Lecture 6
3D Modeling in Blender

98-127: Game Creation for People Who Want to Make Games (S19)

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1 Objectives

By the end of this lesson you will be able to:

- Understand the basics of the Blender user interface
- Build 3D models using local mesh editing tools
- Utilize global mesh editing tools (Modifiers)
- Map a texture to a 3D model using UV unwrapping
- Export 3D models in a Unity-optimized format

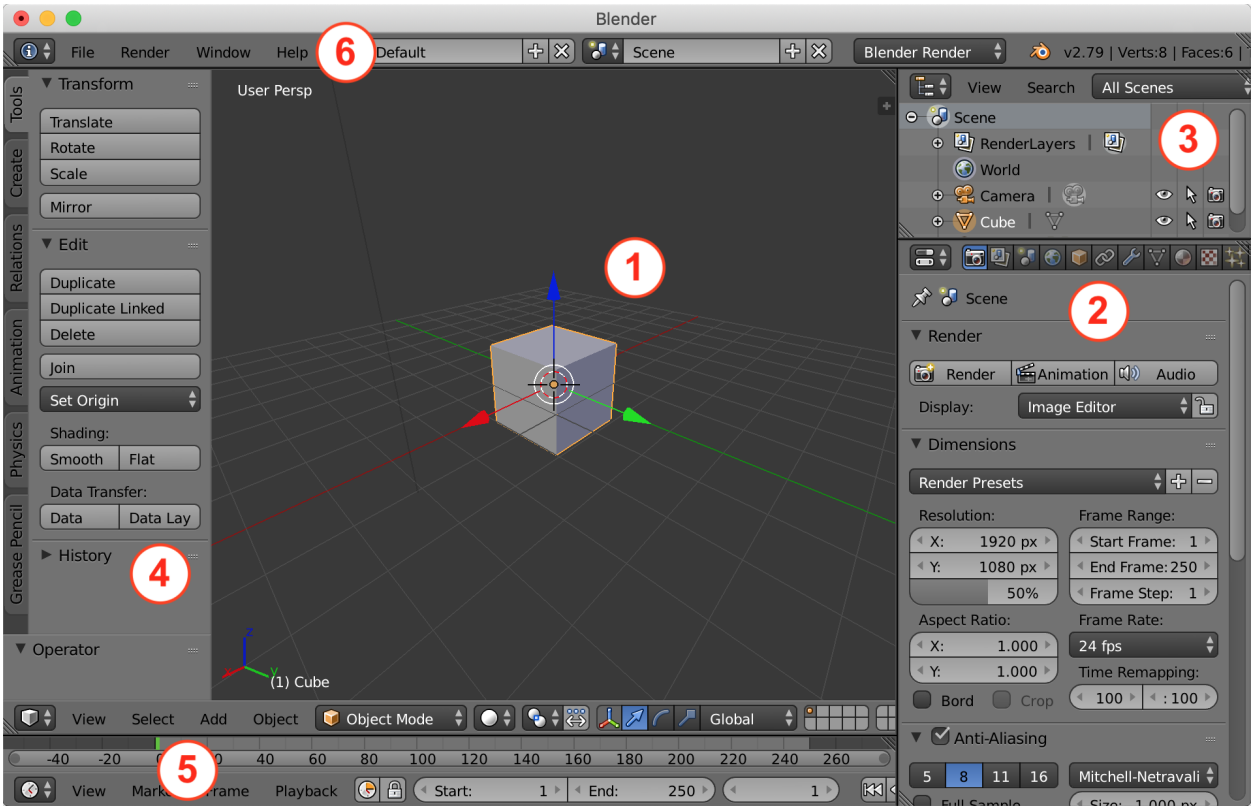
These lecture notes were written for **Blender 2.79b**. Keep in mind that at the time of writing, a new version with a vastly different user interface, Blender 2.8, is in beta. If you're reading this after 2.8 is officially released, you can still enable a mode that uses keybindings from earlier versions of Blender. More info here.

We will also be looking at blender with a comparative eye towards Unity. It may be helpful to have some background on using Unity before looking at these notes. Check out the Intro to Unity notes here.

2 Downloading Blender

Blender is a free and open source 3D modeling package that can be used to build assets for your games. You can download blender at blender.org – make sure to download version **2.79** for compatibility with these lecture notes. The primary alternative to blender, and a common option in industry, is **Autodesk Maya**. However Maya is very expensive for commercial use, so we will not use it in this class. For all but the most advanced tasks, blender has feature parity with Maya, however you may need to use Maya if you get a job at a studio. That being said, the techniques you learn here are transferable to Maya; you'll just need to learn the new interface. You can download the Maya student edition (note: the student edition can not be used for any games that you plan to sell) here. You are going to want to use a mouse for this tutorial, as a mouse makes navigating blender's complex interface much easier.

3 Blender Interface Basics



This is the default configuration of Blender when you open it for the first time. Each panel that you see in the above screenshot is labeled as follows:

1. The **3D View** is your main view into the scene you are editing. Unsurprisingly, this is where most of your work happens. We will talk more about how to navigate the 3D view in the subsection below. This is similar to the scene view in Unity.

2. The **Properties** panel allows you to edit various properties of your scene, including the camera, the currently selected object, the currently selected mesh, textures, materials, and so on. We will often use the Properties panel throughout this tutorial. The Properties are analogous to Unity's inspector.

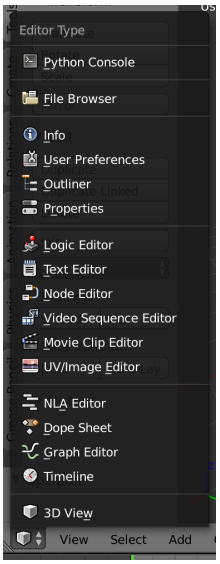
3. The **Outliner** lists all of the objects, meshes, armatures (we'll get to this in a later lecture), and so on in your scene. The outliner is most similar to the hierarchy view in Unity.

4. The **Tool Shelf** contains shortcuts for common editing operations. You can toggle the tool shelf on and off with T. If you ever forget a shortcut, the tool shelf is your friend!

5. The **Timeline** is used to scrub through animations (we will talk about 3D animation in a later lecture).

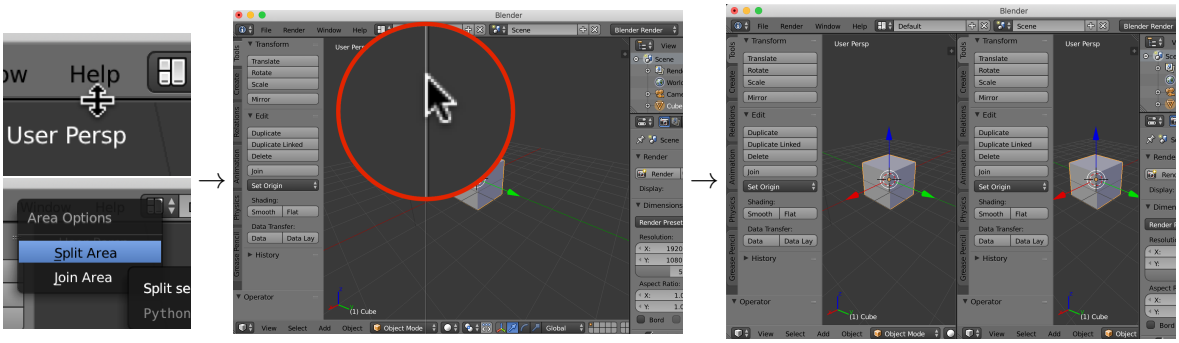
6. The **Info** panel contains common menus like File and Window, and allows you to change between preset layouts. If you ever want to reset the blender UI, use the dropdown: 

and select "Default".



You may have noticed that at the corner of each panel there is a dropdown. This dropdown allows you to change the *Editor Type* of each panel. For example, we can change from the 3D view to the text editor by clicking on the dropdown on the bottom left of the 3D view and selecting "Text Editor." Fun fact: the entire blender front-end is written in python and is fully scriptable and extendable. The text editor is used to write python scripts for blender – but we won't be using it now. Switch back to the "3D View" using the same dropdown. Also notice how all of the panels discussed on the last page are available here. For example, it may not be all that useful, but you can change the 3D view into a huge timeline.

You can resize each panel by clicking and dragging at the borders. If you want to create more editor views than the default, **right click** on the border of two panels and select Split Area. Then move your mouse over the panel you would like to split and **left click** to apply. This process is detailed below:



You can also select "Join Area" and click on one of the two bordering panels to join them together.

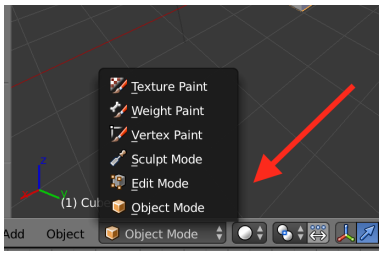
3.1 Navigating the 3D View

You can navigate the 3D view using the following controls:

- To **orbit** (rotate) the view, hold Middle Mouse Button while dragging the mouse.
- To **pan** (translate) the view, hold Shift + Middle Mouse Button while dragging the mouse. You can also hold Shift + Ctrl + Midle Mouse Button to "Dolly Zoom", which moves the camera forward and backwards.
- To **zoom** the view, hold Ctrl + Middle Mouse Button while dragging the mouse, or scroll Mouse Wheel. This is different than the dolly zoom because the viewport camera does not move.
- If you ever get lost, press Numpad . (period) to zoom and pan to the currently selected object.

3.2 Working in Object Mode

By default, when blender opens you will be in **Object Mode**. You can verify what mode you are in by checking the *Mode Switcher* at the bottom of the 3D View. Each **Object** in blender (analogous to a GameObject in Unity terminology) has a **Mesh** attached. Just like in Unity, you can transform Objects. Below

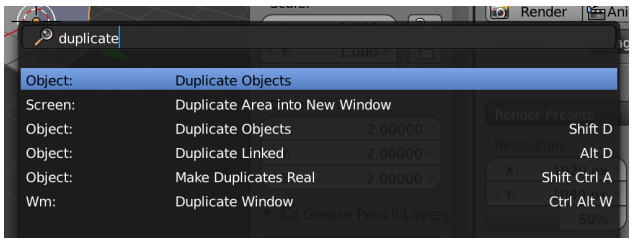


The Mode Switcher

are some common shortcuts to manipulate objects in Object Mode (*Important: Make sure your mouse is on top of the 3D view when using these shortcuts, because shortcuts are different depending on which view is "active."*)

- Press Right Mouse Button to select an object. **Important: Left Mouse button does not select objects in blender!** This is a common point of confusion for new users. [1]
- Press Left Mouse Button to move the *3D cursor*. The 3D cursor is used for many 3D operations as a reference point – for now, though, you can largely ignore it.
- Press G ("Grab") to Move an object, R ("Rotate") to Rotate an object, or S ("Scale") to Scale an object. You can move the mouse to control the transformation; click Left Mouse Button or press ↵ to apply. While grabbing / rotating / scaling, you can press X / Y / Z to constrain the transformation to a single axis. Press the same key again to switch from Global axes (relative to the origin) to Local axes (relative to how that object is rotated).
- Press X to delete an object.
- Press Shift + D to duplicate an object. You can also press Alt + D to "Duplicate Linked," which shares the same mesh between the two objects. This is similar to the idea of prefabs in Unity: editing the mesh of either object will affect the appearance of both. This is especially useful because this link will actually persist when you import to Unity – cool!
- Press T to toggle on and off the Toolshelf. The toolshelf has clickable buttons for many common editing operations (including all of the shortcuts listed above).
- Press N to toggle on and off the **Properties** panel. The properties panel allows you to directly manipulate the position / rotation / scale of whatever you have selected, as well as various miscellaneous settings for how the mesh displays in the 3D View.
- Press A to select all or deselect all (depending on if anything is selected).

Blender has an incredibly robust shortcut system – almost *every* common editing operation has a corresponding shortcut. So while it may be difficult to get used to blender's UI, mastery of it will allow you to do things very quickly. For example, rotating an object 45 degrees in the Z axis is as easy as R > Z > 4 > 5 > ↵. That being said, it is still very easy to forget all of the random incantations–er–key combinations you need to use to do what you want. Luckily, pressing Space at any time will bring up a search bar that allows you to search for any operation. It will also show any relevant key combinations. You can then hit ↵ to apply the operation.



[1] I know this is really confusing, but there is hope: in the Blender 2.8 beta, the developers have changed the default to left-click select. As you can imagine, this has been a source of debate and nerd wars in the blender community for *decades*!

Searching for Shortcuts

4 Local Mesh Editing

5 Using Modifiers for Global Editing Operations

6 Texture Mapping

7 Exporting to Unity

8 Exercise