3

Extended Primitives

Learning Objectives

After completing this chapter, you will be able to:

- *Understand Weighted Normals modifier*
- *Understand Bend modifier*
- *Understand Taper modifier*
- *Create and edit extended primitives*



INTRODUCTION

In this chapter, you will learn to create complex 3D shapes using extended primitives. Also, you will learn in detail the usage of the **Weighted Normals** modifier, **Bend** modifier, and **Taper** modifier.

MODIFIERS

In 3ds Max, modifiers are used to apply various types of functions or effects on an object. There are different types of modifiers that perform different functions about which you will learn in the later chapters. In this section, you will learn about the **Bend**, **Taper**, and **Weighted Normals** modifiers.

Weighted Normals Modifier

The **Weighted Normals** modifier is used to smoothen the object using normals. It generates explicit normals for meshes. The weight applied by this modifier in the mesh is based on the area, angle, or both. To apply the **Weighted Normals** modifier on an object, select the object and choose **Modifiers > Mesh Editing > Weighted Normals** from the menu bar. Alternatively, you can select the object in the viewport and choose the **Modify** tab from the **Command Panel**; the **Modifiers List** drop-down list will be displayed. Select **OBJECT-SPACE MODIFIERS > Weighted Normals** from the **Modifier List** drop-down list; the **Weighted Normals** modifier will be displayed in the modifier stack, refer to Figure 3-1. Also, the **Weighted Normals** rollout will be displayed in the Modify panel, as shown in Figure 3-2. The options in the **Hard Edge Detection** area of this rollout are used to smoothen groups, UV seams, and hard angles. The options in the **Smoothing** area are used to apply a smoothed calculation between the area or angle weighting options. The options in the **Weighting** area of the **Weighted Normals** rollout are discussed next.

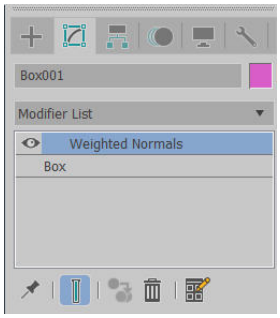


Figure 3-1 *The* ***Weighted Normals*** *modifier displayed in the modifier stack*

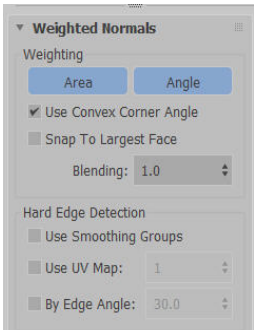


Figure 3-2 *Partial view of the* ***Weighted Normals*** *rollout of the* ***Weighted Normals*** *modifier*

Area

The **Area** button in the **Weighting** area is used to calculate the weight based on the face area. This button can be used individually or with the **Angle** button.

Angle

The **Angle** button in the **Weighting** area is used to calculate the weight based on the face corner angle. This button can be used individuall or with the **Area** button.

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Use Convex Corner Angle

The **Use Convex Corner Angle** check box enables you to create a convex angle at concave corners.

Snap to Largest Face

When this check box is selected, the computation of normals will depend on the face that has the largest weight value. This value will differ based on the button chosen: **Area**, **Angle** or both.

Blending

The **Blending** spinner is used to set the blending between weighted and unweighted normals. A value of 1.0 will apply a fully-weighted calculation.

Bend Modifier

The **Bend** modifier is used to bend an object upto 360 degrees along the X, Y, or Z axis. To apply the **Bend** modifier on an object, select the object and choose **Modifiers > Parametric Deformers > Bend** from the menu bar. Alternatively, you can select the object in the viewport and choose the **Modify** tab from the **Command Panel**; the **Modifiers List** drop-down list will be displayed. Select **OBJECT-SPACE MODIFIERS > Bend** from the **Modifier List** drop-down list; the **Bend** modifier will be displayed in the modifier stack, refer to Figure 3-3. Also, the **Parameters** rollout will be displayed in the Modify panel, as shown in Figure 3-4. The areas in the **Parameters** rollout are discussed next.

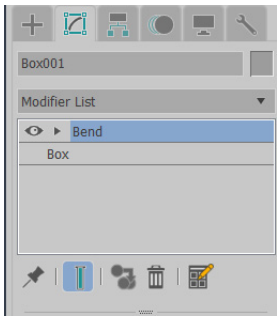


Figure 3-3 *The **Bend** modifier displayed in the modifier stack*

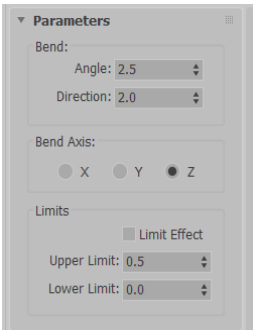


Figure 3-4 *The **Parameters** rollout of the **Bend** modifier*

Bend Area

The options in the **Bend** area are used to set the parameters to bend an object. The **Angle** spinner is used to define the angle of the bend along the X, Y, or Z axis. The **Direction** spinner is used to define the direction of the bend.

Bend Axis Area

The options in the **Bend Axis** area is used to define the axis, which needs to be bent. By default, the **Z** radio button is selected. As a result, the object will be bent about the Z axis. You can also select the **X** or **Y** radio button. Note that the axis to be bent should be local to the bend gizmo instead of the selected object.

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Limits Area

The options in the **Limits** area are used to apply constraints to the bend effect. Select the **Limit Effect** check box to make the options in this area active. By default, value in the **Upper Limit** and **Lower Limit** spinners is zero. The **Lower Limit** and **Upper Limit** spinners are used to specify the bending limits of the modifier from its center point.

Taper Modifier

The **Taper** modifier is used to taper an object by scaling it on both ends. After applying this modifier, one side of the object will be scaled up and another will be scaled down. To apply the **Taper** modifier, choose **Modifiers > Parametric Deformers > Taper** from the menu bar; the **Taper** modifier will be displayed in the modifier stack, refer to Figure 3-5. Also, the **Parameters** rollout will be displayed in the Modify panel, as shown in Figure 3-6. The areas in this rollout are discussed next.

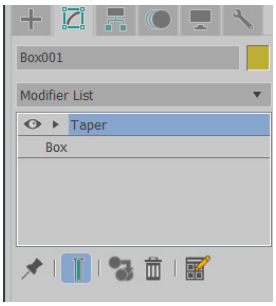


Figure 3-5 *The* ***Taper*** *modifier in the modifier stack*

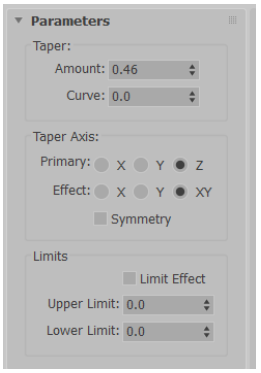


Figure 3-6 *The* ***Parameters*** *rollout of the* ***Taper*** *modifier*

Taper Area

The options in the **Taper** area are used to set the parameters for scaling the shape of an object. The **Amount** spinner in the **Taper** area is used to define the amount of taper. The **Curve** spinner is used to define the curve applied to the gizmo, and it helps in creating different shapes of the taper. You can set the values of the **Amount** and **Curve** spinners from -10.0 to 10.0.

Taper Axis Area

The Primary group in the **Taper** Axis area is used to define the central axis of the taper. By default, the **Z** radio button is selected in the **Primary** group. As a result, the Z axis is used as the central axis for the taper. You can also specify the X or Y axis as the central axis for the taper by selecting the **X** or **Y** radio button in the Primary group. The **Effect** group is used to define the direction of the taper from the primary axis. By default, the **XY** radio button is selected in the **Effect** group. As a result, the direction of the taper will be along the XY plane. You can also specify the direction of taper along the X or Y axis by selecting the **X** or **Y** radio button from the **Effects** group. The radio buttons in the **Effect** group change according to the selection of the primary axis. You can select the **Symmetry** check box in this area to create a symmetrical taper around the primary axis.

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Limits Area

The options in this area are same as discussed in the **Bend** modifier.

EXTENDED PRIMITIVES

In 3ds Max, there are some complex 3D geometric shapes, which can be used to create 3D objects. These shapes are known as extended primitives. The extended primitives are chamfer box, spindle, hedra, and so on.

To create an extended primitive, you need to choose **Create > Geometry** from the **Command Panel**; a drop-down list will be displayed with the **Standard Primitives** option selected by default. Now, select the **Extended Primitives** option from the drop-down list. Activate the viewport in which you want to create the primitives and then choose the corresponding tool from the **Object Type** rollout. In this section, you will learn to create and modify the extended primitives using various tools available in the **Object Type** rollout.

Creating a Hedra

Menu bar:	Create > Extended Primitives > Hedra
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > Hedra

To create a hedra, activate the viewport and make sure that the **Extended Primitives** option is selected from the drop-down list in the **Command Panel**. Now, choose the **Hedra** tool from the **Object Type** rollout; the **Name and Color** and **Parameters** rollouts will be displayed, as shown in Figure 3-7. Now, press and hold the left mouse button in the viewport to define the center point of the hedra, and then drag the cursor to define its radius. Release the left mouse button to get the required radius; a hedra will be created, as shown in Figure 3-8.

Various rollouts used to create and modify the hedra are discussed next.



Tip

If you are creating an extended primitive that requires multiple steps, you can pan or orbit the viewport in between the steps. To pan the viewport, drag the cursor with the middle-mouse button or mouse wheel held down. To rotate the viewport, press and hold the ALT key and then drag the cursor with middle-mouse button or mouse wheel held down.



Note

*1. The options in the **Name and Color** rollout of all the extended primitives are same as those discussed in the **Box** tool of Chapter 2.*



*2. After creating an extended primitive, if you right-click in the viewport to exit the tool, the **Parameters** rollout will disappear from the **Create** tab. In such a case, to modify the parameters of the primitive, select the primitive in the viewport and choose the **Modify** tab from the **Command Panel**; the **Parameters** rollout will be displayed.*

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Parameters Rollout

The parameters in this rollout are discussed next.

Family Area

The options in the **Family** area are used to define various types of hedra, refer to Figure 3-9. By default, the **Tetra** radio button is selected which is used to create a tetrahedron. You can select the **Cube/Octa** radio button to create a cube or octahedron. Note that the hedra created will depend on the value entered in the spinners in the **Family Parameters** area. If you select the **Dodec/Icos** radio button, a dodecahedron or icosahedron is created. Select the **Star1** and **Star2** radio buttons to create two different star-like polyhedra.

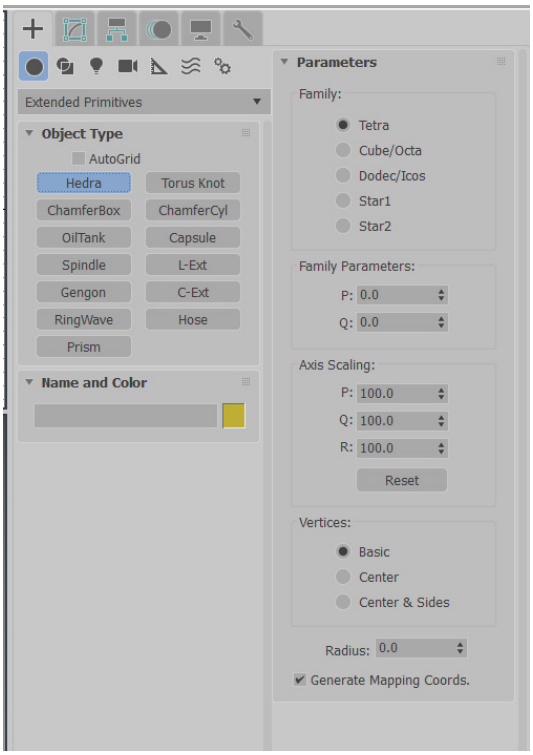


Figure 3-7 *Various rollouts to create a hedra*



Figure 3-8 *A hedra displayed in the viewport*

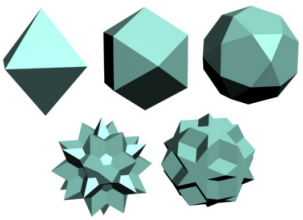


Figure 3-9 *Five basic shapes of hedra*

Family Parameters Area

The two spinners in this area, **P** and **Q**, are used to modify the vertices and faces of a polyhedron. They are related to each other and their combined value can be equal to or less

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than 1.0. When you set maximum values in P and Q spinners, one parameter represents all vertices while the other represents all facets.

Axis Scaling Area

A polyhedron can have three shapes of polygonal facets: triangle, square, and pentagon. The **P**, **Q**, and **R** spinners in this area control the axis of reflection for one of the facets of a polyhedron. By default, the value in these spinners is 100. If you change the values in these spinners, they will push the facets in the object or out of the object. On choosing the **Reset** button, the values in these spinners will be reset to 100.

Vertices Area

The options in the **Vertices** area determine the internal geometry of each face of a polyhedron. By default, the **Basic** radio button is selected. As a result, facets are not subdivided and thus have minimum vertices. On selecting the **Center** radio button, an additional vertex is created at the center of each facet. If you select the **Center** and **Side** radio buttons, a vertex is created at the center of each facet and at the edges of all the facets. To see the internal edges, you need to convert the polyhedron object into the **Edit Mesh** or **Edit Poly** modifier. You will learn about the **Edit Mesh** modifier in the later chapters.

Radius

The **Radius** spinner is used to modify the radius of a polyhedron.

Creating a Chamfer Box

Menu bar:	Create > Extended Primitives > Chamfer Box
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > ChamferBox

A chamfer box is similar to a box in the standard primitives with the only difference that it has beveled or rounded edges. To create a chamfer box, activate the viewport and choose the **ChamferBox** tool from the **Object Type** rollout; the **Name and Color**, **Creation Method**, **Keyboard Entry**, and **Parameters** rollouts will be displayed, as shown in Figure 3-10.

Now, press and hold the left mouse button at a point in the viewport for defining the first corner of the chamfer box, and drag the cursor to define its length and width. Release the left mouse button to get the desired length and width. Next, move the cursor up or down to define its height, and click on the viewport to get the desired height. Move the cursor to define the fillet and click on the viewport to get the fillet or chamfer; a chamfer box will be created, as shown in Figure 3-11.

Various rollouts used to create and modify a chamfer box are discussed next.

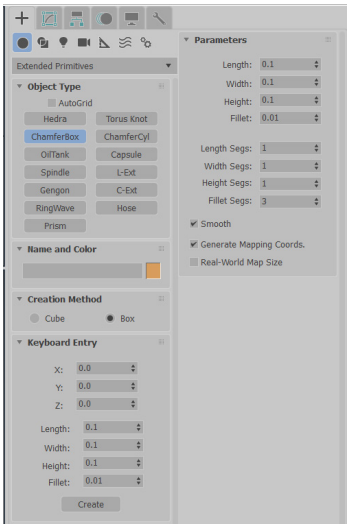


Figure 3-10 *Various rollouts to create a chamfer box*

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Creation Method Rollout

There are two radio buttons in this rollout. By default, the **Box** radio button is selected. As a result, a chamfer box is created with individual settings for length, width, and height. You can select the **Cube** radio button to create a chamfer box of equal length, width, and height.

Parameters Rollout

The options in this rollout are used to modify the chamfer box. The **Length**, **Width**, and **Height** spinners are used to specify the length, width, and height, respectively of a chamfer box. The **Fillet** spinner is used to bevel the edges of a chamfer box. Higher the value of the Fillet spinner, more refined will be the fillet on the edges of a chamfer box. The **Length Segs**, **Width Segs**, and **Height Segs** spinners are used to define the number of segments along the length, width, and height, respectively of a chamfer box. The **Fillet Segs** spinner is used to specify the number of segments in the fillet of a chamfer box.

By default, the **Smooth** check box is selected. As a result, the chamfer box will be smooth at rendering, as shown in Figure 3-11. If this check box is cleared, a chamfer box with beveled edges will be created, as shown in Figure 3-12.

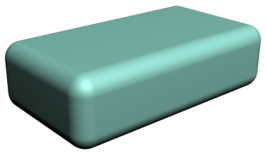


Figure 3-11 *A chamfer box with rounded edges*

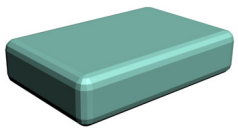


Figure 3-12 *A chamfer box with beveled edges*

Creating a Chamfer Cylinder

Menu bar:	Create > Extended Primitives > Chamfer Cylinder
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > ChamferCyl

The chamfer cylinder is similar to the cylinder in the standard primitives. The only difference is that the chamfer cylinder has beveled or rounded edges. To create a chamfer cylinder, activate the viewport and choose the **ChamferCyl** tool from the **Object Type** rollout; the **Name and Color**, **Creation Method**, **Keyboard Entry**, and **Parameters** rollouts will be displayed.

Next, press and hold the left mouse button at a point in the viewport for defining the center of the base of the cylinder and then drag the cursor to define its radius. Release the left mouse button and move the cursor up or down to define its height. Click on the screen to get the desired height and move the cursor to define the fillet. Again, click on the screen to get the desired fillet; a chamfer cylinder will be created, as shown in Figure 3-13.

Various rollouts used to create and modify a chamfer cylinder are discussed next.

Creation Method Rollout

The options in this rollout are the same as those discussed while creating the sphere in Chapter 2.

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Parameters Rollout

The options in this rollout are used to modify a chamfer cylinder. The **Radius** spinner is used to set the radius of a chamfer cylinder. The **Height** spinner is used to set the height of a chamfer cylinder. The **Fillet** spinner is used to bevel the top and bottom cap edges of a chamfer cylinder. Higher the value specified in the **Fillet** spinner, more refined will be the fillet along the cap edges of a chamfer cylinder. The **Height Segs** spinner is used to define the number of segments along the height of a chamfer cylinder. Similarly, the **Fillet Segs** spinner is used to define the number of segments in the fillet area of a chamfer cylinder. The **Sides** spinner specifies the number of sides of a chamfer cylinder. The **Cap Segs** spinner is used to define the number of segments on each end of the cylinder. By default, the **Smooth** check box is selected. As a result, it creates a chamfer cylinder with rounded edges. If this check box is cleared, a chamfer cylinder with beveled edges will be created, as shown in Figure 3-14. The options available on selecting the **Slice On** check box are the same as those discussed in Chapter 2.

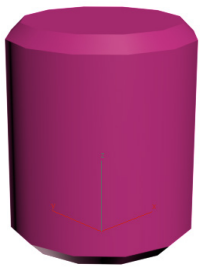


Figure 3-13 *A chamfer cylinder displayed in the viewport*



Figure 3-14 *A chamfer cylinder with beveled edges*

Creating a Capsule

Menu bar:	Create > Extended Primitives > Capsule
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > Capsule

To create a capsule, activate the viewport and choose the **Capsule** tool from the **Object Type** rollout; the **Name and Color**, **Creation Method**, **Keyboard Entry**, and **Parameters** rollouts will be displayed.

Now, press and hold the left mouse button in the viewport to specify the center of the first face and drag the cursor to define the radius of the capsule. Release the left mouse button and move the cursor up or down to define the height of the capsule. Click on the screen to get the desired height; a capsule will be created, as shown in Figure 3-15.



Figure 3-15 *A capsule displayed in the viewport*

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Various rollouts used to create and modify the capsule are discussed next.

Creation Method Rollout

The options in this rollout are the same as those discussed in the previous chapter.

Parameters Rollout

The options in this rollout are used to modify the dimensions of the capsule. The **Radius** and **Height** spinners specify the radius and height of the capsule, respectively. By default, the **Overall** radio button is selected. As a result, the caps will also be included in the overall height of the capsule. However, if you select the **Centers** radio button, the height of the caps is not included in the overall height of the capsule. The **Sides** spinner specifies the number of sides around the capsule. The **Height Segs** spinner defines the number of segments along the height of the capsule. By default, the **Smooth** check box is selected, therefore the surface of the capsule will be smooth at rendering. The options available on selecting the **Slice On** check box are the same as those discussed in the previous chapter.

Creating a Spindle

Menu bar:	Create > Extended Primitives > Spindle
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > Spindle

A spindle is a type of cylinder with conical caps. To create a spindle, activate the viewport and choose the **Spindle** tool from the **Object Type** rollout; the **Name and Color**, **Creation Method**, **Keyboard Entry**, and **Parameters** rollouts will be displayed. Now, press and hold the left mouse button in the viewport to specify the center of the first face and drag the cursor to define the radius of the spindle. Release the left mouse button and move the cursor up or down to define the height of the spindle. Click in the viewport to get the desired height and move the cursor again to define the height of the conical caps. Next, click in the viewport again; a spindle will be created, as shown in Figure 3-16.



Figure 3-16 *A spindle displayed in the viewport*

Various rollouts used to create and modify the spindle are discussed next.

Creation Method Rollout

The options in this rollout are the same as those discussed in the previous chapter.

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Parameters Rollout

The options in this rollout are used to modify the dimensions of the spindle. The **Radius** and **Height** spinners are used to set the radius and height, respectively of the spindle. The **Cap Height** spinner is used to set the height of the caps. By default, the **Overall** radio button is selected. The functions of the **Overall** and **Centers** radio buttons are same as discussed for the capsule. The **Blend** spinner is used to bevel the top and bottom caps. The rest of the parameters are same as those of the other extended primitives.

Creating an L-Ext

Menu bar:	Create > Extended Primitives > L-Extrusion
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > L-Ext

The L-Ext or L-Extrusion is an L-shaped object. To create an L-Ext, activate the viewport and choose the **L-Ext** tool from the **Object Type** rollout; the **Name and Color**, **Creation Method**, **Keyboard Entry**, and **Parameters** rollouts will be displayed.

Now, press and hold the left mouse button in the viewport and drag the cursor to define the overall length and width of the object. Release the left mouse button and move the cursor up or down to define the height of the L-Ext. Click in the viewport to get the desired height. Move the cursor again to define the thickness of the L-Ext and click in the viewport; an L-Ext will be created, as shown in Figure 3-17.

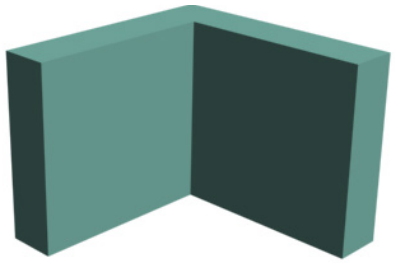


Figure 3-17 *An L-Ext displayed in the viewport*

Various rollouts used to create and modify the L-Ext are discussed next.

Creation Method Rollout

There are two radio buttons in this rollout. By default, the **Corners** radio button is selected. As a result, the L-Ext is created from one corner to another. You can select the **Center** radio button to create the L-Ext from its center to the outward direction.

Parameters Rollout

The options in this rollout are used to modify the L-Ext. The **Side Length** spinner is used to define the side length of the L-Ext. The **Front Length** spinners are used to define the front length of the L-Ext. Similarly, the **Side Width** and **Front Width** spinners specify the overall width of the L-Ext. The **Height** spinner is used to specify the height of the L-Ext. The **Side Segs** and **Front Segs** spinners are used to define the number of vertical segments on the sides of the L-Ext. The **Width Segs** spinner specifies the number of segments on the width or thickness of the L-Ext whereas the **Height Segs** spinner specifies the number of segments along the height of the L-Ext.

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Creating a Gengon

Menu bar:	Create > Extended Primitives > Gengon
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > Gengon

To create a gengon, activate the viewport and choose the **Gengon** tool from the **Object Type** rollout; the **Name and Color**, **Creation Method**, **Keyboard Entry**, and **Parameters** rollouts will be displayed. Now, press and hold the left mouse button in the viewport and drag the cursor to define the radius of the object. Release the left mouse button and move the cursor up or down to define the height of the gengon. Click in the viewport to get the desired height and move the cursor again to define the size of the fillet of the gengon. Next, click in the viewport; a gengon will be created, as shown in Figure 3-18.

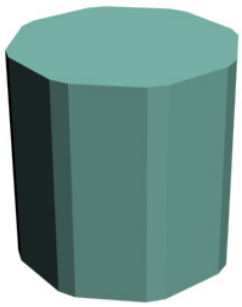


Figure 3-18 *A gengon displayed in the viewport*

Various rollouts used to create and modify the gengon are discussed next.

Creation Method Rollout

The options in this rollout are the same as those discussed in the **Sphere** tool of the previous chapter.

Parameters Rollout

The options in this rollout are used to modify the dimensions of gengon. The **Sides** spinner is used to specify the sides of the gengon. Higher the value of the sides of the gengon, more circular will be the gengon. The **Radius** spinner is used to specify the radius of the gengon. The **Fillet** spinner is used to bevel the corners of the gengon. The **Height** spinner is used to specify the height of the gengon. The **Side Segs**, **Height Segs**, and **Fillet Segs** spinners are used to define the segments on the sides, height, and fillet of the gengon respectively.

Creating a RingWave

Menu bar:	Create > Extended Primitives > RingWave
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > RingWave

A ringwave is a ring-shaped object that can have irregular inner and outer edges which can be animated. To create a ringwave, activate the viewport and choose the **RingWave** tool from the **Object Type** rollout; the **Name and Color** and **Parameters** rollouts will be displayed.

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Now, press and hold the left mouse button on a point in the viewport to specify the center of the ringwave and drag the cursor to define its outer radius. Release the left mouse button and move the cursor to define the inner radius of the ringwave. Click in the viewport to get the desired radius of the object; a ringwave will be created, as shown in Figure 3-19.



Figure 3-19 *A ringwave displayed in the viewport*



Tip

After creating the ringwave, you can view its in-built animation by dragging the time slider on the track bar or by choosing the ***Play Animation*** *button from the animation playback controls.*

The rollouts used to create and modify the ringwave are discussed next.

Parameters Rollout

The options in this rollout are used to modify the ringwave. The areas in this rollout are discussed next.

RingWave Size Area

In the **RingWave Size** area, the **Radius** spinner is used to define the outer radius of the ringwave. The **Radial Segs** spinner specifies the number of segments between the inner and outer surfaces along the circumference of the ringwave. The **Ring Width** spinner is used to specify the width of the inner ring.The **Sides** spinner is used to specify the number of sides around the circumference of the ringwave. The **Height** spinner is used to specify the height of the ringwave and the **Height Segs** spinner specifies the number of segments along its height.

RingWave Timing Area

The options in the **RingWave Timing** area are used to animate the ringwave. The ringwave grows from the value 0 to the value specified in the **Radius** spinner of the **RingWave Size** area. Select the **No Growth**, **Grow and Stay**, or **Cyclic Growth** radio button to define the pattern of the ringwave growth. The values in the **Start Time**, **Grow Time**, and **End Time** spinners are used to specify the number of frames at which the ring wave starts appearing, reaches to its full size, and disappears, respectively.

By default, the **No Growth** radio button is selected. As a result, the ringwave will not grow over the time. It just appears at the frame number specified in the **Start Time** spinner and disappears after the frame number specified in the **End Time** spinner. You can select the **Grow and Stay** radio button to animate a single growth cycle. In this case, the ringwave starts growing at the frame number specified in the **Start Time** spinner, grows up to its maximum

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radius in the number of frames specified in the **Grow Time** spinner, and disappears at the frame number specified in the **End Time** spinner. If you select the **Cyclic Growth** radio button, the ringwave animates repeatedly. In this case, the ringwave will start to grow from the specified frame in the **Start Time** spinner. Its radius will grow till the specified frame in the **Grow Time** spinner. This cycle of start and grow of the ring wave will continue upto the specified frame in the **End Time** spinner.

Outer Edge Breakup Area

The options in the **Outer Edge Breakup** area are used to change the shape of the outer edge of the ringwave and define the breakup of the outer edge. To activate the options in this area, you need to select the **On** check box. The **Major Cycles** spinner specifies the number of major waves around the outer edge of the ringwave. The **Width Flux** spinner specifies the size of the major wave in percentage. The **Crawl Time** spinner specifies the number of frames in which a single major wave moves around the outer circumference of the ringwave.

The **Minor Cycles** spinner are used to define the number of small and random-sized waves in each major wave. The **Width Flux** spinner specifies the size of the smaller waves in percentage. The **Crawl Time** spinner specifies the number of frames in which a single minor wave moves around its respective major wave.

Inner Edge Breakup Area

The options in the **Inner Edge Breakup** area are used to change the shape of the inner edge of the ringwave. Also, it defines the breakup of the inner edge. To activate the options in this area, you need to select the **On** check box. The **Inner Edge Breakup** area has the same options for defining the inner edge of the ringwave as those discussed in the **Outer Edge Breakup** area for defining the outer edge of the ringwave.

Surface Parameters Area

The **Texture Coordinates** and **Smooth** check boxes are selected by default in the **Surface Parameters** area. The **Texture Coordinates** check box is used to define the required coordinates for the mapped-material on the ringwave. The **Smooth** check box is used to smoothen the ringwave.

Creating a Hose

Menu bar:	Create > Extended Primitives > Hose
Command Panel:	Create > Geometry > Extended Primitives > Object Type rollout > Hose

A hose is an extended primitive that can link two objects. It reacts to the movement of linked objects. To create a hose, activate the viewport and choose the **Hose** tool from the **Object Type** rollout; the **Name and Color** and **Hose Parameters** rollouts will be displayed. Now, press and hold the left mouse button in the viewport to specify the center of the hose and drag the cursor to define its radius. Release the left mouse button and move the cursor up or down to define the height of the hose. Click on the screen to get the desired height of the hose; a hose will be created, as shown in Figure 3-20.

The rollouts used to create and modify a hose are discussed next.

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Hose Parameters Rollout

The options in this rollout are used to modify the hose. The different areas in this rollout are discussed next.

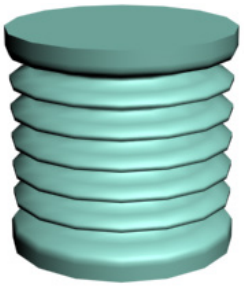


Figure 3-20 A hose displayed in the viewport

End Point Method Area

In the **End Point Method** area, the **Free Hose** radio button is selected by default. As a result, a free hose is created which is not bound to other objects. You can modify the height of the free hose by setting the value in the **Height** spinner in the **Free Hose Parameters** area. If you want to bind the hose with two objects, then you need to select the **Bound to Object Pivots** radio button in the **End Point Method** area. On selecting this radio button, the options in the **Binding Objects** area will be enabled.

Binding Objects Area

The options in this area are used to bind two objects to the hose at the pivot point of these objects. The **Pick Top Object** button in the **Binding Objects** area is used to bind the object with the top of the hose. The **Pick Bottom Object** button in this area is used to bind the object with the bottom of the hose. When you select the objects for the top and bottom of the hose, the name of these objects will be displayed in the **Top** and **Bottom** labels. The value in the **Tension** spinner is used to control the tension between the bend in the hose and the top or bottom objects.

Common Hose Parameters Area

In the **Common Hose Parameters** area, the **Segments** spinner specifies the number of segments along the length of the hose. By default, the **Flex Section Enable** check box is selected. As a result, the **Starts**, **Ends**, **Cycles**, and **Diameter** spinners will be enabled. The values in all these spinners are a percentage of the values of the main hose. The value in the **Starts** spinner specifies the point where the flex section starts along the hose. The value in the **Ends** spinner specifies the point where the flex section ends. The **Cycles** spinner is used to define the number of cycles in the flexible section. To display all the cycles properly, the number of segments should be more. The **Diameter** spinner is used to specify the secondary diameter of the flexible section.

Smoothing Area

By default, the **All** radio button is selected in this area. As a result, the entire hose is smoothened. You can select the **Sides** radio button to smoothen only the sides of the hose. If you select the **None** radio button, it creates a faceted surface of the hose. You can also select the **Segments** radio button to apply smoothness on the inner section of the hose.

By default, the **Renderable** and **Generate Mapping Coords** check boxes are selected in this area. The **Renderable** check box is used to view the hose on rendering. The **Generate Mapping Coords** check box is used to automatically assign the mapping coordinates to an object.

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Hose Shape Area

The options in the **Hose Shape** area are used to define the basic shape of the hose. By default, the **Round Hose** radio button is selected. As a result, a circular cross-section is created. If the **Round Hose** radio button is selected, the **Diameter** and **Sides** spinners will be activated. The **Diameter** spinner specifies the diameter of the hose. The **Sides** spinner specifies the number of sides of the hose.

Select the **Rectangular Hose** radio button to create a rectangular hose; the **Width**, **Depth**, **Fillet**, **Fillet Segs**, and **Rotation** spinners below this radio button will be activated. The **Width** and **Depth** spinners are used to define the width and depth of the hose, respectively. The **Fillet** spinner specifies the value by which the cross-section corners of the hose get rounded. The value in the **Fillet Segs** spinner should be higher in order to view the fillet. The value in the **Rotation** spinner rotates the hose around its local Z-axis.

If you select the **D-Section Hose** radio button, a D-shaped hose is created. Also, the **Width**, **Depth**, **Round Sides**, **Fillet**, **Fillet Segs**, and **Rotation** spinners below this radio button will be activated. The **Width** and **Depth** spinners in the **D-Section Hose** radio button are used to define the width and depth of the hose, respectively. The value in the **Round Sides** spinner specifies the total number of segments along the rounded side of the D-shaped hose. The **Fillet** spinner specifies the value by which the square corners of the cross-section get rounded. The value in the **Fillet Segs** spinner should be higher to view the fillet. The value in the **Rotation** spinner rotates the D-shaped hose around its local Z-axis.

TUTORIALS

Tutorial 1

In this tutorial, you will create a 3D model of a couch, as shown in Figure 3-21, by using the extended primitives. **(Expected time: 30 min)**

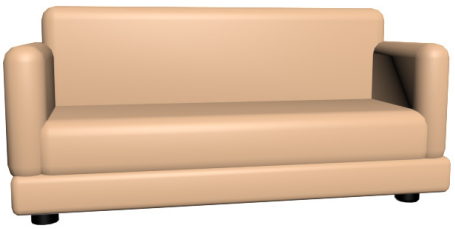


Figure 3-21 *The model of a couch*

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create seat support.
c. Create back support.
d. Create left side of the couch.
e. Create right side of the couch.
f. Create base of the couch.
g. Save and render the scene.

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Creating the Project Folder

Create a new project folder with the name *c03_tut1 at \Documents\3dsmax2023* and then save the file with the name **c03tut1**, as discussed in Tutorial 1 of Chapter 2.

Creating Seat Support

In this section, you will use the **ChamferBox** tool to create seat support of the couch.

1. Activate the Top viewport. Choose **Create > Geometry** from the **Command Panel**. In this panel, by default, the **Standard Primitives** option is displayed in the drop-down list. Select the **Extended Primitives** option from the drop-down list and choose the **ChamferBox** tool from the **Object Type** rollout.

2. Expand the **Keyboard Entry** rollout and set the parameters as follows:

   Length: **62.342** Width: **155.575** Height: **22.222** Fillet: **6.0**

3. Choose the **Create** button; a chamfer box is created, as shown in Figure 3-22.

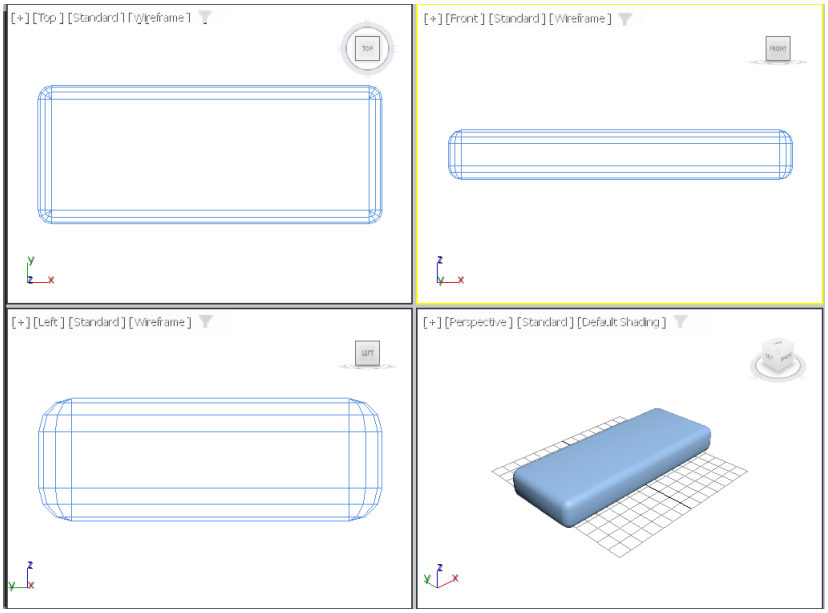


Figure 3-22 *A chamfer box created for seat support*

4. In the **Parameters** rollout, set the **Fillet Segs** spinner to 3.0.

5. In the **Name and Color** rollout, enter **seat support** as the name of the chamfer box and press ENTER. Also, use the color swatch to modify the color of *seat support* by entering the values as given below:

   Red: **225** Green: **143** Blue: **87**

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Creating Back Support

In this section, you will create a chamfer box primitive to create back support of the couch.

1. Make sure that the Top viewport is activated and the **ChamferBox** tool is chosen.

2. In the **Keyboard Entry** rollout, set the parameters as follows:

   Length: **15.413** Height: **48.089**

   Also, make sure the value in the **Fillet** spinner is 6.0.

3. Choose the **Create** button; another chamfer box is created.

4. In the **Name and Color** rollout, enter **back support** as the name of the new chamfer box and press ENTER.

5. Assign the same color to *back support* that was assigned to *seat support*.

6. In the **Parameters** rollout, make sure the value in the **Fillet Segs** spinner is **3.0**.

7. Choose the **Zoom Extents All** tool to display the objects to their extent in all viewports.

   Next, you need to align *back support* with *seat support*.

8. Choose the **Select and Move** tool and select *back support* if not selected, and move it in the viewports to align it with *seat support*, as shown in Figure 3-23.

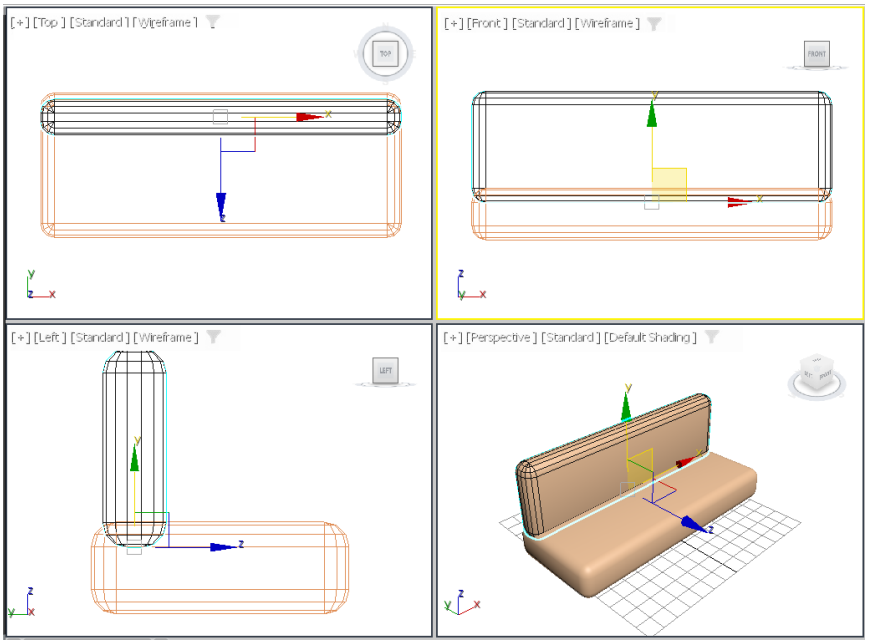


Figure 3-23 *Alignment of back support with seat support*

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Creating Left Side of the Couch

In this section, you will create a chamfer box for left side of the couch.

1. Activate the Top viewport by middle-clicking in it and choose the **ChamferBox** tool. Now, in the **Keyboard Entry** rollout, set the values in the respective spinners as given next:

   X: **-80.0** Length: **62.323** Width: **14.506**
   Height: **48.895**

   Also, make sure the value in the **Fillet** spinner is 6.0. Use the default values for other parameters.

2. Choose the **Create** button; another chamfer box is created, as shown in Figure 3-24.

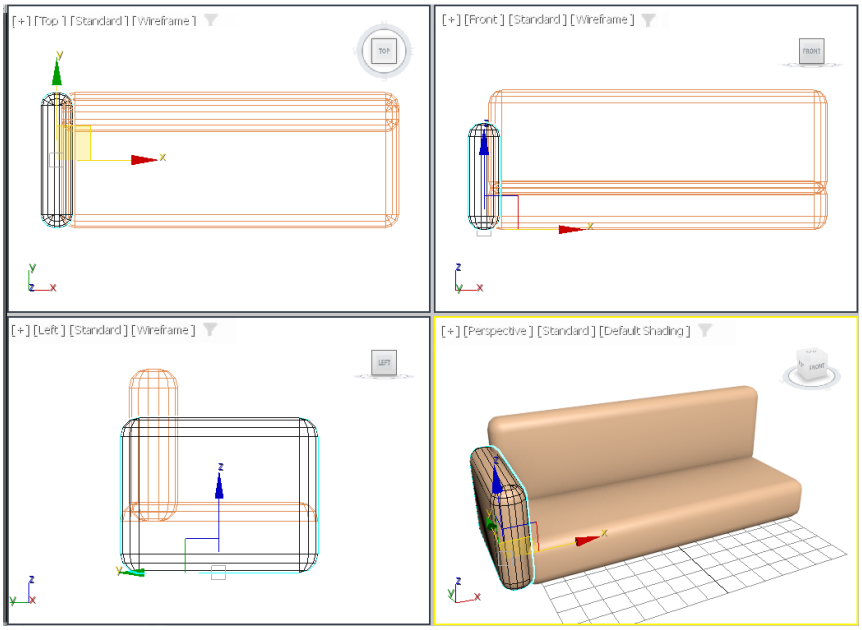


Figure 3-24 *The another chamfer box displayed in the viewports*

3. In the **Parameters** rollout, make sure that the value in the **Fillet Segs** spinner is **3.0**.

4. In the **Name and Color** rollout, enter **left side** and press the ENTER key. Assign the same color to *left side* that you assigned to *seat support*.

Creating Right Side of the Couch

To create right side of the couch, you need to copy *left side* of the couch.

1. Activate the Top viewport. Make sure *left side* is selected.

2. Choose the **Select and Move** tool. Next, move the cursor over the horizontal axis; it turns yellow. Press and hold the SHIFT key and the left mouse button, and then drag the cursor

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toward the right side of the couch until the value in the **X** spinner in the coordinate display becomes about 159. Release the left mouse button and the SHIFT key; the **Clone Options** dialog box is displayed.

3. In the **Clone Options** dialog box, make sure that the **Copy** radio button is selected and the value in the **Number of Copies** spinner is set to **1**. In the **Name** text box, enter **right side** and choose **OK**; *right side* of the couch is displayed, as shown in Figure 3-25.

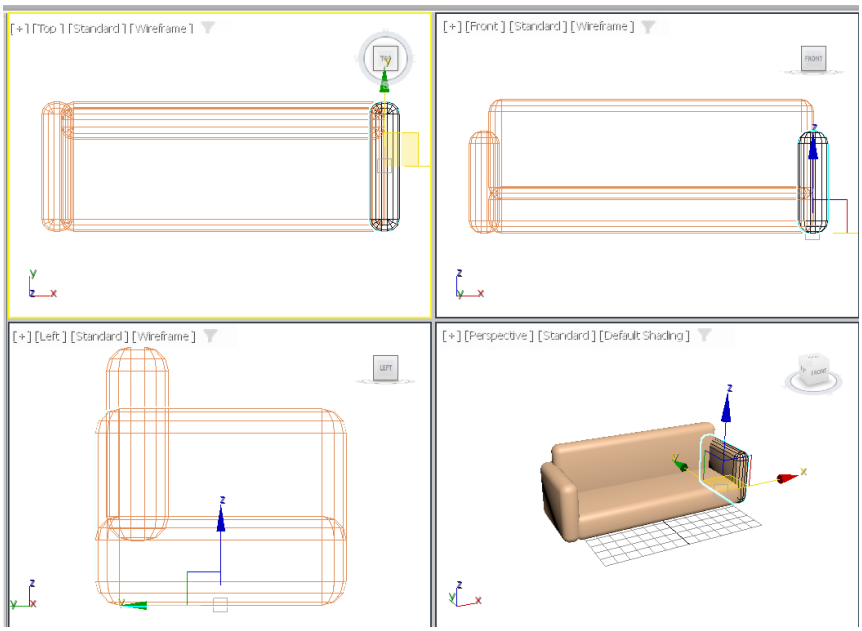


Figure 3-25 *The right side geometry displayed in the viewports*

Creating Base of the Couch

To create the base of the couch, you need to create another chamfer box.

1. Activate the Top viewport and choose the **ChamferBox** tool. In the **Keyboard Entry** rollout, set the following parameters:

   X: **0** Z: **-12.0** Length: **62.782**
   Width: **172.0** Height: **15.0** Fillet: **6.0**

   Make sure **0** is entered in the **Y** spinner.

2. Choose the **Create** button; another chamfer box is created, as shown in Figure 3-26.

3. In the **Name and Color** rollout, enter **base** as the name of the chamfer box and press the ENTER key.

4. Assign the same color to *base* that you assigned to *seat support*.

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5. Make sure the Top viewport is activated and then choose the **ChamferCyl** tool. In the **Keyboard Entry** rollout, set the following parameters:

   Radius: **5.0** Height: **5.0** Fillet: **1.0**

   Choose the **Create** button; a chamfer cylinder is created.

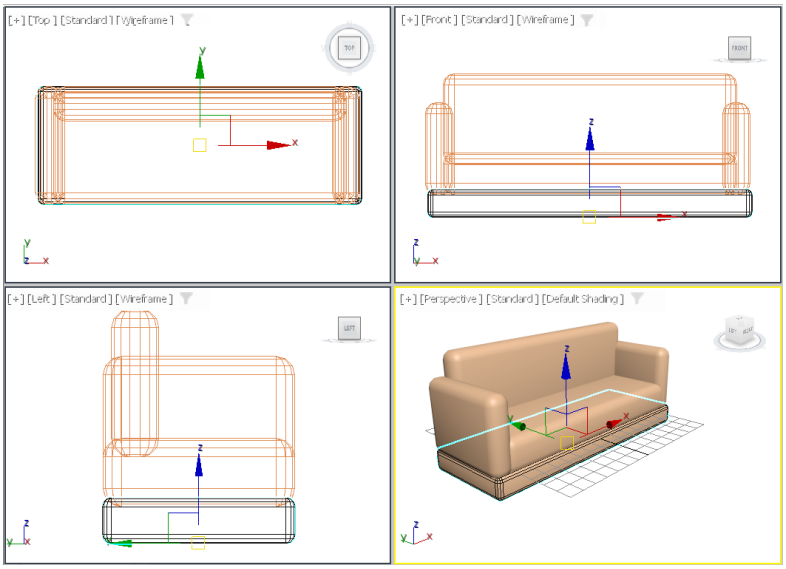


Figure 3-26 *The base geometry displayed in the viewports*

6. In the **Name and Color** rollout, enter **support1** and press the ENTER key. Assign black color to it. Next, align it at the bottom left corner of *base*, as shown in Figure 3-27.

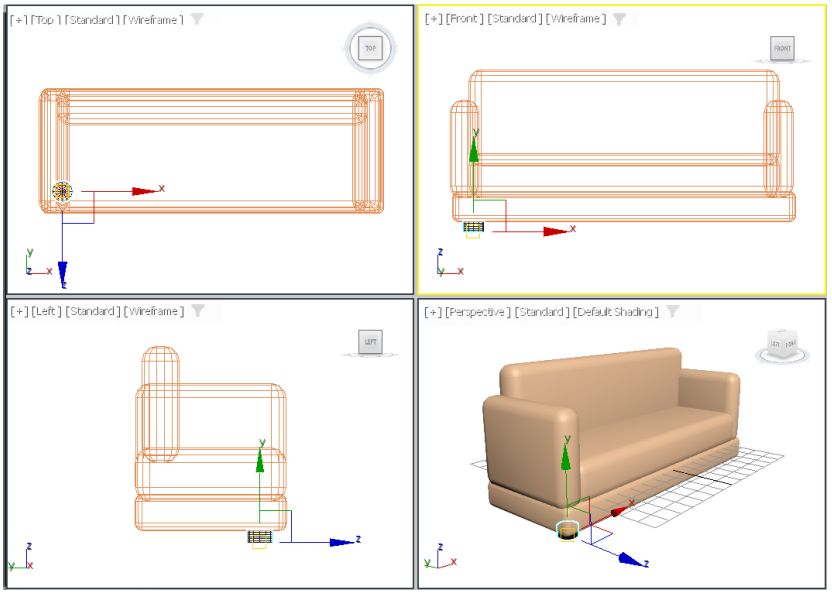


Figure 3-27 *The support1 geometry aligned in the viewports*

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7. Create three copies of *support1* as discussed earlier and align them, as shown in Figure 3-28.

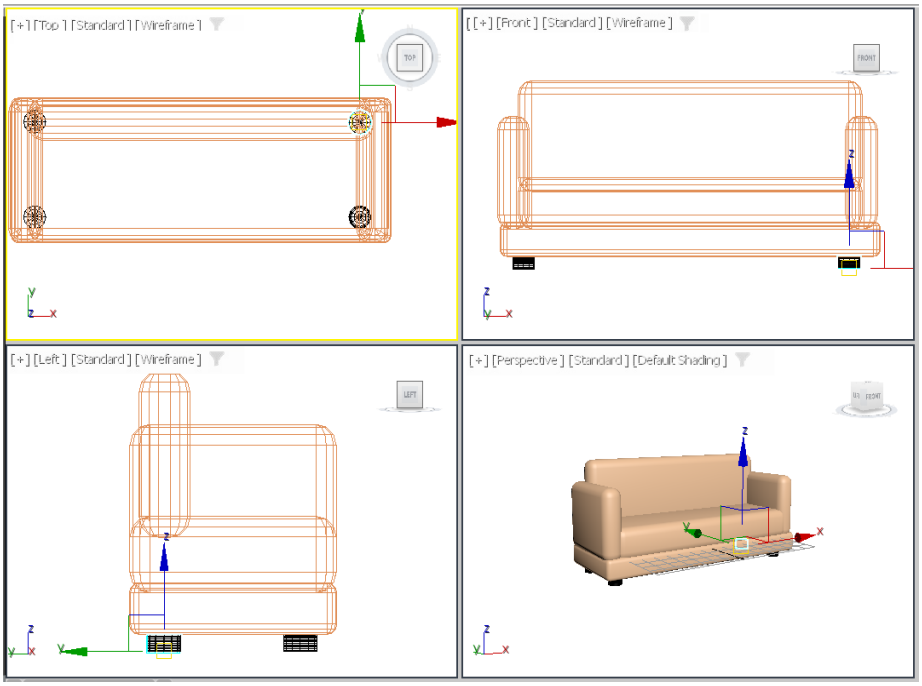


Figure 3-28 *All supports aligned in viewports*

Saving and Rendering the Scene

In this section, you will save and then render the scene. You can also view the final rendered image of this scene by downloading the *c03_3dsmax_2023_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 2023: A Comprehensive Guide*

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

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

3. Activate the Perspective viewport and then 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 Figure 3-29.



Figure 3-29 *The final output after rendering*

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Tutorial 2

In this tutorial, you will create the model of a chair, as shown in Figure 3-30, using the extended primitives and modifiers. **(Expected time: 40 min)**

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create seat support.
c. Create back support.
d. Create spring support.
e. Create leg support.
f. Create legs.
g. Create the rollers for legs.
h. Create right hand support.
i. Create left hand support.
j. Save and render the scene.



Figure 3-30 *The model of a chair*

Creating the Project Folder

Create a new project folder with the name *c03_tut2* at *\Documents\3dsmax2023* and then save the file with the name **c03tut2**, as discussed in Tutorial 1 of Chapter 2.

Creating Seat Support

In this section, you need to create a chamfer box primitive to create seat support of the chair.

1. Activate the Top viewport. Choose **Create > Geometry** from the **Command Panel**; the **Standard Primitives** option is displayed by default in the drop-down list. Select the **Extended Primitives** option from the list and then choose the **ChamferBox** tool from the **Object Type** rollout.

2. Expand the **Keyboard Entry** rollout and set the values as follows:

   Length: **90.0** Width: **100.0** Height: **17.0**
   Fillet: **10.0**

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3. Choose the **Create** button; a chamfer box is created.

4. Make sure the chamfer box is selected. In the **Parameters** rollout, set the value **10** in the **Fillet Segs** spinner; the chamfer box is modified, as shown in Figure 3-31.

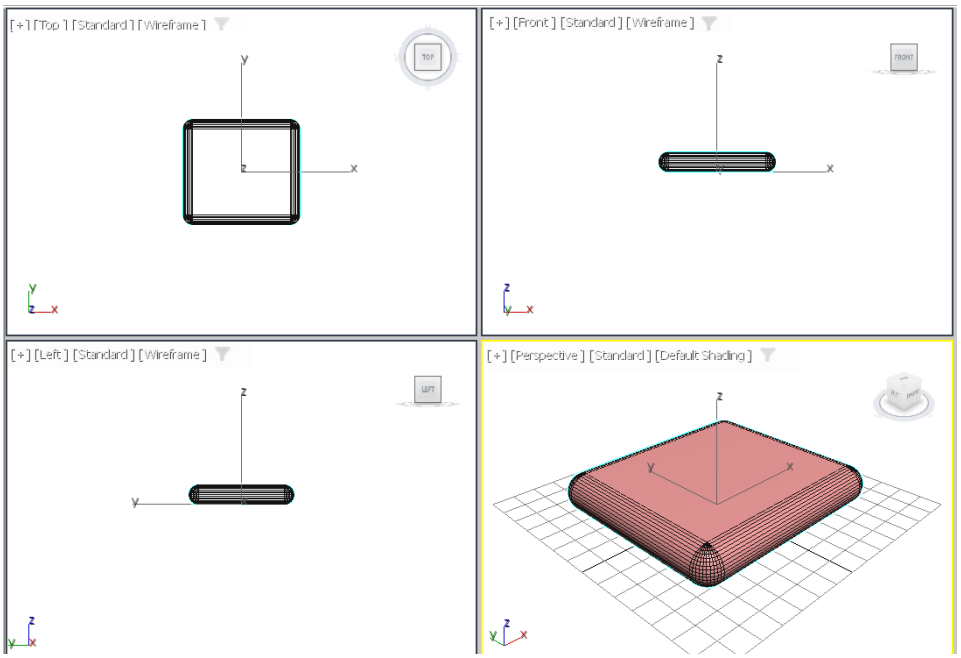


Figure 3-31 *The chamfer box created for seat support of the chair*

5. In the **Name and Color** rollout, enter **seat support** as the name of the chamfer box and press ENTER.

6. Use the color swatch to modify the color of *seat support* by entering the values as follows:

Red: **88** Green: **199** Blue: **225**

Creating Back Support

In this section, you will use the **ChamferBox** tool from the extended primitives to create back support for the chair.

1. Activate the Front viewport and make sure that the **ChamferBox** tool is chosen.

2. Expand the **Keyboard Entry** rollout and set the values as follows:

X: **0.0** Y: **65.0** Z: **-65.0** Length: **90.0**
Width: **100.0** Height: **19.633** Fillet: **10.0**

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3. Choose the **Create** button; a chamfer box is created. In the **Parameters** rollout, make sure the value in the **Fillet Segs** spinner is set to **10** and enter **back support** as the name of the chamfer box in the **Name and Color** rollout, refer to Figure 3-32.

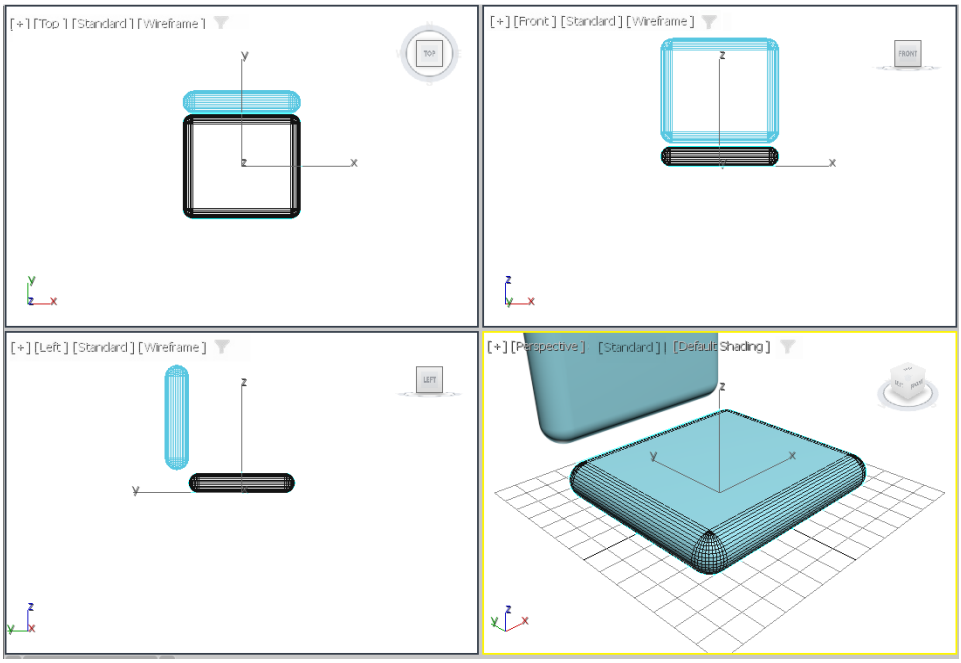


Figure 3-32 *The back support geometry in viewports*

4. Choose the color swatch and assign the same color to *back support* that you assigned to *seat support*.

5. Choose the **Zoom Extents All** tool to display the objects properly in all viewports.

   Next, you need to create the spring support to join *seat* and *back support*.

Creating Spring Support

In this section, you will create spring support by using the **Hose** tool from the extended primitives.

1. Activate the Top viewport. Choose **Create > Geometry** from the **Command Panel**. Make sure that the **Extended Primitives** option is selected in the drop-down list and then choose the **Hose** tool from the **Object Type** rollout.

2. In the Top viewport, press and hold the left mouse button and drag the cursor to specify the radius of the hose, and then release the left mouse button. Next, move the cursor up to specify the height of the hose and click on the viewport; a hose is created.

3. In the **Name and Color** rollout, enter **spring support** as the name of the hose and press ENTER. Also, modify the color of *spring support* to black.

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4. In the **Hose Parameters** rollout, set the values of *spring support* as follows:

End Point Method Area
Make sure that the **Free Hose** radio button is selected.

Free Hose Parameters Area
Height: **25.815**

Common Hose Parameters Area
Cycles: **9**

Use the default values for the other options in this area.
Smoothing Area
Make sure the **All** radio button is selected.

Hose Shape Area
Make sure the **Round Hose** radio button is selected.

Diameter: **15.0** Sides: **8**

After setting the values in the **Hose Parameters** rollout, align *spring support* in the viewports, as shown in Figure 3-33.

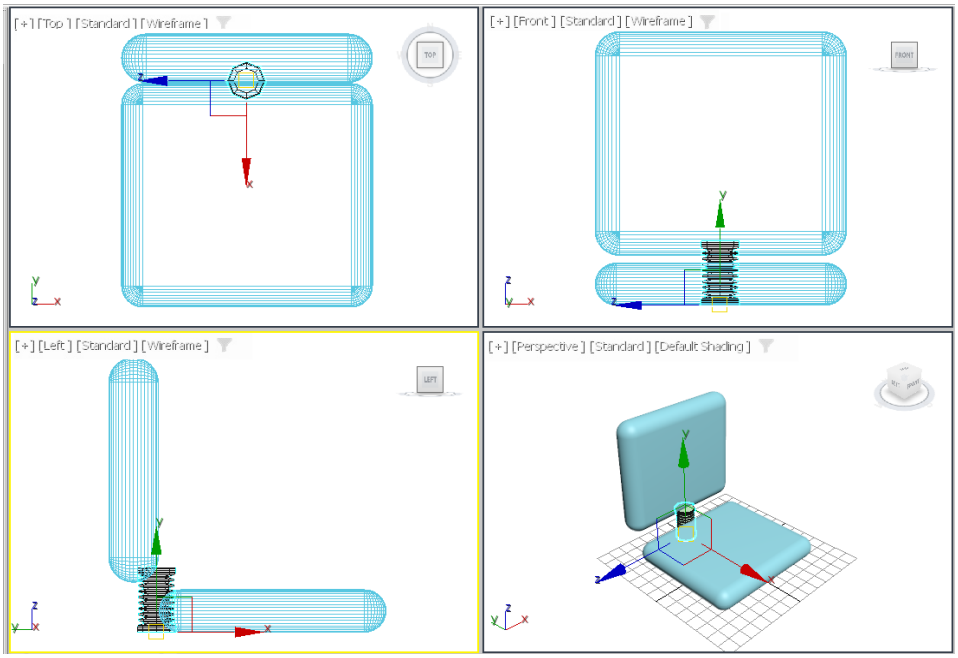


Figure 3-33 *The spring support geometry in viewports*

Next, you will apply the **Bend** modifier to *spring support* to join *seat* and *back support*.

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5. Make sure *spring support* is selected and then choose **Modifiers > Parametric Deformers > Bend** from the menu bar; the **Bend** modifier is displayed in the modifier stack. Also, the **Parameters** rollout is displayed in the **Modify** tab.

6. In the **Parameters** rollout of the **Bend** modifier, set the values as follows:

   Bend Area
   Angle: **90.0** Direction: **90**

   Bend Axis area
   Make sure the **Z** radio button is selected.

7. After entering the values, *spring support* is displayed, as shown in Figure 3-34.

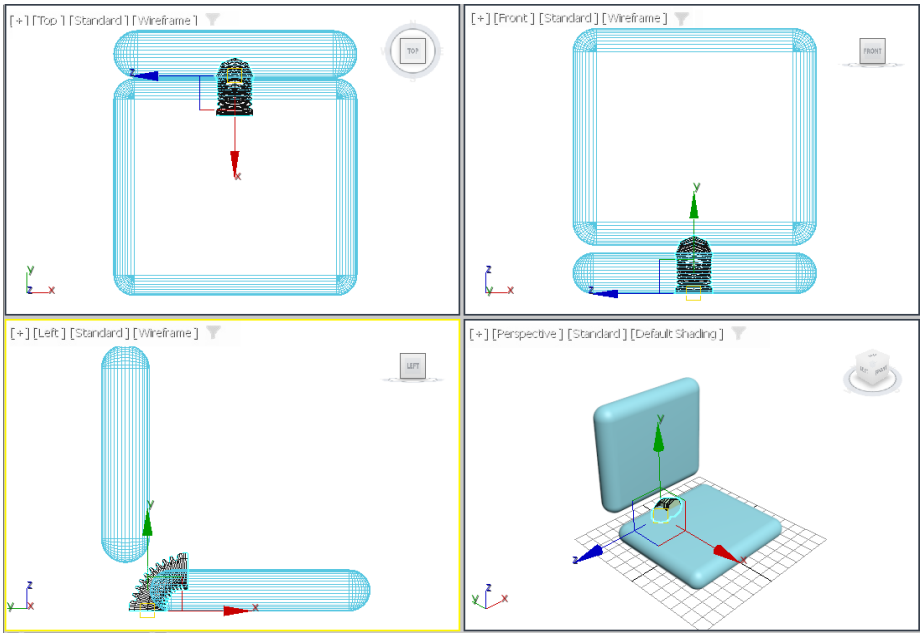


Figure 3-34 *The spring support geometry after applying the* ***Bend*** *modifier*

Next, you will align *spring support*.

8. Activate the Left viewport and make sure that *spring support* is selected. Choose the **Zoom Extents Selected** tool; *spring support* is zoomed in the Left viewport, as shown in Figure 3-35.

9. Right-click on the **Select and Rotate** tool; the **Rotate Transform Type-In** dialog box is displayed. In the **Offset: Screen** area, set **90** in the **Z** spinner and press ENTER; *spring support* is rotated, as shown in Figure 3-36. Now, close the **Rotate Transform Type-In** dialog box.

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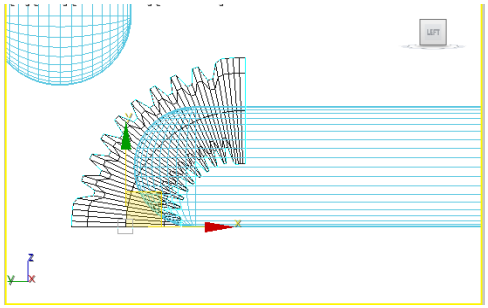


Figure 3-35 *The spring support geometry zoomed in the Left viewport*

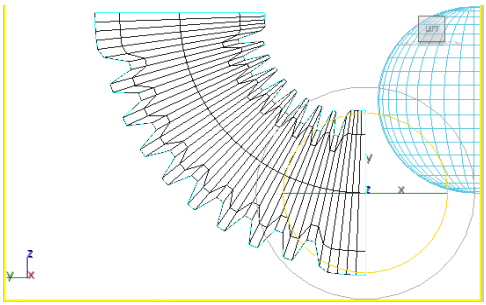


Figure 3-36 *The spring support geometry rotated in the Left viewport*

10. Choose the **Select and Move** tool and align *spring support*, as shown in Figure 3-37.

11. Choose the **Zoom Extents All** tool to display all the objects properly in the viewports, refer to Figure 3-38.

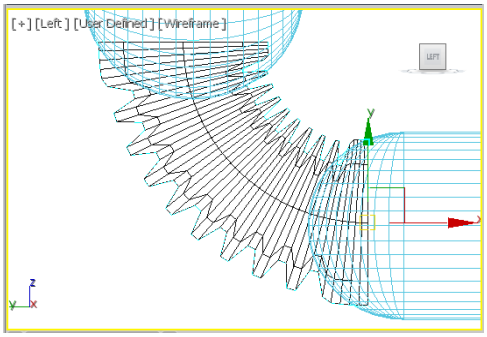


Figure 3-37 *Alignment of spring support in the Left viewport*

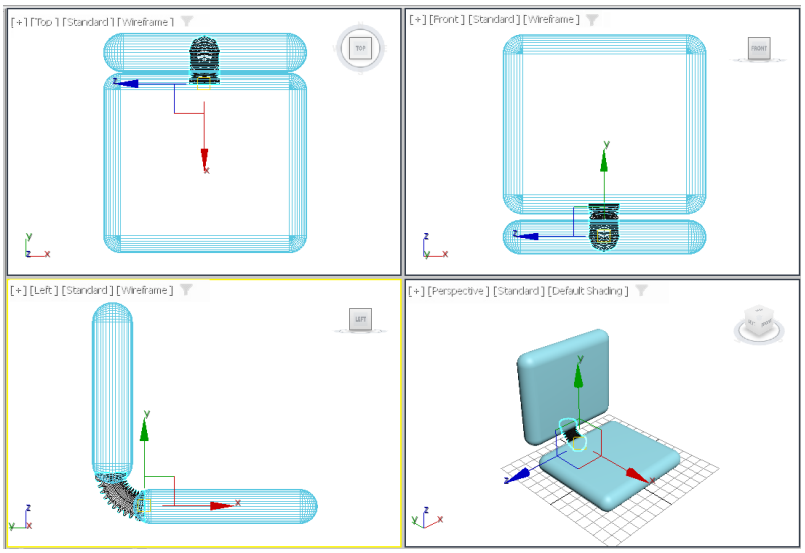


Figure 3-38 *Alignment of spring support in the viewports*

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Creating Leg Support

Now, you need to create leg support. You will use the **Hose** tool from the extended primitives to create it.

1. Activate the Top viewport and then create a hose object as discussed earlier.

2. In the **Name and Color** rollout, enter **leg support** as the name of the hose and press ENTER. Also, modify the color of *leg support* to black.

3. In the **Hose Parameters** rollout, set the values of *leg support* as follows:

   End Point Method Area
   Make sure that the **Free Hose** radio button is selected.

   Free Hose Parameters Area
   Height: **42.0**

   Common Hose Parameters Area
   Make sure that the **Flex Section Enable** check box is selected.
   Starts: **22.0** Ends: **82.0**
   Cycles: **10**

   Make sure the value in the **Diameter** spinner is **-20.0**.

   Smoothing Area
   Make sure the **All** radio button is selected.

   Hose Shape Area
   Make sure the **Round Hose** radio button is selected.

   Diameter: **17.0** Sides: **8**

4. Make sure *leg support* is selected and then choose **Modifiers > Mesh Editing > Weighted Normals** from the menu bar; the **Weighted Normals** modifier is displayed in the modifier stack. Also, the **Weighted Normals** rollout is displayed in the **Modify** tab.

5. In the **Weighted Normals** rollout of the **Weighted Normals** modifier, make sure the **Angle** button is chosen in the **Weighting** area. Deactivate the **Area** button. Make sure the **Use Convex Corner Angle** check box is selected. Now, set the values as follows:

   Hard Edge Detection Area
   Select the **By Edge Angle** check box.
   Select the **Smoothing Group** check box
   By Edge Angle: **180**

   Smoothing area
   Smoothing: **1** Hard Edge Blending: **1**

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6. Choose the **Select and Move** tool and align *leg support* in the viewports, as shown in Figure 3-39.

Creating Legs

In this section, you will use the **ChamferBox** tool from **Extended Primitives** to create legs of the chair.

1. Activate the Top viewport and choose the **ChamferBox** tool.

2. Expand the **Keyboard Entry** rollout and set the values as follows:

   X: **-29** Y: **0.0** Z: **-42.0** Length: **5.748**
   Width: **44.0** Height: **7.0** Fillet: **2.0**

3. Choose the **Create** button; a chamfer box is created.

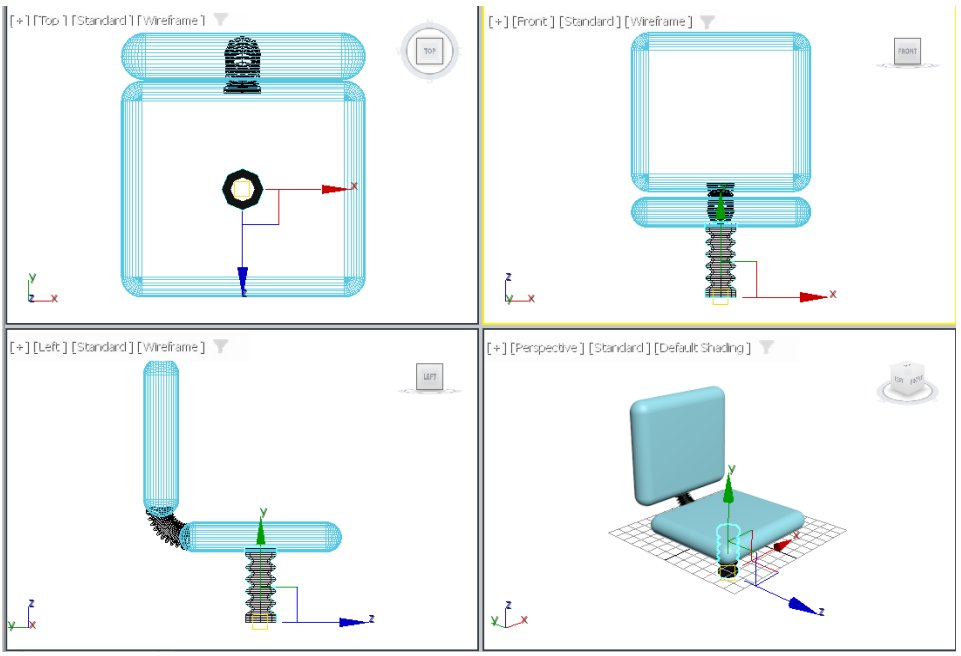


Figure 3-39 *Alignment of leg support in the viewports*

4. Make sure the chamfer box is selected. In the **Parameters** rollout, set the values as follows:

   Length Segs: **10** Width Segs: **10** Height Segs: **10**

   Make sure the value in the **Fillet Segs** is **10**.

   After entering the values, the chamfer box is modified.

5. In the **Name and Color** rollout, enter **leg01** as the name of the chamfer box and press ENTER. Also, modify its color to black.

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6. Choose the **Select and Move** tool and align *leg01* with *leg support* in the viewports, as shown in Figure 3-40.

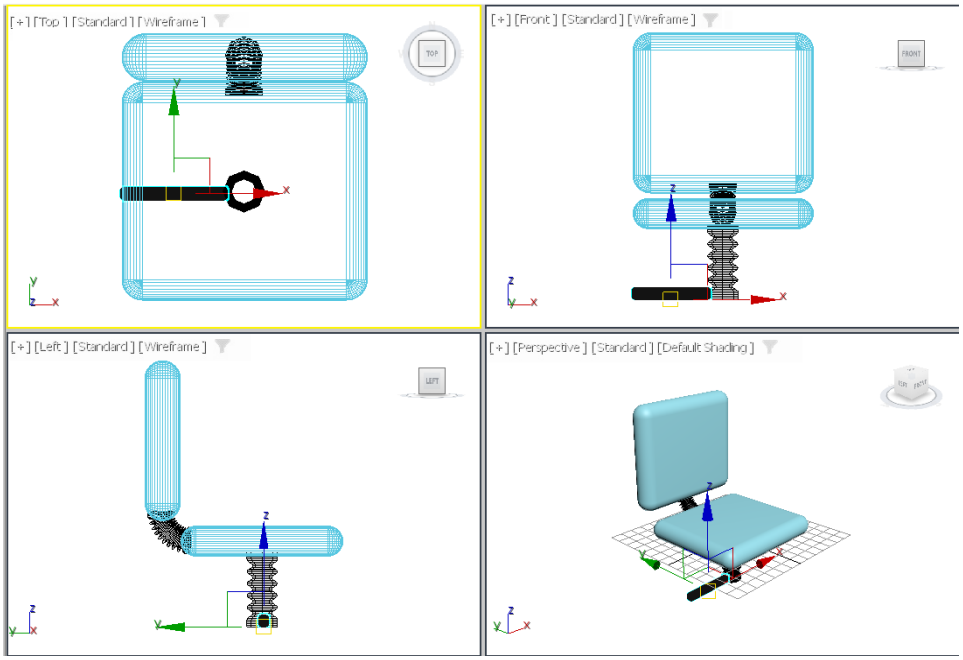


Figure 3-40 *Alignment of leg01 in the viewports*

Now, you need to apply the **Taper** modifier to *leg01* to taper it.

7. Make sure that *leg01* is selected, and then choose the **Zoom Extents All Selected** tool; *leg01* is zoomed in all viewports, as shown in Figure 3-41.

8. Choose **Modifiers > Parametric Deformers > Taper** from the menu bar; the **Taper** modifier is displayed in the modifier stack. Also, the **Parameters** rollout is displayed in the Modify tab.

9. In the **Parameters** rollout of the **Taper** modifier, set the values as given below:

Taper Area
Amount: **0.53**

Taper Axis Area
Select the **X** radio button in the **Primary** group and make sure the **ZY** radio button is selected in the **Effect** group.

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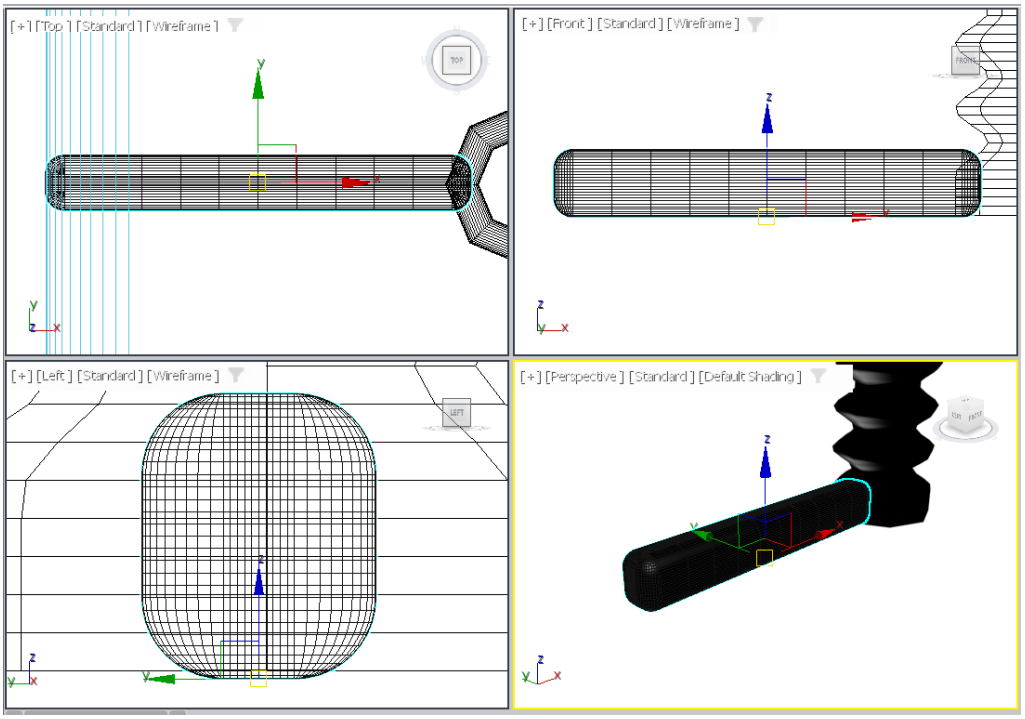


Figure 3-41 *The leg01 geometry after invoking the* ***Zoom Extents All Selected*** *tool*

10. After entering the values, *leg01* is tapered, as shown in Figure 3-42.

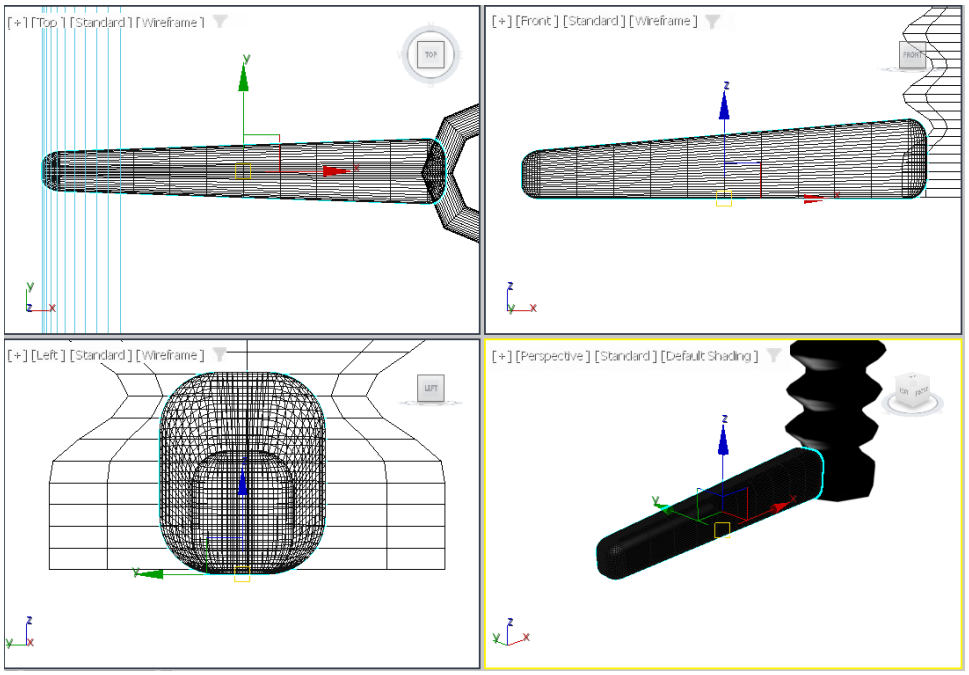


Figure 3-42 *The leg01 geometry displayed in viewports after applying the* ***Taper*** *modifier*

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Creating the Rollers for Legs

In this section, you will create rollers. You will use the chamfer box and chamfer cylinder primitives to create them.

1. Activate the Top viewport and choose the **ChamferBox** tool.

2. Expand the **Keyboard Entry** rollout and set the values as follows:

X: **-40**	Y: **0.0**	Z: **-20.0**	Length: **7.032**
Width: **14.816**	Height: **1.799**	Fillet: **1.0**	

3. Choose the **Create** button; a chamfer box is created.

4. Make sure that the chamfer box is selected. In the **Parameters** rollout, make sure the value in the Length Segs, Width Segs, Height Segs, and Fillet Segs spinners is **10**.

5. In the **Name and Color** rollout, enter **box01** as the name of the chamfer cylinder. Also, modify its color to black.



Note

*To view box01 in viewports, you need to adjust the view by invoking the **Zoom** and **Pan View** tools.*

Next, you will apply the **Bend** modifier to *box01*.

6. Choose **Modifiers > Parametric Deformers > Bend** from the menu bar; the **Bend** modifier is displayed in the modifier stack. Also, the **Parameters** rollout is displayed in the Modify panel.

7. In the **Parameters** rollout of the **Bend** modifier, set the values as follows:

Bend Area
Angle: **173.5**
Bend Axis Area
Select the **X** radio button.

8. After applying the **Bend** modifier, *box01* is displayed, as shown in Figure 3-43.

Next, you need to create a chamfer cylinder.

9. Make sure the **Extended Primitives** option is selected in the drop-down list of the **Command Panel**. Now, choose the **ChamferCyl** tool from the **Object Type** rollout.

10. Activate the Top viewport and expand the **Keyboard Entry** rollout. Set the values as follows:

X: **-40**	Y: **0.0**	Z: **-20.0**
Radius: **5.0**	Height: **7.0**	Fillet: **1.0**

11. Choose the **Create** button; a chamfer cylinder is created.

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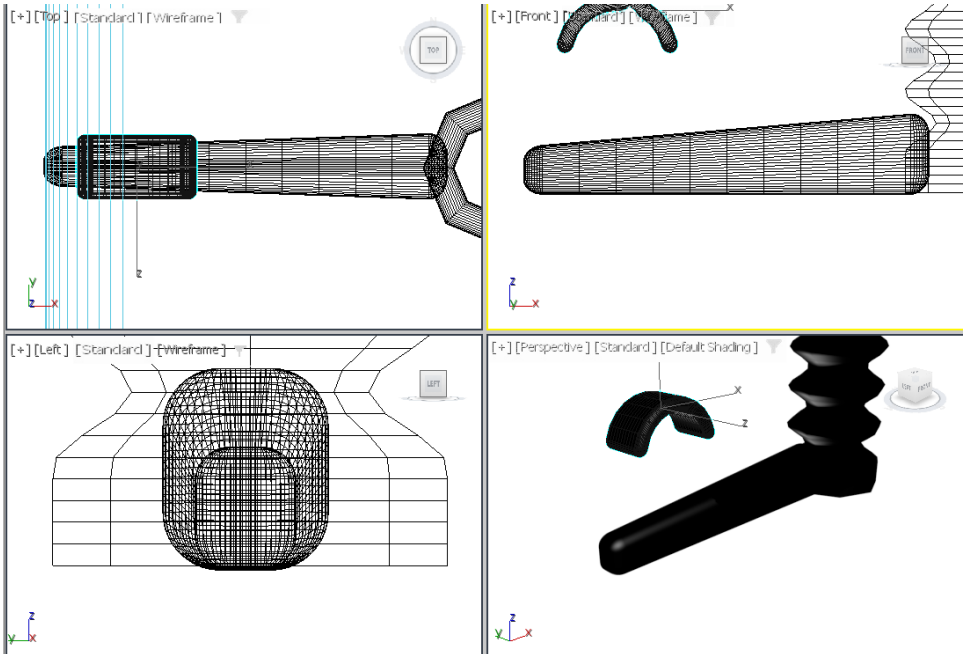


Figure 3-43 *The box01 geometry displayed in viewports after applying the* ***Bend*** *modifier*

12. Make sure the chamfer cylinder is selected. In the **Parameters** rollout, set the values as follows:

    Height Segs: **10** Fillet Segs: **10** Cap Segs: **11**

    Make sure the value in the **Sides** spinner is **12** and the **Smooth** check box is selected.

13. In the **Name and Color** rollout, enter **cylinder01** as the name of the chamfer box and press ENTER. Also, modify the color of chamfer box by specifying the values as follows:

    Red: **151** Green: **151** Blue: **151**

14. Align *cylinder01* with *box01* in the viewports using the **Select and Rotate** and **Select and Move** tools, refer to Figure 3-44.

    Next, you need to group *cylinder01* and *box01*.

15. Select *cylinder01* and *box01* from the Scene Explorer and right-click; a quad menu is displayed. Choose **Add Selected to > New Group** from the quad menu; the **Group** dialog box is displayed.

16. Enter **roller01** in the **Group name** text box and choose the **OK** button; the group is named as *roller01*.

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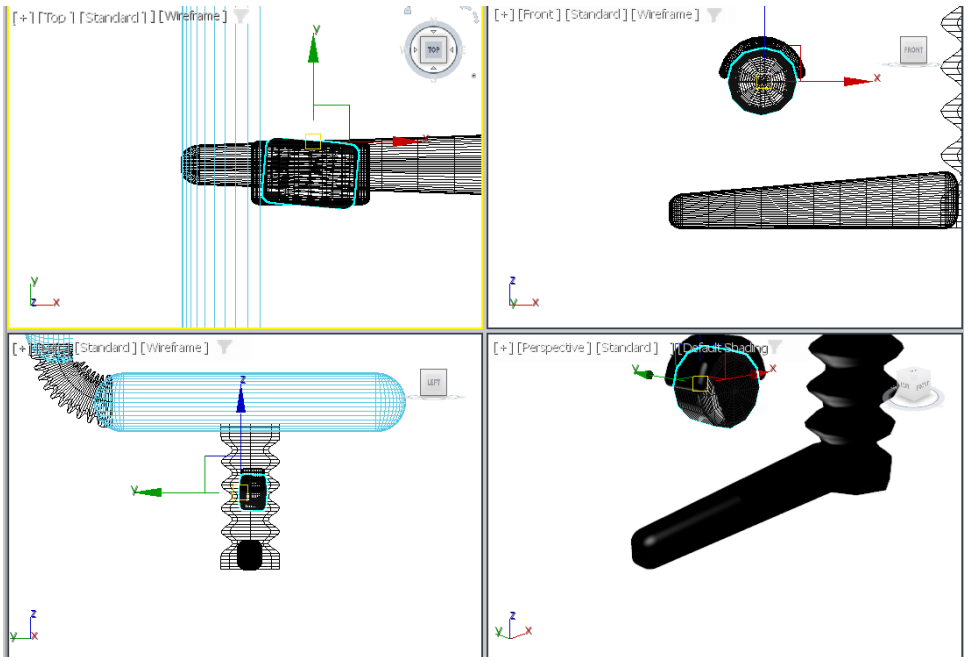


Figure 3-44 *Alignment of cylinder01 with box01 in viewports*

17. Using the **Select and Move** and **Select and Rotate** tools, align *roller01* with *leg01* in all viewports, as shown in Figure 3-45.

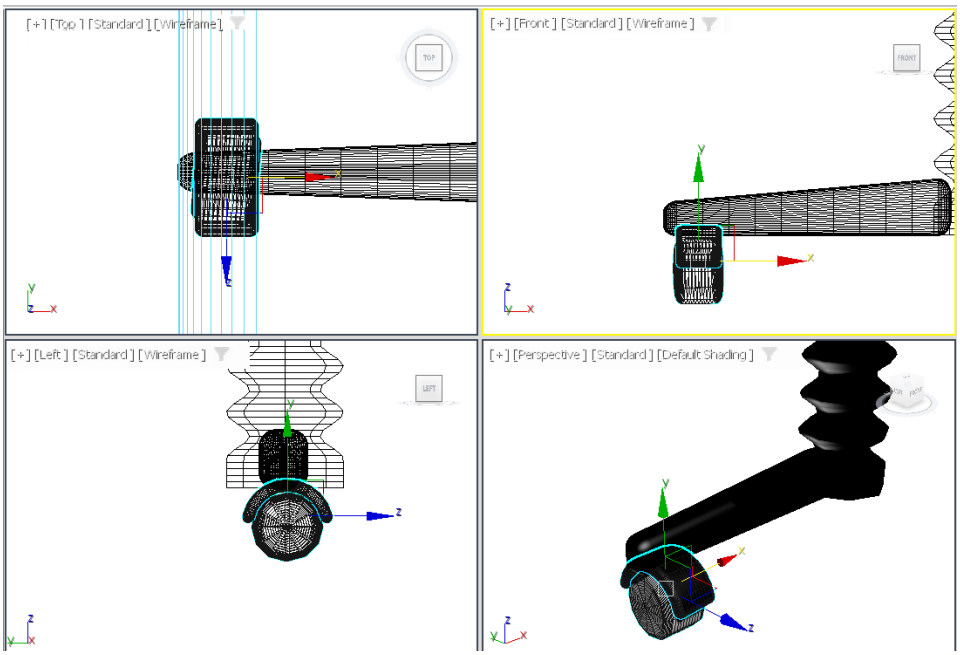


Figure 3-45 *Alignment of roller01 with leg01 in viewports*

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18. Group *leg01* and *roller01* as *f_leg01* as done earlier.

19. Choose the **Zoom Extents All** tool to view all the objects in the viewports.

    Next, you need to create other legs for the chair using the same dimensions. To do so, you need to copy *f_leg01*.

20. Activate the Top viewport and make sure *f_leg01* is selected. Now, choose the **Hierarchy** tab from the **Command Panel**. In the **Pivot** tab, choose the **Use Working Pivot** button in the **Working Pivot** rollout; a gizmo is displayed at the center of the scene. Also, the **USE WP** text is displayed below the viewport label in the viewports.

    The working pivot point enables you to rotate *f_leg01* about an arbitrary and persistent point in the scene without affecting the original pivot point of the object.

21. Activate the Top viewport and then choose the **Select and Rotate** tool; a circular gizmo is displayed, as shown in Figure 3-46.

22. Move the cursor over the Z-axis that is blue in color; it get highlighted in yellow color. Now, press and hold the SHIFT key as well as the left mouse button and drag the cursor until the value in the **Z** spinner in the coordinate display is around **-72**, refer to Figure 3-47. Release the left mouse button; the **Clone Options** dialog box is displayed. Make sure that the **Copy** radio button is selected. Set **4** in the **Number of Copies** spinner. Choose the **OK** button; *f_leg002*, *f_leg003*, *f_leg004*, and *f_leg005* are displayed in the viewports, as shown in Figure 3-48.

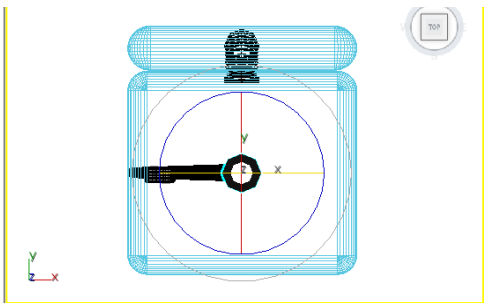


Figure 3-46 *A circular gizmo displayed at the location of the working pivot point*

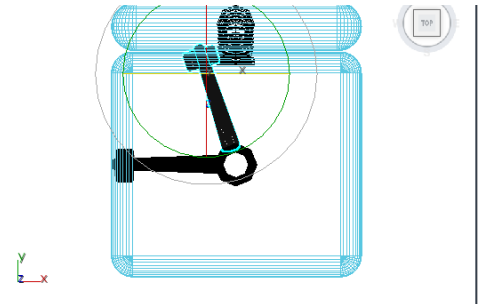


Figure 3-47 *The f_leg01 group rotated about* ***-72*** *degrees with respect to the working pivot point*

23. Click and deactivate the **Use Working Pivot** button in the **Working Pivot** rollout; the cursor moves to its original position. Also, the USE WP text disappears from the viewport label in the viewports.

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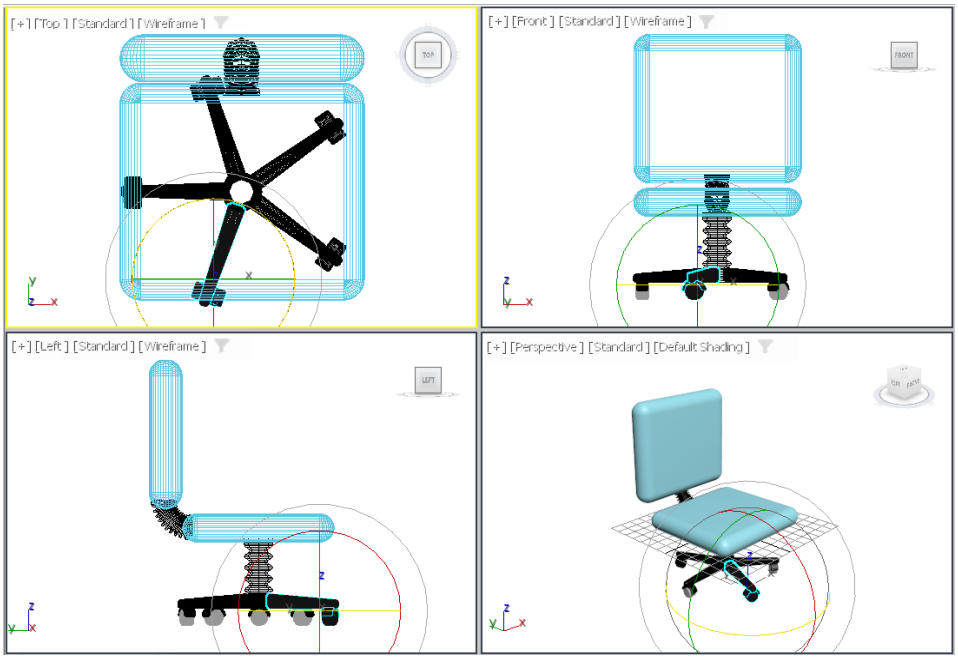


Figure 3-48 *The f_leg002, f_leg003, f_leg004, and f_leg005 in viewports*

Creating Right Hand Support

In this section, you will use the **Box** tool from **Standard Primitives** to create right hand support of the chair.

1. Activate the Top viewport and choose **Create > Geometry** from the **Command Panel**. Now, select the **Standard Primitives** option from the drop-down list. Also, choose the **Box** tool from the **Object Type** rollout.

2. Expand the **Keyboard Entry** rollout and set the values as follows:

   Length: **5.515** Width: **9.0** Height: **55.0**

3. Choose the **Create** button; a box is created.

4. In the **Parameters** rollout, set the values as given below:

   Length Segs: **15** Width Segs: **15** Height Segs: **15**



Note

The more the number of segments in an object, the smoother will be its surface when you apply a modifier to it.

5. In the **Name and Color** rollout, enter **right hand support01** as the name of the box and press ENTER. Also, change its color to black. Next, you need to apply the **Bend** modifier to *right hand support01* to give it the shape of a hand rest.

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6. Make sure that *right hand support01* is selected and then apply the **Bend** modifier to it as discussed earlier.

7. In the **Parameters** rollout of the **Bend** modifier, set the parameters as follows:

Bend Area
Angle: **107.5** Direction: **270.0**
Bend Axis Area

Make sure the **Z** radio button is selected.

8. Align *right hand support01* in all viewports, as shown in Figure 3-49.

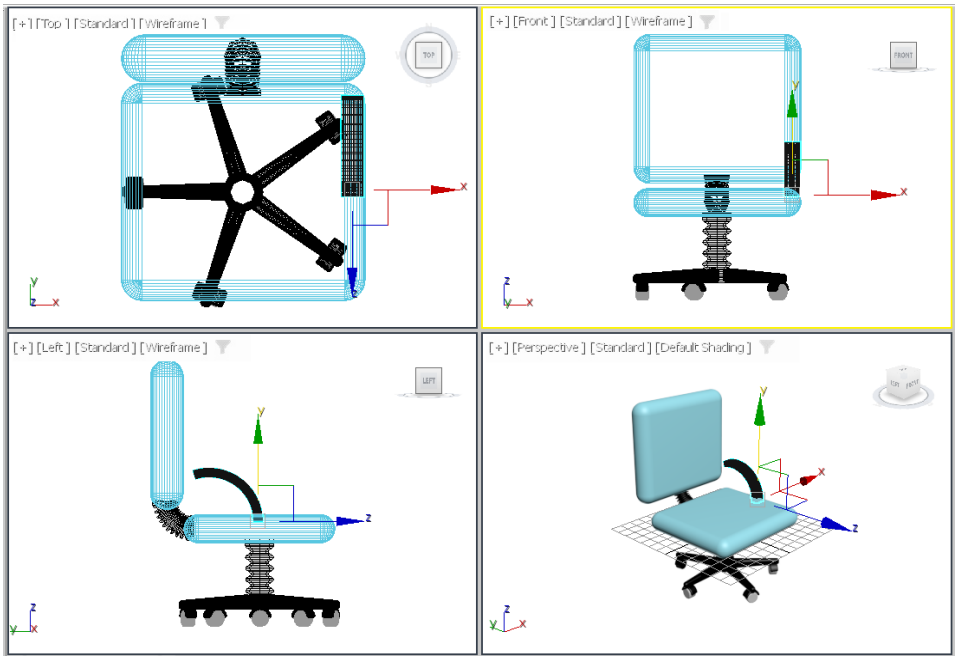


Figure 3-49 *Alignment of right hand support01 in viewports*

Next, you need to create the second part of *right hand support01*. To do so, you need to copy *right hand support01*.

9. Activate the Top viewport, select *right hand support01,* and then create its copy; the copy is automatically named as *right hand support002*.

10. In the **Parameters** rollout of the **Bend** modifier, set the values as follows:

Bend Area
Angle: **90** Direction: **180**

Bend Axis Area
Make sure the **Z** radio button is selected.

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Limits Area
Select the **Limit Effect** check box.
Upper Limit: **18.0**

11. After entering the values, *right hand support002* is modified, as shown in Figure 3-50.

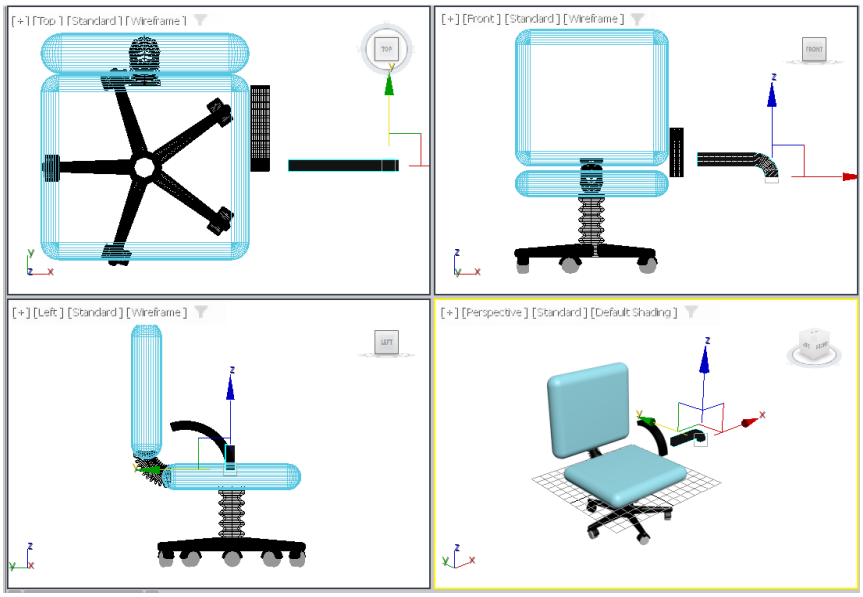


Figure 3-50 *The right hand support002 geometry after modifying the values of the* ***Bend*** *modifier*

12. Align *right hand support002* in viewports using the **Select and Move** and **Select and Rotate** tools, as shown in Figure 3-51.

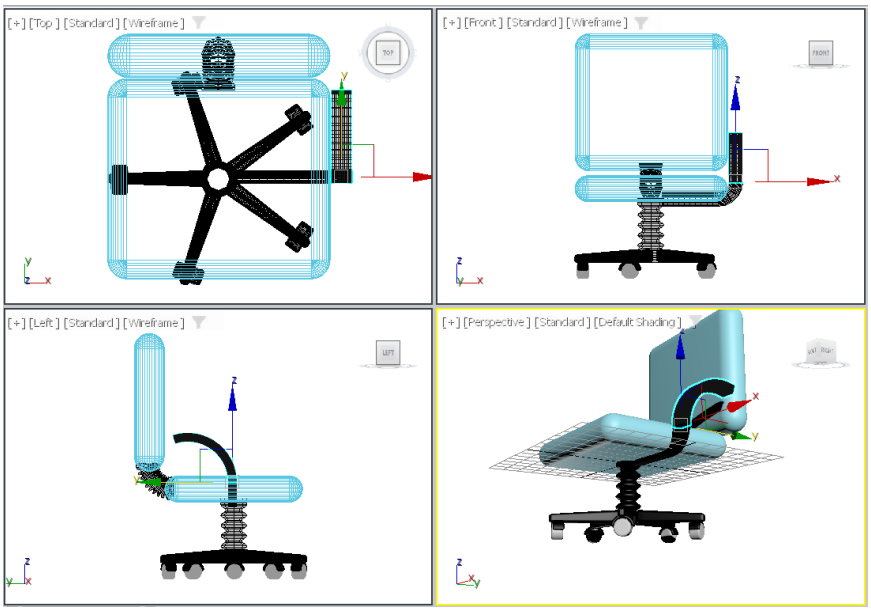


Figure 3-51 *Alignment of right hand support002 in viewports*

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Note

*You can use the **Orbit** tool in the Perspective viewport to view the proper alignment of right hand support002 in viewports.*

13. Select *right hand support01* and *right hand support002* and group them as *right hand support*.

14. Choose the **Zoom Extents All** tool to view all the objects in the viewports.

Creating Left Hand Support

In this section, you will create a copy of *right hand support* to create a support for the left hand.

1. Activate the Top viewport, select *right hand support*.

2. Choose the **Mirror** tool from the **Main Toolbar**; the **Mirror: Screen Coordinates** dialog box is displayed, as shown in Figure 3-52.

3. In this dialog box, make sure that the **X** radio button is selected in the **Mirror Axis** area and set -81.4 in the **Offset** spinner. Next, select the **Copy** radio button in the **Clone Selection** area and then choose the **OK** button.

   Figure 3-53 shows *left hand support* in the viewports.

Saving and Rendering the Scene

In this section, you will save and then render the scene. You can also view the final rendered image of this scene by downloading the *c03_3dsmax_2023_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 2023: A Comprehensive Guide*

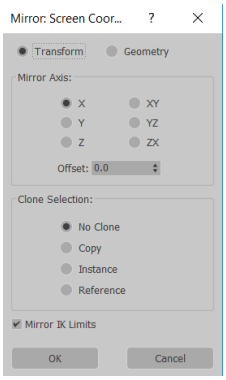


***Figure 3-52** The **Mirror: Screen Coordinates** dialog box*

1. Change the background color of the scene to white by following the steps given in Tutorial 1 of Chapter 2 .

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

3. Activate the Perspective viewport. Next, choose the **Render Production** tool from the **Main Toolbar**; the **Rendered Frame** window is displayed showing the final output of the scene, refer to Figure 3-54.

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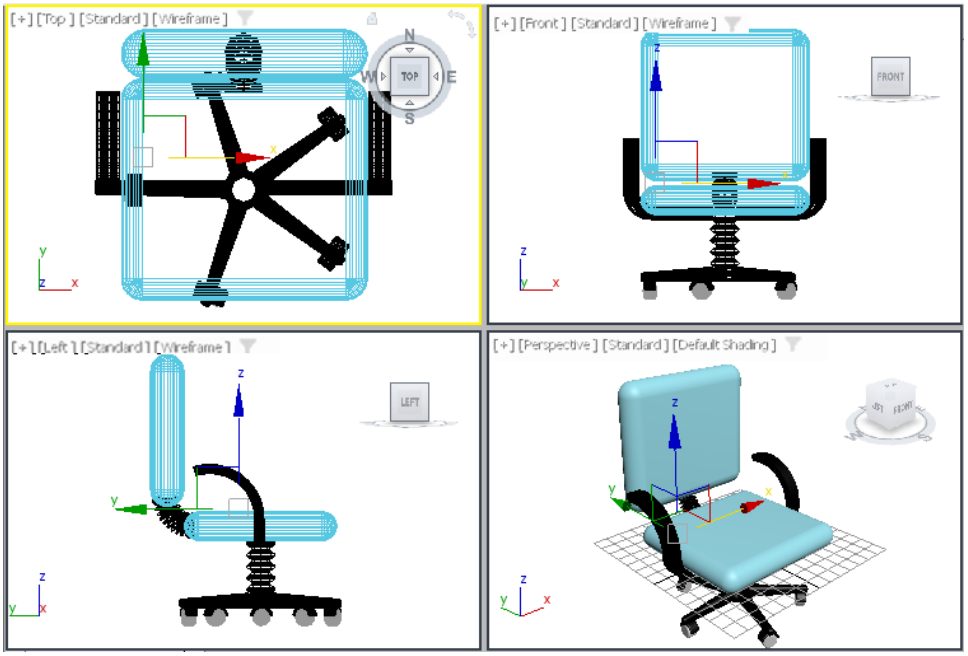


Figure 3-53 *The left hand support geometry in viewports*



Figure 3-54 *The final rendered output*

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Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. Which of the following modifiers is used to bend an object along its axis?

   (a) **Bend** (b) **Taper**
   (c) **Percent Snap Toggle** (d) None of these

2. Which of the following tools in the extended primitives, when invoked, do not display the **Creation Method** and **Keyboard Entry** rollouts?

   (a) **RingWave** (b) **Hedra**
   (c) **Hose** (d) All of these

3. Which of the following radio buttons is selected by default in the **RingWave Timing** area of the **Parameters** rollout?

   (a) **No Growth** (b) **Cyclic Growth**
   (c) **Grow and Stay** (d) None of these

4. Which of the following spinners is used to bevel the top and bottom cap edges of a chamfer cylinder?

   (a) **Sides** (b) **Fillet**
   (c) **Cap Segs** (d) **Fillet Segs**

5. The value in the _____ spinner in the **Bend** area of the **Bend** modifier is used to define the angle of bend along the X, Y, or Z axis.

6. The options in the _____ area are used to change the shape of the outer edge of the ringwave and define the breakup of the outer edge.

7. The _____ spinner in the **Taper** area of the **Taper** modifier is used to define the amount of taper.

8. You can modify the height of the free hose by setting the value in the _____ spinner of the **Free Hose Parameters** area. (T/F)

9. In the **RingWave Size** area, the **Radius** spinner is used to define the outer radius of the ringwave. (T/F)

10. The options in the **Inner Edge Breakup** area are used to change the shape of the inner edge of the ringwave. (T/F)

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Review Questions

Answer the following questions:

1. Which of the following command sequences is followed to create a hedra from the **Command Panel**?

   (a) **Create > Extended Primitives > Hedra**
   (b) **Create > Geometry > Extended Primitives > Object Type** rollout **> Hedra**
   (c) **Create > Standard Primitives > Hedra**
   (d) **Create > Shape > Extended Primitives > Object Type** rollout **> Hedra**

2. Which of the following radio buttons is selected by default in the **Family** area of the **Parameters** rollout while creating a hedra?

   (a) **Tetra** (b) **Star1**
   (c) **Star2** (d) **Dodec/Icos**

3. Which of the following three shapes of the polygonal facets are there in a polyhedron?

   (a) triangle, square, and rectangle (b) triangle, square, and octagon
   (c) triangle, square, and pentagon (d) triangle, square, and hexagon

4. Which of the following spinners is used to specify the number of segments in the fillet of a chamfer box?

   (a) **Fillet** (b) **Width Segs**
   (c) **Height Segs** (d) **Fillet Segs**

5. Which of the following is an extended primitives?

   (a) **Capsule** (b) **Chamfer Box**
   (c) **Chamfer Cylinder** (d) All of these

6. In the **Parameters** rollout of the **Taper** modifier, the **Primary** area is used to define the _____ axis and the **Effect** area is used to define the _____ from the primary axis.

7. In the **Limits** area of the **Parameters** rollout of the **Bend** modifier, the default value in the **Upper Limit** and **Lower Limit** spinner is _____.

8. In the **Parameters** rollout of the chamfer cylinder, the **Slice On** check box is used to specify the start and end angle of the chamfer cylinder. (T/F)

9. The **Taper** modifier is used to bend an object in angular increments. (T/F)

10. In the **Family Parameters** area of the **Parameters** rollout of the hedra, the combined value of the **P** and **Q** spinners can be either equal to or less than 1.0. (T/F)

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EXERCISES

The rendered output of the models used in the following exercises can be accessed by downloading the *c03_3dsmax_2023_exr.zip* file from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2023: A Comprehensive Guide*

Exercise 1

Create the model of a stool shown in Figure 3-55 using your own dimensions.

(Expected time: 30 min)



Figure 3-55 *The model of a stool*

Exercise 2

Create the models shown in Figures 3-56 and 3-57 by using your own dimensions.

(Expected time: 30 min)



Figure 3-56 *The model of a table*



Figure 3-57 *The model of a chair*

Answers to Self-Evaluation Test

1. a, **2.** d, **3.** a, **4.** b, **5. Angle**, **6. Outer Edge Breakup**, **7 Amount**, **8. Height**, **9.** T, **10.** T

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