3D PRINTING ORIENTATION

Westlake Porter Public Library

DEFINITION

- **3D Printing** is "a process for making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of a material."
- A plastic ***filament*** from a spool is loaded into a 3D printer. It is melted, then squirted out the ***extruder*** (heated nozzle, ***hot end***, *or* ***print head***) into a shape defined by a computer. An object is built layer by layer from the bottom up onto a ***build plate*** (sometimes called a ***print bed***).
- The 3D-printable object made on a computer often has the file extension **.STL** (for "stereolithography", which means 3D printing)

MATERIALS

- The material we have is non-toxic PLA (polylactic acid) filament
- Current PLA colors: Glow, Transparent, Black, White, Bone White, Natural, Light Brown, Brown, Bronze, Gold, Silver, Gray, Dark Blue, Blue, Light Blue, Lavender, Purple, Pink, Red, Raspberry Red, Orange, Yellow, Neon Green, Green, Dark Green, Twinkle Rainbow, Rainbow 3, and Tri-color.
- Patrons cannot supply their own filament, but can request more varieties.
- If you want an object that is multiple colors, print it in white and paint it with acrylic, cellulose spray, enamel, or oil paint. Acrylic paints work best.

WHERE TO GET 3D MODELS

- Objects can either exist already, or be created from scratch on a computer
- 3D-printable objects that other people have designed can be downloaded from websites including those below. You can also download these objects and change ("remix") them to suit your own needs.
- Choose a photographed object instead of a plain blue-on-gray computer model to see that it prints correctly in real life.
- www.thingiverse.com (hosted by Makerbot)
- www.youmagine.com (hosted by Ultimaker)
- Make your own designs using a CAD (computer aided design) program, like the free **Tinkercad**

TINKERCAD

- A free, easy-to-use online program that walks you through how to design custom 3D objects
- Sign up for a free Autodesk account at tinkercad.com
- You will be emailed a confirmation, so you may want to open another tab in order to sign into your email
- Although staff ***will not help design your 3D object***, there are LinkedIn Learning courses for Tinkercad, designing 3D-printed replacement parts, and much more! At westlakelibrary.org, check the **Research** tab, then **Databases and Subscriptions**. Click the **A-Z** tab and scroll down to **LinkedIn Learning** (formerly Lynda.com).

MORE DEFINITIONS

- ***Overhang*** – a part of an object that hangs over a lower part, like an ear of the Stanford Bunny. Sometimes needs supports underneath to hold it up while printing.
- ***Infill*** – the amount of plastic that the inside of the object is filled with, usually a percentage. 100% infill is solid plastic; the default infill is 15-20% (prints much faster. The inside looks like a semi-hollow "waffle pattern," but the outside of the object looks the same).
- ***Raft/Brim*** – a flat layer of plastic support material printed underneath the actual object
- ***Slicer*** – software that "slices" a 3D object on the computer into horizontal layers that can be 3D printed. **Cura** is what we use here.
- ***Support material*** – plastic printed as either a raft or to support overhangs (as you cannot print in thin air). After the print is done, PLA supports are broken off the object and discarded. PVA (polyvinyl alcohol) supports dissolvable in water are no longer available here.
- ***Manifold*** – term meaning the object's geometry fits together correctly and is OK to 3D print

YOU MAY NOT PRINT AN OBJECT THAT IS:

- a. Prohibited by local, state or federal law.
- b. Unsafe, harmful, dangerous, poses an immediate threat to the well-being of others, or is otherwise inappropriate for the Library environment. (Such use may also violate the terms of use of the manufacturer.)
- c. In violation of another's intellectual property rights. For example, the printers will not be used to reproduce material that is subject to copyright, patent or trademark protection.
- d. The Library reserves the right to refuse any 3D print request.

PRINTING

- Save your **.STL** file (extract it from any **.zip** files downloaded) and **Rename** the file to **Color – Your Name – Object Name – Date.stl**
- Submit the STL file to the form at https://www.westlakelibrary.org/3d-request
- Staff will tell you if it will take too long to print (must be under 4 hours). You can request staff to shrink the object, reduce the infill (no less than 15%), or reduce quality to save time
- You must agree to the library's 3D Printing Policy
- Full procedure: https://westlakelibrary.org/makerspace-3d-printing
- Finished prints will be $0.05/gram

TRY IT OUT AT HOME FIRST

- You can view the file on your home computer first if you'd like.
- Download and install the slicer program Cura (https://ultimaker.com/software/ultimaker-cura)
- Open the .STL file in it
- Set the printer to Creality Ender 3 Pro v2 (what we have here).
- Resize the file if you'd like (https://support.ultimaker.com/hc/en-us/articles/360012031159-How-to-scale-models-in-Ultimaker-Cura)
- Slice the file to see how long it will take (must be under 4 hours)
- Optionally, send us both the .STL file and the resulting .GCODE (.gz) to makerspace@westlakelibrary.org

YOUR FINISHED OBJECT

- You will be contacted when the object is complete.
- Completed prints will cost $0.05/gram
- Pick it up at Drive-Through Window. After you've picked up your object, you may submit another one for printing.
- Break off any support structures yourself. You can file down any rough edges.
- Enjoy!