

3D PRINTING @ DKPL



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WHAT IS 3D PRINTING?

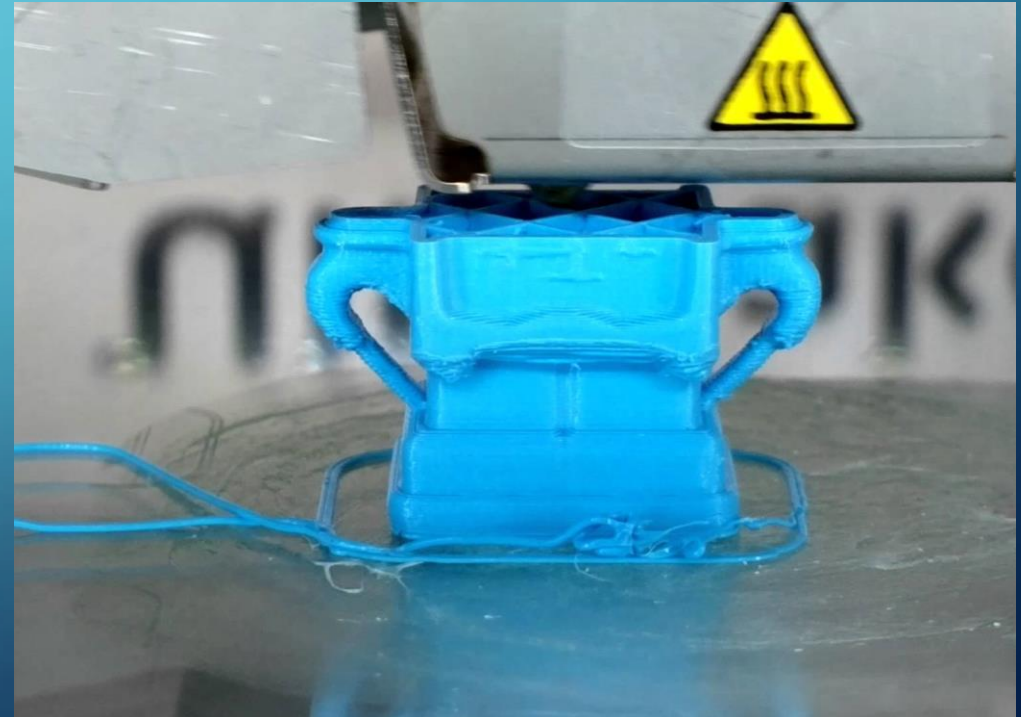
- Simply put, 3D printing is the process of taking a digital file and making a physical object from that file.
- It is sometimes called “Additive Manufacturing”, as it takes a material and adds on to it.
- Can also be called “Rapid Prototyping”.
- It is different from CNC (Computer Numerical Control) manufacturing because it’s adding material to make an object. CNC manufacturing is a “Subtractive” process as it takes a solid piece of material, and removes material to create the final object .

3D PRINTING VS. CNC MACHINING

CNC MACHINE



FDM 3D PRINTER



3D PRINTING HISTORY

- Theoretical work was laid out in the early 1980s.
- First functional 3D printer was an SLA (Stereo Lithography) machine.
- Files were transferred from a computer to a printer using .stl files—which are the same format we still use.
- 3D printers finally came down in price to where it was feasible for consumers to purchase them around 2010.

TYPES OF 3D PRINTERS

- The first style of 3D printers was the aforementioned Stereo lithography type.
- The most common consumer 3D printer is currently the FDM (Fused Deposited Material) or FFF (Fused Filament Fabrication) or “Filament” type.
- There also exists other, more exotic types of printers in the commercial market, including “Directed Energy Disposition” , “Laser Sintering” and “Inkjet head 3D Printing”.

HOW DO 3D PRINTERS WORK?

- After an object is designed on the computer, it needs to be converted to an .stl file.
- When an object is converted to an .stl file, it is sliced into many hundreds or thousands of vertical layers. These layers are what is printed by the 3D printer.
- The printer software then takes the .stl file and plots out the coordinates for the print. It will sometimes also have different settings for different parts of the print. This is referred to as the “G-Code”.
- The “G-code” also controls things such as speed, temperature settings and how the print will be supported.

WHAT 3D PRINTERS DOES DKPL HAVE?

- We have 2 Ultimaker 2+ FDM printers. They utilize a 3.0 mm filament.
- We have 1 Formlabs 2 SLA Printer. It uses a photo reactive resin.

WHAT'S THE DIFFERENCE BETWEEN SLA AND FDM?

- FDM printers take a role of a plastic filament, heat to a semi-molten state, and extrude the semi-molten plastic into the shape of the printed object based on the G-code developed from the .stl file.
- FDM filament comes in many types, but the most common is PLA, or “Polylactic Acid”. It can be made from vegetable oil, and has desirable working characteristics in a FDM printer
- SLA printers start with a vat of photo-reactive liquid resin, and use a laser to harden the resin in layers, likewise guided by the machine’s G-code.

WHAT DOES THAT DIFFERENCE MEAN TO YOU?

- FDM printers are currently cheaper, both for hardware and consumables.
- FDM printers are easier to work on and modify.
- Filament is “open source”, meaning it’s universal and one companies' PLA will be functionally identical to another's—making it easier to source and cheaper for consumables.
- FDM quality is limited to a particular constraint—meaning “how good the print is” is governed by the fact that you are extruding a semi-solid substance through a hole.

WHAT DOES THAT DIFFERENCE MEAN TO YOU?

- SLA printers use a laser to draw out the object's layers, hardening the resin as soon as the laser hits it.
- This allows for very nice prints, as each layer is now created by a very fine laser as opposed to the FDM process.
- SLA Printers are more expensive—although the pricing is getting better.
- Resin is “Closed Sourced”. It can only be purchased from the printer manufacture. It's is also far more expensive than FDM filament. Over \$150 per liter as opposed to \$50 for 2.2 pounds of filament.
- SLA Prints need to be “Post Processed”, meaning washed in a bath of isopropyl alcohol and cured with UV light, or sitting in the sun for a long period of time. It also needs removal of supports.

WHAT'S THE DIFFERENCE LOOK LIKE?



WHAT PRINTER IS RIGHT FOR YOUR JOB?:

- Reasons to use the Ultimaker FDM Printer?
 - Cost: it is about 1/3 the cost per gram of the Form SLA.
 - Speed: on many prints it is quicker than the Form. We also have two so the wait time will be less.
 - Good quality: with a resolution of .2mm, the Ultimaker can print many things that don't need to be ultra smooth.
 - Practical examples of Ultimaker jobs: Proof of concept prints. Children's toys. Objects that can't wait for post-processing.

WHAT PRINTER IS RIGHT FOR YOUR JOB?:

- Reasons to use the Formlabs SLA Printer:
 - Quality: at 0.05mm resolution you can hardly tell the object was 3D printed. Even at .1 mm resolution, the quality is very good.
 - Time: some prints actually print faster on the Form than they do on the Ultimaker
 - Practical examples of Formlabs SLA Prints: Casting prototypes, jewelry and high-quality hobbyist builds.

WHERE TO FIND THINGS TO PRINT?

- Design something yourself:

- Software such as AutoCad and Solidworks are professional CAD (Computer Aided Design) software. They are very expensive and require a lot of training
- Free CAD alternatives:
 - [Tinkercad](#) Works in a web browser. No need to download any software and all your jobs are available on the internet. Basic, but easy to use. Many “how-to” tutorials and videos available.
 - [FreeCad](#) Downloadable software. Full CAD suite, and many advanced functions. High learning curve to master. Does have a strong support community that also has many “how-to” tutorials and videos.
 - [Blender](#) Downloadable software. Design and animation suite that can also make models to be printed. Very high learning curve and may require special computer hardware. Also has a strong support community.
 - [Wings3D](#): Low Polygon count 3D design software. Can import a picture or plans and build the model of that. Medium-Strong support community.

WHERE TO FIND THINGS TO PRINT?

- [Thingiverse](#): Online repository for free downloadable “things”.
 - Users design a “thing” and upload it to Thingiverse for others to use.
 - “Caveat emptor”: Many designs are made by amateurs, and were not designed for printing, or will print poorly.
 - Different models may have different licenses, check before you print!
- [Yeggi](#): Online aggregator of .stl designs from Thingiverse and its competitors

HOW TO PRINT AT DKPL:

- Once you have designed or found a “thing” to print, save it to a flash drive as an .stl file.
- Bring your “thing” and your library card (in good standing!) to the Help Desk (located in the Haish building) M-F 1pm-8pm and Saturday 9am-12:30pm
- Non-residents of DeKalb may purchase a 3D Print Card for \$15/year and receive the same printing privileges as patrons.
- We’ll load the file, estimate the cost of the print and give you an estimated completion time (usually 3-5 Business Days, but may vary).
- Printing is prepaid; there is a \$5 setup fee as well as the material cost. The printer software will estimate the material used, and we’ll base the charge on that. If less material is used, we’ll refund you, and if more is used, you’ll need to pay the difference at pick-up. Any variance is usually very minor.
- The Ultimakers are \$0.10/gram and the Form is \$0.30/gram.

THE PRINT

- The staff will then check the model for printability and make sure it is set-up in a way that helps ensure a satisfactory print.
- We'll remove the print and do some required post processing.
- We will not remove any of the supports. This can be a tedious and time consuming process, please be aware of that.

MISPRINTS

- Misprints happens. They can happen because a portion of a model isn't suited for printing, a support is missing or sometimes for seemingly no reason what so ever.
- As we have used the material, you will still be charged for that, but we will refund you the \$5 set-up fee.
- You are not charged if the mis-print was due to machine error—your job will be reprinted.

HOW CAN WE PRINT AND IS THERE ANYTHING THAT CAN'T BE PRINTED?

- You may bring in your print jobs M-F 1-8 and Saturday 9am-1230pm.
- Currently our only restrictions are on printing firearms and weapons, though we do reserve the right to refuse any print job.

A COUPLE OF FINAL THINGS:

- 3D Printing as a technology is still in it's infancy. Not everything that should seeming be able to be printed, can.
- We are still learning some of these things as we go, so policies and procedures will change based on real-world experience.
- Have fun!