

Introduction to 3D printing

Many processes that are available in the Makerspace start with a block of material and remove areas to create their final output. 3D printing is different. It's an additive manufacturing process where strands of filament are laid down on top of each other, slowly building up your model, starting from nothing.



What can you 3D print?

You can use 3D printing to create many more things than you might have considered. The Makerspace is a place for you to use your imagination to produce decorative and useful things.

Many people start 3D printing by producing things that were designed by others. There are many websites e.g. Thingiverse, Printables and Yeggi, with 3D models which can be easily reproduced on a 3D printer. As your competence builds, it will become natural to start making changes to existing designs, to begin combining models from others and then ultimately even designing more complex objects from scratch.

The Makerspace is here to help you on every step along this journey.

Domestic 3D printing technologies

Hobbyist 3D printers use one of the following two methods to create an object layer by layer.

Fused Deposition Modeling (FDM) - Printing with filament

This is the most common technology used in desktop 3D printers. Thermoplastic material is heated and extruded through a nozzle. The nozzle deposits the molten material layer by layer onto a build platform. Each layer sticks to the one beneath it. Layers of between 0.1 and 0.2mm are generally laid down with a 0.4mm nozzle.

Stereolithography (SLA) - Printing with liquid resin

The build platform is raised from a bath filled with a special liquid photopolymer resin. The resin is light-sensitive and becomes solid when exposed to a UV laser light beam.

Each cross section of the 3D model is attached onto the layer of cured resin that came before it, the layers are very fine and deposited very rapidly. This is repeated layer by layer until the 3D object is completed. SLA printing produces much finer models with layering which is practically invisible.

3D printing materials can be enriched by adding other materials such as wood, metal or carbon fibre for strength, electrical conductivity, and appearance.

Types of 3D printing filament

The most common materials used in hobbyist FDM 3D printing are PLA and PET-G.

PET-G (PolyEthylene Terephthalate Glycol) is a modified version of the PET plastics well known for use in drinks bottles. It is modified to change its heating characteristics to meet the needs of 3D printing. It is more difficult and time consuming to print with due to poorer adhesion and extrusion characteristics and needs slightly increased temperatures and slower printing speeds. However, PET-G is much stronger and more flexible than PLA making it more suitable for certain applications and designs. PET-G is naturally transparent and very useful where this is a requirement.

PLA (PolyLactic Acid) is much simpler to print with, is best for beginners, and is the most commonly available filament. Where additional strength is required filament additives can be used to strengthen PLA, most commonly carbon fibre, without having to resort to using PET-G

What are the limitations of 3D printing?

3D printing is limited by the size of the 3D printer and the time taken to lay it down each of the layers. The printers in the Makerspace can only print one material at a time. There are 3D printers available which can change material during printing.

Software for 3D printing

Creating a file to drive a 3D printer is a two-stage process.

Firstly, a file is created which describes the model. This file is typically in one of two formats - .OBJ (Object) file, or .STL (Standards Tessellation Language) file.

These are created or modified in a CAD (Computer Aided Design) program. There are numerous free and open source CAD packages available, such as Tinkered, 3D Slash, Scad and Free Cad. All of these have tutorials available on YouTube.

There are also commercial packages designed for professional use with greater functionality, notably Fusion 360. Fusion 360 does offer either a slightly restricted hobbyist license (not widely promoted) or can be acquired with a free trial before the subscription kicks in.

Having described the model, it then must be converted into the instructions required by the specific printer which is going to manufacture it. Because 3D printing is carried out in layers, the software describes the model as series of layers, and each layer to be laid down is generated by "slicing software". This slicing software generates G Code.

Printer manufacturers normally supply slicing software with the machine, although these programs are often very similar and capable of driving machines other than the one with which it is supplied with. Our Ultimaker machines come with slicing software called Cura.

Safety and the Environment

3D printing is largely done with plastics. Heating and extruding plastics comes with some potential hazards and environmental impacts.

Environmental considerations

- PLA (PolyLactic Acid) plastic is generally made from plant-based materials and can, with industrial processes, be composted.
- PET-G (PolyEthylene Terephthalate Glycol) plastic is, like PET, derived from oil but is recyclable.
- PLA probably has the lowest environmental impacts but how they are manufactured and what is added to the material also must be considered.

Safety Considerations

While 3D printing is not difficult, most people buy a printer and get on with it without incident. In the Makerspace we insist that everyone is adequately trained, complies with our procedures and is familiar with our risk assessments. The Makerspace is a public space run by a Community Interest Company and Health & Safety legislation for companies applies.

Educational Value

3D design is part of the Science Technology Engineering Maths (STEM) curriculum at secondary school stage of education. It is valuable as a way of developing practical application of knowledge at the intersection of maths, computing and creative arts.

In the Makerspace we are keen to give local school students the satisfaction of turning their ideas into reality and are working with Dunblane High School on this initiative.

How to get access to the Makerspace 3D printers.

Talk to us! We have regular introductory nights where we can arrange training - it only takes an hour or two. We will then support you through your first prints until you are confident that you can use the machines.

We have a subscription fee (free to under-18s and while you are training) and any materials you use will need to be paid for, but it is all relatively low cost. We aim to be accessible to the whole community.

Contact us

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