

**3D printing technology** has revolutionised the design sector. *Gian Luca Amadei* investigates how this form of rapid prototyping is also changing traditional crafts

British industrial designer and writer Lewis Foreman Day once stated that 'no machine can approach the best work of men's hands'. One wonders what Day, working in the 19th century, would make of today's increasingly popular production method of 3D printing, a technology that combines high precision with short production time at a low cost.

The process, a category of rapid prototyping, creates three-dimensional objects from two-dimensional digital files by layering and bonding successive cross-sections of material. Rapid prototyping became available in the late Eighties to produce prototype parts. Its high cost prompted research into cheaper solutions, including 3D printing.

In the design sector, this technology is primarily used in industrial design and architecture, for product prototypes and scale models of buildings. A lesser-known application is one being pioneered in conjunction with traditional crafts by British ceramicist Michael Eden.

While studying at the Royal College of Art, Eden took Wedgwood's 1817

Creamware catalogue as the starting point for his final MPhil project. Using 3D printing technology, he subverted the design of a tureen, a traditional deep serving dish, and directly challenged its use of material and production process in a way which would have been impossible in the 18th century, aptly naming it Wedgwoodn't.

'I chose a ceramic piece based on an early 18th-century Wedgwood,' says Eden, 'Josiah Wedgwood was at the forefront of the first Industrial Revolution. He was important in socio-political terms, introducing a division of labour and being a slavery abolitionist.'

Eden found inspiration in the texture and patterns of artificial bone structures produced using 3D printing in medical research.

The delicate pattern that Eden developed for the tureen tested the limits of the production technique. The first prototype was particularly fragile, and even the hardening procedure of injecting a binding agent, was not sufficient to make it sound. Another challenge was

getting the right colour. Eden wanted the tureen to be in the typical Wedgwood black, Jasper.

To resolve the piece's strength and colour, Eden worked with French ceramic specialist, Axiatex, based in Limoges. Experimenting on the plaster used in Eden's 3D printer, Zcorp 131, Axiatex discovered that the material could withstand heat, and therefore that it could be glazed, and fired with a traditional ceramic glaze. In the process, Axiatex also discovered that they could produce rapid prototyped moulds for glass blowing, glass casting, and low temperature metals – previously uncharted territory.

The research and development was supported by the Rapidform department at the RCA, managed by Nick Grace. It was keen to get the widest range of use out of the technique. 'The glass and ceramic departments were not using the facilities and the team was interested in expanding its knowledge in possible applications of 3D printing technologies combined with traditional crafts,' he says.

Rapidform RCA is the world's

*Above: Close-up of the prototype for the lid of Michael Eden's tureen, built using 3D printing technology*





largest academic digital manufacturing facility, operating 10 machines ranging from a device that produces low-definition wax models to an Electronic Beam Melting machine, that produces titanium parts. As well as offering the service to students, Rapidform also rents the facilities to small businesses.

Recently, Rapidform opened a new 3D printing department at London's Bartlett architecture school, managed by Martin

Watmough, who, while at the RCA, played a key role in the development of Eden's tureen.

For Eden, 3D printing is not replacing traditional crafts but is a new tool, which will increase the possibilities for experimentation in ceramics.

Eden began his career at Leeds Polytechnic, studying Industrial Design. 'I didn't really fit with the way industrial design was taught,' says Eden. 'I felt it was all about

marketing and producing for production's sake.'

Eden moved to the Lake District at the end of his first year, and worked in Conservation and Forestry. He took a job as a landscape designer while he and his wife, a ceramicist, opened a pottery studio in Cumbria, which they have been running since.

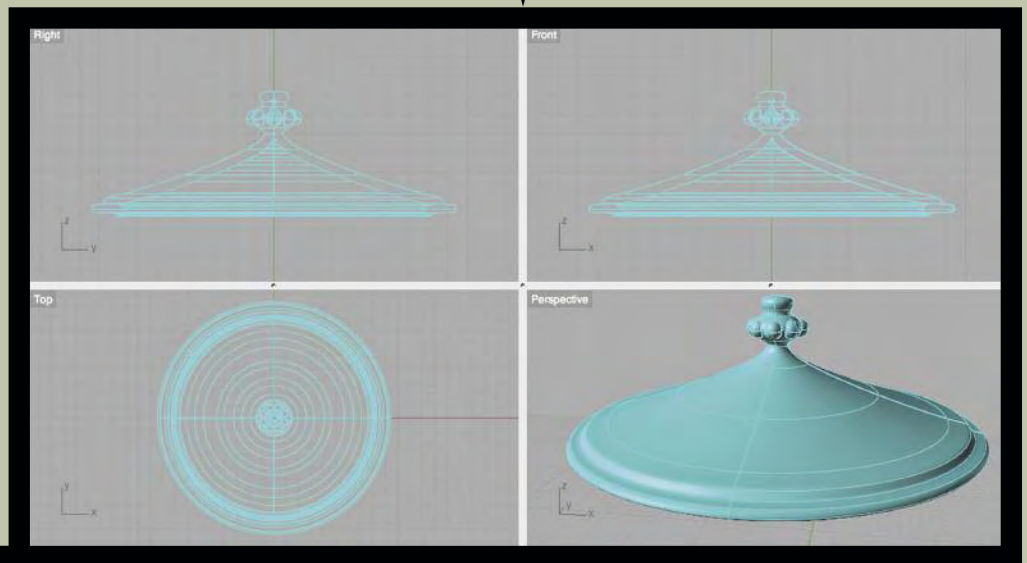
Eden returned to the RCA to complete his MPhil. 'Part of my project at the RCA was to see how

I would have coped with my traditional background in ceramics,' says Eden. The outcome was a success. The Wedgewoodn't won the 2008 Design Directions, Ceramic Futures competition, and Eden is designing a series for Wedgwood this year, for its 250th anniversary.

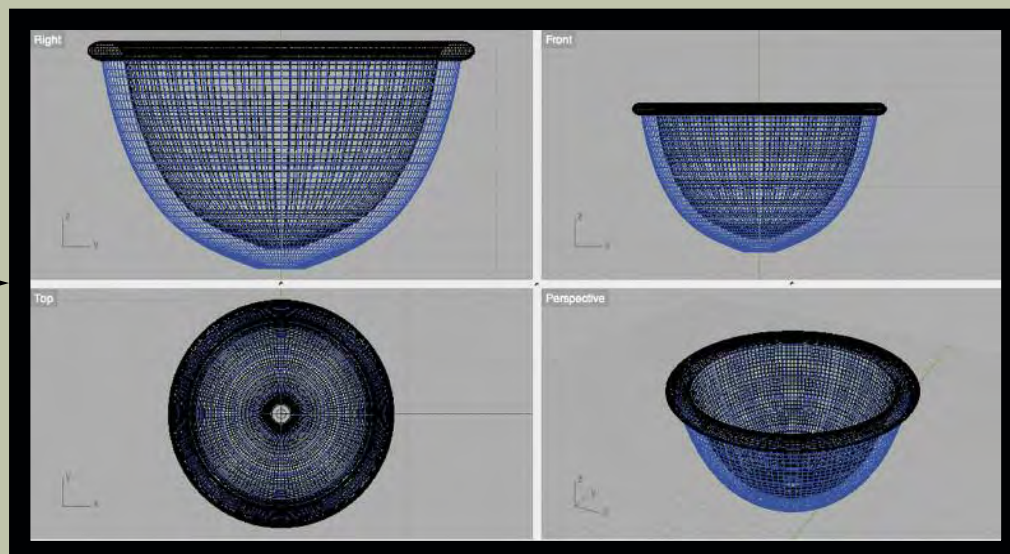
Like Eden, Lewis Foreman Day also designed for the Wedgwood company in the early years of his career. No doubt Day would have welcomed Eden's vision to fuse craft with technology.



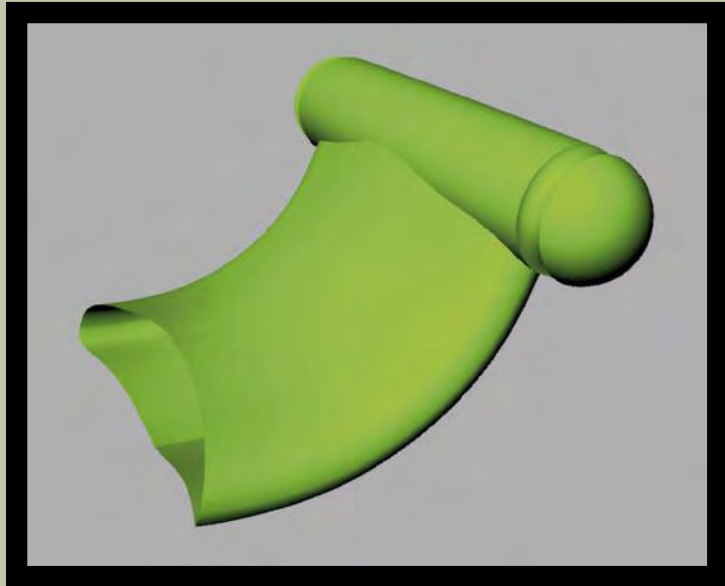
Far left: An extract from the original Wedgwood Creamware Catalogue, 1817, showing the design variety in the mass-produced ceramic collection



Above right: Eden's investigations into the proportions of the lid, using the computer rendering programme, Rhino

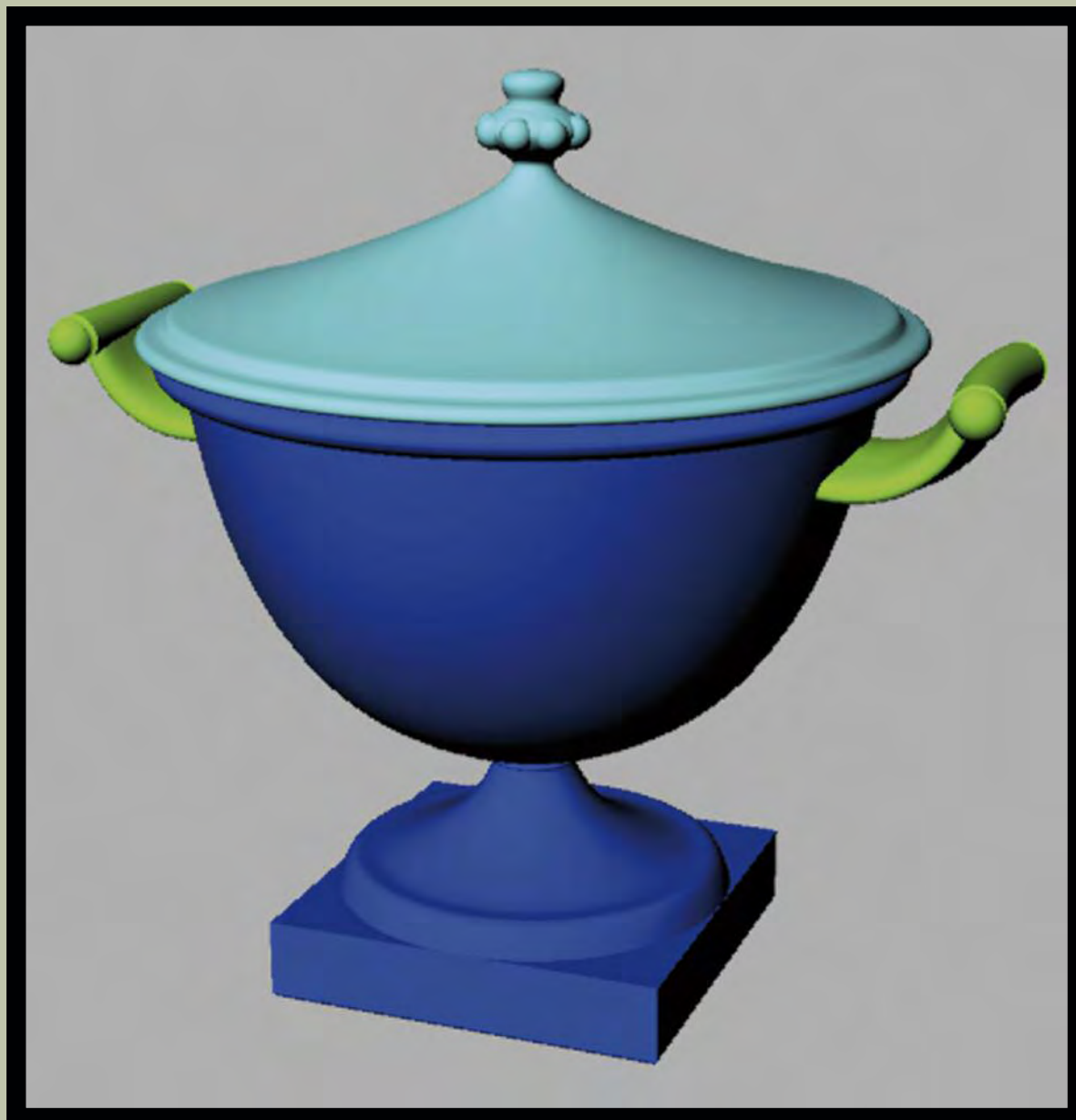
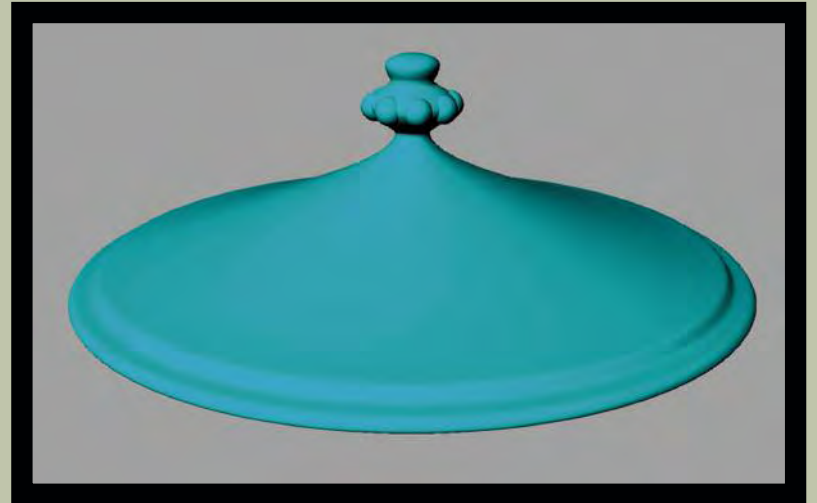


Left: The first application of the design pattern to the tureen bowl. Each element, such as the foot and the handles, were developed separately



Above: Close-up showing details of the tureen's handle. Once identified, the right proportions of the component will be attached to the main body

Below: The final form of the lid before the surface treatment. Although faithful to the original decorative elements, Eden mixed forms and details

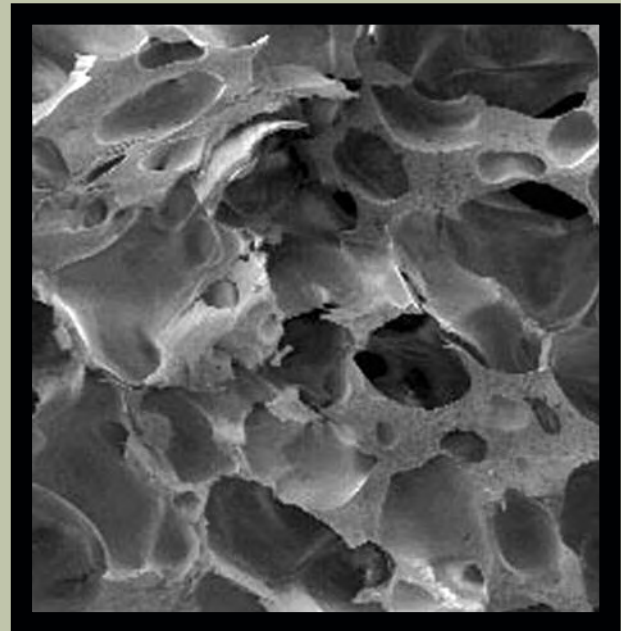
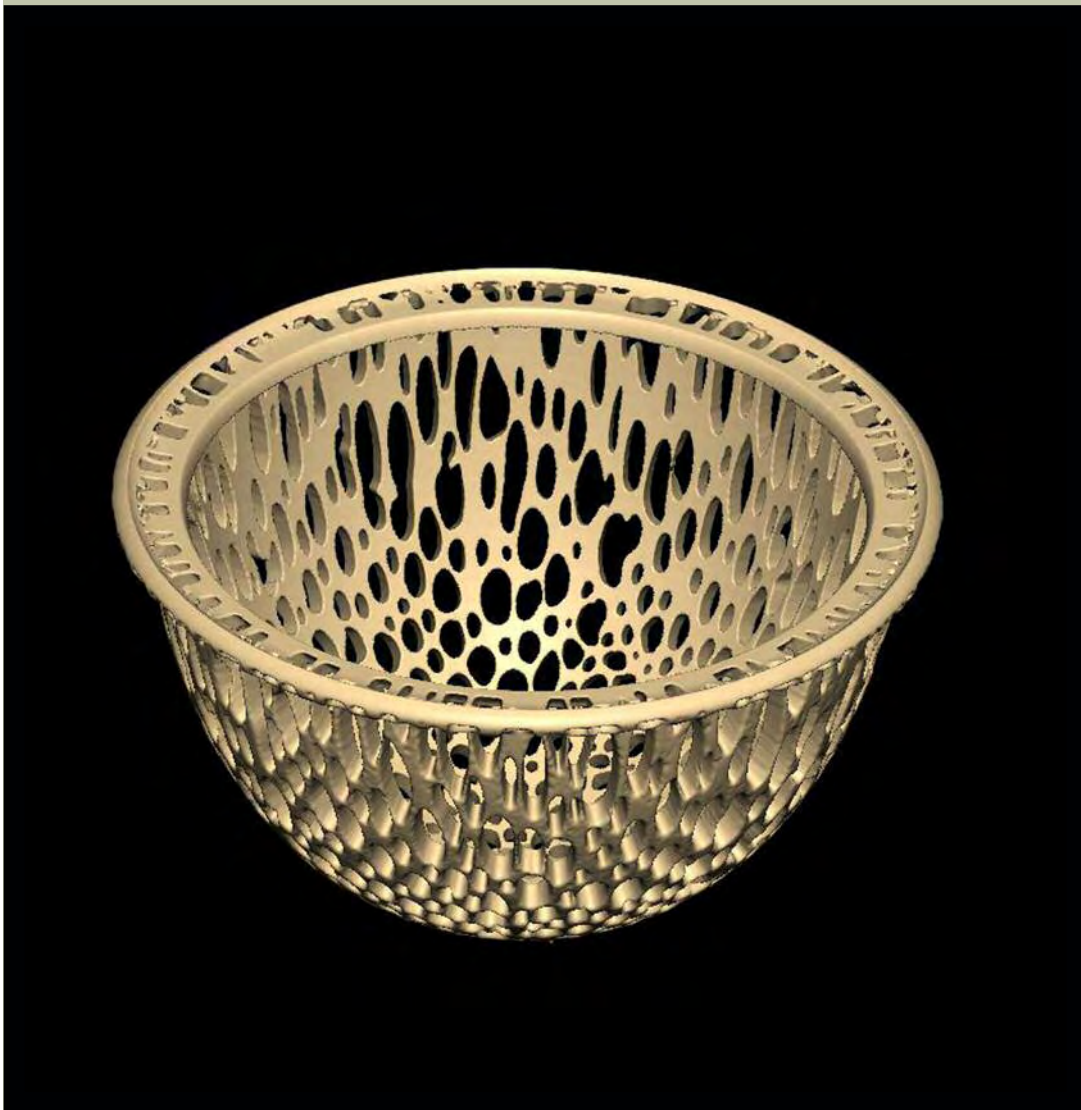
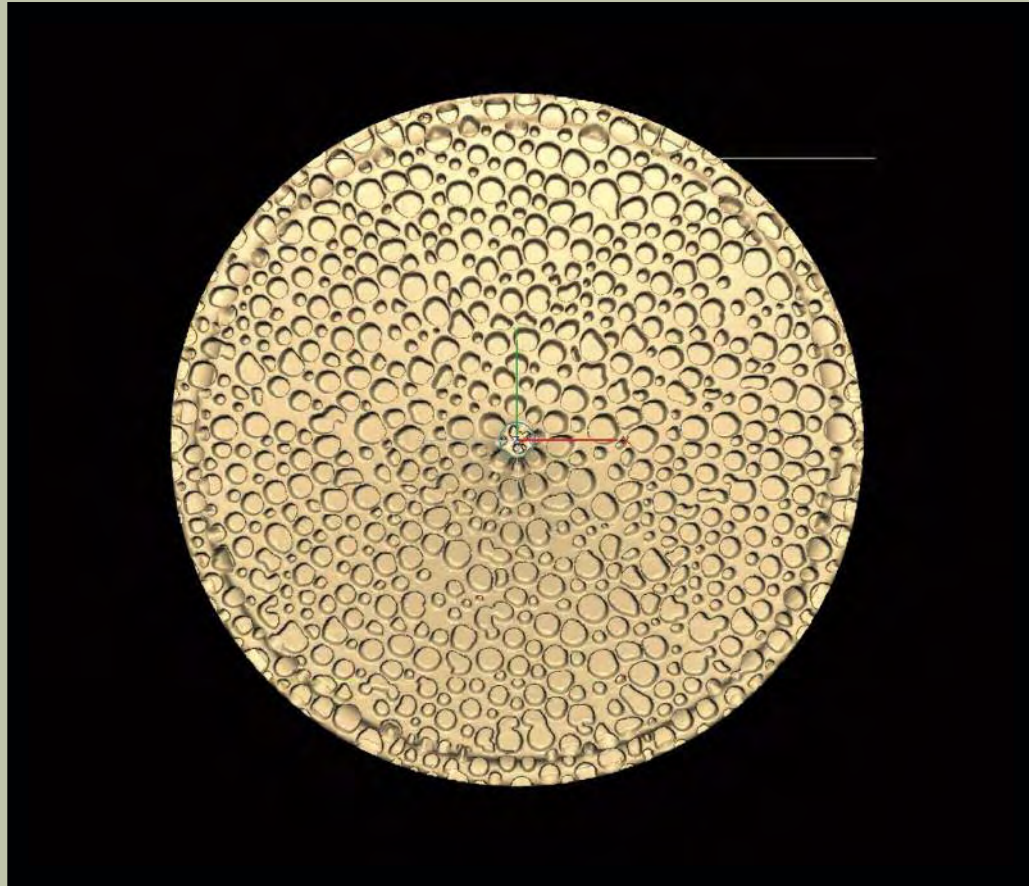


Left: Rendering of the complete tureen before the application of the pattern, which Eden created separately on Photoshop



*Right: The digital file is then divided into horizontal layers, so that each layer has a 2D outline, legible for the 3D printer*

*Below: The finalised design as a digital file is fed into the printing machine*



*Above: The pattern for the tureen was inspired by the structure of bone*





*Top right: After printing, the solid object is extracted from the excess powder. The object is very fragile, and must be cleaned by hand with an air-jet, and brushes*

*Right: Eden's tureen in Wedgwood black, Jasper, achieved with French ceramic specialist Axiatec*