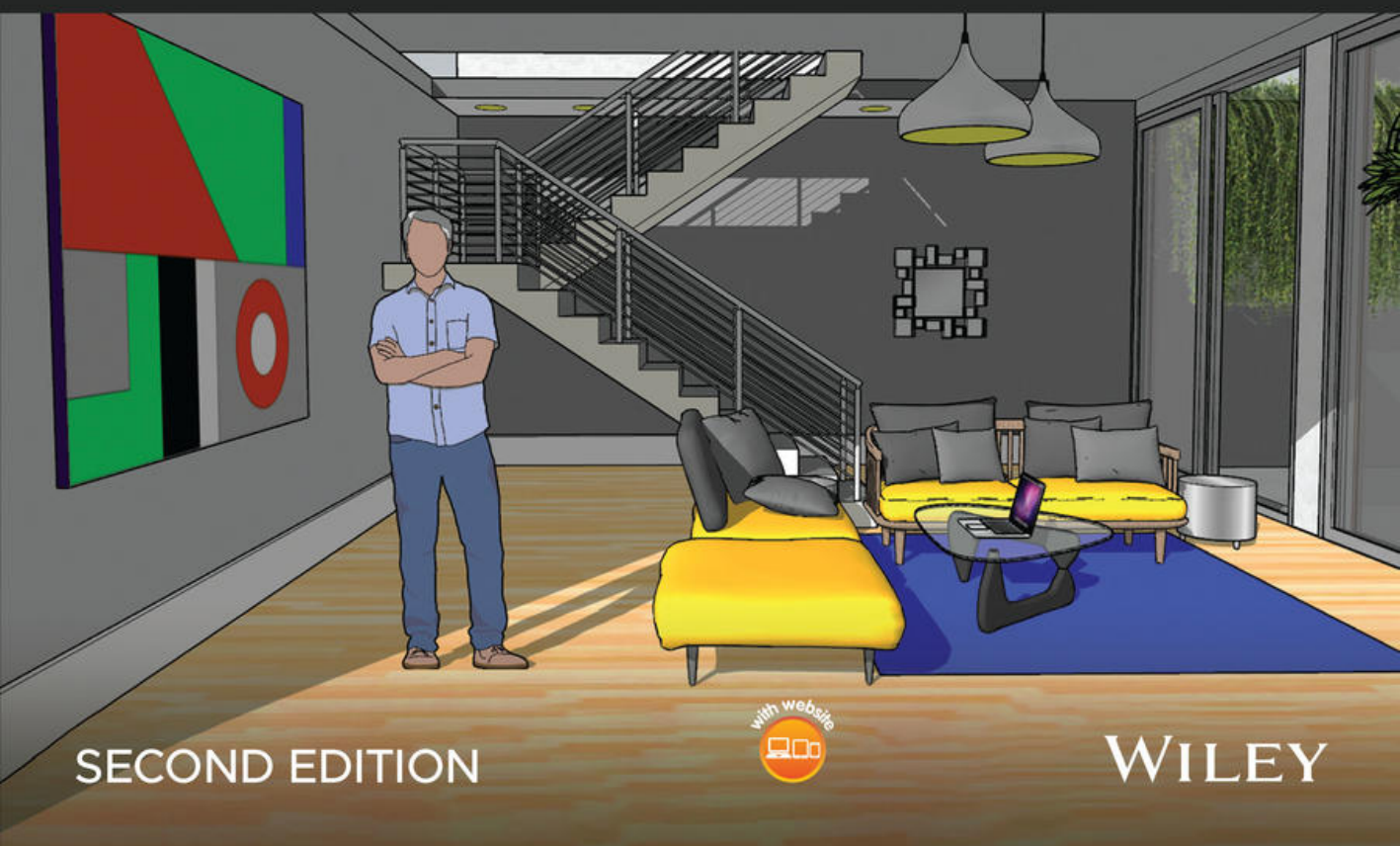
SketchUp for Interior Design

3D Visualizing, Designing, and Space Planning

Lydia Sloan Cline



SECOND EDITION

WILEY

SketchUp for Interior Design

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3D Visualizing, Designing, and Space Planning

Second Edition

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WILEY

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Contents

Foreword

Welcome to the second edition of *SketchUp for Interior Design*! Modeling software has largely replaced traditional two-dimensional drafting as the means for designers to create and communicate. SketchUp remains the modeling program of choice in many diverse fields due to its low price and short learning curve. Like the first edition, this one is for the beginner who wants to get up and running fast.

Why Read This Book?

You may be wondering why you should read a SketchUp book when there is so much content online. My answer is that online content, while very good, is not organized. If you don't know what the software's capabilities are, you don't know what to ask or search for. This book leads you through SketchUp in an orderly manner. Its intent is to acquaint you with SketchUp's many capabilities. Toward that goal, tools and functions are described under their own headings and then used in tutorial examples.

SketchUp's most popular functions are introduced early, to enable you to quickly do what you want with it. Some tools are revisited later to show more complex options. By the time you finish, you'll have been exposed to most of the tools, one or two options for each, and different approaches for solving modeling problems. You'll be given links to forums where you can ask your increasingly complex questions. End-of-chapter resources will also help guide you through the ocean of Web information.

What's Covered?

Coverage is specific to the interests of interior designers and interior architects: How to model interior spaces; study scale and proportion; test design ideas; plan spaces; present solutions; generate architectural floor plans, elevations, and sections. Also discussed is using SketchUp in conjunction with other industry-popular programs.

Any Pre-Reqs?

Prior knowledge of drafting software is not needed. However, it is assumed that the reader has basic architectural drafting knowledge, such as what floor plans, interior elevations, perspective, isometric, and section views are. This book shows how to use SketchUp to create those drawings; it doesn't discuss what they are. If you could benefit from a drafting refresher, check out the resources at the end of this Foreword.

Computer and Version of SketchUp Discussed in this Book

Only SketchUp Pro is discussed because the free Web version does not yet have all Pro's capabilities. Most screenshots are from a PC, but where Mac operations are different, Mac screenshots

are included. This book also assumes the reader uses a laptop or tower computer. SketchUp can be used on some tablets, but a desktop or laptop with a three-button mouse (two buttons plus scroll wheel) exploits its full capabilities.

Extra Goodies

On the Wiley site there is a Homework folder with files for completing the end-of-chapter exercises. Download and save the whole folder at once to your desktop so everything will be available when needed. Instructors have an additional folder with answers to the end-of-chapter questions.

So, let's get started!

Further Resources

Cline, Lydia Sloan *Architectural Drafting for Interior Designers*, 3rd edition, New York: Bloomsbury, 2021

Lydia's YouTube channel has architectural drafting and SketchUp tutorials. **https://www.youtube.com/user/ProfDrafting**

Download past versions of SketchUp here. **https://www.sketchup.com/download/all**

About the Companion Website

This book is accompanied by a companion website:

www.wiley.com/go/Cline/SketchUpforInteriorDesign

From the website you can find the following online materials:

- Quiz Questions and Answers
- End-of-Chapter Exercises
- Wallpaper and Draperies
- Homework

CHAPTER 1

What Is SketchUp and How Do Interior Designers Use It?

Objective: This chapter discusses what modeling is and how the SketchUp modeling program is used by designers.

Concepts and Functions: SketchUp Pro, SketchUp Free, SketchUp Shop, SketchUp Make 2017, model, solid/surface/t-spline/mesh model, BIM, geometry, plane, polygon, vector, raster

What Is SketchUp?

SketchUp is a *polygonal surface modeling program*. *Polygonal* meaning that everything SketchUp creates is made from *polygons*. Those are *planes*—flat shapes bordered by straight lines (Figure 1-1). *Surface* meaning that everything SketchUp makes is hollow. *Modeling* meaning that the result is a three-dimensional (3D) digital drawing composed of lines and faces (planes). Collectively, those lines and faces are called *geometry*.

SketchUp is also a *vector* program, meaning it creates vector files. A vector file is a collection of lines and curves that scale up or down without loss of quality. Examples of vector files are PDFs (Adobe documents) and DWGs (AutoCAD documents). This is as opposed to a *raster* file, which is a collection of individual pixels and loses resolution quality when enlarged. Examples of raster files are JPGs and GIFs. SketchUp creates SKP and SKB files. SKP is the SketchUp file; SKB is an automatically created backup file. It preserves the next-to-last save. To change an SKB file into an SKP file, just over-type the SKB extension with SKP.

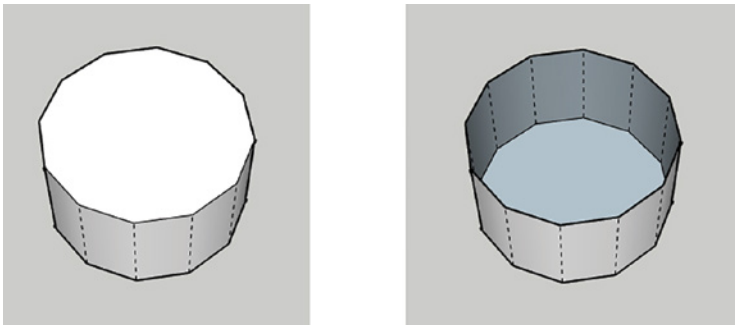


Figure 1-1: All SketchUp models, including circular ones, are made of polygons and are hollow.

What Is SketchUp Used For?

SketchUp is used to electronically sketch ideas three-dimensionally—to "get your doodle on." It's an alternative to pencil and tracing paper for thinking out ideas. Many use it for quick iterations, design studies, and presentations. Since you can sketch loosely (meaning without imputing numbers), SketchUp helps you think spatially. Height/width relationships are easy to see; for example, a hallway that seems wide in a floor plan may present dark and narrow when the vertical dimension is added. As with a physical foam core *model*, a digital model can be studied from any direction. However, SketchUp one-ups the foam core model with camera tools that let you stroll through at eye level.

Who Uses SketchUp?

SketchUp was written as a user-friendly alternative to complex modeling software in the architectural field, its original user base. However, it has since been widely adopted by diverse fields such as interior design, game development, filmmakers, woodworkers, catalog illustrators, packaging designers, landscapers, real estate agents and stagers.

SketchUp Pro

SketchUp Pro is a subscription product; compare prices at **https://sketchup.com/plans-and-pricing**. Educational pricing is available for students and faculty; academic proof must be submitted. One license permits two sign-ins.

SketchUp Pro works on both the PC and the Mac. Files made on one platform transfer easily to the other. It can be operated in limited fashion on some Wacom and Surface tablets, and on the iPad. A free viewer app can be downloaded at **https://www.sketchup.com/products/sketchup-viewer/downloads** or from the App store. This lets you open and look at SketchUp files without having the software.

SketchUp Free and SketchUp Shop

SketchUp Free is a web app (**https://app.sketchup.com/app?hl=en**). It targets K-12 students and is for noncommercial use. Access it from any WebGL-enabled browser. It's version-less and always sports the latest release. You can save your work as an STL file, which is useful for 3D printing simple models. However, *Free* lacks important features such as the ability to install extensions or to save models as SKP. There is a subscription product called *SketchUp Shop* that is SketchUp Free with some added functionality. Free has a different interface than Pro (Figure 1-2).

SketchUp Make 2017

SketchUp Make 2017 is a legacy version that has most of Pro's features but lacks some features that designers may need, such as the ability to import DWG files and geolocation data.

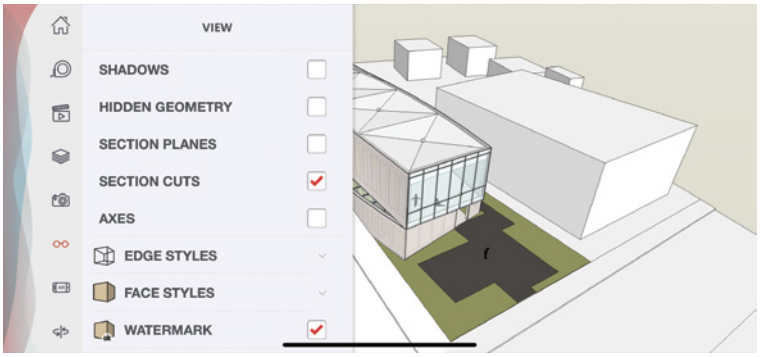


Figure 1-2: The Free interface.

Download 2017 free at https://help.sketchup.com/en/downloading-older-versions. Pro and Make cannot both be installed on the same computer.

Is SketchUp Easy to Learn?

It's probably easier than other commercial industry-standard modeling programs, as it has fewer features and is somewhat intuitive. But "easy" is relative. Like everything else, SketchUp still takes practice—you probably didn't make great pencil sketches right away, either.

Know that there are many ways to do the same thing in SketchUp, and no one right way. Some ways may take a few more steps, but if you make learning SketchUp the priority, efficiency will follow.

Do I Need to Know AutoCAD?

AutoCAD or any other two-dimensional (2D) drafting program is not a prerequisite to learning SketchUp. This is because drafting and modeling programs operate differently. If your computer drafting experience has only been with traditional 2D software, you will find that modeling requires a different approach. You may also find that you never want to go back to 2D software once you see the power of 3D.

Difference between Traditional CAD Drawings and Models

With traditional 2D computer-aided drafting (CAD) software such as AutoCAD, the mouse is an electronic pencil with which you replicate the hand-drafting process. 3D drawings made with 2D software are really just a collection of 2D pieces assembled to give the illusion of three dimensions.

A model, however, is a true 3D object that you can orbit around to view from any direction (Figure 1-3). By default, SketchUp displays the model as a 3-point perspective. That is, all parallel lines converge to left, right, and top or bottom vanishing points. However, SketchUp

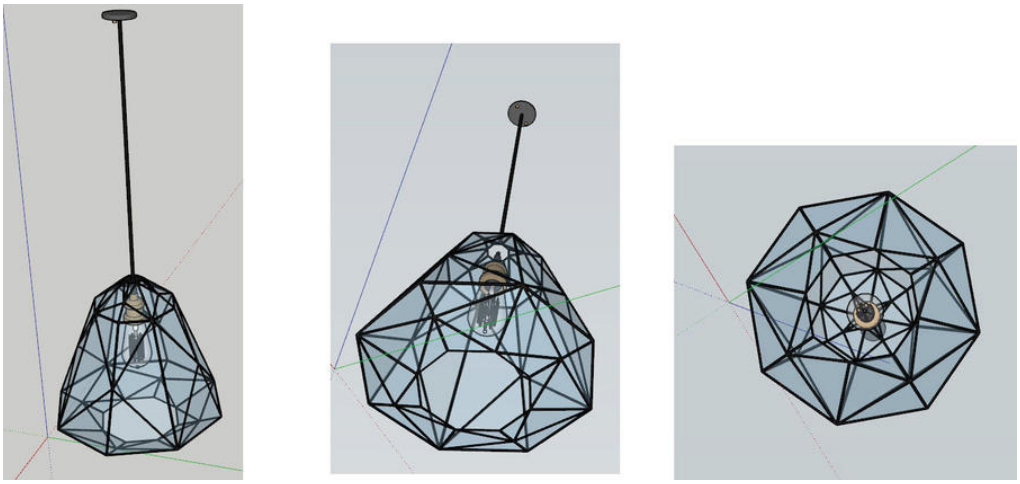


Figure 1-3: Orbit around a model to view it from any position.

can be set to display as a 2-point perspective, as an *isometric* (3D view in which parallel lines remain parallel), and orthographically (plan, elevation, and section views). Orthographic (2D) views are generated from the model. A model makes the jump to scaled construction documents in the LayOut program that installs with SketchUp.

There are five model types: *solid, surface, t-spline* (Figure 1-4), *mesh*, and *building information model (BIM)*. It's helpful to know a bit about them all, as this may affect time spent trying to achieve a specific result in SketchUp. No model type is best, as all have different abilities. For example, designs that require a constant wall thickness are better drawn with a solid modeler. Designs that require organic forms are better drawn with a sculpting modeler. A common workflow is to start a model in one program and export it to another for further development. This exploits the capabilities of both.

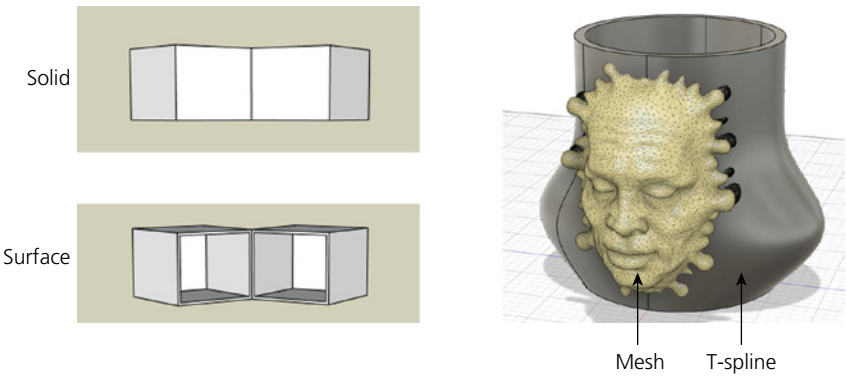


Figure 1-4: Solid, surface, mesh, and t-spline models.

Solid Models

These are filled solid inside; think rock. They contain data like interior volume, mass, and weight. This enables you to perform tasks like specifying a constant wall thickness or connecting and curving adjacent edges. Create solid models by adding and subtracting primitive geometric forms, such as cubes and cylinders, to and from each other, or by sketching shapes and extruding them into solid forms. Solid models are used to create product models that have many parts and details. SolidWorks and Fusion 360 are popular solid modeler programs.

Surface Models

These are hollow with a skin composed of lines and faces. You can create complex curves and forms, but they have hard, not smooth, edges. Only surface data, such as area, is stored. A surface model doesn't recognize geometry as specific features; for example, where a solid model would recognize a staircase and perform relevant calculations, a surface model just sees the staircase as lines and faces. Surface models are used when the designer is primarily concerned with form and appearance. SketchUp is a popular surface modeler for building design; Fusion 360 and Catia are popular surface modelers for product design.

T-spline Models

This is a type of surface model that is free-flowing and curvy, and composed of four-sided polygons. It's used to create organic forms. You sculpt a t-spline model by pushing and pulling the polygons and dragging control (editing) points. Blender and ZBrush are popular t-spline programs.

Mesh Models

A mesh is a type of surface model that is created when a raw model is exported as an STL file from whatever software it was designed in. STL is a 3D printing format. Mesh models often have very high polygon counts. Ones with low polygon counts can be imported into SketchUp for further development.

Building Information Management (BIM)

A BIM model contains all building systems: architectural, electrical, plumbing, and heating, ventilation, and air conditioning (HVAC). The model lives on a server and can be accessed by anyone authorized to do so. BIM models also contain nongraphical data, such as material, fire resistance class, color, and cost of the objects in it. Revit and Chief Architect are popular BIM programs with architects and interior designers. SketchUp is not BIM, but with downloaded extensions it can have BIM properties.

What SketchUp Pro Can Do

With this program you can:

- *Model complete interiors and exteriors of buildings* (Figure 1-5).

Figure 1-5: This house is completely modeled inside and out.

- *Import real-life terrain contours and geolocation information* (Figure 1-6).

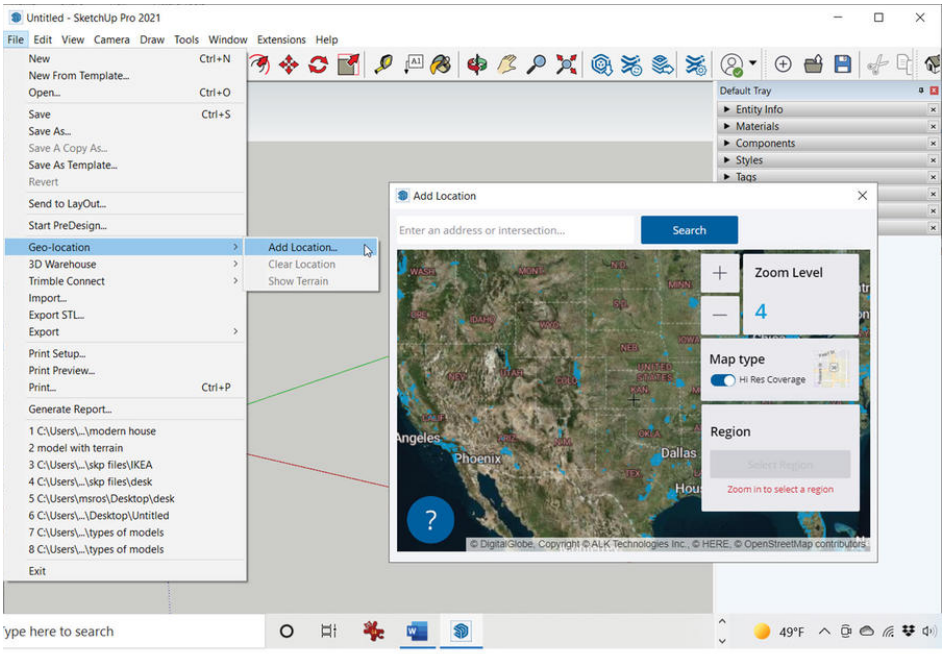


Figure 1-6: Access land contours and geolocation data anywhere in the world through SketchUp.

- *Apply artsy styles with one click* (Figure 1-7). Export as high-resolution JPGs or animations for marketing and presentations.

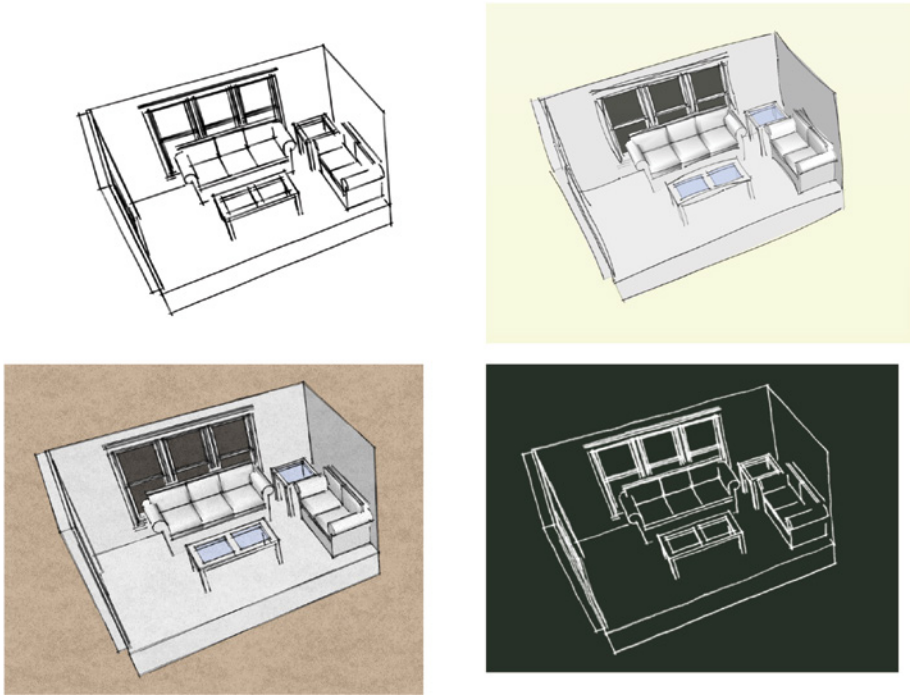


Figure 1-7: Four of the many line types and styles in SketchUp.

- *Access high-quality, ready-made models from the 3D Warehouse*, including products from manufacturer catalogs (Figure 1-8).

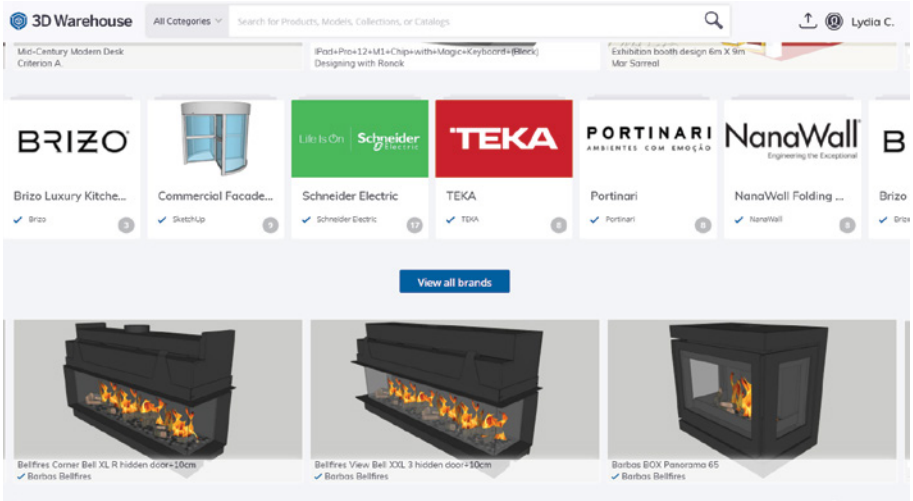


Figure 1-8: Catalogs of product models in the 3D Warehouse.

- *Access extensions (add-on tools) from the Extension Warehouse.*
- *Import JPG files of floor plans to trace and model.*
- *Import DWG (AutoCAD) files of floor plans to trace and model* (Figure 1-9). DWG files become SketchUp geometry.
- *Export SketchUp models as a DWG file for import into AutoCAD, Revit, or 20/20 for further development.*
- *Create presentation boards and scaled drawings from the model with LayOut, a program that installs with SketchUp* (Figure 1-10).

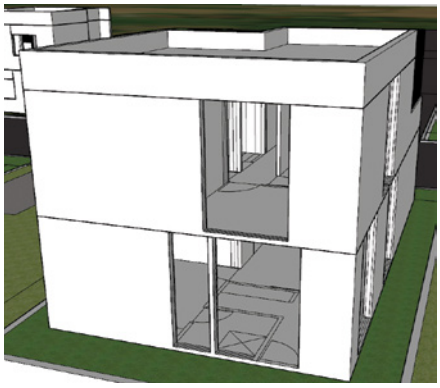


Figure 1-9: This model was made from an imported AutoCAD plan.

Figure 1-10: Create scaled drawings from the model in LayOut.

- *Use, create, and edit dynamic components.* These are models programmed to store information and perform specific actions. For instance, staircases can add steps when height is adjusted; cabinets can open doors with a mouse click; price and parts information can be stored.
- *Perform additive and subtractive modeling tasks called Boolean operations.* This saves modeling steps, making for a faster workflow (Figure 1-11).

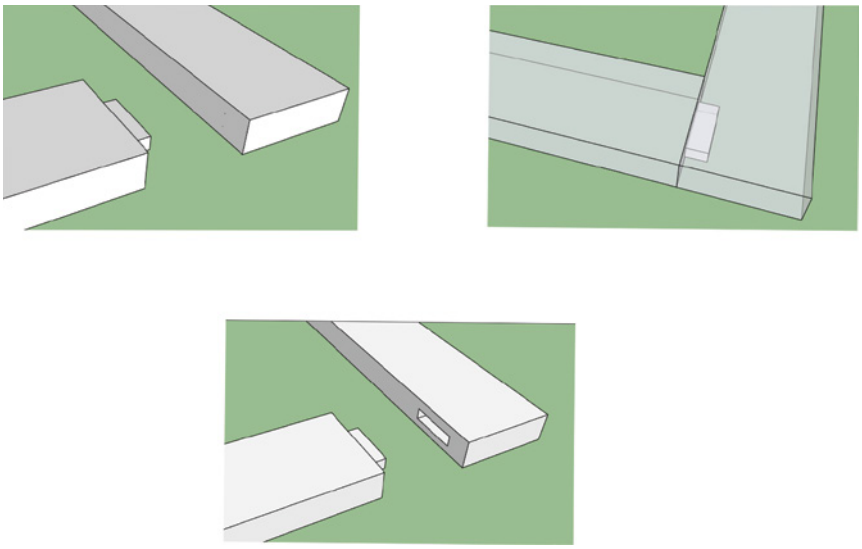


Figure 1-11: With solid modeling tools, a tenon is pushed into a block of wood, then pulled away, revealing a clean mortise joint created.

- *Generate reports, which are tables of information of the objects in the model.* These tables can be lists and quantities of materials that are helpful for cost estimating, such as deciding how much paint to buy based on the area of walls in the model. Reports are generated with one click and downloaded as a CSV (Excel) file (Figure 1-12).

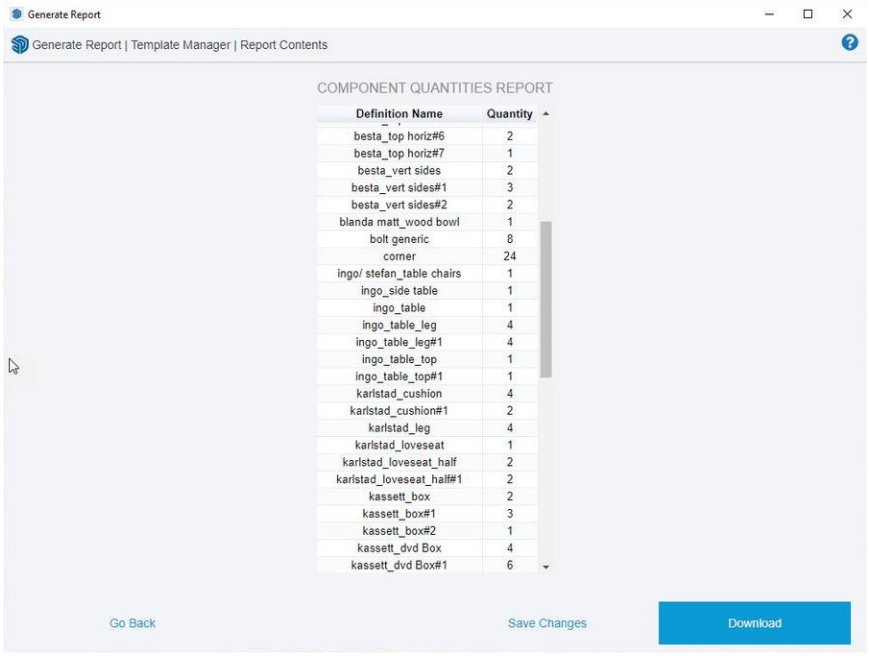


Figure 1-12: A materials list of objects in the model.

- *Receive one year of free technical support via phone and e-mail with a Pro subscription*. After that, a Maintenance and Support subscription is needed to receive support.
- *Import hand sketches into SketchUp, trace and model*.
- *Do shadow studies*.
- Export the model as a JPG and import it into a digital imaging program to add color (Figure 1-13).

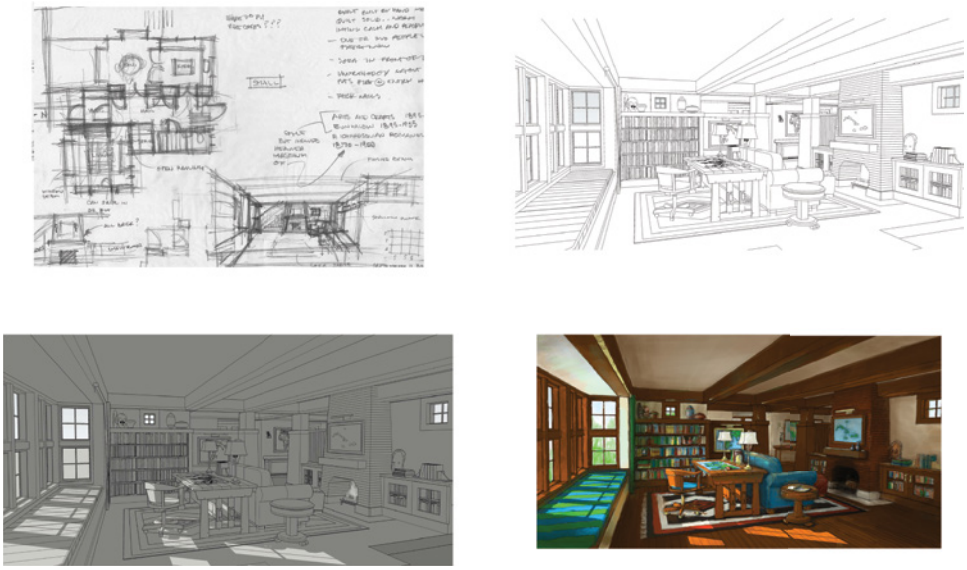


Figure 1-13: Hand sketches imported, modeled, shadow-studied, and then colored in Photoshop. Courtesy of **mkerrdesign.com**.

- *Incorporate artwork and photos into the design*. The tabs at the top of Figure 1-14 are preset scenes for a slideshow presentation.

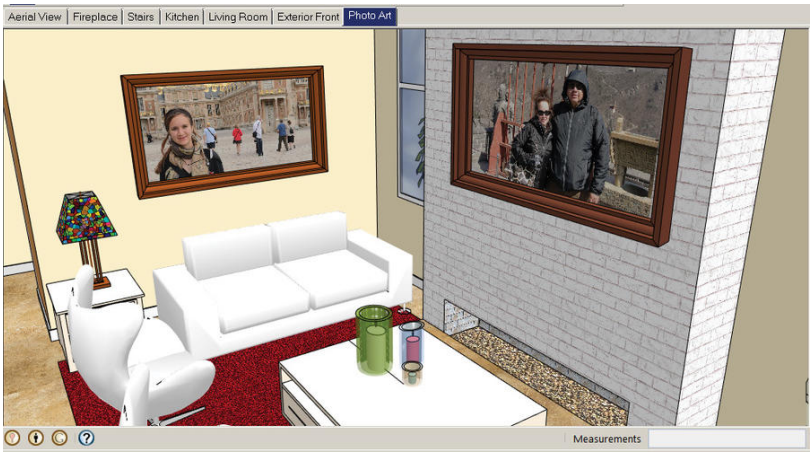


Figure 1-14: Incorporate artwork and photos into the design.

- *Import images of the textiles to be used in the design* (Figure 1-15).
- *Save models locally on your own computer or on the Trimble Cloud for remote collaboration* (Figure 1-16). You have unlimited online storage.

Figure 1-15: A textile pattern imported and applied to a drapery model.

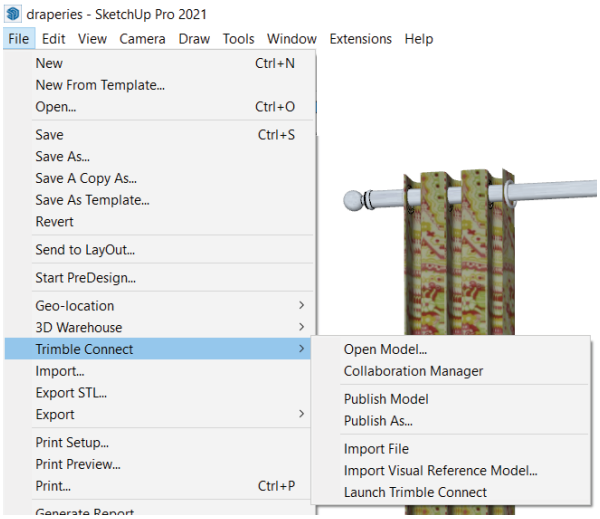


Figure 1-16: Upload your model to the Trimble Cloud directly from SketchUp and collaborate with others on it.

Want to learn more? Join me in Chapter 2, where we'll discuss what's needed to run SketchUp, put it on your computer, and explore its interface.

Summary

SketchUp is a surface modeling program used by interior designers for space planning, conceptual design, client presentations, and document drawings. Users can think through an idea, study design options, and present them creatively.

Further Resources

The Official SketchUp Blog: **http://sketchupdate.blogspot.com/**

Buy SketchUp here: **https://store.sketchup.com/**

Learn about SketchUp on the iPad: **https://www.sketchup.com/products/sketchup-for-ipad**

SketchUp for Web: **https://www.sketchup.com/products/sketchup-for-web**

Download a free SketchUp viewer: **https://www.sketchup.com/products/sketchup-viewer/downloads**

Compare plans and prices: **https://sketchup.com/plans-and-pricing**

SketchUp Shop: **https://help.sketchup.com/en/sketchup-web/whats-included-sketchup-shop**

Learn about other modeling types: *Fusion 360 for Makers*, 2nd edtion by Lydia Sloan Cline. San Francisco: Maker Media.

CHAPTER 2

Getting Started

Objective: This chapter discusses what is needed to run SketchUp and looks at the interface.

Concepts and Functions: three-button mouse, video card, Space Mouse, workspace, menu bar, global axes, scale figure, origin, measurements box, instance, viewer app, template, Trimble Connect, coordinates, backup files

Hardware, Operating System, and Browser Requirements

An internet connection is needed to authorize SketchUp each time you open it, and to use some of its features. A late-model computer and operating system is recommended, as SketchUp is a graphics-intensive program. The more detailed your model, the more processing power it needs. Following are the recommended specifications. SketchUp's help menu has a downloadable app that can check your machine for compatibility.

PC: Windows 11, Windows 10

- 2+ GHz processor
- 8+ GB RAM
- 700 MB of available hard-disk space
- 3D-class *video card* with 1 GB of memory or higher and support for hardware acceleration
- Video-card driver must be up-to-date and support OpenGL 3.1 or higher
- Microsoft .NET Framework version 4.5.2
- *three-button, scroll-wheel mouse*
- Microsoft Internet Explorer 9.0 or higher

Mac: OS 12+ (Monterey), 11+ (Big Sur), and Mac OS 10.15+ (Catalina)

- 2.1+ GHz processor
- 8 GB RAM
- 700 MB of available hard-disk space

- 3D-class video card with 1 GB of memory or higher and support for hardware acceleration. The video-card driver must support OpenGL version 3.1 or higher and be up-to-date.
- Three-button, scroll-wheel mouse
- QuickTime 5.0 and Safari

A keyboard and three-button scroll-wheel mouse are needed. A one-button mouse or trackpad is doable but difficult. 3D modeling requires much more on-screen movement than 2D drafting. A scroll wheel and right-click button let you make that movement faster than clicking icons and keyboard shortcuts, tapping, and sliding.

> SketchUp can adjust icon and drawing element sizes appropriate for high DPI (dots per inch) screens. Icons are sized when SketchUp starts up. If you adjust your DPI or scale (Microsoft Windows, up to 150%) you will need to restart SketchUp to see correctly sized icons and drawing elements.

Tablets

SketchUp can also be used on an iPad Pro, Surface Pro, and Wacom graphics tablet. Use it with an Apple Pencil, mouse, and keyboard; a stylus pen; and/or gesture software.

Viewer App

SketchUp has a free *viewer app* that can be used on an Apple or Android phone or tablet (Figure 2-1). This is useful for showing a model on the job site. The viewer app can also be downloaded on a desktop, useful for someone who wants to see the model but doesn't have SketchUp. The viewer's interface resembles SketchUp's Web version. A model must be downloaded to the device to be viewed; the viewer app cannot access the model from the cloud.

Figure 2-1: The SketchUp viewer on an iPad Pro.

Video Card

The *video card*, also called a *graphics card*, is an electronic board inside the computer that sends information to the monitor. Standard computers come with a built-in card that may display SketchUp models with a low-resolution, jagged appearance. A dedicated card, such as the kind used for graphic design, HD-video editing, animation, and gaming will give a smoother

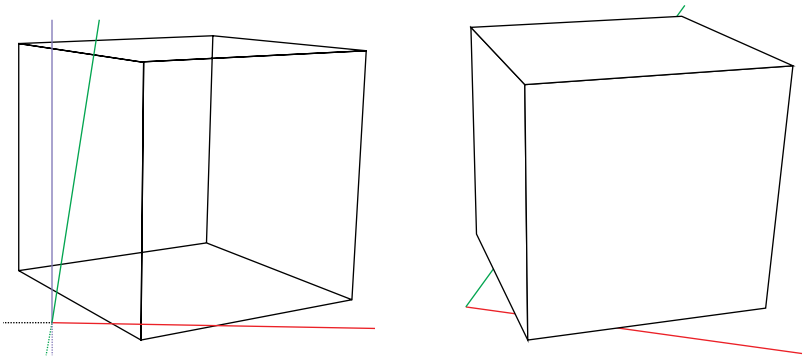


Figure 2-2: Standard video-card output (left), dedicated graphics card (right).

appearance (Figure 2-2) and better handle the high demands of modeling software. If you plan to print SketchUp models for construction documents and marketing purposes, a high-level video card is especially important.

Space Mouse

A mouse option for both the PC and Mac is 3DConnexion's *Space Mouse* (Figure 2-3), designed for modeling software. You push, pull, twist, or tilt the mouse to pan, zoom, and orbit around the model. The Space Mouse has programmable buttons for your most-used tools. It's not a replacement for the traditional mouse; you still use that to select, create, and edit.

Figure 2-3: The 3D mouse is used with a traditional mouse.

Download SketchUp Pro

It's time to point your browser to **www.sketchup.com** and download Pro (Figure 2-4). Note the offerings under the Products tab. Pro, Studio, Higher Education, and Universities are the same product with different subscription prices. Shop is the same as Free with the ability to import and export more file types and access to *Trimble Connect* for storage and collaboration.

Three programs will download: SketchUp Pro, LayOut, and Style Builder (Figure 2-5). All can be used independently or linked to each other. Linking lets you sync updates.

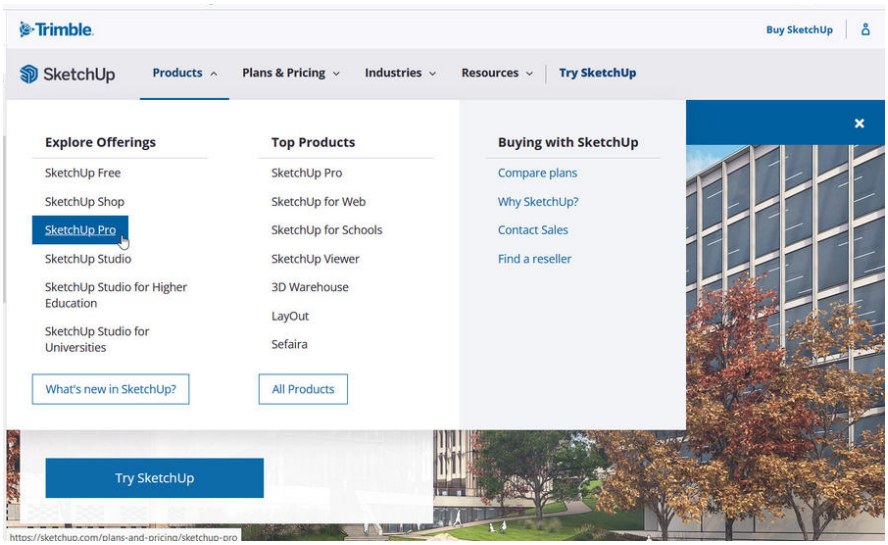


Figure 2-4: Download SketchUp Pro.

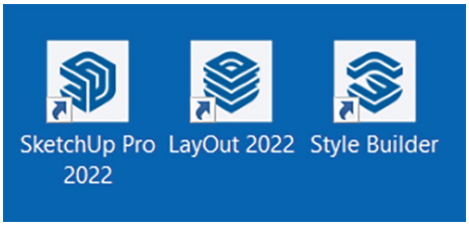


Figure 2-5: SketchUp Pro, LayOut, and Style Builder icons.

Launch SketchUp Pro

Click on the *SketchUp Pro* icon to launch. You'll be asked to sign in (Figure 2-6). Use your Google, Apple, or Trimble account. If SketchUp is already open on more computers than your license allows, a splash screen will tell you so.

Click on the *Manage activations* button. It sends you to your Trimble account. Managing the activation is the one time you will need a Trimble account. You can make one here or on any SketchUp site, such as the 3D Warehouse. Click on **My Products>View Included Applications**. Then click on *Manage Devices* for SketchUp Pro, LayOut, and Style Builder. Once deactivated, sign out of Trimble, re-sign in, and restart SketchUp.

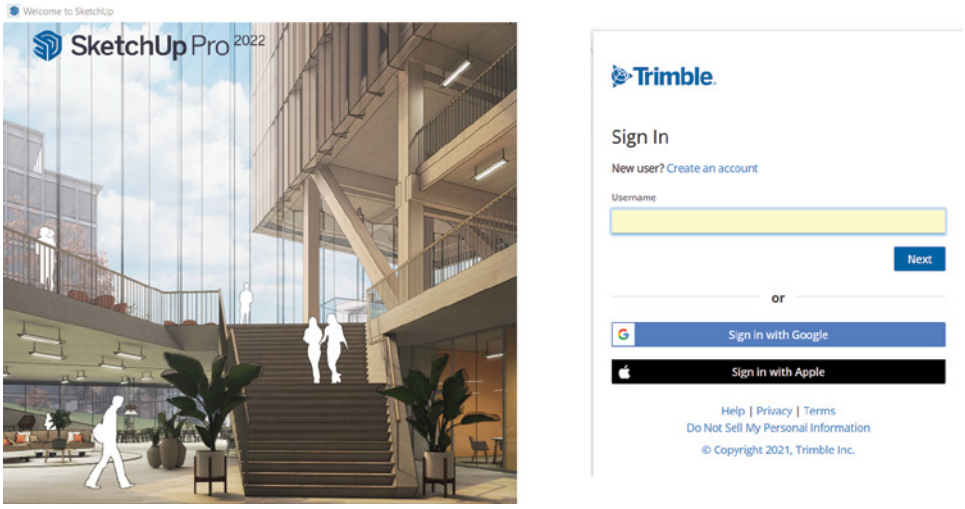


Figure 2-6: The sign-in screen.

Choose a Template

Once signed in, a Welcome screen with six *template* choices appear (Figure 2-7). These are files with different default measurement settings to accommodate different uses, such as woodworking and 3D printing. Click *More templates* for another 12 choices. SketchUp will open after you choose a template. The template you last chose will appear as the first thumbnail on the template choice page. You can skip this screen by clicking on **Preferences>General** and unchecking *Show Welcome Window*. If you do this, your default template will open. Making your own custom template is discussed in Chapter 3. For our practice file, choose *Architectural Inches*.

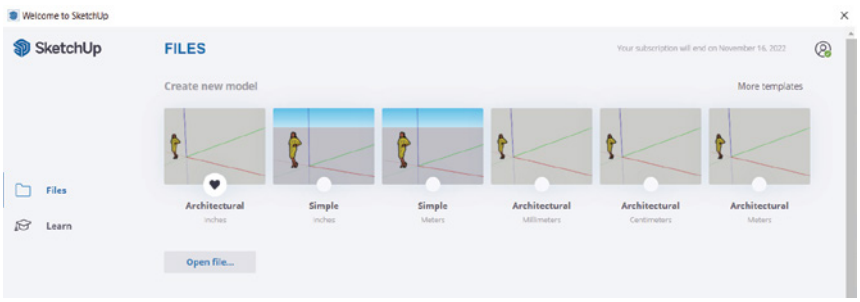


Figure 2-7: Choose a template.

With this template, all dimensions appear in a feet and inch format (Figure 2-8). When you type a number, the default is inches, so no need to add the inch unit (″). But to enter feet, you must add the foot symbol (′) after a dimension number. Know that you can also type dimension units in metric (mm, cm, m) in the architectural inches template; just include the unit after the dimension number.

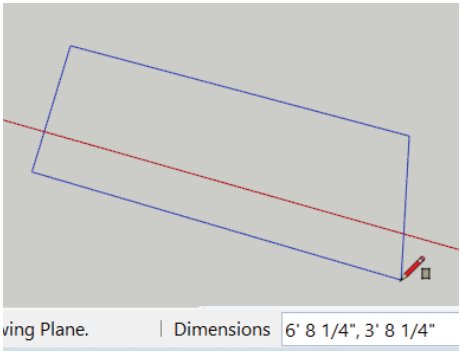


Figure 2-8: Dimensions in the architectural inches template appear in feet and inches.

The Workspace

The *workspace* operates a bit differently in PC and Mac, and we'll note those differences as we get to them.

Figure 2-9 shows the PC screen. The Mac screen is almost identical; Figure 2-10 shows differences. Mac users, your menu starts with a **SketchUp** entry, and that entry contains the *Preferences and Licensing/Update* options that are under the PC's **Window** and **Help** menus. Mac users also don't have the panel trays on the right side of the screen that PC users have. Instead, Mac users click open individual submenus, double-click on them to minimize, and then stack and move them together around the screen.

Following are the elements of the workspace.

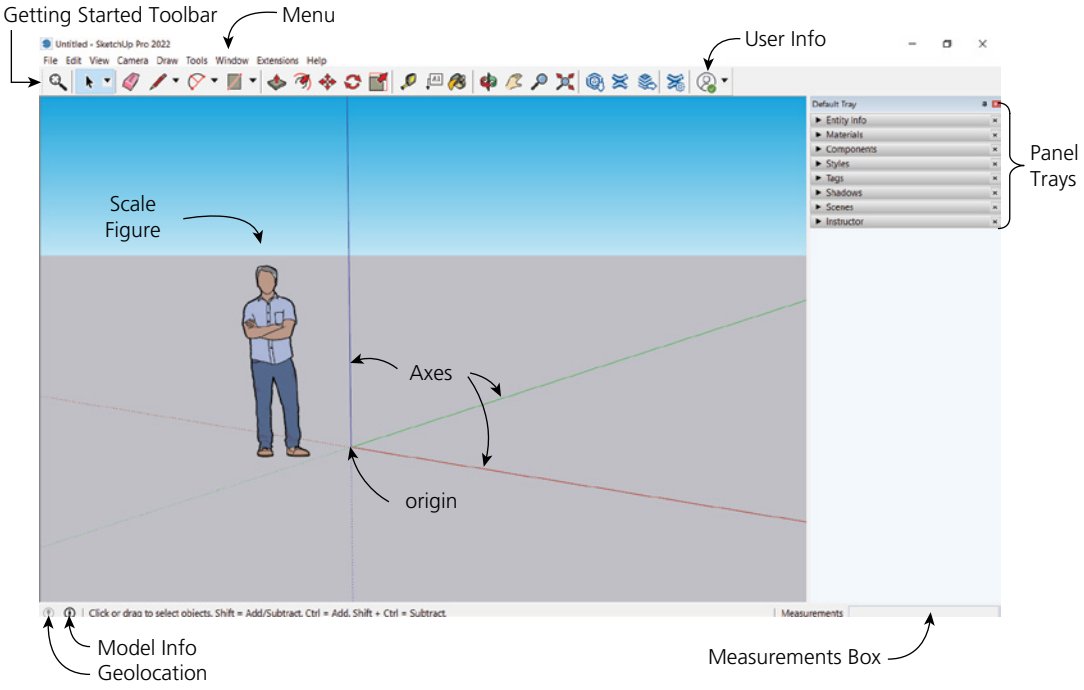


Figure 2-9: The PC's workspace.

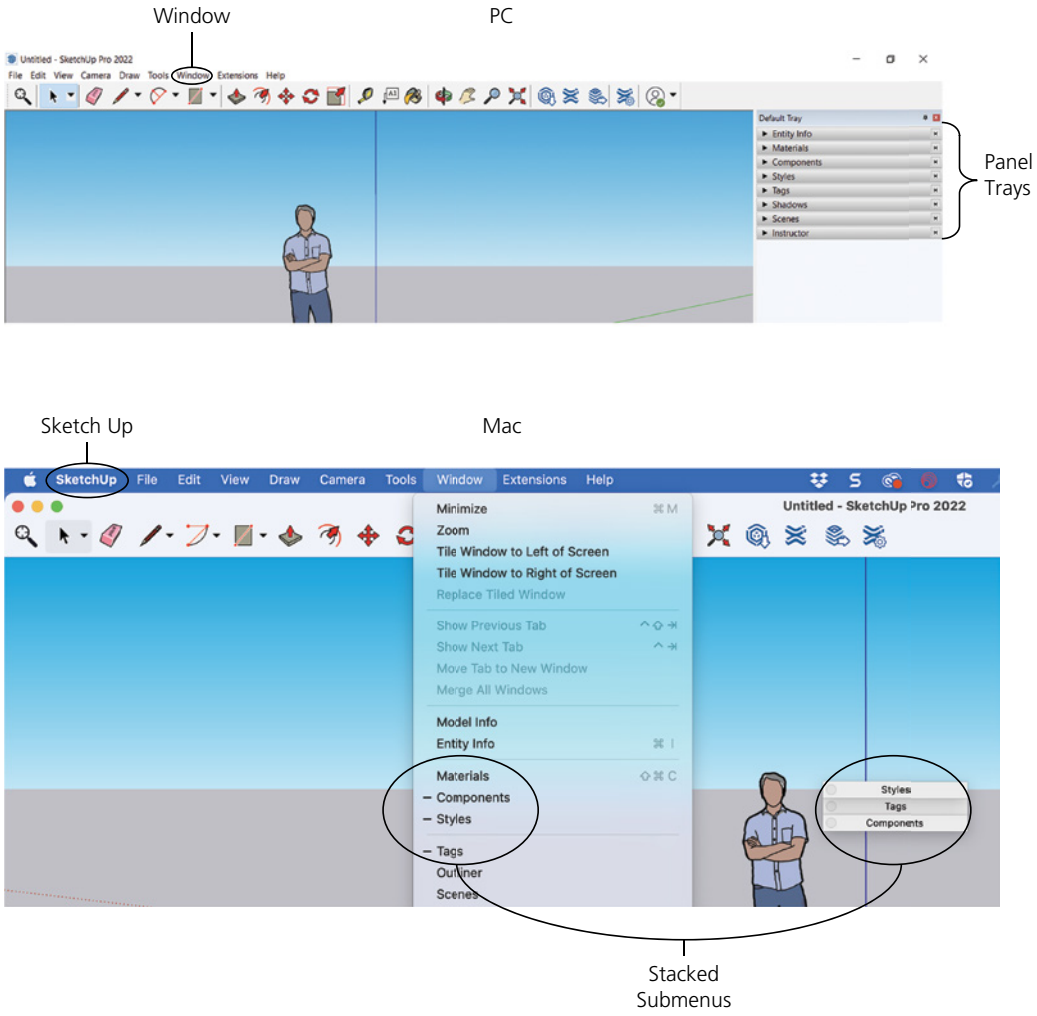


Figure 2-10: The PC and Mac menu bars.

Menu Bar

This is a horizontal bar at the top of the screen that houses tools and functions. It has nine categories: file, edit, view, camera, draw, tools, window, extensions, and help.

- *File.* Contains functions that let you open, save, print, import/export files, send files to LayOut, geolocate a file, and access Trimble Connect, which is online storage and collaboration space. There's also a Predesign option, which assists with research.
- *Edit.* Contains standard undo/redo, cut, copy, and paste functions plus SketchUp-specific ones like making selections, groups and components, hide/unhide, and deleting guides.

- *View.* Contains options that alter how the model looks, such as opaque or transparent, how section cuts are filled, show hidden geometry, shadows, fog, and animation settings.
- *Camera.* Contains tools that affect how you view the model, such as in perspective, isometric, or 2D; orbit/pan/zoom; walk and look around at eye level; and match the model's perspective with that of an imported photo.
- *Draw.* Contains line, arc, and shape tools for creating the model.
- *Tools.* Contains what's needed to edit and modify. Here you'll find the eraser, paint bucket, move, rotate, scale, push/pull, follow me, offset, tape measure, and protractor. Also contains dimension and text tools, the section plane, solid tools (these mimic a solid modeling experience) and the outer shell tool (this removes interior overlapping geometry).
- *Window.* Here is where you turn the panel trays on and off. Also, access model information, preferences, components options/attributes, and the 3D Warehouse (models that others made) here.
- *Extensions.* Access the Extension Warehouse (more tools) and Extension Manager (install and update).
- *Help.* Here you can return to the template choices, access online support, check what version you're using and if there's an update, manage your license, and download an app that checks your computer for the ability to run SketchUp.

Getting Started Toolbar

The horizontal bar under the *Menu bar* contains icons that activate the most common drawing and editing tools. It opens by default when you open SketchUp.

The Global Axes

These are the height, length, and depth lines along which you draw. Their intersection is called the *origin*. The height (z) line is blue, and the ground lines (x and y) are red and green. The axes lines are solid in the positive directions and dotted in the negative. Every point has a *coordinate* (group of numbers) that describes its location. For example, (3,4,5) means 3 units along the x/red axis, 4 units along the y/green axis, and 5 units along the z/blue axis. You can find each point's coordinates by clicking the Text tool onto it and then dragging. The coordinates will appear in the text box (Figure 2-11).

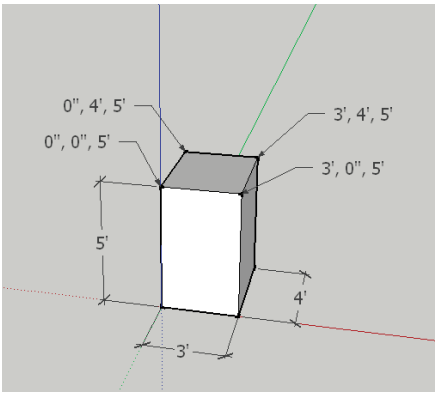


Figure 2-11: Every point has a coordinate that describes its location along the axes.

Global axes apply to the whole model. Individual components have their own, local axes. Those local axes can be rotated so they don't match the global axes if the design warrants it. If a downloaded component's local axes don't match the global axes, they can be rotated to match.

Scale Figure

This human shape helps you visualize sizes, which is useful when you're loosely sketching instead of imputing dimensions. The *scale figure* is a component, meaning a collection of loose lines and planes that are manipulated together. It is a 2D shape, but 3D figures are available in the Warehouse.

▶ Fun fact: In each major annual release the scale figure is a different SketchUp team member. You can download them all from the Warehouse. Earlier scale figures are dynamic, meaning when you click the dynamic components tool on them, some characteristics change.

Bottom-left Screen Icons

Pin activates the geolocation tool (this defines the precise location on Earth where the model exists).

Figure opens the model information window. Here you can access and modify settings on functions such as animations, dimensions, components, text, and units.

Instructor. This icon is on the Mac and opens a brief tutorial for the currently activated tool (Figure 2-12). On the PC, access the Instructor at **Window>Default Tray** and click *Instructor* to make it appear in the panel trays. Links inside the Instructor take you to the SketchUp Knowledge Center. Clicking on a different tool changes the information in the Instructor. If the Instructor distracts you, go to **Windows> Instructor** and uncheck it. When you want it back, recheck. You can also make the Instructor appear and disappear by clicking the circled question mark in the lower-left corner of the modeling window.

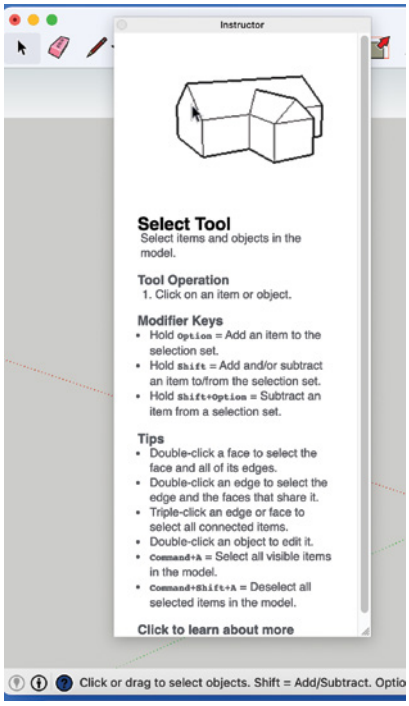


Figure 2-12: Icons and Instructor window on the Mac.

Measurements Box

The rectangular field in the lower-right corner displays all dimensions. If you don't see it, it may be hidden behind your taskbar/dock. Maximize the SketchUp screen or drag it higher on the desktop.

Typing numbers is how to make SketchUp models accurate. You don't have to type numbers specifically in the *Measurements Box*—that's just where they'll show up. Such numbers

include line lengths; circle diameters; rectangle sizes; number of polygon sides; number of copies; distance to move, offset or push/pull something; and rotation angles. Some tools cause default numbers to appear, and you'll overtype them when needed. For example, when you click on the *Polygon* tool, the number 6 appears in the box, meaning you'll draw a polygon with six sides. Before clicking the polygon in place, click in the Measurements box and type in the desired number. Then draw the polygon.

The nature of the number that appears in the Measurements box depends on which tool is activated. The number could mean inches, degrees, or number of sides. As we cover different tools, how they're entered in the measurement box will be discussed.

Panel Trays

These are where files and functions are stored. Earlier we clicked open the Instructor tray. Click on the *Materials* tray now. You'll find a drop-down menu with nested options for stone, tile, carpet, and other items (Figure 2-13). View the trays on a PC at **Window>Default tray** (Figure 2-14). That's where you click individual trays on and off. If you inadvertently turn off a tray, just go there to turn it back on. Tray order can be changed by dragging them. Mac users, you need to turn the trays on under the **Window** menu.

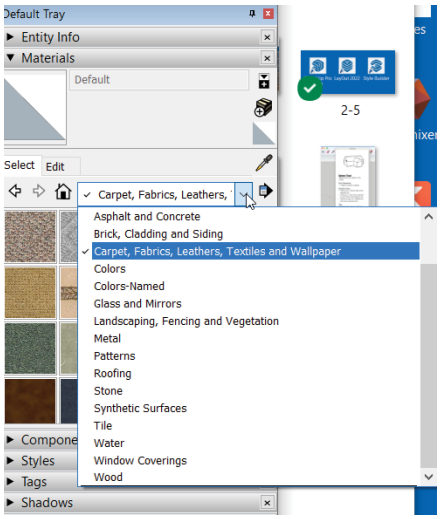


Figure 2-13: The *Materials* tray/ carpet options.

Run Multiple SketchUp Files at the Same Time

On a PC, clicking **File>New** prompts you to save the current file. Upon saving, the file closes, and a new *instance* (open copy) of SketchUp opens. If you want to close the file without saving but keep SketchUp open, click *No* when asked to save the file. Clicking **File>Open** prompts you to save the current file and then navigates to another one. You can run multiple instances (copies of SketchUp software) on a PC by right-clicking on the *SketchUp* desktop icon and selecting open or clicking on the desktop icon of the file you want to open. While you can run multiple instances, you can't run multiple files under one instance.

On a Mac you can have multiple files open in one instance. Clicking **File>Open** or **File>New** opens a new file without closing the current one.

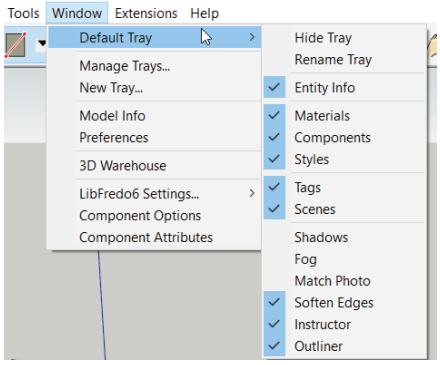


Figure 2-14: View all trays at **Windows>Default tray.**

Save Options

Under **File** there are four save options. *Save* does just that—it saves the open file. *Save As* replaces the open file with a new one. *Save A Copy As* leaves the current file open and makes a closed copy at a location you choose. *Save As Template* makes a template out of your file. The file is saved with an SKP extension and it will appear with all the other template choices when you open SketchUp. Files made in earlier versions of SketchUp can be opened in later ones. Files made with later versions may not work correctly in earlier versions if they can be opened at all. You can save a file as an earlier version by scrolling through the *Save As Type* field at the bottom of the *Save* dialog box (Figure 2-15) and choosing the earlier version of SketchUp you want.

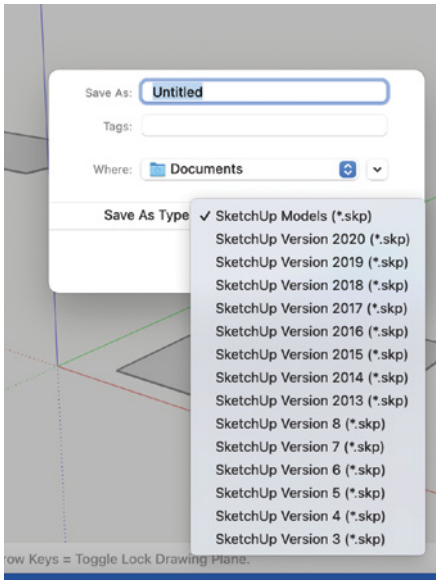


Figure 2-15: Save SketchUp files in their current version or as an older one in the *Save As* dialog box.

SketchUp automatically creates an autosave file at a time increment of your choice after the last save. Set that increment at **Window>Preferences >General** and check *Autosave* (PC), and at **SketchUp>General** (Mac). The autosave file deletes once you save again or exit. If SketchUp crashes, the autosave file remains, giving you almost up-to-date work. Set a frequent autosave to protect against crashes.

Backup Files

Backup files are automatically made in the same location as the SKP file (ensure that the Create Backup box is checked at **Preferences>General**). They have an SKB extension. Don't delete backups until done with a project, as they're useful if (oh, the horror) the SKP file gets corrupted or accidentally overwritten. SketchUp's backup files are unique in that they're the previously saved version of the model, not the last saved version. This is handy if you mess up a model after a save and need to backtrack a bit. Convert an SKB file into an SKP file by overtyping the *b* into a *p*.

Save and Exit the Software

PC users, click **File>Exit** or the *X* in the upper-right corner. Mac users, go to **SketchUp>Quit SketchUp** to exit the software; clicking the red button in the upper-left corner just closes the active file, not the software, because you can have multiple files open in one instance.

Now's a good time to save the file—call it *Practice* and choose where on your computer to save it. Perhaps make a folder called SketchUp Files and put all work from this book in it. Next up is navigating around the workspace! Join me in Chapter 3 where we'll start learning tools.

Summary

SketchUp runs on both the Windows and Mac platforms. It requires an internet connection and is optimally used on a tower or laptop computer with a strong graphics card, three-button mouse, and keyboard. It can be run on some tablets. A viewer app is available that enables you to see a model without installing the SketchUp software. SketchUp can run multiple simultaneous files; on the PC they are separate instances and on the Mac the files can run under one instance. The automatically created SKB backup file preserves the next-to-last saved version.

Further Resources

Hardware needed to run SketchUp: **https://help.sketchup.com/en/sketchup/system-requirements**

SpaceMouse models: **https://3dconnexion.com/us/spacemouse/**

Download SketchUp viewer app: **https://www.sketchup.com/products/sketchup-viewer/downloads**

SketchUp Free vs. SketchUp Shop: **https://help.sketchup.com/en/sketchup-web/whats-included-sketchup-shop**

Tips on using Trimble Connect: **https://blog.sketchup.com/article/7-tips-for-remote-collaboration**

Overview of the Predesign feature: **https://help.sketchup.com/en/predesign-sketchup/getting-started**

CHAPTER 3

Exploring the Interface

In Chapter 2 you installed and launched the SketchUp software and saved a file called *Practice*. Open it, as we're going to maneuver around the workspace now.

Add the Large Tool Set

The *Getting Started* toolbar doesn't contain every tool. There are a lot more. On the PC, click **View>Toolbars**. This opens the toolbar window, which shows them all (Figure 3-1). Check the box in front of *Large Tool Set* to make that toolbar open, and then double-click on the toolbar's top bar to dock it (Figure 3-2). On the Mac, click **View>Tool Palettes>Large Tool Set** (Figure 3-3). A floating toolbar will appear. Mac toolbars don't dock or minimize with the workspace. On both the PC and Mac you can move toolbars off SketchUp and onto the desktop for more workspace room.

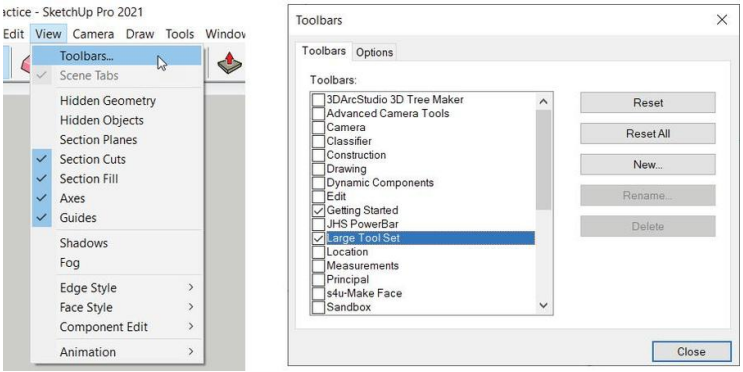


Figure 3-1: On the PC, click **View>Toolbars** to see all the tools available.

Objective: This chapter discusses the SketchUp desktop and how to maneuver around it.

Tools: screen tip, select, rectangle, push/pull, pan, orbit, zoom, move, transparent tool

Concepts and Functions: menu bar, getting started toolbar, views toolbar, standard toolbar, large tool set, auto-select, inference engine, inference lines, windows, preferences, model info, transparent tool, modifier key, plan, elevation, perspective, paraline, isometric, selection window, crossing window, template, select, erase, undo, rectangle, rotated rectangle, lasso, push/pull, impute numbers, orbit, pan, zoom, move, copy

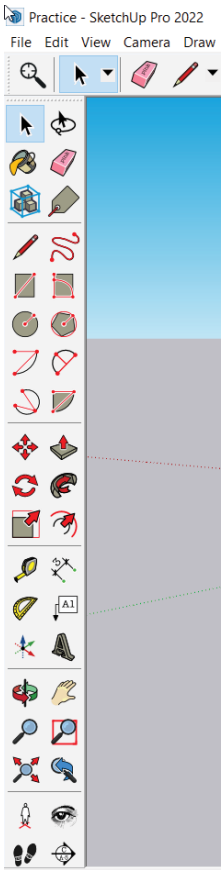


Figure 3-2: Click open the *Large Tool Set*.

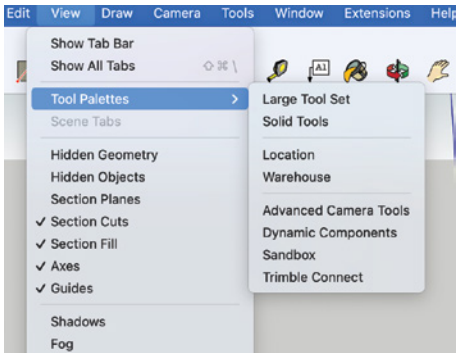


Figure 3-3: On the Mac, click **View>Tool Palettes>Large Tool Set** to add it to the workspace.

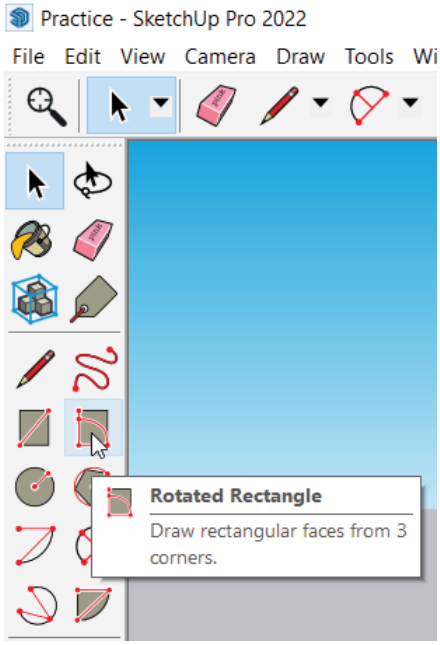


Figure 3-4: Hover the mouse over a tool icon to see its screen tip.

Large Tool Set duplicates many of the tools in *Getting Started* and has additional tools. Throughout this book we'll mostly access tools through toolbars. But you can access them through the **Camera**, **Draw**, and the **Tools** menus at the top of the screen if you want.

Explore! Hover the mouse over each icon to read its *screen tip*, a pop-up menu that describes what each tool is and what it does (Figure 3-4) to get familiar with the icons. Click on the Menu items and read the submenus. Shortcut fans can find a list of keys that activate tools at **Window>Preferences>Shortcuts** (PC) or **SketchUp>Preferences>Shortcut** (Mac). Now let's play with some of those tools.

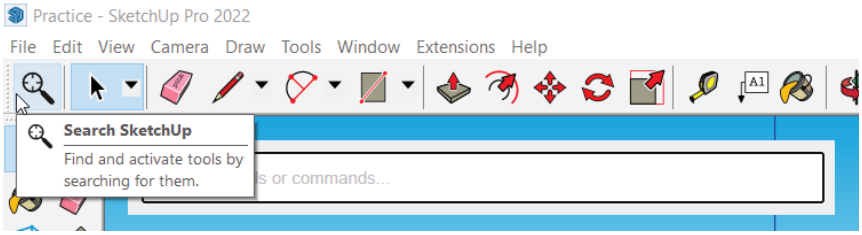


Figure 3-5: The Search window.

The Search Tool

Click on the magnifying glass and a search box appears (Figure 3-5). The shortcut is **Shift + S**. You can quickly find and activate both built-in commands and installed extensions. Just type the tool's name or a word related to its workflow, such as "*elevation*" or "Boolean." This search box is especially helpful with tool menus that have a lot of icons. Instead of keeping that toolbar open all the time, you can just type in its name when you want it and the toolbar will appear.

The Select Tool, Erase and Undo

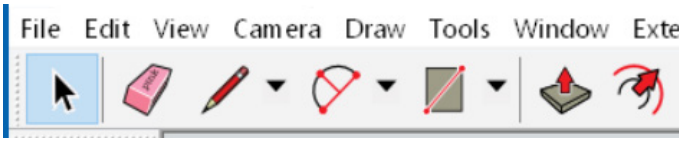


Figure 3-6: The *Select* tool.

The *Select* tool icon (Figure 3-6) is an arrow. It highlights objects for editing and for context menu-clicking. Click to activate.

With the *Select* tool activated, click on the scale figure component. A blue box appears around it, indicating that it is highlighted. This means you'll get a specific context menu when you right-click on it. Right-click inside the blue box and choose *Erase* from the context menu (Figure 3-7). He's gone! No worries, go to **Edit >Undo Erase** to bring him back. *Undo* reverses the last action, and you can undo all actions one at a time until the last save. Or just reimport him by clicking on the *Components* tray from the *Panels* tray on the right (Mac Users, find it under the **Window** menu) and then on the house icon (Figure 3-8). All components in the model, including erased ones, appear under the house icon, and you can drag them into the workspace. Return to the *Select* tool by clicking the space bar.

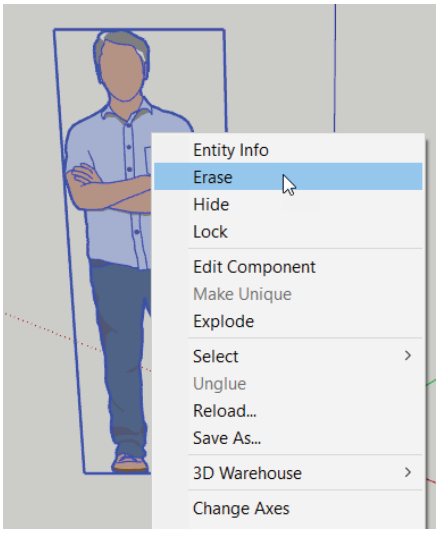


Figure 3-7: Right-clicking on a selected item brings up a context menu.

The *Select* tool has a drop-down arrow in which a *lasso* is nested. This lets you select irregular boundaries. Its shortcut is **Shift + Spacebar**

The Rectangle Tool

The *Rectangle* tool looks like a square and its dropdown arrow accesses a *rotated rectangle* (Figure 3-9). Click it.

Now click the cursor anywhere on the modeling window, drag and click again. You've just drawn a rectangle (Figure 3-10).

The Inference Engine

While dragging the rectangle, you may have noticed a diagonal dotted line appear and disappear (Figure 3-11). That's SketchUp's *inference engine* at work. This diagonal line appeared when the rectangle's shape was dragged into a proportion called the Golden Section. If the rectangle is dragged into a perfect square, a screen tip that says *square* will appear.

The inference engine is a geometric analysis feature that enables you to draw accurately. It helps you make accurate models without constantly typing dimensions. Based on how and where

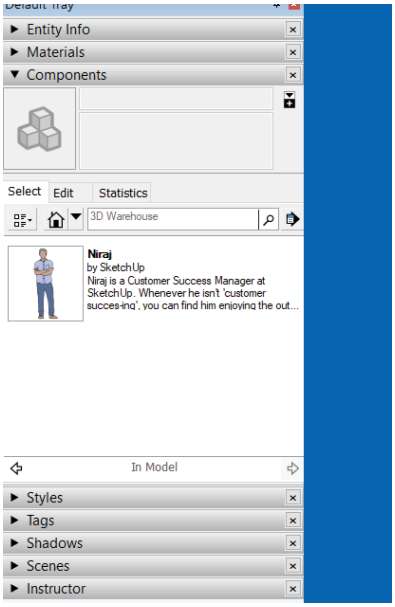


Figure 3-8: The house icon shows all components in the model.

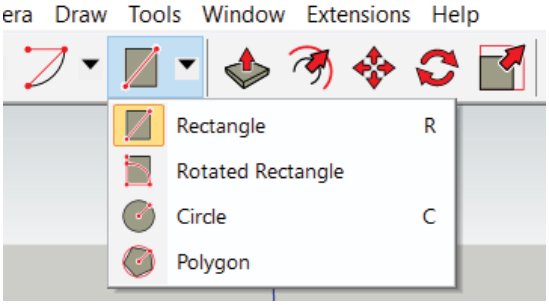


Figure 3-9: The *Rectangle* tool.

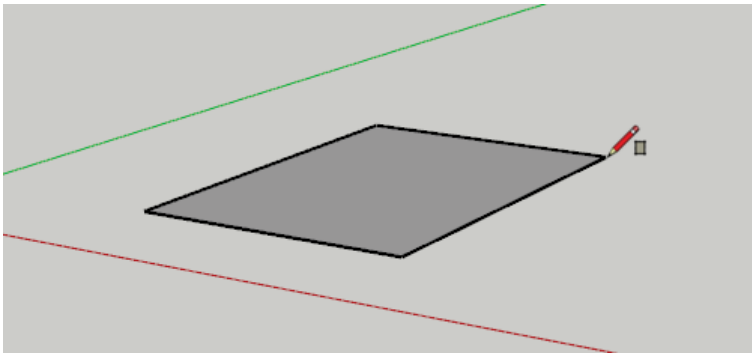


Figure 3-10: A rectangle drawn with the *Rectangle* tool.

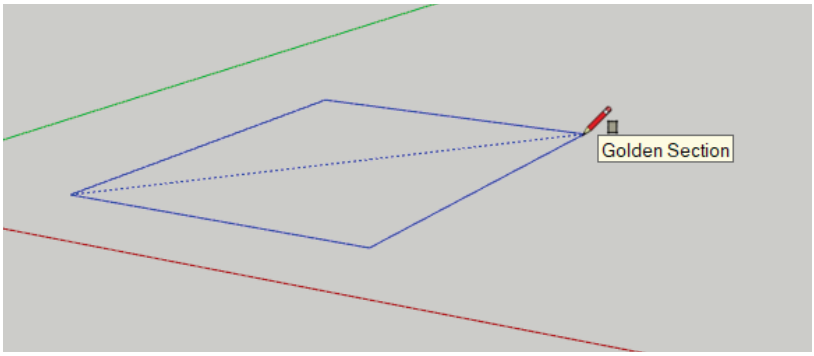


Figure 3-11: This dotted inference line indicates the rectangle has Golden Section proportions.

you move the cursor, it assumes, or infers, the specific points, planes, and directions you want, like AutoCAD's *osnaps*, if you're familiar with those. For example, if you hover over the approximate location of the midpoint, endpoint, or edge with the Pencil tool, the actual midpoint, endpoint, edge, etc., will appear as a colored dot or line.

> Tip: Sometimes the inference you want won't pop up immediately. In that case, encourage it by moving the cursor a few seconds over that area.

There are three kinds of inferences: *point* (e.g., to an endpoint or midpoint), *linear* (along the three axes), and *planar* (on the model's faces). To clarify planar inferencing, SketchUp snaps to a plane when it cannot snap to a specific piece of geometry.

Instead of abstractly discussing inferencing, we'll discuss it as we use it. For now, just go to **Edit>Undo Rectangle** (Figure 3-12) and then redraw the rectangle as a square by watching for the diagonal *inference line* and clicking when the "square" screen tip appears.

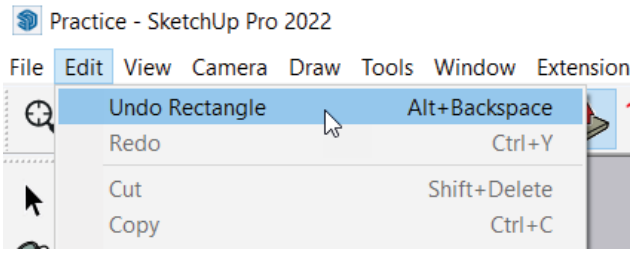


Figure 3-12: Every action is immediately reversed with the Undo function.

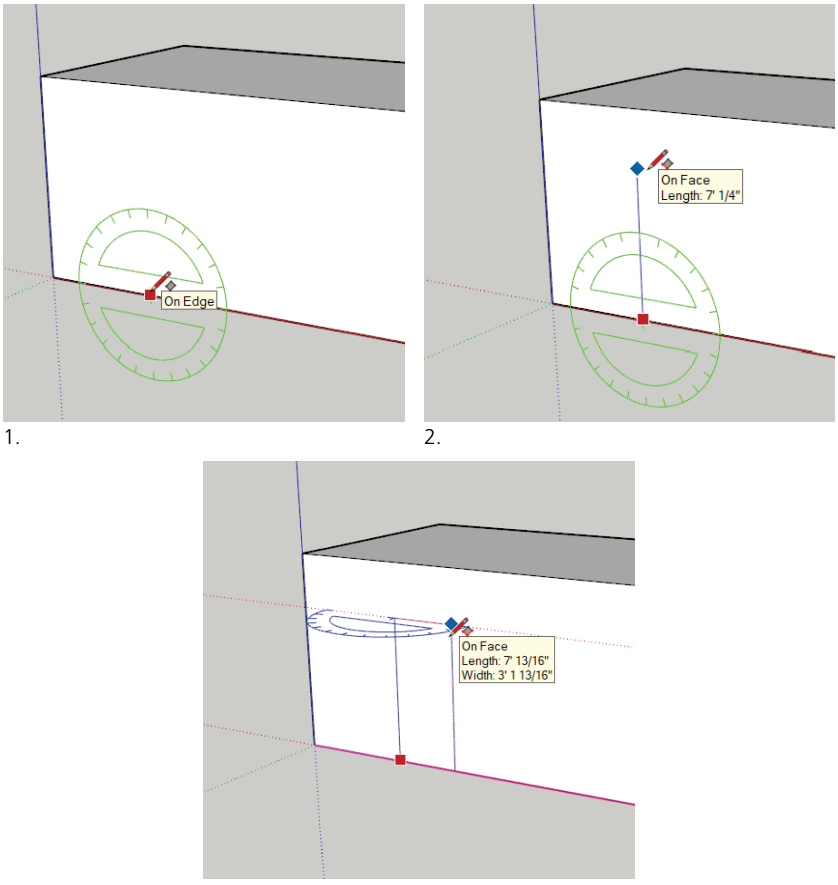
The Rotated Rectangle Tool

This is nested in the *Rectangle* tool and lets you use three points to create a rectangle. This is helpful for items that need two endpoints for length and another for height, such as doors (Figure 3-13).

The Circle Tool

This is also nested in the *Rectangle* tool. Click on the tool and move the cursor to the workspace, but don't click it on the workspace yet. Notice the 24 that appears in the Measurements box (Figure 3-14). This circle is really a polygon with a default of 24 sides. Before clicking the circle into place, hit the **Backspace** key and the 24 will disappear, enabling you to type a new number. *Do not* hit any key in between the **Backspace** key and new number; if you do, the new number won't take.

Why would you want to change the polygon number? Well, a bigger number creates a smoother shape that more closely resembles a circle. The downside is that also creates a larger file size, so is inadvisable if the circle is a minor feature. If you won't be zooming in on this



1. 2.

3.

Figure 3-13: Use the Rotated Rectangle to draw a door.

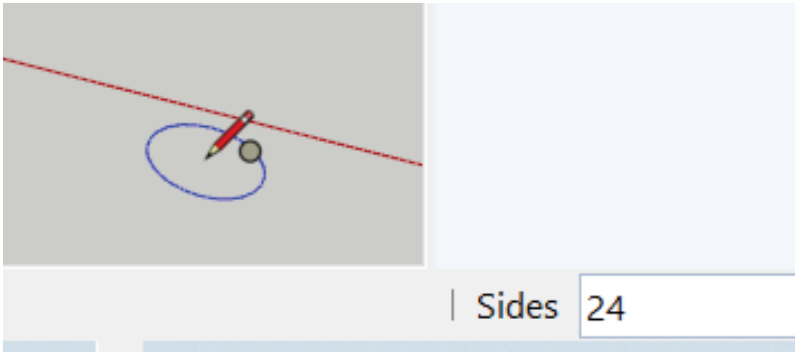


Figure 3-14: The default for the circle is 24 sides.

circle because it is a minor feature, type a smaller number. Let's accept the default of 24 and click the circle tool twice to create it.

What makes the circle-polygon different from the polygon made with the Polygon tool that is also nested with the Rectangle tool? Click the *Polygon* tool, backspace the default of 6, type **24** and hit **Enter**. Your polygon will have 24 sides just like the circle. But when you extrude it up with the *Push/Pull* tool, all the sides will show. When the circle is extruded, it is smooth (Figure 3-15).

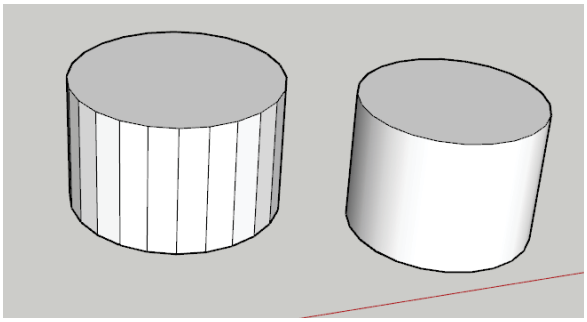


Figure 3-15: An extruded polygon and circle.

The Push/Pull Tool

Push/pull (Figure 3-16) adds volume to a face by extruding (stretching) it. It's an *auto-select* tool, meaning when you move it onto a face, the face highlights. Not all tools auto-select; generally, you must highlight a face in a separate action with the *Select* tool. Click the push/pull icon and then move the mouse onto the square you just drew. See how the face becomes dotted? That means it's selected and ready to edit. Click, hold, and drag the cursor up, let the cursor go, type **5′** and hit **Enter**. The square is now a 5′ tall cube (Figure 3-17).

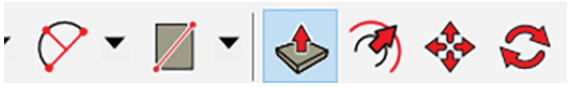


Figure 3-16: The Push/Pull tool.

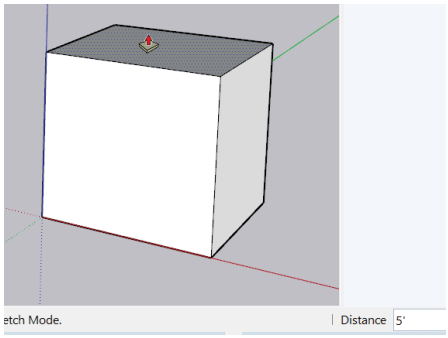
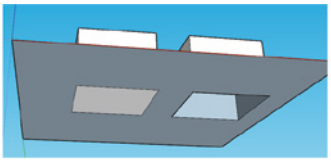


Figure 3-17: A cube made with Push/Pull.

Note that while 5′ appears in the measurements box, I didn't have to type inside that box. I can type the number anywhere on the screen. Since we're using the inches *template* you don't need to type the inch symbol (″) after each number, but you do need to type the foot symbol (′) if you want feet. Type metric units (mm, cm, m) if you want those.

When the face being extruded is adjacent to another face, it will pull that face along (Figure 3-18). To keep the adjacent face intact, press and release the **Ctrl** key **(Command** on the Mac) right before performing the push/pull action. If you push/pull a face on an angled surface up, the resultant volume will be rectangular. Press and release the **Ctrl** key to preserve the original shape.



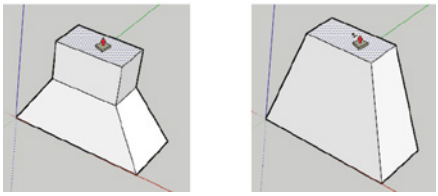


Figure 3-18: Press the Ctrl key (Command on the Mac) to preserve faces and forms when using *Push/Pull*.

Impute Numbers

To make the cube a specific size, type its dimensions as you model it. For example, after clicking the first point of a rectangle, type *5′,5′* and hit **Enter**. The rectangle will snap to 5 feet on each side. The first dimension goes along the red axis, the second dimension goes along the green. To change the size, type new numbers immediately after hitting **Enter**. If you perform any intermediate action after hitting **Enter**, such as clicking on a different tool, you won't be able to enter new numbers. SketchUp draws at a 1:1 scale, so the 5′ is true size, meaning an actual 5′. Working with true size numbers makes calculations for scaling the model easier.

To impute fractions, add a space between the inch and fraction. For example: 7′-6 1/2, 7′-6 1/2. Don't forget the comma between the set of numbers (Figure 3-19). Change the precision of fractions at **Window>Model Info>Units** (Figure 3-20).

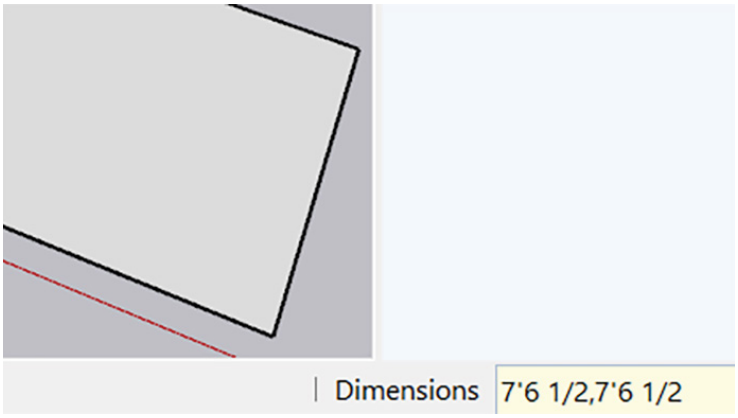


Figure 3-19: Imputing whole numbers and fractions.

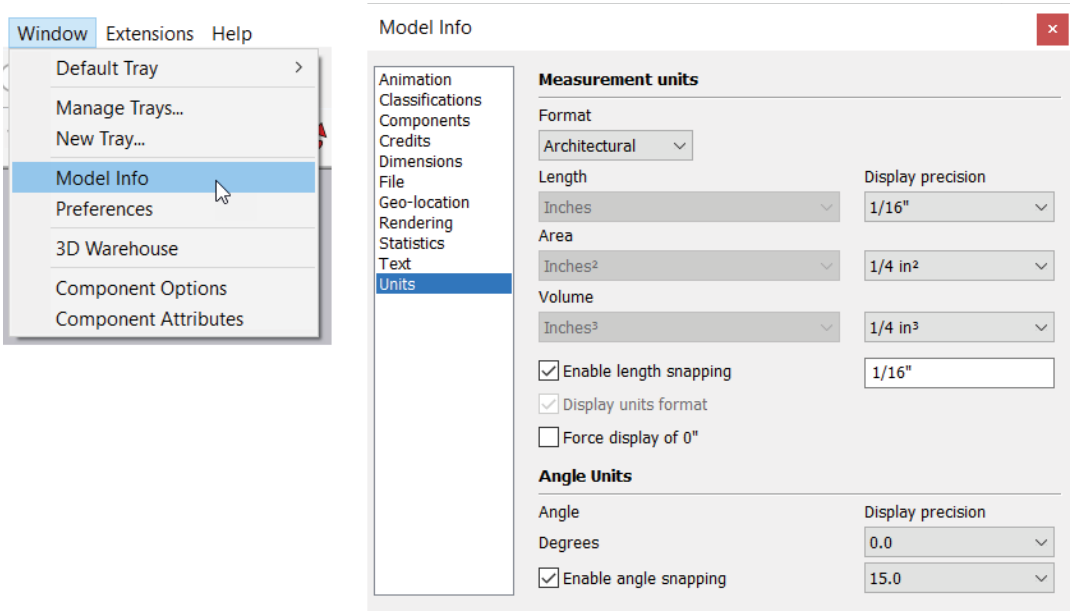


Figure 3-20: To change the model's units, go to Window>Model Info>Units.

> Tip: You don't have to type two numbers to draw a rectangle. You can type one number and click on a piece of geometry for the second number. Either type the first number and click the second or click the first number and type the second.

The *Pan*, *Orbit*, and *Zoom* Tools

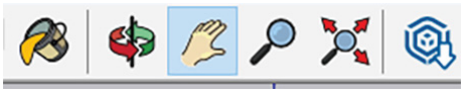


Figure 3-21: The *Pan* and *Orbit* tools

Pan looks like a hand; click on it. (Figure 3-21). Then click on the cube, hold, and drag it around the screen. You're panning, that is, moving the view around the desktop. You can also pan by holding the left mouse button and the scroll wheel down together. Pan is useful for moving geometry away from anything overlapping it, such as other geometry or dialog boxes (pop-up *windows*).

Now click on the *Orbit* tool, the circular arrows left of *Pan*. This whirls you, the viewer, around the cube; the cube itself doesn't move. *Orbit* lets you spin around the model to view it from all angles. The most efficient way to orbit is to hold the mouse scroll wheel down and drag it around.

Orbit on top, below, and behind the cube (Figure 3-22). Hold the **Shift** key down while orbiting to temporarily pan.

The *Zoom* icon is a magnifying glass to the right of *Pan*. Zooming in brings you close to an object, which lets you examine small details. Zooming out takes you farther away, which lets you see the big picture.

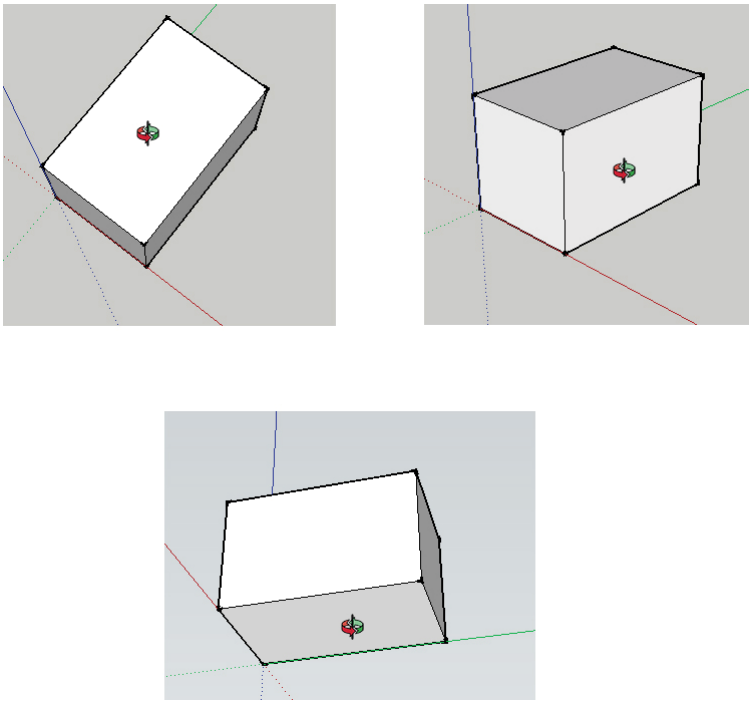


Figure 3-22: Orbiting around the cube.

Click the *Zoom* tool onto the model, hold the left mouse key down and drag it up and down to zoom in and out (Figure 3-23). Even better, just rotate the scroll wheel on the mouse. The icon to *Zoom's* right—the magnifying glass with three arrows—is *Zoom Extents*. Clicking it makes the whole model fill up the window.

If you click *Zoom Extents* and your model hides off in a corner, it's because there are little pieces of geometry you drew earlier still lurking around. Find and erase them, and your model will come back. Clicking *Zoom Extents* is a good way to locate those lost, small pieces.

Pan, *Orbit*, and *Zoom* are *transparent tools*, meaning you can activate them while using another tool and then pick up the other tool where you left off. For example, if you're drawing something with the *Pencil* and click on *Orbit*, the

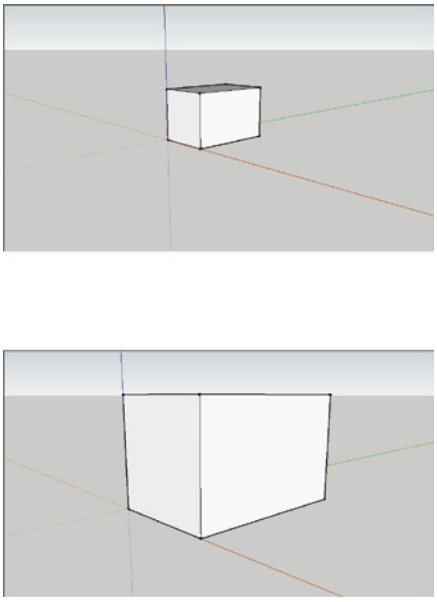


Figure 3-23: Zooming out and in.

Pencil icon will deselect. When you click the *Pencil* to reactivate, it will resume drawing in the location it was before you clicked *Orbit*.

Modifier Keys

Modifier keys are keys pressed while using a tool to make it do something else. Examples are the **Shift** key while orbiting to temporarily pan, or the **Ctrl** key while push/pulling to keep a face intact. Here are PC and Mac modifier key equivalents:

PC	MAC
Alt	Command
Ctrl	Option
Enter	Return
Shift	Shift

The Escape Key

The **Esc** key quits an operation. It cancels dialog boxes, closes menus, and quits functions. If you're in the middle of something and need to get out, just hit **Esc**.

The Camera and the Views Toolbar

You've probably noticed by now that the cube you modeled appears in *perspective*. That is, it looks the way the eye sees it: parallel lines converge to vanishing points and its size changes with proximity to viewer location. Three-point perspective is SketchUp's default mode. However, you can make the model appear as a *paraline* view, which is where parallel lines remain parallel; they don't converge. Click on **Camera>Parallel Projection** (Figure 3-24). Now the cube appears as an *isometric* view, a type of paraline drawing where the horizontal lines slope at a 30° angle.

With parallel projection on, let's do something that makes modeling software really shine. We'll generate orthographic views from this cube, specifically top, front, and side views. Or in architectural drafting terms, the *plan* and elevations.

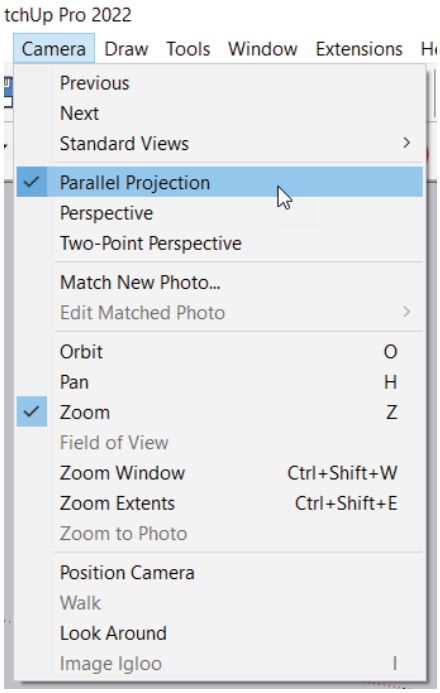


Figure 3-24: Click on Camera>Parallel Projection to see the model in a paraline view.

On the PC, click on **View>Toolbars** and check the *Views* box. A toolbar with icons that look like 2D views of a house will appear (Figure 3-25). On the Mac, go to **View>Customize Toolbar**. A tools page appears on which tools are stored (Figure 3-26). Drag the *Views* toolbar from this window into the *Getting Started* toolbar (Figure 3-27). Drag the *Undo/Redo* arrows there also, while you're at it.

Figure 3-25: The *Views* toolbar.

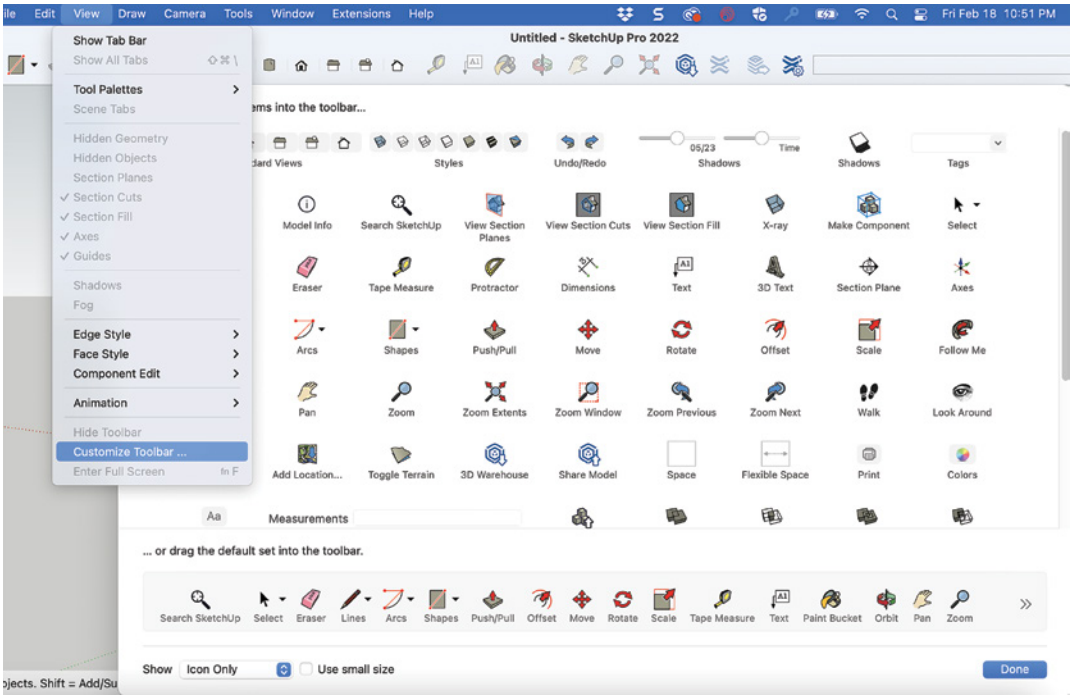


Figure 3-26: On the Mac, **Views>Customize Toolbar** brings up a tools dialog box.

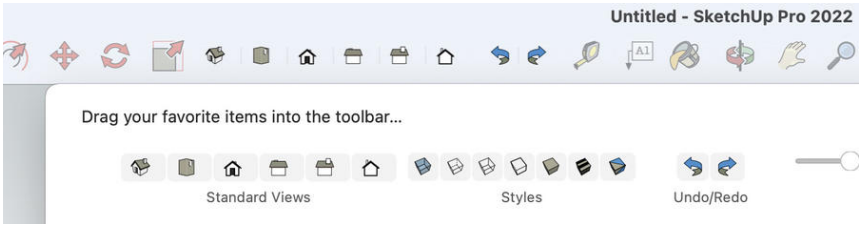


Figure 3-27: On the Mac, drag the *Views* toolbar into the *Getting Started* toolbar.

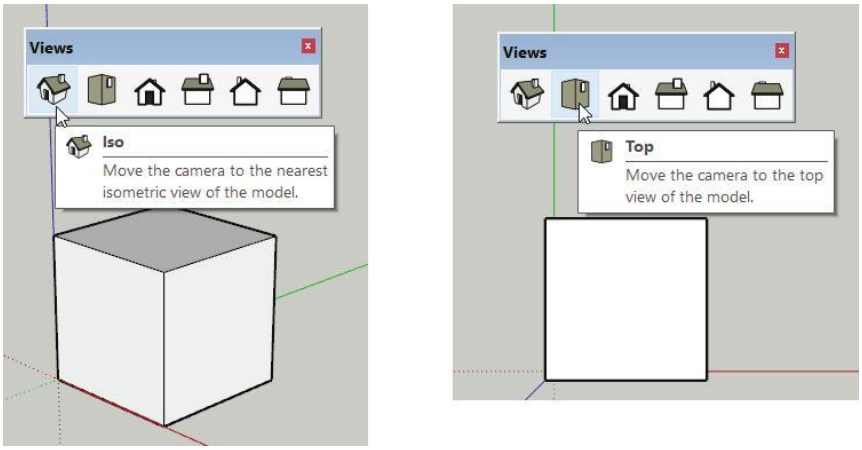


Figure 3-28: Isometric and top views of the cube.

Clicking on *View's* icons generates top, front, right, back, and left views (Figure 3-28). To return to the isometric view, click the *View* toolbar's first icon, the one whose screen tip says *iso*. Finally, click **Camera>Perspective** to return the model to a perspective view.

Selection Techniques

Geometry must be selected before anything can be done with it. A highlighted cube has blue dots on its faces and is ready for editing. Activate the Select tool by clicking on it. Your selection options are:

Selection Window (Figure 3-29). Hold the mouse down and drag it from the upper-left corner to the lower-right corner. Let go. All geometry entirely within that window will get selected for editing. Anything partly outside the window will not be selected.

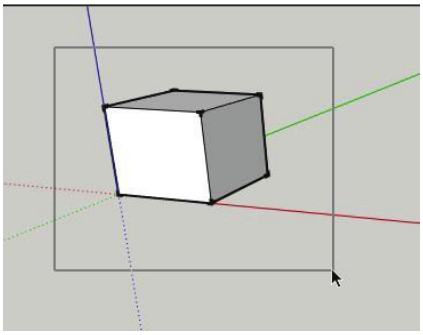


Figure 3-29: Drag a selection window from the upper-left to lower-right corners.

Crossing Window. Holding the mouse button, drag it from the lower-right corner to the upper-left corner. This creates a *crossing window*. All geometry touched by that window, whether entirely inside it or not, will get selected.

Right Click on selected geometry. You'll get a slightly different context menu depending on whether you select a line or plane, but options include selecting by connected faces; all connected geometry; all with the same tag; and inverting the selection (Figure 3-30).

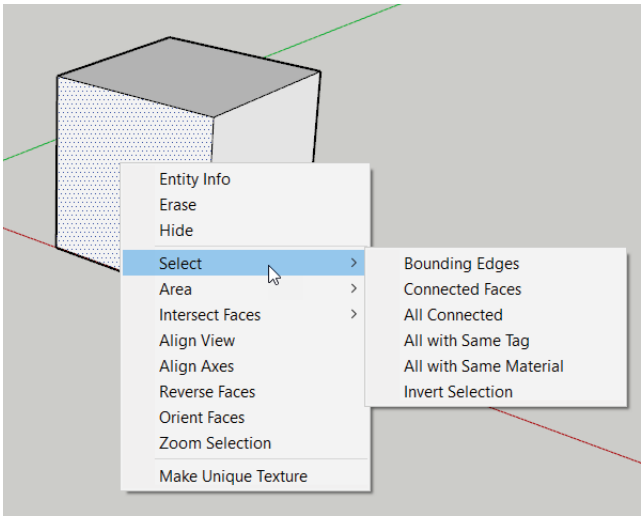


Figure 3-30: A selection window and the highlighted cube.

> Tip: A performance issue with a weak video card is an inability to make selection windows. A quick fix is to go to **Preferences>OpenGL** and uncheck *Use Fast Feedback*. Know this will also slow the program down when working on large models.

Single, Double, and Triple Clicks. Click the *Select* tool once on a face to select it. Double-click to select a face and all its bordering edges. Triple-click an edge or a face to select all attached geometry (Figure 3-31).

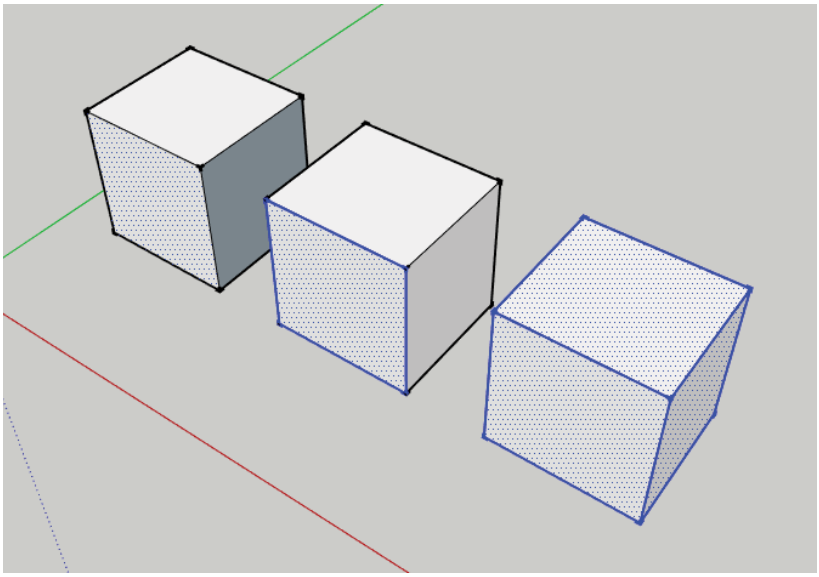


Figure 3-31: Single-click to select a face. Double-click a face to select it and all its edges. Triple-click an edge or face to select everything attached to it.

Shift *and* ***Control*** *Keys.* Hold the **Shift** key down to bring up a plus/minus sign. This indicates you can add or remove individual pieces from the selection. Hold the **Ctrl** key down to bring up a plus sign, indicating you can add individual pieces to the selection.

The *Move* Tool

Move (Figure 3-32) relocates selected geometry. Click on its icon, click on the cube, and move it around. When you move parallel to the axes, lines that color-coordinate with those axes appear. They're inference lines, telling you that you are indeed parallel to the axis. Figure 3-33 shows the cube moving along the red axis.

Figure 3-32: The *Move* tool.

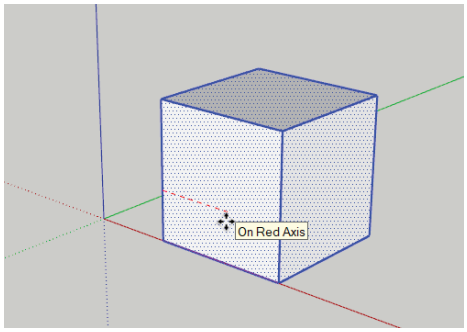


Figure 3-33: A red inference line appears when the cube moves parallel to the red axis.

You can edit a line's length with the *Move* tool if the line doesn't bound a face. Hover *Move* over one of the line's endpoints and then click and drag the endpoint to change the line's length. The *Move* tool also copies. Press and release the **Ctrl** key. A plus sign appears, indicating you can make a single *copy* of what is selected (Figure 3-34). Press and release the **Ctrl** key twice to "stamp," or make multiple copies. Press and release the **Ctrl** key to return to *Move* mode. Alternatively, you can select geometry, click **File>Copy** and then **File>Paste**. Then click the copy that appears into place.

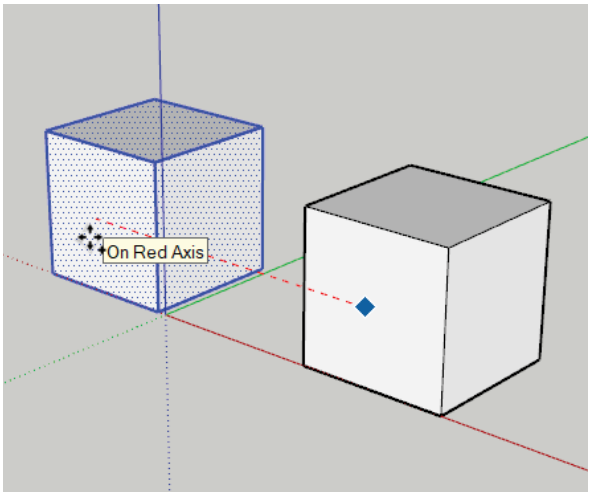


Figure 3-34: The *Move* tool moves and copies.

Resize a Circle with the *Move* Tool

If a circle's perimeter is highlighted, click the *Move* tool anywhere onto the circle to relocate it. If a circle's perimeter isn't highlighted, click the *Move* tool anywhere onto the circle to resize it by dragging.

Customize the Workspace

What if you don't like where the toolbars are? Or you want a custom toolbar with the icons you use most? Personalize the workspace by customizing the toolbars and changing their locations.

Customize Toolbars on the PC

On the PC, undock and move toolbars by grasping their handles, those dotted lines at the left end or top. Remove a toolbar from the modeling window by unchecking it in the **View>Toolbars** window. Incidentally, you can right-click on a blank spot up on the top *menu bar* area to access the toolbar list and click them on and off (Figure 3-35). Toolbars can also be moved off the workspace and onto the desktop to free up more modeling room

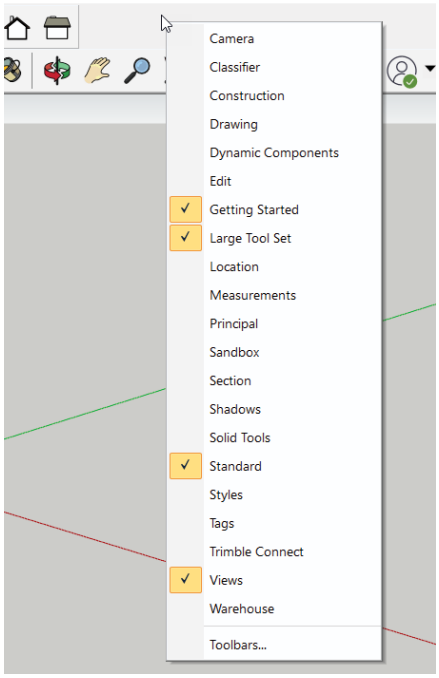


Figure 3-35: Right-click at the top to quickly access toolbars.

To make a custom toolbar go to **View>Toolbars**. Click *New*, and a pop-up menu box will appear. Name it and hit OK (Figure 3-36). Drag and drop tools from other toolbars into the new toolbar. The toolbars window must remain open while doing this. Note that the new toolbar is listed with all the others (Figure 3-37). While that window is open you can also move the position of individual tools on the *Getting Started* and other menus by sliding the icons around with the cursor.

When you drag a tool from one toolbar into another, the tool disappears from the one it was dragged from. To return it, you'll have to drag it back; open the toolbars window to do that. It's possible to lose or inadvertently delete a tool. With the toolbar window still open, right-click on a toolbar to see its context menu and click Reset All to restore it to defaults (Figure 3-38). You can also restore an individual toolbar by clicking it in the Toolbars window and then clicking the *Reset* button. Reset all toolbars at once with the *Reset All* button. Your custom toolbar stocked with its tools will remain. Delete a custom toolbar by highlighting it and clicking the *Delete* button. Once you close SketchUp with the toolbars in their new docked positions and shapes, it will remember them each time it opens.

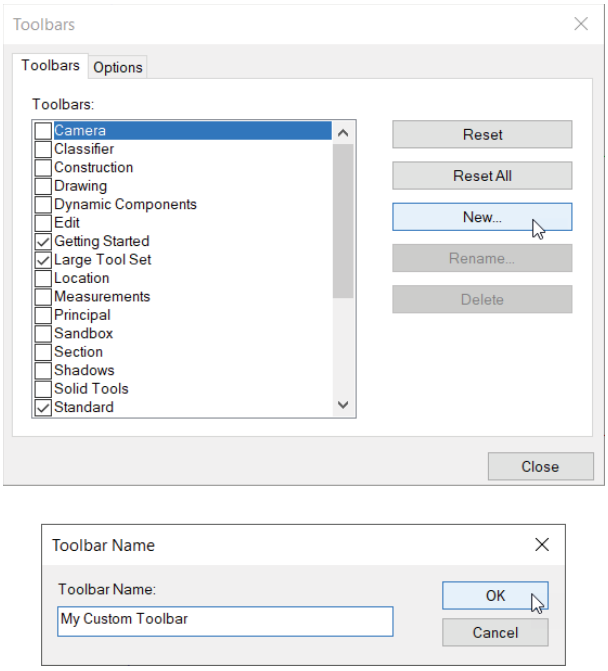


Figure 3-36: Make a custom toolbar at **View>Toolbars>New**.

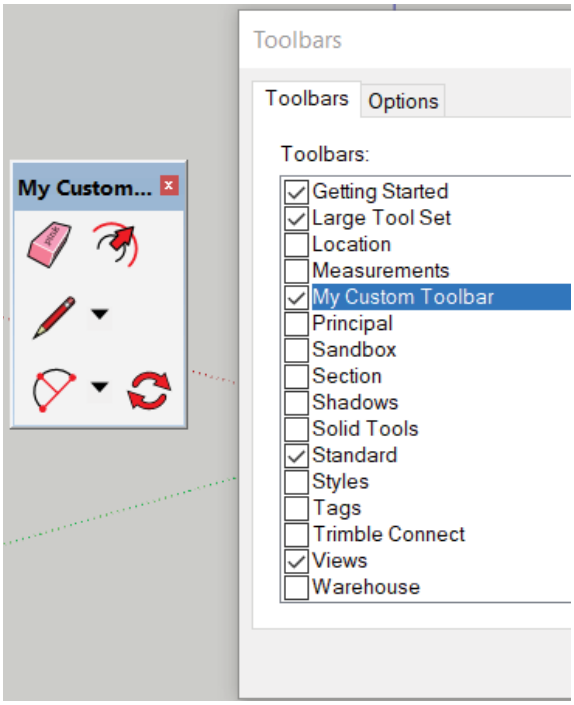


Figure 3-37: Drag tools from other toolbars into the newly created one.

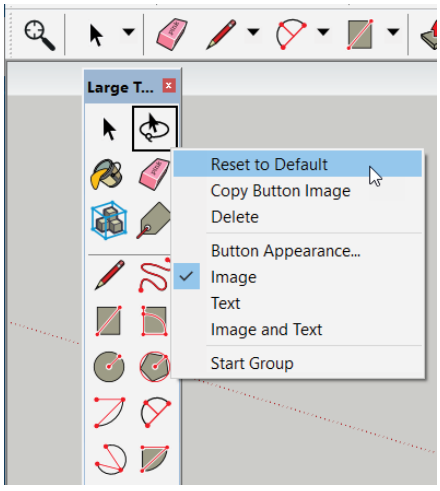


Figure 3-38: Right-click on a toolbar for a context menu.

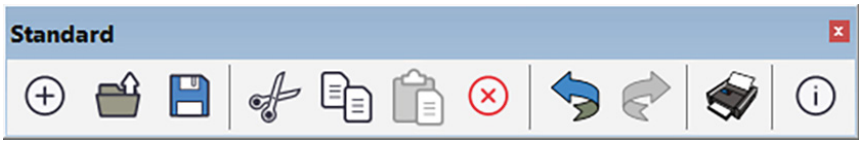


Figure 3-39: The *Standard* toolbar.

A useful toolbar to activate is the *Standard* toolbar, which contains operating system commands such as Save, Copy, Undo, and Redo (Figure 3-39). We'll be activating other toolbars as needed throughout the book.

Customize the *Getting Started* Toolbar on the Mac

Customization on the Mac consists of adding, deleting, and relocating tools to the *Getting Started* toolbar. Right-click on a blank space on the *Getting Started* menu and choose *Customize Toolbar* (Figure 3-40). The tools window we saw earlier appears; drag what you want from it into the *Getting Started* bar. Delete icons from *Getting Started* by dragging them back into the tools window. Drag tools left and right on the *Getting Started* bar to reposition them (the tools dialog box must be open while doing this) and click *Done* to set.

To restore *Getting Started* to its original state, drag all its tools into the tools window and then drag the default set toolbar at the bottom of the tools window up to the top of the screen. SketchUp will remember any other modeling window changes made, such as the screen size and the location of other toolbars.

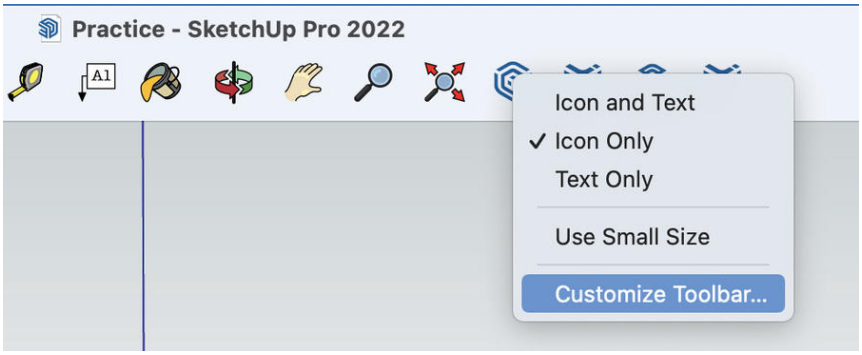


Figure 3.40: Click on *Customize Toolbar* to create one with your preferences.

Make a Custom Template

A template is a file of default settings. You may want to customize one after you start "sketchupping" in earnest. Click on **File>New** to open a new SketchUp file. Here are features to consider for a custom template:

- *Custom toolbars* and specific locations for them on the workplace.
- *Units, Dimensions, and Text.* Go to **Window>Model Info**. Adjust settings such as those shown in Figure 3-41.

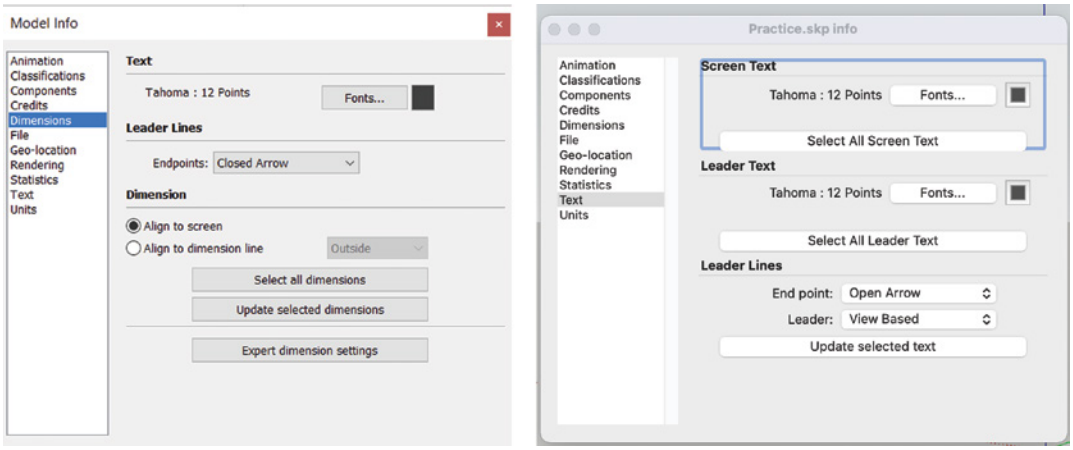


Figure 3-41: Dimensions (PC) and text settings (Mac).

- *Styles, Components, Materials.* Go to **Window>Style** and adjust whatever settings there you want, such as workplace color and model style (Figure 3-42). Click open the components and materials windows to add anything there. You might want to add a different scale figure component or delete the one that's there.

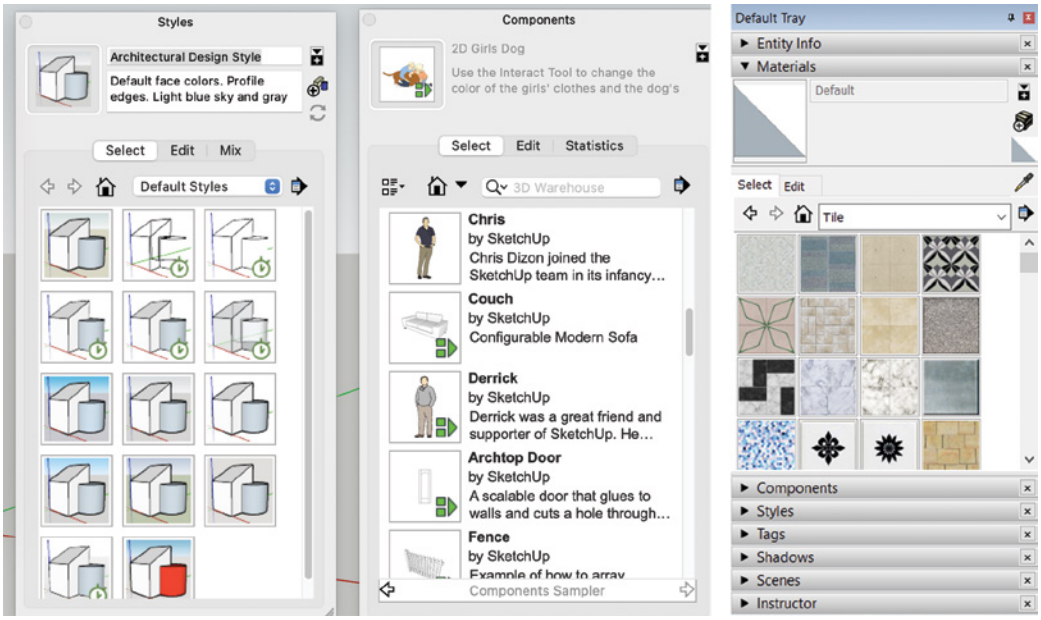


Figure 3-42: The Styles, Components, and Materials windows.

- *Perspective.* Go to the **Camera** menu and change the default to 2-point perspective or paraline.

When you've finished choosing all the settings, save and name the file at **File>Save As Template** (Figure 3-43). Then click on **File >New** from Template to see the custom thumbnail appear with the built-in ones (Figure 3-44). To delete the custom template, go to **Window>Preferences>Files** on the PC and **SketchUp>Preferences>Files** on the Mac. Click on the folder next to Templates. A browser window will open in which you can delete the template (Figure 3-45).

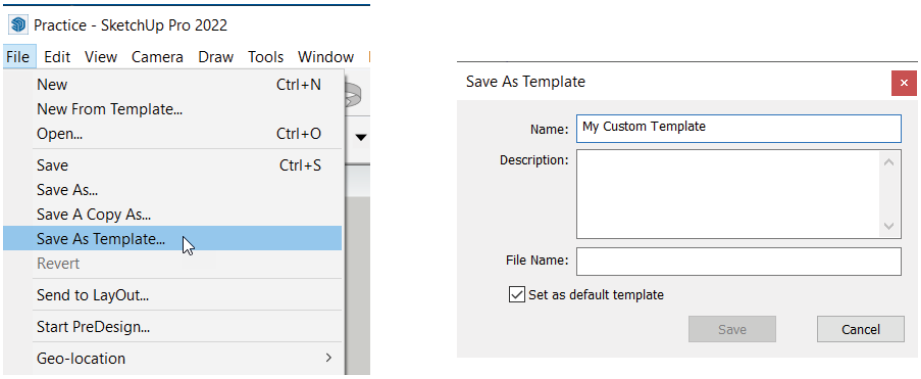
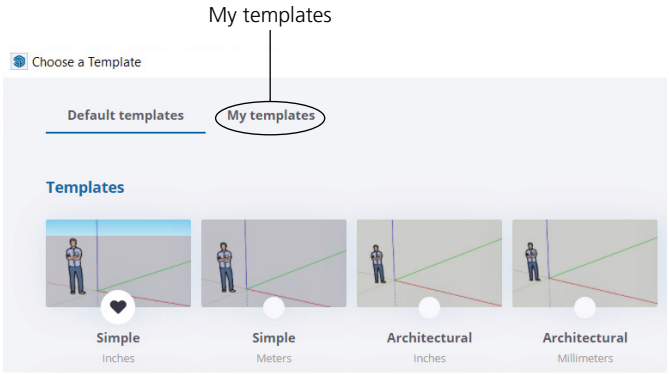


Figure 3-43: Save and name the custom template file.



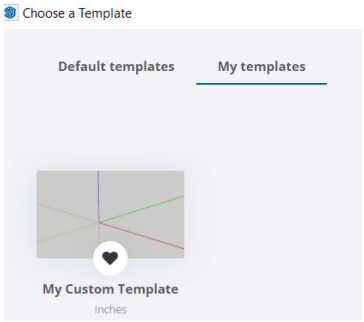


Figure 3-44: Find the custom template under *My Templates*.

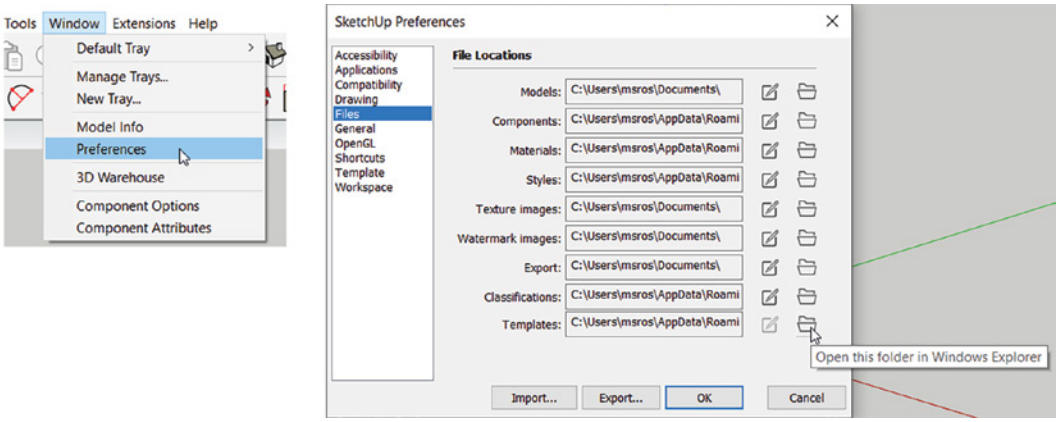


Figure 3-45: Delete a custom template at Preferences/Files.

The Help Function

Stuck? Click on **Help>Help Center** (Figure 3-46). This will take you to a page with tutorials, and if you scroll to the bottom, there's a link to the official SketchUp community forums at https://forums.sketchup.com/. The community forums at https://sketchucation.com/ are another nice resource. However, just typing your question into Google may be fastest, as it has probably been asked and answered already on one of the many places where SketchUp is discussed.

Now that you can maneuver around the workspace, it's time to model something. Join me in Chapter 4 and we'll make some furniture.

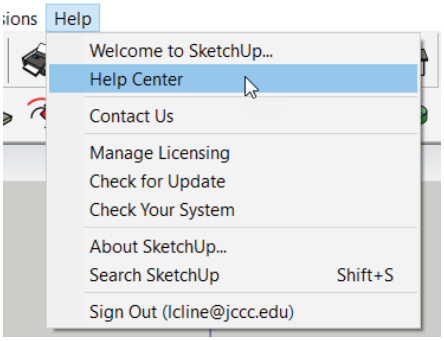


Figure 3-46: Accessing online help.

Summary

Personalize the workspace with modified toolbars and custom templates. *Impute numbers* and watch for inference prompts to model accurately. The *Select* tool highlights geometry, which enables editing. The *Pan*, *Zoom*, and *Orbit* tools maneuver around the modeling window; *Rectangle* makes faces; *Push/Pull* adds volume; *Move* relocates and copies; and **Esc** gets you out. Find tools quickly with the Search box. Generate 2D views with the *Views* toolbar and take questions directly to Google for the quickest answers.

Further Resources

SketchUp channel on YouTube: http://www.youtube.com/user/SketchUpVideo

SketchUp Blog: https://blog.sketchup.com/

Lydia's YouTube channel. Lots of SketchUp tutorials: https://www.youtube.com/user/ProfDrafting

Exercises

This exercise will get you comfortable with the SketchUp interface. Download the Eames Chair file from the Wiley site.

- Use *Orbit* to move around it and *Pan* to move it around the modeling window.
- Zoom in and out of it.
- Change its view in the **Camera** menu from perspective to paraline, and then activate the *Views* toolbar.
- Click on the *Views* toolbar's icons to see the chair's different orthographic views.
- Click on the *iso* icon to return it to a 3D view, then click **Camera>Perspective** to return to a perspective view.
- Click the *Select* tool on the chair and notice the blue bounding box that appears. That will be discussed in Chapter 4.
- Open a new SketchUp file. Customize the toolbars and then save it as a template file. Close it, and then find and re-open.

CHAPTER 4

Modeling Furniture

In Chapter 3 we maneuvered around the modeling workspace. Here we'll use SketchUp's built-in tools to create a table, a bookcase, and a clock.

Objective: This chapter uses SketchUp's native modeling and editing tools to create three furniture and accessory models.

Tools: rectangle, pencil, freehand, eraser, tape measure, scale, offset, arc, rotate, circle

Concepts and Functions: edge, face, normal, geometry, rubber banding, fill, stickiness, group, nested group, bounding box, component, component/local axis, definition, instance, redo, grips, guidelines, guide points, shadows, hide, editing box, *Materials* tray, flip along axis, line, setting axis colors, cursor cross hairs, entity info box, escape key, taper a leg, linear and radial array

Faces and Edges

Open the Cube file from Chapter 3. The cube, like all surface models, consists of *edges* (lines) and *faces* (planes). Collectively those edges and faces are called *geometry*.

Edges are lines. They're always straight and have no thickness. You can apply styles that make them appear thick, but that's just a display trick. The geometry itself isn't thicker. Faces are *coplanar* surfaces, meaning flat like a piece of paper. They're bounded by at least three edges and lack thickness. The front, called the *normal*, is white; the back is blue.

You can't have a face without edges, as the *Eraser* tool will now demonstrate.

The *Eraser* Tool and Erasing

The *Eraser* (Figure 4-1) deletes edges. Click it onto an edge to delete it. Continuously erase multiple edges by holding down the left mouse button and dragging. But the fastest way to erase multiple items at once is to select them and hit the **Delete** key.

Highlight a face with the *Select* tool, right-click and choose *Erase* from the context menu. Figure 4-2 shows an edge and face being erased. When right-clicking, ensure that a tool is active, not *Orbit*, *Pan*, or *Zoom*, because those have different context menus.

Figure 4-1: The *Eraser* tool.

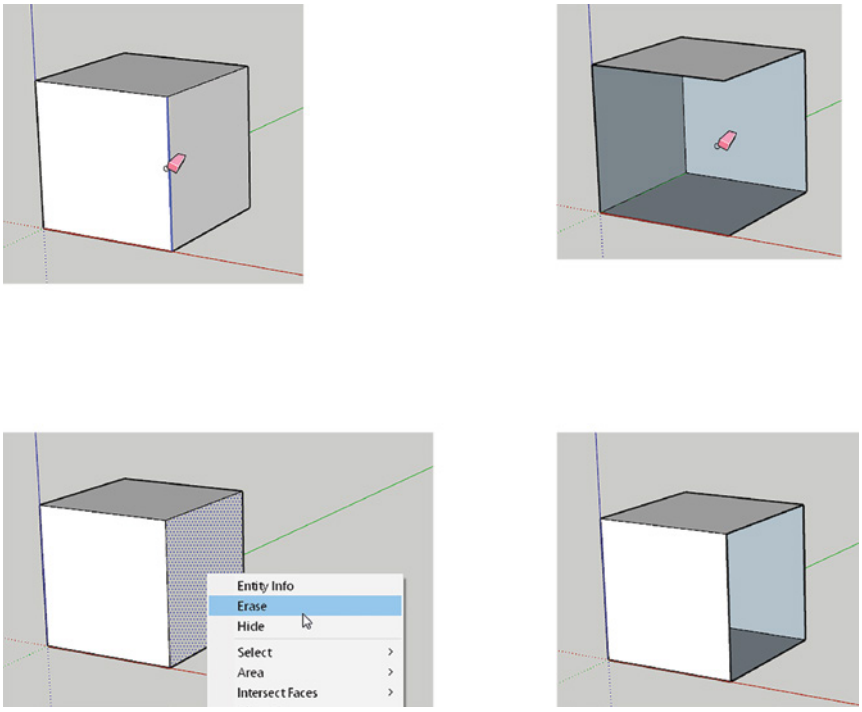


Figure 4-2: Erasing edges and faces.

At **Edit>Undo**, click to restore the cube. Note there's a *redo* option also in case you undo too much. You can also just drag a crossing window around the cube, hit **Delete**, and redraw it.

The *Pencil* and *Freehand* Tools

The *Pencil*, also called *Line*, draws straight lines (a model's edges). After clicking two endpoints, hit **ESC** to finish a line. *Freehand* (Figure 4-3) draws irregular lines in any direction and can draw on adjacent faces in all three planes (Figure 4-4). *Freehand* lines are multiple straight segments that behave as a single line.

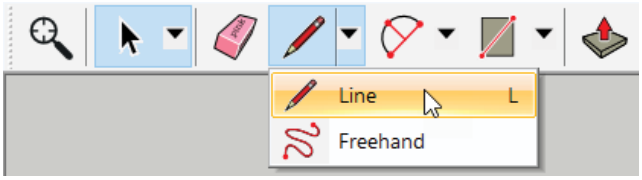


Figure 4-3: The *Pencil* and *Freehand* tools.

Activate the Pencil and draw a line on the top of the cube from midpoint-to-midpoint (Figure 4-5). Find those midpoints by hovering over them until the cyan midpoint inference appears. Click, draw to the opposite side, and click on the midpoint inference again. Always draw parallel to the global axes unless the item you're modeling is skewed to the axes for a design reason. When drawing parallel to an *axis*, holding the **Shift** key down locks the Pencil along that axis.

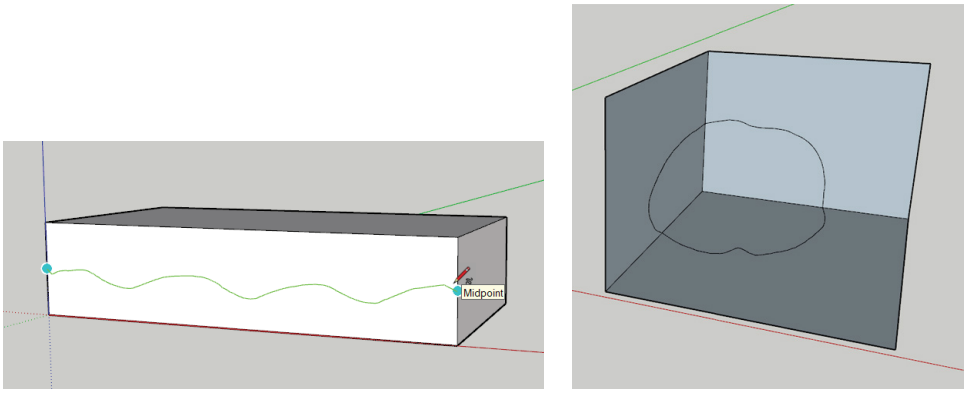


Figure 4-4: *Freehand* lines.

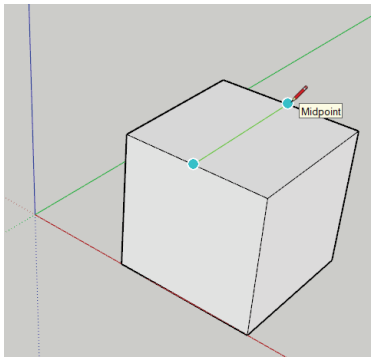


Figure 4-5: Hover over the midpoint until an inference appears.

The Pencil "rubber bands," meaning the endpoint of one line is the start point of another. Clicking the **Esc** key exits the Pencil, as it does all other tools. If rubber banding annoys you, go to **Preferences>Drawing** and unclick *Continue line drawing* (Figure 4-6) to turn it off.

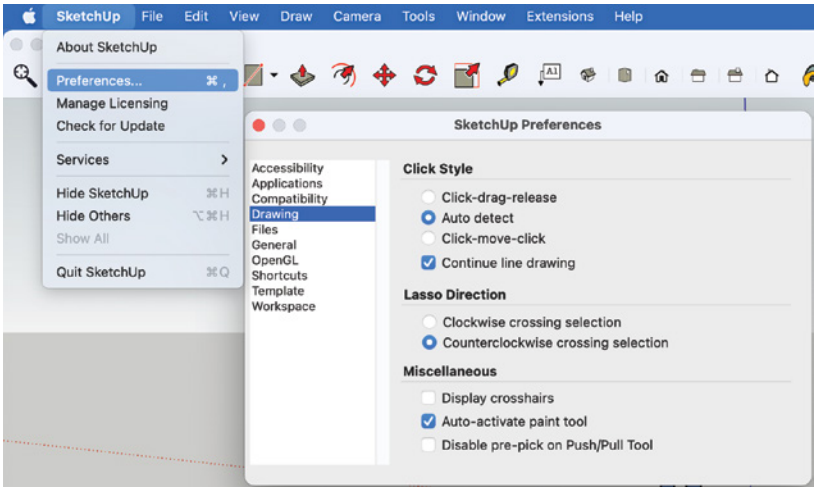


Figure 4-6: Adjust *Pencil* settings in *Preferences*.

Note that in Figure 4-5 the line between the two midpoints is green. That's the inference engine telling you the line is parallel to the green axis. Once you click on the second midpoint, the line turns black. While you are drawing, a line not parallel to any axis will appear black.

> Tip: Modifiers are keys that, when pressed and released, make tools do different things. When a tool is activated, you can see what modifiers are available in the status bar at the bottom of the screen. Confirm the current modified state of the tool by examining the cursor (there will typically be a plus or arrow sign near it) or the tool's on-screen modeling behavior. To exit a modified tool state either hit the modifier key again or change tools.

Make a Roof Ridge with the *Move* tool

Activate the *Move* tool (Figure 4-7) and click it anywhere on the line you just drew. *Move* is auto-selecting, meaning it highlights geometry just by touching it. Now move the mouse straight up. When a blue inference line appears, you're moving parallel to the blue axis. Hold the **Shift** key down while using *Move* to lock the movement along an axis. Click the line at a random height to make a roof ridge (Figure 4-8) on this little house.

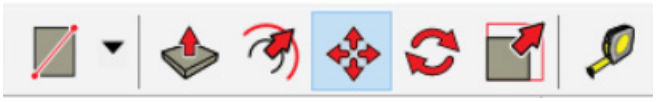


Figure 4-7: The *Move* tool.

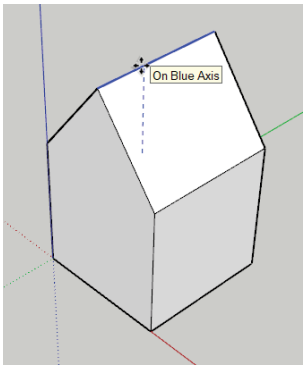
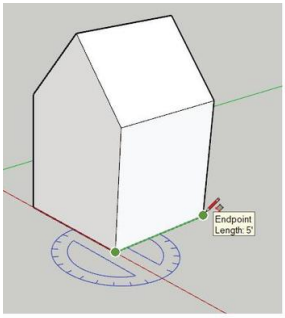


Figure 4-8: Drag the line up with the *Move* tool to create a roof ridge.

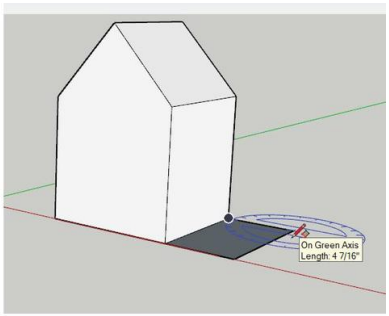
Stickiness

When you moved that roof line, it took the planes on both sides with it. That's called *stickiness*, the fusion of objects that touch. Stickiness lets you do great things like create a roof peak by moving a line up. It can also be frustrating if you don't know how to work with it, because it will deform objects you didn't mean to deform. As an example, activate the *Rotated Rectangle* tool. Click it on the front and back corners of the house as shown in Figure 4-9—note the green endpoint inferences and tooltips—and then move it any distance to the right to make a *rectangle*. Note that the rectangle is filled in. That means a face was created. Next, push/pull the rectangle up until the blue midpoint inference point appears. Click on that point. Then click on the *Select* key.

Sometimes the normals (front faces) orient inwards. Correct them to orient outwards so that SketchUp knows which is the inside and outside of the cube. That's important for tasks such as 3D printing, sending the model to another program for rendering and using the



1.



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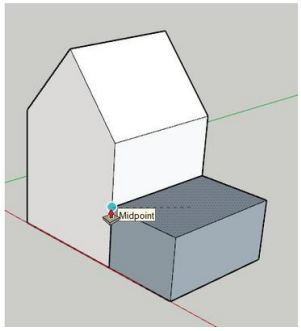


3.

Figure 4-9: Use the *Rotated Rectangle* to make a rectangle adjacent to the house and push/pull it up.

Solid tools and calculating volume on models made with the *Solid* tools. Select, right-click, and choose *Reverse Faces*.

Drag a selection window around both blocks (Figure 4-10) to highlight them. Now hold the **Shift** key down. A plus and minus sign appears, meaning you can add or subtract individual pieces from the selection (Figure 4-11). Double-click the *Select* tool onto all planes of the second box. This will deselect them and their edges, leaving just the house highlighted.

Now click *Move* onto the house and do just that, move it around. See what happens? The house sticks to the block, causing the block to deform (Figure 4-12). Not good! Click **Edit>Undo** to restore the block and house to as they were before moving the house.

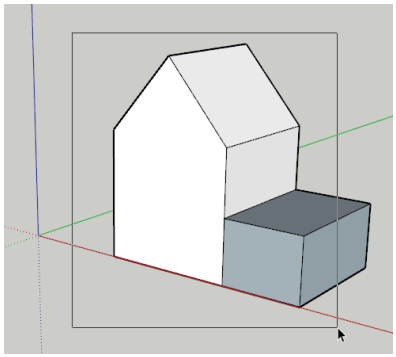


Figure 4-10: Drag a selection window around the blocks, press and hold **Shift**, and deselect the second box.

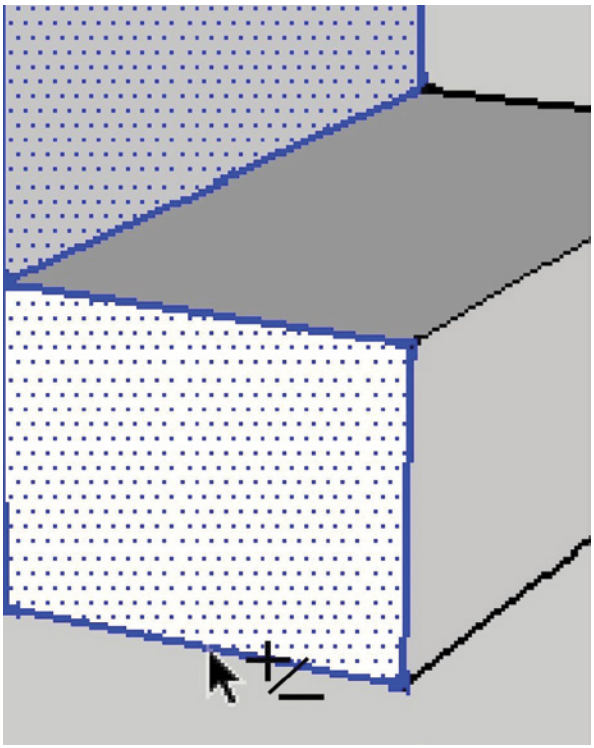


Figure 4-11: The plus and minus sign that lets you add or subtract individual pieces from the selection.

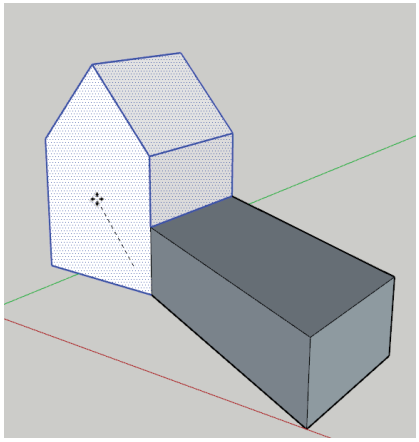


Figure 4-12: Moving the house causes the block fused to it to deform.

What Is a Group?

Here's how to manage SketchUp's stickiness. Make a *group*, which is a collection of loose geometry inside an invisible shell. Any geometry can go in a group: edges, faces, text, dimensions, cutting planes, as well as photos and textures. Groups can even contain other groups, which collectively are called a *nested group*.

A group is isolated from the rest of the model's geometry, hence it doesn't stick to anything. Along with solving the stickiness issue, groups let you manipulate—move, *rotate*, scale, paint, etc.— all the pieces inside them together. Copies of groups behave independent of each other.

Make a Group

Undo the model until just the house remains. Then draw a selection window around it, right-click on it, and choose *Make Group* (Figure 4-13). A blue *bounding box* appears.

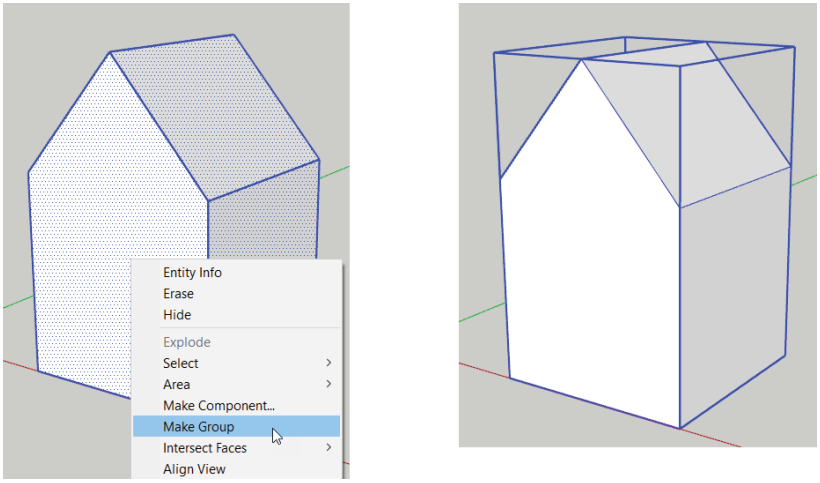


Figure 4-13: Select the house, right-click and choose *Make Group*. A blue bounding box appears around it.

This is the invisible shell that encloses the loose geometry and signifies that it is indeed now a group.

Redraw the block next to the house, from corner to corner like you did the first time. Then click *Move* onto the house again and move it around. It easily moves without taking the block along (Figure 4-14).

The bounding box should be the same size as the geometry inside it. If it's bigger, you inadvertently included something else. Right-click and choose *Explode* from the **Context** menu to return the group to its individual edges and faces. Then carefully select and group the house again.

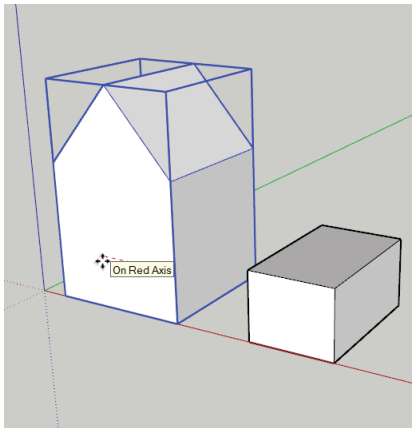


Figure 4-14: Groups don't stick to anything.

Edit a Group

Editing must be done inside a group's bounding box (also called the *editing box*). Double-click on the bounding box to access the loose geometry. Everything outside the bounding box will gray out. Draw a line on the house. Then click on the workspace to close the editing box. Move the house. You'll see that the line moves with it.

Before we continue, click open the bounding box again and then click on both sides of the line you just drew. The faces highlight separately (Figure 4-15). This is because lines break up faces. So, erase any unnecessary geometry as you work. Now erase this line, click the *Select* tool, and click on the workspace to close the bounding box.

If you draw a line on a group outside its bounding box, that line won't be part of the group and will get left behind when you move the group. It's easy to think you're adding lines to a group when you're really drawing outside the group, since loose geometry and groups can occupy the same space.

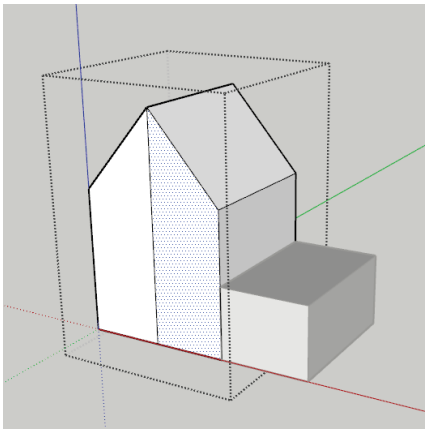


Figure 4-15: Edit a group inside its bounding box. Draw a line to see how it breaks up a face.

Causes of a Non-Filling Face

Before we start our project, let's discuss a common modeling problem: tracing a perimeter that won't fill. No fill means no face. If you're not sure if a face has formed, click the *Select* tool on it. A face will become covered with blue highlighting dots. No dots mean no face.

The following may cause a non-filling face:

The model is very large or very small. SketchUp doesn't deal well with either. Other problems may also arise with extreme sizes. If this describes your model, make it smaller or larger and see if that helps. You can always *scale* it back to size when you're finished. We'll discuss how to do that later in this chapter.

There are gaps between lines. See if there's an unconnected line by clicking **Window>Styles>Edit** and checking the *Profiles* box to turn profiles on. You may also need to increase the profiles number. This makes any line not connected to others on both sides appear thinner than lines that are connected to others on both sides.

There is overlapping geometry. Make the model transparent at **View>Face Style>Xray** and then zoom in closely to look for small, overlapping pieces.

The face is not coplanar. This is because:

1. The endpoints aren't aligned. They may be misaligned just enough to form a subdivided plane, one where a face forms if a diagonal line is drawn across it. See if SketchUp supplied a hidden diagonal line by clicking **View>Hidden Geometry**. Alternatively, click the *Text* tool on each point, hold the mouse down and drag. This creates a leader line and text field in which the point's coordinates appear (Figure 4-16). All points

must have the same last coordinate (the z/blue axis) to be coplanar.

Or

2. One line isn't parallel to the rest of the lines. Assuming you're modeling parallel to the global axes (the best way to model), set all lines so they match the color of their parallel axes (discussed shortly). Any line not parallel with the axes will be black.

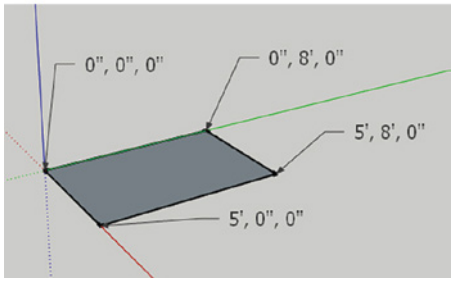


Figure 4-16: Click the *Text* tool on the plane's corners to reveal its coordinates. All corners must have the same last coordinate to be coplanar.

Best Practices for Modeling

Start your model on or near the origin. Some tools simply operate better there, plus SketchUp can get glitchy when the model is far from the origin.

Model in the upper-right quadrant. Number coordinates are positive there, making imputed numbers and calculations easier.

Align the front of your model (the longest side) with the red axis. This makes it work well with the *Views* toolbar.

Model all lines parallel to the axes. This facilitates accuracy, coplanar faces, and works best with the *Views* toolbar. Modeling parallel to the axes is so important that we're going to color-coordinate the lines of our first project with the axes to help develop your feel for when you're modeling along the axes and when you're not.

Color-coordinate Axes and Model Lines by Changing the *Edge Style* Setting

Styles are display settings that change the model's appearance. Line color, thickness, and endpoint size are examples of those settings.

Figure 4-17 shows how to change line color to coordinate with their parallel axes. Click on the *Styles* panel (PC) or **Window>Styles** (Mac) to open the *Styles* dialog box. Click the *Edit* tab to bring up the edit panel. Then click the first icon, *Edge Settings*. At the bottom of the panel is a *Color* field. Scroll to *By axis*. This will color-coordinate the edges with the axes they're parallel to and take effect immediately. Note that the roof's sloped lines remain black. This is because they're not parallel to any axis.

Another aid in modeling accurately is activating the cursor's crosshairs. You can color-match them to the axes, too, for instant visual feedback. Go to **Preferences>Drawing** and check *Display crosshairs* (Figure 4-18).

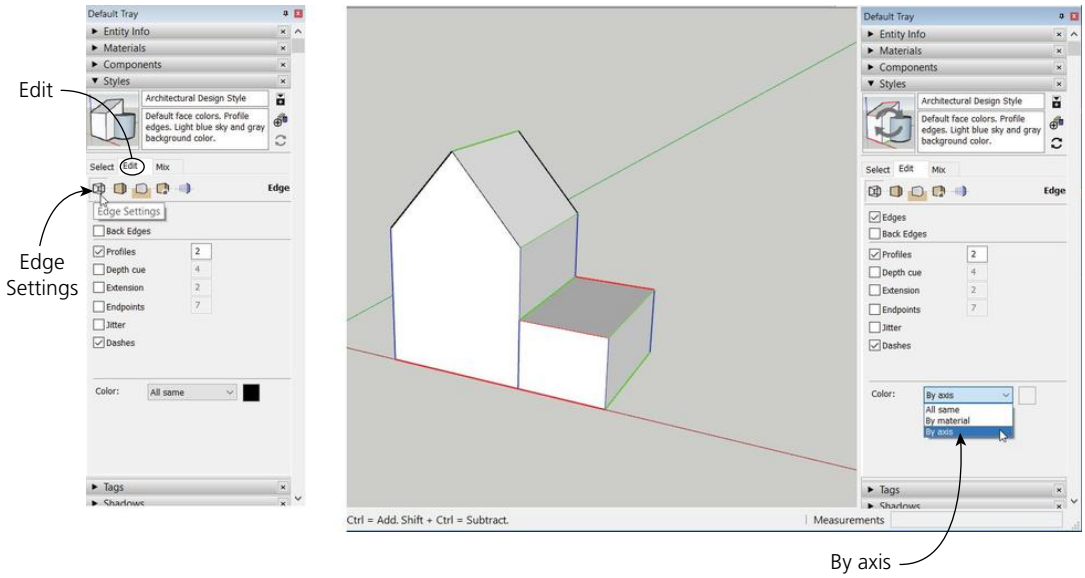


Figure 4-17: Click **Windows>Styles** to open the *Styles* dialog box; then the *Edit* tab; then the *Edge Settings* icon; then scroll to *By Axis* in the *Color* field to color-coordinate lines with the axes they're parallel to.

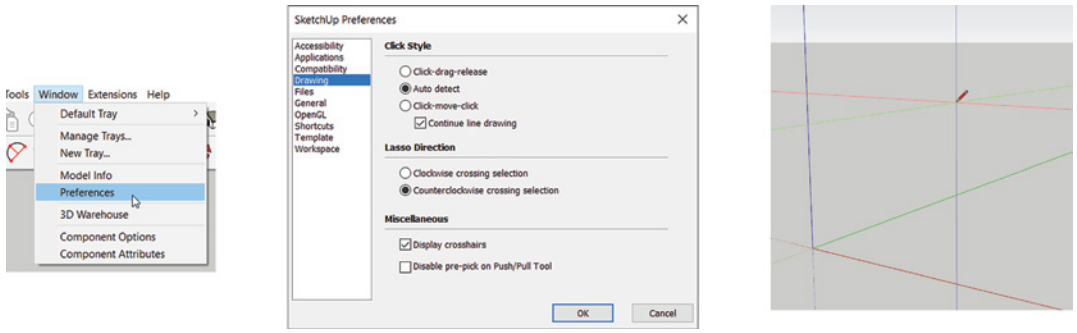


Figure 4-18: Color-coordinate the cursor's crosshairs with the axes.

Model a Table

So! It's time to implement these tools and techniques. Let's model the table in Figure 4-19. Go to **File>Save** and choose *Save As*. Type *Table* in the pop-up screen. This will save and close the Practice file and make a new file active called Table. It will have the same settings as Practice, including the color-by-axis setting. Drag a selection window around the house and block, right-click and choose *Erase* to delete them.

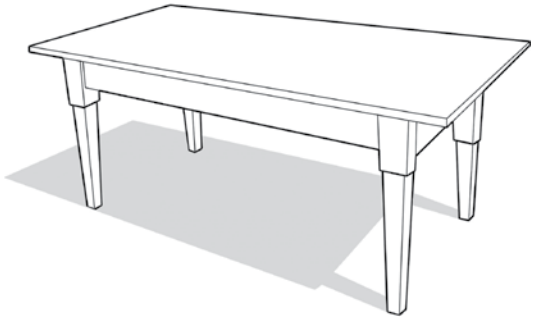


Figure 4-19: Table.

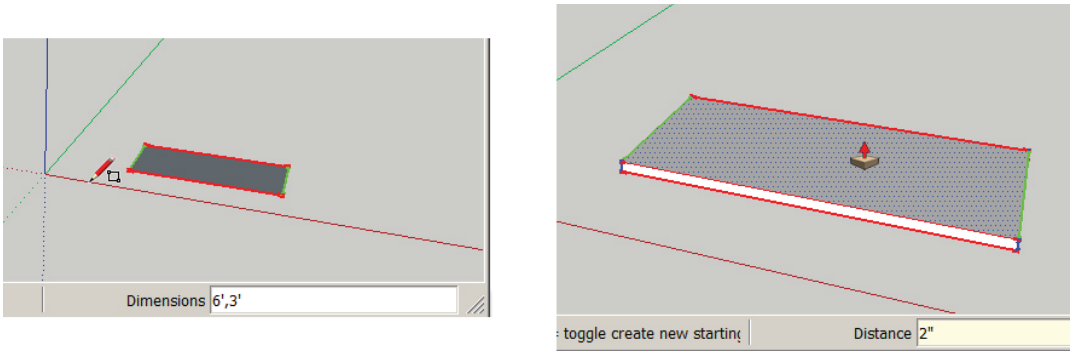


Figure 4-20: Make a rectangle 6′ × 3′ and push/pull it up 2″.

Model the Tabletop

Model the tabletop (Figure 4-20). Activate the *Rectangle* tool, click it on-screen, and type 6′,3′. The first number goes along the red axis, the second along the green. Add the foot symbol since the default is inches. Remember that you don't have to type inside the Measurements box. Next, push/pull the rectangle up a little bit and let go. Immediately type 2. The top will adjust to a 2″ thickness.

Make the tabletop a group. Drag a selection window around the tabletop, right-click and choose *Make Group* (Figure 4-21). Now we need some guidelines for leg placement.

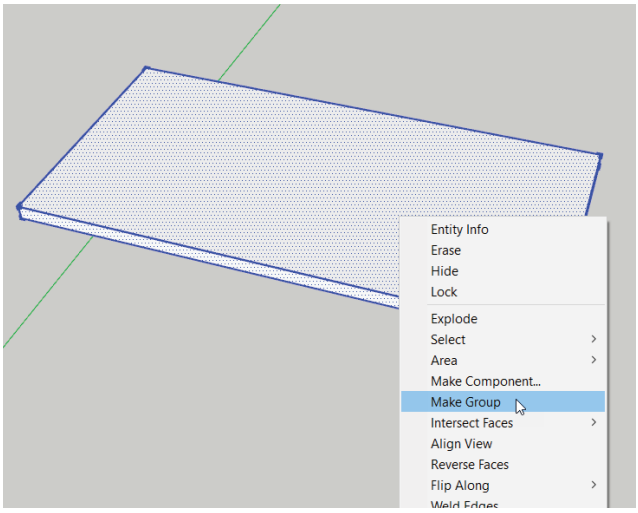


Figure 4-21: Select the tabletop, right-click and choose *Make Group*.

Guidelines and Guide Points

Guidelines are dashed, infinite-length construction lines. *Guide points* are marks at specific locations. Neither are part of the model; they're strictly for construction purposes. Both can be made anywhere on the screen, hidden, erased, moved, and rotated. Use the *Tape Measure* (Figure 4-22) to make them.

Figure 4-22: The *Tape Measure*.

The *Tape Measure*'s Two Modes

The *Tape Measure* (Figure 4-22) has two operating modes:

Mode 1: This measures lines and creates guidelines and guide points. By default, the *Tape Measure* is in guideline mode. The - - + signs next to its icon (Figure 4-23) tell you that it's in guideline mode. Measure a line by clicking the *Tape Measure* on the endpoints. Create guidelines by clicking the *Tape Measure* onto a line on the model and dragging it to the desired guideline location. Create guide points by clicking the *Tape Measure* on an endpoint or midpoint and then clicking on the desired guide point location. Click the *Tape Measure* onto opposite corners of a rectangle to create diagonal guidelines. Where the guidelines intersect is the center of that rectangle.

Figure 4-23: The - - + signs mean the *Tape Measure* is in measure and guideline mode.

Too many guidelines and points can interfere with inference engine accuracy, so erase when no longer needed. They can be erased individually or all at once at **Edit>Delete Guides**. If you think you might use them again, select them, right-click, and choose Hide.

Mode 2: This scales a model bigger or smaller. Click the *Tape Measure* on two endpoints, type the desired size, and hit **Enter**. The whole model will resize, not just the item you clicked on. To only size one part of the model, group it, open its editing box, and rescale inside the editing box. The *Tape Measure* can also scale a model based on one known dimension, which we'll do in Chapter 5.

Click the *Tape Measure* on two of the tabletop's endpoints. To confirm your dimensions, you should see 6′ or 3′ appear in the Measurements box. The measuring tape functions like an inference line, changing colors to match parallel axes. The Measurements box dynamically displays the length of the measuring tape as the mouse moves.

Place Guidelines for the Table Legs

Orbit under the table, click the *Tape Measure* on an edge, move the *Tape Measure* in the direction the guideline is needed, let go and immediately type 2. A guideline 2″ from the edge appears (Figure 4-24). Place guidelines on the other three edges. Note that you can type another number immediately after placing a guideline and the guideline will adjust to that number.

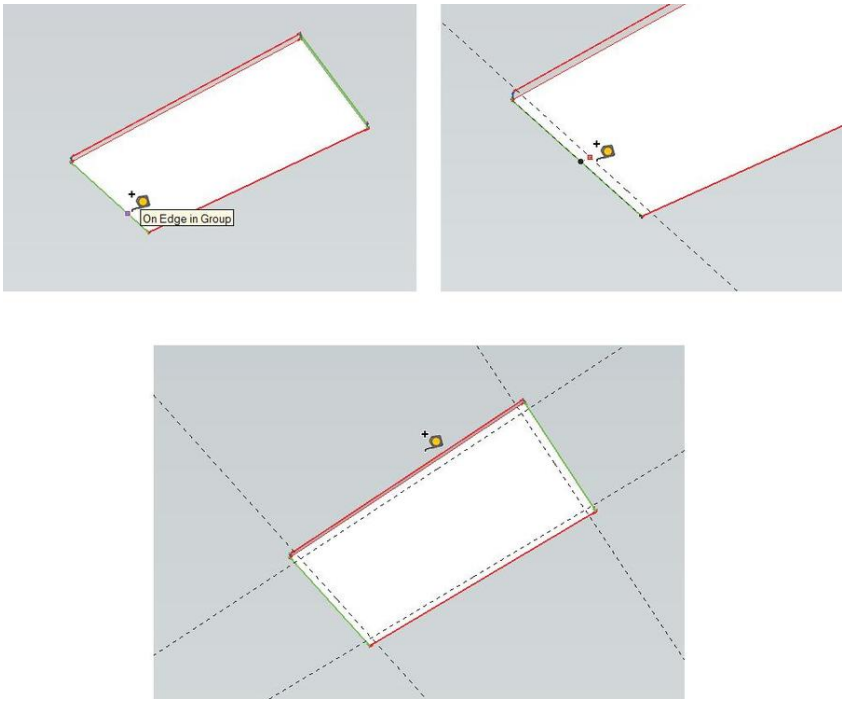


Figure 4-24: Click the *Tape Measure* onto a line, move it inward, let go, and type 2 to create a guideline 2″ from the edge.

Model the Table Leg

Let's draw one leg. Outside the tabletop's group shell, click the *Rectangle* tool on the intersection shown in Figure 4-25, and then click a second point. Immediately type *4,4*. The rectangle will adjust to a 4″ × 4″ square. Remember that you must type those dimensions immediately after clicking the second point or the dimensions won't take. To change the rectangle's size later, the *Scale* tool, discussed later in this chapter, is needed. You might notice some flashing in the square; that's just SketchUp telling you that two faces are adjacent. Once you push/pull the square, the flashing will disappear. But before going further, let's turn this square into a *component*.

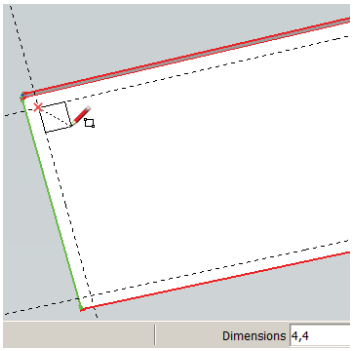


Figure 4-25: Draw a 4″ × 4″ square to serve as the top of the leg.

What Is a Component?

Like a group, a component is a collection of loose geometry that moves together and doesn't stick to anything. Unlike a group, a change to the *definition* (original) component applies to all *instances* (copies) of it, which makes components a powerful modeling tool. Components also take up less file space than groups. When multiple copies are needed, make those copies components.

Most components are 3D, but there are also 2D ones, such as the scale figure. 2D components take up less space than 3D ones, so are good for entourage items such as trees and people.

Edit a Component and Make It Unique

A component is created by right-clicking on selected geometry and choosing *Make Component*. As with groups, make changes inside its bounding box. And, as with groups, loose geometry and components can occupy the same space, so it's easy to think you're editing the component when you're really drawing outside its bounding box. If you want to change just one instance, select it, right-click and choose *Make Unique* from the context menu. You can also hold the **Shift** key down to select multiple components to make unique. Subsequent edits to the other instances won't affect the unique component(s). Change a unique component's name so you can distinguish it from the rest when viewing a list in the *Outliner* panel tray.

▶ Double-click on the scale figure to open its editing box. You can then apply different colors and materials to it.

Turn the Leg Square into a Component

Let's make the square a component, copy it once, and model it into a leg.

Select the square, right-click, and choose *Make Component* from the context menu. A dialog box appears (Figure 4-26). In the Name screen, over-type "Component 1" with "Table Leg."

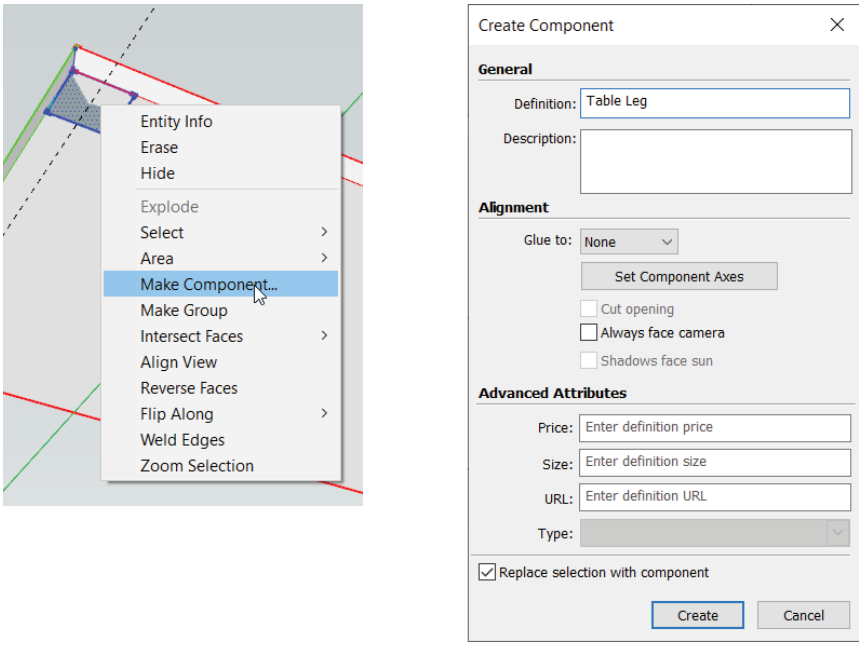


Figure 4-26: Select the square, right-click and choose *Make Component*.

Component Options

We'll keep the defaults for the other options, but here's what they mean:

- *Glue to.* This attaches components to faces. The alignment option determines which face the component "glues" or snaps to. If your component is a window, door, or piece of wall art, choose *vertical* to make it snap to walls. A vertical orientation will also make the component automatically rotate when moved to a perpendicular wall.
- *Set Component Axes.* This lets you give the local axes a different orientation than the global axes. Every component has its own axis, which sets orientation upon insert and is the "handle" when moved. By default, the component axes are aligned with the global axes, and the origin is in the corner of the bounding box closest to the global origin.
- *Always face camera.* This applies to 2D components. Have you noticed that no matter which way you orbit, the scale figure always faces you? Check this box or you'll see the component's unfinished backside when orbiting.
- *Replace selection with component.* Make sure this box is checked. If it isn't, what you've selected will not be made a component.

Copy the Leg Component

Select the component, activate the *Move* tool, and then press and release the **Ctrl** key (**Option** key on the Mac). **Ctrl** is a modifier that makes the *Move* tool copy. Grab a corner, slide the copy to the other side, and align to a guideline (Figure 4-27). Then repeat to the table's remaining corners.

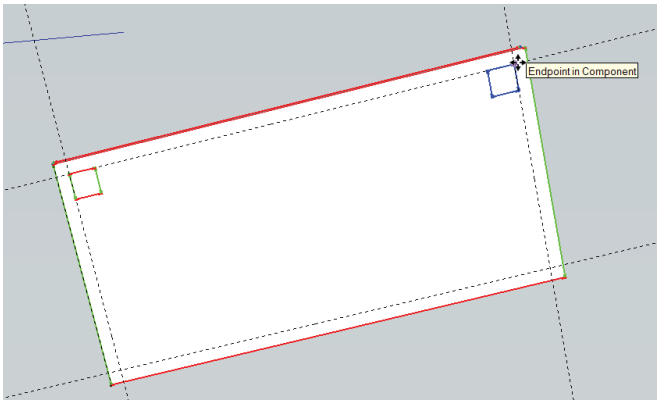


Figure 4-27: Use *Move* plus **Ctrl** key to copy the component square.

Add Volume to the Leg Component

Activate the *Select* tool and double-click the component to open its editing box. Click the *Push/Pull* tool onto the square, extrude it down a random distance, and type *6*. The leg will adjust to a 6″ length (Figure 4-28). Note this affects the copied components, too.

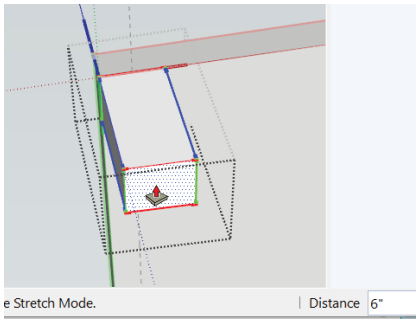


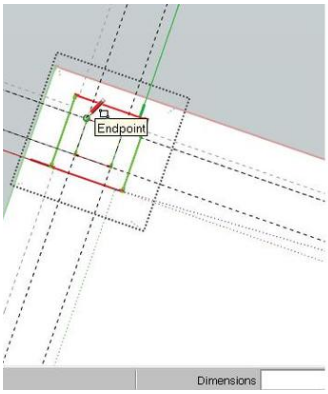
Figure 4-28: Open the component editing box and push/pull the square down 6″.

Add the Leg's Lower Part

Place guidelines 1″ from each of the block's edges and sketch a 2″ × 2″ square inside the larger square, using either the *Pencil* or *Rectangle*. Then push/pull that square down 26″ (Figure 4-29).

How to Edit the Leg's Length

If you want to add more length later, open the bounding box, select the bottom of the leg, and stretch it out a random length with push/pull. Then type a specific number and hit **Enter**. That number will get added to the existing length. To make the leg shorter, push/pull the leg closer to the tabletop, type a number, and hit **Enter**. That number will be subtracted from the existing length. When finished, right-click the *Select* tool anywhere on the screen to close the editing box.



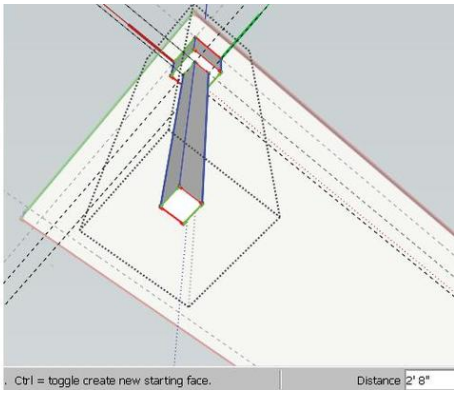


Figure 4-29: Sketch a square and push/pull it down 26″.

Taper the Leg with the *Scale* Tool

The *Scale* tool (Figure 4-30) can resize the whole model or just part of it. Figure 4-31 shows the process for tapering the rectangular leg.

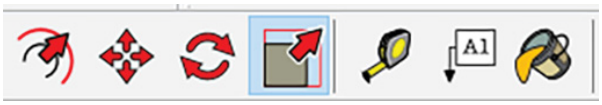


Figure 4-30: The *Scale* tool.

Select its bottom surface by clicking twice to active both the face and its four edges. Then activate *Scale*. The selected part automatically highlights with green cubes called *grips*. Hover the mouse over a grip to activate it. Corner grips scale around points and distort geometry. Grab an edge grip and hold the **Ctrl** key down, which will force scaling around the center of the selection. Then move the grip inward to taper the leg. Click the *Select* tool outside the editing box to close. Note how the leg edges are now black, as they're not parallel to any axis.

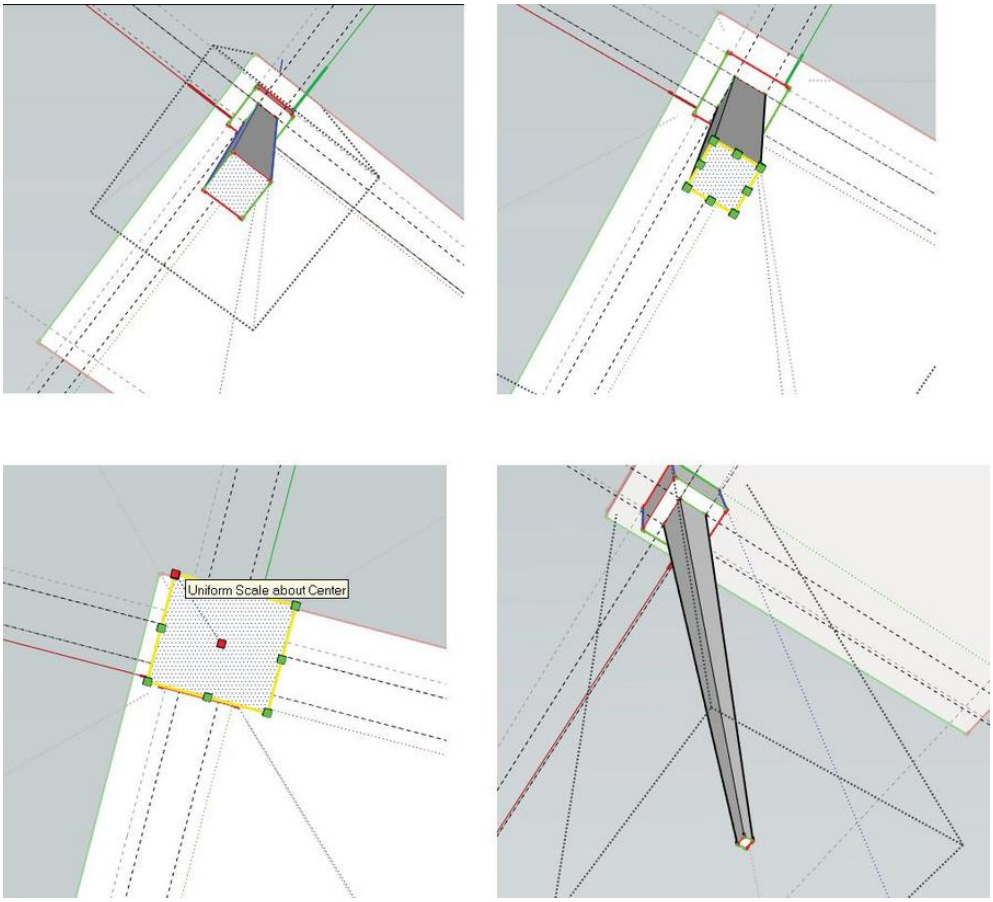


Figure 4-31: Tapering the leg with the *Scale* tool.

Adjust Size with the *Scale* Tool

You can scale an item by eyeballing its proportions or by typing numbers for precision. For example, to adjust the table leg to 24″ long, triple-click on it with the selection tool to highlight it all. Then activate *Scale*. The grips will appear on all sides. Grab one grip, drag it a random length in any direction, then immediately type *24,24,24*. The leg will adjust to that size. Type *0.5* to *scale* it down to half its size.

Scale can be clicked on the whole model or just one face. You can even click on one face and a line to scale those two items proportionately to each other. To change the tabletop's size, select it (include its thickness) and activate *Scale*. Grab a grip, randomly move it, and type two numbers separated by a comma. Remember that the first number scales along the red axis and the second number scales along the green.

Draw the Apron

Draw a 1″ × 4″ rectangle at the top of one of the table legs, and then push/pull that rectangle forward (Figure 4-32). Click on an *Edge* inference at the opposite end. Triple-click the apron to select and make it a group. Then copy it with *Move* and **Ctrl** and move the copy to the opposite side of the table. Make an apron for the short side of the table (Figure 4-33), and then group, copy, and move it in place.

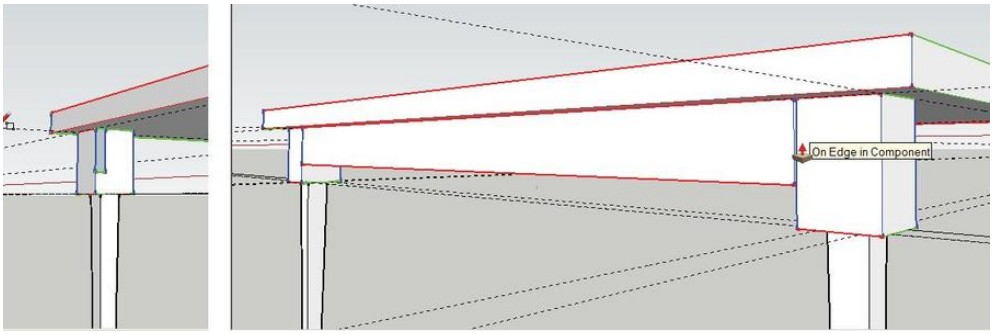


Figure 4-32: Draw a 1″ × 4″ rectangle and push/pull it to the opposite leg.

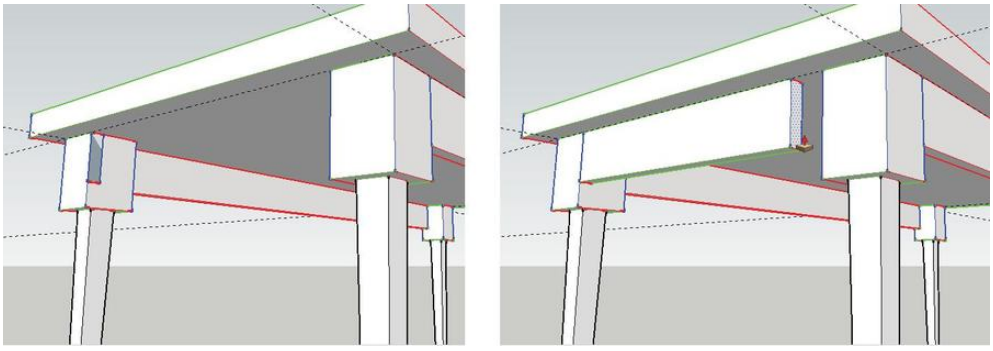


Figure 4-33: Make an apron for the short side of the table.

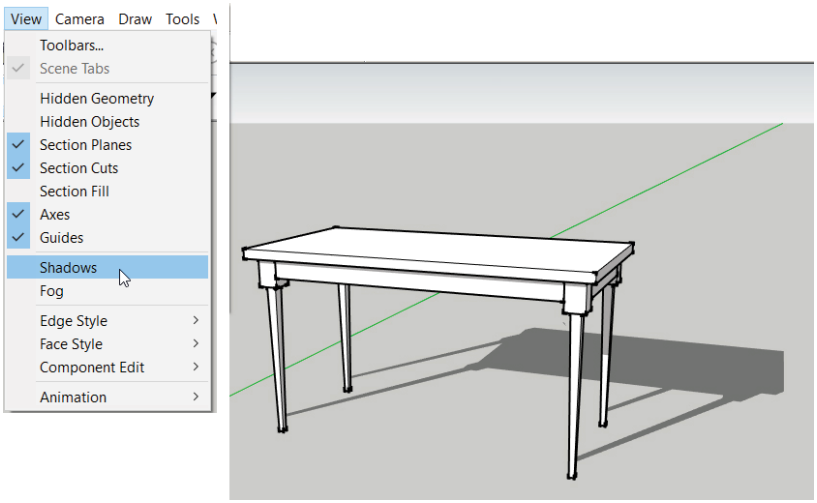


Figure 4-34: The finished table.

Add a Shadow

Delete all guidelines by erasing them individually with the *Eraser* tool. If the guidelines were created inside a group or component, they must be erased within the bounding box. Alternatively, erase them all at once via **Edit>Delete Guides**, which will remove ones inside groups and components. Return all edges to black by going to **Window>Styles>Edit**, click on the *Edge Settings* icon, and scroll to *all same* in the Color box. As a final touch, click **View>Shadows** to apply a shadow (Figure 4-34). Voila! The finished table.

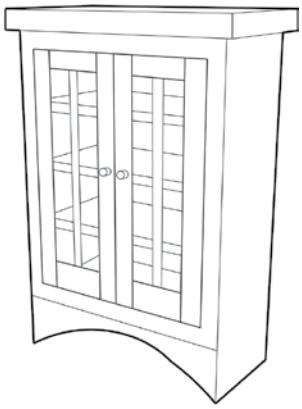


Figure 4-35: Bookcase.

Model a Bookcase

Let's model the bookcase in Figure 4-35. Open a new file, choose the Architectural Inches template and delete the scale figure.

Make a Shell with the *Offset* Tool

Draw a rectangle 48″ × 24″ on or near the origin, and push/pull it 72″ high (Figure 4-36).

To turn the block into a shell click on *Offset* (Figure 4-37). It creates copies of faces and edges at a specified distance from the originals. It also works on two or more connected,

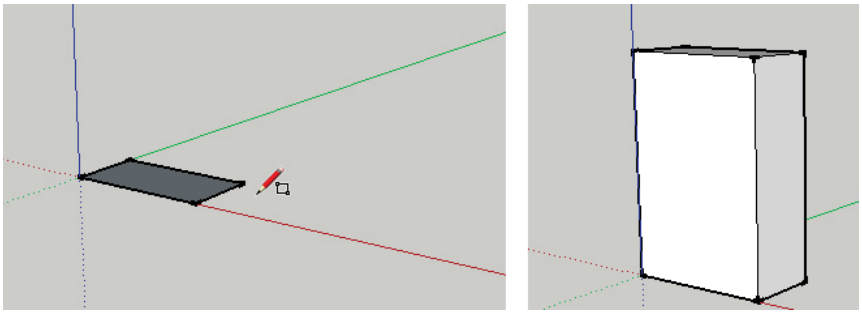


Figure 4-36: Model a 48″ × 24″ × 72″ block.

Figure 4-37: The *Offset* tool.

coplanar lines. *Offset* is auto-selecting, so hover it over a face to select. Grab one of the face's edges, move it in or out, type a specific distance to offset, or just click somewhere. Offsetting a face creates a new face. Click *Offset* onto one of the block's edges. Drag it toward the center of the block and release. Immediately type *4*; the edge will adjust to a 4″ offset.

Next, click *Move* onto the bottom edge. The edge will self-select; move it straight up along the blue axis, release, and type 12. Push/pull the face inward, release, and type 22. (Figure 4-38).

Group the Shell

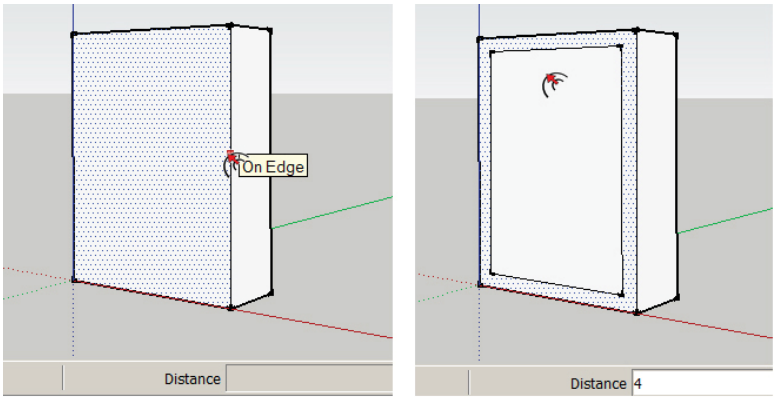
Select the entire shell with a selection window or by clicking three times anywhere on it (Figure 4-39). Remember, a triple-click selects all connected faces and edges. Right-click and choose *Make Group*. Now we can place shelves inside the shell that won't stick to it.

Make and Array a Shelf Component

Click the *Rectangle* onto the lower-left and upper-right corners of the shell's bottom. Double-click to select the rectangle face and edges, then right-click and choose *Make Component* (Figure 4-40). Now we'll array (make multiple copies of) that shelf.

What Is Array?

Array is a function that copies and arranges. There are *linear and radial arrays*. A linear array is equally spaced copies along a straight line. You can array between two endpoints (think shelves on a bookcase) or array copies with a specific distance between them (think of a row of trees in a park).



1. 2. 3. 4.

Figure 4-38: Making a bookcase shell.

To array equally spaced copies between two endpoints, make the original, select it, copy it with *Move* plus **Ctrl**, and place the copy the desired distance from the original. The original and that copy define the endpoints. Next, type **/** and the number of total copies wanted; for example, */5*. This creates four copies equally spaced between the original and first copy, so five copies total. You must type */5* immediately after placing the first copy for this to work; don't perform any other action between making the first copy and typing */5*.

To array copies with a specified distance between them, make the original, select it, make one

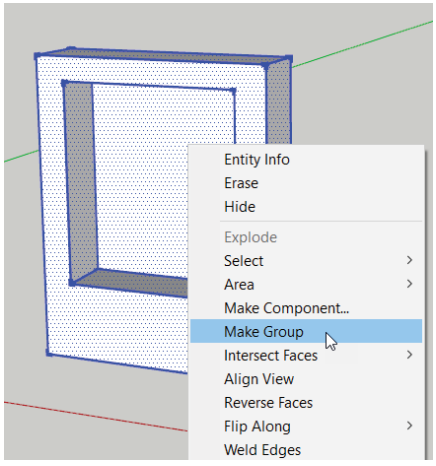


Figure 4-39: Group the shell.

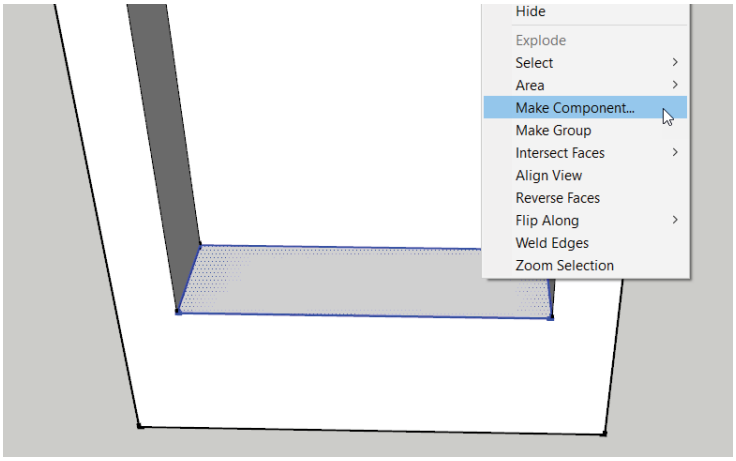


Figure 4-40: Draw a shelf, select, and turn it into a component.

copy with *Move* plus **Ctrl**, and then place the copy the distance you want from the original. Type *x* followed by the number of copies wanted; for example, *x5*. This creates four more copies (so five copies total), each separated by the same distance as that which is between the original and the first copy.

Linear Array the Shelf Component

Copy the shelf and move the copy to the top of the bookcase shell. Type */4*. This creates three shelves between the shelf and the first copy. Remember not to do anything between placing the first copy and typing */4*. If you inadvertently do an intermediate function, go to **Edit>Undo**, recopy the shelf, and type */4* again (Figure 4-41).

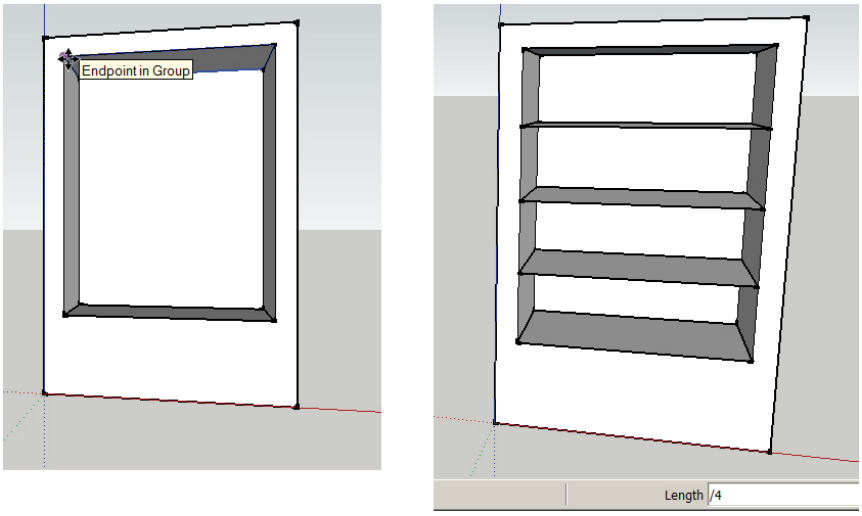


Figure 4-41: Copy/move the shelf to the top and type */4* to create three intermediate shelves.

Erase both the original shelf and the first copy because we only needed them to define the end-points (the array distance). Select them, right-click, and choose *Erase*.

Change the Shelves' Height and Depth

Click on one shelf to open its bounding box. Push/pull it 2″ up and 2″ back (Figure 4-42). Activate the *Select* tool and click it anywhere on the screen to close the bounding box.

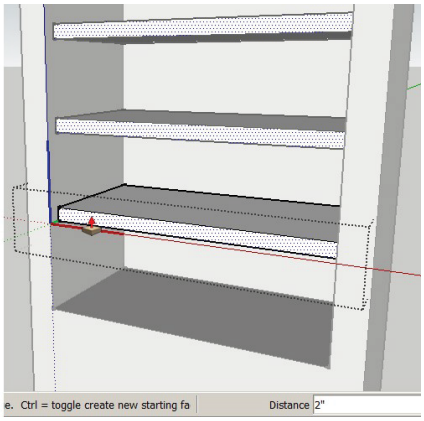


Figure 4-42: Edit one component shelf's height and depth.

Add a Curved Apron with the *2-Point Arc* Tool

Double-click on the bookcase to open the group bounding box. We want to draw a line 12″ above the bottom. Make a guide point by clicking the *Tape Measure* onto the bottom-right corner, moving it up, and typing *12*. The guide point will appear 12″ from the bottom. Starting at the guide point, draw a line with the Pencil across the bookcase, parallel to the red axis. Make sure the *On Face* inference appears, confirming that you are indeed drawing on the bookcase's face (Figure 4-43). Pay attention to inference pop-ups because they tell you if you're placing your geometry where you think you are. If you don't see *On Face,* you may be tilting the arc instead of pulling it straight up.

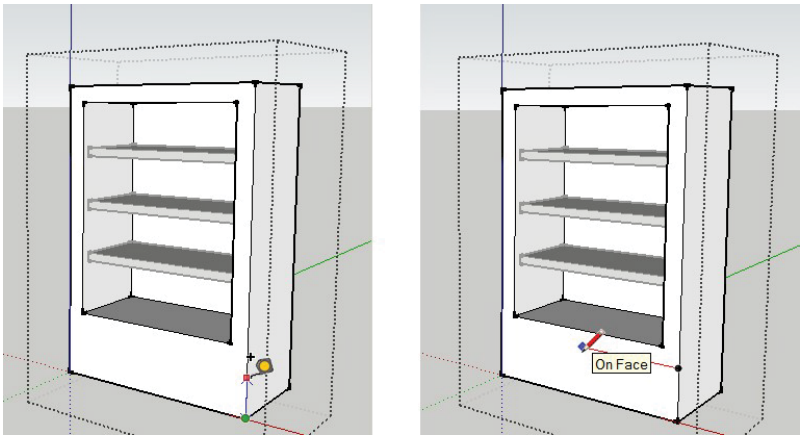


Figure 4-43: Draw a line at the bottom of the bookcase.

The *2-Pont Arc* (Figure 4-44) makes circular arcs. Which, in SketchUp, are 12 straight, connected lines edited as a single arc; you'll see the number 12 in the Measurements box right after activating the tool. If you want more than 12 segments to make the arc look smoother, type that number immediately after activating *Arc*, and hit **Enter**.

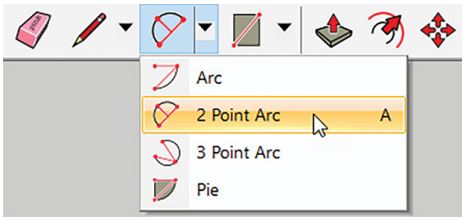


Figure 4-44: The *Arc* tool.

Click *Arc* onto the bookcase's endpoints, lift the bulge, and click it onto the line (Figure 4-45). For more precision, type numbers for the distance between the arc's endpoints and the height of the bulge.

All the native SketchUp arcs are based on a 360° *circle*. While an arc's shape can be somewhat manipulated by clicking the *Scale* tool on it and pulling the grips, if you want Bezier curves, you'll need to download an extension for making them. Extensions are discussed in Chapter 9. But you can modify an arc's radius, length, and number of segments in its *entity info box*.

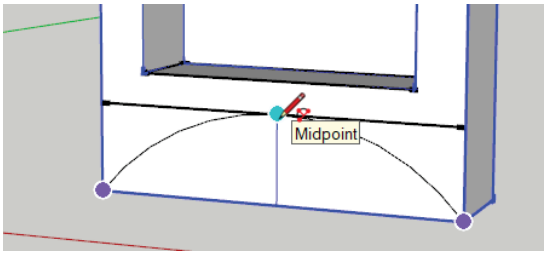


Figure 4-45: Draw an arc.

What Is the Entity Info Box?

Entity Info is a dialog box that shows a piece of geometry's attributes—its properties and characteristics. Select the geometry and open the *Entity Info* panel (Figure 4-46). Different options appear based on what is selected. The *Entity Info* boxes for circles, polygons, arcs, and lines have text fields to change size, length, and add line segments (Figure 4-46).

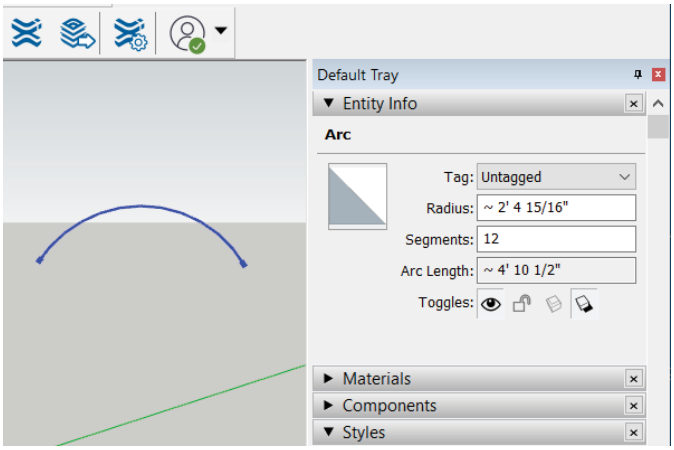


Figure 4-46: Change geometry via the *Entity Info* box.

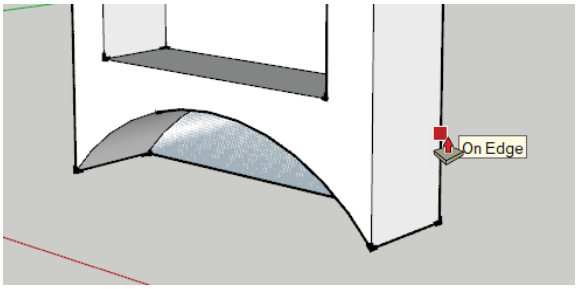


Figure 4-47: Push/pull and click on the bookcase's back edge.

Push/pull the arc through the bookcase shell and click on the shell's back edge. That prevents the push/pulled volume from going past that back edge (Figure 4-47).

Make a Component Door

We'll place these outside the group, so don't open the bounding box. Draw a rectangle on the group's shell, using corner and midpoint inferences. Make the rectangle a component called Door. Then double-click to open the bounding box, and push/pull it 1″ thick (Figure 4-48).

Add 4″ wide rails and stiles to the component door (Figure 4-49). Click the *Tape Measure* on the top and bottom door edges and then click it 4″ away to make guide points. Draw vertical lines from those guide

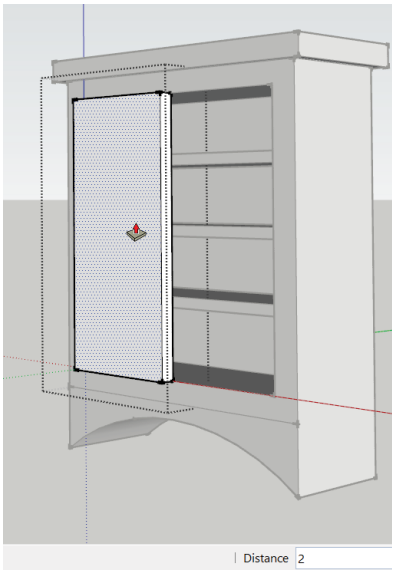


Figure 4-48: Make a component door.

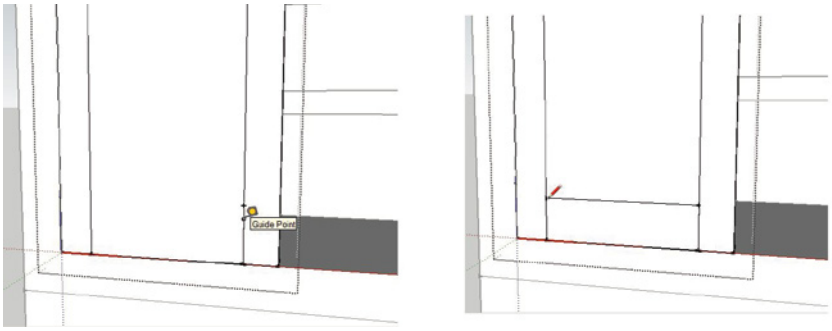


Figure 4-49: Draw the rails and stiles.

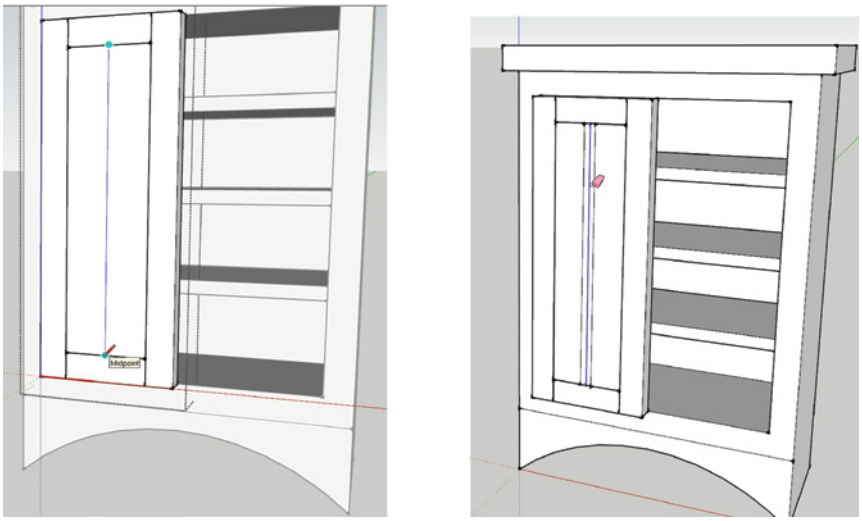
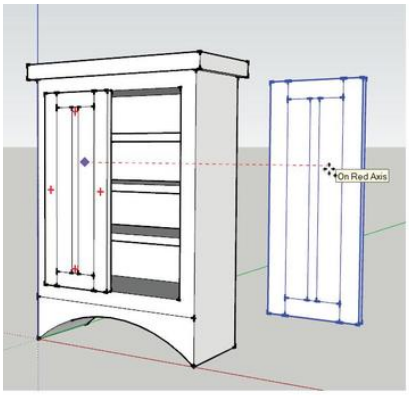


Figure 4-50: Draw the center stile.

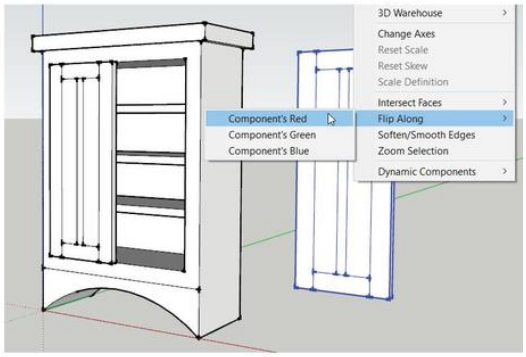
points down to make stiles. Do the same thing at the top and bottom to make rails. For the center stile, draw a line down the middle of the door, copy it 1″ on both sides by selecting it, click *Move* on it, press/release the **Ctrl** key, drag the center line left, let go, type *1″* and hit **Enter**. Repeat on the right and then erase the middle line (Figure 4-50).

Make a Second Component Door and Mirror It

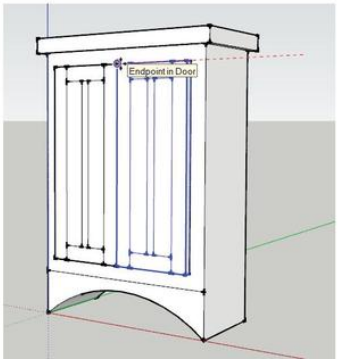
Highlight the door component, copy, and slide it off to the side along the red axis. Select it, right-click, and choose *Flip Along Component's Red*. Now that it's a mirror of the first door, editing applied to one will appear in reverse on the other. Grab it by a corner and move it into place (Figure 4-51).



1.



2.



3.

Figure 4-51: Copy the component door and flip it along the red axis.

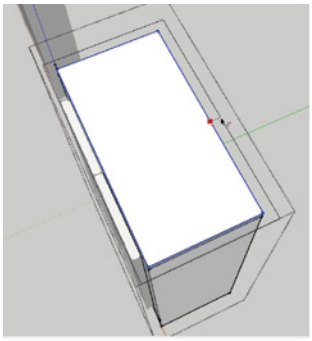
Model a Crown Molding

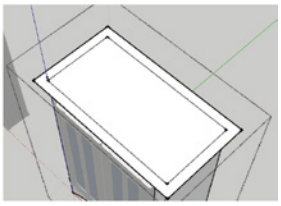
Orbit to the top of the bookcase, open its bounding box, and select the bookcase's edges (click *Select* on each edge while holding down the **Shift** key). Selecting the edges instead of the face means the bookcase's height won't be affected. Offset the edges 2″ and then push/pull it up 2″. (Figure 4-52). This creates a crown molding trim.

If you want to change the top to a solid slab later, just draw a line between two corners. This creates a new face. Then erase the remaining lines (Figure 4-53).

Put Glass in the Doors

The doors would look nice with some glass in them. For that we need the *Materials tray* (on the Mac, **Windows>Materials**). Click it open to see folders of color and texture swatches and





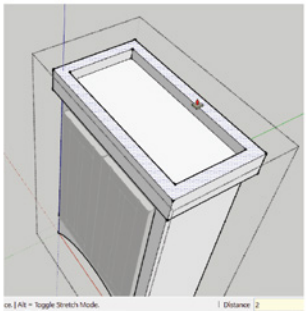


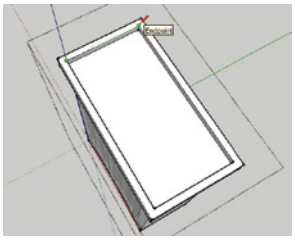
Figure 4-52: Offset and push/pull the edges.

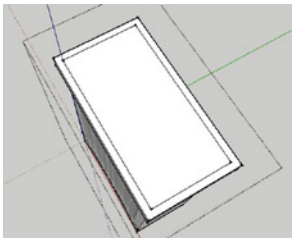
scroll to *Glass and Mirrors* (Figure 4-54). We'll discuss painting more in Chapter 7, but here's a taste of it.

Open one component door's bounding box. Click on *translucent glass blue*. The paint bucket cursor appears; click it onto the doors. Both will turn blue (Figure 4-55).

A Translucent Workaround with the *Rotate Tool* and *Hide*

So, the glass is blue, but not translucent. Why? Because SketchUp is designed for single-face modeling. When we made the component door, we push/pulled it 1″ thick. That made it double-faced. Double-faces present problems that require workarounds. A workaround for making the glass in this door appear translucent is to either *hide* the back face or paint it translucent blue. To access that back face, rotate the doors open.





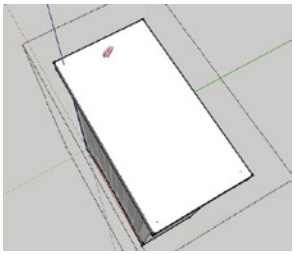


Figure 4-53: You can turn the crown molding into a solid slab by drawing a line between two corners.

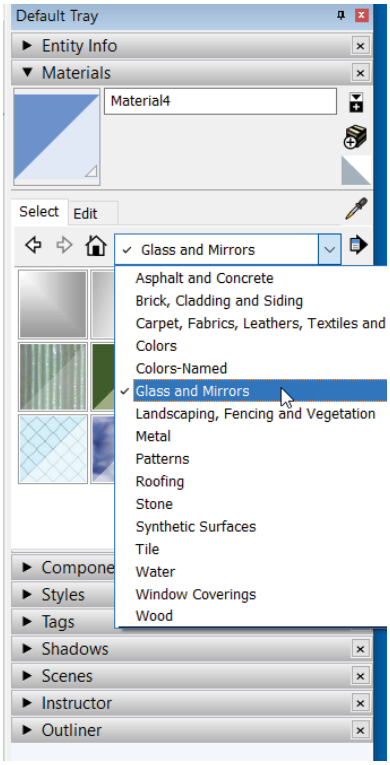


Figure 4-54: The *Glass and Mirrors* folder in the *Materials tray*.

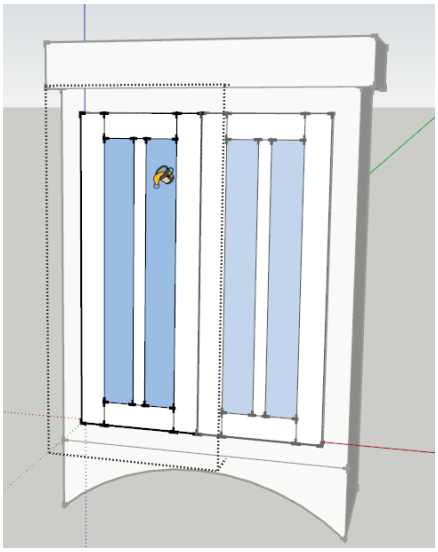


Figure 4-55: Paint the doors translucent blue.

Figure 4-56: The *Rotate* tool.

The *Rotate* tool (Figure 4-56) spins geometry around an axis. It aligns itself with whatever plane it's parallel to. For instance, if the cursor is above the model, *Rotate* aligns with the blue axis; if the cursor is in front of the model, Rotate aligns with the green axis; if the cursor is on the side of the model, Rotate aligns with the red axis (Figure 4-57). The cursor itself color-coordinates with the axis it is spinning an object around. A black rotator means the object isn't aligned with any axis. Press and release the arrow keys on the keyboard to lock *Rotate* into different axes. Press and release to unlock. Hold the **Shift** key down to lock an axis in place. All orientations are most likely to appear if you model near the origin. You can also click on the *Rotate* tool and drag it to change its orientation.

Open one door's editing box and select the whole door by triple-clicking. Move *Rotate* on top of the bookcase. Once the blue appears, hold the **Shift** key down to lock it in place, and click the rotator onto the door's top hinge. Then click it at the opposite endpoint. Swing the door open with the mouse. Both doors will open (Figure 4-58). Note that you must select the entire door. If the door warps when rotated (Figure 4-59), you didn't select it all.

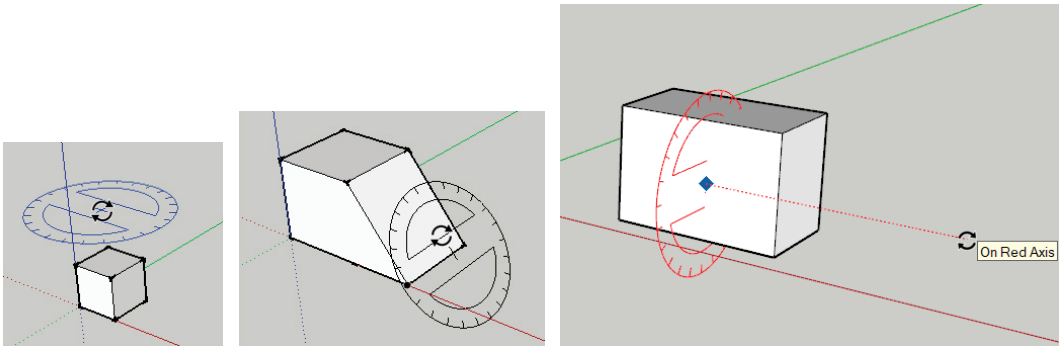


Figure 4-57: The *Rotate* tool aligns itself with the plane it's parallel to. You can also click and drag it.

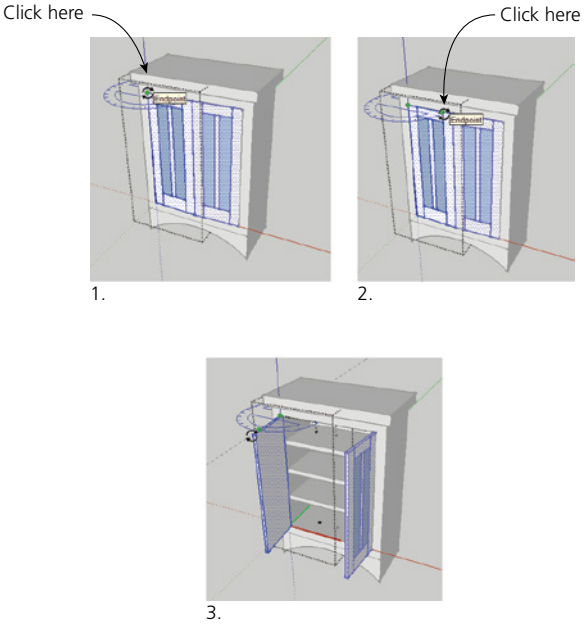


Figure 4-58: Rotating the doors open.

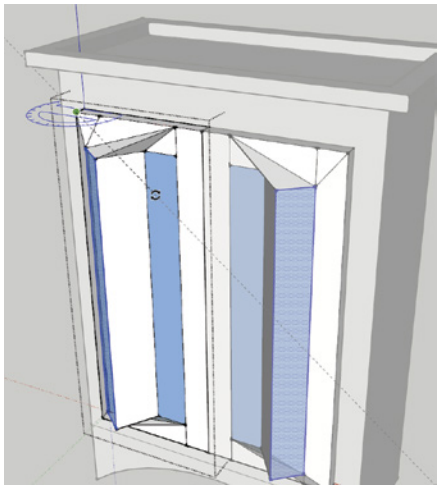


Figure 4-59: The door will warp when rotated if not fully selected.

Select the back face of the door and click on **Edit>Hide**. It disappears, making the front face's translucency settings apparent (Figure 4-60).

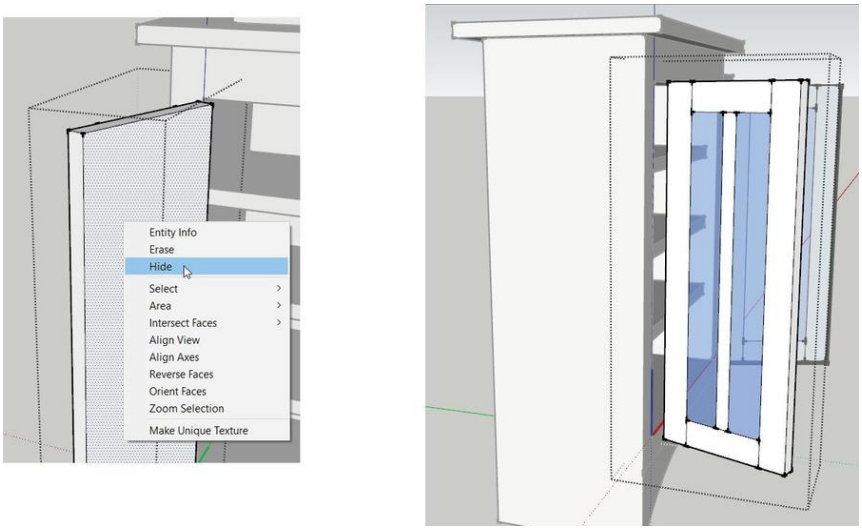


Figure 4-60: Hide the double-faced door's back face to show translucency.

You can unhide the face anytime at **Edit>Unhide** (Figure 4-61). Note that one of the *Unhide* options is *Selected*. To view and select hidden items, click on **View>Hidden Geometry**. *Hidden geometry* appears with a light grid (Figure 4-62).

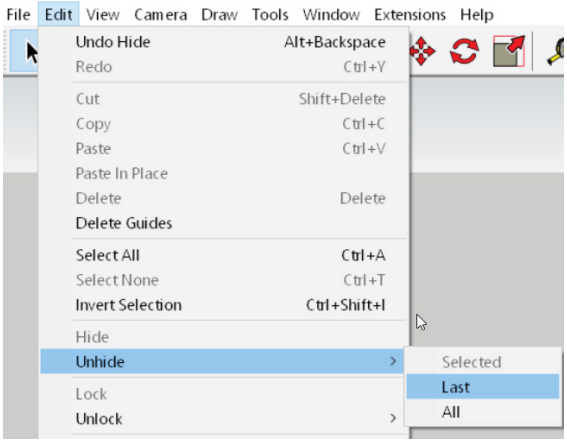


Figure 4-61: Unhide hidden geometry.

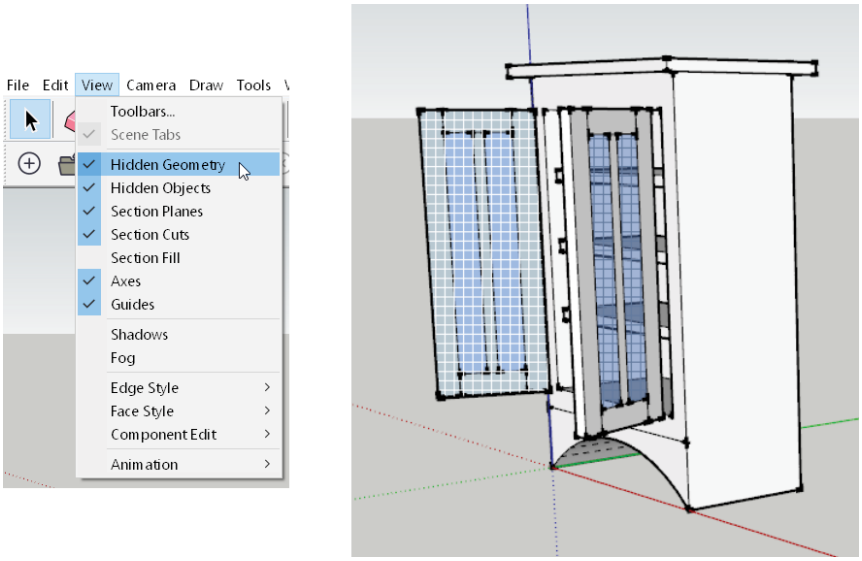
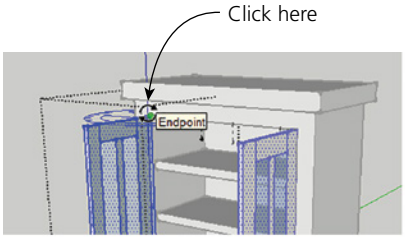
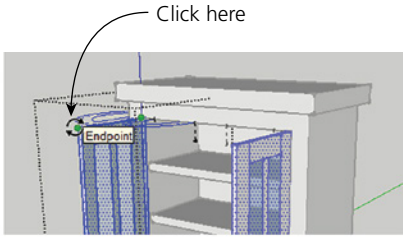


Figure 4-62: Hidden geometry appears with a light grid.

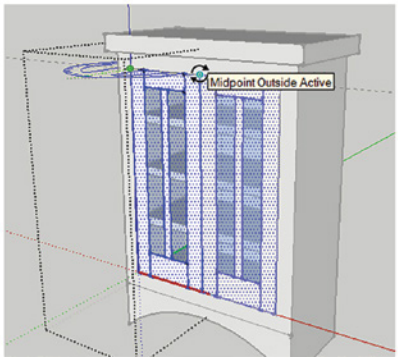
Finally, click the *Rotate* tool onto the hinge, then onto the opposite corner, and move the mouse to swing the doors shut (Figure 4-63).



1.



2.



3.

Figure 4-63: Rotate the doors shut.

Add Knobs with the *Circle* Tool

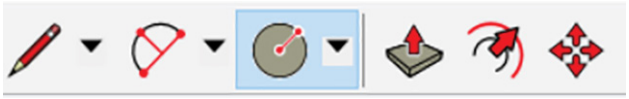


Figure 4-64: The *Circle* tool.

The *Circle* tool (Figure 4-64) is nested within the *Rectangle* tool. When activated, the number *24* appears in the *Measurements* box because the circle is really a polygon with 24 segments. You can change that default number by overtyping the *24* with a new number. More sides will make the circle smoother, less sides will take up less file space. Like *Rotate*, the *Circle* tool aligns with whatever side it is parallel to. Click keyboard arrows to change its orientation and press and hold **Shift** to lock it in place.

With the door component editing box open, click *Circle* onto one of the lock stiles. Click again to define the radius. To change the radius after clicking, immediately type a new number. The circle's radius and segments can be changed later by right-clicking on it, choosing *Entity Info*, and typing a new radius (Figure 4-65). Then push/pull out. Our bookcase knobs have a 1″ radius and are 1″ long (Figure 4-66). Click on **View>Shadows** and we're done (Figure 4-67).

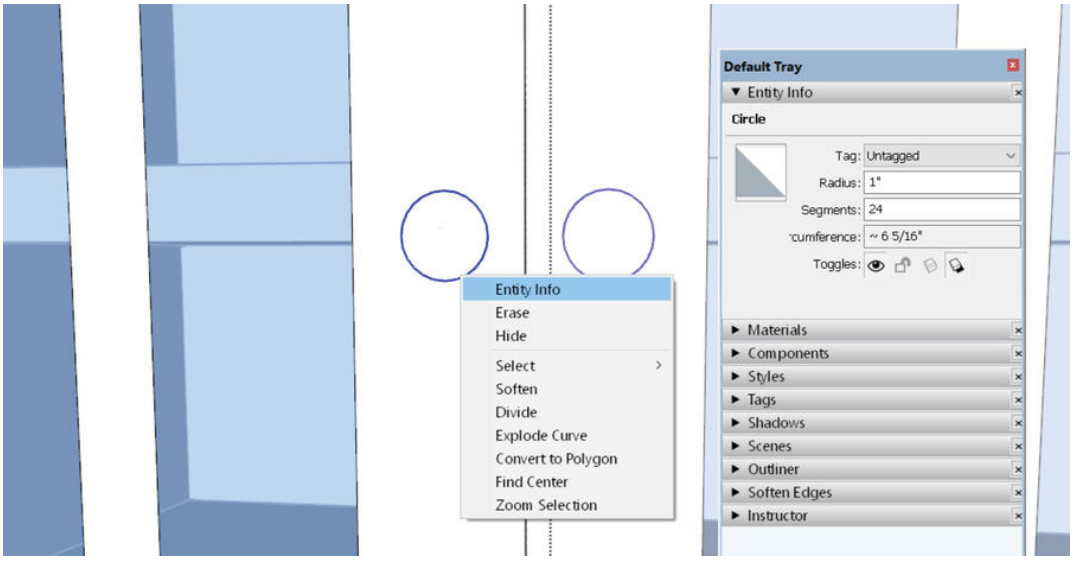


Figure 4-65: Change a circle's properties through its *Entity Info* box.

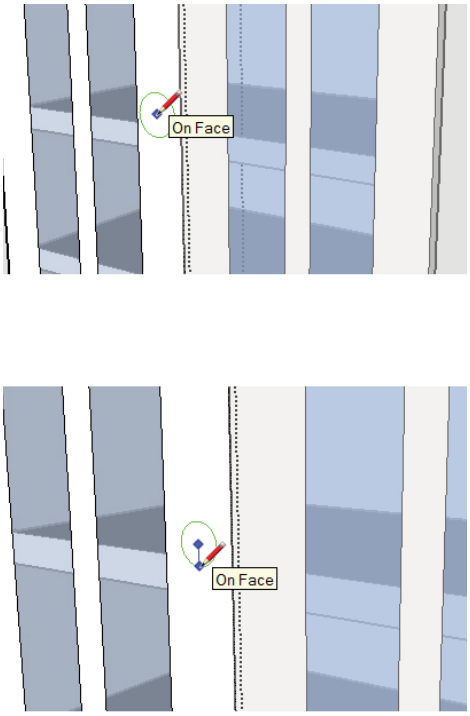


Figure 4-66: Making knobs with the *Circle* tool.

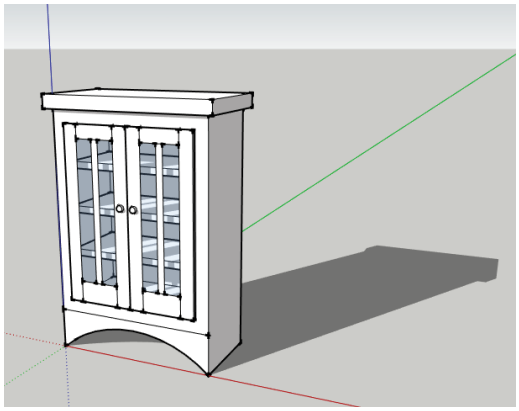


Figure 4-67: The finished bookcase.

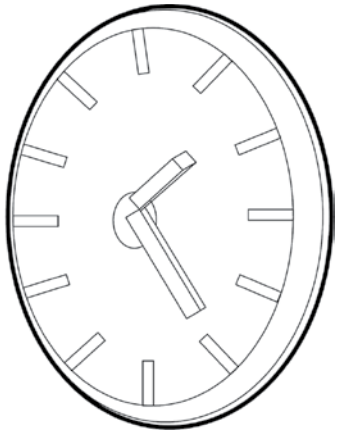


Figure 4-68: Clock.

Model a Clock with Radial Array

Let's model the clock shown in Figure 4-68. In the process we'll do a radial array, which is multiple copies arranged in a circle. Access the **Views** toolbar (Figure 4-69), at **View>Toolbars** (PC) and **View>Tool Palettes** (Mac) and then click the front view icon.

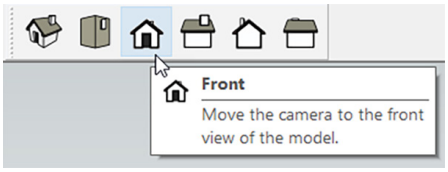


Figure 4-69: The front view icon on the Views toolbar.

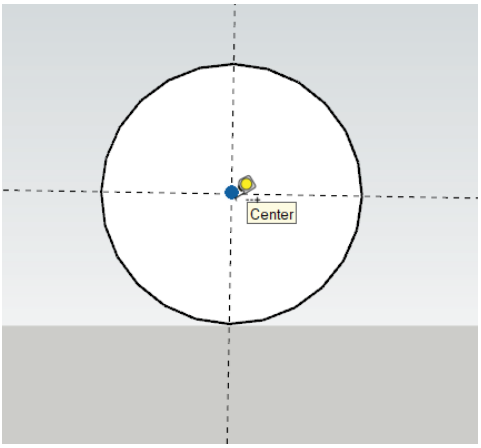


Figure 4-70: Draw a circle and place guidelines at its center.

Draw a 3′ diameter circle with the *Circle* tool. Group it. Hover the *Tape Measure* over the circle's center until the *Tape Measure* snaps to it and draw horizontal and vertical guidelines through that center (Figure 4-70).

Draw a rectangular hour mark at the 12:00 position with the *Pencil*. Use the inference engine to match the rectangle's lengths by hovering the cursor over the first length until a pop-up circle guides you for the other length (Figure 4-71). Then select the rectangle and make it a component (Figure 4-72).

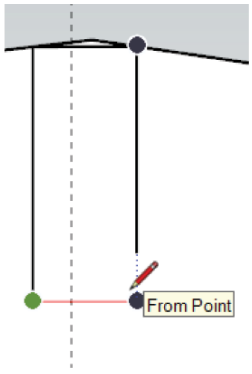


Figure 4-71: Make an hour mark.

Array 12 hour marks around the clock face (Figures 4-73 and 4-74). Here's how:

a. Select the hour mark component and click *Rotate* onto the circle's center.

b. Click *Rotate* on the top of the hour mark.

c. Press and release the **Ctrl** key. A + sign appears over the *Rotate* cursor, indicating multiple copies will be made. Move the cursor a bit to the right (but don't click).

d. Type *360* and **Enter**.

e. Type */12* and **Enter**.

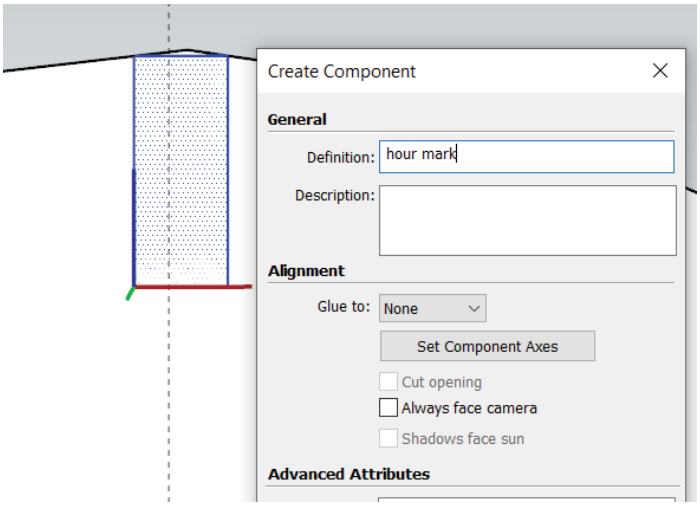
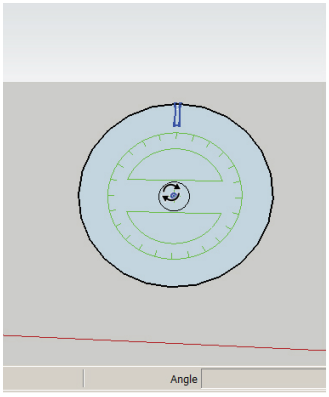
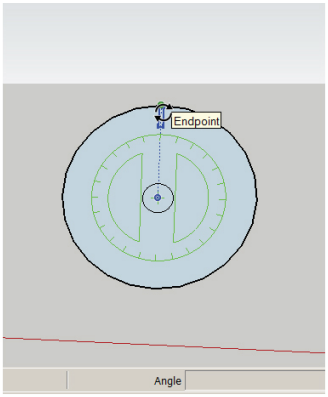


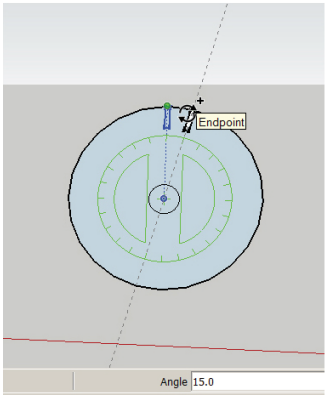
Figure 4-72: Turn the hour mark into a component.



1.

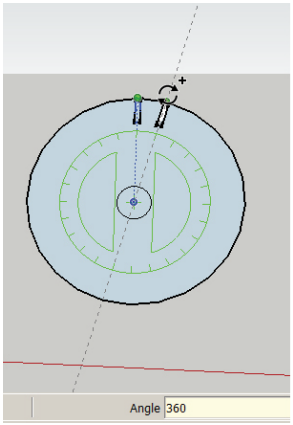


2.

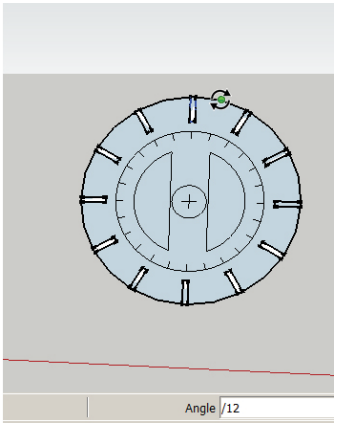


3.

Figure 4-73: Set up the array with the *Rotate* tool.



4.



5.

Figure 4-74: Type *360* and */12*.

Add thickness to the clock face by opening its bounding box and push/pulling it straight back Offset the clock face and give the offset thickness with push/pull (Figure 4-75).

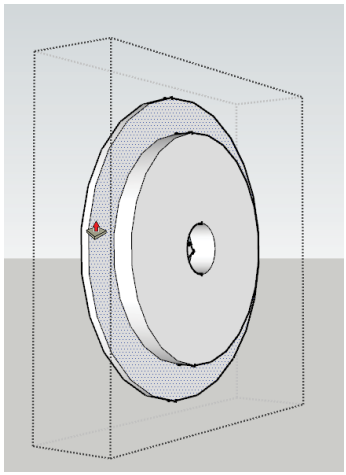


Figure 4-75: Offset and push/pull the clock face.

Draw Clock Hands with Inference Matching

Use the *Rectangle* tool to draw clock hands off the clock face. Group, and then rotate them (Figure 4-76).

Open the editing box and push/pull one hand forward. Click *Push/Pull* on the face of the second hand and hover it over the face of the first. The second item will snap to that thickness (Figure 4-77). Release the cursor and close the editing box.

If needed, adjust the size and proportion of the hour marks and hands with the *Scale* tool (Figure 4-78). *Scale* works inside or out of the bounding box. However, since the hour marks are components, a change made inside one bounding box will affect them all.

Done! (Figure 4-79)

This is the extent of furniture and accessories modeling we'll do. Why? Because there are sources from which you can download just about any ready-made, editable component you

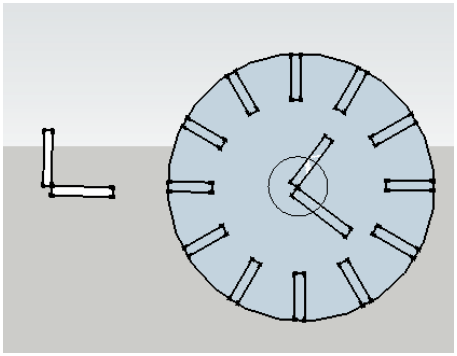


Figure 4-76: Draw clock hands.

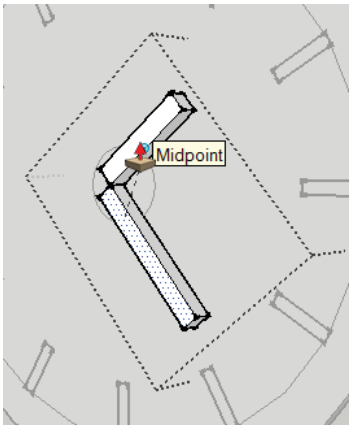
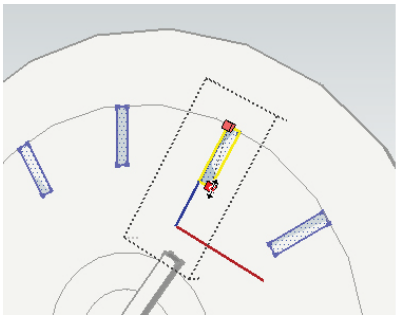


Figure 4-77: Inference-match the clock hand's thickness.



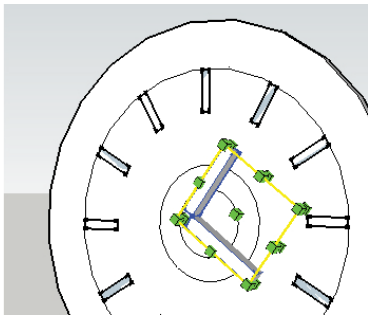


Figure 4-78: Scale the hands and hour marks.

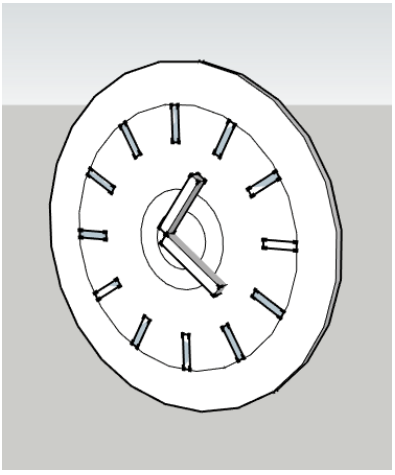


Figure 4-79: The finished clock.

Figure 4-80: Accessories were downloaded from the Trimble 3D Warehouse and scaled to size. Note the translucent paint on the door. Courtesy Matthew Kerr, **mkerrdesign.com**.

need (Figure 4-80). Editing a component is generally more time-efficient than making one from scratch. Head to Chapter 5 now, where we'll model a floor plan and download components from the Trimble 3D Warehouse.

Summary

In this chapter we used SketchUp's native drawing and editing tools to model a table, bookcase, and clock. In the process we learned what stickiness is and how to manage it with groups, examined non-filling faces, made and edited components, mirrored geometry, applied translucent paint, scaled and arrayed, changed a style setting, and inference-matched. We also discussed modeling best practices.

Exercises

1. Make a 5′ × 5′ × 5′ cube
   - Group it.
   - Apply the *Rotate* and *Scale* tools to it.
   - Flip it along an axis

- Change the color of its axes.
- Hide and unhide its surfaces.
- Click shadows on and off it.
- Turn it into a component.

2. Model a piece of furniture from a photo.
3. Model a clock like the one in this chapter.

CHAPTER 5

Drafting, Modeling, and Furnishing a Floor Plan

In this chapter we'll model spaces from plans. We'll do this three ways: 1. By tracing over a raster file; 2. By drawing from a paper sketch; and 3. By importing an AutoCAD file. So, open a new SketchUp file and we'll start with importing a raster file.

Objective: This chapter shows different ways to draft and model a plan, and how to import ready-made components.

Tools: section, text, protractor, views, tape measure

Concepts and Functions: import raster and AutoCAD files, change face and line styles, change line color, inference-match, tracing techniques, scale a model, explode, stretch a line, 3D Warehouse, components browser, link a local collection, paste in place, purge, move geometry with coordinates, clipping, flashing, make a sloped ceiling, measure an angle, geo-locate, tags, make SketchUp run faster, polygon count.

Prepare a Raster File for Import

Figure 5-1 shows the files that can be imported on a Mac. The PC imports the same ones except for PDF. SketchUp will resample (downsize) files larger than 1024 × 1024 pixels. However, that size is still much larger than what is usually needed. Large files slow down the software, so crop and resample them yourself before importing.

To further keep file size down, use compressed file types. JPGs and PNGs are compressed, plus they're smaller than other file types, hence the best choice. PNGs preserve transparency layers, important when importing a file adjusted with digital imaging software. Convert GIF files (which are not importable) and BMP files (which are not compressed) on the Mac by right-clicking on the image and choosing **Quick Actions>Convert Image** (Figure 5-2).

Once imported, a raster file is permanently part of the model. SketchUp doesn't externally reference files, meaning it won't search for them on your computer each time the model is opened and display a red *X* when it can't find them.

Draft a Plan by Tracing a Raster Image

Import a raster image floor plan. Click on **File>Import**. Choose *All Supported Types*, navigate to the floor plan JPG, click the *Image* radio button and then click the *Import* button (Figure 5-3).

Place the file. Click once to place the JPG's lower-left corner, and then click anywhere a second time to place the upper-right corner (Figure 5-4). It's best to model on or near the origin and

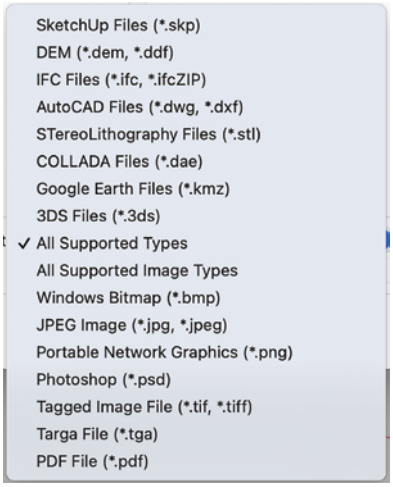


Figure 5-1: Importable files.

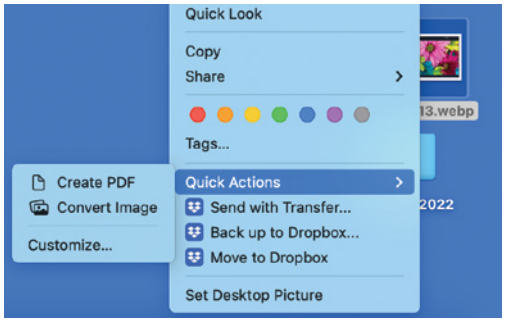


Figure 5-2: Converting a file on the Mac.

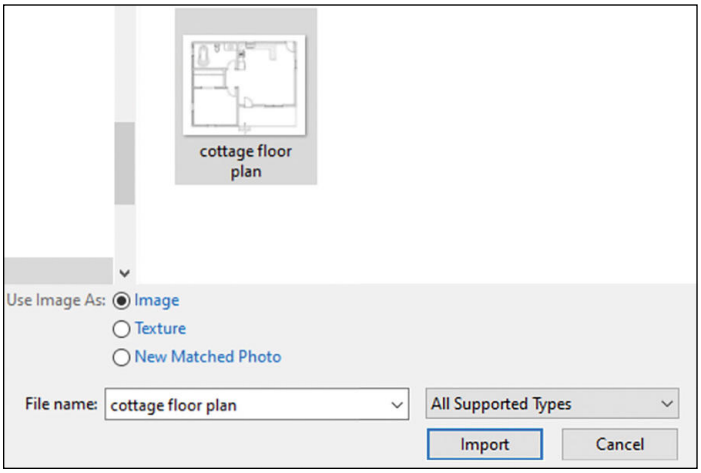


Figure 5-3: Import the JPG.

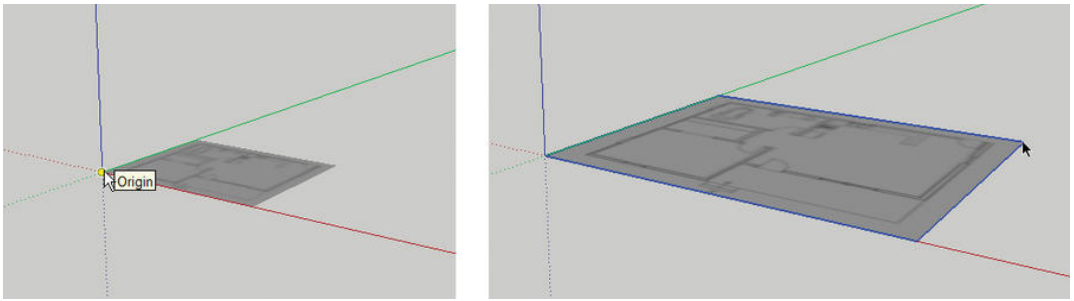
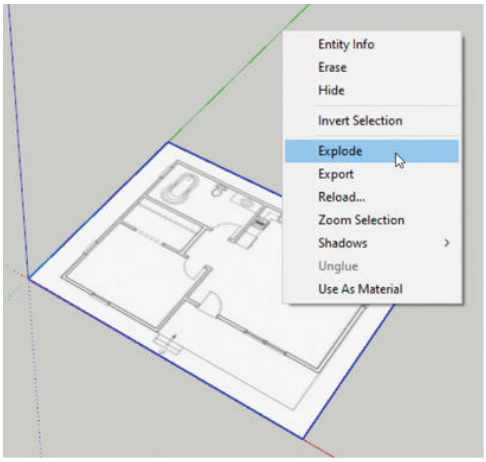


Figure 5-4: Click twice to place the JPG.



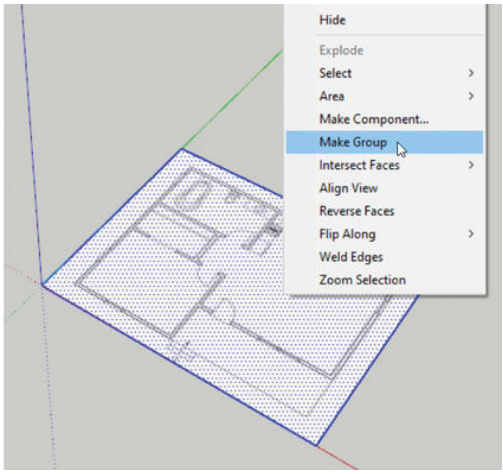


Figure 5-5: Explode and group.

in the upper-right quadrant. Then select and explode the JPG and make it a group (Figure 5-5). A JPG imports with some group-like qualities, but is not a true group.

The *Explode* Function

Explode reduces a group or component to its individual geometry. Nested groups and components—that is, groups or components that are inside other groups or components—may need to be exploded multiple times to edit what you're trying to edit. However, know that adjacent nested geometry fuses upon explosion. Exploded geometry gets automatically selected, so you can quickly re-group if necessary. Exploding circles and arcs reduces them to individual line segments that don't behave as a whole anymore. Fix by selecting, right-clicking, and choosing *Weld* (Figure 5-6).

How to Resize Geometry

If you're wondering why we didn't address scale when importing the file, it's because we can scale anything at any time. All geometry and imported files can be resized based on a known dimension. Say you want to make a wall 10′ long. Click the *Tape Measure* on the wall's endpoints, and then immediately type *10′*. The wall resizes, but so does everything else in the file. To preserve the scale of everything else, put the geometry that you want to resize inside a group or component and resize inside its bounding box.

Scale the Imported Floor Plan with the *Tape Measure*

Scale the floor plan (Figure 5-7). We'll adjust the plan's size by scaling a doorway. Interior doors are typically 2′-8″ wide. Click the Tape Measure on one side of a door jamb and then on the other. A pop-up box displays the distance as 1′-5/8″. Type *2′8*. A dialogue box appears asking if we want to resize the model. Click *Yes*. The whole model will resize to a proportion in keeping with the new doorway opening size of 2′-8″.

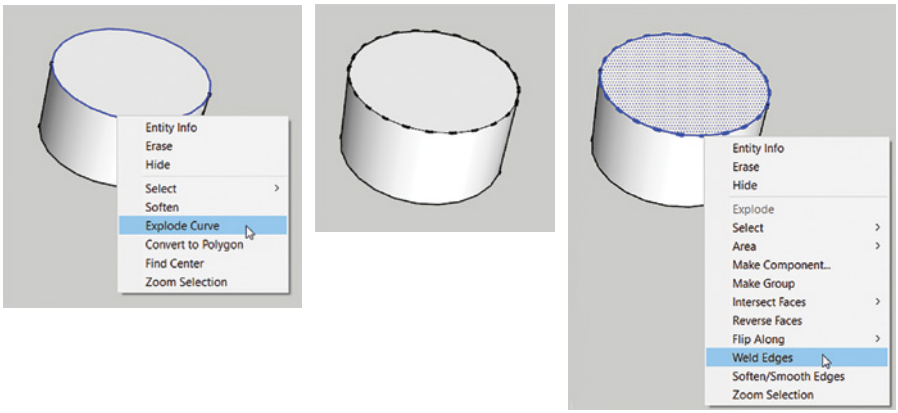
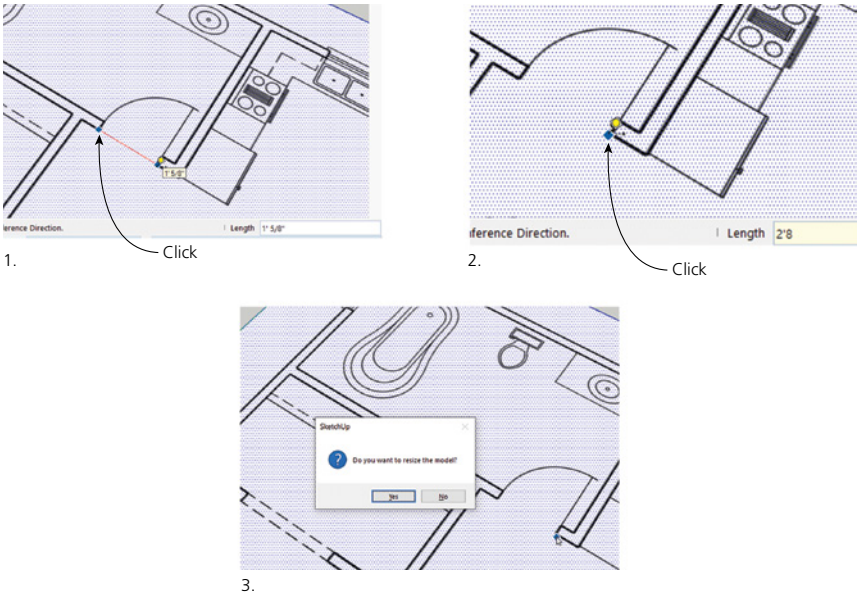


Figure 5-6: Exploding and welding a curve.



1.

2.

3.

Figure 5-7: Resize a doorway to scale the floor plan.

It's easier to trace in a plan view. So, add the *Views* toolbar to your workspace (**View>Toolbars**). It has icons that display top and side views of the model. Click the top view icon to see the image as a plan (Figure 5-8).

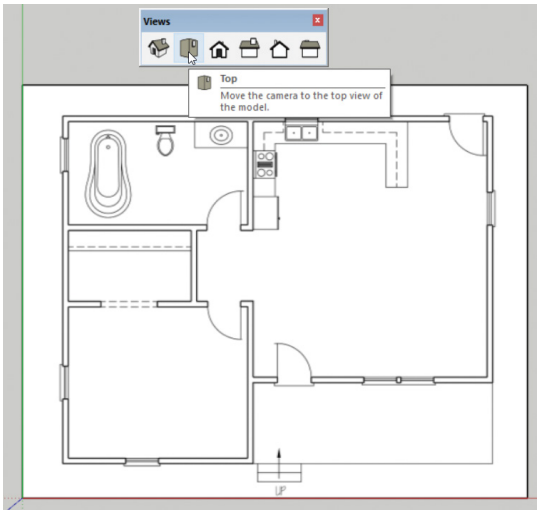
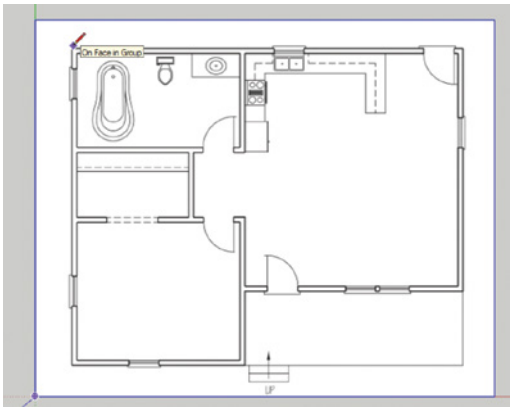
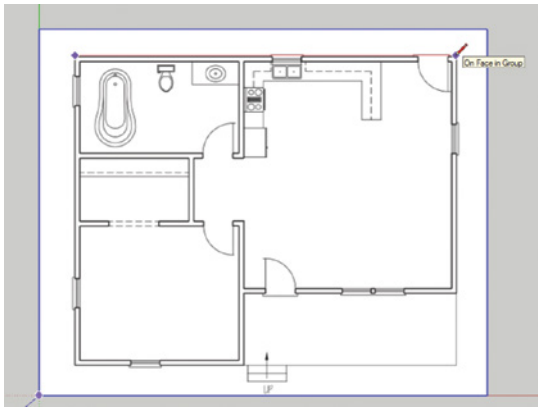


Figure 5-8: Display the plan as a top view.

Trace the plan's perimeter (see Figures 5-9 a–g). Outside the group's bounding box, trace the walls with the *Pencil*. Ensure you're drawing parallel to the axes and that the *On Face in Group* pop-up appears when you click at each corner. if you don't see the pop-ups, your points won't be coplanar. Use *inference-matching* to draw the line in *f*; when the two black dots appear, the bottom horizontal line is the same length as the top horizontal line. If black dots don't appear, hover the cursor over the top corner and then slowly drag it down to the bottom corner. When finished, a face is created, as seen by the opaque fill. If the fill doesn't appear, a face hasn't been created. The corner points are probably not coplanar; erase and redo is the easiest fix.

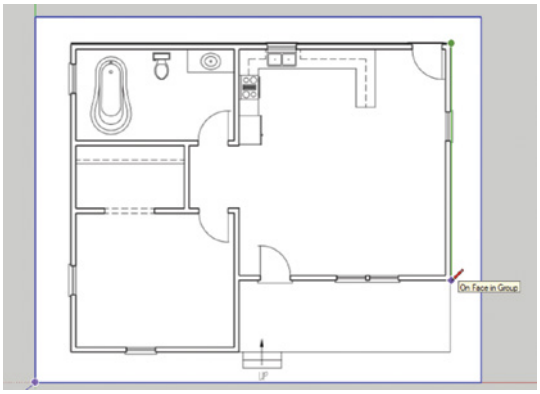


a.

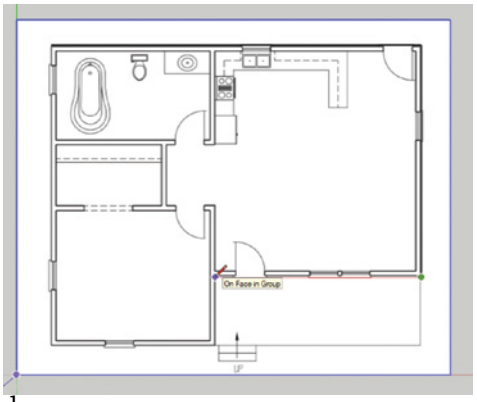


b.

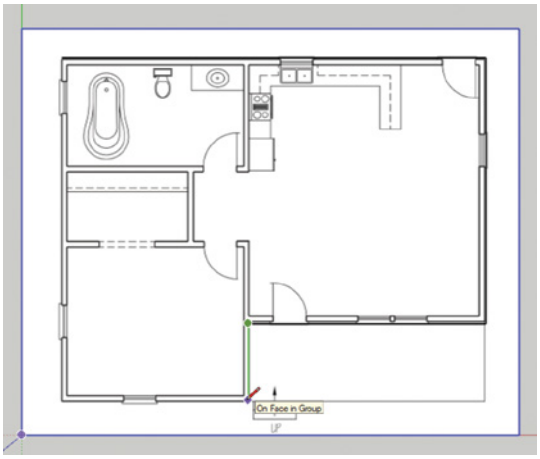
Figure 5-9: a–g Trace the raster plan.



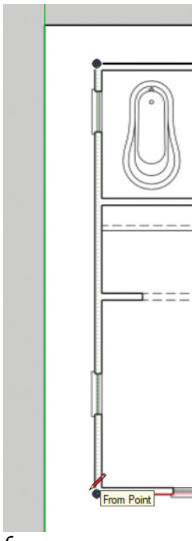
c.



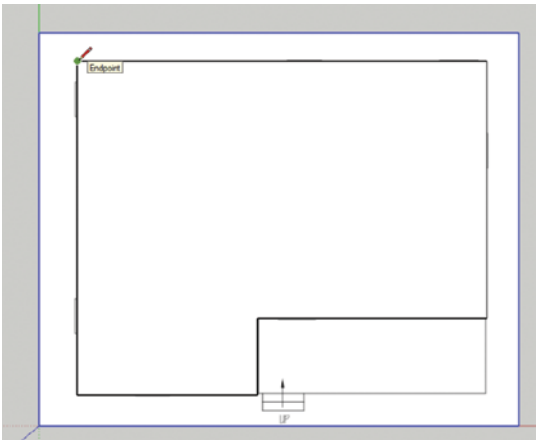
d.



e.



f.



g.

Figure 5-9: (continued)

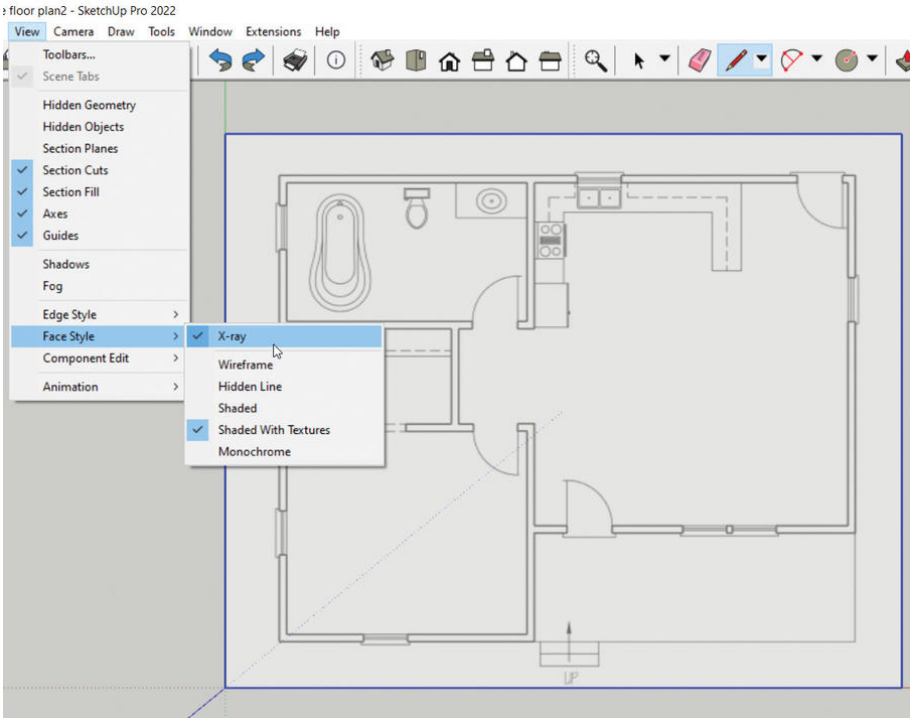


Figure 5-10: Make the face transparent.

Make the face transparent. We can't trace the interior walls through an opaque face, so go to **View>Face Style** and click *X-ray* to make the face transparent (Figure 5-10).

Offset the perimeter walls. Use the *Offset* tool and type *6*, which is the wall thickness (Figure 5-11).

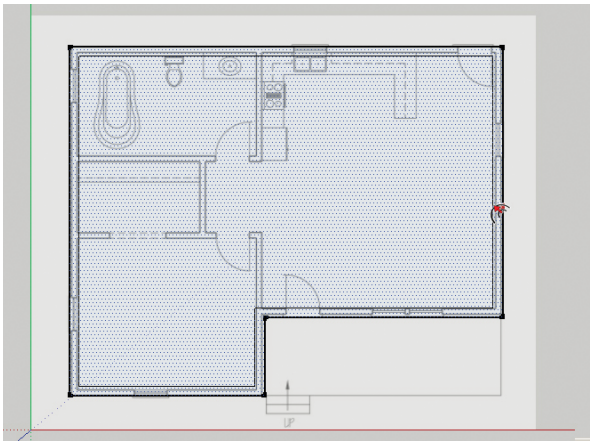


Figure 5-11: Offset the perimeter walls.

Change Line Color

Black lines over a black-and-white drawing are hard to see, so make them red. To do this on the PC, click on the *Styles* tray, and then the *Edit* tab. In the *Color* box, scroll to *All Same*. There's a box next to it that's filled black, which is the line's current color. Click on it to make a picker wheel appear, click on red, move the slider up until the preview box is filled red, and then click *OK* (Figure 5-12). On the Mac, click on **Window>Styles** and then click on the *Edit* tab. In the *Color* box, scroll to *All Same*. A color wheel will appear; click on red and then move the slider over to red (Figure 5-13).

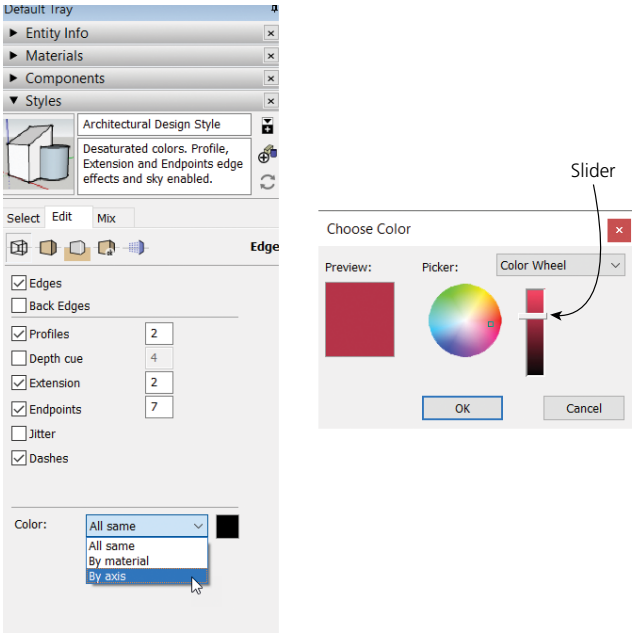


Figure 5-12: Changing the line color on a PC.

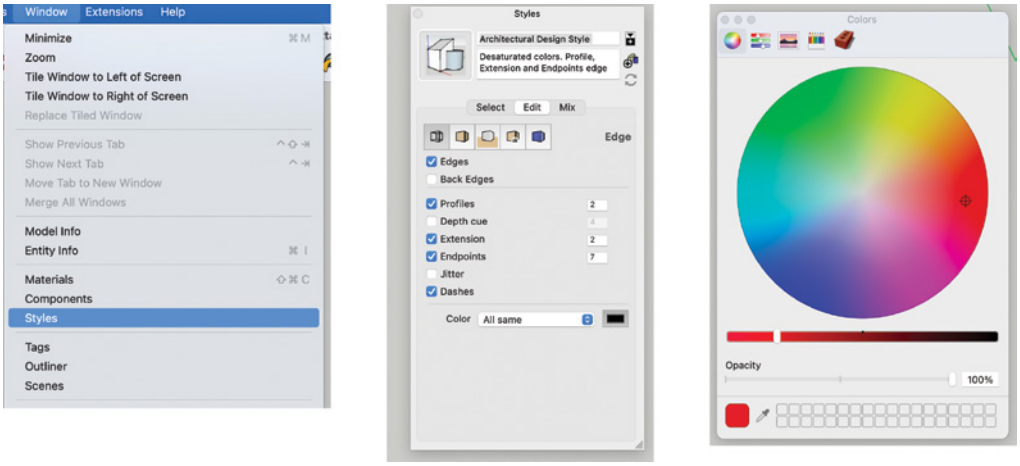


Figure 5-13: Changing the line color on a Mac.

Trace Interior Walls

There are multiple approaches to tracing the interior walls, so rather than go step by step, here are some techniques for you to apply.

- Trace one line on each interior wall and then copy it 6″ to the left or right (Figure 5-14).
- Obtain line lengths by inference-matching. Click the new line's first endpoint. Hover the cursor over the point shown in Figure 5-15's top graphic, and then move the cursor up (bottom graphic) until it locks in place.

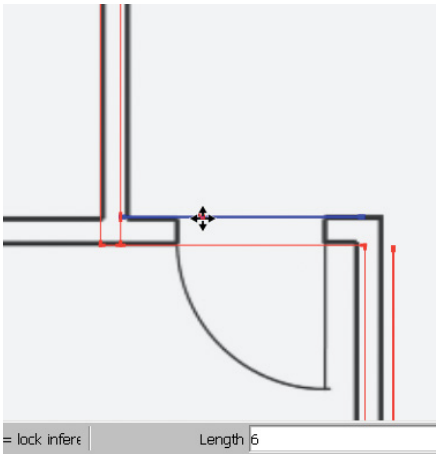
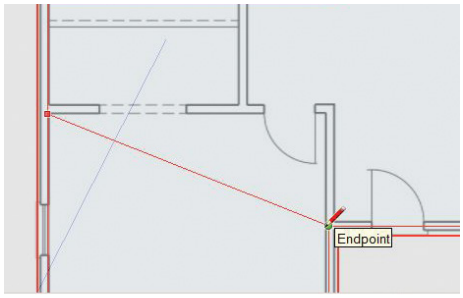


Figure 5-14: Draw one line, copy it, and move it 6″ away.



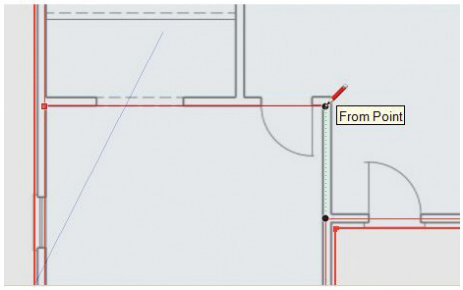
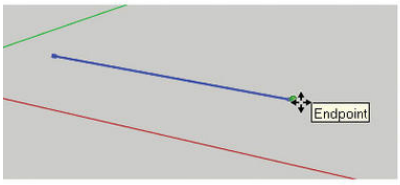


Figure 5-15: Inference-match line lengths.

- Use the *Move* tool to stretch lines and faces longer or shorter (Figure 5-16). Select the line and move its endpoint forward or backward. Stretch a face by selecting an edge, grabbing it somewhere along its length, and moving it forward or backward. This won't work if the line and face are connected to other geometry that stretches with it.



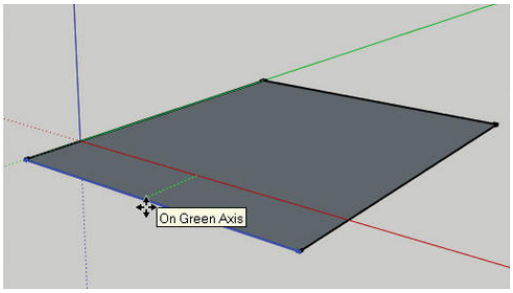


Figure 5-16: Stretch a line by moving its endpoint; stretch a face by moving its edge.

- Use the *Pencil* to add to lines whose endpoints can't be moved because they're attached to other geometry. This results in two lines: the original and the added (Figure 5-17).

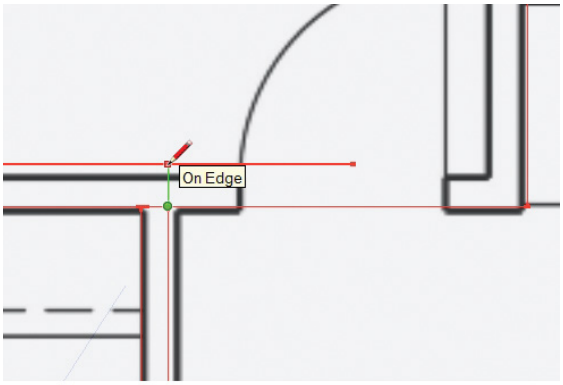


Figure 5-17: Add line length with the *Pencil*.

After you finish drawing the interior lines, return to **View>Face Style** and unclick *X-ray*. The face becomes opaque again, allowing you to see any missing lines or areas to clean up, such as crossed lines at intersections. If you inadvertently erase a line, just redraw it with the Pencil.

Edge Styles Again

Eventually your plan should look like the one shown in Figure 5-18.

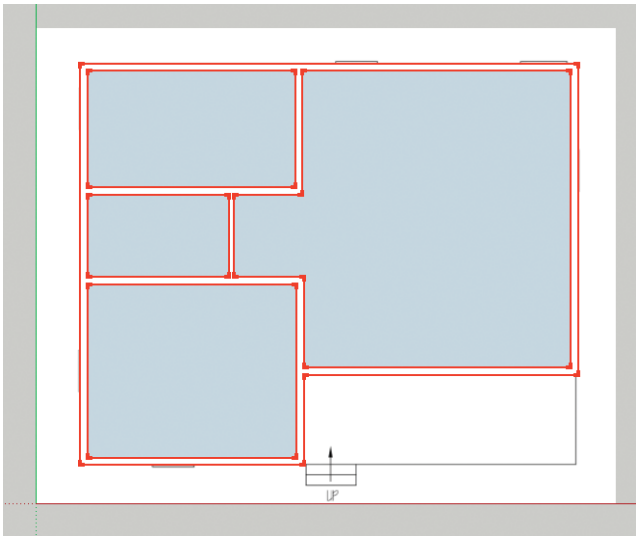


Figure 5-18: The completed plan.

Note that all intersections are "clean," meaning there are no crossed lines in them. This makes the walls contiguous, which is necessary to pull them up together. Also note the thickened endpoints; those are a default style. You can remove them at **Window>Styles**. *Style* options include changing endpoints and profiles (the appearance of line thickness). Unclick the *Endpoints* box, and the endpoints will disappear (Figure 5-19). Experiment with different numbers in the checkbox to see how the endpoints are affected. Increase the number in the *Profiles* checkbox to see how the lines display thicker (Figure 5-20). Know that technically the lines are still thin; the thickness is just a display trick.

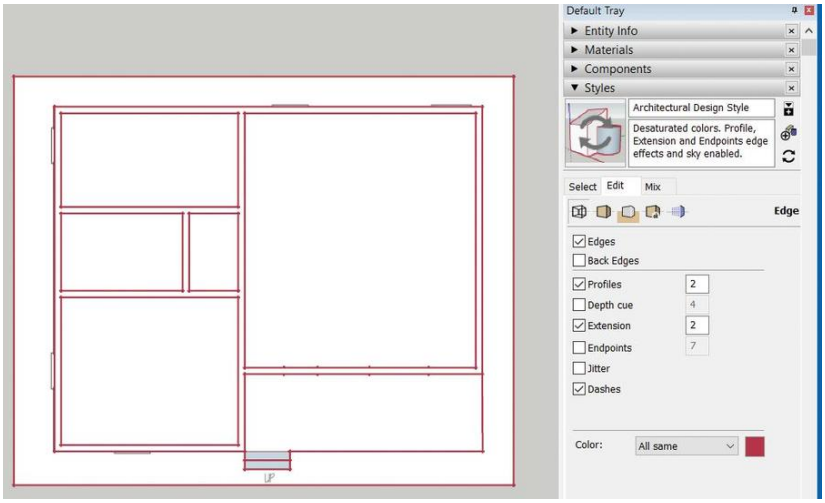


Figure 5-19: Uncheck the *Endpoints* box so the endpoints don't display.

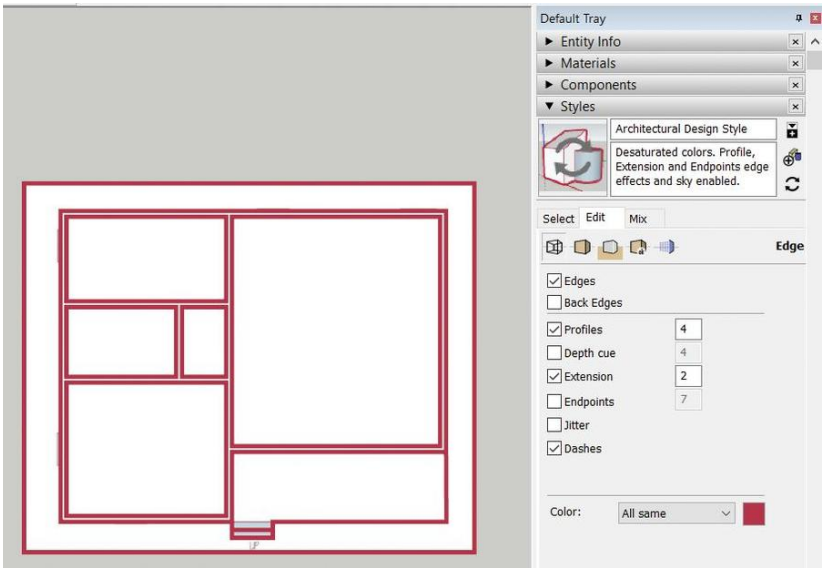


Figure 5-20: Increase the *Profiles* number to make the lines look thicker.

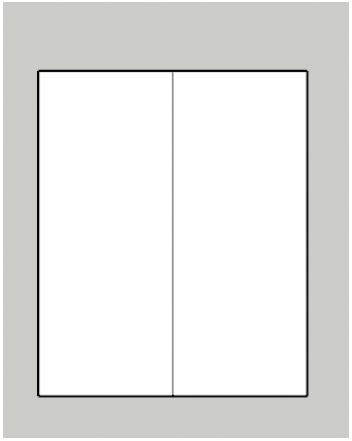


Figure 5-21: Interior lines are thinner than exterior ones.

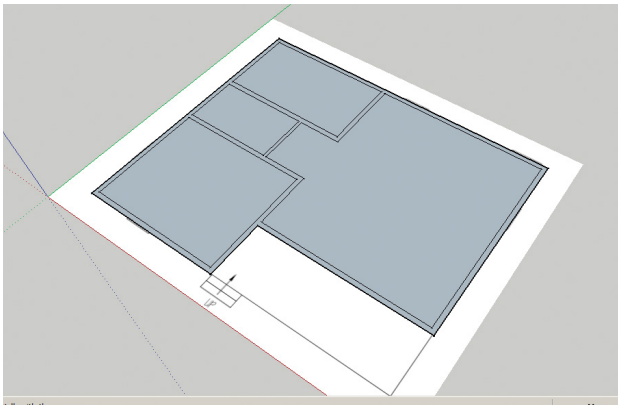


Figure 5-22: The finished plan. *X-ray* is turned off, the edge color is black, and the iso icon in the **Views** toolbar is checked.

The enabled *Profiles* feature is what causes Interior lines on a plan to look thinner than the perimeter lines (Figure 5-21). Thick lines indicate that those lines do not enclose a coplanar face. In the isometric and perspective views, a thicker appearance is the default, mimicking how designers outline forms with thicker line weights to visually define them. You cannot assign different thicknesses to different lines in SketchUp. If you don't like the different thickness at all, turn them off by unchecking the *Profiles* box. However, leaving *Profiles* on helps to see which lines aren't connected, which is useful when troubleshooting problems like a non-filling face.

Return the edge style to black and click the *iso* icon in the **Views** toolbar. Your plan should now look like Figure 5-22.

From Plan to Model

Hover *Push/Pull* over a wall. Ideally, all walls will highlight. Extrude up 10′ (Figure 5-23). Erase any extraneous vertical lines that appear on the walls.

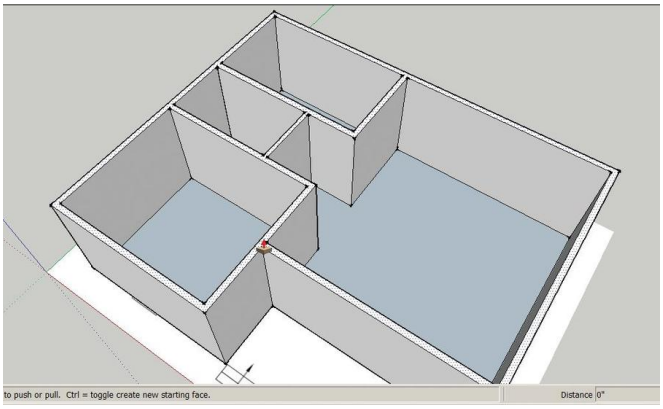


Figure 5-23: Push/pull the floor plan up.

I say ideally because if your walls didn't extrude this smoothly, something went wrong. Did a floor area extrude up with the walls? Push/pull the walls back down and trace the perimeter of that floor area with the *Pencil*. Sometimes that solves the problem. Erase some faces or walls and redraw them. SketchUp takes playing and practice to get things exactly as you want.

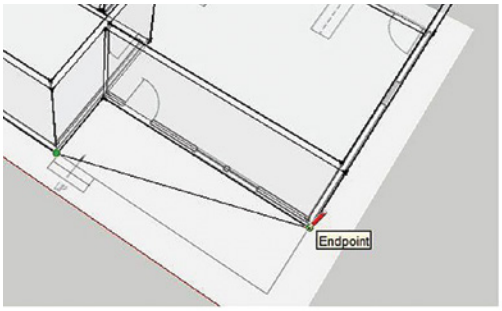
Add a Porch, Door, and Window

Put the faces in *X-ray* mode again (**View>Face style>X-ray**) and we'll add the porch, a door, and window.

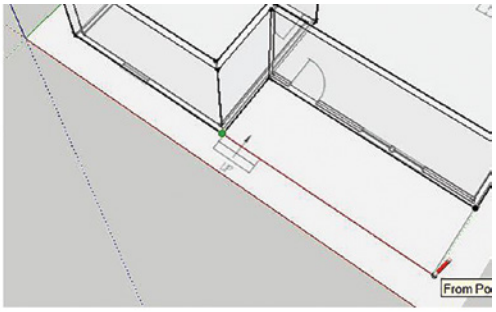
Draw the porch (Figure 5-24). Use inferencing to draw the length of the porch, and then push/pull it up 12″.

Add the porch steps (Figure 5-25). Trace them with the *Pencil*. Push/pull the second step level with the porch. Push/pull the first step to the midpoint of the second—an inference dot and screen tip will appear as the cursor approaches the midpoint. When you're finished, if the faces are reversed (the white side should face out), select and right-click the stairs and choose *Reverse Faces*.

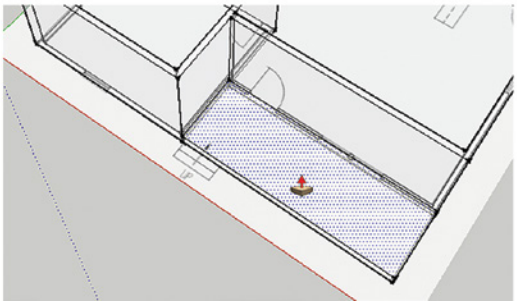
Add the door (Figure 5-26). Click the Rectangle at the bottom of the wall (level with the step) for the door opening's lower-left corner, type *2′8,7* and hit **Enter** to make the rectangle 2′-8″



1.

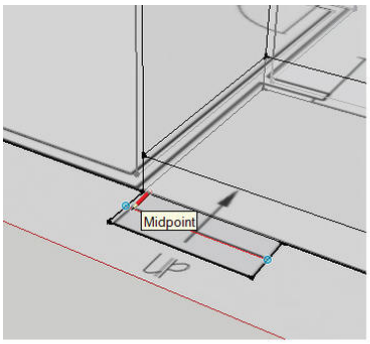


2.

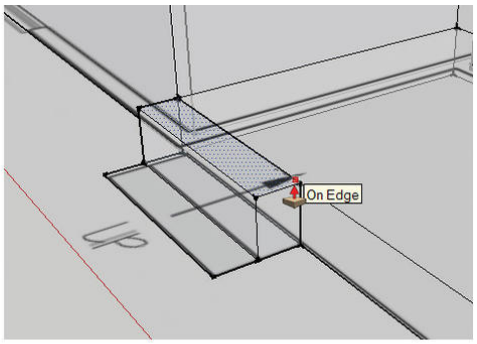


3.

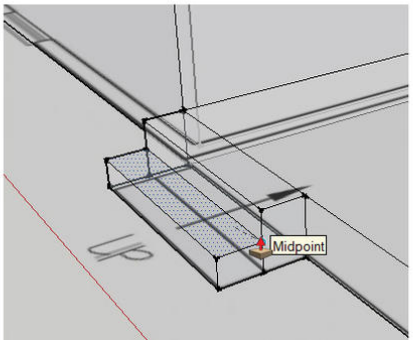
Figure 5-24: Draw the porch and push/pull it up.



1.



2.



3.

Figure 5-25: Trace the steps and push/pull them up.

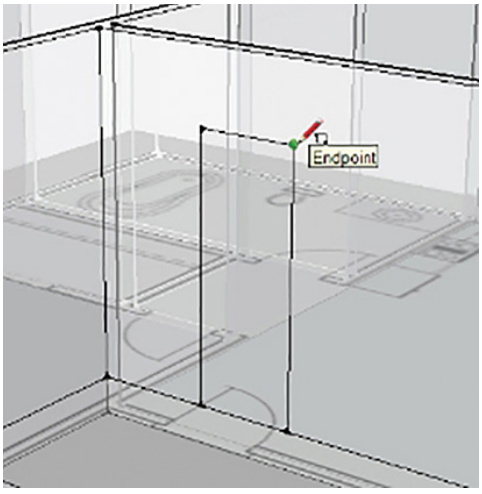


Figure 5-26: Add a door opening.

wide and 7′ tall. Remember, there is no space between the comma and the 7. You could also click anywhere the second time and immediately type the dimension. The opening will adjust.

Add a window (Figure 5-27). Place the window head (top) level with the door head. Hover the *Rectangle* at the top of the door, move it to the right along the axis (watch for the dotted inference line), and click to place the window's upper-left corner. Click again to place the lower-right corner or type a dimension. Alternatively, place guidelines at the window locations in the plan view and then click the *Rectangle* on those guidelines (Figure 5-28).

Cut the door and window openings. Push/pull the faces back a bit, type *6* (the width of the wall in inches), and hit **Enter** (Figure 5-29).

Raise the interior floor. Orbit inside the model. The doorway is above the floor. Push/pull the floor up and click it on the door sill (Figure 5-30). Raise the floors in the other rooms by inference-matching them to that floor (Figure 5-31).

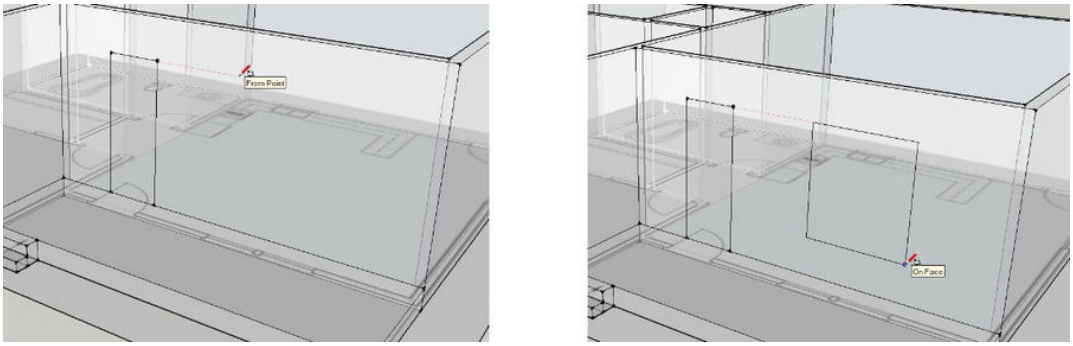


Figure 5-27: Use inferencing to align the door and window heads.

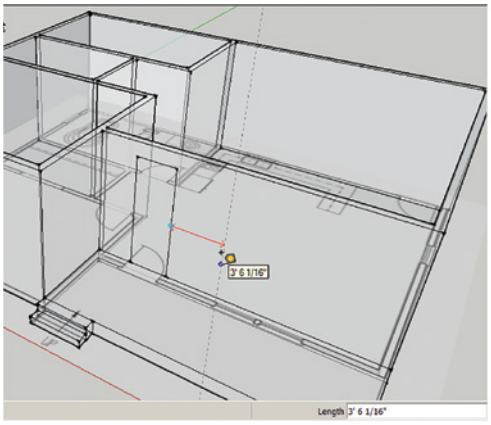


Figure 5-28: Guidelines drawn in plan can be used to place the window opening.

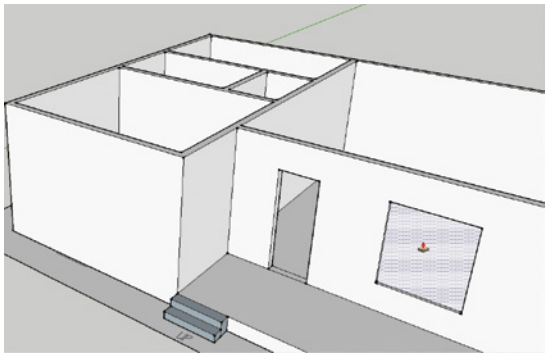
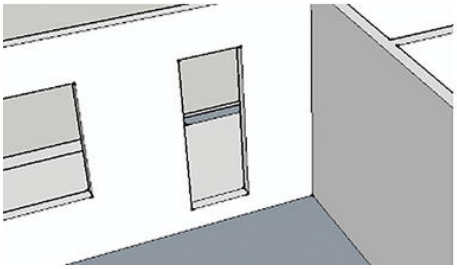


Figure 5-29: Cut openings by push/pulling the faces back 6".



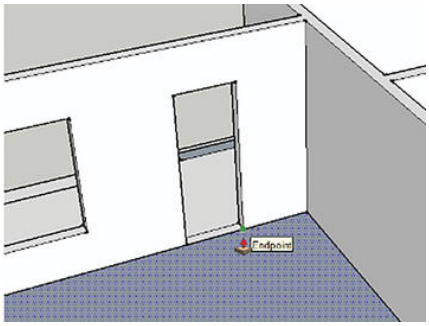


Figure 5-30: Raise the interior floor to the door sill.

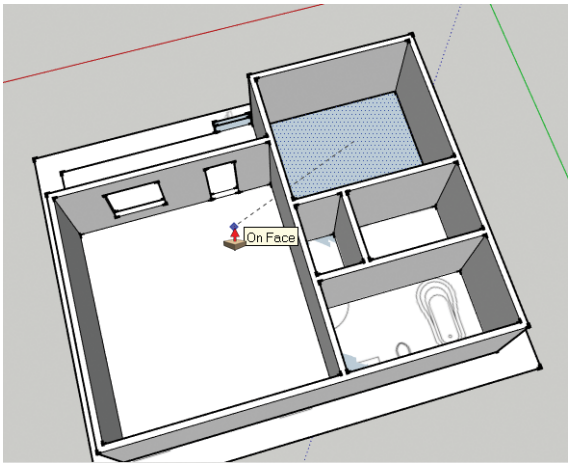


Figure 5-31: Inference-match the other rooms' floors to the new floor height.

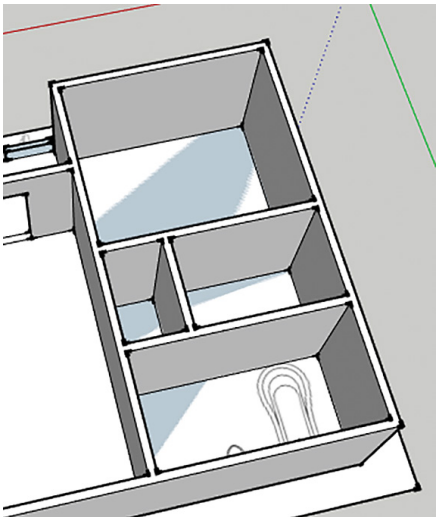


Figure 5-32: When two planes are adjacent to each other, they flash.

Flashing Planes

Before you raised the floor, you may have noticed flashing when orbiting around the cottage (Figure 5-32). This is called "z-fighting" and happens when two planes are adjacent. Flashing tells you that the planes are occupying the same space and SketchUp doesn't know which to display. Here it was happening because the floor plane was on top of the imported JPG, which is a plane, too. Raising the floor hides the flashing under the new face plane.

Draft a Plan from a Paper Sketch

Designers typically have a sketch of a space's layout and dimensions. In this project we'll trace and model a dorm room from an imported JPG of the plan (Figure 5-33).

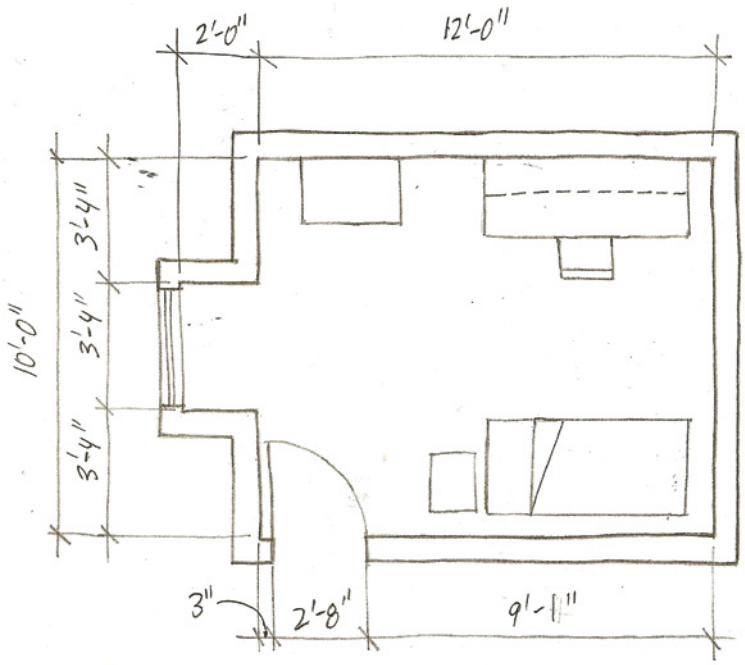


Figure 5-33: A floor plan sketch.

Import the sketch and size it. Click the plan icon in the **Views** toolbar and follow the same instructions as with the floor plan we imported earlier.

Place guidelines on the sketch. Use the *Tape Measure* to create guidelines defining a 14″ × 10″ rectangle. After you draw one horizontal and one vertical guideline, you can click and drag those guidelines to create the rest. Type distances after dragging but before clicking in place. Then trace over the guidelines on the sketch (Figure 5-34).

If the default black guidelines are hard to see, change their color. Do this at **Styles>Edit** and click the fifth icon that's directly below the *Edit* tab. Click on *Guides*, click on a color from the picker wheel, and move the slider up (Figure 5-35).

Return the plan to a perspective view. Click *iso* on the **Views** toolbar and delete all guidelines at **Edit>Delete Guides**. Right-click on the imported sketch to select it and choose *Hide*.

Model the plan. Push/pull the face up 9′. Right-click on the face that is created and choose *Erase* (Figure 5-36). Or just hide if you think you'll use that face as a ceiling later. Make a guideline 3″ from the corner for the door. Let's put a door in now.

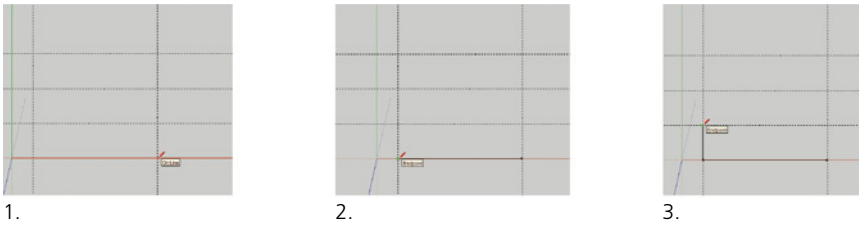


Figure 5-34: Place and trace guidelines.

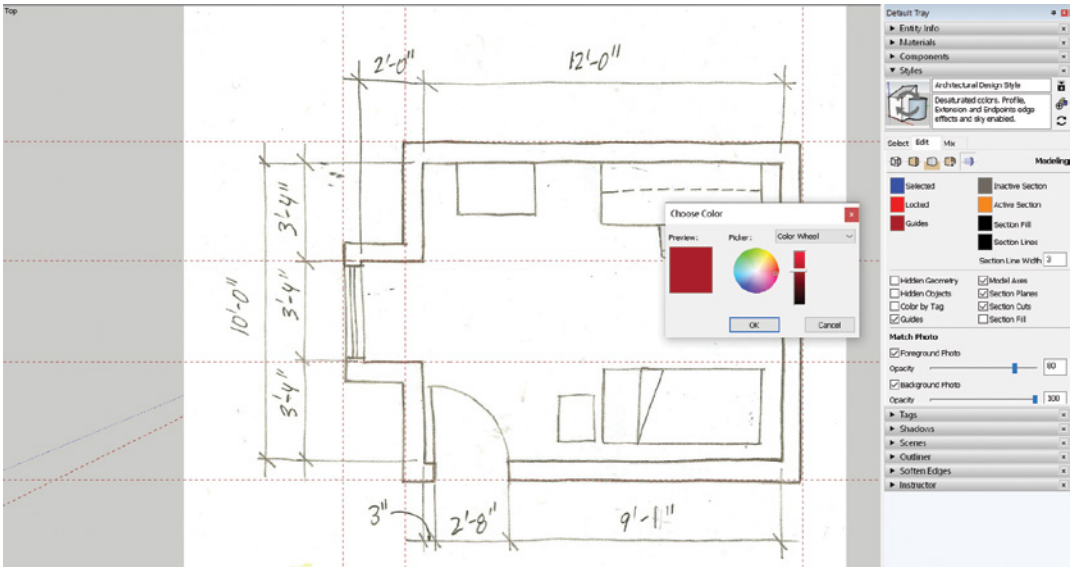


Figure 5-35: Change the guidelines' color to make them easier to see.

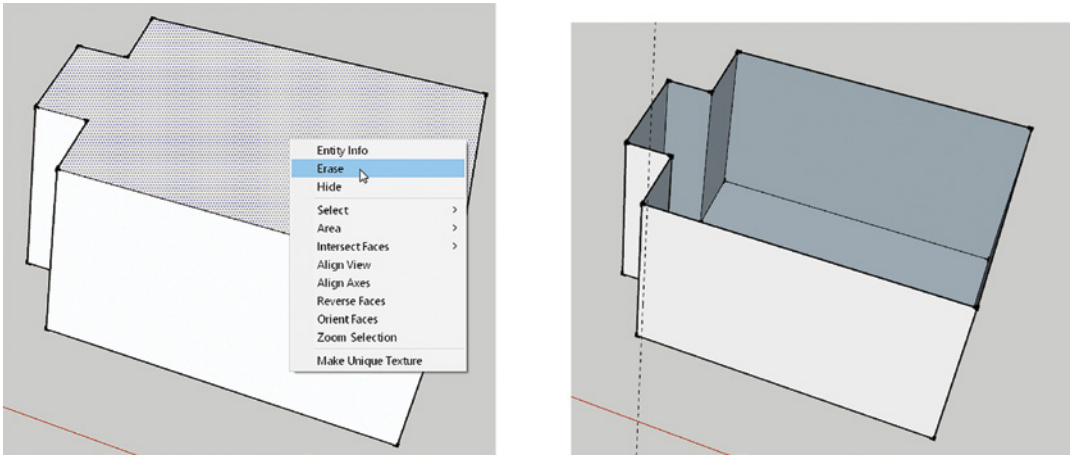


Figure 5-36: Model the plan.

The 3D Warehouse

In Chapter 4 you modeled some furniture. The ability to do that is nice but saving time by using other people's models is even better. You can import doors, windows, furniture, flowerpots, food, whatever you want from the many online libraries that exist. The largest source of free SketchUp components is the 3D Warehouse, a library where millions of people upload and download models.

People use the Warehouse for different things, such as selling products and advertising their modeled or design services. Beginners and pros upload their creations; companies upload their products. Anyone can contribute. You can find whole buildings and cities, and rooms filled with furniture, fixtures, and equipment. Excluding branding and logos, all content is free, reusable, editable, and republishable. A link to the Warehouse's terms of use is at the end of this chapter. In that spirit of sharing, this book liberally uses Warehouse models.

There are multiple ways to access the Warehouse, all requiring an internet connection. One way is directly at https://3dwarehouse.sketchup.com. Contents are easiest to browse there. However, it is more convenient to access the Warehouse through the SketchUp software. Clicking on the *Warehouse* icon (Figure 5-37) takes you directly to it. However, we're going to access the Warehouse through the *Components* tray, which has category folders.

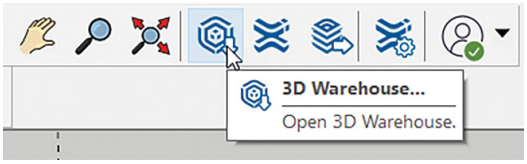


Figure 5-37: The Warehouse icon.

Import a Door through the Components Tray

Import a door component (Figure 5-38). Click open the *Components* tray, click the dropdown arrow, and then click on the *Construction* folder. This accesses multiple subfolders; click on *Doors Low Poly*.

This spirits us to the Warehouse, where many door types are presented (Figure 5-39). I chose *Door with left jamb reverse* (Figure 5-40). Click *Download*. You'll be asked if you want to load the model directly into your SketchUp model. Click *Yes*.

To Download into the Model or Not?

A Warehouse component, as well as any component you make, is a full-fledged, self-contained model. When you download a component, you're embedding that model into your own model. You're also bringing in all that model's imported images, tags, scenes, and styles. That can be dangerous! All that stuff can bloat your file, there may be corrupted elements in it, and it might take a long time to remove unwanted items. If you've spent hours developing your own model, don't download a Warehouse component directly into your file; rather, click *No*, and a navigation browser will appear enabling you to download the component separately. Check it out, delete what you don't want, and then import into your file. You can import the Warehouse

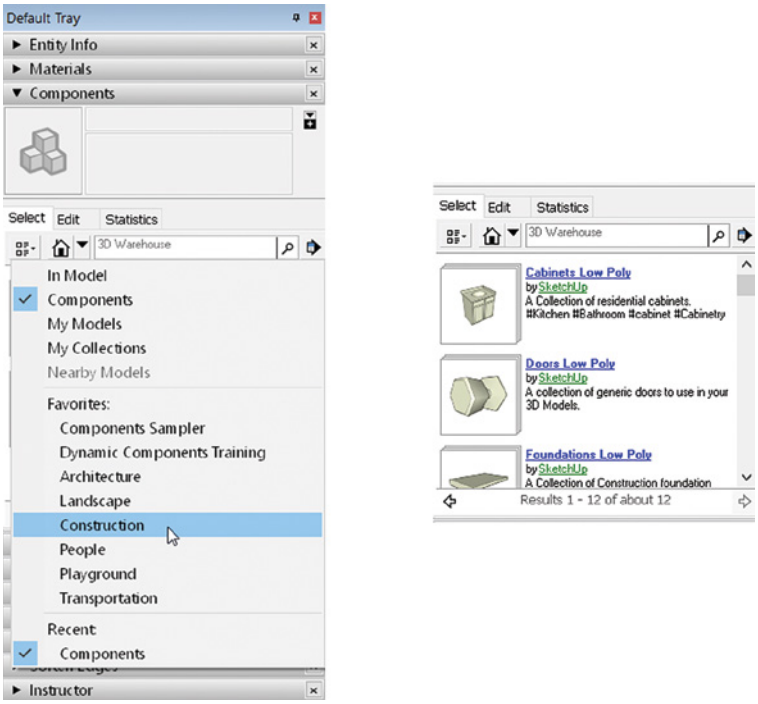


Figure 5-38: Access the Warehouse via **Components>Construction>Doors Low Poly**.

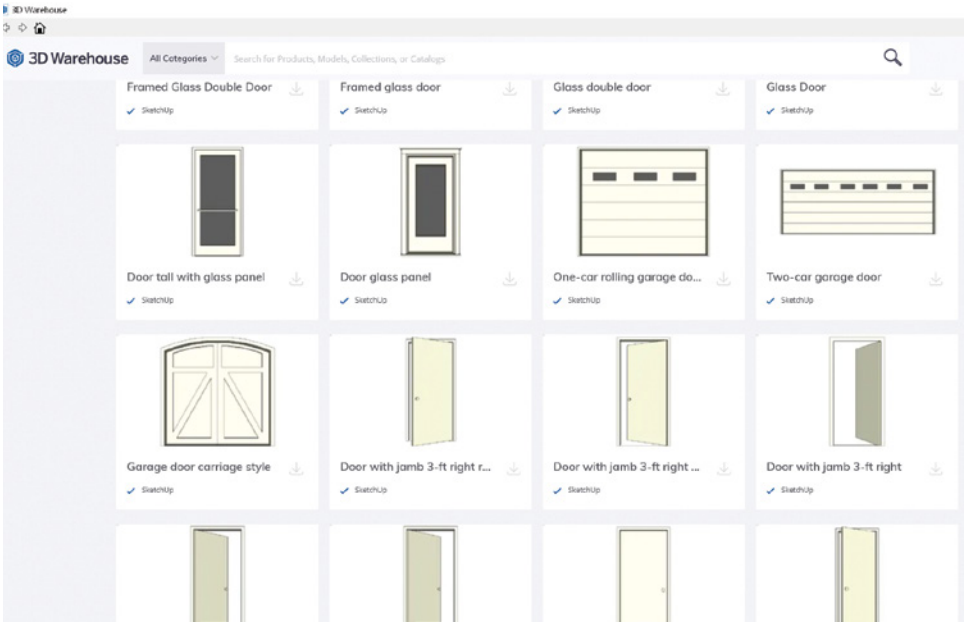


Figure 5-39: Many door types are at the Warehouse.

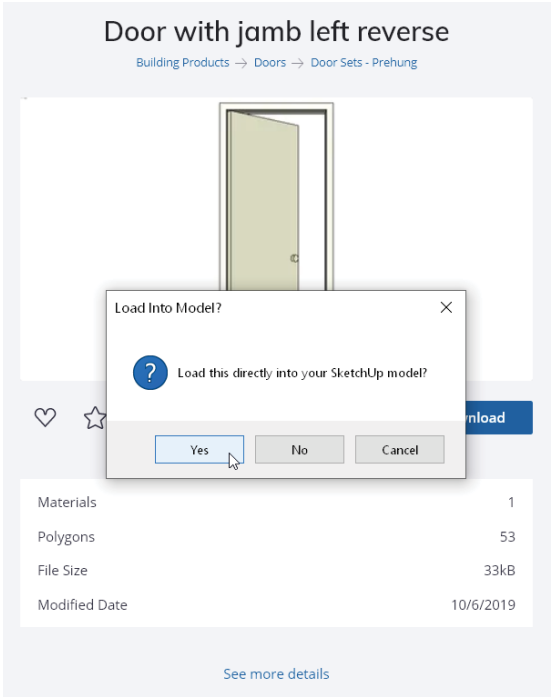


Figure 5-40: Let's download this door.

model at **File>Import**. Alternatively, select the component, press **Ctrl** (or **Command**) **C**, then click on your file and press **Ctrl** (or **Command**) **V**. Since we haven't spent much time on our practice model, download the Warehouse model directly into your open file.

Place the door. The *Move* tool is active and is attached to the door's local axis. Note how the door attaches or "glues" itself to whatever plane it's on. Gluing is an option when a component is created (Figure 5-41), so if a component doesn't glue as expected, inspect that option by clicking on the house icon to access all components in the model. Then find the component's thumbnail, right-click and choose *Properties* (Figure 5-42).

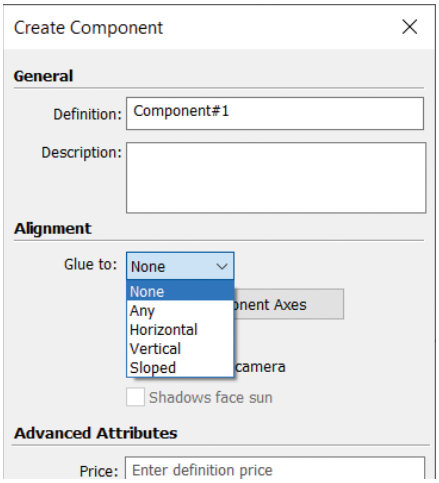


Figure 5-41: The component's *Glue* option.

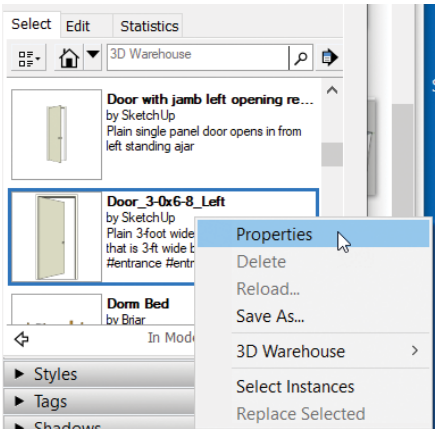


Figure 5-42: If a component doesn't attach to a wall, inspect its gluing option.

Click the back of the frame onto the floor and guideline (Figure 5-43). Four crosses will appear when you hover the *Move* tool over the door. Those allow you to rotate the door. While you obviously don't want to rotate a door, those crosses appear on all downloaded components to enable rotation right away instead of as a separate task.

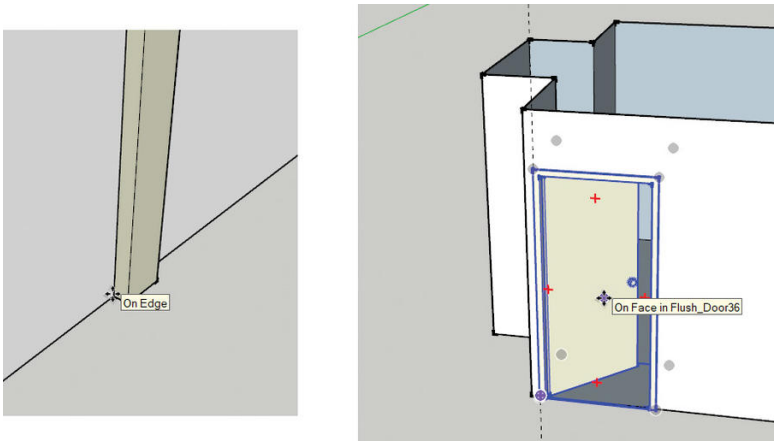


Figure 5-43: Click the door's frame onto the wall.

Component Door in Single- versus Double-sided Walls

Note that the component door cut a hole in the wall. This is an option when creating a component (Figure 5-44). If you delete the door, the hole will also delete; if you move the door, the hole will move with it. This is a huge benefit of using component doors instead of manually cutting holes in walls. However, this only works on single-face walls, not double-face walls like we modeled in the cottage. Since designers typically draw walls with thicknesses, a workaround for a double-face wall is needed. Sometimes you can draw a rectangle around the door or window component, push the face back, and that cuts a hole through the second face. Other times you might have to push the face back and then select/delete it.

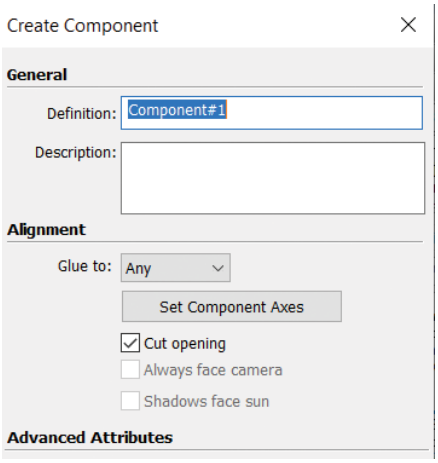


Figure 5-44: Select *Cut opening* when creating a door component.

Import and place the window. First, draw a guideline 2′-2″ from the ceiling to mark the window head (Figure 5-45). Then go to **Window>Components>Construction>Windows Low Poly**, which takes you to the Warehouse and presents windows to browse (Figure 5-46). Choose one, bring it into the model, and click to place (Figure 5-47).

Import Warehouse Furniture Through the *Components* Browser Search Field

Let's import a desk, dresser, and bed now. In the *Components* browser's search field, do separate searches for *small dresser*, *dorm bed*, and *desk* (Figure 5-48). Thumbnails will appear in the browser; double-click ones that interest you and download into the model. Alternatively,

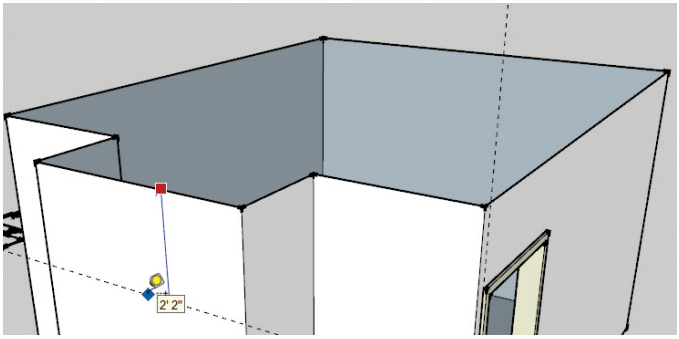


Figure 5-45: Make a guideline for the window head.

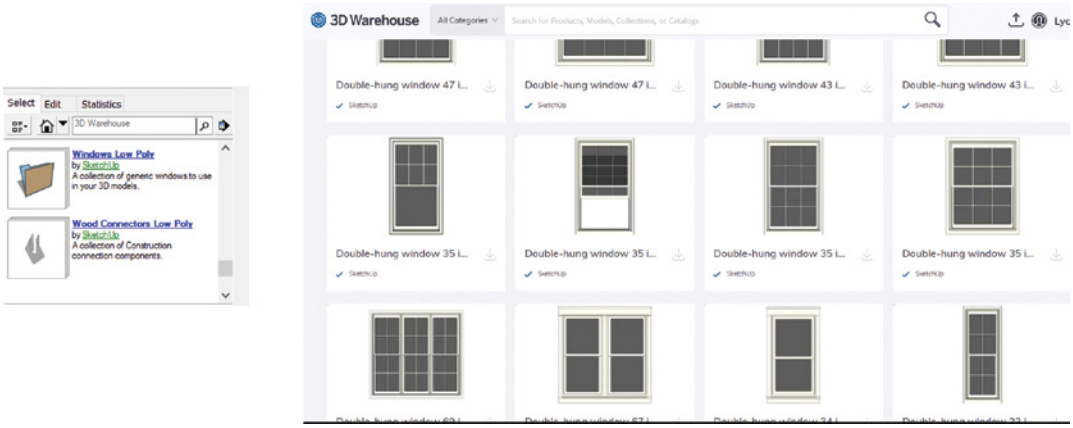


Figure 5-46: Browse the *Windows Low Poly* folder.

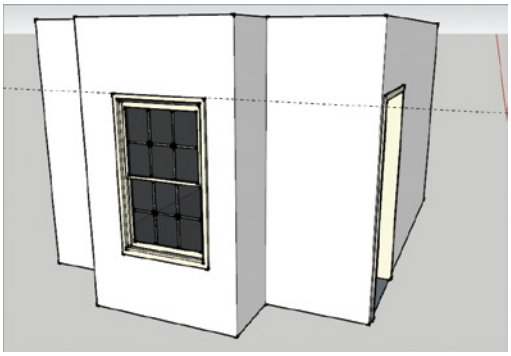


Figure 5-47: Click a window into place.

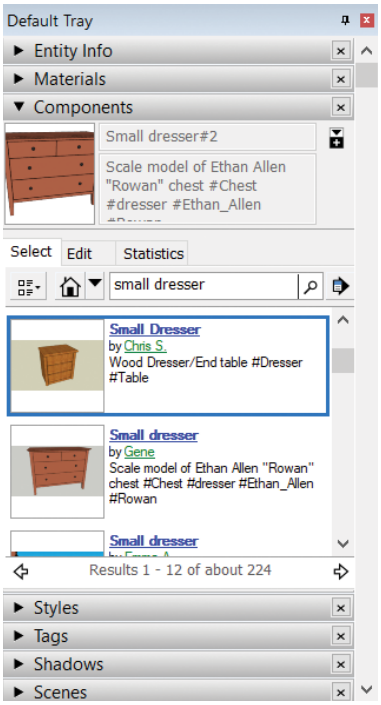


Figure 5-48: Use the search field to find Warehouse components.

click the *Details* arrow and choose *View in 3D Warehouse* (Figure 5-49). You'll be taken directly to a Warehouse page with the same search results, which makes browsing the individual components easier.

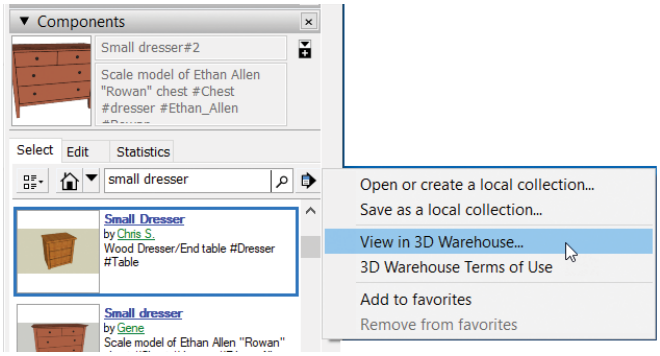


Figure 5-49: Click the *Details* arrow for a fly-out menu.

I imported storage cabinets for under the bed and a poster (Figure 5-50). The poster is an image, and flashed when put against the wall. I opened its editing box and push/pulled it out a bit to give it thickness and stop the flashing (5-51).

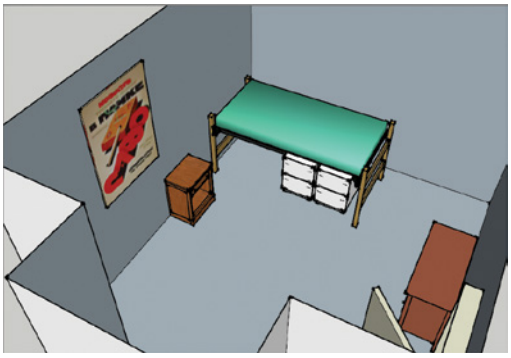


Figure 5-50: The dorm room with imported furniture.

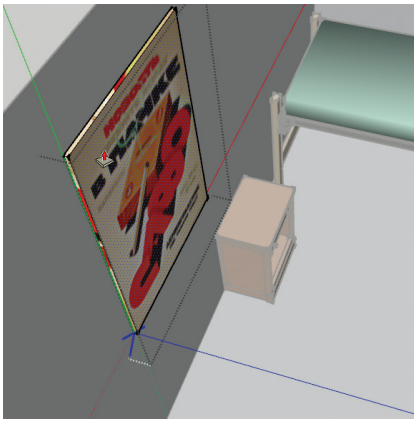


Figure 5-51: Thickening an imported image.

Copy and Paste Between SketchUp Files

You can copy and paste components from one SketchUp file to another. Open both files. You must click the second file open from the SketchUp icon to open two instances of the software. Merely clicking **File>Open** will close the active file.

Select the item to copy in the first file and press **Ctrl C** (copy). Click on the second file, activate the *Select* key, and press **Ctrl V** (paste). On a Mac, press **Command C** and **Command V**. Alternatively, go to the **File** menu and click **Edit>Copy** in the first file and **Edit>Paste** in the second. Cutting and pasting works on geometry within a file, too.

Paste In Place

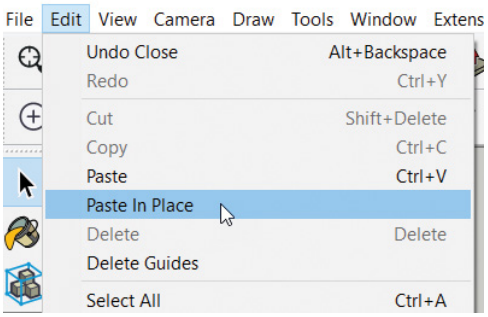


Figure 5-52: The *Paste In Place* function.

Simple pasting puts the content anywhere in the active SketchUp file. The **Edit** menu has a cool feature called *Paste In Place* (Figure 5-52) that puts an item in the same location it was cut or copied from. This is great for moving items that are outside a group/component into it while preserving the location. Because groups/components and loose geometry can occupy the same spot, a common error is to inadvertently make edits outside a group/component's shell instead of opening the bounding box and editing inside it. Relocate geometry to the same place inside the group/component by selecting the geometry, clicking **File>Cut**, opening the group's bounding box, and clicking **File>Paste** in Place.

Here are a couple more tips. Go to **File>Import**, set the *Files of Type* field to SKP and navigate to the file you want to import. This brings the whole file into the open one. You can also drag that file's desktop icon into the open file. Large files will take a while to import.

See All Components Loaded in the Model with the *In Model* Icon

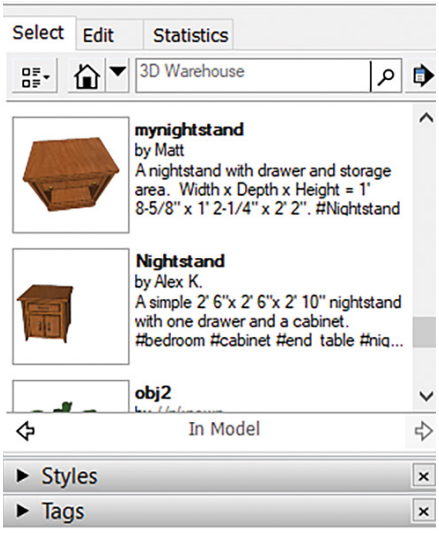


Figure 5-53: Click the house icon to see all components in the model.

Once downloaded, a component remains in the file even if you delete it from the model. At **Window>Components** we clicked the dropdown arrow to see the *Construction* and other component collection folders. To only see components that have been loaded into the model, click the *In Model* icon; it's the house (Figure 5-53). Every component added to the model through any method—downloading, importing, making it yourself, cutting and pasting—shows up here. You'll probably return to this window often to purge or retrieve components.

Purge and Delete Unused Components

Unused components increase the file size, so get rid of them. Click the *Details* arrow on the *Components* browser and choose *Purge Unused* from the fly-out menu (Figure 5-54). Purging removes all unused components from the file.

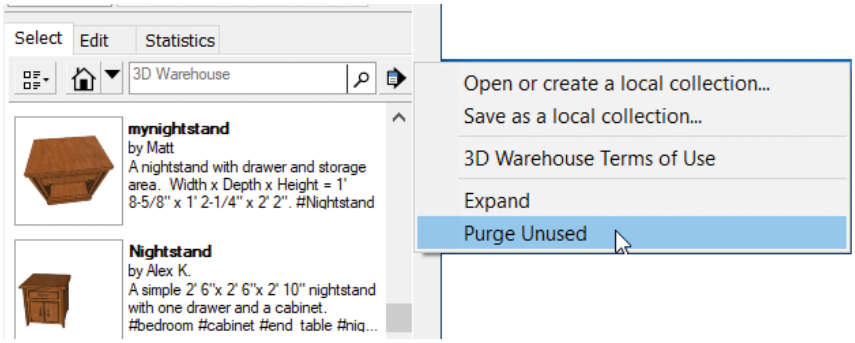


Figure 5-54: Purge unused components.

You can also right-click on a component and choose **Delete**. That removes the component from the file and from the SketchUp software. Deleting components is a useful way to get rid of unneeded blocks that were part of an AutoCAD import. If you think you might reuse purged or deleted components for a different project, make a local collection for them.

Make a Local Collection and Link It to the *Components* Browser

A local collection is a folder on your computer in which components are kept. You can link this folder to the *Components* browser for easy access to its contents each time you open any SketchUp file. Here's how.

1. Click the arrow in the upper-right corner of the *Components* browser to open the secondary (bottom) pane (Figure 5-55). It looks just like the top pane. However, you can create your own collection folders in this pane and drag components from the top pane down into them.
2. Make a new folder on your desktop and call it *My Components*. Then click the *Details* arrow and choose *Open or Create a local collection*; on the Mac choose *Create a new collection* (Figure 5-56).

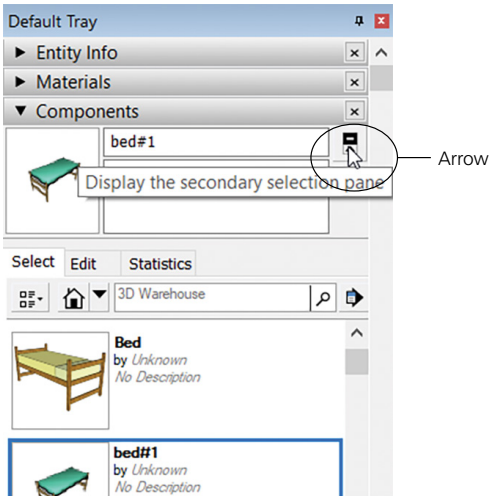


Figure 5-55: Click the arrow to open the bottom panel.

Navigate to the *My Components* folder that you just made. Select it and click the *Select Folder* button (Figure 5-57). That collection is now open in the lower pane. Populate the

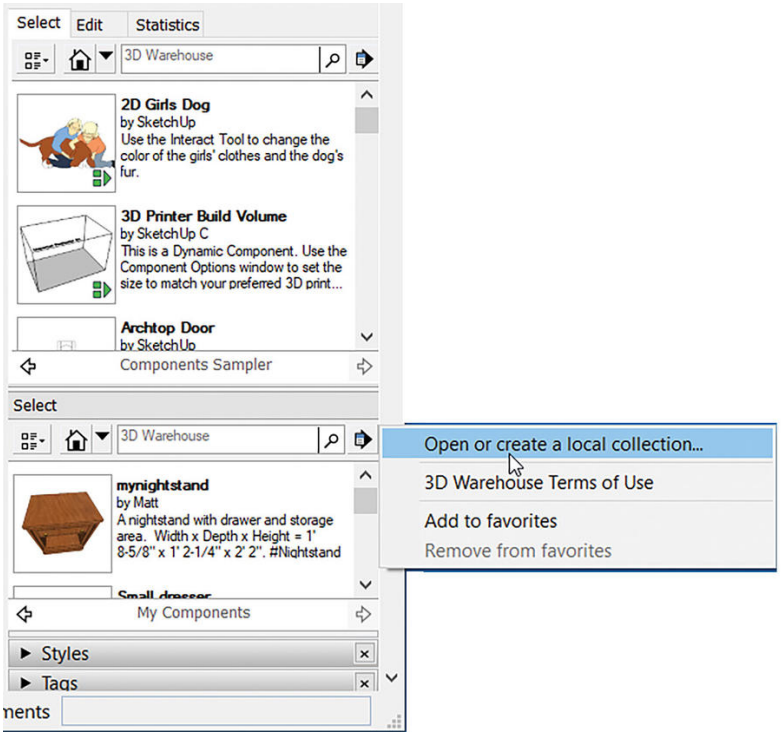


Figure 5-56: Click the arrow and choose *Open* or *Create a local collection*.

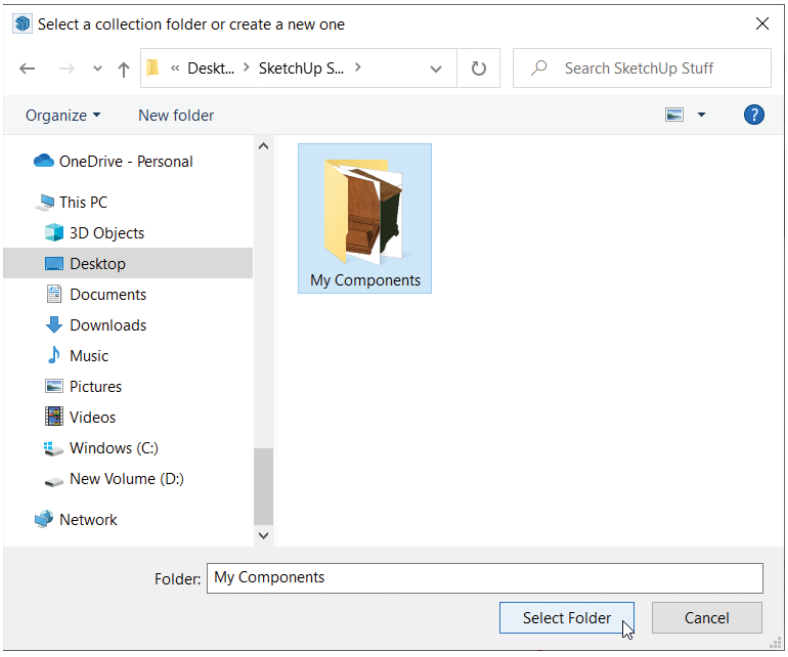


Figure 5-57: Navigate to the *My Components* folder and click *Select Folder*.

folder by dragging components into it (Figure 5-58). Open the folder on the desktop to verify that the components are, indeed, in there now.

Right-click on the *Details* arrow in the lower pane and choose *Add collection to favorites*; on the Mac choose *Save as a local collection*. When you click the dropdown arrow, the *My Components* folder will appear, too (Figure 5-59).

Eventually you'll want to make local collections for different categories, such as rugs, tables, and lighting fixtures. You can even save searches as a collection. Type search terms in the components search field, hit **Enter**, and after results are returned, click the *Details* arrow and choose *Add to favorites*. Your search will appear with all the other collections. To remove a collection, select it, click the *Details* arrow again, and choose *Remove from favorites*.

> Tip: If you can't drag components from the top to bottom pane or make local collection folders, your permission settings may be locked.

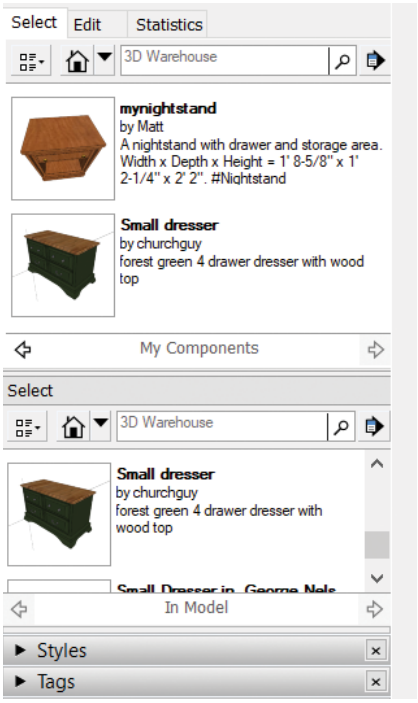
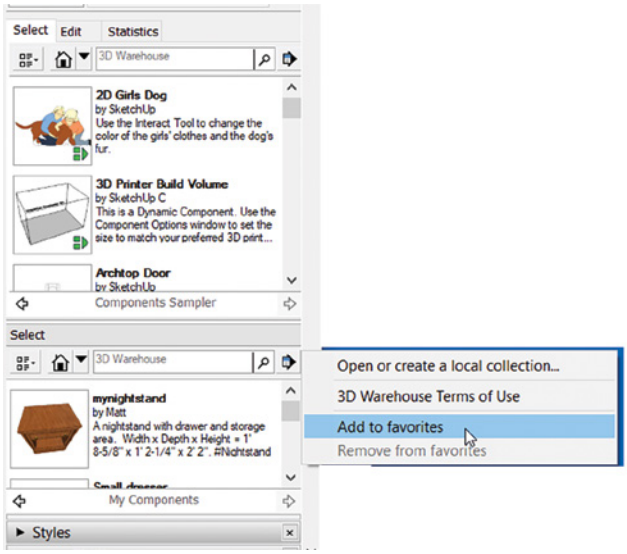


Figure 5-58: Drag components from the upper pane into the lower pane.



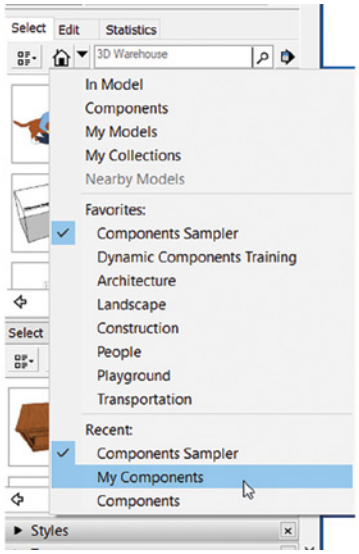


Figure 5-59: Add your local folder to Favorites.

Create Plan and Elevation Views

If you prefer to study the model in orthographic views, you can. When we imported the JPG plan of the cottage, we clicked on the **Views** toolbar's *plan* icon for a plan view. However, what we're getting is an aerial perspective (Figure 5-60).

Make an orthographic top view of the model by clicking **Camera>Parallel Projection** (Figure 5-61) and using it in tandem with the **Views** toolbar.

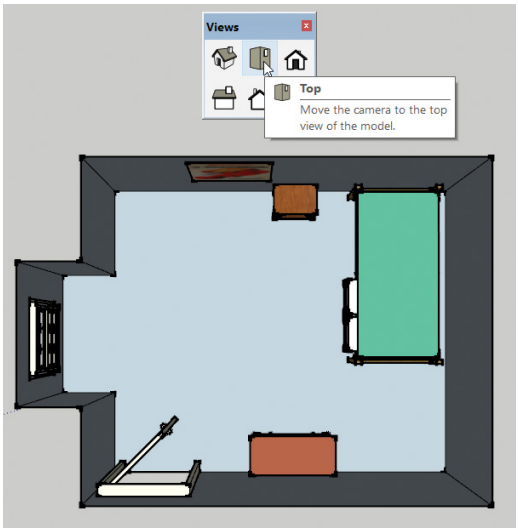


Figure 5-60: A model in *Plan* appears as an aerial perspective.

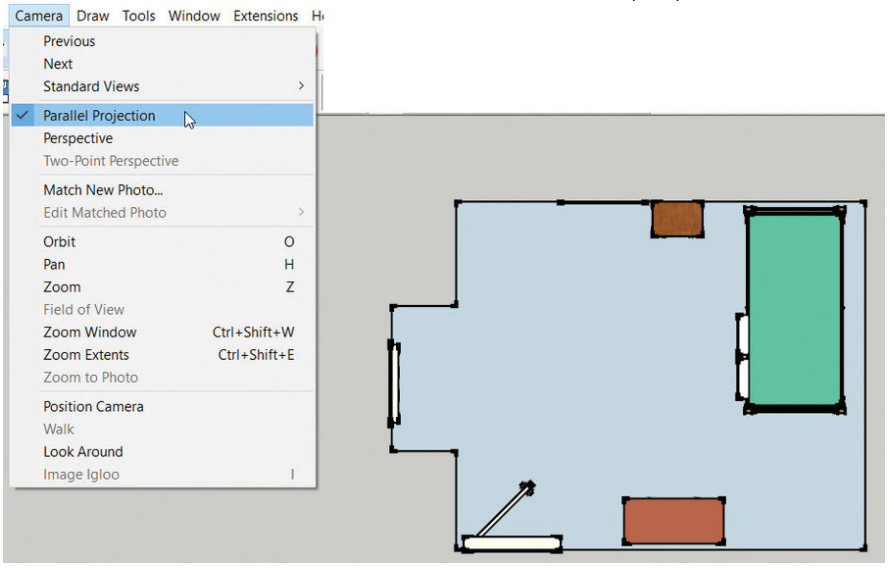


Figure 5-61: **Camera>Parallel Projection** and the *Plan* icon creates an orthographic view.

The other **Views** icons yield exterior elevation views, so a workaround is needed to obtain an interior elevation view. One way is to hide the wall opposite the one you want an interior elevation of (Figure 5-62). To finesse the location where the elevation view is made, use the *Section* tool.

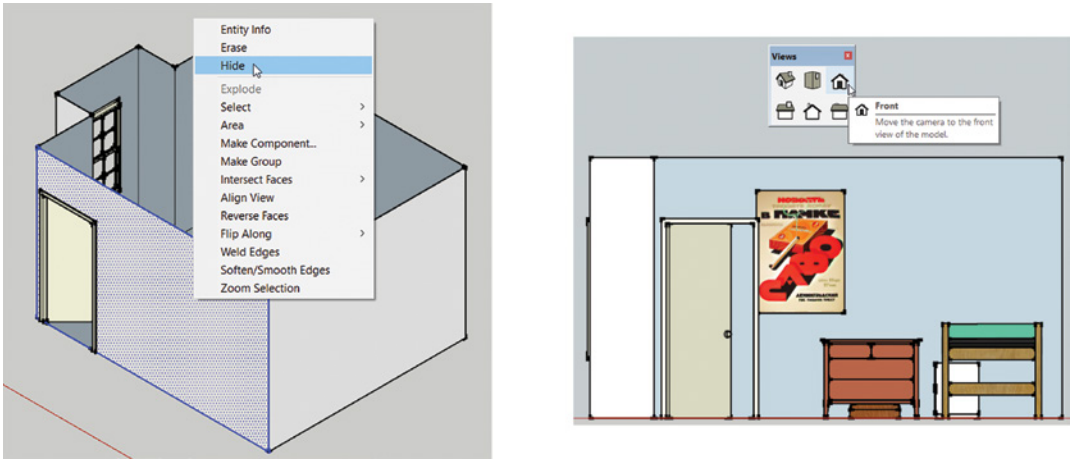


Figure 5-62: Hide a wall to obtain an interior elevation.

The *Section* Tool

Figure 5-63: The *Section* toolbar.

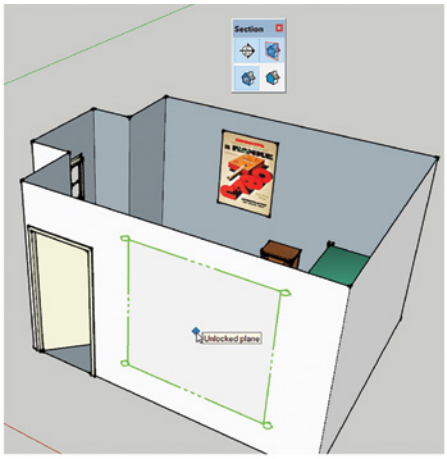
Activate the *Section* toolbar (Figure 5-63) at **View>Toolbars>Section**. It creates cut-through views of the model. It doesn't cut the model; it just displays a view of the cut. There are four icons: one draws the plane; one toggles the plane on and off; one toggles the cut on and off; and one toggles section fill on and off.

Click on the first icon and place the cursor on the wall you want to remove from the cut (Figure 5-64). Name the cut in the dialog box. Move the plane to the desired location and click in place. You can lock its orientation in place with the arrow keys. Toggle both the cutting plane and the cut part on and off with the other icons. To change the cut's location, select it and use *Move*. To change the plane's direction, select it and use the *Rotate* tool (Figure 5-65). To remove a section plane, select and delete it.

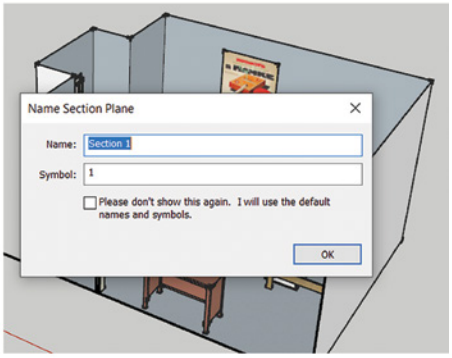
Make a Section Cut with *Create Group* from *Slice*

You can make multiple section cuts in a model (Figure 5-66), but only one will be active at a time. A workaround for making simultaneously active planes is to group the model with a section plane and then create another section plane outside the group. Grouping the model and applying the *Section* tool inside the group's bounding box is useful if you have other models in the file, because otherwise the section plane cuts through everything.

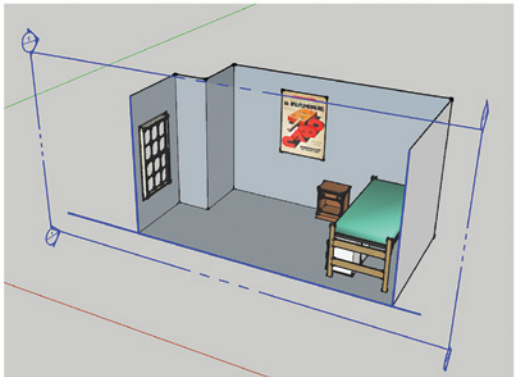
Actual cuts in the model can be generated from section plane views. Select a plane, right-click on it, and choose *Create group from slice*. This makes a cut at the insertion location (Figure 5-67). If you made the plane cut inside a group, you'll need to open the group's bounding box for the *Create group from slice* option to appear.



1.



2.



3.

Figure 5-64: Creating a cut with the *Section* tool.

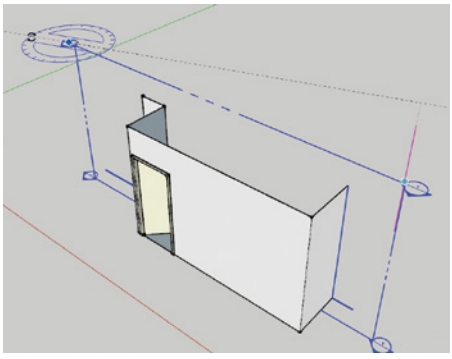


Figure 5-65: Use *Rotate* to change the plane's direction.

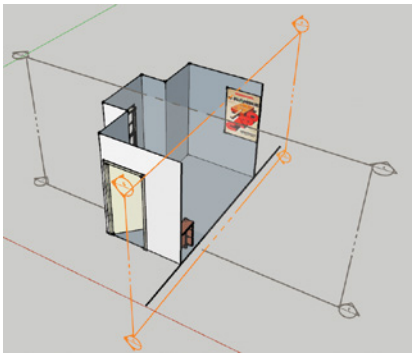
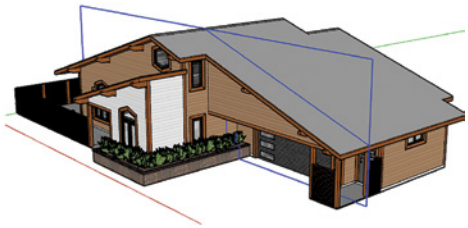
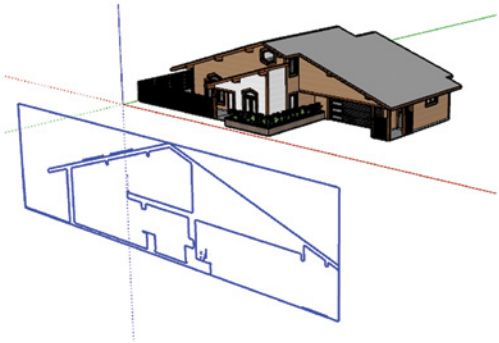


Figure 5-66: Multiple section cuts in a model.

1.



2.



3.

Figure 5-67: Creating a cut from a section view.

The cut is a group that can be removed or exploded in place. Removing enables further development. Exploding severs the model in two, enabling separate editing of each part (Figure 5-68).

Model a Building from an AutoCAD (DWG) Plan

So far, we've drafted floor plans from imported raster files. You can also import a DWG or DXF file, which becomes SketchUp geometry upon import. This is a common design workflow (Figure 5-69).

You don't need AutoCAD software installed on your computer to import a DWG file into SketchUp. However, a DWG file needs preparation before import for best results, and optimally this is done within AutoCAD. Simpler files need less preparation than data-rich ones that have lots of layers and line weights, and you probably don't need to do everything on the following list, but all can make a difference. As with a Warehouse model, it's best practice to import a DWG or DWX file into a new SketchUp file before bringing it into your open model to ensure it isn't problematic.

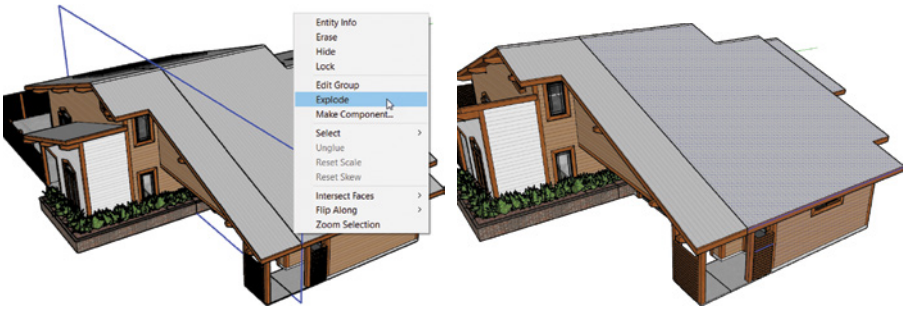


Figure 5-68: Exploding a slice severs the model in two.

Figure 5-69: This office was modeled in SketchUp from an imported AutoCAD plan. Courtesy **mkerrdesign.com**.

Prepare a DWG File for Import

- Import files smaller than 15MB. Larger files either take a long time to import or fail to import. If the file is larger, consider breaking it into smaller files. For example, one file can have a site plan, and another can have a floor plan.
- Copy and paste the plan into a new AutoCAD file. This keeps stale metadata from importing into SketchUp.
- Run the *PURGE* and *AUDIT* commands to clean up any old data that did enter the new AutoCAD file.

- Import only necessary geometry. Delete text, dimensions, hatch lines, x-references, layers, and any "smart" items (ADT or ARX objects). Delete anything with no 3D relevance, such as door and window symbols and furniture blocks, unless you want to use them as references.
- Explode all polylines, arcs, and filleted lines. Also erase any construction objects, such as points created where lines were divided. These often import as artifacts (bits and pieces of geometry).
- Remove all textures, x-referenced and imported files, colors, and dynamic blocks. These may cause problems upon import.
- Ensure that lines connected at endpoints are indeed connected. This is especially important for lines that define surfaces you plan to model.
- Run the *Units* command so you know what the units are. Scale the file to 1:1 if it isn't scaled to that already. SketchUp 2018 and later enables you to scale the model using the CAD file units.
- Save the AutoCAD file as release 13 or 14, as best import results are obtained with those.
- Locate the plan at the origin.

Import a DWG File of the Cottage

Let's import the AutoCAD file shown in Figure 5-70.

1. Click **File>Import**, navigate to and select the DWG file. Make sure that either *AutoCAD Files* or *All Supported Image Types* is visible in the Files field. Then click the *Options* button (Figure 5-71).
2. In the *Options* dialog window, check the first two boxes (Figure 5-72). They tell SketchUp to remove triangulated lines from planes and to orient faces uniformly. Set the *Units* field to the AutoCAD plan's units. Meaning, if the plan's units are feet, set it to feet. If the AutoCAD plan's scale and this field's scale are different, the plan will not enter SketchUp correctly scaled. If you don't know the units, choose *Model units*, and SketchUp will turn one CAD unit into 1″ in SketchUp. Alternatively, use a large unit type, such as feet or meters, and then resize the plan after import.

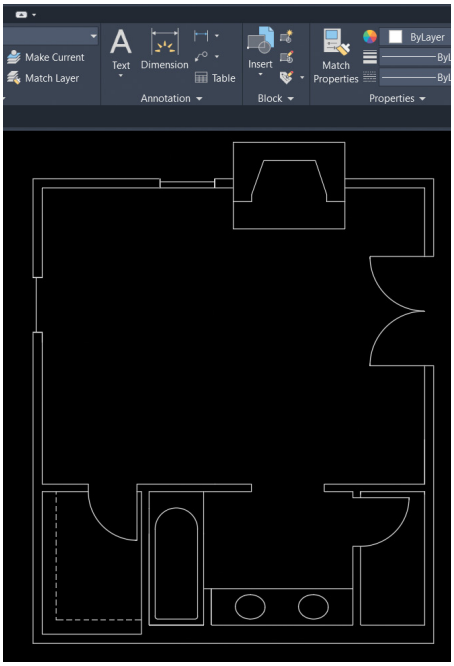


Figure 5-70: AutoCAD file simplified for import.

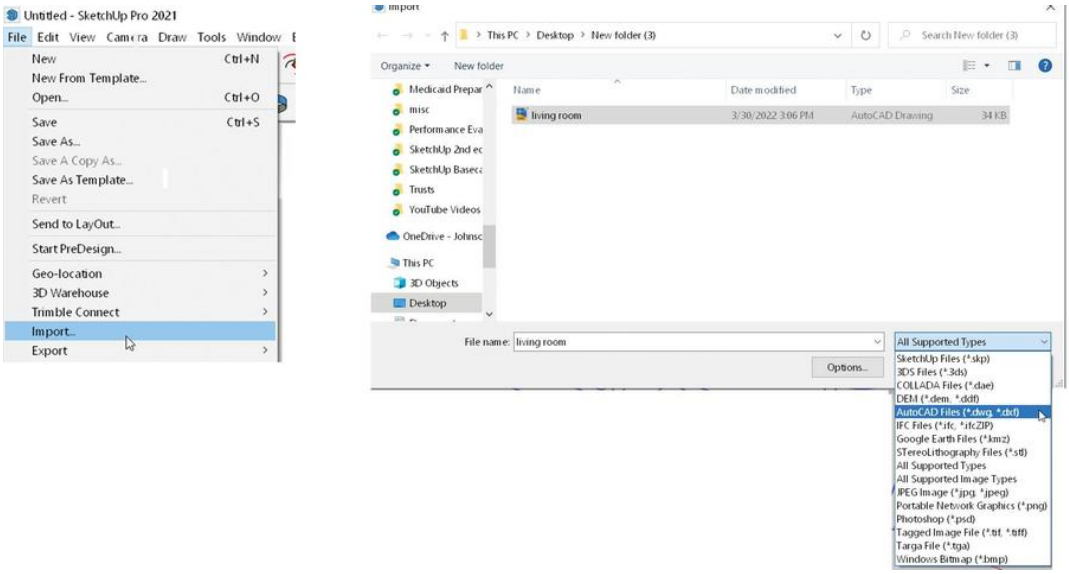


Figure 5-71: Locate the file to import.

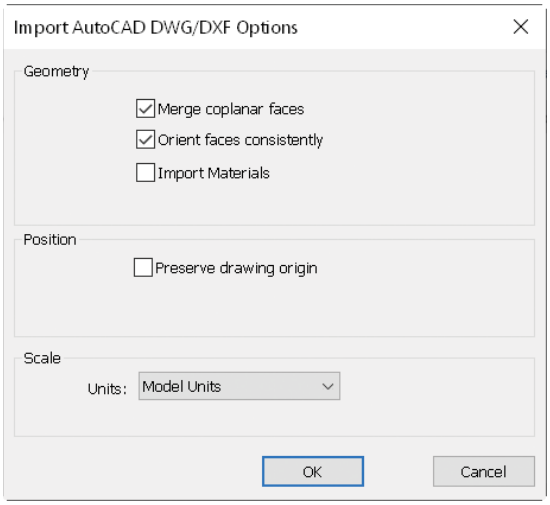


Figure 5-72: Set the options.

Uncheck the *Preserve drawing origin* box. SketchUp will then place the imported plan at the origin. If the plan is placed elsewhere, "clipping" may occur, a glitch that causes part of the plan to disappear. Then click *OK*.

3. Click *Open* to import the DWG file into SketchUp. A box appears showing the specific data imported. Click again and ta-da! The imported DWG file is now SketchUp geometry. It imports as a component, so right-click and choose *Explode* (Figure 5-73). If needed, scale the plan to its correct dimensions with the *Tape Measure*.

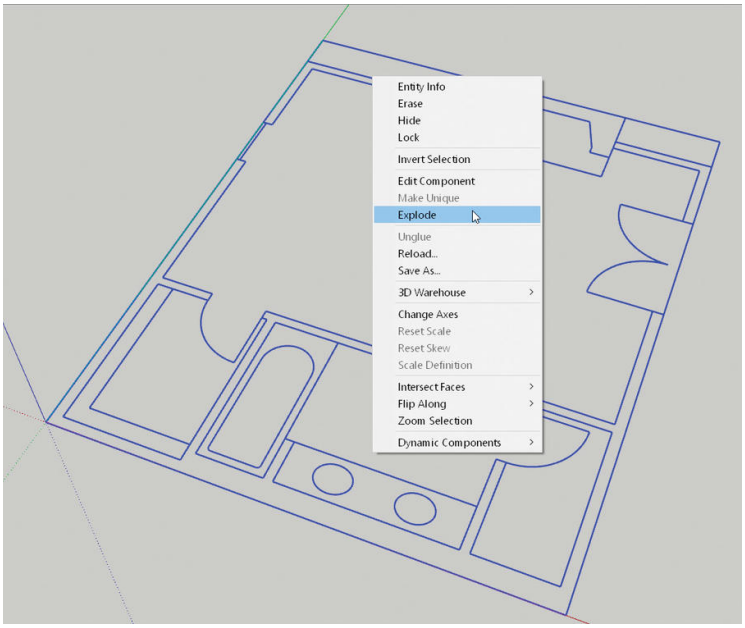


Figure 5-73: The imported DWG file.

Some clean-up can be done on the AutoCAD file up after import. Delete unneeded geometry by selecting and erasing. Delete unused data at **Window>Model Info>Statistics** and click the *Purge Unused* button at the bottom (Figure 5-74). If any AutoCAD blocks came into the file, find them in the *Components* tray and delete them there.

Model the DWG File

Erase unneeded geometry and turn walls into faces by tracing over them with the *Pencil* or the *Rectangle*. You'll probably have to do this separately for the walls and interior spaces (Figure 5-75). There's an extension called S4U Make Face that can help. Extensions are discussed in Chapter 9.

Push/pull the walls up (Figure 5-76). Create heads over doors and windows with the *3-Point Rectangle* and *Push/Pull* tools (Figure 5-77).

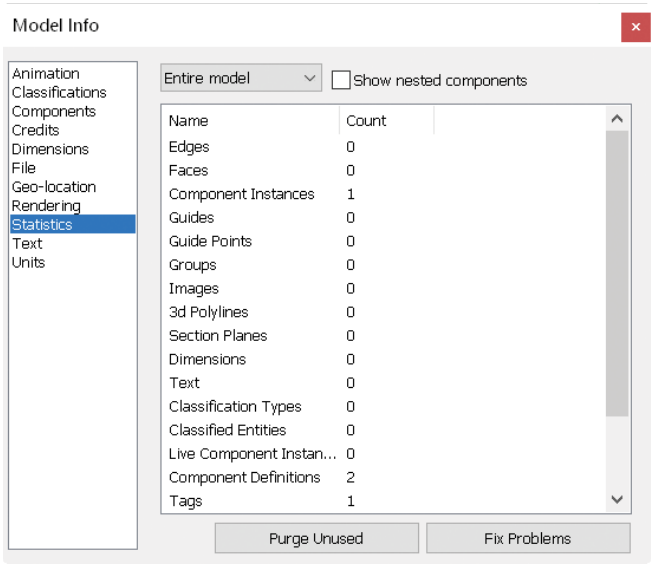


Figure 5-74: Purge unneeded data that came in with the AutoCAD file.

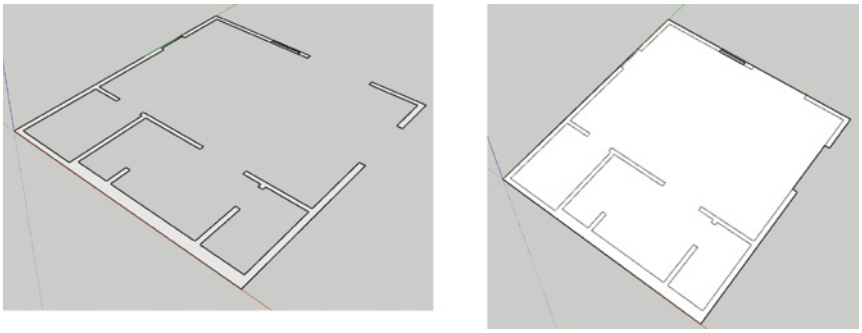


Figure 5-75: Trace the plan to create faces.

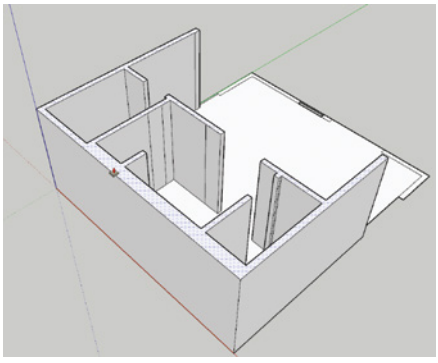


Figure 5-76: Push/pull the walls up.

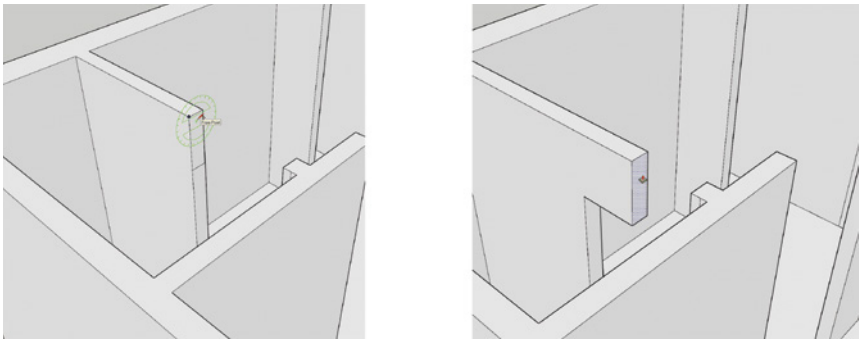


Figure 5-77: Make door heads with the *3-Point Rectangle* and *Push/Pull* tools.

Export the File

You can also import SketchUp files *into* AutoCAD. All exported plans, elevations, and sections keep their true scale, and components and layers stay intact. Units default to inches. Go to **Export>3D Model** and export as a DWG or DXF file. There's also a DAE option (Figure 5-78), which enables exporting the SketchUp model to other 3D programs such Maya, 3DS Max, and Blender.

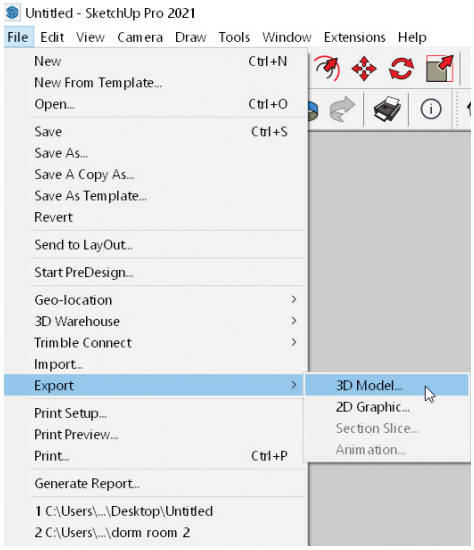


Figure 5-78: Export an SKP file to import into other programs.

Interact with Revit, 20-20, and Chief Architect

You can import SketchUp models directly into Revit and 20-20. Import a Revit model into SketchUp by exporting the RVT file as a DWG or DXF file, and then importing that file into SketchUp. Import 20-20 models into SketchUp by exporting the KIT file to a DXF file, and then importing the DXF into SketchUp. Import SketchUp models directly into Chief Architect; import Chief Architect files into SketchUp as 3DS Max files. A lot of cleaning up for all will probably be needed.

"Clipping" (Disappearing Geometry)

Clipping is a glitch that causes faces to partially disappear when orbiting and zooming. Clipping occurs when geometry is very small or very large or when it's located far from the origin, common with a DWG import. Fix by clicking *Zoom Extents*, and then move the geometry to the origin.

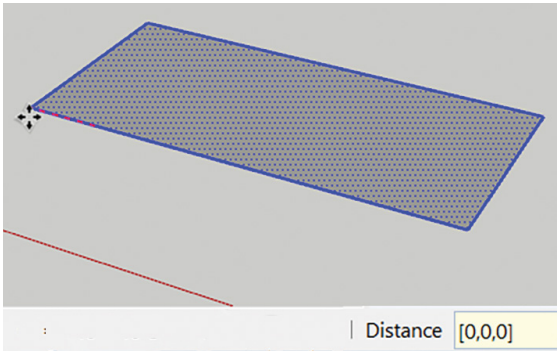


Figure 5-79: Type coordinates to move geometry.

Figure 5-80: The *Text* tool.

Move Geometry with Coordinates

To move a far-away piece of geometry to the origin, select it, click *Move* on a ground-plane corner, move the geometry a bit, and type [0,0,0] (include the square brackets). Then hit **Enter**. (Figure 5-79). The selected geometry will snap there.

This technique also moves distant pieces of geometry together. By now you've probably experienced the difficulty of moving two far-apart or non-aligned items. The next time that happens, click the *Text* tool (Figure 5-80) on a corner of one item to see its coordinates. Select the other item, activate *Move*, grab a bottom corner, type those coordinates in square brackets, and hit **Enter**. The item will snap to, or near, the coordinate location.

Add Tags to Control Visibility

Tags are an organizational tool. You create and assign geometry to them, then turn them on and off to control the geometry's visibility. This is useful when viewing or modeling something that is obstructed by something else. The turned-off geometry also speeds up regeneration time. Tags let you present different design options for one space, which we'll discuss in Chapter 8.

Click on the *Tags* tray, click on the plus sign to create a tag, and name it. Select geometry to put on it through the *Entity Info* box. In the *Entity Info* box, click the dropdown arrow until the new tag appears, and click on it. The selected geometry is now on that tag, and by clicking the eye in the *Tags* tray, you can turn its visibility on and off. The pencil graphic on the far right of a tag indicates that tag is current, meaning everything you draw will go onto that tag. You can't make the current tag invisible.

Only put groups and components on any tags you create, not edges and faces. This will make it harder to "lose" pieces of geometry or deform them. All loose geometry should be on the "Untagged" tag at the top of the list. You cannot rename this tag. You can click the *Pencil* on any tag to make it current, but experienced SketchUp users keep the default Untagged tag current because organizational problems occur when others are made current. When a tag is turned off, only visibility is affected; the geometry on that tag is still attached to geometry on other tags. You'll deform your model by forgetting about geometry on invisible layers.

Delete a tag by right-clicking on it and choosing **Delete**. A window will appear asking if you want to move its items to another tag or just delete them.

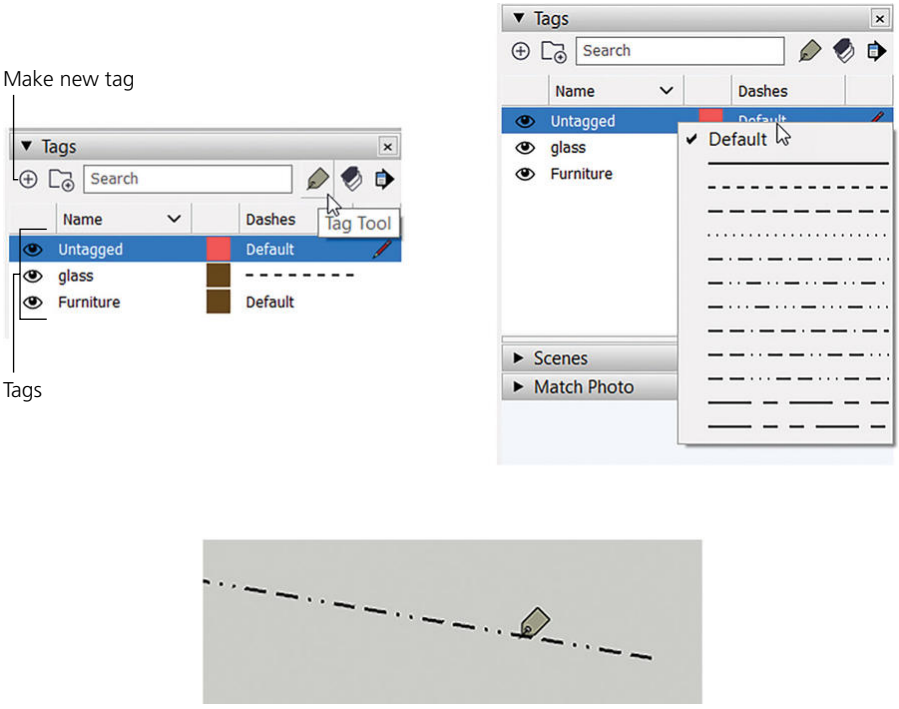


Figure 5-81: Change line type with the *Tag* tool.

Change Line Type with *Tag*

Click on the *Tag* icon and then click it onto a named tag to bring up line type choices (Figure 5-81). Click on the line type you want. Then click on a line in the model with the *Tag* icon and that line will change to the chosen line type.

Modeling Tips

- Reconstruct a broken face by tracing the face's perimeter. If the face won't fill, review Chapter 4 for possible causes.
- Inference-match to obtain line lengths, watch for inference tooltips when connecting the lines, and draw along the axes. Hold the **Shift** key down to lock the *Pencil* and *Move* tools along the axes.
- If geometry is in an awkward location to modify, cut and paste it somewhere else on the screen, work on it there, and then move it back.
- Make a copy of the work and try different modeling techniques on it. For instance, if drawing multiple parallel lines is problematic, select one already drawn and copy it to other locations.
- If something goes wrong, *undo* is your friend.

Model a Sloped Roof with the *Protractor* Tool

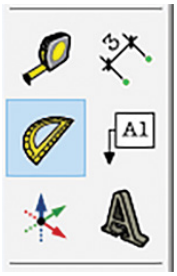


Figure 5-82: The *Protractor* tool.

Want a sloped ceiling? Group the whole house so the roof doesn't stick to it. Then activate the *Protractor* tool (Figure 5-82). It measures angles and creates angled guidelines.

The protractor aligns with the plane it is on. Click the protractor onto the appropriate plane; click it again; move the protractor until the angle you want appears (read it in the *Measurements* box); click a third time to lock that angle in place (Figure 5-83). When the cursor is close to the protractor, it snaps to 15° increments. When the cursor is farther away, it moves more smoothly and precisely. The protractor leaves a guideline at the angle specified.

After you set the angle, trace over the guideline with the pencil. Then push/pull the roof's shape to give it volume (Figure 5-84). From the inside the roof will look like a sloped ceiling.

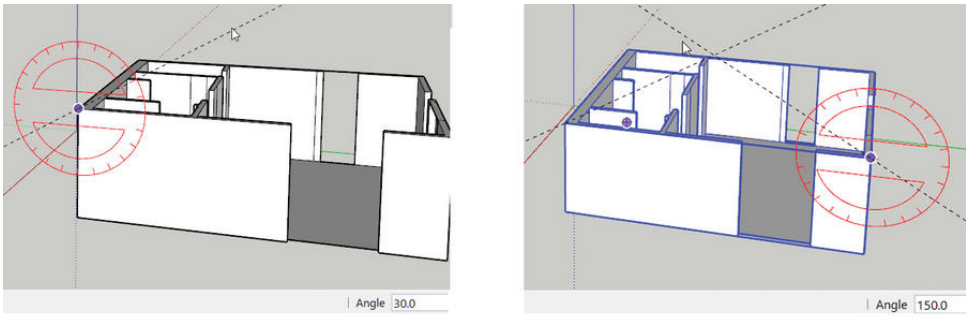


Figure 5-83: Setting a roof angle with the *Protractor*.

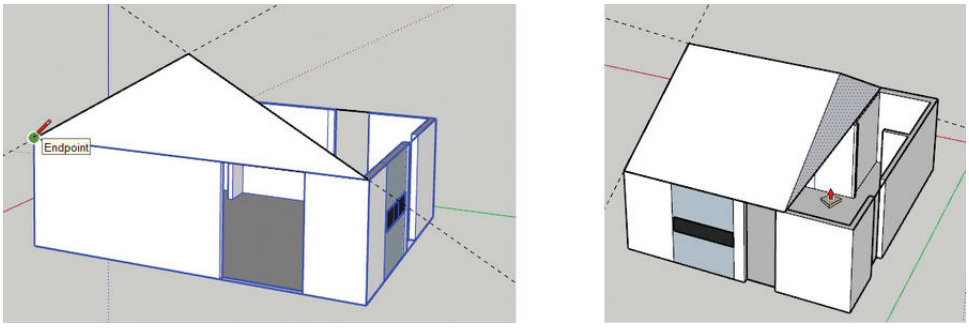


Figure 5-84: Trace and push/pull the roof.

To measure an angle with the protractor, click it on an endpoint; click it under the other endpoint, and then click on the opposite endpoint (Figure 5-85).

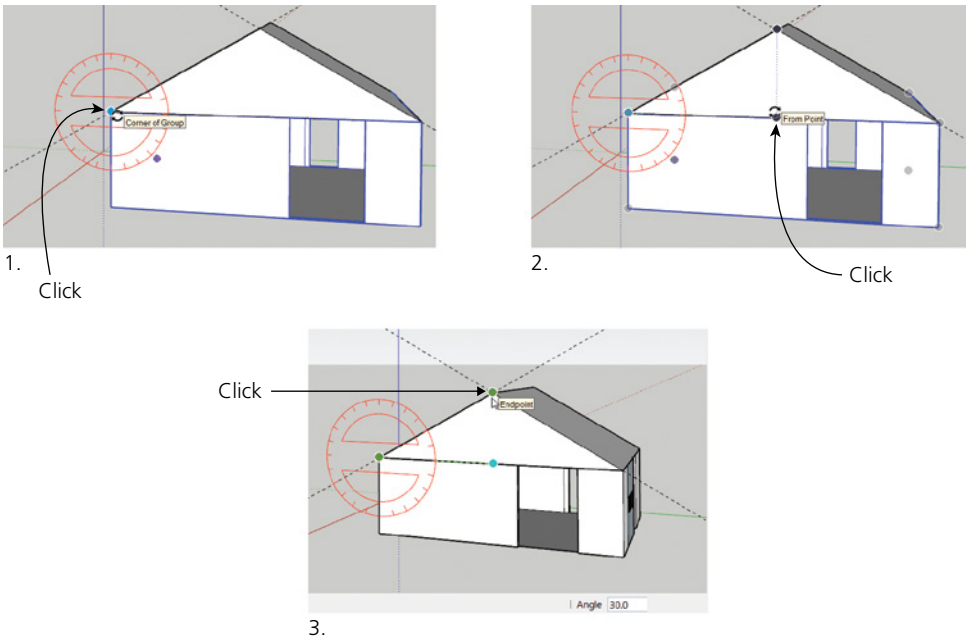


Figure 5-85: Click three times to measure an angle.

Geo-locate a Model

SketchUp can place the model in its geographical location with online digital information. *Geo-location* is helpful for shadow studies and presentations. The *Geo-location* function imports both 2D imagery and 3D contours, if available. Here's how to access it.

1. Click on **File>Geo-location>Add location**. A map will appear (Figure 5-86).
2. Zoom into the area you want or type an address. Select a region by drawing a window around it. Choose a digital imagery provider (I chose Digital Globe) and click the *Import* button (Figure 5-87).

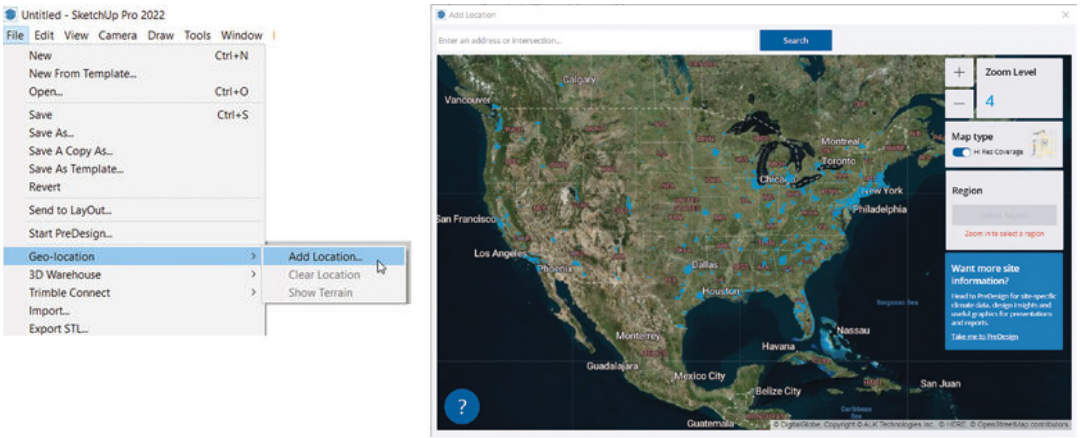


Figure 5-86: The *Geo-location* function.

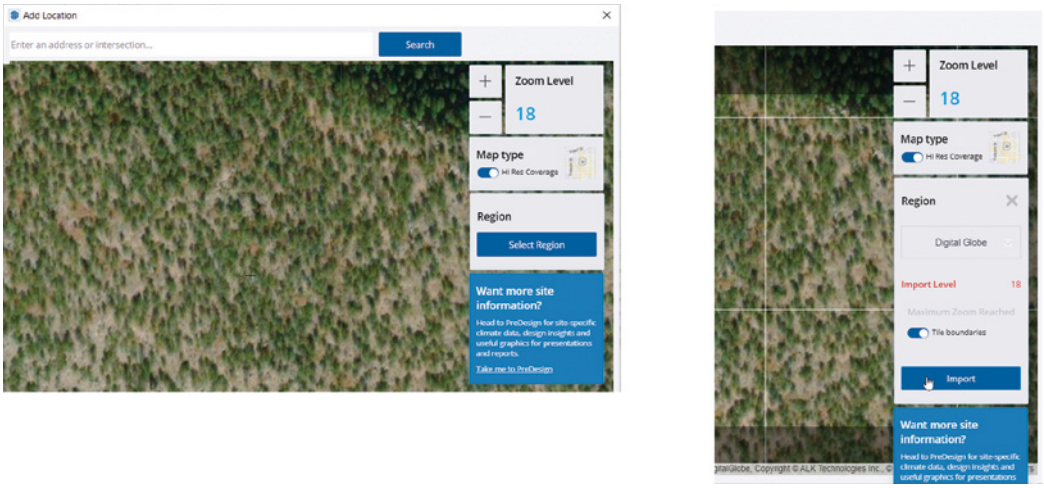


Figure 5-87: Select the region to import.

The terrain comes in as a flat raster file. Open the *Tags* tray and you'll see there are two tags. Turn off the *Location Snapshot* tag and turn on the *Location Terrain* tag to get the result in the bottom graphic of Figure 5-88.

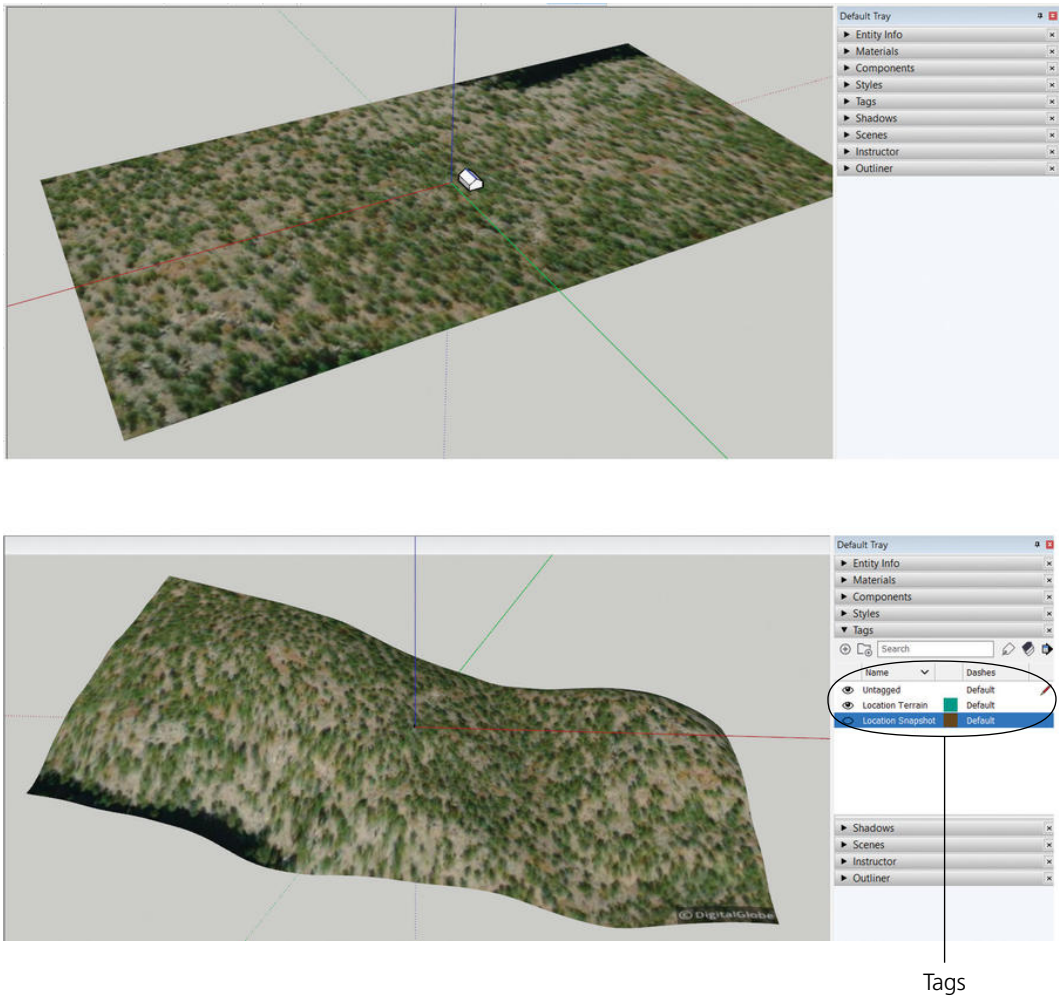


Figure 5-88: The imported terrain.

Fun Exports and Imports

You can place your model on Google Earth. This is a 3D site of the whole globe built on satellite imagery, aerial photography, and Geographical Information Systems (GIS) data, and lets you view cities and landscapes from all angles. Export the SketchUp model as a Google Earth (KMZ) file at **File>Export>3D Model>Google Earth File**. Then open Google Earth, go to **File>Open**, navigate to the KMZ file, and bring it in. The model will appear correctly located and oriented in Google Earth.

Do you design video game assets? Import and export Collada (DAE) files, which are used in games. If you extract a character as a DAE file from a game, you can import it into SketchUp.

Is SketchUp Running Slow?

By now you may have experienced SketchUp slowdowns, freezes, and display abbreviations, where bounding boxes are shown instead of components, and details/textures lost. Assuming your computer's RAM, processor speed, and graphics card meet minimum standards, slowdowns are caused by bloated geometry, which means an excessive number of polygons (the plane figures that make up a SketchUp model). This isn't necessarily the same thing as a large file size. A large file size can reflect bloated geometry, and indicates complexity, but it's possible to have a small file size and a large polygon count (the number of polygons in a model).

Check file size by right-clicking the model's desktop icon and choosing *Properties*. The Warehouse doesn't accept uploads larger than 100 MB so use that as a guide.

Make SketchUp Run Faster by Keeping the Polygon Count Down

SketchUp calculates each polygon when you pan, orbit, and zoom, so keep the polygon count down. Be cognizant of how much geometry the shapes you create have. Figure 5-89 shows two cylinders with the hidden geometry option turned on. The left is made with the default 24 sides, the right with 12 sides. While the left one looks smoother, it has more geometry. If the circle isn't important, will 12 sides suffice?

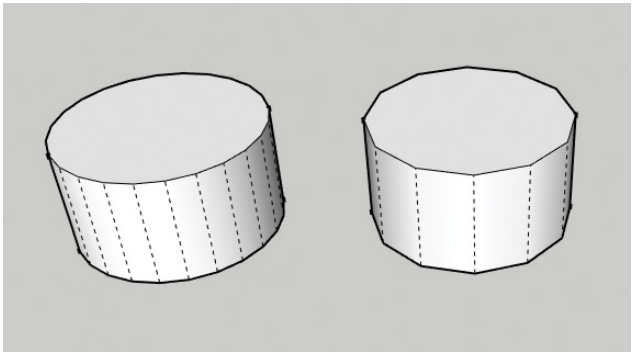


Figure 5-89: The smoother circle has more geometry.

SketchUp also makes hidden lines when autofolding, creating curves, and using *Follow Me* (the path line gets left behind). Some of this can be erased. Examine the model in *Hidden* and *X-ray* modes (**View>Face style>X-ray**) for extra geometry. You may find parts stuck into each other; not deliberately intersected, just stuck (Figure 5-90). Erasing them reduces the polygon count and keeps the model clean.

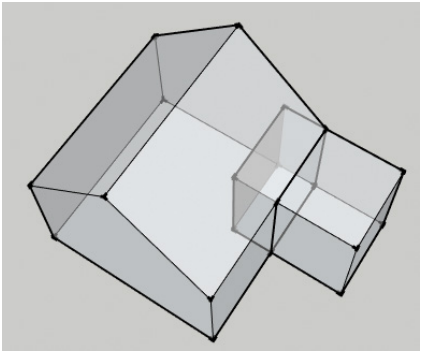


Figure 5-90: *X-ray* mode may show extra pieces.

At **Window>Model Info>Statistics** the amount of geometry is displayed. More than 100,000 edges causes slowdowns. Following are strategies to manage the polygon count and hence make SketchUp run faster.

Strategies to Make SketchUp Run Faster

- Purge unused files. In the *Components*, *Materials*, and *Styles* trays, click *In Model* (the house icon) and then click the *Details* arrow. Choose *Purge Unused* (Figure 5-91). At **Window>Model Info>Statistics**, click the *Purge Unused* button at the bottom (Figure 5-92). This removes unused materials, components, and styles all at once, as well as unused tags and stale metadata accumulated during the modeling process.

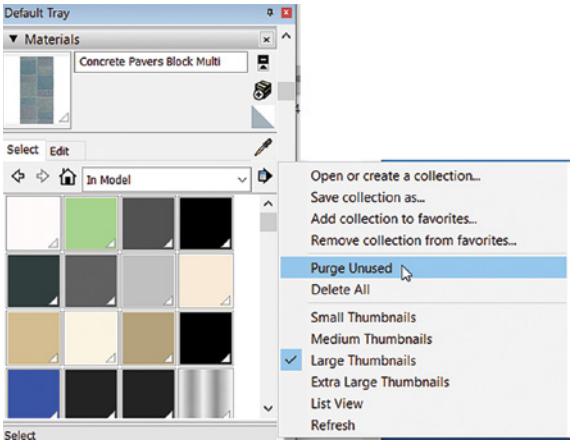


Figure 5-91: Purge unused materials, components, and styles.

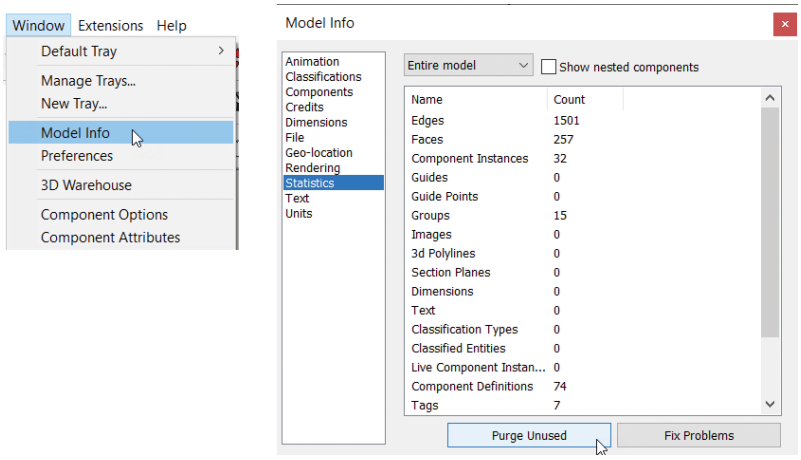


Figure 5-92: Purge everything unused.

- Use images instead of textures when only one instance is needed. Images take less space than textures. Choose JPGs or PNGs when possible, as they take the least space.
- Use appropriate sizes for imported images. Is the image a major part of the model? Must it display in high resolution? If not, cut its image size down in digital imaging software and import a smaller resolution file, such as 512k × 512k.
- Model minor items simply. A small, detailed model takes up as much file space as a large one. When zooming in to work on a small piece, it's easy to lose sight of its relative importance. But small items should be simpler than large ones, and background items even simpler.
- Download components to the desktop and purge unused/unneeded items before copying or pasting them into the model.
- Use components for multiple copies. Components take less space than groups. Use groups for single instances only.
- Model half of symmetrical items. Make it a component and copy/flip along axis to complete. This saves time and takes up less space than a fully modeled component.
- Place groups and components on their own tags and turn off the tags that aren't needed. Turned-off tags don't get calculated. Until you're ready to print, does entourage such as trees and people need to be displayed?
- Use 2D components for people, cars, and trees that always face the camera (check that setting in their editing box). If a plan view isn't needed, use 2D plants. Put them in 3D pots to look more convincing.
- Model with textures off. Textures are calculated with each pan, orbit, and zoom. Click **View>Face Style>Monochrome** after you're done painting. Make a scene with the *Shaded with textures* face style to quickly view it as needed.
- Model with a simple default style. Don't model with an elaborate style, as it takes longer to recalculate when rendering, panning, orbiting, and zooming.
- Turn off shadows while modeling. They slow the model down and are only needed when adjusting position and value, and when printing a hard copy.
- Turn off edge profiles, depth cue, and extensions at **View>Edge Style** by unchecking their boxes (Figure 5-93). All these settings are on by default but add little and slow the model down a lot. In the Styles tray, click *Edit* and set the edge color to *All the same* (Figure 5-94). Hide any watermarks—click on the fourth cube under the *Edit* tab to access watermarks (Figure 5-95).