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LAB 9: OBJECT CONSTRUCTION AND MANIPULATION

05/12/2016

GOALS

In this lab we begin to go slightly beyond what we did in POV-Ray and get you to create novel geometrical objects with more than just CSG

There are two main approaches to this

- ✦ Build from scratch using some low-level authoring tools
- ✦ Take simpler objects and manipulate them

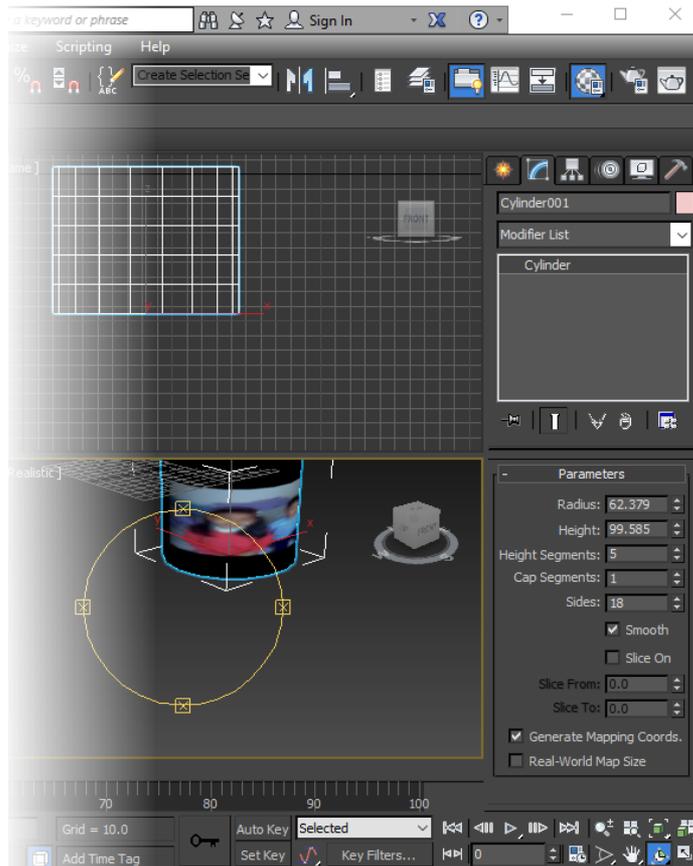
In 3DS Max both of these deal with Object Modifiers which is a central theme of this lab

Other themes we explore in this lab include:

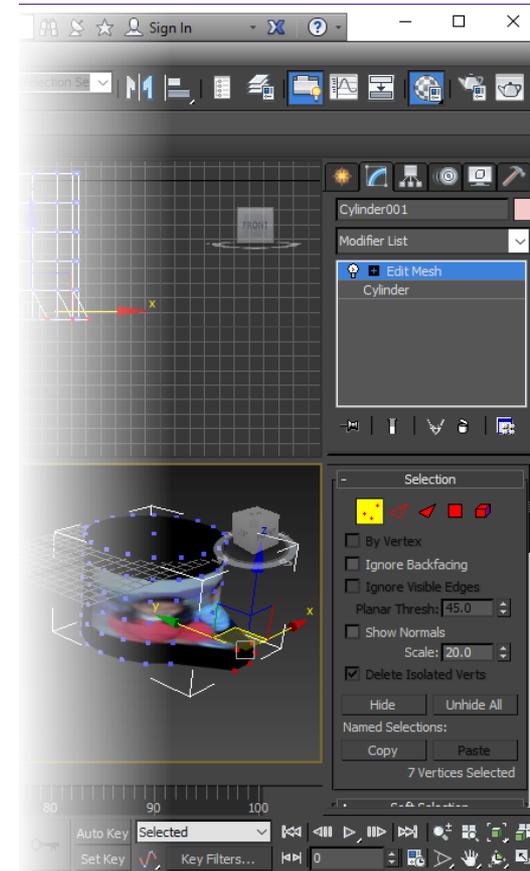
- ✦ Modify Panel
- ✦ Shapes (2D objects)
- ✦ Object modifiers: lathe, sweep
- ✦ Edit Poly

Note that this is all just a snapshot of some of the ways you can create objects. A full description of all tools is beyond the scope of this module and is also partly dependent on the skills and preferences of the modeller

THE MODIFY PANEL



- If a previously-created object is selected, the Modifier allows you to change some of it's parameters.
- In the above example, we can change it's height, radius etc.)



- The modify panel is also a means of accessing a number of powerful modifier functions that can manipulate the object.
- Here the Edit Mesh modifier is used to allow us to change the shape of the cylinder.

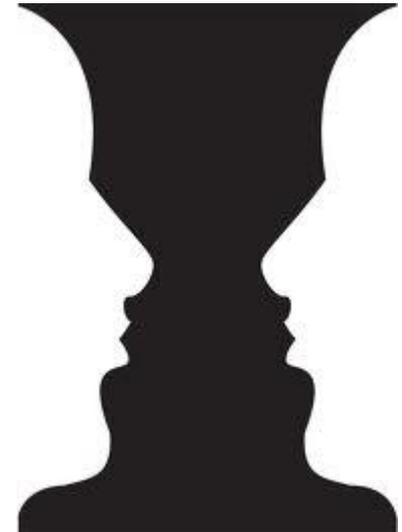
THEME FOR LAB: RUBIN'S VASE

A famous perceptual illusion

- ❖ Figure/ground illusion: which is object and which is background?

Image credits:

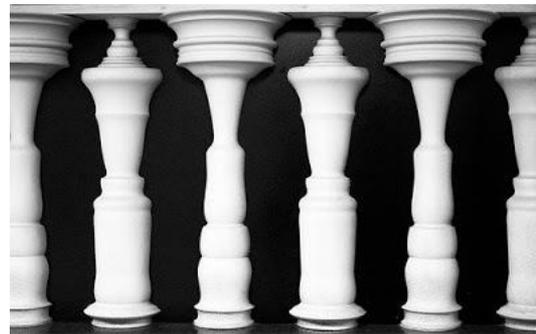
- (1) <http://layersmagazine.com/negative-space.html>
- (2) <http://www.broadsheet.ie/tag/face/page/2/>
- (3) http://www.strangeharvest.com/mt/archive/the_harvest/queens_face.php
- (4) <http://thesituationist.wordpress.com/2008/06/08/the-situation-of-sight/>
- (5) <http://www.turnyourhead.com/>



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SAMPLE RENDERING



SPLINE

In Command Panel,

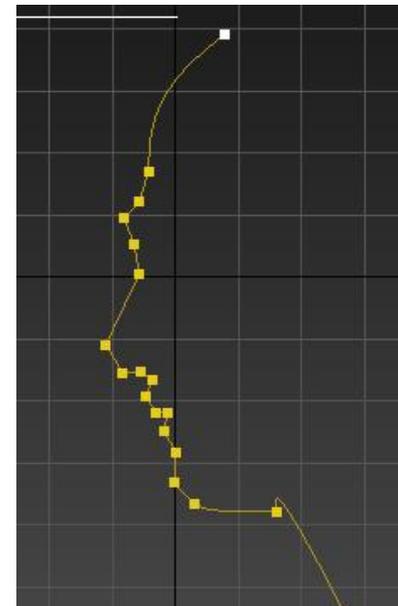
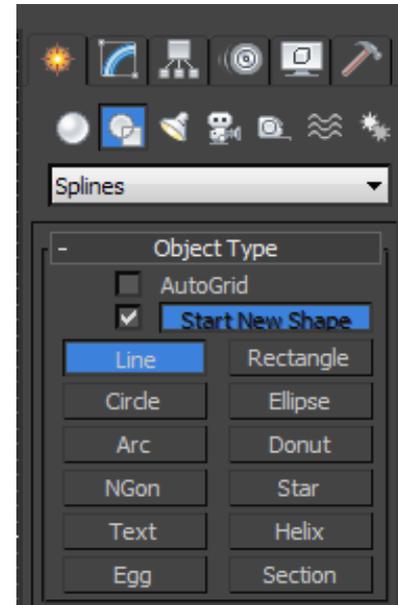
- ✧ Click on the “Create” tab
- ✧ Click on the *Shapes* button 
- ✧ Select “Splines” in the pull down menu,
- ✧ Select “Line” in the Object Type roll-out

In the editing viewport create the silhouette of a vase

- ✧ Left-clicking adds a “Corner vertex” by default.
- ✧ Clicking and dragging adds a Bezier vertex (see next slide).
- ✧ Right-clicking ends the Line

NOTE: It doesn't need to be perfect; you can go back and edit the points including whether or not they are corners or bezier vertices. You can also: add new vertices, attach two lines into one object (this doesn't mean they are connected) and connect two end vertices (See the FAQ at the end of these slides)

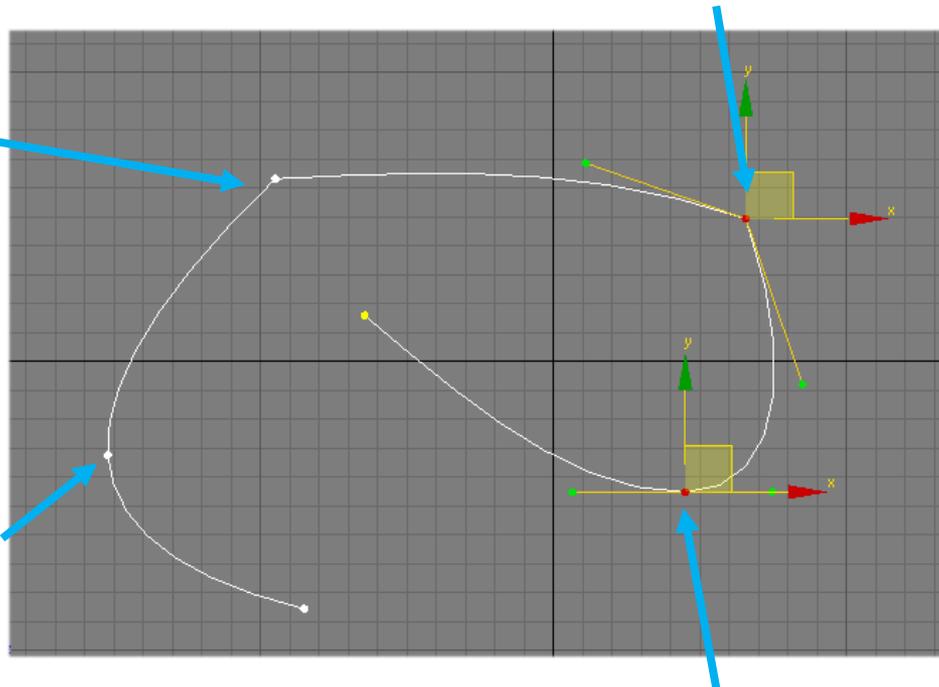
Try to ensure there are no loops, or crossings, in the line and keep a consistent direction (clockwise/anti-clockwise) even if you are attaching several lines together



TYPES OF VERTICES ON A SPLINE

2. Corner vertex: sharp change in line. Affected only by position of vertices as with 1.

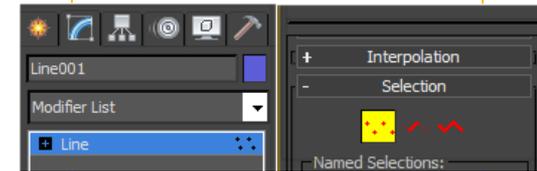
3. Bezier Corner vertex: sharp change but the curvature to left and right can be affected by the handles (green points on yellow lines)



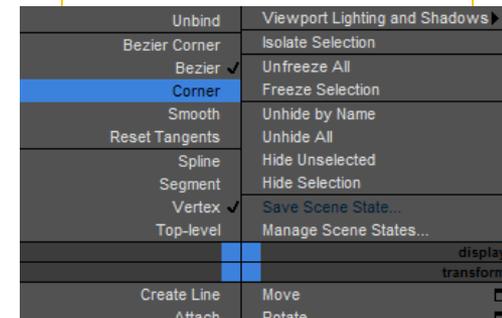
1. Smooth vertex: spline transitions smoothly to the left and right of this point (no real control over the curve except by its position)

4. Bezier vertex: smooth transition as in 1. but with handles to control the curvature as in 3.

To change types:
Select a spline object and in the modifier panel, under selection choose *vertices*.

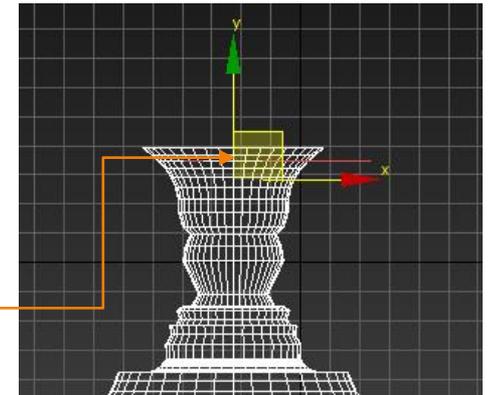
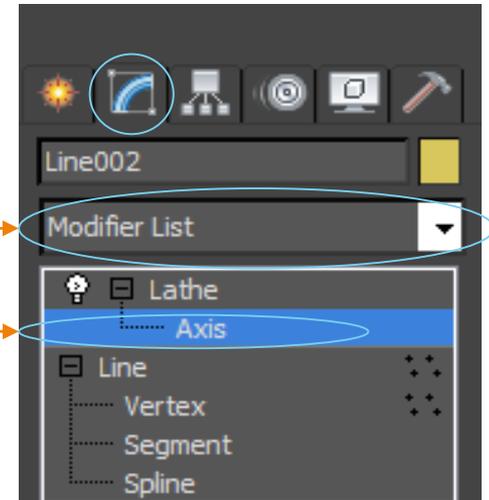


Right click on a vertex and you can change its type in the pop-up menu

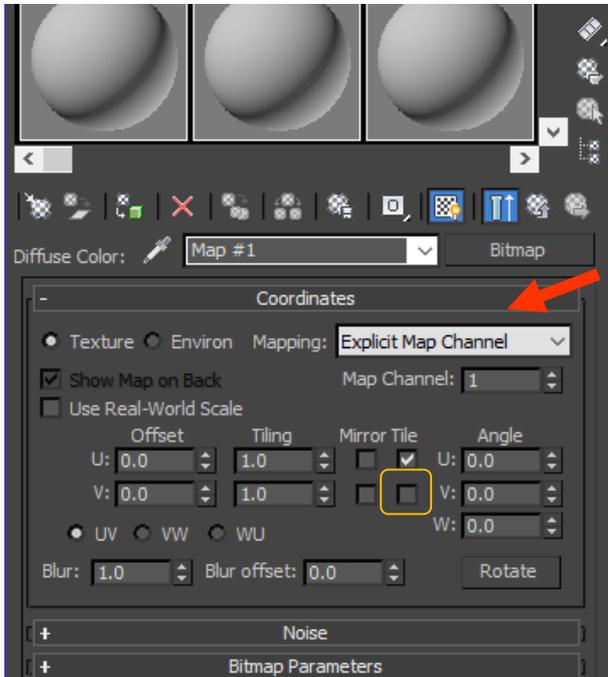


LATHE

- ✧ Select the line you created and click on the *Modify* panel 
- ✧ Pull down the “*Modifier List*” and click on the “*Lathe*” modifier
- ✧ This should create a Lathe of your silhouette in 3D
- ✧ You can change the **AXIS** of the lathe (the central line about which you rotate your line to generate the 3d object) by expanding Lathe in the modifier stack (under the modifier list), clicking on “*Axis*” and then Moving this
- ✧ In case you see strange lighting effects here, it may be due to an issue of your normals (see later slides to see how to fix this)



OPTIONAL: TEXTURE

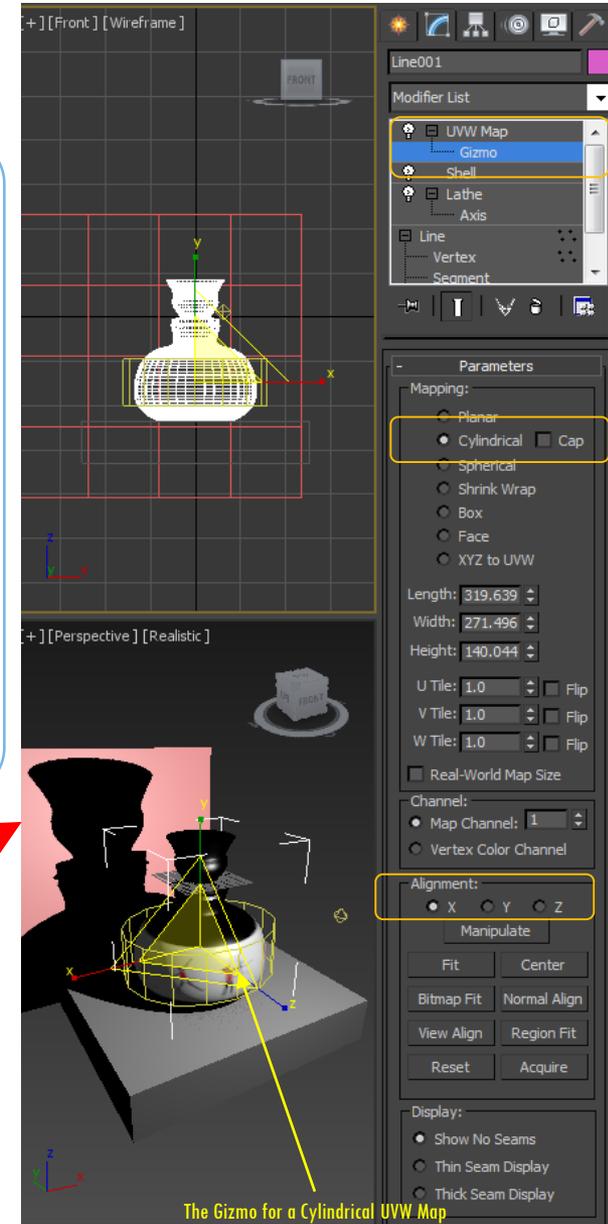


In the **Material Editor**,

- Create a material with a “Diffuse Color” consisting of a **Bitmap** texture - and load an image for a texture (see last week’s lab notes)
- In the Map’s properties, under **Coordinates** Roll-out..
 - Untick “Tile” for the **V:** direction
- Assign the material to your vase (see last week for details)

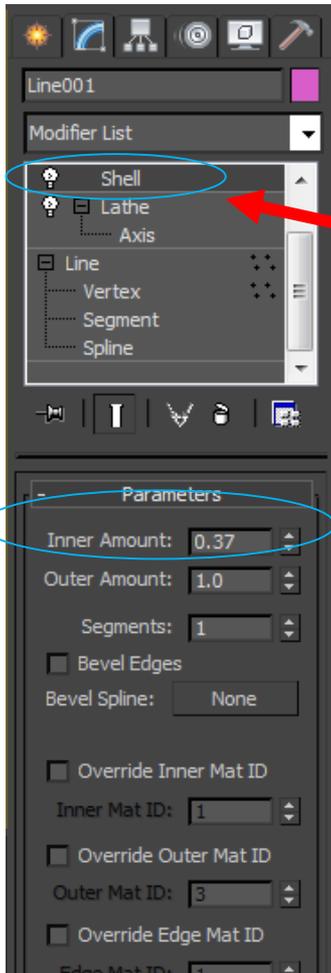
Select the vase: and in the modify panel pull down the list and choose “**UVW Map**” Modifier. Under this modifier’s settings:

- Under **Mapping:** Choose cylindrical mapping, untick cap
- Under **Alignment:** choose the appropriate one that matches the axis of your vase
- In the modifier stack, expand the UVW Map, click on gizmo
 - Translate and scale so that it covers the right part of your vase



The Gizmo for a Cylindrical UVW Map

OPTIONAL: ADDITIONAL TIPS

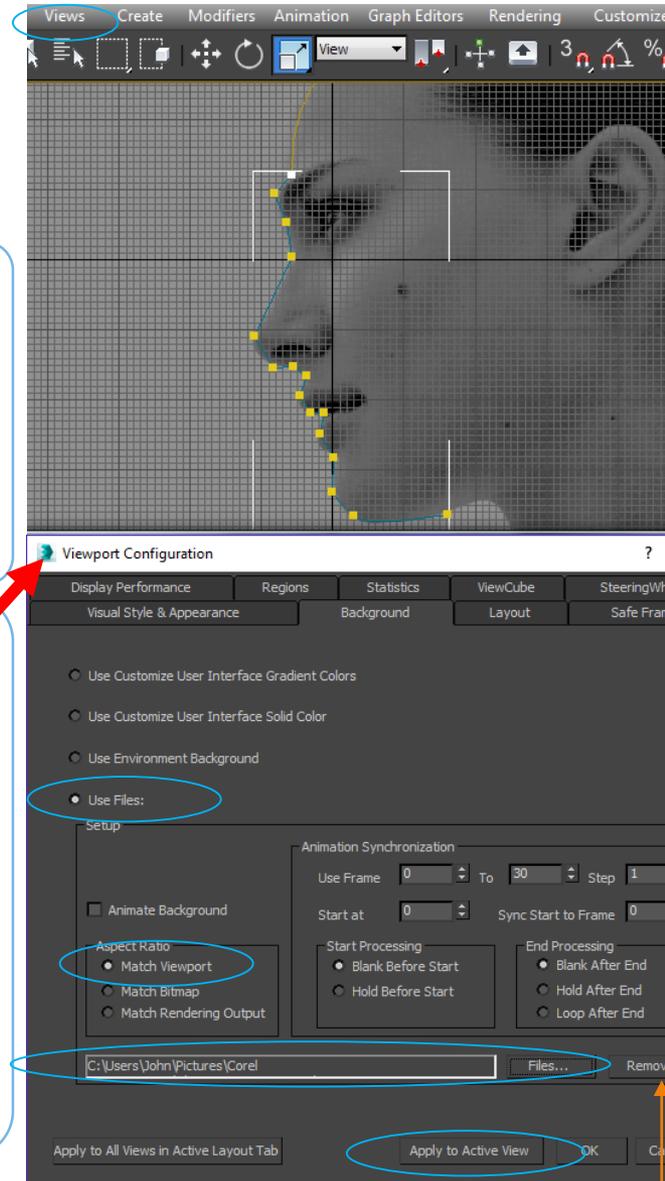


To thicken the shell of the vase:

- Select the vase and apply the Shell Modifier.
- Under this modifier's parameters, increase **Inner amount** to increase the depth

To trace the the vase from an image (e.g. your own face):

- Select a view and in the menu, click Views -> Configure Viewport Background
- Select "Use Files:", Click files and load an image
- Under Aspect Ratio: choose match bitmap
- Apply to Active View
- Trace you're your line
- You can disable it by clicking Remove in the same menu (note the image won't show in rendering anyway)



NOTE: Due to changes in functionality since 3DS MAX 2014 – a better option is to load a Plane with a texture of the image.



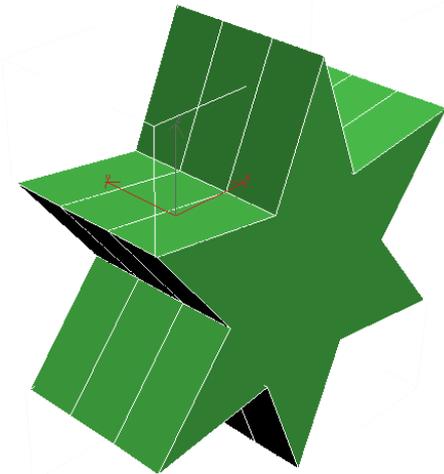
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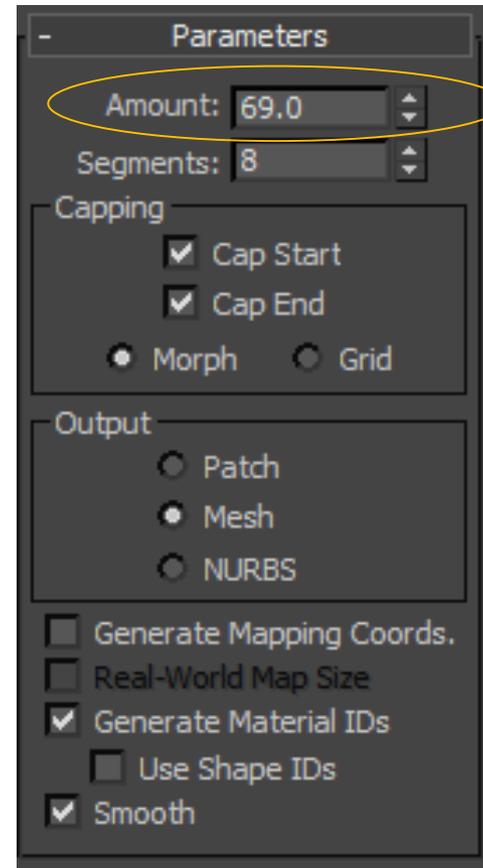
OTHER WAYS TO CREATE OBJECTS

EXTRUDE

- Create a shape (I suggest you pick something other than “Line”) and select it
- On the Modifiers tab, under the Modifiers pull-down list, select the **Extrude** modifier
- Change the extrude Amount to affect the depth of extrusion
- The segments number adds detailed slices to the model

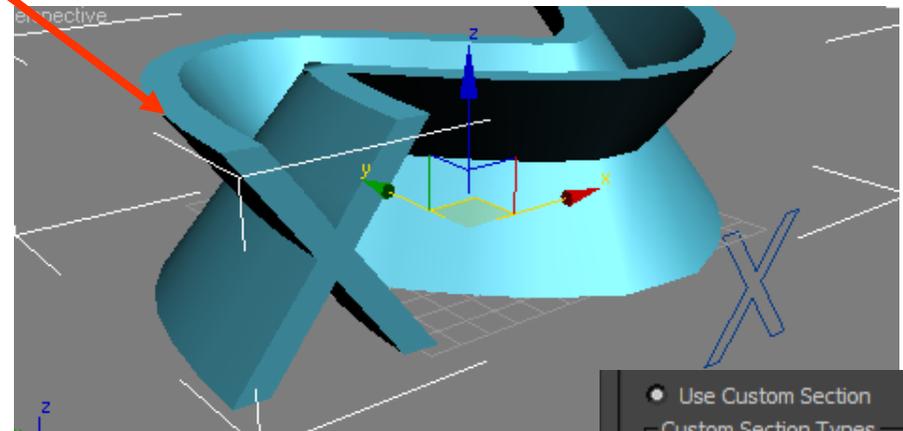
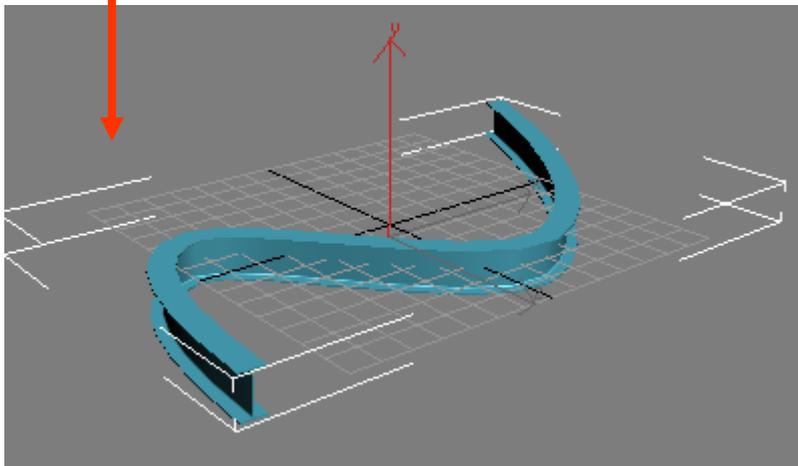
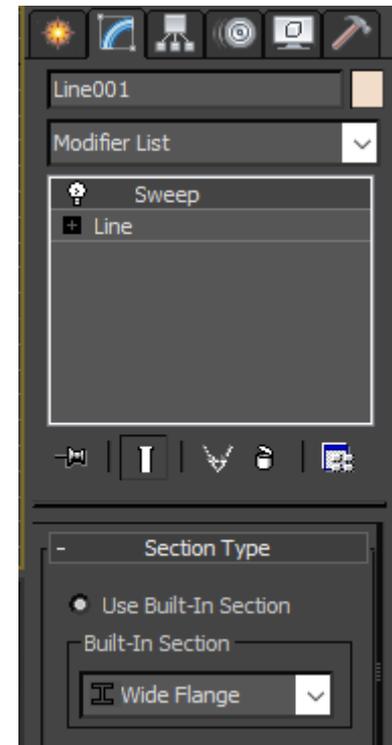
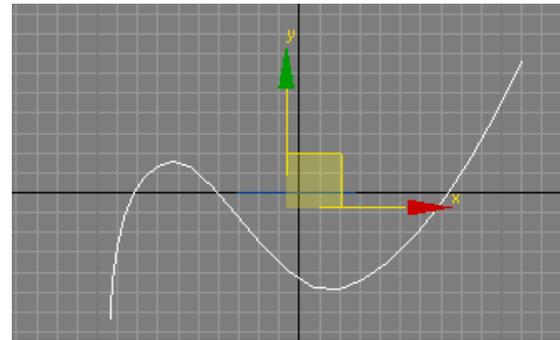


Extruded star shape

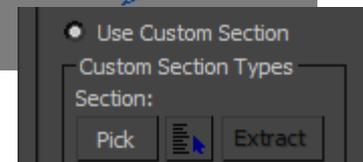


SWEEP

- Create a Line
- Choose the Sweep Modifier
- Select a sweep cross-section and select a built-in pattern from the drop-down menu
 - For a custom cross-section first create any shape, select the Line and choose the sweep modifier. Select Use Custom Section and select the other shape.



Create a shape of your own and use it as a cross section





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FAQ: SPLINES LINES AND LATHES

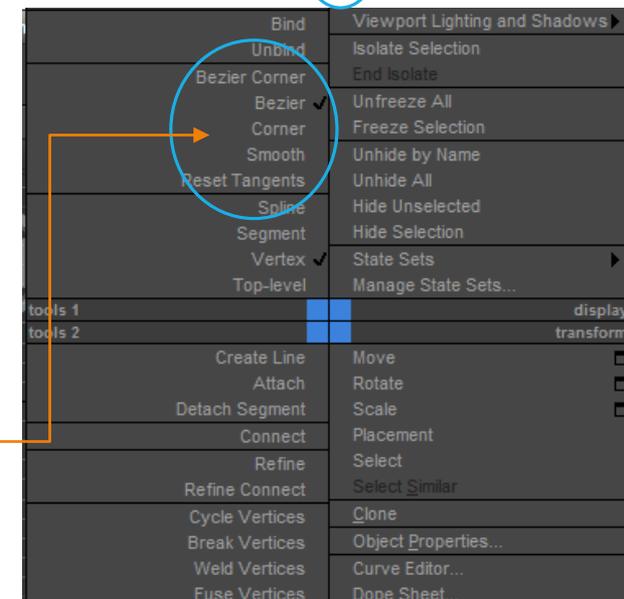
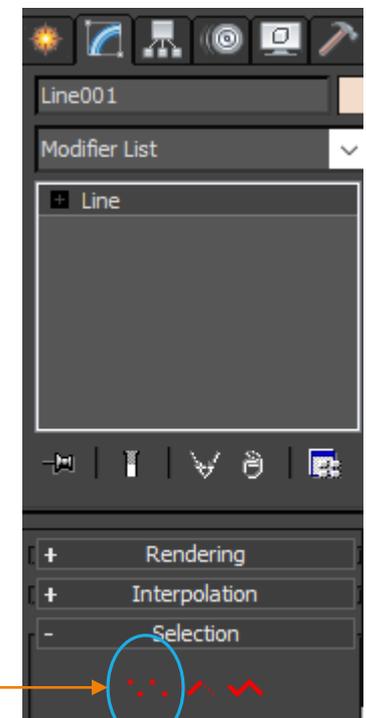
These following slides are completely optional (and are not really required to complete the lab)
They provide a bit more detail on operations that may help in working with splines

MODIFYING SPLINES

The instructions for lab 8 show you how to create the shape based on creating the spline in one pass. You can also **edit nodes in the spline, split or combine splines** created in separate instances.

Editing splines you've already created:

- ❖ Select the spline
- ❖ Click on the Modifier tab
- ❖ In the "Selection" rollout, choose Vertex
 - ❖ Use translate tool to select and move vertices
 - ❖ RIGHT-CLICKING on a spline vertex brings up a menu that allows you to change between bezier, smooth or corner



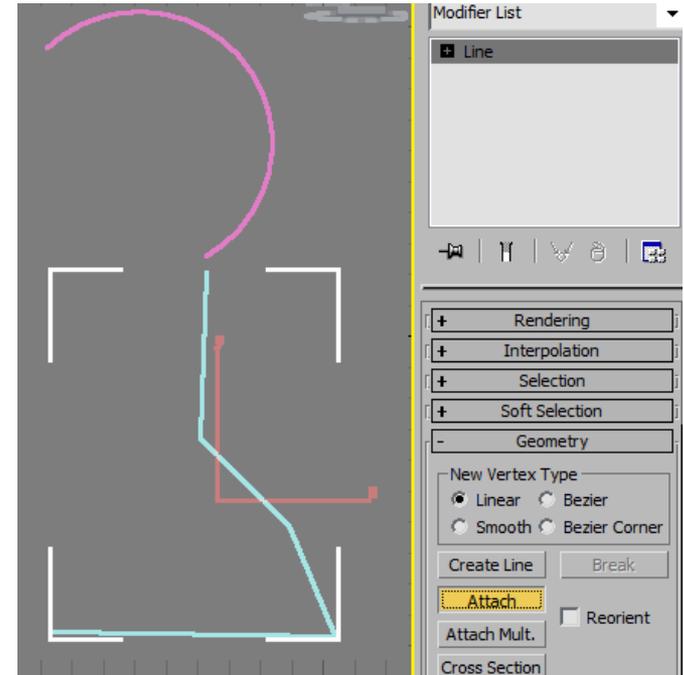
ATTACHING TWO SPLINES

Multiple splines can be grouped together so that operations (such as Lathe) can be performed on them collectively

Assuming you have two lines..

- ✧ Select one Line
- ✧ In the modify panel under the “Geometry” roll- out click on the “Attach” button
- ✧ Select the second spline

The opposite of this operation is Detach



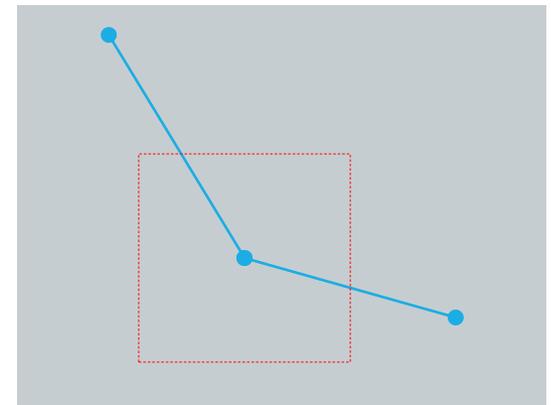
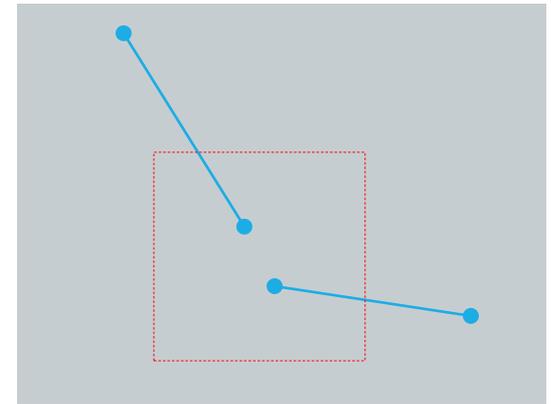
N.B. This doesn't physically join the two up (there can be gaps within the spline) just that operations such as transforms and modifiers affect both parts

FUSE AND WELD

The **Fuse** tool can be used to move two vertices can be moved to the same point in space.

- ✦ With a spline selected, in the Modify panel, Under Selection, choose Vertex.
- ✦ Drag a rectangle around two nearby vertices you want to fuse, click the “*Fuse*” button in the Geometry roll-out

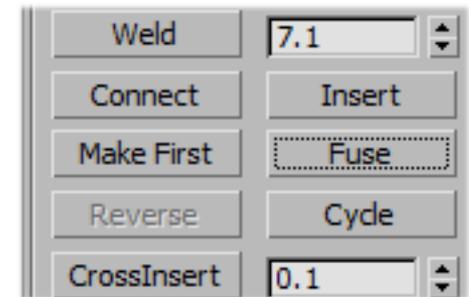
Note that the two vertices will be moved to the same point in space but they are still two vertices at this stage



The **Weld** tool replaces two collocated (or very close) vertices with a single vertex

- ✦ Drag a rectangle to highlight two vertices
- ✦ Click on the “*Weld*” button

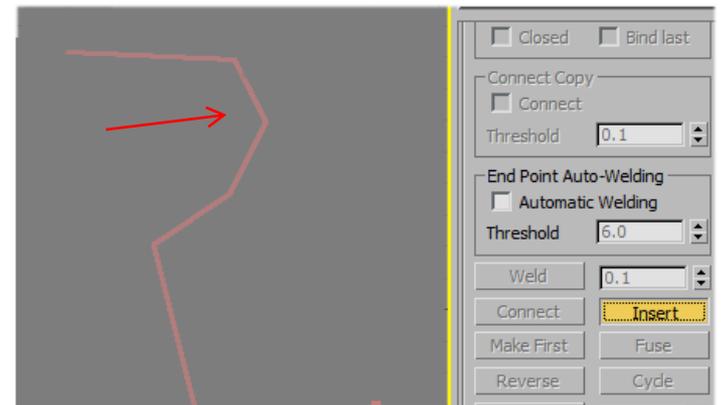
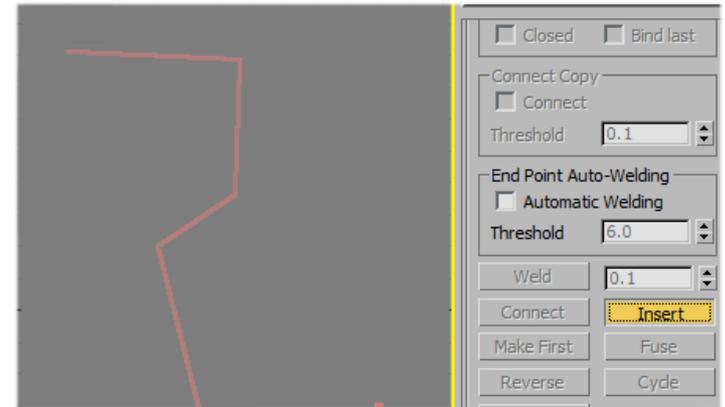
Note that only End vertices can be fused (more than two lines cannot meet at a single point). The opposite of this is Break



The Weld threshold: how close two objects need to be for them to be welded together

ADDING ADDITIONAL VERTICES

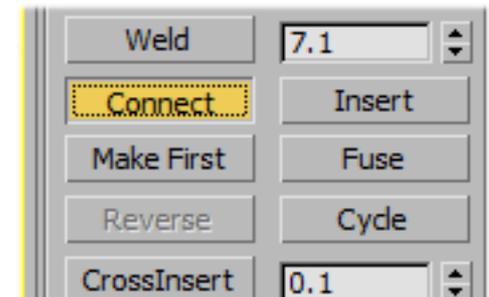
- ✧ In the geometry roll out on the modify panel for a spline, choose Insert then click somewhere on the spline to add a vertex there
- ✧ Move and left click to position the new vertex
- ✧ You can add further vertices by continuing to cleft-lick or right-click to stop inserting further points



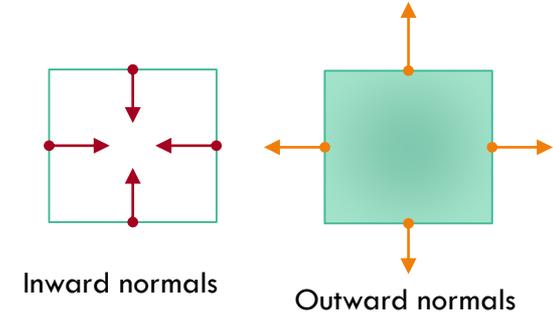
CONNECT TOOL

Chose Connect and drag a line from one vertex to another to create an edge between the two.

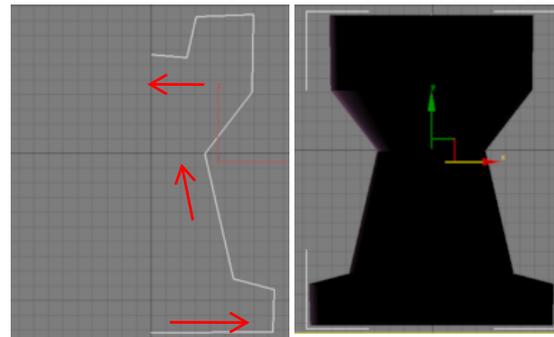
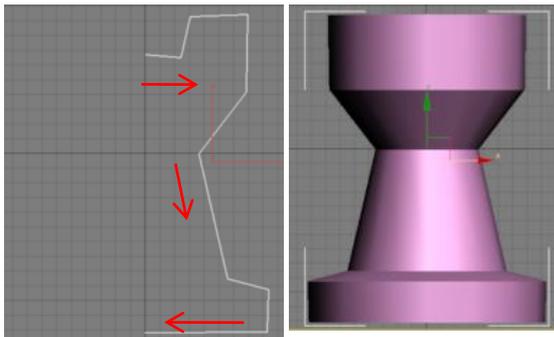
- ✧ Unlike weld or fuse this leaves the old vertices unmoved
- ✧ N.B. This only works for end vertices. Both segments must be already “Attached” to the same object



NORMAL DIRECTION



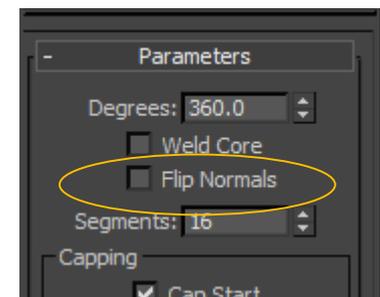
- ❖ The direction of the normals affects lighting on an object. Unfortunately the system has to make a bit of a guess when you create a 3d object, about which way to face the normals e.g. in a lathe operation
- ❖ Usually this is based on the “winding” direction i.e. The order (clockwise or anti-clockwise) in which you create the spline affects the normal direction and therefore how the object is lit



Reverse winding caused normals to face inwards so lighting on the object is wrong

The Lathe Modifier provides an option to allow you to flip normals

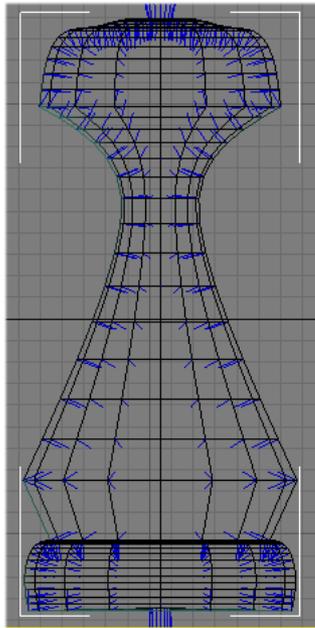
- ❖ Essentially this reverses what is considered the inside and outside of the object



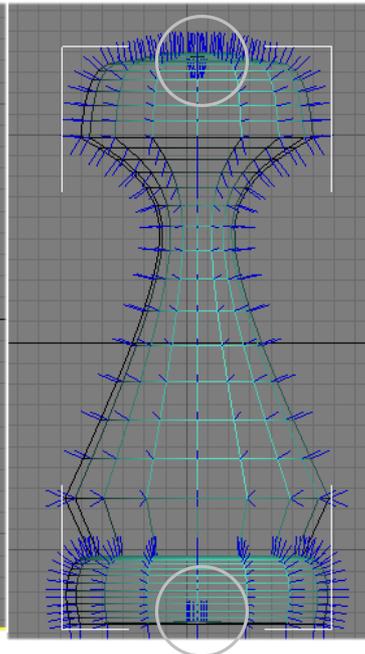
MODIFIER: EDIT NORMALS

You can edit selected normals using the edit Normals Modifier

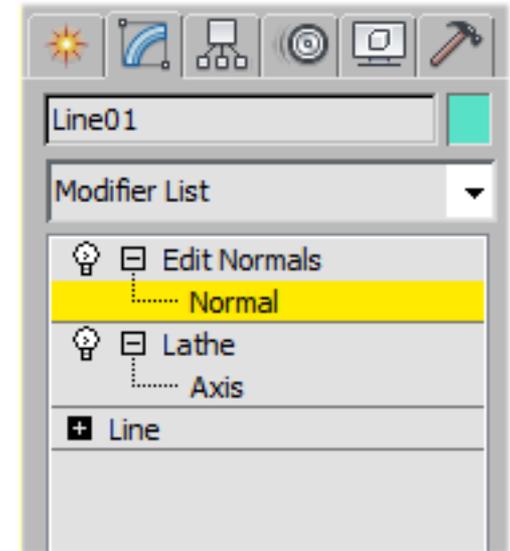
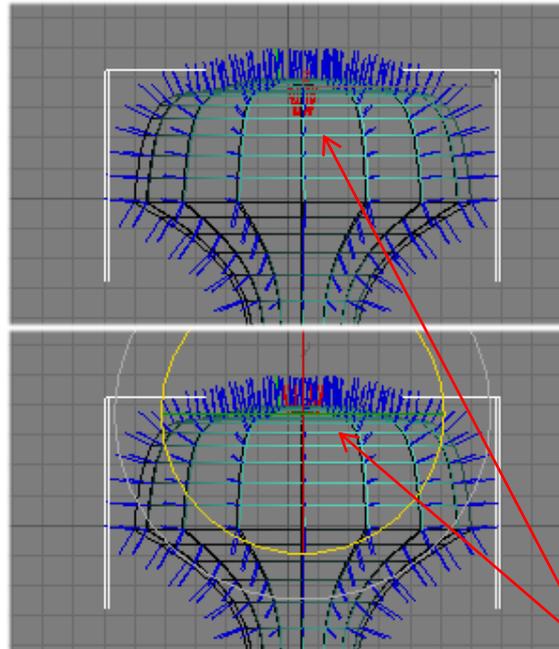
E.g. in below example, a small number of normals are wrong at the very top and bottom center of the object. Flipping all normals is not sufficient. Edit normals allows us to correct just the small errors



Mostly Inward normals



Flipped normals (still some errors)



Edit Normals modifier used to select and **rotate** the incorrect normals

RENDER 2-SIDED

- ✧ If all else fails or it is too difficult to correct normals, a final option is Force 2-sided in the rendering setup dialogue (F10)
- ✧ This treats objects as if they have normals facing both in and out (this costs more time to render and may have some side-effects but should work in most cases)

Two-sided normal: at each point there is one normal facing in AND one facing out

