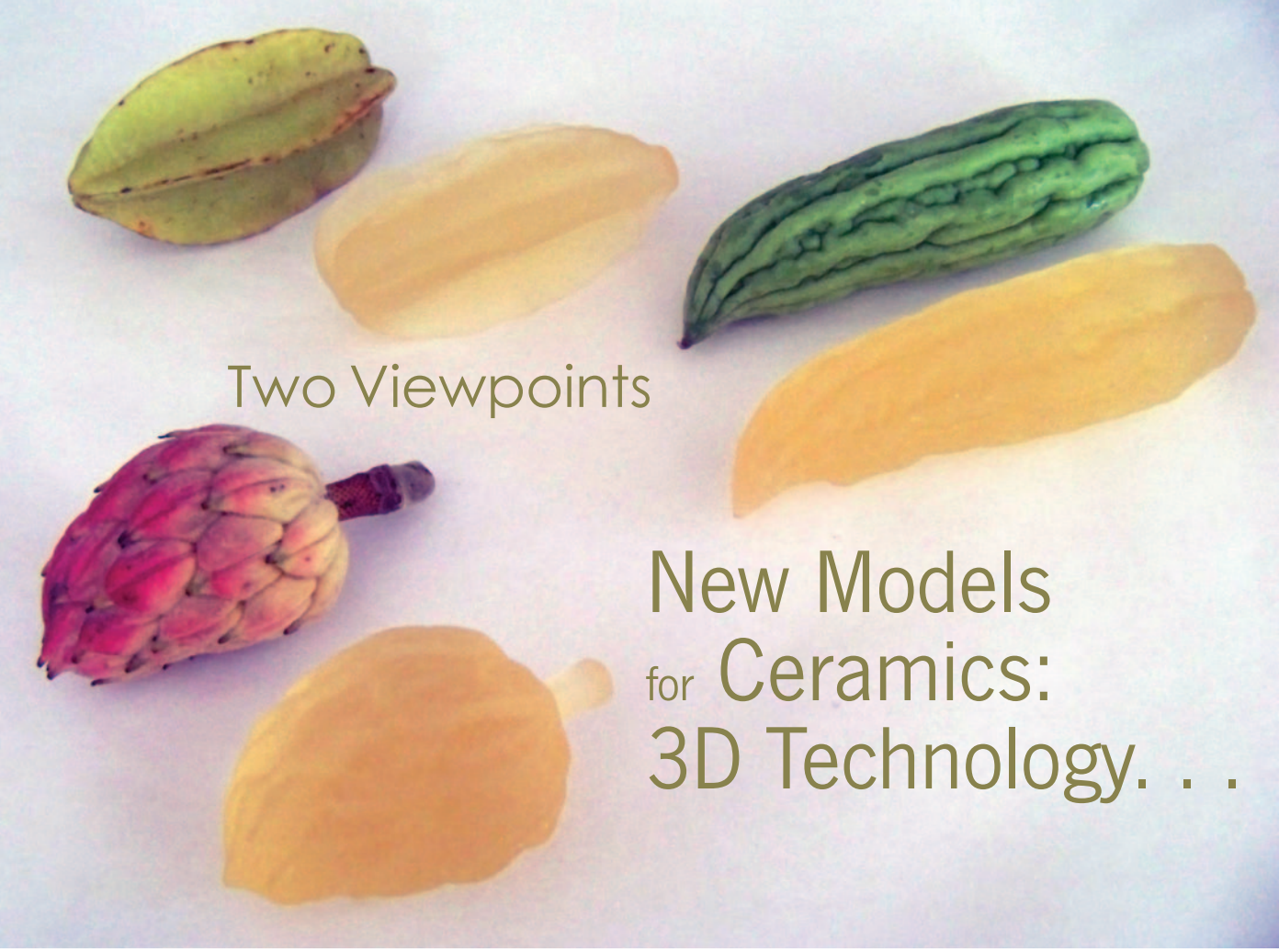
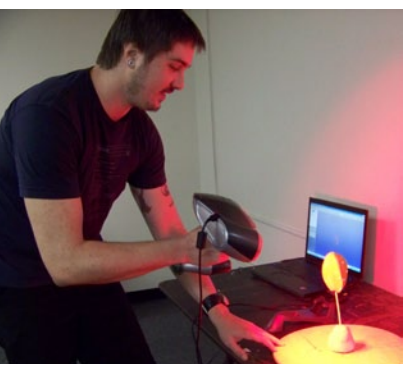


Two Viewpoints

New Models for Ceramics: 3D Technology. . .

Daniel Tankersley describes the process for the application of this new process to ceramics

Above: ***Nature and Models.***
Below: ***Dan Tankersley scanning a form with the 3D Scanner.***



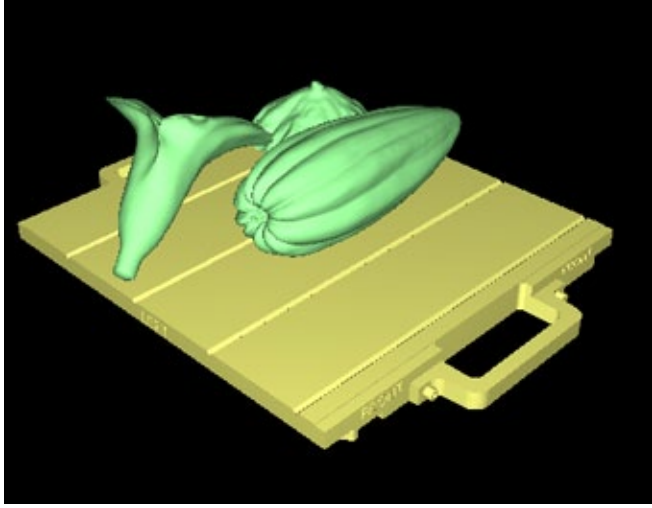
THE INTERSECTION OF ART AND TECHNOLOGY IS often a space where mental and physical realms interact. New tools can help bring existing ideas to fruition. They can also spur the imagination and expand a sense of what is possible. In my own practice, I am particularly interested in engaging technology to see what lies beyond the limits of its intended use.

First as a graduate student and then an adjunct faculty member at University of Florida (UF), I had the opportunity to help establish the new Art and Architecture Fabrication Laboratory (A2 Fab Lab). The facility hosts some impressive hardware including computer-guided laser cutters, a handheld 3D scanner and rapid prototyping machines capable of printing physical 3D objects from digital files. While this sort of equipment has existed for more than 20 years, high expense and a veil of trade secrecy have mostly restricted its use to industrial and scientific applications. Only a handful of academic institutions have

addressed the potential for applying digital fabrication techniques to art making, although that number is quickly increasing as costs shrink and awareness grows.

Eager to experiment with some new possibilities for her ceramic work, Anna Calluori Holcombe enlisted my help with the technical aspects of 3D scanning and printing. She collected a number of organic forms including a calla lily flower, an acorn squash and seed pods from palm and magnolia trees. In the lab, I scanned the objects using a ZCorp ZScanner 700 CX to create high-resolution digital 3D models. The scanner requires objects to be covered in randomly spaced reflective dots, which help it maintain a cohesive picture of the entire surface while the object is being moved around to scan from all angles.

It is worth noting that the ZScanner is promoted by its manufacturer mainly as an industrial tool for reverse-engineering consumer products and mechanical parts. The models that it creates are incredibly precise, though not entirely free of imperfections. Throughout the scanning process, I was struck by the trans-coding aspect of what we were doing, namely, using a living object (an expression of genetic code) as an intermediary to create a digitally coded file describing its form. Like genetic code itself, this conceptual aspect of the work is not explicitly visible in the finished objects, but is nonetheless present in the performance of their creation.



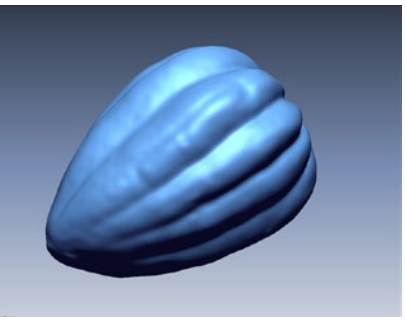
Top: ***Calla Lily, Squash and Lotus Pod Screen Shot after Scanning.***
Above: ***3D Models and their Moulds.***

Using Rapidform 3D modeling software, I removed unwanted information (such as the tabletop where the objects had been resting) from the raw scanner data. I also mended the models to fill small gaps left by the scanning process. We then adjusted their sizes digitally and, in one case, altered shape and proportions.

Holcombe and I used an Objet Eden 260V rapid manufacturer (3D printer) to create solid physical versions of the virtual organic forms from hard, waterproof, durable resin. This machine works by successively layering liquid resin via hundreds of tiny nozzles. The resin is quickly hardened by exposure to an intense UV (ultra violet) lamp. Secondary support material necessary for holding the object together during the printing process is removed afterward with a water jet. Once finished, Holcombe packed the 3D prints in her suitcase and headed to her residency in Hungary.

The A2 Fab Lab also houses another 3D printer, a ZCorp ZPrinter 450, capable of producing full-colour prints by applying inkjet pigment and a binding agent to layer upon layer of plaster powder. Art students at UF have used this machine to create wonderful miniature sculptures featuring intricately coloured patterns and details. The material used in the Zprinter, however, while relatively inexpensive, is quite fragile. It is prone to disintegration when exposed to moisture and, thus, not useful for creating durable moulds for ceramic pieces.

Above: ***3D Prototype Printer.***
Below: ***Screenshot of a Scanned Squash.***



A minimum of digital modification was necessary for the project described by this article but, in general, the possibilities for deforming, combining and scaling scanned forms are practically limitless. The basic advantages of working with virtual models are shared with most other digital art making processes: the ability to undo any previous action, to produce an unlimited number of modified variations without consuming materials, to achieve extreme mathematical precision and to automate repetitive processes. Virtual models can be viewed easily from any angle and multiple perspectives can be shown on-screen simultaneously.

Models can also be created from scratch in a wide variety of software programs, though they do require special care to ensure integrity when printed. Perhaps counter-intuitively, 3D modelling with a computer is often an intensely physical process. Manipulating and viewing a model requires precise mouse gestures and key presses. Although the learning curve feels steep at first, many of my students concentrating in ceramics have quickly found that their dexterity with clay easily translates to modelling with a computer. Through 3D modelling, scanning and printing, distinctions between the virtual and the physical are profoundly blurred.

Daniel Tankersley has taught courses in digital fabrication, videogames, internet art, digital imaging, and time-based media. He is currently an Assistant Professor of Art at Western Oregon University. You can discover his work online at dantank.com.

. . . and Recent Work

Anna Calluori Holcombe describes its effect on her work

Background image:
Natura nel Scatola X (Detail).

THERE WAS A TIME WHEN I THOUGHT THE DISCIPLINES of ceramic arts and digital technology media belonged in different worlds. Then I initiated the process that eventually led to a grant from the University of Florida (UF) Office of Research to set up and equipped a 3D fabrication lab in a collaboration between the College of Fine Arts School of Art and Art History and the College of Architecture. Little did I know how much of an effect the lab would have on my current ceramic work. I have been swept into the magic of this technology and it has helped me to see the future of the field.

A team of faculty, staff and administrators was brought together to plan and set up the Art and Architecture Fabrication Lab (A2 Fab Lab). Daniel Tankersley, a digital media artist in UF's MFA program at the time, assisted in organising the lab. He researched and developed best practices for the new equipment and eventually taught classes for exploring its use for art. All of this technology was so new to me but I had the foresight to hire Tankersley to work with me on 3D scanning and printing.

Why use digital 3D technology for ceramics? First, the files are easily reproduced, altered and resized. They can be transported via email or flash drive, providing a degree of speed and flexibility not found in hand modelling. Most importantly, 3D scanning and printing processes can produce durable models in a relatively short amount of time.

In the summer of 2010, with a generous Faculty Enhancement Opportunity grant from the UF to study European porcelain (see article *Ceramics TECHNICAL*, No. 32, 2011, pp 48–55), I was able to return as a

Above left: ***Natura nel Scatola IV.***
Above right: ***Natura nel Scatola X.***
Below: ***Glazed Herend Porcelain Slipcast Objects.***

resident to the International Ceramics Studio (ICHSU) in Kesckemet, Hungary with a group of invited artists hosted by Joe Bova. This was my second residency there, the attraction being the excellent facilities and wonderful people, as well as the availability of porcelain from the world- famous Herend Porcelain factory. The ICHSU is the only place outside of the factory where this porcelain slip is available.

My first visit in 2004 had been a month-long residency and I had handbuilt the models to make the moulds that I used. There had been ample time to build the models, make the moulds and then slip cast. I continued my *Tondo* series, which I had been working on for some time; this time in porcelain, however, rather than earthenware. I china painted and lustred the glazed work, then mounted the pieces on to thrown porcelain plates.

In preparing for this second visit, I realised that I would have only half of the time of my previous stay. Since working with Herend porcelain was my main goal, I had to reconsider the time-consuming model and mould-making part of the process. Moulds are heavy to transport and thus expensive, but I determined I could make the models ahead so I could quickly make moulds upon my arrival to Kecskemet. Working together, Tankersley and I produced eight prototypes for me to take to the residency. We scanned organic objects such as fruits, vegetables, seedpods, and so forth. My interest is in their basic forms and how they might be used to create small vessels. Some of the same considerations when making models for moulds by hand (such as avoiding undercuts and too much texture) are also considerations in scanning and printing an object for this use. One of our 3D printers proved useful in manufacturing models that can be used over and over again to make moulds.

From the point of the mould-making, this process becomes 'traditional'. I spent my first few days in the plaster studio making about eight moulds of the 3D rapid prototyped models. I slipcast them in Herend Porcelain, adding and combining forms. The slip, amazingly beautiful when fired in reduction to cone 12 (resulting in a cold white) and in oxidation to cone 11 (resulting in a warm white). I then applied china paints, lustre and decals after I returned to my studio at home.

This new series, *Natura nel Scatola*, allows me to explore some familiar themes and some new ones. I am particularly interested in the juxtapositions I can create. Some of these combinations include the permanence of clay versus the ephemera of paper, the 2D collage versus the 3D clay object and, fittingly, nature versus the current technologies.

I continued to scan and print with Tankersley upon my return from Hungary in preparation for a Visiting Artist in Residency at Australia National University (ANU) in May-June 2011. At a certain point, I realised that I was limiting myself to found objects and if I wanted to create my own forms it would be best to learn the 3D software. I sought the tutoring of Zacharias Castedo-Rodgers, another MFA student of the UF Digital Media program. Although there are many packages from which to choose, Castedo-Rodgers expertise is in AutoDesk Maya, the software of choice for many animators. I will never use all of the capabilities of Maya, as it offers an incredible number of options for constructing forms, adding texture and so forth. In a tutorial approach, he built a model of a heart that I had chosen, with my personal twist of using the veins typically found on leaves rather than in hearts. This software allowed me to combine two of my iconic shapes and to continue with the concept of ambiguity.

My first of four weeks at ANU involved mould making, this time some more complicated model forms and hence more parts per mould. With this new series, *Piante*, I took the work off of the wall, combining many of the shapes to create unique forms with a much broader vocabulary.

What does the future hold? From my perspective, as 3D scanners and printers get smaller and more affordable, they will become established tools of ceramics artists. A 3D printer that can print clay is close to becoming a reality. Scanners and software for 3D imaging are becoming more and more sophisticated with endless possibilities for form. Students are being exposed to these technologies and looking at the possibilities with a fresh eye. Using these tools, in collaboration with conventional tools and materials, will allow for new designs and easy low-volume production. Personally, I am excited about what the future holds for my work and across the ceramics field I can see the same anticipation building about the technology.

Suggested reading
The Manufacturing Guides: Prototype and Low-Volume Production, Thompson, Rob. New York: Thames and Hudson, 2011.

Background image:
Natura nel Scatola IV (Detail).

Anna Calluori Holcombe is a Professor of Ceramics in the School of Art and Art History at the University of Florida. Her research on 3D scanning and printing are documented in her blog annaholcombe.blogspot.com .