

LASER-CUT PUZZLES



design custom jig-saw puzzles using:

TinkerCAD

+

puzzle generators

+

TTU Makerspace's Glowforge Plus

+

Glowforge draftboard

2024

Who am I?

Sean W Scully

Lead Administrator – TTU Libraries Makerspace

Rhino3D, TinkerCAD, AutoCAD Inventor, Fusion360, Blender, Solidworks
MakeCode, Python, Scratch, C++, C, MATLAB, Arduino, JavaScript, Assembly, Verilog,
Xilinx

MFA, Studio Art – Metals/Jewelry/Enameling, Kent State Univ

BFA, Studio Art – Metalsmithing/Jewelry Design, TTU

AA, Fine Arts, South Plains College

[linkedin.com/in/seanwscully](https://www.linkedin.com/in/seanwscully)



Who am I?

Jake Syma

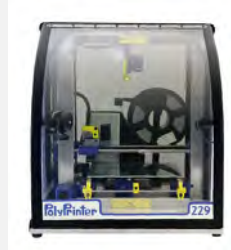
Associate Librarian – Technology Services
TTU Library Emerging Technology

VR/AR/XR, Data Visualisation, TinkerCAD

jake.syma@ttu.edu

Welcome to the TTU Library's Makerspace!!

Makerspace:
Main Library, 2nd floor, room 210



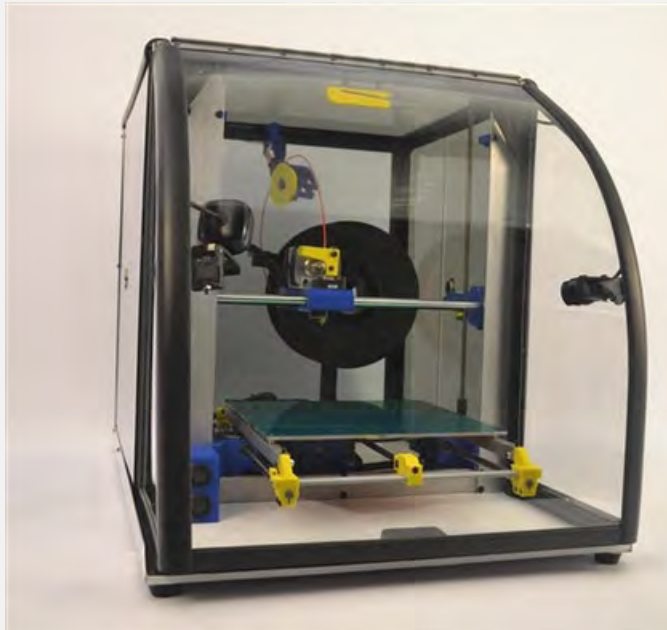
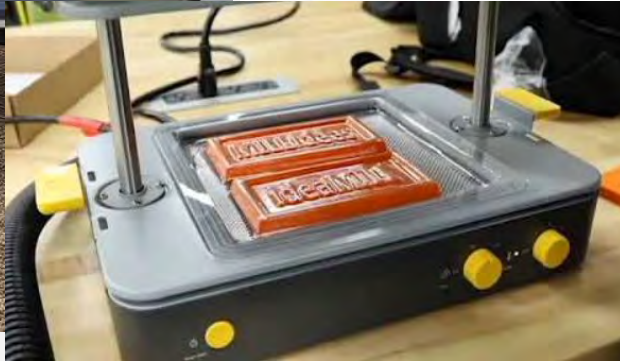
VR Lab:
Main Library, 2nd floor, room 201A



make@ttu.edu

<https://www.depts.ttu.edu/library/make/>





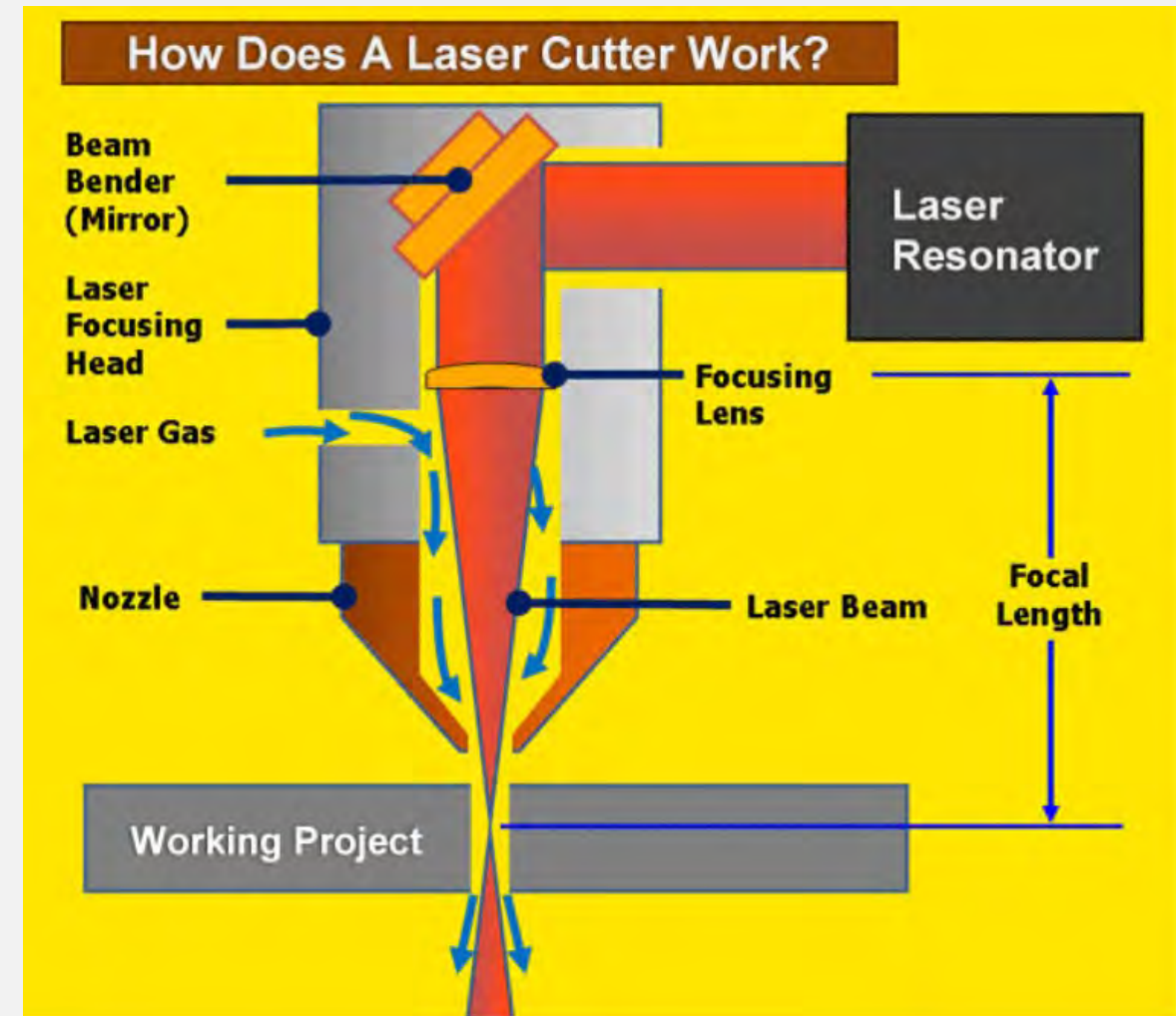
- Cricut Maker
- Glowforge Lasercutter
- Matter&Form 3D Scanner
- PolyPrinters 229 & 508
- Ultimaker 3, S7
- Sewing machines



- Robo Kits (15)
 - *Adafruit's Circuit Playground Express (CPX)*
 - *Adafruit's Crickit robotic control board*
 - *geared motors (2), micro servo*
- ElectroSoldering Kits (5)

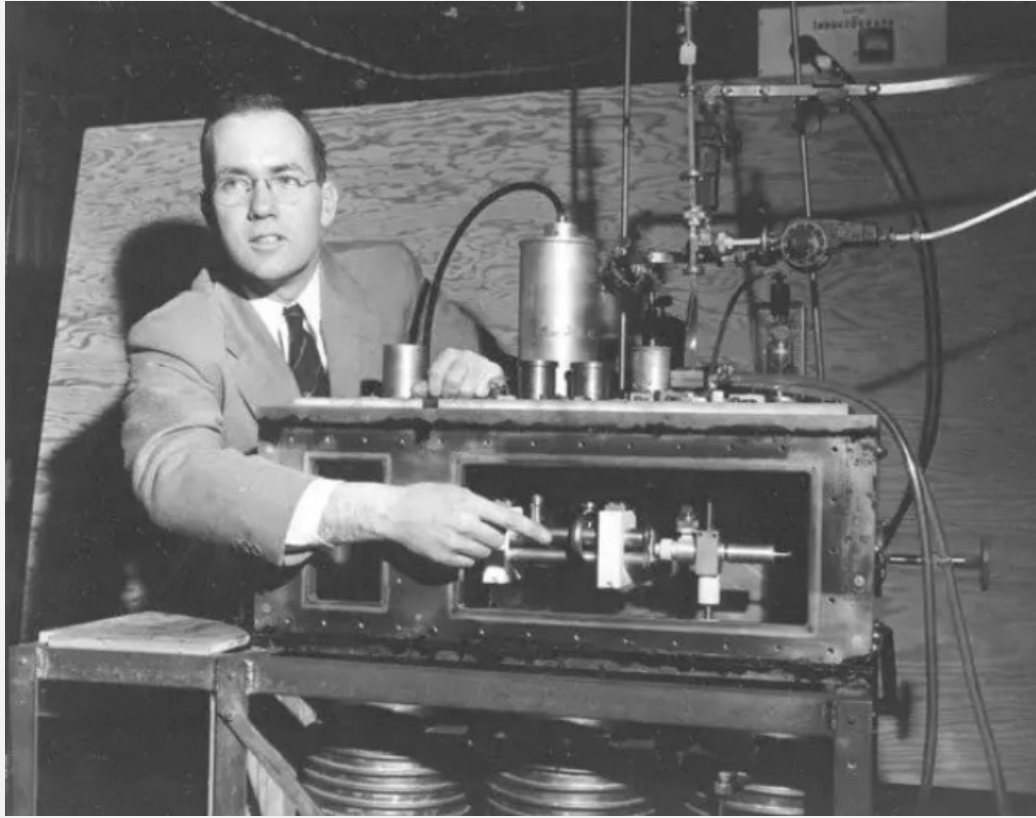
what is a lasercutter?

- CNC – computer numerical control
 - motors control x,y axis movements
 - beam is variably powered
 - cooling and exhaust system
- subtractive vs. additive
 - burns away material – engraver/cutter
 - fuses ink onto a material – laser printer
- laser beam types/categories/sources
 - CO2
 - fibre
 - UV – ultraviolet
 - plasma beam
 - diode – highpower LED
- uses adjustable mirrors and lenses to focus the beam



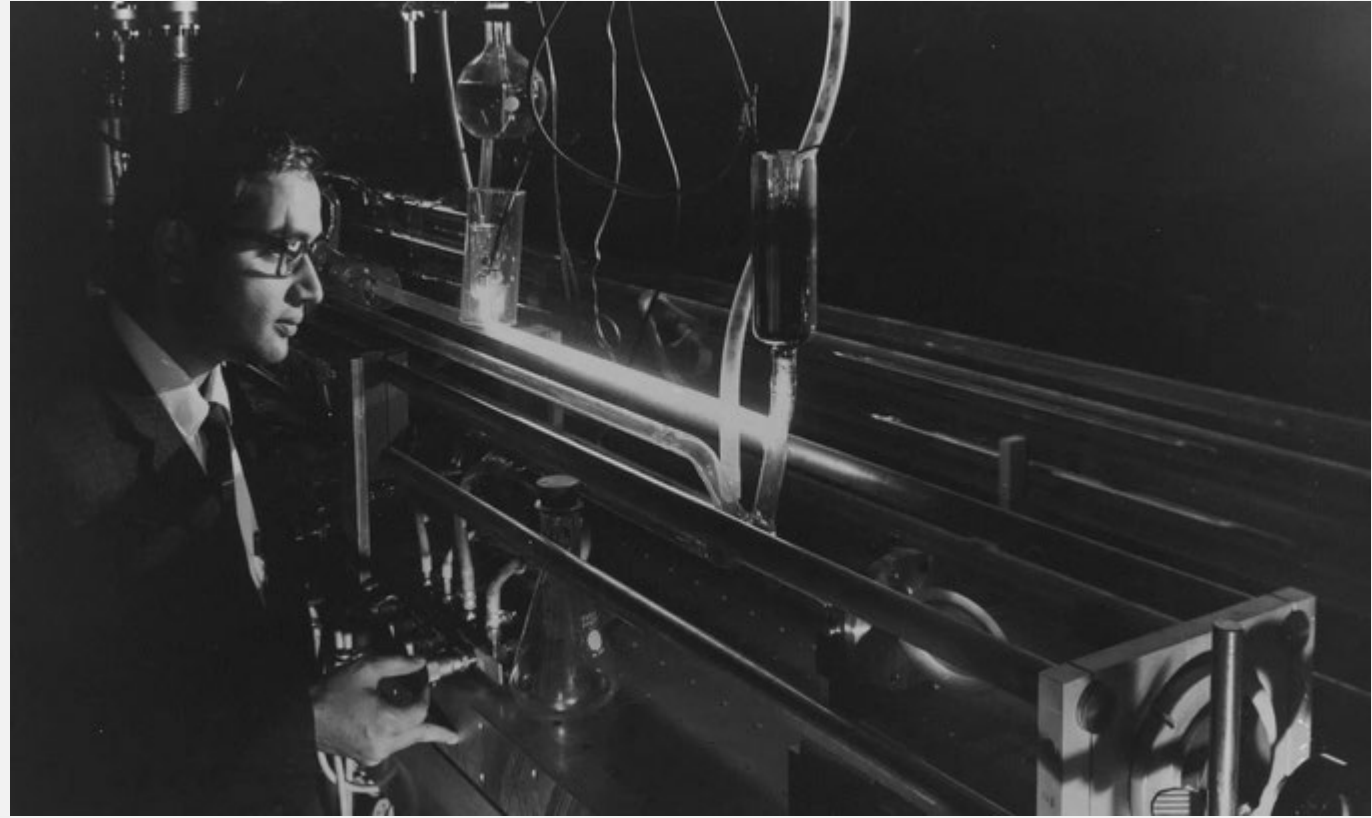
lasercutting history

- MASERs (1950s) vs LASERs (1960s)



Charles Townes

MASER - Microwaves Amplification by Stimulated Emission of Radiation



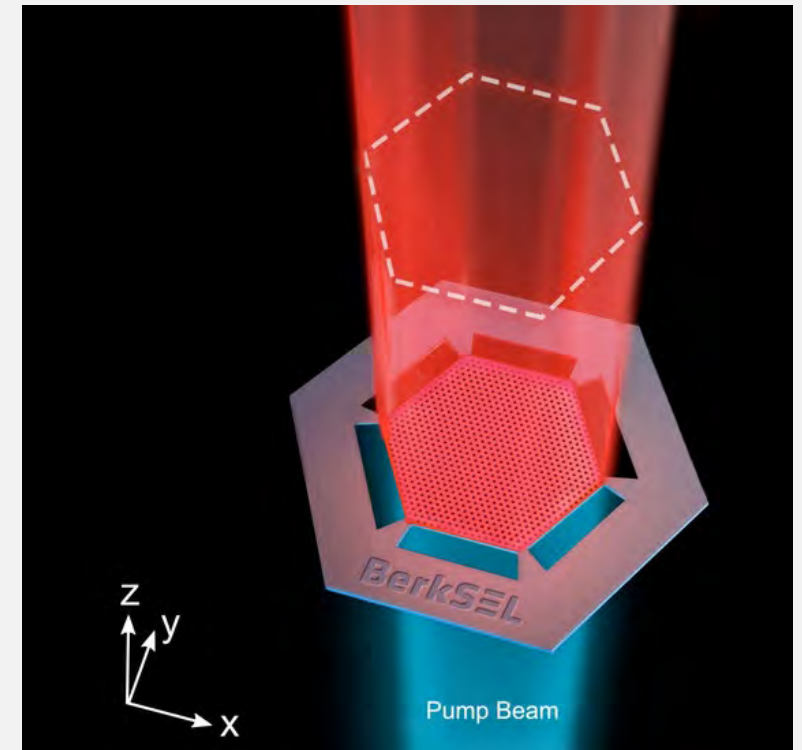
Kumar Patel

LASER - Light Amplification by Stimulated Emission of Radiation



lasercutting into the future

- Einstein, *On the Quantum Theory of Radiation* (1917)
- synthetic ruby (1950s)
- CO₂ & gas-based (1960s)
 - *titanium, diamond, ceramics*
- Fibre (1980s–2007)
 - *super thick steel*
- BerkSEL (2022)
 - *Berkeley Surface Emitting Lasers*
 - *semiconductor membrane-based*





what materials can the Glowforge Plus cut/engrave?

- paper
- wood
 - plywood
 - veneer
 - draftboard
- acrylic
- leather
- fabric
- metal
- stone (shale)





where to find materials for the Glowforge Plus?

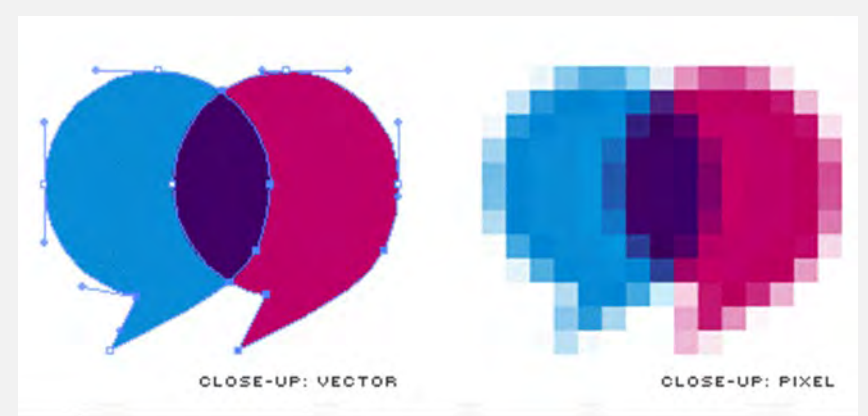
- Glowforge Website - recommended
 - <https://shop.glowforge.com/>
- local hobby shops
 - Michaels/HobbyLobby
 - Walmart/DollarTree/DollarStore
 - Joann's Fabrics
- local consumer/prosumer wood suppliers
 - Acacia Hardwoods – recommended (<https://www.acaciahardwoods.net/>)
 - Lowes/Home Depot
- online suppliers
 - Amazon.com
 - DickBlick.com





file types

- why is a JPG not an SVG?



Vectors

Pixels

Bitmap/Raster/Pixels vs. Vector Graphics

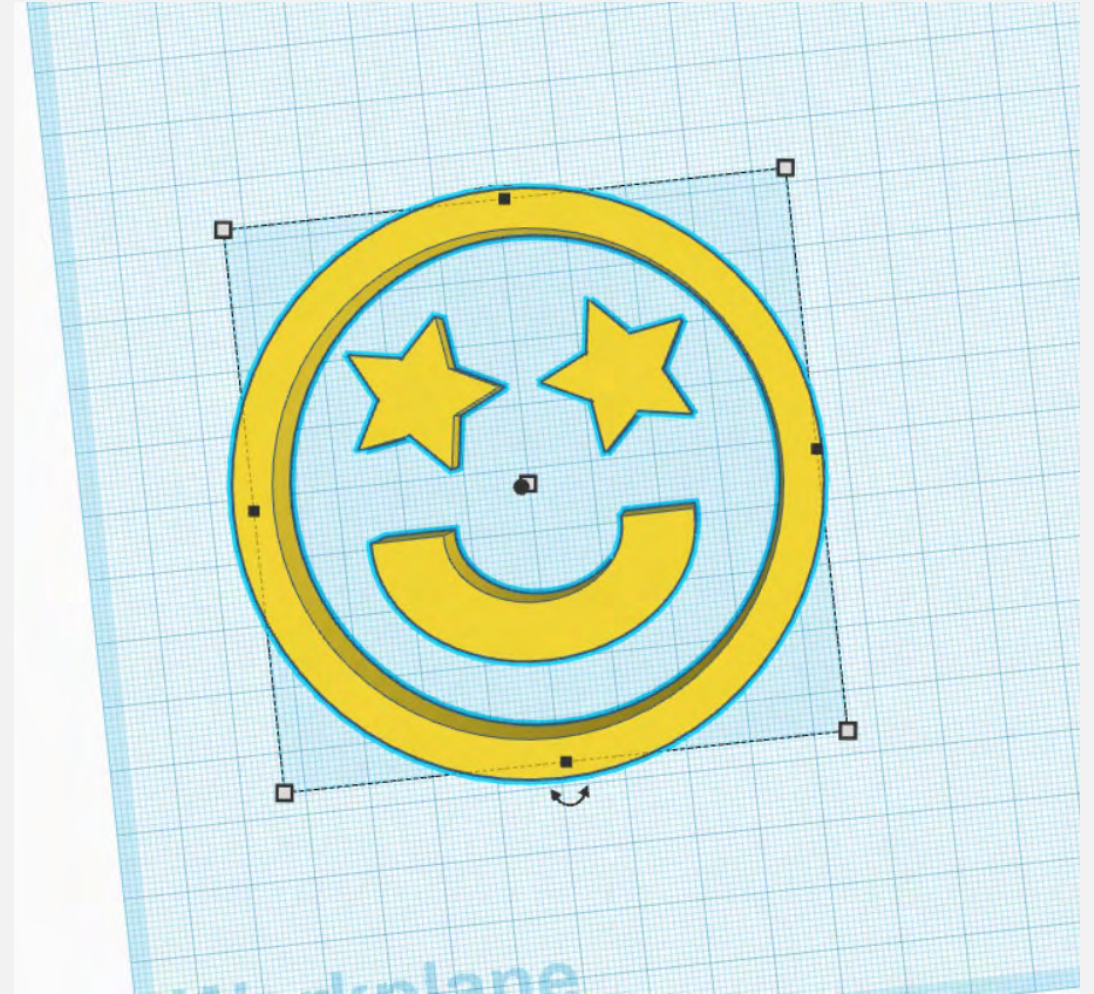
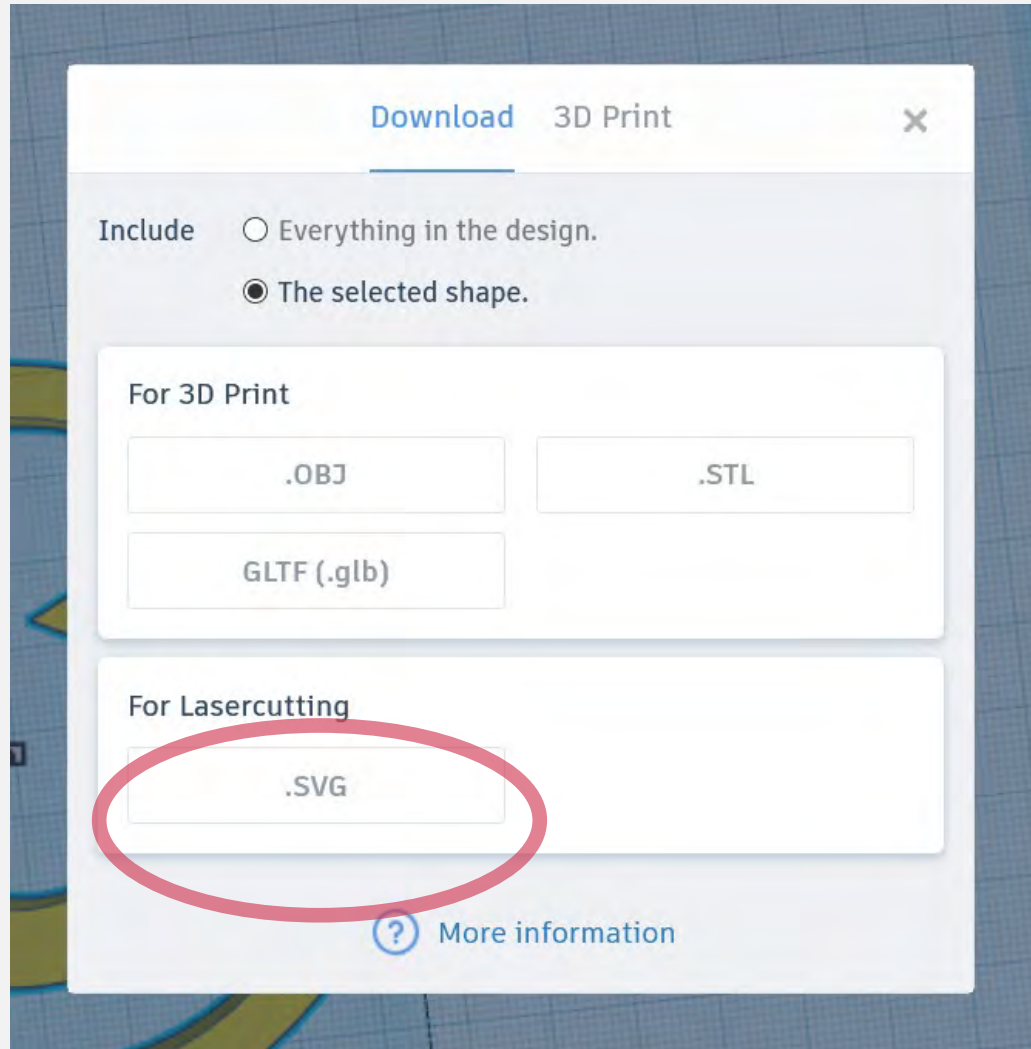
- Bitmap (JPG, GIF, PNG):
 - made of dots/pixels that distort when the image is scaled
- Vector (SVG, AI, PDF):
 - calculation of points connected with lines that will not lose clarity when scaled up or down (math path)

software – freeware: TinkerCAD



- free online Autodesk CAD software, simplified for kids
- runs in your browser – Chrome/Firefox
 - <https://www.tinkercad.com/>
- complex and simple shapes available for remixing
- export file options
 - *SVG – lasercut or Cricut Maker it*
 - *STL – 3D print it*
 - *glb/glbTF – 3D model optimized for web design*

software – freeware: TinkerCAD



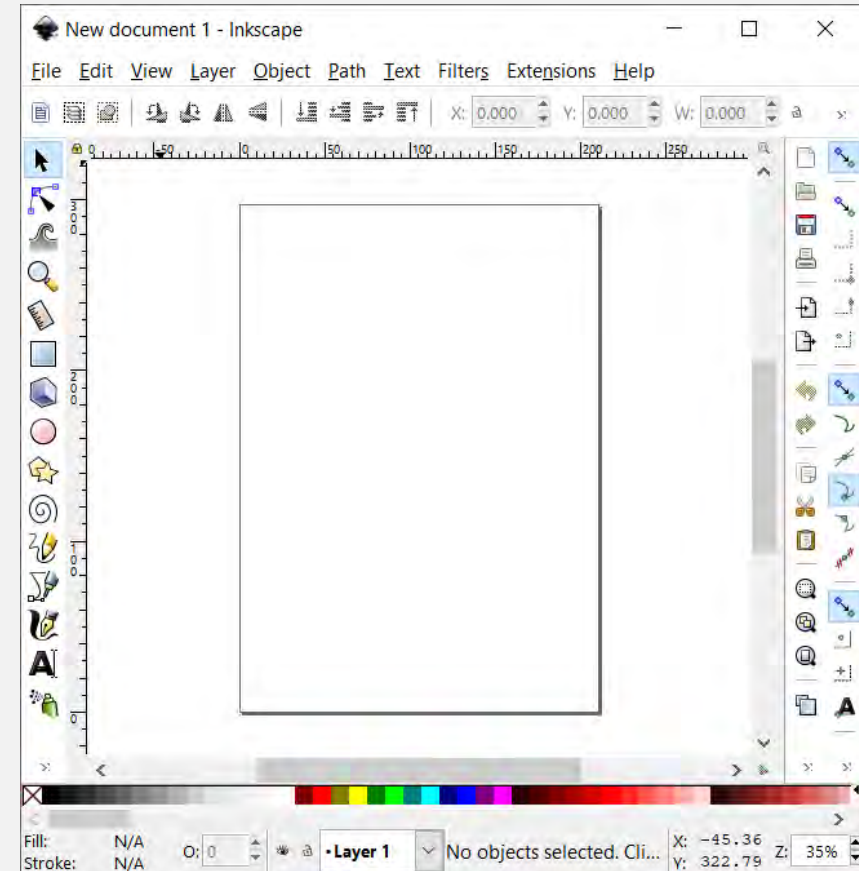
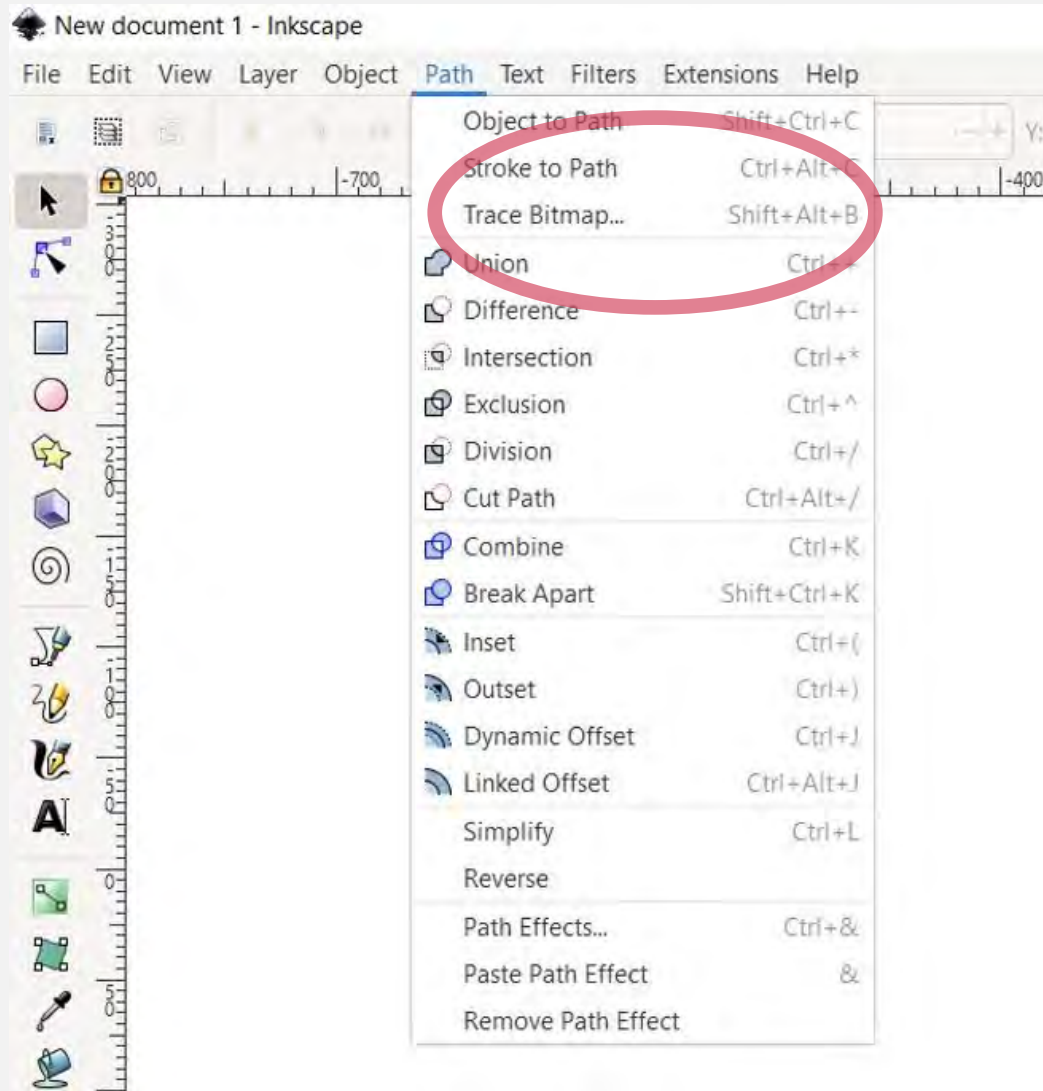
- all objects the same height (5-10mm)

software – freeware: Inkscape



- free offline vector graphic software
- Illustrator-style program
- install software from
 - <https://inkscape.org/>
- importing images to make custom SVG files
- trace your vector design over an existing image
- start a vector drawing from scratch

software – freeware: Inkscape



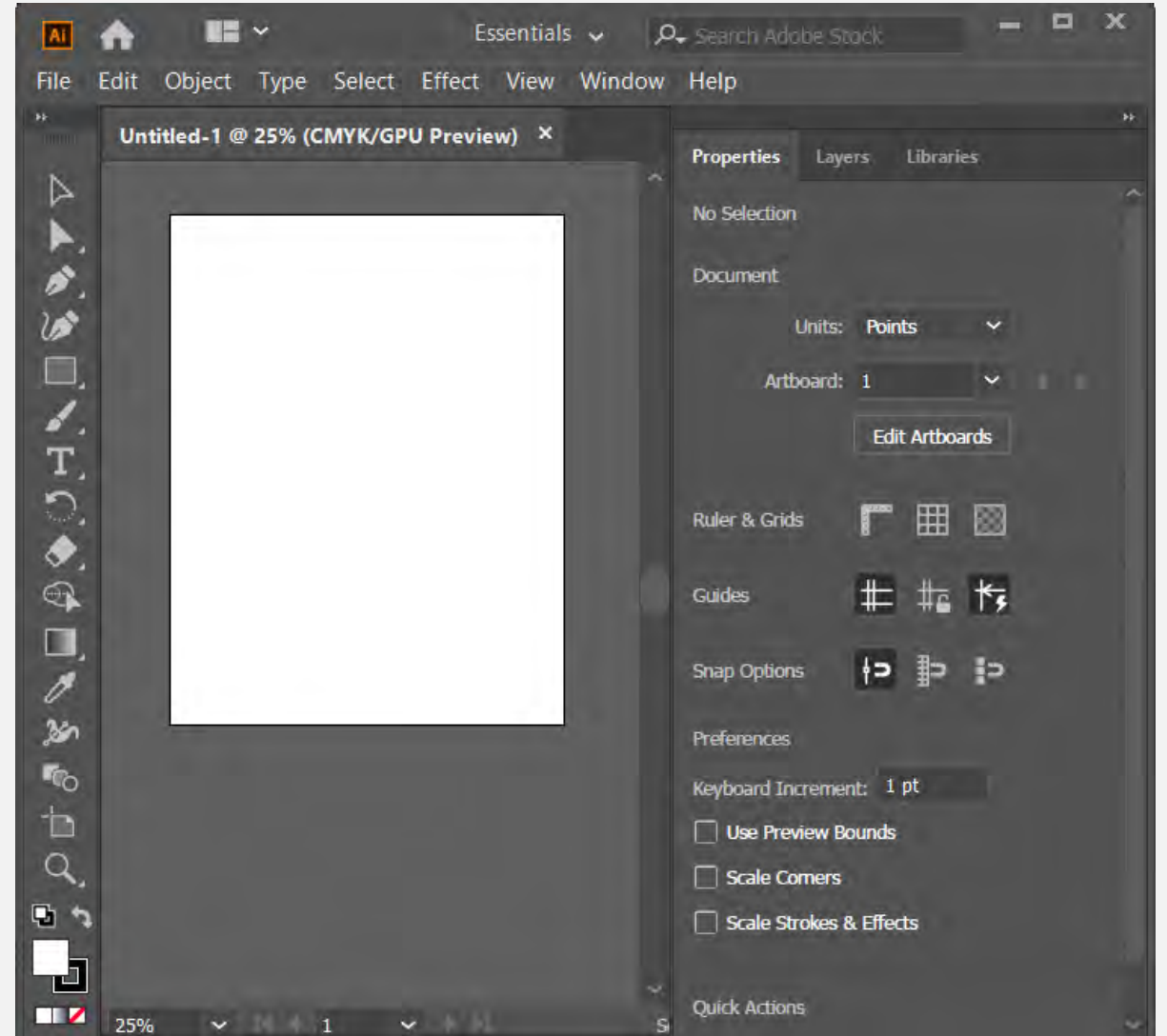
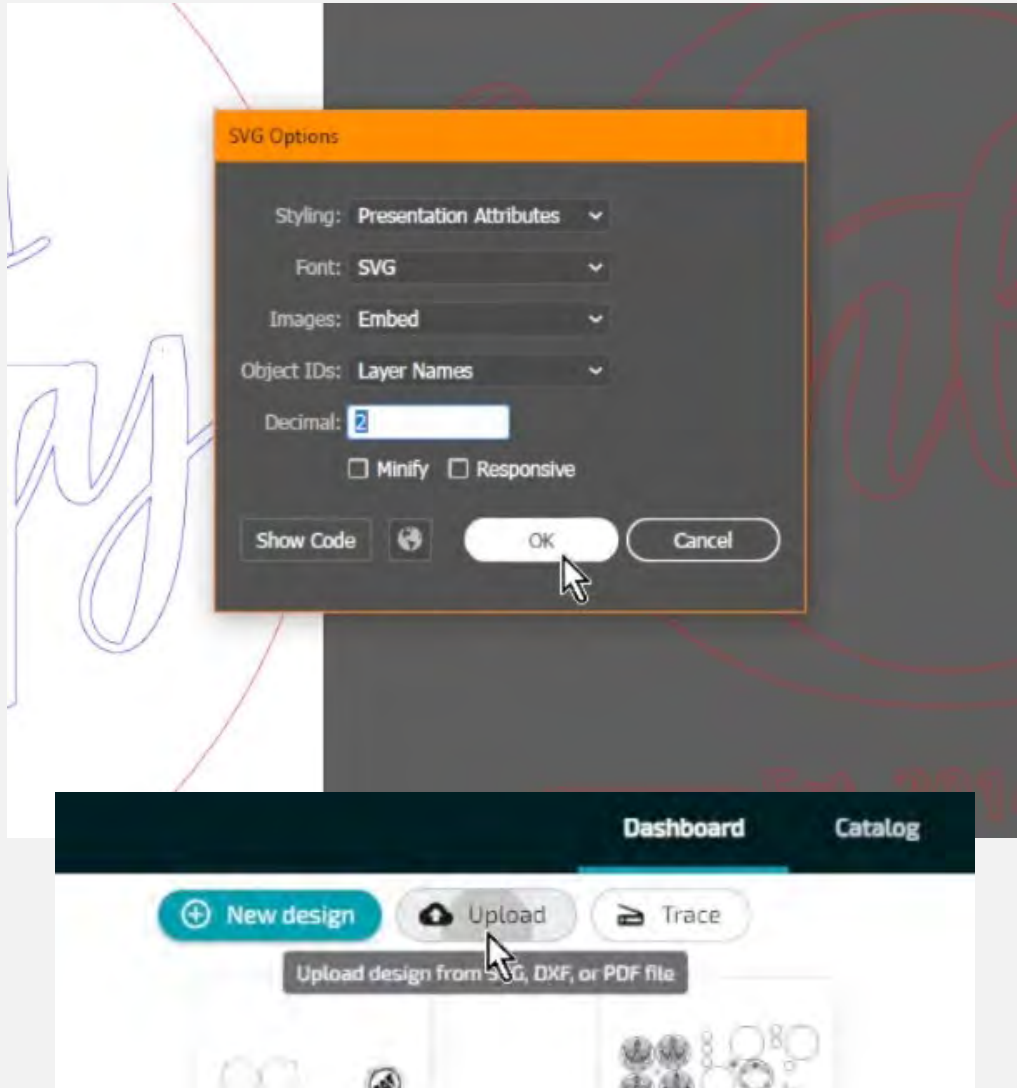


software – Adobe Illustrator

- offline vector graphic design software
- wide array of tools available
 - *fonts/Lettering*
 - *graphic effects/textures*
 - *starting a vector drawing from scratch*
- export as
 - *bmp, png, or jpg file*
 - *SVG is possible, but can be complicated*
- install software from your Adobe account (free/low cost for students)



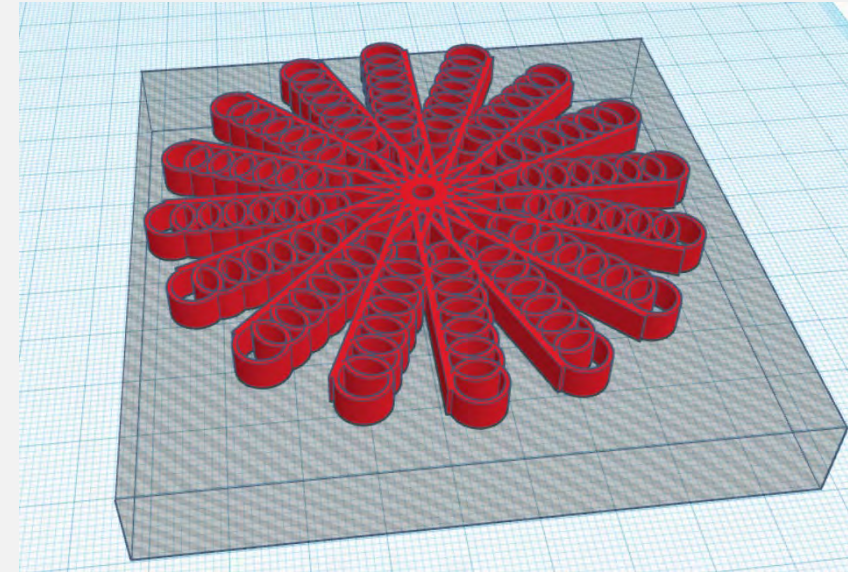
software – Adobe Illustrator



let's get started – TinkerCAD!!



- setup TinkerCAD account
- design your puzzle image (draw on paper first)
- build your design in TinkerCAD
 - *outline* (outside edge for reference)
 - *text/design/logo* (engraved design/image)
- export your design (.SVG files)
 - *text/design/logo* (engraved design/image)
- email your design files to make@ttu.edu
 - *subject: "LaserCut Workshop"*






let's get started – puzzle generators!!


- Websites (<https://tinyurl.com/laserpuzzlegen>)
- <https://gists.rawgit.com/Draradech/35d36347312ca6d0887aa7d55f366e30/raw/b04cf9cd63a59571910cb226226ce2b3ed46af46/jigsaw.html>
- <https://zvikabenhaim.appspot.com/software/jigsaw-svg/?#>
- **Dimensions** (we will keep them simple, small, and fast today)
 - *100mm x 100mm*
 - *Pieces: 3 x 3 (keep pieces large enough that you don't lose the design)*
- let's cut some puzzles!




puzzling generators!!

- Dimensions
 - *(simple, small, and fast today)*
 - *100mm x 100mm*
 - *Pieces: 3 x 3*
 - *(large enough that you don't lose the design)*
- <https://tinyurl.com/laserpuzzlegen>
- let's cut some puzzles!

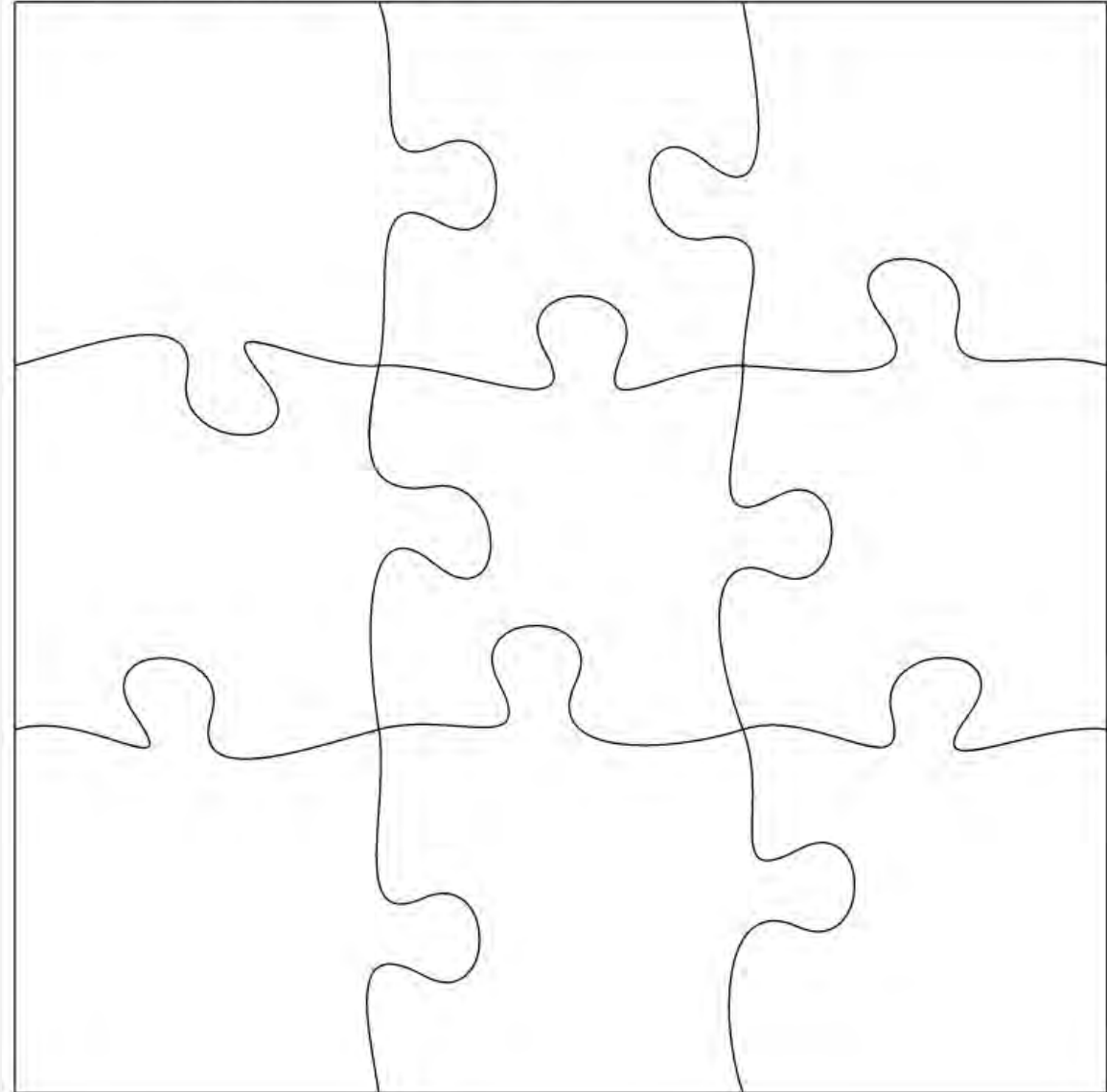
Seed: 

Tab Size: 

Jitter: 

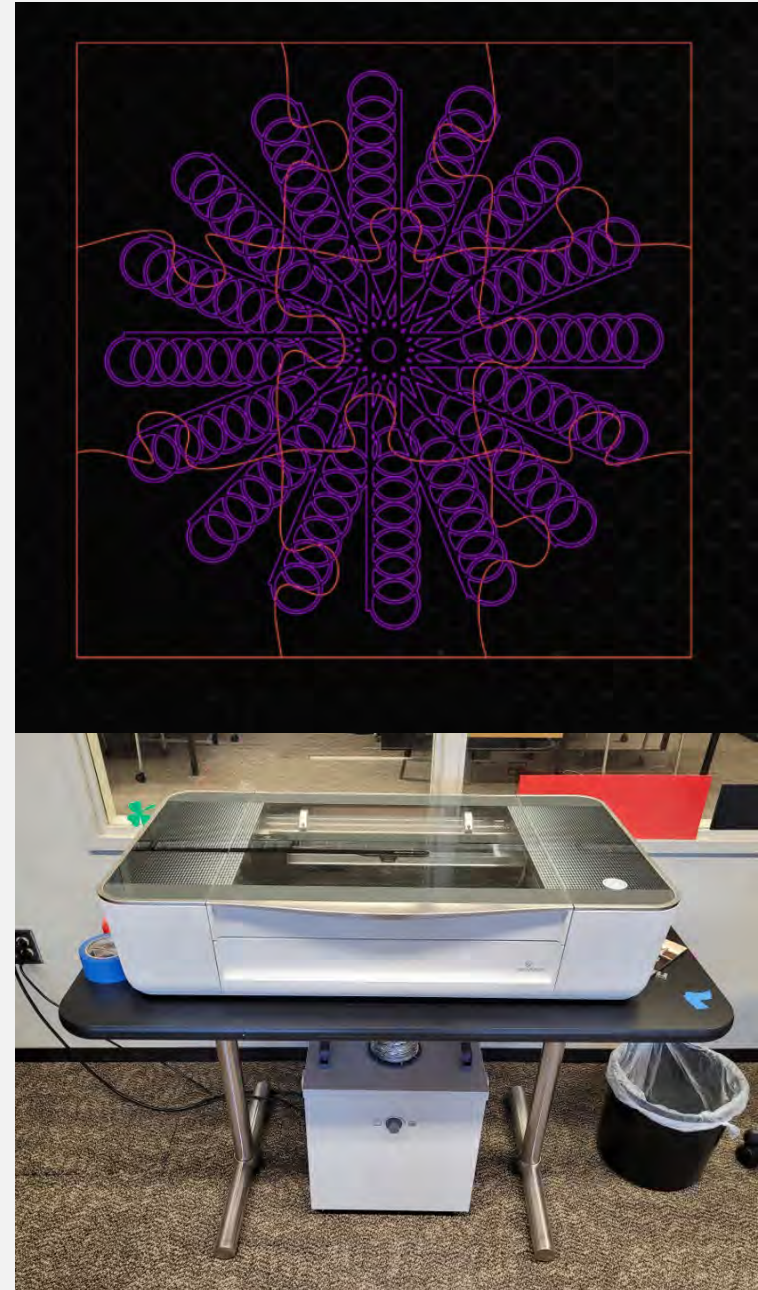
Tiles: x

Size: x mm [Download SVG](#)



using Makerspace's *Glowforge Plus*

- arrange a \$2.00/hr appointment time to work
- send us your files to ensure they work
- grab your materials
- have fun!
- brainstorm by exploring Glowforge's project guides
 - <https://glowforge.com/discover/>
 - <https://community.glowforge.com/>
- explore Glowforge's professional-grade materials
 - <https://shop.glowforge.com/>

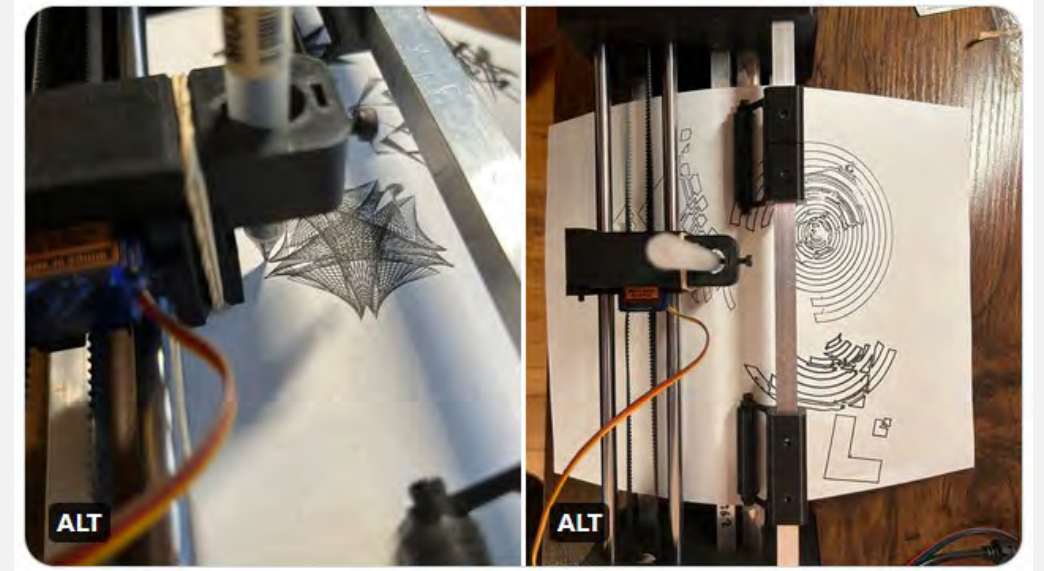


moving forward

- The Staff and Student Assistants in the Makerspace are here to help!
- There are O'Reilly video and text tutorials available to help learn the more advanced software (TinkerCAD, Inkscape, etc.) through Library Databases:
 - *Search for "oreilly" @*
 - <http://texastech-mt.hosted.exlibrisgroup.com/V/?func=find-db-1>
- <https://inkscape.org/learn/tutorials/>
- Makerspace's Inkscape Workshop: <https://guides.library.ttu.edu/inkscape>
- trace bitmap image in Inkscape for Glowforge
 - <https://www.youtube.com/watch?v=UY6diLQl4cY>
- Glowforge and lasercut
 - https://www.youtube.com/watch?v=dP5Qnp_2igk

lasercutting - *onward*

- explore
 - *“plottertwitter”*
 - *Op Art*
 - *“generative design”*
- as springboards to the next level consider
 - *line quality*
 - *composition*
 - *other design elements*
- make mistakes, learning is messy





lasercutting – *inspiration*

hobby electronic projects

- <https://learn.adafruit.com/search?q=lasercut>

make boxes, looms, and cases!

- <https://www.instructables.com/The-Ultimate-Guide-to-Laser-cut-Box-Generators/>
- <https://festi.info/boxes.py/>
- <https://www.makercase.com/>
- <https://makeabox.io/>
- <https://talk.vanhack.ca/t/laser-cut-inkle-loom-project/5503>

other project generators – even puzzles

- <https://makerdesignlab.com/tutorials-tips/online-file-generators-for-laser-cutting/>
- <https://www.instructables.com/howto/lasercut/>

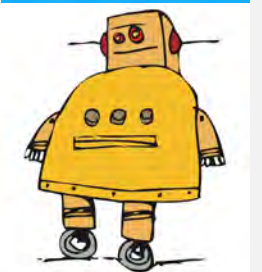
projects galore

project-sharing websites (some require membership)

- <https://learn.adafruit.com/>
- <https://www.hackster.io/>
- <https://www.instructables.com/>
- <https://hackaday.io/>
- <https://make.co/>

Support/Forums/Discord

- **Glowforge** (create a free log-in first - <https://glowforge.com/create-account>)
 - <https://community.glowforge.com/>
- **Adafruit**
 - <http://adafru.it/discord>





thank you!

please share your projects and progress!

“Laser-cut Puzzles” with Instructor Sean Scully & Jake Syma
review this workshop here:

<https://ttu.libwizard.com/f/instructor-eval>

Lead Administrator - sean.scully@ttu.edu

Assoc. Librarian - jake.syma@ttu.edu

Makerspace - make@ttu.edu

Director/Librarian - ryan.cassidy@ttu.edu

Staff Member - corina.alvarado@ttu.edu

Workshop Guides- <https://tinyurl.com/TTUMakerspaceGuides>