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Push/Pull with Modifier Keys

When you press certain modifier keys while using Push/Pull, you can control how adjacent faces act. To demonstrate this, we’ll work on the back face of the trapezoidal model.

1. Orbit to the back and pull out the face shown. This leaves the neighboring faces in place, and adds new vertical faces between existing faces and the pulled-out face.

2. **Undo** this operation (Ctrl+Z or Cmd+Z), and pull it again, this time pressing and holding the Alt/Cmd key. The pulled face remains the same size, but the neighboring faces move with it.

3. **Undo** and try again, this time press the Ctrl/Option key (you don’t have to keep it pressed). The difference this time is that dividing lines are created along faces that would otherwise be healed, such as the top face.

4. For another demonstration of modifier keys, **Undo** again, and pull out the side of the trapezoid (with no modifier keys).

5. Then pull out the face shown.

**NOTE:** You could get the same results using the Move tool, but Push/Pull ensures that you are always moving perpendicular to the face.
**Round Objects**

By extruding a face along a circle, you can create rounded, or lathed, objects.

1. We’ll start with the most basic round shape - a sphere. Start with a circle in **Top** view.

   ![Circle in Top View](image)

2. Orbit so that you can create a new circle perpendicular to the first one. (The circle preview must be red or green, and you can hold Shift to lock its orientation.) Start the new circle at the center point of the first one, and make it larger.

   ![New Circle Perpendicular](image)

3. Select the new, larger circle. You can select either the face or the edge.

   ![Select Larger Circle](image)

4. Activate **Follow Me**, and click the smaller circle. The smaller circle is driven around the larger one.

   ![Follow Me](image)

5. Erase the larger circle to get the sphere.

   ![Erase Larger Circle](image)

   (You also could have driven the larger circle around the smaller one, but then the smaller circle would end up inside the resulting sphere and therefore harder to erase.)

6. For another way to create a sphere, start with a half-circle arc closed by a line.

   ![Half-Circle Arc](image)

7. Draw a circle perpendicular to the arc shape. The center point must be aligned with the line, but does not have to touch it. (It might help to use **Tape Measure** to draw a guide line; then you can center the circle at the endpoint of the guide.) The circle can be any size, as long as its center point is located correctly.

   ![Perpendicular Circle](image)

8. Select the circle, activate **Follow Me**, then select the half-circle face. The sphere is created.

   ![Follow Me Sphere](image)

9. To create a hemisphere, start with the same arc shape as before. Then draw a perpendicular circle of any size at the midpoint of the arc shape line.

   ![Hemisphere](image)
10. Select both edges of the circle, and use **Follow Me** on the arc shape, to create the hemisphere.

11. The location of the **Follow Me** circle affects the outcome of the extrusion. Draw a rectangle with some lines and arcs inside it.

12. Erase as needed to make a face like this.

13. Place a perpendicular circle at the corner point shown.

14. Use this circle to extrude the shape, and this is the result, shown in **X-Ray** view. The rectangular cutout is in the center of the object.

15. **Undo**, and this time place the circle at this corner point:

16. The extrusion this time has the rectangular cutout on the outside and the curved portion on the inside.

17. Here’s a funny aspect of **Follow Me**. Replace the circle with a half-circle.

18. Use **Follow Me** along the 180-degree arc (not the half-circle face). If you look closely, you can see that the start and end faces are not flush.
Building the First Dormer

1. Now we can start the first dormer. The dormer is to be aligned with the side of the house, and start directly above an existing window. Activate Line and place your cursor along the left edge of the left window frame (don’t click yet).

2. Press and hold Shift to lock the face constraint, and move the cursor to the roof face. The red square indicates where this line would start. Don’t click however, because we are going to try another way to start the first edge.

3. Hover over this top corner of the window:

4. Press the Up or Down arrow key. (You don’t have to keep it pressed.) This locks the line to start directly above the point where you are hovering. Move the cursor to the roof face to see where the line will start.

5. Click the roof face to start the line. To end the line, press and release the Right arrow to lock the red direction, and click anywhere on the other side of the window below.

TIP: If you find it hard to remember when to use the Right and Left arrows, remember R=R (Right = Red).

6. Make the next edge vertical, leaving enough height so that the dormer peak will still be below the main roof.
7. For the third edge, hover over this midpoint:

8. Complete the edge directly above this midpoint.

9. Next, hover over this endpoint:

10. End the edge when you see this double constraint:

11. Complete the front face.

12. To build the dormer walls, start a line at the dormer peak, and press the Left arrow to lock the green direction. Then click anywhere on the roof face.

13. Press Esc to end the line, then draw the line shown below the same way:

14. Now add two more lines to complete the side of the dormer.

You could complete the other half of the dormer the same way, but then the completed dormer would cover the face you need to erase to make the hole in the roof. So we’ll create the roof cutout face first, and then complete the dormer sides.
**Scaling Components**

This is a good technique to use if you want to use one (or few) components repeatedly but still produce a random look. You make several copies of the component, and use **Scale**, **Rotate**, and **Move** as needed to give the components different sizes, locations, and orientations.

Because the component is changed from “without” (not changed via editing), the original component definition does not change, so SketchUp only has to know which component has which location, orientation, and size.

1. A good example for showing this technique is to create a group of random trees. In the **Components** window, search for “google pine tree 2D.” Click the thumbnail for the model shown below.

2. Insert one tree in the file, and make a few copies. Naturally, each looks identical to the other.

3. Use **Scale** on one tree to make it larger. (This is done on the closed component - you don’t have to open it for editing.)

4. You can also use **Scale** to turn one tree inside-out, and make it wider as well.

By applying different scale values, you can get a random-looking group of trees, without bogging down your file with extra objects.

**Note:** If you have components with different scales, and you replace them all with a new component, the new components will have the same scale values.
9. Now all the yard needs is a house. Search for "too-small house rosles," and click the thumbnail for the model shown below.

10. Insert this house. Surprise, the size of the house is too small for its yard.

11. To resize the house, activate **Tape Measure**. Click two endpoints to get the actual measurement, then enter something realistic like 45'.

12. You are asked to confirm the resizing, and the message informs you that not everything will scale uniformly. Click **Yes** anyway.

13. Zoom out to see what happened. The objects that are resized are the yard (a group), the shed (an internal component, created within this file), and the pool (ungrouped). These resized objects are now much too large. The objects that retain their original size are the house and trees: components loaded from external files.

14. **Undo** the resizing.

15. Resizing an external component needs to be done within the component. So open the house component for editing, and then use **Tape Measure** on the same endpoints.

16. When you enter the new length (45'), you now get a different confirmation message:

17. Click **Yes**, and only the house resizes.

18. Close the house component.
8. Draw a room with two walls and a floor, and apply the material to the walls.

9. The second method involves importing the texture directly onto a face. Start a new file and draw a new room.

10. Choose **File / Import** from the main menu. Make sure you are searching for files of all supported image types, and check **Use as texture**.

11. The image is now attached to your cursor. Click the first corner within one of the walls, then move the cursor to define the second corner. The **Dimensions** field lists either the image’s width or height, depending on where the cursor is along the image.

12. Click the define the second corner, and the image tiles to fill the face.

13. Windows: Make sure the new material is active, and click **Create Material**.

The image now appears in **In Model**. Now we’ll copy it to make a similar material.
8. Orbit to the other side of this wall; it still has the default color.

9. Return to the side you painted with stone, and edit its **In Model** material to be translucent. Now you can see into the other room. *(Mac: don’t forget to click the Close button when you’re finished editing.)*

10. Orbit again to the other side of this wall; it now has the same translucent material. This is by design; SketchUp assumes that windows are supposed to look the same on both sides. But we can change this.

11. Paint one side of this wall to match the tile of the rest of the room. Now it is opaque on this side.

12. Return to the other side, and it is still translucent. This is how you can make a “one-way” window like you might see in an interrogation room or a casino - you can see in but others can’t see out.

13. Make a new window in this wall and make it translucent.
7. Then right-click on the group and choose **Explode**.

![Explode menu]

**NOTE:** You could also **Explode** first, then run **Intersect with Model**.

8. Trim away the extra parts of the exploded group, and this is what’s left. The faces of the tunnel through the box are the default back face color.

![Trimmed group]

This is because you painted the cutting object *before* grouping it, and when you painted the faces, the backs of the faces remained in the back face color.

9. By reversing two steps, we can change the results. **Undo** until you return to the box and the ungrouped, unpainted cutting object.

![Undo example]

10. Make the unpainted cutting object a group.

![Grouped object]

11. Paint the group (without opening it for editing). This paints both the fronts and backs of faces in the group.

12. Repeat the steps of moving, intersecting, exploding, and trimming. Now the passageway has the color you assigned to the group.

![Painted group]

If you’re so inclined, try “Arch Cutouts Using Groups” on page 105 again, painting the cutting groups before interesting and trimming.

You can get this colorful result:
12. Activate a red color and click anywhere on the table. The legs were already painted, but the default-colored table top is now red.

13. Bring in another table from the In Model folder of the Components window. The new table has the default table top.

The In Model folder still contains one component - the basic definition of the table is the same.

14. Bring in two more tables, and paint each one a different color.

15. Look at one of the table’s Entity Info windows. The component’s default color is the one you used to paint the entire component.

**NOTE:** If you have a component in which each face has an assigned material, you can still assign a default material by painting a closed component. The default material will not appear anywhere on the component since all the faces are already painted, but any new objects created within the component would have the default material.

16. Open one of the tables for editing and paint the table top white.

17. Close the component and each table has a white top.

Currently the default color is assigned to the top of the table. Now we’ll change this so that the legs get the default color.
21. To dimension the lower arc, click the arc and click again to place the dimension.

22. If the “R” prefix does not appear with the radius dimension, you can attach it. Open the Dimension page again, and click Expert dimension settings.

23. Make sure Show radius/diam prefix is checked.

24. Dimension the upper arc the same way.

25. The model is starting to look cluttered, so it’s a good idea now to modify the display. Open the Expert Dimension Settings again and check Hide when foreshortened.

26. With this setting, dimensions oblique to the viewing plane are hidden. Orbit to a more vertical view, and the dimensions on the red-green plane will disappear.

Mac: To close this window, click the Expert dimension settings button again.
Smoothing Faces of Rotate-Copied Curved Objects

For exercises such as the previous "Domed Apse" on page 318, you need to consider the interior walls of copied objects and how they affect edge smoothing.

1. Work the previous “Domed Apse” exercise and look at the results in X-Ray view. Each copied wedge has side walls.

This explains why, when you smooth the edges, it still has a faceted look. As long as interior walls exist between the exterior walls, the exterior walls cannot be smoothed.

2. To change this, the side faces should be removed. **Undo** or erase as needed, to return to this step:

3. Erase the vertical faces on both sides of the slice, plus the small vertical line between them. The slice should now consist of two exterior faces.

4. Select these two faces and rotate-copy them along the 180-degree arc.

5. Replace the front faces by retracing any edge.

6. You can now soften the edges without the facets.

**NOTE:** For the smooth version (without interior faces), if you smooth each edge individually by right-clicking and choosing **Soften**, you will still get a faceted (not smooth) look. Either use the **Eraser** tool with Ctrl/Option pressed, or select all edges, right-click and choose **Soften/Smooth Edges**.
23. Display hidden edges (View / Hidden Geometry). Unsoften a few edges, as shown below, by activating Eraser and clicking on them while pressing Shift+Ctrl/Option.

24. Turn off the hidden edge display, and you should now see these two lines. These represent where the left and right mouse buttons will go.

25. Use the same method to create some lines for the thumb button.

26. To block off these areas, add a few extra lines as shown. It’s easiest to do this while displaying hidden edges as a guide. Soften the remaining segment edges by using Eraser + Ctrl/Option.

27. Color the mouse and its three buttons.

28. For the mouse wheel, make a sphere as described in "Round Objects" on page 98. Use Scale to adjust the sphere’s size, and to push in the sides. Finally, make the sphere a group, so that it won’t stick to the mouse.
9. This larger model doesn’t fit well in its current space, so we’ll find a new location for it in Google Earth. Get to a view like the one below, switching to a bird’s-eye view and rotating so that the North arrow is approximately in the 3 o’clock position. Zoom so that you can see this patch of green space between Stockton and Powell Streets.

10. Zoom in closely on this park.

11. Return to SketchUp and click Get Current View. The building and its current location remain in place, and the new terrain view is added to the model (you may have to zoom out to see it).

12. If the terrain views are still displayed, click Toggle Terrain to bring back the flat snapshot views. The flat views are better for moving objects around.

13. Move the building to the new view, positioned how you want it within the park.

14. Toggle the terrain back on. The building still has its elevation from its location on Telegraph Hill, which is higher than its new location.

15. Move the building straight down to meet its new terrain.
16. Use **Place Model** again to relocate the building within Google Earth as well.

As we just saw, when moving a building to a relatively close location, such as another part of the same city, you can see both the current and new terrain views within SketchUp. However, imagine if you wanted to move this building to Paris or Tokyo - the two terrain views would be much too far apart to see both within SketchUp. The solution is to save the building model and start over in a new file.

17. Return to SketchUp. If you save the current SketchUp file as is, you will also be saving its geographical data, which is the only part of the model we don’t want. Instead, we’ll save just the building into its own file. First, make the building into a component (right-click on the group and choose **Make Component**).

18. You’re not asked to assign a component name, because when you make a group into a component, its name is assigned automatically as “Group1.” To change this name, open the **Entity Info** window and change the component’s **Definition Name**. I’m using the name “Exhibit.”

19. Now save the component as its own file by right-clicking on it and choose **Save As**. Save it in a location you will remember; its name will be the same as the component name.

20. Now return to Google Earth, where we’ll find a new location for the building. Enter “Washington Monument” in the **Fly To** field, which brings you to the National Mall in Washington, DC.
Collections
If this syntax is not used, Google will search primarily for models, though collections can also turn up in searches. But you can narrow your search to yield only collections, as long as other terms such as title or tag is also included. For example, the syntax
dishwasher is:collection
will yield collections of dishwashers, most likely from manufacturers.

To filter out collections, and search only for models, use the syntax
dishwasher is:model

Georeferenced Models
You can search for models that have specific locations, or for models that appear on the 3D Buildings layer of Google Earth.
For example, the general syntax
art museum
yields all models with “art museum” in the title, tags, or description. There are 641 models found in this case.

If the syntax is changed to
art museum is:geo
the search yields only art museum models that were uploaded with location data (a mere 426).
11. Back in SketchUp, create the chair model you want to add to the chair collection. Then click **Share Model**.

12. Once uploaded, the chair model’s details page contains a link “Add this model to a collection.” Click this link, and the “Bonnie’s Chairs” collection is available from the drop-down list. (The “Bonnie’s Office Furniture” collection is not available, because that collection cannot contain models, only other collections.)

**NOTE:** If you add other people’s models to your collections, be aware that the models can be removed at any time by the person who uploaded it.

13. You are not limited to placing only your own models in your collections. Search the 3D Warehouse for another chair you like, made by anyone, and the “Add this model to a collection” link appears.

14. Creating a child collection is not the only way to add a collection to another collection. Start a new collection from scratch, using the “Create” link you used to create your first collection. This new collection is for desks, and contains models. Once created, there is a link “Add this collection to another collection.”
Chapter 12: Program Settings

Shaded with textures

This is the default rendering view, displaying any materials that have been applied to faces. (Materials are covered in Chapter 7.)

Shaded

Single colors are applied to all faces. If any materials are used, they are represented their base colors.

Hidden Line

Edges behind faces are hidden. Faces are displayed, though they are not colored. So you can Select or Push/Pull a face, which you cannot do in Wireframe view.

Wireframe

Displays the model as a collection of simple lines. There are no faces displayed, and faces cannot be selected. (Though if faces were selected before switching to Wireframe view, they will remain selected.)