

THE INTERDISCIPLINARY CLASSROOM

Universal Design and Fabrication was a course conceived as part of a new interdisciplinary classroom research space called the Digital Craft Research Lab (DCRL) housed within the department of Art and Design and the University of Wisconsin-Milwaukee. The DCRL offers students, researchers, and faculty access to both low-resolution and high-resolution prototyping machinery and materials to conduct design and art-based research. The space was conceived as an interdisciplinary research space accessible to makers across the university campus and hosts several interdisciplinary courses. This poster reports on the role of interdisciplinary participatory research methods and results of the Universal Design and Fabrication course.

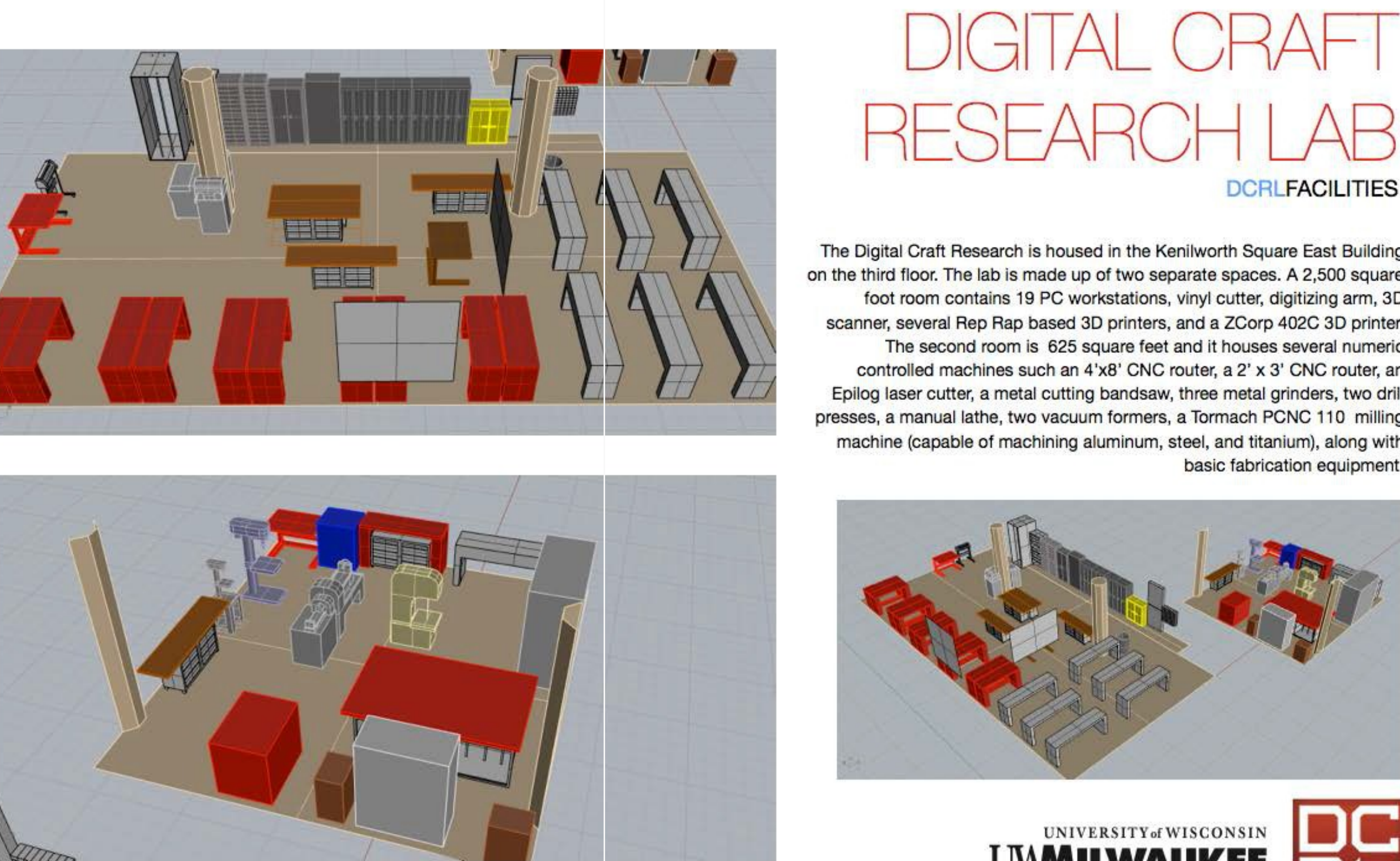


Figure 1. Images of the DCRL classroom space.

BREAKDOWN

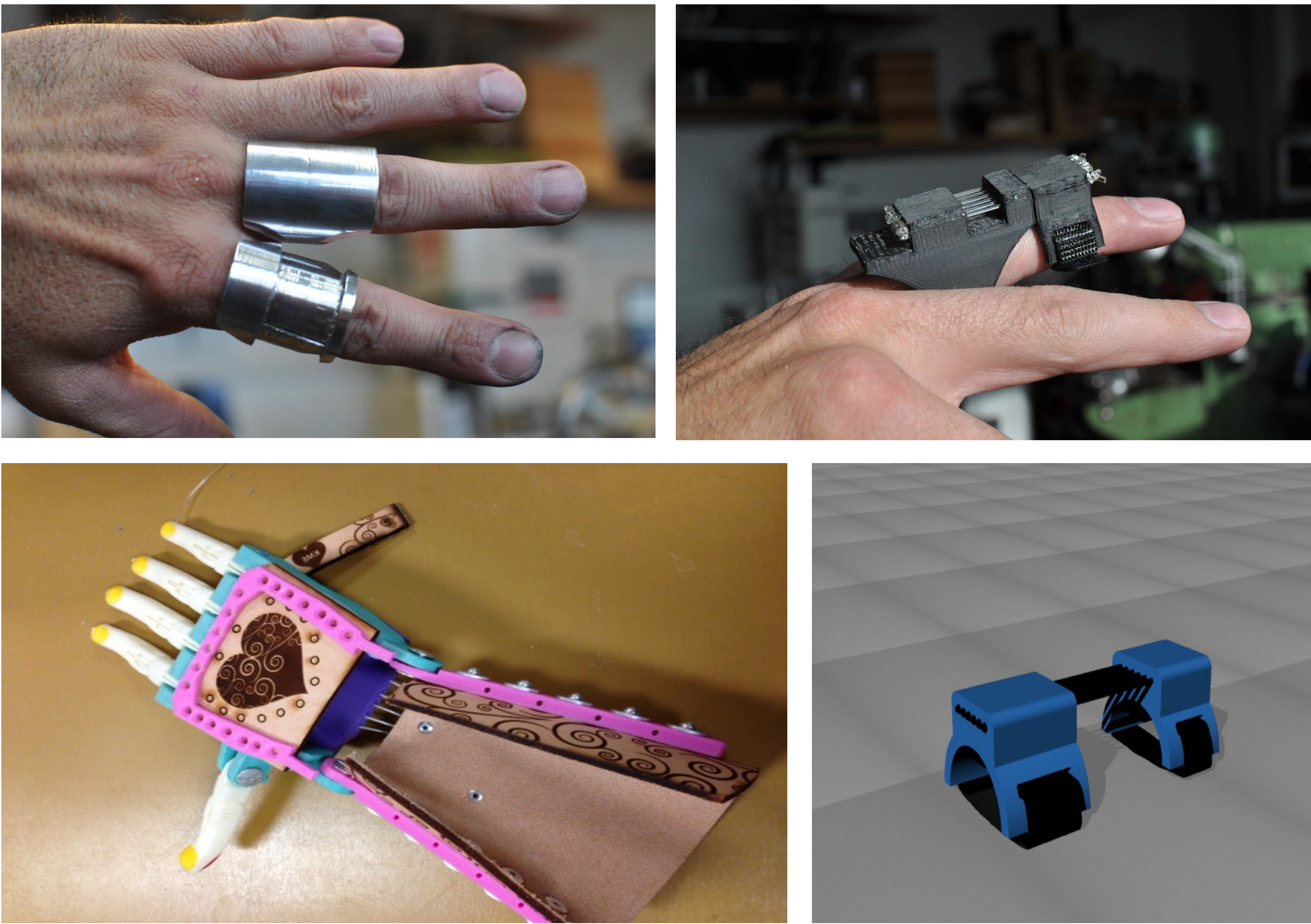
Universal Design and Fabrication is offered during the spring on a yearly basis and is cross-listed with programs in Art and Design, Engineering and the Health Sciences. The course ranges from 16-21 upper level undergraduate and graduate students from across campus and has been taught by art, design and health science professors.

In this course, students are asked to fabricate between three and four projects focused on personal and spacial orthotics over the course of 15 weeks, culminating in a public critique and poster session of the finalized work.

Students use 3D printing and modeling programs in addition to laser cutting and CNC routers to create their final prototypes for the course.



Figures 2-6 (clockwise from top left). *Figure 2* Silicone custom fit dust mask with universal attachment. *Figure 3* Wayfinding mask using sensors for navigation. *Figure 4* Directional hearing enhancement for riding bikes. *Figure 5* Spec mask to reduce/enhance smells. *Figure 6* Weighted hood for use with sensory issues.



Figures 7-10 (clockwise from top left). *Figure 7* Jewelry-based finger orthotic for finger contractures. *Figure 8* 3D printed flexible finger orthosis. *Figure 8* Model of above finger orthotic. *Figure 10* 3D printed and leather etched hand prosthetic.

RECOMMENDATIONS

An audit of the course following it offering over the prior two years revealed the following student-based criticisms of the course.

- Additional knowledge of kinesiology for design and engineering students is required to make educated decisions on prosthetic-based work.
- Fabrication time needed to make 3-4 projects required by this course dictated a higher credit hour allocation.
- Access to the fabrication space was necessary on a 24 hour basis. In order to accommodate this, we added the addition of 3 hours or weekly “student tech” hours to maintain the lab as well as keep it open beyond the typically student work day.
- 3D printed greatly increased the prototyping timelines and many students had long printer wait times and resulting printer failures.



Introduction

Catalhoyuk is a circa 9000 years old settlement located in Central Anatolia, Corum Region, Turkey. The site is particularly important as it is the first known settlement with a city planning map and roof top street infrastructure. The site, in terms of buildings and daily life objects, is very well preserved. With this property, it is possible to research and observe daily life of ancient citizens in this settlement.

All buildings in the settlement are constructed with a traditional material named Kerpik which is commonly used by ancient Mediterranean civilizations. Eventhough there are various formulas of Kerpik in Mediterranean Region, main components of the material is soil, water, and wheat or barley straw.



Tomb Wall Figurine

Biomaterial Research:

- 1 Biomaterial research started with sample analysis of 20 different samples gathered from Catalhoyuk and rural areas in the hinterland.

Buildings in the hinterland were aged between 80 to circa 500 years old. Circa 500 years old building was a public kitchen in Corum Alaca Village region, with restored wall cracks with the same material after an earth quake in 1960. All of the sample sources were fully built with kerpik, including the roofs.

Samples were in dimensions of 2cm x 2cm x 2cm with close a proximity. All samples were lab tested to find out material properties and similarities.

Conclusion:

Traditional kerpik, a type of mudbrick, which is durable, sustainable, and a low cost material can be manufactured with industrial methodologies. It can be a good material alternative for sustainable and affordable housing.

Bibliography:

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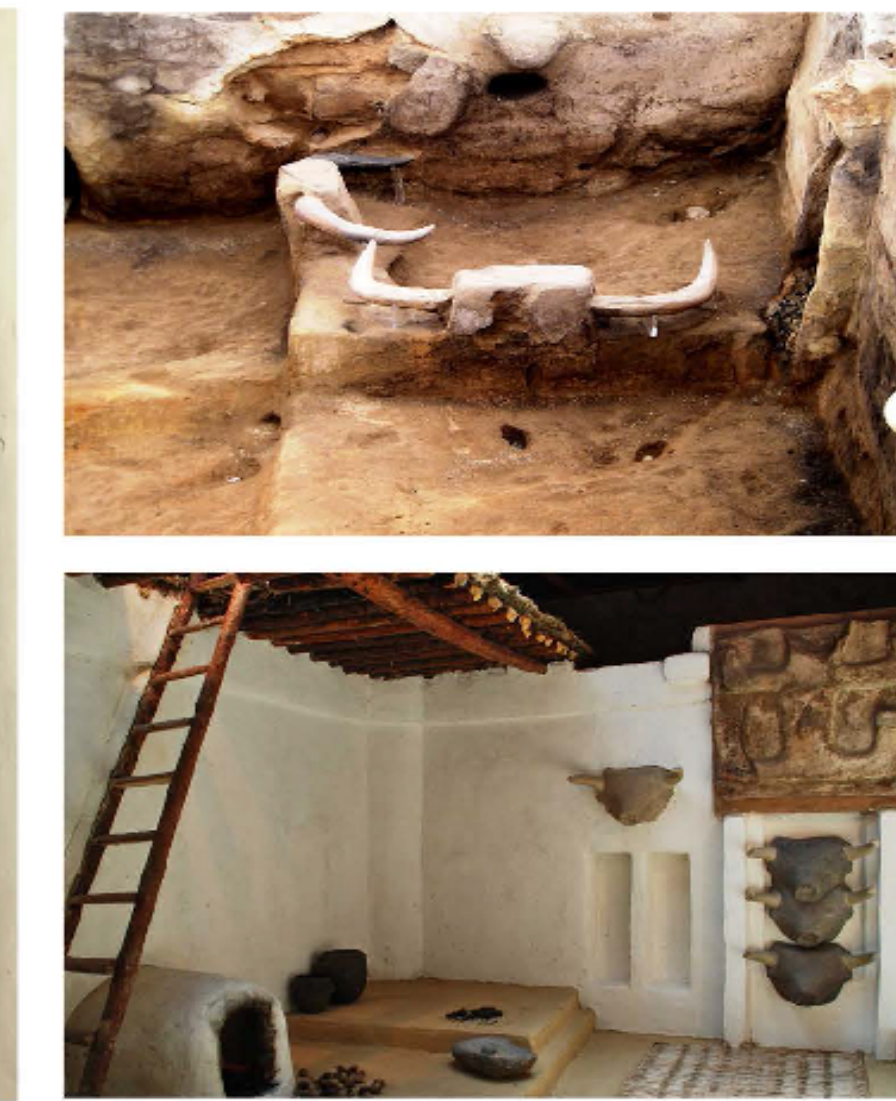
Excavation site



Excavation site



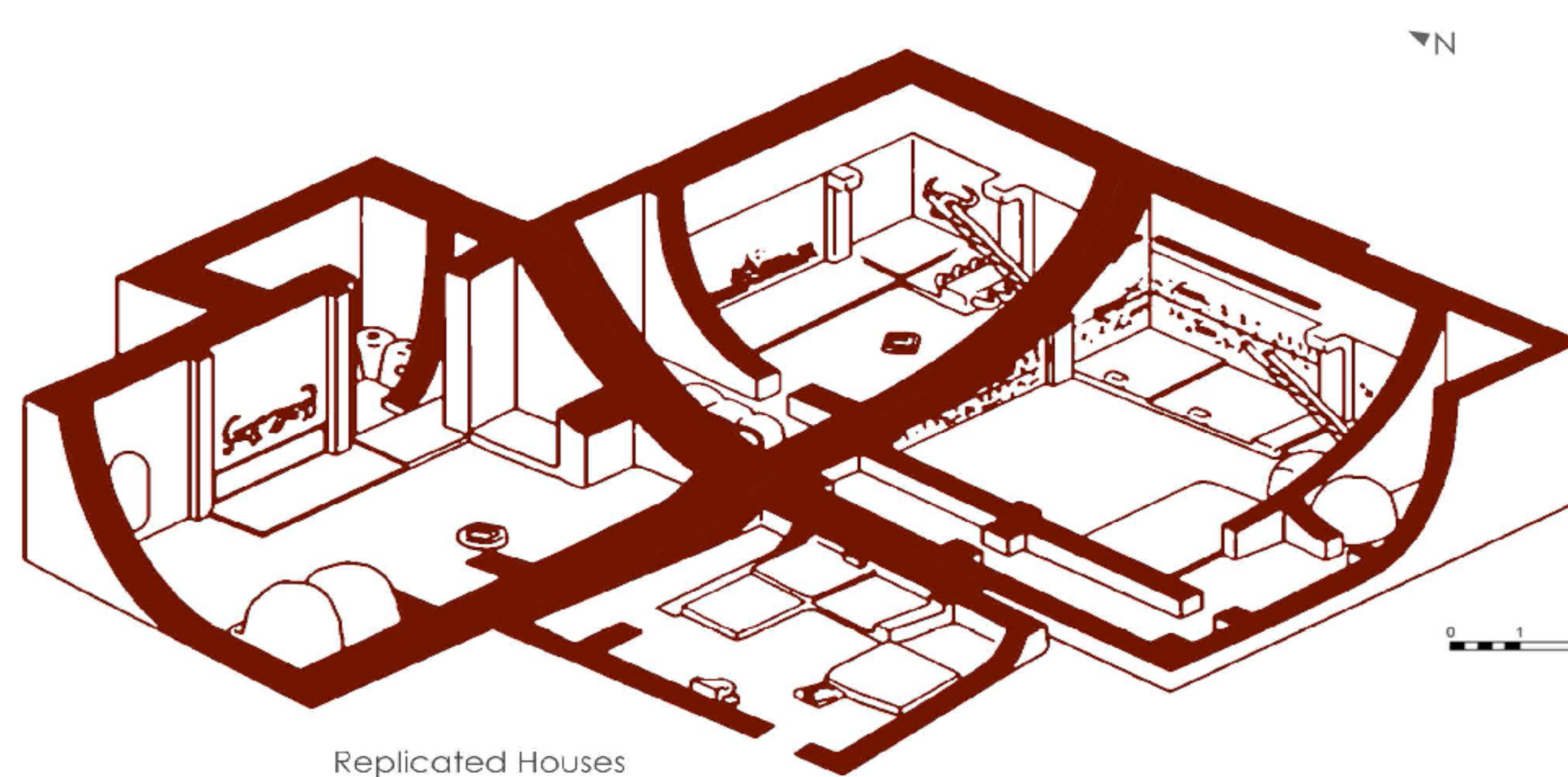
Replica House representing the original finding from circa 7000BC/ Site Museum



Bull Skulls in excavation site / Museum



Excavated Site Plan / 2015



Replicated Houses

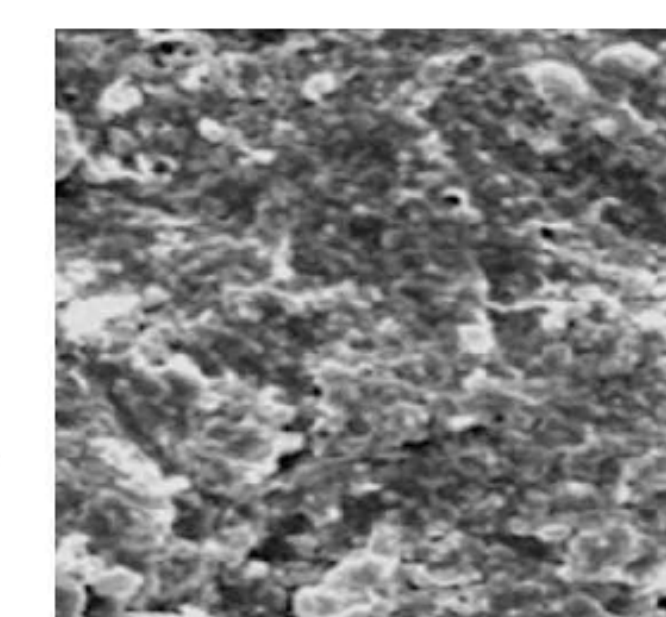


Wall Ornamentation Pattern / Hunting / circa 7000 BC

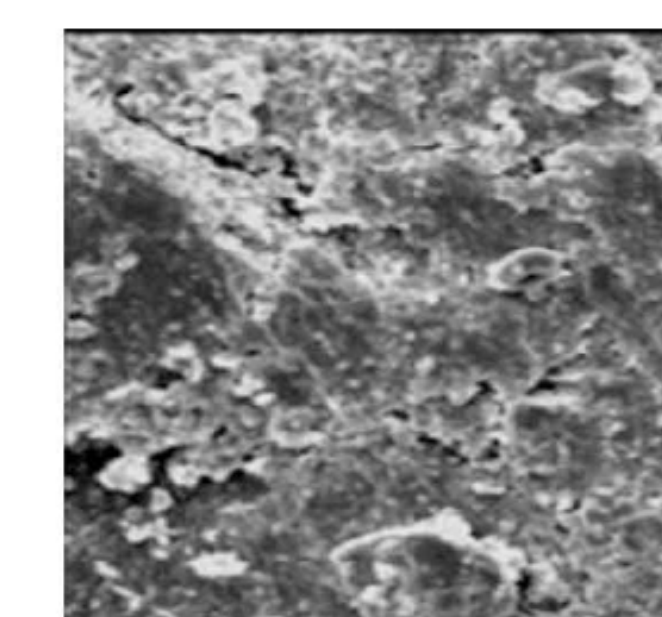
Ethnographic Research:

During the ethnographic research it is found that animal sacrifice ceremony was common in daily life of Catalhoyuk Citizens, practiced before most of the important occasions as before birth of child, after death of family members, harvesting, spring solstice, before marriage, and building a house for newly married couple. Archeological researches address that hunting for "religious" ceremonies was also very common in their life, and blood of hunted animals were used as sacrificial presents in sanctuaries. Findings show that there was a particular importance of scarifying bull and keeping the skull of animal as a symbol of present, this practice shows similarities with Mithraism religion.

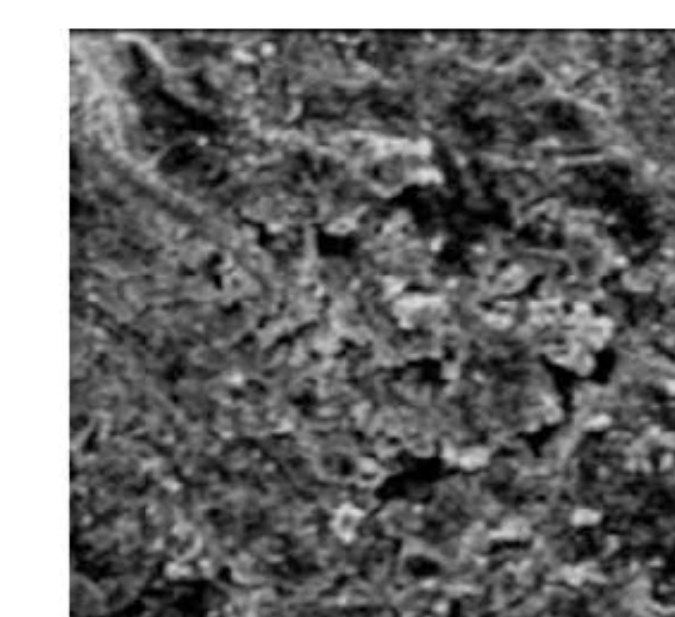
In following stage of ethnographic research, verbal history and recipes about kerpik housing in the rural hinterland of Catalhoyuk were focused. It is found that similar animal sacrifice ceremonies were still held before constructing kerpik houses. The ceremonies had several stages as; slaughtering animal, draining blood, mixing blood with animal's feces and keeping the mixture in the foundation of house for seven days, and mixing soil, straw bale and water with this mixture to build the house.



Catalhoyuk Sample



Corum Alaca Sample



Lab Generated Sample

- 2 Samples were tested of density, porosity, water absorption, shrinkage, hardness and compressive strength. Mineralogical composition, granulometric distribution, fibre from straw bale examined. Mineralogical composition and fibre amount in all samples varied but porosity and water absorption showed similarities in samples. Random sized porosity around fibres referred to carbon monocyte emission, which is a characteristic of bacteria and or yeast existence in the medium.

- 3 Material samples were created with bacteria and yeast composition. Selections were made according to bacteria families existing in intestinal flora of herbivorous animals, particularly bulls and cows.

- 4 Sample created with "Bacteroides fragilis", "Clostridium spp", "Bifidobacterium" and live yeast "Saccharomyces cerevisiae" in lab environment show proximate similarities in porosity, water absorption, shrinkage, hardness and compressive strength with Catalhoyuk and other samples.

Sebnem Yanc Demirkan

Professor of Practice

sebnemyd@ksu.edu

Kansas State University

Faculty of Architecture Planning & Design

Department of Interior Arch. & Product Design

Abstract:

Following the Footprints of an Ancient Constructural Biomaterial in Catalhoyuk:

Research on Re-formulating Traditional Kerpik

This ethnographic and biomaterial research focuses on Catalhoyuk, circa 9000 years old settlement in Southern Anatolia, Turkey, in scope of Kerpik, a traditional mudbrick construction material.

Catalhoyuk is an important ancient settlement with the properties of having a well-defined infrastructure map and architectural samples with well preserved dwellings.

The material used in the region is Kerpik, a form of mudbrick commonly used by ancient Mediterranean civilizations.

The starting question at the background of this research was what made mud, simply soil, water, and straw bale durable up to 9000 years.

Ethnographic research phase focused on existing formulas in rural areas and biomaterial research phase focused on methodologies to re-formulate fermentation in mud to create a new, mass producible Kerpik formula.

As a conclusion, traditional biomaterial kerpik can be manufactured with fermentation of soil and strawbale with Bacteroides fragilis, "Clostridium spp", "Bifidobacterium" and live yeast "Saccharomyces cerevisiae".

Kerpik can be a low cost, durable and sustainable material for affordable housing.

KEYWORDS:
Biomaterial, Kerpik, Mudbrick, Affordable Housing



Design Principles & Practices