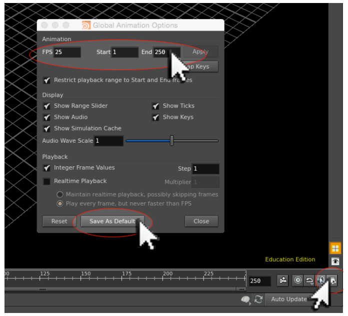
HOUDINI GLOBAL ANIMATION OPTIONS

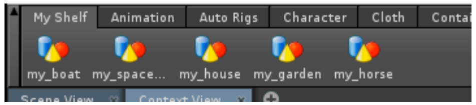
The Global Animation options **of Houdini can be found in the bottom right hand corner of the Viewer pane.**



By default in the Creation Desk, the **Frames Per Second** value should be set to **25**, with a **Start Frame of 1** and an **End Frame of 250**. **Adjustments** to the **Start and End Frames** can **increase or decrease** this timeline range according to the current project. When required, these settings can be saved as defaults.

SHELF FUNCTIONALITY

The **Houdini Shelves** can be used as a way of **storing developed assets** that may be required for multiple usages. For example, Primitive Models can be developed and then stored on the Shelves for future access. **By default** in the **Creation Desk**, an empty Shelf called **My Shelf** is the first shelf in the Shelf Tabs.



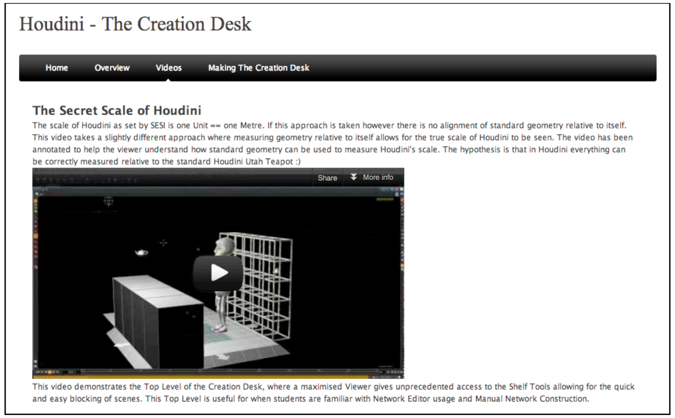
Objects can then be **LMB dragged** and **dropped** onto my Shelf for storage. **RMB** on a **Shelf Tool** will give options for removing it from the shelf, or editing its creation script.

DEFINING UNITS IN HOUDINI

The official measurement for Houdini is 1 Unit == 1 Metre. In real terms this means a standard box == 1 cubic metre. This however creates inconsistencies between a box and other objects (for example a standard teapot is larger than a standard box). A better approach to take is to see a standard box as representing 10 cubic cm. This in turn means that a standard grid becomes 1 square metre, and a standard teapot also becomes the correct scale relative to the grid and box.

A demonstration about how to think about Houdini's scale based upon a 10 cubic cm standard box scenario can be seen in the video '**The Secret Scale of Houdini**'.

http://houdinicreationdesk.ipage.com/videos.html

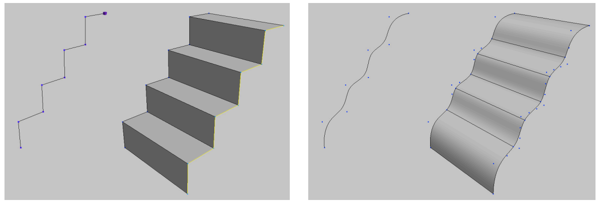


How Houdini internally perceives its scale can also be set in the main **Edit > Prefences > Hip File Options** menu. These settings have an effect on Dynamics calculations, but for the purposes of modelling, any scale can be worked at, as objects can always be resized later on in production to match the scale of other objects.

GEOMETRY TYPES FOR MODELLING

In total, Houdini uses five Primitive Types for representing geometric shapes. These are:

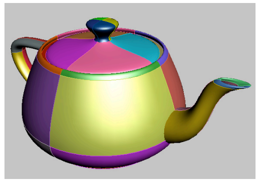
Primitive	for basic geometric shapes (easy to calculate and quick to render)
Polygon	for hard-edged shapes constructed from one or more closed planar curves.
Mesh	for hard-edged shapes that have cubic topology (easy to calculate and quick to render)
NURBS	(**N**on **U**niform **R**ational **B**-**S**pline) a curved surface or curve
Bezier	An alternate curved surface or curve



The above illustration shows the same extruded curve set as both Polygon and NURBS types. A Polygon curve interpolates a hard-edged line by going **through** its points. Polygons can be utilised for both inorganic and organic objects, as they can be smoothed (or subdivided) to create curved surfaces. A NURBS or Bezier curve however draws a line by interpolating **between** the curve points. They are generally used for creating smooth shapes and contoured inorganic surfaces.

NURBS MODELLING

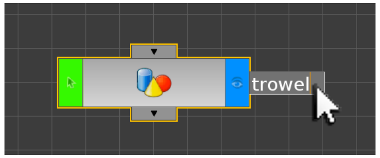
NURBS (non uniform rational b-splines) is a universal method of modelling in 3D animation systems. It is primarily used for recreating manufactured smooth surfaces. A NURBS surface is a single patch or square of geometry that can be shaped to create these surfaces. A NURBS model can be made up of varying combinations of patches collectively creating the final shape.



Although created from Bezier Patches rather than NURBS Patches, the Houdini Utah Teapot demonstrates how patches can be utilised to create a final model. The Houdini teapot consists of 33 patches (individually coloured for the purposes of illustration).

MODELLING A NURBS TROWEL

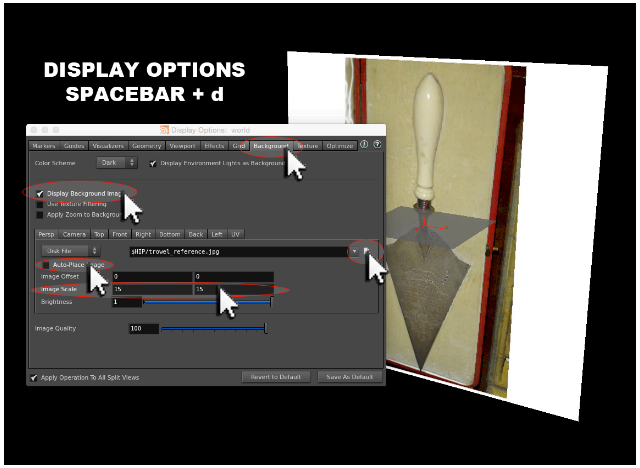
In a **new Houdini scene**, at **Object Level**, create a new **Geometry Object**, renaming it from **geo1** to **trowel**. **Double LMB click** the trowel object to go inside it, and **delete** the default **File SOP**.



DISPLAYING MODELLING REFERENCE IMAGES

Modelling objects accurately is made simpler by having a reference image to model to. Reference images for each view can be activated through the **Viewer's Display Options** (**SPACEBAR + d** with the mouse over the **Viewer**).

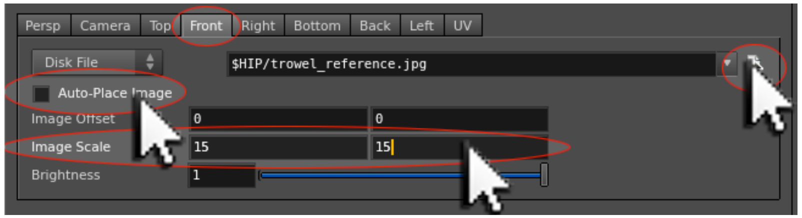
From the **Background** section of the **Display Options**, activate the **Display Background Images** option, and load in the **trowel_reference.jpg** using the **File Chooser button**. By default, this will display the reference image in the Persp View.



From the **Persp** sub-section, **deactivate** the **Auto-Place Image** option, and specify:

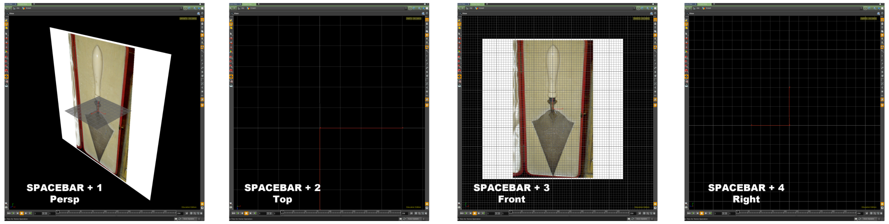
Image Scale **15** **15**

This will lock the image to Persp Viewer grid, and scale the image to an appropriate size.

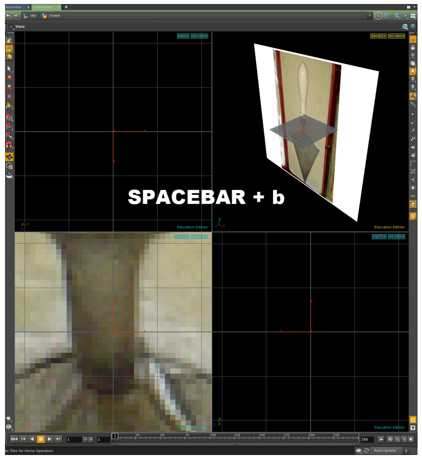


Repeat this process for the **Front section** of the **Background Display Options**. The Front View is a **flat orthographic view** that can assist accurate modelling. The Display Options can now be closed.

SPACEBAR + (**1,2,3,4**) with the mouse over the Viewer will switch between the **Persp View** and the (**top, front, right**) **orthographic views**.



SPACEBAR + b with the mouse over Viewer will **toggle** between **a single window** and **split window view**.

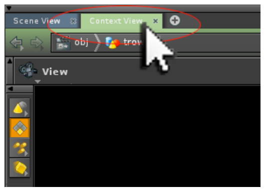


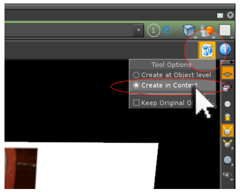

Display Background

Displayed images can also be activated or hidden in the Viewer by **LMB** pressing the **Display Background button** on the right hand side stow bar of the Viewer.

WORKING IN CONTEXT

Ensure that the **Context Viewer TAB** is active rather than the Scene View Tab. Set the **Tool Options** button in the right hand corner of the Viewer to **Create in Context**.

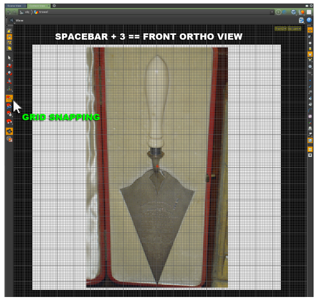




This will ensure that any base operators created in the Viewer (such as spheres, grids and curves etc) are created within the current object rather than being created as a new scene object.

GRID SNAPPING

Activating the **Grid Snapping** (Magnet) **button** located on the left hand side Viewer Stow Bar can enhance modelling accuracy further. This will automatically lock any modelling activity to the points of the viewport grid.

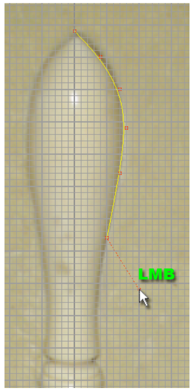


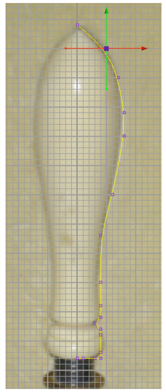
The View Pane can also be set to the **Front Orthographic View** (**SPACEBAR + 3**) in preparation for modelling.

CREATING THE TROWEL HANDLE

Examination of the **trowel_reference.jpg** reveals that the trowel is constructed from components which be recreated individually and then merged together to form the final trowel.

To model the trowel handle, activate a **Curve SOP** interactively using the **Viewer**. Press **TAB** with the **mouse over the Viewer** and type curve to activate this operator. In the **Parameters** for the **Curve SOP** specify a **Primitive Type** of **NURBS** to provide a smooth curve, and begin to draw around the edge of the handle. When a curve representing the profile of the handle has been created, press **ENTER** to confirm the curve's creation. Ensure the **first** and **last points** of the curve are **aligned** with the **central Y-axis**. Drawing the curve in an orthographic view also ensures that all points exist on the same plane.

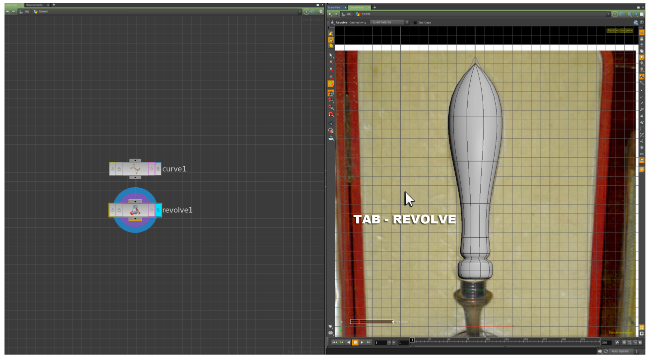




NOTE: Curve Points can be interactively edited after a curve has been created by pressing **ENTER** on the keyboard with the mouse over the Viewer. This will activate a single point-editing handle in the Viewer. Curve Points can also be inserted into an existing curve by **SHIFT + LMB** on the curve.

REVOLVING A CURVE

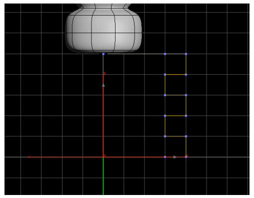
With the curve still selected, press **TAB** with the **mouse over the Viewer** and type **revolve**. This will revolve the curve to form the handle. The shape of the handle can be examined in the Perspective view and reedited if necessary by selecting the Curve SOP in the Network Editor and activating its Tool Mode in the Viewer.

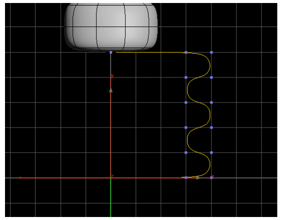


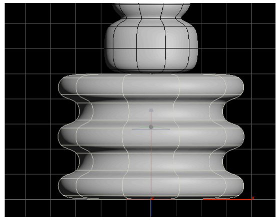
Note: This operation will automatically append a Revolve SOP to the Curve SOP in the Network Editor.

CREATING THE HANDLE THREAD

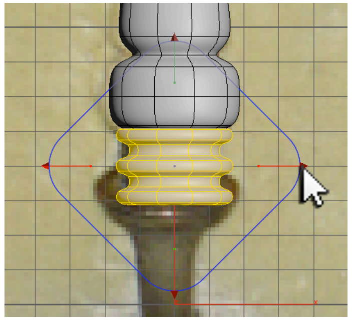
This curve revolve technique can also be utilised to create the trowel handle's thread component. Ensure Grid Snapping is activated, and draw the thread curve using the front orthographic view as a big E shape.







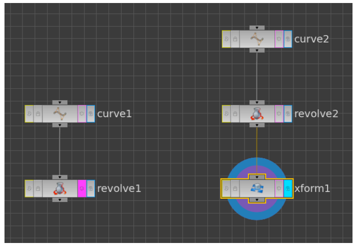
The **Primitive type** of the **curve** can be then set to **NURBS**, and a **Revolve operation** can be performed on it.

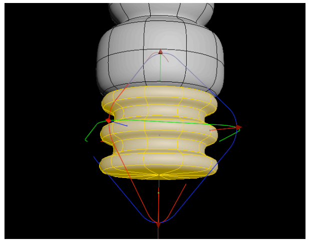


Finally, a **Transform SOP** can be activated through the **Viewer**, and the **Handle Thread** can be **scaled down** and **positioned beneath** the **Handle** relative to the reference image.

INTERACTIVE TEMPLATED GEOMETRY

As the second Curve SOP was interactively created in the Viewer, the existing revolved handle geometry will remain in view as an **interactive Templated Display**. The **Pink Template Flag** on each SOP therefore has **two functions**. The first is to **display geometry as** a non-interactive light **grey wire-frame outline**; the second is to display geometry as a **shaded object**, which can be **interacted with**. While this second mode is visually clearer, it can cause modelling errors if the shaded templated geometry is inadvertently interacted with.

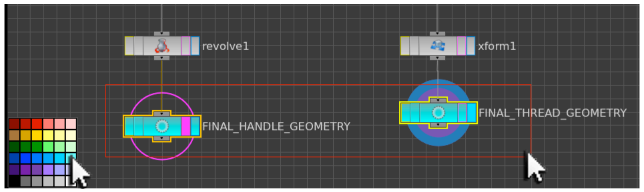




To manually set a piece of geometry to a **template wire-frame** view, **LMB** activate the pink Template Display Flag on the SOP node. To manually set a piece of geometry to a **template shaded view**, use **Ctrl + LMB** to activate the pink Template Flag of the SOP node. In both cases holding down **SHIFT** will allow more than one piece of geometry to be templated.

ANNOTATING NETWORKS & COLOURING NODES

Null SOPs can be now added to each network chain and renamed to describe each network chain's purpose. Ensure Null SOPs are always capitalised.

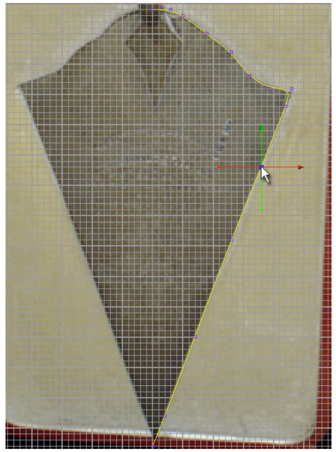


With the mouse over the **Network Editor** press **c** to activate the **Colour Swatch**. Select both **Null SOPs** and using the colour swatch; select a colour for the nodes that will help identify them. Pressing **c** once more with the mouse over the Network Editor will hide the colour swatch.

See modelling_a_trowel_stage1.hipnc

CREATING THE TROWEL FACEPLATE

A slightly different modelling procedure can be utilised in order to generate the faceplate of the trowel. With the mouse over the **Front View Pane (SPACEBAR + 3)**, press **TAB** and type **curve**. This will activate a third **Curve SOP**. Place the first and last points of this curve on the central Y Axis, and Use **Grid Snapping** to help ensure this.



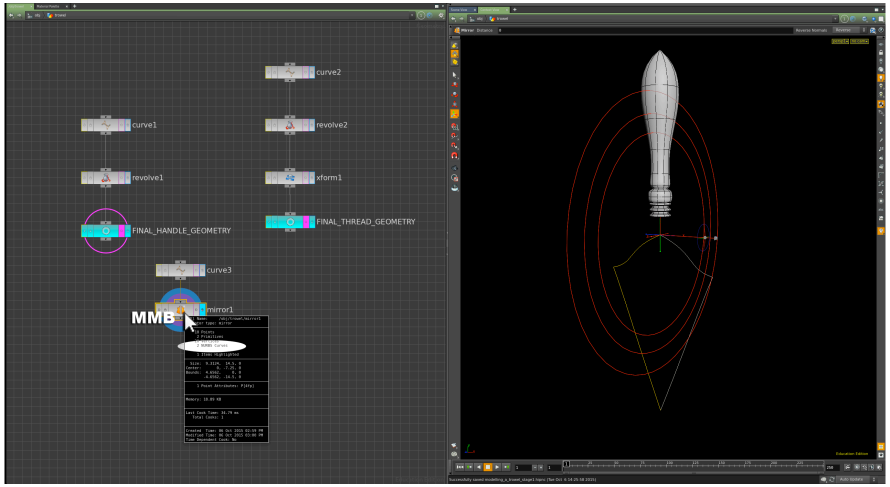
Draw the profile shape of the trowel faceplate as a **NURBS curve** and press **ENTER** to confirm the operation. **Edit** the curve points appropriately so that they closely match the shape of the faceplate reference.

SHIFT + LMB can be used to **add additional curve points** to the side of the faceplate where a sharper curve is required.

NOTE: Grid Snapping can be **deactivated** after the initial curve has been drawn, in order to allow for precision placement of its curve points.

THE MIRROR SOP

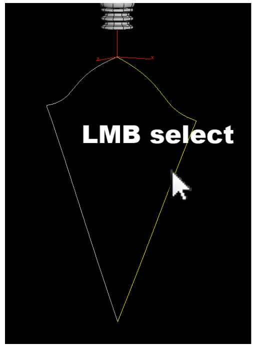
Return back to the **Perspective View** (**SPACEBAR + 1**), and with the curve still selected and the mouse over the Viewer, press **TAB** and **type Mirror (Utility)**. This will activate a **Mirror SOP** in the **Network Editor**, mirroring the faceplate profile curve to create a whole shape.

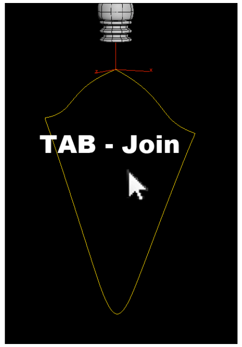


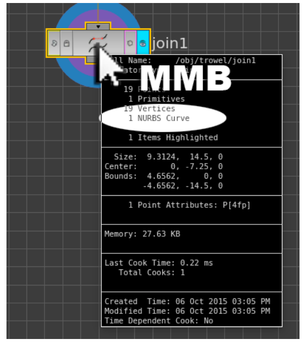
MMB on the **Mirror SOP** in the **Network Editor** will reveal the **Information Card** for this node. This states that there are **2 NURBS curves** being processed (the first drawn by the Curve SOP, the second created by the Mirror SOP). These two curves will need to be joined together before the faceplate geometry can be created.

JOINING CURVES

Using the Select Arrow, select the right side faceplate curve, and with the mouse over the **Viewer**, press **TAB** and type **join**. This will activate a **Join SOP.**



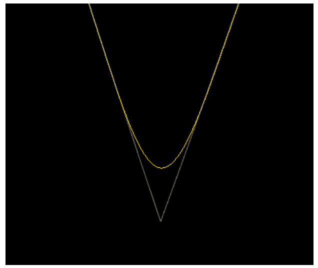




MMB on the **Join SOP** in the **Network Editor** will reveal that the two curves are now a single NURBS curve.

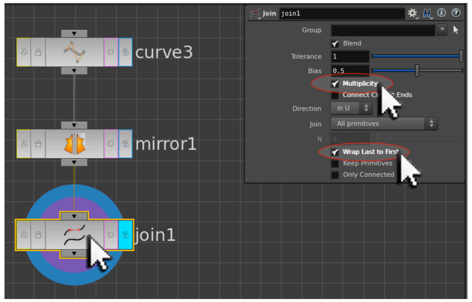
REFINING CURVES

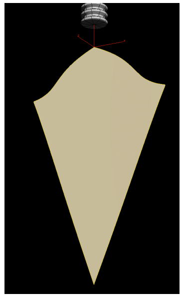
Upon examination, the joined curve no longer quite reflects the shape of the original two curves that made it. This is most noticeable at the tip of the faceplate curve, which has become rounded, rather than remaining pointed.



This discrepancy can be rectified by adjusting the **Parameters** of the **Join SOP**. Activating the **Multiplicity** tick box in the **Parameters** of the **Join SOP** will restore the shape of the trowel.

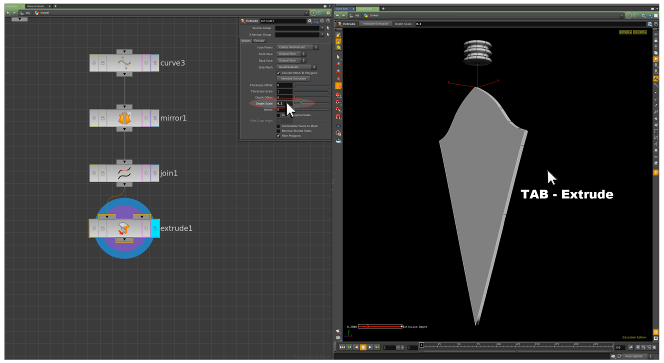
Activating the **Wrap Last to First** tick box in the **Parameters** of the **Join SOP** will turn the curve into a single NURBS surface.



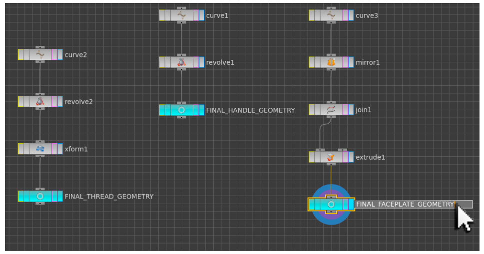


EXTRUDING CURVES

A NURBS curve or surface can be extruded to create thickness. With the faceplate geometry still selected, press **TAB** with the mouse over the **Viewer** and **type extrude**. This will invoke an **Extrude SOP**. Press **ENTER** to confirm the extrusion.



Modify the **Depth Scale** parameter of the **Extrude SOP** to reduce the thickness of the extrusion.

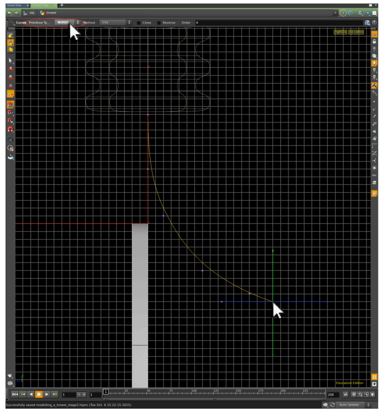


As a final step, append a **Null SOP** to the faceplate network to annotate it. It can be coloured to match the other network annotations in this object.

See modelling_a_trowel_stage2.hipnc

CREATING THE TROWEL STEM

Switch the **View Pane** to the **Right Orthographic View** (**SPACEBAR + 4**) and with the mouse over the **View Pane** press **TAB** and type **curve**. This will activate a fourth Curve SOP. Using **Grid Snapping**, draw a curve that will form the backbone of the trowel stem. **Set** the **Primitive Type** of the curve to **NURBS**.

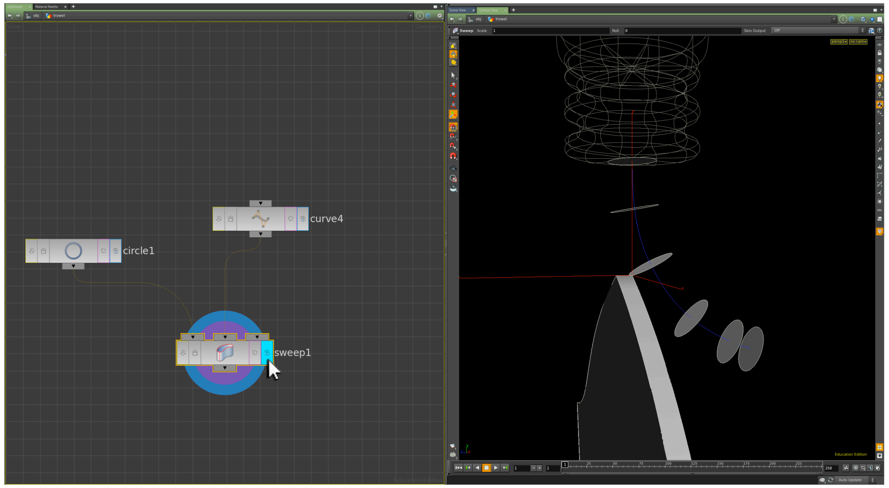


SWEEPING A CURVE

Manually in the Network Editor, create a **Circle SOP** alongside this newly created curve. In the **Parameters** for the **Circle SOP** specify:

Primitive Type	**NURBS Curve**	
Radius	**0.3**	**0.3**

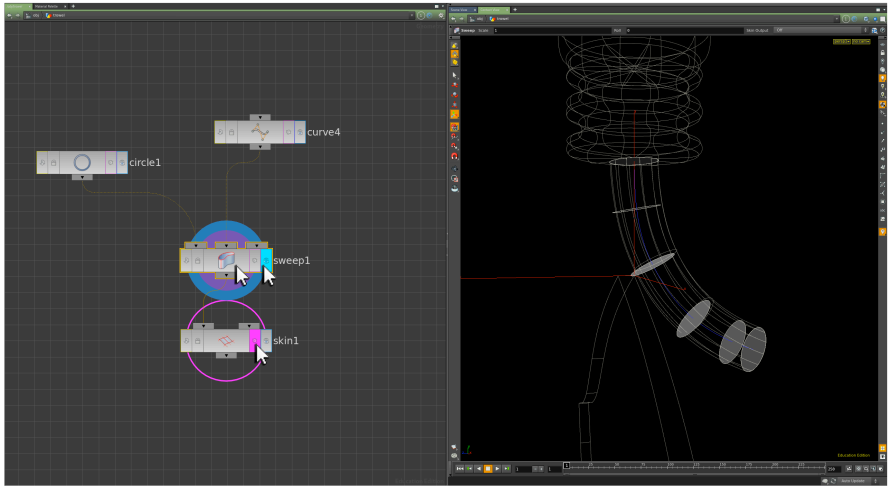
This will create a small circle that can be assigned to each point on the stem curve by performing a sweep operation.



With the mouse over the **Network Editor**, press **TAB** and type **sweep**. This will create a **Sweep SOP**. Manually wire the output of the **Circle SOP** into the **first input** of the **Sweep SOP**. **Manually wire** the output of the **Curve SOP** into the **second input** of the **Sweep SOP**. This will copy an instance of the Circle SOP onto each point of the stem curve.

SKINNING A SWEPT CURVE

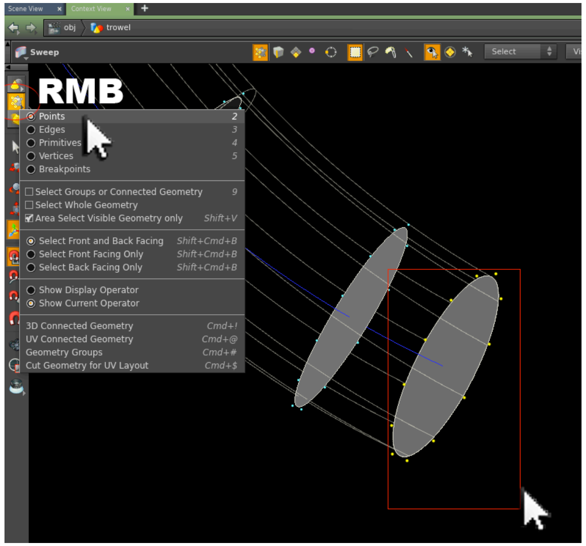
While the parameters of the **Sweep SOP** do allow for a skin to be created over the resulting shape, there is also an independent Skin SOP operation that will create the same effect. The advantage of assigning this separately is that it will allow for simpler editing of the shape.



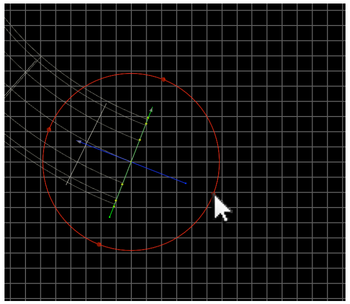
In the **Network View RMB** append a **Skin SOP** to the **Sweep SOP**. Holding down **SHIFT**, activate the **pink Template Flag** for the **Skin SOP** so that a preview of its effect can be seen in the **Viewer**.

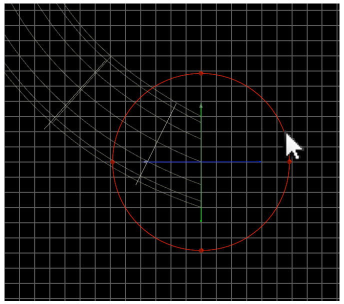
REFINING THE STEM SHAPE

RMB on the **Geometry Selection** button and from the resulting menu choose **Points**. This will change the selection so that the points of the circle are selected. Activate the **Select tool** from the left hand side Viewer Stow Bar and select the end circle of the sweep operation.

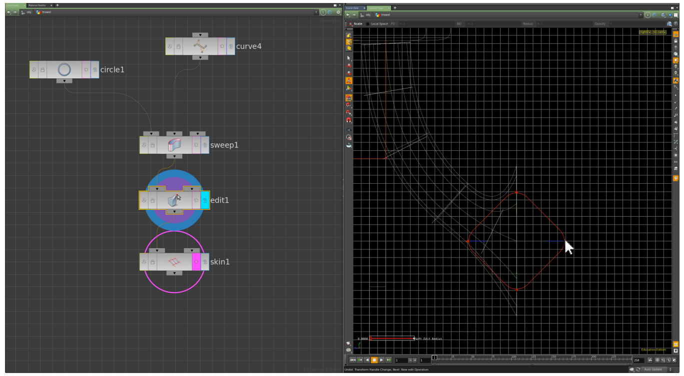


Switch to a **Right Orthographic View** (**SPACEBAR + 4**) and using the Viewer's Rotate tool rotate the points to a vertical alignment. This will automatically insert an **Edit SOP** into the network (after the Sweep SOP and before the Skin SOP). An Edit SOP can also be created by pressing TAB and typing edit.

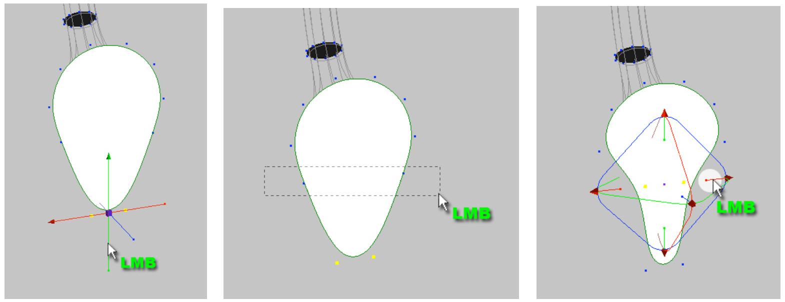




Press e with the mouse over the Viewer to activate the Scale Tool for the Edit SOP. Uniformly scale the selected points to create the base of the stem.



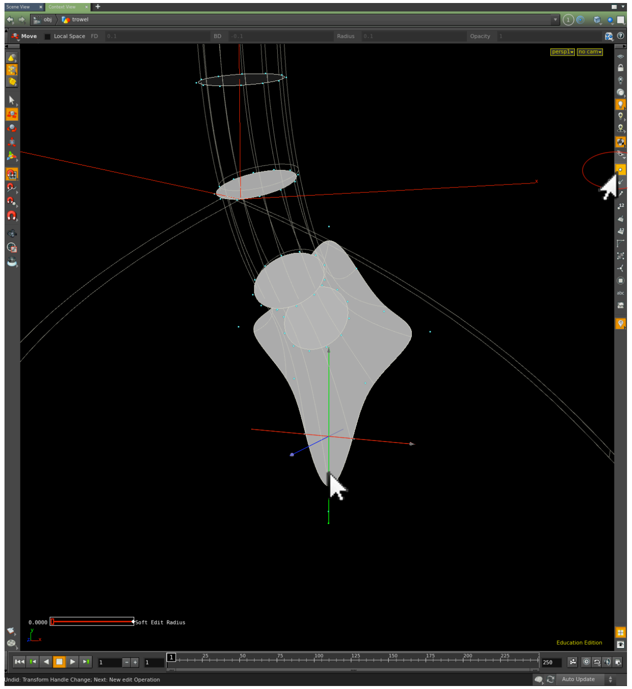
NOTE: All edits of geometry will be stored in the existing Edit SOP until a new operation is activated. This means that Edit SOPs cannot be key-framed (use a Soft Transform SOP instead if this functionality is required).



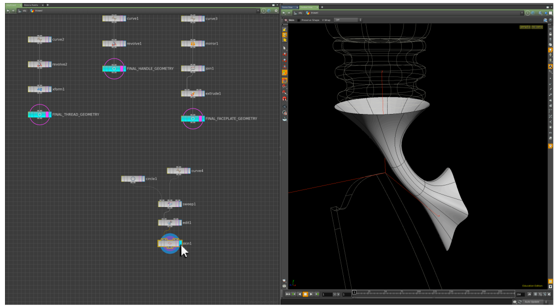
Switch to the **Persp View** (**SPACEBAR + 1**) and **continue editing individual groups** of **points** for the end circle to begin to **form the diamond shape** of the trowel stem.

DISPLAYING POINTS

When editing geometry, it is useful to display all points in the Viewer. This can be done by activating the **Display Points** button from the **right hand viewer side stow bar**. It is also useful to set all other geometry to a non-interactive template wireframe display so that only the points associated with the Edit SOP are displayed.

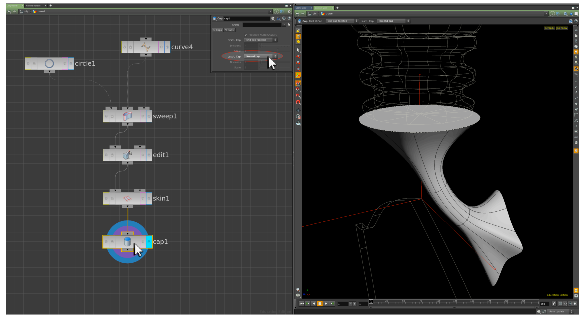


Continue editing the points of the end circle to create a diamond shape. Use the **trowel reference image** as a guide for creating and finalising the shape. When the editing of the stem is complete, activate the **Display Flag** on the **Skin SOP** to **see the final stem geometry**.



THE CAP SOP

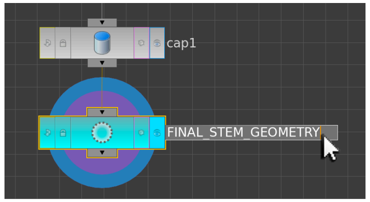
At present the stem has hollow ends. While this is fine for the end that aligns with the faceplate, a cap needs to be added to the end that aligns with the trowel thread.



In the **Network Editor**, append a **Cap SOP** to the **Skin SOP**. By default this will cap both ends of the input geometry. In the **parameters** for the **Cap SOP** specify:

Last U Cap **No end cap**

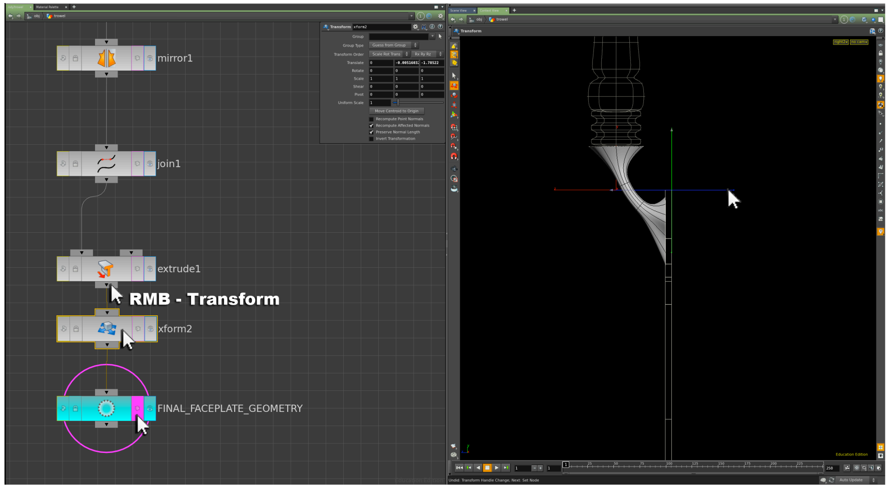
This will uncap the end of the stem that will align with the faceplate, making it more render efficient.



As before, a **Null SOP** can be appended to this network chain, annotating its purpose.

ALIGNING THE FACEPLATE

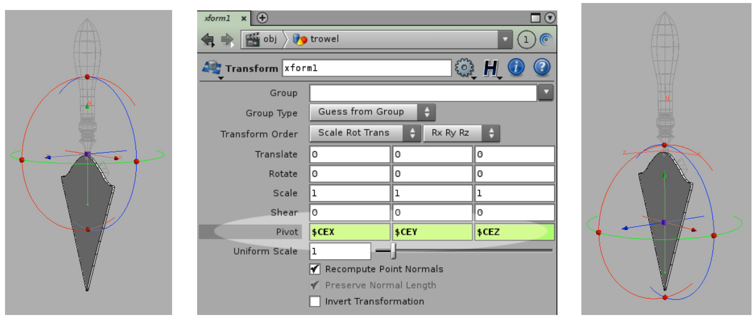
Return back to the network chain responsible for creating the trowel faceplate. Before the final Null SOP **RMB insert** a **Transform SOP**. This can move the faceplate geometry into position relative to the other trowel components.



CENTERING TRANSFORM PIVOTS

The pivot for the Transform SOP handle is set to the relative origin (0,0,0). A pivot can be centred by entering into the Pivot parameter of the Transform SOP the following variables:

Pivot **$CEY** **$CEY** **$CEZ**



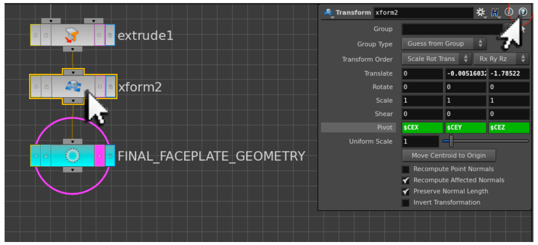
These variables will automatically compute the centre position of the input geometry for each axis. The advantage of utilising these variables is that this pivot positioning will automatically re-evaluate itself should any further shape refinement happen to the faceplate. This procedural approach to data management is central to Houdini.

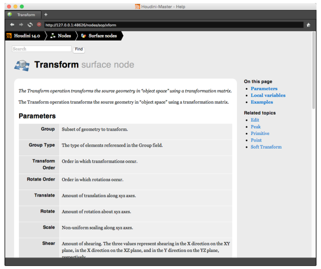
NOTE: These variables can be mathematically refined further. For example, entering **$CEY / 2** into the **Pivot Y** parameter will move the height of the pivot to exactly ¼ of the geometry length. These variables are also specific to the Transform SOP.

RMB on the **transform handle** in the **Viewer** will also give options for pivot manipulation. **INSERT** can be pressed with the mouse over the Viewer to activate Pivot Placement handles. Pressing **INSERT** after the pivot has been moved will restore the regular transform handle.

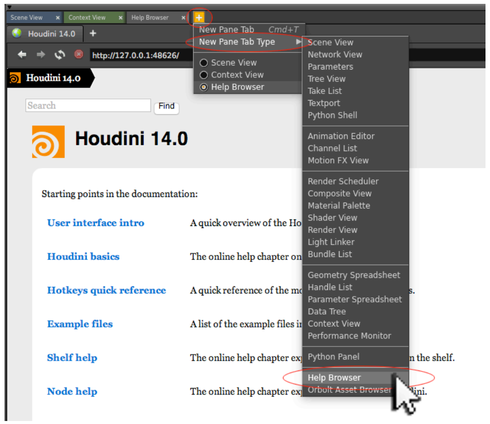
OPERATOR HELP CARDS

Each operator also has a **Help Card** assigned to it. When faced with a problem in Houdini it is always worth investigating the Help Card of an operator before creating another node to solve it. These Help Cards explain the function of a node, list any local variables specific to that operator and give loadable examples of the operator in use. A help card for an operator can be found by **LMB** pressing the button located in the top right hand corner of the operator's parameters.



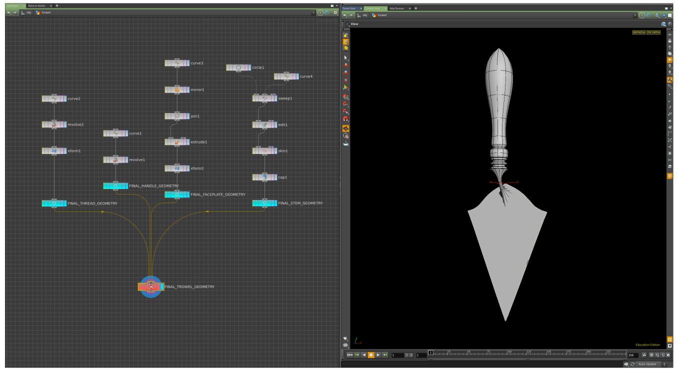


A **Help Browser** can also be **activated over the Viewer** as a **New Pane Tab Type**. This can make searching for help simpler.



COMPLETING THE TROWEL

With the pivot of the Transform SOP centrally aligned, All of the components that create the trowel can now be merged together using a **Merge SOP**.



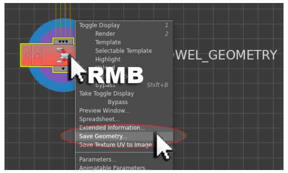
The **Merge SOP** can also be utilised to annotate the completed network. If at any point a trowel component requires further refinement (for example further editing of its shape, or the addition of textures), the network chain associated with it can be expanded upon further to incorporate other nodes.

See **modelling_a_trowel_end.hipnc**

SAVING GEOMETRY TO DISK

The trowel geometry can now be saved out to disk as a geometry file. This will ensure that the network generated to model the trowel will not be evaluated when the animation is processed. It also means that the scene containing the trowel network does not inadvertently get modified.

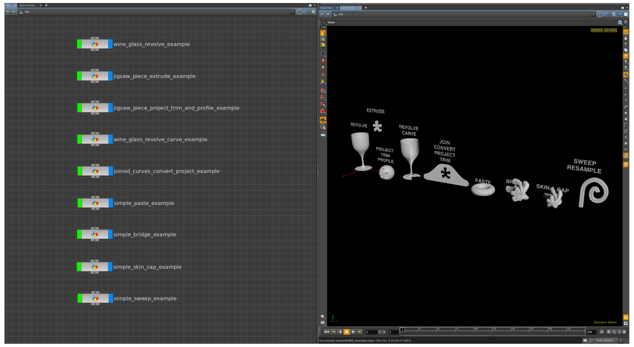
RMB on the **final_trowel_geometry Null SOP** and from the resulting menu choose **Save Geometry…**



This will activate a dialog window for saving the geometry to disk. Save the geometry as a file called **trowel.bgeo** to an appropriate location on disk. This **.bgeo** file can be read into any new scene by using a **File SOP**.

Note: A .bgeo file is Houdini's native geometry format. Other geometry formats such as .obj can also be created.

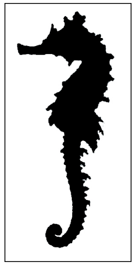
OTHER NURBS MODELLING TECHNIQUES



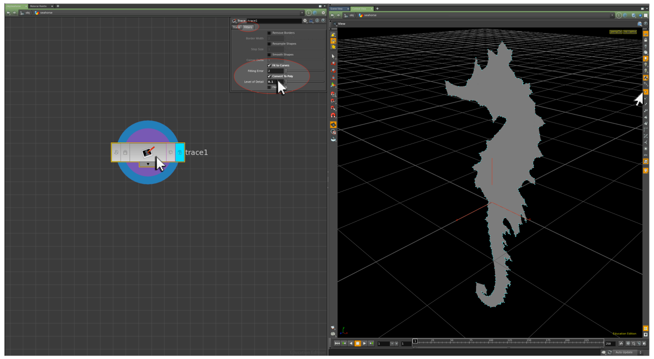
NURBS surfaces can be combined to produce other modelling functionality. These include creating holes in surfaces (**Trimming**), extracting projected curves from a surface (**Profiling**), parametrically reducing a surface area (**Carving**), copying one NURBS surface into another (**Pasting**), and creating a surface between two curves (**Bridging**).
See NURBS_examples.hip

ORGANIC POLYGON MODELLING

In a new Houdini, create a **Geometry Object** and rename it to **seahorse**. Inside the object, delete the default **File SOP** and in its place create a **Trace SOP**. This operator will automatically trace the outline of an image.



A paint package has been utilised to convert a reference image into a black and white mask specifically for creating an outline. This outlined image (**seahorse_outline.jpg**) can be read into **Houdini** using the **Trace SOP**.



When **Point Display** is activated in the **Viewer**, there are many points generating the outline. This can be rectified by adjusting the **Filters** section of **Trace SOP Parameters**.

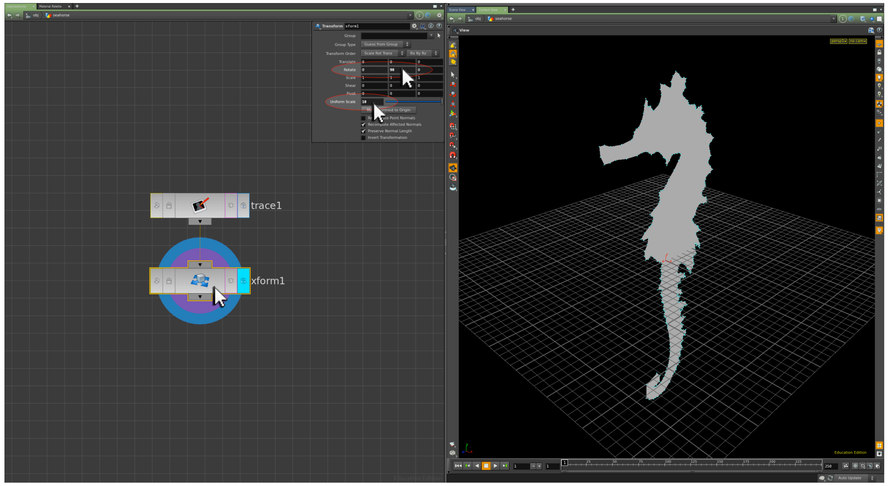
In the **parameters** for the **Trace SOP**, activate the **Fit to Curves** option and the **Convert to Poly** option. In the **Level of Detail Parameter** associated with the Convert to Poly option specify:

Level of Detail	**0.1**

This will produce a single polygon with a manageable number of points from which a model can be generated.

Append to the **Trace SOP** a **Transform SOP**. In the **Parameters** for the Transform SOP specify:

Rotate	**0**	**90**	**0**
Uniform Scale	**10**		

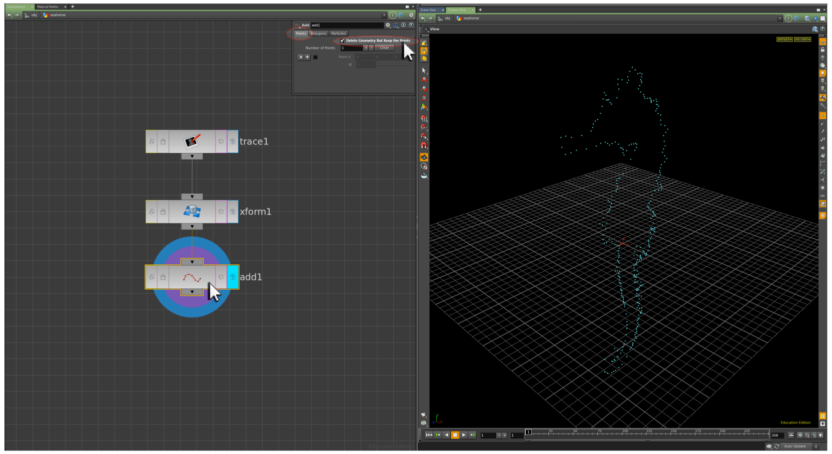


This will enlarge the seahorse shape and orientate it correctly for modelling.

CREATING AN OUTLINE FROM A SHAPE

At present the seahorse shape has a primitive face created by the closed polygon curve created by the Trace SOP. This face will cause problems when modelling. This face can be removed by **appending** an **Add SOP** to the **network** and specifying under the **Points section** of the **parameters**:

☑ **Delete Geometry But Keep the Points**



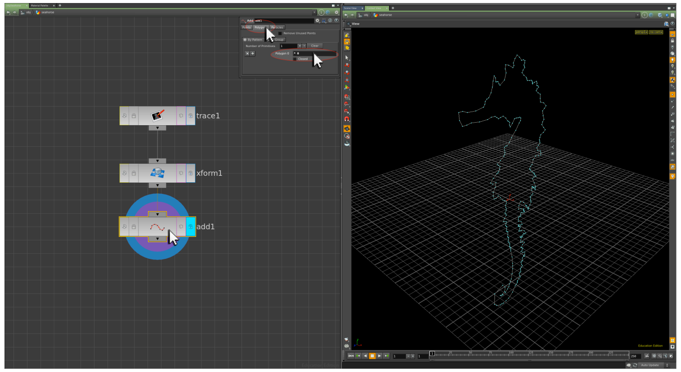
When this operation is applied, the seahorse face will disappear leaving only its point data.

JOINING THE DOTS

Under the **Polygons** section of the **Parameters** for the Add SOP specify:

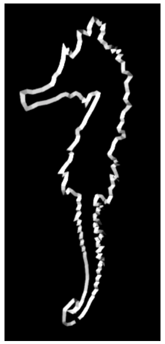
Polygon 0	*** 0**

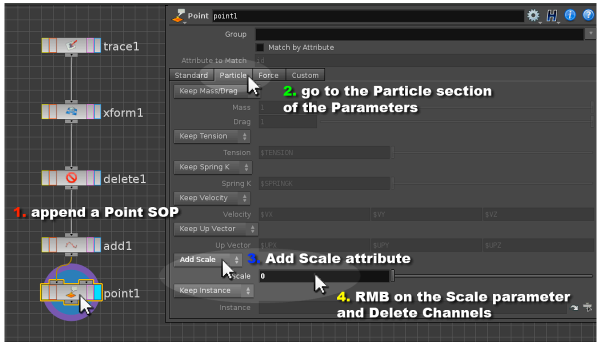
This will draw a curve using all (the wildcard *) of the points. Appending 0 at the end of this * will join the last point back to the first point (0) without closing the curve to create a face.



CURVES AND RENDERING

By default Houdini will render curves. A Render Region Preview reveals the outline curve of the seahorse. Even after modelling of the seahorse is complete, this curve will still appear.

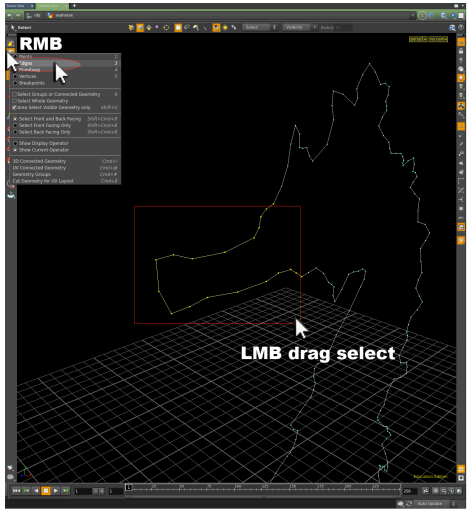




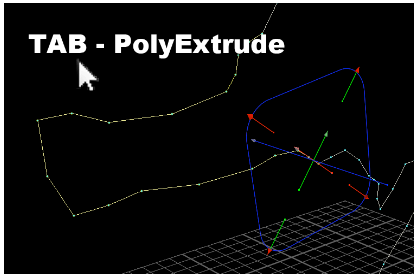
This can be fixed by appending a **Point SOP** to the network, and using it to add a **Scale Parameter value** of **0** to the curve.

CREATING THE MUZZLE

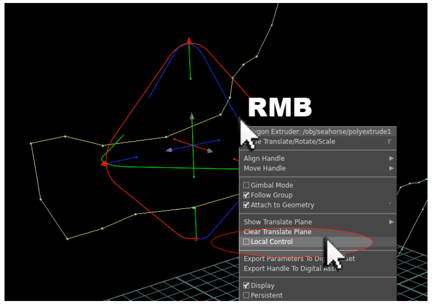
RMB on the **Geometry Select Mode** button and specify a selection type of **Edges**. In the **Viewer**, select all of the edges that make up the muzzle of the sea horse.



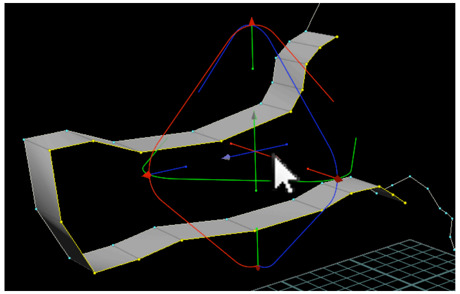
In the Viewer, press **TAB** and typing **polyextrude**. A **PolyExtrude SOP** will be **appended to the network**, and its **interactive handles** will **appear in the Viewer**.

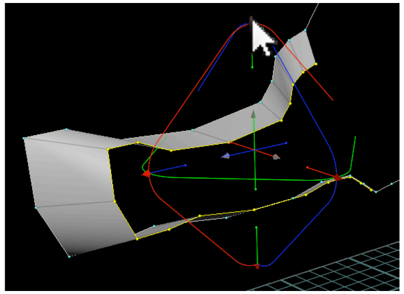


The **PolyExtrude Operation** has **two modes** in which in can function. The **default** mode is **Local Control**. This means that the transformation handle is orientated to one of the edges being extruded.



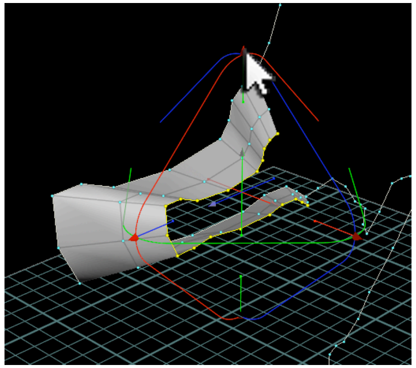
RMB holding on the **transformation handle** and **decactivating** the **Local Control** option will orient the handle to Object Space. This second mode function is known as **Global Control**.





With the **PolyExtrude** operation set to **Global Control**, extrude the edges outwards in the positive X Axis, whilst scaling them down slightly.

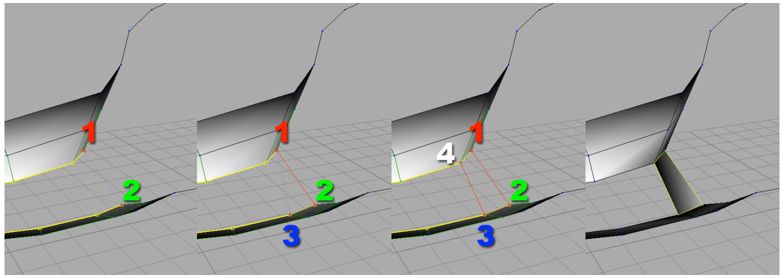
With the mouse over the **Viewer**, press **q** to repeat the current operation. Ensure that **Global Control** is activated for this second **PolyExtrude** operation, and once more extrude the edges in the positive X Axis, whilst scaling them down slightly.



See file seahorse_stage1.hipnc

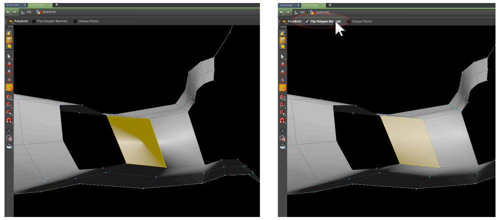
CREATING ADDITIONAL POLYGONS

Ensure the **Shading Mode** of the **Viewer** is set to **Smooth Wire Shaded**, and with the mouse over the **Viewer**, press **TAB** and type **polyknit**. This will activate an operation to draw polygons between the extruded faces. **Individually select** a **square of points** to be knitted and press **ENTER** to confirm the operation. A new polygon face will be created.

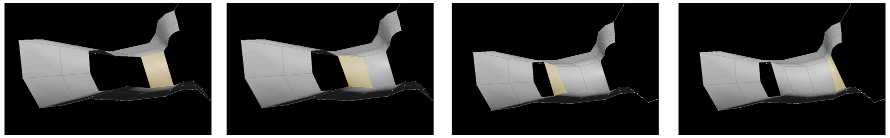


NOTE: It is always better when poly-knitting to select points across a gap first, rather than points running down an existing edge.

Press q to **repeat this operation** to draw a second polygon.



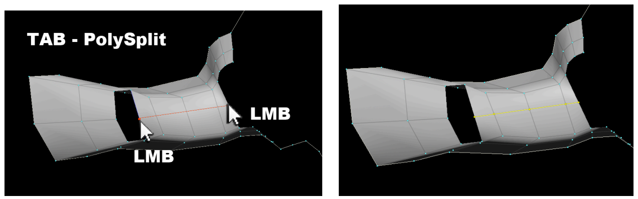
The **point order selection** of the **Poly Knit** determines how the **new face** will be **orientated**. Sometimes is it necessary to activate the **Flip Polygon Normals** parameter so that the new face responds correctly to lighting calculations.



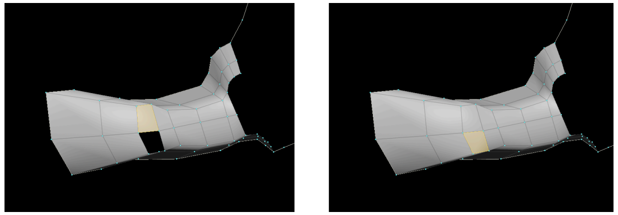
Press **q** on the keyboard to repeat the operation, creating individual faces for the remainder of the gap.

SPLITTING POLYGONS

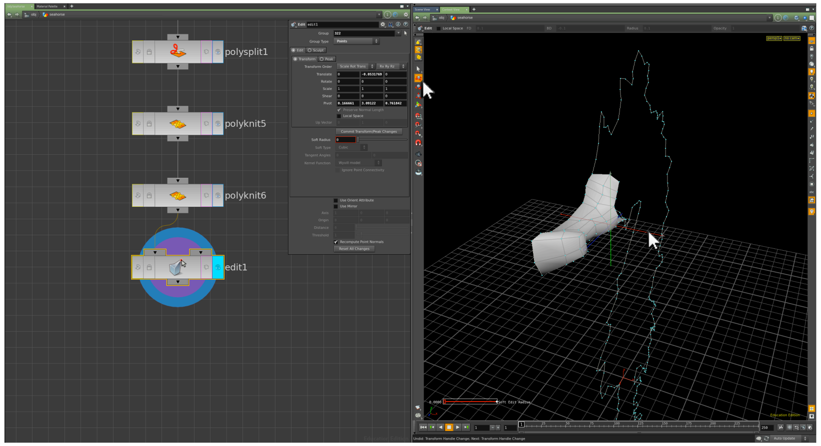
In order to knit the final part of the gap, it is necessary to split the polygon in order to give the correct topology for the knit. With the mouse over the **Viewer** press **TAB** and type **polysplit**.



LMB select a start point and an end point for the split, and press **ENTER** to confirm the operation. This will divide the polygon faces. With the **PolySplit operation complete**, the **remainder of the gap** can be filled using **PolyKnit operations**.



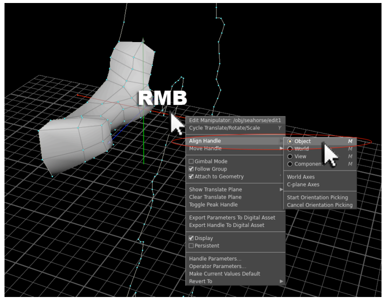
When creating this type of model, it is necessary to ensure all faces being created are square rather than triangular. This will ensure clean geometry topology for aiding deformation-based animation later in the production pipeline. The shape of the seahorse muzzle can be further refined by an **Edit** operation.



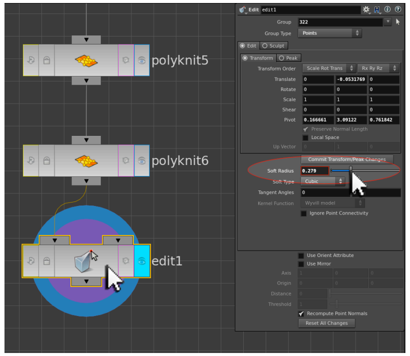
See file seahorse_stage2.hipnc

EDIT SOP TIPS

When using an Edit SOP interactively in the Viewer, it can be a good idea to align the edit handle with Object Space. This can be done by **RMB** on the **Edit Handle** and choosing **Align Handle > Object**.



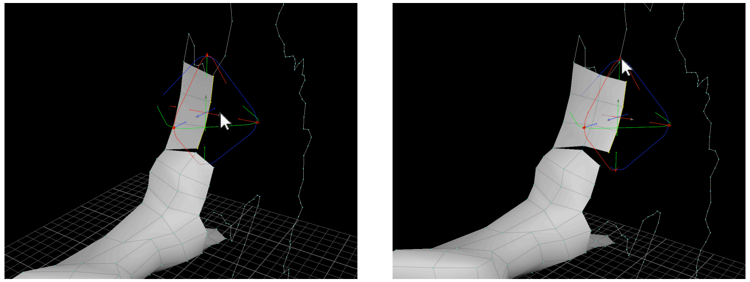
The **Edit SOP** also has a **Soft Radius option**. When this **value is increased**, the **influence** of the **current edit** will **start extending** to the **surrounding points**.



Sometimes it can also be useful to deselect a current edit before selecting a new edit. This can help prevent inadvertent movement of the current active point if the Edit Handle is moved instead of selecting a new point.

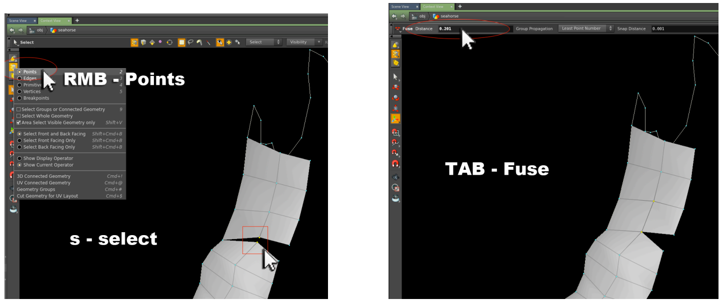
CREATING THE FOREHEAD

The initial process **extruding edges** can be repeated for the **forehead of the seahorse** by utilising the **PolyExtrude operations** once more.



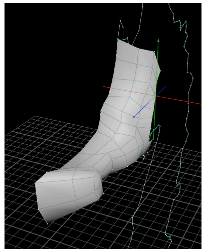
FUSING POINTS

After creating the rough geometry for the forehead, it can be joined to the muzzle by using a **Fuse SOP**. In the Viewer, press **s** to enter selection mode, and **RMB** on the **Geometry Select Mode** button to set the selection type to **Points**.



Select the **two points** to be fused, and with the **mouse over the Viewer** press **TAB** and type **fuse**. This will activate a Fuse operation. When the **Distance parameter** of the **Fuse SOP** is **increased**, the two points will snap together.

A **combination** of **PolyExtrudes, PolyKnits, Edits and Fuses** can be utilised to complete the rest of the seahorse forehead and its attachment to the muzzle.

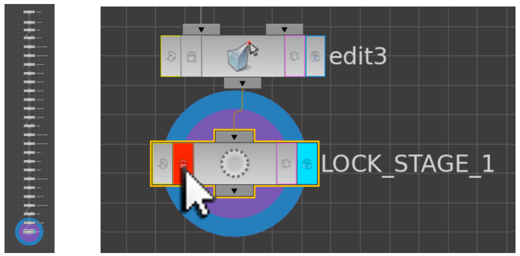


Wherever possible for organic modelling, the geometry edges should follow the natural muscle or feature lines of the shape being created. This will allow for extra detail to be modelled around these areas, as well as aiding deformation-based animation.

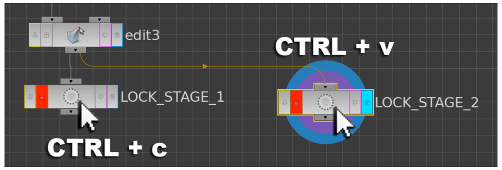
See file seahorse_stage3.hipnc

LOCKING NODES (DELETING THE CONSTRUCTION HISTORY)

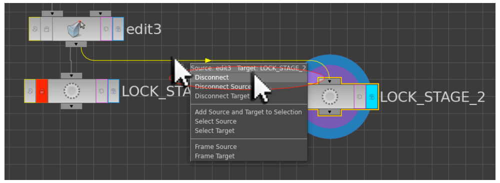
When viewed in its entirety using the Network Editor, there is a long list of nodes creating the seahorse muzzle and forehead. This is known as the construction history; and for this type of modelling these nodes can be deleted or locked, as the model progresses.



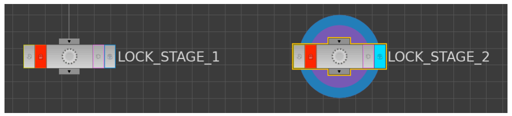
In the **Network Editor** append a **Null SOP** to the network and rename it **LOCK_STAGE_1**. **LMB** click on its **Lock Flag** (**alternately**, **RMB** on the **node** and choose **Lock/Unlock**). This will lock all of the information generated by the modelling construction history into this node.



Select the **locked Null SOP**, and **Copy** (**CRTL + c**) and **Paste** (**CTRL + v**) to create a second version of it. This copied node will automatically be renamed as **LOCK_STAGE_2**.



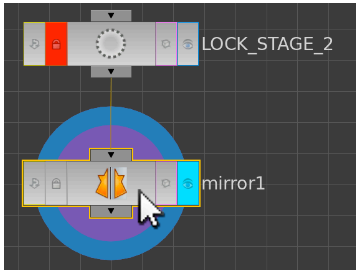
The **wire connecting LOCK_STAGE_2** can then be **disconnected** by **either RMB** on the **connecting wire** and **choosing Disconnect**, or by **vigorously shaking** the **LOCK_STAGE_2 node** in the **Network Editor**. The LOCK_STAGE_2 node can then be utilised at the starting point for developing the model further

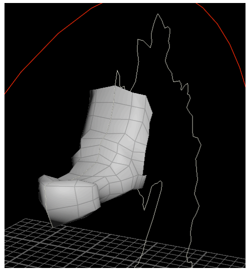


NOTE: if a network is deleted and the locked SOP is then unlocked, the information locked into the node will be lost and an error returned.

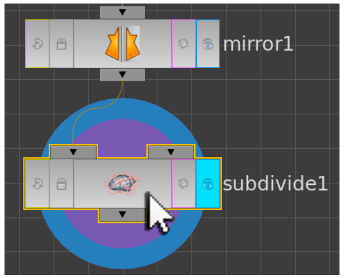
CHECKING THE MODEL

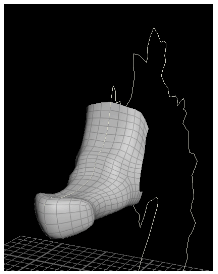
To the **output** of the **LOCK_STAGE_2 Null SOP**, append a **Mirror SOP**. This will mirror the current progress of the modelling to give a better understanding of how the model will look when it is completed.





A **Subdivide SOP** can also be appended to the **Mirror SOP** in order to smooth the geometry further. Again, at this stage, this is for visualisation purposes only.

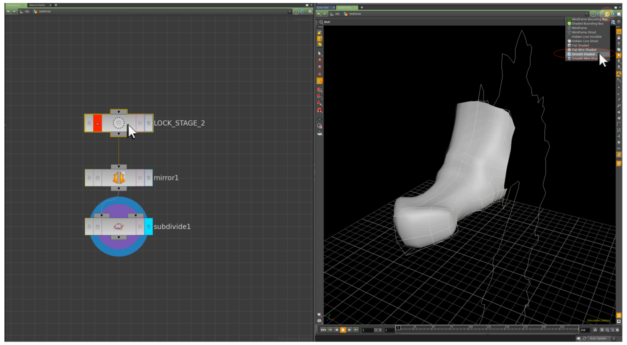




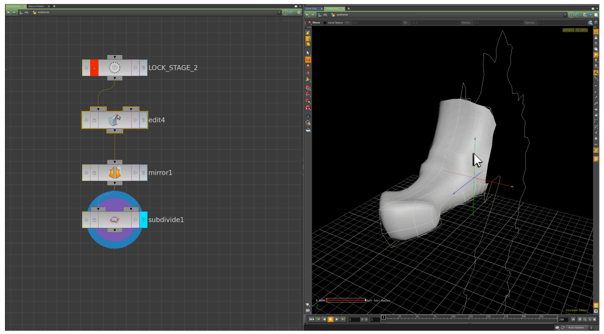
REFINING THE LOW POLYGON MESH

Even with the seahorse model mirrored and subdivided, it is still possible to edit the low polygon seahorse mesh further. This low mesh version of the geometry can be used as a modelling cage, where changes to the low mesh can be viewed on the mirrored subdivided high mesh.

Set the **Viewer** to display **Smooth Shaded** geometry. In the **Network Editor**, set the **Display Flag** to the **Subdivide SOP** and **select** the **LOCK_STAGE_2 Null SOP**.



The **mesh information** of the **LOCK_STAGE_2 Null SOP** will now appear as a cage over the subdivided mesh.



Edits can now be performed on the low polygon mesh cage, with the results of the edits affecting the final geometry.

See file seahorse_stage4.hipnc