



Aalto University  
Media Factory

# Digital\_Fabrication\_Studio.06

## 3D Printing / Scanning – from atoms to bits and back

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21.05.2012

Aalto Media Factory  
Helsinki



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## Today:

- \* 3D scanning: examples
- \* 3D scanning: tools and softwares
- \* 3D printing: technologies
- \* 3D printing: examples
- \* Design techniques



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# 01. 3D scanning: bits from atoms

# 3D scanning and 3D printing...



From atoms to bits and back!

# Radiohead: *House of Cards* video



No cameras / lights: 3D scanning collected information about the shapes and relative distances of objects. The video was created with visualizations of the data.

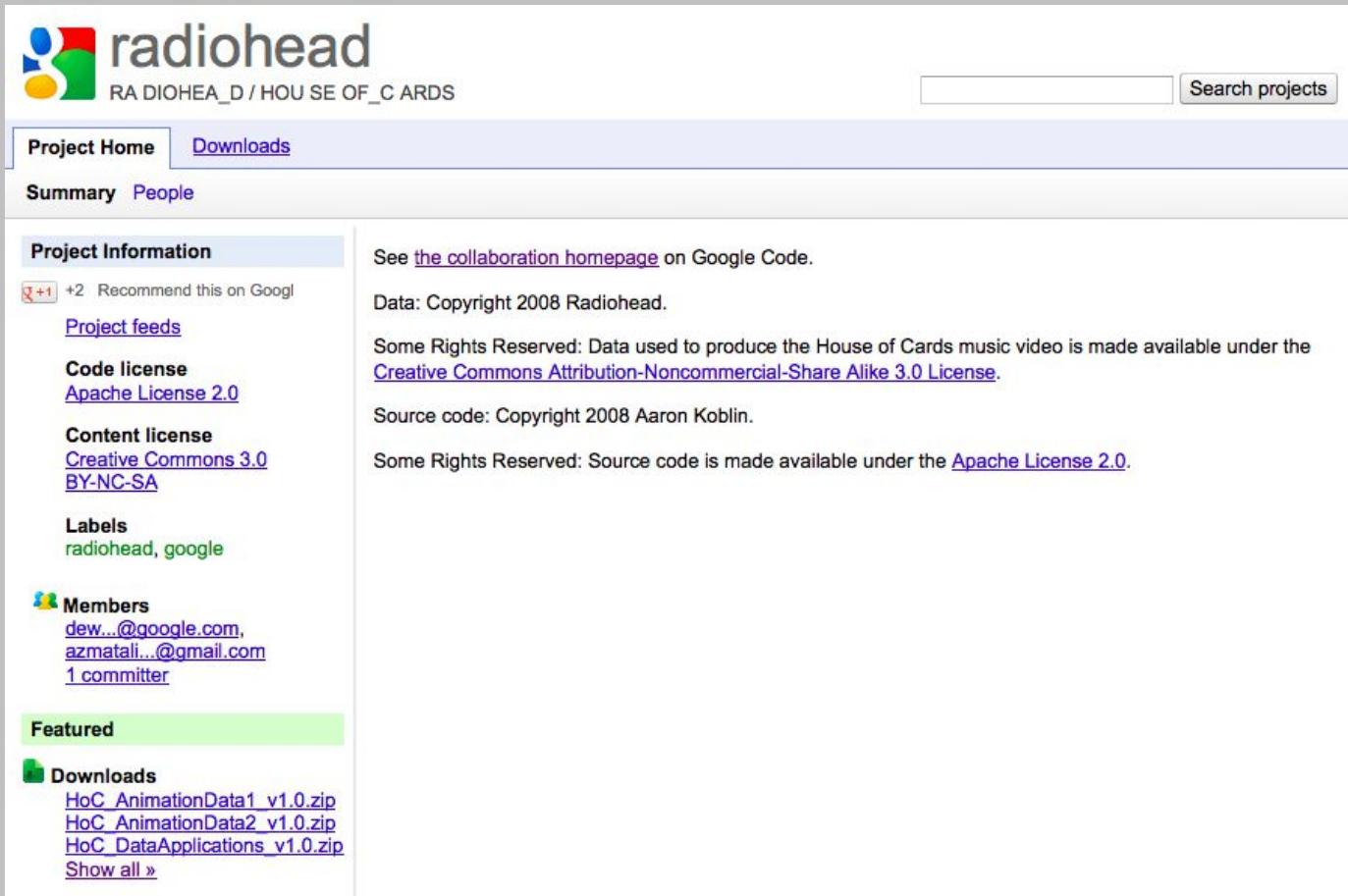
# Radiohead: *House of Cards* video

Aaron Koblin



No cameras / lights: 3D scanning collected information about the shapes and relative distances of objects. The video was created with visualizations of the data.

# Radiohead: *House of Cards* video



The screenshot shows the 'radiohead' project page on Google Code. The header features the Radiohead logo and the text 'RA DIOHEA\_D / HOU SE OF\_C ARDS'. A search bar and a 'Search projects' button are on the right. Below the header, a navigation bar includes 'Project Home' (which is active), 'Downloads', 'Summary', and 'People'. The main content area is divided into sections:

- Project Information**: Includes a '+2 Recommend this on Google+' button, 'Project feeds', 'Code license' (Apache License 2.0), 'Content license' (Creative Commons 3.0 BY-NC-SA), and 'Labels' (radiohead, google). It also links to 'the collaboration homepage' on Google Code.
- Members**: Shows two committers: dew...@google.com and azmatali...@gmail.com, with 1 committer listed.
- Featured**: Shows a 'Downloads' section with three files: HoC\_AnimationData1\_v1.0.zip, HoC\_AnimationData2\_v1.0.zip, and HoC\_DataApplications\_v1.0.zip, plus a 'Show all »' link.

An open data / open source project on Google Code: point cloud data and Processing software are available!

Source: <http://code.google.com/p/radiohead/>

# Radiohead: *House of Cards* video



Learn about how the video of "House of Cards" was made and the various technologies that were used to capture and render 3D data.

# Smithsonian 3D scans its objects



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A new effort under way at the world's largest museum could bring more of its 137 million objects will be publicly available.

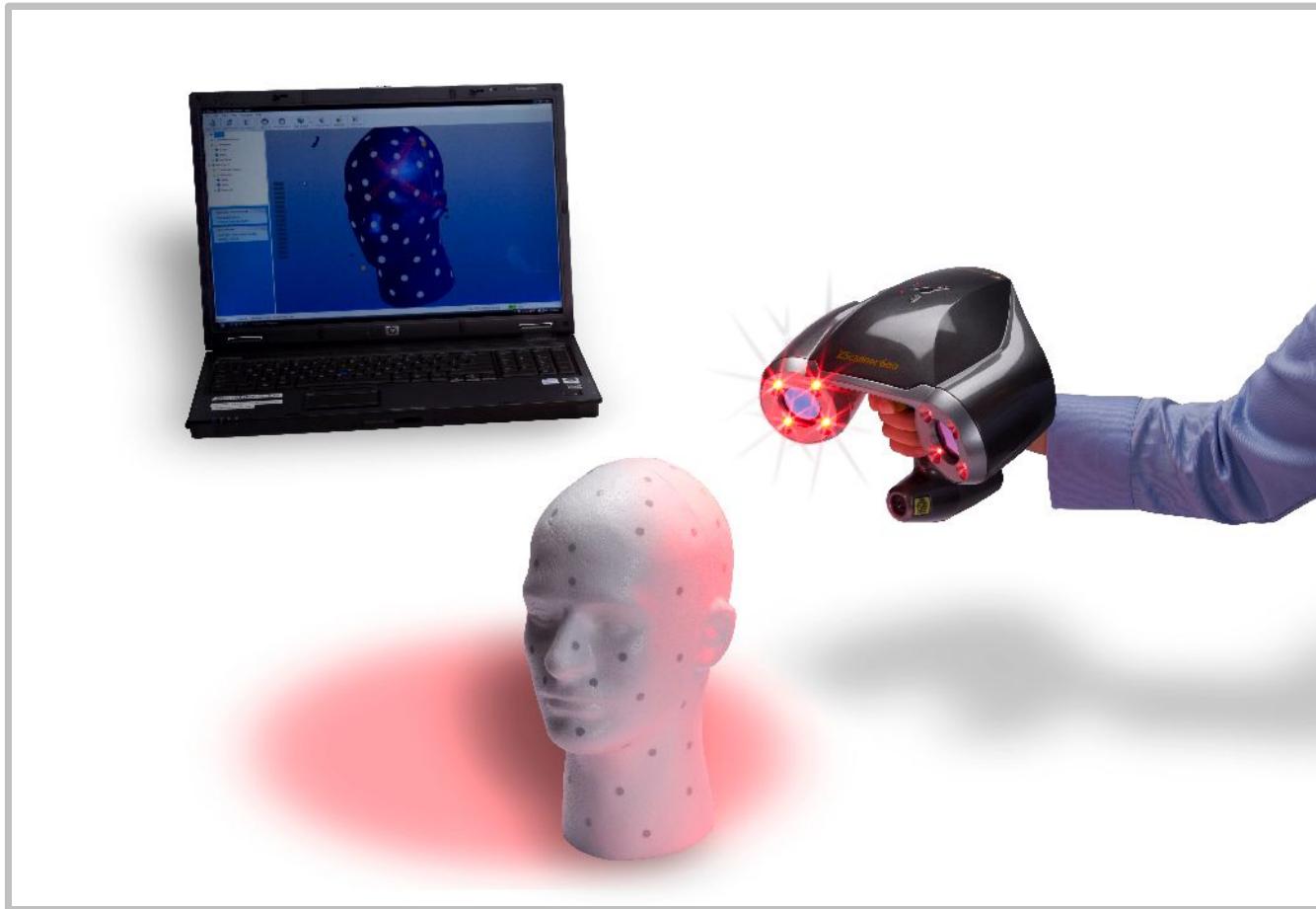


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02.

## 3D scanning: tools and softwares

# Hardware: expensive and not complete



There is still the problem of stitching together the meshes obtained.

# Hardware: a very good option

 **NEXTENGINE**

HOME PRODUCTS APPLICATIONS GALLERY SUPPORT FAQ BUY COMPANY

ASK NEXTENGINE



**The #1 Selling 3D Scanner.**

The NextEngine 3D Scanner captures objects in full color with multi-laser precision. Breakthrough technology has made it the World's most popular 3D Scanner, with thousands of users in over 80 countries.

In one box is everything you need to digitize 3D models, including ScanStudio HD software. Exports to **STL, OBJ, VRML, XYZ** and other formats.

Output 3D scan models to popular design software like **SolidWorks, 3ds Max, ZBrush, Rhino, Mathematica** and more. Use with **ScanStudio CAD Tools** to quickly make surface files or **RapidWorks** to build solid files. Print models on **Dimension, 3D Systems, zCorp, Objet**, and other 3D printers.

**\$2,995** High performance at 1/10th the price.

The NextEngine 3D Scanner captures objects in full color with multi-laser precision.

Source: <http://www.nextengine.com/>

# Hardware: cheap DIY version

The screenshot shows the DAVID Laserscanner website. At the top, the DAVID logo is displayed with the text "DAVID® LASERSCANNER". Below the logo is a navigation bar with links: DAVID Laserscanner, Shop, Wiki, Forum, DAVID Vision Systems, and Contact. A large image of a baby's face is visible in the background.

**MAIN MENU**

- Start**
- Features
- Starter-Kit
- Downloads
- Manual
- Gallery
- References
- News
- Buy License

**FORUM**

- 2012-05-20 , 08:07:58 pm Max distance between camera and object
- 2012-05-20 , 11:58:00 am saving depth-map as gray scale image
- 2012-05-21 , 12:37:10 pm Two scans: a sculpture and a person
- 2012-05-20 , 04:38:45 pm what is the best option for

**DAVID-LASERSCANNER 3.3!**  
Incredibly Low-Cost 3D Scanner for Everyone!

What do I need to build a 3D scanner?

- A camera (e.g. web cam)
- A hand-held **line laser** (starting at €19.90)
- Two plain boards in the background
- A Windows PC
- Our free software DAVID-LASERSCANNER

Or use the brand-new DAVID Starter-Kit!

If you don't want to start searching and tinkering, the **DAVID Starter-Kit** contains all necessary hardware and software to set up your own 3d scanner!

Supports both, Laser Scanning AND Structured Light Scanning!

How does Laser Scanning work?

1. Set up background and camera
2. Calibrate your camera with one click
3. Start **scanning** by sweeping the laser line over the object
4. Gaze at the 3D window and export your result to .OBJ
5. Optional: Automatically **stitch** several scans/meshes with DAVID-Shapefusion and export .OBJ, .STL, or .PLY

**GALLERY**

**NEWS**

- 2011-12-21 Special X-Mas Prices & DAVID 3.2
- 2011-09-22 DAVID Newsletter: DAVID 3 Released!
- 2010-11-18 DAVID Newsletter
- 2009-10-10 Mesh2Flash and CCD Cameras

**ONLINE SHOP**

DAVID-laserscanner is a low-cost system for scanning of 3d objects. Requirements are a commercial hand-held laser and a standard camera.

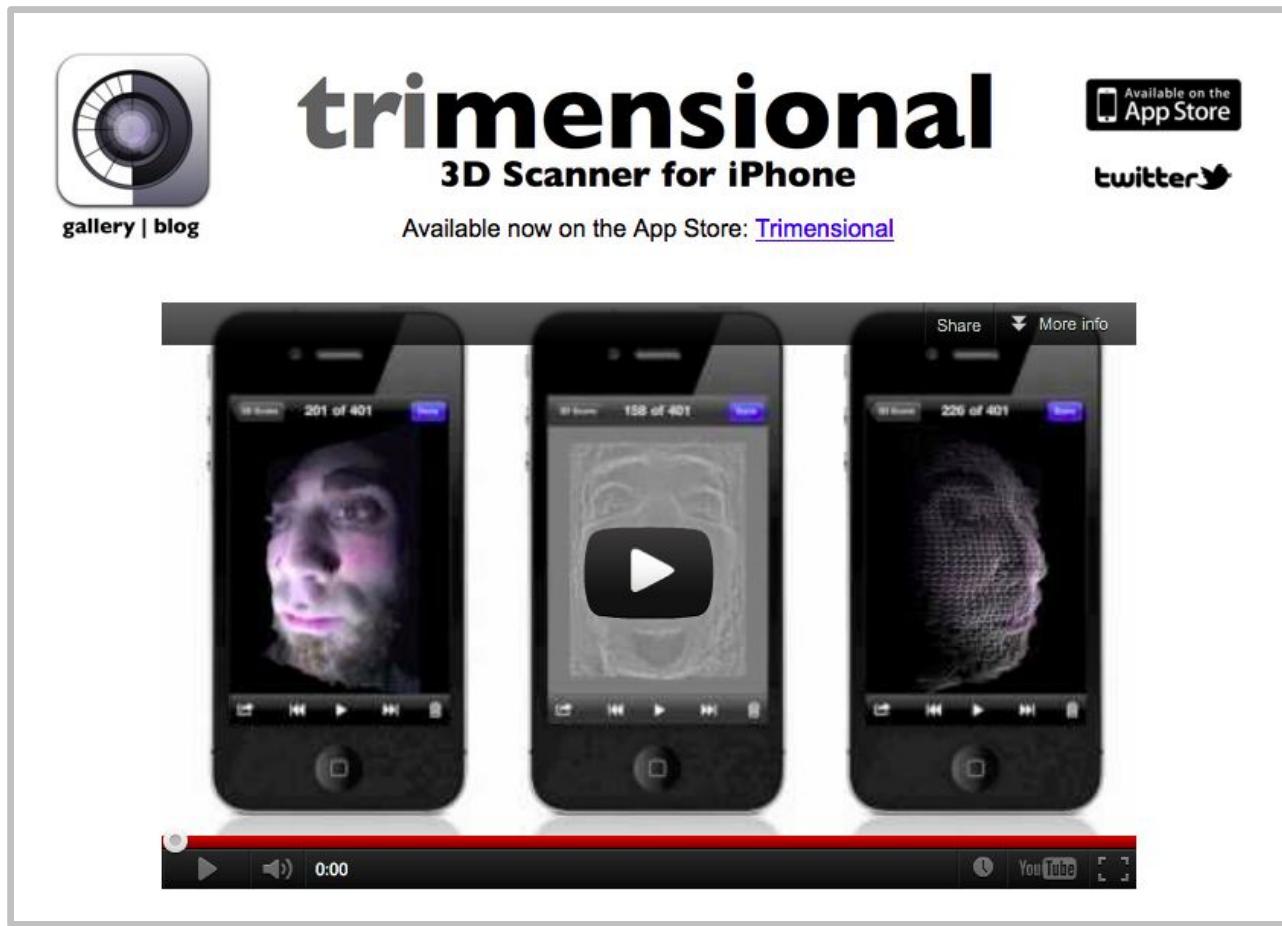
Source: <http://www.david-laserscanner.com/>

# Hardware: Modela MDX-20



You can scan also with the Modela, with a special head.

# A 3D scanner app for iPhone



Trimensional uses both the screen and the front-facing camera on an iOS device, detecting patterns of light reflected off your face to build 3D model.

Source: <http://www.trimensional.com/>  
<http://youtu.be/IEZtiDrxh-E>

# A 3D scanner with Kinect: ReconstructMe



ReconstructMe is a software tool for Windows that uses the Microsoft Kinect (or Asus Xtion PRO LIVE) to capture 3D models in real-time.

Source: <http://youtu.be/LZZqffZk0w0>

# 3D Scanning and character animation

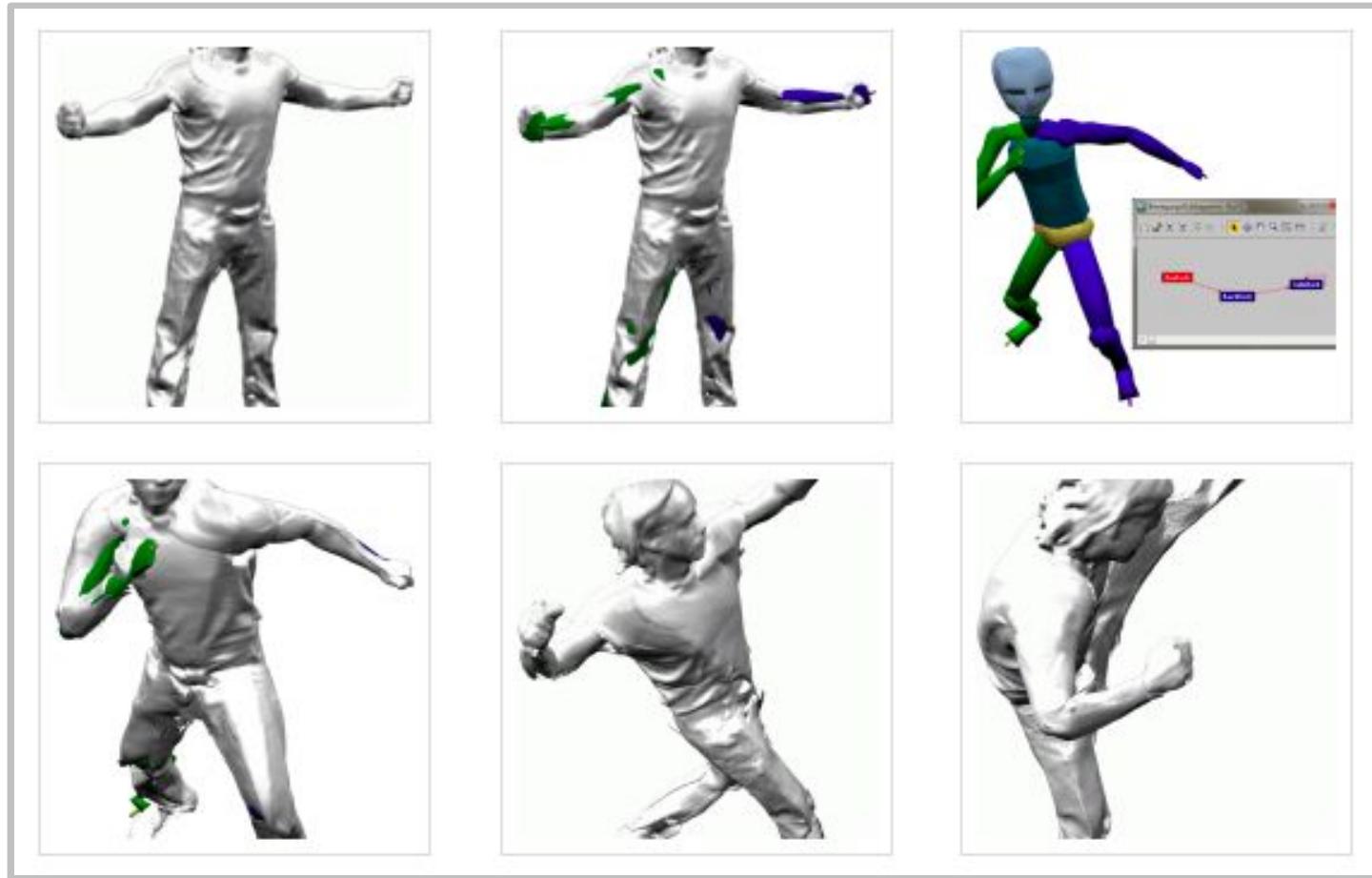


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“We have created a full body scan one of our coworkers while using a bigger volume, and he used this as the basis for a character animation.”

Source: [http://youtu.be/uimmxD0a\\_IM](http://youtu.be/uimmxD0a_IM)  
<http://reconstructme.net/2012/03/20/character-creation-with-a-reconstructme-scan/>

# 3D Scanning and character animation



“We have created a full body scan one of our coworkers while using a bigger volume, and he used this as the basis for a character animation.”

Source: <http://reconstructme.net/2012/03/20/character-creation-with-a-reconstructme-scan/>

# Be your own souvenir

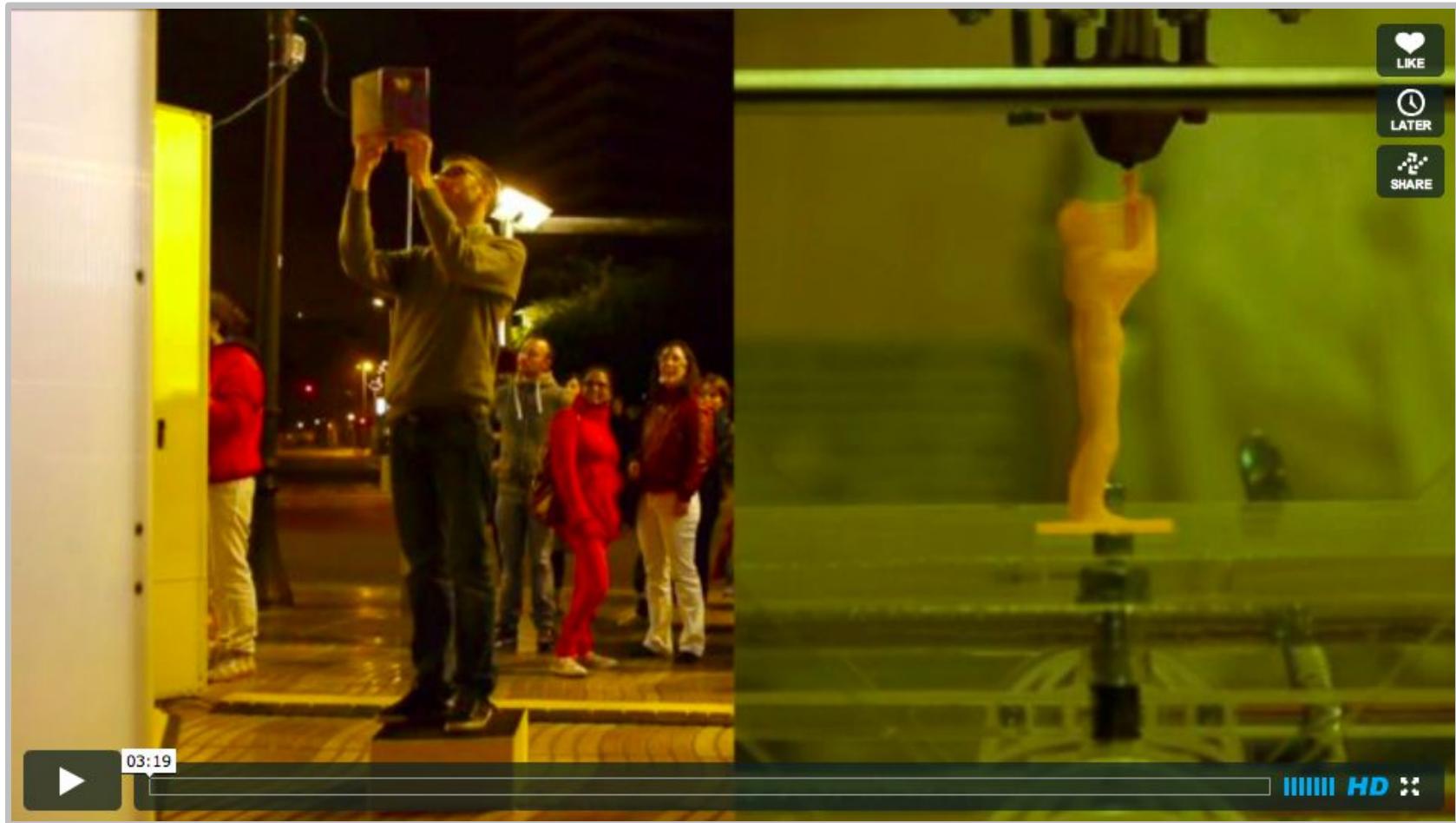


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The project from blablabLab uses custom software developed using openKinect and openFrameworks (and Meshlab and Blender).

Source: <http://www.notcot.com/archives/2011/04/be-your-own-souvenir-by-blabla.php>  
<http://www.blablablab.org/>

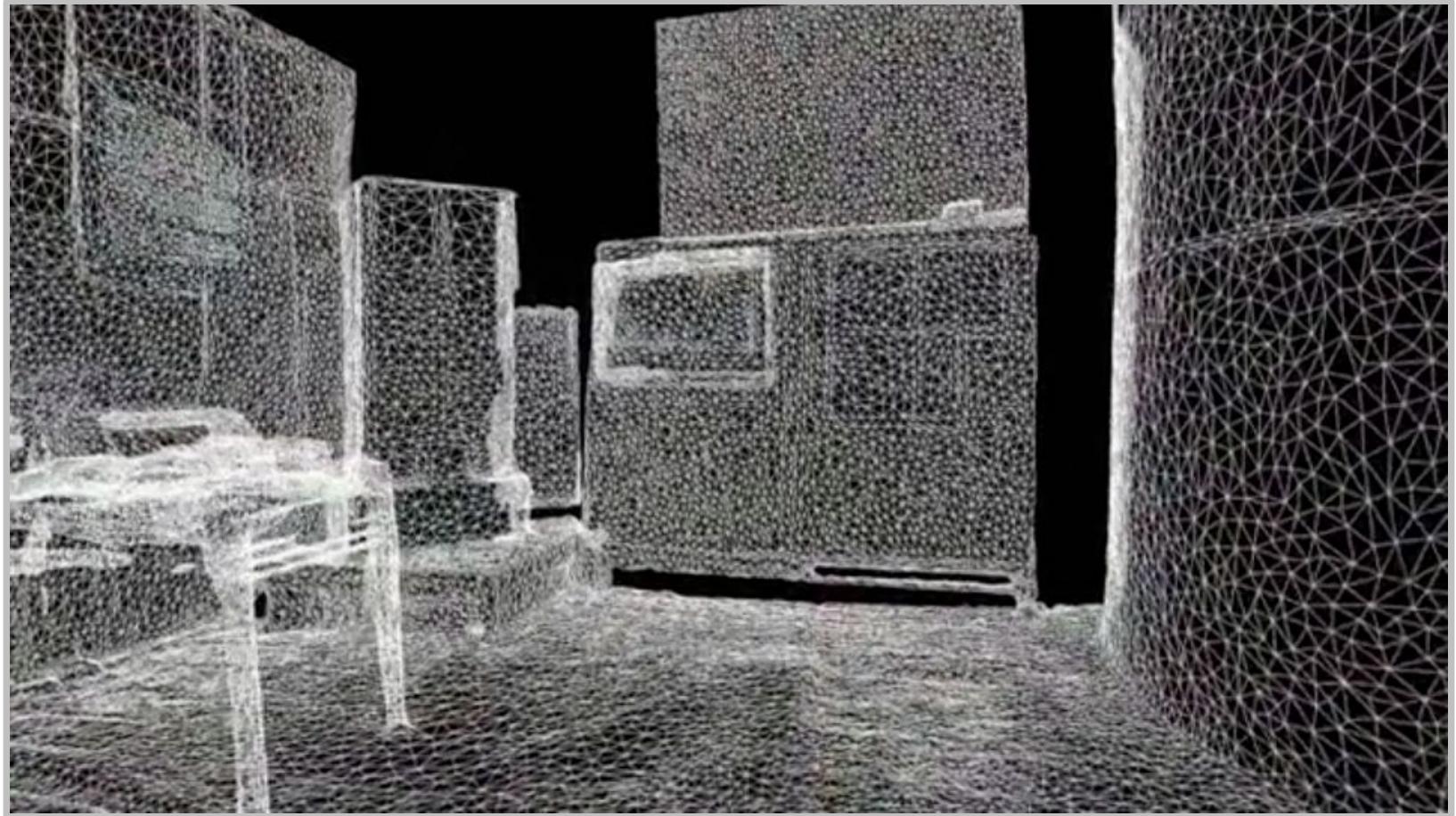
# Be your own souvenir



The project from blablabLab uses custom software developed using openKinect and openFrameworks (and Meshlab and Blender).

Source: <http://vimeo.com/21676294>  
<http://www.blablablab.org/>

# Scan spaces with Kinect



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Matterport is creating a 3D reconstruction system that allows anyone to create 3D models of physical objects and interior spaces.

Source:<http://matterport.com/#video>

# The easiest way: 123D Catch

The screenshot shows the Autodesk 123D Catch website. At the top is a dark blue header with the 123D logo on the left and navigation links for "apps", "gallery", "fabricate", and "my corner" on the right. Below the header is a light gray main area. In the top left of this area, there's a link to "Autodesk 123D Catch" and other links like "get the apps", "at-a-glance", "tutorials", and "forums". The central part of the page features the slogan "Take and make." in large blue text. Below it, a subtext reads "Take ordinary photos and turn them into extraordinary 3D models." To the right of the text are two images: a tablet displaying a 3D model of a man's head and a 3D wireframe mesh of the same head, both resting on a surface with small colorful blocks.

Autodesk 123D Catch | [get the apps](#) | [at-a-glance](#) | [tutorials](#) | [forums](#)

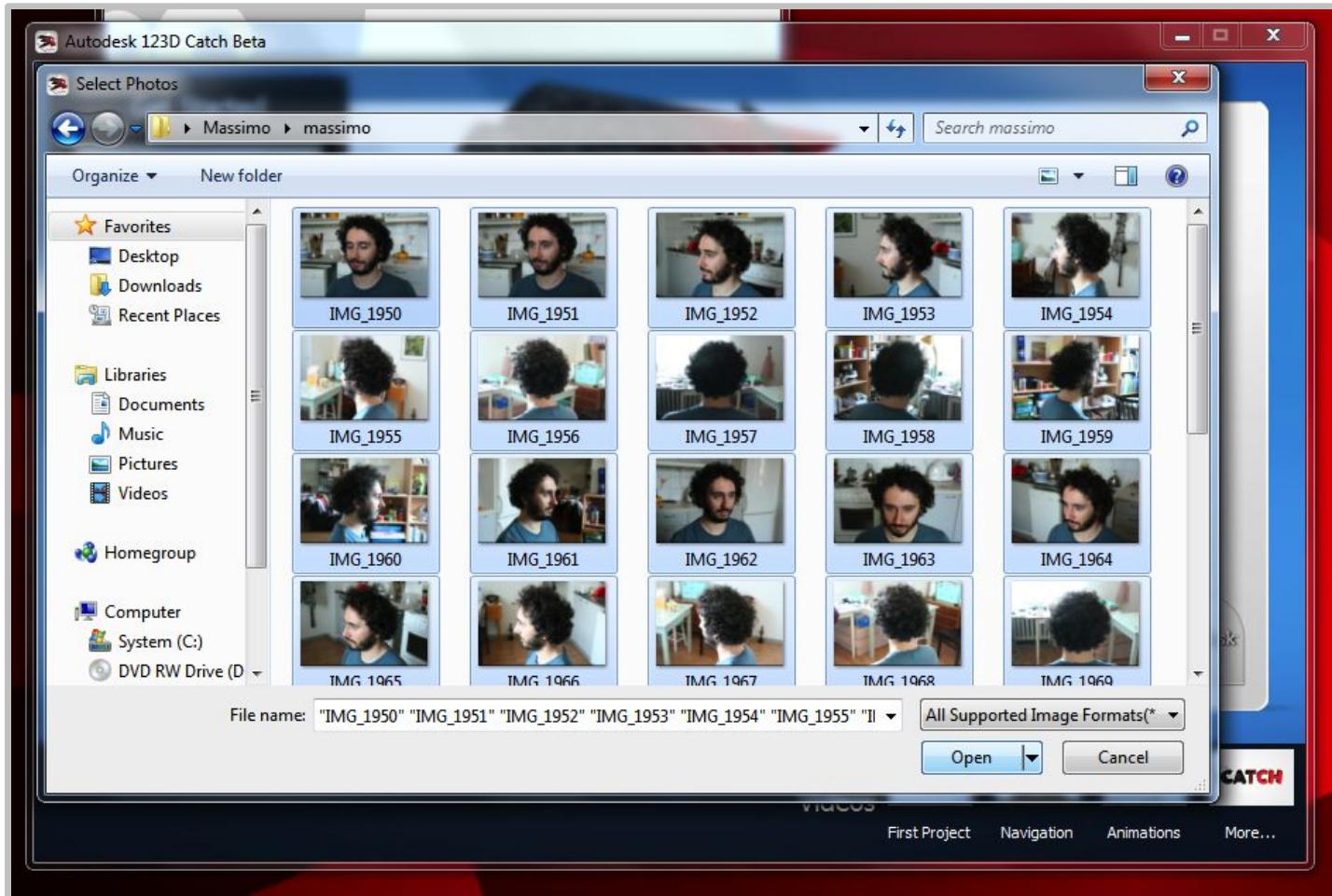
**Take and make.**

Take ordinary photos and turn them into extraordinary 3D models.

**Get Started with 123D Catch**

The easiest and cheapest way, just take many pictures  
(but no reflective and transparent materials).

# 123D Catch: workflow



Read the whole workflow here (exercise 10):

# 123D Catch: workflow



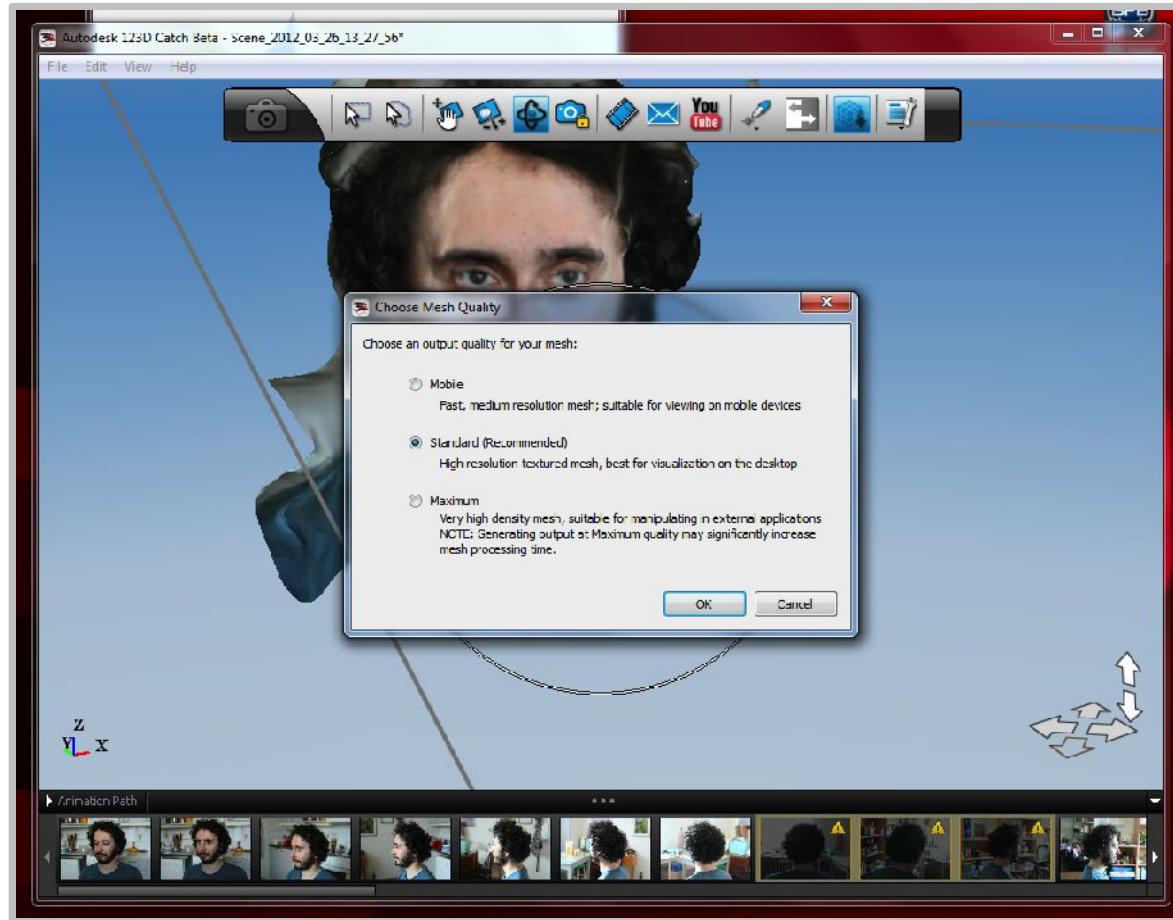
Read the whole workflow here (exercise 10):

# 123D Catch: workflow



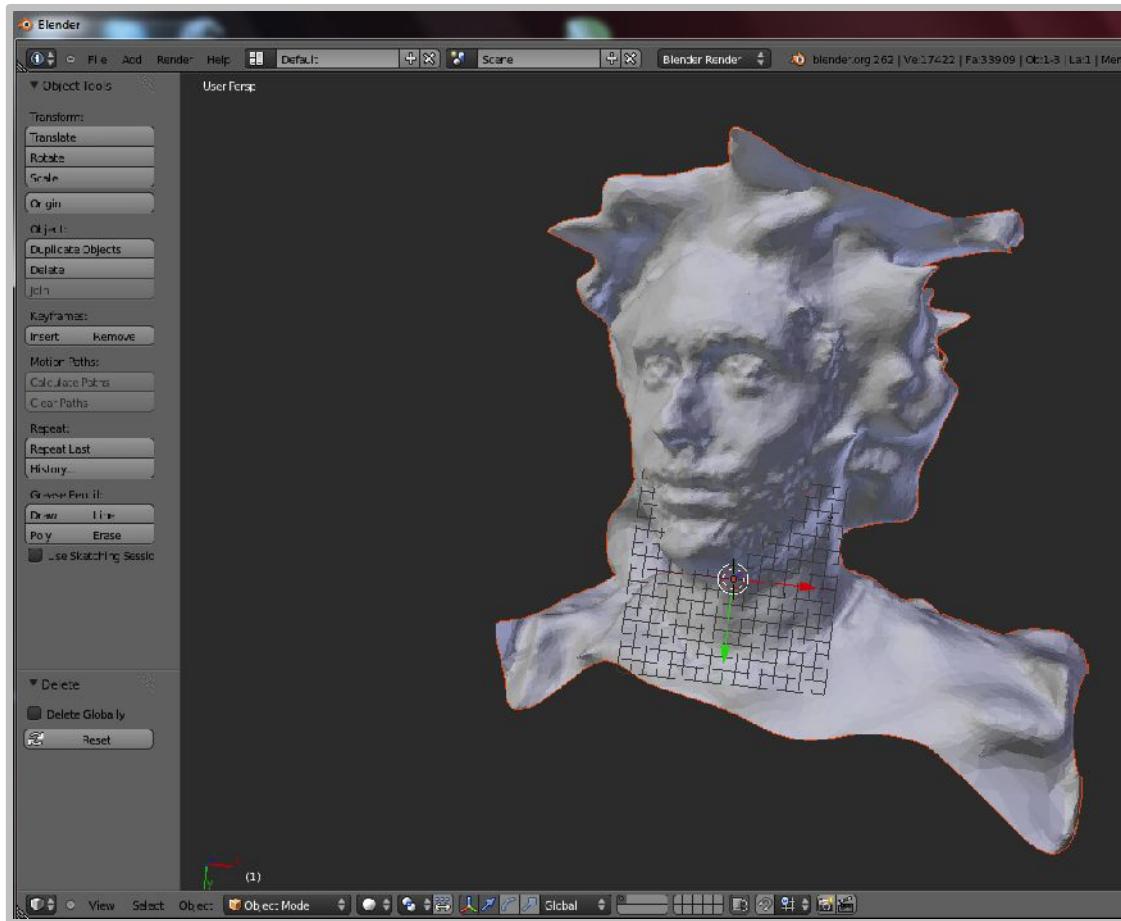
Read the whole workflow here (exercise 10):

# 123D Catch: workflow



Read the whole workflow here (exercise 10):

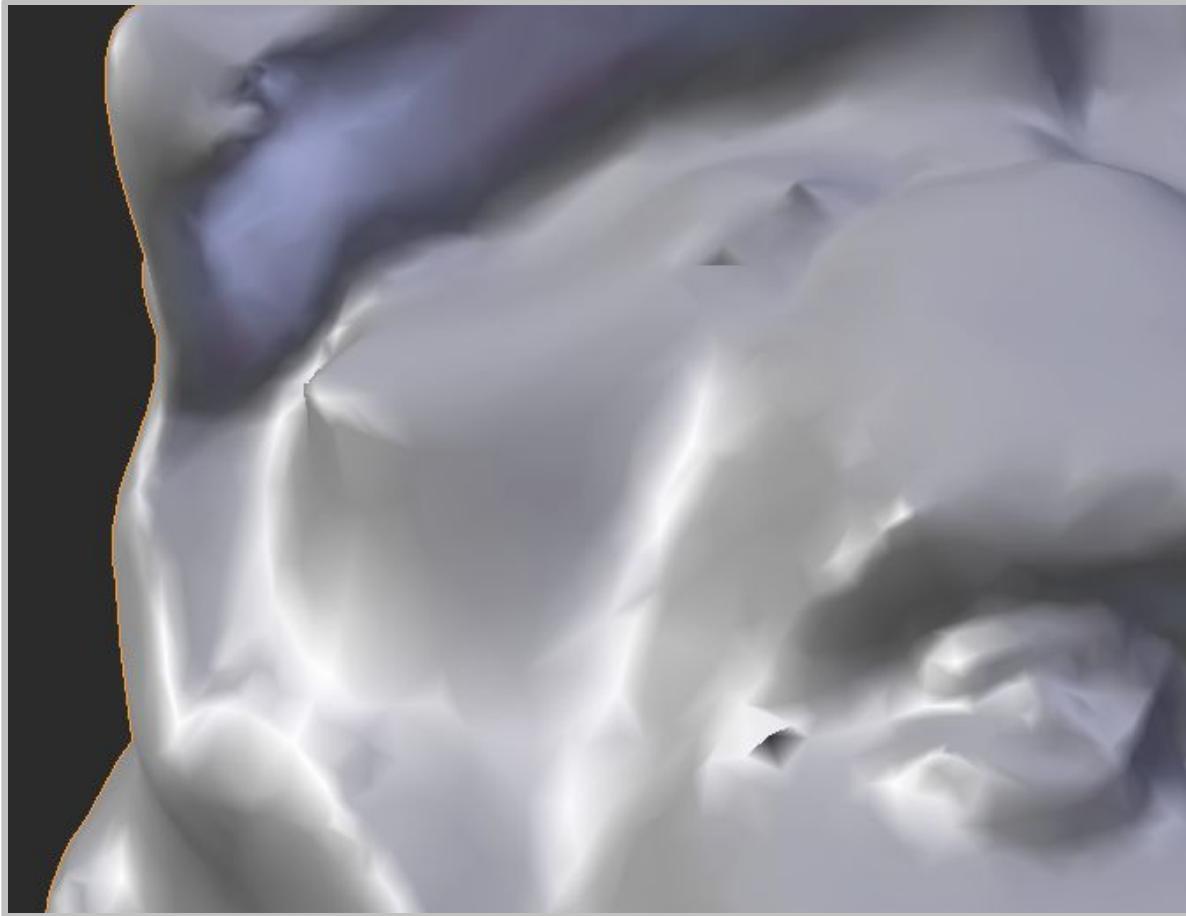
# 123D Catch: workflow



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Read the whole workflow here (exercise 10):

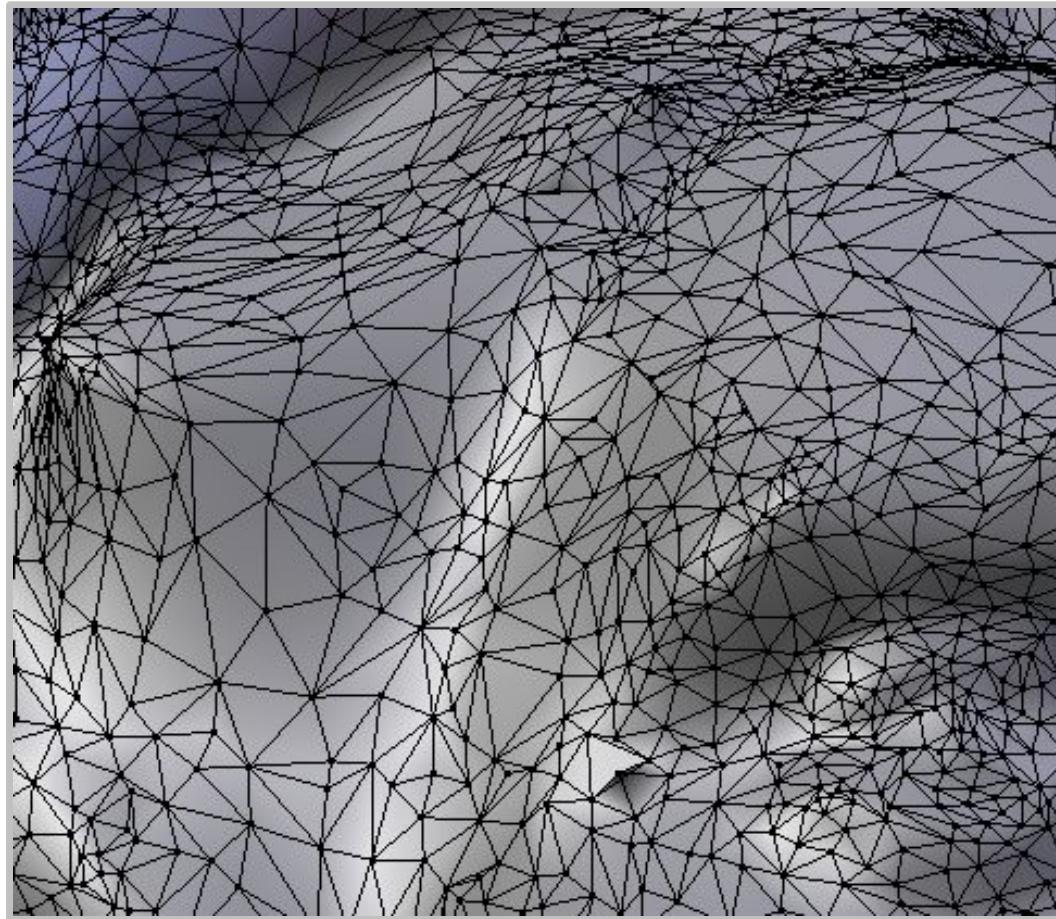
# 123D Catch: workflow



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Read the whole workflow here (exercise 10):

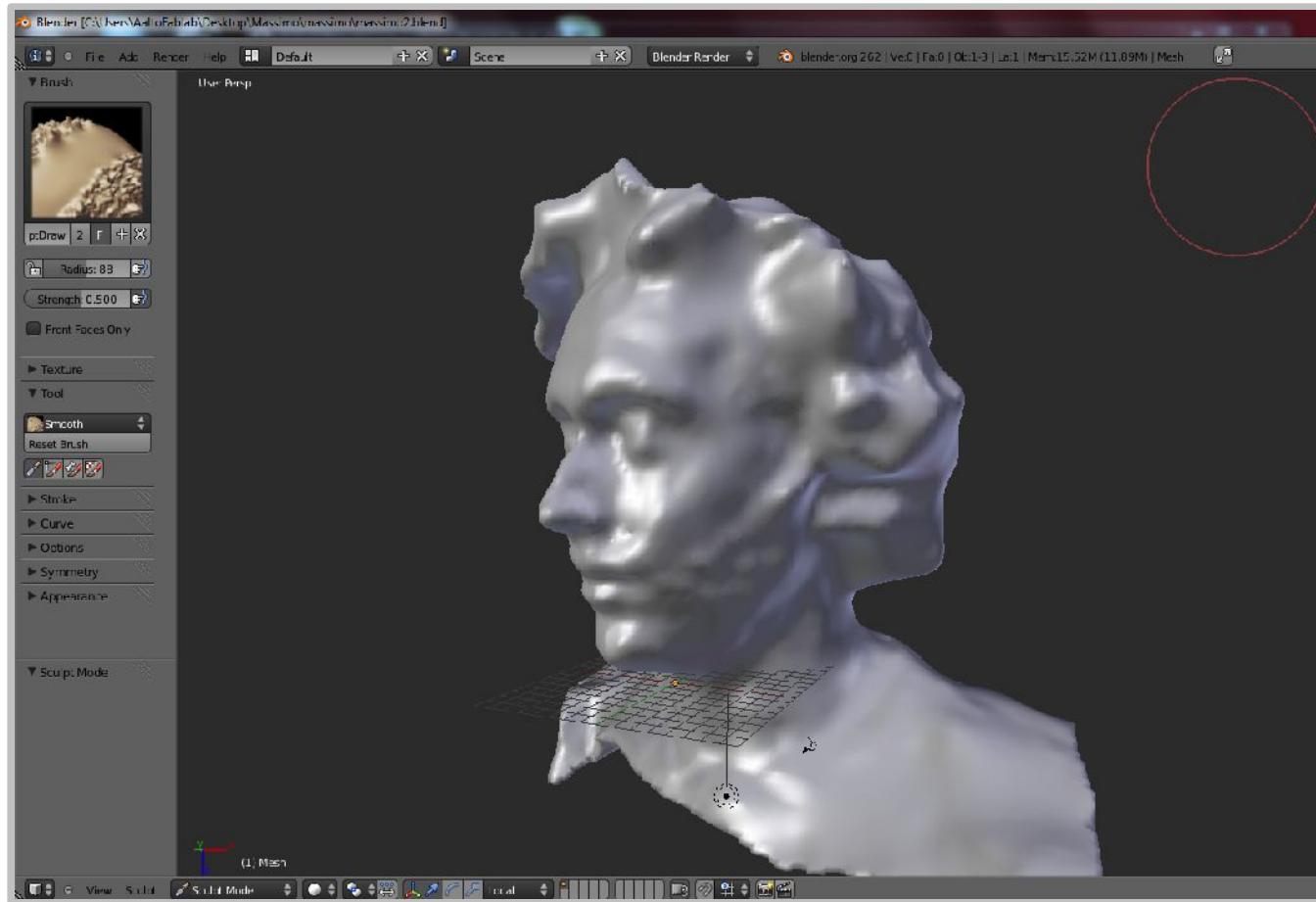
# 123D Catch: workflow



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Read the whole workflow here (exercise 10):

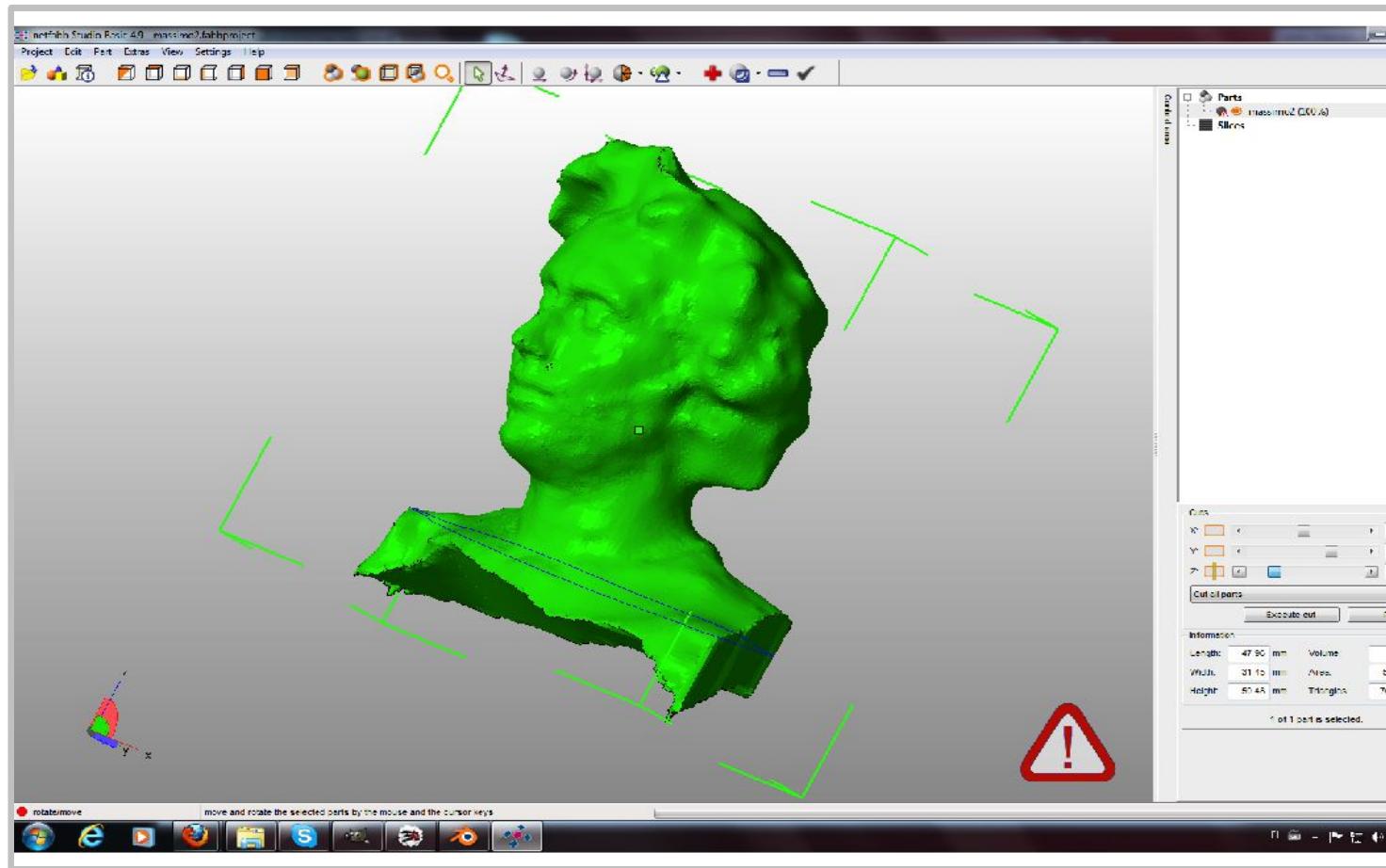
# 123D Catch: workflow



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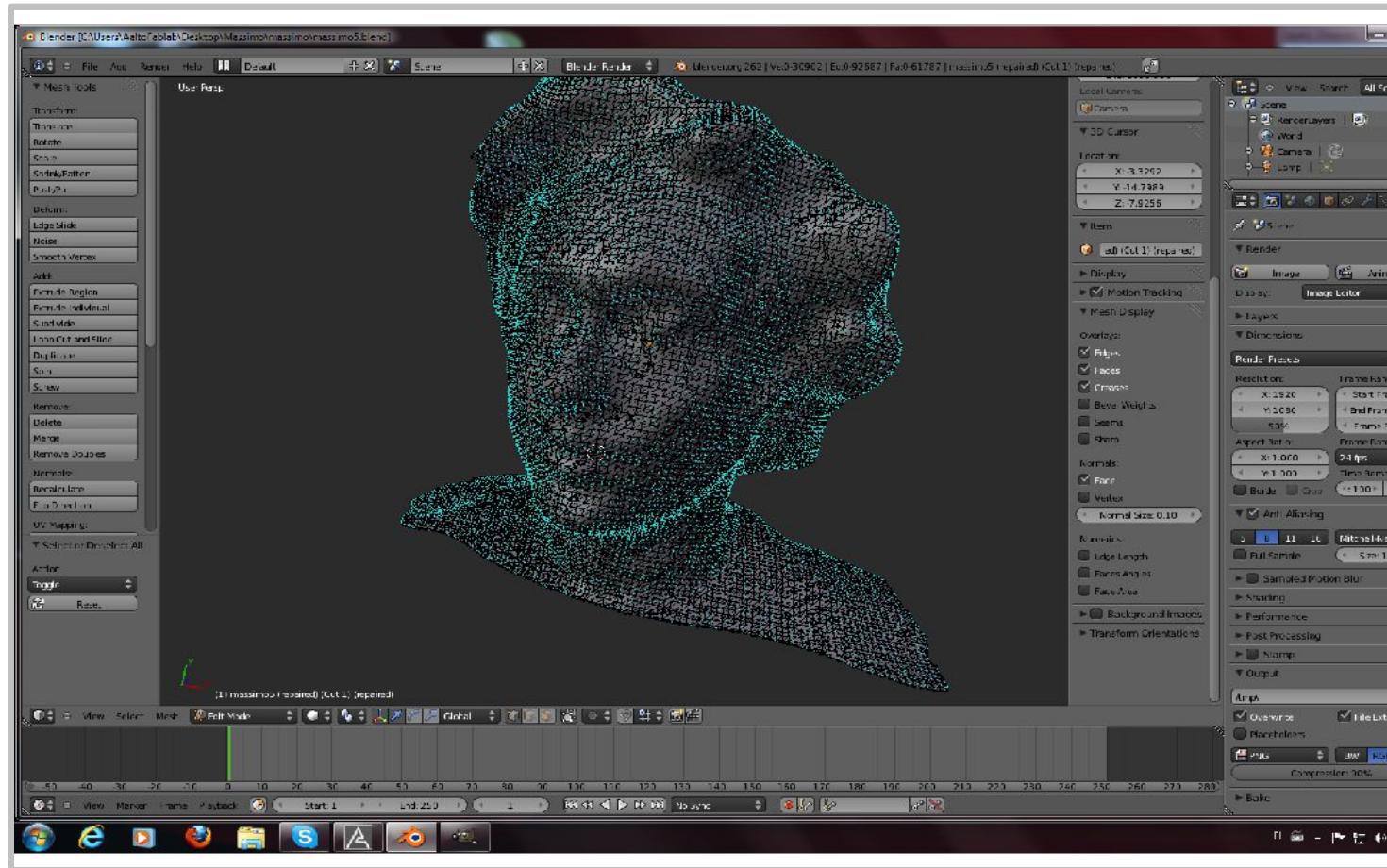
Read the whole workflow here (exercise 10):

# 123D Catch: workflow



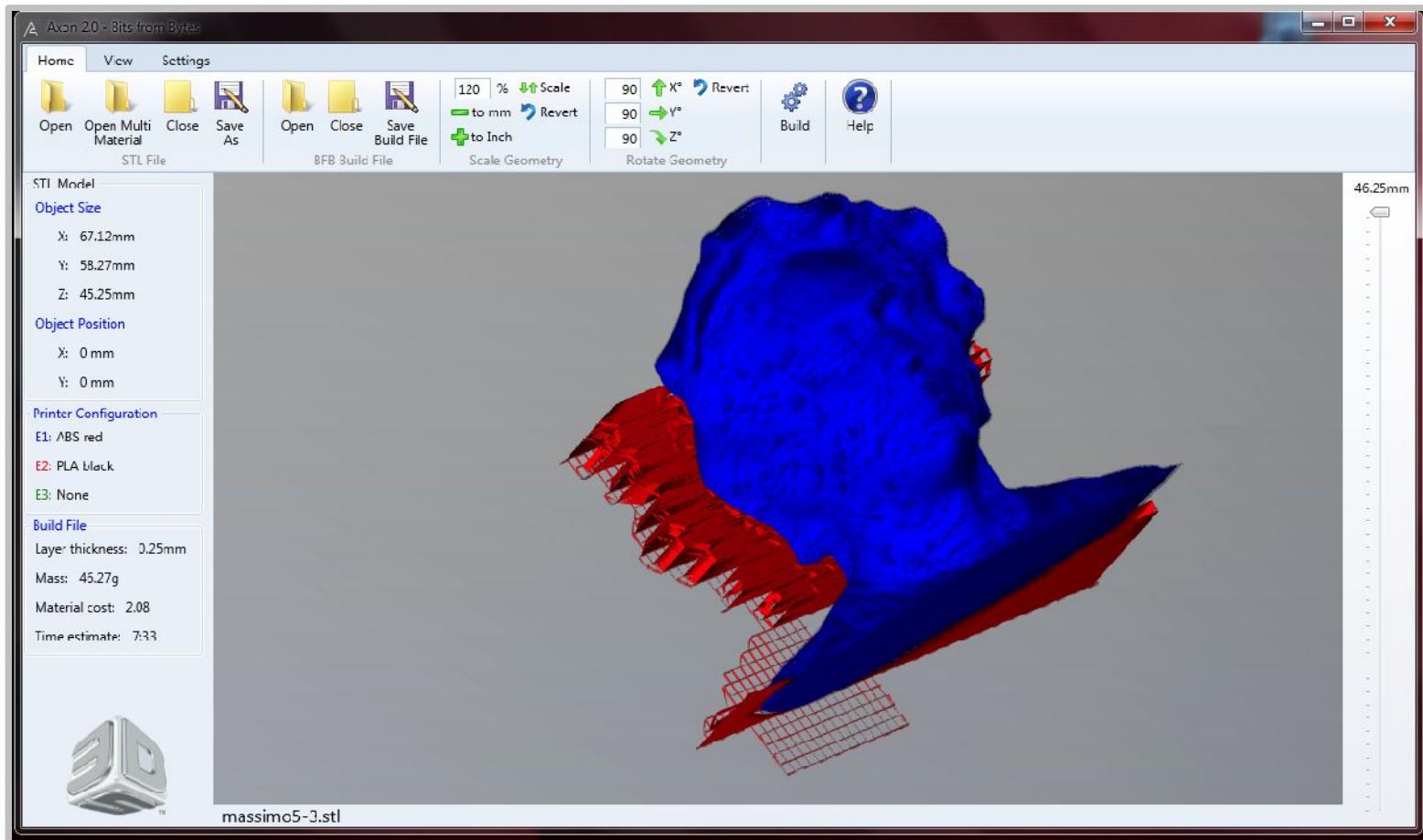
“... and I will probably design and make my own tools” [metadesign]

# 123D Catch: workflow



Read the whole workflow here (exercise 10):

# 123D Catch: workflow



Read the whole workflow here (exercise 10):



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03.

# 3D printing technologies: atoms from bits

# Technologies: 3D printing



Refers to object made using ink jet technology in 3 dimensions by layering powder and binding it with pigmented glue.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://youtu.be/7QP73uTJApw>

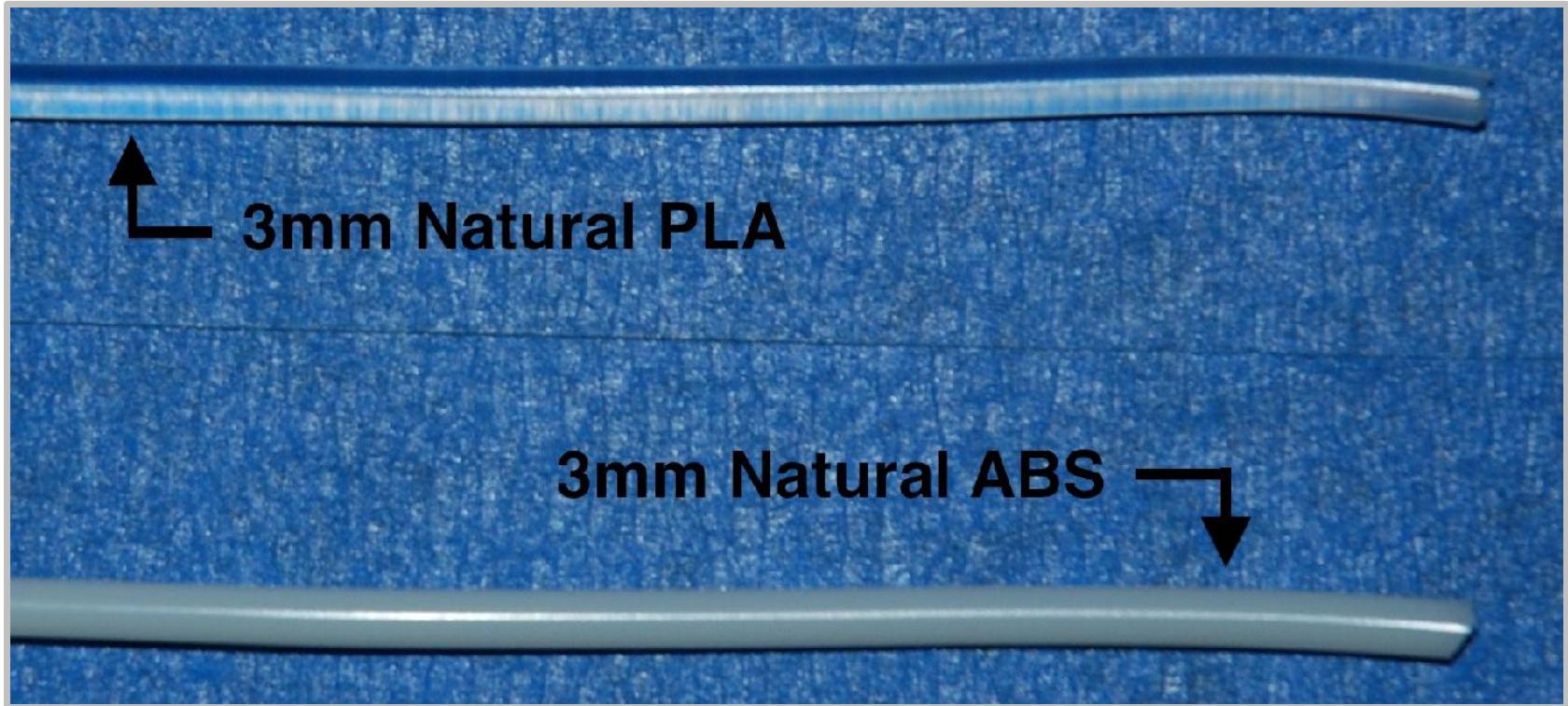
# Technologies: Fused Deposition Modeling



Fused Deposition Modeling (FDM) creates models by heating and extruding a filament of plastic material.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://youtu.be/h8XJUqHXgls>

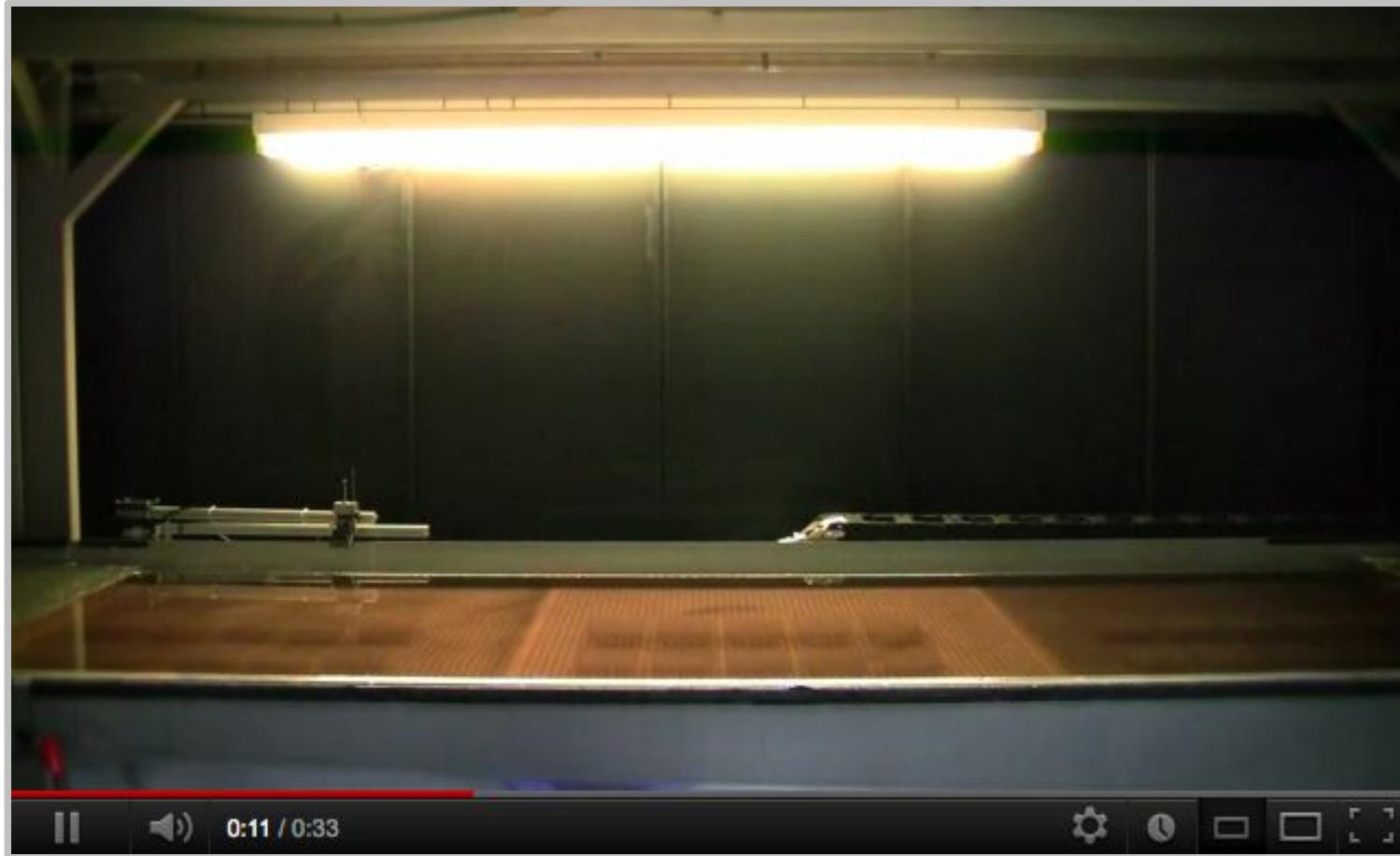
# Technologies: materials for FDM



Most of the 3D Printing community uses either ABS or PLA in either 3mm or 1.75mm diameters.

Source: <http://www.protoparadigm.com/2011/11/filament-tolerances-and-print-quality/>

# Technologies: Stereolithography



Stereolithography produces models by tracing a beam of UV light over a photosensitive pool of liquid. Over time the part is lowered into the bath.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://youtu.be/ygHVVKKkJWI>

# Technologies: Stereolithography



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Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://youtu.be/sn0Erp0P5Xk>

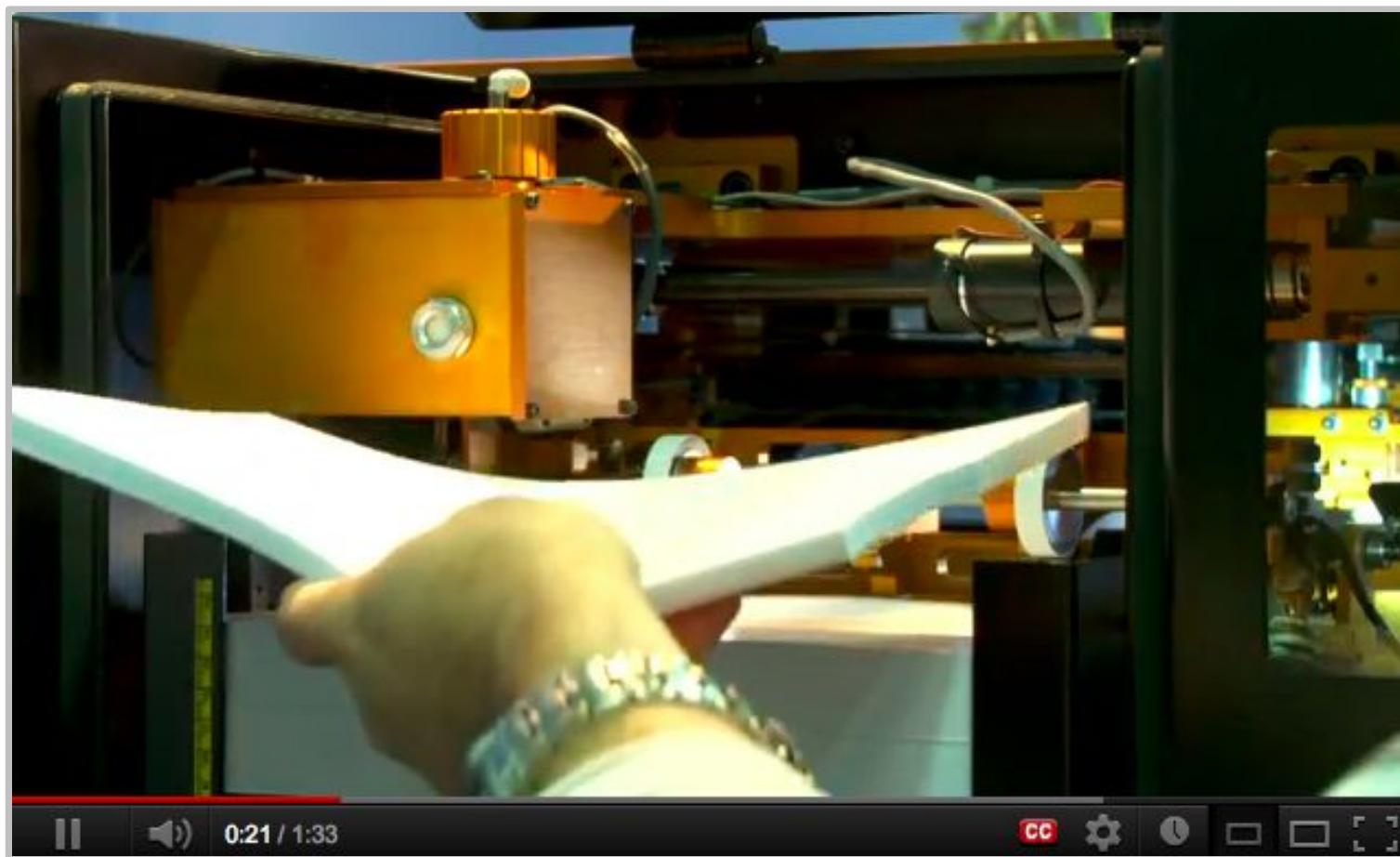
# Technologies: Selective Laser Sintering



Selective Laser Sintering (SLS) is similar to stereolithography replacing the UV light with a laser and a vat of liquid with a powdered base.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
[http://youtu.be/lCOuVO\\_uT0s](http://youtu.be/lCOuVO_uT0s)

# Technologies: Laminated Object Manufacturing



Laminated Object Manufacturing (LOM) machines cut and glue thousands of sheets of material together to form solids, sometimes with standard A4 paper.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://youtu.be/FjxI2HszHzo>

# Technologies: Laminated Object Manufacturing

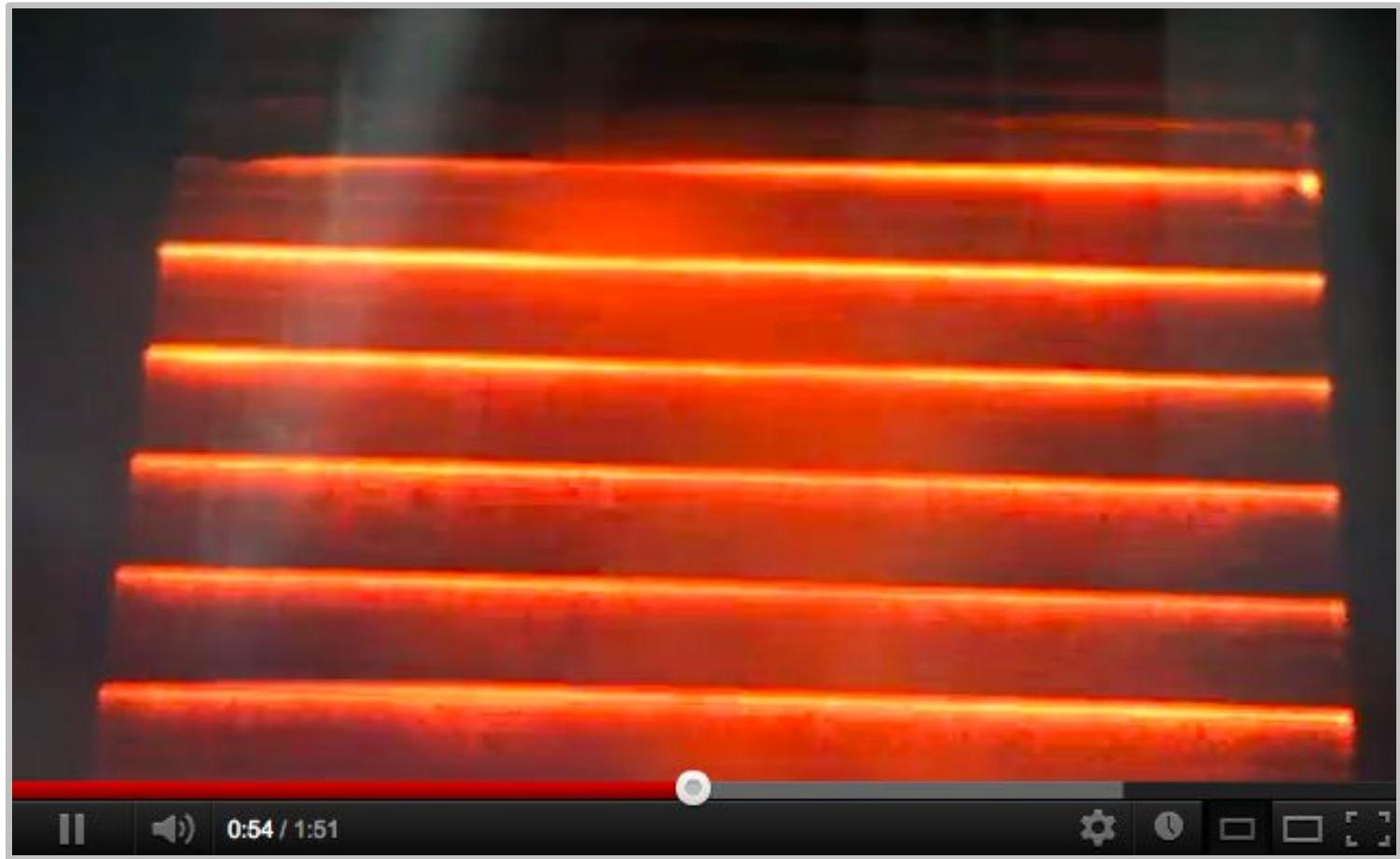


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Laminated Object Manufacturing (LOM) machines cut and glue thousands of sheets of material together to form solids, sometimes with standard A4 paper.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://www.mcortechnologies.com/gallery>

# Technologies: Electron Beam Melting



Electron Beam Melting (EBM) is similar to SLS except the process is far more exact and capable of producing implant grade parts to be used in orthopedic surgery.

Source: <http://replicatorinc.com/blog/2009/02/4-types-of-3d-printing/>  
<http://youtu.be/E7--ZWPVVdQ>

# 3D Metal printing



Now it is possible to print your model in stainless steel on Shapeways! The material will be finished in a shining stainless steel look and costs \$10 / cm<sup>3</sup>.

Source: <http://youtu.be/B9V0wqt0glg>  
[http://www.shapeways.com/themes/stainless\\_steel\\_3dprinting\\_gallery](http://www.shapeways.com/themes/stainless_steel_3dprinting_gallery)

# 3D Glass printing

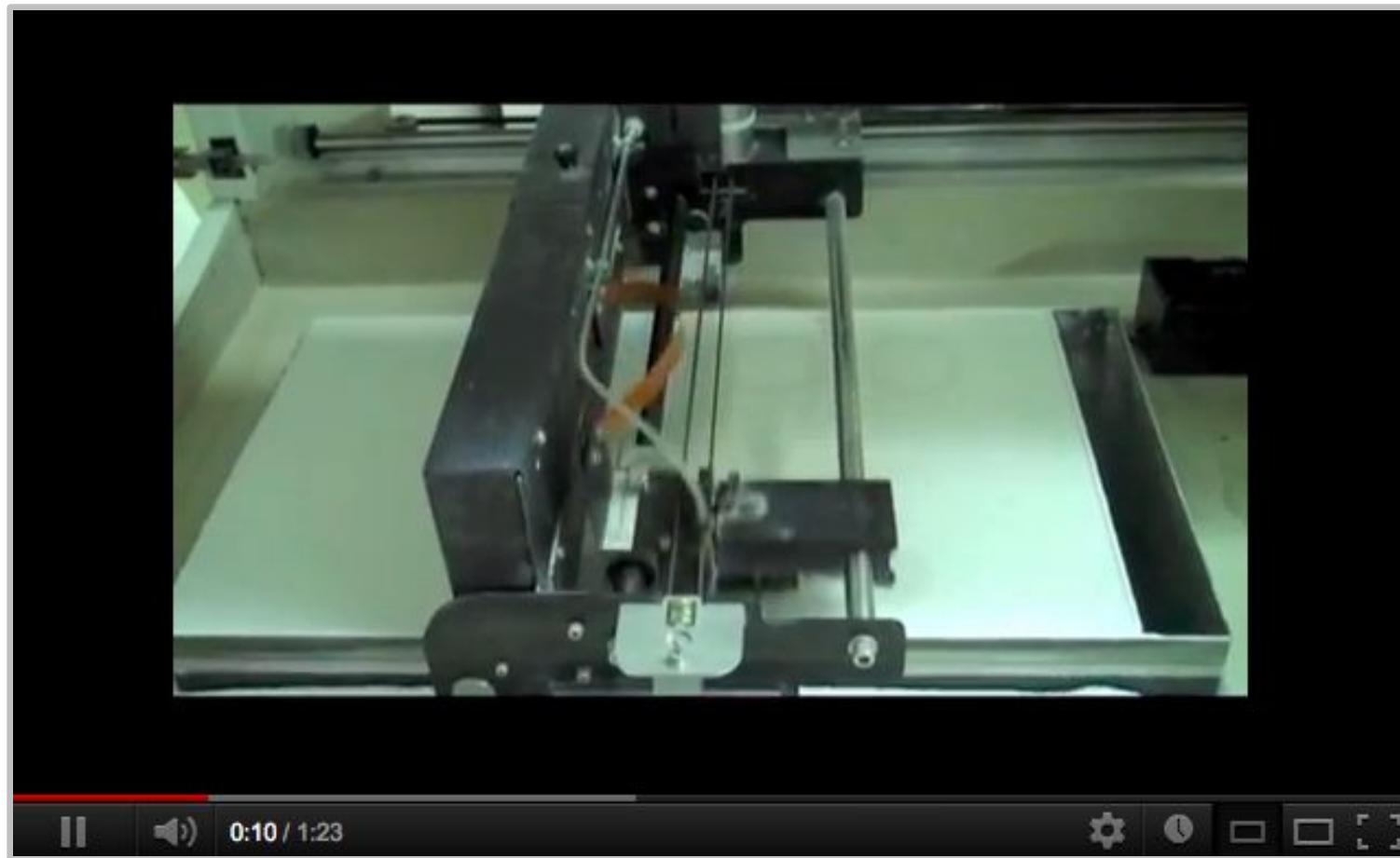


The material is porous, opaque and fragile and made from recycled soda-lime glass, the fine glass powder is glued together with a binder and then sintered.

Source: <http://youtu.be/BtK-Hqd6Q2I>

[http://www.shapeways.com/materials/milky\\_white\\_matte\\_glass](http://www.shapeways.com/materials/milky_white_matte_glass)

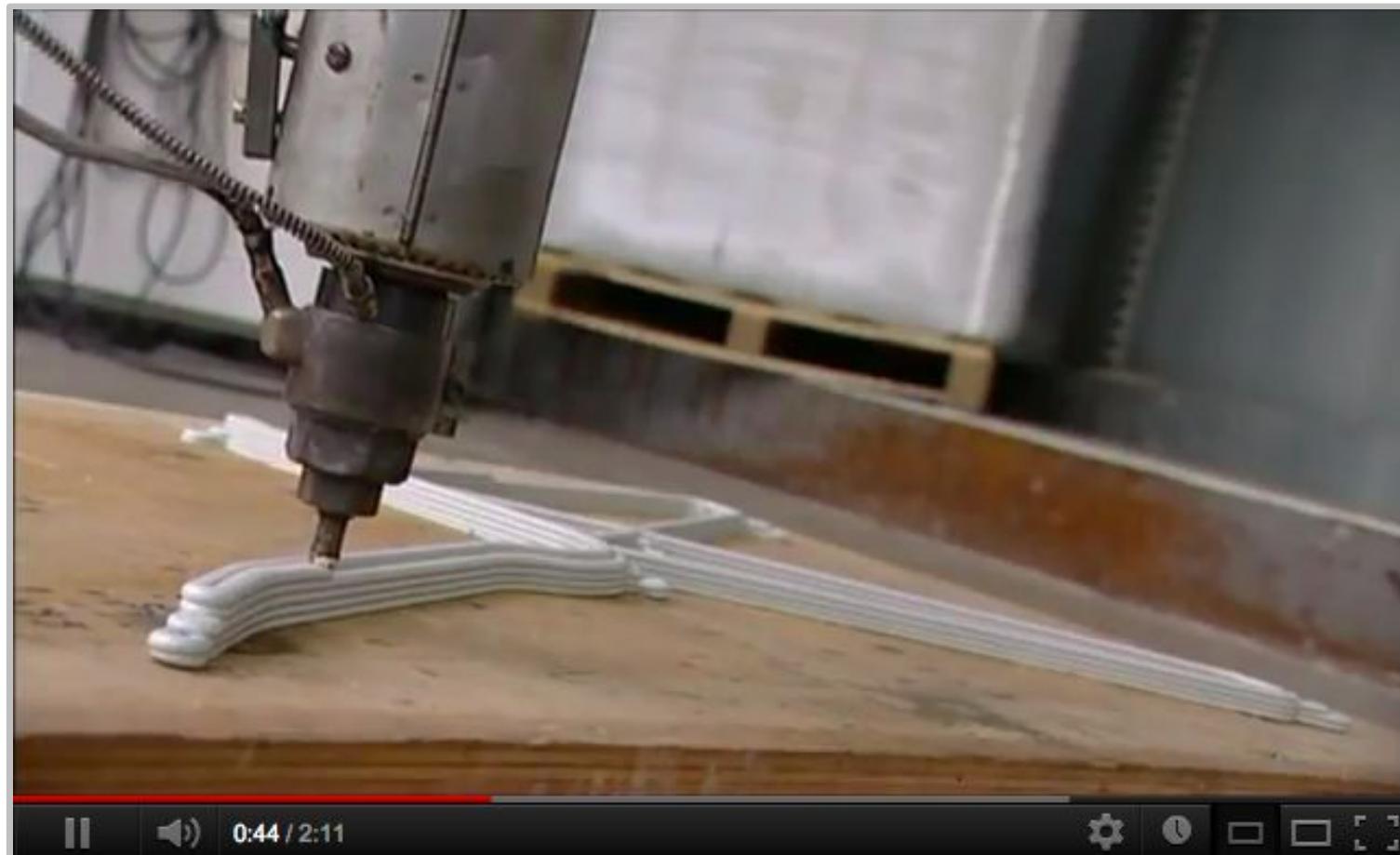
# 3D Ceramics printing



Material properties are the same as standard ceramics. Fine ceramic powder bound together with binder, fired, glazed with lead-free, non-toxic gloss finish.

Source: <http://youtu.be/zZU701BHfyo>  
<http://www.shapeways.com/materials/ceramics>

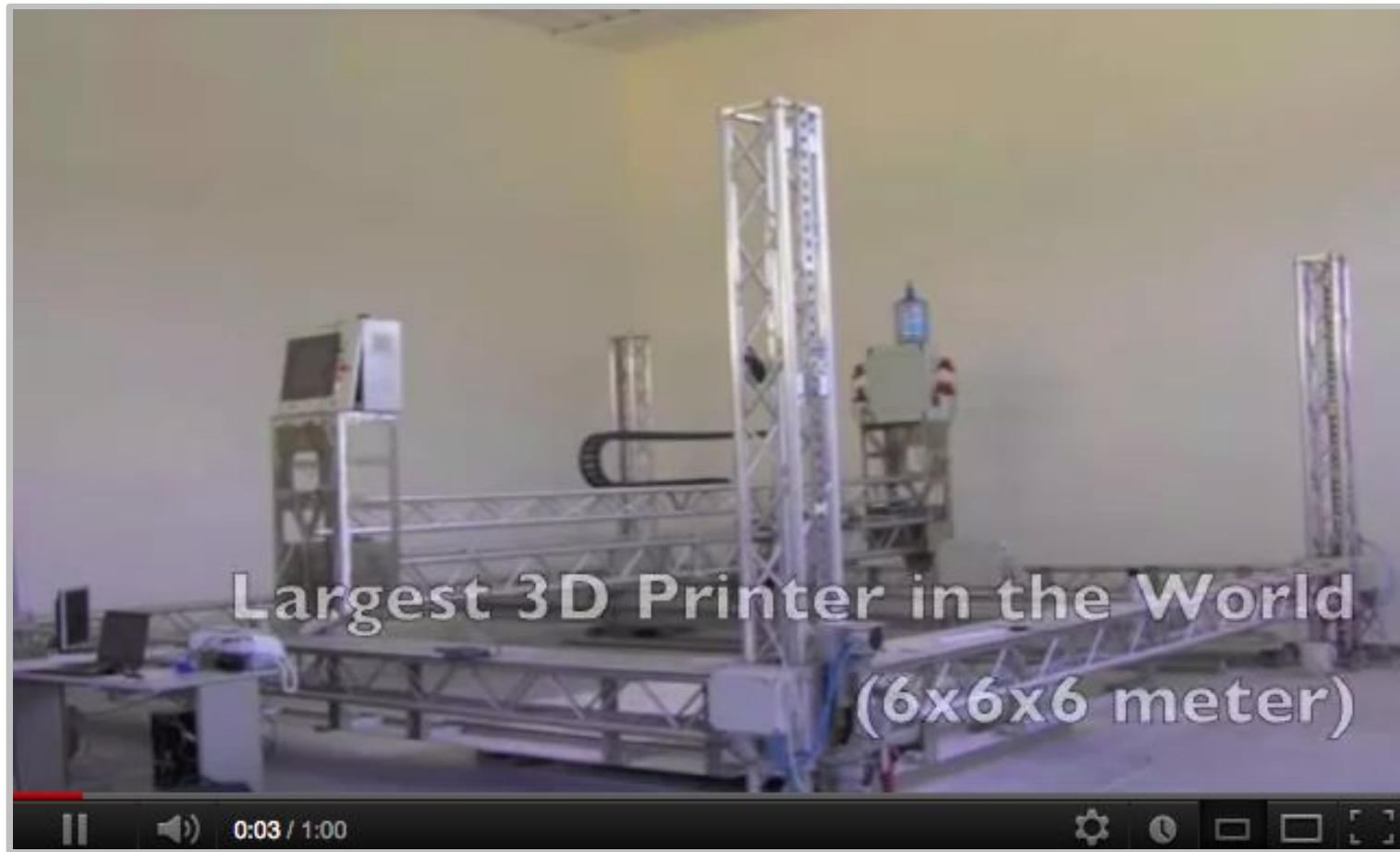
# Big size 3D printing: Endless chair



Printing an Endless Chair from recycled refrigerators.  
Design by Dirk vander Kooij.

Source: <http://youtu.be/FvRTHynk9KA>  
<http://www.dirkvanderkooij.nl/en>

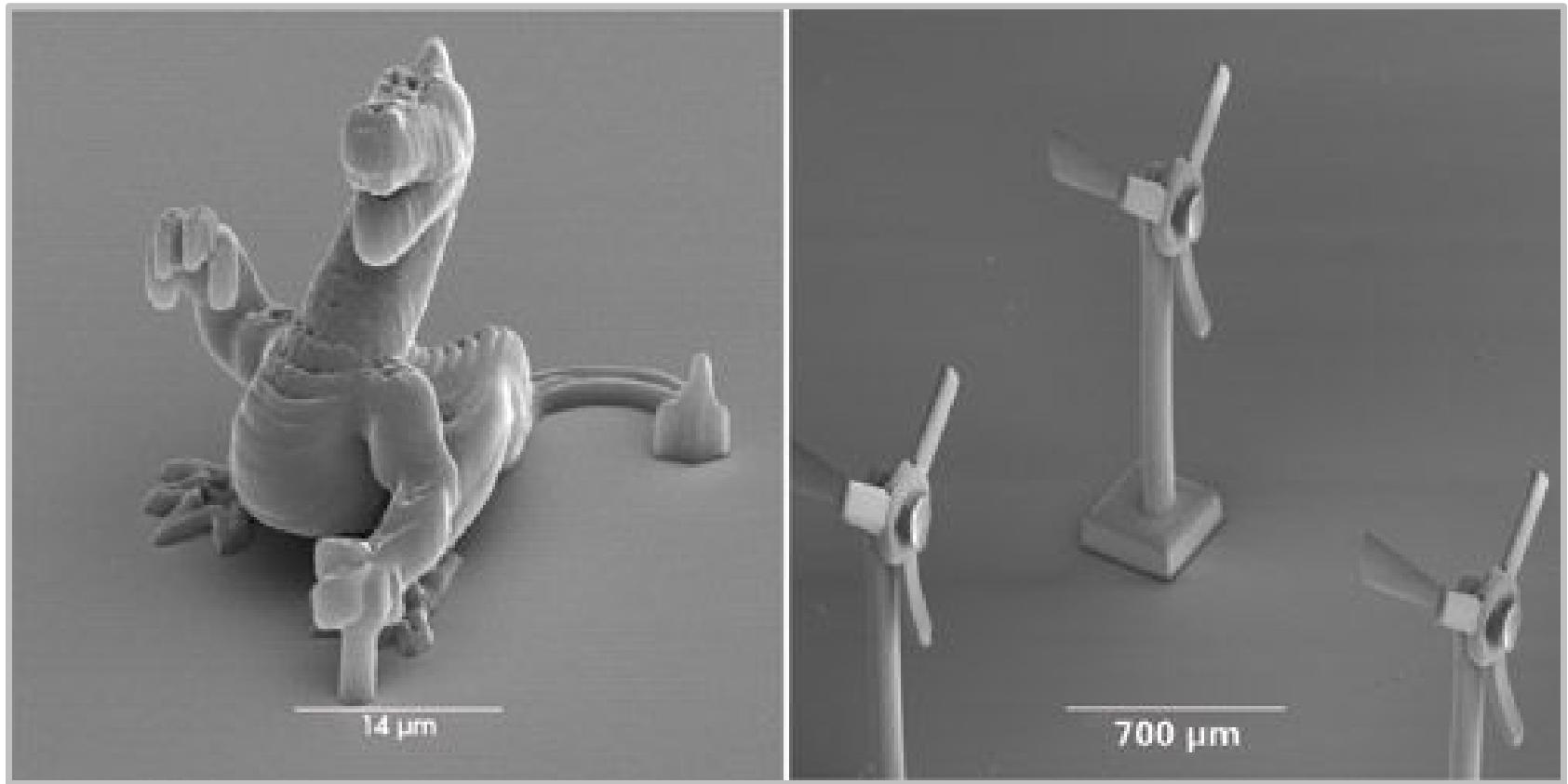
# Big size 3D printing: D-Shape



D-Shape is a new robotic building system using new materials to create superior stone-like structures.

Source: <http://youtu.be/HBxx8XTpDZ4>  
<http://d-shape.com/>

# Small size 3D printing: 2 photons polymerization



A promising 3D microfabrication method that has recently attracted considerable attention is based on two-photon polymerization with ultrashort laser pulses.

Source: <http://www.photonics.com/Article.aspx?AID=26907>

# Bio 3D Printing



A new tissue engineering technology now has the ability to arrange culture cells in three dimensions. It is now possible to manufacture tissue in demand.

Source: <http://youtu.be/YOnIxcc0DW8>

# Bio 3D Printing: Organovo

The screenshot shows the Organovo website homepage. At the top left is the Organovo logo. To its right is a search bar. Below the header, a large banner features the tagline "Tissue on demand." and a description of the company's bioprinting platform. Two news items are listed below the description: "April 25, 2012: Organovo Expands Management Team, Announces Promotion" and "April 2, 2012: Organovo Reports 2011 Financial Results". To the right of the banner is a graphic titled "tr50 The 50 Most Innovative Companies in 2012" from MIT Technology Review, showing Organovo's position in the biomedicine sector. Below this is a smaller box stating "Named to MIT Technology Review's List of Most Innovative Companies". The footer contains links for About, Products, Science, Newsroom, Investors, and Contact.

**ABOUT**  
Our Management  
Careers

**PRODUCTS**  
NovoGen MMX Bioprinter™  
Support

**SCIENCE**  
Publications  
Collaborations  
Links

**NEWSROOM**  
Overview  
Press Releases  
Media Coverage  
Media Contact

**INVESTORS**

**CONTACT**

**tr50** The 50 Most Innovative Companies in 2012

Organovo BIOMEDICINE

Named to MIT Technology Review's List of Most Innovative Companies

Organovo is focused on delivering breakthrough three-dimensional biology capabilities to create tissue on demand for research and surgical applications.

Source: <http://www.organovo.com/>

# Bio 3D Printing: Organovo



The screenshot shows the Organovo website's products page. At the top, there is a navigation bar with links for ABOUT, PRODUCTS, SCIENCE, NEWSROOM, INVESTORS, and CONTACT. Below the navigation bar, the word "products" is displayed in white text on a dark blue background. To the right of the text, there is a photograph of the NovoGen MMX Bioprinter, which is a large, industrial-looking machine with various components and a robotic arm. On the left side of the main content area, there is a sidebar with links for Overview, NovoGen MMX Bioprinter™, and Support. The main content area features a heading for the NovoGen MMX Bioprinter™ and a subtext "Human biology, *in vitro* convenience." followed by a detailed description of the machine's capabilities.

**Overview**

**NovoGen MMX Bioprinter™**

*Human biology, *in vitro* convenience.*

The NovoGen MMX Bioprinter™ is a novel hardware and software platform at the forefront of bioprinting research and development. The NovoGen MMX™ was developed to meet challenges in biological research. The platform takes primary or other human cells and shapes them into 3D tissue, with tremendous cellular viability and biology that is superior to even an animal model. The platform is being used by Organovo's Pharma partners today to enable cutting edge research into drug discovery.

The NovoGen MMX Bioprinter™ is a novel hardware and software platform at the forefront of bioprinting research and development.

Source: <http://www.organovo.com/products/novogen-mmx-bioprinter>

# Drug 3D Printing

SCIENCE April 19, 2012 - 12:45pm

<http://www.gizmodo.co.uk/2012/04/who-needs-a-pharmacy-when-you-can-just-print-out-your-own-drugs-at-home/>

Researchers from Scotland have made their own DIY 3D-printing drugstore and you'll be able to use them to print your own drugs right at your own home.

Source: <http://www.gizmodo.co.uk/2012/04/who-needs-a-pharmacy-when-you-can-just-print-out-your-own-drugs-at-home/>

# Food 3D Printing



Choc Creator, the world's first 3D chocolate printer was developed by a team of researchers at the University of Exeter and is now available to purchase.

Source: <http://laughingsquid.com/choc-creator-the-chocolate-3d-printer-is-now-available-to-purchase/>  
<http://youtu.be/r7xs-cHAt3I>

# Food 3D Printing

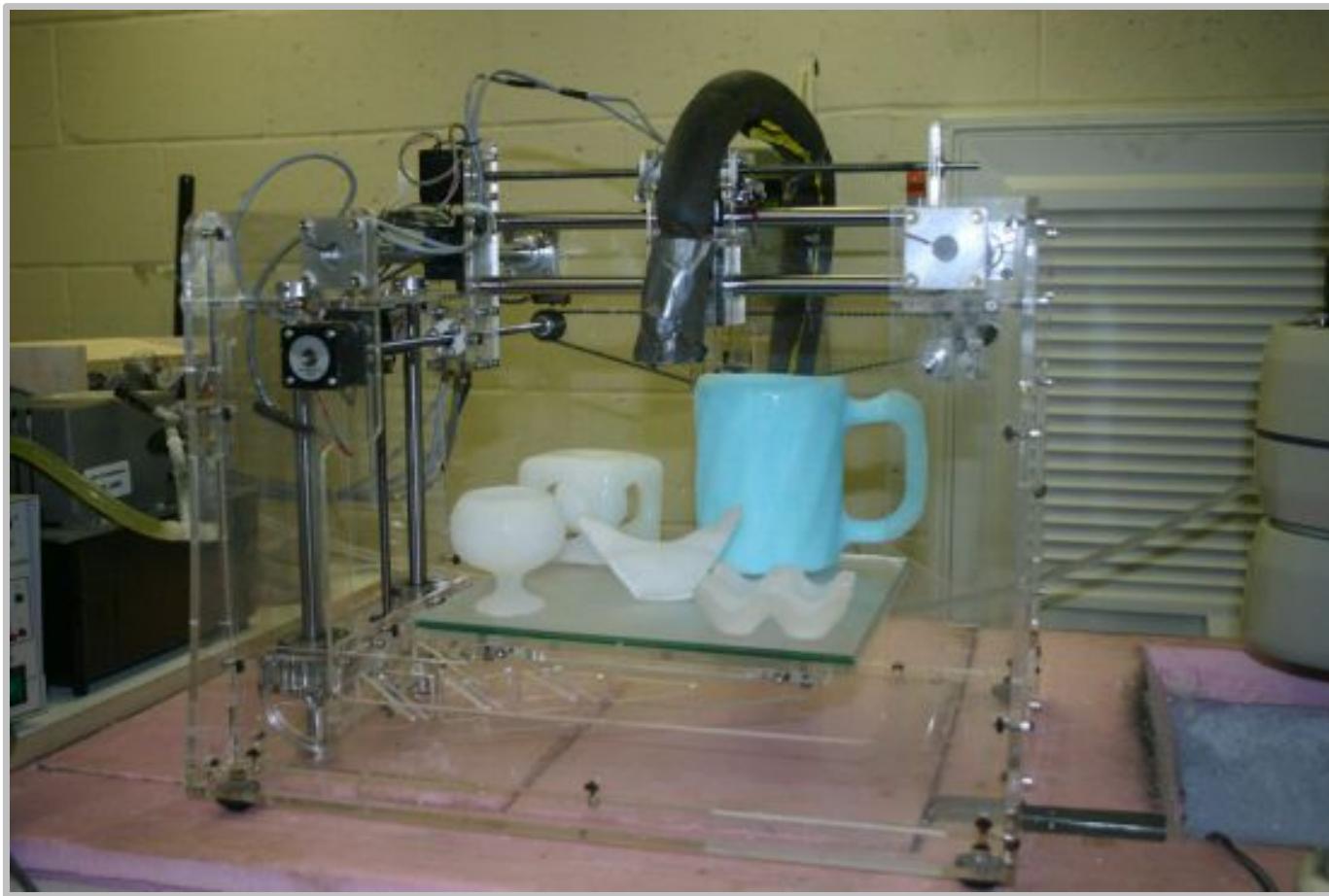


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CandyFab is a machine that can make arbitrary 3D solid objects at low cost from a variety of low-melting point materials including pure sugar.

Source: <http://laughingsquid.com/choc-creator-the-chocolate-3d-printer-is-now-available-to-purchase/>  
<http://youtu.be/r7xs-cHAt3I>

# Ice 3D Printing



Pieter Sijpkes, a professor at McGill University, has discovered since cobbling together a machine that prints objects by building up ultrathin layers of ice.

Source: [http://www.wired.com/magazine/2011/12/st\\_3diceprinting/](http://www.wired.com/magazine/2011/12/st_3diceprinting/)  
<http://www.3ders.org/articles/20120103-3d-ice-printer.html>

# Recycle plastic for your FDM machine

KICKSTARTER Discover Start BLOG HELP SIGN UP LOG IN

## Filabot: Plastic Filament Maker

A Technology project in Milton, VT by Tyler McNaney · send message

PROJECT HOME UPDATES 14 BACKERS 156 COMMENTS 239



156 BACKERS  
\$32,330 PLEDGED OF \$10,000 GOAL  
0 SECONDS TO GO

FUNDING SUCCESSFUL  
This project successfully raised its funding goal on January 23.

PLEDGE \$1 OR MORE  
41 BACKERS

Like 243 people like this. Be the first of your friends. Tweet Embed http://kck.st/uYHFdj

A 3D plastic extrusion system for mostly any type of recyclable plastic, to make usable 3D printing filament by grinding, melting, extruding the plastic filament.

Source: <http://www.kickstarter.com/projects/rocknail/filabot-plastic-filament-maker>

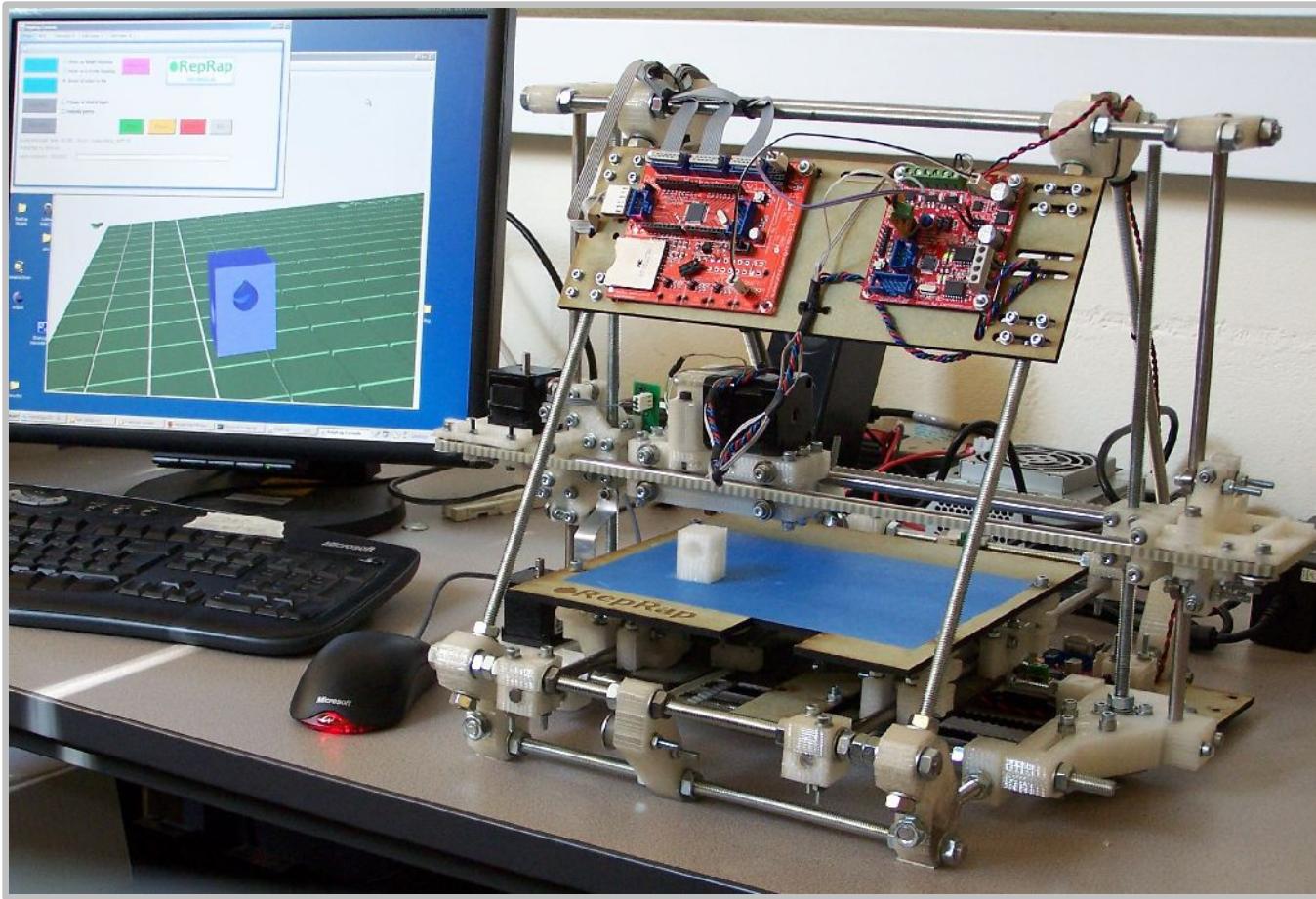
# Markus Kayser - Solar Sinter Project



In this experiment sunlight and sand are used as raw energy and material to produce glass objects using a 3D printing process.

Source: <http://vimeo.com/25401444>

# Open Source 3D printers: RepRap

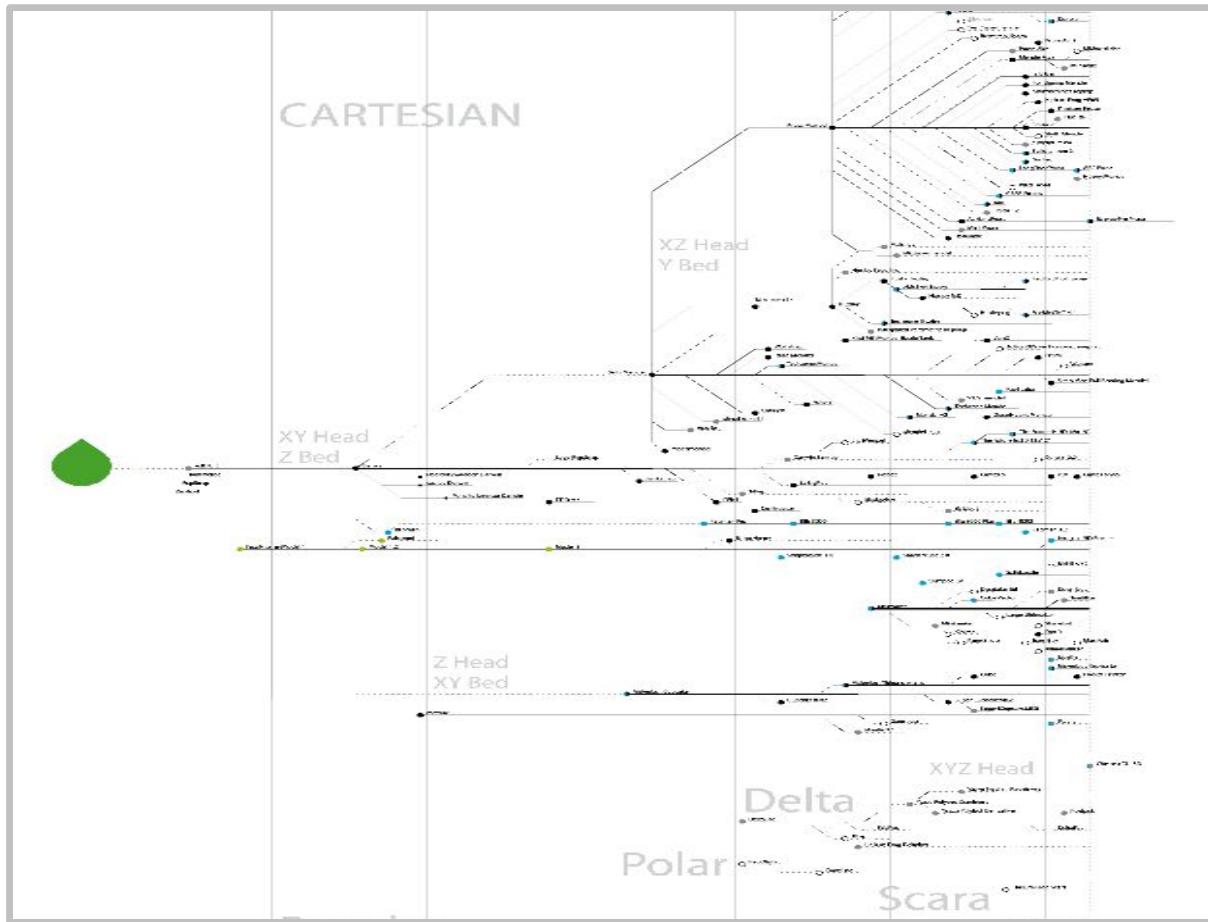


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It's the second, improved version of RepRap: small enough to fit on your desk, but with a print volume large enough for you to make big things.

Source: <http://reprap.org/wiki/Mendel>

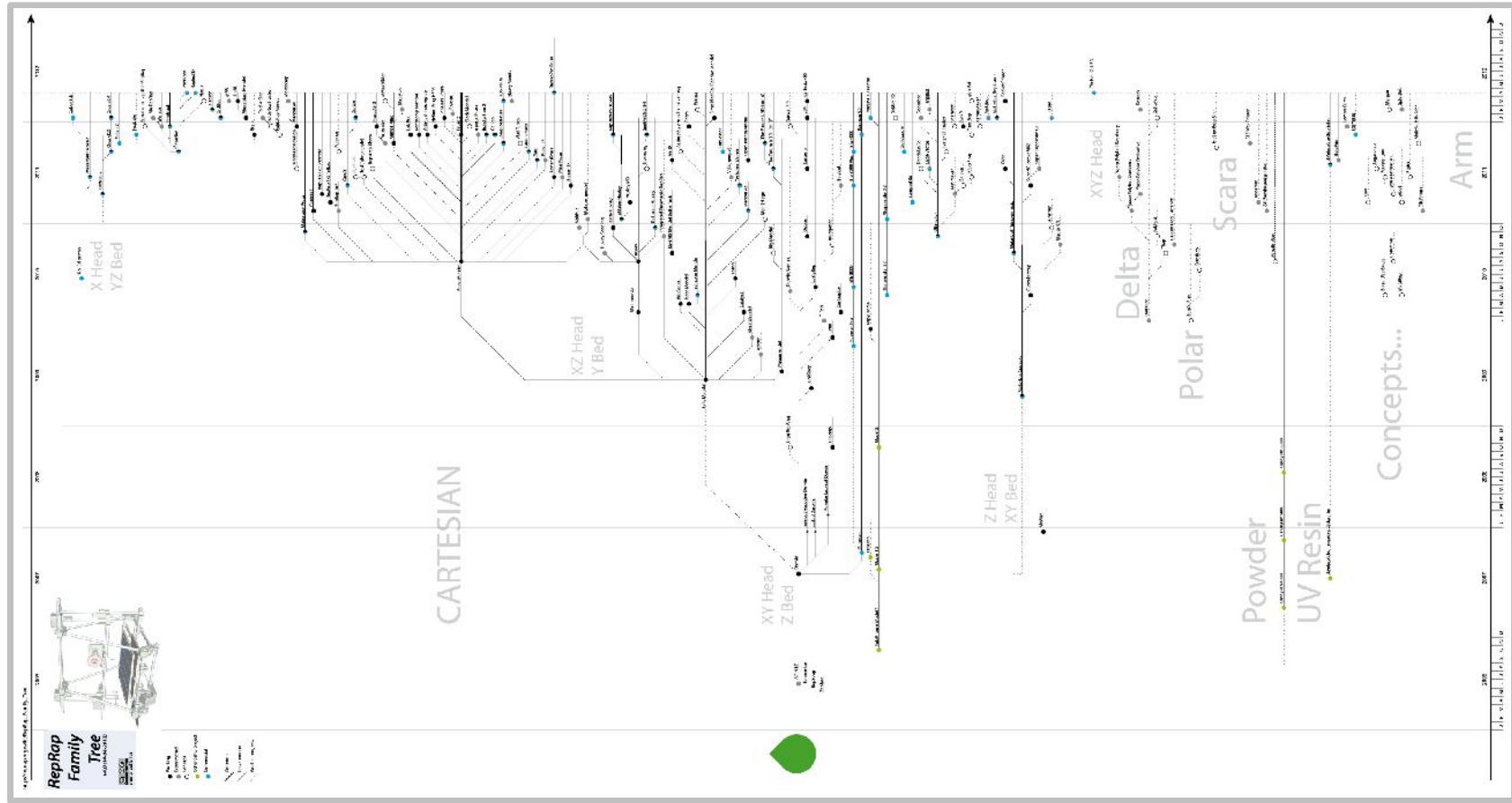
# Open Source 3D printers: RepRap



Again, the evolution of an open source project that's too big to fit into one slide...

Source: [http://reprap.org/wiki/RepRap\\_Family\\_Tree](http://reprap.org/wiki/RepRap_Family_Tree)

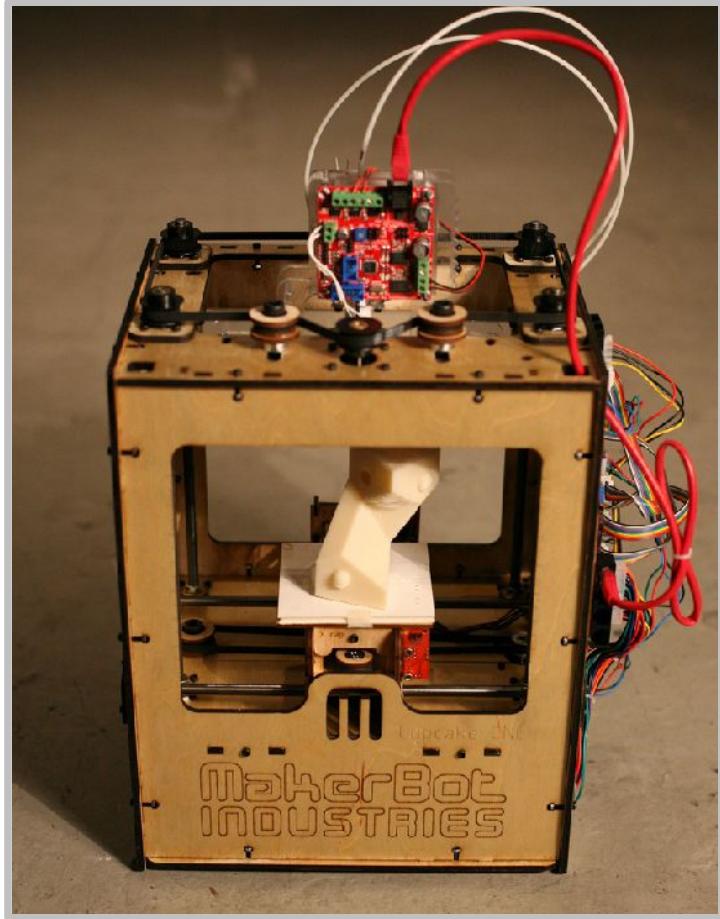
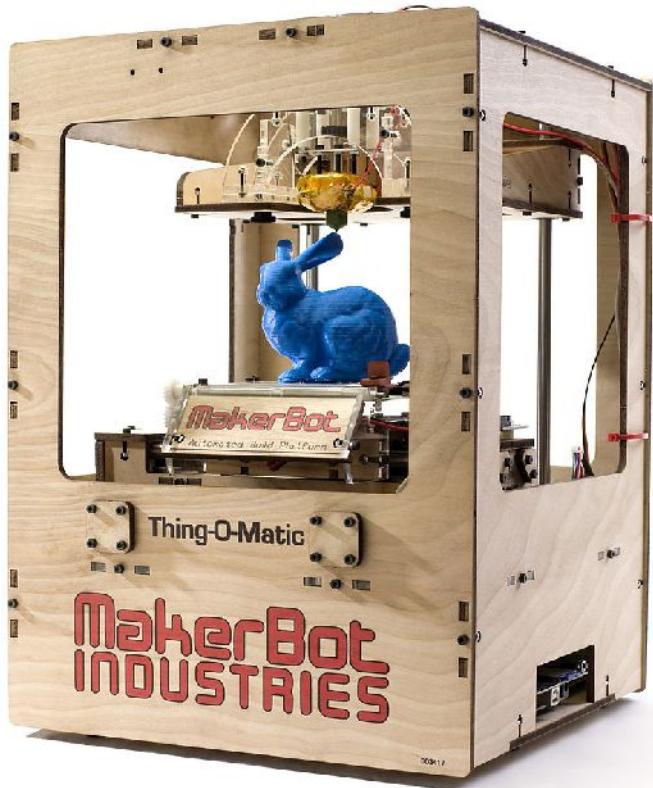
# Open Source 3D printers: RepRap



Again, the evolution of an open source project that's too big to fit into one slide...

Source: [http://reprap.org/wiki/RepRap\\_Family\\_Tree](http://reprap.org/wiki/RepRap_Family_Tree)

# RepRap and its children... Makerbot



Again, the evolution of an open source project that's too big to fit into one slide...

Source: <http://en.wikipedia.org/wiki/Makerbot>

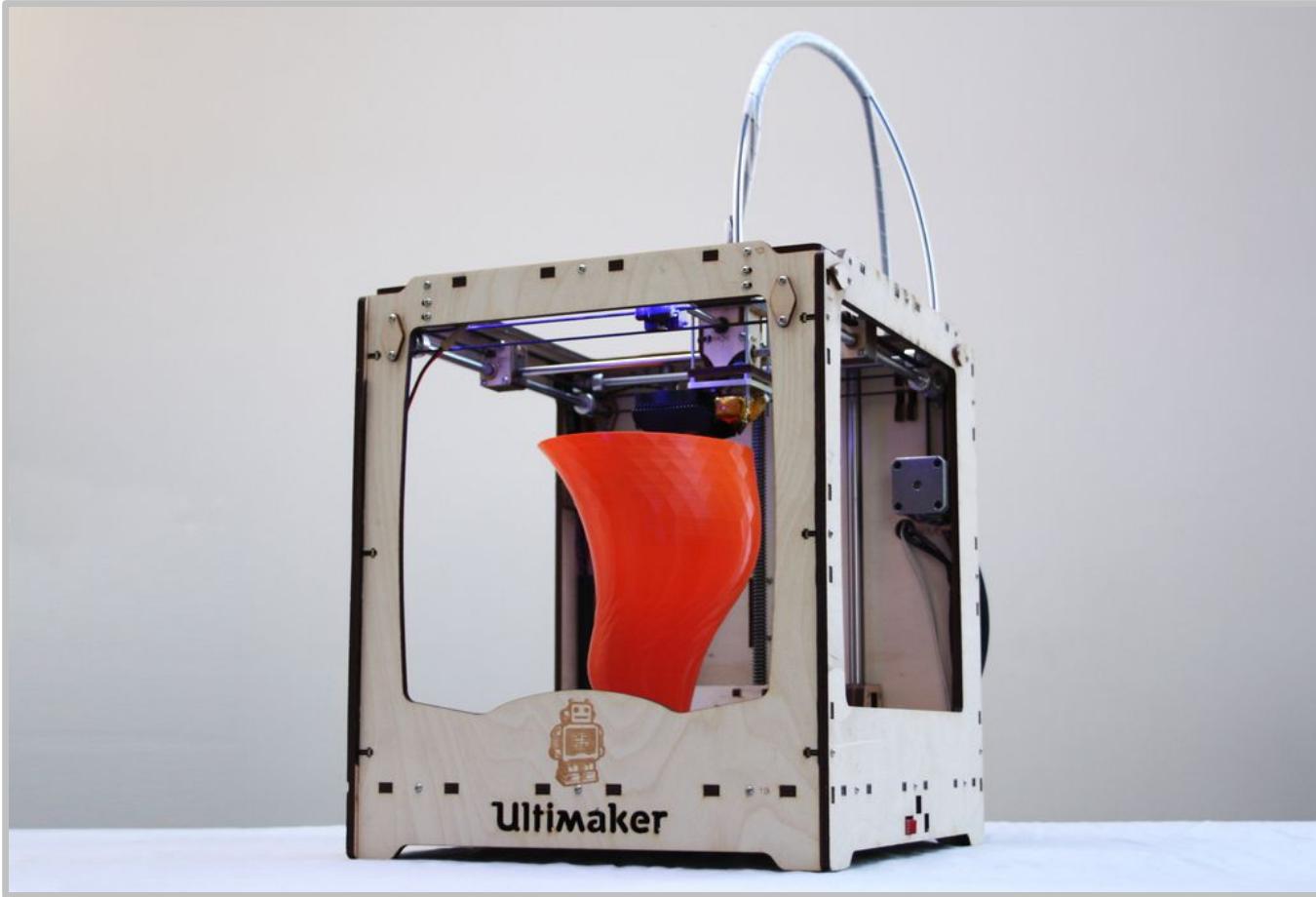
# RepRap and its children... Makerbot



Again, the evolution of an open source project that's too big to fit into one slide...

Source: <http://store.makerbot.com/replicator-404.html>

# RepRap and its children... Ultimaker

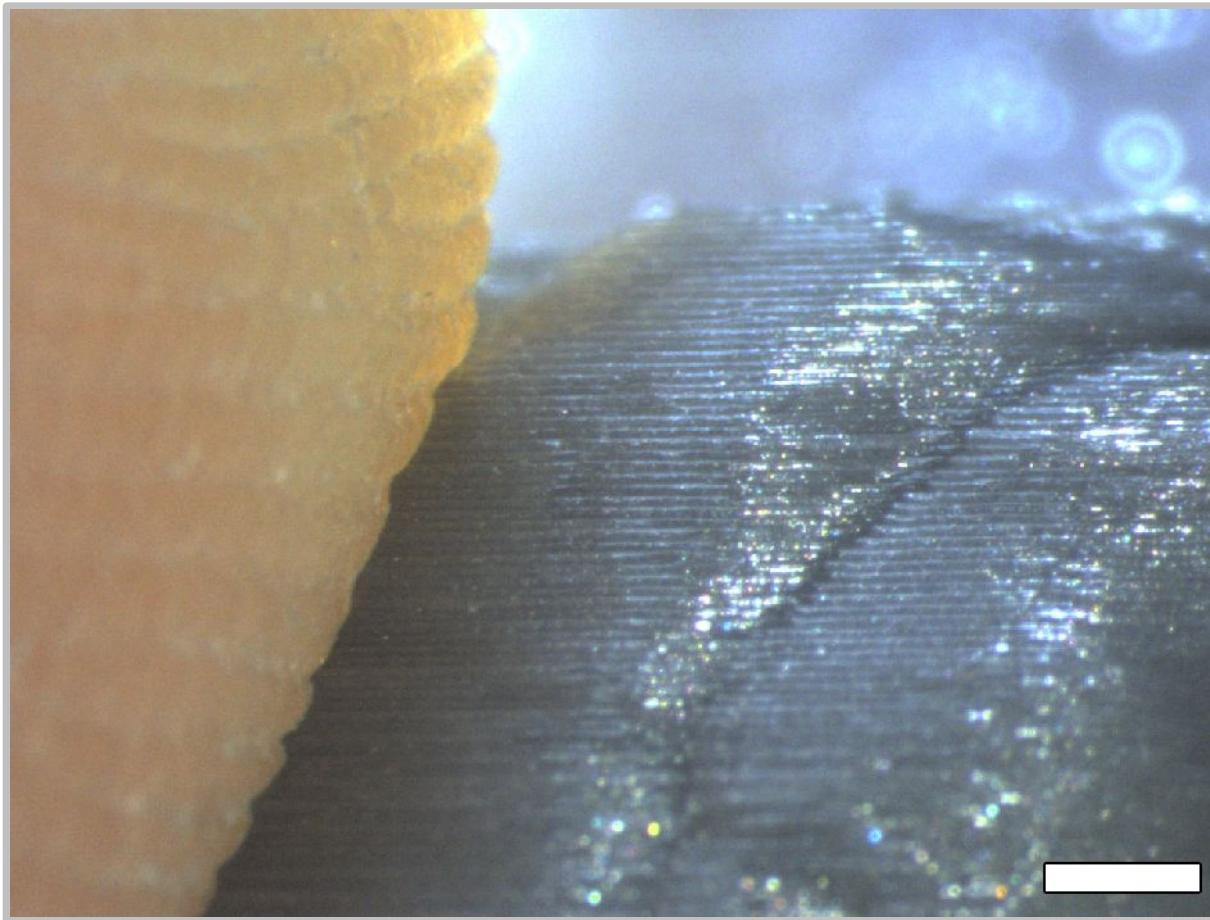


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Again, the evolution of an open source project that's too big to fit into one slide...

Source: <http://reprap.org/wiki/Ultimaker>  
<http://blog.ultimaker.com/>

# RepRap and its children... Ultimaker



---

The average layer height in that pic is around 0.074 mm (that is 74 microns).

Source: <http://www.hive76.org/insane-3d-printing-resolution-ultimaker-under-the-micro>



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# 3D printing: examples what people are doing with it

# Printable VELCRO

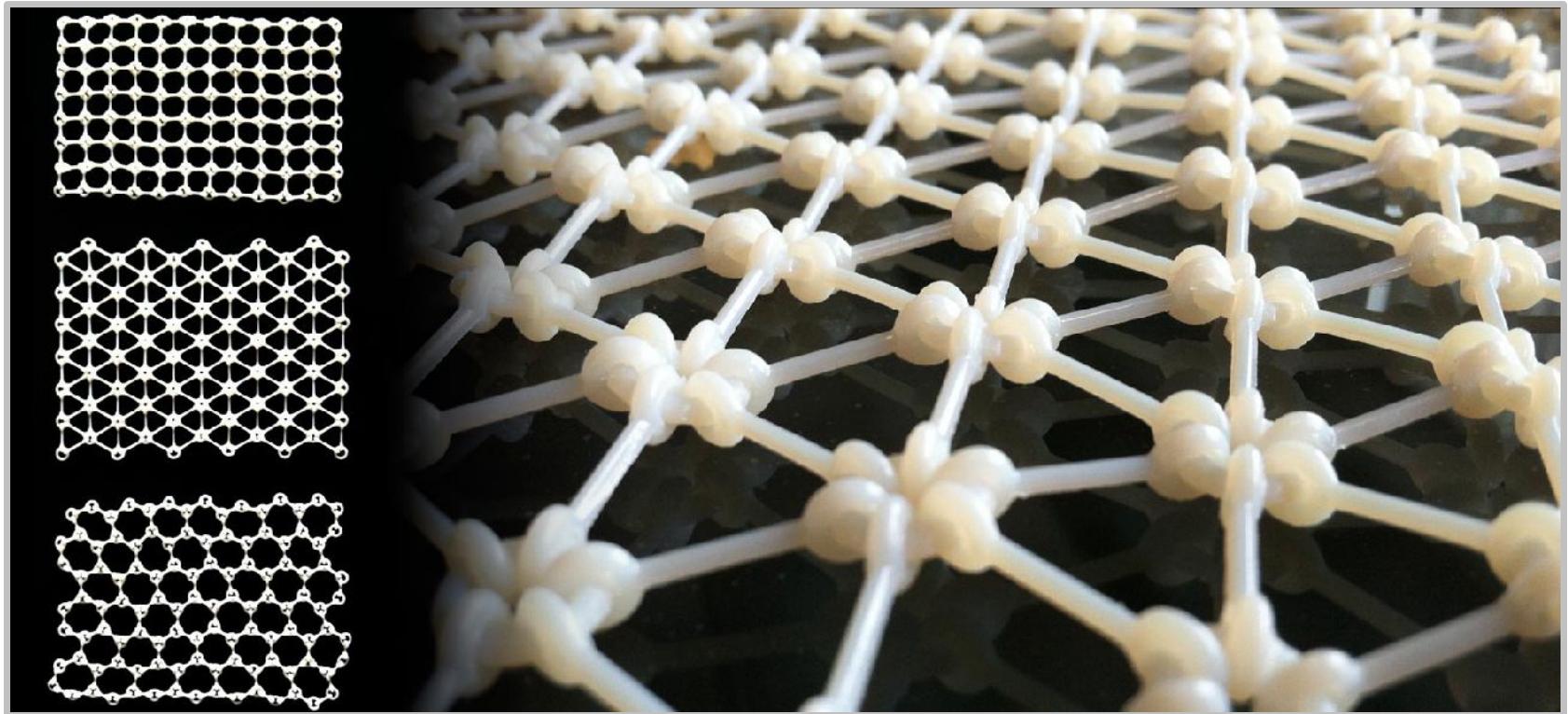


---

The velcro is printed with 0.3mm ABS with a  
MK6 extruder on a Makerbot.

Source: <http://www.thingiverse.com/thing:12798>

# 3D Printing Flexible Grids

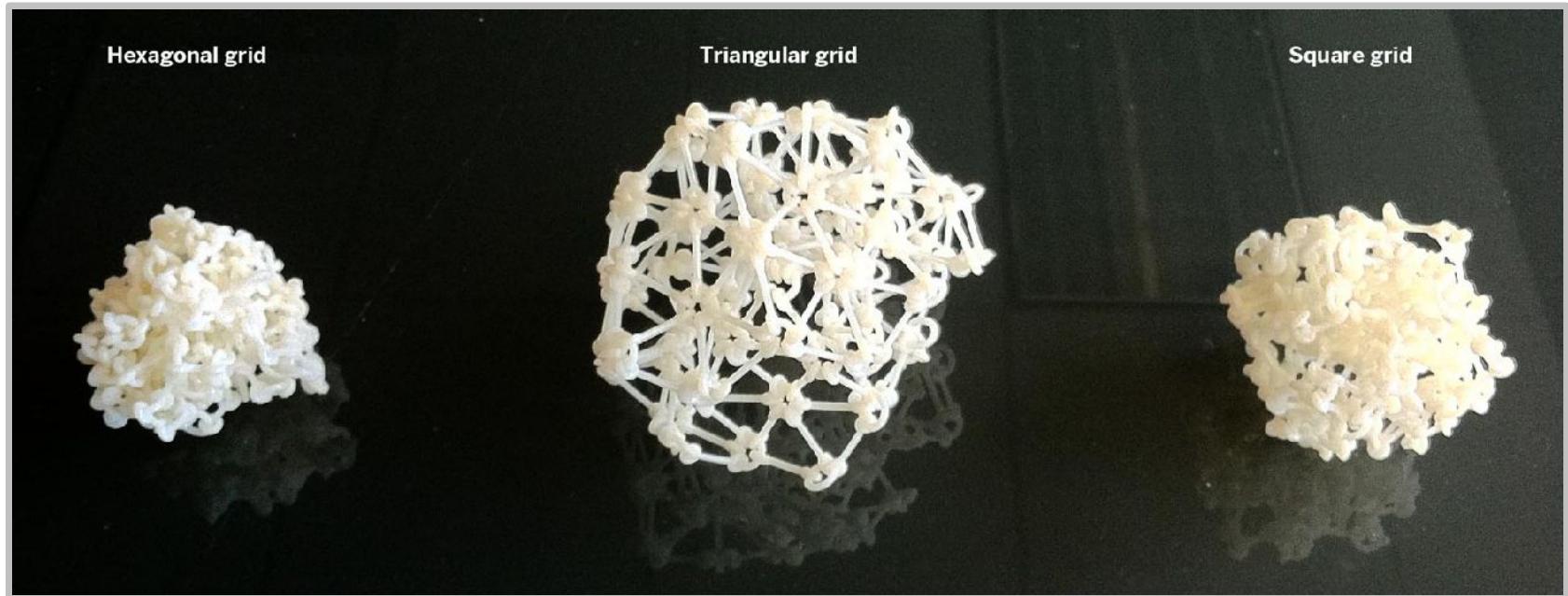


---

Done with a Grasshopper definition that used the grid components to create a set of flexible triangular, square, and hexagonal grids.

Source: <http://lmnts.lmnarchitects.com/fabrication/printed-flexgrids/>

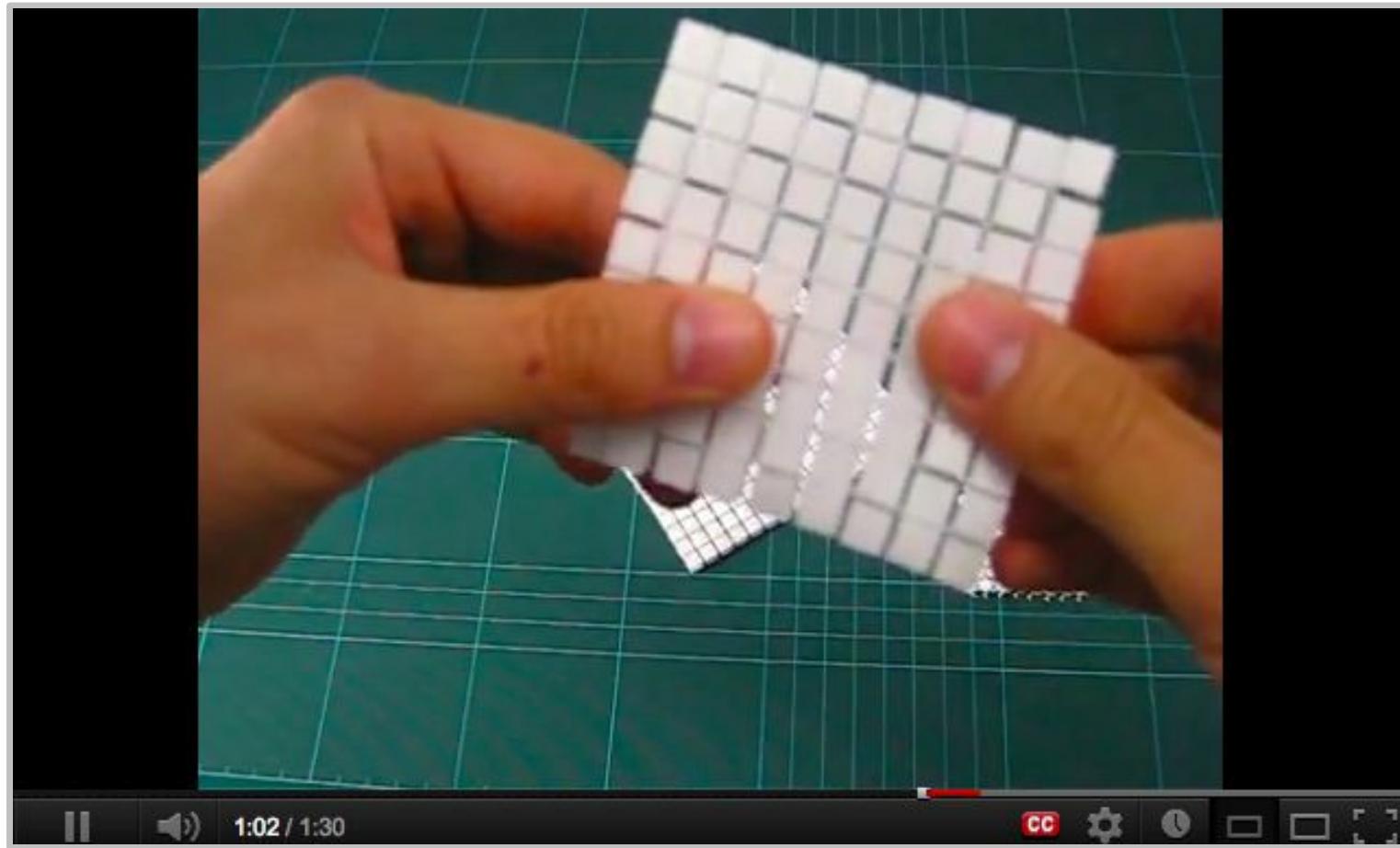
# 3D Printing Flexible Grids



Done with a Grasshopper definition that used the grid components to create a set of flexible triangular, square, and hexagonal grids.

Source: <http://lmnts.lmnarchitects.com/fabrication/printed-flexgrids/>

# Digi-Fabrics



A test done by Shapeways with their White Strong & Flexible material.

Source: <http://youtu.be/JSCDw6mThk4>

<http://www.shapeways.com/blog/archives/525-White-Strong-and-Suuuper-Flexible..html>

# 3D printed bikini



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The N12 bikini is the world's first ready-to-wear, completely 3D-printed cloth. All of the pieces are snap together without any sewing.

Source: <http://www.continuumfashion.com/N12.html>

# 3D printed fashion design



---

Dutch designer Iris Van Herpen uses 3-D printers to create designer fashion for Björk and Lady Gaga.

Source: <http://www.wired.com/design/2012/04/10-things-3d-printers-can-do-now?pid=167>

# 3D printed fashion design



A collection of 3D printed hats and accessories were shown on the runway as part of the Materialise World Conference in Leuven, Belgium.

Source: <http://blog.ponoko.com/2012/04/24/a-fashion-show-of-3d-printed-hats/>  
<http://i.materialise.com/challenge/the-hats-off-to-3d-printing-challenge/>

# 3D printed shoes



Melissas' shoes are among the most amazing examples of what 3D printing can do for style and design. Designer Andreia Chaves created the Invisible Shoes

Source: <http://blog.sculpteo.com/2012/03/29/3d-printing-for-green-fashion-melissas-footwear-experiments/>

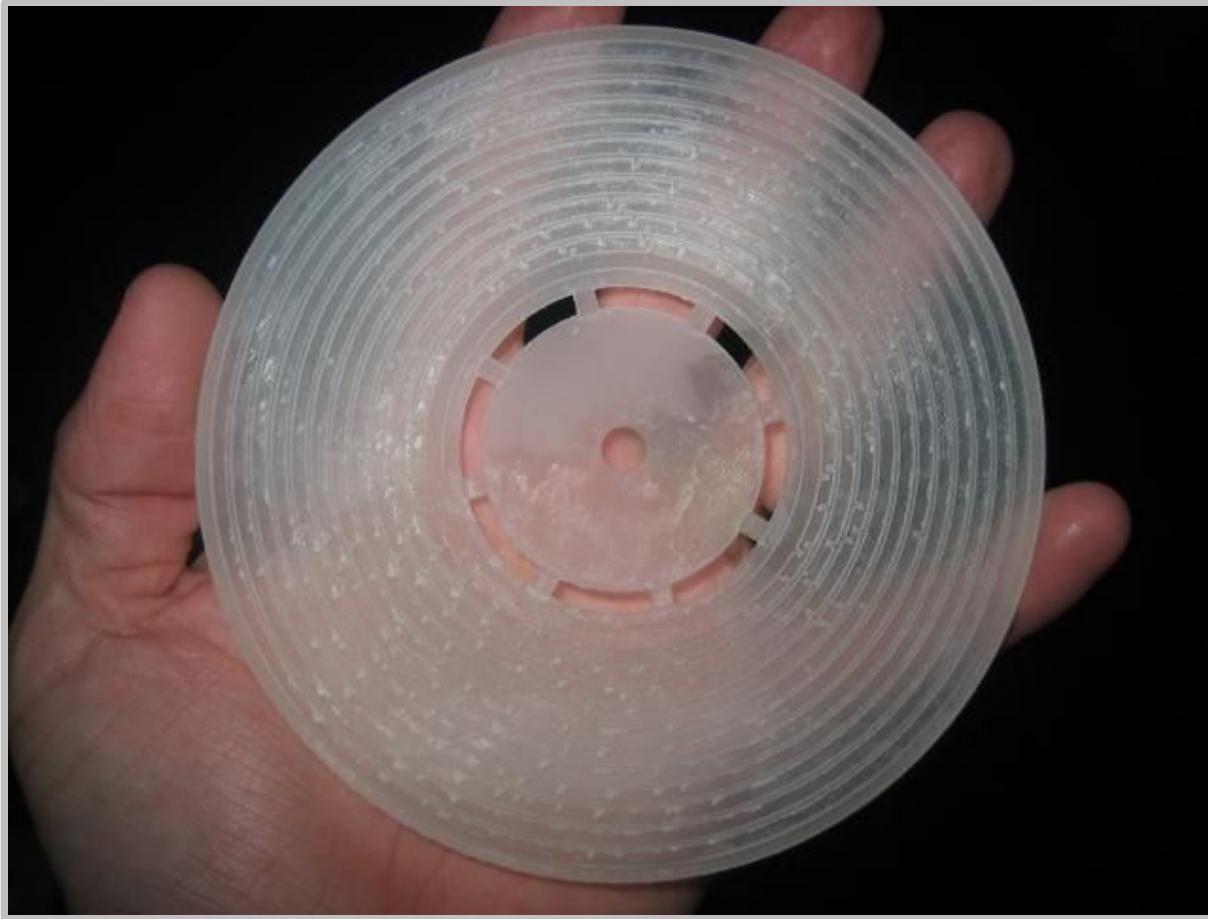
# 3D printed characters



Yoni Binstock is using front and side portrait photos together with 123D Catch to reconstruct a facial model and texture this on to a cake topper design.

Source: <http://www.shapeways.com/blog/archives/1332-Lifes-Memorable-Moments-Captured-In-3D.html>

# 3D printing media...



---

A 3D printed record for the Fisher-Price record player playing 'Still Alive'. The tune and model were all generated in Processing. Sold on Shapeways.

Source: <http://www.shapeways.com/blog/archives/1179-Video-of-3D-Printed-Record-Playing-Still-Alive-from-Portal.html>

# 3D printing media...



A 3D printed record for the Fisher-Price record player playing 'Still Alive'. The tune and model were all generated in Processing. Sold on Shapeways.

Source: <http://youtu.be/EIAJJnSvQtk>

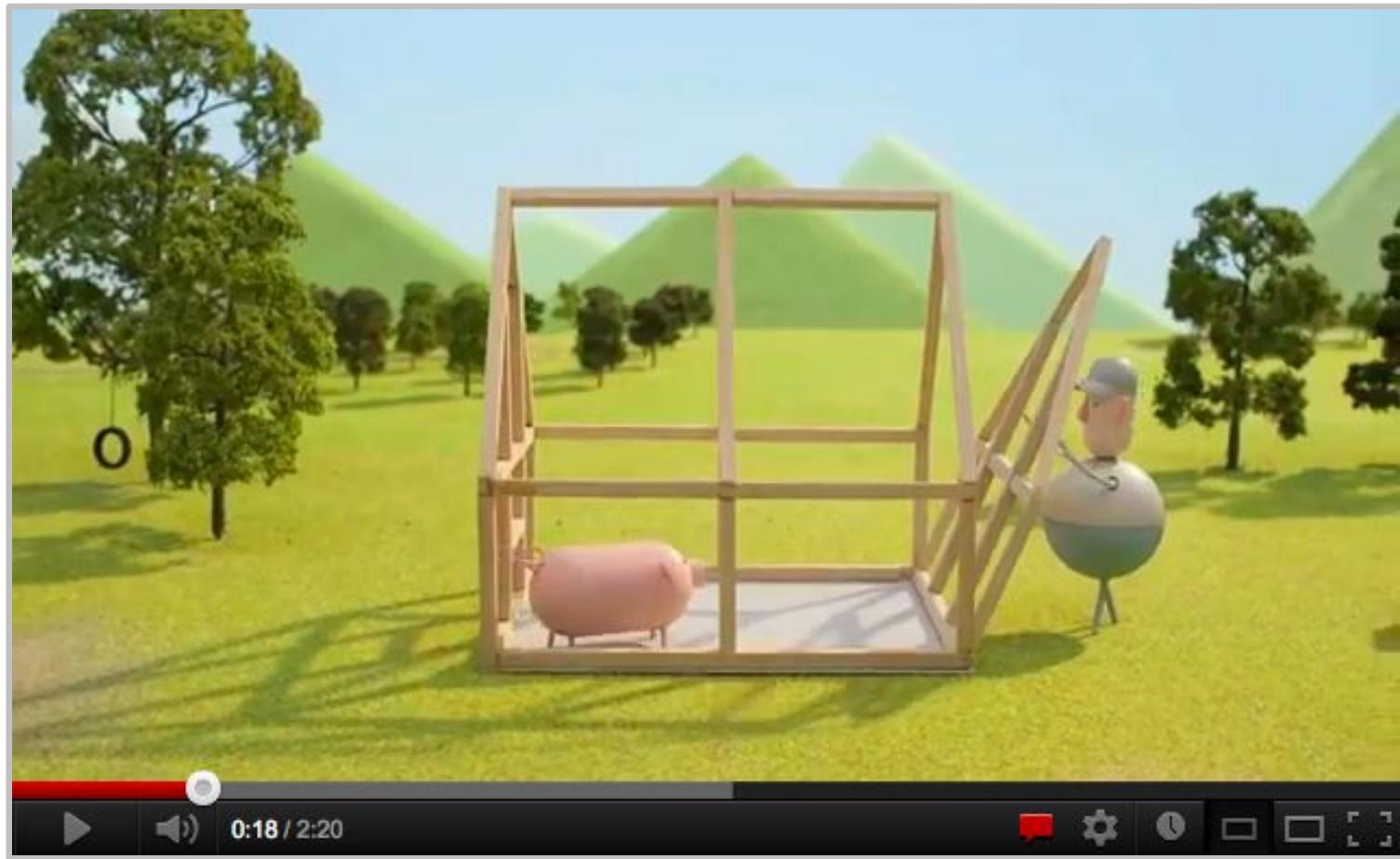
# 3D printing media...



The first 3D printed prototype of the programmable kalimba sequencer.  
Pegs can be set to produce different 16-step sequences of 5 tones.

Source: <http://youtu.be/ERiw664xMKE>

# 3D printing media...



3D printing of film props has long been common in big budget movies, but now its increased affordability is aiding its introduction to smaller budget productions.

Source: <http://youtu.be/aMfSGt6rHos>

<http://blog.ponoko.com/2011/12/11/3d-prints-in-stop-motion-animation/>

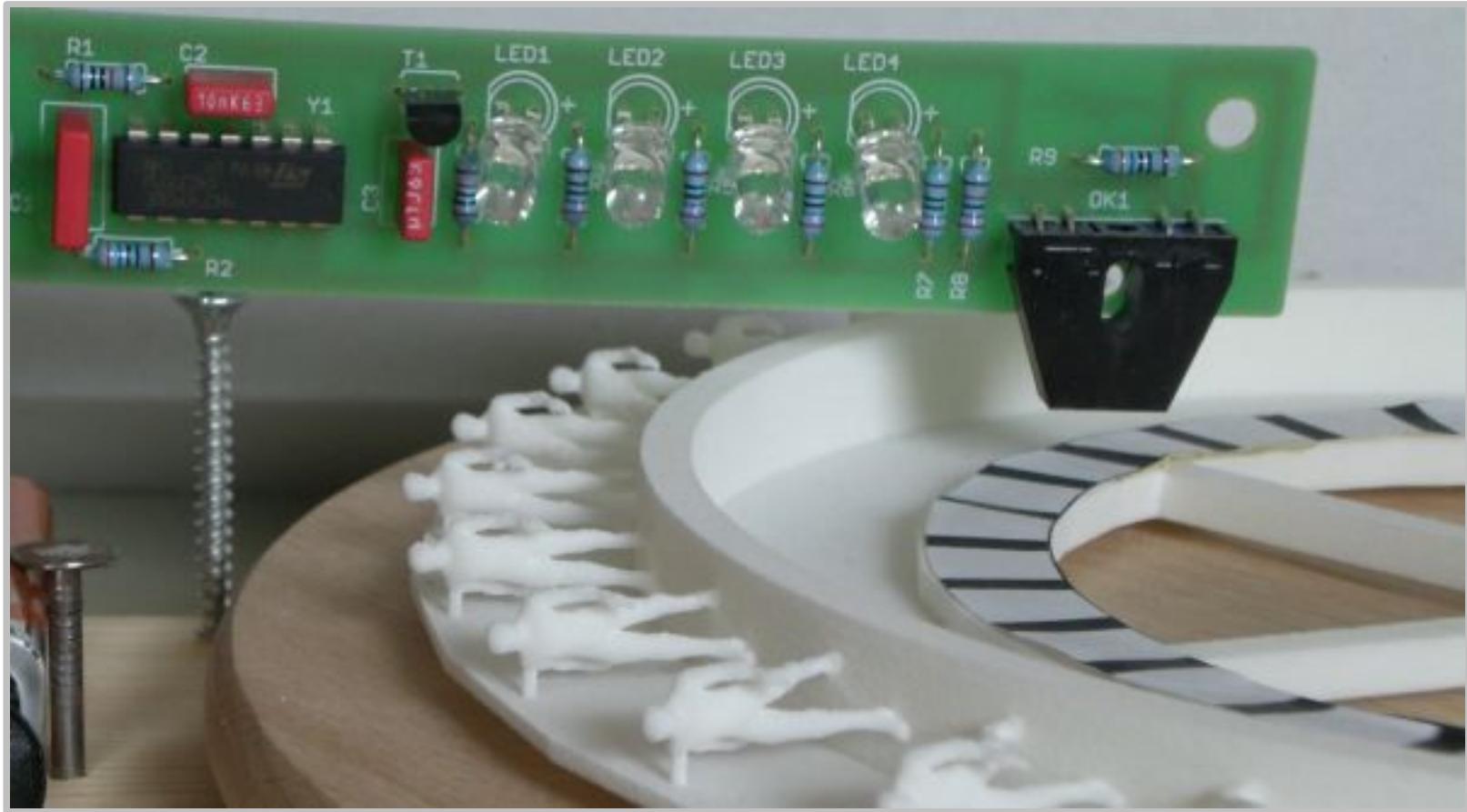
# 3D printing media...



With the help of technologies from Objet Geometries, the creative team behind the feature film, Coraline, broke new ground in stop-motion animation.

Source: [http://youtu.be/\\_2F0PA7qUQE](http://youtu.be/_2F0PA7qUQE)

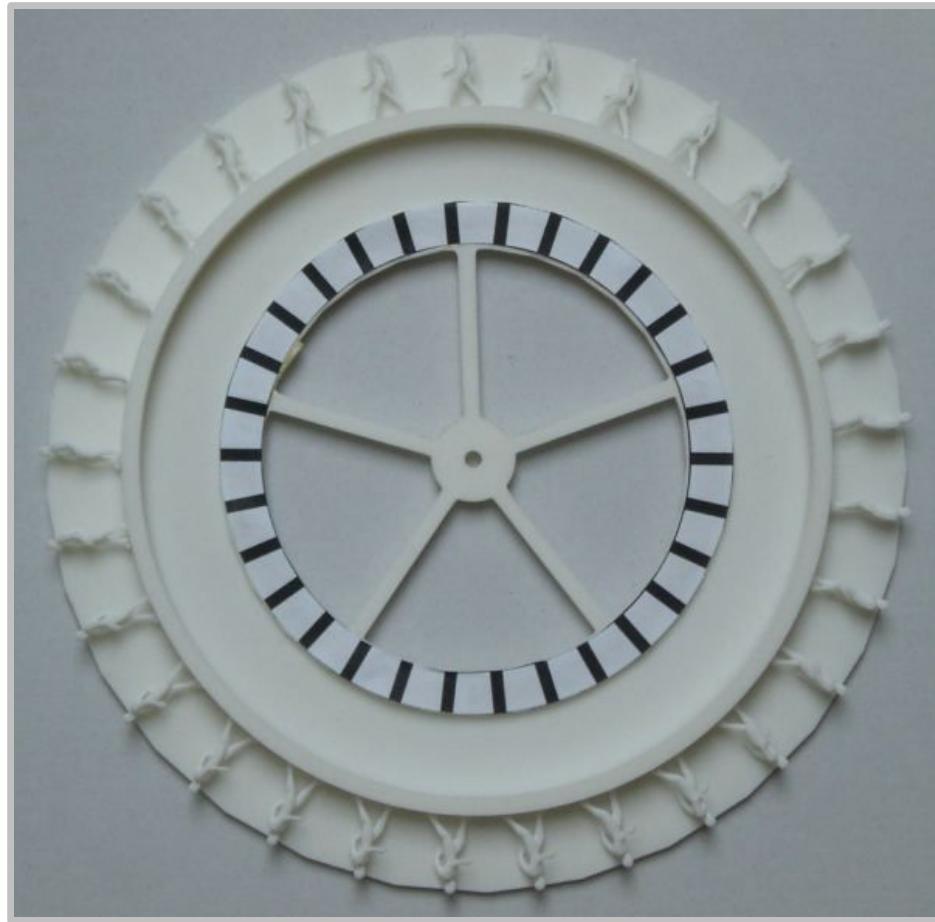
# 3D printing media...



3Drehkino took an animation in Blender, 3D printed it with Shapeways, hacked some electronics and created his own zeotrope under a CC license.

Source: [http://drehkino.de/3Drehkino\\_en.php](http://drehkino.de/3Drehkino_en.php)

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---

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Source: [http://youtu.be/LVa\\_WwBFtA4](http://youtu.be/LVa_WwBFtA4)

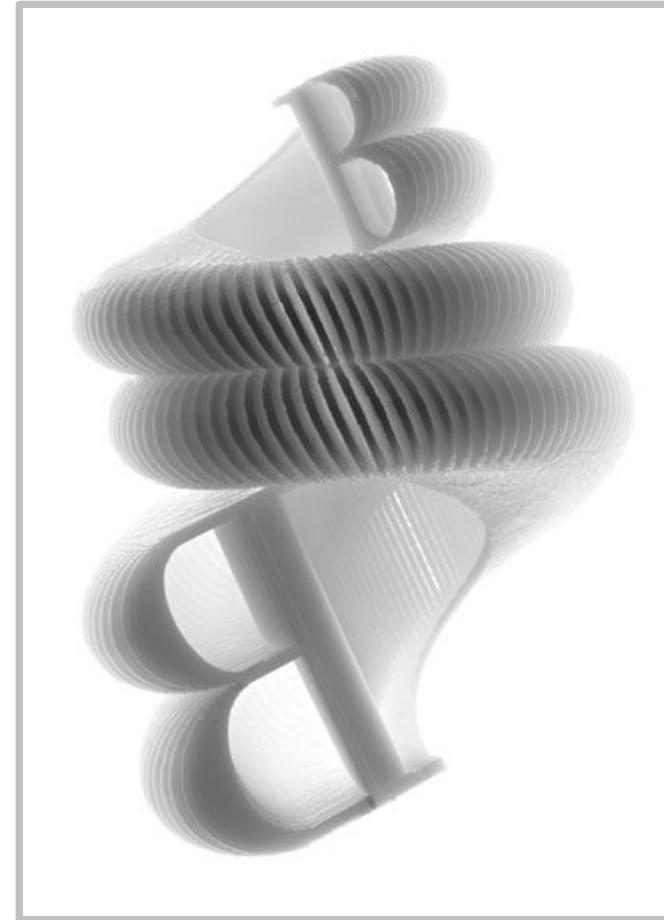
# 3D printing in media: Print magazine cover



Print magazine August 2008 cover design generated with Processing and 3D printed.

Source: [http://postspectacular.com/process/20080702\\_printmagcover](http://postspectacular.com/process/20080702_printmagcover)

# 3D printing in media: Arkitypo

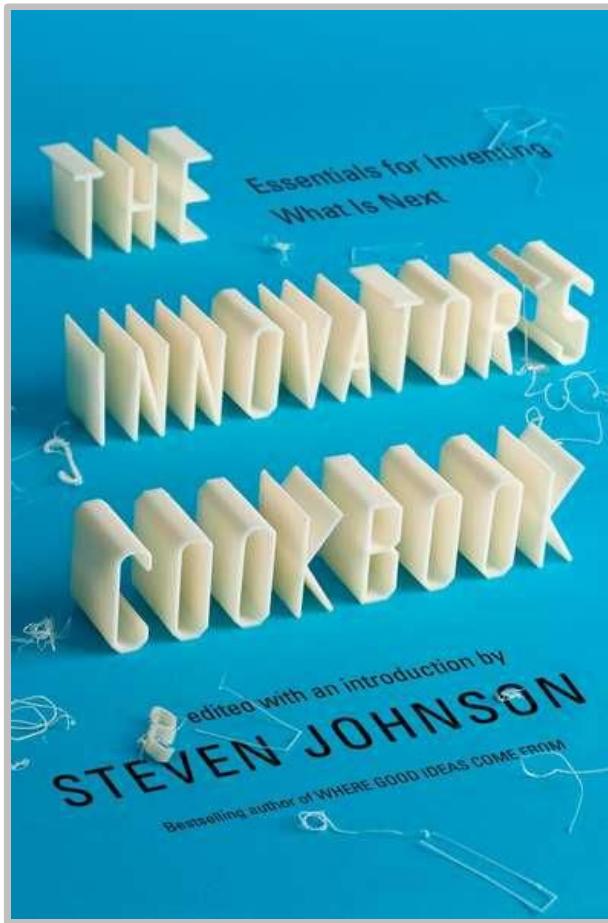


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The idea was to 3D-print an entire alphabet derived from the historical story of how a typeface beginning with the same letter came to be.

Source: <http://johnsonbanks.co.uk/thoughtfortheweek/index.php?thoughtid=711>

# 3D printing in media



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Printing the cover of the book *The Innovator's Cookbook* by Steven Johnson with a Makerbot.

Source: <http://www.casualoptimist.com/2011/10/18/the-innovators-cookbook/>

# 3D printing in media



Printing the cover of the book *The Innovator's Cookbook*  
by Steven Johnson with a Makerbot.

Source: <http://youtu.be/S2EqxdvOKVc>  
<http://www.casualoptimist.com/2011/10/18/the-innovators-cookbook/>

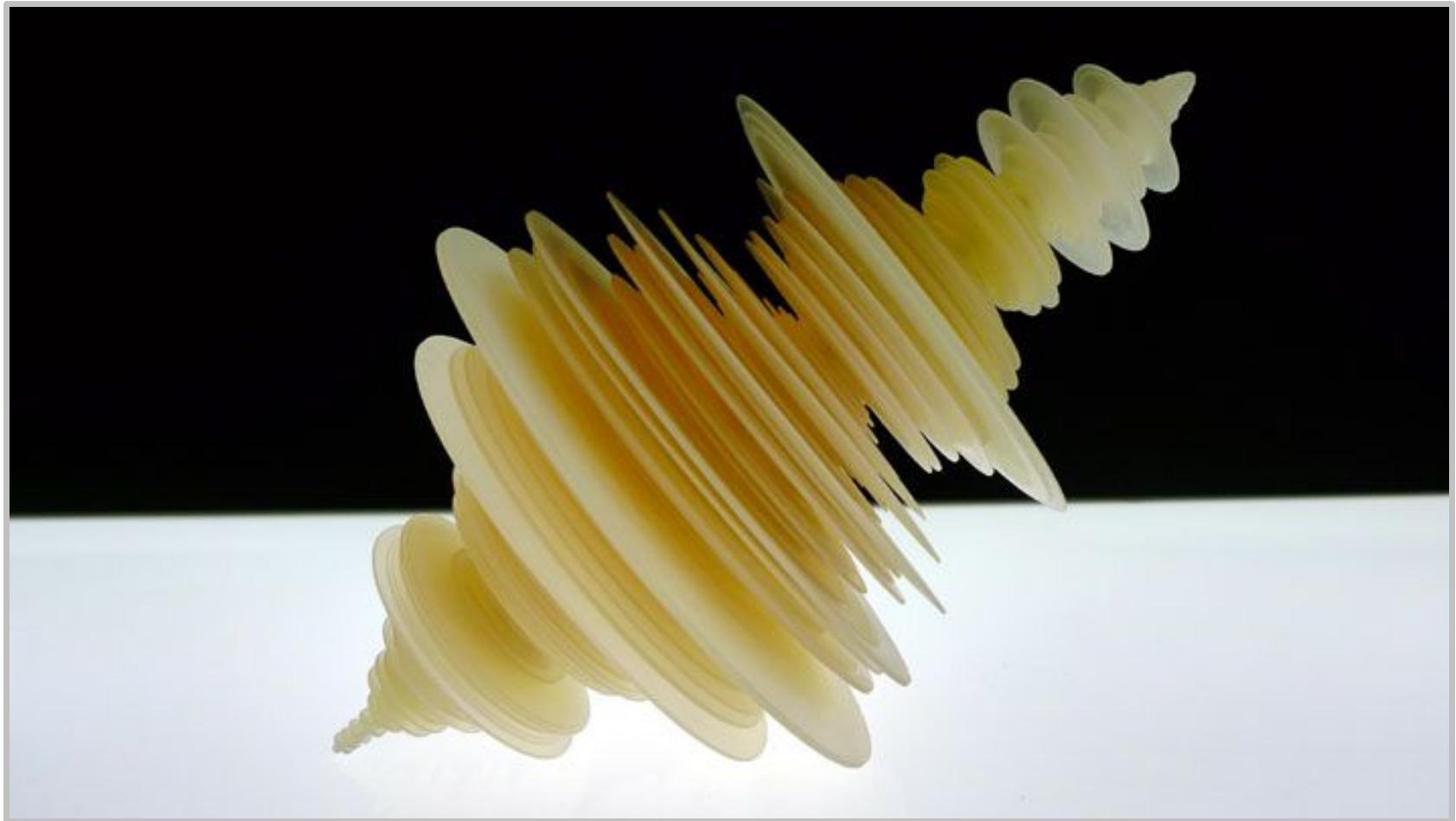
# Successful transplant of a 3D printed jaw



A 3D printer-created lower jaw has been fitted to an 83-year-old woman's face in what doctors say is the first operation of its kind.

Source: <http://www.bbc.co.uk/news/technology-16907104>

# 3D printing data: Luke Jerram



To create the sculpture a seismogram of the earthquake, was rotated and then printed in 3 dimensions using rapid prototyping technology.

Source: [http://www.lukejerram.com/projects/t%C5%8Dhoku\\_earthquake](http://www.lukejerram.com/projects/t%C5%8Dhoku_earthquake)

# 3D printing data: sound

The screenshot shows the homepage of the Shapeways 'the vibe' service. At the top, there's a logo consisting of the Shapeways and SoundCloud logos plus a plus sign, followed by an equals sign and the 'the vibe' logo. Below this, the main title 'Sound You Can Touch' is displayed in large, bold, dark letters. A subtitle below it reads '3D print a custom iPhone case with your favorite sound from SoundCloud'. A large orange 'Get Started!' button is centered. Below the button, a link says 'Never heard of SoundCloud? [Find out more.](#)' In the bottom section, there's a box titled 'Here's How It Works...' containing three steps: 'Connect to SoundCloud.' (with an icon of a plug in a cloud), 'Choose your favorite sound.' (with a screenshot of the Shapeways website showing a sound waveform and price), and 'Get your custom iPhone case!' (with an image of a hand holding a black iPhone case with a red and white soundwave pattern). The background of the page features a subtle grayscale waveform pattern.

shapeways + SOUNDCLiND = the vibe

# Sound You Can Touch

3D print a custom iPhone case with your favorite sound from SoundCloud

Get Started!

Never heard of SoundCloud? [Find out more.](#)

Here's How It Works...

Connect to SoundCloud.

Choose your favorite sound.

Get your custom iPhone case!

“Welcome to the era of mass customization in which anyone can build a unique iPhone case for \$25.”

Source: <http://www.shapeways.com/creator/thevibe>

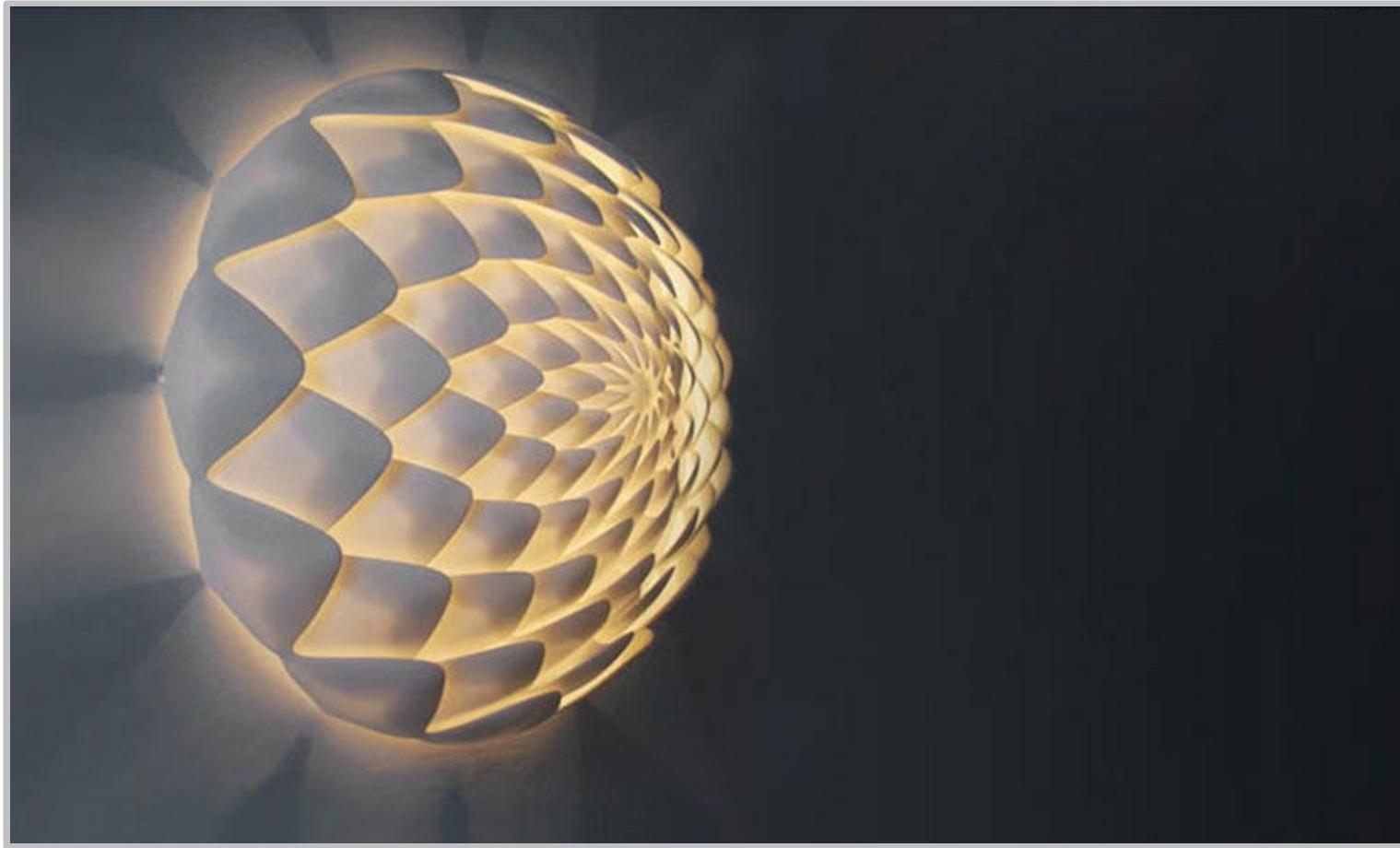
# 3D printing data: sound



“Welcome to the era of mass customization in which anyone can build a unique iPhone case for \$25.”

Source: <http://www.protoparadigm.com/2011/11/filament-tolerances-and-print-quality/>

# 3D printed lamps



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Freedom Of Creation is an edition of exclusive design objects, furnishing complements, lighting and accessories.

Source: <http://www.freedomofcreation.com/>

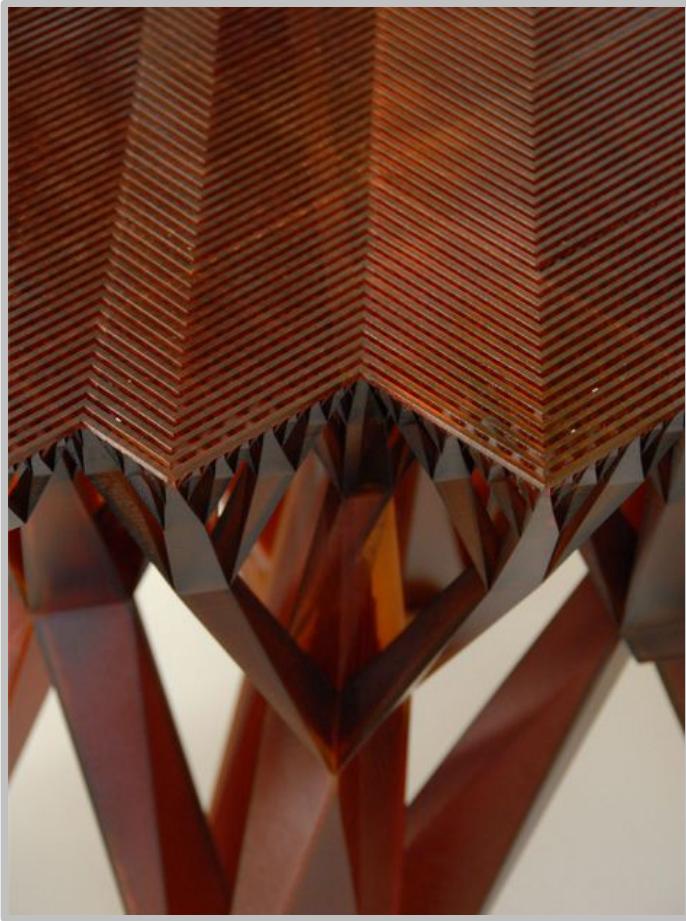
# 3D fractal furniture design



Fractal Table is a generative design table produced by Materialise as a single piece SLA in epoxy resin. Its dimensions in cm are: L98 x W61 x H42.

Source: <http://www.platform-net.com/>

# 3D fractal furniture design

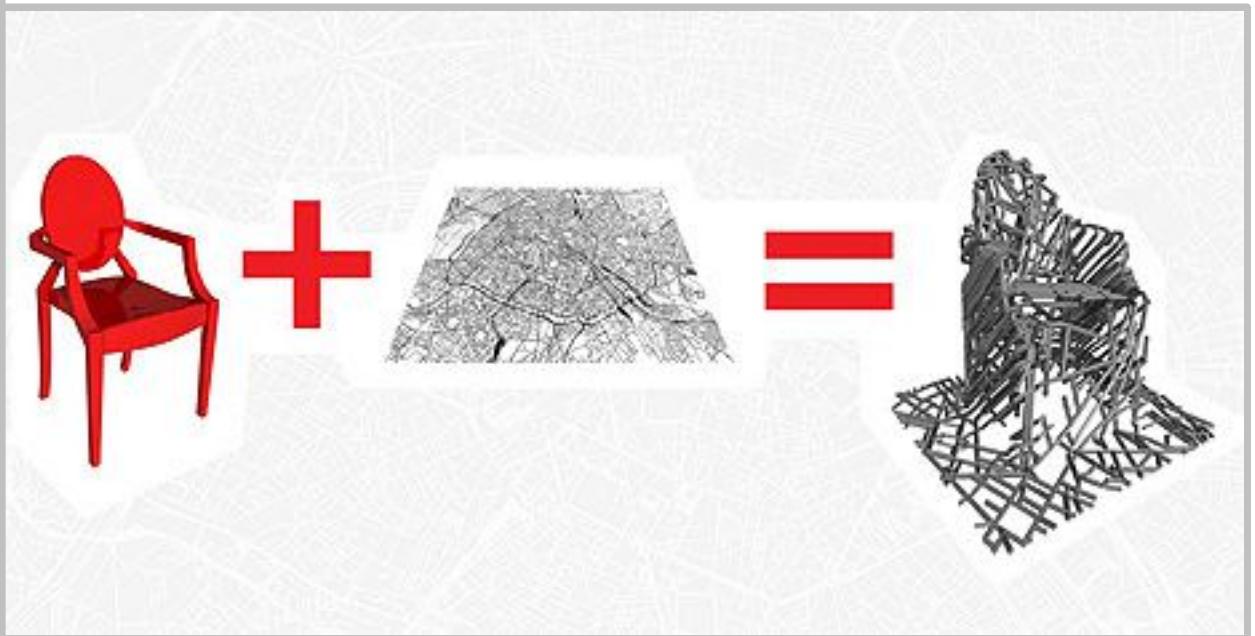


---

Fractal Table is a generative design table produced by Materialise as a single piece SLA in epoxy resin. Its dimensions in cm are: L98 x W61 x H42.

Source: <http://www.platform-net.com/>

# 3D printed furniture design



---

The Throne of Paris (John Briscella)

Source: <http://i.materialise.com/blog/entry/5-amazing-full-sized-furniture-pieces-made-with-3d-printing>

# 3D printed guitar



Each guitar is fully customizable, as the designers remove or insert various segments from the 3D model before each printing, with selectable colour.

Source: <http://www.designboom.com/weblog/cat/16/view/20135/skeletal-3d-printed-guitar.html>

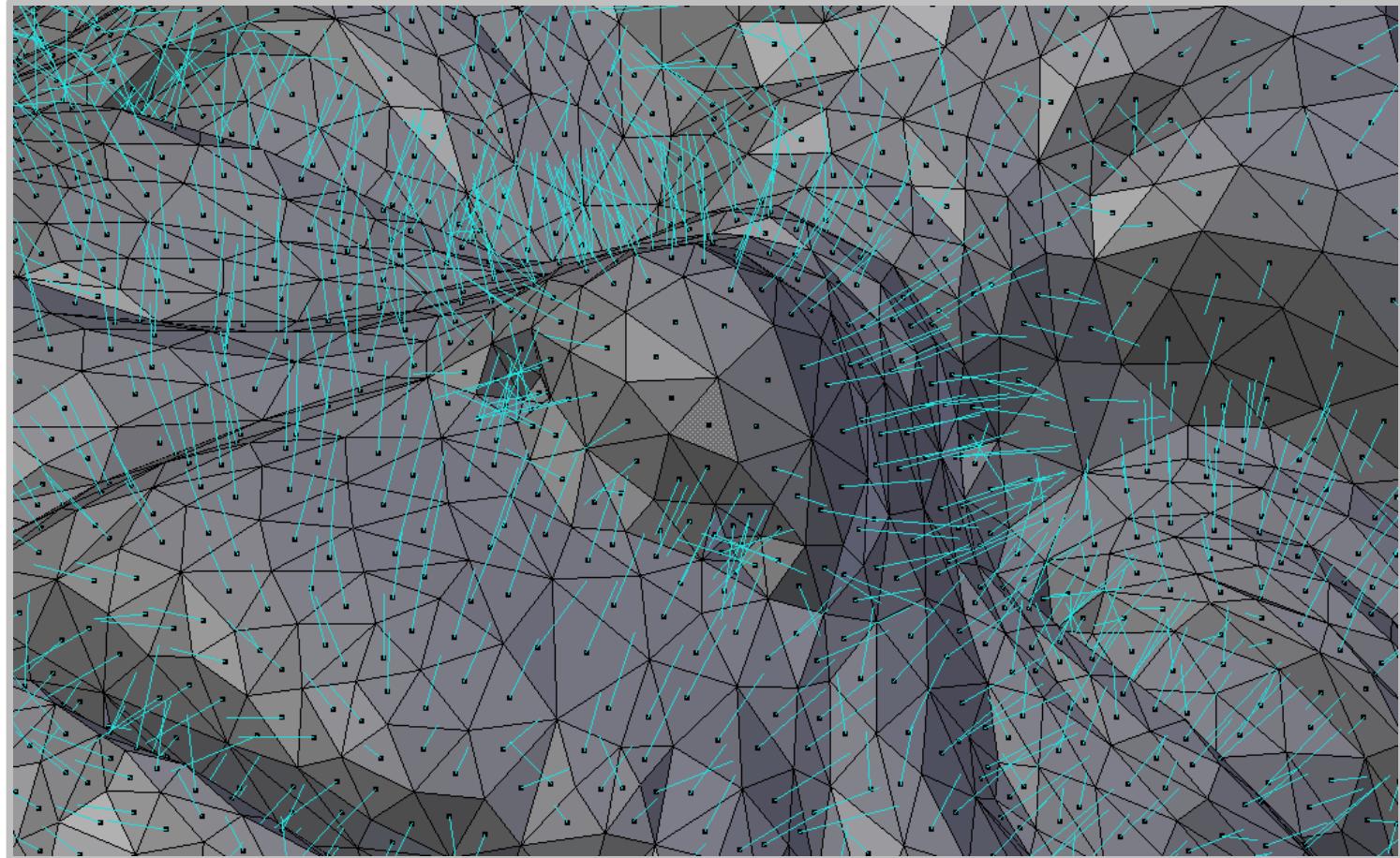


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# 3D printing: design techniques things to consider...

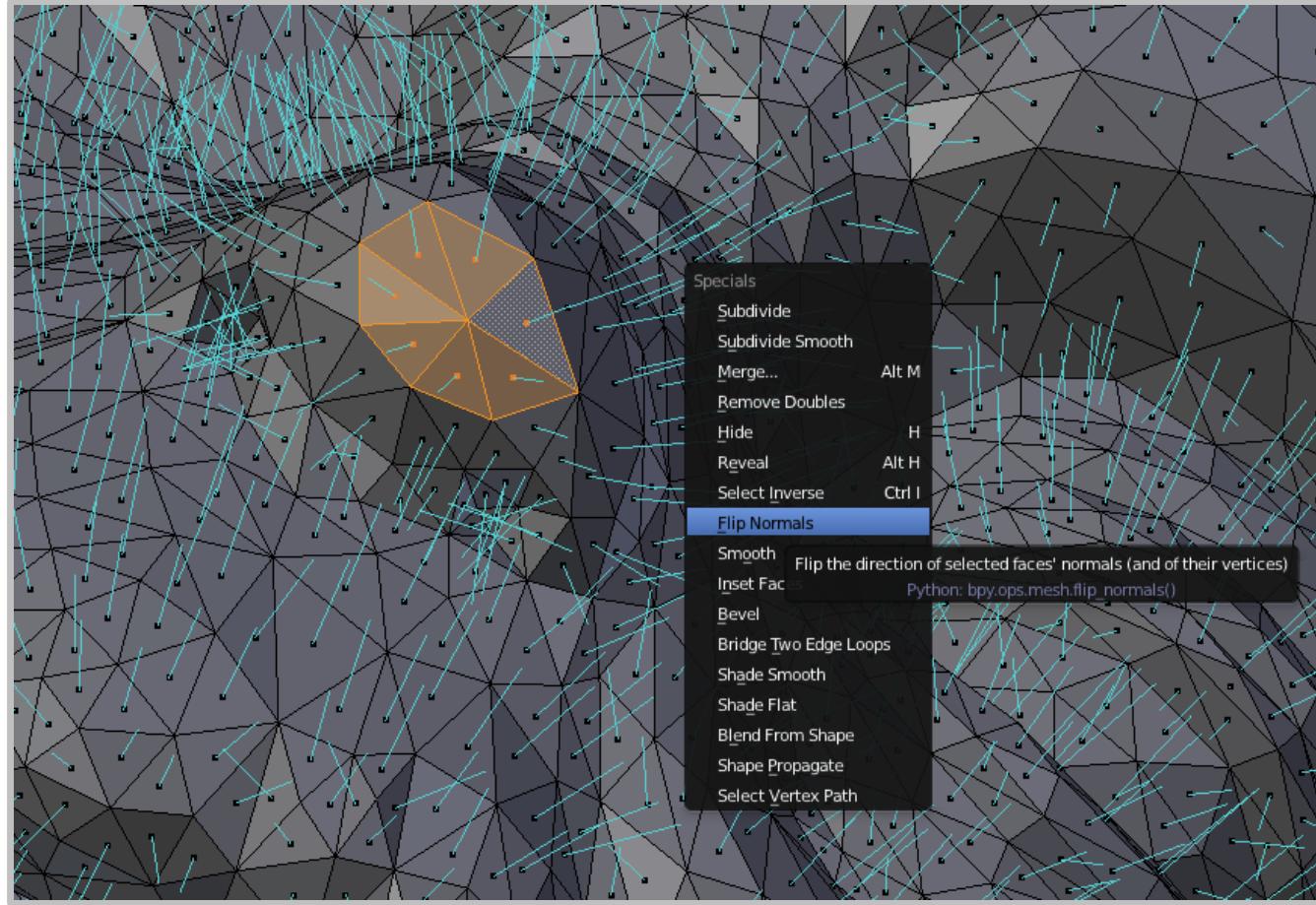
# 01: check the normals



---

They should point outwards! The faces of a mesh are only 1-side.

# 01: check the normals



---

Edit mode > W > Flip normals

# 02: check your technology

## Watch out with very thin connections

The droplet below necks down to a very thin cross-section. The droplet on the end is too large then goes to a small cross-section. This will crack or tear.

"Water Crown Chopsticks stand", by [wuct88](#)



Check your specific material and technology,  
Shapeways is a good resource.

Source: [http://www.shapeways.com/tutorials/design\\_rules\\_for\\_glass\\_3d\\_printing](http://www.shapeways.com/tutorials/design_rules_for_glass_3d_printing)

## 03: Yes to moving parts and undercuts



But not with FDM!!!

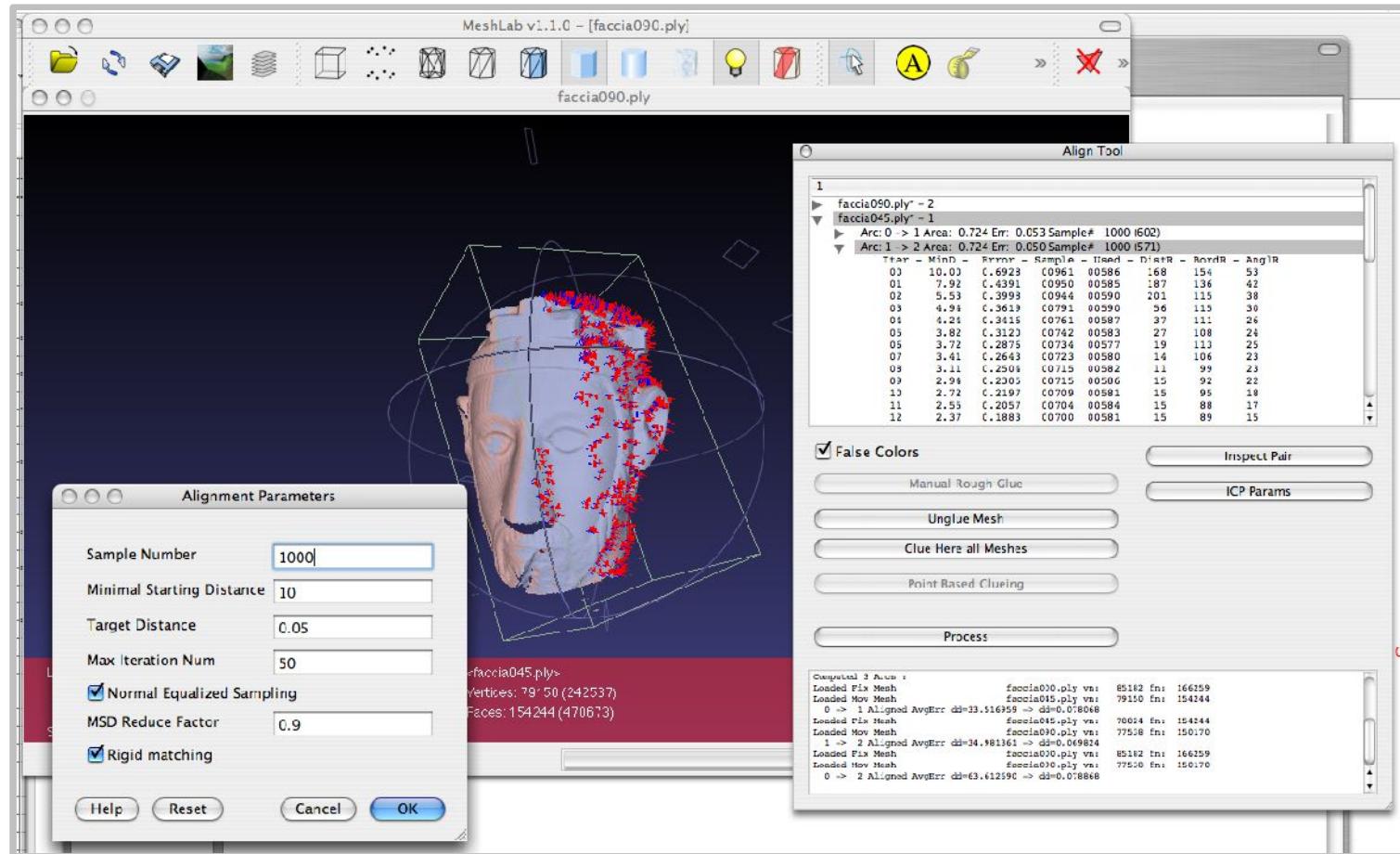
# 03: FDM: use support material



PVA is the best option, it is water soluble.

Source: <http://youtu.be/FqhBmNyvNhQ>  
<http://store.makerbot.com/makerbot-pva-1kg-spool.html>

# 04: Clean it with Netfabb / Meshlab



And you may need to import it into Blender again.

# 3D printing: what could go wrong?



---

Too fast: we cannot achieve the full cylinder.  
We had to slow the speed down and rise a bit the temperature.

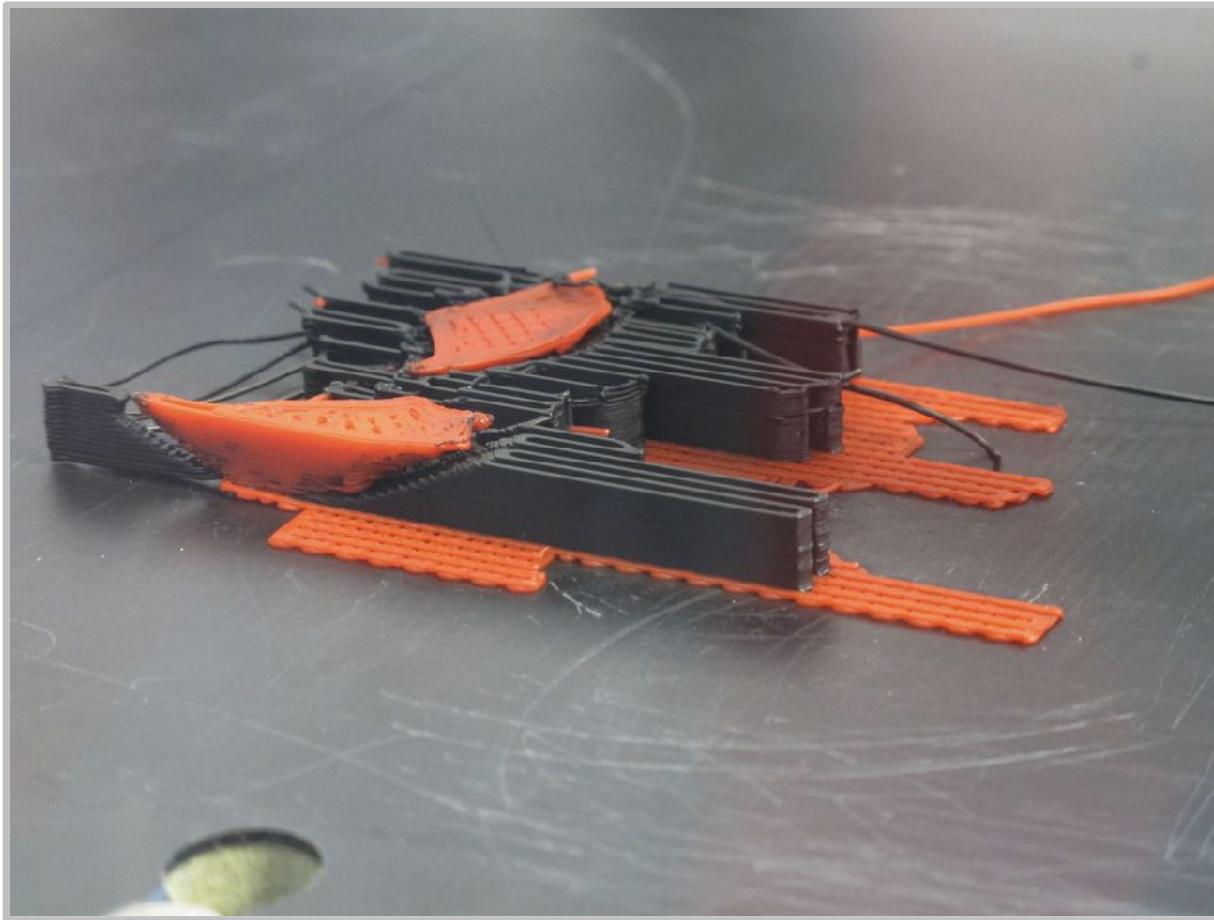
# 3D printing: what could go wrong?



---

Too fast: the material does not have the time to solidify.  
Also: too thin, and the roof collapses. On the right: slower and bigger detail.

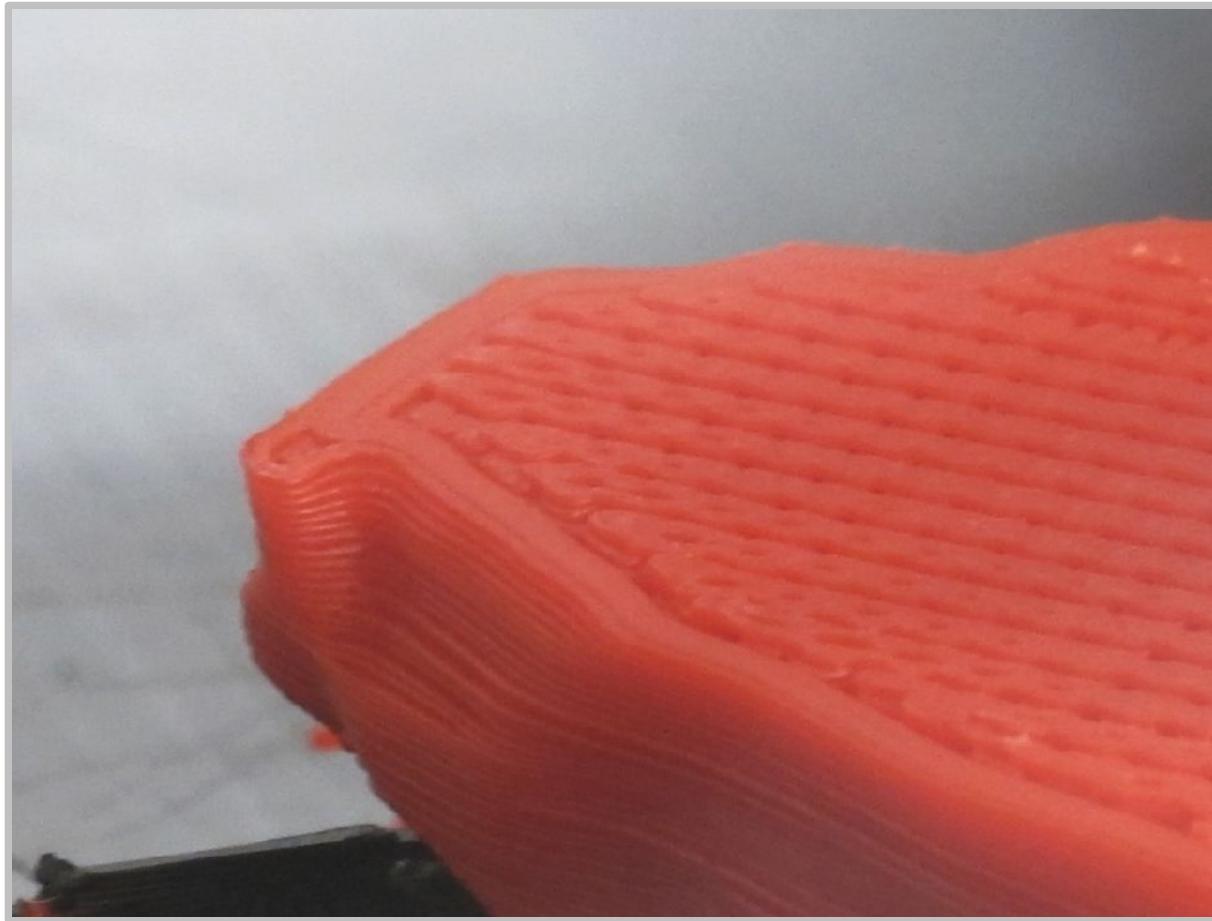
# Think about the speed



---

Each different material melt at a different temperature,  
mixing them means slowing down the process.

# Skins and filling



---

You can add extra skins and reduce the density of the filling, if you just need a shell.

# 123D Catch: result



---

See the orientation of the layers?

# 123D Catch: result



---

Support material (PLA) and object material  
(ABS) mixed a bit.

# A”

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# Thank you!!

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@openp2pdesign  
<http://www.slideshare.net/openp2pdesign>



21.05.2012

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