

3D PRINTING BASICS



WHAT IS 3D PRINTING?

A 3D printer works essentially like a traditional printer except it prints in plastic layers to make 3-dimensional designs. 3D printers can print in several different materials including plastic, limestone, and even wood and metal. Elmhurst Public Library uses a **MakerBot 5th Generation Replicator** which uses a PLA filament: a corn-based plastic. 3D printing has been around as early as the nineties but has exploded in popularity due to technology advances and lowered costs. Although many 3D printers themselves can cost hundreds, if not thousands of dollars, the materials are relatively inexpensive after the initial purchase.

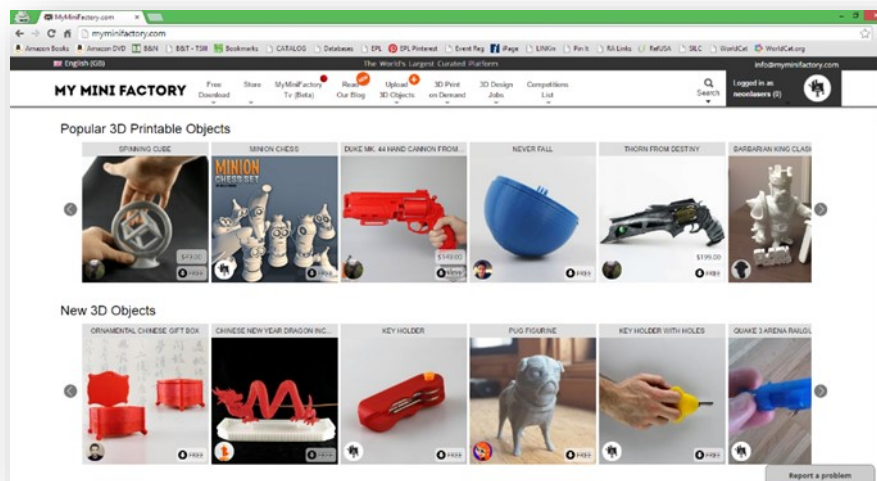
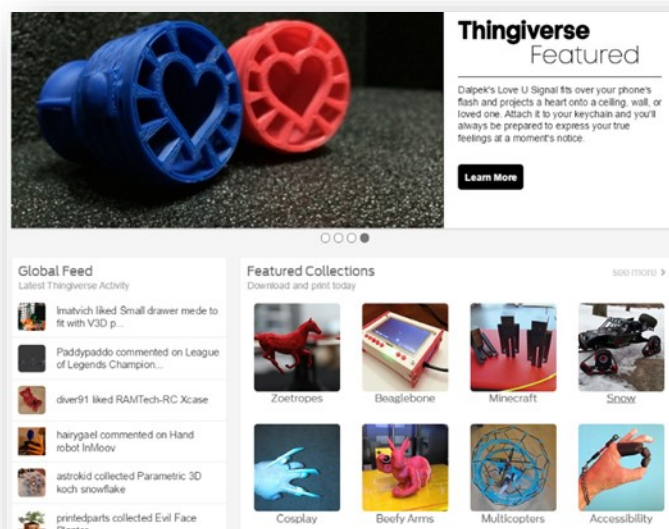
Why 3D print?

Many different types of people use 3D printers for different things. Several news stories have covered incredible 3D printing projects like parents creating prosthesis for their children or the development of 3D printed cars, but there are plenty of uses for everyone. Some reasons you may use a 3D printer include:

- ◆ Replacing a broken cabinet handle
- ◆ Making fun gifts
- ◆ Printing the case for a prototype electronic component
- ◆ And maybe most importantly learning to use 3D printing software is a valuable skill

WAYS TO PRINT

The easiest way to start printing is to use a design created and uploaded on the Internet. Several websites have large libraries of user-uploaded designs which can be printed freely. Later we will be introducing the MakerBot site **Thingiverse** but other high quality sites include **Autodesk 123D**, and **My Mini Factory**.



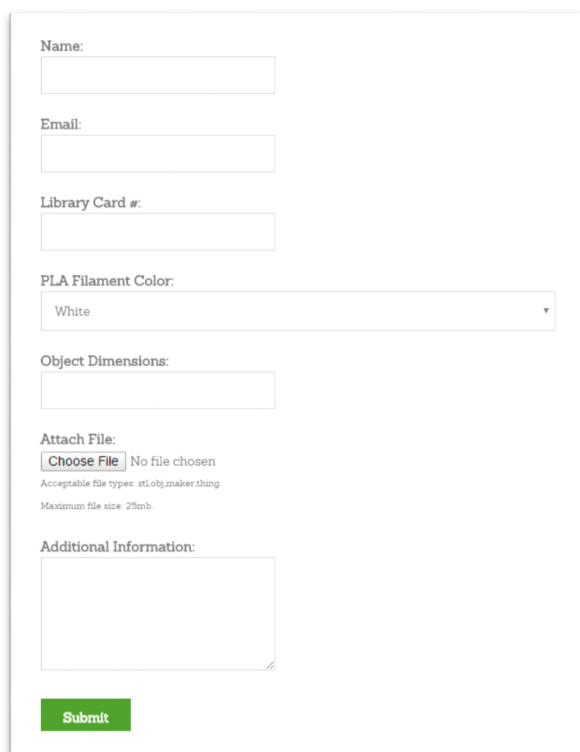
PRINTING AT EPL

To print at EPL you will need to submit your print through:

<http://elmhurstpubliclibrary.org/about-us/building-information/3d-print-request/3d-form/>

Please note that there are a few limitations to printing:

- ◆ 8-hour print limit
- ◆ Maximum size:
 - ◆ 25.2 L x 19.9 W x 15.0 H cm
 - ◆ 9.9 x 7.8 x 5.9 in
- ◆ .10 per gram, with a one dollar minimum (Elmhurst Public Library cardholders only)
- ◆ Printing is done by Library staff and is attended to on a first come, first served basis
- ◆ Priority printing given to Library programs and events
- ◆ Email will be sent once the print job is complete
- ◆ Item may be picked-up at the second floor Digital Services Desk



The form contains the following fields and options:

- Name:
- Email:
- Library Card #:
- PLA Filament Color:
- Object Dimensions:
- Attach File: No file chosen
Acceptable file types: stl,obj,maker.thing
Maximum file size: 25mb
- Additional Information:
- Submit:

Files should be submitted as .obj, .stl, or .MakerBot

If you have any questions about how to submit, exporting your file or anything else feel free to contact us at reference@elmhurst.org

DESIGN YOUR OWN

Creation Tools

Create your own 3D designs with this FREE software

Tinkercad



- ◆ Web-based 3D modeling software
- ◆ Includes lesson modules that lead you through 3D design basics
- ◆ Great beginner design platform

123D Catch app



- ◆ Take photos and create 3D scans of virtually any existing object with this app
- ◆ Use with a mobile device

123D Design



- ◆ Powerful yet simple 3D creation and editing tool which supports many new 3D printers
- ◆ Part of the vast Autodesk suite of 3D tools
- ◆ Great stepping stone for more advanced 3D design software, like Maya
- ◆ Other free Autodesk software

Sculptris



- ◆ Beginner digital sculpting tool
- ◆ Great stepping stone for more advanced digital sculpting software, like ZBrush

Blender



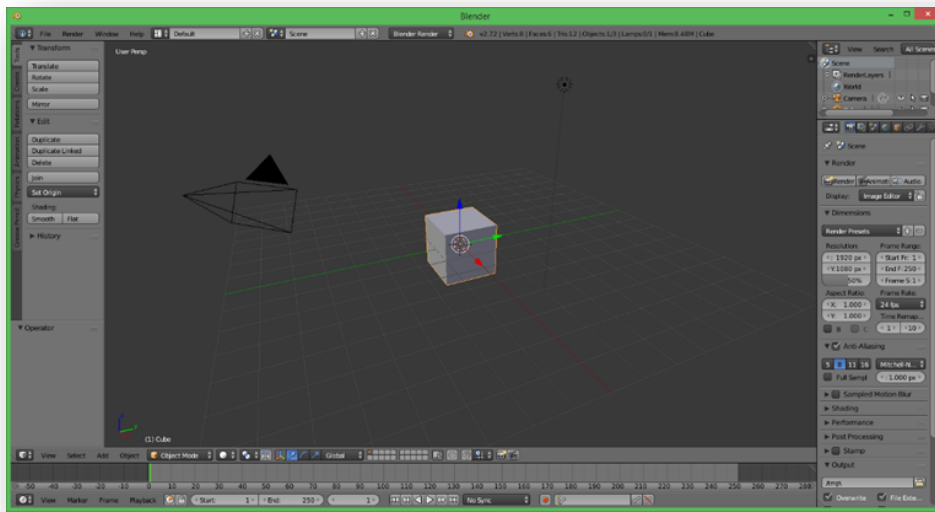
- ◆ 3D animation suite
- ◆ Supports the entirety of the 3D pipeline—modeling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation

MakerBot Desktop



- ◆ 3D printing solution for discovering, managing, and sharing your 3D prints

DESIGN YOUR OWN



(Blender)

Scanning

The Elmhurst Public Library owns a **MakerBot Replicator** which will scan objects and create a 3D model of them. In addition there are several apps for smartphones such as **123D Catch**, which allow you to take a series of photos and convert them into a 3D model. While the Replicator will produce a better result, the quality of the generated 3D object will be nowhere near the quality of the original, as small details are hard to generate, and scanned objects will most likely need to be brought into software for additional work.

3D Printing Limitations

While 3D printing is extremely cool and useful, there are several limitations on what is possible right now. A few warnings before starting your project may include:

- ◆ 3D printing takes time! Printing a larger or more detailed design may take several hours of printing to complete and using some of the 3D printing creation software can be difficult at first.
- ◆ Size of prints is limited to the size of the MakerBot's work area and objects that are too large for the base will need to be cut into pieces and prints separately, and then combined after.
- ◆ Overly complicated designs may print incorrectly or with minor to major errors in the layers.
- ◆ At this point you can only 3D print in one color at a time per print

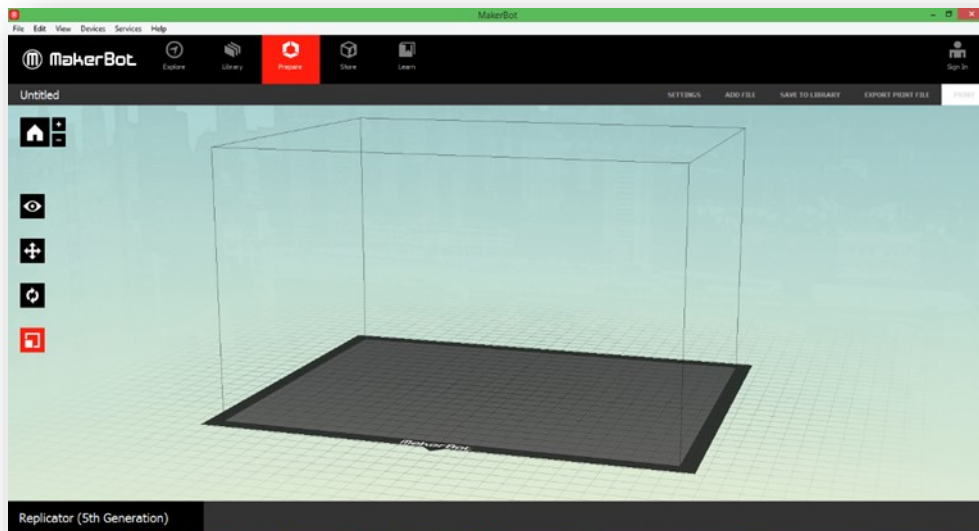
EXERCISE

During this class we will practice downloading and preparing a design to 3D print.

Today we'll cover:

- ◆ Pulling a model down from Thingiverse
- ◆ Importing into the MakerBot software
- ◆ Preparing the item to print by rotating, moving, and resizing the object
- ◆ Exporting and previewing the print for any complications
- ◆ Printing from a USB

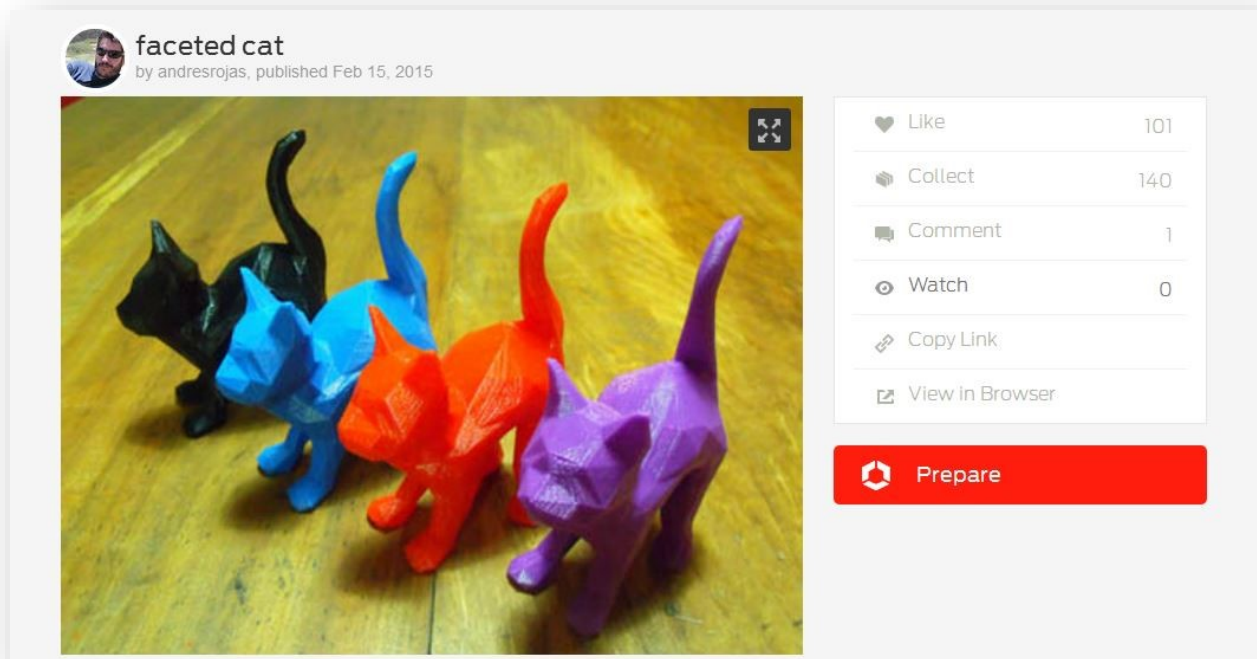
1. First open up the MakerBot software on the desktop.



2. Next we'll go into Thingiverse using the **'Explore Button.'** This opens the Thingiverse website. The Thingiverse website can also be accessed using a web browser but opening it in the MakerBot software makes it easier to import.

EXERCISE

3. Next, click the  icon in Thingiverse and search for the design '**Faceted Cat.**'



faceted cat
by andresrojas, published Feb 15, 2015

Like 101
Collect 140
Comment 1
Watch 0
Copy Link
View in Browser

Prepare

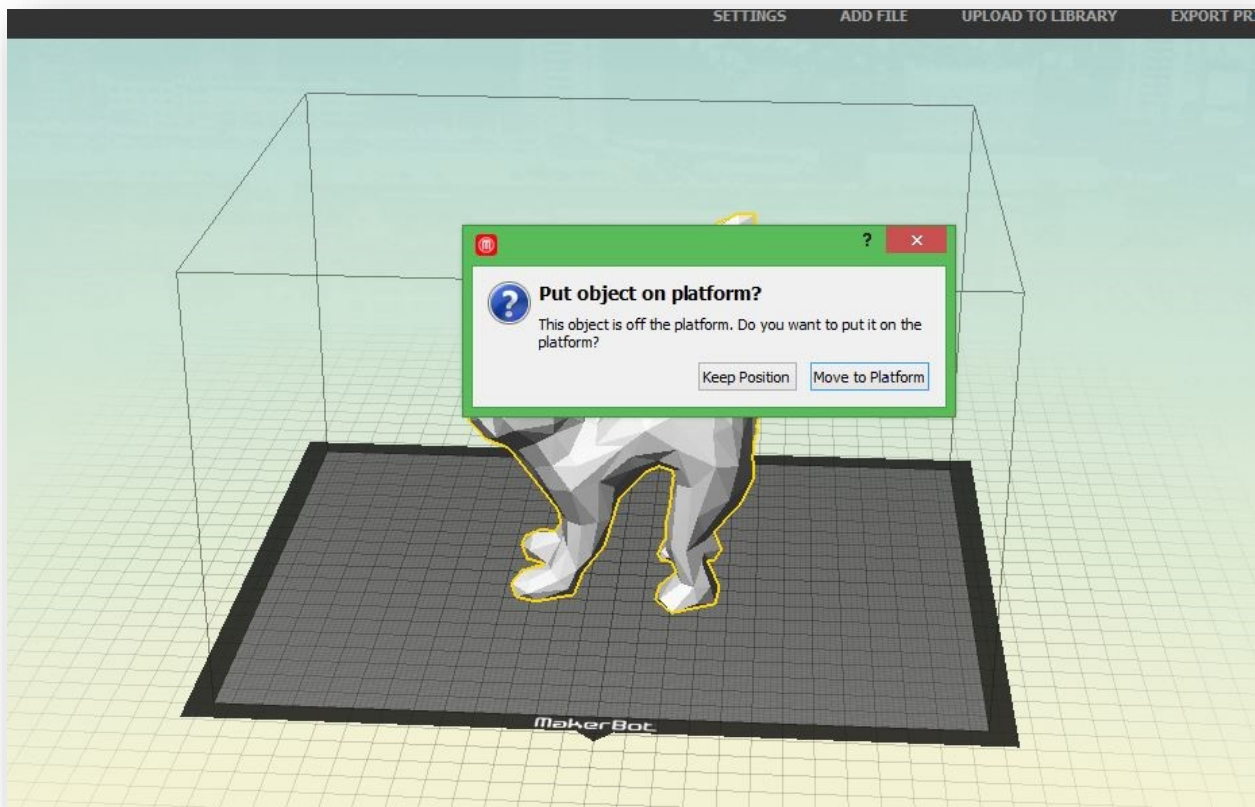
4. Once you find **Faceted cat**, click '**prepare.**' It should automatically be sent to the MakerBot build plate.

File Name	Downloads	Size	Actions
 gato_3.stl Last updated: 02-15-15	1192	507kb	Prepare

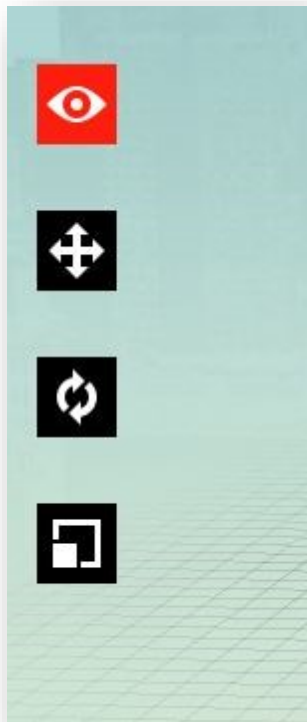
EXERCISE

5. Now that the file has been added we will need to check its size and orientation. When you are prompted to 'Put object on the platform' please do so.

Because this file is so simple there is nothing we need to do in order to ensure a good print, but more complicated objects might need to be reoriented to make the printing process easier. To determine which way to lay the object, rotate it so the most surface area is touching the bed to keep the amount of supports that need to be generated to a minimum.



MAKERBOT DESKTOP TOOLS



MakerBot offers a few tools to reposition, resize, and rotate files imported into the software. Double-clicking on any of the icons will bring the full options for each. In order to interact with the object, you must first select it by clicking on it.

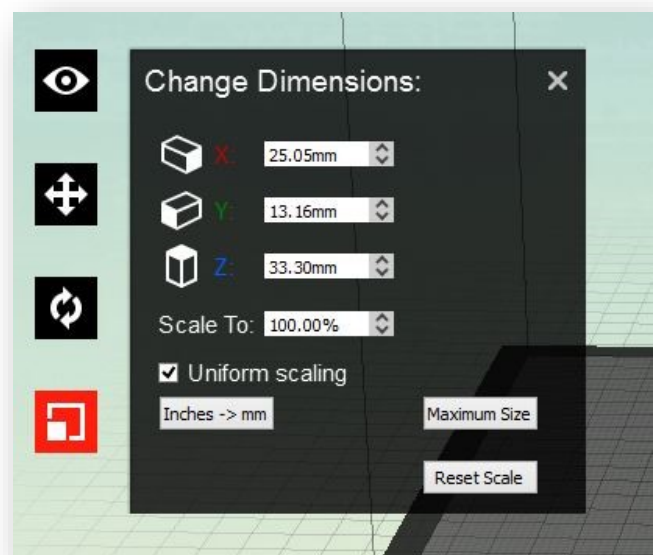
Change Position: Allows you to move the object along the x, y, and z axes on the build plate. Try clicking **Top**, **Side**, and **Front** to see how display changes.

Change Rotation: Allows you to rotate an object along the x, y, and z axes on the build plate. Perhaps you would like to print multiple copies, click on cat and move it to the left of the platform. Making sure it is outlined in yellow, use CTRL-C to make a copy of it, then click in the open space to the right and use CTRL-V to paste the copy. Use CTRL-Z to undo.

Change Dimensions: Scaling adjusts the size of a print. When a print comes in from Thingiverse, it comes in the size the author intended, but clicking on the resize button can make it smaller or larger. In the advanced menus, you can also determine size by metric measurements in millimeters which is extremely helpful sometimes.

For this print, change the x dimension size to 25 mm.

Once we have determined if our file is the correct size and orientation, we'll then check the print settings.



PRINTING

Settings:

EPL staff usually set these, but you can make requests in the note section of the form.

Quality: Standard or High for detailed prints. The higher the quality, the longer the print.

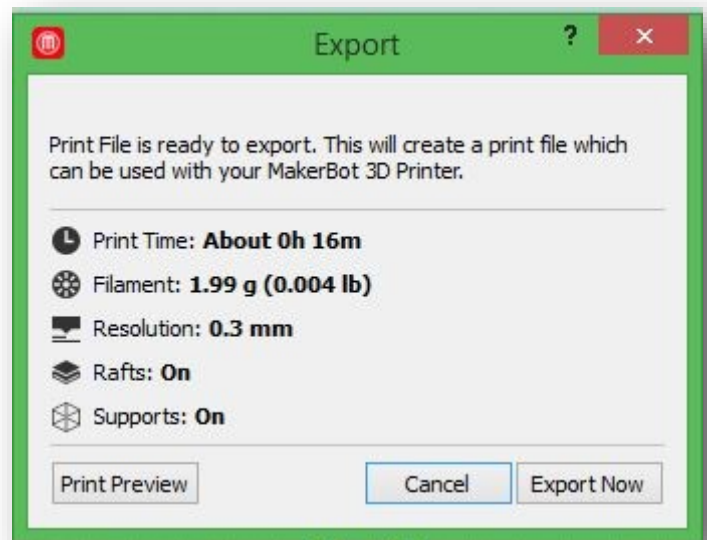
Raft: This is the platform that is generated first for the print. It is made to snap off the print.

Supports: essential to proper prints. See Examples.

Export Print File:

To export click '**Export Print File**' it will then prepare the design to print. **Note if the export is taking forever, so will your print!

After MakerBot prepares the design, select a location to save the file, either to your computer or to a USB drive. This is the file you attach to the form that you submit via Library website.



Conclusion:

Today we've covered the basics of 3D printing but there is a lot more to learn; the next step is to dive in! The best way to learn is to experiment and make mistakes. Creative Studio staff members will be available to help troubleshoot or assist you in starting a project. Also be on the lookout for our Intermediate 3D printing courses which cover various creation software. Thanks so much for attending and we hope to see what cool and creative projects you come up with!