

Learning by Doing

Eric Peterson, PhD

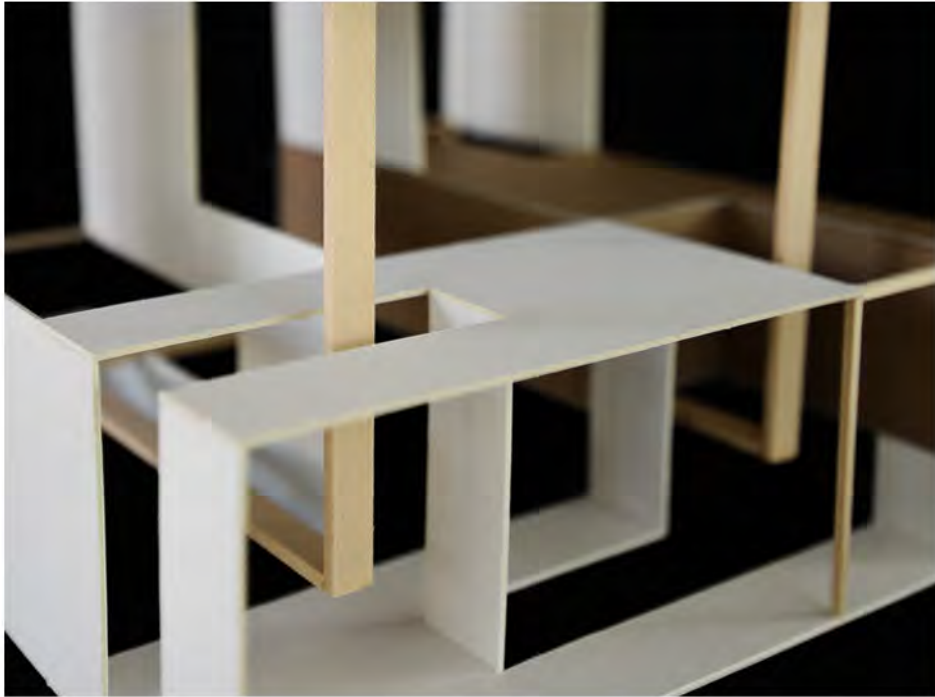
Assistant Professor
School of Architecture
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Education

PhD in Design, Università degli Studi di Genova
Master of Architecture, University of Florida
Bachelor of Arts in Sociology and Anthropology, Middlebury College

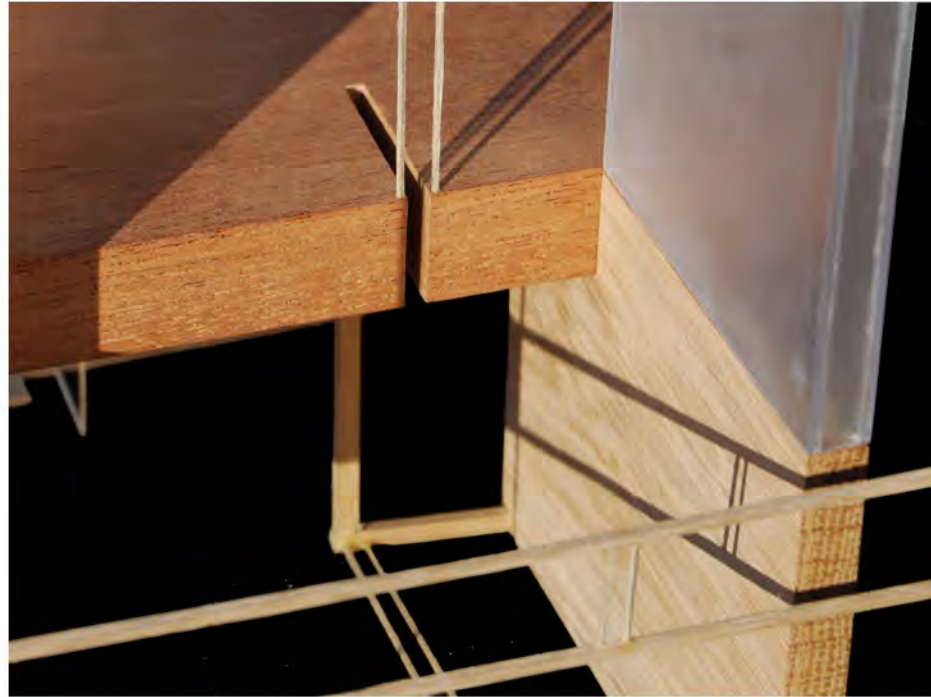
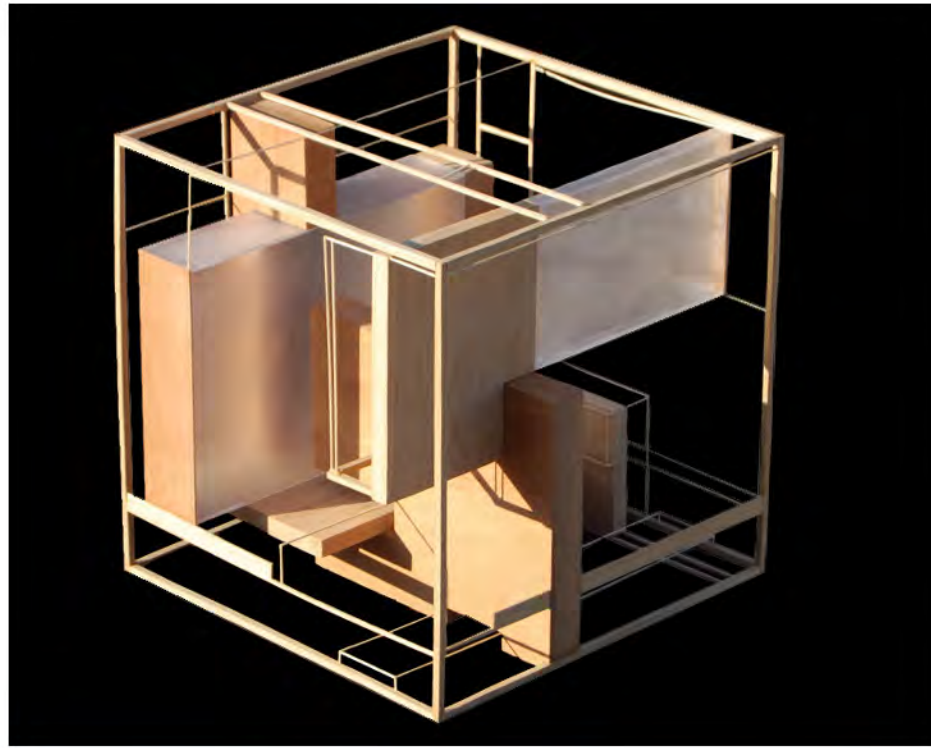
Specialization

Curriculum and Pedagogy for Alternative Learning Environments,
Study Abroad Programs, Interdisciplinary Architecture & Design Studios,
Furniture Design, Fabrication, Design/Build, CNC and Robotics.



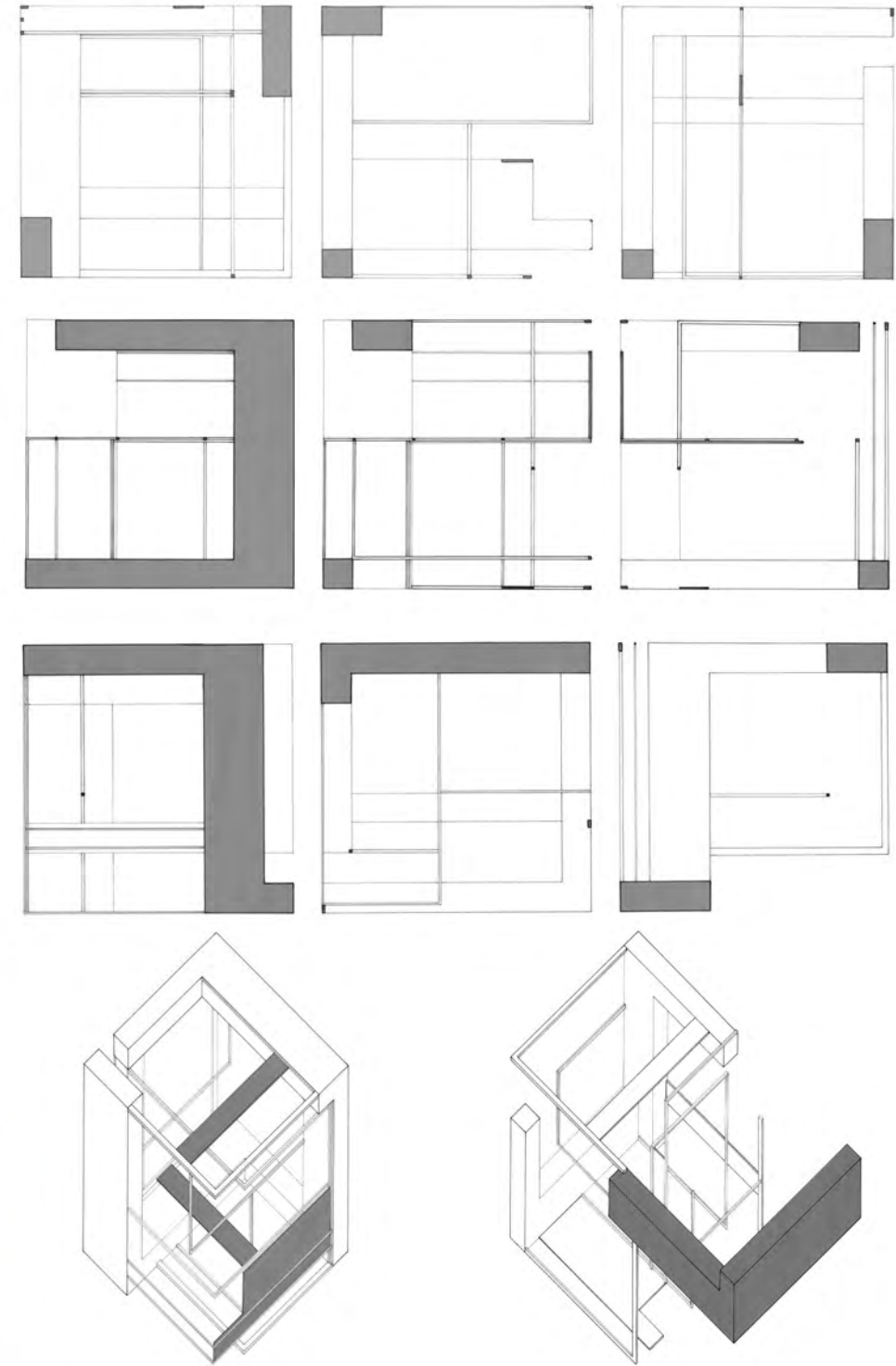
Articulating Space

Beginning design studios focus on the fundamentals of architectural space-making: defining and controlling space using systems of mass, line, and plane.



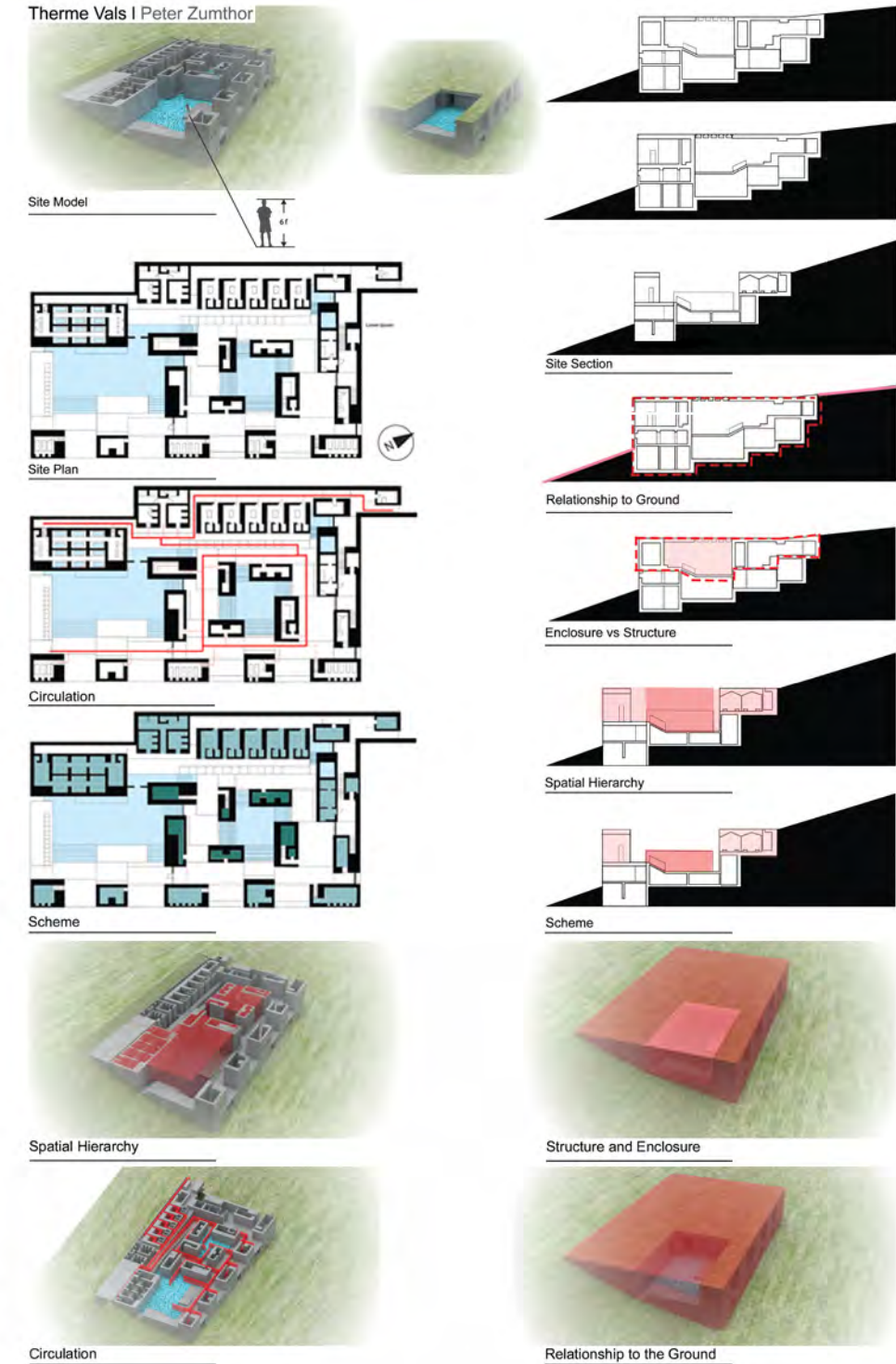
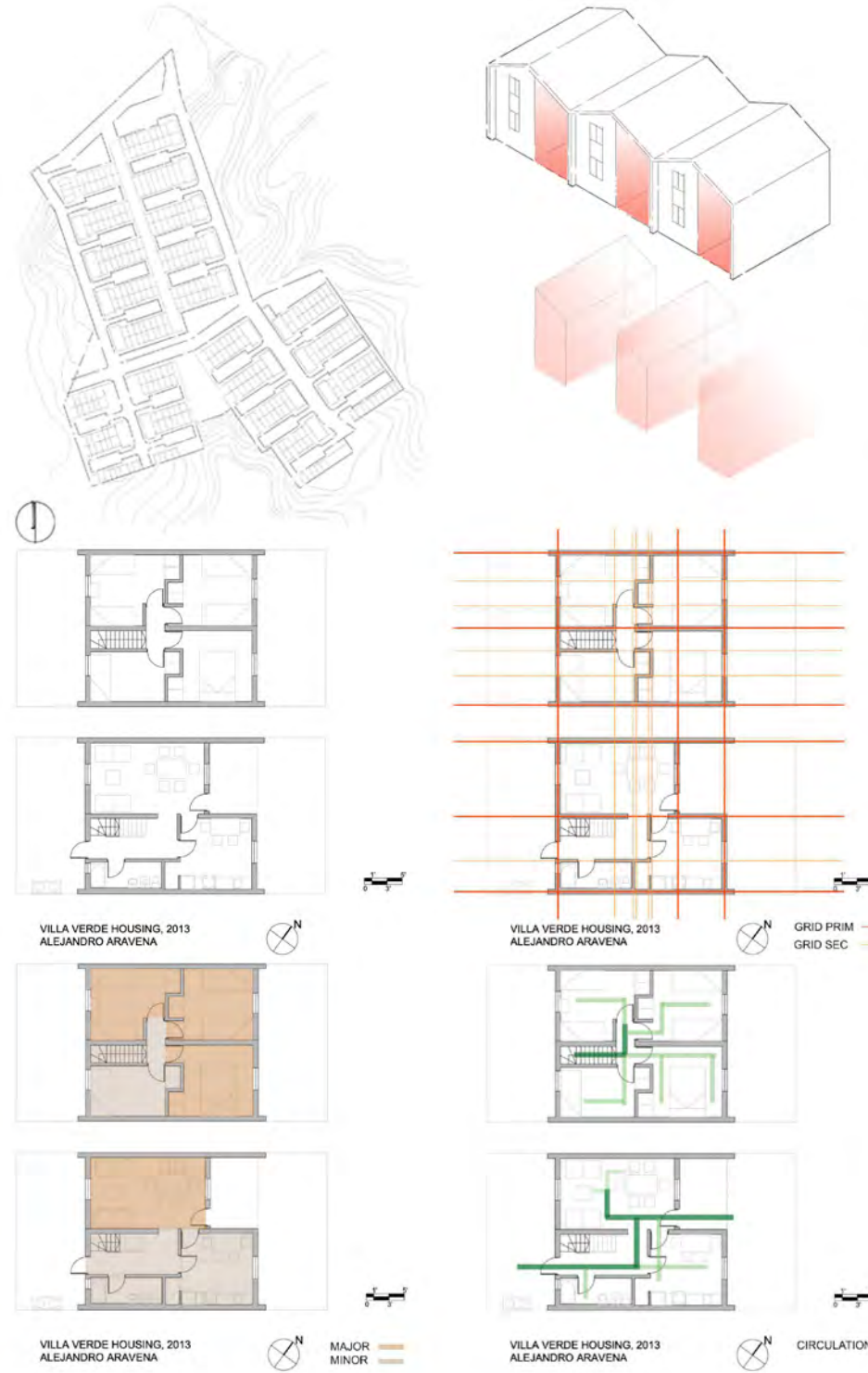
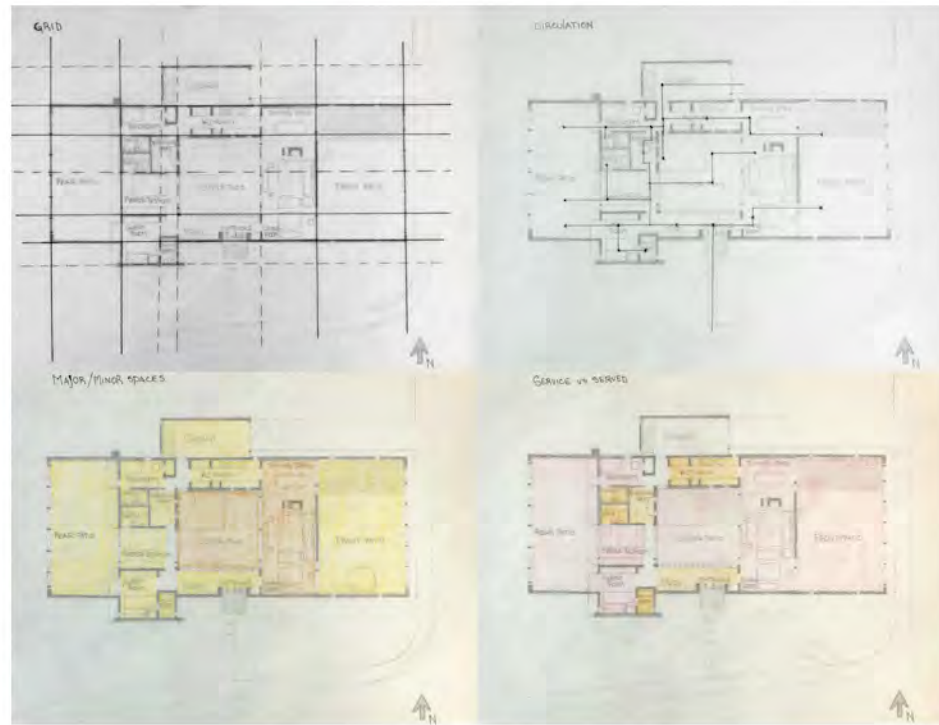
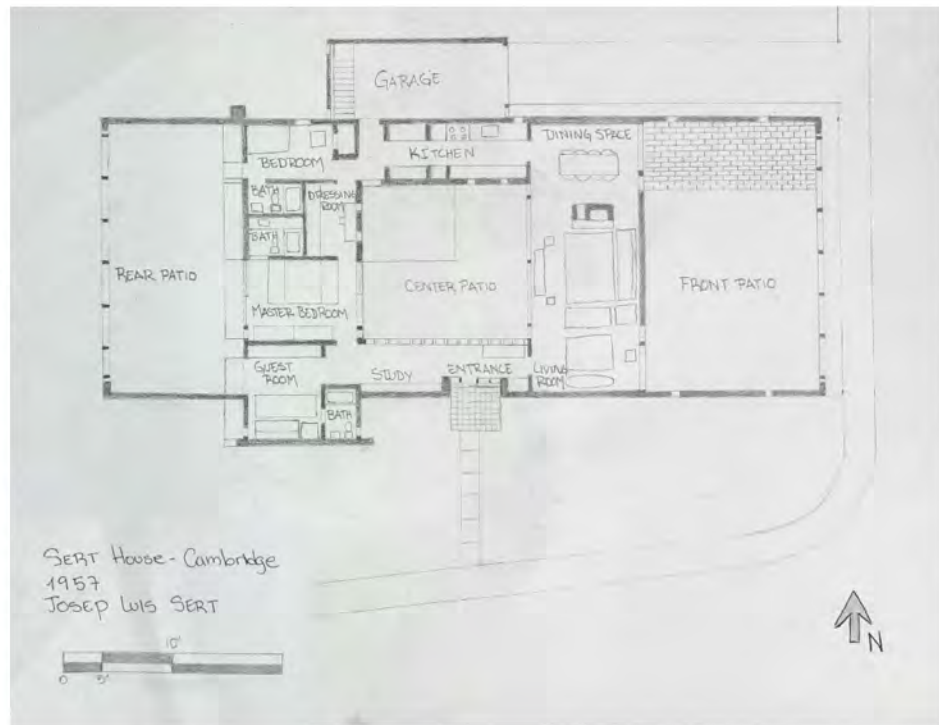
Materiality and Craft

Formative students learn their craft by working with a variety of modeling materials and methods including paper, chipboard, matteboard, basswood, acrylic, and hardwood.



Digital Tools

Software for drawing and diagramming simple spatial compositions is a critical component of the first-year curriculum helping students to build basic graphic literacy.



Hand-Drawn Diagrams

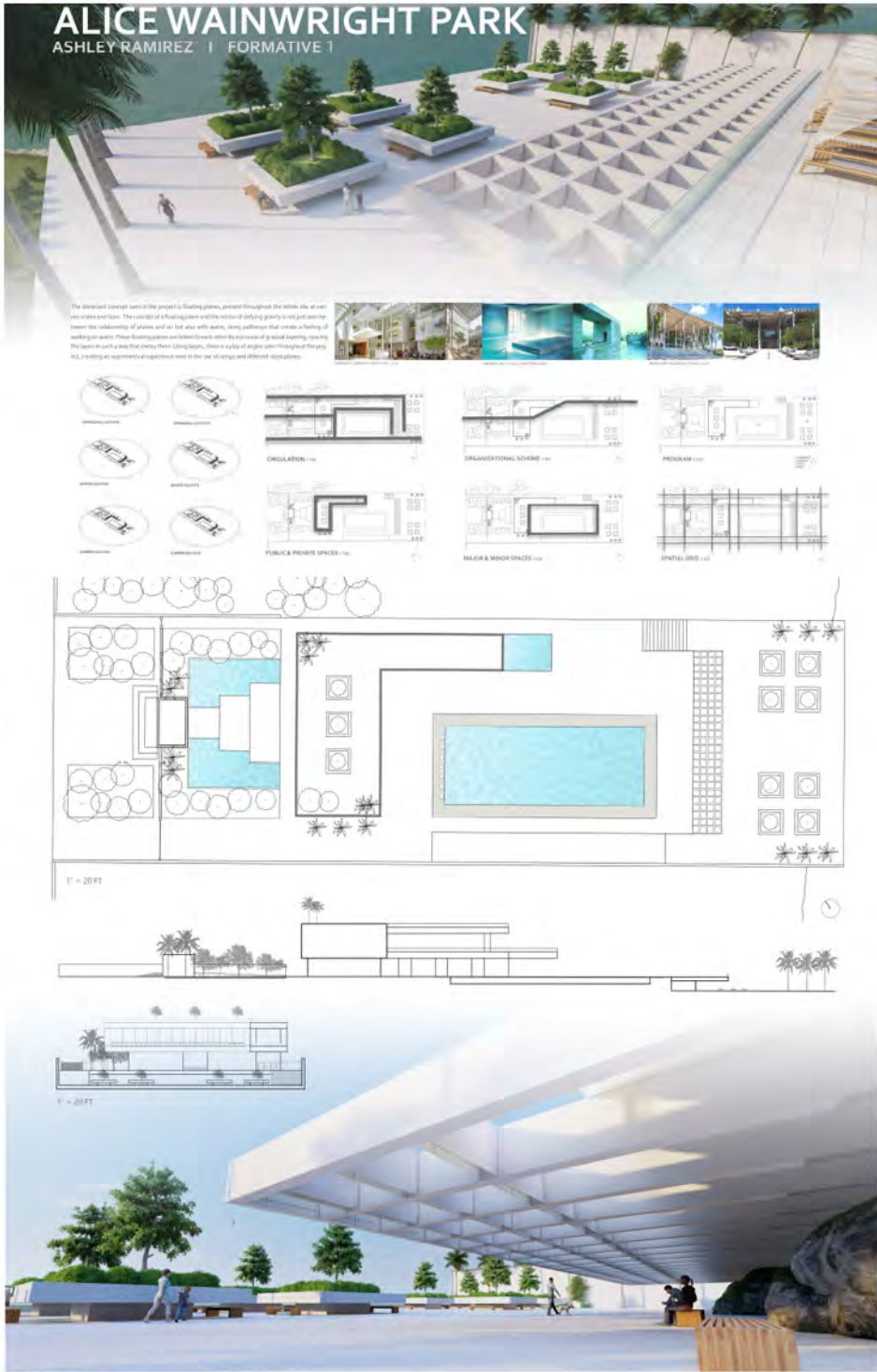
Copying scale drawings of important precedent projects and creating diagrammatic overlays with trace paper is an effective method for learning how to draw and analyze architecture.

Digital Diagrams

Precedent studies teach analytical skills and provide an opportunity to learn computer aided drawing software and graphic design programs including AutoCAD, Photoshop, and Illustrator.

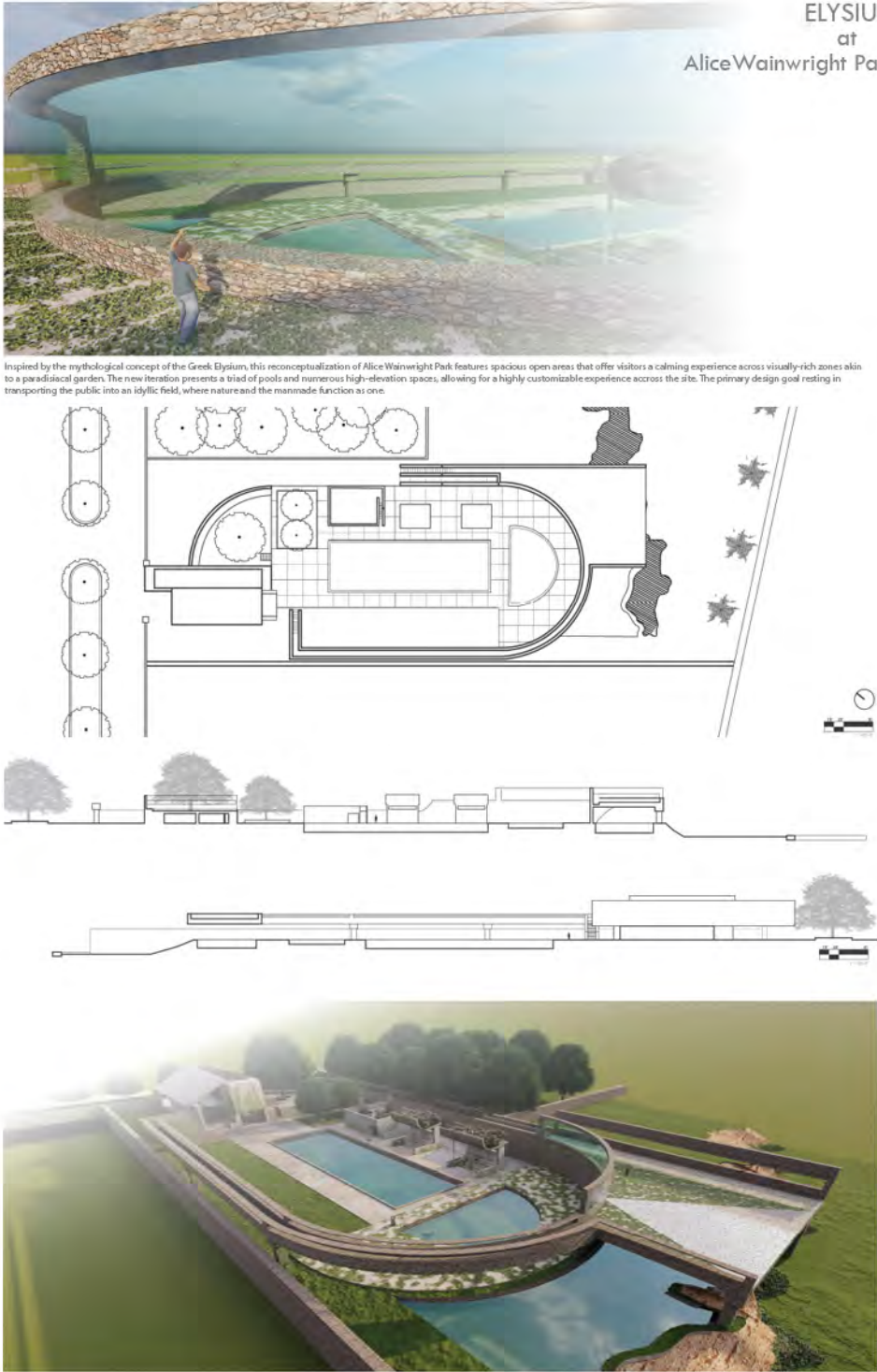
3D Model Diagrams

Digital models are also effective tools for learning how to analyze architecture using 3D modeling and rendering software including Rhinoceros and Sketchup.



Digital Design Skills

Formative students develop new skills quickly. This project from 2019 used AutoCAD and Illustrator for intitial diagrams, Revit and Photoshop for orthographic drawings, and Lumion for final renderings.



Concept and Form

Learning how to develep an idea that expresses itself through design is a critical skill. This project from 2020 relies on an ancient concept from the Western tradition to support an emerging formal language.



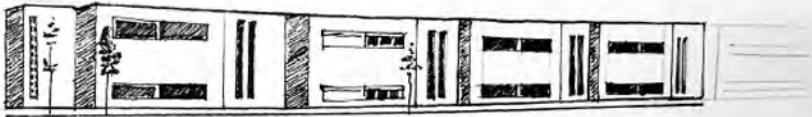
Site Analysis and Site Planning

Site analysis is a critical component of the first-year curriculum. This project from 2021 demonstrates how rendering can be used as a tool for testing analyses with architectural massing and programming.

DESSAU - TÖRTEN HOUSING ESTATE

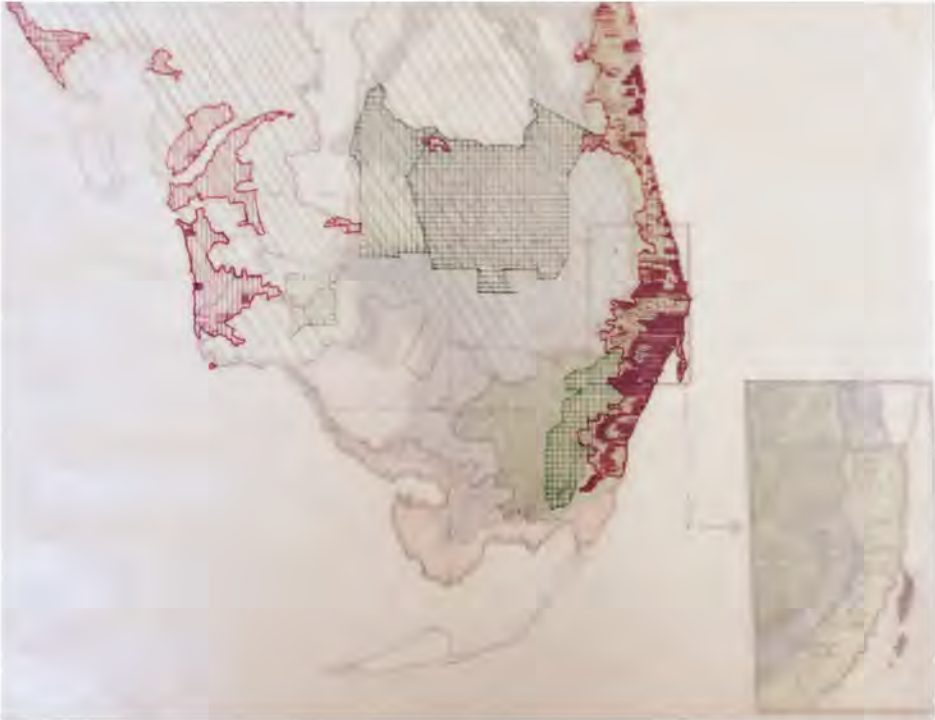
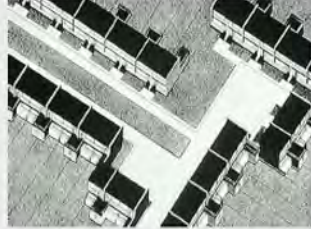
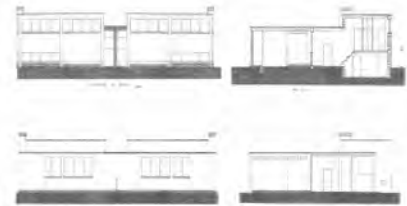
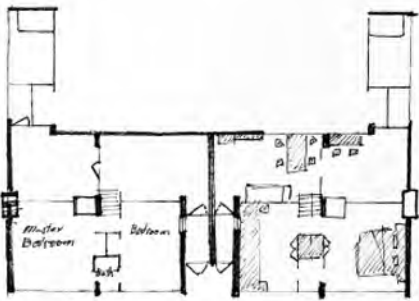
DESSAU, GERMANY 1926 - 1928 RESIDENTIAL

Shortage of affordable residential housing during Weimar Rep. in Germany (1919-33). Expertise of Bauhaus used by Dessau; Bauhaus director, Walter Gropius, commissioned to build a housing estate with 314 single-family houses in the suburb of Törten. Individual assembly of prefabricated building components (reduction of costs), standardization & cost efficient work routines (modeled after assembly line mass productions in the US).



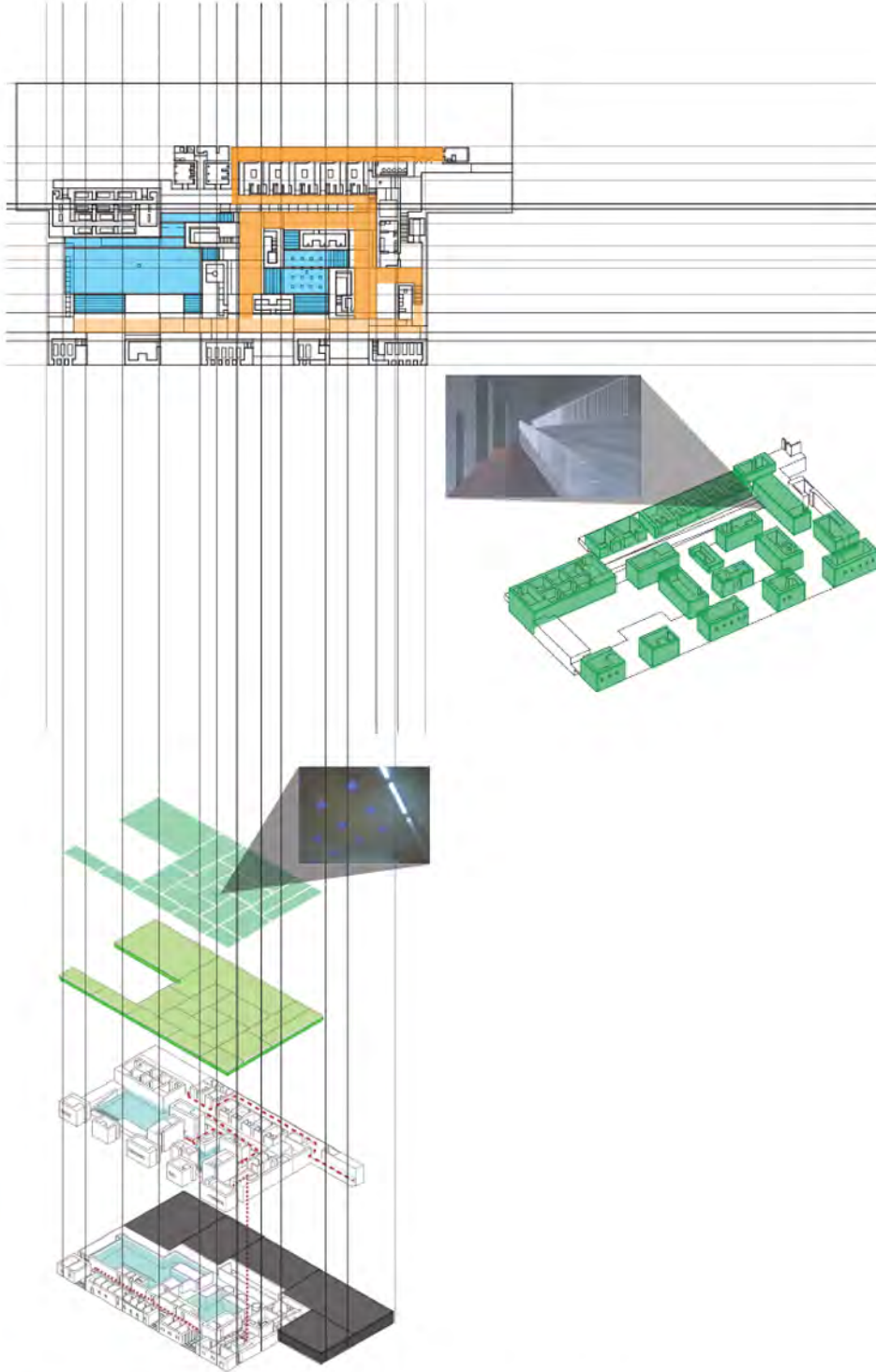
Constructed over 3 main building phases. 3 different house types: 74 m², 70 m², 67 m². To keep living costs low, the houses had gardens where residents could grow produce & have livestock. The houses were combined in groups of 9-12 units. The facades are ÷ by vertical & horizontal rows of windows; the inside's color scheme were light colors.

Residents highly criticized construction defects which caused the overall construction costs to rise. The owners often changed the structure, facades, & interiors. In 1993 the city of Dessau acquired the house on Miltberg 38 & restored it.



Mapping as Discovery

Drawing large layered maps on trace paper or vellum allows students to find patterns, relationships, and systems of order that can inform how they choose to operate at the scale of site and building.

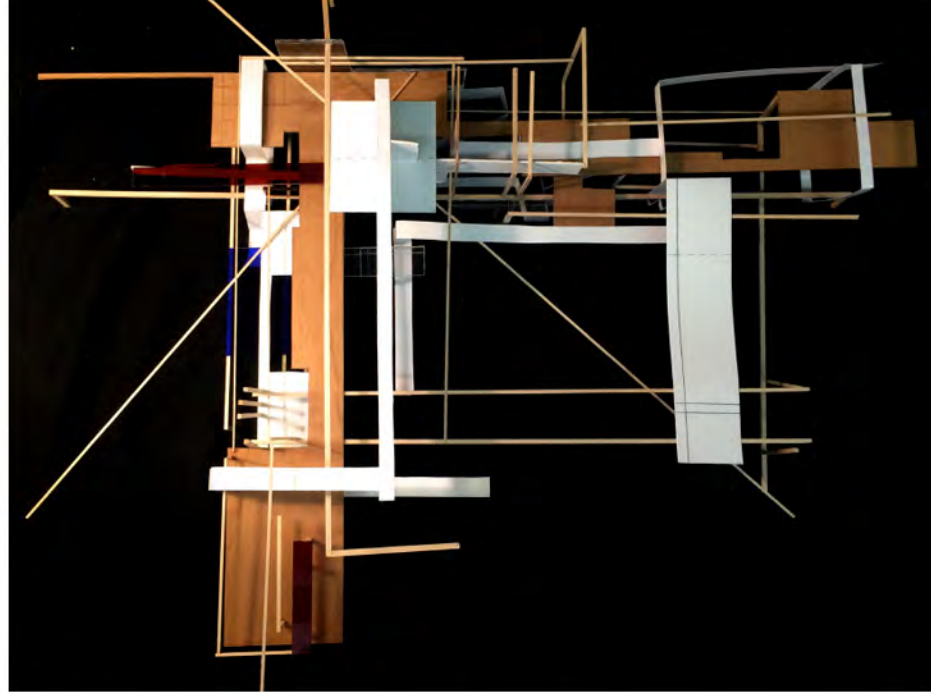
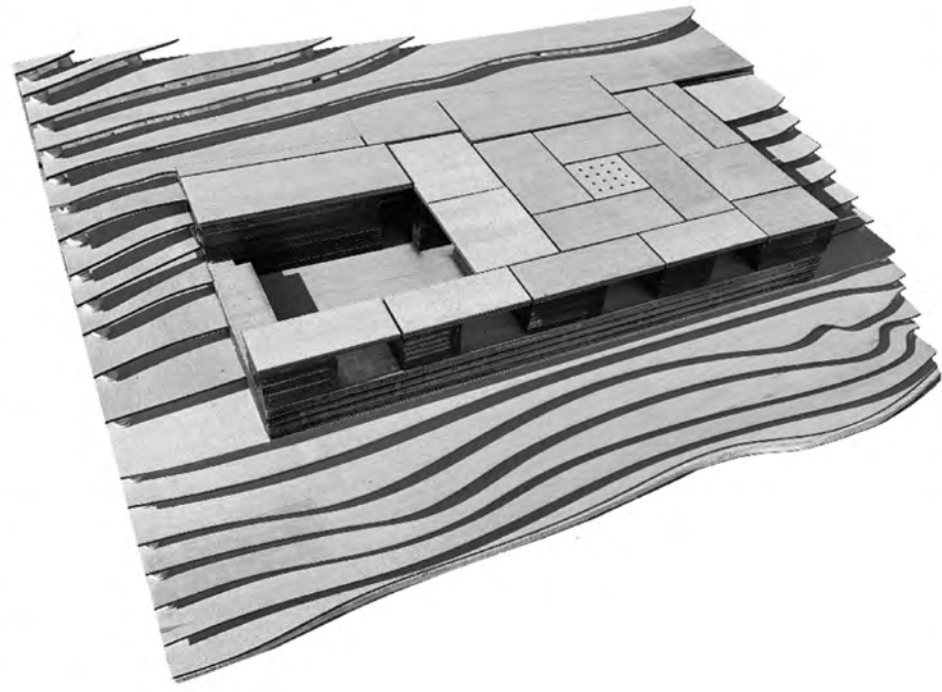
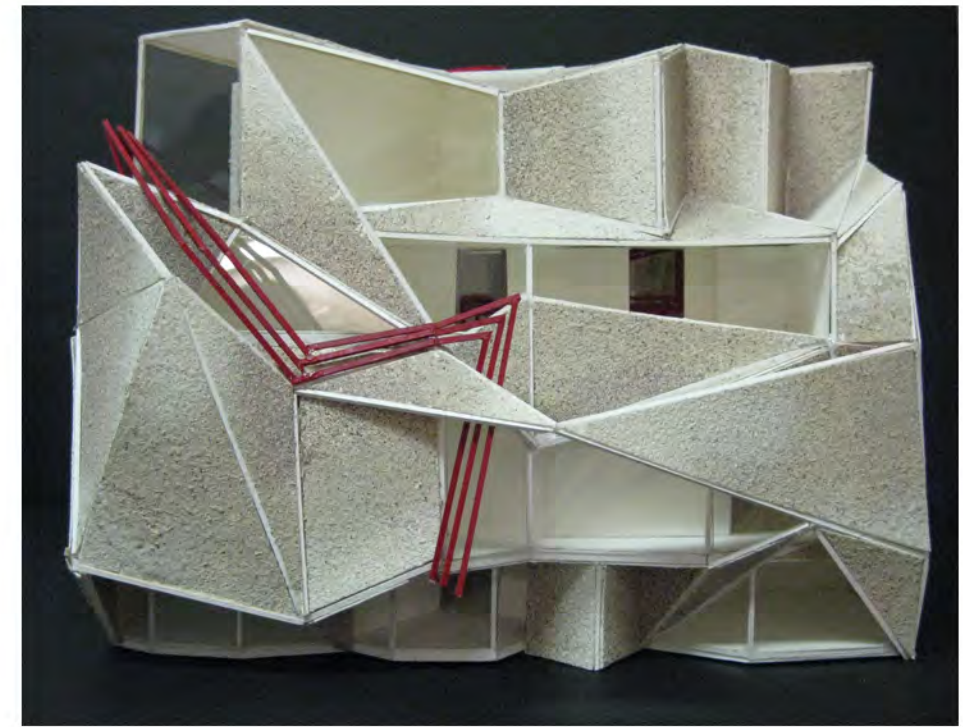
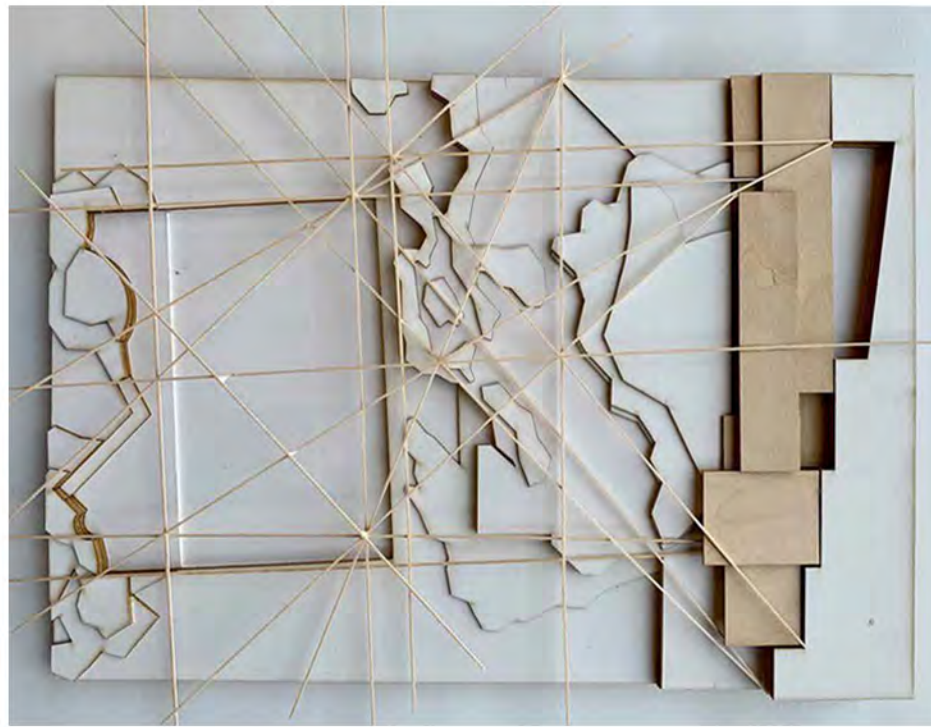


Computer Modeling for Precedent Analysis

The combination of computer modeling with graphic design software allows students with an emerging command of representational tools to find new avenues for inquiry and analysis.

Sketchbook as Analytical Practice

Drawing is the way designers come to make sense of things. The sketchbook can be used as a method for instilling and reinforcing drawing and note taking as a rigorous analytical practice.



Analytical Models

In second-year undergraduate design studios analytical modeling reinforces knowledge of fundamental architectural principles and teaches methods for understanding precedent, context, and site.

Fields, Systems, and Regulating Lines

Early design studios help students to find ways of revealing latent relationships and systems of order within a built work or the natural environment: models allow their discovery.

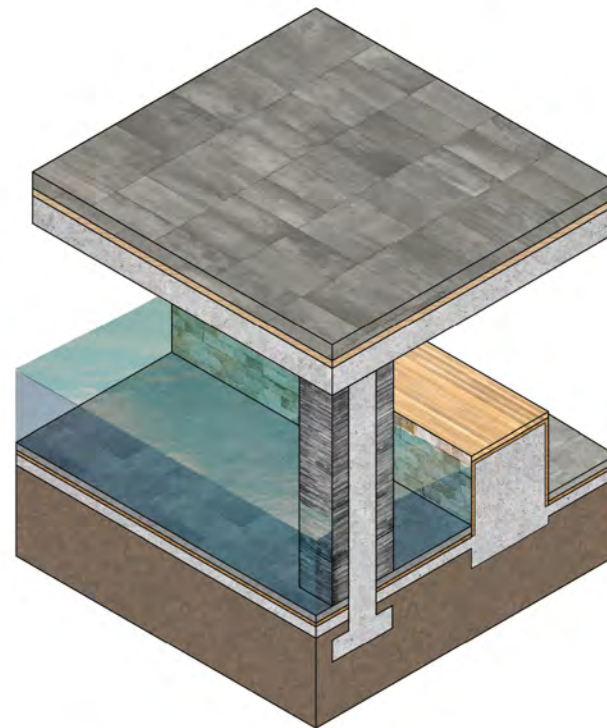
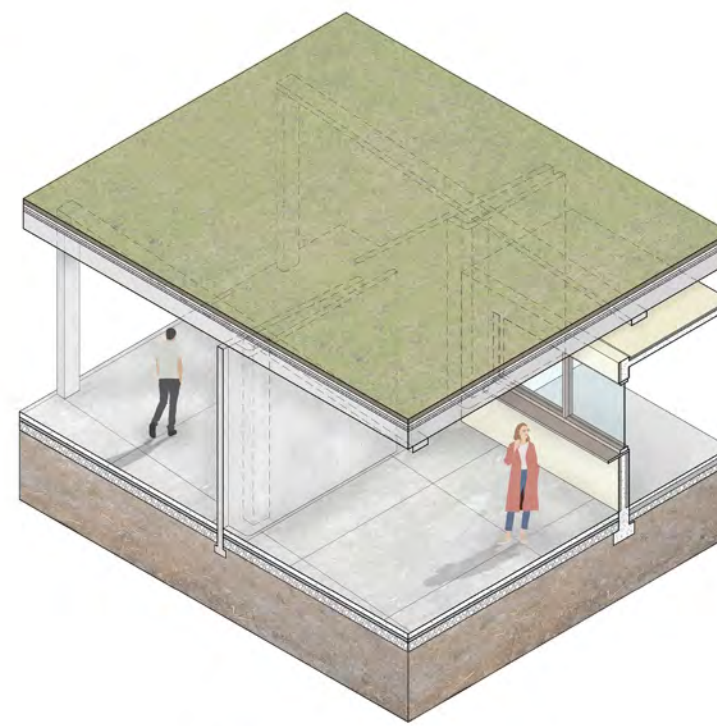
Scale and Method

Analytical models of an emerging design can shift the students' focus from the model as a mode of representation to a mode of critical inquiry into their own design work.



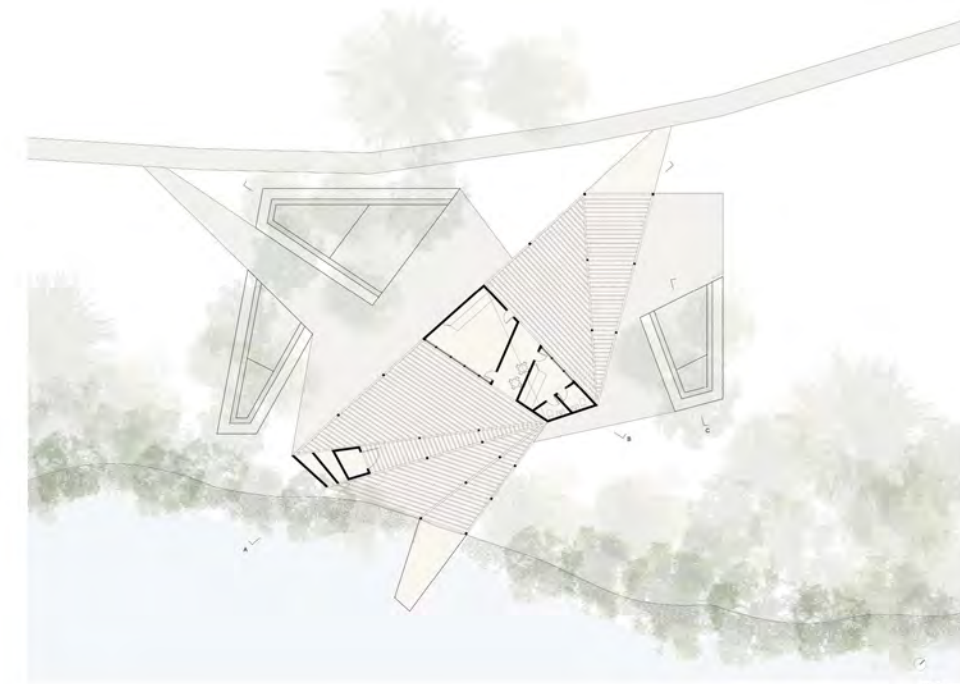
Collage Rendering

Collage allows students to explore a representational language that suggests both an emerging material logic as well as the social and emotional qualities of the spaces they are designing.



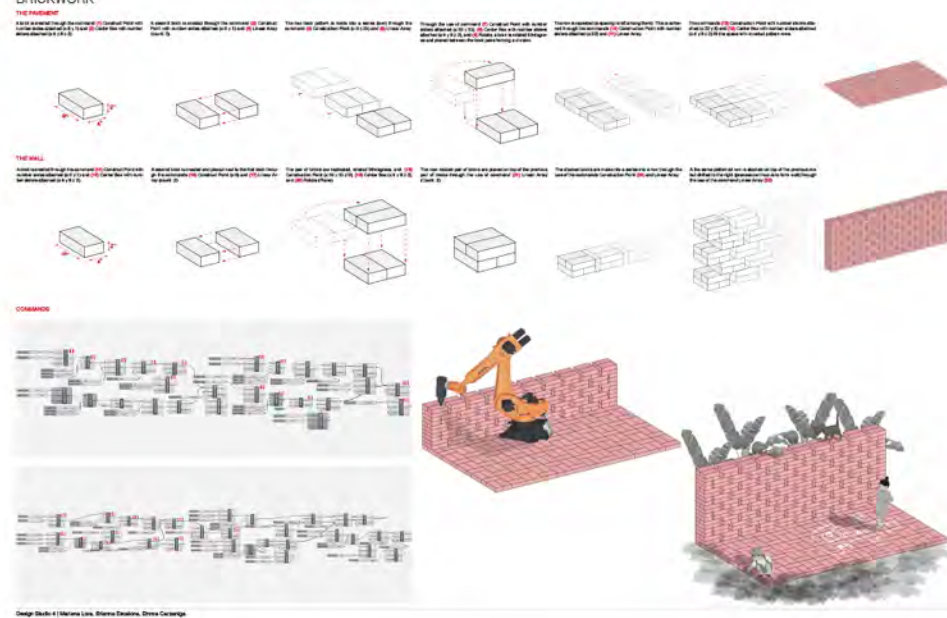
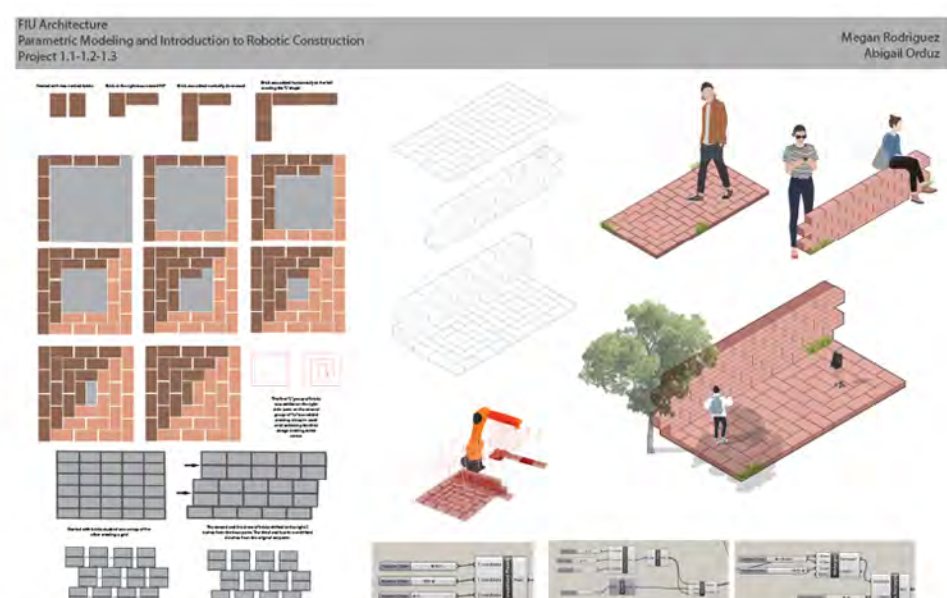
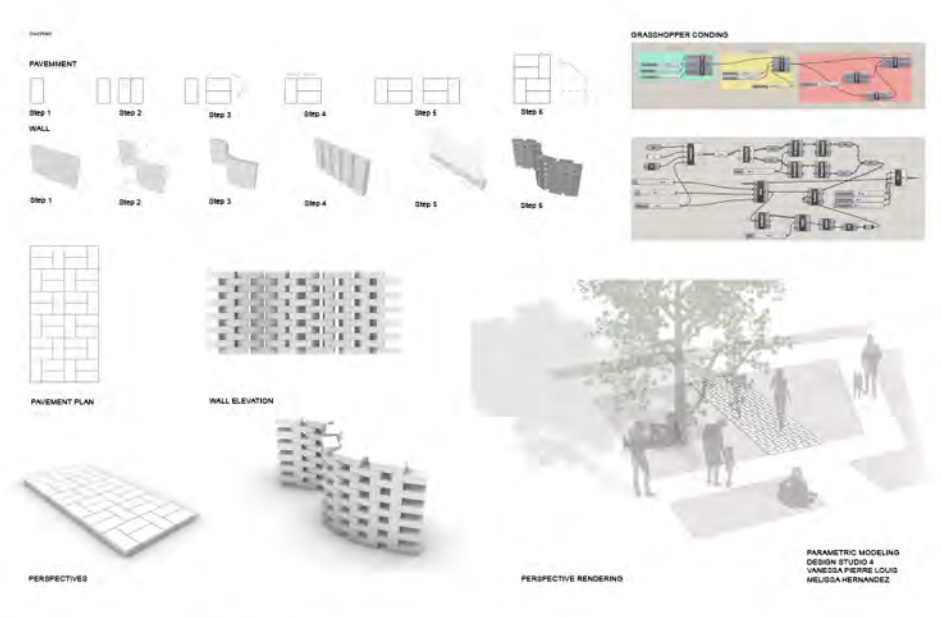
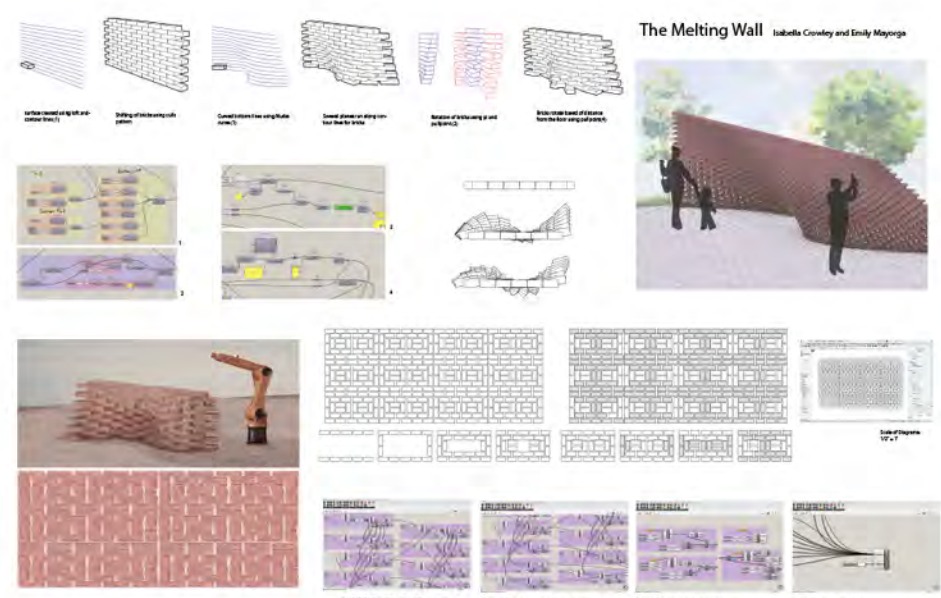
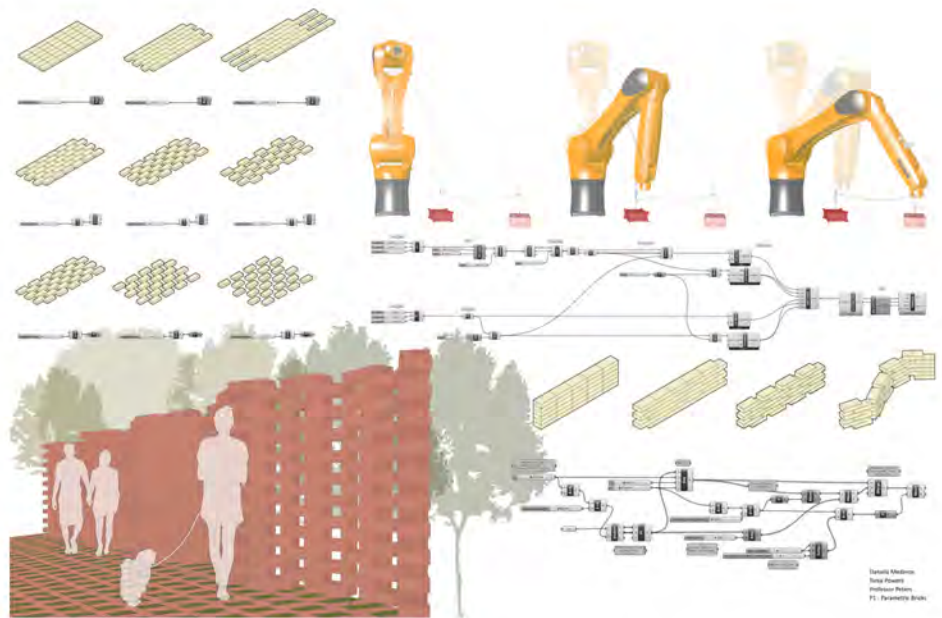
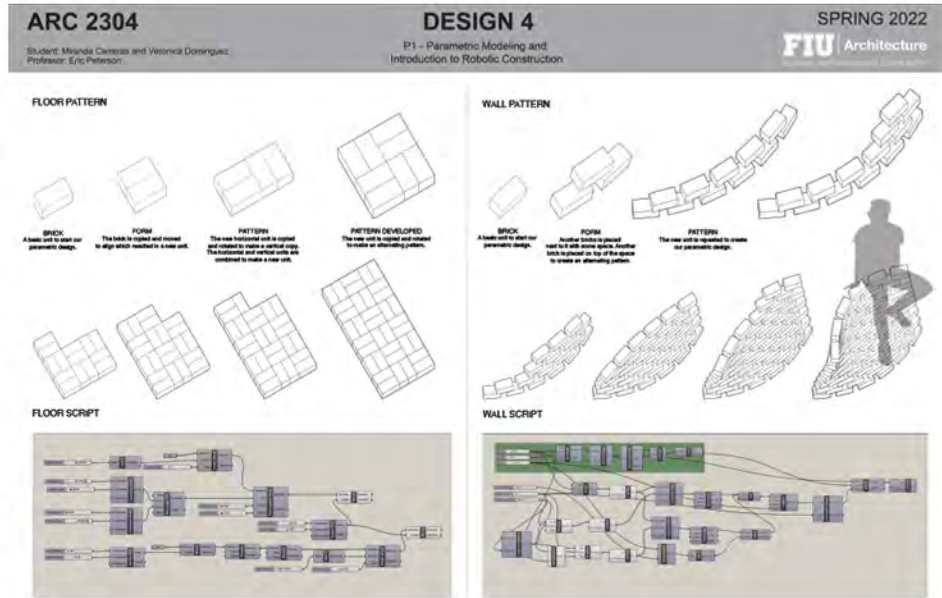
Rendered Excerpt

In this exercise students use a Boolean operation to extract a portion of a computer model and render the excerpt with a speculative graphic depiction of material and tectonic logic.



Rendered Drawings

Rendering plans and sections encourages students to express the mood of their project while exploring a graphic language common to both two dimensional drawings and perspectives.



Experimental Teaching Module

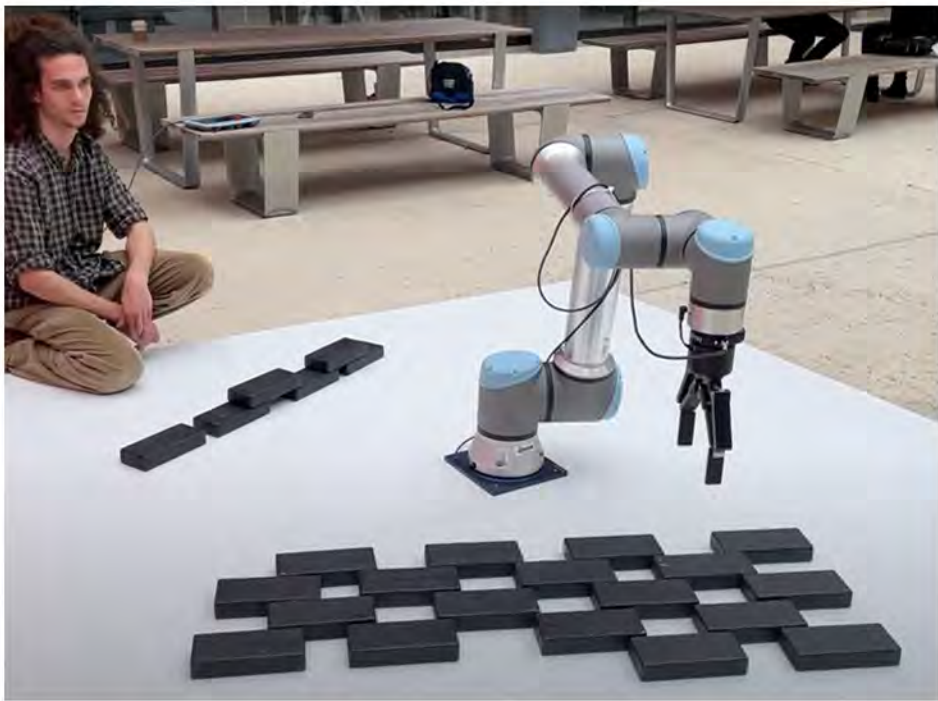
In 2022 I designed and tested a five-week module for second-year students to learn basic principles of parametric design and the fundamentals of robotic programming.

Parametric Modeling

After a series of tutorials in Grasshopper, students worked in pairs to develop two parametric projects: a simple paving pattern and wall using stacked bricks.

Robotic Programming

Using KukaPRC students developed and simulated a simple pick and place program transferring bricks from a standard stack to one or both of their parametric designs.



Virtual Reality and Robotics

In Spring 2022 students served as test subjects in a research project to evaluate *The Robotics Academy* VR learning platform. They used their knowledge to create a robotic pick and place program.

Training, Education, and Learning Sciences, Vol. 59, 2022, 188–197
<https://doi.org/10.54941/ahfe1002400> AHFE International

Evaluating an Immersive Learning Environment for Robotics Training

Eric Peterson, Biayna Bogosian, and Shahin Vassigh

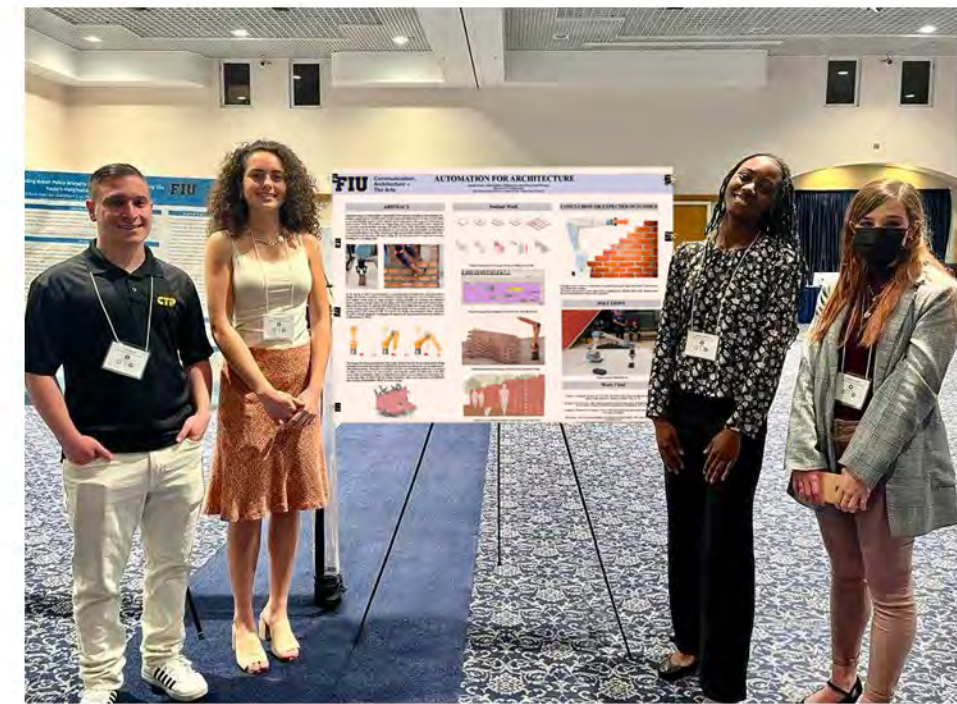
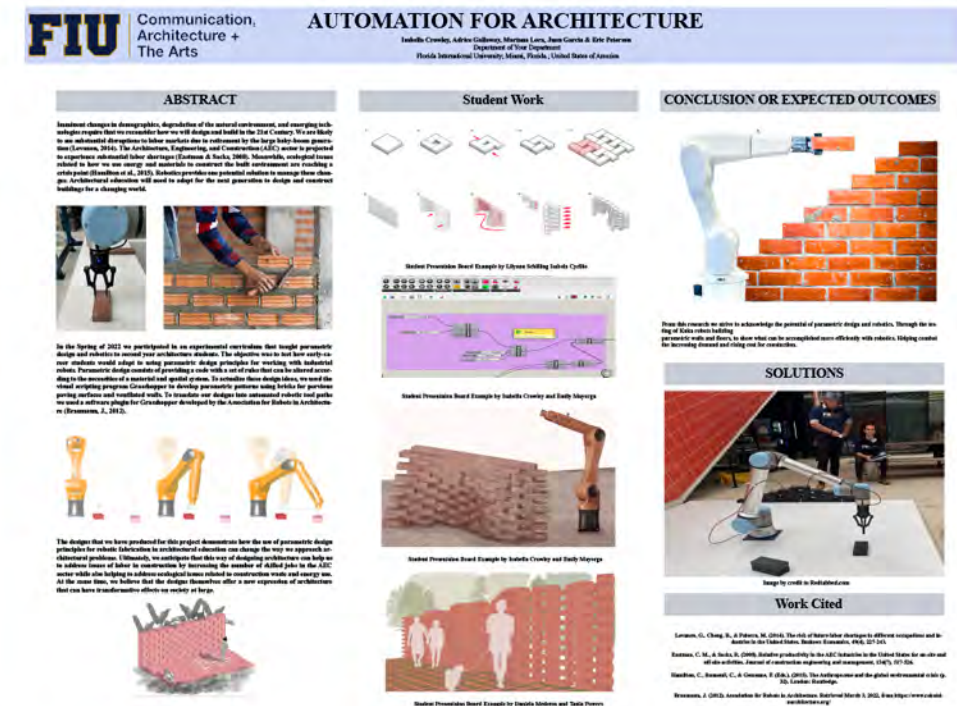
Florida International University, Architecture Department, 11200 SW 8th Street, Miami, FL 33199, USA

ABSTRACT

In Spring 2021, an interdisciplinary team of researchers at Florida International University (FIU) designed a virtual reality (VR) training prototype for novices to learn how to work with industrial robots. Developed with the support of a grant from the National Science Foundation (NSF) by a team of architecture and computer science faculty, the Robotics Academy immersive learning environment prototype leverages advanced technologies to teach robotics in a fully immersive VR environment. This paper will describe the learning environment, the introductory lesson prototype, the learning evaluation tools, and the comparative outcomes of testing this learning prototype with a test group and a control group.

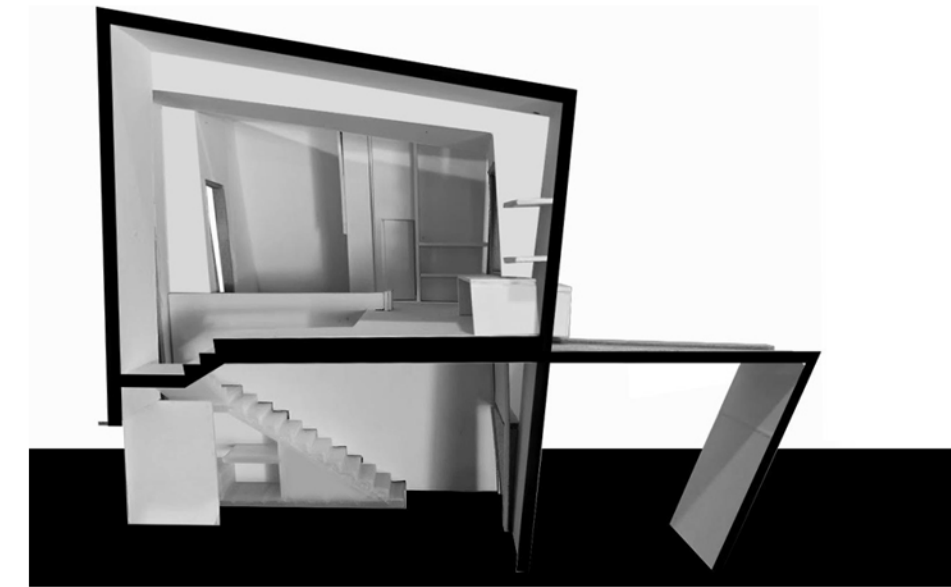
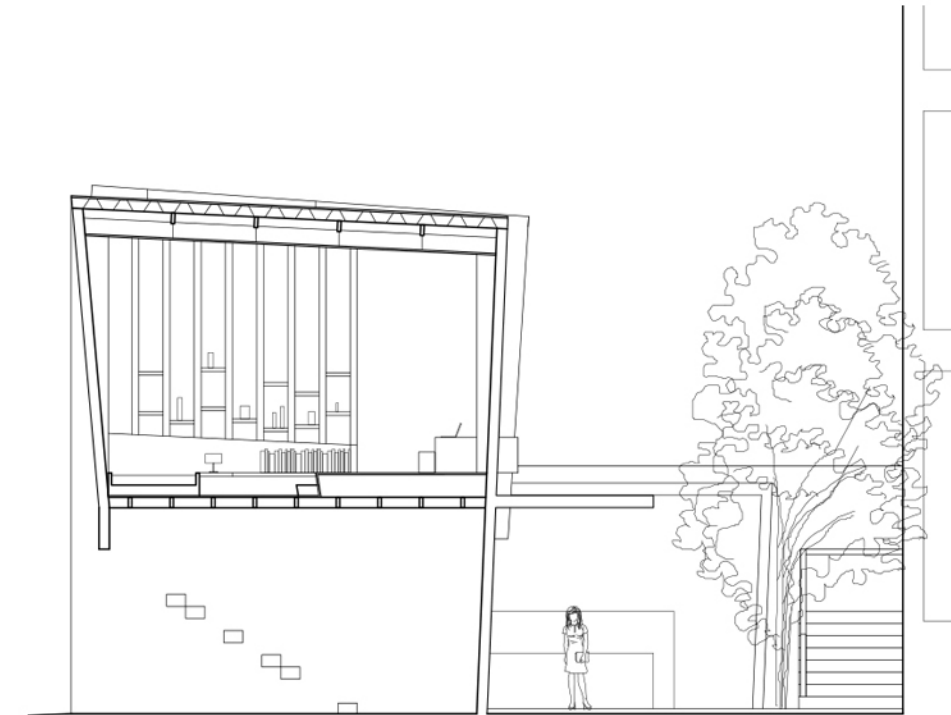
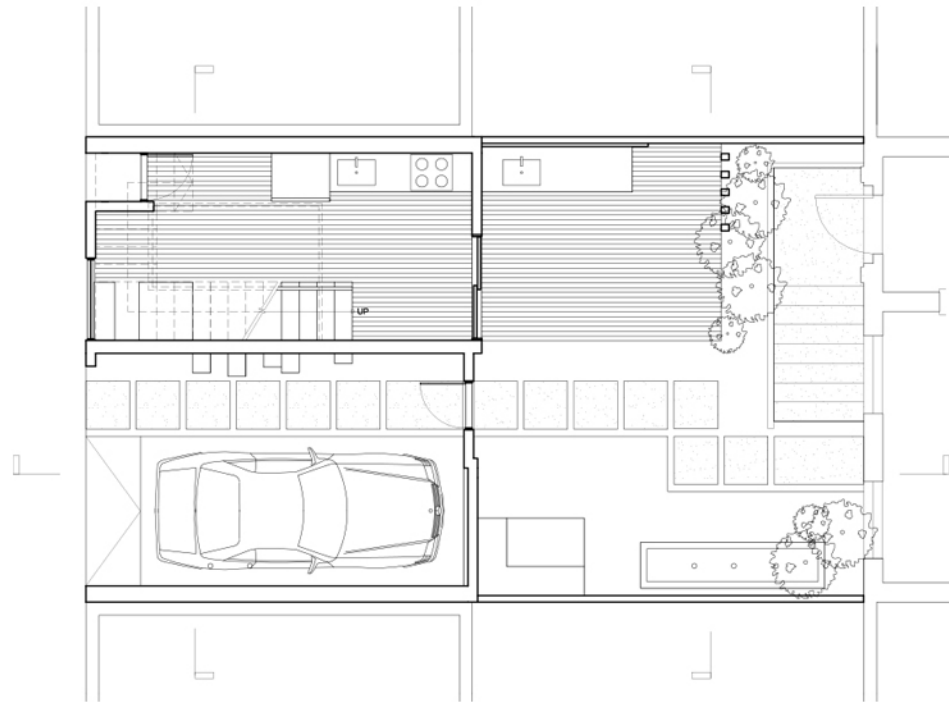
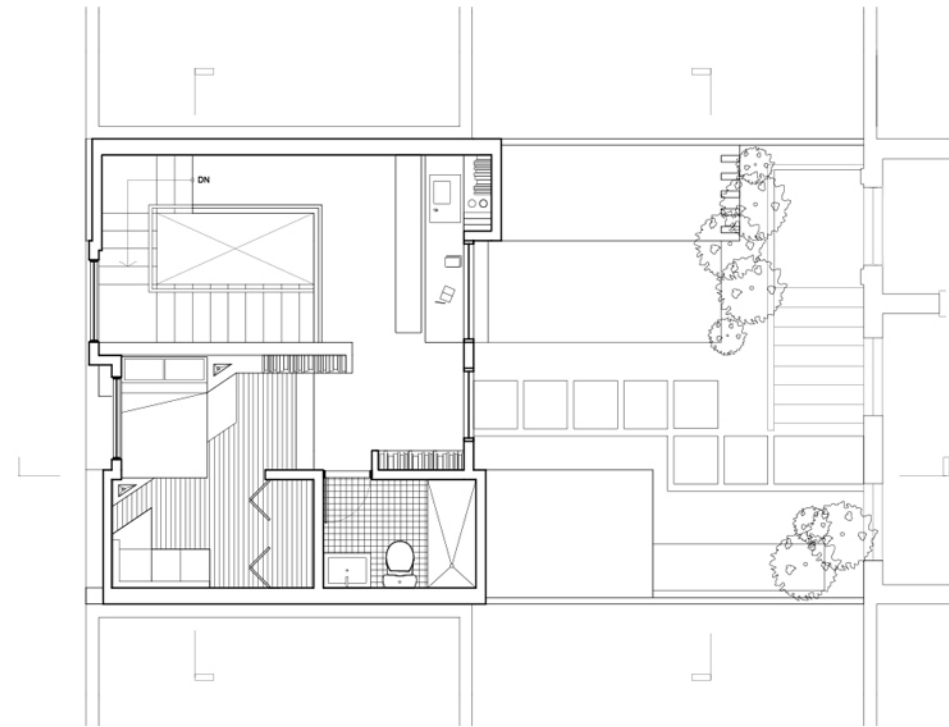
Integration of Research and Teaching

An NSF grant helped fund the development of the VR prototype lesson for teaching robotics. VR evaluation test results from the group were published in the AHFE 2022 conference proceedings.



FIU Undergraduate Research Conference (URC)

A group of students interested in continuing their Automation for Architecture research presented a poster at the URC and published a paper in the FIU Undergraduate Research Journal.



Carriage House Project

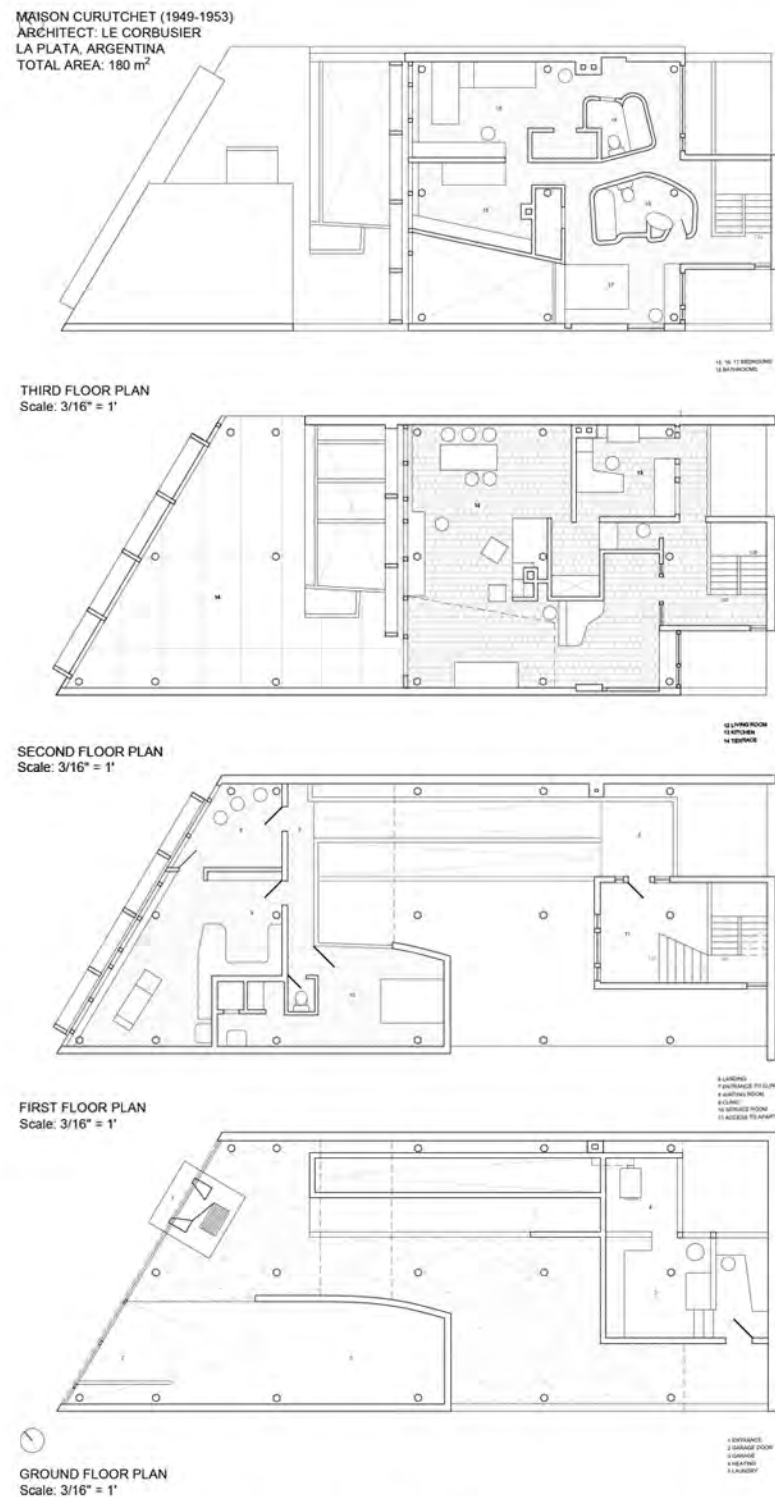
Third year curriculum focuses on the discipline of technical drawing. The first project is a 720 sf converted carriage house designed for a writer, located in the dense urban fabric of Savannah, GA.

Rigorous Line Drawings

Microhousing serves as a programmatic typology supporting exploration of the drawing conventions and linework variations required for a larger housing project.

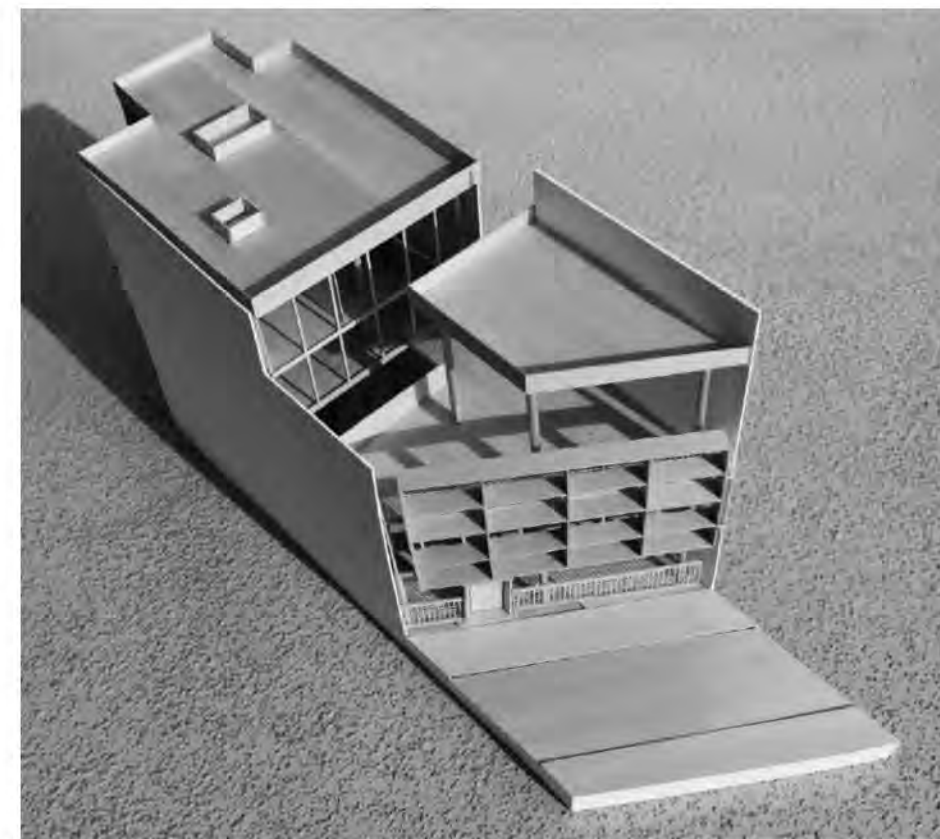
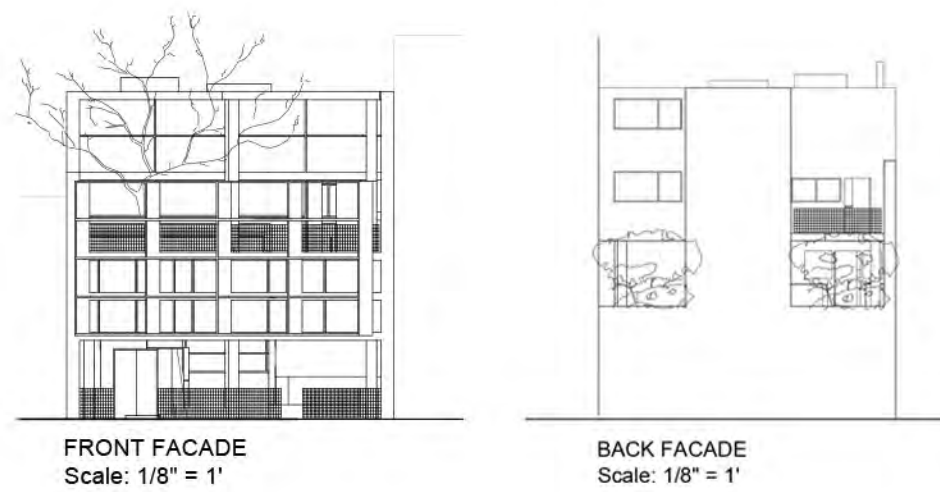
Formal Models

Simple matteboard models promote a method for designing architectural space and form that is initially isolated from concerns about materiality and tectonics.



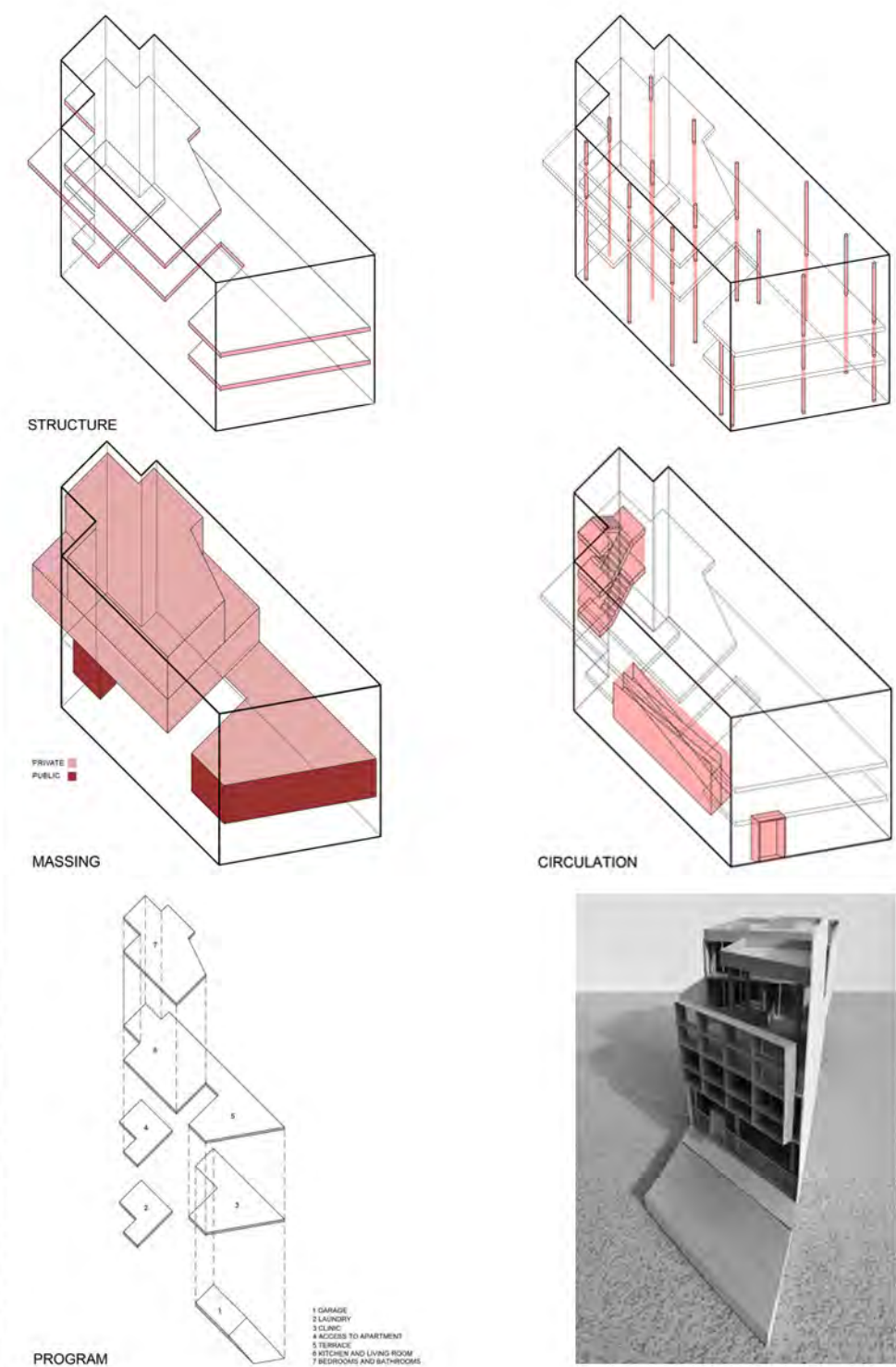
Disciplined Precedent Drawings

The second project of the semester is a precedent study that aims to introduce the rigor of documenting an existing project with accurate plans, sections, and diagrams.



Restrained Precedent Models

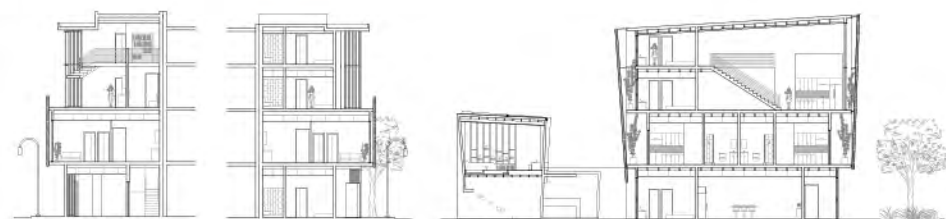
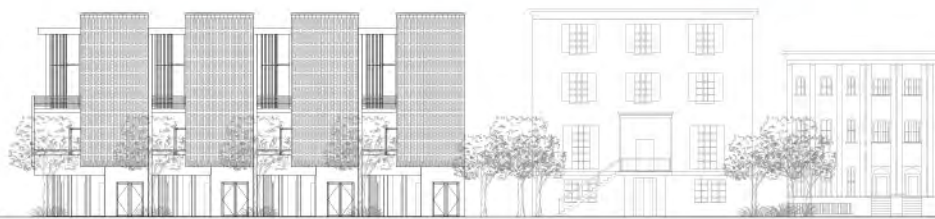
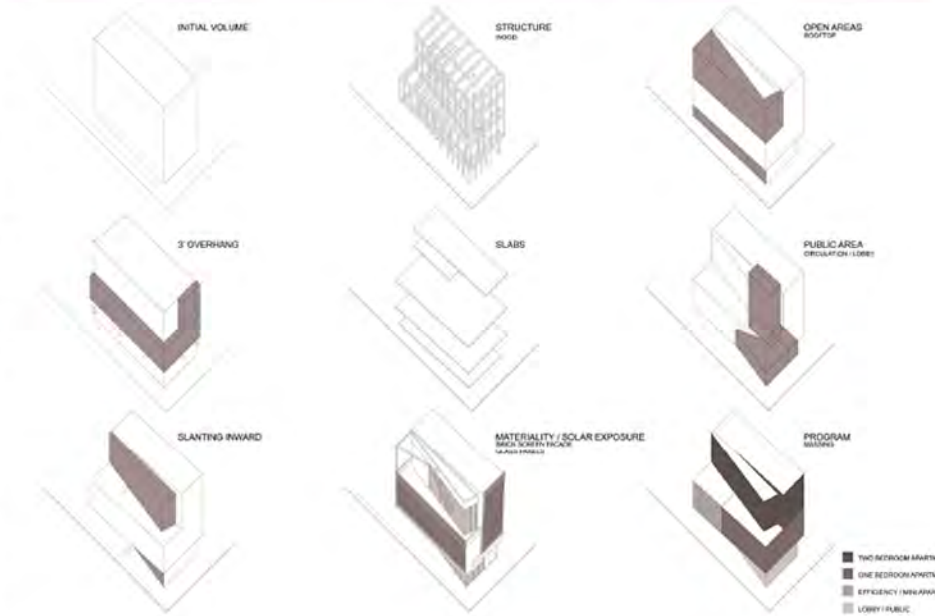
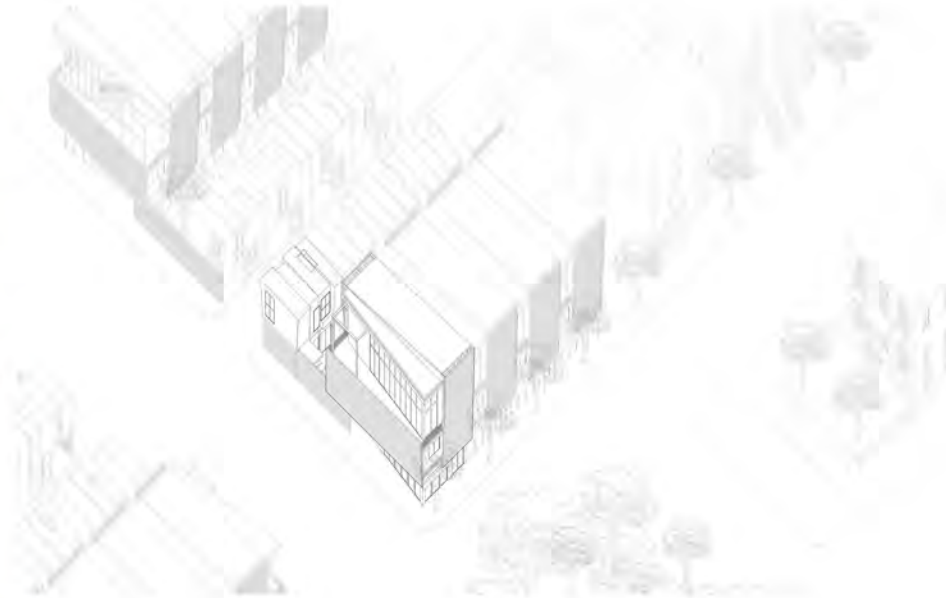
This style of precedent model serves as a documentary artifact as well as a strategy for understanding a built work by restraining one's own desire to embellish or speculate.



Descriptive Diagrams

For this style of disciplined precedent study, analytical diagrams serve to simply depict the building systems exactly as they are in the built work according to the expressed intentions of the architect.

Design 6 : Multi-Family Housing THIRD YEAR



Infill Housing

The final project for Design 6 is a multi-family townhouse in Savannah, GA that is either an infill project or a corner unit that can be subtly modified and repeated at various points along a block.

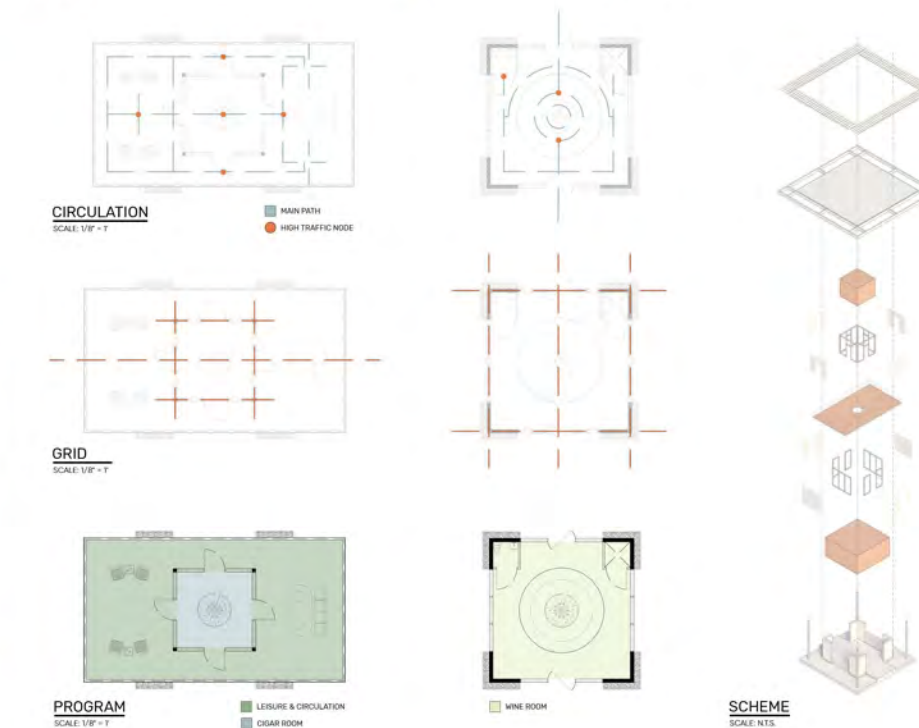
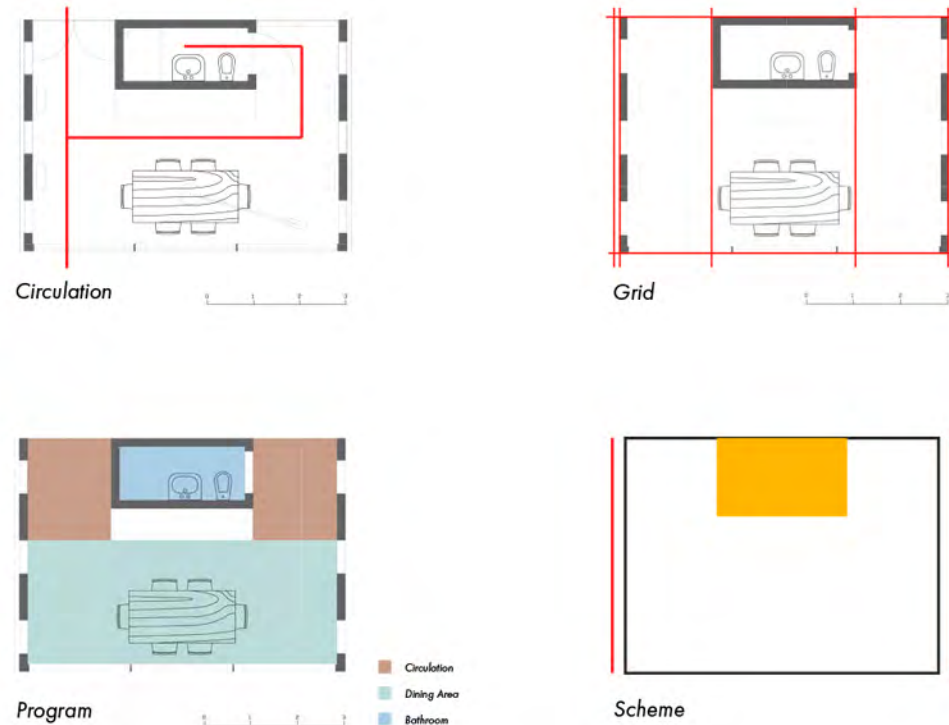
Detailed Drawings

The primary objective for this studio is to produce a set of drawings that is both beautiful and correctly drawn using industry standard drawing conventions.



Comprehensive Drawings

Students are required to produce a rigorous and comprehensive set of drawings that reflect relevant local, regional, and national building codes and legal standards.



Rendering as Design Tool

This 2022 sponsored studio partnered with Aryaman Builders to develop proposals for Accessory Dwelling Units. Rendering was used as the primary tool for iterative design generation and refinement.

Plan Diagrams

To accelerate the design process the class relied on standardized diagramming tools and streamlined their productivity with preconfigured software workflows.

Rendering as Materiality Study

Tools, including Lumion, Enscape, and Twinmotion, allow realtime visualization of materials in realistic lighting scenarios, offering students the opportunity to speculate about materiality and tectonics.

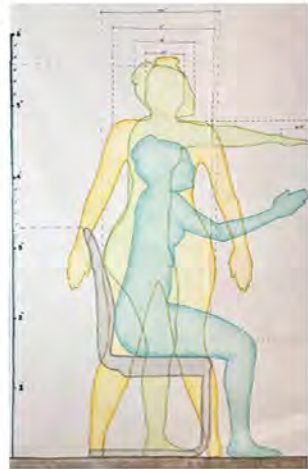
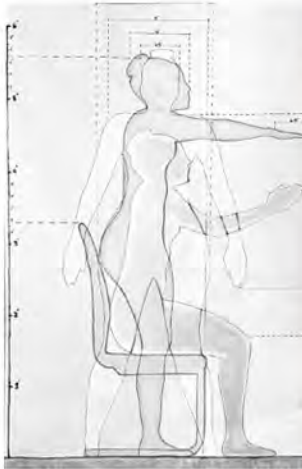
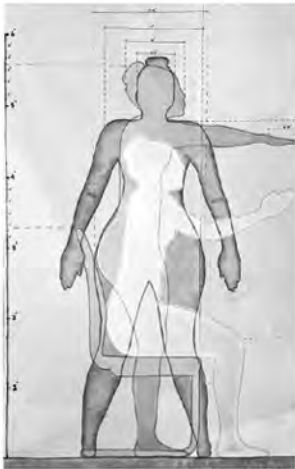


ERGONOMICS

HOW MUCH SPACE WE OCCUPY ?

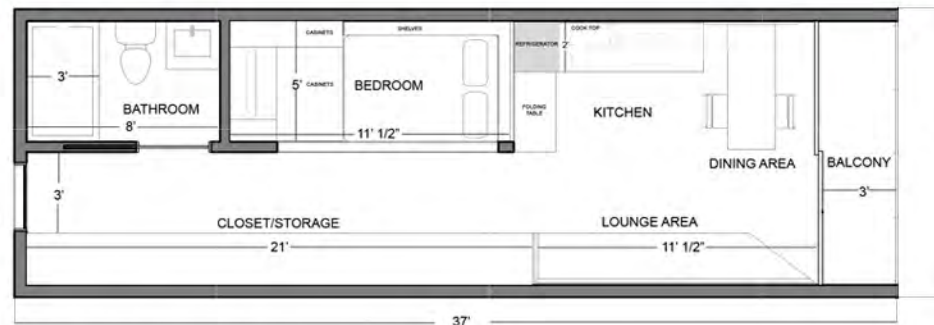
This exercise made me ask myself, how big I am, or how big is my hand. Once you are aware about your true size, it will help you to better understand how our body works in terms of space.

The process of this second ergonomic was easier. I did almost the same that the first one. However, This time, I traced the chair to give more sense of scale. In addition, I drew other key measurements besides the height ruler. I also drew a line as a base to simulate the floor, and that helped make it look much more real.



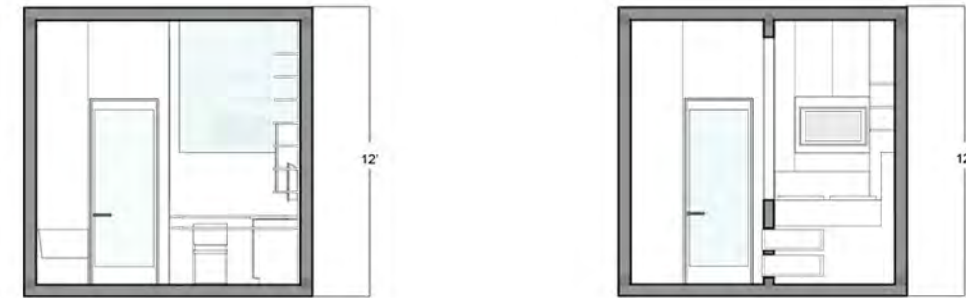
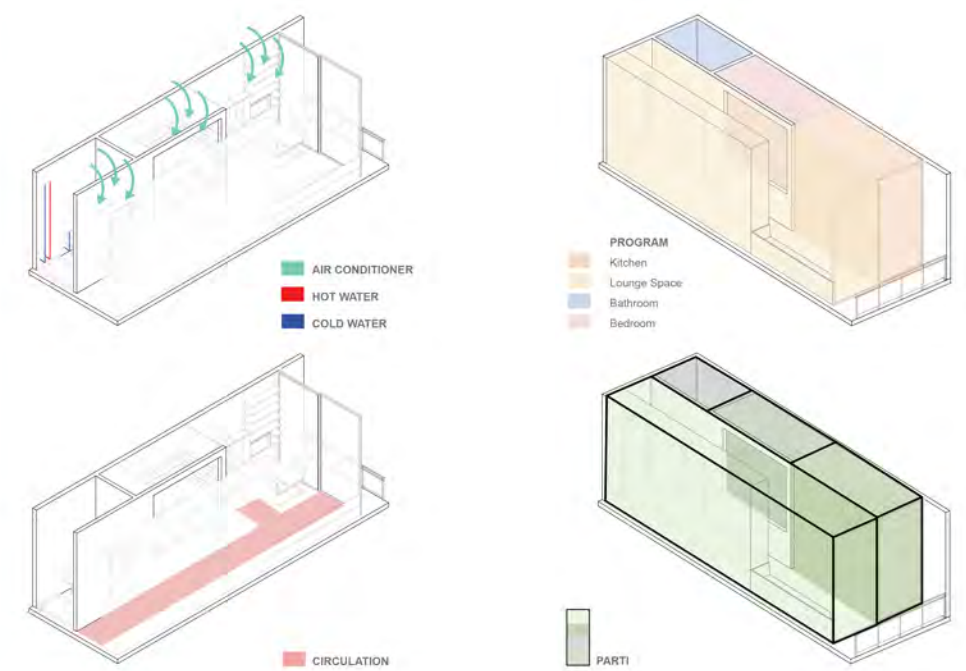
Ergonomic Studies

Understanding the proportions and scale of the human body is critical for microhousing and prototyping projects: tracing and measuring oneself is a critical first step toward building this knowledge.



Master Planning

The semester included a short module to develop a site and context for the microhousing on Biscayne Bay featuring waterfront workforce housing designed to withstand a 12' storm surge.



Unit Plan

Using non-standard precedents such as economy and capsule hotels, cruiseship cabins, and recreational vehicles students designed a series of efficiency, one, and two bedroom apartments.



Drawings and Diagrams

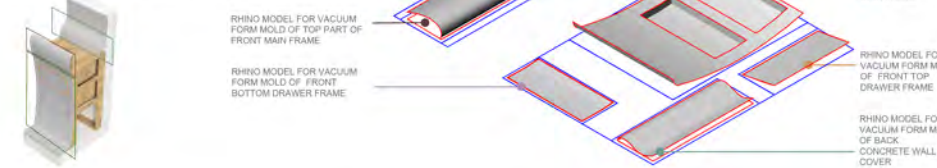
Throughout the prototyping process students are encouraged to move back and forth between drawing and diagramming as a way of documenting and thinking through how to build their prototype.

CNC PROCESS



PROCEDURES USED TO CREATE VACUUM FORM MOLD:

1. Rhino file with specific models for each mold piece
2. NC file set up for CNC machine
3. 2 pieces of 4" thick ISO foam: 36" X 48" and 12" X 48"

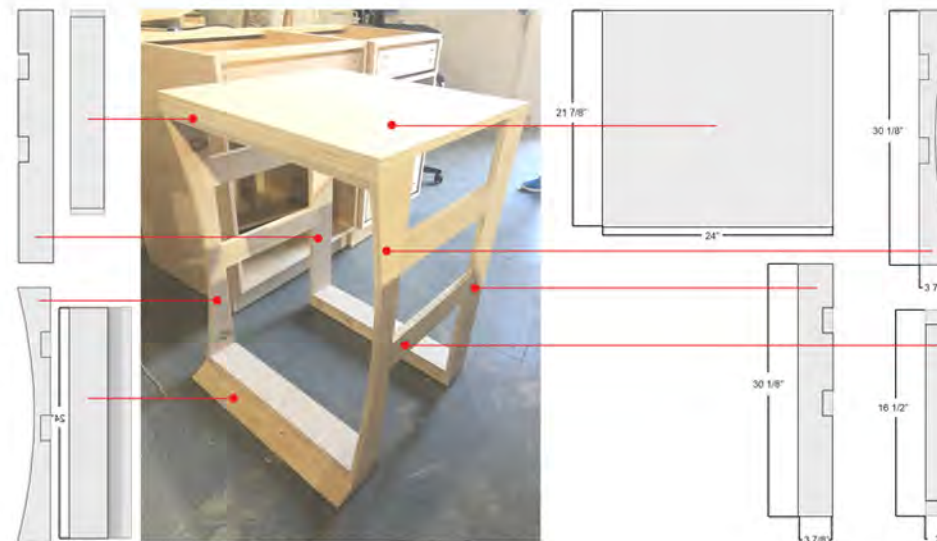


VACUUM FORMING PROCESS



PROCEDURES USED TO VACUUM FORM:

1. Place ISO foam mold in the vacuum forming bed
2. Place sheet of 1/8" plexi glass in the machine
3. Heat up the sheet of plexi glass into bendable forming temperature
4. Bring lever down to stretch plexi glass onto the single-surface mold and force against the mold by a vacuum
5. Let cool and remove from foam
6. Cut excess material and sand edges



Fabrication Process

Students can use a variety of tools and methods for fabrication: this project from 2019 combined traditional cabinetry with CNC and vacuum forming to create curved acrylic surfaces.

FABRICATION PROCESS



PROCEDURES USED TO CREATE CABINET:

1. Wooden structure construction and assemble using 3/4" thick plywood
2. Clamping vacuum formed front frame to measure drawer size and separation between the wooden horizontal studs and where the drawer slides should go in order to easily allow for drawer in and out movement
3. Creation of an L shape inward extruded wooden addition piece to attach drawer slides
4. Concrete wall simulation by creating a framed wooden box which provides stability and is laminated white to resemble a real wall
5. Construction of 17" x 19 3/4" drawers by creating first the drawer side pieces, nailing it together and then nailing the drawer bottoms
6. Sand all edges



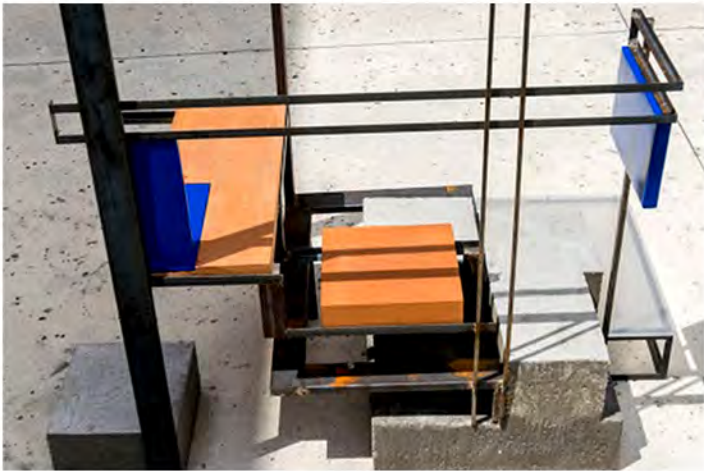
Finished Prototype

The final prototype is a functional part of the microhousing apartment unit that aims to establish a method of fabrication that can be applied throughout the project.



Cubic Stair

The Cubic Stair is a literal and metaphoric journey through time and space. It describes a path through space that is completely derived and dependent upon its massive concrete foundation. A linear system of steel elements generates a spatial network around the mass and helps to support a system of wood and resin planes that articulate and direct upward movement. The narrative that guided my design decisions came out of a series of reflections about my education as a designer and the things I learned in my very first studio.



With this project the last three years of my education came full circle for me. My very first project in design school was a classic cube problem and, like others before me, I struggled with making space using the fundamental elements of design. Through the process of working on Cubic Stair, I was finally able to make sense of my initial challenge: to articulate the values that underpin ordering systems for defining and controlling space. I was finally able to solve the Cube!

-Ruth Brooks

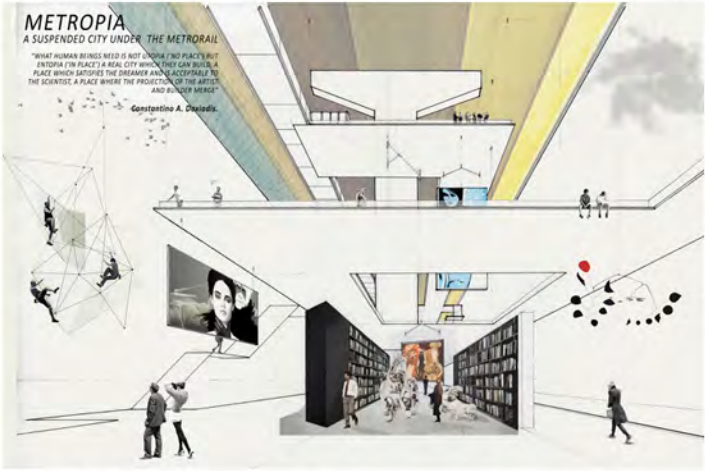
Cubic Construct Redux

A series of readings about memory and architecture encouraged Ruth to reevaluate her previous education and revisit a challenging assignment at full scale using concrete, steel, mahogany, and acrylic.



METROPIA

Metropia proposes a free multisensory experience of the city were people meet under the Metrorail. Based on the every touching experience of architecture as a multi-sensory experiment where our mind constantly evaluating the quality of matter, scale and space, Metropia tries to put human interaction as the center projecting them to the city and projecting the city to them. "It is like a dynamic street in the air" The idea was to maximize and celebrate the beauty of movement. Public spaces should be the physical manifestation of human values. Metropia tries to encourage that humanism where there is no difference between outside and inside, enclosed and open; it is only the way to intermingle people in a fair way where everybody is represented as a community but also individuality can be expressed.

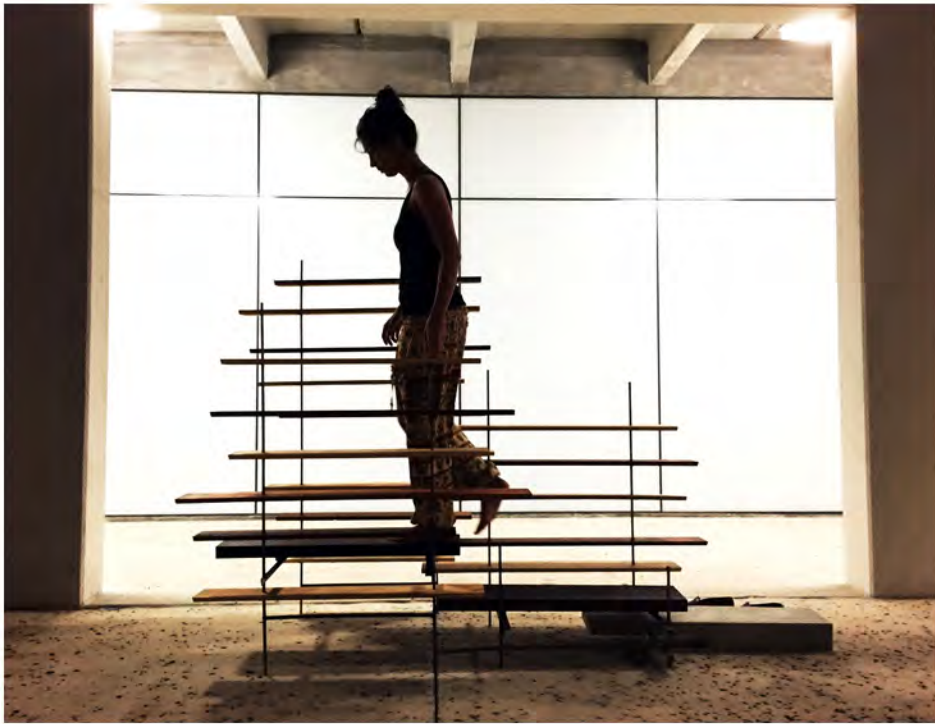


This project allowed me to explore a place which brings people together creating an environment for human interaction, for the exchange and development of ideas, a place that react to the exiting condition becoming a catalyst of continuous change and evolution. But most importantly, a place where users have total control of the place rather than the city controlling or programming the daily life of its citizens; a place to influence, to educate and inspiring people.

-Jorge Fabregat

A Utopian Vision for the City

A quote from J. Pallasmaa inspired Jorge to explore a utopian vision for the city: for this ambitious project he used steel cables and CNC milled plywood components fastened with threaded rods and steel bolts.



Thirdspace: The Stair of Exile

The Stair of Exile is a personal exploration of liminal space; the in-between existence that immigrants may experience living in a foreign country. Forced to leave their homes, emigres and exiles find themselves in a state of uncertainty and ambiguity, never really here nor there. They inhabit a sort of thirdspace condition living with a mind occupied by memories of home and a body that inhabits an unfamiliar land. Boundaries are blurred and direction is unclear. As a liminal thirdspace condition, the stair seeks to embody and give form to the ambiguous condition of the exile experience and give architectural context to the sometimes intense discomfort of displacement.



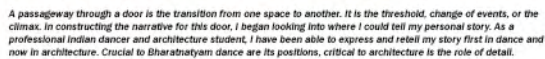
To take something so personal and translate it into architectural terms was a challenging experience for me physically, intellectually, and emotionally. It was a gratifying experience that encouraged me to appreciate the art of the detail, and the labor and patience it demands. It also helped me to identify and come to terms with the situation in my home country and my own current situation as a displaced person, and it helped me find a way to channel those emotions into architecture.

-Eileen Nunes Koo

The Stair of Exile

Reflecting on her status as a displaced person with complex ethnicity, Eileen built a narrow tenuous pasageway with delicate wooden stair treads of different species suspended on thin square metal rods.

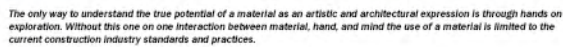
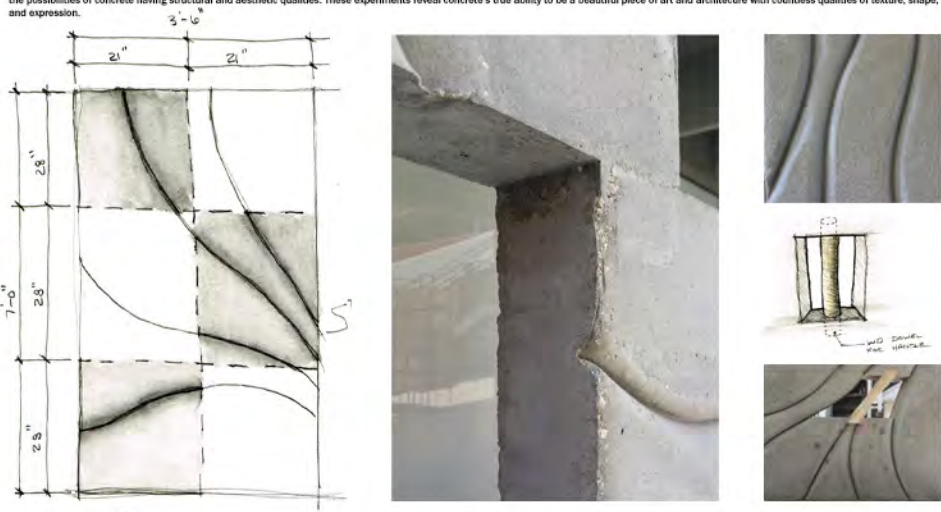
Architecture is a narrative. That is, the design process and the final product are not the story itself, but a telling of a story. A story is simply a sequence of events while a narrative recounts the events, leaving some occurrences out, while emphasizing others. Thus, the narrative shapes the history of the story or memory. This is architecture. The architect, and the individual experiencing the architects work are in the process of rediscovering a memory, and retelling it with detail.



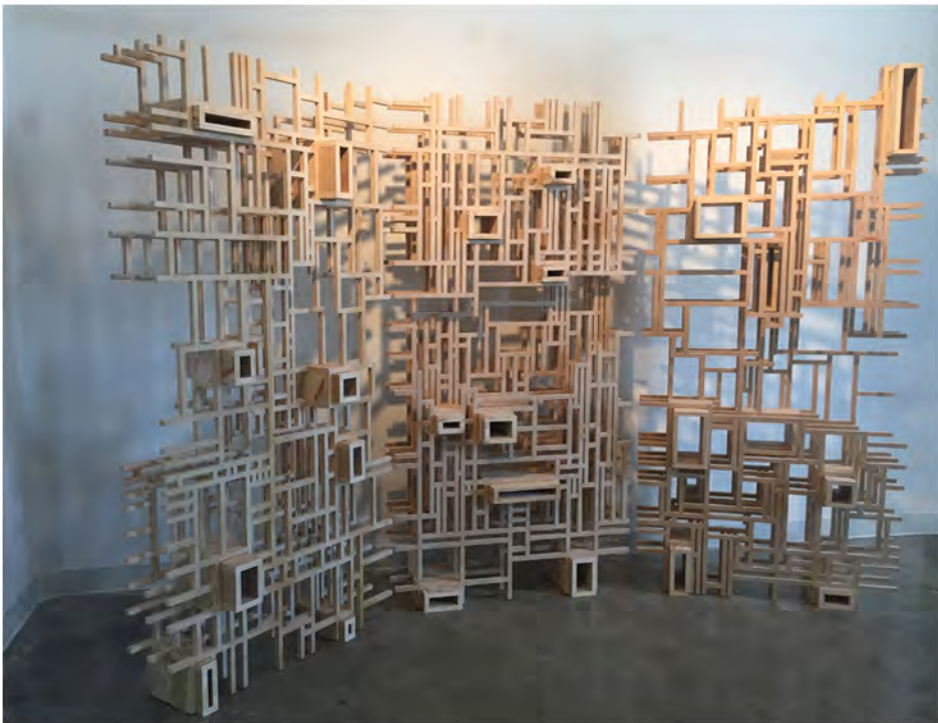
Meryl reflected on her memories of color, light, and movement from the costumes she wore for Bharatnatyam dance. A series of collages led to the design for a hanging panel of red and yellow acrylic.



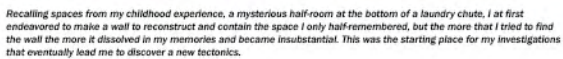
This project sets out to explore concrete as a visually light and expressive material. Concrete is typically seen as a monolithic and static material being confined to the internal structure of a building. The visual massiveness of a concrete structure can make an observer feel small and weak compared to the immense weight and appearance of concrete. Through hands on experiments this project explores the possibilities of concrete having structural and aesthetic qualities. These experiments reveal concrete's true ability to be a beautiful piece of art and architecture with countless qualities of texture, shape, and expression.



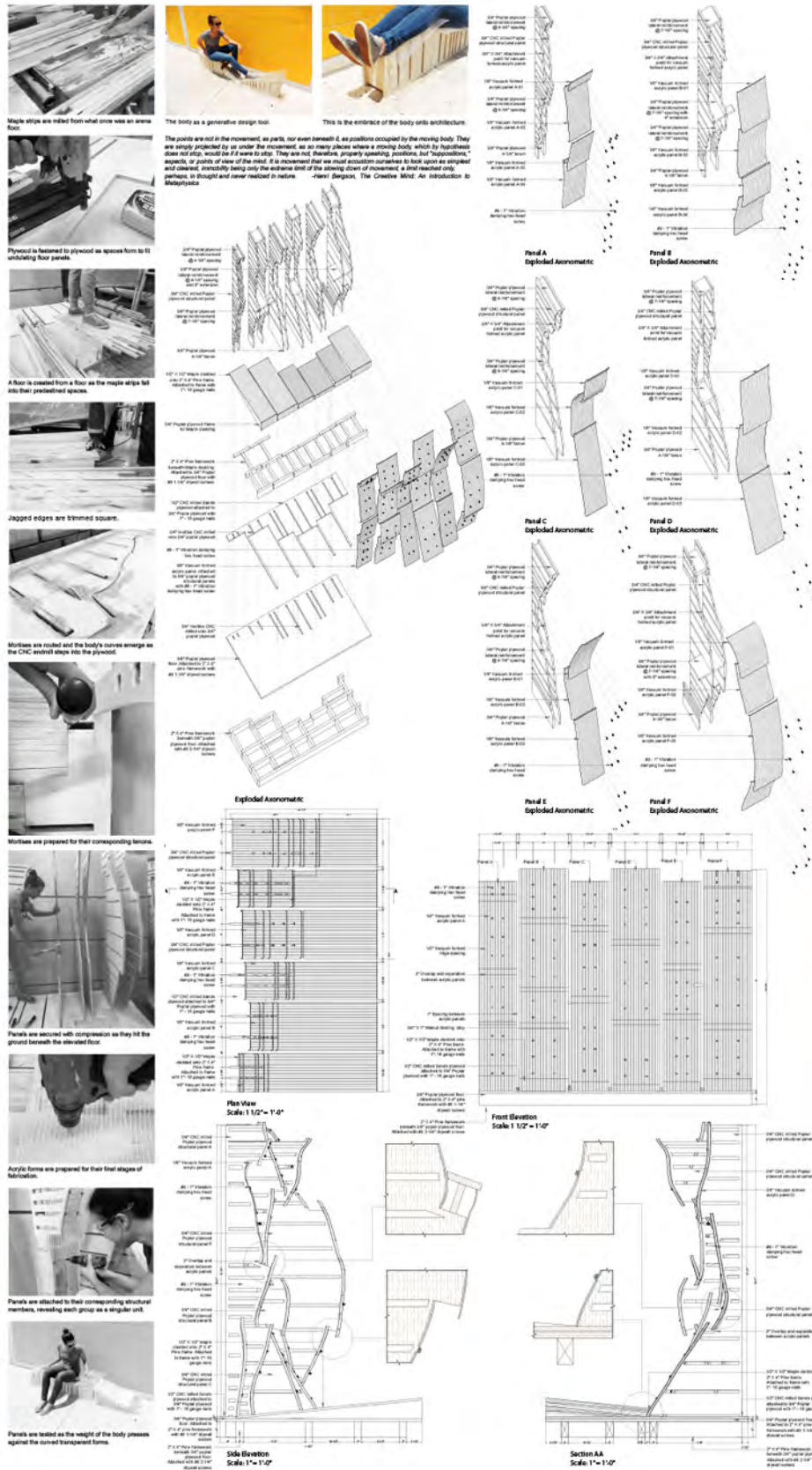
A quote from M. Frascari inspired JR to experiment with concrete to retain its fluid qualities: the final project is a three-panel concrete door in a steel frame with an integral wooden handle.



G. Bachelder claims, "The human being... knows instinctively that this space identified with his solitude is creative; that even when it is forever expunged from the present, when henceforth, it is alien to all the promises of the future, even when we no longer have a garret, when the attic room is lost and gone, there remains the fact that we once loved a garret, once lived in an attic." Recalling such spaces, at least one of which was, for me, a half-room at the bottom of a laundry chute, I at first endeavored here to make a contained structure, albeit one with a rigorous commitment to only rectilinear forms in planar and volumetric expressions; doing so helped, I hope, to create a dynamic and expressive rhythm.



A reading of G. Bachelard led Adam to speculate about fragmentary memory. Using CNC as a primary tool, he created a series of screens and objects using both additive and subtractive tectonics.



Lounging Wall
Julia designed an architecture / furniture hybrid. Based on profiles of the human body in various poses, the wall panel serves as a lounging surface that can be used in an airport or similar waiting area.



Fabrication as Design Method

Students are encouraged to explore their furniture design ideas using a full-scale prototyping methodology that relies on real materials and joinery strategies.

Digital and Hand Craft

Tools, processes, and fabrication methods are selected for their utility for the task at hand with the understanding that all ways of making rest on craft.

Materiality

For the sake of economy students often choose to work with found objects and recycled materials including shipping pallets and steel rebar.



Tectonics and Joinery

As performative prototypes, joinery design and ergonomics are critical. Serial profiles and threaded rods are common for novices, advanced students explore more sophisticated tectonics.

Product Design

Certain students are more inclined to product design, choosing to use the class to explore materials, tools, and fabrication methods in a serial process of discovery.

Fashion Design

For Eco-Couture, our annual fashion show using recycled materials, Kelly designed a dress made from reclaimed lumber from discarded shipping pallets.



Serious Play

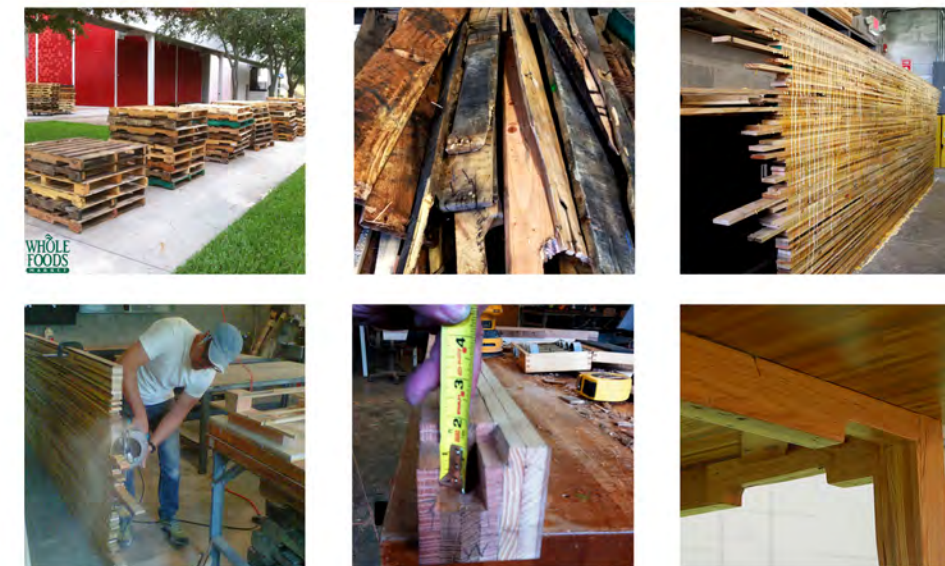
Bauhaus Master J. Itten promoted the idea that playfulness is of critical importance to the education of a designer. Students are encouraged to explore whatever forms and materials they find exciting.



Collective Projects

Coming to recognize the financial burden on some of our students, the course has gradually transitioned to more collective projects with donated or recycled materials.

PALLETCRAFT



Palletwood Furniture Design Team (from left to right): Indra Alam, Princess Moquette, Tom Pupo, Adam Feinstein, Jordan Johnson, Danielle Bayrami, Ana Echeverri, Alan D'Amore, Anyeli Silva, Juan Chiu, Carmen Rivero, Agnieszka Larson, Eric Peterson, Mauricio Deleon, *in absentia* Martina Gonzalez.



Mission Statement

The Palletwood Furniture Design Team at Florida International University School of Architecture believes that there is hidden beauty in even the most humble materials. We believe that it is our duty as designers and material researchers to investigate the infrastructure that supports our culture and propose new uses for the cast-off materials that surround us.

Our first project is a 10' x 4' conference table built entirely from dilapidated shipping pallets donated by Whole Foods.

Process

The design team disassembled the shipping pallets and removed all nails and metal hardware. Slats were milled to a standard size and sorted by species and color. The slats were glued and nailed together using a non-toxic carpenter's wood glue until the overall size of the tabletop slab met the required dimensions. It was planed and sanded until smooth, and then coated with a chemically inert resin. The legs were made from laminated slats while the frame was assembled from the thicker pallet skids using traditional hand cut dovetail and mortise and tenon joinery.

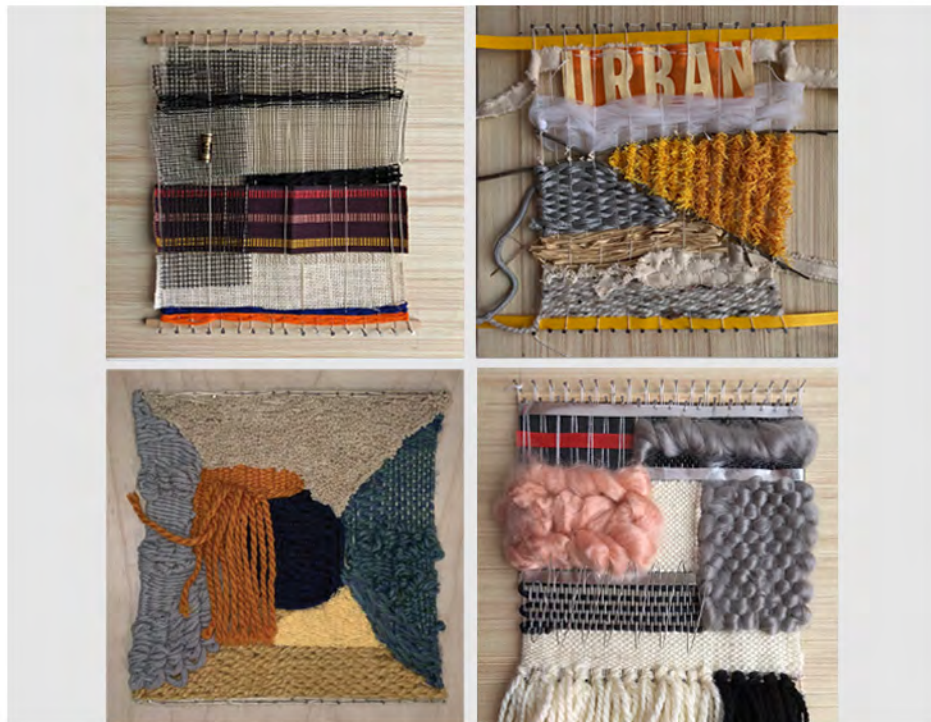
PalletCraft

Using reclaimed lumber from discarded shipping pallets, the course partnered with WholeFoods Marketplace exploring issues of consumerism, global shipping, sustainability, and recycled materials.



Bauhaus Stage

The first year of this two-week Summer semester study abroad program led to a performance on the Bauhaus Stage. We explored improvisational bodies in motion as a form of spatial design.



Weaving and Graphic Design

Weaving workshops encourage students to explore graphic patterns as tectonic constructions. Meanwhile graphic design relies on collage as the primary compositional method.



The Bauhaus Building

Working in the historic building allows students to connect with and understand the immense influence that the Bauhaus exerted over 20th Century architecture.



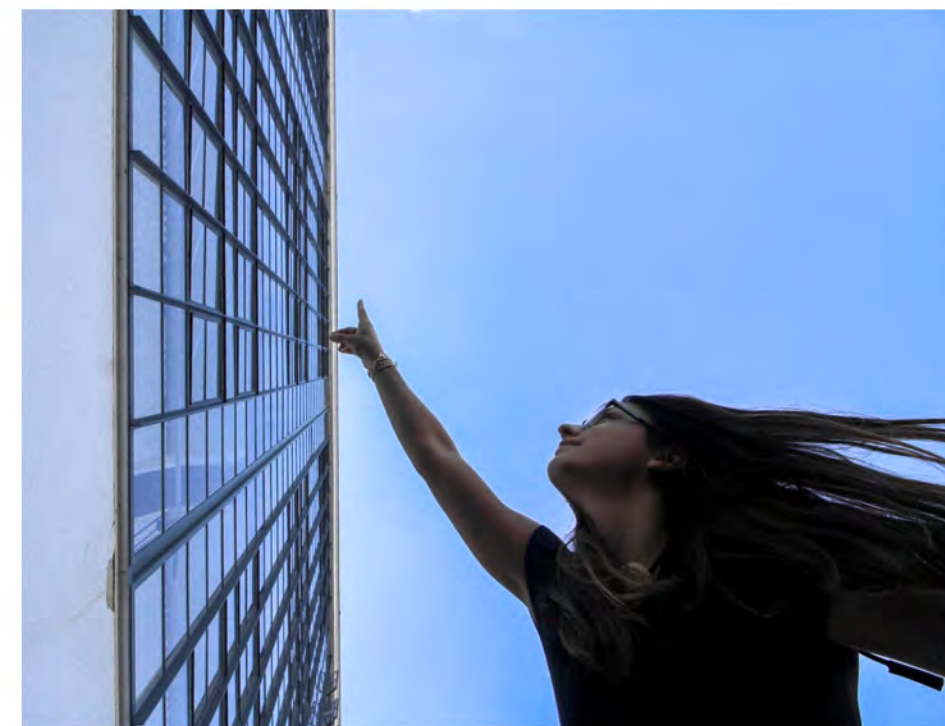
Formal Composition

Our students use a variety of materials and methods including laser cutting and 3D printing to create formal compositions deploying strategies they have learned from studying work from the Bauhaus.



Paper Folding

J. Albers had students work with humble materials to understand structure, form, and composition. Our students work with paper to discover and understand fundamental design principles.



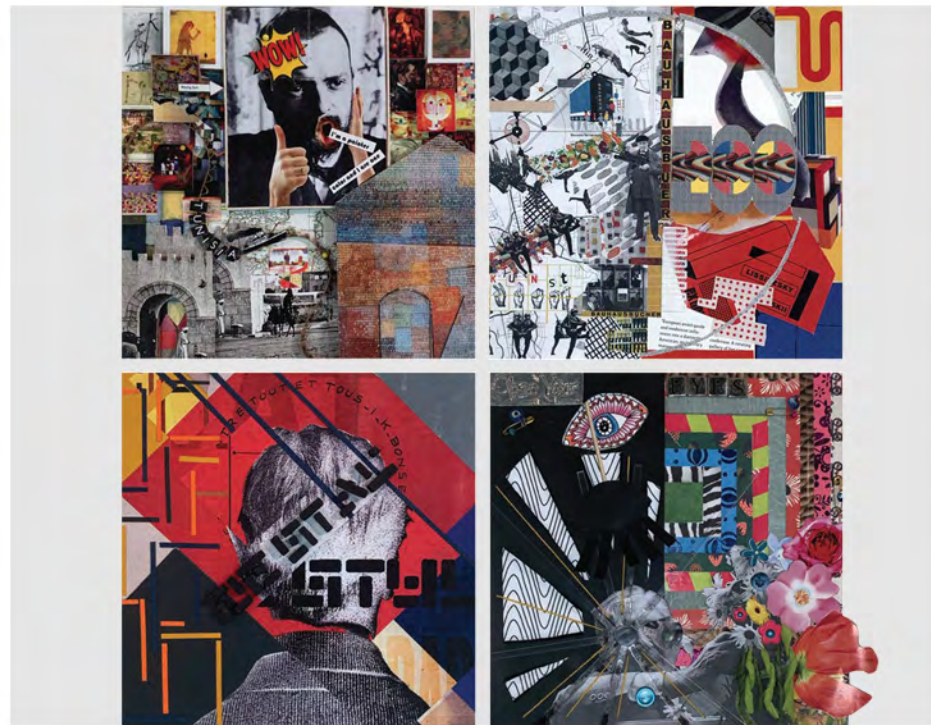
Animation

Studying the work of L. Moholy Nagy, H. Beyer, and J. Schmidt, our students develop animations to explore the rules of composition using moving graphic designs.



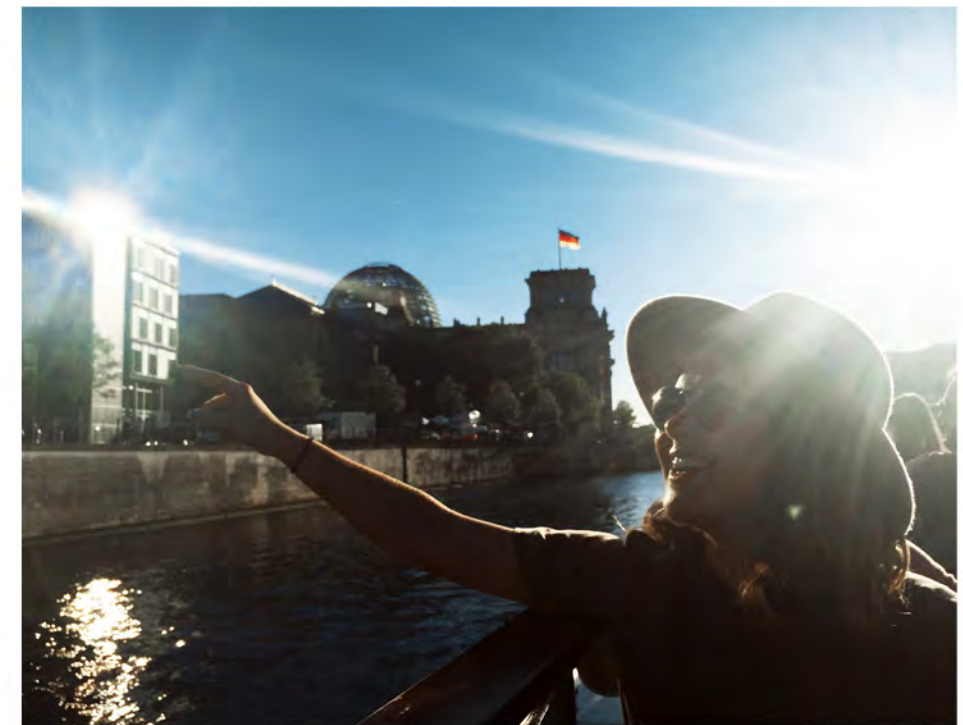
Photography

While studying at the Bauhaus we recreate iconic photographs as a means of understanding the compositional strategies that Bauhaus photographers used.



Collage and Color Theory

We study famous paintings from the Bauhaus to learn about the rules of color and composition and then use collage as a tool to quickly test an emerging knowledge.



Joyful Play

J. Itten famously wrote, "Play becomes party, party becomes work, and work becomes play." While traveling and studying, joyful play is our modus operandi.



FLORIDA INTERNATIONAL UNIVERSITY // ARCHITECTURE IN GENOA

FALL 2015



Semester Abroad in 4th and 5th Year

This Fall semester in Genoa Italy includes three courses and a D8/10 vertical studio with three weeks of travel to visit architectural precedents in various cities in Italy and Southern Europe.



FLORIDA INTERNATIONAL UNIVERSITY // ARCHITECTURE IN GENOA

FALL 2016



Site Visits

We visit over 200 precedents from antiquity to the contemporary era including works by Brunelleschi, Bernini, Boromini, Michelangelo, Corbusier, Scarpa, Piano, Hadid, MVRDV, and Herzog and DeMeuron.



FLORIDA INTERNATIONAL UNIVERSITY // ARCHITECTURE IN GENOA

SPRING 2018



Precedent Studies and Sketching

Students have a class devoted to precedent analysis so that they can learn from what they have seen and instrumentalize it in their own design work.



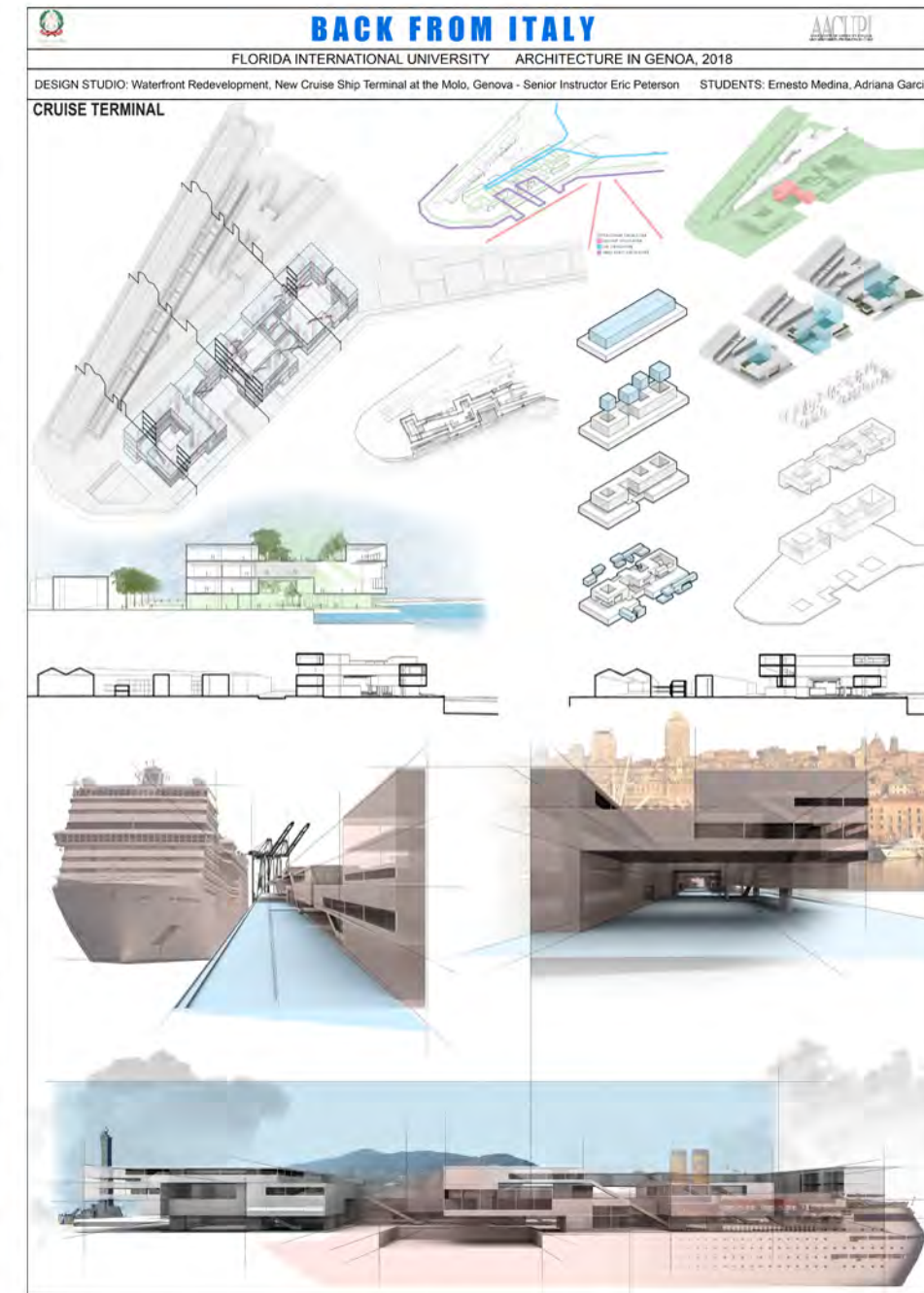
2015: Section City Fencing Studio

A disused empty lot adjacent to the ancient city wall served as the site for an Olympic Fencing Center including a training facility with dormitories, a gym, and regulation competition pistes.



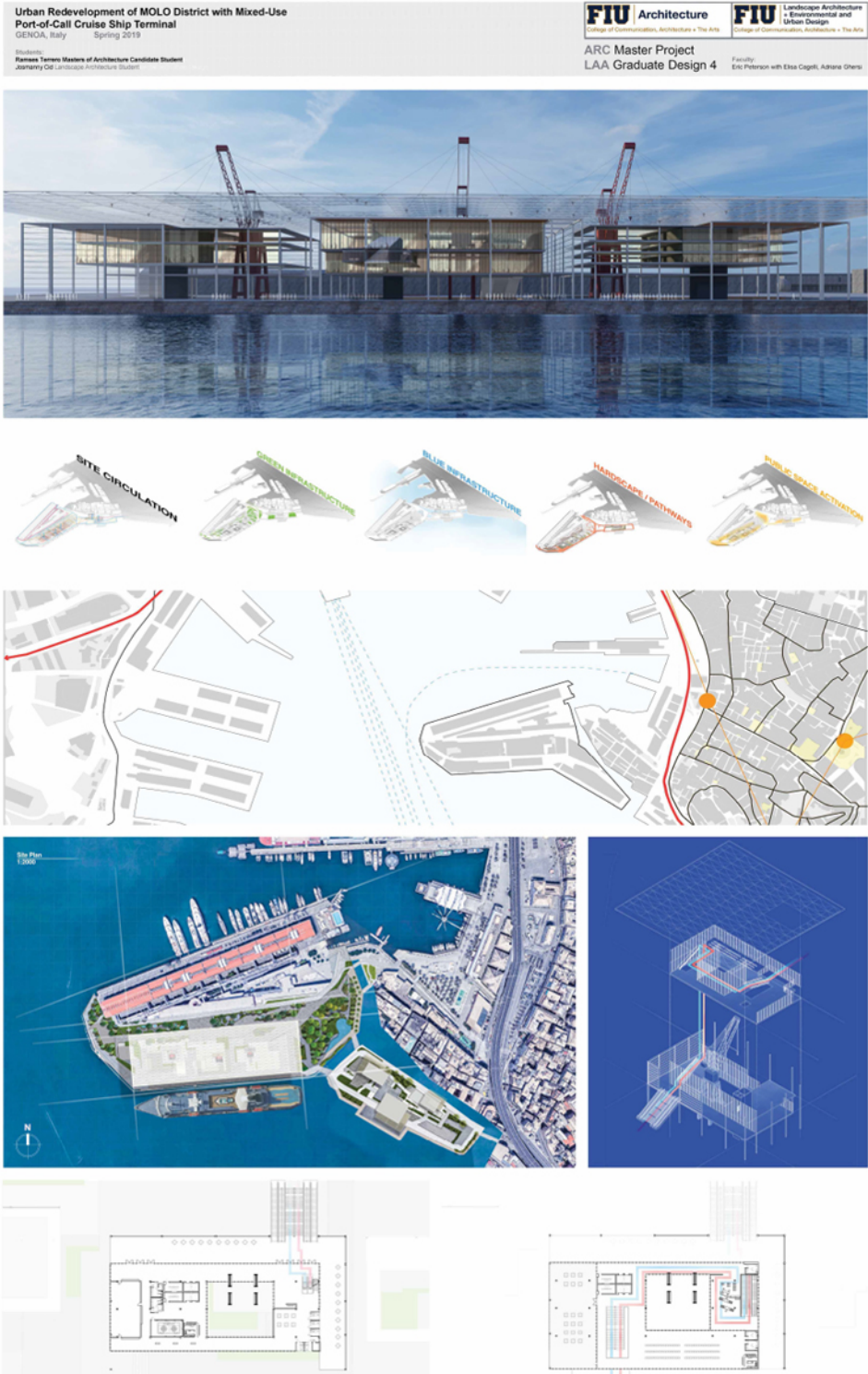
2016: Post-Industrial Italian Design Center

An abandoned train yard was reconceived as a new campus featuring fabrication workshops and maker spaces including the Italian Design Research Center and exhibition space.



2018: Waterfront Cruiseship Terminal

A portion of the industrial waterfront was redeveloped as a cruiseship terminal including offices, waiting lounges, retail spaces, exhibition spaces, and a multimodal transit hub.



Cruiseship Terminal: Interdisciplinary Studio
A portion of the industrial waterfront was redeveloped as a cruiship terminal. An interdisciplinary studio with Landscape Architecture, Josmany and Ramses won a Miami AIA Student Project Award.

