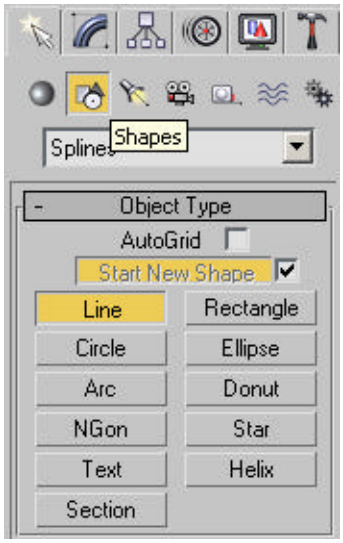
Drawing Splines—A Review

The process uses an awkward method of clicking and dragging out handles that seems to have a mind of its own. Most users find this method difficult to control. However if you take the time to understand the options and conventions that the program uses, you can have stunning success in drawing and controlling splines. You just need to know what the program is up to.

When you draw a spline in 3ds Max, you use the tools found on the *Create* panel. Primarily you will use the *Line* tool when you want to draw, but you can actually use any of the eleven shape object tools to create splines to use for modeling.



There are so many different artists creating tutorials for 3ds Max these days. One of the best all around tutorials can be found on http://3dtotal.com

Click Free Stuff > Tutorials This click takes you to a 3d Studio Max> Beginners page. Choose Complete Projects, then scroll down till you find Modeling Joan of Arc by Michel Roger. This tutorial primarily uses edge extrusion and box modeling techniques, but also touches on some vertex welding and other methods.

For a variety of tutorials see:

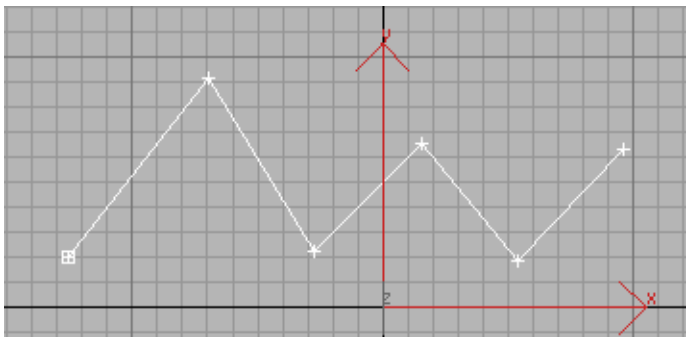
http://www.3dlinks.com/Links.cfm?categoryid=13&subcategoryid=105&subsubcategoryid=44

For a video tutorial that shows off spline modeling see:

http://www.simplymax.com/movie_pages/tutorial.mhtml?tut_id=10

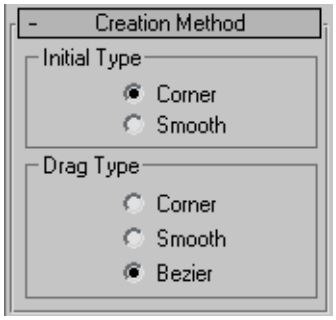
Spline objects

To draw a line, turn on the *Line* object button in the *Object Type* rollout; then draw in the viewport. Click in the viewport, move the mouse, click again, and move the mouse again. If you click and move repeatedly, you'll draw straight line segments. The line vertices you create will be Corner vertices. Vertices can be Smooth, Corner, Bezier, or Bezier Corner.

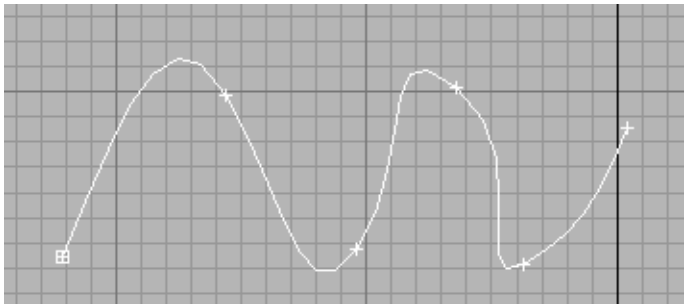


Straight line segments drawn using the click and click method.

The *Creation* method rollout has options for *Initial Type* and *Drag Type*. As a default, the drag type is set to Bezier.



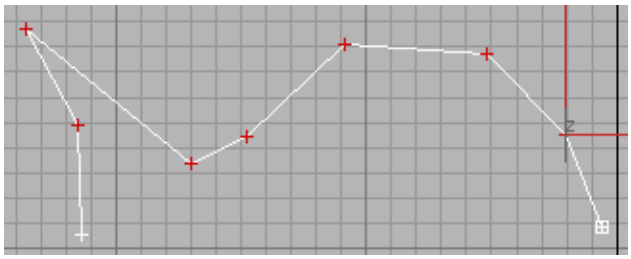
When you want to draw curves you can click in the viewport, move the mouse, then instead of clicking, drag the mouse and watch a curved line grow out of both sides of the vertex.



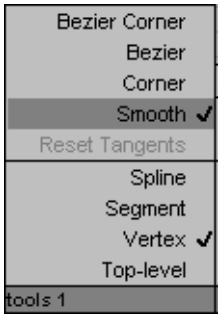
Curved lines drawn with click and drag method.

This method is difficult to control during drawing. It's easier to draw by using this trick:

Draw your drawing in straight line segments; then in the Modify panel, go to the Vertex sub-object level and choose Vertex. In the viewport, select the vertices you want curves drawn through.

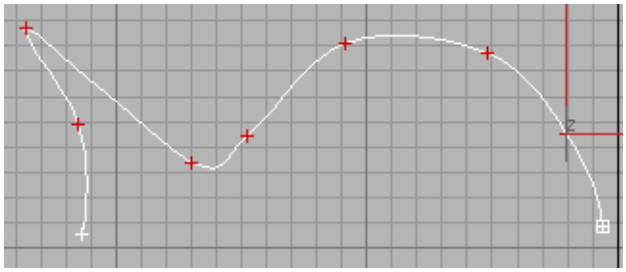


Right-click and choose Smooth or Bezier from the upper left quadrant, the Tools 1 quad.



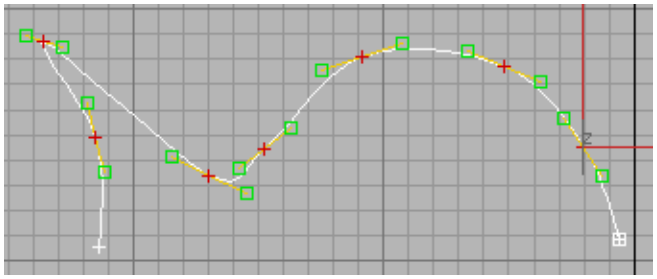
Tools 1 quad menu

The straight line segments will be replaced with smooth curve line segments. The vertices will have Smooth definition rather than Corner properties.



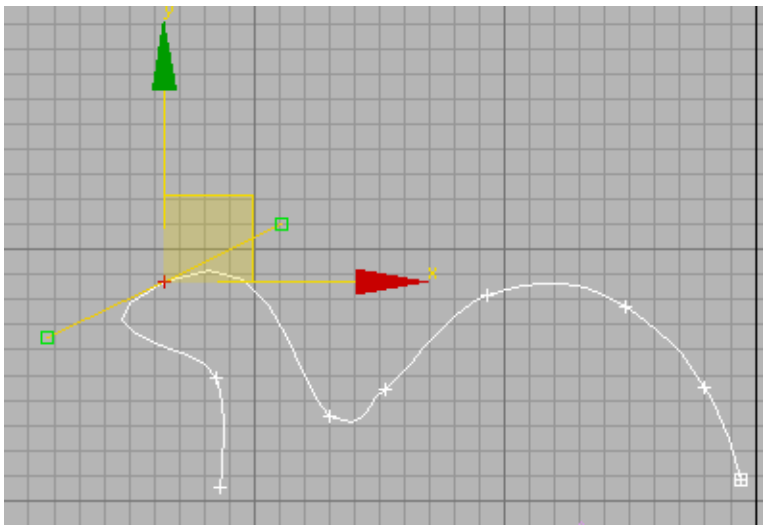
Smooth vertices

If Bezier is chosen instead of smooth; handles are displayed on the vertices.



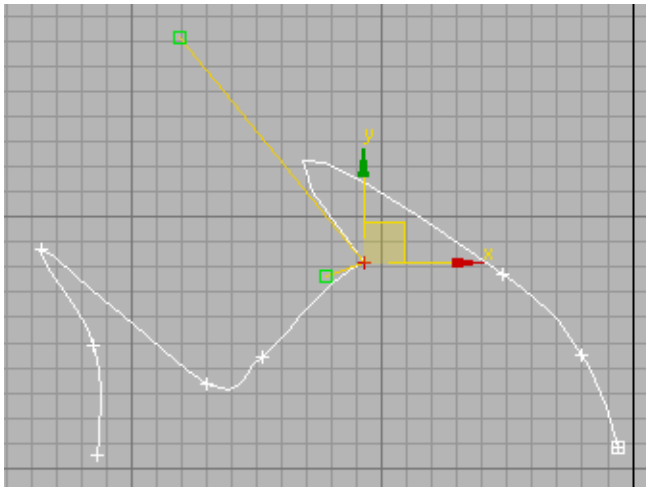
Bezier handles.

Use the handles to adjust the curvature of the line.



Bezier handles are used to control the curves.

If you hold down the SHIFT key, you can move one handle independently from another to create discontinuity or sharp corners.

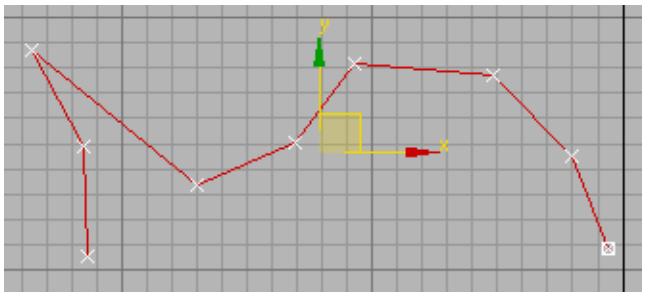


Discontinuity uses the SHIFT key to drag a single handle

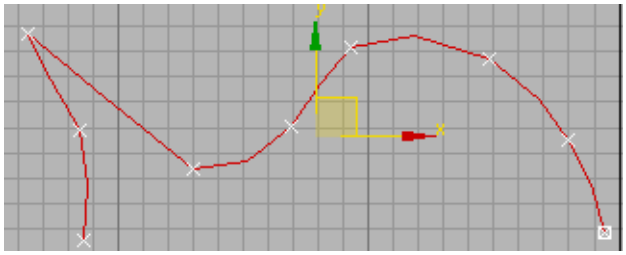
The vertex property of Corner, Smooth, Bezier, or Bezier Corner will have an effect on the kind of 3D model you create. If you use the line as a path for animation, you'll also get the same result. So be aware of the vertex type you are setting, and adjust it if it gives you problems.

If you've ever used a vector drawing program like Adobe Illustrator, you'll find familiarity in these tools. Essentially 3ds Max gives you 2D drawing tools, but lets you use them to create 3D lines in space.

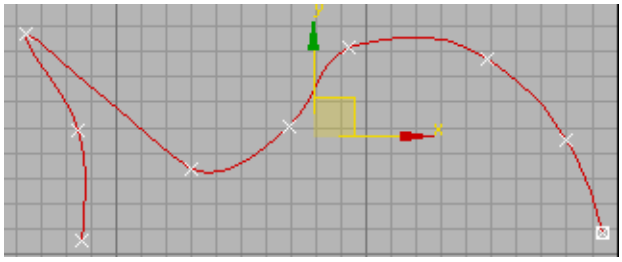
When drawing curves, the settings in the Interpolation rollout define the smoothness of the curve. The Steps field delineates the number of times the straight line segments is divided to create a curve.



Steps set to 0 means no division of the straight line segments between line vertices.



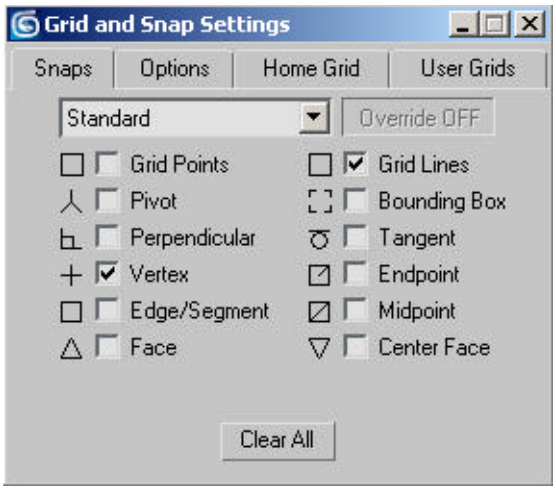
Steps set to 1 means a single division.



Steps set to 6 (the default setting) makes for the appearance of smooth curves.
The Step settings can be useful in controlling the density of a lofted object.

Drawing with Snaps

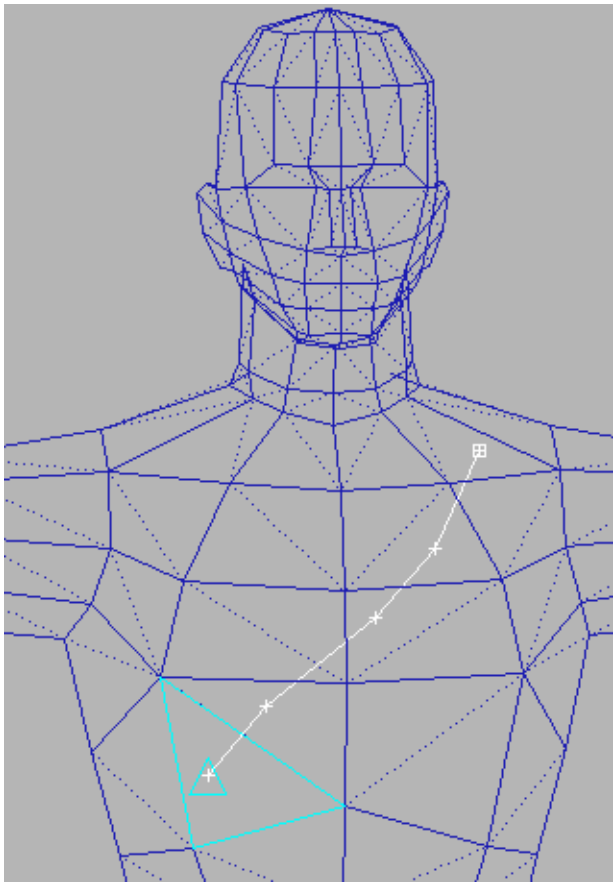
3ds Max has very powerful tools that let you snap your cursor to a dozen different things in the scene viewport. You can snap to grid points and grid lines, midpoints, endpoints, vertices, faces and edges among others. You can turn snaps on and off in the *mid-drawing operation by* pressing the “S” key on the keyboard. A right-click on the *Snaps Toggle* icon in the *Main* toolbar brings up the *Grid and Snap Settings* dialog where you can select which of the twelve choices you wish to select.



Grid and Snap Settings are defined here.

It is important to note that to snap from a spline's vertex to a grid, that *both* Vertex and Grid Points snap types must be checked *On*.

Tip: If you need to draw a line on a surface, set snap to Face, Center Face, Edge, and Vertex. Then you can draw straight line segments snapping from Vertex to Face to Vertex. If you draw small segments, you will create a line on the surface of the object.



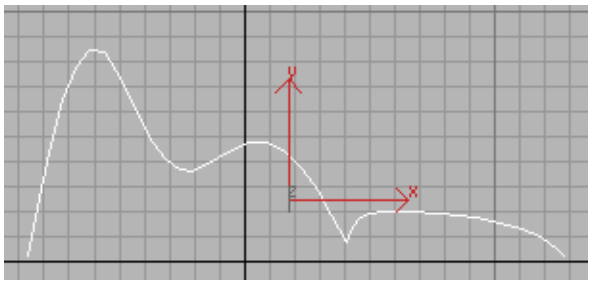
Snap to Face is useful for drawing on the surface of objects.

Refine

You can add vertices to a line you have drawn by using the *Refine* function. Once you have drawn a line, open the modify panel, and with the line selected, expand the stack and choose Vertex or Segment sub-object level. Then in the Geometry rollout, click Refine. Click to add vertices on the line as needed.

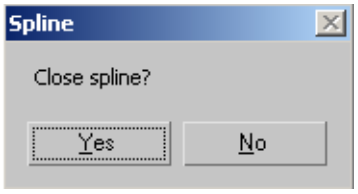
Open and Closed Shapes

When you draw a line in the viewport, you can create either an open or a closed shape. An open shape does not enclose an area; a closed shape does completely enclose an area.

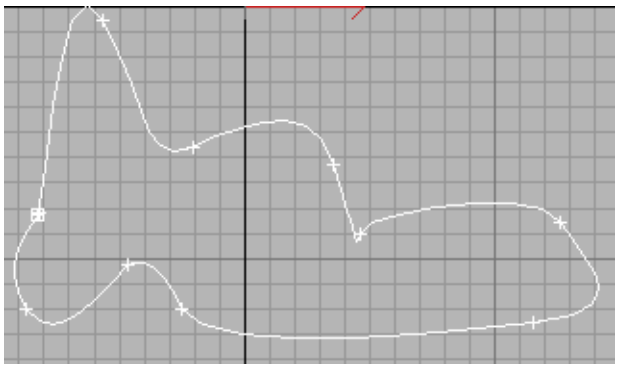


Open Shape

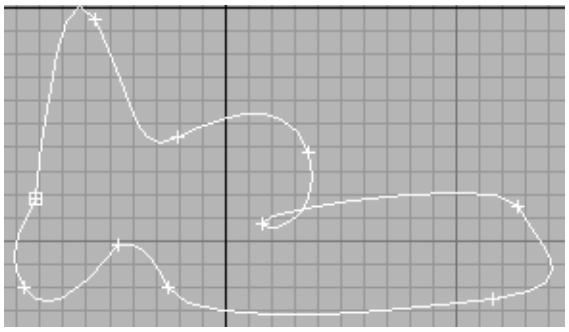
When you are finished drawing a shape and you want to close it, place the cursor over the initial (first) vertex in the spline and double-click. A dialog box will appear asking if you want to close the shape.



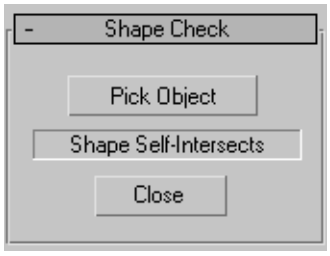
Closed shapes work best for lofting shapes; open shapes are good as paths.



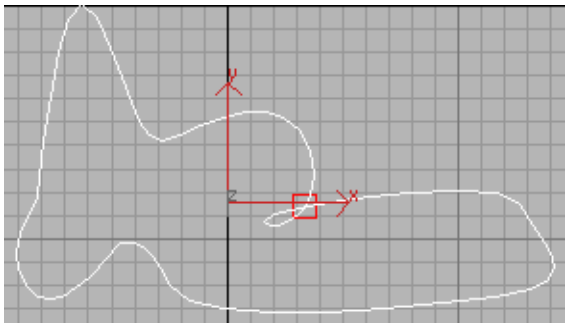
Tip: Don't create *self-intersecting* shapes. Often when you bring in vector shapes imported from other packages, you will get self-intersecting shapes. Use the Shape Check Utility located under the Utility panel to spot where the problems occur.



Self Intersecting Shape



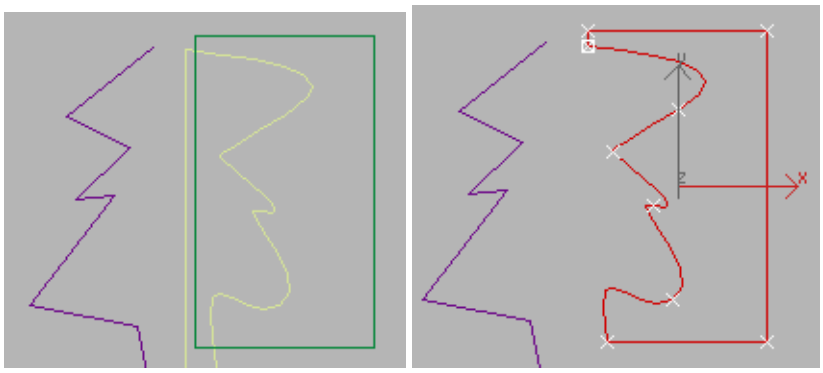
Shape Check utility confirms the shape is self-intersecting



The Red Square shows the self-intersection.

Attaching and Welding

To combine two spline objects into a single object, you must first use the *Attach* command. You can use this command either at the object or sub-object level. With one spline selected, go to the Spline sub-object level, and in the Geometry rollout click *Attach*. Now the 2 splines are part of a single object. This process will let you do 2D Boolean operations to add or subtract 2D splines to create a single shape.



2D Boolean used to create a closed shape.

To attach multiple objects use *Attach* List. Use the *Detach* command to do the opposite, to separate splines into multiple objects.

Tip: Click the *Attach* button to turn *Attach* off when you're finishing attaching objects. Otherwise the next thing you try to do won't be available.

Weld

To combine two vertices into a single vertex, you can use the Weld button. The vertices have to belong to the same object; then you can just select the two vertices and press Weld. If the Weld doesn't do anything, increase the Weld Threshold. If you only have two vertices selected, you can increase the Weld Threshold to any large amount, and then the weld operation will work nicely. Welding will only occur between end point vertices or adjacent vertices within the same spline.

Warning: If you have Ignore Backfacing turned off, and you region select your vertices, it's likely you'll also pick up vertices on the far side of the model. Then when you weld, you'll possibly be welding vertices unintentionally, not simply the two you thought you were welding. This is a common error.

Lathe/Extrude Modifiers

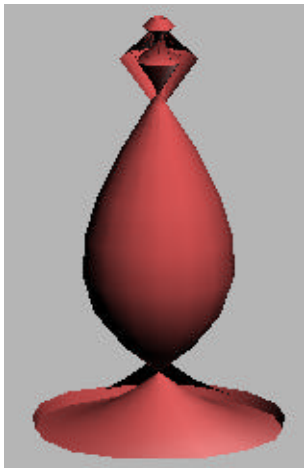
Probably the oldest method of computer graphic 3D object creation is to revolve a spline around a central point. In the real world, a clay cup can be created by centering a lump of clay on a spinning wheel, then applying pressure with the thumbs to build the walls. In a similar fashion, applying a *Lathe* modifier to a spline produces a mesh.

Virtual clay pot created with *Lathe* modifier

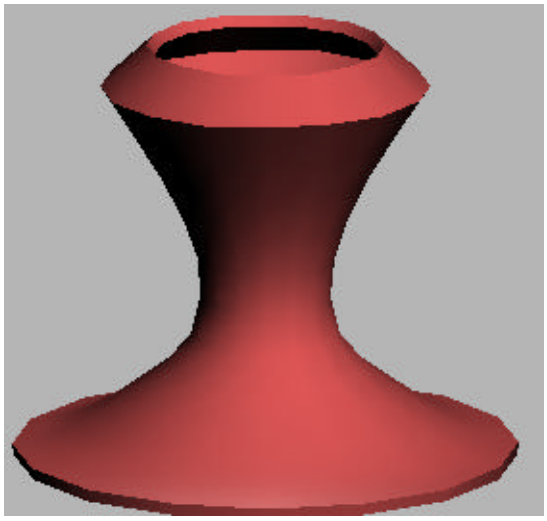
You don't have to revolve the spline the complete 360 degrees. Here the lathe only goes halfway around.

180 Degree Lathe revolution

There are three Align options: Min, Center, and Max. Center is the default.

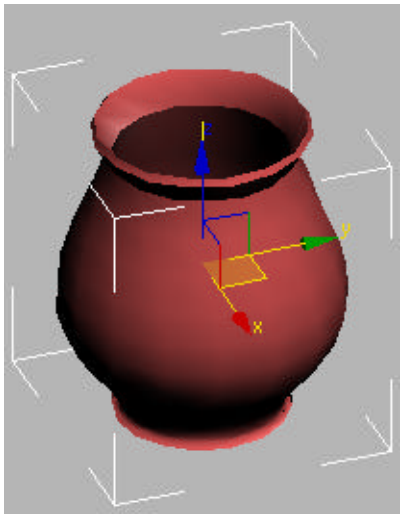


Center Axis Alignment



Min Axis Alignment

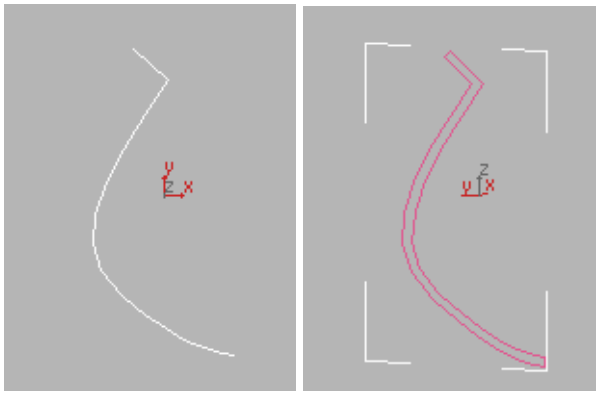
You can also position the Axis manually. Expand the Lathe modifier in the stack and highlight the Axis.



Move the Axis by using the transform gizmo

Outline

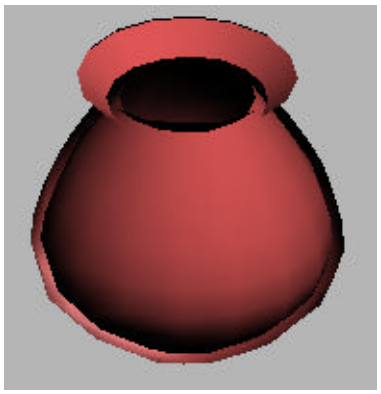
If you lathe an open shape, you'll only get faces on one side of the mesh. To obtain a closed shape from an open shape, you can use the *Outline* command. This command has the option of outlining from the center or from the original curve. The Center option removes the original curve and creates a new curve centered over the location of the old one. Watch out. It's easy to create self-intersecting outlines, especially when using the Center option.



Outline turns a 2D open shape into a closed shape

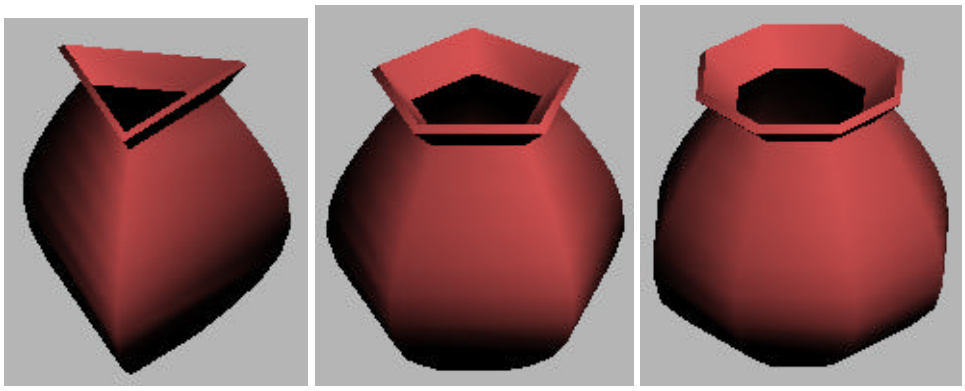
Flip Normals

Often, when you do use a lathe modifier, the object appears inside out. The program has generated the normals incorrectly in that instance.



If your lathe looks like this, it needs to have its face normals flipped.

Tip: Lower the Segments parameter to generate lower poly versions.



Segments set to 3, 5 and 8.

***Cap Holes* modifier**

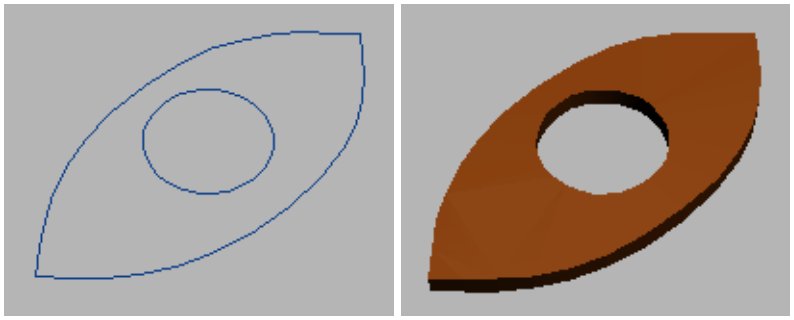
Frequently when you do a lathe, you don't have the vertices lined up evenly, and you get a hole in the model. Apply a *Cap Holes* modifier to the object after creating the *Lathe* to make sure the object has surface integrity. Using a *Cap Holes* modifier to close any holes is very important if you plan to do any Booleans with the Lathe created mesh. When a Boolean fails, undo, then try adding a *Cap Holes* modifier and try again.

Use *Lathe* modifier to create clubs and wizard's staffs; it is also good for flying saucers.

Flying Saucer

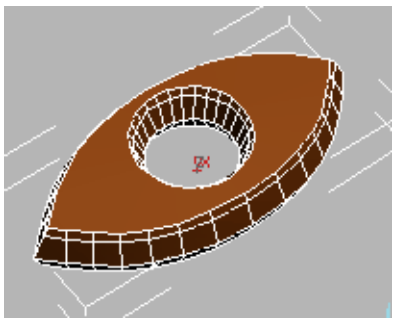
Extrude

Another fundamental technique for 3D modeling is to extrude a closed shape. You've seen how you can to do this already in box modeling, using the *Extrude Settings* dialog. You can also simply select a spline and apply an *Extrude* modifier to it.



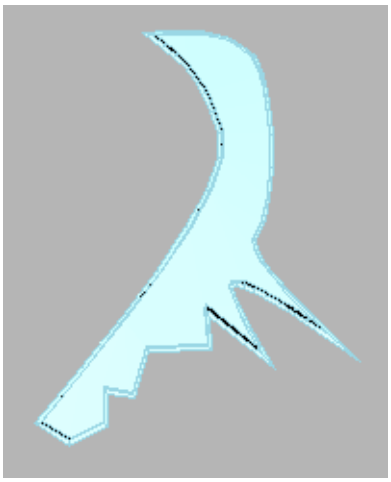
Spline is on the left and the Extruded mesh is on the right.

To create a rounded Extrusion, use the *Bevel* modifier instead of the *Extrude* modifier.



Bevel modifier

It lets you create 3 levels with definable heights and outlines and is good for modeling swords.



Sword blade created with *Bevel* modifier

Sidebar:

Artist Adel Adili has a tutorial that teaches you more about spline modeling.

http://www.3dtotal.com/team/Tutorials/astronaut/astronautpatch_1.asp

Lofting

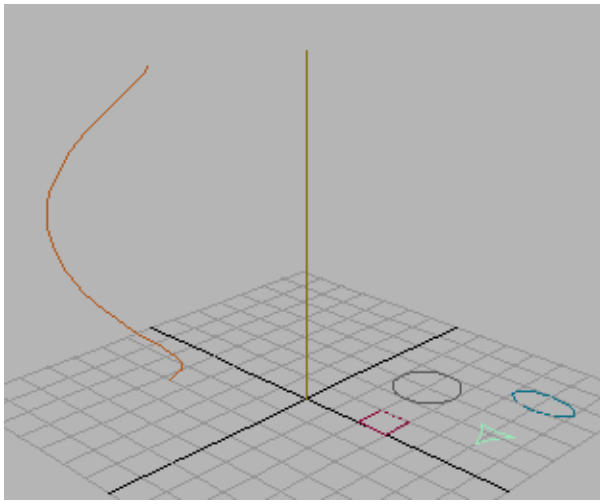
3ds Max has a very powerful modeling feature called lofting. Lofting is based on shipbuilding methodology where rails were attached to staves or ribs to produce a shell. In a similar fashion, lofting lets you construct objects by creating an extrusion between multiple shapes following a path. There are control tools within the lofting parameters that can help you lower the polycount automatically as you work. Use lofting to create objects that follow a path, such as a belt or bandolier on a character, space android Borg eyetubes, and other kinds of piping objects.

Lofting has interactive deformation graphs that you can use to sculpt your model. This technique really gives you the feeling of using a plastic medium; it is fluid and easy to create forms without impediment. If you use this technique you'll model without consideration of the polycount, and you can optimize the mesh later.

Lofting is very old technology; it was the primary method for modeling in the original 3D Studio program that was the antecedent of 3ds Max. At is hasn't changed much over the years; you need only to follow some simple rules to get your lofts to work properly.

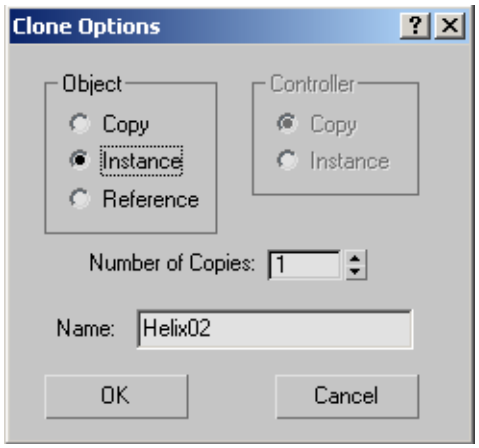
Lofting methods

To loft, you need to create at least two things-- a path and at least one shape.



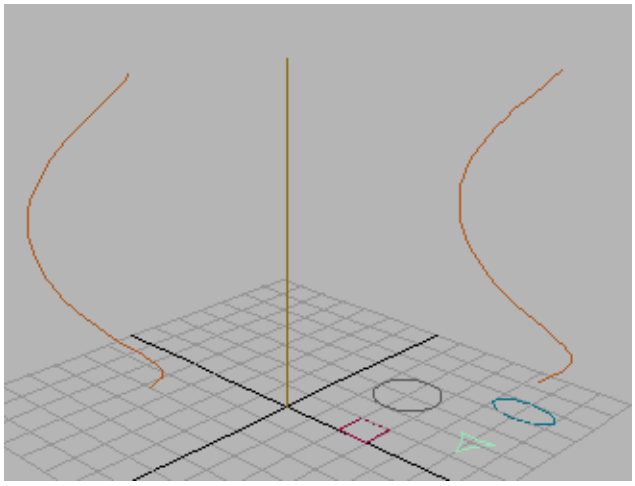
Some shapes and paths

TIP: It's a good idea to make an instance of the path before you begin lofting. Use Shift+Move and in the *Clone Options* dialog, make sure *Instance* is selected.



The Clone Options Dialog lets you define instances.

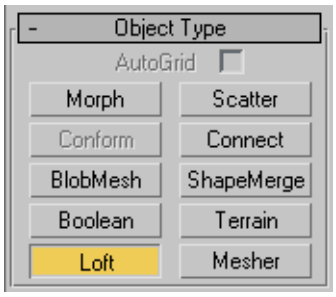
You'll use the instanced path as a sculpting tool.



Helix path is instanced in viewport.

Adding Shapes to the Loft Path

Select the path, and on the *Create* panel, click the dropdown arrow next to *Standard Primitives;* then choose *Compound Objects* from the list. In the *Object Type* rollout click *Loft*.



Clicking on the *Loft* button converts the path to a *Loft* object.

The next step is to get a shape to apply to the path. In the *Creation* method, there are a few options to choose from. *Get Path* allows you to loft along a *Path* from a selected *Shape*. *Get Shape* allows you to apply a *Shape* along a selected *Path*.

Tip: The Loft is created in the same orientation as the first object selected. If the Loft needs to follow a particular path in space, create a line that follows exactly where the Loft needs to be. Then pick the spline shape that defines the path first, and then choose Pick Shape.

There are also three radio buttons: Move, Copy, and Instance.

Move

When you select *Move,* the original shape disappears and becomes part of the Loft.

Copy

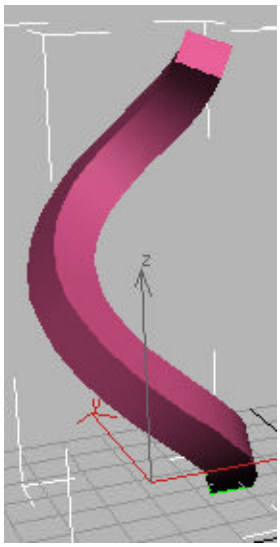
When you select Copy, an independent copy of the shape is created to become part of the Loft; and the original shape remains.

Instance

When you select *Instance*, an instanced copy of the shape is created to become part of the Loft; and the original shape remains. You can then edit the original shape in subobject mode and have the results updated on the Loft.

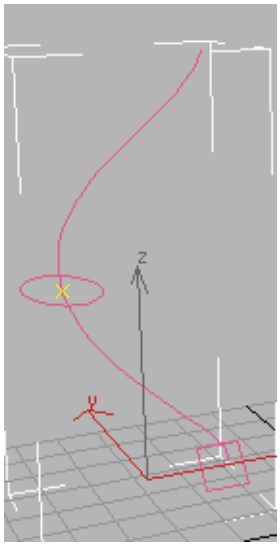
A Word of Caution: Instancing the shapes allows you to modify the shapes at the subdivision level and have them update in the final loft or extrude. However, it is important that you convert the shapes from the default primitive into an editable spline before you start the process.
If you convert the shapes after creating the Loft object, the instancing will be disabled, and you'll no longer be able to modify the shape of the lofted object with the original shapes.

To create the Loft, make sure you have the *Path* selected, then click *Get Shape* and then click on a shape in the viewport. This process will put a shape at the beginning of the *Path*. A 3D mesh is created by the extrusion of the shape along the path.



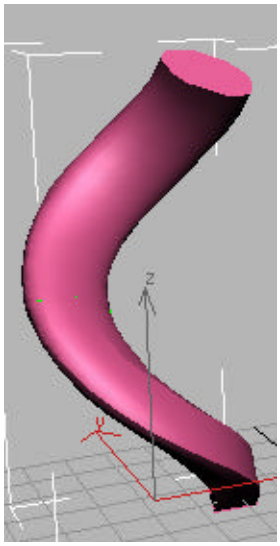
Lofted Rectangle along Helix

You can experience the joy of sculpting when you add multiple shapes to the loft. In the *Path Parameters* rollout, there is a *Path* spinner/field. Use this field to move along the path. A yellow indicator displays in the viewport as you move up the path.



Move up the path, and watch the yellow X.

Click the *Get Shape* button again, and click a different shape in the viewport.

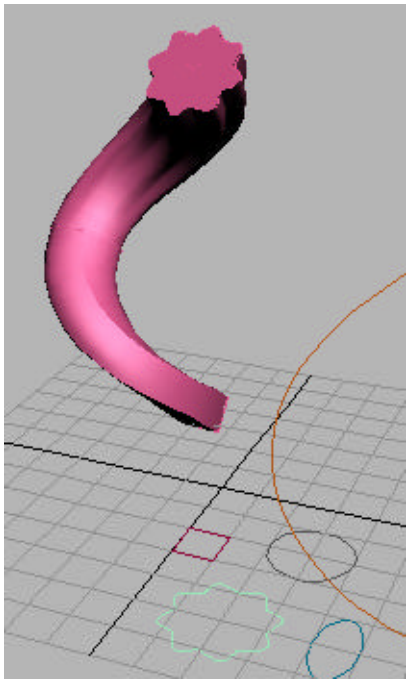


An ellipse shape is added halfway along the path.

Go all the way to the end of the path, and add another shape. Here we've added a star.

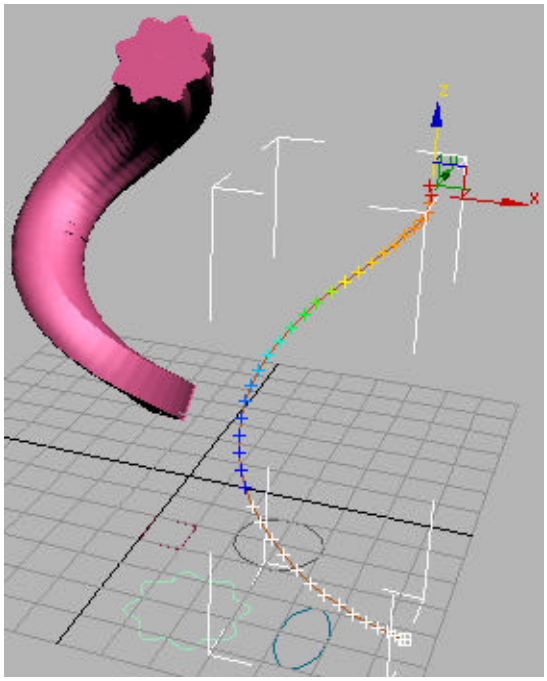
Here is a loft object from rectangle to ellipse to star.

You can select the star shape in the viewport and modify its parameters. When you do so, the loft, automatically updates.

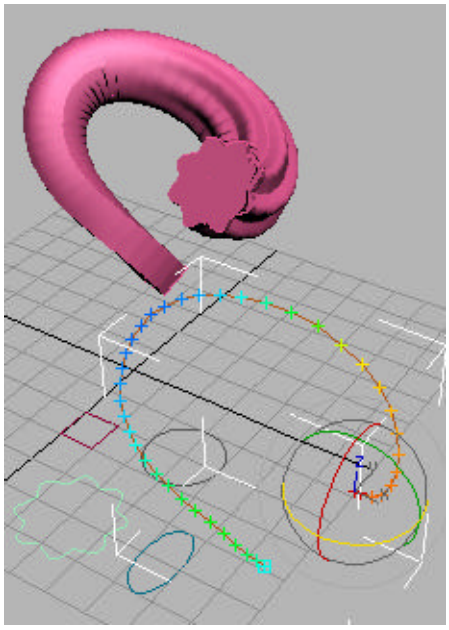


Adjust the star parameters; the displays the changes.

You can do the same for the instanced path. Making changes to that path will automatically reflect in the loft.



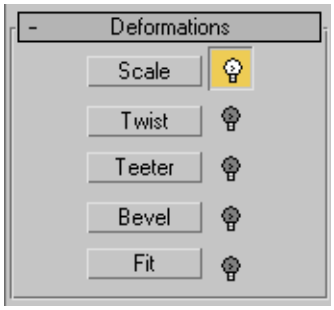
Here we're using soft-selection on the helix path vertices. When you move the mouse button, you'll see the new path configuration. Releasing the mouse button will let you see the skin of the loft mesh.



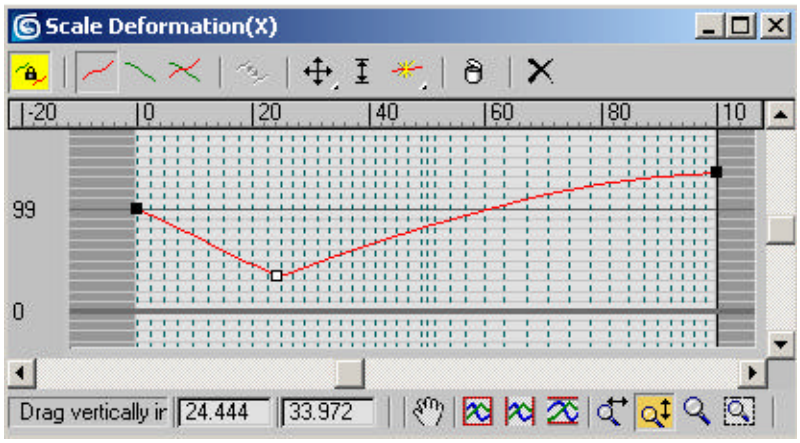
Using an instanced path is a great tool for interactive modeling. Since the loft mesh surrounds the path, it's hard to see the path if you don't use this technique.

Lofting Deformation Graphs

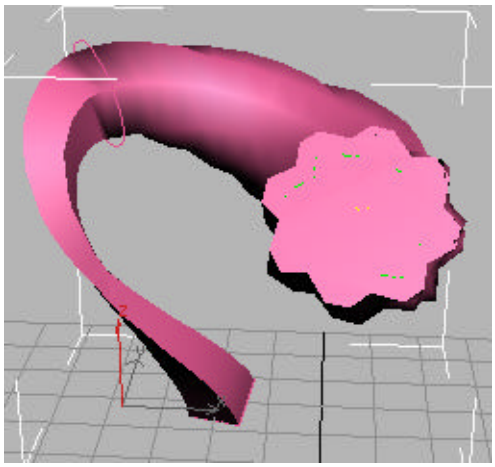
In the *Modify* panel, the *Loft* object has a *Deformations* rollout. This rollout gives you access to five deformation graphs that let you make additional changes to your model.



Here the scale graph is used to add some contour to the form.



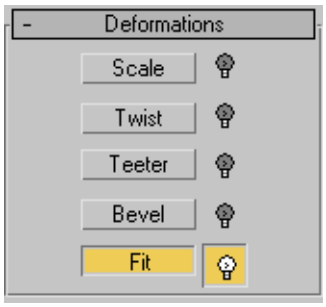
The scale graph lets you manipulate a curve to shape the model.



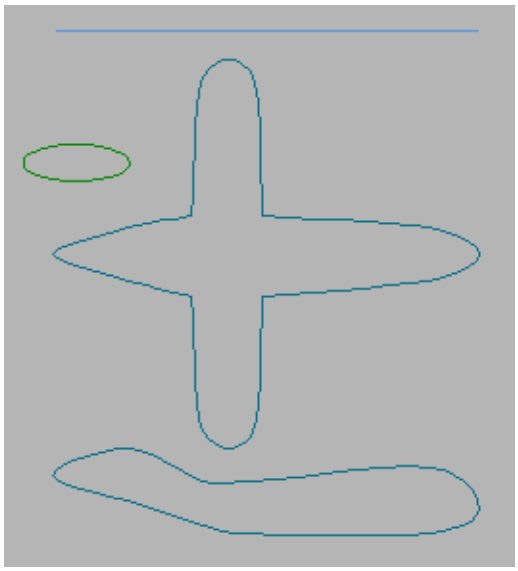
Loft object with scale applied.

Fit Shape techniques

Lofting has one special deformation type called *Fit*, which lets you define the scaling of the shape according to two profiles. To do a fit deformation, you need a path, a shape, and two profiles.

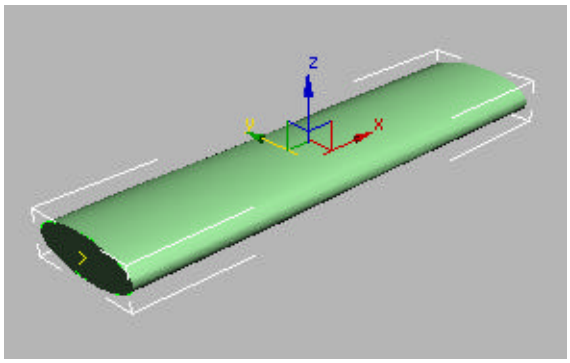


TIP: To make efficient models, create a curve for the top half of the first profile. Mirror it to create the curve for the bottom half of the profile; then attach it, and weld the center vertices.



A shape, a path, and two fit profiles.

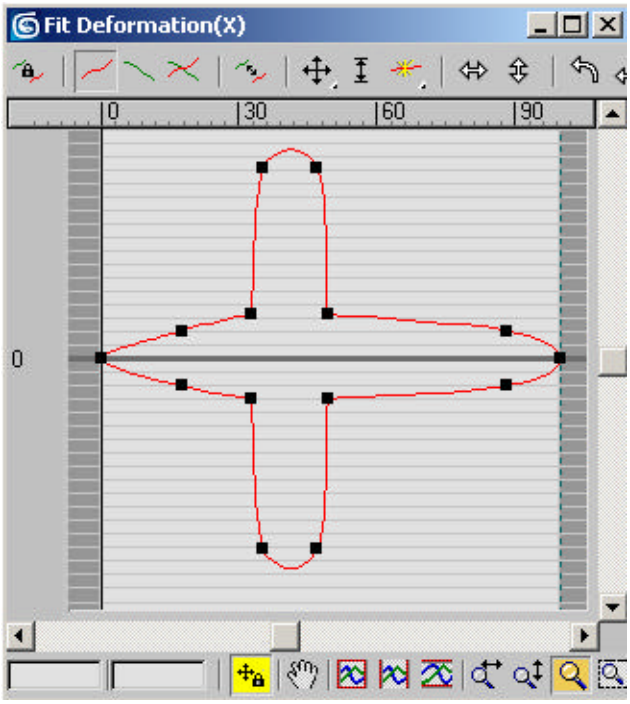
Create the Loft object as before by choosing the path, selecting *Loft Object*, and then using the *Get Shape* option.



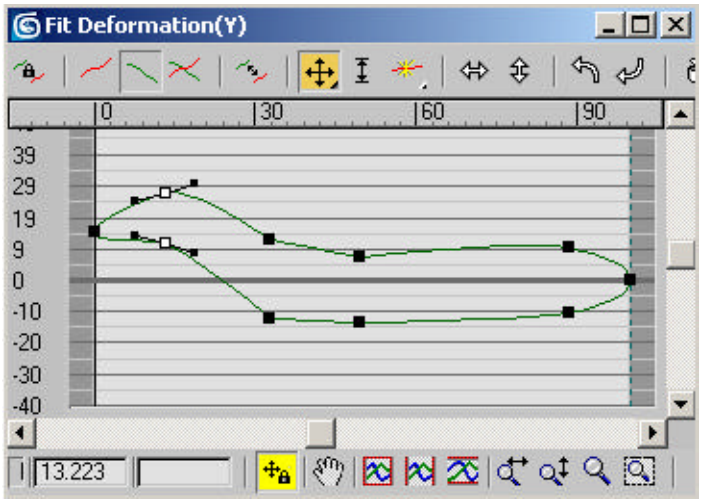
Here is the Loft object before any Fit deformation.

In the *Fit Deformation* graph, turn off *Symmetrical*; then click the *Get Shape* button in the *Fit* toolbar.

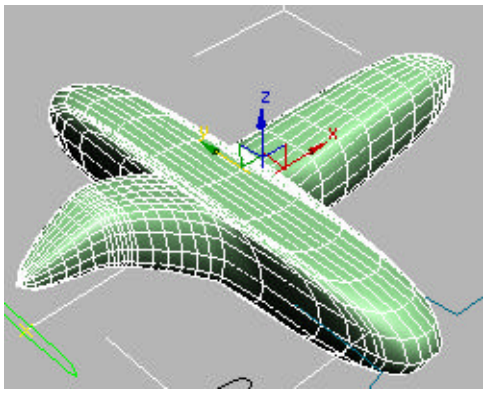
Click on the shape in the viewport to get the profile into the graph. Here the *X axis* shape is selected.



Select the *Display Y Axis* button on the toolbar; then again use *Get Shape* to add the second profile.

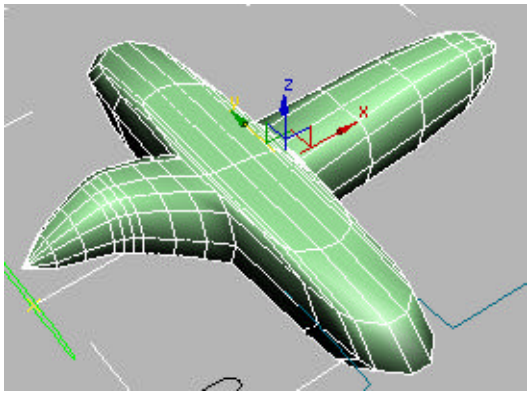


A loft is created using both profiles to deform the object.



Fit shape creates the loft object.

Changing the Shape and Path Steps to 2, respectively, will lower the mesh density.



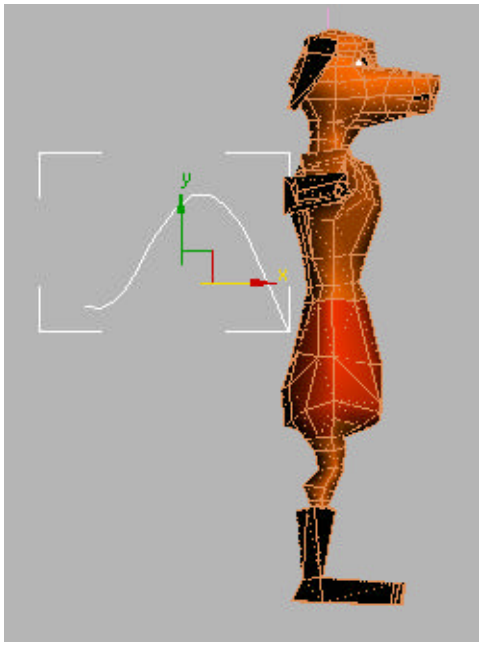
Edged face mode shows the polygon structure.

Generate Mapping by Using Loft

One of the great advantages of using a loft is that it will procedurally generate mapping coordinates for you along the length of the loft path. To automatically create mapping coordinates, check the *Apply Mapping* check box under the *Surface Parameters*. You can adjust the amount of times the mapping repeats itself by using the *Length Repeat* and *Width Repeat* spinners. This feature comes in very handy when dealing with tiling textures.

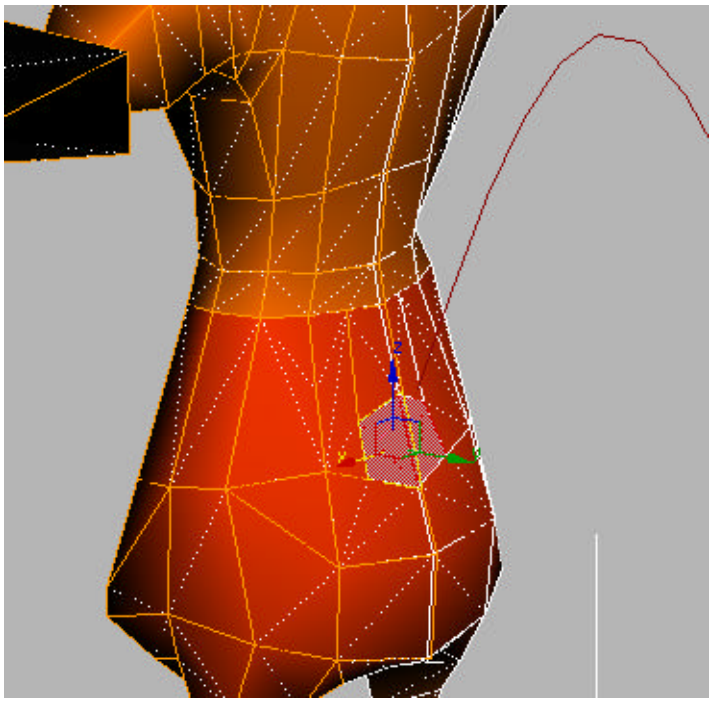
Extrude Along Spline

There is a tool in Edit Poly that performs a very similar function to the loft object. It's called *Extrude along Spline*. It doesn't allow for multiple shapes, but it will create the geometry by sweeping the shape along the path.



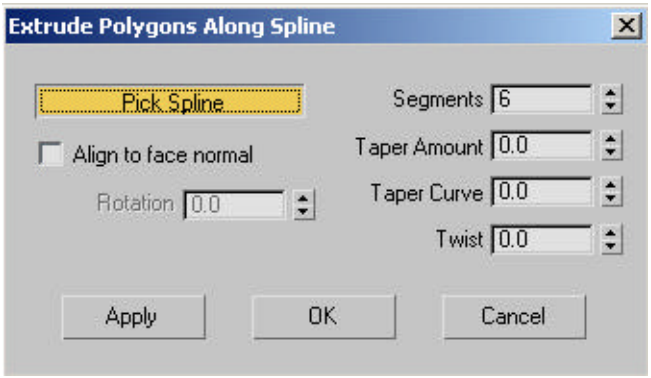
Just like when you're creating a Loft object, you need a path for the extrusion.

Tip: Draw this path in an orthogonal view, or you may get unexpected twisting.

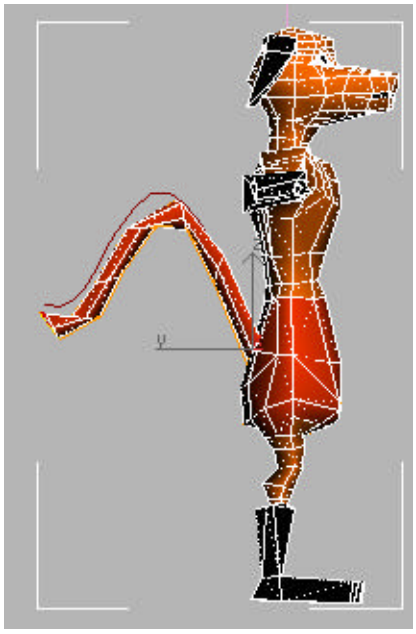


Select a polygon for the extrusion. Here we've used the *Cut* tool to add a small section at the base of the spine.

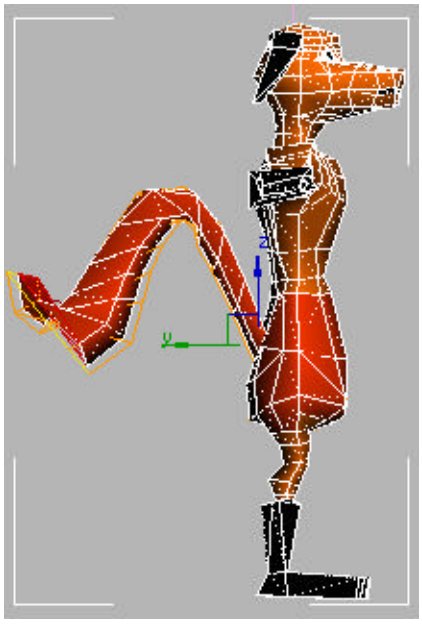
Click the *Extrude Along Spline* settings button, and then in the dialog that appears, click Pick Spline; then select the spline in the viewport.



The settings dialog lets you try out the parameters before you apply them.

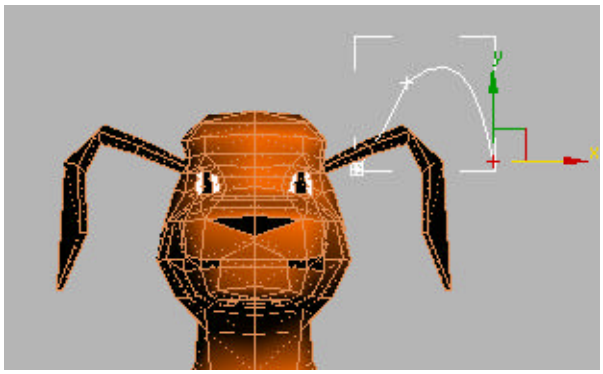


Here you see the tail with 6 segments.



Here the segments have increased to 10, and the Taper Parameter is set to 3 for a full bushy tail.

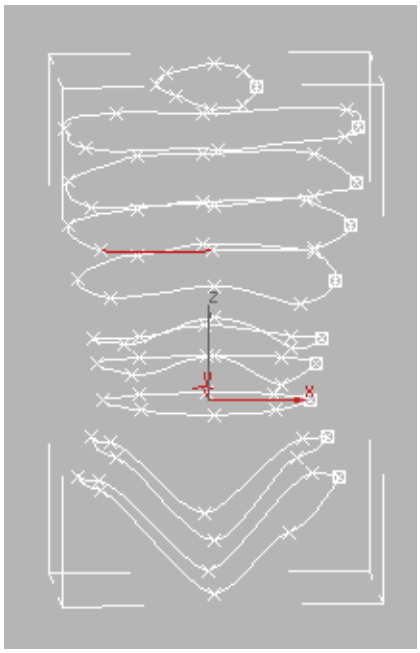
Extrude Along Spline isn't parametric, there is no stack entry. You can't go back tomorrow and edit the spline like you can with a Loft object. For example, the ears on this canine character were created with *Extrude Along Spline*, but editing Line01 will not change the ears in another session.



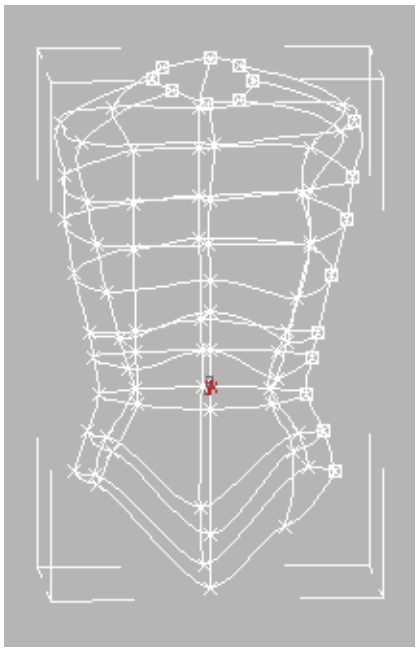
Spline Cage Modeling

Spline Cage modeling is a very powerful method of modeling in 3ds Max. You create multiple editable splines, all part of one Editable Spline object. You can overlap these splines into a "cage" and apply a Surface modifier to that cage to generate faces. This is a very good tool for doing organic surfaces and adding detail. It is quite fussy about what it requires, so you need a clear understanding of how it works.

There are multiple methods of constructing a spline cage. One simple method is to Shift+Move splines at the sub-object level to clone and reposition the splines. The vertices in the clones are pushed and pulled in the viewports.

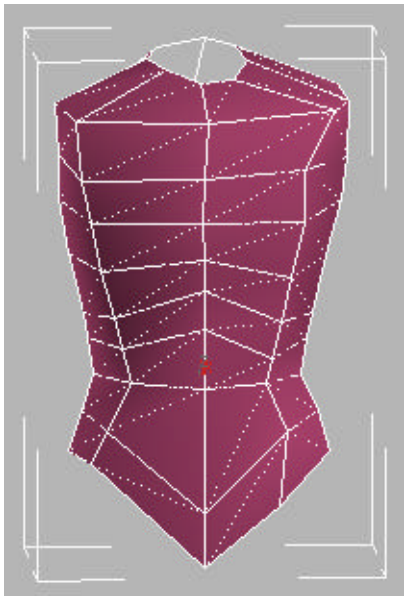


Then you add a *CrossSection* modifier to create the vertical lines, the uprights.

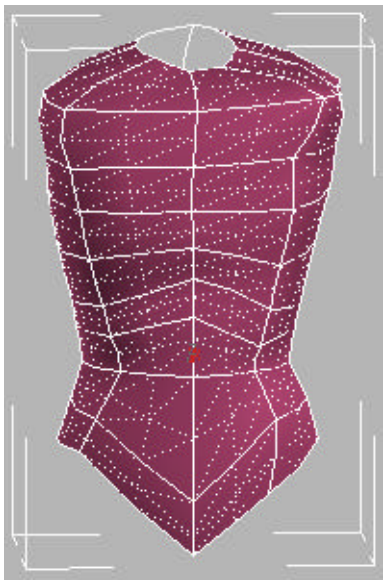


CrossSection modifier used to create the vertical lines.

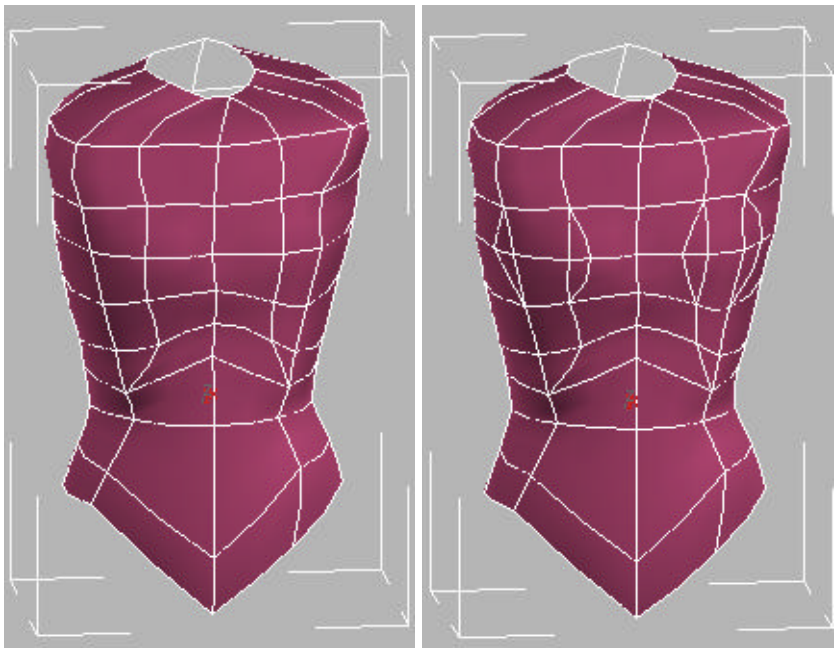
Next you add a *Surface* modifier to create the mesh.



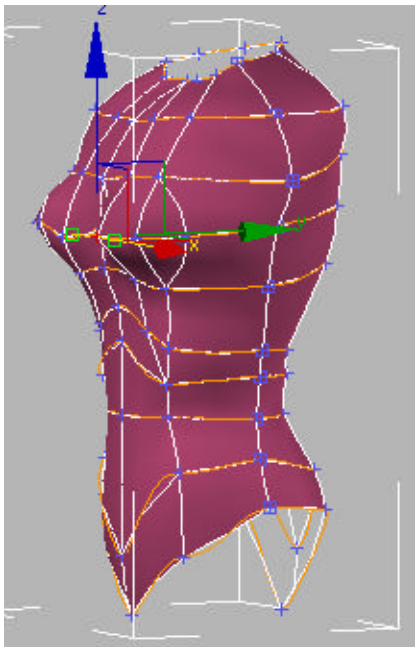
You can increase the Patch Topology Steps setting to get more geometry. This setting is useful if you want to use the bump or normal mapping. You can get a high res version of your model with the click of one setting. Use the high res version as the source for your *Projection* modifier for normal mapping.



The beauty of this method is that you can use *Vertex Refine* on the splines to create additional polygons where you need them.



To build out the breasts, use the *Refine* tool



You can adjust the spline vertex handles to shape the chest.

Tip: The CrossSection modifier uses the Attach order to generate the surfaces. If the CrossSection modifier creates surfaces in the wrong order, you can detach all your splines and then reattach them in the order you need them by using the attach button.

There are other ways to build a spline cage. Instead of using the CrossSection modifier, there is also a Cross Section button at the sub-object level of Editable Poly objects and Edit Poly modifier. The Cross Section button will let you click from spline to spline, building the connecting lines.

Note: Modifier is called CrossSection. Button is called Cross Section (with a space).

Warning: If you use this method, the CrossSection vertices that overlap with the spline vertices won't automatically stay together. When you move one vertex, the other may stay behind. Therefore, if you use this feature, remember to Region-select with a window instead of clicking. Or you can turn on *Area Selection* in the *Selection* rollout of the *Vertex* sub-object level of Edit Poly.

If the vertices come apart, the surface will have holes in it. Use the *Fuse* button to move the errant vertices back to a coincident location.

Sidebar:

Another technique is actually to draw splines, using snap to vertex, and then skip the CrossSection function entirely. This is the technique taught in the 3ds Max tutorials titled Modeling a Chess Set —> Modeling a Knight. Artist Michael Comet has a great tutorial showing this technique. Click here to see it:

http://www.comet-cartoons.com/toons/3ddocs/facialmodeling/modeling.html

Tip: To work with an Editable Spline cage and see your surfaced mesh simultaneously, try the following: Create a spline cage using Editable Spline, then create a *Reference* of the spline cage. Apply a *Surface* modifier to the referenced object, and freeze it so you don't accidentally select it. Now any modifications you do to your original spline cage will be made to your referenced mesh.