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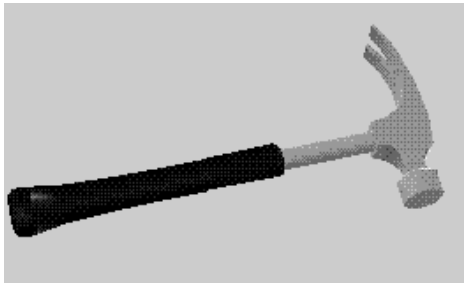
CHAPTER 9 ● Examples

In this chapter we take you step by step through the procedures we used to build three models in the TriSpectives catalogs. These models — the bar stool, the hammer, and the cellular telephone — feature the following TriSpectives tools and techniques, if you'd like to learn more about them by seeing them in action:

- Creating 3D custom shape tools from 2D cross-sections
- Creating hole shapes with 3D custom shape tools
- Copying shapes
- Creating mirror images of shapes in the 2D cross-section
- Positioning with SmartSnap
- Precise positioning of copied shapes with the TriBall tool
- Precise positioning with SmartDimensions

In the first two model-building procedures, you'll create several
2D cross-sections and 3D custom shapes. In the last model, the telephone, you'll use many of the positioning tools in TriSpectives.



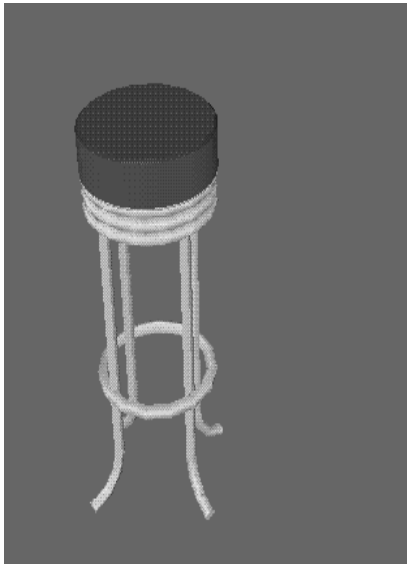
In this chapter

- Building a bar stool
- Building a hammer
- Building the body of a cellular telephone

Building a bar stool

The bar stool model consists of three main shapes: the seat, the legs, and the footrest ring at the bottom. The seat and legs are 2D cross-sections that TriSpectives extends into 3D. The footrest ring is a torus shape from the Shapes catalog.

In the following procedures you'll build these shapes and position them to create the bar stool model. When you're done, it looks like the model in the Showcase catalog and the following illustration:



Finished bar stool model from Showcase catalog

Preparation

Before you start building the model, take these steps:

1 Create a new scene in your WorkBook.

- If TriSpectives is open but you don't have an open WorkBook, choose New from the File menu. Select 3D Scene in the WorkBook Wizard and then select Finish.
- If you have an open WorkBook, choose Scene from the Insert menu. In the resulting Insert Scene dialog box, choose As New Scene in WorkBook, and then choose OK.

1 If they're not showing already, open the 2D Drawing toolbar and 3D Shapes toolbar.

Select Toolbars from the View menu. In the resulting dialog box, check the boxes next to 2D Drawing and 3D Shapes, and then choose OK.

Custom shape tools

2D Drawing toolbar

3 Show measurements for your 2D cross-sections, and make the measurements in centimeters.

Select Options from the Tools menu and then:

- Click the 2D Drawing tab. In the ensuing properties sheet, click the check box next to Show Snap and Measurement Feedback.
- Click the Units tab. In the next properties sheet, select Centimeters in the Length field and then click OK.

Beginning the seat shape

To begin the bar stool, create the seat. Use the 3D Spin Shape tool.

▶ ***To begin making the seat of the bar stool:***

1 **Select the Edit IntelliShapes tool.**

3 **Select the Spin Shape tool on the 3D Shapes toolbar.**

2

3 Click in the scene and then select Finish on the Spin Shape Wizard.

TriSpectives displays a grid and the Edit Cross-Section dialog box. You'll use the grid to draw the 2D cross-section of the seat.

Make sure the vertical axis of the grid is on the left.

***Tip**: Drag the dialog box out of the way so it doesn't interfere with your work on the grid. You should also select the Look At tool and then click the grid to view it straight on.*

4 Change the grid settings to create a finer network of grid marks.

Right-click the scene background, select Grid Settings from the pop-up menu, enter 1.5 as the vertical and horizontal grid line separations, and then click OK.

5 **Use the Zoom Camera tool to close in on the grid until you feel you can draw on it comfortably.**

You're ready to draw the 2D cross-section that TriSpectives will spin into a seat.

Creating the seat cross-section

The cross-section for the bar stool seat consists of a series of lines and arcs. To make sure the lines and arcs form a continuous cross-section, begin each 2D shape by clicking in the same spot you clicked to end the previous 2D shape.

When you're over this spot, a green dot appears. If you don't use the green dot, your lines will be discontinuous

and TriSpectives will be unable to extend the cross-section into 3D.

As you use the next few steps, refer to the following illustration of the completed cross-section for assistance.

▶ ***To draw the 2D cross-section:***

1 **Select the Line tool and create your first line.**

Move your mouse pointer to a grid line on the vertical axis near the top of the grid. Click and drag a straight line to the right. When TriSpectives reports that you've moved 18 cm from the vertical axis, click to end the line. Because you set the grid line separations at 1.5 cm, your line should span 12 squares.

2 With the Line tool still active, connect a second line to the first.

Move your mouse pointer to the spot where you ended the first line. When the green dot appears, click and drag the mouse straight down. When TriSpectives reports that the straight line is 7.5 cm long (5 squares), click to complete it.

3 Select the Arc tool and draw a series of five connected arcs directly under the second line.

Move your mouse pointer to the spot where you ended the second line. When the green dot appears, click and drag to define the first arc.

Repeat this step to make the remaining arcs. Each arc should be 1.5 cm long (1 square) with their crowns facing right. In the next two steps you'll flip some of them to create a ridged effect.

4 Select the Arc tool again to turn it off.

5 Flip the second and fourth arcs to make the five arcs form a curved ridge.

When you turn off the Arc tool, a square handle appears in the center of each arc. On the second and fourth arcs, drag this handle to the left to reverse their orientation. Release the mouse when the revised arcs are the same size as the other ones.

When you're done, the arcs should face left, then right, then left, and so on, as shown in the following illustration.

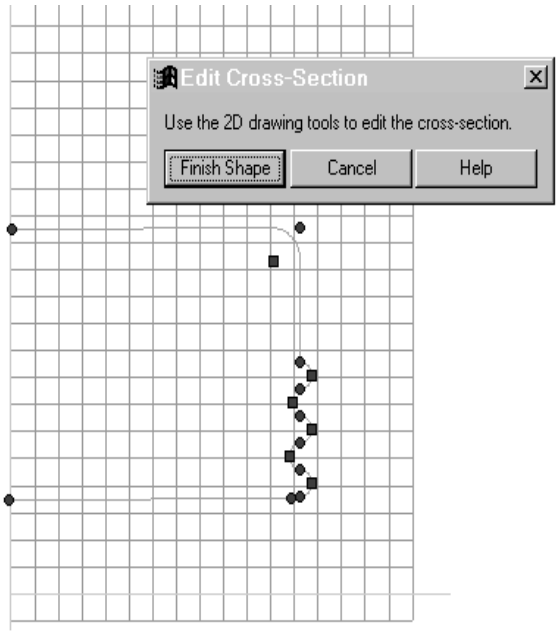
6 Select the Line tool and create a line that connects the endpoint of the bottom arc to the

vertical axis.

Move your mouse pointer to the spot where you ended the last arc. When the green dot appears, click and drag to the vertical axis. When you're over the axis, click to end the line.

7 **Select the Fillet tool and round the corner in the juncture of the lines you created in Steps 1 and 2.**

With the tool on, click the juncture, then drag down and to the left. When you're done, the cross-section should look like this:



Finished cross-section for seat of bar stool

8 To turn the cross-section into the seat of the bar stool, select Finish Shape in the Edit Cross-Section dialog box.

The seat appears. Next, you create the legs of the bar stool.

Beginning the leg shape

In this procedure you'll use the Sweep Shape tool to create a leg for the bar stool. The sweeping procedure has two parts: first you create a cross-section to determine the first two dimensions, and then you create a path that TriSpectives uses to sweep the shape into the third dimension.

▶ ***To make a leg of the bar stool:***

1 **Use the Orbit Camera and Look At tools to look straight at the bottom of the seat.**

2

3 **Choose the Select tool and then choose the Edit IntelliShapes tool if it isn't selected already.**

4

5 **Select the Sweep Shape tool on the 3D Shapes toolbar.**

4 Click in the scene on the seat, near its edge.

The seat appears in green highlight when the pointer is over it.

5 On the Sweep Shape Wizard, make the following selections:

- On page 1, choose to sweep the new shape Away from the seat. Select Next to move to page 2.
- On page 2, choose a Straight line as your sweep path. Select Next to move to page 3.
- On page 3, choose to Add material to the seat, and then select Finish on the wizard.

TriSpectives displays a grid and the Edit Cross-Section dialog box. You'll use the grid to draw the 2D cross-section of the leg.

***Tip**: Drag the dialog box out of the way so it doesn't interfere with your work on the grid. You should also select the Look At tool and then click the grid to view it straight on.*

6 Change the grid settings to create a finer network of grid marks.

Right-click the scene background, select Grid Settings from the pop-up menu, enter 1.0 as the vertical and horizontal grid line separations, and then click OK.

7 **Click the Circle tool, move the pointer to the grid, and draw a circle with a diameter of 4 cm.**

Click at the origin of the grid and drag to form the circle. Release the mouse when TriSpectives reports that the radius is
2 cm.

8 Choose Finish Shape on the Edit Cross-Section dialog box.

TriSpectives displays a second grid, this time along the path. You also see the Edit Sweep Path dialog box.

Use the Orbit Camera tool to change your view and look at the seat from the side. The grid should appear to be parallel with the scene. To turn off the Orbit Camera tool, click on it again.

9 Adjust the line separations in the grid to 5 cm.

Right-click the scene background, select Grid Settings from the pop-up menu, enter 5 as the grid line separations, and then click OK.

10 Create the first line of the sweep path.

Click the red handle at the end of the sweep path line and drag the handle away from the seat. When the line is 60 cm long, release the mouse. If you reach the edge of the scene before the line is long enough, use the Zoom Camera tool to make your vantage point seem farther away.

11 **Click the Arc tool and add an arc to the end of the sweep path.**

Move your mouse pointer to the spot where you ended the line. When the green dot appears, click and drag away from the seat to define the arc. Release the mouse when the arc is 15 cm long.

12 Select the Arc tool again to turn it off, and then revise the shape of the arc.

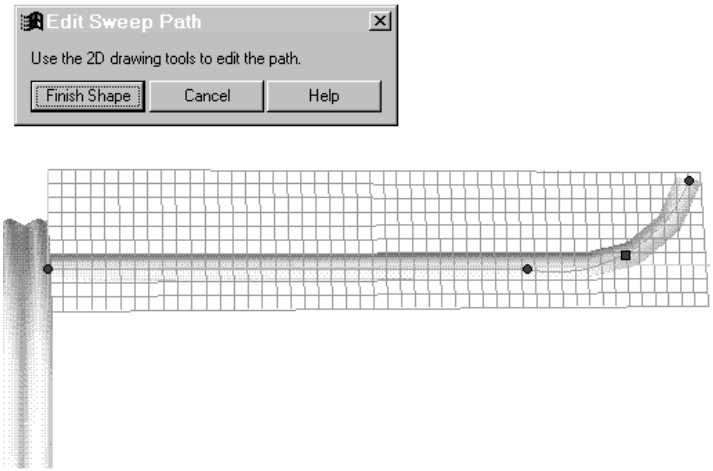
To reshape the arc, drag it by its square and round handles. When you’re done, the arc should still be 15 cm long. The endpoint of the arc should sweep

away from the main line by 5 cm (one square).

The sweep path should look like the following illustration.

13 Choose Finish Shape on the Edit Sweep Path dialog box.

TriSpectives moves the circle along your sweep path to create the bar stool leg.



Sweep path of bar stool leg

Positioning the leg on the seat

Use the TriBall tool to position the first leg under the seat of the bar stool. When you like the first leg, you'll copy three more and position them with the TriBall as well.

▶ ***To position the bar stool leg with the TriBall tool:***

1 **Use the Orbit Camera tool to rotate the bar**

stool and make it seem upside down.

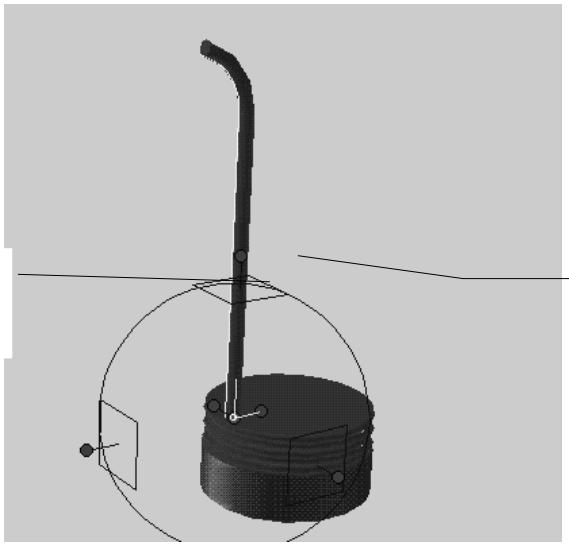
Stop rotating when you can see a sizable portion of the bottom of the seat. You'll use this surface to position the leg.

2 **Choose the Select tool and then choose the Edit IntelliShapes tool if it isn't selected already.**

3 

4 **Select the leg and then select the TriBall tool.**

The TriBall tool appears over the leg.



TriBall tool

4 Drag the leg until it is just inside the edge of the seat.

Place your mouse pointer in the 2D plane on top of the model. This plane is shown in the preceding illustration. When the pointer becomes four straight arrows, you can drag in a 2D plane along the seat bottom. Drag the leg into position.

5 Rotate the leg until its sweeping side faces in the opposite direction from the seat.

To rotate the leg, click the 1D handle above the plane you just moved. The handle is shown in the preceding illustration. When the axis of rotation appears in yellow, move your pointer inside the TriBall. When the pointer changes to a hand and arrow, drag the leg around the axis until the sweep faces away from the seat.

You might need to use the Orbit Camera tool and view the model from several angles before you can rotate the leg into the perfect position. The Orbit Camera tool and the TriBall work in tandem, so you don’t have to turn one off to use the other.

To help with the previous step, you can try the following:

Turn off the TriBall, select the leg, then right-click it and select Edit Path from the pop-up menu. When the path grid appears, select the TriBall tool again, then select the axis of the TriBall that is perpendicular to the seat bottom. Next, select the seat bottom on a point that's *outside* the TriBall, and use the Look At tool to view the bottom surface directly. Finally, use the TriBall hand and arrow to rotate the leg until the sweeping portion is radial. When you're done, select Cancel from the Edit Path dialog box.

Copying and positioning the other legs

When you're satisfied with the position of the first leg, create copies of it.

▶ ***To copy the other legs:***

1 **Choose the Select tool and then choose the Edit IntelliShapes tool if it isn't selected already.**

2 **Right-click on the table leg and then drag it along the underside of the seat toward the opposite edge.**

The precise placement of the leg isn't important at this point.

3 **Release the leg when you get close to the opposite edge.**

4 **From the pop-up menu, choose Copy Here.**

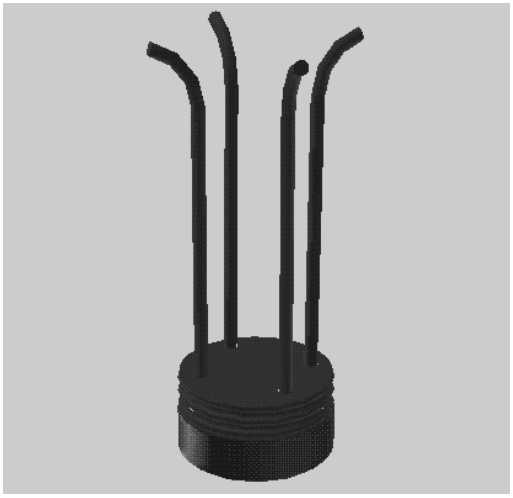
Now the bar stool has two legs. The second leg appears where you released the mouse.

5 **To position the second leg, repeat Steps 3 through 5 of the procedure in the previous section.**

6 Use the steps above to copy and position two more legs.

When you finish, the model should look like the following illustration. The next two sections show you how to finish the model.

***Note**: If you'd like examples of copying and positioning according to specific distances, see "Using the TriBall for precise copying" and "Using SmartDimensions for precise positioning" in the final model-building example of this chapter.*



Bar stool in progress

Creating the footrest ring

The last part of the bar stool model is the ring near the bottom, where patrons rest their feet. Unlike the first two shapes, you can drag this one out of the Shapes catalog.

▶ ***To add the footrest ring to the model:***

1 **Select the Edit IntelliShapes tool if it isn't selected already.**

2 **Click the Shapes tab at the right of the window to see the items in its catalog.**

3 **Drag the Torus shape from the catalog and drop it on the model.**

Release the mouse when one of the bar stool legs appears in green highlight.

4 **Change the dimensions of the torus shape to make it fit the model.**

Use the shape's Sizebox properties. Right-click the torus, select IntelliShape Properties from the pop-up menu, and click the Sizebox tab.

In the Sizebox properties sheet, change the height, width, and length of the torus to 44 cm each. Click OK when you finish.

In the next series of steps, you change the diameter of the torus ring.

▶ ***To change the diameter of the torus ring:***

1 Right-click the torus and select Edit Cross-Section from the pop-up menu.

TriSpectives displays a grid and the Edit Cross-Section dialog box.

2 Adjust the line separations in the grid to 4 cm.

Right-click the scene background, select Grid Settings from the pop-up menu, enter 4 as the grid line separations, and then click OK.

3 Click a square handle on the torus cross-section and drag until TriSpectives reports that the radius is 2 cm.

4 Choose Finish Shape on the Edit Cross-Section dialog box.

Next, position the ring on the stool. Again, use the TriBall.

▶ To position the footrest ring:

1 **Use the Orbit Camera and Zoom Camera tools to look down the legs of the bar stool and see the seat bottom.**

Tip: To position the ring, it might help to see the shape's underlying geometry. Right-click the scene background, choose Scene Properties from the pop-up menu, and then click the Rendering tab in the resulting dialog box. In the next dialog, select Wireframe style and click OK. If you prefer the

default setting, repeat the steps and select Realistic Shading.

2 **Choose the Select tool, select the footrest ring, and then select the TriBall tool.**

The TriBall tool appears over the ring.

3 **Rotate the ring until it's perpendicular to the bar stool legs.**

To rotate the ring, click the 1D handle at the side of the ring. When the horizontal axis of rotation appears in yellow, move your pointer inside the TriBall. When the pointer changes to a hand and arrow, rotate the ring. Because the ring started in a vertical position, you should rotate it 90 degrees to make it horizontal.

4 **Drag the ring until it encircles the four legs and intersects them where the arcs of the legs begin.**

Place your mouse pointer in the 2D plane parallel to the plane of the torus. When the pointer becomes four straight arrows, you can drag within the 2D plane to reposition the ring.

Finally, move to a side view of the torus. Push or pull on the handle at the end of the torus' vertical axis to adjust its height along the legs.

You might need to use the Orbit Camera tool and view the model from several angles before you can drag the leg into the perfect position. The Orbit Camera tool and the TriBall work in tandem, so you don't have to turn one off to use the other.

Adding colors and textures

Now that the model is done, all you have to do is apply colors and textures. The seat looks nice with a shiny red finish. Give the legs and ring a steel finish.

▶ ***To add colors and textures to the model:***

1 **Switch to Model mode.**

If the Edit IntelliShapes tool or Edit Surfaces and Edges tool is selected, click it off.

2 **Click the Metals tab at the right of the TriSpectives window to see the items in its catalog.**

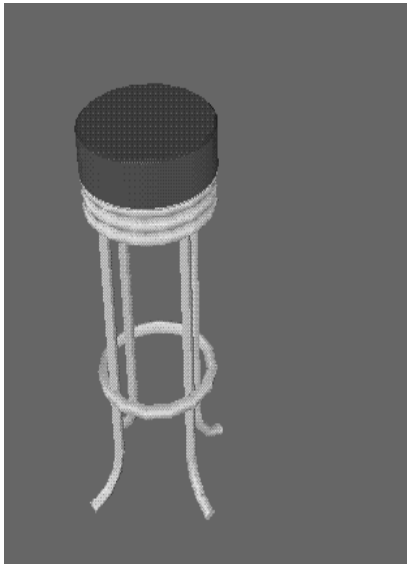
2 **Scroll through the catalog items, locate Steel, and drag it from the catalog onto the model.**

4 **Switch to Surfaces mode by selecting the Edit Surfaces and Edges tool.**

5 **Scroll through the Surfaces catalog items, locate Shiny Red, and drag it from the catalog onto a surface of the seat.**

Repeat this step a few more times to apply the Shiny Red finish to all surfaces of the seat.

When you finish, the bar stool looks like the following illustration:



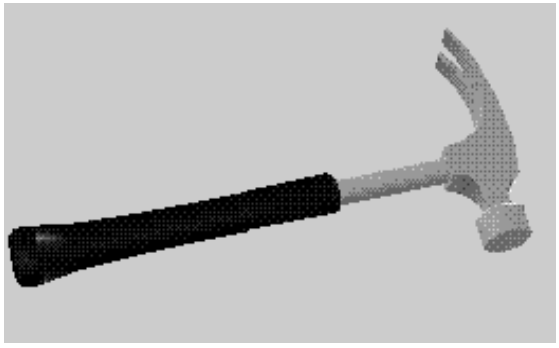
Finished bar stool

Building a hammer

The hammer model is made up of four shapes, three of which you create using the 3D custom shape tools. In the following exercises, you'll build the hammer by creating and combining these shapes:

- The shaft, which you create using the Spin Shape tool.
- The hammerhead, a combination of positive and negative cross-sections you make with the Extrude Shape tool.
- The flat striking surface, a cylinder from the Shapes catalog.

When you finish, your model will look like the hammer in the Showcase catalog and the following illustration:



Finished hammer model from Showcase catalog

Preparation

Before you start building the hammer, take these steps:

1 Create a new scene in your WorkBook.

- If TriSpectives is open but you don't have an open WorkBook, choose New from the File

menu. Select 3D Scene in the WorkBook Wizard and then select Finish.

- If you have an open WorkBook, choose Scene from the Insert menu. In the resulting Insert Scene dialog box, choose As New Scene in WorkBook, and then choose OK.

1 If they're not showing already, open the 2D Drawing toolbar and 3D Shapes toolbar.

Select Toolbars from the View menu. In the resulting dialog box, check the boxes next to 2D Drawing and 3D Shapes, and then choose OK.

Custom shape tools

2D Drawing toolbar

3 Show measurements for your 2D cross-sections, and make the measurements in centimeters.

Select Options from the Tools menu and then:

- Click the 2D Drawing tab. In the ensuing properties sheet, click the check box next to Show Snap and Measurement Feedback, and change the Snap To distance increment to 0.25. Click to remove the checks from the Grid, Geometry, and Angles boxes under Snap To.
- Click the Units tab. In the next properties sheet, select Centimeters in the Length field and then click OK.

Beginning the hammer shaft

To begin the hammer, create the shaft. Use the 3D Spin Shape tool.

▶ ***To begin making the shaft of the hammer:***

1 **Select the Edit IntelliShapes tool.**

3 **Select the Spin Shape tool on the 3D Shapes toolbar.**

2

3 Click in the scene and then select Finish on the Spin Shape Wizard.

TriSpectives displays a grid and the Edit Cross-Section dialog box. You'll use the grid to draw the 2D cross-section of the shaft. Make sure the vertical axis of the grid is on the left.

***Tip**: Drag the dialog box out of the way so it doesn't interfere with your work on the grid. You should also select the Look At tool and then click the grid to view it straight on.*

4 Change the grid settings to create a finer network of grid marks.

Right-click the scene background, select Grid Settings from the pop-up menu, enter 1.0 as the vertical and horizontal grid line separations, and then click OK.

5 **Use the Zoom Camera tool to close in on the grid until you feel you can draw on it comfortably.**

You're ready to draw the 2D cross-section that TriSpectives will spin into a hammer shaft.

Creating the shaft cross-section

The cross-section for the hammer shaft consists of a series of lines and one Bezier curve. To make sure the lines and curve form a continuous cross-section, begin each 2D shape by clicking in the same spot you clicked to end the previous 2D shape.

When you're over this spot, a green dot appears. If you don't use the green dot, your lines will be discontinuous and TriSpectives will be unable to extend the cross-section into 3D.

As you use the next few steps, refer to the following illustration of the completed cross-section for assistance.

▶ ***To draw the 2D cross-section:***

1 **Select the Line tool and create your first line.**

Move your mouse pointer to the vertical axis near the bottom of the grid. When you're over the vertical axis, click and drag a straight line to the right.

When TriSpectives reports that you've moved 1 cm from the vertical axis, click to end the line. Because you set the grid line separations at 1 cm, your line should span exactly one square.

2 **Select the Bezier tool and create a line.**

Move your mouse pointer to the spot where you ended the first line. When the green dot appears, click and drag the Bezier line up and to the right. Release the mouse when the line is 1.75 cm above and 0.5 cm right of the previous line's right endpoint.

In the next step you'll drag the handles of the line to create the Bezier curve.

3 Select the Bezier tool again to turn it off and then create the curve.

When you turn off the Bezier tool, two square handles appear on the surface of the line. Drag the bottom square handle down and to the right to create the Bezier curve.

Release the mouse when the square handle is about 0.75 cm right of the bottom endpoint of the Bezier line and about 1.5 cm below the top endpoint of the Bezier line. When you're done, the Bezier curve should look like the one in the following illustration.

4 **Select the Line tool and create a series of lines to complete the cross-section of the shaft.**

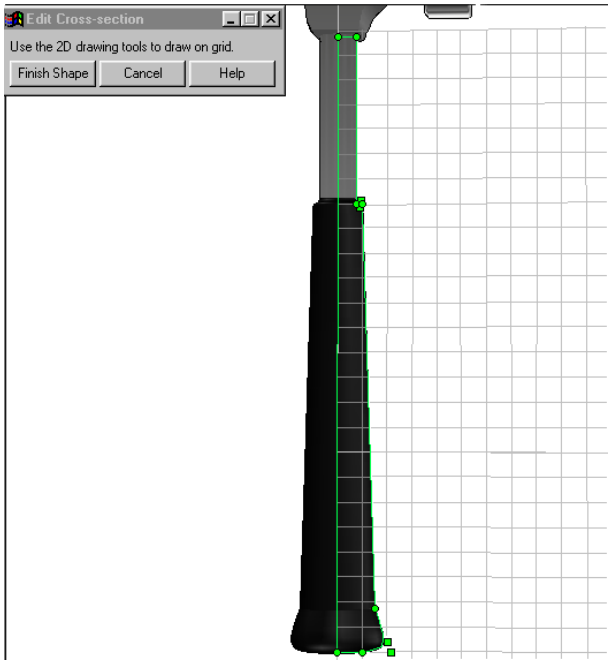
Move your mouse pointer to the top endpoint of the Bezier line. When the green dot appears, click and drag straight up. The line should be parallel to the vertical axis. When TriSpectives says the line is 16 cm above the previous point and 0.5 cm closer to the axis, click to end the line.

Draw three more lines to complete the cross-section. Use the green dot to ensure connected lines.

- From the top endpoint of the previous line, draw a line toward the vertical axis that's 0.25 cm long. The line should be perpendicular to the vertical axis.
- From the left endpoint of the previous line, draw a line parallel to the vertical axis that's about 7 cm long.
- From the top endpoint of the previous line, draw a 0.75-cm line to the vertical axis. When you're over the axis, click to end the line.

5 **Select the Fillet tool and round the two corners in the juncture of the first and second lines you created in Step 4.**

Use the Window Zoom tool to focus on this small area. With the Fillet tool on, click the junctures, then drag down and to the left from the first corner. From the second corner, drag up and to the right. When you're done, use the Fit Scene tool to restore a complete view. The cross-section should look like this:



Finished cross-section for hammer shaft

6 To turn the cross-section into the shaft of a hammer, select Finish Shape in the Edit Cross-Section dialog box.

The shaft appears. Next, you create the hammerhead.

Beginning the hammerhead

In this procedure you'll use the Extrude Shape tool to begin making the cross-section of a hammerhead. After you create this shape, you'll create a hole shape with the Extrude Shape tool to sculpt the hammerhead.

▶ ***To begin making the hammerhead:***

1 **Use the Orbit Camera and Look At tools to look straight at the top of the hammer shaft.**

2

3 **Choose the Select tool and then choose the Edit IntelliShapes tool if it isn't selected already.**

4

5 **Select the Extrude Shape tool on the 3D Shapes toolbar.**

4 Move your pointer over the top of the hammer shaft and release the mouse when a green dot appears in the center.

This ensures that the hammerhead is positioned in the center of the shaft.

5 On the Extrude Shape Wizard, make the following selections:

- On page 1, choose to extrude the new shape Along the end of the shaft. Select Next to move to page 2.
- On page 2, choose to Add material to the shaft and then select Finish on the wizard.

TriSpectives displays a grid and the Edit Cross-Section dialog. As usual, drag the dialog out of the way so it doesn't interfere with your work on the grid. Use the Look At tool to get a direct view of the grid. Use the Window Zoom tool to close in on the grid.

Normally, the hammer handle will be pointing up, and the origin of the grid will be centered on the end of the

shaft. In this case, you will be working on the screen entirely below the top of the shaft.

Leave the grid line separations at 1 cm, the setting from the previous example. You’re ready to begin drawing the hammerhead.

Creating the hammerhead cross-section

The cross-section for the hammerhead consists of a variety of lines, arcs, and Bezier curves. To make sure these shapes form a continuous cross-section, begin each by clicking in the same spot you clicked to end the previous 2D shape.

When you're over this spot, a green dot appears. If you don't use the green dot, your lines will be discontinuous and TriSpectives will be unable to extend the cross-section into 3D.

As you use the next few steps, refer to the following illustration of the completed cross-section for assistance. This is much like a sketch that a tool designer would use in creating a hammer.

▶ To draw the hammerhead cross-section:

1 Select the Line tool and draw a line of 2 cm along the end of shaft and centered on the shaft.

Because the grid spacing is 1 cm, this line should span exactly two grid cells.

2 **Select the Arc tool and draw an arc from one end of the previous line, spanning 2.25 cm in the direction of the shaft and 0.75 cm away from the axis of the shaft.**

Don't worry about the initial shape of the arc. Select the Arc tool again to turn it off, and then refine the arc's shape.

To reshape the arc, drag it by its square handles. When you're done, the arc should be concave outward, as shown later in the illustration of the finished cross-section.

3 **Select the Bezier tool and create a Bezier curve.**

The curve should extend from the free end of the previous arc to a point 6.25 cm farther away from the axis of the shaft. In the other direction, there should be no offset with respect to the starting point.

Select the Bezier tool again to turn it off. Next, manipulate the square handles near each end to match the curve shown later in the illustration of the finished cross-section.

4 **Select the Line tool and draw a small line.**

Because you're creating a small line, use the Window Zoom tool to zoom in on the endpoint of the previous curve. From this endpoint, draw a line that extends 0.25 cm farther along and 0.25 cm farther from the axis of the shaft. Select the Fit Scene tool to return to a longer view when you're done.

5 **Select the Bezier tool again and create another curve.**

This curve extends from the end of the previous line 10 cm back toward and across the shaft axis, and 1.5 cm farther along the axial direction.

When you release the mouse to finish defining the curve, select the Bezier tool again to turn it off. Two square handles appear on the surface of the line, and round handles appear on the ends. Use the square handles to create a flat Bezier curve that is convex outward. If you need help, see the following illustration.

6 **Select the Bezier tool once more for the next curve, which extends from the end of the previous curve.**

This curve extends 1.75 cm laterally from the shaft and 1.0 cm axially back toward the shaft.

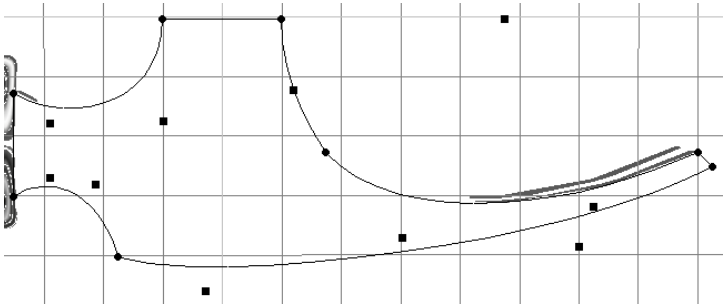
When you finish defining the curve, select the Bezier tool again to turn it off. Move the square handles to mimic the concave outward slope shown in the following illustration.

7 **Select the Line tool, then make a line that extends 1.75 cm from the end of the previous curve and is parallel to the shaft axis.**

8 9 **To close the curve, select the Bezier tool again and create one last curve.**

This curve extends 1.25 cm axially and 1.75 cm laterally.

When you’re done, the cross-section should look like the following illustration.



Finished cross-section for hammerhead

9 To turn the cross-section into a hammerhead, select Finish Shape in the Edit Cross-Section dialog box.

The hammerhead appears.

10 Make the length of the hammerhead 4.5 cm.

Right-click on the hammerhead in IntelliShape mode, select IntelliShape Properties from the pop-up menu, and click the Sizebox tab in the resulting dialog box. In the Sizebox properties sheet, enter 4.5 in the Length field and select OK.

11 Center the hammerhead on the shaft using the TriBall tool.

By using the Orbit Camera tool to examine the hammerhead, you’ll notice that it now extends 4.5 cm from the center-line axis of the shaft. To center the hammerhead, you need to move it 2.25 cm.

First, select the hammerhead in IntelliShape mode and then select the TriBall tool. If necessary, use the Orbit, Pan, Zoom, and other Camera tools to improve your view. These tools work while the TriBall is active.

Next, click the handle of the axis along which you’ll move the hammerhead. When the axis turns yellow,

drag the hammerhead by the TriBall handle until a distance measurement appears. Right-click the measurement, select Edit Value from the pop-up menu, type 2.25, and choose OK.

You have centered the hammerhead.

Next, you'll create a negative hole shape that carves out a section of the hammerhead. When positioned properly, the hole shape combines with the positive shape to finish the hammerhead.

Beginning the hole shape of the hammerhead

In this procedure you'll again use the Extrude Shape tool. You can think of your hole-shape cross-section as a "cookie cutter" which, when extruded from the top of the hammerhead, will cut away material to produce the desired shape.

▶ ***To begin making the hammerhead hole shape:***

1 **Use the Orbit Camera and Look At tools to look straight at the planar pounding surface of the hammerhead.**

2

3 **Choose the Select tool and then choose the Edit IntelliShapes tool if it isn't selected already.**

4

5 **Select the Extrude Shape tool on the 3D Shapes toolbar.**

4 Move your pointer over the planar pounding surface of the hammerhead and release the mouse when a green dot appears in the center.

This ensures that the hammerhead hole shape is positioned in the center of the positive hammerhead shape.

We could not have done this easily on the top, curved surface of the hammerhead. Furthermore,

although we want to position the hole extrusion grid above the hammerhead, by starting with a known plane we can position it precisely later with the TriBall tool.

5 On the Extrude Shape Wizard, make the following selections:

- On page 1, choose to extrude the hole shape Away from the surface. Select Next to move to page 2.
- On page 2, choose to Remove material from the surface and then select Finish on the wizard.

TriSpectives displays a grid and the Edit Cross-Section dialog. Drag the dialog out of the way so it doesn't interfere with your work.

6 Select the TriBall tool.

The tool is active for the Extrude Cross-Section grid. We want to rotate the grid 90 degrees and then move it parallel to the shaft axis until it is just above the hammerhead.

First, click the handle of the axis along which you'll rotate the grid. When the axis turns yellow, move the mouse pointer inside the TriBall. When the pointer changes to a hand and arrow, drag the TriBall to rotate around the axis. When an angle measurement appears, right-click the measurement, select Edit Value from the pop-up menu, type 90, and choose OK.

Next, with the TriBall still on, choose the Look At tool and point to a lateral surface of the hammerhead. This gives you a good side view of the extrude grid position.

Finally, click the handle of the axis that's parallel to the shaft axis, and then drag the grid until it is just above the hammerhead. The grid remains perpendicular to the plane of the pounding surface and to the axis of the shaft.

7 Use the Look At tool to click on the grid and

view it straight on.

Use the Window Zoom tool and other Camera tools to improve the view, if necessary.

The hammer's pounding surface should be at the top of the scene and the claw should be at the bottom.

8 **Extend the grid over the full top surface of the hammerhead.**

Select the Project Edges to Drawing Grid tool and then click the upper surface of the hammerhead. The grid extends to cover the entire upper surface of the hammerhead. To turn off the Project Edges to Drawing Grid tool, click it again.

The outline of the top surface of the hammer is projected onto the grid as construction lines. You want to work slightly outside these lines to ensure that all material you want to remove is fully accounted for when you create the hole shape.

Leave the grid line separations at 1 cm, the setting from the previous example. You're ready to draw the hammerhead hole cross-section.

Creating the hammerhead hole cross-section

Because you've already drawn two cross-sections to help create the hammer model, we'll be as brief as possible in taking you through the steps of the following procedure. As you move through the steps, keep these points in mind:

- To make sure you create a continuous cross-section, begin each 2D shape by clicking in the same spot you clicked to end the previous 2D shape. When you're over this spot, a green dot appears.
- Refer to the following illustration of the completed cross-section for assistance.

  Also be assured that even though you're drawing a hole shape, the lines you draw for its cross-section are solid. They won't disappear.

  The following steps assume the extrude grid is oriented so the hammer's pounding surface is at the top of the screen and the claw is at the bottom.

▶ ***To draw the hammerhead hole cross-section:***

1 **Select the Line tool and place your pointer 0.25 cm below the bottom left corner of the hammerhead top.**

2 **Draw a line that extends 10.25 cm up and 0.75 cm to the right.**

3 **Select the Arc tool and draw an arc that starts from the top endpoint of the previous line and extends up 2 cm, beyond the surface of the hammerhead, and to the right by 0.5 cm.**

Don’t worry about the initial position of the arc. To finish the arc, drag it by its square handles. If you need help, see the illustration of the finished cross-section later in this procedure.

4 **Select the Line tool and draw a series of five lines.**

The first three lines are connected to each other. To draw the fourth and fifth lines, you’ll return to the first line of this cross-section and start the lines from there.

- Start the first line in this series from the top endpoint of the previous arc. Draw a horizontal line 2.0 cm long away from the hammerhead. This line is off the surface of the hammerhead.
- From the left endpoint of the previous line, draw a vertical line 13.25 cm down toward the claw end. This line is left of the surface of the hammerhead, and ends below the plane of the hammerhead.
- From the bottom endpoint of the previous line, draw a horizontal line 2.75 cm to the right. This line is just below the plane of the hammerhead, and falls just short of the axis of the grid.
- From the *starting point of the first line you drew for this cross-section*, draw a horizontal line 1.25 cm to the right, along the bottom line of the hammerhead.
- From the right endpoint of the previous line, draw a diagonal line 6 cm up and 0.75 cm to the right. This point too falls just short of the grid axis.

5 Draw a “mirror” line, which you’ll use to add a symmetrical duplicate on the right side of the cross-section you’ve created.

With the Line tool still active, draw a vertical line straight up along the grid axis, starting from well below the edge of the hammerhead. End the line above the top edge of the hammerhead plane, so that the mirror line bisects it.

6 **Click the Line tool again to turn it off, and then choose the Select tool.**

7 Right-click on the mirror line and select Use Outline for Construction Only from the pop-up menu.

This step eliminates the mirror line from being extended into 3D. You're only using it to construct the cross-section.

8 Select the first shape in the cross-section, hold down the Shift key, and then click all the other shapes in the cross-section, *including* the mirror line.

9 **Select the Mirror Curve tool and then click the mirror line.**

TriSpectives duplicates the cross-section symmetrically on the other side of the mirror line's axis.

10 Enclose the cross-section.

First, clean up your view of the cross-section by deleting the mirror line and the remaining construction lines, which are shown in dark blue.

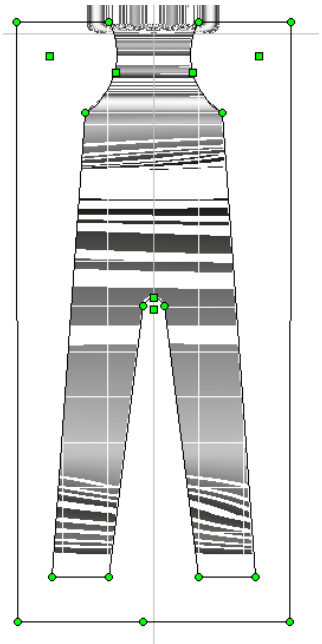
You still have two gaps to close. One is at the crotch of the claw and the other is outside the outer edges of the claw.

Address the latter gap first by dragging one of the red dots until it matches the other. The dots coalesce into a single green dot to show your success.

Next, use the Zoom Window tool to zoom in on the crotch of the claw. Select the Arc tool and create an arc to connect the two red points. Select the Arc tool

again to turn it off, and then drag the arc's square handles until you have a smooth curve.

When you're done, the cross-section should look like the following illustration.



Finished cross-section for hole shape of hammerhead

11 To turn the cross-section into a 3D hole shape for the hammerhead, select Finish Shape in the Edit Cross-Section dialog box.

Creating the striking surface of the hammer

The last part of the hammer model is the striking surface. Unlike the first three shapes, you can drag this one out of the Shapes catalog and drop it on the model.

▶ ***To add the striking surface to the hammer model:***

1 **Use the Orbit Camera and Look At tools to look straight at the front of the hammerhead.**

2 3 **Choose the Select tool and then choose the Edit IntelliShapes tool if it isn't selected already.**

3 Click the Shapes tab at the right of the TriSpectives window to see the items in its catalog.

If necessary, scroll through the catalog items to find the Cylinder shape.

4 Drag the Cylinder shape from the catalog and drop it on the hammerhead when a green dot appears.

This ensures that the striking surface is positioned in the center of the hammerhead. If a green dot doesn't appear, you can position the striking surface later.

5 Change the dimensions of the cylinder shape to make it fit the model.

Use the shape's Sizebox properties. Right-click the cylinder, select IntelliShape Properties from the pop-up menu, and click the Sizebox tab. In the Sizebox properties sheet, enter the following values.

Height: 2 cm
Width: 3 cm
Length: 3 cm

Click OK when you finish.

If a green dot did not appear in Step 4 above, drag the striking surface along the surface of the hammerhead until it looks centered.

The hammer model now contains all its shapes. In the next two sections, you'll add some finishing touches to make the hammer look more realistic.

Beveling the striking surface

The striking surface needs rounded edges to make it look more like a hammer. To round the edges, apply a bevel to the starting and ending sections of the surface.

▶ To bevel the striking surface:

1 **Select the Edit IntelliShapes tool if it isn't already selected.**

2 **Right-click the striking surface and choose IntelliShape Properties from the pop-up menu.**

3 **Select the Bevel tab on the properties sheet.**

The Bevel properties appear.

4 **Choose the End Section Edges option.**

This selection specifies which end of the shape you want to bevel.

5 **Choose the Blend option and then type 0.2 as the blend radius for the ending section edge.**

6 **Choose the Start Section Edges option, choose Blend again, and type 0.2 as the blend radius for the starting section edge.**

7 **Choose OK to close the properties sheet and see the beveled striking surface in the scene.**

Adding colors and textures

To complete the hammer model, give the handle a shiny black finish and apply a steel finish to rest of the surfaces.

▶ ***To add colors and textures to the hammer:***

1 **Switch to Model mode.**

If the Edit IntelliShapes tool or Edit Surfaces and

Edges tool is selected, click it off.

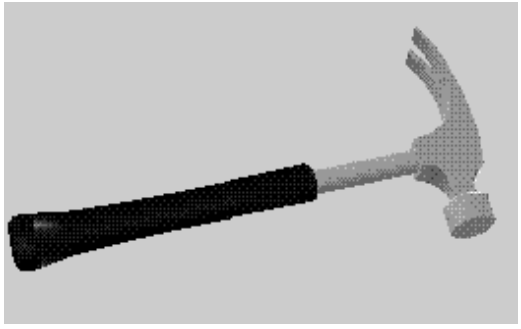
3 **Click the Metals tab at the right of the TriSpectives window to see the items in its catalog.**

2 **Scroll through the catalog items, locate Steel, and drag it from the catalog onto the hammer.**

4 **Switch to Surfaces mode by selecting the Edit Surfaces and Edges tool.**

5 **Scroll through the Surfaces catalog items, locate Shiny Black, and drag it from the catalog onto a surface of the hammer's handle.**

Repeat this step a few more times to apply the Shiny Black finish to all surfaces of the handle. When you finish, the hammer looks like the following illustration.



Finished hammer model