Basic Mesh Modeling

By Friend

Pre-workshop

- Read and do stuff assigned in sections up to and including “Install and open Blender”

If there’s a word you don’t understand in the slide, let me know and I’ll add it here

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Note

- If it’s a keyboard shortcut, I’ll use [ ]
- If it’s a mouse click, I’ll use “ ”

Agenda

- We'll walk through the process of making something similar to this pencil cup
  - https://www.thingiverse.com/thing:2143549
  - https://www.thingiverse.com/thing:933001
- You'll learn some Blender basics along the way
- Enough to get you through 90% of 3D printing prototyping

Why Blender is better than Solidworks (sometimes)

#1: Save time (and money)

- For most basic, first iteration prototypes, most likely someone's already made something similar that you can adapt to your project
- And they've put it up for free, online
- Adapting it to your ideas is less time, compared to CAD something from zero
- Popular 3d-print-able format for 3D models is STL (mesh, not CAD files, unfortunately), so Blender is better suited than Solidworks

#2: You can do everything Meshmixer does with Blender, and more

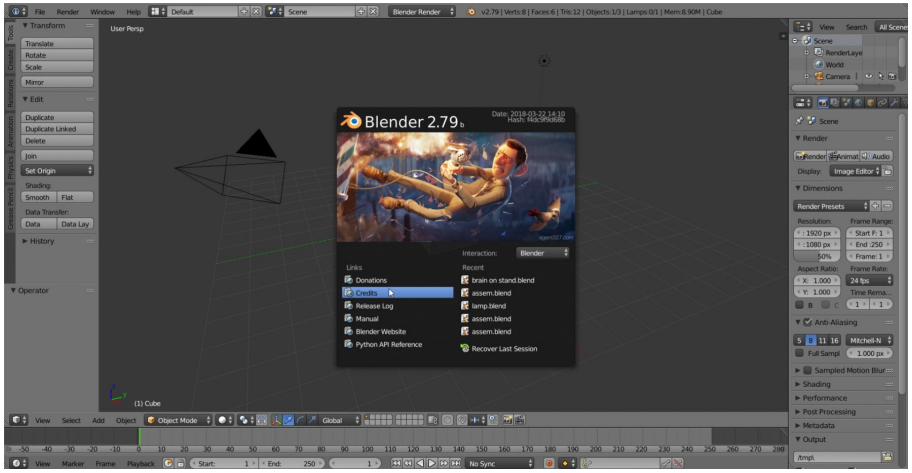
- Some examples:
  - Closing hole: https://blender.stackexchange.com/questions/52661/how-can-i-close-a-big-hole-in-a-mesh
  - Plane cut: https://blender.stackexchange.com/questions/88578/how-do-i-bisect-along-an-axis
- Much larger user community than Meshmixer
  - Someone's already answered any question to anything you need to fix in Blender
  - Many useful Blender plugins people write and put up for free
- You can do animation, video editing, modeling, etc. (and even CAD if you want to)

Find models

- The main elements of this project are:
  - A model
  - A hole
  - A bottom plate if the hole cuts through the model, or model doesn't stand on itself
- We can make the hole and the bottom plate in Blender, so for now, find a nice model on thingiverse.com you want to put a hole through
  - Good if it's solid block that stands on its own
  - Ideas: dogs, cats, skull, moon, globe, turtle, bunny, R2D2, mushroom cloud

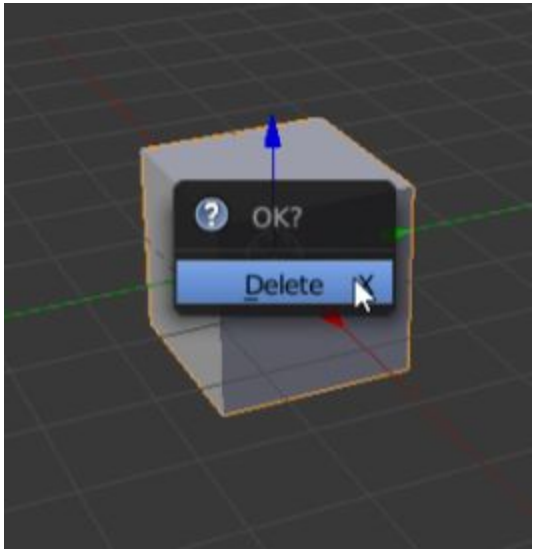
Install and open Blender

- Go to blender.org, download, and install
  - It's a fairly clean website unlike Lulzbot's so I won't go into detail
  - I'll use Blender 2.79 in this workshop, but any version should work fine
- Open it once you're done, click anywhere outside the center to make the middle pop up go away



Install and open Blender

- Get rid of the default cube by pressing [X] and click “Delete”

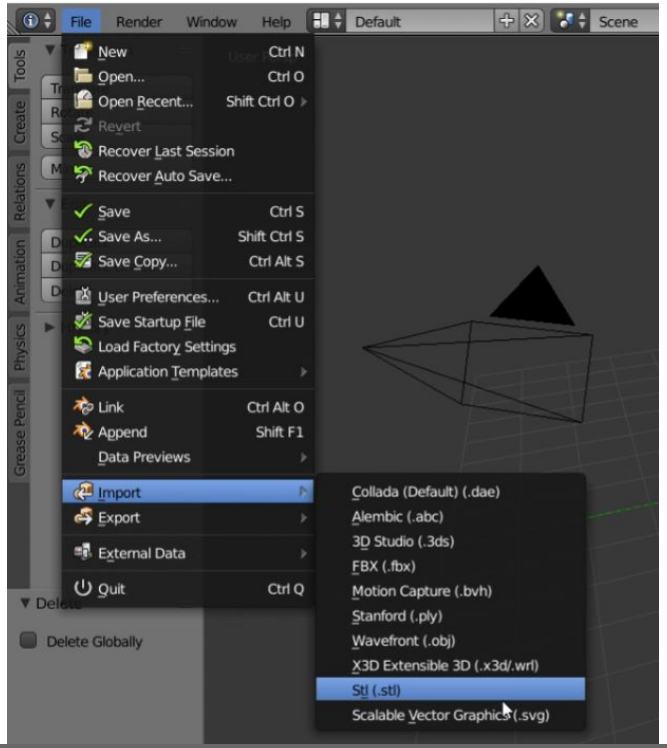


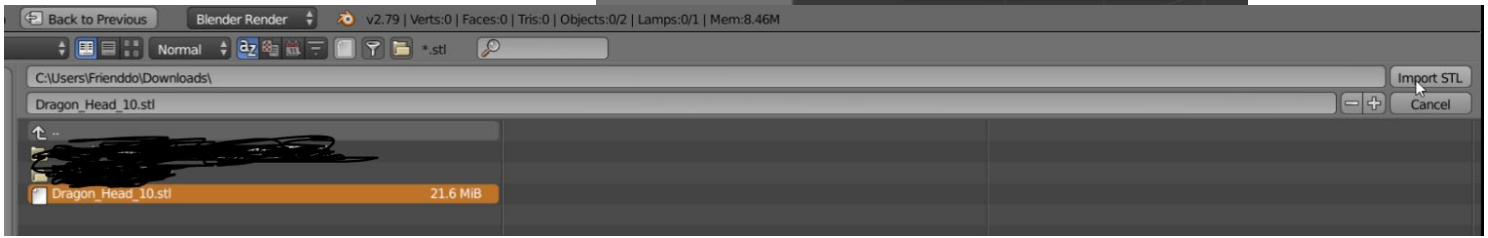
Manipulate your view

- To rotate view, hold middle mouse button, and drag your mouse
- To move view, hold [Shift] and middle mouse button, and drag your mouse

Import and center your model

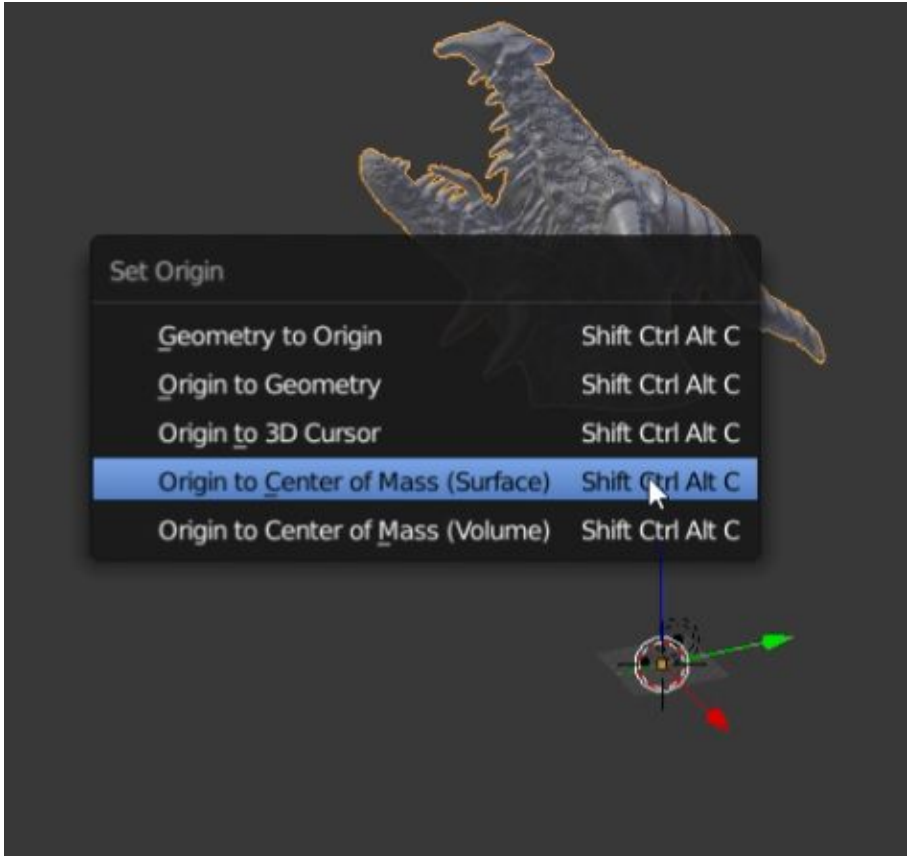
- To import, click “File” (top left corner) -> “Import” -> “Stl (.stl)”
- Go to the folder, click on the file, then click “Import STL”
- I picked this https://www.thingiverse.com/thing:478774





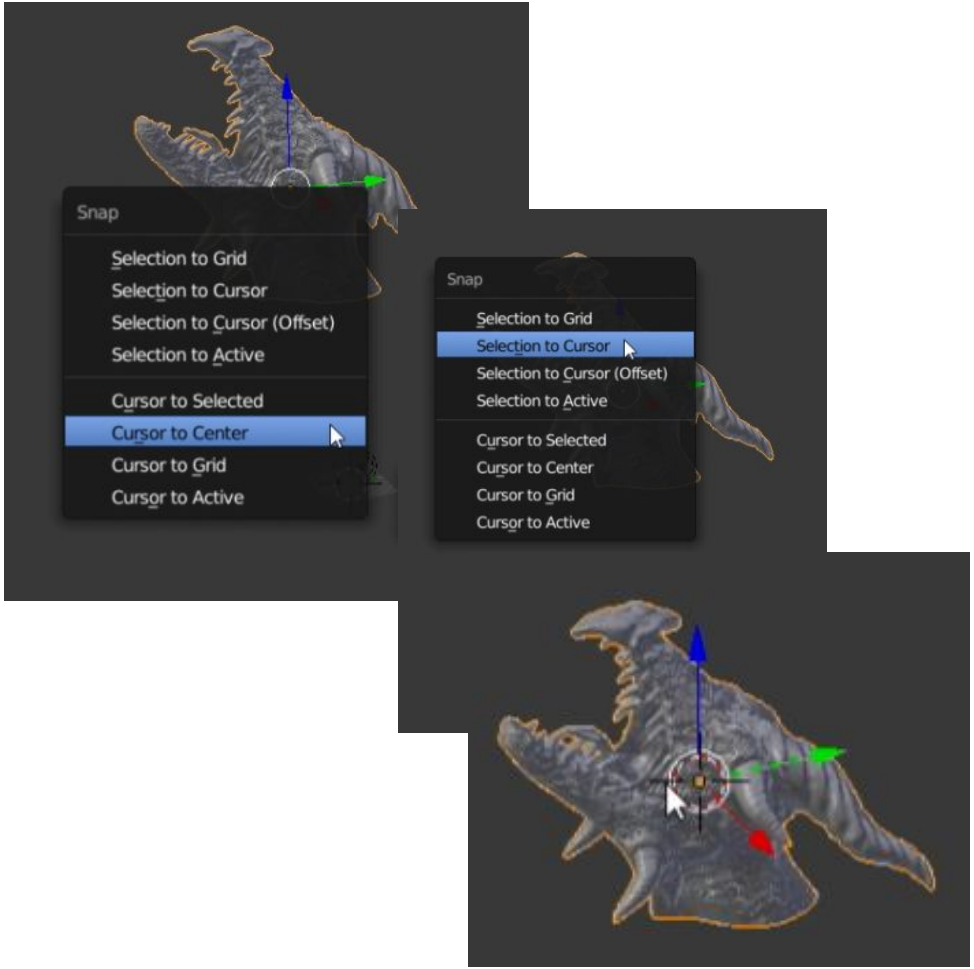
Import and center your model

- STL are sometimes not centered to origin
- If you don’t see it, use the middle mouse scroll, and zoom out until you see it
- Press [Shift]+[Ctrl]+[Alt]+[C], then click “Origin to Center of Mass (Surface)”
    - You can use Volume as well; they’re approximately the same



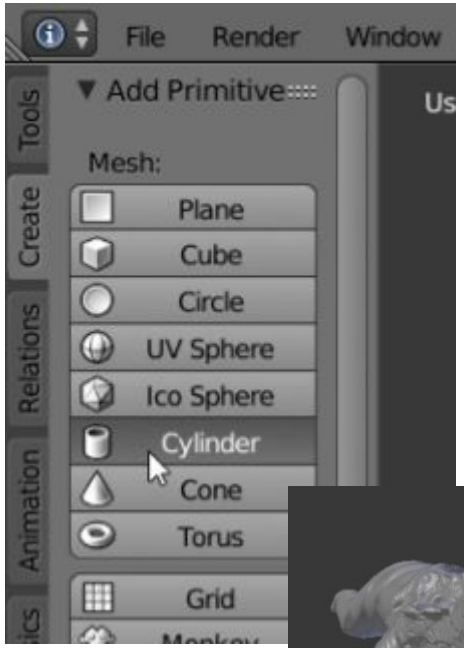
Import and center your model

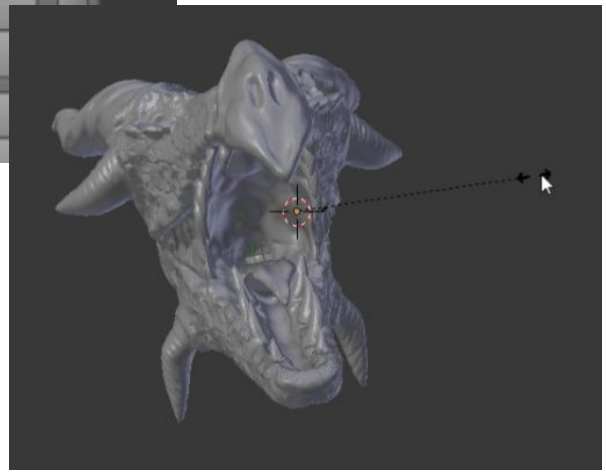
- Press [Shift]+[S], click “Cursor to Center”
- Click “Selection to Cursor”
- Your model should snap to center of the world now



Make a hole

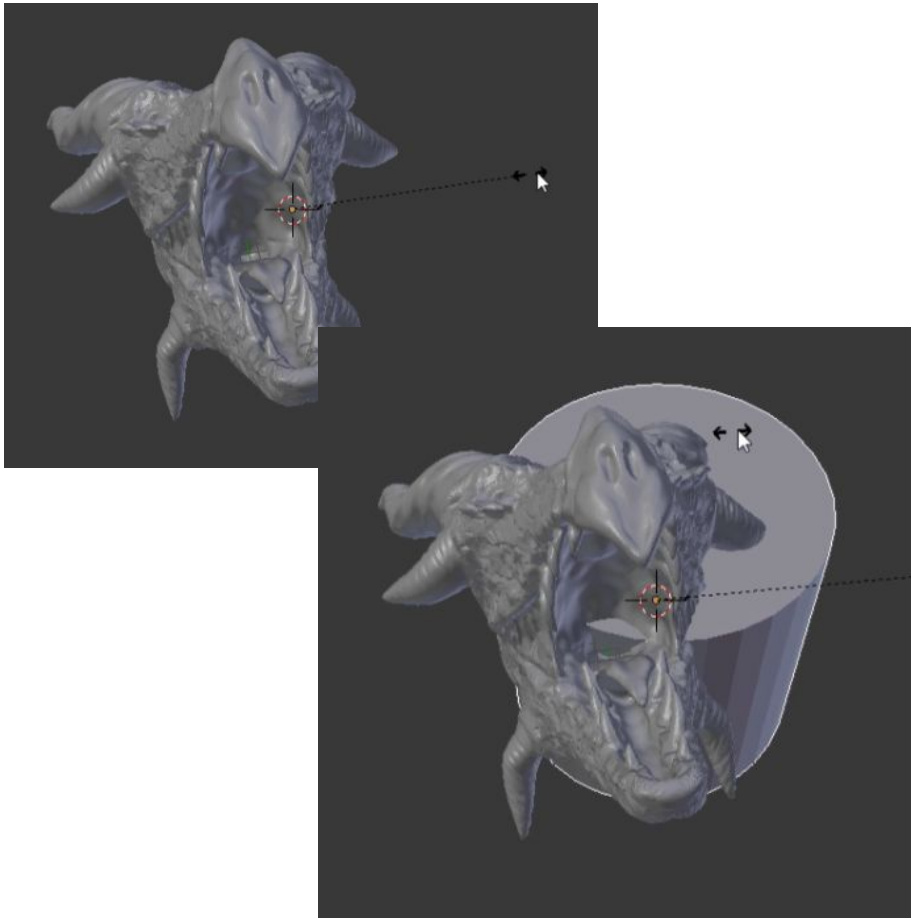
- Click “Create” -> “Cylinder”
- We’ll use this model to as the hole
- You can make a square, or a cone hole too if you want
- Before you click anything else, press [S] and drag your mouse outwards
- This will scale up your cylinder





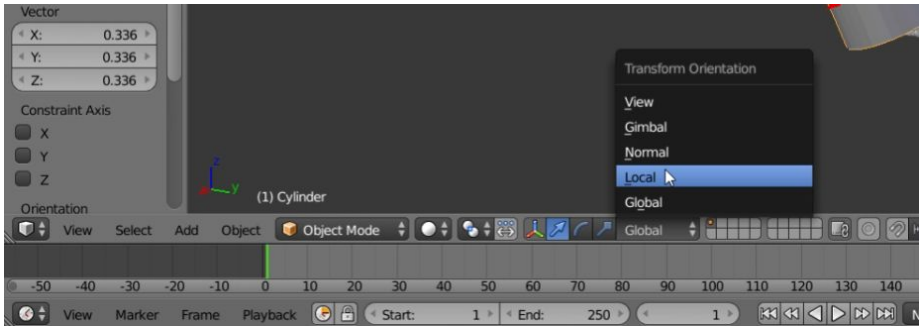
Make a hole

- Once it’s to a scale that you can see, stop
- To move the model, click [G]+[x/y/z]
  - To move along the local axis, rather than global axis, click [G]+[x/y/z]+[x/y/z]
- To rotate the model, click [R]+[x/y/z]
  - To rotate along the local axis, rather than global axis, click [R]+[x/y/z]+[x/y/z]
- To scale the model, click [S]+[x/y/z]
  - To scale along the local axis, rather than global axis, click [S]+[x/y/z]+[x/y/z]



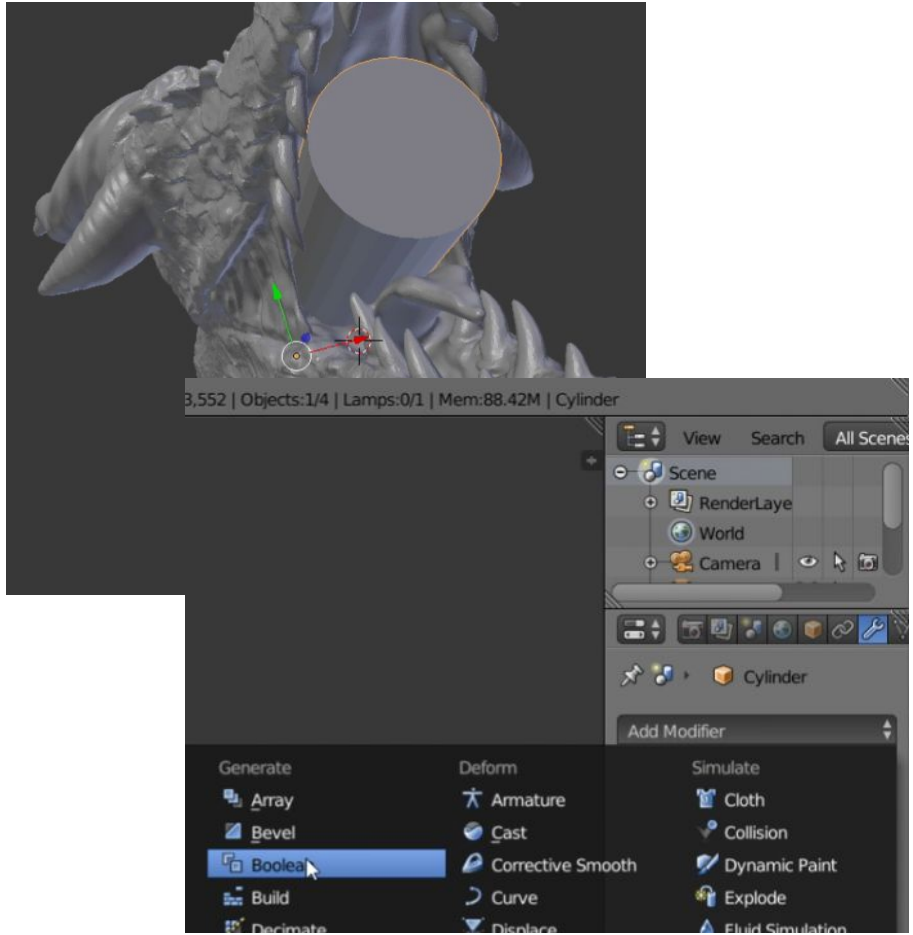
Make a hole

- It might be hard to visualize rotating or scaling along local axis without seeing local axis, so you can change that on the bottom toolbar



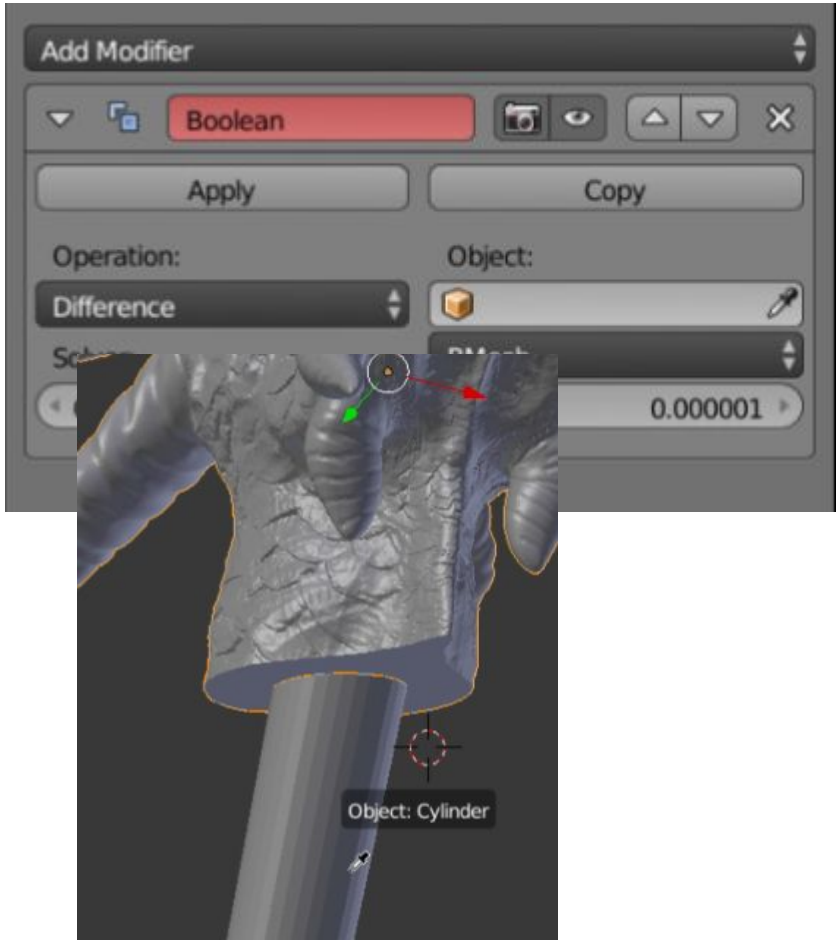
Make a hole

- Once you have put it in the right position, go to the right toolbar, click on the wrench icon -> “Add Modifier” -> “Boolean”
- THE IMAGE IS WRONG! You should select the main object, not the cylinder when applying boolean
    - You want to cut the hole in the dragon, not cut a dragon-shape hole in the cylinder



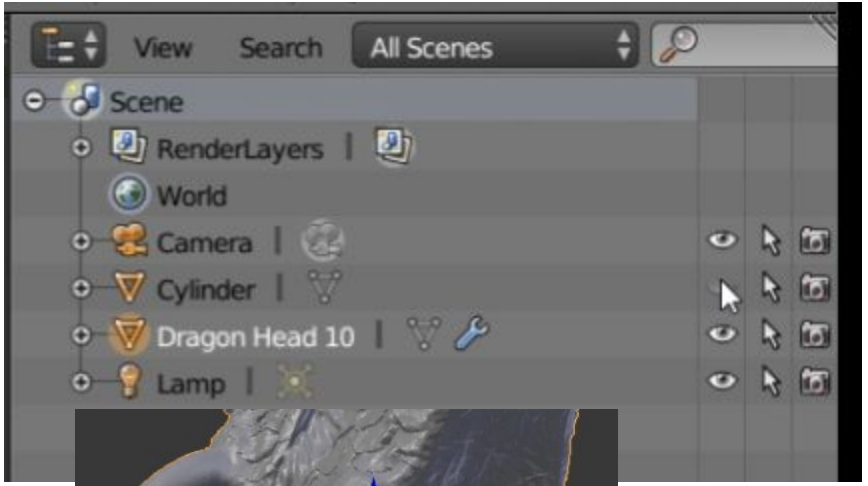
Make a hole

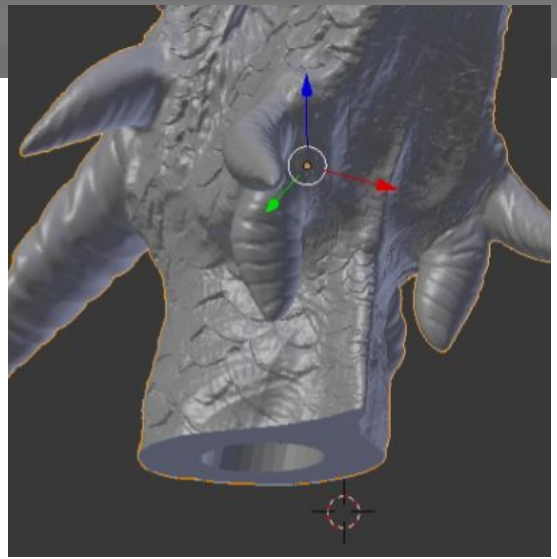
- Change Operation to “Difference” (it’s a drop down menu)
- Use the eyedrop icon near Object to select your cylinder



Make a hole

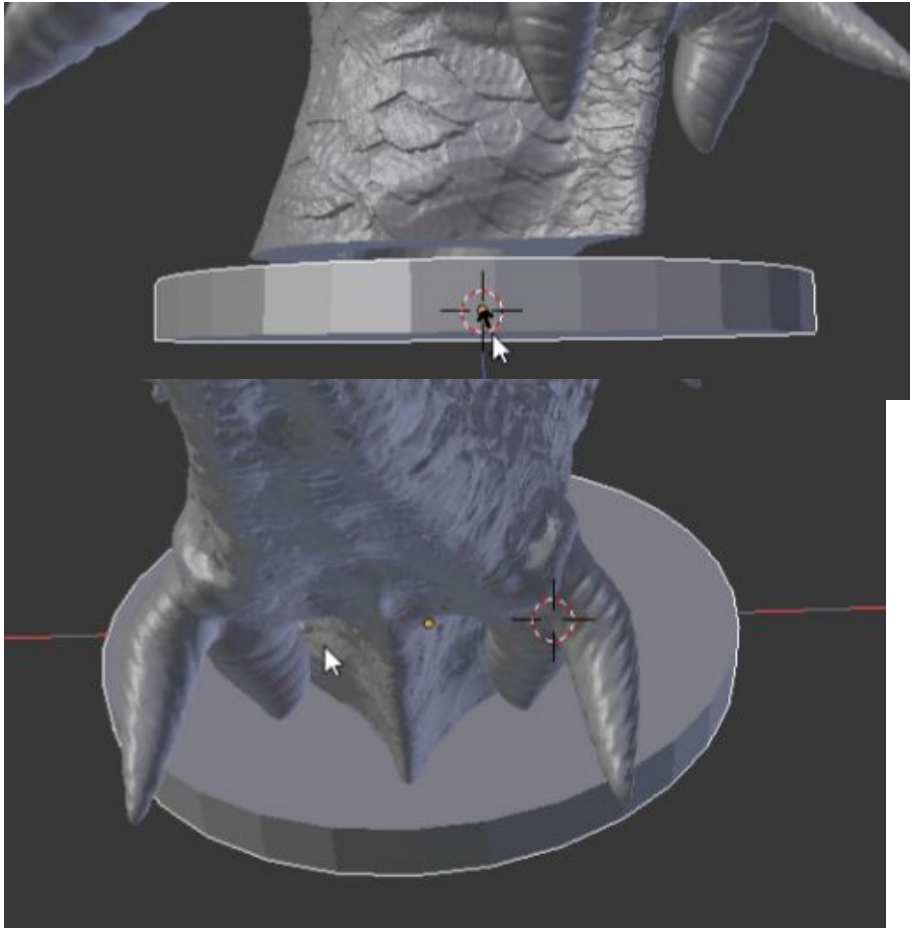
- Click on the eye icon next to the cylinder’s name to not see it
- You should be able to see the hole you’ve made very clearly





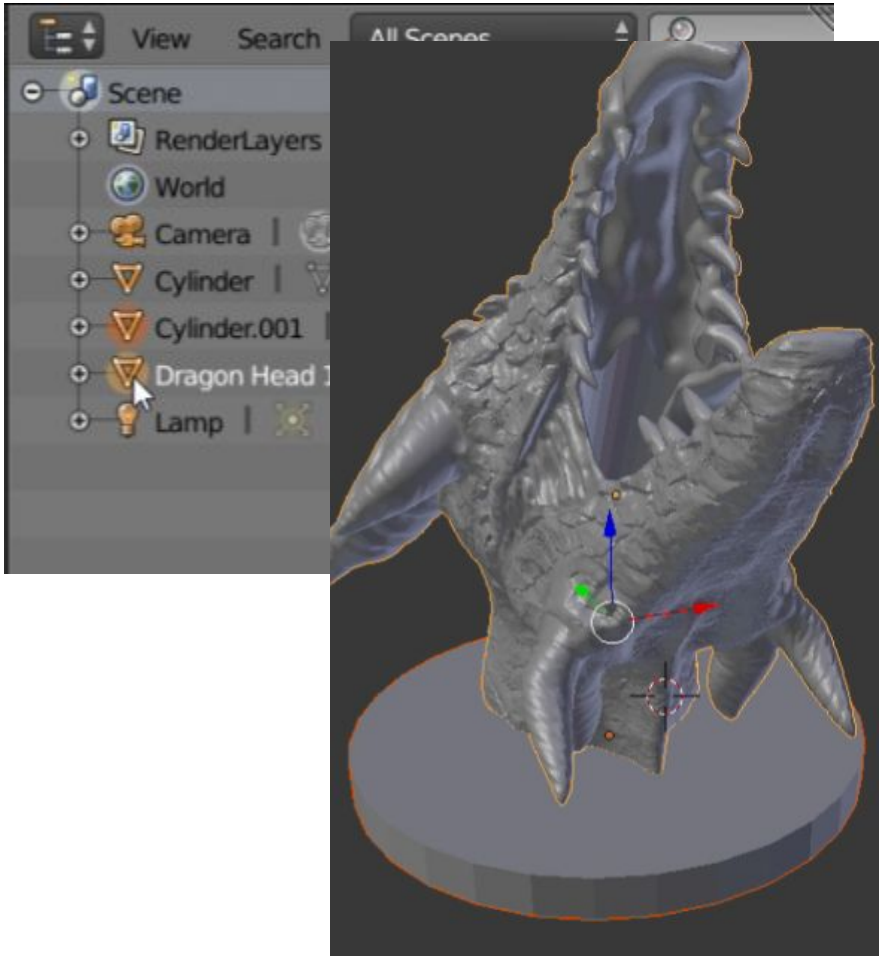
Make a base

- Use the skills you learned when moving, rotating, and scaling a model to make the base
- Make another cylinder and manipulate it into a base
- Make sure the main model (ex: dragon) overlaps a bit with the base so it can become a single solid model



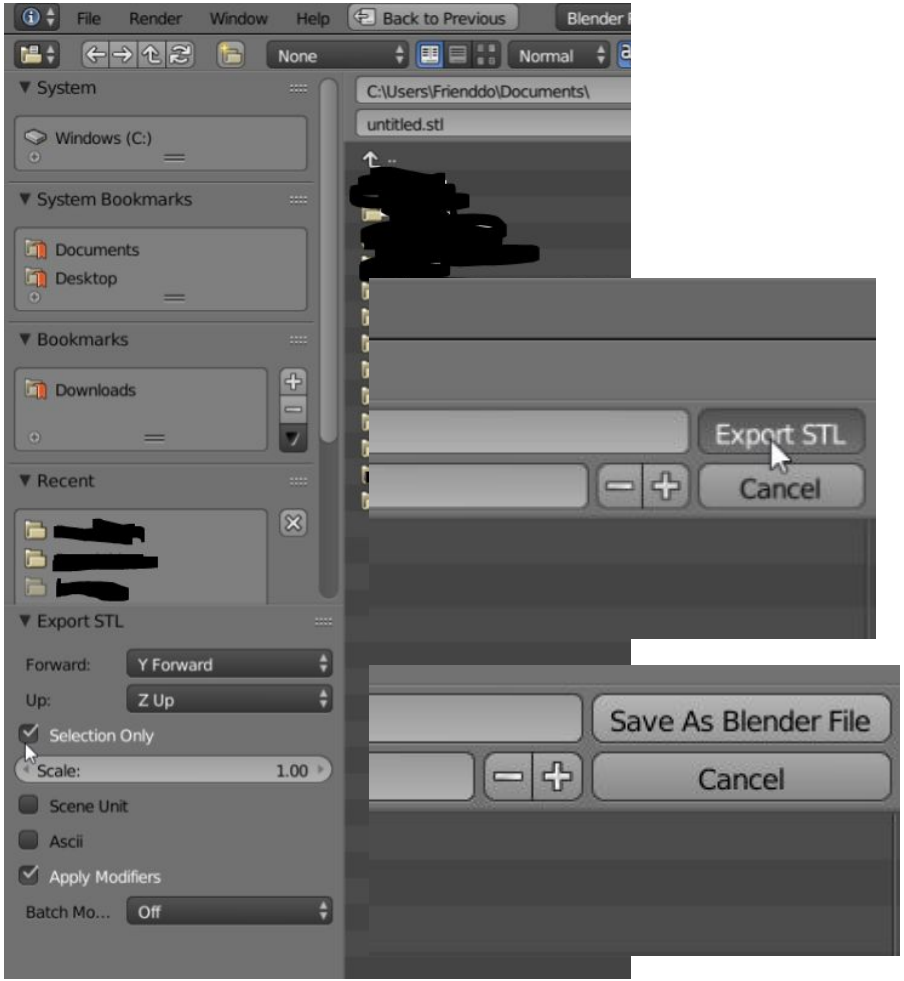
Exporting

- Select only the model you want to export (hold [Shift] to select multiple things at once)
- If you haven’t noticed by now, a model that is selected has an orange highlight around it



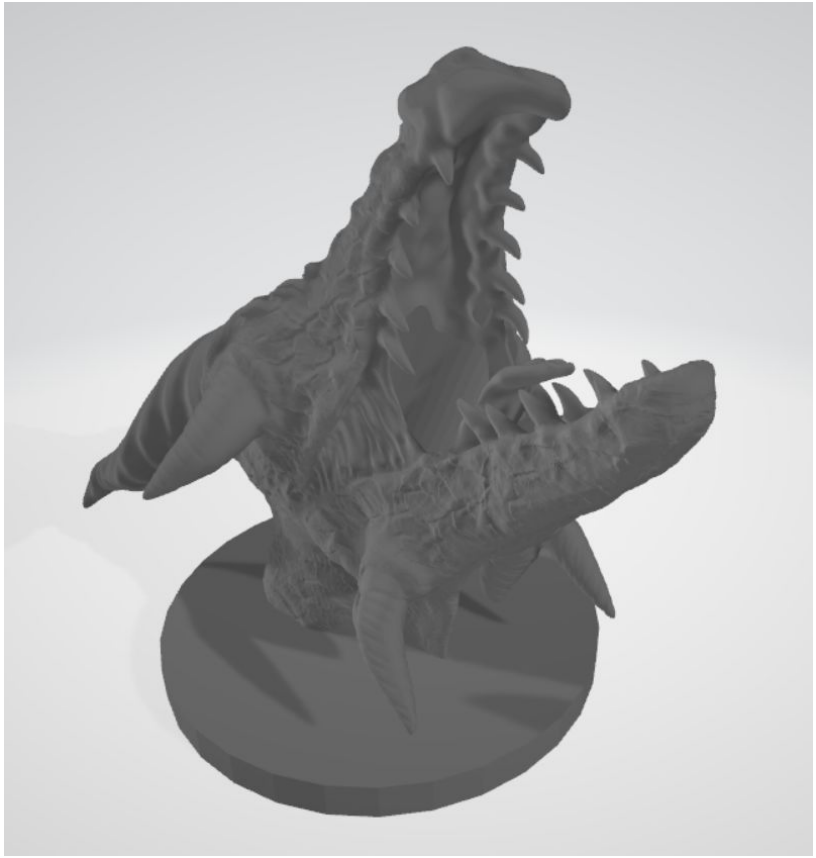
Exporting

- Tick yes on “Selection Only” and “Apply Modifiers”
  - This will make sure only the stuff we’ve selected is exported (so the hole model doesn’t get exported), and the hole is actually cut into the main model
- Save it anywhere you’d like by clicking “Export STL”
- Save the whole Blender project by pressing [Ctrl]+[S], find a good directory, then click “Save As Blender File”
  - It’ll say “Save As” the first time you save



Final product

- Nice
- You can open it with 3D viewer (Windows) or Preview (Mac)
- Import it to Cura to print



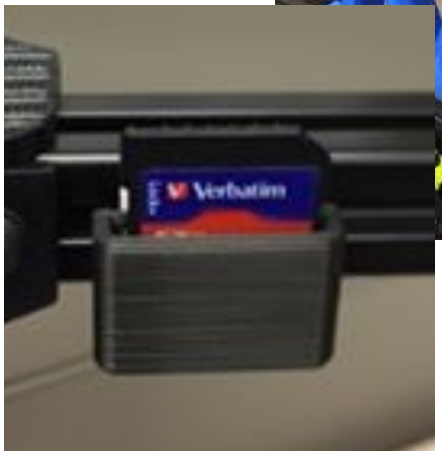
Other useful/cool stuff I didn't mention

- In edit mode, [Alt]+[S] to shrink/fatten
  - Good for clearances
- In object mode, there's Decimate as one of the boolean operations
  - Use to make low-poly toys

A few examples from what I've made

SD card holder for our printer

- SD card holder with boolean difference to cut it to have only one SD card slot
  - https://www.thingiverse.com/thing:56074
- Spool holder with boolean difference to cut out for only the section to slot into aluminum extrusion
  - https://www.thingiverse.com/thing:1608830
- Export them together



Some further readings

- Modeling organic shapes https://blender.stackexchange.com/questions/45925/whats-the-best-way-to-model-organic-shapes
- Physics simulation https://github.com/jonbruner/blender/tree/master/Cloth