



UMD STEM Workshop 2023

Week Three: 3D Modeling and 3D Printing

What is 3D Modeling?

3D modeling, also known as **CAD**, or **Computer Aided Design**, is the process of making a *virtual* version of real 3D objects. It is very similar to drawing, which lets you make a version of 2D objects, but 3D modeling is much more useful!

All technology is 3D modeled before it is actually made in the real world. Airplanes, cars, and rocket ships are 3D modeled and then tested on a computer before the factory even makes a single one!

3D modeling also allows us to 3D print, simulate, and communicate our ideas to other people very easily!



Where do I 3D Model?

We recommend you start with something like **Tinkercad** (<https://www.tinkercad.com/>) because it is free and usable on the web. It is also simple compared to some other 3D modeling apps, which can be hard to learn at first.

The next level up would be a software like **Fusion360**. If you are interested in learning it, here is a helpful video: <https://www.youtube.com/watch?v=d3qGQ2utl2A>



How do I use TinkerCAD?

We recommend you look over our slideshow to learn the basics of TinkerCAD!

If you want to learn about some of the tools we didn't mention in our slideshow, we recommend watching this video: https://www.youtube.com/watch?v=gOs6Mdj7y_4



What is 3D Printing?

3D printing is a type of *additive manufacturing*, which means that you can make things by adding plastic. Think of adding legos together.

Subtractive manufacturing is also a thing! You can remove material to do this. Think of cutting shapes out of paper, or carving out of wood. 3D printing is *not* subtractive, which makes it very unique!

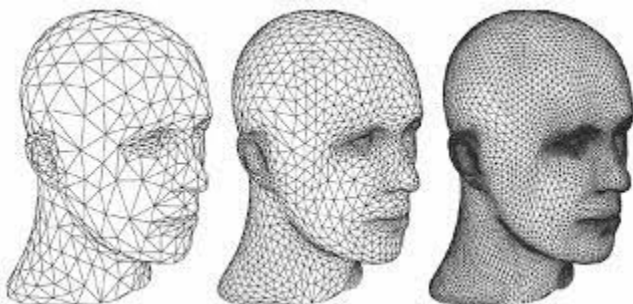
How does it work?

In 3D printing, you basically just melt together very thin layers of plastic! That's it!

Step 1:

You create or find a 3D Model, the simpler the easier it is to 3D print.

- Usually, we use **STL** files. That stands for "Stereolithography mesh"
- You don't need to know what that is! An **STL** is just a way for the computer to understand your 3D model. If you want to get really technical, your computer saves your 3D model as thousands of triangles, which are very simple shapes, so the computer can understand them.
- Here is an example of a 3D model of a face saved as an **STL**, you will notice that even though it is made of triangles, when they get smaller, it begins to look more real!



Step 2:

Slice your file using a **Slicer**.

- When programming, we talked about how computers, and other machines, have trouble understanding our commands. If you just give your 3D model to a 3D printer,



it would have no idea how to actually print it!

- That is why we need to use a **Slicer**. This is a program which cuts your 3D model into layers, and writes thousands of very simple commands for your printer to do.
- This produces what is called a **.gcode**, which is just a list of super simple commands like "go forward a bit, go to the left a bit, put down some plastic..."
- Some examples of slicers include [Cura](#) and [Prusa Slicer](#)

In this step is where you want to change your printing settings:

How thick should your layers be?

How fast should you go?

Do you need supports?

(The safe option is to always include supports)

All of these options, and more, are what you can control about your 3D printer and the 3D print.

Step 3:

Give the **.gcode** to your printer, and watch it go!

Your printer will begin to follow the simple lines and instructions in the **.gcode**, which look like this:

