

3D printing process: expectations and mindset



Idealised process: *Simple & unproblematic!*

1. Have great idea!
2. Model it!
3. Print it!
4. Perfect print first time!



In reality: *Still some way to go!*

1. Some ideas unworkable!
2. Difficult to use software!
3. Technical limitations!
4. Unpredictable outcome!
5. Process of trial and error!

Conclusion:

use the media to your advantage!

- The media's capability:
 - High level of detail.
 - Can work with unique, complex shapes.
 - If you get the chance, iterate your designs.
- Err on the side of caution:
 - 3D model has to be solid (math-speak: manifold)
 - Avoid “sticky-out bits” (can break off).
 - Smaller is cheaper and faster.

So how do you get started?

- There are many options.
- Some may have experience already of computer 3D modelling, other not. Help each other!
- We will be using:
 - **Photogrammetry** – technique for capturing real world objects.
 - **Sculptris** – create organic 'sculptures' easily.
 - **Blender** – full blown software (we'll use it for converting between file formats, fixing models).

What is 3D printing?

Video of process: <http://www.youtube.com/watch?v=R3-PC13GUoI>

- Range of different technologies, but typically:
 - Additive: building object up layer by layer.
 - Monochrome ABS (thermo) plastic material.
 - New professional printers and services increasingly offer polychrome and multi-material printing.
- We have access to various 3D printers:
 - Max print area: $\sim 20 \times 20 \times 30$ cm.
 - 0.33mm per layer.
 - Speed: $\sim 5 \text{cm}^3$ per hour.

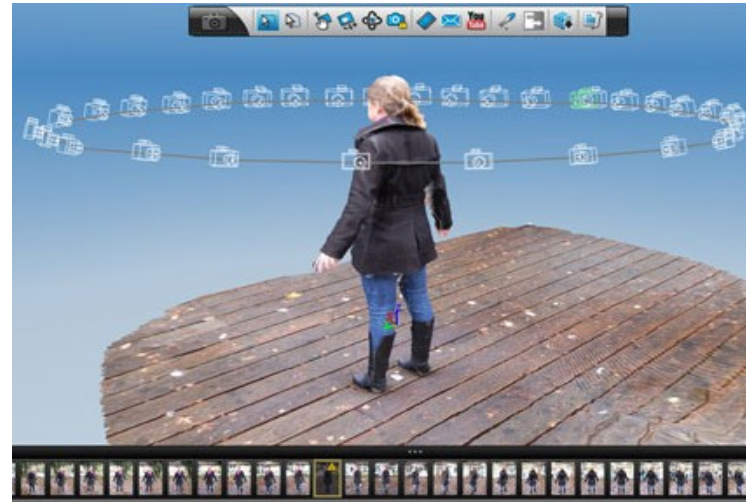


Capturing real world 3D objects: LIDAR vs. photogrammetry

- LIDAR is a professional high resolution scanning technique.
 - Time consuming.
 - Requires skills and equipment.
- Photogrammetry is cheap and cheerful!
 - ~5 minutes to capture an object.
 - Only an easy to operate digital camera is needed.
 - Your mileage may vary...



How to do photogrammetry?



Process:

1. Take 40-50 pictures of object from all angles, with about five degrees between each picture.
2. Upload images to a service that calculate the geometry by matching image features, such as:
 - 123D Catch (www.123dapp.com/catch)
 - My 3D scanner (www.my3dscanner.com)
3. Correct, modify and print the resulting model.

Photogrammetry don'ts



Photogrammetry don'ts

NEVER USE TURNABLE!



Go Around Object, Do Not Move It!



Photogrammetry don'ts



Here's one we did earlier: Egyptian cat sculpture



- 10cm object
- 40 images
- General shape correct, but details are lacking:
E.g. carvings, tail and ear.



You will have a chance to try photogrammetry this afternoon

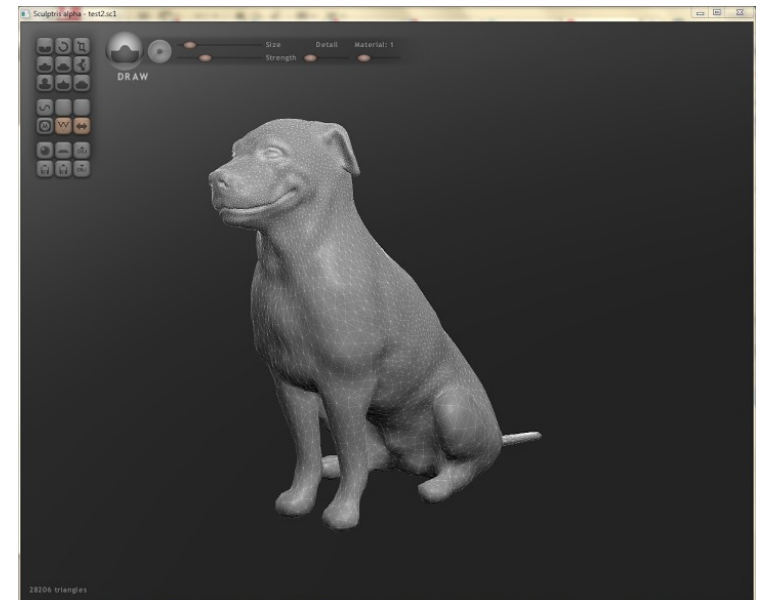
- We will bring cameras during the outdoor walk.
- I will collate all pictures and upload them to the photogrammetry services.
- By tomorrow morning, we should have a handful of 3D models.
- These could be a starting point for 3D modelling and printing (or not) – it's up to you!

But what if I want to create something from scratch?

- There's lots of software out there.
- We have picked **Sculptris** because it is
 - Fun
 - Intuitive
 - Outputs solid (manifold) objects suitable for print.
 - Free (www.pixologic.com/sculpttris/)
- Of course, you can use any software you want as long as it outputs solid STL or OBJ files.

More about Sculptris

- Competes with Zbrush (pro 3D modelling).
- Your task for the next hour is to download, install and play with the software:
www.pixologic.com/scuptris/
- We will give a quick demonstration to show you the main features.
- But first some advice



Sculptris advice



- The most important tools are:
 - Draw (adding geometry)
 - Crease (make a mark/incision into the object)
 - Smooth (great for fixing a broken solid)
- Avoid the pinch and inverse drawing tool – they can break your model
- Tools can be inverted for interesting effect.