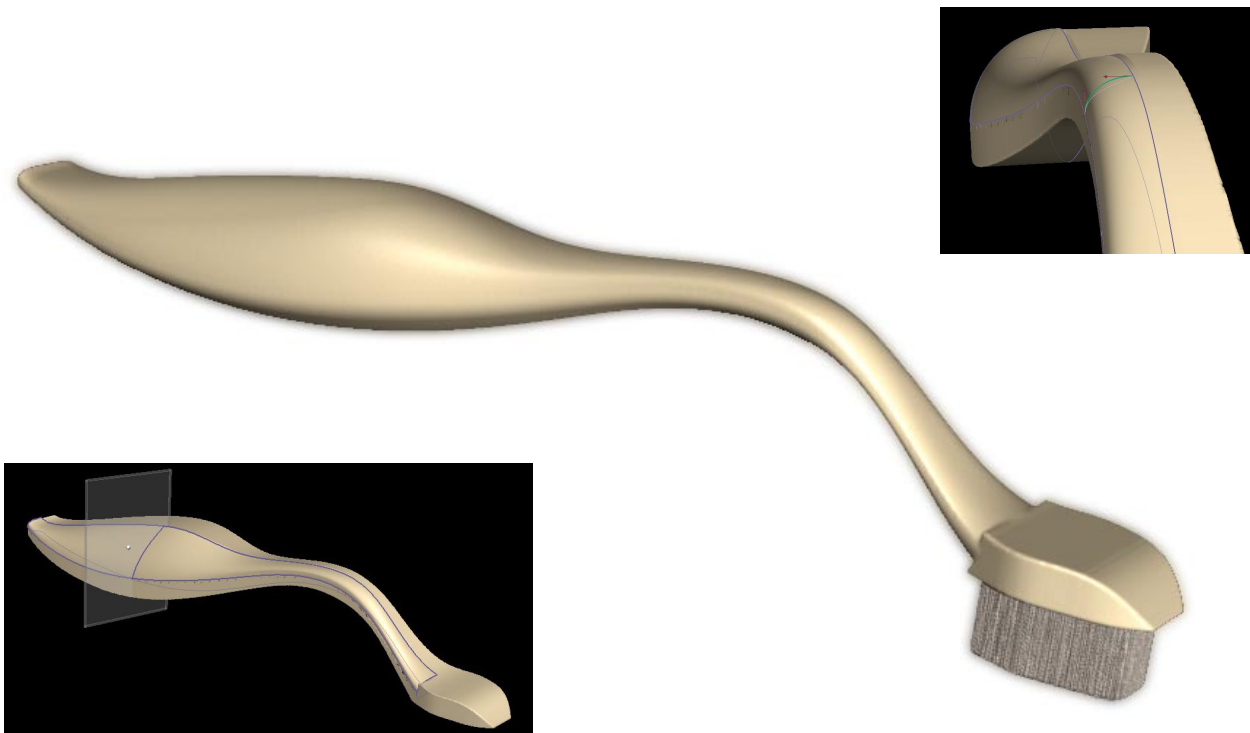




FREEFORM™
FEEL THE DIFFERENCE

FreeForm Modeling System Workflow Study “Shape Tool Techniques”



Modeler: Jay Kushwara – Customer Support Manager, SensAble Technologies

Description: This workflow demonstrates how to fully utilize the Shape tool

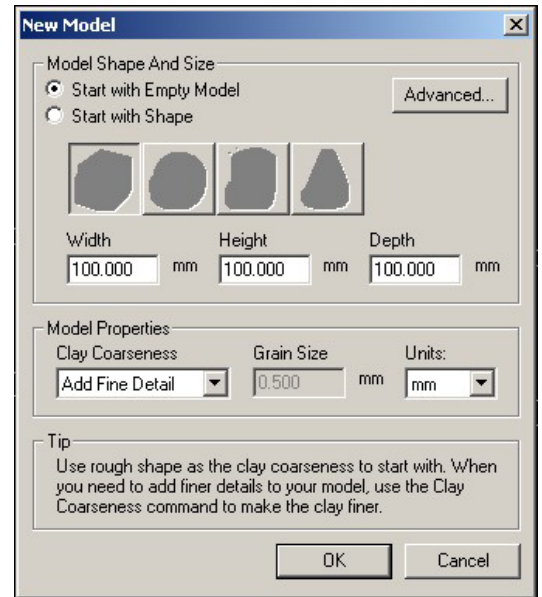
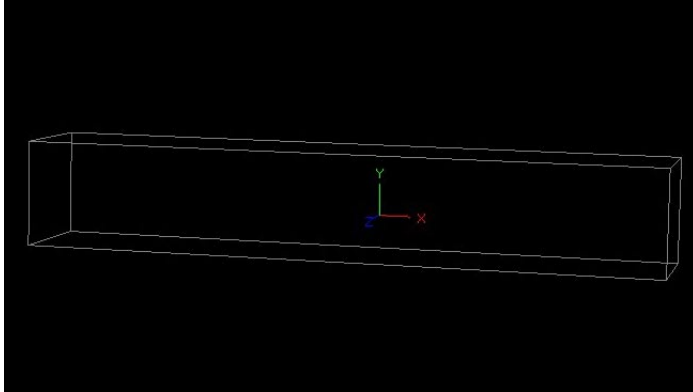
Timeline: 1 hour 30 minutes

Software Version: FreeForm Plus™ modeling system, version 4.

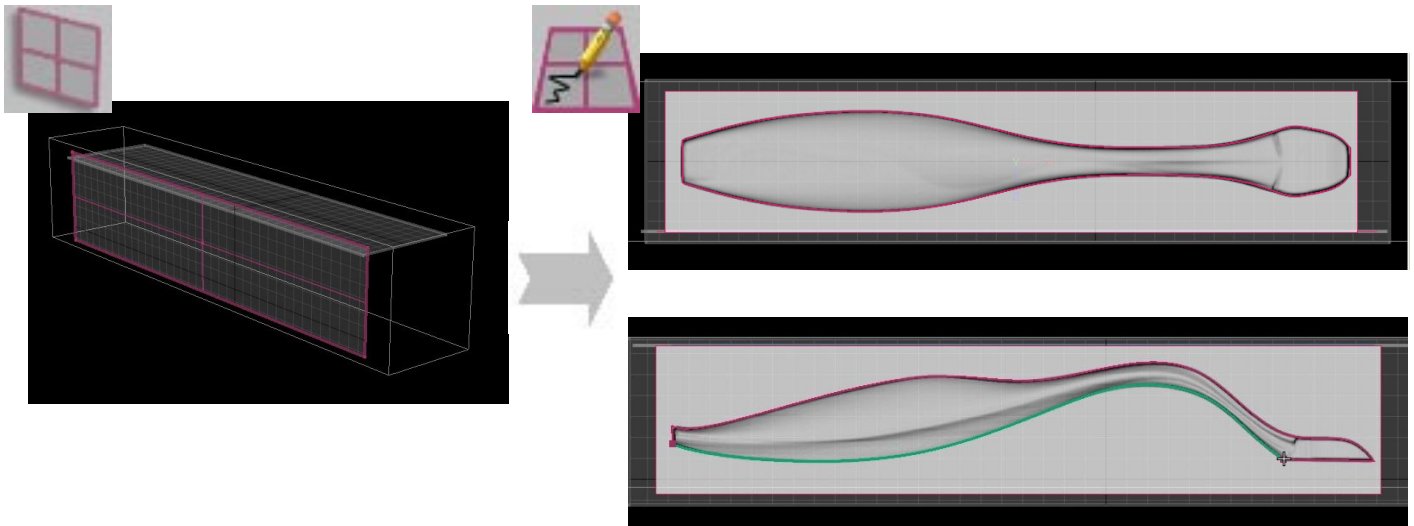
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Step 1) Using Sketch to create profiles, parting and character lines.

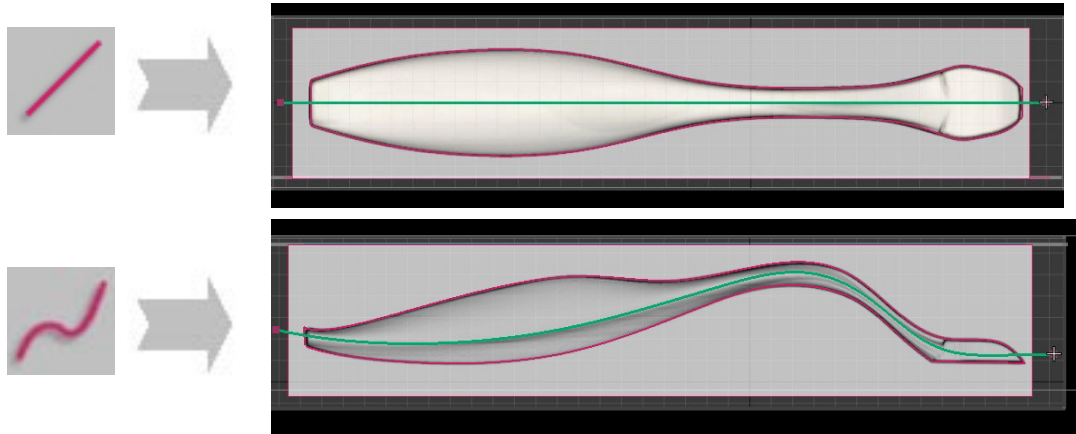
1. Start with an empty centered workspace at 170mm by 40mm by 40mm with a **Clay Coarseness** setting of *Add Fine Detail*.



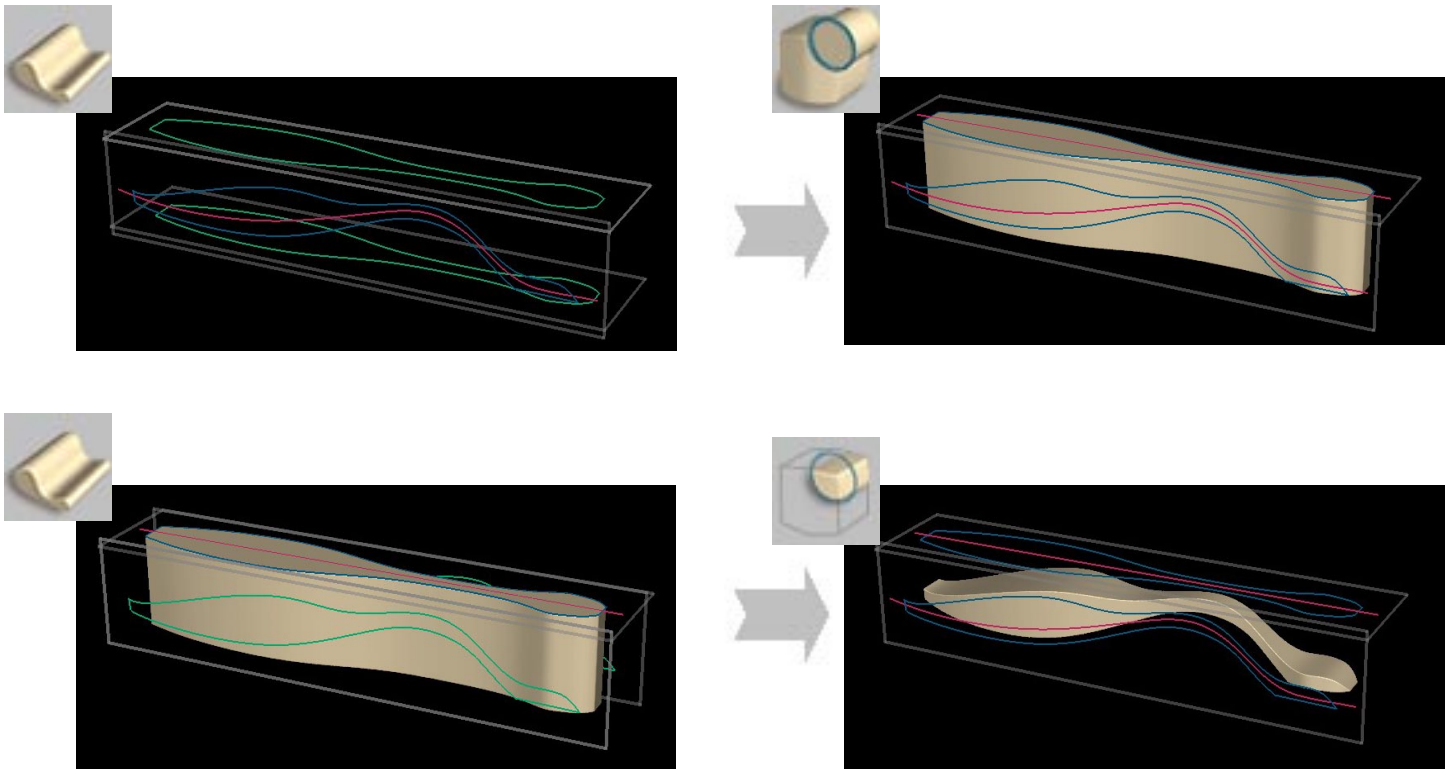
2. Place new planes on the top and side of the object. Enter **Sketch** mode on each plane and under the **File** menu select **Import** then **Image**. Select your top and side view bitmaps. Use the **Freehand Curve** tool and trace the top and side views to create the profiles. In the top view, only outline half of the basic shape then Select the outlined half and use **Mirror** to complete.



Add a straight centerline in the top view, extending beyond both ends of the profile sketch. On the side profile, add a centerline (also the parting line) using the **Freehand Curve** tool that follows the desired highlight.



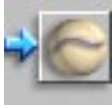
3. Start the **Wire Cut** tool and choose the top sketch plane. Be sure to use the *Select profiles one by one* option and select only the profile (not the centerline) then select Next. Choose *Add Inside* to create the clay using the top profile. Then, select the side profile from the other sketch plane and choose *Cut Outside* to create a rough version of the model. Select **Mirror** and apply – this creates a center mirror plane that will be used later in the process.



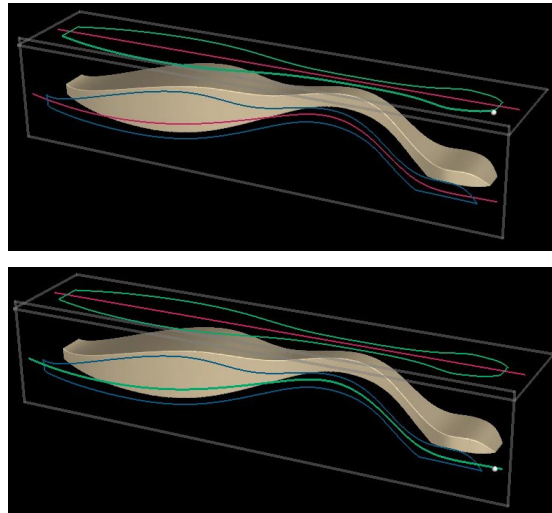
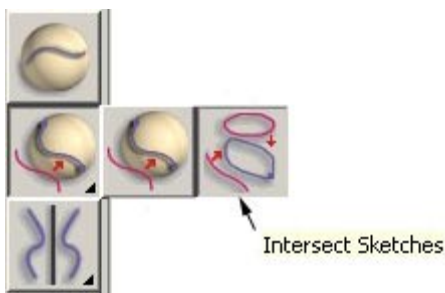
Step 2) Creating the 3D “Character” curves.

Traditionally, the next step in this process using the FreeForm modeling system would have involved a combination of carving and smoothing, using (oddly enough) the **Carve** and **Smooth** tools – as well as **Smudge**, **Tug**, etc. In order to demonstrate the full power of the FreeForm Plus system’s **Shape** tool we are going to take a completely different approach this time: utilizing silhouette curves and profiles to define our shape all at once.

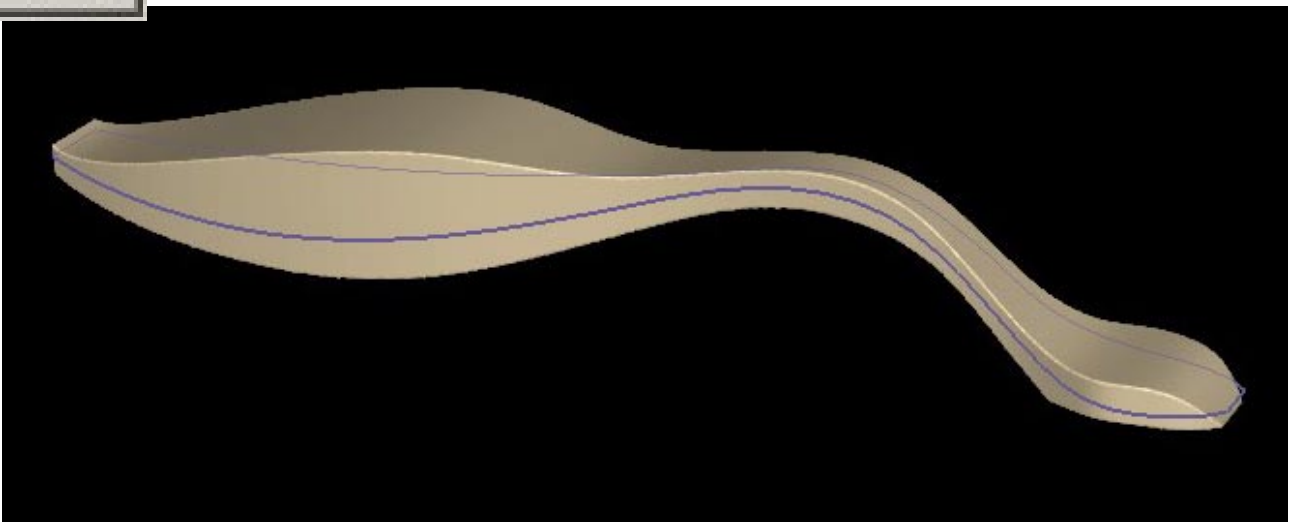
1. Select **Construct** on the toolbar to switch to the Construct Environment.



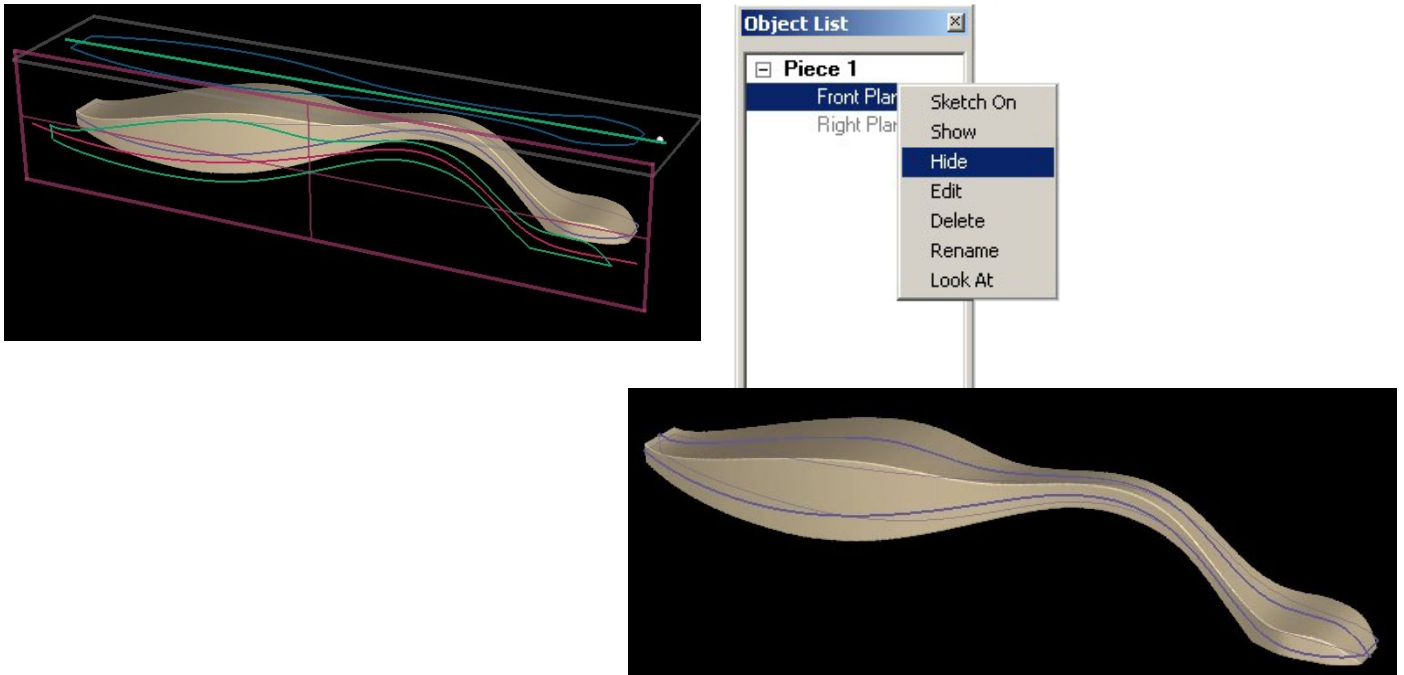
2. Select the **Intersecting Sketches** tool from the **Project Sketch** tool fly out. Start with the top profile sketch planes and use the PHANTOM stylus to select all the curves that make up the profile (*not* the centerline curve). Then, select the centerline curve from the side plane and click the apply button on the Dynabar. The result is a 3D curve that follows the top profile and the side centerline directly on the rough clay model.



Apply



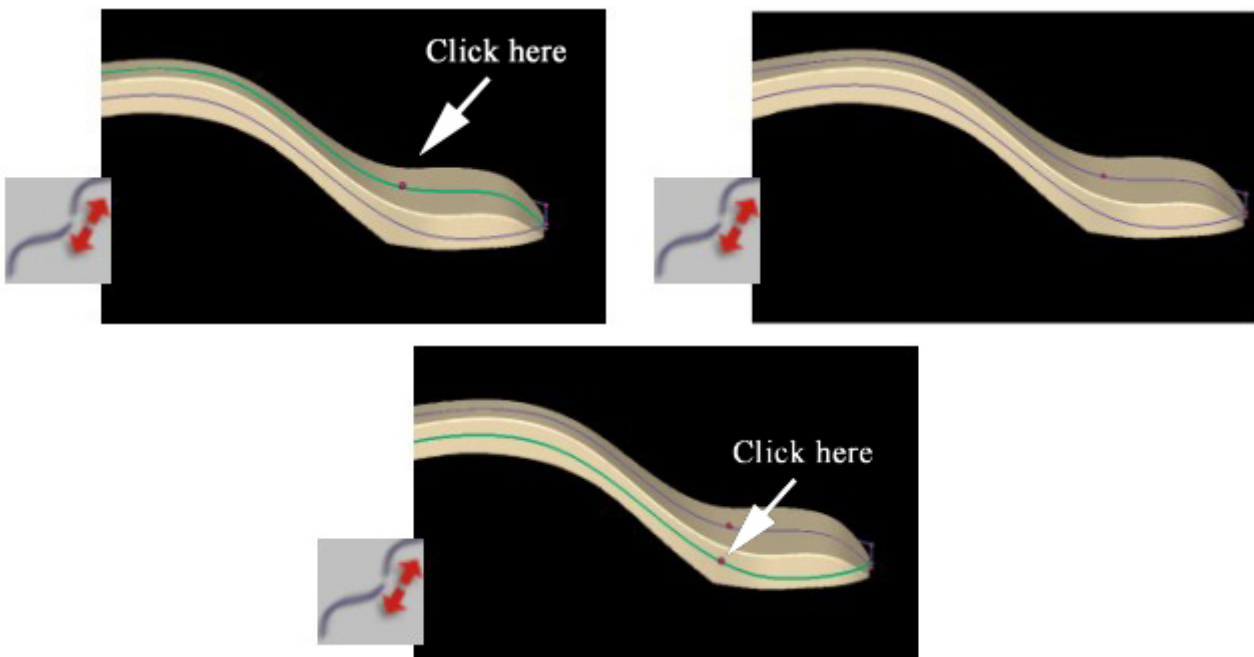
- Repeat the procedure but this time use the side profile and top centerline. At this point we are finished with the Sketch planes and can remove them from view by right clicking on them in the Object List and choosing Hide.



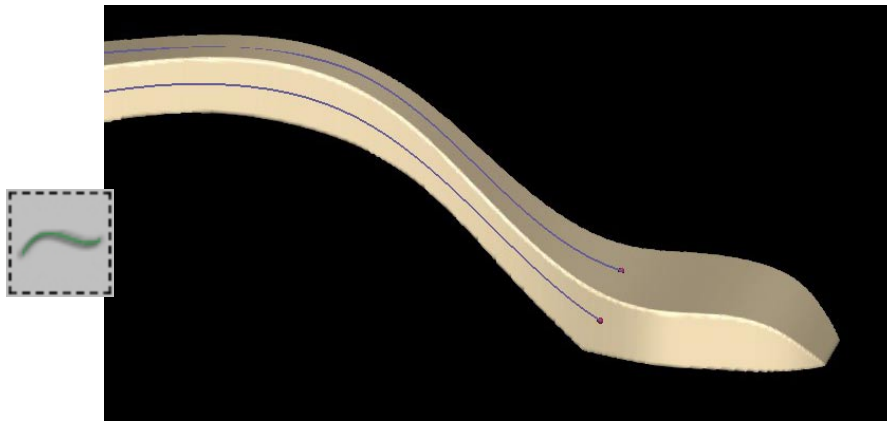
Step 3) Modifying 3D curves for use with Shape tool

The Shape tool creates surfaces by utilizing a four-sided 3D curve boundary. Using a combination of tools in the construct environment we need to modify our existing curves to create proper Shape boundaries.

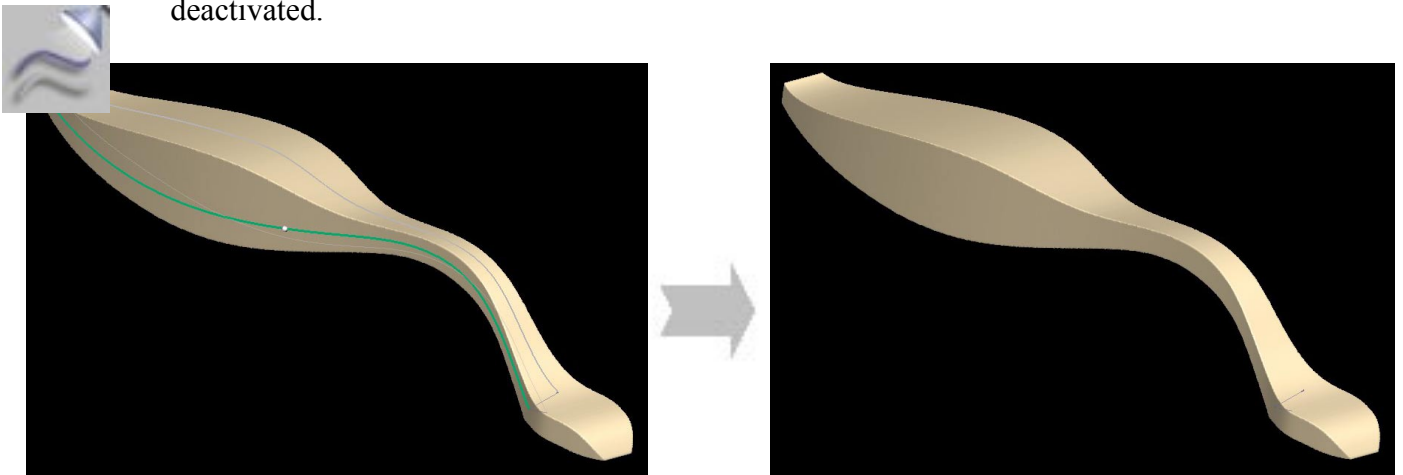
- Use the **Split** tool to create anchor points where the 3D character curves need to be bridged between. First select the curve to activate the tool, and then click at the spot you want to split the curve. It is best to design the boundary patch to be as rectangular and even sided as the model's design will allow. The more distorted and skewed the four sides are, the more likely the resulting Shape area will distort and skew as well. Notice that in this case, the curves are split where they meet the brush head and at the brush base.



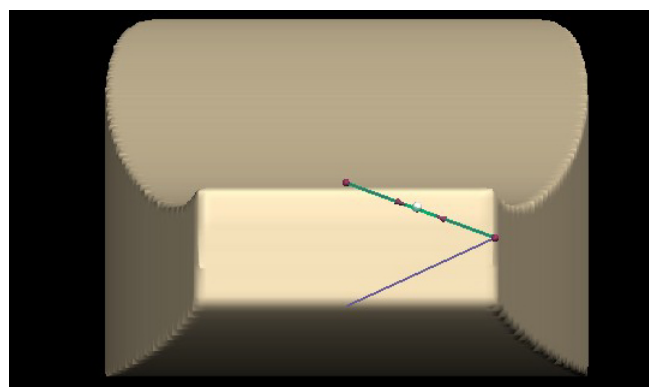
2. Remove remaining unnecessary curves at the front of the model using the **Select** tool then hitting the Delete key.



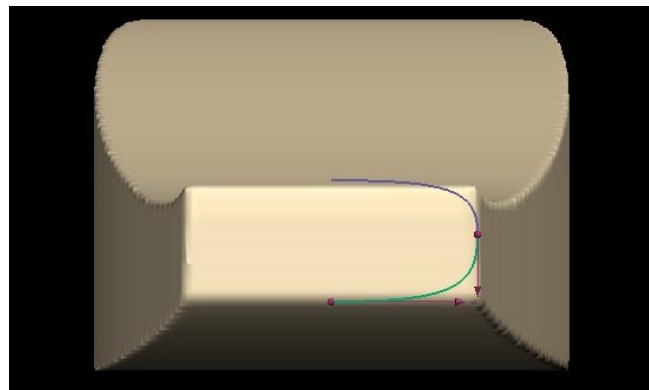
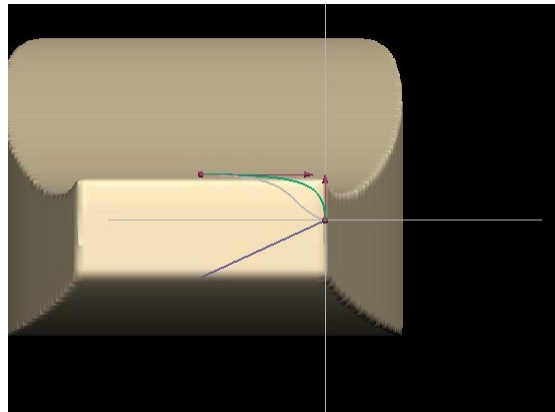
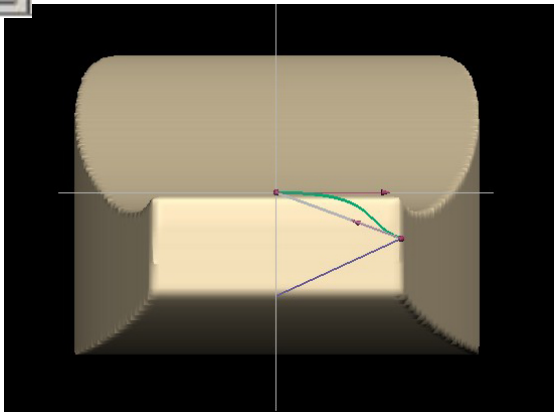
3. Select the **Curve** tool and draw additional curves that close off the character curves ends to create four sided boundaries. Do this by finding the top curve's end point with the PHANTOM stylus – a subtle “gravity” will tug your tool onto the point as soon as you get close. Click to start the curve, then find the end point of the side curve. Once the gravity sucks you to the point, click again to end the connecting line. It is important that this be a two-point curve without any points between its end-points. It is only necessary to do this for the top and bottom section of half of the model as the **Mirror** tool can be used later to complete the other half. Select the **Hide And Show Curves** tool and using the PHANTOM stylus select all curves except for the two end-connecting border curves. The selected curves will change from the normal purple color to a lighter version of the color, and will be completely hidden from view once the **Hide And Show Curves** tool is deactivated.



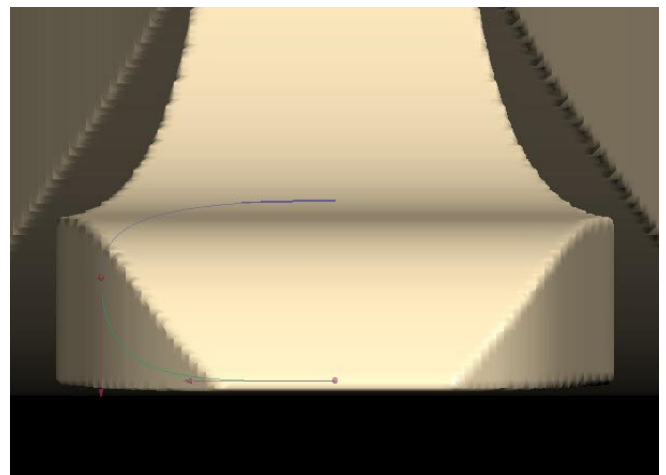
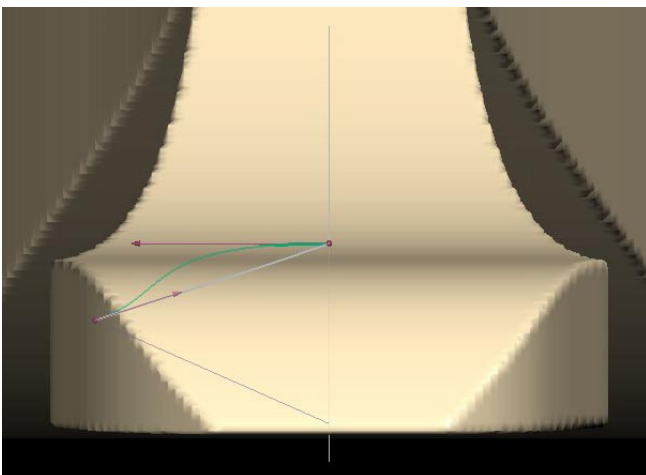
5. Using **Select**, choose the top boundary curve on the base of the brush. Orient the view so that you are looking straight through the base of the model and **Save View** (found in **View - Saved Views – Save Views** or by using shift F11) for later use.



6. Select **Move in View** from the Dynabar. In the Construct environment a 3D curve can be manipulated anywhere within the 3D space (x,y,z axis). **Move in View** locks movement of points on the selected 3D curve to a 2D plane oriented parallel to the viewing plane, much like working on a Sketch plane, and makes for much easier and accurate curve editing. It will also help create better Shape surfaces later. Adjust the Tangent Arrows, (the arrows coming from the curve's end points) to create a nice curve that accurately follows the contour of the desired surface. The crosshairs that are visible assist in controlling the curve's tangency along the centerlines. Following the crosshair direction controls the degree of smoothness at the centerline. Moving off the crosshair results in a sharp transition at the centerline.



7. Repeat the same procedure for the closing curve at the opposite end.

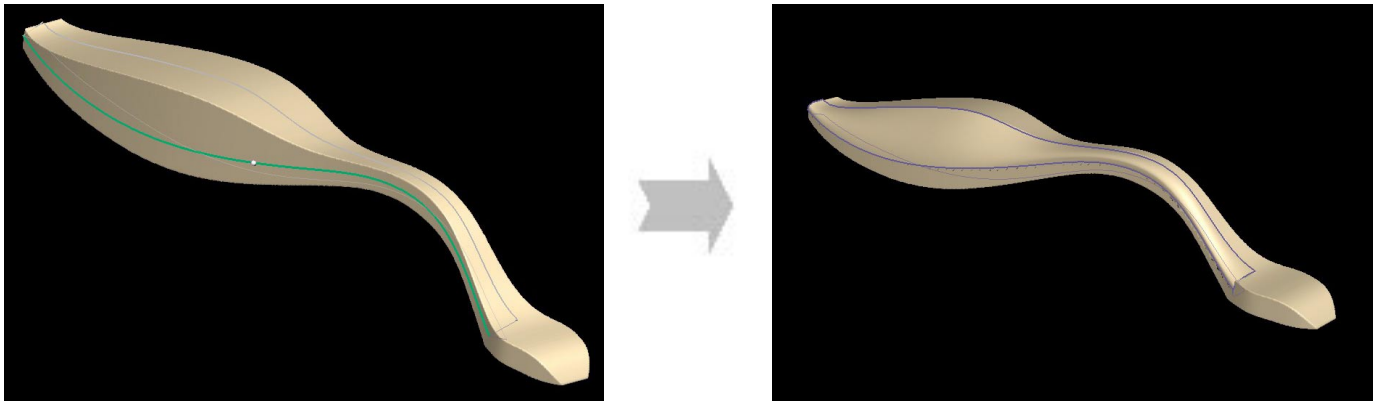


Step 4) Using Shape to create the surface form

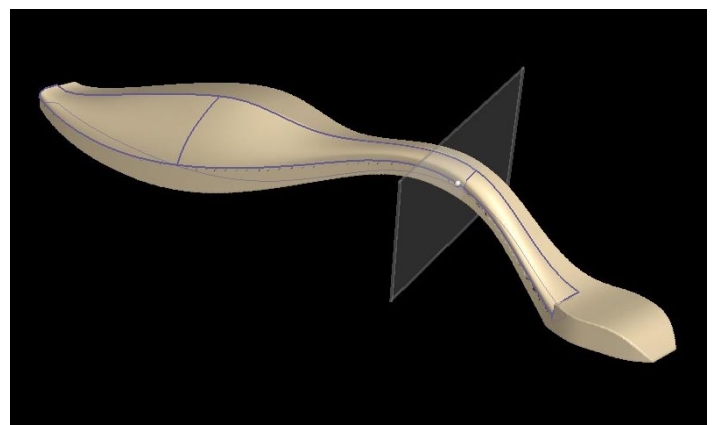
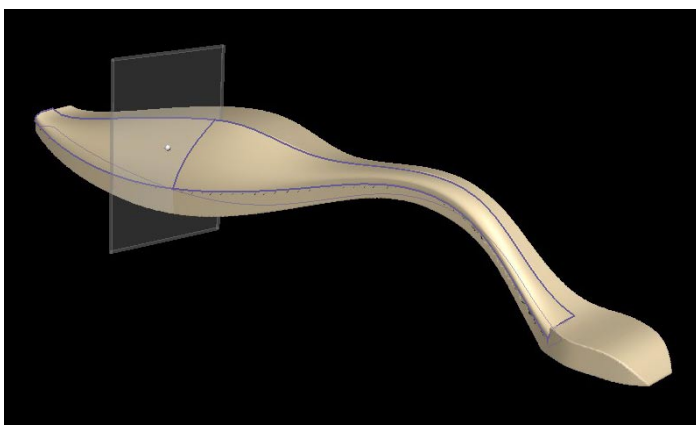
1. Select **Shape**. This places you in the first of three Shape steps (Boundary Step) seen on the Dynabar below. Select the *Fit sections to boundaries only* radial button. The other two fit options don't apply here because the existing rough clay model has very little bearing on the final surface we want to create. If the surface of the rough clay model had more closely followed the desired final form, we might use one of the other two options to maintain the surface flow of the underlying clay.



2. Use the PHANTOM stylus to pick the four curves that border our first Shape area. When the fourth curve has been selected, the clay within the border has been transformed to smoothly transition between the boundaries.



3. Select the **Section Step** tool on the dynabar. Use the PHANTOM stylus to move the plane to create sections along the Shape area that allow further control over the form using the **Orient Parallel to Plane** tool. It is best to use as few sections as possible, in this case one section was placed at the widest point on the handle and another placed at the high point of the brush neck.

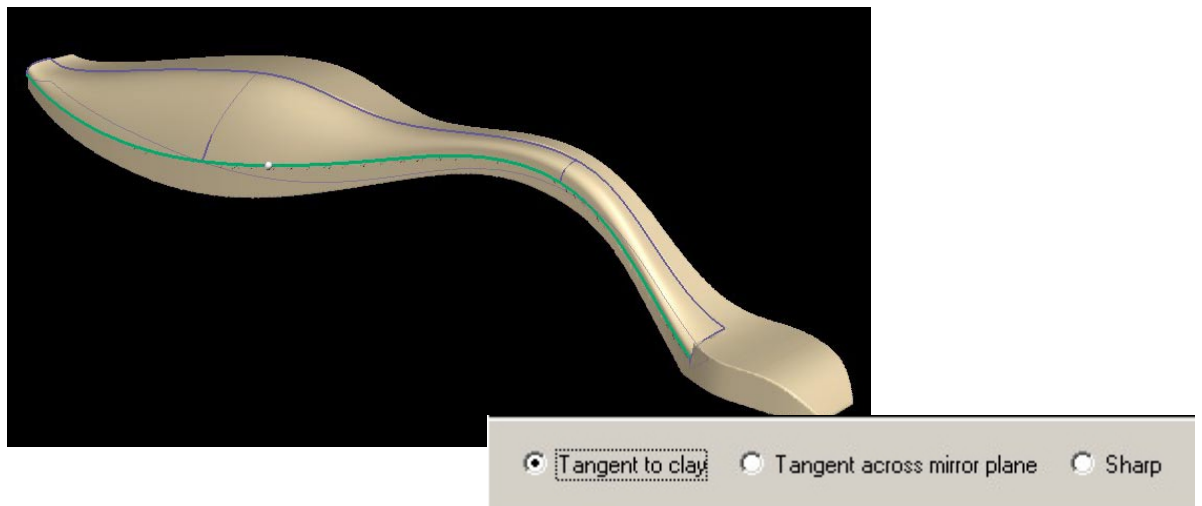


Sections must be positioned to run side to side along the shape area's vertical or horizontal axis. There are three positioning tools on the Dynabar that help place sections more accurately. **Unlock Plane Orientation** is the active default; it allows you to orient the planes any way you like. **Orient By Pivot Axis** restricts section plane rotation to the x, y or z axis. **Orient Parallel to Plane** locks the plane to the x, y, or z axis. Select the icon multiple times to toggle between the x,y,z options for each tool. It is usually best to use either the Orient by Pivot Axis or Orient Parallel to Plane mode for the best results.

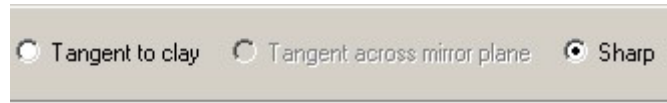
4. Select the **Shape Step**. Select the top border curve and choose the Tangent across mirror plane radial button on the Dynabar. This will help create a seamless transition between the left and right halves that carries through any mirroring procedure. The border curve must run along the same axis and position as the mirror plane for this option to be used.



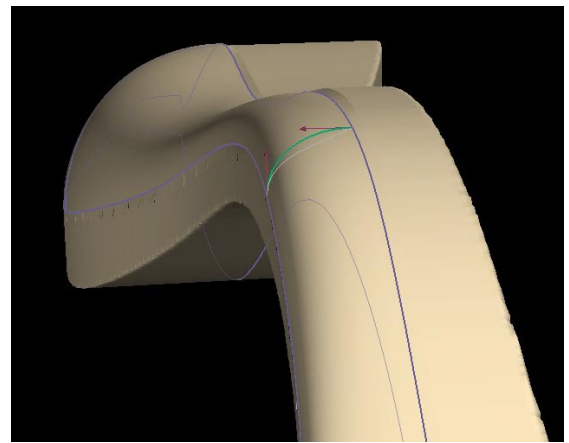
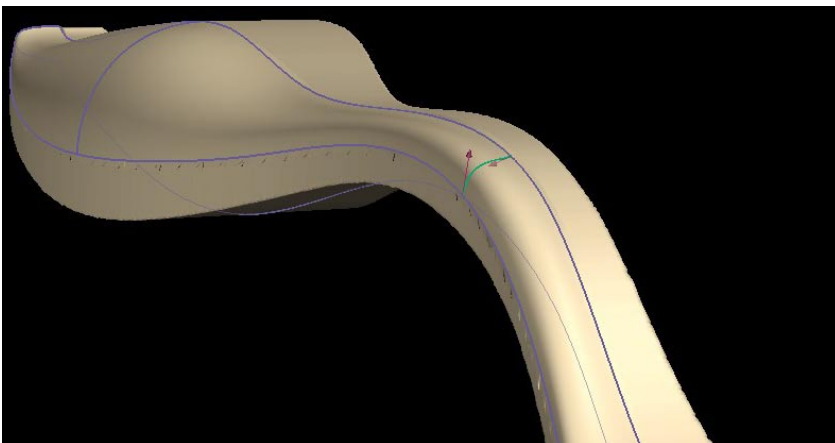
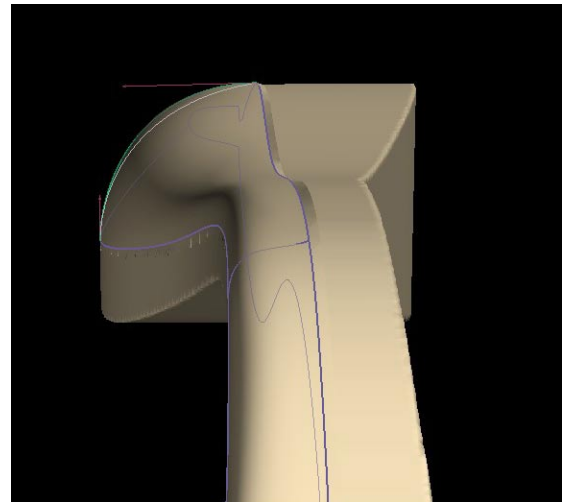
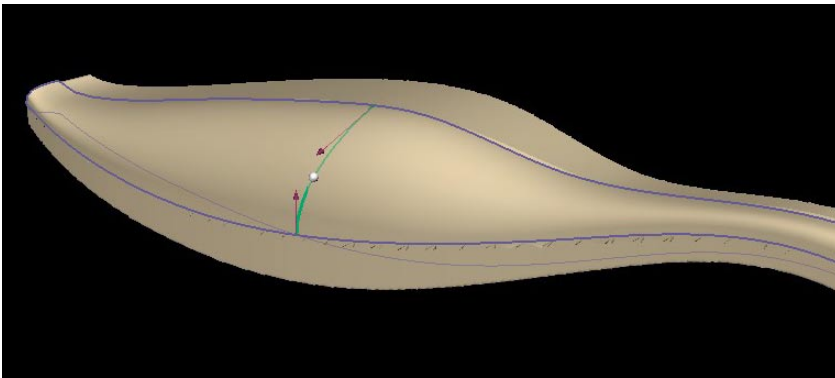
5. Select the side border curve and choose the Tangent to clay radial button. This will help create a smooth transition between the upper and lower Shape section.



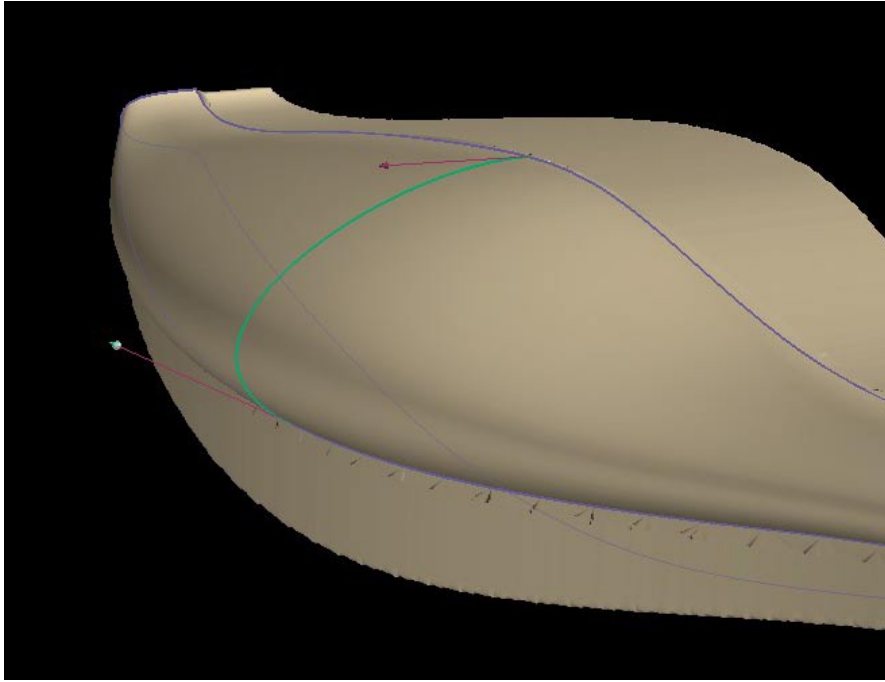
- The border curves at either end can be left on the default setting of Sharp. The Sharp radial button option is best used on sharp edges that do not transition smoothly into other areas of the model.



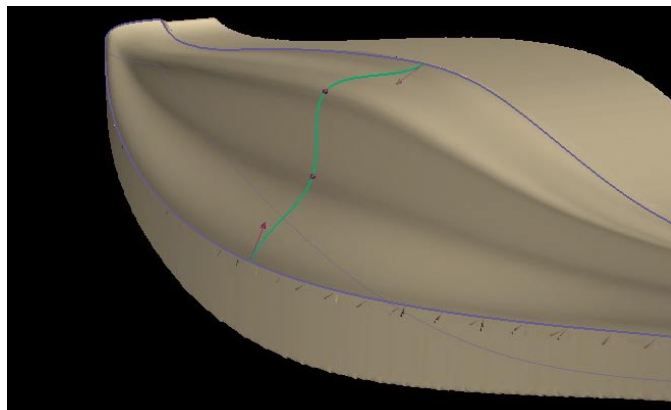
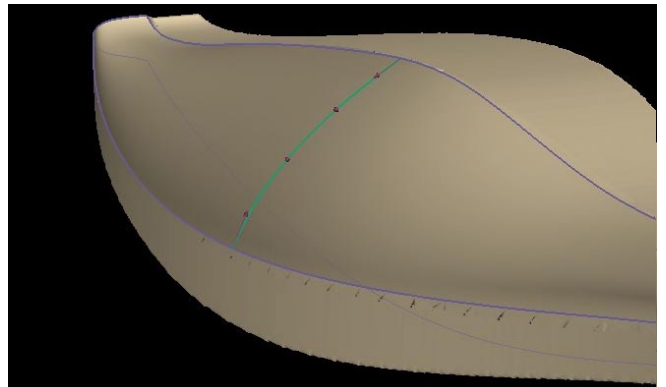
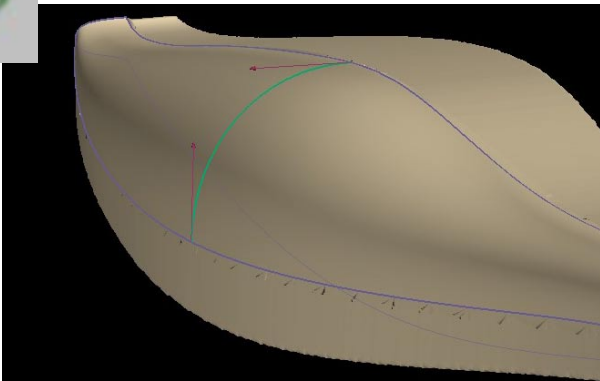
- Select the Shape crosssections one at a time, and adjust the Tangent Arrows to affect the form. Because the top and side borders have been set to be tangent, the handles are locked along that tangent, which keeps the top and side borders smooth. Go ahead and experiment with how the tangent arrows can be used to modify the shape by pulling them away from and pushing in toward the borders.



If we had set the border curves to Sharp in steps four and five, the handles could then be positioned in a non-tangent manner. This would allow the shape section to make sharp creases along those borders (as shown below). Notice how the side tangent handle is no longer vertical but rather pointed out into space. This pulls the clay out that way and creates the sharp crease where the Shape area borders the unshaped area.

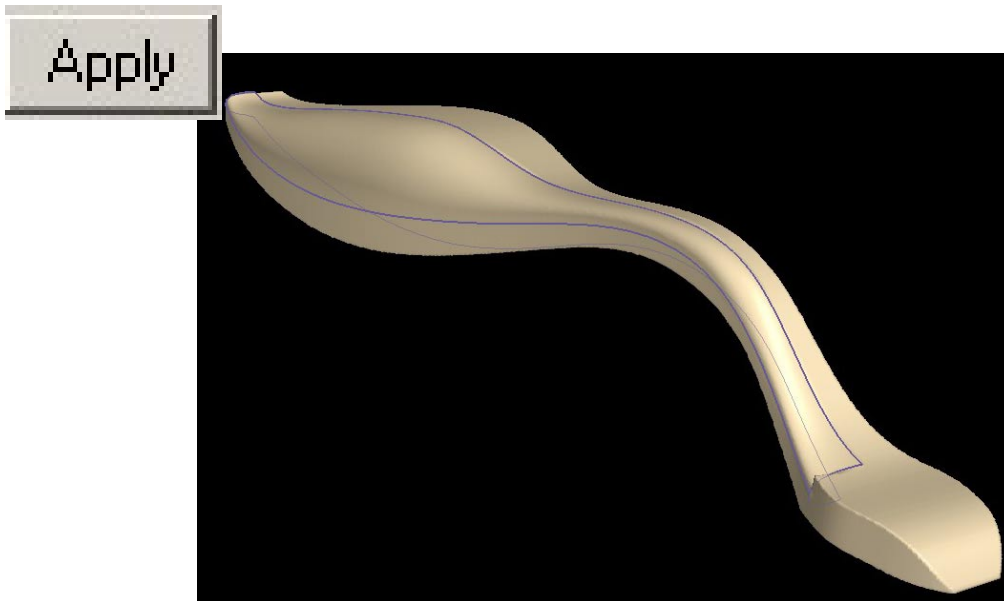


There are also a number of additional controls when editing sections found on the Dynabar. Edit points can be added or removed on a section curve to allow greater control over the model surface.

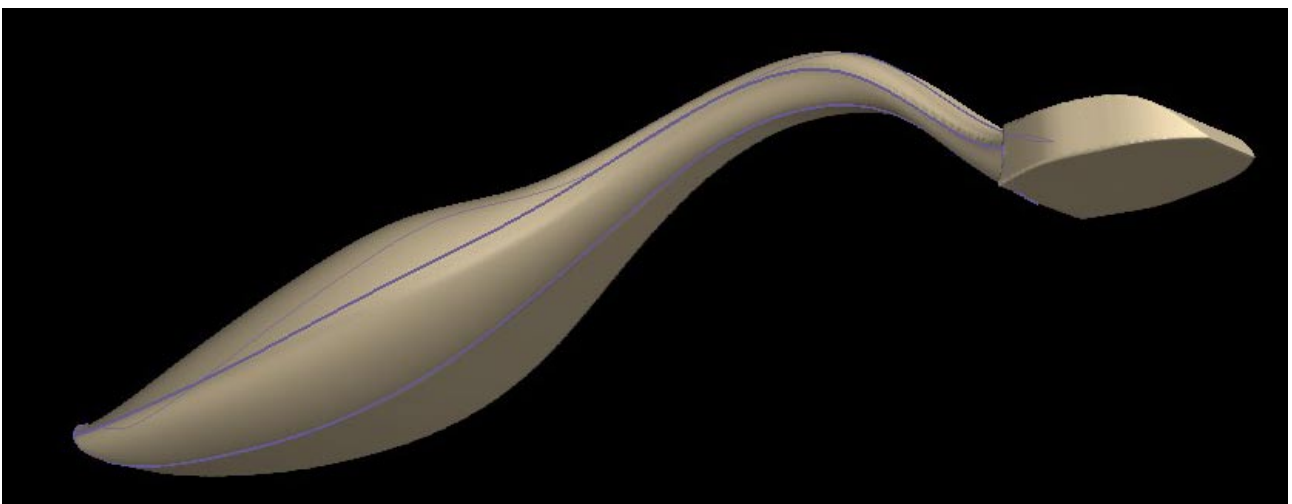
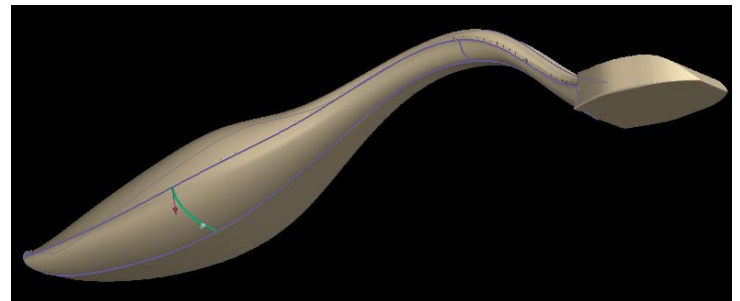
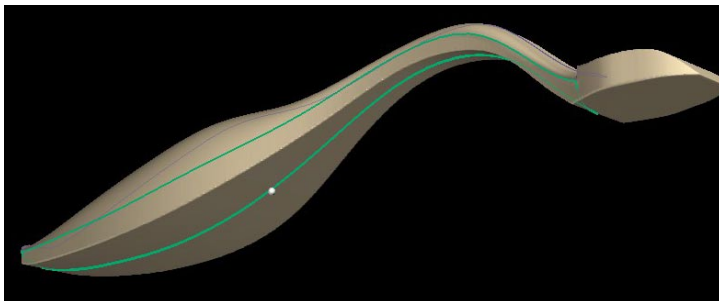


Curves can also be smoothed to remove unwanted ridges and the border curves can be hidden while editing section curves.

8. When you have adjusted all the sections to create the desired form, click on **Apply**.



Repeat the shape procedure for the lower half of the model.



Step 5) Finishing Touches

1. At this point, the only thing left to do to finish the handle form is to use the **Mirror** tool to duplicate the shaped side to the other side. The addition of bristles at the end of the brush, the basic model is complete and ready for any final detailing.

