

Guide to 3D Printing at Georgina Public Library



Welcome to the Wonderful World of 3D Printing!
Creating your ideas at the library.
Here are some instructions to get you started.

Questions or Comments, contact us:

Kate Gibson: 905-722-5702

Ruth Berry: 905-476-5762 ext. 4520



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What is 3D printing?

Georgina Public Library has a MakerBot Replicator Mini Desktop 3D printer that makes three dimensional objects from a digital model.

The printer uses a manufacturing process to build objects layer by layer from a 3D design file, using a polylactic acid filament, a renewable bioplastic with a corn starch base, designed to prevent peeling, curling, or sliding.

What Can You Make?

Anything from board game pieces, and pet toys to small scale replicas of real-life buildings or objects. It is limited only by the size of the build space which is 4" L x 4"W x 4" H.

Here are just some of the objects that we have printed so far.



Pre-Designed Models

If you are new to 3D printing, this is a great place to start. There are many pre-designed models available for free online. Try Thingiverse (thingiverse.com). It has thousands of objects to choose from and they are free to download.

Wherever you get your model from, be sure to select one that has a [.STL](#) or [.THING](#) file format as this is required by the MakerBot printer.

Designing Your Own Model

For the more advanced user, you can design your own object with the use of 3D design software. There are a number of free websites that will allow you to do this, such as:

Tinkercad – tinkercad.com SketchUp – sketchup.com (requires download & STL plugin) Autodesk 123D Design - 123dapp.com/design

All of the websites mentioned above have tutorials that teach you how to use their software.

Getting Your Design Print-Ready

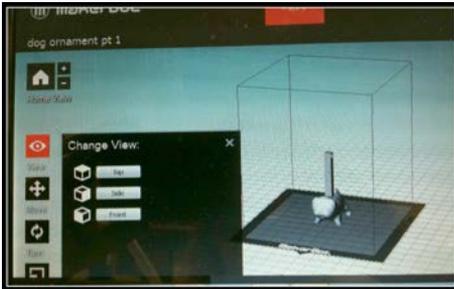
Slicing

Before the file can be transferred to the printer it must first be “sliced”; this process determines the amount of material needed and the time it will take. This can be done using the MakerWare Desktop software available on our library computers.

Using MakerWare

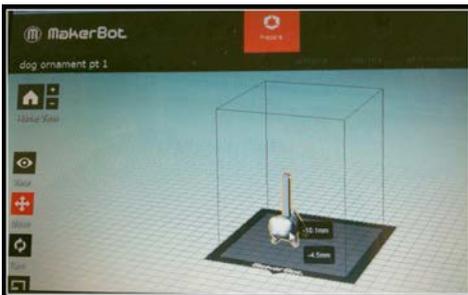
Open MakerWare Desktop. Click Add and select a [.STL](#) or [.thing](#) file you have created or downloaded from Thingiverse.

View



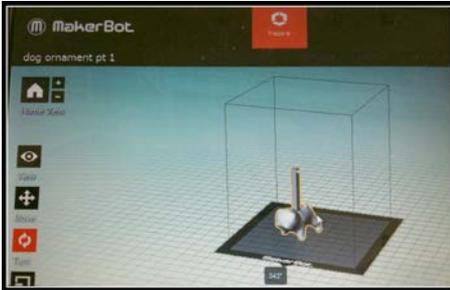
This mode allows you to rotate your view around the object. With the View button selected, click on the object and drag the mouse to change your view. If you would like to view your object from the top, side or front, click the small arrow beside the View button to access those commands.

Move



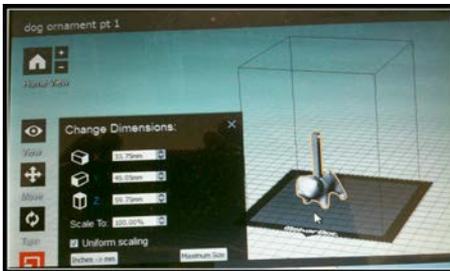
This mode allows you to move the object around the build plate. With the Move button selected, click on the object and drag the mouse to maneuver the object around the build plate. Advanced options are available by clicking the small arrow beside the Move button. These options allow you to change the position of the object using set values.

Turn



This mode allows you to rotate the object. With the Turn button selected, click on the object and drag the mouse to rotate the object around the build plate. If you need to rotate the object along the X axis (horizontal) or Y axis (vertical), open the advanced options with the small arrows next to the Turn button. Once you are done rotating the object, make sure you click on Lay Flat to ensure the object is sitting flat on the build plate.

Scale



Scale allows you to scale the size of your model. With the Scale button selected, click on the object and drag the mouse to increase/decrease the size of the object. Advanced options can be accessed with the small arrow next to the Scale button. These options allow you to change each dimension individually. To ensure your object stays uniform (maintains proportions), click on Uniform Scaling.

Save to the Library

The “save to library” gives you an option to save your object as a .STL or .thing file. STL files can be opened with many different programs whereas .thing files allow you to continue editing multiple objects on the build plate independently.

Settings

Click on the **Settings** icon at the top of the screen.



- **Material:** MakerBot PLA
- **Resolution:** Specify the quality of your build. A higher resolution will produce a better quality object but will increase the build times significantly.
- **Raft:** Used to create base support for the object. Rafts can easily be removed after the object has been completed.

• **Supports:** Used to create a support structure for objects that have overhanging parts. These supports can be removed after completion. Removing multiple supports can be time consuming depending on the complexity of your object, but can be necessary to maintain the shape of your design.

• **Advanced Options:** This opens up a menu with more detailed options. These options may set automatically depending on what resolution you choose.

- **Infill** is the how solid the inside of your object is. A higher percentage will increase the time and material needed.
- **Shells** are the outer layers of the object. The more shells you have, the stronger it is.
- **Layer Height** sets the thickness of each layer. The MakerBot Replicator Mini can print between 2 mm and 4mm.



After saving your settings, click on Export Print File to get the

estimated build time & weight.

Cancel the export window and save your file as .STL or .thing.

Files can be saved to the computer's desktop and sent as an attachment in an email to library staff at:

3dprinter@georgina.ca

In the body of your email, please include: your full name; what colour you would like (if a colour is not chosen, we will choose for you); the infill percentage (100% infill is completely solid; and 0% infill is hollow—our default is 10%); and the maximum you want to spend on your print (we will email you if the estimate is higher).

Once you send your email, come to the service desk. If the library is not busy, and staff has time to print your object, they may do so. If not, we will print the object when we can and notify you by phone or email that it is ready for pick up.

Rules & Regulations

1. Maximum print time is 3 hours.
2. Last print job of the day must finish 30 minutes before closing.
3. We print each print job in one colour only.
We print using colour currently in the printer.
We will have in future, clear or white filament, only.
4. Cost of printing: \$1 plus \$0.10 per gram + HST
5. No illegal, dangerous or otherwise inappropriate materials will be printed.
6. Users must not infringe copyright when using the printer
7. Must be library card holders with Georgina Public Libraries
8. All print jobs must be approved by a staff member
9. Users must sign an acceptable use agreement

Expectations

Please note that not all designs will be perfectly smooth and some may not work out at all, particularly those objects that have overhangs (areas with no support beneath them).



Example of a project that did not turn out as expected.

The printing process halted in the middle of the run, leaving the lion incomplete.

Georgina Public Library staff members are not experts in 3D model design; we are here to provide support and learn along with you. There are, however, many resources available online to help you get started.

Finished Model

When your 3D model is finished you will be notified by email. The email will include the cost of the print job. Bring a copy of the email with you when you come to the circulation desk to pay for the print job and pick up your object.

Clean up of the 3D model (removal of rafts and supports) is the user's responsibility.

Tools that you **may** need for this task include: tweezers, pliers, scissors, files, sandpaper and an X-acto knife.

Painting MakerBot PLA Filament

MakerBot PLA Filament is easily painted with cellulose spray paints or oil paints, though acrylic paints are considered to be the best choice. For optimal safety, use child-friendly paints.

For the most even colors and longest lasting effect, prime the surface with a non-toxic, water-based acrylic paint designed for use on plastic, metal, and resin.

Approach the object you're painting in sections. Start with a light coat, and add more paint with subsequent coats. Save detailing until the end.

Maintain a light hand at all times; clumped brushes and the unexpected blobs they can make may ruin a great piece.

Let your first layer of paint dry before painting more embellishments or additions.

Additional Resources

1) How the MakerBot Replicator 2 works:
www.youtube.com/watch?v=pQv89fiir4U

2) Makerbot Replicator Mini time lapse: making a tree
www.youtube.com/watch?v=1_j2zuwjGnY

We hope you will have fun finding or designing objects to print!