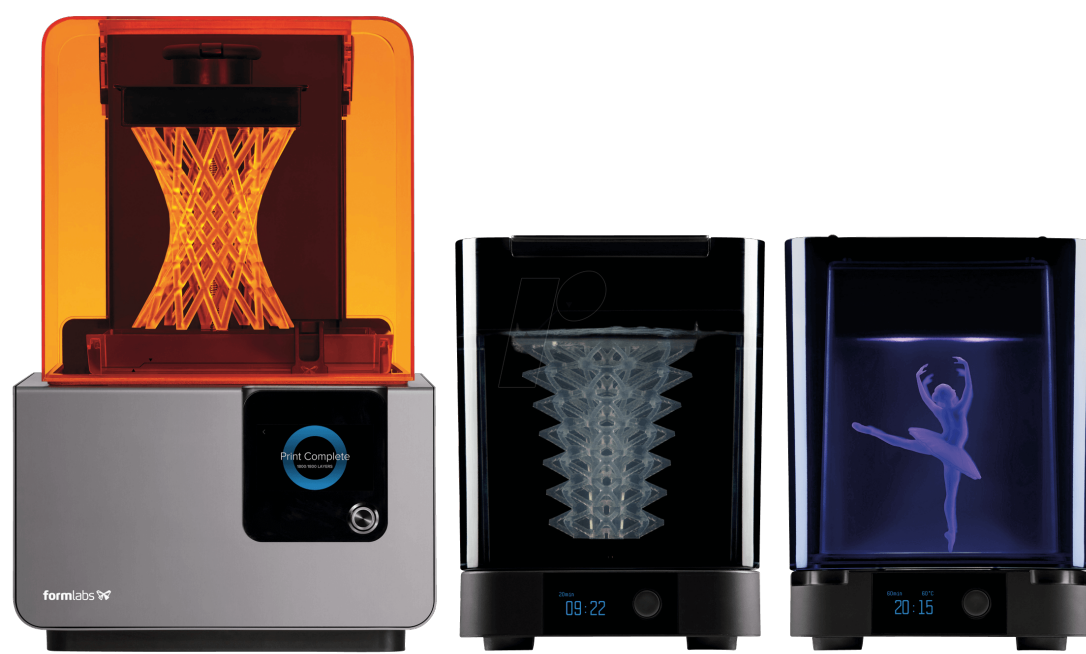




3D Printing



Resource Guide

What is 3D Printing?

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the entire object is created.

3D printing starts with a digital file derived from computer aided design (CAD) software. Once a design is completed, it must then be exported as a standard tessellation language (STL) file, meaning the file is translated into triangulated surfaces and vertices. The STL file then has to be sliced into hundreds, sometimes thousands, of 2-D layers. This is performed using a software program called a Slicer. The Slicer then sends the job directly to the 3D Printer.

A 3D printer then reads the 2-D layers as building blocks which it layers one atop the other, thus forming a three dimensional object.

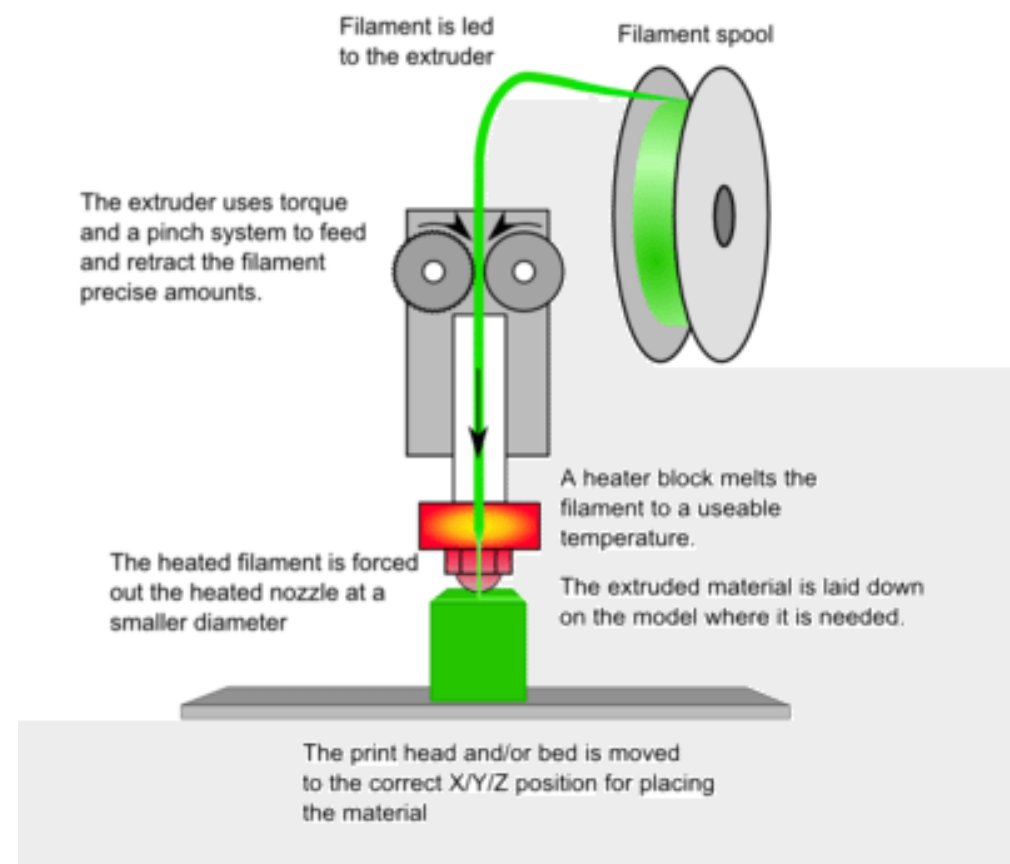
Common 3D Printer Types

Fused Deposition Modeling (FDM)

3D printers which use FDM Technology construct objects layer by layer from the very bottom up by heating and extruding thermoplastic filament.

FDM printers are popular due to their speed and ease of use. FDM prints require little or no post-processing.

FDM printers are limited in their ability to produce finely-detailed objects.

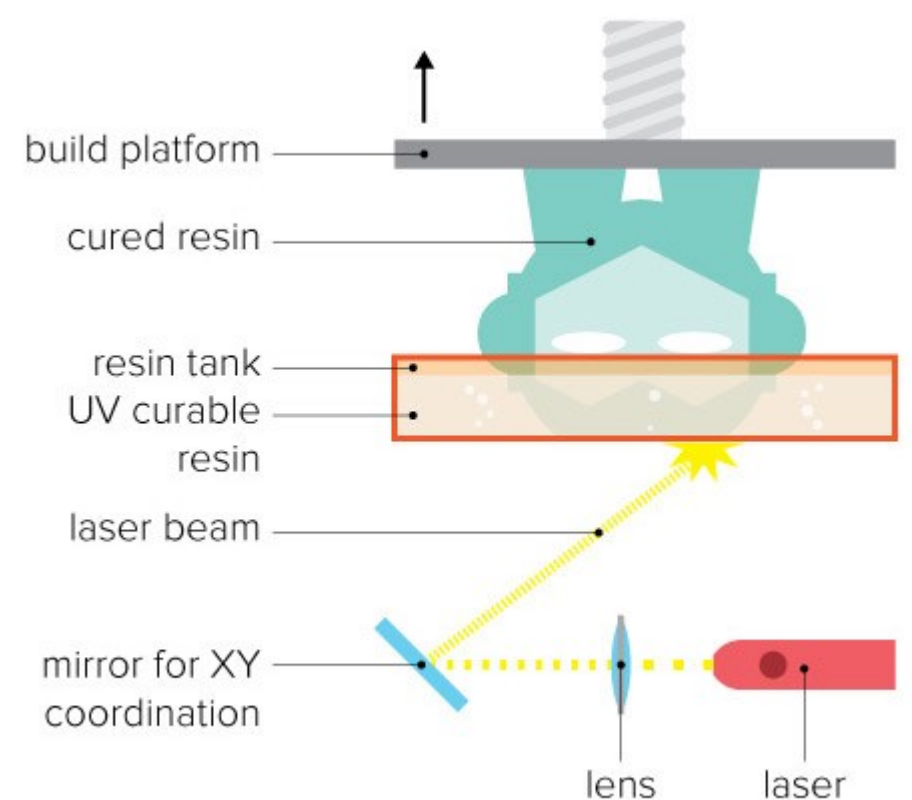


Stereolithography Apparatus (SLA)

3D printers using SLA technology work by curing liquid resin with UV light. The light, emitted via laser or a projector, solidifies resin and builds objects layer by layer.

SLA printers are popular due to their ability to produce highly detailed and intricate designs. The type of resin used will determine the mechanical strength, color and texture of the design.

Models created with an SLA printer will require post-processing routines or finishing procedures.



Getting Started With 3D Printing

Download a Model

Print-ready designs are available to download from various websites. Some designs are free of charge and others are available for sale. Downloaded models can be sent to a 3D printer immediately or they can be further customized using CAD 3D modeling software.

Design a Model

3D Modeling software can be used to design a 3D model from scratch or it can be used to customize models that have been downloaded from a website.

Replicate an object with a 3D scanner

A 3D scanner is a device that analyzes a real-world object or environment to collect data on its shape and appearance. The collected data can then be used to construct digital, three dimensional models.

How Can I Download Models?

You can browse and download .STL and .OBJ files from various open-source marketplaces such as:

Thingiverse



YOUMAGINE

THINGIVERSE is the ultimate 3D printing community. *Thingiverse* is comprised of over 500,000 3D models downloadable for free, under the Creative Commons License.

www.thingiverse.com

YOUMAGINE's 3D community consists of 10,000 designs which are customizable and sharable, for free. Like *Thingiverse*, *Youmagine* also has design reviews and images of prints made.

www.youmagine.com

MYMINIFACTORY consists of free downloadable 3D designs, as well as 3D prints for sale. 3D designers have the ability to earn tips for their original designs.

www.myminifactory.com

SHAPEWAYS is a marketplace for 3D printed objects. With *Shapeways*, you can either Shop or Create which enables you to turn your digital designs into actual products for sale.

www.shapeways.com

shapeways★



Design Your Own 3D Object

You can also create your own designs and 3D prints using free CAD (computer aided design) software.



TINKERCAD- is the ultimate free tool for creating your own 3D designs. *Tinkercad* is a powerful, browser-based CAD program suitable for all ages and levels of skill.

www.tinkercad.com

SKETCHUP- For the intermediate to advanced CAD users, *Sketchup* is used by architects, engineers and professionals because of its specific drawing tools and options. A free version of Sketchup, accessed via a web browser is available for personal use.

www.sketchup.com/products/sketchup-free

BLENDER- For those skilled in CAD, *Blender* is another free alternative for designing your own models. *Blender* is known to have advanced tools for more complex modeling designs and is available for download on PCs and Mac computers.

www.blender.org

Achieving the Perfect Print

Understanding 3D printing settings can be helpful for the success and quality of your prints. The following settings are found within slicing software such as Preform, Cura or Slic3r.

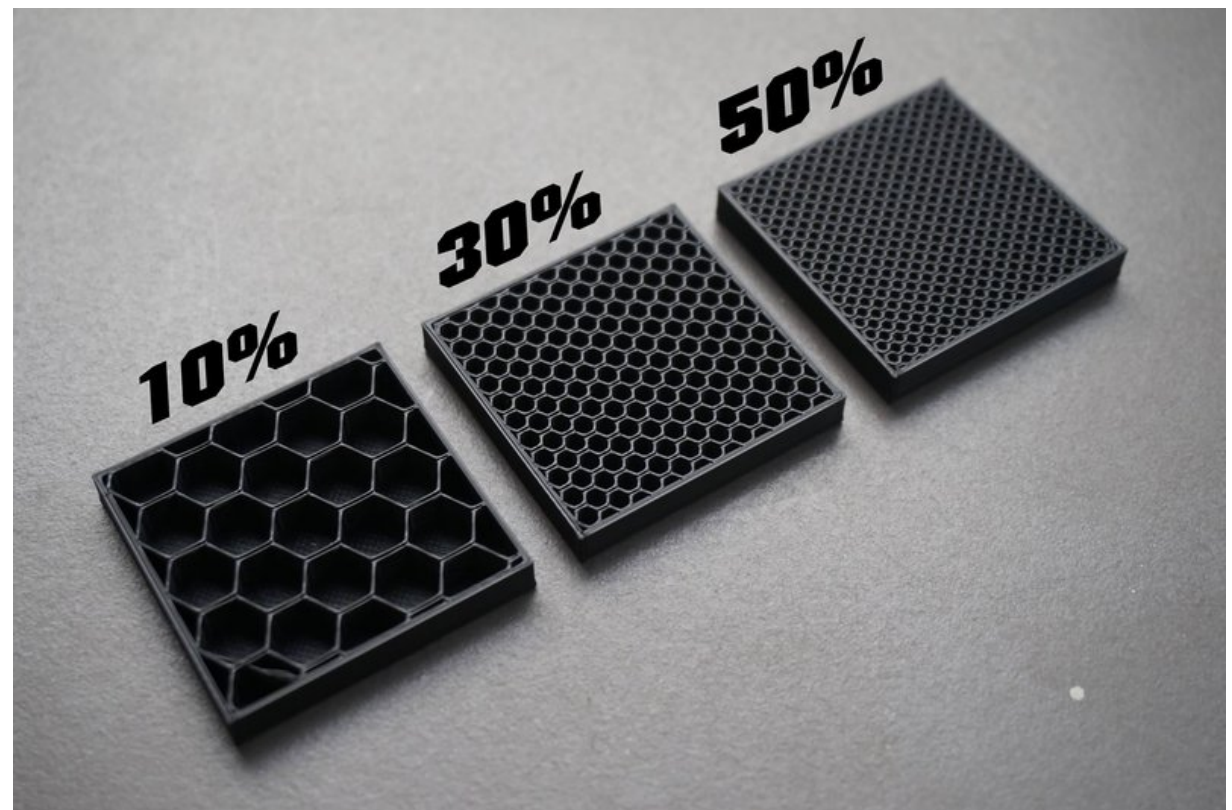
INFILL- infill refers to how densely filled the inside of your print will be. Your software will typically use an infill density of 20% to produce a good 3D print. Infill ranges from 0% (hollow) to 100 % (completely solid).

SHELLS- are the outer thickness layer or the walls of your 3D object. Shells determine the stability of your print.

SUPPORTS- think of Supports as scaffolding under your object. Supports are used when objects have overhang, shallow angles, or just don't print well on their own.

RAFT- is a type of platform adhesion that helps objects stick more securely to the build plate of the printer.

BRIM- is a thinner type of platform adhesion.



Infill Density- the inside of your 3D print.



Example of an object with both Rafts & Supports used for stability. Rafts and supports are later removed from the print.

Filament and Materials

FDM Printers use material called Filament which is melted at a high temperature in the heated extruder head of the printer. The melted filament quickly hardens as your object starts to build.

SLA Printers use a material called resin. UV lasers cure liquid resin into hardened plastic.

Filament can be made of various materials such as: metal, wood, resin, clay, and the most commonly used, plastic (ABS, PLA, Nylon, HIPS, PVA, PET, nGEN).

PLA- a biodegradable thermoplastic made out of corn starch and sugar cane. PLA is considered to be more environmentally friendly.

ABS- thermoplastic that is harder and more durable than PLA. This is the same plastic used to make Legos.

Flexible- TPE/TPU- thermoplastic elastomer with rubber-like qualities. Flexible filament has stretch to it and can be used to make automotive parts like tires, wearables such as shoes, watches, jewelry, or even smart phone cases.

Resin- Standard, Engineering, Dental, Jewelry & Ceramic- SLA printers accommodate several different types of resin.



Basic Finishing Steps

Finishing your 3D printed model requires the use of some basic tools. These tools include clippers, sand paper and paint.

Finishing steps can vary depending on the material used in printing.

Washing and Curing

Models created using resin require washing and curing after printing. Models created with filament do not require washing and curing.

Supports and Raft Removal (Roughing)

Both Filament and Resin based models may require the removal of support structures. Supports and Rafts should be removed using clippers to prevent damage to the model. Be sure to wear eye protection when clipping as small pieces of plastic tend to fly around.

Sanding

After the supports and rafts are removed, use a fine to medium grit sandpaper to smooth the surface of your model. Medium grit sandpaper may be used to remove leftover blemishes from where the supports and raft were clipped. Fine sandpaper should be used to smooth all surfaces in preparation for painting.

Priming

The goal of priming is to create a pristine surface before painting. After priming, it may be necessary to use sandpaper again to remove any imperfections exposed. A second coat of primer is optional. Priming of resin based models prevents sunlight from over-curing models which can cause them to become brittle.

Painting

Choose thin paint that's easy to control. Hardware store paint (or even fine art paints designed for rough surfaces) are the opposite of what you want. They tend to clump and form thick, rough layers.

Fine spray primer and paint by Tamiya is recommended for use on 3D models.

Always wear eye protection when applying primer and paint via spray cans.

Learn More with Lynda

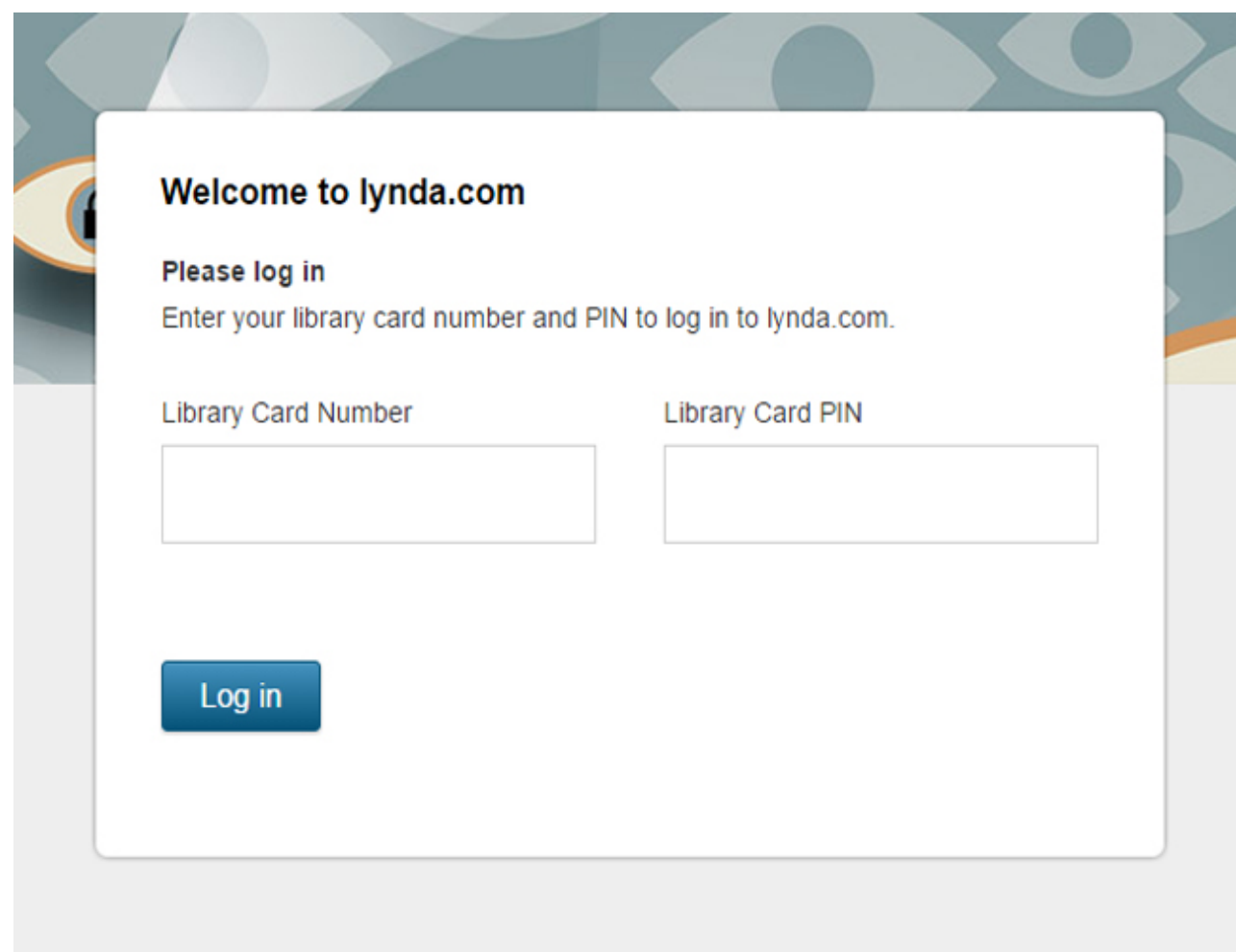
Access Lynda by going to

<https://www.lynda.com/portal/patron?org=shpl.info>

Enter your library barcode and pin. Then click “Log in”.

Use Lynda, our free online learning tool, to watch instructional videos on everything from 3D basics to more advanced demonstrations of CAD software design.

There are over 1,400 results for *3D Printing* on Lynda. Filter your search by subject, software, skill level and become an expert on 3D printing!

A screenshot of the Lynda.com login page. The page has a white background with a decorative header featuring stylized eyes in shades of blue and green. The main content is a white rectangular box with rounded corners. At the top of the box, it says "Welcome to lynda.com". Below that, it says "Please log in" and "Enter your library card number and PIN to log in to lynda.com.". There are two input fields: "Library Card Number" and "Library Card PIN". Below the input fields is a blue "Log in" button.

Welcome to lynda.com

Please log in
Enter your library card number and PIN to log in to lynda.com.

Library Card Number Library Card PIN

Log in

South Huntington Public Library 3D Printing Policy

To advance its goal of providing free and open access to technology and information promoting literacy, education, enlightenment and entertainment, the South Huntington Public Library offers patrons the opportunity to 3D print their own original designs or those found on various open-source websites.

Formats accepted are as follows: .stl or .obj. Patrons are permitted to submit their file for review through the Library's website. Upon approval, patrons will be notified of a print price.

Prints will be priced according to the volume of material used. Prices are subject to change.

Patrons will be contacted when their print is ready for pickup. Prints that are not picked up after 30 days will become the property of the Library and unpaid charges will be applied to the patron's library account.

Users may not print items that are prohibited by law or do not comply with Library policy.

In addition to the above restrictions, the Library reserves the discretionary right to refuse any 3D print request that it deems inappropriate or unwarranted.

By submitting content, the patron agrees to assume all responsibility for, and shall hold the Library harmless in, all matters related to patented, trademarked, or copyrighted materials. The South Huntington Public Library is not responsible for any damage, loss, or security of data arising from the use of its computers or network, nor for the functionality or quality of content produced on the 3D printer.

Examples of Size, Color and Cost

The picture below illustrates the size and color of 3 models that were printed on our SLA Form2 printers.

The models pictured have not been sanded, painted or polished. The only post-processing performed was the removal of support and raft structures.

SMALL model was printed with CLEAR resin for \$2.00.

MEDIUM model was printed with WHITE resin for \$5.00.

LARGE model was printed with GREY resin for \$15.00.



Note: Models printed with clear resin will appear cloudy until sanded and polished with a clear coat of lacquer.

3D Printing at SHPL

1. Go to :
<https://shpl.info/3dform.pdf>
and complete our *3D Print Request Form*.

Follow the instructions on the form to:

*Fill out your contact information
Upload and attach your .stl or .obj file
Agree to our 3D Print Policy terms
Submit your form*

2. A staff member will get back to you with a print price and an estimated time for completion
3. You will be notified once the print is ready
4. Go to the Circulation Desk to pay the print fee and pick up your new print!

