Google SketchUp

Essentials One Training

Course No: 3HBA04

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Mastering 3D Using SketchUp: Essentials One Training

Course Objectives

Visualizing spaces in three dimensions is critical to the success of the design of architectural spaces. The interplay of light, color, space, and form make exciting spaces function successfully. Traditional methods for exploring these issues are very labor intensive. Use of computer software has enabled quicker (and sometimes more accurate) study models to be generated, explored, and iterated more times in the design time available to you.

SketchUp enables you to draw using a familiar pencil and paper paradigm in a software context. The *Mastering 3D Using SketchUp: Essentials One Training* course provides students with an excellent choice for beginning to learn to use SketchUp. This course is intended for students with little or no 3-dimensional drawing or SketchUp experience, but who want to start to create 3-dimensional models using SketchUp.

To be successful in this course, you should already be able to:
Define fundamental geometric terms including: polygon, parallel, perpendicular, axes, arc, and array.
Define 3-dimensional drawing terms including: rendering, field of view, and point of view.
Demonstrate mouse skills including: double-click, single-click, drag, and right-click (context-click).

* You will need a basic 3-button scroll wheel mouse to use SketchUp efficiently.

Upon completion of this course, you should be able to:

Create 2-dimensional (2D) geometry in a 3-dimensional (3D) environment
- Create surfaces from lines
- Create surfaces from circles
- Generate surfaces from polygons
- Generate surfaces from arcs

Demonstrate stickiness of geometry
Create 3-dimensional geometry
- View a model in 3D
- Create surfaces from lines in 3D

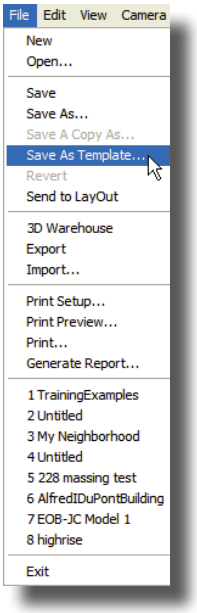
Demonstrate stickiness of geometry in 3D
- Create geometry with the Push/Pull Tool
- Move entities to manipulate geometry
- Maintain coplanar geometry

Connect and generate forms
- Lock inferences
- Generate forms quickly
- Restore/Heal a surface

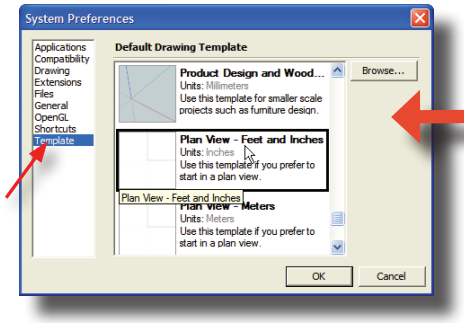
Create a model, step-by-step
Mirror a model
Create an array
Apply materials
Create 3D Text
Import (download) models from the Google 3D Warehouse
Alter a model using Styles
Import site information (imagery and topography) from Google Earth
Position and export models to Google Earth

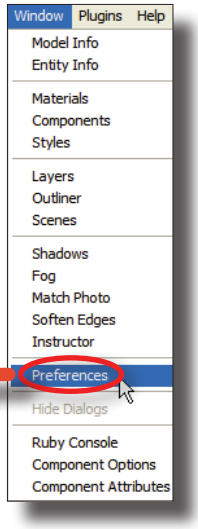
Setting Your Template

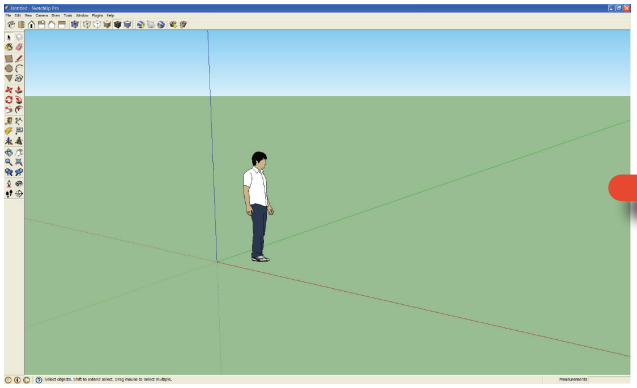
SketchUp 7 opens with a 'Welcome to SketchUp' introduction window. From here you can Learn more about SketchUp (through videos and documentation), view License details, choose a Template, or just start using SketchUp. Click on '**Choose Template**'. You will see a list of sample templates with various units, some of them show a human figure in perspective view with a visible ground and sky; these templates help new users understand SketchUp's 3D environment. Let's scroll down and select a template called '**Plan View - Feet and Inches**' near the bottom of the list, then click on 'Start using SketchUp'. For our purposes, this template is good because it allows us to begin a new SketchUp file looking down in a plan view so it will be easier to explore some of the basic functions of SketchUp.



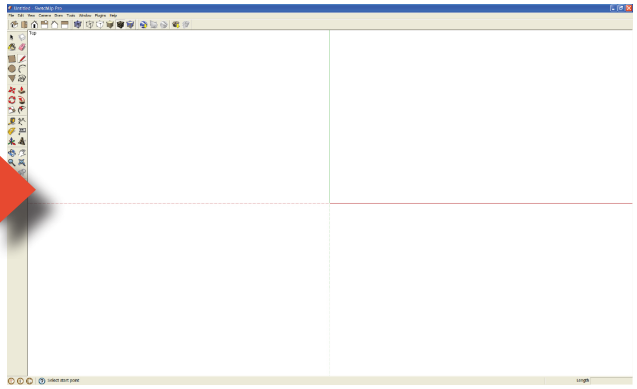
You can also access templates once you're in SketchUp by going to the *Window* menu and selecting *Preferences* [Mac: go to the *SketchUp* menu, then *Preferences*]. Click on *Template* at the bottom of the list on the left side and select the appropriate template. Then click on OK and go to *File > New* to create a new SketchUp file. *You won't see your new template activate until you start a new file. You can also create your own templates by modifying any of the existing templates to best meet your needs. When you are ready to do this, go to *File > Save As Template...* and you can give it a Name, Description, and even set it as the default template every time you open SketchUp. Once you save it, your new custom template will be accessible at the Welcome to SketchUp intro and also in System Preferences as described above.







sample template:
Simple Template - Feet and Inches

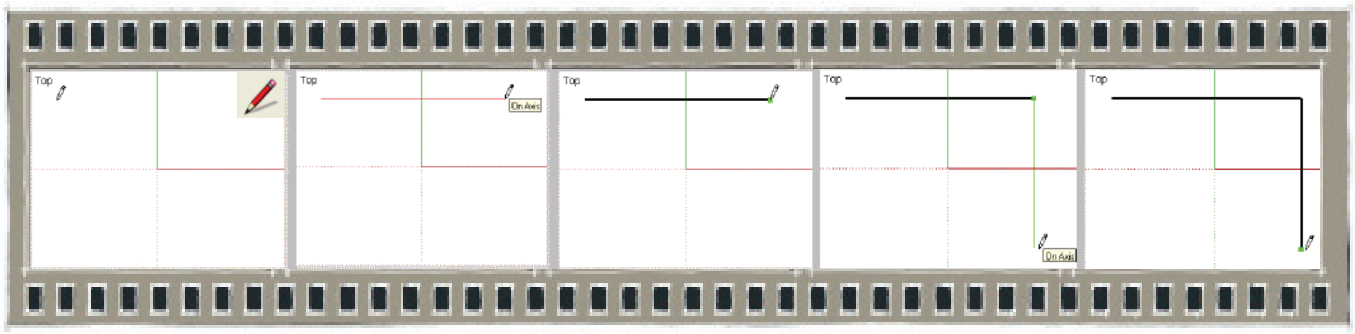


change to:
Plan View - Feet and Inches

Creating Basic Geometry

Creating Surfaces From Lines

To draw an edge, select the **Line (pencil) Tool**  from the Drawing toolbar. Click somewhere on the screen (push the left mouse button down), then *RELEASE* and move the mouse around (watch the cursor hover around on screen). You will see a '**rubber-band line'** extending from the start point to your cursor. As you move the cursor, the rubber-band line will be black when it is not parallel with the **axes (red, green, or blue)**. When the rubber-band line is parallel (or **aligned**) with one of the primary axes, its color will change to match the axis to which it is aligned. Click the mouse button to complete the line segment and it will be drawn on the screen (this is the **model area**). Now move the cursor down and draw a vertical edge.

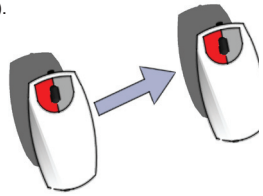


In SketchUp, you can draw lines by clicking on each individual endpoint or by dragging the second point of each line. The clicking method (called click-move-click) is easier on your wrist, and insures that those beginning with the software will have better success at learning, since they leave their mind free between clicks to notice the screen without having to concentrate on holding down the mouse button. The click-move-click method will also ensure that you do not create small edge segments throughout your model by accident. These small segments can really cause havoc in a model.

Avoid dragging the mouse during edge (line) drawing. The click-move-click method of drawing edges allows the edges to "chain" as they are drawn. This means that until you form a closed loop of edges, the pencil will automatically continue drawing another line from the end of the last segment. The dragging method of drawing a line will only draw one line at a time limiting your efficiency of drawing.

Note: At this point, it is good to review how the mouse buttons work. There are three distinctly different terms you will hear when using a computer mouse: clicking (sometimes called left-clicking), dragging, and right-clicking (or context-clicking).

Clicking the mouse means to hold the mouse still while pressing down and releasing the button. It is critical that you not move the mouse during this process.

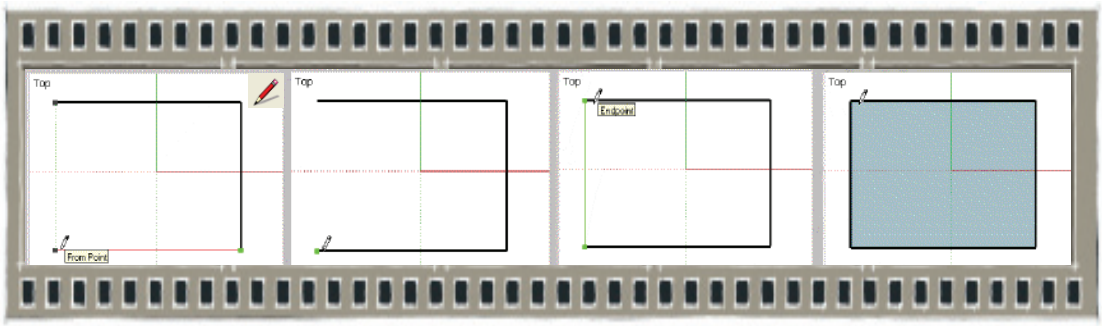


Dragging the mouse means to press down on the mouse button and continue to hold it down as you move the cursor over the screen. When you reach the desired location on the screen, release the button to finish the operation.

Right-clicking (or context-clicking) the mouse means to click on the right mouse button (press down and release without moving the mouse).

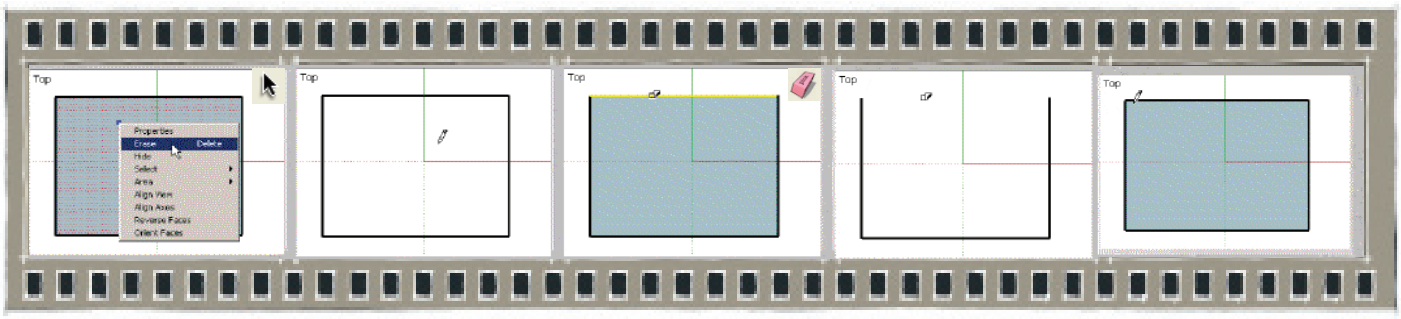
Want To Be Exact?

At any time while you are drawing a line, you can type an exact length and have SketchUp make precise geometry; try it. Click to start drawing a line, then type a length like 10" or 20' and hit ENTER. The line will be drawn to that exact length. SketchUp doesn't require you to be precise but it allows you to define exact dimensions anywhere along the way. Be as loose or as precise as you want. If the line turns out a lot longer or shorter than you expected, remember SketchUp defaults to inches if you don't type units after the number, so try it again. Start drawing, type your dimension followed by the single quote (feet) or double quote (inches), then hit ENTER. SketchUp displays this dimensional information in the lower right corner of your window, in an area called **Measurements**. Notice that you don't need to click into this Measurements area because SketchUp accepts numerical input during the drawing process.



Notice when the cursor is across from the start point on the screen, it shows a **dotted line** connecting the cursor to the other (start) point. This is called an **inference**. In SketchUp, all geometry is interconnected and "knows" about the placement of other geometry. To accept the inferred point, just click the mouse when you see the inference indication.

In SketchUp, all geometry consists of **edges** and **surfaces**. The edges form a surface when all their endpoints meet, and when all those edges lie in the same plane (**coplanar**). An edge can be straight or curved, but when curved - the curve must be coplanar with all other edges.



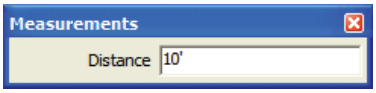
When you form a *closed loop of coplanar edges,* SketchUp puts a surface (or "skin") on that wire frame. This surface can be erased by **right-clicking** (push down on the right mouse button when over an entity) or **context-clicking** on a Mac [hold the Ctrl key while clicking the mouse button over an entity and selecting Erase. Notice that the edges remain when the surface is erased.

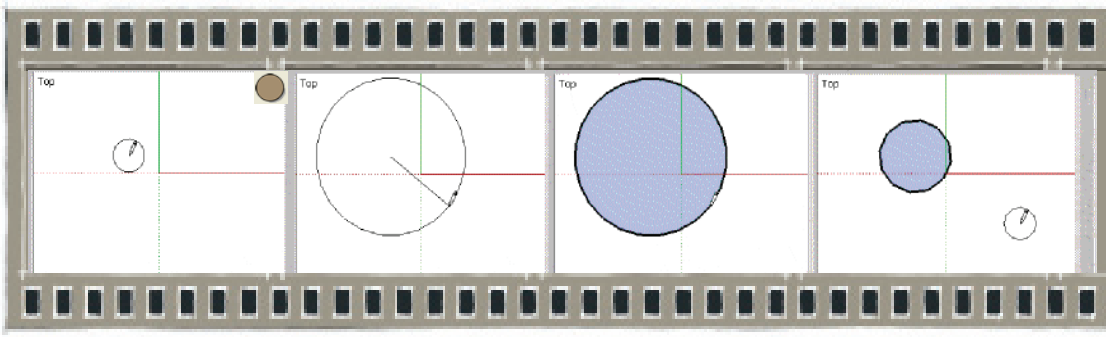
Now select the **Eraser Tool**  and click on the top edge. Notice that both the surface and the edge are removed (because surfaces are defined by closed edge boundaries).

Creating Surfaces From Circles

Let's look at drawing other shapes. You can draw a circle using the **Circle Tool**  . Click once somewhere on the screen to place the centerpoint of the circle. If you want to change the **radius** of the circle, just type in a number with units. Try giving the circle a 10 foot radius (type 10' and then hit the Enter [return] key).

Note: As mentioned before, the numbers and letters you type appear automatically in the **Measurements** area (Value Control Box) at the lower right corner of your SketchUp window. If you prefer to see the Measurements box in different location, go to *View > Toolbars > Measurements*. This allows it to act like any other toolbar in SketchUp. You can dock it where you like, and it will return to the default lower right if you click the X to close the toolbar. Any values you type as you model will appear in this Measurements area (except for text and dimensions you have in model space). You can activate various toolbars in SketchUp by going to *View > Toolbars* on a PC [Mac: go to *View > Customize Toolbar...*].





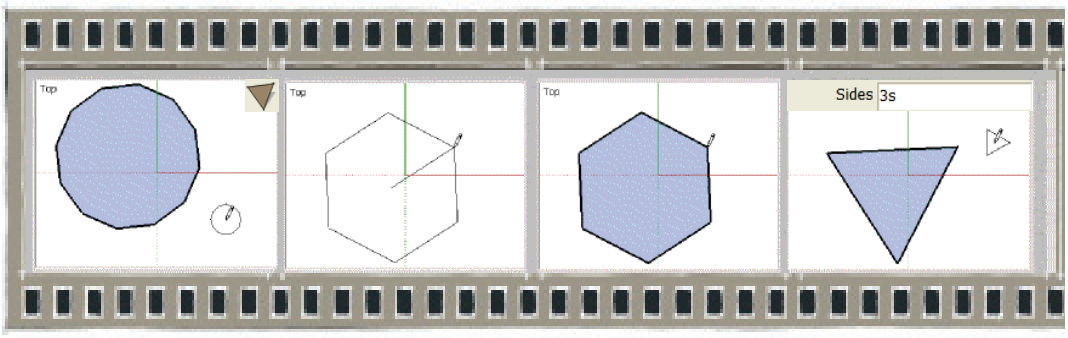
You can also change the radius of the circle after it as been created by right-clicking [context-clicking] on it and selecting **Entity Info** (also accessed by *Window > Entity Info*). This informative box gives you instant access to key attributes of all SketchUp entities, where you can view or edit the entities in your model directly from this box. It may be useful for you to always have this box open while you are modeling.

Creating Surfaces From Polygons

Polygon Tool  Polygons behave in a similar way.

> **Note:** You can change the number of **segments** used to draw the polygon prior to or even after placing the surface. Just type in a number followed by the letter "**s**" (for segments), then hit the **Enter (return)** key.

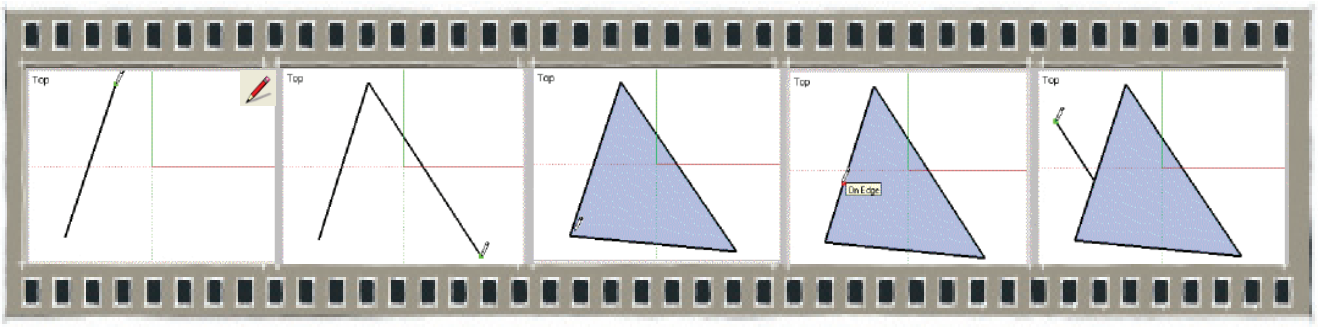
Change your polygon to 12s (twelve segments). Try making it a 6s (six segments) polygonal surface, or 3s. You can also change the radius or the number of segments for a polygon through the **Entity Info** box, described below. Remember that SketchUp will remember the last value you input - so the next time you use the Polygon or Circle Tool, it will have retained that value initially.



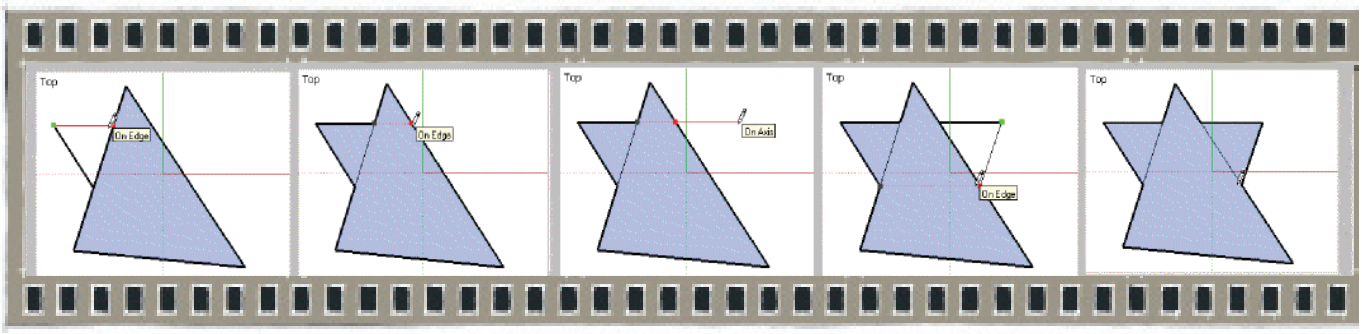
After you have explored the Circle and Polygon Tools, start a new file by going to *File > New*.

Understanding The Stickiness Of Geometry

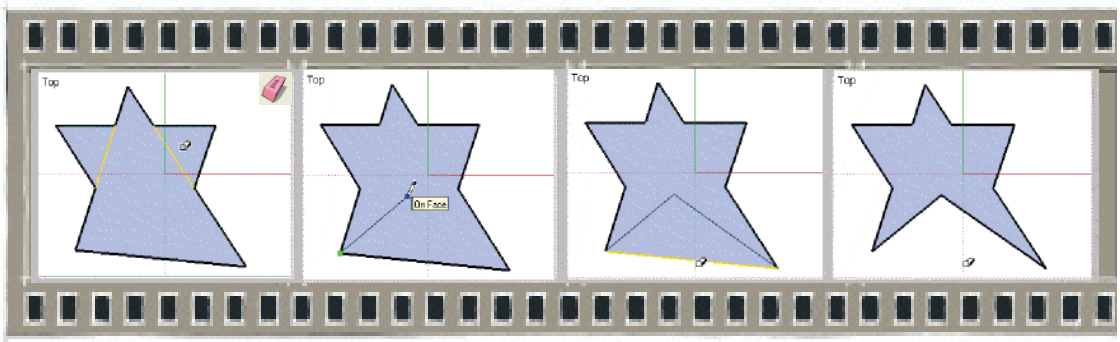
You can draw lines that are not aligned to an axis; try creating a triangle. Let's explore how to think differently about geometry within SketchUp. Any geometry can be 'broken' along its edges to modify its shape, like creating a star from our triangle. With the Line Tool selected, hover your cursor over different parts of the triangle. Notice that some informative labels (inferences) appear when you hover (pause) over certain parts of geometry. Move the cursor around (without clicking) until you see 'On Edge' (red square inference marker), 'Endpoint' (green circle inference marker), 'Midpoint' (cyan circle inference marker), and 'On Face' (dark blue diamond inference marker). By starting "On Edge" when drawing an edge, the vertex of the new edge has broken the existing edge at that point, creating a vertex at which three edges meet.



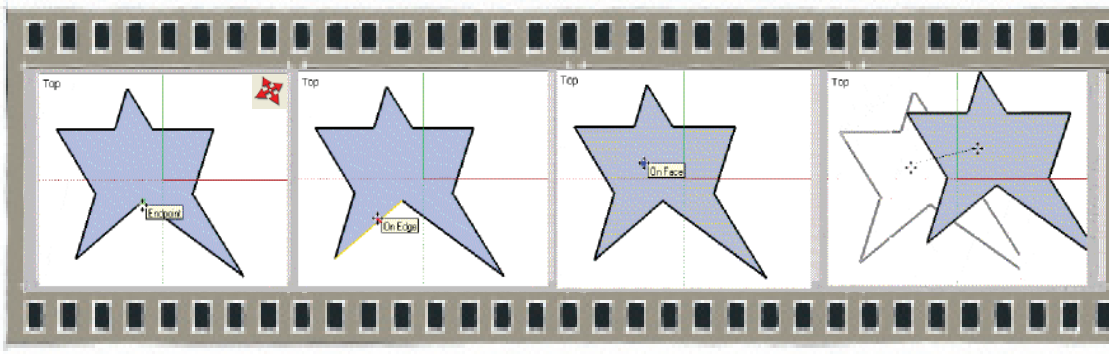
Notice the option to draw the new arm of the star as aligned to an axis. Notice too, the inferences created from other vertices in the model. This feature will be continually useful to you. It's like a virtual T-Square or 3D snap grid, without the hassle of specifically placing one. If you start drawing a line and decide you don't like it, you can always use the Esc key to cancel the tool operation and start again (works with most of the tools).



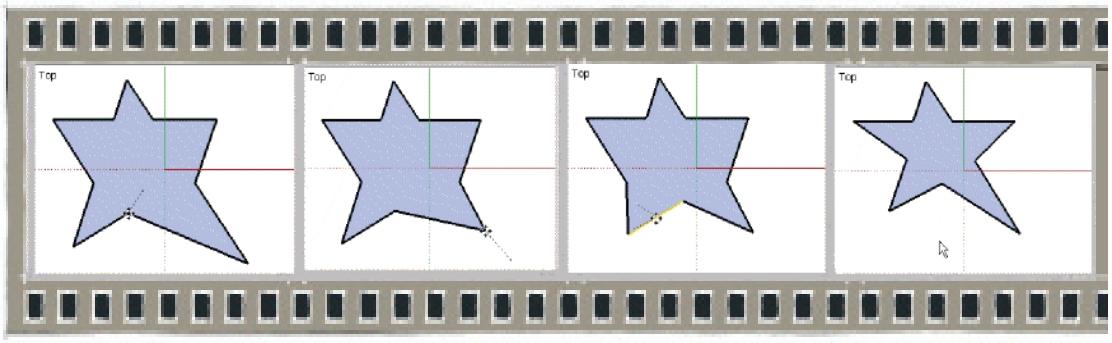
Take the Eraser Tool again, click and drag (hold the left mouse button down - and while continuing to hold it down, move it across the screen) the mouse cursor over both the interior edges you no longer need. Then release the mouse button, and both edges are erased.



Click on the Move Tool . As you move the cursor over the screen, notice that edges and surfaces get highlighted as you move over them. This is called **active highlighting**, which allows you to act on geometry without needing to pre-select it with the Select Tool. Several tools have this ability. You can move entire surfaces, individual edges (line segments), or an individual vertex of an edge(s). Keep in mind that you can always use the Select Tool to pre-select geometry in your model before choosing the tool that you need.



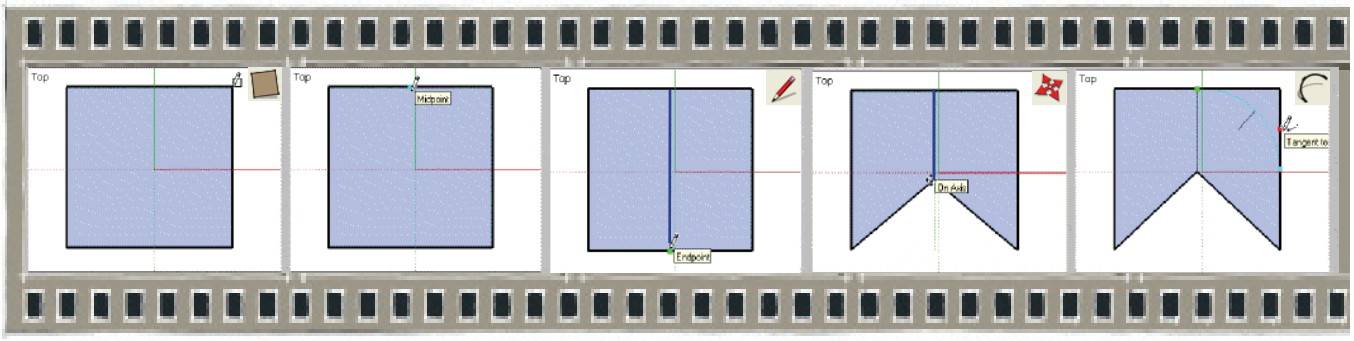
Moving just vertices and edges, practice adjusting the surface to make it appear more “star-like”. Notice that when moving a vertex or edge, all the attached geometry is affected also. This is fundamental behavior for SketchUp. Edges and points are shared between surfaces, allowing very plastic manipulation of the model.



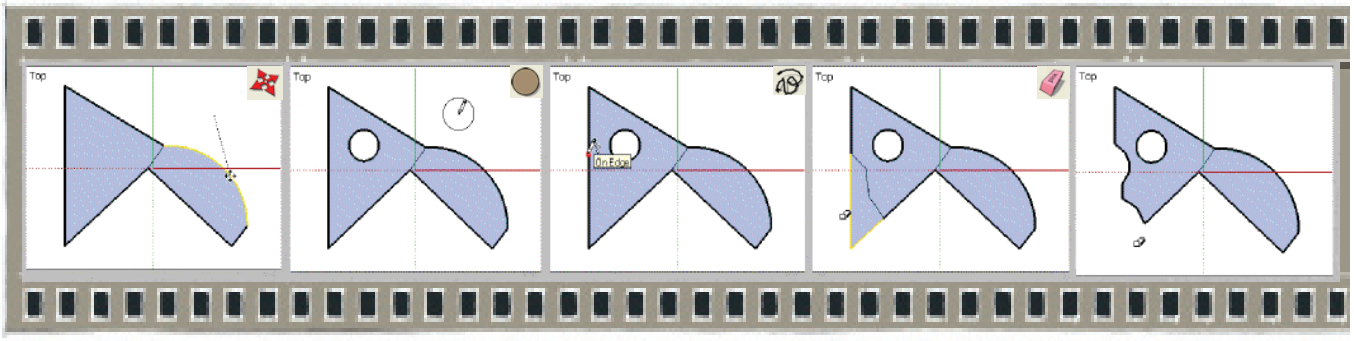
Activity: 10 minutes to practice

Now take some time to experiment drawing lots of different shapes. Use the Move Tool on different parts of your shapes to explore how they affect each other.

A "Putting It All Together" Exercise



Rectangle | Line (from midpoint to midpoint) | Move vertex | Arc fillet on corner

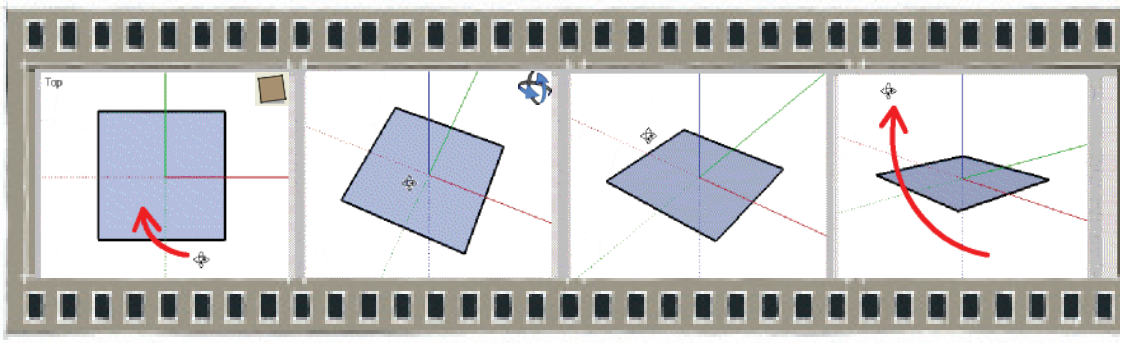


Move arc | Circle, then Erase | Freehand edge to edge | Erase | connected shapes

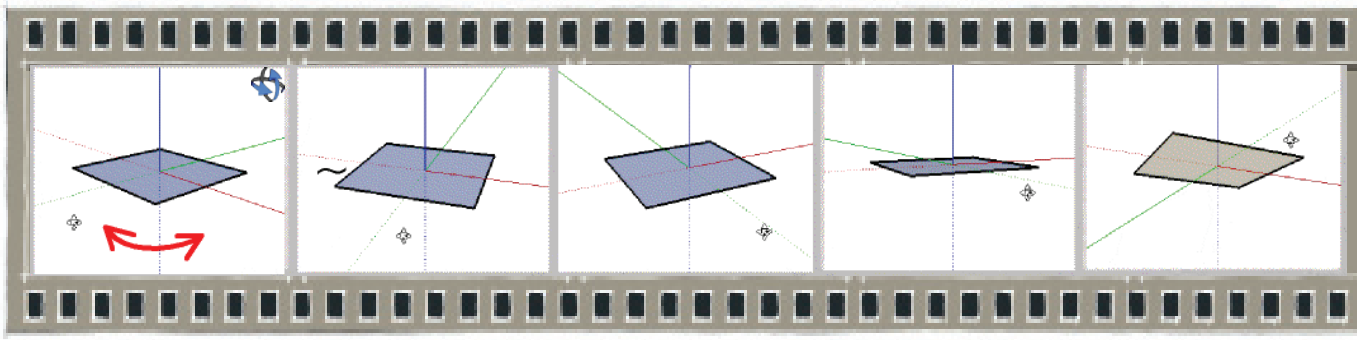
Creating Basic Geometry In 3 Dimensions (3D)

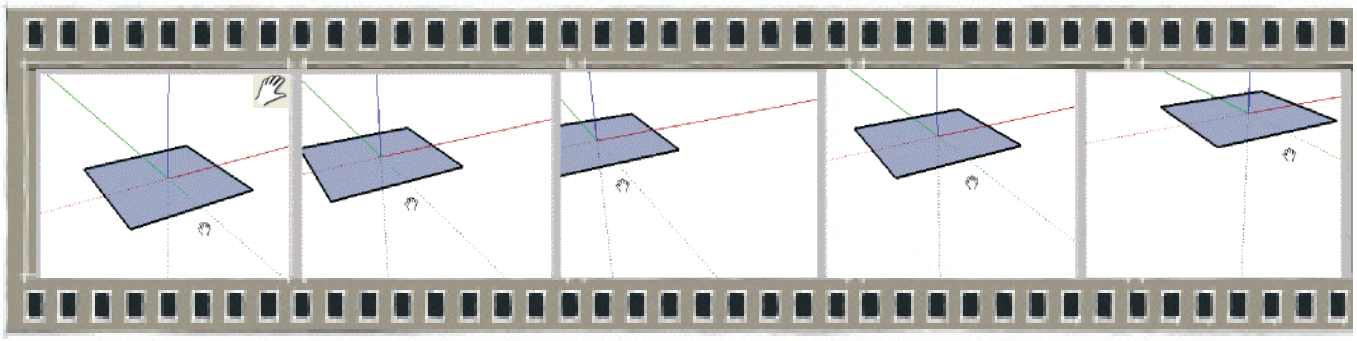
Viewing the model in 3D

In SketchUp, you are always working in a 3D environment. So far we have been in a top or plan view, looking down on the model (notice the word 'Top' in the upper left of the screen).

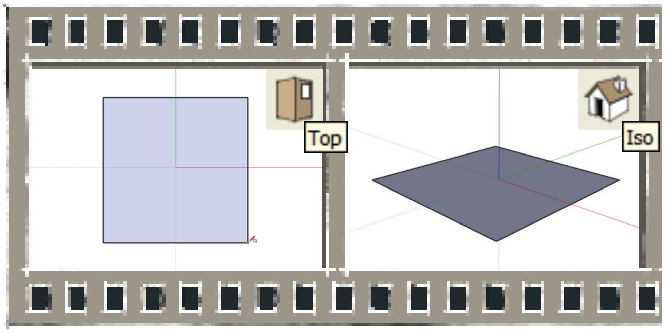


Draw a rectangle (15',15') on the screen and then click the **Orbit tool**  . Now place the cursor near the bottom of your screen, click and **drag** (hold the left mouse button down - and while continuing to hold it down, move it across the screen) it upwards. Drag it right and left… see how the model's **blue axis** (vertical) is now visible. The Orbit tool is used to navigate and examine your designs.

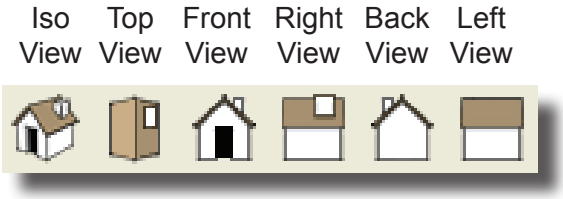




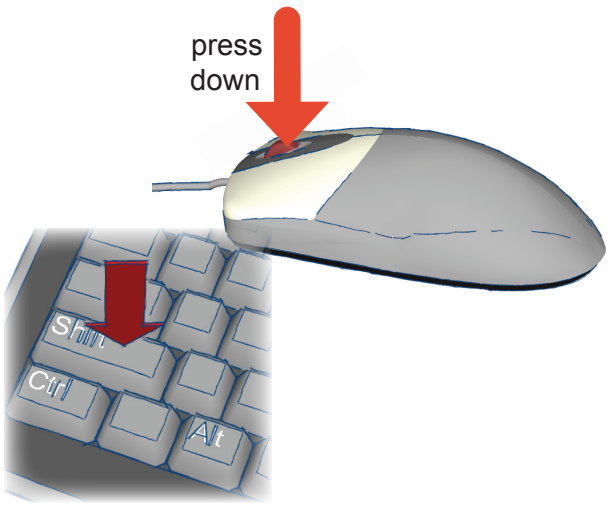
Select the **Pan Tool**  . Click and drag the cursor around on the screen. This moves the model without changing the viewing direction.



If you have a mouse with a **scroll wheel** button, try rolling the wheel back and forth. This will zoom you in closer and out farther from your model centered on the place the cursor is over. Now try holding the scroll wheel button down while moving your mouse. This activates the **Orbit** Tool - as long as you hold down the scroll wheel button. Release, and you are right back to the tool you were using! Try holding down the **Shift** key while clicking and dragging the scroll wheel; this activates the **Pan** Tool. *Using the mouse for naviagtion allows you to manipulate your model solely with the mouse, avoiding the need to pick most of the viewing tools. It also speeds up your working process, because you are not distracted with viewing buttons while trying to draw or model.



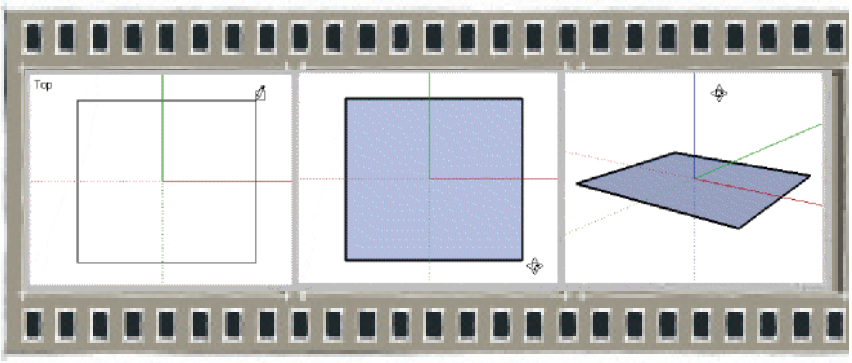
Click on the **Top View** icon and the **Iso View** icon. These can help you quickly orient yourself in 3D space.



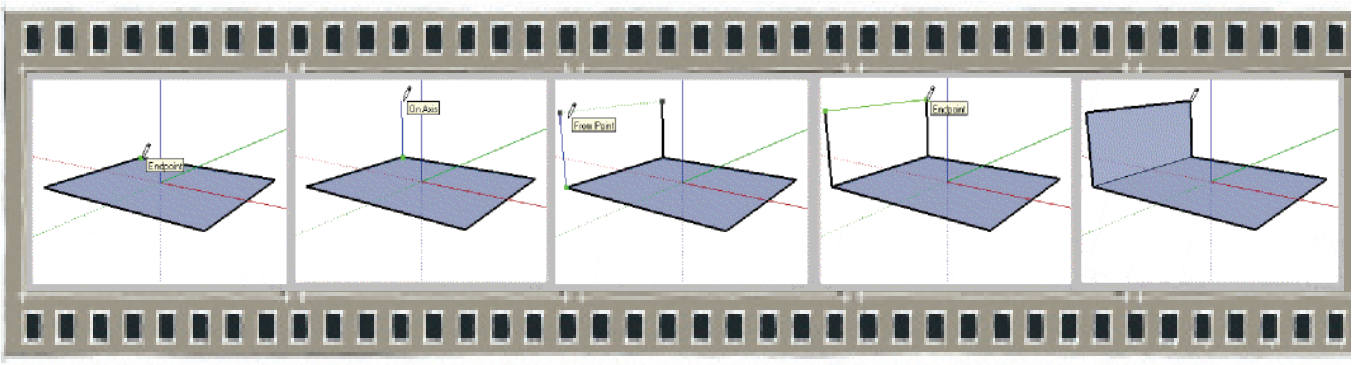
hold down middle scroll wheel + Shift to pan

Drawing In 3D Using The Line Tool (pencil)

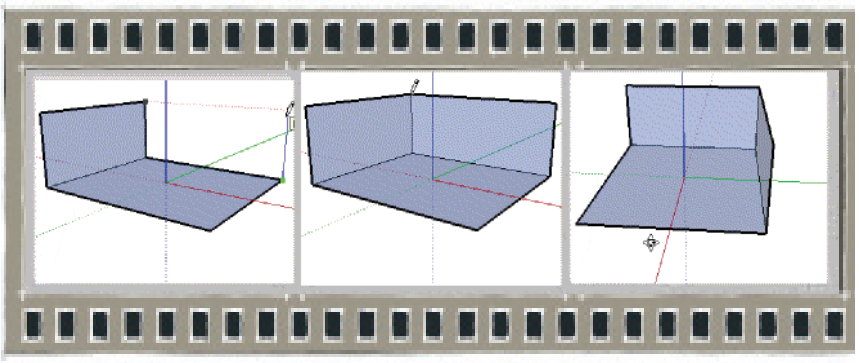
Let's continue sketching; draw a rectangle and orbit the model to an isometric view.



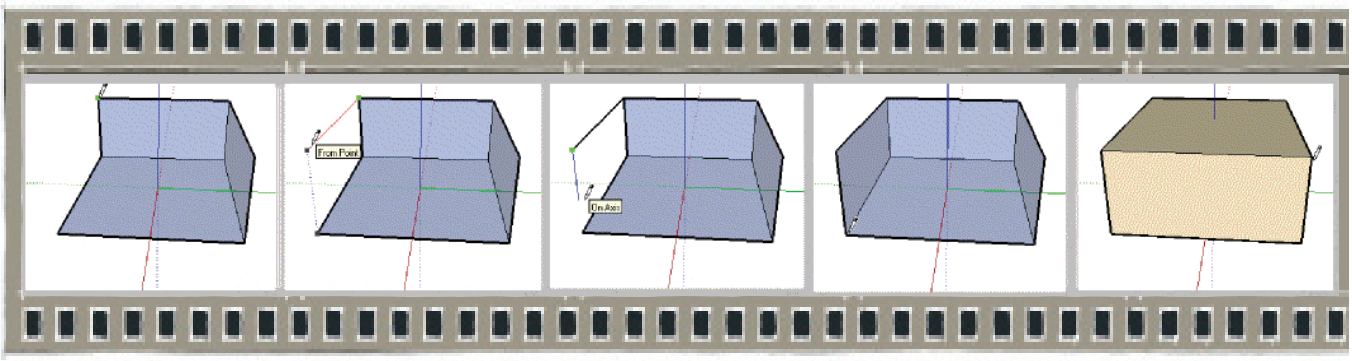
To draw a rectangular boxed volume, draw upwards in the blue direction from a corner of the rectangle. Watch the cursor hint at the axis and turn to a blue rubber band line and report "On Axis" letting you know that you are perfectly vertical. Hitting the **Esc** key cancels an operation in progress, and in this case can be used to 'finish' the line once you click a second time. Draw a second vertical line in the blue direction. Notice that it will also inference to the height of the first line when you go high enough. Now complete the side of the cube.



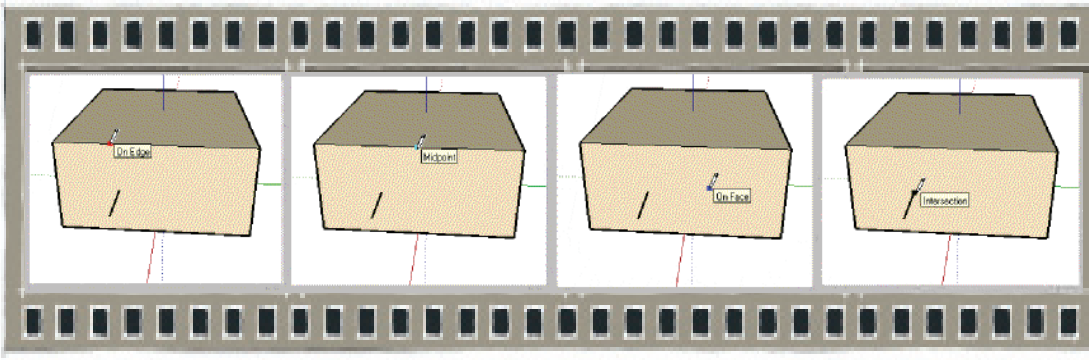
Do the same for the other side of the cube. Then orbit the model to see that the sides are truly vertical in 3D space. You can always trace in edges in SketchUp to form surfaces. This is the basic construction method.



It does not matter what order you draw the edges, just be sure that the sides of your cube are coplanar relative to the edges that bound each side. Draw in an upper horizontal edge, parallel to the ground. After you have drawn three of the sides, watch as you draw in the last edge… both the top and side surfaces of the cube are completed at once. This is because each of those surfaces share that same edge.



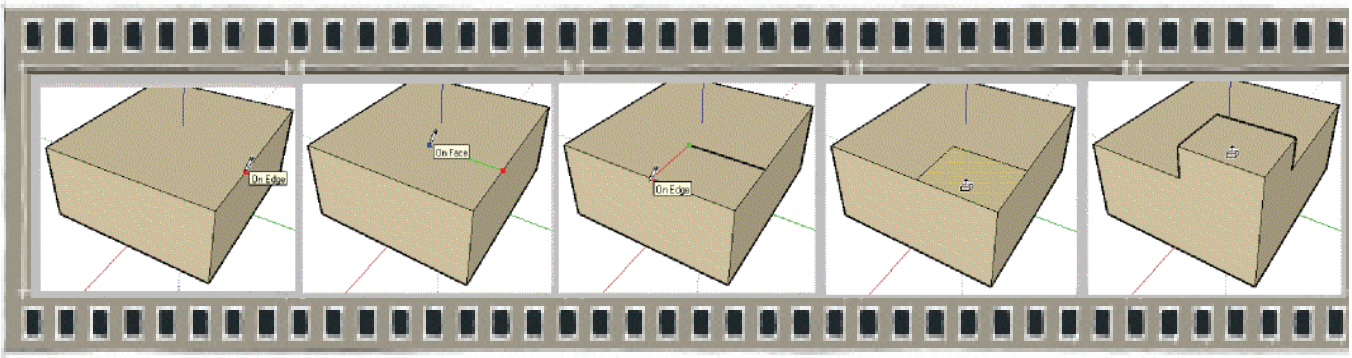
Orbit your model to check your work and get a good feel for orbiting around geometry in SketchUp. SketchUp acknowledges a variety of inference points to help you model quickly and easily. We've already noticed many of these in the 2D example, now get familiar with inferences on your cube in 3D. In addition to the 'On Axis' inferences (red/green/blue axis inference lines), you'll see On Edge, Endpoint, Midpoint, and On Face. There are also inferences for Center (blue), Parallel to Edge (magenta line), Tangent (magenta line), and Intersection or From Point (black).



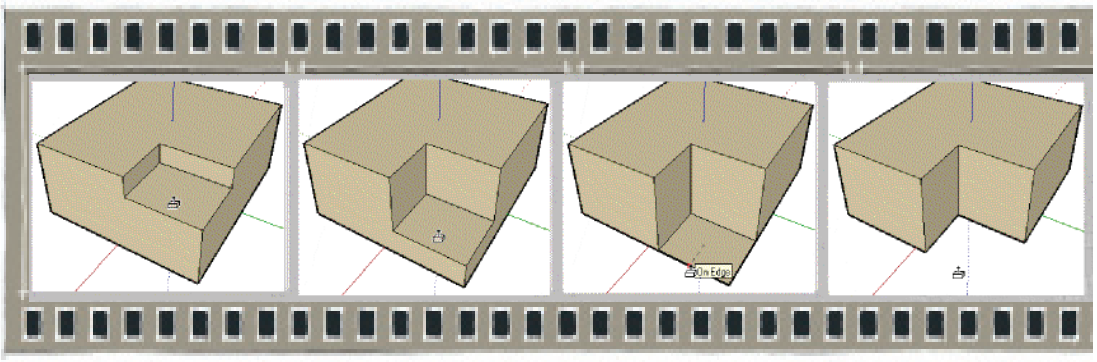
Understanding Stickiness In 3D

Using the Push/Pull Tool

Draw some edges on the top surface. Make sure the edges start when the cursor dot turns red and says "On Edge". This insures that the new edge will break the existing edge into two edges. Now take the Push/Pull Tool  and click once on the new smaller surface you created. Notice that it auto-highlighted that surface as you moved the cursor over it. Now hover your mouse upwards on the screen and click a second time to end the push/pull operation. Remember to click-release-click, and not to click-and-drag the mouse.

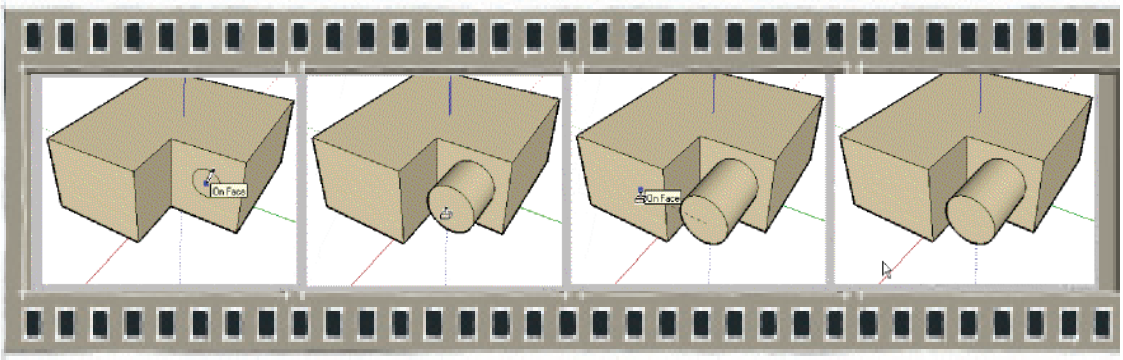


Now try moving the mouse downwards after you've clicked once to initiate the push/pull. Anyplace you stop moving the mouse and click a second time, the surface will stay there. This tool creates extrusions **perpendicular** to the starting surface. Try pulling the surface down and click on the bottom edge (look for the red On Edge inference). This subtracts that geometry because you've basically "cancelled-out" the surfaces (next page).



Draw a circle on the front face of the new inner surface. Use the Push/Pull Tool to extrude it, but this time we will explore a new inference. When you are push/pulling, move the cursor over the front face and notice the inference line that extends from the face you are moving to the face you are touching. This is letting you know that you are aligned exactly to that surface. Click there, and orbit to examine your results.

Go ahead and create more shapes by drawing new surfaces on the model and push/pulling them into new geometry. Remember that you can always type in an exact dimension with the Push/Pull Tool just like any of the other tools. Click once to start the push/pull, release and move your mouse in the direction you want to go, then type in a dimension.



Activity: SketchUp calisthenics

At this point, let's look at a basic sequence of steps in SketchUp that begin most models. Let's practice it several times (kind of like push-ups: drop and give me 10!)

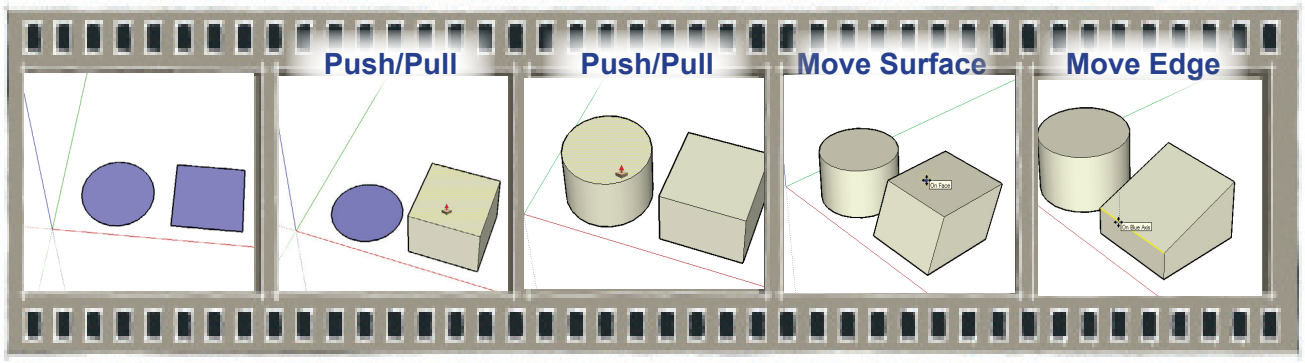
The steps are:

1. select the Rectangle Tool
2. draw a rectangle
3. select the Orbit Tool
4. click+drag the middle mouse button to get to an isometric view
5. select the Push/Pull Tool
6. extrude a cube along the blue (vertical) axis

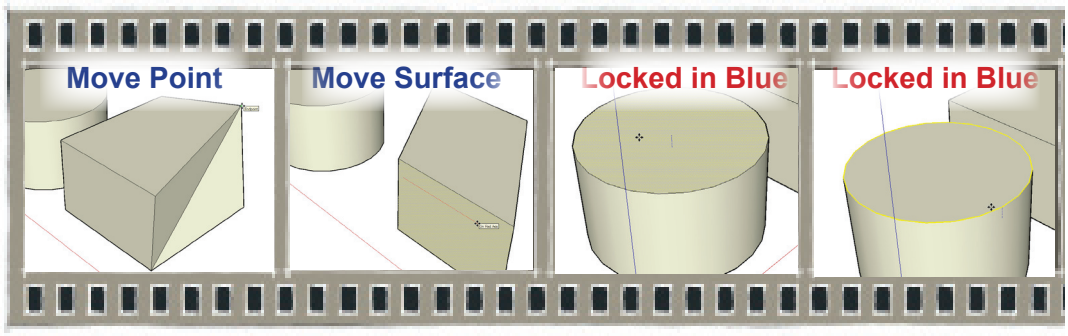
Try this several times… rectangle, orbit, push/pull… start a new file and do it again… and again…

Using The Move Tool In 3D

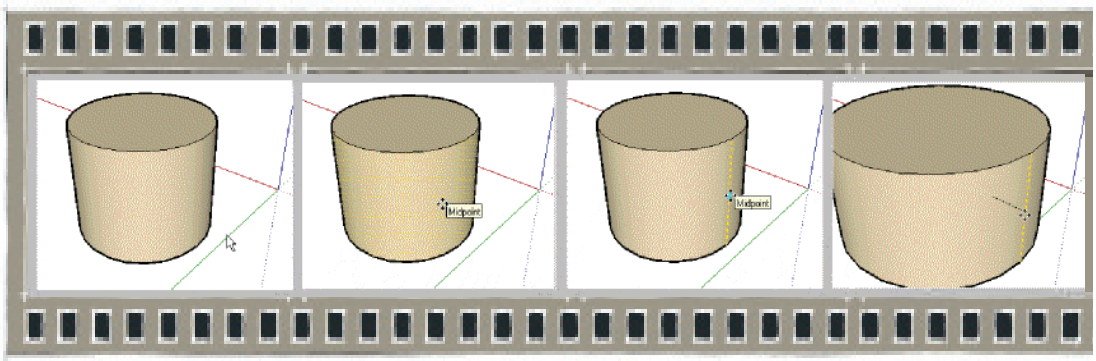
The Move Tool creates different results depending on whether you move a face, an edge, or a vertex. Draw a rectangle and place a circle next to it.



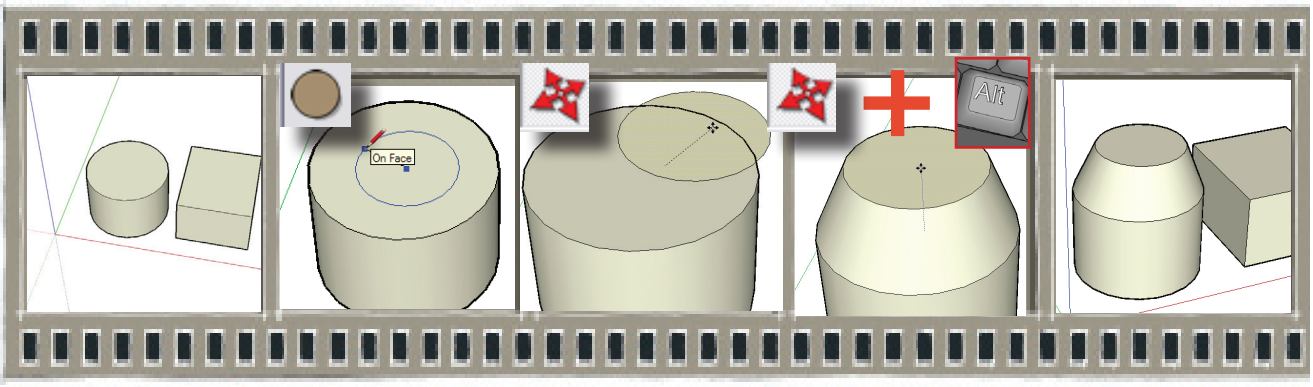
Now push/pull them both into volumes and orbit the model as shown. The Move Tool will not only move a surface, but all attached surfaces are affected as well. When an edge is moved, all connected edges are affected as well. You can move a surface, an edge, or a point where two edges meet. In all cases, SketchUp will do its best to allow you to move in the desired direction while preserving your surfaces. See the effect on the cube, and notice that trying to move the top surface or edge of the circle can only be done in the blue axis direction.



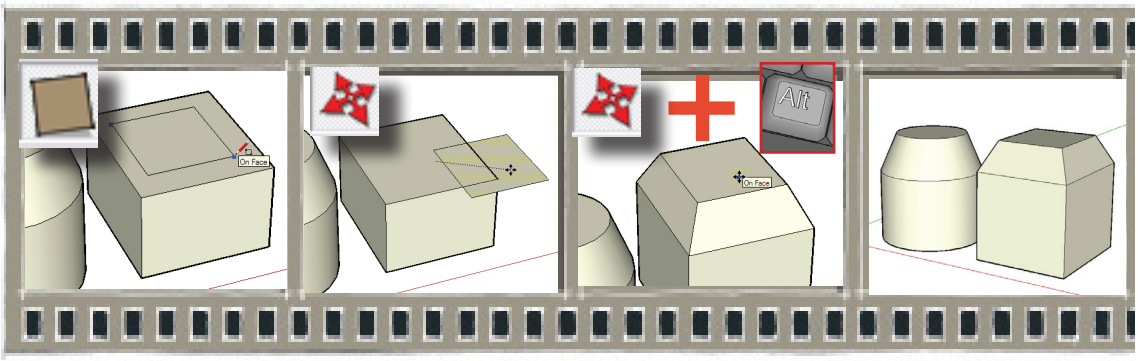
When a vertex is moved, all edges sharing that endpoint are affected. If surfaces bounded by the affected edges are caused to become non-planar, SketchUp will automatically create **fold lines** (edges) to keep the surfaces planar. Let's undo-back until we get to having just the cylinder and the cube. Hover the Move Tool over the curved surface until you see a dotted blue line highlight (there will be 4 of these at each quadrant of the cylinder). Click and move the quadrant 'midline' to adjust the radius of the cylinder. Do the same to adjust the radius of an arc or circle. Move the cursor over the perimeter until only the midpoint/quadrant point is highlighted (and not the entire circle) and click then.



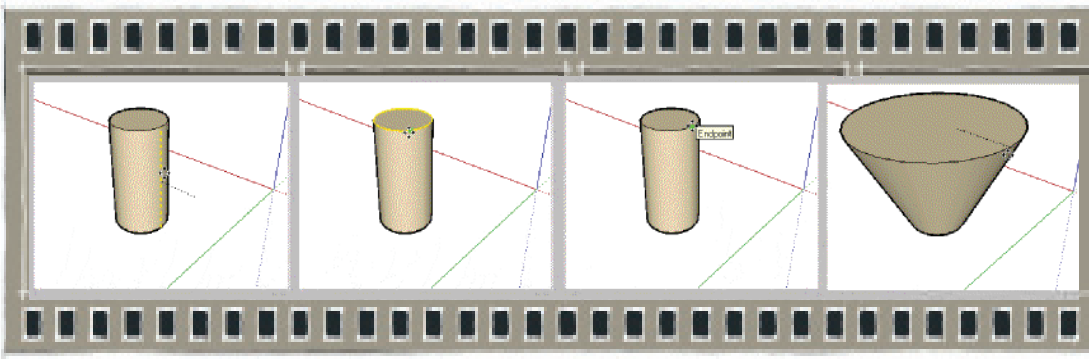
Keeping Things Coplanar: Autofold



In the example model below, try moving the rectangle as shown. Notice that SketchUp limits the movement and you can't move this rectangle in the blue axis direction. Sometimes when moving a surface or a vertex, SketchUp will only move in certain directions to keep the surfaces planar. If you want to move in another direction, you must invoke the **Autofold** override using the **Alt** key on the PC [**Cmd** key on the Mac]. To move the vertex downward in the blue direction, first get the Move Tool and click on the vertex, then tap the Alt [Cmd] key and move in the blue direction. Orbit to check your work. Autofold is a toggle command, so you don't need to hold the key down.



Try the Move Tool on a circle. Notice how the highlighting changes when you find the quadrant point(s). This is very subtle and allows you to change the radius, so be careful to orbit and zoom close enough to see the difference on screen.



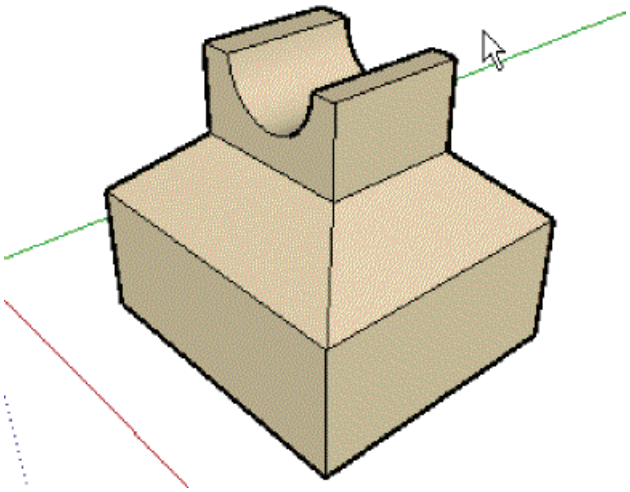
Take some time to play around with the concepts you've learned. Experiment with drawing closed edge shapes on surfaces of varying orientations and move them, then push/pull them to explore the differences.

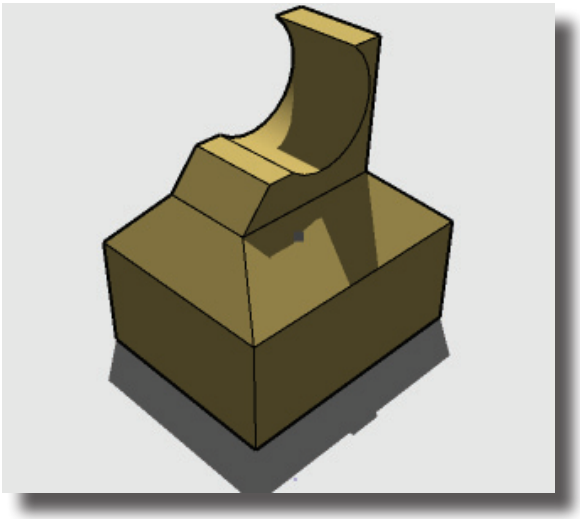
Activity: 10 minutes to play

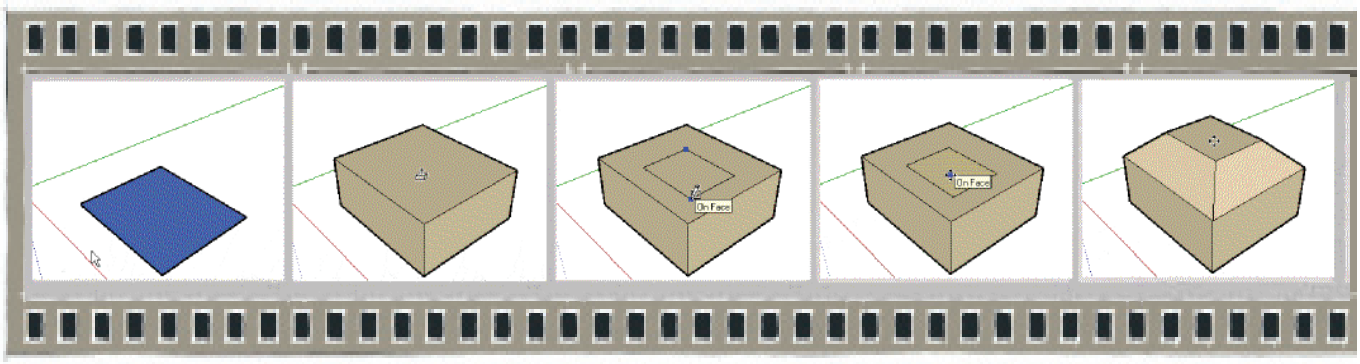
Go ahead and experiment with drawing different forms in 3D. Try drawing one surface on another to subdivide them, then use Push/Pull on them to generate quick new forms. Try the Move Tool on everything…

Activity: Bringing it all together

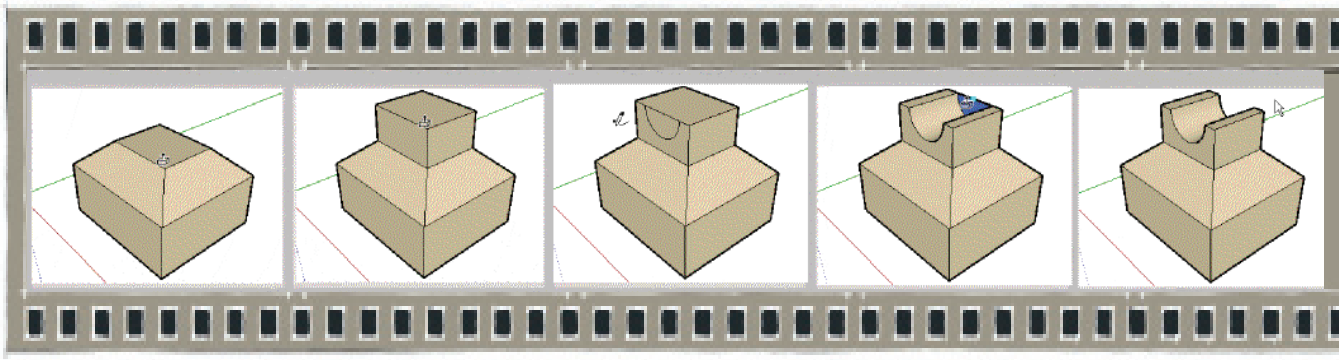
Try drawing the following shape using the tools and concepts covered thus far. Try creating it without referring to the steps below. If you run into trouble, follow the illustrated steps below.







Rectangle | Push/Pull | Rectangle | Move | + Alt



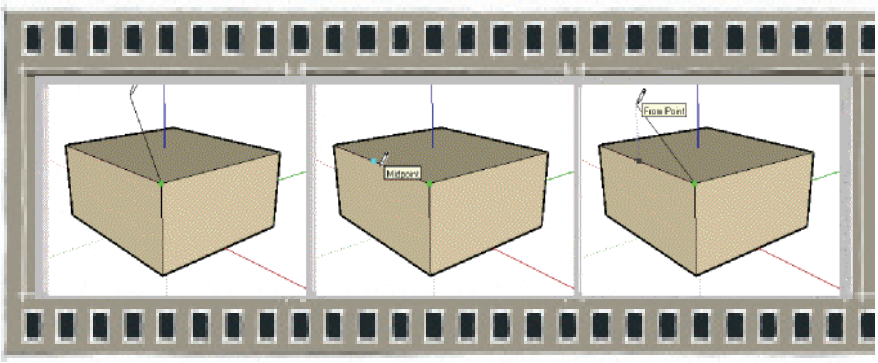
(don't forget Autofold!) | Push/Pull | Arc | Push/Pull | finished!

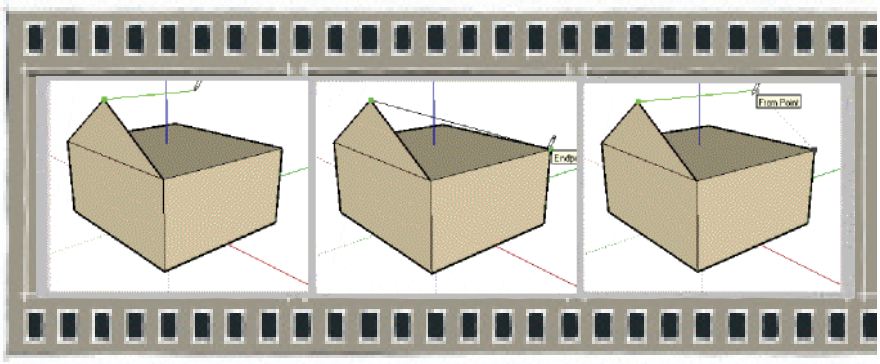
Connecting And Generating Forms

Locking an inference

Now that you know how the drawing tools for SketchUp work, let's look at how to begin drawing complex interconnected forms. The remainder of the examples in this seminar will be in 'comic book' form, where only new concepts will be elaborated upon, and all existing drawing skills are indicated with a simple caption or statement. We will start by drawing a simple form.

We will create the form using only the Line (pencil) Tool and **inference locking** (holding down Shift while inferring). You can also lock axis inferences by hitting and releasing the arrow keys on your keyboard. Up/Down arrows lock in Blue, Left arrow in Green, Right in Red. Locking an inference keeps the tool aligned to a particular inference direction while combining that direction with another inference - either a point, direction, or surface. This is to show you the power of this most basic tool in SketchUp. If you are having trouble manipulating a form, you can always just pick up the pencil and draw it in!

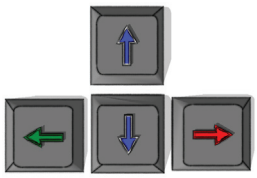




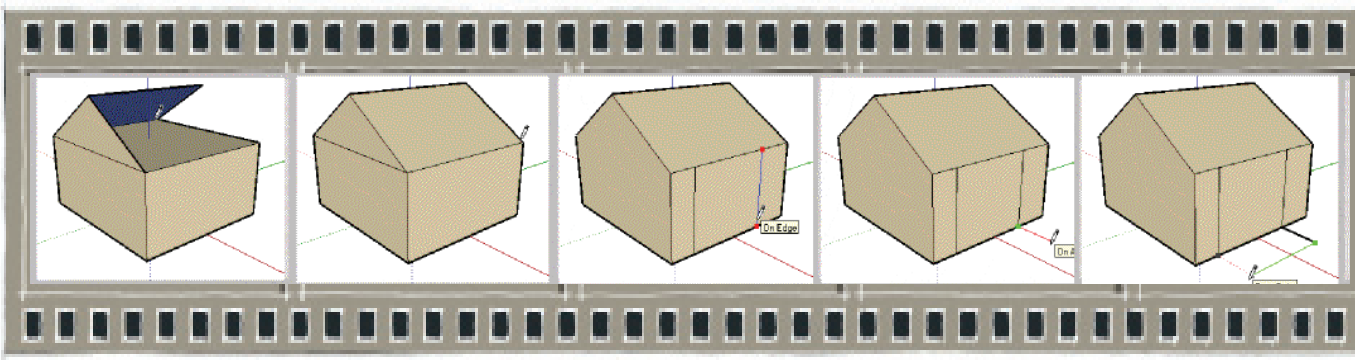
Let's look at how to **activate focus** for an inference if it is not indicated automatically for you. To do this, **hover** (move the cursor over the point or surface and pause for a moment, but don't click!) over the point or surface you want. In this case, we are focusing on the midpoint of the edge, then moving the cursor in the blue direction to establish the ridge height. You see an inference message indicating "From Point".

Note: You can also LOCK an inference using the keyboard ARROW KEYS, just start drawing and then click and release an arrow key:

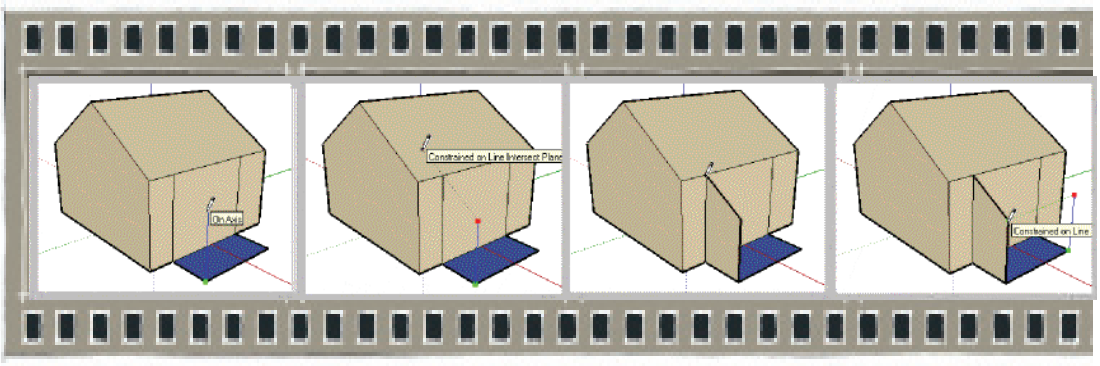
Up & Down = Blue axis
Right = Red axis
Left = Green axis



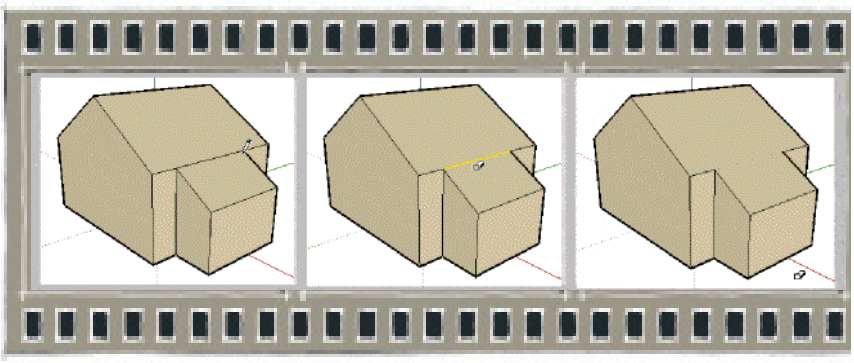
Try it again to infer the ridge in the green direction across from the other end of the house form.



draw the back rake edge | finish other side | draw the addition limits | draw | the footprint



You have been inferring along directions and to and from points; you can also infer to a surface. Start a line from the corner of the addition footprint and infer in the blue direction and lock it with Shift. **Continue holding Shift** and click anywhere on the roof plane. The pick point registers as the point directly up in the blue direction where that blue vector would intersect with the surface you indicated. This will allow you to make the roof slope of the addition match that of the rest of the roof. Try it again, locking the inference in the blue and select the height for the other vertical edge of the addition to the house. Remember to move your cursor around until you locate the blue inference line, and THEN hold down Shift.

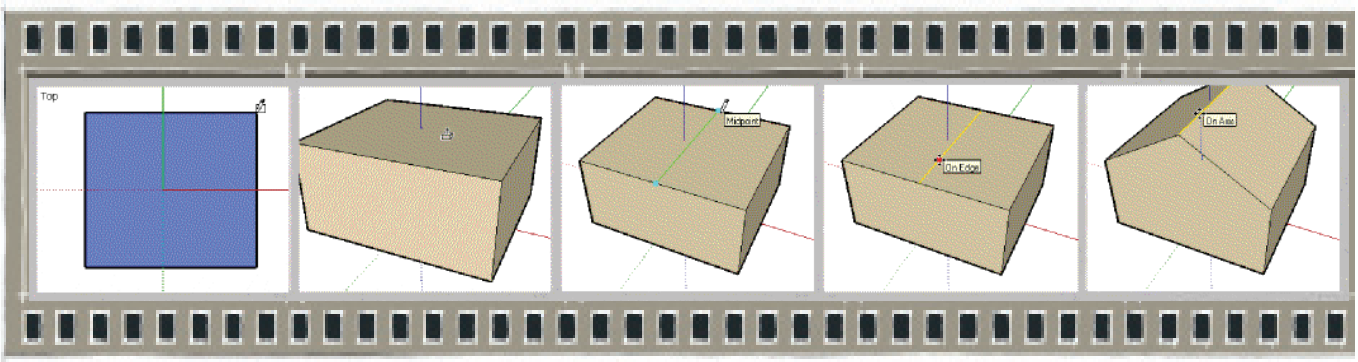


Finish drawing the back sloping edge and erase the unwanted edge that divides the roof plane.

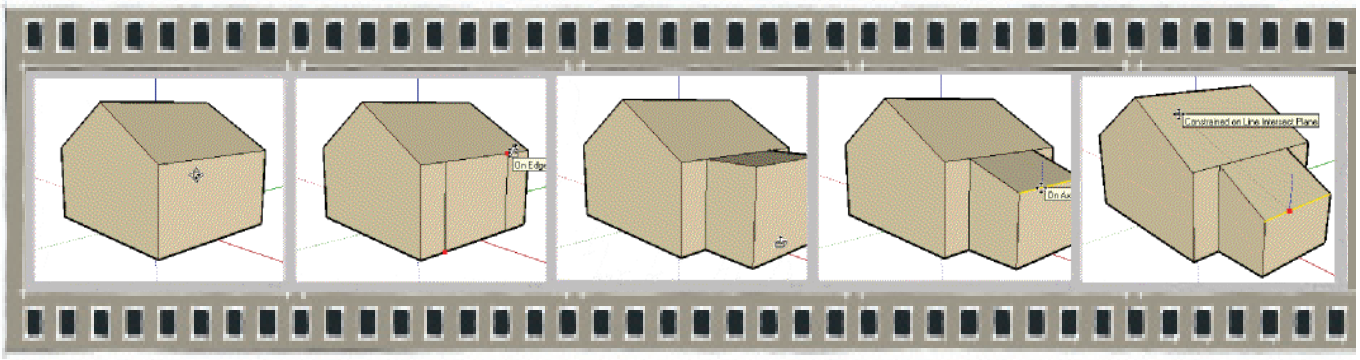
> **Reminder:** This entire example was constructed using only the Line tool combined with inference locking. Anything can be drawn with the pencil and this excellent geometry alignment engine! If you get stuck, just pick up the pencil and draw it.

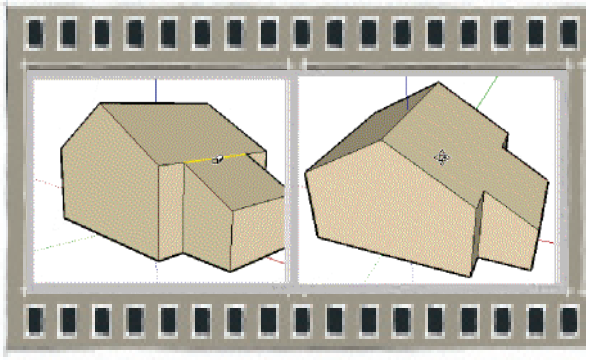
Generating Forms Quickly

Now let's look at another way to create this same house form; this time we will use more advanced tools.



Rectangle	Push/Pull	using Line Tool, draw ridge line between midpoints	move ridge up with Move Tool,	watching for blue direction indication

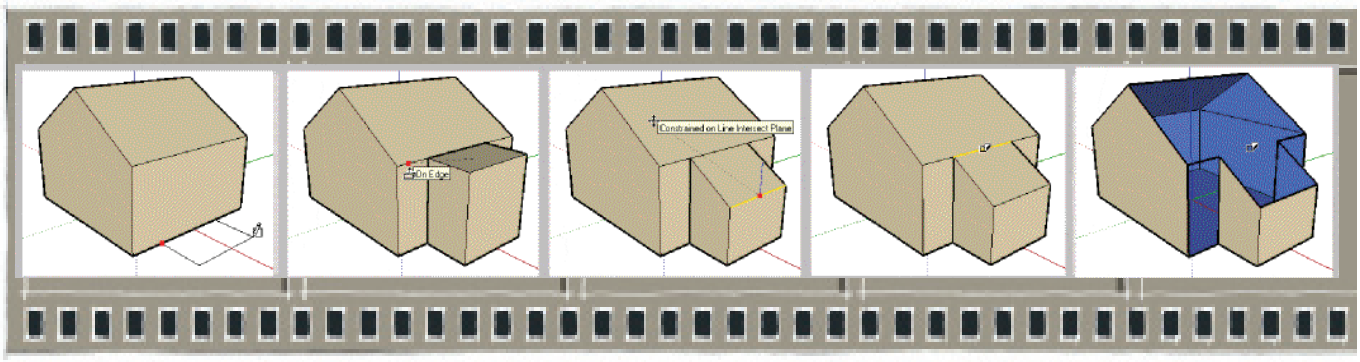




Erase the line that divides the roof surface. Since the two adjacent surfaces are now coplanar, erasing the edge creates one larger, more complex surface. Remember to use inferring whenever possible. This is your “3-dimensional T-square”. It is the feature which, more than any other, gives SketchUp its power and versatility.

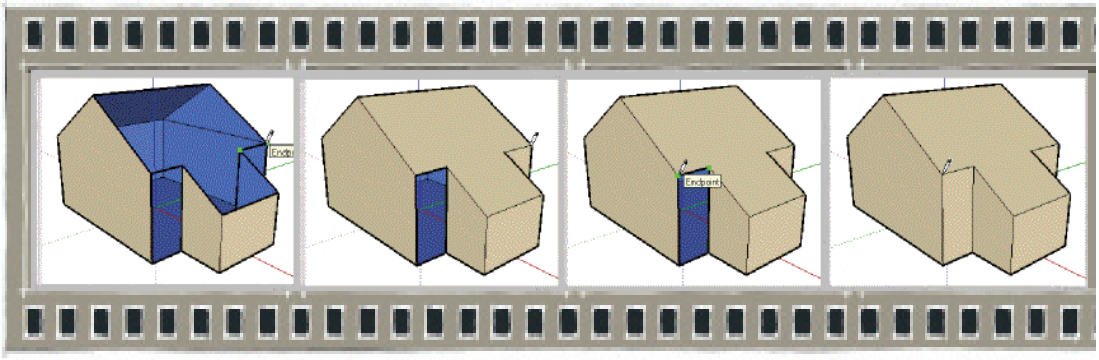
Restoring (Healing) A Surface

Try another way to draw this form on your own using Push/Pull and Move. Notice that Push/Pull is automatically locked in a parallel direction and infers other points. Sometimes when erasing an edge, other faces get erased as well. No problem.



Just use the Line (pencil) Tool and trace over one of the edges from end to end. All valid coplanar loops will be healed or filled in as surfaces. Continue tracing edges until all surfaces are back. *If a surface will not heal, usually it is because the edges are not coplanar. When possible, the face finder will fill in valid coplanar loops.

Note: Sometimes you may have to triangulate between edges across an area to get a surface to fill in. This often happens with input from CAD applications that have many disjointed line segments which confuse the face finder.



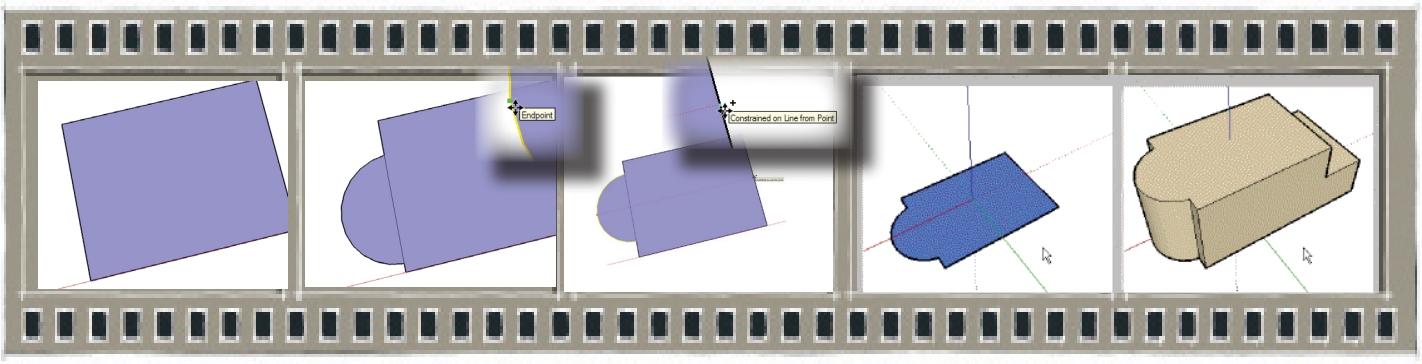
Activity: 10 minute play time

Go ahead and play with SketchUp. Know that you can always use the Line Tool, or accelerate your geometry creation using Push/Pull and Move.

Constructing A Building Footprint

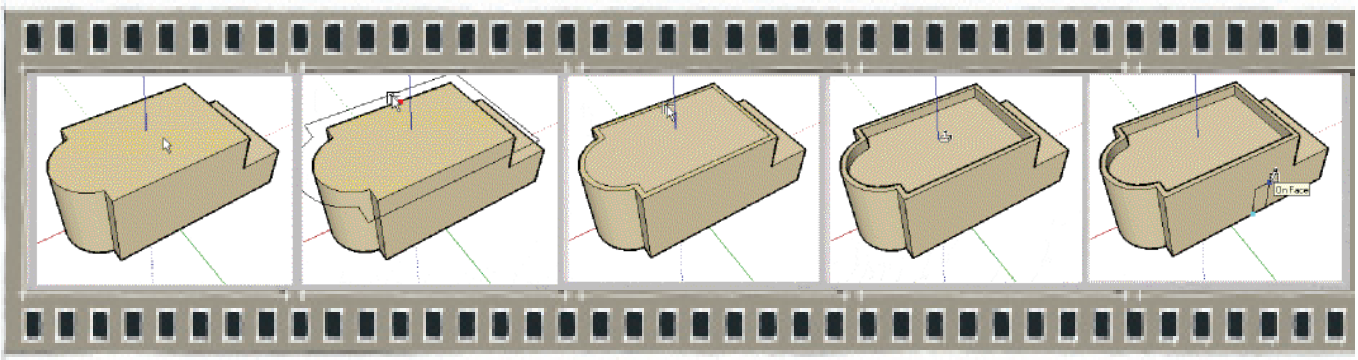
Lay a rectangle out on your ground plane. We are creating a building that has a circular wing outcropping. Grab the Arc Tool and create a half circle along the edge (there is a half circle inference if you hover carefully as you create an arc). You can eyeball the inset from the foundations on either side, or better yet, use inferencing to exactly match the center of the arc with the midpoint of the side (after you draw the arc). To do so, use the Select Tool to pre-select the arc edge. Now grab the Move Tool and hover along the edge of the arc until you get an endpoint indicated at the midpoint of the arc. Click that endpoint and start moving the arc parallel to foundation edge. Hold the Shift key down to lock that direction. Now you can move your mouse to the back edge of the foundation and hover until you find the midpoint of that back edge. Now use the Eraser Tool to erase the line dividing the arc surface and the foundation surface.

Push/Pull the building foundation up vertically. Use the Line Tool to split the roof surface opposite the curved face and Push/Pull down to create the beginning of a balcony.

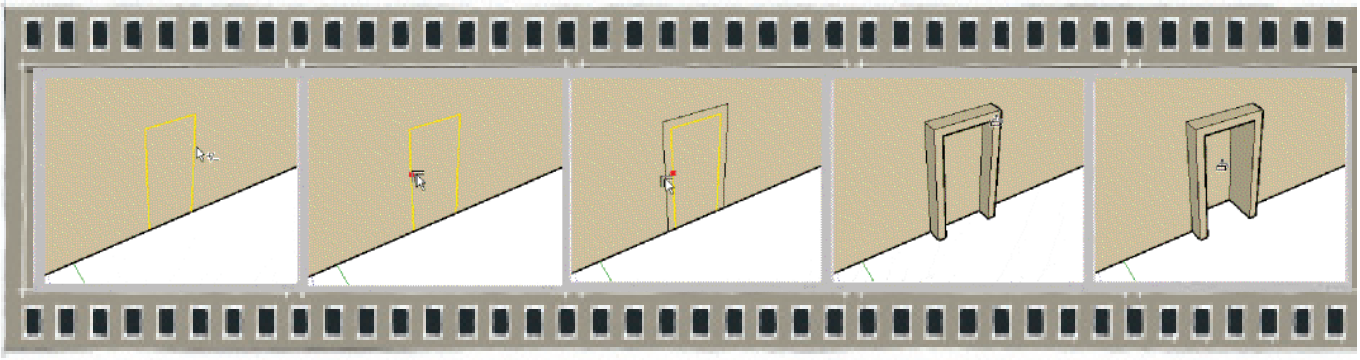


Creating Concentric Surfaces

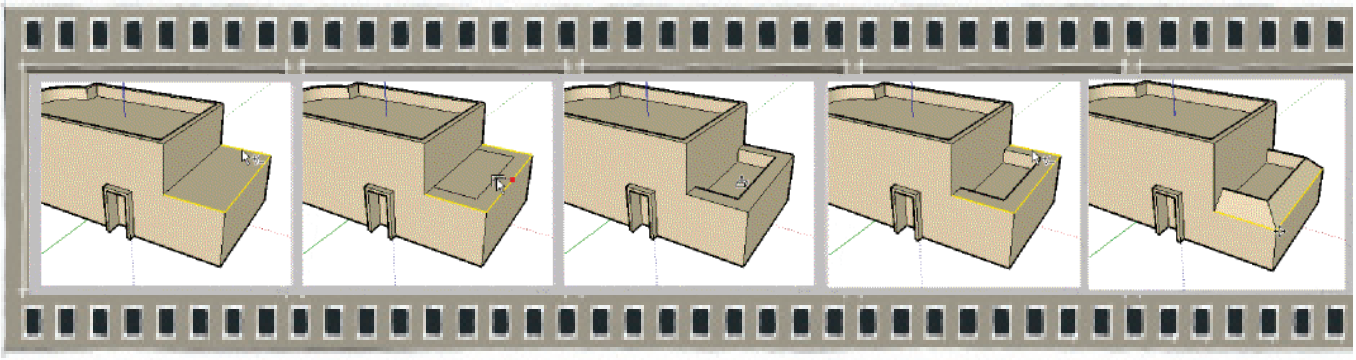
Another basic tool in SketchUp is the Offset Tool  , which creates edges parallel to the perimeter of a selected surface (or to those edges selected) at a user-specified offset distance. To offset edges of a surface, click once on the surface and then hover the mouse to start the offset. Click a second time to set the new edges into place. You can always type in a distance on the keyboard after the first click, and then hit Enter [Return], and the edges will be drawn that exact distance in the direction indicated. Then Push/Pull the interior surface down to create a parapet wall.



Let's draw a door (rectangle) on one side of the building. Hold down the Shift key with the Select Tool to select multiple entities. Using the Shift key with the Select Tool allows you to add/subtract geometry to/from the current selection set.



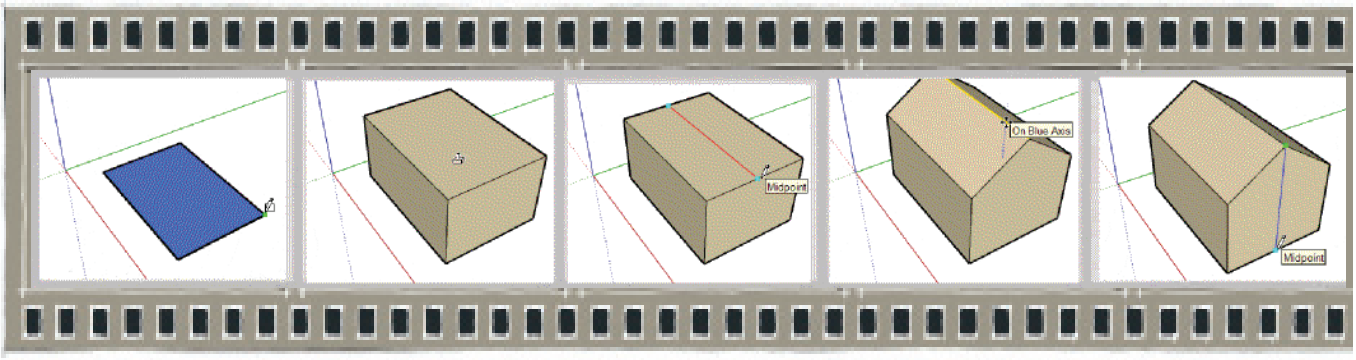
Select 3 edges using **Shift** key to select **multiple items** | Offset Tool | offset the frame | Push/Pull frame out | Push/Pull door in



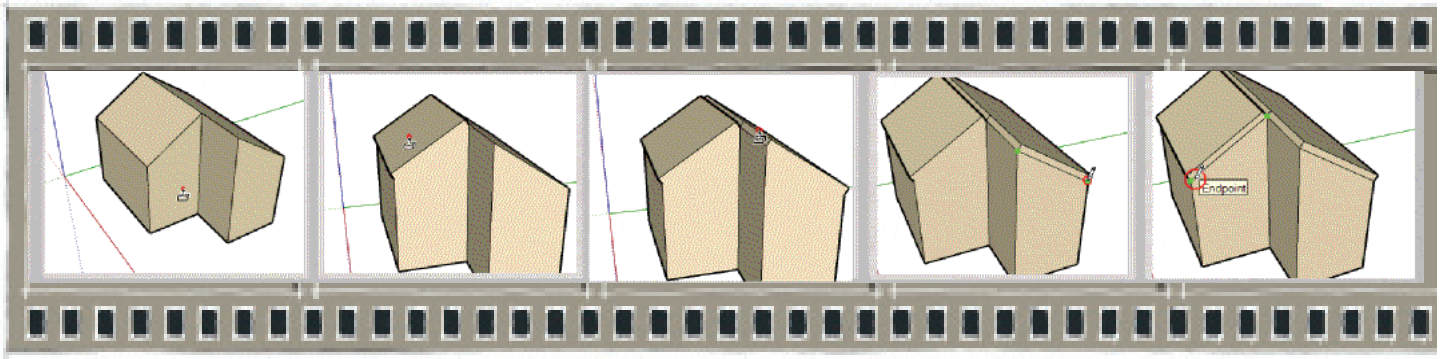
Create a balcony area from the lower section by offsetting the three edges and pushing the interior surface down… or we could make a sloping mansard. Select the three edges (using Shift), and use the Move Tool to create the shed (remember Alt [Cmd] to activate Autofold!).

Drawing A Model Step-By-Step

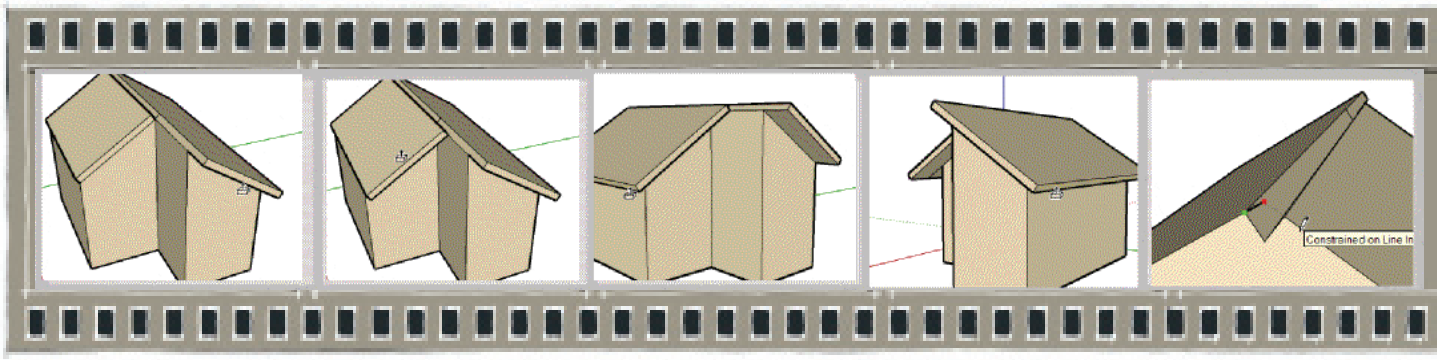
Let's create something that we can use for mirroring and array examples.



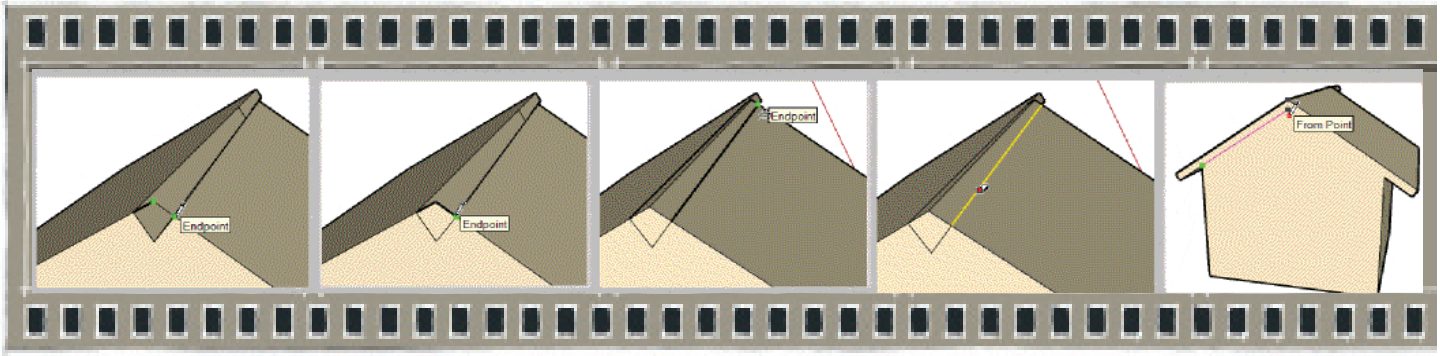
Draw a 35',25' rectangle | Push/Pull form up 12' | draw ridge edge | Move ridge edge 10' up | divide gable with edge



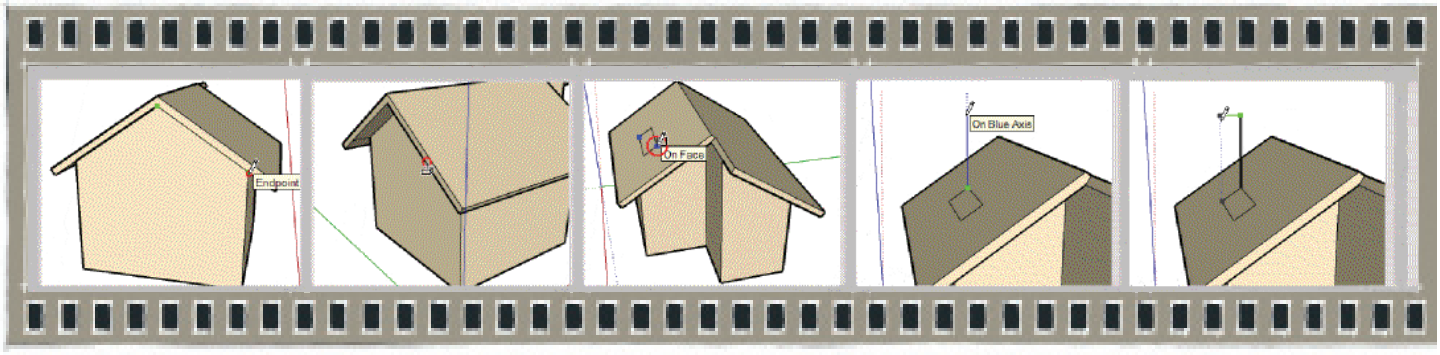
Push/Pull one side back 10’ | Push/Pull roof surface out 8” | double-click repeats Push/Pull distance | draw facia edge | each side



Push/Pull rake eave | 24” each side (double-click) | Push/Pull eave each side | by double-clicking | inference lock along rake

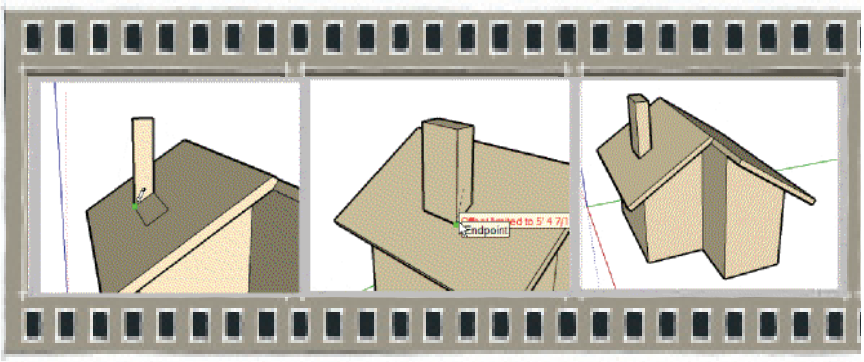


infer to the opposite roof surface | close ridge diamond surface | Push/Pull ridge diamond | Erase unnecessary edges | draw rake



each side | Pull/Pull rake | draw chimney footprint | draw in blue direction | infer in green direction

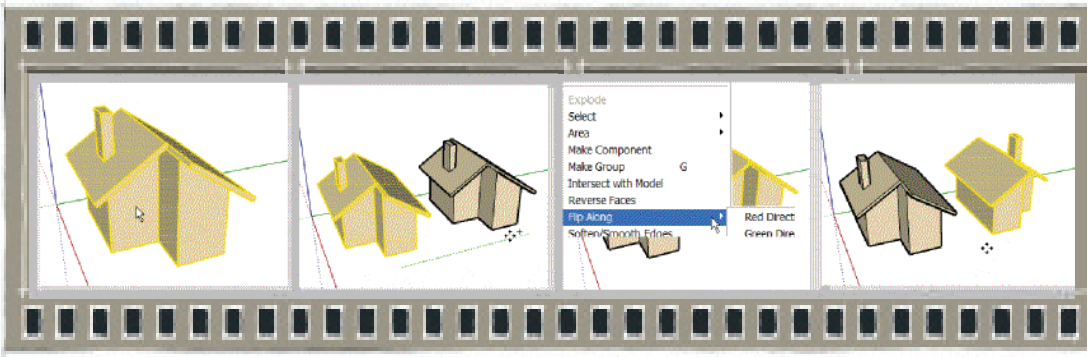
Now draw in a chimney by inferring in the vertical direction. You can infer as you draw the edge upwards, or you can be drawing above the surface of the roof and infer downwards from a point while continuing to draw above the roof surface.



draw back to roof | Push/Pull chimney | finished house!

Mirroring In SketchUp

Let's select the house we just drew and make a mirrored version of it. First copy the house using Ctrl with the Move Tool [Option with Move for Mac]. Using Ctrl [Option] to copy geometry is also a toggle command, so you only need to tap the key once to toggle on/off the copy function.



Select objects (triple-click) | Copy using Ctrl + Move or [Option+Move] | right-click [context-click] | Select 'Flip Along', and choose axis direction

Review note: You can single-click on an edge or surface to select it. By **double-clicking** on an edge or surface you select the edge and any attached surfaces, or the surface and any bounding edges. By **triple-clicking** on an edge or surface, you quickly select that entity along with any attached geometry extended to the outer limits of connectivity.

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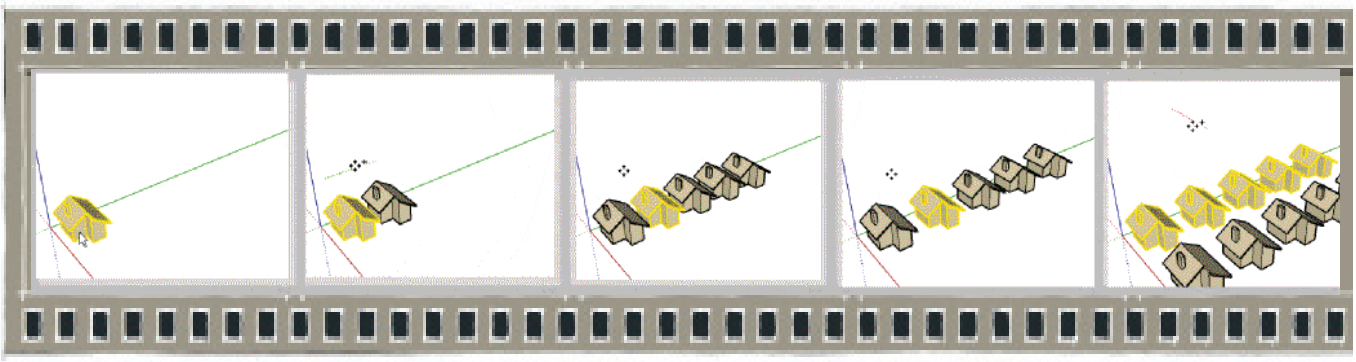
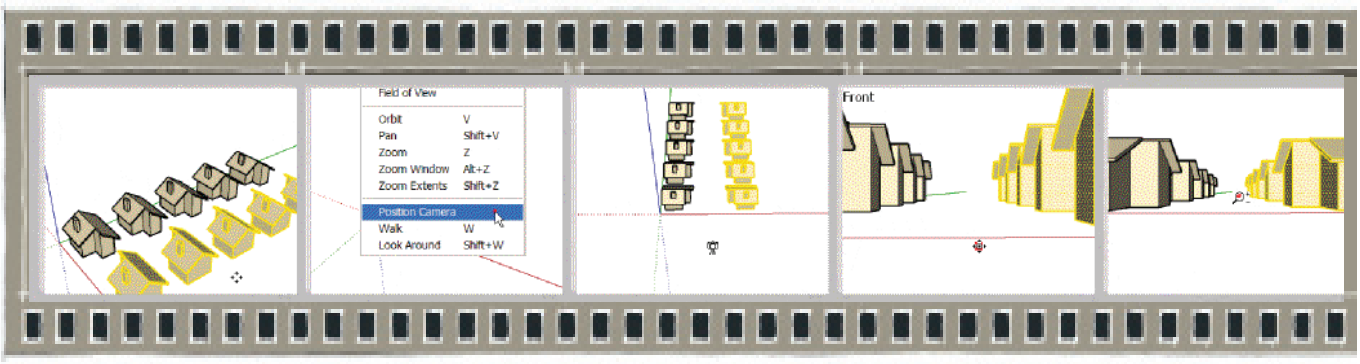
Making An Array



Select (triple-click) | make a copy with Ctrl [Option] | Type 4x (for # of copies) | Type 45' (for separation) | copy entire row over

(these steps are interchangeable and values can be overridden while still in this tool operation)



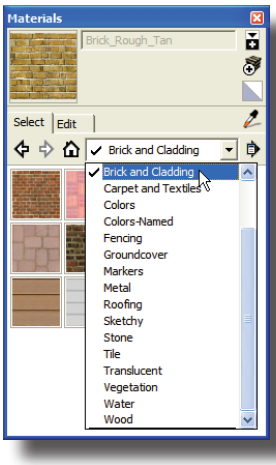
...and flip them | Camera menu > Position Camera | and click points in the scene | Camera menu > Field of view | adjust Field of View

Now we have an array of houses; that's neat, we have a neighborhood. Let's save the file as "My Neighborhood"

You can also set the Field of View with the Zoom Tool  . The camera lens is likely shown in the Measurements box as 30.00 degrees. To change the field of view, just type in a number when the Zoom Tool is activated; this number refers to the focal length of the 'lens' in SketchUp. You can type in *deg.* or *mm* after the number to specify the units.

Applying Materials

Our neighborhood is still pretty boring, let's paint some textures on our houses with the Paint Bucket Tool.

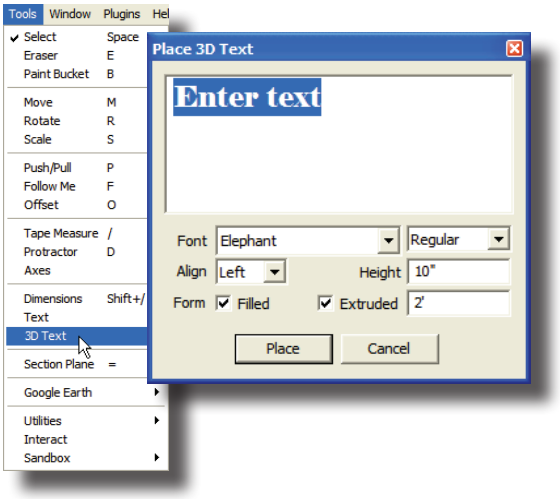


The Materials Browser will open automatically when you click the Paint Bucket Tool. Search through the categories of available materials. Select a roofing material and apply it to the roofs of your buildings. Do the same with the 'Brick and Cladding' category to find a nice siding treatment for your houses. Finally, paint a brick texture on your chimney. It's as easy as clicking on the surface you want to paint!

3D Text

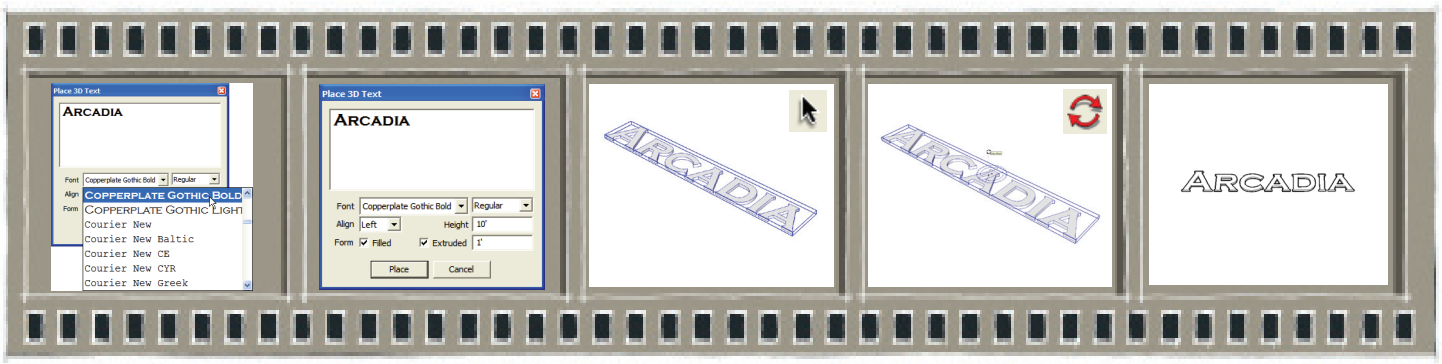
Creating 3D Text is a breeze. Simply go to the TOOLS menu and select 3D Text. 3D Text has a lot of applications, but it basically allows you to turn words or phrases in a specific type face into SketchUp geometry that can be painted, scaled, and positioned in your model. Some modelers will even do text treatments in 3D in a separate model to get exactly the treatment they want. As with any SketchUp file, text files can be saved out as high resolution graphics.

In the Place 3D Text dialog, type the text you want to convert into geometry. Let's review some of the options.



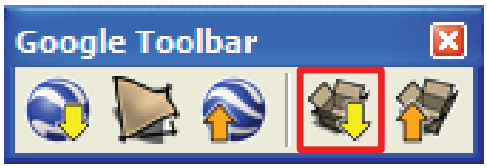
FONT - controls the style and shape of the letters
"Regular" - this pull-down menu lets you choose attributes like regular, bold, and italic when a font has those options
ALIGN - positions the word or phrase within its bounding area
HEIGHT - sets the height from bottom of the letter to top
EXTRUDED - sets the depth of the letters from the face to the back; if 'Extruded' is unchecked, the letters will have just surfaces and no depth
FORM - uncheck the 'Filled' box if you just want the outlines of the letter without surfaces

Type in "Arcadia", select a font, and make sure that Filled and Extruded are selected. Enter 10' for the Height and 1' for the Extrusion. Click on 'Place'. The text is converted into geometry and it automatically becomes a Component. Now you need to select a location for it in your model. Components will orient themselves to whatever surface you are on. Let's drop the text onto the ground plane. Use the Move Tool to position and orient the text however you want. Hovering over any of the RED CROSSES of the Component bounding box will allow you to rotate the text in certain directions. You can also try using the Rotate Tool for more rotation options. We will cover the Rotate Tool in more detail in the next class.

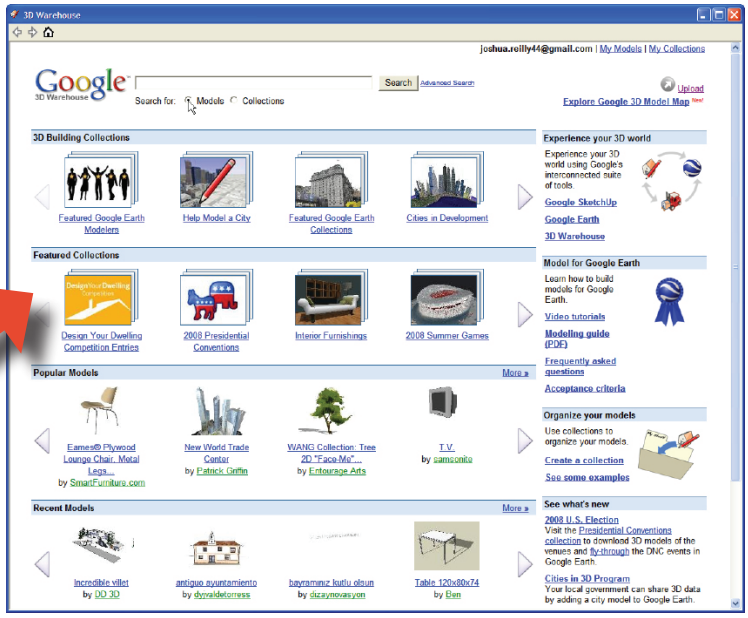


Google 3D Warehouse

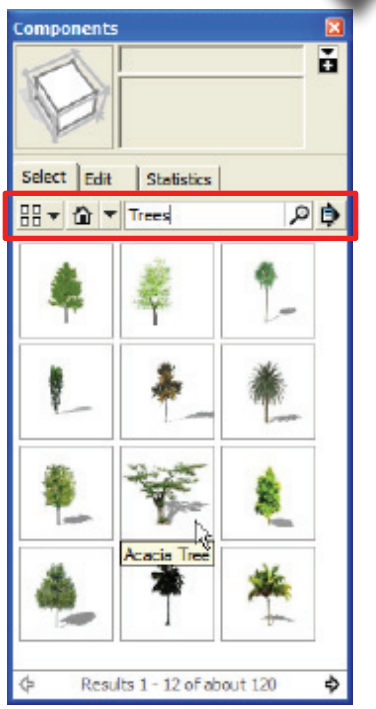
Now we have an arrangement of houses, but our neighborhood is still pretty stark. It would be great if we could grab some trees and cars to add to the context of our model. Fortunately, the Google 3D Warehouse is only a mouse click away!



The 3D Warehouse is a repository for everything 3D: doors, windows, appliances, fixtures, houses, cars, buildings, trees, etc. It is a virtual library of free models that anyone can **upload to** and **download from**, and is an easy way to add entourage to your models. To access the Google Toolbar, go to *View > Toolbars > Google* on a PC [Mac: *View > Customize Toolbar...*]



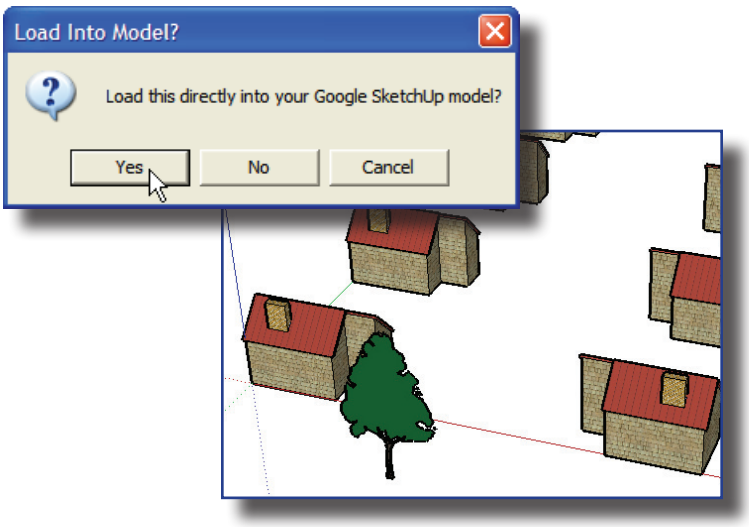
To search for and download models, simply click on the GET MODELS icon  to launch the 3D Warehouse within SketchUp. However, you might prefer to browse the contents of the warehouse **directly from the Components Browser** in SketchUp! To do this, just go to *Window > Components*.



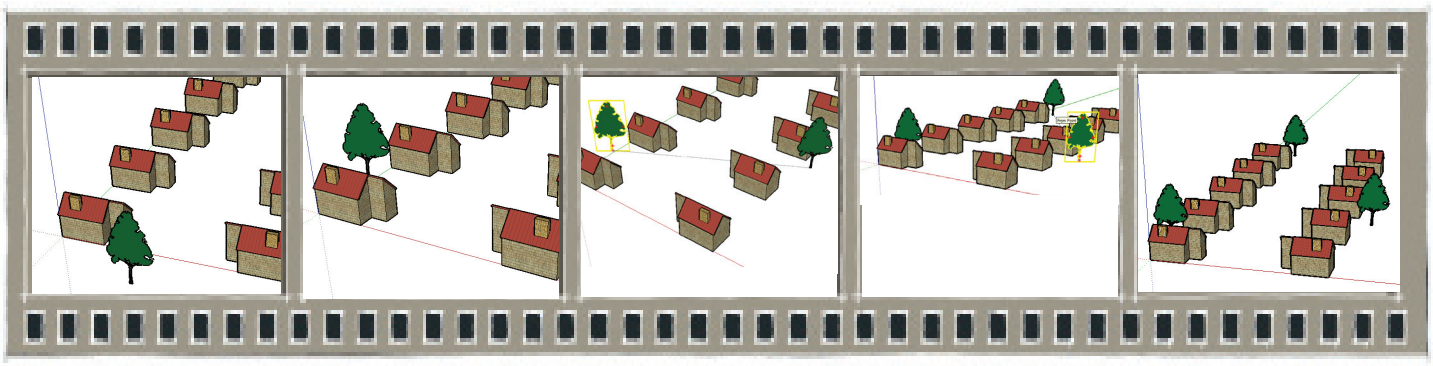
use the Components Browser to explore the contents of the Google 3D Warehouse

You can type in search queries (try 'trees') in the search box just below the 3 tabs. Click once on any search result to automatically have that item downloaded into your model. The '**View Options**' button to the far left of the search box lets you choose the way your search results are displayed. The 'house' icon lets you view all the components currently **in** your **model**. Using the '**Details**' arrow on the right side, you can save a 3D Warehouse search as a '**Favorite**' and download any warehouse collection for offline use! Use the '**Navigation**' arrow to the left of the search box to access Favorites or Recent search collections.

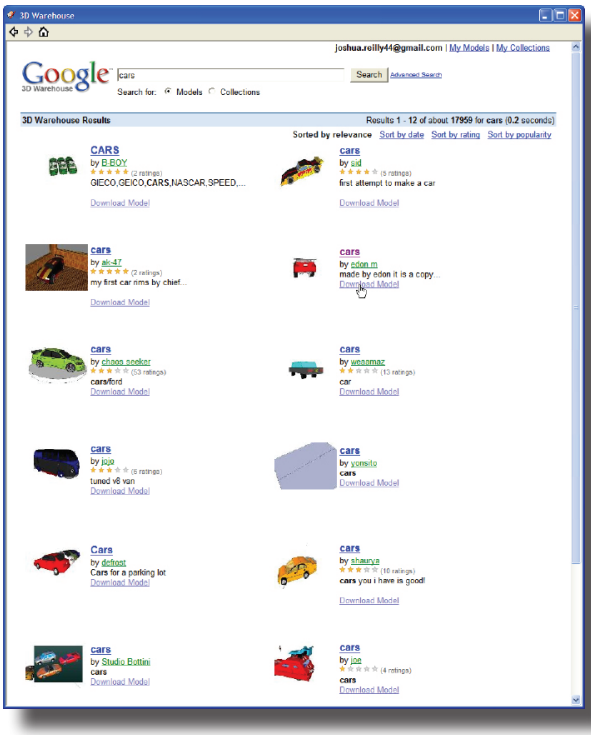
Search for '2D schematic juniper2 tree'. This Juniper looks good; click on it once to download it. If you're not searching from the Component Browser, you'll need to click on the item you want, then click on Download Model.



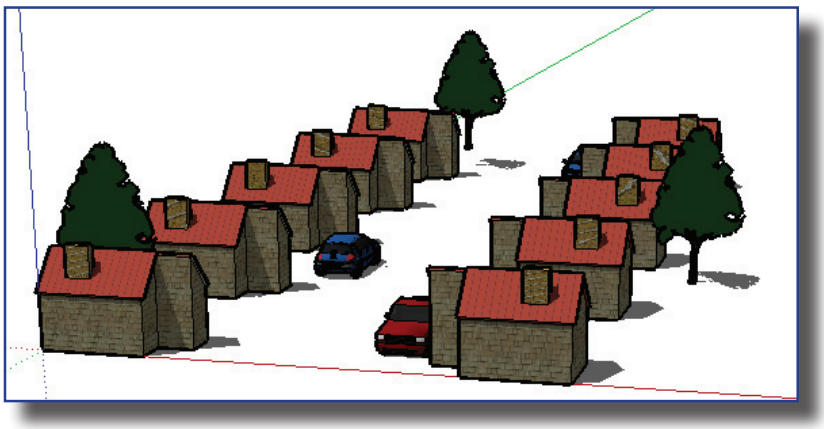
Click on Yes to download the item into your current SketchUp model (you'll only see this prompt if you search the warehouse from the toolbar icon). It's as easy as that, the new tree component can be positioned anywhere in your model. Drop it at some interesting location, and then orbit to verify that you placed it on the ground plane. Now tap the Ctrl key with the Move Tool and you can make copies of the tree around your neighborhood.



Let's go back to the 3D Warehouse and grab some cars to finish out our scene. Click on the 'Get Models' button or just type 'car' into the Components Browser search box and hit Enter.



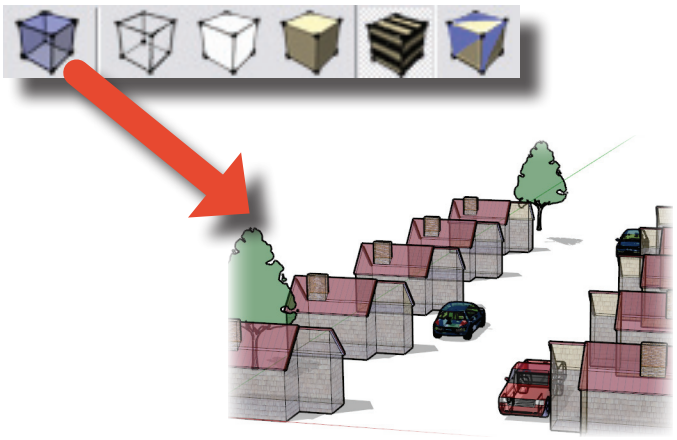
Find a car you like and place it in your model. The 3D Warehouse works just like the Google search. If you don't see something you like on the first page click on the 'Next' link to see another page of models. After you get the car in your model, go back and try searching for "pickup truck". Grab one of the trucks and drop it in. The 3D Warehouse makes it a snap to add entourage and complete the look of your model!



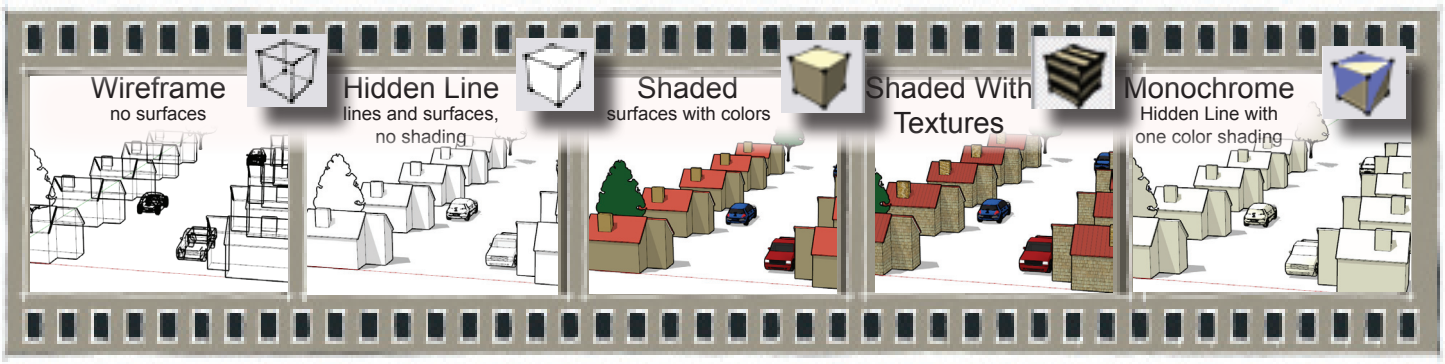
Display Options And Styles

SketchUp gives you a great deal of control over how your geometry is displayed on screen and for printing.

Display Options (Face Style)
In your menu, you should see a series of icons representing different modes for displaying your model. If not, you can access this toolbar from *View > Toolbars > Face Style*. Let's see how our model looks in each of these modes.



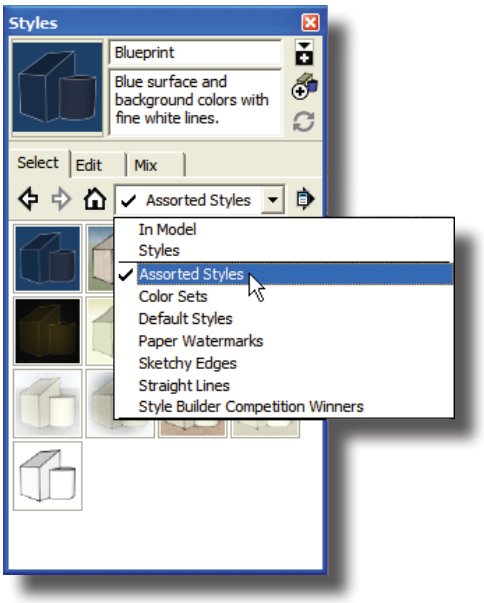
The cube icon on the far left of this toolbar represents **X-RAY** mode. This is a *toggle* that shows all surfaces, materials, colors, etc., but makes them transparent so you can see through the geometry. Since it is a toggle, the X-ray mode can be on or off in combination with any of the other display modes. The other display options are shown and described below.



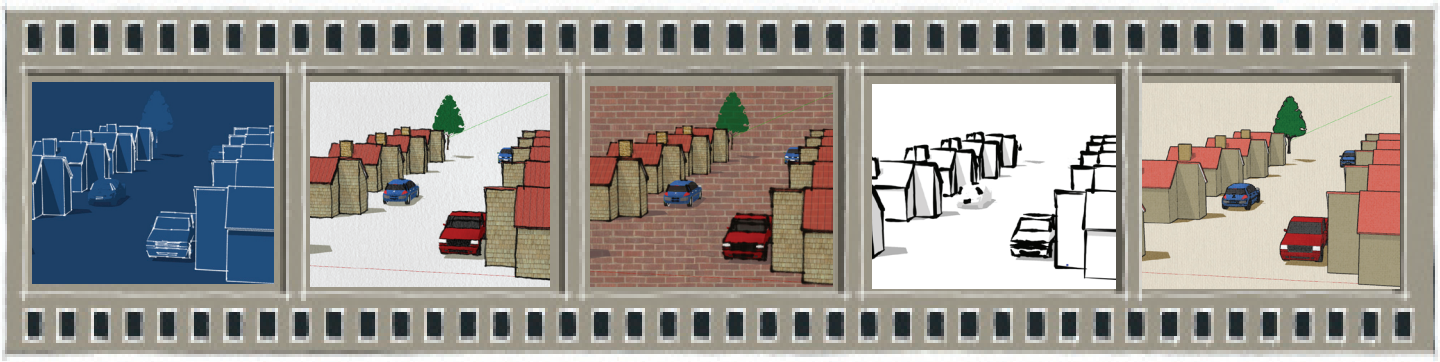
Styles

In addition to the display modes available in the menu, SketchUp allows you to apply a collection of display properties which we call a STYLE. To apply a style, simple go to the *Window* menu and select *Styles*.

Applying styles is just as easy as clicking on one of the icons in the Styles Browser. Check out the 'Assorted Styles' category in the pull-down menu and try some of those. Styles are made up of various face treatments, which are the same as the modes described previously, but also include additional line and overall model treatments. These assignable attributes include settings like background color, ground/sky, depth cue, line extensions, and halo. Styles also give you the ability to apply foreground and background watermarks, and can give your linework a variety of different appearances to help your model feel more sketched and loose, or make it look precise and finished. Play around applying different Styles to see how quickly and easily you can completely change the look of your model. Remember that applying Styles does not affect the actual geometry, it only changes the visual representation of it. Be sure to save your neighborhood model to the desktop when you're finished.

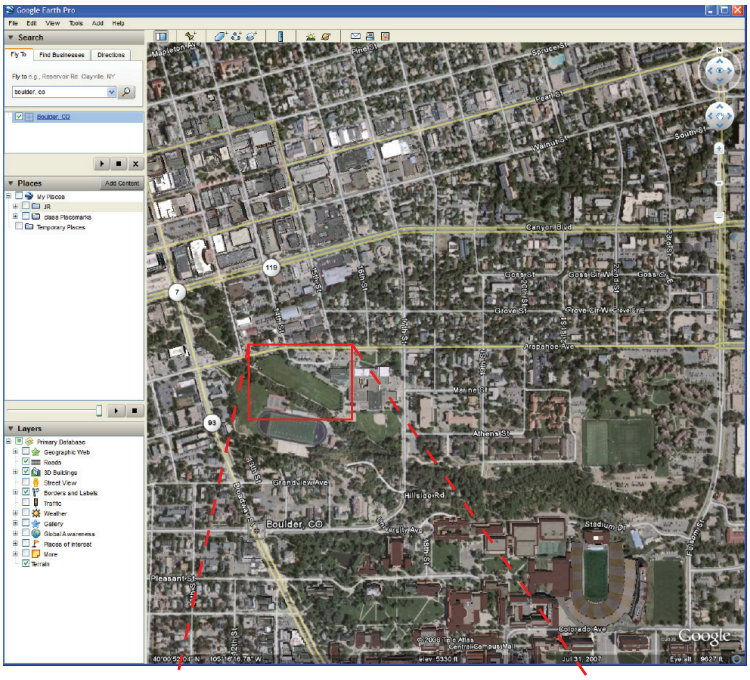


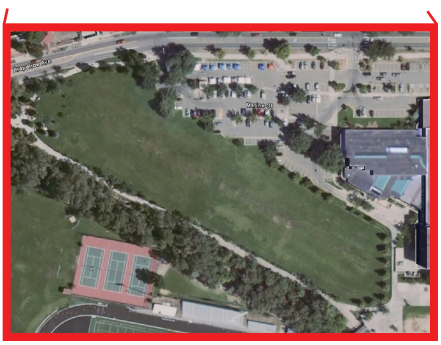
Sketchy Edges are very cool. Rather than rendering your geometry in straight lines, various stroke treatments can be applied. As you zoom away from the model, details drop away; just like in the real world!



See Your Model In Google Earth

Finally, let's take a look at a great free way to share your models and show them positioned in Google Earth.





zoom in and fill your screen with this open field so we can import this view into SketchUp

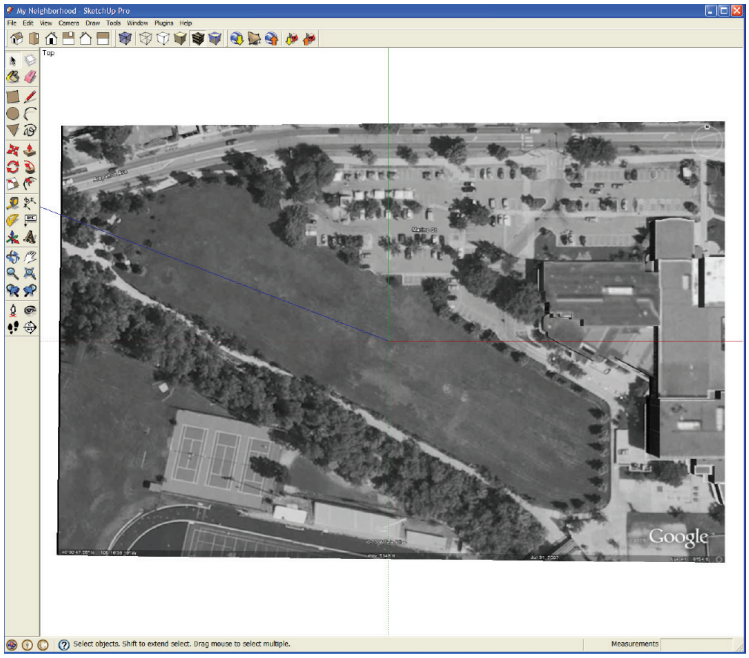
Note: Before you click on 'Get Current View' in SketchUp, make sure your view in Google Earth is oriented perpendicular to the ground. Use the keyboard shortcut "R" to Re-orient your view quickly to looking straight down and North pointing 'up' on the compass. Also, make sure you don't have any extra Layers turned on. Any icon graphics and content in Google Earth that appear with certain Layers will also be included in your satellite image when it gets put into SketchUp.

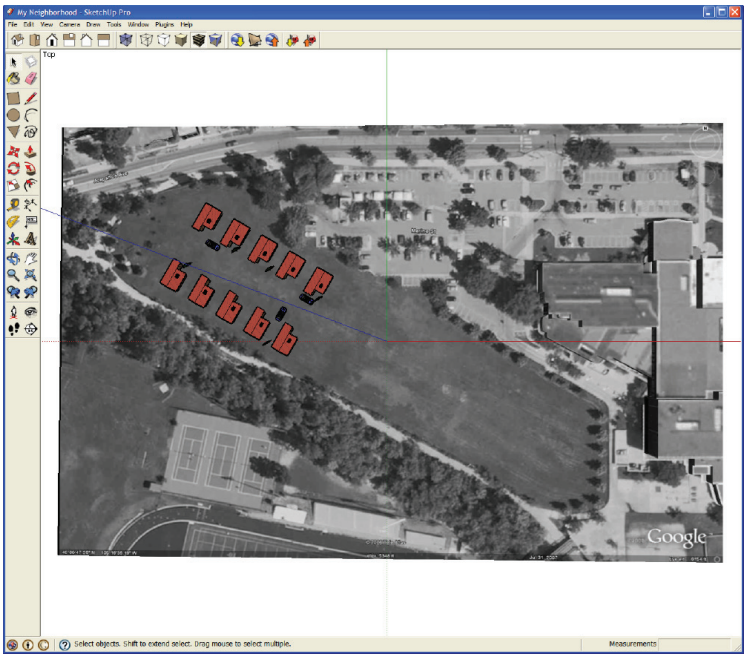
Google Earth is free for anyone to download and browse. It is really a virtual world. As we said earlier, Google 3D Warehouse is a repository of 3D models of all types. The warehouse isn't limited to just Components, it is also a storehouse for "geo-located" (or geo-referenced) models; that is, for models that have been exactly positioned in the virtual realm of Google Earth to match their location on planet Earth.

Let's take a look at how that works - start by launching Google Earth. Type in "Boulder, CO" and hit Enter. We're going to take our neighborhood model and position it in an open area near downtown Boulder. Let's zoom into the field and position our view so that we have isolated just the area that we want to model on. Now start a new file in SketchUp.

In SketchUp, click on GET CURRENT VIEW 

SketchUp brings in a SNAPSHOT of the Google Earth view that contains both the **satellite image** and the **topographical data** for your site! Go to *Window > Layers* to see the Snapshot and Terrain on separate layers. Here you can toggle on/off the visibility of the terrain with the Layers check boxes. You can also do this with the 'Toggle Terrain' icon. 

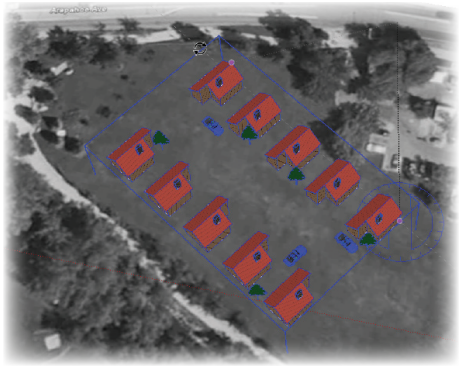




Now let's bring in your neighborhood. In SketchUp, go to the *File > Import*, select your saved neighborhood model, and click on 'Open'. The entire model comes in as a Component.

Now we can position the model in the context of our satellite site image. Select the Move Tool and move the neighborhood to a location of your choosing in the open field. You can also use the Move Tool to easily orient your neighborhood by rotating it with the red rotation grips on the Component bounding box.
Finally, orbit and zoom in SketchUp to a convenient isometric view of the neighborhood. The view seen in SketchUp will be the default view/orientation of your model for anyone browsing it, until you change it in Google Earth.

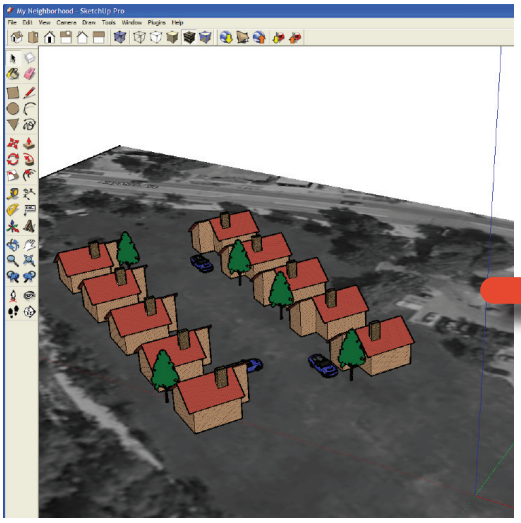
Google Earth launches and shows you your neighborhood in its exact latitude/longitude position on the globe!



rotate neighborhood to fit into field

Initially, this model will be a temporary file in the Places panel on the left. To save this to your local hard drive, just click and drag the file up into the 'My Places' category. To make a public version of your geo-located neighborhood, simply click on the 'Share Model' button. 

This will launch the Google 3D Warehouse so can easily create a log-in and then share your model. Now anyone who browses the 3D Warehouse will be able to access not just your model, but a geo-located version of it as well!



once positioned, click on 'Place Model' to export model to Google Earth