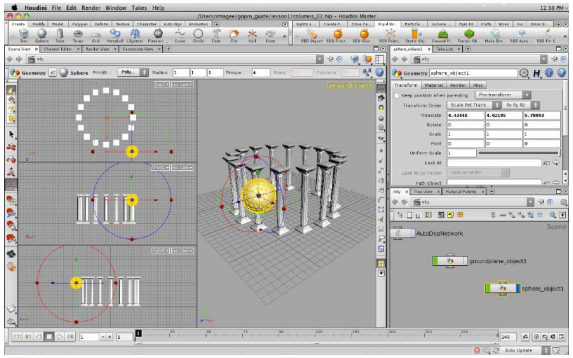
WHAT GOES ON IN THE DYNAMICS NETWORK?

TIP

As you start to turn objects into dynamic objects, the **AutoDopNetwork** appears which contains networks of dynamic nodes. This is where objects, forces and constraints are set up and the network defines how they interact.

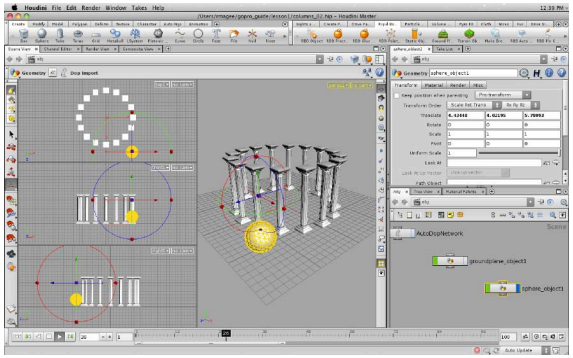
Each object you insert into the network gets a DOP [Dynamic Operator] import node added to the end of its chain. This node sends information about the object to the DOP network and then sends motion back to the object once the simulation is completed.

This is why the DOP network itself is hidden at the object level because its resulting sim is handed back to the objects which orginally created it.



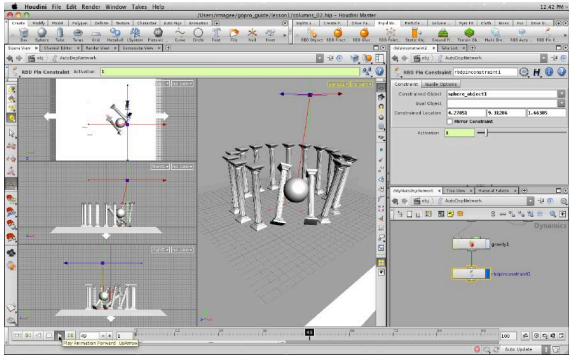
5 From the **Create** shelf, click on the **Sphere** tool. Press **Enter** to place it at the origin. With the **Handle** tool active, you can use the **Operation Controls** at the top of the Scene view to set its **Primitive Type** to **Polygon** and **Frequency** to **4**. This will eventually be the hidden object you use as a virtual wrecking ball to smash up the columns.

Use the handle to move it out to the edge of the circle then up off the ground. Move it just in front of the columns where you will use it to knock them down.



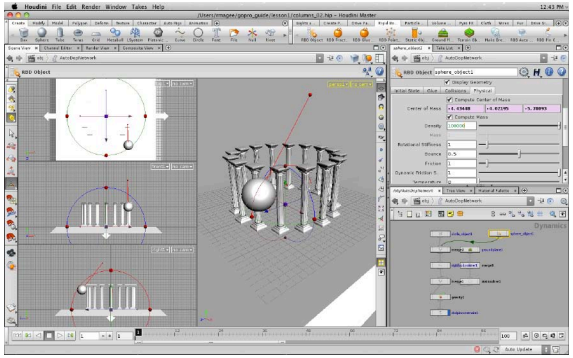
6 Select the Sphere. Go to the **Rigid Bodies** shelf and click the **RBD Object** tool. Set the frame range to 1-100 using the white fields at the start and finish the playbar. Now press **Play** to start the simulation.

The ball falls to the ground. Press **Escape** to stop the simulation and then click on the **Reset to First Frame** button in the playbar. To make the sphere hit the columns you will now turn it into a wrecking ball by adding a pin constraint.



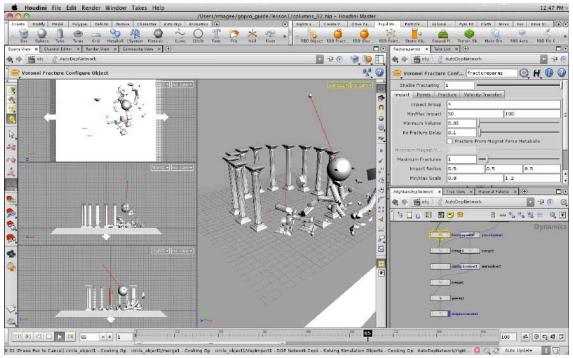
7 Select the Sphere. From the **Rigid Bodies** shelf, click on the **RBD Pin Constraint** tool. Move your cursor to the Scene view then press **Enter** which takes you into the *AutoDopNetwork* with the sphere object selected. Press **Enter** again to place the constraint at the origin. Use the handle to raise it up above the column.

Press **Play** to try again. The ball should be knocking down some columns. If you don't like how the columns are being hit then reposition the constraint and test the sim again.



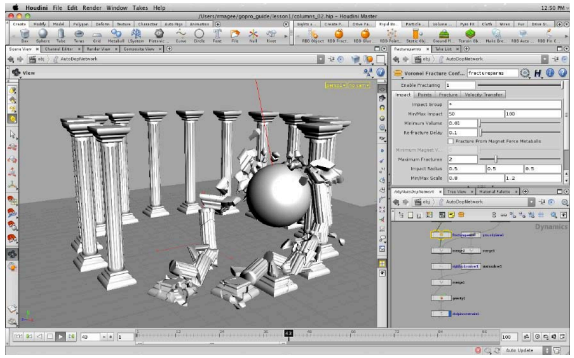
8 Go to frame 1. In the *AutoDopNetwork*, select the *sphere_object1* node. In the Parameter pane, click on the **Physical** tab. Set the **Density** to **100000** to increase the mass then go back to the object level. Move the sphere up and out then re-simulate to check out the results.

You can now tweak the simulation by repositioning the sphere at the object level, by adjusting the constraint at the Dynamics level or changing the mass at the Dynamics level. Now lets make the columns breakable!



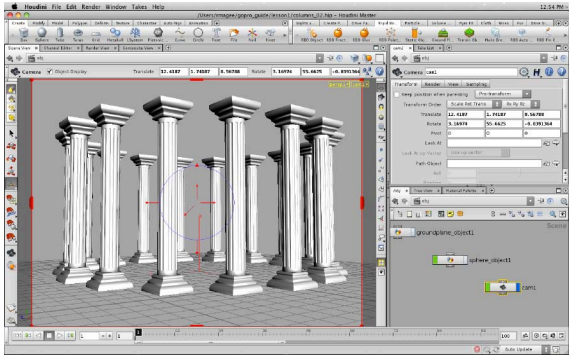
9 Go to frame 1. Select the columns. From the **Rigid Bodies** shelf, click on the **Make Breakable** tool. This will jump you back to the Dynamics level. With your cursor in the Scene view, press **Enter** to accept. The columns will now break up during the simulation.

Press **Play** to test the simulation. The column geometry is altered with each frame in reaction to impact. The calculations take longer because this high quality sim reacts accurately to the collisions as they happen.



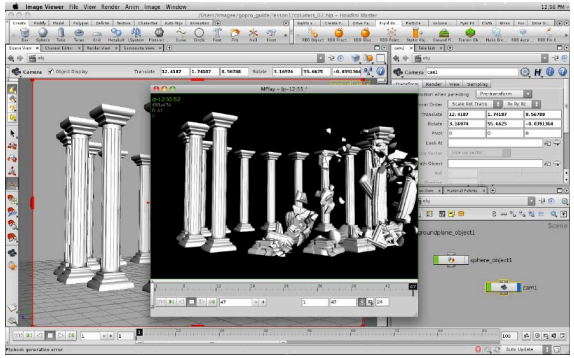
10 Go to frame 1. In the network view, go inside the *AutoDopNetwork* and select the *fractureparms* node. Set the **Maximum Fractures** to **2** then re-run the simulation.

Now you are breaking the columns up into more pieces. You can tweak these values to adjust how the columns are being fractured dynamically.



11 When you finish, go to frame 1, go to the object level, and hide the sphere. Use your view tools to set up a view that you want to see it in camera. From the Scene view's camera menu select **New camera**.

The camera is placed based on the chosen view. You get some handles you can use to adjust the framing of the view to fit well with the aspect ratio.



12 Choose **File > Save As...** and rename the file *columns_03.hip*. It is a good idea to save things under different names in case you want to go back to an earlier step.

Now click on the **Flipbook** button on the toolbar. Turn on Render Beauty Pass Only then set the **Frame Range** to **1, 100** and under **Size** tab set **Zoom** to **75%**. Click **Accept** and wait for the scene to flipbook the results. If you want to save the movie then select **File > Export > Quicktime Movie Exporter** and save the sequence as a **.mov** file.

TIP

HOUDINI'S IMAGE VIEWER

When you create a flipbook or render an image or image sequence, you are often taken to Houdini's Image Viewer called **Mplay**. This viewer lets you view different channels, compare shots and tinker with brightness and contrast as you playback your sequences.

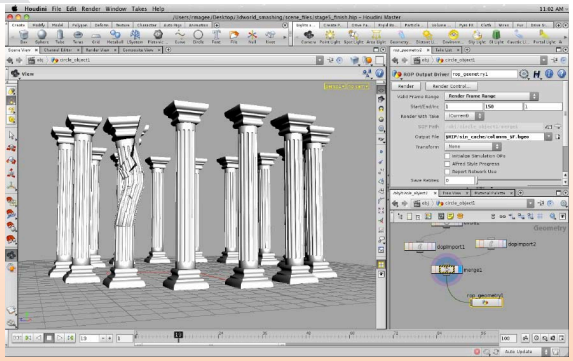
The viewer can also incorporate sound and can open and save images out in different formats such as **OpenEXR**, **TIFF**, **JPG** or **Quicktime**.

Mplay can also be opened independently to view your work.

Rendering the Shot

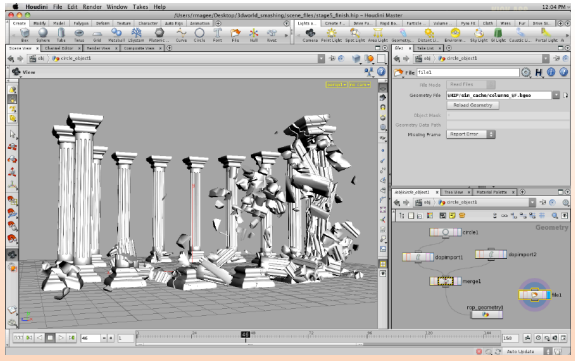
To create a finished shot, you can now add cameras, lights and materials to your columns. You can then render out an image sequence using Houdini's renderer called Mantra. This final movie can then be saved out as a Quicktime movie from Houdini's Image Viewer.

Before you start rendering, you will cache out a geometry sequence of the smashing columns to make the rendering process more interactive.



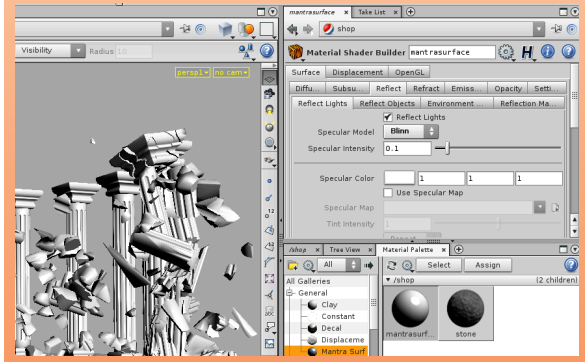
1 Double-click on the *circle_object* to dive into it. **RMB-click** on the output of the *merge* node and select **Managers>ROP Output Driver** and set **Valid Frame Range** to **1, 150**. This will create a longer simulation.

Now you will cache the sim to make it easier to light and render the shot. Click on the chooser button next to **Output File** and create a new folder called *sim_cache*. Set the file name to *columns_$F.bgeo* and click **Accept**. Click on the **Render** button to cache the sim.



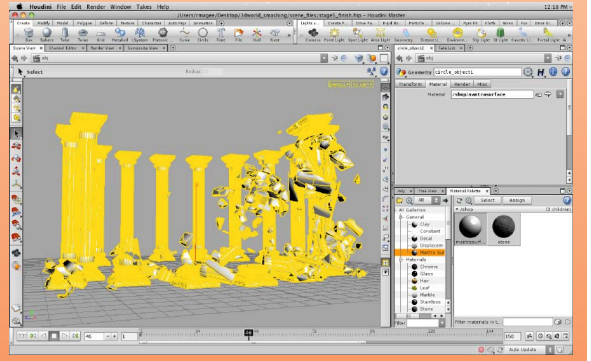
2 Press **tab>Export>File** and place down the node. Set **Geometry File** to *$HIP/sim_cache/columns_$F.bgeo* then set its **Display flag**. You can now scrub through the timeline to see the cached sim.

If you want to change the sim, tweak the setup then use the *rop_geometry* node to re-cache. The cache can then be used to flipbook or render the scene. This will allow you to focus on lighting the shot and not on simulating every time you want to render.



3 In the pane in the bottom left, click on the Material Palette tab. Drag a **Mantra Surface** and **Stone** material from the gallery to the palette work area.

Click on the *mantrasurface* material and in the Parameter pane, click on the **Reflect** tab and set **Specular Intensity** to **0.1**. Then click on the *stone* material and under the **Diffuse** tab and **Stone Pattern** tab, set **Stone Color** to **1, 0, 0**. This way the stone shows up as red in the viewport and is easy to find when we first assign it.



4 In the Scene view, press s to get the **Select** tool then **1** to jump to Object selection. With the columns selected, click on *mantrasurface* in the Material palette then click **Assign** at the top of the palette work area.

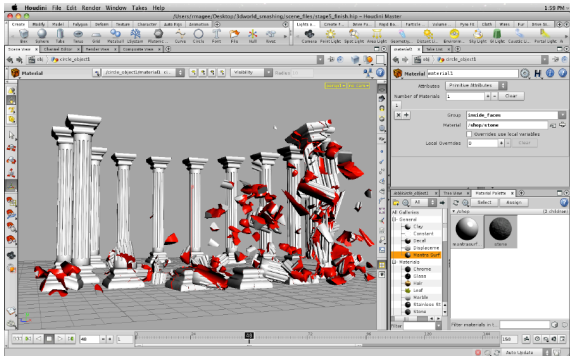
In the Parameter pane, click on the *circle_object's* **Material** palette. You can see that the *mantrasurface* material has been assigned to this object.

TIP

MATERIALS AND SHADING NETWORKS

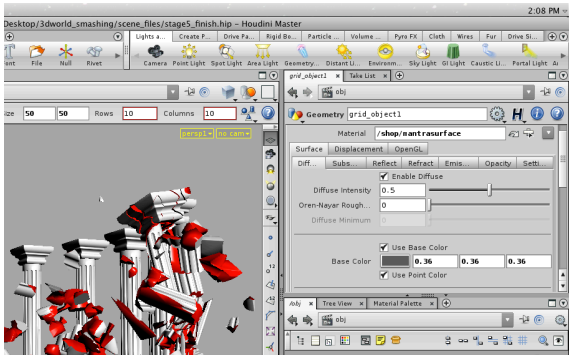
The Materials in the palette can be used as shown. Each has parameters you can set and often fields for adding texture maps. In many cases these top-level controls are all you need.

As you dig deeper, you will learn how to dive into those materials and work with their shading networks to create custom looks. For now materials will do the job for you.



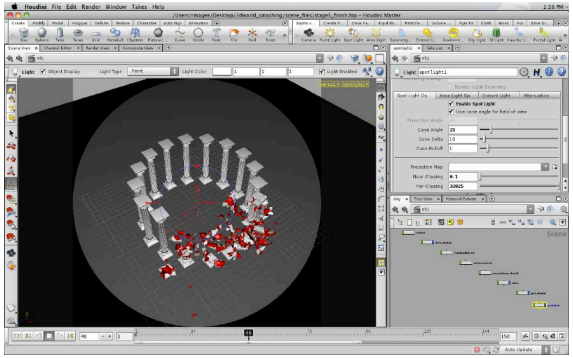
5 In the Network view, **RMB-click** on the output on the *file* node and select **Material > Material**. Place the node down and set its **Display flag**. Under **Group** type *inside* then click on the node selector next to **Material**. From the **Choose Operator** window, open *shop* and click on *stone* then click **Accept**.

The inside group was created by the fracture solver and can be used to find these surfaces. In the viewport they look red because of the red color you set for the stone.



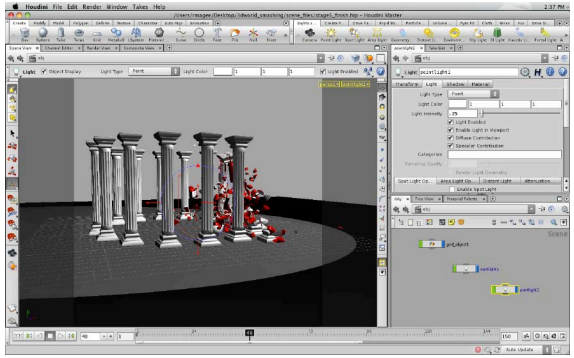
6 From the **Create** shelf, click on the **Grid** tool and in the Scene view press **Enter** to place it at the origin. In the **Operation Controls** set **Size** to **50, 50**.

Click on the **Material** tab and use the node selector to assign the *mantrasurface* material to the ground. Click on the **grey arrow** next to **Material** and select **Create All Local Material Parameters**. This adds all the parameters to the object. Click on the **Surface** tab then the **Diffuse** tab and set **Base Color** to a dark grey.



7 In the Scene view, tumble until you are looking at the scene from above at a bit of an angle. From the **Lights and Cameras** tab, **Ctrl[Cmd]-click** on the **Spot Light** tool. This adds an spot light to your scene which is aiming in the direction of the view you were looking through.

In the Parameter pane, under **Light** and **Spot light options**, set the **Cone Angle** to around **25**. This will get you closer to you objects and create a more focused light cone.



8 In the Scene view, tumble and dolly to a point where you are looking at the dark side of the columns. From the **Lights and Cameras** tab, **Ctrl[Cmd]-click** on the **Point Light** tool. This adds a fill light to your scene.

In the Parameter pane, under **Light**, set the **Light Intensity** to **0.25**. This will provide a secondary light source for your shot. If you want to reposition it then use the handles in the Scene view which work the same as the camera handles.

TIP LOCAL MATERIALS PROPERTIES

In step 6, you create local material parameters for the ground surface. This speeds up rendering because each material can be processed once then used for multiple objects. It is also great for objects which need to look similar but require unique texture maps for object-specific details.

TIP POSITIONING LIGHTS AND CAMERAS

As you work with lights and cameras, you can reposition them by look through the camera using the camera menu in the Scene view. **RMB-click** on the menu to look through a light.

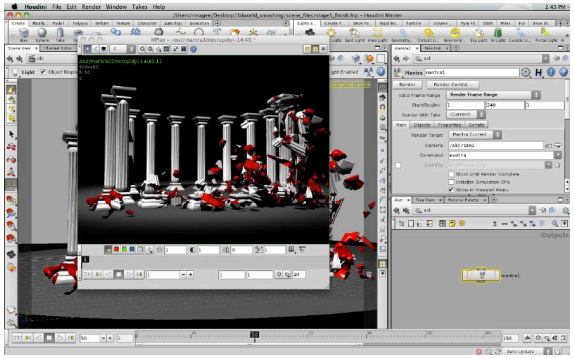
You can then use the **Lock Camera to View** button on the display option bar and all view changes - tumble, dolly, track - will reposition the light/camera. Don't forget to turn off the lock button when you are finished.

You can also select the light/camera and use the viewport handles with the **Handle** tool.

MOTION BLUR AND DEPTH OF FIELD

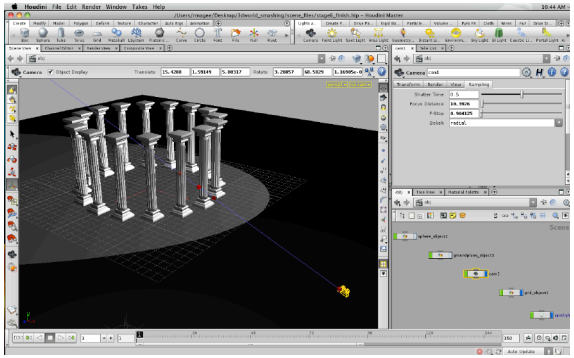
TIP

Houdini's Mantra renderer is able to render both **Depth of field** and **Motion blur** without making render times too long. These features can help add realism to your renders and are well worth utilizing in your final renders.



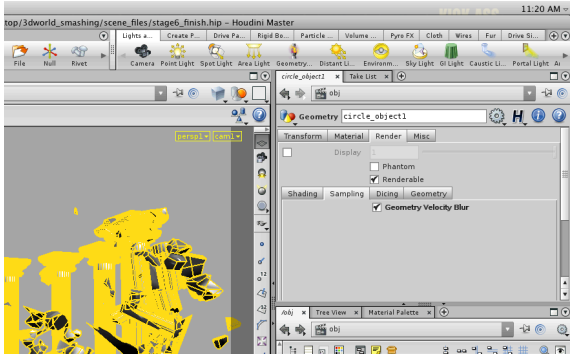
9 **Save** your Scene file. From the **Render** menu, select **Create Render Node > Mantra.** This node will use the camera you created earlier and will render the curent frame. Go to frame **50** then click on the **Render** button.

This will start a render in the **Mplay** image viewer. You can now go back and make changes such as choosing a color other than red for the inside surfaces, tweaking the specular highlights or adjusting the positioning and intensity of the lights. Re-render to test out your various creative choices.



10 In the Network view, select your camera. Press **Enter** in the Scene view to go to the handle tool tumble round to see the camera from above. **RMB-click** on the handle and select **Focus Handle**.

Drag the square handle to the columns at the front then drag the arrow handle to tighten the focus. This sets the **Focus Distance** and **F-stop** from the **Sampling** tab for rendering with depth of field. You will need to turn this on in the *mantra* node for depth of field to work properly.



11 In the Parameter pane, click on the **View** tab and set **Resolution** to **1280, 960**. **Note:** If you use the free Houdini Apprentice then you are limited to 720x576.

Next, go to the object level and select the *circle_object* node in the Network view. In the Parameter pane, click on the **Render** tab and then the **Sampling** tab and turn on **Geometry Velocity Blur**. This will use velocity information from the geometry cache to create motion blur when that feature is turned on in the *mantra* node.

12 In the Parameter pane's path widget, **LMB-click** and from the menu select **out.** This selects the *mantra* node. Set **Valid Frame Range** to **Render Frame Range** and set the **End frame** to **150**. You can also go to the **Properties** tab and the **Sampling** tab and turn on **Enable Depth of Field**. and **Allow Motion Blur** to turn on these features.

Click **Render**. The depth of field and motion blur will add visual interest. When you are finished, you can export the results as a Quicktime movie.