

Establishing the Modeling Mindset

IN THIS CHAPTER

- » Understanding edges and faces
 - » Representing three dimensions on a two-dimensional screen
 - » Inferencing like a pro
 - » Warming up with SketchUp
 - » Lining up entities with guides
 - » Adding color and texture to your work
-

When you were learning how to drive a car, you probably didn't just get behind the wheel, step on the gas, and figure it out as you went along. (If you did, you probably have bigger things to worry about than getting started with SketchUp.) The point is, knowing some basic concepts can make your first few hours with SketchUp *much* more productive and fun.

So here's the deal: This chapter has three main parts:

- » The first part talks about edges and faces — the basic *stuff* that SketchUp models are made of.
- » The second part explains how SketchUp enables you to model in 3D (three dimensions) on a 2D (flat) surface — namely, your computer screen. Understanding how SketchUp represents depth is *everything* when making models. If you've never used 3D modeling software before, pay close attention to the middle part of this chapter.
- » The final part of this chapter is about the things you need to do all the time — things like navigating around your model, drawing lines, selecting things, and working with accurate measurements.

All about Edges and Faces

In SketchUp, everything is made up of one of two kinds of *elements*: edges or faces. They're the basic building blocks of every model you'll ever make.



REMEMBER Collectively, the edges and faces in your model are *geometry*. Other modeling programs have other kinds of geometry, but SketchUp is pretty simple. That's a good thing — you have less to keep track of.

The drawing on the left in [Figure 3-1](#) is a basic cube drawn in SketchUp; it's composed of 12 edges and 6 faces. The model on the right is a lot more complex, but the geometry's the same; it's all just edges and faces.

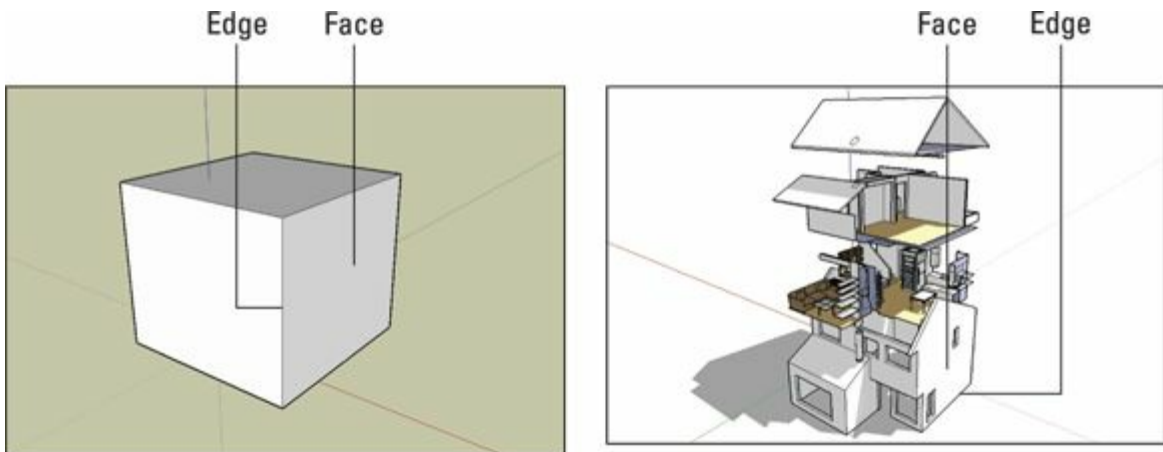


FIGURE 3-1: SketchUp models are made from edges and faces.

Living on the edge

Edges are lines. You can use lots of tools to draw them, erase them, move them, hide them, and even stretch them. Here are some things you ought to know about SketchUp edges:

- » **Edges are always straight.** Not only is everything in your SketchUp model made up of edges, but all those edges are also perfectly straight. Even arcs and circles are made of small straight-line segments, as shown in [Figure 3-2](#).
- » **Edges don't have a thickness.** This one's a little tricky to get your head around. You never have to worry about how thick the edges in your model are because that's not how SketchUp works. Depending on how you choose to *display* your model, your edges may look like they have different thicknesses, but your edges themselves don't have a built-in thickness.
- » **Just because you can't see the edges doesn't mean they're not there.** Edges can be

hidden so that you can't see them; doing so is a popular way to make certain forms. Take a look at [Figure 3-3](#). On the left is a model that looks rounded. On the right, the hidden edges are visible as dashed lines — see how even surfaces that look smoothly curved are made of straight edges?

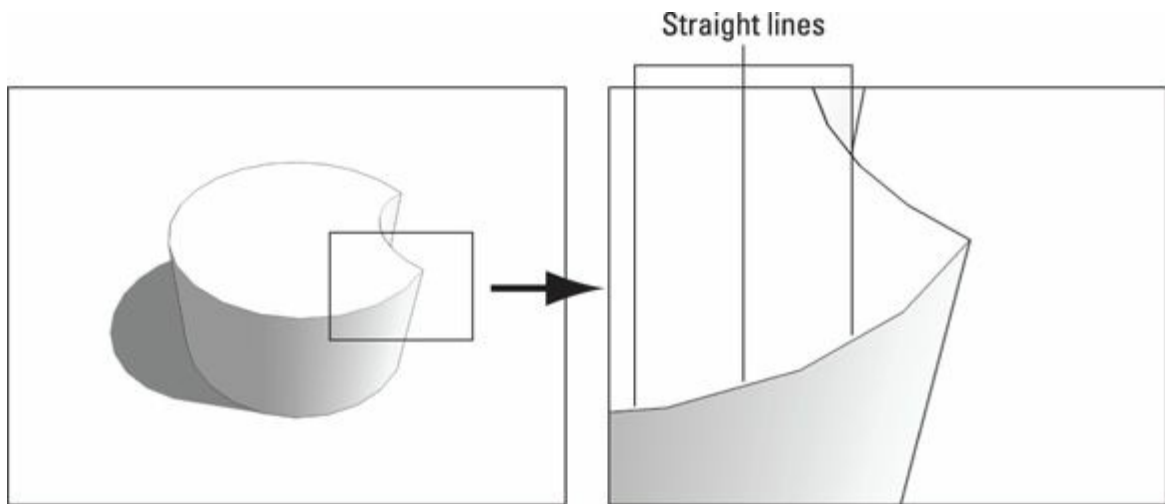


FIGURE 3-2: Even curved lines are made up of straight edges.

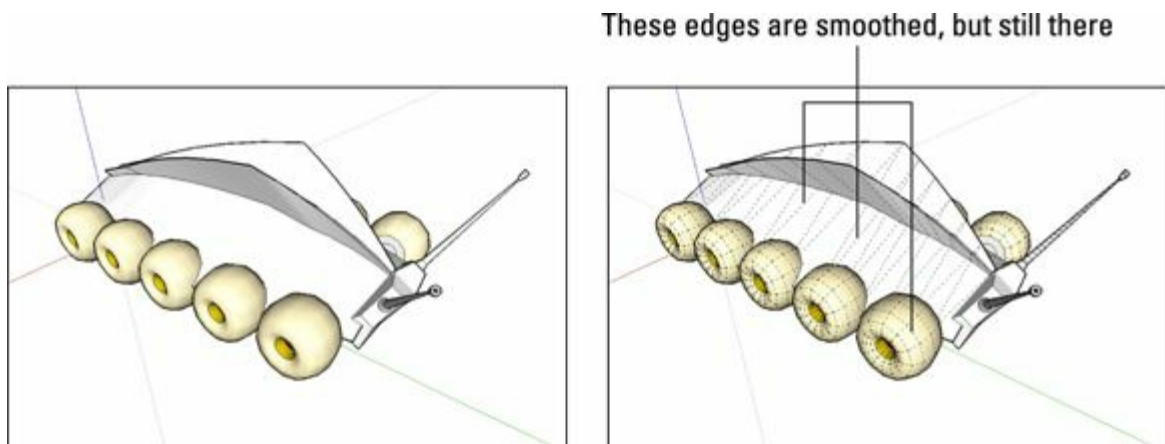


FIGURE 3-3: Even organic shapes and curvy forms are made up of straight edges.

Facing the facts about faces

Faces are surfaces. If you think of SketchUp models as being made of toothpicks and paper (which they kind of are), faces are basically the paper. Here's what you need to know about faces:

- » **You can't have faces without edges.** To have a face, you need to have at least three *coplanar* (on the same plane) edges that are connected. In other words, a face is defined by the edges that surround it, and those edges all have to be on the same, flat *plane*. Because you need at least three straight lines to make a closed shape, faces must have at least three sides. There's no limit to the number of sides a SketchUp face can have, though. [Figure 3-4](#) shows how faces can disappear when you erase an edge that defines one or more faces. We started with the model on the left and deleted the edge that completed both the top face and one of the side

faces. The result, shown in the right, is that both of those faces disappeared.

- » **Faces are always flat.** In SketchUp, even surfaces that look curved are made of multiple, flat faces. In the model shown in [Figure 3-5](#), what look like organically shaped surfaces (on the left) are really just lots of smaller faces (on the right). To make a bunch of flat faces look like one big, curvy surface, the edges between them are *smoothed*. You find out about smoothing edges in [Chapter 6](#).
- » **Just like edges, faces don't have any thickness.** If faces are a lot like pieces of paper, they're *infinitely thin* pieces of paper — they don't have any thickness. To make a thick surface (say, a 6-inch-thick wall), you need to use two faces side by side.

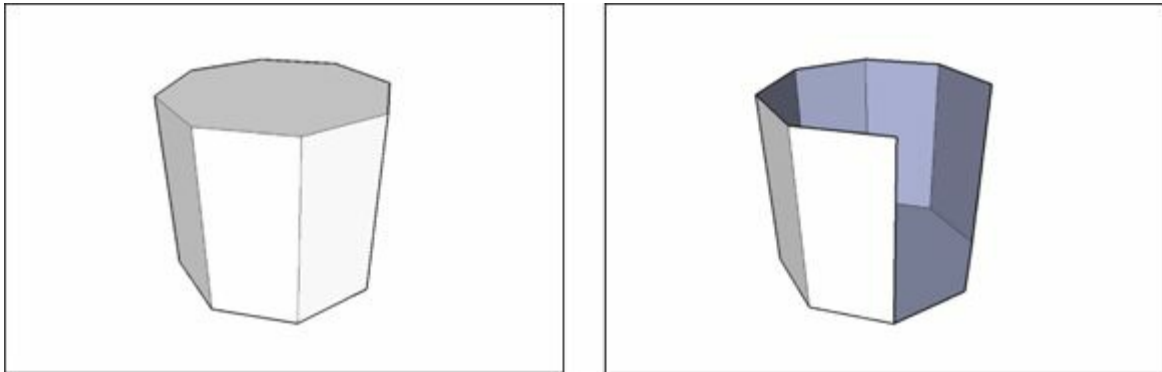


FIGURE 3-4: You need at least three edges to make a face.

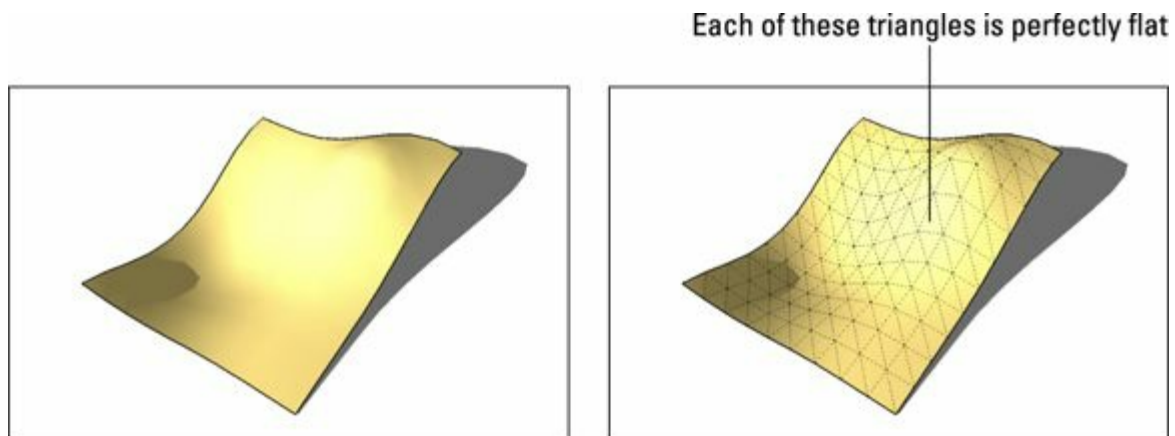


FIGURE 3-5: All faces are flat, even the ones that make up larger, curvy surfaces.

Understanding the relationship between edges and faces

Now you know that models are made from edges and faces, you're most of the way to understanding how SketchUp works. Here's some information that should fill in the gaps:

- » **Every time SketchUp can make a face, it will.** There's no such thing as a "Face tool" in this software; SketchUp just automatically makes a face every time you finish drawing a closed shape out of three or more coplanar edges. [Figure 3-6](#) shows this in action: As soon as a line connects the last edge to the first one, SketchUp creates a face.

- » **You can't stop SketchUp from creating faces, but you can erase them if you want.** If SketchUp creates a face you don't want, just right-click the face and choose Erase from the context menu. That face is deleted, but the edges that defined it remain, as illustrated in [Figure 3-7](#).
- » **Retracing an edge re-creates a missing face.** If you already have a closed loop of coplanar edges but no face (because you erased it, perhaps), you can *redraw* one of the edges to make a new face. Just use the Line tool to trace over one of the edge segments, and a face reappears, as shown in [Figure 3-8](#).
- » **Drawing an edge all the way across a face splits the face in two.** When you draw an edge (like with the Line tool) from one side of a face to another, you cut that face in two. The same thing happens when you draw a closed loop of edges (like a rectangle) on a face — you end up with two faces, one “inside” the other. In [Figure 3-9](#), we split a face in two with the Line tool and then extruded one face a little bit with the Push/Pull tool.
- » **Drawing an edge that crosses another edge splits both edges where they touch.** In this way, you can split simple edges you draw with the Line tool, as well as edges created when you draw shapes like rectangles and circles. Most of the time, this auto-slicing is desirable, but if it's not, you can always use groups and components to separate your geometry. Flip to the first part of [Chapter 5](#) for more information.

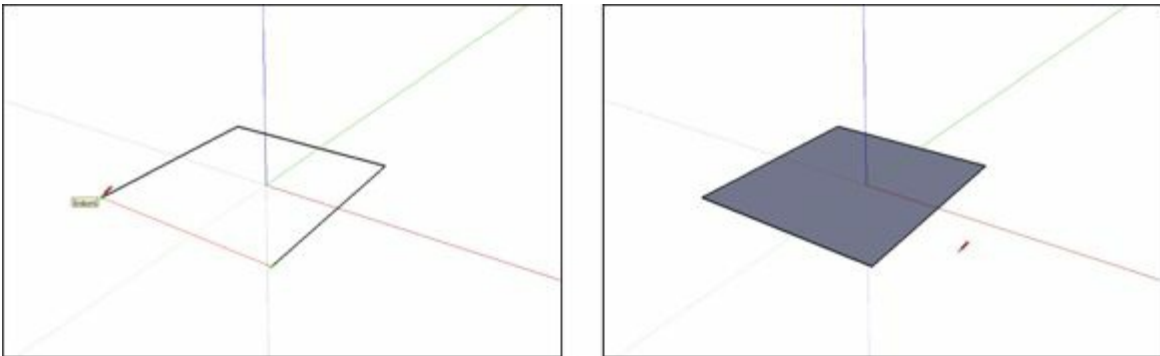


FIGURE 3-6: SketchUp automatically makes a face whenever you create a closed loop of coplanar edges.

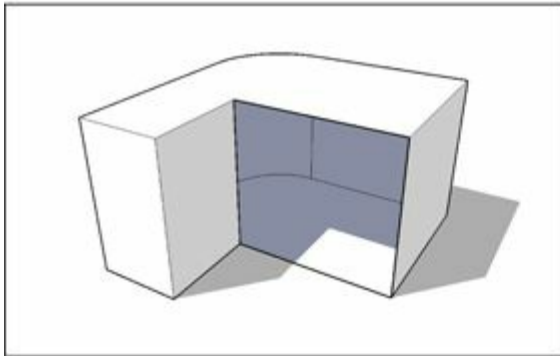
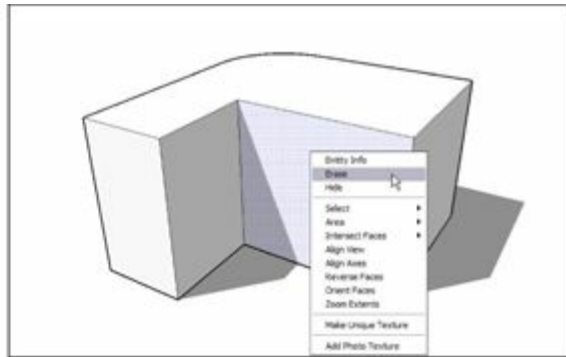
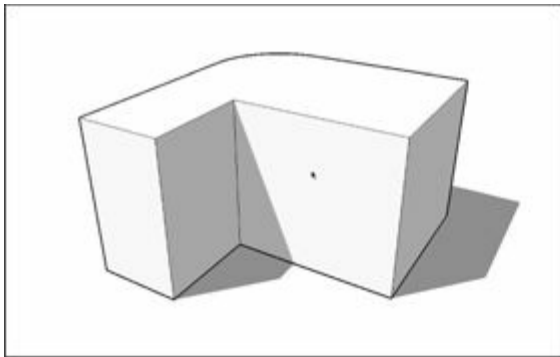


FIGURE 3-7: You can delete a face without deleting the edges that define it.

Drawing an edge from here...

...to here...

...causes this face to be created

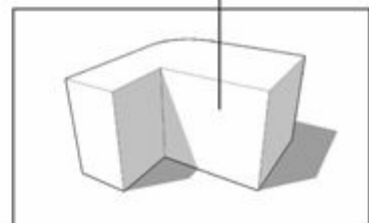
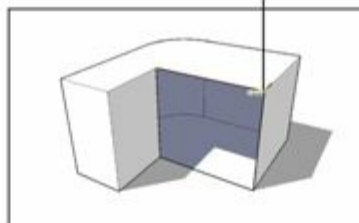
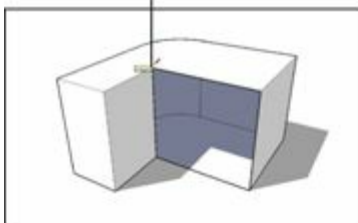


FIGURE 3-8: Just retrace any edge on a closed loop to tell SketchUp to create a new face.

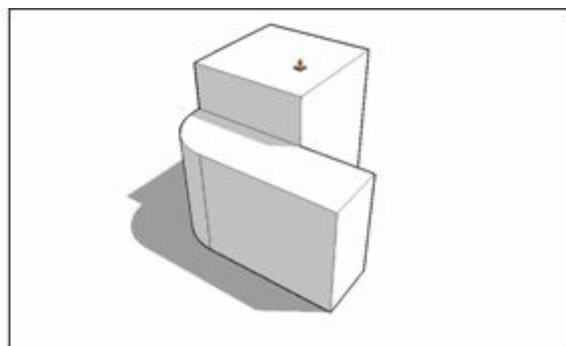
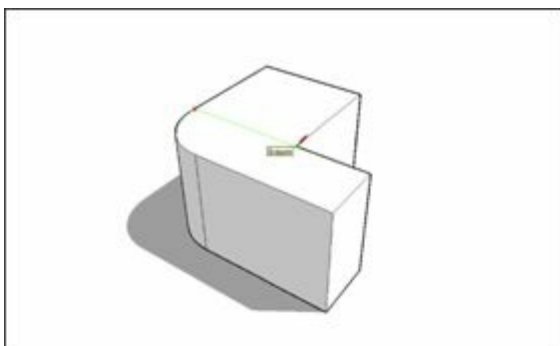


FIGURE 3-9: Splitting a face with an edge, and then extruding one of the new faces.

Drawing in 3D on a 2D Screen

For computer programmers, letting you draw 3D objects on your screen is a difficult problem. You wouldn't think it'd be such a big deal; after all, people have been drawing in perspective for a very long time. If some old guy could figure it out 500 years ago, why should your computer have problems?

The thing is, human perception of depth on paper is a trick of the eye. And of course, your computer doesn't have eyes that enable it to interpret depth without thinking about it. You need to give your computer explicit instructions. In SketchUp, this means using drawing axes and inferences, as we explain in the sections that follow.

DON'T WORRY ABOUT DRAWING IN PERSPECTIVE

Contrary to popular belief, modeling in SketchUp doesn't involve drawing in perspective and letting the software figure out what you mean. This turns out to be a very good thing for two reasons:

- **Computers aren't very good at figuring out what you're trying to do.** This has probably happened to you: You're working away at your computer, and the software you're using tries to "help" by guessing what you're doing. Sometimes it works, but most of the time it doesn't. Eventually, the computer's bad guesswork gets really annoying. Even if SketchUp *could* interpret your perspective drawings, you'd probably spend more time correcting its mistakes than actually building something.
- **Most people can't draw in perspective anyway.** Even if you're one of the few folks who *can*, you know darn well that most people couldn't draw an accurate 3D view of the inside of a room if their lives depended on it. Drawing just isn't one of the things people are taught, unfortunately. So even if SketchUp *did* work by turning your 2D perspective drawings into 3D models (which it most certainly doesn't), the vast majority of those who "can't draw" couldn't use it. And that would be a shame because building 3D models is a real kick.

Giving instructions with the drawing axes

See the three colored lines that cross in the SketchUp modeling window? These are the *drawing axes*, and they're the key to understanding how SketchUp works. Simply put, you use SketchUp's drawing axes to figure out where you are and where you want to go in 3D space. When you're working with the color axes, you need to keep three important things in mind:

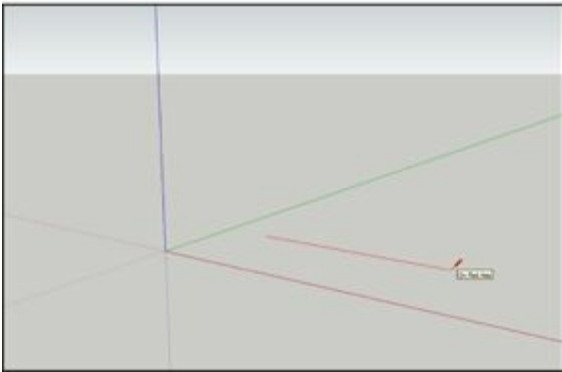
- » **The red, green, and blue drawing axes define 3D space in your model.** If you were standing at the spot where all three axes meet — the *axis origin* — the blue axis would run vertically, passing through your head and feet. The red and green axes define the ground plane in SketchUp; you'd be standing on top of them. The axes are all at right angles to one another, and extend to infinity from the origin.
- » **When you draw, move, or copy something parallel to one of the colored axes, you're working in that color's direction.** Take a look at [Figure 3-10](#). In the first image, we're drawing a line parallel to the *red* axis, or drawing "in the *red* direction." You know a line is parallel to the red axis because the line turns red to let you know. In the second image, we're moving a box parallel to the *blue* axis, or "moving in the *blue* direction." The dotted, blue line appears to tell you so.
- » **The colored drawing axes help you tell SketchUp what you mean.** For example, in [Figure 3-11](#), moving the cylinder in the blue direction and the green direction both involve moving the cursor up. The drawing axes help SketchUp know whether you want to move the cylinder *up* in space (above the ground) or *back* in space.



REMEMBER When you work in SketchUp, you use the colored drawing axes *all the time*. They're not just handy; they're what make SketchUp work. They make modeling in SketchUp quick, accurate, and relatively intuitive. As you model, all you have to do is make sure that you're

working in your intended color direction: Line up your geometry with the appropriate axis and watch the visual cues that tell you what direction you're working in.

Drawing in the red direction



Moving in the blue direction

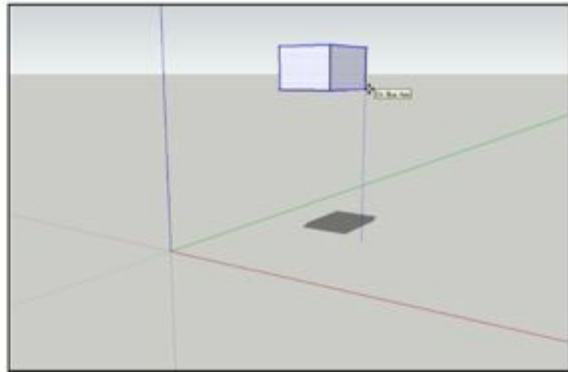
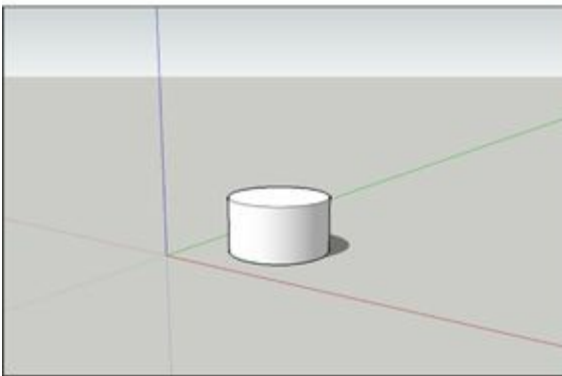
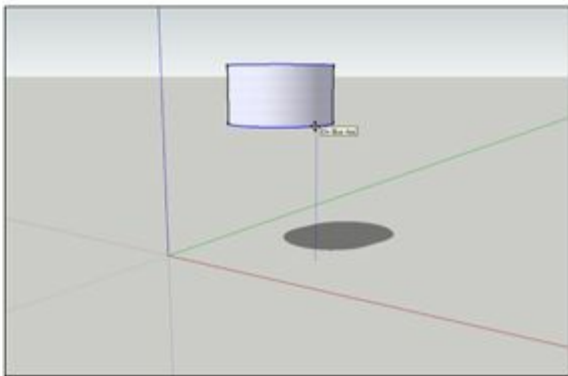


FIGURE 3-10: Visual cues tell you when you're drawing or moving geometry parallel to a drawing axis.



To go up, move in the blue direction



To go back, move in the green direction

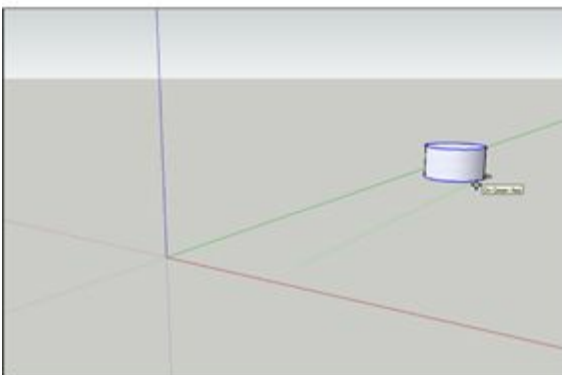


FIGURE 3-11: The axes help you create 3D models on a 2D screen.

Keeping an eye out for inferences

If you've spent any time fiddling with SketchUp, you've noticed all the little colored circles, squares,

dotted lines, yellow screen tips, and other doodads that show up as you move your cursor around your modeling window. All this stuff is referred to collectively as SketchUp's *inference engine*, and its sole purpose is to help you while you build models. Luckily, it does. Without inferences (the aforementioned doodads), SketchUp wouldn't be very useful.

Point inferences

Generally, SketchUp's inferences help you be more precise. *Point* inferences appear when you move your cursor over specific parts of your model. They look like little colored circles and squares, and if you pause for a second, a yellow label appears. For example, the little green Endpoint inference (which appears whenever your cursor hovers over the end of an edge) helps you accurately connect an edge that you're drawing to the end of another edge in your model.

[Figure 3-12](#) shows the point inferences that you use most often.

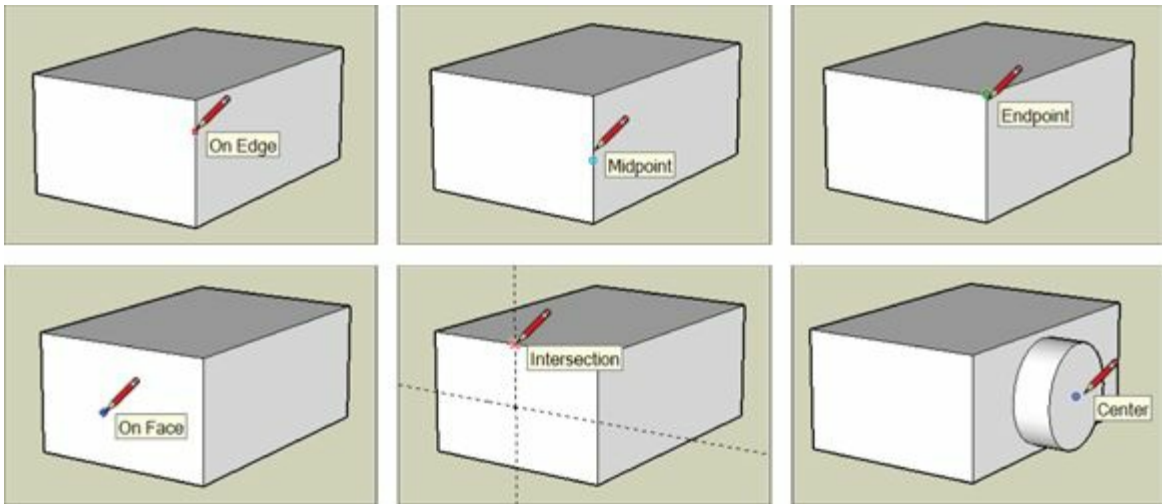


FIGURE 3-12: Point inferences appear when you hover your cursor over key points and help you draw accurately.



REMEMBER In SketchUp, lines are called *edges*, and surfaces are called *faces*. Everything in your model is made up of edges and faces.

Linear inferences

As you've probably already noticed, color plays a big part in SketchUp's *user interface*, or the way it looks. Maybe the best example of this is in the software's *linear* inferences — the “helper lines” that show up to help you work more precisely. [Figure 3-13](#) illustrates the important linear inferences, and here's a description of what they do:

- » **On Axis:** When an edge you're drawing is parallel to one of the colored drawing axes, the edge turns the color of that axis. In [Figure 3-13](#), you see the On Red Axis inference.
- » **From Point:** This one's a little harder to describe. When a colored, dotted line appears as you

move your cursor, your cursor is “lined up” with the point at the other end of the dotted line. Naturally, the color of the From Point inference reflects the axis you’re lined up “on.” Sometimes From Point inferences show up on their own, and sometimes you have to *encourage* them; see the section “[Using inferences to help you model](#),” later in this chapter, for details.

- » **Perpendicular:** When you draw an edge that’s perpendicular to another edge, the one you’re drawing turns magenta (reddish purple).
- » **Parallel:** When the edge you’re drawing is parallel to another edge in your model, it turns magenta to let you know. You tell SketchUp which edge you’re interested in “being parallel to” by *encouraging* an inference.
- » **Tangent at Vertex:** This one applies only when you draw an arc (using the Arc tool) that starts at the endpoint of another arc. When the arc you’re drawing is *tangent* to the other one, the one you’re drawing turns cyan. *Tangent*, in this case, means that the transition between the two arcs is smooth.

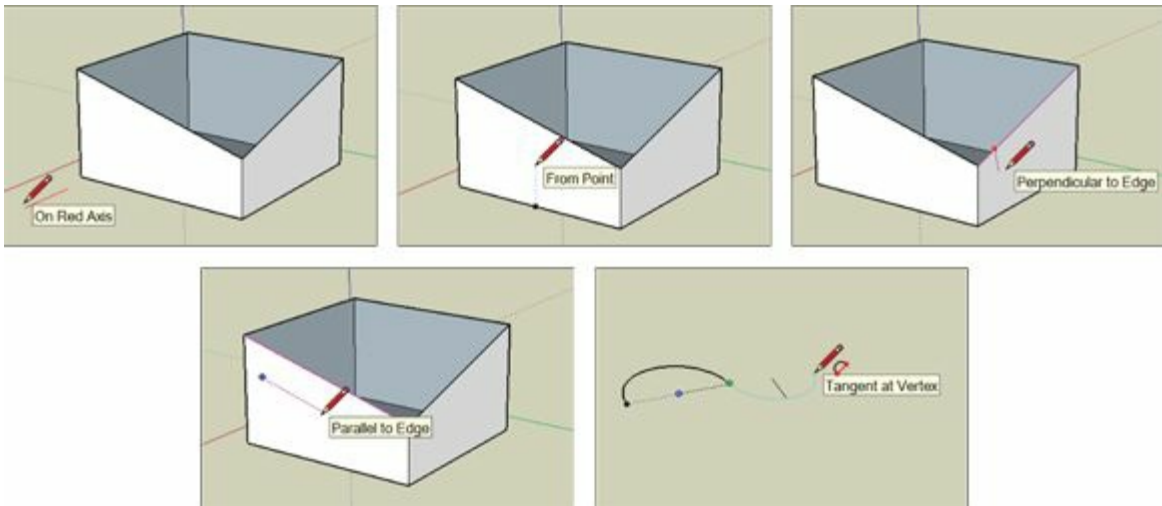


FIGURE 3-13: SketchUp’s linear inferences help you align new geometry with existing geometry.



TIP One of the most important inferences in SketchUp is one that you probably didn’t even realize was an inference: Unless you specifically start on an edge or a face in your model, you always draw on the ground plane by default. That’s right — if you just start creating stuff in the middle of nowhere, SketchUp just assumes that you mean to draw on the ground.

Using inferences to help you model

A big part of using SketchUp’s inference engine involves *locking* and *encouraging* inferences — sometimes even simultaneously. At first, these actions seem a little like that thing where you pat your head and rub your stomach at the same time, but with practice, they get easier.

- » **Locking inferences:** If you hold down the Shift key when you see any of the first four types of linear inferences described previously, that inference gets *locked* — and stays locked until you release Shift. When you lock an inference, you constrain whatever tool you’re using to work only in the direction of the inference you locked.
- » **Encouraging inferences:** Sometimes an inference you need doesn’t show up on its own. When this happens, you have to *encourage* it. To encourage an inference, hover your cursor over the part of your model you want to “infer” from and then slowly go back to whatever you were doing when you decided you could use an inference.

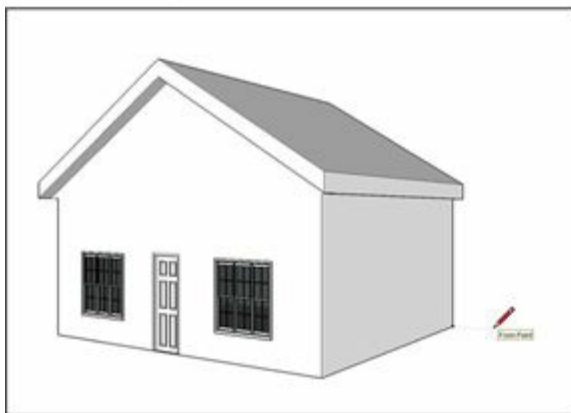
The following example illustrates how you might lock and encourage inferences to draw a 3D model. In [Figure 3-14](#), say you want to draw a line on the blue axis that’s parallel to the back-right corner of the house and as tall as the roof’s bottom edge. Here’s how you might use inferences to help you:

1. **With the Line tool selected, encourage a From Point inference by hovering the cursor over the back-right corner of the house and then slowly moving your cursor away from that corner to encourage a From Point inference.**
2. **Click to set the line’s starting point and hold down the Shift key to lock the line in the blue direction as you draw the line.**

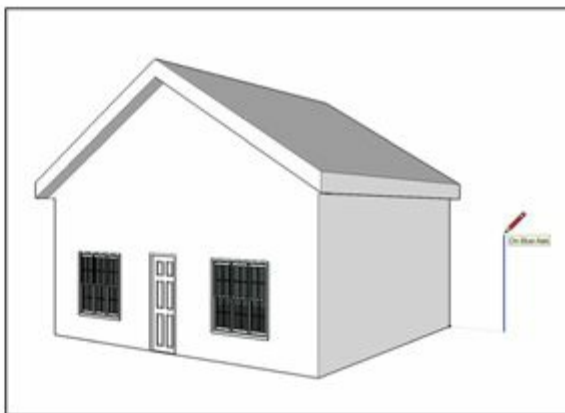
The blue line inference becomes thicker to show the line is locked in the blue direction.

3. **When the line is close to your desired endpoint, hover your mouse cursor over that endpoint while continuing to hold down the Shift key. When the inference to the endpoint appears, click to set the endpoint of your new line.**

1. Encourage a From Point inference.



2. Lock the direction.



3. Encourage another point inference.

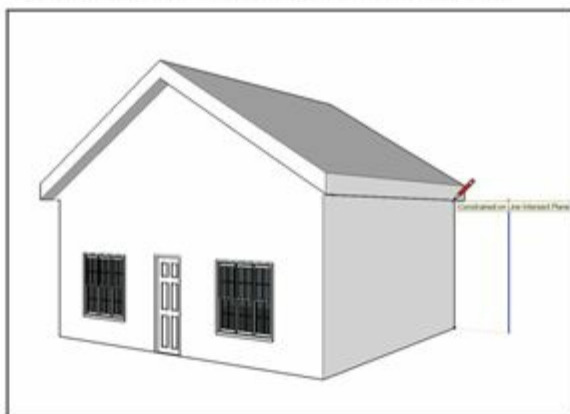


FIGURE 3-14: Lock and encourage inferences as you draw new geometry in relationship to existing geometry.

Warming Up Your SketchUp Muscles

About eight SketchUp skills are useful every time you use SketchUp. Formal-education types would probably call them *core competencies*. Whatever you care to call these activities, we introduce them all in the following sections. Anytime you need a quick refresher, come back to this section.

Getting the best view of what you're doing

Using SketchUp without learning how to orbit, zoom, and pan is like trying to build a ship in a bottle. In the dark. With your hands tied behind your back. Using chopsticks. Get the picture?



REMEMBER Fully half of modeling in SketchUp uses the Orbit, Zoom, and Pan tools, which let you change your view so that you can see what you're doing. Most people who try to figure out SketchUp on their own take too long to understand the importance of these navigation tools and spend hours squinting, grunting, and having an all-around miserable time trying to “get at” what they're working on. The following sections help you avoid the headache (literally).

Going into orbit



Hold a glass of water in your hand. Now twist and turn your wrist around in every direction so that the water's all over you and the rest of the room. Stop when the glass is completely empty. We think that's a pretty memorable way to find out about the Orbit tool, don't you?

Just as your wrist helps you twist and turn a glass to see it from every angle, think of using Orbit as the way to fly around your work. [Figure 3-15](#) shows Orbit in all its glory.

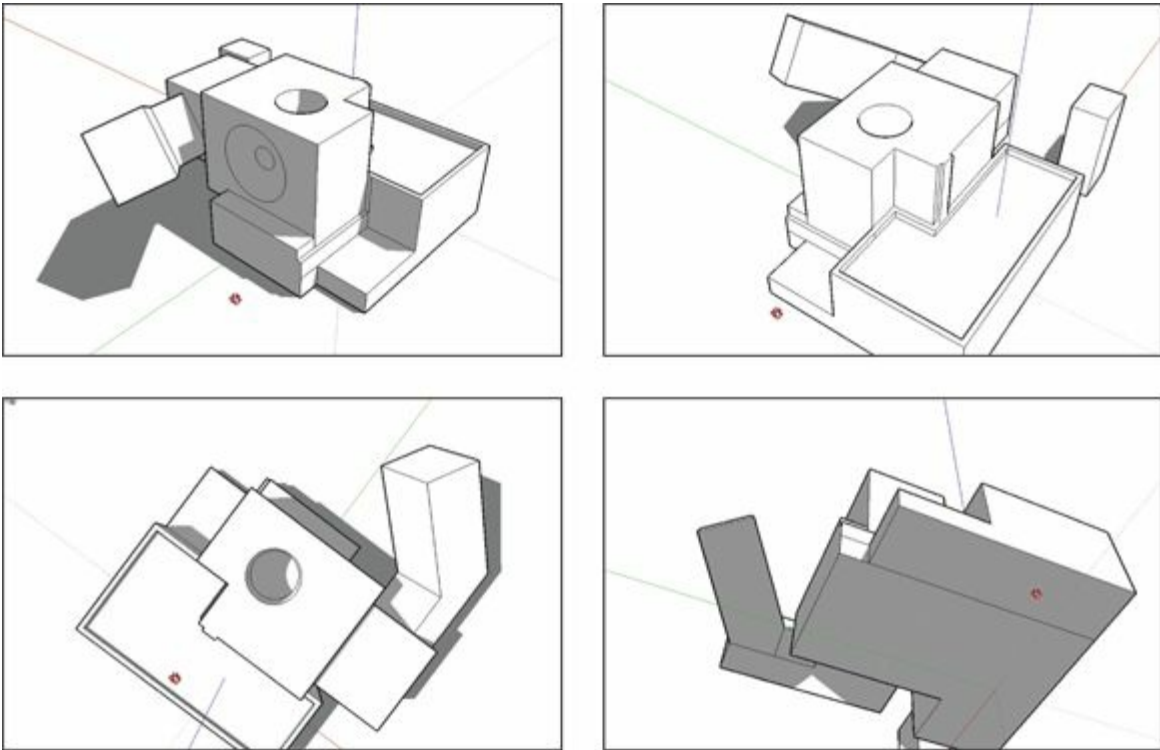


FIGURE 3-15: The Orbit tool lets you see your model from any angle.



TIP Although you can find the Orbit tool on the Camera menu and an Orbit button on the toolbar, here's how you should *always* orbit: Hold down your mouse's scroll wheel and move your mouse around. See your model swiveling? Release the scroll wheel when you're done. Using your mouse to orbit means that you don't have to switch tools every time you want a better view, which saves you *truckloads* of time.

Zooming in and out



Hold your empty glass at arm's length. Close your eyes and then bring the glass rushing toward you, stopping right when it smashes you in the nose. Now throw the glass across the room, noticing how it shrinks as it gets farther away. That, in a nutshell, describes the Zoom tool.

You use Zoom to get closer to (and farther from) your model. If you're working on something small, you zoom in until it fills your modeling window. To see everything at once, zoom out. [Figure 3-16](#) is a demonstration.

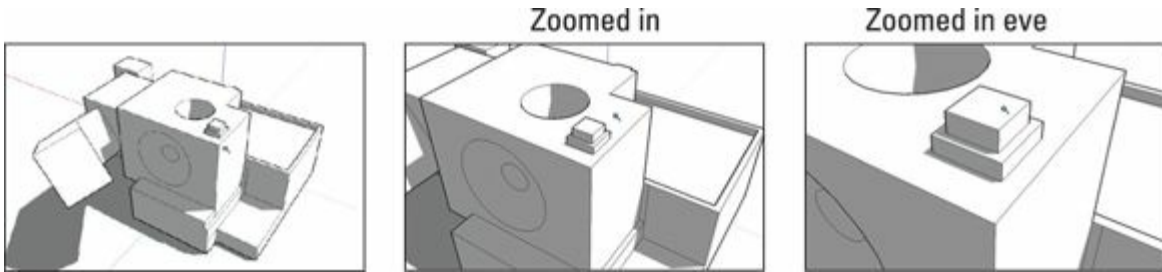



FIGURE 3-16: Use the Zoom tool to get closer to the action.



TIP As you're drawing in SketchUp, you zoom in and out of your model all the time, and the following tips make zooming quick and easy:

- » **To zoom in and out, roll your finger on your mouse's scroll wheel.** This method is the easiest way to zoom. You can find a Zoom tool on the Camera menu and a Zoom button on the toolbar, but zooming with your mouse's scroll wheel means that you don't have to switch tools. When you stop scrolling, you stop zooming and revert to your active tool.
- » **As you scroll, SketchUp zooms in on your cursor.** Position the cursor over whatever part of your model you want to see closer (or from farther away).
- »  **Use Zoom Extents to see everything.** If you want your model to fill your modeling window (which is especially useful when you "get lost" with the navigation tools — trust us, it happens to everyone), just choose Camera ⇒ Zoom Extents. You can also click the Zoom Extents button on the toolbar.

Just panning around



Using the Pan tool is a lot like washing windows: You move the paper towel back and forth, but it stays flat and never gets any closer or farther away from you. The Pan tool is basically for sliding your model view around in your modeling window. To see something that's to the right, you use Pan to slide your model to the left. It's as simple as that.



TIP Although you find a Pan tool on the Camera menu and a Pan button on the toolbar, here's the best way to pan: Hold down your mouse's scroll wheel button and press the Shift key. When you do both at the same time — basically, Orbit+Shift — your cursor temporarily turns into the Pan tool, and you can move your mouse to pan.

Drawing and erasing edges with ease


Here's *the* secret to modeling anything you want in SketchUp: Learn to use the Line tool without

having to think too much about it. You use the Line tool to draw individual edges, and because SketchUp models are really just fancy collections of edges (carefully arranged of course), anything you can make in SketchUp, you can make with the Line tool.



REMEMBER SketchUp models are made up of edges and faces. Any time you have three or more edges that form a closed shape and are *on the same plane*, SketchUp creates a face. If you erase an edge that *defines*, or borders, a face, the face disappears, too. Take a look at the section “[All about Edges and Faces](#),” earlier in this chapter, for more information on the relationship between edges and faces.

Drawing edges is simple. Just follow these steps:

1.  **Select the Line tool.**
You can select the Line tool from the Draw menu or the toolbar. Pressing the L key activates the Line tool, too.
2. **Click where you want your line to begin.**
3. **Move your cursor to the desired endpoint for your line and click again to end.**
When you draw a line segment with the Line tool, notice how SketchUp automatically tries to draw another line? This is called *rubber banding* — the Line tool lets you continue to draw edge segments, automatically starting each new one at the end of the previous one you drew.
4. **When you want the Line tool to stop drawing lines, press the Esc key to snip the line at the last spot you clicked.**



TIP SketchUp lets you draw lines in two ways: You can either use the click-drag-release method or the click-move-click one. We highly recommend training yourself to click-move-click. You'll have more control, and your hand won't get as tired. When you draw edges by clicking and *dragging* your mouse (click-drag-release), you're a lot more likely to “drop” your line accidentally. Because the Line tool draws only straight lines, think about using it less like a pencil (even though it looks like one) and more like a spool of sticky thread.



The Eraser tool is specifically designed for erasing edges. You find this tool on the Draw menu and the toolbar, or activate it by pressing the E key. To erase an edge, select the Eraser tool and click the edges you don't like to delete them. You can also *drag* over edges with the Eraser, but that's a little harder. To erase several edges at once, select them (selecting is explained in the upcoming section, “[Selecting what you mean to select](#)”); then context-click the selection and choose Erase.

TURNING OFF RUBBER-BANDING LINES

Depending on what you're making and how you work, you may want to turn off the Line tool's rubber-banding behavior. To do so, follow these steps:

1. **Choose Window ⇒ Preferences (SketchUp ⇒ Preferences on the Mac).**
2. **Choose the Drawing panel from the list on the left in the Preferences dialog box.**
3. **Clear the Continue Line Drawing check box.**

Injecting accuracy into your model

Most of the time, you need to make sure that your model is accurate — that what you've modeled is precisely the size you intend it to be. In SketchUp, the key to accuracy is the Measurements box. This powerful little text box lives in the lower-right corner of your SketchUp window.

Here are some things the Measurements box can do:

- » Make a line a certain length.
- » Draw a rectangle a certain size.
- » Push/pull a face a certain distance.
- » Change the number of sides in a polygon.
- » Move something a given distance.
- » Rotate something by a certain number of degrees.
- » Make a certain number of copies.
- » Divide a line into a certain number of segments.
- » Change your field of view (how much you can see).



TIP

Here's what you need to know about the Measurements box:

- » **You don't have to click in the Measurements box to enter a number.** This one's a big one: SketchUp beginners often assume that they need to click in the Measurements box (to select it, presumably) before they can start typing. You don't have to click it — just start typing, and whatever you type shows up in the box automatically. Whenever you're drawing, the Measurements box "listens" for you to type something that controls your geometry's precision.
- » **The Measurements box is context-sensitive.** The box accepts values based on what you're doing. If you're drawing an edge with the Line tool, the box listens for a length; if you're rotating a shape, the box listens for an angle.

»» **You can set the default units for the Measurements box and override the default when needed.**

- *You don't need to type a unit if you want to use the default unit.* Perhaps you want a line you're drawing to be 14 inches long. If inches are your default unit of measurement, just type **14** into the Measurements box and press Enter — SketchUp assumes that you mean 14 inches.
- *Do type a unit if you want to override the default unit.* For example, if your default is inches and you want to draw something 14 *feet* long, type **14'** and press Enter. You can override the default unit of measurement by typing any unit you want. If you want to move something a distance of 25 meters, type **25m** and press Enter.
- *You set the default units in the Model Info dialog box.* You can open this dialog box from the Window menu. Open the Units panel, and choose your new default unit from the drop-down menu.

»» **Sometimes, the Measurements box does more than one thing.** In certain circumstances, you can change the box's mode (what it "listens for") by entering a unit type after a number. For example, when you draw a circle, the default "value" in the Measurements box is the radius. If you type **6** and press Enter, a circle radius becomes 6 inches. But if you type **6s**, you're telling SketchUp that you want 6 *sides* (and not inches), so your circle becomes a hexagon. If you type **6** and press Enter, and then type **6s** and press Enter again, SketchUp draws a hexagon (a 6-sided circle) with a radius of 6 inches.

»» **The Measurements box lets you change your mind.** As long as you don't do anything after you press Enter, you can always type a new value and press Enter again; there's no limit to the number of times you can change your mind.

»» **You can use the Measurements box *during* an operation.** In most cases, you can use the Measurements box to be precise *while* you're using a tool. Here's how that works:

1. *Click once to start your operation (such as drawing a line or using the Move tool).*
2. *Move your mouse so that you're going in the correct color direction. Be sure not to click again.*

If you're using the Line tool and you want to draw parallel to the green axis, make sure that the edge you're drawing is green (displays the green edge inference).

3. *Without clicking the Measurements box, type the dimension you want.*

The dimension appears in the box.

4. *Press Enter to complete the operation.*

»» **You can also use the Measurements box *after* an operation.** Doing so revises what you've just done. For example, say you want to move a box, as shown in [Figure 3-17](#), 5 meters in the red direction (parallel to the red axis). Here's what you do:

1. *With the Move tool, click the box once to pick it up.*
2. *Move the mouse until you see the red linear inference.*

3. Type **5m** and press *Enter*.

The box is positioned exactly 5 meters from where you picked it up. However, after you see that placement, you realize the box needs to move a little farther.

4. Type **15m** and then press *Enter* again. The box moves another 10 meters in the red direction.
5. You can keep changing the box's position until you're happy (or bored).

» **The Measurements box tells you what value or values it's expecting.** For example, select the Line tool and the Measurements box tells you it's listening for a length. Select the Move tool, and you see the box is expecting a distance. This feature is great because remembering everything the box can do at any given moment is pretty difficult — even for experienced SketchUp modelers.

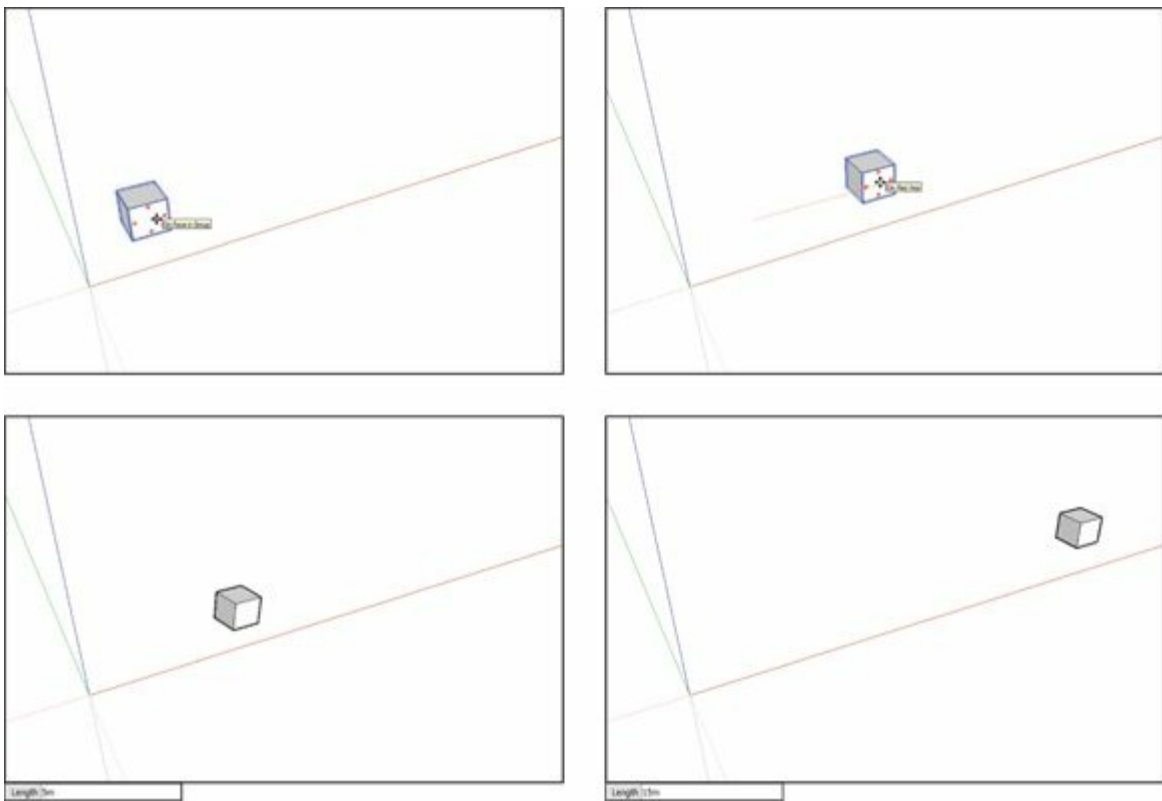


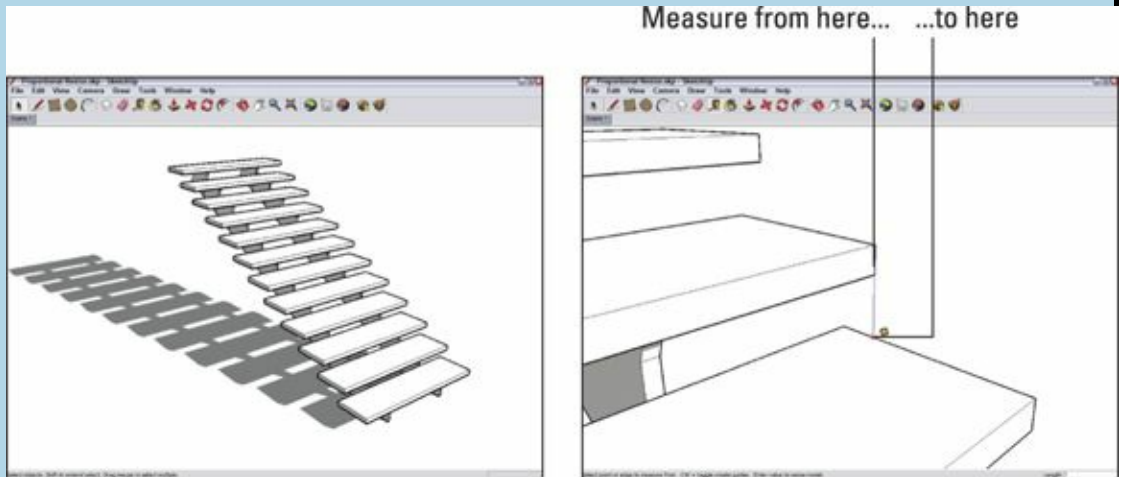
FIGURE 3-17: You can move the box 5 meters and then change your mind and move it 15 meters instead.

RESIZING EVERYTHING WITH THE TAPE MEASURE TOOL

Consider that you've been working away in SketchUp, not paying particular attention to how big anything in your model is, when you suddenly decide that you need what you've made to be a specific size. SketchUp has a terrific trick for taking care of this exact situation: You can use the Tape Measure tool to resize your whole model based on a single measurement.

Here's how this tool works: In the following figure, Aidan started to model a simple staircase. Making sure that it's the right size will make working on it easier. Aidan knows the *riser height*, the vertical distance between the steps, should be 7 inches, so this is what he does:

1. Select the **Tape Measure** tool on the toolbar or the **Tools** menu.



2. To put the Tape Measure in Measure mode, press the Ctrl key (Option on the Mac) so that the plus sign (+) next to the Tape Measure cursor disappears.
3. Click once to start measuring the distance that will change (in this case, the riser height) and click again to stop.
4. Type the desired dimension (7 for 7 inches).
5. In the dialog box, confirm the resize by clicking Yes.

After Aidan clicks the Yes button, his whole model is resized proportionately to the dimension he entered.

Selecting what you mean to select

If you want to move, rotate, copy, scale, or otherwise manipulate existing geometry in your model, you need to select it first. Your selection tells SketchUp what geometry you want to change.



To select things, you use (drum roll, please) the Select tool, which looks exactly the same as the Select tool in every other graphics program on the planet — it's an arrow. That's a good thing because selecting isn't the sort of thing you should have to relearn every time you pick up a new program. Here's everything you need to know about selecting things in SketchUp:



» TECHNICAL STUFF

Technically, every single thing you see in your modeling window is an *entity*. SketchUp has three different kinds of entities:

- *Elements* are basic pieces of geometry like edges and faces.
- *Objects* are made up of elements. Components and groups, which we cover in [Chapter 5](#), are objects. Anytime you want to make a separate *thing* with its own name and metadata, you make an object. In SketchUp, they're everywhere.
- *Annotations* are things like text, guides, dimensions, and section planes. It's kind of a catch-all category — anything that isn't an element or an object is an annotation.

» Just click anything in your model to select it (while you're using the Select tool, of course).

» To select more than one thing, hold down the Shift key while you click all the things you want to select.



TIP

The Shift key works both ways when it comes to the Select tool. You can use it to *add* to your set of selected things (which we mention earlier), but you can also use it to *subtract* something from your selection. In other words, if you have a bunch of stuff selected and you want to deselect something in particular, just hold down Shift while you click it — it isn't selected anymore.

» Selected entities in SketchUp look different depending on what they are:

- Selected edges turn blue.
- Selected faces change from plain gray to blue gray (if you're using the default style).
- Selected groups and components have a blue box around them.
- Selected annotations turn blue.



» TIP A much fancier way to select things in your model is to double- and triple-click them. When you double-click a face, you select that face and all the edges that define it. Double-clicking an edge gives you that edge plus all the faces that are connected to it. When you triple-click an edge or a face, you select the whole conglomeration that it's a part of. See [Figure 3-18](#).

» You can select several things at once by dragging a box around them. You have two kinds

of selection boxes; the one you use depends on what you're trying to select. See [Figure 3-19](#):

- *Window selection*: If you click and drag from *left to right* to make a selection box, you create a window selection. In this case, only things that are *entirely* inside your selection box are selected.
- *Crossing selection*: If you click and drag from *right to left* to make a selection box, you create a crossing selection. With one of these, anything your selection box touches (including what's inside) is selected.

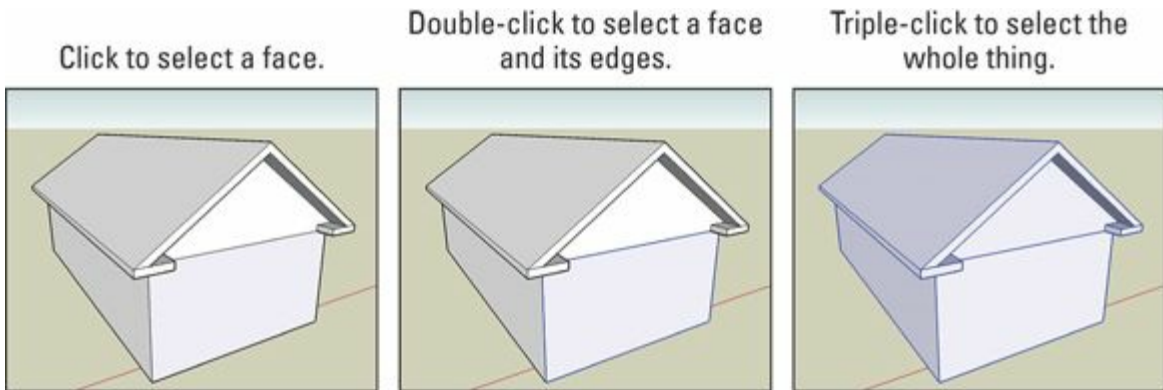


FIGURE 3-18: Try single-, double-, and triple-clicking edges and faces in your model to make different kinds of selections.

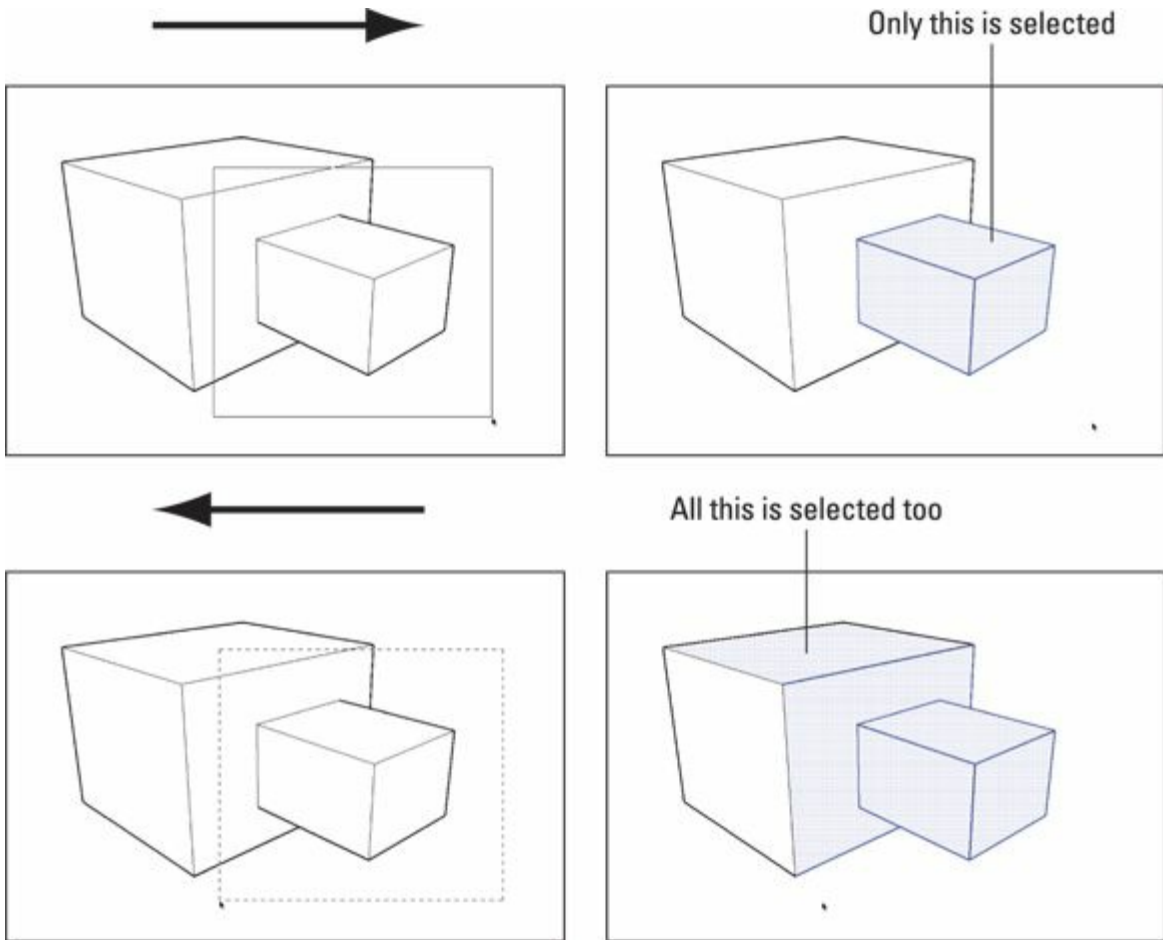


FIGURE 3-19: Dragging left to right selects everything inside your selection box. Dragging right to left selects everything that your selection box touches.



CHANGING THE COLOR OF MODELING CUES

Whether you have color blindness or the default selection colors and other colored modeling cues simply don't work for you, know that you can change the selection color, the axis colors, and several other visual cues. You control these colors with SketchUp styles and preferences settings that are new in SketchUp 2017. See [Chapter 10](#) for details.



REMEMBER Just because you can't see something doesn't mean it isn't selected. Whenever you make a selection, it's a very good idea to orbit around to make sure you have only what you intended to get. Accidentally selecting too much is an easy mistake to make.

Moving and copying like a champ



To move, stretch, or copy geometry in SketchUp, use the Move tool. That's right, the Move tool isn't just for moving, and this section explains all the Move tool secrets that will help you quickly advance to more complex 3D modeling.

Moving things

The Move tool is the one that looks like four red arrows. Using this tool involves clicking the entity you want to move, moving it to where you want it to be, and clicking again to drop it. The maneuver isn't complicated, but getting the hang of it takes a bit of time.



TIP Here are tips for using Move successfully:

- » **Click, move, and click. Don't drag your mouse.** Many new SketchUp users are tempted to move stuff by clicking and dragging. That works, but in the long run, moving things is harder that way. Instead, practice clicking once to pick something up, moving your mouse without any buttons held down, and clicking again to put down whatever you're moving.
- » **Click a point that will let you position whatever you're trying to move.** For example, [Figure 3-20](#) shows two boxes. To stack one on top of the other precisely, you can't just click anywhere on the first box and move it over the other one. You have to click the *bottom corner* of the soon-to-be top box and move the cursor over the *top corner* of the bottom box.
- » **Press the Esc key to cancel a move operation.** When you start to move something (on

purpose or accidentally), it's tempting to use Move to put things back the way they were. Inevitably, Move messes up your model instead. Instead, press Esc, which is the quickest and easiest way to get out of a Move operation and keep your model intact.

- » **Watch for helpful inferences.** To move something in one of the colored directions, wait until you see the dotted On Axis linear inference appear; then hold down Shift to lock yourself in that direction. For more information about using SketchUp's inference engine, check out the earlier section "[Keeping an eye out for inferences.](#)"
- » **Move precisely with the Measurements box.** You can move things precise distances with the Measurements box; see "[Injecting accuracy into your model.](#)" earlier in this chapter.

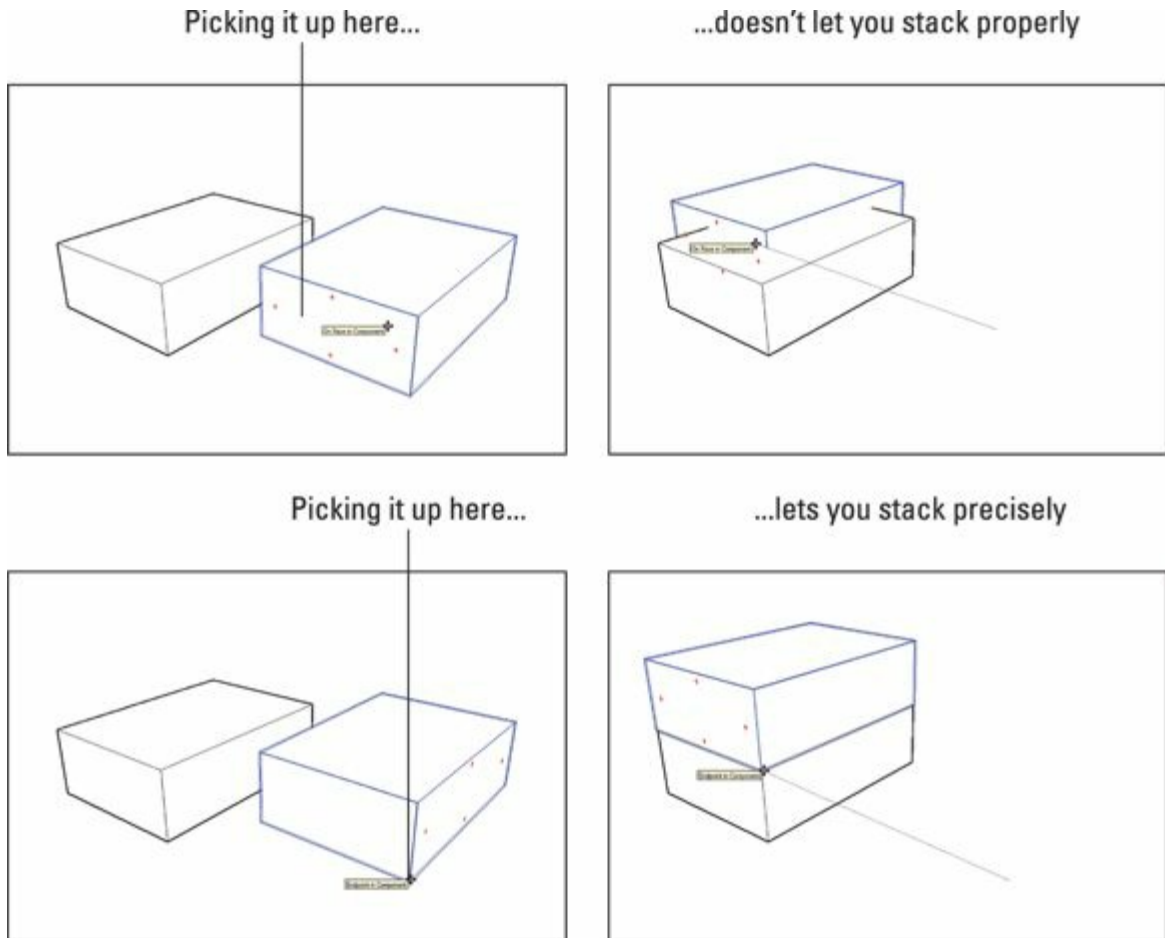
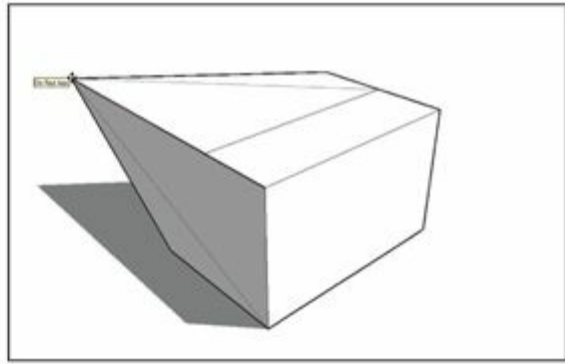
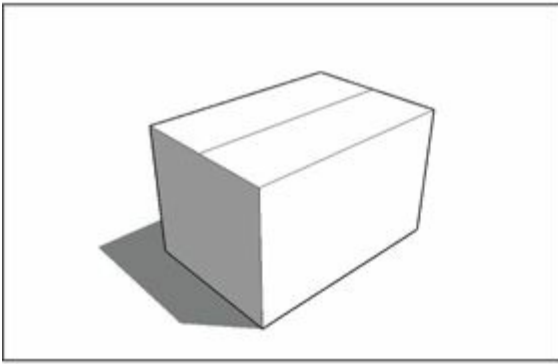


FIGURE 3-20: To move things precisely, choose precise points to grab things and put them down.

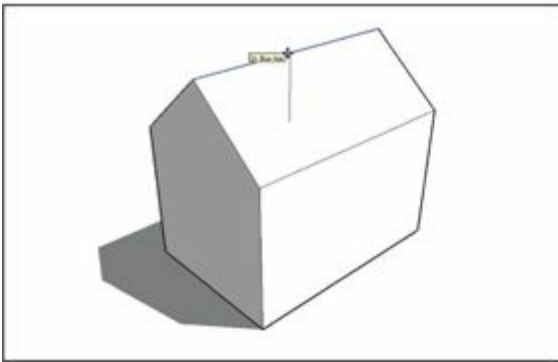
Shaping forms with the Move tool

SketchUp's Move tool isn't just for moving whole objects. You can also use this tool to change the shape of your model. To do this, move a *vertex* (where edges' endpoints come together), an edge, a face, or a combination of any of these. By moving only certain *entities* (all the things we just mention), you can change the shape of your geometry pretty drastically, as shown in [Figure 3-21](#).

Moving a vertex



Moving an edge



Moving a face

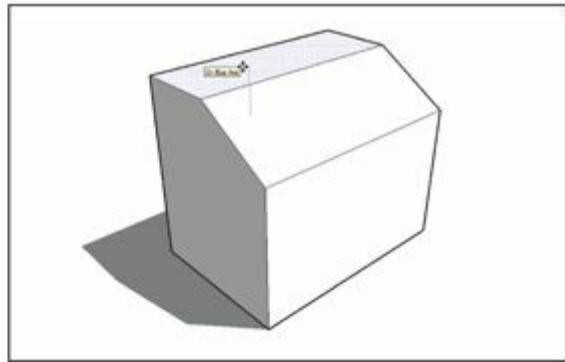


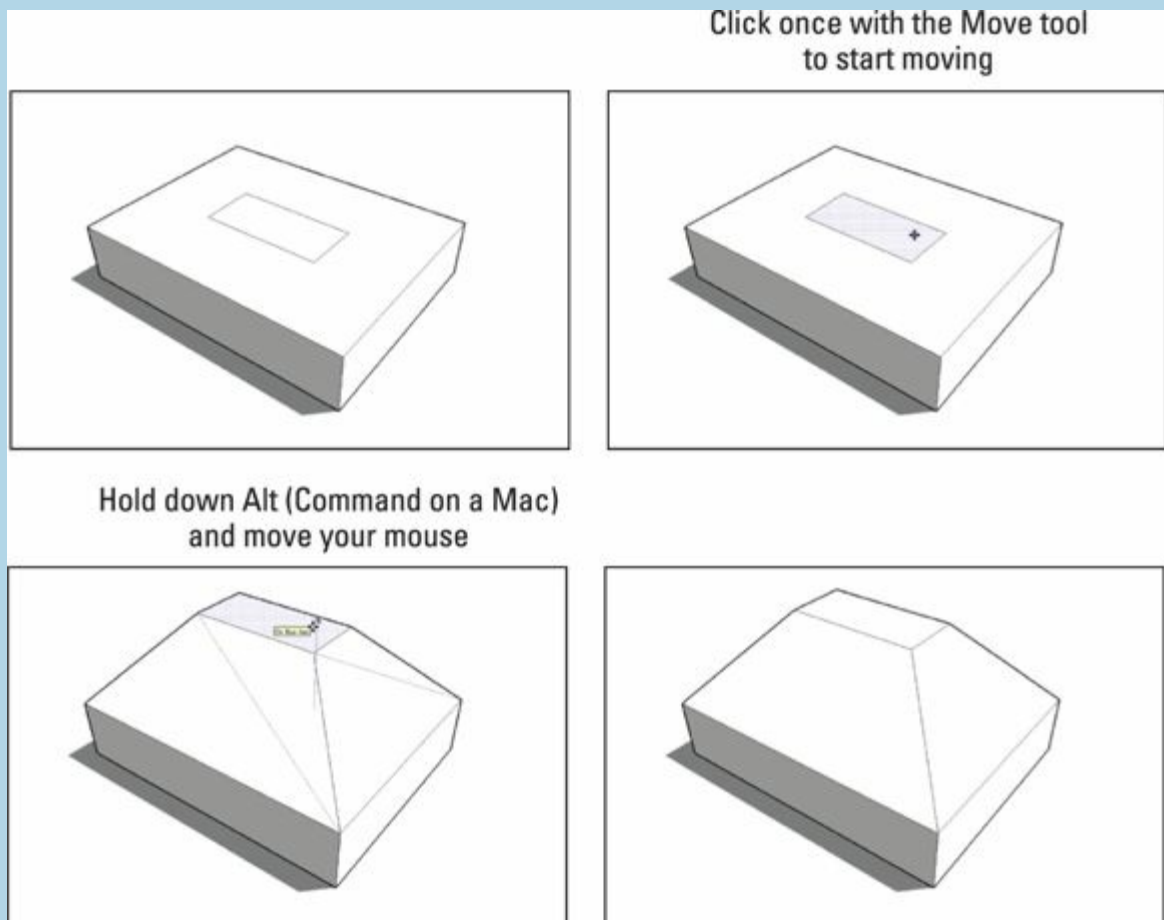
FIGURE 3-21: You can use the Move tool on vertices, edges, and faces to model different forms.



TIP Using the Move tool to create forms (instead of just moving them around) is an incredibly powerful way to work but isn't particularly intuitive. After all, nothing in the physical world behaves like the Move tool. You can't just grab the edge of a hardwood floor and move it up to turn it into a ramp in real life. In SketchUp, you can — and should.

TELLING SKETCHUP WHO'S BOSS WITH AUTO-FOLD

This will happen to you sooner or later: As you try to move a vertex, an edge, or a face, you can't go in the direction you want. SketchUp doesn't like to let you create *folds* (when extra faces and edges are created in place of a single face) with the Move tool, so SketchUp constrains your movement to directions that won't add folds. To force the move, press and hold down the Alt key (Command on a Mac) while you move. When you do this, you're telling SketchUp that it's okay to proceed — to create folds if it has to. This is called *Auto-Fold*, and the following figure shows how it works.



To preselect or not to preselect

The Move tool works in two different ways; you eventually need to use them both, depending on what you're trying to move:

- » **Moving a selection:** When you select one or more entities, the Move tool moves only the selection. This behavior is handy when you need to move more than one thing all at once; [Figure 3-22](#) shows how to move selected items with the Move tool.
- » **Moving without a selection:** If you don't make a selection, you can click anything in the drawing window to move it around. Only the thing you click moves.

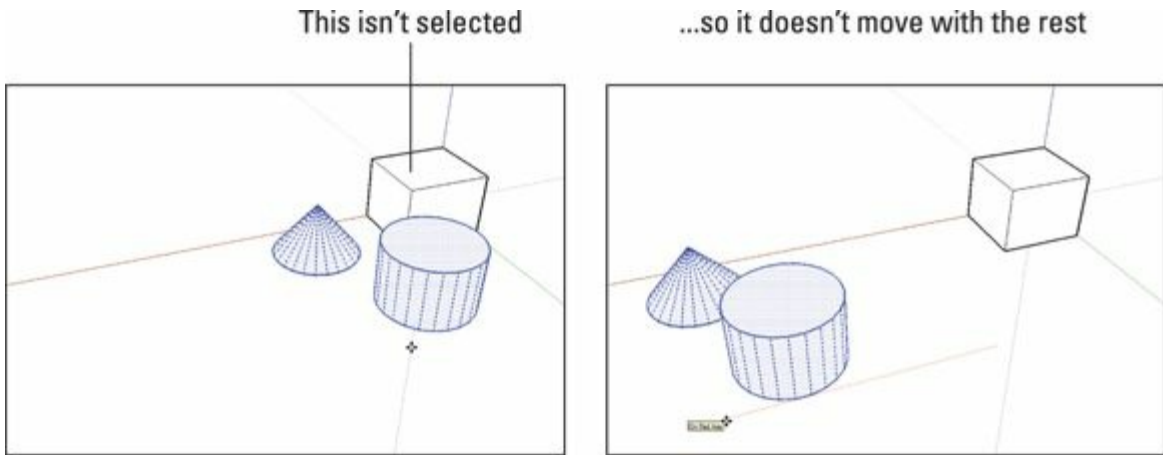


FIGURE 3-22: Using the Move tool when you have a selection moves only the things in that selection.

Making copies with the Move tool

Lots of folks spend time hunting around in SketchUp, trying to figure out how to make copies. It's very simple: You just press a *modifier key* — a button on your keyboard that tells SketchUp to do something different — while you're using the Move tool. Instead of moving something, you move a copy of it. Here are a couple things to keep in mind:

» **Press the Ctrl key (Windows) or the Option key (Mac) to create a copy.** You can press the modifier key before or after you click the entity you want to move. When the Move tool is in Copy mode, a little + appears next to the Move cursor, and your copy moves when you move your mouse. [Figure 3-23](#) shows this in action.

If you decide you don't want to make a copy, just press the Ctrl key (Option on a Mac) again to toggle back to Move; the + sign disappears.

» **Copying is just like moving, except you're moving a copy.** This means that all the same rules for using the Move tool apply to making copies, too.

» **To make more than one copy at a time, use the Measurements box.** For example, say you want to make five equally spaced copies of a column, as shown in [Figure 3-24](#). First, move a copy to where you want the last column to be; then type 5/ and press Enter. This makes five copies of the column and spaces them evenly between the first and last column in the row. Neat, huh?



TIP To set a precise distance between your copies, move a copy to set the distance between each copy. Then type 5x, and press Enter.

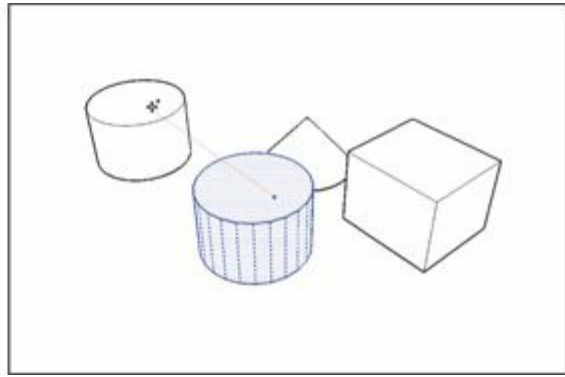
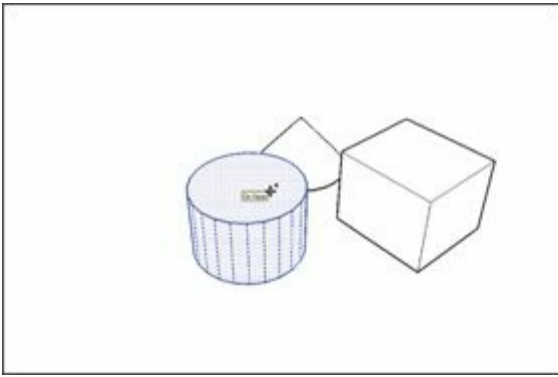


FIGURE 3-23: Press Ctrl (Option on a Mac) to tell SketchUp to make a copy while you move something.

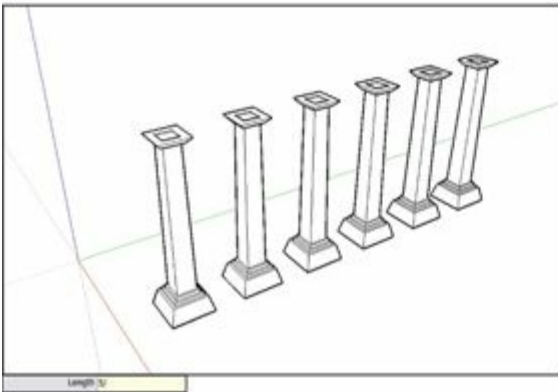
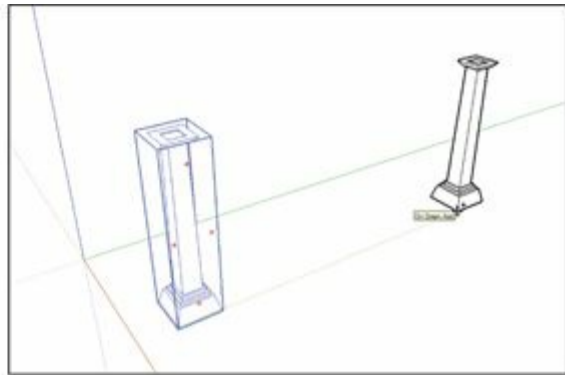
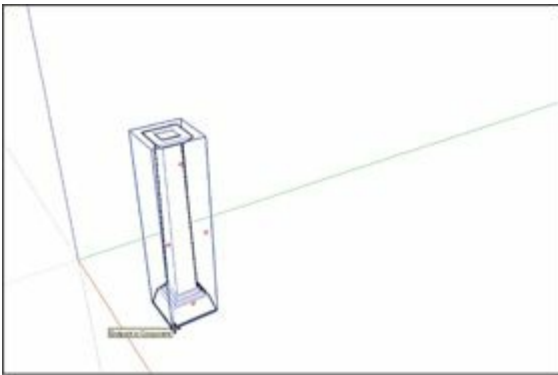


FIGURE 3-24: Use the Measurements box to make multiple copies.

Rotating the right way



The Rotate tool spins geometry based on an angle you specify. No surprises there. However, the Rotate tool also has a trick up its sleeve that most new modelers don't discover until hours after they could've used it. First things first, though:

» **It's better to preselect.** As with the Move tool, rotating something you've already selected is usually easier.

- » **The Rotate tool can make copies, too.** Press the Ctrl key (Option on a Mac) to switch between rotating your original or rotating a copy. You can also make several copies arranged in a circle or along an arc. Check out the earlier section “[Making copies with the Move tool](#),” to read about using x and / to create multiples.
- » **You can be precise.** The Measurements box enables you to type exact angles while you’re rotating. Take a look at “[Injecting accuracy into your model](#)” (earlier in this chapter) to find out more.

Using Rotate: The basic method

Follow these steps to rotate things in your model:

1. **Select everything you want to rotate.**

2. **Activate the Rotate tool.**

The default keyboard shortcut for Rotate is Q. The Rotate tool also appears on the toolbar and the Tools menu.

3. **Click once to establish an axis of rotation.**

Your *axis of rotation* is the theoretical line around which your selected entities will rotate; picture the axle of a wheel. Although it’d be nice if SketchUp drew the axis of rotation in your model, you just have to imagine it.



TIP

As you move the Rotate tool’s big protractor cursor around your screen, the cursor sometimes changes orientation and color. When you hover over a face, the cursor realigns itself to create an axis of rotation that’s perpendicular to that face. When the cursor is red, green, or blue, its axis of rotation is parallel to that colored axis.



TIP

You can (and should) use *inference locking* when you’re using the Rotate tool. Just hover over any face in your model that’s perpendicular to the axis of rotation you want, hold down the Shift key to lock in that orientation, and click where you want your axis to be. See “[Using inferences to help you model](#)” (earlier in this chapter) to read all about it.

4. **Click again to start rotating.**

Clicking part of the thing you’re rotating is helpful, especially if you’re rotating visually instead of numerically (by typing an angle).

5. **Move your mouse; then click again to finish rotating.**

If you like, now is a good time to type a rotation angle and press Enter. As with everything else in SketchUp, you can be as precise as you want or need to be.

Using Rotate: The not-so-basic method

The basic method of using Rotate is fine when you need to rotate something on the ground plane, but this method isn't as useful when your axis of rotation isn't vertical. Finding a face to use to orient your cursor can be tricky or impossible, and that's where a lot of SketchUp modelers get hung up.

With this not-so-basic rotation method, you can establish a precise axis of rotation (the invisible line around which you're rotating) *without having any pre-existing faces to use for orientation*. This makes rotating things about a million times easier.

In this case, using Rotate goes from being a five-step operation to a seven-step one. Check out [Figure 3-25](#) for a visual explanation:

- 1. Select everything you want to rotate.**
- 2. Activate the Rotate tool (Tools ⇒ Rotate).**
- 3. Click once to establish your axis of rotation, but *don't let go* — keep your finger on your mouse button.**
- 4. Drag your cursor around (still holding down the mouse button) until your axis of rotation is where you want it.**
As you drag, notice your Rotate protractor changes orientation; the line from where you clicked to your cursor is the axis of rotation.
- 5. Release your mouse button to set your axis of rotation.**
- 6. Click (but don't drag) the point at which you want to “pick up” whatever you're rotating.**
- 7. Click again to drop the thing you're rotating where you want it.**

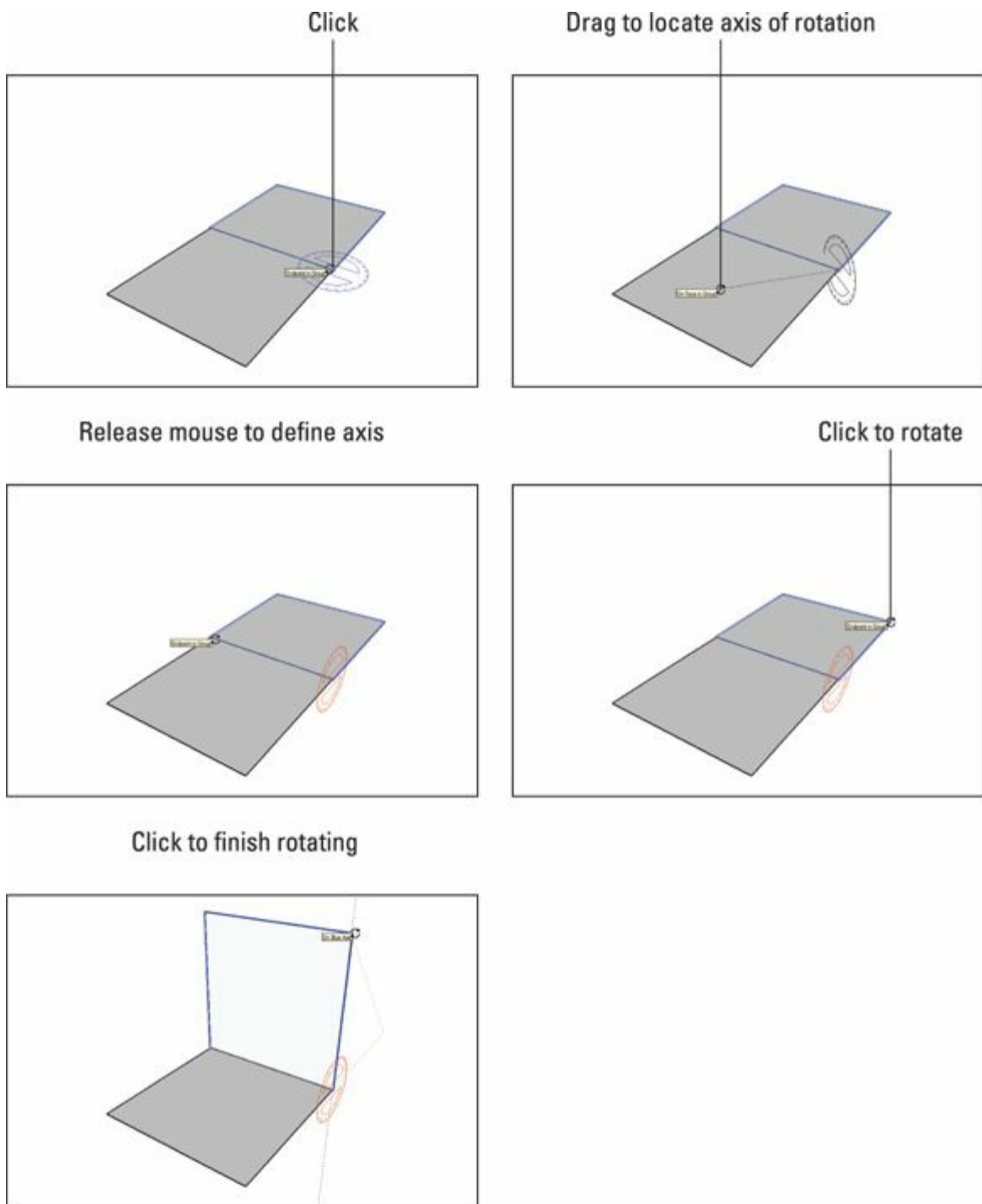


FIGURE 3-25: Define a custom axis of rotation by click-dragging your mouse.

Making and using guides

Sometimes you need to draw temporary lines while you model. These temporary lines, or *guides*, are useful for lining up things, making things the right size, and generally adding precision and accuracy to

what you're building.

In previous versions of SketchUp, guides were called *construction geometry* because that's basically what they are: a special kind of entity that you create when and where you need them. They aren't part of your model because they're not edges or faces. This means that you can choose to hide them or delete them — like other annotations, they don't affect the rest of your geometry.

[Figure 3-26](#) shows an example of guides in action. The guides are positioned 12 inches from the wall and 36 inches apart to draw the sides of a doorway. Another guide (6 feet, 8 inches from the floor) indicates the top. With these guides in place, you can easily draw a rectangle, bounded by your guides, which you know is exactly the right size and in the correct location.

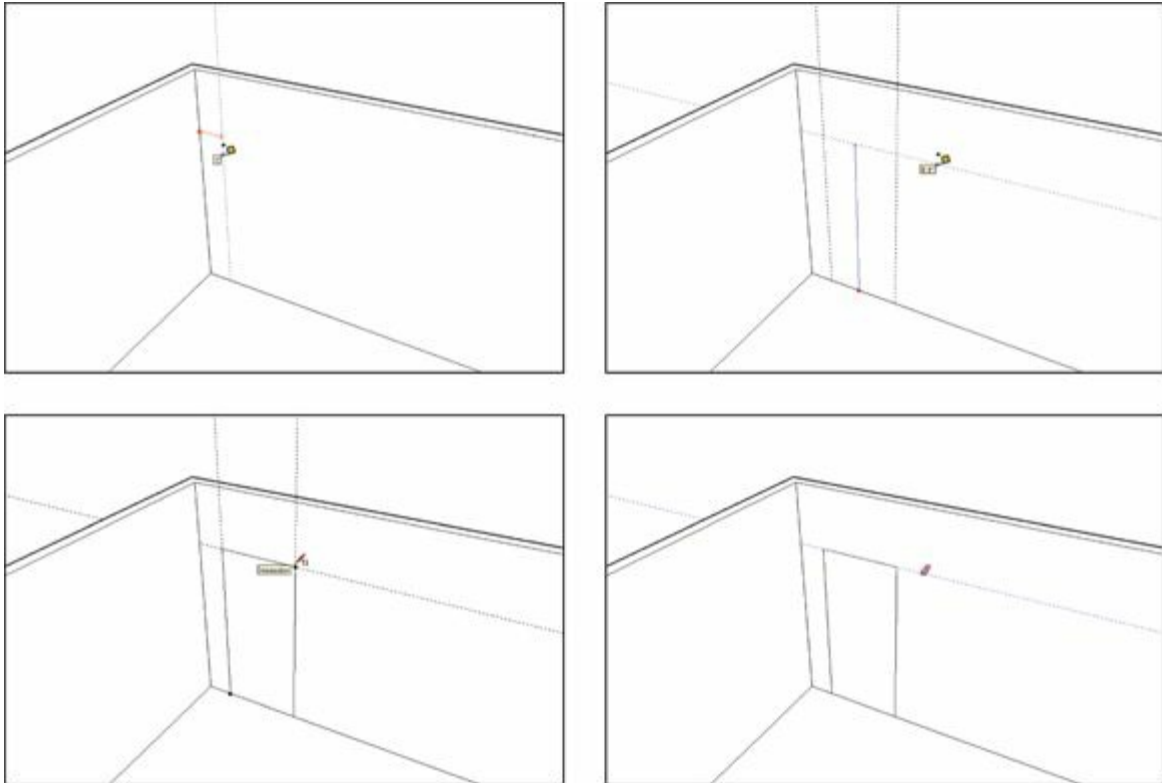


FIGURE 3-26: Use guides to measure things before you draw.

Creating guides with the Tape Measure tool



You can create three kinds of guides, and you use the Tape Measure tool to make them all, as shown in [Figure 3-27](#).

- » **Parallel guide lines:** To create a guide that's parallel to an edge, select the Tape Measure tool, and click anywhere (except the endpoints or midpoint) along an edge. Then move your mouse, and a parallel, dashed guide appears. Click again to place the guide wherever you want.
- » **Linear guide lines:** To create a guide along an edge in your model, click anywhere along the edge *except* on either endpoint. Then click again anywhere else along the edge.

- » **Guide points:** You may want to place a point somewhere in space; you can do exactly that with guide points. With the Tape Measure tool, click an edge's endpoint, and then click again somewhere else. A little x appears at the end of a dashed line — that's your new guide point.

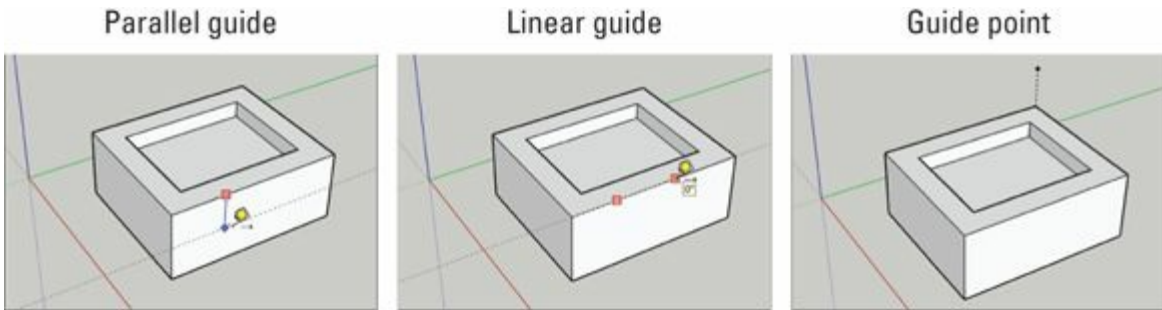


FIGURE 3-27: Use the Tape Measure tool to create guide lines and points.



REMEMBER Here's an important point about the Tape Measure tool: It has two modes, and it creates guides in only one of them. Pressing the Ctrl key (Option on a Mac) toggles between the modes. When you see a + next to your cursor, your Tape Measure can make guides; when there's no +, it can't.

Using guides to make your life easier



TIP As you're working along in this software, you'll find yourself using guides all the time; they're an indispensable part of how modeling in SketchUp works. Here's what you need to know about using them:

- » **Position guides precisely using the Measurements box.** Check out the section "[Injecting accuracy into your model](#)," earlier in this chapter, to find out how.
- » **Erase guides one at a time.** Just click or drag over them with the Eraser tool to delete guides individually. You can also context-click them and choose Erase from the context menu.
- » **Erase all your guides at once.** Choosing Edit ⇒ Delete Guides does just that.
- » **Hide guides individually or all at once.** Context-click a single guide and choose Hide to hide it, or deselect View ⇒ Guides to hide them all. It's a good idea to hide your guides instead of erasing them, especially while you're still modeling.
- » **Select, move, copy, and rotate guides just like any other entity in your model.** Guides aren't edges, but you can treat them that way a lot of the time.

Painting your faces with color and texture

When adding colors and textures — collectively referred to in SketchUp as *materials* — to your model, look no further than the Materials panel and the Paint Bucket tool. [Chapter 2](#) introduces you to this winsome pair and provides a workflow for adding materials to your mode. This section offers a more in-depth introduction to your options.

The Materials panel

The Materials panel looks different in the Windows and Mac versions of SketchUp, but they do basically the same thing. By default, the Materials panel appears on the Default Tray (Windows only). If the panel is ever hidden and you need to reopen it, choose Window ⇒ Default Tray ⇒ Materials (Windows) or Window ⇒ Materials (Mac).

In SketchUp, you can choose from two kinds of materials to apply to the faces in your model:

- » **Colors:** These are simple — colors are always solid colors. You can't have *gradients* (in which one color fades into another), but you can pretty much make any color you want.
- » **Textures:** A SketchUp texture is a tiny image that is tiled to cover a face. If you paint a face with, say, a brick texture, what you're really doing is telling SketchUp to cover the surface with however many “brick photo” tiles it takes to do the job. The preview image you see in the Materials panel is actually a picture of a single texture image tile.

SketchUp comes with a whole bunch of textures, and you can always go online and choose from thousands more available for sale. And if that's *still* not enough, you can make your own (though the process is well beyond the scope of this humble tome). For details on more advanced techniques like creating a custom texture, check out the SketchUp Help Center (<http://help.sketchup.com>).

The following facts about SketchUp materials are also handy to know as you work with them:

- » **Materials can be translucent.** Sliding the Opacity slider makes the material you've selected more or less translucent, which makes seeing through windows in your model a lot easier. On Windows, you find the Opacity slider on the Edit tab.
- » **Textures can have transparent areas.** If you take a look at the materials in the Fencing library, you'll notice that a lot of them look kind of strange; they have areas of black that don't seem right. These black areas are areas of transparency: When you paint a face with one of these textures, you can see through the areas that look black.



TECHNICAL
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There's actually a third thing (besides colors and textures) you can apply to the faces in your models: photos. In fact, *photo-texturing* is an incredibly important part of some SketchUp workflows. As such, we dedicate a good portion of [Chapter 8](#) to the subject of modeling with photographs.

The Paint Bucket tool



Activating the Paint Bucket tool automatically opens the Materials panel so it's handy. Here's everything you need to know about the Paint Bucket tool:

- » **You fill it by clicking in the Materials panel.** Just click a material to load your bucket and then click the face you want to paint.
- » **Holding down the Alt key (⌘ on a Mac) switches to the Sample tool.** With the Sample tool, you can click any face in your model to load your Paint Bucket with that face's material. Release the Alt key to revert to the Paint Bucket tool.
- » **Holding down the Shift key paints all similar faces.** Don't like the dark brick on your house model? Select a new material in the Materials panel, hold down the Shift key, and click any face with the brick applied. In [Figure 3-28](#), Paint Bucket tool is ready to change the dark brick to a lighter option, which you see as the active material in the upper left of the Materials panel. When you're done, all faces in your model that match the one you click are painted with the new material. If things don't turn out the way you want, just choose Edit ⇒ Undo to go back a step.

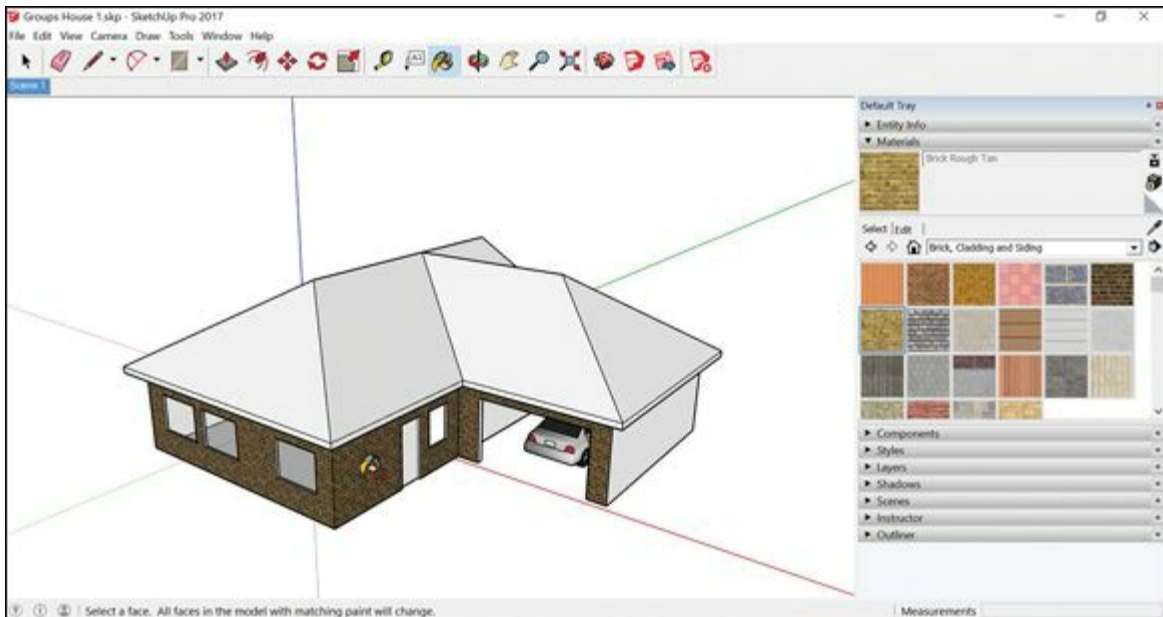


FIGURE 3-28: Press Shift and click with the Paint Bucket to replace one material with another.