



The Journal of
**AUSTRALIAN
CERAMICS**

Vol 55 No 3 November 2016 \$16

**Focus: Terra Nova
3D Printing
Pippin Drysdale**

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Cover:

Front cover: The Robotic Fabrication in Architecture, Art and Design Conference, a 3D printing workshop was hosted by the Uni of Sydney and UNSW at Pier 2/3 in Sydney in March 2016. The photo shows one of the resulting forms with variations caused by light sensor inputs, i.e. the shape changes as data from light readings is inputted into the program.

Back cover: Ade Oggunniyi (from UNSW) operating the robotic 3D printer at the Pier 2/3 workshop.

Photos: courtesy University of Sydney

Publication dates

1 April, 17 July, 20 November

Publisher

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Focus: Terra Nova
Janet DeBoos and Kate Dunn

New Technologies for the Ceramics Studio

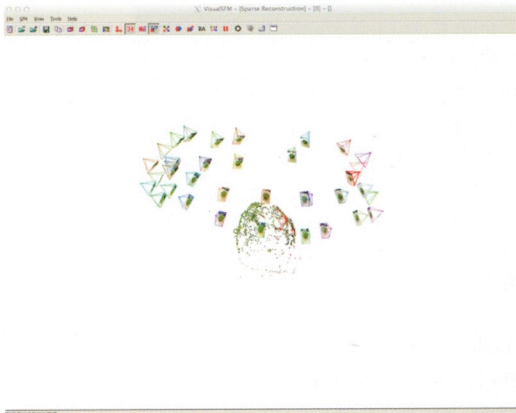
by Anna Calluori Holcombe

The abstract for my presentation at Stepping Up: The Australian Ceramics Triennale was based on the realisation that, with the almost daily developments in 3D scanning and printing, the ceramic artist can feel overwhelmed and even threatened. The traditional theory of craft requiring the touch of the hand is incongruent with the reality of using computer software and a machine to produce an object. And yet, artists have the opportunity to use this technology which has recently become much more economically accessible. It can be used to design, model, prototype and even create ceramic objects. At the conference I presented my personal process of using 3D scanning and printing to create my ceramic work. I made the case that this new technology is just another tool available to the ceramic artist. I continue to utilise these tools in my work today, though the technology is ever-changing.

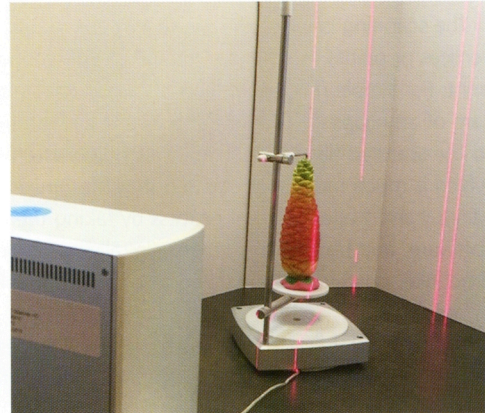
When I travel and explore the world, I cannot help but make connections, and Nature is one place that I look for these connections. My creative process involves 3D scanning then 3D printing models – often items found in the landscape – in plastic and resin. These models are used to make moulds for the porcelain slipcast pieces that I use in assemblages, and it is at this stage that I make the connection of the plastic model to the ‘plastic’ clay object. Although I use this technology, I still do a great deal of hand work – fettling, cleaning, connecting, glazing and sometimes adding decals and china paints, so the ‘touch of the hand’ is still there.

In my current research I continue to rely on the collaboration of art and technology artist Thomas Storey, with a focus on more affordable and easier-to-use software and hardware. We believe that as these technologies are available and accessible to the ceramic artist today, 3D scanning is a powerful way to digitise existing items to be used as 3D models, which can then be used to make 3D prints. It is a more object-based approach to working with digital imagery, less reliant on often-complicated modelling software. This photogrammetric process requires common points of contrast between a number of 2D images of the object in a variety of angles to reconstruct it digitally in 3D (image1). The uploading process can take a long time, even hours. However, if high quality images are used, the results are amazingly detailed and crisp.

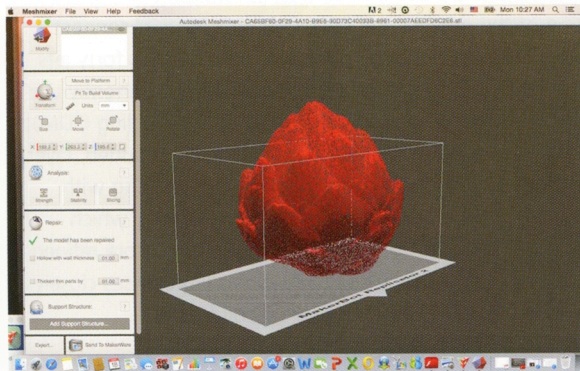
I have tried a number of scanners starting out with a high end ZCorp 3D scanner. On the other end of the spectrum, I have had some success with Autodesk® 123D Catch®, which is a free 3D scanning app for your iPhone and iPad, as well as a web app that can be used through a web browser with a camera. Lately, my scanner of choice is the NextEngine 3D Scanner2 (image 2). The advantages of this scanner, compared to the Z Corp scanner I used previously, are many. One is cost, with the new model ZCorp at about ten times the cost of the NextEngine. The NextEngine’s software is simpler to use and interfaces well with other software programs. Another advantage is convenience as the NextEngine is stationary and has its own mechanical turntable and light source. For scanning on the go, I am testing the Structure Sensor scanner that connects to an iPad.



1



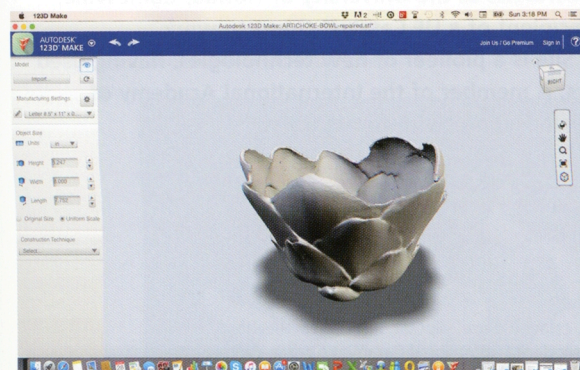
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1 Screen capture of a photogrammetric scan of an artichoke. At this point in the process, a 'point cloud' has been generated from pixel data from a set of images. (The next step is to connect the individual points together to create a continuous surface) 2 Next Engine 3D scanner, scan in process 3 Screen shot of mesh 4 Screen shot of scan of artichoke 5 Screenshot of artichoke scan as bowl 6 Model printed on a Makerbot 3D Printer

The scanning process will create a 'mesh' or line segments to form a polygon mesh connected by vertices or points in 3D space (image 3). All scanned files need work on the scanned mesh to produce a print. For simple models in need of minor adjustments, free software called Autodesk Meshmixer takes care of any gaps or 'holes' that prevent the file printing. For a more complicated cleanup and variations to the scanned file, I work with Storey who uses Blender free and downloadable modeling software, which is much more sophisticated than Meshmixer and MeshLab, but not as complicated as Autodesk Maya. I am challenging the process by taking the scanned files, together with Storey's abilities with software, and transforming them digitally into models for functional work. An example is a scan of an artichoke, opened and stretched to create a model for a bowl (images 4, 5 & 6, page 37).

My most recent work continues the *Piante* Series, building in an assemblage fashion to create the arrangement. Taking natural objects into a digital form creates a juxtaposition that I find interesting, suggesting a relationship between the forms that take on the genre of the still life.

As I continue to explore 3D technologies and how I might use them in my work, I have been increasingly interested in the digital mark-making of the process and have begun to further connect the two. In the past I used a high-end polyjet Objet 3D printer, known for precision, with its forty jets placing layer upon layer on the bed giving me smooth and highly detailed resin models. I currently use a Makerbot – a desktop, and relatively inexpensive, printer. This is a Fused Deposition Modeling (FDM) printer that uses a thermoplastic filament which is heated to its melting point and then extruded, layer by layer, to create a three-dimensional model. Through an interdisciplinary grant I am working with materials engineer Dr Juan Claudio Nino, using a Delta-type 3D printer with a clay extruder, which allows us to print objects directly. We are researching the development of a stronger and more refined than currently available material with which to print. Intriguingly, these technological processes closely mimic the way civilisations have been building with clay since primitive times – coil by coil.

Anna Calluori Holcombe is a Professor of Ceramics at the University of Florida, Gainesville, USA. She is a UF Research Professor and recipient of a UF Catalyst Grant to work collaboratively with a Materials Engineer. She is a pioneer of new technologies, having used 3D scanning and printing for about 6 years. A member of the International Academy of Ceramics, she enjoys travelling extensively, including twice to Australia.

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Opposite:

All work by **Anna Calluori Holcombe**

1 *Piante 50*, bowls in plate, 2016, Jingdezhen porcelain, celadon glaze, slipcast 3D model, wheelthrown plate, h.15cm, diam.42cm; collection of the Shangyu Celedon Modern International Ceramics Centre, China

Photo: Terri Frame

2 *Piante 47*, 2014, porcelain, 3D scanned and printed models, slipcast, kiln-cast glass, lustres, h.12cm, diam.38cm

Photo: Alan Cheuvront

3 *Piante 51*, 2016, Jingdezhen porcelain, celadon glaze, slipcast 3D models and wheelthrown plate, assembled, h.20cm, diam.33cm; collection of the Shangyu Celedon Modern International Ceramics Centre, China

Photo: Terri Frame

