Chapter 6: Draw with the Pen Tool

Overview

The unique power of vector drawing programs such as Illustrator lies in their ability to generate perfect curves. It's amazing how much freedom you have to create illustrations by combining straight lines and curves. And the ultimate curve tool in Illustrator's arsenal is the Pen tool.

The Pen tool isn't easy to master, and it isn't intuitive. When you draw in "real life," you don't consciously think of generating paths controlled by anchor points that define the curvature of a path. But that's how the Pen tool works. You don't "click and drag" with the Pen tool as you do with the Pencil tool (or a real pencil). Instead, you click to define the location of anchor points, and then manipulate control points associated with those anchors to define the curvature of your path. All this takes much practice.

Few digital artists sit down and "free-flow" design with the Pen tool. Instead, it's more often used to trace scanned artwork or generate exact curves based on a template or model. That said, the Pen tool is the single most effective, fine-tuned, and essential resource in Illustrator.

Pens and Paths

Other tools, such as the Pencil or the shape tools, are sufficient for creating already defined shapes or imprecise drawings. But to really unleash Illustrator's ability to generate and control curves, you'll need to pick up the mighty Pen tool. The Pen tool provides unlimited control over the curvature of line segments and how they connect with each other.

In this chapter, you'll learn techniques that will demystify the process of generating curves with the Pen. And you'll learn tricks for creating smooth, precise illustrations with this most powerful of Illustrator tools.

The Math of Paths

Without the math underlying Illustrator, you'd be without the freedom to create beautiful, accurately defined curved paths.

An Illustrator vector object is a combination of anchor points and the line segments in between those anchor points (along with a defined fill). Illustrator saves programming code (called PostScript, a page-description language) that defines the nature of each path. This vector-based method of saving graphic files is rooted in the mathematical formulas for defining curves pioneered by a French engineer named Pierre Bézier.

Bézier's curves revolutionized the way graphic files were saved. Vector images are often smaller in file

size and, as explained briefly in Chapter 1, they are always more easily resizable than bitmap images. Vector graphics are, indeed, an efficient way to save illustrations. But they are also a dynamic and unique way to create drawings.

Did you know?
Vectors Help You Draw

In the movie *Zoolander*, Ben Stiller's character was determined to found an institution for kids who "can't write good." Illustrator's vector drawing tools aren't exactly the remedy for folks who "can't draw good," but they can be a big help. Illustrator compensates for our humanly imperfect drawing skills. And, while we marvel at the drawings of M.C. Escher, even the most accomplished artist can't duplicate the precision and control that Illustrator provides over curves.

Tip If you're unfamiliar with the groundbreaking work of M.C. Escher, you can visit
http://www.worldofescher.com/gallery/ to be introduced to some of his work. Preceding the era of digital art, he nevertheless incorporated new discoveries in math and philosophy in his amazing drawings.

If you don't count yourself among the drawing elite, you can still create perfect curves. The most powerful and versatile tool for generating and altering curves is the Pen tool. The Pen tool creates anchor points and the line segments between them.

The nature of a segment (curved or straight) is defined by the anchor points at either end of the segment. Anchor points that connect (or end) straight lines are referred to as *corner anchor points* (or *corner anchors* or *corner points* for short). Anchor points that connect (or end) curved lines are referred to as *smooth anchor points* (or *smooth anchors* or *smooth point*s for short). Anchor points that connect a curved path segment with a straight path segment are called *combination anchor points*.

Smooth anchor points are manipulated by moving the anchor control points associated with the anchor points. The direction lines that connect control points to their associated anchor point make it easier to get a feel for how moving a control point affects the curve associated with a smooth anchor point. The following illustration shows a drawing that is composed of a combination of smooth, corner, and combination anchor points.
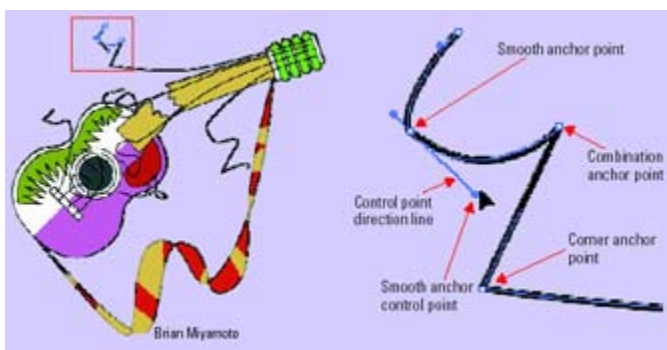
As you explore and experiment with the Pen tool, you'll gain a wizard-like ability to draw with it. And with some practice, it will become an extension of not just your hand but your imagination.

Team LiB

Draw Line Segments with the Pen Tool

The easiest and most basic type of line segment you can create with the Pen tool is a straight segment: a line segment with two corner points. To draw a straight line with the Pen tool, click once and then click again at another location on the artboard. Complete the straight corner point by clicking a third time anywhere on the artboard, as shown in Figure 6-1. Finish the path segments by clicking on another tool (like the Selection tool), or holding down the COMMAND (CTRL) key and clicking with the Pen tool.
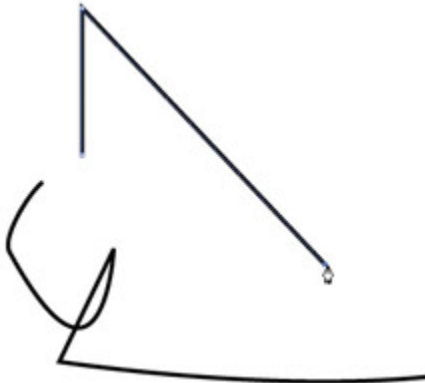

Figure 6-1: Three clicks and you're on—drawing a corner with the Pen tool

Tip As with all of Illustrator's drawing tools, the Pen tool cursor can be displayed as cross hairs for more accuracy. To display the Pen tool cursor as cross hairs, press caps lock on your keyboard. Pressing caps lock again reverts to the normal cursor display.

End a Pen Segment

The Pen tool stays active and continues to add on to your path until you indicate that you're done. When you have completed the set of line segments, hold down COMMAND (CTRL) and click to deselect the Pen tool.

Another way to deselect the Pen tool is to simply select another tool. A quick, easy way to do this is to use a keystroke shortcut (such as the letter V, which selects the Selection tool) to quickly deselect the Pen tool. You can press P or select the Pen tool from the Toolbox to begin a new set of line segments.

Alternatively, you can end a series of straight line segments by closing the path. Just move the Pen cursor over the original anchor point and click. As you move the cursor over the starting anchor point, the Pen tool cursor displays with a circle next to it, as shown in Figure 6-2.
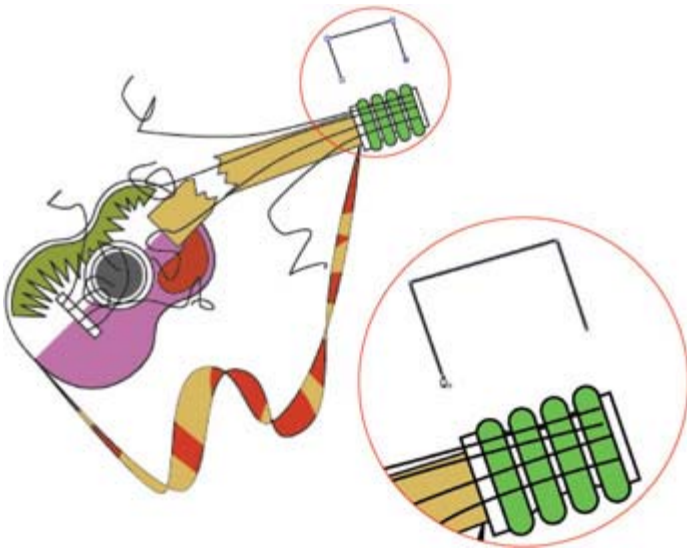
Figure 6-2: Closing a path with the Pen tool

Constrain Pen Angles

As you click to create straight corner points, you can constrain the line segments you draw to 45-degree increments by holding down the SHIFT key as you click to create new anchor points.

If you turn on Smart Guides, 45- and 90-degree angle points are illustrated. (Choose the View menu and make sure Smart Guides is selected.)

You can add more angles or edit the default settings for Smart Guide angle constraints by choosing Illustrator (Edit) | Preferences | Smart Guides & Slices. You can choose angle options from the Angles drop-down menu or type in exact angles in the boxes in the Angles area. So, for instance, if your illustrations require many 30-degree angles, you can program the Smart Guides to help you draw that angle.

Create and Edit Smooth Anchor Points

Curved line segments are defined by the length and location of their associated control points. Direction lines that connect control points to smooth anchors make it a bit more intuitive to manage curves by manipulating control points. As you get more comfortable with the Pen tool, you cannot only use it to generate anchor points, but you can also, simultaneously, manipulate anchor control points as you draw.

To create and fine-tune a smooth anchor point as you draw with the Pen tool, follow these steps:

1. Select the Pen tool and click on the artboard to create the first anchor point.

2. Move your cursor (without clicking and dragging) to the location of a second anchor point, and click. Don't release the mouse button.

3. With your mouse button still down, drag from the new anchor point to create a control point (indicated by the resulting direction line) and generate a smooth anchor.

4. Click on a third point on the artboard.

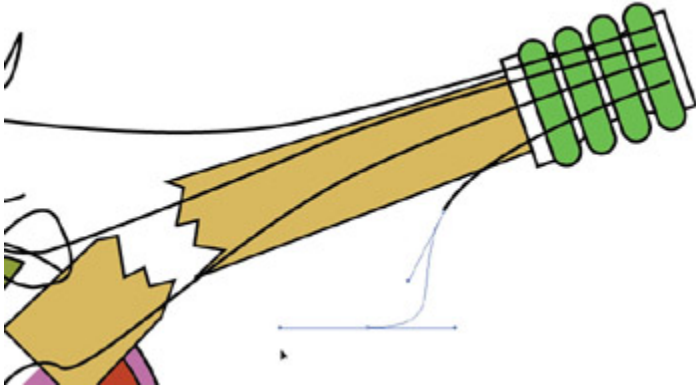5. Press COMMAND (CTRL) and click to finish the path, as shown in Figure 6-3.

Figure 6-3: Generating a smooth anchor as you draw with the Pen tool

Draw Wave Forms

Waves are a widespread phenomenon in nature, and therefore in art as well. One of my favorite uses of the Pen tool is to generate smooth, flowing, and easily altered waves. The exercise of drawing a wave is also a good way to get a feel for how curves are defined by manipulating control points and their associated direction lines.

Follow these steps to draw a set of waves with the Pen tool:

1. To get help drawing evenly spaced waves, select View | Show Grid and then select View | Snap To Grid.

2. Select the Pen tool, and click and drag horizontally to create a horizontal direction line.

3. Draw a second horizontal direction line lower on the page. Remember, you're not drawing a line now, you're manipulating a control point to define a smooth anchor point. You'll create the actual line when you define the next anchor point.

4. Press COMMAND (CTRL) and click to end the path, as shown in Figure 6-4. To create a set of wave-form paths, duplicate the generated path.
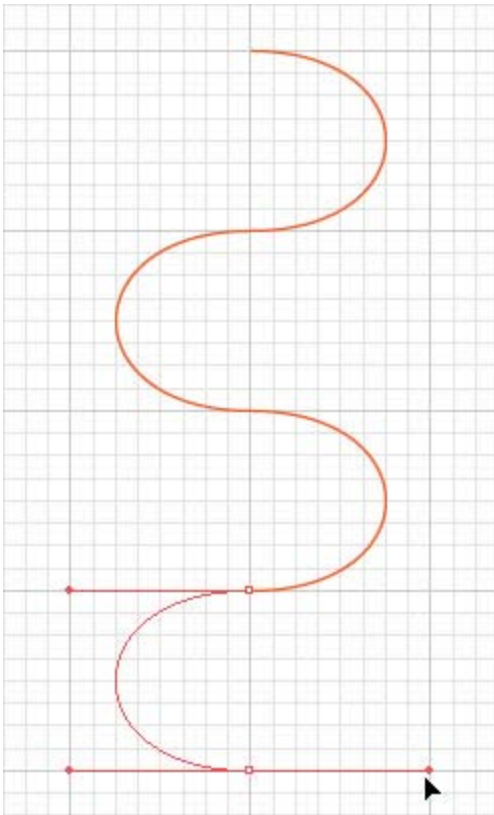
Figure 6-4: Generating a wavelike curve with the Pen tool

Note After you draw a wave, you can use all the transformation tools (discussed in Chapter 7) to resize, rotate, and otherwise distort your waves for effect.

Manipulate Control Points

When you generate a smooth anchor point, you can manipulate the curve of the attached line segment(s) by moving the control points. You can make a curve steeper by extending the control points away from the anchor point (lengthening the Direction lines). Make a curve more shallow by shortening the direction lines, as shown in Figure 6-5.

Figure 6-5: Shortening a direction line to make a curve shallower

Tip Select an anchor point and activate the control points by clicking on the anchor point with the Direct Selection tool. Locating an anchor point with the Direct Selection tool can be tricky, however. As you hover over an anchor point, the Direct Selection tool cursor turns into a tiny open square. It's easier to identify anchor points if you turn on Smart Guides (choose View | Smart Guides from the menu).

In addition, you can alter the angle of the intersection of curved line segments by rotating the direction line by dragging on a control point. To change the direction or length of a direction line, use the Direct Selection tool to select the anchor point. As you do, the direction line(s) become visible. Click and drag on the control point at the end of a direction line to lengthen or rotate the direction line, as shown in Figure 6-6.
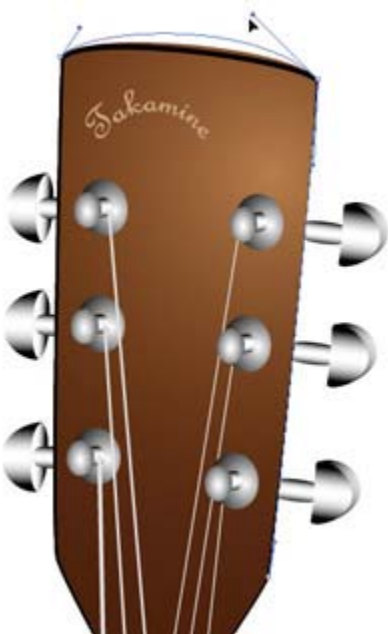
Figure 6-6: Changing the radius of a curve by rotating a direction line

Combine Straight and Curved Segments

Complex drawings mix and match both straight corner and curved corner anchor points. To create a complex path of both curved and straight segments, use the Pen tool to generate your curve by clicking to create anchor points.

For those anchor points you want to act as smooth anchors, click and drag to generate a pair of control points for the anchor. For straight corner points, simply click. Try clicking and dragging with the Pen tool to generate one smooth anchor point. Remember, you can always change the height and direction of a curved segment by later manipulating the direction lines. The basic technique is this: first rough out your path, and then fine-tune the curve by clicking and dragging on control points to manipulate the direction handles. This method provides a very high degree of control over the curvature of paths.

Tip You can move an anchor point by selecting the anchor with the Direct Selection tool and then clicking and dragging that point to a new location.

Team LiB   ◀ PREVIOUS   NEXT ▶
Team LiB   ◀ PREVIOUS   NEXT ▶

Add or Delete Anchor Points

After you generate a path with the Pen tool, you can easily add or remove anchor points with the Add Anchor Point or Delete Anchor Point tool—both found on the Pen tool tearoff.

With the Add Anchor Point tool selected, click anywhere on a path to create a new anchor. The new anchor point is created with the attributes (curved or straight) of the existing segment. So, for instance, if you click a straight line segment with the Add Anchor Point tool, you'll create a new straight corner point. Similarly, you can use the Delete Anchor Point tool to remove unwanted anchor points. Select the tool and point and click an existing anchor point, and it's gone.

Automatically Create or Delete Anchors

You can also add anchor points automatically between every pair of anchor points in a selected path. Perform this task by first selecting the path and then choosing Object | Path | Add Anchor Points. You'll instantly double the number of anchor points, providing more flexibility in manipulating the path.

To automatically reduce the number of anchor points (and thus smooth out a curve), select Object | Path | Simplify. The Simplify dialog box appears. The Simplify dialog box has Curve Precision and Anchor Threshold sliders, as well as check boxes for Straight Lines, Show Original, and Preview. Higher Curve Precision values increase the number of anchors that will be left after simplifying. The Angle Threshold slider can be used to prevent some angle anchors from being smoothed into curves. The Straight Lines check box changes curved paths to straight lines.

The great thing about the Simplify dialog box is that you don't need to really grasp these settings to manage the process. If you click both the Show Original and the Preview check boxes, your original anchors will display in red, while the anchors that result from simplifying display in blue. Tweak the angle threshold and curve precision settings to experiment, observing the changes in your drawing as

well as the net reduction in anchors that will result from your settings, as shown in Figure 6-7.
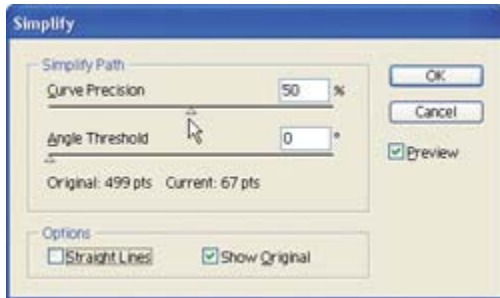

Figure 6-7: Reducing the number of anchors with the Simplify dialog box. The original set of anchors is illustrated in red, the resulting set in blue.

Tip The Simplify feature is effective in many important ways. It can be used to clean up extraneous anchors in scanned and traced objects. It can clean up unnecessary Pen-generated anchors. And simpler curves mean smaller file sizes, so when you can remove anchors without distorting your illustration, it's a good idea to do so.

Change Anchor Types

You can transform anchor points from corner to smooth, or vice versa. The easiest way to perform this task is to use the Convert Anchor Point tool (in the Pen tool tearoff).

When you point and click on an anchor point with the Convert Anchor Point tool, curved points are instantly converted to straight corner points. In Figure 6-8, the curved anchor point is about to be converted to a corner point.

Figure 6-8: Converting a smooth anchor point to a corner anchor point

If you convert a straight point to a curved point, you can immediately click and drag to define and manipulate control points to edit the line segments that connect to that point. In Figure 6-9, a straight corner anchor has been converted to a smooth anchor with the Convert Anchor Point tool, and the control points are being maneuvered to define the curve.

Figure 6-9: Adjusting the control points on a converted anchor

Edit with the Pen Tool

You'll almost always want to modify curves that you create with the Pen tool. Often you'll want to quickly switch back and forth between touching up your curves and creating new ones. Illustrator provides many tricks for doing this. Depending on when and how you use it and which keyboard keys you hold down, the Pen tool converts to several related tools.

In addition, Illustrator provides features for automatically smoothing or touching up your Pen-drawn curves, including the ability to line up anchor points, delete stray anchor points, and simplify a curve.

Because the Pen tool is the most powerful and useful tool in Illustrator, you'll have it selected most of the time as you create a drawing. By moving the cursor to different parts of a path, or by pressing COMMAND (CTRL) or OPTION (ALT), you can temporarily change the functioning of the tool.

You can use the Pen tool to add segments to an existing path and to add or delete anchor points to a path. The Pen tool can even be converted so that it temporarily functions like the Convert Anchor Point tool.

Add Segments to a Path

To add segments to an existing path, move the Pen tool over an endpoint in the path. As you do, the cursor displays as a slash (/).

With the Pen tool cursor displaying with a slash, click the current endpoint in the path. Then click again to define a contiguous segment, as shown in Figure 6-10.

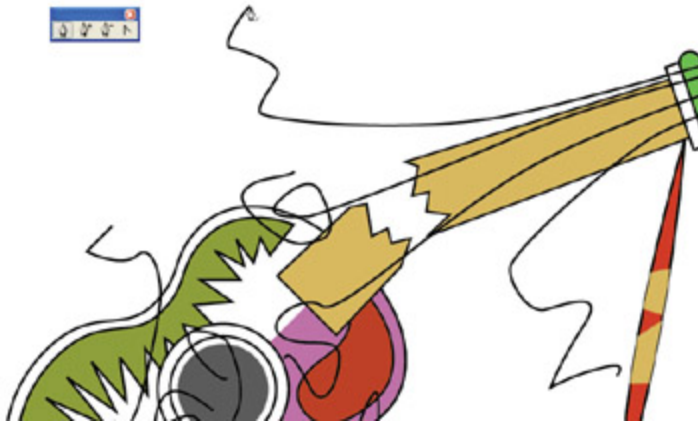Figure 6-10: Extending a line with the Pen tool
Tip If you click and drag instead of just clicking, you'll define a new curved anchor point.

Add, Delete, and Adjust Anchor Points with the Pen Tool

When you point to an anchor point, the cursor displays with a minus (–) sign, and the Pen tool takes on the persona of the Delete Anchor Point tool. Move the Pen tool over an existing anchor point, look for the minus sign cursor, and click. The selected anchor point disappears.

When you point to a path (but not an anchor point on the path), the Pen tool temporarily assumes the identity of the Add Anchor Point tool. Click to create new anchor points. The new anchor point assumes the characteristics of the line segment to which it is added. So a new anchor point on a curved line segment will be a curved anchor point.

Control Pen Tool Mode

When you hold down COMMAND (CTRL), the Pen tool changes to the most recently chosen selection tool. After you've jumped to the Direct Selection tool once, for example, the next time you need to toggle from the Pen tool to the Direct Selection tool, just press COMMAND (CTRL) to convert the Pen tool on the fly to the Direct Selection tool.

One frequent scenario that uses this technique is when you have added an anchor point by pointing and clicking on a path. You can then press COMMAND (CTRL) to convert the Pen tool to the Direct Selection tool. Now you're ready to adjust the control points on the new curved anchor point.

Team LiB
Team LiB

◄ PREVIOUS   NEXT ►
◄ PREVIOUS   NEXT ►

Manage Paths

You can use menu options to close a path and to "average" a path to align points. These options help create symmetrical, clean drawings.

You can also use menu options to find and clean up those stray anchor points that are created when you click with the Pen tool but don't generate a path. Somehow, those darn things always seem to litter a complex illustration.

Align Points by Averaging Paths

Illustrator allows you to align specific anchor points within a path. This trick can be handy when you need to create symmetrical or aligned objects. Generally, when you average paths, you'll want to apply the averaging only to selected points. Otherwise averaging tends to mush your path into an unrecognizable mess.

Tip If you are trying to look up how to align objects (not anchor points), jump ahead to Chapter 11.

To average points in a path, follow these steps:

1. Use the Direct Selection tool to select two (or more) anchor points in a path.

2. With two or more points selected, choose Object | Path | Average. The Average dialog box appears.

3. Select Horizontal to align the selected points on a horizontal plane; select Vertical to line the points up vertically. If you select both, the selected points will move to the same location (and merge into one point).

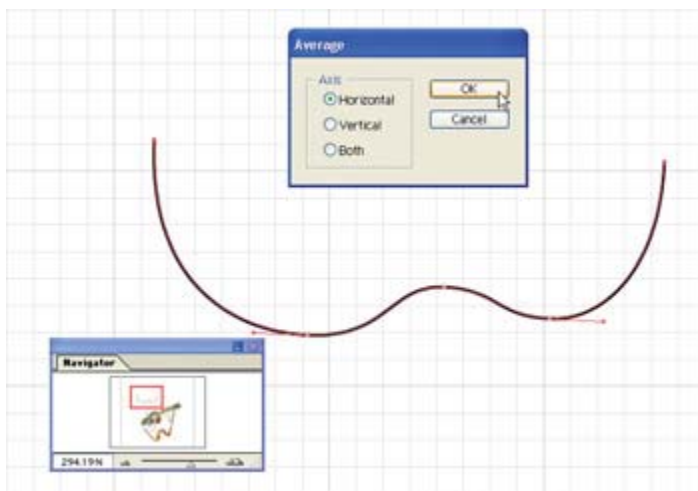4. Click OK to apply the changes to the path, as shown in Figure 6-11.

Figure 6-11: Horizontal averaging on two points in a path

To close an unclosed path, select all the line segments and choose Object | Path | Join. A line segment is generated between the first and last anchor point in the path. If you select two anchor points that are already in the exact same place and choose Object | Path | Join, you convert them into a single anchor point. If one of the anchor points is a smooth anchor and the other is a corner point, you can use the Join dialog box to choose whether to convert the newly merged point to a smooth or corner point.

Tip The easiest way to select just two anchor points is to select one and then hold down shift and select a second point.

Because anchor points are tiny, it's sometimes hard to tell if they are selected. Selected anchor points display as filled squares instead of hollow squares, and they are easier to identify in Outline view. To view your illustration in outline view, choose View | Outline. You can revert to Preview view by

choosing View | Preview.

Clean Up Stray Anchor Points

A click here, a click there, and suddenly your artboard is littered with a bunch of invisible (unless selected) anchor points. Although they don't print, they mess up your project by adding space and size to exported files. And they cause confusion by appearing when you select objects and find you've also grabbed a few stray anchor points. You can see stray anchor points in Outline view, and you can delete them manually.

Thankfully, Illustrator also allows you to identify and delete these stray anchor points automatically. Just choose Select | Object | Stray Points and press DELETE to clean them up. Figure 6-12 shows stray anchors selected all around the illustration—ready for deletion.
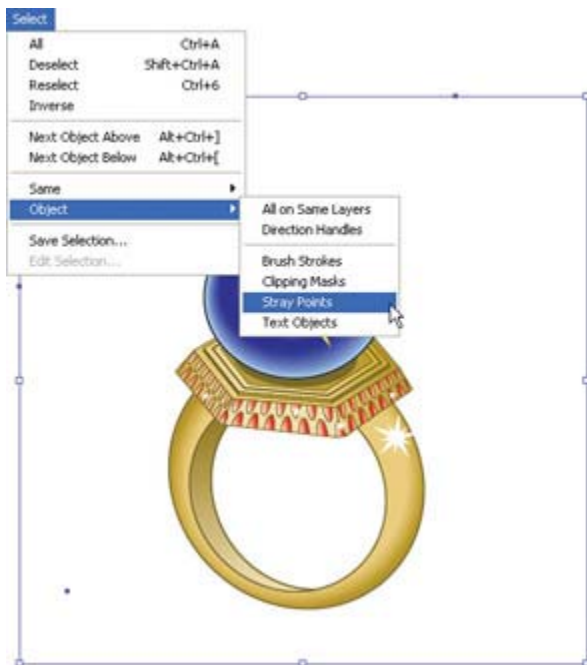

Figure 6-12: Cleaning up stray anchor points prepares the file for print or export

Another way to clean up stray points is to select Object | Path | Clean Up. This strategy opens the Clean Up dialog box, with check boxes that allow you to get rid of stray points, unpainted objects, and/or empty text paths.