

3D Modeling with Blender:

01. Blender Basics



Overview

This lesson introduces Blender, covering the tools and concepts necessary to set up a minimal scene in virtual 3D space.

Concepts Covered

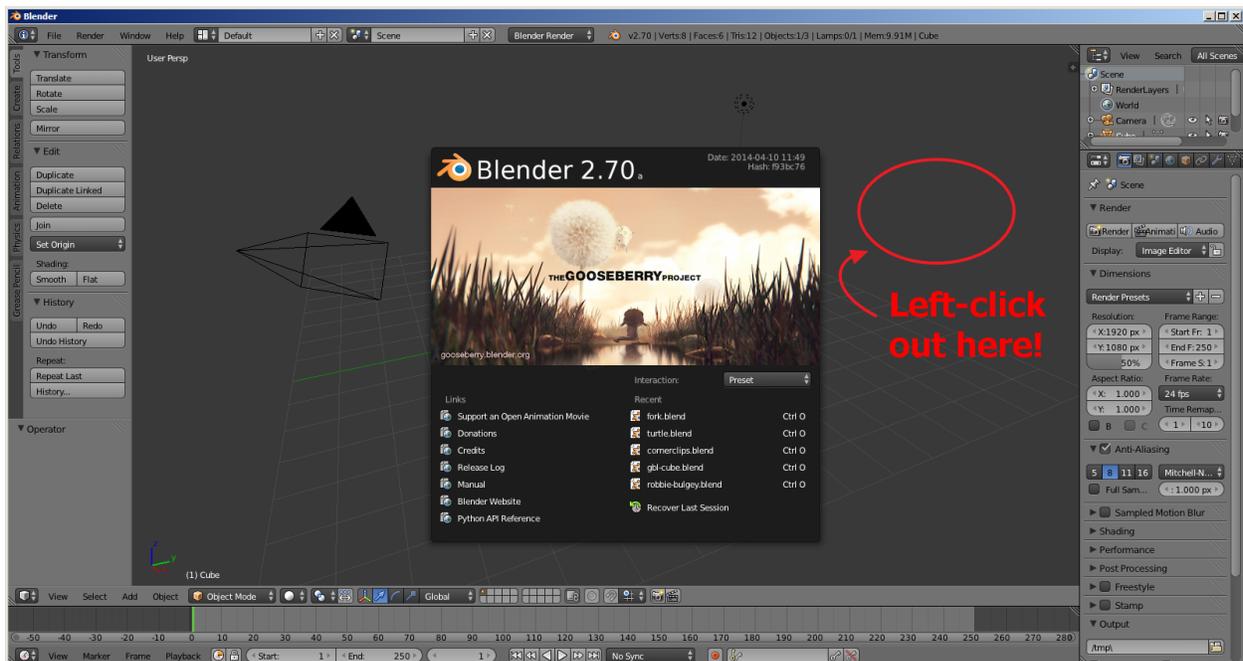
- Blender's window layout
- Navigating the 3D space
- Adding 3D objects to the scene
- Basic editing of 3D objects -- moving, rotating, scaling
- Various core keyboard shortcuts

Preparation

- Run Blender. You do not need to load any special .blend file.

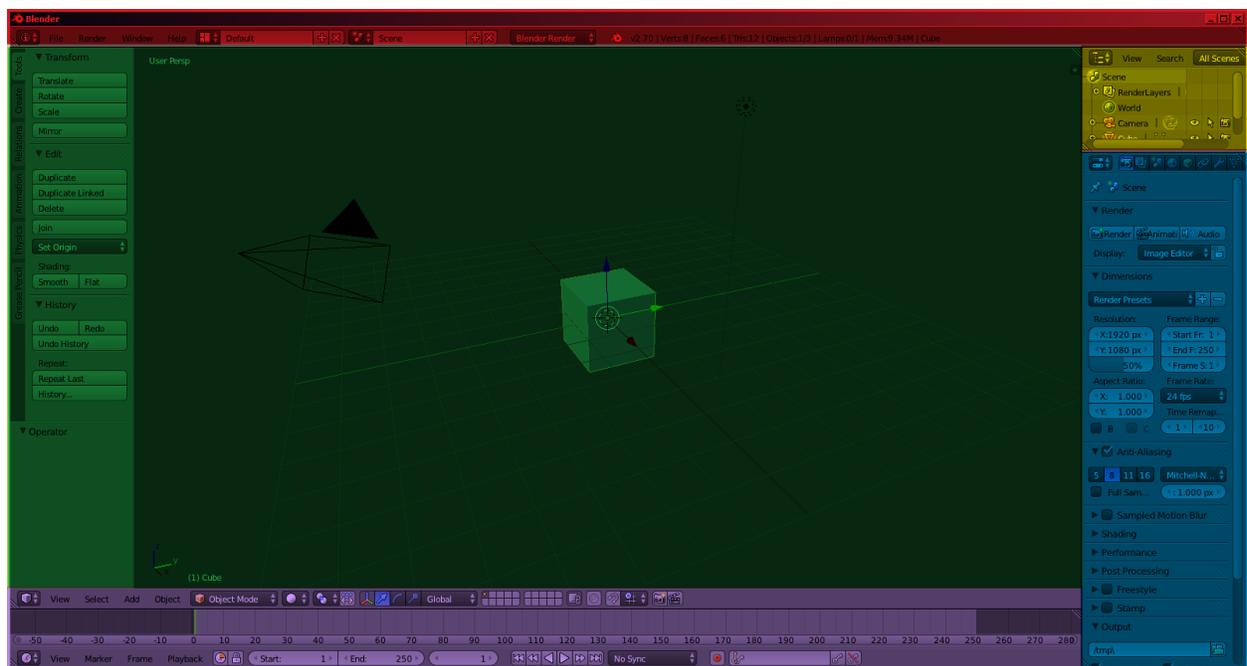
Open Blender. When Blender first opens, it will show a small splash screen in the center of the window, partially overlapping its main interface.

Click just outside of the splash screen to close the splash screen:



What you're now looking at is the default interface layout and starting scene of Blender. Any time you begin a new file in Blender, it will give you this same layout and scene (which includes a cube and some other things). The interface is separated into five windows, shown below:

- The Info window (shaded red) at the top. The Info window is comprised solely of a header. This is where you'll be able to save your file, load a different file, etc.
- A large 3D window (3D View) (shaded green). This is where you'll be viewing and manipulating your scene in virtual 3D space.
- A Timeline window at the bottom (shaded purple). This is used for animation.
- An Outliner window at the top right (shaded yellow). This lists all entities present in your scene.
- A Properties window (Buttons window) at the bottom right (shaded blue). This is where you can see details about objects, and make special alterations to the scene and objects.



Part Two: LOOKING AROUND

Before you begin to change your 3D scene, you need to know how to observe it. There are three core 3D View Navigation tools.



Mouse Position Matters: Whenever you use a mouse shortcut or keyboard shortcut in Blender, your mouse must be hovering over the 3D View portion of Blender's interface. (This is the green highlighted section above.) This includes the 3D View Navigation tools we're about to cover. So, if a shortcut isn't working, check where your mouse is!

Orbit

Click and drag with the **middle mouse button** to orbit. This will allow you to look at the scene from a different angle.

Zoom

Scroll your mouse wheel in or out to zoom. This will allow you to look more closely at a scene, or view it from further away.

Pan

While **holding SHIFT**, **click and drag the middle mouse button** to pan. This will allow your view to move up, down, and side to side, without changing your viewing angle.

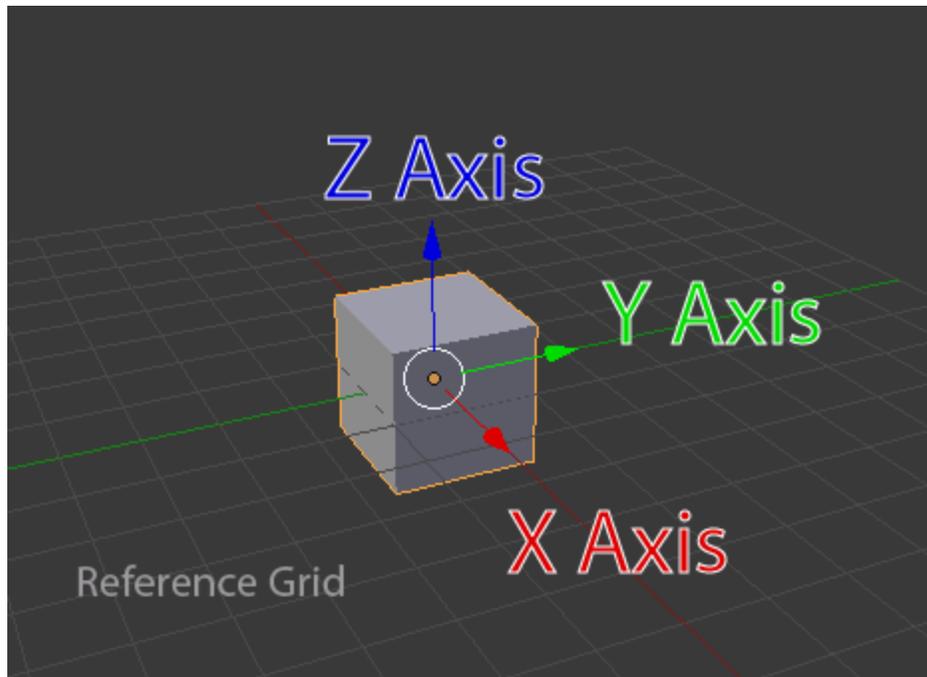


Look around often! You are working in a virtual 3D space, but you are using a 2D medium -- your computer's screen. This means that you cannot use depth perception to judge things like distance, size, and positioning. The only way you can be certain of the state of your 3D scene is by constantly looking at it from different angles.

Spend some time now to practice these navigational tools. Orbit to get a good look at all of the six sides of the cube.

Part Three: MANIPULATING THE SPACE

Now that we can observe the space, we can begin to manipulate it. Let's start by talking about the things we currently see in the space.



The Imaginary Grid: Presently, the only object in the scene is a cube. The grid that you see may look like a floor, but it's actually just a reference grid; it won't show up in any of our final 3D images or animations.

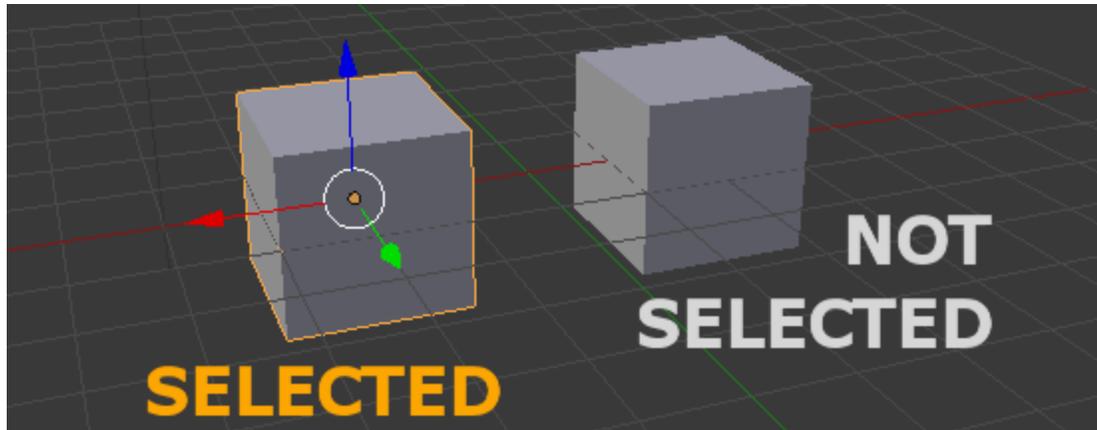
Three-dimensional space includes three axes: the x-axis, y-axis, and z-axis. We can see these axes represented in three places:

1. The arrows coming out of the block
2. The small, multi-colored widget in the bottom-left corner of the screen
3. The colored lines on the grid that represents the floor (although the z-axis is not shown)

Looking at these representations, we can see that each of the axes is color-coded. X is red, Y is green, and Z is blue.

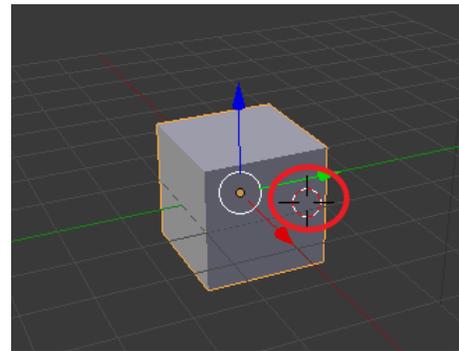
Selection

Right-click the cube to select it. You can tell that it is selected by the orange outline that you see around the cube.



Left vs Right: You may assume that left-clicking will select an object. Attempting to do so will cause a small “crosshair” to appear where you left-clicked. Don’t worry if this happens.

Left-clicking simply moves that crosshair around. It’s called the 3D cursor, and it will be discussed in future lessons. For now, you can trust that it won’t interrupt your work.



Press “A” on your keyboard to deselect the cube. “A” is a kind of keyboard shortcut known as a *toggle shortcut*. It has two functions, depending on the current state of your Blender interface:

1. If you have *one or more objects* selected, “A” will deselect all objects.
2. If you have *no objects* selected, it will select all objects.

To demonstrate this, try pressing “A” repeatedly. Note how it flips back and forth between selecting all objects, and selecting none.

After practicing these shortcuts, make sure you have *only the cube* selected. (Hint: you may need to press “A” a couple times to make sure you have nothing selected, before right-clicking the cube to select it.)

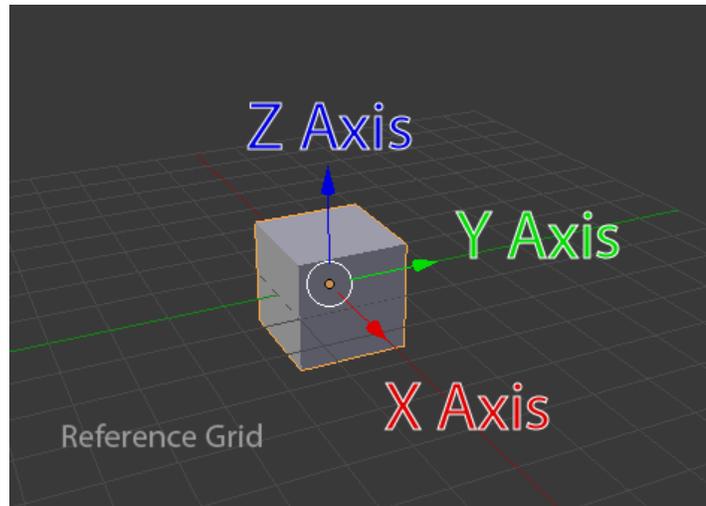
Now that you can select objects, we’ll review the three transformational tools: grab, rotate, and scale.

Grab

With the cube selected, click and drag on one of the three “arrows” coming out of the center. You can see that as you move your mouse, the cube moves as well. Let go of the mouse button and the cube will be placed there.

Each of the three arrows represents an “axis” in 3D space. The three axes are the **x axis**, the **y axis**, and the **z axis**. Pay attention to the colors of the axes and look at how they are arranged.

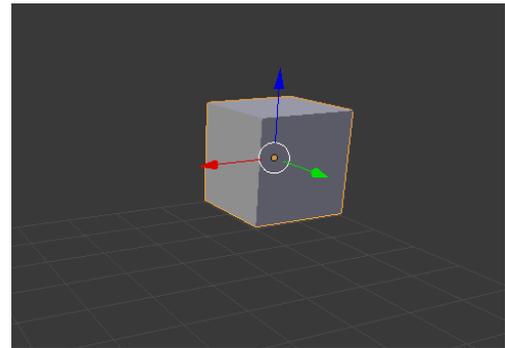
Move the cube along all three directions and examine the result. Try to get the cube sitting just on top of a corner of the grid, like shown at right:



Check Multiple Views! It may look like you’ve placed the cube in the corner of the grid just right, but if you don’t look at it from multiple angles, it might just be an optical illusion!



Aim at the Arrowheads! When using the arrows to move objects, you need to grab the *end* of an arrow. If you grab too close to the white circle in the center, the cube will move “freeform” (i.e. along all axes simultaneously). This makes it hard to tell where the cube really is!



Rotate

With the cube selected, press “R” on your keyboard once to begin the Rotate action. You can see the cube begin to spin as you move your mouse around the cube. **Left-click to confirm the rotation.** In just about all of Blender’s tools and techniques, left-click *confirms the action*. In this case, you are *confirming* that you want the cube to be in this new orientation. Conversely, right-click *cancel*s the action. If you were to have right-clicked instead of left-clicked, the cube would have gone back to where it was before you pressed “R” to Rotate.

Scale

With the cube selected, press “S” to begin the Scale action. As you move your mouse closer to the cube, the cube becomes smaller (scaling down), and as you move your mouse farther away from the cube, it becomes larger (scaling up). **Left-click to confirm the action.**



Left-click, Right-click, and Hotkeys: Actions such as Rotate and Scale behave pretty similarly. Each time you want to perform one of these actions, you press the **hotkey**, such as “R” for Rotate or “S” for Scale; then you move the mouse to adjust something, and then you either **left-click to confirm** or **right-click to cancel**.

The “Undo” Command

In preparation for the next section, we want to get the cube back to how it started. **Press CTRL+Z on your keyboard once.** This will undo your most recent action. Multiple executions of the Undo command will allow you step backwards in your scene’s history of changes.

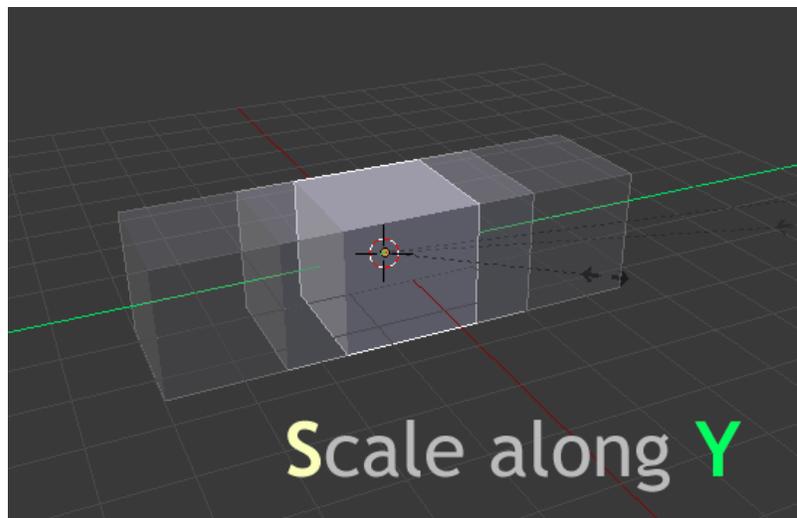
Continue pressing CTRL+Z until the cube has returned to its original location, rotation, and scale.

Part Four: FINE-TUNED TRANSFORMATIONS

At this point, your cube is probably pretty different from how it started. Not only has it been transformed, but it’s been transformed pretty roughly. All of the actions you took were *freeform*, relative to your perspective. We want to be able to make transformations with more control and precision.

Axis Constraint

With the cube selected, press “S” to begin the Scale command. Now, before left-clicking, press “Y” on your keyboard. You’ll see a green line appear, going through the cube and stretching out both ways as far as can be seen. If you move your mouse now, you’ll see that it is stretching in one direction only.



By pressing X, Y, or Z after commencing an action (*but before confirming it with left-click!*) you can *constrain* the action to the x-axis, y-axis, or z-axis, respectively.

Once you've chosen a new length for the cube along the y-axis, left-click to confirm the Scale action. Then, use the same technique to practice scaling the cube along other axes, each time pressing **S**, then **X**, **Y**, or **Z**.

You can use Axis Constraints on other actions, too! **Try starting a Rotate ("R"), then press X, Y, or Z to constrain to an axis. Left-click to confirm the action.**

Fine-Tuning

Sometimes we want to move, rotate, or scale objects, but in very small amounts.

With an object selected, press "R" to Rotate. Now, hold the Shift key on your keyboard while you move the mouse. You should find that you are rotating the object much more slowly than before.

You can also hold Shift when performing other actions to change them in smaller amounts.



Hold Shift after the hotkey! You need to press the hotkey (or click down on the X/Y/Z arrows) *before* you hold Shift, and you can't do them at the same time. This is because Shift+R or Shift+S might be totally different hotkeys for different actions. So press the hotkey, and then start to hold Shift if you want to do fine-tuned control.

Part Five: MULTIPLE OBJECTS

At this point, we've done about as much as we can with this singular cube. We want to add more objects to this scene.

Add a Cylinder to the scene: **Press Shift+A on your keyboard to bring up the "Add" menu.** Under "Mesh", select "Cylinder".

A cylinder should appear in the scene. Note where the cylinder appears. It is centered on the 3D cursor, the red/white crosshair that you can move by left-clicking. This is one of the primary functions of the 3D cursor: *any newly-created object comes into the scene centered on the 3D cursor.*

When Blender starts a brand new file, the 3D cursor begins at the very center of the scene, also known as the *origin point*. However, it's likely that you've accidentally left-clicked at some point during this tutorial, and the 3D cursor is no longer in the center. Let's fix this now, so that our next object appears in the center of the scene.



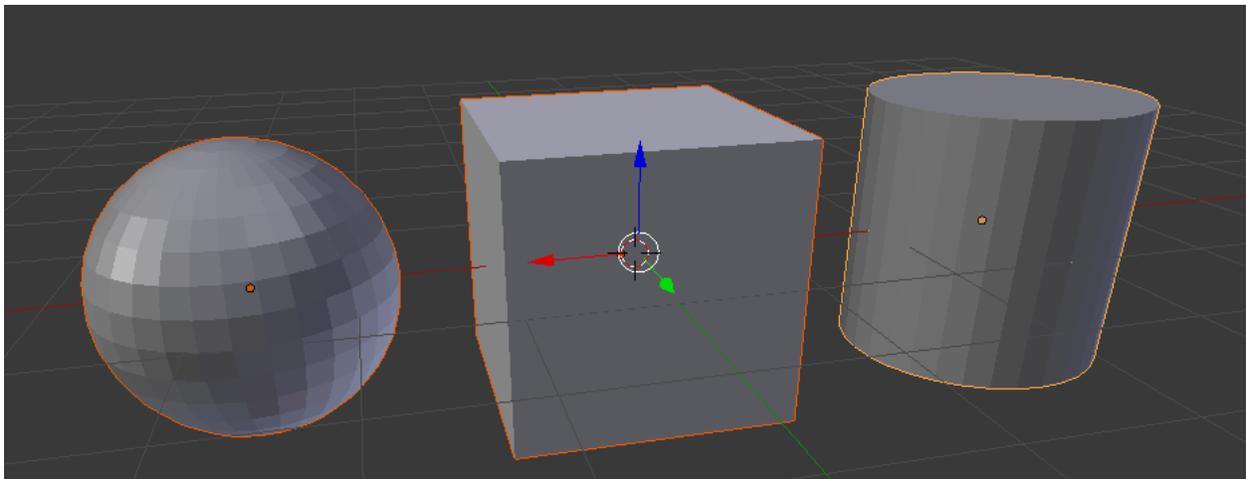
Press Shift+S on your keyboard. The menu that appears is the “Snap” menu, allowing you to move certain entities to other entities. In this case, **we want to choose “Cursor to Center”**, to move the 3D cursor to the scene’s origin point.

Add a UV Sphere to the scene, in the same way that you added the cylinder (Press Shift+A on your keyboard to bring up the “Add” menu, and under “Mesh”, select “Cylinder”). Since the 3D cursor is back at the center, the new sphere should end up in the center of the scene

Selecting Multiple Objects

Right-click one object, then right-click another. You’ll notice that when you select the second object, the first object becomes unselected. There will be times, however, when you want to manipulate multiple objects at once, so you’ll need to include more than one object in your selection.

Press “A” until no objects are selected. Then, while holding Shift, right-click each of the objects in your scene. You’ll note that this time, since you’re holding Shift, *all* objects end up with orange outlines, showing that all objects are selected.



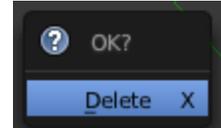
(Note: you may notice that the most recently clicked object has a bright orange outline, while the rest of the objects in your selection have a dark orange outline. This distinction has a purpose in more advanced techniques, but for now you don’t need to worry about it; consider all objects with orange outlines -- dark orange or light orange -- to be part of your selection.)

Click-and-drag on the X/Y/Z arrows and move your mouse around. You can see that by selecting multiple objects, you can perform multiple movements at once.

Deleting Objects

With an object selected, press X on your keyboard. “X” is the Delete shortcut, but instead of immediately deleting, Blender will ask you to confirm the action by popping up a small, one-option menu next to your cursor.

Choose “Delete” and the object will be deleted. (If you don’t want to delete, you can simply move your mouse away from the menu and it will disappear.)



Practice: Make Something (using Primitives)

To tie all of these concepts together, we’ll use what we know about creating, selecting, and moving objects to assemble a building or some other object.

Here’s what we can do:

- Add Meshes like cylinders, cones, cubes, etc. using **Shift+A**.
- Select these objects by **right-clicking on them, holding Shift to select multiple** if needed.
- **Rotate (R), Scale (S), and move (arrows)** these objects.

Try to combine different shapes in interesting ways. Although you can add other things (such as “Curve,” “Empty,” or even something called a “Metaball”) **we want to stick to Mesh objects for now.**

