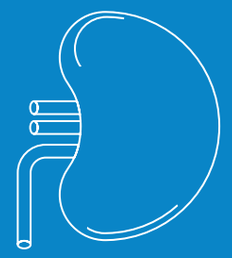
Shape Shifters

3D printing has created a return to the tailor-made, the bespoke and customised, similar to a time before mass production. The way we design, buy and interact with products is set to transform.

Geography and ownership are no longer limitations to making things because the share economy has exploded the way objects are made.

Find out how 3D printing will affect our homes, our health and our appearance.

Australian Design Centre



How will 3D printing effect our health?

How will 3D printing affect our homes?

How will 3D printing effect our appearance?

How will 3D printing effect our health?

Everyday, we witness advancements of 3D technologies in the medical world. From prosthetics to pre-surgical models for the rehearsal of complex procedures, the progress of 3D printing and related technologies is revealing a remarkable future. We can now improve human lives using personalised medical devices printed by a machine.

The benefit of digital technology is once again customisation. Off the shelf components are no longer the only option. We now have new intelligence to scan patient's bones and joints to make an exact fit. Made to measure prostheses decrease pain and recovery time and are much easier on the bank account. This is already dramatically impacting bracing, hip and knee replacements, hearing aids and dental engineering.

Although it might sound like science fiction, advances in medical technology will make it possible to construct human tissue in the future. Even whole organs could eventually be grown in labs, implanted in patients and grown in real bodies. One company, Organovo, is already commercially 3D printing liver tissue for research purposes. Tissue engineering is just one of the exciting new advances researchers have made in the medical 3D printing field. Coined as 'bio-printing', experts predict the market to reach $6 billion by 2024. #savinglives

Right now, 3D printing is dissolving barriers in accessing medical aids. Whilst waiting for the technology to catch up, researchers and surgeons are focusing on short term, quick fixes, such as customised, affordable, easily assembled prosthetics – but this is just the beginning. The real life applications of 3D printing being used to improve our health is almost too hard to imagine.

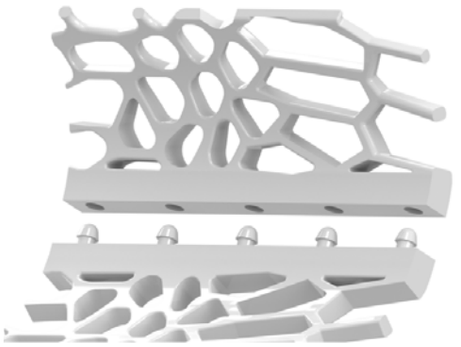
The Cortex
by Jake Evill

Ever break your arm as a kid? Lost a pen or two during the long weeks of having a heavy plaster cast on your leg?

Recent Victoria University of Wellington graduate, Jake Evill, has the solution for you. He has developed a visually stunning and long-overdue alternative to the cumbersome and itchy plaster cast. The Cortex claims to bring fracture support `into the twenty-first century'. The fully ventilated (tick), super lightweight (double tick) cast is washable, hygienic, recyclable and thin enough to fit under a shirt sleeve (tick, tick, tick, tick)!

The exoskeleton cast prototype provides a highly technical and trauma zone localised support system. It uses x-rays of the patient's bone, combined with 3D limb scans and super-smart computer software to determine the optimum bespoke cast shape, with denser support focused around the fracture itself.

No cast is ever the same. Each responds directly to where support is needed most. Evill? Not so much.



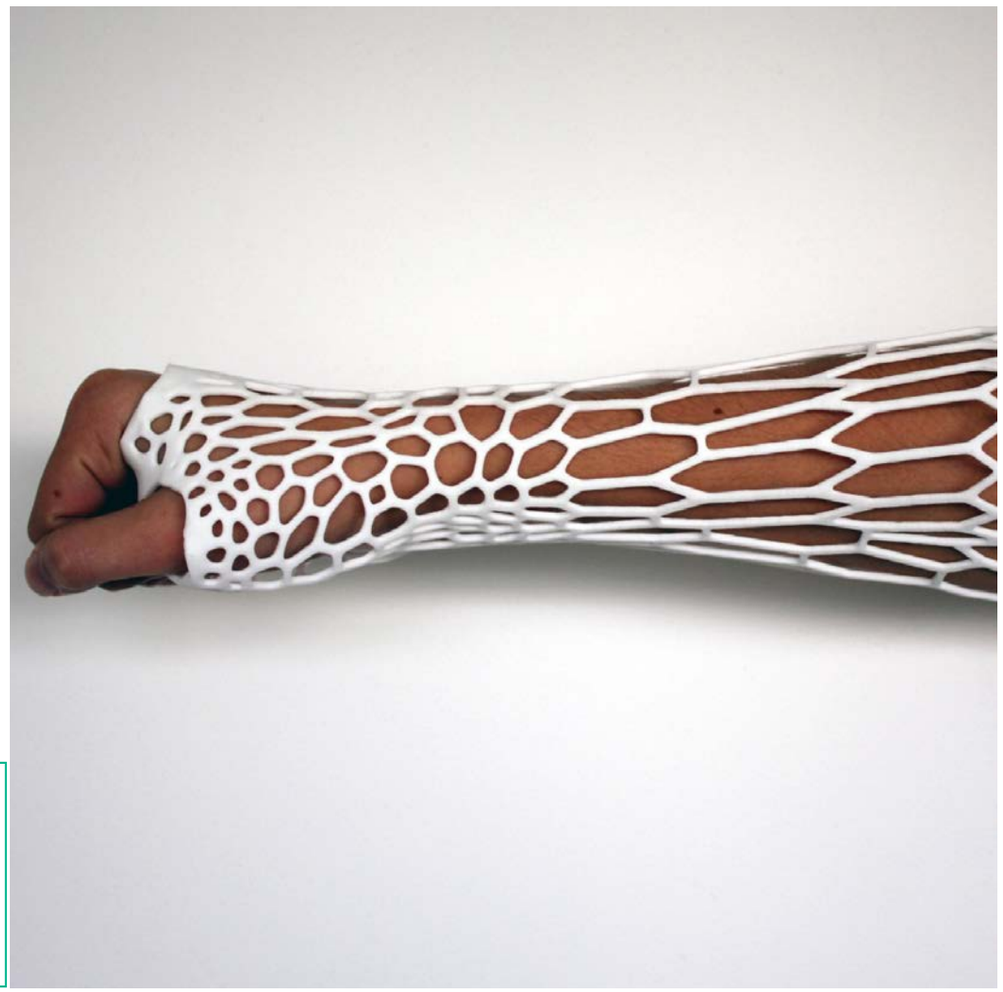


Image credit: Jake Evill, The Cortex, 2013, polyamide, image courtesy of Jake Evill.

Open Bionics
by Joel Gibbard

Joel Gibbard is all of 25 years old. Yet he has just created a 3D printed robotic hand that costs less than $1000. Plus, he won the 2015 James Dyson Award. His prototype project, Open Bionics, could be available on the market this year.

Advanced prosthetics currently cost up to $120,000 and only last three to five years. Long waiting times can delay patients receiving a prosthesis for months. Gibbard's hand can be measured, manufactured and custom-fitted in a single week!

This is achieved through an entirely 3D-printed production process that uses the light-weight and flexible materials of soft robotics in a bio-mimetic way, which more closely replicates the movement of bones, ligaments and skin. Open Bionics is (hands down) going to change lives.

And the best news? Gibbard plans to make the files open source to encourage continued improvements to the design. In his words, "This is about driving a big change and democratising technology".

Watch this space.

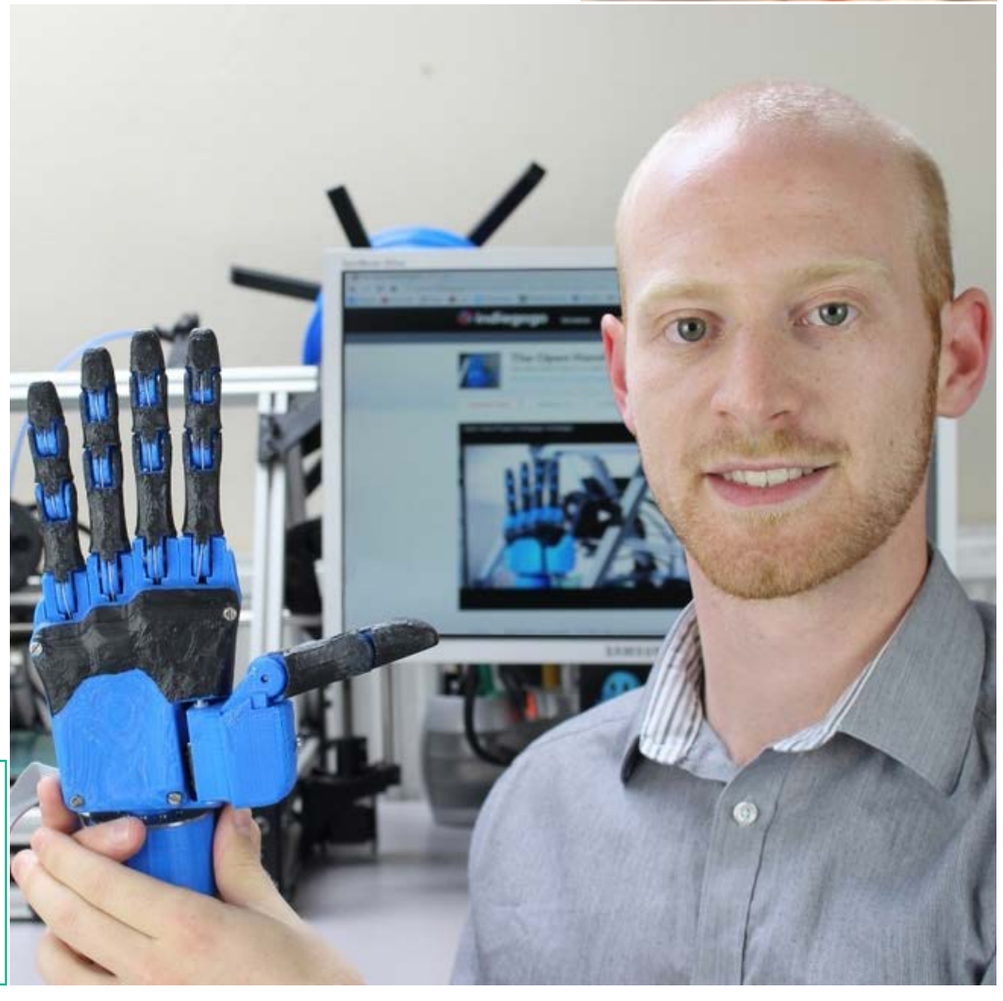


Image credit: Joel Gibbard, Open Bionics, 2014, plastic polymer, image courtesy of Open Bionics

University of Michigan's C. S. Mott Children's Hospital

Condition: Tracheobronchomalacia.
Definition: When part of an infant's airway is too weak to support itself. How to fix it? 3D printing!

In 2012, a medical team at the University of Michigan's C.S Mott Children's Hospital used 3D printing to save the life of a baby boy with this rare condition.

While surviving on a ventilator, the medical team set out to solve the problem. The tissue needed to be repaired or replaced — a dangerous operation in so small a patient. Soon they agreed that a 3D printer was the right tool for this delicate, lifesaving task.

A CT scan was converted into a detailed 3D map of the child's airways before a strong (yet flexible) biocompatible tube was designed and printed. The tube acted as a splint to hold open the airway, expanding as the infant grows and dissolving harmlessly.

Image credit: Trachea Splint, image courtesy of: University of Michigan C. S. Mott Children's Hospital

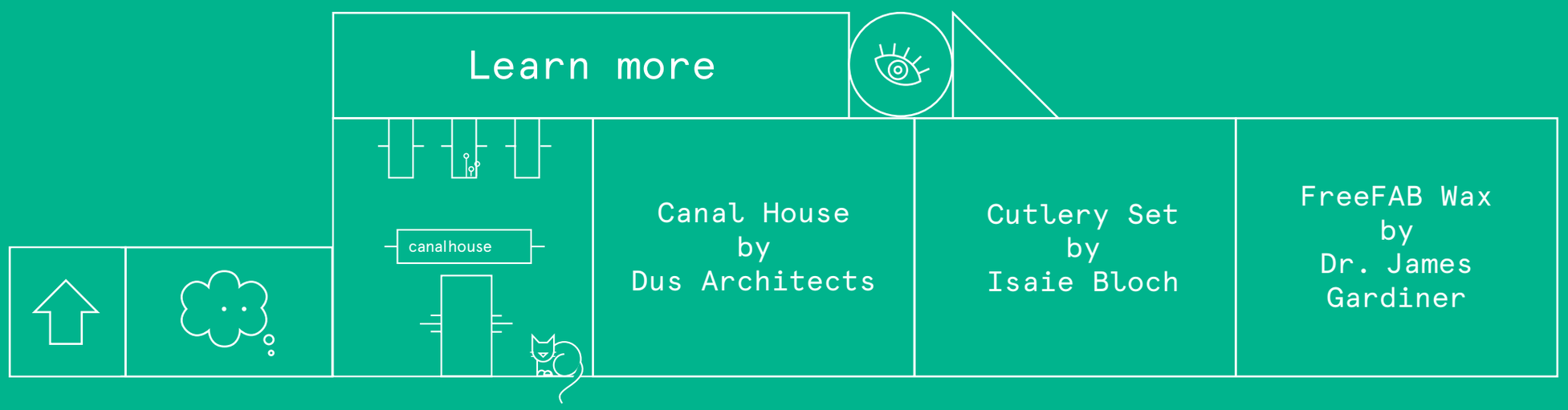
How will 3D printing affect our homes?

3D printing and other digital technologies hold massive potential to solve many design and manufacturing challenges in architecture and engineering - meaning the way we live in our homes will be transformed.

Imagine a world where the cost of building your own home was dramatically reduced and it was commonplace to 3D print a rapid response solution for communities affected by natural disasters, or even temporary homes for refugees.

Designers are already creating architectural components with 3D printers – changing not only the construction industry but how cities are built. Everyone is exploring and experimenting with different materials and methods. Standard building components can be replaced by highly customised, locally made structures. This process is much more sustainable, as printing onsite skips delivery and minimises waste.

Facades and formwork are now being printed in plastics, sand and concrete and algorithms allow material to be placed only where it is most structurally efficient. What will happen next?!



Canal House by Dus Architects

Dutch architect firm, Dus Architects, are putting the promise of 3D printed buildings to the test by creating the entirely 3D printed Canal House.

The complete process is open to the public with thousands of people already visiting the site. Even Barack Obama examined the prototype during a recent visit to Amsterdam. (If it's good enough for Barack....)

Dus Architects' intention is to revolutionise the polluting and inefficient methods of the construction industry. Together with Dutch firm, Ultimaker, Dus Architects developed The KamerMaker or Room Builder – a scaled-up version of an open-source desktop 3D printer.

It uses the same principle of a desktop printer – extruding layers of a molten bio-plastic mix, yet is about ten times the size. Dus Architects are continually experimenting with other materials, from a translucent plastic to a wood fibre mix. Building blocks will be stacked between 2014 to 2017 to form a 13-room complex modelled off a traditional Dutch canal house.

Image credit (below): Dus Architects, Artist Impression 3D Print Canal House, image courtesy of Dus architects

Cutlery Set by Isaie Bloch

Belgian designer, Isaie Bloch demonstrates that the technology is able to produce almost any type of intricate geometry.

Bloch's work is highly ornamental, lending itself perfectly to the traditions of silverware. For this series, each piece was sculpted in CAD software before 3D printed wax casts the cutlery set in sterling silver or 18 carrot gold. The precision and decorative nature of the objects were inspired by the decadence of Romanticism, yet new impossible forms are achieved. They intentionally appear to be organic shapes, despite the highly digital process. Here, Bloch combines craftsmanship with additive manufacturing in a way that reveals his artistic hand.

Bloch is a prominent figure at the forefront of computational design and 3D printing. Spanning architecture, fashion, sculpture and art, Bloch aims to create work that is technically unachievable by artisanal methods – intricate objects simply impossible to replicated without 3D printing.

While 3D printing may change how we make things, the technology does not outweigh the artistic vision of its maker – it instead allows that vision to be realised.

Image credit: Isaie Bloch, Eragatory Cutlery Set, 2013, in sterling silver and 18kt gold plated, 3d printed wax cast for bass casting, image courtesy of Isaie Bloch

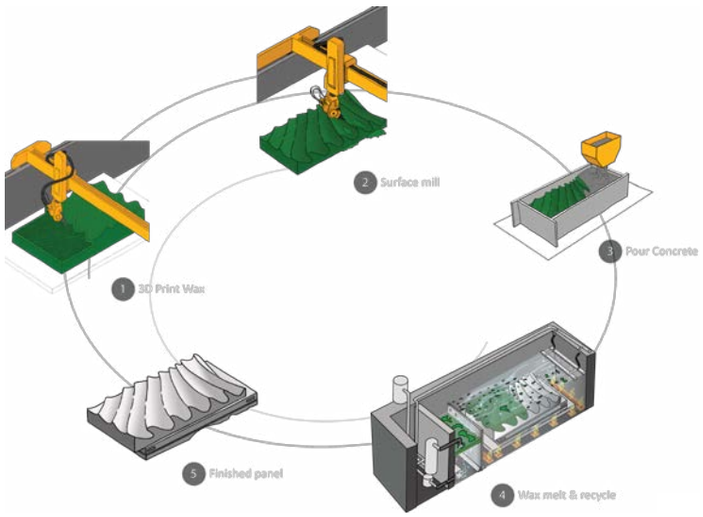
FreeFAB Wax
by Dr. James Gardiner

Architect and engineer, Dr. James Gardiner, has developed a 3D printed wax system that could transform the building industry.

In downtown Sydney, Australia, Gardiner is currently Lead of Design Innovation with the Engineering Excellence Group at the Laing O'Rourke innovation lab. It is here he invented FreeFAB™ .

From Sydney to London, where a construction scale 3D printer (L 30m x W 4.5m x H 1.5m) is located, Gardiner leads a team designing wax moulds for concrete. Gone are the days of plywood rectilinear moulds, Gardiner has invented a system to 3D print large volumes of wax at high speeds to create moulds for wall, floor and roof structures. By using CNC milling on the surface of the wax, he has created an incredibly efficient way to create very smooth concrete. Once the concrete has set, the wax is melted off and re-used for the next mould, making it one of the fastest, most inexpensive and sustainable systems around. #zerowaste

The FreeFAB Wax project started production in the UK during 2015. It is making many of Gardiner's construction 3D printing inventions a commercial reality.



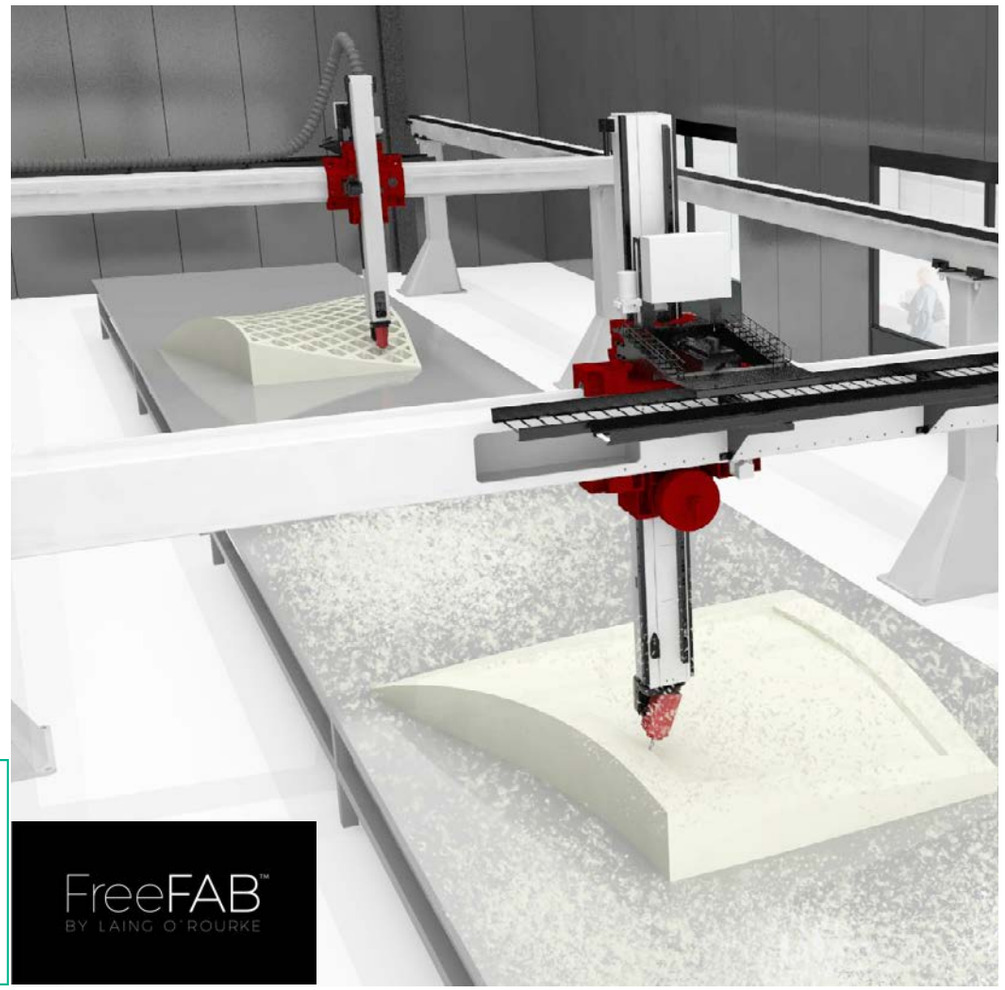


Image credit (above): Dr James Gardiner and the FreeFAB™ Team, Laing O'Rourke, IG FreeFAB Process, 2015, image courtesy of The Engineering Excellence Group, Laing O'Rourke

Image 2 (below): Dr James Gardiner and the FreeFAB™ Team, Laing O'Rourke, Render Gantry View, 2015, image courtesy of The Engineering Excellence Group, Laing O'Rourke

How will 3D printing effect our appearance?

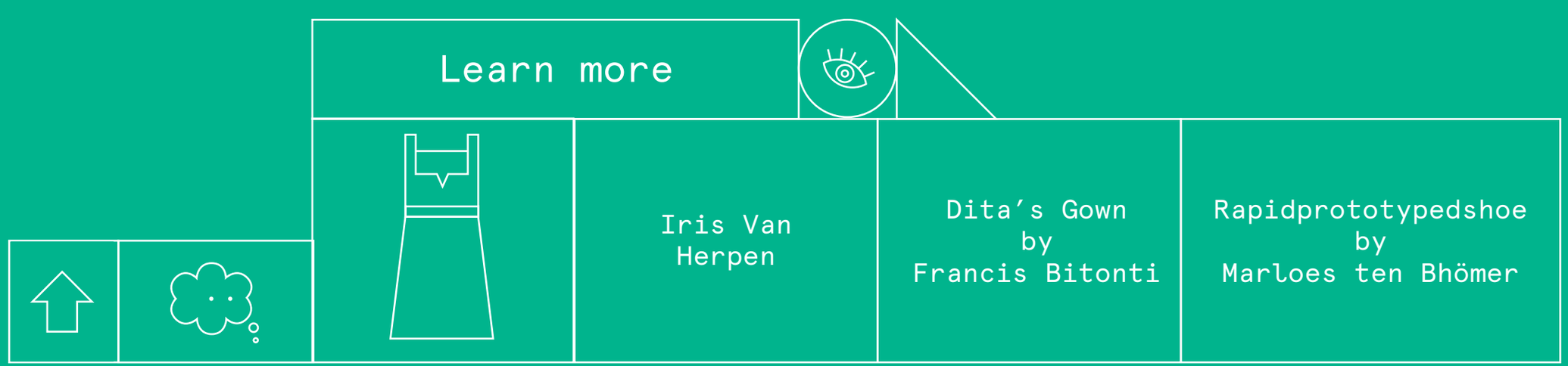
For fashion and jewellery designers, 3D printing bursts open new possibilities for creative expression.

3D printed garments, accessories and jewellery adorn the body in ways never seen before. Shoes can now be individually customised for the perfect fit (no more blisters), and metal powders allow gold, silver and titanium to be printed in intricate detail.

Digital tech is not being used to replicate what already exists, but rather to make things that don't exist yet. Imagine wearing a dress that responds when somebody looks at you. Innovative and experimental wearables now react to environmental and sensory stimuli, transforming with movement or even the wearer's emotions. Designers are transposing ideas from digital design practices to tangible consumer experiences and products.

3D printing is also becoming a more integral part of the design process. It gives the designer a completely new toolkit. Several iterations of the same design can be quickly produced and tested in different materials. Hallelujah!

With the open source movement, more and more designers are offering their CAD files for others to hack. Fashion can now quickly react to current trends. Imagine having a 3D printer at home to print off your favourite dress – customised perfectly to your body and taste!



Dita’s Gown by Francis Bitonti

If there is anyone in the world that could get away with wearing a 3D printed, crystal encrusted gown, it’d be burlesque dancer, Dita Von Teese. It may even have been one of fashion’s most talked about stories in 2012.

Francis Bitonti collaborated with Shapeways and designer, Michael Schmidt, to create this masterpiece in 3D printed fashion. Dita’s Gown took the geometry of the mathematical golden ratio and applied it to an intricate 3D printed ‘fabric’ – a mesh made up of 2,633 independent links or articulated joints. The fabric was then broken into 17 parts, each laser-sintered before being hand-assembled and embellished with 3000 Swarovski crystals. (Show me the money!)

The Francis Bitonti studio is devoted to designing for the future of the information age. Bitonti claims that advancements in computer-based design means that “the separation between what you can simulate and what you can physically model is gone”.

Such innovations could soon trickle down to everyday consumers, not only affecting what icons like Dita wear, but our appearance as well.

Image credit: Francis Bitonti in collaboration with Michael Schmi, Dita’s Gown, 2012, polyamide nylon, crystals, image credit: Albert Sanchez

Rapidprototypedshoe by Marloes ten Bhömer

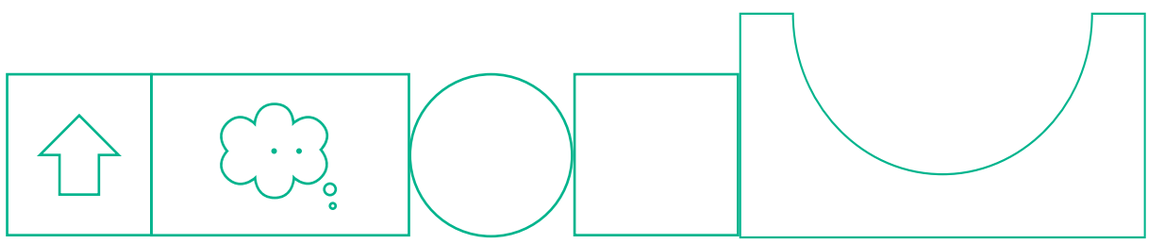
The Dutch did it again.

Dutch designer, Marloes ten Bhömer, has created a 3D printed shoe by that can be individually customised. Not only has Bhömer ensured that these shoes will fit perfectly, parts of the shoe can be dismantled and replaced when damaged too! No more expensive heel replacements. These shoes are in fact designed to wear and break down in layers so they can be easily changed.

Rapidprototypedshoe is inspired by the fact that 3D printing removes the necessity for traditional assembly work. Instead, the shoes are created by printing two different materials in tiny, microscopic structures.

Bhömer's futuristic shoe designs are a result of combining artistic and technological experiments. Most Importantly, they focus our attention on sustainability and the longevity of the products we consume.

Image credit: Marloes ten Bhömer, Rapidprototypedshoe, 2010, photopolymer, image courtesy of Marloes ten Bhömer



Cinnamon Lee

Romantic engineering. We think it’s a thing.

Cinnamon was one of the very first contemporary jewellers in the world to utilise digital technologies for creative outcomes. Over a 20-year career, Cinnamon has specialised in combining traditional skills with emerging technologies, harnessing the powerful tension between the hand and the machine.

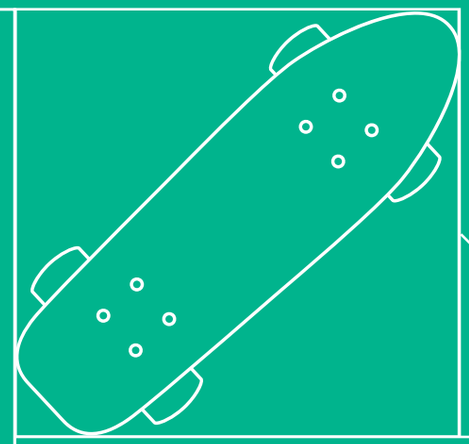
Her jewellery would be impossible to make using conventional methods. High-definition rapid manufacturing and lost wax casting techniques allow Lee to make incredibly complex forms. Her experiments with digital metal fabrication cement her as pioneer in bringing traditional silver-smithing practices into the digital age.

Cinnamon explains, “In my practice...I blend the past with the future. I embrace technology to inspire new ways of creating objects while respecting the tradition that has come before me”.

image credit (below): Cinnamon Lee, Multicopy ring stack, 2008, oxidised 925 silver, image credit: John Lee

Shape Shifters

Australian Design Centre



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