Learning Objectives

After completing this chapter, you will be able to:
- **Adjust the pivot point of an object**
- **Use the Lathe modifier to modify objects**
- **Modify shapes**
- **Use editable spline objects**

INTRODUCTION

In this chapter, you will learn to modify shapes such as splines and extended splines at advanced level. Also, you will learn about the pivot point and the **Lathe** modifier.

PIVOT POINT

The pivot point of an object represents the local center and its local coordinate system. When you transform an object, the pivot point acts like a center. To adjust the pivot point of an object, select the object in the viewport and then choose the **Hierarchy** tab in the **Command Panel**. By default, the **Pivot** tab is chosen in the **Hierarchy** tab, as shown in Figure 6-1. You can set the position of the pivot point of an object using the rollouts displayed in the **Pivot** tab. Some of the rollouts in the **Pivot** tab are discussed next.

Figure 6-1 The **Pivot** tab chosen in the **Hierarchy** tab

Adjust Pivot Rollout

The options in this rollout are used to adjust the position and orientation of an object's pivot point. The areas in this rollout are discussed next.

Move/Rotate/Scale Area

There are three buttons in this area, **Affect Pivot Only**, **Affect Object Only**, and **Affect Hierarchy Only**. These buttons are used to specify the part of an object that will be affected while performing

the functions such as rotation, movement, and so on.

The **Affect Pivot Only** button is used to affect the pivot point of the selected object. To affect the pivot point, choose the **Affect Pivot Only** button; the pivot point of the selected object will be displayed in the viewport, refer to Figure 6-2. Now, you can adjust the position of the pivot point by moving or rotating it. Also, you can use the **Align** tool from the **Main Toolbar** to align the pivot point.
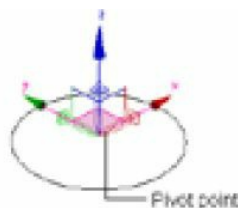

Figure 6-2 The pivot point of a circle

Note
Scaling has no effect on the pivot of an object.

The **Affect Object Only** button is used to affect only the selected object. It means that transforms are applied only to the selected object and do not affect the pivot point of the object. On choosing the **Affect Object Only** button, the pivot point of the object will be displayed in the viewport. You can adjust the position of the object according to the pivot point by moving, rotating, and aligning the object.

The **Affect Hierarchy Only** button is used to affect the hierarchy of the objects by rotating or scaling the position of the pivot point. But, the pivot point will not be affected. Select the object in the viewport, choose the **Affect Hierarchy Only** button, and then use the **Select and Scale** or the **Select and Rotate** tool to view the effects on the hierarchy of the objects. You will learn about creating the hierarchy in the later chapters.

Note
*When you choose the buttons in the **Move/Rotate/Scale** area of the **Adjust Pivot** rollout, it is recommended to exit the command after adjusting the position of the pivot point or the object. To exit the command, you need to choose the activated button again.*

Alignment Area

The options in this area depend on the selection of buttons in the **Move/Rotate/Scale** area.

If you choose the **Affect Pivot Only** button in the **Move/Rotate/Scale** area, the **Center to Object**, **Align to Object**, and **Align to World** buttons will be activated in the **Alignment** area. Choose the **Center to Object** button to align the pivot point to the center of the object. Choose the **Align to Object** button to transform the pivot to align with the object's transformation matrix axes. Choose the **Align to World** button to transform the pivot to align it with the world coordinate axes.

If you choose the **Affect Object Only** button in the **Move/Rotate/Scale** area, the **Center to Pivot**, **Align to Pivot**, and **Align to World** buttons will be activated in the **Alignment** area. Choose the **Center to Pivot** button to align the center of the object to its pivot point. Choose the **Align to Pivot** button to transform the object to align its transformation matrix axes with the pivot point. Choose the **Align to World** button to transform the object to align its transformation matrix axes with the world coordinate axes.

If you choose the **Affect Hierarchy Only** button in the **Move/Rotate/Scale** area, then the options in the **Alignment** area will be deactivated.

Pivot Area
The **Reset Pivot** button in this area is used to reset the position of the pivot point of the object.

Working Pivot Rollout
You can use the working pivot to transform the objects without affecting their main pivot point at the object or the sub-object level. For example, you can rotate an object in a scene about an arbitrary point without affecting its own pivot point.

ⒾNote
A scene has only one working pivot along with the gizmo, which is independent of other objects in the scene, as shown in Figure 6-3.
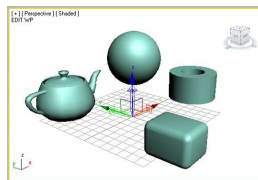

Figure 6-3 The working pivot along with the gizmo in the scene

You can modify the position of the working pivot. To do so, choose the **Edit Working Pivot** button; the working pivot will be displayed at the center of the scene, refer to Figure 6-3. Also, the *EDIT WP* text will be displayed below each viewport label. You can modify the position of the working pivot by moving it.

If you choose the **Use Working Pivot** button and select any of the objects from the scene, then a transform gizmo will be displayed at the location of the working pivot, refer to Figures 6-4 and 6-5. Also, the *USE WP* text will be displayed below each viewport label. Now, the objects or the sub-objects in the scene will be transformed according to the working pivot.
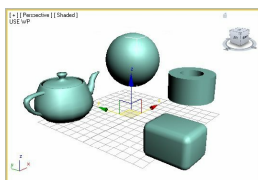

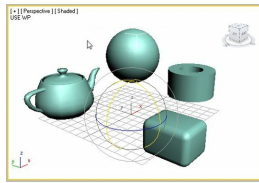
Figure 6-4 The move transform gizmo displayed

Figure 6-5 *The rotate transform gizmo displayed*

The **Align To View** button is activated when the **Edit Working Pivot** and **Use Working Pivot** buttons are chosen. The **Align To View** button is used to reorient the working pivot of the XY plane parallel to the active view plane and to orient the X and Y axes parallel to the edges of the viewport.

The **Reset** button in the **Working Pivot** rollout is used to move the working pivot to a location where the pivot of the selected object is placed. If there are more than one objects selected in the viewport, then the working pivot will move to the pivot position of the last selected object.

Place Pivot To Area

The options in this area are used to position the working pivot using the mouse. This enables to set the working pivot quickly on the viewport. To do so, choose the **View** button, move the cursor in the viewport, and click on any location; the working pivot will be placed accordingly. Next, right-click to exit the command. Alternatively, you can choose the **Surface** button and move the cursor in the viewport. Now, click on the surface of any of the objects in the scene to place the working pivot on the surface. You can also click on the active grid to place the working pivot on it.

The **View** button is used to position the working pivot in the screen space without changing its depth in the screen. The **Surface** button is used to position the working pivot on a surface. If there is no surface present in the scene, then the construction plane will be created in the viewport at the point you click on. By default, the **Align To View** check box is selected. As a result, the working pivot is aligned automatically to the surface or viewport.

LATHE MODIFIER

The **Lathe** modifier is a shape modifier and is used to create 3D objects by rotating shapes about their axes. The direction of the axis of revolution depends on the pivot point of the shape. To apply the **Lathe** modifier on a shape, create a shape in the Front viewport and select it, as shown in Figure 6-6. Choose the **Modify** tab in the **Command Panel** and then select **OBJECT-SPACE MODIFIERS > Lathe** from the **Modifier List** drop-down list; the 2D shape will be converted into a 3D object and it will be displayed in the viewports, refer to Figure 6-7. When you apply the **Lathe** modifier on a shape, it will be displayed in the modifier stack. The **Parameters** rollout will be displayed below the modifier stack. You will learn more about this modifier in Chapter 12.
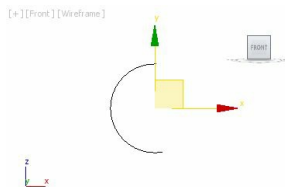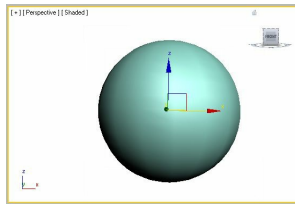

Figure 6-6 *An arc displayed in the Front viewport*

Figure 6-7 *The arc converted into a 3D object after applying the **Lathe** modifier*

MODIFYING THE SHAPES

To modify the shapes in 3ds Max, first create a shape using the tools from **Create > Shapes > Splines/Extended Splines > Object Type** rollout in the **Command Panel** as discussed earlier. Next, select the shape in the viewport and choose the **Modify** tab in the **Command Panel**; the Modify panel will be displayed with various rollouts. Now, you can modify the shapes using one of the following methods:

1. By entering new parameters in the rollouts displayed in the Modify panel. You have already learned about it in the previous chapters.

2. By applying a modifier from the **Modifier List** drop-down list. You will learn about applying modifiers in later Chapters.

3. By converting the shapes into editable splines, which is discussed next.

Converting the Shapes into Editable Splines

You can modify all the spline and extended spline shapes at advanced level by converting them into editable spline objects. The editable spline objects provide the sub-object levels of the shape. These sub-object levels help you to select the sub-objects of the shape in the viewport. You can convert a shape into an editable spline using one of the following methods:

• Create a shape and then select it in the viewport. Next, right-click on the shape; a quad menu will be displayed. Choose the **Convert To** option; a cascading menu will be displayed. Choose **Convert to Editable Spline**; the shape will be converted into editable spline.

• Create a shape and then select it in the viewport. Choose the **Modify** tab in the **Command Panel**. In the modifier stack, right-click on the name of the tool; a shortcut menu will be displayed. Choose the **Editable Spline** option; the shape will be converted into an editable spline.

• Create a shape and then choose the **Modify** tab in the **Command Panel**. Click on the **Modifier List** drop-down list in the **Command Panel** and select **Editable spline** from it;
the **Editable Spline** modifier will be applied to the shape in the modifier stack.

Sub-object Levels in Editable Spline

When you convert a spline object into editable spline, the name of the tool in the modifier stack will

be replaced by **Editable Spline**. This level is known as the object level. Click on the plus sign on the left of the **Editable Spline** to view the sub-object levels such as**Vertex**, **Segment**, and **Spline**, as shown in Figure 6-8. On converting a spline object into editable spline, various rollouts such as **Rendering**, **Interpolation**, **Selection**, **Soft Selection**, and **Geometry** will also be displayed in the Modify panel, refer to Figure 6-8. These sub-object levels and rollouts are discussed next.
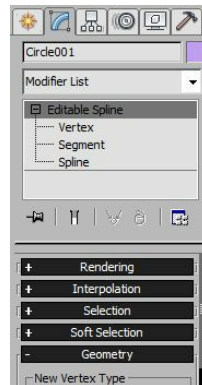
Figure 6-8 *The sub-object levels and rollouts displayed*

Sub-object Levels

The sub-object levels help you to modify the object by moving, rotating, and scaling the sub-objects. To do so, select one of the sub-object levels in the modifier stack; it will be activated and turn yellow. Also, it will prompt you to select the corresponding sub-objects in the viewport. You can select a sub-object in the viewport by clicking on it. If you want to add more sub-objects, then hold the CTRL key and click on the sub-objects that you want to add. You can also drag a selection box around the sub-objects to select them simultaneously. These sub-objects are discussed next.

Vertex

The vertex is a point on the spline. To modify an object using vertices, select the **Vertex** sub-object level; the white and yellow colored vertices of the spline will be displayed in the viewports, as shown in Figure 6-9. The yellow colored vertex is the first vertex or the starting point of the spline, refer to Figure 6-9.

There are various types of vertices such as bezier, corner, smooth, and bezier corner vertices, which depend on the type of spline. You can convert a vertex into a bezier, corner, smooth, or bezier corner vertex. To do so, select a vertex in the viewport and right-click on it; a quad menu will be displayed, as shown in Figure 6-10. Choose the type of vertex from the quad menu, refer to Figure 6-10; the vertex will change based on the option chosen from the quad menu.
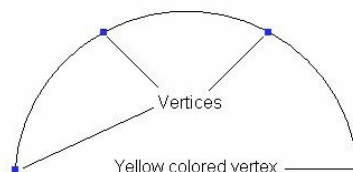
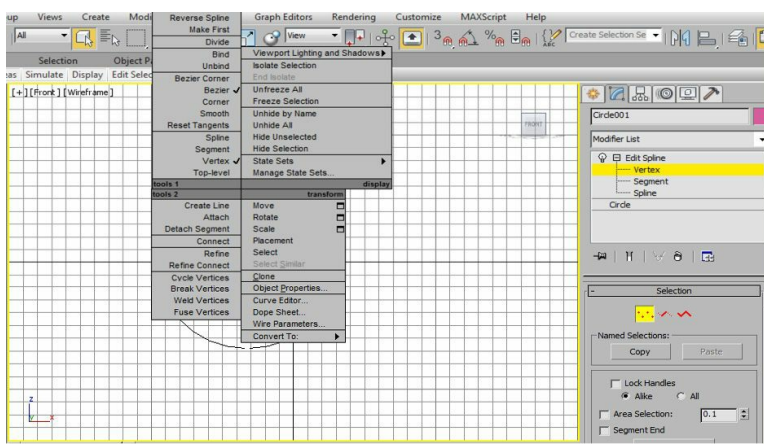*Figure 6-9* *The vertices of an arc spline displayed after selecting the **Vertex** sub-object level*

Figure 6-10 *Various types of vertices in a quad menu*

The bezier vertex has bezier handles to adjust the shape of the spline on both sides of the vertex. The smooth vertex is used to smoothen the curve of the spline. The corner vertex is used to make the corners of the spline. The bezier corner vertex also has bezier handles and is used to adjust the shape of the spline independently on both the sides, refer to Figure 6-11.

Segment

The segment is a line or a curve between two vertices. To modify an object through segments, you need to select the **Segment** sub-object level. On doing so, you will be prompted to select the segments of the object, refer to Figures 6-12 and 6-13.
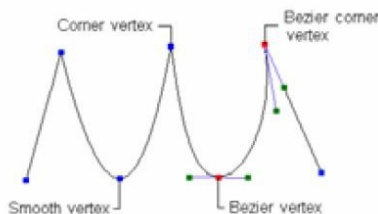
Figure 6-11 *Various types of vertices in a line spline*
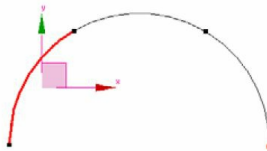
Figure 6-12 *The curved segment selected in an arc spline*
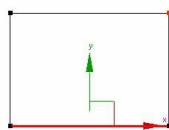
Figure 6-13 *The line segment selected in a rectangular spline*

Spline

A spline consists of all the adjacent segments of an object. To modify an object using the spline, you need to select the **Spline** sub-object level. On doing so, you will be prompted to select all the adjacent segments of the object, as shown in Figure 6-14.
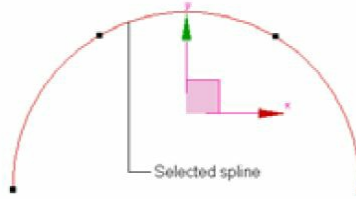

Figure 6-14 The spline selected in an arc

Rollouts

When you convert a spline object into an editable spline object, various rollouts will be displayed below the modifier stack in the Modify panel. You can modify the spline objects at sub-object levels using these rollouts. These rollouts are discussed next.

Note

*1. By default, the **Line** spline has all the sub-object levels and rollouts. So, you do not need to convert it into editable spline.*

*2. The options in the **Rendering** and **Interpolation** rollouts are same as described in Chapter 5.*

*3. The **Surface Properties** rollout will not be displayed at the **Vertex** sub-object level.*

Selection Rollout

At the top of the **Selection** rollout, there are three buttons, **Vertex**, **Segment**, and **Spline**, refer to Figure 6-15. These buttons are used to select the sub-objects of a spline and have been discussed in the previous section. Choose one of the buttons to make it active. It is same as selecting the sub-object level in the modifier stack. The check boxes in the **Display** area are used to display the vertex numbers in the viewport. When you select the **Show Vertex Numbers** check box, the vertex numbers will be displayed in the viewport, as shown in Figure 6-16. Select the **Selected Only** check box to display the vertex number only for the selected vertex.
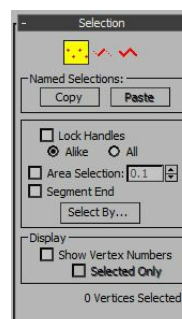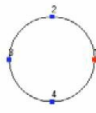

*Figure 6-15 The **Selection** rollout*

Figure 6-16 *The vertex numbers displayed on selecting the* ***Show Vertex Numbers*** *check box*

Soft Selection Rollout

The options in this rollout allow you to soft-select the objects. You can select the **Use Soft Selection** check box to activate the options in this rollout. When you select the sub-objects of an object in the viewport, it shows the falloff in different color combinations. The influence of the colored zone is determined by the value in the **Falloff** spinner. The shape of the falloff is controlled by the value in the **Pinch** and **Bubble** spinners.

Geometry Rollout

The options in this rollout are used to edit the spline at the object and sub-object levels, refer to Figure 6-17. These options are discussed next.

Create Line

The **Create Line** button is used to add a line spline to the selected spline. To do so, select the editable spline object in the viewport and choose the **Modify** tab; all the rollouts will be displayed in the Modify panel. Now, choose the **Create Line** button in the **Geometry** rollout; the button will be activated. Move the cursor in the viewport; its shape will change, as shown in Figure 6-18. Create a new line; it will automatically be attached to the selected spline. Next, right-click in the viewport or choose the **Create Line** button again to exit the command. The **Attach** button is used to attach another spline to the selected spline. When you choose the **Attach Mult.** button, the **Attach Multiple** dialog box will be displayed. It contains the list of all other splines in the scene. Select the shapes in the dialog box that you want to attach and then choose the **Attach** button to attach the shapes.

The **Reorient** check box, next to the **Attach** and **Attach Mult.** buttons, is used to align the local coordinate system of the attached spline with the local coordinate system of the selected spline.
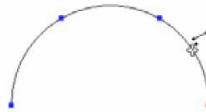
Insert

The **Insert** button is used to insert additional vertices in the splines to create new segments. To do so, select the editable spline object in the viewport and choose the **Modify** tab; all rollouts will be displayed in the Modify panel. Now, choose the **Insert** button in the **Geometry** rollout; it will get activated. Next, move the cursor over the spline; the shape of the cursor will change, as shown in Figure 6-19. Then, click to create a new vertex and move the cursor to place it. Again, move the cursor and click in the viewport to place the new vertices on the spline and right-click to exit the command.
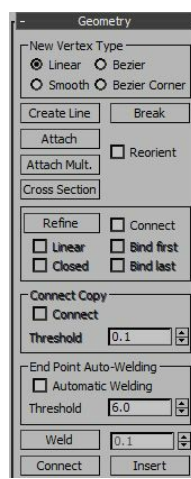
*Figure 6-17 Partial view of the **Geometry** rollout*
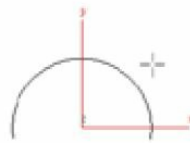
*Figure 6-18 The cursor displayed in the viewport on choosing the **Create Line** button*

*Figure 6-19 The cursor displayed after choosing the **Insert** button*

Break

The **Break** button is available for the **Vertex** and **Segment** sub-object levels. It is used to break a spline at the selected point. If you select the **Vertex** sub-object level, then select one or more vertices in the viewport to break the spline. Next, choose the **Break** button in the **Geometry** rollout; the spline will split at the selected point. Similarly, if you select the **Segment** sub-object level, then choose the **Break** button and click on a point on the selected spline to break it. To view the split splines, select the **Spline** sub-object level in the modifier stack.

Refine and Connect

The **Refine** button and the **Connect** check box are available for the **Vertex** and the **Segment** sub-object levels. The **Refine** button is used to add new vertices to the selected spline. To add new vertices, choose the **Refine** button and move the cursor over the selected spline; the cursor for refining the spline will be displayed. Then, click on a point to add a new vertex. You can repeatedly click on the spline to create more than one vertices. Next, right-click or choose the **Refine** button again to exit the command.

The **Connect** check box on the right of the **Refine** button is used to connect the new vertices by a segment. To do so, select the **Connect** check box, choose the **Refine** button, and then move the cursor over the selected spline; the cursor for refining will be displayed. Now, click on a point to add a new vertex and then click again to create another vertex. Next, right-click to exit the

command; a segment will be created to join the two new vertices, as shown in Figure 6-20.
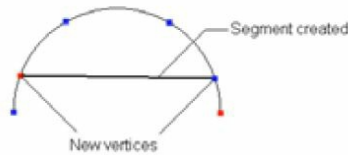

*Figure 6-20 The new vertices and the segment created using the **Refine** button and the **Connect** check box*

Note

*If you insert a vertex using the **Refine** button, then the curve shape of the selected spline will not change. But, if you insert the vertex using the **Insert** button, then the curve shape will change.*

Weld

The **Weld** button is available only for the **Vertex** sub-object level. It is used to join the selected vertices into a single vertex. To do so, select the editable spline object in the viewport and then select the **Vertex** sub-object level; the **Weld** button will be available in the **Geometry** rollout. Next, select the vertices that you want to join together in the viewport and choose the **Weld** button; the vertices will be joined together to create a vertex. The spinner on the right side of the **Weld** button is used to specify the distance between the vertices that can be welded. If the value in the spinner is less than the distance between the vertices, then the vertices will not be welded.

Connect

The **Connect** button is available only for the **Vertex** sub-object level. It is used to connect two end vertices of a spline by creating a segment in between the vertices, refer to Figure 6-21. To do so, select the editable spline object in the viewport. Next, select the **Vertex** sub-object level in the modifier stack, and then choose the **Connect** button in the **Geometry** rollout. Next, move the cursor over one of the end vertices of the spline; the shape of the cursor will change, refer to Figure 6-22. Now, press and hold the left mouse button and drag it to move the cursor over another end vertex; the shape of the cursor will change again and a dotted line will be generated, as shown in Figure 6-23. Now, release the left mouse button; a segment will be created joining the end vertices, as shown in Figure 6-24.
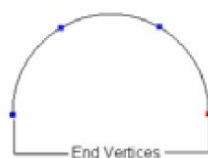

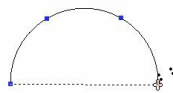*Figure 6-21 The end vertices in an arc spline*

Figure 6-23 *The cursor over another end vertex and the dotted line displayed*

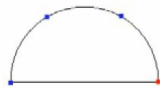***Figure 6-22*** *The cursor over one of the end vertices*

Figure 6-24 *The end vertices connected with a segment*

Make First

The **Make First** button is used to make any vertex of the spline as its first vertex or the starting point. To do so, select a vertex of the spline in the viewport and choose the **Make First** button in the **Geometry** rollout; the selected vertex will turn yellow and become the first vertex of the spline.

Note

In an open spline such as line, arc, and so on, only the end vertex can be the first vertex.

Fuse

The **Fuse** button is used to move all the selected vertices of a spline to their average center. Select the vertices of a spline in the viewport, as shown in Figure 6-25, and then choose the **Fuse** button in the **Geometry** rollout; the selected vertices will fuse together at their average center, as shown in Figure 6-26.
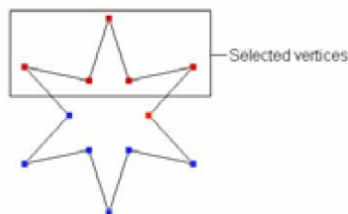
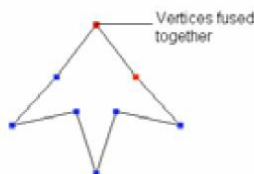***Figure 6-25*** *The selected vertices inside the rectangular area*

Figure 6-26 *The selected vertices fused at their average center*

Fillet

The **Fillet** button is used to create round corners in a spline by creating two new vertices. Create a star spline, refer to Figure 6-27. Next, choose the **Fillet** button in the **Geometry** rollout and move the cursor over a vertex; the cursor will change, as shown in Figure 6-28. Now, press the left mouse button and drag the cursor up; the new vertices with a round corner will be displayed, as shown in Figure 6-29. When you drag the cursor to fillet the vertex, the value of fillet will also be displayed in the spinner on the right side of the **Fillet** button. You can also perform this command by selecting a vertex and entering the value for the fillet in this spinner.
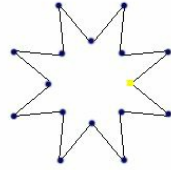
Figure 6-27 The star spline
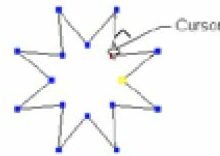
Figure 6-28 The changed shape of cursor displayed after moving the cursor over the selected vertex
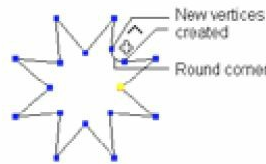

Figure 6-29 The two new vertices and the round corner displayed

Chamfer

The **Chamfer** button is used to create bevel corners in a spline by creating two new vertices. To do so, select the corner vertex of an editable spline object in the viewport. Next, choose the **Chamfer** button in the **Geometry** rollout and move the cursor over the selected vertex; the shape of the cursor will change. Now, press the left mouse button and drag the cursor up; the new vertices with a beveled corner will be displayed, as shown in Figure 6-30. Next, release the left mouse button. You can also chamfer by selecting a vertex and entering the value for the chamfer in this spinner.
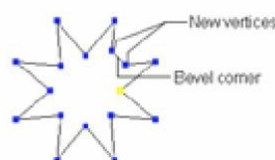
Hide and Unhide All
The **Hide** and **Unhide All** buttons are available for all sub-object levels in the editable spline object. The **Hide** button is used to hide the selected sub-object in the viewport. The **Unhide All** button is used to show all hidden sub-objects in the viewport. To hide the sub-objects of the editable spline object, select them in the viewport and choose the **Hide** button in the **Geometry** rollout. Similarly, to unhide the hidden sub-objects, choose the **Unhide All** button in the **Geometry** rollout.

Delete
The **Delete** button is available at all the sub-object levels and is used to delete the selected sub-objects in the viewport. To do so, select a sub-object in the viewport and choose the **Delete** button; the selected sub-object will be deleted.

Divide
The **Divide** button is available only for the **Segment** sub-object level. It is used to subdivide the selected segment by inserting a number of vertices on it. The number of vertices to be inserted can be set in the spinner on the right side of the **Divide** button. To subdivide a selected segment, select the **Segment** sub-object in the viewport, as shown in Figure 6-31. Next, choose the **Divide** button; the selected segment will be sub-divided, refer to Figure 6-32.

Detach
The **Detach** button is available at the **Segment** and **Spline** sub-object levels. It is used to detach the selected sub-objects from the original one and create a new shape. To do so, select one or more segments of the editable spline object in the viewport, refer to Figure 6-33. Next, choose the **Detach** button in the **Geometry** rollout; the **Detach** dialog box will be displayed, as shown in Figure 6-34. By default, the name of the new shape will be displayed as *Shape001* in the **Detach as** text box. Modify the name if you want and then choose the **OK** button; the detached segment will now behave like a new independent shape, refer to Figure 6-35.
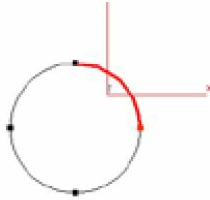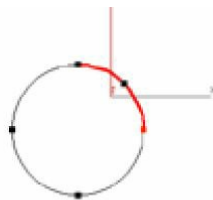
Figure 6-31 *A segment selected in the circle spline*

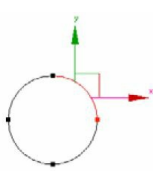*Figure 6-32* *The selected segment sub-divided after using the **Divide** button*

Figure 6-33 A segment sub-object selected in the circle spline
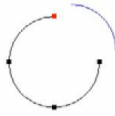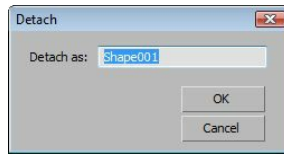

Figure 6-35 The detached segment as a new independent shape

*Figure 6-34 The **Detach** dialog box*

Reverse

The **Reverse** button is available only at the **Spline** sub-object level. It is used to reverse the direction of the spline. To do so, select the editable spline object in the viewport, select the **Spline** sub-object level in the modifier stack, and then select the spline in the viewport, as shown in Figure 6-36. Now, choose the **Reverse** button in the **Geometry** rollout; the direction of the selected spline will get reversed, as shown in Figure 6-37. To view the reversed direction, you need to select the **Show Vertex Numbers** check box in the **Display** area of the **Selection** rollout.
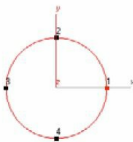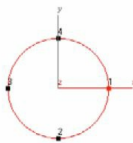

Figure 6-36 The spline selected in a circle

*Figure 6-37 The reversed direction of the selected spline after choosing the **Reverse** button*

Outline

The **Outline** button is available only at the **Spline** sub-object level. It is used to create a copy of the spline at a distance that you enter in the spinner on the right side of the **Outline** button. To do so, select the spline of the editable spline object in the viewport. Next, choose the **Outline** button; the button will be activated. Next, move the cursor over the selected spline; the shape of the cursor will change, as shown in Figure 6-38. Now, press and hold the left mouse button and move the cursor up or down over the selected spline to create a copy of the spline which behaves like its

outline, as shown in Figure 6-39. Now, release the left mouse button. Also, right-click in the viewport or choose the **Outline** button again to exit the command.
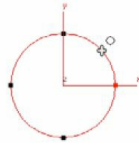

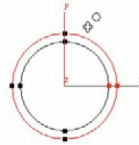*Figure 6-38 The shape of the cursor changed after choosing the **Outline** button*

Figure 6-39 A copy of the spline created as an outline of the selected spline

Note

*If you use the **Outline** button for an open spline such as arc, line, and so on, then the copied spline will be attached to the selected spline. Also, the resultant spline will be a closed one, refer to Figures 6-40 and 6-41.*

Figure 6-40 An open arc spline

e

*Figure 6-41 The closed spline after using the **Outline** button on the open splin*

Boolean

The **Boolean** button is available only in the **Spline** sub-object level. You can choose this button to create complex shapes from two spline objects. Note that these two spline objects should be closed, intersect each other, and should be attached. Also, they should be in the same plane. There are three buttons available on the right side of the **Boolean** button, **Union**, **Subtraction**, and **Intersection**.

The **Union** button is used to remove the overlapping portion of two splines and to create a single spline by combining them, refer to Figures 6-42 and 6-43. The **Subtraction** button is used to subtract the overlapping portion of the second spline from the selected spline and remove the extra portion of the second spline, as shown in Figure 6-44. The **Intersection** button is used to remove the non-overlapping portion of the splines and retain the overlapping portion of the splines, as shown in Figure 6-45.
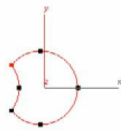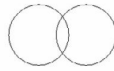
Figure 6-44 The subtraction boolean

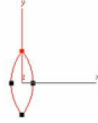*Figure 6-42* The two attached splines overlapping each other

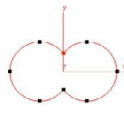*Figure 6-45* The intersection boolean
final output

Figure 6-43 The union boolean
final output

To perform the boolean operation, create two splines and convert them into editable splines and then attach them using the **Attach** button as discussed earlier. Next, select the **Spline** sub-object level in the modifier stack. Now, choose one of the boolean type buttons on the right side of the **Boolean** button in the **Geometry** rollout and then choose the **Boolean** button and move the cursor over the attached splines; the cursor will get changed. Click on the overlapping area; the splines will be modified to form a single spline on the basis of the boolean type button chosen.

Mirror
The **Mirror** button is available only at the **Spline** sub-object level. It is used to move the selected spline in a particular direction. There are three buttons on the right side of the **Mirror** button, **Mirror Horizontally**, **Mirror Vertically**, and **Mirror Both**. These buttons are used to define the direction of movement of the spline. To mirror a spline, select the editable spline in the viewport and then select the **Spline** sub-object level in the modifier stack. Specify the direction of movement of the spline by choosing one of the buttons on the right side of the **Mirror** button. Next, choose the **Mirror** button; the spline will move in the specified direction, refer to Figures 6-46 through 6-48.

Select the **Copy** check box below the **Mirror** button to create a copy of the spline while mirroring, as shown in Figures 6-49 through 6-51. Select the **About Pivot** check box to mirror the spline according to the pivot point of the spline.
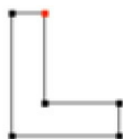
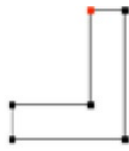*Figure 6-46* The angle extended spline created to mirror
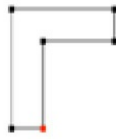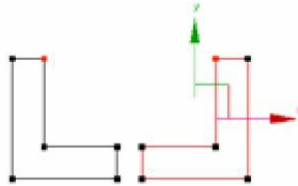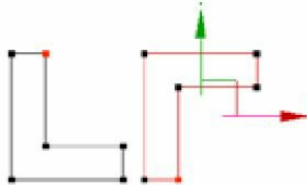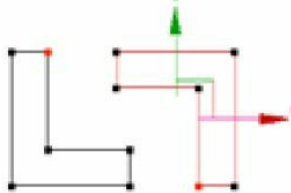
Figure 6-47 The spline mirrored horizontally

Figure 6-48 The spline mirrored vertically

Figure 6-49 The spline mirrored horizontally after selecting the **Copy** check box

Figure 6-51 The spline mirrored vertically after selecting the **Copy** check box

Figure 6-50 The spline mirrored on both the sides after selecting the **Copy** check box

Trim

The **Trim** button is available only at the **Spline** sub-object level. It is used to remove the overlapping segments of the two attached splines. To do so, create two splines, convert them into editable splines, and then attach them using the **Attach** button as described earlier, refer to Figure 6-52. Next, select the **Spline** sub-object level in the modifier stack. Choose the **Trim** button in the **Geometry** rollout and move the cursor over the overlapping segments of the attached splines; the cursor shape will get changed, as shown in Figure 6-52. Now, click on the overlapping segments to remove them, refer to Figure 6-53.
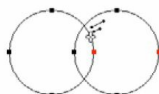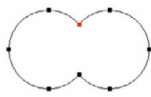
Figure 6-52 The two attached splines and the cursor over the overlapping segments
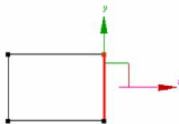
Figure 6-53 *The splines after using the **Trim** button*

Explode
The **Explode** button is available only at the **Spline** sub-object level. It is used to break a spline into a number of splines. The number of broken splines depends on the number of segments of the spline. To break a spline into a number of splines, select the editable spline in the viewport and select the **Spline** sub-object level in the modifier stack. Next, choose the **Explode** button; the spline will be broken into a number of splines, refer to Figures 6-54 and 6-55.


Figure 6-54 *The rectangular spline for explosion*

Figure 6-55 *One of the broken splines selected after using the **Explode** button*

There are two radio buttons in the **To** area below the **Explode** button, **Splines** and **Objects**. These buttons are used to select the type of explosion of the spline. By default, the **Splines** radio button is selected, which enables you to break the spline into a number of splines that will be attached together. On selecting the **Objects** radio button, the new splines will be created but they will behave as independent shapes.

Select the **Objects** radio button and then choose the **Explode** button to explode the spline; the **Explode** dialog box will be displayed, as shown in Figure 6-56. Enter a name in the **Object Name** text box and choose the **OK** button; all new shapes will be named according to the name entered in the **Object Name** text box.
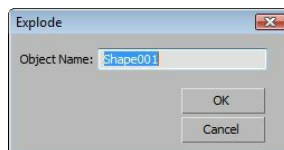
Figure 6-56 *The **Explode** dialog box*

Display Area
The **Display** area will be only active in the **Vertex** and **Segment** sub-object levels. In this area, the **Show selected segs** check box is cleared. As a result, the selected segments will be displayed in the **Segment** sub-object level only. But, if you select the **Show selected segs** check box, the selected segments will be displayed in red color at the **Vertex** sub-object level also.

TUTORIALS
Tutorial 1

In this tutorial, you will create the glass models, as shown in Figure 6-57, by converting 2D splines into 3D mesh objects. **(Expected time: 15 min)**

Figure 6-57 *The glass models*

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create a line spline for glasses.
c. Apply the **Lathe** modifier.
d. Assign materials to the glasses.
e. Save and render the scene.

Creating the Project Folder

Create a new project folder with the name *c06_tut1* at *\Documents\3dsmax2015* and then save the file with the name *c06tut1*, as discussed in Tutorial 1 of Chapter 2.

Creating a Line Spline for Glasses

In this section, you will create a shape similar to the half portion of the glass using the **Line** tool.

1. Activate the Front viewport and choose **Create > Shapes** in the **Command Panel**. The **Splines** option is selected by default in the drop-down list below the **Shapes** button. Now, choose the **Line** tool from the **Object Type** rollout.

2. In the **Creation Method** rollout, select the **Smooth** and **Corner** radio buttons in the **Initial Type** and **Drag Type** areas, respectively.

3. Click at the bottom middle point of the Front viewport to create the first vertex or the starting point of the line spline. Now, move the cursor around four grid points toward left to define the distance

between the first and the second vertex, and then click on the viewport to create the second vertex. Again, move the cursor and click to create additional vertices to get the required shape of the spline, as shown in Figure 6-58. After getting the required shape, right-click to end the creation of line spline.
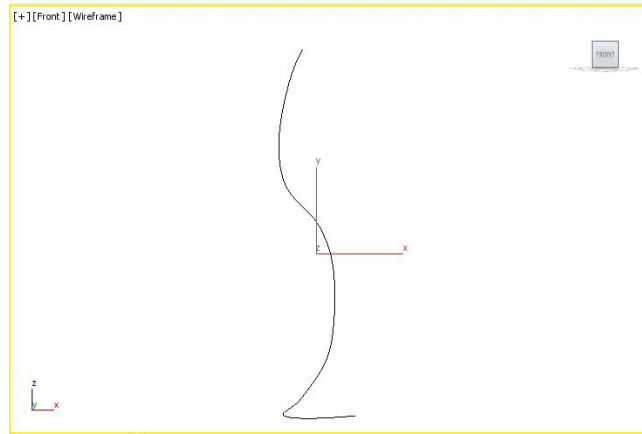

Figure 6-58 *The line spline created for glass*

You can also modify the shape of the line spline after creating it.

4. Make sure that the line spline is selected in the viewport and choose the **Modify** tab in the **Command Panel**. Now, select the **Vertex** sub-object level in the modifier stack; all the vertices of the line spline are displayed in the viewport. Next, select the vertices in the viewport one by one and modify the shape by moving them as per requirement. After getting the required shape, select the **Vertex** sub-object level in the modifier stack again to deactivate it.

Next, you need to apply the **Lathe** modifier to convert the 2D spline into a 3D mesh object.

Applying the Lathe Modifier

In this section, you will set the pivot point of the line spline because the **Lathe** modifier creates the 3D object by rotating a 2D shape about an axis. The direction of the axis of revolution depends on the pivot point of the shape.

1. Select the line spline in the viewport to set the position of the pivot point and choose the **Hierarchy** tab in the **Command Panel**. By default, the **Pivot** tab is chosen in the Hierarchy panel. In the **Adjust Pivot** rollout of the **Pivot** tab, choose the **Affect Pivot Only** button in the **Move/Rotate/Scale** area; the pivot point of the line spline is displayed in the viewports, as shown in Figure 6-59.
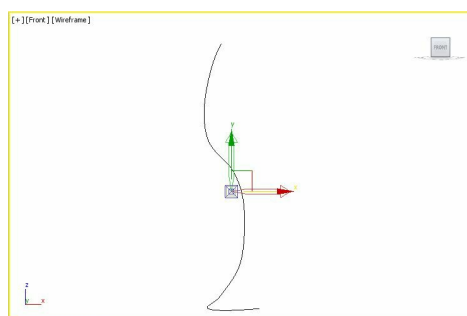
Figure 6-59 *The pivot point of the line spline at its original position*

2. In the Front viewport, move the pivot point on the first vertex of the line spline using the **Select and Move** tool, as shown in Figure 6-60. Now, choose the **Affect Pivot Only** button again to deactivate it; the pivot point disappears.
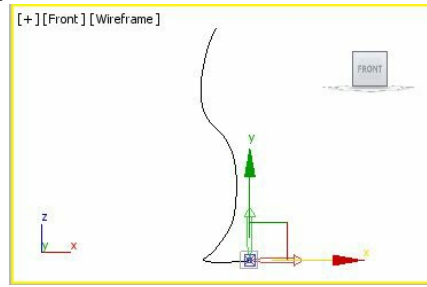

Figure 6-60 *The pivot point after adjusting its position in the Front viewport*

Note

*While applying the **Lathe** modifier, you can also select the first vertex of the line spline instead of adjusting its pivot point, as shown in Figure 6-61.*
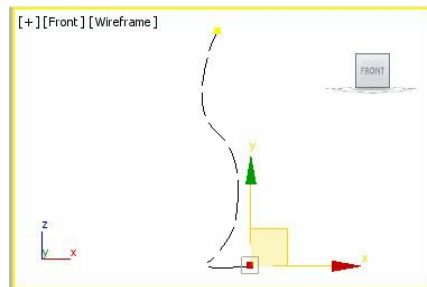

Figure 6-61 *The first vertex selected in the line spline*

3. Make sure that the line spline is selected in the viewport and choose **Modifiers > Patch/Spline Editing > Lathe** from the menu bar; the 2D line spline is converted into the 3D mesh object. Also, the **Parameters** rollout is displayed in the Modify panel.

4. In the **Parameters** rollout, select the **Flip Normals** check box.

5. Name the new 3D object as *glass*. Next, click on the **Modifier List** drop-down list and select **Shell** from it; the **Shell** modifier is applied to *glass*.

6. In the **Parameters** rollout, set the value **1.5** in the **Inner Amount** spinner.

7. Next, click anywhere in the viewport to deselect *glass*. Choose the **Zoom Extents All** tool; *glass* is displayed in the viewports, as shown in Figure 6-62.

8. Create a copy of *glass* in the Front viewport to make a pair and then choose the **Zoom Extents All** tool; a pair of cocktail glasses is displayed in the viewports, as shown in Figure 6-63.
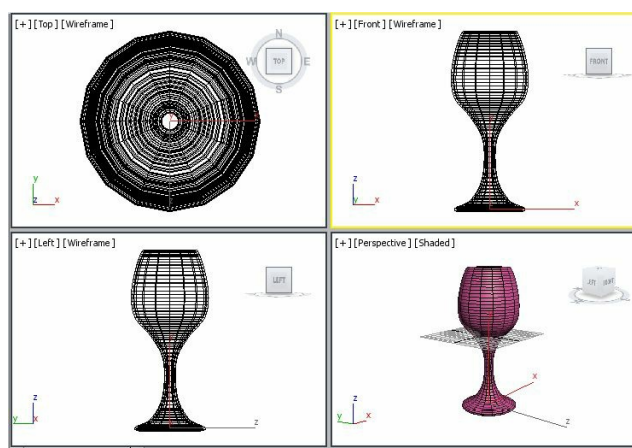
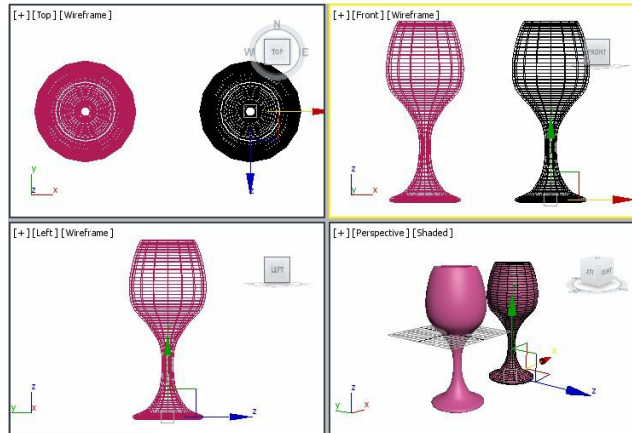**Figure 6-62** *The glass geometry displayed in viewports*

Figure 6-63 *A pair of glasses in viewports*

Assigning the Material to Glasses

In this section, you will assign materials to the pair of glasses.

1. Choose **Rendering > Material Editor > Compact Material Editor** from the menu bar; the **Material Editor** dialog box is displayed, refer to Figure 6-64.

2. Select the **01 - Default** sample slot in the **Material Editor** dialog box, if it is not already selected. Now, in the **Shader Basic Parameters** rollout, select the **2-Sided** check box to apply the material on both sides of the faces, as shown in Figure 6-64.
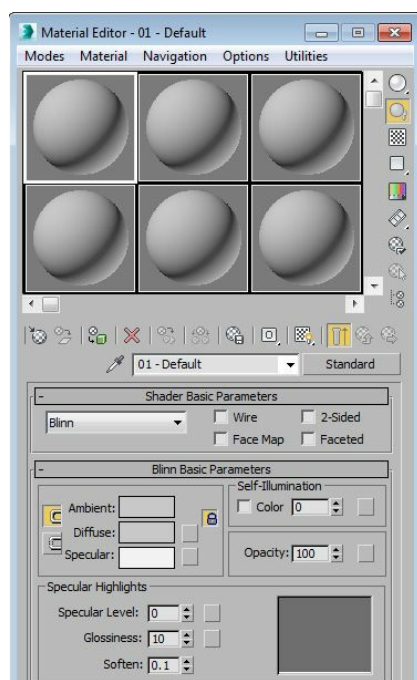
Figure 6-64 *Partial view of the **Material Editor** dialog box*

3. In the **Blinn Basic Parameters** rollout, choose the **Diffuse** color swatch; the **Color Selector: Diffuse Color** dialog box is displayed. Set white color in it and choose the **OK** button; the white color is displayed in the **Diffuse** color swatch.

4. In the **Specular Highlights** area, set the value **123** in the **Specular Level** spinner and set the value **30** in the **Glossiness** spinner, refer to Figure 6-64.

5. Select glasses in any of the viewports and make sure that the **01-Default** sample slot is selected in the **Material Editor** dialog box. Next, in the **Material Editor** dialog box, choose the **Assign Material to Selection** button; the material is assigned to the pair of cocktail glasses in the viewport. Next, choose the **Show Shaded Material in Viewport** button to view the material in the viewports and close the dialog box.

Saving and Rendering the Scene

In this section, you will save the scene and then render it. You can view the final rendered image of this scene by downloading the *c06_3dsmax_2015_rndr.zip* file from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2015: A Comprehensive Guide*

1. Change the background color of the scene to white, as discussed in Tutorial 1 of Chapter 2. Next, choose **Save** from the **Application** menu.

2. Activate the Perspective viewport. Next, choose the **Render Production** tool from the **Main Toolbar**; the **Rendered Frame** window is displayed. This window shows the final output of the scene, refer to Figure 6-65.
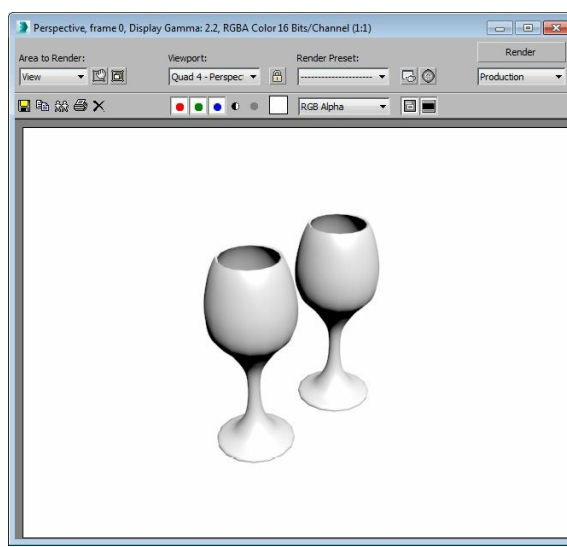
Figure 6-65 *The glass models in the final output after rendering*

Tutorial 2

In this tutorial, you will create the model of a vase with flower plant, by converting a 2D spline into a 3D mesh object, as shown in Figure 6-66. **(Expected time: 25 min)**

Figure 6-66 *The model of a vase with flower plant*

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create a line spline for the vase.
c. Apply the **Lathe** modifier.
d. Assign the material to the vase.
e. Create a stand for the vase.
f. Save and render the scene.

Creating the Project Folder

Create a new project folder with the name *c06_tut2* at *\Documents\3dsmax2015* and then save the file with the name *c06tut2*, as discussed in Tutorial 1 of Chapter 2.

Creating a Line Spline for the Vase

In this section, you will create a shape similar to the half portion of the vase using the **Line** tool.

1. Activate the Front viewport and choose **Create > Shapes** in the **Command Panel**; the **Splines**

option is selected by default in the drop-down list below the **Shapes** button. Now, choose the **Line** tool from the **Object Type** rollout.

2. In the **Creation Method** rollout, select the **Corner** radio button in the **Initial Type** and **Drag Type** areas.

3. Create a line spline as discussed in Tutorial 1. This spline should be similar to the half portion of the vase, refer to Figure 6-67.

4. Choose the **Modify** tab and select the **Vertex** sub-object level in the modifier stack; all vertices of the line spline are displayed in the viewport. Next, select the vertices one by one in the viewport and modify the shape by moving them to get a perfect shape.

Applying the Lathe Modifier

In this section, you will apply the **Lathe** modifier to convert the 2D spline into the 3D mesh object.

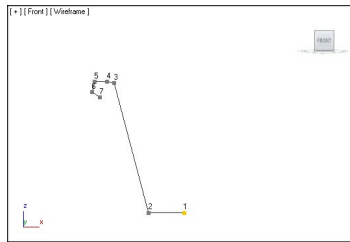1. Select the first vertex of the spline in the Front viewport, as shown in Figure 6-68.

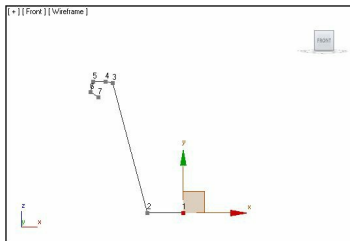*Figure 6-67 A line spline created for the vase*

Figure 6-68 The first vertex of the line spline selected in the Front viewport

2. Choose **Modifiers > Patch/Spline Editing > Lathe** from the menu bar; the 2D line spline is converted into a 3D mesh object.

3. Name the new 3D mesh object as *vase*. Also, click anywhere in the viewport to deselect the *vase*.

4. Choose the **Zoom Extents All** tool; the entire *vase* is displayed in the viewports, as shown in Figure 6-69.
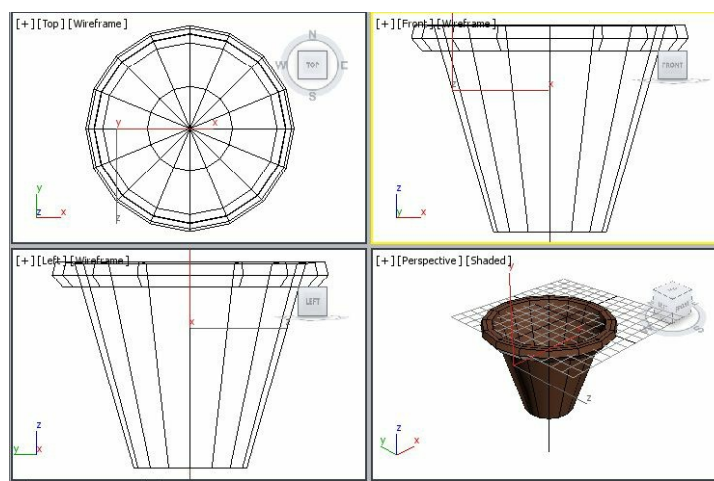
Figure 6-69 *The vase geometry after applying the **Lathe** modifier*

Assigning Material to Vase

In this section, you will assign the material to *vase* using the **Material Editor** tool as discussed in Tutorial 1 of this chapter.

1. Choose **Rendering > Material Editor > Compact Material Editor** from the menu bar; the **Material Editor** dialog box is displayed.

2. Select the **2-Sided** check box in the **Shader Basic Parameters** rollout of the **Material Editor** dialog box. This enables you to view both sides of *vase* in the final output. Also, in the **Blinn Basic Parameters** rollout, choose the **Diffuse** color swatch; the **Color Selector: Diffuse Color** dialog box is displayed. In this dialog box, enter the values as follows:

Red: **177** Green: **88** Blue: **27**

Choose the **OK** button in the **Color Selector: Diffuse Color** dialog box; the selected color is displayed in the **Diffuse** color swatch.

3. Make sure that *vase* is selected in the viewports. Next, choose the **Assign Material to Selection** button in the **Material Editor** dialog box; the selected material is assigned to *vase* in the viewport. Next, choose the **Show Shaded Material in Viewport** button in the same dialog box to view the material in viewport. Next, close the **Material Editor** dialog box.

Next, you need to use the **Foliage** tool to put a plant in *vase*.

4. Activate the Top viewport. Choose **Create > Geometry** in the **Command Panel**; a drop-down list is displayed below the **Geometry** button. Select **AEC Extended** from the drop-down list and then choose the **Foliage** tool from the **Object Type** rollout.

5. In the **Favorite Plants** rollout, double-click on the **Society Garlic** foliage; it is displayed in the viewports.

6. In the **Name and Color** rollout, name the foliage to *plant* and press ENTER.

7. Make sure that *plant* is still selected. Choose the **Modify** tab in the **Command Panel**; the **Parameters** rollout is displayed.

8. In the **Parameters** rollout, set a value in the **Height** spinner to adjust the height of the *plant* according to *vase*.

9. Choose the **Select and Move** tool and align *plant* with *vase* in the viewports, refer to Figure 6-70. Choose the **Zoom Extents All** tool; *vase* and *plant* are displayed, as shown in Figure 6-70.
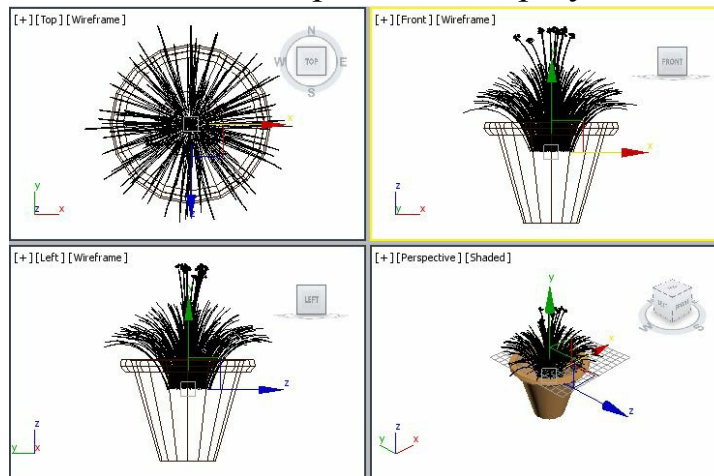

Figure 6-70 Alignment of plant with vase in viewports

10. Select *plant* and *vase* in the viewports and group them as *flower vase*.

Next, you need to create a stand for *flower vase*.

Creating a Stand for the Flower Vase
In this section, you will create a stand for the flower vase.

1. Select *flower vase* and right-click on it; a quad menu is displayed. Choose the **Hide Selection** option from it; *flower vase* disappears temporarily from the viewports. Now, you can work easily in the viewports.

2. Activate the Top viewport. Choose **Create > Shapes** in the **Command Panel**; the **Splines** option is selected by default in the drop-down list below the **Shapes** button. Now, choose the **Circle** tool from the **Object Type** rollout and create a circular spline.

3. In the **Parameters** rollout, set the radius of the circle to **11.662** in the **Radius** spinner.

You may need to modify the radius according to the scene in the later section.

4. Expand the **Rendering** rollout and select the **Enable In Renderer** and **Enable In Viewport** check boxes. Select the **Radial** radio button, if it is not already selected. Also, make sure that the **Auto**

Smooth check box is selected. Now, enter the values as follows:

Thickness: **2.0** Sides: **15** Angle: **0.99**

5. The circular spline is automatically named as *Circle001*. Now, change its color by entering the values as follows:

Red: **193** Green: **193** Blue: **193**

6. Create another circle in the Top viewport. It is automatically named as *Circle002*.

7. In the **Parameters** rollout, set the radius value of *Circle002*, which should be just the double the radius value of *Circle001*.

8. Change the color of *Circle002* to black.

9. Choose the **Zoom Extents All** tool and align both the circles using the **Select and Move** tool, as shown in Figure 6-71.

Note

*When you set the parameters for a spline in the **Rendering** rollout, they remain constant on creating another spline. Therefore, the new spline automatically takes the same parameters unless you change them.*

10. Choose the **Line** tool from **Create > Shapes > Splines > Object Type** rollout.

11. In the **Creation Method** rollout, select the **Corner** radio button in the **Initial Type** and **Drag Type** areas.
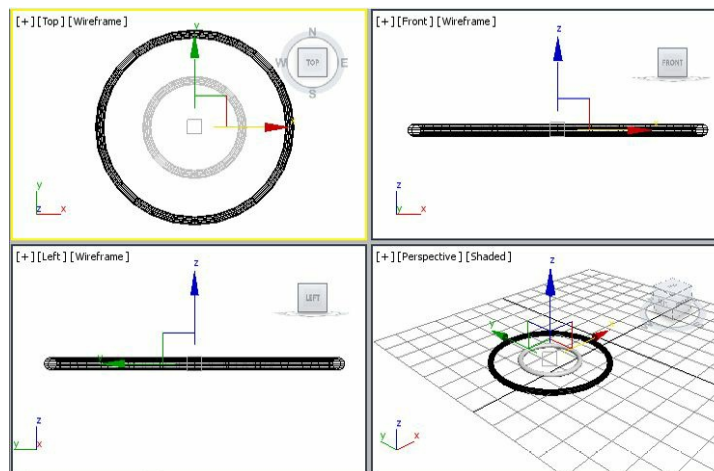

Figure 6-71 Alignment of the circles in viewports

12. Activate the Top viewport. Next, create four line splines to join both the circles, as shown in Figure 6-72.
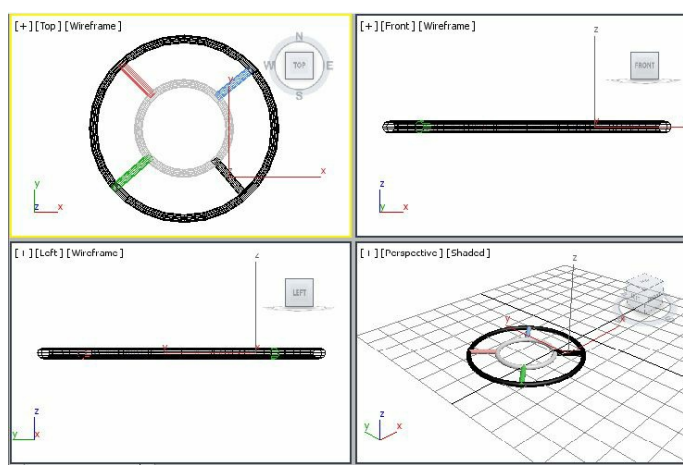
Figure 6-72 The line splines created to join both the circles

13. Assign black color to all the line splines.

14. Select the line splines and both the circles in any viewport by dragging a selection box around them, and then group them as *upper portion*.

15. Select *upper portion* and hide it temporarily as described earlier. Then, choose the **Zoom Extents All** tool.

Next, you need to create the legs for the stand using the **Line** tool.

16. Activate the Front viewport. Next, choose the **Line** tool from **Create > Shapes > Splines > Object Type** rollout.

17. In the **Creation Method** rollout, select the **Smooth** radio button in the **Initial Type** and **Drag Type** areas.

18. Create a line spline in the Front viewport, as shown in Figure 6-73. It uses the same parameters from the **Rendering** rollout that you had set earlier.
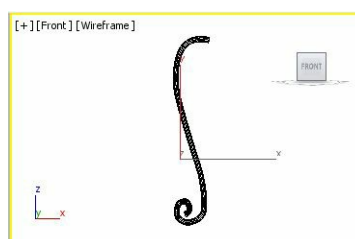

Figure 6-73 The line spline for leg of stand

19. In the **Rendering** rollout, make sure that the **Enable In Renderer** and **Enable In Viewport** check boxes are selected. Select the **Rectangular** radio button and enter the values as follows:

Length: **2.0** Width: **1.5** Angle: **0.0**

20. Name the line spline as *leg01* and change its color to black.

21. Right-click in any of the viewports; a quad menu is displayed. Choose the **Unhide by Name** option; the **Unhide Objects** dialog box is displayed. Select *upper portion* from the list given in this dialog box and choose the **Unhide** button; *upper portion* is now displayed in the viewport. Choose the **Zoom Extents All** tool.

⦿Note
*You can resize leg01 according to the size of the upper portion using the **Select and Uniform Scale** tool.*

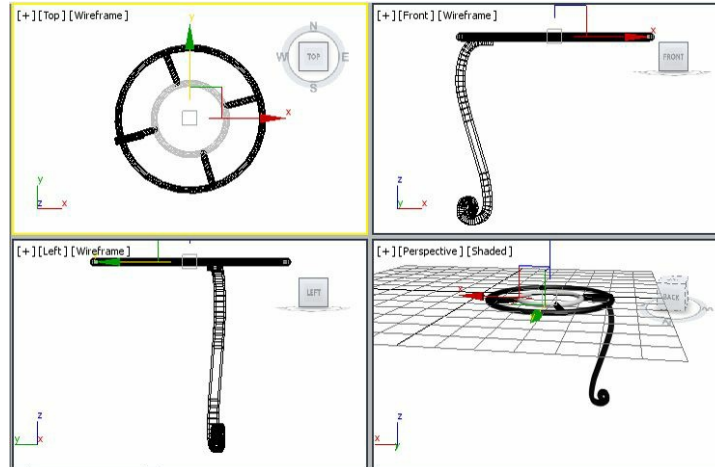22. Align *upper portion* and *leg01* in viewports, as shown in Figure 6-74.

Figure 6-74 *Alignment of upper portion and leg01 in viewports*

Next, you need to copy the *leg01* to create other legs.

23. Create three copies of *leg01*; they are automatically named as *leg002, leg003,* and *leg004.*

24. Align *leg01, leg002, leg003,* and *leg004* using the **Select and Move** and **Select and Rotate** tools, as shown in Figure 6-75.

25. Select all the objects in the viewport and group them as *vase stand.*

26. Right-click on the viewport; a quad menu is displayed. Choose the **Unhide All** option; all the hidden objects are displayed in the viewports.

27. Align *flower vase* and *vase stand* and choose the **Zoom Extents All** tool, refer to Figure 6-76.

⦿Note
*You can adjust the size of the flower vase according to the size of the vase stand using the **Select and Uniform Scale** tool.*

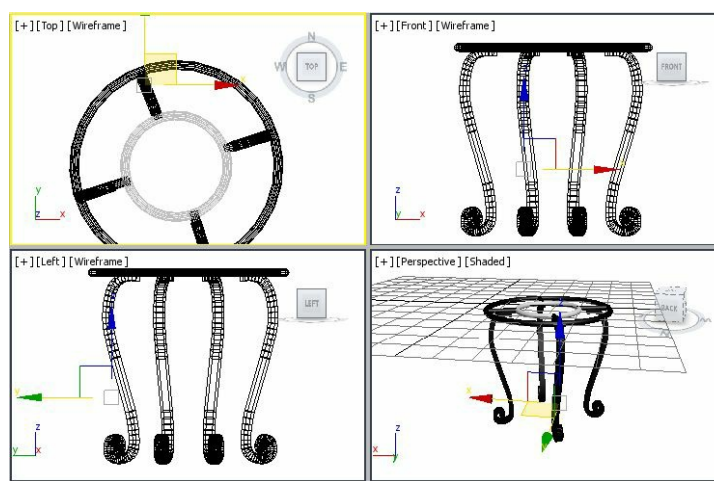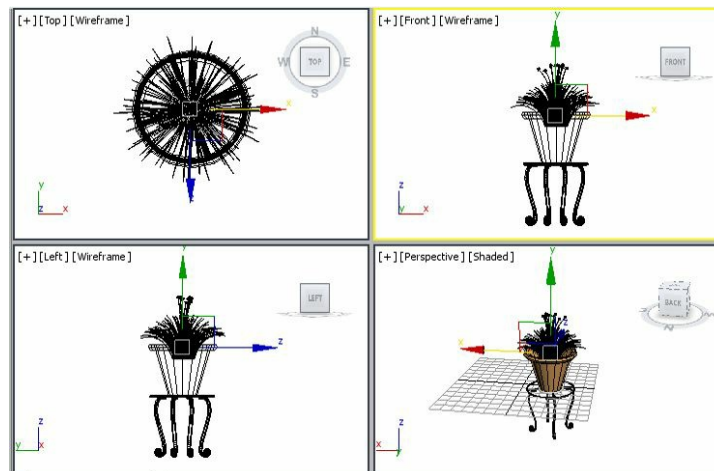*Figure 6-75* Alignment of leg01, leg002, leg003, and leg004 in viewports

Figure 6-76 Alignment of flower vase and vase stand in viewports

Saving and Rendering the Scene

In this section, you will save the scene and then render it.

1. Change the background color of the scene to white, as discussed in Tutorial 1 of Chapter 2.

2. Choose **Save** from the **Application** menu.

3. Activate the Perspective viewport. Next, choose the **Render Production** tool from the **Main Toolbar**; the **Rendered Frame** window is displayed. This window shows the final output of the scene, refer to Figure 6-66.