Blender Course Outline

What is Blender?

- Blender is a free and open source 3D animation suite. It supports the entirety of the 3D pipeline —modeling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation.

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Blender Platforms:

- Linux
- Windows
- Mac

Capabilities of Blender:

http://www.youtube.com/watch?v=eRsGyueVLvQ

Blender also can be used as a 3D printing/CNC application to create, export, edit, and repair a variety of 3D files including.stl and .obj files.

Download and Install:

As stated before, Blender is a free, open source 3D program available for the public to download, use, improve, and customize.

To download Blender, visit Blender.org and click on the download link or visit:

http://www.blender.org/download/ for the file and installation instructions.

Lets Begin

We will start by walking through the process of making something similar to the image below.

Important Hotkeys:

G-Translate/Move selection   Shift+A-Add Object
S-Scale selection   Tab-Toggle Edit mode
R-Rotate selection   B-Box Select
E-Extrude Selection   C-Circle Select
Z-Toggle Wire-frame View   A-Select/Deselect all
5-Toggle orthographic/perspective view   0-Camera Perspectives
1-Side view   Ctrl+Z-Undo
7-Top View   Crlt+Shift+Z-Redo
3-Front View   X-Delete

Mouse Controls:

Left Click-Move 3D Cursor   Shift+MMB-Pan
Right Click-Select   Ctrl+MMB-Zoom
Middle Mouse Button (MMB)-Orbit   Scroll-Zoom
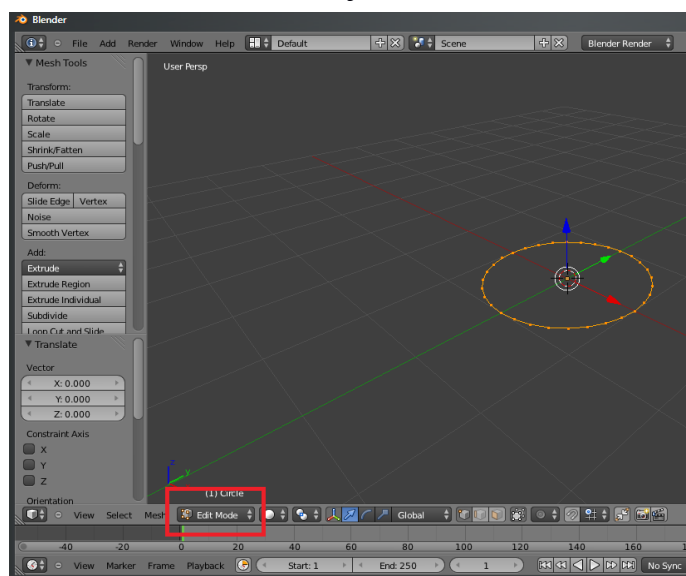
Step 1:
Right click the cube in the center of the screen, press X, and click Delete.
With the mouse in the center of the screen, press shift+A to open the "Add" menu. Navigate to "Mesh" and select "Circle".
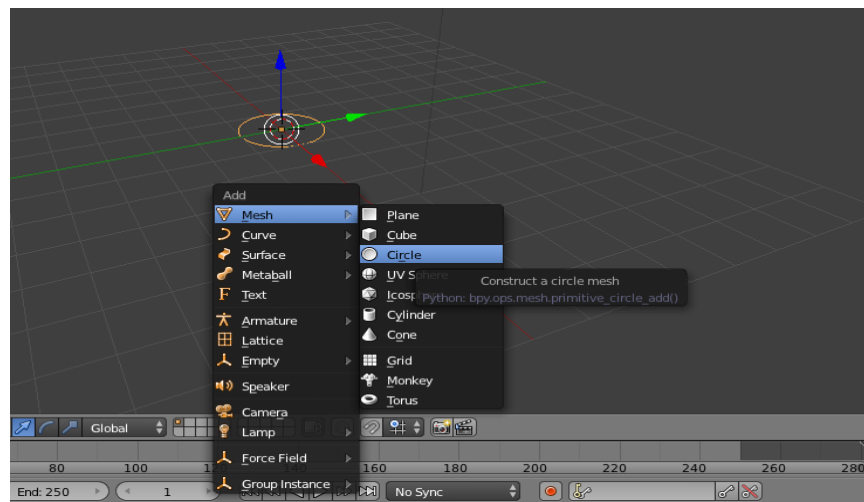

Step 2:
With the circle inserted, press tab to switch from "Object Mode" to "Edit Mode".

Step 3:

With all the vertices selected, extrude, scale, and move them using E, S, and G respectively. When you have your desired shape press Tab to switch back to Object mode. If you want to smooth out the final object, click the "Smooth" button located in the Object Tools toolbar on the left side of the screen. Keep in mind, the smooth tool is only for rendering purposes. If you export the object as a .stl or .obj file it will not be smooth. Press ctrl+2 to add more subdivisions for a smoother model.
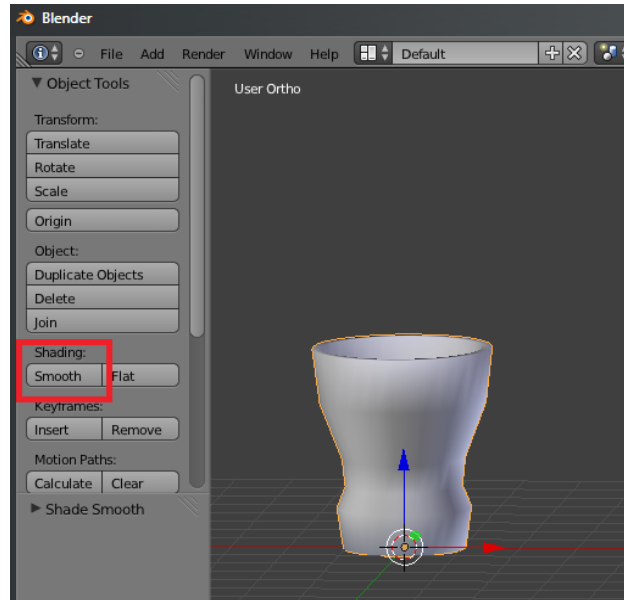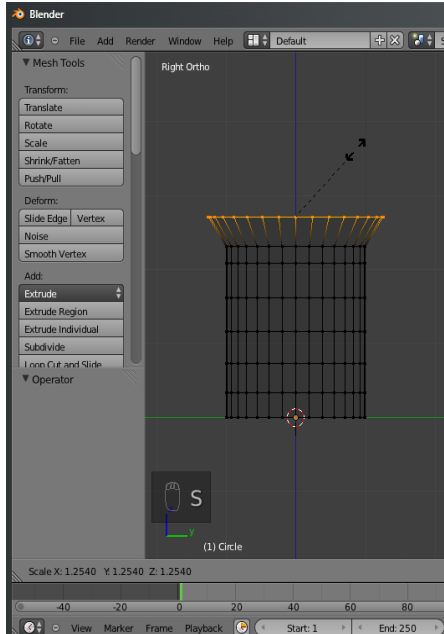

Step 4:

Just as we added the circle, add two planes into your scene. Take one plane, place it at the base of the cup and scale it by 50 times by typing S → 50 or dragging the mouse until the plane is big enough to fill your scene. Take the second plane and raise it above your object. This will act as our light source.
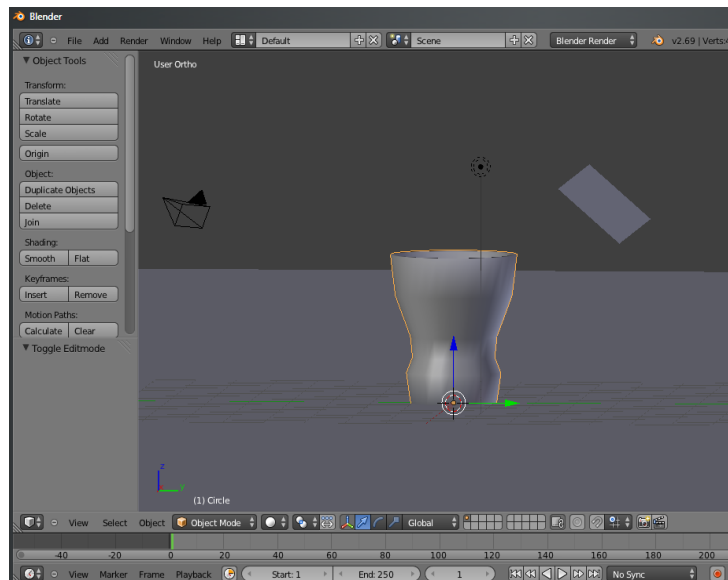
Step 5:

Before we start adding materials, make sure at the top of the screen you have the Cycles Render engine selected. Next, with your object selected, navigate to the materials tab on the right side of the interface. Press "New" and change the surface type from "Diffuse BSDF" to "Glass BSDF". BSDF stands for bidirectional scattering distribution function. Essentially, it's a mathematical function that determines the probability that a specific ray of light will be reflected (*scattered*) at a given angle.

Finally, select your smaller plane and using the same method, choose "Emission" to add light to your scene. You can change the strength of the light source by adjusting the strength slider under "Color". The higher the number, the more light emitted from the plane.
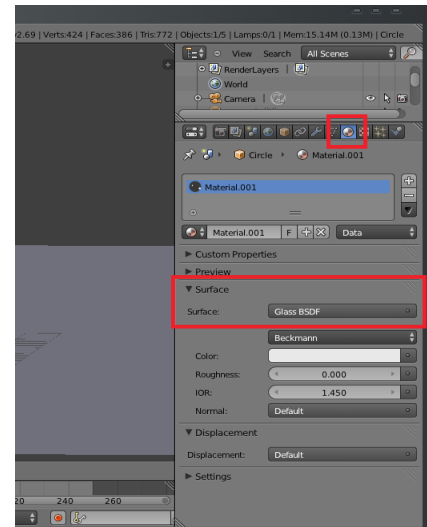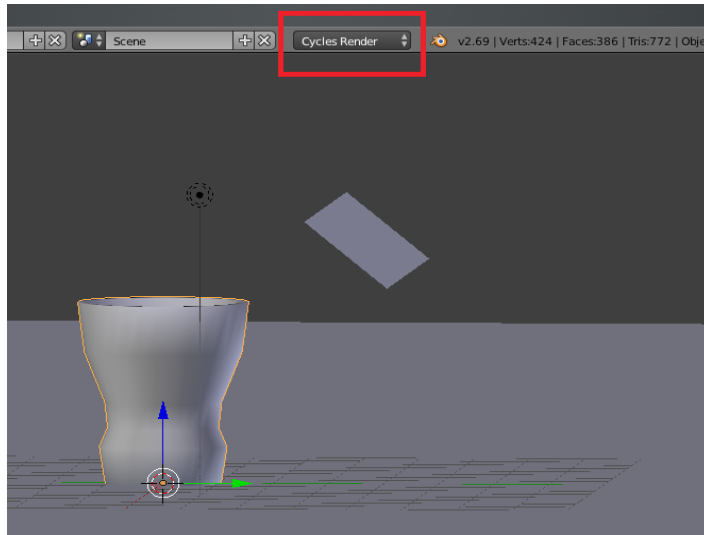

Step 6:

Almost done! Press 0 to change your view to Camera Perspective mode. This is what you will see in the final render. To change the view, you can relocate the camera using G, S, and R (move, scale, and rotate), or if you press "N" and check the "Lock Camera to View" box, the camera will be locked to the 3D view until you press 0.
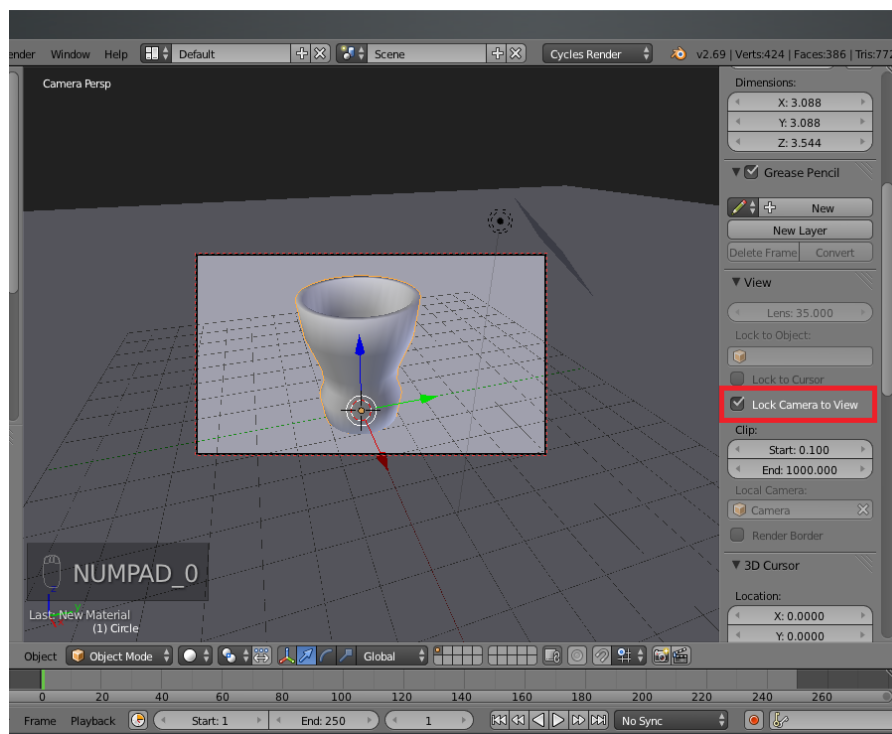
Step 7:

When you have the desired angle and perspective click on the Render tab (looks like a camera) on the right side of the screen to change your render settings. Go into the sampling settings and change the number of render samples from 10 to 100, or whatever works for your scene.
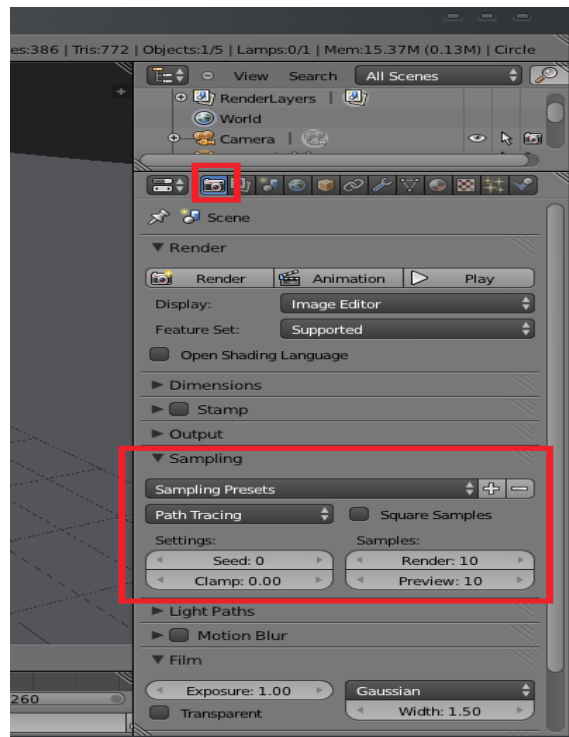
Step 8:

Finally, click the Render button at the top and wait for the image to fully render. If you are happy with the result, press F3 to save the image.
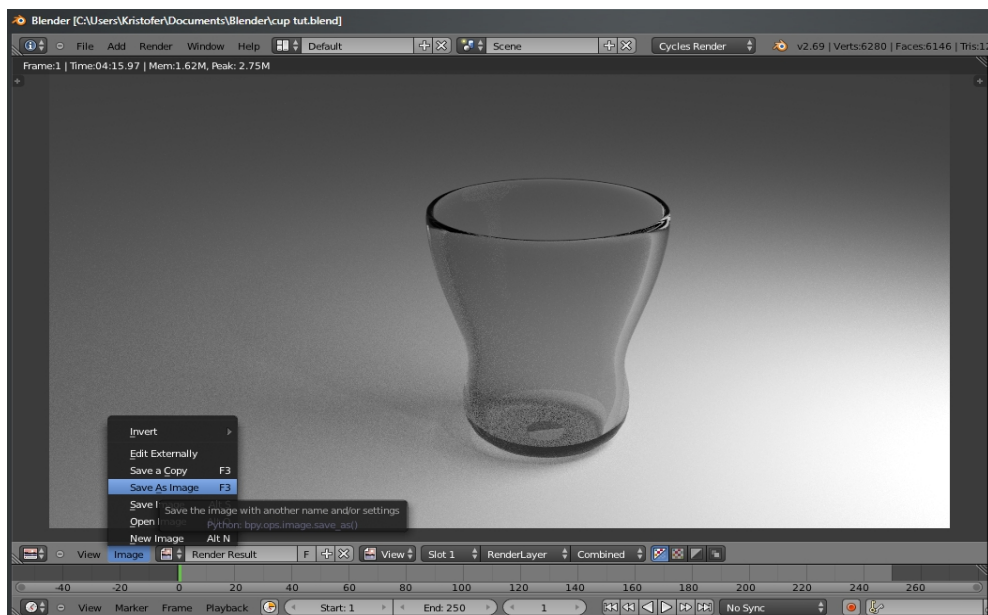
<u>Lets Go Back</u>
Now that we have made our first model in Blender, lets take a step back and see what's really going on within the user interface.

User Interface
Information window: (Top)

(From left to right)

Red Box- The Window/Editor Type Selector allows you to change the type of window that will be displayed. This selector is located on every window/panel in the user interface.

Yellow Box-The Menu Options offer the most basic settings and functions of the program including, but not limited to, saving files, importing/exporting files, changing user preferences, taking screen shots, etc.

Blue Box- The Screen Selector allows you to change between preset screen layouts to help improve work flow and efficiency.

Green Box-The Scene Selector allows you to create and toggle between various scenes within one .blend file.

White Box-The Engine Selector allows you to select between Blenders different engines including the Blender Render Engine, the Cycles Render Engine, and the Blender Game Engine.

Orange Box-The Resource Information region provides the user with information about Blender and system resources in use. This region will tell you how much memory is being consumed based on the number of vertices, faces and objects in the selected scene, as well as totals of what resources are currently selected. This can help identify when you are reaching the limits of your hardware.
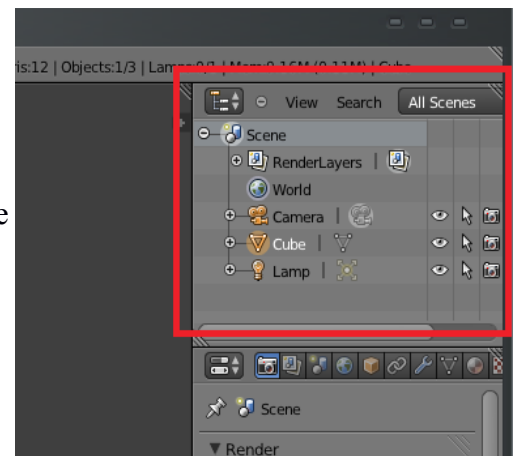
Outliner Window: (Right)
The Outliner Window lists all objects, groups, and elements within the file. In the window you can toggle the display, render, and selection restrictions on/off for all items listed.
Eye-Restrict Viewport Visibility
Pointer-Restrict Viewport Selection
Camera-Restrict Rendering

Properties Window: (Right)
The Properties Window displays panels of functions grouped together by similarity. In the header of the Properties Windows is a row of buttons (called Context Buttons) that allow you to select which group of panels are shown. Some panels are only visible when particular Objects are selected. Panels can be collapsed by use of the small arrow left of the panel title and may be rearranged by dragging the top right corner.
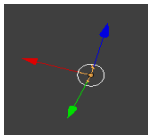
Properties Window Header
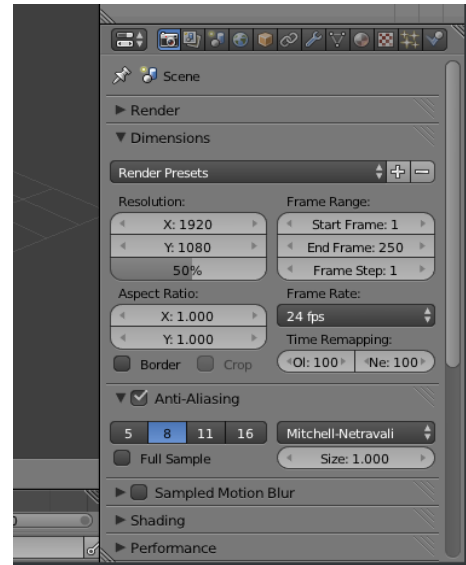
3D Window View:
Located in the center of the screen, it is the main window where 3D objects appear and are manipulated..

- 3D Cursor: Can have multiple functions. For example, it represents where new objects appear when they are first created, or it can represent where the center of a rotation will be.

- 3D Transform Manipulator: Is a visual aid in transforming objects (grab/move, rotate and scale). Objects can also be transformed using the keyboard shortcuts: (G/R/S); Ctrl+Space will toggle the manipulator visibility.

3D View Header (footer):

(From left to right)

Red Box- The Window/Editor Type Selector allows you to change the type of window that will be displayed. This selector is located on every window/panel in the user interface.

Yellow Box-The Menu Options offer the settings and functions of the 3D view and the objects within the scene.

Orange Box- The Interaction Mode allows you to change between different interaction modes of the object selected.

Black Box-The Viewport Shading allows you to switch between various shaded view modes..

Blue Box-The Pivot Point Selector allows you to change the center of rotation and scaling for the selected object/s

Green Box-The 3D Transform manipulator options allow you to hide/show the transform, rotate, and scale manipulator.
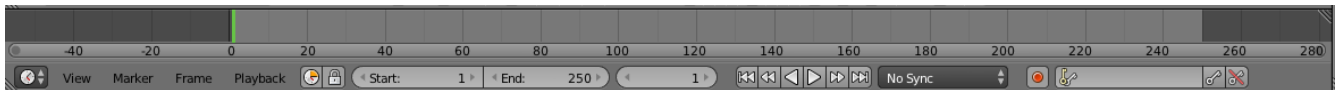
White Box-The Layers Panel allows you to distribute objects into functional groups, keeping the scene more organized.

Brown Box-Turn layers on and off.

Pink Box-The Snap Options allows you to toggle on/off as well as change the type of snapping of objects to parts within the scene.

Gray Box-Render active viewport.

Timeline Window:

The Timeline Window shows the animation time frame and it allows you to change, animate, and control the keyframes of an animation.

Tool Shelf: (T)
The Tool Shelf lists the most common and useful tools used for 3D modeling and animation. It contains many of the important functions necessary for scene creation with nearly all functions linked to keyboard shortcuts. (Refer to keyboard shortcut document)

Transform Properties Panel: (N)

The Transform Properties Panel allows you to manually/numerically control the position, rotation, and other properties of an object, in Object mode. Additionally you can edit display settings of the 3D view.
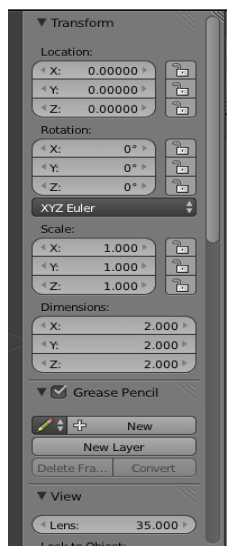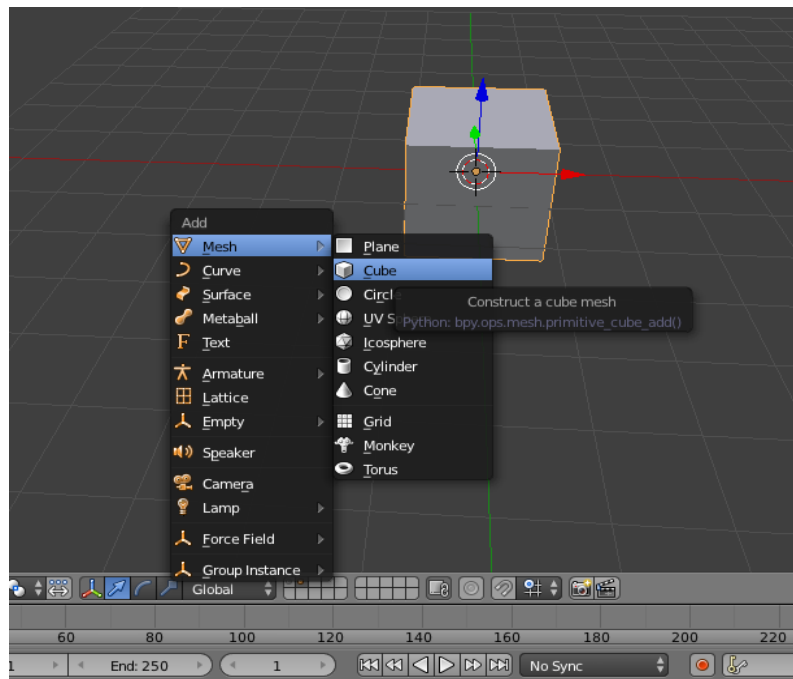
Editing and modeling shapes

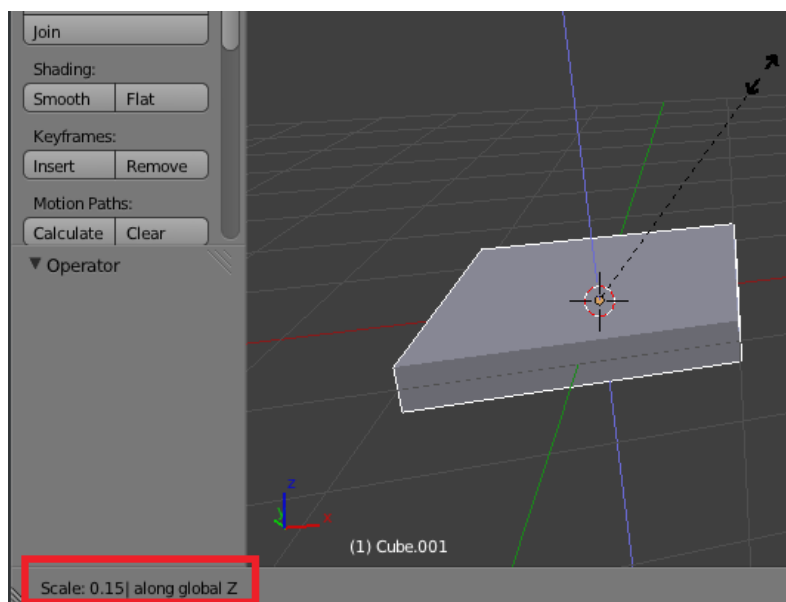We have seen how to create an object from scratch now lets see what we can do with pre-existing models and shapes.

Step 1:
With the mouse in the 3D View, press shift+A open the "Add" menu. Navigate to "Mesh" and select "Cube".

Step 2:
Press S+Z to scale the cube along the z axis and type .15 to scale the cube to 15% height.

Step 3:

Next, press tab to enter edit mode and press A to deselect all faces. Holding shift, select the top and bottom faces of the cube. Tap W to bring up the specials menu and click "Subdivide". On the left side under "Subdivide", change the number of cuts to 5.
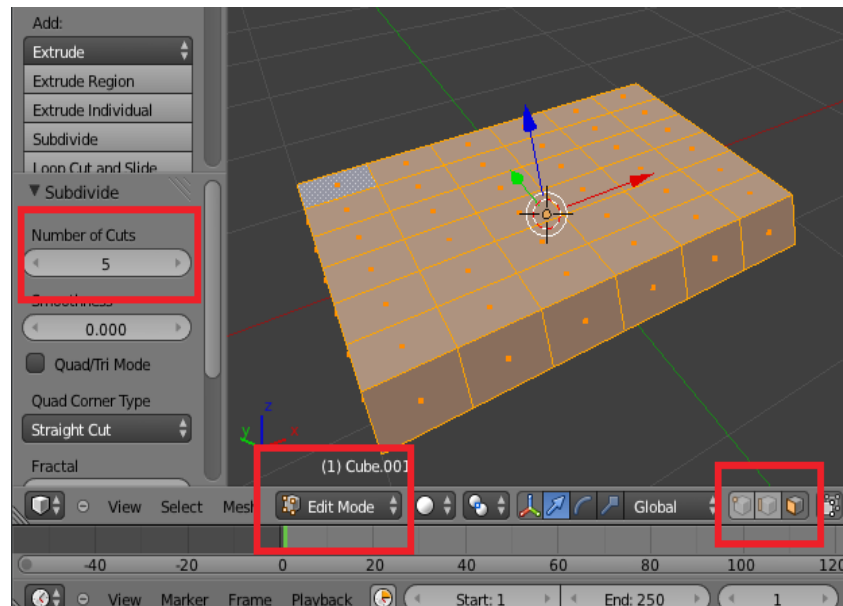

Step 4:

On the bottom of the screen, change the select mode from vertex select to face select. Holding shift, click the four corner faces on the bottom of the cube. Press E+Z to extrude selected faces along the z axis. These will be the legs of the chair. Do the same to any two corner faces on the top of the cube. These will be part of the back support.
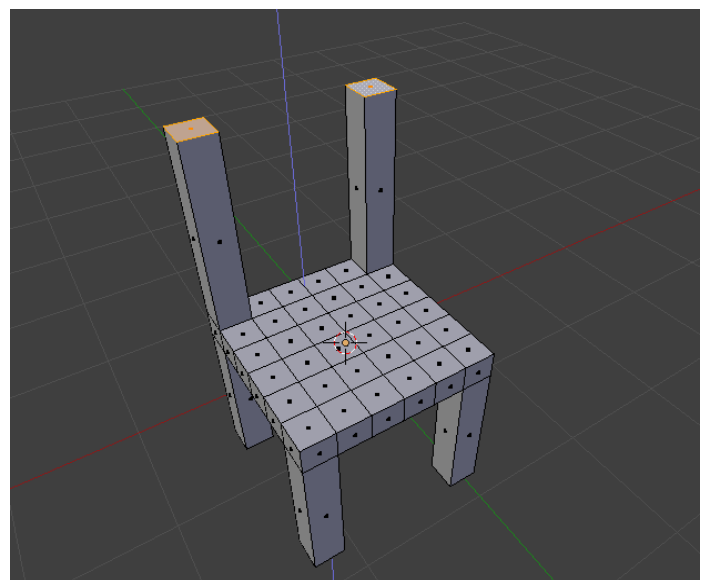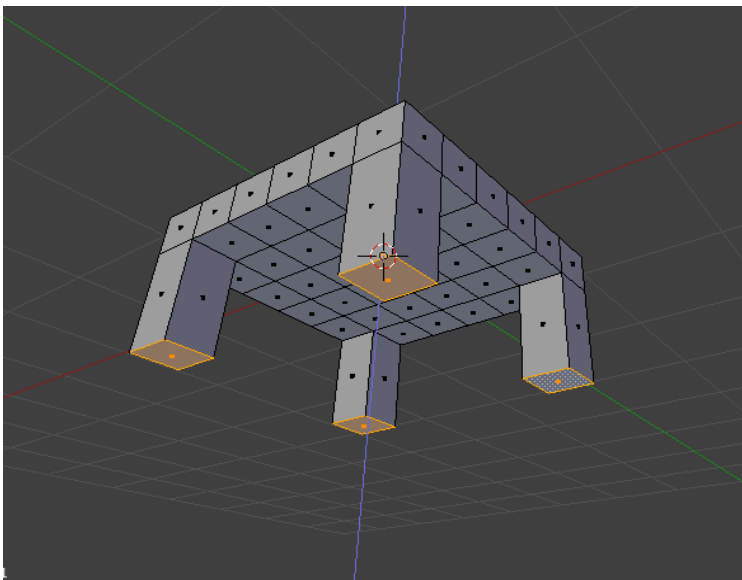
Step 5:
Put your mouse over one of the back support beams and press ctrl+R to perform a loop cut. You should see a purple colored loop form around the beam. Next, type 5 or scroll until you see 5 subdivisions. Then, press Enter/Left MB and press Esc/Right MB. Loop cuts essentially subdivide an entire section of an object along the x, y, or z axis.
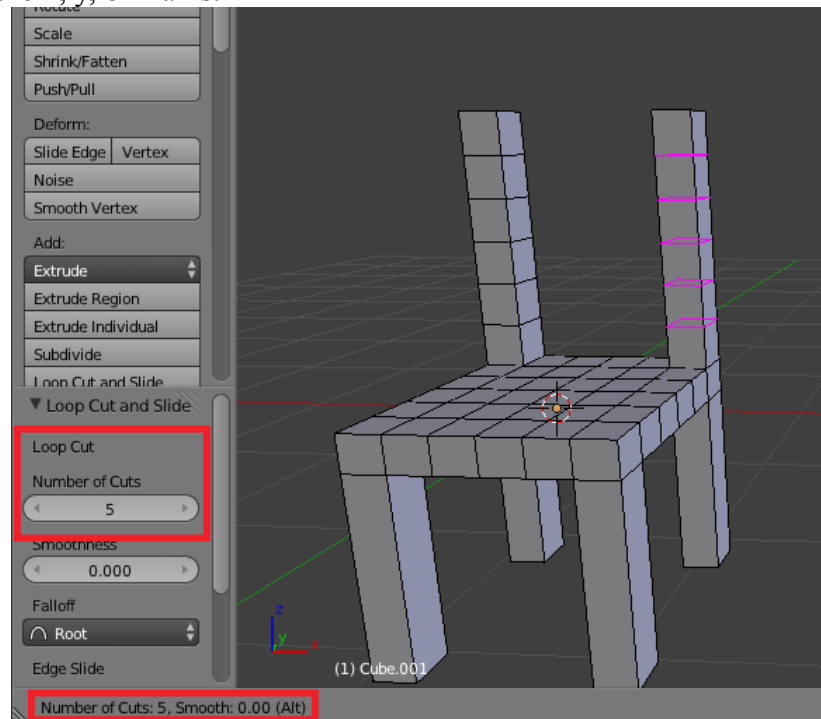

Step 6:
Now we are going to make the horizontal back supports of the chair by bridging the vertical supports. Select the top inner faces of the vertical back supports and press X to open the delete menu. Click on "Faces" to delete just the selected faces.
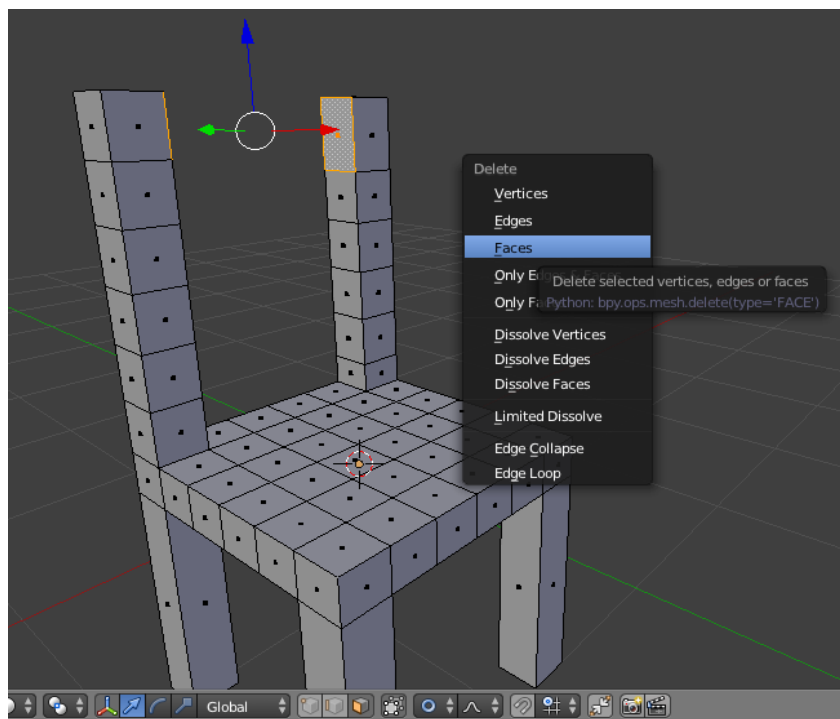
Step 7:

Next, switch to Edge Select by clicking the edge icon at the bottom of the 3D view. Select one edge from each side of the vertical back supports and press F to bridge the gap. Do this to the remaining edges to form an entire horizontal back support. Repeat step 6 and 7 until you are happy with the result.
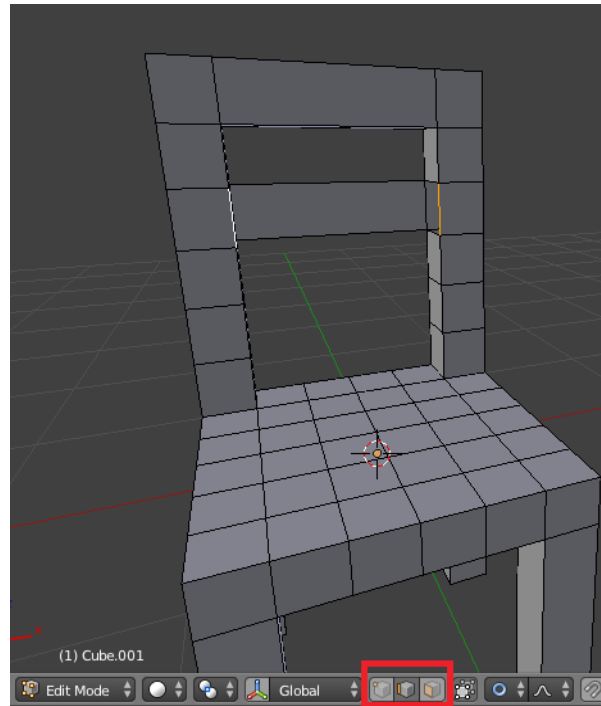

Step 8:

If you want to render it with materials, repeat steps 4 through 8 from the previous walkthrough. Rather than using a "Glass BSDF" surface, experiment with other surface types. Try selecting "Mix Shader" (combination of two surface types) and input a "Diffuse BSDF" and a "Glossy BSDF".
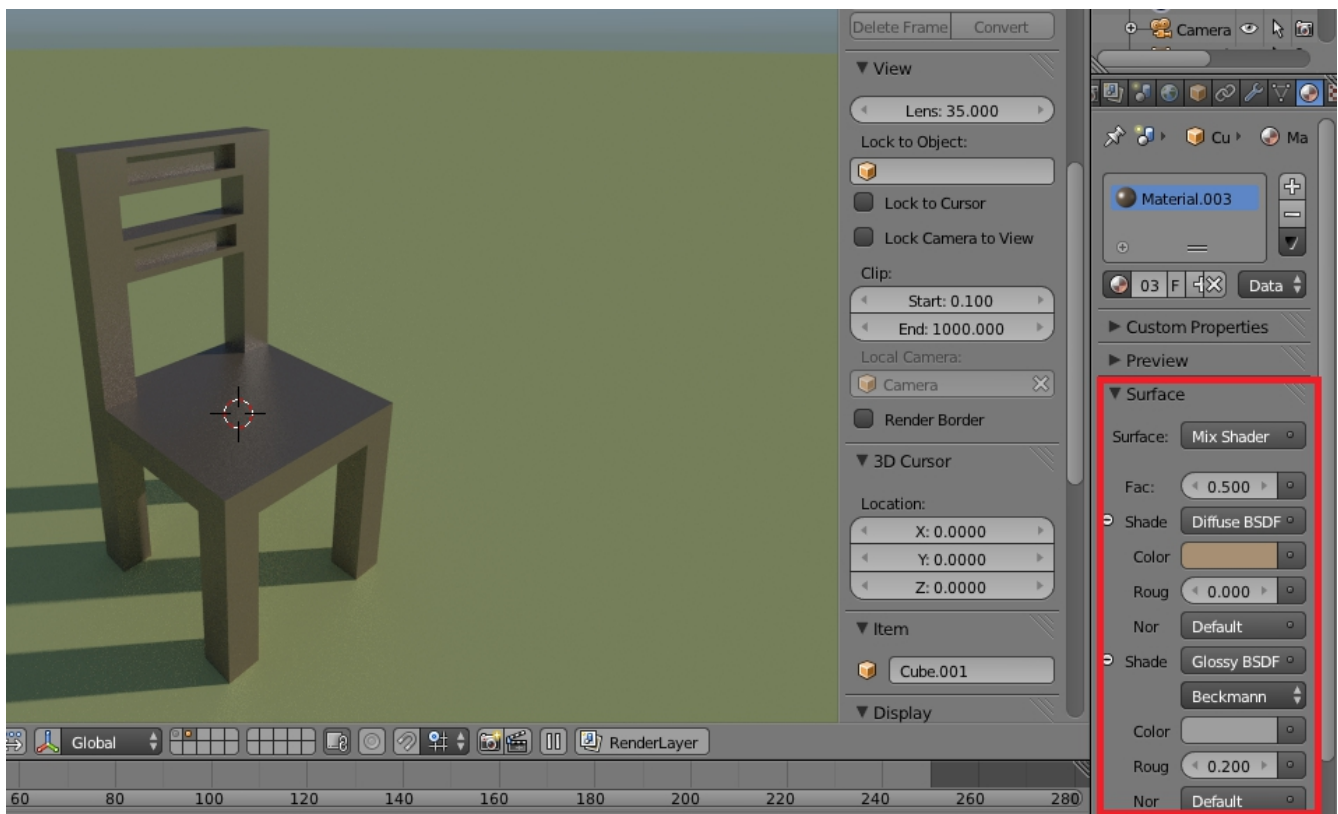
Modifying .stl files

Step 1: Download the file from http://www.thingiverse.com/thing:27053/#files. Open Blender and click
File → Import → Stl (.stl)
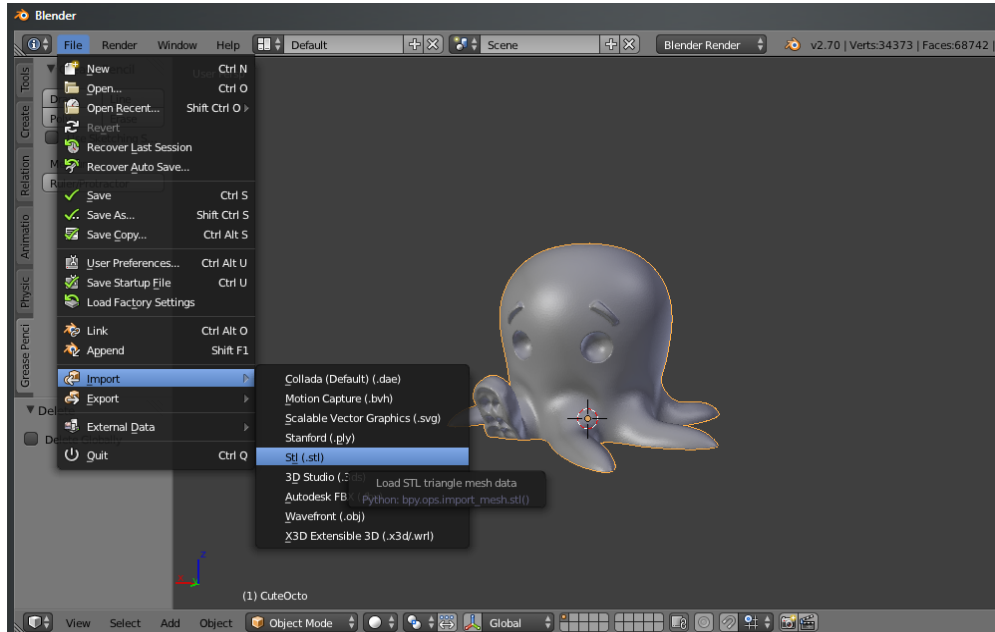
Step 2:
With the octopus selected, press tab to enter edit mode and press O to enable proportional editing. This
will give the translation, rotation, and scaling a falloff so that other vertices/lines/faces around the
selection will also be affected causing smooth editing.
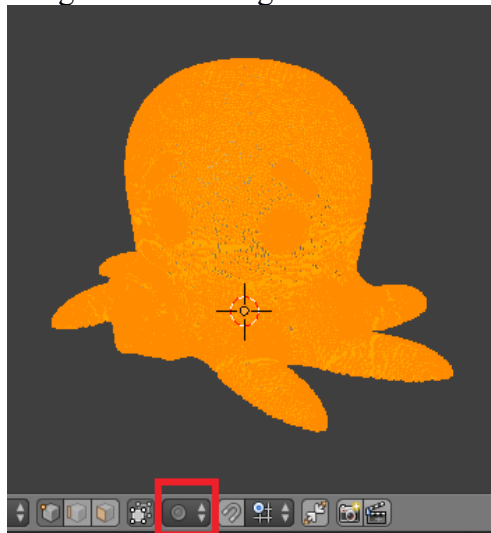
Step 3:
Click the face selection tool and select a single face on the top of the octopus head. Press S to scale and as you move your mouse, use the scroll wheel to change the size of the fall-off until it is slightly affecting the side of his head. Alter the octopus until it looks similar to the one below or until you think it looks good.
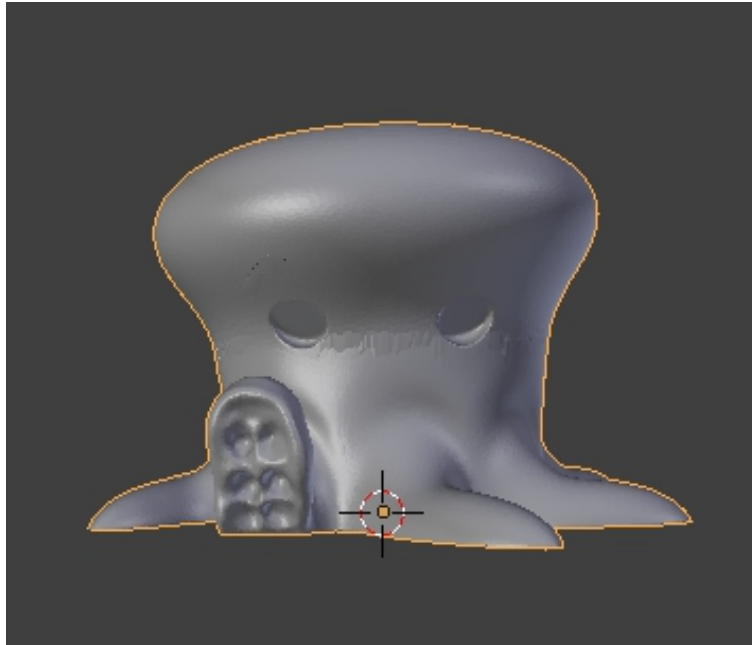

Step 4:
Before we export it, we need to make sure the file is not broken. We can do this by going to vertex select mode, pressing Z to go into wireframe view, and with all vertices deselected pressing Ctrl+Shift+Alt+M. This will select any vertices that are not connected and tell us where the file is broken. If it is broken, we can not print it so before we export we must troubleshoot and fix the areas with highlighted vertices. When completed, press Tab to exit edit mode.
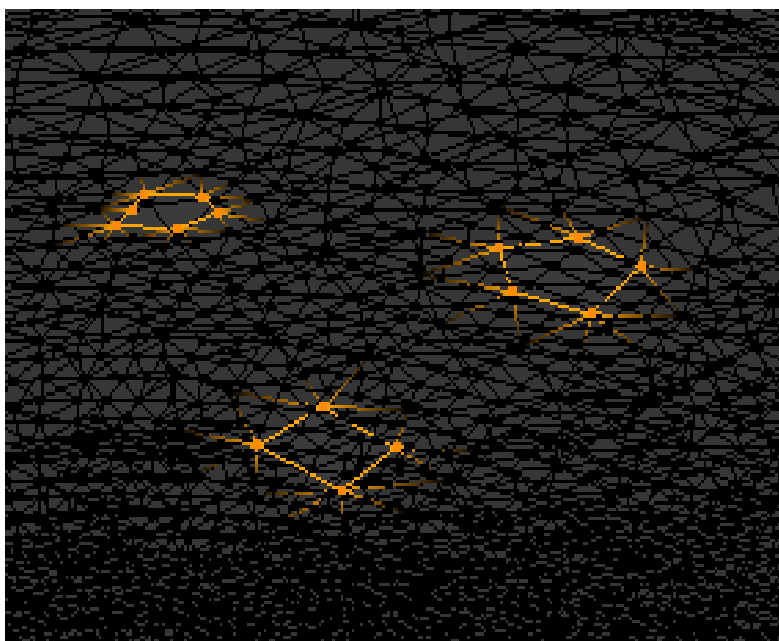
Step 5:
When you are ready to export, go to File → Export → Stl (.stl). Choose your file location and press the export button. When it is done exporting, Blender will go back to the main view. With your file exported, you should be ready to print.
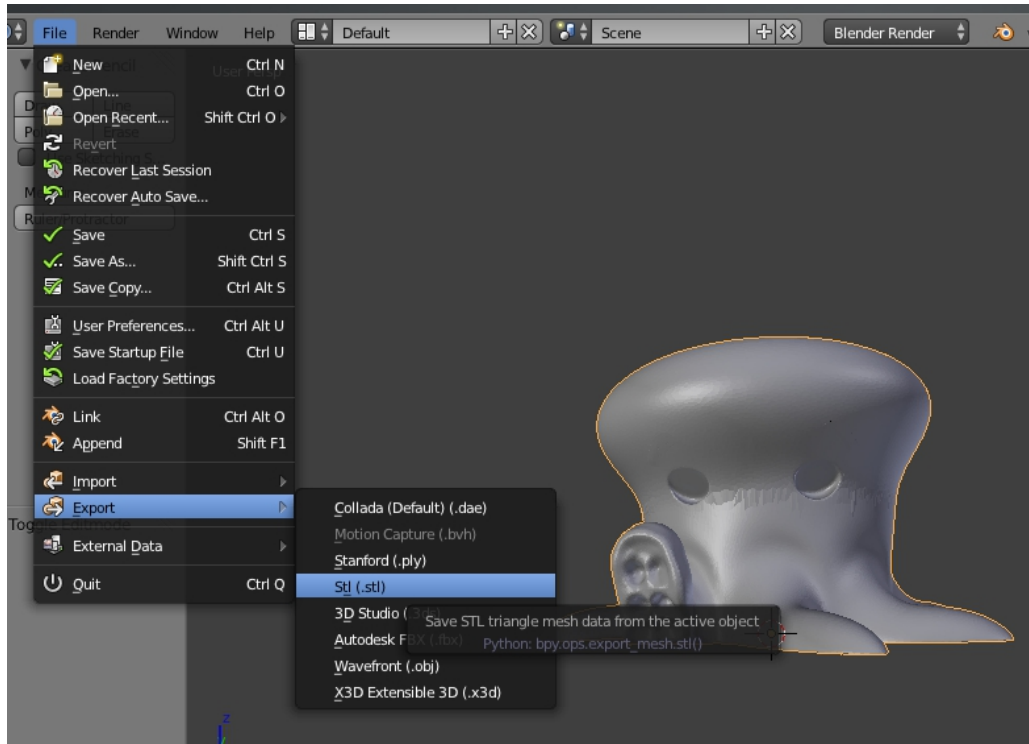
NOTE: To modify further, you can use the same functions we used in creating the cup and the chair to reach your desired result.

Personal Notes/ Questions: