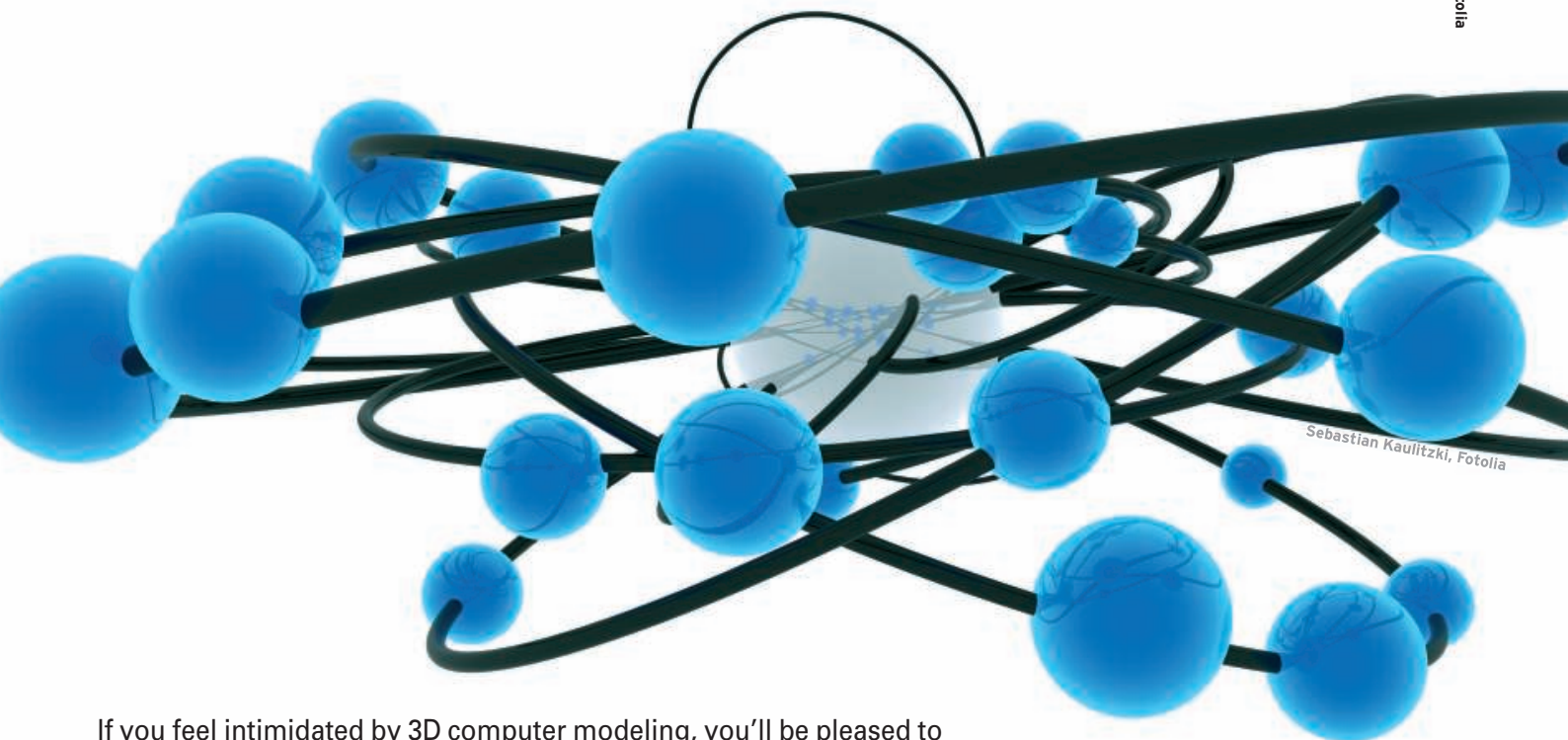Fearless 3D with Google SketchUp

MODEL MAGIC

Sebastian Kaulitzki, Fotolia

If you feel intimidated by 3D computer modeling, you'll be pleased to find Google SketchUp. Now in release 7.0, Sketchup is extraordinarily simple to use and free for personal use. **BY CURT SHONTZ**

Some 3D software – even the free versions – can take so long to learn that it's not worth the hassle. True to Google's tag line, SketchUp [1] is "3D for everyone" and can be downloaded for free [2]. SketchUp was developed by @Last Software, Inc. in the early 2000s and acquired by Google in 2006. Current versions support Windows XP, Windows Vista, and Mac OS X. A Linux version is not available, but some Linux users have succeeded with running SketchUp on Wine [3].

SketchUp approaches the often difficult concept of three-dimensional visualization differently than many of the heavy hitters in the 3D arena. Rather than relying on the creation of solid primitives, such as spheres, boxes, and pyramids, followed by repeated applications of Boolean add, subtract, and intersect operations, SketchUp simplifies things by letting you draw simple 2D shapes like you would on a sheet of paper, and then extruding them into the third dimension. Add to that a handful of basic tools that have multiple uses, and you have a lean and efficient tool for building models of just about anything you can imagine.

A simple demonstration of how to use the tools available in SketchUp would be pretty boring, especially when there are countless online video tutorials that already do that quite well.

To introduce SketchUp, I'll take you through an example by creating my idea of how Googlebot – a software "robot" that crawls web pages looking for relevant content to carry back to Google's search indexes – might look in the flesh (Figure 1).

SketchUp novices should be able to follow along without previous experience, but a little working knowledge of the program's basics will make it easier to follow. Navigating your way around a 3D model involves some practice with tools such as Orbit, Pan, and Look Around.

Google's tutorials for beginners are available online [4], through the Help menu, or via the introductory launch window.

Getting Started

When you first open SketchUp, an introductory dialog box appears (Figure 2). Clicking on the *Choose Template* button simultaneously collapses the Learn window and expands the Template window, revealing a list of predefined work environments for you to select. To work with feet and inches, select the Simple Template at the top of the list, which is the one I'll use for this article. Metric options are also available.

After selecting your template, click on the *Start Using SketchUp* button located in the lower right-hand corner. The standard user interface appears (Figure 3), complete with a set of three global axes:
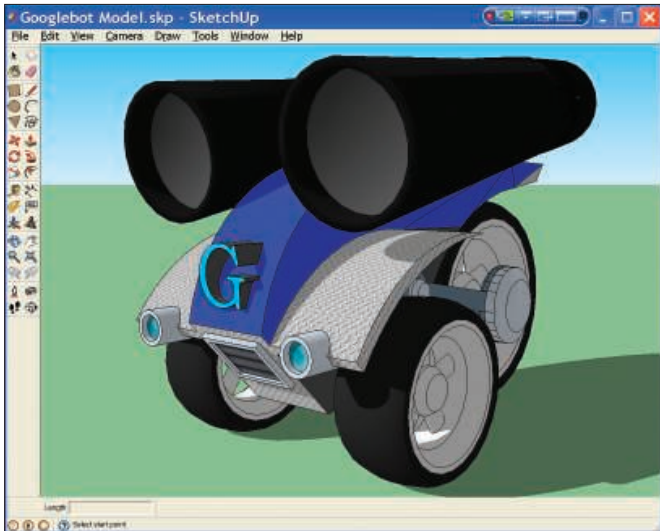
Figure 1: To introduce SketchUp, here's an interpretation of how Googlebot might look.
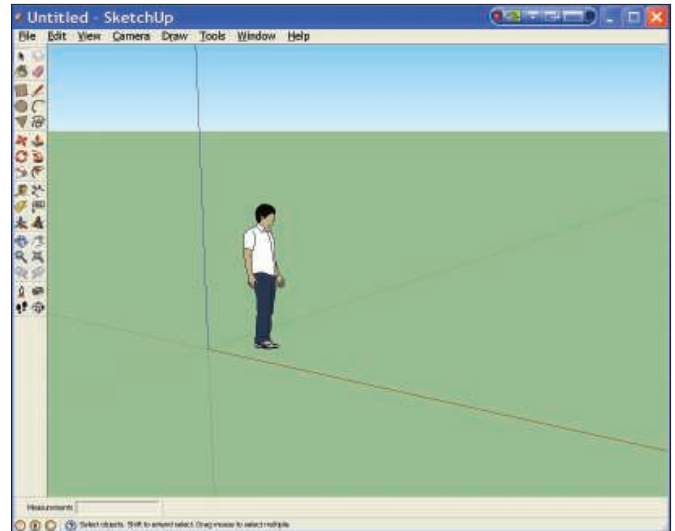

Figure 3: Google SketchUp's User Interface shows three axes. You can opt to delete the default human character.

a vertical blue axis and two axes on the ground plane (one red and one green). SketchUp also plants a human figure, which you can delete with a click, on the ground plane near the origin of your design world.

SketchUp presents you with a standard set of default tools on the left-hand side of the work space. If you don't see them, click on the *Large Tool Set* option under *View | Toolbars*. Also, you might want to select *Measurements* from the same menu; this feature appears in the lower left-hand corner and displays a small window that reports important data that will help you place objects accurately.

For this article, I took the screenshots with the shaded view option (*View | Face Style | Shaded*). To keep SketchUp running smoothly and quickly, consider using the simpler *Hidden Line* option

Figure 2: When you open SketchUp, you'll see the Introductory Window.

while constructing your model (*View | Face Style | Hidden Line*); the less SketchUp needs to render, the faster it will run.

3D Warehouse

One of the most powerful functions of SketchUp is 3D Warehouse, a searchable online kit-of-parts built by the SketchUp user community and free for use in your model. Filled with a mind-boggling array of downloadable 3D models, 3D Warehouse provides a browser-based interface with easy access to models of anything you can imagine, such as simple household objects, classic automobiles, insects, people, and even models of the Roman Colosseum. Yes, the Colosseum.

If you choose to build a 3D model of a building – your own house, for example – there's even an interface to Google Earth that allows you to upload your model and drop it right on the street where you live.

3D Warehouse is home to the first object used to build my sample Googlebot: a five-spoke wheel and tire assembly. To save time, I've already built this component and uploaded it to the 3D Warehouse for your use. To insert the wheel assembly into your model, go to *File | 3D Warehouse | Get Models*. A simple browser window appears, showing a

search bar and a random sample of models in the warehouse.

Typing in *Wheel and Tire for Googlebot* into the search bar should produce an icon representing the model you want. After you click on the image, the browser displays a page that will allow you to download the model directly into your file (Figure 4).

Next, click on *Download Model*. The insertion point for this model is at the bottom of the tire along its centerline. When you click on the origin of your work space, the assembly drops into place directly onto the ground plane.

The individual surfaces that comprise this assembly have been grouped together into one object. As you create
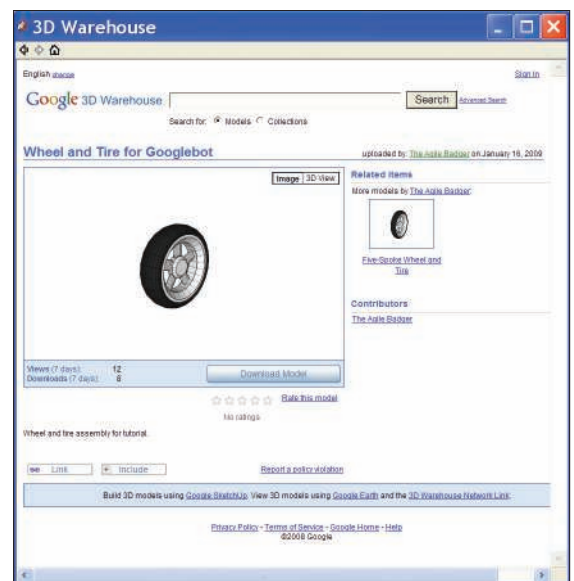

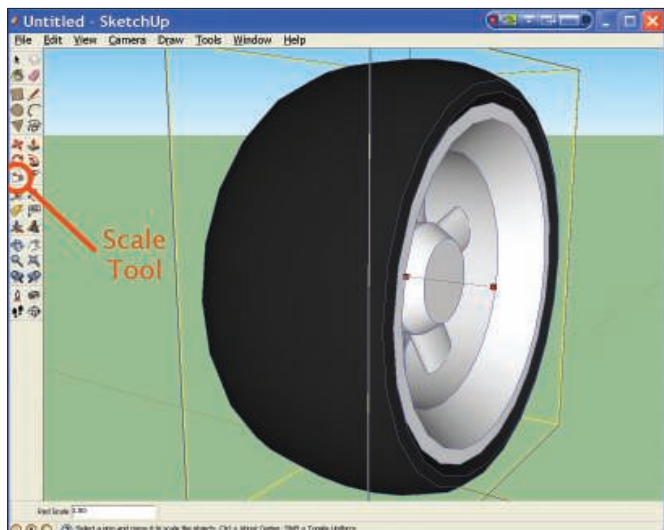**Figure 4: Google's 3D Warehouse interface displays the wheel assembly.**

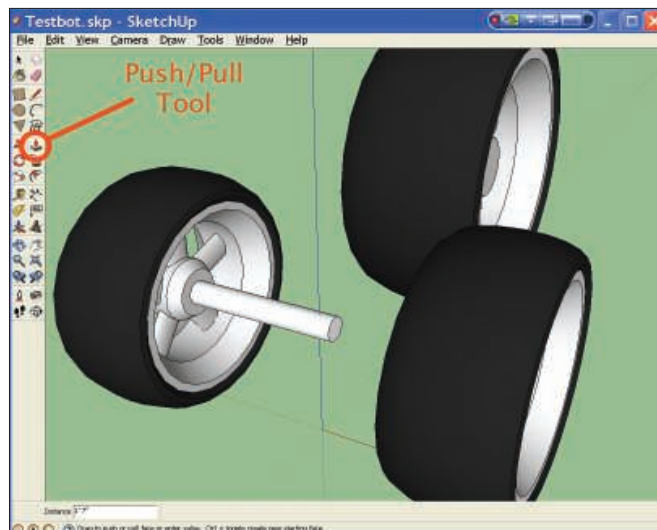**Figure 5: Use SketchUp's Scale tool to fatten up the wheel.**

Figure 6: SketchUp's Push/Pool tool helps to create an axle.

individual subassemblies like these, it's good practice to collect them into groups (*Edit | Make Group*), which helps SketchUp run faster and allows easy manipulation of complex geometry. To edit groups without expanding them, just double-click on the group.

Cyberspace can be a slippery place at times, so you'll want to give the Googlebot a little extra traction. To fatten up the front wheel assembly, first select it, then click on the *Scale* tool in the *Large Tool Set* on the left-hand side. If you're using a PC, hold down the Ctrl key and click on the grip box at the center of the wheel. SketchUp notifies you that you have selected "Red scale about center." Next, drag the grip in the direction of the red (horizontal) axis until the numbers in the Measurements box reads 1.50. When you release the mouse button, your new wheel is fatter by 50 percent.

Holding the Ctrl key forces the scaling to be fixed about the center of the object, which keeps the wheel centered on the blue-green plane (Figure 5). Without using this key, the base point for scaling defaults to the grip located directly opposite the one you selected, which means that the center of the fatter wheel would end up being pulled slightly to one side.

Move Tool

To move the wheel exactly where you want it, use the *Move* tool, which is located above the *Scale* tool. As you might expect, the *Move* tool moves objects from any origination point along a straight line to a specified destination

point. For our example, click on the *Move* tool, click anywhere on the wheel, and then drag it along the red axis until the Measurements bar reads 1'-8" and release the mouse button.

Alternatively, you could simply type in the distance 1'-8" and then hit Enter after you've established the correct direction, and the wheel assembly will land in the right place.

In either case, SketchUp will draw a dynamic dashed line between your origination point and your cursor until you've located your destination point. As you move your object, that dashed line will change to the color of one of the three global axes when it is parallel to it. If you hold down the Shift key when you've found your alignment, the dashed line is locked in that direction.

To make a second front wheel, use the same Move tool, but to create a copy of the object rather than just moving it, hold down the Ctrl key as you drag the wheel along the red axis. SketchUp leaves your wheel assembly in its original location while it waits for you to specify where you want the duplicate. Check the Measurements window for a distance of 3'-4" and then release the mouse button. To keep things tidy, create the duplicate wheel on the opposite side of the blue-green plane. Use the Move tool with Ctrl to locate the single rear wheel (centered between the two front wheels and located 3'-6" behind them).

To give the Googlebot some attitude, you can scale the rear wheel up by an additional factor of 1.50, but this time,

apply the scaling to all three dimensions of the wheel, not just its width. To do this, use the Scale tool as before, but grab one of the grips located on a corner of the blue bounding box instead of the grip located at the center of the vertical face.

Because this scaling process increases the size of the wheel in all directions from the center of the wheel, the bottom of the tire moves slightly below the ground plane. With one more application of the Move tool, you can raise the wheel assembly upward along the blue axis until its contact point is back on the green axis.

To make axles for the front wheels, use the Circle tool to make a 1.5" radius (3" diameter) circle centered on the inside face of one of the wheels. With the Circle tool, SketchUp turns your cursor into the shape of a protractor of varying colors depending on the rotation axis to which it's snapping. You might need to move your cursor around the screen until SketchUp offers you the orientation of the circle plane you want. Once you've found it, hold the Shift key to lock that orientation, and then click on the point where you want the center of the circle to be drawn. Pull your cursor away from the center until the Measurements bar reads 1.5, or simply type in 1.5 and press Return. To tell SketchUp that you want it to snap to the wheel's center, hover around the edge of the outer circle before your first click.

Next, select the Push/Pull tool (sixth tool down from the top of the right-hand column), click and release on the circle

you just created, and drag your cursor along the red axis until any point on the inside face of the opposite wheel hub is highlighted. Then click on that point and you've got a sturdy axle (Figure 6).

Before you begin building the body, you'll want to collect everything you've created so far into a group. This will protect your wheels, tires, and axles by preventing any future creations from cutting into or sticking to them. Select all the parts in your model, right click, and select *Make Group*.

Push/Pull Power

In the previous section, I explained how to use the Push/Pull tool to construct the front axle. Any time you see a flat surface in your model, you can use Push/Pull to extrude it along a perpendicular direction, much like clay squeezing its way through an oddly shaped hole. SketchUp will not allow you to push or pull on a curved surface, but that does not reduce the tool's value.

To build the body of the Googlebot, I'll use a technique that's applicable to projects of all kinds. First, draw a profile view of the shape you want onto a rectangular surface, divide it into sub-regions with various drawing tools, and then use the Push/Pull tool to extrude the shapes into 3D. To apply this to the Googlebot, use the Line tool or the Rectangle tool to make a large drawing surface directly onto the blue-green plane.

If you choose to use the Rectangle tool, it might be easier to create the geometry on the red-green plane, and then

use the Rotate tool to flip it vertically. Again, think of this surface as a big piece of drawing paper, so be sure it's large enough to encompass your planned design (Figure 7).

At this point, you might find it useful to work on your body profile from a direct side view. To do so, choose *Camera | Parallel Projection* to remove perspective, and then choose *Camera | Standard Views | Right* to get a right-side view. From here, you can easily use the Line, Arc, Circle, or Rectangle tool to draw the body profile any way you like. To ensure that your line work snaps directly to the rectangle and not to points on a wheel, hover over an empty space on the rectangle until SketchUp reports "On Face," and then hold down the shift key to lock your subsequent clicks onto the plane.

Each time you draw onto this plane, SketchUp automatically cuts through the hosting rectangle like a knife and creates separate sub-regions that can be operated on independently. So, you can select the outer waste region of your large rectangle and then delete it. If you return to a perspective oblique view using the Camera menu and the Orbit tool, you can then use the Push/Pull tool to extrude the faces of the body panels to whatever thickness you like. You can also use the Move tool on individual lines and points within your sub-regions to make bulges in the body panels.

At this point, you have one half of the full body. To create the other half, you'll use the Scale tool as before, but this time with a trick. SketchUp does not have a

mirror tool, but if you realize that scaling an object along an axis using a negative scale factor will create a reflected image about a plane that is normal to that axis, you have a nifty solution to the problem.

To do this, first group the body pieces you've created so far by selecting them, right clicking on your mouse, and selecting *Make Group*. Next, make a copy of this group elsewhere in the model space. Select this new group, click on the Scale tool, and grab the center grip on the large rectangular face. Then drag the grip toward the opposite side of the body centerline until the Measurements bar indicates "Red Scale -1.00," and click to finish the operation.

Next, move your mirrored duplicate body half adjacent to the original. If you want, you can now explode each of the two groups that form your full body by using *Edit | Component | Explode*, and use the Eraser tool to remove the lines along the seam between the two halves. Be careful: SketchUp might need some of those lines to define surfaces, so be prepared to undo an erased line if a surface disappears with a deleted line. If this happens, you might just have to live with the extra lines. Then reselect all of the body entities and create a new group (Figure 8).

Groups and Components

A proper Googlebot wouldn't be able to scan web pages very well if it didn't have some pretty powerful eyes. To that end, I chose a pair of Nikon binoculars
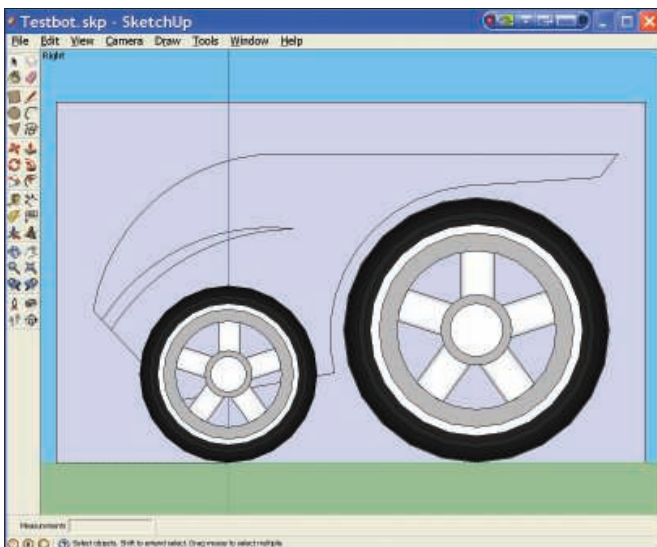

Figure 7: Use lines and arcs to create a profile sketch of Googlebot's body design.
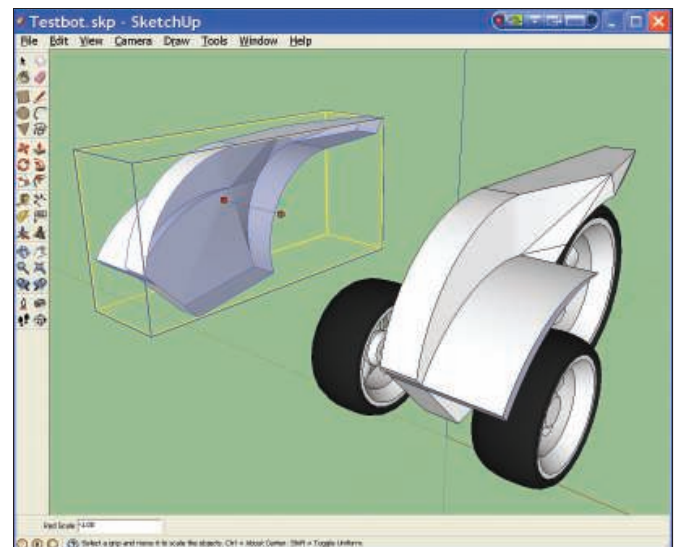

Figure 8: Using SketchUp's Scale tool lets you create a mirrored object.

modeled by a SketchUp user who goes by the name Birdman (his collection of on-line models includes dozens of highly detailed birds). To insert these binoculars into the model, enter the 3D Warehouse through *File | 3D Warehouse | Get Models* and type "Nikon 10x42 Monarch" into the search bar. Then click on *Download Model* and insert it anywhere in your work space.

The binoculars will enter your model as a "component" rather than a "group." Components are much like groups in SketchUp, except that they also have associative properties. That is, changes to any one component will propagate to all its copies. Groups, on the other hand, are stand-alone entities that have no linked association with their duplicates.

Let's not make any copies of the binoculars component, but let's rotate the binoculars around the red axis so that they're looking forward and slightly downward. When selected, components will display a blue bounding box that encompasses all of the contained objects. SketchUp also displays small red crosshairs on each face of the blue bounding box. Clicking on one of these crosshairs will automatically activate the rotate function, allowing you to orient your component about an axis normal to the associated face (Figure 9).

Before placing the binoculars onto the body, you'll need a turret for it to sit on, so draw a circle on the top of the body and use Push/Pull to extrude it up vertically about 12 inches.

You'll be moving the binocular component from a point on its underside to a point on the top of the turret. In cases like this, there is no hidden-line view that gives you clear access to both points. To solve this problem, switch to wireframe mode (*View | Face Style | Wireframe*). If you're not accustomed to 3D modeling on a computer, you'll find this view very confusing at first, but there are times when there is no other way to gain access to the points you'll need.

At this point, all the primary pieces of the Googlebot are assembled. As with most projects, the amount of detail you could apply is limitless. For example,
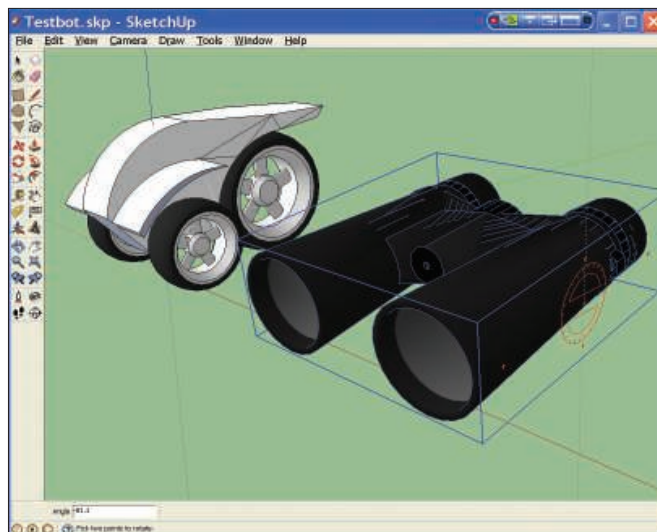

Figure 9: SketchUp provides rotation grips on the faces of a selected component's bounding box.

there aren't any headlights to illuminate the depths of a code-bloated web page. By now, you've seen all the SketchUp tools and tricks necessary to build a version of the Googlebot that solves these problems.

Presentation

SketchUp gives you several ways to enhance the appearance of your models by allowing you to apply various material textures, colors, even shade and shadows. To apply textures to surfaces, first activate the *Shaded with Textures* option under the View menu, and then select the *Paint Bucket* tool. The Materials dialog box appears and shows all of the textures that come installed with SketchUp.

From the drop-down menu, I chose Metals, which then presented 10 options. For my Googlebot, I chose *Metal_Steel_Textured_White* to give the heavy-duty look of diamond-plate sheet steel, and I applied it to the front fenders and grill. The drop-down menu also lists Colors-Named, which provides 137 colors to choose from; I applied 0103_Blue, 0098_Dodgerblue, and a variety of dark and medium grays to the remaining surfaces of the body.

The Materials dialog box was also designed to accept downloads of other predefined material textures, but at the time of this writing, Google had not yet made that option available from their Bonus Pack download center [5].

Using the Edit tab on the Paint Bucket dialog box, you can still add user-created textures. The " + " icon in the upper

right-hand corner leads you to the Create Material window from which you can load an image file that was created using just about any third-party image-editing software. Using the 3D Text tool, you can also add 3D text to your model.

Google makes no claim that their free software will provide photo-realistic images of your models, but they've given SketchUp a variety of export formats that are readable by many of the powerful rendering tools available on the market. Still, SketchUp provides surprisingly accurate shading and shadowing. To add this final touch of realism to your model, select the *Shadows* option from the View menu. SketchUp's performance will slow down noticeably in this mode, so it's best to reserve this option for last.

Using the Window menu, you can adjust the sun angle. Select *Window | Model Info | Location* and choose a city from the drop-down menu. Adjust the north direction numerically by entering an angle measured from the green axis, or graphically using the *Select* option. Next, open the *Window | Shadows* dialog box to define the date, the time of day, even the intensity of the incident light and resulting shadows.

Conclusion

SketchUp is a practical, powerful, and fun tool for tapping into your creativity without wasting your valuable time or money. Happy modeling! ∎

INFO

[1] SketchUp:
http://sketchup.google.com

[2] SketchUp download:
http://sketchup.google.com/download/index.html

[3] SketchUp on Wine: *http://wiki.winehq.org/GoogleSketchup*

[4] SketchUp video:
http://sketchup.google.com/training/videos/new_to_gsu.html

[5] Bonus Pack download center:
http://sketchup.google.com/intl/en/download/bonuspacks.html