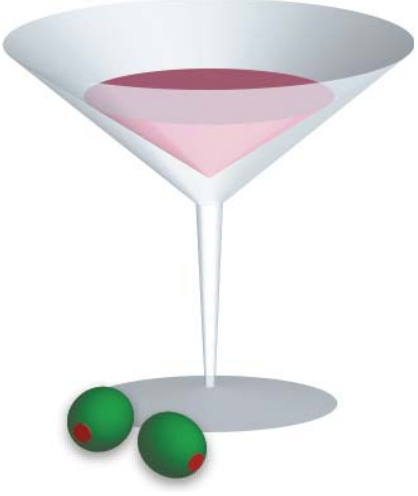
Exploring the World of 3D



You already know that in the arena of computer graphics, there are two playing fields: pixel-based graphics and vector-based graphics. It just so happens that in the world of 3D, there is also an important distinction between pixels and vectors. When you think about 3D, imagery like that seen in blockbuster Hollywood movies and in animated feature films comes immediately to mind. The tools used to create these realistic images are incredibly sophisticated (and expensive), and they render shading, surface textures, and reflections using pixels. In contrast, the 3D feature in Illustrator uses vector artwork to generate not just the 3D geometry of an object but also the lighting and shading.

This distinction is important, because you will find that in no way does Illustrator replace applications like Autodesk 3ds Max or Maya. In fact, as you'll soon learn, the 3D feature in Illustrator has its share of limitations. At the same time, the vector-based 3D functionality in Illustrator is extremely powerful—and useful—once you learn its strengths.

At first blush, you can think about how 3D in Illustrator can assist with product packaging mock-ups and help give a logo that added touch. But the real power of 3D is how it can be applied to everyday creative tasks. Throughout this chapter, the creative side of 3D will become readily apparent.

3D in Illustrator: What It Is and What It Isn't

Few features in Illustrator are as fun to use as the 3D effect. You might want to clear your calendar for a few days so you have time to explore all the cool functionality you're about to discover.

However, before you tie a bungee cord to your ankles and jump into the spectacular world of 3D, it's important to realize just what the 3D effect in Illustrator is capable of and what its limitations are. In this way, you'll get a better idea of what you can realistically expect from the 3D effect:

- **The 3D effect in Illustrator is real 3D.** Unlike 3D plug-ins or other vector-based applications that have 3D features (such as FreeHand or CorelDRAW), the 3D effect in Illustrator isn't some cheesy feature. Rather, Illustrator does real 3D rendering in a true 3D environment. Although the artwork that appears on the artboard is 2D, within the Effect dialog box the artwork exists in a 3D space where you can rotate and view it from any angle (**Figure C.1**).

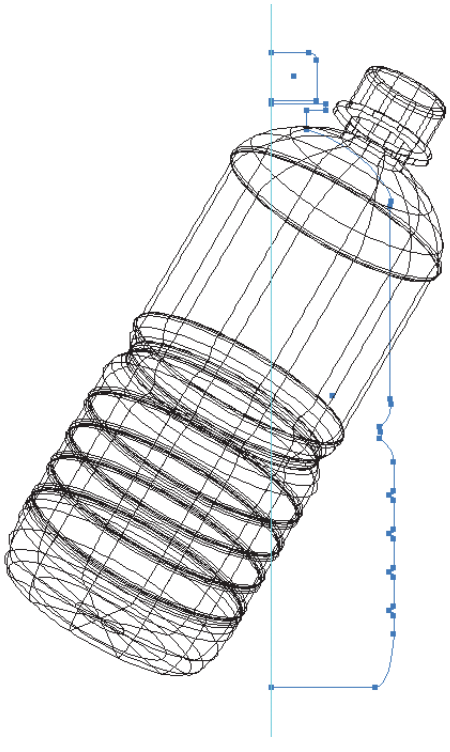


Figure C.1 *Once you've applied a 3D effect to a shape, you can choose to view it from any angle.*

- **The 3D effect in Illustrator is vector-based.** Illustrator applies 3D effects to vector objects, and the result is a vector object. Lighting and shading take place through the use of blends (more detail on this later). Illustrator does not use *ray tracing*—a pixel-based rendering technique that can create shading and lighting with reflections and refractions.
- **The 3D effect in Illustrator supports artwork mapping.** The 3D effect has the ability to map 2D artwork onto the surface of 3D objects. Artwork that will be mapped onto a 3D surface must first be defined as an Illustrator symbol.
- **The 3D effect in Illustrator is self-contained.** Because 3D in Illustrator is an effect, it applies to particular objects you have selected. Each object is treated as a separate entity and lives in its own individual 3D world. This means separate 3D objects cannot interact with or intersect each other (like a rod that pierces a sphere). Additionally, each object maintains its own vanishing point. This limitation makes it difficult to create 3D compositions in which multiple objects share the same vanishing point (although using groups can make a difference).
- **The 3D effect in Illustrator is proprietary.** The 3D effect is an internal feature and is applicable only within Illustrator. You cannot export 3D geometry from Illustrator (although you can export the 2D representation of that artwork), and you cannot import 3D geometry from CAD or 3D modeling applications (such as Maya or even Google SketchUp). This also means the 3D support in Photoshop Extended doesn't work with 3D art made from Illustrator.
- **The 3D effect in Illustrator is a live effect.** As a live effect, the 3D features in Illustrator abide by the same rules as other effects. This means you can apply 3D effects to groups (which is important, as you'll see later), you can save them as graphic styles, you can edit them easily, and you can expand them.

Many different uses come to mind when we think about using the 3D effect in Illustrator. Drawing boxes and bottles for product packaging concepts and mock-ups, as well as text headlines or logos with added dimension, are some examples. However, as you will see, the 3D effect in Illustrator can also serve in an extremely creative fashion. As you explore the different capabilities of the 3D effects, try to envision how you might use them to create illustrations or design elements. We will help by offering examples along the way, providing a spark for your creativity.

NOTE Because Illustrator does real 3D rendering, performance is commensurate with system resources.

Looking Inside the 3D Effect

The 3D feature in Illustrator is extremely deep and comprises four components, each serving a different purpose:

- **Extrude & Bevel.** The *extrude* effect adds dimension to an object by extending it and giving it depth. Although 2D objects have an X axis and a Y axis, an extruded object also adds a Z axis. A simple example is a square with just one side (front) that becomes a cube (**Figure C.2**) with six sides (front, back, top, bottom, left, and right). A *bevel* is a chiseled effect you can add to the surface of an extruded object (**Figure C.3**).

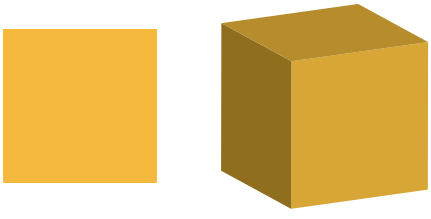


Figure C.2 *When you start with a regular square (left), adding an Extrude effect results in a six-sided cube (right).*

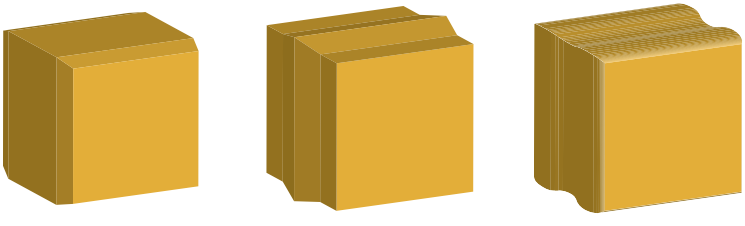


Figure C.3 *Bevels can add a chiseled appearance to an extruded object.*

- **Revolve.** The Revolve effect adds dimension to an object by defining an axis and then revolving the shape around that axis. A simple example is a rectangle with just one side (front) that becomes a cylinder (**Figure C.4**) with three surfaces (side, top, and bottom).

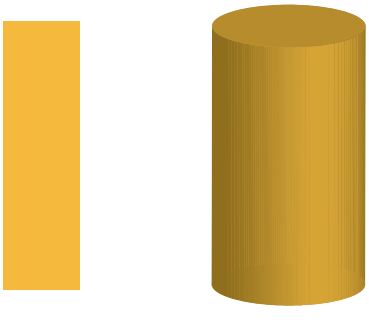


Figure C.4 *When you start with a regular rectangle (left), adding a Revolve effect results in a three-sided cylinder (right).*

- **Rotate.** The Rotate effect doesn't add dimension at all but simply allows you to rotate your object in 3D space (basically an extrude without the depth added). This allows you to apply perspective to an object using a 3D reference (**Figure C.5**).

Figure C.5 *When you start with a regular square (left), adding a Rotate effect results in a shape that appears to have the perspective of 3D (right).*

- **Artwork mapping.** Artwork mapping is a feature used to render 2D artwork onto the surface of a 3D object (**Figure C.6**).

Figure C.6 *Once you've created regular artwork (left), you can map it onto the surface of a 3D object (right).*

Naturally, each of these four components is a full-blown feature and requires its own detailed instructions. However, before we get to that, you need to learn some general information about how the 3D effect in Illustrator works.

NOTE Illustrator allows artwork mapping only on objects with the 3D Extrude & Bevel or 3D Revolve effect applied. The 3D Rotate effect does not support artwork mapping.

Using Fills and Strokes and the 3D Effect

To harness the depth of the 3D effect in Illustrator, you have to learn what makes the effect tick. The way in which you create and edit your vector shape affects how the 3D settings are applied to that shape. For example, take two identical shapes: One has a stroke applied, and the second has the

stroke set to None (**Figure C.7**). When the same 3D Extrude effect is applied to both objects, each assumes a different appearance (**Figure C.8**).

Figure C.7 *These shapes are identical with the exception of the 1-point stroke applied to the one on the left.*

Figure C.8 *The extruded area of the shape on the left takes on the appearance of the object's stroke, whereas the shape on the right uses the appearance of the fill.*

Here's what happens: Right before Illustrator applies 3D to an object, the effect breaks apart the elements internally and applies the 3D effect to each of the elements. When you have an object that has just a fill applied, the fill itself is extruded, and the extruded areas are shaded in the same color as the fill. However, if a stroke is applied to the object as well, Illustrator extrudes the fill and the stroke, and the appearance of the extruded areas shows the stroke color, not the fill color.

In fact, when you have a stroke applied, Illustrator is really extruding two separate objects—the fill and the stroke around it (**Figure C.9**). If you change the Fill setting to None, you'll be able to see right through the middle of the object, because then Illustrator is extruding only a stroke, not a fill (**Figure C.10**).

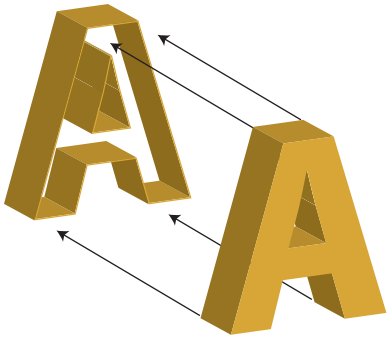


Figure C.9 *When an object with a fill and a stroke is extruded, you can think of the stroke as a slipcase for the fill.*

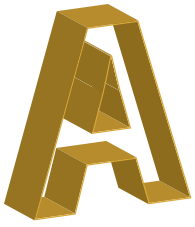


Figure C.10 *When no fill is present, Illustrator extrudes only the stroke, resulting in a hollow shape.*

Another side effect to applying a 3D effect to an object with a stroke applied pertains to artwork mapping. You already know that artwork mapping allows you to apply 2D art to the surface of any 3D object. We'll discuss exactly how artwork mapping is applied later in the chapter (see the section "Mapping Artwork to 3D Surfaces"), but one of the main tasks you'll need to do with artwork mapping is choose on which surface of a 3D object you want your mapped artwork to appear (you can apply artwork to multiple surfaces, as you will learn later).

When you apply an Extrude effect to a rectangle with just a fill, the result is a 3D object that has six surfaces. However, if you apply a stroke to that rectangle, the result is a 3D object with 16 surfaces. This is because Illustrator counts all the surfaces generated by the fill as well as those generated by the stroke (the surfaces that appear along the inside of the stroke, even though they are not visible, are still counted as surfaces). Because of this, it can be difficult to choose from the numerous surfaces to figure out which one you want the artwork mapped onto.

Of course, sometimes you will want to apply a stroke to an object with a 3D effect, such as with extruded text. By adding a stroke to your text object, you can create text that is filled with one color but that is extruded using a different color (**Figure C.11**). Chances are you won't be mapping artwork onto your text, so this example is a good use of a stroke on a 3D object.

Figure C.11 *When extruding text, adding a stroke allows you to create a powerful contrast to the extruded effect.*

In review, feel free to use strokes on your objects if you need them to achieve the look you want. However, be aware that adding strokes slows performance and makes artwork mapping a confusing process because of all the extra surfaces.

Editing a 3D Effect

Because 3D is a live effect in Illustrator, you can make edits to the original vector shape on the artboard, and the 3D effect updates accordingly. You can also change the color of the object, and the 3D effect automatically updates as well, including the shading of the object.

You know that you can click an effect listed in the Appearance panel to edit 3D effects that have already been applied to artwork. However, it's important to remember that the artwork that appears on your artboard after you've applied a 3D effect is 2D. If you want to rotate a 3D object, don't do it on the artboard using the usual transformation tools. Rather, click the 3D effect in the Appearance panel, and rotate the object in the 3D Options dialog box. Changing the artwork on the artboard produces undesirable results (**Figure C.12**). For more information on transforming artwork that has live effects applied, see the sidebar "Transforming Objects with Effects" in Chapter 7, "Working with Live Effects."

Figure C.12 *What started as a water bottle (left) may not appear the same when you rotate it on the artboard (right). To rotate the bottle in 3D, you have to edit the 3D effect.*

Applying the 3D Extrude & Bevel Effect

Now that you generally understand how the 3D effect works in Illustrator, you will learn how to apply the effect, determine all its settings, and, perhaps most importantly, study a few practical examples of how you might use such an effect.

As we defined earlier, the Extrude & Bevel effect adds depth to an object. To apply this effect, select a vector object on the artboard, and choose Effect > 3D > Extrude & Bevel to open the 3D Extrude & Bevel Options dialog box. First, select the Preview check box in the dialog box so you can see what the 3D effect looks like as you adjust the settings. If you don't have a large screen, it helps to position your artwork on one side of the screen before you apply the effect and to move the 3D Extrude & Bevel Options dialog box (when it opens) to the other side so you can see the preview on the artboard (**Figure C.13**).

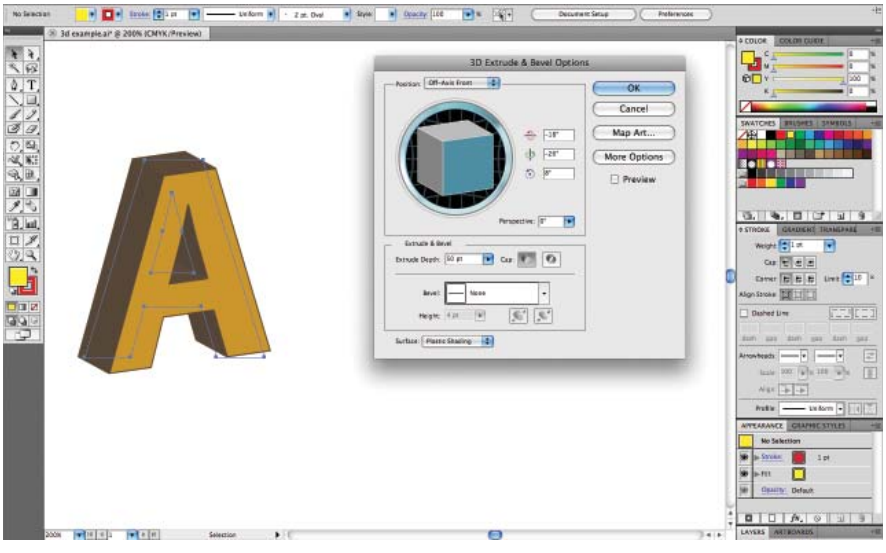


Figure C.13 *Especially on smaller screens, it helps to keep your art positioned on the left side of the screen so you have room to preview the art while you make adjustments in the 3D Extrude & Bevel Options dialog box.*

At this point, you are ready to begin experimenting with the settings in the dialog box. To make the feature more approachable, Adobe splits the dialog box into two parts. By default, only half the settings appear in the dialog box. By clicking the More Options button, you can expand the dialog box to show all the settings we will be talking about here (**Figure C.14**).

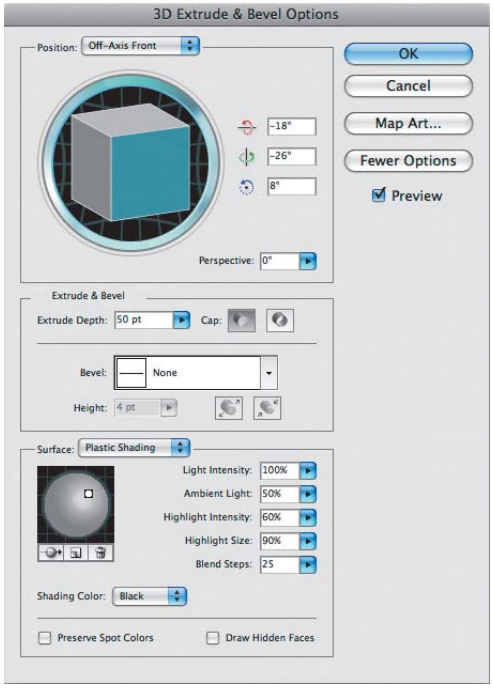


Figure C.14 *By clicking the More Options button, you can expand the 3D Extrude & Bevel Options dialog box to see all the available settings.*

NOTE You'll always have to select the Preview check box when you open the dialog box. Adobe chose this behavior for performance reasons.

The 3D Extrude & Bevel Options dialog box is divided into three sections—Position, Extrude & Bevel, and Surface—each covering a different aspect of 3D.

Specifying the Position settings

The Position section of the 3D Extrude & Bevel Options dialog box lets you rotate your object within 3D space (on its X, Y, and Z axes) in order to control the view of your object. In 3D applications, the term *camera* is used to define the view of the object (as if you were seeing the object through the lens of a camera; **Figure C.15**).

NOTE Most 3D applications allow you to change the position of the objects and the camera in a scene. Because each 3D effect lives within its own 3D world, the camera in Illustrator is always stationary, and you are adjusting the position of the object only.

The most distinctive element in the 3D Extrude & Bevel Options dialog box is what Adobe engineers affectionately call the *track cube*—a visual representation of the position of your 3D object. The track cube acts much like a trackball, only it isn't round (and hence it's called the track *cube*). To adjust the position of your 3D object, simply click and drag the track cube. As you adjust the position, a wireframe preview appears on your screen, indicating how the object will appear (**Figure C.16**). When you release the mouse, a full preview, with shading, appears.

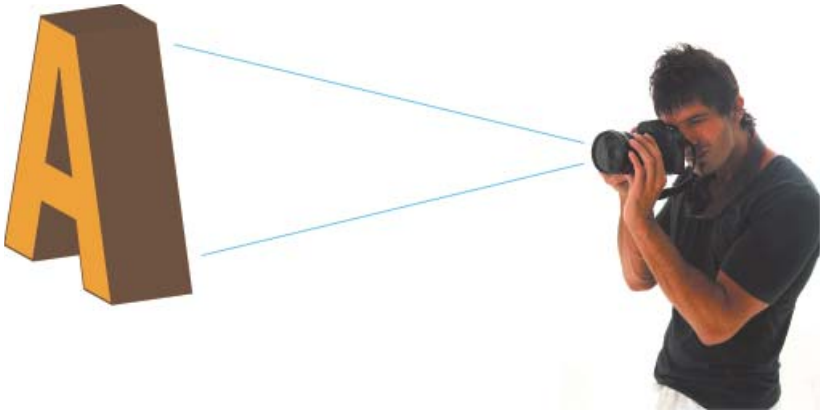
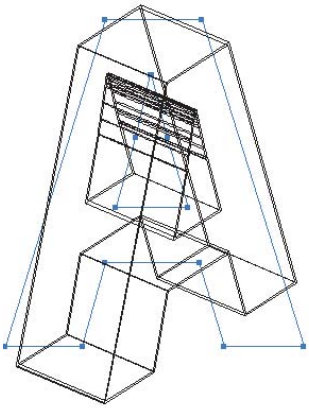


Figure C.15 *The Position setting allows you to rotate the view of an object, as if you were looking at the object through the lens of a camera.*



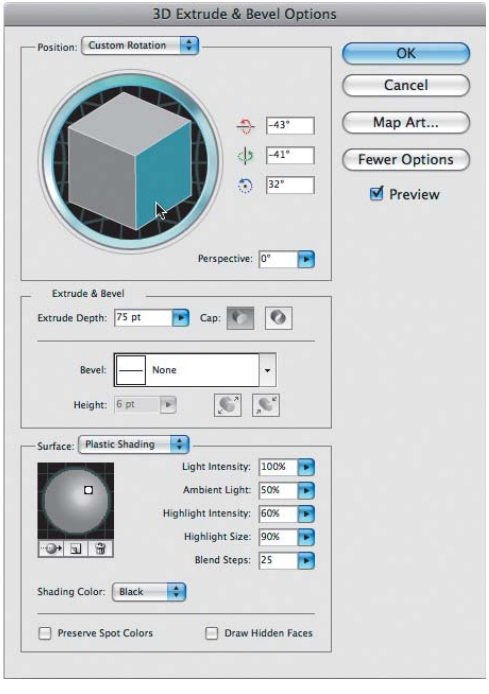


Figure C.16 *As you adjust the track cube, a wireframe preview shows you what your art will look like.*

The track cube is more than just fun to play with—it also has some pretty cool functionality. The sides of the cube are shaded in different colors to help you easily identify the position of your object: The front side is blue, the back is a dark gray, the top and bottom are light gray, and the left and right sides are a neutral gray.

In addition, as you move your pointer over the edges of each side, you'll notice the edges highlight in red, green, and blue (**Figure C.17**). Clicking and dragging these highlighted edges constrains the object to rotate along only one axis, making it easier to control the position of your object. Holding the Shift key while dragging the track cube simulates a rotation of the floor beneath the object, and dragging the outer ring of the track cube constrains the rotation in the other direction.

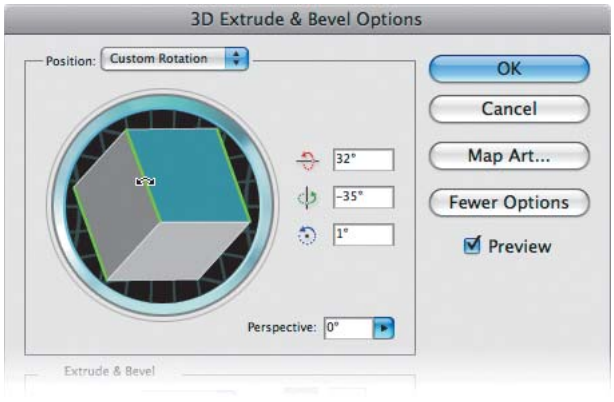


Figure C.17 *Moving your pointer over the edges of the track cube allows you to adjust one axis at a time.*

NOTE Illustrator uses a track cube instead of a trackball because it is difficult to differentiate between the multiple sides (front, back, and so on) of the 3D object using a sphere as a reference.

Along the right side of the track cube are three values representing the three axes that a 3D object needs. Each axis can have a value of –180 to 180 degrees (for a total of 360). You'll notice that the highlighted, colored track cube edges match the color shown for the icon in each of these three axes.

Appearing directly above the track cube is a pop-up menu that lists preset positions from which you can choose. Choosing one of these presets positions your object in a variety of different views. Unfortunately, you cannot define your own presets here, but these presets can make it easy to apply consistent views throughout your artwork (**Figure C.18**).

Last, you can add perspective to your object by dragging the Perspective slider. This setting mimics the natural lens distortion that occurs if you move your object closer to the lens of the camera (**Figure C.19**). If you hold the Shift key while adjusting the slider, you will see your preview update in real time (system performance permitting). Using the Shift key to generate real-time previews actually works when using any slider in the 3D dialog box.

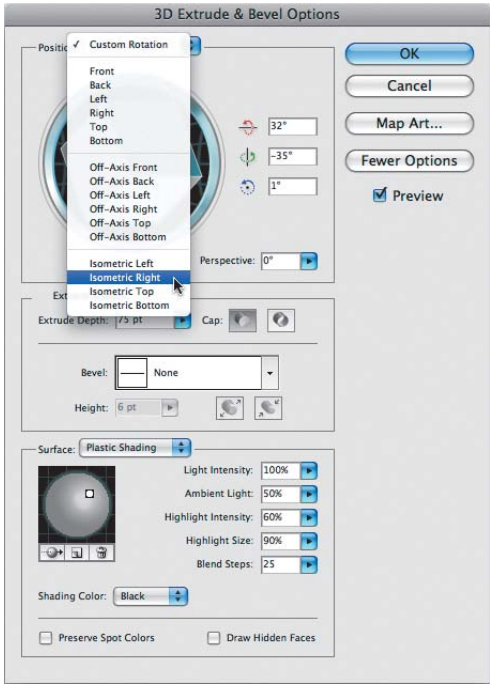
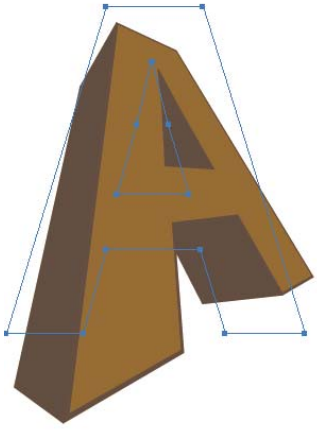


Figure C.18 *Choosing one of the preset position settings in Illustrator can make it easy to position several objects with the same view, such as when you are creating isometric art.*



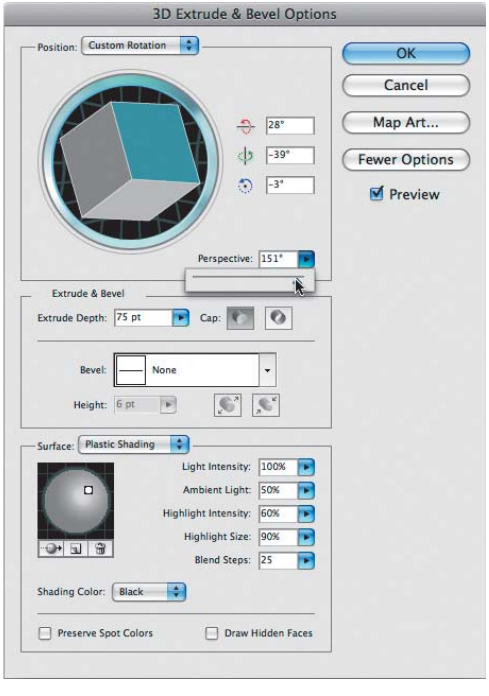


Figure C.19 *Adjusting the Perspective slider can add natural distortion to your object.*

TIP While the 3D Extrude & Bevel Options dialog box is open, press the Option (Alt) key, and the Cancel button turns into a Reset button. Clicking the Reset button resets the values in the dialog box so you can start fresh.

You will notice that as you increase the Perspective value, your 3D object becomes darker. Think about it: As you move an object closer to the lens of a camera, less light is available to reflect off the object, and the object becomes darker. Soon we'll talk about surface and lighting options, which you can use to adjust the lighting of the object.

Specifying the Extrude & Bevel settings

The Extrude & Bevel section of the 3D Extrude & Bevel Options dialog box allows you to define the depth of your object as well as how the edges of your 3D object appear, also known as the *bevel*.

TIP When you specify a bevel, sometimes you might see rendering errors caused by self-intersecting paths. You can usually alleviate the problem by specifying a smaller bevel size, using a less complex bevel, or adjusting the position or perspective settings.

To adjust the depth of your object, enter a numeric value, click and drag the Extrude Depth slider, or enter a value in the field. If you hold the Shift key while adjusting the slider, you can preview the Extrude Depth setting in real time. The values used for the Extrude Depth settings are shown in points, although you can specify values in inches or any other format, and Illustrator will do the conversion for you. You can specify an extrude depth up to 2,000 points (a tad more than 27.75 inches). Speaking of measurements, when you're trying to create package mock-ups, it's always a good idea to work at actual size or in scale to ensure that your 3D object is proportioned correctly.

By default, Illustrator creates closed extruded objects from filled paths. However, you can also specify the extrude setting you want to use so it shows only the extrusion and not the actual face or back of the shape. Toggling between the two Cap settings lets you control whether your objects have a solid or hollow appearance (**Figure C.20**).

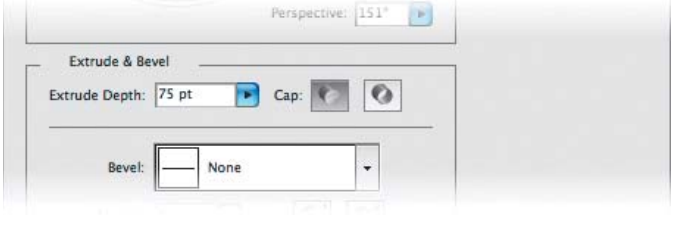


Figure C.20 *The Cap setting appears as two icons. The shaded icon indicates the selected setting.*

When you extrude an object, you can almost think of copying your object, offsetting the copy from the original, and then connecting the two with

straight lines (**Figure C.21**). A bevel is defined when you connect the two shapes with a line that is not straight, and therefore, the extrusion follows the direction of the line (**Figure C.22**).

Figure C.21 *A normal extrude is created by connecting the front and back faces of an object with a straight line.*

Figure C.22 *An extrude with a bevel is created by connecting the front and back faces of an object with a line that is not straight.*

Illustrator provides 10 bevels, which you can choose from the Bevel pop-up menu. The Height setting controls the size of the bevel. You can also choose whether you want the bevel to be subtracted from the size of the original shape or whether you want it added to the shape (**Figure C.23**).

Figure C.23 *Toggling between Bevel Extent In and Bevel Extent Out options can affect the overall size of your object.*

Specifying the Surface settings

The first two settings of the 3D Extrude & Bevel Options dialog box, Position and Extrude & Bevel, define the actual geometry of the shape. The Surface section enables you to control the appearance of the surface of your object. This includes the type of shading used, and it indicates how light will interact with the object. If you talk to photographers, they will tell you that, above all, lighting is of utmost importance. As you'll find out, the same is true with 3D.

You may have noticed that when you first selected the Preview check box to see what your 3D effect looks like on the artboard, the object changed somewhat in color. For example, if your original object was filled with a bright yellow color, the object might now show a darker, muddy yellow color instead. By default, 3D objects in Illustrator are rendered with a single light source from the upper right and are shaded by adding black to the original fill color, giving a darker appearance.

Using the Surface pop-up menu, you can choose from one of four options to specify the type of surface you want your 3D object to have. The surface type you choose also defines what other surface settings are available for your object and ultimately how you see the final 3D object (**Figure C.24**).

Figure C.24 *From left to right, this art demonstrates examples of Plastic Shading, Diffuse Shading, No Shading, and Wireframe.*

The four surface settings are as follows:

- **Plastic Shading.** You use the Plastic Shading setting when you want your object to have a highly reflective surface, such as glass or metal. This shading option lets you adjust and control a lighting highlight on the object.
- **Diffuse Shading.** You use the Diffuse Shading setting when you want your object to have a matte surface, such as paper or wood. This shading option does not have a highlight setting.
- **No Shading.** The No Shading option disables shading completely and renders each side of your object using the solid color defined for the object. Granted, this option doesn't leave your object with a 3D appearance, but if your intent is to expand the 3D effect so that you can edit the geometry of the shape, this setting could be helpful.
- **Wireframe.** The Wireframe surface setting removes all filled areas, or *walls*, from your object and displays the object's 3D wireframes. The result is technical and rather cool, and it is useful for creating design elements. The rules that make up the wireframe are set to .25 point in width and cannot be changed without first expanding the 3D effect.

On the left side of the Surface section of the dialog box is a lighting sphere, which is used to control how light is directed at your 3D object. A small white circle indicates the light source, and you can drag it to control the direction of the light (**Figure C.25**). As you move the light source, you can hold the Shift key to see the shading preview in real time. To add lights (you can add up to 30 of them), click the New Light icon that appears directly below the sphere, and to delete a selected light, click the Delete Light icon. You can also send lights behind an object by clicking the Move Selected Light to Back of Object icon.

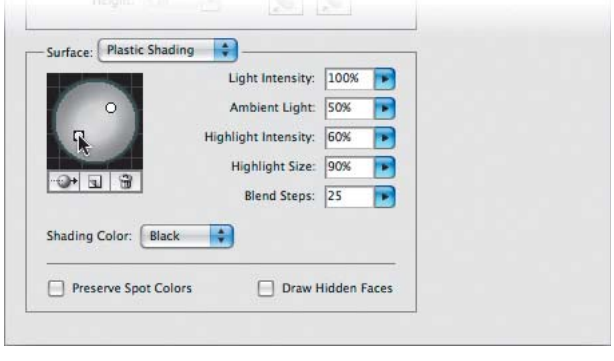


Figure C.25 *You can drag lights across the sphere to adjust the shading of the 3D object.*

To the right of the lighting sphere are five settings that define how the surface and the lighting interact with each other. Depending on the surface option you select, you may see all or only some of these options:

- **Light Intensity.** The Light Intensity setting controls the strength, or brightness, of the selected light. Think of this setting as a dimmer switch—the closer the value is to 100, the brighter the light; the closer the value is to 0, the dimmer the light. You can use this setting to apply different intensity values for each selected light.
- **Ambient Light.** The Ambient Light setting is a general lighting setting that affects the entire surface of the object. By default, this is set to 50%, which is a neutral setting. Think of this setting as a global lightness/darkness setting for the object itself, not for the individual lights.
- **Highlight Intensity.** The Highlight Intensity setting controls the contrast or transition between the surface and the highlight. Higher values produce sharper highlights, indicating a more reflective surface, like glass. This highlight setting is applied globally to all highlights on the object (you can't set this differently for different lights). This setting is available only when you choose the Plastic Shading option.
- **Highlight Size.** The Highlight Size setting controls the size of the highlights on a 3D object. This highlight setting is applied globally to all highlights on the object (you can't set this differently for different lights). This setting is available only when you choose the Plastic Shading option.
- **Blend Steps.** The Blend Steps setting is an extremely important setting, and therefore, it's difficult to understand why it appears listed at the bottom of the dialog box, grouped with other lighting settings and seemingly hidden. Illustrator uses blends to create shading, not gradients (blends are covered in depth in Chapter 2, "Selecting and Editing Artwork"). A blend consists of a start object and an end object, with multiple "steps" in between. If there are too few steps in a blend, you can see the individual steps, which results in shading that appears posterized and not smooth (**Figure C.26**). By default, Illustrator specifies 25 blend steps, which is fine for viewing art on a computer screen or for printing smaller 3D shapes; however, for the best results in a high-resolution print workflow, a blend step setting of 200 or more is necessary. The reason why the default setting in Illustrator is set to 25 is strictly for

performance reasons. A higher Blend Steps setting results in much slower 3D performance, so it's a good idea to work with the default setting and then increase it right before you send your final file to the printer.

Figure C.26 *Without enough steps in a blend, you can see "stair-stepping" side effects (referred to as* banding*) rather than a smooth transition of color.*

Illustrator also offers a pop-up menu from which you can choose a shading color. By default, Illustrator adds black to your object to simulate shading; however, you can choose Other and pick any color from the Color Picker or from existing swatches in your document to use as a shading color instead. If you use colors other than black for shading, the result will be as if you were casting a colored light on your object.

TIP If you want to use gradients to do your own shading (which decreases file size when you're exporting art to Flash), choose the No Shading option, expand the appearance of the object, and then manually fill the shapes with gradients.

Using Spot Colors in 3D Objects

If your object is filled with a spot color and if you use black or a spot color as your shade color, selecting the Preserve Spot Colors option causes the overprint function to be utilized when you're creating blends for shading. The result is an object that prints and separates correctly using the spot colors. You may have to view your file with Overprint Preview selected if you want to preview the art correctly on your screen.

Creating 3D Geometry—Draw Visible Faces

Although it's true that the 3D feature in Illustrator is doing real 3D rendering in a 3D world, that's true only while a 3D effect dialog box is open on your screen. Once you click OK, Illustrator creates a 2D representation of that graphic and displays it on your artboard (the artboard is only 2D). If you want to view your object differently, you can always edit the effect by clicking it in the Appearance panel, at which time the dialog box opens. At this point, you're in the 3D world again, where you can rotate the object in space and then click OK to create the 2D representation that is displayed on the artboard.

Because Illustrator knows that the end result will be a 2D drawing, it saves processing time by calculating and drawing only the visible sides of an object. For example, if you were to create a rectangle and extrude it to create a cube, at any one time you would be able to view only three of the six surfaces. You can see this for yourself by following a few quick steps to expand the appearance of a 3D object:

1. Using the Rectangle tool, draw a 2-inch square.
2. Give the square a solid color fill of choice and a stroke of None.
3. Choose Effect > 3D > Extrude & Bevel.
4. Leave the position set to Off-Axis Front, set Extrude Depth to 2 inches, and click OK to apply the effect.
5. Choose Object > Expand Appearance to expand the 3D effect.
6. Deselect the object so nothing is selected.
7. Switch to the Direct Selection tool, and move each panel of the cube. You'll see that only the visible surfaces of the cube are there (**Figure C.27**).

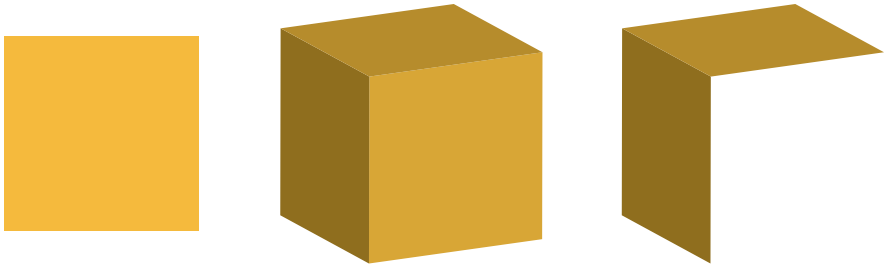


Figure C.27 *A regular square (left), with an Extrude effect applied (center), and then expanded with the front face removed (right).*

Creating 3D Geometry—Draw Hidden Faces

Sometimes, however, you might want the full geometry of the 3D object rendered. For example, if you wanted to expand the cube you created to modify the 3D object on your own, you might want all the surfaces to be available. For this reason, Illustrator includes the Draw Hidden Faces option, which forces Illustrator to render the entire object, even the surfaces that aren't visible. Again, you can easily see the difference by following a few short steps using the Draw Hidden Faces option:

1. Using the Rectangle tool, draw a 2-inch square.
2. Give the square a solid color fill of choice and a stroke of None.
3. Choose Effect > 3D > Extrude & Bevel.
4. Leave Position set to Off-Axis Front, and set Extrude Depth to 2 inches.
5. Click the More Options button in the 3D Extrude & Bevel Options dialog box, and select the Draw Hidden Faces check box.
6. Click OK to apply the 3D effect.
7. Choose Object > Expand Appearance to expand the 3D effect.
8. Deselect the object so nothing is selected.
9. Switch to the Direct Selection tool, and move each panel of the cube. You'll see that all the surfaces of the cube are there, even those hidden from view (**Figure C.28**).

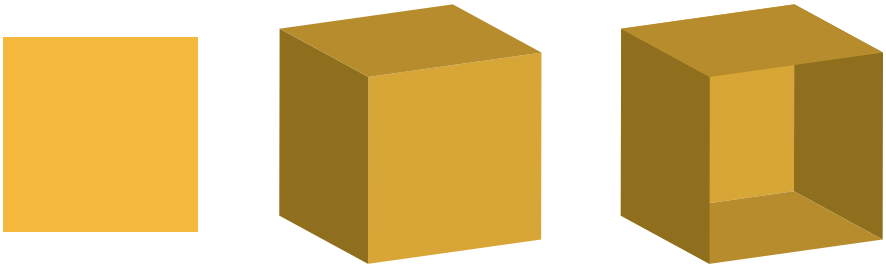


Figure C.28 *A regular square (left), a regular square with an Extrude effect applied with Draw Hidden Faces selected (center) and then expanded, and with the front face removed (right).*

As you learn more about the 3D effect, you'll find the Draw Hidden Faces option has other uses as well.

Creating a Photorealistic Button

Now that you've learned the different settings for the 3D Extrude & Bevel effect, it's time to put that knowledge to good use. In this exercise, you will create a realistic button (the kind you would find sewn to a shirt), but don't worry—you don't need to know how to draw. The Illustrator 3D effect allows you to create this button easily by drawing simple shapes.

1. Using the Ellipse tool, create a .25-inch circle.
2. Fill the circle with a color of choice, and set the Stroke setting to None.
3. With the circle selected, double-click the Selection tool in the Tools panel to open the Move dialog box.
4. Specify a Horizontal value of .375 inch and a Vertical value of 0, and click the Copy button. This gives you two buttons.
5. Now, select both circles, and double-click the Selection tool to open the Move dialog box again.
6. This time, specify a Horizontal value of 0 and a Vertical value of .375 inch, and click the Copy button. You now have four circles (**Figure C.29**).

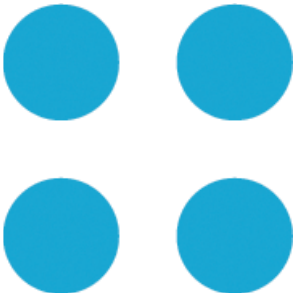


Figure C.29 *Once you've created the duplicates, you should see four circles.*

7. Select all four circles, and click the Unite button in the Pathfinder panel. This combines the four circles into a single shape.
8. Using the Ellipse tool, create a 2-inch circle.
9. Give the large circle the same fill as the other small ones and a stroke of None.
10. With the large circle selected, choose Object > Arrange > Send to Back.
11. Using the Selection tool, select all five circles, and open the Align panel.

12. Click the Horizontal Align Center button once and the Vertical Align Center button once. Because you combined the four smaller circles with the Unite function, they are centered nicely within the larger circle (**Figure C.30**).

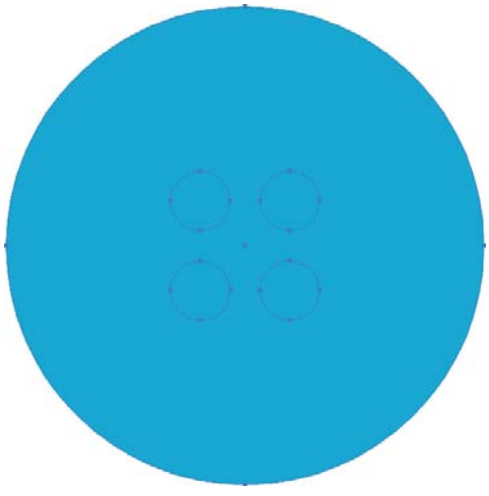


Figure C.30 *All the circles, centered, now make up the shape of a button.*

13. With all five circles still selected, open the Pathfinder panel, and click the Minus Front button. This "cuts" the smaller circles out from the larger one, allowing you to see through the button. This action also combines all five circles into a single path, allowing you to apply a single 3D effect to all the circles at once (**Figure C.31**).

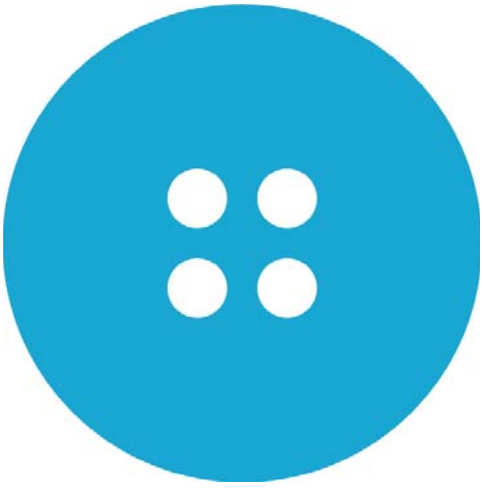


Figure C.31 *Once you've subtracted the smaller circles from the larger one, you're left with the art that you will use to create a button.*

14. With the button artwork selected, choose Effect > 3D > Extrude & Bevel, and select the Preview check box.
15. Set Extrude Depth to .25 inches, and set the bevel to Rounded.
16. Adjust the position to your liking, and click OK to apply the effect (**Figure C.32**).

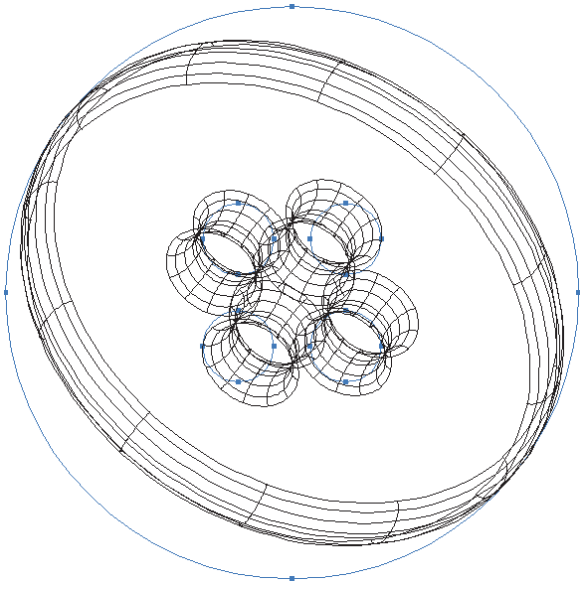


Figure C.32 *A wireframe preview allows you to position your 3D object with precision.*

Because 3D is applied as a live effect, you can change the color of the button simply by applying a different fill color to the shape. Additionally, you can click the effect in the Appearance panel to edit it and change the position of the button so you can view it from virtually any angle (**Figure C.33**). This is a great example of how you can use the 3D Extrude & Bevel effect in a creative way, allowing you to easily create design elements that might otherwise be difficult to draw.

Figure C.33 *Once you've created the button in 3D, you can change its fill color and position so you can view it from any angle.*

Applying the 3D Revolve Effect

As we briefly discussed earlier, the Revolve effect adds dimension to an object by rotating a 2D shape around an axis. To apply this effect, select a vector object on the artboard, and choose Effect > 3D > Revolve to open the 3D Revolve Options dialog box. First, select the Preview check box in the dialog box so you can see what the 3D effect looks like as you adjust the settings. If you don't have a large screen, it helps to position your artwork on one side of the screen before you apply the effect and to position the 3D Revolve Options dialog box, when it opens, to the other side so you can see the preview on the artboard.

At this point, you are ready to begin experimenting with the different settings in the dialog box. As with the 3D Extrude & Bevel Options dialog box, the 3D Revolve Options dialog box has a More Options button, which expands the dialog box to reveal all the settings for the feature (**Figure C.34**).

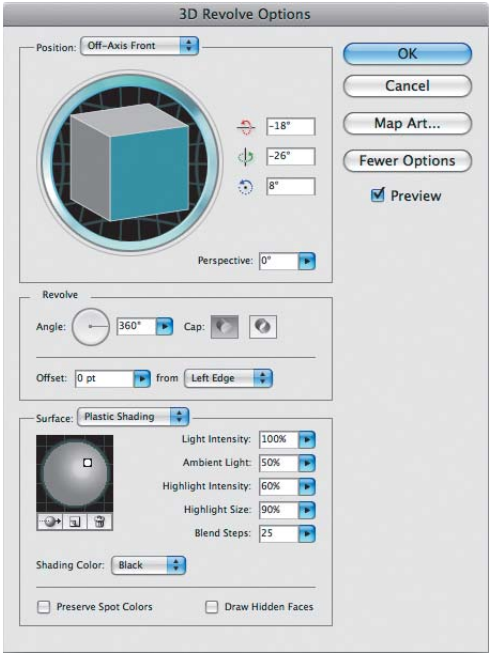


Figure C.34 *Similar to the 3D Extrude & Bevel Options dialog box, you can expand the 3D Revolve Options dialog box to reveal more options.*

The fully expanded 3D Revolve Options dialog box is divided into three sections: Position, Revolve, and Surface. The Position and Surface sections are identical to those in the 3D Extrude & Bevel Options dialog box, so we will focus on just the Revolve section here.

Specifying the Revolve Settings

The Revolve section of the 3D Revolve Options dialog box allows you to define exactly how your object will appear when revolved around an axis. Before we discuss the settings, it's important you first understand how the 3D Revolve effect in Illustrator works. By default, the leftmost point of the selected object becomes a vertical axis for the effect. An object can have only one axis, and the axis is always vertical. Unfortunately, Illustrator doesn't preview or show you this axis onscreen, so think of it as an imaginary axis (**Figure C.35**).

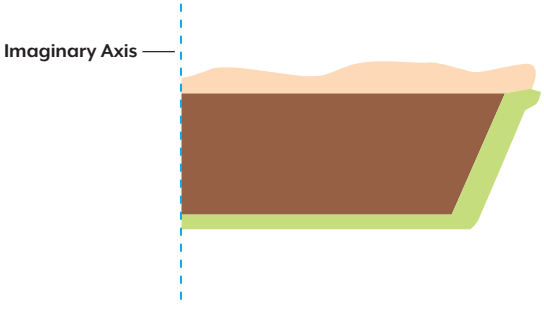


Figure C.35 *By default, the 3D Revolve effect in Illustrator uses the leftmost side of an object as the vertical axis.*

Now that you understand how the 3D Revolve effect works, you can learn how to use the remaining settings in the Revolve section of the dialog box:

- **Angle.** The Angle setting determines how far around the axis the artwork travels. By default, the angle is set to 360, which creates a shape that goes completely around the axis, resulting in a closed shape. Smaller values result in an object that seems to have a piece missing (**Figure C.36**). You may find the Angle setting useful when you want to create a cutaway view to the inside of an object or when you want to display just a portion of an object, like a single slice of pie (**Figure C.37**).

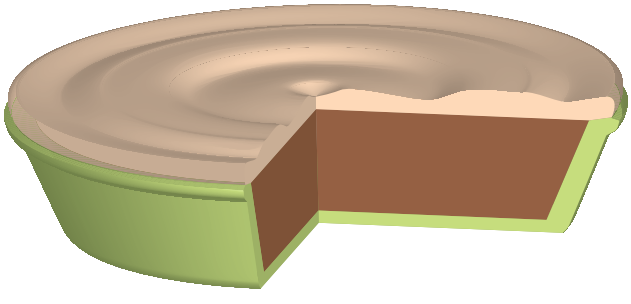


Figure C.36 *Using a large Angle setting can leave you with almost an entire pie...*

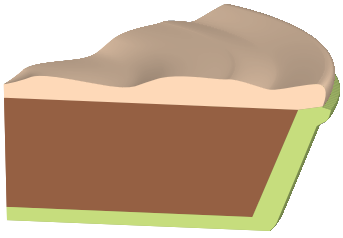


Figure C.37 *...or you can be left with just a small slice of pie with a small Angle setting.*

- **Cap.** Similar to the Cap setting in the 3D Extrude & Bevel Options dialog box, here you can toggle between objects that have either a solid appearance or a hollow appearance.
- **Offset.** The Offset setting is specific to the invisible axis. An Offset value repositions the axis and effectively allows you to revolve an object from a point other than its leftmost edge. The result is an object that is hollow (**Figure C.38**). In addition, you can specify whether the axis is offset from the left or right side of the object.

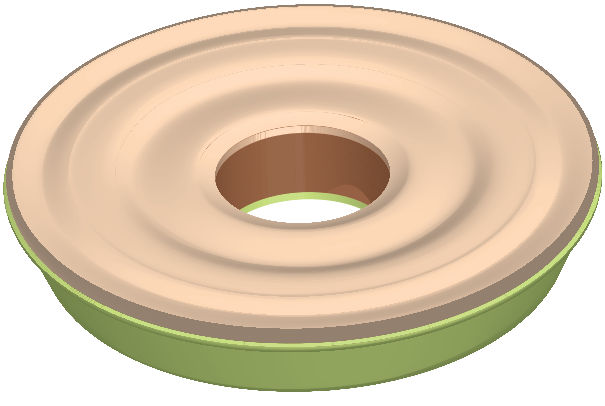


Figure C.38 *Adding an Offset value to the 3D pie results in a pie that resembles a Danish pastry with a hollow center.*

Drawing a sphere

Now that you've learned how the 3D Revolve effect works, you can learn how to create a simple object—a sphere (**Figure C.39**).

Figure C.39 *From left to right: creating a circle, deleting an anchor point to create a semicircle, and applying a 3D Revolve effect to create a sphere.*

1. Using the Ellipse tool, draw a 2-inch circle.
2. Give the circle a fill of choice and a stroke of None.
3. Select the Direct Selection tool, and deselect the circle.
4. Then select just the left anchor point of the circle by clicking it once.
5. Once the anchor point is selected, press the Delete key on your keyboard to remove the selected anchor point and the paths connected to it. You will be left with half a circle.
6. With the semicircle selected, choose Effect > 3D > Revolve. The default settings are fine for this exercise.
7. Click OK to apply the effect.

The most important part of this exercise was deleting half the circle. As we mentioned earlier, the left side of the object is what defines the invisible axis on which the object revolves. If you were to apply a 3D Revolve effect to a full circle, the result would be quite different (**Figure C.40**). In fact, applying the 3D Revolve effect with an offset value specified would produce a doughnut shape, which is nice but not what you intended (**Figure C.41**). Getting hungry?

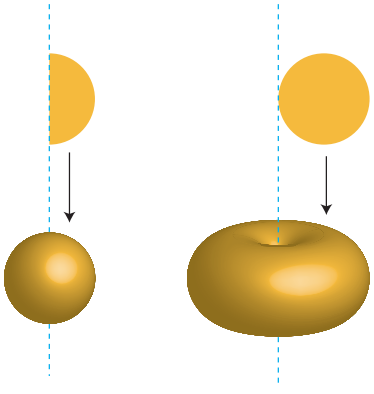


Figure C.40 *It's important to pay attention to where the vertical axis is. With a semicircle (left), the vertical axis is positioned to create a sphere. With a full circle (right), though, the vertical axis is positioned to create a doughnut shape.*

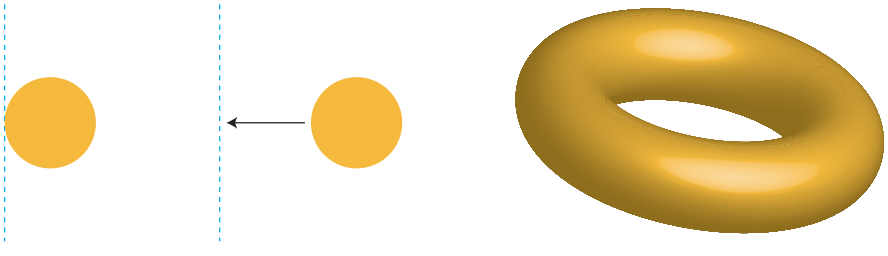


Figure C.41 *Starting with a full circle (left) and specifying an offset for the axis (center) results in a doughnut shape (right).*

Drawing an Exercise Barbell

To get your mind off food for a while, here's a little mental exercise that uses the 3D Revolve effect and incorporates the use of groups—an extremely important aspect of creating complex 3D shapes (see the sidebar "The Importance of Applying 3D Effects to Groups" later in this chapter). In this example, you will create a group of shapes that will result in a great-looking barbell. Again, you don't want to focus on drawing a barbell as much as trying to build the shapes that will eventually help the Illustrator 3D feature draw it for you (it's always preferable to let the computer do all the hard work while you relax and rack up the billable hours).

To create the barbell, perform the following steps:

1. Choose View > Show Rulers, and drag out a vertical guide (anywhere on your screen is fine).

   Although creating a guide isn't necessary, you will find that this vertical guide will help you visualize where the invisible axis will be. In addition, the guide will help you align the objects so they are all aligned to the same left edge.

   Remember when you used ordinary circles to create a button using the Extrude effect? Well, this time, you're going to use ordinary rectangles to create your barbell.

2. Use the Rectangle tool to create a rectangle with a width of .25 inches and a height of 3.25 inches.

3. Give the rectangle a fill of 60K and a stroke of None. This shape will be the handle for your barbell.

4. Position the rectangle so that its left edge touches the vertical guide you created in the previous step (**Figure C.42**).

Figure C.42 *Aligning the rectangle to a guide will help you visualize where the vertical axis will be.*

5. Create a second rectangle with a width of 1.25 inches and a height of .25 inches.
6. Give the rectangle a fill of 25K and a stroke of None. This shape will be one of the weights that appear on your barbell.
7. Choose the Selection tool, and select both rectangles.
8. Then, click the larger rectangle once, and open the Align panel.
9. Click the Horizontal Align Left button once and the Vertical Align Bottom button once.
10. Then select just the smaller rectangle, and double-click the Selection tool in the Tools panel to open the Move dialog box.
11. Specify a value of 0 for Horizontal and .25 inch for Vertical, and click OK (**Figure C.43**).

Figure C.43 *The first two rectangles are in position. Notice how they both are aligned to where the vertical axis will be.*

12. Select the small rectangle, and double-click the Selection tool to open the Move dialog box.
13. Specify a value of 0 for Horizontal and .375 inch for Vertical, and click the Copy button. You will now see two stacked rectangles. These will be the weights that appear on one side of the barbell.
14. To create the weights that will appear on the opposite side of the barbell, select both small rectangles, and open the Move dialog box once again.

15. Enter a value of 0 for Horizontal and 2.125 inches for Vertical, and click the Copy button. You now have all the shapes necessary to create your 3D shape (**Figure C.44**).

Figure C.44 *All the necessary shapes are now created and aligned correctly.*

16. Use the Selection tool to select all the objects, and choose Object > Group. This will allow the 3D effect to treat all the objects as one unit so they all share a single vertical axis.

17. With the group selected, choose Effect > 3D > Revolve, and select the Preview check box.

18. Edit the position of the object to your liking using the track cube, and then click OK to apply the effect (**Figure C.45**).

Figure C.45 *Adding a Perspective setting can add a touch of realism to your barbell. Try adding more lights and increasing the highlight intensity and blend steps to get a more metallic look.*

The most important part of this exercise is to try to visualize where the invisible axis is. When you think of a barbell, you may think of it as you normally see it—lying on the ground in a horizontal format. Because the Illustrator Revolve effect always uses a vertical axis, you had to think of the barbell as standing on its side. Once it's created, you can use the track cube to rotate it into any position or orientation you need.

The examples you've tried so far should help fuel your creativity and give you the information you need to create complex 3D objects on your own.

The Importance of Applying 3D Effects to Groups

When applying any 3D effect, it's important to understand its limitations so you can figure out how to make it do what you want. Previously in this chapter, we stated that the Illustrator 3D effects have two main limitations: 3D objects cannot intersect each other, and each 3D object lives in its own 3D world. Hence, each object maintains its own individual vanishing point or invisible axis. Basically, multiple objects in your document cannot share a single vanishing point, share the same perspective, or revolve around the same axis.

If you were paying attention in Chapter 5, "Organizing Your Artwork," you remember that effects produce a different appearance when applied at the group or layer level instead of at the object level. Because 3D is a live effect, the same rules for how groups work apply here as well. If you apply a 3D effect at the group level, all objects inside that group can share the same vanishing point or perspective.

In the example of the barbell you just created, you were able to create a single axis that all the objects shared by grouping all the objects together before applying the 3D effect. Had you selected the objects in the file and applied the 3D Revolve effect without first creating a group, the result would be different and not what you would expect (**Figure C.46**).

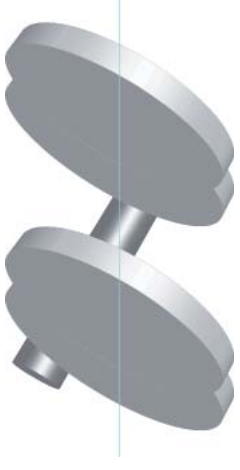


Figure C.46 *If you take the same barbell example but skip the step that collects all the shapes within a single group, the result is quite different.*

Applying the 3D Rotate Effect

The Revolve effect doesn't add dimension to an object. Rather, the effect allows you to position a 2D object in a 3D space. Basically, the 3D Rotate effect does the same as the 3D Extrude effect without adding any depth. To apply this effect, select a vector object on the artboard, and choose Effect > 3D Rotate to open the 3D Rotate Options dialog box. The settings for this 3D effect are identical to those we've already discussed, although take note that the 3D Rotate effect is limited to far fewer options (**Figure C.47**). Most notably, you can specify only the Diffuse Shading or No Shading option, there are no bevels, and there is no support for artwork mapping (which we'll cover next).

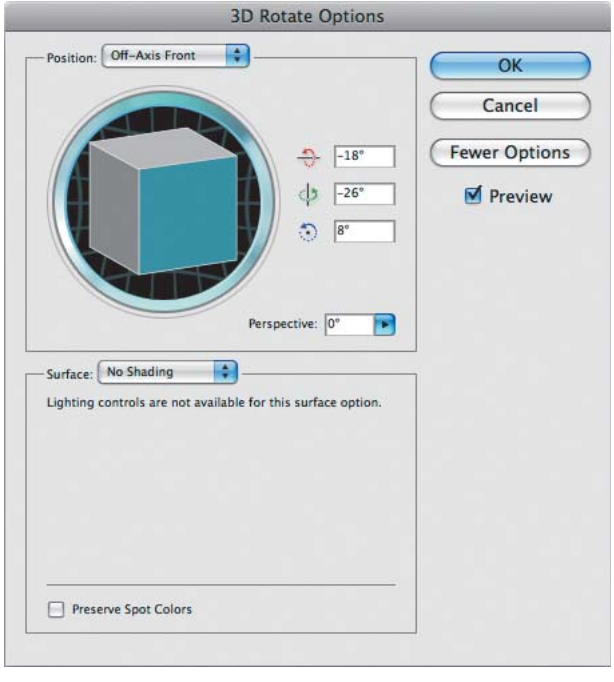


Figure C.47 *Although there is a More Options button in the 3D Rotate Options dialog box, you'll find it doesn't really offer that much.*

The 3D Rotate effect can be useful for applying distortion to artwork, such as making artwork look as if it's mounted on a billboard. It also enables you to add perspective to your artwork.

Mapping Artwork to 3D Surfaces

One of the features that really sets the Illustrator 3D effect apart from the 3D effects in other vector applications is the ability to map 2D artwork onto the surface of a 3D object. This method of combining 2D and 3D graphics is called *artwork mapping*.

So that you understand what artwork mapping really is, let's take a closer look at a 3D cube. As we discussed earlier in the chapter, a 3D cube has six surfaces. Each of these surfaces is treated as a separate entity, and artwork mapping is the process of placing artwork on these surfaces (**Figure C.48**).

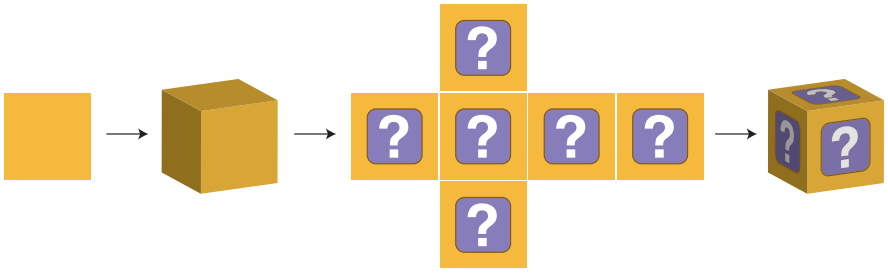


Figure C.48 *Starting with a normal square, a 3D Extrude effect produces a cube with six surfaces. When 2D artwork is placed onto these surfaces, the result is a 3D object with artwork mapping.*

You need to know a few facts before working with artwork mapping:

- Artwork must first be defined as a symbol before it can be mapped to a 3D surface. This is actually pretty cool because as you modify a symbol, you will see it automatically update on any 3D surfaces. Refer to Chapter 9, "Drawing with Efficiency," for detailed information on how to create and modify symbols.
- You can't map (wrap) a single symbol across multiple surfaces of a 3D object. If your 3D object has multiple surfaces, you can map symbols to each side individually (**Figure C.49**).

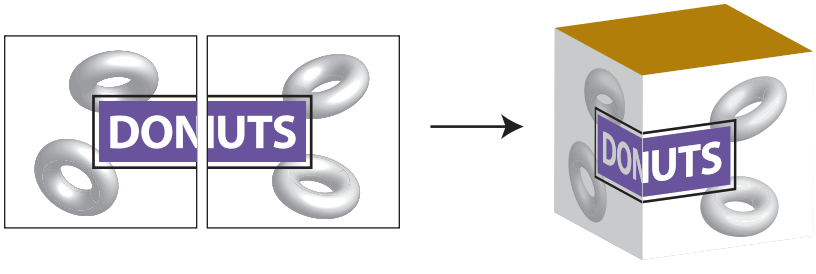


Figure C.49 *To create the appearance of artwork that wraps around multiple sides of an object, you have to create multiple symbols and map each section separately.*

- When rendering a 3D object, Illustrator uses corner anchor points to define a new surface. Smooth anchor points will not define a new surface. When drawing your art, carefully specifying where corner or smooth anchor points appear on your path gives you greater control over how many surfaces are created and where they appear (**Figure C.50**).

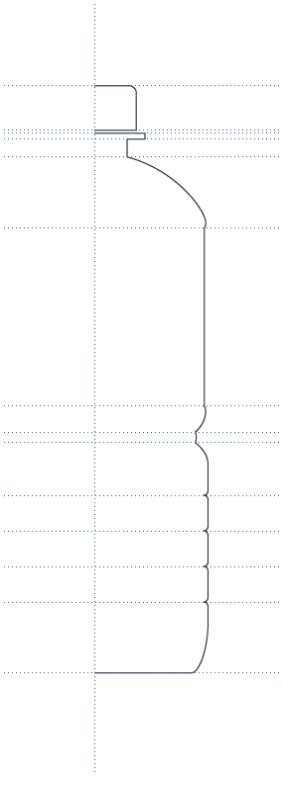


Figure C.50 *By using corner anchor points at certain points on the path of this profile of a water bottle, you can specify several surface areas to which you can map art.*

- Stroked objects make things more complicated. As you learned earlier in the chapter, objects with fills and strokes applied result in an object that has many more surfaces, which makes it difficult to work with. When you're creating a 3D object that will have artwork mapped to it, it's best to avoid using stroked paths.
- Although the 3D effect in Illustrator produces vector results, sometimes the 3D effect has to rasterize mapped artwork. If your mapped artwork contains gradients or raster images (such as those placed from Photoshop), Illustrator renders them at the resolution that is set in the

Document Raster Effects Settings dialog box. Even if your mapped art contains a high-resolution Photoshop file, Illustrator resamples it to match the resolution set in the Document Raster Effects Settings dialog box. For best results, make sure the resolution setting in this dialog box is high enough for your output needs. Refer to "Massaging Pixels in Illustrator" in Chapter 7 for more information about the settings in this dialog box.

Specifying Mapped Artwork

To map artwork onto the surface of a 3D object, you must first apply a 3D effect to an object. Then, from either the 3D Extrude & Bevel Options dialog box or the 3D Revolve Options dialog box, click the Map Art button to open the Map Art dialog box (**Figure C.51**). If the Preview check box in the resulting Map Art dialog box isn't selected, select it so you can see what your mapped artwork will look like as you adjust it.

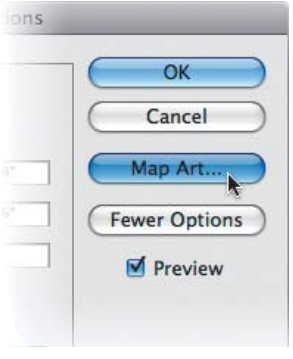


Figure C.51 *The Map Art button appears directly below the Cancel button in the 3D Revolve Options or 3D Extrude & Bevel Options dialog box.*

Before you can map art onto your object, you have to choose onto which surface of the object you want to place your artwork. At the top of the Map Art dialog box, the buttons with arrows allow you to navigate or step through each of the surfaces of your object. As you step through each surface, Illustrator displays the selected surface in the center of the Map Art dialog box. In addition, Illustrator tries to help you identify the selected surface by highlighting it with a red outline on the artboard (**Figure C.52**). Depending on the color of your object, this red outline could be helpful, or it could be barely visible.

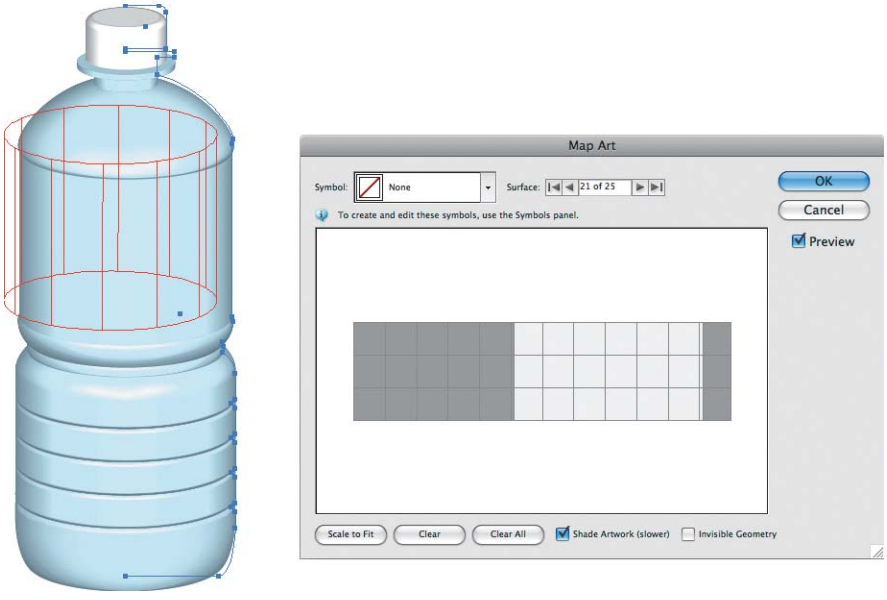


Figure C.52 *Illustrator tries to help you identify each of the surfaces, although the alignment of the red outlines isn't always perfect on the artboard.*

The surface that appears in the Map Art dialog box is shaped as if it is laid flat. You'll notice as you step through the different surfaces on your object that some show a light gray background whereas others show a dark gray background. Some surfaces may even show a background that is dark gray only in certain areas. This is Illustrator letting you know which surfaces, or which parts of a surface, are not visible or are hidden from view (**Figure C.53**). As you would expect, if you choose to use the track cube to view your object from a different perspective, the shaded surface areas in the Map Art dialog box update accordingly.

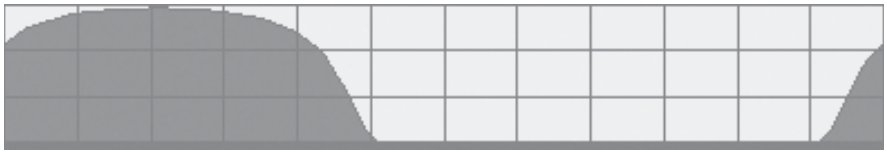


Figure C.53 *This surface, which is the section that connects the body and neck of the water bottle, has both shaded and nonshaded sections.*

TIP It's easier if you create your symbols at the correct size before you map them to a surface; this way, you won't have to worry about getting just the right size or position in the Map Art dialog box.

Once you've chosen the surface you want to map art onto, use the Symbol pop-up menu to choose a symbol. The selected symbol appears on the surface area in the Map Art dialog box with a bounding box. You can drag the symbol to position it to your liking on the surface, and you can also drag the

handles to resize it (**Figure C.54**). As you adjust the position of the symbol, you will see the preview update on the actual 3D object on the artboard. Alternatively, you can use the Scale to Fit button at the bottom of the Map Art dialog box to have Illustrator resize your symbol to fit to the surface, although it does so nonproportionally.

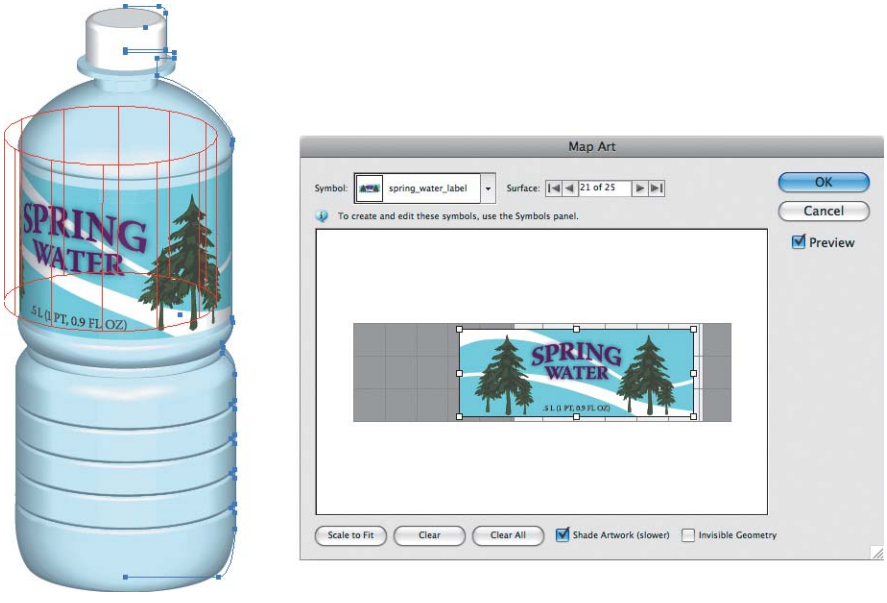


Figure C.54 *You can move and rotate a symbol so that it appears as you need it to on the surface of the object.*

Once you're happy with the size and position of your symbol on the selected surface, use the arrows at the top of the dialog box to navigate to another side to map additional symbols, as needed. At any time, you can click the Clear button to remove a symbol from a selected surface, or you can click the Clear All button to remove symbols from all surfaces at once.

NOTE A surface can contain only one symbol. If you want multiple art items to appear on a single urface, you have to define a single symbol with all the elements in it.

By default, Illustrator calculates shading and lighting only for the actual surface of a 3D object, not artwork that is mapped to a 3D surface. Illustrator does this purely for performance reasons. We mentioned earlier that Illustrator uses blends to calculate shading, and the process of breaking down intricately mapped artwork and shading each element with blends takes quite a bit of processing. However, to get a realistic appearance, most likely you will want your mapped artwork to be shaded, even if it takes a bit longer to do so. Selecting the "Shade Artwork (slower)" check box forces Illustrator to shade both the surface of your object and the mapped artwork.

This setting applies to the entire object, and you don't need to turn it on for each individual surface.

The last setting in the Map Art dialog box is the Invisible Geometry check box; *invisible geometry* is a slightly technical phrase. When this option is selected, Illustrator hides the actual 3D object on your artboard and displays just the mapped artwork. The result is a symbol that appears to float in space. A good example of when this setting might be useful is when you want to make text appear as if it were wrapped around a sphere (**Figure C.55**).

Figure C.55 *You can map artwork around a sphere (left), and by using the Invisible Geometry option in the Map Art dialog box, you can hide the sphere leaving just the artwork (right).*

When you're happy with your artwork mapping settings, click OK to accept the settings in the Map Art dialog box, and then click OK to close the 3D dialog box.

What If...You Add Transparency to 3D?

Throughout this entire book, you've seen how transparency is integrated into the Illustrator feature set with features such as soft drop shadows and opacity masks. You might ask yourself, "What if I added transparency to a 3D object?" After all, wouldn't it be cool to make a 3D object that was also transparent so that you could see right through to the back of the object?

Have no fear—as if the 3D effect weren't cool enough, you can also create transparent 3D objects—but you'll have to address two issues in order to get transparency and 3D to work together.

Applying Transparency

NOTE If your symbol contains transparency or overprint settings, those will not interact with the 3D object itself. For example, if a symbol uses a blending mode and you mapped that symbol to a 3D object, you wouldn't see the symbol multiplying with the 3D shape, because the appearance is limited to the symbol itself.

As you learned earlier in the chapter, before Illustrator applies a 3D effect to an object, it breaks the object down into its components (fills and strokes). In that process, transparency attributes are tossed out, and just the appearance remains. For example, if you set an object to 50% opacity, the 3D effect sets the object to a 50% tint of that color, but you won't be able to see through to what's behind the object. The trick is that you have to sneak transparency into the 3D effect without letting the effect know about it. You can accomplish this in one of two ways:

- If you have a single object that you're working with, you can target just the fill of the object in the Appearance panel and then change the Opacity value (**Figure C.56**).
- Alternatively, you can create a group (you can create a group of one object, if you'd like). If transparency is applied to any object within a group, that transparency makes it through the 3D effect unscathed.

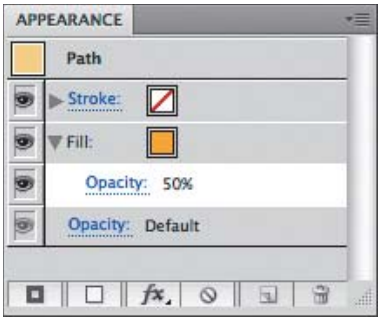


Figure C.56 *When you're using the Appearance panel, targeting the fill allows you to apply transparency to just the fill and not the entire object.*

Drawing Hidden Sides

Another useful nugget of information that you learned earlier is that, by default, Illustrator renders only the parts of a 3D object that are visible. To speed up the rendering process, Illustrator doesn't bother drawing the sides of a 3D object that are hidden from view. Well, this presents a problem if you're creating an object that is transparent and you expect to see through the front of the object to the back side. After all, if Illustrator isn't drawing the hidden side of an object, how does Illustrator know what the back side of the object looks like? The answer is that you have to force Illustrator to draw the hidden sides—you do this by turning on the Draw Hidden Faces option in the 3D Extrude & Bevel Options or 3D Revolve Options dialog box.

Once you've addressed the issues of transparency and hidden sides, you'll end up with a 3D object that is truly transparent (**Figure C.57**). Adding transparency to 3D objects opens new doors to creativity, such as when creating transparent glass bottles and vases. And don't forget to throw some artwork mapping in there as well. If you map art to a transparent 3D object, you'll be able to see through to the art on the other side. Now you've got to admit—that's pretty freakin' cool, no?

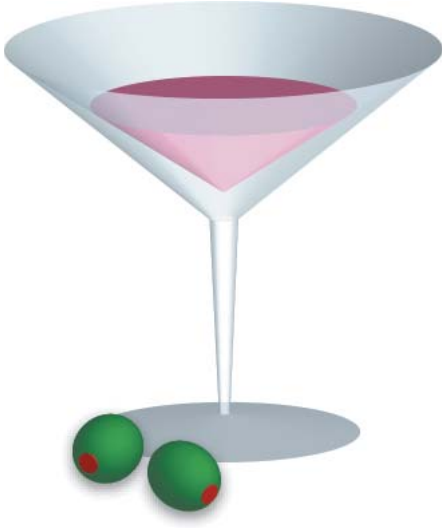


Figure C.57 *This martini glass is transparent, allowing you to see what is inside.*

What If...You Blend 3D Objects?

In Illustrator, you can select two objects and choose the Object > Blend > Make feature to morph one vector shape into another. This technique, covered in Chapter 2, can be useful for a variety of tasks including shading, special effects, and object distribution. However, what if you created a blend using two 3D objects? Would the 3D effect morph as well, along with the blend?

The answer is, yes, it will! If you apply a 3D effect to an object and then duplicate that object (so you have two identical objects), you can create a blend between them. Because 3D is a live effect, you can edit the 3D effect of one of the objects and change the position so you're viewing the object from a completely different angle. The blend will then update—and generate the intermediate steps (**Figure C.58**).

Figure C.58 *By creating a blend between spheres with mapped artwork, you can create the illusion of the sphere rotating.*

Not impressed? Well, in Chapter 11, "Web Design," you'll learn how to use blends to create instant Flash animations that you can put on your website. That means you can create a box and have it rotate in space.

What If...You Apply a 3D Effect to a Graph?

A graph consists of a group of objects. Since a 3D effect applied at the group level results in all the objects in that group sharing the same effect, what happens if you apply a 3D Extrude effect to a graph? The answer is that you get a powerful way to present numbers in an eye-catching manner (**Figure C.59**). And if you add transparency to a 3D graph—well, you can see where that might lead.

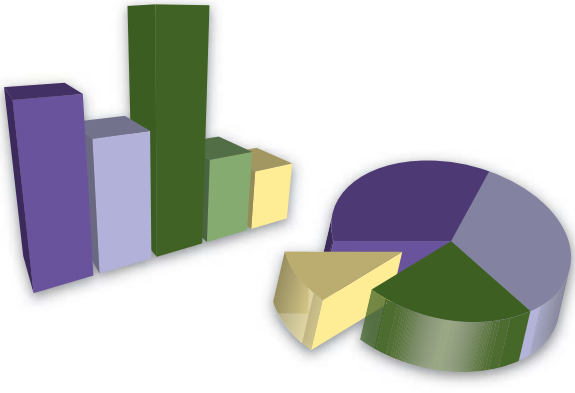


Figure C.59 *Adding 3D effects to just about anything, such as graphs, for example, can turn something ordinary into something unique and attention-grabbing.*

At the end of the day, the 3D effect in Illustrator has many creative uses. Now that you understand everything there is to know about 3D in Illustrator, the only limit is your own imagination.