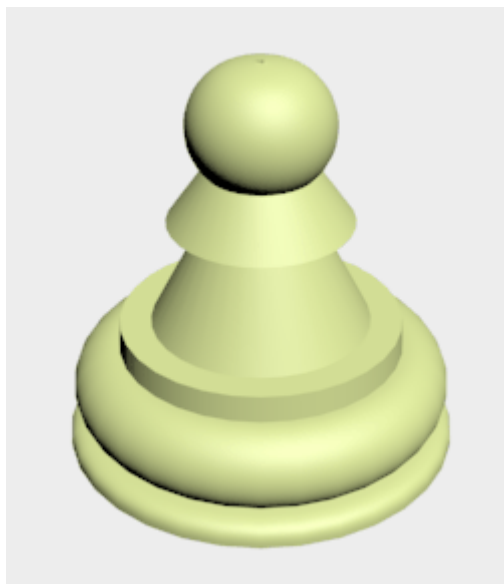


Modeling a Pawn

In this lesson, you will model a pawn for a set of chessmen. In a wooden chess set of standard design, pawns are turned on a lathe. You will use **3ds max** to do something similar: draw the pawn's outline, and then use a **Lathe** modifier to fill out its geometry. The **Lathe** modifier revolves the outline around a central point to create a shape, not unlike the way wood is turned on a machine lathe.



Features and techniques covered in this lesson:

- Using spline shapes to draw an outline of an object.

- This lesson also briefly introduces you to spline editing.

- Splines are a type of curve that is interpolated between two endpoints and two or more tangent vectors. The term dates from 1756, and derives from a thin wood or metal strip used for drafting curves in architecture and ship design.

- Using **2D snap** to help control spline drawing.

- Using the **Lathe** modifier to turn a 2D outline into a 3D model.

Skill Level: Beginner

Time to complete: 15 minutes


Set up the lesson:

Start **3ds max** or choose **File > Reset** if the program is already running.

No startup file is necessary for this tutorial.

Set up the grid and 2D snap:


You need to choose **2D snap** options that will help you draw the outline. 2D snap can snap to the **home grid** that appears in viewports, or to other geometry in the scene. You also need to adjust the **home grid** so it is easy to see your work.

-  On the toolbar, click and hold down the **Snap** flyout and choose the **2D snap** type. The **2D Snap** Toggle is located on a flyout of **2D/3D snap** options.



2. Right-click the **2D Snap** Toggle. The **Grid And Snap Settings** dialog appears.
3. On the dialog's Snaps tab, turn on **Grid Points** and **Grid Lines**.
4. On the dialog's **Options** tab, set **Snap Preview** Radius to **10**, and set **Snap Radius** to **10**.
5. Close the **Grid And Snap Settings** dialog by clicking the **X** button in the upper-right corner of the dialog's window.





Warning: The Clear All button at the bottom of the dialog clears all your snap settings. It is easy to confuse this button with a Close button!

6.  In the Front viewport, and Zoom in until the viewport is a little over 10 grid squares high.

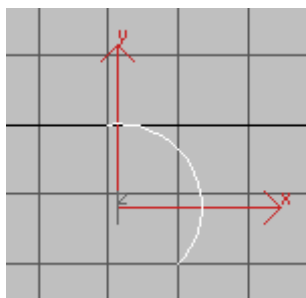
Now you are ready to begin drawing.

Start the pawn's outline:

You will draw the pawn's outline from the top down, beginning with the "knob" on top.

1.  On the **Create** panel, click **Shapes**  , then click **Arc**. 
2.  Make sure that **2D Snap** is turned on.
3. In the Front viewport, drag from a grid point near the top center, to the point one square to the right and two squares down. Release the mouse, then drag until you have an **arc** to the right side that corresponds to the top of the pawn.

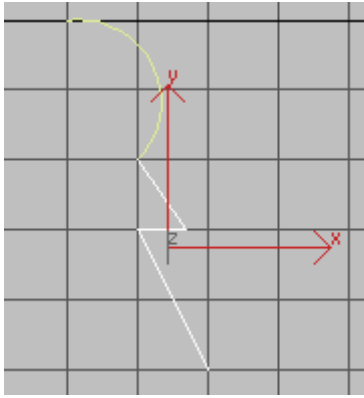
The top of the **arc** should not rise much above the grid line (otherwise, the pawn will result with a dent on top).



First draw an arc like this.

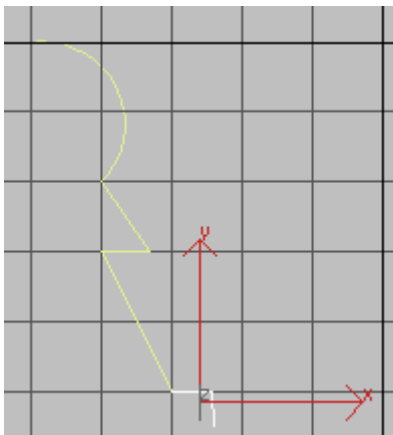
Yellow snap indicators should appear while your cursor is over a grid point or a grid line.

4. For the body of the pawn, click **Line**. Draw a zigzag downward from the grid point where you finished the **Arc**. Drag from that point to the bottom edge of the same square. Click to set the new point, then drag horizontally to the grid point on the left. Click to set another point. Finally, drag to the point two squares down and one to the right. Click to set the last point of the **Line**, and then right-click to end Line creation.



Next draw a zigzag line.

- The top of the base of the pawn has a small ledge. Draw this as another Line with two segments: just drag to the right a bit, click, and then drag down (ignoring snaps for the last point). Right-click to complete this Line.



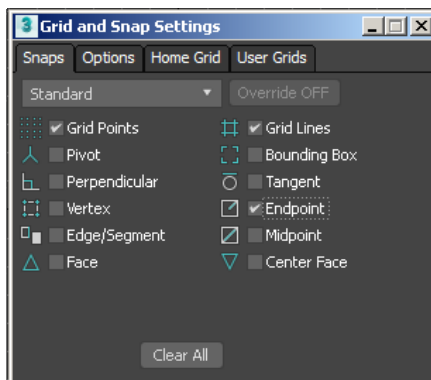
Add the ledge

You are now ready to complete the base.

Complete the pawn's outline:



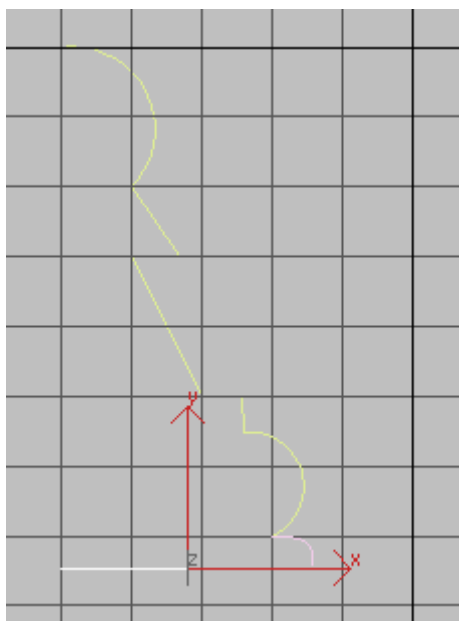
- Right-click **2D Snap** again. In the **Grid And Snap Settings** dialog, make sure **Endpoint** is on. (Leave **Grid Points** and **Grid Lines** turned on as well.) Because you didn't use snap for the end of the last Line, you need something else to "grab onto" while completing the outline.



- Close the **Grid And Snap Settings** dialog by clicking the **X** button in the upper-right corner of the dialog's window.



- Make sure that **2D Snap** is turned on.
- Turn on **Arc** again. Drag from the endpoint of the line that forms the "ledge" at the top of the base, to the grid point of the next square down, and to the right of the ledge.



Finish the lathe profile



7. Turn off **2D Snap**.

8. Save the file as **my_pawn.max**.

Tip: Make a **MyTutorials** folder on your hard disk to store the files you create with these tutorials.

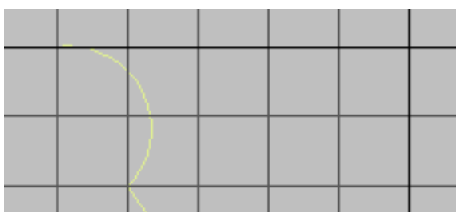
Edit the outline:

Tip: At this point, you can continue with the file you created in the previous steps, or you can open the file **pawn_outline_completed.max**, and continue from there.

Before you use the **Lathe** modifier, the outline should be consolidated into a single spline, rather than a collection of individual spline objects. To do this, you convert it to an **Editable Spline**.



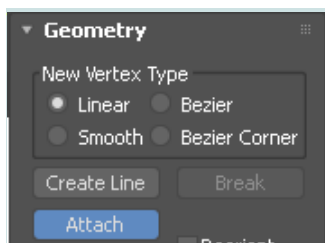
1. In the Front Viewport select the arc at the top of the pawn's outline.



2. Right-click, and on the **Transform** (lower-right) quadrant of the **quad** menu, choose **Convert To > Convert To Editable Spline**.

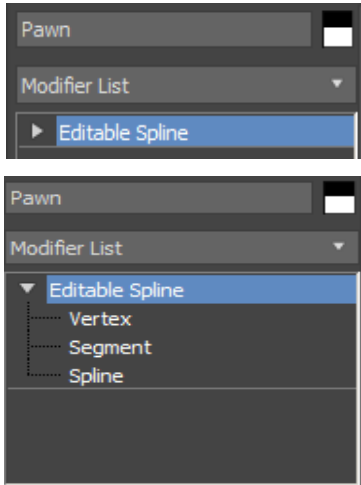


3. Go to the **Modify** panel. In the name field at the top of the panel, rename the object from **Arc01** to **Pawn**.
4. On the **Geometry** rollout, click **Attach**, and then click each of the other splines that make up the outline.



Now the **pawn** outline is a single object.

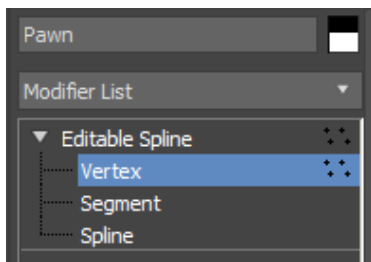
- The **modifier stack** display is the window near the top of the **Modify** panel. In this window, click the triangle icon next to **Editable Spline**, to show elements of the spline geometry.



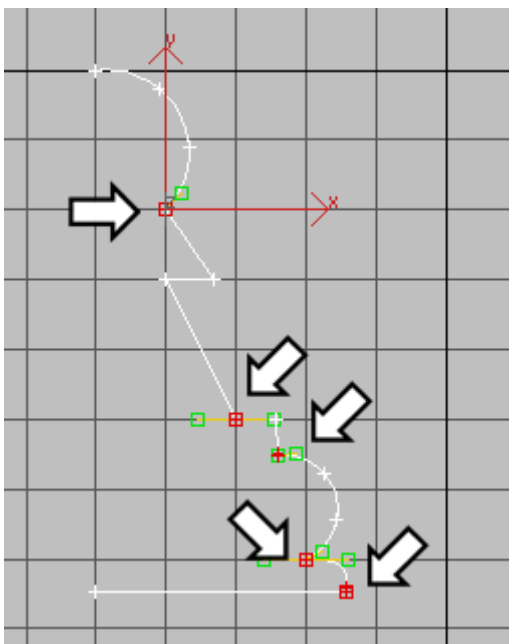
Editable splines and **editable** surfaces are made of various elements known as “sub-objects.” **Editable splines** have three sub-object levels, as the stack display shows: **Vertex**, **Segment**, and **Spline**. The **Spline sub-object** level corresponds to the individual splines you created in previous steps.

You are going to “clean up” some of the vertices to make the outline simpler.

- Click the **Vertex** entry to highlight it. The **Vertex** sub-object level is now active.





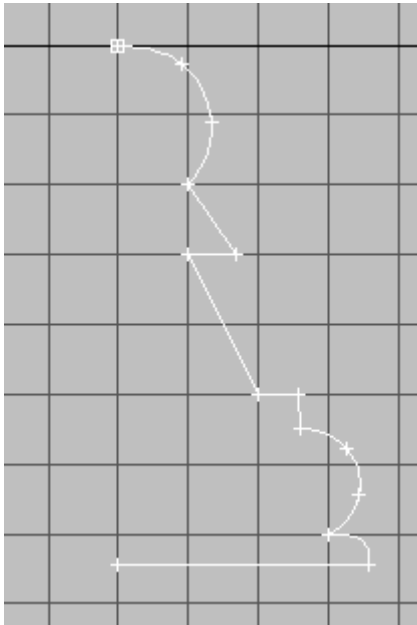
The original splines overlap at their endpoints. In most cases, **3ds max** displays these double vertices with an additional box around them.



Overlapping vertices shown selected in red, and indicated by arrows.

- On the **Geometry** rollout, increase the value of Weld to **1.0** (this is the spinner to the right of the Weld button).

8.  Click **Select** (this turns off **Attach**). Select the upper overlapping endpoints by dragging a box around them. (Just clicking might select only one of the two vertices.) Then hold down **CTRL** while you drag a select box around the other overlapping endpoints.
9.  Click **Weld**. Look in the Geometry rollout, further down. The outline is now a single spline, instead of the six original ones. It has fewer vertices, and no redundant ones.

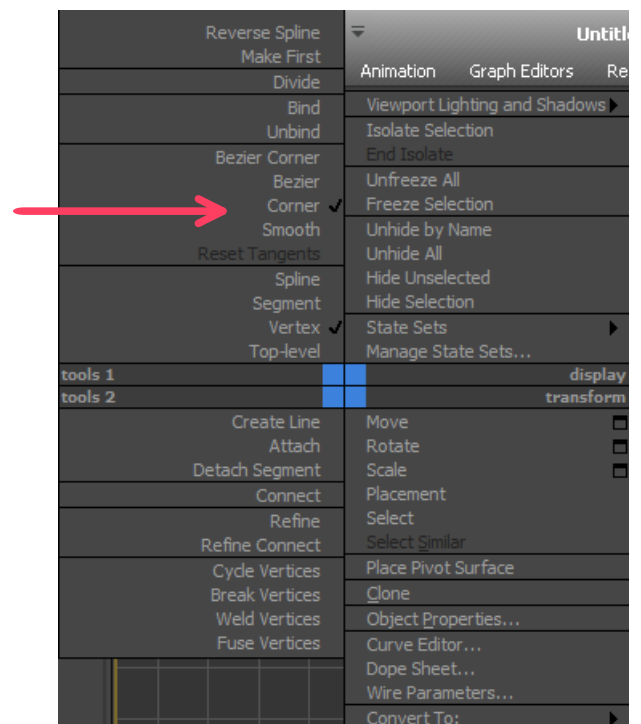
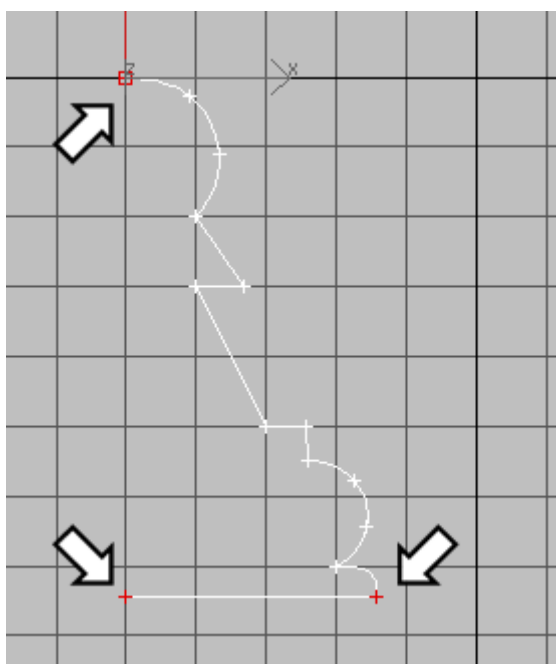


10. Choose **File > Save**.

Turn some vertices into corners:

Sometimes curvature can “creep in” to a spline. To avoid this, and to get a clean top to the pawn, you will make some vertices into **Corner** vertices.

1. Right-click the topmost vertex, and choose **Corner** from the Tools 1 (upper-left) quadrant of the **quad** menu.



2. Repeat step one for the two bottom vertices.

Arrows show the three vertices to make into Corner vertices.

The other options for vertex type, **Bezier**, **Bezier Corner**, and **Smooth**, all generate more curvature than **Corner**.



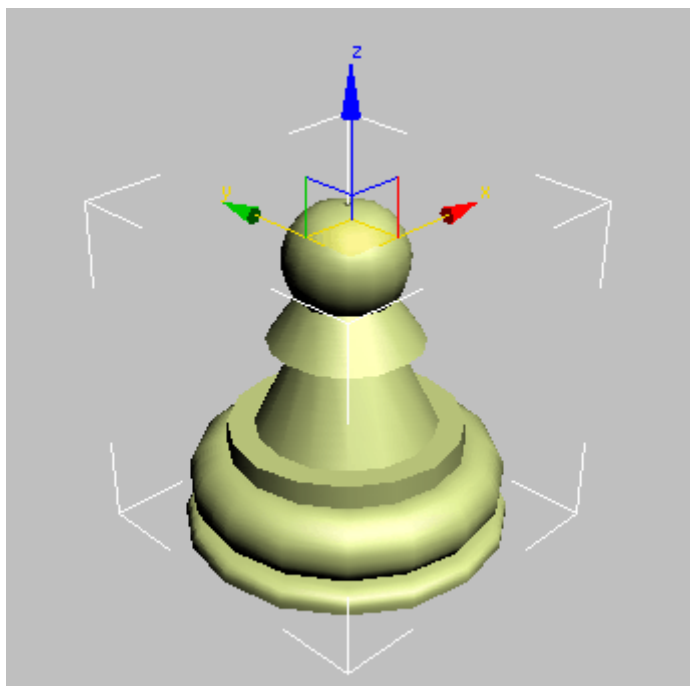
Tip: The **lathe** comes out best if the bottom of the piece is completely horizontal. At this point, you might want to move the lower-left vertex so the bottom line is completely flat. Be careful not to move this vertex left or right, however. It needs to be directly below the top vertex for the lathe to be clean.

3. Click the **Editable Spline** entry in the modifier stack display. This turns off the **Vertex** sub-object level.
4. Choose **File > Save**.

Lathe the outline:

Tip: At this point, you can continue with the file you created in the previous steps, or you can open the file **pawn_outline_edited.max**, and continue from there.

1. Select the pawn and click **Modifier List** above the modifier stack display. This is a drop-down list of various modifiers.
2. From the list, choose **Lathe**. If you type **L**, all modifiers starting with L will be proposed one by one. The pawn is now a 3D object.

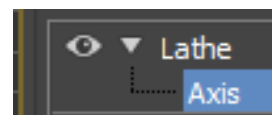


Tip: If your pawn model looks different from this, on the **Parameters** rollout of the **Lathe** modifier, find the **Direction** group and click **Y**. If it still looks funny, or "inside out," turn on **Flip Normals**.

Tip: If your pawn model looks too "fat" or "skinny" , click on the small triangle sign to the left of "**Lathe**"



This will give you access to the Lathe axis.



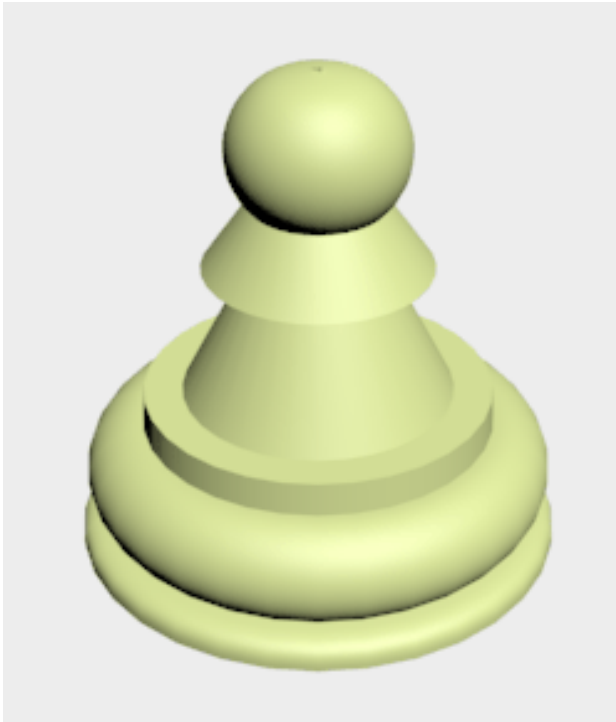
Click on the **Axis** name to make it active (blue).

If you move the axis on the model pulling the red **Gizmo** arrow to the left or right, you can adjust how "fat" you want your pawn.

3. As you can see in the Perspective viewport (you might have to zoom in), the outline of the lathed pawn is a bit "choppy." To fix this, on the **Parameters** rollout of the **Lathe** modifier, increase the number of **Segments** to **32**.

The pawn is now smoother, as you can see if you render the Perspective viewport.

Tip: If, for some reason, you find a hole in the top or bottom of the pawn, you can apply a **Cap Holes** modifier to the object to fix the problem.



4. Choose **File > Save**. Name your file **mypawn01.max**

Summary

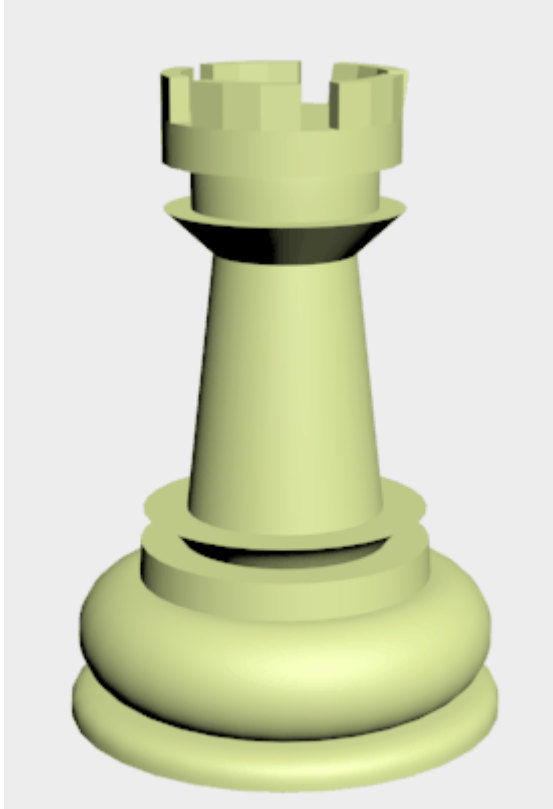
In this lesson you learned spline creation and editing. You also learned to create 3D geometry using the Lathe modifier.

Next

[Modeling a Rook](#)

Modeling a Rook

In this lesson, you will model a rook for the chess set. The base of the rook has already been created. You will add the battlement on top of the rook. If you were making a wooden chess set, this is a part of the piece for which you could not use a lathe, and so it is with the 3D model: although the base of the rook is a lathed spline, like the pawn's, its top uses a different modeling technique.



Features and techniques covered in this lesson:

Using Align to align objects.

Using face extrusion to change geometry.

Using a Boolean operation to combine two pieces of geometry.

Time to complete: 15 minutes


Set up the lesson:

Open the file **rook_base.max**.

This file contains the base of the rook.



Create a cylinder:

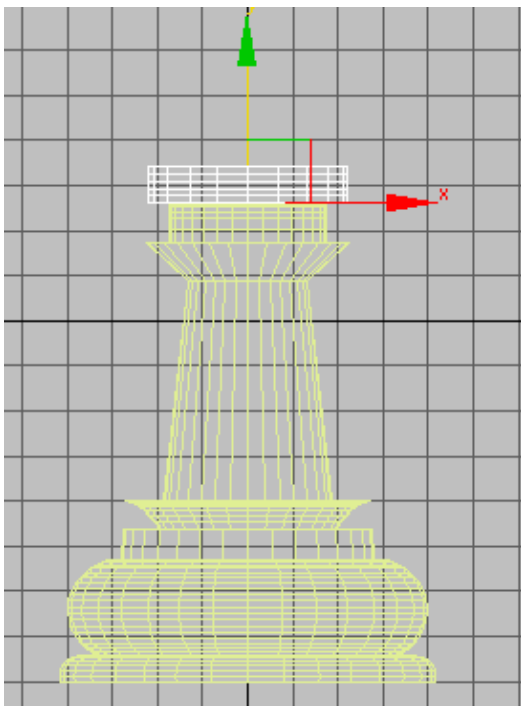
The top of the rook begins as a cylinder.

-  Go to the **Create** panel and click **Geometry**. Make sure **Standard Primitives** is chosen in the drop-down list. Click **Cylinder**.
- Create a cylinder in the Top viewport. First, drag from the center outward to set a preliminary radius. Release the mouse, and then drag to set a preliminary height.
- On the Parameters rollout, set the cylinder's **Radius** to **22.0** and its **Height** to **8.0**. Also, set **Cap Segments** to **6** and **Sides** to **20**.

These values for **Cap Segments** and **Sides** subdivide the cylinder so you can easily create a battlement after you turn the cylinder into a mesh.

Position the cylinder:

-  Make sure the cylinder is selected and the Top viewport is active. On the toolbar, click **Align**, then in the Top viewport click the base of the rook. An Align Selection dialog is displayed.
- On the dialog, make sure that **Center** is chosen in both the **Current Object** and **Target Object** groups. In the **Align Position** (Screen) group, turn on the **X**, **Y**, and **Z** positions, then click **OK**. This aligns the vertical centers of the two parts of the rook.
-  Activate the Left viewport, and click **Align** once again. Then in the Left viewport click the base of the rook.
(Align uses the XYZ axes of the active viewport.)
- In the **Align Selection** dialog, in the **Align Position** (Screen) group, turn on **Y Position**. Then in the **Current Object** group choose **Minimum**, and in the **Target Object** group choose **Maximum**. This aligns the bottom of the cylinder to the top of the base, along the viewport's Y axis.




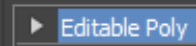
- Save this scene as **my_rook.max**.

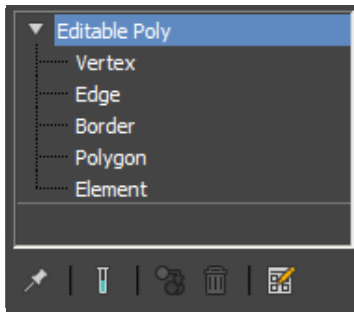
Turn the cylinder into an editable poly:

Right-click the cylinder, and from the **Transform** (lower-right) quadrant of the quad menu, choose **Convert To > Convert To Editable Poly**.

When you convert, you lose the cylinder object's explicit control over the radius, height, and so on, but you gain the ability to do various kinds of editing, including face extrusion.

Create the battlement:

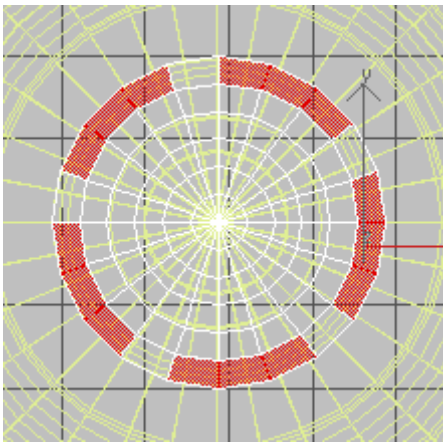
-  If you are not already there, go to the **Modify** panel.
-  Click the arrow icon to expand the **Editable Poly's** sub-object levels.
Click the **Polygon** sub-object level to make this level active.



- On the **Selection** rollout, turn on **Ignore Backfacing**.
If **Ignore Backfacing** is not turned on, you might select other faces inadvertently, and get some weird-looking extrusions.

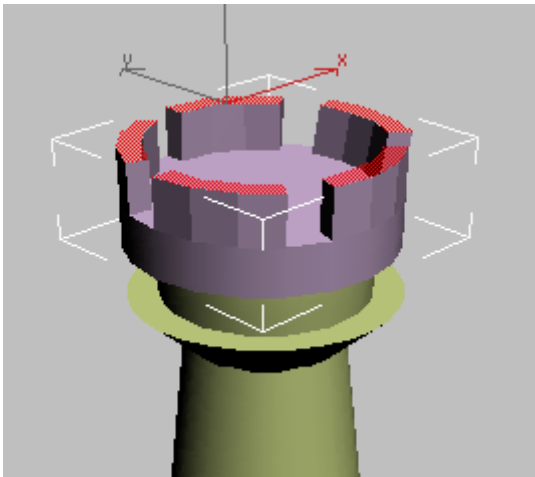


- In the Top viewport, use **CTRL** plus **Select** to select polygons around the rim of the cylinder. Select them in groups of three, leaving out every fourth polygon. You should wind up with five groups of three polygons selected.



Edge polygons selected to form the base of a battlement



- On the **Edit Geometry** rollout, set **Extrude** to **8.0**.
The faces are extruded and form the rook's battlement.

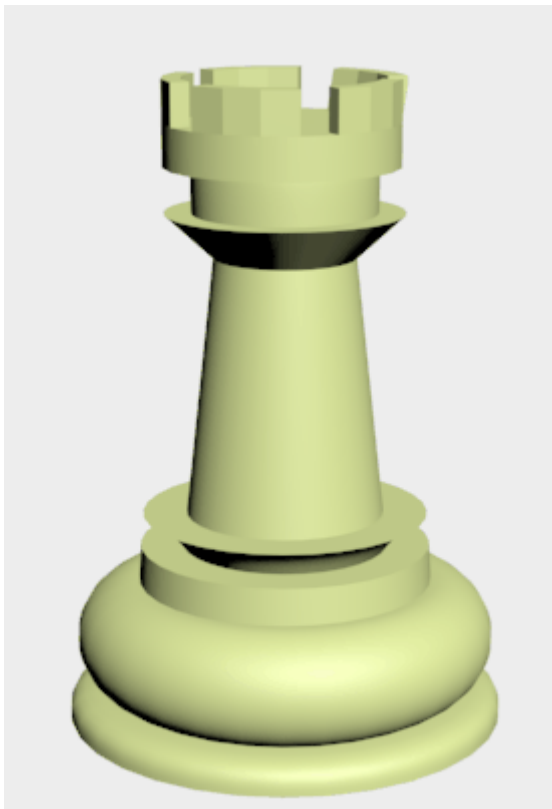


The battlement is formed of extruded faces.

- Click **Editable Poly** in the modifier stack display to exit the **Polygon** sub-object level.
- In the name field, rename the cylinder **Rook Top**.



Combine the two pieces of the rook:

1.   Go to the **Create panel, Geometry** section. Choose **Compound Objects** from the drop-down list.
2. Make sure the **Rook Top** object is selected.
3. Click **Boolean**.
The **Boolean** compound object is a way to combine two objects into one. The two components of the boolean are called operands.
4. On the **Pick Boolean** rollout, click **Add Operands**, and then pick the Rook Base object. The base disappears!
Subtraction is the default **Boolean** operation. In this case, it is not what you want.
5. On the **Parameters** rollout, in the **Operation** group, change the type of operation from **Subtraction** (A-B) to **Union**.



Tip: The “**Boolean**” topic in the user’s reference has guidelines for **Boolean** modeling. You should refer to these guidelines before you use **Boolean** yourself, to get the best results from this object type.

Consolidate your work:

1.  Select the Boolean object that combines the base and top of the rook.
2.  Go to the **Modify** panel, and in the Name field, rename the object **Rook**.
3. Right-click the rook object, and from the **Transform** (lower-right) quadrant of the quad menu, chose **Convert To > Convert To Editable Poly**.

Compound objects such as **Boolean** and modifiers such as **Lathe** add complexity to your scene, and consume system resources. Once geometry has the form you want, converting it to an editable poly can save system resources and make the scene more efficient.

Incidentally, the reason we did not convert the pawn to an editable mesh, was that we used a portion of the pawn’s outline curve to create the base for the rook and other chessmen.

4. Choose File > Save.

Summary

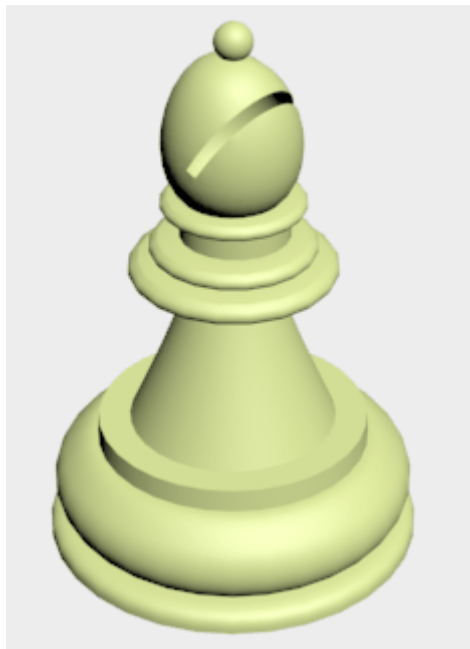
In this tutorial you learned to create new geometry using face extrusion, and to use the align tool to align objects. You also learned to add objects together using Boolean compound objects.

Next

[Modeling a Bishop](#)

Modeling a Bishop

In this lesson you will model a bishop for the chess set. As with the rook, the base of the bishop has already been created. You will add the "miter" on top of the bishop.



Features and techniques covered in this lesson:

- Using "soft selection" to create a free-form shape.
- Using Lock Selection to transform only what you want to.
- Using Boolean to subtract (instead of add) geometry.

Skill Level: Beginner

Time to complete: 15 minutes


Set up the lesson:

Open the file **bishop_base.max**.


This file contains the base of the bishop.

Create a sphere:


The top of the bishop begins as a sphere.

-  Go to the **Create** panel and click **Geometry**. Make sure **Standard Primitives** is chosen in the drop-down list, and click **Sphere**.
- In the Top viewport, drag from the center out to create a sphere. On the **Parameters** rollout, set its **Radius** to **18.0**.


Position the sphere:

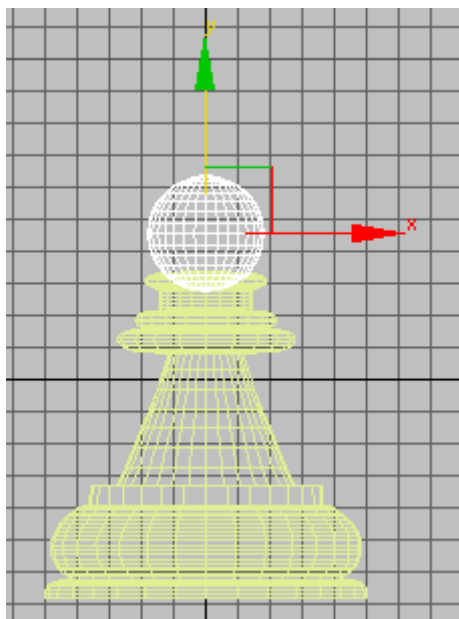
-  Make sure the sphere is selected and the Top viewport is active. On the toolbar, click **Align**. Then in the Top viewport, click the base of the bishop. An **Align Selection** dialog is displayed.
- On the dialog, make sure **Center** is chosen in both the **Current Object** and **Target Object**


groups. In the **Align Position** (Screen) group, turn on the **X**, **Y**, and **Z** positions, then click **OK**. This aligns the vertical centers of the two parts of the bishop.

-  On the status bar, click to turn on **Lock Selection**.
You are going to move the sphere, and this prevents you from accidentally moving the base instead.

Tip: **SPACEBAR** is the keyboard shortcut for **Lock Selection**.

-  In the Left viewport, move the sphere vertically. Leave part of it sunk into the top of the base.






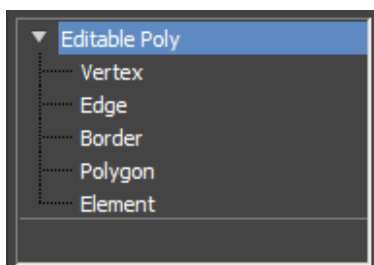
-  Turn off **Lock Selection**.
- Save this scene as **my_bishop.max**.


Turn the sphere into an editable mesh:

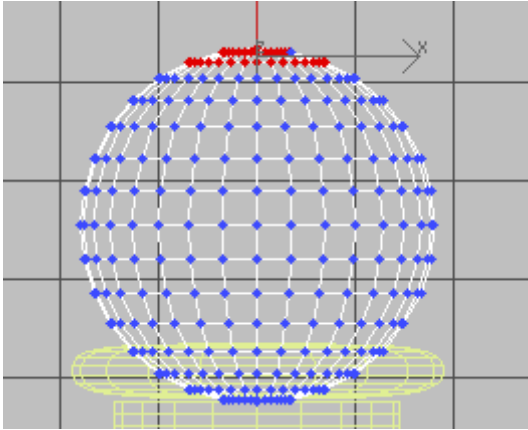
Right-click the sphere, and from the Transform (lower-right) quadrant of the quad menu, choose **Convert To > Convert To Editable Mesh**.

Use soft selection to stretch the mesh:

-  If you are not already there, go to the **Modify** panel.
-  In the Left viewport, region zoom in on the sphere at the top of the bishop. Leave a bit of space above for it to grow.
-  In the modifier stack display, click the arrow icon to expand the **Editable Poly**'s sub-object levels. Click the **Vertex** sub-object level to make this level active.

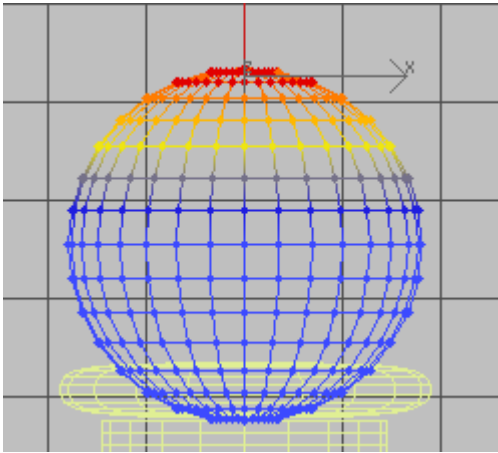


4.  In the Left viewport, drag a box to select the top two rows of vertices.

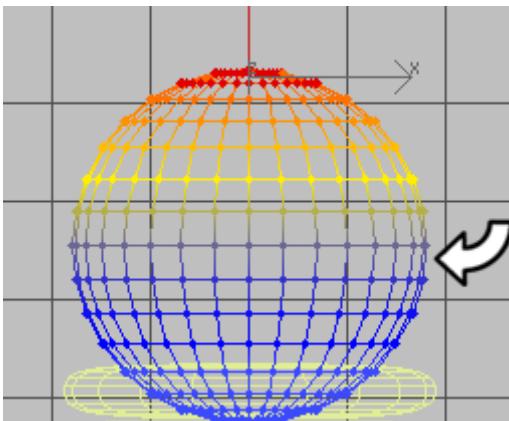


5. Go to the **Soft Selection** rollout, and turn on **Use Soft Selection**.


Soft selection provides a sort of gravity field: when **soft selection** is on and you move sub-objects, they drag other sub-objects along with them. Sub-objects affected by **soft selection** are indicated by how "hot" their color appears in viewports. The **Falloff** value controls the size of the affected area.



6. Increase the **Falloff** to about **28.0**, so **soft selection** will affect the sphere's upper vertices, but not its lower ones.

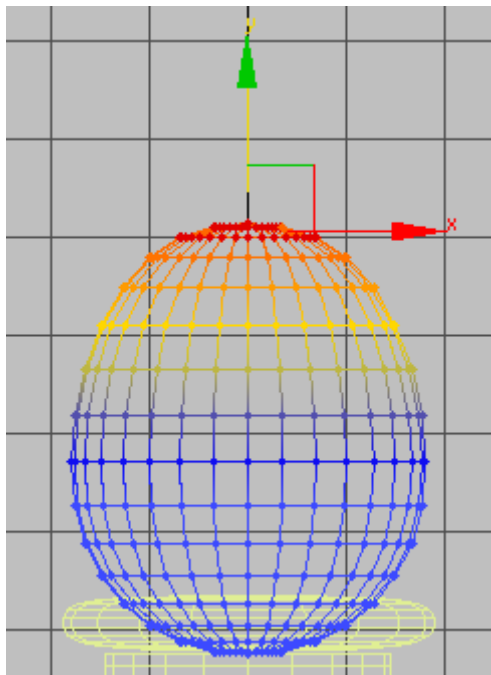


Vertices above the arrow are affected by soft selection. Vertices below it, shown in blue, are not.

7.  Turn on **Select and Move**, and move the selected vertices vertically about 8 units. (You can see the amount of units displayed in the **Y** field of the **XYZ** spinners on the status bar, below the viewports.)

Note: You can use real-world units such as inches and feet, or meters if you like. In this tutorial you are using standard generic units which have no corresponding value in the real world.







With **soft selection**, other vertices trail after the selected ones, creating a characteristic egg-like shape for the top of the bishop.

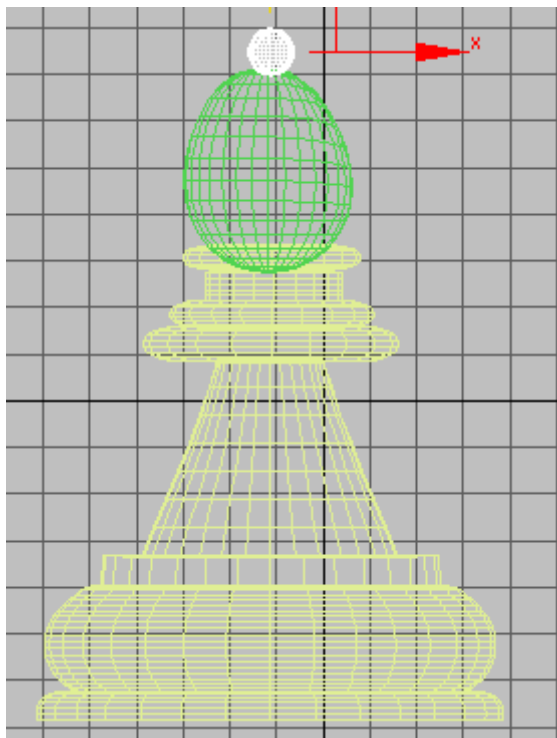


8. In the modifier stack display, click **Editable Mesh** to turn off the **Vertex** sub-object level.

Create the knob at the very top:




These steps are a miniature version of creating the main top piece.

1.   Go to the **Create** panel and click **Geometry**. Make sure **Standard Primitives** is chosen in the drop-down list. Click **Sphere**.
2. In the Top viewport, drag to create another sphere. Set its **Radius** to **5.0**.
3.  With the sphere selected and the Top viewport active, click **Align**. Then in the Top viewport, click the base of the bishop.
An **Align Selection** dialog is displayed.
4. On the dialog, in the **Align Position** (Screen) group, turn on **Z** position, then click **OK**. This aligns the knob to the rest of the bishop.
5.  On the status bar, click to turn on **Lock Selection**.
6.  Activate the Left viewport, and then click **Zoom Extents**.
The **Zoom Extents** button is one of the viewport navigation buttons in the lower-right corner of the **3ds max** window.
7.  In the Left viewport, move the sphere vertically so it caps the chess piece.







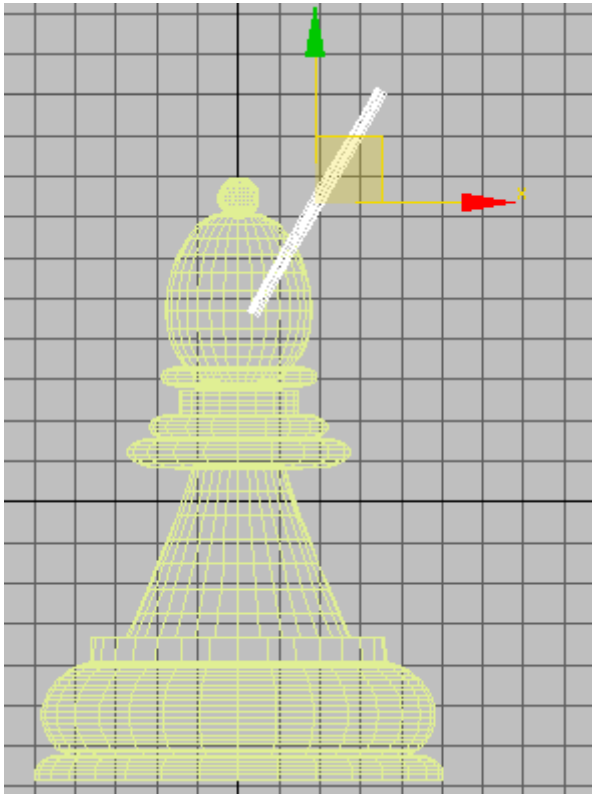
8.  Turn off **Lock Selection**.
9. Choose **File > Save**.

Consolidate the model:

1.  Select the base of the bishop.
2.  Go to the **Modify** panel, and in the **Name** field, rename the object **Bishop**.
3.  On the **Modify** panel, go to the **Edit Geometry** rollout, and turn on Attach.
4. Click each sphere object to make it part of the mesh.
5. Choose **File > Save**.

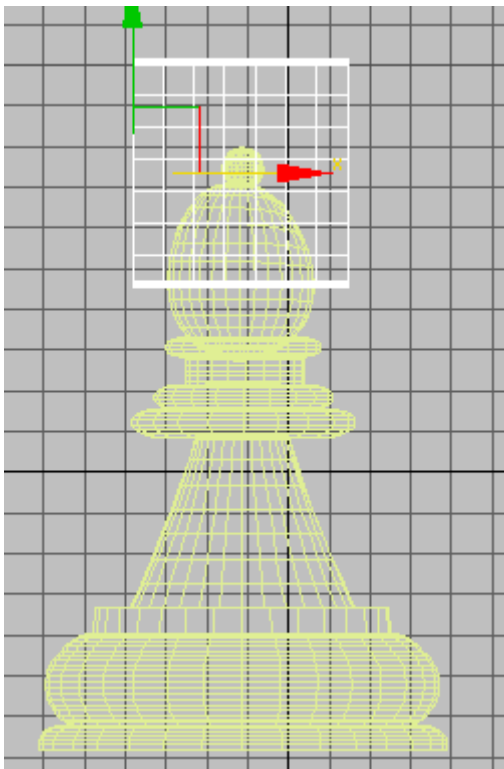
Create a box to slice the "miter," and position it:

1.   Go to the **Create** panel and click **Geometry**. Make sure **Standard Primitives** is chosen in the drop-down list, then click Box.
2. In the Left viewport, drag to create a box. Set the box's Width to **3.0**. The **Length** and **Height** values don't matter, but they should be somewhat larger than the dimensions of the egg shape of the bishop's top.
(In the Left viewport, you should be looking at the box edge-on. That is, in the Left viewport, the narrow Width side of the box should face you.)
3. Set the box's Length, Width, and Height Segments ("Segs") all equal to **7**.
Important: This is an important step, because if there is too big a difference in the complexity of geometry, the Boolean operation might not work correctly.
4.   In the Left viewport, **Rotate** the box about **-30** degrees, and then **Move** it so it intersects the top of the bishop.

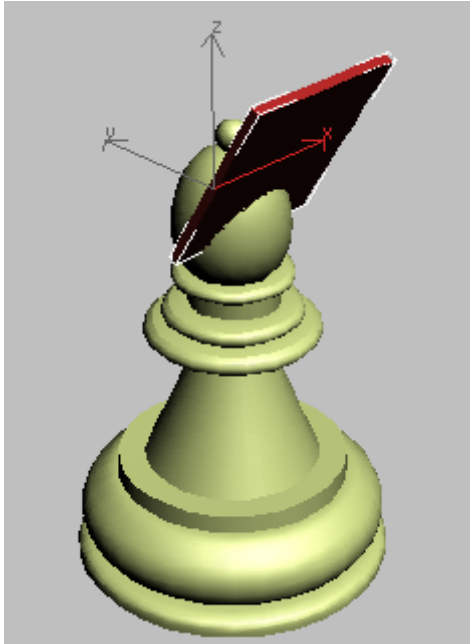


Box intersecting the bishop in the Left viewport

5. In the Front viewport, move the box so it intersects the entire width of the bishop top.





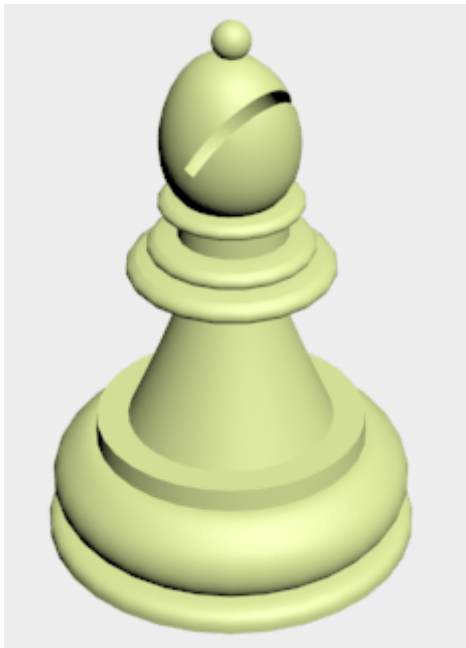
Box intersecting the bishop in the Front viewport



The box intersection in a Perspective viewport

Create the slice using Boolean:

1.  Select the base of the bishop, rather than the box.
2.  On the **Create > Geometry** panel, choose **Compound Objects** from the drop-down list.
3. Click to turn on **Boolean**.
4. On the **Boolean Parameters** rollout, click **Add Operands**, and then click the box.
5. On the **Operand Parameters** rollout, choose **Subtract**. The “miter” of the bishop chess piece now has a slot in it.



6. Choose **File > Save**.
Tip: The “Boolean” topic in the user's reference has guidelines for Boolean modeling. You should refer to these guidelines before you use Boolean yourself to get the best results from this object type.

Summary

In this lesson, you learned to stretch the geometry using soft selection of vertices. You learned to align objects with the align tool, and you cut a hole in the object using Boolean operations.