

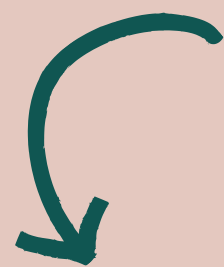
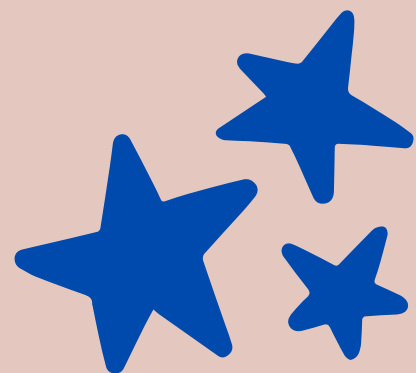
# BEFORE WE BEGIN

---

## 3D Printer Orientation:

- Please sign-in on the attendance sheet. Include your first and last name, email address, and check 'yes' or 'no' for if you have a Beanstack account.
- If you do not have a Beanstack account, please stay after the orientation to create an account. You must have an account if you want to use a PPL 3D printer!
- Take a seat and we will get started shortly.

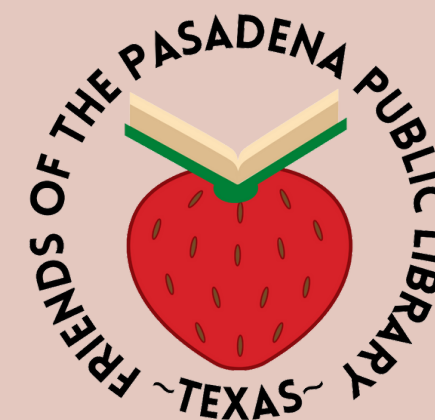
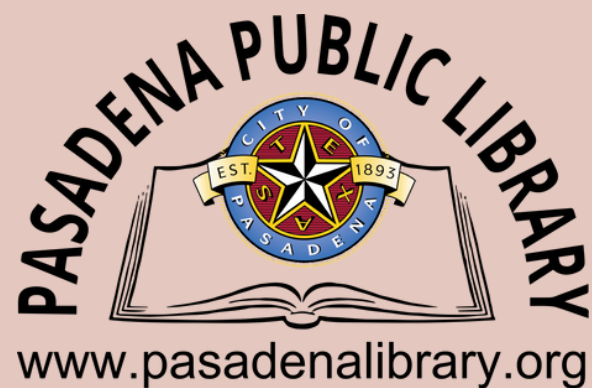
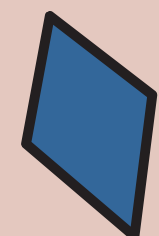




**Pasadena Public Library presents**



# WELCOME TO THE MAKER LAB

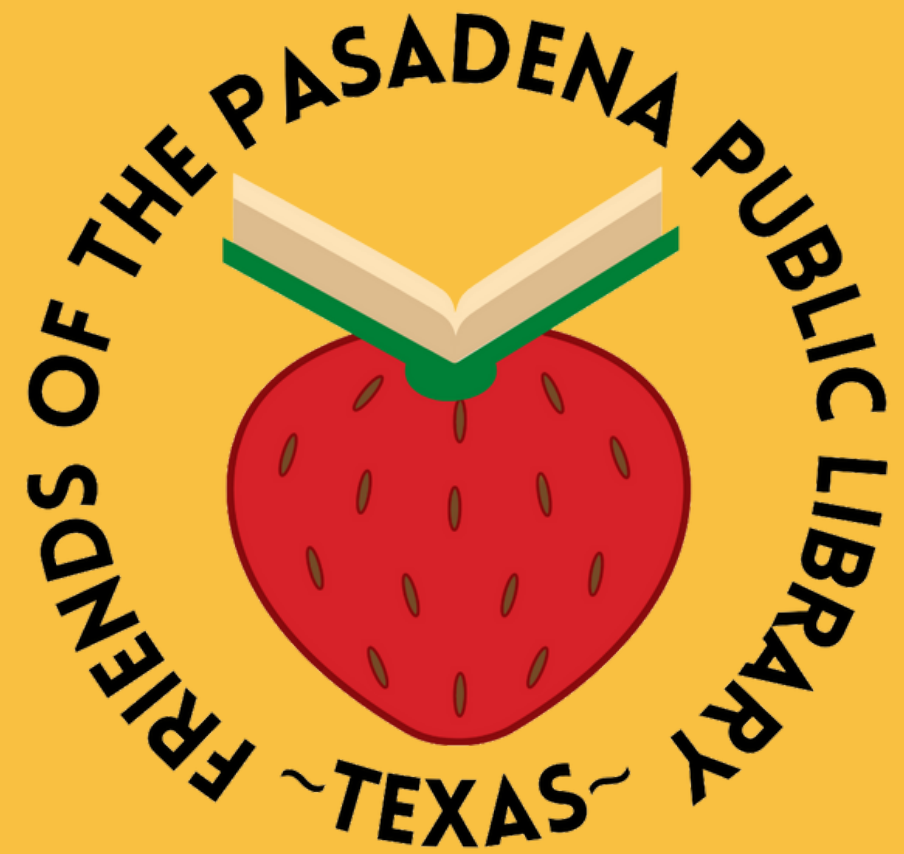





# PASADENA PUBLIC LIBRARY MAKER LAB

---

This Maker Lab, its equipment and supplies and services, are made possible with the assistance from The Friends of Pasadena Public Library and Chevron.





# WHAT IS A MAKERSPACE?

---



A makerspace is a place where a community can gather to access tools and resources for making and to network with other makers.



# MISSION

---

Our mission is to give you the space to be creative! We will provide the tools and equipment, you just need your imagination.



# WHAT IS MAKING?

Making = Creating!

INDUSTRIAL ARTS

S.T.E.A.M.

ENGINEERING

HANDS-ON SCIENCE

DIGI-TECH

MAKERS

TINKERERS

GREEN TECH

*we are all*

CHEMISTRY "MAGIC"

CRAFTS

**MAKERS**

ARTISTS

YOUNG MAKERS

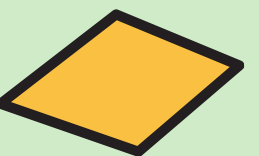
ALTERNATIVE ENERGY

DIY

ROBOTICS

RECYCLING

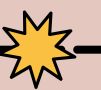
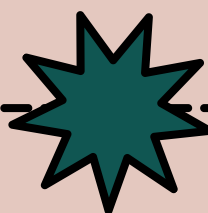
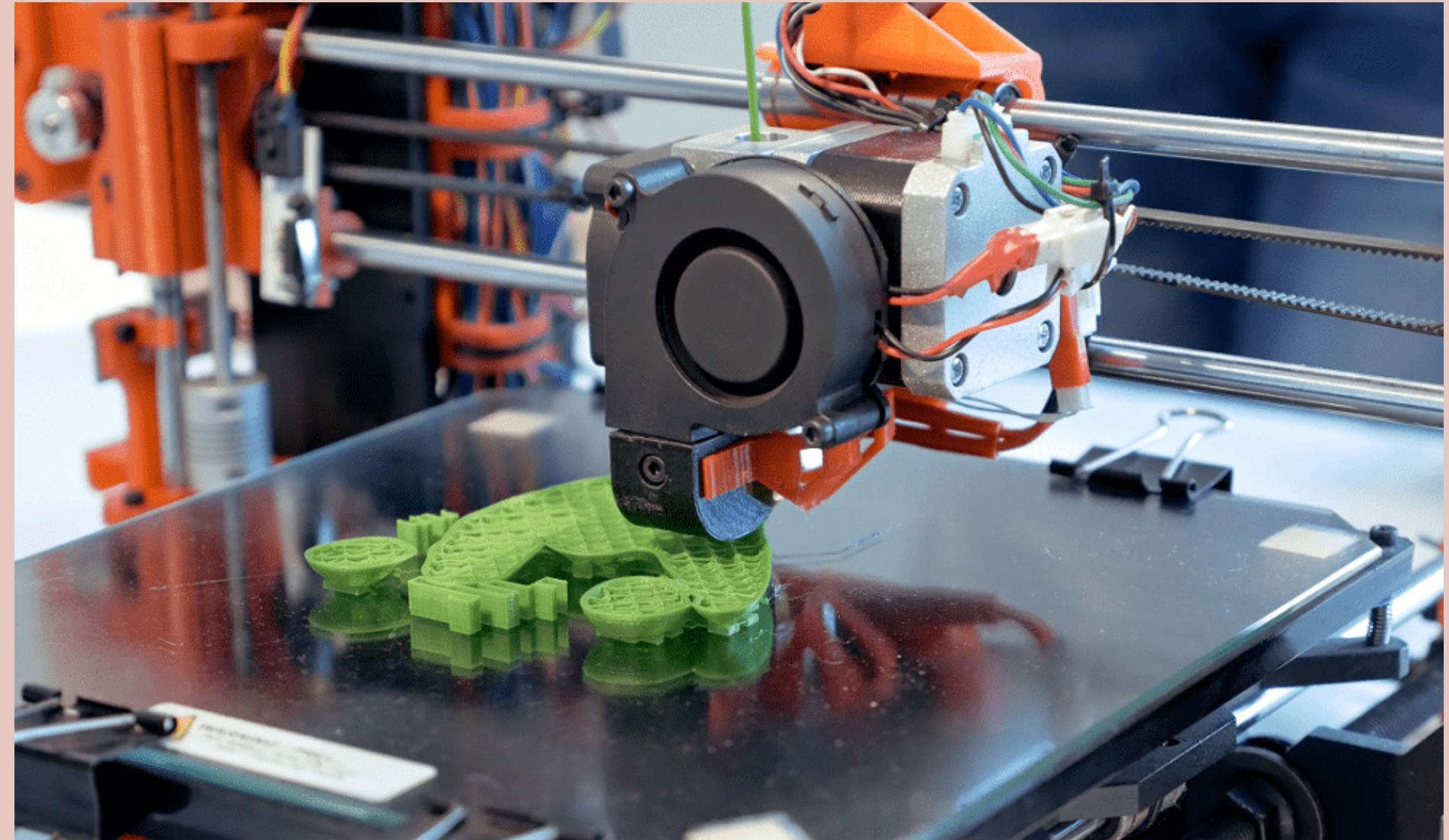
MUSICIANS

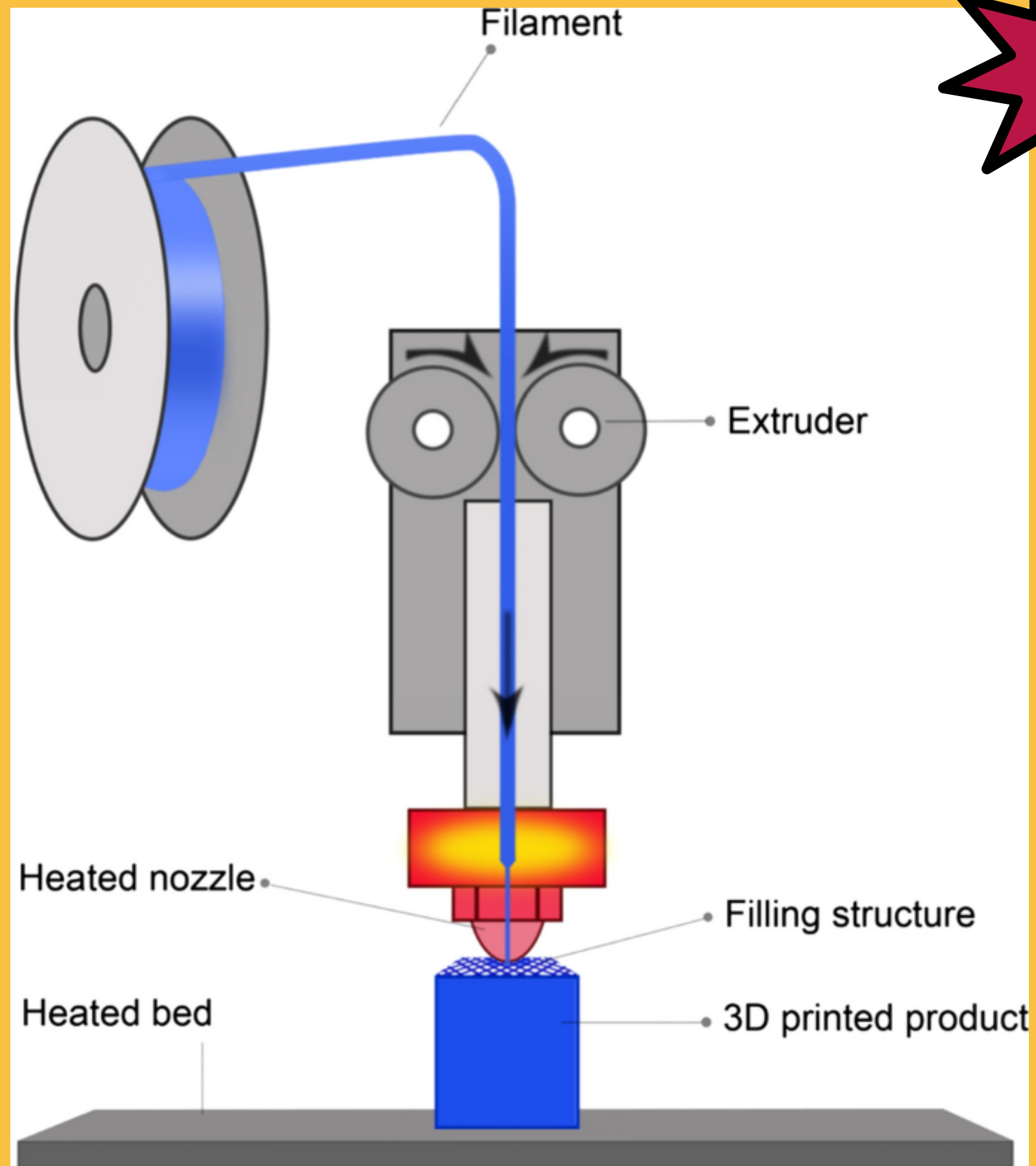
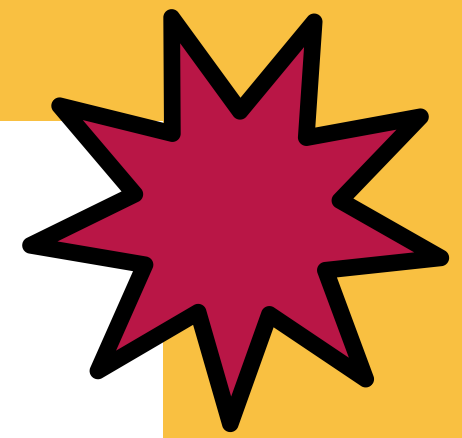




**WHAT IS 3D  
PRINTING?**

- Additive manufacturing
- Making a physical object from a three-dimensional digital model.
- PPL only offers fused filament fabrication (FFF).

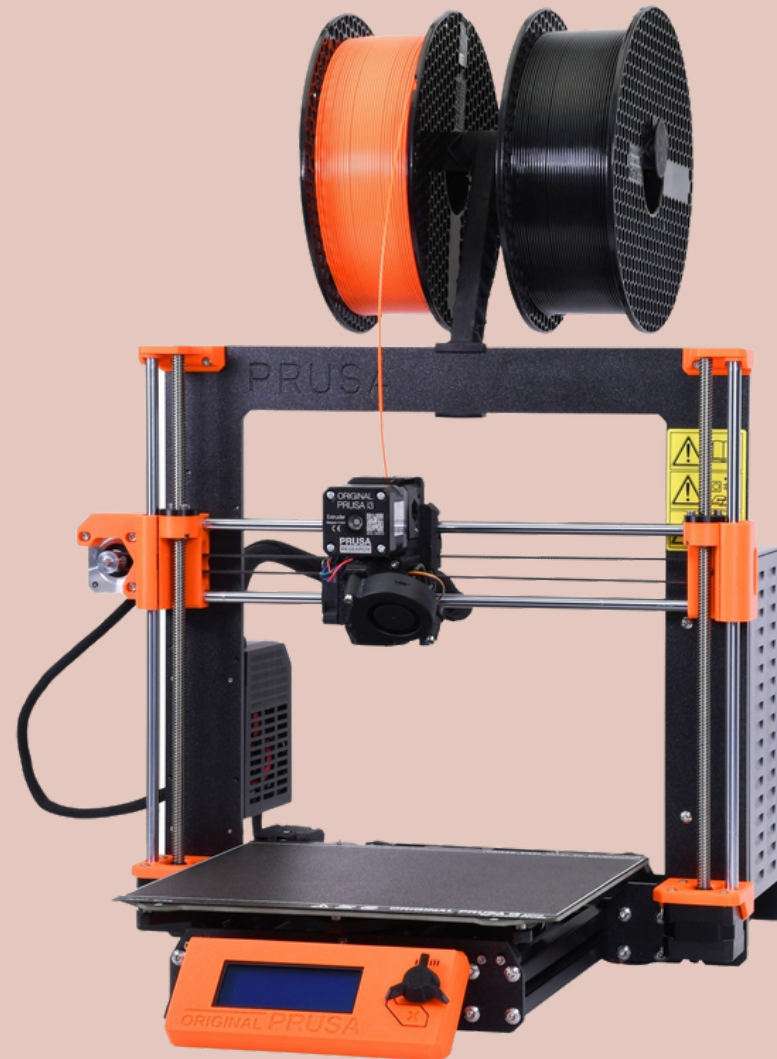




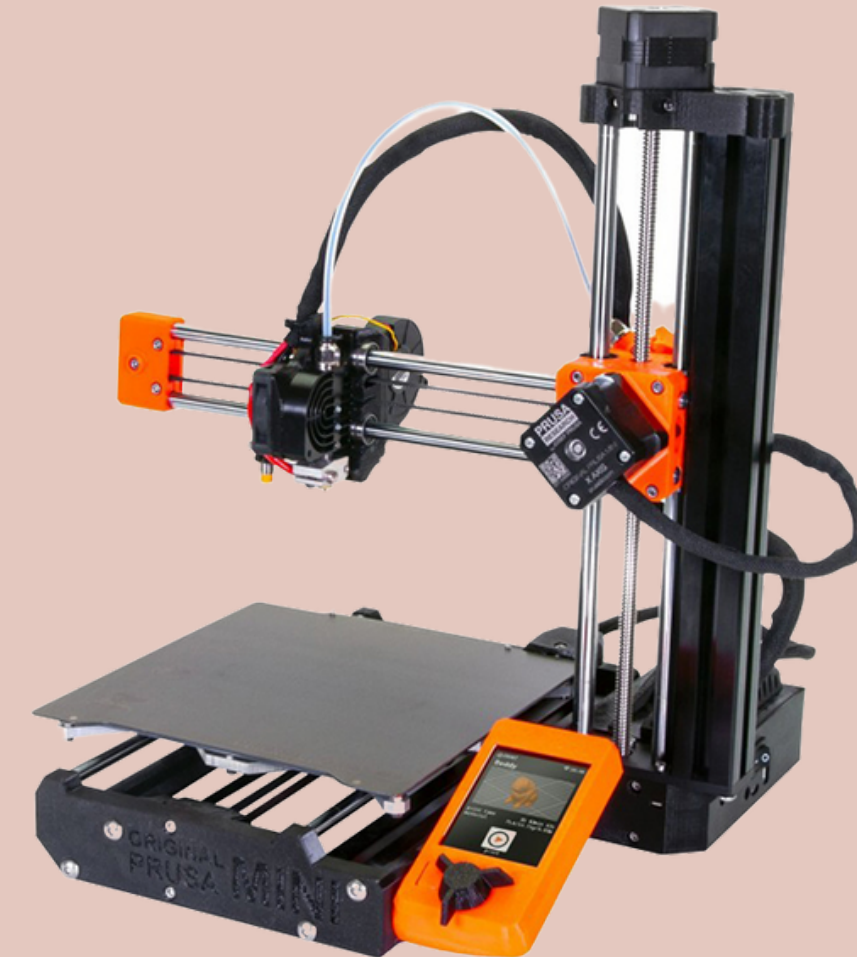
# FUSED FILAMENT FABRICATION (FFF)



# 3D PRINTERS AT PPL 😊



- PRUSA ORIGINAL I3 MK3S+
- MAX BUILD VOLUME: 25 X 21 X 21 CM
- MAX NOZZLE TEMPERATURE: 300°C / 572°F
- PRINT BED: REMOVABLE MAGNETIC STEEL SHEETS
- LAYER RESOLUTION: 0.05 - 0.35 MM
- MAX HEAT BED TEMPERATURE: 120°C / 248°F

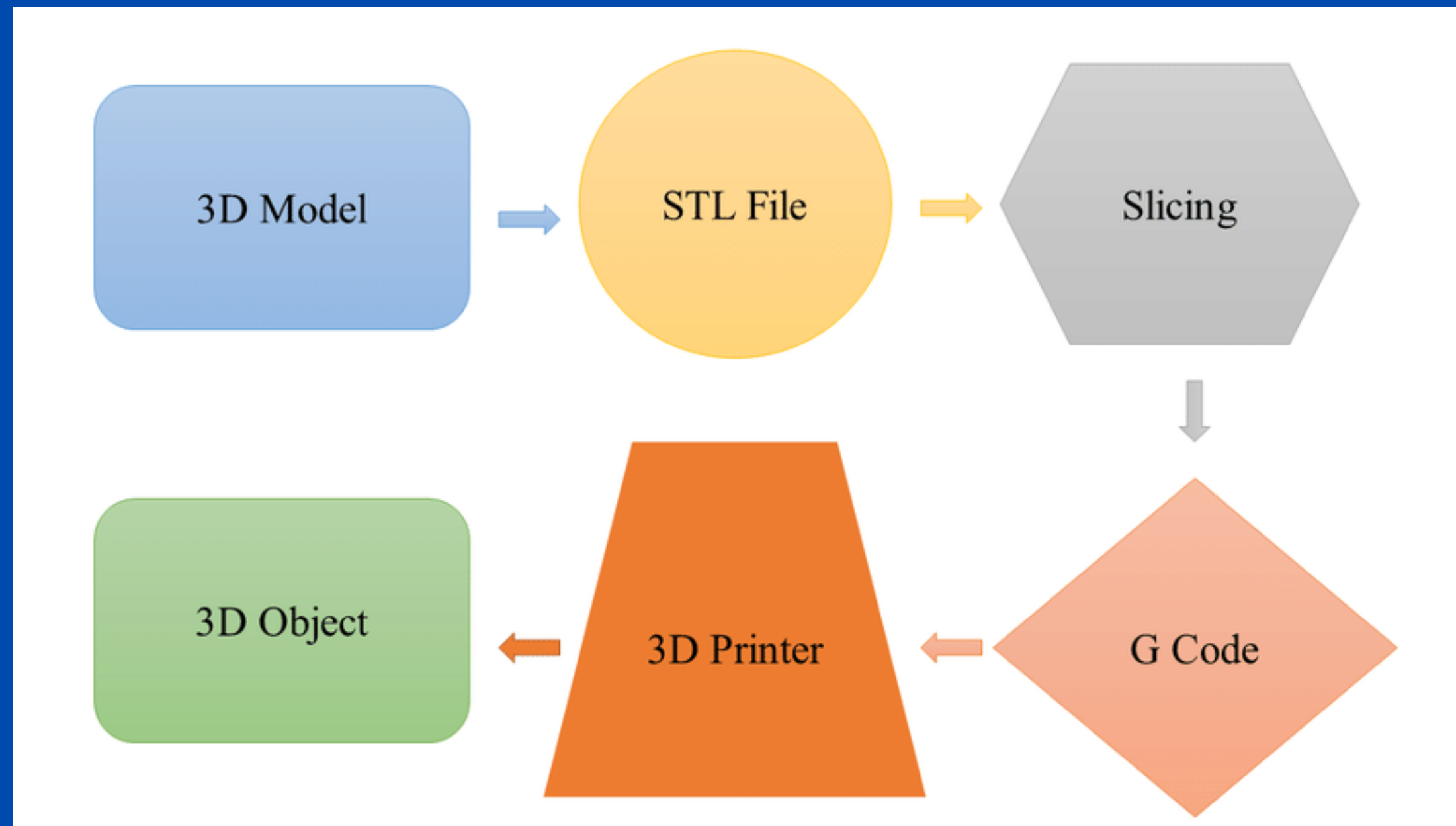


- PRUSA MINI+
- MAX BUILD VOLUME: 7 X 7 X 7 IN
- MAX NOZZLE TEMPERATURE: 280°C / 536°F
- PRINT BED: REMOVABLE MAGNETIC STEEL SHEETS
- LAYER RESOLUTION: 0.05MM - 0.25MM
- MAX HEAT BED TEMPERATURE: 120°C / 248°F



# Digital Fabrication

A manufacturing process where the machine is controlled by a computer



# DESIGNING 3D MODELS COMPUTER-AIDED DESIGN (CAD)

---

- TinkerCAD
- FreeCAD



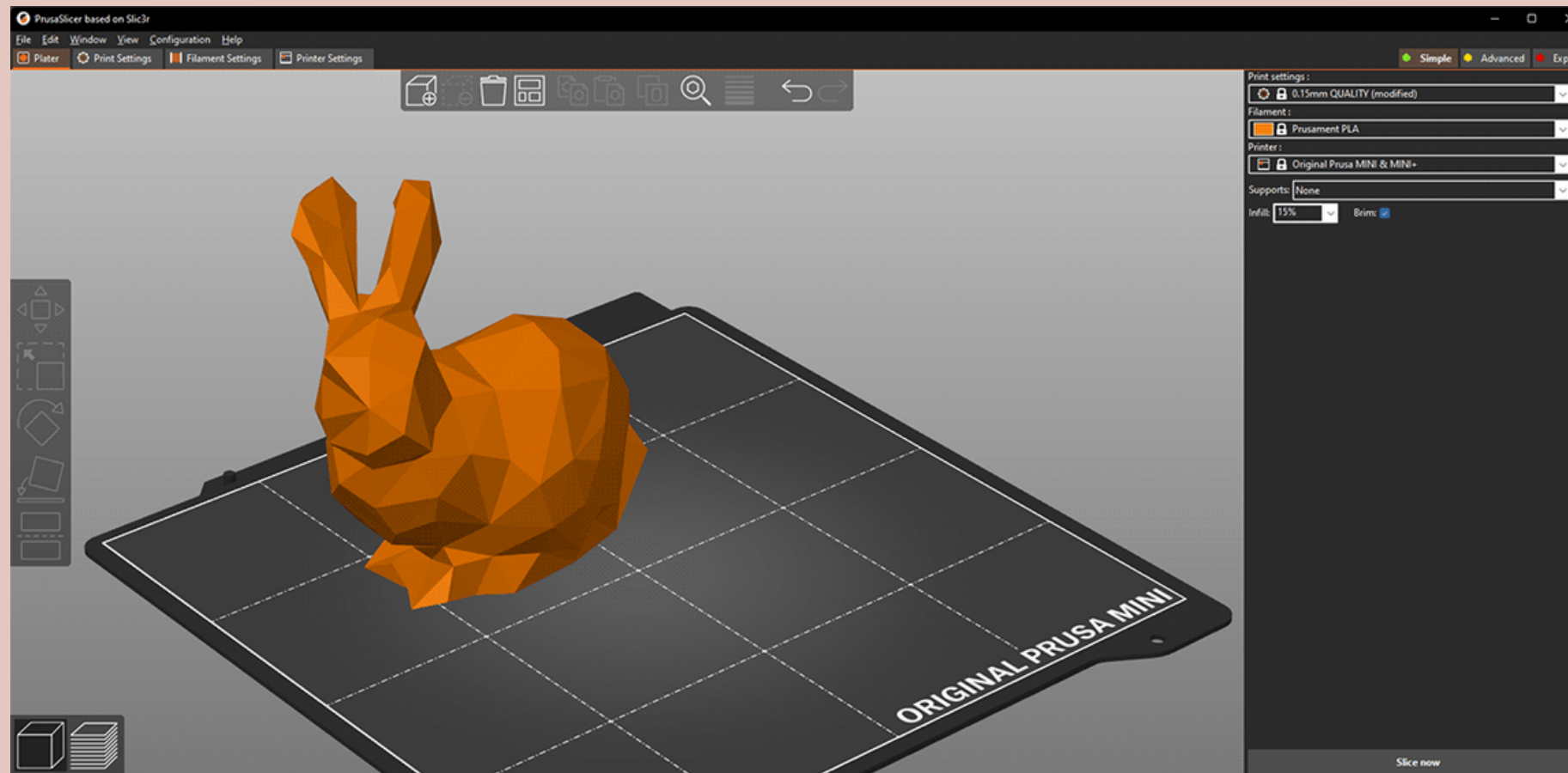
# 3D MODEL DEPOSITORIES

---

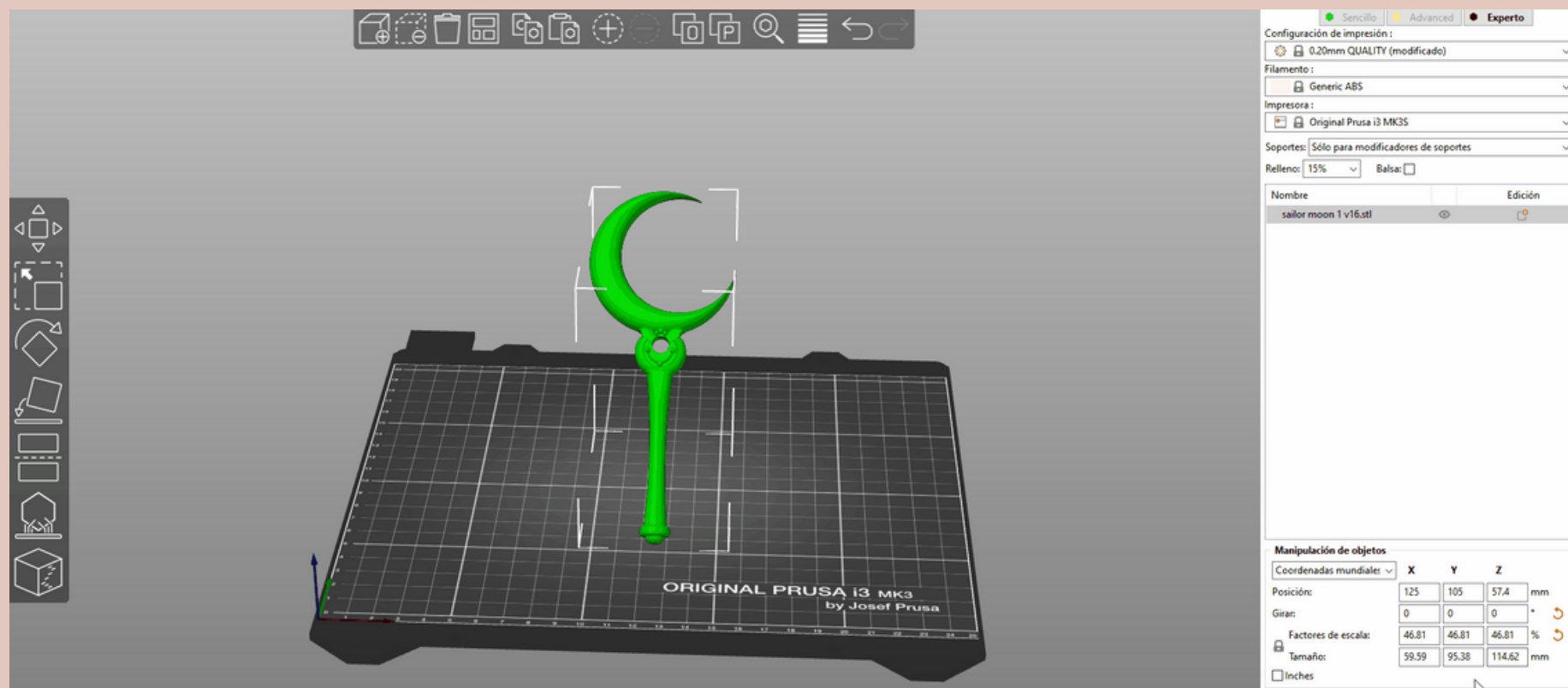
- Thingiverse
- Pinshape



# SLICING



- The PrusaSlicer software is what prepares your 3D model for the 3D printer.
- You need a flat base to print on the print bed.
- The slicer generates a G-code, instructions that tell the 3D printer what to print and how to print.



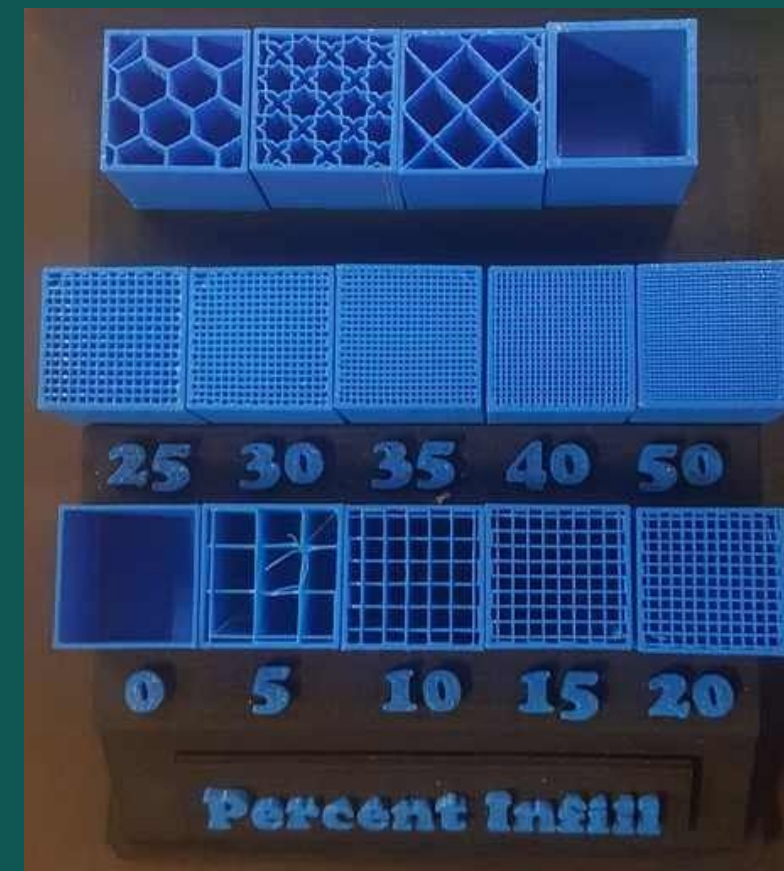
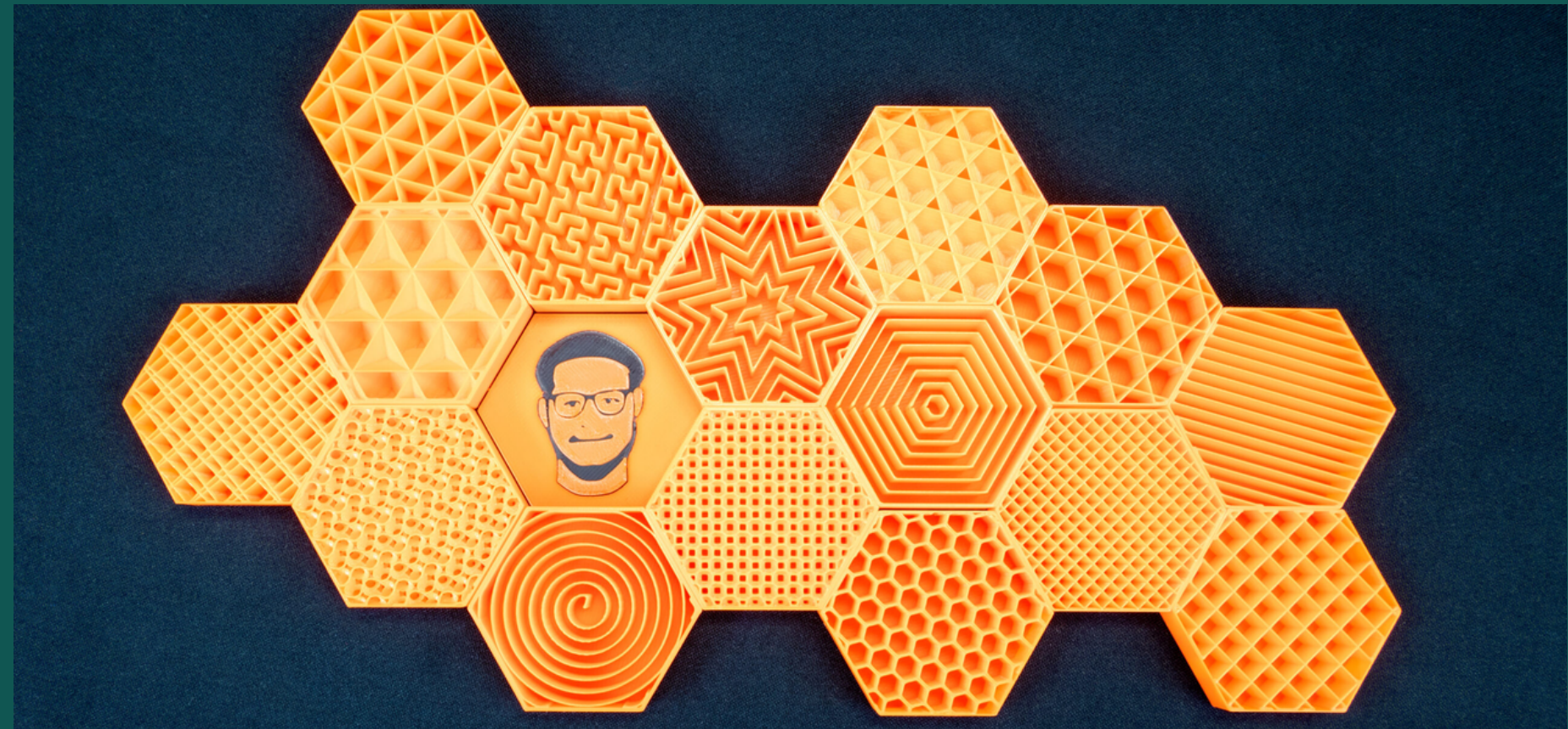
# Slicing: Layer Height

- The height of each layer of plastic
- **The slicer cuts the 3D model into many horizontal layers and produces a path the printer can follow - line by line, layer by layer**
- Layer height affects print speed, resolution, and smoothness



# Slicing: Infill

- A repetitive structure inside a 3D print
- Infill makes 3D prints stronger and more durable
- There are many patterns and percentages, and each has their strengths and weakness

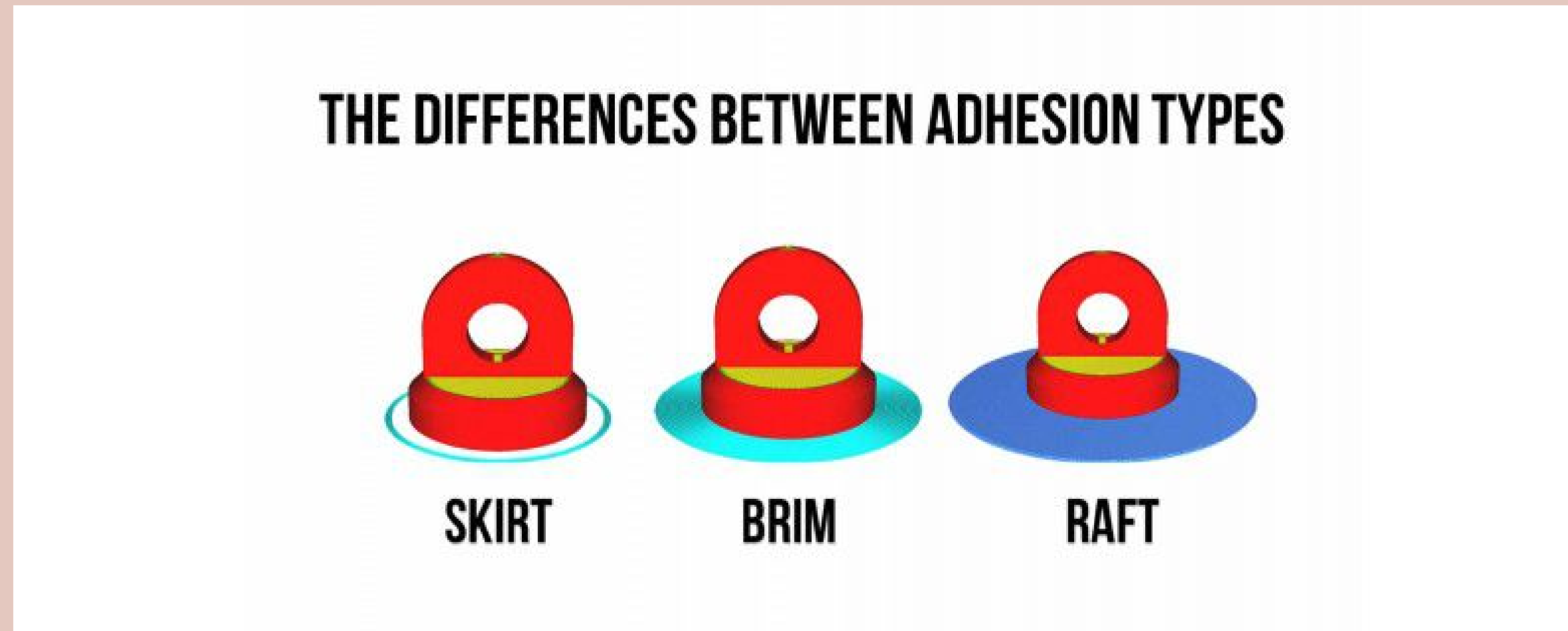


# Slicing: Wall (shell) Thickness



- Affects the strength and durability of the prints
- Adding walls increases print time and weight

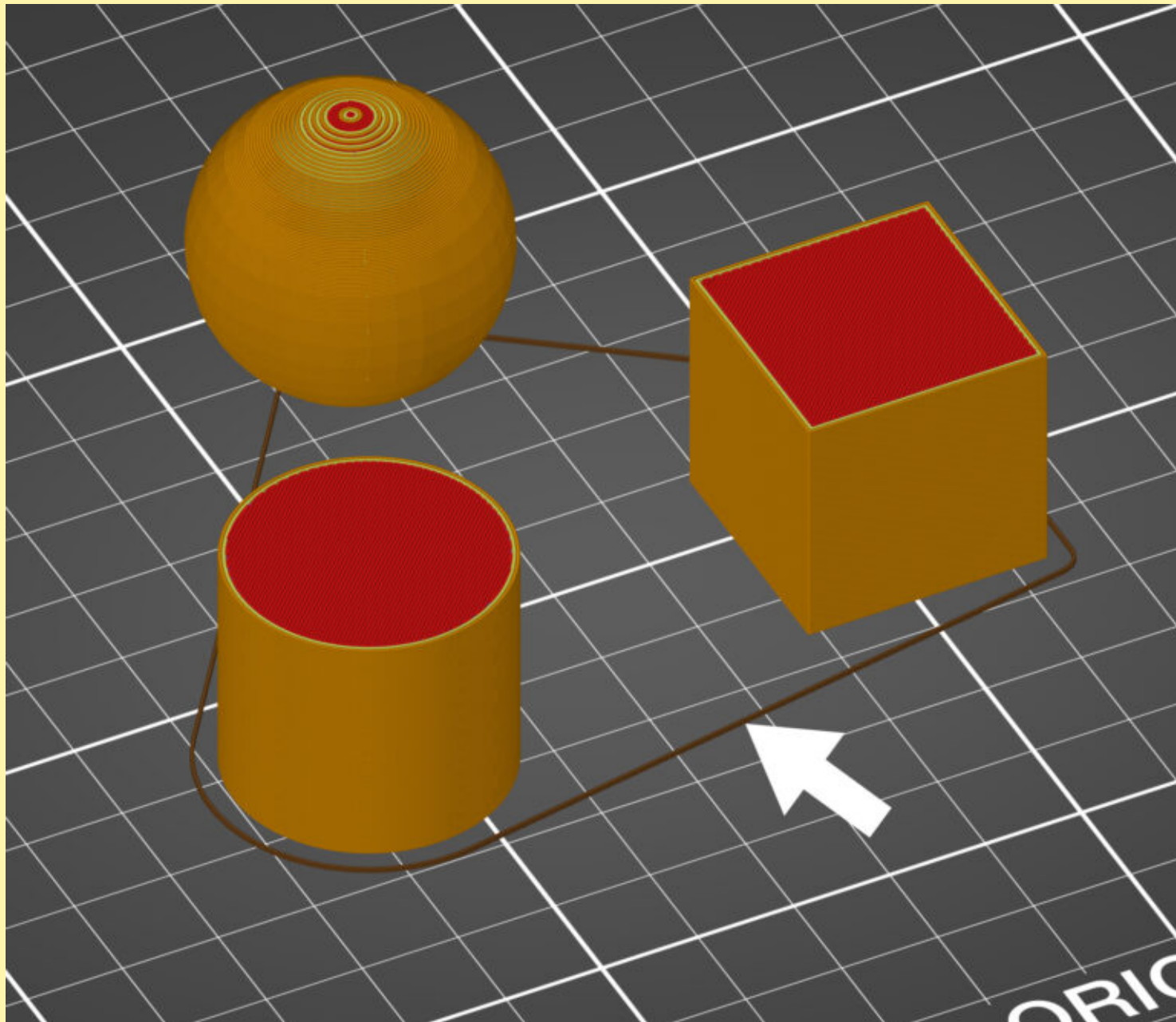
# Slicing: Bed Adhesion



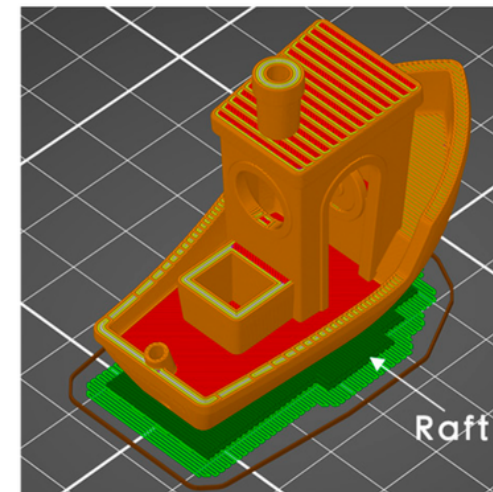
Bed adhesion is a major part of obtaining the best finished printed product

# Skirt

- Does not attach to the 3D printed object at all and prints a couple of layers around the perimeter
- Good for priming the nozzle

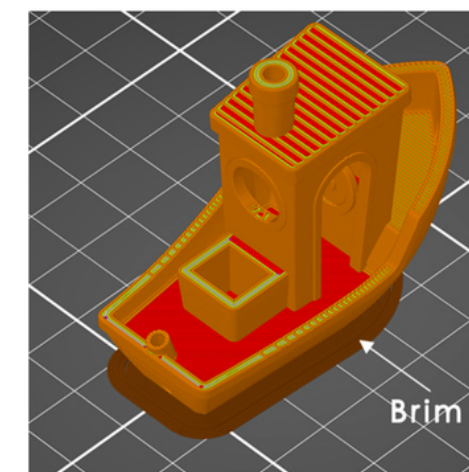


**Raft**



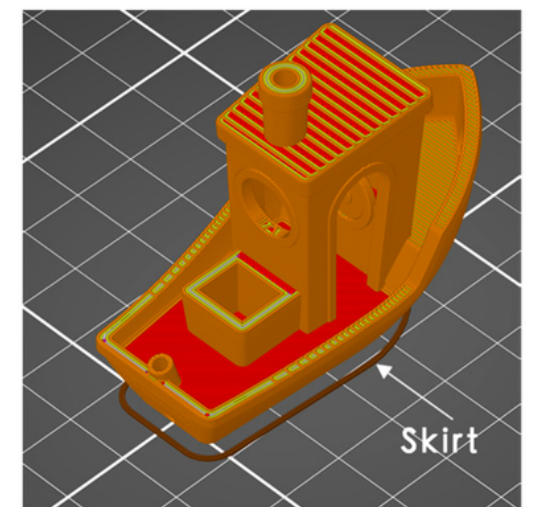
A raft is a horizontal latticework surface that sits under the print part with a specific distance away from the sides of the object.

**Brim**



A brim is a single layer flat area around the base of the model to prevent warping.

**Skirt**

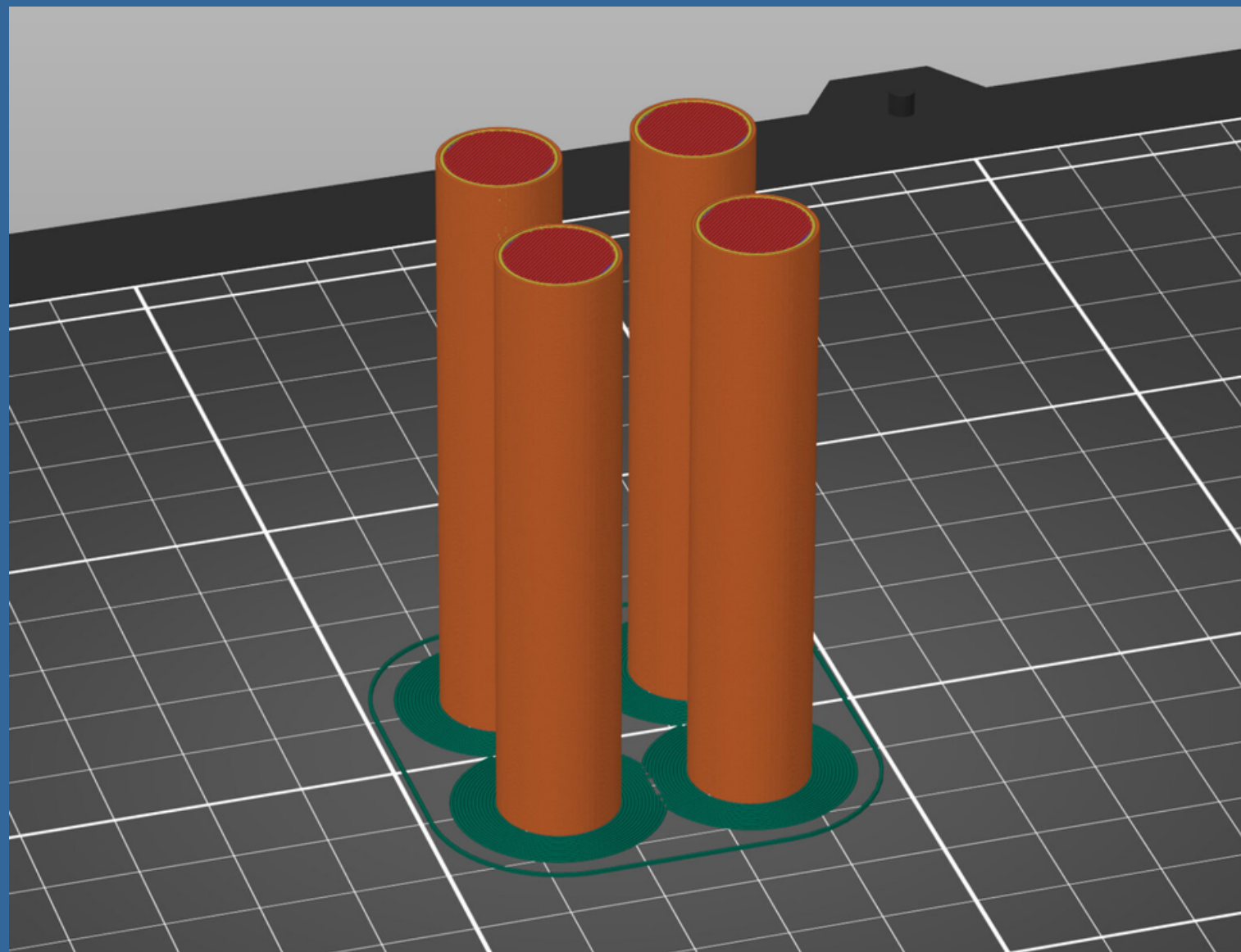


A skirt is a printed line that is offset around the object on the first layer.

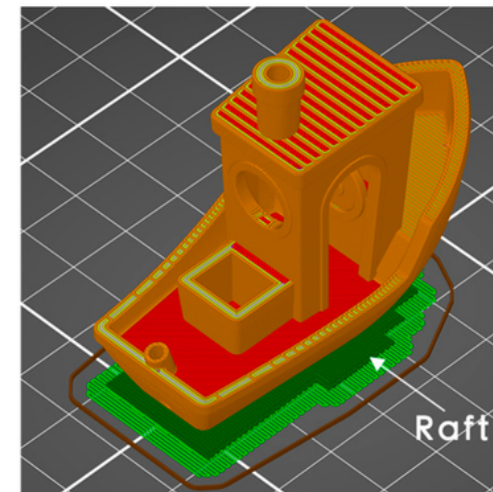


# Brim

- A very thin layer attached to the build plate then the 3D printed object only at the perimeter of the base. It does not sit under the print
- Good for large bases to prevent warping
- Good for adhering small, thin prints to the bed

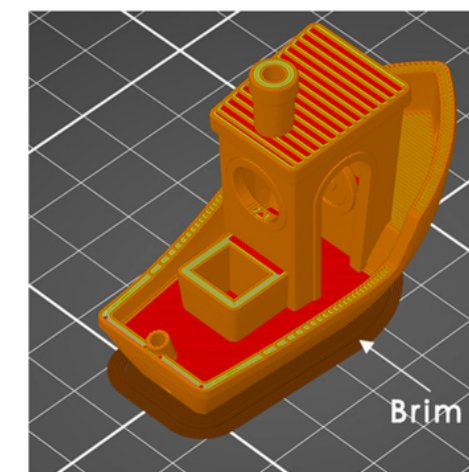


**Raft**



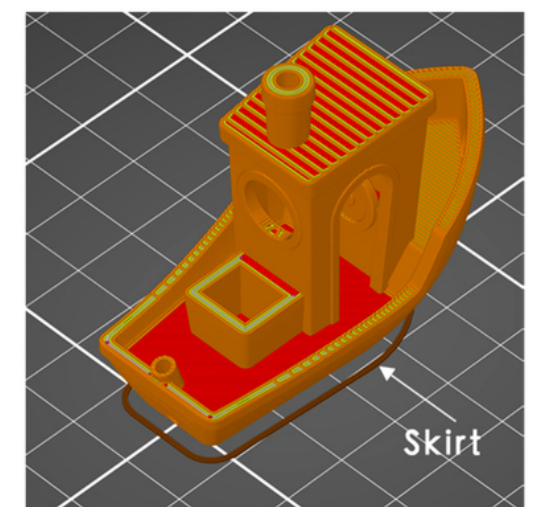
A raft is a horizontal latticework surface that sits under the print part with a specific distance away from the sides of the object.

**Brim**



A brim is a single layer flat area around the base of the model to prevent warping.

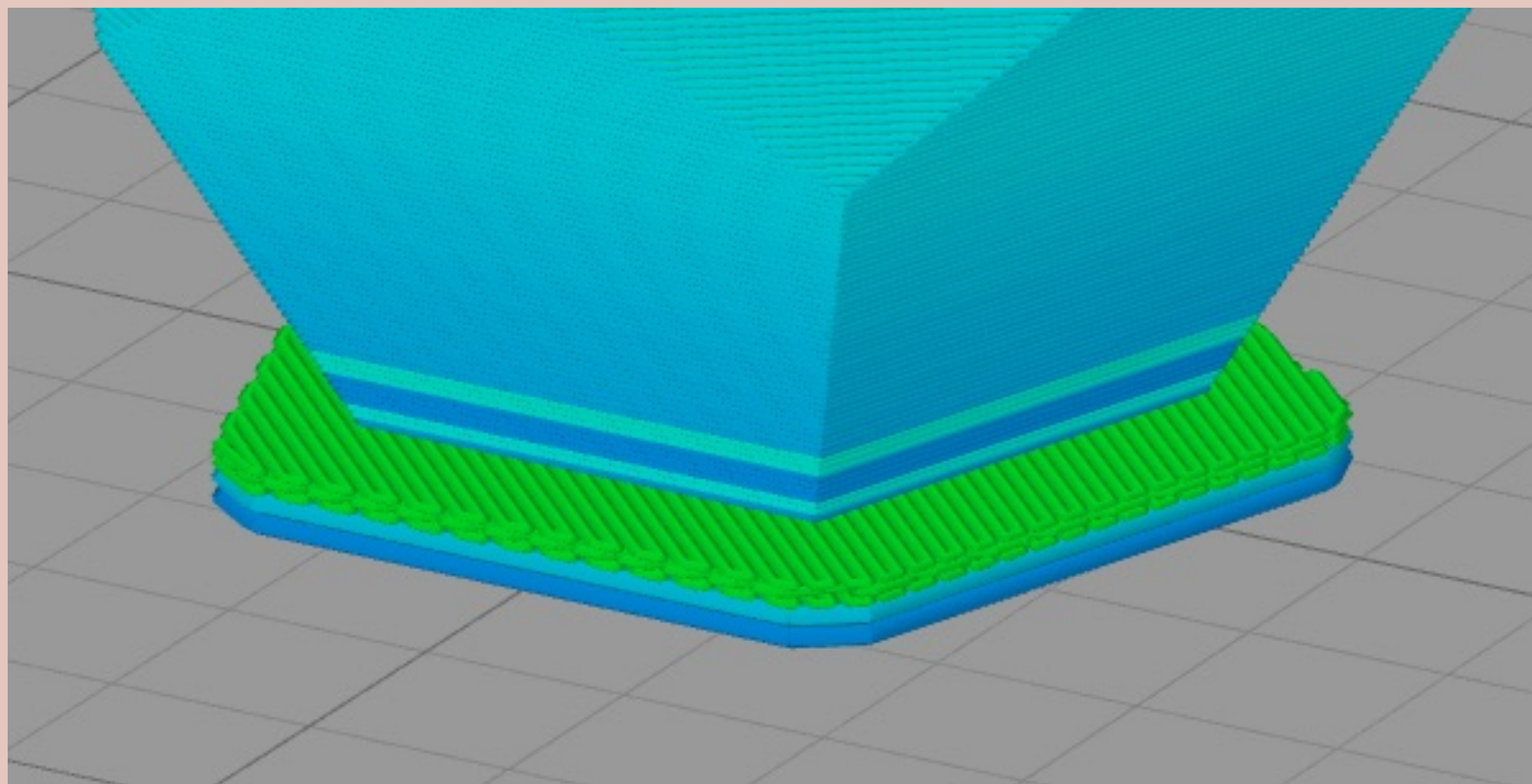
**Skirt**



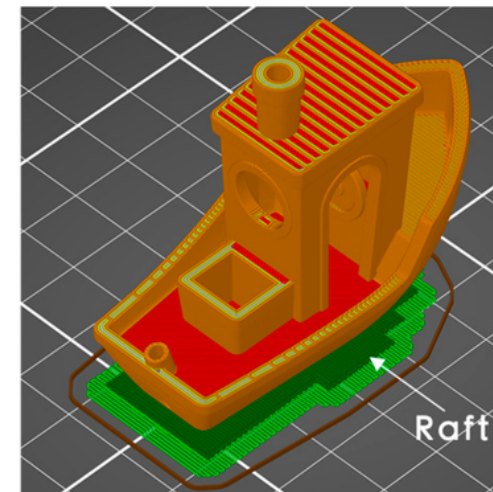
A skirt is a printed line that is offset around the object on the first layer.

# Raft

- A temporary base structure that attaches the print to the build plate. It sits under the print
- Not generally needed for 3D printers with heated build plates
- The raft will require careful removal. There is a small gap between the raft and the part to reduce bonding

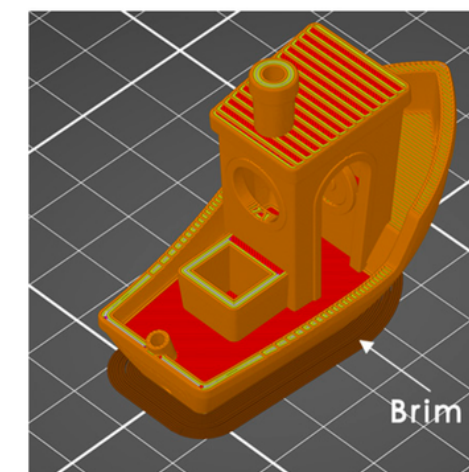


**Raft**



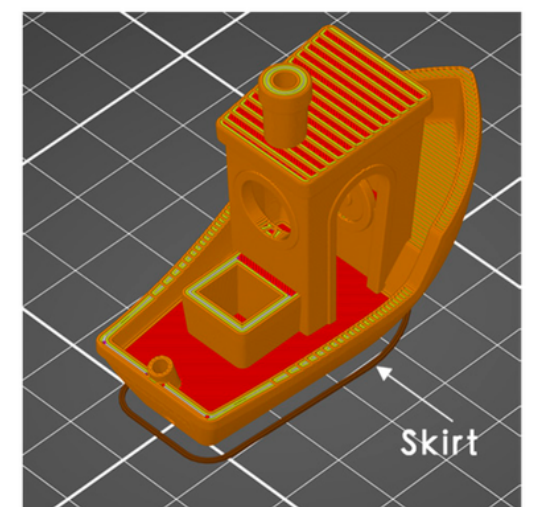
A raft is a horizontal latticework surface that sits under the print part with a specific distance away from the sides of the object.

**Brim**



A brim is a single layer flat area around the base of the model to prevent warping.

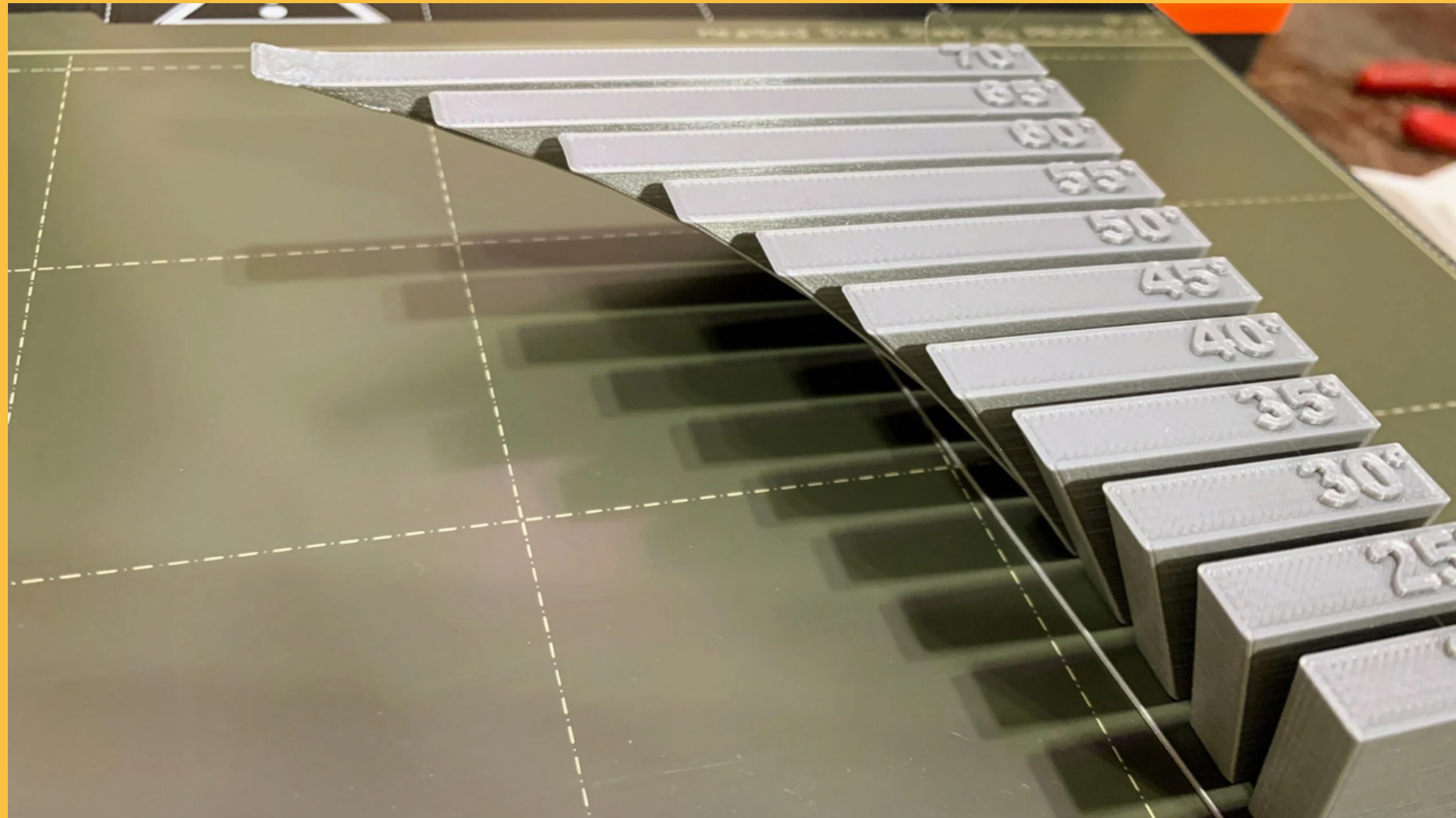
**Skirt**



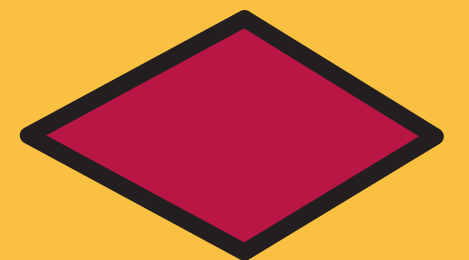
A skirt is a printed line that is offset around the object on the first layer.



# 3D PRINTING DESIGN CONSIDERATIONS

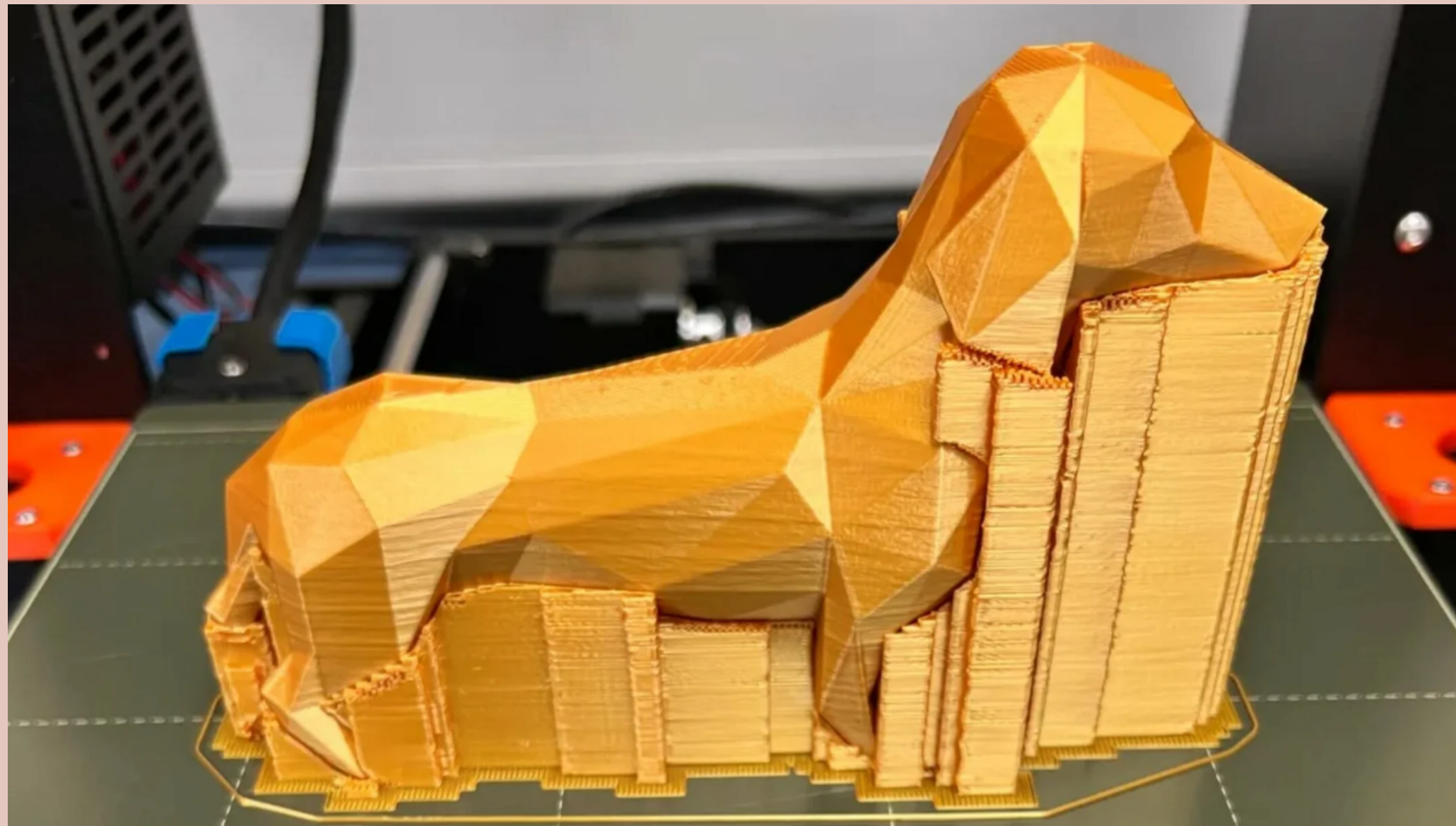


- "Overhangs" should be less than  $45^\circ$  from vertical



# Supports


- A temporary scaffold structure that supports overhangs
- Generally required for overhangs over  $45^\circ$  or for projects that don't have a flat base to print on
- Most slicing software determines where supports are needed throughout the printing process
- Requires careful removal after print





# Policy and Procedures

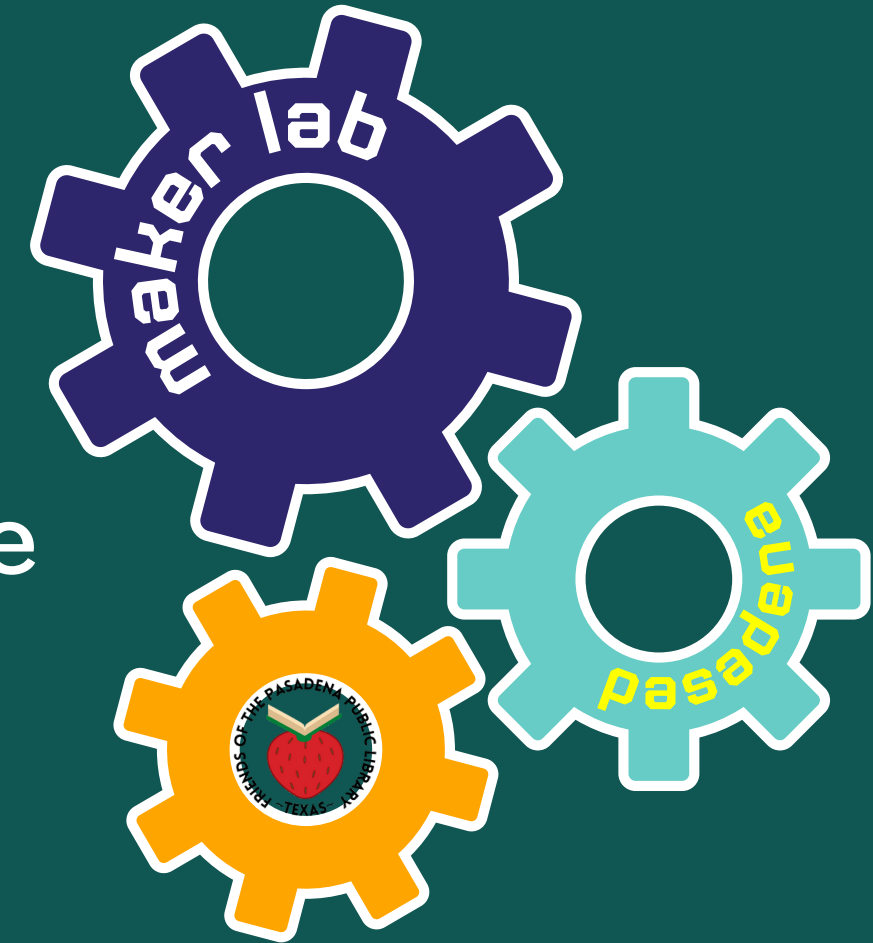


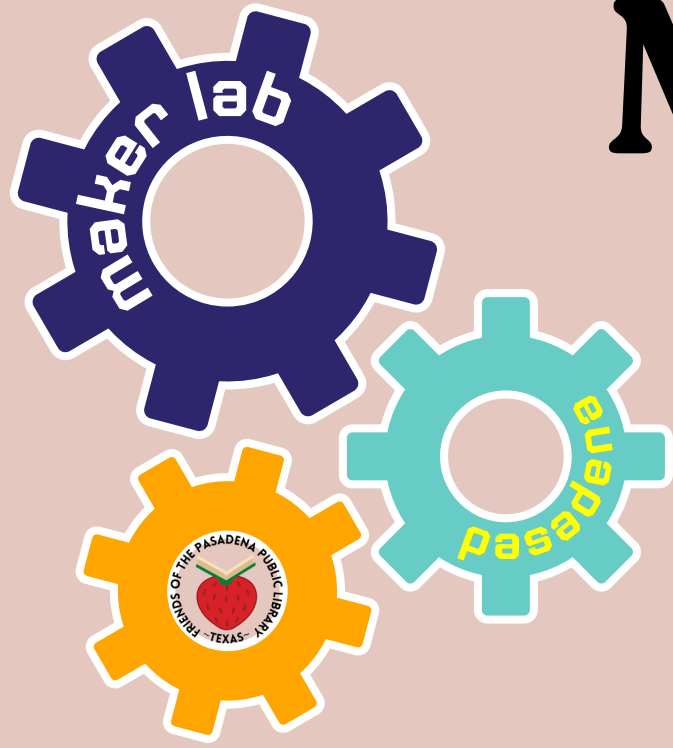
- Patrons can reserve up to four hours of machine time. Reservations for the 3D printers may not exceed four hours and all prints must be completed within your allotted time. However, as the schedule allows, time may be extended based on the availability of equipment and staff.
  - Patrons must be present for the first 30 minutes to begin the print and remain in the library for the duration of the print job.
  - 10 cents per gram (regular filament) and 20 cents per gram (special filament) to be rounded to the nearest gram.
  - PPL's maker machines may be used only for lawful purposes. Illegal, inappropriate items, or items violating copyright laws are not permitted. Library staff has the right to deny prints that we deem as violating this policy.
  - Patrons under age 16 must be accompanied by a parent/guardian who has also taken the 3D Printer Orientation.
- 

# Sign up for the Maker Lab challenge!

[ppltx.beanstack.org](http://ppltx.beanstack.org)

- Log into Beanstack and join the Maker Lab Challenge
- If you haven't created a Beanstack account:
  - Create an "individual" account
  - Join the Maker Lab Challenge
- Staff will register your orientation completion in Beanstack
  - Please allow for two business days
  - You will receive a confirmation email
  - You can now click on the rewards tab and make a Cricut and Heat Press reservation
- Join us for other orientations and get "badged" for all of our machines!





# Making a Reservation

## [ppltx.beanstack.org](http://ppltx.beanstack.org)

- AFTER you receive your confirmation email, log into Beanstack and return to the Maker Lab Challenge
- Click on the rewards tab to see your earned rewards. Follow the link to schedule your reservation.

**Maker Challenge**  
Ongoing Challenge

Overview Badges Rewards

0/4 Earned Rewards

- Reserve a 3D printer!  
Complete the 3D Printer Orientation to Unlock This Reward.
- Reserve a Cricut machine!  
Complete the Cricut Orientation to Unlock This Reward.
- Reserve a Laser Cutter machine!  
Complete the Laser Cutter Orientation to Unlock This Reward.
- Liability Walver Signed - You are ready to start making!  
Complete the Liability Walver to Unlock This Reward.

**RESERVED**