INTRODUCTION

How can one distinguish between the work of man and machine? That line has been all but absorbed today with the emergence of parametric and computational design technology. With the emergence of digital technologies and parametric design, a growing obsession in digital formalism is more evident in the new generation of architects. With several courses taught at the University of Cincinnati, as well as several thesis researches in the past two years, the authors experimented a series of research projects that investigated combining digital (machine) and analog (man) craft and its processes. Material and method of fabrication were examined while utilizing various tools such as 3D printing, CNC machinery, conventional mold casting and vacuum forming techniques. These findings demonstrated the convergence of digital and analog methodologies influenced by the concept of craft as a driver for architectural form.
EXPERIMENTS

The practice of machining artifacts follows the idea of embedding memory of fabrication and design processes into the built artifact. The project titled “dragon skin” presents research conducted in CNC customized tool path for generating complex surface texture. Machining artifact becomes apparent as unique surface texture is generated, developing emergent patterns from manufacturing processes. The model is then casted into porcelain and metal. The machining artifact is translated by man during the mold making, casting process.

SEAMLESS ORNAMENTATION WALL
CNC+VACUUM FORMING

In this project, digital production processes that were used during the course allowed for distinct design and fabrication phases. The ornamentation panels required the use of parametric modeling techniques with Rhino, Grasshopper, and Maya for the design of forms and components based on a seamless pattern across large surface. A panel mold is fabricated with CNC and used for multiple vacuum forming. The “dripped” form during the vacuum forming is different from its mold due to the material stiffness of polythermo, forming temperature and time. The “unexpected” result, as a new man-machine approach, is promoting designers to consider evaluation processes and material behavior to inform the design process.
INTEGRATED WORK OF MAN AND MACHINE
SEAMLESS POROUS WALL
3D PRINT + CERAMIC MOLD CASTING

In this project, man-machine relationship can be understood in this context as the ability of the craftsman to interpret complex mathematical model and act as they take place in terms of both design generation and design production. A porous CMU block is 3D printed and used as a prototype for ceramic production. Due to the delicate nature of the 3D printed object, it is necessary to create a mother mold using silicone in order to generate a solid plaster copy that will withstand the physical demands of the plaster mold making process. A complex multi-piece plaster mold in tandem with slip-casting processes is used to mass produce the CMU block in ceramic. The CMU blocks are then used to create a seamless wall. There are many challenges such as the tolerance and limitations of the physical properties of ceramic materials, such as multi-piece mold making, and shrinkage and warping during the firing process.

IMAGE CREDITS
Research project: Ming Tang, Colin Klimesh, Merrick Anderson, Julie Ward, Andrew Glass, Melisa Long
Seamless Ornamentation Wall: Luke Sherron, Zak Kolada, Diego Macias, Jonathan Wilkinson, Lauren Buffenbarger, and other students in ARCH3014 and ARCH7013

MING TANG, LEED AP, is the Assistant Professor at School of Architecture and Interior Design, University of Cincinnati. He is also the founding partner of Tang & Yang Architects, which has won numerous design awards internationally. He is the author of the book, Parametric Building Design with Autodesk Maya, published by Routledge in 2014.

COLIN KLIMSESH is currently working toward an MFA in Studio Art at the University of Cincinnati. With a background in Ceramics and Print Media, he is pursuing research that employs the use of digital technologies—such as 3D modeling software and rapid prototyping—in tandem with ceramic materials and processes to generate sculptural objects and installations.