3D PRINTING:

Media Hype or Manufacturing Reality ?

Textiles Surface Fashion Product Architecture.

Textile Centre of Excellence, Huddersfield UK
17th February 2014

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 Printed Food, by Shapeways 3D printing bureau. www.shapeways.com

YOUR 3D PRINTING MENU:

- **3D HUMAN HYPE OR HUMAN REALITY?**
- **MANUFACTURING REALITY:**
- 3D RAPID PROTOTYPING MACHINES AND MATERIALS
- **HOW 3D PRINT WORKS**

3D R&D IN SCHOOL OF ART DESIGN & ARCHITECTURE

- 3D PRINT IN TEXTILES / AND/ FASHION
- **QUESTIONS & CONCLUSIONS**
- THANKS

1980s

A BRIEF HISTORY OF 3D PRINTING

The inception of 3D printing can be traced back to 1976, when the inkjet printer was invented. In 1984, adaptations and advances on the inkjet concept morphed the technology from printing with ink to printing with materials. In the decades since, a variety of applications of 3D printing technology have been developed across several industries. The following is a brief history of the major milestones along the way.

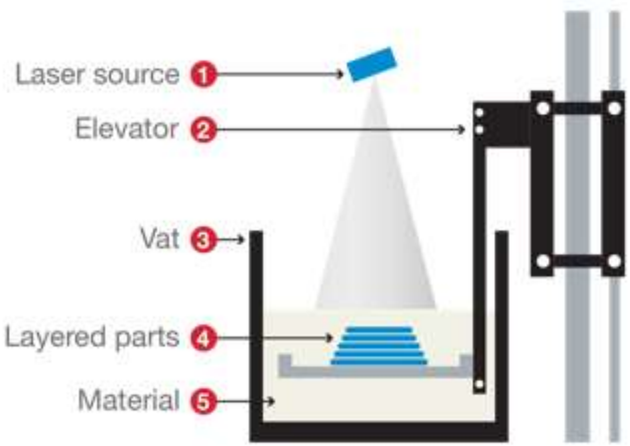
1984

THE BIRTH OF 3D PRINTING

Charles Hull, later the co-founder of 3D Systems, invents stereolithography, a printing process that enables a tangible 3D object to be created from digital data. The technology is used to create a 3D model from a picture and allows users to test a design before investing in a larger manufacturing program.

HOW 3D PRINTING WORKS

3D printers work like inkjet printers. Instead of ink, 3D printers deposit the desired material in successive layers to create a physical object from a digital file.



1. A laser source sends a laser beam to solidify the material.
2. The elevator raises and lowers the platform to help lay the layers.
3. The vat contains the material used to create the 3D object.
4. The 3D object is created as parts are layered on top of each other.
5. Advanced 3D printers use one or more materials, including plastic, resin, titanium, polymers and even gold and silver.

CREDIT. INFOGRAPHIC: http://individual.troweprice.com/public/Retail/Planning-&-Research/Connections/3D-Printing/Infographic

1990s

'92 BUILDING PARTS, LAYER BY LAYER

The first SLA (stereolithographic apparatus) machine is produced by 3D Systems. The machine's process involves a UV laser solidifying photopolymer, a liquid with the viscosity and color of honey that makes three-dimensional parts layer by layer. Although imperfect, the machine proves that highly complex parts can be manufactured overnight.

'99 ENGINEERED ORGANS BRING NEW ADVANCES TO MEDICINE

The first lab-grown organ is implanted in humans when young patients undergo urinary bladder augmentation using a 3-D synthetic scaffold coated with their own cells. The technology, developed by scientists at the Wake Forest Institute for Regenerative Medicine*, opened the door to developing other strategies for engineering organs, including printing them. Because they are made with a patient's own cells, there is little to no risk of rejection.

2000s

'02 A WORKING 3D KIDNEY

Scientists engineer a miniature functional kidney that is able to filter blood and produce diluted urine in an animal. The development led to research at the Wake Forest Institute for Regenerative Medicine that aims to "print" organs and tissues using 3D printing technology.

'05 OPEN-SOURCE COLLABORATION WITH 3D PRINTING

Dr. Adrian Bowyer at University of Bath founds RepRap, an open-source initiative to build a 3D printer that can print most of its own components. The vision of this project is to democratize manufacturing by cheaply distributing RepRap units to individuals everywhere, enabling them to create everyday products on their own.

CREDIT. INFOGRAPHIC: http://individual.troweprice.com/public/Retail/Planning-&-Research/Connections/3D-Printing/Infographic

2000s

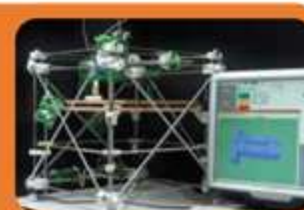
'06 SLS LEADS TO MASS CUSTOMIZATION IN MANUFACTURING

The first SLS (selective laser sintering) machine becomes viable. This type of machine uses a laser to fuse materials into 3D products. This breakthrough opens the door to mass customization and on-demand manufacturing of industrial parts, and later, prostheses.

That same year Objet, a 3D printing systems and materials provider, creates a machine capable of printing in multiple materials, including elastomers and polymers. The machine permits a single part to be made with a variety of densities and material properties.

'08 THE FIRST SELF-REPLICATING PRINTER

Following its launch in 2005, RepRap Project releases Darwin, the first self-replicating printer that is able to print the majority of its own components, allowing users who already have one to make more printers for their friends.



'08 DIY CO-CREATION SERVICE LAUNCHES

Shapeways launches a private beta for a new co-creation service and community allowing artists, architects and designers to make their 3D designs as physical objects inexpensively.

'08 MAJOR BREAKTHROUGH FOR PROSTHETICS

The first person walks on a 3D-printed prosthetic leg, with all parts — knee, foot, socket, etc. — printed in the same complex structure without any assembly. The development guides the creation of Bespoke Innovations, a manufacturer of prosthetic devices which makes customized coverings that surround prosthetic legs.

http://individual.troweprice.com/public/Retail/Planning-&-Research/Connections/3D-Printing/Infographic

2010s

'11 WORLD'S FIRST 3D-PRINTED ROBOTIC AIRCRAFT

Engineers at the University of Southampton design and fly the world's first 3D-printed aircraft. This unmanned aircraft is built in seven days for a budget of £5,000. 3D printing allows the plane to be built with elliptical wings, a normally expensive feature that helps improve aerodynamic efficiency and minimizes induced drag.

'11 WORLD'S FIRST 3D-PRINTED CAR

Kor Ecologic unveils Urbee, a sleek, environmentally friendly prototype car with a complete 3D-printed body at the TEDxWinnipeg conference in Canada. Designed to be fuel-efficient and inexpensive, Urbee gets 200 mpg highway and 100 mpg city. It is estimated to retail for $10,000 to $50,000 if it becomes commercially viable.

'11 3D PRINTING IN GOLD AND SILVER

i.materialise becomes the first 3D printing service worldwide to offer 14K gold and sterling silver as materials — potentially opening a new and less expensive manufacturing option for jewelry designers.

'12 3D-PRINTED PROSTHETIC JAW IS IMPLANTED

Doctors and engineers in the Netherlands use a 3D printer made by LayerWise to print a customized three-dimensional prosthetic lower jaw, which is subsequently implanted into an 83-year old woman suffering from a chronic bone infection. This technology is currently being explored to promote the growth of new bone tissue.

CREDIT. INFOGRAPHIC: http://individual.troweprice.com/public/Retail/Planning-&-Research/Connections/3D-Printing/Infographic

The cortex cast utilizes the x-ray and 3d scan of a patient and generates a 3d model in relation to the point of fracture. The cast is lightweight and shower friendly providing the patient with more freedom and convenience. "At the moment, 3D printing of the cast takes around three hours whereas a plaster cast is three to nine minutes, but requires 24-72 hours to be fully set," says the Cortex System designer Jake Evill.

With the improvement of 3D printing, we could see a big reduction in the time it takes to print in the future.

CREDIT. Dezeen - http://www.dezeen.com/2013/06/28/cortex-3d-printed-cast-for-bone-fractures-jake-evill/

A 3D model of a complex anaplastology case created in collaboration with the anaplastologist Jan De Cubber and the 3D bureau Materialise.

Sourced Sunday Morning Herald www.smh.com.au/digital-life/

CREDIT. Sunday Morning Herald www.smh.com.au/digital-life/ /

3D bio-printers to print skin, cartilage, bone, and other body parts. Bioprinting cartilage has been tried "fairly successfully" in animal models, and printing cartilage cells directly into the meniscus of an injured knee to reconstruct it is successful.

CREDIT. http://www.zeitnews.org/node/974

Fripp Design and Research, are developing 3D-printed ears and noses for patients with facial disfigurements, the company has collaborated with Manchester Metropolitan University to develop ocular prosthetics that are 3D-printed in batches

http://www.frippdesign.co.uk/

3D-printed eyes. A handmade eye can cost up to $10,000, but a 3D printed one will only cost around $160.
The parts are printed in full colour in starch powder using a Z Corp Z510 colour 3D printer.
The lightweight model is then vacuum-infiltrated with medical grade silicone, binding it together.

Sourced: Dezeen.com - Collaboration between Fripp Design and Research Manchester Metropolitan University.

The 3D printed eyewear feature one-piece frames of printed polyamide with flexible joints instead of hinges.

"It's the first pair of glasses that I know about that is one component," says Arad. "It's monolithic."

(Dezeen, April 2013)

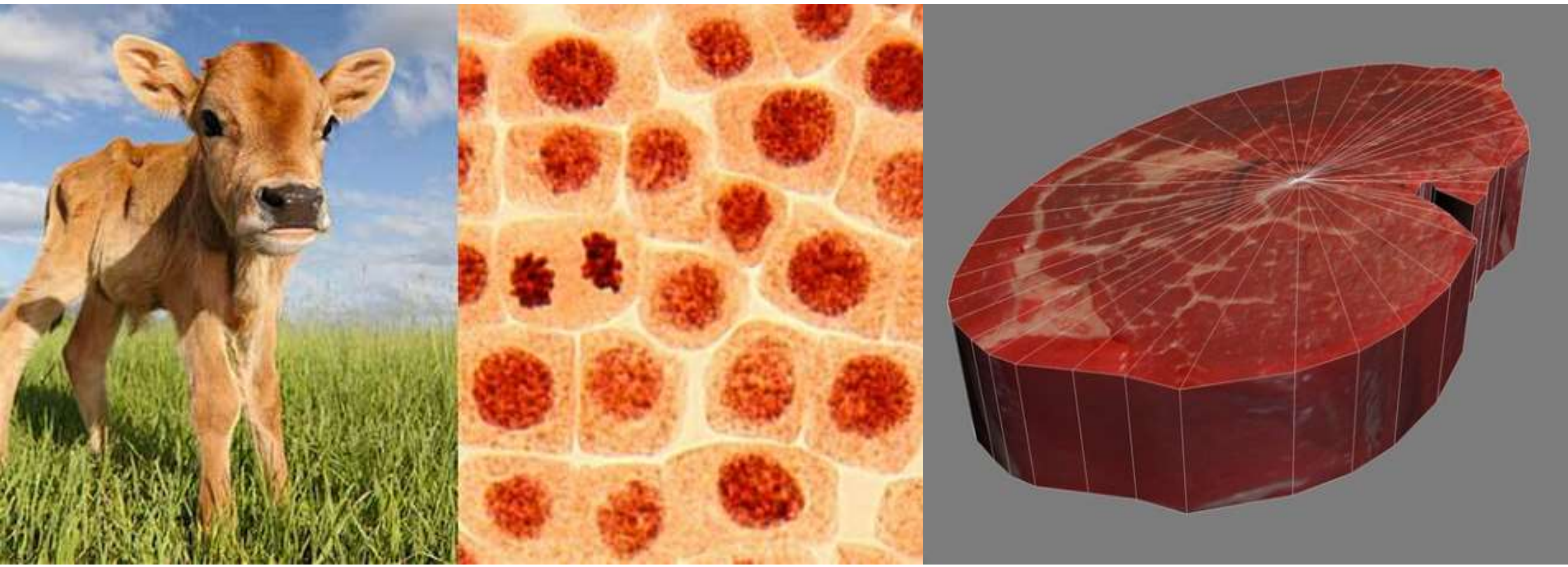
Sourced: Dezeen.com

“At the moment, the technologies that we use are very, very crude. So they solidify matter, either by powder or by liquid or extruded filaments and so-forth.”
Janne Kyttanen Co Founder of Freedom of Creation (Dezeen, March 2013)

"What if, instead of starting with a complex, sentient animal, we started with what the tissues are made of, the basic unit of life, the cell?" Andras Forgacs, CEO of Modern Meadow.

Biofabrication, signals the rise of a new industry that is both sustainable and humane and could radically change a society and environment shaped by the consumption of animals.

Modern Meadow is combining regenerative medicine with 3D printing to imagine an economic and compassionate solution to a global problem.



CREDIT. http://www.geekosystem.com/3d-printed-meat-modern-meadow/

Foodini machine 3D Printer uses the recipe and raw food "inks" that are fed into the printer to create pizzas.

CREDIT. http://www.businessinsider.com/foodini-3d-printed-pizza-2014-1/

The chocolate Ford mustang ponycars were made in a limited quantity for a one-time-only Valentine's Day celebration by 3D Systems Sugar Lab.

CREDIT. http://www.3ders.org/articles/20140214-ford-3d-printing-2015-mustangs-in-chocolate-for-valentines-day.html /

Like other plastic-based 3D printers, it works by extruding melted material layer-by-layer. The plastic then hardens and fuses together into a solid structure. The KamerMaker puts out more material at once than a standard desktop 3D printer, and can build large objects faster. It’s still a slow process though. It's printing and it's working, but it's not yet working perfectly, it's not fast enough,” who hopes the project will inspire new ideas about architecture and housing construction.

- **Universe Architecture — Architect Janjaap Ruijssenaars —building the world's first 3D-printed house in Amsterdam**
http://www.dw.de/dutch-architects-say-3d-print-technology-could-solve-the-worlds-housing-problems/a-17036716

Foster + Partners and the European Space Agency (ESA)

http://www.dexigner.com/news/image/23232/3D_Printed_Structures_on_the_Moon_03 from £60

Instore 3D Printing

3D SCANNING • 3D PRINTING • 3D YOU

3D Systems

Manchester United FC AND 3D Systems personalised 3DMe service

http://www.prsnlz.me/

3D scan and printing figurine versions 'selfies'of people and animals.
Petfig is Japanese brand. You send photos of a pet they convert into 3D models via Shapeways 7-9cm (2.7"- 3.5") in height. The cost for 3D process is -25,200 yen, roughly €190/$250.

http://www.dailymail.co.uk/news/article-2391216/Captured-Dimensions-Texas-offers-ultimate-3d-printing-service-creates-lifelike-photo-replicas.html and http://www.3ders.org/articles/20130527-petfig-transforms-photo-of-your-pet-into-3d-sculptures.html

3D PRINTING: MACHINES & MATERIALS

What exactly is 3D printing ?

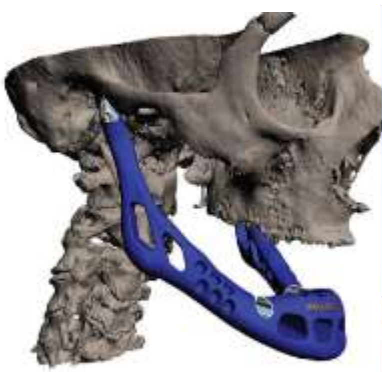
3D Printing is a newer generic term for Rapid Prototyping or Additive Manufacturing use to describe the process of additive manufacturing or prototyping.

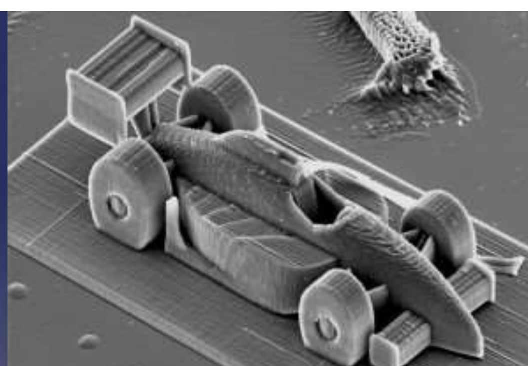
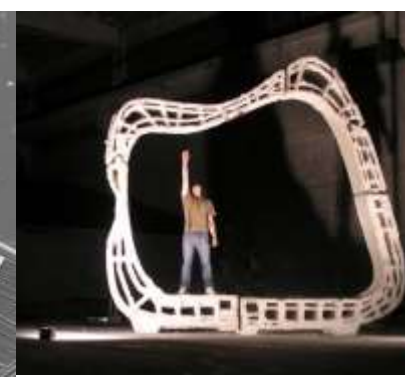
This is a process where layers are deposited on top of one another to a build a three dimensional form.

The technology is currently used for both prototyping and direct manufacturing in:

Jewellery, footwear, industrial design, architecture, engineering, automotive, aerospace, dental and medical industries, education, geographic information systems, military armour and many other industries.

Currently technology is being used / researched to built titanium aircraft parts, human bones, complex, nano-scale machines.




How 3D print works ?

3D Printing methods can be categorised into 4 sub groups

STEREOLITHOGRAPHY :

This is the oldest and the earliest 3D process invented by Chuck Hull in 1986. Uses Liquid Resin, which hardens when it meets ultraviolet light. Objects are printed layer by layer in a tank of liquid using an ultraviolet laser, which traces a cross section of the object onto the surface of the liquid, solidifying it where it hits. Then a platform supporting the solid layer descends and the next layer is printed on top.

FUSED - DEPOSITION MODELLING:

Originating in 1988. FDM is the simplest and most affordable 3D technology available. It uses a plastic filament fed into a nozzle, which melts it into a semi-liquid for extrusion. Objects are built in layers on a descending platform. With the possibility of colour and different materials combined in the same object. Generally most low Cost personal home 3d printers use this principle.

LASER SINTERING:

Started in 1992. High power laser melts and fuses together plastic, metal or ceramic powder . Each new layer is applied while lowering the platform to build the part and this process repeats. The machines are often more expensive although can produce higher quality surfaces, more accurate tolerances and larger size models than FDM machines.

.

OTHER PROCESSES:

Laminated LOM, Light polymerised, Electron beam metal, etc.

3D Printers:

Categorised into Personal Professional Production.

Personal

With a build size of up to 6 x 6 x 6 inches (152 x 152 x 152 mm, ABS (Acrylonitrile Butadiene Styrene) PLA , (Cost from £200 to £3000)

Professional

ProJet® 3510 CP

Objet 500

Price Range: £3K - £80K

Production

Renishaw's and EOS additive manufacturing machines
Price Range > £80k and more

Wide range of 3D printer types and manufacturers available. The models shown are selected for demonstrating the categories only.

For further information: 2013: Trends, myths, and investments in additive manufacturing, by Terry Wohlers

3D PRINT MATERIALS

PERSONAL 3D PRINTERS -

PLA - Bio degradable plant Based (corn, Soybeans etc.)
Less Common, hard, brittle.

ABS - Petroleum Based commonly used, plastic smell.
Hard tough but flexible.

MID RANGE

ABS,PLA, Powder, Various polymer based, ceramics,

SELECTIVE LASER SINTERING

Specifically developed powder materials including plastic, metal, ceramic, titanium & others.

Print bureaus now offer a service for plastics and metal including:

Polyamide	:A strong and flexible material with a high level of detail
Alumide	:A polyamide-like material with a distinctive look
Multicolor	:A full color plaster
High detail resin	: Lovely fine details on this photopolymer
Paintable resin	: Beautiful when painted. Water resistant. If it has to be flawless
Transparent resin	: See through
ABS	: Strong and tough with the highest level of dimensional accuracy
Titanium	: Light and the strongest 3D printing material in the world
Silver	: Sterling silver
Gold	: 14 carat solid gold
Prime gray	:Very smooth, detailed and "luxurious" to the touch
Brass	: Copper and Zinc, united as one
Bronze	
Ceramics	:A food safe material that shines like no other
Stainless steel	: High grade stainless steel with a superb level of detail
Multi Material	: Single part contains more than one material
Rubber like	: Soft and Flexible properties

APPLICATION OF SELECTIVE LASER SINTERING IN ADA

Plastic Additive Manufacturing (AM) - also referred to as 3D Printing - produces parts suitable for both prototyping and production applications using Selective Laser Sintering. The process generates accurate models and one-off prototype parts for design approval, trial and testing purposes, through to production components to be used in true working environments.

Metal 3D Printing :

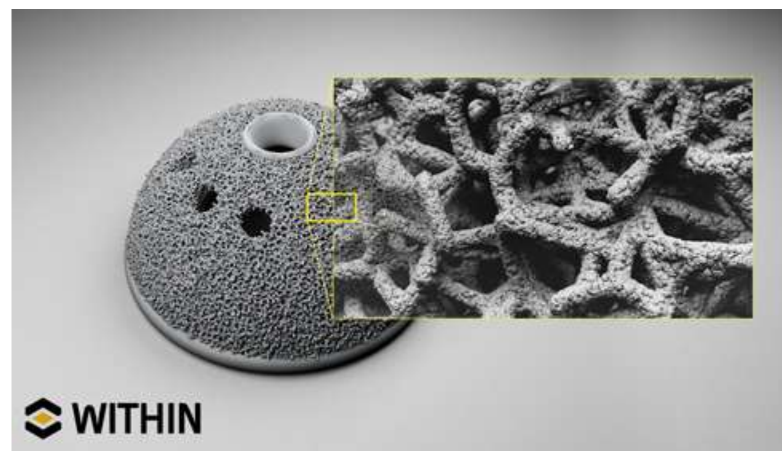
- **Direct Metal Laser Sintering (DMLS)**
- **Electron Beam Melting (EBM)**

DMLS from EOS of Germany - cost over £ 500k
EBM from ARCAM of Sweden - cost over £750k

Materials include: Cobalt Chromium, Titanium, Aluminium and Bronze Alloys

Variation of Laser Sintering (AM) - also referred to as 3D Printing - produces parts suitable for both prototyping and production applications using Selective Laser Sintering. The process generates accurate models and one-off prototype parts for design approval, trial and testing purposes, through to production components to be used in true working environments.

Heel are made from titanium (Design and source: Kerrie Luft)



Acetabular cup with lattice structures for improved osseointegration. (Source: Within)

The Black Art of Post Processing:

- **Layers based printing requires finishing the model with a range of different processes:**

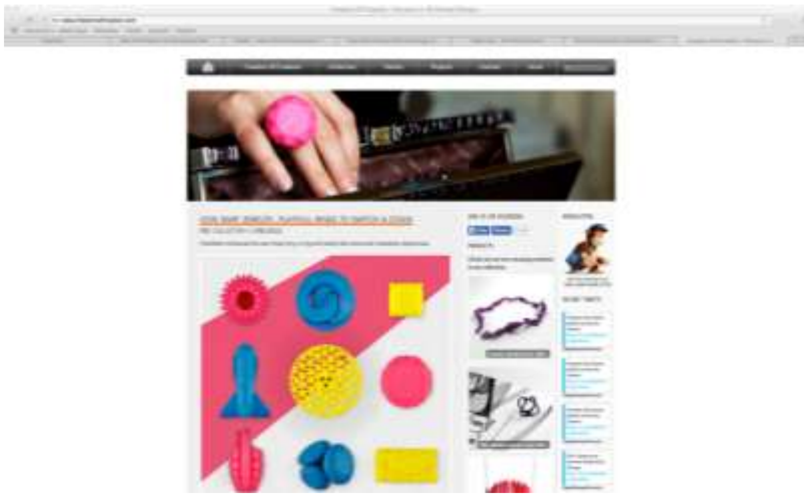
- Powder based 3D printers such as Zorp require cleaning the powder, brushing/ blowing, then gluing by hand or in bath and hardening the surface after the printing process as well as remaining powder may require recycle.

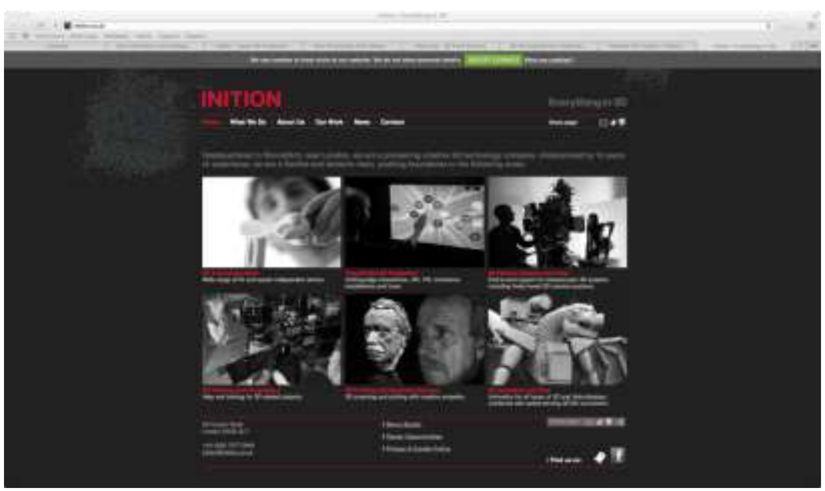
- Fused Deposited Modelling machines such as Stratasys or low cost desktop 3D printers require removal of support materials manually and keeping the printed parts in the liquid solution until the support parts dissolves.

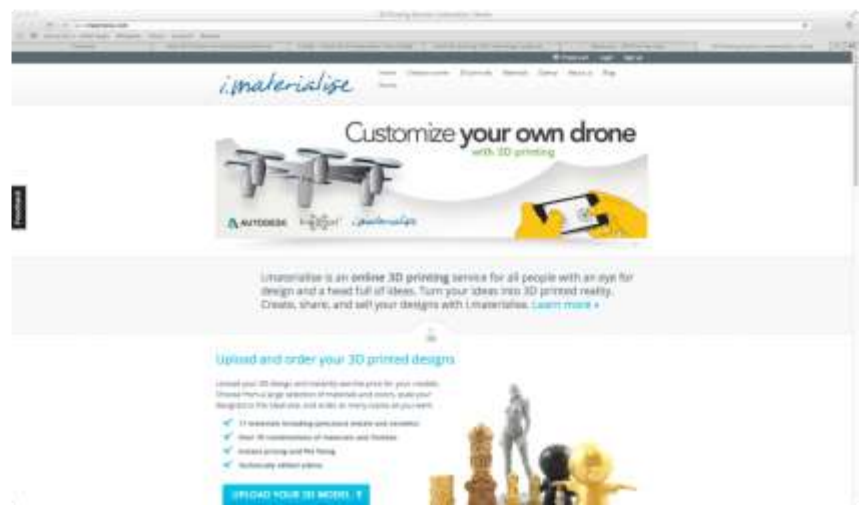
- Laser sintering is also similar to Powder based printing, generally requires washing the parts for post processing.

All 3D printing requires post processing:
intensive finishing , including blowing, brushing, dissolving, surface painting, sealing, glueing and drying.

3D PRINTING:
BUREAUS AND HOW TO PRINT YOUR OWN

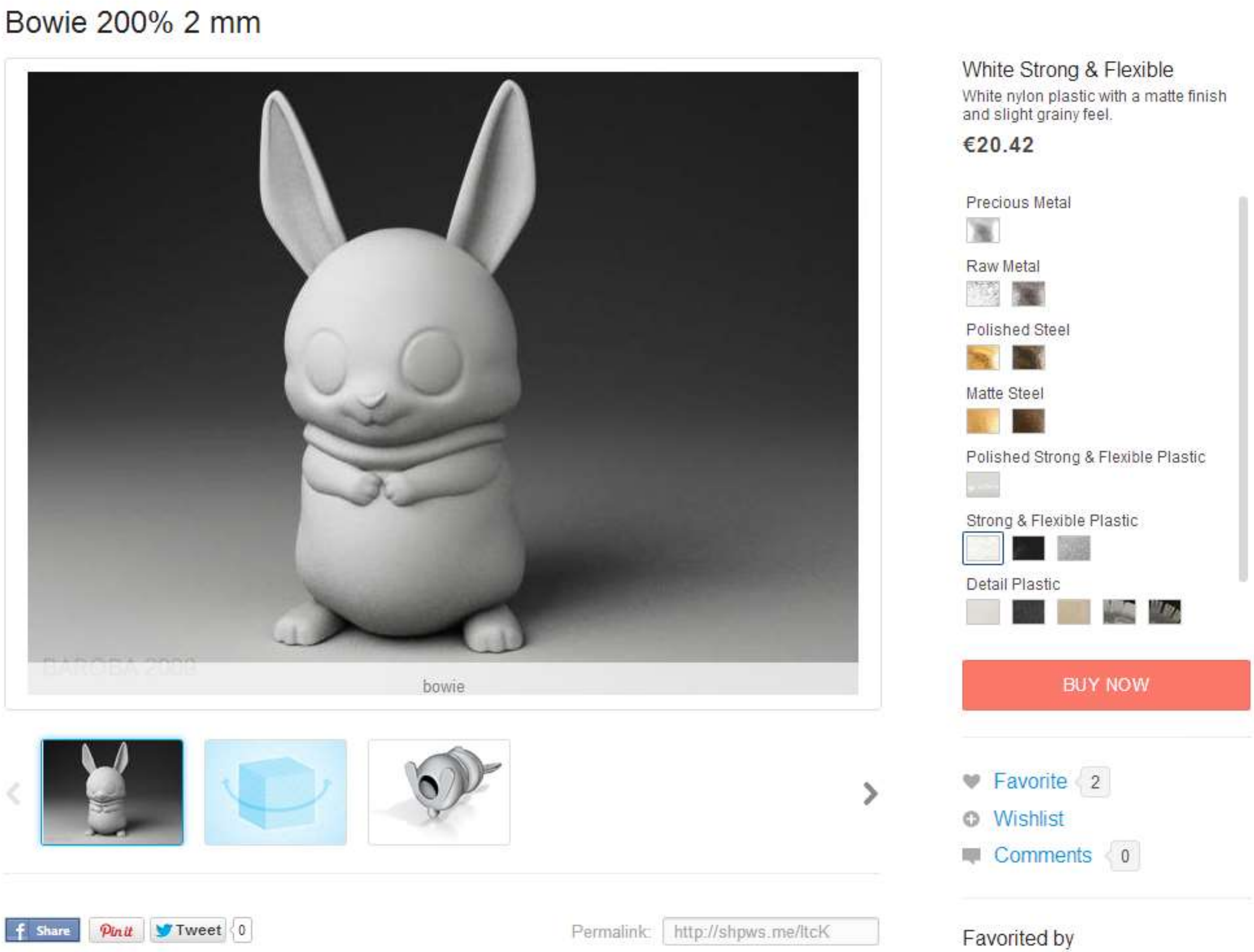




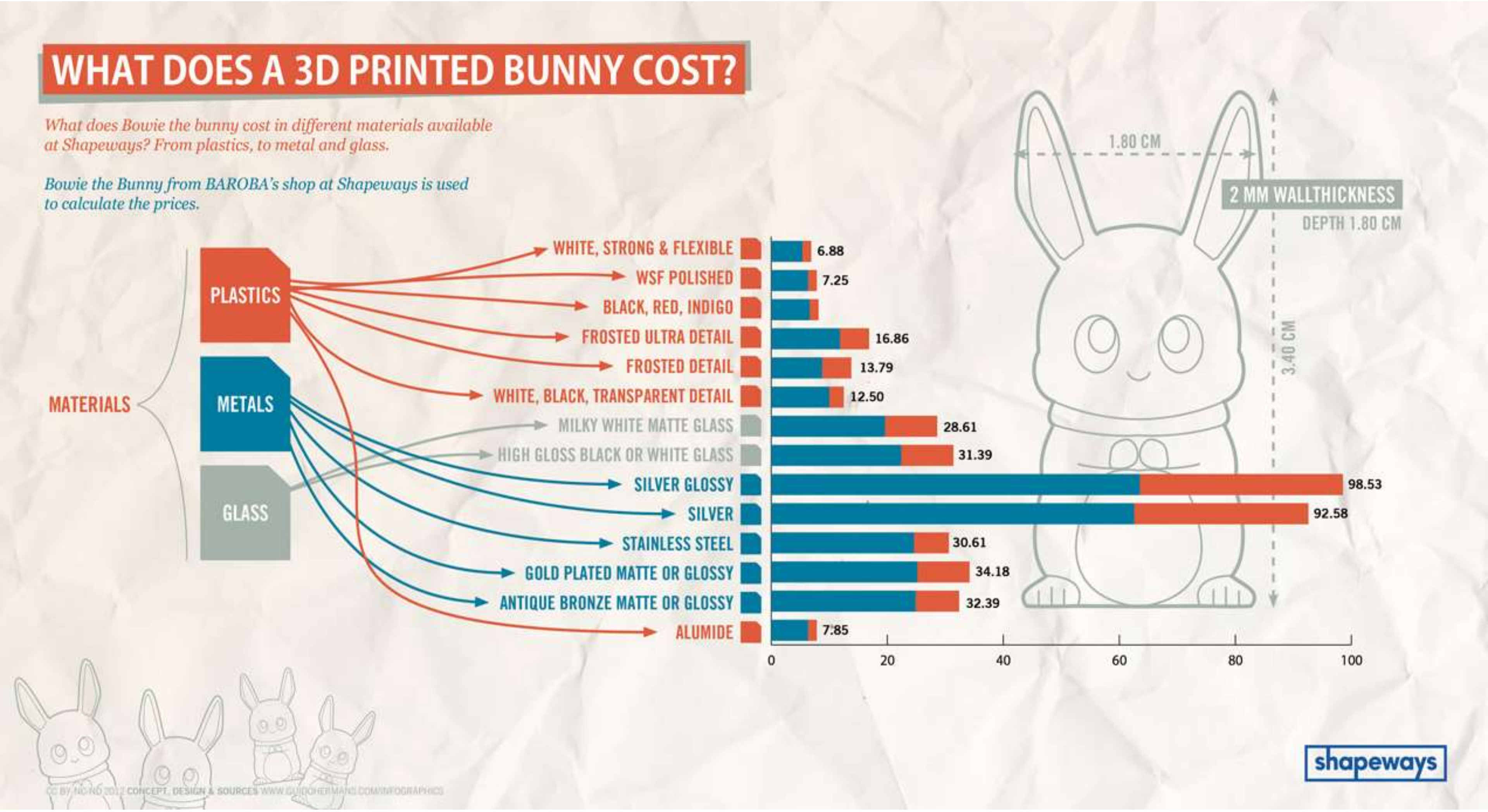


Please note: there are many other 3D printing companies available worldwide we have selected only a few for the talk.

http://www.shapeways.com/



Bowie the Bunny designed by Baroba. Shapeways.com



Bowie the Bunny designed by Baroba. Shapeways.com

3D PRINT R&D:
SCHOOL OF ART, DESIGN & ARCHITECTURE

3D PRINT R&D:
SCHOOL OF ART, DESIGN & ARCHITECTURE (ADA)
3D PRINTERS IN ADA 3D DESIGN DEVELOPMENT CENTRE

ZCorp 650
ZBuilder Ultra
Stratasys Fortus FDM 360

Zcorp 650 Details: http://www.zcorp.com/en/Products/3D-Printers/spage.aspx

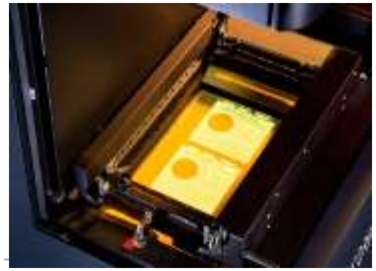
Z Corporation now part of 3D Systems Corporation produce multi-color inkjet 3D printing machines.

Zcorp 650 use the technology similar to inkject printing where parts are produce layer by layer using varous types of powder and binder.

Fast printing, low cost material and initial investment, good for educational use,

But issues include : Surface finishing quality, post processing requirements using glue after the parts are manufactured

ZBuilder Ultra :



How it Works
Similar to SLA systems
High-resolution DLP system instead of complex laser technology
Exposed photopolymer solidifies into robust solid plastic

STRATASYS - FDM in ADA

PolyJet™

High-Performance Resins

High Feature Detail & Finish

Scalable Technology

Multi-Material Printing

FDM®

Production-Grade Thermoplastics

Highly Durable Parts

Office Friendly

Functional Parts

SolidScape®

Wax material

Castability

Concept Modeling	Fit, Form Prototyping	Functional Prototyping	Direct Digital Manufacturing

3D Printers at University of Huddersfield:
3M Business Innovation Centre

3M Business Innovation Centre has
EOS FORMIGA P 110
Laser Sintering Machine cost around £200k,
Similar Machines for metal sintering cost over £500k

A wide range of materials are available:
(PA 2200, PA 2201, PA 3200 GF, PrimeCast 101 & PA 2105)

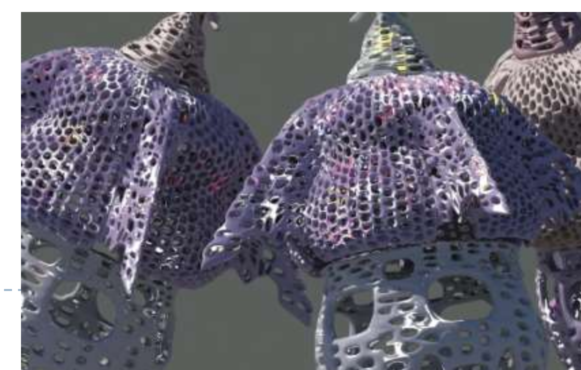
Design for low-dust, ergonomic work conditions
Layer thickness (depending on material): 0.06 mm, 0.1 mm, 0.12 mm
Effective building volume: 200 mm x 250 mm x 330 mm
Building speed (depending on material): up to 20 mm/h
Laser type : CO_2, 30 W
Power consumption : 2 kW

Requires Compressed air supply and integrated Nitrogen generator

BIC offering free 1 day 3D printing and modelling services for local businesses through 2014 !
Contact Susan Lipthorpe at 3D BIC

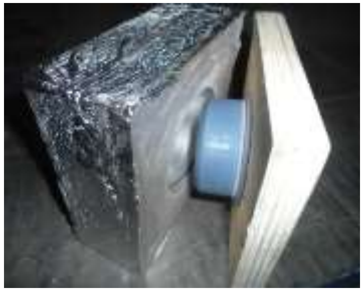
3D PRINTING @ SCHOOL OF ART, DESIGN AND ARCHITECTURE:

Students and research project from 2003 onwards. Including the **Future Factories** Project in 2003, at ADA, University of Huddersfield where to research the direct digital manufacture of randomly generated and consumer controlled 3D models. This led to the "Automake Project" in collaboration with Sheffield Hallam and Falmouth Universities. Product/Transport students at Huddersfield used 3D printing for design realisation.



3D PRINTING @ SCHOOL OF ART, DESIGN AND ARCHITECTURE:

Using 3D printed patterns for creating tool using Low Melting Alloy :
Bismuth for Injection moulding / Sheet metal forming composites with RP




Application of 3D printing technology for Archaeological and Architectural visualisation and reproduction.
Neville Tomb and Stonehenge Projects use 3D scan data and 3D printing.




Research into developing carbon fibre automotive parts using 3D printed transfer moulds to produce high quality internal and external finishes.

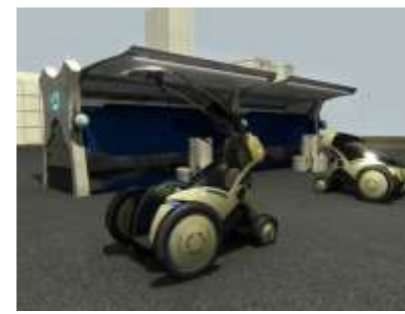



3D software for Concept modelling in ADA:

3D Solid: Solidworks, Catia, Unigraphics, Autodesk Inventor, Pro Engineer or similar.
Surface modleling: NURBs: stitching required, including Alias Design Studio, Rhino.
Surface modelling: Polygon, Mesh : Low tolerances, easy to model: includes, 3D Studio max, Maya, Zbrush, Mudbox.

Other 3D software: Autodesk products including Revit Architecture, Google Sketchup, Blender, and many others can be used.






3D PRINTING:
R&D IN TEXTILES DESIGN + MANUFACTURING

Cosyflex™ is an innovative process for 3D Printing for Fabrics

Our innovations in equipment components, the production process and fabric characteristics are protected by patents.

Advantages of the technology include:

- Industrial scale mass production, 3D Fabric Printing
- A fully automated process
- Instant creation of finished products from raw materials
- Mass production or on-demand production catering to immediate local needs
- No cutting no waste.

Cosyflex: An innovative process for 3D Printing for Fabrics

- Cosyflex™ is an innovative process for 3D Printing for Fabrics, utilizing:
-
- Instant creation of finished products from raw materials with no cutting and no waste.
-
- Manufacturing with multiple stage 3D printing processes and with many controllable variables allowing unlimited fabric variations.
-
- Various types of liquid polymers such as natural latex, silicon, polyurethane and teflon, as well as variety of textile fibres such as cotton, viscose and polyamide enable tailor-made fabrics for any need.
-
- Patterns, perforations, embossing and decorations may be created by printing on a 3D structured base plate

Udi and Tamar Giloh of *TamiCare* and their manufacture process of the Cosyflex product

 http://www.thejc.com/news/uk-news/114142/knickers-are-downloaded-couple-produce-underwear-3d-printer December, 2013

Cosyflex compression wearable garment, made by additive technology to create fabrics

Black Drape Dress by Jiri Evenhuis and Janne Kyttanen, Freedom of Creation FOC. 3D printed in 2000 using the SLS process in polyamide.

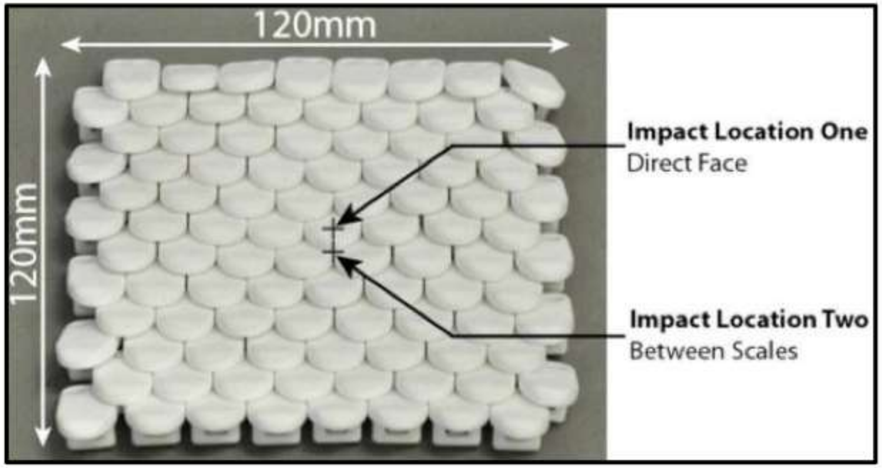
Designer **Jiri Evenhuis**, in collaboration with Janne Kyttanen of Freedom of Creation, utilising 3D printers to create textiles. Evenhuis makes the claim that;

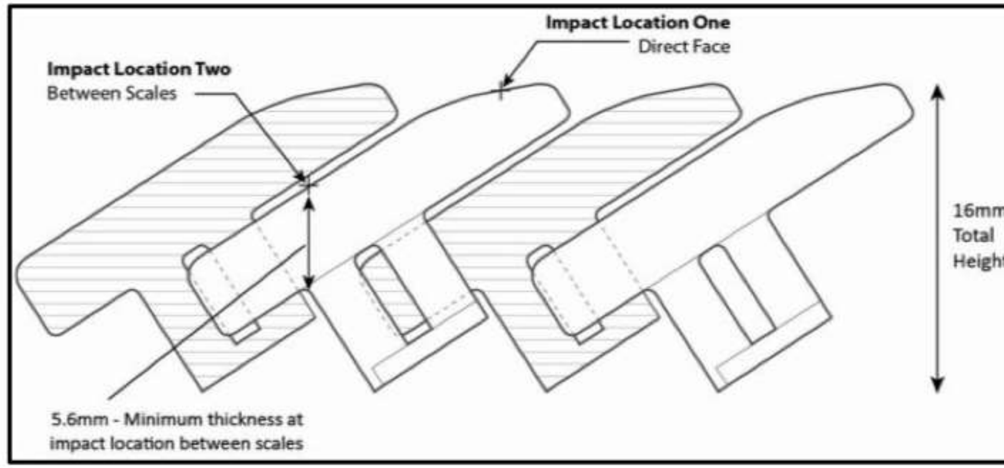
"Instead of producing textiles by the meter, then cutting and sewing them into final products, this concept has the ability to make needle and thread obsolete."

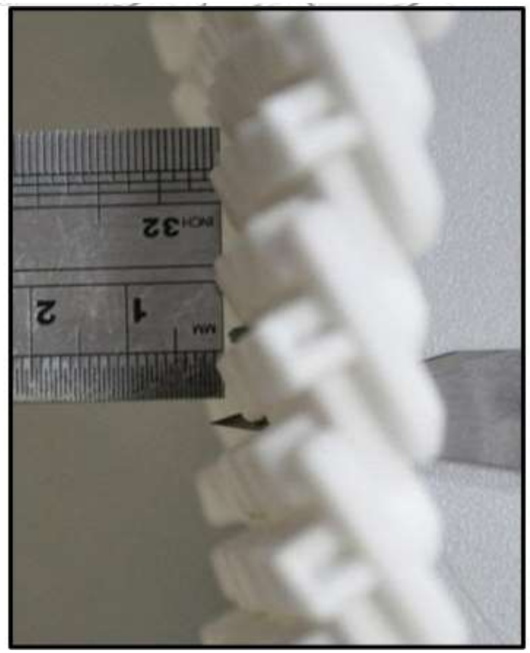
Making interlocking structures with 3D printing:

3D printing has the "ability to make needle and thread obsolete," says designer Jiri Evenhuis.

FREEDOM OF CREATION 3D Glove by JIRI EVENHUIS and WITHIN & PHILLIP DELAMORE at LONDON COLLEGE OF FASHION



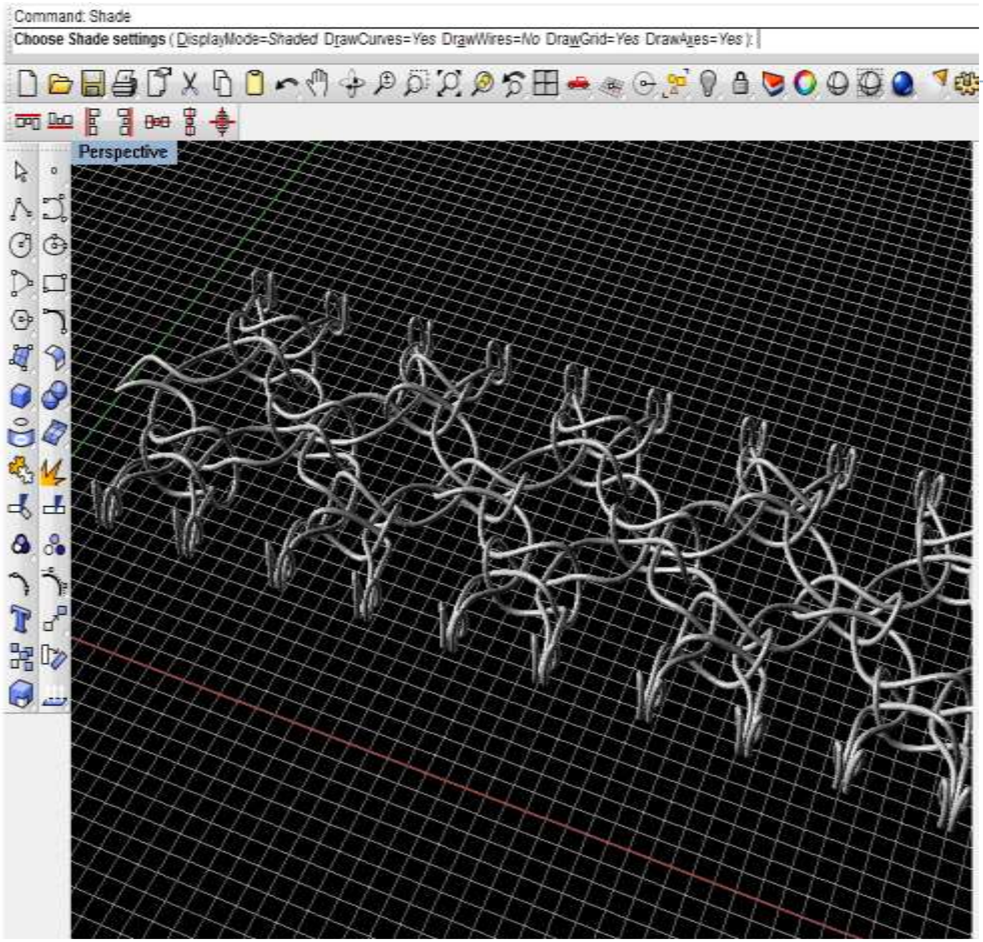


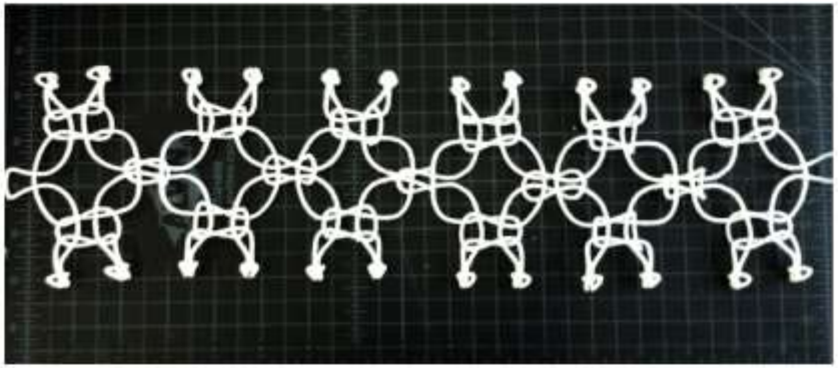


Establishing the performance requirements for stab resistant Additive Manufactured Body Armour (AMBA)

A.Johnson*, G.A. Bingham*, and C. E. Majewski† Loughborough Design School, Loughborough University, Loughborough, UK, LE11 3TU †Advanced Additive Manufacturing group (AdAM), Department of Mechanical Engineering, University of Sheffield, Sheffield, UK, S1 3JD

3D PRINTED WEAVE

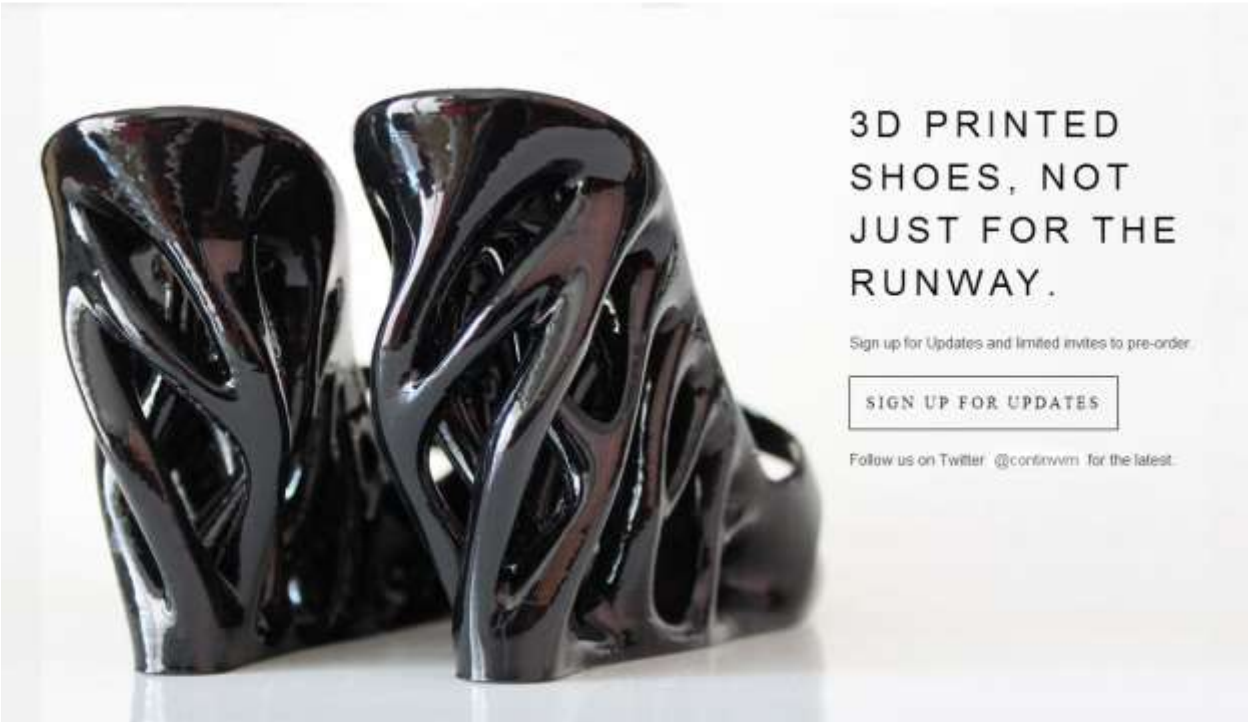




Sourced @ newtextiles.media.mit.edu *by henryskupniewicz*

DIGITALLY MANUFACTURED

"CONTINUUM" represents the continuity of inspiration, to design, manufacturing, and distribution .



www.continuumfashion.com

[Video 2min : http://youtu.be/ekMNtTmqjzE](http://youtu.be/ekMNtTmqjzE)

What is Makies? A create-your-own 10" high action doll, complete with poseability, cute clothes, and removeable/changeable eyes & hair.

The team will 3d-print your doll, dress it up - clothes and accessories are added according to your choices. The doll is then sent to you in the mail. "What does a MAKIE feel like? Like unglazed porcelain, sort of." There are first 100 Alpha Edition MAKIES up for early adopters, each 3D printed MAKIE will cost you £99 inc VAT.

Makie claims 3D customization creates a stronger bond between the object and the child

http://makie.me/

3D PRINTING FASHION

Designed by Michael Schmidt and 3D modeled by architect Francis Bitonti to be 3D printed in Nylon by Shapeways

http://www.shapeways.com/

Following previous 3D design the "Verlan" dress, is the spiritual sister of an earlier Bitonti creation that burlesque star Dita von Teese modeled in March 2013.

The "Dita" dress consisted of 2,633 independent links, each of which had to be manually assembled, the Verlan required only 59.

The body of the dress is derived almost entirely from MakerBot's Flexible Filament, with some traditional MakerBot PLA Filament to buttress its chest and shoulders.

Bitonti printed the dress using two MakerBot Replicator 2 Desktop 3D Printers, which ran for close to 24 hours a day for two weeks.

Sourced: http://www.3ders.org/articles/20130906-verlan-3d-printed-dress-built-with-replicator-2-and-new-makerbot-flexible-filament.html

IRIS VAN HERPEN

Credit : http://www.irisvanherpen.com/

Conclusion

Hype or Reality?

Modelling Process: Learning 3D modelling, 3D Scanning- editing the scan data, time consuming process. Downloading 3D models very easy from bureaus but creating and modifying correctly is not easy.

People's unrealistic expectations: Due to hype public see high quality 3D printed finished parts, shoes, etc made with expensive high-end printer, People then assume that they can create objects with a machine cost £500 or less and without any training.

Surface finish: The models are usually a matt finish with rough layer lines. 'smooth' surface finish requires post-processing generally involves labour and/or chemicals, resulting loses of detail and tolerance on parts.

Strength: 3D printed parts are not as strong as traditionally-manufactured parts. In injection moulding, provides a even strength across the part, as the material is of a relatively consistent material structure.

Speed: Printing process takes hours to print, even days. The speed can be increased by making the layers thicker, resulting in poorer surface finish quality.

Cost: Cost of parts is based on material used, so big objects are expensive. The raw materials used in 3D print is also *much* more expensive than material used traditional manufacture, prices range from £20 to £300 per kg,

Conclusion

The current reality of 3D Printing:

- Increase innovation, Improve communication by creating parts quickly.
- Enables customisations & personalised items, digital object storage.
- Faster design cycle with greater accuracy.
- Rapid Prototyping helps to identify design errors earlier and cuts traditional prototyping and tooling costs.
- Enables low volume manufacturing, local manufacturing.
- Enables the production of parts impossible to manufacture with other methods.
- Shape optimisation for weight, strength resulting in reduced material and energy usage.
- Open source files, available to anyone to print, access.
- Enable customer to interact with the design and manufacturing process.
- May help to improve creativity in democratising 3D design innovation to masses

Questions and Answers

Professionals and academics at the University of Huddersfield have a wealth of expertise and experience providing external businesses with tailored consultancy services. We are committed to building professional, valuable, and lasting partnerships with companies.

Researchers and academics in the University of Huddersfield offer independent advice and we are happy to discuss your projects not only 3D printing and technology but also exploring and developing the potential of your ideas.

References:

http://www.eos.info/en
http://www.3dsystems.com/
http://www.stratasys.com/
http://www.zcorp.com/en/home.aspx
http://en.wikipedia.org/wiki/3D_printing

Useful Selected videos:

3D Printshow London 2012: https://www.youtube.com/watch?v=S-E6vRfnijw
Artist: Leaders Of The 3D Printing Revolution : Shapeways online 3D
https://www.youtube.com/watch?v=IS4Xw8f9LCc
How 3D Metal Printing May Change Manufacturing:
https://www.youtube.com/watch?v=zT63OOLADU8
Future: TED: Skylar Tibbits: The emergence of "4D printing:
https://www.youtube.com/watch?v=0gMCZFHv9v8
BBC: Printing a bicycle with a 3D printer:
https://www.youtube.com/watch?v=hmxjLpu2BvY
Bio Printing: http://www.youtube.com/watch?v=9D749wZSIb0
Functioning tissue printing: http://www.organovo.com/
Electron Beam Freeform Fabrication
http://www.youtube.com/watch?v=oRL4cBbKYb8

Other Useful Links:

How to do online Printing and costing using i-materialise:
http://www.youtube.com/watch?v=FdTmh5j6SPM
Could 3D Printing Change the World? Technologies, Potential, and Implications of Additive Manufacturing:
http://www.acus.org/files/publication_pdfs/403/101711_ACUS_3DPrinting.PDF
Astroid http://www.businessinsider.com/deep-space-industries-asteroid-mining-plans-2013-1
http://www.rapidtoday.com/design.html
http://www.3dprintingnews.co.uk/page/3/

CAD Packages:

Alias Design Studio: http://www.autodesk.com/products/autodesk-alias-products/overview
CATIA: http://www.3ds.com/products/catia/welcome/
Solidworks : http://www.solidworks.co.uk/
Pro Engineer: http://www.ptc.com/
Rhino: http://www.rhino3d.com/nurbs/
ICEM http://www.3ds.com/products/catia/portfolio/icem-surf/icem-surf-overview/
MODO: http://www.luxology.com/modo/
NX : ttp://www.plm.automation.siemens.com/en_gb/products/nx/for-design/index.shtml

3D Printed items for sale / 3D services:

http://makie.me/
http://www.thingiverse.com/
http://www.kraftwurx.com/
http://www.sculpteo.com/en/
http://www.shapeways.com/
http://www.freedomofcreation.com/
http://www.makeeyewear.com/about-our-eyewear/
http://i.materialise.com/
https://www.ponoko.com/
http://www.quickforge.co.uk/
http://www.3trpd.co.uk/
http://www.futurefactories.com/
http://www.automake.co.uk/

Books:

Rapid Prototyping: Principles and Applications by Rafiq I. Noorani (8 Nov 2005)

Stereolithography & Other RP&M Technologies: From Rapid Prototyping to Rapid Tooling (Hardcover) By: **Paul F. Jacobs (Author)**

Articles:

Kus, Abdil, Unver, Ertu, Jagger, Brian and Durgun, Ismail (2013) *A Study of Injection Moulding with Bismuth Alloy.* In: Green Design, Materials and Manufacturing Processes. Taylor & Francis. ISBN 978-1-138-00046-9 (In Press)

Unver, Ertu, Swann, David, Bailey, Rowan, Govindarajan, Iniyanrajan and Dollan, Fiona (2013) *The Art of 3D Sculpted Printing : Royal Coat of Arms Case Study.*

Unver, Ertu (2013) *Can 3D Printing change your business?* In: CKMA Calderdale and Kirklees Manufacturing Alliance Meeting , 11th April 2013, 3M Buckley Centre, Huddersfield.

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Taylor , Andrew, Unver, Ertu, Armstrong , Barry, Ward, Geoff, Agnew, Alison, Hughes-McGrail, Daniel and Argyrou , argyroulla (2013) *3D digital technologies: Sculpting, modelling & construction of patterns for costume & clothing.* In: The First International Symposium for Creative Pattern Cutting, 6th - 7th February 2013, University of Huddersfield.

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Taylor, Andrew and Unver, Ertu (2012) *Biomimetic radiolarian lamp prototypes*

Dean, Lionel Theodore, Unver, Ertu, Campbell, Ian and De Beer, Deon (2012) *Making it real: virtual tools in 3D creative practice.* In: Making: an International Conference on Materiality and Knowledge. Book of Abstracts . NordFo, Nordic Research Network, Notodden, Norway, p. 76

Taylor, Andrew and Unver, Ertu (2012) *Practice based 3D surface design research: Zooplankton Lamp & Particle fluid lamp.* In: Surface Design Show 2012, Februrary 7-9 2012, Business Design Centre, Islington. London

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Kus, Abdil, Unver, Ertu and Taylor, Andrew (2009) *A comparative study of 3D scanning in engineering, product and transport design and fashion design education.* Computer Applications in Engineering Education, 17 (3). pp. 263-271.

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Unver, Ertu (2006) *Strategies for the transition to CAD based 3D design education.* Computer-Aided Design and Applications, 3 (1-4). pp. 323-330. ISSN 1686-4360

Unver, Ertu, Atkinson, Paul and Tancock, Dave (2006) *Applying 3D scanning and modeling in transport design education.* Journal of Computer-Aided Design and Applications, 3 (1-4). pp. 41-48. ISSN 1686-4360