

3D Printing

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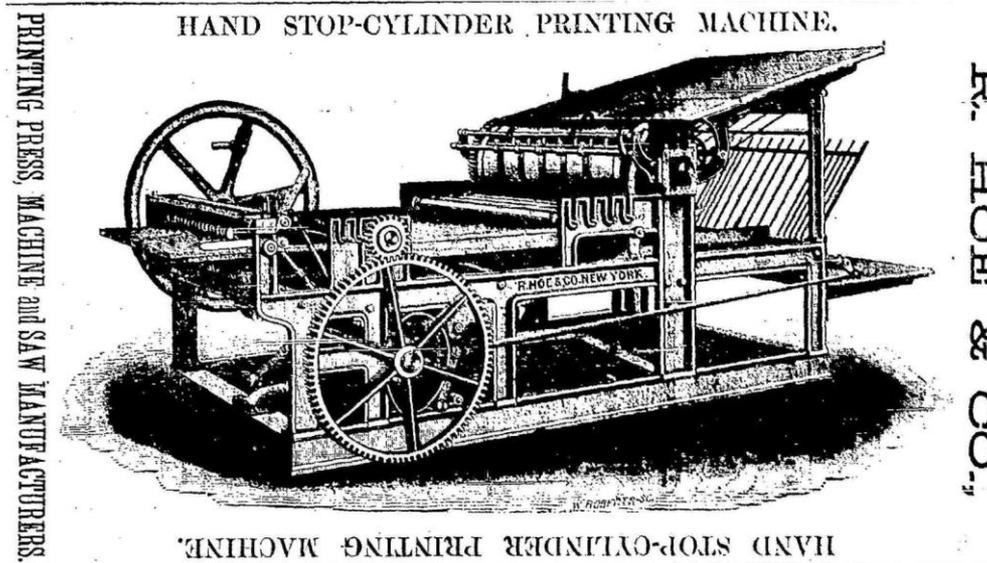
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Agenda

- 3D Printing Overview
- 3D Printing Workflow
- Design something and Print it
- The future of 3D Printing

Printing



- Not that many years ago having your own colour printer was the stuff of dreams
- Nowadays you can buy them for next to nothing
 - Although the ink is always very expensive

3D Printing

- Printing in 3D might seem as far fetched as everyone owning their own colour printer, or TV camera, did a few years ago
- The technology is now becoming almost mainstream
- We can print cheaply enough, and in sufficiently strong materials to make the technology viable



Uses for 3D Printing

- Rapid prototyping of designs
 - Prove that a physical design works as expected
- Short production runs of components
 - It may be uneconomical to mass produce the item
- Print things that can't be made any other way
 - Can print objects “inside” each other

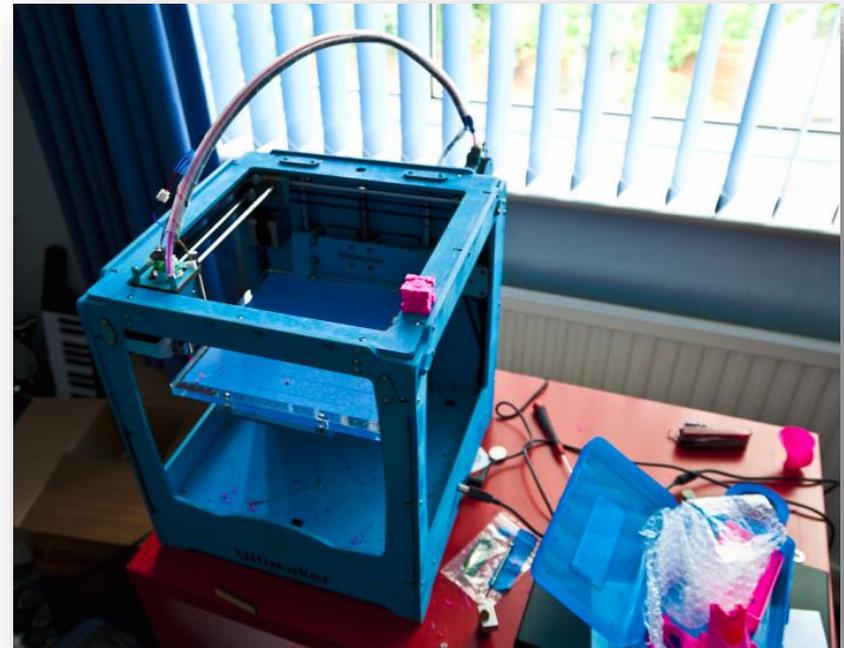


3D Printing Technologies

- There are lots of ways to print in 3:
 - Selective Heat Sintering
 - Heat up powdered plastic so it melts and fuses together and forms hard objects
 - Digital Light Processing
 - Shine a UV light onto liquid plastic which makes it harden
 - Fused Deposition Modelling
 - Lay down layers of material which is extruded onto a flat bed
- Each has its advantages and disadvantages
 - I don't think any of them are ready for prime time yet

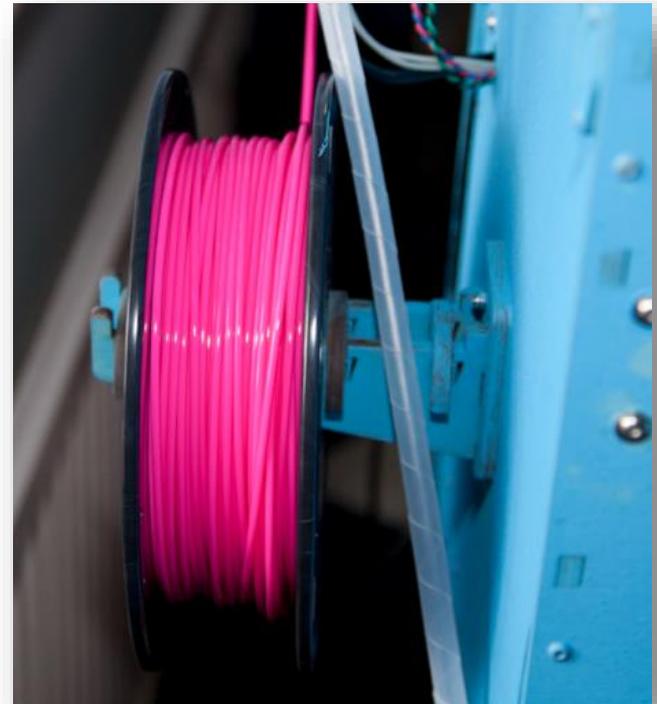
Introducing Una

- Una is an FDM 3D printer
- She prints by “knitting” together a continuous hot plastic fibre to make solid objects
- She is a bit temperamental, but when she is in a good mood she can print some amazing stuff



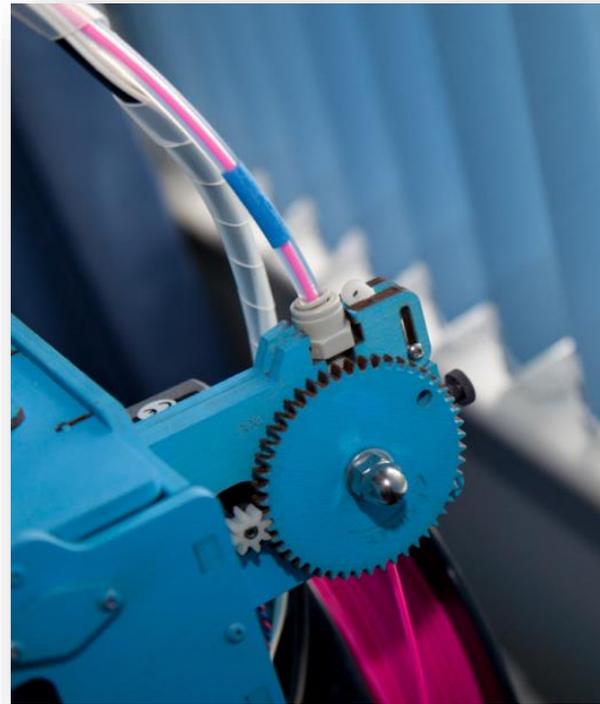
Raw Materials

- Una can print on ABS or PLA types of plastic
- PLA is biodegradable and melts at a lower temperature
- It is supplied as a 3mm wide fibre strand which is fed into the machine from a roll



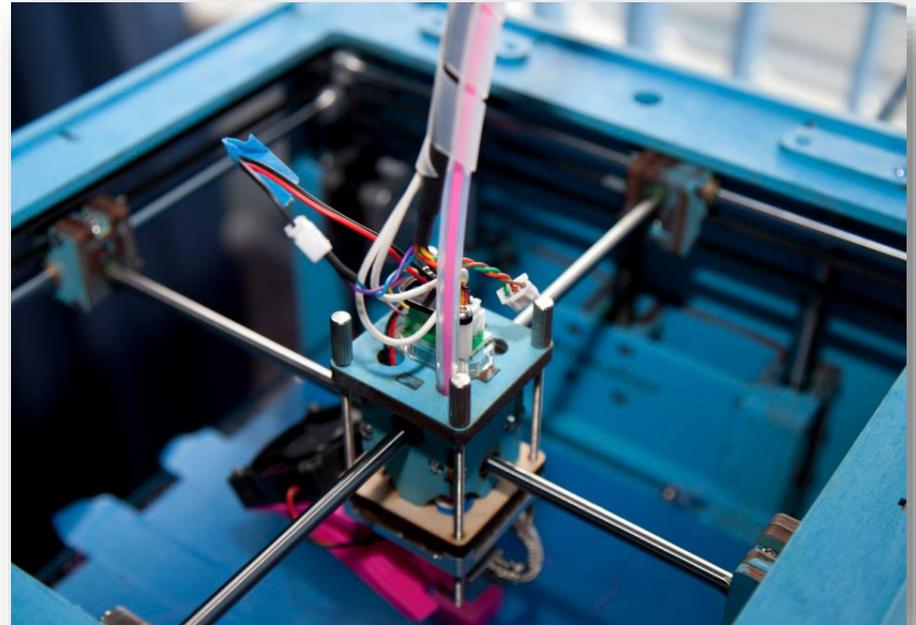
Feeding Plastic

- The drive motor pushes the plastic fibre into the clear tube towards the print head
 - This is called the “Bowden Tube”
- At this point the plastic is still solid
- Note that one of the gears is made of wood....



The Print Head

- The print head is driven left and right by stepper motors
- These allow very precise positioning
- The plastic fibre is fed through the Bowden Tube into the print head at the top



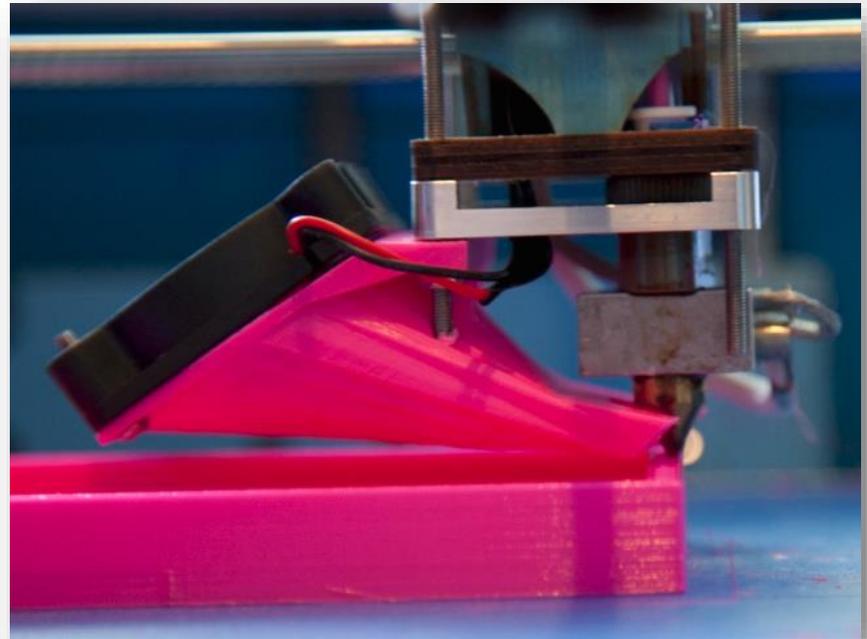
The Print Head

- The shiny metal block in the middle contains a heater that melts the plastic
- It then comes out of the print nozzle at the bottom and lands on the thing Una is building
- Una builds each layer in turn



Printing in action

- Here Una is building the side of a box
- The hot plastic is coming out of the brass nozzle
- The fan on the left is cooling it down so that it sticks to the previous layer



FDM Printing

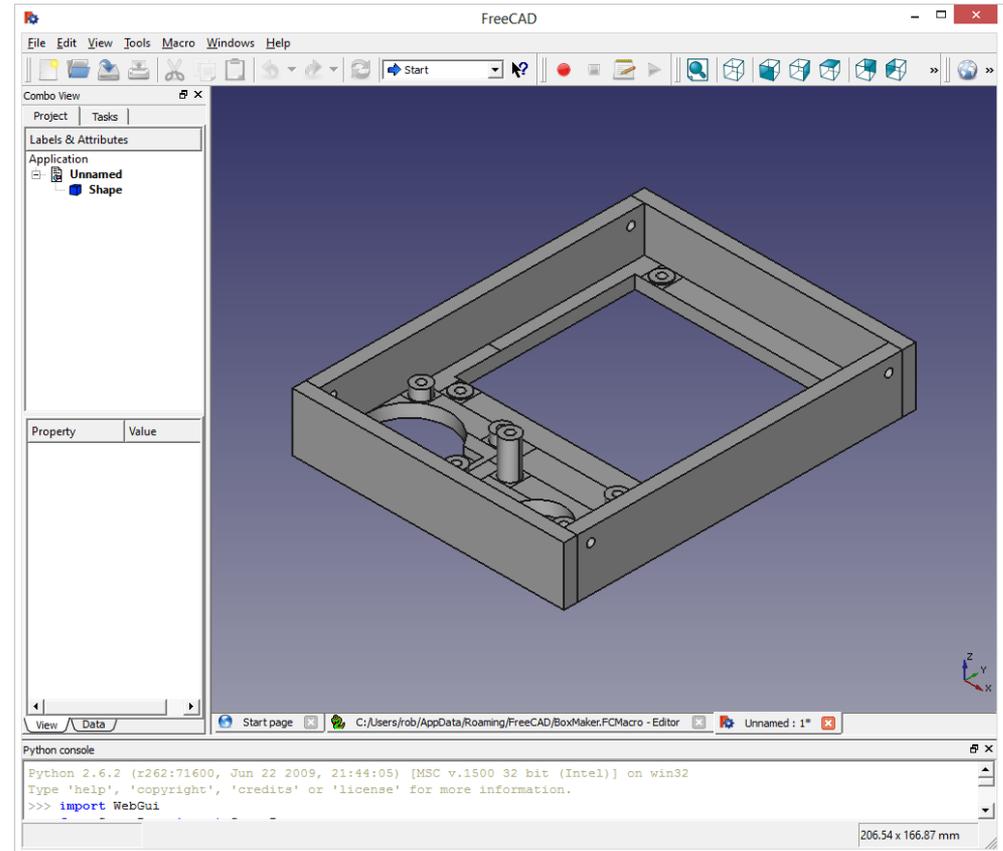
- The great thing about FDM printing is that it works
- There are a few less great things though
- Models are built up of layers, which means that things like overhangs are hard for printer to produce
 - You can print at an angle of up to around 45 degrees before things start to go badly
- The material itself is prone to shrink as it cools, leading to warping of flat surfaces
- You can only print in one colour at a time

3D Printing Workflow

- Create the design using a 3D package
 - FreeCad, Autodesk 123D, Sketchflow all work well
- Export to an STL file
 - This contains a mesh that describes the object to be printed
- Slice the mesh to produce a “GCode” file that describes the printer path
 - I use a program called Cura to do this
- Send the design to the printer

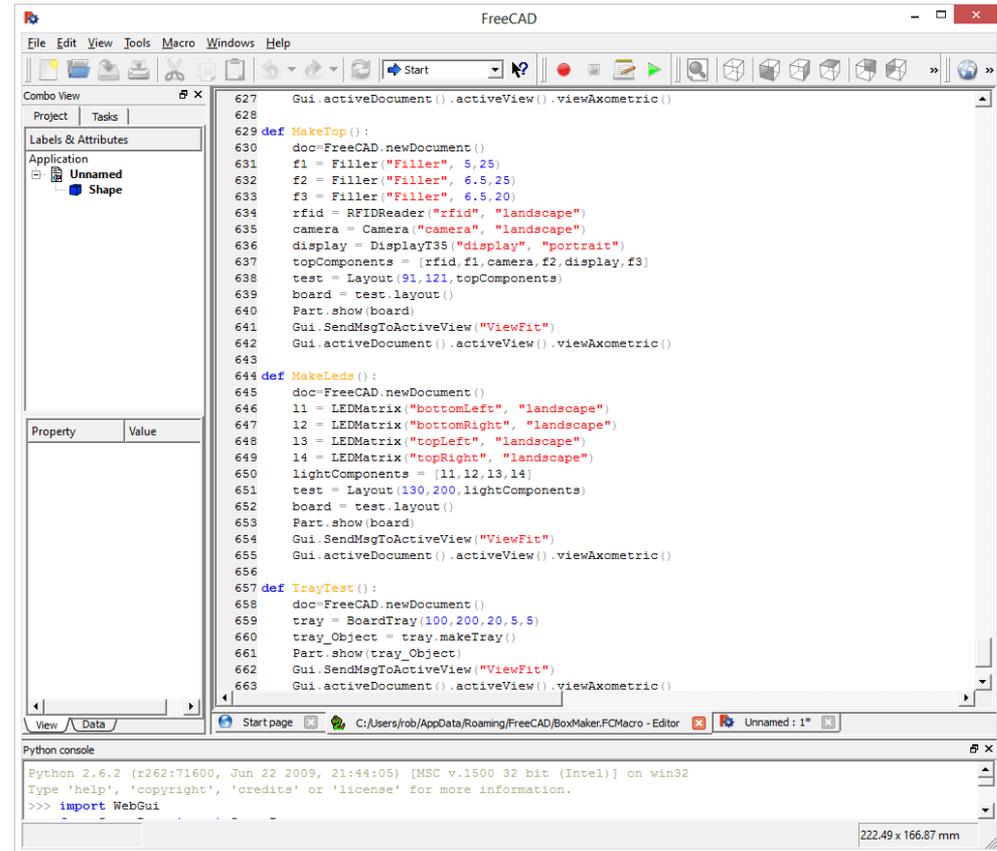
FreeCAD

- FreeCAD lets you design things in 3D
- This can be a bit painful
 - Visualising and manipulating things in 3D is hard



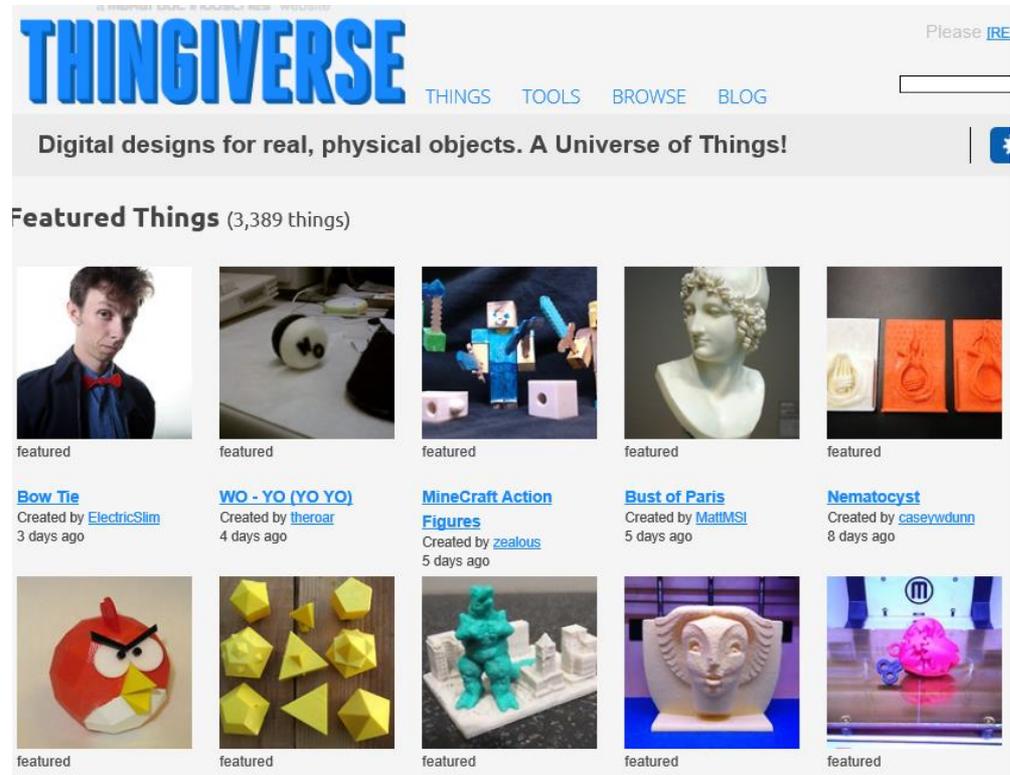
FreeCAD and Python

- One of the great things about FreeCAD is that it lets you generate objects using Python programs
- These run inside the tool and let you create objects programmatically



What can you print

- You can print anything – within reason..
- There is quite a community of people who make and share object designs
- I use thingiverse.com as a good starting point



3D Scanning



a MakerBot Industries website
THINGIVERSE THINGS TOOLS BROWSE BLOG

Welcome, friend.
 Please [REGISTER](#) or [LOGIN](#) to rock.

Digital designs for real, physical objects. A Universe of Things!

[SEARCH](#)

[UPLOAD A THING](#)

Site 3 open house 3D scans from 2012-08-16



Created by [technight](#)

Created on Aug 22, 2012

[Models > People](#)

Featured on Aug 22, 2012

We used a Kinect and ReconstructMe to make 3D scans of members and guests during our weekly open house night on August 16th, 2012.

Each scan has an "original" version and a "final" version. The final ones have been cropped and cleaned a bit and are ready for 3D printing.

- There is an iPhone app called 123D Catch from Autodesk which will take 40 pictures and make a 3D model from them
- You can use the new Microsoft Kinect SDK to scan in 3D

3D Printing and Fun

- You can generate the designs (and even the GCode files) programmatically
- The printer firmware can also be reprogrammed
- Many printer designs and control software are open source, so you can fiddle with them
- You can also use a 3D printer to print parts to make another 3D Printer
 - You can also print extra parts for your printer

3D Printing and the Future

- Selling 3D printing technology as something which is here now is being wildly optimistic
 - Although they are great fun to tinker with and for prototyping at a very low cost
- It is pretty much certain that our future will contain 3D printers of some kind
 - Although I'm not convinced that the current generation of technology will be how they end up working
 - They need to get a lot cheaper
 - They need to be able to print in colour
 - They raise a whole new set of copyright issues

Useful Stuff

- 3D Printers and Cura
 - <http://www.ultimaker.com/>
- Free 3D Design and Scanning Tools
 - <http://www.sketchup.com>
 - <http://sourceforge.net/projects/free-cad/>
 - <http://www.123dapp.com/>
- Things
 - <http://www.thingiverse.com/>
- My Blog
 - <http://www.robmiles.com>