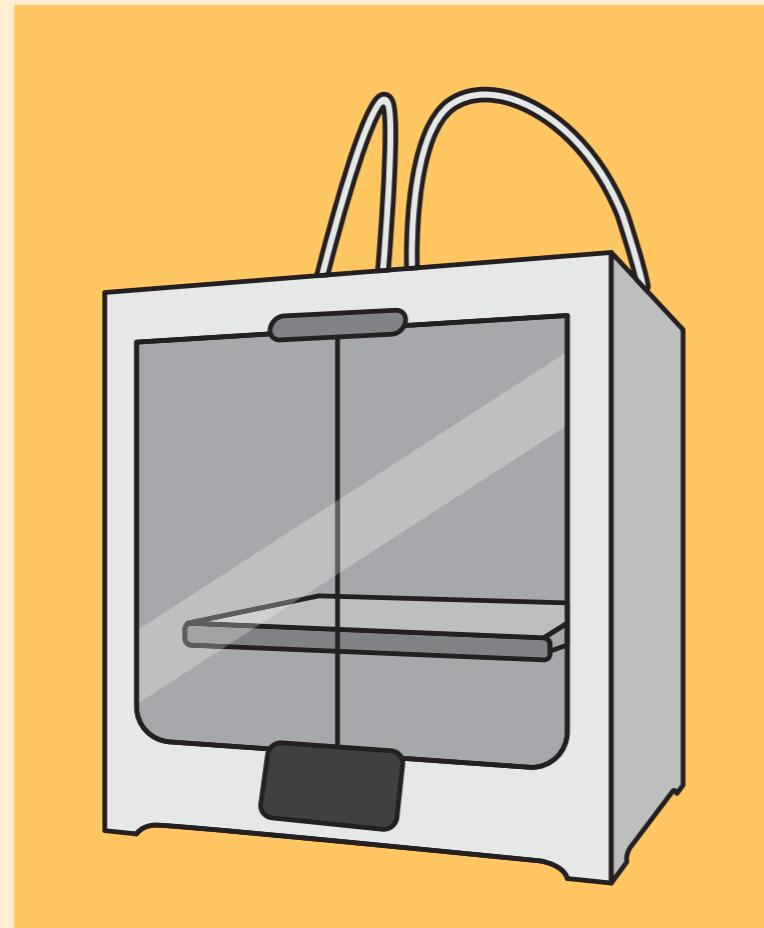


# A glossary guide to 3D Printing

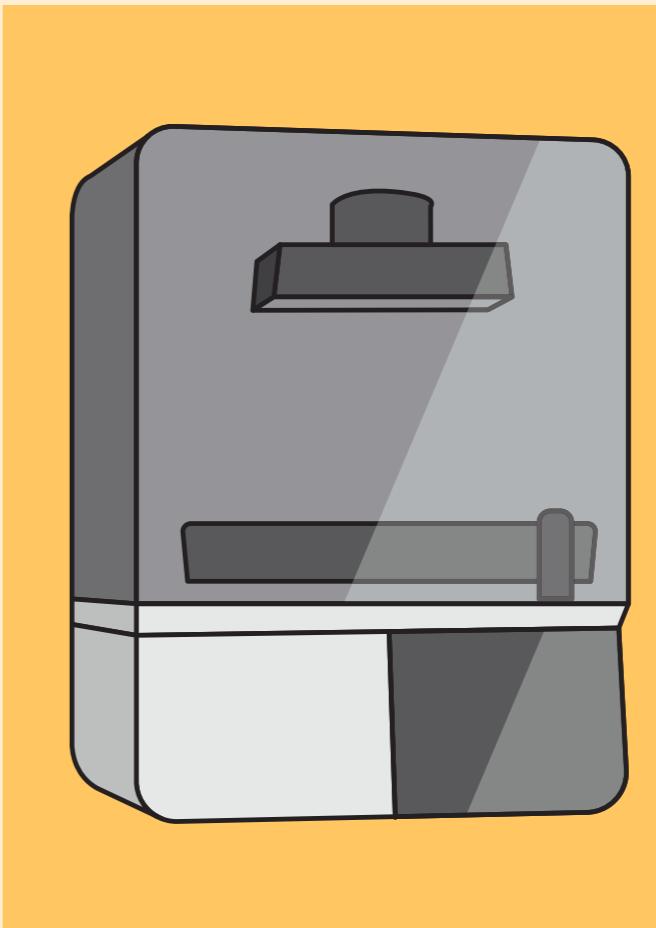
## Intro

3D Printing is a way to get your digital 3D models into the real world - whether that's a prototype for a product, piece of a game or a figurine there's a printer for everything. In the 3D workshop we have standard plastic and resin printers, as well as a specialist full colour printer and a clay printer. More information about all these printer types can be found on Moodle, along with the 3D Workshop online inductions. This glossary will take you through some common 3D printing terminology to get you started.



## Ultimakers

The Ultimaker printers print using **PLA** (polylactic acid - a type of plastic made from cornstarch). This is the most common type of 3D printing. The printers heat up the PLA, and squeeze it out layer by layer to build up a 3D print in the shape of your model. The material is **cheap** and **strong** - good for prototypes and mechanical parts, but the printers can be slow and the material can feel a bit rough. We have PLA in a variety of colours, but white is strongly recommended as you can then spray-paint later.



## Formlabs

The Formlabs resin printers print using **UV reactive liquid resin**, which is exposed to a UV light within the printer which cures the prints layer by layer. Resin prints come out **very smooth** and can pick up a lot of small intricate detail, meaning that they are good for printing models of characters, 3D scans, or a smooth print to use for mould making. The resin printers can print **quickly**, however extra time is needed at the end for the prints to get washed and dried. We have resin in white and clear.

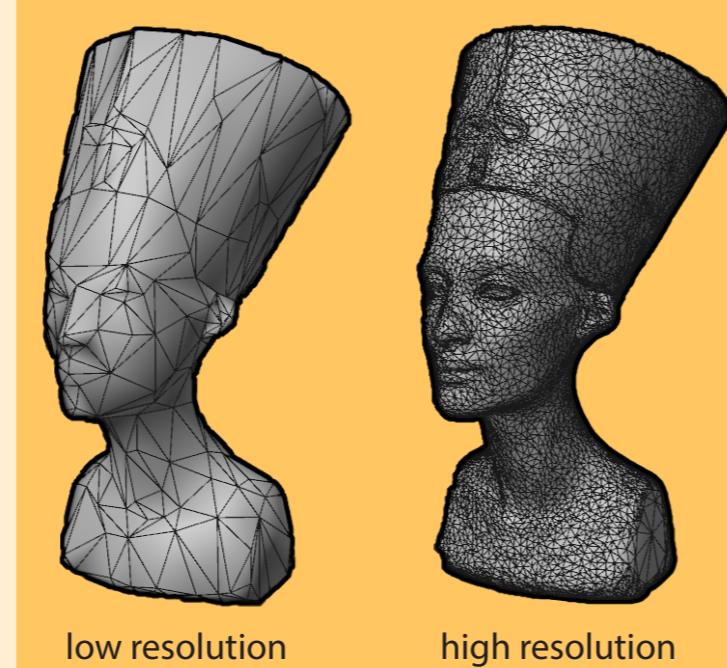
## 3D Modelling



### Model

3D printing starts with a **3D model**, which is a **digital 3D object**. There are many ways of getting a 3D model:

- make it yourself in a software like Blender, C4D, Rhino, Sketchup or Nomad
- download a model online
- AI generate a model
- 3D scan an object



### Mesh

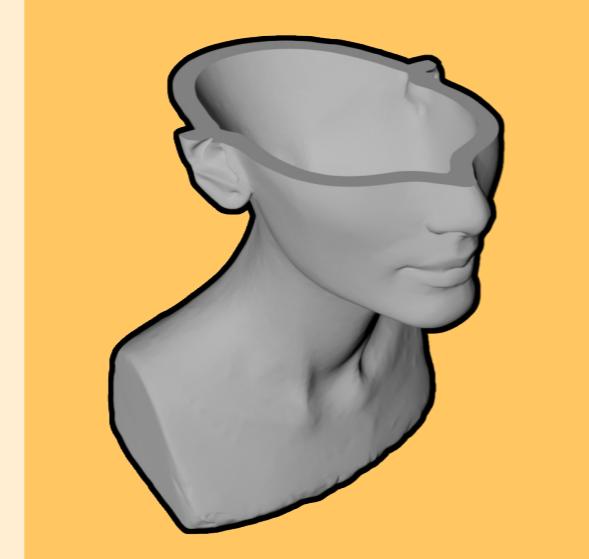
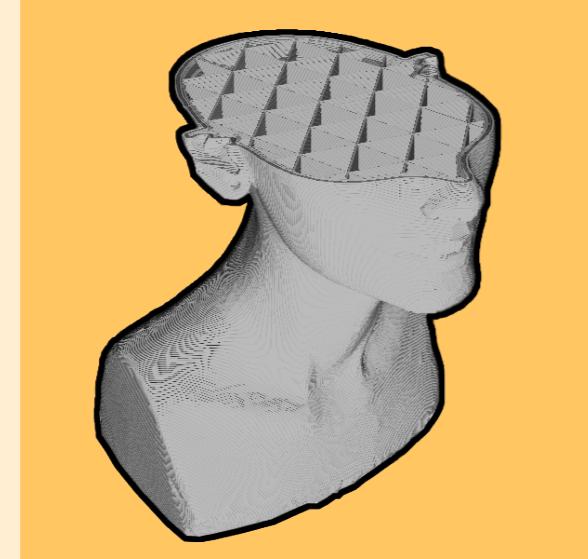
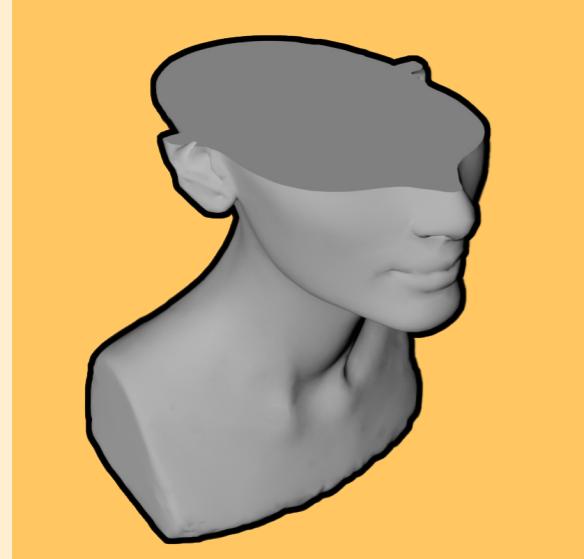
If you look closely at the surface of a 3D model it is actually made of **small triangles or squares** (polygons). We always want a **closed mesh** - this means no holes or gaps in the network of polygons. A **high resolution mesh** will have lots of polygons, creating a smooth and detailed model. A **low resolution mesh** will have less polygons, creating a model with less detail that has a rougher surface.



### Slice

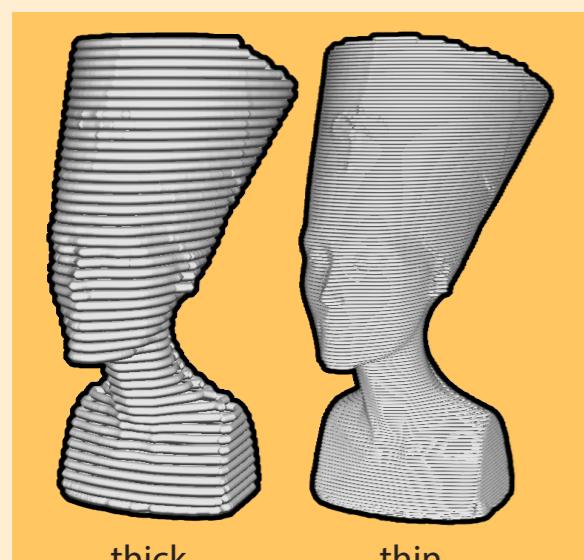
Once you have a 3D model, you need to **slice** it to be ready to 3D print. Slicing splits the model up into **thin layers**, and the printer will print the model **one layer at a time**. Thin layers will create a very smooth print, but can take longer to print. Thicker layers will create a rougher print, but it will print faster.

## 3D Printing



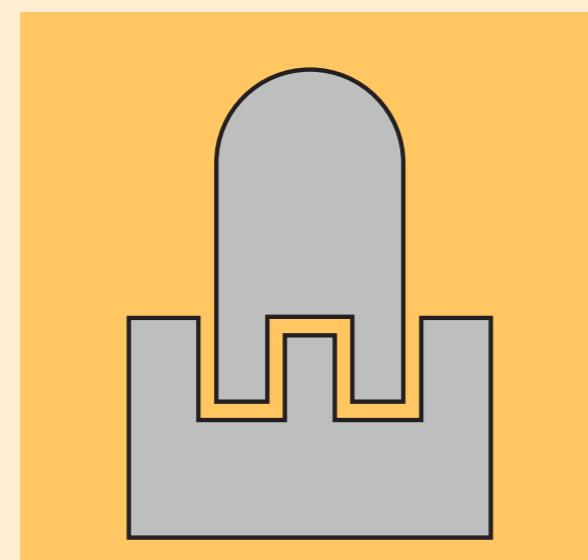
### Solid

A model printed completely **solid** is likely to be **strong** but will use a lot of material (which can cost more). The resin printers always print in solid resin.



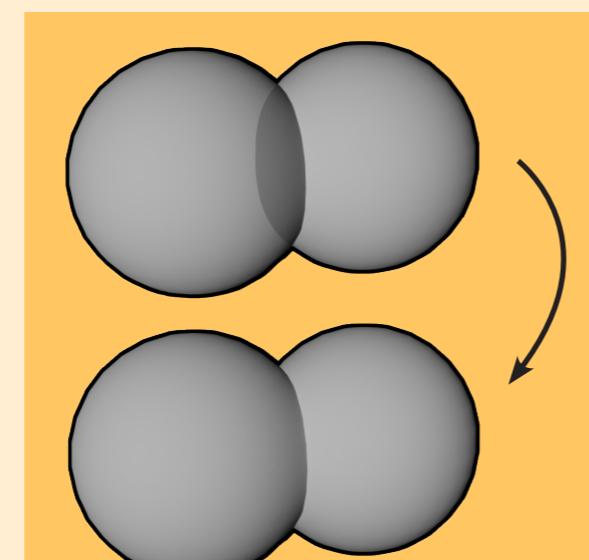
### Infill

**Infill** is generated while slicing, and creates a **structure inside a print**. It helps the prints print **faster**, while still strong, and can come in different shapes and sizes.



### Hollow / Shell

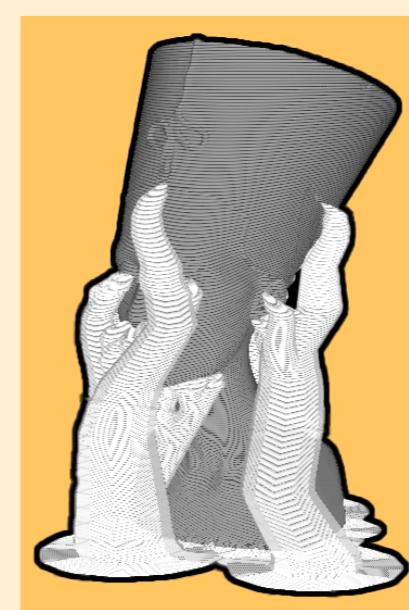
A model does not have to have infill - it can be printed **hollow** which means it has a gap inside. A hollow model is sometimes referred to as a **shell** or a **skin**.



## Finishing Touches

### Support

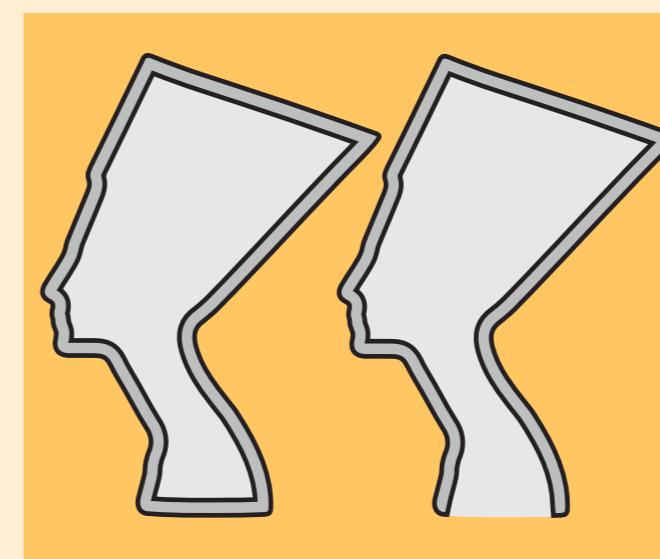
3D printers need to generate **support structures** while they print 3D models. This structure looks different for each printer, but it allows the printer to print complex forms. Even a hollow print will need to have some support structures inside the hollow part to allow it to print.



**Ultimaker support** is made of a different material to the model, and can be ripped off with pliers after the model has printed. This is called **tree support**.

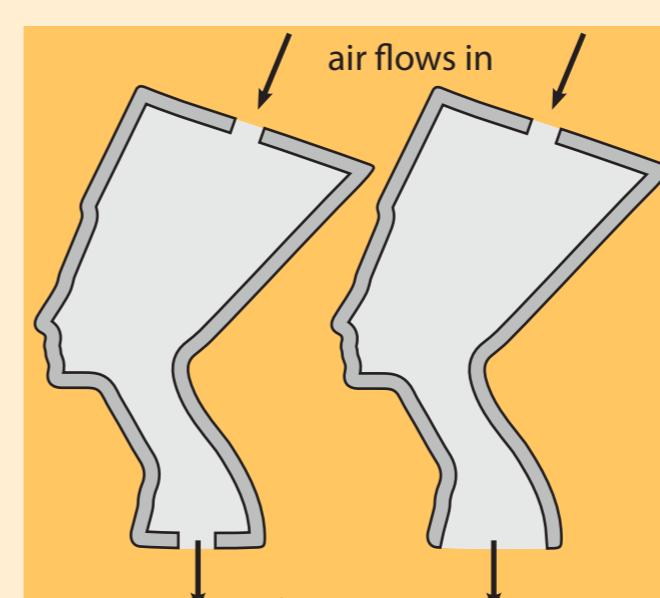


**Formlabs support** is made of a **scaffolding-like structure**, which reaches up to all the parts of the print. This support has to be cut off using snips, available in the workshop.



### Cups

The Formlabs resin printers print using liquid resin, and the models print **upside down** - dipping into the resin. A **cup** (light grey) is formed usually by a **hollow space** or **gap** in a model (dark grey - cross section), and can cause issues by vacuum suctioning to the base of the printer and getting stuck. We try to avoid cups by tilting the model, or by adding **air holes** and **vents**.



### Air holes + vents

An **air hole** can be added to a print at the **location of a cup** to break the vacuum suction and allow the print to print normally. If printing a hollow shell on the Formlabs then you actually need **multiple air holes** - at the **top** for air to come in, and at the **bottom** for resin to pour out. Talk to technicians if you need help with this!

### Layer height

The **smaller (thinner)** the layer height of a print, the **smoother** the surface will be. However this will take more time to print, so sometimes a **larger (thicker)** layer height can be beneficial if you want something **fast** and don't mind the surface being **rougher** or the layer lines more visible.

### Tolerance

If you 3D print two objects and want them to fit together, **you need to leave a bit of a gap between them** to allow them to slide in - this is called the **tolerance**. Each printer, and also each project, will have a different tolerance so you sometimes have to **test** a few times before finding the perfect fit.

### Boolean Union

A 3D model can be made of different shapes, but it is always best to **join** these shapes together. Different softwares have different names for this, but it is usually called a **boolean union**, a **bool** or just **merge / join**. Not joining separate objects together before printing can cause complications.

Ready to learn about file setup, or book a 3D printer? Complete the 3D Workshop Moodle inductions today!

3D Printing open hours

Mon-Fri: 11am-5pm

Wed: 2pm - 5pm

 Located in WG28d