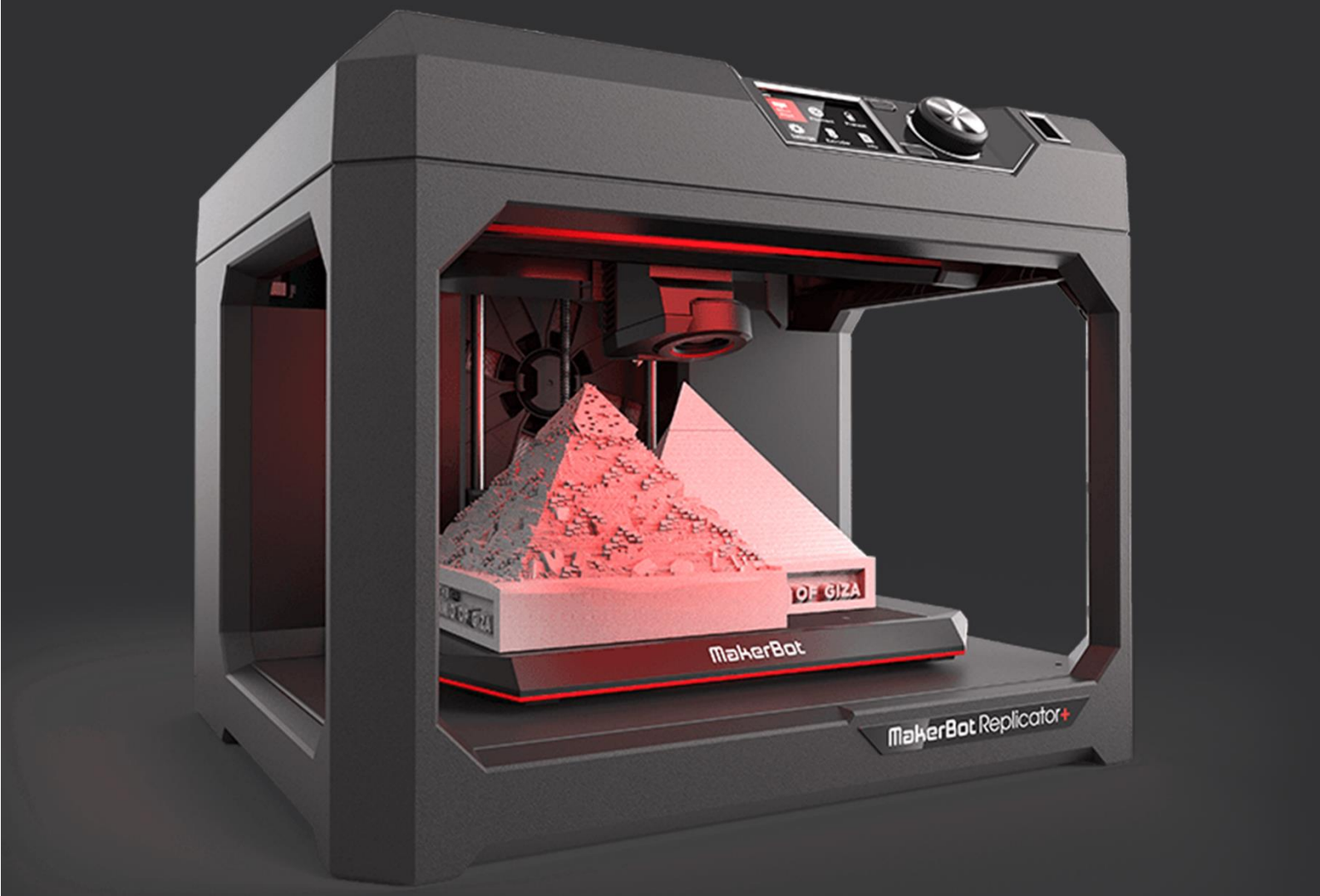
UKRI Science and Technology Facilities Council

MakerBot® Replicator®

DESKTOP 3D PRINTER

USER MANUAL



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Safety alert symbols precede each safety message in this manual. These symbols indicate potential safety hazards that could harm you or others or cause product or property damage.

Warning: The MakerBot Replicator generates high temperatures. Always allow the MakerBot Replicator to cool down before you reach inside.

Warning: The MakerBot Replicator includes moving parts that can cause injury. Never reach inside the MakerBot Replicator while it is in operation.

Warning: There is a risk of shock. This product is not user serviceable.

WHAT IS A MAKERBOTS PURPOSE?

The MakerBots in the Campus Technology Hub (CTH) provide a way to create models that have numerous purposes. The MakerBots specialise in prototyping because they can take any 3D model and replicate it, often achieving certain mechanics that traditional manufacturing struggles with such as inbuilt chains, links and structures within a structure.

As the technology matures, it becomes a cheaper alternative for creating prototypes rather than traditional manufacturing, which often struggles with producing unique models due to the cost of designing and creating an injection mould.

HOW DO THE MAKERBOTS WORK?

The MakerBots work by printing a thin layer of heated plastic filament that sets quickly, then repeating this process on top of previous layers in order to build their way up to a 3D model. To do this, it needs a 3D file. Once it has been told to print that file it will begin heating up the extruder. Once it has reached the temperature required, the plastic filament will begin to melt. This plastic cools down fast so it has a chance to set before a new layer is added on top of it. Slowly, layer by layer, it will create a 3D model.

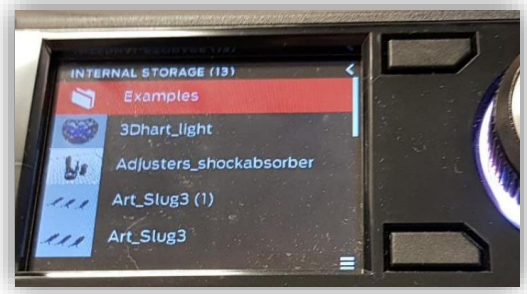
This plastic filament comes in spools that are attached at the back of the printer. These filaments come in various colours, but with this printer you can only use one colour for each print.

BASIC OPERATION

To begin with, we need to get used to the MakerBots interface and a few other things before we start printing our own models. Following the steps below, print the example box. This is a great test to make sure the 3D printer is functioning correctly.

To begin with, select the 'Print' menu by turning the silver wheel. Once 'Print' is selected, simply press the wheel. Then use the same controls to go into the 'Internal Storage'.

From here enter the folder labelled 'Examples' and select '20mm Box'. As the print time will show it is a very fast and simple print, as it only takes 13 minutes. Now all you need to do is select 'Print'.



And now it will begin the setup process. This will heat up the extruder and help the extruder find the exact centre of the build plate. The printer needs to do this otherwise it will not know the exact distances it needs to travel in order to make the model. As it builds, you will see a couple of stages.

Please be aware that the extruder tip reaches above 200 degrees Celsius so do not attempt to touch it.

Initially it will build the raft. This raft is a supportive design that is used to anchor or adhere the model to the build plate. Without this raft, the model can often get stuck on the build plate and misalign, so a raft is always recommended.

Once the raft is complete, it will begin printing the actual model. You'll notice as it builds the model, it will build a small structure inside. This is called the infill and provides extra support. For a small model like this it doesn't need a complex infill, but for some models you will need complex infills for added support.

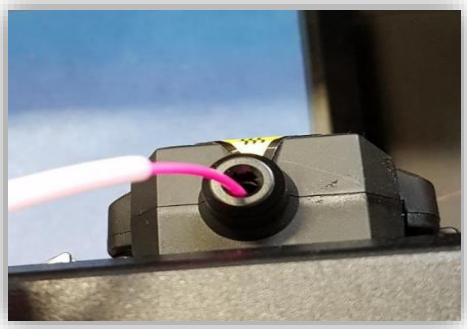
FILAMENT CHANGE

It is important to know how to change the printer's filament. Knowing how to change the printer's filament allows you to not only replace empty spools, but also the change the colour of the printed model itself. Following the steps below you will learn hoe to change a spool of filament.

First you will need to select the 'Filament' option on the menu and then select 'Unload Filament'.

After you have done this, the extruder will heat up to 215 degrees, in order to melt the filament so that It can be removed from the extruder. This will take a few minutes.

Once the extruder has finished heating up, it will begin unloading the filament. When it has done this you will see that the filament wire is visible atop the extruder, simply pull on the filament to remove it. It will need to go through a tight section so do not be afraid to pull it. If the fillament is really stiff, then it will be worthwhile to go through the unloading process shown above again, and see if it will dislodge itself.



Once the filament is out, I would recommend snipping the end of the filament off. This is because the end is usually damaged by the heat of the extruder, and makes it much more difficult for the extruder to accept it, if you use the same spool again. Simply cut the filament a few centimeters down from the damage.

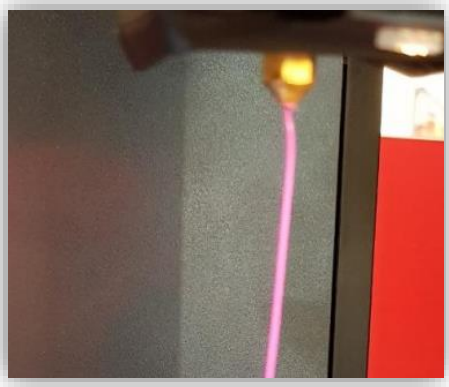
Now that you have unloaded the filament from the extruder, all that you need to do is open up the section at the back of the printer and lift up. Then you will need to wind the spool back up, so that the filament inside of the white feed tube is removed. Once the spool is out of the printer, you should feed the filament through the small holes on the spool, in order to keep it tidy. Once this is done, make sure to place the filament in a bag and reseal it.

LOADING FILAMENT

In order to load a new spool, you will need to know where to find them. The filament spools can be found in the end cupboard (Highlighted Below).

Once you have found the spool you need, you will need to snip the end of the filament at an angle, to help with the extrusion. Simply place the filament into the spool holder at the back of the printer and start feeding your freshly cut filament through the small white tube, you will feel a slight resistance once you have reached the extruder. Once you feel this resistance stop feeding it through.

When loading a new filament, follow the steps before then select the 'Load Filament' option on the menu. It will begin to heat up the extruder (this will take a couple of minutes). This next part will be explained via the lcd screen on the printer itself. Simply follow the instructions.



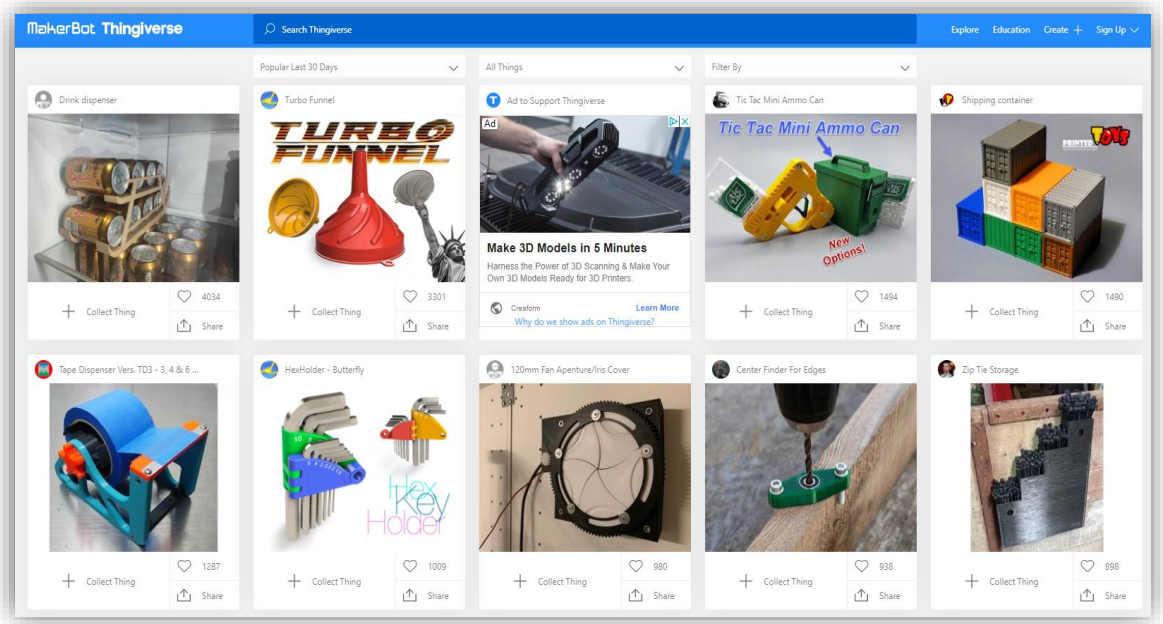
Once these instructions have been followed you will see your filament begin to extrude. Make sure that your spool is rotating in the holder, if it is then you know you have successfully changed the filament on the MakerBot. Initially you may see the previous filaments colour, but after a while it will all be extruded out, and your chosen colour will begin to extrude.

SOURCING YOUR OWN MODELS

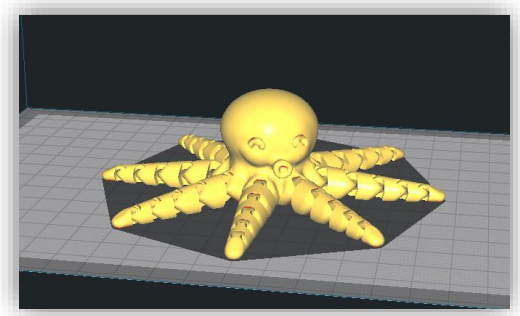
Now that you have a grasp of the basics of using a MakerBot, you can now choose and print your own models! In order to do this, we will need to cover some of the software and resources that you will need to use. You will also need a USB stick in order to move the 3D files from a computer to the MakerBot.

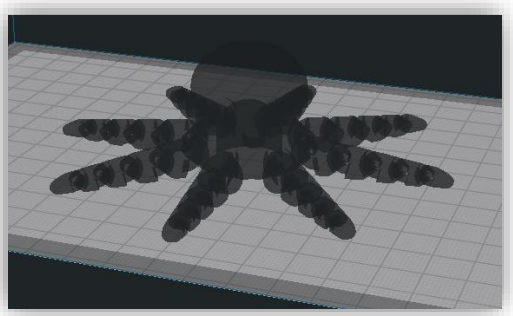
Within the Campus Technology Hub (CTH), there is a room called the CAD Office in which there are two computers equipped with 3D modelling software. Ask a technician if the computer is not logged in.

Once logged in to the computer, open an internet browser and search for a website called 'Thingiverse'. This is an online sharing platform, that allows its users to share 3D models made specifically for 3D printing. Once you are on the website you can search for any model you would like to print (Anything you can think of, they will most likely have).



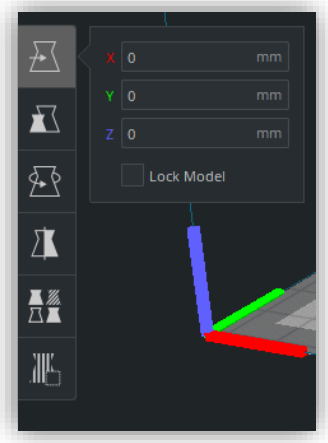
Here you can see that I found a model of an octopus that has articulated arms. Once you have found the model that you would like to print download it, and then open the program on the desktop called 'Ultimaker Cura'. When it has loaded simply drag and drop the file you have just downloaded into the program, and you should see the model displayed like this:





ULTIMAKER CURA

There are several tools at your disposal within Cura. The main tools that you will be using are located on the left-hand side of the software. Here is a breakdown of what each one does.



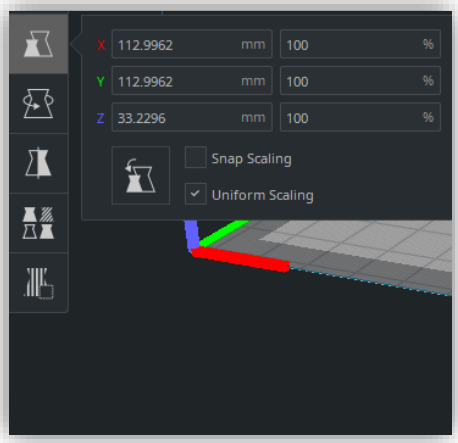
This is the move tool. When selected it allows you to move the position of the model around the virtual build plate, extremely useful for prints that require multiple parts, or larger parts.

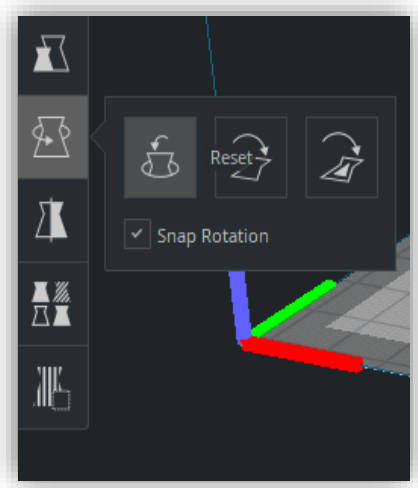
This tool can be accessed by clicking on the icon or pressing the 'T' key on the keyboard.

This is the scale tool. When selected it allows you to adjust the scale of the model. Very useful if the model you have downloaded is either too large or too small.

Smaller prints = shorter build time. But with shorter build times comes less fidelity.

This tool can be accessed by clicking on the icon or pressing the 'S' key on the keyboard.

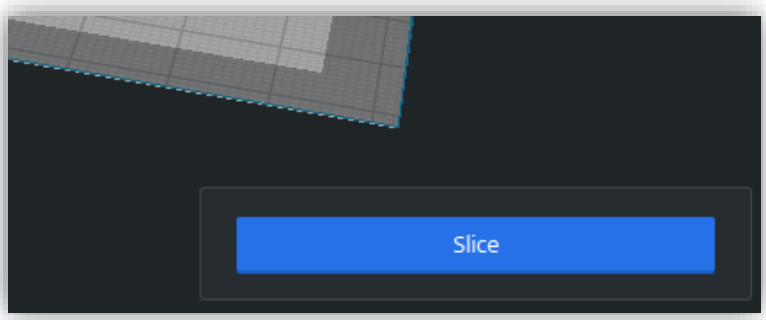




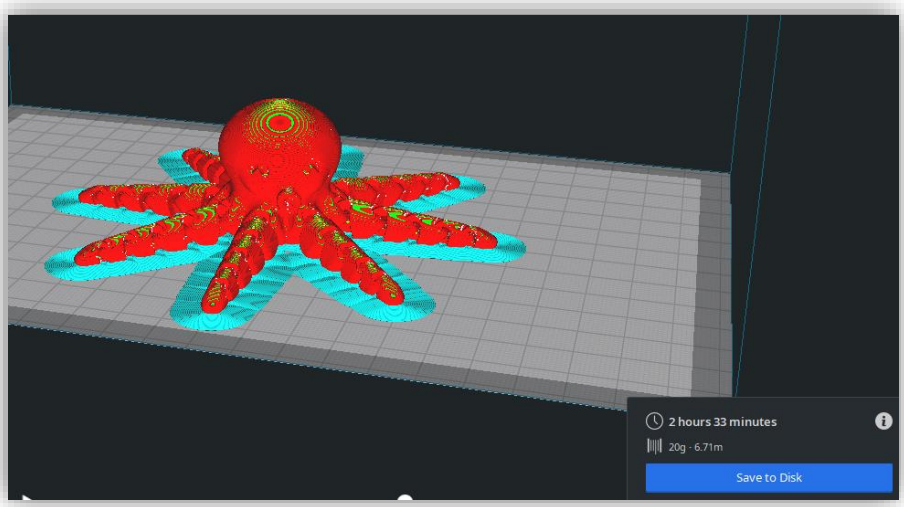
This is the Rotate tool. When selected it allows you to rotate the model across all axes. Allowing for repositioning of the model, often for shorter print times. Or printing without supports.

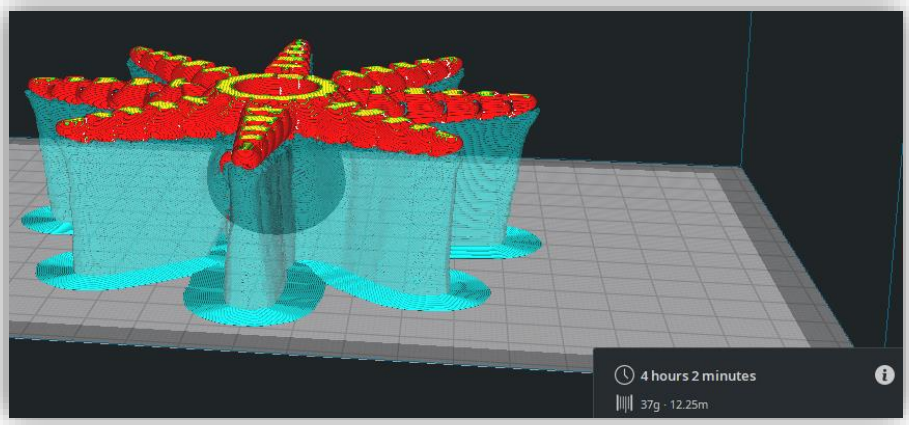
This tool can be accessed by clicking on the icon or pressing the 'R' key on the keyboard.

Once you are happy with the positioning, scale and rotation of the model, you can press the 'Slice' button, in order to begin the structure generation. This is located at the bottom right of the application.



Using these tools wisely is the key to reducing print times, as well as material usage. Look at the two examples below, that showcase the importance of correct orientation when it comes to print times.

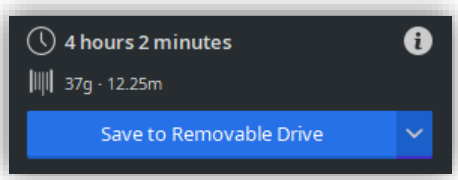


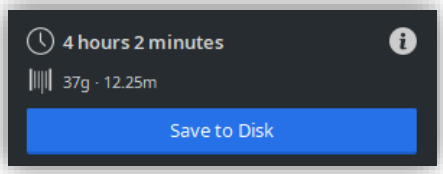


PRINTING YOUR OWN MODELS

Once you are happy with your model, make sure to save the file onto your USB stick, so that you can transfer the files to the MakerBot.

Once you have inserted your USB into the computer, Cura will automatically recognise the removable drive, and the 'Save to Disk' prompt will change to 'Save to Removable Drive'. Simply click this button and it will save the file to your USB.





Once you have saved the file to your USB, you can go to the MakerBot, and insert the USB. Once you have inserted the USB follow the menu for 'Print' and then 'USB Storage'. Once in this menu, navigate to your downloaded models file, and select 'Print'. Personally, I would recommend staying around for the first few minutes of the print just to make sure that there are no errors.

Once your model has printed, make sure to remove the finished print from the raft carefully, as if you are too aggressive you could damage the build itself. Now you will have the finished 3D printed product! If there are any support structures left, you can remove them from the building using pliers, or a fine cutting tool.

CONTACT

Thankyou for reading the MakerBot Guide. If you have any questions or queries do not hesitate to contact me 😊

ben.powell@stfc.ac.uk