Taking Advantage of Components to Build Better Models

A huge amount of the stuff in the galaxy is made of some kind of *repeated element*. In the case of bilaterally symmetrical objects (like most furniture), that element is a mirrored half. For things like staircases, it's a step or tread. The *whole* is composed of two or more instances of a single *part*. This makes modeling a heck of a lot easier because you don't often have to model things in their entirety — especially if you use components.

In the following sections, you discover two methods for modeling with components. The first method involves symmetrical objects, and it covers about 50 percent of the things you might ever want to model. The second technique applies to things like stairs and fences, which are both perfect examples of why components were invented in the first place.

Modeling symmetrically: Good news for lazy people

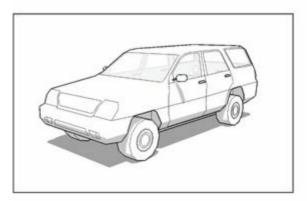
And smart people, too! First off, take a hard look at the shape of the things you may want to model. Then think about all the objects in the universe. We'll wait a couple of minutes while you do that. Done so soon? Good. Everything in the world can be categorized as either of the following formal types:

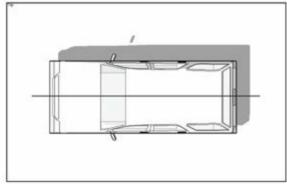
- >> Symmetrical: Objects that exhibit *bilateral symmetry* are made of mirrored halves. You're (more or less) bilaterally symmetrical, and so is your car. Another kind of symmetry is *radial symmetry*. Radially symmetrical objects can be (conceptually, anyway) cut into identical wedges that all radiate from a central axis. Starfish are good examples of this, as are umbrellas and apple pies. If you were going to build a model of something that exhibits some form of symmetry, building one part and making copies would be a smarter way to do it.
- **>> Asymmetrical:** Some things puddles, oak trees, and many houses aren't symmetrical. There's no real trick to making these things; you just have to get some coffee, settle in, and get to work.

You can take advantage of both bilateral and radial symmetry with SketchUp components. To do so, assemble those components as follows, depending on what type of symmetry your object has (also take a look at Figure 5-14):

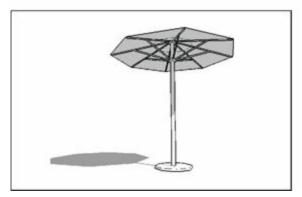
- **Bilateral symmetry:** To make a model of something that's bilaterally symmetrical, build half, make it into a component, and flip over a copy.
- >> Radial symmetry: You can use components to model radially symmetric things, such as car wheels and turrets, by building a single wedge and rotating a bunch of copies around a central point.

Axis of symmetry





Multiple axes of symmetry



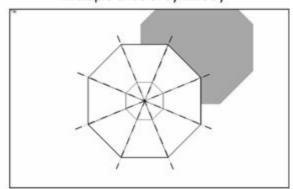


FIGURE 5-14: Bilateral symmetry (top) and radial symmetry (bottom) make your SketchUp life a lot easier.

Working smarter by building only half

Bilaterally symmetrical forms are everywhere. Most animals you can name, the majority of the furniture in your house, and your personal helicopter — they can all be modeled by building half, creating a component, and flipping over a copy.

Follow these steps to get the general idea of how to build a bilaterally symmetrical model in SketchUp (see <u>Figure 5-15</u>):

1. Make a simple box.

You can do this however you want, but the easiest way is to draw a rectangle and push/pull it into 3D.

2. Draw a diagonal edge on the corner of your box.

The point of this step is to mark one side of your box so that when you flip it over, you don't get confused about which side is which.

3. Turn your box into a component.

See "Creating your own components," earlier in this chapter, if you wonder how to do this.

4. Make a copy of your new component instance.

<u>Chapter 3</u> has information about moving and copying objects in SketchUp.

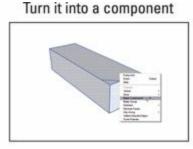
5. Flip over the copy.

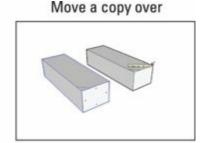
To do this, context-click the copy and choose Flip Along from the context menu. If you moved your copy in the red direction in the preceding step, choose Flip Along ⇒ Component's Red. Choose Component's Green if you moved in the green direction.

6. Stick the two halves back together.

Using the Move tool (this time without Copy toggled on), pick up your copy *from the corner* and move it over, dropping it *on the corresponding corner* of the original. Take a look at the last image in <u>Figure 5-15</u>. Doing this precisely is important if you want your model to look right.

Make a box





Flip the copy



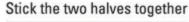




FIGURE 5-15: Getting set up to build a bilaterally symmetrical model.

Now you're set up to start building symmetrically. If you want, you can do a test to make sure things went smoothly. (See <u>Figure 5-16</u>.) Follow these steps:

- 1. With the Select tool, double-click one of the halves of your model to edit it.
- 2. Draw a circle on the top surface and push/pull it into a cylinder.

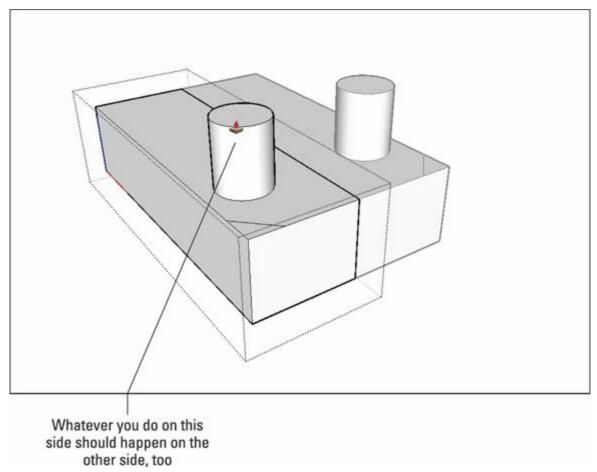


FIGURE 5-16: Test your setup to make sure that everything works.

If the same thing happens on the other side, you're good to go. If the same thing *doesn't* happen on the other side, it's possible that:

- **You're not really editing one of your component instances.** If you aren't, you're drawing *on top of* your component instead of *in* it. You know you're in edit mode if the rest of your model looks grayed out.
- **You never made a component in the first place.** If your halves don't have blue boxes around them when you select them, they're not component instances. Start a new file and try again, paying particular attention to Step 3 in the previous steps.



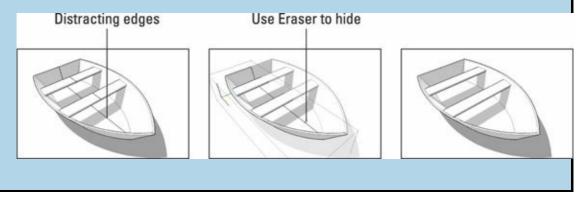
MAKING TWO HALVES LOOK LIKE ONE WHOLE

Looking carefully at the little boat in the figure that follows, notice how the edges in the middle clearly show that it's made out of two halves? If you were to erase those edges, the whole model would disappear because those edges are defining faces, and without edges, faces can't exist.

Instead of erasing those unwanted edges, you can hide them by using the Eraser while pressing the Shift key. See the second and third images of the boat? When you hold down Shift while dragging over the edges that you want to hide with the Eraser, they disappear.

Keep in mind these two important details about hidden edges:

- **Hidden edges aren't gone forever.** Actually, this applies to any hidden geometry in your model. To see what's hidden, choose View ⇒ Hidden Geometry. To hide it again, just choose the same thing.
- To edit hidden edges, you have to make them visible. If you need to make changes to your model that involve edges you've already hidden, you can either view your hidden geometry (see the preceding point) or unhide them altogether. Just show your hidden geometry, select the edges you want to unhide, and choose Edit ⇒ Unhide ⇒ Selected.



The coolest things since radially sliced bread

You can model objects that exhibit radial symmetry just as easily as those with bilateral symmetry. You just start slightly differently. Before you start, the only thing you have to decide is how many wedges — that is, how many identical parts — you need to make the whole object.

To model something with radial symmetry, start with one wedge, make it into a component, and then rotate copies around the center. Follow these steps to get the hang of it:

1. With the Polygon tool, draw a polygon with as many sides as the number of segments you need for the object you're modeling.

Here's the easiest way to draw a polygon in SketchUp, as shown in <u>Figure 5-17</u>:

a. Choose Tools \Rightarrow Polygon to select the Polygon tool. You can also select it from the Shapes menu on the toolbar.

- b. Click once to establish the center (Aidan likes to place the center on the axis origin), move your cursor, and then click again to establish the radius.Don't worry about being accurate right now.
- c. Before you do anything else, type the number of sides you want your polygon to have and press Enter.

2. Draw edges from the center of your polygon to two adjacent vertices (endpoints) on the perimeter, creating a wedge.

To find the center of a polygon (or a circle), hover your cursor over the outline for a couple seconds and move the cursor toward the middle; a center inference point appears.

3. Erase the rest of your polygon, leaving only the wedge.

The first three steps in this list are all about making sure that your wedge is the correct angle; if it isn't, this technique won't work.

4. Turn your wedge into a component.

Check out "Creating your own components," earlier in this chapter, if you're unsure of how to do this.

5. Make copies of your wedge component instance with the Rotate tool. (See <u>Figure 5-18</u>.)

As with the Move tool, you can use the Rotate tool to make copies. You can even make an *array* (more than one copy at a time). Here's how:

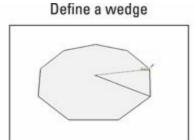
- a. Select your wedge's edges (heh, heh) and select the face, too.
- b. Choose Tools \Rightarrow Rotate to select the Rotate tool.
- c. Press the Ctrl key (Option on a Mac) to tell SketchUp you want to make a copy.

 A plus sign (+) appears next to your cursor.
- d. Click the pointy end of your wedge to set your center of rotation.
- e. Click one of the opposite corners of your wedge to set your rotation start point.
- $f. \ \ \textit{Click the other corner to make a rotated copy of your wedge}.$
- g. Type the number of additional wedges you want, followed by the letter x, and then press Enter.

6. (Optional) Test your setup.

Follow the steps associated with <u>Figure 5-16</u> to test whether updates to a single component in your new object updates all instances of the component.

Make a polygon





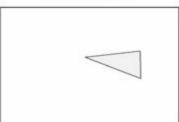
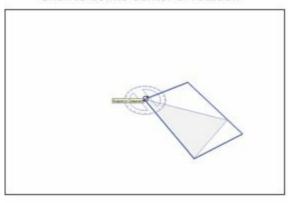
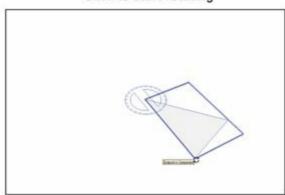


FIGURE 5-17: Draw a polygon to start, draw two edges to create a wedge, and erase the rest of your polygon.

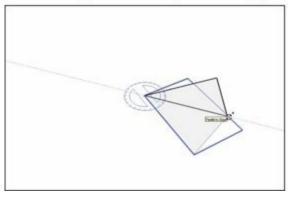
Click to define center of rotation



Click to start rotating



Press Ctrl (Option on Mac) to rotate copy



Make more copies

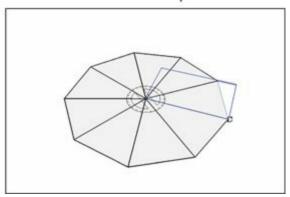


FIGURE 5-18: Use the Rotate tool to make copies of your wedge component instance.



REMEMBER Hiding the edges in your component instances makes your finished model look a whole lot better. Take a look at the sidebar "<u>Making two halves look like one whole</u>," earlier in this chapter, to discover how.

Modeling with repeated elements

A staircase is a perfect example of an object that's composed of several identical elements. If, when you hear the phrase "several identical elements," a big, flashing neon sign that screams "COMPONENTS!" doesn't appear in your head, you're not using SketchUp enough. On the other hand, maybe we need to get out more often....

The following example demonstrates two handy SketchUp modeling tricks:

- >> Using components to model more efficiently
- **>>>** Building a set of stairs the smartest way (for readers of <u>Chapter 4</u>)

The Treads Are Components method involves (you guessed it) making each *tread* (step) in your staircase into an instance of the same component. Basically, you build one simple tread that's the right depth, make it into a component, and copy a bunch of instances into a full flight of stairs. Because every step is linked, anything you do to one automatically happens to them all. If you don't know the first thing about components, now would be a terrific time to start from the beginning of this chapter.

Go through these steps to build a staircase using the Treads Are Components method:

1. Model a single step, including the tread and the riser.

You can make the step very simple at this stage if you want to; all that matters is that the tread depth and the riser height are correct. You can fiddle with everything else later. See <u>Figure 5-19</u>.

2. Make a component out of the step you just built.

Take a look at "Creating your own components," earlier in this chapter, if you need help.

- 3. Move a copy of your step into position, above the first one, as shown in Figure 5-20.
- 4. Type the total number of steps you want, type an x, and then press Enter.

You're creating a *linear array*, meaning that you're making several copies at regular intervals, in the same direction you moved the first one. Typing **12x** generates 12 steps the same distance apart as the first step and its copy. See the last image in <u>Figure 5-20</u>.

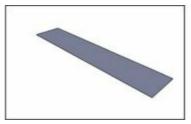
5. With the Select tool, double-click any one of your steps to edit all instances of your component.

Everything besides the component instance you're editing fades out a little.

6. Go nuts.

This really is the fun part. Having your staircase made up of multiple component instances means that you have all the flexibility to make drastic changes to the whole thing without ever having to repeat yourself. Add a *nosing* (a bump at the leading edge of each tread), a *stringer* (a diagonal piece of structure that supports all your steps), or even a handrail by getting creative with how you modify a single component instance. Figure 5-21 shows some of what you can do.





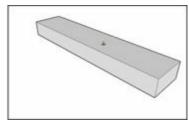
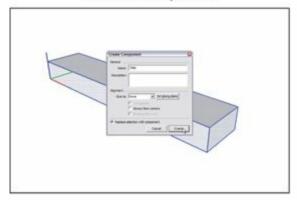
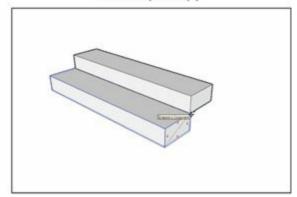


FIGURE 5-19: Model a single step, making sure that the depth and height are accurate.

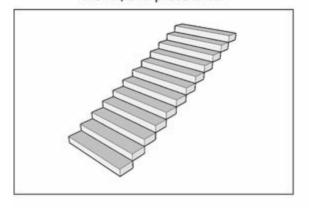
Create a component



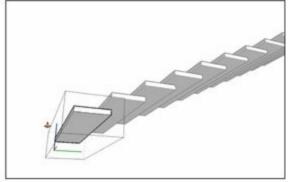
Move up a copy



Type the number you want, then **x**, and press Enter



Edit one instance



All components change

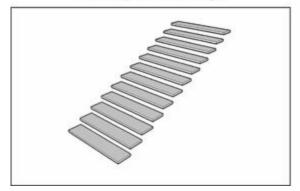
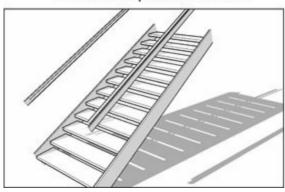


FIGURE 5-20: Make your step into a component instance, move a copy into position above the original, and then create an array.

Series of component instances

A single component instance



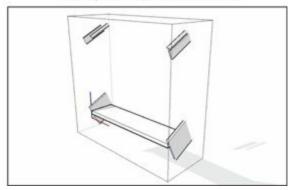


FIGURE 5-21: A flight of stairs with side stringers and a handrail. On the right, a single component instance.