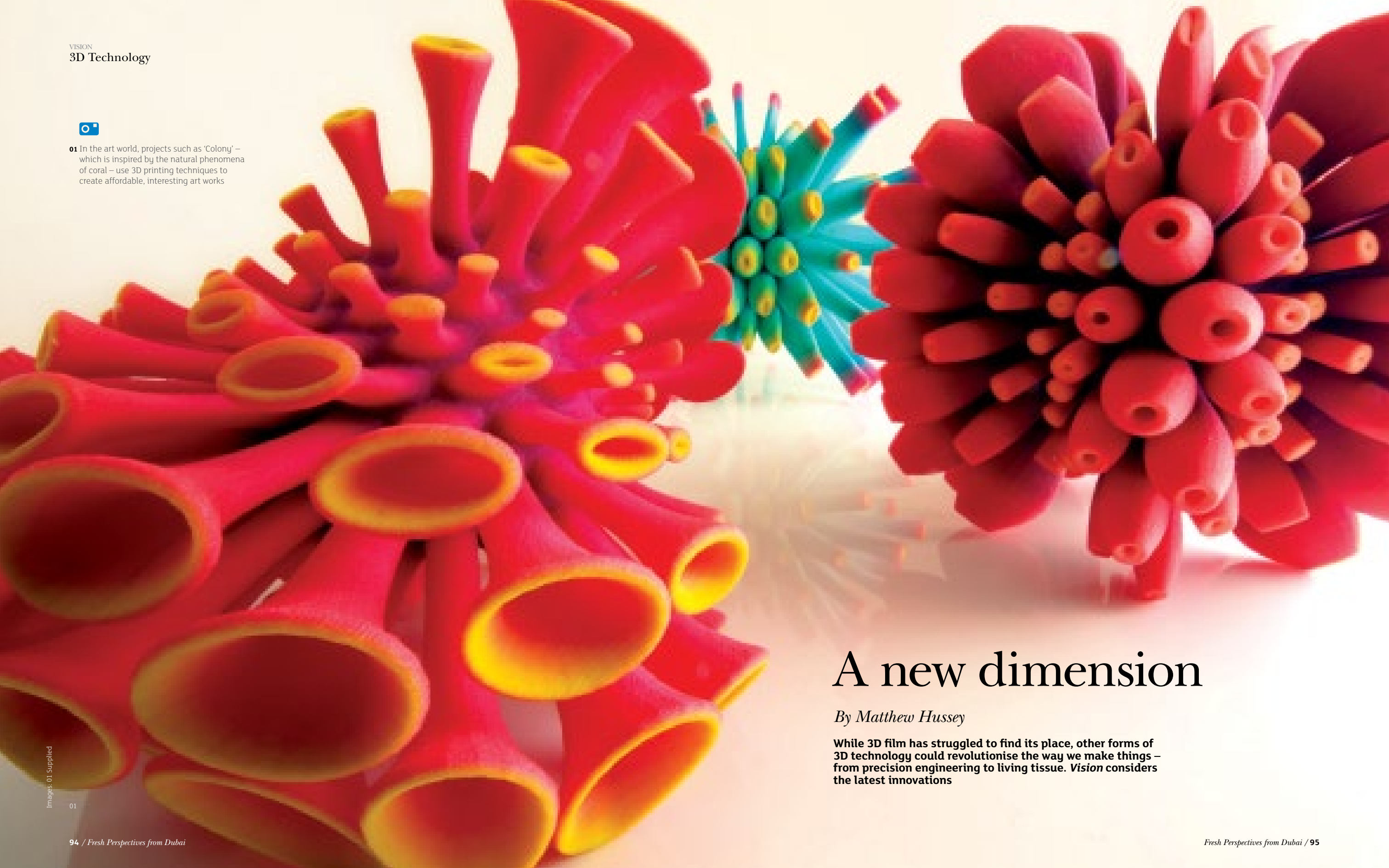




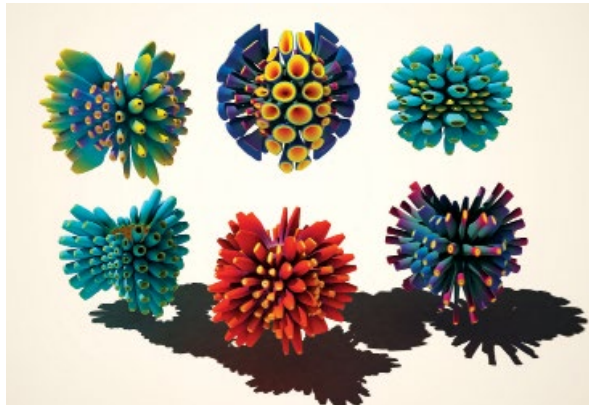
01 In the art world, projects such as 'Colony' – which is inspired by the natural phenomena of coral – use 3D printing techniques to create affordable, interesting art works



A new dimension

By Matthew Hussey

While 3D film has struggled to find its place, other forms of 3D technology could revolutionise the way we make things – from precision engineering to living tissue. *Vision* considers the latest innovations



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- 01 Jessica Rosenkrantz's 3D 'Colony' collection comprises a number of unique pieces of art
- 02 Universe Architecture's Landscape House is shaped as a continuous Möbius loop
- 03-04 3D printer 'The Replicator 2', created by Bre Pettis's company MakerBot, extrudes wafer thin plastic layers
- 05 Designer Iris van Herpen often collaborates to produce clothes using 3D printers

3D printing typically uses only a tenth of the material used from machining a part from bulk, and any waste material can potentially be reused

For most of us, our experiences with three-dimensional technology (3D) start and end at the cinema: wearing the garish red-and-green specs popular in the 1970s and 1980s, or watching James Cameron's record-breaking 2009 blockbuster *Avatar*. We've yet to experience 3D in other, more meaningful ways – but that's all about to change.

The film industry has been coming under pressure to drop 3D – a recent YouGov poll in the UK found just 19 per cent of respondents thought 3D improves a film – but over the past 12 months there have been flashes of 3D's potential.

Crowds in Los Angeles couldn't believe their eyes when a 3D projection of long-deceased hip-hop icon Tupac Shakur joined Snoop Dogg on stage at the Coachella music festival to perform 'live' in April 2012. This year, however, 3D is about to enter our world in a big way, as another

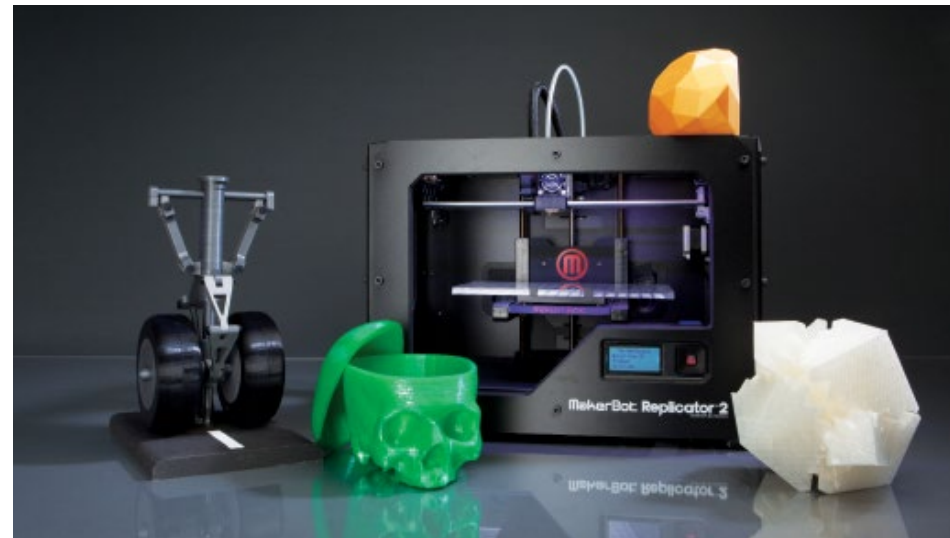


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kind of 3D technology has been quietly growing elsewhere.

Whereas 3D film is about depth perception – creating the illusion of something in three dimensions – 3D printing allows the construction of precise, complex 3D objects without the need for laborious

hand-modelling or machining. Though 3D printing has been used for some time in engineering and industrial design, recent advances mean the cost of the technology has reduced dramatically. At this year's 2013 Consumer Electronics Show in Las Vegas, the buzz among journalists and



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observers was the emergence of companies offering 3D printers to the public at affordable prices.

"This is the most exciting time ever to be an engineer, an industrial designer, or an architect. We've put the factory into a little box. The factory can be one person at home again," says Bre Pettis, CEO of MakerBot, a brand of 3D printer.

But how far can 3D technology go? In the future, will we simply print out everything we want and need from a desktop device no bigger than your current printer? Or will 3D technology quietly work behind the scenes while normal, 2D life carries on?

At its most basic level, a 3D printer is a modified ink-jet printer that deposits successive layers of material until a three-dimensional object is built up. It typically uses only a tenth of the material used from machining a part from bulk, and any waste material can potentially be reused. The material used for printing can be

a thermoplastic such as acrylonitrile butadiene styrene (ABS), polylactic acid or polycarbonate, metallic powders, clays or even living cells, depending on what you want to use it for.

Inside a clean, quiet office in Dubai Investments Park, Lothar Hohmann, the CEO of PRECISE, is using the newest 3D printers to make tiny versions of you, a tenth of the size, in just a few hours.

"You can either come into our offices, step on board one of our buses, or even send us a photograph, and we can create lifelike figurines of whoever you wish."

The TIM (This Is Me), introduced in 2012, is made by taking a scan of your entire body using a combination of scanners, lasers and camera equipment, taking typically just two to three seconds. The composite image is then fed into a printer as a digital file, and the machine will print a layer of powder just 0.0875mm thick, followed by an ink-jet machine to



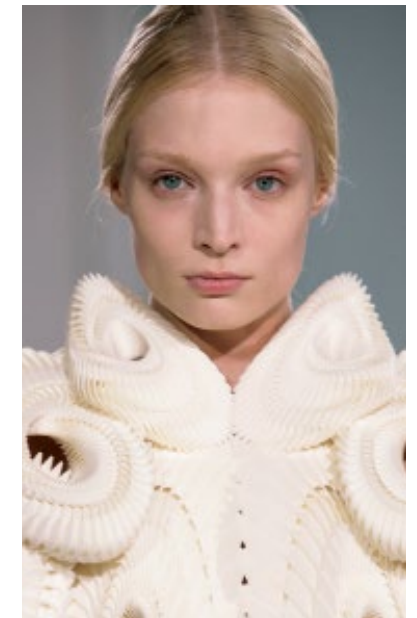
About the writer

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give it colour. The process is then repeated thousands of times to create an accurate version of you.

"The capabilities to create things on an incredibly personalised basis, quickly, has never been seen before," explains Hohmann, one of the early pioneers of printing in 3D, who also produces architectural 3D printed models. Architects no longer have to spend hours painstakingly constructing models of their projects for clients. Building designs created using CAD software can simply be sent to a 3D printer. Dutch architecture studio Universe Architecture, however, is taking that concept one step further, by attempting to print an entire, liveable house in the same way they print models.

With the help of a giant printer, the Landscape House will be printed in sec- >



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The march of 3D into our lives over the past two years has allowed buildings to change shape, architects to build houses without builders and for clothes to be cloth-free

tions of up to six by nine metres, using a mixture of sand and a binding agent to create artificial sandstone. The house, designed as one surface folded into an endless Möbius band, would be printed in as little as six months with assembly taking another six. "In traditional construction, you have to make a mould of wood, and you fill it with concrete, and then you take out the wood – it's a waste of time and energy. [Now] you can print what you want – it's a more direct way of constructing," says Janjaap Ruijsseenaars, an architect working on the project.

But while Hohmann and Ruijsseenaars have been exploring how 3D printing can help make solid shapes, designer Iris van Herpen has been tapping 3D printing's ability to make more fluid objects. At Paris Fashion Week this year, the designer, along with printers Stratasys, created an 11-piece set made without a bolt of cloth or string of thread in sight. Using multi-material 3D printing technology (a combination of hard and soft materials), they created clothes that could move and flex like any other, but with intricate forms that traditional techniques would struggle to replicate.

"I believe it will only be a matter of time before we see the clothing we wear today produced with this technology, and it's because it's such a different way of man-

ufacturing, adding layer by layer, it will be a great source of inspiration for new ideas," says van Herpen.

While 3D film has struggled to find its niche with a cinema audience, the advertising industry has harnessed the technology to create 3D experiences. In London last year, Battersea Power Station became a giant Rubik's Cube, thanks to 3D projection technology developed by Drive Productions. Unlike traditional projectors, these next-generation variants create a sense of depth on a flat surface. In 2010, Ralph Lauren's London and New York stores became giant storyboards, as the buildings appeared to be shifting in size and form.



"It went viral in over 100 countries in five days," explains Drive Productions' CEO, Ben Fender. "It set the benchmark for what could be done in advertising. For us, 3D technology enriches a live experience and creates content that people want to share." The march of 3D into our lives over the past two years has allowed buildings to change shape, architects to build houses without builders and for clothes to be cloth-free. But what's the next step?

In Dubai, the government is working on introducing 3D printing competitions into schools to equip the next generation's workforce with the understanding and skills of what many observers are calling the "new internet".

"The major large-scale effects of 3D printing will ripple throughout our global economy and change how we build things. Because we've started investing in education now, our kids will be technically proficient when that time comes," explains one government source.

The rapid evolution of 3D is already changing other industries. In medicine, scientists are developing ways of printing living organs including kidneys and hearts, which could potentially solve the



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organ donor crisis. In the US, researchers at Wake Forest University in North Carolina have collaborated with the Armed Forces Institute for Regenerative Medicine to bio-print cells directly onto skin wounds of mice to accelerate the healing process.

3D, it seems, is only limited by our imagination. Gabor and Andras Forgacs' company Modern Meadow is working on printing meat for human consumption and has produced a prototype for producing hamburgers that don't require farming, slaughter or processing.

"Will the future involve us going into a shop and asking for a green bucket and

the shopkeeper printing it? No. But what this technology offers is an opportunity to create products perfectly tailored to one person's needs," concludes Hohmann.

The future then, is not only three-dimensional, but printable, too.



- 01-02 Lothar Hohmann's Dubai-based firm PRECISE creates lifelike figurines
- 03 A 3D printer could make building a lunar base simpler by using local materials
- 04 The D-shape printer for ESA's 3D-printed lunar base study constructs objects by binding together layers of sand

Aiming for the Moon

There are many challenges associated with constructing a base on the Moon, not least the logistics of firing the necessary building materials from Earth. A group of companies has teamed up with the European Space Agency to solve the problem by using a 3D printer to build a station using moon rock.

The renowned architects Foster + Partners designed a domed concept base with a cellular structured wall to shield against inclement space conditions including radiation. Another UK company, Monolite, printed a 1.5-tonne demonstration building block using powdered volcanic basalt ("glued" with a binding salt) to replicate the moon rock. Italian space firm Alta built a simulated moon environment to test the printer's capabilities in a vacuum, firing the building material into the "regolith" layer. The material was trapped by capillary forces in the soil, which means that it is possible to construct in a vacuum without the building "boiling off" into deep space. One small step...