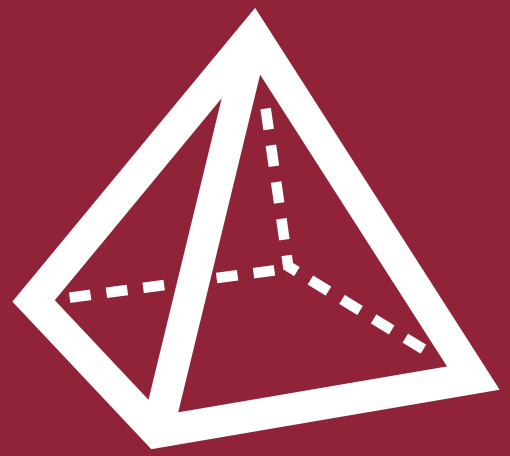
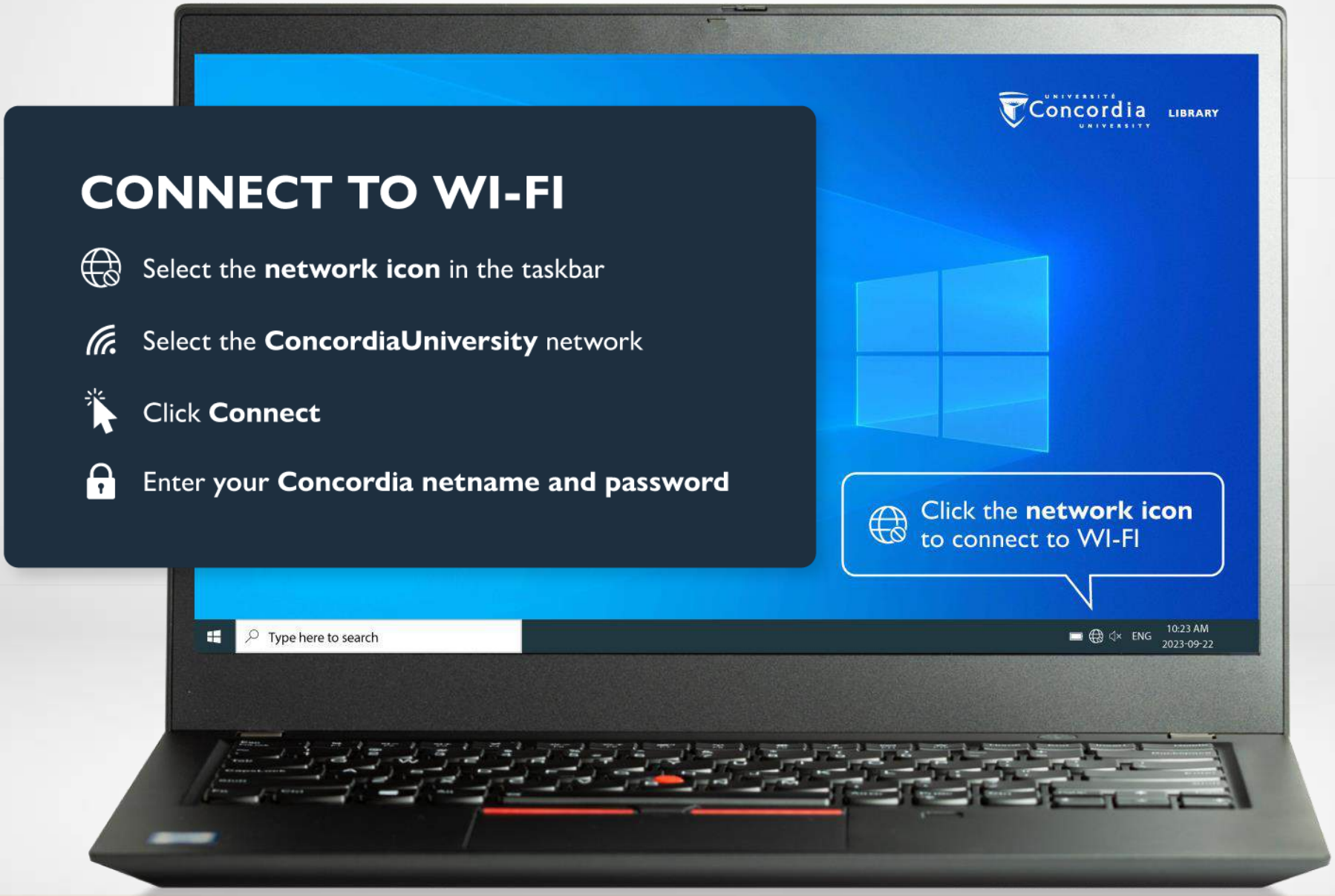


Design for 3D Printing

A FAST AND EASY GUIDE TO

DESIGN AND PRINT 3D MODELS

melissa.rivosecchi@concordia.ca | jasia.stuart@concordia.ca


CONNECT TO WI-FI
Select the network icon in the taskbar
Select the ConcordiaUniversity network
Click Connect
Enter your Concordia netname and password
Université Concordia University LIBRARY
Click the network icon to connect to WI-FI
Type here to search
ENG
10:23 AM
2023-09-22

FutureBound

Digital Capabilities & Mindset

- Undergraduate students
- Complete 4 activities
- Please sign registration sheet

Digital Capabilities & Mindsets Activities

Complete 4 activities and get the Digital Capabilities & Mindsets certificate.

JAN 16 **Arduino 101**
Thursday, 2 p.m. – 4 p.m.

JAN 20 **Design for 3D Printing**
Monday, 2 p.m. – 4 p.m.

JAN 21 **Expand your Excel skills: Beginner - Online**
Tuesday, 5 p.m. – 6:30 p.m.

JAN 28 **Expand your Excel skills: Intermediate - Online**
Tuesday, 5 p.m. – 6:30 p.m.

FEB 10 **Intro to Python: Start programming - Online**
Monday, 5:30 p.m. – 7:30 p.m.

FEB 11 **Thinking critically about AI - In-person**
Tuesday, 2 p.m. – 3:30 p.m.

FEB 19 **Building your graphic design skills with Canva - Online**
Wednesday, 4:30 p.m. – 6 p.m.

MAR 3 **Data analytics 101 - Online**
Monday, 5:30 p.m. – 7:30 p.m.

MAR 5 **Telling stories with data - In-person**
Wednesday, 11 a.m. – 12:30 p.m.

MAR 12 **AI in action: Insights from the workforce - Panel & networking event - In-person**
Wednesday, 3 p.m. – 5 p.m.

MAR 20 **What's in a prompt? - In-person**
Thursday, 2 p.m. – 3:30 p.m.

Intro
5 min

Theory
35 min

Activity
25 min

Recap & resources
15 min

Questions
10 min

Workshop Objectives

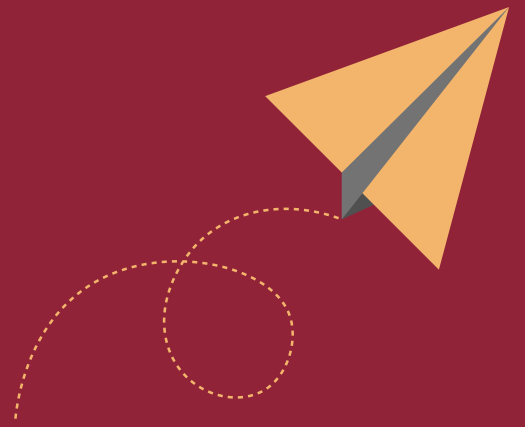
By the end of this workshop, you will be able to:

Explain the basics of:
- 3D Printing
- 3D Design

Design appropriately for 3D printing

Modify an existing 3D design

Export model for 3D printing



What is 3D Printing?

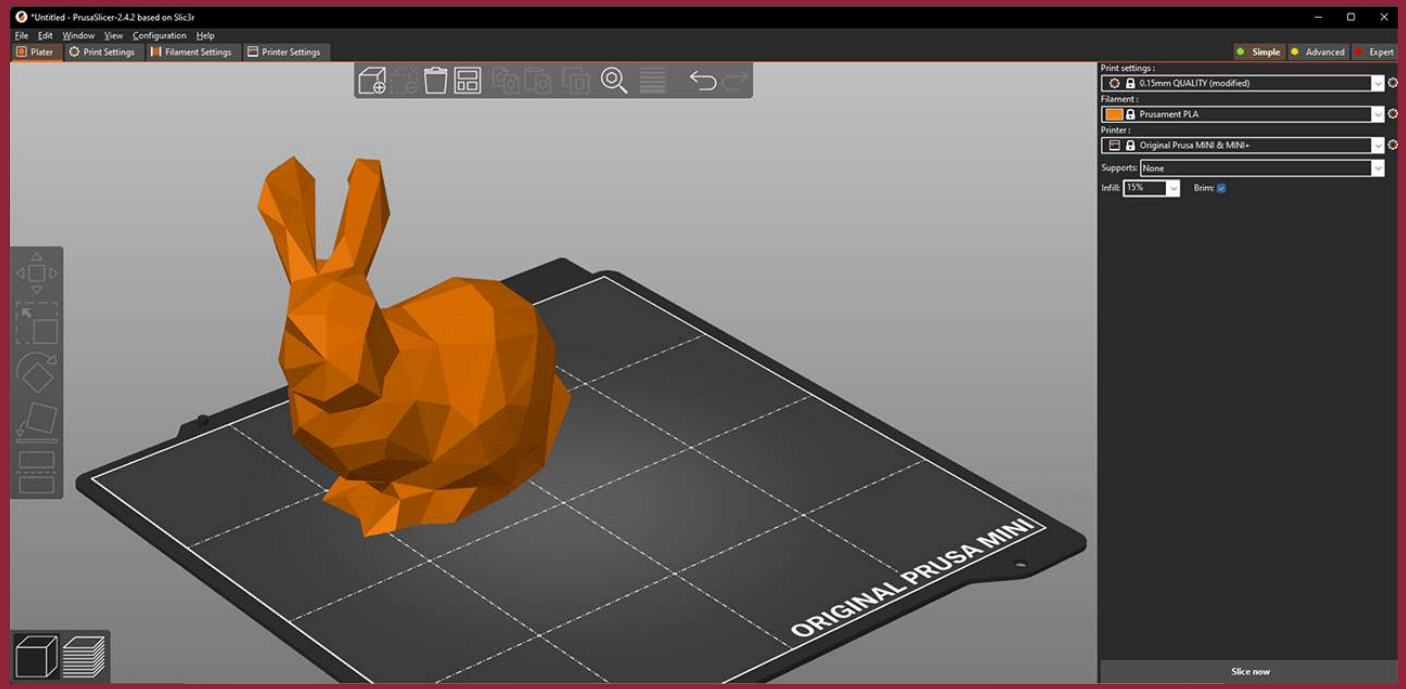
1. An additive manufacturing technology

Additive

Subtractive

What is 3D Printing?

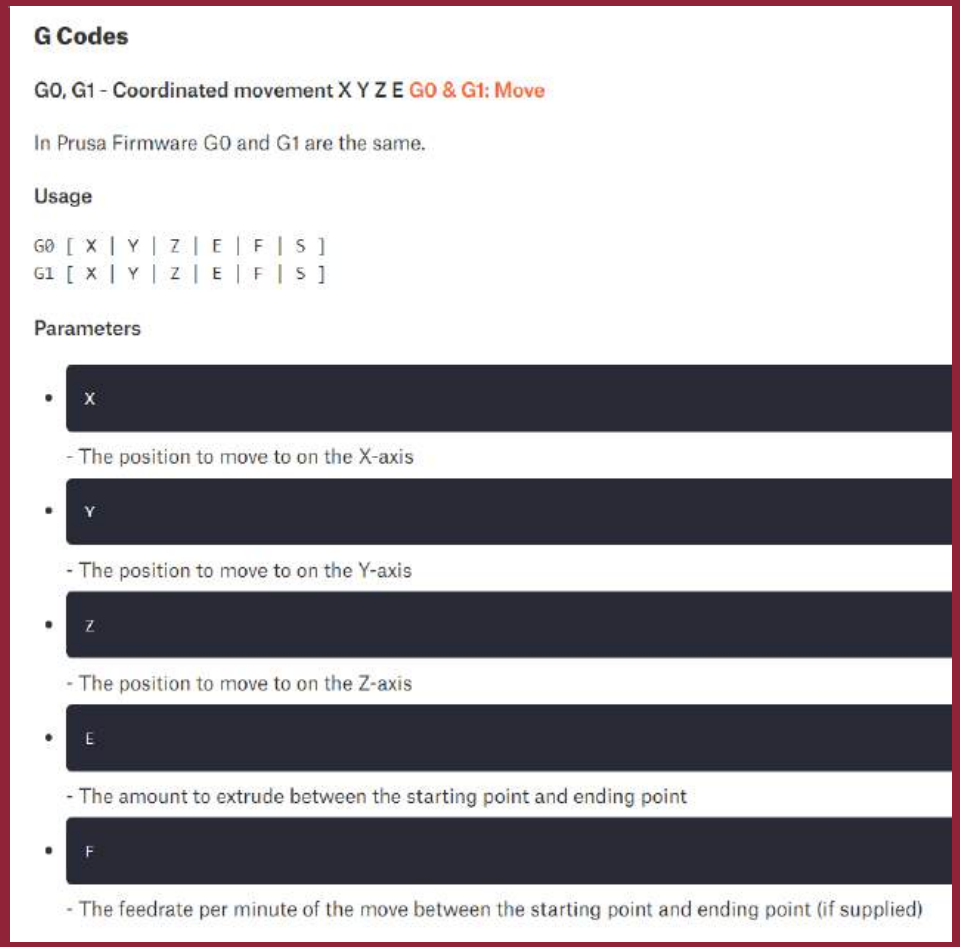
2. Computer controlled



What is 3D Printing?

3. Printers use G-code, the most widely used computer numerical control programming language

```
G0 X12                    ; move to 12mm on the X axis
```



G Codes

G0, G1 - Coordinated movement X Y Z E G0 & G1: Move

In Prusa Firmware G0 and G1 are the same.

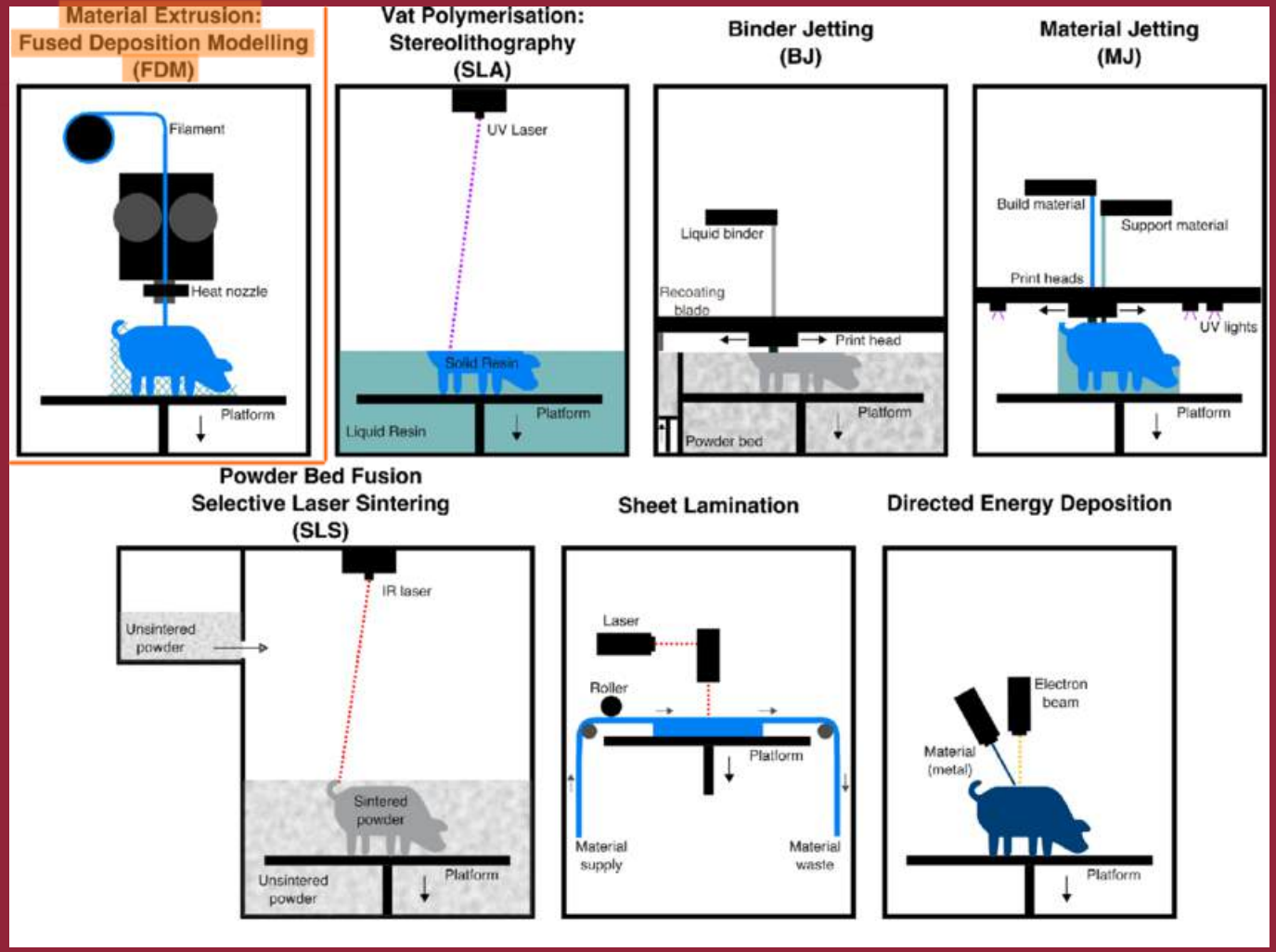
Usage

```
G0 [ X | Y | Z | E | F | S ]
G1 [ X | Y | Z | E | F | S ]
```

Parameters

- X
  - The position to move to on the X-axis
- Y
  - The position to move to on the Y-axis
- Z
  - The position to move to on the Z-axis
- E
  - The amount to extrude between the starting point and ending point
- F
  - The feedrate per minute of the move between the starting point and ending point (if supplied)

Types of 3D printing

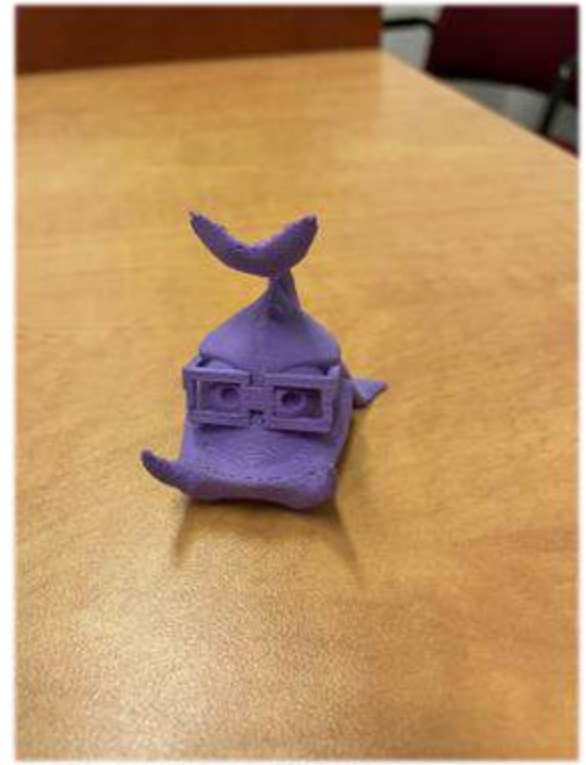


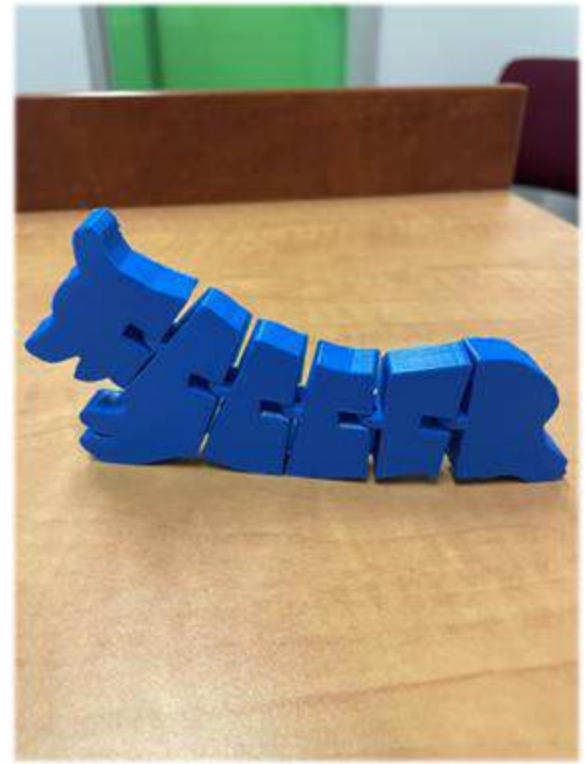
Why 3D Print?

- Prototype a design for larger production
- Solve a unique one-off problem
- Reverse engineer a broken part
- Aesthetics
- Troubleshoot your 3D design
- Print a test in PLA before producing in a more expensive material

What can you 3D Print?

- Figurines and models (architecture, DnD)
- Joining devices, hooks, attachments
- Artwork, sculptural pieces
- Organizers, containers, holders
- Puzzles and toys
- Casing and stands





Material choices

PLA – Safe, Cheap, Easy (free for students)

Outside the Sandbox:

- Other plastics (stronger, flexible, high rez) and resins
- Metals (cast or direct)
- ‘Sandstone’
- Colors

Constantly evolving – look for local then Canadian options to save $$

What is 3D Design?

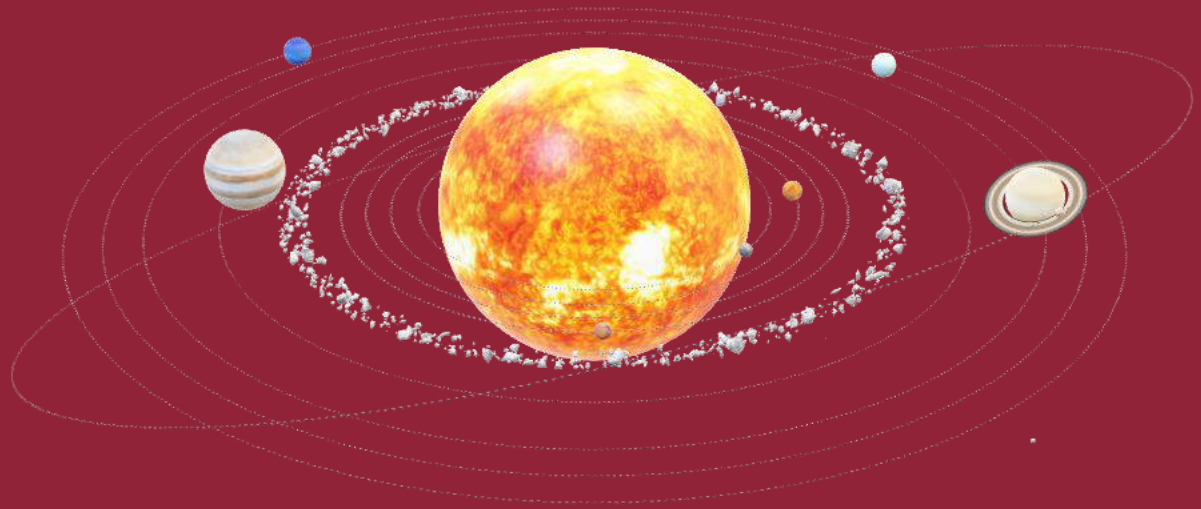
- Process of using computer-modelling software to create an object within a three-dimensional space
- Representation of a 3-dimensional object or shape
- End result is a 3D model

Why 3D Model?

- For 3D printing
- Other design applications, e.g., CNC mill, laser cutter, etc.,
- Video games
- CGI
- VR experiences
- Architecture
- Simulation purposes

What are some 3D file types?

- STL
- OBJ
- GLTF/GLB
- PLY (point cloud)
- FBX (Autodesk Filmbox)
- Many more – conversions generally possible to some extent

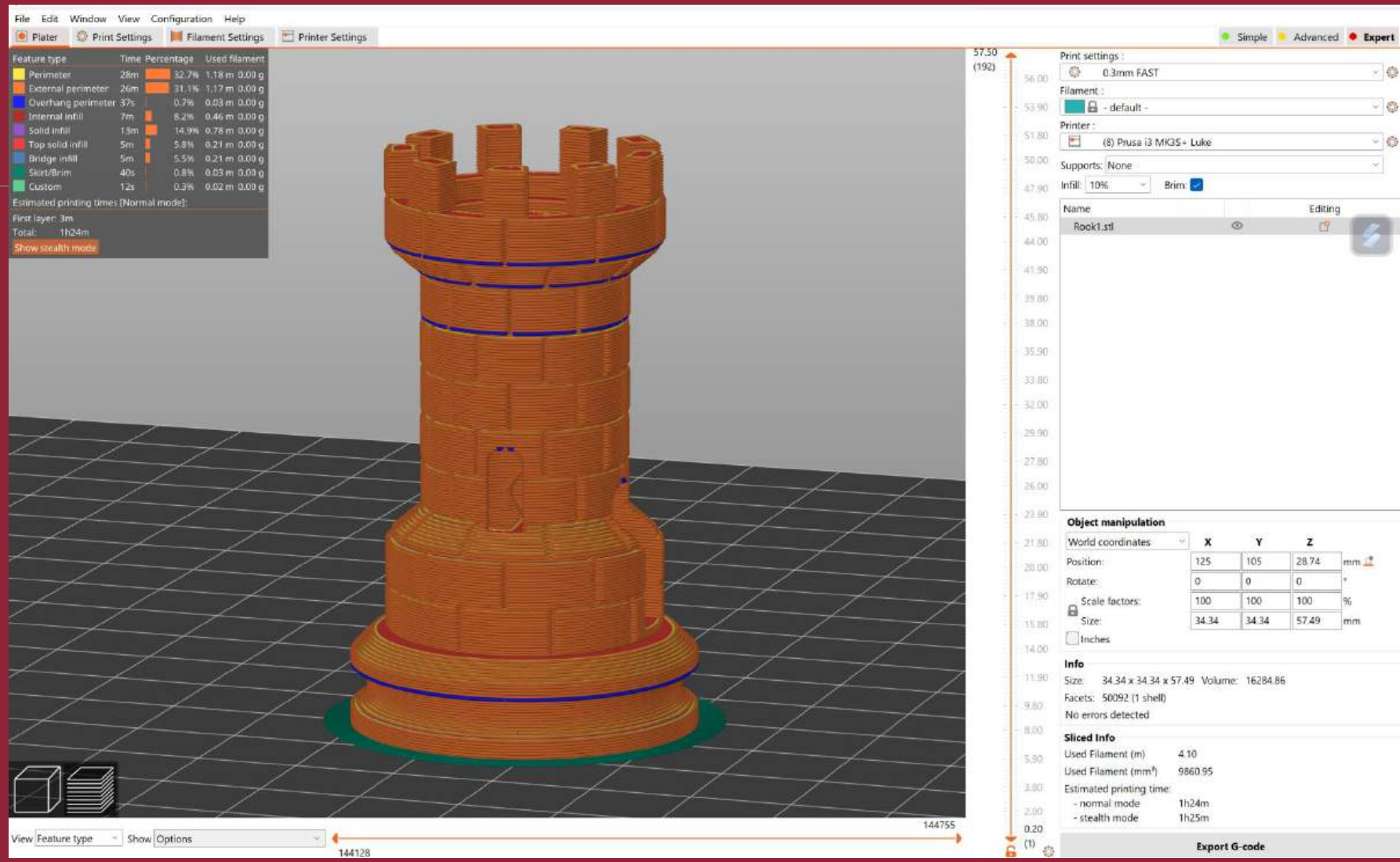


How does a printer understand 3D files?

G-code!

Image from the Technology Sandbox

Slicing – Turn a 3D file into a list of G-code instructions



Design considerations - FDM

- Overhang
- Rotation
- Support material
- Total size – modularity
- Movement (Dynamic objects)
- Melt-ability

How can I design files in 3D?

Make a TinkerCAD account:

https://www.tinkercad.com

… and Sign-IN

Follow the tutorials

- 3D designs, learn
- Starters: Place It!, View It! …complete as many as you can
- 15 minutes to get to know the interface
- Drag and drop
- Easier with a mouse (but you can survive without)

Modify a Design

- Visit the Thingiverse.com site
- Locate a file you would like to modify (i.e. cellphone case you want your initials on)
- Ideally one part
- Download the .stl, import it into TinkerCAD
- Modify
- Export the .STL

Next Steps

- Bring your file on USB to the Sandbox to print
- Complete more tutorials in TinkerCAD
- Work on mods and mashups
- Design something from scratch
- Investigate different 3D modeling options –advantages and limitations

3D PRINTING GUIDE

Do you have a 3D model?

YES

Do you have an .stl?

⇩

Export .stl or .obj

⇩

NO

SEARCH (thingiverse.com)

-or-

MODEL (TinkerCAD, OpenScad, etc.)

⇦

Open in Prusa Slicer (Click ADD)

1. Choose printer
2. Set layer height (0.1-0.3)
3. Add support material
4. Add brim
5. Change fill density (10-60%)

} if needed

⇨ SLICE NOW ⇨ EXPORT GCODE

preview

Onto SD card

⇩

take to printer ⇦ PREHEAT ⇦ Upload Gcode ⇦ Change filament

PRINT! (WATCH for 2 layers)

What did we learn?

- Explain the basics of 3D Printing/3D Design
- Identify some common printer types and file types
- The 3D Printing services offered in the Technology Sandbox
- Identify the applications of 3D modelling; choose software that can meet your needs
- Find and modify 3D models
- Export models for 3D Printing

Continue Learning

Tinkercad

OpenSCAD

Blender

Sketchup (changed ownership from Google to Trimble)

Udemy Concordia

Introduction to SOLIDWORKS

AutoCAD Beginners Course

3D printing start to finish with TINKERCARD & CURA software

3D Modelling 102: OpenSCAD

So you want to model things in 3D, but you're unfamiliar with how to do it or the software you're using doesn't give you the fine control you need? Come to our workshop. For this session, we are going to focus on building practical structures for lab environments. OpenSCAD is free, open-source software for detailed, programmatically defined, primitive based rendering software. If that sounds complicated, you will be pleasantly surprised at how easy and intuitive the software is once you get started.

No programming experience required (although it doesn't hurt).

Computer and software are provided, but to walk away even better prepared, feel free to bring your own laptop and have OpenSCAD installed on your computer before the session.

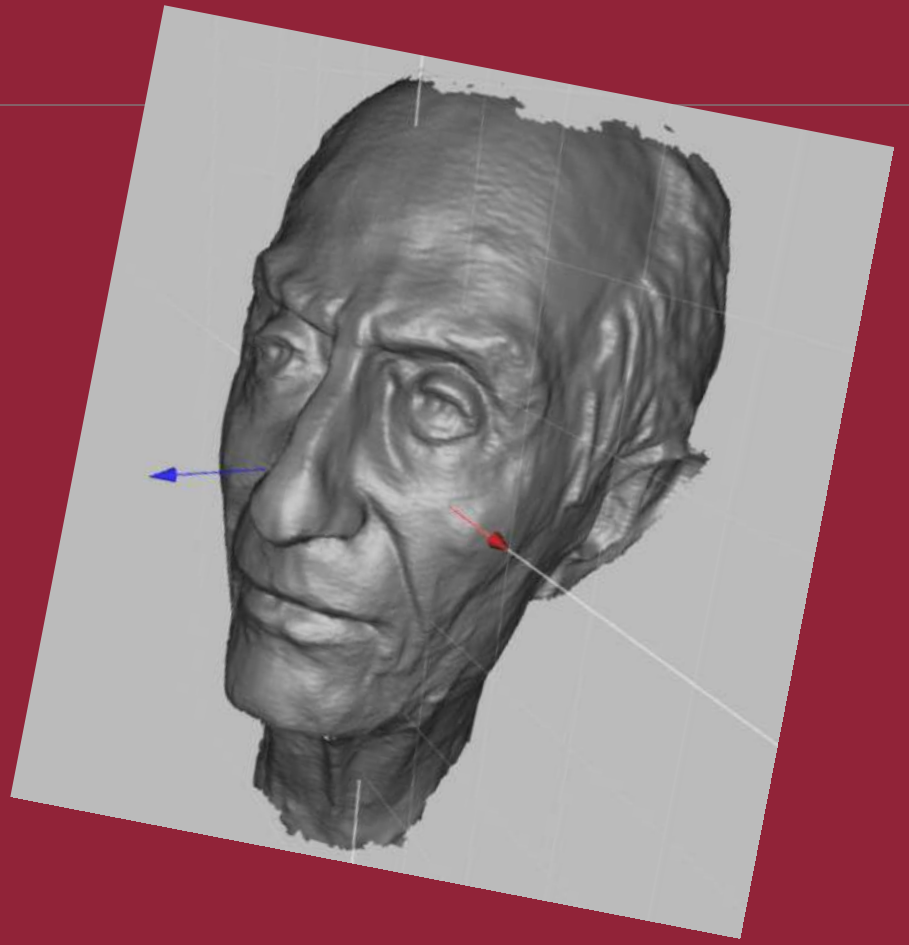
Speaker: Sean Cooney, Technology Sandbox Technician, Concordia University Library

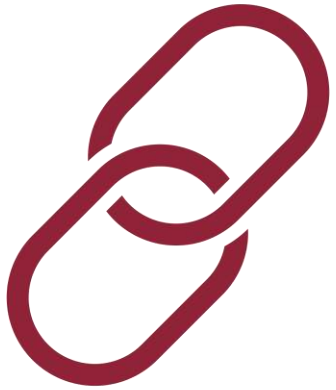
February 4 (2-4 pm)

Register at this link

3D Scanning

- Arctec Eva scanner
- iPads (Scaniverse application)





Information/inspiration

Thingiverse

Sketchfab (3D models, generally less for printing, some are paid)

Designs

SuperMod Is A 3D Printed Modular Wall System

Stool - 3D Printable Life Size Furniture

Space Fabric Cloth

Suppliers + commercial services

Prusa 3D Printers

- Printers in the Sandbox

Creality 3D

- Getting a lot of attention because of the price, Sandbox has not tested the quality

Filaments.ca

- A filament suppliers we use for PLA

Shapeways

- Very large US based printing service. They are one of the oldest – local options would be cheaper and faster. This is a reference for the material selection not a recommendation)

Vocabulary

Fused Deposition Modelling – a very common and inexpensive type of additive manufacturing, building up layers by extrusion

Stereolithography (SLA)– type of vat photopolymerization

Digital Light Processing (DLP) –another tyle of vat photopolymerization

Selective Laser Sintering (SLS) – additive manufacturing that fuses polymer particles with a laser

Selective Laser Melting (SLM) – additive manufacturing that melts powdered metal into solid objects

TECHNOLOGY SANDBOX INFO AND RESOURCES:

LIBRARY.CONCORDIA.CA/TECHNOLOGY/SANDBOX/

(SUBSCRIBE TO OUR NEWSLETTER!)

Technology.Sandbox@concordia.ca