Introduction to T-Splines and Rhino® 4

Surface from curves

Designing a spoon

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The **T-Splines** for Rhino plugin brings industrial designers new ways to easily create and modify freeform designs. One T-Splines workflow is to create entire, editable surfaces from input curves using the **tsSkin** command. This tutorial will show how to use this workflow to create a spoon. This tutorial assumes the user is generally familiar with Rhino and has successfully completed the "Getting Started" tutorials available in the Rhino 4 Help Menu.

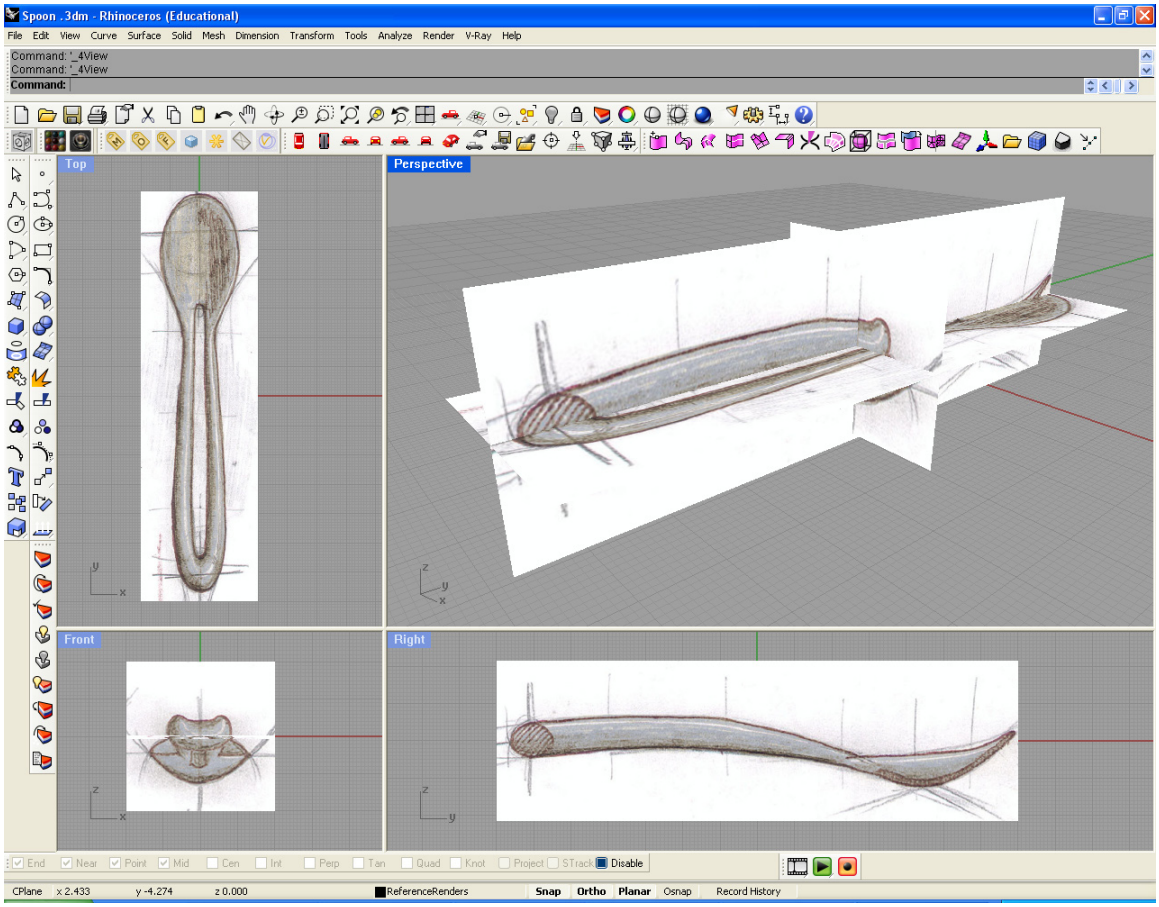
In this tutorial, anything in Blue is a Rhino command, while anything in Red is a T-Splines command. Type these commands in the command line of Rhino to run them.

The best way to read this tutorial is by looking at the 3D model at the same time. You can follow the model's progress by selecting the different layers in the file. The model can be downloaded at www.tsplines.com.

1 Creating input curves

Reference drawings

Input curves can be obtained by different methods; one way is to draw them directly in Rhino using hand-drawn concept pictures for reference. Bring the reference pictures into your Rhino scene using the _PictureFrame command. Position and scale them until they are aligned.



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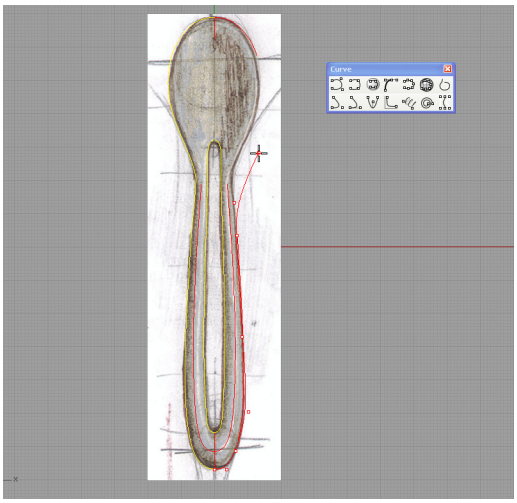
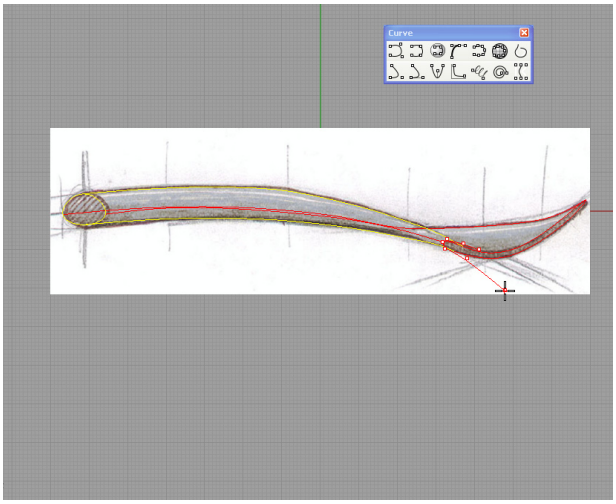
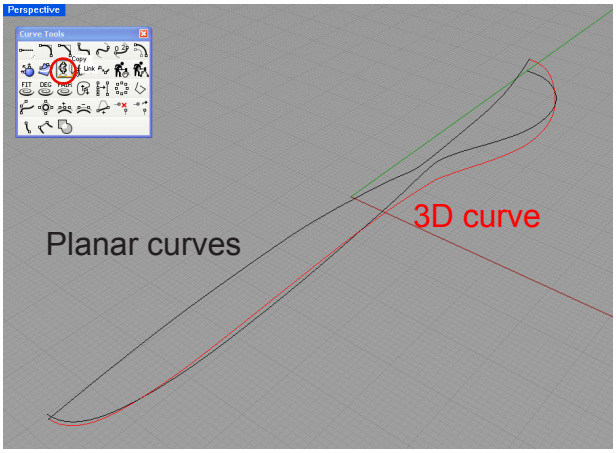
Generating the curves

In one view at a time, carefully draw the contour curves of the spoon using the _Curve command. Always try to use the fewest number of points possible to get the desired curvature.





One way to generate the 3D contour curves is to use the _crv2view command; this will transform two planar (profile) curves to a single 3D curve that describes the 3D shape of the spoon.

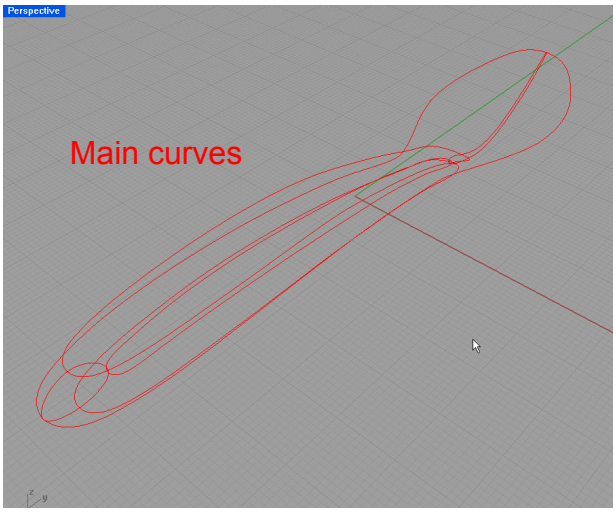


Once you have the main curves, it is time to add cross-section curves. While doing this, keep in mind the following rules of thumb:

First, create four-sided faces (quad regions) when possible. This will minimize the number of star points and generate a smoother surface.

Second, when possible, have 3 or 4 curve segments intersect at each intersection.

Third, use only the necessary cross sections to get the desire shape. Extra curves can yield a less smooth result.



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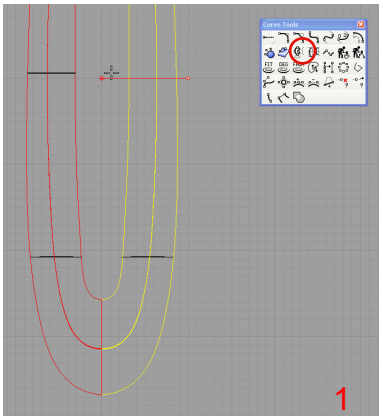
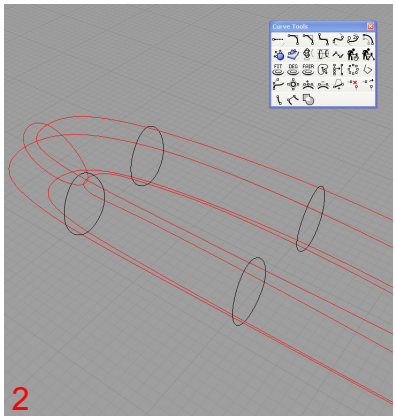
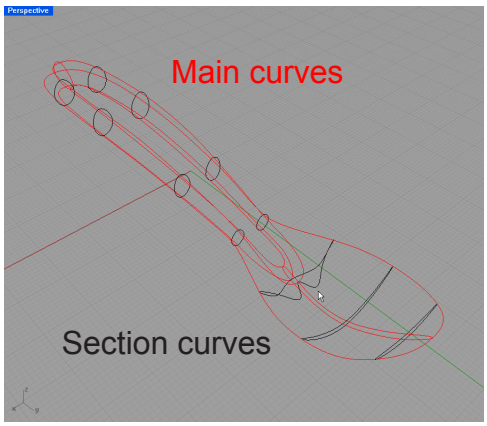
The section curves can be drawn by hand or by using the _CSec (curve from cross section profiles) command.
Since a regular surface continuity is desired, try to space the sections regulary, at approximately the same distances.



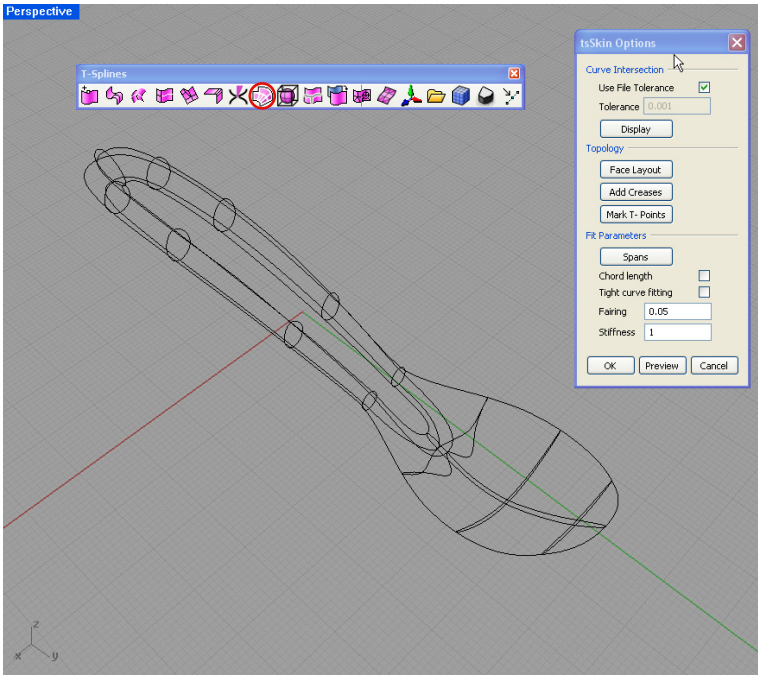




Input curves
Now all the curves necessary for the tsSkin command are in place.

2 tsSkin command

Select all the curves and run the _tsSkin command.
The options dialog box will appear.



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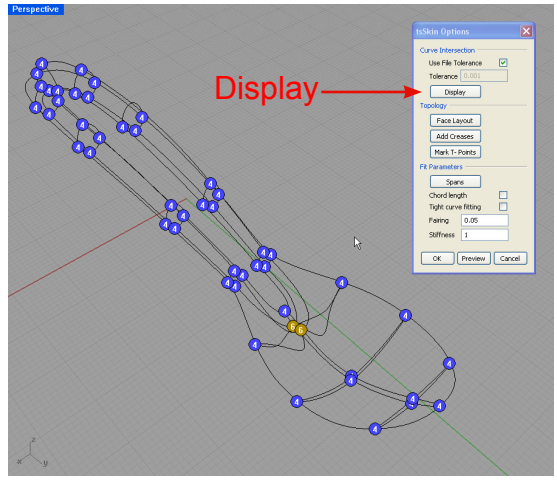
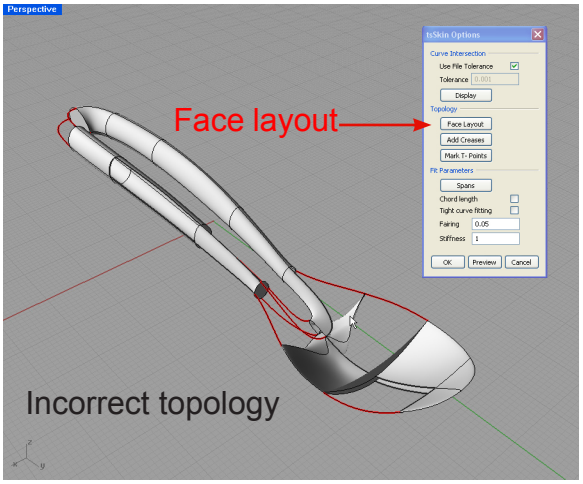
Display

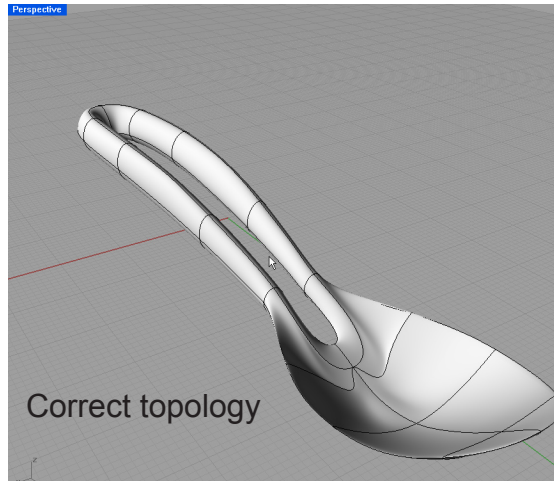
Once inside the command, the first thing to do is to set the tolerance for defining the curve intersections. Often the file tolerance will recognize all intersections (it does in this case) but the tolerance can be increased if your curves don't exactly touch. If you've laid out your curves well, you should mainly have intersections with 4 segments (blue dots). In this case some 6-segment intersections (which will be star points in the final model) are also used to define a complex part of the shape.



Face layout

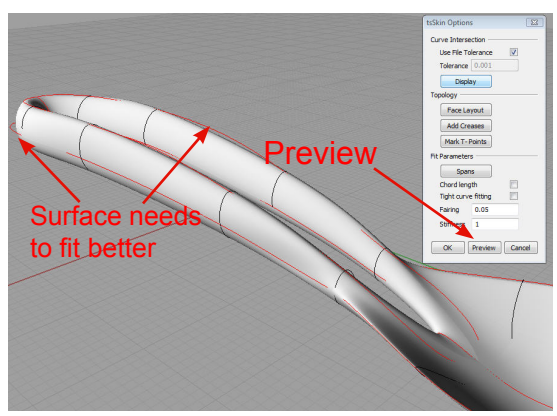
Now is the time to define the topology of the surface. tsSkin will automatically try to define the topology, but won't always guess right, so you need to provide input by selecting and deselecting the faces. For more help on achieving the correct face layout, watch this one-minute movie: http://www.youtube.com/watch?v=HP4SBDvX0Es





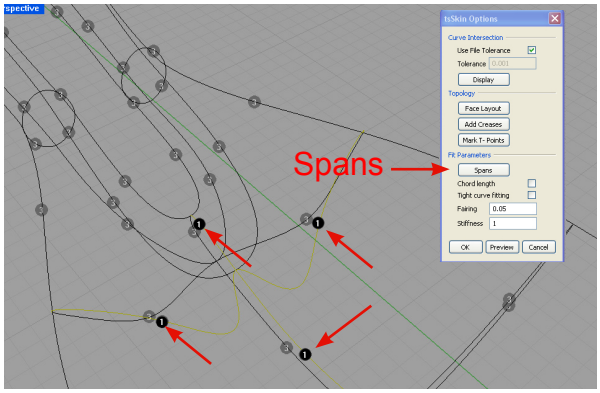
Preview

Use the preview option to check how the final surface will look. In this case, the surface doesn't fit to some of the curves as well as would be desired. To fix this, adjust the spans.



Spans (fit parameters)

To determine how tightly the surface will fit to the curves, change the number of spans on each curve. Each time a span is increased by one, a new control point will be added to the surface. This will allow the surface to fit more precisely to the input curves. In this case use 3 spans on nearly every curve. To release some "tension" on the complex part of the surface, use only 1 span on four of the curves.



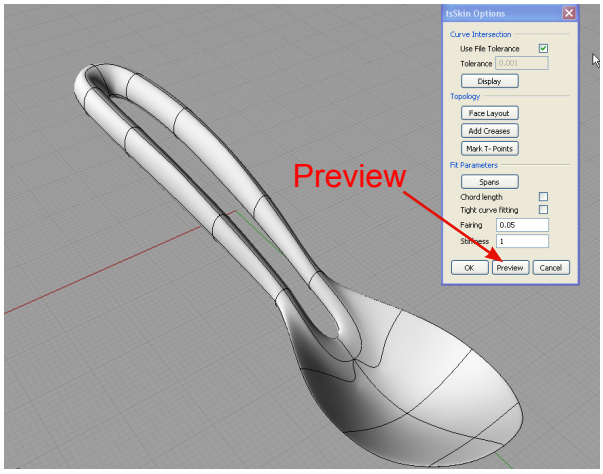
Preview

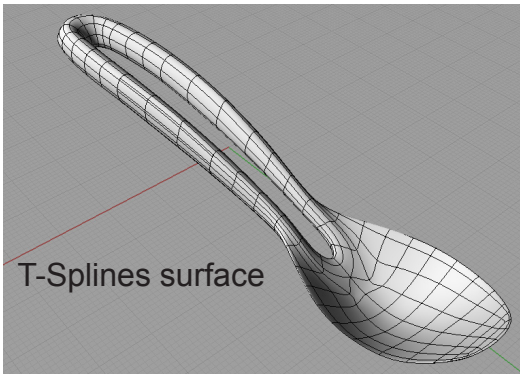
Now, the preview surface looks exactly as desired.

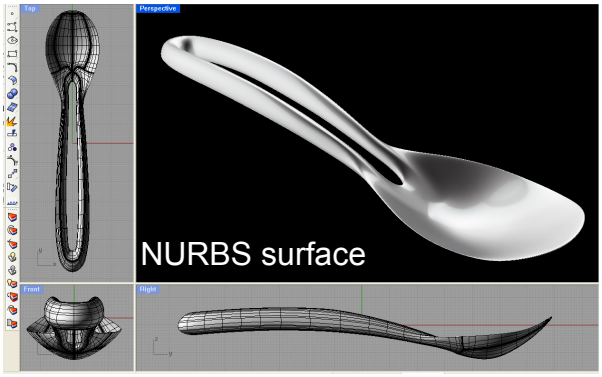
Press OK to generate the surface.

If you want to smooth the star points of the surface use the command _tsStarSmoothness. Five smoothing steps is generally enought to get a soft surface.

Now the spoon is smoothed.







The control points of the T-Spline can be further edited, or the surface can be converted to NURBS (_tsConvertToRhinoSurface) and modifed by any of the native Rhino tools.

Download a free trial of T-Splines for Rhino at www.tsplines.com