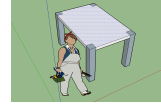


How to Make a 3D Model of a Table



Below contains instructions on how to build a 3D model using CAD (computer-aided drawing) software. Typically, CAD models are used in engineering to represent their designs in three dimensions and provide precise measurements of their design to manufacturers or parts suppliers. CAD models can also be used in a less professional setting for 3D printing the model. Over the past couple of years, 3D printers have become more common in households and schools. For this reason, it is essential that anyone wishing to 3D print, regardless of background, learns how to build a 3D model.

These instructions use Google SketchUp, a simplified version of complicated CAD software. SketchUp has even been successfully taught to young children as young as 10. For purposes of learning the basics, SketchUp can be an incredibly useful tool.

Instructions

1. Start SketchUp


Google SketchUp should be open and running, if not, select the program and open it up.


2. Get Familiar with the Toolbar

The first thing you should notice is the top panel of icons. This is where all the tools you need to design are. Move your mouse over each to see what they are. For this project we will be using select, shape tools, push pull, orbit, and pan.



Hints:

The **orbit** button allows you to change views in your  3D world

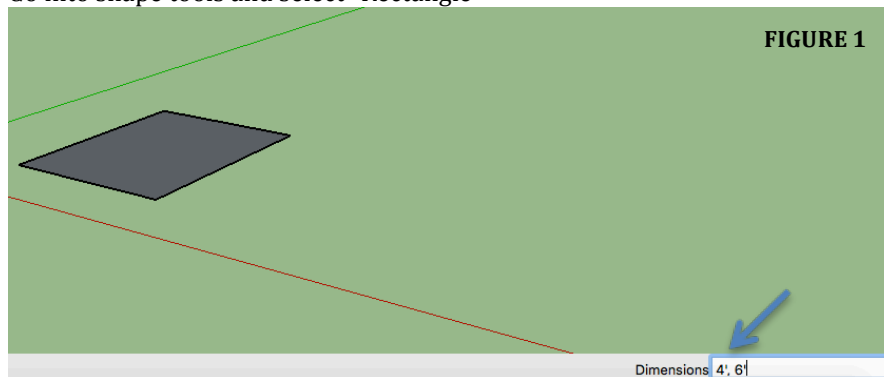
The **pan** button allows you to pan your current view 

Moving two fingers up and down the laptop's track pad allows you to **zoom in and out**.

Use keys Command+ Z on the keyboard to **undo** a wrong move you made. It is crucial that each step is done correctly or downstream errors may result.

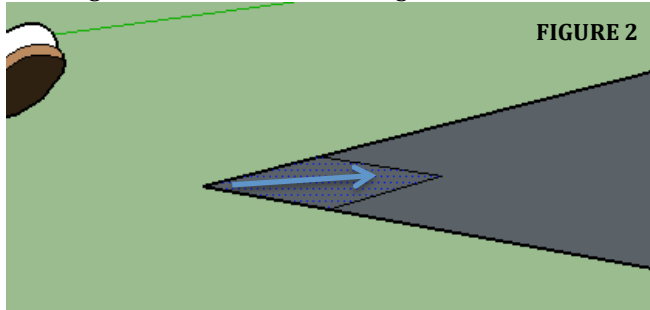
3. Create the Reference Base


- Go into shape tools and select "Rectangle"

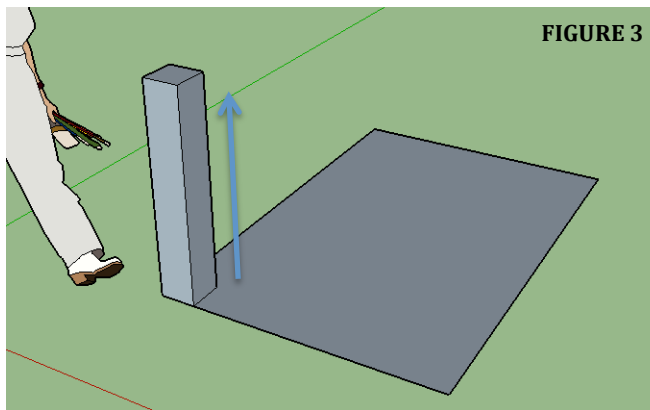



- Create a rectangle that is roughly 4 feet by 6 feet.
Hint: You can edit the current size in the dimensions box in the bottom right corner of the screen as shown in figure 1.

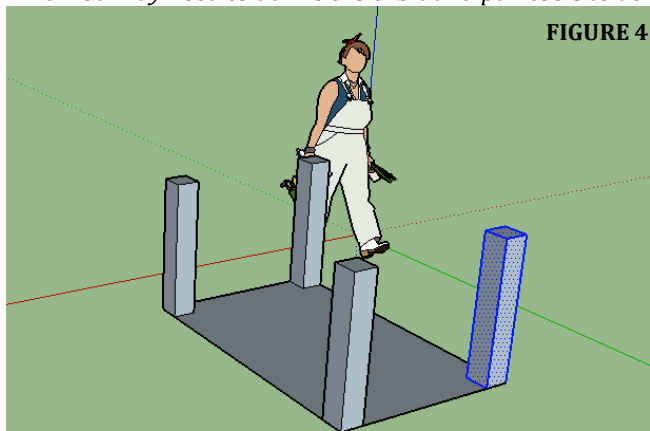
- c. Edit this box so that it says 4',6' and press enter
- 4. Create the Leg of the Table**
 - a. Go into shape tools and select "Rectangle"
 - b. Create a square at one of the corners by starting at one corner of the base and working inwards. Make the rectangle 6", 6"



- c. Select the push pull tool 
- d. Hover over the small square you just made and pull it up until it measures 3' tall. *Hint: Remember to use the measurements box. Delete any negative signs that may appear on the measurement.*



- 5. Copy the Leg**
 - a. Use your select tool to create a box around the entire leg to highlight it. 
 - b. Press command+ C on the keyboard to copy the leg
 - c. Press command + V anywhere on the screen and paste this leg at another corner of the base. Continue the process until you have all four legs. *Hint: You may need to utilize the orbit and pan tools to achieve this.*



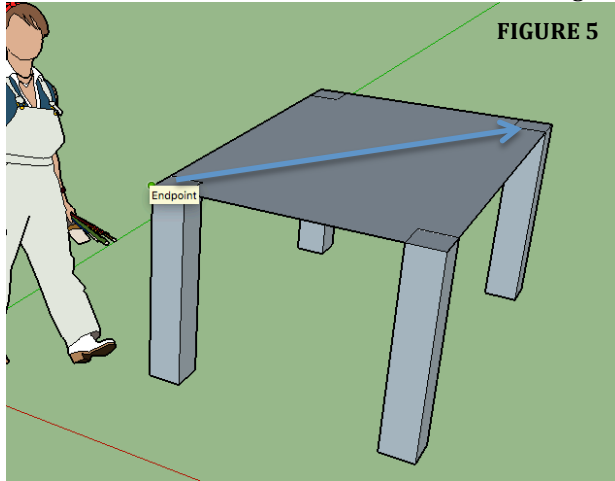
6. Delete the Base

- a. Use the select tool to select and delete the reference base that connects the legs. Make sure to delete all lines as well. 

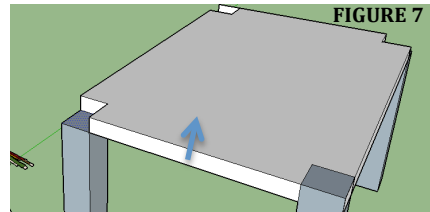
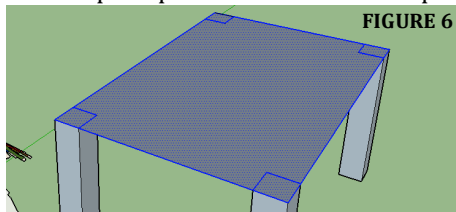
Hint: You may also utilize the erase tool to accomplish this

7. Create the tabletop

- a. Go into shape tools and select "Rectangle"
- b. Start on one outer corner and make this to the diagonal outside corner



- c. Use the push pull tool to make the top 3" thick



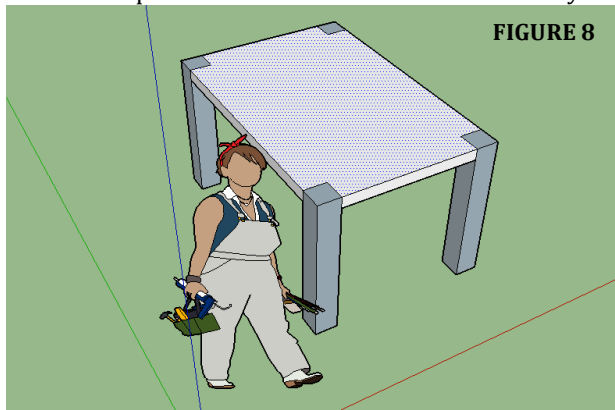
- d. Pull up each corner individually to match the entire table top

8. Save your file

- a. Select file and save as to save your file

9. Congratulations

You now have a simple table that can be modified later as you explore SketchUp.



MEMO

To: Sara Kelm
From: STUDENT
Subject: Usability Test Report
Date: April 4, 2016

Statement of Purpose

The overall purpose of this memo is to describe the progress of Unit III: Instructions and provide a usability test report. This will be accomplished by giving a brief summary and overview and also describing the methods, findings, and revision areas in further detail.

Summary of Test Findings

For Unit III, a set of instructions were created to allow the user to create a 3D model of a table by using the 3D software, Google SketchUp. By making a simple object like a table, the user is able to understand the basics of 3D Computer-Aided Drawing (CAD) software. The participants of the usability test were members of Ms. Kelm's 9:05 Technical Writing Class. In general, the users of these instructions will be individuals looking to 3D software for the first time. Their motive may be to obtain general knowledge or have some underlying motivation like the need to 3D print an object.

During the two days and three rounds of usability testing, trends were seen while the user attempted to complete the set of instructions. Some problems arose from the user's unfamiliarity with MacBooks and the operating system itself. Other problems came as the user made minor errors with each move without realizing that those may have downstream problems. A simple "command+Z" to delete would have solved over 50% of the errors.

Instruction Overview

Typically, CAD models are used in engineering to represent their designs in three dimensions and provide precise measurements of their design to manufacturers or parts suppliers. CAD models can also be used in a less professional setting for 3D printing the model. Over the past couple of years, 3D printers have become more common in households and schools not. They are now more prominent than ever with non-engineering applications. For this reason, it is essential that anyone wishing to 3D print, regardless of background, learn how to build a 3D model.

The software used in the instructions was Google SketchUp, a simplified version of expensive CAD software. Google SketchUp is available for a free download online, and has the ability to be converted into a 3D printable file. Since the audience was an individual who may be completely unfamiliar with the world of CAD modeling, this program was an ideal choice. Other programs like Autodesk Fusion 360 and SolidWorks are a lot more complex in nature and thus have more unnecessary buttons when the purpose is to cover only the absolute basics. Other programs also have the ability to make computations with the model like fluid flow simulations and precise surface area computations of the model. For this project, something to that extent could have been very overwhelming in a classroom other than an engineering one. Thus, the confidence of the user and ultimate success of the instructions could have been compromised. The instructions involved creating a model of a table simply because it covers a

variety of basics one would want to know when learning how to use CAD software. I found that this would be simple and effective.

Methods

Three usability tests were conducted in class with Carter Ratley, Margaret Dooley, and Alan Zhang. During the three usability tests, notes were taken on extra sets of instructions. I had the testers verbalize their concerns during the test as well as provide feedback afterwards. Outside of class, the instructions were timed with myself and then time was added to provide a more reasonable estimate.

Discussion of Findings

When writing the instructions I, myself, timed my completion. It took me roughly 10 minutes to complete. This helped me to figure 15 would be ample time for someone unfamiliar.

The usability test with Carter was completed in 12 minutes with minimal issues and fair ease of completion. He suggested a couple of steps that may need pictures. The format needed some improvement since some steps were not entirely on the same page. He also described some issues with the program like not knowing when an object is selected. He also suggested adding a trouble shooting section.

The second test with Margaret was by far the most problematic. Along with glitches with the computer, small errors were made within the steps which caused downstream problems. For example, in step 7 she made minor errors when drawing the table top so when she got to step 8, she was unable to use the push/pull tool. I realized that letting the user know how to undo would be essential. I also realized that the user needs to understand that any small error may cause downstream problems. I had to redirect her several times because the undo button was not used when she made a mistake. She also did not pay close enough attention to the details which is essential. Margaret was able to complete the test in 15 minutes.

The third test was conducted with Alan. He was unfamiliar with the MacBook and its trackpad made the process difficult. He suggested using a mouse for the test. He also had similar problems with the computer glitching and not knowing how to undo. He would have liked to see more icons. He completed the test in 13 minutes.

Revisions

Several revisions have been made throughout the process. After the initial test, the steps were reformatted from the first draft to ensure each step was together on the same page. Headers were bolded and more figures were added.

After the second and third tests, additional background information was added to ease anxieties of the user. I explained that a group of ten year olds were able to use this software. A picture of the finished product was also added to the top of the instructions. Labels and arrows were added on the figures. A hint box was created on the first page of instructions that include the most common mistakes and useful tips that were established in the usability tests. In this box key words are highlighted so the reader can come back and easily find them. Emphasis was placed on the precision of their moves and the ability to use command+z to delete.