

3D PRINTING and PIXELS



Tom Hammond
tominohio@gmail.com
www.itwinkle.org



A PICTURE IS WORTH A THOUSAND WORDS

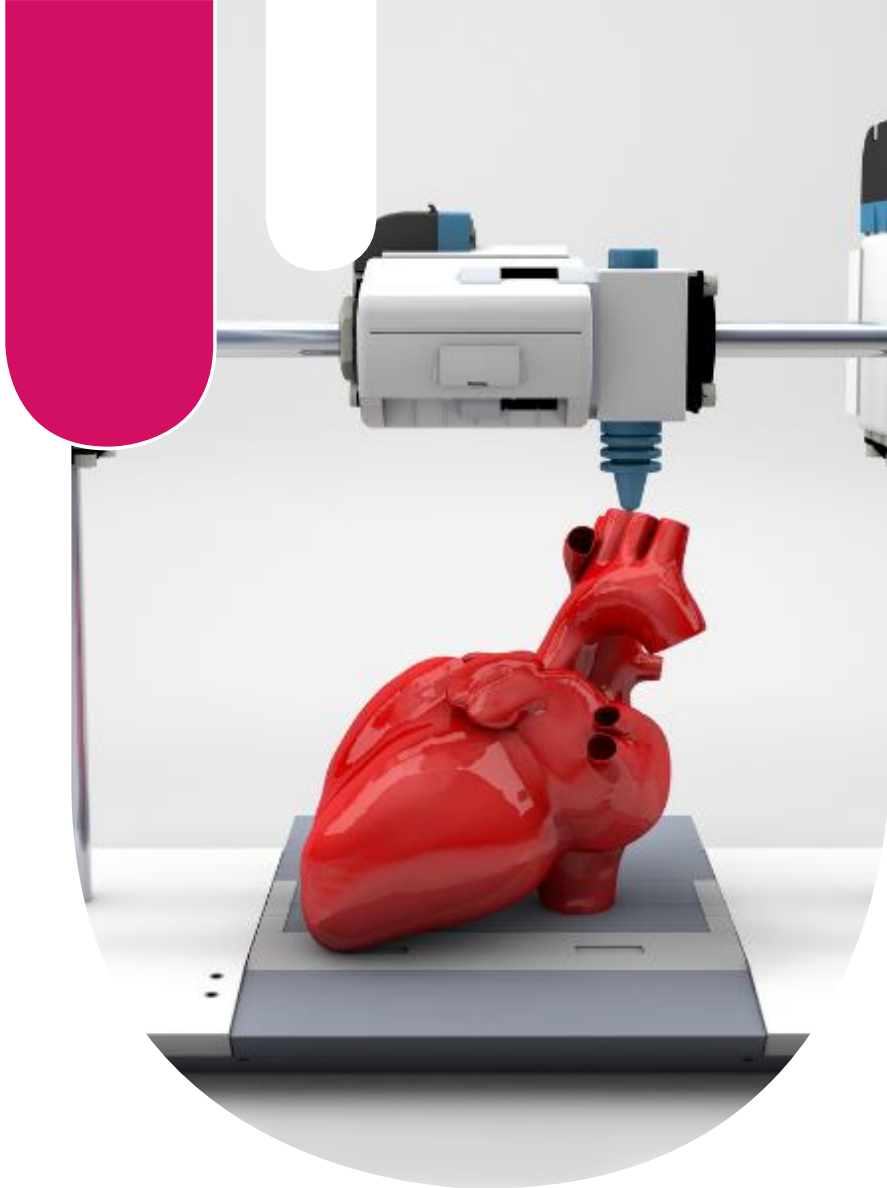


itwinkle.org > [Support](#) > [Christmas Lights Users Groups](#)



CONTENTS

- History
- How they work
- Christmas lights uses
- Print your own or buy
- Where to find them
- Design your own or buy
- Filament
- 3D printing software
- Printing tips
- Makerspaces



HISTORY

It's been around longer than you think!



HISTORY

- **First idea in 1980**
photo-sensitive resin & UV light
- **First patent in 1986**
Charles “Chuck” Hall of 3D Systems
- **Patent expired in 2009**
anyone can sell a 3D printer



HOW THEY WORK

From idea on computer screen to printed reality



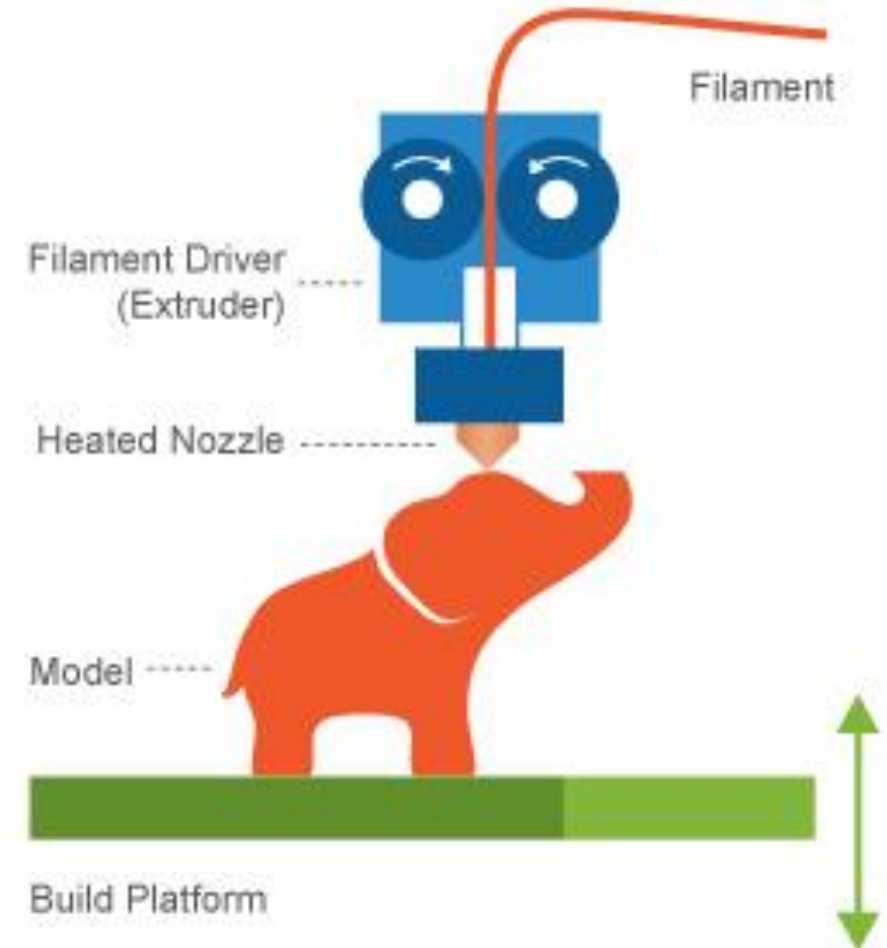
HOW THEY WORK

- **Similar ideas**
ice cream machine
glue gun
additive vs subtractive



HOW THEY WORK

- **Temperature**
nozzle up to 260°C
bed adhesion
- **Layers**
0.2mm common
thicker layers = faster



TRIVIA BREAK!

Which year was 3D printing patented with a device that was produced shortly after?

1986

1992

2007

2010

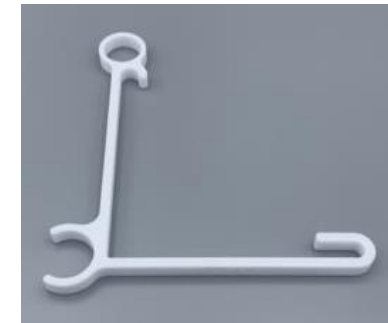
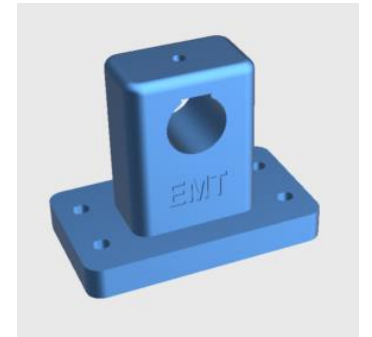
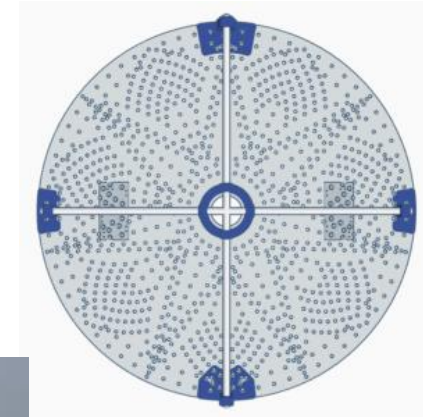
CHRISTMAS LIGHTS USES

How 3D printing can simplify and improve what you do



WHAT CAN YOU MAKE?

- **House clips**
Gutter, shingle, eaves, siding
- **Conduit attachments**
House mounts, pixel clips
- **Prop mounts**
House/yard mounts, coro braces



WHAT CAN YOU MAKE?

- **Tools**
Pixel pushers/jigs
- **New props**
Stars, spinners, candy canes
- **Modify traditional props**
Spiral trees, RBLs
- **Controller/power supply mounts**



3D PRINTING VS. TRADITIONAL

- **3D printing**
Small
Repetitive
Complicated
Custom
- **Traditional**
Large, strong parts



TRIVIA BREAK!

What type of 3D printer was first invented, patented, and produced?

Filament

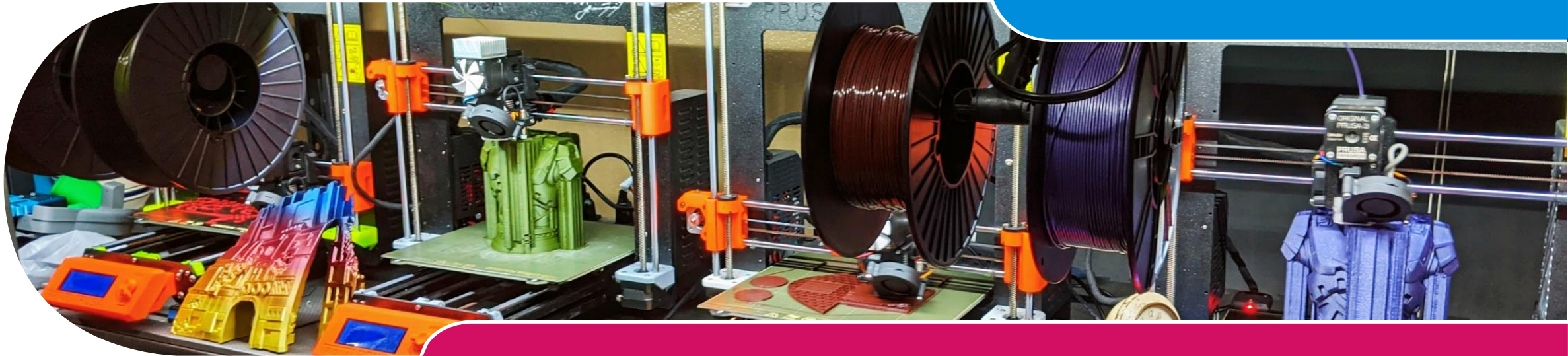
Polyjet

Sintering

Resin

PRINT YOUR OWN OR BUY

Should you own a 3D printer or buy parts preprinted?



PRINT YOURSELF OR PREPRINTED?

INDIANA MINI
LIGHT BUILDERS CONFERENCE

- **Buy a printer**

Printer & filament cost, machine repair/maintenance, time to print

- **3D printing services**

wide variety of materials

shapeways.com

craftcloud3d.com

treatstock.com

shapeways*



Craftcloud®



TREATSTOCK

WHERE TO FIND THEM

Buy, borrow, or build one yourself



WHERE TO FIND THEM

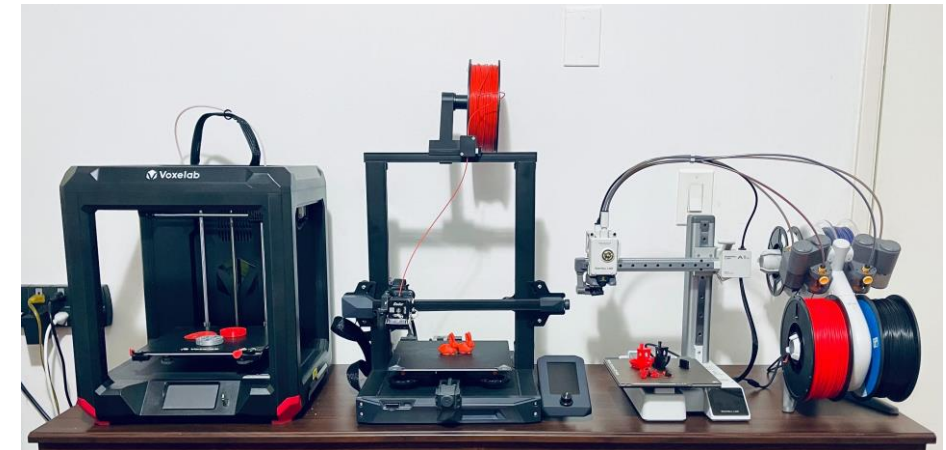
- **Where to buy**
Amazon, Micro Center
- **Best ready-to-run (Apple)**
Prusa, Bambu
- **Best budget/tinkering (Android)**
Ender
- **Buyer's guide: [All3DP.com](https://www.all3dp.com)**



WHAT TO LOOK FOR

- Open vs. enclosed
- Heated bed vs. enclosure
- Build volume
- Auto leveling
- Bowden tube vs. direct drive
- Nozzle temp

Up to 260C for PETG, 270 for ASA
Fast material flow for fast printing



TRIVIA BREAK!

What was the first object electronically sent to the Space Shuttle and 3D printed in space?

Screwdriver

Rocky

Ratchet

Pliers

DESIGN YOUR OWN SHAPES OR BUY

Making custom parts yourself or buying premade ones



WHERE TO FIND SHAPES

INDIANA MINI
LIGHT BUILDERS CONFERENCE

- **Facebook**

[Official xLights Sharing Group](#)

[Official xLights Support Group](#)

[3D Printing For True Holiday Light Enthusiasts](#)

[3D Printing For Holiday Lighting Enthusiasts Group.](#)

- **3D printing repositories**

thingiverse.com ([DIY Christmas](#))

printables.com

makerworld.com



WHERE TO FIND SHAPES

INDIANA MINI
LIGHT BUILDERS CONFERENCE

- Christmas lighting vendors

Flash The Neighbors

Inspire Light Shows

JustinZDesign

SFL Designs

Your Pixel Store



INSPIRE
LIGHT SHOWS



DESIGNING SHAPES



INDIANA MINI
LIGHT BUILDERS CONFERENCE

- **Beginner 3D design software**
tinkercad.com
 - **Next-level software**
Fusion 360
(free personal/hobbyist license)
- YouTube is a great way to learn!*



TRIVIA BREAK!

What was the first 3D printed object on the first commercially made 3D printer?

Eyewash cup

Machining jig

Control knob

Gumby

FILAMENT

Choosing the correct filament for your needs



FILAMENT TYPES

- **PLA**
Low temp, brittle, outside maybe, easy to print
- **ABS**
High temp, strong, outside friendly, not UV safe, warping & cracking
- **PETG**
High temp, strong, outside friendly, UV safe, somewhat easy to print



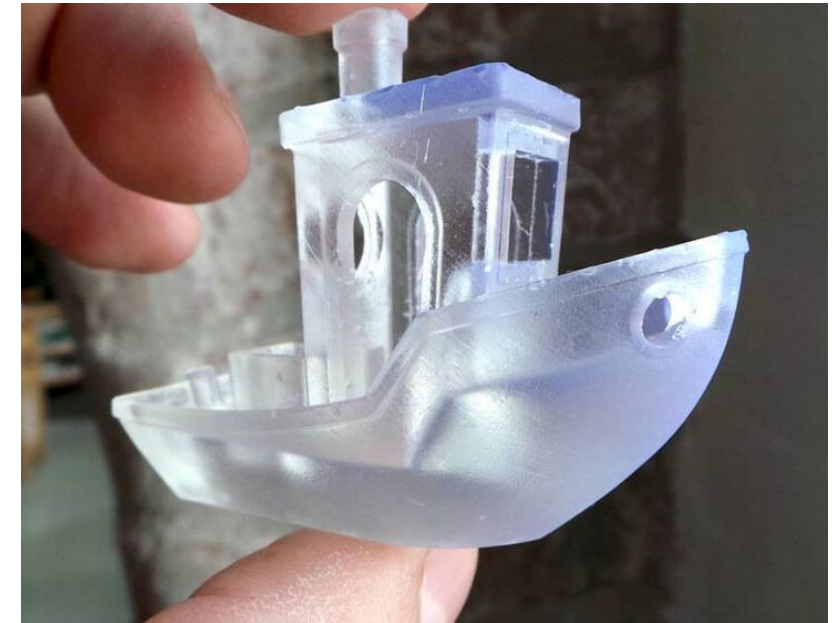
FILAMENT TYPES

- **TRANSPARENT**

Tricky to get “clear”, PLA/PETG, nozzle temp, fan cooling, thin layers, vase mode

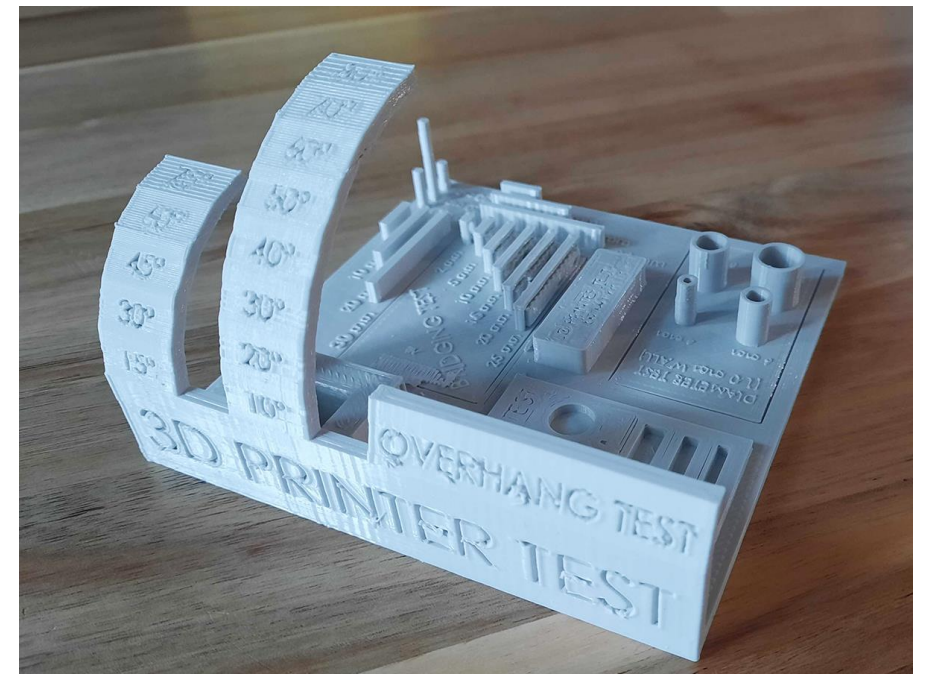
- **TPU**

Rubber-like, shore hardness, very strong, NinjaFlex



FILAMENT CALIBRATION

- **Temperature**
Drooping, layer fusing
- **Speed**
Under extrusion, layer separation
- **Flow**
Bulging, under extrusion
- **Retraction**
Stringing, under extrusion



FILAMENT CARE

- Filament absorbs moisture
PETG the worst
- Becomes brittle & snaps
- Store in sealed bag with desiccant packet
- Dry in oven (low temp) or food dehydrator



TRIVIA BREAK!

What was the first 3D printed and successfully transplanted human organ?

Windpipe

Bladder

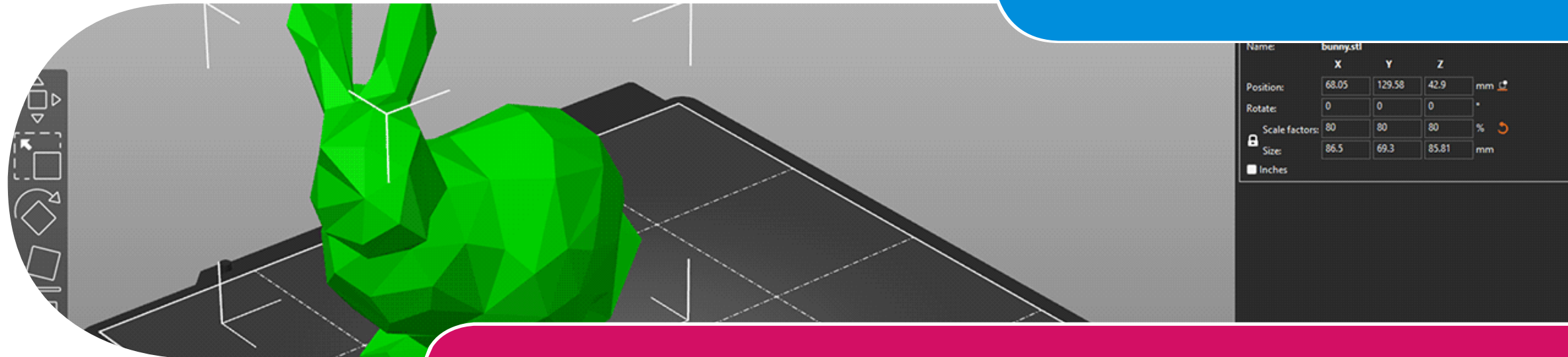
Heart

Ear



3D PRINTING SOFTWARE

Sending shapes from your computer to the printer



3D PRINTING SOFTWARE

- **“Slicer”**

Converts shape (.STL file) into printer movements
(.gcode file)

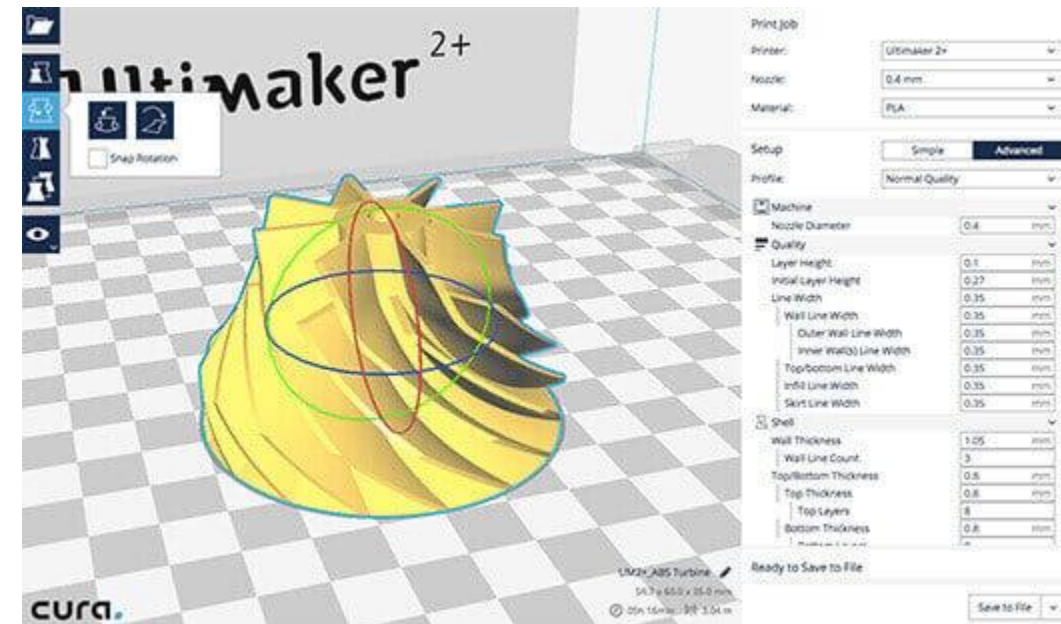
Come with printer

- **Types**

Proprietary

Universal

Cura, PrusaSlicer, others



3D PRINTING SOFTWARE

- **Common software settings**

Infill

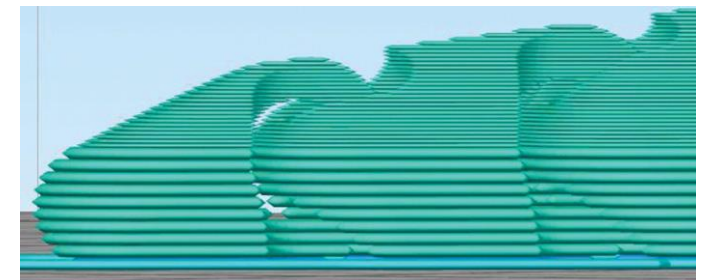
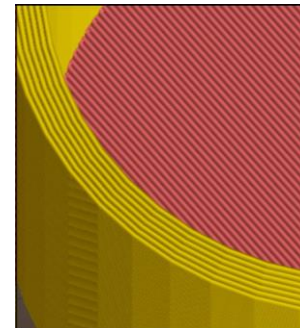
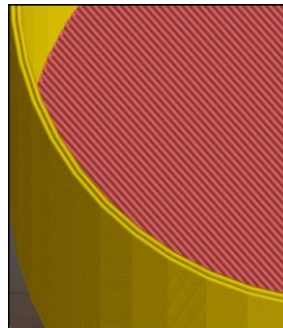
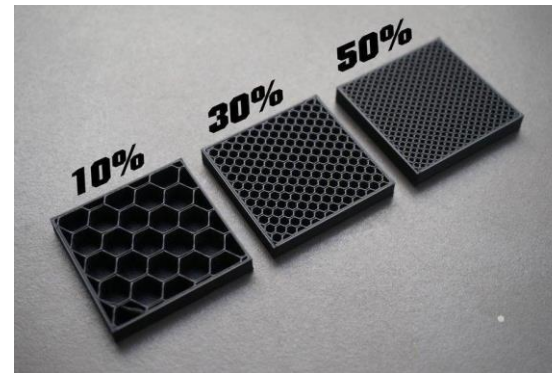
Supports

Perimeters, vertical shells

Layer height

Filament type

Your favorites?



PRINTING TIPS

Advice for successful 3D printing



FIRST LAYER IS IMPORTANT!

- **Bed type**

Glass (PETG sticking issue)

PEI (powered coat vs. laminate)

Rigid, flexible, magnetic, steel

- **Adhesion**

Glue stick, Kapton tape, painter's tape, hairspray, none



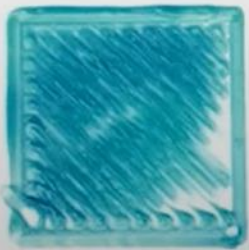
Bed Leveling

Billy Ruben - <https://tinyurl.com/2bu4drst>



X MUCH TOO CLOSE

Filament extrudes thin or not at all in some places, often bulging out in others. Extruder motor might slip/click



X A LITTLE TOO CLOSE

Filament bulges out of the sides of the nozzle which squishes into other lines, sometimes causing a pattern



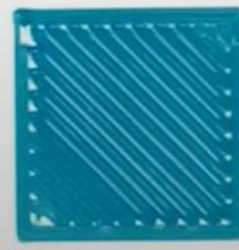
✓ PERFECT

Filament is flattened, adheres well to nearby lines, no gaps or peaks between lines



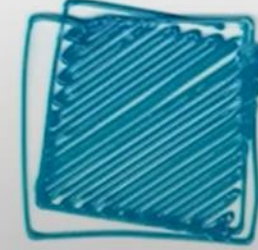
X A LITTLE TOO FAR

Filament appears rounded, connection between lines is loose, gaps may appear



X MUCH TOO FAR

Filament is totally rounded, little to no connection between lines, doesn't stick to bed



Optimal gap is two sheets of 20-weight (standard thickness) paper

Nozzle too low, elephant's foot, affects layer fusion

Filament must slightly "squish" into bed

Nozzle too high, part comes loose during printing

FIRST LAYER IS IMPORTANT!

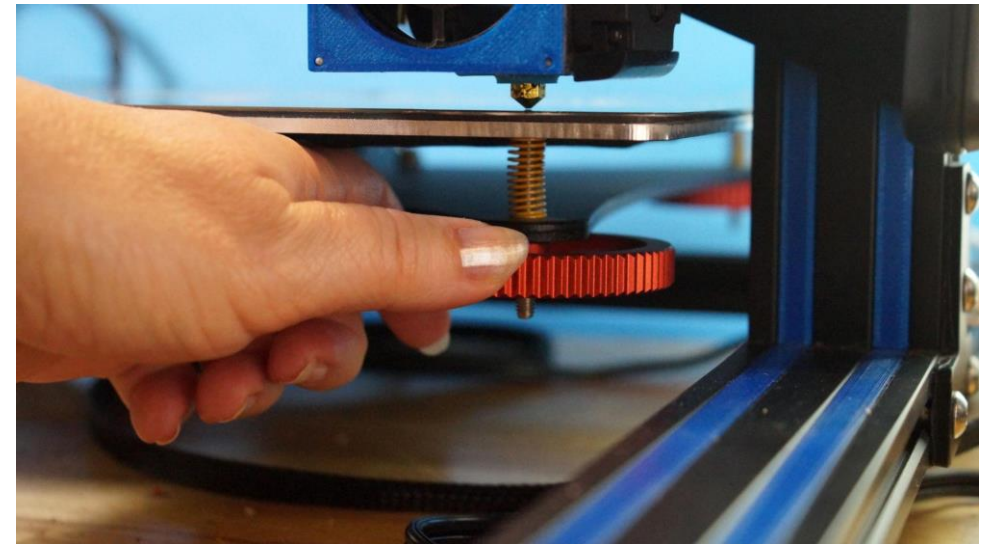
- **Prep**

*Level bed (manual/probe/
load cell)*

Skirt/brim/raft

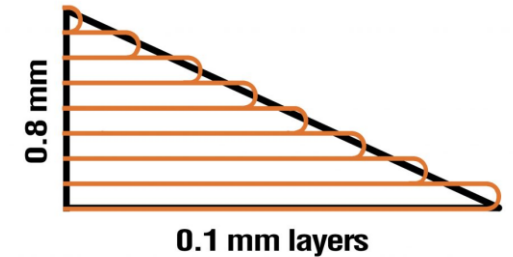
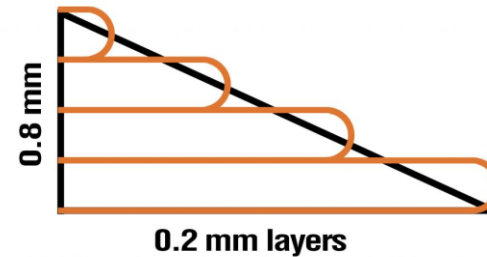


*Clean surface
(hand oil, rubbing alcohol, Dawn dish soap)*



PRINTING LARGE OBJECTS

- **Nozzle size**
fewer layers, less detail, 0.04-1.0+mm, high-temp heat block
- **Filament difficulty**
PLA → PETG → ABS → ASA
- **Heated enclosure**
Reduce warping & cracking



PRINTER CALIBRATION

- Needed for “budget/tinker” printers (Creality)

X Y Z axis steps

E steps

*As simple as using
a ruler & calipers*



TRIVIA BREAK!

In the James Bond movie Skyfall, which vehicle was 3D printed full-size for 3 explosion scenes?

Aston Martin DB5

Yugo

Jaguar X-X75

Mercedes S400

MAKERSPACES

Be part of the maker movement!



MAKERSPACES

- **Traditional and modern tools**
Wood/metalwork, 3D printers, laser cutters, electronics, sewing
- **Classes & workshops**
- **Make friends, build community**
People of different backgrounds helping each other



MAKERSPACES

The logo for the Indiana Mini Light Builders Conference features a stylized map of Indiana. The map is composed of a grid of lines, with several points on the grid connected by lines to form a circuit-like pattern. At the ends of these lines are small, colorful light bulbs in shades of yellow, orange, and blue. The text "INDIANA MINI" is written in a bold, sans-serif font above the map, and "LIGHT BUILDERS CONFERENCE" is written in a smaller, all-caps font below it.

INDIANA MINI
LIGHT BUILDERS CONFERENCE

- **Area Makerspaces**

*Sears think[box] at
Case Western Reserve University*

- *50,000-square-foot facility*
- *Space & tools for any project
from electronics to blacksmithing*
- *Free and open to the public*

case.edu/thinkbox

The logo for think[box] consists of the text "think[box]" in a white, lowercase, sans-serif font. The text is centered within a dark blue rectangular background.

think[box]



MAKERSPACE COMMUNITY



- **Area Makerspaces**

- Akron Makerspace*

- *3D printers, laser cutter, metalsmithing, welding, CNC router*
 - *\$40/month membership*

akronmakerspace.org

AKRON
MAKERSPACE



MAKERSPACES

- **Area Makerspaces**

Libraries

- *Cleveland Public Library
TechCentral*

cpl.org/location/techcentral

- *Akron Public Library
TechZone@Main*

akronlibrary.org/locations/main-library/techzone-main



WANT TO KNOW MORE?

Get more information about 3D printing




WANT TO KNOW MORE?

The logo for the Indiana Mini Light Builders Conference features a stylized outline of the state of Indiana. Inside the outline, there is a circuit board pattern. The text "INDIANA MINI" is written in a bold, sans-serif font across the top of the state outline, and "LIGHT BUILDERS CONFERENCE" is written in a smaller font below it. The logo is set against a background of colorful, glowing light bulbs in shades of blue, green, and yellow.

INDIANA MINI
LIGHT BUILDERS CONFERENCE

- **All3DP.com**
get on their mailing list
- **Facebook support groups**
- **Makerspaces**

The All3DP logo consists of the text "All3DP" in a large, white, bold, sans-serif font, with the "3" being a stylized number. Below it, the text "ALL ABOUT 3D PRINTING" is written in a smaller, white, all-caps, sans-serif font. The entire logo is centered on a solid blue rectangular background.

All3DP
ALL ABOUT 3D PRINTING





OHIO
LIGHTING
MINI

QUESTIONS?



THANK YOU!

Tom Hammond

Phone

330-658-3872

Email

tominohio@gmail.com

Website

itwinkle.org

