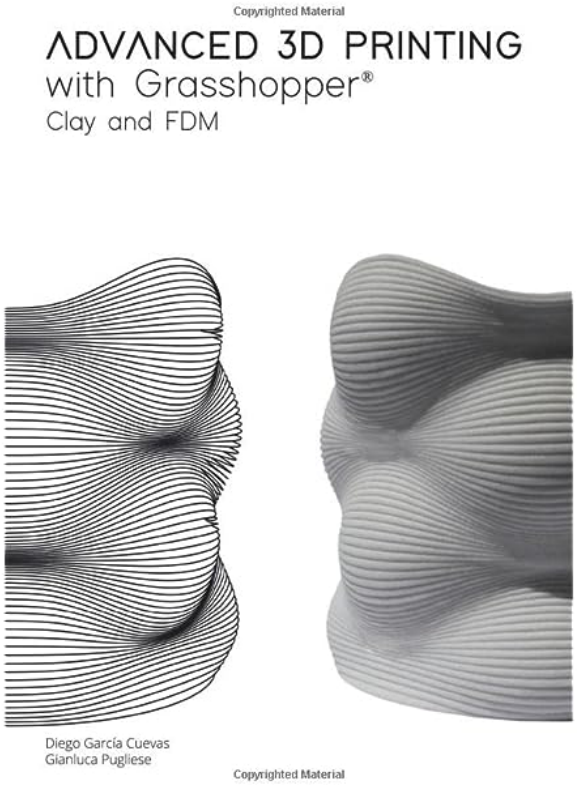
Basics to Clay 3D Printing- Overview 3a

The utilization of ceramics goes back over 20,000 years ago during the Paleolithic Era. It has flourished by the hands of artisan over the many years. As technology has progressed and 3D printing emerged it was not long that the two crafts were blended into a new and exciting era of not only ceramics but the other disciplines it applies to, like architecture. The combination of this technology and these materials enables the ability to create complex geometries that are not possible with the traditional ceramics techniques. Not only that but they allow for more cost effective, faster, and less material then traditional ceramics techniques. In this module you will explore the intersection of 3D printing and ceramics using the Eazao Ceramic Printer and the unique properties that come with the materials. You will be guided through the how to prepare your files for printing.

Vessel Design Criteria

During this assignment you will be asked to design a vessel within the boundary of **4 inches x 4 inches x 4 inches**. You may design this vessel with any program you would like. We will walk you through a simple lofted option but you may design with different digital design options like grasshopper. There is a resource book called "Advanced 3D Printing with Grasshopper: Clay and FDM" by Diago Garcia Cuevas and Gianluca Pugliese.

We will provided some examples of clay 3D prints to the right. Please also take note that the taller the vessel that more opportunity for your print to fail.



Basics to Clay 3D Printing- Loft Design 3b

In this assignment, you will review some basics about how to digitally design a lofted vessel using Rhino. If you do not have a proficiency or have access to Rhino you can apply these same digital design principles to other software to generate your vessel. There are many ways to achieve a vessel within Rhino and you may explore various digital modeling techniques to reach the vessel digital design. One approach is to draw some sketches of different vessels designs that you can think through the digital design process in which you might go about creating your vessel model. The design can be as simple or as complex as you desire. Once you have finished your vessel design you will need to generate a .gcode file of your vessel utilizing the Cura slicing software with the profile settings that we will walk you through. Once completed you will move forward with slicing you file for printing.

Vessel Loft Digital Design Process

Step 1 - Open **Rhino** and open a new **"Small objects- inches"** file.

Step 2 - Type **"Box"** in the command line and select the first corner of the base at the file origin (where the green and red line intersect). Once you have selected your starting point you will need to type **"4 in"** inside the command bar three times.

Step 3 - Select your box and move it to its own layer and lock this layer and rename the layer Bounding Box.

Step 4- Next you will need to design a closed curve of your choosing for the base of the lofted vessel. A circle is an example of a closed curve. Make the closed curve in a new layer and name it Curves. The closed curve will need to be at the bottom of the bounding box. Make sure it fits within the bounding box and take note that a strong base is suggested for a greater chance for a successful print.

Step 4- Now you will continue to create closed curves and stack them above your base curve in your curves layer. You will need to make sure that the **"Gumball"** is on and in either front or right side view select the **"Blue Z-Axis"** arrow to drag each closed curve up.

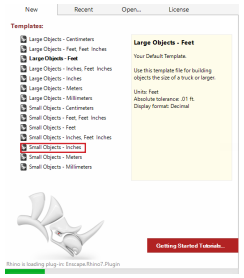
Step 5- Now scale and rotate the different closed curves to create you vessel geometry. You can scale the geometry with the two small red and green squares on the Gumball in the red circles to the right. You can rotate the geometry with the blue curve in the oval to the right.

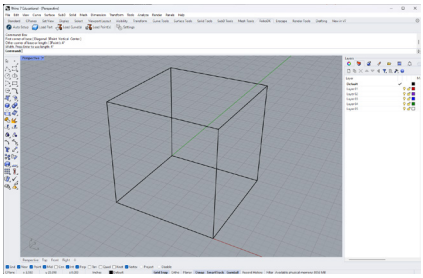
Step 6- Then you will need to type **"Loft"** in the command line and then select all of your closed curves. You will then click enter and will see a line and some arrows connecting your closed curves. Next there will be a pop up window and you will just select **"OK"**. If you end up with geometry that intersects itself do a loft between only two adjacent closed curves at once. Once you have the multiple surfaces you will need to type **"Join"** in the command line and select each surface.

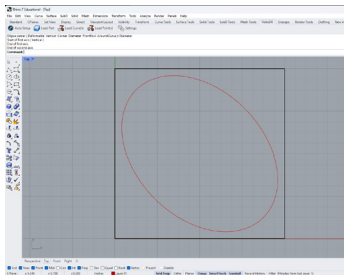
Step 7- Finally you will need to make a bottom for you vessel. You will need to type **"Planar Srf"** into the command line. Then you will select your base closed curve and hit enter. Then you will need to type **"Join"** again in the command line and select your base surface and your vessel then hit enter. You can preview your vessel by clicking the little drop down arrow next to the name of your perspective view window and then select **"Rendered".**

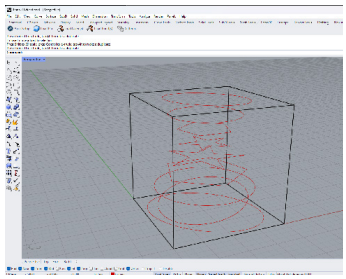
Step 8- Click **"File"** in the menu toolbar and then **"Export Selected"**. You will then need to select **".stl"** file type. Then use the naming convention **"First Name_Last Name_MOD-11-A2_Date"**.

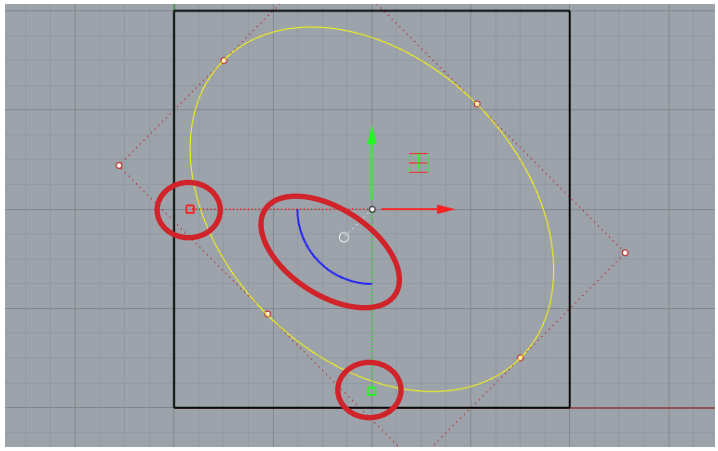
Step 9- Now you will need to upload it to the onedrive file "insert link" and schedule a consultation to review your file before moving on to slice your vessel to print.

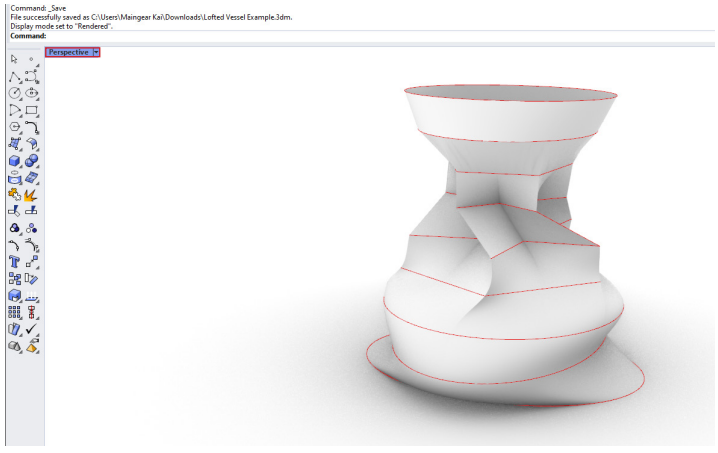












Basics to Clay 3D Printing- Revolve Design 3c

In this assignment, you will review some basics about how to digitally design a lofted vessel using Rhino. If you do not have a proficiency or have access to Rhino you can apply these same digital design principles to other software to generate your vessel. There are many ways to achieve a vessel within Rhino and you may explore various digital modeling techniques to reach the vessel digital design. One approach is to draw some sketches of different vessels designs that you can think through the digital design process in which you might go about creating your vessel model. The design can be as simple or as complex as you desire. Once you have finished your vessel design you will need to generate a .gcode file of your vessel utilizing the Cura slicing software with the profile settings that we will walk you through. Once completed you will move forward with slicing your file for printing.

Vessel Loft Digital Design Process

Step 1 - Open **Rhino** and open a new **"Small objects- inches"** file.

Step 2 - Type **"Box"** in the command line and select the first corner of the base at the file origin (where the green and red line intersect). Once you have selected your starting point you will need to type **"4 in"** inside the command bar three times.

Step 3 - Select your box and move it to its own layer and lock this layer and rename the layer Bounding Box.

Step 4- Next you will need to design a closed curve of your choosing for the base and top of the revolved vessel. A circle is an example of a closed curve. Make the closed curve in a new layer and name it Curves. The closed curve will need to be at the bottom of the bounding box. Make sure it fits within the bounding box and take note that a strong base is suggested for a greater chance for a successful print.

Step 4- Now you will continue to create closed curves and stack them above your base curve in your curves layer. You will need to make sure that the **"Gumball"** is on and in either front or right side view select the **"Blue Z-Axis"** arrow to drag each closed curve up.

Step 5- Now you need to create a curve that connects the base and the top closed curves that you will revolve to create your vessel.

Step 6- Next you will need to create a cross line on the base and top of your boundary box for you to select later on in you revolve command. Create two intersecting lines like shown to the right.

Step 7- To create your vessel you will now need to type **"Revolve"** into the command line. Then you will select your connecting curve and hit enter. Then you will need to select your axis to revolve around. You will select the intersection of the crossing lines you made in the previous step both the top and then base. You will now need to select the width of the revolve by dragging the mouse as far as you want shown in the preview and click. Follow it up with dragging you mouse in a 360 degree path around you revolve curve

Step 7- Finally you will need to make a bottom for you vessel. You will need to type **"Planar Srf"** into the command line. Then you will select your base closed curve and hit enter. Then you will need to type **"Join"** again in the command line and select your base surface and your vessel then hit enter. You can preview your vessel by clicking the little drop down arrow next to the name of your perspective view window and then select **"Rendered".**

Step 8- Click **"File"** in the menu toolbar and then **"Export Selected"**. You will then need to select **".stl"** file type. Then use the naming convention **"First Name_Last Name_MOD-11-A2_Date"**.

Step 9- Now you will need to upload it to the onedrive file "insert link" and schedule a consultation to review your file before moving on to slice your vessel to print.