

## 1. SELECT Tool

a) BLACK ARROW on Toolbar , hit SPACEBAR to exit any tool and return to select tool.

- For most commands you need to select specific objects to work on.
- Better to Select Object before executing command.
- You also need to let them go when you are done. (Click in empty space to deselect)
- White arrow selects items from toolbars and menu commands, Black arrow selects entities within the model (no color change on Macs)

b) OBJECTS THAT ARE SELECTED ARE HIGHLIGHTED IN BLUE.

- CLICK with the arrow IN EMPTY SPACE to deselect an object.
- Several ways to use this tool to select multiple objects.
- Hold SHIFT key to add or remove objects from the selection set
- Left to Right BOUNDING BOX-everything entirely in box is selected
- Right to Left CROSSING BOX-everything in or crossed by boundary of box is selected
- DOUBLE-CLICK-object clicked on and other objects attached to it are selected
- TRIPLE-CLICK-selects objects attached to objects selected with DOUBLE-CLICK

## 2. CREATING EDGES & FACES

a) (DRAWING LINES)

- KEYBOARD SHORTCUT is “L”. Preferred Method.
  - PENCIL Tool on Toolbar
  - Also appears as “LINE” on the Draw Menu, but this is a slow and tedious way to get there

b) Click anywhere to start line and move mouse. CLICK AND LET GO!

c) As you move the mouse, pay attention to COLORED INFERENCES to move parallel to one of the colored axes.

- SHIFT key will hold line on axis after drawing is started
- ARROW KEYS will also lock axis inferences, up and down = blue axis, right = red, left = green

d) PRACTICE-Draw lines of random length in direction of each axis

- ESCAPE key stops drawing and leaves pencil tool active (this works for most operations)
- SPACEBAR stops drawing and returns cursor to black selection arrow.
- Use colored inference lines and snap cues to draw squares or boxes, a FACE is created when EDGES enclose a space.

e) PRACTICE- Draw a line a precise length.

- Type a number after first mouse click and axial direction is established.
- Then hit “ENTER” before doing anything else.
- Number will appear in MEASUREMENTS WINDOW
- Don't try to fiddle with the mouse to hit a specific number in the measurements window.
- Tilde (~) before number means distance is approximate

## 3. REMOVING UNWANTED LINES

a) With SELECT arrow

- Click on black arrow on toolbar, or hit the spacebar on keyboard
- Move cursor over line and click, line will turn BLUE when selected
- Press DELETE key on keyboard

b) Drag a box to select multiple lines

- Two types of selection boxes

- Dragging from left to right creates a bounding box-everything entirely within the box is selected
- Dragging from right to left creates a crossing box-everything within or crossing the box is selected

## c) With ERASER tool:

- Hit "E" on keyboard or Select Eraser icon from toolbar
  - (can also invoke the tool from Tools menu but this is slowest way)
- Look closely at cursor with eraser tool active.
  - selection box is tiny square at lower left of cursor icon
  - With an unwanted line visible in the cursor selection box, click on unwanted line or . . .
  - Hold down left mouse button and drag cursor across unwanted line
- ERASER only works on lines, it won't work on faces.
  - However, WHEN LINES THAT DEFINE FACES ARE REMOVED, THE FACES CEASE TO EXIST.

## d) With UNDO

- Ctrl+z (apple+z on Mac)
- Black curved arrow on toolbar
- Undo from edit menu
- Can undo multiple steps, but undo does not work on zoom or other navigation commands
- UNDO does work on any command, back to the last "Save" of the model.

e) PRACTICE erasing lines with these methods, redraw random lines if needed.

## 4. RECTANGLE TOOL

## a) Keyboard shortcut "R"

- Square with pencil on toolbar
- Select from draw menu

## b) CLICK to set starting point, LET GO then move mouse diagonally and CLICK end point.

- Type dimensions after first click, separate length and width with comma.
- Will draw on ground plane unless there are existing points to snap to

## c) When drawing rectangle connected to existing geometry, you don't need to enter both dimensions. Typing "X," or ",X" will use existing dimension before or after comma

## d) PRACTICE drawing rectangles of different sizes on the ground plane

## e) PRACTICE drawing connected rectangles to form simple boxes

## 5. PUSH/PULL (Extrudes individual faces to Three-dimensional objects at a ninety-degree to the face)

## a) KEYBOARD shortcut "P"

- Box with red arrow extending from top on toolbar
- Select Push/Pull from Tools Menu

## b) HOVER CURSOR over face, blue dots should appear

- CLICK & LET GO, then move cursor at a right angle to the face you want to extrude
- TYPE LENGTH of extrusion in measurements window or

## c) SNAP to existing geometry (after extrusion has started, you can snap to any visible point).

## d) When using PUSH/PULL ON MULTIPLE FACES in succession, DOUBLE-CLICK a face to extrude it to the same dimension as previous face.

## e) PRACTICE drawing boxes with Push/Pull

## f) Works in both directions, you can extrude a face of a 3D object to make a hole.

## 6. RELATIONSHIP OF LINES AND FACES

- a) Erase one line of a box-faces that are defined by that line will cease to exist
- b) Redraw line and face reappears
  - What if the face doesn't reappear?
- c) What happens when you cross a face with a line?
  - How to get rid of a face
- d) STICKINESS, STRETCHINESS & THE CURE:

## 7. GROUPS-selection of geometry combined into a single object

- a) Once defined a group behaves as a single entity, a group won't "Stick" to anything else, and objects within a group won't stretch unless the group is "Open for Editing".
- b) Groups overcome most of the issues of stickiness
- c) Groups can be changed by selecting a group, right-clicking and picking "edit group" from the menu
  - When "edit group" is active, the group is highlighted and the rest of the model is locked (look for change in appearance between group and rest of model)
  - Editing a group only changes that instance of the group
  - Selecting "explode" from the menu returns the objects in the group to their original status, edges and faces. It doesn't make a noise and it doesn't an exploded view.

## 8. Basic tools to MODIFY EXISTING GEOMETRY

### a) MOVE tool

- Keyboard shortcut "M"
- Icon with arrows pointing in four directions on toolbar
- Select Move from tool menu
- Two distinct ways move tool works
  - Tool first
    - Select MOVE tool and HOVER cursor over an object, object selected will turn blue
    - CLICK & LET GO, then move mouse cursor in desired direction.
    - Will only work on a single object
    - Selecting can be difficult if multiple objects are close to each other
  - SELECT FIRST (preferred method)
    - Select one or more objects, then select Move Tool
    - CLICK & LET GO to begin move (start from a specific point), MOVE CURSOR in desired direction, CLICK on a second point to end the move.
      - MOVE will end on the same point on the object you use to start.
      - After MOVE is complete, OBJECT WILL STILL BE SELECTED, AND MOVE TOOL WILL STILL BE ACTIVE. Hit the SPACEBAR AND CLICK THE CURSOR IN EMPTY SPACE to avoid moving twice.
- Will work on multiple objects
- Review SELECTION ARROW and methods for selecting multiple objects.
  - SHIFT key to add to selection set.
  - Left to Right BOUNDING BOXES.
  - Right to Left CROSSING BOXES.
- Color change of selected objects
- Single click, double click, triple click

- When using either method, work with axial inferences and point inferences
  - Colors to move in the right direction-shift key will lock direction after move has started
- Move from a specific point to a specific point, try to make the move in one step by zooming in and out during the move.
- Control distance of move by typing a dimension after the move has started, or immediately after a move, before doing anything else. After typing the dimension, hit the Enter key "Before You Do Anything Else".
- **REMEMBER TO DE-SELECT THE OBJECT AND DEACTIVATE THE MOVE TOOL WHEN FINISHED.**
- Additional functions of Move tool
  - **MAKE COPIES** of existing geometry
    - Not the same as "copy and paste"; don't use "copy and paste" unless there is no alternative.
    - Make selection and invoke MOVE tool, then hit the CTRL KEY (alt on a Mac) a PLUS SIGN (+) will appear next to the cursor
    - Click and move cursor as when moving; program will create an exact copy of selected objects at second click point, or at typed dimension.
  - Two ways to MAKE MULTIPLE COPIES
    - Multiple copies an EQUAL DISTANCE APART: After making a copy, but "before doing anything else" type the number of copies you want, then X, then Enter. Program will create that number of copies, spaced by the first move distance in the direction of the original copy.
    - Multiple copies EQUALLY SPACED BETWEEN ORIGINAL OBJECT AND FIRST COPY: After making a copy, but "before doing anything else", type a forward slash (/) followed by the number of spaces desired between the first and last copy. Program will create copies in between. Typing /4 will make 3 copies and 4 equal spaces.
  - Auto-Fold- adds geometry in some cases when faces are moved
    - This is more of an advanced technique and it will be covered later on

#### b) **ROTATE** Tool

- Similar to Move Tool, rotates objects about a pivot point
- KEYBOARD SHORTCUT "Q"
  - Two circular arrows on Toolbar
  - select Rotate from the Tools menu
- Setting the rotation axis can be tricky, protractor that appears will change color and orientation to show rotation axis
  - Need a face in model to set rotation plane (draw a cube for reference if you need to)
  - Shift key will lock inference
- SELECT PIVOT POINT AND ONE OTHER POINT TO ESTABLISH FIRST LEG OF ROTATION ANGLE
- AFTER ESTABLISHING FIRST LEG OF ROTATION ANGLE, DRAG MOUSE IN DIRECTION OF ROTATION. ANGLE OF ROTATION APPEARS IN MEASUREMENT WINDOW-CAN TYPE IN EXACT NUMBER
- Rotate tool has SIMILAR COPY functions to MOVE tool, including multiple and arrayed copies
- PRACTICE moving, copying and rotating simple box shapes

- Remember to use colored axis inferences to move in the desired direction
- Use point inferences to move from one specific point to a second specific point
- Move exact distances by typing in the measurements window
- Lock direction with shift key or arrow keys

### 9. BAD HABITS TO AVOID

- Trust the cues and inferences within the program, not your eye. Learn to watch where you are going as well as where you are coming from.
- Moving too fast can cause you not to see the program cues, or keep the cues from appearing.
- Not going from a specific point to a specific point, zoom, orbit and pan to make sure you are placing things exactly where you want them.
- General Reluctance to Zoom and Orbit-make sure you can clearly see what you are doing, and that you are close enough to hit specific points. Navigation commands work in the middle of other commands.
- Don't try to create a 2d drawing. Make a model first, then develop printed views-solve the problem, then do the presentation
- If you are struggling with a task, look for a different way to do it, or adjust your point of view. Make sure what the problem is you are trying to solve before diving in to the solution.
- Learn to draw strategically.
  - How you start makes every following step easier or harder. Fix problems when you see them.
  - Always leave an escape route, make a copy and work on the copy if you aren't sure what to do.
  - Don't make anything you won't be able to change later on.
  - Don't be afraid to start over if you've made a mess. It will be quicker and you need the practice.

### 10. AIDS WITHIN THE PROGRAM TO MAKE THINGS EASIER

- INFERENCES
  - Colors for each axis
  - Tags and dots for specific points
- COMMAND LINE at lower left of screen
  - Options for each tool
  - Next step in using each tool
- Measurements-The MEASUREMENTS WINDOW
  - Entering dimensions in the window (so easy, almost no one can figure out how to use it)
  - Enter dimensions in middle of command. CLICK & LET GO!
  - Or enter dimensions immediately after a command "BEFORE YOU DO ANYTHING ELSE!"
- TOOL TIPS & TAGS
  - Slow down so you can see them.
  - Names of tools
  - Inference points
- INSTRUCTOR WINDOW
  - Help for each tool.
  - Information changes with change of tools
  - Basic help information is within the program, Advanced Help is online

### 11. Using the TAPE MEASURE Tool to draw accurately

- Keyboard shortcut= "T"

- Tape measure icon on toolbar
  - Select tape measure from the Tools menu
- b) TAPE MEASURE has two main functions:
- MEASURE DISTANCES between existing geometry
    - Measures between specific points. Get close enough to see and snap specific points.
    - Remember to use inferences when Measuring existing geometry.
  - CLICK & LET GO on one point, then hover cursor over second point.
    - Dimension will appear in both a popup text box in the modeling area, and in the measurements window.
    - Escape key ends measurement, and numbers will disappear .
    - Clicking on second point will end measurement and dimension will remain in Measurements window until next command is started.
  - CREATE GUIDELINES AND GUIDEPOINTS to aid in creating new geometry
    - PROGRAM WILL CREATE A GUIDELINE PARALLEL TO EXISTING LINE FROM ANY POINT ON THE LINE EXCEPT AN ENDPOINT .
    - Program will create a guidepoint only from end point inferences, or at a non-parallel angle.
    - Control key (ALT on a Mac) toggles these functions, a plus sign (+) appears next to the cursor when “create guidelines” is active.
    - Creating guidelines is default setting, and hitting enter will return it to active state.
  - CREATING GUIDELINES:
    - Guidelines are infinitely long, parallel to existing geometry.
    - CLICK & LET GO, on existing geometry, (including the colored axes or other guidelines). Then move cursor in desired direction and click again.
    - DISTANCE from start to guideline is controlled by:
      - Typing in the measurements window.
      - Point inferences, including intersections of guidelines.
      - Program will display last measurement in tag on cursor, if you don't move too fast.
      - Hit “Escape” to end measurement without closing Tape Measure tool.
      - Hit SPACEBAR to CLOSE tool.
  - CREATING GUIDEPOINTS
    - GUIDEPOINTS BEGIN FROM ENDPOINTS of lines or other guidepoints. (If you mean to create a guideline, click anywhere other than an endpoint)
    - GUIDEPOINTS are drawn in any direction that isn't parallel to an existing line, usually at a right angle
      - A fixed length guideline extends from the point of origin to the guidepoint.
      - Distances are controlled the same way as all other geometry.
  - CREATING GUIDELINES AT ANGLES that are not parallel to an axis.
    - Use PROTRACTOR Tool (protractor icon on toolbar or select from tools menu-no default keyboard shortcut) to measure angles and create angled guidelines. Onscreen it looks exactly like ROTATE tool.
      - Establish center point of angle and another point to establish baseline. (where the angle is from)
      - Drag cursor to desired angle, click to establish guideline.

- Numerical measurements (degrees of angle) can be entered in measurements window.
- Angle snap increments and angle precision can be set in "UNITS" in the MODEL INFO Window.
- Locating the tool can be troublesome in directions other than horizontal.
  - A face in the plane of rotation needs to exist for tool to align.
  - Tool will change colors to indicate direction of rotation.
  - PRESS SHIFT KEY TO LOCK direction for rotation plane.

## 12. GROUPS DEFINED:

### a) Selection of geometry combined into a single object

- Once defined a group behaves as a single entity
- Groups overcome most of the issues of stickiness
- Groups can be changed, the process is called "opening a group for editing"
  - Select a group, right-click and pick "edit group" from the menu, or
  - double-click on the group
  - When "edit group" is active, the group is highlighted and the rest of the model is locked
  - lines and faces within the group can now be changed, will "stick" to each other, and will "stretch" with adjacent geometry.
  - Editing a group only changes that instance of the group
- Selecting "explode" from the menu returns the objects in the group to their original status, edges and faces. It doesn't make a loud noise or create an exploded view.

## 13. COMPONENTS

### a) Similar to Groups but better.

- Groups are heroes in SketchUp.
- COMPONENTS ARE SUPER HEROES
  - Behave as one object unless open for editing
  - Components with the same name are clones of each other-
    - Change one and you change them all.
    - A copy of every component is available in the COMPONENTS WINDOW.

### b) MAKE A COMPONENT:

- SELECT a bunch of OBJECTS,
- RIGHT-CLICK with mouse cursor over selection
- SELECT "MAKE COMPONENT" from menu
  - Create Component Pop Up Window Appears
    - Unless you make a component from an existing group, in that case the component will be named "GroupX" and the options window won't appear.
    - Options are available at any time through the Components window
  - NAME-Use the same name you would use in a cut list
    - Description-not needed unless there is something important to remember about the component. Description will appear under the name in the components window
  - Alignment options let you assign a direction to new instances of a component when dragged into the drawing-You will rarely want to do this.
    - Components also have a set of blue, red and green axes;
    - if you don't assign them in the Create Component window they will be the same as

the model axes, when the component was originally drawn.

- Don't check "Always Face Camera"
  - Do CHECK "REPLACE SELECTION WITH COMPONENT"
  - Make sure the "REPLACE SELECTION WITH COMPONENT" box is checked.
  - Unlike groups, components have a place to live within the drawing file, but outside the modeling space, this is called the Components window
- c) COMPONENTS WINDOW lists every component in model, or other collections of components on your computer or on the internet
- Components can be dragged from the Components window and into the drawing
  - Components can be saved in Libraries for use in other models
- d) A COMPONENT'S GEOMETRY CAN BE EDITED
- Double-click on a Component or
    - Select a component and with the cursor hovering over the selection right-click.
    - Select "Edit Component" from the pop up menu.
  - *EDITING ONE INSTANCE OF A COMPONENT WILL AUTOMATICALLY CHANGE EVERY OTHER INSTANCE OF THAT COMPONENT IN YOUR MODEL!*
    - Good News: you can add a detail, or make a change in one part, and have all other like parts also change instantaneously.
    - Good News: You can change a component in a different area of the model, and instances of it already in place will automatically change .
    - Bad News: be careful if you only want to change one individual component.
      - Before selecting "Edit Component"
      - Select "Make Unique" from the menu.
      - This creates another copy named "Component 1".
    - When open for editing:
      - the component is highlighted with a box of dashed lines
      - the rest of the drawing is dimmed.
      - The component is the only area of the model that can be edited.
    - Click outside the highlighted box to close the Component
      - (or right click and select "Close Component")
  - EXPLODE A COMPONENT:
    - Returns the component to a state of individual edges and faces
      - (right click and select "Explode" from the menu)
      - Explode only affects that particular instance of a component.
      - A copy of the original component still lives in the Components window
  - MAKE A COPY OF A COMPONENT THAT IS A MIRROR IMAGE
    - When you copy (or move) a component, you can make it "FLIP ALONG" any of it's axes.
    - Right click immediately after move, with cursor over the component.
    - Select "Flip Along" and an axis direction from the menu.
    - "Flip Along" changes the component to a mirror image of the original, reflected on one or more of the colored axes.

#### 14. FOLLOW ME

- a) Follow Me extrudes a face along a path



- Similar to Push/Pull but can turn corners and follow curves
  - Icon similar to Push/Pull but base is round and arrow is curved
  - Follow Me is only on the Toolbar and Tools menu-no default keyboard shortcut
  - “Follow Me” is an easy way to wrap moldings around cases, complex faces can be extruded
- b) Hard Way & Easy Way to use FOLLOW ME.
- The Hard Way:
    - After invoking tool, select face to extrude, then click and let go and drag mouse along path without holding down any buttons. Click again to end the extrusion.
    - Move mouse slowly and carefully and watch red line as path is defined, back up if needed.
    - Alternately, select the face to extrude, hold down the alt key and click on a face, extrusion will follow perimeter of face
  - The Easy Way to Use FOLLOW ME
    - SELECT THE PATH FIRST. Then select the Follow Me tool, then the face you want to extrude.
    - Use Undo if results are not what you want and try again
  - “Follow Me” won't work on a component, unless you open the component for editing and create the face to be extruded within the component.
    - If you want to run a molding around a cabinet, draw the profile of the molding in place on a back corner of the cabinet. (Or bring in a saved component of the profile and explode it.)
    - Draw the path with the line tool, select the path and the molding profile, make these a component. Open this component for editing before using Follow Me to Extrude. This keeps the molding as a discrete object from the cabinet.
  - “Follow Me” can also be used to make turnings by using it on a circular path .

## 15. ELEVEN THINGS TO REMEMBER

### a) LEARN TO NAVIGATE

- zoom, orbit and pan with the mouse, not the tool icons
- you can navigate in the middle of a command

### b) DIRECTIONS ARE RELATIVE TO THE COLORED AXES, NOT REAL LIFE DIRECTIONS

- It will take some time and practice to get a) & b)
- Play with a finished model or simple shapes to develop these skills

### c) CLICK & LET GO!

- For Most commands:
  - Click the left mouse button and let it go
  - Move the mouse (without touching any buttons) in the direction you want to go.
  - Click again to end the command.

### d) STAY ON AXIS & ON TARGET

- Watch for colored cues as you draw or move
- Black lines following cursor mean you are “lost in space”
- Find “Display Crosshairs” –Preferences/Drawing/Miscellaneous

### e) WATCH FOR POINTS ON ENDS & CENTER OF LINES & TAGS TO MOVE PRECISELY

- Move slowly to allow inference points and snap points time to appear
- Click when points are visible to snap to them

### f) CONTROL DISTANCES BY TYPING A DIMENSION

- either during or immediately following a command
  - look for display in Measurements window
- g) THERE ARE SEVERAL WAYS TO SELECT OBJECTS-HOW YOU SELECT MAKES A DIFFERENCE:
- Draw a box from left to right (crossing) or right to left (bounding)
  - If you select an object first or a tool first (object first is usually easier and more precise)
  - Hit the spacebar to end a command and click “out in empty space” to deselect an object.
- h) COMBINE OBJECTS INTO GROUPS OR COMPONENTS AS SOON AS POSSIBLE
- work with chunks of wood, not sticky and stretchy lines and faces
- i) DON'T DRAW UNLESS YOU HAVE TO, COPY INSTEAD
- Move command with CTRL key) (Move + Option on a Mac)
  - Look for + (plus sign) next to cursor
  - Play around with blocks and simple projects to develop these skills
- j) LEARN KEYBOARD SHORTCUTS FOR THE MOST OFTEN USED COMMANDS
- L = Line, R = Rectangle, P = Push/Pull, M = Move, E=Eraser
  - Spacebar ends command and returns selection arrow (click in empty space to deselect)
  - CTRL + Z= Undo (Apple + Z on a Mac)
- k) DON'T BE AFRAID TO EXPERIMENT:
- Materials cost nothing in SketchUp
  - “Undo” is your best friend
  - After you make a Component, you have a limitless supply
16. **COMPONENTS & COPYING ARE THE KEYS TO EFFICIENCY**
- a) COMPONENTS
- Make Components as soon as you can
    - Select a bunch of objects, right-click over the selection, select “Make Component”
    - Keeps one part of model from affecting another-cures stickiness and stretchiness
    - Make sure “Replace Selection With Component” box is checked when creating
  - Double-click component to edit (rest of model shaded out and blocked)
    - Component can also be opened for editing by right-clicking and selecting “Edit Component” from the pop-up menu.
    - Close component after editing; click in empty space outside dashed box look for visual cues to be sure component is closed.
  - Editing one instance of a component changes all other instances
    - Make Unique (from right-click menu) creates a new component, identical to the first, with a number added after the name.
      - Editing a “unique” component will protect the other instances from changes.
      - Both versions will be available from the Components window.
  - A copy of a component lives in the “Components” window
    - Components can be saved in library for use in other models
    - Unlimited supply of components
    - Thousands of components are available from the 3D Warehouse
  - Edit a copy of a component away from the rest of the model to have room to work
    - other instances with the same name will also change.
  - Components can be redefined by exploding, then “making component” using the same name

**b) COPY AND CHANGE SOMETHING YOU HAVE, RATHER THAN START FROM SCRATCH**

- Copy is a function of the Move tool (Move + CTRL on PC, Move + Option on a Mac) toggles copy on and off-look for + sign next to Move icon
- Copies can be flipped-mirror images made.
  - Right click and select “Flip Along” the appropriate axis from the menu.
- Copying a face allows you to pull precise parts out of a “sticky” model
  - To add an object to a component, put it in position, and use Edit/Cut to place it on the computer's clipboard
  - Open component for editing, then select “Paste in Place” from the Edit menu.
- Copy an entire model to explore variations, or to create detail & exploded views.
- Components make it possible to change objects, using stickiness and stretchiness to your advantage.

Contact information for Bob Lang, Bob's SketchUp books, current class schedule, SketchUp tutorials, videos and blog posts are all available at <http://readwatchdo.com>