Equipment, Software, and Models
3D Modeling

- **TinkerCAD**
  (Beginner) Free online editor. One unique feature is the ability to import vector graphics and turn them into 3D objects.

- **Autodesk 123D Design**
  (Beginner) Free 3D modeling software. Offered either as a download or as web-based tool.

- **Google SketchUp**
  (Intermediate) Create, modify and share 3D models. Lots of tutorials on the website and YouTube.

- **Blender**
  (Advanced) 3D modeling and animation program for Windows and Mac. There are lots of helpful tutorials and examples on the website.

- **MeshLab**
  (Advanced) open-source program for processing 3D models useful in preparation of files for 3D printing.

- **Netfabb**
  A free web-based service that processes and repairs 3D files to prepare them for 3D printing.

- **SketchUp STL extension**
  This plugin will allow you to import and export STL files (works for SketchUp 2013 and 2014).

- **CAIDisp plugin for SketchUp**
  This plugin will allow you to export models from SketchUp as .stl files (Note: for Sketchup 6, 7 and 8 - not Sketchup 2013).

- **Free Autodesk software for students**
  Did you know that as a student you can obtain a FREE 3-year license for a variety of Autodesk software? This includes AutoCAD, 3ds Max, Maya, Inventor Professional and Revit.
MOBILE 3D MODELING APPS

- **123D Catch**
  Turn your object into a 3D model with photos! Works on iPad/iPhone or also as a web-based app

- **123D Sculpt**
  Sculpt in 3D using this free iPad app.

- **MakerBot PrintShop**
  The Shape Maker feature in this free iPad app allows you to convert basic 2D sketches or images into printable 3D models

ONLINE 3D MODELING COMMUNITIES

- **Thingiverse**
  from Makerbot - a place to share and download free printable 3D model designs

- **Smithsonian X 3D**
  The Smithsonian is in process of digitizing its collection in 3D and offers free, downloadable model files

- **Sketchfab**
  Online community for publishing and browsing 3D models - some offer the option to download

- **YouMagine.com**
  a file-sharing 3D printing community with a built-in web-based 3d modeling tool

- **My Mini Factory**
  Downloadable 3D models (some free); sign up for a free account to earn free credits toward downloads; upload your own designs to earn more credits (and can even charge for your models)

- **Shapeways**
  Make, buy and sell 3D printed products

- ** Ponoko**
  Make, share, buy or sell 3D product designs

3D PRINTING SOFTWARE

Most 3D printers use specific software to prepare model files for print. Sometimes it is helpful to preview your model in the 3D printing software in order to have a better understanding of how your model will be produced (sizing, supports needed, etc.) while also helping you spot potential printing issues. Here are the free software programs for our 3D printers, available for download:

- **Makerbot Desktop**
  (free) 3D printer software for the Makerbot Replicator 2x

- **Cura**
  (free) 3D printer software for the Ultimaker 2
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
3D Printing Guide | How to Find Models to Print?
http://projects.informatics.mit.edu/maker/3d-printing-libguide/3

ONLINE RESOURCES
Rapid Prototyping Applications
Finding Models and Scanning Objects
Preparing Models for Printing

3D PRINTING GUIDE

HOW TO FIND MODELS TO PRINT?
The easiest way to get started with printing is to start with an existing model or existing object. There are thousands of models freely available, and free software that allows you to convert photos into models.

Finding Models Online
Makerbot Thingiverse
A design community for discovering, making, and sharing 3D printable things. All designs on the website are encouraged to be licensed to allow others to use and alter.

NIH 3D Print Exchange
An open, comprehensive, and interactive website for searching, browsing, downloading, and sharing biomedical 3D print files, modeling tutorials, and educational materials.

3D Warehouse in SketchUp
Contains millions of models created with SketchUp. Files can be downloaded for free.

Scan Your Own Models
3D Scanning at the Smithsonian
The video introduces the 3D documenting work at the Smithsonian. It might inspire your thoughts of 3D scanning.

Autodesk 123d catch Tutorials
A scanning software available on Android, iPhone and iPad, and PC.
Equipment & Software

Fusion 3 F306
Build Volume
12 x 12 x 12 in.

Print Material
PLA (polylactic acid) bioplastic

File Type
.STL

Operating Systems
Windows (7+), Mac OS X (10.6+), LINUX (UBUNTU 12.04+)

Connectivity
USB, SD Card

MakerBot Replicator 2
Build Volume
11.2 x 6 x 6.1 in.

Print Material
PLA (polylactic acid) bioplastic

File Type
.STL

Operating Systems
Windows (7+), Mac OS X (10.6+), LINUX (UBUNTU 12.04+)

Connectivity
USB, SD Card

MakerBot Replicator 2X
Build Volume
9.7 x 6 x 6.1 in.

Print Material
ABS filament or MakerBot dissolvable filament; capable of printing in two interlaceable colors

File Type
.STL

Operating Systems
Windows (7+), Mac OS X (10.6+), LINUX (UBUNTU 12.04+)
### Connectivity
USB, SD Card

### MakerBot Replicator Mini
**BUILD VOLUME**  
3.9 x 3.9 x 4.9 in.

**Print Material**  
PLA (polylactic acid) bioplastic

**File Type**  
.STL

**Operating Systems**  
Windows (7+), Mac OS X (10.7+), LINUX (UBUNTU, Fedora)

**Connectivity**  
Wi-Fi, USB

### Sense 3D Scanner
This is a portable, easy-to-use 3D scanner. The Sense 3D Scanner can be checked out of the library for a 24 hour period of time.

**Software**  
Sense scanning software

### NextEngine 3D Scanner
This Full color, high resolution, professional 3D scanner can produce 3D-printable files.

**Software**  
ScanStudioHD

### Raspberry Pi Starter Pack
Raspberry Pi kits can be used in the library for 4 hours at a time or checked out of the library overnight.

**Contains:**
- Raspberry Pi Model B 512MB RAM
- Adafruit Pi Case
- 3' long USB Micro-B Cable
- 5V 1A power adapter
- USB TTL console cable
- 4GB SD Card
- Assembled Adafruit Pi Cobbler kit with GPIO cable
- USB microSD card reader
- Large full-size breadboard
- Breadboarding wires
- 10' long Ethernet cable
- 5 x 10K resistors for pullups on the buttons
- 5 x 560 ohm resistors for the LEDs
- 1 red 10mm diffused LED
- 1 green 10mm diffused LED
- 1 blue 10mm diffused LED
- 3 tactile pushbuttons
- Light-sensitive resistor photocell
- 1uF capacitor

Hakko-FX888D Soldering Iron

Procedures and policies.

Singer 9410 Sewing Machine

Procedures and policies.

Software

3D Design and Editing
Blender
kokopelli (Mac only)
MakerBot Desktop
Maya
MeshLab
meshmixer
netfabb
OpenSCAD
PyMOL
SketchUp
UCSF Chimera

Electronics
Arduino IDE
Processing
3D Printing: Software

Getting Started
There are two kinds of software you will need to use prior to printing.
- **Design Software**: to create your design
- **Printing Software**: to print your design

Looking for inspiration? Be sure to check out the 3D Model Gallery to explore different collections.

Design Software
To create your own designs you have quite a few different options in design software. All of the following programs are free for you to use to create 3D models. Looking for inspiration? Be sure to check out the 3D Model Gallery below to explore premade designs.

- **AutoCAD**
- **Tinkercad**: Currently available on TAP computers.
- **Blender**: A web-based program for the beginner.
- **SketchUp**: 
  - **MakeMeister**: 100 free 3D printable models.
  - **DrawSpace**: Over 700 3D printable models.

Printing Software
The Cube will only print via SCAD files. Download the Cubify software to convert your file by clicking the link below.

- **Cubify Printing Software**

3D Model Gallery
If you're just looking for inspiration or want to explore the possibilities of 3D printing, check out the following collections with downloadable 3D model designs.

- **Cubify**
  - **Cubify Fashion**: Fashion designs for both men and women including shoes, jewelry, watches, and more.
  - **Cubify Home**: Designs for your home. Think frames, desktop accessories, bow ties, and more.
  - **Cubify Kids**: This collection includes all kinds of fun toys and accessories.
  - **Cubify Entertainment**: This collection includes games, music, food, and even licensed products. You can even print a personalized super hero action figure.

- **Tingkite**
  - **Tingkite Home**: Not just for men, this collection includes all kinds of gadgets and devices.
  - **Tingkite Toys**: Tingkite is a community dedicated to sharing 3D designs.

If you do choose to use a downloadable file, be sure to read through the Helpful Hints section above to make sure your design is printer-friendly prior to printing.
FREE 3D SOFTWARE

- Tinkercad
  Tinkercad has a free version of its software that creates 3D digital models. This is a great program for beginners and is used in the web browser.

- Autodesk 123D Design
  Free design software that can be used as a web app, downloaded to PC or Mac, or as an iPhone/ipad app. This is a great program for beginners.

- SketchUp
  SketchUp Make is a free 3D drawing tool.

- Blender
  Blender is a free open source computer graphics software that can be used for 3D modeling.

- Sculptris
  Sculptris is a virtual sculpting program.

- OpenSCAD
  OpenSCAD is a free software to create solid 3D CAD objects.

- Meshlab
  Meshlab is an open source program for processing and editing unstructured 3D triangular meshes.

- Meshmixer
  Meshmixer is a free prototype design tool.

- Netfabb
  Netfabb is a free software that processes and repairs stl files to prepare them for 3D printing.

OBJECT REPOSITORIES / COMMUNITIES

- Thingiverse
  Thingiverse is a community to discover, make, and share 3D models. Users can download files of objects that others have made. Several of the objects can be customized and modified.

- Yeggi
  Yeggi is a search engine to find 3D printable objects.

- Repables
  Open repository of digital files suitable for 3D printing.

- SketchUp 3D Warehouse
  Sketchup's design library of 3D models.

- Smithsonian X3D
  Collection of 3D models of various artifacts from the Smithsonian Museums.

- NIH 3D Print Exchange
  Search, browse, download, and share 3D biomedical printable models including custom labware.

- NASA 3D Resources (Beta)
  NASA’s 3D resources site that includes several printable models in .STL format.

- British Geological Survey
  Site contains many 3D models of fossils. You can download an OBJ file to use in 3D printing.

- AfricanFossils.org
  Africanfossils.org has several 3D models of significant fossils and artifacts in categories such as hominids, animals, and tools. It is a partnership with Autodesk, National Geographic, the Turkana Basin Institute, the National Museum of Kenya, and Stony Brook University.

- The Collection - Art & Archaeology Museum
  3D Scan project by artist Oliver Laric at The Usher Gallery at The Collection in Lincolnshire, UK.

- The Virtual Hamson Museum
  3D scans of Native American artifacts from the Hamson Archeological Museum State Park in Wilson, Arkansas. OBJ files are included.
3D Printing @ Gerstein + MADLab
Everything you need to know about the Gerstein Science Information Centre’s 3D printer in the MADLab

Makerbot Desktop
A complete, free 3D printing solution for discovering, managing, preparing, and sharing your 3D prints. Get it here.

Other 3D Printing Software
- Netfabb 3D Model Repair Service
  Use the Microsoft 3D Model Repair service powered by netfabb to repair STL, OBJ, or 3MF files automatically. Like a spellchecker, this service will save you time by taking care of the many common errors in 3D models that otherwise would require manual repair by a dedicated designer. The service checks holes in the model, fuses face normals, removes self-intersections, and more. You’ll be more productive and be on your way to more reliable 3D manufacturing in minutes!
  Just upload your STL, OBJ, or 3MF file. We’ll check and fix the model and return you a new file, ready to print. Enjoy!

Free 3D Modelling Software
- Scupltoris
  Sculptoris provides an excellent gateway into the exciting world of 3D. Its features are easy to learn, even for someone with no experience in digital art, yet robust enough for creating basic models that can then be refined in other applications.
  Start with a sphere of virtual clay and shape it into whatever you want it to be. This is made possible in Sculptoris by its amazing ability to locally redefine the internal structure of the model.
- Autodesk 123D Design
  123D Design is a free, powerful, yet simple 3D creation and editing tool which supports many 3D printers.
- OpenSCAD
  You can use SketchUp to explore design ideas and experiment with 3D. You can draw your home or famous buildings, use it for projects at home or school, or create fun stuff like cars, space ships, bars, or your dream house. You can share your models with others via the 3D Warehouse. And if your model has a license (yes it is a Googel Earth map), you can also view it in Google Earth.
- OpenSCAD
  OpenSCAD is a software for creating solid 3D CAD models. It is free and available for Linux/UNIX, Windows, and Mac OS X. Unlike most free software for creating 3D models (such as Blender), it does not focus on the artistic aspects of 3D modeling but instead on the CAD aspects. Thus it might be the application you are looking for when you are planning to create 3D models of machine parts but pretty sure it is not what you are looking for when you are more interested in creating computer-animated movies.
  OpenSCAD is not an interactive modeler. Instead it is something like a 3D-compiler that reads in a script file that describes the object and renders the 3D model from the script file. This gives you (the designer) full control over the modeling process and enables you to easily change any step in the modeling process or make designs that are defined by configurable parameters.
Representative Documents: Equipment, Software, and Models

UNIVERSITY OF TORONTO
Software & Designs
http://guides.library.utoronto.ca/c.php?g=251855&p=1678121

• 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. Advanced users employ Blender’s API for Python scripting to customize the application and write specialized tools often these are included in Blender’s future releases. Blender is well suited to independent and small studios who benefit from its unified pipeline and responsive development process.

Designs that Work
The Materialise BigRep 2 shuck with various easy-to-print, successful designs pre-loaded on an SD card. If you are brand new to 3D printing and just want to print something quick and easy, these designs might be what you want to start with. More than lines, a to a stretchy broccoli, to a nut and bolt, and Mr. Jaws, these designs do a great job of demonstrating the potential of 3D printing, while taking less than an hour (most are under 30 minutes) to complete!
Check out 3D Printing at Gemini + MACU’s smart collection of easy first time prints on Thingiverse for more inspiration.

Download a Pre-Existing 3D Design!
It’s not a thing, 3D designers and printers all share their work. Check out the links below and search for or browse for a design that suits your fancy. If you’re a beginner, we recommend going with designs that have a picture of the finished product. That way, you might be able to tell if it’s worth it!

• Thingiverse
Browse the world’s largest 3D design community for discovering, printing, and sharing 3D models, used over 150,000 community members in downloading, sharing, and remixing 3D designs.
• NIH 3D Print Exchange
Few scientific 3D-printable models are available online, and the expertise required to generate and validate such models remains a barrier. The NIH 3D Print Exchange bridges this gap with an open, comprehensive, and interactive website for searching, browsing, downloading, and sharing biomedical 3D print files, modeling tutorials, and educational material.

The NIH 3D Print Exchange is a collaborative effort led by the National Institute of Allergy and Infectious Diseases in collaboration with the Ex 展 Kennedy Cancer Institute of Child Health and Human Development and the National Library of Medicine.

• Smithsonian X 3D
Smithsonian X 3D features a set of use cases which apply various 3D capture methods to iconic collection objects, as well as scientific missions. All of these use cases are accessible through the Beta Smithsonian X 3D Explorer, as well as video documenting the project. For many of the 3D models, raw data can be downloaded to support further inquiry and 3D printing.
• NASA 3D Resources
Here you’ll find a growing collection of 3D models, textures, and images from NASA. All of these resources are free to download and use. Please read the Usage Guidelines.

Adobe Creative Cloud
The MACU has two workstations with Adobe Creative Cloud!
Adobe CC includes Photoshop 3D (including 3D printing functionality), Illustrator and more.
Contact macu.lib@utoronto.ca to book time on the Adobe workstations (no charge).
Find out more about Photoshop and 3D printing here.