Proceedings

NCBDS 38

National Conference on the
Beginning Design Student

May 18-20 2023

Known and Unknown Territories

Hosted by

School of Design, Architecture & Art
North Dakota State University
Fargo, North Dakota

NDSU SCHOOL OF DESIGN, ARCHITECTURE AND ART SoDAA

Co-Chairs

Jennifer Brandel, MFA, AIA, NCARB, NOMA
Assistant Professor | Department of Architecture

Charlott Greub, MA, MFA, Dipl.-Ing. NRW
Associate Professor | Department of Architecture

Susan Schaefer Kliman, Ph.D., FAIA
Chair & Professor | Department of Architecture

Regin Schwaen, MA, MAA, AIA Assoc.
Associate Professor | Department of Architecture

Aaron Zhenhua Yang, MFA, Ph.D.
Instructor | Department of Visual Arts

Conferfence Director

Jennifer Brandel, MFA, AIA, NCARB, NOMA
Assistant Professor | Department of Architecture

On-Site Coordinators

Ben Bernard, MS
Design Technologist | School of Design, Architecture and Art

Jennifer Brandel, MFA, AIA, NCARB, NOMA
Assistant Professor | Department of Architecture

Teresa Enderson,
Administrative Assistant | School of Design, Architecture and Art

Regin Schwaen, MA, MAA, AIA Assoc.
Associate Professor | Department of Architecture

Graphic Design and Website

Regin Schwaen, MA, MAA, AIA Assoc.
Associate Professor | Department of Architecture

Aaron Zhenhua Yang, MFA, Ph.D.
Instructor | Department of Visual Arts

Proceedings Editors

Jennifer Brandel, MFA, AIA, NCARB, NOMA
Assistant Professor | Department of Architecture

Regin Schwaen, MA, MAA, AIA Assoc.
Associate Professor | Department of Architecture

The Proceedings were published in conjunction with the 38th National Conference on the Beginning Design Student, held at North Dakota State University, May 18 - 21, 2023. Abstracts were double blind peer-reviewed and each abstract received a minimum of two reviews.

The photo from the Knife River Historic Village Site, ND, that mirror the NDSU Land Acknowledgement is by Meghan Duda.

The photos from the University of Mary in Bismarck, ND, that mirror the index are by Regin Schwaen.

Provost

David Bertolini, Ph.D.
Provost | North Dakota State University

Conference Sponsors

Dominic L. Fischer, PLA, MLA, ASLA
Chair and Associate Professor | Landscape Architecture

Susan Schaefer Kliman, Ph.D., FAIA
Chair & Professor | Department of Architecture

Michael J. Strand, MA, MFA
Professor and Director | School of Design, Architecture & Art
Chair, Visual Arts

Student Assistants

Dahlia Bender
Belle Helseth
Matthew Peikert
Ashifur Rahman
Brandon Geiselhart
Madeline Hursey
Beth Ponto
Caleb Springfield

Reviewers

Matthias Altwicker
Hala Barakat
Kory Beighle
Eric Bellin
Alejandro Borges
Sean Burns
Erin Carraher
Madison Cook
Cesar Cruz
Meghan Duda
Roderick Grant
Erin Hunt
Meg Jackson
Sarah Keogh
Deborah Ku
Leyuan Li
Michael Lucas
Tim McGinty
Margaret McManus
Virginia Melnyk
Annika Miller
Taryn Mudge
Dillon Pranger
Sarah Ra
Sarah Rupani
Kyle Schumann
Lloyd Shenefelt
Malini Srivastava
Stephen Temple
Anna-Maria Visilia
Nicholas Wickersham
Ross Wienert
Robert Arens
Kristin Barry
Kaden Beilman
Andrea Melgarejo de Berry
Stephanie Bunt
Simon Bussiere
Mike Christenson
Marianne Cramer
Will Doss
Trace Gainey
Liane Hancock
Richard Hunt
Tim Karoleff
Emily Knox
Brian Lee
Deeg Lohren
Radu Remus Macovei
Mark McGlothlin
Victoria McReynolds
Meghan Mick
Bailey Morgan Brown Mitchell
Kristopher Palagi
Eleanor Pries
Georgios Rafailidis
Madison Sabatelli
Matthew Shea
Peter Sprowls
Jonathon Stevens
Kentaro Tsubaki
Bradford Watson
Mira Woodson
Sarah Young

ISBN: 978 1 312 29955 9

NDSU SCHOOL OF DESIGN, ARCHITECTURE AND ART SoDAA

NDSU Land Acknowledgement

We collectively acknowledge that we gather at NDSU, a land grant institution, on the traditional lands of the Oceti Sakowin (Dakota, Lakota, Nakoda) and Anishinaabe Peoples in addition to many diverse Indigenous Peoples still connected to these lands. We honor with gratitude Mother Earth and the Indigenous Peoples who have walked with her throughout generations. We will continue to learn how to live in unity with Mother Earth and build strong, mutually beneficial, trusting relationships with Indigenous Peoples of our region.

Table of Contents

MODERATORS

Mike Allmendinger
President, Kilbourne Group, Fargo, ND

Kristin Barry
Associate Professor, Department of Architecture,
Ball State University, Muncie, IN

Whitney Bourgois
Adjunct Professor of Architecture, North Dakota
State University, Fargo, ND

Jennifer Brandel
Associate Professor, Department of Architecture,
North Dakota State University, Fargo, ND

Erin Carraher
Associate Professor, Director of Undergraduate Studies,
University of Utah School of Architecture, Salt Lake City, UT

Mike Christenson
Professor of Architecture, Digital Design Center Director,
School of Architecture, University of Minnesota, Minneapolis, MN

Lisa Eggebraaten
Head, North Dakota State University, Downtown Branch
Libraries and Design Librarian, Fargo, ND

Don Faulkner
Professor Emeritus, Department of Architecture,
North Dakota State University, Fargo, ND

Jessica Garcia Fritz
Assistant Professor, School of Architecture,
University of Minnesota, Minneapolis, MN

Dominic Fischer
Associate Professor, Chair of Landscape Architecture,
North Dakota State University, Fargo, ND

Charlott Greub
Associate Professor, Department of Architecture,
North Dakota State University, Fargo, ND

Meg Jackson
Associate Instructional Professor,
University of Houston, Houston, TX

Susan Schaefer Kliman
Professor, Chair of Department of Architecture,
North Dakota State University, Fargo, ND

Albert Marichal
Associate Professor of Design
Texas Christian University, Fort Worth, TX

Tim McGinty
Professor Emeritus, Assistant Dean, Arizona State University,
Boulder, CO

Victoria McReynolds
Assistant Professor, Huckabee College of Architecture.
Texas Tech University, Lubbock, TX

Andrew Stark
Assistant Professor of Practice, Department of Visual Arts,
North Dakota State University, Fargo, ND

Kentaro Tsubaki
Favrot Associate Professor, Associate Dean for Academics,
Tulane University School of Architecture, New Orleans, LA

Nick Wickersham
Assistant Teaching Professor, University of Southern Mississippi,
Hattiesburg, MS

AUTHORS

* Paper not presented at the NCBDS 38 conference in Fargo

Preamble

The space between idea and outcome is the time of unknown navigation as a designer. Over time and with experience one may gain insights into a process that works for one's self. But what of the beginning designer? The one who is yet to develop a process of ideation and testing, failure and success, trust with one's self and others. An educator or mentor may help guide a student through the many ways a design process may unfold, but ultimately each person must choose what works for them in any given circumstance and with any known or unknown constraints.

What is Known and Unknown Territories? What is the direction? What is the outcome? Imaging the unknown future is not an easy venture. This is what makes the educational process of the beginning design student so important and worth considering. Unlike many fields, design is one with multiple answers and ingemination. Definitiveness is based on knowledge, experience, intuition, and expertise but each designer's outcome is different, potentially valid, and at their best, innovative for the present and future we need.

The divergence of treading in unknown territory to find new ways to design, represent design, and hone design thinking as a way to test new ways of being in the world is the elasticity of a creative mind. This adventure requires the right tool sets physically, mentally, emotionally, and socially and this is the work of beginning design education. What follows here is a collection of thoughts on this process from educators from 36 institutions and numerous perspectives on the main themes of this conference: Terra Incognita, Otherness, Future & Past, Technology, and Speculation. Welcome to the known and unknowns in beginning design.

Fargo, North Dakota, 18th of May, 2023
Jennifer Brandel
Regin Schwaen
Proceedings Editors

Known and Unknown Territories

Known and Unknown Territories

The conference focuses on ways in which known territories and unknown territories are contemplated, explored, and defined in the beginning design education and spatial thinking. The question of Known and Unknown Territories is intended to guide beginning design students to a new place of understanding rather than to a location. How does this question manifest in pedagogical processes? Didactic, haptic, and technological inventions are in constant flux and evolution. Reconsiderations of how we approach the built environment and the systems we interact with are emerging from the Pandemic into a space in which we must reconsider how and where we design.

The conference organizers welcome educators and students from the fields of art, architecture, design, and landscape architecture within five areas or perspectives:

Terra Incognita
Otherness
Future and Past
Technology
Speculation

By embracing these themes and their intersections, the conference organizers hope to initiate conversation and stimulate thoughtful debate on the role of Known and Unknown Territories and their intersection with respect to multi-disciplinary beginning design.

Terra Incognita

How do we define the blank space on the map and why? How do we define the Unknown? How are students taught to enter and explore areas that are unfamiliar? When does the Unknown become Known in the field of art, architecture, design, and landscape architecture? How do we trace the path of peoples, animals, wars, climates, and technologies on a global scale in order to research humanity's impact on the planet, and the ways in which we can make a real impact to save it, and to thrive as a species?

Otherness

How does the beginning design student define Otherness? What is Otherness in art, architecture, design, and landscape architecture? Does the creative mind seek Otherness or does it object to Otherness? What is the Known and Unknown in Otherness? What if we seek lines of communication through the lens of the other, not just that of humans but within the depth of the natural world around us?

Future and Past

How do certain aspects of the past endure, and how do these components and/or characteristics influence the Future? How do we navigate venturing into the completely Unknown? How does knowledge of the Past and the risk of innovation factor into design and how we introduce it to beginning students?

Technology

How is Technology introduced to the emerging students in art, design, and landscape architecture? How is Technology implemented and are there any pedagogical goals or restrictions? How do rapid changes in Technology influence design, from the tools we use to the materials with which we design? In an increasingly expansive and undifferentiated platform of information and opportunity, what is the future architect, designer, and artist? Will emerging students design on solid ground or in mediated realities and platforms?

Speculation

What if? How might we? What can we learn about designing for the future through examination of extreme or unrealistic propositions? What is the impact when students are unleashed from the typical constraints of gravity, economy or even established societal norms thereby creating a petri dish of design possibility and failure? How can running amongst the extremes of utopian visions and dystopian manifestations wherein lies a landscape of design push imaginative alternative futures and possibilities?

Session 1

Getting to Know the Unknown by Starting Small

Emily Knox, Auburn University

Introduction

Landscapes are endlessly complex and dynamic. Yet designers, both seasoned and emerging, are often asked to know them quickly. Methods for doing so are many; a long list of architectural site planning and site analysis textbooks describe various ways of introducing oneself to a place[1]. Though the methods are diverse, more often than not, we are trained to "see" unfamiliar terrains by zooming-out. Drawings at the scale of a map, or at the grain of a diagram are popular tools. These artifacts are valuable; they allow us to see places from above. This way of looking is especially useful to unearth large-scale processes and patterns[1], which would otherwise be difficult to perceive from the human vantage point on the ground. But, despite its wide acceptance, this way of seeing is certainly not the only way to get to know an unknown terrain[2]. For the beginning design student, it is perhaps even not the best way. This paper argues for the value of starting small in beginning design; of zooming-in, rather than out. It argues that there is much to learn about the large from the minute, and that the details help us become fluent in the grand. For the beginning design student, especially in landscape architecture, starting small is particularly valuable in the ways that it privileges the physical materials of landscape: plants, soils and water, over large-scale systems. Though both scales are important, students must inevitably understand the former to truly engage the latter.

The paper will first consider the contemporary role and value of zooming-out – of mapping and diagramming –in the design disciplines. Then, it will explore what it means to, as an alternative strategy, start small. It will do so by presenting four iterations of a beginning design studio run in Auburn University's graduate landscape architecture program. The entirety of the 16-week studio is built upon a several week-long study of a very small site – a 1m x 1m square of ground. Through recurrent hand-drawn mapping, each student is tasked with gaining an intimate understanding of the dynamic nature of an unfamiliar, and seemingly mundane site. Rather than zooming-out, the exercise asks them to closely observe and record small shifts in the most basic elements of the landscape - soils, topography, vegetation, climate and water. The small site allows them to look closely and frequently and to become experts through intimate engagement over time. It does not allow for abstraction, but rather forces students to ask questions about individual plants, soils, moisture, sunlight and process - to see and draw what they might otherwise reduce or dismiss.

Mapping / zooming-out

Increasingly, mapping has become a critical site analysis tool in the design disciplines. The map offers an invaluable method for zooming-out, seeing landscapes processes and patterns which occur over large scales[3]. Maps and cartography have long been used by other related disciplines as a method for describing places, though Ian McHarg is often given credit for adapting the map to the design disciplines[4]. His work, which predates digital Geographic Information Systems (GIS), used analog techniques to overlay and map land use criteria, unearthing overlaps and patterns which could be used to make design decisions. The work was at the same time innovative and problematic, often critiqued for reducing complex landscape dynamics to a series of two-dimensional hatches and colors[5]; but, his legacy very much lives on in the discipline. Both in academia and practice, the map is arguably now just as common an artifact as a traditional plan or section drawing.

The map, which is inherently spatial, allows designers to take on a new domain of knowledge or scale of practice. A project like Richard Weller's Atlas for the End of the World, for instance, takes the world as it's site[6]. The project consists of a catalog of maps at the scale of planet earth, which serve as powerful storytelling devices. As a collection, they spatialize a range of global, landscape-based trends, from urbanization to meat production, to conflict and corruption. This work could be understood as a type of "site analysis", the map functioning as a tool of producing knowledge about a place (the world) and its dynamic networks and relationships. Similar examples abound, from Forbes Lipschitz' Atlas of Adaptive Agro-Ecologies[7] or even Jane Wolff's field guide of the California delta, from her book *Delta Primer*[8]. Though at different scales and drawn using different media, each example zooms out to perform a type of site analysis: to see, make

sense of, and communicate a complicated set of site dynamics occurring at a large scale.

This trend also infiltrates into landscape pedagogy. In beginning design sequences specifically, site analysis often uses the map as a tool to zoom-out and record simple inventories. Locations of trees are marked as points, surface materials noted with hatches, movement of water, people or creatures recorded with lines or arrows. More broadly, a seemingly growing proportion of work coming out of both graduate and undergraduate landscape architecture programs begins at the scale of the map. This makes sense, as landscape architecture has increasingly taken on issues of large-scale systems, like food or energy production, often at the expense of the plaza or park. The Green New Deal Superstudio, for instance, which ran between 2020-2021, was made up of more than 180 studio courses taken by nearly 3,000 students across the globe and took on a range of national landscape issues addressing climate justice, job creation and infrastructure[9]. Again, over the last several years, there have been a slew of other landscape architecture studios who take the maps as a starting point. Typically, that map would serve as a systems scale site analysis tool, eventually leading students to zoom in to a smaller site related to the larger patterns in some way.

This work, and these working methods are valuable. Zooming-out allows us to see things beyond the human perspective, and perhaps reflects contemporary trends in the discipline like addressing climate change. But it would be irresponsible to assert that the map is sufficient. While zooming-out is capable of informing our design decisions, allowing us to see and engage with regional or global scale landscape issues, it simply will not ground those decisions in the real, experienceable, human scale of a place. And, in the end, landscape architecture happens on the ground. It is the details – the soils, plants and water, which get reimagined, reorganized and managed to shape experience and atmosphere. The sensitive designer should have fluency in not one, but both scales of seeing and knowing. Despite this, in beginning design, and landscape pedagogy more generally, methods of zooming-out are privileged – creating students fluent in systems, but illiterate in landscape details.

.

To be landscape literate in this way is no simple task, though there are disciplinary models of this multi-scalar sensitivity to refer to. The work of the Dredge Research Collaborative (DRC), for instance, often begins with a map.

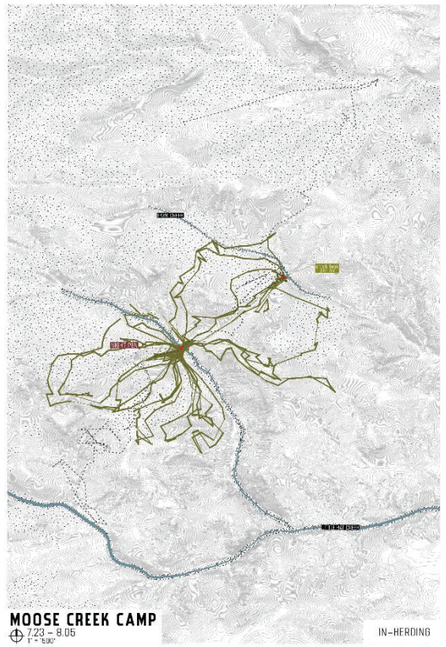


Fig.1: Map of grazing allotment and grazing patterns used to understand large scale ecological processes and patterns.

Those maps cover a breadth of scales with a range of intentions. Sometimes the map digests global transport and navigation networks, while at other times they more closely explore the inner-workings of a watershed, bay or "sediment-shed"[10]. For the DRC, this type of site analysis is necessary. To address sediment issues, the group must understand its complex networks: where the sediment is coming from, where it is headed, and who is impacted along the way. Sediment does not move at the scale of a discrete site, but rather a larger geographic region. It is however, perceived at the scale of a discrete site. And so, the Dredge Research Collaborative, as site designers, must inevitably jump scales of seeing and knowing. They must know the precise make-up of that sediment, in order to understand it's movements; they must also understand how small-scale shifts in sediment load may impact individual plants and ecologies or how placing specific amounts of sediment here leads to accumulation there. The group uses a range of tools to zoom in, including on-site methods like photography, and remote methods like sediment tables[11]. Both offer ways of seeing the small, understanding the details, and guiding design action.

In my own work in large rangeland and grazing landscapes, the map serves as a tool for understanding patterns of movement and ecological processes. Like in the work of the DRC, these maps are a potent and necessary tool for unearthing forms which would otherwise be obscured by scale and time (figure 1). But to begin making decision about manipulating those large patterns, the map must be paired with a human scale site reading, one based in the tangible and real. The scale of the plants, soils and creatures which make up these landscapes is ultimately where the power of design lies – ecologically and aesthetically. One must supplement the map with this scale of information: only then, can grounded design choices be made.

Methods / Starting Small

While we are practiced at asking students, and particularly beginning design students, to learn about a place by zooming-out, the following describes a method and outcomes of introducing students to an unknown terrain through the opposite: by zooming-in or starting small.

Part 01 / Site Reconnaissance

The studio begins outside, though where exactly outside is not so important. Across four years, the studio has been run on three distinct sites. First, a post-industrial ruin; next, a demonstration forest composed largely of commercial loblolly pine (Pinus taeda) stands; and finally, a working cattle farm. Each site was representative of a typological southeastern landscape, and each created unique, but equally valuable opportunities for student learning. There is much to learn about each of these landscapes by looking from above, or producing a map that considers the structure, flows and patterns of the entire site. But instead, students begin the studio by walking the larger landscape, in search of three small sites (figure 2). This collection of small worlds become their focus for the next seven weeks. For four of those weeks, each student returns again and again to their three sites, looking closely for change through time. Though they may look beyond the boundaries of their worlds for clues, they are never asked to look at a scale beyond what's perceptible on-the-ground. Instead, they are asked to recurrently map their worlds - some years in plan and others in section - recording and translating the small changes that accrue over time. While at first students wait patiently for something dramatic to occur, for the grasses to uproot, or the bank to erode, they quickly learn that to meaningfully complete the assignment requires them to observe much more closely. They must look closely enough to see the shifts in the form of moss relative to humidity and rainfall levels, or the small amounts of sediment that accumulate on exposed roots leading to the growth of an opportunistic species. Even these small changes may not occur during the four-week time period, and so students

Fig.2 Students select small sites in Opelika, Alabama.

must infer histories and see into the future to piece together the unique puzzle of their site. The drawings, all completed at either half or full-scale, become an important tool for seeing at this scale. To draw small change at this large scale requires careful attention. The students whose drawings appear flat have clearly not succeeded in seeing the small, but the students whose drawings, through careful use of texture and mark-making, express small differences in soil moisture, soil texture or shadow, have begun making a highly specific reading of site dynamics.

In the first iterations of the studio, students were required to draw four plan drawings and two section drawings per site across four weeks. The emphasis on plan drawing allows students to understand all sites as a series of a gradients – of sun, shadow, moisture, soil type and slope. Representing each square inch of the site forced students to recognize these gradients at a meaningful scale, then relate those gradients back to landscape processes like plant growth and decay or erosion and sedimentation. Though at a much different scale than typical site analysis, these plan drawings forced students to consider representational abstraction in similar ways that they would with a map or diagram. To draw the site photorealistically is not useful as an analytical or storytelling tool; instead, students grappled with amplifying some qualities and omitting others to narrate their world. Successful work abstracted the aforementioned gradients or individual plants to a series of marks and notations, rather than drawing to precise detail. Students are forced to ask questions about the physical materials of the landscape in order to draw them. For example, in 2019, Anna Mitchell studied the deterioration of a fallen loblolly pine at the Mary Olive Thomas Demonstration Forest. Her series of plan drawings interrogated the relationship between the log's rate of decay and its vulnerability to water infiltration in the concentric rings of the tree. In this case, her ability to see this phenomenon was magnified by the act of drawing at this scale (figure 3).

In 2018, the studio cohort completed the exercise on a post-industrial site in Opelika, Alabama. Romina Delgado observed how post-industrial materials like brick and gravel pair with unique subsurface conditions (namely soil compaction) to create a distinctive ground plane, species composition and growth patterns. Through her drawings,

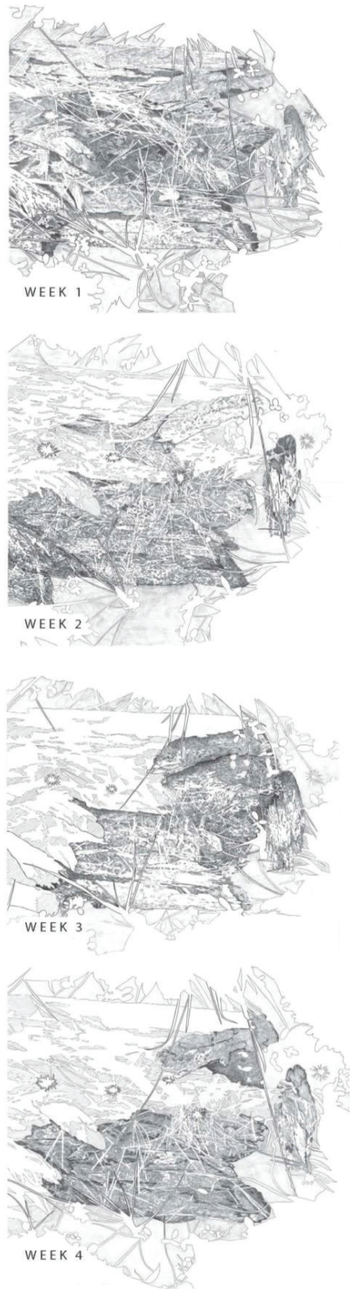


Fig.3 Anna Mitchell draws a decaying loblolly pine at the Mary Olive Thomas Demonstration Forest.

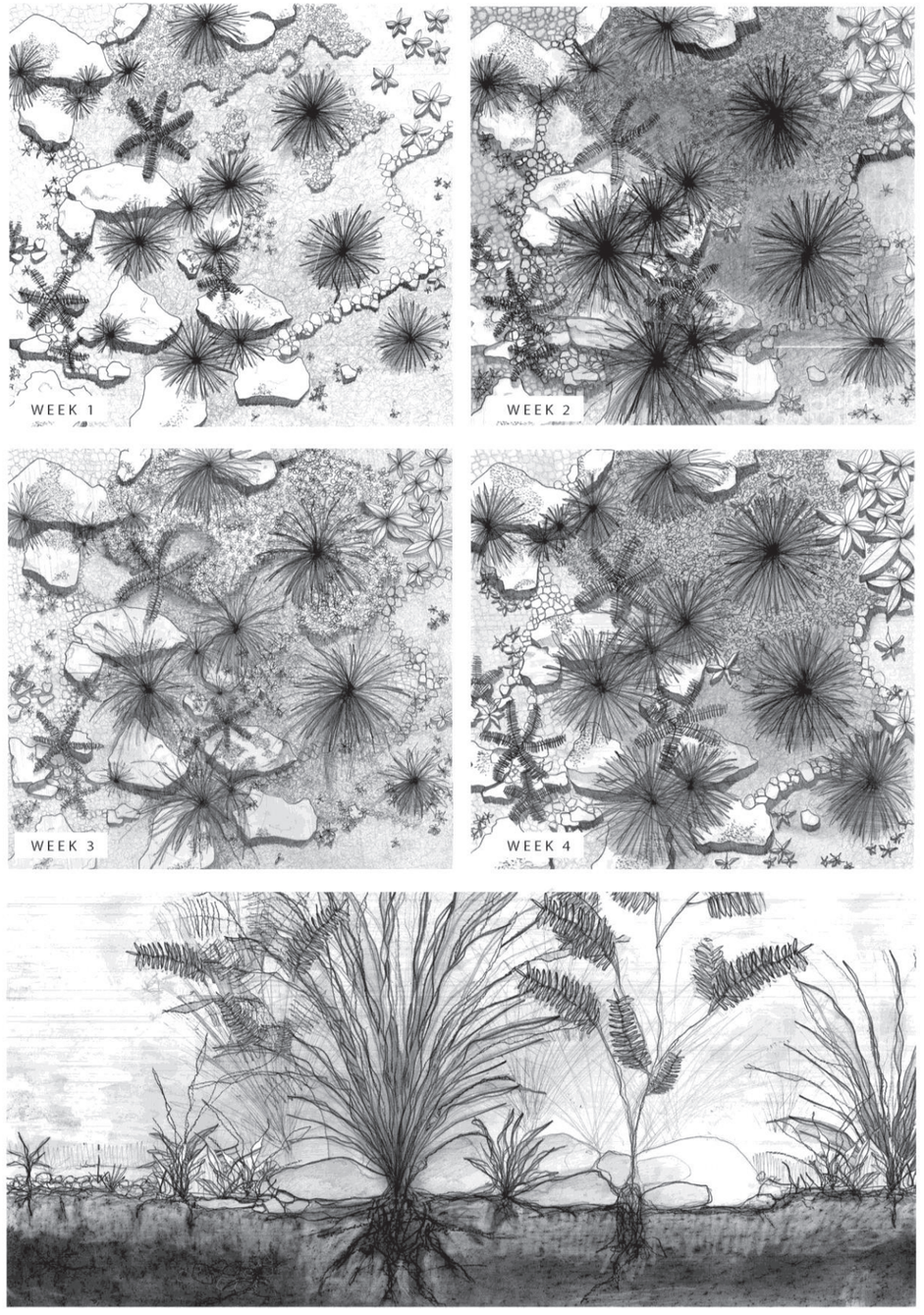


Fig.4 Romina Delgado studies unique post-industrial plant and material assemblages in Opelika, Alabama.

retention. Larger chunks of brick and concrete created microclimates capable of hosting plant communities that grew and decayed relative to weather patterns over the four-week period (figure 4).

In later iterations of the studio, students were asked to draw three sections and a plan twice during the four-week period. In this case, they were tasked with selecting which moments in time were most critical to capture. The emphasis on section drawing generated a much different collection of landscape representations. By requiring three sections students were forced to slice through or dissect their small site at what seemed like an absurd frequency. That frequency, though, once again forced a scale of seeing atypical to traditional site analysis. Through highly detailed, full-scale section drawing, students had no choice but to document the smallest of shifts in topography or soil quality that were responsible for the unique condition of their site. The resultant drawings of this exercise were far more literal than the previous iteration – often including precise line drawings of plants paired with an abstracted or notational strategy for representing the force at work behind the scenes – whether that was related to water, sun or soil.

Anna Claire, for example, studied a seemingly banal patch of pasture in Camp Hill, Alabama. While at first glance, one might only notice a chaotic tangle of tired grass, Anna Claire's collection of section drawings unearthed a much a more complicated and compelling story about relationships between cool and warm season grasses. She recorded carefully how the individual bahia grass (*Paspalum notatum*) leaves cured and decayed, creating space and light for new broomsedge (*Andropogon virginicus*) and little bluestem (*Schizachyrium scoparium*) leaves and seedheads to emerge (figure 5). If asked to draw the entire pasture, the drawings would inevitably become generalizations, unable to reach the scale of the soil or individual grass. In the opposite direction however, starting small gave students the literacy to apply what was seen within the boundaries of their worlds to what occurs beyond.

Each iteration of this exercise had its own merits – leading to distinct learning outcomes. In the post-industrial iterations, students grappled with the ways that man-made conditions lead to new and distinct site assemblages. In the Mary Olive Thomas Demonstration Forest, they begin to read the constructed forest as the result of industrial processes butting heads with ecological processes like growth, decay and disturbance. And on the working farm, drawings interrogated the layered agricultural processes and impacts of animals that have, over time, accrued to produce the present condition.

Fig.5 Anna Claire Mitchell studied the relationship between warm and cool season pasture grass species.

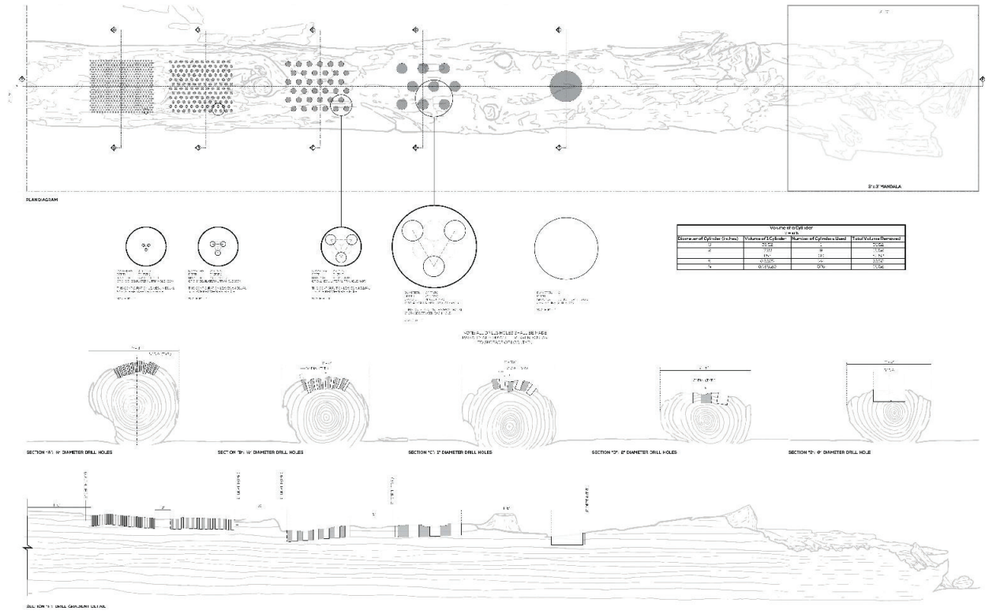


Fig.6 Terrain Intervention: Construction drawings by Anna Mitchell.

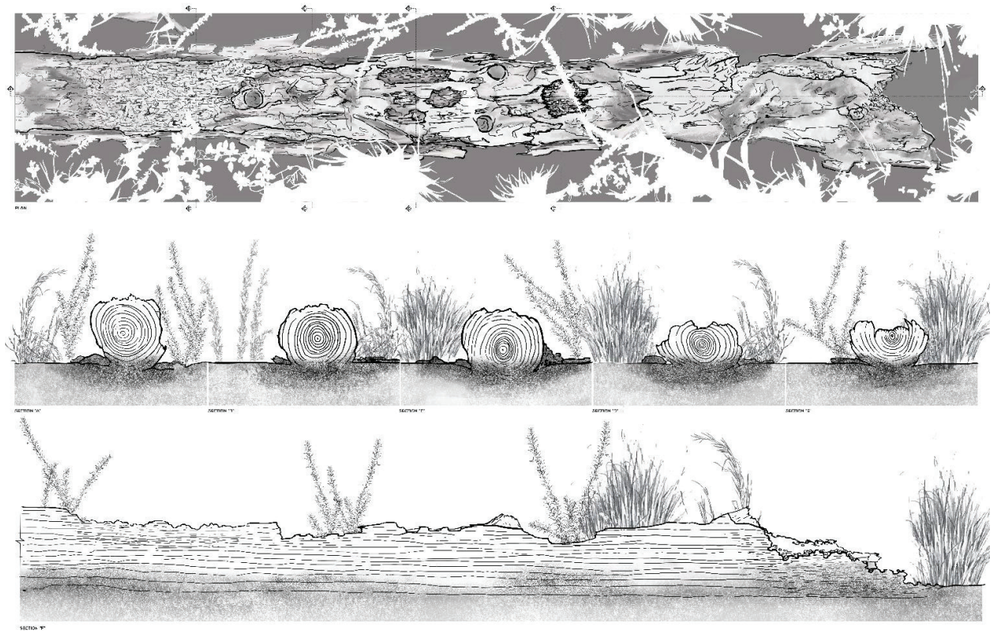


Fig.7 Terrain Intervention: Speculation drawings by Anna Mitchell.

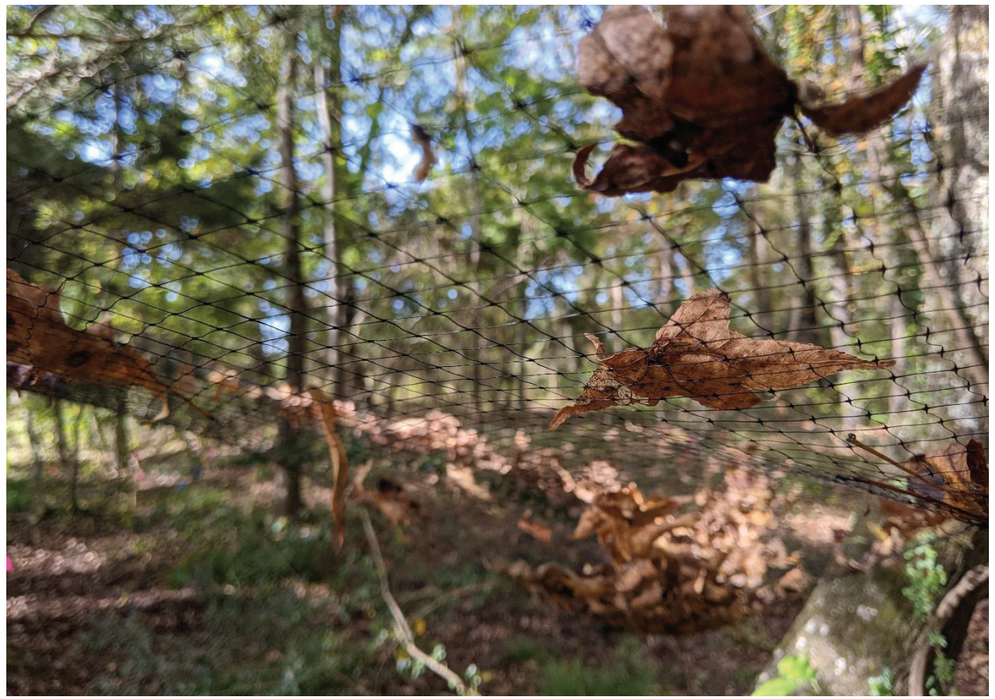


Fig.8 Anna Claire Mitchell's designed leaf catchment system at work in Camp Hill, Alabama.

Part 02 / Terrain Intervention

In the second portion of the assignment, Terrain Intervention, students are asked to translate their observations into an act of design. This exercise required a more traditional set of digital or hybrid drawings, including analysis, construction and speculation. This exercise is less about drawing, and more about three-dimensional making, relying heavily upon the drawings from Terrain Reconnaissance. Each student selects one of their three sites to expand and further investigate, now tasked with engaging the processes and relationships they drew in the previous assignment, shifting, shuffling or amplifying the observed dynamic condition. Terrain Intervention is explicitly not about creating social or ecological value; nor does it require ethical grounding. Instead, it is about a potent and meaningful conversation with site. This often requires redirecting energy from solving a landscape-based problem (what many beginning landscape students expect to be doing) and instead, instigating an intimately scaled response to soil, plants, and process. The exercise requires learning that design action can and should grow directly from site readings and observation. Students observe that even small interventions can produce significant landscape changes, a demonstration of the designers' agency.

Site boundaries may be redrawn beyond the original small worlds, where knowledge from Terrain Reconnaissance can be drawn upon to recognize larger-scale landscape patterns. Drawings are made digitally and expand according to their new site boundaries. The new drawings inevitably lose specificity, clarifying the importance of the original exercise. Without Terrain Reconnaissance, students would not have seen their previously unknown terrain closely enough to engage their sites with sensitivity. After designing their intervention, they are then asked to speculate into the future about changes that will unfold as a result of their meddling.

Anna Mitchell studied the deterioration of a fallen loblolly pine at the Mary Olive Thomas Demonstration Forest. After interrogating the relationship between a fallen log's rate of decay and its vulnerability to water infiltration in the concentric rings of the tree (figure 3), her Terrain Intervention work created a new series of perforations into the trunk, accelerating the process of decay relative to the density and size of the bored holes. She tested multiple tools and forms, and ultimately selected the tool that allowed her to reliably vary the depth and volume of her perforation (figures 6 and 7).

On another site, Anna Claire initially studied nutrient cycling in the forest floor. As leaves and pine straw hit the ground, they decayed in different layers and at different rates, depending on the species. She interrogated that process through her drawings, and its impacts on growth and decay in the ground plane and shrub layer. Later, in Terrain Intervention, she responded to these observations by designing a catchment system that withheld or concentrated new debris layers, creating new and interesting growth patterns on the ground (figure 8).

Discussion

This paper does not seek to pit one way of seeing against another. It simply advocates for valuing a broader range of tools for doing the difficult job of getting to know an unknown terrain. It hinges on the notion that the way that we see dictates the way that we act or respond[12]. And so, the work of this studio is about understanding the type of sensitivity that is produced by fostering a different scale of seeing.

In Terrain Reconnaissance, this method of zooming-in prioritizes a reading of the landscape as a collection of tangible and interconnected materials which exist at the human scale, rather than an abstract network of relationships only visible from above. Students are forced to ask questions about those physical materials in order to draw them. It is that scale of seeing and knowing which then informs their design work in Terrain Intervention. If the studio had begun by zooming out, observing larger site patterns, the design work would have inevitably also occurred at that scale, for we are only capable of responding to what we know. Instead, the design work of Terrain Intervention is a direct outgrowth of the scale of seeing afforded by the initial assignment. Though this design exercise does not ask students to create space intended for humans, or space imbued with social, aesthetic or ecological value (the typical task of a landscape architect) it introduces them to an intimate, carefully calibrated design ethos which can be carried into future work. Successful projects are attuned to the scale of the individual plant, gully or microclimate. Students shift and shuffle the most basic of landscape elements, testing their own agency to produce an altered condition. This prompt forces them to begin from, rather than erase, what exists.

The studio intentionally introduces students to this alternative way of seeing early in the curriculum, to foster this sensitivity to the physical realities of the landscape – its soils, topographies and ecologies. To skip this step is to ignore a critical building block. Students must inevitably understand the details if they are to responsibly or thoughtfully engage a larger system. Though later in the curriculum they move onto more traditional methods of familiarizing themselves with unknown terrains, zooming-out, mapping and diagramming, this initial exercise in Studio 1 serves as a rich base which they can inject into more advanced studio courses.

Starting small has additional pedagogical benefits. Participants in the studio leave having learned that everywhere is somewhere, and that process unfolds in all landscapes at all scales. Most importantly, they take their first steps towards landscape literacy[13], learning to look closely and read carefully. The tactile understanding of the landscape that emerges from this work and these drawings becomes a base upon which students build a strong, sensitive and rich landscape practice. As previously discussed, the studio has been tested in various contexts: a working farm, a demonstration forest, and a post-industrial ruin. Ultimately, each has unique fodder for student discovery and growth. The set of exercises is entirely transferable, and could be run in most landscapes, from the wild to the everyday. The small site allows them to look closely and frequently and to become experts through intimate engagement over time. As an approach to beginning design, these sensibilities ground students in landscape as a physical medium and jump start the process of becoming fluent in the language of plants, soils, and process. In choosing to zoom-in, rather than out, the studio cultivates beginning design students who are curious, who experience wonder, and who look carefully and engage meaningfully with the complex landscapes that surround them.

Bibliography

Corner, James. "*The agency of mapping: Speculation, critique and invention*". na, 1999.

"Green New Deal Superstudio.", 2021. https://www.gndsuperstudio.com/

Herrington, Susan. "The nature of Ian McHarg's science." *Landscape Journal* 29, no. 1 (2010): 1-20.

Holmes, Robert, Milligan, Brett, and Wirth, Gina. "Silt, Sand, Slurry: Dredging, Sediment and the Worlds We Are Making." San Francisco, Applied Research and Design, 2023.

Holzman, Justine. "Review: Dredgefest Great Lakes Symposium." *Landscape Journal* 35, no. 1 (2016): 140–43. http://www.jstor.org/stable/44132777.

Lutsky, Karen, and Sean Burkholder. "Curious methods." *Places Journal* (2017).

Simonds, John Ormsbee. *Landscape architecture: a manual of site planning and design*. No. Sirsi) i9780070577091. 1997.

Spirn, Anne Whiston. "Landscape literacy and design for ecological democracy: the nature of Mill Creek, West Philadelphia." *Grounding Urban Natures: Histories and Futures of Urban Ecologies* (2019): 109.

Steiner, Frederick R. "The Ghost of Ian McHarg." *Log* 13/14 (2008): 147-151.

Weller, Richard J., Claire Hoch, and Chieh Huang. *Atlas for the End of the World*. University of Pennsylvania, Martin and Margy Meyerson Chair of Urbanism and Chair of the Department of landscape architecture, 2017.

Wolff, Jane. *Delta primer: A field guide to the California Delta*. San Francisco: William Stout Publishers, 2003.

End Notes

[1] Simonds, John Ormsbee. *Landscape architecture: a manual of site planning and design*. No. Sirsi) i9780070577091. 1997.

[2] Karen Lutsky and Sean Burkholder, "Curious Methods," *Places Journal, May 2017.*

[3] Corner, James. *The agency of mapping: Speculation, critique and invention*. na, 1999.

[4] Steiner, Frederick R. "The Ghost of Ian McHarg." *Log* 13/14 (2008): 147-151.

[5] Herrington, Susan. "The nature of Ian McHarg's science." *Landscape Journal* 29, no. 1 (2010): 1-20.

[6] Weller, Richard J., Claire Hoch, and Chieh Huang. *Atlas for the End of the World*. University of Pennsylvania, Martin and Margy Meyerson Chair of Urbanism and Chair of the Department of landscape architecture, 2017.

[7] Lipschitz, Forbes. "Atlas of Adaptive Agriculture." Working Landscapes Lab, 2019. http://working-landscapes.com/project/atlas-of-adaptive-agriculture/.

[8] Wolff, Jane. *Delta primer: A field guide to the California Delta*. San Francisco: William Stout Publishers, 2003.

[9] "Green New Deal Superstudio.", 2021. https://www.gndsuperstudio.com/

[10] Holmes, Robert, Milligan, Brett, and Wirth, Gina. "Silt, Sand, Slurry: Dredging, Sediment and the Worlds We Are Making." San Francisco, Applied Research and Design, 2023.

[11] Holzman, Justine. "Review: Dredgefest Great Lakes Symposium." *Landscape Journal* 35, no. 1 (2016): 140–43. http://www.jstor.org/stable/44132777.

[12] Karen Lutsky and Sean Burkholder, "Curious Methods," *Places Journal, May 2017.*

[13] Anne Whiston Spirn, "*Landscape Literacy and Design for Ecological Democracy: The Nature of Mill Creek*" in Grounding Urban Natures ed. Henrik Ernstson and Sverker Sörlin *(MIT Press, 2019),* 1-10.

Aqua Incognita: Mapping the Great Salt Lake

Erin Carraher, University of Utah

"What does it mean to say that we are on a site? To be at a location, in position, to have found the spot—all seem to strike at something similar, but don't quite hit the mark. For a site is a patch of earth that not only warrants our attention, for one reason or another, but also brings further expectation that something is going to happen there, or maybe already has. Location, spot, environment, area, and so on—these all describe the space itself. A site, however, intimates more. Similar to a place and the liveliness of place-making, a site is a space that has been worked, whether that work be actual labor or the conception of a design, singular activity or myriad enterprises, conscious plans ore unforeseen episodes. This is the site of….It is the inkling of these further activities that turns a location into a site."[i]

Curricular Context

Beginning in 2015, the faculty of the School of Architecture (SoA) at the University of Utah conducted a holistic re-imagination of our undergraduate and graduate curriculum through a facilitated "backward design" process led by the university's Center for Teaching and Learning Excellence. The resulting integrated curriculum model began implementation in Fall 2018 with final beginning design course redevelopment continuing through 2021. A comprehensive curriculum map guides the overall program objectives and outlines where and when conceptual and technical topics are introduced, how they are revisited throughout the curriculum, and what integrations take place around a set of themes (rather than project typologies) each semester.

After a year-long Design Foundations course sequence in which all students in the college partake, the sophomore workshops bridge the broad Design Foundations content with in-depth disciplinary topics covered in junior-year courses and studios. The mapping project covered in this paper occurs in ARCH 2634, Architectural Design Fundamentals Studio, taken during the second of two 3-credit sophomore workshop classes. Beyond the accreditation criteria that requires students gain competency in fundamental principles of land use, regulation, and site conditions as they apply to a project location[ii], the faculty established curricular objectives related to site that ask students to take on a deeper and more complex engagement with landscapes beginning early in the undergraduate curriculum.

High-level curriculum objectives for the class are centered around the framework of exploring "vexed landscapes" and teaching students fundamental processes for observation, evaluation, positing, and developing design interventions in response to a landscape's history, narrative, meaning, and land use issues. This multi-layered approach to engaging with site is reiterated in subsequent semesters of the undergraduate program.

The choice to focus on the theme of vexed landscapes—those that are distressed, grieved, worried, or troubled—rather than picturesque ones as the first deep engagement with site is intentional. Utah is a state known for its striking natural landscapes. What lies beneath the postcard images, however, are serious environmental, economic, and political issues that have shaped and will continue to reshape the place and how architects work within it. The mapping exercise asks students to challenge what they think they know about the place where they live to explore the unknown territories that offer fertile ground for architectural response.

Figure 1. Student sketching at the Great Salt Lake

Second Sites

A few key definitions are needed to align the nomenclature of the project with that of the conference. The term "territory" has historical ties to colonial, religious, and regulatory definitions of land. Instead, the mapping project uses the term "landscape," which is both a noun and verb, as a way to describe both a bounded region and the representation of it. In this paper, landscape is seen as a layered series of relationships in a region that define the past and present physical, environmental, and cultural readings of the place. The term "site" is the specific geographic location within a landscape where a built structure is positioned.

A site does not exist only at a moment in time but in dialog with its larger physical, social, economic, political, cultural, environmental, and human landscapes. Sites and the understanding of them also change over time. Art historian and visual studies professor, James Nisbet, offers the framework of "second site" as a way of understanding the relationship between sites and structures over time—how they came into being and the reciprocal effect they have on one another.[iii] According to Nisbet, "'second site' also

evokes the notion of ‘second nature.’ By this latter term, I don’t mean a person’s habits or intuitive responses. I refer instead to the idea that we as humans do not have access to a raw version of nature out in the world, or what might be called a ‘first nature.’ What we access has instead already been filtered through social constructs. The implications of this insight for site-specificity are twofold: not only does a site transform from its ‘original’ condition moving forward in time, but such a condition has already been adapted from past states.”[iv] The idea of second site is presented to students through the project provocation as a way of challenging them to move beyond their immediate, visual experience of the site to plumb its unknonwn depths.

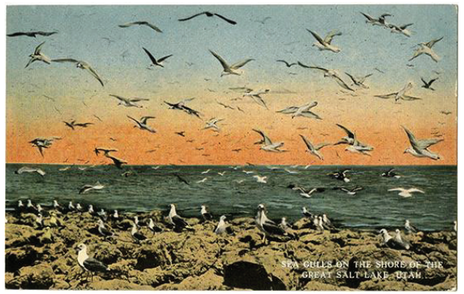


Figure 2. Seagulls on Shore of the Great Salt Lake, Utah. C. 1924. (https://collections.lib.utah.edu/ark:/87278/s6gb758m/1511776)

Secondness alters more fundamental relationship to site than appearance alone.[v] It frames the site as an active agent in the making of architecture, often revealing unintended relationships and interpretations that develop over time. Nisbet uses the example of Andy Goldsworthy’s 2008 land art piece, Spire, a site-specific sculpture comprised of thirty-seven standing Monterey cypress tree trunks to illustrate this point. The hundred-foot-tall trunks were cut as part of a reforestation process in the Presidio National Park. Goldsworthy intended the sculpture as a marker of the regenerative growth and decay of forests as the piece was gradually reabsorbed. In the summer of 2020, a forest fire broke out in the area, leaving the sculpture with a charred exterior that adds another layer to the work that speaks to the increasingly devastating wildfires in places like the American West.[iv] The resulting relationship between artist’s intention, built work, and ecological landscape that encompasses the site allows for a deeper and more rich understanding of the project than any one snapshot in time could allow.

This idea of “secondness” is used to describe the conceptual underpinnings of the mapping exercise. By combining the rational with the experiential, current conditions with deep time, and spatial understanding with political forces acting on the site, students mine the vexed landscape of the Great Salt Lake as a site for further exploration and intervention.

Figure 3. Seagull on the Shore of the Great Salt Lake, Utah. C. 2022.

Site Context

The Great Salt Lake contains untold depths even though the lakebed only reaches around 30’ at its current depth. The lake is a large remnant of the ancient Lake Bonneville, which existed from 31 to 14 thousand years ago and had a maximum depth of 1000’. The lake is bounded on the east by the Wasatch and on the south by the Oquirrh ranges of the Rocky Mountains, the shoreline of the ancient lake still visible as a datum surrounding the valley. To the west of the lake are the Bonneville Salt Flats that extend all the way to the Nevada border.

The surrounding landscape is the ancestral land of the Eastern Shoshone, Goshute, and Ute peoples who occupied the valley as farmers and foragers for millennia, peaking in population during the Freemont era, roughly 900 years ago. Populations decreased in the 17th century, believed to do so as the result of diseases introduced by European settlers. Euro-American settlers began to arrive in the form of fur trappers and explorers in the late 18th and early 19th centuries.[vii] Mormon pioneers arrived in the Salt Lake Valley in 1847 and began the process of laying out the large-scale grid of blocks based on the Plat of Zion.[viii] The grid has extended throughout the valley, which runs north and south between the mountain ranges.

As Lake Bonneville shrank over time, the salt in the predominately freshwater lake concentrated to form the current briny mix that remains in the lake today. The northern arm of the lake currently has a 25% salinity concentration (roughly 10 times the salinity concentration of seawater) and is so murky and mineral rich that downed planes are often never recovered. The lake is endorheic, meaning it has inlets but does not drain outward toward an ocean. Water leaves the lake only through evaporation and manmade means like industrial plant cooling and farmland irrigation. Because of the high salinity levels, only a few species of algae and bacteria can live in the lake, with the largest population of animals being tiny brine shrimp that attract migrating bird populations.
The lake provides significant industry through the mining of salt and other minerals. The 1200’ Kennecott Copper ore smelting smokestack is an industrial landmark located just south of the project site, and salt evaporation ponds along the west and eastern shores of the lake form a colorful patchwork for those flying into the SLC International Airport just to the southeast. The “golden spike” was driven just north of Salt Lake City to join the east and west branches of the first transcontinental railroad, which crossed the lake on a large, elevated trestle that divided the lake into a north and south arm.[ix]

The lake is the site of two significant land art works—Spiral Jetty by Robert Smithson and Sun Tunnels by Nancy Holt— that provide a local example of the “secondness” of site described by Nisbet. Smithson’s Spiral Jetty was installed just a few years prior to a record high lake level and then spent almost three decades completely submerged under water. Today, the water line is hundreds of feet away from the jetty as a result of a two decade long drought in the west.

Several iterations of the Saltair pavilion located just to the east of the project site have served as a primary location for recreation and entertainment on the lake. Historical

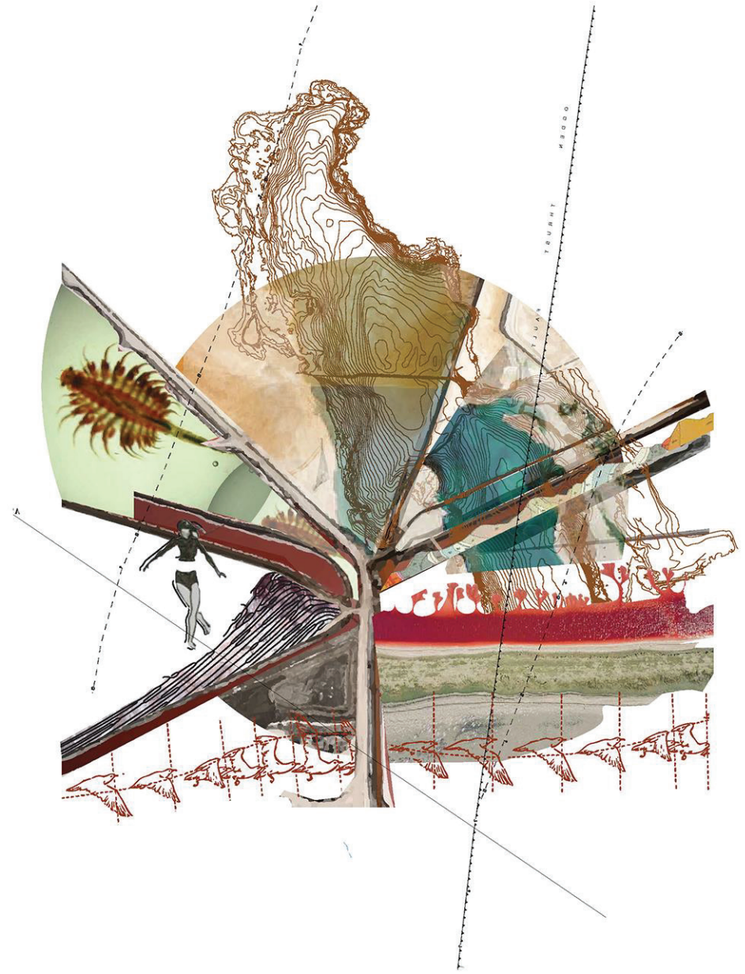


Figure 4. Great Salt Lake Map. W. Stratton

records, photographs, and postcards from the late 19th century show residents and visitors swimming and sailing on the lake, with the common claim of “floating like a cork” in the water due to the high salinity rate. Today, the lake is both largely unappealing and unsanitary to swim in thanks to decades of industrial mining, sewage dumping, and climate change that has rendered recreational infrastructure like the marina located in the site area unusable.

Currently, the lake is in a state of ecological crisis, in large part due to the “megadrought” that has left 99.9% of Utah in “severe” or “extreme” drought levels.[x] This affects all aspects of life in the region, from air quality issues that arise from the particulates and minerals kicked up from exposed areas of the dried lakebed, to the large number of dead birds surrounding the lake due to the loss in brine shrimp populations, to the proposed restrictions on water use for farming, to the economic impact on surrounding ski resorts as a result of decreased “lake effect” snow fed by moisture evaporating off of the lake. The Great Salt Lake is the epitome of a “vexed landscape” just outside of Salt Lake City where the university is located.

Mapping Prompt

Landscape architect, James Corner, describes the American landscape as a place of irony and contradiction, citing at the core of this dichotomy the “aporia[xi] of modern measure.” “On the surface, America is a carefully measured landscape of survey lines, rectangular fields, irrigated circles, highways, railroads, dams, levees, canals, revetments, pipelines, power plants, ports, military zones, and other such construction. All are efficiently laid out with ingenious indifference to the land, crossing desert, forest, plain, marsh, and mountain with a cool, detached, and rational logic. These highly planned constructions are literally measures that have been taken across the American landscape in order to ensure a productive human occupation of the earth and its resources.”[xii] The rational, utopian grid does not represent the full reality, however, of the landscape or our experience of it. Corner juxtaposes this type of rational measure with traditional practices of measure, which connected the human body with physical activities and the everyday world to the larger scale movements of the universe.[xiii] “This splitting of the objective from the subjective established, for the first time, a detached distance between the human and phenomenal worlds, enabling humankind to assume a position of supremacy and mastery over nature.”[xiv]

How do we bring these contradictory understandings of measure into dialog with one another as a way of understanding a landscape and project site? The work of philosopher Charles Sanders Peirce offers a conceptual framework to bridge the divide between subjective (firstness) and objective (thirdness) through another interpretation of secondness, which he defines as the way of making meaning. Peirce established three levels of understanding. “Firstness” means as having an unfiltered grasp of something in everyday life. This is a person’s sensate experience of an environment or landscape. “Secondness,” according to Peirce, is “to have, or be capable of providing, a general definition of that concept” (i.e. how to you begin to analyze and create meaning from your observations). “Thirdness” is the theory or explanation about a place reached after considerable inquiry and development of thought—the “true understanding of the dynamic object.”[xv]

The mapping exercise asks students to “take measure of” a landscape that is both known and unknown to them. The site is the Great Salt Lake State Park and Marina, which is located on the southeastern edge of the lake, approximately 20 miles west of downtown Salt Lake City. Students are asked to enter into the project through a visit to the site (firstness) where they respond to a series of prompts and document their experience on a shared Miro board. They are asked to follow their intuitive response to the site and identify a primary driver that they will further research (secondness). Using the technique of collage, students construct a map that grounds their observations in further research in a layered representation of the landscape. Eventually, students will use the map as a foundation for defining the site and approach of a small-scale pavilion (thirdness).

Students are given no prior information about the project before arriving at the site. They are directed to spend time as rural flaneurs, wandering the site and seeing what they can see. They document their observations through drawing, photography, watercolor, etc. and return to the studio for the next class session where they present their experience on the site before the mapping exercise is introduced. This part of the assignment asks students to create a collaged map that layers multiple scales, information types, and their experience of the site.

Intentionally paired with this exercise is a reading assignment of James Corner’s essay, “Taking Measure: Irony and Contradiction in an Age of Precision,” which includes numerous illustrations of Corner’s collaged maps. On the same day as the initial drafts of the mapping assignment are due, the class engages in a facilitated discussion that ties the reading to the students’ work through conceptual, technical, and artistic means.

A summary of the site analysis and mapping exercise, which took place over the course of 2 weeks, are below:

1. Site visit: During a visit to the Great Salt Lake State Park & Marina, focus on the multi-sensory experience of moving through the landscape, particularly of your body in the landscape. Begin by walking away from other visitors and classmates for 10 minutes. Stop and consider how far you have moved and what the experience of moving has been. Turn around and begin to walk back. Pay attention to changes in texture, views, found objects, etc.

2. Site documentation: Record the territory you have covered and the experience of moving through the landscape. Plan to spend at least 1 hour on site. Sketch, draw, map, and/or photograph elements you were intuitively drawn to while at the site. These documents should be of extremely high quality and may take on any number of forms. Think of them as artifacts, which are defined as objects that have been intentionally made or produced for a certain purpose. Often the word ‘artifact’ is used in a more restricted sense to refer to simple, hand-made objects from a particular culture. Aristotle divided existing things into those that “exist by nature” and those existing “from other causes.” The former includes “animals and their parts, … and the plants and the simple bodies (earth, fire, air, water)”, the latter include “a bed and a coat and anything of that sort, qua receiving these designations, i.e., in so far as they are products of art.” Aristotle makes here a distinction between natural objects and artifacts and describes the latter as products of the art of making things. The art of making something involves intentional agency; thus an artifact may be defined as an object that has been intentionally made for some purpose. (Stanford Encyclopedia of Philosophy).

3. Collage map: Develop a collage map that layers multiple scales, different types of information, and your personal experience of the site. There are three primary elements of this composition:

    a. Element 1 - Base map: You will be given access to several types of base maps of the region surrounding the site as a reference. Choose one of these as your base map or feel free to locate other map types from the resource links provided.

    b. Element 2 - Supplemental research: Once you return from your visit, think about the things that you were intuitively drawn to on the site or questions that arose for you while you were exploring the area. This might be the history of recreation of the site as evidenced by the Saltair venue and marina, the geology of the valley and formation of the lake, the salt and mineral content of the water, the current lake level and questions around managing lake levels that are part of the current legislative session, etc.

    c. Element 3 - Mapping layers: Using an existing map as the base, create a composition that layers the information you observed and researched about the site. You can see one version of such a map on the Miro board, though this is by no means the only approach. Additional examples of site mapping collage can be seen in James Corner's work in the "Taking Measure" reading. Collage maps can be constructed using whatever means you choose—analog, digital, multi-media, 3-dimensional, etc.—and take on a more interpretive or informational approach.

Pedagogical Approach

There are several layers to the pedagogical approach to the class as a whole and this project in particular. My teaching practices are a combination of personal experience as a student with excellent and not-so-excellent teachers, over a dozen years full-time teaching in higher education, and research in the areas of architecture education history and contemporary higher education practices. Primary influences include historical figures like Walter Gropius and John Dewey, social scientists like Donald Schön, Ernest Broyer, contemporary scholars like Joan Ockman and Antoine Picon, and directors of university centers for teaching and learning excellence like Kevin M. Gannon. Gannon, in his book “Radical Hope: A Teaching Manifesto,” calls on teachers to recognize that putting their pedagogical practices into action is a political act. “Our pedagogy is a declaration of what we think matters. It’s a living description of how we think good teaching and learning should occur, and of the moral imperative to create the type of inclusive and equitable learning spaces in which our students become critically conscious and actively engaged in their own education.”[xvi]

Figure 5. Great Salt Lake Map. O. Etz

In his book, *Pedagogy of the Oppressed*, Paulo Freire further defines the notion of pedagogy as a political act through the traditional teacher-student relationship: "The teacher talks about reality as if it were motionless, static, compartmentalized, and predictable. Or else he expounds on a topic completely alien to the existential experience of the students. His task is to 'fill' the students with the contents of his narration—contents which are detached from reality, disconnected from the totality that engendered them and could give them significance."[xvii] Freire challenges the oppressive nature of this type of education, which turns students into receptacles to be filled with content that is determined by the teacher as having meaning. He states that praxis, a combination of reflection and action, is the process for challenging this top-down model. "Knowledge emerges only through invention and re-invention, hopeful inquiry human beings pursue in the world, with the world, and with each other."[xviii]

Gannon outlines a number of ways in which an intentional learning environment can support actualizing stated objectives such as fostering creative thinking and risk taking. He states the importance of meeting students where they are as they enter a class or project and reminds us that "for many of them (in particular, our first-year students), the seemingly simple act of challenging prior assumptions can be fraught with risk."[xix] He posits that it is necessary to pair the appropriate scaffolding and support with intended objectives. "It's in the liminal spaces between not knowing and engaged understanding that deep and meaningful learning occurs. Those spaces are where old paradigms give way to new ways of knowing and understanding, a process that might—but does not have to—be fraught and risky. A learning environment that encourages students to occupy these spaces without anxiety, where structure and support are available to those who need it, is an environment in which the project of higher education functions at its best."[xx]

Lastly, my pedagogical approach adapts Donald Schön's model of the "reflective practitioner" for beginning architecture students. Schön describes the unique methods of architecture education as related to the "knowing-in-action" implicit in architectural making, which he defines as the "capacity for intuitive and spontaneous performance, that comes into play in the uncertain, unique, and conflict-laden situations."[xxi] Schön describes the process of teaching in an architecture studio similar to that of coaching a sport, where the instructor supports the students' design discovery process through various forms of showing and telling throughout the process of design.

Overlaying Schön's knowing-in-action with Gannon's emphasis on supportive scaffolding and Freire's focus on praxis, I have developed a teaching modality that incorporates modeling into early architecture studios. By this I mean modeling "to present in outline or as a model; to portray or describe in detail"[xxii] rather than the use of physical models in the traditional architecture sense. This practice includes conducting my own analysis and documentation while visiting the site with students and working through various project phases with them.

This is a significant shift in approach to the first decade of my teaching career. I have avoided developing or demonstrating my own design response in classes, believing that showing how I would approach a problem would set students up to think that there is only one way to do so. This changed during the early days of the Covid-19 pandemic when I was rapidly transitioning to online instruction platforms and needed to develop videotutorials to support the delivery of technical skills and offset the Zoom fatigue engendered by spending 18 contact hours a week with students in my fall courses. I worked through the assignments just ahead of the students in order to develop the videotutorials and found that for certain aspects of the projects—especially those dealing with unconventional program types or creative practices—it was freeing rather than restricting for students to see a competent example of the design process modeled for them.

I have come to believe through this experience as well as subsequent reading on pedagogical practices that this approach is supportive as a scaffold in beginning architecture studios as well as classes where there is a heavy digital technology load for students so they are not trying to conceptualize how to do something at the same time as they are being asked to do the same thing well. This practice is intentionally paired with a supportive learning environment where each student's individual creative process is championed rather than compared to the instructor's approach. Furthermore, this practice has helped me gain clarity around the conceptual foundations I have developed for projects and the actualities of what it takes for students to respond to the prompts.

I believe, but have no empirical evidence to support, that this approach also helps break down some of the traditional hierarchies outlined by Friere in the classroom setting when students see the instructor performing the same actions as they are. "All learning takes place in settings that have particular sets of cultural and social norms and expectations. These settings influence learning and transfer in powerful ways."[xxiii] As such, the students see the often messy design process transparently modeled by the instructor, the false starts and shifts in direction that occur along the way, as well as how the project starts to coalesce and be communicated toward the end result. While this is a vulnerable practice for me as a teacher, I believe is a necessary offer to make, seeing as how we ask for similar vulnerability from our students.

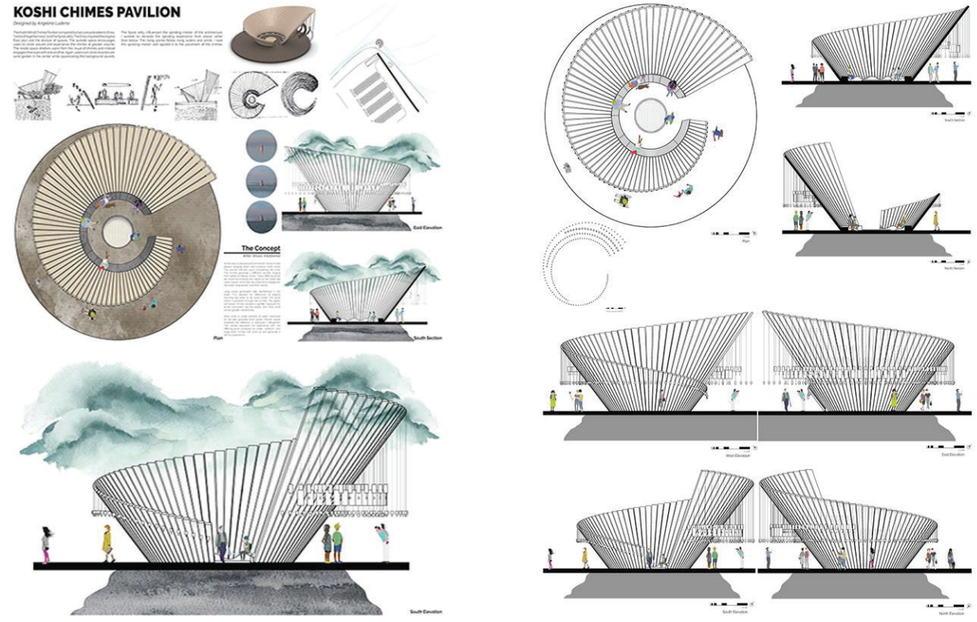


Figure 6. Koshi Chimes Pavilion. A. Ludena

Reflection and Redevelopment

Variant 1

The project has been taught twice with feedback from the first iteration informing changes to the subsequent year's exercise based on student engagement and success with the project. For example, in the first year the project was taught, students were required to develop their site maps as a literal set of layered drawings, with velum overlays on top of an opaque base map. There were technical and conceptual challenges to this approach, including how to pass along the communal roll of plotter velum to a class of 25 students, which limited the iterative process of exploring the possibilities of the translucent layers of velum were intended to support. Some students did very well on the project; others made largely conventional maps that just so happened to be printed on translucent paper. In response, the second iteration kept the same approach to incorporating different scales and types of information onto a base map but did so through techniques of collage rather than analytical overlays.

Figure 7. Example Great Salt Lake Map. E. Carraher

The second iteration was much more successful in terms of composition, communication, and supporting the identification and development what caught students' interest on the site. Examples of these ranged from local folklore about an "English scientific gentleman" who planned to stock the lake with whales imported by barge from Australia to catalyze a whaling industry in the lake, to the stromatolite formations in the lake (similar in appearance to coral but in actuality historic fossils from the ancient Lake Bonneville that house algae that attracts migrating bird populations), to the colors, patterns, and process of salt mining. Another distinction that I believe helped in the success of the second iteration was the incorporation of a "modeled example" of my own map development as described above.

Variant 2

The other key distinction between the first and second year of the project was that the class visited the site as a large group the first year while students went alone or in small groups the second year. This started as a logistical response to timing with the academic calendar and resulted in unexpectedly rich class discussions because students each experienced the site in slightly different ways. For example, one small group was at the site during the time that a blaring alarm was going off at the Kennecott Copper Mine smelter plant just across the highway from the state park. This sound colored their experience of the normally quiet site. Others visited just prior to a major winter storm when the sky was full of ominous clouds and frigid winds blowing at them off of the lake. A few visited just after 16" of snow had fallen in the valley. Others were there on a bright and sunny day. The resulting maps representing this range of experiences gave students a multivalent representation of the site and drew attention to various aspects of the site that were highlighted by the prevailing conditions of their visit. It is not coincidental that the student who spent an hour listening to the piercing alarm on site was drawn to the mining and rail infrastructure in her map while one who visited on a bright sunny day was interested in the current and historic recreation practices on the lake.

Limits of the Exercise

Variations of the site visit exercise have been taught in beginning studios for the past dozen years. Some limitations to doing so in this particular class and project (in some ways due to the integrated curriculum model) are as follows:

1. Prior to the current curriculum, this type of site visit took place in the junior-year, which is a traditional 5-credit studio. Students were all in the same lockstep courses at that time, meaning we could plan an overnight camping trip for the class to conduct a 24-hour site analysis of sites like the Bonneville Salt Flats, Spiral Jetty, and Sun Tunnels. The new curriculum moves this process earlier in the sequence to a 3-credit workshop where students may be taking a variety of other classes outside of the workshop and an overnight trip is not currently feasible. The longer duration spent on site gave a richer pool of experience and material for students to work from, though the current model introduces the content earlier as a precursor for studio-based travel in the senior year.

2. Because students have hot desks as freshmen and sophomores and only meet for two class sessions a week, there are other frameworks needed to support the building of studio culture. This starts with a group project for the first month of class and continues through a shared Miro boards for project development. By requiring students to keep a digital record of their design and research process, I can comment and provide resources in real time and students are able to see each other's work develop. While a physical studio space would be preferable, until the resources are available to expand our facilities, these practices have had positive results.

3. In the freshman and sophomore years, students have classes that need to be taken in sequence but are not mandated for a specific semester. This allows a certain flexibility for students transferring from other institutions and changing majors but also means that students arrive to the workshop with varying levels of communication skills, particularly with regard to digital drawing and graphic design tools. This means that there essentially needs to be a nested communication class embedded within the design workshop in order to support the assignments, which takes away from already limited class time or requires substantial outside work for the faculty to prepare asynchronous resources.

4. Despite the assignment prompt and resources provided, students have not engaged with the economic, political, or social histories of the site as much as they have with the ecological and physical elements. In response, my plans are to host a "Great Salt Lake Summit" the next time the class is offered where I will invite guests with different expertise related to the lake—a geologist, a natural resources conservation representative, a state history archivist, a senior local resident with personal memories of recreating on the lake, and a representative from one of the mining industries—to present different perspectives. The intent is that by humanizing the less tangible aspects surrounding the site, that students will be able to find a different way of entering into engagement with these "layers."

5. Lastly, one of the more general observations about the sophomore workshops has been the limited (or total lack of) people in the representation and development of projects and sites. As a result, a new transitional exercise has been introduced this year after the mapping assignment that asks students to diagram the movement of one or more people at two scales on the site—one the scale of arrival/departure and choreography of the journey through the landscape to the location for the future pavilion and the other at the scale of movement of a person engaging with the site at or through the pavilion. The intention of this exercise is to promote a human-centered rather than a form-first response that builds on the students' individual experiences on the site.

Conclusion

At the scale of the program, curricular assessment is ongoing as the Design Foundations classes are currently being redeveloped in response to the outcomes of the first graduating classes to complete the full new curriculum sequence. By curating students' first deep engagement with an architectural site through the lens of a "vexed landscape," our intention is to embed an appreciation for the rich opportunities and complex challenges architects face when responding to a site. This approach is reiterated two additional times in the upper-division studios in the BSAS program, with one focusing more on master planning and site development from a landscape architecture perspective while the other focuses more on the mapping of cultural landscapes.

The next steps in assessing the success of the pedagogy beyond the specific project and semester will take place through exit interviews with students who have completed the new ARCH 2634 class as they eventually prepare for graduation. The intention is that these students will have gained competency in the ability to map not only physical characteristics and significant features but also the experiential aspects of sites. As James Nisbet states, "site-specificity cannot be extracted from its many past and future lives."[xxiv] Similarly, educational efficacy must be understood as part of a student-specific continuum.

End Notes

[i] Nisbet, James, *Second Site*. Princeton University Press, 2021: xiii

[ii] NAAB, "3.2 Student Criteria (SC): Student Learning Objectives and Outcomes." *Conditions for Accreditation: 2020 Edition*. Published 10 February 2020.

[iii] Nisbet, James, *Second Site*. Princeton University Press, 2021: xx

[iv] Nisbet, James, *Second Site*. Princeton University Press, 2021: xx-xxi

[v] Nisbet, James, *Second Site*. Princeton University Press, 2021: xxiv

[vi] Nisbet, James, *Second Site*. Princeton University Press, 2021: xxxi-xxxii

[vii] Simms, Steven R. and Stuart, Mark E., "Ancient American Indian Life In The Great Salt Lake Wetlands: Archaeological and Biological Evidence," in *Great Salt Lake: An Overview of Change*, Utah Geological Survey, J. Wallace Gwynn, ed. 2002:. 71-83.

[viii] Gwynn, J. Wallace, "Commonly-Asked Questions about the Great Salt Lake and Historic Lake Bonneville," *Public Information Series 39*, Utah Geologic Survey, 1996.

[ix] Gwynn, J. Wallace, "Commonly-Asked Questions about the Great Salt Lake and Historic Lake Bonneville," *Public Information Series 39*, Utah Geologic Survey, 1996.

[x] https://www.bloomberg.com/news/features/2022-07-08/drought-leaves-salt-lake-city-with-a-looming-water-crisis

[xi] Aporia is an irresolvable internal contradiction or logical disjunction in a text, argument, or theory (OED).

[xii] Corner, James and Alex S. MacLean. Taking measures across the American landscape. Yale University Press, 1996: 25

[xiii] Corner, James and Alex S. MacLean. Taking measures across the American landscape. Yale University Press, 1996: 27

[xiv] Corner, James and Alex S. MacLean. Taking measures across the American landscape. Yale University Press, 1996: 28

[xv] Atkin, Albert, "Peirce's Theory of Signs", *The Stanford Encyclopedia of Philosophy* (Spring 2023 Edition), Edward N.

Zalta & Uri Nodelman (eds.), forthcoming URL = <https://plato.stanford.edu/archives/spr2023/entries/peirce-semiotics/>.

[xvi] Gannon, Kevin M. *Radical Hope: A Teaching Manifesto*. West Virginia University Press, 2020: 22-23.

[xvii] Freire, Paulo. *Pedagogy of the oppressed*. Bloomsbury publishing USA, 2015: 71

[xviii] Freire, Paulo. *Pedagogy of the oppressed*. Bloomsbury publishing USA, 2015: 72

[xix] Gannon, Kevin M. *Radical Hope: A Teaching Manifesto*. West Virginia University Press, 2020: 136.

[xx] Gannon, Kevin M. *Radical Hope: A Teaching Manifesto.* West Virginia University Press, 2020: 146.

[xxi] Schön, Donald A. "The architectural studio as an exemplar of education for reflection-in-action." *Journal of Architectural Education* 38, no. 1 (1984): 3

[xxii] "model, v.". *OED Online*. March 2023. Oxford University Press. https://www-oed-com.ezproxy.lib.utah.edu/view/Entry/120578?rskey=szgAgP&result=1&isAdvanced=false (accessed March 07, 2023).

[xxiii] Bransford, John D. (et al), *How People Learn: Brain, Mind, Experience, and School*, 2000

[xxiv] Nisbet, James, *Second Site*. Princeton University Press, 2021: 80

Bibliography

Bransford, John D. (et al), *How People Learn: Brain, Mind, Experience, and School*, 2000.

Corner, James and Alex S. MacLean. *Taking measures across the American landscape*. Yale University Press, 1996.

Freire, Paulo. *Pedagogy of the oppressed*. Bloomsbury publishing USA, 2015.

Gannon, Kevin M. *Radical Hope: A Teaching Manifesto*. West Virginia University Press, 2020.

Nisbet, James, *Second Site*. Princeton University Press, 2021.

Schön, Donald A. "The architectural studio as an exemplar of education for reflection-in-action." *Journal of Architectural Education* 38, no. 1 (1984).

Mortality and Genesis: Teaching Adaptive Thinking

Sarah A. Ra, Oklahoma State University

Introduction

The movement toward designing with reuse as a priority has been slow to gain ground, particularly in teaching students to think first about reuse from the outset, in the earliest stages of design learning. Typically relegated to upper-level studios or graduate education, adaptive reuse of buildings is left out of beginning design conversations. The layers of complexity that are associated with adaptive reuse can deter studio faculty from exploring the topic early. Students don't understand buildings yet, but are typically more focused at this level with design basics. What if we start to translate the concepts defining building adaptation into beginning design thinking? This paper shares strategies and design studio exercises that explore initial implementation of adaptive thinking in beginning design.

In their text *Buildings Must Die*, Cairns and Jacob's quest to examine the many attitudes toward the death of buildings assesses the numerous approaches to dealing with the mortality of built forms. Ultimately, their aim is to uncover "architectural agency and its capacity to make worlds differently".[1] Their departing thought is situated within considerations of ecology and the necessity and urgency with which we must change our perspectives on the lives of buildings.

Defining the Shift

In anticipation of this shift in designing and making, many important initiatives and writings have contributed to the conversations surrounding the need for reuse. An early treatise was Kevin Lynch's *Wasting Away* (1990), which offered a way for living well with the dross of the built environment.[2] He was an early advocate to argue that architects should consider how buildings will be disposed of. "What one considers junk, another takes as inspiration. What one considers proof of the death of architecture, the other draws upon to breathe new life into the profession."[3] A related concept that emerged in the 1990s, Design for Disassembly (DfD), gained traction as a potential ecological approach to reducing material consumption in the building industry.

William McDonough and Michael Braungart's efforts toward a circular economy are outlined in their 2002 work *Cradle to Cradle*, where they call for elimination of waste and for cyclical material consumption.[4] In their most recent text, *The Upcycle*, they take their proposal further, arguing that not only should we not extract raw materials, we should increase the value of existing materials in order to thrive.[5] In the nearly twenty years since their landmark work was introduced, changes have been relatively slow in practice, and little has changed in academia. However, strides have been made to introduce adaptive reuse and a culture of reuse, but now we must focus on how to fully integrate reuse principles into the design curriculum.

In her research initiative for change, Charlotte Malterre-Barthes seeks a larger scale reset on thinking about the built environment. In her *Global Moratorium on New Construction*, she states that a "drastic change to construction protocols is necessary: the suspension of new building activity must be enforced."[6] Real change has been slow to pass, and could be accelerated by regulating new building. While a bold premise, one assumes that this type of abrupt reset could well lead to faster progress.

These various theoretical approaches were folded into thinking about our role in academia. Bold initiatives for practice necessitate a bold shift in educating designers. How can we change the conversation from the beginning of the educational sequence?

Adaptive Thinking Strategies

Adaptive thinking requires altering pedagogical strategy in order to create designers who will now think in layers of time and potentialities instead of generating from scratch. McDonough and Braungart's call to cyclical thinking, as well as to design for disassembly, asks us to reframe the entire design process. We can no longer assume a linear and strictly forward-moving pathway.

An adaptive design process is necessarily a resultant of cyclical thinking. Could the process become more additive, perhaps as a collaboration with what has come before? Adapted by surrealists in the 1920s, the game *Exquisite Corpse* (from the French *Cadavre Exquis)*, requires each

Fig. 1 *Cadavre Exquis*. Andre Breton, Jacques Herold, Wifredo Lam, 1940.

participant to take a turn drawing on a sheet of paper, folding it to conceal his or her contribution, and then passing it to the next player for further contribution. Adaptive design thinking necessitates assemblage. To introduce this mode of thinking, we look first at *analysis* and *observation*.

Observation

Observation is important to developing our ability to see the potential in the built environment around us. This stems from increased awareness of our surroundings, and a consciousness of material matter in its various states. As a certain clarity comes during meditation, we must develop a mindfulness about our immediate context, in order to better observe potentialities. With this comes a need for creative antagonism of the accepted norm, by considering what a place could be, perhaps in opposition to the expected. For example, we assume a rectangular space of a particular proportion might be ideal for conversion to a theater, but might a round space just as easily be adapted? Observation is a critical skill to pursue in beginning design, and it can be focused even more towards adaptation specifically.

In order to adjust our modes of awareness, observation should be conducted at both the macro and micro scales. At the macro scale, looking at entire neighborhoods - and how buildings shape them and are shaped by them - can give us clues to adaptive potential. How do people interact with the buildings, and how do the buildings interact with their surroundings? At the micro scale, we focus upon the building level: How does a place change throughout a day, or over a year? Changes in character and usage of the spaces can suggest a flexibility that can be harnessed.

Identifying spaces or built forms that have potential for reuse is an outcome of this observation process. However, it is imperative to balance respecting historical value and seeing the potential for change (acknowledging that some buildings should be preserved). This line has been the subject of much debate. Rem Koolhaus's *Cronocaos* exhibition for the 2010 Venice Biennale addressed this tension; he looked at the consequences of how we 'build, rebuild, and remember'.[7] While these conversations are beyond the scope of this paper, they are worth noting as another aspect to ponder in considering how to introduce students to observation in the built environment, which necessitates a careful, but perhaps surface level of observation, followed by more in-depth research into historical issues.

Analysis

Observation is the natural precursor to analysis. The evaluation of a building for adaptive reuse is similar in many regards to that of a typical analysis of a built work. In Roger Clark and Michael Pause's *Precedents in Architecture*, we find the classic analyses topics – hierarchy, massing, geometry, repetition, and structure.[8] The authors use the typical format of plan, elevation, and parti diagrams. But in the *Formative Ideas* section of the text, we find more speculative analyses: *Transformation* (potential), *Transitions* (existing transition strategies that could be adopted), *Progressions*, and *Mediations*, which are the beginnings of an adaptive style of analysis. These can progress to analysis of elevation, structure, and spaces for potential joining, subtracting or other modes of intervention.

Other analysis such as materiality can aid in determining potential for surface changes and use of light to generate designs to address the new use and transitions from the original enclosure. Pattern and texture can play an essential role in establishing a meaningful relationship between old and new portions of the design.

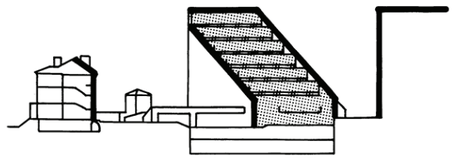


Fig. 2 *Mediation Diagram*. Clark & Pause, Precedents in Architecture.

While this is necessary for Adaptation, we must take the process one step further toward integration possibilities, or potential for adaptations. This murky area admittedly lies somewhere between analysis and design, but we must dwell here for effective studies in potential interventions. Adaptation is more complex than ground-up design, and therefore requires a necessary give and take in the design process, that bleeds back into analysis.

Genesis

How do we translate observation and analysis into design genesis, in order to bridge the divide? While observation provides a framework of larger issues and ways to consider potential building stock or elements, analysis looks at the finer scale, to assess various ways in which the intervention could be accomplished. This is then tested during the design process, and the process moves back and forth.

The items assessed during analysis, such as qualities of building stock or material stock, impact the order of early design process. When we apply adaptive thinking to beginning design, there is a shift to material or structural emphasis, wherein the form and scale are at least partially determined by the use of existing elements. Local salvage industry and material streams are critical to the process. For example, Rhode Island's recycled material warehouse plays a huge role in the educational process for local schools and universities, providing materials for students to create and build their designs. Salvage involves identification of architectural source flows and analysis of available materials and their forms which can impact the design output to a great degree.

Pascal Hentschel of Swiss architecture firm *baubüro in situ* discusses the firm's evolution in design process: "Normally, first you do your design and then you specify materials to build it. But in this case, you first look at what materials are available and put together a material catalog. You have to constantly analyze how to use what's available."[9] Part of the struggle to achieve successful built work with materials reuse is still the lack of a readily accessible 'material catalog'. Finding it is the most difficult part. The firm has phrased the role of 'component hunters', someone who can find usable material at demolition sites.[10] This in turn becomes a shift in aesthetic approach, to valuing texture and the patina of age. For students, this means addressing the question of materials much earlier in the design process.

Yet another concept contributing to reuse is Design for Disassembly (DfD), which was established in the 1990s, and follows upon the traditions of open building. In the beginning design process, this translates into consideration of repetition and modular shapes. Principles of DfD such as using fewer composite materials (which are not as conducive to reuse), and utilizing fastened connections instead of glued assemblies, are all items which can translate to this shift in early design thinking.

From these emphases, we can observe that instead of space or form being considered first, structure, skin, and material are first in the genesis of a project. We've moved past *form follows function*; is it now *form follows available matter*? The design genesis has evolved to a cyclical thinking process, where observation and analysis are crucial to understanding *what* we can design with. Cairns and Jacobs note the shift in thought, conceiving of buildings now as 'moving projects'. "Seen in this way, a building is flow, not form; it is creative, not merely a creation."[11]

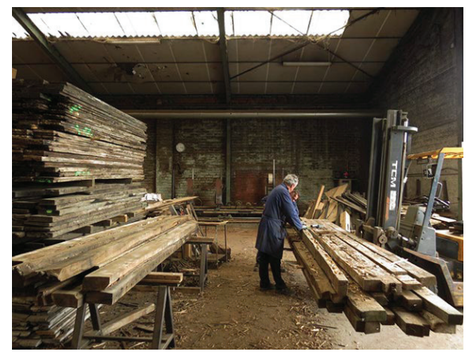


Fig. 3 *Reuse preparation*. Rotor DC salvage processes, Opalis.

Early Implementation in Design Studios

In order to test these elements of adaptive thinking, early exercises were created in parallel with the traditional studio

project sequences in the first year design studio, and in the third year design studio. The design explorations focused upon observation, analysis, and genesis. Due to the large first year class and the full schedule of design basics and skill-building, a smaller group of honors students were given the exercises. The first year studio tends to offer many opportunities for observation through sketching, but typically less analysis. The third year studio conducts more analysis through the study of precedents, but the implementation of an adaptive reuse project was new to this year level.

First Year Studio Exercise

In order to break down the scale and complexity often associated with adaptive reuse projects, the first year studio activity was conducted at the scale of objects. Through an exercise in object observation and analysis, students deconstruct the known relationships between form, function, scale, and image in order to strip away preconceptions. Students work with found objects, first analyzing the formal massing, structural aspects, and material qualities. Students select one simple shape, and a more complex technological remnant as well to conduct their work. These exercises became a morphing of observation and analysis, with time spent sketching and observing properties of the subject matter, then diagramming its properties.

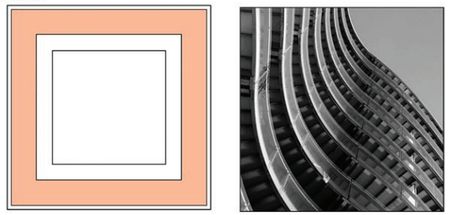
To complete the exercise, students reimagine the object's potential; physical alterations and combination with other elements are encouraged. Emphasis was placed upon transformation potential for joining, subtracting, or merging with other objects. In parallel, actions typical of the physical operations of adaptive reuse are explored, such as extracting, extending, inserting, wrapping, and reconfiguring. Students make reflections to speculate on application of the outcomes of these exercises to the design of their projects, implementing one or more strategies into their final semester projects.

Third Year Studio Exercise

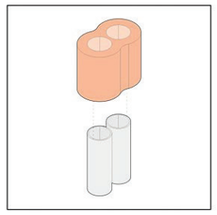
In the third year studio, a slightly different approach was taken, developing an exercise in analyzing the various means of interaction of old and new. Case studies of varying types of adaptive reuse were identified. Students analyzed how the precedent's new construction engaged with the existing buildings, both in degree and type. Inspired by work on development of analysis for adaptive reuse, the exercise employed intervention types outlined in the work of Dafna Fisher-Gewirtzman[12] and Graeme Brookner and Sally Stone[13], students conducted analyses of six case studies. Projects were chosen for their variation in approach, in form, structure, and material consideration. Projects included Coal Drop Yards by Thomas Heatherwick, the Neues Museum by David Chipperfield, The International Library for Children by Tadao Ando, Fuzhou Teahouse by Neri & Hu, and Gemini House by MVRDV.

Brooker and Stone outline three main categories for adaptive reuse that describe the extent of transformation of an existing building: *installation*, *insertion*, and *intervention*. Students were asked to analyze their given precedent, and to utilize a scale to assess the form of reuse. They were also tasked with assessing individual characteristics of the

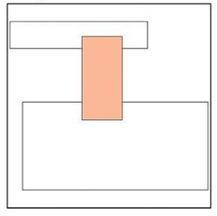
Skin:



HAT:



Bridge:



Jesus Fuentes, and Evan McDonald, Spring 2023.

project: formal massing, structure, and material approach. These were shared with the group in order to build a catalog of potential approaches to design with reuse. These studies ultimately informed their design approach for the final studio project, the adaptive reuse of a local historic black school under threat of demolition, the historic Booker T. Washington School here in Stillwater.

For the genesis portion of the exercise, students were asked to identify the portions of the original school building to be preserved. They also analyzed existing components of the building to be salvaged and integrated into the new design, as well as researching local material streams and available components early in the design process. This generated varied approaches and resulted in a number of shifted formal and material outcomes.

Project Outcomes

In both exercises, observation and analysis were intertwined in the early process, and led to a shifted mode of initial design thinking. Students sought space making as a resultant of several factors, in lieu of the typical conceptual and form-generating approaches. In beginning design, it is undoubtedly difficult but necessary to provide alternative thinking in this critical moment of the commencement of the design.

While the first year genesis was applied effectively to their studio projects, it was more abstracted and interpreted through formal essence and manipulation, as well as interaction with other components. Due to the abstract design exercises, the material emphasis was less influential in the process. In the third year studio, students were able to utilize the existing building intervention analysis and examples as a springboard to effectively explore massing. By incorporating material from the deconstruction of the wings, they implemented material reuse of available components as well. Their schemes effectively employed both the strategies - discovery through observation and analysis, and material integration - into the genesis of their designs.

Conclusions

The studio explorations were an early foray into shifting the pedagogical approach to reuse, but confirmed that the design process is fundamentally shifted. The same principles are essential to beginning design, but within a new framework. Creative flows and circular thinking come out of this evolved process. While we still cover basic design principles and their application, we did so in a more intentional way to develop the observation and analysis skills necessary to this new mode of thinking. Showing more examples from adaptive reuse or material reuse projects supported this effort. The genesis became richer as a result.

Effective adaptation requires imagination; a creative re-examination of something from the past is essential. Teaching students to simultaneously look backward and forward, and to learn to see the potential in the mundane, are key fundamentals to this evolving approach. Studying physical objects at smaller scales can foster early a creative thinking mode which can be applied to architectural and other design interventions at larger scales. Our future depends on our past; what we have made before must be reintegrated into the fabric of that yet to come. We bring the inevitable mortality of buildings to the realm of creative birth, to the genesis of the design process.

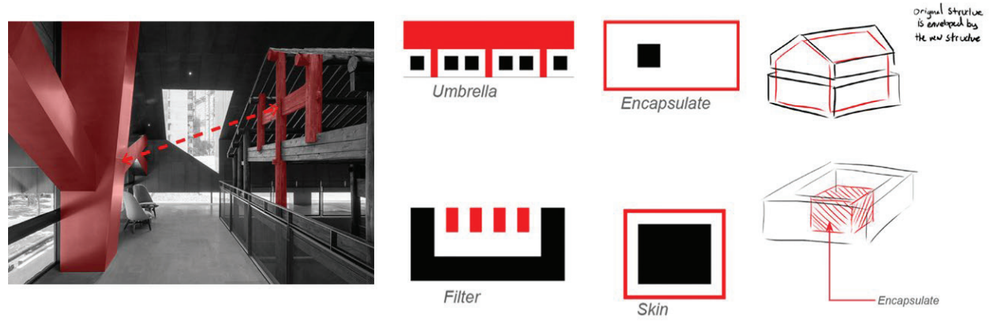


Fig. 5: *Third Year Studio Student Analysis of Fuzhou Teahouse*, Abigail Richardson, Emily Smith, and Andrew Truong, Spring 2023.

End Notes

1 Cairns, Stephen and Jane M. Jacobs. *Buildings Must Die: A Perverse View of Architecture*. Cambridge: MIT Press, 2017. p 225.
2 Lynch, Kevin. *Wasting Away: An Exploration of Waste.* New York: Random House, Inc., 1991.
3 Cairns and Jacobs, *Buildings Must Die,* 45.
4 McDonough, William and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things.* New York: North Point Press, 2002.
5 McDonough, William and Michael Braungart. *The Upcycle: Beyond Sustainability: Designing for Abundance.* New York: North Point Press, 2013.
6 Malterre-Barthes, Charlotte, "A Global Moratorium on New Construction", accessed Feb. 21, 2023, https://www.charlottemalterrebarthes.com/practice/research-practice/a-global-moratorium-on-new-construction/
7 Koolhaas, Rem. "Cronocaos." *Log,* no. 21*:* (Winter 2011): 119-123.
8 Clark, Roger H. and Michael Pause. *Precedents in Architecture: Analytic Diagrams, Formative Ideas, and Partis.* Hoboken: John Wiley & Sons, 2012.
9 Brand, Michèle, "Extending the Cycle in Switzerland", *Global Holcim Awards Interview*, April 11, 2022. p 16.
10 Brand, "Extending the Cycle in Switzerland", 17.
11 Cairns and Jacobs, *Buildings Must Die,* 67.
12 Fisher-Gewirtzman, Dafna. "Adaptive Reuse Architecture Documentation and Analysis*."* *Journal of Architectural Engineering Technology* 5, no. 3, (Jan. 2016): 1-8.
13 Brooker, Graeme and Sally Stone. *Re-readings II: Interior Architecture and the Principles of Remodelling Existing Buildings*. London: RIBA Publishing, 2019.

Bibliography

Brand, Michèle, "Extending the Cycle in Switzerland", Global Holcim Awards Interview, April 11, 2022.

Brooker, Graeme and Sally Stone. *Re-readings II: Interior Architecture and the Principles of Remodelling Existing Buildings*. London: RIBA Publishing, 2019.

Cairns, Stephen and Jane M. Jacobs. *Buildings Must Die: A Perverse View of Architecture.* Cambridge: MIT Press, 2017.

Clark, Roger H. and Michael Pause. *Precedents in Architecture: Analytic Diagrams, Formative Ideas, and Partis.* Hoboken: John Wiley & Sons, 2012.

Devlieger, Lionel, and Maarten Gielen. "How to Teach Architectural Design in the (New) Age of Contingency." https://www.rotordb.org/en/stories/how-teach-architectural-design-new-age-contingency

Fisher-Gewirtzman, Dafna. "Adaptive Reuse Architecture Documentation and Analysis*."* *Journal of Architectural Engineering Technology* 5, no. 3, (Jan. 2016): 1-8.

Koolhaas, Rem. "Cronocaos." *Log,* no. 21*:* (Winter 2011): 119-123.

Lynch, Kevin. *Wasting Away: An Exploration of Waste.* New York: Random House, Inc., 1991.

Malterre-Barthes, Charlotte, "A Global Moratorium on New Construction", accessed Feb. 21, 2023, https://www.charlottemalterrebarthes.com/practice/research-practice/a-global-moratorium-on-new-construction/

McDonough, William and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things.* New York: North Point Press, 2002.

McDonough, William and Michael Braungart. *The Upcycle: Beyond Sustainability: Designing for Abundance.* New York: North Point Press, 2013.

Parametric Tools as Teaching Instruments in Architectural Education

Stephanie Bunt, The Pennsylvania State University

Although parametric modeling tools are often used in architectural design strategies to explore geometric solutions, they are less commonly incorporated as teaching instruments to reinforce design concepts. Parametric tools can connect design variables to numerical performance objectives, allowing designers to explore a design space and respond to feedback about a building's objective performance. Although architectural education tends to focus more on design process than design outcome, emphasizing the relationships between a building's measurable characteristics can reinforce multi-disciplinary learning goals that are sometimes difficult to represent and challenging to assess. Parametric tools can provide formative feedback about a building's quantitative performance and support student summative learning without elaborate evaluations. Educators in other disciplines have used parametric models to teach complex concepts (Mirth, 2012; Lai, 2014) and incorporating parametric learning models in design pedagogy may be helpful in illustrating multi-dimensional architectural goals. However, these technology-based tools often exist in unknown territories for both beginning designers and architectural educators. Nevertheless, there are still promising opportunities to employ parametric thinking in educational capacities.

Context of Existing Strategies

While architectural education is crucial for the development of our built world, there is criticism of its pedagogical techniques to train architecture students to think interdisciplinary (Charalambous and Christou 2016). While the design studio is not the only form of education in architecture, it is the most prevalent teaching model and the least consistent in its approach to multi-disciplinary design. Although valid for their own purposes, the structure of the design studio's information delivery methods vary by professor pedagogies and mediums of instruction (Crowther 2013; Hettithanthri and Hansen 2022; Milovanovic and Gero 2022). The incorporation of digital tools in learning, however, have been shown to improve student design thinking skills (Hettithanthri and Hansen 2022). In addition, parametric tools can provide a variety of pedagogical feedback along with information about building performance in building design exploration strategies.

Summative and Formative Feedback

It has been suggested that while open-ended design studio projects allow for creative ideas, they do not always prepare students with skillsets for functional design understanding (Brady). The pedagogical structure of design studios with intermittent and final critiques could be considered summative feedback, where the learner receives evaluation of their knowledge over an aggregate topic, unit, or chapter, as experienced in tests. Alternatively, formative feedback, as defined by Shute (2019) is "information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning." Formative feedback should be timely (immediate feedback about performance), supportive (affirmative of correct answers), nonevaluative (or reduce cognitive load), and specific (reduced uncertainty) (Shute 2010). Tutorials, for example, may be a form of formative feedback (Smith 2022). In some ways, studio desk crits may also provide formative feedback (El-Latif et al. 2020), but effective practice of formative feedback in design studios can be inconsistent (Ardington and Drury 2017). Alternatively, digital tools, which can provide immediate performance feedback in response to designer decisions, can provide clear formative feedback in architecture education through strategies of exploration.

Parametric Tools for Design Exploration

Parametric tools allow designers to explore many design options, but strategies for responding to performance feedback can vary in rigor. While formal, mathematical methods, like Design Space Exploration, follow a "process of finding a design solution, or solutions, that best meet the desired design requirements, from a space of tentative design points" (Cardoso, Coutinho, and Diniz 2017), using digital design exploration as a teaching strategy can be a looser in application. It can borrow concepts from Design Space Exploration and appropriate them to teaching strategies and architectural 3D modeling. For example, in simple Design Space Exploration, a designer sets boundaries on a building's variables with objective goals, to search for better performing solutions. Often, objective goals have inverse relationships. Figure 1 shows a conceptual parametric building with two variables, height and width, and two normalized objectives of daylight and

cost. In this example, a larger building creates more surface area allowing for more natural daylight to enter the building, but a larger building also increases the cost of the building. Here, the objectives are inversely related such that a "perfect" solution, where each objective is minimized, does not exist. As a building becomes more elaborate, it will have more variables and objectives with complex relationships that can be challenging to navigate without the help of digital tools. To help navigate these complexities, parametric tools can enable designers to make informed decisions when selecting a building that meets the design needs by providing immediate performance feedback. In addition, parametric modeling tools have been used in previous research as viable environments for design decision making (Brown and Mueller 2016; Brown 2020; Arnaud 2013; Lee, Gu, and Ostwald 2015).

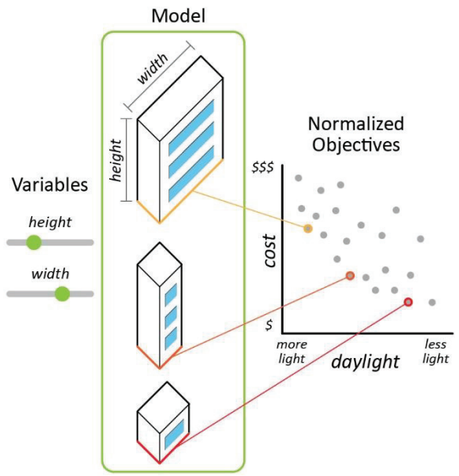


Figure 1. Example of a parametric model with two, inversely related objectives

While digital tools with performance feedback have been employed in architectural education (Gaulmyn and Dupre 2019; Stravric and Marina 2011), robust analysis tools often require students and instructors to have an intimate knowledge of the tool to effectively use it. Alternatively, parametric models can be built by an instructor and explored by a student with less familiarity of the programs. For a person exploring the model, parametric tools are controlled by predefined variables with clear objective feedback, making them accessible to novice designers.

Parametric Tools for Beginning Designers

Beginning design students are often asked to readily absorb and apply many architectural design concepts during their early courses, but they rarely begin their education with digital skillsets to help them synthesize design concepts in their own work. For example, a student may learn about different window orientations to increase daylight in a room, but not be able to model and run daylight analysis on their design to verify the effects of their design decisions. As a potential learning strategy, digital design exploration can support complex, multi-objective thinking though parametric environments that do not require extensive tool-based knowledge to explore. These tools can provide visual and numeric feedback while a user changes a prebuilt model's variables. Additionally, using digital tools in education have been shown to work better than reading texts alone (Hickey et al. 2009) and unlike graduate students, who express more agency in their education, undergraduate students view feedback as necessary in their educational improvement (Smith 2021). Therefore, this paper will now provide examples of useful tools and potential applications in architectural education for students and instructors.

Simulation Teaching Tools

Digital simulation tools have been used in other areas of education, such as chemistry, physics, and biology, to illustrate concepts through interactive platforms (Feldhausen, Weese, and Bean 2018) and parametric modeling (Devine 2008). Online simulation examples include PhET (PhET), Articulate (Articulate), and Merlot (Merlot). These websites support simulations tangentially useful for building design, such as wave modes, balancing forces, lighting simulations, and models of material mechanics. However, these examples are not specific to building typologies or architectural interdisciplinary problem-solving. Parametric modeling options, on the other hand, may allow for more relevant model building.

Parametric Options

Several existing software can facilitate an interactive parametric model and vary by their complexity and dimensionality of feedback.

Spreadsheet tools, such as an Excel file with rule-based cells, are readily accessible to create a model with relating variables and objectives. The models are also easy to explore. While Excel does not have 3D modeling capabilities and has limitations in its live feedback and computational capabilities, it provides a basic example to illustrate design space thinking as a teaching tool. In learning wall system assemblies, an Excel model built by an instructor, could provide several variables, such as insulation thickness, area of window openings, and the number of glass panes. The resulting objectives could include U-value, cost, and daylighting. As a student explores the model by changing the variables, they will see how changes in the variables impact the objectives numerically. A thicker insulation will provide a better U-value, but it will also cost more, and a larger window will allow for more light, but reduce temperature control of the wall assembly. For students who learn by example, a model with quick, numeric feedback in an easily accessible program could be useful in illustrating relationships in building design. The lack of 3D geometry illustration and restrictions in computation power, however, makes this tool limited for application in personal projects.

Other programming platforms allow for greater freedom in constructing parametric models, such as Jupyter Notebook (Jupyter), which hosts different coding languages, like Python. Models built using Python code can assess large datasets, customized for specific buildings, and can include optimization techniques. Several platforms can support Python, but Jupyter enables coding in a user-friendly interface while allowing for file sharing in a cloud, making collaborative work easy. However, tools like Jupyter require both the modeler and the user to have a thorough understanding of the programing languages, which can be challenging to learn if the users do not have a background in coding. In addition, the tools alone lack direct 3D modeling capabilities with live geometric updates, which are valuable streams of information in architectural building design.

Alternatively, parametric modeling platforms that can be applied to geometric 3D models, such as Grasshopper for Rhinoceros and Dynamo for Revit, have been developed for professionals and integrated into architectural academia. While these tools can be very robust in their application to wholistic building design, constructing an entire parametric model is laborious, and beginning design students, who are novices at the tool, may not be able to develop a sophisticated model from a blank file. In addition, learning objectives of a course likely focus on design considerations and do not intend to teach modeling techniques. Alternatively, to reinforce learning objectives concerning technical building design, online platforms can host parametric, 3D models with live, performance feedback. These formative feedback tools can be developed by an educator and explored by a student. For example, Shapediver (Shapediver, 2019) is an online file hosting platform that allows external users to navigate 3D parametric models from a Grasshopper file without editing the original file. Shapediver has been used in many contexts including product customization (Romani and Levi 2020) and design studies (Bunt & Brown, 2022), with one of its applications being end user accessibility while overcoming technical gaps in their understanding (Canestrino 2021). Furthermore, tools like Shapediver can provide timely, nonevaluative, and specific formative feedback. Table 1 shows a few of these different types of parametric modeling tool types and their advantages and disadvantages. For beginning designers, who do not yet have skills for complex building modeling, these tools can teach characteristics of design performance in an affirming, spatial environment. Prompting student designers to engage with design space thinking early in their education can help them consider relationships between building objectives in their future courses and instructors deliver information more comprehensively.

Table 1. Advantages and Disadvantages of Parametric Modeling Platforms

Tool Type	Advantages	Disadvantages
Spreadsheets *(Excel)*	-Readily accessible	-Limited functions -No 3D model
Coding Languages *(Python)*	-High processing capabilities	-All users must know coding language well -No 3D model
Visual Programming Tools *(Grasshopper)*	-3D model projection -Coding is visual and often linked to geometry	-Constructing model can be laborious
Parametric Platforms *(Shapediver)*	-Accessible to user -Interface is controlled	-Writer must know Grasshopper

Parametric Tools for Architectural Pedagogies

While navigating a parametric tool can be intuitive, building and implementing the parametric model for education may require more active modeling expertise. However, constructing meaningful, parametric models can be done in a variety of programs and have many advantages. These parametric models can be adapted to many contexts and provide novel metrics for gauging student understanding outside of traditional forms of assessment.

Parametric Tools as Formative Feedback

Parametric tools can provide formative feedback by responding to user input quickly, affirming effective design choices, and reinforcing specific concepts. In addition, they can be a nonevaluative form of learning. For example, if used as an interactive teaching instrument throughout a lesson, students can explore a parametric model to develop an appropriate solution to a design task that meets certain objective requirements while following along with instructor directions. Outside of the classroom, students can also explore a model on their own as part of an assignment to reinforce learning objectives. Although, in order to be useful, the parametric tool should still be readily accessible to novice users and present performance values in an intuitive way.

In an application where novice pre-designers used a parametric modeling tool to develop a conceptual skyscraper design with geometric and numerical goals, a research study considered high school students' identity in STEM to their design behavior in the tool. The study was conducted at a high school in the Northeastern United States with 107 ninth and tenth grade student participants. For the study to be conducted in a timely manner with concise results to avoid participation fatigue, the tool needed to be quick to learn and easy to interpret. It was situated in a website built for the study, which contained a Shapediver API interface hosting a Grasshopper file of the study's parametric skyscraper model. [OBJ]task, the students were provided a brief lesson on skyscraper design and shown how to use the design tool. The task asked the students to develop a skyscraper for Google, addressing technical goals of cost, energy, and artificial light, while also considering the skyscraper's appearance. In the Shapediver model space, students explored the parametric skyscraper by changing 11 design variables. The model showed the performance of the 3 technical objectives as live feedback bars that changed size and color as the objectives improved. The website collected information about the students' design behavior, including the final values of their technical objectives. The students had one hour to develop their design and submit screenshots of their final solution. Figure 2 shows the tool's program structure and an example of the modeling interface.

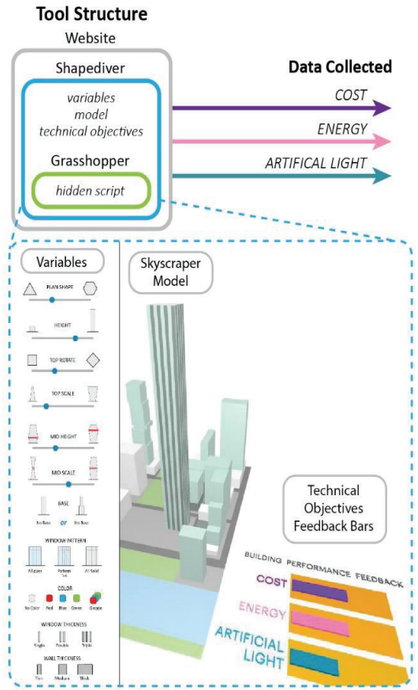


Fig. 2 The example study's tool structure with the default skyscraper model, variables, and technical objectives feedback bars.

While the study's research goal focused on student identity and behavior, the study's design sessions provide an example of novice designers working in a parametric tool to explore better performing designs. The students were able to work in the tool immediately, often exploring representation settings of the tool which the study had not prompted them to do. Regarding student technical design performance, 87.8% (94) of the students submitted final designs that performed better than the original model. As an exercise, the students responded to the design task in the allotted time and produced improved design solutions, suggesting the effectiveness of the tool as a formative feedback instrument.

The educational protocol from the study could be used as part of an assignment in a classroom, with additional objectives being added with new lessons. Students in this example could learn how new design considerations impact the performance of their designs through active exploration.

Parametric Tools as Summative Feedback

As an additional application, parametric modeling tools can be used in building design education where other forms of assessment may struggle to best capture student understanding. Summative feedback reflects student understanding over a broad topic or series of topics, like in a test, rather than short, focused responses, like in a tutorial. Although conventional written exams are familiar forms of summative feedback, they may be limited in capturing student understanding of design in application. Alternatively, incorporating parametric modeling tools in an exam can allow for comprehensive, application-based assessment, rather than asking students an insular multiple-choice question to judge their understanding. For example, a student could be asked to find the variables or values of particular variables in a building model that lead to a specified outcome. In some ways, a question about variables could be explored randomly, but for a timely response, students would need an intuitive understanding of building design to guide themselves to a valid solution.

In addition, parametric exploration, used as a method for investigative problem-solving, allows for self-led learning while working off a structured evaluation system. Parametric model exploration follows three of the leading recommendations for project-based learning based on literature evaluation. According to Kokotsaki et al. (2016), three of six necessary qualities of project-based learning should balance didactic instruction with independent inquiry, emphasize reflection and self-evaluation, and allow for student choice and autonomy. Parametric exploration permits students to explore a model with their own strategies, provides performance feedback, and enables students to make decisions within the context of set variables. Although exploring a model is not as open ended as a semester long design project, it does allow for focused critical thinking skills in application of a building's complex technical objectives.

While parametric space thinking as a strategy for design development is gaining popularity in architectural education, incorporating methods for parametric exploration in design teaching activities is not yet fully explored. The potential advantages for pedagogies involving beginning design students may benefit summative and formative feedback strategies, which are useful for learning complex relationships in technical building design.

Bibliography

Ardington, Angela and Helen Drury. "Design Studio Discourse in Architecture in Australia: The Role of Formative Feedback in Assessment." *Art, Design & Communication in Higher Education* 16, no. 2 (2017): 157-170. https://doi.org/10.1386/adch.16.2.157_1

Articulate. Accessed: February 15, 2023. https://community.articulate.com/articles/11-awesome-examples-of-interactive-sliders-in-action

Arnaud, V. B. "Quantifying Architects' and Engineers' Use of Structural Design Software." Master of Engineering, Massachusetts Institute of Technology, Boston, 2013.

Brady, Ross. "Architecture School Is Broken. Here's How We Should Fix It." Architizer. Accessed February 16, 2023. https://architizer.com/blog/practice/details/architecture-education/

Brown, Nathan C. "Design Performance and Designer Preference in an Interactive, Data-driven Conceptual Building Design Scenario," *Design Studies* 68 (2020): 1–33. https://doi.org/10.1016/j.destud.2020.01.001

Brown, Nathan C. and Caitlin T. Mueller. "The Effect of Performance Feedback and Optimization on the Conceptual Design Process," in *International Association of Spatial Structures Annual Symposium*, September 2016.

Bunt, Stephanie and Nathan C. Brown. "Evaluating Profession-based Vocabulary in Teams of Architecture and Engineering Designers." In *International Conference on Structures and Architecture*. July 6-8. Aalborg, Denmark. 2022.

Cardoso, João M. P., José G. F. Coutinho, and Pedro C. Diniz. "Chapter 8 – Additional Topics." *Embedded Computing for High Performance* (Morgan Kaufmann, 2017), 255-280. https://doi.org/10.1016/B978-0-12-804189-5.00008-9

Canestrino, Giuseppe. "Use of Parametric Approach for user-oriented Development in Building Design: Preliminary Investigations." *Urban and Environmental Studies* 5, no. 1 (2021). https://doi.org/10.21625/archive.v5i1.826

Charalambous, Nadia and Natasa Christou. "Re-adjusting the Objectives of Architectural Education." *Procedia – Social and Behavioral Sciences* 228, (2016): 375-382. https://doi.org/10.1016/j.sbspro.2016.07.056

Crowther, Phillip. "Understanding the Signature Pedagogy of the Design Studio and the Opportunities of its Technological Enhancement." *Journal of Learning Design* 6, no. 3 (2013): 18-28.

Devine, K. L. "Using a Parametric Solid Modeler as an Instructional Tool." *The Engineering Design Graphics Journal* 72, no. 2 (2008).

Feldhausen, R., J. L. Weese, and N. H Bean. "Increasing Student Self-Efficacy in Computational Thinking via STEM Outreach Programs." In *Proceedings of the 49th ACM Technical Symposium on Computer Science Education*, 302-307. 2018. https://doi.org/10.1145/3159450.3159593

Gaulmyn, Camille d. and Karine Dupre. “Teaching Sustainable Design in Architecture Education: Critical Review of Easy Approach for Sustainable and Environmental Design (EASED).” *Frontiers of Architectural Research* 8, no. 2 (2019): 238-260. https://doi.org/10.1016/j.foar.2019.03.001

Hettithanthri, Upeksha and Preben Hansen. “Design Studio Practice in the Context of Architectural Education: A Narrative Literature Review.” *International Journal of Technology and Design Education* 32 (2022): 2342-2364. https://doi.org/10.1007/s10798-021-09694-2

Hickey, Daniel T., Adam A. Ingram-Goble, and Ellen M. Jameson. “Designing Assessments and Assessing Designs in Virtual Educational Environments.” *Journal of Science Education and Technology* 18, (2009): 187-208. https://doi.org/10.1007/s10956-008-9143-1

Jupyter. Accessed February 15, 2023. https://jupyter.org/about

Kokotaski, Dimitra, Victoria Menzies, and Andy Wiggins. “Project-based Learning: A Review of the Literature.” *Improving Schools* 19, no. 3 (2016): 267-277. https://doi.org/10.1177/1365480216659733

Lai, Chia-Hung, Shu-Hsien Huang, Ming-Chi Liu, and Yueh-Min Huang. (2014). “Task-Based Learning in Vocational Education: A Case Study of 3D Parametric Mechanical Design Course with Cloudized Learning Platform.” In *2014 International Conference of Educational Innovation through Technology*. Brisbane: IEEE, October 2014. https://doi.org/10.1109/EITT.2014.33

Lee, J. H., N. Gu and M. J. Ostwald. “Creativity and Parametric Design? Comparing Designer’s Cognitive Approaches with Assessed Levels of Creativity.” *International Journal of Design Creativity and Innovation* 3, no. 2 (2015): 78-94. https://doi.org/10.1080/21650349.2014.931826

Merlot. Merlot Materials. Accessed February 15, 2023. http://www.merlot.org/merlot/materials

Milovanovic, Julie and John S. Gero. “Exploring the Use of Digital Tools to Support Design Studio Pedagogy Through Studying Collaboration and Cognition.” In *Design Computing and Cognition ’20* (2022): 21-39.

Mirth, John A. 2012. “Parametric Modeling: A New Paradigm for Mechanism Education?” In *ASME 2012 International Design Engineering Technical Conferences and Computer Information in Engineering Conference*, 1487-1502. Chicago, IL: August 12-14, 2012.

PhET Interactive Simulations. University of Colorado Boulder. Accessed: https://phet.colorado.edu/en/simulations/

Romani, Alessia and Marinella Levi. “Parametric Design for Online User Customization of 3D Printed Assistive Technology for Rheumatic Diseases.” *International Conference on Augmented Reality, Virtual Reality and Computer Graphics* (2020): 174-182. https://doi.org/10.1007/978-3-030-58468-9_14

Shapediver GmbH. (2019). Shapediver. www.shapediver.com `.

Shute, Valerie J. “Focus on Formative Feedback.” Review of Educational Research 78 no. 1 (2008): 153-189. https://doi.org/10.3102/0034654307313795

Smith, Charlie. “Architecture Students’ Uptake and Use of Formative and Summative Feedback.” Assessment & Evaluation in Higher Education 47, no. 1 (2022): 29-44. https://doi.org/10.1080/02602938.2021.1892028

Stravric, M. and O. Marina. “Parametric Modeling for Advanced Architecture.” *International Journal of Applied mathematics and Informatics* 5, no. 5 (2011): 9-16.

Into the Unknown: Abductive Reasoning in Beginning Design Education

Matthew Shea, University of Colorado Denver

"I can never accomplish what I want – only what I would have wanted had I thought of it beforehand."

--Richard Diebenkorn

Introduction

In beginning design education, many processes and bodies of knowledge are taught. Students are taught craft skills, design principles, organizational systems, terminology, etc. They learn to manipulate the composition of form and space and articulate a process or design intent, and how to present their results to colleagues, instructors, and reviewers (jurors). They are asked to make something that they do not know what it is before they make it. They are given prompts, constraints, elements, and sites to guide and limit their explorations. The students receive feedback, criticism, and encouragement along the way. Though, from time to time, students may receive instruction in the ambiguous and over-used term of “design thinking,” the mode of reasoning that underpins their design decisions and processes is rarely, if ever, explicitly discussed or engaged. Students are left with a sense that the design process is a matter of luck, arbitrary or mechanistic, often leading students to wait for a muse or look for design recipes.

This paper takes the design process as a form of reasoning through which inferences are created about the world. But what is this process, and what is the reasoning model most fitting for a designer? What does it mean for a designer to make an inference about the world, and what form does that inference take? To address these questions, we will turn to the work of the American pragmatist logician C. S. Peirce and his taxonomy of ten modes of inference. termed *abductive reasoning* as its primary mode of thinking.[1] Pierce claims that, unlike its better-known siblings, deductive and inductive reasoning, abductive reasoning is the only form of reasoning that can create new knowledge through its inferences,[2] that is, to create something previously unknown—something we task our students with all the time. Through an exposition of its characteristics (revisable, fallible, plausible, and open-ended), and the process of abductive reasoning (fact-finding, proposition, testing, and revision), this paper proposes a set of guidelines to help explicitly develop the necessary conditions in the design studio for abductive reasoning to more easily take place and engaging and teaching the underlying process of abductive reasoning in the design process.

Abductive Reasoning Defined

In order to develop the guidelines for teaching abductive reasoning, it is necessary first to have an understanding of what it is, what characteristics it has, and how this mode of reasoning works. Understanding that abduction is the only form of reasoning that can produce new knowledge is paramount. In the most basic terms, the product of abductive reasoning is “a hypothesis, a best guess, based on the given knowledge and evidence at that moment.”[3] Unlike deductive inferences, which are based on possibility and function in the realm of actuality, or inductive inferences, which are based on probability and function in the realm of regulation, abductive inferences are based on the criterion of plausibility and function in the realm of potentiality.[4]

To illustrate the differences between these means of inference, we can look at Douglas Walton’s comparison. Suppose a bag contains only red marbles, and you take one out. You may infer that the marble is red through the deductive process. On the other hand, suppose you do not know the color of the marbles in the bag, and you take one out, which is red. Using the inductive method, you may infer that all the marbles in the bag are red. However, suppose you find a red marble near a bag of red marbles. Using the abductive method, you may infer that the marble is from the bag using the abductive processes.[5] In the first two cases of deduction and induction, the state of affairs (all that can be considered) is set and complete (the bag of marbles and the one marble in question), and the hypothesis that is derived is testable against those conditions—all the marbles in the bag can be taken out to prove or disprove the inferences made.

On the other hand, in the abductive process, the state of affairs is incomplete and is not set. The hypothesis or inference acts as the best explanation for the conditions and

information at that time. Abduction is the process of assuming something to be true that we do not know to be true that allows disparate facts into a plausible explanation.[6] As such, the hypothesis does not privilege universal validity but rather remains a revisable and refutable inference and becomes more valid as it is revised by including more information. Additionally, the validity of an abductive inference is directly related to its usefulness in explaining the given conditions with the greatest amount of economy.[7]

Peirce describes the experience or act of abduction as a flash, an insight, and a suggestion, throughout his writing on the subject. These terms raise implications for the role of the subject, the person who has the abduction, and their relationship with the abduction itself. He describes it as it "comes to us like a flash. It is an act of insight, although an extremely fallible insight…It is the idea of putting together what we had never before dreamed of putting together which flashes the new suggestion before our contemplation."[8] Describing it as such suggests that abduction can happen instantaneously and that the subject has little participation. Likewise, he states that "No reason whatsoever can be given for it…and it needs no reason, since it merely offers suggestions."[9] Implying that abductions are unfounded and do not require or have a rationale. This further suggests a separation between the agency of the subject and the abduction. It suggests that the subject has no control over the act of abduction, which would be something rendered out of our control and a skill that cannot be improved upon or taught.

However, if we look at two other quotes by Pierce, we find that abductions are situated within a given state of affairs over which the subject has some control. Pierce states, "But suddenly while we are poring over our digest of the facts and are endeavoring to set them into order, it occurs to us that if we were to assume something to be true that we do not know to be true, these facts would arrange themselves luminously. That is abduction."[10] In this quote, we can see the subject's roles in the abductive act. The first is that the subject must place themselves in a problem of amassing the given facts. Second, the subject must set themselves to labor to set them in order. Third, the subject must make an assumption that would explain the facts of the situation, even though they do not know if it is true and there is nothing at that time that would let them prove or disprove the hypothesis. Nevertheless, the assumption does have to explain the facts and their relationship to one another. The subject must set the condition, ask questions, collect facts, and make observations to be considered and understood.
The second scale in which Pierce suggests that the subject has the capacity or agency to affect the abductive process is in the larger arch of time or in the collective knowledge of the subject. Pierce states, "[a]n Abduction is a method for forming a general prediction without any positive assurance that it will succeed either in the special case or usually, its justification being that it is the only possible hope of regulating our future conduct rationally, and that induction from past experience gives us strong encouragement to hope that it will be successful in the future.[11] As we can see at the end of this quote, Pierce suggests that the inferences of previous experiences will advance the possibility of an abduction, successfully explaining the present state of affairs. In this case, the subject primes the potential of an abduction with their previous experiences.

In the marble example above, this could be understood as the previous experience or knowledge that marbles of any color come in bags, allowing the subject to make the abduction that the marble on the floor came from the bag. Of course, until it is discovered whether the bag has been opened. In the first case, the abduction is strengthened but not proved, i.e., one must know that the bag must be opened if a marble were to have escaped it. Nevertheless, the abduction is not proven, given that the known conditions cannot prove that the marble came from that particular bag, although it could have. However, in the latter case, if the bag is closed, the same previous experience weakens the abduction by opening up the fact that with the given information, the marble more than likely did not come from the bag, of course, unless one has experience or knowledge that bags can be easily resealed.

This example further illustrates another quality of abductive reasoning: abductive reasoning is cumulative. In any given situation, and builds upon a previous abduction, strengthening or weakening it. Pierce states, "…not the smallest advance can be made in knowledge beyond the stage of vacant staring, without making an abduction at every step."[12] In abductive reasoning, this cumulative quality functions in multiple ways. In the first instance, the cumulative quality works with the mutable quality, allowing an abduction to become stronger (more valid) or weakened and need further abductions to strengthen it. In the second instance, the cumulative quality in that one abduction influences or primes an abduction in another domain.

Another quality of abduction for Pierce is that it is diagrammatic in nature. Pierce states that, …abduction rests upon diagrammatic reasoning" and that it "furnishes all our ideas concerning real things."[13] For Peirce, diagrammatic reasoning is a pre-linguistic visualization of novel patterns. Peirce states, "[w]e form in the imagination some sort of diagrammatic, that is, iconic, representation of the facts, as skeletonized as possible…that with ordinary persons this is always a visual image...This diagram…is then observed, and a hypothesis suggests itself that there is a certain relation between some of its parts — or perhaps this hypothesis had already been suggested. In order to test this, various experiments are made upon the diagram, which is changed in various ways."[14] In this situation, the diagram represents the state of affairs under consideration and the object from which an abduction is produced. As we have seen before, this diagram is changed by testing the hypothesis and expanding the facts to be considered.

In summary, abductive reasoning is distinct from induction and deduction due to its open universal domain and appears to the subject as a flash, insight, or suggestion. An abduction is mutable and characterized as plausible, with its validity increasing or decreasing with additional facts and consideration. The flash-like process dissociates the subject from direct agency in the act of abduction. However, the subject is able to influence the nature and potential for abduction to take place by shaping the conditions necessary for abduction and the previous experiences the subject brings to the state of affairs in which abduction will take place. Additionally, the process of abduction is cumulative and based on diagrammatic reasoning.

Design as Abductive Reasoning

How or where do we find abductive reasoning in the design process? Neither design nor abductive reasoning is a formulaic process that follows a monodirectional process —one act flowing directly into the next, concluding in an answer of a predetermined form, such as an if-then statement. Rather, in order to understand the relationship between design and abductive reasoning, it is most productive to identify aspects and qualities of abductive reasoning that are inherent to design and the design process and to make them explicit and in an abductive way, produce an inference that best describes the disparate facts. For the purpose of this paper, these will be illustrated in terms of beginning design pedagogy, which sets the foundation for the student's educational and professional careers.

In order to understand the design process as embodying or using abductive reasoning, it is necessary to understand the results and product of the design process as an inference. However, for this discussion, it is important to sidestep the linguistic/semiotic theories of architecture that foreground a design proposal as a linguistic statement that produces a meaning that an observer can read. Outside of this linguistic understanding of inference and even more fundamental understanding, an inference is a conclusion formed due to known facts or evidence—a state of affairs. In all design, there is a movement from a set of defined facts to a proposal that best attempts to respond to and incorporate those facts. As designers and instructors, we give our students a set condition from which to design their projects. Variability arises through the difference between what is considered to be within the domain of the situation and also through the varied translation and construing of the milieu of facts in any given condition.

In architectural education, as in any design problem, the state of affairs, the domain, and the set of facts upon which a design is to be based must be defined yet understood to be continually expanding. This state of affairs can be broad and incorporate conflicting, indifferent, reciprocating, etc., facts from divergent realms such as physical, cultural, social, economic, and regulatory contexts, theoretical discourses, and user and financial requirements. A designer must collect and define the state of affairs that is being addressed, accommodated, or responded to in a design proposal as a point of departure for the design proposal. As in all abductive reasoning, the designer must welcome new information to be used in the expansion or refinement of the proposal. Through this process, not all information is treated equally; rather, some become more pertinent than others.

When moving from the analytical process of collecting and defining the data and information on which they are going to base their design proposal to the synthetic process of developing the proposal itself, the designer, as Peirce suggests, must assume things that are not known to be true, but that best explain the facts. Inherent to the idea of being the best explanation of a state of affairs is the notion that the proposal must be as economical as possible; it must explain the state of affairs with the fewest assumptions—leaps of faith—and can be expressed with the least amount of energy. For abductive reasoning and, in most cases, in

design, the more economical a proposal is, the more robust the proposal is. Likewise, the inclusion of superfluous assumptions or elements weakens a proposal. In both cases, assumptions upon which a proposal is developed must be defined and not taken as part of the state of affairs because these assumptions will be adjusted and refined as more information is added to the state of affairs.

Design, as in abductive reasoning, assumptions, and proposals, are cumulative, building off one another to expand and refine the proposal. The designer begins with a limited and incomplete set of facts in the design process. They make gross assumptions based on this limited set of facts. They develop a rough, incomplete, gross, suggestive proposal that lacks refinement or nuance, e.g., a simple massing or a *parti* diagram. The design/reasoning process adds more information to the state of affairs and must be incorporated into the proposal or hypothesis. As a cumulative process, adding new information should not be understood or taken as a completely new project. It should be understood as a development of the existing proposal, even if the new information requires an almost complete reconsideration of the proposal.

A proposal in a design process or a hypothesis in abductive reasoning is cumulative and inherently mutable, incorporating new facts and information into the proposal or hypothesis. These changes can be of any scale ranging from the fundamental to the most superficial. At the fundamental scale, the assumptions upon which a proposal or hypothesis is based and the proposal or hypothesis itself may need to be almost completely reconsidered and restated. Such a scenario could happen in design when the original information or facts to which the primary proposition responded are changed. For example, if budgetary constraints were prioritized as part of the original set of facts, monumentality was not considered part of this set of facts. Still, with the inclusion of new information (an economic windfall for the client), the priority of the two facts could change, forcing an almost complete reworking of the proposal. Likewise, on a smaller scale, as a designer considers additional information such as local building code, they may have to incorporate small changes to a material assembly. Even after the building is built, the proposal can be adjusted through additions and renovations. Add something about testing.

In design, as in abductive reasoning, diagrammatic reasoning is used. Throughout the design process, a designer uses visual/graphic diagrams that are skeletonized or reduced to the most pertinent facts to be considered. This pre-linguistic image of the state of affairs set the foundation for and begins to suggest a proposal. These diagrams are generative. They lay the foundation for the proposal by connecting the facts in particular ways, producing hierarchies amongst them, and organizing them in a way that allows them to be considered in multiple ways. This process of diagrammatic reasoning follows, and I would argue, constitutes the structure of the design process from the diagram of the state of affairs, the conditions to which the proposal must respond, to the parti or program diagram that describes the basic organization or form that the proposal must respond to, to the plans, sections, and elevations that are diagrams to which the proposal's actualization must respond, to the descriptive diagrams that retroactively describe the proposals response to the conditions embodied in the earlier generative diagrams.

Fostering Abductive Reasoning

Now with an understanding of the relationship between abductive reasoning and design, it is now possible to turn our attention to how it is possible to make something inherent in the design process explicit in the hopes of further fostering its development. This process intends to remove some of the mystery surrounding the design process, thus giving the students more agency and awareness around developing and constructing the conditions that make abductive reasoning possible. Following the attributes of abductive reasoning, this paper offers guidelines for framing and developing design curricula for beginning design students, making the students aware and confident in the mode of reasoning they use as they design. proposes

The first guideline is to frame the product of the design process as an inference. Often to the beginning design student, the product of the design process is an object/design that resulted from luck, a muse, a process, or instructions from their instructor. To frame the design process as the production of an inference requires the instructor to explicitly frame the design process as a process of constructing the necessary conditions for abductive reasoning. As we have seen above, to construct these conditions, a student must be guided in collecting the facts that will be the basis for abductive reasoning. And the importance of what facts are collected and how they are arranged should be of the utmost importance. In beginning design education, students are often tasked with an abstract project to teach basic design principles, visual literacy, and composition. Students often find these projects disconnected from what they perceive to be architecture—not having a site, program, etc. It is necessary to frame all design problems as having a set of facts made explicit and collected to form a state of affairs in which the student operates, whether it is a size of a bounding box as a site, an organization system, or translation of a concept to form that must be considered.

The second guideline is framing the analytical process of site analysis, user requirements, and material studies as the production of a state of affairs. In formulating this state of affairs, students must enumerate the facts that will be foundational for abductive reasoning. These facts can include a broad range of topics from site and climate information, user needs, client's desires, theoretical discourse, regulatory requirements, etc. The process of forming the catalog of facts could be accomplished both in a narrative statement or in graphic form. Working with the students to construe and organize the facts in different arrangements and hierarchies is paramount. By doing this, the students understand that collecting and arranging these facts is one of the greatest aspects of their agency in the design process. Through the conscious enumeration and arrangement of facts, students are shielded from the design paralysis that comes about by either attempting to consider too many facts in an unspecified arrangement or considering too few. In the first case, the students "spin their wheels," negating an abduction by immediately changing the state of affairs. In the second case, students are left waiting for a muse to show up or a stroke of creativity.

The third guideline is to frame the design process as a process of making assumptions about the defined state of affairs. This process is difficult for students to comprehend because they are so used to using induction or deduction problem-solving processes. Students often become stuck moving from the analytical process of observing and collecting facts to the synthetic design process because they desire or strive for an indisputable proposal. By framing the process of moving from the analytical to the synthetic mode by making assumptions about the state of affairs, the students understand more clearly and explicitly that the design process is open-ended and fallible and that the product of this process is a set of assumptions that must be tested and adjusted. There is no one set solution to the state of affairs. Rather, there are only proposals that are better or worse at addressing the facts in the state of affairs. Students become more comfortable with the ambiguity of the unknowable and unprovable state of assumption. Additionally, as students consciously make and state these assumptions, they come to take ownership of them.

The fourth guideline is to frame the evaluation or testing of the product of the assumptions in terms of economy. This is not a restatement of the quote often attributed to Mies van de Rohe, "Less is More," but rather an attempt to right-fit a solution to a state of affairs. Using evaluative criteria based on the idea of economy, students must justify all aspects of their design work regarding the givens in the state of affairs. This would prevent the often-witnessed process of a student attempting to "shoehorn" in a preconceived solution into a state of affairs that does not support or even contradicts it. Again, I will reiterate that this is not a call for austerity in a design proposal or any aesthetic "style." Rather, it requires the student to explicitly include a theoretical discourse or material practice in the state of affairs from which they are working. Additionally, the criteria of economy helps students from mistaking the addition of superfluous elements, spaces, etc., in the project's development.

The fifth guideline is to frame the design process as cumulative and mutable. It is important to frame the design process and the product in such a way as to circumvent two common conditions that arise in the design studio, particularly in beginning design. The first is to prevent the student from becoming stuck on the results of their first abduction. Students in this situation are unable to develop or move the project forward and view it as complete. We often see this when a student has a "good" midterm review and has nothing to "fix" in their projects. The second situation is on the opposite end of the spectrum, which is to completely scrap a proposal as a response to critical feedback. As a cumulative process that produces a mutable outcome or proposal, students understand that in order to produce a stronger, richer, and more robust proposal, they must build on to and refine their original proposal and have a deeper understanding of their proposal as necessarily mutable and changeable to accommodate the inclusion of new information or the rearrangement of information in the state of affairs to which it is responding.

The sixth guideline is to emphasize diagrammatic thinking in the studio. The process of arranging the state of affairs in a non-linguistic fashion allows the students to spatially define the original state of affair, test their proposal that is based on the assumptions made concerning the diagram,

and willfully adjust the diagram as more information is added to the set of facts that constitute the state of affairs. The process of diagrammatic thinking helps the student further clarify what their project is responding to, allowing them to sidestep the pitfall of design paralysis due to an attempt to respond to an unspecified and amorphous set of facts. Additionally, the diagram can serve as a record of the cumulative set of assumptions, tests, adjustments, and inclusion of additional information into the design process in an orderly and productive manner.

Conclusion

This paper assumes that the abductive reasoning process is latent in the design studio setting and beginning design education. It argues that by making it explicit, students gain a greater agency in their design process. As instructors in beginning design, we should evaluate the exercises we give to our students in terms of whether or not they foster the conditions for abductive reasoning based on these guidelines. We should explicitly frame them so that the students learn to develop the right conditions for abductive reasoning in their design process so that they come to deeply understand that the design process is a cumulative process that produces a mutable product. Through an understanding of the abductive reasoning process, they come to understand the importance of nuanced observation and articulation of the conditions in which they are working, more deeply engaging the process of ideation and iteration, allowing for greater revision and development, and developing the confidence to step into the unknown.

End Notes

1 Thomas Fisher. Designing Our Way to a Better World, University of Minnesota Press: Minneapolis 2016. pp. 21-31.
2 Rapanta, Chrysi. “Teaching as Abductive Reasoning: The Role of Argumentation” in Informal Logic. Vol. 38, No. 2, 2018. pp. 294.
3 Ibid, p. 295.
4 Ibid, p. 295
5 Walton, Douglas. “Abductive, Presumptive and Plausible Arguments. Informal Logic. Vol. 21, No. 2, 2001. p 141-169.
6 Pierce, Charles Sanders. Harvard Lectures on Pragmatism, deleted passage (1903), in Pragmatism as a Principle and Method of Right Thinking: The 1903 Harvard “Lectures on Pragmatism. ed. Patricia Ann Turrisi. State University of New York Press: Albany 1997. p 282.
7 Pierce, Charles Sanders. Carnegie Application (L75; 1902) in The New Elements of Mathematics by Charles S. Peirce, ed. Carolyn Eisele. Mouton: The Hague 1976 4:37-38
8 Peirce, Charles Sanders. Collected Papers of Charles Peirce. 8 vols. Harvard University Press: Cambridge Mass. 1931-58. 5.181
9 Ibid, 5.171-72
10 Pierce, Charles Sanders. Harvard Lectures on Pragmatism, deleted passage (1903), in Pragmatism as a Principle and Method of Right Thinking: The 1903 Harvard “Lectures on Pragmatism. ed. Patricia Ann Turrisi. State University of New York Press: Albany 1997. p 280.
11 Peirce, Charles Sanders. “A Syllabus fof Certain Topics of Logic” (1903), in The Essential Peirce: Selected Philosophical Writings, vol. 2, ed Peirce Edition Project. Indiana University Press: Bloomington 1998. p 299.
12 Peirce, Charles Sanders. “The Proper Treatment of Hypotheses: A Preliminary Chapter, toward and Examination of Hume’s Argument against Miracles, in Its Logic and in Its History” (MS 692;1901), in Historical Perspectives on Peirce’s Logic of Science: A History of Science, 2 vols. Ed. Carolyn Eisele. Mouton: Berlin 1985. 2:898-900.
13 Pierce, Charles Sanders. “PAP (Prolegomena for an Apology to Pragmatism), (MS293; circa 1906) in The New Elements of Mathematics by Charles S. Peirce, ed. Carolyn Eisele. Mouton: The Hague 1976. 4:319-320.
14 Peirce, Charles Sanders. “Diagrammatic Reasoning” in Collected Papers of Charles Peirce. 8 vols. Harvard University Press: Cambridge Mass. 1931-58. 2.778

Using 3D-Printed Structural Units to Enhance the Studio Engagement and Structure Learning Efficiency of Architecture Students

Zhuodan Guo, Zhenhua Yang, Ben Bernard, North Dakota State University

Abstract

This paper presents a new teaching approach that addresses the educational challenges faced in the third-year architecture design studio. The approach involves students designing and constructing a masonry wall bond using 3D-printed structural units scaled to 1:8, with appropriate instructional guidance, and integrating the wall design outcomes into the studio project. This approach enhances student engagement, promotes collaboration in team design, emphasizes their involvement, and strengthens the integration of structural education and studio project design. The final survey results confirm the effectiveness of this innovative approach.

Key words: architecture design studio, masonry bond, 3D printing, architecture education, structural education, team collaboration, student engagement

1. Introduction

The design studio is an essential component of architecture education that serves as a bridge between theory and practice. It creates an interdisciplinary learning environment that encourages students to apply the concepts they learn in lecture-based courses to practical applications, helping them develop professional design skills.

To succeed in architecture, graduates must have a solid understanding of construction science, which is critical to understanding how buildings are constructed and how they stand up. A regular studio does not provide few opportunities for the students to apply their knowledge of structural design, tectonics, detailing, and other related fields to real-world scenarios.

In our third-year fall semester, we introduced the structure course to the students. In addition to developing professional design skills in the studio, we challenged students to design buildings with specific structural types to promote integration between form, movement, and structural design. Students were required to holistically develop, test, refine, and revise their projects.

However, we have noticed that structural courses' technical and mechanical nature can pose a challenge for some students and may discourage them from bringing their knowledge into the design studio. Many students memorize and forget tectonics and structural types for exams shortly after. This separation of construction knowledge from design can lead to a lack of integration between the two and cause issues when designing buildings.

For example, when faced with a design brief that mandates a "masonry building," some third-year students might perceive "masonry" as merely a "textured skin" that they can select from a material library in modeling software. Due to the prevalence of modeling and rendering software that allows for fast development, some students may add a brick-like "surface skin" to their building model to satisfy the "masonry structure" requirement without completely comprehending the underlying structural principles (see Figure 1 and Figure 2). This trend is particularly noticeable among students who struggle with structure courses and tend to prioritize the visual aspects of the building over its structural components.

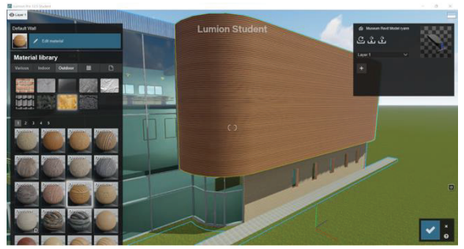


Figure 1. The process of dragging a wood-clad-looking façade from a library and dropping it onto a digital model to complete a "wood structure design."

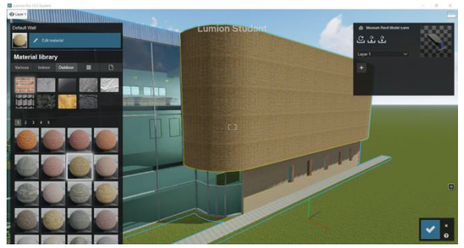


Figure 2. The process of dragging a brick-looking façade from a library and dropping it onto a digital model to complete a "masonry structure design."

It is essential to implement construction knowledge into the design studio to address this issue and boost design motivation, particularly for students who face difficulties with structural courses. In this paper, we tested a new teaching approach in the 2022 fall semester compared to the 2021 fall semester in the third-year design studio. We used 3D printing (3DP) technology to create structural elements and enabled students to physically construct their building, starting with brick courses and wall bonds. This approach incorporated the design-build system into the third-year architecture studio, emphasizing learning through practical experience. We collected student attitudes through two surveys among 25 students. The results are discussed in this paper and demonstrate that the teaching approach can significantly enhance students' design motivation, structural design ability, and team engagement, improving their overall learning efficiency. The paper consists of a brief review of relevant literature, an explanation of the experimental design, an analysis of the findings, a statement of the limitations, and a conclusion.

2. Related Work

Separating construction knowledge from architecture education has created a myopic perception of the profession [1]. In 2004, UNESCO/UIA Charter for Architectural Education indicated that architectural education should involve the acquisition of the capabilities of understanding technical knowledge of structure, materials, and construction [2]. However, in some cases, construction courses are not integrated into the architectural design studio education, leading to a limited understanding of construction issues among graduates [3]. Salama [4] argues that formal education in architecture has not been treated as a whole nor appropriately conceptualized as part of a process.

According to Latif Rauf and S. Shareef, students often need more motivation to apply the knowledge they gain from construction courses to their design projects. Rather than engaging in creative problem-solving and critical thinking, students are often required to memorize and reproduce instructional material that is primarily technical and mechanical. This approach to learning can stifle students' passion for the subject. Furthermore, students are often evaluated based on their ability to reproduce what they have been told or shown rather than their ability to think creatively or solve problems. Examinations typically test the student's ability to recall and reproduce material previously presented [1, 3, 4].

Architecture educators have been working for decades to bridge the gap between construction and design studio education, seeking ways to enhance student motivation and engagement. Salama [4] argues that a systemic pedagogy, which emphasizes learning by experience, can effectively achieve this goal. Inquiry-based learning (IBL) is an instructional method that has emerged in response to the limitations of traditional instruction, where students were expected to memorize and reproduce instructional material. IBL and active and experiential learning emphasize developing critical thinking and analytical skills. Gaber [5] insists on the importance of design-build or learning by making in the early stages of architectural education. He calls for students to create full-scale constructions for their designs, considering historical, cultural, practical, budgetary, and material considerations of the selected context. By doing so, students can engage with the material and develop the practical skills needed for their profession.

Some educators dedicate themselves to 3D printing (3DP) to find better ways to integrate architectural knowledge. Using 3DP can improve student confidence in the oral presentation when demonstrating their 3D-printed model and communicating their learning, enhance their creative flexibility and critical thinking, and build confidence in physical making, improve their creative flexibility and critical thinking, as well as build on skills in the virtual making to build confidence in physical making [6, 7, 8]. 3DP has been tested to raise student engagement and motivation and can short design-test-revise cycle time [9]. It is recommended that similar education-focused 3DP exchanges be created to lower the barriers to integrating 3DP into teaching, avoid the duplication of effort in modeling, and reduce the cost of creating assistive technologies and lab ware [10].

In a recent review article [10], 44 academic papers were examined that used the research terms "3D printing" and "additive manufacturing" in combination with "teaching" and "education". The study found that 3D printing has various applications in higher education. However, using 3D-printed structure units as an assistive tool to help architecture students understand architectural construction was not among the identified applications. Our paper will, therefore, focus on exploring the use of 3D-printed structure units to assist architecture students in integrating construction and structure learning into their design studio.

3. Experimental Design

During the Fall semesters, the Arch 371 architecture design studio assigns two projects to third-year students. The second project focuses on designing a masonry building and is used as an experimental field to test a new teaching approach to enhance third-year students' design motivation, structural design ability, and team engagement.

The control group for the experiment comprised four teams comprising 13 students from 2021, while the experimental group consisted of four teams consisting of 12 students from 2022. It is important to note that the 2021 control group and 2022 experimental group were assigned different building occupancies, but these occupancies were not tested as part of the experiment. The experiment allowed for comparing the outcomes of a new teaching approach applied only to the 2022 experimental group.

3.1 Design Consideration

When designing a teaching approach, the following considerations should be taken into account:

Our approach is to offer students hands-on construction experience by providing them with scaled-down structural units for design and construction practice. This approach will help them learn about structures by actually building one and can complement traditional teaching methods like lectures and table critics. In the case of masonry, the primary building units will be bricks and concrete masonry units (CMUs).

The approach should be user-friendly and easy to operate, allowing individuals with varying building experiences to participate. It has the potential to encourage greater participation and contribution from students who may have yet to excel in structural learning or need more proficiency in digital rendering. This teaching approach will allow these students to engage in the design process with teams.

Students can use scaled-down structural units to design new wall bonds, cornices, and window beams based on the bond types they learned in their structure course. This building experience will help them refresh their understanding of structural concepts and gain a deeper

appreciation for integrating structure and the studio project. Afterward, they can apply their creative bond designs to create masonry building facades with the aid of digital rendering software, allowing them to gain a more comprehensive understanding of how the structure and studio design intersect.

The scaled-down structural units provide better spatial perception support than computer-aided 3D modeling [11]. Engaging with these physical models can train students to design building masses while considering the constraints of gravity and assembly processes during the structure design phase.

The scaled-down structural units should be low-cost, accessible, and reusable. They should be designed for mass manufacturing and manufactured with high accuracy to ensure consistency and reliability. The size of the units should be deliberately chosen to be easy to pinch with the thumb and finger but not so large as to form a bulky masonry wall model.

After considering the abovementioned factors, we have ruled out several fabrication-aided tools available in our college. Firstly, we have excluded the scaled-down bricks made of concrete and wood mold due to their fragility and lack of accuracy. In addition, laser-cut components were deemed unsuitable due to the thickness limitations of the cutter, and wood-shop machines were not considered due to the high level of operation technique required to obtain accurately sized units. Lastly, we did not adopt digital modeling during 3.2.2. Wall bond design and model build stage because structures modeled in such software do not collapse, and beginning students cannot visually detect errors by watching digitally piled bricks.

In summary, we used the Prusa i3 MK3S+ 3D printer [12] to create 1:8 scale structure units consisting of four types of brick and four types of CMU. The actual bricks and CMU that the units are modeled after were represented by nominal sizes [13], guaranteeing that all units are part of a modular system and removing the need to consider mortar thickness. Table 1 displays the quantities and sizes of the units we adopted for the experiment. Our research shows that a 10'x10' running bond requires 675 standard bricks [13]. We have produced 1200 standard bricks to accommodate four teams, each receiving 400 standard bricks. This quantity is adequate for one team to construct at least two 10'x4' wall models with a 24-brick-course height, which will display a clear repetition pattern of the façade design. We have also calculated the necessary quantity of other auxiliary bricks to ensure a sufficient supply for the experiment.

Table 1 Quantities and sizes of the units.

	Nominal size (W x L x H)	3DP size (W x L x H)	QTY. (Appx.)
Standard Brick	4"x8"x2 2/3"	1/2"x1"x1/3"	1200
3/4 L Brick	4"x6"x2 2/3"	1/2"x3/4"x1/3"	300
1/2 L & W Brick	2"x4"x2 2/3"	1/4"x1/2"x1/3"	300
Queen Closure	2"x8"x2 2/3"	1/4"x1"x1/3"	200
Standard CMU	8"x16"x8"	1"x2"x1"	300
1/2 H CMU	8"x16"x4"	1"x 2"x1/2"	300
1/2 L CMU	8"x8"x8"	1"x1"x1"	300
U block CMU	8"x16"x8"	1"x2"x1"	200

3.2 Design Implementation

In October 2022, four teams of third-year students began a studio project to design an office complex building using masonry as the experimental group. Similar to the 2021 control group, they completed site visits, site mapping and analysis, design programming, and bubble diagrams before proceeding to the structure design phase. Following this, a new teaching approach was introduced, consisting of five stages, which took approximately 10 days to complete. In contrast, the control group used these 10 days as free working time to develop their grid system and facade patterns.

3.2.1. Lecture Stage

In addition to the customary lecture on masonry building appreciation and history provided every year by studio instructors, a new lecture was given to refreshing the students' understanding of masonry construction. During the lecture stage in the studio, students were reminded of brick wall positions and patterns, such as a running bond, English bond, common (American bond), and Flemish bond. They also reviewed the construction of various brick masonry walls, including cavity walls, brick veneer/steel stud walls, and brick veneer/wood stud walls. The studio instructor also provided digital brick models to explain the particular function of the non-standard-shaped bricks, such as a Queen Closure, in an English bond. Students were encouraged to rotate the models and view them from different angles, zoom in and out to focus on specific details, and observe the wall courses and wythes layer by layer. Figure 3 and Figure 4 show two examples that were used during the lecture to help refresh students' knowledge of masonry structures and tectonics.

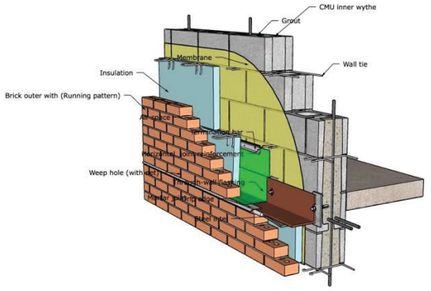


Figure 3. A SketchUp model provided by the instructor to help students observe the masonry construction wythe by wythe

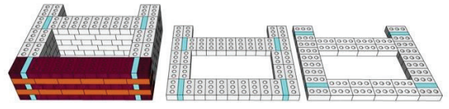
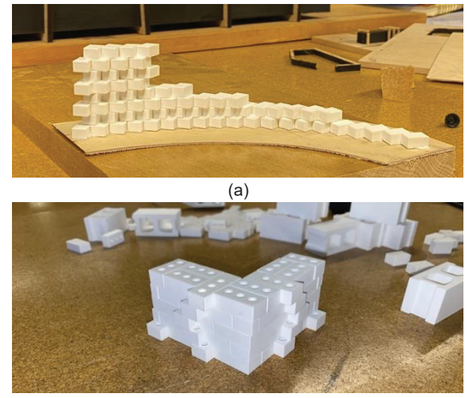


Figure 4. Three SketchUp models provided by the instructor to help students observe the English bond layer by layer

3.2.2. Wall Bond Design Stage

During the wall bond design stage, the 2022 student teams collaborated to create an innovative and distinctive bond for their studio project. Students were instructed not to replicate existing bonds but instead were encouraged to incorporate the strengths of different bonds into their design. To show a repetition pattern, the wall bond model should consist of different layouts in adjacent odd and even courses with at least 10 to 12 courses. The bond had to be constructed with standard-sized 3D-printed bricks or CMUs, along with non-standard-shaped 3D-printed bricks like the Queen Closure and 1/2 and 3/4 sized bricks. The placement of these non-standard bricks was critical, as the joints had to be staggered and not aligned with the joints of the course below. In addition, students had the option to design their unique bricks but were also required to include auxiliary bricks to evenly distribute the structure's weight and prevent the formation of vertical joints in the wall. Figure 5 shows the processes of the students designing and making their wall bonds.



(a)

(b)

Figure 5. Students designing wall bonds brick by brick.

3.2.3. Window Beam and Cornice Design Stage

After the teams completed the wall bond design and model build stage, they moved on to the window beam and cornice design stage. The studio instructor guided the students to consider the appropriate size of the window and encouraged them to question why windows on masonry structures are typically smaller than those on steel frame constructions and why facade design with curtain walls is not typically preferred for masonry structures. Once they started to build the brick courses of the cornice, the instructor guided them to appreciate the natural beauty of a masonry facade that is created by their careful arrangement of pop-out stretchers, soldiers, headers, and rowlocks. This required a focus on building the facade brick by

brick instead of simply selecting material from a digital library and dragging and dropping it onto the digital model (as shown in Figure 1 and Figure 2). Figure 6 shows the students' process of designing window beams and cornices using the 3D printed units.

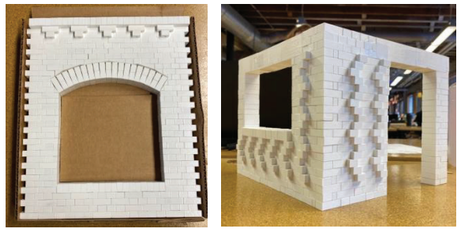


Figure 6. Students designing cornices and beams brick by brick.

3.2.4. Structural Application Stage

During the structural application stage, the teams digitally applied their completed wall model with the bond, beam, and cornice design into the floor plan design and facade design. The studio instructor guided the students in designing the grid system, considering the dimensions of each room in the office building to match the standard brick module numbers. After completing this phase, the students finalized their floor plans and elevations. Figure 7 to Figure 9 demonstrate how students applied their hands-on construction skills to the façade design and the project design.

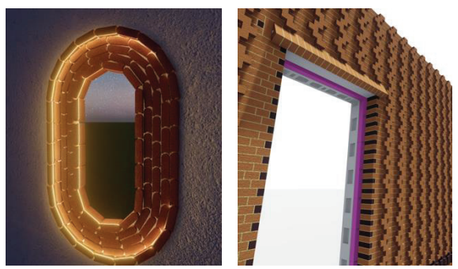


Figure 7. Façade designs

Figure 8. Interior design

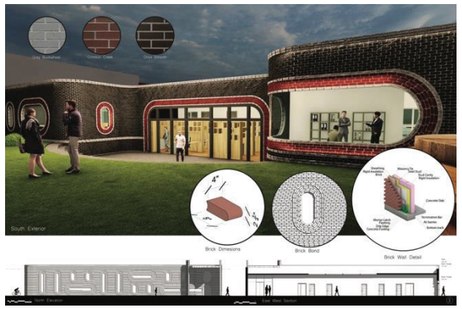


Figure 9. Exterior design

3.2.5. Units Recycle Stage

The wall models were assembled using thin double-sided tape, which facilitated easy disassembly for the students. Once the students presented their final boards to fulfill the requirements of the Arch 371 design studio, the 3D-printed units were collected by the studio instructor to be reused in the following year's teaching. This recycling effort promotes sustainability and minimizes environmental impact (see Figure 10).

Figure 9. Units recycling process.

3.3. Result

A survey was conducted among the control group and experimental group after the completion of the masonry project. The survey was designed as a self-evaluation, where students were asked to rank their studio performance and design abilities using a self-evaluation form consisting of 15 tasks. These tasks aimed to collect the students' attitudes toward their team engagement, time management, studio attendance, space design, structure design, facade design, site design, disability design, and board design. The instructor explained every task to both groups. For each task, students were required to score their performance from 1 to 10, with 1 representing limited performance, 5 representing fair performance, and 10 representing good performance.

The key collection objects for the teaching approach discussed in this paper were team engagement, structure design, and facade design. All 25 students successfully scored their performance, and the average scores for the key objects are presented in Figure 10, 11, and 12. Students were not aware of the experimental purpose, ensuring that their self-ranking was not affected.

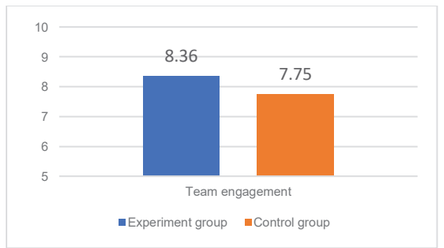


Figure 10. Average scores of Team Engagement

Figure 10 illustrates the average scores of the team engagement of two groups. Experiment group achieved a score of 8.36 and control group achieved 7.75. The difference is not significant (p= 0.0919).

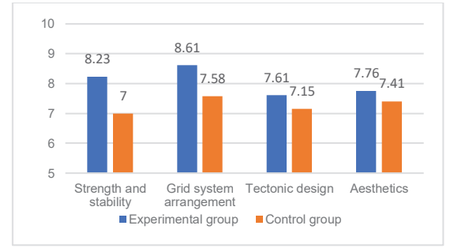


Figure 11. Average scores of Structure Design

The evaluation for the structure design is based on the strength and stability, grid system arrangement, tectonic design and aesthetics (see Figure 11). Compared to the control group, the experimental group has the significant higher rates than control group in terms of strength and stability (p=0.003), and grid system arrangement (p=0.009).

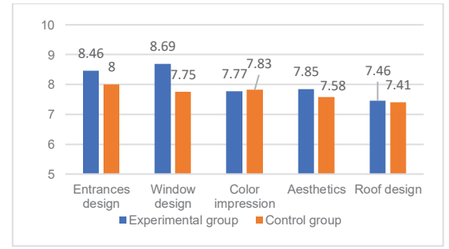


Figure 12. Average scores of Façade Design

For the façade design, we evaluated entrance design, window design, color impression, aesthetics, and roof design (see Figure 12). Compared to the control group, the experimental group has the significant higher rates than control group in terms of windows design (p=0.001).

4. Discussion

4.1. Experimental Analysis

Based on the experimental results, we can affirm that the new teaching approach validated our hypothesis that it can significantly enhance students' design motivation, structural design ability, and team engagement, improving their overall learning efficiency.

According to our subsequent analysis, the experimental group outperformed the control group in the studio engagement category due to the learning-by-building method. During the experiment, we observed that this approach allowed students who struggled in structural courses or needed to improve in computer modeling to contribute to the team by working on the wall construction with 3D-printed structural units. This building experience enabled them to showcase their design abilities to their peers, resulting in improved self and team engagement.

The enhanced performance of the experimental group in the structure design category can be attributed to their greater understanding of the construction process for masonry structures. Unlike the control group, who engaged in the free exploration, the experimental group received guided instruction that facilitated a more directional grasp of the structural design process. As a result, their structure designs were more intentional and purposeful.

Similarly, the experimental group's superior performance in the facade design category can be attributed to the opportunity they had to apply their own designed and named bonds and exterior wall decoration details to their studio project. This approach fostered a more personalized and creative design process that allowed for greater autonomy, resulting in higher levels of satisfaction with their facade designs. Moreover, this hands-on experience provided the students with a deeper appreciation and understanding of the aesthetic and structural aspects of masonry.

The experiment's findings suggest new and innovative approaches for integrating 3DP technology into architecture education. In the past, 3DP was primarily used to create site models and final building designs in the later stages of design. Prior to physical model printing, all designs were created in digital modeling software like Rhino and SketchUp. 3D printers were primarily used to present finalized designs based on given specifications. This study shows a potential use case for 3DP technology that involves printing structural units as unfinished components that can then be assembled to create a design product. This approach allows maximum utilization of 3D printers in an architecture program at a university.

By incorporating 3DP technology earlier in the design process, students can explore and experiment with different design iterations and better understand their designs' physical properties. This approach can also encourage students to think more creatively about using 3DP technology to achieve their design goals.

4.2. Limitation

Developing undergraduate students' structural design abilities in an architecture studio is a long-term process that requires studying and practicing every project every semester from the second to the fourth year. The final design works submitted by the experimental group showed that their projects needed more attention to the structure of the roof, proper positioning of the load-bearing wall, and accurately presenting the delicately designed wall patterns through digital software. These findings indicate that more than a single semester of introducing the proposed teaching approach was needed to improve the overall architecture design abilities of the students. Given the size of this study and attendance, our paper only tested and discussed an entry point to enhance the performance of students' design ability in certain aspects and cannot address every part of studio learning. In the future, we will discuss and address the potential benefits of combining our teaching approach with 3DP wood structure units, steel units, or other methods to further improve students' design abilities.

The experiment has also revealed a limitation associated with the use of 3DP technology. The process of 3DP is time-consuming. For example, a Prusa i3 MK3S+ 3D printer can only print 20 units in three hours. Moreover, the process of removing the printed units from the printer bed, cleaning the bed, and restarting the printer was also found to be laborious.

The introduction of an advanced belt printer, such as the Creality CR-30 Belt 3D Printer [14], has been suggested to address this issue. This type of 3D printer is equipped with an auto-moving belt that facilitates the transfer of well-printed units to a collector and repeats the printing process until the desired quantity is achieved. It is believed that this new belt printer has the potential to significantly reduce the time and labor associated with the 3DP process. In future research, the effectiveness of this type of printer could be examined.

5. Conclusion

This paper examines architecture studios' current learning and practice challenges and proposes a teaching approach integrating hands-on construction knowledge into studio education, aiming to boost students' structure learning motivation, design ability, and team engagement. The approach was tested in an experimental group and compared to a control group, and the results demonstrate its effectiveness.

Overall, this teaching approach provides an innovative way to utilize 3D printing in architecture education while addressing the challenges in studio education. It emphasizes the importance of hands-on experience, collaboration, and integrating theoretical knowledge with practical skills. It also highlights the need for educators to continually develop and implement new teaching methods to enhance student's learning outcomes and prepare them for the ever-changing demands of the architecture profession.

Reference

[1] Latif Rauf, Hozan, and Sardar S. Shareef. 2019. “Understanding the Relationship between Construction Courses and Design in Architectural Education.” International Journal of Recent Technology and Engineering 8 (3): 3201–7.
[2] UNESCO/UIA. "UNESCO/UIA Charter for Architectural Education," 2004.
[3] Rael, Ronald. "The Myopia of Architecture Education." Metropolis Magazine, 2010.
[4] Salama, Ashraf M. “Seeking Responsive Forms of Pedagogy in Architectural Education.” Field 5, no. 1 (November 2013): 9–30.
[5] Gaber, Tammy. “The Agency of Making and Architecture Education: Design-Build Curriculum in a New School of Architecture.” International Journal of Architectural Research: ArchNet-IJAR 8, no. 3 (November 30, 2014): 21. https://doi.org/10.26687/archnet-ijar.v8i3.507.
[6] Schelly, Chelsea, Gerald Anzalone, Bas Wijnen, and Joshua M. Pearce. “Open-Source 3-D Printing Technologies for Education: Bringing Additive Manufacturing to the Classroom.” Journal of Visual Languages & Computing 28 (June 2015): 226–37. https://doi.org/10.1016/j.jvlc.2015.01.004.
[7] Akundi, Aditya, Eric Smith, and Tzu-Liang Tseng. “Integration of Additive Manufacturing Technology in Curricula to Enhance Concept-Based Learning.” In 2017 ASEE Annual Conference & Exposition Proceedings, 28564. Columbus, Ohio: ASEE Conferences, 2017. https://doi.org/10.18260/1-2--28564.
[8] Loy, Jennifer. “ELearning and EMaking: 3D Printing Blurring the Digital and the Physical.” Education Sciences 4, no. 1 (February 24, 2014): 108–21. https://doi.org/10.3390/educsci4010108.
[9] “Invited Review Article_ Where and How 3D Printing Is Used in Teaching and Education | Elsevier Enhanced Reader.” Accessed February 3, 2023. https://doi.org/10.1016/j.addma.2018.10.028.
[10] Pasin, Burkay. “Rethinking the Design Studio-Centered Architectural Education. A Case Study at Schools of Architecture in Turkey.” The Design Journal 20, no. sup1 (July 28, 2017): S1270–84. https://doi.org/10.1080/14606925.2017.1352656.
[11] Boumaraf, Hemza, and Mehmet İnceoğlu. 2020. “Integrating 3D Printing Technologies into Architectural Education as Design Tools.” Emerging Science Journal 4 (2): 73–81. https://doi.org/10.28991/esj-2020-01211.
[12] https://www.prusa3d.com/category/original-prusa-i3-mk3s/
[13] Wing, Charles. The Visual Handbook of Building and Remodeling: A Comprehensive Guide to Choosing the Right Materials and Systems for Every Part of Your Home. 4th edition. Newtown, CT: Taunton Press, Inc, 2017.
[14] https://www.creality3dofficial.com/products/cr-30-infinite-z-belt-3d-printer

Teaching Architecture Where there is None: Methods for Expanding Experiment, Precedent and Equity in Architectural Education

Peter Sprowls, University of Florida School of Architecture
Nic Rabinowitz, Florida International University School of Architecture

The Inescapable Context

As Florida natives, Nic Rabinowitz and I have spent the past few years teaching at the University of Florida School of Architecture and have spent much of that time wiping sweat off of our respective brows and squinting against the sun. The humidity renders the air almost volumetric, described by light and color at the start and end of every day and this begs many architectural questions as we drive upwards of 300 miles a week to reach different studio spaces between Gainesville and Orlando. The scale and environment of this place is thick with unexplored questions and observations that can probe typical architectural pedagogy.

Framework of Thinking

Our fascination with this natural landscape and the relative lack of any significant architectural work, at least beyond the residential scale, leaves us thinking about how to define the landscape in architectural terms - how to measure the vast distances that we drive in ways that are meaningful at the architectural scale. How might we perceive space at 80 miles an hour from a vehicle on the highway? (A touch faster than on Brown and Venturi's Las Vegas strip) How might we draw a cloud as a site? Is there a way to describe the boundaries of sunset?

The projects described here attempt to answer some of these questions or at least propose methods for how to move towards answers, but each project is also intentionally tethered to conventional methods of architectural representation. While it is pleasant to daydream about a passing cloud, there is an obligation to translate that amorphous observation into clear, precise, architectural description for it to become useful for architects. It is through a common language of architectural convention that architectural education can continue to expand its library of precedent, its catalog of elements and its applications to different areas of human activity.

With this in mind, we find ourselves returning to plan and section, the beaux arts analytique, and physical modeling to test new ideas while using common languages of representation to compare these tests to typical examples of architectural precedent.

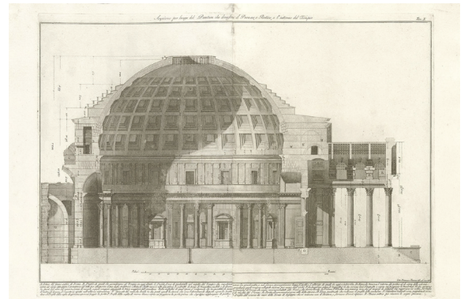


Fig. 1 \ Piranesi's longitudinal section, a stunning example of typical architectural analysis and precedent.

Silver (Basswood) Linings

At school and in a typical studio, this is where one can find the best chance of looking past the Florida landscape. In the chill of conditioned air and through the screens of the internet it is possible to suspend reality and participate in the routines of architectural education much as you might find it anywhere else in the western world. Here, in the studio, students can examine the hallmarks of western architectural thought, work side by side on models and drawings and work relatively uninterrupted, or at least indefinitely, with each other.

With the onset of distance learning and remote work in 2020, as we all experienced, these basic assumptions for how students work and what resources they have were changed. Projects were restructured to ensure that all students had access to some sort of common experience, common subject matter and common resources. Largely, this meant stripping down the tools with which we would work and identifying what we all had around us. We were

all at home, we were all hesitant to venture out in the world and we were all looking out of the window.

This reduced access to resources, by the end of the project, became one of the most productive constraints. In the search for consistency in teaching, we found common ground in the landscape around us and a potential spring of new architectural subjects - subjects that were often more provocative and complex than the built, suburban environment in which we were living.

Three Projects

The projects presented here are all from the first three semesters of the undergraduate architecture program at the UF School of Architecture. Each of these projects proposes a method for addressing precedent and offers examples of alternative subjects for these precedents, namely: the view out of a window, a swamp and a cloud.

At the root of each of these projects is their adherence to standard forms of architectural description and representation; plan, section, elevation and model are used as precisely as possible with special care given to the technical precision of each representational type. Through this common language of projection drawing and model making, it's possible to relate, or at least compare, disparate aspects of the context around us that may not have historical architectural applications.

Finally, the projects are not presented in curricular order; instead they are presented in order of conception, each building on the ideas and results of the previous project.

Project 1: The Escape Plan

The Escape plan is, fundamentally, a catalog of architectural elements and edges; the wall, window, column, ground, roof, frame, etc. Alone, this is a typical exercise, but The Escape Plan was conducted first during the spring of fall of 2020 at the height of remote learning and covid restrictions. This change of venue dramatically changed the resources of the students and so it was necessary to identify common resources, opportunities and spaces among all of the students.

Every student had access to some sort of interior space with a window, to small space for drawing and to the passage of time. This new parameter catalyzed a shift in how we might build a catalog of elements and how we might document and describe them. Building on this set of resources and leaning on typical architectural techniques, students were asked to draw a plan of the room that they work in and to include, as an extension of this plan, the space that they could view from their window.

Method: Analysis through Drawing

Plan - 5 hours
Draft a plan at ½"=1' through the room where the drawing is being made, extending plan information to include the space visible outside of the window. The boundaries of the plan drawing are determined by the size of the paper. Iterate to achieve precision, specificity and legibility.

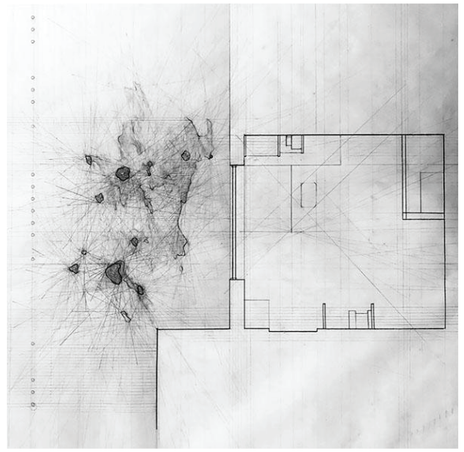


Fig. 2 \ A plan of the interior and exterior space drawing all edges with equal craft and attention

Shadow Elevation - 3 hours
At the same scale as the plan but on a new sheet of paper, draft an elevation of the view from the window including the window itself. This elevation should describe the edges of shadows visible in the elevation, both inside and outside of the window. This elevation changes over time due to the nature of shadows but care should be given to represent the edges of shadows as precisely as possible. Iterate to edit out unnecessary information, focus on shadows and differentiation of line type.

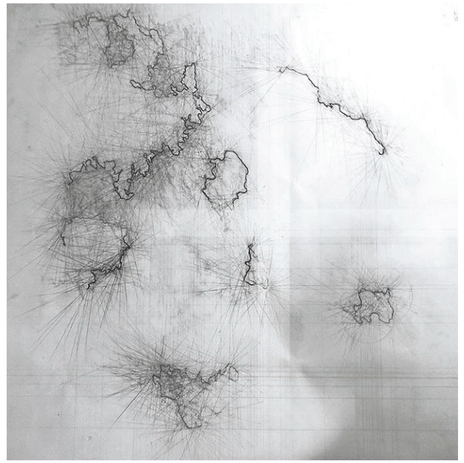


Fig. 3 \ A shadow plan with the muntins of the window lightly visible in white

Tracking Movement - 48 hours
This step occurs over a few days because it requires movement over time. Identify a moving element in the same elevation view; this could be rain on the glass, a bug crawling across the window ledge, the movement of leaves outside, etc. On a new sheet of paper, track this movement by drafting the path of movement focusing on the quality of that movement; brisk, sharp, slow, wandering, streaking, etc. Iterate to clarify techniques for representing different forms of movement.

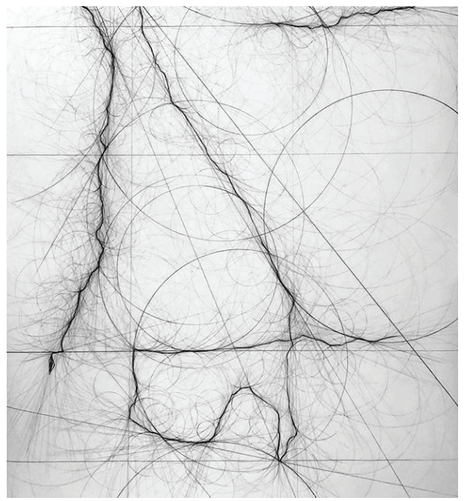


Fig. 4 \ Movement of rain drops tracked along the glass window pane

Window Sill Plan - 3 hours
On a new sheet of paper draft a plan of the window sill at 6"=1'. Include any artifacts that are on the window sill - cups, trinkets, dirt, etc. - and the window frame itself. This plan is drawn with the same techniques and precision as the original plan but enlarged to describe a detail within space. Iterate to describe relative scale, clarity and legibility.

Method: Proposal through Fragments

The Analytique - 4 hours
Using 1:1 scans of the four original drawings, digitally (or physically) compose a single drawing that uses at least one fragment from each of the drawing types. This new drawing, made of fragments, should attempt to describe all of the elements and edges in the space by presenting them side by side. The composition should be driven by technical continuity; elevation aligns with and begets plan, plan enlarges to detail, etc. The final drawing should be legible both as a collage of fragments and as a new, independent proposal of space.

Fig. 5 \ Analytique built from four projection drawings

Construction - 6 hours
Reading the analytique as an independent proposal of space, build a physical model that describes the nature of space visible within the drawing. This model should be no more than 2" tall but can extend horizontally to the full extent of the drawing. The model should consider basic

ideas of spatial continuity - informal circulation - and, necessarily, structure as an imposed addition to and clarification of the potential spaces visible within the drawing.

Hanging in the Window - Time Varies
Hang the model in the window that has been used to frame the original analysis. The window acts as a physical “site” for the model and orients the model in space vertically. The views of and through the model are a “final product” of sorts which presents both the original site and the catalog of architectural elements identified by the student in one composition. Iterate the model in dialogue with its site.

Fig. 6 \ The model in the site of the window with the view through the window beyond.

Occupying the Window - 5 hours
To hypothesize on how it could be possible to occupy this new spatial proposal and address the relationship between site and intervention, cut a cross section through the model and the window; the window now transformed in scale from element in a building to landscape.

The Role of Fragment and the Analytique

The Escape Plan is built directly from the elements of the Beaux Arts analytique drawing. The analytique describes fragments of a whole design as interrelated and dependent on each other to create a complete understanding of the building. Each fragment is drawn to a consistent scale and in a consistent style, allowing them to be combined to form a cohesive whole. Using this approach we can ground, catalog and recompose “elements” in any landscape as long as they are described using a common language and with precision.

Since non-standard architectural elements, such as the tree, are drawn with the same degree of precision as elements like walls and windows, there is a shift in emphasis to the continuity of space from inside to outside and a de-emphasis of the totalizing importance of the building envelope; the idea being that space can be described and dimensioned with elements found in any landscape and readily at hand.

Fragmentation, a prominent aspect of the second project as well, allows students to look past the image of “non-architectural” things in their surroundings and crop these elements by identifying architectural qualities. The reassembling of these fragments into a meaningful whole, the essence of the analytique, transforms the analysis of the non-architectural into an act of design and a proposal of dimensional space.

Project 2: Swamp Chapel

The Swamp Chapel, while taught in the early days of returning to studio in the summer of 2021, builds on this focus on the immediate environment from the previous project to look at the terrestrial ground, with an emphasis on site, promenade and edges. This project was completed by students in a second semester studio over the course of 4 weeks.

This project introduces students to precedent analysis and several drawing techniques, such as plan, elevation and collage. The study of precedent can help students to understand the context of specific buildings and designs. By examining the historical, social, and cultural context of a particular design, students can gain a deeper understanding of the forces that shaped it. This can help students to develop a more nuanced and sensitive approach to design, one that takes into account the broader context in which a building or design is situated. For the Swamp Chapel, rather than beginning with typical architectural precedents, this project looks to the

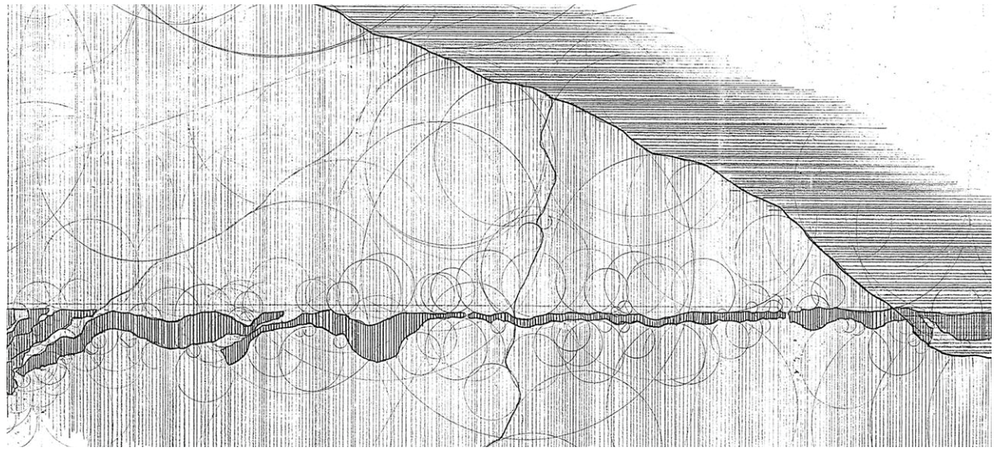


Fig. 7 \ A drafted set of edges found in the swamp landscape. These edges are drawn in the orientation that best describes their role as a boundary of space.

landscape as a commonly experienced and immediately accessible precedent for architectural space.

In order to focus student attention within this large precedent landscape, students develop a narrative of experience based on a 5 minute walking itinerary. Along this route, students develop a narrative that identifies the various, perceived thresholds and/or edges of the different spaces that comprise the walk. These spaces receive names that suggest some sort or means of occupation, i.e. hall, porch, breeze way, lounge, etc. In this way, students identify a spatial precedent through analysis - what we would call “Active Analysis”.
The project uses drawing paper at 11x17” and 18x24”, graphite, a drafting board, basswood, bristol paper and vellum. Additionally, students will benefit from access to a camera or scanner and photoshop. The project requires space to walk in a natural or relatively unbuilt environment and space to draw.

Method: The Narrative Precedent

Drafted Rubbings - 4 hours
Using charcoal and one sheet of 11x17” drawing paper at each site, create a rubbing of three different textures at three distinct areas of the walk. These rubbings should capture distinct textures and one of these textures should be non-natural, i.e. sidewalk, brick, organized plantings, etc.

Translate each rubbing to a new sheet of 11x17” drawing paper by drafting a precise re-presentation of each rubbing. This should focus on constructing complex geometry with accuracy and developing specific line types/languages for describing rubbed textures. Iterate to develop precision of different line types and textures.
(Fig. 7)

Building the Swamp - 4 hours
Students develop a narrative of how to occupy the landscape in question. This narrative is formed from their own experience intersected with a “fascination” of the site. This fascination can be a natural occurrence (qualities of light, movement of the sun, sound, wind, etc.) a historical overlay, social observation - it is important that this is at the student’s discretion. The narrative should lead to names for three spaces, each related to the location of a rubbing.

Using the drafted rubbings as a diagram of structure, scale and texture, students build models that propose spaces for each idea of occupation suggested in the name of each space. Iterate to develop techniques for translating drawn edges into structurally stable spaces that describe mass, volume and scale.

Photographic Analysis - 2 hours
Photograph each model with the aim of showing spaces that carry qualities from the landscape into “architecturalized” space. This is to say, compare these modeled spaces with the original landscape via photographs. These should compare like with like; texture

with texture, light with light, scale with scale. These photos should show spaces that are activated by student narratives and built with a toolkit born of the landscape.

Reexamine and possibly rename the spaces constructed to clearly identify the dominant architectural elements and/or forms of occupation. These names should consist of known architectural vocabulary so that these spaces share a common language with other architectural precedents.

Method: Dissecting Architectural Precedent

Finding Architectural Counterparts - 2 hours
In a reversal of operations from the The Escape Plan, students are tasked with finding “counterparts” or similar elements from a given architectural precedent for each of the named spaces that were constructed in the Narrative Precedent. For this project, Chiesa San Giovanni Battista, more commonly called the Chiesa dell’Autostrada (Church of the Highway) was selected. Without going into the fascinating history of this project, it was selected for its unusual formal catalog of architectural elements and clear structural diagram. Distributed drawings of Chiesa dell’Autostrada give a common method for reviewing the building.

Students identify fragments of the church that they believe share similar spatial, light, textural, scalar qualities with their narrative precedent spaces.

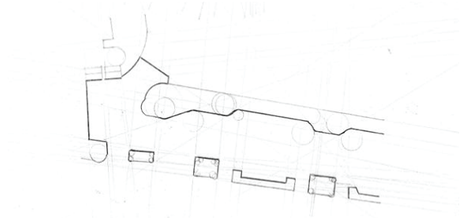


Fig. 8 \ A portion of the Chiesa San Giovanni Battista described as similar to elements of the swamp

Drawing Common Languages - 6 hours
Using a relative scale, students redraw these fragments of the church alongside fragments of their own spaces (the models from “Building the Swamp”) in plan and on the same sheet of paper, one 18x24” sheet for each pairing. These plan drawings should aim to compare like with like across the two precedents. Iterate to refine the clarity of both the fragment of the church and the fragment of their precedent landscape.

The Swamp Chapel - 8 hours
Through axonometric drawing, students use the identified elements in the previous drawings to reconstruct the original walk through the local landscape. This new drawing should relate back to the original edges identified in the rubbings, but is no longer limited to the vocabulary of the local site alone. This new drawing develops a set of spaces that volumetrically describe the originally non-architectural space of the walk; a translation of tectonic language with a continuity of comparison and narrative.

Iterate these drawings by scanning and digitally reorganizing the components, now all described in the common language of axonometric convention, to add complexity, specificity and differentiation to increasingly describe the original walk in volumetric terms.

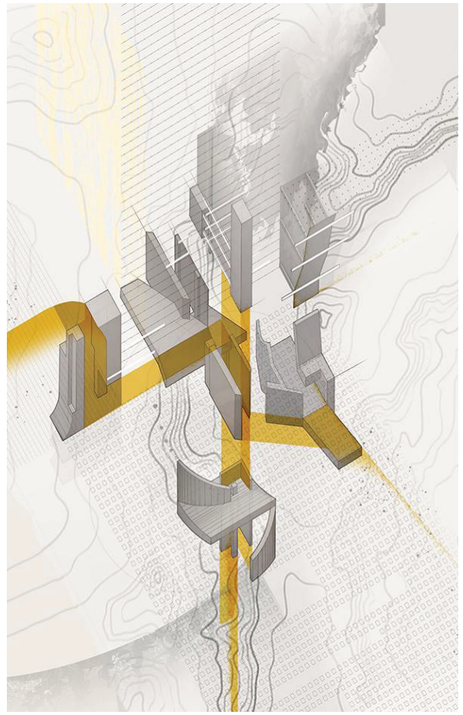


Fig. 9 \ A composed “Chapel” with influences from both the landscape and the precedent church.

The Terrestrial Ground

The reversal of precedent introductions, beginning with a “non-architectural” landscape and moving towards a typical architectural precedent, develops a catalog of spatial qualities and architectural elements that have been identified by the student and are immediately tangible - the landscape is just outside and occupied by the student. With this intimate familiarity, students can then look to distant architectural precedent equipped to examine qualitative aspects that may otherwise be overlooked or difficult to glean from available photos and drawings alone such as quality of light, sound within the space or material texture..

This new “chapel” is a collage construction driven by student experience of the immediate surroundings and structural/architectural forms from the church precedent. The typical architectural precedent continues to function as a source of architectural logic, design inspiration and conceptual framework applied in a student-centered manner rather than being examined as an architectural ideal.

Project 3: Humid House

Humid House continues to build on the idea of natural precedent, drawing with precision and exploiting fragments to look upwards, towards the sky. This upward view towards a skyscape introduces dynamic forms, blurry edges and vast dimensions that often exceed typical architectural representation; miles instead of inches and cubic feet instead of square feet. This project was completed by students in a third semester studio in the Fall of 2022 over the course of 6 weeks.

Humidity exists in gradients, lacking sharp edges or boundaries and so clouds become fascinating, visual graphs of different boundaries constructing the skyscape. By looking upwards and attempting to draw clouds with the same drawing and model-making conventions of static work, students can examine issues of multiplicity, complex form, geometric translations and quantitative issues of light.

The primary goal of the project is for students to develop their own dimensional metrics for defining a body in dynamic motion - in this case a cloud - and, in doing so, draw time.

In this project, students are also encouraged to not reinvent the wheel. Even in this peculiar orientation, students can find and/or be given precedent work that suggests methods of working. By looking to meteorology, aeronautical charts, flight maps, oceanographic maps, wind maps, etc. it is possible to find several technical methods for begging to dissect and describe clouds, wind, light, density, light and movement.

The project uses drawing paper at roughly 18x24”, graphite, drafting boards, basswood, bristol paper, vellum, tulle fabric, sewing kits and a camera that can record video. It requires access to space where students can view and record the movement of clouds and space to draw and make small models.

Method: Drawing Clouds

Recording Clouds - 2 Hours
Record clouds making a series of 20 second videos. Videos do not need to be edited, but should show subtle movement of the clouds over time.

While looking at clouds directly, draw contour line drawings of 3 distinct clouds. These line drawings should attempt to describe the surface of the clouds and not the outline or silhouette of the clouds.

While looking at the video recording of clouds, draw three more contour line drawings of distinct clouds. This framed view of the video recording and the ability to play back the video should allow for multiple passes over the same drawing, further developing surface definition

Cutting Clouds - 3 Hours
Using the previous contour drawings as a dimensioned reference and the videos of clouds, cut a section through three distinct cloud types focusing on the differences in form, edges and thickness.

Complex geometry should be constructed through discretized approaches and not drawn “free hand”. Iterate to clarify techniques for differentiating between different edge and surface qualities found in the different cloud types.

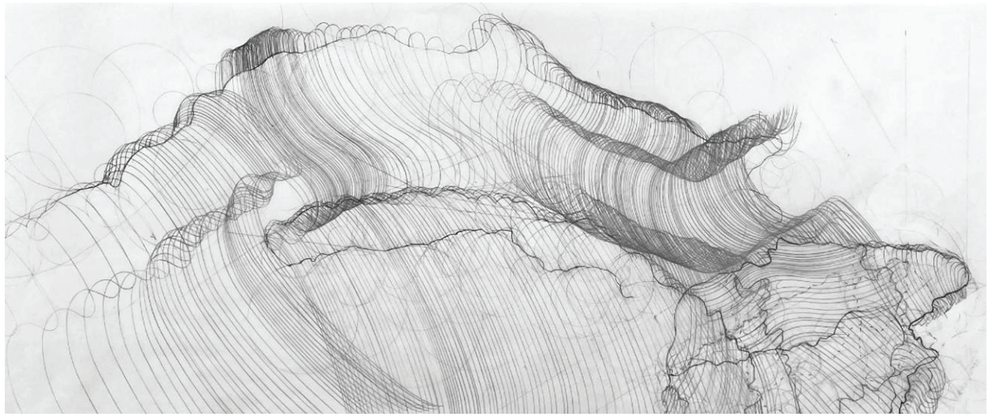


Fig. 10 \ Serial sections describing areas of density and areas of sparsity in a cloud

Slicing the Sky - 6 Hours
Building on the section drawings, cut serial sections through one of the cloud types. These sections should be taken at regular intervals of the students choosing. The interval forms the basis of measurement and can be either a graphically standard dimension or based on more qualitative information such as level of light at different parts of the cloud, quality of edges, perceived density, etc. (Fig. 10)

Defining Volume - 6 Hours
Using these serial sections, scan and digitally compile these images to approximate an axonometric view of the cloud, composing the arrayed sections. This process involves skewing the sections to be legible in axonometric projection.

One a new sheet of paper, draw an axonometric projection of each cloud type, using the digital compilation of sections as a basic model for assembly. Each axonometric drawing should be composed of sections, cut in multiple directions and mapped in the X,Y and Z directions along the basic unit of measurement selected by the student. Iterate this to clarify how the interval relates to the legibility of volume within the projection drawing.

This process results in a specific and precise cloud, constructed on a unit of measurement that bears qualitative information about the nature of the form. Students are able to use this method to then describe or design which side of the cloud is “up” and which is “down”, and layer in other graphic methods such as shading and annotation to describe non-volumetric qualities of the cloud.

These drawings should be able to be read as a thickened space organized by areas of density and areas of sparsity. This idea of “Tonal Space” broadens students’ understanding of edge types and possibilities. Time also exists within these drawings as a function of the original subject matter and through the idea of “interval” instead of “module”.

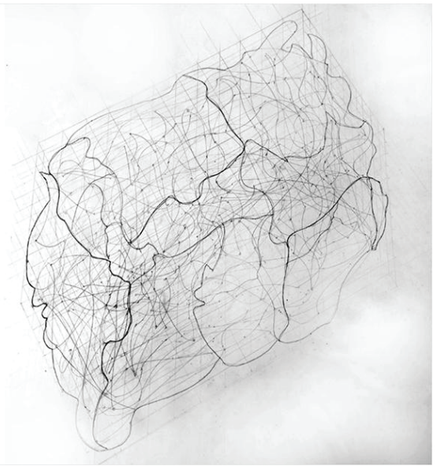


Fig. 11 \ Axonometric organization of serial sections with attention paid to the interval

Method: Building Clouds

Cropping and Layering - 6 Hours
Identify three areas of density within the axonometric drawings. These crops should include the space spanning from “outside” of the cloud to an area of density within the body of the cloud.

Build a model of each of these crops using tulle, thread, and plastic stitching canvases. These materials allow for the overlap, layering and “bunching” that can represent two dimensional areas of density in three dimensions. These models are largely “flat” in that they do not have defined “interior” space yet but instead attempt to develop a technique for rendering surfaces. Iterate to develop three models that describe distinct tonal qualities for each area of density.

Fig. 12 \ A tulle cloud model with shadow

Expanding Spaces and Gradients - 6 Hours
Using at least two of the surface models, situate the models with respect to each other as if they were two clouds in the sky, paying attention to form an identifiable space between them.

Draw a section of the space between these two surfaces at twice the size of the original models. This space between surfaces, between areas of density, is the new space of occupation - one or multiple cloud “rooms”. Iterate to clarify an orientation of space, light quality and potential forms of occupation. Is this space large? Small? Could it accommodate a large dinner or is it a small space for sleeping. The qualities of the space drive the program.

Fig. 13 \ A series of rooms between cloud surfaces and densities with initial ideas of potential structure

Humid House - 20 Hours
By scanning and digitally reorganizing the sections from the previous exercise, they become a guide for designing a house of three primary spaces - one for sleeping, one for eating and one for an occupation. The proximity of these spaces are driven by the spatial forms found in the original cloud observations and videos. Speculate on the scale of each space by including scale figures in these new section drawings.

Build a model of this new “house” using any and all available modeling techniques - both those that are conducive for the construction of well defined structure and those capable of developing nuanced areas of density and sparsity. These areas of density and sparsity drive light conditions, scale of the respective spaces within the house and levels of enclosure. Iterate to refine complicated model making techniques that convey these issues of light, scale,

form and enclosure while remembering that these humid houses are not clouds themselves but architectural approximations and require structure and dimension.

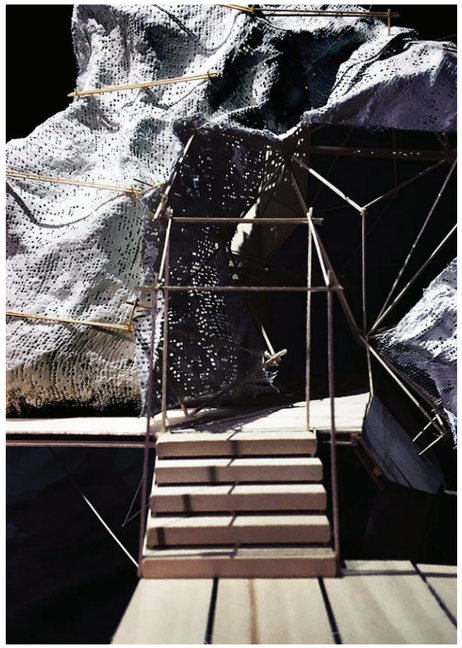


Fig. 14 \ The “Humid House” as an occupiable space with indications of the human scale

Dimension and Form

This final question of structure and dimension works back to initial questions confronted by the students about how to define vast and distant figures like clouds. This project is bookended by the question of dimension; beginning with the invention or selection of an interval for which to begin measuring clouds and then by situating this cloud based house with respect to the human scale.

At this scale, the scale of the territory, there are opportunities to use architectural techniques to define/affect/interact with space at the scale of urbanism. Mario Gandelsonas termed the contemporary scale of the city as “X Urbanism”, a new super-scale of suburban city that is characterized by nodes of density separated from each other by vast distances traversed at high speed, most often by vehicle. In this X Urban space, we find the natural landscape between fragments of the city; we find forests between our house and the grocery store. This is the scale at which we also find the cloud and to be able to use this skyscape as a way of understanding dimension at the architectural scale points to one of the ways in which architecture can continue to impact and relate to our contemporary cities.

Implications for Equity and Inclusion

The basic material requirements, general work times and timelines have been included for each of the steps in these projects to highlight the relatively “Lo-fi” nature of the work. These projects can all be completed without access to rendering engines, 3d printers, laser cutters, networked software licenses, plotters, CNC machines, wood shops, or even a studio space.

While each one of these tools is excellent, valuable and useful, the ambition of this method of teaching is to reconsider what is critical to the process of design instruction and to remove potential barriers to participation in an architectural education. Pedagogical practices must be reimagined in order to promote greater equity in architectural education. They suggest that this can be achieved through a range of strategies, such as incorporating more diverse perspectives into the curriculum, creating more opportunities for collaborative learning and community engagement.

Aside from a reduction in program cost - something that these projects alone are not going to achieve - these projects aim to offer methods for greater shared experiences in architectural education. In learning from a swamp or a cloud, we are not asking students to exclusively study precedent projects that can be found, usually, in distant places or deep inside the western cultural cannon.

We can foreground shared precedent experience to open up classroom discussion to a diversity of opinions, life experiences and cultural wisdoms. With this common language established, we do not jettison typical architectural precedent, but instead we understand them as just one example of many and not singular in their methods of success.

Narrative and Personal Precedent

Each of the projects described here require a level of narrative participation and invention on behalf of the student. The direction and emphasis of this narrative can be focused by the design faculty, but it is inherently personal to the student and born from their own experiences. This narrative formulation is significantly different from possibly more common modes of narrative that plug into existing architectural types, programs, histories, theories. This shift is due to the fact that the precedent in question in these projects sits outside of architectural space and, as such, must be brought into architectural focus through the invention of the student and through their own lens of experience.

Next iterations of these could use human interactions as the catalyst for precedent development; social interactions and conventions being another form of dynamic movement with blurry edges, rich with narrative possibility. Instead of meteorology, anthropological techniques of documentation, annotation and description could offer a jumping off point for development of plan and section.

With this open-ended method of questioning, it is possible to pivot conventional architectural techniques to build a larger catalog of architectural precedent and a more inclusive definition of architectural space.

Endnotes

Figure 1 - Piranesi, Giovanni Battista. "Longitudinal Section of the Pantheon," drawing. 1756. Central St. Martin College of Art and Design, London. pg. 1

Bibliography (Arial Narrow Bold, 11 pt.)

Colomina, Beatriz, Ignacio G. Galán, Evangelos Kotsioris, and Anna-Maria Meister. Radical Pedagogies. Edited by Beatriz Colomina, Ignacio G. Galán, Evangelos Kotsioris, and Anna-Maria Meister. Cambridge, Massachusetts: The MIT Press, 2022.

Landers, Lisa, and Abolfazl Falahati. "From the Pantheon to the Parthenon: A Study of Ancient Architecture as a Model for Contemporary Design." Journal of Green Building 9, no. 3 2014

Michaela Wozniak, “How to Improve Architectural Education: Learning (and Unlearning) from the Beaux Arts Method,” ArchDaily, April 19, 2016, https://www.archdaily.com/785820/how-to-improve-architectural-education-learning-and-unlearning-from-the-beaux-arts-method (accessed February 7, 2023).

Venturi, Robert., Steven Izenour, Denise Scott Brown, and Denise Scott Brown. Learning from Las Vegas. Cambridge, Mass: MIT Press, 1972.

Rocchi, Giuseppe. Le Corbusier, Terragni, Michelucci : nelle tre opere più note : Cappella di Ronchamp, Casa del fascio, Chiesa dell’Autostrada. Firenze: Alinea, 2000.

US Department of Commerce, NOAA. “Discussion on Humidity.” National Weather Service. NOAA's National Weather Service, June 13, 2015. https://www.weather.gov/lmk/humidity.

How does your building meet the ground?

Simon M. Bussiere
University of Hawai‘i at Mānoa

Sean Burns
Ball State University

Abstract

To move forward into uncertainty and anticipate new territories, students must first build confidence and a willingness to cast aside preconceptions of the environment as they establish an approach to each design challenge. Regardless of the project program, location, or typology, one of the earliest problems they face is in perhaps one of the simplest questions—How does your building meet the ground? It’s not as clear as it first appears. More questions follow: How then might (we) beginning designers first perceive the ground? This question may reward more deliberate scrutiny and interrogation. “In a certain sense the materiality of the ground forms the basis of all architecture. Architecture's dependency on the ground is reflected in buildings that deliberately display the nature of the ground on which they stand or out of which they rise.” (Ruby, 2007) Ground itself is not passive. It registers as more strategic and potent when viewed through the lens of “field-conditions”; organized spatial patterns explored in the work of Stan Allen. Where field and ground describe the horizontal, “a space of propagation, or effects, functions, vectors and speeds”, (Kwinter, 1986) excavation provides a local relational framework to unify and integrate new and existing materials and their uses. “Field conditions move from the one toward the many, from individuals to collectives, from objects to fields.” (Allen 1985) Excavation moves in the opposite direction, with the goal of bringing together dissimilar dynamic forces in three dimensions.

To further complicate things, sites themselves are often equated with building-lots, “...available parcels bound by legal demarcations driven by property ownership—as opposed to understanding them as large complex landscapes—relational networks of artifacts, and organizations and processes that operate at diverse spatial and temporal scales.” (Czerniak, 2011) If instead design is undertaken with an understanding of a site’s ecological foundations, the act of conceptually extracting and integrating volumes of ground/site also leads to site-dependent opportunities for anchoring, footing, and other tectonic integrations between static and dynamic materials

.

Outcomes of two courses are compared in this paper: a combined first-year MLA + fourth-year BEnvD seminar and a second-year BARCH studio. The goal of the MLA +BEnvD course is for students to develop an understanding of the basic principles of landscape ecology and to describe the structures, functions, and dynamic processes in urban landscapes. That introductory knowledge is applied in field observations, analysis, and experimentation/application at a range of spatial scales. The BARCH studio explores architectural theories, processes, and methodologies that allow students to capture and define space – examining what is announced & present compared to what is silenced & absent in their observations and assertions. Students in both explore ecological layers of the site, then experiment with stereotomic mass formations, and frame elements to identify ways in which site and architecture can interface more symbiotically with one another. They are asked to describe how their projects behave - and what they might achieve within (and beyond) a given landscape, rather than what their intervention might resemble based merely upon preconceived notions and/or accepted symbols. The authors put the two courses in juxtaposition to highlight pedagogical opportunities at the intersection of conceptual ideas in architecture, excavation, and ecology. The outcomes consider the site conceptually through constructivist frameworks of analysis and design, with the goal of greater ecological comprehension, and tactile understanding of foundational landscape and architectural materials in beginning design.

Grounding

Beginning designers are confronted with so many unknowns. They form questions and concepts, often gradually, about how to perceive, describe, and respond to introduced situations and conditions. There is an urgency to make the critical unknown things known. Of equal concern is the definition of criticality itself or the determination of

what is critical. What is it that is most important? Structure and strategy can help prioritize and rank these questions and topics for further attention. The following describes longitudinal outcomes of two teaching approaches in beginning design, one in landscape, and the other in architecture. Our aim is to highlight outcomes and spark debate about pedagogical and creative intent in beginning design education.

Taught at the University of Hawaii, *Urban Ecological Analysis and Design*, and *Site Design Studio* explore landscape as the key driver of urban and community form. The Hawaiian archipelago offers students direct exposure to concentrated, exaggerated, and amplified elements of contemporary tropical urbanism; its materials, structures, habits, and patterns set in a dramatic landscape. Students at UH understand the need for designers to be immersed in the physicality of a site, as a precursor to framing what is there, and what might yet make that place more ideal for a given set of agendas. The long history of reading and editing sites inspires the next generation of designers toward integrated and layered ideas about design with the existing conditions of a place.

Beginning design students, entering their first-year of architectural studies at Ball State University reconsider the commonly-accepted prescriptive procedure of visiting, recording, and documenting the ground's dominant features when first visiting a project's site. This process is limiting in its capacity to fully embrace the site's prospects to influence and drive design maneuvers for their proposed project solutions. Instead, beginning design students should be encouraged to discover opportunities for how the atmospheric conditions of the site, within, along, and beyond the earth's substance, might prolong the dialogue between site and architecture throughout the duration of the project.

Through his writings, architect and theorist Greg Lynn discusses opportunities for how the ground might be perceived to accommodate an introduced mediating object about its surface and substance. Here Lynn states that the, "…earth is conceived as a porous mass capable of supporting objects not only on its surface, but also burrowing and floating within its mass, then a new sense of ground has been established and a new mobility achieved." (Lynn, 1998) These messages from Lynn are important as beginning designers should not assume that the given/existing conditions of a site are sacred articles, unable to be altered and muted in their ability to influence the iterative design process. Alternatively, the ground of the site should be reconsidered and reimagined as an agile agent of design.

Burrowing and Floating

When we arrive at a new site; on new ground. How do we get our bearings? How do we measure and describe our surroundings? Any number of instruments are available to scan, dimension, and precisely document the physical qualities of space within a particular view. But which ones offer the most useful information? The ground is a great place to start. But too often, it is viewed exclusively in two dimensions, an overly simplistic analysis is only horizontally oriented, and can remain superficial. What is added to the site, in the view of many, should always be secondary to what the site provides. Unless it floats or flies, most, if not all environmental or built work will engage the ground. Consider it with deference, as you would a living organism. The ground is alive, moving, and changing, an active and arguably dominant agent in the site equation. The ground is three-dimensional. It is composed of heterogeneous materials. Replete with sources of information and clues about what might be expected or anticipated, the ground on which and into buildings emerge is to be seen not as a flat clean pad, but instead as a flexible armature or scaffold that accommodates heterogeneous activation, material interplay, and ultimately succession.

The sum total of materials on the planet is actually quite constant. Yet, these materials are continuously reshaping and recomposing themselves. How should we attempt to learn directly from this phenomena? How might an increased awareness of this understanding of temporality (decay, entropy, restoration, maintenance, etc.) impact beginning design students? How might they anticipate a more dynamic future in their early conceptual design work?

Only until very recently in natural history, the changes that have occurred on the surface of the earth have been largely unmitigated by human hands. Since the dawn of civilization, ideas and constructs for shaping the land have been mainly reactionary and situational. Historically, processes and procedures of excavation have been acknowledged to incite potentially negative implications. Excavation, at its simplest measure, is merely a human-scale exaggeration of natural processes of erosion and deposition. Earth may be assumed to be removed or carved from a site, yet in actuality, it is simply displaced temporarily.

When compared to natural geological succession and evolution, this action, taken to ostensibly improve the land for human use, is by necessity towards an accelerated endeavor. What then is conceptually offered (as related to the formation of design concepts) at such an accelerated pace? What does this dramatic decrease in the duration of excavation processes offer designers in their near and long term prospects? And how should beginning designers work out how to approach such temporal complexity?
The idea that change is inherently unstable is much more pronounced within the arbitrary boundaries of a given parcel of land. Materials may be eroding or depositing on the site, or its adjacent sites, against the preferences of a given authority of that piece of property. That site-dependent context/situation is far too complex to fully understand at the beginning design level. But with basic introduction and exposure to relational notions of excavation, students can gain a degree of increased awareness of the broader implications for environmental design.

When suitability and ecological fitness are prioritized, excavations can lead to tangible improvements; to positive change or direction. Say in the form of a drainage system that closely mimics natural hydrological cycles. That is a productive and prospective form of excavation. When excavations are less deliberate however, perhaps in preparing the ground for a monofunctional piece of static infrastructure, the extracted materials and the void they left can more often than not be detrimental to ecological performance for generations. Less careful structures can work for periods of time, and often well, but when they ultimately fail, the results can also be catastrophic.

Building Ground

Shaping ideas about suitability – or how well an idea or situation might perform within a given context and its carrying capacity - stems from first-hand immersion and experience with the materials and conditions of a particular place. Growing frustrated with narrowly focused student outcomes tending toward the static or monofunctional built form, set into a passive placeholder-landscape, these courses instead search for facts – principles, sequences, and other replicable observable patterns on and about real sites and their materials. We do this as a means of increasing ecological comprehension and identifying more nuanced and artful approaches to designing (broadly), and siting, and building on the ground (specifically).

Work in *Urban Ecological Analysis and Design* leads students through a sequence of ten projects, each growing incrementally in scale, complexity, and precision as the semester progresses. Students test conventional building materials 1:1 throughout. By conventional materials, we refer to the stuff that makes landscapes and buildings. As materiality becomes more familiar through direct engagement, students show a heightened awareness of their inherent instability and responsiveness to external stimuli. One exercise asks students to put two materials, one static, and one dynamic into deliberate juxtaposition. A gradient of ratios is explored at this stage, with sets that include 10% : 90%, 25% : 75%, 50% ; 50%, 75% : 25%, and 90% : 10%, respectively. With cubes made to express these combinations, students then simulate a disturbance, either chronic (as related to climate, or long-range pollution) or episodic in nature, (as related to shorter-frame incidents of dramatic change, wildfire, earthquake, flood, etc.)

Material reactions are recorded and analyzed and a better impression of the physical and performative qualities of the subjects under study becomes much more granular and yet also more pronounced and relevant. Abstractions that follow aim to simplify the highly complex observed patterns into discernable gestures; meaningful data which aggregate and reveal a site framework and offer staging for subsequent diagrams that lead to a more synthetic and generous reading of the ground. (Fig 1)

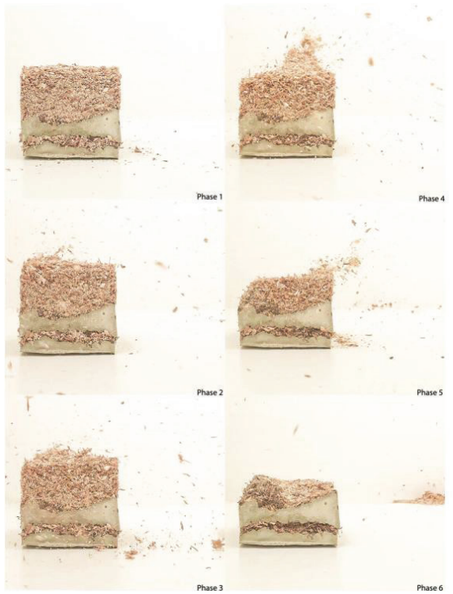


Fig. 1 Controlled ratios of static and dynamic materials are subjected to simulated ecological disturbance. Concrete, sawdust, and variable wind velocity as high-wind/erosion simulation. An "optimal" structure, expressed in phase 6 responds to and rebounds from the disturbance. Student: Rebekah Dalton, BEnvD 21'.

Earthwork as Framework

Environmental design implies an ability to improve the performance of a site, while simultaneously acknowledging, respecting, and co-existing among its situational circumstances. Therefore, all design maneuvers must be *situational* and *site-specific*. To accommodate this, it is important for beginning design students to remain cognizant and considerate of the ground's character as a compositional negotiator of the design process. Landscape urbanist Stephen Graham argues for a world where "architecture increasingly melds into landscape." (Castro, et.al., 2012) In support of this statement, any distinguished

territorial divide, which may be preconceived by beginning designers, to exist between the jurisdictions of building and ground must be dissolved for environmental design to realize its full potential. The pliant and supple conditions of the earth accommodate a wide range of integrations.

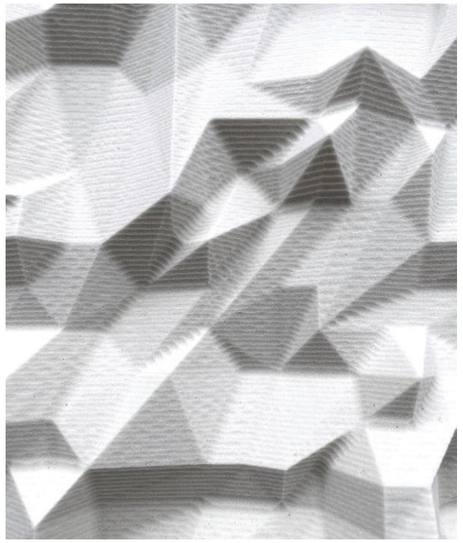


Fig. 2 The faceted surface of a CNC milled model, expressing an abstracted, tessellated, and integrated topography for a development site. Student: Dephine Homeroksi, MLA 23'.

The writings of cultural geographer Denis Cosgrove define situational land-formations about a site as 'landscapes,' which provide opportunities to perceive and manage the context of the world: "…landscape is embedded in the practical uses of the physical world as nature and territory." Cosgrove, further describes these conditions as being reliant upon, "…the material foundations for the landscape idea, (where) the obvious point of departure is the human use of the earth, the relationship between society and the land." (Cosgrove, 1998) These messages from Cosgrove suggest that landscapes are malleable vessels, instead of residual artefacts to be consumed by the interventions of synthetic architectural devices.

The terms *stereotomy* and *tectonics* are valued topics of architectural theory to explore for how buildings might meet and engage the ground. Gottfried Semper first introduced these terms as a challenge to the Vitruvian principles of architectural theory. Semper's writings suggested that architecture should be categorized and measured by its methods of construction, as well as the materials that compose these fabricated procedures. Among his four elements of architecture, exist the taxonomies of earthwork and framework. These classifications (as further explored through the analysis by Sepmper, Kenneth Frampton, Robin Evans, and other authors) have guided architectural theory to acknowledge tectonic framework systems and stereotomy as relevant aspects of architectural design.

Fig. 3 'Negotiated Mass' project: a study of the site's ability to respond, conform, and inform an introduced additive tectonic structure about a stereotomic mass. Work by 2nd year architectural student, Elise Matney.

Architectural scholar Francesco Cacciatore explored the impact of fabricated systematic and structural assemblies about the formations of architecture poché's matter within his writings of *"The Tradition of Thickness."* Here, Cacciatore provides a detailed account of tectonic devices and stereotomic procedures in relation to their respective positions within architectural design. "The distinction between tectonic and stereotomic...relates to essentially different ways of conceiving construction, hence architecture. It reveals the tendency of built form to emerge and express itself in two fundamental and opposed stances..." Cacciatore expresses that the disparity among tectonic strategies and stereotomic procedures, in relation to design and construction processes resides in their respective identity. The tectonic element, "... is dynamic and developed from a principle of addition and juxtaposition of elements, while the other (stereotomy) is static and operates on a principle of excavation and removal of parts." (Cacciatore, 2016).

Second-year architectural design students were given the opportunity to explore the processes and establishments of additive tectonic systems and stereotomic practices in a series of projects. These design exercises explored how a site might be an accommodating "body" to integrate with an intervening architectural form. The first project, entitled 'negotiated mass' began with students casting a plaster mold, capable of being refined and crafted to accept a tectonic assembly among its form (Fig 3). The subsequent project, titled 'domain of equal subadditivity' examined a scenario for the students to elicit new spatial configurations by inverting the conditions of mass and frame from their previous exercise. The original stereotomic mass was to transform to a systematic tectonic framework (Fig 4, Fig 5). Consequently, all implied or realized spaces defined by the tectonic systems of the previous exercise were to be reimagined as stereotomic matter. A deliberate comparison of the two related projects was intended for the students to recognize opportunities where a site's boundary surface and architectural connections might be interchangeable. In this way, the intended lessons of these tandem projects communicated the messages of Graham and Cosgrove relative to landscape and architectural design.

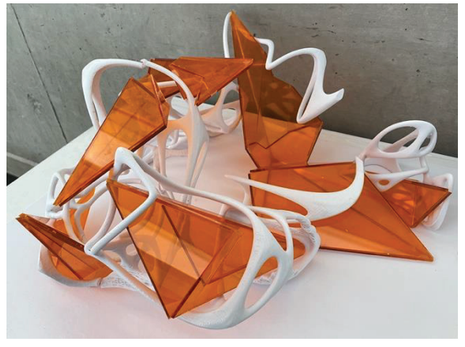


Fig. 4 'Domain of Equal Subadditivity' project: A response to the previous project 'Negotiated Mass', inversing properties of mass confines and framed assembied to further investigate how site and architecture might inform one another. Work by 2nd year architectural student, Lindsey Thole.

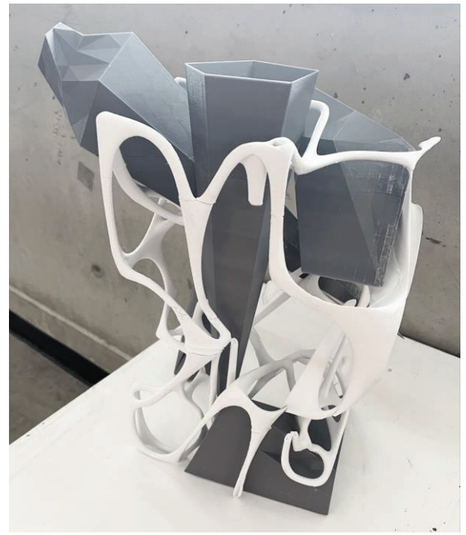


Fig. 5 'Domain of Equal Subadditivity' project: A response to the previous project 'Negotiated Mass', inversing properties of mass confines and framed assembied to further investigate how site and architecture might inform one another. Work by 2nd year architectural student, Elise Matney.

More on "Meeting"

In conclusion: When the question, *how does your building meet the ground?*, gets asked, the implication often assumes a passive relationship between a static building and a solid ground; an object placed or inserted on an unresponsive plane. It's a fairly straightforward, well-intentioned inquiry, asked often by a critic aiming to help improve a student's understanding of tectonics, anchoring, fastening, and overall integration of these two seemingly dissimilar elements. *Meeting* can be interpreted in this way as overly simplistic, but when applied as a more fluid term of art, or conceptually, it can be readily expanded. Consider what it means to *meet* someone, or something. Meeting entails first impressions, it suggests a parley between potentially disagreeable agents perhaps working toward some common center; a newly negotiated shared space. Agents are things, people, and organisms of all cloth. Incidentally, some often only meet once. Some meetings are spontaneous, others predetermined. Some last for hours, or even years in the case of the built environment. The nature of intent varies wildly. Some materials meet actively, in dynamic juxtaposition, pivoting, buckling, bending, or swirling around one another. While others appear to meet in tension, with little movement, yielding, or attention to the needs of the other. The projects explored in this paper suggest a prospective attitude about *meeting,* or of the deliberate, intentional intersection of the inherited and

the proposed; the ground and the building. *Meeting* in this sense can be more meaningfully directed as a lens for viewing critical moments of contact and attention.

How does your building meet the ground is an age-old and time-tested prompt. It gets us thinking about how things work, and how the pieces come together and make a whole. But on reflection, it remains a bit out of touch with the idea that these two (or more) conditions are in fact already well-acquainted. What if the building *was* the ground; *what if the ground was the building?* Perhaps another term is required to essentialize the argument for such a naiive assertion. David Leatherbarrow writes of the term, *topography* as just such a mediator. He describes how, "Topography incorporates terrain, built and unbuilt, but more than that, for it also includes traces of practical affairs ranging from the typical to the extraordinary." This implies that the ground is not there to simply recive or respond to architecture, to building materials, per se, but rather as a more all-encompassing registration for how humans, nature, and their united activities operate and adapt to one another in largely informal and organic terms.

Leatherbarrow describes hows topographical traces (of built and unbuilt form) offer an "…outline or proposal that is taken up in an act of making or inhabiting that has no obligation to its past, other than the preservation of a tension between its forms and those projected out of the present." Topography in his view, gives over itself to matters of "perception, experience, and knowledge as both a representation and an accommodation of prosaic and practical purposes, historically formed and reformed." This examination of topography focuses not only on the "profile, compass or configuration" of a given ground; a plot, parcel, or stretch of land, "for the project's realization and expression depend equally on the materiality, color, thickness, temperature, luminosity, and texture of physical things. Further, when considered in its temporal aspects, it is plain that land is not only soil but all that is hidden beneath it and emerges from it, as well as the several agencies that sustain that emergence." So then, the building doesn't need to meet the ground at all. The building *is* the ground.

Bibliography

Allen, S. *'Field Conditions', Points + Lines: Diagrams and projects for the city* (1999), pp. 92-103

Allen S. (2017). *Stan Allen : Four Projects (First Editions).* Applied Research and Design Publishing.

Czerniak, J. *"Looking back at landscape urbanism: speculations on site."* Ed. Waldheim C. (2006). The landscape urbanism reader. Princeton Architectural Press.

Castro, Eva and Alfredo Ramirez, Rico Eduardo, Douglas Spencer. *Critical Territories, From Academia to Praxis*. Florence, Italy: Laboratorio Editoriale, 2012). pp 9-10.

Cacciatore, F. *The Wall as a Living Place: Hollow Structural Forms in Louis Kahn's Work*. (Siracus: Lettera Ventidue Edizioni, 2016), p 23.

Cosgrove, D. *Social Formation and Symbolic Landscape*. (Madison: University of Wisconsin Press, 1998). p 2.

Evans. R., The Projective Cast: Architecture and its Three Geometries (Cambridge, Massachusetts: MIT Press, 1995), 179-180.

Frampton, K. and John Cava, *Studies in Tectonic Culture, The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge, Massachusetts: MIT Press, 1995).

Hensel, M.U., & Turko, J.P. (2015). *Grounds and Envelopes: Reshaping Architecture and the Built Environment (1st ed.)*. Routledge.

Judd, D. *"Specific Objects,"* Arts Yearbook (1968); republished in Donald Judd, Complete Writings 1959-1975. (Halifax: Nova Scotia College of Art and Design, 1975), 184.

Kwinter, S. *"La Cittá Nuova: Modernity and Continuity in Zone ½"* (New York, 1986), 88-9.

Leatherbarrow, D. *"Is Landscape Architecture?"* Doherty G. & Waldheim C. Eds. (2016). *Is landscape ...? : essays on the identity of landscape.* Routledge.

Lynn, G. *Folds, Bodies, & Blobs: Collected Essays*. (Bruxelles: La Lettre Volée, 1998), pp 105–106.

Ruby I. & Ruby A. *Groundscapes : Land and Scape* (Barcelona: Gustavo Gili.)

Semper, G. *Style in the Technical and Tectonic Arts"*(Los Angeles, California: Getty research Institute, 2004), 109-111.

How to Befriend a Chimera: lessons on site analysis

Ana T Orosco, FAMU

Maxim D Nasab, FAMU

Fig. 1 Site analysis model - urban context as a creature

Keywords: authored site, architectural site, site analysis, beginning design studio

Abstract

Site plays a crucial role in architectural design, especially when it comes to concept development. This paper discusses site analysis assignments presented to four different beginning design studios at the undergraduate and graduate levels. The underlying thread between these was to use site observations and ideas as the basis for concept development, breaking away from traditional site analysis methods and focusing on abstractions through maps and physical modeling. As theorized by Kahn and Burns in Site Matters, the project site was presented as three overlapping areas: the plot delimited by property lines, the "area of influence", and the "area of effect". By encouraging students to develop site models that differ from purely building mass and topography, they were able to explore a deeper sense of place through complex connections and synergy within the narrative of the site. The assignments asked them to build physical models that represent the site as a living thing, highlighting one or two major conceptual thoughts. Students were required to use materials that were not tied to the site itself but rather to the idea. This led them to discover the culture, history, physical and metaphysical connections, pathways, and veiled social issues at the center of their analysis rather than the standard climate and circulation diagrams - taming the infamous chimera and embracing the unknown.

As a fundamental connection to all urban scales, *site* is an inescapable interface through which architectural ideas and manifestations flow. In the context of a beginning design studio, *site* can feel like a *chimera* of sorts where seemingly incongruous elements collide. How does an educator introduce this creature so that it becomes a fun glittering [insert here your mythical creature preference], instead of a ruthless gate-keeping minotaur? From topography to wind patterns, sun path, flora, fauna, underground systems, overhead structures, existing buildings, and human interaction, the site, as a creature, encompasses elements that can be challenging to measure, difficult to grasp, and represent holistically. As Kahn and Burns frame it:

> "The concept of site, then, simultaneously refers to seemingly opposite ideas: a physically specific place and a spatially and temporally expansive surround."

Looking at the site as a living being is helpful in shifting the perception from places as static passive elements to ever-changing dynamic systems. The importance for students to comprehend and analyze their project site is more pressing than ever, with topics like regionalism, sustainability, equity, culture, history, and transportation being key issues that are interwoven within their projects.

Defining the site

To define "site," it is perhaps useful to look at the explanation of *non-site* by Robert Smithson. In his series of *non-sites*, the exhibition showcases images and maps of specific places, along with rocks, sand, and dirt collected from them, displayed in bins. The ensemble of items direct the viewer to explore an invisible boundary of the site represented by the *non-site*. He states that diagrams and maps are a "logical two dimensional picture" that work as an "analogy or metaphor."[1] Here, the landscape is defined and becomes a site because of the intervention and active documentation of Smithson.

Thinking of the site as an authored landscape is necessary in redefining site analysis as a responsible act of design instead of a merely objective pre-design activity. Samuels, in "The Biography of Landscape," delineates a helpful parallel between art and landscape, stating that "landscapes without authors would be like books without writers."[2] The geographer compares context to the language in the pages of a book; landscape as the biography or content; and humans to the authors/readers. All three are entangled as a construct that only jointly can define landscape and site.

In "Site Matters," Diedrich defends a shift from site-specific to *radicant* site in how designers approach site analysis. For the author, specificity is linked to observing physical elements, while *radicantity* relates to an evolving construct.[3] Constraining site analysis to a prescribed set of maps and diagrams implies homogeneity and weakens students' agency over their design. Because there is an everlasting flow of change traversing every imaginable setting, conceptualizing *site* as a living creature helps to articulate elements that are fundamental to a landscape but also ephemeral. The idea of evolution adds a set of dimensions to a place that are not readily measurable.

How can this be translated into a methodological process for architectural studios? Enters the chimera. Daughter of a nymph, combining speed and strength in a seemingly incongruous combination of species (lion, goat, and serpent)[4], she embodies the authored connections that define a site after the mystery of diving in the unknown ocean of a place. The hypothesis here is that as an initial process, understanding the site and formulating a conceptual framework grounded on the site is a multifaceted task that demands an interface. Myths help connect creativity and technique - an essential combination for architectural design.

In 2006, McClure reported on an adaptation of the scientific method as an academic studio site analysis protocol. They defended that "in order to critically observe a site, one must discover phenomena and invent a tentative description, called a hypothesis, which is consistent with what is observed."[5] Their methodology sets up a rigorous process while fostering creative site thinking. While the *chimera* exercise does not follow the same exact structure, it maintains a similar approach. Here, the hypothesis takes the form of an invented being.

This paper discusses experiments in deriving site analysis from a designed creature in an architecture studio setting and engaging students in defining the boundaries of a site. The ability to play and create something that is inherently fictitious allows the students to free themselves from implied boundaries. Instead of deriving the *parti* from a preconceived idea of the project or an abstract idea that is manifested without connection to the site, the concept is unveiled by careful exploration and definition of the site and its parameters.

The site as a creature

The word *creature* implies not only a living thing but also a creative act. Making a creature derived from in-site observations brings to the surface ideas that are not accessed through a sun chart or a rainfall diagram. *Sun, Wind, & Light*, a revered reference for site analysis, reads on its cover that the content presented is, in fact, a set of "architectural design strategies," stating in its introduction that "at first, the designer works primarily in a synthesis mode, bringing ideas together, not in an analysis mode."[6] Discovering and designing a creature acts as the catalyst for synthesizing the *evolving construct* of a physical place.

Once each student defines their site by means of a *creature* model and maps, a framework can be drawn from it, setting the stage for analysis and a building design proposal. As Burns and Kahn assert, "a specific locale provides the material ground for action in design practice, and the designers' ideas about site provide a theoretical background against which design actions are taken."[7] The characteristics, habits, and mode of travel are all indicative of how students are thinking about the site. In other words, the *creature* reveals the student's theoretical stance through making.

In one of the studios where this methodology was implemented, the location was adjacent to a canal in Spring Creek, FL. Because the students had the opportunity to spend over 5 hours there and tour the bay by boat, they were able to experience how much the coastal landscape changes over the course of just a few hours. This relationship inspired "creatures" that were water-loving and adaptive. One of the students, Xiaohua Carter, was curious about the small animals that inhabit the crevices of oyster shells. She identified the site as a small nest connected to a larger network of water and land in flux.This design process was then centered around the concept of nesting (Fig. 2).

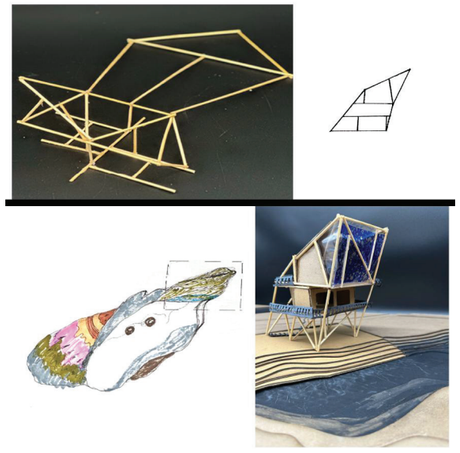


Fig. 2 Student work, Xiaohua Carter. Top-left: Creature model; Top-right: Parti; Bottom-left: Creature watercolor; Bottom-right: Proposed design

Because there are so many things happening all at once in the field, visible and invisible, even designing *one creature* can be daunting. Honing into one or two main conceptual thoughts, transposing them into a *creature-model*, to then extract a framework was effective in weaving a thread throughout the design process. As Diedrich beautifully puts it, "the act of design, rather than formalization of static site components, becomes then an act of continuous translation."[8]

Process

For all of the classes, the project was presented as a whole, and the first task given to the students was *site analysis*. The prompt was slightly adjusted with each new studio, but the overall structure consisted of:

- Step 1: Observe/interact with the project location: gather information about the user and user environment/culture/community
- Step 2: Model: Build a physical model defining the site as a living creature - highlight one or two major conceptual thoughts.
- Step 3: Map: Create a series of maps derived from the concepts discovered through the investigation of the creature.

Other guidelines consisted of parameters for the model and the maps. Those stated that the model materials should be tied to the conceptual thoughts related to the creature, and no scale was required. The maps should be derived from the creature exploration, use a scale bar and north arrow, generate a color palette with consistent graphics, and outline opportunities/constraints as well as conceptual ideas discovered.

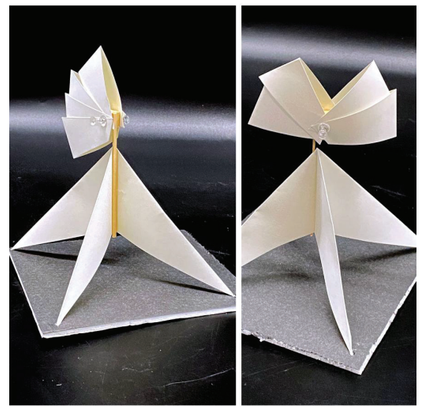


Fig. 3 Student work, Justyn Grant. Creature study model showing motion

The timeframe for the first pass of the creature model and maps was ten days, with an additional week for a revised version of all deliverables. The time for revisions overlaps

with the beginning of program analysis. The following prompts were presented to assist in the re-iteration:

- Identify one or two key concept words (verbs are better) to describe your creature and/or what it does
- Write one paragraph (around 250 words) describing what you identified as the needs of the creature (opportunities and constraints)

The variety of results is staggering and attests to the wide range of interests and idiosyncratic definitions of site. This list of creatures compiles some of the investigations from students across studio projects located in Atlanta (GA) and/or Spring Creek (FL): barnacle, cat, Cerberus, crab, crane, Ditto (Pokémon), dolphin, dragon, eagle, Ents (Lord of the Rings), glass frog, magnolia flower, octopus, Ouroboros, owl, oyster, phoenix, sponge, squid, sun. Some of the creatures, like Justyn Grant's (fig. 3), became a completely invented being with an internal logic - his was a four-legged octopus (a quadopus?!) that opened and closed its shell to adapt to the environment. Instead of a repetition of sun charts and wind diagrams, this exercise supports students in fostering creative site thinking.

Discussion

Site analysis can sound very seductive because it implies that a locus is a finite object that can be parsed and fully understood. The reality is that all things are constantly changing, and there will be something different, even if minimal, with every new second that rolls over. Places are not fully graspable. One of the benefits of reading the site through a designed creature is that it defines a set of markers that can be understood in depth.

As a design exercise this process helped students focus on certain aspects of the location they visited and study them more carefully. This movement helped them establish a conceptual arc that remained through the entirety of the project - even if it did not directly generate a parti or major design movement, it did create a dialogue that influenced it. John Williams, for example, became interested in the movement of water in and out of the canal in Spring Creek, and modeled his creature inspired by the flow of water in bivalves (fig. 4). His final design interpreted *flow* as the combination of environmental and human activities converging at the proposed building.

Although the exercise was successful in bringing ideas that transcended rationalizations of the space, most of the students' first impulse was to make a figurative representation of the creature they identified. The freedom of materials also prompted the use of literal representations of a certain quality instead of the translation of an idea. After working on the map, writing about the creature, and being able to connect concepts to reality, the creature models were re-iterated. In the second-year studio, the variation of how this exercise was presented curbed some of the figurative results by asking the students to model the movement of the creature instead of the creature itself. The material was also prescribed: wood dowels or paper.

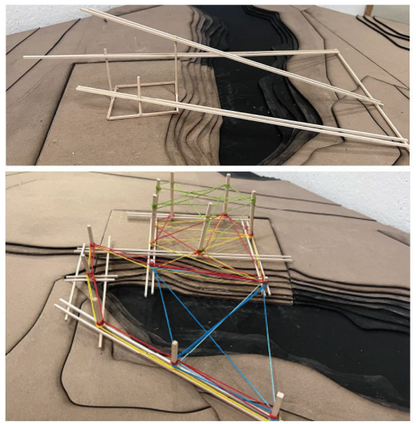


Fig. 4 Student work, John Williams. Top: Creature study model; Bottom: Creature movement study model

Defining the site through a back-and-forth between observing, making, writing, and iterating is a powerful design tool. Site thinking and design can not only inform one another but create new meanings and modes of observation that are intertwined. Summoning Diedrich, "on an epistemological level, this testifies to the entanglement of theory and practice: studying practice allows reflection on modes of thinking, theory evolves from looking into practice."[9]

Alchemizing the site

Continuing a conceptual thread between site observations and design intentions can feel like a mystifying task. Identifying a creature is helpful because it lays out a set of conceptual ingredients that can be alchemized into program analysis. The resulting elixir can include any combination of cultural, historical, societal, physical or metaphysical connections as it relates to both site and program. Outlining the transition from site to program is necessary because together, they establish the bounds that will be addressed by the design proposal. In the context of this paper, it is meant to describe the overlap between site and program as it relates to the *creature*.

This passage from *Invisible Cities* illustrates what this conceptual alchemy could look like: "when you concentrate and stare at the carpet, you recognize the street you were seeking in a crimson or indigo or magenta thread which, in a wide loop, brings you to the purple enclosure that is your real destination."[10] If the site is a living creature, the program is a quest that identifies and follows the threads leading to the "purple enclosure" that will become its habitat. Quests are about a search for clues. What are the key elements and concepts that emerged from the site analysis? How do they inform patterns that traverse the site? What are the main players?

Program analysis is not about proposing a purple enclosure; it is instead about identifying possible paths to what will lead to the design. As Peña and Parshall define,"if programming is problem seeking, then design is problem solving."[11] In order to sediment and link site analysis to the next step, students are tasked with addressing the program from the standpoint of the ideas derived from the *creature* through an inquiry process. The alchemical process is complete when *creature* and quest are combined into a set of well-defined parameters.

Process

The programs presented for each studio varied in scale and complexity, meant as a guideline to help raise questions that parse through the interactions between user and site. The Atlanta site had a multi-use building, whereas the Spring Creek site was prescribed a live-work station for oyster farmers. One of the biggest challenges when working on program analysis is to incorporate the conceptual ideas found in the site into a reading of the programmatic requirements. Here is where the alchemy between site thinking (*creature*) and engaging the program (quest) happens.

Starting from the conceptual framework of the creature coupled with the maps from the site analysis, each student developed a sequence of "if/then" statements in the form of drawings and digital models. The students were tasked with studying the program guidelines and creating a to-scale mass model that accurately illustrates the proposed areas. The process is described on this list:

- Step 1: Create a digital massing model that explores one "if" statement and two (2) "then" questions; i.e., *if* easy access to art and culture is a priority, *then* where should points of access be placed? What program component(s) should be highlighted?
- Step 2: Print the digital massing model on 11x17 paper with appropriate background information (creature, site, views, map, etc). Using tracing paper, draw three (3) iterations. Formulate your next "if" statement.
- Step 3: Repeat steps 1 and 2 until you have a sequence of five (5) minimum. This should be an iterative process.
- Step 4: Overlay your drawings. Revisit each "if/then" statement and, using tracing paper, study opportunities and constraints as it relates to the connection of program components: how does one move from one space to the other?

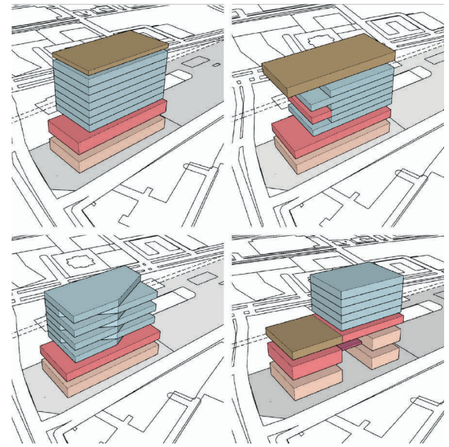


Fig. 5 Student work, Nicole Spina. Program analysis diagrams

The threshold where the program and site collide is the main driver here. Having the creature as a point of reference, students were quick to link the existing dynamics they uncovered during site analysis to a handful of "design problems" that needed to be addressed. A student who had

an owl as their creature focused on how to organize the program so that throughout the building, there would be "perches", translated as visibility, open spaces, and strategic views of the city. Figure 5 shows a set of program analysis iterations based on a "morphed magnolia" (creature). Here, Spina identified the needs of the creature as the ability to grow and evolve into a landmark (full bloom) while preserving moments of privacy (roots, internal processes). Given those parameters, the different options reflected her systematic analysis of "if/then" statements concerning: access, views, pedestrian edge, and iconic moments.

Conclusion

From unknown to tangible, the process described in this paper aims at a reflection on the pedagogical thinking surrounding the representation and definition of *site* in architecture design studios. The creature exercise proposes a layered design methodology grounded on a physical place. Instead of taming multiple heads that breathe fire and ravage lands all at once, the process described focuses on one element at a time, allowing ideas to be extracted critically and carried to the next step.

Some of the strategies that seemed to have been beneficial were the following:

- Defining the number and overall scope of maps;
- Presenting the exercise as a discussion with a step-by-step format;
- Tying the exercises to an internal project narrative that establishes the bounds of the investigation; and
- Building a balance between creative and technical endeavors within the exercise.

Compared to a technical site analysis approach, the results were unique solutions from each student. Unveiling site thinking at the beginning of the project also seemed to be beneficial in weaving a conceptual design narrative throughout the whole project.

Based on lessons learned from the four studios, future iterations of this exercise should encompass one or all of the items on this list:

- Prescribed materials that can be transformed to represent different ideas (i.e.: paper, cardboard, plaster, wood, or concrete);
- Presenting initial graphics of the site as transitional borders instead of just the plot dimensions;
- Adopting a new vocabulary that is more accurate in describing the process, such as site definition or site translation or site *radicantity*.

Because the language used to guide the process can sound esoteric, using a structured set of instructions similar to the methodology described by McClure proved to be very helpful. The reflections for future iterations are about furthering the clarity of how the exercises are presented.

Making a *creature* accounts for a set of features that unveil site thinking and support a conceptual project narrative. Topography models and climate diagrams are very helpful but do not get across the weight of an evolving, dynamic landscape. As Smithson would argue, it is through an authored "three dimensional metaphor that one site can represent another site which does not resemble it."[13] Defining a site should be a design exercise that takes into account the multifaceted nature of a place.

The definition of site and how to parse it is still not a topic in vogue in architecture education. As Diedrich wisely frames, "engaging sites as resources in design requires research on, and within, practice in a transdisciplinary mindset while widening the professional and disciplinary horizons of those not only supported but also sometimes limited by their respective professions and disciplines."[12] Architecture does not exist in a vacuum. Introducing *site* as a conceptual underpinning for architecture to establish a dialogue with is a necessary step towards fully exploring the multidimensional nature of architectural design.

End Notes

1 Smithson, Robert. "A Provisional Theory of Non-sites." In *Robert Smithson: The Collected Writings, ed.* Flam, J.. University Of California Press, 1996. p 364

2 Samuels, Marwyn, "The biography of Landscape." In *The Interpretation of Ordinary Landscapes: Geographical Essays.* Ed. Meinig, D et al. New York: Oxford University Press, 1979. p 64-65

3 Diedrich, Lisa. "Translating Sites: A Plea for Radicant Design." In *Site Matters*, ed. Kahn, Andrea et al. Milton: Taylor & Francis Group, 2020. p 176-188.

4 Hesiod. Theogony works and days. line 320

5 McClure, Michael, and Ursula Emery McClure. Fluid and Tolerant Teaching. p 1

6 Brown, G. Sun, Wind, and Light p xviii-xix

7 Kahn, Andrea, and Carol Burns Site Matters : Strategies for Uncertainty Through Planning and Design.

8 Diedrich, Lisa. "Translating Sites: A Plea for Radicant Design." In *Site Matters*, ed. Kahn, Andrea et al. Milton: Taylor & Francis Group, 2020. p 176-188.

9 Diedrich, Lisa. "Translating Sites: A Plea for Radicant Design." In *Site Matters*, ed. Kahn, Andrea et al. Milton: Taylor & Francis Group, 2020. p 176-188.

10 Calvino, Italo. Invisible Cities. p 96

11 Peña William, and Steven Parshall. Problem Seeking, p 5

12 Diedrich, Lisa. "Translating Sites: A Plea for Radicant Design." In *Site Matters*, ed. Kahn, Andrea et al. Milton: Taylor & Francis Group, 2020. p 176-188.

13 Smithson, Robert. "A Provisional Theory of Non-sites." In *Robert Smithson: The Collected Writings, ed.* Flam, J.. University Of California Press, 1996. p 364

Bibliography

Brown, G. Z., Mark DeKay, and Virginia Cartwright. *Sun, Wind & Light: Architectural Design Strategies*. New York, NY: Wiley, 2001.

Calvino, Italo, William Weaver, and Italo Calvino. *Invisible Cities*.New York, N.Y: Harcourt Brace Jovanovich, 1974.

Flam, J. *Robert Smithson: The Collected Writings*. University Of California Press, 1996.

Hesiod. *Theogony works and days.* Translated by M. L. West. Oxford: Clarendon Press, 1997.

Kahn, Andrea, and Carol Burns, eds. 2020. *Site Matters: Strategies for Uncertainty Through Planning and Design*. Milton: Taylor & Francis Group. Accessed February 23, 2023. ProQuest Ebook Central.

McClure, Michael, and Ursula Emery McClure. *Fluid and Tolerant Teaching*. 94th ACSA Annual Meeting Proceedings, Getting Real. Accessed. February. 23, 2023. https://www.acsa-arch.org/proceedings/Annual%20Meeting%20Proceedings/ACSA.AM.94/ACSA.AM.94.57.pdf

Meinig, Donald William, and John Brinckerhoff Jackson. *The Interpretation of Ordinary Landscapes: Geographical Essays*. New York: Oxford University Press, 1979.

Ockman, Joan, and Rebecca Williamson. *Architecture School: Three Centuries of Educating Architects in North America*. MIT Press, 2012.

Peña William, and Steven Parshall. *Problem Seeking: An Architectural Programming Primer*. Hoboken, NJ: John Wiley & Sons, 2012.

Session 2

Experiential Mapping: A Novel Approach to Orthographic Projection

Ross Wienert, Univeristy of Houston
College of Architecture and Design

Mapping as Method

In their search for new concepts, Gilles Deleuze and Felix Guittari offer the tree and the rhizome as metaphors for the known and unknown. Where the tree stands for an established and finite way of thinking, the rhizome possesses the potential to extend in a myriad of new directions and offers the possibility of extending itself towards previously unestablished connections.[1] The principal logic of the tree and the rhizome extend into respective concepts that are more closely related to the field of architectural representation, the map and the tracing:

"Make a map, not a tracing…What distinguishes the map from the tracing is that it is entirely oriented toward an experimentation in contact with the real. The map does not reproduce an unconscious closed in upon itself; it constructs the unconcscious… A map has multiple entryways, as opposed to the tracing, which always comes back "to the same".

-Gilles Deleuze and Felix Guattari[2]

In architectural education, two-dimensional drawings feel increasingly as if they're falling into the category of the tree. While certainly established as a paradigm of architectural education, these types of drawings have become so familiar to both students and faculty that the method of producing them and the ideas they represent lack understanding. In architectural representation, an increasing dependence on the digital model as a tool for generating two-dimensional drawings has become pervasive.

Rather than constructing drawings using traditional means of orthographic projection, it has become a common practice to extract linework from a digital model. Automated commands package complex tasks into one-word commands that export linework. Those commands are well known, but the results they produce remain unfamiliar. While a seasoned architect can parse through the extraneous linework and read the extraction, produce remain unfamiliar. While a seasoned architect can parse through the extraneous linework and read the extraction, students new to architectural representation often find themselves unable to decipher the collection of lines that emerge from the black box that the command creates. This practice creates an over-reliance on software and an ignorance of what the output represents. A method of drawing that revives traditional drafting techniques, while applying them in non-traditional ways, may enable young designers to better comprehend what their drawings communicate while also enabling them to draw more effectively.

Rather than asking students to produce known or traditional drawing types, the process of experiential mapping challenges students to use established drawing conventions to produce something unconventional and unknown. This approach to drawing has been applied as an experimental method of representation in the office where the author practices as well as in first and second year design studios. The results demonstrate the potential of mapping to both enhance students' understanding of the relationship between two-dimensional plans and sections as well as their ability to comprehend architecture as a thing intended to be experienced rather than an object meant to be observed.

The experiential map relies on known techniques of orthographic projection but applies those techniques in ways that break with established practices. Instead of generating static representations of a singular object, these drawings unroll a line of circulation that moves through a series of spaces. The experiential map illustrates a narrative path through the building. The conventions of traditional drafting provide the constraint of measurability and precision. The bold lines serves as the primary space defining element, while the qualities of light and materials augment the spaces those lines define. Rather than attempting to render these qualities everywhere, the map considers their presence relative to the path of circulation, reflecting the awareness of someone walking that path.

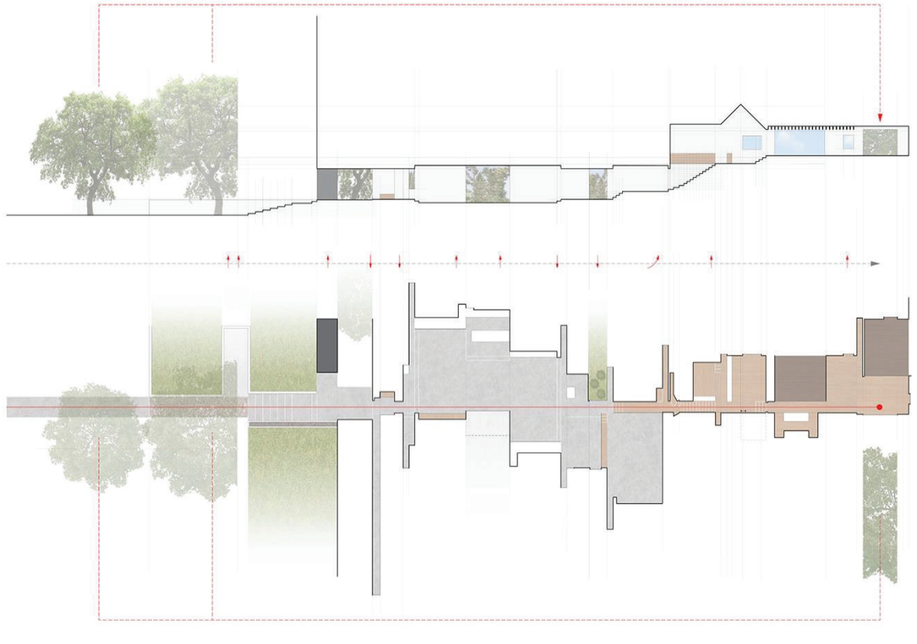


Fig. 1 Experintial Map of the Puzzle House by CONTENT Architecture

Learning to Read and Write

Experiened architects understand two-dimensional drawings as if they were a native language. Line weights, line types, and symbols combine in an established manor to signify architectural elements. The language of drawing possesses a structure with shared common elements that enable clarity of communication while still enabling a sense of freedom of expression. Much like in literature, different authors may utilize this language to communicate architectural space using their own unique means to achieve radically different effects.

While the familiarity with that language and how to communicate through it develops over time, students often struggle to comprehend these drawings and how to communicate intentions through them. The act of exporting two-dimensional lines from their three-dimensional digital model results a struggle to both read and write via two-dimensional drawings. The practice of exporting lines from a digital model equates to allowing an AI program such as ChatGPT to write a research paper. The software provides the desired result, but the comprehension of that content remains shallow.

The practice of mapping possesses the potential to enable students to read, comprehend, and produce two dimensional drawings more clearly. In order to enable that comprehension, a need exists to undermine expectaitons and pre-conceptions. Known drawing types that result from orthographic projection, such as floor plans and sections, are too familiar as concepts to today's students as they enter college level design programs. Their past exposure to those forms parallels the *tracing*. Instead of relying on traditional drawing types, the map offers the opportunity to deploy drawing conventions in an unconventional way. This process of mapping asks students to explore and represent something unfamiliar that results in the unknown.

Drawing Experience

For many students, ignorance of two-dimensioanl drawing goes beyond how they are produced and extends to what they represent. Students struggle to see beyond the abstract compostions of lines on a flat plane and place themselves within the three-dimensioal space the drawing

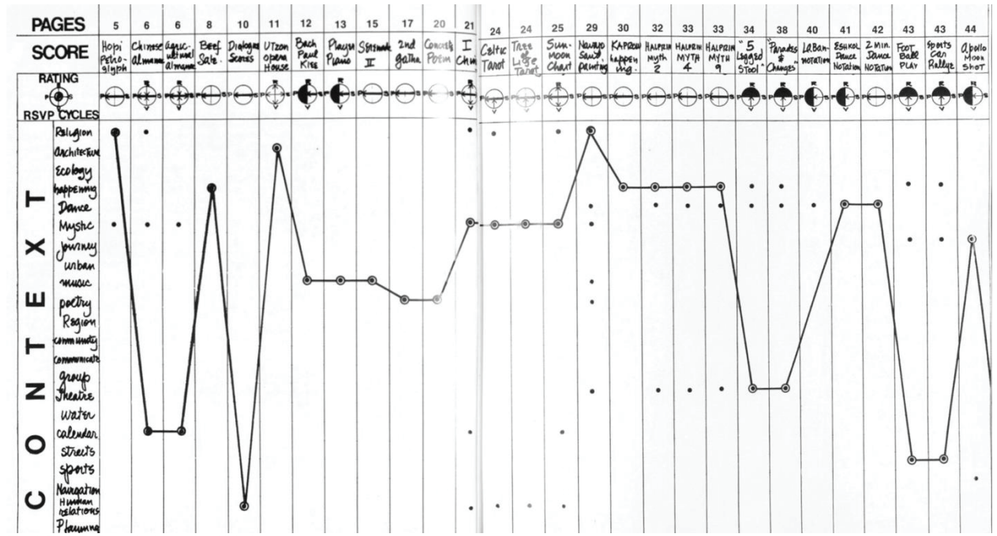


Fig. 1 Sample Score by Lawrence Halprin

describes. To make the transition from viewing a drawing to visualizing a space, students need to understand the drawing as something you move through mentally rather than something you simply observe.

The concept of motion in two-dimensional drawings typically does not exist. Instead, the drawing relies on the capacity of the observer to imagine themselves moving through the building and visualize their transition through spaces the drawing defines. While that capacity may feel like second nature to an experienced designer, for someone new to visualizing architectural space and more familiar with the digital model than two-dimensional drawing, that translation proves difficult. To better enable students to comprehend the drawing as a thing experienced rather than observed, the component of movement must be made more explicit.

Movement plays a key role in architecture and the way we experience space. In her exploration of mapping, Nichole Wiedemann obersves that "The author and/or user, literally and perceptually, measures the world with their bodies and exists as an agent of the environment."[3] The problem of the map lies in how to create a body-centric drawing that captures the movement of that body systematically.

Motation

If constraints are helpful when working with familiar elements, then they are necessary when encountering the unknown. The act of drawing in an unfamiliar manner, requires a framework. In response to this need, a system needed to be developed that captures architectural experience two-dimensionally. Rather than rendering a fixed space, the drawing aims to communicate how space changes as one moves through it.

In his attempts to notate fluctuations in activity in public spaces, Lawrence Halprin explored the concept of "scores". He defined these explorations as "symbolizations of processes which extend over time."[4] While the musical score provides the most common example, this idea of scoring can be applied to "all fields of human endeavour", including passage through an architectural space.

In his studies of movement notation, Halprin points out "the need for new notation arises out of the inability of the traditional approach to express new concepts." The experiential map aims to capture both the quantitative and qualitative aspects of architectural space. The rules of orthographic projection provide an ideal system for communicating the measurable aspects of architecture. That system as traditionally utilized renders the physical environment as fixed and motion as something else.[5] In moving away from a drawing that conceives of the building as a fixed object and moves toward depicting the the experience of

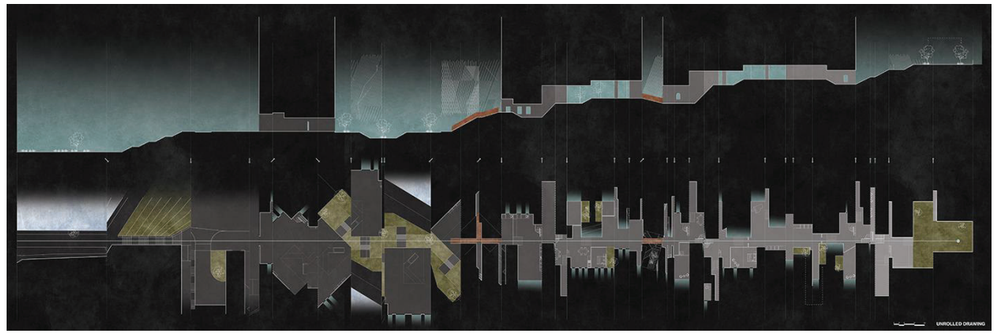


Fig. 3 Experiential Map of 2nd Year Design Project by Alfred Rivera

spaces within that object, orthographic projection is useful, but the method of application needs to be re-considered.

Rather than drawing the building as a fixed object, the map charts the spatial conditions relative to an observer as they move through space. The drawing applies the rules of orthographic projection, but it measures spaces in terms of their proximity to that observer as they navigate a path through the building.

Make 2D

The floor plan fits in the category of *tracing* as a known thing with established parameters and meanings, but the tracing also possesses the capacity for something new and unique to grow out of it. Rather than rejecting the tracing outright, Delueze and Guittari assert that "the tracing should always be put back on the map".[6] As a first step in generating the experiential map, the author of the drawing defines a path of circulation that moves into and through the floor plans of the building.

While any path can lead to the production of the map, the author should consider a path that passes through a variety of spaces and the key thresholds that define them. As Nichole Wiedemann suggests, that path within a map possesses the potential to serve "as a tour, an itinerary synthesizing time, space, and action."[7] The act of choosing the path is similar to selecting where to place the section plane in a traditional building section, but in the map the cut is non-linear. Instead, it is a dynamic path that changes direction relative to the observer.

Once the author establishes this path of circulation, they effectively unroll each of the path's linear segments so that the winding line of circulation in the plan becomes a straight line in the map. As the author transfers each segment of circulation from the plan to the map, the space defining elements along that segment are transported with it. Dark lines define the walls that enclose the space along the path much like in a typical floor plan, and in between those dark lines, light and medium lines describe changes in floor heights and material transitions. Unlike the traditional plan, the map omits any information that lies beyond the dark lines of the walls in an effort to focus solely on the moments encountered by the observer.

While the lines define the measurable aspects of the spatial sequence, the space between these two lines provides the opportunity to communicate the qualitative and material qualities of the space. Colors, textures, and images augment the map, indicating the presence of materials and the presence of light. The author calibrates the intensity of these effects relative to their proximity to the path. Things in the distance become muted even if they lie within the same space. In all cases, material textures are applied lightly so that the lines that define the space maintain their presence.

Upon completion of the plan view of the map, a similar process measures the spatial sequence that occurs in section. Along a parallel path above the unrolled plan, two dark lines define the vertical measurement of the space. One line tracks the ground plane below while the other captures the changing height of the ceiling above, as well as its potential absence. The changing proportions of the space correlate. As the eye moves from left to right, the drawing maps out the spatial sequence both horizontally and vertically, showing how the space expands and contracts around the observer.

Capturing Experience

As one moves through an architectural space, "the author and/or user, literally and perceptually, measures the world with their bodies and exists as an agent of the environment."[8] The resulting drawing illustrates the way that spatial conditions, materials, and light transform as the observer passes through that space. The method of the map attempts to utilize the known techniques of orthographic projection in an unknown way. This approach reveals the dynamic experience of the building in a way that a collection of static plans and sections only suggest.

This new application defamiliarizes the author with the drawing process and requires them to slow down and think critically about the relationship between plan and section as they document spaces. The hesitation induced by the unfamiliar can be productive in that it requires the author to stop relying on preconceived notions of what a plan and section should be and focus on what those drawings are truly intended to communicate.

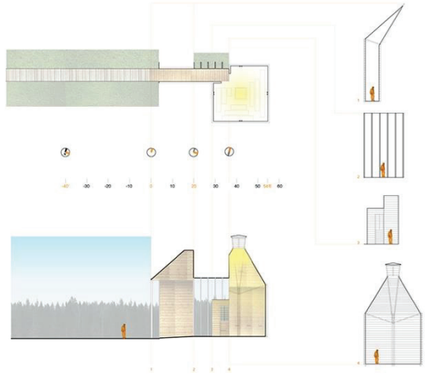


Fig. 4 Experiential Map of OOPEAA's Karsamaki Shingle Church by Felipe Harker

Precedent Analysis

This strategy of mapping an experience through drawing offers students a unique approach to the analysis of precedents. Instead of simply reproducing the plans and sections they find in their research, they are required to think critically about the series of moments one would encounter as they approach the building and eventually pass through the spaces within. This necessity sets them on a path to consider the building not as a sculptural artifact, but as something inhabited and experienced with an emphasis on thresholds and transitions.

The initial phase of the precedent analysis asks students to collect plans, sections, elevations and photographs of their precedent and use those found images to digitally draft a set of drawings. While the faculty emphasize the need for students to measure and produce their own drawings without tracing, the results typically indicate that resisting that temptation proves difficult. Those found drawings exist as a target for the student to chase after, but they're attempting to create a visual match without understanding what the original communicates. This practice illustrates "why the tracing is so dangerous."[9]

Whether they are literally or conceptually tracing, the majority of students replicate the drawings they find without fully comprehending them. The floor plan is a concept students are familiar with. While they may not know how they are constructed, their assumptions exist. Those pre-conceived notions can prove to be debilitating and dismantle the students' capacity to approach the drawing with an open mind about the outcome.

Rather than considering the plans and sections as representations of spatial conditions, most students focus on visually matching what they have found without truly understanding what that thing communicates, as evidenced by their inclusion of lines from the originals that they can't identify. The thing they produce may look like the original, but few fully understand what they have produced or what the original intends to communicate.

Upon completion of this initial task, each student generates a map of how their precedent would be experienced. Students receive a tutorial on the process of unrolling a line of circulation through the plan of their precedent in order to begin generating their own map. In A Thousand Plateaus, Deleuze and Guittari assert that "the tracing should always be put back on the map" in a way that enables new connections or possibilities to emerge from it.[10] While the floor plan they have produced exists as a tracing, that drawing becomes a useful starting point in the generation of the map.

In the production of the map, preconceptions about how the drawing should appear prove less useful. Students are unable to rely on existing drawings as a target to replicate because the drawing they seek does not exist. Instead, they venture into unknown territory as they begin constructing the map. Students must forget their preconceptions of what a plan and section are in order to construct a drawing that communicates the spatial qualities that a plan and section intend to convey. Taking this step requires a leap of faith in order to believe that the drawing will emerge successfully if they trust the process.

Emergence of Narrative

Whether applied to a precedent analysis or a design project, the experiential map brings the experience of architecture to the foreground. Form becomes secondary, in part because form is difficult to perceive from within. While dynamic transitions and moments of complexity occur within the two-dimensional space of the

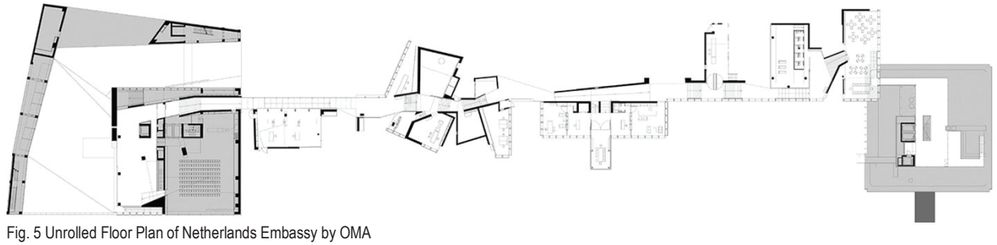


Fig. 5 Unrolled Floor Plan of Netherlands Embassy by OMA

drawing, those instances emerge out of the spatial sequence rather than sculptural gestures. As one moves along the path of circulation "movement structures the environment through a complex network of relationships, mixing space, time, and narrative."[11] Along this path, the legibility of a potential narrative emerges.

Scripting

In discussion of his transition from screen writing to architecture, Rem Koolhaas states the realization that "An architect writes scripts also, but for people, not for actors." In terms of drawings, the emphasis on scripting moments together is most visible in OMA's drawing for the Netherlands Embassy in Berlin where the spaces that cut through the building unroll into a linear experience, framing views of the surrounding city along the way. In that project, the narrative that emerges along that path intends to give Dutch nationals working in the embassy a better understanding of Berlin's complexities.[12] That drawing serves as a precedent for the map in the way that it challenges conventional drawing standards in order to communicate an intention clearly and explicityly.

While designers certainly possess ideas related to narrative in their work, the reading of those conceptions is often limited in the plans, sections, and photographs that attempt to substitute for a walk through those spaces in person. The discontinuity of those images fragments the legibility of the narrative. While someone with an advanced understanding of architecture could string together those moments in their mind in a way that enables them to imagine that sequence, the experiential map takes the implied sequences of moments and makes them explicit.

Reading the Map

"Maps enable us to comprehend things unseen."
-Nichole Wiedemann[13]

As a pedagogical tool, attempts at this drawing demonstrate both successes and failures. While students do not necessarily require an understanding of the basic rules of orthographic projection prior to staring this drawing, possessing some experience with that drawing proves useful. When assigned to a first year studio in which students explore buildings for the first time, many students struggled to develop the drawing, but these struggles can be fruitful.

Their experiences are symptomatic of a lack of understanding of two-dimensional drawing and those students would likely also struggle with traditional orthographic drawings. When they lack a target that can serve as a tracing, their specific issues are easier to diagnose. This enables more precise direction to be given and allows them to develop their understanding of how to draw more effectively.

Second year students who possess some background in two-dimensional architectural drawings without feeling like they're mastered that skill engage in the drawing much more quickly. They possess more familiarty with the tools and draw more confidently. Mistakes are made along the way, but they move past those issues more quickly.

Up to this point, the map has been used primarily as a way to document a space. In some cases, that means the analysis of a precedent, and in others the drawing depicts a design the student has developed using other means. In that role, it serves as way of depicting things that are less apparent in other drawings. It reveals what has been considered and what remains to be considered. As an example, a project with a dynamic floor plan that lacks sectional variety becomes apparent as the map takes shape. The potential exists for students to create the map as a design tool rather than a means of documentation. If students create the map as a score that lists their design intentions, that linear tracking of experience could be woven through the space of a compact site.

In all cases, the process requires patience and planning. The implementation of the drawing takes place in phases. The schedule allows rooms for mistakes to take place and for revisions to happen before moving forward. This method of representation emphasizes construction over reproduction. The designer must assemble the drawing, considering the series of moments and translating the measurements from the traditional floor plan and section to the field of the map.

This practice enables the ability to create rather than simply re-create. Re-learning the process of constructing two-dimensional drawings possesses the potential for those methods of representation to be re-invigorated with fresh understanding. That understanding enables students to create drawings that are not simply tracings, but "experimentations in contact with the real".[14]

End Notes

1 Deleuze, Gilles, and Felix Guittari. *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: The University of Minnesota Press, 1987), 6-7.
2 Deleuze and Guittari, *A Thousand Plateaus: Capitalism and Schizophrenia, 12-13.*
3 Wiedemann, Nichole. "What Came First, the Map or the World?*" in *Poetics and Pragmatics: A Design Studio Companion*, ed. Smilja Milovanovic-Bertram and Joyce Rosner (Dubuque: Kendall Hunt Publishing, 2018), 223.
4 Halprin, Lawrence. *The RSVP Cycles: Creative Processes in the Human Environment. (New York: George Braziller, Inc, 1969), 1.*
5 Halprin, *The RSVP Cycles: Creative Processes in the Human Environment, 71.*
6 Deleuze and Guittari, *A Thousand Plateaus: Capitalism and Schizophrenia, 13.*
7 Wiedemann, Nichole, "What Came First, the Map or the World?*", 221.
8 Wiedemann, Nichole, "What Came First, the Map or the World?*", 223.
9 Deleuze and Guittari, *A Thousand Plateaus: Capitalism and Schizophrenia, 13.*
10 ibid
11 Wiedemann, Nichole, "What Came First, the Map or the World?*", 223.
12 Glass, Nick and Rose Hoare, "Koolhaas rewrites script with blockbuster buildings." Updated Oct 3, 2012, https://www.cnn.com/2012/10/02/world/asia/koolhaas-big-pants-cctv/index.html
13 Wiedemann, Nichole, "What Came First, the Map or the World?*", 224.
14 Deleuze and Guittari, *A Thousand Plateaus: Capitalism and Schizophrenia, 13.*

Bibliography

Deleuze, Gilles, and Felix Guittari. *A Thousand Plateaus: Capitalism and Schizophrenia.* Minneapolis: The University of Minnesota Press, 1987.

Wiedemann, Nichole. "Which Came First, the Map or the World?*." In *Poetics and Pragmatics: A Design Studio Companion*, edited by Smilja Milovanovic-Bertram and Joyce Rosner, 216-224. Dubuque: Kendall Hunt Publishing Company, 2018.

Halprin, Lawrence. *The RSVP Cycles: Creative Processes in the Human Environment*. New York: George Braziller, Inc., 1969.

Glass, Nick and Rose Hoare. "Koolhaas rewrites script with blockbuster buildings." Updated Oct 3, 2012 https://www.cnn.com/2012/10/02/world/asia/koolhaas-big-pants-cctv/index.html

Discerning the Perception of Territories and Boundaries

Sean Burns, Ball State University

Introduction

For beginning design students, the term *territory* is a frequently unappreciated quality of architecture. Often, early designers regard this expression as a synonym of *boundary* – an instrument used to divide and isolate two-dimensional parcels of land according to their strict metes and demarcated values. Under this assumption, *territory* is unfairly postured as a permanent and inflexible constraint of architecture. The author of this paper challenges the circumstances and merits that qualify these terms: *boundary* and *territory*, as conditional agents of architectural design.

Boundaries of a site are dependent upon restrictions and limitations that are often predetermined and placed along the principal surface of the earth. Deployed and established boundaries create distinguishable confines for architects to survey, follow, and respond to as quantitative criterion for their design opportunities. Alternatively, territory may be observed as a qualitative analysis of the site – where the political, environmental, cultural, historical, and social aspects of a site might be examined and communicated. Architect and theorist Bernard Cache states, "… the surface of a territory is mobile and fluid as it is given to the distortions of memory."[1] Here, Cache implies that territory is not a static, nor unyielding, property of design. Instead, it should be accepted as a responsive and evolutionary quality that offers development to a site - among, beneath, and beyond the ground's shell. It is the author's belief that the conditional parameters of *boundary* and *territory* may be better understood and acknowledged through their respective associations with the temporal dimensions of a site. Questions then arise pertaining to the role and responsibility of these terms for how beginning design students might document and observe the given or existing conditions of a site.

> *"Sites are surveyed in the early stages of design so that given conditions can be described and understood. While this seems obvious, the term 'given' conditions is far from clear. We assume that the place exhibits 'its intentions' the way designs present theirs; in both, intentions are shown, and givenness we believe, offers expressive display."*[2]

This paper will examine a series of projects, introduced to second-year architectural students, encouraging them to investigate the known and unknown qualities and quantities associated with *territories* and *boundaries* towards introducing an architectural intervention. Students were urged to explore the limitations and constraints of the earth's terrain as a means to discover opportunities for architectural devices and spatial prospects to occur among the iterative design process.

Challenging the Qualifications of Boundaries and Territories as Recognized Isolative Barriers

Within his writings, anthropologist Tim Ingold suggests that there are four central conditions for how we might study the potential interactions among organic entities within life's opportunities to support growth and movement. The 'container' is one of these suggestive distinctive conditions, which Ingold describes as a precarious and preventative model that restricts opportunities for objects/beings to collaborate, inform one another, and progress. For Ingold, 'containers' have clear insides and outsides, subdivided by defined surfaces that are intended to enclose and separate the adjacent substances.[3] The inclusion of this barrier condition may be perceived as a prohibitive element due to its inability to promote communication and influence among the neighboring constituents within its formation. Thus, the 'container' model is limiting in its capacity to entertain any event that might be intended to encourage development and evolution among its formation.

In the field of architectural design, too often the surface of the earth's crust is deemed as a barrier intended to divide the atmospheric conditions of the sky from the substrate of the ground. This assessment of a given site recalls many attributes of Ingold's aforementioned 'container' model, whereby two realms of a site are realized as insulated entities – each hampered in their ability to affect one other. For architecture to progress beyond this mode of thinking, designers must be willing to disregard the ground's shell as a demarcating device of the site, and instead soften all

boundary scenarios of the earth's crust to embolden the ground as a negotiable plane and/or malleable substance to support an architectural intervention. This modified attitude of the ground presents an opportunity for architectural design to prolong the dialogue between site and edifice throughout the entirety of the design process. Instead of beginner designers visiting, recording, and accepting the site's existing ground configuration as a sacred article, they may instead accept the ground as an opportunistic agent of design in an effort to prolong the dialogue between site and any imposed architectural intervention throughout the iterative design process.

Architect Giuseppe Strappa has written extensively about the formation of territory within architecture as a constituent of *materia signata* (designed matter): "… a substance which man's consciousness acknowledges as having an aptitude for transformation.". For Strappa, the formation of a territory extends beyond this synthetic 'designed matter,' as it must also account for the 'natural matter' of the earth.[4] Any establishment of a territory is therefore dependent upon the ability of *matter* to transform into *material* to the extent that it becomes:

> *"…a product of a common environment with its values, techniques, characteristics, and culture springs from solidarity and cooperation between nature and people. As an organism composed of structures modelled by the hand of man from a natural soil, it must be defined as a construction, and should be interpreted as such."* [5]

Through their investigative writings about the forms of mapping techniques, Eva Castro, Alfredo Ramirez, Eduardo Rico, and Douglas Spencer discuss the influential features that signify and represent a given territory. Here, these authors suggest that a mapping device's ability to index and record a territory is conditional upon, "its topographical, geological, environmental, demographic and socio-economic conditions as processes, forms and parameters. From its reading of constituent elements, it establishes a kind of common language that enables an understanding of their interrelated operations as a contingent whole."[6]

In his critique and review of the writings by Gilles Deleuze and Félix Guattari, with respect to the incidents of territorial conditions, philosopher Bruce Janz states that, "A territory is the interrelation of many milieus. It is, in a sense, a stance taken on milieus. It is not our site, but our situation."[7] Here, the phrase milieu suggests a social construct within the formation of an environment and territory provides a generative network to host milieus as they might evolve and change. Further, Janz declares that any, "Territory becomes an action, and just as milieu markers may shift, so too can territory."[8]

Over time, the limits and extents of a territory may directly influence the establishment of a boundary upon a site. While this relationship demonstrates a degree of association between the two terms, it is worth recalling the messages (by Strappa, Castro, Ramirez, Rico, Spencer, and Janz), who both suggest that these conditions are distinct in their qualifications to occur among a site. Ultimately, boundaries may be perceived as a quantitative measure of the site, assessed with a high degree of accuracy, and aimed to provide distinguishable confines among the body of a site. By comparison, territories are generative qualities of a site that absorb, respond, and evolve from a variety of issues that are impressed upon the site's body over time (including social, political, environmental, cultural, etc.).

Topography as a Vehicle of the Site

The term *terrain* refers to the physical features about the ground's pinnacle covering. Terrains are forged by geological interferences from the earth's tectonic plates over extensive periods of time and sutured together to form an engendered matter. Further, the disposition of a terrain is vulnerable to nature's abrasive activity that continually refines its figuration and formation. For beginner designers to appreciate the positioning of a site's current terrain, they must first consider its evidential topographical premises. If *terrain* is the manifestation and progression of earth's physical body over time, *topography* is the medium that allows beginning design students to effectively comprehend its compositional assembly.

Within his writings, architectural theorist David Leatherbarrow states a desire to introduce a "rapport between landscape and architecture," within the designed environment where, "…the two are best understood when seen as parts of something more basic and inclusive: topography."[9] Here, he offers six essential criteria for topography to achieve for it to be empowered as an essential intermediate between architecture and landscape in the field of design. These criteria are:

- *that its character is horizonal*
- *that (its) movement within it continually confronts contrary conditions and mosaic heterogeneity*
- *that it cannot be equated with land or materials as physical substances*
- *that it is not form either, when that is taken to be immaterial volume or profile*
- *that its manner of presenting itself is paradoxical: manifestly latent, or given, not shown*
- *that its temporality allows it to serve as both record of and invitation to human praxis, a chronicle and condition of human freedom* [10]

Guided by these decisive conditions, Leatherbarrow imagines a situation where site and any imposed object may be tolerant and unite towards achieving a site-specific design solution. Topography is pliable and unyielding in its ability to reformulate and reconfigure itself to accommodate architecture to realize this condition. Leatherbarrow further explains this in his writings, stating:

> *"Topography persists as a remnant in finished works, a remainder that resists complete (perfect) cultivation, finishing or articulation, a neglected capacity that 'might break through' just because it is regellos. Figuration uses but does not sever the ties between the object and this substrate, for topography has (is) the power to continually reform what has been formed, unsettling previously settled arrangements."*[11]

In their introductory narrative of '*Augmented Landscapes*,' scholars Mark Smout and Laura Allen refer to a state of 'restlessness,' when describing man's persistent desire to acquire and develop natural fields. Smout and Allen state that, "Man continues to mark the land, relentlessly shaping the surface from wilderness to cultivation."[12] The authors suggest several design cases where the essential physical aspects of a site, and its capabilities to provoke transformation, might be studied and exploited to uncover how, "the resulting architectural interventions respond to their dynamic and fluxing territories." '*Scope and Scape*' is one of these cases, which is further explained as: "The 'scope' of landscape – the careful view, or examination, and the 'scape' – the expansive scene - provide a duality that is employed by the architecture and experienced by the occupant."[13] These lessons remind us that a site is agile in its ability to both initiate change and entertain transformation. Further, the properties of a site – specific to its '*Scope* and Scape' - are dynamic and essential to provide a memorable experience for its occupants.

Student Exercises Intended to Ponder the Instances and Margins of Territories and Boundaries

Beginning design students, within their first-year of study within an accredited architectural program, were initially asked to reflect upon the following statement at the outset of their studio course:

> Architecture is unjustly concerned and surveyed by early-designers by the methods and design solutions for how it may ascend towards and among the atmospheric conditions of the sky. Alternatively, how might the given site for a project continually shape the conceptual approach for an intervening architectural design response among, within, and beyond the site's accepted confines?

The studio was intended to incite students to explore the possibilities for how the earth might become empowered as an active participant throughout the duration of the design process. As such, each student was asked to investigate the earth as a negotiable plane and/or malleable substance to potentially accommodate an architectural intervention effectively to create a site-specific 'place,' instead of a non-descriptive 'space' where architecture might be arbitrarily deployed among the site's body. This required students to reassess any of their respective predetermined definitions for the terms: territory and boundary, in an effort to entertain a scenario where the horizon and all regulating bounds of a site might become distorted.

Students were given two peripheral introductory studio projects to investigate these issues. The pairing of these sequential projects was intended to allow students to examine how site and architecture might work together to influence a proposed design solution. Students were asked to explore the lessons of Smout and Allen's studies of '*Scope and Scape'*, as well as related theories of terrain, boundary, and topography (many of which have been described above, within this paper). At the final juried review session for each project, students were promoted to discuss how their response to the project addressed the capacities of their site and any intervening architectural device to

effectively accommodate one another throughout the duration of the project.

Woven Terrain

A project entitled, 'Woven Terrain,' was introduced to beginning design students as an investigative study to reconsider the role of the earth's confines to host a designed article. All schemes to deploy limitable bounds and territorial zones for this project were to be guided by the introduced readings and messages, which are summarized above within this paper. Additionally, students were urged to explore and challenge any recognized constraints amidst the earth's terrain as a means to discover opportunities for architectural devices and spatial prospects to prosper among the earth's terrain throughout the duration of the iterative design process.

Ilka and Andreas Ruby state that the ground is, "just as suitable of a milieu for architecture as the air."[14] Expanding upon this statement, Ilka and Andreas Ruby present several opportunistic situations for architecture to engage the earth's terrain. Here, the authors urge designers to reassess their valuation of the earth and its role among architectural design. "In order to treat the ground as more than just an earth encompassing skin of the territory where spatial objects are positioned, we must treat the ground itself as a spatial body."[15] Further, Ilka and Andreas Ruby endorse designers to consider the latency that exists among any generated or intentional interstitial cavities, "The void between building and ground condenses to become a real space that defines the relationship between architecture and territory."[16]

The project was split into two phases. For phase one, students were asked to establish a two-dimensional grid and then alter this latent/flat network, guided by a series of descriptive operations/action words, to become a three-dimensional tectonic framework. At this point of the project, it was discussed and debated with the students that tectonic elements may be perceived as additive systems, closely associated with the sky. Tectonics also implies an attention to how these additive linear framework components are configured to celebrate the craftsmanship among their "art of joining" strategies. As the students progressed through the phases of the project, towards their final presentation, these might acknowledge the precision and attention to detail among and beyond their deployed tectonic systems (Fig 1).

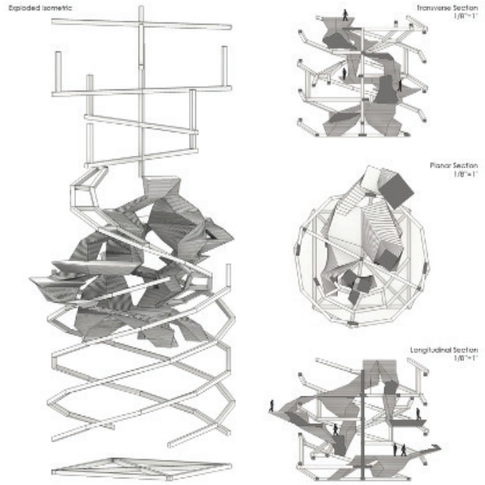


Fig. 1. Project: 'Woven Terrain,' drawings by second-year student Alyvia Hebner.

Phase two of this introductory project requested students to explore how a terrain's stereotomic mass might encounter, agree, or oppose the tectonic skeleton, established from the previous phase of the project. The students were requested to study the woven terrain's ability to assimilate, consent, and contest the previously designed tectonic assembly for this ultimate phase of the project (Fig 2).

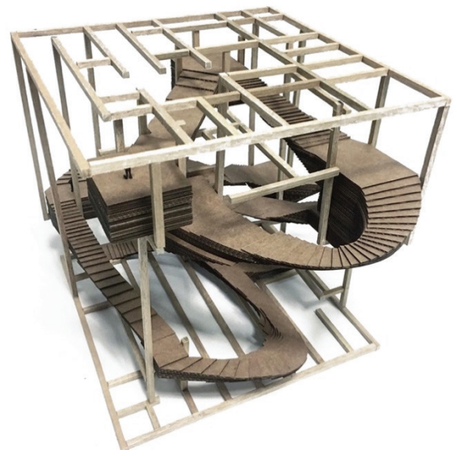


Fig. 2. Project: 'Woven Terrain,' physical model by second-year student Finn Hannan.

*Coming to Grips With_*

Vittorio Gregotti stated that, "The worst enemy of modern architecture is the idea of space, considered solely in terms of economic and technical exigencies indifferent to the ideas of the site...before placing stone on stone, man placed the stone on the ground to recognize a site in the midst of an unknown universe: in order to take account of it and modify it."[17]

A project, entitled 'Coming to Grips With ,' provided an opportunity for beginning design students to apply the discovered and acquired lessons from the previous project to an existing and local site. An expired limestone quarry, identified as Vinegar Mill, integrated as a portion of Muscatatuck State Park in south-eastern Indiana, was chosen as the location for this project (Fig 3).

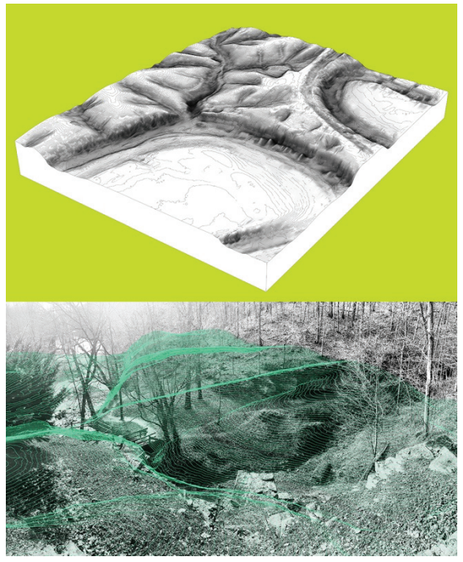


Fig. 3. Three-dimensional mapping studies of site at Vinegar Mill at Muscatatuck State Park for project: Coming to Grips With_.

For the project, students were asked to augment the responsibilities of the earth's terrain to design and develop an act of architecture that reconsidered the site's biased boundary conditions and territorial tendencies. The chosen site at Muscatatuck State Park yields a volatile disposition among its current land-formations, where the ground's steep and passive covering is often interrupted with bold intervening limestone remnants exposed by the previous quarry's measures to harvest its resources. These conditions provided a terrain that is rich in its aptitude to negotiate and host an architectural event among, within, and beyond its irregular matter for this design exercise.

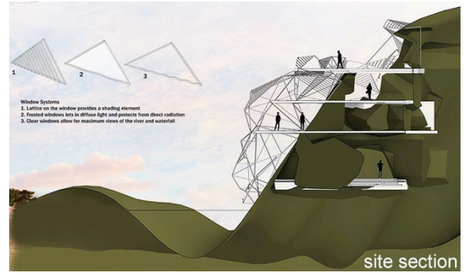


Fig. 4. Project: 'Coming to Grips With_,' site-section drawing by second-year student Emma Schuck.

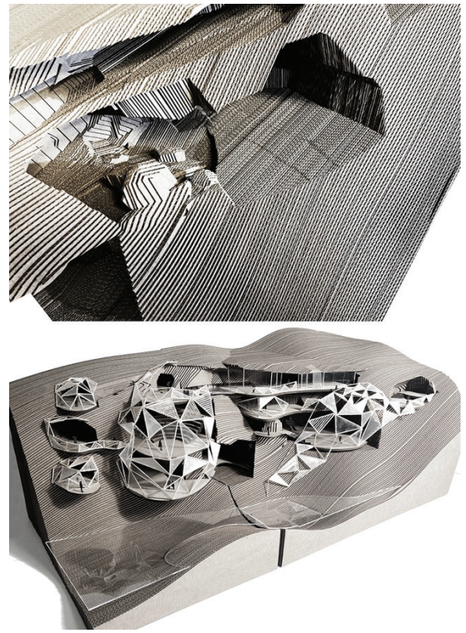


Fig. 5. Project: 'Coming to Grips With_,' physical model of terrain reformations (above) and final design solution (below) by second year student Emma Schuck.

For the program of this project, students were asked to design a complex that promoted an activity for the users of the site or celebrated the heritage of the site. Additionally, the complex was to include four distinctive dwelling units. These dwellings were allowed to be either temporary or

permanent in nature. In response to the site's profile, which included several instances of vertical surfaces, students were prompted to consider modes to adhere, grip, or nest, to the aggressive terrain for their approach to the project (Fig 4). Finally, students were mandated to excavate and/or displace the site to accommodate several instances of space within the existing terrain in support of their design solution for the project. These ensuant spaces were not permitted to be saturated with architectural elements. Instead, these reformations among the substance of the earth were to endure among the student's design solutions as exterior spaces, primarily defined and bounded by the excavated, manipulated, or displaced stereotomic terrain. This requirement encouraged students to consider opportunities and strategies to blur all demarcating limits between site and any proposed architectural mediating devices (Fig 5).

Conclusion and Findings

The described series of projects were presented to second-year students as part of their first-year architectural design studio. The intentions of these projects were for beginner designers to consider new modes of thinking related to the role and responsibilities of the site throughout the design process and how the multitude of a site's properties might continually inform and respond to an introduced architectural object. To give agency to the site's atmospheric conditions – within, among, and beyond the ground, students were asked to interrogate all conditions that might suggest a boundary or territory condition. In this way students began to provide interference for any delimitations between architecture and the earth. Further, these tandem of projects urged students to primarily design in three-dimensions, with the site included, throughout their iterative studies to produce an architectural solution that was unified with the environment (Fig. 6). These lessons promoted students to evaluate the nature of any surface element within their project for how they might beneficially contribute to the realm of design, instead of being designated as either an article of the site or architecture.

Current fourth-year architectural student, Emi Shima, who completed these projects as a second-year student, commented on if/how these lessons influenced her current approach to design:

> *"Working on these projects allowed me to critically think about how architecture might integrate the surrounding context into the design and use the landscape to its advantage. Upon completing these projects, I have been able to carry these ideas into my recent design investigative studies. Most specifically, I now have an appreciation for utilizing the idea of carving into a solid to create cavernous spaces, thus emphasizing how the relationship between solid and void might impact the individual user's experience."*[18]

Fig. 6. Subsequent project portion of drawing board by second-year student Casey Stamm.

End Notes

1 Bernard Cache and Jean Wilcox, *Earth Moves: The Furnishing of Territories* (Cambridge: MIT Press, 1995), 10.
2 David Leatherbarrow, *Topographical Studies, Stories in Landscape and Architecture* (Philadelphia: University of Pennsylvania Press, 2004), 251.
3 Tim Ingold, *The Life of Lines* (New York: Routledge, 2015), 14.
4 Giuseppe Strappa, *Morfologia Urbana e Tessuti Storici - Urban Morphology and Historical Fabrics* (Rome, Italy: Gandemi Editore, 2016).
5 Ibid.
6 Eva Castro, Ramirez, Alfredo, Rico, Eduardo, and Spencer, Douglas, *Critical Territories, From Academia to Praxis* (Florence, Italy: Laboratorio Editoriale, 2012), 10.
7 Bruce Janz. "The Territory is Not the Map: Place, Deleuze, Guattari, and African Philosophy," *Philosophia Africana*, vol 5, issue no. 1 (March 2022): 1-17,
8 Ibid.
9 David Leatherbarrow, "Topographical Premise," *Journal of Architectural Education*, vol 57, issue no. 3 (Feb. 2004): 70-73, https://doi.org/10.1162/104648804772745184
10 Ibid.
11 Ibid.
12 Mark Smout and Laura Allen, Augmented Landscapes (New York: Princeton Architectural Press, 2007), 6-9.
13 Ibid.
14 Ilka Ruby and Andreas Ruby, Groundscapes. The Re-Discovery of the Ground in Contemporary Architecture (Barcelona: Gustavo Gili, 2006), 49.
15 Ibid. 71.
16 Ibid. 33.
17 Vittorio Gregotti, "Address to the New York Architectural League, October 1982," Section A1, no. 1 (Feb/March 1983): 8,17.
18 Emi Shima, email message to author, February 8, 2023.

Bibliography

Cache, Bernard, and Jean Wilcox. *Earth Moves: The Furnishing of Territories*. Cambridge: MIT Press, 1995.

Castro, Eva and Alfredo Ramirez, Rico Eduardo, Douglas Spencer. *Critical Territories, From Academia to Praxis*. Florence, Italy: Laboratorio Editoriale, 2012.

Ingold, Tim. *The Life of Lines*. New York: Routledge, 2015.

Janz, Bruce B. "The Territory is Not the Map: Place, Deleuze, Guattari, and African Philosophy." *Philosophia Africana,* vol 5, issue no. 1 (March 2022): 1-17.

Gregotti, Vittorio. "Address to the New York Architectural League, October 1982." (Feb/March 1983).

Leatherbarrow, David. *Topographical Stories, Studies in Landscape and Architecture*. Philadelphia: University of Pennsylvania Press, 2004.

Leatherbarrow, David. "Topographical Premises." *Journal of Architectural Education*, vol 57, issue no. 3 (Feb. 2004): 70-73.

Ruby, Ilka, and Andreas Ruby. *Groundscapes. The Re-Discovery of the Ground in Contemporary Architecture*. Barcelona: Gustavo Gili, 2006.

Smout, Mark, and Laura Allen. *Augmented Landscapes.* New York: Princeton Architectural Press, 2007.

Strappa, Giuseppe. *Morfologia Urbana e Tessuti Storici - Urban Morphology and Historical Fabrics* Rome, Italy: Gandemi Editore, 2016.

Matrix models as layers of intersection between the knowns and unknowns.

Hala Barakat, University of Idaho

Abstract

This research examines the significance of implementing matrix models in early design pedagogy. Matrix models are layered physical constructs of different linear elements without a projected design, but rather a constantly iterative process that supports discovery upon making of the model. Matrix models require thinking through making, students need to start at an intersection on an initial map or two-dimensional lines to extrude the elements from and orchestrate their significance and depth. As they continue to layer the construct, the concept of the project formulates providing a framework to their future design.

Projects shown in Fig 1 start with concepts then translate into two dimensional lines and finally turn into threedimensional spaces. Allowing students to start thinking about their own methods of understanding a site could increase their design awareness and eventually assist their design making process. Under the theme of known and unknown, this project translates into exploring different qualities to guide students in the site analysis process. While known qualities could be visible elements, including viewpoints, the unknown qualities could be opportunities to incorporate the narrative into the design. The project challenges students to juxtapose the known and unknown into a layered juxtaposition.

<Matrix model as knowns - Site analysis, historical maps and existing context: In the examples shown, the matrix models assist in discovering new modes of thinking about hardscape qualities and their influence on the design Processes, pedagogies, and productions. The physical context translates into thicker basswood sticks and linear movements. Matrix models as a tool help early design students gather and organize different types of information into one composition interwoven with narratives and abstract components.

<Matrix models as unknowns – narrative, emotions and intangible characteristics:

Emotions as the intangible attributes within the project often defined as the unknown can now become layers of multiple hierarchies in a field. Using this technique has allowed students to integrate hidden effects into the project by defining the narratives as non-linear movements of different sizes. The layered matrix acts as fertile ground for new designs and generate complex frameworks.

Using matrix models as a tool to help early design students gather and organize different types of information into one composition. The layered models acts as fertile ground for new designs and generates complex frameworks without the limitations for a projected design. They have proven to be rich in their ability to host different scales regardless of the size of the models.

The role of the instructor is now primarily providing confidence and supporting the speculation of the design away from the authorized relationships, affected by the online delivery and more successful outcomes from in-person delivery. Differentiating between size and scale helps students make decisions on the prominence of the layers and control their influence on the projected design, making the design a more enjoyable and intentional process.

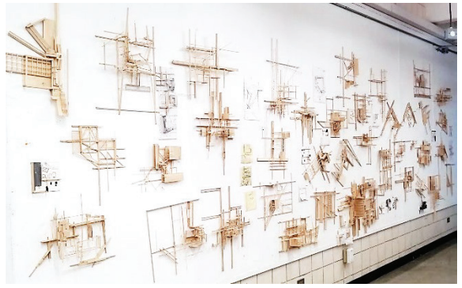


Fig. 1 *Architectural Foundation I Matrix Models, University of Idaho Fall 2022.*

Order, Rhythm + Tectonics

"*The long path through function to creative work has only a single goal: to create order out of the desperate confusion of our time."* Mies van der Rohe

Matrix Models in early compositional design studies

This research will access the significance of introducing matrix models into the design process at foundational level studios. Matrix models referenced in this paper consist of linear elements of multiple scales, connected with emphasis on the tectonics and details between the different layers. Matrix models are developed at the start of a project, between the analysis and schematic phase of the design; they are iterative in nature and could evolve into a supporting ground structure for the final intervention.
The matrix represents multiple layers on a site that generate the foundations and promenade to the new intervention. The main objective proposed from the introduction of matrix models is to allow horizontal and vertical elements in 2-Dimensional and 3-Dimensional compositions to exist at the same moment. While student often start with a sketch, collage, site plan or 2-Dimensional drawing, the matrix model introduces moments of extrusion and points of intersection with the landscape.

The biggest challenge in foundational studios is helping students understand their own design thinking process. In order for students to understand the potential of their ideas from conceptual words to 2-Dimensional and 3-Dimensional constructs. In the book Collage and Architecture, Jennifer A. E. Shields describes the tectonic legibility of Mies van de Rohe's perspective drawings and work as themes of pure form and skeletal visibility. Similarly to the ability of matrix models in transforming conceptual and factual elements of a site or project into a coherent building systems. Starting with foundational elements that conceptualize the space at multiple scales, from large scale global issues to local zoning requirements. The vertical structural systems provide the framework for the interior program and defined the edges for building envelopes. The notion of grounding the design in a horizontal form then extracting the matrix to design a vertical skeletal structure is shown in an example model in Fig 2.

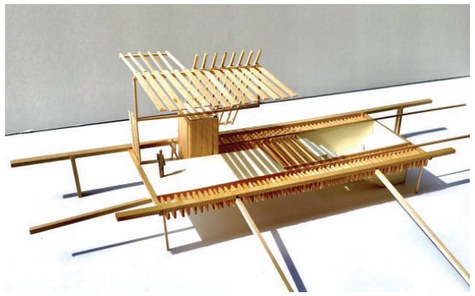


Fig. 2 Matrix model by Jade Fredericks.
Architectural Foundation I, University of Idaho Fall 2021.

Matrix models require a level of abstraction and the challenging of existing symbols within the context of the project. Mies used abstraction in building construction and vagueness of figure and field in the design of the German Pavilion in Barcelona. Construction lines and points of intersections translated into an architectonic language. "Abstraction played a critical role by exploiting the geometric potential of points, lines, and planes". (E., Shields, 2014)

Encompassing process of building Matrix Models

Matrix models start with an intersection of two lines on a piece of paper. Often driven by quick sketches students developed on site visits, or composite drawings based on a collage designed for a given prompt. Initially, students identify the moment of intersection on the site, followed by a datum that defines the orientation of the structure. In the next steps the horizontal lines intersection to create a structural skeleton of the model. In Mies van de Rohe's collage-drawings address an abstract ordering of space through planar configuration shown in Fig 3. The linear configurations come before the planar and massing elements as grounding and foundational systems. The models tend to dematerialize and descale the architecture speculation in the early phases allowing students to reconfigure and edit the models continuously. The mechanics of model making directly informs the mechanics of the construction process, composing edges and walls in the model orderly. The matrix model layering allows different elements to pass through multiple layers developing strong rhythmic languages.

The Potential of Structure

The book Studio Craft & Technique for Architects explains the potential of structure to serve the spatial concept beyond its durability to the assembly of the space. The design process of building a matrix model not only allows students to establish an understanding of the nature of structure by using linear elements, but also to explore different methods of incorporating the structural elements into the space with meaning and relevance to the design concept. Because of the nature of linear elements it offers
Cecil Balmond, "The mystery is in the unseen calculation of exact balance, of up versus down, of substance versus immateriality, of light against shadow". The mystery of the unseen or unknown provides unlimited possibilities to the extraction of spatial qualities of the design. (Delaney, 2018)

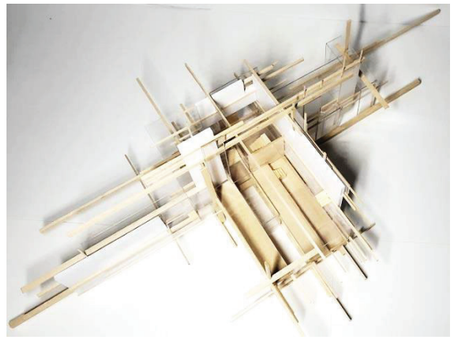


Fig. 3 Matrix model, *Architectural Foundation I, University of Idaho 2022.*

Layers between the axes

As part of the Matrix model assignments students are required to prioritize and organize the information provided and analyzed. The models maintain the spatial relationships between the x + y + z axes but the hierarchy is transformed: the architecture and landscape are juxtaposed, and the vertical structure is reflected onto the background. The interior figures of the matrix inform and foreground the surrounding landscape, challenging preconceived concepts of human behavior and interaction. As seen in Fig 4, the matrix is an inversion of the existing characterizes of the site, allowing the shadows on the site plan to suggest new pathways and methods of circulation. It established a successful opportunity for a dialogue between the architecture and context. Using linear elements of different sizes suggests the multiplicity of systems; ranging from existing elements on the site, to historical narratives buried in the ground for years. All layers can be exposed and organized accordingly to serve the concept.

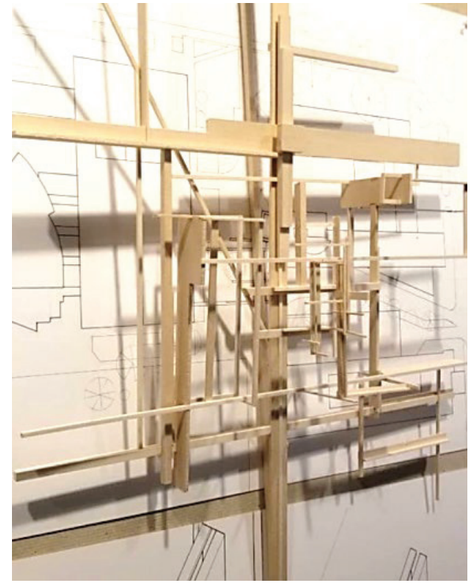


Fig. 4 Matrix model, *Architectural Foundation I, University of Idaho 2022.*

Matrix model as a tool for critical thinking

The Landscape Imagination book introduces critical thinking as a primary tool of critical actions in society, where multiple ideas and fields of discourse were drawn together into observations and arguments. Utilizing matrix models to question the existing is of maximum significance to landscape architecture and place making and a method of balancing art with life. The article Critical thinking and landscape architecture in the book introduced the practice of plotting to students as methodology of articulating the landscape. Similarly to plotting, matrix models encompass the same fourfold meaning and suggestiveness mentioned in the article. A machine of plotting, as a critically cultivating tool of our relationship to landscape through 4 steps:

1- Marking and building a piece of the ground, the moment of intersection on the model.
2- Representing the landscape graphically as a plotted map or plan, the translation of the analysis gathered and applied into the construct.
3- Constructing a narrative or time series, the incorporation of non-tangible or visible characteristics. A crucial point for students to take

ownership of the design and embrace their findings.

4- Suggesting the intentional and nonconforming act of formulating and hatching a plot, the moment in the model where decisions are required for the definition of the concept.

(Corner, 2014)

Based on James Corner's Landscape's cultural agency diagram, there are four methodologies that work circularly: Givens + Time defined in the research as knowns, and Potentials + Form measured as unknowns. (Corner, 2014)

Matrix models as knowns- Elements of Objectivity and Recovery

In this category are models or early layers that are based entirely on factual data, observational and measurements that are known and seen on the site. In this category layers reflect clear architectonic logic, defined scale figures and direct connections to the landscape. Through matrix models we can provide an accurate dimension of the physical site making. Known layers and models in Fig 5, adopt the practice of plotting as a method of abstracting the existing to generate the new. The time and givens are structured into the grid of the matrix.

A main part of the known and objective layers is scale. Scale is introduced to students as the definition of areas of meaning on the site, focused on the student's ability to define space and study the area requirements. Architecturally speaking, Eugene Raskin links scale to the meaning of "sense of security" defined by psychologist, as acceptance by the individual of their relationship with the environment. Architecturally speaking, this awareness of the environment and how one stands to regard it is evident in how students select the elements appropriate for the layer. Raskin states that scale responses are highly conditioned, as they depend heavily on what the eye has learned to expect and trained to interpret. (Raskin, 1987)

Fig. 5 Matrix models from Architecture Gallery project, *Architectural Foundation I, University of Idaho Fall 2022*

Matrix models as unknowns – Elements of Subjectivity and Invention

Within this group are models and layers that are based on opinions and points of view of the designer. In such layers the students express non tangible characteristics of the site. Such examples are considered personal interpretations, opinion, feelings and point of view. The layers reflect tension and shifts within the landscape, often not visible, for example the change in boundaries or loss of Native American Land over time. While the border shifts are not visible the effects of such actions leave imprints on the landscape. Unknown layers offer a strong exploration of cultural and social agencies. The work shown in Fig 6 represents the composite drawing accompanying the matrix model with transparent layers, consisting of multiple layers recorded during a site visit to the Olympic National Park, WA. The layers include senses; viewpoints, sound on the site, smell of water and materials identified from the context. Followed by Narrative layers, explaining the concept of the design on the site memories formulated from the trip. Finally the program and speculation drawing;
The final product of the following layers generates eidetic sites, future sites are considered imagined and projected leaving the design with the utmost possibilities of form.

Raskin, defines rhythm as a tool that appeals to roots of feelings. The emotional effect of rhythm can be verified by reactions and responses. While rhythm is intangible it offers an intense foundational system to the composite as show in Fig 6 and Fig 7.

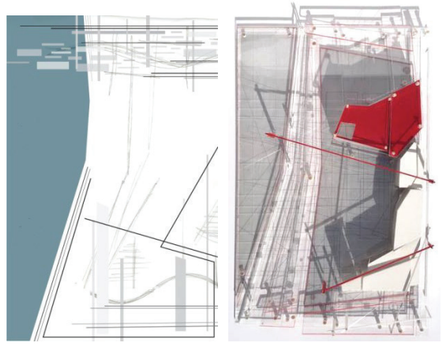


Fig. 6 Composite drawing and Matrix model by Amanda Eller, *Architectural Design III, and University of Idaho Fall 2019*

Observations and conclusion

How to embrace ambiguity in design

Ambiguity in form generation allows student to trust and explore their intuition. Using matrix models as a method of documenting ideas increase confidentiallity in the design process phase. When approaching a design matrix models allow one to start by mapping the context, adding site observation and research inlduing circulation, sun paths and sound movements in a space. The models provide a level of personability as students order the layers and information into a hierarchial organizational system. The individuality in every model is informed by decisions made by each student based on their interests and observation, knowns and unkowns, objectivity and subjectivity towards the design prompt.
Matrix models allow students to document their design thinking process in a 3-Dimensional perspective. The model's ability to grow infinitely provides students with unconstrained possibilities of their design and research. Having the ability to observe the students' progress over a year proved that students felt more confident and enjoyed ownership of the research and concept by having a model that records the process all the way to the final iteration.

Fig. 7 Matrix model by Trista Spencer, *Architectural Design III, University of Idaho Fall 2019*

Speculation

In a rapid moving world speculation remains the most critical thinking tool as it encompasses the knowns and unknowns, objectivity and subjectivity that result in a rich dialogue between the architecture and context. While we discussed the knowns and unknowns as separate layers, they need to exist together in a matrix model for the speculation to initiate a dialogue. Most importantly, it is the exposure students investigate with various methods of representation that helps them, understand their individual design thinking process...

Bibliography

Corner, James, and Alison Bick Hirsch. *The Landscape Imagination: Collected Essays of James Corner, 1990-2010*. New York: Princeton Architectural Press, 2014.

Delaney, Miriam, and Anne Gorman. Studio Craft & Technique for Architects. London: Laurence King, 2015.

E., Shields Jennifer A. *Collage and Architecture*, Mies van de Rohe, 71-75. Routledge, 2014.

Raskin, Eugene. *Architecturally Speaking*. Illustrations by Robert Osborn. New York: Bloch Pub. Co., 1987.

The Rules of the Game

Sarah Young, University of Louisiana at Lafayette
Annika Miller, University of Louisiana at Lafayette

Pre-pandemic, our first-year design methodology worked well for incoming students with prepossessed skills (drawing, making, time-management, etc.) and resources (money, time, social support, academic confidence, etc.), but it was bewildering and alienating for others. Post-pandemic, academic inequity deepened; many in our incoming class did not meet one or more requirements for university admission. Clearly, the learning needs of current students did not fit our existing pedagogy. In our existing system, the game would be rigged against many of our incoming students. As we redesigned our first-year studio, our guiding question was: how might we move from a first year that alienates and limits access to a first year that embraces students of diverse skill levels, resources, and needs?

This paper will examine one pedagogical change designed to help students navigate the various skills and mindsets required in an iterative design process: the separation of assignments into two types; technical skills assignments and exploratory skills assignments. For the first half of the semester, we divided assignments into one of these two categories. This split allowed the learning of two necessary but seemingly contradictory design mindsets – one methodical and precise and the other playful and outside the box. Students completed both types of assignments concurrently and separately, allowing them to shine in one area while building ability in the other.

A Rigged Game: Existing Pedagogy vs. Contemporary Students

The multidisciplinary first-year design studios at the University of Louisiana at Lafayette serve beginning design students in architecture, interior design, and industrial design. Beyond the requirements for university admission, there are no additional GPA or portfolio requirements for students to enter our design programs. Our aim is to provide all these students, regardless of their abilities on Day 1, with the skills necessary to progress into their discipline-specific second-year studios. Over 70% of our incoming students report having little or no experience with art or design education prior to starting our programs. Around 60% of our first-year students report planning to work at a job for at least 10 hours per week.[1]

It has long been the position of our faculty that one of the most essential foundational skills for the design disciplines is iterative design process. Therefore, our school has a long tradition of teaching iterative design in the First Year. For decades, our first-year studios have worked within a modernist paradigm prioritizing originality and individual artistic expression.[2] Our students were given an open-ended brief for each multi-week project; for example, “design a mask that embodies your personality.” They would then undertake a design process in which they created several iterations of gestural and, later, tectonic models assembled from any materials they chose. Many of these experiments would be unsuccessful, but students were expected to learn through their failure and by paying attention to successful strategies used by their classmates. These strategies were discussed during large group critiques that would take up most of the class time. Elements and principles were not explicitly taught; rather, students were expected to come upon these visual tools intuitively, learning the language of design through immersion in it. Successful project outcomes required an interrelated understanding of craft, design process, design elements and principles, materials, joinery, and more.

Fig 1. Self-portraits made by students in previous years.

Over the last several years, it has become clear that this paradigm of design education is not well-suited for contemporary students. Though minor incremental changes had been made in recent years to adapt the existing methodology to contemporary students’ learning needs (new grading rubrics to give students clearer feedback on

their progress, new presentations to explain concepts, provide inspiration, and set expectations, etc.), retention rates remained low (around 73%) and student stress levels remained high.

In part, the increasing ineffectiveness of the existing pedagogy had been due to significant generational shifts. Research shows that the current generation of students has grown up with a large degree of parental oversight and infrequent opportunities to fail and recover from failure. Therefore, learning through failure does not come naturally to current students and can be a great source of stress.[3] Gen Z has also grown up in a world where information has always been a Google search away. Utilizing oral critique as the sole source of course content is not well-suited to first-year students who have always been able to simply search for an answer when in doubt. This generation is also more practical and career-focused than generations past,[4] making them less inclined to trust the process when assignments do not seem directly related to their future careers (for example, how will designing a mask that embodies their personality help them become an architect?)

Fig 2. "Design a mask that embodies your personality."

Pre-pandemic, it was clear that the learning needs of our students were at odds with our first-year methodology. This mismatch was exacerbated by the pandemic. While research on college students post-COVID is still emerging, projections were that they would be less academically prepared and less mature than their peers just a couple of years ahead of them.[5] Furthermore, if pre-pandemic students experienced high levels of stress in first-year studios, it seemed unlikely that post-pandemic students would be more prepared to cope after two frazzling years of remote learning, social upheaval, and uncertainty.

Beyond these concerns, it had also become glaringly obvious that the existing pedagogy did not present a level playing field for all incoming students. Assignments that required the practice of complex, interconnected skills presented a difficult learning curve for all incoming students, but it presented intensified challenges for students who entered with little or no art, design, or hands-on craft experience. Students who entered with little experience or little confidence in their creative skills were at a distinct disadvantage compared to their peers with more experience. Additionally, students with limited resources (limited money for supplies, limited time to spend on homework due to work schedules, limited support from friends and family to pursue a creative degree, etc.) could easily be derailed in the existing system. Frustrated or overwhelmed with the course, a sizable portion of our students would inevitably withdraw from the course mentally, socially, physically, or officially.

It was clear that a more equitable, scaffolded pedagogy was necessary for developing a solid foundation of skills for all incoming students, no matter their background. Sweeping structural change was necessary to meet incoming students where they are and remove barriers to their success. Through a faculty task force and a student focus group, we gathered feedback and strategized improvements. The primary question we attempted to answer as we redesigned our first-year pedagogy was: how might we move from a first year that alienates and limits access to a first year that embraces students of diverse skill levels, resources, and needs?

The Split: Technical Skills Assignments vs. Exploratory Skills Assignments

Acknowledging that our incoming students come from diverse backgrounds and experiences, and therefore, have different strengths and areas of comfort was a key insight in the course redesign process. How could we play to each student's strengths while simultaneously developing new skills? Our answer to this question was to split our assignments into two types: technical skills assignments and exploratory skills assignments.

For the first half of the semester, assignments would be split into these two categories to create diverse learning experiences to match a diverse incoming cohort. Technical skills and exploratory skills each require particular mindsets. In this context, we use the term "mindset" to mean the

Technical Skills Assignments	Exploratory Skills Assignments
Vocabulary and craft skills	Iterative Design Skills
Closed-ended instructions	Open-ended instructions
Mostly individual	Mostly in groups
Precise	Rough
Slow and Quiet	Quick and Active
Teacher feedback	Peer feedback

Table 1: Characteristics of "Technical Skills Assignments" and "Exploratory Skills Assignments."

attitude with which students should approach the assignment. Technical skills (like cutting, gluing, and measuring) require a careful, precise mindset, while exploratory skills (like ideation and prototyping) require a playful, outside-the-box mindset. Each incoming student usually starts off feeling more comfortable in one mindset over the other, but it is important for them to learn how to work well in both. Each attitude is important at specific moments during the design process; there is a time for quick, rough idea generation and a time for careful precision and working out the details. We wanted to give each student opportunities to exercise the skills and mindsets they are comfortable with while practicing novel approaches to expand their comfort zone. In theory, by having two types of assignments run concurrently, students would always be working on one assignment they could feel confident about, and another that would challenge them to hone less developed skills.

On Day 1, we explained that the course would have two types of assignments. Each assignment type was intended to teach them two contrasting mindsets essential to design practice, and each was essential to master at the foundation level before entering their discipline-specific studios in the second year. We explained that they would likely feel more comfortable with one over the other and that this was perfectly normal. We also explained that they would practice these skills and mindsets independently at first and that as the semester progressed, they would begin to decide for themselves the appropriate approach for the task at hand.

Written instructions for each assignment were provided in a weekly assignment sheet packet. Each assignment sheet included the following information: assignment instructions, the mindset and level of craft required for the assignment, a supplies list, learning objectives, real-world applications in professional design practice, and a glossary of new terminology. If a student missed class, the packet allowed them to see what they missed and to catch up.

Technical Skills vs. Exploratory Skills

What we called "technical skills" were skills related to craft (measuring with a ruler, cutting with an X-acto knife, etc.) or developing design-related vocabulary (identifying examples of each of the design elements, identifying gestalt principles used in a magazine layout, etc.) These assignments asked students to read instructions and definitions closely, plan ahead, and practice doing things correctly. What we called "exploratory skills" were skills related to iterative design (ideation, rapid prototyping, etc.) These assignments asked students to experiment, make things quickly, and suspend judgment until later.

Closed vs. Open-Ended Instructions

Technical skills assignment instructions were closed-ended: each student's final submission must conform to the same requirements and constraints. These assignments often asked students to demonstrate that they could correctly identify key terminology. In contrast, exploratory skills assignments asked students not to look for correct answers, but to look for possibilities. In much of their previous academic experience, students may not have had an opportunity to grapple with ambiguity or open-ended experimentation. Exploratory skills assignment instructions were open-ended to allow many ways of satisfying the requirements, and students would proceed with the understanding that every student's project would satisfy

Fig 3. Students become more comfortable with quick, imperfect experiments in their exploratory skills assignments.

them differently. Students who found the open-ended assignments to be uncomfortable could take comfort in the technical skills assignments' lack of ambiguity as they expanded their comfort zone. For students who found the technical skills assignments to be dry and boring, exploratory skills assignments offered an outlet for demonstrating their creativity.

Individual vs. Group Work

Technical skills assignments were primarily done individually and were therefore suited to students who prefer to work alone and have total control over the result. Individual assignments set expectations that all students would be held accountable for learning specific skills. Exploratory skills assignments were primarily done in groups of 4-5 students. These group assignments were more suited to students who prefer to learn more socially, with the help and input of their peers. Group assignments set expectations that design is often a collaborative endeavor and that learning to work well with others is an important design skill. Students who are frustrated by group work could prove their skills and dedication through their technical skills assignments, while simultaneously developing their collaborative skills. For students who are shy and reserved at first, especially those that perceive themselves to be "other" within the cohort, group work could help connect them with their classmates early on and ease their feelings of otherness. For students who are naturally more social, group assignments would provide a built-in social outlet.

Precise vs. Rough Craft

Technical skills assignments asked students to demonstrate care, precision, and a methodical approach to craft with few and minor deviations from the assignment requirements. Exploratory skills assignments started off with quick, rough sketches and prototypes, asking students to prioritize speed and quantity of ideas over perfection. Students who naturally strive for perfection can embrace this tendency in their technical skills assignments while becoming more comfortable with quick, imperfect experiments in their exploratory skills assignments. Likewise, students who struggle with precise craft can practice their craft skills while finding relief in assignments in which craft is not a priority.

Slow and Quiet vs. Quick and Active

Time spent during class on technical skills assignments was typically slow and quiet; students put on their headphones and worked at their desks, learning to absorb themselves in focused work time. In contrast, during exploratory skills assignments, students were gathered at each other's desks, talking rapidly while sketching ideas or holding pieces of cardboard together while another student quickly taped them together. In these contrasting settings, students who work well in one setting over the other would spend half their class time in their preferred work environment while getting used to the contrasting work environment. They could also notice what kinds of environments they work best within and use this knowledge to decide how, where, and with whom they wanted to work on homework outside of class.

Fig 4. Group assignments, such as the Marshmallow Challenge, set expectations that design is often a collaborative endeavor.

Teacher Feedback vs. Peer Feedback

During the first couple of weeks of technical skills assignments, teachers critiqued students individually at their desks, allowing students to ask questions without feeling self-conscious in front of the group. During exploratory skills assignments, students in each group were asked to provide feedback to their peers in other groups. By having students actively engage in peer-to-peer critique from the start, they see each other as sources of feedback and support. Because most feedback up to midterm is private or given to the whole group, students become used to receiving feedback before being publicly critiqued, making individual public critiques later in the semester less intimidating.

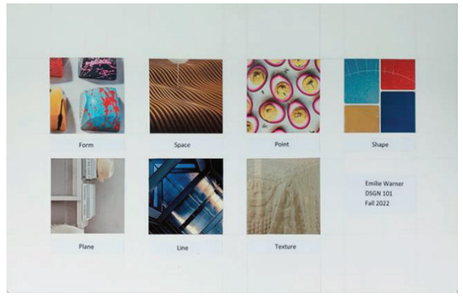


Fig 5. Example of technical skills assignment, Elements of Design.

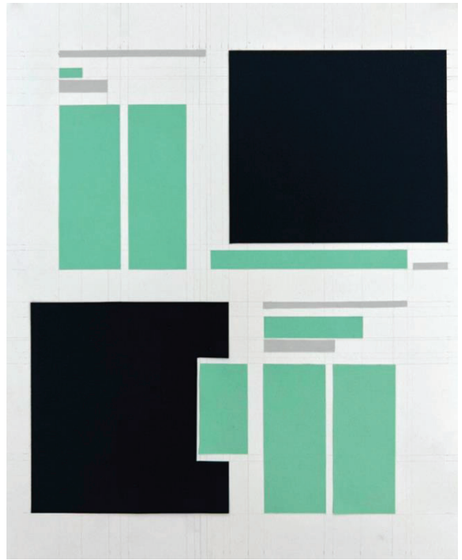


Fig 6. Example of technical skills assignment, Gestalt Principles.

Scaffolding Craft-Skills and Vocabulary through Technical Skills Assignments

Technical skills assignments were a scaffolded series of vocabulary- and craft skills-building assignments. In these assignments, students created a series of well-crafted boards exemplifying the "rules" of design (elements, principles, gestalt, and color principles) through magazine or paper cutouts.

To build craft skills, technical skills assignments began with demonstrations and detailed step-by-step instructions for using an X-acto knife, using a metal ruler to cut a perfectly straight edge, drawing a gridded layout, neatly gluing, etc. Assignments become more complex as the weeks went on, at first asking students to strictly follow a given layout composed of squares, later asking them to design their own visually balanced layouts using various sized rectangles, and so on. The step-by-step nature of technical skills assignment instructions allowed the students to stay on track and eliminated confusion about the end deliverable. This clarity also facilitated greater peer-to-peer communication; having a concrete goal made students more likely to give each other advice.

To build vocabulary, technical skills assignments asked students to first identify elements and principles of design before being asked to apply them. Examples of elements and principles of design found in magazines were to be neatly cut out and displayed on each board. We began with the least abstract concepts, first identifying design elements of design (point, line, shape, plane, form, and texture), then principles of design (symmetry, asymmetry, alignment, axis, etc.), gestalt principles of perception (common region, figure-ground, similarity, etc.), and finally, color theory. Glossary crossword puzzle assignments were administered alongside these assignments to reinforce the learning of key terminology.

By asking students to discover found examples in magazines, they were unable to search and print examples from the web. This ensured that students discovered and understood design elements and principles before they were asked to apply them in their own work. If a student wasn't sure they had found a good example or which example they should choose to best exemplify the term, they could discuss the term in more depth with their instructor to gain a deeper understanding of the concept. Until midterm, students simply demonstrated their understanding of the terminology; afterward, they applied the elements and principles of design through three-dimensional compositions in assignments that combined technical and exploratory skills.

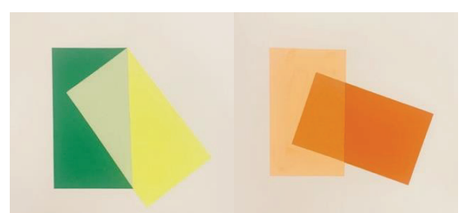


Fig 7. Examples of technical skills assignment, Color Theory.

While taking this studio course, students were enrolled in a co-requisite lecture course designed to align with the learning objectives of the studio. In this support course, the content aligns directly with each technical skills assignment, reinforcing the vocabulary and exposing students to examples of elements and principles of design used in actual architecture, interior design, and industrial design projects. These real-world examples help students understand the importance of learning these "rules" even though they are perhaps more abstract than they expected.

Scaffolding Iterative Design Skills through Exploratory Skills Assignments

To learn skills of iterative design process in the exploratory skills assignments, students were first asked to complete a series of exercises designed to help them become comfortable brainstorming and drawing in front of each other. To this end, students completed the Marshmallow Challenge[6], practiced drawing confident lines, and played Pictionary during the first two weeks of class.

In week 3, students began the "Game Day!" project, a group assignment in which students are asked to design a new game. For this first design project, students were not graded on whether their game was the most fun, instead, they were graded on whether or not their group meaningfully engaged in ideation, prototyping, and evaluation during their game's development. The intention of this assignment is for students to learn to use the steps of an iterative design process without the pressure to create beautiful objects. As they learn the basic steps, they simultaneously and separately continue to refine emerging visual vocabulary, manual skills, and creative confidence through their technical skills assignments.

The Game Day project begins with an individual comparative analysis of two games that the student has played in the past. Thinking through their own experiences of games, their rules, and what makes them fun provides a starting point for considering their future games. With this analysis in mind, groups of 4-5 students are assigned a random object (e.g., rubber gloves, dental floss picks, shower curtain rings, etc.) that they must incorporate into a new game. Groups begin their work together by considering all the ways they can use their given object. However mundane their object is, through wild brainstorming and experimentation, various intended, unintended, and comical

Fig 8. The process for designing games allowed students to continually refine, experiment and prototype without the pressure to produce beautiful, well-crafted objects at each stage.

Fig 9. A student is explaining the rules of their game to the players.

uses of the object quickly emerge. Through lively banter about the possibilities held by their object, the students loosen up and get to know each other better. As the game development advances throughout the next few weeks, the students create prototypes for whatever their game requires; goal posts, game boards, catching apparatuses, etc. For their first prototypes, students are encouraged to start with rough, 5-minute models using paper, cardboard, masking tape, and whatever else is on hand. Over the next few weeks as the game develops, students introduce new elements, develop game rules, refine their prototypes, and test and provide feedback on their peers' games. Through an iterative process of ideation, rapid prototyping, testing, and evaluation, students quickly design fun, interesting new games in a low-stakes, collaborative environment. At the culmination of this project, first-year students invite their upper-level near peers to play their games in a new annual school-wide event: Game Day!

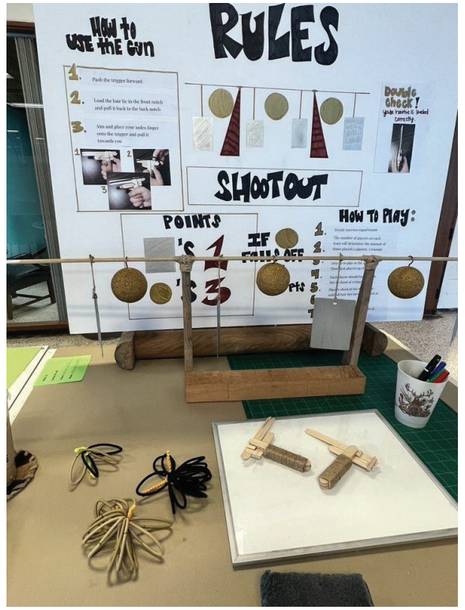


Fig 10. The rules are defined and refined, and finally, they are ready for the big reveal: Game Day!

Fig 11. Building community and studio culture at our first Game Day event.

There were several goals for this project that reached beyond providing a foundation for future design projects. In the past, as many as 30% of our students ended up switching to another major or leaving the university. Knowing that students may not stick with their design major, it was important to provide them with useful, transferrable skills before the deadline to withdraw from a course.

Through the Game Day project, students learned the basic iterative design skills that could be used in any field. This project was also intended to foster peer-support networks through low-stakes group work. Through this project, first-year students were able to get to know each other early, empowering them to navigate the challenging work ahead with peer support. This project also helped build community between our first-year students and the rest of the School of Architecture and Design. Game Day acted as our first-year students' debut within the school's community, and students from all year levels and disciplines accepted the invitation to attend. At the event, the typical power dynamic between first-year students and upper-level students was inverted; upper-level students were beginners at the games, while first-year students held positions of power as game experts. This provided a venue for students in different year levels could meet each other and connect on a level playing field. As one of the first whole-school gatherings after years of pandemic isolation, the event also created an opportunity to rebuild the in-person studio culture which had been lost.

Combining Technical and Exploratory Skills

While the first half of the semester requires the separate practice of technical and exploratory skills, after midterm, students begin to use these skills in tandem in their first formal design project. The second half of the semester was scaffolded into phases based on knowledge of design elements and principles gained from their two-dimensional boards. Rather than simply identifying examples, students now began to apply these elements and principles, developing their own visual language through three-dimensional study models. Students developed their visual language over several weeks through assignments of growing complexity, eventually using it to create a functional and attractive window screen for our studio space.

During the first phase of the combined skills project, students use their technical craft skills to build a "Widget," a 4"x4" cubic volume of foam core planes that followed a given set of rules (e.g. include one diagonal element, include one arced element, etc.) While the guidelines for assembly are the same for everyone, each widget produced is totally unique. Students are able to rely on the craft skills used in previous technical skills assignments to create a well-crafted result. This widget is set aside for the next phase but will be revisited later on in the project.

Students are then assigned two design elements and two design principles each and create a series of small study models exploring different ways of using their given elements and principles. Students are encouraged to use their exploratory skills throughout this assignment, creating multiple rough "low fidelity" prototypes to quickly explore

several possibilities, and using their favorite prototypes as the basis for more and more refined versions which form the basis of their visual language. Students are prompted to

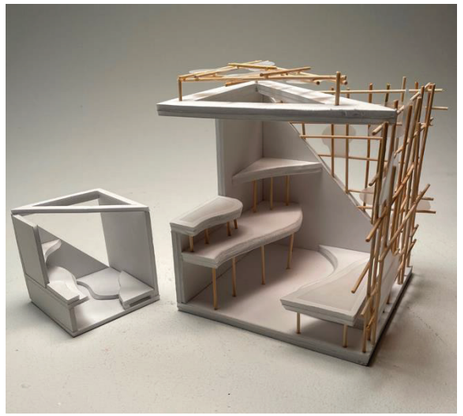


Fig 12. Original "Widget" and edited "Widget" at twice the scale.

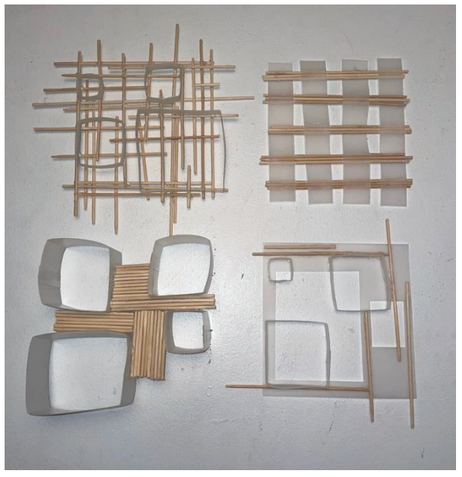


Fig. 13. Rough "low fidelity" prototypes using a visual language.

select the appropriate mindset and level of craft for the task at hand. By going through the exploratory assignments earlier in the semester, students understand the value of using quick exploratory sketching and modeling as ideation tools before spending more time and care on more detailed, crafted drawings and models. Furthermore, through the creation of 20-30 prototypes all using the same elements and principles, students begin to understand that the design elements and principles can be used in infinite ways.

Students then remake the original widget at twice the scale, editing as necessary to make their new widget formally match their visual language. During this assignment, elements and principles come to be understood less as a set of rules, and more as useful tools for creating a cohesive design.

Finally, students are asked to develop their visual language into a 16"x18" window screen for the studio space. Using their earlier experiments as a starting point, students create study models that use their visual language to filter sunlight, creating indirect light for the design studio while being a beautiful object in itself.

We asked our students to consider the transparency of the window, the opacities of their materials, and layering effects, all while creating a set of rules based on their design language and in response to different lighting conditions on their given site. Students must also consider weight limitations and create full-scale mock-ups of how their window screens will connect to the window. During the last week of classes, the window screens are installed in the studio windows, forming one large-scale installation created by the entire cohort in which they have used all their technical and exploratory skills combined.

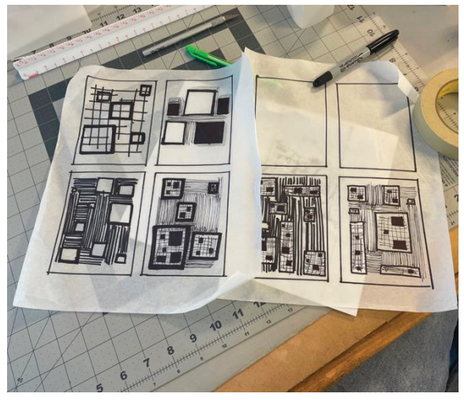


Fig 14. During this assignment, elements and principles come to be understood less as a set of rules, and more as useful tools for creating a cohesive design.

Outcomes

Projections about intensified academic inequity in our incoming class were well-founded: an unprecedented 40% of our incoming first-year class failed to meet one or more of the university's requirements for admission and thus were admitted "by committee." This meant that the academic preparedness of our incoming class was at an all-time low.

Fig 15. A final window screen installed.

Despite this fact, retention, class attendance, and learning outcomes were significantly improved from previous years.

Comparisons of attendance records and final grades between this class and the previous class show evidence of improved outcomes. Class attendance was dramatically improved with the new methodology this year. Our syllabus sets 9 or more absences as the threshold before triggering an automatic failing grade for the course; last year 24% of students had 9 or more absences, and this year only 8% of students had 9 or more absences. This suggests that our new methodology encourages students to stay more engaged with the course. Furthermore, there was a significant increase in the number of students eligible to continue to their next design studio from 73% last year to 86% with the new methodology, suggesting that learning outcomes were acquired more evenly by this cohort.

More anecdotally, while we started formally designing far later in the semester than in years past, faculty felt that iterative design skills were acquired more evenly by all students, and they showed a deeper understanding of how and why iterative design is useful. First-year faculty also remarked that, compared to previous cohorts, students demonstrated a vastly improved ability to use appropriate design-related terminology and confidently speak about their work. Faculty also reported that far fewer students were "outsiders" in their studios or withdrawn during class activities. Almost all students seemed confident enough to speak up in class, or at the very least, to meaningfully discuss their work with their classmates. Students were also more supportive of their peers; they were quick to share advice and extra supplies with their classmates and unafraid to ask for help from peers and teachers. Additionally, fewer students fell behind on assignments, likely because the addition of weekly assignment sheets made it easier to catch up on work missed due to absence. All around, students seemed to be less stressed, more excited about their work, and appeared to genuinely enjoy their time spent in class.

Outcomes show that scaffolding both technical and exploratory skills allowed incoming students with a range of experiences and skills to build a well-rounded foundation of design skills. By scaffolding technical skills and exploratory *skills* separately, students were able to develop their undeveloped abilities while simultaneously demonstrating their strengths, resulting in both greater well-being and improved learning outcomes across the cohort. Additionally, teaching technical and exploratory *mindsets* separately allowed students to become comfortable with different approaches to drawing and making. By practicing different approaches, they were able to select the appropriate level of craft and amount of time (quick and rough, careful and refined, or somewhere in between) to devote to their prototypes at earlier and later stages of the iterative design process.

End Notes

1 University of Louisiana at Lafayette. Day 1 Survey, "DSGN 101 Student Responses". University of Louisiana at Lafayette. August 2022.
2 Meredith Davis. "Teaching Design: A Guide to Curriculum and Pedagogy for College Design Faculty and Teachers Who Use Design in Their Classrooms" Allworth Press, an imprint of Skyhorse Publishing, Inc. 2017. p 3-46
3 Hart, Susan. "Today's Learners and Educators: Bridging the Generational Gaps". Organization for Associate Degree Nursing. Published by Elsevier Inc. 2017. p 254.
4 Chasteen Miller, Amy. Mills, Brooklyn. "'If They Don't Care, I Don't Care': Millennial and Generation Z Students and the Impact of Faculty Caring" in Journal of the Scholarship of Teaching and Learning, Vol. 19, No. 4, October 2019. p 79
5 Emma Dorn, Bryan Hancock, Jimmy Sarakatsannis, and Ellen Viruleg. "COVID-19 and education: The lingering effects of unfinished learning". McKinsey & Company. 2021. P 2-5
6 Suzuki, N., Shoda, H., Sakata, M., Inada, K. "Essential Tips for Successful Collaboration – A Case Study of the "Marshmallow Challenge"". In: Yamamoto, S. (eds) Human Interface and the Management of Information: Applications and Services. HIMI 2016. Lecture Notes in Computer Science(), vol 9735. P 82

Room City: Towards An Architecture of Urban Interiors

Leyuan Li, University of Colorado Denver

Abstract

The paper presents a series of design experiments in sophomore architecture studios. It investigates the unknown and underrepresented territory of the interior in architectural education in response to the current socio-political climate, proposing an interior-oriented framework that restructures the relationships between inside and outside, domestic and urban, and individual and collective, among others.

Historically, the regime of the interior has always been positioned independently from the territory of urbanism and inferior to the major canon of architecture. In disciplinary discourse, divergent voices have promoted architecture either as an autonomous object that emphasizes its physical, exterior qualities in the urban fabric, or as an activist-protagonist project that engages the social and political landscape through its exploration of entanglements between forces and tensions. It is not difficult to discern that in architectural education and practice, the overemphasis on the geometry, envelope, and external forces of the built form has led to the neglect of interiors and interior objects that define the inner space of the built environment—the immediate habitat around us. As a result, the interior has been relegated to a separate, minor realm of attention regardless of the urban and social effects informed by these often-overlooked elements.

To confront such a dilemma, the paper intends to foreground the instrumentality of the interior in the current architectural paradigm, exploring its unknown physical, spatial, and social significance in relation to the known territories of architecture, such as form, geometry, and materiality. It examines different typologies and organizations of the interior, seeking new spatial possibilities of domestic and public interiors that respond to the climatic, cultural, and social conditions of the urban environment. Departing from the introduction of several drawing techniques, including orthographic drawings and diagrams, the paper starts with the methods of analyzing and distilling interior urban typologies from canonical architectural works. It then introduces a pedagogical approach that empowers students to speculate on the ideas of *Room* at divergent scales and arrive at their perceptions and concepts of *Room City*. By presenting detailed line drawings, collages, and large-scale physical models that showcase the qualities of the interior in studio projects, the paper aims to demonstrate the effort of experimenting with an interior-oriented model for producing new forms of urban and public experience in beginning design studios.

Interior as Urban Condition

Interior and Urbanism have been positioned at divergent poles of spatial practice. Acting as a mediator, architecture has always been called to restructure the divide. The last century has witnessed the rapid construction of vast interior spaces well engineered by revolutionary, mechanical technologies. With its transcendent capacity to traverse the limits of dimension and orientation, the territory of the interior began to swell, expand, and interconnect, rendering eligible a new urban model that overwrites the convictions of conventional urbanism. With its powerful apparatus pumped by the machine of capitalism, the grand interior has preceded and superseded architecture by dissolving its boundary and collapsing its appearance. By removing the role of architecture from the equation, the emergence of the interior became the new world of infinite projection and subjection—an overarching, spatial machine unleashed to exacerbate the increased polarities of Interior and Urbanism.

The massive proliferation of the interior is senseless, formless, and endless. It engulfs and integrates every project of the capitalist world—shopping malls, airports, and galleries—into a seamless whole. Diagnosed by Rem Koolhaas as "Junkscape," these spaces are curated, immersed in the pure enclosure of laissez-faire consumerism, and molded into a pernicious network that rejects any legible logic and framework of urbanism. It relies on the total control of artificial illumination and air circulation and refuses to engage the exterior, resulting in the increasing concern around Interior Urbanism that is formless, unsustainable, privatized, and thus hard to be regulated and balanced. Amidst social, environmental, and political complexities and precarity between Interior and Urbanism, how does architecture manifest itself through its entanglements with form, materiality, and technology? How do we, as spatial planners, position the role of architecture that proactively engages the challenges intertwined with the interior and urban, promoting a sustainable, healthy mode of Interior Urbanism that expands the disciplinary boundary of architecture?

In response to these questions, a series of teaching projects, entitled *Room City*, calls for an increased agency to address the precarious violence between Interior and

Urbanism. It introduces a series of design strategies and concepts as productive armatures to reconsider the relationship between the interior, architecture, and the city, redefining the convoluted relationship between the sheltered interior and the exterior world. In doing that, the studios shed light on the instrumentality of the interior from two perspectives. On the one hand, it focuses on the flexibility and adaptability of domestic interior spaces that could be reconfigured to accommodate a variety of users and activities that engage the ever-changing nature of the urban environment. On the other hand, it focuses on the investigation of interior typologies that are seamlessly integrated into the network of urban spaces, seeking spatial tactics that produce interior public spaces in response to current environmental, social, and cultural issues deeply entrenched within our societies.

To elaborate on the emphasis on domestic and public interiors, the essay is intended to showcase a series of students' works from two beginning design studios that I instructed at the University of Houston in 2022, entitled *Urban Room* and *A Collective Interior for the Homeless*. As the third and fourth studios in the undergraduate sequence that introduce students to fundamental design principles, strategies, and concepts, students are tasked with investigating small-scale design problems to understand the complex relationship between the context, architecture, and the interior, while comprehending drawing conventions and representational techniques to delineate the architectural work.

Teaching Methodology

Precedent Analysis as Analytical Tool

The studios depart from a systematic taxonomy of distributed precedents that familiarize students with certain preconceptions and prerequisites related to domestic and public interiors. Each student is assigned a precedent and tasked with collecting comprehensive information that thoroughly documents the precedent. After organizing the research materials in a way that demonstrates the architect's design intentions and methodologies, each student uses the collected information to develop a comprehensive set of two-dimensional drawings in Rhino, including plans, sections, and elevations, representing the architectural work in an accurate manner. Through the exercise of drafting, students are tasked with measuring the dimensions of typical building components and developing a better understanding of drawing conventions.

Moving forward, each student constructs a detailed digital model and creates a set of orthographic diagrams using the digital model and its corresponding drawings. This synthetic set of diagrams and drawings serves as the medium for dissecting all possible matters related to the design method deployed in the architectural work, including but not limited to its organization, spatial logic, building typology, circulation, structure, as well as the relationships between exterior and interior, solid and void, and public and private. To better embody the architect's design methodologies, each student is required to develop the documentation precisely and thoroughly, and format their precedent analysis using a provided template.

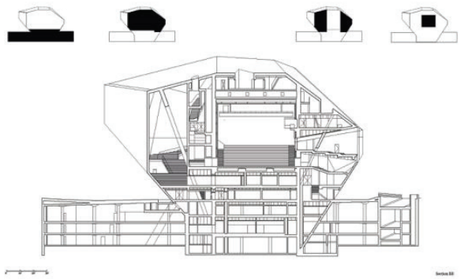


Fig. 1 Precedent analysis of OMA's Casa da Musica by student Isabel Albuquerque.

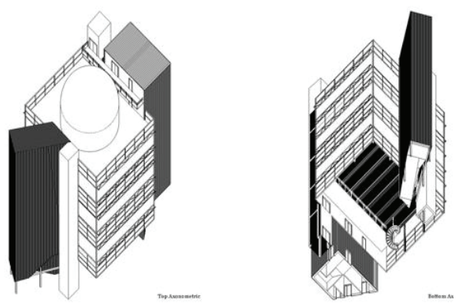


Fig. 2 Precedent analysis of Bruther's New Generation Research Center by student Brandon Garcia.

Material as Quality

To comprehend the material dimension of the interior spaces, students are tasked with using collage techniques and making large-scale physical models to experiment with different combinations of materials. In collages, different textures, colors, human figures, plants, furniture, and other interior objects are used to represent the desired qualities and ambiance of the interior spaces. In large-scale room models, students are asked to select a domestic room from the distributed precedent and make a detailed 1" room model. Rather than replicating the existing conditions, students are challenged to reinvent the room through the reinterpretation of layouts, materials, and interior objects. As a new domestic program is required to be introduced in combination with the existing program, this exercise not only provides an excellent opportunity for students to experiment with alternative materials and techniques to represent the domestic interior, but also guides students to investigate the ideas of flexibility, adaptability, multi-functionality that speculate on the relationship between the furniture, body, and the immediate space around them. This exercise also lays out the foundation for students' future development of their studio projects in the making of a detailed sectioned model.

Fig. 3 3/8" chunk model by student Eddy Sanchez.

Entourage as Protagonist

In the studios, the role of an entourage is emphasized as a critical part of the design process rather than as a populating tool in architectural representation. Historically, entourages have been often considered as a group of off-centered elements, such as people, plants, furniture, and other interior objects, that indicate the scale and the spatial atmosphere of the created space. In other words, the entourage is often placed in a subordinate position to centralize the audience's attention toward architecture. In these two studios, the relationship between the entourage and architecture is interrogated. Rather than merely using entourages to delineate the qualities of the space, students are tasked with understanding the scales, materials, and activities of different types of entourages and how these objects could be deployed to impact the thinking and making of architectural spaces. For instance, in one of the student projects, the entourages of single mothers with their children are analyzed to help devise a series of interior elements that could be adjusted to accommodate the specific users' needs. These entourages are actively considered in this student's design thinking that ultimately shapes the making of architectural spaces.

Furniture as Operation

Another important layer of the studios rests on the spatial and formal significance of furniture in contemporary spatial practices. Placing emphasis on the adaptability, flexibility, and materiality of the furniture, it aims at guiding students to progress from the small to the large, from the minor to the major, understanding the agency of furniture as a measure to expand disciplinary boundaries. In line with my research project, Balchen (Fig.1 and Fig.2), the investigation of furniture evolves into the unfolding of the scalar relationship between furniture, interior, building, and city. Furniture is powerful. It is the most immediate tool that produces architectural programs by directly influencing the user's actions and sensations. It performs as the measure between space and the human body, in a similar fashion that architecture serves as the framework between the interior and the urban. This similarity between furniture and architecture as the interconnecting medium has informed my teaching of producing furniture as micro-architecture, calling attention to the manifold relationships between part and whole, object and field, inside and outside, stable and unstable, generic and specific, and stagnant and flexible, among others.

Fig. 4 “Balchen” installation at the 9th Bi-City Biennale of Urbanism and Architecture in Shenzhen by Office for Roundtable.

Room City as Public Interior

In the sophomore studio that I instructed in the Spring of 2022, *Urban Room*, students start with investigating the long tradition of the public interior and approaching large-scale interior environments by analyzing canonical precedents across the world. Each precedent is dedicated to manifesting a peculiar set of formal gestures, internal organizations, and urban typologies that contribute to the distinct urban experience evoked by the interior space. For instance, in the building for the Faculty of Architecture and Urbanism at the University of Sao Paulo, designed by João Vilanova Artigas and Carlos Cascaldi, a large central space, made possible by its structural specularity and open accessibility, performs as an interior plaza that convenes public events and activities at different scales and sizes. In the Ford Foundation, designed by Kevin Roche John Dinkeloo and Associates, an interior garden is integrated within a greenhouse-like atrium surrounded by open office floor plans. The generous green space with flourishing vegetation, together with open terraces and other spaces in-between, provides a convening space for the workers as well as an interface between the Foundation and the city.

Each student begins with analyzing the elements, organizations, and systems of the precedent's interior in relation to its envelope and built form through a series of planar and sectional diagrams, representing the spatial qualities and attributes of the embodied interior urban typology through bird's-eye and worm's-eye axonometric drawings. In combination with the student's research on the social and cultural dimension of the precedent in relation to its situated context, these diagrams and drawings are organized in a booklet to establish the narrative of the collective political system that informs the relationship between the conditioned interior territory and the outer world.

Moving forward, students are asked to distill the design methodologies embedded in the precedents and apply them to generate an institutional building located on flat, open terrain near the Menil campus. Situated adjacent to museums, such as the Menil Collection and Menil Drawing Institution, as well as to campus facilities, such as the University of St. Thomas, the public building should include a series of dormitories, an indoor sports field, a book store, and a coffee/lunch shop. Hybridizing the distilled design strategies with the programmatic complexities, students are asked to consider how the researched public interior could be edited and translated into a spatial, material assembly in dialogue with the environmental and social conditions of the site. For instance, as shown in the drawing, the student draws on the typology of the interior garden inherited from the precedent and proposes a sports court that is integrated with the landscape on the ground floor, continuous with the outdoors, and accessible to the public. The rigid grid system and open floor plan in the project are also informed by similar spatial tactics deployed in the precedent of Lynch’s Ford Foundation.

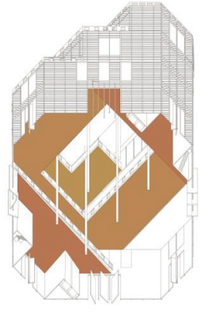


Fig. 5 Worm’s-eye Axonometric Drawing by Evelyn Huerta Munoz.

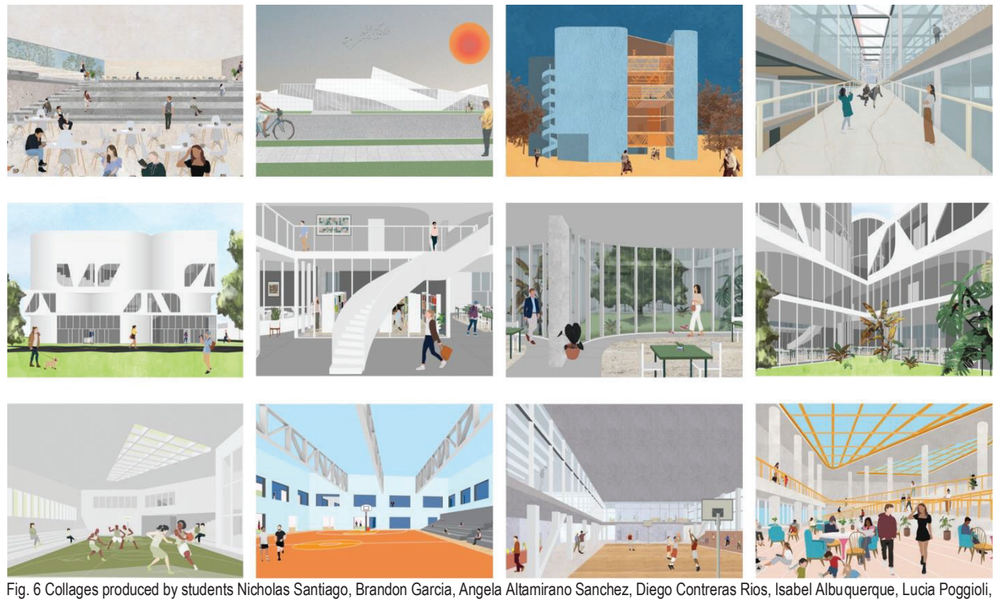


Fig. 6 Collages produced by students Nicholas Santiago, Brandon Garcia, Angela Altamirano Sanchez, Diego Contreras Rios, Isabel Albuquerque, Lucia Poggioli, Amal Khalil, Elizabeth Mendoza.

During the final development, students are asked to delineate their desired imagery of the urban rooms using collages and consider how the combination of colors, materials, textures, and entourage elements would inform the dynamic and atmosphere of these interior public spaces. In addition to a 1/8” physical model that reveales the spatial organization of their project, each student is asked to produce a series of detailed technical drawings that consider the tectonic and structural aspects of the building assembly that make possible the large-scale infrastructure in the interior. Through exploring representational tools at divergent resolutions and scales, students improve their abilities on material practice that transitions from the idea to the constructed form, and from the abstract apparatus to the assembly of material realities.

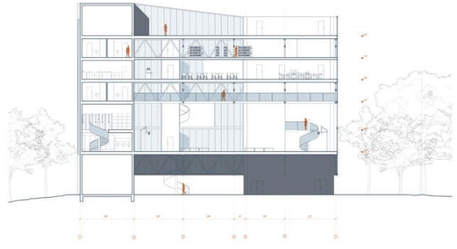


Fig. 7 1/8” section by student Brandon Garcia.

Fig. 8 1/16” models produced by students.

Room City as Domestic Interior

A Collective Interior for the Homeless is the second studio under the theme of *Room City* that expands into the territories of domesticity. By unfolding the spatial and material tactics of domestic interior spaces, students are asked to speculate on new modes of domesticity in producing the wellness of inhabitants and the productivity of a community around Downtown Houston.

As the first architectural studio that introduces small-scale design problems, students are tasked with developing a collective housing scheme for the homeless by investigating the organization and system of interior elements. Located at 110 Milam Street, the site is a historic building that was part of Houston Ice and Brewing Co's Magnolia Brewery Complex and is nowadays occupied as a private residence. Three of the four facades are preserved with original bricks, while the northwest facade is renovated with curved curtain walls. In order to perpetuate the building's historical legacies, students are not allowed to disrupt the major framework of the structure or eliminate the original envelopes unless certain design gestures are deployed to improve the building performance, such as introducing more natural light and passive ventilation. This design constraint leads students to explore the dialogues between envelope and interior, new and old, preservation and restoration, and inside and outside, among others.

Fig. 9 Site analysis by student Lara Rafols.

To begin with, students are assigned canonical precedents to research different spatial organizations that represent certain preoccupations and presumptions of housing, understanding how the specific arrangements and dimensions of interior elements could contribute to shaping domestic spaces for caring and comforting. Later on, each student is asked to select a room from their assigned precedent and make a 3/8" room model to explore the scalar relationship between the body, furniture, and its immediate space, speculating on how the adaptability, flexibility, and mobility of furniture and other interior elements could be deployed to reinvent the spatial qualities of the existing room.

Moving forward, students are asked to conduct a series of site analyses and investigate the internal and external factors that contribute to the design problem. This process involves the making of a site model, as well as the mapping of the physical, cultural, and environmental dimensions related to the natural and built environment. The process of the site analysis is considered more than a simple, analytical represen-tation of the existing conditions. It suggests a generative and projective approach that speculates on what spatial forms could emerge from a particular context of the material reality, guiding students to understand the urgency of homelessness in different groups of constituencies. Moving through different components, ranging from demographic mapping to programmatic analysis, this series of documentation and research aims at evoking productive themes and tactical approaches to generate housing concepts that respond to specific occupants and programs.

In the next phase, students are asked to develop the plan and section layouts that render different arrangements of the interior feasible and visible. Since the structure and original facades remain untouched, the design strategies are drawn toward the investigation of flexibility, mobility, and adaptability of the interior elements and objects within the fixed and static framework. For instance, as shown in this project, moveable walls, curtains, and closets are used to generate different enclosure conditions of the room, which could accommodate the specific needs of single mothers with children at different times of a day.

Fig. 10 Floor plan by student Ana Valencia.

In another project, public showers and bathrooms are placed on the ground floor to serve the homeless groups wandering and dwelling in Downtown Houston. The interior of the building is returned to a minimal state, which allows the moveable sleeping units to travel on different floors through a customized elevator. These interior components

Fig. 11 Model photos by students Danna Martinez, Edwin Tovar, Nadine Khoury, Gaby Ochoa, Lara Rafols, Anh Huynh, Eddy Sanchez.

are no longer stabilized, prescribed objects that confine domestic interiors as the isolated, privileged realm of privacy for individual illusion and defensiveness from the outer world. Instead, performing as vehicles that travel in networks of bodies and environments, these objects operate as the materials that provoke new relationships between individual and collective, unfolding issues around gender, race, and well-being to promote a healthy housing community.

In the final assignment, each student is tasked with the making of a ⅜" sectioned model that showcases their

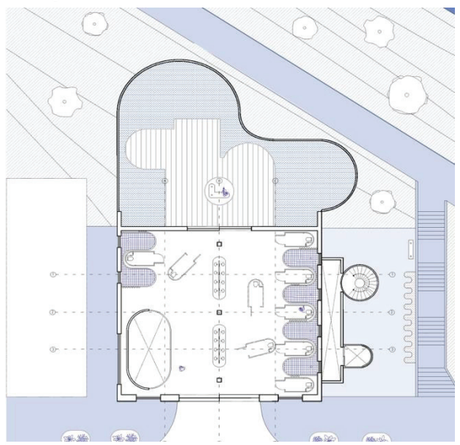


Fig. 12 Ground floor plan by student Misa Lewis.

desired qualities of the interior. Students collect daily objects they could find at home and grocery shops, such as necklace beads, tree brunches from their backyard, and textiles from old clothes, to populate the interior and represent their ideal imagery of collective living for the homeless. The outcomes are full of surprise, joy, love, and their increasing care for the underserved and underrepresented communities in a world of uncertainties and instabilities.

Reflection

Through these exercises, students are able to investigate a design discourse that privileges the interior conditions in the current paradigm of architecture. By exploring the qualities, materialities, and attributes of the interior in relation to other dimensions of architecture as well as the complexities of the context, students are guided to expand their research on the unknown territories of the interior, tackling design problems inherited from the political, social, and environmental issues in our urban environment through interior-oriented design approaches. In beginning design studios, one of the immense challenges is incorporating the learning of divergent representational media and basic architectural principles into the learning of design and research methodologies. Rather than treating the idea of

representation as a tool for final production, students are expected to deploy different representational techniques, such as line drawings, model photos, and collages, to engage the design thinking process. In this regard, the departure from drafting the assigned precedent and making a large-scale physical model would be a productive way to implement the integration of representational study and design investigation. Through the back-and-forth process of drafting and making, students could improve their two- and three-dimensional visualization skills while deepening their understanding of architectural graphics and drawing conventions. Meanwhile, by closely examining the precedents, students could distill the design strategies embedded in these canonical architectural works, which would pave the path for beginning design students to devise creative methodologies that engage the challenges of an ever-changing urban environment.

Bibliography

Koolhaas, Rem. *Junkspace*. Rome: Quodlibet, 2006.

Pimlott, Mark. *The Public Interior as Idea and Project*. Santa Monica: RAM Publications, 2016

Pimlott, Mark. *Without and Within*. Rotterdam: Episode Publishers, 2007.

Rice, Charles. *Interior Urbanism: Architecture, John Portman, and Downtown America*. London: Bloomsbury Publishing, 2016.

The Unfamiliar

Matthias Altwicker, New York Institute of Technology

Regin Schwaen, North Dakota State University

Karl-Heinz Winkens, Fachhochschule Potsdam

In this paper the authors are presenting findings from international workshops that had the aim to let architecture students from different schools meet, discuss, generate, and learn something new. To travel is extraordinary for most academic fields, yet it is fundamental in the education of an architect. To begin a design project, it is inherent in architecture to visit a site making the unfamiliar to some degree familiar. It was the intention of the authors to bring architecture students together from different cultures and backgrounds, to have students communicate across unknown or a not so familiar languages, and to let the unknown and the unfamiliar be a source of curiosity, exchange, and inspiration for the task at hand.

Basic Dynamics

From 2011-2021, three universities – New York Institute of Technology (NYIT), North Dakota State University (NDSU), and University of Applied Sciences Potsdam (FHP) shared semi-annual workshops bringing students and faculty together with professional and municipal leaders from the location of the workshop. This built on experience already gained through an earlier series of workshops between NYIT and FHP from 2006-2010.

The dynamics of the participants was as follows: teams were made that included students from each participating university in each team. Each participating school determined the level of the participating students, typically creating a mix of undergraduates from second to fifth year, and occasionally including masters students. Each student team was assigned a team leader to guide the process. The team leaders came from local professionals or the academic faculty. This was further developed by allowing the students to take the lead on the projects and the organization, setting in motion a wide variety of points of view on the methods and techniques of group design work.

The expectations of the workshops were always the same: generate a wide array of design ideas for the workshop hosts. The local hosts, ranging from municipalities to developers to not-for-profits, gave each of the workshops a feeling of specificity, with strong buy-in from the hosts working as a motivator for the students and professionals alike.

Traditions and their Limitations

There are several academic traditions that have been used as the primary methods for learning design in unfamiliar places throughout the last few centuries of architectural education.

The first is based on the neoclassical tradition of the grand tour – a long trip with overtones of architectural tourism that allows for immersion and learning via observation and documentation. The grand tour started in the 18th century with the intention of learning about the architecture of other places. Those lessons would both broaden the abilities of the architect but also the cultural value of the architect's financial supporters through the expansion of horizons. For example, Karl-Friedrich Schinkel's various travel tours as the Prussian state architect were as much about him learning from the traditional architectures of Greece and Rome as it was about giving cultural validity to the architecture of the Prussian Empire. For twentieth century modernist architects such as Le Corbusier, these trips became networking opportunities – as much about sharing the thoughts and ideas of the visitor as to gain exposure to local experts.

Fig. 1 View of Prague, Karl-Friedrich Schinkel, Travels to Italy, 1803.

The second tradition is a more recent development that grew out of the academic participatory design experiments that became more prevalent in the 1950s and 1960s. These developed as a kind of Peace Corps-type outreach, as workshops of intense exchange typically with eventual realization of a small project or research experiment. The dynamics driving these were the shock of being in a new location and situation, combined with the not so subtle idea that the traveler and their perspective and knowledge could come to the aid of the local. In this way, this tradition built on those of the early 20th century travelers, albeit in a more dynamic environment. And, just as the neoclassical tradition reflected the larger cultural expressions of the time, these workshops were directly related to the attitudes of architects and architecture schools at the time – experimental but moreso outside of their own context.

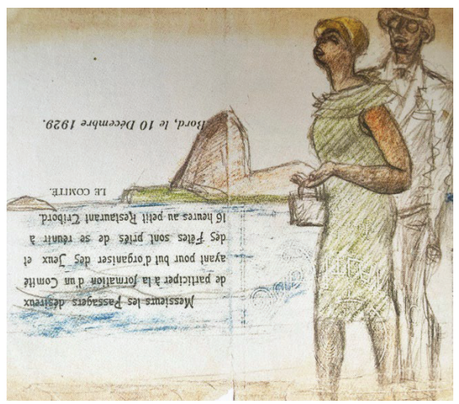


Fig. 2 Le Corbusier, Postcard, Voyage to South America, 1929.

In both cases, the travel was highly scheduled, structured, and controlled. Observation was always done through the lens of the local experts, with the travelers lending their thoughts from the outside. This had the decided disadvantage of keeping the reality of the place at arm's length, managed through extremely controlled narratives and schedules. Understanding these traditions became a starting point allowing us to modulate and craft a hybrid experience that in practice attempted to eliminate the pitfalls of these approaches and take advantage of their strengths of exchange.

Meet, Discuss, Generate, Learn

Each year, at the start of the workshop planning, we asked ourselves a number of questions. What are the student outcomes of those interactions and collaborations? Did the annual workshops between the institutions improve the curriculum or was it disruptive to the typical studio environments, seminars, and classes? What did the faculty and professionals involved gain from the interactions, and how did each faculty and professional address the unfamiliar specifically? By asking these questions, we were able to recalibrate the workshops every year, finding a range of possible teaching methodologies in the process.

While the specifics of the basic workshop structure adjusted with the location, the people involved, and the actual project, the dynamics of interaction remained the same and were perhaps the most important elements of all the workshops: meet, discuss, generate, and learn something new.

Meet

This may have been the strongest and smartest part of the entire endeavor: put students in contact with one another and let them sort it out. For each workshop we began by putting the students in contact with one another so they could start their own interactions separate from those with the professors or professionals. This was prior to starting the project, so the local students acted as liaisons for housing, food, transportation, and other immediate means of understanding a place. Having this information come through the eyes of peers instead of authority figures immediately made for a tighter bond within the groups. They learned communication and negotiation with one another far before they began working together, and this set up fantastic group dynamics before the teams were formed.

Fig. 3, Student Generated Interaction, Workshop Drewitz, 2008.

Perhaps we were fortunate to have the right personalities to cross reference and engage with one another, but the repeated positive feedback over time allows us to think that groups of people have the ability to form and organize without intervention.

Discuss

Typically the professionals were a mix of local architects and artists not affiliated with the participating universities, or they were academics who were not from the location of the workshop. This made for an interesting set up where 2/3 of those involved in each group were working in an entirely new location. Typically, since the team leaders did not necessarily know all the strengths of the various students, it was first up to the group to determine who would do what. Each student then had an opportunity to speak up about their strengths or acquiesce to being assigned a role. In the initial phase of the group dynamics, this made for an exciting moment of self-evaluation with the group.

These moments grew well out of the first round of introductions between the students. And, while each professional was free to use their own method for developing the project within their group, they were advised to allow their methods to take the lead in the group and the ideas to grow out of the students. What was fascinating to see was how many students, given the freedom of the relaxed phase of meeting and engaging beyond the project, redefined themselves in the new context and location. The situation gave them a freedom to be either someone else or who they were – free to be the wild card, free to mess up, free to lead.

Fig.4, Collective Design, Workshop Drewitz, 2008.

Generate

Within a week, team leaders bring together and focus shared ideas and concepts of clients and students. This process of ideas has created a remarkable clarity and consistency in the presentation of ideas using diagrams and dynamic spatial representation. Simple diagramming is used to convey the larger scale regional strategies. Unlike the oft-confusing communicative qualities of conventional regional and urban design plans, diagrams elaborate the content of the project in the most direct way possible. Dynamic representations of space are not conventional perspectives that homogenize public space into easily digestible snapshots, but rather images that are alive with possibility and fantasy about use and potential that thinking about an unfamiliar location demands. Both the diagrams and the spatial representations become an accessible, immediate method of engaging a broader public. The methods of representation and exchange within and between the groups highlights the very intense process by which these ideas come to fruition.

Fig. 5 Collaborative Production, Workshop Luftschiffhafen, 2011.

The messiness of the various methods of design the various team leaders gravitated towards created an odd sense of the

familiar and the new amongst the students, who on one had were being asked to use their skills to assist with the direction of the project but on the other had were being asked to do new things in a situation completely unfamiliar to them – from the location of the project, to the location of the studio, to the location of their apartment, to their group colleagues.

Fig. 6 Student Design Team, Workshop ATB Bornim, 2013.

Learn

How does learning actually occur beyond the interactions with fellow students and team leaders? Each workshop required an interim public presentation to provide a feedback loop. Sometimes these were directly with the constituents, other times with a group related but not directly involved with the content of the workshop. In both cases, the interim presentation became a point of anxiety and a first test of the group internal dynamics in a public setting. Properly calibrated as an interim review, the feedback was directed, sometimes harsh, but always constructive and calibrated to the hopes and intentions of the reviewers. In this case the mix of those involved – the academic side, the client side, and the public side – left the teams at a point where they needed to select a direction and to give hierarchy to the various voices they heard.

Fig. 7 Public Presentation, Luftschiffhafen, 2011.

This repeated itself at the end of each workshop. There was always a public presentation and discussion, open to everyone – all local constituents and interested parties - bringing the project closer to the reality of the situation. These moments delivered to the students in many cases their first contact with direct public feedback –from a group of people and from a culture they had just begun to understand

Project Types

The learning was also very much affected by the group of students and team leaders as related to the project types that were the basis of the workshops over the years. We tested a variety of project types, various levels of community and professional input, community interactions, and student collaborations. This constant testing of possible interactions - as a way to manage the unfamiliar - lead to pedagogically interesting conclusions about how they could be done and rethought from one year to the next. The project types we tested fell roughly into three categories:

Urban and Regional Design

The initial workshops were the most traditional. These workshops were done in collaboration with a municipality and developers from the area to bring students into the early stages of how planning works across various fields and with various levels of input. Two locations on the periphery of a larger metropolitan areas – Wyandanch on Long Island, as part of New York City, and Drewitz as part of Berlin / Potsdam.

Fig. 8, Garden City Wyandanch, Team Markus Loeffler, 2010

These regional workshops started with one very specific goal: make the workshop participants and the constituents understand that their situation is part of a much larger regional condition. Every decision that they make will affect many more people than they imagine, and the area impacted by these decisions will be much larger than they imagine. While seemingly obvious, this is not how decision making and planning actually occurs in these complex megaregions. In the case of Wyandanch, decisions made by powerful local governments on Long Island and networked planning institutions in New York City often counteract each other, slowing productive decision making and regional progress. The format of the workshops made collaborative, synthetic thinking possible and opened up the governments to an understanding beyond their immediate jurisdiction. In the case of Wyandanch, the work became the basis of a series of larger planning strategies adopted by the Town and realized in 2015.

Fig. 9, Wyandanch Town Center, Torti Gallas + Partners, 2015

Building and Campus

Another set of workshops engaged buildings as organizers of a broader context. A range of private clients – The Houses of Sagaponac on Long Island, the Sportpark Luftschiffhafen in Potsdam, and the Leibniz Institute for Agricultural Engineering and Bioeconomy in Bornim – engaged the workshop structure as a way to understand how their plans for new buildings could become part of a larger replanning of the larger site.

These projects gave us the opportunity to rethink how to discuss building types and programs with students. We set two goals for each team. The first was to have them define an identifiable place, filled with activity and memorable qualities that could serve as a center for further development of the area, and connectivity to the surroundings. The second is the production of new building typologies that respond to place and climate and which would allow program to overlap in unconventional ways. These typologies enable the definition of the place and a relationship with the complex surroundings.

Sketching by hand and working on computers that are not stationary created a dynamic workshop environment. The physical architectural models, as in the urban design workshops, were crafted together in a participatory process. While it is more conventional to have multiple authors on an urban and regional design project, the collaborative nature of building design became a challenge of authorship for the students. There was a general tendency for the team leaders to have to take a stronger role in with this type of project, despite the fact that the students tended to be more familiar with building design than urban design.

Fig. 10, Collaborative Design, Workshop Luftschiffhafen, 2011

Conceptual Design

During the pandemic the workshop was done virtually for the first time. The project - a reimagination of the Minuteman Missile Complex site in Nekoma, North Dakota - was at a location that has always been exceptionally difficult to access. Our awareness of this fact allowed us to incorporate it as an objective for the task at hand.

Fig. 11, Minuteman Missile Complex, North Dakota.

It would perhaps have been unlikely to ever visit the site even if the pandemic hadn't taken place, so this created an opportunity to rethink what the unfamiliar meant in a larger sense. We did not set specific architectural goals for this project – we felt the situation of the world at the time and the way in which the students needed to engage one another became enough of an opportunity for their imaginations. At the same time, we were able to use the abstract aspects of the site to encourage an alternate way to travel and engage in the unfamiliar. This site in particular, with its abstract visual power, appeared even more extreme when seen from afar, on a screen, during a pandemic, where comprehension of distance, open space, and travel are warped and continuously recalibrated with each successive image. The primacy of these create inspiration rather than transformation. The work of the students shows this. At times the artifacts are kept at arms length, reverently and subtly engaged; at other times the artifacts are made part of a larger more radical configuration.

Fig.12, The Orb (student project), Nekoma Workshop 2020.

Zoom and other means of engagement (Miro, WhatsApp, etc.) mirrored the same student to student meetings that took place when meeting in person, and these in total created a virtual environment for teaching, learning, studying, collaborating, and presenting design project proposal. Like many professors and students, we all became agile in using this new form of collaboration, and the students nimbly moved between three time zones nine hours apart for both formal presentations and on an informal basis between groups in the workshop.

It was interesting to observe that students from this workshop, on their own initiative, made a physical book of the entire process and results, despite the access to many virtual presentation options. The work is not so much a collection of proposals, but instead a collection of recordings of students seeing a site for the first time, their minds open to new things, and their thoughts inspired by the possibilities of someday meeting them in person.

Possible Positives

Given the global nature of architecture practice today, the way the unfamiliar is accessed for the emerging architect is a critical methodology to learn. These students in particular, through the dynamic that these workshops created, made for a fertile testing ground of architectural education in general and for education as preparation for a future architect. Global practices, or even larger national ones, require a different skill set in design process than those learned in the review/presentation structure of the typical studio. Understanding how one can possibly fit in to a group, understanding of oneself as an architect in a group vs a hierarchical setting, becomes the first time many students are given the opportunity to see themselves reflectively. This understanding of self is a critical aspect in all types of situations for future architects.

As we have outlined, the working in dynamic groups, the sharing of skills, and the ability to understand other colleagues and other cultures through engagement and work is paramount to most futures in architecture. If one adds to that the ability to find methods of interaction and communication that transcend spoken language, one finds infinite value in these interactions. Design in unfamiliar places is one of the most challenging things any architect can engage in. Through our attempts and studies, we are trying to find a way to teach students how to engage a complex future of interactions.

Typographic otherness and design education

Richard Hunt, OCAD University

Teaching typography is a changing landscape for many reasons. There are new programs, and new font formats. There are new media in which typography is practiced, with motion software, such as AfterEffects and programming applications, such as Processing, having become available. Typographic fashion, as always, is changing, as does the relationship between the designers and audiences, as well as the relationship of users themselves to typographic form and use. Most design applications also now have the capability to deal with non-roman scripts.

As long ago as 2005, in *The Education of a Graphic Designer*, Audrey Bennett suggests that

> Today, teaching graphic design students how to communicate visually requires teaching them how culture affects the audience's interpretation of visual language.[1]

Students and classes have changed too, with more international students and migration of students from one part of the word to another. When I began teaching sessionally in 2002, the great majority of my students had grown up in Canada. My class sizes were smaller with a limit of 22 students per class, and, in the institution where I taught, a four-hour class time. Now, class sizes have grown to a number approaching or surpassing 30, and in an institution that has three-hour studios, with an increasing number of students who are either international students (almost 30%) or new immigrants, many of whom are from East Asia, the Indian subcontinent, or the Middle East. The larger classes and larger number of international students invite a new look at teaching typography in the early years.

Lastly, perceptions have changed. Students of all origins are beginning to question the discipline of graphic design as a promoter of capitalism and a recapitulation of Eurocentric values and cultural norms. One way of approaching part of this change is to encourage students to incorporate their own values and culture. Other scripts and users of those scripts, by using them, are both challenging the primacy of roman script as the embodiment of design's commercial values, and given the opportunity to consider type as form and culture outside the aesthetic and functions that we often unthinkingly accept.

In the school in which I currently teach, we have many students who have not grown up with roman scripts as the major means of visual communication of language. This is most significant in graphic design programs, but students in any design discipline will have to deal with typography, even if typography classes are not part of their programs.

Writing and typography first represent language, and visually representing language is the raison d'être of scripts. However, scripts also have visual form. Students from every design discipline will likely engage with typography, and hence both its linguistic function and its visual form. By the end of a design program, most students are expected to be able to deal competently with typographic form and its application. They will develop an awareness of some of the relationships between the semantic content of a script and its function. This will come most naturally if they are working in their own languages, but many relationships will be clear even if in different languages or different scripts.

Teachers often take an authoritative stance in typography classes, which is not, perhaps, surprising, because, more than other aspects of graphic design, there are many generally agreed upon 'rights' and 'wrongs' in roman typographic practice, particularly when dealing with text. Spelling and typographic errors, hyphens in the middle of a syllable and double word spaces in the middle of a sentence are concrete and clearly identifiable errors. Things such widows, distracting shapes in rags, justification that leaves holes in text, and other such matters are usually agreed upon by typography instructors to need correction. There are also conventions that are so well established that ignoring them can be considered 'wrong'. These kinds of things are found in style guides, though often their consideration of typographic matters is somewhat cursory.

Because of this type instructors may be authoritative in other areas where rights or wrongs can be disputed (A

'bad' or 'inappropriate' typeface for a given purpose, for example, choice of space and line length, or the aesthetics of typographic choices.) The advice given is often useful, but is also often contestable. Confidence in making this kind of decision may not come naturally to students, especially those who grew up in a culture where the dominant script is other than the Greek-Roman tradition. For all students, much of this kind of direction is better taken as advice rather than direction. However, those with less confidence in the use of a script are more likely to take suggestions as requirements.

However, students with less familiarity with roman script, are likely to have more confidence in using another script or scripts. Allowing or encouraging students to explore using any scripts with which they may have abilities gives them an area to deal with typographic form where they may have an advantage. Those teaching typography may be understandably uncomfortable in dealing with scripts of which they have little knowledge and no expertise in using, and thus may be expected to defer to students in matters of which they have no expertise. However, this doesn't mean they must abandon the students entirely to their own typographic devices.

Teasing apart objective aspects from cultural aspects of typography is likely to give students, whether domestic or international, a better understanding of how to best incorporate typography into their practice.

The universal: objective aspects of typography

Although scripts are different in their appearance, structure and method of communicating language, there are many elements that can be considered universal, and thus can be usefully applied to any script system.

Physiology of vision

Human vision around the world is generally similar in its ability to discern form (and the effects of visual disabilities are likewise accultural). Visual disabilities are also similar, and addressing them will demand similar tactics.

The way that human examine a scene or read is, from a physiological point of view, universal. We see larger or distinctive elements first, and our eyes move around from focal point to focal point in saccades, [Saccades are rapid movements of the eyes that abruptly change the point of fixation. They range in amplitude from the small movements made while reading, for example, to the larger movements made while taking in a scene, or looking at a poster[2]

This has been explored more widely in recent years due to the wide availability of eye tracking technologies and research done by researchers in user studies of how people interact with websites.[3] The physiology of reading is more consistent, as it is a more defined process than engaging with other scenes. We need the x-height of normally proportioned typographic elements of roman type to be around 15 arcminutes to be easily legible. Chinese text has to be larger to clearly identify more complex forms,[4] but is also more efficient, as more information is carried in each character than alphabetic text does. The same applies to Korean script, as each character contains a syllable, though as the Korean characters have a lower maximum complexity, the size is likely more a matter of convention, a reflection of the cultural influence of Chinese script.

Although smooth eye movement is possible, it normally occurs only when the eye is following a movement, so is generally relevant only in kinetic typography.

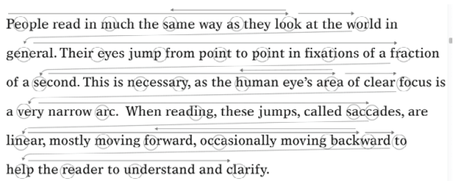


Figure 1. This diagram represents how the eye jumps from point to point when reading. This eye movement is a characteristic of human vision, not of culture.

Gestalt and other principles of perception

Human cognitive psychology, such as the Gestalt principles of perception, are believed to generally apply across cultures, though some caution is necessary.[5]

Some Gestalt principles that appear to operate similiarly across all scripts follow:

Proximity refers to visual elements that are close to each other being perceived as related. This is at the root of roman typography: letters on their own rarely have meaning, and we read entire words in most cases, not the separate letters, and further, usually encounter groups of words, so this also applied, to a lesser extent, to ideographic scripts. So placement of typographic elements is related to meaning in any script. This principle can be considered in the effective placement of related elements, such as headlines and subheadings, images and captions, or in screen environments or signage to aid users' navigation. This is one of the principles at the basis of the idea of "chunking" typographic elements.

Similarity of typographic treatment or location is perceived to indicate a functional relationship. Chapter titles, subheads, captions, pull quotes, etc., are normally able to be categorized by the viewer as such because of their visual similarity with each other. This can be readily seen in publications in many languages and scripts.

The *figure / ground* relationship always applies to typography, as the difference between figure and ground identifies the form of characters. Most commonly, the figure of black type is on a white ground but can be used for visual effect with display type with any script.

When considering objective visual principles as they apply to typography, having less familiarity with roman script may be an advantage, as the lack of familiarity may make it easier to see type as form, rather than as simply representing a word.

Other principles of cognitive science also have relevance. An important one is "salience bias," which suggest that readers of all cultures are naturally prioritize looking at elements that are visually and physically prominent, that contrast with the visual environment.[6] This applies to visual salience; semantic salience (where word meaning is the salient point) is of course dependent on understanding script and language.

Typographic structure

Although her focus is the Roman alphabet. Catherine Dixon's classification system describes several formal characteristics that don't rely on historical classification and can be applied to other scripts.[7]

In Dixon's system, *construction*, referring to the nature of the strokes that form the letters, typically are composed of round and straight forms which generally have a common nature in a script.

Shape refers to the central armature of characters, the basic skeleton of the characters. This applies best to simple phonetic scripts, as the complexity of ideographic scripts often tend to a overall square or rectangular shape.

Proportions describes the overall widths of characters, and the vertical relationships between the main body of the type (x-height in roman, but applicable to other scripts with some adjustment.)

Modelling deals with the rate of change between thinner and thicker strokes, which refers to the instrument and method of writing rather than the script itself.

Weight deals with the overall thickness of character strokes, which can usually be described as the ratio of stroke height to stroke width.

Terminations deals with how strokes are terminated, whether pointed, rounded, serifed (or with similar structures), etc.

All these can be used in analysis of most scripts, both in terms of the characters themselves or in considering the relationship between characters or groups of characters.

Bouba / Kiki

Another aspect of form that some studies have shown to be universal is the relationship of form to perceived sound, though his may apply more to alphabetic scripts than ideographic scripts, as complex shapes, and those that include round and square forms (example of k and o), but has been shown to apply to Korean.[8]

-

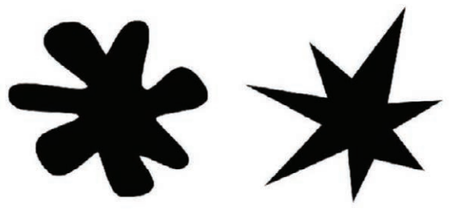


Figure 1. The ‘bouba’ form on the left is associated with soft phonemes and the ‘kiki’ form on the right is associates with shar phonemes across different cultures.

Subjective aspects of typography

Much of typographic practice is subjective. Both the creator and the audience have preferences and interpretations. How well a set of typographic decisions functions could be quantified by asking users to respond to it, that is, through user testing, but often this is not practical or possible, and is some ways antithetical to the creative process. It can also be misleading, as an initial response to a created typographic form might not be the same as the response over time or repeated exposure. Consequently, judgement and perception of such decisions are necessarily dependent on an implicit knowledge of how others will perceive a particular work. Designers may, through experience and cultural immersion, have a good idea of how others might perceive and interpret their work in a culture similar to theirs.

Understanding and using appropriate cultural conventions and the connotations of type form and use require knowledge of the script culture, as well as subcultural elements. Right to left scripts suggest different page layouts. The visual quality of typefaces, or the particular associations of a typeface, may have different implications in different cultures.

Visual and semantic properties of typography

While the alphabet functions in the same way in display and text or navigation type in that it represents language, the visual qualities of display type is generally more important than it is in text type. While students may have a good sense of the connotations and visual appropriateness of a typographic decision, the visual qualities of such a decision can be treated more objectively, or at least by questions that suggest an objective approach. For example, is the type colour contrast clear? Is the size appropriate for its place in the logical hierarchy? Is the legibility appropriate for how the reader will interact with it. What connotations does the type have? The instructor may not be able to address this last question in the case of other scripts, while the student from another scripts culture may not be able to confidently address the same question in a roman script context, but the posing of such questions is useful.

It is not unusual to see a script being used to communicate a cultural reference even though few of those who see it will understand its meaning. Usually, in a roman context, the text is repeated in Roman type (Fig. 2). Seeing a script that you don’t read may denote a particular culture, connote a certain kind of experience or product, but has no linguistic function. A script you can read primarily denotes language, while also having connotative qualities

Figure 2. This restaurant sign has both Japanese text, and roman text that visually resonates with the Japanese. The only false note is the neo-grotesque typeface used for the two lines of text at the bottom.

Scripts, typefaces and other typographic choices are used in many cultures for connotation. This happens to some degree using the roman scripts that are used in a roman script environment. A French restaurant may use the French language to signify “frenchness,” whether or not the onlooker has any familiarity with French. Or a Chinese business may use a roman typeface that is constructed of strokes that evoke Chinese characters, often in red and yellow, to connote (ironically enough) authenticity.

Some aspects of typographic practice are non-existent or entirely different in other script systems. For example, kerning (the adjustment of individual letters to balance formal relationships) ragging, type (to create an unobtrusive and even varying line length) or adjusting justified type to avoid uneven word spacing normally have no meaning in Asian scripts which are formed on blocks of equal widths (like monospace roman fonts). Furthermore, hyphenation of text is not needed. Alll this must be recognized, both by students new to learning the use of roman script, and to expand all student’s understanding of other scripts.

Every script has different attributes: for example, Perso-Arabic scripts have a more complex vertical structure than roman type, and uses kashidas, extended character forms that can be used to improve justified settings in a script in which hyphenated word breaks do not exist.[9]

CJK scripts are well-suited to, and often are, set vertically, something Roman script isn’t well suited to. (It’s possible, but structurally doesn’t work well with letter forms that have varying widths.)

Sabrina Song

Amy Bui

Figure 3. In this first-year typography exercise, students are asked to use a roman and non-roman script in a simple composition.

Conventions

Although conventions are not in themselves ‘correct’, it is important for students to be aware of them (even if they choose to do something differently). Encouraging all students to refer to style guides, which typically include typographic conventions, when using roman, especially as it relates to text is a good idea. Students from any background will benefit from an understanding and implementation of typographic treatment and choices, especially as they apply to editorial work. Although major languages have style guides, they are, of course, written in the language they apply to. However, because English is the dominant language on the internet, it is relatively easy to find guidance on the use of other scripts. The World Wide Web Consortium, for example, has guidance for setting text on the web that also applies to other uses of scripts.

Style and taste

It can be hard for instructors to distinguish matters of taste from matters of good typography, and taste can further vary between cultures, even in today’s relatively culturally flat world. For example, while European typographic movements are often familiar to designers from other cultures, the Swiss modernist style of typography appears to be less dominant in other cultures such as China and India. Unless an assignment is specifically addressed to a particular style, we must recognize the value of different approaches to typography. We might be inclined to tell students that their choices aren’t appropriate for a given purpose. This might seem to be true, but unless we can articulate reasons why, the student will not have learned anything useful.

Culture

It is not possible to understand all the nuances of a culture without living in it. Much like language, we learn culture by being immersed in it. This happens organically within a script culture, as those who are exposed to different typographic styles and treatments will, to a greater or lesser degree, recognize them and associate them with the kind of purpose they are used for. Students (of any culture) who are readers have an advantage in and

understanding and employing typographic nuance conventions, and how they apply to different contexts within their own culture. Even subtle differences placement of text, choices of typefaces, and the use of negative space is likely to be intuitively recognized by a designer familiar with these kinds of material.

When dealing with different script cultures, the challenges can range from avoiding unintended cultural associations to choosing a typeface that resonates with the content and context. Confidence in this can be best found in consulting with native users of the script in use. Certainly, secondary research can help; the problem with relying on that is it is likely to lead to an imitative approach rather than an original one. While neither domestic nor international students from a different script background may be consciously (or even unconsciously!) aware of the relationships between denotation and connotations of typography in that script, it is a useful exercise for them to consider this, just as it useful for all students in the context of all design.

Right-to-left scripts such as Arabic and Hebrew have an influence on how typography is approached by readers of those texts, and while students may not be using them, it affords an opportunity to discuss expectations and how layouts work. For example, readers of left to right scripts such as roman look first at the top left of a page, while users of right to left scripts first look at the top right.[10]

The form of type has also connotations. As with all connotations, because they are not explicit, there can be different connotations drawn from typography depending on the cultural context and awareness of the onlooker.

Students often approach typography with largely formal consideration: their attention is on whether the typeface and treatment work visually with other graphic or architectural form, as well as more prosaic considerations, such as visibility, legibility, appropriateness of location, etc. Students who are familiar with a script are usually able to avoid gross typographic solecisms, but don't have a good sense of typographic subtleties. In considering the idea of connotations in scripts in other scripts (or even languages that use roman script, students may gain a stronger understanding of the importance of the connotations of typographic form.

Audiences

The subtleties of typographic choices may be lost on a viewer as well, but as designers are also often concerned with the perceptions of their peers, critics and other sophisticated users, it is important that students consider connotations of typography. How can we teach students to consider typography beyond the formal and relate it to culture?

Those who have considered the implementation of typographic use will likely develop an instinctive knowledge of how to choose and apply typographic form appropriate to its function, even if their knowledge derives largely from experience rather than study. How can we teach this to students who have not had such education or experience?

As increasing numbers of our students come from other cultures, typographic application in student projects may derive from imitation without understanding. This is also true of local students, but we should particularly avoid imposing or encouraging aesthetics that are fundamental in the context of North American schools based on a European model on students from other cultures. It is more important than ever that instructors avoid impressing their cultural tastes and practices on their students.

Furthermore, students from other script cultures may find themselves in the position of having to use those scripts in their current and future work, and they are unlikely to receive much guidance from instructors who are familiar only with Roman script. Many students from other parts of the world, seeking design education in North America, will not have had experience in considering and applying their own scripts, and will lack the tacit knowledge of the significance of typographic form and treatment of Roman script that naturally develop in North American contexts. This implies that research into typographic use by students becomes more necessary.

In contemporary practice, North Americans are increasingly exposed to other scripts, and may be asked to incorporate them in their work. If we are asked to provide a typographic element in the context of another script or culture, there is a new set of cultural considerations. Whatever sophisticated knowledge a designer or teacher might have in the Euroamerican context will not likely not apply in other cultures. While we may feel confident in our

Figure 4. A page spread from a first-year typography class, in which students are asked to document classifications of roman typefaces as well as a non-roman script. (Aaryan Pashine)

typographic decisions in the context in which we normally work, such confidence would be misplaced in another script context.

Designers will also be increasingly expected to deal with other scripts. This might be in bilingual or multilingual work, but increasingly, both informational and wayfinding work, expected to incorporate user-chosen languages and scripts into adaptive systems.

Disciplinary perspectives

Although the awareness of typography has grown due to the widespread use of computers and availability of typefaces, other designers form a disciplinary audience. While graphic designers may have a higher awareness of current typefaces and type treatments than industrial designers or architects, most designers would rather make choices that are at least defensible from an expert's point of view. For example the use of Impact, Arial or Myriad invites criticism from type-aware designers, Impact because of its short ascenders and descenders and its widespread use in memes, and Arial largely because of its history as a font designed mainly to avoid paying license fees for Helvetica, and Myriad because it is the default typeface in Adobe Illustrator.(Fig. 5) Students need to be made aware of this in order to avoid typefaces that will undermine the perception of their design. Though any students may choose a typeface that has baggage they might be unaware of, experience suggests that this is more likely among students who are less familiar with roman script.

Figure 5. The typographic approach is reasonable but undermined by the use of Arial, which to some disciplinary onlookers signals a lack of sophistication.

While secondary research and user studies have become the basis of practice in many fields of design, this has not been true in the case of typographic design education. While typography that is less than optimal in terms of user perceptions may function adequately, typographic design will be stronger if we are both willing take a more culturally-located approach, and consider form more separately from Euroamerican typographic culture.

Such an approach may both strengthen typographic design in local and other contexts, and serve to mitigate Euroamerican typographic hegemony.

Conclusion

The current teaching approach to typography is effective in teaching Euroamerican typography in European or American contests, but that is no longer enough. For both practical reasons, as designers will be expected to work with other scripts in their careers, and for reasons of inclusion and respect for other cultures.

A new approach to the teaching of typography is needed; one that prioritizes user perception based on research and consultation, with less focus on historical and contemporary European forms and history. So we must separate, at least to some degree, the objective aspects of typography, the way it works perceptually, which are largely universal, and the subjective aspects, the differences between different scripts in terms of how they function, and their connotative cultural aspects. So type that is too small to perceive, or doesn't have a logical relationship with other content is something that can be can be evaluated more or less objectively. More or less because, they cannot always be completely separated, because structure of a script affects logic, as direction of text, such as that of Arabic or Hebrew, changes the readers relationship of other elements on the page, as does the relatively normal use of vertical settings, as in the Chinese, Japanese and Korean (CJK) scripts.

Finally, students must recognize that there is a disciplinary audience (or viewership) that is distinct from the lay audience, which should not be ignored. This can affect even the most sophisticated typographic designers when designing for users of other scripts. With few exceptions, I propose that designers' reputations are as dependent on the evaluation of peers and critics as they are on the evaluation of the public who encounter and use their work.

To address the question of how to approach or resolve: ask students to engage with other scripts in terms of observation, information and form (see fig. 4).

One problem is that students are taught the implication that roman script is the most important one to learn from a design point of view. Another is that the background of the increasing number of students from different script traditions is ignored in the course material of typography classes.

Consequently, instructors should learn something about different scripts, and encourage students who have experience with them to make use of them, and learn to be comfortable with having less knowledge than the students in this area. While almost no instructors will have the cultural knowledge to be able to fully guide students in the use of these scripts, they can provide guidance in the objective visual aspects that can help make their work with other scripts stronger. It is also useful to show exemplary work that uses other scripts, and ask students to find examples of them.

Some concrete suggestions are:

- Ask students to observe, and record other script systems in the environment, and to develop an understanding of the affordances of those scripts.
- Encourage research into the use of scripts that may be unfamiliar to them, ask students to engage with those scripts in a respectful way, and particularly encourage (but avoid requiring) students to use scripts other than roman if they have a background in them, and present their work.
- Consider the affordances of other scripts; can they be inspirational in roman text? Can the qualities of roman text apply to other scripts?

  Teaching typography from a less Eurocentric stance, as well as recognizing and encouraging the use of other scripts makes sense in today's world, where we recognize that colonialism is not simply its literal practice, with today's students, who increasingly come from other script backgrounds, and with the recognition that travel and communication technologies have made the world a flatter place.

  This might cause discomfort to typography instructors, but we can still bring objective critique of the use of other scripts from our understanding of form and visual relationships. Sometimes we may be learning more from some of our students than we are teaching them. We should value that learning, and value the knowledge of those students.

Caution is needed

Domestic students may not recognize they are operating from a position of ignorance, while this will likely have been clear to students who are working with what, to them, is a less familiar script. Having students in the classroom who are familiar with the script can help students recognize the depth and complexity of unfamiliar writing systems. The value of knowledge of others should be brought to students' attention.

It is also important to be careful make sure that students don't feel pressure to work with, or provide expertise for, scripts that they may have a background in. For many reasons, they may prefer not to draw attention to this knowledge. When I assign the kind of projects shown in figures 3 and 4, I am struck by the varied choices that students who have a command of a script other than roman: some welcome the opportunity to research and use scripts with which they are familiar, while others choose to work with a script with which they have little or no prior experience.

Also, using other scripts purely as form may lead to students ignoring meaning and convention. However, in my view it is worth the risk, as long as students are made aware of the dangers of cultural appropriation.

End Notes

1 Bennet, Audrey. *The Education of a Graphic Designer*. New York: Skyhorse Publishing Inc., 2005. 274. Print
2 "Types of eye movement and their Function." *Neuroscience.* 2nd ed. https://www.ncbi.nlm.nih.gov/books/NBK10991/
3 https://www.nngroup.com/articles/text-scanning-patterns-eyetracking/
4 Wang, CX, et al. "Visual requirement for Chinese reading with normal vision." *Brain and Behavior*, April 2019, v.9(4).
5 Cenek Jiri and Sasinka Cenek. "Cross-cultural differences in visual perception," *Journal of Education Culture and Society* No. 1_2015.
6 Bylinski, Z. et al. "Learning Visual Importance for Graphic Designs and Data Visualizations." *Proceedings of the 30th Annual {ACM} Symposium on User Interface Software and Technology,* 2017. https://vcg.seas.harvard.edu/publications/learning-visual-importance-for-graphic-designs-and-data-visualizations/paper.
7 Baines, Phil and Andrew Haslam.*Type and Typography*, London: Laurence King. 2002. pp 50–52.
8 De Carolis, Léa, et al. "Assessing sound symbolism: Investigating phonetic forms, visual shapes and letter fonts in an implicit bouba-kiki experimental paradigm." https://royalsocietypublishing.org/doi/10.1098/rstb.2020.0390.
9 Smitshuijzen, Edo. "The Big Kashida Secret" https://www.khtt.net/en/page/1821/the-big-kashida-secret
10 "The dynamic effect of reading direction habit on spatial asymmetry of image perception." Afsari, Zaeinab et al. *Journal of Vision*, September 2016, Vol.16, 8.

Outside Inside: Open Enclosures and Performative Materials

Eleanor Pries, San José State University

"Designing from the outside in, as well as the inside out, creates necessary tensions, which help make architecture. Since the inside is different from the outside, the wall - the point of change - becomes an architectural event. Architecture occurs at the meeting of interior and exterior forces of use and space." [1] Robert Venturi

Contents

What if buildings were more open? Through "Outside Inside" we can design porous walls with productive materials to imagine and test a future of environmental performance and flexibility. The beginning design student becomes an environmental steward and a material innovator, embracing light, shade, air, and new productivity for building enclosure.

"Outside Inside" includes two fabrication pedagogies. Both are rooted in climate context, public benefit, materiality, and precedent. Discussions can probe what is "interior" and what is "public" in architecture. Students question the solid and inert building envelope; they build environmental awareness and develop material sense.

1. Calling for Open Enclosure

As resources increasingly become politicized commodities and global shortages become more dire, design must take steps to improve relationships with the environment. We know that buildings occupy a heavy footprint in annual global carbon emissions. The hermetic quality of buildings is one exacerbating factor. Typical construction methods produce continuous wall assemblies to keep the elements out, simplify construction, and reduce cost. The continuous envelope is a basic hindrance to a more productive architecture. Closed buildings shut out natural light and air. Even glazing increases the energy spent on indoor air quality and climate control.

Interior architecture can also step up. Closed and compartmentalized interiors prevent the distribution of light and air. Petroleum-based synthetic furniture and finishes are designed to resist fire, defy wear and tear, and in the process off-gas toxins. Frequent redesigns (such as for commercial interiors) can compound environmental impacts in one building over decades.

Environmental laws and incentives are part of the solution. Title 24 regulations in California require environmental design features, low-energy systems and fixtures, and renewable materials. LEED also incentives such measures at a national level. In the technology sector, companies (eg. Ecomedes Inc., mindful Materials Inc. and Reseat LLC) have created new reporting and tracking systems to build transparency and ease for designing and outfitting carbon-free interiors.

Despite the requirements, the culture of innovation, and the widespread benefits of porosity, we are still building hermetic space, especially for our more ubiquitous and vernacular buildings. Sustainable design incentivizes alternatives, but part of the dilemma are the criteria and the specialization of the programs. If we leave our charge for environmental design to specialized energy consultants or rely on fixtures and finishes, we are leaving designers, and our design students, out of the process and the solutions toward transformation.

"Outside Inside" takes liberties in enclosure and materials. It questions: What if the materials were different? What if some of the programmatic assumptions about interior, were looser? There could be a place for more open enclosures, for a more productive and performative materiality.

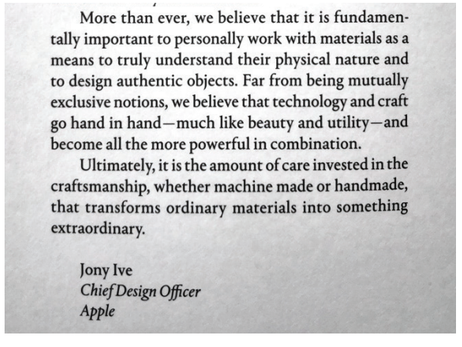
More light, more air, more water. Students imagine and test a future with fewer solid walls. They may become stewards for climate justice, inclusion, public health, and public space.

2. On Speculation

"It is an essential aspect of being in the World that it in some ways implies a being outside. Therefore, architecture is not only a means to build a World, but also, at the same time, to create many different kinds of "inside". Architecture mediates: it is essentially about establishing and defining the relationship between Inside and Outside, between the home and the World." [2] Bart Verschaffel

Open Enclosures use a looser conception of the role of the wall. Unleash students from the preconceptions of what constitutes a wall and what constitutes "interior". When we expand the possibilities of a wall, we also expand the experiential range of being inside. The culture and practice of design education offers the creative space for students to question and innovate on what "enclosure" means for the future.

As enclosure becomes an active and productive filter, we can use non-traditional materials and assemblies. An enclosure of vesicular basalt or polyamide felt can absorb and store water. Malleable hessian textile, sculpted and refashioned, can iteratively define and redefine space. Can a conductive enclosure be fabricated out of conduit? Concrete cast with biofoam redefines formwork and can produce habitat. Building on the words of Sanford Kwinter, "it is our duty to deliver ~~human sensation~~ [performance]… the new [productive] materialism may well be a new expressionism." [3]



More than ever, we believe that it is fundamentally important to personally work with materials as a means to truly understand their physical nature and to design authentic objects. Far from being mutually exclusive notions, we believe that technology and craft go hand in hand—much like beauty and utility—and become all the more powerful in combination.

Ultimately, it is the amount of care invested in the craftsmanship, whether machine made or handmade, that transforms ordinary materials into something extraordinary.

Jony Ive
Chief Design Officer
Apple

Fig. 1 Sponsor's Statement by Jony Ive, in A. Bolton *Manus x Machina* [4]

Lastly, students speculating for performance trade museum board for biofoam, canvas, clay, felt, hessian textiles, LDPE plastics, palm fibers, sand, sedges, soil, and stone. They explore and test and discover the functional capacity of materials as well as sculpting the beautiful effects they can produce. New material expressionism builds their confidence in material craft; beginning design students become agile, curious, and empowered fabricators.

---

3. Outside Inside — Performative Screens

3-week initial brief for introductory interior architecture students. Students adapt this initial design work into the final 8-week project.

This brief quickly produces layered and materially-rich physical screen designs. "Screens" begin as porous walls that filter light, air, view. Students invent rapid screen designs and then later revise them into a developed interior architecture project. In this scenario, the final project is a public non-profit "Workshop Art Residence" with a local artist. Developed screens may be operable and used to reapportion or subdivide space. The screens can become systematized and adapted into skylights, storefronts, storage, display, and exterior systems like scrims or brise-soleil.

Impetus

At this early and introductory level, a primary agenda is challenge and expand student conceptions of how to enclose and define space. It has been fruitful to discuss with students what they consider a wall is, what is inside, what is outside. Unpacking precedents helps show how layered screens and space can gradually distinguish interior from exterior or produce liminal zones in architecture. Continuing discussion and precedents can reveal the benefits for designing buildings to be more open and flexible, benefits for the: environment; public health; public space; occupant health and productivity; spatial efficiency; long-term cost savings; material richness; experiential phenomena and delight.

Precedent Research

Historic and contemporary architects, builders, and engineers have been realizing porosity and performance within building envelopes for millennia. Educators can easily tailor precedents for this pedagogy to respond to their agenda. Rigorous precedent research by the students legitimizes the brief and can offer essential inspiration or material ideas.

Additionally, two specific buildings are particularly helpful for beginning students, because of their direct provocative intent and their limitations. In 1995, Shigeru Ban designed "Curtain Wall House" in Tokyo, replacing typical layered walls and screens with a set of thick slick curtains. The curtains can be open, even blowing, or they can be drawn closed and latched. This design produces a provocative and ironic total openness in an urban context. Closed it is also radical, a soft system wrapper. But a reality of this design is that the enclosure is largely binary, either open or closed, without the possibility of gradations of light or air to exist in-between — a direct scenario for students to problematize.

Fig. 2 Curtain Wall House, Shigeru Ban 1995, Tokyo

In 2017, Aki Hamada Architects adapted traditional *shoji* and *fusuma* systems for Substrate Factory, Ayase. Divided on a 3 x 3 structural grid, operable screens and panels slide to flexibly enclose the interior and subdivide interior working zones. Many spatial configurations are possible. This precedent beautifully engages the past and future of Japanese screen traditions. The benefits for flexibility, efficiency, program, and cost are straightforward. At the same time, the solid panels limit daylight, airflow, view, and any interior effects that could enrich the space. How can the panels become screens and improve performance? This precedent is a direct comparison for students to visualize operability and imagine porosity.

Central Exploration

Screens are the primary device to explore four aims. Design a screen system to create:

1. **Fluidity between outside and inside;**
2. **Passage of light, air, view;**
3. **Flexible spatial organization; and**
4. **Beauty of material and effects.**

Step 1.1: Drawing Inspiration — Analysis of Artwork

Accompanied by research and presentation on artist, their background, methods, and artwork.

Students select from a curated list of artists to inspire their screen design. The artist list can tackle social aims, inclusionary design, or favor certain materials. Students are aware that their final design project will be a public Workshop Art Residence including that artist and will feature the screen design. Students research the artist and make a series of 2D analytical drawings based on one or more of their works.

Sample Artist List:

El Anatsui (metal, mixed media)
Germane Barnes (metal, wood)
Sigrid Calon (risograph printing)
Barbara Chase-Riboud (metal, textile)
Tanabe Chikuunsai (wicker)
Tim Collingwood (textile)
Jim Isermann (mixed media)
Gee's Bend Guild (textile)
Johanna Grawunder (glass)
Hella Jongerius (textile)
Yvonne Mouser (wood)
Rita Nazareno (wicker)
Allan Wexler (wood)
Bari Zipperstein (ceramics)

<u>Analytical Methodology:</u>

"Analysis" here means to look closely, draw, and discover patterns in something that already exists (ie the Artist's work). It can be necessary to clarify the difference between illustrating /rendering and reductive analysis. Drawing prompts can highlight basic patterns, solid space, void space, colors, repetitive elements, and implied directions in the art. More is more — students produce nine analytical drawings to reveal latent systems in the art.

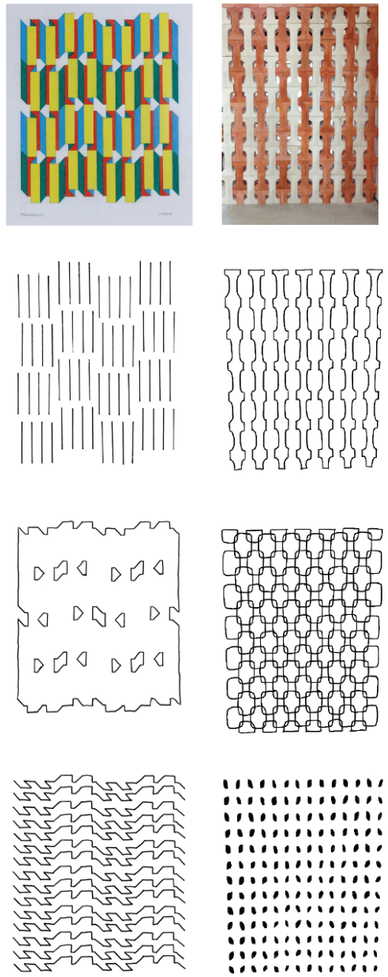


Fig. 3 Student Analytical Drawings of Jim Isermann artworks
G. Foglio, Fall 2022

drawings. It has been helpful to provide dimensions for the screen models. A proportional range of dimensions can allow for variation and easy scale factor (such as 1"=1') for future design use. Exaggerating the depth dimension helps students achieve thickness early.

Adaptive Methodology:
"Adaptation" here is to modify something that already exist, according to a new set of aims, criteria, or spatial conditions, without losing a relationship to the original or essential qualities.

Initial Screen Model Criteria:

- 1 wood; 1 paper; 1 "other" material.
- Directly relate to analytical drawings.
- Porosity with holes or openings for light, air, view to pass through (not solid).
- Double-sided with no flat "backs". Constructed independent of any base.
- Size: see size range diagram.

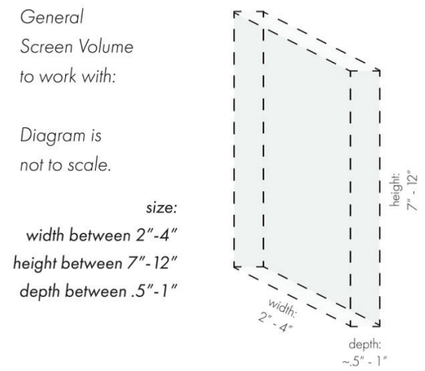


Fig. 4 Initial screen proportion diagram to provide to students

On Materials:
Beautiful screen models can be created with inexpensive design materials. These are introductory students with no digital fabrication experience or access. Even during shelter-in-place or quarantine, students can complete these models using basic household items at home. It can be helpful to discuss and demonstrate the capacities of materials and their attributes (acoustics, transparency, translucency, reflection, refraction, etc…) that create performance and effects.

Step 1.2: 2D to 3D — Adaptive Screen Models
Begin by sketching the analytical drawings as 3D screens and quick testing of materials.

Using three different materials (wood, paper, other) students interpret and adapt the 2D drawings into physical screen models. Students turn lines and tone into physical material members, solids, voids, cuts, folds, stitches, nodes, etc… Students to discover repeated elements and invent a system, while staying loyal to the essence of their analytical

Fig. 5 Performative screen development stages of the first year design student. Version 1 (L), Version 2 (M), Version 3 (R). S. Tholfsen, 2022

Step 1.3: Test! then Layer / Puncture / Densify / Expand — Clarify and Develop Screen Model Design
Accompanied by group testing light, air, view, and writing out essential performative intent of screen.

Students select one of the three screens to develop, or strategically aim to combine aspects from two into a hybrid version. In this development step, students can "test" and document the models with light to observe light and shadow, a fan to sense airflow, and take photos through the screen to approximate "view". Common developments include: duplicating, layering, creating variation, using two materials, exploring connections, changing size or density of solids or voids, expanding the width or depth, etc… It can be helpful to try to quantify "density"; in most cases, screens should have more solid and less void to effectively, screen. This is a time to clarify or enrich the relationship to the analysis and the artist. Improve craft and create cleaner, designed connections.

On Software, Skills and Technology:
Early students are at a transformative moment in their skills and software development. In one semester, they begin Adobe Creative Suite, Revit, Rhinoceros, Enscape, and other composite techniques for rendering. By the final project, students can build the screen in Rhino, import it into larger Revit model, and render with light and material in Enscape. This is important digital skills development and workflow at multiple scales.

The students accomplish more design complexity and material richness in their screens by starting work physically by hand, than they would starting digitally. The photographs of the screen models and their effects are always better than the rendered versions.

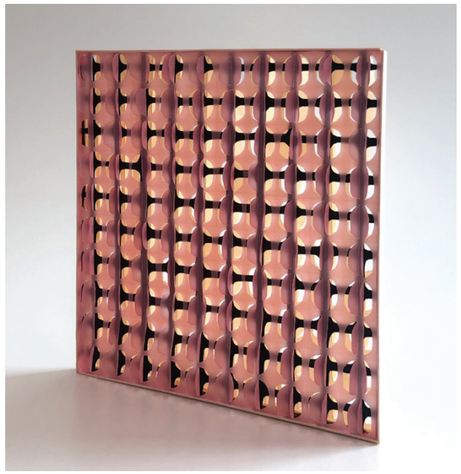


Fig. 6 Third Iteration Physical Screening Model, G. Foglio, Fall 2022

Step 1.X: Integrate into Final Project: Adapt for Site and Program

The screen design can become one component and feature within a larger design. Within a final project, students can work to productively situate the screen in space, in relation to structure, circulation, and program. The public "Workshop Art Residence" program combines public gallery, studio, meeting, learning, and residence (among other utilities) which is conducive to flexible and porous divisions using the screen.

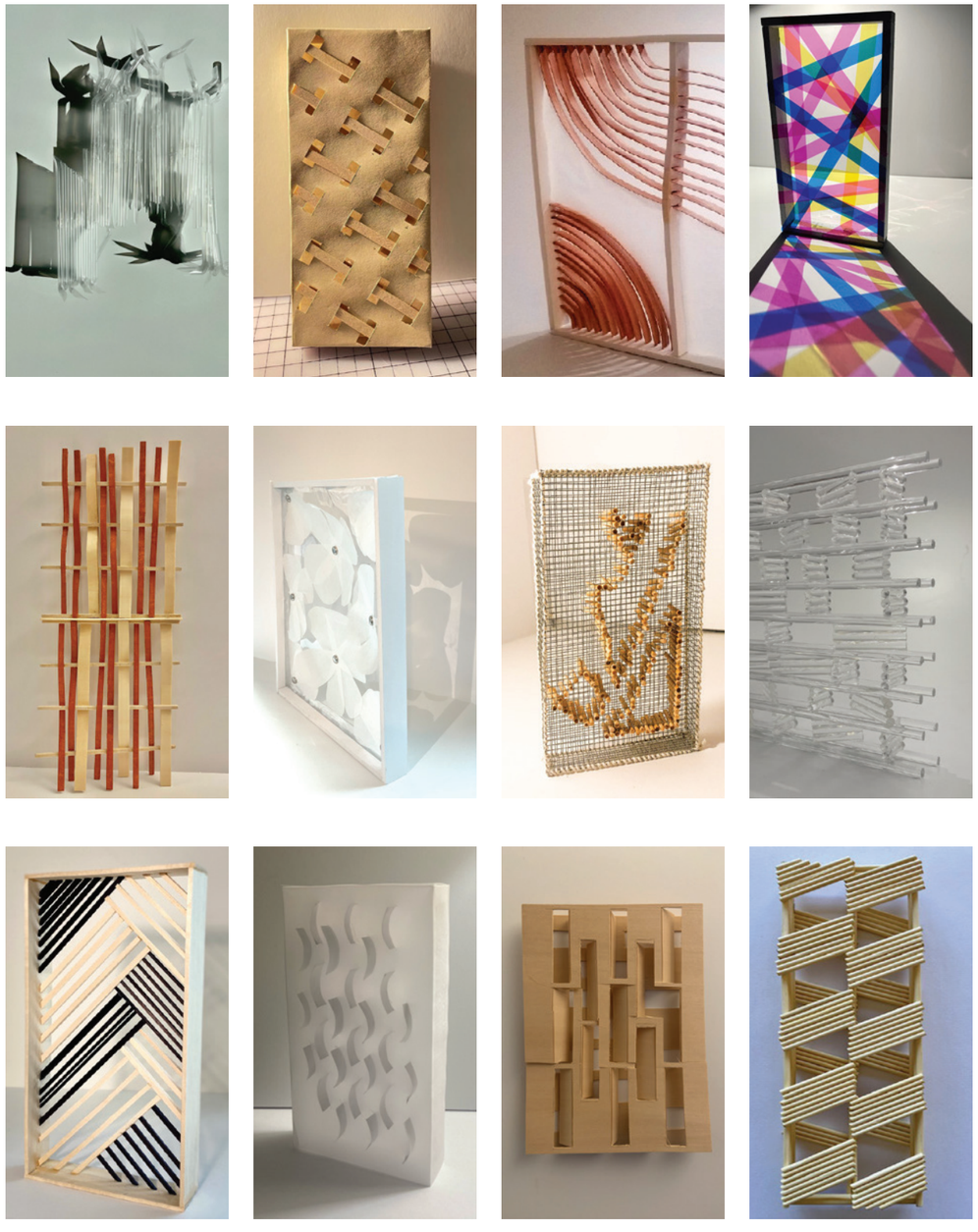


Fig. 7 Light & Air — Selection of Performative Screens 2020-22. Top L to R: S. Masoodi, S. Rao, N. Iligan, J. Salinas; Middle L to R: T. Soong, A. Toyoka, C. Davis, D. Tran; Bottom L to R: K. Thu, C. Nguyen, H. Luo, M. Rodriguez.

In this stage, students can further develop and adapt the screen design. Solar orientation, wind direction, temperature, humidity, air quality, noise, specific setting (trees, cars, sidewalks etc..), and local culture are some factors that may inflect the design. It is likely an introductory student can address one or two site factors. Programmatic development can be exciting. How does a version of the screen become: a door or skylight, display or storage, seating, create more privacy, exist outside?

Enclosures can certainly be performative, crafting light, air, view, and subtly dividing flexible spaces. Enclosures can also be more productive; they can be actors with greater agency in shaping climate, space, and program. Using materials, we can speculate on how enclosure can be productive. Enclosure can: absorb, communicate, compost, condensate, conduct, cultivate, distribute, drain, ferment, generate, grow, house, illuminate, ventilate, warm... in addition to creating phenomenal effects. As we reimagine and adapt mundane materials, some beautiful in their banality, we can discover enclosures that perform work.

---

4. Open Enclosures — Productive Materiality

Impetus

First and foremost, this brief aims to swap the tendency of students to: design first, apply material second (or much later…). By starting with materials, students ask what the material can do, formally and performatively. At this intermediate level, students become material innovators, stewards of new techniques for a different future. Practice builds confidence to move beyond basswood or museum board. To craft a productive open enclosure, introduce students to: clay, bamboo, felt, hessian textiles (jute), palm fiber, sedges, stone, waste, as well as sustainable concrete formwork. What can the material do?

This brief also uses this opportunity to introduce casting. Casting research frames a discussion around concrete construction. Concrete, once dominant in the AEC industry, is challenged by a large carbon footprint. The cost and waste in the design and construction of formwork diminishes its favor. At the same time, the plasticity of concrete has incredible structural and formal potential, marked durability over time, and beauty in design. Given this complexity, how can we approach formwork more environmentally? As part of their material practice, students test methods for casting with non-traditional formwork: biofoam, bioplastics, canvas, clay, earth, felt, food, ice, paper, sand, sedges, stone, textiles, wax.

Precedent Research

Rigorous precedent research helps legitimize and inspire. There are multiple tracks possible:

- World architectures and natural architectures are exemplary, climate-based precedents of building materiality, some practiced over millennia: mud brick, rammed earth, 3d-weaving with sedges, layered palm fibers, bamboo scaffolds, sand and stone filters… or even nests of birds and insects.
- Serpentine Pavilions pose intricate, digestible lessons on open enclosure and tectonics, especially: Lina Ghotmeh (2023), Junya Ishigami (2019), Frida Escobedo (2018), Diébédo Francis Kéré (2017), Sou Fujimoto (2013).
- Real concrete fabrication. Students can research works such as: Paolo Soleri's earthen formwork at Arcosanti; the slim pneumatic casts of Dante Bini or TU Wein; bulbous nylon-cast P_Wall by Matsys; 3D-printed vertical concrete of Virginia San Fratello and Ron Rael (Emerging Objects); and "FoamWork" by Anna Szabo and Patrick Bedarf of DBT at ETH Zurich.

Fig. 8 Formable and reformable, malleable hessian textile interwoven with copper wire, L. Lawrence, 2019

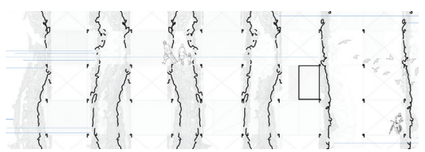
Central Explorations
Develop a material practice with a renewable material to form an enclosure with a productive function. Develop a fabrication method for casting which is either reusable or reduces environmental impact.

Step 2.1: New Material Practice — Begin by Making
Accompanied by group research and presentation on material capacity or relevant precedent.

Students select from a list of possible materials. Ideally the material is aligned with their research or precedent. Students must source enough material for iterative physical making and larger-scale final tests. Students construct a progressive and developing series of 3d material studies,

New Material Laboratory Methodology
This is innovation through making. Students learn, bravely, by trying something new and then persisting, day after day. Physical models are first produced by hand and may later be customized with digital tools.

Initial new material studies are small, the size of a grapefruit, with volume and density. Position this as a testing "laboratory", with cause and effect, analyze and describe. Students study and document the new material tests through photographs and 2D drawing. Prompts for iterations can probe how to craft the new material to produce: variation, differentiation, gradient, structure, fineness, expansion in XYZ. OR how does the new material interact with light, air, water, heat, cold… Set the bar and declare: no glue is allowed… Accompany the final set of material tests with 2D documentation drawings, fabrication diagrams (their "recipe"), and process photos.



g. 10 Iterative casting laboratory with water soluble biodegradable ofoam and material drawings, L. Locke, 2019

Fig. 21 Felted "shingles" for water absorption and softness
L. Oyler, 2020

Step 2.2: Creative Casting: Discovering Formwork
Accompanied by group research and presentation on concrete innovation.

Students explore creative, sustainable, or renewable formwork for small-scale casting. Similar to Step 1, students construct an iterative set of small casts, with the goal of demonstrating how the formwork is reusable or reduced impact. Rockite is ideal for small studies: quick drying, easy release, and fine grain results. This formwork step also builds basic skills in positive/negative relationships and spatial acuity.

Discuss the benefits and constraints of media. Formwork media fit into three general types:

- Silt casting methods use "ground" as formwork. In this case, "ground" may be: clay, sand, soil, or other aggregate such as stones and vegetation. (compression)
- Soluble casting methods use media that dissolve as formwork. This may be: ice, wax, or new materials like water-soluble biodegradable biofoam made from corn. (compression)
- Sheet casting methods use surface materials or bladders as formwork. In this case, "sheet" may be: bioplastics, paper, recycled LDPE plastics, or a variety of felts or textiles in suspension or inflated. (suspension or inflation)

Creative Casting Methodology:
Begin with in-studio demonstration on casting with rockite using sand formwork. The demo can cover media choices, wetting media, casting best practices, lubricants, curing and release. Within a couple of weeks, students will have individual methods and will share tips and strategies with each other. Initial studies are small, the size of a grapefruit, 3d but integrating holes, not solid. Prompts for casting iterations can engage: formwork texture, thinness, structure, formal investigation, apertures, deformations, multiple voids. Students can explore plaster, quickcrete, or concrete in the third or fourth round of casts or as needed individually.

Step 2.1 and Step 2.2 can be scheduled consecutively or concurrently with alternating deadlines.

Fig. 12 Rockite casting with damp sand formwork, T. Tran, 2022

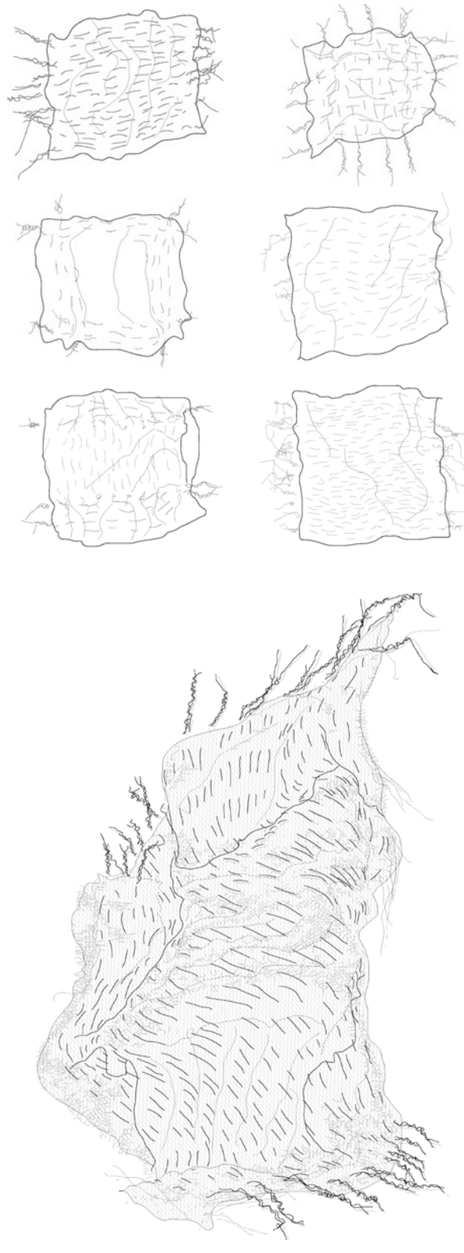


Fig. 13 Drawings from the porous hessian textile (jute) laboratory. Early studies were tested for strength and malleability. L. Lawrence, 2019

Fig. 14-22 Selection of early studies from creative casting with sustainable formwork: biofoam, bioplastics, canvas, clay, paper, and sand. Clockwise from top right: A. Nikzad, S. Park, W. Wong, D. Dinh, A. Nguyen, A. Nguyen, J. Velasco, J. Lindberg.

Step 2.3: Make it Bigger — Testing and Scale
Accompanied by testing productivity and describing the performative intent in writing.

"Can you make it bigger / Expand in XYZ"? Increasing the size of the new material tests and the castings is an essential step in proof of the fabrication concept. Both the new material physical models and the casting formwork begin to demand structural integrity, designed connections, calibrated weight at around 14" high. Students construct a larger new material test and a larger cast, such as a minimum of 42 total linear inches.

At this leap, new issues may arise to be creatively solved. Fabrication challenges may require: supportive structures, mechanical connections, or integrating digital tools.

<u>On Software, Skills and Technology:</u>
Intermediate students have more digital skills and are in the process of improving use of Rhino and the Creative Suite. As the studies increase in size, the process may engage digital fabrication, laser cutting, digital cutting, 3d printing.

Students accomplish more design complexity and material richness in their work by starting physically by hand. Encourage photo collage rendering for better material quality.

Fig. 33 Post-Industrial Habitat collage rendering using concrete cast with water soluble biodegradable biofoam, L. Locke, 2019

Fig. 44 Vineyard production bi-products and waste enclosure, phased collages, L. Koche, 2019

Step 2.X: Site Situation and Productive Program

In a later, final phase, students work to develop their methods in relation to site and program. At this point, students may proceed with integrating both the new materials and casts, or they may focus on developing one.

In lieu of a pre-determined program, students can align program with the productivity of their inventions. Program may be general such as "habitat" or specific such as "covert vineyard speakeasy". "Site situations" can be similarly loose — a situation establishes a series of relationships to ground and air, but not a precise location or size. One option is for students to invent hypothetical sites. Alternatively, select a local post-industrial manufacturing or brownfield site. Defunct sites helpfully engage a position between nature and industry, past and future. Located on the periphery, post-industrial sites offer real conditions with the freedom and license for speculative proposals.

In this stage, students tailor their designed systems toward site and climate conditions. These may be typical environmental criteria, or students may imagine a future dystopic or post-apocalyptic scenario which further engages the speculative intent of their work. This becomes an opportunity for students to write a project description, narrative, or a project manifesto of sorts.

Image Credits

Fig. 2 Curtain Wall House image by 準建築人手札網站 Forgemind ArchiMedia used with creative commons license: https://www.flickr.com/photos/eager/13390108074

End Notes

1 Venturi, Robert and Stierli, Martino. *Complexity and Contradiction in Architecture*. Museum of Modern Art: New York, NY. 1977. p 86.

2 Verschaffel, Bart. "The Interior as Architectural Principal" in *Palgrave Communications* DOI: 10.1057/palcomms.2017.38, p. 2.

3 Kwinter, Sanford. "The Judo of Cold Combustion" in *Atlas of Novel Tectonics.* Princeton Architectural Press, New York, NY. 2006. p 15.

4 Ive, Jony. "Sponsor's Statement" in Bolton, Andrew. *Manus x Machina.* Yale University Press: New York and London. 2016. Fronticepiece.

Bibliography

Bolton, Andrew. *Manus x Machina.* Yale University Press: New York and London. 2016.

Rajagopal, Avinash. "Why Interior Designers Must Fight Climate Change." *Metropolis online,* December 2, 2020.

Reiser, Jesse and Umemoto, Nanako. *Atlas of Novel Tectonics.* New York: Princeton Architectural Press: 2006

Venturi, Robert and Stierli, Martino. *Complexity and Contradiction in Architecture.* New York: MOMA, 1977.

Verschaffel, Bart. "The Interior as Architectural Principal" in *Palgrave Communications* DOI: 10.1057/palcomms.2017.38.

Session 3

Toward a Philosophy of Beginning Design: To the Things Themselves

Stephen Temple. University of Texas at San Antonio

Introduction

It is a common in architectural pedagogy to believe that to learn to become an architectural designer, one must first learn some basic lessons about the discipline to operate creatively within the practice environment of architecture. However, just by living in the physical world, beginning design students already know a great deal about the discipline of architecture through embodied experience. So rather than contesting with student experience, shouldn't beginning design studio courses instead be more focused on it? Learning about and acting on the creative processes at the core of design is largely unknown to beginning design students, so learning to recognize and reshape prior experiences creatively into design processes is a primary pedagogical challenge of beginning design. Juhani Palassmaa expresses this learning about architecture as a transformation of lived-experience. He states, "Education in any creative field in our time has to begin with the questioning of the absoluteness of the lived world and with the re-sensitization of the boundaries of self. (Palassmaa 2009) This notion leads to the idea that architectural design pedagogy should be more focused on the lived-body at the core of lived-experience as a means of investigating what is basic about architectural experience in relation to human endeavors. Being creative means to transform, and what is most transformed during early learning is student life-experience. Enabling student self-transformation is far more meaningful than lessons of the discipline because a transformative pedagogy will enable heuristic learning – education that enables students to discover and learn something for themselves, and importantly, to then become aware of the possibility of this search. A personal inroad into this arena is what is being searched for and what must be supported in beginning design.

How is heuristic learning to be put into play? The pedagogy that most emphasizes heuristic learning is a strategy of 'learning-by-doing,' structured by methodologies that employ empirical experiences and reflective analysis of their meanings as a means of articulating reflection on human experience as it manifests in creative activities. The aim is to engage the student in the art and methodology of interpretation of ideas amid developing understanding of the validity of the ideas, toward realizing a search for ideas of validity and depth within dialogue about the subject. This is ideally what all design studio courses desire to enact and what beginning design studio courses intend to initiate. Engaging making is an optimal pedagogy for beginning design students because of the immediate engagement of the "thinking body" with materials instead of mental objects. Making is a return "to the things themselves," that builds knowledge structures through a progressive internalization of actions in the immediacy of moment-to-moment judgments that actualize thought in action, enabling students to begin to develop an ability to assign their own tasks and make their own inquiries and judgements in the context of learning how to learn. This essay will further elaborate the theoretical underpinnings of a heuristic of 'learning-by-doing,' and will explain design exercises in making in the first semester curriculum in which I teach.

Learning to Be Creative

Being creative is defined in the dictionary as "an ability to generate and recognize original, novel, unusual, and/or innovative ideas, alternatives, and possibilities in the production of something new and imaginative," a daunting task for beginning design students. Mainstream research on creative practices in the last 80 years have ranged widely, from the idea that for creativity to occur, there must be an established disciplinary context (Amabile 1996), to creativity as a "reflective practice" (Schön 1984), to the idea of "flow" as a distinct state of mind of the creative (Csikszentmihalyi 2013), to the notion of creativity as a kind of improvisation, similar to that which happens in jazz – (Sawyer 2007) to idea that creative people actually possess "creative intelligence" (Nussbaum 2013). As distinctly diverse as research in creativity has become, there are commonalities within this research that are telling for beginning design pedagogy. First, being creative always involves a tacit or explicit reference to some specific generative process involving iterations. Secondly, being creative involves a search for constraints on what is possible in a creative venture, especially when these constraints are self-generated. Third, and most importantly, to be creative one is engaged in a transformation of both the thing being created and the self who is doing the creating.

Learning to be creative is a primary activity of beginning design education too often taken for granted and sometimes lost to other agendas such as discipline-based lessons and too often, identifying the talented. Teaching beginning design should never be a search for talent because it is instead a matter of student self-transformation and basic development of creativity as a transformation of life-experience. This means that teaching and learning design must take education seriously from the perspective of the transforming learner. Many aspects of learning creativity that are otherwise marginalized or taken for granted by beginning design pedagogy can happen in beginning design exercises and related classroom encounters.

Learning to be creative can be learned and developed in student activity as a kind of "classroom know-how." However, self -transformation is key, within a recognition of design process and the role of ambiguity and uncertainty in its formation. (Temple 2015) Classroom experiences can reveal to the beginning student that that inquiry begins with curiosity, exploration can disclose constraints, discovery will reveal concepts, iteration is critical to process, critique is critical to iteration, and that creativity can be modeled, and thus viewed from outside personal perspectives. The latter is crucial to student self-transformation. As a student is beginning to develop as a creative thinker, the notion of "design thinking" can serve pedagogy as a point of clarification and further self-transformation. Specific distinctions between creative and critical thinking can inform the notion of creative design problem solving as distinct from artistic creativity or engineering processes, and in so doing, specifically provide the student with direction.

Learnig Design and Experience

Learning theorist, David Kolb, has characterized experiential learning as a cycle beginning with direct experience and its corollary in reflection and mental representations prior to the next step of abstracting it for the purpose of a conceptualizing it into active experimentation as subject matter for multiple iterations of this cycle. (Kolb 2014) The important aspect of this process for beginning design pedagogy is the transformative activity for students involving experience and reflection. It is an act of phenomenological hermeneutics - the activity of structuring methodologies by employing empirical experiences and reflective analysis of their meanings as a means of articulating reflection on human experience as it manifests in creative activities. (Gander 2017) Methods commonly used in doing this are descriptive awareness of personal experiences, conversational interview, close observation (through phenomenological description), and critique. Phenomenological hermeneutics begins with engaging curiosity about what it is like for a person to have a particular experience. The intent is to pursue something from a truly reflective awareness, enabling the full complexity of the tasks at hand to be taken into consideration – not just to satisfy necessity, convenience, preconceptions, whimsy, expedience, or other rationales. In design studio education, hermeneutics involves the art and methodology of interpretation of ideas amid a developing understanding of the validity of the ideas. Hermeneutics helps to reveal the knowledge a student already has, toward realizing a search for ideas of validity and depth. This helps in creating dialogue about a subject matter. The set of relations involved in hermeneutics is ideally what design studio courses desire to enact and what beginning design studio courses intend to initiate. Also significant is that this pedagogy operates with respect to studio culture as a place where students to reflect together to realize the common goal of self-transformation.

Enacting phenomenological hermeneutics in the beginning design studio is to employ a heuristic methodology. A heuristic is a way of working that enables someone to discover or learn something for themselves. Heuristic learning is engaged within trial and error strategies as processes of experiment and discovery that engage curiosity as a core motivation, within an awakening of a realization of a search for something. This act is also self-transforming, as described by Walker Percy, "The search is what everyone would undertake if not stuck in the everydayness of his own life. To be aware of the possibility of the search is to be on to something." (Percy 1961) Heuristic processes simplify design decision-making in ways that may not be optimal, perfect, or fully rational, but are nevertheless sufficient for reaching an approximation within an iterative process and a given timeframe, which characterizes well the act of design decision making. Ultimately, heuristic knowledge structures are the more experiential and judgmental knowledge of what commonly constitutes 'good judgement' in the discipline. The artist Robert Irwin, reflecting upon teaching in his later life as an educator, summarized an attitude crucial to this approach:

> "My ideal of teaching has been to argue with people on behalf of the idea that they are responsible for their own activities, that they are, in a sense, the question, that ultimately they are what it is they have to contribute. The most critical part of that is for them to begin developing the ability to assign their own tasks and make their own criticism in relation to their own needs and not in light of some abstract criteria. Because once you learn how to make your own assignments instead of relying on someone else, then you really learn the only thing you really need to get out of school, that is you've learned how to learn. You've become your own teacher. After that you can stay on - for the facilities, the context, the dialogue, the colleagueship, the structure, and so forth. But you'll already be on your own." (Irwin 1983)

If each beginning design student can discover their own search in their early design experiences, they will learn that what is to be a designer means that they develop their own questions, and construct their own means of searching, as a way of informing their own design work. This is what is most primary to beginning design pedagogy, to enable a fundamental transformation of life-experience as a foundation that makes the quest for the rest of design education a deeply meaningful experience on which to build a design career.

Building a beginning design pedagogy that can enable students to realize a self-transformation will result in recognizable encounters and realizations for both students and faculty. It is the role of the beginning of design education to bring about creative activity and creative thinking and not just to implant disciplinary lessons or sort out talent. Developing in the student an inroad into creative thinking means to become amenable to transform from having a fixed mindset to a growth mindset with a corresponding adjustment of preconceptions and misconceptions about the role of the self in design processes. (Dweck 2007)

Developing Fundamental Design Pedagogy

It can be challenging to implement a reasonable and clear approach to pedagogy in the context of one's own career as an educator. Too many design educators simply teach as they were taught without realizing that they to, must continue their own search and transformation. Teaching students merely through disciplinary lessons or teaching them how-to-do-things is insufficient. Teaching skills or establishing for beginning students a disciplinary context may seem like a reasonable strategy but it does little to help them engage a structure of thought about what they are doing within even the simplest design exercise. Exercises in architectural design require that beginning students develop a basic structure for observing the world and one's actions within it. A structured relationship between thought and action on materials can be delivered through the philosopher Plato's "Analogy of the Line."

As derived from Plato's dialog in "The Republic" to explicate relations between the intelligible world and the visible world, Plato's "Analogy of the Line" places horizontal line between ideas and abstractions on one side of the line and actual things and experiential appearances on the other. A vertical line that bisects the horizontal results in four segments that represent four distinct "affections" of the psyche. The lower two sections correspond to the sensible world and the upper two sections correlate with the intelligible world. Successively increasing levels of reality are described from imagination to belief to thought, resulting in understanding, or knowledge, ultimately for Plato as "Forms." Forms are the absolute good that exists only within the ethereal "World of Forms," as the highest ascension. (Plato 1941, Ross 1951, Fine 1999, Mitrovic 2011) The lower section of the line that represents the "sensible world" of perceptual appearances, available to us by way of sensory perception, is held to be incapable of supporting knowledge in that it cannot be "known in-itself" because, at its lowest level, it consists of illusion and imagined images. The next higher section of the sensible world consists of acts of sensation conjured by actual contact with the material things of the world - matter itself. That things exist, for Plato, cannot occur in the lower portion solely within the sensible world without also being brought into relation to the intelligible world in the upper portion of the line. (Fine 1993, 1999; Press 2007) It is the basis of Platonic thought that the nature of the world occurs as a structured correlation of relations of interiority to exteriority. The upper portion above the line consists of forms accessed by way of thought and ultimately, understanding, which is held to be an access to knowledge in an absolute sense - ideas. (Fine 1993, 1999; Press 2007) Plato is not explained to beginning design students in this way. Instead, a simplified version of Plato's "Analogy" is presented as and interactive structure between thought and the physical world. The basic model of relations in the diagram derived from Plato between ideas, abstractions, and matter generate for the student a way to constructively model their creative thoughts and actions onto the world as a beginning of thought about architectural design:

IDEAS
I
ABSTRACTONS
I
MATTER.

Because beginning design students are grappling with defining, identifying, explicating, and even the "having" of ideas in a somewhat rarified sense, the contrast of ideas to matter itself makes sense to them, especially when they are holding raw materials in their hands and thinking about doing something to it as part of a design exercise. It is then explained that when they think about what to do with the materials they are abstracting. And when they draw to explore what they are doing they are acting on abstractions. Making a model, or working in scale, is an abstraction, as a miniature reduction of the actual world. With this generalized model of Plato as idea/abstraction/matter, it's dynamic interaction can enable a generalized understanding of creativity in design activities in the following way: Ideas are transformed by matter, and in turn matter transforms ideas, and the operation of transformation is abstraction. And all of these elements are in flux through the design process. This gives beginning design students a basic model for thinking about what they are doing when designing as manifesting a system of relations, and it provides conceptual inroad into how to think creatively. (Temple 2017)

Making

Because the generalized structure of design implied in Plato's "Analogy of the Line" specifies an interactive relationship between ideas, thought, and materials, the act of making is an optimal means of explicating its relation to design activities. The actions on materials involved in making precede abstracting, but at the same time are informed by abstracting. Matter is the ground of abstraction because abstraction emanates from its origin in the actual things of the world. Because abstraction is drawn out of the actual, the "thinking body" can become a locus for transformations between matter and idea. (Lozanovska 2019) As a pedagogical methodology, engaging making activates Plato's analogy in design studio exercises. Plato, ideas and materials have an interactive

relationship that students can easily realize in making something - ideas transform materials while at the same time, ideas are transformed by materials. Because of this, activities of making ground thought. As ideas emerge, making transforms thought as ideas become realized in material form. To 'realize' an idea means to make the idea real. Another instructive correlation with the Platonic diagram is that making depends upon the fact that for an idea to be made real and be perceived, the activities of making rely upon geometry to become worked out, tooled, and ultimately exist in lived-experience.

In beginning design exercises that make something, there is a messy vitality that gives life, simultaneously and in the moment, to both inquiry and ideas. A dictionary definition of vitality is the state of being active and energetic but it also represents the power of giving continuance of life, which is present in all living things. Thus, making is a best practice for a pedagogy of learning creativity because the vitality of constructionism is fundamental activity of learning. Making builds knowledge structures through a progressive internalization of actions in the immediacy of on-going judgments that actualize thought in action amid the iterative construction of inquiries about thought/action relations. Moment-to-moment reflection on actions on materials enables students to begin to develop an ability to assign their own tasks and make their own inquiries and judgements in the context of learning how to learn. Importantly, engaging making realizes ideas in a context that is tangible and sharable in reflective studio dialog with others engaged in similar transformative learning experiences. (Harel and Papert 1991)

Activities of making engage the whole learner, body and mind together, in self-directed learning. Making actualizes thought in action and thought about action (Schon) in a collaborative conversation w/objects. Making enable the development of knowledge in on-going judgments across many iterations as decisions are made about material substances and joinery, all within an aesthetic and functional context. Making is always an engagement in process. Making something results in a materialization of ideas in a context that is tangible and sharable is display, discussion, and critique. A heuristic of 'learning-by-doing' can be elaborated by design exercises in making in the first semester. Each exercise should be a 1:1 desk-top size investigation that is intentionally non-representational. Each exercise should develop out of the previous with new constraints as analogous to full-scale architecture. A culminating project should be large enough that students can occupy it and learn from their embodied experience of moving into it.

Concluding remarks

In this paper I have tried to make an case that developing pedagogy for developing creative thinking must seek to transform the student life-experience. Learning "skills" is secondary to engaging students in generative processes because personal transformation is a necessary part of learning to be creative. (Temple 2019) Engaging student transformation in pedagogy recognizes that learning is the building of new synapses in the brain, especially when learning experiences connect the internal to the external, such as that which happens when making things within a heuristic learning structure. Engaging in heuristic inquiry, beginning from the body through making, enables the realization of the search for design inquiries of depth and genuine persuasiveness. However, It must be clear that it is not only beginning design pedagogy that brings about transformation of students, it is the province of an entire curriculum to construct creative designers. Beginning design is the opening up and initialization of the student to possibilities in the realization of their own transformation.

The student has an outsized role in beginning design learning. Beginning design students undergoing self-transformation are in search of a clear picture of themselves as designers, as identity is a foundational layer of self-understanding. Students must not only come to accept their own self-transformation and must actively engage in reconstruction of their own self-transformation. A first step is to not waiting to be told what to do even when ambiguity, not-knowing, and uncertainty are encountered. In the context of design exercises, the student must come to realize there is a special magic about not knowing what you are doing and be completely honest about it. This will free the student to authentic encounters with creativity, but while encountering this freedom, the student may venture into recklessness. Students must be reminded that they are seeking 'peradams' - something that is revealed only when someone knows they are seeking it. (Daumal, 2004). This will lead the student to recognize certain aspects of self-transformation in creative acts but only if efforts are led by curiosity within a heuristic structure. Also, central to learning to be creative is that students must develop the courage to create rather than cater to expectations as a remedy of self-doubt. (Woolf 2003) However, students will learn that engaging curiosity and courage depends requires commitment and resolve to persevere.
The paragraphs below are encounters normal to teaching beginning design studio courses that are transformative opportunities that pedagogy can readily employ. Each issue within design learning discloses need for further experimentation and research.

Learning design requires the modeling of design processes to give context to creative processes. In beginning design it is instructive to characterize design as "thinking before building" to give structure to thinking and doing as forms of design engagement, but the Platonic structure of relations between idea/abstraction/material can better provide a basic structure for modeling design processes. Design exercises that start with making something, then work through drawing representations back to re-making the object based on what was learned can trigger students to inspect design processes. The issue of workmanship as a critique of the objects of making is intimately correlated with modeling design processes. Discussing workmanship can, of course, lead to way to make a more well-made object, but discussion of workmanship also leads students to many other design issues related to modeling design processes. (Temple 2011)

Learning design at foundations also means giving clarity to abstraction and uncertainty. Encountering abstraction is a also threshold issue in design learning and when forming a design process. Important to emergence from this threshold is that students develop increasing comprehension of abstract processes through discourse and critique as they are encountered in design exercises. (Temple 2020) Within design activity, ambiguities and uncertainties are encountered as a normal aspect of creative processes. Though confounding for beginning students, these encounters are thresholds that must be traversed because doing so enables students to come to realize measures of design engagement within the direct experience of design processes. Encountering uncertainty raises other possibilities, as provocations to view them as opportunities for design. Design exercises for beginning design students that foster "open exploration' with no predetermined outcome will allow for encounters with uncertainty that lead to engagement in a search for constraints & principles as a part of design processes. This activity both reveals and sorts out possibilities but does so in an introspective search for conceptual intent in a manner that effects personal transformation.

It is imperative in beginning design studio courses that experiences are shared in dialog with other students engaged in transformation. Beginning design learning experiences that happen from the perspective of the body, prompt an understanding of space that is directly correlated with the "thinking body." Skill sets learned in direct contact with the physical world comprise simple yet important ways in which we engage our surroundings, but it is when these skills are reflected upon and then put into conceptualized action that design takes place. Reflecting with others on the learning that can occur through design exercises can disable a preconception that ideas have priority, and thus teach that thinking is no more a priority than acting.

Often overlooked in design pedagogy is that learning to engage design through play can open one up to a search for content in the context of design processes. The robustness of play emerges in making things and this experience of the "flow" of play is at the root of learning to be creative. Seeking innovation begins with play as a reflective and critical attitude begins developing about one on is engaged in. To truly pay attention to what one is doing is the kind of engagement in creative thinking that promotes self-transformation and development of ability to model design processes for one's self. Paying attention means to begin is to engage the intangible in lieu of the practical, as a way of transforming tacit presumptions into an understanding. In design thinking, beginnings of comprehension often happen in a gap between tacit & disciplinary knowledge. As design is an ill-structured knowledge domain, learning to design requires a pedagogy that both elicits and respects cognitive flexibility in students, and it must do so in a manner students can recognize as they transform – to get students to "Try to realize it's all with yourself, no one else can make you change." (Harrison 1967)

Bibliography

Amabile, Teresa M. 1996. Creativity in Context: Update to the Social Psychology of Creativity. Boulder CO: Westview Press.

Harrison, George. 1967. "Within You Without You." Sgt. Peppers Lonely Hearts Club Band. Beatles.

Csikszentmihalyi. Mihayli. 2013. Creativity - Flow and the Psychology of Discovery and Invention. New York: Harper Modern Classics.

Daumal, Rene. 2004. Mount Analog. New York: Overlook Press.

Dweck, Carol S. 2007. Mindset: The New Psychology of Success. New York: Ballentine Books.

Fine, Gail. 1993. On Ideas: Aristotle's Criticism of Plato's Theory of Forms. Oxford, NY: Clarendon Press.

Fine, Gail. 1999. "Knowledge and Belief in Republic V-VII," in Plato I: Metaphysics and Epistemology. Edited by G. Fine, Oxford: Oxford University Press. 215–75.

Gander, Hans-Helmuth. 2017. Self-understanding and Lifeworld: Basic Traits of a Phenomenological Hermeneutics. Indiana University Press.

Harel, Idit and Papert, 1991. Seymour. Constructionism. Westport CT: Praeger.

Irwin, Robert. 1983. quoted in Lawrence Weschler, Seeing Is Forgetting the Name of the Thing One Sees. University of California Press.

Kolb, David. 2014. Experiential Learning: Experience as the Source of Learning and Development. New Jersey: Pearson FT Press.

Lozanovska, Marjana. 2019. "The Spatial Body in the Proto-Architectural Phase of Design." In Temple Stephen. Developing Creative Thinking in Beginning Design Studios. New York: Routledge. 165-183.

Bruce Nussbaum. 2013. Creative Intelligence: Harnessing the Power to Create, Connect, and Inspire. New York: Harper Colliins.

Palassmaa, Juhani. 2009. The Thinking Hand: Existential and Embodied Wisdom in Architecture. New York: Wiley.
Percy, Walker. 1961. The Moviegoer. New York: Farrah, Straus, and Giroux. Quoted in Unwin, Simon. Analyzing Architecture. New York,: Routledge, 2020.
Plato. 1941. Plato's the Republic. Translated by Benjamin Jowett. New York: The Modern Library.
Press, Gerald A. 2007. Plato: A Guide for the Perplexed. New York: Continuum International Publishing Group.
Ross, David. 1951. Plato's Theory of Ideas. Westport, CN: Greenwood Press.
Sawyer, Keith. 2007. Group Genius: The Creative Power of Collaboration. New York: Basic books.
Schön, Donald. 1984. The Reflective Practitioner: How Professionals Think In Action. New York: Basic Books.
Temple, Stephen. 2011. Making Thinking: Beginning Architectural Design Education. Dubuque, Iowa: Kendall Hunt.
Temple, Stephen. 2015. "Ambiguity and Decision Making in Beginning Design Experiences". Proceedings of the National Conference on the Beginning Design Student NCBDS 31, Houston TX: University of Houston, 551- 558.
Temple, Stephen. 2017. "Plato's "Analogy of the Line" as a Pedagogical Device for Enlightening Beginning Designers to Design Thinking in Architectural Education ". International Journal of the Constructed Environment 8(4), 1-12.
Temple Stephen. 2019. Developing Creative Thinking in Beginning Design Studios. New York: Routledge.
Temple, Stephen. 2020. "The Threshold of Abstraction in Beginning Design Pedagogy." Journal of Design Studio v:2 n:2, 101-110.
Woolf, Virginia. 2003. *A Writer's Diary.* New York: Houghton Mifflin Harcourt.

Disability and Impairment Accommodation in the Studio Environment

Liane Hancock, University of Louisiana Lafayette
Kiwana McClung, University of Louisiana Lafayette
Dr. Claire Schultz, University of Louisiana Lafayette
Kris Lyon, University of Louisiana Lafayette

Introduction

In beginning design studios, faculty endeavor to create an inclusive environment for all. For students this is typically the first time they have engaged in a college level design course, and the terrain is open for them to explore and discover. However, this terrain can become clouded, and obstacles can arise when students with impairments and disabilities attempt to navigate the course. To make the path easier, the University Office of Disabilities (ODS) has a range of accommodations and/or modifications that it can offer. But often these accommodations are just a beginning, and it is sometimes difficult to correlate traditional accommodation and/or modification such as extended test taking to performance-based pedagogy courses that require creative constructed solutions.

While conducting research on the suitability and equity of the studio environment, in the form of an electronically administered survey to beginning design students, questions about disability accommodation arose, resulting in some contradictory findings. The number of students who self-identified as having a disability was significantly greater than those who reported receiving accommodations through the Office of Disability Services (ODS). This discrepancy and the implications of it revealed additional challenges to creating an inclusive, equitable studio environment. This paper will explore the nuances of disability and impairment accommodation in the beginning design studio environment so that adequate considerations can be made when attempting to create equitable and just studio environments.

Performance/Performative Pedagogy

In post-secondary education, courses are typically classified as lectures, seminars, or labs. Lab based courses presuppose projects and products that require a level of physical performance to complete. Performance is based in the act of creating- objects, movements, music. When learning is connected to bodily movement the experience becomes somatic, engaging the mind and movement in a coordinated manner. This type of cognition is on the higher end of the taxonomy of learning meaning that learners are engaged in the highest level of thinking and thought processing. The coursework in these labs require physical manipulation or touch and often engage the other senses: smell, sight, hearing, and sometimes even taste. The student must engage in processes which call for analysis or production with sensitivity and dexterity.

Academic research also employs the term Performative to this type of pedagogy. Performative pedagogy is indicative of the articulation of the body in classroom teaching and learning. Visual arts and design curriculum at the secondary level is generally performative in nature, including acts of demonstrating specific skills and technical abilities in a variety of two and three-dimensional media. The teacher's understanding of the role, impact, and limitations performative pedagogical practices bring to the learning environment, enhances teaching and learning. Implementing performative pedagogy models in the classroom links the corporal to experience in a flexible, open way connecting the body and knowledge. Performative pedagogy allows for the use of the body as an instrument, embodying the work with one's subjectivity and individual expression. The social context of the performance is also important to the subject's interpretation of the corporal representations because it is without saying anything that one can say everything all at once. Instructional use of performative pedagogies is layered over the inherent and greatly nuanced performance of individuals. Teachers ask students to perform in specific ways and in so doing create a product of corporal articulation with foundational aspects engendered with and derived from political, social, and cultural influence. This qualitative understanding and representation of identity, knowledge, and meaning making is an implicit activity and using performance as an explicit pedagogical practice enhances our understanding of the implicit practices that may go unnoticed or worse be misunderstood. [1]

Foundation level performance-based coursework, in particular, draws upon standard processes of action. These regularly presume able bodied participants learning physical skills and having traditional cognitive processes and falling within the norm of social and cultural influence – though certainly design also rewards "out of the box" making and doing. Yet in general, standard processes of action typically serve as foundational methods that are then applied to more complex assignments.

Metacognition

Within design and the arts, creativity abounds in performance-based coursework. Analysis leads to synthesis and creativity during the multivalent making process. Risk and invention are valued over convention. Individual perspectives and creative methods are supported and celebrated. This type of awareness of one's own thinking and thought process is on the highest end of Bloom's taxonomy.

However, reliance upon one's own interests and experience to create something unique can elicit undue stress. All too often coursework encourages comparison between students in a very visible and public way. This comparison raises equity issues due to differences in levels of student engagement that can exist for a variety of reasons. The nature of critique in design studio environments is such that comparison can be unavoidable and, in the spirit of facilitating a healthy studio environment, sometimes even encouraged. According to the American Institute of Architecture Students' Model Learning & Teaching Culture Policy, studio environments should be formatted to capitalize on the power of the collaborative design process, with students and faculty working together so that students are prepared for the collaborative professional spaces they will engage in in the future.[2] This view of the studio environment is certainly altruistic and offered with the most positive intentions considering the profession these students are preparing to enter. The reality, however, is layered with the various intersections of identity: personality, neurodiversity, socio-economic variation, race/ethnicity, and even cultural differences that create differences in student production, response to critique, and peer interactions. With these differences come perceptions of student engagement and dedication to their work. Contemporary studies of performance-based curricula in other disciplines echo these inequities, acknowledging the existence of implicit messaging and hidden curriculums that could negatively affect the experiences of students.[3]

There is also the issue of differential learning styles and variations in language when considering performance-based pedagogy. Culturally, many students learn in response to verbal prompts while others are visual learners, taking in information through visual aids or by watching others.[4] If the nature of studios, however, requires that students engage in visual exploration while also collaborating with their peers in an open studio environment, this leaves the onus on students with the more verbally guided exploratory learning style to provide examples for those who are more visual learners. [5]

Culture could also be a factor in addressing performance-based pedagogy as it pertains to communication. Low-context cultures favor written, direct, and precise communication styles and that straight-forward while high context cultures rely on oral communication and body language.[6] Differences in languages among various cultural, racial, and ethnic groups result in misunderstandings which can hinder students. Thus, feedback and the manner in which it is given becomes crucial and important to a student's success or failure in employing metacognition in the studio environment.

Layering in with these considerations is how disability accommodation affects engagement in the beginning design studio environment. A review of literature reveals very little is written with regard to accommodating disabilities and impairments in lab-based coursework utilizing performance / performative pedagogy. Because this environment is so different in character from lectures and seminars, it seems accommodation should be different as well and perhaps more situational. For the purpose of this paper, we have focused upon work in design studio coursework for disciplines such as architecture, interior design, and industrial design. However, we also believe that this research is applicable to other laboratory-based coursework in the sciences, engineering, the arts, and medical disciplines such as nursing.

Eligibility and Accommodation of Office of Disability Services

Accommodation offered by the Office of Disability Services at a University is mandated if a university receives Federal Financial Assistance. Accommodation is governed by three federal laws: Individuals with Disabilities Education Act (IDEA, originally the Education for All Handicapped Children Act, 1975); Section 504 of the Rehabilitation Act (1973); and Title II of the Americans with Disabilities Act (1990). In the United States, 7.5 million students are eligible for accommodation through these laws.

It is not individual limitations, of whatever kind, which are the cause of the problem but society's failure to provide appropriate services and adequately ensure the needs of disabled people are fully taken into account in its social organization.[7]

For K-12 public education schools, the law guarantees free appropriate public education (FAPE) in the least restrictive environment (LRE) to every child with a disability. [8] FAPE provides mandated coordination between students, parents, teachers and school administration. Each student has a team of partners working to ensure best educational outcomes. Post-secondary education is not required to provide FAPE by federal law. Instead, the requirement is "reasonable accommodation" which provides appropriate academic adjustment within a course. Significant is that students no longer have team support. They are expected to independently register with the Office of Disability Services, to discuss the disability that they have, and to choose which accommodation is most appropriate.

As students enter Freshman year of college in a design program, they may not know how to anticipate which accommodations would best serve them in a performance-based studio design course. They may never have taken a studio-based class, and their faculty, who are not federally mandated to be partners in identifying appropriate accommodation, will not have prior knowledge of the student's disability or impairment. The transition from highly regulated support to self-reliance may be overwhelming for some students as they enter the college environment.

These students who have previously registered with a disability or impairment are broadly aware of the types of accommodation available. The Office of Disability Services also serves two additional user groups: students who find they are not able to meet post-secondary academic expectations due to a disability or impairment, though they were academically successful in the K-12 environment; and students who witness a change in their lives due to illness or trauma either to themselves or to their immediate family or social circle. In both cases, these students must work through the uncertainty of identifying their disability or impairment prior to registering with ODS. Additionally, the students' disability identity, which changes depending upon the amount of time since they have been diagnosed or disabled, affects their view of accommodation.

Unlike the high school environment, however, it is the student's responsibility to initiate requests for services in the postsecondary environment… While complying with legal mandates to provide reasonable accommodations, higher education administrators may also need to assist students with disabilities in the development of their independence and self-determination skills (Brinckerhoff et al. 2002). Students are expected to manage increased levels of personal freedom, deal with the unique challenges presented by their disabilities, and to matriculate successfully into a new collegiate environment… For students with disabilities, challenges can include the development of skills such as stating one's disability or discussing disability-related accommodations with professors—all strategies related to a successful transition from high school to college (Heiman and Precel 2003). [9]

Cultural identity and race may also play a part in whether a student elects to register with the Office of Disability Services. Research has found that there is an over-propensity to identify minority students as having a learning disability in k-12.

African American and other students of color have the highest risk ratio for being placed in special education and they received the most segregated special education placements (Blanchett, Mumford, & Beachman, 2005; Dunn, 1968; Losen & Orfield, 2002; Mercer, 1973). [10]

Other research has identified the tendency to label minority students as disruptive and defiant. Imposing disciplinary action instead of investigating behavior as an outgrowth of learning disability may mean a student is unaware of their disability.

Some civil rights advocates argue that children of color are more likely to be profiled as disruptive or defiant by condescending white teachers… [and] that children of color with real needs are neglected when they should be identified as having learning disabilities and emotional disturbances. [11]

If minority students have experienced either of these situations, it may affect their relationship with the Office of Disability Services, and their choice in registering. The added uncertainty of how the Office of Disability Services may accommodate performance-based coursework may further discourage students to register.

The disproportionate identification of learning disabilities among certain socio-demographic subgroups, typically groups who are already disadvantaged, is perceived as a persistent problem within the education system. The academic and social experiences of students who are misidentified with a learning disability may be severely restricted, while students with a learning disability who are never identified are less likely to receive the accommodations and modifications necessary to learn at their maximum potential. [12]

According to a survey by the National Center for Educational Statistics, nationwide twelve percent of students informed their post-secondary institution that they had a disability and *"among students who responded that they did have a disability while attending college, about one-third of students (37 percent) informed their college.*" [13] At University of Louisiana at Lafayette, 4.9% of students register with the Office of Disability Services. This paper has not collected enough data to verify why this number is different from national statistics.

Some design students self-report to faculty that they have an impairment or disability but that they elect not to register with ODS for performative based courses because they do not view the menu of accommodations as providing appropriate or adequate support. When this occurs, the faculty member is faced with dilemmas on providing accommodation and/or modification. It is not always clear whether self-reporting is self-diagnosis, if self-diagnosis is correct or if other impairments and disabilities may exist.

Conventional Accommodation and Its Efficacy in Performance-Based Courses

Lecture and seminar coursework falls into a predictable set of tasks: listening to lectures, taking notes, completing written or calculated homework assignments, discussion, and testing. In response to these methods of assessment disability services across the United States have developed a menu of associated accommodation.

Cultural rituals can also disable people. [Examples include] rituals of standardized testing that serve as mechanisms for gatekeeping into postsecondary programs, and rituals of testing and assessment that may label disabled students who have been admitted to a program as "not meeting program standards." [14]

For performance-based pedagogy, this menu of accommodation does not fit with the expectations of courses, and how they evaluate learning. At University of Louisiana at Lafayette Office of Disability Services letter covers this variability with the following language

"Please view this letter as a conversation starter to determine how best to provide an accessible learning environment for this student. If you have other ideas regarding how to create access for your course beyond what is listed in this letter, we encourage you to speak with the student to explore alternative modifications. You are also welcome to consult with our office to discuss course design, learning objectives and reasonable access options."

The drawbacks of this method, however, are that the instructors cannot not directly reference a student's disability and the students themselves may not be willing or open to engaging in a conversation with instructors. Student perceptions and internalized feelings of begin voiceless, being misunderstood, having to work harder than other, fear of being seen as lazy, and not wanting to be seen as a victim can manifest as student hesitancy in engaging with instructors concerning accommodation.

If a student does initiate a conversation with faculty, the faculty in performance-based courses receive no training or direction on how to accommodate federally protected disabilities in performance-based courses. The student may make suggestions but having a menu or selection of possible accommodations would certainly frame the conversation and provide at least a foundation for the discussion. Without this training or menu, text in syllabi stating that accommodation will be made seems insufficient. Dimly lit spaces, older buildings, un-easy wait times all discourage a disabled or impaired student. A student may feel their disability is tolerated. But actual accommodation is not a passive act.

Disability and Accommodation in Performance-Based/Performative Coursework

The following section presents a few ways in which disabilities and impairments may affect students in performance-based coursework.

Neuro Divergence

Neuro Divergence in students relates to learning disabilities such as Dyslexia, Autism, ADHD, and ADD. These students struggle with standardized testing evaluation and environments but often find great success when able to demonstrate knowledge in performance or project assessment. Because of their experiences with the K-12 educational system, these students often have a well-developed sense of coping strategies from previous experiences navigating normalized systems, and problem-solving skills honed by constantly interacting with conforming systems that do not accommodate them.

Neuro divergence is also related to divergent thinking strategies. Students can generate multiple viable creative solutions but then struggle to refine the ideas through iterative convergent processes. Put in a different way, neuro divergent students are often excellent at big picture thinking and the ways in which everything connects but converging the ideas into one final solution is the difficult cognitive task.

Creativity can be defined as the ability to generate new, adaptive ideas or novel solutions to problems that may have substantial value to humanity (Runco and Jaeger, 2012). Creative thinking relies on divergent thinking (Milgram and Livne, 2006; Runco, 2010). Divergent thinking is the ability to produce multiple ideas and associations to a given problem. This ability consists of fluency (number of responses), flexibility (shifting between different ideas), originality (uniqueness of ideas), and elaboration (amount of detail). The ability is assessed by open-ended tests that establish the fluency while generating as many multi solutions as possible (Guilford, 1959). [15]

For instance, findings show that the performance of the dyslexics was better in the overall understanding of the whole image, holistic processing, and representation of complex and impossible figures, and they showed a faster reaction time to taking in this data. Some sources say that dyslexics have special visual-spatial talents, but academic research does not yet support that assertion.

Students with Autism exhibit better performance on novel creativity. "*People with more autistic traits, when asked to name as many uses as they can for a common object such as a paper clip, come up with fewer suggestions, but the suggestions they offer are more unusual than those of their neurotypical counterparts. They exhibit more 'divergent thinking.'*" [16]

Students with ADHD are also more likely to be creative, but for different reasons. "*People with ADHD often lack inner inhibition. This means they have trouble holding back when they want to say or do something. And while that can cause problems, it can also make people less likely to have an inner critic that silences their flow of ideas… People with ADHD also tend to be easily distracted. (That is, unless they're hyperfocused on something.) But studies suggest a possible benefit to this, too. Kids who have trouble tuning out things in their environment may find that all those elements combine in interesting ways. And that can lead to new ideas."* [17]

ADHD students exhibit fluency in idea generation, and flexible switching between different ideas that are not redundant. Students with ADHD excel in cognitive flexibility. By contrast cognitive persistence is where ADHD students may exhibit impairment.

Since convergent thinking requires prolonged sustained attention and goal-directed behavior, this type of creative thinking may be positively related to good inhibitory skills and negatively to distractibility and ADHD (Hommel, 2012; Lucas & Nordgren, 2015) [18]

Visual Impairment

Color exists as a natural phenomenon in the world we exist in with light, natural pigments but color is also exists as a function of cognition as we input the natural phenomenon and it is decoded by cognition. Color Blindness is not a federally protected disability. However, within the design field color theory and color selection are important components to coursework especially for interior design and industrial design. It seems for performance-based classes like these, students should have the ability to register with the Office of Disability Services, and faculty should receive training on how to accommodate students with this condition.

Mobility

Being left-handed is not a protected disability and yet use of equipment and instruction materials may not provide accommodation in performance-based courses. If equipment such as scissors are provided to students during

a project, particularly during the first year when students have not yet purchased their own materials, faculty should provide left-handed equipment to ensure accessibility. Equipment in laboratories and shops may also need to be reset and students trained to ensure efficacy of use. Additionally, instruction materials for drafting and using a computer mouse often privilege right-handed students. Instructions such as "Left click on this button, then right click to enter," may prove confusing to a student who is using a left-handed mouse.

Health

Some students may suffer limited clotting due to a blood disease like Hemophilia or Von WIllebrand or as a side effect of medication. This is an unlikely situation but is worth consideration for the broader argument of this paper. Studio classes require students to extensively use sharps to cut materials in order to form three-dimensional work. A student who has a disease or side effect from medicine that results in limited clotting may be put at risk if the faculty member requires the use of the sharps. Both the student and the faculty member may be unaware that this is a case where the student should register with the Office of Disability Services.

These examples are just a small sampling of possible ways disabilities and impairments that can be accommodated in performance-based coursework. The co-authors plan to research additional accommodation through interviewing self-identifying students for future publication.

Conclusion

The terrain of disability accommodation within the design studio is a largely an uninvestigated landscape. This paper seeks to shed light on the subject in an attempt to increase scholarship and to provide insight into accommodating this group of students who identify as other, or different, because of their disabilities and/or impairments.

Disability and impairment accommodation adds a complexity to the issue of cultivating equitable and just studio environment in a way that can seem insurmountable, however, there are steps that instructors can take to begin addressing them. Academic departments and instructors can work closely with offices who coordinate accommodations for students with disabilities at the start of the semester, to devise blanket strategies for both the physical studio environment and the planned curricula. Instructors can also be highly intentional about communicating to students the benefits of addressing their disability and arranging appropriate accommodations at the onset of the course. This can be done by scheduling meetings with each student at the start of the academic semester and ensuring that information about the benefits of discussing accommodation is accessible and available in a variety of formats. These methods should be employed with the intention of reducing the stigmas, anxiety, and stress of discussing mental or physical illness, neurodivergence, and/or physical disability with others. Departments and Instructors would also not be remiss in familiarizing themselves with those disabilities that are most prevalent in students and ensuring that physical studio environments and pedagogies are designed to accommodate those disabilities in the most comprehensive manner possible. This approach may present solutions that challenge the traditional design studio model that has existed since the Ecole des Beaux Arts, but perhaps it is time for these traditions to be examined critically to determine if they actually to serve beginning design instructors and students today.

End Notes

1 Francombe, Jessica. "Methods that move: A physical performative pedagogy of subjectivity." Sociology of Sport Journal, vol 30, issue 3. p 256-273. https://journals.humankinetics.com/view/journals/ssj/30/3/article-p256.xml

2 The American Institute of Architecture Students, "The American Institute of Architecture Students' 2020 Model Learning & Teaching Culture Policy," The American Institute of Architecture Students. 2020. http://www.aias.org/wp-content/uploads/2020/07/AIAS-Learning-Teaching-Culture-Policy-Project-Packet-2020.pdf.

3 Rennert-Ariev, Peter. "The Hidden Curriculum of Performance-Based Teacher Education," Teachers College Record: The Voice of Scholarship in Education, vol 110, No. 1. 2008. p. 105-138, https://doi.org/10.1177/016146810811000105.

4 Pashler, Harold et al. "Learning Styles," Psychological Science in the Public Interest, vol 9, no. 3. 2008. p. 105-119, https://doi.org/10.1111/j.1539-6053.2009.01038.x.

5 Hall, Tracey. Differentiated instruction. Wakefield, MA: National Center on Accessing the General Curriculum. 2002. https://www.cast.org/products-services/resources/2014/ncac-differentiated-instruction-udl

6 Richardson, Rieko Maruta, Smith, Sandi. The influence of high/low-context culture and power distance on choice of communication media: Students' media choice to communicate with Professors in Japan and America. International Journal of Intercultural Relations, vol 31, issue 4. 2007. p 479-501. https://www.sciencedirect.com/science/article/abs/pii/S0147176707000053

7 Clifton, Maggie. "Reviews: Michael Oliver, Understanding Disability: From Theory to Practice, Gerald Hales (Ed.), beyond Disability: Towards an Enabling Society." Journal of Social Policy 25, no. 4. 1996. p. 590-592. https://doi.org/10.1017/s0047279400024053.

8 U.S. Department of Education, "About Idea," Individuals with Disabilities Education Act, U.S. Department of Education. 2022. https://sites.ed.gov/idea/about-idea/.

9 Hadley, Wanda. "College students with Disabilities: A student Development Perspective" Disability Services and Campus Dynamics. New Directions in Higher Education, no. 154, Summer. 2011. p 77-79

10 Blanchett, Wanda. "Telling It Like It Is: The Role of Race, Class, & Culture in the Perpetuation of Learning Disability as a Privileged Category for the White Middle Class." Disability Studies Quarterly, vol 30 no. 2, 2010. https://dsq-sds.org/article/view/1233/1280

11 Chen, Michelle. "Public schools' disturbing conflation of race and disability" Aljazeera America. September 4, 2015. http://america.aljazeera.com/opinions/2015/9/public-schools-disturbing-conflation-of-race-and-disability.html

12 Shifrer, Dara et al. "Disproportionality and Learning Disabilities: Parsing Apart Race, Socioeconomic Status, and Language." Journal of Learning Disabilities, vol 43 no. 3. May-Jun 2011. P 246-257. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4133990/

13 Delarosa, Josh. National Center for Education Statistics. "A Majority of College Students with Disabilities Do Not Inform School." New NCES Data Show. April 26, 2022. https://nces.ed.gov/whatsnew/press_releases/4_26_2022.asp)

14 Gabel, Susan. "A Disability Studies Framework for Policy Activism in Postsecondary Education." Journal of Postsecondary Education and Disability, vol 23, no 1. 2010. P 64. https://files.eric.ed.gov/fulltext/EJ888645.pdf

15 Hoogman, Marine et al. "Creativity and ADHD: A review of behavioral studies, the effect of psychostimulants and neural underpinnings." Journal of Neuroscience Biobehavior Reviews, vol 119, December 2020. p 66-85. https://repository.ubn.ru.nl/bitstream/handle/2066/227072/upload_in_progress_2066_227072.pdf?sequence=1

16 Cohen, Barb. "Autism and Creativity." Psychology Today. December 18. 2016. Based upon study published in The Journal of Autism and Developmental Disorders. https://link.springer.com/article/10.1007/s10803-015-2518-2) https://www.psychologytoday.com/us/blog/mom-am-i-disabled/201612/autism-and-creativity

17 See endnote 15.

18 See endnote 15.

Bibliography

The American Institute of Architecture Students, "The American Institute of Architecture Students' 2020 Model Learning & Teaching Culture Policy," The American Institute of Architecture Students. 2020. http://www.aias.org/wp-content/uploads/2020/07/AIAS-Learning-Teaching-Culture-Policy-Project-Packet-2020.pdf.

Blanchett, Wanda. "Telling It Like It Is: The Role of Race, Class, & Culture in the Perpetuation of Learning Disability as a Privileged Category for the White Middle Class." Disability Studies Quarterly, vol 30 no. 2, 2010. https://dsq-sds.org/article/view/1233/1280

Chen, Michelle. "Public schools' disturbing conflation of race and disability" Aljazeera America. September 4, 2015. http://america.aljazeera.com/opinions/2015/9/public-schools-disturbing-conflation-of-race-and-disability.html

Clifton, Maggie. "Reviews: Michael Oliver, Understanding Disability: From Theory to Practice, Gerald Hales (Ed.), beyond Disability: Towards an Enabling Society." Journal of Social Policy 25, no. 4. 1996. p. 590-592. https://doi.org/10.1017/s0047279400024053.

Cohen, Barb. "Autism and Creativity." Psychology Today. December 18. 2016. Based upon study published in The Journal of Autism and Developmental Disorders. https://link.springer.com/article/10.1007/s10803-015-2518-2) https://www.psychologytoday.com/us/blog/mom-am-i-disabled/201612/autism-and-creativity

Delarosa, Josh. National Center for Education Statistics. "A Majority of College Students with Disabilities Do Not Inform School." New NCES Data Show. April 26, 2022. https://nces.ed.gov/whatsnew/press_releases/4_26_2022.asp)

Francombe, Jessica. "Methods that move: A physical performative pedagogy of subjectivity." Sociology of Sport Journal, vol 30, issue 3. p 256-273. https://journals.humankinetics.com/view/journals/ssj/30/3/article-p256.xml

Gabel, Susan. "A Disability Studies Framework for Policy Activism in Postsecondary Education." Journal of

Postsecondary Education and Disability, vol 23, no 1. 2010. P 64. https://files.eric.ed.gov/fulltext/EJ888645.pdf

Gould, Jim. Learning Theory and Classroom Practice. Sage Learning Matters: London. 2012.

Hadley, Wanda. "College students with Disabilities: A student Development Perspective" Disability Services and Campus Dynamics. New Directions in Higher Education, no. 154, Summer. 2011. p 77-79

Hall, Tracey. Differentiated instruction. Wakefield, MA: National Center on Accessing the General Curriculum. 2002. https://www.cast.org/products-services/resources/2014/ncac-differentiated-instruction-udl

Hoogman, Marine et al. "Creativity and ADHD: A review of behavioral studies, the effect of psychostimulants and neural underpinnings." Journal of Neuroscience Biobehavior Reviews, vol 119, December 2020. p 66-85. https://repository.ubn.ru.nl/bitstream/handle/2066/227072/upload_in_progress_2066_227072.pdf?sequence=1

Pashler, Harold et al. "Learning Styles," Psychological Science in the Public Interest, vol 9, no. 3. 2008. p. 105-119, https://doi.org/10.1111/j.1539-6053.2009.01038.x.

Rennert-Ariev, Peter. "The Hidden Curriculum of Performance-Based Teacher Education," Teachers College Record: The Voice of Scholarship in Education, vol 110, No. 1. 2008. p. 105-138, https://doi.org/10.1177/016146810811000105.

Richardson, Rieko Maruta, Smith, Sandi. The influence of high/low-context culture and power distance on choice of communication media: Students' media choice to communicate with Professors in Japan and America. International Journal of Intercultural Relations, vol 31, issue 4. 2007. p 479-501. https://www.sciencedirect.com/science/article/abs/pii/S0147176707000053

Shifrer, Dara et al. "Disproportionality and Learning Disabilities: Parsing Apart Race, Socioeconomic Status, and Language." Journal of Learning Disabilities, vol 43 no. 3. May-Jun 2011. P 246-257. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4133990/

U.S. Department of Education, "About Idea," Individuals with Disabilities Education Act, U.S. Department of Education. 2022. https://sites.ed.gov/idea/about-idea/.

Crossing the Threshold with Habits of Mind

Marianne Cramer The University of Georgia

Introduction

Students crossing the threshold of the design studio for the first time are entering *terra incognita*. Most have never experienced studio culture and have no idea whether classroom protocols ingrained from high school still work in this new setting. On the other hand, for studio coaches each student is *ignotus* – an unknown. Students arrive from different places, diverse backgrounds and life experiences: furthermore, each brings with them a set of predispositions that may or may not advance their studio learning. In turn, studio coaches hold some of the "knowns" as written in the course syllabus learning objectives and the stated purpose and requirements for each project brief.

All categories of theory—substantive, procedural, and normative—are introduced in studio either explicitly or through the more tacit learning-by-doing studio model. Although comfortable with memorizing content such as color theory or the principles of design, students find it more difficult to apply what they are learning in the process of design. A variety of staged process models to help students order the design process, but have little to do with designerly ways of thinking, knowing, and doing. What is crucial to introduce and practice are the embodied cognitive skill sets that generate design. The author has been investigating the cognitive skills shown in Figure 1 for the past decade and is now introducing them in beginning design studio as explicit content only to find that the teaching and learning agenda is still not complete.

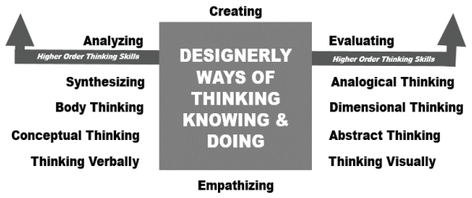


Fig. 1. Cognitive skill set introduced in the author's beginning design studio. Diagram by author.

Researchers now claim that any sort of thinking and learning involves more than knowledge and skills—that being disposed toward certain kinds of affects or attitudes toward good thinking, are necessary. (Tishman & Perkins, 1997; Costa and Kallick, 2008). For the author, this novel way of viewing teaching and learning—that attitudes should presage cognition—has led to this attempt to consider how habits of mind might become teaching and learning specific in the beginning design studio. The paper begins with a review of definitions, how academia currently views the subject and finally compares three habits of mind lists to see what can be learned.

Positioning habits of mind in the current design culture

Habits of Mind in Perspective

According to Dan Berrett (2012), the idea of intellectual virtues or habits of mind originate in the disciplines of philosophy, psychology and education. Although the history of habits is complicated and beyond the scope of this paper, it was John Dewey, a pioneer in all three disciplines, who considered habits essential to cognition. In his writings he often referred to the common usage of the word—a wide variety of responses, patterns, and ways we engage in our worlds, which could include not only physical habits like walking every day, but mental ones like always exploring possibilities before committing to one. Dewey thought of habits as dominant powers totaling what we consider our selfhood or personality and were the result of conscious interventions, not automatic responses Campbell (2013) calls Dewey the Father of Habits of Mind. Today, researchers and educators identify habits of mind of equal, if not of more importance, than the thinking skill sets themselves (Berrett, 2012; Costa & Kallick, 2008; Tishman, Jay & Perkins, 1993). "Thinking skills alone may show up well on exercises and tests, but, without dispositions to spur them into action, they are likely to remain inactive during real-life situations." (Tishman & Perkins, 1997 p. 372). If what Tishman and Perkins are suggesting is accurate, then these habits of mind or what some describe as personal dispositions should be a critical part of studio learning culture.

Figure 2 illustrates in onion-like fashion how Costa and Kallick organize the levels of educational outcomes. Their hypothesis rests on the following concepts: that any systematic activity is basically a subsystem of another; that learning is related to and a product of the subsystem we are operating in; but that the level of learning we are in actually controls information on the levels below it; and that learning on the upper or more inclusive levels will inform and influence things on the lower levels, but not the reverse (Costa and Kallick, 2008, pp 46-48).

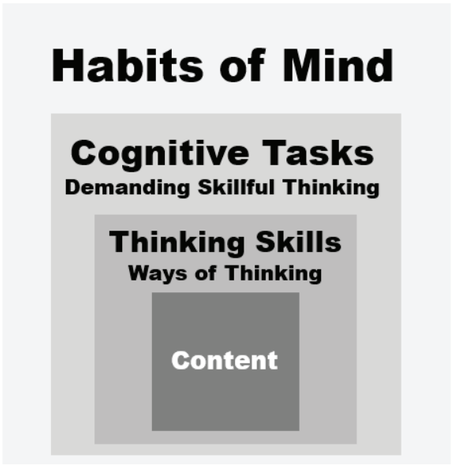


Fig. 2. Levels of educational outcomes. From Costa and Kallick (2008; p. TK. Redrawn by author.

.

This hypothesis suggests that habits of mind are an aspect of cognition that affects and controls other facets of thinking. Unlike the traditional classroom where teachers prepare and deliver knowledge which is then expected to be received, stored and retrieved on demand by the learner, studio culture values active learning (Tishman, et al. 1993). Studio is an environment where knowledge, ways of thinking, and the tasks students perform that demand those specific ways of thinking are occurring.

Defining Habits of Mind and Dispositions

No matter whether habits of mind or dispositions is favored, definitions do vary. Some include both terms. Peter Nelsen (2014) considers dispositions as clusters of habits drawing on modes of response to situations and problems that arise with specific contexts. On the other hand, Kallick (2019) and Tishman, et.al. (1993) define habits of mind as a set of dispositions or attitudes or thoughtful behaviors employed to be a successful learner in the world. There are others who avoid the most common names for phrases such as “intellectual virtues” (Berrett, 2012). Nelsen (2014) does make a distinction between the two by describing dispositions as clusters of habits that may work simultaneously or in tandem. One issue with the use of the word “habits” as a descriptor is the implication that this process is completely automatic. Research suggests more active thinking is in play. Louis and Sutton further argue that the cognitive process entails “switching gears” between automatic behavior and active engagement in a decision-making process including sensing when the switch is necessary (1991, p.56).

Other descriptions commonly used include cognitive behaviors, mental attitudes and underlying traits. There seems to be less agreement whether the actual cognitive skills such as analyzing, evaluating or creating should be included as part of the definition, but habits are specific to certain behaviors that manage our thinking processes. Costa and Kallick (2006) favor their inclusion contending that habits of mind are deployed in response to unresolved questions and problems and are closely related to cognition. Csikszentmihalyi (1990) sees the dispositions not as single deployments, but in pairs alternately deployed. Tishman et. al. (1993) consider the habits of mind nonhierarchical and deployable in clusters.

So, we can consider our student’s habits of mind as their behavioral responses when they don’t know what to do next—a regular occurrence in beginning studios. The importance of habits of mind are still in debate. The one question important to this discussion is whether habits of mind are an immutable part of our basic personalities difficult or impossible to change or whether they can be developed through education.

Habits of Mind Across the Academy

Throughout current academic literature, habits of mind are associated with the higher order thinking skills, found in association with specific disciplines, and isolated and studied separately. A brief overview of how habits have been applied in academic settings follows.

Habits for Higher Order Cognition.

According to Berrett (2012,) Don Fabun was one of the first researchers to categorize the creative thinking dispositions including inherited sensitivity; early training; liberal education; asymmetrical way of thought; personal courage; sustained curiosity; not time-bound; dedication; and willingness to work. Note that some of the habits are not behavioral but situational. It is important to remember that the modern cognitive sciences were just beginning to emerge in the 1960s when Fabun’s article was published (Thagard, 2023). Six additional attributes were added by Silvano Arieti (1976) that include the markers used by Paul Torrance to identify creatives—fluency, flexibility, originality, resistance to closure and elaboration (Alabasi, Paek, Kim, & Cramond, 2022). Arieti added tolerance for ambiguity and the ability to recognize what we know in new ways also known as knowledge transfer. Torrance himself called out eighteen main abilities of a creative—many of them correlating to Costa and Kallick’s list (Torrance & Shaughnnessy, 1998).

Critical thinking dispositions have also been listed by Siegel (1988), Ennis (1996), and others. Siegel’s list, very different from the Fabun/Arieti combination, includes six habits: the ability to think critically; objectivity intellectual honestly, impartiality, a willingness to conform judgements and actions to principle; and a commitment to week and evaluate reasons.

The critical thinking skills of analyzing and evaluating, plus creating are Anderson’s revision of Bloom’s taxonomy (Anderson & Krathwohl, 2001).. John Lyle (1985, p.7) calls critical and creative thinking the “alternating current of design process.” It can be best described as the sometimes rapid, sometimes not so rapid back-and-forth between critical reflection and the creative leap forward that occurs during design activity.

General Versus Discipline-Specific Habits of Mind

Probably the most familiar list of habits of mind comes from Arthur Costa and Bena Kallick who have been researching habits for the past thirty years (2008). They consider their list of 16 habits relevant for thinking creatively or critically in any discipline and of benefit to a wide range of situations. In the literature there are additional attempts to craft discipline-specific habits of mind. They exist for engineering, mathematics, and STEM subjects in general (E.g.. Lim & Selden, 2009; Lucas & Weitlauf, 2016; Asunda & Weitlauf, 2018). Two of the more applicable habits lists to this paper is what Tishman et. al. call studio thinking, habits of mind targeting the visual arts (1993). They include learning to: develop the craft, engage and persist, envision, express, observe, reflect, stretch and explore beyond the familiar and understand the world of the artist (Hetland, Winner, Veenema & Sheridan, 2007). The second list of interest is from the Design Learning Network (DLN) detailing 19 habits of mind. Because this list is specific to creative problem-solving it does contain a better balance of behaviors necessary to both critical and creative thinking.

Habits that include cognitive skill sets

There is an important issue of note with the lists of habits: embedded in many of them are the actual cognitive skills themselves. For example, the habits of studio thinking include learning to envision which is part of how we mentally visualize something that has never been seen before and part of visual cognition. Tough (2012) contends that this inclusion is particularly prevalent in higher education where the cognitive skills and behaviors appear in both definitions and habits lists. When behaviors are deployed, each is context-specific and are tied to particular cognitive skill sets. Engaging a particular behavior would not be necessary unless there was a problem in how to proceed cognitively, so the two are probably more intertwined than can be explained. The author argues that no matter how intertwined, cognitive skills and specific habits of mind can be approached jointly or separately in studio learning.

Attitudes.

According to Costa & Kallick (2008) and Tishman, et. al. (1993), there is more than the habits of mind to consider when deploying behaviors. Both describe three specific conditions or attitudes that are necessary in order to activate particular behaviors. First, there must be an *inclination* or tendency to employ a certain intellectual behavior. Second, there must be an *alertness,* sensitivity or awareness to need a particular behavior. Finally, there must be the *ability* or capacity to follow-through: If inclination, alertness, and ability are not present, the behaviors will not be deployed.

The Role of Mindsets

From her research on the power of beliefs to affect how we think and act, psychologist Carol Dweck has found that those who believe their intelligence or creativity is fixed at birth have a fixed mindset that will hinder cognitive growth

and change. Those that believe hard work and perseverance is key to growing and developing their intelligence have a growth mindset. If we look at mindset as a behavioral trait, it is very similar to habits of mind. Dweck uses a gradient to describe where anyone might fall at any given time based on situational Issues. Where we are on the gradient affects our ability to grow by being mindful, embracing challenges, persevere in the face of adversity and learn from failure (2012). These are habits of mind that will appear on subsequent lists. We could propose that mindsets fit into the dispositional category, but based on Dweck's description, mindsets may fall on an even higher systemic level of educational outcomes. It is not likely that anyone would be inclined to consider dispositional behaviors in a fixed mindset.

Habits of Mind: A Comparative Analysis

Based on what we have seen in the literature, what can we learn from a preliminary analysis of three current habits of mind lists— Costa and Kallick's 16 habits of mind (C&K), eight studio habits of mind from *Studio Thinking 2: The real Benefits of a Visual Arts Education* and part of Harvard's Project Zero (ZERO), and19 habits of mind from the Design Learning Network (DLN). The lists were adapted in the following ways. In order to look more might be deployed, it is the curiosity and questioning that begin the design process and may continue to be deployed later in design development. It is persistence and flexibility—knowing when to persevere, and nurture the "never give up" mentality and when to be more flexible, reassess, and try another course of action. Although self-reflection and metacognition do not necessarily equate, the idea of thinking about both product and process helps complete, the entire design cycle in a more explicit way. The author would argue that all four dispositions are applicable in almost any part of the design process depending on how they are viewed. For instance, the curiosity that would fuel exploration might encourage inquiry-based behavior during a site reconnaissance. All four habits are foundational in both critical and creative thinking; however, the question of whether these might be core dispositions, has not been answered.

Figure 3 also includes the author's list of dispositions emphasized in the fall 2022 semester studio (black background). Flexibility, resistance to closure, and the exploration of possibilities were behaviors that had been introduced in previous studio years without a way to identify them or how important they might be. Going through the habits of mind lists rang bells. One of the predispositions easiest to identify, but difficult to change is

HABITS OF MIND	C&K	ZERO	DLN
Persisting; staying the course; perseverance			
Thinking flexibly; looking at alternatives			
Questioning & posing problems; inquiry-minded			
Metacognition; thinking about thinking			
Taking (responsible) risks; out on the edge			
Open to continuous learning			
Managing impulsivity; circumspection			
Explore possibilities; play around; experiment			
Transferring knowledge			
Coping with uncertainty			
Learning from failure			
Being mindful			
Finding humor			
Responding with wonder			
Striving for accuracy			
Being humble			
Independent-minded			
Taking initiative			
Developing craft			
Resisting premature closure			

Figure 3. Comparative analysis of three sets of habits of mind. Habits listed in the black background are from the author's list from fall semester beginning studio. Chart by author.

the lack of interest in exploring possibilities, experimenting with different approaches and just playing around with ideas that may on the surface have nothing to do with learning outcomes, but might inspire new viewpoints in the problem and solution space. It wasn't until a separate track evaluating the extent of exploration, not the product results that students began taking exploration more seriously closely at the specific habits of mind, all the cognitive skill sets have been removed from the lists. Then the multiples from Project Zero's list have been separated. Because design, unlike art, is essentially a collaborative endeavor, the DLN articulates seven dispositions associated with successful collaboration. This paper argues that collaboration is a unique way of thinking and doing, worthy of a separate investigation. With the exception of flexibility, all the other collaborative-specific habits have also been removed from the DLN list.

When the resulting three lists are compared in Figure 3, only four habits of mind appear in common—persisting, thinking flexibly, being curious or inquiry-minded and metacognition. In thinking about where these behaviors

.

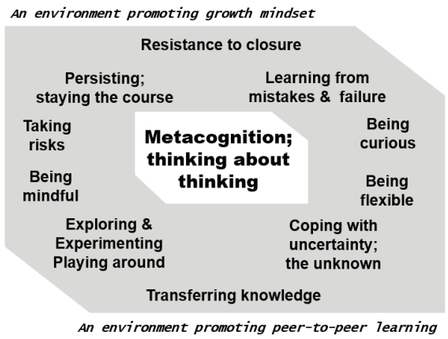


Figure 4. An in-progress diagram of habits of mind introduced in fall semester beginning studio. By author.

Figure 4 has been compiled as a habits of mind "touchstone" for fall semester beginning studio. As with the Project Zero list, behaviors have no specific order of use with the exception of metacognition. In order to think about thinking, it is not just the cognitive skill sets featured in a reflection-on-action discussion, but now a whole range of habits. There is also the chance to link habits and skills during the teachable moments when students are focused on process rather than product. Going META could be considered a particular disposition, but located at the core The context for the dispositions shown in Figure 4 includes attempting to maintain an environment that supports growth mindset. Although growth mindset could very well be considered another habit of mind, the idea has larger implications for the author. A belief that the mind can grow and change might also affect other behaviors—if we can change and grow to be a better thinker, then we can change all the other predispositions. Likewise, offering peer-to-peer learning opportunities further impacts studio culture. Learning opportunities involve practicing the visual and verbal design vocabulary and language including evaluation.,

Limitations

Parsing terms and definitions for the comparative analysis shown in Figure 3 has been difficult. Costa and Kallick provide a "word splash" synonym list for each disposition, but synonyms then sometimes overlap with actual habits from other in other lists. Taken into consideration that the comparison is a work in progress, lessons can still be learned.

In Sum.

Habits of mind by their very definition and application are situational and specific to tasks in play at any one time in a teaching and learning environment. The studio is no exception; in fact, this paper submits that the choice of habits is strongly connected to design process and the cognitive skills necessary to carry out specific tasks. Habits of mind are operational on a gradient from disciplines to individual studios and can be an intensely individualized process. Given the small class size, high contact hours and a focus on problem-based active learning, there are opportunities available to address these dispositions.

Predispositions that do not support designerly ways of thinking, knowing, and doing are critical to identify early in the studio sequence. Creating an environment encouraging the adoption of new habits of mind that support design cognition is also necessary. However, creating the environment does not necessarily mean that all of the behaviors will become habits by the end of the first-year studio experience. For the author, being explicit with content delivery has changed studio culture and how students talk about their thinking during reflection exercises. When phrases such as "knowledge transfer: are reflected back as "I didn't use what I learned last semester very well in this project," a new awareness may be building, but not yet accepted as a disposition.

It then depends on teaching and learning up the studio ladder for these attitudes to become actual habits of mind. Unfortunately, when this knowledge is not part of a

pedagogical approach and not reinforced, then there is every reason to believe that even the inclination to use them will fade.

Bibliography

Alabasi, A. M. A., Paek, S. H., Kim, & B. Cramond). "What do educators need to know about the Torrance tests of Creative Thinking: A comprehensive review." *Frontiers in Psychology. (*2022) DOI: 10.3389/fpsyg.2022.1000385

Alhamlan, S., Aljesser, H., Almajed, A., Almansour, H. A., and Alamad, N. "A systematic review: Using habits of mind to improve student's thinking in class". *Higher Education Studies* 8: (2018): 25-35.

Altan, S., Lane, J. F. , and Dottin, E. "Using habits of mind, intelligent behaviors, and educational theories to create a conceptual framework for developing effective teaching dispositions". *Journal of Teacher Education*. (2017): 1-15. DOI: 177/0022487117736024

Anderson, L. W. & D. A. Krathwhol. *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman, 2001.

Arieti, S. *Creativity: The magic synthesis.* New York: Basic Books, 1976.

Asunda, P. A., & J. Weitlauf. "STEM habits of mind: enhancing a PBL design challenge-integrated STEM instruction approach." *Technology and Engineering Teacher* 78.3 (2018): 34-38.

Berrett, D. "Habits of mind: Lessons for the long term." *The Chronicle of Higher Educatio*n, October 8, 2012 https://www.chronicle.com/article/habits-of-mind-lessons-for-the-long-term/

Campbell, J. "Theorizing habits of mind as a framework of learning." *Proceedings of the Australian Association for Research Education Conference*. Adelaide, South Australia, 2006.

Csikszentmihalyi, M. *Flow: The psychology of optimal experience*. New York: Harper and Row, 1990.

Costa, A. & B. Kallick. *Learning and leading with habits of mind: 16 essential characteristics for success*. Alexandria VA: ASCD, 2008.

Dweck, C. S. *Mindset: Changing the way you think to fulfill your potential*. New York: Random House Inc, 2012.

Ennis, R. H. (1996) Critical thinking dispositions: Their nature and assessability. *Informal Logic* 8 nos. 2 &3 (1996): 165-182.

Gardner, H. E. *Multiple intelligences: New horizons in theory and practice.* New York: Basic Books, 2006.

Hetland, L., Winner, E., Veenema, S. & K. M. Sheridan. *Studio thinking: The real benefits of visual arts education*. New York: Teachers College Press, 2007.

Henriksen, D., Mishra, P., Creely, E., & M. Henderson. "The role of creative risk taking and productive failure in education and technology futures." *Teach Trends* 65 (2021): 602-605.

Hildebrand, David, "John Dewey", *The Stanford Encyclopedia of Philosophy* (Winter 2021 Edition), Edward N. Zalta (ed.), URL = https://plato.stanford.edu/archives/win2021/entries/dewey/

Kallick, B. "Author interview with Bena Kallick: Part I." ERduplanet21. February 19, 2019. https://www.youtube.com/watch?v=iU9koGVUC-A

Lim, K.H., & A. Selden. "Mathematical habits of mind." *Proceedings of the thirty-first annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, 2009.

Louis, M. R. & R. Sutton. "Switching cognitive gears from habits of mind to active thinking." *Human Relations*. 44 no.1 (1991): 55-76.

Lucas, B., & Hanson, J. (2014). Thinking like an engineer: using engineering habits of mind to redesign engineering education for global competitiveness. In *SEFI 2014 Annual Coonference* http://www.sefi.be/?page_id=5173

Lyle, J. T. "The alternating current of design process" *Landscape Journal.* 4 no. 1 (1985): 7-13.

Mishra, P., Koehler, M. J., & D. Hendriksen. " The seven trans-disciplinary habits of mind: Extending the TPACK Framework towards 21st century teaching". *Educational Technology*. 51 no. 2 (2011): 22-28.

Tishman, S., Jay, D. & D. N. Perkins. "Teaching thinking dispositions: From transmission to enculturation." *Theory into Practice.* 32 no. 3 (1993): 147-153.

Tishman, S. and D. N. Perkins. (1997). The language of thinking. *Phi Delta Kappan; Bloomington.* 78 np. 5 (1997): 368-374.

Torrance, E.P. *Torrance Test of Creative Thinking: Interpretive manual*. IL: Scholastic Testing Service, Inc, 2018.

Torrance, P. & Shaughnnessy, M. F. (1998). An interview with E. Paul Torrance about creativity. *Educational Psychology Review*: 10 no. 4 (1998) 441-452

Tough, P.. *How children succeed: Grit, curiosity, and the hidden power of character.* Boston: Houghton Mifflin Harcourt, 2012.

Thagard, P. "Cognitive Science" *Stanford Encyclopedia of Philos ophy* (Spring 2023 edition) editor: Edward N. Zalta and Uri Nodel man, Metaphysics Research Lab, Stanford University} URL = https://plato.stanford.edu/search/searcher.py?query=how+to+cite

Lucas, B. & J. Hanson. "Thinking like an engineer: using engineering habits of mind and signature pedagogies to redesign engineering education". *International Journal of Engineering Pedagogy*, 6 no. 2 (2016): 4-13. Available: http://online-journals.org/index.php/i-jep/issue/view/288Grazer, Brian, and Charles Fishman. *A Curious Mind: The Secret to a Bigger Life.* New York: Simon & Schuster, 2015.

Keng, Shao-Hsun, Chun-Hung Lin, and Peter F. Orazem. "Expanding College Access in Taiwan, 1978–2014: Effects on Graduate Quality and Income Inequality." *Journal of Human Capital* 11, no. 1 (Spring 2017): 1–34. https://doi.org/10.1086/690235.

Lahiri, Jhumpa. *In Other Words*. Translated by Ann Goldstein. New York: Alfred A. Knopf, 2016.

LaSalle, Peter. "Conundrum: A Story about Reading." *New England Review* 38, no. 1 (2017): 95–109. Project MUSE.

Satterfield, Susan. "Livy and the Pax Deum." *Classical Philology* 111, no. 2 (April 2016): 165–76.

Smith, Zadie. *Swing Time*. New York: Penguin Press, 2016.

Thoreau, Henry David. "Walking." In *The Making of the American Essay*, edited by John D'Agata, 167–95. Minneapolis: Graywolf Press, 2016.

DISCOVERING THE UNKNOWN

Nicholas E. Wickersham, The University of Southern Mississippi

discover *(Merriam-Webster)*
verb
dis·cov·er | \ *di-ˈskə-vər*
1a: to make known or visible
2a: to obtain sight or knowledge of for the first time
2b: find out

Discovery

The design process begins with discovery. Discovery in architecture is the search for the unknown. The unknown is the intangible, immaterial, and phenomenological things that transform the mundane to the extraordinary. We as designers search for the unknown in form and space, as well as in the design process. In the design process we want to surprise ourselves and end up with new solutions that we could have never foreseen.

In *The Thinking Hand*, Juhani Pallasmaa says: "Even masterful architects do not invent architectural realities; they rather reveal what exists and what are the natural potentials of the given condition, or what the given situation calls for. Alvaro Siza, one of the finest architects of our time in combining a sense of tradition with a unique personal expression, puts it sharply: 'Architects don't invent anything, they transform reality' … Architecture is also a product of the knowing hand. The hand grasps the physicality and materiality of thought and turns it into a concrete image. In the arduous processes of designing, the hand often takes the lead in probing for a vision, a vague inkling that it eventually turns into a sketch, a materialisation of an idea."

The unknown does not exist as a resultant in the design process; at the start of the project, an unknown, void, nothingness exists in lieu of the project. The studio project brief is an endless sea of possibilities. To some these possibilities are fuel enough and to others they are crippling. In *How to Fly a Horse*, Kevin Ashton discusses beginning the design process: "All that is necessary is to begin. 'I can't' is not true once we begin. Our first creative step is unlikely to be good. Imagination needs iteration. New things do not flow finished into the world. Ideas that seem powerful in the privacy of our head teeter weakly when we set them on our desk. But every beginning is beautiful. The virtue of a first sketch is that it breaks the blank page. It is the spark of life in the swamp. Its quality is not important. The only bad draft is the one we do not write."

The discovery within a project is not a singular event but is consistently happening throughout the duration. Every day is met with new challenges that lead us down certain roads. Ashton illustrates the unknown that faces the designer everyday: "Work is the soul of creation. Work is getting up early and going home late, turning down dates and giving up weekends, writing and rewriting, reviewing and revising, rote and routine, staring down the doubt of the blank page, beginning when we do not know where to start, and not stopping when we cannot go on. It is not fun, romantic, or, most of the time, even interesting. If we want to create, we must, in the words of Paul Gallico, open our veins and bleed."

If time were not a constraint, this would allow the designer to explore all paths before achieving the finished product. Our relationship to time changes the design process from a fact-finding mission to a journey that is based on feeling and intuition. In the *Design and the Design Process* by Tim McGinty, he, like Pallasmaa, alludes to the idea that our discovery is not of fact but intuition: "For example, designers must work in situations with some degree of ambiguity. They must often make decisions when they do not have enough information. This in turn can lead to high levels of frustration. A rational person expects to collect and analyze information and thus discover a solution. Unfortunately, in architecture, not only is there often a lack of sufficient information, but also the process by which a solution is to be derived is often uncertain."

Similar to that of an out-of-body experience, the hand (the act of making: drawing, modeling, writing, and other forms of production) can lead us to discovery. It is the repetition of the hand - the iterative process - that leads us to the fully recognized idea. When we begin the design process, it is also important to note that the idea is rarely fully flushed out. It takes time to unravel and discover the full form of the idea. In ways, comprehending an idea is like that of understanding a building. Early on we do not know what the building is like on the other side or the inside. It takes

exploration in order to gain full knowledge of what this building truly is. While we are on this course of discovery, we must trust the process and our intuition. There are many tools that can guide us within the creative process such as the hand and iteration; however, there is something within us that can further direct our course.

The Well

How does the unknown come to a designer? The simplest answer is that it often already dwells within the designer. It is the intangible that truly informs our projects. We all have a well within us that contains a wealth of experiences, feelings, ideas, and other emotions. When we tap into this well, these things can help influence our designs. These things allow us to not only connect to the physical aspects of the site, building, and other built features, but also to the individuals that interact with the project. These emotions, ideas, feelings, and experiences are the things that allow us to empathize with others and be able to relate to various situations. Built work is often the conduit that connects the designer to other people.

Peter Zumthor recalls past experiences at an aunt's house in his book, *Thinking Architecture*: "Memories like these contain the deepest architectural experience that I know. They are the reservoirs of the architectural atmospheres and images that I explore in my work as an architect. When I design a building, I frequently find myself sinking into old, half-forgotten memories, and then I try to recollect what the remembered architectural situation was really like, what it had meant to me at the time, and I try to think how it could help me now to revive that vibrant atmosphere pervaded by the simple presence of things, in which everything had its own specific place and form. And although I cannot trace any special forms, there is a hint of fullness and of richness that makes me think: this I have seen before. Yet, at the same time, I know that it is all new and different, and that there is no direct reference to a former work of architecture which might divulge the secret of the memory-laden mood."

The strongest experience in my well is a time spent at my grandfather's house in southern California. It is a distant memory; and like a well-worn picture where time has faded it, the image and corners are no longer bright and crisp. It must have been spring as there was a scent that permeated the home, and sometimes during spring I catch a smell that takes me back to this memory. This house was dynamic in that it connected people from the first floor to the second floor. There was always a unity about this house. It brought the people together even when they weren't gathered together in a singular room. On the second floor was a bedroom with a balcony, but the balcony didn't extend to the outside, it overlooked the dining room. This always struck me as different and odd. It seemed like a portion of a play/opera would take place from here, but it was the play of life that was performed here. As one entered the kitchen, there was a portion of ceiling that was made of glass block, which allowed light to enter the kitchen from the second floor/ceiling and it also connected the people from the first floor to the second as you could see them moving through the transparent floor. It is from this experience in my well that I often design from. I am constantly searching for connectivity within my architecture, whether that is connecting people to people or people to place.

I do not think that Zumthor is talking about romantic ideas or that of reproduction or re-creation of any of the spaces and ideas that he describes. He is talking about abstracting the memory of an architectural experience and turning into something that he can utilize within his new work. He combines a few of these distilled memories into a hybrid which creates a new and unique experience. For the rest of us, it is also about slowing down and taking the time to create a connection from what is asked of the designer (the brief) and what they have within them (the well). The designer can then take these experiences and imbed them into the materials and architectural compositions, which will hopefully yield an architectural experience.

Pallasmaa alludes to the tool that we need in order to craft these spaces: "Finally, the architect needs his/her heart in order to imagine situations of real life and to feel compassion for the human destiny. In my view, the gift of heart is most underestimated as a prerequisite for architecture in our times of self-centredness and false self-assurance."

A shed is not architecture. It is a simple structure made to serve a specific purpose. It is the intangible that makes architecture. These intangible things that are infused into the architecture are what people connect to, and this is the meaning that they take away. Whether it is the memories that Zumthor describes or the heart Pallasmaa calls for, it is these phenomenological things that transform the same materials that the shed is built of into architecture. Furthermore, the resultant of this process is not only form or space, but an architectural experience. It is after all the architectural experience/s that moves people.

The Narrative of the Studio Project

Designing The Studio

When I approach an architecture studio project for students, I think about what skills, lessons, and other techniques I will be able to teach them. In the early design studios of an architecture program, we are tasked with teaching so many different ideas and skill sets to an often novice group. So, the question typically becomes, what projects are capable of teaching many architectural ideas and techniques? In addition to teaching ideas and techniques, I try to fold intangible elements, such as the concept of empathy, into these projects. How can a designer create without thinking about how the client, patrons, visitors, or other individuals will react within the designs they have created? Therefore, I often ask the students, how does the architecture make you feel? How do you want these people to perceive this space, not only visually but emotionally? In addition to teaching my students about empathy, I empathize with my students and try my best to put myself in their shoes, to think about how they will thrive within these projects, and, also, ascertain the knowledge and skills the future requires of them.

Very seldom do we have projects that are constructed or sculpted from a homogeneous material. Most of the buildings in the built environment are constructed of a multitude of different materials, like the brick. The brick or the CMU block have many ways in which they can be transformed. With the possibilities of the singular material, and if the designer were to incorporate all these many transformative options into a project, the design possibilities could be endless. This knowledge of the brick and other building-block work led to the idea that the students could design a more dynamic, complex, unique module of their own; so, the students would not only design the wall, but also the material. Questions I wanted the students to ask include: How can you make the most out of a single or a few modules? How can the singular module do more for the experience when rotated, flipped, combined, and other types of transformative procedures?

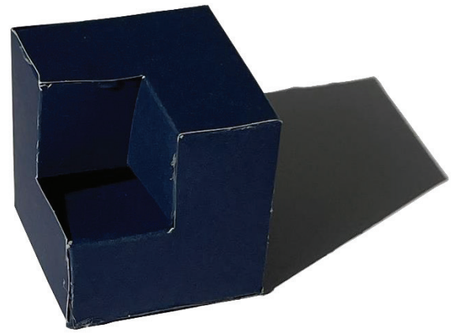


Fig. 1 The singular module. Work by USM architecture student.

I personally believe that the act of physical model making is not dead and is a tool that needs to stay in academia, as well as practice. What makes physical model-making so important is that the student is quickly capable of understanding the space and form they create. Furthermore, the students are immediately exposed to architectural tectonics. How can they attach one material to another and what does that connection mean? The model is also a crash course in structures and alludes to how our buildings must achieve equilibrium. The detail is not only a means to an end of connecting materials together but is an expression that reflects the ideas and ethos of the project, program, client, and other important factors. Juhani Pallasmaa states: "The door pull is one of the details of any building that call for close ergonomic attention and provide an opportunity for a nearly physical contact between the architect's hand and the hand of the occupant through the mediation of this object. The door pull or handle of the main door is the handshake of the building, and the pulling of the door with one's body weight is often the most intimate encounter with an architectural structure." From concept to tectonics the intimate involvement with these models allows the connection between designer and patron.

Studio Brief

The Modular Wall project was an architecture studio assignment in which the students were asked to create a module similar to that of a brick; however, they were required to create something more complex than a simple cube or rectangle. In the studio's previous project, the students worked on a series of orthographic drawings and were beginning to understand how to draw three-dimensional space in two dimensions. The Modular Wall

project allowed the students to utilize a physical model prior to making two dimensions orthographic drawings. The students were initially required to create three different types of modules and needed to have four identical copies of each different type of module. Students quickly realized that the four copies of the module told them very little about the totality of what their modular wall could be. They then chose which module to continue to pursue throughout the duration of the project. The module was transformed into a scaled element at ¼" = 1'-0". During this process of scaling the module, I asked all students to consider the experience when standing next to their module/s. I talked with them about the different feelings one might feel when standing next to a brick wall versus a CMU block wall, and so on. To reinforce the idea of standing next to the wall, I required all to have a scale figure that could stand next to their wall. The final requirements of the Modular Wall project were 10'-0" in height and 15'-0" in length. Each project was required to have a minimum of one opening for viewing and an opening for the entry of a person. The final models were at ¼"=1'-0" scale. A floor plan and elevation at ¼"=1'-0" scale was also required from the students. These are questions that were included in the brief: Connections – How does the module connect from the left to the right? How does the module connect from above and below? Lack of Module – is it possible to remove modules to create a different design and why would you remove modules? How does this form work with light and shadow? How does the wall connect to the ground? How does the wall connect to the sky? What other questions will you ask about this work?

The School of Construction and Design does not have any fabrication tools, from laser cutters to the most basic wood working tools; therefore, I had the students use cardstock. I showed them ways of folding and transforming these simple pieces of paper into complex forms. In ways, the lack of technology is a blessing. Going back to the roots of simple hand modeling, the students took to this quite quickly. I further echoed that this is an invaluable skill, and when the students are in an office or other professional situation, and they are unable to draw or digitally model a form or space, they will always have the ability to make a physical model. They will always have this skill at their command.

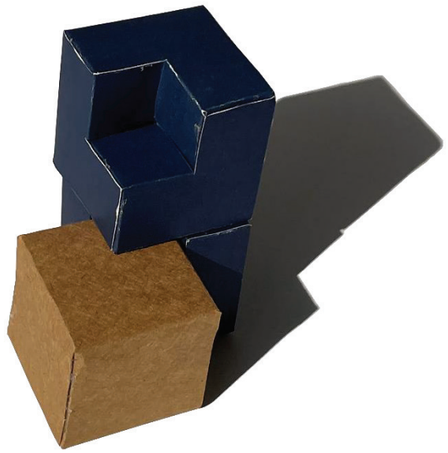


Fig. 2 Combining, three modules coming together. Work by USM architecture student.

Student Response

Once all students decided upon a final module/s to proceed with is when the 'work portion' of the studio started. Many students had to build upwards of thirty-plus modules to create their walls. I showed them time-saving tips like tabs (when folding the cardstock in a similar way to that of origami, tabs can be helpful to glue the tab behind another surface) as well as photocopying sheets, so each module did not have to be drawn. As the students toiled on the task at hand of making lots and lots of modules, the exhaustion in the studio was growing. Just before exhaustion became frustration, most of the studio shared a "eureka" moment! Students suddenly had enough modules to start production on the wall. The pain and toil of their efforts were now starting to pay off. I saw joy and pride on their faces as they quickly made realizations of what these modules can do. Students began to rotate, flip, turn, and transform these modules in various ways. One module stayed stationary while the one adjacent was rotated. It became apparent to the students that these moves led to limitless possibilities. Most of us have a memory of playing with Legos, Lincoln Logs, or other building toys. From this experience we understand how things go together. The students experienced failures and successes. Structures collapsed before their eyes and caused heartbreaking disappointment, but they were also capable of making things they never could have imagined. They were no longer working - they were immersed in play!

Light and shadow were beginning to come into the conversation. Our studio overlooks the school's conference building, which is a solid flat wall of brick that has few windows, exudes little to no interest, and does not interact with the light. I have pointed out this wall several times to students and said, "This is the antithesis of our project." Furthermore, I have mentioned that this wall is without soul or spirit. It is the intangible quality missing from this example project that I ask my students to incorporate into their work.

As the project wrapped up, the students were initially excited to arrange and rearrange their modules. I told them to take pictures of the configuration so they could get back to a previous version if needed. As all began to settle on a design, I saw students getting detailed and precise about exactly where every piece went and why. One of the things that I constantly urge my students to do is to project themselves into their work. I asked them to make a scale figure for the model, so they can understand the scale of what they are designing. I also ask the students to walk the plan, be in the model, and then they can tell what the experience is like. I felt as though this project allowed them to be immersed into a feeling and an experience of what they were creating and not just working with form and space.

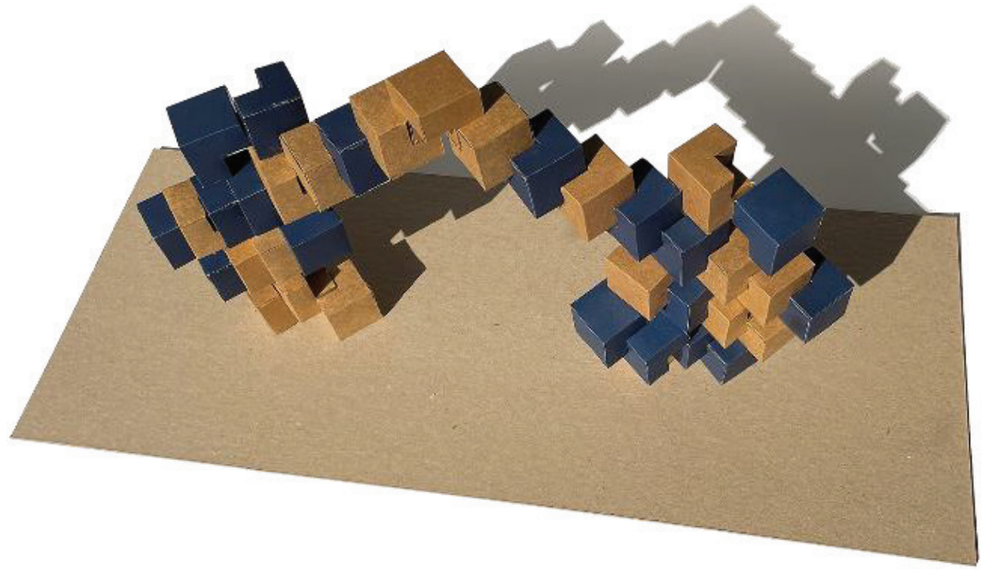


Fig. 3 The resultant of all of the modules coming together to create work that could never be envisioned. Work by USM architecture student.

Upon completion of the project, I asked each student if they could envision what they created and all answered "no." So, what was the path that led them to the unknown? It was simply the act of "play." Though we are talking about college students and adults, we all have a need to play within ourselves. Oddly, as I designed this project, I had ideas of what I wanted both the students and me to accomplish, and the result was something magical that I could not have known!

Conclusion

When designing this project, I never envisioned that the "work" portion of the building of the models would help the design portion. Suspending the design and creative portion of the project allowed for pause, reflection, and the opportunity to resonate on the brief. This period of resonation gave the students time to research, experience, and make connections to the project brief. The ideas simply needed time to form and grow.

By suspending the design portion of the project, the students got excited about designing. With each module they built, they were also building up excitement. By the time each student had completed all the modules they needed to build their wall, they had a wealth of potential energy. This potential energy was then released during the design process. As the flood gates opened, students were excitedly attacking the problems in several different ways. As the requirements of making many modules became 'work', something unexpected happened. By this portion of the process becoming 'work', it then alludes to the designing portion of the process as the part that one wants to achieve, and not just the 'final results.' This design work is not only the desired portion, but the opposite of the 'work' portion, and it becomes play.

We are all different and we design and think in different ways. The advantage that I see in the Modular Wall project is that the student has two opportunities to connect to their well: First, in the work portion, while design is suspended. They are given the opportunity to ponder the project and its meaning, and what the students will contribute while they make a multitude of modules. Second, the opportunity of connecting to their well is within the design process through the experience of play. Play is a part of our early development. It lives within us and can certainly allow us to connect with memories and tap into the intangible.

Many are often eager to jump right into designing the task at hand. This is often the most exciting and the most desired part of an architectural project; however, I see great value in slowing down and suspending the design process to allow for resonation. I am excited to fold these ideas into my next architectural studio project to see if it yields the same positive results as the Modular Wall project. There is no doubt that I will discover new and unknown things in the next iteration.

Bibliography

Ashton, Kevin. *How to Fly a Horse: The Secret History of Creation, Invention, and Discovery*. New York: Anchor Books, 2015. Pg. 24 & 25

McGinty, Tim. *Introduction to Architecture: Design and the Design Process*. New York: American Publishing, 1977. Pg. 186

Merriam-Webster.com s.v. "Discover." accessed February 20th, 2023, www.merriam-webster.com/dictionary/discover

Pallasmaa, Juhani. *The Thinking Hand: Existential and Embodied Wisdom in Architecture*. Chichester, West Sussex, UK: John Wiley & Sons LTD, 2009. Pg. 16 & 148

Zumthor, Peter. *Thinking Architecture*. Basel, Boston, Berlin: Lars Muller Publishers, 1998. Pg.8

Housing the Other: Beginning Design Learning through a Situated Multidisciplinary Project

Sarah Keogh PhD, Ball State University

Introduction

This paper critically reflects on the experiences of a multidisciplinary undergraduate design course in which the students were tasked with designing a transitional housing village for a local homeless population. These beginning design students experienced a situated epistemology that stemmed from working within multidisciplinary design teams and in direct collaboration with various community partners. The class was asked to design a tiny home village for a specific homeless population on a local, leftover, ecologically damaged site. As a part of their learning experience, the students were confronted with larger dialogues surrounding equity and sustainability that included economics, resiliency, management planning, accessibility, and buildability. The student design teams applied their multidisciplinary experiences to effectively use a variety of sustainability and equity lenses to explore social constructions of place and community. This paper delineates the benefits of a multidisciplinary immersive learning approach to beginning design pedagogy and examines a number of specific techniques used to foster multidisciplinary ideation and creative exploration.

Project Introduction: Muncie's New Hope in a Tiny House Village Project

Struggles of homelessness are a prevalent concern in Indiana, with an estimated 150-200 people considered "unsheltered" in Delaware County alone. To help combat this issue, a Ball State immersive-learning course partnered with the City of Muncie's Office of Community Development to plan the Tiny House Village Project. The project, funded by a federal grant, is not designed to have long-term residences, but rather function as transitional housing. The project enabled students to work with various community members to study the interrelated elements of ecological design, landscape architecture, social justice, and community development to propose a design that considers both the environment and people in need of secure housing.

Over the summer and fall semesters of 2022, twenty-eight undergraduate students from a variety of year-levels worked in multidisciplinary teams to develop designs for the tiny houses, the community building, and the site itself. These teams met with city officials; community members who run existing social service programs in Muncie; Ball State professors and support staff from several project-affiliated departments; and Ball State graduate students studying homelessness in the United States.

This project was implemented through a Sustainability course that is open to any Ball State student who is working towards a Sustainability minor. In both the summer and fall semesters, we had students from the first, second, and third years of Ball State's 5-year Architecture program. In the summer course we also had two 5th-year Architecture students; and in the fall we had two 4th-year Architecture students. In both semesters, almost half the class was made up of non-architecture students, most from non-design disciplines. We had one Landscape Architecture student in the fall semester, and in both semesters had students from Biology, Geology, Journalism, Natural Resources and Environmental Management, and Anthropology.

Project Goals

We initially defined our project goals through discussions that leveraged our diverse backgrounds and addressed the three pillars of sustainable development: Social Equity, Economics, and the Environment. In our discussion of social equity, we discussed the primary goals and site requirements for a successful transitional tiny house village project. We met with local community and social support program directors to define how our project could tie into the existing local programs. We also identified accessibility as a primary construction and design goal — the tiny houses needed to be easy to build and the full site, the community building, and every tiny house unit would be ADA accessible.

We discussed the economics of sustainable development and defined low cost and ease of construction as primary

goals for the 60+ tiny house units which would allow the project to use the existing money and offer easy expansion opportunities most effectively. The tiny house unit assembly booklets, which were the final deliverables of the summer course, were aimed to allow an unskilled team to construct a tiny house in a day (we envisioned high school student volunteers) and the beginning design students took the lead in helping us to produce assembly drawings that are legible to anyone.

Our discussion of environmental sustainability benefited greatly from our multidisciplinary group and in both semesters, we were able to define a wide range of environmental sustainability goals. The architecture students defined local and reused building materials as an essential component to our designs. Passive design strategies and energy-efficiency were embedded in our design thinking. The social anthropologist helped to define our design spaces' social agendas. The biology and natural resources and environmental management students built our approach to the site design and defined native planting palettes, designed gardens and ground covers that would support local pollinators, and identified site-appropriate soil remediation techniques. The geology students helped us to identify and address existing runoff issues within the site and the local river zone.

These sustainability discussions were an especially productive start to recognizing the strength of our multidisciplinary approach. These discourses highlighted both our disciplinary differences and the obvious benefits of having diverse views and knowledge bases within a design team.

Three Techniques to Foster Multidisciplinary Immersive Learning

Multidisciplinary learning can be challenging but offers numerous opportunities to build a rich learning environment. As described earlier, the students in this course came from a variety of backgrounds each holding diverse disciplinary perspectives and interests. This multidisciplinary class offered a unique learning opportunity where students learned to communicate across traditional disciplinary boundaries, learned various problem-solving approaches embedded in the disparate disciplines, refined their interdisciplinary collaboration skills, and learned to appreciate diverse sets of skills and knowledge within a working group. The students also expanded their communication and collaboration skills through numerous meetings with community partners where they had to present and discuss their current design thinking with a variety of non-design professionals.

Because this was a real-world immersive learning project with real stakeholders, the students were invested in a way that is hard to elicit in an academic design project. The students worked diligently to define productive workflows, create effective community presentation and discussion opportunities, and to design a good project that would help real people. All these immersive learning experiences reinforced the learning benefits of a multidisciplinary group.

The course started each semester with a general design discussion and students were split into pairs for the second half of the first class and each pair came up with an initial design idea. Instead of a traditional design proposal where premade images and drawings are presented, the students were asked to draw their ideas as they described their designs. The intention of this introduction was to reinforce real-time drawing as an integral part of design conversations. Throughout the course three specific learning techniques were used to foster productive learning in a multidisciplinary immersive learning environment.

Foundational Knowledge Mapping

First, the students built a foundational knowledge map. The students were each asked to assess their own project-relevant skills and strengths, and this functioned as a productive introduction of themselves to the rest of the class. The students were asked to list and describe their specific skills and knowledge sets. The students referred to individual classes they had taken and to influential books and articles; they reflected on past projects and papers they were proud of; they referenced non-academic hobbies and outside jobs. We used a virtual whiteboard application to post notes and texts, images, diagrams, and reference materials. As we collectively processed everyone's information, we edited the aggregate map to coordinate labeling and color-coding across all our information so we could start visualizing our distributed skill sets and specialized knowledge as well as identify shared interests and agendas.

This mapping helped the students clearly identify how much they can learn from each other and identify areas of similarity and overlap. This mapping helped us organize and define initial working groups based on shared interests and a balanced distribution of skills. We used this map to define areas of specialization; we also used this map to identify gaps in our knowledge and define critical research areas. Essentially this map functioned as a foundation for building a viable community of practice for this project.

We continued to use this map throughout the semesters adding to its information as research and learning proceeded. We found ourselves referencing the map throughout the semester to identify task leaders for specific stages of work. This map helped the students define what they could learn from each other. It helped students structure and organize their learning and working process and allowed them to define working roles within each group and set expectations and responsibilities for each group member.

Continuous Drawing Roll

The second technique used to foster multidisciplinary design learning was to use a continuous drawing roll as a central element of our design process. Based on the theory of peripheral participation, this technique allowed students who were new to design learning (over three-quarters of each class) to simply watch until they gained a basic understanding of how to participate in the sketching portion of the design discourse. The drawing roll was used to help students, especially those from non-design disciplines who are often tentative about sketching, learn to use drawing as a tool for design communication, exploration, and iterative thinking. The fact that we had a few upper-level architecture students helped to get the drawing discourse started. These students led the first few ideation discussions and actively used sketching as a tool for design description and exploration. This allowed students who were initially unfamiliar with architectural drawing-types to watch as sections and plans and diagrams were used as a part of the group conversation. This initial process then set the expectation that sketching should be an integral part of the ideation process and the drawing roll became a focus for our in-class discussions.

As everyone became fluent in the use of sketching as a part of our course communication (being good at drawing was definitively not a requirement for successful sketching), the drawing roll became integral to our design decision-making. Most of our class-time was spent around the drawing roll and our daily design process

Fig. 1 Use of the continuous drawing roll as a focus of in-class design discussions. Photo by author, July 2022.

conversations happen through the activity of drawing. This continuous roll became a recorded history of our design decisions. Throughout the semester, as we moved forward through an iterative design process, we used the drawing roll to look back on earlier thinking and often found ourselves pulling from earlier drawings or diagrams to refine our current design iteration.

In retrospect, the drawing roll also functioned as an effective introduction to design criticism. As we progressively talked thorough our ideas, our sketches continually changed as our design evolved and there was very little sigma surrounding productive criticism — which is commonly a hard to learn skill for early designers. Because the drawing was a shared record, productive criticism was always aimed at our collective representations and authorship was shared amongst everyone. Therefore, it was easy for students to feel comfortable critically assessing the current state of the project.

While the shared continuous drawing roll was a spectacular tool for early design learning, this also benefited the few upper-level students who in their design studios had moved toward primarily working in the digital realm. This course's process reminded them of the iterative power of hand sketching.

We used the drawing roll to inform physical models at various stages of our design process and at multiple scales of exploration. The models would then inform the next iterations of our drawings. Students would also bring their computers to the drawing roll later in the semester to reference the ideation record as they refined the project's digital models. The continuous drawing was a full record of the course's design process and functioned to record our decision-making, helped us to tie design ideas together, and aided us in defining and refining our next-step priorities and goals.

Physical Modeling

The third technique used to foster multidisciplinary immersive learning was to use modeling at various scales to aid in both design communication, learning, and exploration. We explored the use of a variety of model types over the course of the semester. Scrappy iterative form models helped us to think through basic design relationships to context and, in the summer, explore how the tiny home units could aggregate across the site. Assembly models helped the students test various ideas of basic construction and, again in the summer, helped us first explore and then define and refine the tiny houses' final wall panel system. Joint models built with real materials and at full scale helped the students visualize, refine, and test various detail and assembly ideas. All the models helped the beginning design students to connect 2D and 3D thinking, refine their understand of various drawing types, and support their continued learning of how to explore and express their design ideas more fully.

Fig. 2 Various physical model on display at a community partner meeting. Photo by author, July 2022.

The models helped the students communicate with each other — for example, on a rare occasion when a student could not get another student to grasp their idea through drawing, a simple model sufficed to create a shared understanding. Models also helped the students share their ideas with the community partners and offered a medium that the partners could manipulate and visualize, often more effectively than though architectural drawings. For example, in the summer, we brought over sixty tiny form models to discuss our two primary ideas about how the tiny house units could aggregate across the site to create various scales of social zones among the units. Overall, modeling at various levels of detail and at different scales enabled a depth of design exploration and understanding not always accessible through drawings alone. Models also effectively improved communication among all the projects invested parties: the students and community partners.

Conclusions

The final course deliverables were construction assembly books that the community partners can use to move the project forward to eventual construction. The fact that the majority of the students were beginning design learners and represented a variety of disciplines actually improved the clarity of the design communication of the assembly booklets. As a final product, these books helped the students to reflect on their own learning trajectories over the course of their semester and offered a concrete example that demonstrated their multidisciplinary group's accomplishments.

This course analysis ties in theories of situated learning and peripheral participation into multidisciplinary immersive design teaching and the course outcomes substantiate a learning approach that is inclusive and responsive to situated issues of equity and otherness. Throughout this course three multidisciplinary beginning design teaching techniques were used to improve learning outcomes. First, the class took advantage of the students' various disciplinary backgrounds and built and used a foundational knowledge map that referenced both the students' disciplinary and personal interests. Second, students learned to explore team design thinking through a shared continuous drawing roll that was brought out at the beginning of each class and allowed the students to delineate their progress and current focus through their shared sketches. Finally, the students exemplified their experiential and construction ideas through modeling at various levels of refinement and at different scales. Through these exercises and workflows, the students learned to listen to each other, work effectively together, and as a team, productively process critiques from each other and from community partners. This paper considers this course structure as a potential foundation for a multidisciplinary beginning design curriculum, one that is inclusive and responsive to issues of social and environmental inequity.

Bibliography

Lave, Jean and Entienne Wenger. *Situated Learning: Legitimate Peripheral Participation.* Cambridge: Cambridge University Press, 1991.

Wenger, Entienne. *Communities of Practice: Learning Meaning, and Identity*. Cambridge: Cambridge University Press, 1998.

Gentle Giants: Unifying Difference in Beginning Design Education

Radu-Remus Macovei, University of Wisconsin-Milwaukee
School of Architecture and Urban Planning

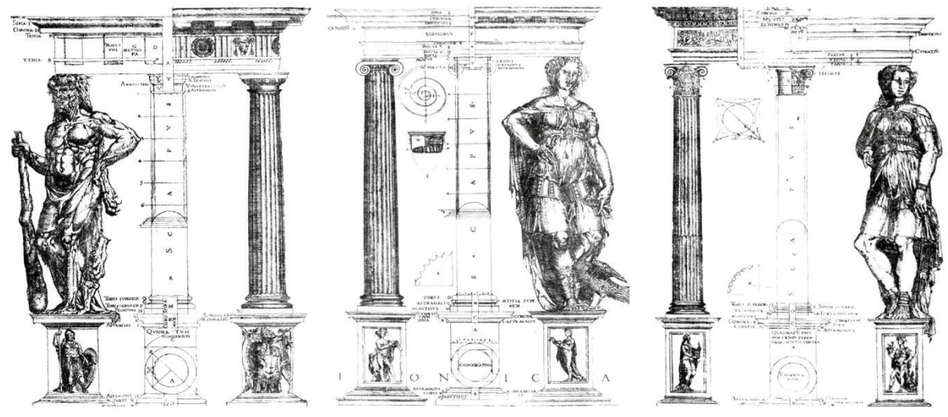
Otherness and the Beginning Design Student

Students enter beginning design studios with architectural ideas which were naturalized during their upbringing in oftentimes conformed neighborhood architectures. The desire to conform to existing images of the built environment makes for both a predictable and a dull project. Beginning design studios need to challenge students' preconceptions and demonstrate that architectural design does not need to imply conformity with established ways of building. Starting from the premise that "architecture is substantially in the mind,"[1] Andrew Ballantyne categorizes four architecture-machines, assemblages of images of buildings that commonly structure how we experience difference in the built environment:

(1) buildings that conform to their context (e.g. Tudor in Tudor style suburbs),
(2) buildings that continue a tradition found elsewhere (e.g. Tudor in Greek Revival style suburbs),
(3) buildings that create a new tradition (e.g. avant-garde),
(4) buildings that signify social aspiration (e.g. palatial house to signify status).

While beginning design students come in with a variety of worldviews, our studios aspire to re-territorialize them into category (3) where the absorption of many images of buildings they are exposed to produces more or less sophisticated schemes. To achieve this re-territorialization, beginning design pedagogy must threaten the conformity and stability of preconceived images of buildings and deform them. The process of deformation produces otherness, i.e. different architectures generated from familiar forms.

While this definition is borrowed from theoretical reflections on monsters in relationship to normatized bodies, it is just as useful for our purposes here. So is the term 'monster' itself whose etymology stems from the 13th c. French monstre, meaning 'misshapen being.'[2] Setting aside the frightening connotations we associate with monsters today, 'misshapenness' assumes bodies have a 'right' shape, the idealized bodies we design from and for within the Eurocentric tradition: Vitruvius's Doric man and Ionic woman; Leonardo da Vinci's Vitruvian Man, Cesare Cesariano's Vitruvian Man, Francesco di Giorgio's temple-like youth, Jacques Francois Blondel's human profiles as Orders, Oskar Schlemmer's Vordruck of a 'new man',



The Doric Order | The Ionic Order | The Corinthian Order

Fig. 1 Gendered Architectural Orders as conceived by Vitruvius, drawn by J.N.L. Durand, 1800 © Recueil et parallèle des édifices de tout genre, anciens et modernes : remarquables par leur beauté, par leur grandeur, ou par leur singularité, et dessinés sur une même échelle by J.N.L. Durand. pub. l'Imprimerie de Gillé fils; (1799 or 1800).

Le Corbusier's Modulor, Neufert's standardized body, among many others. These gendered, stable, mostly male, normatized bodies have laid the basis for building geometries, dimensions and proportions and have structured the design of both what is commonly called 'the architectural canon' and most of the conformed built environment today. In this analogy of body and architecture, what does the misshaped body, i.e. the non-normatized-body, imply for buildings?

By reclaiming 'other' bodies as starting points for deriving a set of principles, monstrosity is relevant to architectural design in its presentation of images of difference that challenge disciplinary norms and conventions and in its inherent potential for formal experimentation and discovery. After situating the historical and theoretical context of monstrosity and its challenge to the normatized body assumed by Vitruvius and his followers, I will introduce monstrosity as a pedagogical tool to re-territorialize and to engage the beginning design student in understanding and reconciling difference in the built environment.

Bodies and Buildings

Representations of bodies in architecture have been theorized since at least Vitruvius's De architectura a little over two millennia ago.

"Without symmetry and proportion there can be no principles in the design of any temple; that is, if there is no precise relation between its members, as in the case of those of a well-shaped man. For the human body is so designed by nature that the face, from the chin to the top of the forehead and the lowest roots of the hair, is a tenth part of the whole height; the open hand from the wrong to the tip of the middle finger is just the same."[3]

More literally, Vitruvius suggests that from the stereotypical "strength" of the male body, the ancients derived the "thickness" of the Doric Order. Similarly, the "tall" Ionic Order was derived from the stereotypical "slenderness" of the female body.

"Thus, in the invention of the two different kinds of columns, they borrowed manly beauty, naked and unadorned, for the one, and for the other delicacy, adornment, and proportions characteristic of women."[4]

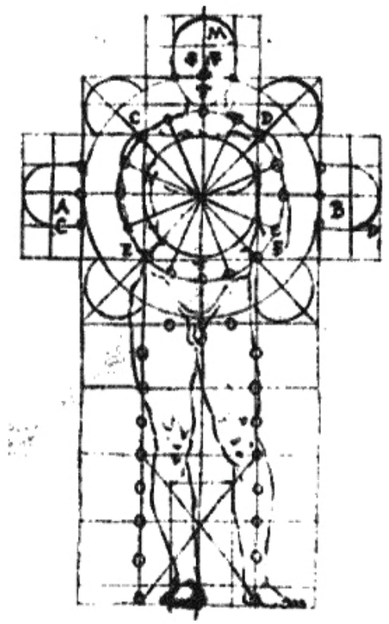


Fig. 2 Francesco di Giorgio's illustration of method to derive temple floor plan from proportions of human body, 16th c. © Francesco di Giorgio , Trattato, Florence, Bibl. Naz., MS II.I.141.

These so-called ideal bodies Vitruvius derives architectural principles, proportions and dimensions from are not geometrically accurate. Leonardo da Vinci's Vitruvian Man demonstrates that man's navel cannot be the center of both the circle defined by the outward extension of the limbs and the square described by body's height. "...even the ideal body that was to serve as the model for Roman and Greek architecture resisted systematization and representation."[5] Yet given that the use of Orders is "a hard spine through the soft flesh of European history,"[6] similar geometrical analogies have been drawn and redrawn over the course of time to justify specific proportions, dimensions and principles. While we most associate the body and architecture analogy with the composition of architectural facades, represented in elevation drawing, some have applied bodily proportions to planar organizations. In the late Renaissance, Francesco di Giorgio Martini detailed the design method used for the plan of a church. The elevation of a male human body is subdivided into a grid of 9 squares, each the size of the head, which becomes the modular system to locate and derive the size of church elements.

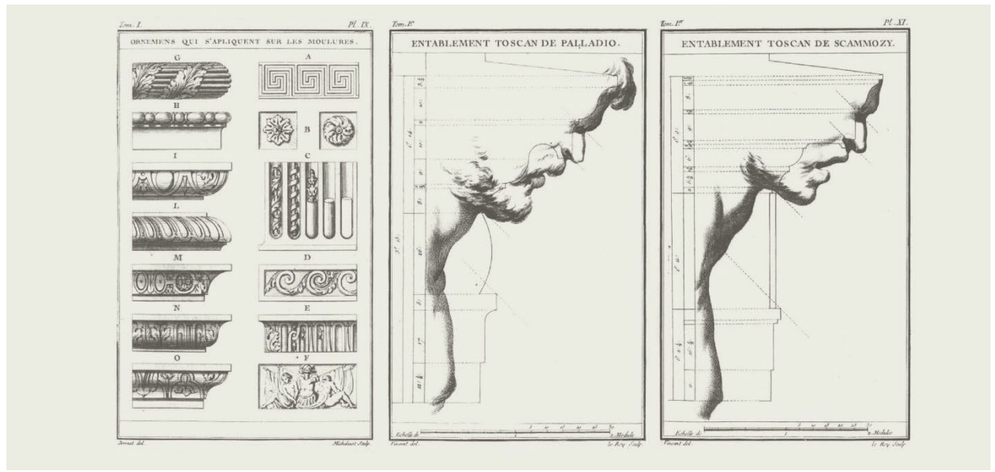


Fig. 3 Jacques-Francois Blondel's analogy between the human profile and the entablature. © Jacques-François Blondel, Cours d'architecture, vol. 1 (Paris: Desaint, 1771): the Tuscan entablature according to Palladio, Vignola, and Scamozzi, Plates IX–XI.

These detailed illustrations and visual analyses of the so-called 'ideal' human body seeped into treatises that would lay the foundations of classical architecture where antiquity was seen as "a source of method which was enshrined in the touchstone of the orders through which the harmony of the noble senses, of sight and sound, was guaranteed."[7]

This method lies at the basis of the neoclassical doctrine promoted in the Enlightenment, notably by Jacques Francois Blondel who illustrated the theory of profiles described by Francesco di Giorgio Martini, Giacomo Barozzi da Vignola, Vincenzo Scamozzi and Andrea Palladio centuries earlier. Here, the profiles of specific male heads are overlaid with those of Order entablatures to suggest an anthropomorphic source for the latter with the aim of emphasizing the physiognomies architecture could adopt in the new neoclassical doctrine. Whether informing elevation/section, plan or ornament, the normatized body became architectural source.

Following this tradition, two major normatized bodies emerged in the 20th c. which were rapidly codified around the world: Le Corbusier's Modulor and Ernest Neufert's Architect's Data figures. Ernest Neufert's Architect's Data, published in 1936, presents thousands of illustrations of the normatized body of a 1.75 m (5 feet 9 inches) tall man, the average height of a European man at the time. Le Corbusier's Modulor, developed during the 1940s, was first constructed on the 1.75 m male height average, but was later adapted to represent a man 1.83 m (6 feet) tall to reflect "good-looking men" described in English detective novels[8] and set the basis for many of his buildings' designs.

In this context, if the built environment our students have been brought up in is designed to reflect the formal and proportional qualities of the normatized bodies described hitherto, what do non-normative, clearly 'other', bodies imply for architecture?

Monstrous Bodies

In 1548, Italian historian Benedetto Varchi presented his study "On the Generation of Monsters" where he disassociated monsters from mythology. Based on descriptions of anatomical dissections, he concluded that monsters are real people who have "too many or too little ordinary members, both external ones and internal ones, or their members are transposed or damaged."[9] Only a few decades later, in 1573, French surgeon and philosopher Ambroise Paré published his study "On Monsters and Marvels" where he asserts that "monsters are things that appear outside the course of Nature."[10] Recent editions include countless illustrations, copies of Paré's originals and new additions, that supposedly show strange human births the surgeon observed, as well as non-normative animals. Both studies are some of the earliest and problematic forms of categorizing non-normative human bodies and fueled the fear that, unlike mythological creatures, monsters could suddenly be generated from familiar forms.

"(...) the fear of "multiplicity within unity" threatened to destabilize an acceptable language of visual form. The relationship of appendage to the body, or the part to the whole, disrupted any comprehension of a recognizable geometry or proportions. In other words, a lack of syntax represented (...) deformations that merged or combined many different visual references into one singular body. Deformations (...) bear relevance for architectural design as images of difference, difference that becomes more marked as an object that bears a slight visual resemblance to the original but with a greater number of repetitive or hybridized elements."[11]

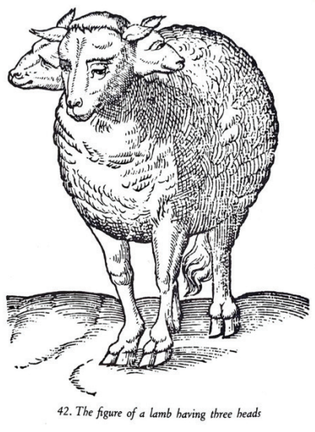


Fig. 4 Lamb with three heads. © Paré, Ambroise. On Monsters and Marvels, transl. Janis L. Pallister. University of Chicago Press: Chicago and London. 1982. p. 72.

With these studies, the integrity of the Vitruvian bodies became threatened by deformation. In this context, monstrosity, or the chiasm expressing multiple bodies in a singular entity,[12] became a tool to subvert the 'morality' of classical form promoted in Western architectural practices and education since at least Jacques-Francois Blondel. "Blondel ardently believed that unity in architecture could only be created by joining together the functions, use, and decoration of a building."[13] Few dared to use this tool, but some successfully did, including Jean-Jacques Lequeu who deployed "a type of visual monstrosity that arises from the transmutation of orthodox architectural elements. Lequeu transformed columns and pediments into extravagant forms and removed civic buildings from their expected contexts (...)."[14]

The formal deformations inherent to this definition of architectural monstrosity evoke images of difference which expand the beginning design student's formal, visual and linguistic vocabulary. The interplay of elements to be unified lead to complex architectural concepts presented in a playful and accessible, yet rigorous format. The subversive and unassuming nature of monstrosity that ties together seemingly unrelated disparities makes it particularly instrumental in shaping the beginning design student's architectural thinking.

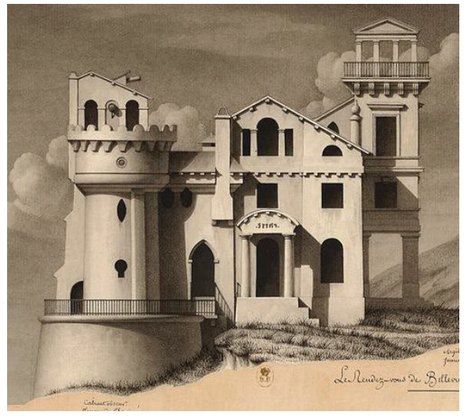


Fig. 5 Jean-Jacques Lequeu's Rendezvous de Bellevue. © Hermitage Gate, a Desert Drinking Pavilion, and a Hunting Retreat, from Civil Architecture, Bibliothèque nationale de France, Departement des Estampes et de la photographie, 18th c.

Starting from familiar and recognizable parts, monstrosity invites the architecture student to design the assembly system that enables the singular reading of the whole. The spatial issues that monstrosity poses for architectural design include part-to-whole, multiplicity within unity, repetition with variation, hybridity, among others, and present rich fields for discovery and experimentation. Unlike exquisite corpse-type pedagogies which presuppose an inherent randomness to the part-to-whole assemblage, monstrosity asks students to be intentional about the unifying system. In this context, my own beginning design pedagogy may provide an initial illustration of how unifying difference could be structured into a beginning design project.

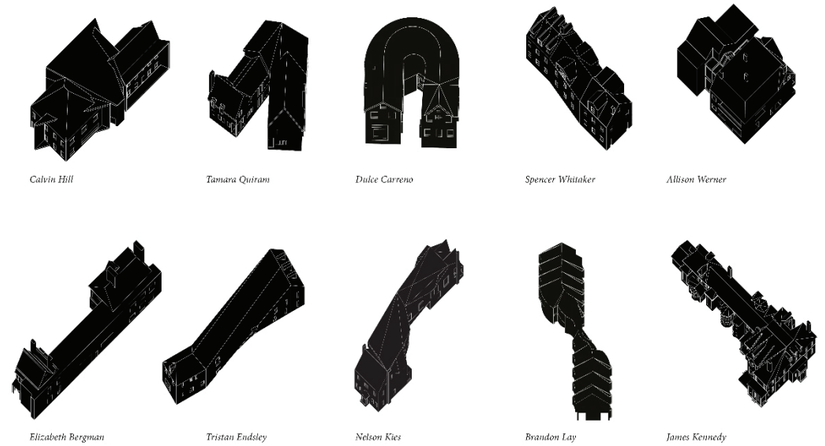


Fig. 6 ARCH810: Introduction to Architectural Design, Fall 2022; Project: "Gentle Giants: Unifying Difference," Instructor: Remus Macovei. University of Wisconsin – Milwaukee School of Architecture and Urban Planning. © Students: Calvin Hill, Tamara Quiram, Dulce Carreno, Spencer Whitaker, Allison Werner, Elizabeth Bergman, Tristan Endsley, Nelson Kies, Brandon Lay, James Kennedy.

Gentle Giants, a Demonstration

The second project of the beginning design studio for first year non-background Master of Architecture students at the University of Wisconsin - Milwaukee in Fall 2022 attempted a first application of this theoretical premise onto an architectural design brief. Titled "Gentle Giants" and starting from a low-density urban block in Milwaukee, the studio brief asked students to each assemble two adjacent lots and to unify the two single-family houses on them into a singular entity. In order to accommodate a third family moving in, the two existing families decide to physically join their buildings: two single family houses become one small multi-family complex. Yet the two existing buildings have different material properties, formal features, dimensional characteristics, aperture logics, roofscapes, access sequences, sectional conditions etc.

A series of questions underpinned the project:

How will they unify to become a single entity?
How will you articulate the multiplicity of difference within the unity of the single entity?
How will the distinctness of the two existing buildings be modified by the unity?
How will the new singular entity rethink the cohabitation of three families, rather than two distinct ones?

While the exercise does not explicitly ask students to rethink or question 21st c. housing typologies, the modifications they incur on the existing houses and the addition of the unifying structure will implicitly ask them to propose a new layout for housing three families. In this context, the extent to which they provide each family member or family unit with privacy, the spatial adjacencies they will determine and the amount, if any, of shared spaces will present their own understanding of the cohabitation of three families today.

It is easy to see the advantages of this approach for beginning design students. Firstly, they are dealing with recognizable building types (single family homes) and are asked to survey the buildings and to derive their floor plans from the size and location of apertures on the exterior envelope. This initial analytical process introduces students to careful observation of the built environment and to derive orthogonal drawings of interior layouts without having seen the buildings inside. Secondly, the students are asked to make an insertion between the two buildings, unifying them into a singular entity to accommodate three families. While they need to retain 50% of the exterior envelope, they are allowed to reimagine the interior in ways that reflect the relationships between the three families. This allows them to control and guide simple programmatic and formal aspects of the design proposal. Thirdly, they are intervening onto two existing recognizable building types in non-nostalgic ways that merge preservation and insertion.

A series of strategies emerged from the studio with some common cross-cutting themes.

Twinning: Morphed Difference

When faced with the task of unifying two adjacent buildings, two students explore morphed twinning as the conceptual premise of their projects. The street-facing facades of the two single family homes are read as the ends of a bar-building that had been bent or splayed. The operations executed on the gable roofs, lofting and intersecting, become key in achieving the unified formal reading as an averaging of the two ends. In this strategy, the treatment of the exterior walling and roofing becomes articulated through a gradient from the patterning, materiality and coloration of one house to another. The programmatic opportunities these schemes allow are many. On the outside, they enable the definition of a small courtyard. On the inside, the elongated floor plan is made manifest through specific circulation systems. In the bent condition, a curvilinear stair takes advantage of the long facade and the views it allows from one side of the house to the other to connect first and second floors, while framing views between private rooms. In the splayed scheme, a broken stairway that mirrors across the central axis frames the entrance view while minimizing corridor space and creates a double height space condition at the middle of the elongated bar for family gathering.

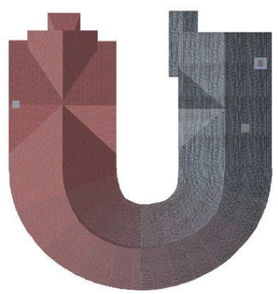


Fig. 7 Unifying difference by Twinning. © Student Project by Dulce Carreno. ARCH810, Introduction to Architectural Design, Fall 2022, Instructor: Remus Macovei.

Wrapping: Multiplicity within Unity

Two projects unify the buildings by wrapping them in an envelope that is materially and formally read as singular. This strategy is reminiscent of Christo and Jeanne-Claude's monumental installations that tightly drape large structures in fabric. Similarly, in this project, the envelope's surfaces negotiate the geometric constraints of the two adjacent lots and buildings through the operations of lofting and sweeping, allowing for multiple differences - the two existing buildings - within a unified envelope. These operations introduce students to complex, yet manageable geometries and demonstrate their strategic use in achieving site step backs. By tapering the volume between the two buildings, the first floor has a smaller area than the second floor. This incongruity triggers specific spatial operations in plan that required an hierarchical organization of the programme across the two levels. Both schemes squeeze the vertical circulation system within the narrowest area of the plan, allowing the experience of slippage from one building to another.

Thickening: Hybridity

By inserting a third element, different to the two existing buildings, two projects unify difference with more difference. Through the intersection of a thick wall and a giant rock with each pair of two buildings respectively, the projects explore poché space to unify differences. This strategy allows students to create buffer areas for circulation and services, while fragmenting their insertions into the existing buildings' floor plans to generate larger rooms. Because their insertions are solid objects - wall and rock - their floor plans and sections reveal tensions between the tectonic constructions of the existing buildings and the stereotomic approaches of their insertions. Instead of creating sameness, the projects generate worlds of difference in a hybrid whole. The location of a thick wall onto the two facades of the existing buildings creates a new front for the entire urban bloc. This false front reorganizes the programmatic hierarchies typically associated with street fronts by locating services and circulation on the main facade. The insertion of a giant rock wedged between the sloping roofs of the two existing houses allows for the first floor to remain unchanged with the exception of the tip of rock pinching the ground to create the main entrance via a circular stairway. The second floor is fully unified, yet retains a clear reading of the three parts of the assemblage, with the thickness of the rock walls leveraged for storage and sound insulation.

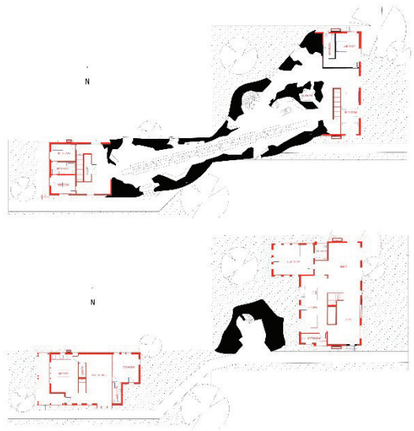


Fig. 8 Unifying by wedging a rock between two buildings. © Student Project by Nelson Kies. ARCH810, Introduction to Architectural Design, Fall 2022, Instructor: Remus Macovei.

Other strategies include offsetting, framing, undulating and distorting grids and allow the studio to experiment and discover various spatial dialectics and their consequences within a manageable programme and building size.

Multiple Conclusions

Instead of inviting closure, the described and illustrated assignment aspires to provide a starting point for discussion. Beyond the theoretical premise of challenging architecture's disciplinary canon by suggesting monstrous assemblages are equally worthy of architectural status as more classical models that promote normatized unity derived from so-called 'ideal' bodies, monstrosity promises productive engagement between the beginning design student, the instructor and the built environment.

The role that monstrous assemblages could play for the beginning design student could unfold at multiple scales, object (building) sizes, programmes and adjacencies, allowing for many briefs that exercise specific formal tensions to emerge. Beyond the described dialectics of multiplicity within unity, other focuses may be hybridity, repetition with variation, part-to-whole, appendage-to-body etc.

The assignment of unifying two existing buildings teases out specific aspects of the design process. First, it requires students to survey and document the two existing buildings and to derive floor plans and elevations from a reading of exterior apertures and dimensions. Secondly, students are asked to develop a spatial concept in collage format by using the photomontages of the building elevations they documented. Thirdly, the project applies the spatial concept onto the floor plans for testing out initial massing studies. Finally, the programmatic impetus and conceptual premise come together in the design proposal. The sequence structures a linear design methodology from analysis (survey, documentation) to speculation (collage) to synthesis (design proposal) that introduces beginning design students to basic design concepts (scale, form, spatial concept) and representational tools (orthographic drawing, photomontage, collage, massing model).

For the purposes of the first semester in beginning design, housing, small buildings and tight adjacencies allow for a recognizable programme and an accessible size that enable the beginning design student to carefully control the formal parameters involved. By engaging a real condition, students are asked to think about site in its formal dimensions where issues of scale and character come into close play.

Finally, the project asks students to engage recognizable building types (the single family home) in playful and non-nostalgic ways. This allows them to disrupt the architecture-machines of continuity and conformity they are mostly accustomed to prior to design education and to think more broadly about the spatial opportunities the built environment provides.

End Notes

1 Ballantyne, Andrew. “Deleuze, Architecture and Social Fabrication” in Frichot, Helene and Stephen Loo, *Deleuze and Architecture*. Edinburgh University Press: Edinburgh. 2013. p 183.
2 "monster, n., adv., and adj.".
OED Online. March 2023. Oxford University Press. https://www.oed.com/viewdictionaryentry/Entry/121738 (accessed March 21, 2023).
3 Vitruvius. The Ten Books on Architecture, transl. Morris Hickey Morgan. Dover Publications: Dover. 1960 (1914). Supra note 8, at 72.
4 Id. at 103.
5 Crawford, Lucas. “Breaking Ground on a Theory of Transgender Architecture” in Seattle Journal for Social Justice: Vol. 8, Iss. 2, Article 5. p. 521.
6 Onians, John. Bearers of Meaning. Princeton University Press: Princeton, NJ. 1988. p. 4.
7 Rykwert, Joseph. The First Moderns: The Architects of the Eighteenth Century. MIT Press: Cambridge, MA. 1980, p. 19.
8 Le Corbusier. The Modulor: A Harmonious Measure to the Human Scale, Universally Applicable to Architecture and Mechanics. Birkhäuser: Basel & Boston. 2004 (1954 & 1958). p. 56
9 Varchi, Benedetto. Lezzioni di M.Benedetto, Sopra la generazione de’Mostri & se sono intesi dalla Natura, ò nò. Filippo Giunti: Florence. 1548. p. 97.
10 Paré, Ambroise. On Monsters and Marvels, transl. Janis L. Pallister. University of Chicago Press: Chicago and London. 1982. p. 3.
11 Ferng, Jennifer. “Monstrosity and Excess in Jean-Jacques Lequeu’s Visionary Architecture” in Fabrications, 26:1, 2016. p. 11.
12 Frascari, Marco. Monsters of Architecture: Anthropomorphism in Architectural Theory. Rowman & Littlefield Publishers: Savage, MD. 1991. p. 35.
13 Ferng, p. 6.
14 Id. p. 7.

Bibliography

Ballantyne, Andrew. “Deleuze, Architecture and Social Fabrication.” In *Deleuze and Architecture*, edited by Helene Frichot and Stephen Loo, 182-96. Edinburgh: Edinburgh University Press, 2013.

Corbusier. *The Modulor: A Harmonious Measure to the Human Scale, Universally Applicable to Architecture and Mechanics.* Basel&Boston: Birkhäuser, 2004 (1954&1959).

Crawford, Lucas Cassidy. “Breaking Ground on a Theory of Transgender Architecture.” *Seattle Journal for Social Justice:* Vol. 8, Iss. 2, Article 5: 515-39.

Ferng, Jennifer. “Monstrosity and Excess in Jean-Jacques Lequeu’s Visionary Architecture.” *Fabrications: 26:1, 2016*: 4-26.

Frascari, Marco. *Monsters of Architecture: Anthropomorphism in Architectural Theory.* Savage, MD: Rowman & Littlefield Publishers, 1991.

Onians, John. *Bearers of Meaning.* Princeton: Princeton University Press, 1988.

Paré, Ambroise. *On Monsters and Marvels.* Translated by Janis L. Pallister. Chicago and London: University of Chicago Press, 1982.

Rykwert, Joseph. *The First Moderns: The Architects of the Eighteenth Century.* Cambridge: MIT Press, 1980.

Varchi, Benedetto. *Lezzioni di M.Benedetto, Sopra la generazione de’Mostri & se sono intesi dalla Natura, ò nò.* Florence: Filippo Giunti, 1548.

Vitruvius. *The Ten Books on Architecture*. Translated by Morris Hickey Morgan. Dover: Dover Publications, 1960 (1914).

A Phenomenological *Epoché* for Beginning Design

Dwaine Carver, University of Idaho

Abstract

This paper presents introductory drawing and design works that seek to expand students’ understanding and conceptualization of space. Within the context of first year undergraduate design and drawing coursework, a series of phenomenologically driven assignments disrupts and enriches the traditional, and arguably necessary, curriculum of orthogonal and orthographic conceptions and projections of space. The paper argues that while the abstraction of ‘rational,’ Cartesian spatial language, thoroughly embedded in the theories and practices of art and architecture, is a necessary and productive convention; it is nonetheless imperative that the beginning student also discover space as a profoundly subjective construct, continuously emergent and contingent, able to advance one’s understanding, agency, and engagement with the larger, intersubjective world.

Introduction

The design and drawing briefs under discussion intersect and coordinate two 100-level courses: introductory architectural graphics and multi-disciplinary design-drawing. The curriculum takes seriously Robert McLeod’s statement, “The immediacy and accessibility of the nine-square [..] is essential to creating a place to begin making architectural decisions.”[1] The student works presented here function as a phenomenological *epoché* within a nine-square and cubic design curriculum; that is, the assignments require a temporary suspension of judgement and certainty, a bracketing of belief in the ‘known’ attributes of an orthogonal spatial order. Students are introduced to phenomena-generated, drawing procedures. Practitioners such as Max Ernst (pendulum generated forms), Rebecca Horn (drawing and painting machines), John Cage (tidal marks) and others, provide conceptual precedents and a range of material and methods for students to engage. Speculative two- and three-dimensional studies analyzing the results of these ‘drawings’ encourage the student to discover a logic or genealogy of their drawings and to develop the potential ‘depth’ of an alternative spatial construct. Finally, the students are requested to return to the known form-language of their previous assignments, but now to significantly inflect or entirely transform a Cartesian order with their phenomenological discoveries.

The paper illustrates a brief sequence of study that engages the beginning design student with the discourse of spatiality by way of the unknown. The phenomenological *epoché* within the introductory curricular context introduces the student to the spatial and form-language possibilities of the subjective encounter with the local phenomena of place, a process that proposes personal perception and the suspension of known, ‘rational,’ orders can reveal the production of space and place as manifold and emergent processes, continuously unfolding in time.

Contingent Autonomies

John Hejduk writes in *The Education of an Architect* that the nine-square problem is a “pedagogical tool,” one which allows the beginning student to “discover and understand the elements of architecture;” he lists, “grid, frame, post, beam, panel, center, periphery, field, edge, line, plane, volume, extension, compression, tension, shear, etc.” [2] Note the list graduates from material elements, to spatial conditions, to physical performance but begins first, and singularly, with form: the grid. Hejduk’s primacy of the grid, and particularly of the nine-square, is explained by Alexander Cargonne as the result of a crucial encounter with Colin Rowe at the University of Texas Austin in the early 1950s. Cargonne’s historical account of the development of the architectural design curriculum at Texas argues that the collective search for essential, introductory principles and elements among Hejduk, Rowe, Robert Slutzky, Bernhard Hoesli, Harwood Hamilton Harris and others, was a response and reaction to the prevailing traditional Beaux-Arts curriculum at Texas as well as to the anti-historical Bauhaus curriculum well underway in the U.S. at the Harvard Graduate School of Design and elsewhere.[3]

It is Colin Rowe’s 1947 essay, “The Mathematics of the Ideal Villa,” that likely provides the clearest underpinning to Hejduk’s nine-square pedagogy. In his comparison of Palladio’s Villa Malcontenta (ca. 1560) with Le Corbusier’s Villa Stein at Garches (1927), Rowe discusses the two works in terms of their plan and façade geometries and their characteristic “tripartite distribution of lines of support,” both subdividing a “single block.”[4] For Rowe, the geometric repetitions of this plan-form across time accounts toward a “Platonic archetype” as well as the continuity of an historical type-form.[5] The essay resuscitates architectural history via typology, providing an alternative reading of continuity between classical composition and modernist ‘ahistorical’ abstraction. For the purposes of the pedagogical goals at Texas, Rowe’s Mathematics essay provides a specific formation of the ‘elements of architecture,’ a bridge between Beaux-Arts parti and Bauhaus “abstract elementarism”[6] by way of purified, historical form.

Joining the Cooper Union School of Art and Architecture in 1964, Hejduk established the nine-square problem as a

decades-long mainstay of the introductory curriculum. It, along with abstract, 'cubic' compositions, both emphasizing plan and axonometric projection, provide the principal form-language of architectural instruction at Cooper Union. The nine-square is the initial field of architectural inquiry and discovery. Understood as a reactivated type-form in service of continuity with the historical avant-garde, its exercises are directed toward the form-language of "Cubism and Neo-plasticism, the very discoveries from which Le Corbusier and other Paris-oriented masters constructed their plastic and spatial language."[7] Procedurally, design is enacted by division, repetition, and rotation of planar elements. Robert Slutzky characterizes the procedure as an investigation of "binary architectonic relationships;" he states, "an insistence upon rules of organization is maintained with the notion that 'concept' and 'percept' not only co-exist but become in fact inseparable."[8] Augmenting this disposition, Hejduk speculates on the Cube Problem, "given an object, perhaps a program can emerge."[9] Concept, percept, as well as program, are understood as emergent from form; and form, as we have seen, is generated almost solely within and from a particular geometric type.

Surface Effects

Given that the grid is thoroughly embedded within the theories, discourses, and methods of art and architecture is inarguable, the accessibility of the nine-square to the beginning design student as an introductory form-language is easy enough to accept; Robert Slutzky's attendant phenomenology of 'transparency,' devoted to the visual structures of Cubism, is perhaps more difficult. Commenting on his collage and color course at Cooper Union, Slutzky's states that his "pictorial problems" of "pure plastic composition" are contained by the picture plane's field of inquiry, "hermetically bound" and "distinct from its physical surround," but are first and foremost intended to "substantiate the concept of relativity."[10] Slutzky's transparency project, an extension of this endeavor, is most clearly outlined in his influential essays, "Transparency: Literal and Phenomenal" and its sequel of the same title, subtitled "Part 2," both co-authored with Colin Rowe.[11] In the first essay, transparency is demonstrated in its analyses of works by Gris and Le Corbusier wherein "suppression of depth, […] oblique and rectilinear grids, and propensities toward peripheric development" are highlighted as the adamantly "shallow" surface attributes of a self-reflexive "phenomenal transparency."[12] Eight years later, in Part 2 of the essay, Rowe and Slutzky temper their claims for shallow space instead focusing on the patterns and fluctuations of figure-ground and "figure-field" effects in 20th century and Mannerist, Neo-classical architecture. Again, historical precedent is enlisted to bridge the discursive and autonomous concerns of the 20th century.[13]

Both the nine-square and its visual percepts of the picture plane inscribe precise, 'hermetically bound' fields of inquiry for the beginning architecture student, and both claim explicit links to the Mannerist-Neo-classical and 20th century avant-garde. These twin limits helped establish a principled, if self-reflexive, pedagogical discourse and curriculum that continues today. In 2022, Wouter Van Acker writes, "Since 1954 the nine-square grid has become an essential figure in both studio language and art historical language."[14] For Van Acker, the nine-square has become an icon without content; it is no longer generative, but simply one more figure in the "flux of imagery" of contemporary architectural culture.[15] The 'content' of the nine-square, however, has always been in question, whether by Rowe trying to fill it or Hejduk attempting to empty it out. Accordingly, Raphael Moneo poses the following question, "does the formal struc-ture of architecture come as a result of making an abstract, modular division of space or does it, on the contrary, arise as an independent assertion making use of elementary images and figures?"[16]

Epoché

The exercises presented below seek to both embrace and inflect the nine-square pedagogy, its form-language, and its particular emphasis upon a phenomenology of autonomous, visual effects. 'Automatic drawings' are the primary tool to instantiate these transformations. The drawings here, are a specific type of automatism; they are made without the human hand. Automatism, in this case, are marks made by simple machines or 'natural' processes such as rain, wind, evaporation, et cetera. This effectively brackets inwardly directed or self-reflexive methods such as 'blind contour' and dissociative markings from the process; by contrast, the intent is to propel the students' perceptions outward and into the world.

Just as a wind or rain drawing is a visual marking of a naturally occurring phenomenon, so too is a machine drawing, such as one made by a pendulum or simple configuration of gears, for it records the effects of gravity, force, and inertia. These automatically produced images initiate the student into the possibility of an "imminent visibility," wherein the "'invisible is the secret counterpart of the visible'".[17] That these images are not produced by the student's hand is key. The production of a complex image that records 'invisible' processes points to the possibility of discovering a possible inner-framework or form-language of a phenomenon.

Through the drawings students are made aware that it is possible to make an image that is not just a representation

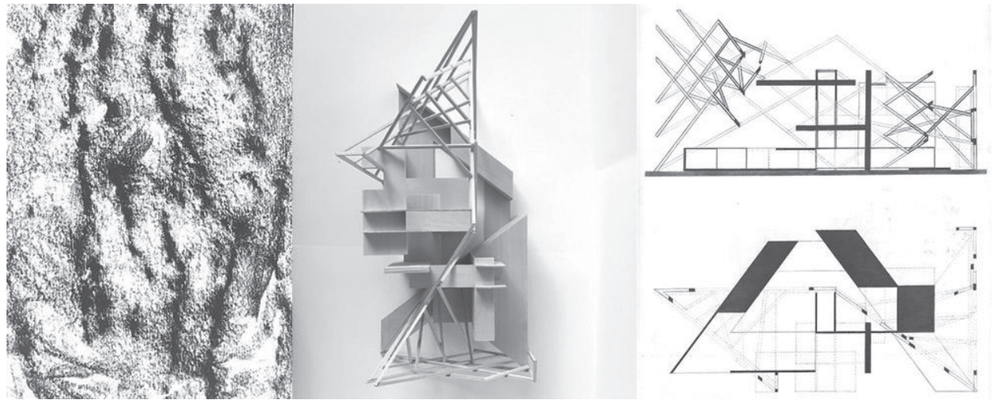


Fig. 1 *Student 1: tree drawing; synthesis model; synthesis plan and section*

but is rather an 'enactment.' By initiating visual works that interact with the environment, the student discovers a means by which to engage the world to produce knowledge; a technique wherein the "the learner is ultimately the one defining what is pertinent or significant".[18] From the point of view of Merleau-Ponty's 'incarnated subject,' the body and the world, the student and the phenomenon, are "reciprocally intertwined;" the "sensing subject cannot be separated from the sensed material, and the viewer cannot be separated from the viewed".[19] Enacted drawings, then, are not representations in the usual sense but closer to demonstrations or recordings of a particular interaction between the student and the environment. (See Figures 1. 2. and 3. tree; wind; and rain drawings.)

The entwinement of the subject and the world allows for the development of depth. According to Glen Mazis, "depth as understood by Merleau-Ponty is not one dimension of space, but rather the *dimension of dimensions*."[20] This is to say that space is a 'bodily space,' one captured within the interrelations of the world. The manifestation of depth is beyond subject-object dualisms and is therefore properly the first, or primordial dimension. It is a fundamental critique of a "neutral and universalizing space being the foundation of existence."[21]

Similarly, Michael Schreyach identifies "pre-objective depth" as a key concept for breaking the 'objective and familiar' attitudes of perception and representation. He states, "the pre-objective world can be understood as an attempt to critique the natural attitude and to establish a "genetic phenomenology" that explains the ways in which embodied perception operates in the world before it is measured."[22] Temporarily rejecting 'objective,' Cartesian structures of perception, the intent of the automatic drawings is to capture any latent order or logic within the phenomenon and to

Fig. 2 *Student 2: wind drawing; translation model; synthesis model*

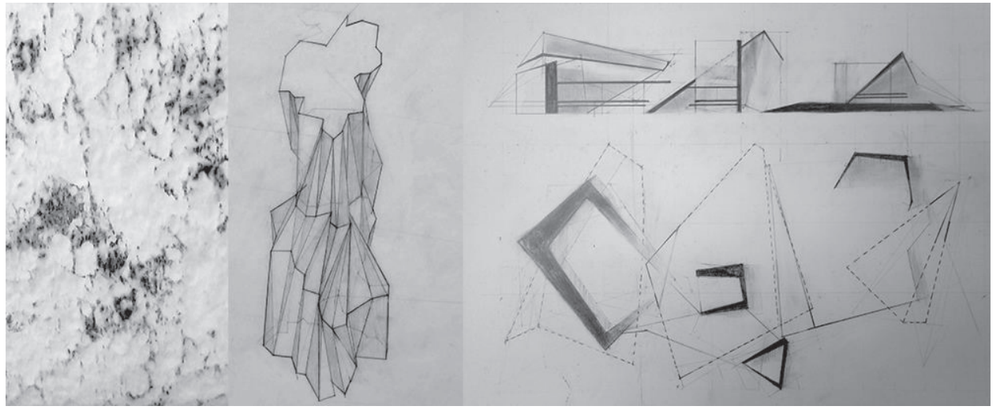


Fig. 3 *Student 3: rain drawing; translation drawing; synthesis plan and section*

"comprehend the genesis of meaning in and through a subject's embodied perception."[23]

Automatic drawings also provoke the idea that images can exert a vital, "quasi-presence;" that images are "beings that are not of the in-itself and that are not nothing."[24] This is to say, an alternative ontology of the image is evoked through the confrontation of the perceiving subject and the image. As Trevor Perri writes, the appearance of the image is "somehow both present and absent, real and unreal, and visible and invisible at the same time."[25] Again, it is the imminent visibility contained within the image that portends a possible knowledge for the viewer. This is evident in Alberto Giacometti's statement, quoted by Merleau-Ponty, "'What resemblance is for me: something that makes me discover the external world a little.'"[26]

The phenomenological e*poché* continues from the production of the automatic drawings with a brief series of assignments designed to discover the potential 'depths' of their image. First, students engage their automatic drawings heuristically, interrogating the image for possible orders of logic or emergent form. Instructed to create precise, measured drawings of the image, students are limited to plan, elevation and isometric projections of the automatic marks. This procedure allows for an analytical 'translation drawing' of the image, an exploration of the 'imminently visible,' of emergent elements, forms or patterns. (See Figure 3. translation drawing.)

The second analytic challenges the student to spatialize the translation into a three-dimensional object. The 'translation model,' limited to line and plane, and rendered solely in wood, necessitates an elemental abstraction of familiar elements but composed into unfamiliar form. The objective is to find another 'enactment' with the material, the beginning of a spatial or formal language that can re-assert, or analogically extend, the language of the image. (See Figure 2. translation model.)

Ultimately, the students are tasked with synthesizing their previous, orthogonal assignment with the nascent forms of their phenomenological studies. The resultant solutions range from minor inflections of the cubic language to its complete transformation. The student's ability to control the scale, extent, and resolution of the new form-language dictate the limits of its integration. (See Figures 1. 2. and 3. synthesis models, and synthesis plan and sections.)

Conclusion

This brief sequence of study engages the beginning design student with an alternative, personal, discourse of spatiality. The *epoché* sequence forces a subjective and fundamental encounter with the world; it necessitates a reckoning with phenomena that must conceptualize, produce, and accommodate, a form-language. The projects propose that students' personal perceptions can potentially reveal and participate in the production of space, place, form, and meaning.

End Notes

[1] MacLeod, Robert M. (2018). "Pedagogical Palimpsests and Cosmic Landscapes," in *Arhitektura Raziskave*, Vol 2018. pp 309–49.

[2] Hejduk, J., Henderson, R., & Diller, E. (1971). *Education of an architect*. Rizzoli. P 7.

[3] Caragonne, A. (1995). *The Texas Rangers: notes from an architectural underground*. MIT Press.

[4] Rowe, C. (1982). *The mathematics of the ideal villa, and other essays*, MIT Press. P 4.

[5] Ibid. P 15.

[6] Banham, R. (1980). *Theory and Design in the First Machine Age*. MIT Press.

[7] Op. Cit. Hejduk, 1971. p 5.

[8] Ibid. p 23.

[9] Ibid. p 99.

[10] Ibid. p 47.

[11] Rowe, C., Slutzky, R. (1963). "Transparency: Literal and Phenomenal," *Perspecta*, *8*, 45–54. https://doi.org/10.2307/1566901 and Rowe, C., & Slutzky, R. (1971). "Transparency: Literal and Phenomenal: Part 2," *Perspecta*, *13*, 286–.

[12] Rowe, C., & Slutzky, R. (1963). Transparency: Literal and Phenomenal. *Perspecta*, *8*, 45–54. P. 46 https://doi.org/10.2307/1566901

[13] Rowe, C., & Slutzky, R. (1971). "Transparency: Literal and Phenomenal: Part 2," *Perspecta*, *13*, 286–

[14] Van Acker, W. (2022). "The Nine-Square Grid: The Surviving Image of an Architecture without Content," Impactum Journal, 13. P 135. https://doi.org/10.14195/1647-8681_13_7

15 Ibid.

[16] Moneo, R. (1980). "The Work of John Hejduk or the Passion to Teach: Architectural Education at Cooper Union," *Lotus International,* no. 27: 65–85, quoted in Van Acker, W. (2022). "The Nine-Square Grid: The Surviving Image of an Architecture without Content," Impactum Journal, 13. https://doi.org/10.14195/1647-8681_13_7

[17] Perri, T. (2013). "Image and ontology in Merleau-Ponty," *Continental Philosophy Review*, *46*(1), 75–97. P 77. https://doi.org/10.1007/s11007-013-9249-x

[18] Tessier, V., Zahedi, M., & Loiola, F. A. (2018). "The Postulate of Enaction in the Design Studio: Toward a New Learning Experience," *International Journal of Design Education*, *13*(1), 11–19. P 13. https://doi.org/10.18848/2325-128X/CGP/v13i01/11-19

[19] Folkmann, M. N. (2010). "Evaluating Aesthetics in Design: A Phenomenological Approach," *Design Issues*, *26*(1), 40–53. P 42. http://www.jstor.org/stable/20627841

[20] Mazis, G. (2015). "Hearkening to the Night for the Heart of Depth, Space, and Dwelling," in Locke, Patricia M., and Rachel McCann., Ed. (2025). *Merleau-Ponty: Space, Place, Architecture*. Ohio University Press, 2015. P 24.

[21] Ibid. P 29.

[22] Schreyach, M. (2013). "Pre-objective Depth in Merleau-Ponty and Jackson Pollock," *Research in Phenomenology*, *43*(1), 49–70. P 53. https://doi.org/10.1163/15691640-12341243

[23] Ibid. P 50.

[24] Op.Cit. Perri. p 95.

[25] Ibid. P 77.

[26] Ibid. P 95.

Bad Ideas and Ugly Models: Two Subversive Pedagogical Strategies That Lead to Innovative Ideas in Design.

Marta Nowak, The Ohio State University

1. Introduction

The unprecedented challenges facing our contemporary world (societal, economical, or climactic), both at a local and a global scale call for radical solutions over incremental improvements. Innovation in these areas requires bold ideas that cannot be born out of a typical design studio process. The challenges surrounding us, and the seriousness of the problems can often be intimidating, especially for the beginner designers. The project briefs given to the students at the onset of the studio demand the complex solutions that can't be solved all at once. Yet, the most challenging part of the design process is often the beginning- ideation- right when students are asked to come up with design ideas. There are a few critical challenges that take place in this moment that require examining:

1.1 Narrowing of the problem.

At the onset of the ideation, beginner architecture designers tend to explore narrower problem space[1], which restricts their imagination. They also often lean on the technical feasibility of an idea rather than their opportunity. This is more of their mechanism of the escape of the problem rather than tackling them. This is what limits their creativity before solving the problem even starts[2]. Even experienced designers sometimes frame problems too narrowly[3].

1.2 Fixation on the first idea

Getting fixated on the first idea that comes to students' mind is a very common occurrence in student designers. As a result, when they are asked to come up with multiple options or iterations, they are not very creative as they already found what they think is "the best solution." Even experienced designers do not always find brainstorming useful[4] and get fixated on ideas they came up with first. Design fixation is a long-studies effect[5] in which prior experience with a precedent prevents designers from exploring other options, settling them down to what has been known and tried before. Fixation is considered inadvertent and counterproductive[6].

1.3 Unwanted Feelings

One of the biggest challenges designers face during the ideation phase is to be tasked with coming up with design ideas and potential solutions to complex problems. This can be a high-pressure situation where the fear of failure and the desire to create something truly innovative can be overwhelming. Students may be reluctant to offer input "fearing their ideas will make them look silly or short-sighted[7]." Sharing first ideas can be intimidating for many as they instinctively want to avoid the feeling of failure. No one likes getting it wrong. Presenting or sharing early ideas, especially in public, may come with emotions like inadequacy, embarrassment, and disappointment[8].

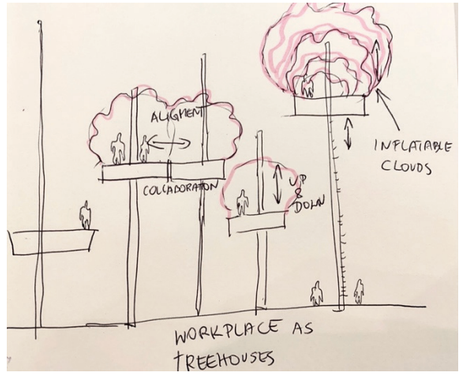


Fig. 1 Bad Ideas sketch example from first graduate studio

1.4 Why to use Bad Ideas method?

There are many creative methodologies that a faculty or a designer can use to think differently, to experiment, to innovate or to get unstuck, but none is more counter intuitive as a Bad Ideas strategy, which can also be called "reverse thinking." Bad Ideas is when you ask students to intentionally think about the worst possible solution to a problem given. It can be used in a studio, in a seminar, in a workshop or any design-oriented setting. Why would using this method be a good idea? Research suggests that there is latent value "in impasses and failure, and that ideation techniques may be most effective under such conditions,

provoking such an experience may be generative[9]." It is also easier to produce bad ideas than trying to come up with good ideas. This approach helps designers explore a much broader problem space and stop their fixation on their initial idea[10]. Because the goal of the game is to produce the silliest, craziest ideas, nobody can lose face. Since the premise of this approach is quite ridiculous, the whole group ends up laughing together, relaxing all students, and taking away the feelings of stress and anxiety. There is no room here for impasse or mental block, no room for pressure which other type brainstorming techniques can often impose. Bad Ideas method has been used in other fields such as product design, UX design, computer- interactive design, business, marketing etc., and is closely related to creative problem-solving methods documented by Charles Thompson in his 1992 book "What a Great Idea'. I have first heard about it from Astro Teller, a CEO of Google X- an Alphabet company that generated moonshot-based businesses and projects including Project Loon (a network of balloons delivering internet to rural parts of African continent), first self-driving car, Google glasses from early 2000s etc. I heard Astro speak about Bad Ideas strategy that he uses with his teams to generate ideas for his projects. Later I used this method in the workshop I led at Google R+D for the Build Environments Lab when we were looking for a creative solution for Hybrid Collaboration Equity tools and spaces. Yet I have not seen anyone use the Bad Idea and Ugly Models method in architecture education, therefore I decided to test it out in two of my classes: a beginning design studio with graduate MArch I Students and in my technology seminar.

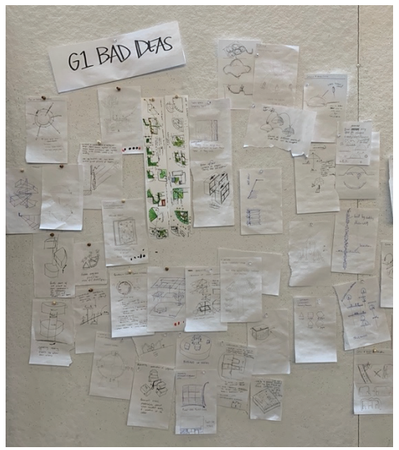


Figure 2. The set of Bad Ideas sketched from the workshop.

1.5 Why to use Ugly Models method?

Another creative tool that any designer can use is the idea of an Ugly Model. An Ugly Model method further solidifies the Bad Idea method. Here the students are asked to build a model that best represents their final idea from the previous session of a Bad Idea workshop. The Ugly Model has to be built in a 'quick and dirty' manner, meaning that it should not be used as a perfect and precise representational model but one that can be built roughly with no precision. The goal here is to express the concept immediately and rightfully. It is all about being smart, not beautiful. It is encouraged to build the models with found or recyclable materials and not with expensive model making materials such as plexi or museum board. Unlike Frank Gehry's study models or OMA's concept models where architects search for programmatic, structural, or formal solutions, the students test out their bad ideas by building an ugly model. The inverted process of "the ugly" again relaxes students, removes the burden of striving for perfection, and boosts their creativity to think differently. Repurposing commonly found materials sparks imagination as they have to find a new purpose to the already known purpose materials for example: candy, paper brown bags, toys etc. It also shifts their attention from expressing the form or technicality of the idea to the clarity of their concept. The shift is to make them think with their brain not with their eye.

2. Methodology

The paper showcases two Case Studies: Case Study 1 looks at G1 students in their first architecture studio, which comprised eight students (five of them not having architectural degree, and three of them have some architectural experience), and Case Study 2 looks at technology seminar with a specialty topic including an unfamiliar design topic, which comprised eight students (four fourth year undergraduate students and four third year graduate students). The students in Case Study 1 were asked to come up with a small Studio Art space that contains five studio spaces for five different types of artists that sometimes need to collaborate and sometimes work individually. The building must adopt some sort of robotic or mobile aperture to accommodate that flexibility of change. The students in Case Study 2 were asked to think about the workplace solution and re-imagine a new type of a partition wall that would be intelligent and allow them to create a pop-up space within an open office. The evaluation of ideas was based on sketch comparison and interviews with students.

2.1 Rationale for using Bad Ideas and Ugly Models strategy.

In Case Study 1, the reason to implement Bad Ideas and Ugly Model strategy was after a week of desk crits when I realized that the ideas the students had were quite narrow, some of the students were fixated on their initial ideas and did not want to explore anything else, and some still had nothing to show (Table 1).

	Nr of students with concepts	Nr of students with narrow concepts	Nr of students fixated on their concepts	Nr of students with no concepts
Students with no architectural experience	1	2	0	1
Students with architectural experience	2	0	1	1

Table 1: Students' ideas distribution before Bad Ideas and Ugly Models workshop in Case Study 1

In Case Study 2, I implemented the Bad Ideas and Ugly Models strategy right after a research phase, after students had examined current technologies in the market and discussed precedents. I implemented the Bad Ideas method within desk crits after seeing students' proposals in the two weeks of ideation, when most of the students analyzed a very narrow scope of concepts despite their exciting research exploration. Also, one student was fixated on one idea and did not want to explore anything else (Table 2)

	Nr of students with concepts	Nr of students with narrow concepts	Nr of students fixated on their concepts	Nr of students with no concepts
Undergraduate students	0	4	0	0
Graduate students	2	1	1	0

Table 2: Students' ideas distribution before Bad Ideas and Ugly Models workshop in Case Study 2

2.2 Research Question

In this paper, there are three key research questions that I would like to address: 1) Can Bad Ideas and Ugly Model help in a studio setting where students struggle with creativity in the early ideation process and unlock the mental block? 2) Can Bad Ideas and Ugly Model yell to unexpected and innovative results in architecture education? 3) Is Bad Ideas and Ugly Model strategy a flexible methodology better suited to beginner architecture designers or more advanced students?

2.3 Case Study 1 Bad Ideas and Ugly Models.

After a week of unproductive ideation, I decided to organize a Bad Ideas workshop. All the students gathered, and after providing them with a brief explanation of the intent of the exercise, they were first asked to spend 5-10 min coming up with bad ideas to solve the project prompt. During that time, I walked around and spoke to them and reminded them that this is a bad idea workshop and not a good idea workshop. Next each student shared their ideas one by one (Figure 1). After the student shared their best worst idea, others had to comment and come up with ideas to make that idea even worse. Then we discussed what were the qualities that made that particular idea really bad. During this process, the students' attitudes completely changed: after being serious and stressed, they began laughing and joking. Every student was contributing to the conversation, which made the discussion very lively and engaged. After a round of bad ideas exchange and big laughs, the students were asked to turn their bad ideas into good ideas. As we continued the discussion, it turned out that some of the proposals were actually not so bad after all and could potentially be considered a seed of something new, while others came up with positive iterations of their bad idea proposals (Figure 3). After the Bad Ideas workshops, the students had a chance to reflect on the discussion, go home, and produce an Ugly Model for their concept. The next week we gathered again all together. Four students did not use their bad ideas, nor their good ideas from their workshop but came up with something completely new and quite interesting. The other two students that were fixated on their first idea abandoned it in lieu of their bad or good ideas from the workshop. And two students who until then had had nothing for the studio came with two bad ideas from their workshop, including one student building a model made out of bubbles (Figure 2). All students built their ugly

models from recycled or found materials and were able to represent their concept in a simple manner. Surprisingly the students with the most architectural experience had the most unsatisfactory ugly models as they defaulted to traditional model building materials and therefore focused on the aesthetics rather than intelligence of the concept. It took multiple rounds and desk crits for them to improve on it.

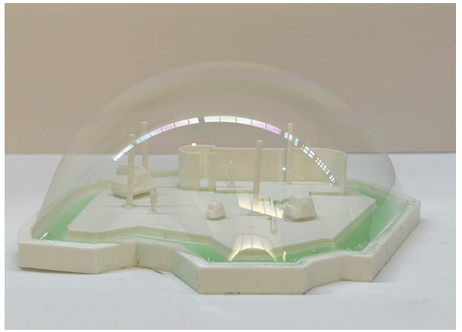


Fig. 2 Ugly Model: bubble over a studio space

2.4 Case Study 2 Bad Ideas and Ugly Models

In the seminar I taught I wanted to test the Bad Ideas and Ugly Model strategy by giving it in a context of students with more design experience but facing more challenging design problems. Here I asked the students to come up with Bad Ideas as a solution to lack of privacy in an office space. They had to think of intelligent and robotic interventions with the use of advanced technology: machine vision, navigation in space, sensors etc. Once the students had come up with their Bad Ideas, they had to evaluate what made these ideas bad, decide whether they were truly bad, and turn them into positive ones. This process allowed for an expansion of exploration, instead of narrowing the problem. One student who was already fixated on the solution finally understood the problem we were solving, and it allowed him to expand his thinking. Meanwhile, four other students pitched new, out-of-the-box ideas: one group built a partition wall made out of fog, while the other built a flying balloon. Unlike in Case Study 1, the students were asked to work in groups of two and build Ugly Models that were quick and dirty. This approach allowed for a rapid prototyping process that enabled the students to refine their ideas and test them quickly. Overall, the Bad Ideas and Ugly Model strategy proved to be an effective approach for challenging design problems. By encouraging students to think beyond the conventional solutions, it allowed them to explore new and innovative ideas that they may not have otherwise considered.

3. Results

3.1 Results: Case Study 1

As a result of the Bad Ideas workshop the discussion around the studio problem widened the understanding of the problem and understanding of the potential solutions. Students had to think about the problem differently, which made them rethink the problem and open it up for more options and possibilities. It also happened that some ideas that initially seemed silly or totally crazy actually could be turned into very innovative and radical solutions. After the Bad Ideas workshop, all students had studio projects. Students who were fixated on their first idea abandoned it in lieu of their new bad or good ideas from the workshop.

Table 4: Students' ideas distribution after Bad Ideas and Ugly Models workshop in Case Study 2

And the number of students who still framed the studio project solution wasn't eliminated but dropped. The ugly models on the other hand, became an integral part of the studio project and were carried through till the end of the studio project. The six students who did it successfully presented the ugly models in their final review as part of the final presentation but those who failed to grasp the idea were not able to incorporate it in their final presentation.

	Nr of students with concepts	Nr of students with narrow concepts	Nr of students fixated on their concepts	Nr of students with no concepts
Undergraduate students	2	2	0	0
Graduate students	2	1	1	0

Table 3: Students' ideas distribution after Bad Ideas and Ugly Models workshop in Case Study 1

3.2 Results: Case Study 2.

The Bad Ideas workshop resulted in four clever proposals out of eight projects. Two other students were able to expand their concepts while three fell back into the familiar and the precedent projects resulting in a narrow concept, similar to where they started. The student who was fixated on his original idea continued to be so once the class was over, although he had pitched a few exciting new concepts during bad ideas ideation. It seems that students with more experience in design and more conviction were split in half in terms of benefiting from the Bad Idea workshop when facing an unknown and challenging territory. However, this was a small sample, and the conclusion cannot be drawn. Further study should be conducted with a larger sample of students. The Ugly Model strategy on the other hand resulted in two excellent innovative models and ideas out of four projects: the fog wall and the flying balloon wall. The balloon wall continued as a research project until the end of the seminar and turned into a funded research project in the summer, showing a lot of promise.

	Nr of students with concepts	Nr of students with narrow concepts	Nr of students fixated on their concepts.	Nr of students with no concepts
Students with no architectural experience	4	1	0	0
Students with architectural experience	2	1	0	0

Table 4: Students' ideas distribution after Bad Ideas and Ugly Models workshop in Case Study 2

4. Conclusion and Discussion

Bad Ideas and Ugly Models proved to be helpful in design settings that struggle with creativity of students who too narrowly frame the problem or may have anxiety or be stressed about coming up with their first studio ideas, or fixated on their first proposals that they came up with. Both methods help to reverse the situation in the class, relax the atmosphere and flip the thinking on their heads, pushing everyone to think harder. They also allow designers to gain new insights and perspectives that they may not have considered otherwise. It enabled designers to identify potential problems or challenges that may arise throughout the design process.

While Bad Ideas or their converted good ideas may not eventually turn into final studio projects and more than half of them got discarded, occasionally, it did however turn into innovative results. In both use cases, students came up with bad ideas or ugly models that turned into innovative projects. One of them became a sponsored summer project, another became a best student award project. And finally, the Bad Ideas and Ugly Models strategy seems to be a very flexible method that could be deployed in a studio or in a seminar, it could be structured as a workshop or done as desk crits, it can be done individually or as groups. But what seems to matter is the effort that students put into it. One observation worth considering is the level of advancement of the students. It seems that beginner students are more willing to take more risk and be more open-minded vs experienced students, who fall back on their experience and are less willing to take risk. But that requires more research, and it cannot be concluded in this study based on a small sample of students. By fostering a culture that reverses the ideation process but at the same time providing an atmosphere where designers can feel more comfortable taking risks and exploring unconventional approaches, these two strategies- Bad Ideas and Ugly Models- ultimately can lead to more successful and impactful designs.

Endnotes

[1] Atman, C. J., Yasuhara, K., Adams, R. S., Barker, T. J., Turns, J., & Rhone, E. (2008), "Breadth in Problem Scoping: a Comparison of Freshman and Senior Engineering Students," *International Journal of Engineering Education*, 24(2), 242.

[2] Toh, C. A., & Miller, S. R, "How engineering teams select design concepts: A view through the lens of creativity," *Design Studies*, 38 (2015), 113.

[3] Svihla, Vanessa, Kachelmeier, Luke. "The Wrong Theory Protocole: a Design Thinking Tool to Enhance Creative Ideation." *The Sixth International Conference on Design Creativity*: 3.

[4] Linsey, J. S., Tseng, I., Fu, K., Cagan, J., Wood, K. L., & Schunn, C., "A study of design fixation, its mitigation and perception in engineering design faculty". *Journal of Mechanical Design*, 132(4), 2010, 041003-3.

[5] Youmans, R. J., & Arciszewski, T., "Design fixation: classifications and modern methods of prevention", *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 28(02), 2014, 129.

[6] Youmans, R. J., & Arciszewski, T., "Design fixation: classifications and modern methods of prevention", *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 28(02), 2014, 133.

[7] Dor, Bob, "Worst Possible Idea," accessed February 28, 2023, https://www.interaction-design.org/literature/topics/worst-possible-idea

[8] Dor, Bob, "Worst Possible Idea," accessed February 28, 2023, https://www.interaction-design.org/literature/topics/worst-possible-idea

[9] Svihla, Vanessa, Kachelmeier, Luke. "The Wrong Theory Protocole: a Design Thinking Tool to Enhance Creative Ideation." *The Sixth International Conference on Design Creativity*: 2.

[10] Silva, P. A., "BadIdeas 3.0: a method for creativity and innovation in design," Paper presented at the Proceedings of the *1st DESIRE Network Conference on Creativity and Innovation in Design*, 2010: 160.

Bibliography

Atman, C. J., Yasuhara, K., Adams, R. S., Barker, T. J., Turns, J., & Rhone, E. “Breadth in Problem Scoping: a Comparison of Freshman and Senior Engineering Students.” International *Journal of Engineering Education*, 24(2), 234-245.

Dor, Bob, “Worst Possible Idea,” accessed February 28, 2023, https://www.interaction-design.org/literature/topics/worst-possible-idea

Linsey, J. S., Tseng, I., Fu, K., Cagan, J., Wood, K. L., & Schunn,

Table 4: Students’ ideas distribution after Bad Ideas and Ugly Models workshop in Case Study 2

C., “A study of design fixation, its mitigation and perception in engineering design faculty”. *Journal of Mechanical Design*, 132(4), 2010, 041003

Silva, P. A., “BadIdeas 3.0: a method for creativity and innovation in design,” Paper presented at the Proceedings of the *1st DESIRE Network Conference on Creativity and Innovation in Design*, 2010: 154-162.

Svihla, Vanessa, Kachelmeier, Luke. “The Wrong Theory Protocole: a Design Thinking Tool to Enhance Creative Ideation.” *The Sixth International Conference on Design Creativity:* 1-8.

Toh, C. A., & Miller, S. R. “How engineering teams select design concepts: A view through the lens of creativity,” *Design Studies*, 38 (2015), 111-138.

Youmans, R. J., & Arciszewski, T., “Design fixation: classifications and modern methods of prevention”, *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 28(02), 2014, 129-137

[1] Atman, C. J., Yasuhara, K., Adams, R. S., Barker, T. J., Turns, J., & Rhone, E. (2008), “Breadth in Problem Scoping: a Comparison of Freshman and Senior Engineering Students,” *International Journal of Engineering Education*, 24(2), 242.

[2] Toh, C. A., & Miller, S. R, “How engineering teams select design concepts: A view through the lens of creativity,” *Design Studies*, 38 (2015), 113.

[3] Svihla, Vanessa, Kachelmeier, Luke. “The Wrong Theory Protocole: a Design Thinking Tool to Enhance Creative Ideation.” *The Sixth International Conference on Design Creativity:* 3.

[4] Linsey, J. S., Tseng, I., Fu, K., Cagan, J., Wood, K. L., & Schunn, C., “A study of design fixation, its mitigation and perception in engineering design faculty”. *Journal of Mechanical Design*, 132(4), 2010, 041003-3.

[5] Youmans, R. J., & Arciszewski, T., “Design fixation: classifications and modern methods of prevention”, *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 28(02), 2014, 129.

[6] Youmans, R. J., & Arciszewski, T., “Design fixation: classifications and modern methods of prevention”, *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 28(02), 2014, 133.

[7] Dor, Bob, “Worst Possible Idea,” accessed February 28, 2023, https://www.interaction-design.org/literature/topics/worst-possible-idea

[8] Dor, Bob, “Worst Possible Idea,” accessed February 28, 2023, https://www.interaction-design.org/literature/topics/worst-possible-idea

[9] Svihla, Vanessa, Kachelmeier, Luke. “The Wrong Theory Protocole: a Design Thinking Tool to Enhance Creative Ideation.” *The Sixth International Conference on Design Creativity:* 2.

[10] Silva, P. A., “BadIdeas 3.0: a method for creativity and innovation in design,” Paper presented at the Proceedings of the *1st DESIRE Network Conference on Creativity and Innovation in Design*, 2010: 160.

Reforming the Ground Plane: tackling urban obduracy with the performance of surface geometry

Kentaro Tsubaki, Tulane University

Charles Jones, Tulane University

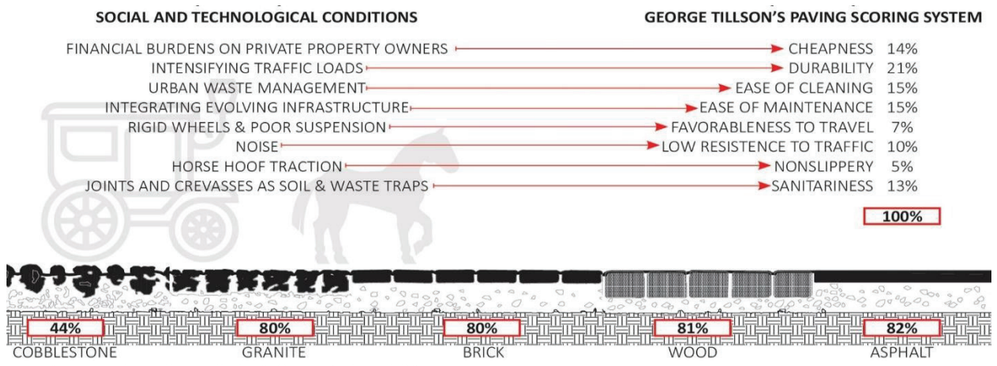


Figure 1: Tillson’s Paving Scoring System[1]. Source: (Authors 2021)

INTRODUCTION

Today, society’s reliance on smooth, impermeable street surfaces stifles innovation in the modern transportation infrastructure. At an increasingly accelerated pace, technological innovations have thrust us into the epoch of the Anthropocene[2]. Ironically, the “innovative infrastructures” from the past struggle to adapt to the persistent pressure of climate change, creating elevated risks for chronic flooding[3]. The resistance to adaptation and change is referred to as the socio-technical dilemma of urban obduracy[4]. It suggests why we had overlooked some advantages of the alternative paving systems before they were rapidly phased out in the first quarter of the 20th century (Figure 1).

New Orleans occupies the Mississippi Delta, the complex ecological system formed by the soil deposits interacting with the river and the gulf. In this soft, fluid ground, finding stability is a constant challenge[5]. With a thoughtful application, modular precast concrete paving systems can reestablish a symbiotic relationship between the built environment and landscape as both infrastructure and public amenity. By leveraging the digital design and fabrication techniques, the ground surface geometry can be performatively and aesthetically aligned; to detain, retain or permeate water, mitigate flooding, and aesthetically embrace the reflectivity of the water surface. In addition, it will contribute to the context’s overall spatial quality, encouraging productive occupation of the ground plane.

The paper outlines the strategy initiating architecture students to the concept of urban obduracy through the “familiar yet, unknown” geometry of the ground. By leveraging accessible open-source databases, digital modeling, and fabrication techniques, the studio systematically addresses the complex, social-cultural, ecological, and economic (infrastructural) relations through the performance of surface geometry of the ground plane concerning water in three distinct scales: component, street, and urban scale.

APPROACH

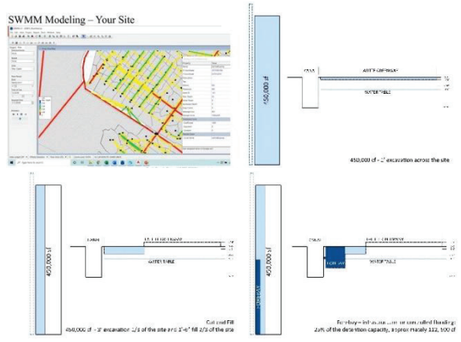


Figure 2: SWMM model analysis[6] and storm drainage overflow retention implications. Source: (Authors 2021)

At the component and street scale, we aim to slow down the storm runoff by momentarily storing it where it falls. A discontinuous, textured, permeable surface enhances pedestrian mobility by increasing accessible surface during and immediately after the rain, channels and detains water to promote plants and tree growth, filter pollutants, and spatially amplify the experience by optically reflecting the surrounding landscape. On an urban scale, we aim to detain overflow from the drainage system during peak storm intensity to maintain the demand at capacity (Figure 2).

The studio prioritizes the design process informed by visualized quantifiable parameters to find "the equilibrium" beyond individual beliefs and aesthetic preferences. The design methodology and resulting solutions are internationally relevant, as the water-related issues are no longer unique to our region[7].

The hypothesis is: Through advanced computational design and fabrication techniques, the surface geometry of the streets and paving units can be performatively and aesthetically aligned; to detain, retain or permeate water, mitigate flooding, and aesthetically embrace the reflective quality of water, contributing to the atmospheric quality of the context and encouraging the productive occupation of the ground plane.

Roads and streets are among the earliest, most effective technological utilities of sustained urban settlements. However, similar to other technological applications developed to overcome the constraints of our physiological adaptation, the benefit is counteracted by adverse impacts on various social-ecological systems.

Smooth, impervious concrete and asphalt surfaces applied to local residential-scale streets are a good example. In the era of the Anthropocene, it can be considered a technical overcorrection, accelerating stormwater collection and discharge, overwhelming drainage systems, and causing chronic flooding. The application of smoothness across multiple street typologies is ripe for re-examination. A discontinuous, textured, porous surface can "slow" the water movement by storing it momentarily where it falls. Appropriately channeled and detained water will promote plants and tree growth that provide shade, filter pollutants, and spatially amplify the experience, dynamically capturing the surrounding urban landscape through its reflective surfaces.

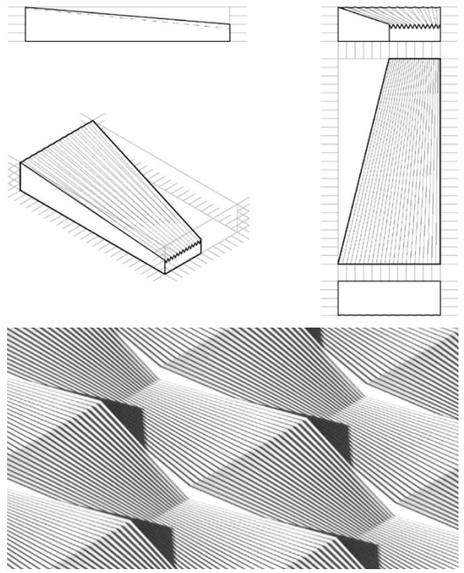


Figure 3: Student work examples of Eccentric Tiling Units exercise (J. Poche). Source: (Authors 2022)

To provoke students to reconsider the prevailing smooth, impervious asphalt, and concrete street surfaces, we developed two exercises and a representational technique to engage surface geometry performance at component and street scales leading into the urban scale project.

1. COMPONENT SCALE

At the component scale, we've explored modular precast systems' surface geometry and fabrication methods that shape and form the street surface.

1.1 The Eccentric Tiling Units

eccentric[8] |ikˈsentrik|
adjective

1. (of a person or their behavior) unconventional and slightly strange: my favorite aunt is very eccentric.
2. technical (of a thing) not placed centrally or not having its axis or other part placed centrally.

Typical masonry units such as bricks, CMUs, and precast paving blocks conform. They are designed to fit in a stable, axial/symmetrical manner, forming predictable, continuous surface planes. The logic of stacking is easily recognizable as repeating patterns. The two-and-a-half-week exercise introduces a biased "eccentric" surface to the default 12" x24" x4" rectangular unit through subtraction. Initial geometric constraints are to alter no more than three sides of the original module. By introducing eccentricity to the geometry of the units, dis/continuous surfaces emerge when tiled on a level horizontal plane. Students systematically investigate the distinct aggregation patterns or absence thereof by paying attention to the extension of surfaces from one unit to another. They speculate the potential function of surface dis/continuity relative to water and sediments, leveraging digital modeling and 3D printing for rapid prototyping and testing (Figure 3).

The two key concepts and skills instilled in students are:

1. The complex surface geometry of the site and the components are abstracted, digitally reconstructed, and controlled with intent as a series of linear ridges, valleys, and planes, not as contour lines or arbitrarily formed compound curvilinear surfaces.
2. Slope and water flow analysis tools[9] are utilized on the abstracted surface geometry to visualize and confirm the performance of the geometry or to identify issues and test improvements.

Students learn how to rationalize and control the complex surface geometry using a physical "folded" sheet material as a guide in Rhino (Figure 3). This simple notion becomes the basis for surface representation and analysis later in the street and urban scale exploration (Figure 4).

Virtual CNC-Milling simulation via Rhino-cam is also introduced to speculate the effect of "tooling" as an additional factor to construct and control surface geometry, jumpstarting the skill development for the subsequent physical prototyping. The exercises utilize accessible advanced computational design and fabrication techniques to bring attention to the function of complex surface geometry. The potential of dis/continuous aggregated surfaces is investigated through iterative prototyping, testing, and observation while introducing the basic skills necessary for subsequent exploration.

2. STREET SCALE

At the street scale, we've explored the design of street surface geometry to function as infrastructure and amenity in a specific New Orleans location.

2.1 The Striating the Smooth

The Striating the Smooth exercise builds on the Eccentric Tiling Units. The three-week exercise asks students to improve the urban streetscape with enhanced street surfaces by strategically deploying precast paving systems based on eccentric unit prototypes.

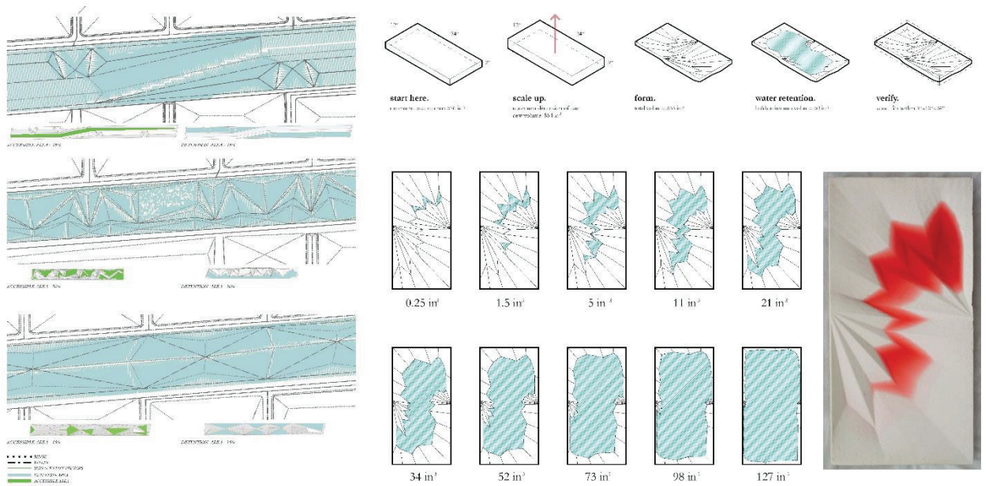


Figure 4: Student work examples of the performance analysis of complex surface geometry at urban and component scales (A. Reeves, G. Rashleigh, K. Tomisato). Analysis (A. Raoufi). Source: (Authors 2019, 2021)

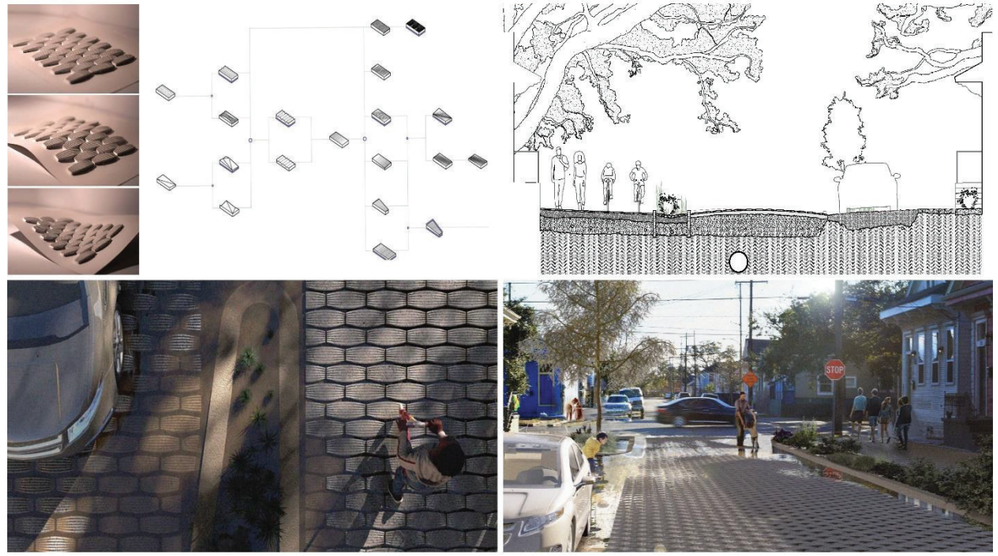


Figure 5: Student work examples of paving unit prototypes and the effect of reflective surfaces (J. Poche). Source: (Authors 2022)

For developments over 5000 sq. ft., New Orleans mandates owners to detain at least the first 1-1/4" of rainfall on-site. However, public streets are not subject to this code. We leverage the "hypothetical" water detention mandate on public roadways to reconsider the potential of the streetscape.

Using the public database, students identify underprivileged streets in the city to speculate improvements. The topographical surface of New Orleans comprises three primary characteristics: the backslope, the bowl, and the lowlands. Students select an approximately two-square-mile area in the three topographical conditions based on their interests. Then, with the i-Tree[10] landscape web application, each location is analyzed with a few basic data parameters, starting with an equally weighted scenario of low tree stocking area and high population density. The resulting prioritization maps guide the selection of nine-city blocks with a particular local street within a 1/4 mile of an existing bus stop. Students then examine the surfaces of the selected blocks and their geometry concerning mobility, ecology, and atmosphere mediated by water.

The students are asked to develop two paver variations concerning pedestrian accessibility: accessible and inaccessible. Inaccessible surface type is less suited to be walked on; It is intended to gently delineate pathways (vehicular from pedestrian, for example) or as edge conditions and provide the opportunity to creatively articulate the transition from one type to another. Along with the surface analysis (slope, water-flow direction, and retention volume) and reflective surface rendering methods, CNC formwork milling/tooling and Hydrocal casting techniques are all introduced in the workshop format. The intention is to foster iterative physical prototyping and testing of the paving system on a larger scale. The project encourages students to reconsider local residential streets, a fixed, utilitarian infrastructure with high-impact design opportunities, by leveraging the necessary urban water management requirements (Figure 5).

2.2. The Reflective Surface Representation

The reflective surface representation technique introduces water as a dynamic, reflective surface and a quantifiable interactive substance over the aggregated pavers. Students learn to control the qualitative rubric of reflective/translucent substances in a digitally simulated environment. Students also learn to quantify how much water the system's surface geometry can detain and speculate the transformation of the amount over time. The change in water level will affect the amount of reflective surface and the perceived quality (Figure 6).

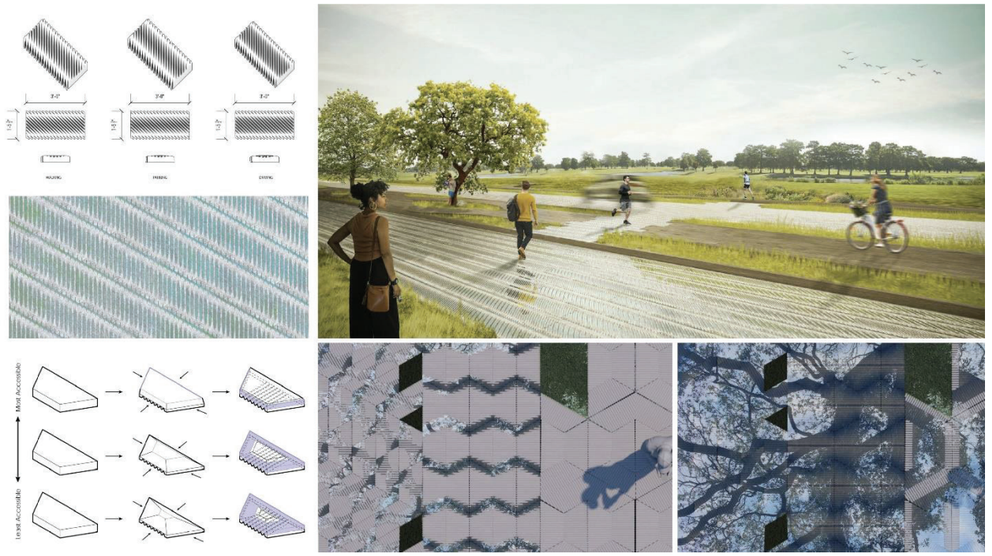


Figure 6: Student work examples of the street scale surface geometry and component application (S. Spencer, E. Luthringshausen). Source: (Authors 2022)

3. URBAN SCALE

On an urban scale, we've explored the surface geometry of the *Laffite Greenway,* an existing linear urban park on an underutilized post-industrial infrastructure corridor parallel to the city's storm drainage system (Figure 7).

3.1. Reimagining the Laffite Greenway

Students are prompted to improve the park's function to serve the adjacent communities better while transforming it into a water detention infrastructure. The site context, including the community engagement outcomes from the planning process of the *Laffite Greenway* project[11], is thoroughly researched and diagramed. The performative application of the complex surface geometry is examined at both urban and component scales to guide, detain water and foster productive occupation of the ground plane (Figure 8).

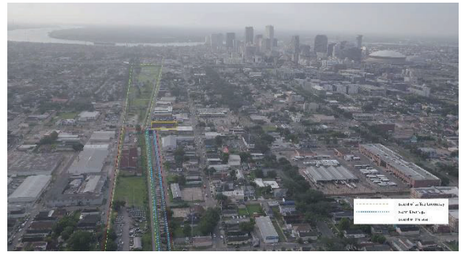


Figure 7: Drone photo of the site. Source: (Authors 2022)

RESULTS

The outcomes elucidate the general design approaches, tactics, and consequences of students' struggles with the complex water management and spatial program distribution challenges at urban scales. It also reveals individual authorship, the aesthetical agenda, fabrication techniques, and component-level invention distinguishing the projects. Representational techniques are explored and developed to consider and communicate the reflective surface quality of water in the urban landscape.

At the urban scale, the surface geometry of the outcomes reveals the following approaches and tactics:

• Carefully orchestrated distribution of floodable and non-floodable surfaces defining the programs.
• Mound, sloped, or stepped landscape with near-equal cut and fill.
• Subtly sculpted section leveraging the existing micro-topography and coordinated with estimated groundwater elevation and expected water level of the city's stormwater drainage system.

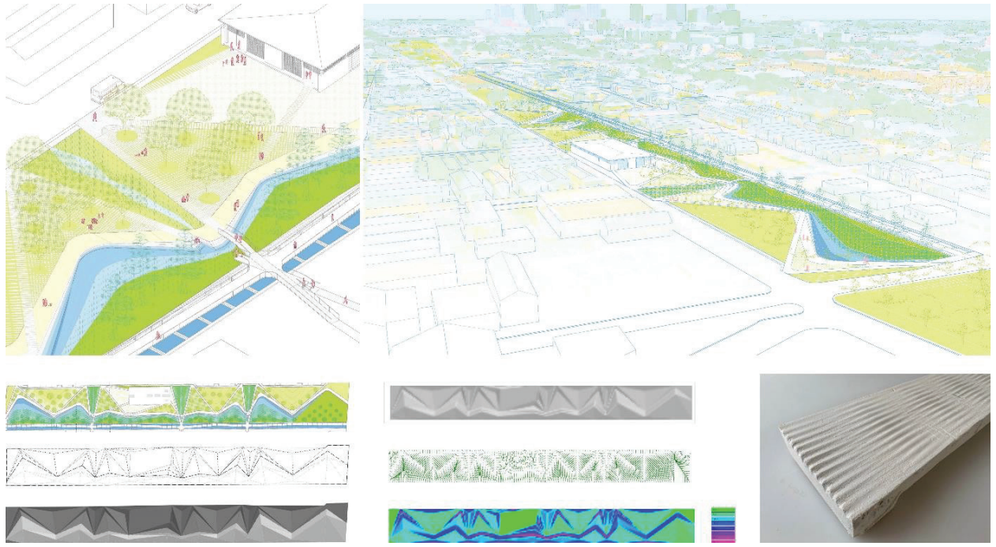


Figure 8: Student examples of the site scale surface geometry (modeling/analysis) and component application (G. Rashleigh). Analysis (A. Raoufi). Source: (Authors 2022)

• System of artificial basins, forebays, weirs, and swales combined with planting materials to slow and momentarily retain stormwater and foster microecology.

At the street scale, the surface geometry of the outcomes reveals the following approaches and tactics:

• Accommodating transverse community pedestrian paths, negotiated with longitudinal bicycle and recreational traffic.
• Purposeful distribution of gradated (blended) surface geometry, textures, and paving patterns.
• Carefully orchestrated edge conditions to delineate program zones.

At the component scale, the surface geometry and fabrication exploration reveal the following potential of the precast paving systems in tandem with the street and urban scale interventions:

• Studied unit and joint profiles to ascertain the surface flexibility as an aggregate to adapt and address the context and function.
• Leveraged unit surfaces to retain/detain or direct water toward the joints and induce vehicular vibrations or graphic illusions for attention.
• The purposeful joint design for permeability, encouraging medium growth.
• Exploration of flexible 3-d printed formwork and surface casting of the photo-luminescent aggregates.

Figure 9: Student examples of the component application. (A. Barber, J. Poche) Source: (Authors 2022)

• Consideration for tooling in CNC-milling in rationalizing the complex surface geometry

The authorship and the aesthetic agenda were not the primary concerns of the research studio. Nevertheless, spatial sensibility emerging from the discovery of fractured reflection and interest in illusionary graphics are two potent concepts. Although students became proficient in the representational techniques, further pedagogical consideration is necessary to elicit a more robust response to forge an aesthetic position (Figure 9).

CONCLUSION

Through a series of design inquiries with students, we've contemplated on the significant shift in urban stormwater management to address the *climate-change* problem. The past solution would have been an engineering solution, calling for enlarging the conduits and pumps to accommodate the increase in peak demand. Instead, we've systematically speculated a multi-faceted scenario to delay excess stormwater from entering the drainage system, reducing the peak demand over time.

We've envisioned revitalizing an underutilized post-industrial urban space as an amenity for the community and a water management infrastructure for the city. We've investigated design strategies sculpting the ground surface to detain water and foster accessibility and communal activities. Furthermore, by reintroducing water as a surface quality, we've sought to strengthen the interlinkages between social and ecological systems by improving our understanding of the natural characteristics of the deltaic landscape.

Ultimately, we've aimed to instill in advanced-level architecture students the confidence to engage environmental concerns beyond the scale of buildings by leveraging discipline-specific expertise they've gained in architectural training. One manifestation of the efficacy is that about one in seven students from the past four studio cycles have sought and landed employment in the top landscape architecture firms in the country. Our sincere hope is to foster architects equipped to systematically engage the *complexity* present in the problems of our time.

ACKNOWLEDGEMENTS

The authors would like to thank the PCI Foundation for supporting our initiative through the Instructional Support Grant. We'd also like to recognize Dean Inaki Alday and the Tulane School of Architecture for providing the context to pursue the investigation, and finally, our graduate research fellows and the students who participated in the research seminars and studios for their contributions.

REFERENCES

Campanella, Richard. 2018. "How Humans Sank New Orleans." *The Atlantic* (February). https://www.theatlantic.com/technology/archive/2018/02/how-humans-sank-new-orleans/552323/.

Hicke, J.A., S. Lucatello, L.D., Mortsch, J. Dawson, M. Domínguez Aguilar, C.A.F. Enquist, E.A. Gilmore, D.S. Gutzler, S. Harper, K. Holsman, E.B. Jewett, T.A. Kohler, and K. Miller. 2022. "2022: North America Supplementary Material." *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: 1982. https://www.ipcc.ch/report/ar6/wg2/

Hommels, Anique. 2020. "STS and the City: Techno-politics, Obduracy and Globalisation." *Science as Culture*, 29:3: 410-416.

McNeill, J. R. and Engelke, P. 2014. "Climate and Biological Diversity," *The Great Acceleration: An Environmental History of the Anthropocene since 1945*. Boston: Harvard University Press. 63-102.

Sewage & Water Board of New Orleans. 2019. "Comprehensive S&WB - City of New Orleans Stormwater Management Model (SWMM); July 10, 2019 Rainfall Event Modeling and Mapping," New Orleans: *Ardurra Report*. https://www.swbno.org/documents/Reports/July%2010%202019%20Rainfall%20Event%20Modeling%20Report.pdf

Tillson, George W. 1901. *Street Pavements and Paving Materials. A Manual of City Pavements: The Methods and Materials of Their Construction*. New York, NY: John Wiley & Sons.

Waggonner, David and Ball, M. 2012. *Greater New Orleans Urban Water Plan.* https://livingwithwater.com/blog/urban_water_plan/reports/

ENDNOTES

1. George W. Tillson, Street Pavements and Paving Materials. A Manual of City Pavements: The Methods and Materials of Their Construction. (New York, NY: John Wiley & Sons, 1901.)

1. George W. Tillson, Street Pavements and Paving Materials. A Manual of City Pavements: The Methods and Materials of Their Construction. (New York, NY: John Wiley & Sons, 1901.)
2. J. R. McNeill and Peter Engelke, “Climate and Biological Diversity,” The Great Acceleration: An Environmental History of the Anthropocene since 1945, (Boston: Harvard University Press, 2014), 63–102. http://www.jstor.org/stable/j.ctvjf9wcc.5
3. With increasing frequency, we are experiencing rain events equivalent to the peak intensity of a 10-year storm. The recently established city mandates require private developers to detain only a fraction (approximately 15%) of what’s necessary on-site for the 10-year storm events. Sewage & Water Board of New Orleans, “Comprehensive S&WB-City of New Orleans Stormwater Management Model (SWMM); July 10, 2019 Rainfall Event Modeling and Mapping,” Ardurra Report, (September 2019). https://www.swbno.org/documents/Reports/July%2010%202019%20Rainfall%20Event%20Modeling%20Report.pdf
4. Anique Hommels, “STS and the City: Techno-Politics, Obduracy and Globalization,” in Science as Culture, no. 3 (February 4, 2020), 410–416. https://doi.org/10.1080/09505431.2019.1710740
5. Richard Campanella. “How Humans Sank New Orleans.” The Atlantic, February 7, 2018. https://www.theatlantic.com/technology/archive/2018/02/how-humans-sank-new-orleans/552323/
6. By diverting the stormwater from the adjacent drainage canal at near-peak capacity and detaining at the site, the overall drainage demand will be kept below the capacity for a period until the storm subsides. The authors collaborated with stormwater management experts to model and test our assumptions on a ten-year storm event via the SWMM model, a dynamic rainfall-runoff, and a subsurface-runoff simulation model developed by EPA.
7. Hicke, J.A., S. Lucatello, L.D., Mortsch, J. Dawson, M. Domínguez Aguilar, C.A.F. Enquist, E.A. Gilmore, D.S. Gutzler, S. Harper, K. Holsman, E.B. Jewett, T.A. Kohler, and K. Miller, “2022: North America Supplementary Material.” Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. 1982. https://www.ipcc.ch/report/ar6/wg2/
8. “eccentric,” Google Oxford Languages Dictionary, accessed September 1, 2022, https://www.google.com/search?q=eccentric&rlz=1C1SQJL_enUS830US830&oq=&aqs=chrome.0.35i39i362l2j46i39i175i199i362j35i39i362l2j46i39i175i199i362j46i39i199i362i465j35i39i362.3807027j0j7&sourceid=chrome&ie=UTF-8
9. We used Bison, a landscape architecture plugin for Grasshopper and Rhino 6: https://www.bison.la/ Note that the slope analysis is relevant to identify occupant accessibility and flow speed. The water flow analysis is pertinent to determine the direction and convergence of the flow and the ground surface treatment.
10. i-Tree is a suite of software applications that assists in analyzing urban forestry conditions, helping to leverage trees’ ecological importance. The USDA Forestry Service manages the platform. https://www.itreetools.org/
11. David Waggonner and Mac Ball, Greater New Orleans Urban Water Plan, (Louisiana State Office of Community Development - Disaster Recovery Unit, 2012). https://livingwithwater.com/blog/urban_water_plan/reports/

Session 4

Intersections: A Synthesized Approach to Biology, Computation, and Design

Michael Gonzales, University of Houston
Meg Jackson, University of Houston

Introduction

With current global attention to climate change and an estimated 68 per cent of the world's population projected to be living in urban areas by 2050[1] there is a critical effort to rethink architectural practice and the construction industry. In 2022 studies showed buildings as being responsible for approximately 1/3 of global greenhouse gas emissions and consuming 40% of global energy production.[2] New alternatives to traditional fabrication practices and materials are urgently needed. Current research in bio-based composites and bio-receptive materials is promising because of its potential to develop resilient, performative materials that not only improve environmental quality but also reduce manufacturing and life-cycle costs. Such efforts can be seen in research into bioremediation and self-repairing organisms such as microalgae and mycelium. Composites using these material strategies have the opportunity to absorb CO2, oxygenate air, and are fully biodegradable.

The case studies presented in this paper explore the applications and implications of using biological systems as a bottom-up approach to beginning design. Recent collaborations between designers, artists, and biologists have resulted in new fields of research that have only begun to be explored such as bio-material composites and bio-computation. The research presented in this paper focuses on three main questions: 1) how to introduce interdisciplinary beginning design students to the concept of designing with biology and nature; 2) how to develop 1:1 bio-materials that are adaptive, self-sufficient, and reduce the impact on the environment; 3) how to develop workflows and fabrication techniques that can be utilized in the production of high-performance multi-material systems.

While we have seen a recent shift in the way students and practitioners approach sustainability, from construction methods and technological systems to the scale of material selections, there is an abundant need to rethink material practice and culture. It is our hope that changes in the way we approach design education allows designers to take a more active role in the creation of new material strategies that attempt to solve the global challenges we face. The shift from choosing more sustainable alternatives to growing and designing these systems requires a collaborative approach that calls on multiple disciplines.

Course Methodology

The authors teach foundation level studios and media seminars in the architecture, interior architecture, and industrial design programs. Most of the work presented in this paper was developed during a new 5-week course focused on biobased design. The seminar introduces students to the field of bio-based design by presenting concepts at increasing scales and levels of complexity – from the study of biomaterial properties and lifecycle costs to growing and fabricating their own biomaterials. Concepts develop incrementally beginning with an introduction to biomaterial terms and their manufacturing processes. Since the field of biomaterials is inherently multidisciplinary, requiring the knowledge of many specialists, one of the challenges was to develop an approach that engaged students to actively participate through physical making and fabrication while incrementally introducing them to the concepts of biobased design as well as manufacturing processes.

Students begin the seminar with an introduction to biobased material concepts by researching various material applications, precedents, and production processes. As students become more familiar with the material properties and their required inputs, they are charged with creating their own materials. In order for students to connect with these concepts in a concrete way, students developed a catalog of "recipes" that could be followed and modified based on the specific design intent and application. Using a workflow mirroring the parametric design process, students test various ratios of the input ingredients to control multiple material outcomes. Students were able to test and explore differences in material properties that corresponded directly to the variations in the recipes. These experiments allow students to build confidence in their "recipe" as well as form

a better understanding of the parametric, manufacturing, and fabrication process. The workshop setting fostered experimentation and students quickly witnessed a shift from the traditional design studio into a laboratory of material exploration. (1)

Case Study 1 | Bio-based Polymers

"Plastics accumulating in our oceans has become a global crisis. Billions of pounds of plastic can be found in swirling convergences that make up about 40% of the world's ocean surfaces. At current rates, plastic is expected to outweigh all the fish in the sea by 2050." [3] While much of the plastic that makes its way to the ocean comes from single-use packaging, designers have the opportunity to rethink our relationship with plastic at varying scales.

Biobased polymers are one alternative to traditional plastics. Made with renewable sources, such as vegetable fats and oils, corn starch, recycled food waste, etc., biobased polymers provide an alternative to traditional plastic production. In this case study, students researched the inputs required for the production of biobased polymers in order to understand the qualities and function of each ingredient. Each "recipe" included 3 essential elements: a polymer (to create a solid), a plasticizer (to provide flexibility), and a solvent (to dissolve the mixture). Throughout the production process, students were asked to modify the provided recipe in order to test multiple material properties such as flexibility, brittleness, transparency, etc.

In order to first test the material performance of basic bio-materials, the students were tasked with creating different base recipes. Students tested and documented the performance of multiple polymer and plasticizer inputs such as agar, gelatin, glycerin, starches, and sodium alginate powder. (2) In subsequent iterations in a parallel first-year studio, students also tested a diversity of starches and fibers, vinegar (a homogenizer) soaps (an expander), and oils (to reduce shrinkage) and recorded their observations. It was important for us to not to only instill a curiosity of biobased design strategies but to intimately engage students in the physical production of the material as well as in applied material research. By combining a laboratory setting within the design studio, students took a more active role in the research and thought critically of the materials they were developing.

After creating a successful "base" recipe defined by the behaviors and properties of the bioplastic, students worked in small groups and further experimented with other variables such as color, thickness, aggregate, casting mediums, texture, and smell. (3) Some of these variables changed the performance of the materials while some only changed their aesthetics. In addition to doing further material property tests and making aesthetic choices, the students were encouraged to look at inputs that interrupted a waste stream and to look at outputs that contributed beneficially to the life cycle of the biobased polymer. Lastly, the students individually tested their handmade materials by recording properties such as strength, heat resistance, rates of dissolving, laser-cutter performance, and water resistance.

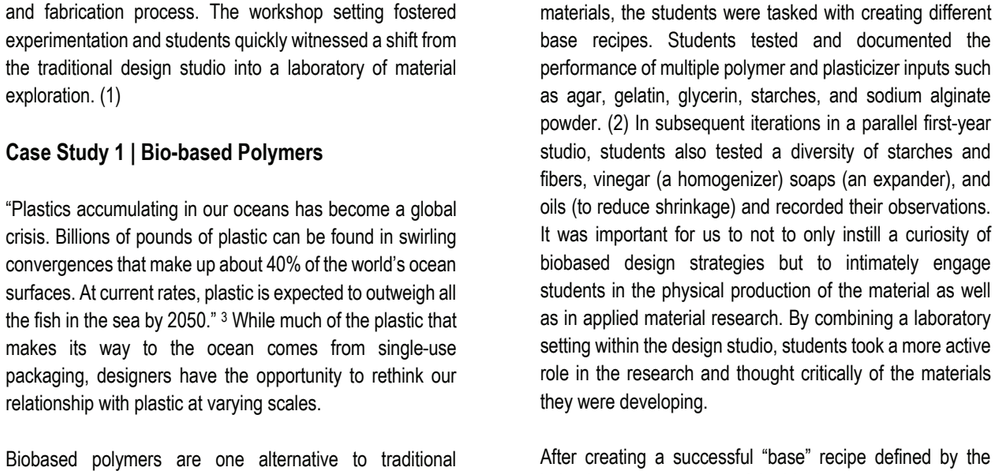


Fig. 1 Students experimenting with material recipes. *Student Work.*

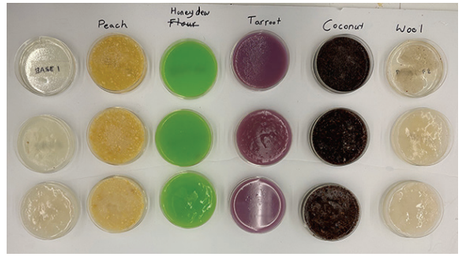


Fig. 2 Biopolymer Tests. *Student Work*

In the seminar, we discussed how to adapt the base material to respond to specific geographic and agricultural inputs potentially reducing the embodied energy of the material. By developing materials from ingredients that are more local or regional, designers can create more efficient and sustainable material practices. The students were very interested in relating their general research to a more specific context. In future iterations of the course, the authors would like to expand on the potential of these studies to connect the students with this material research at the scale and in the context of their own environments.

Fig. 3 Biopolymer with coffee grounds. *Student Work*

The biobased polymer experiments were successful in that students produced a lot of variations both collectively and individually and were invested in the material from the beginning in ways that are not usually present in the traditional design education process. Designing with these new materials required a lot of interaction with the material. Some students were very engaged in testing recipes and discovering variations in the performance of the material tests, while many first-year students struggled with the intense iterative process of making, testing, and modifying the materials. The main disadvantage of these experiments was the length of production time especially when the material was scaled to functional sizes for prototyping. Some students lost interest in the process with the increased production time. However, in general, the students were interested in the investigations and excited to make their own materials.

Case Study 2 | Mycelium-based Composites

Mycelium-based composites have recently attracted much attention as an alternative to many materials used in the construction industry. These composites are produced by binding sustainable materials together with mycelial fibers with relative ease. Mycelium can be grown in various ways on a large variety of substratum. Each substrate and fungal strain are paired together to provide multiple material properties. For this case study, students used a hemp hurd substrate and a proprietary mycelium blend produced by Ecovative. One of the most challenging aspects of using mycelium-based composites is finding the optimal pairing of a fungal strain and substrate. Fungal strains vary in mycelium density, growth rate, and structure. Since students were using a blend known to produce effective results, students were challenged to test the limits of the formwork and molds used to grow their material. Experiments investigated structurally stable forms, volumetric modules, sheet-based forms, and woven structures. Using a workflow similar to concrete or plaster casting, students were able to actively engage with the mold making process. (4) The use of a material relatively unknown to students, such as mycelium, students were forced to investigate and discover relationships between form making, material properties, and assembly strategies.

The students were given short duration design challenges to test and record the material properties of the formed mycelium. While the future of mycelium-based composites seems promising, one major concern is the low tensile strength of the material. In subsequent courses, the authors are interested in investigating various strains, substrates,

and/or integration of additional materials to address this issue.

Fig. 4 Regrinding and packing forms with mycelium and hemp mixture. *Student Work.*

One of the biggest challenges of the bio material tests, including the mycelium tests, was avoiding contamination during the growth process. Slight variations in temperature, humidity, and duration of inoculation resulted in non-functional materials. It is interesting to note, that as a material study, unexpected outcomes like mold, shrinking, shape memory, or poor material performance were seen to authors as productive to document and study. However, the students saw these same outcomes as failure. Beginning design students tend to value products over the process or the discovery. Engaging in basic research in beginning design education, can be useful in creating a rigorous environment that emphasizes a non-linear, yet controlled iterative process based on curiosity and experimentation. Adopting a design/grow/test workflow, borrowed from engineering and synthetic biology, was helpful in providing a framework where students could take risks and iteratively problem solve.

Case Study 3 | Bacterial-based Composites

The textile and fashion industries are responsible for a significant amount of global CO2 emissions, exceeding those from other sectors such as aviation and shipping combined. It is projected that the fashion industry alone will account for approximately 25% of the world's carbon budget by 2050.[4] With this in mind, students researched bacterial-based composites as an alternative to traditional textiles.

Bacterial-based composites are created by capitalizing on the natural metabolic processes of bacteria which create cellulose. The cellulose membrane created during this process can be harvested, dried, and molded to create alternatives to traditional textiles that are completely biodegradable. While this case study took the longest to produce, it required the fewest number of inputs and relied solely on the bacteria for its production. Each student used various sizes of SCOBY (symbiotic culture of bacteria and yeast) and containers to grow their experiments. Each prototype was observed over several weeks and harvested at various durations of growth creating a series of thin films or thick surfaces. (5) Samples varied widely based on the size of container used, size and health of the initial SCOBY, temperature, and the additives used for dyeing. Once harvested, the sample was dried into a sheet material. (6)

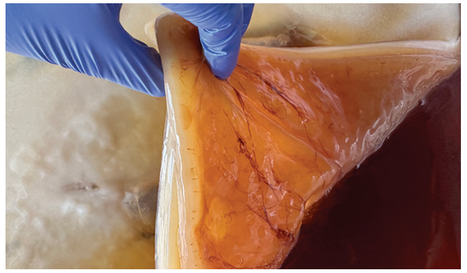


Fig. 5 SCOBY sheet before harvesting. *Student Work.*

Fig. 6 Drying bacterial leather. *Student Work.*

The main challenge of this experiment was the time it took for the sample to grow and the attention span of the students. In some ways the length was a positive, because the students were initially invested in the process and there were noticeable changes daily and weekly that were exciting to watch. However, after a certain time period, some students because less engaged with the process. It is interesting to note, that while a minority of the students remained committed to their material that they had shepherded for weeks, most students suddenly abandoned the material at the last step when the microbial leather was ready to be harvested and functional. However, when discussing the outcomes of the seminar, almost every student cited microbial leather as their favorite experiment.

Throughout the growing process, students were enthusiastic about their results and invested in the process of growing their own material and producing a healthy prototype. While students all used the same set of initial inputs, slight variations in additives and temperature created significantly different results. Students were able to learn collaboratively by observing each other and documenting their process.

Case Study 4 | Bio-Sensing

Current research into bio-sensing materials and systems has the potential to integrate embedded sensing, actuation, and control mechanisms directly into material strategies producing materials and systems with the ability to monitor their environment and trigger dynamic responses based on changing environmental conditions. This provides designers the opportunity to use computational strategies such as algorithmic design, machine learning and computer vision to understand the complex growth, networks, and behaviors in living organisms. This research can give designers insights into the applicability of using natural intelligence to solve complex design problems across multiple scales.

To build upon the material research produced in the first 3 case studies, students used biobased polymers as the substrate for a new, electrically conductive material. Prototypes included additional material inputs that would conduct electricity such as salt and activated charcoal. Through various iterations of the production process, students were able to create a series of materials that would carry a 5v current to illuminate an LED. Through this process, students discovered that the biopolymer substrate had no effect on the conductivity of the material however salt seemed to provide the strongest current. Students identified possibilities for future iterations by prototyping a conductive alginate yarn that can be woven into conductive textile. While these experiments only begin to anticipate the possibilities of bio-sensing materials, the authors find the opportunity to control and embed electric current within biomaterials to be promising for future research.

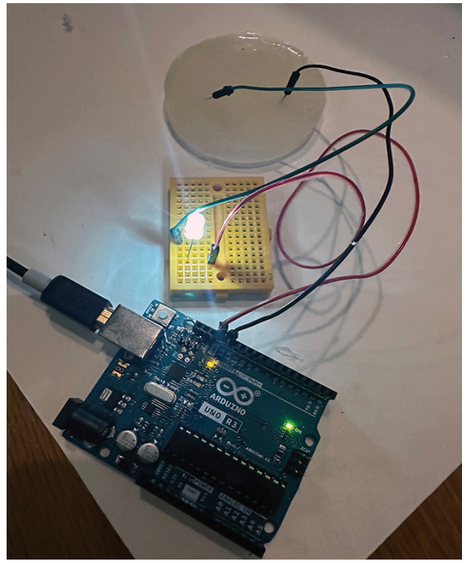


Fig. 7 Conductive biopolymer. *Student Work*

Conclusion

Investigations into bio-based material strategies have proven to be successful in several unexpected ways. The students are genuinely enthusiastic about learning and making. They are learning how to observe, document, and research, while simultaneously being actively involved in hands-on experiences. Many of the bio-based materials explored in the course are not well documented. There are many unknowns and most of the research on the impact on design practice, particularly at the larger scale, remains speculative. While this may dissuade students and instructors away from these types of investigations, we have found that the experimental nature of the research was exciting to the design students both in terms of the larger environmental context and the emerging subject matter. The students feel a responsibility to be part of something bigger. In addition, the participatory nature of the explorations means that the students are truly engaged with the subject matter. By mirroring the parametric design process and introducing the design/grow/test framework within a language familiar to students, we were able to move beyond the presumed scientific constraints and engage with this unfamiliar territory through a designer's lens. The unexpected learning outcomes and benefits of engaging students in this type of process and discovery is important

Canon Fodder: Critical Methods for Diversifying Precedents Through Blogs

Roberto Ventura, Virginia Commonwealth University

RELEVANCE

Background

I teach in the Department of Interior Design at Virginia Commonwealth University (VCU). Our student demographics skew heavily towards students identifying as female (82.8% for undergraduates, 100% for graduates). Our university ranks within the top ten percent in national universities in terms of the *U.S. News and World Rep*ort Diversity Index, a measure of student ethnic and racial diversity (2022-2023 University Rankings by ethnic diversity, n.d.).

campus ethnic diversity-national universities
U.S. News and World Report -fall 2021

schools reporting	410
diversity index - high	0.77
VCU diversity index	**0.72**
diversity index - low	0.02
VCU rank	**33th**
diversity index mean	0.48
median diversity index	0.52

Figure 1: VCU is one of the most diverse universities in the nation.

This past fall, the U.S. Department of Education recognized VCU as a Minority Serving Institution (MSI) (Office of the vice president for research and innovation, n.d.), meaning VCU was now eligible to participate in Strengthening Institutions Programs (SIPs). Our department supports an incredibly diverse student body in terms of interior design and the academy. Less than 49% of our undergraduates identify as white, while almost 18% regard themselves as African-American, 8% as Hispanic, and almost 13% as Asian or Pacific Islander (note: these designations are established by national bodies and are less current and descriptive as more progressive surveys). In interior design, demographic studies are far behind its associated professions, so nationwide numbers are rare. The best gauge of diversity in terms of the interior design programs nationally comes from surveys form Data USA (Interior Design, n.d.). Examining the total number of degrees earned in Interior Design by race and ethnicity reveals less than 5% were by individuals identifying as African-American or Black; our student body often quadruples that number.

I am a white, cis-gender male department chair with a terminal degree in architecture (M.Arch). In the diverse academic ecosystem I lead, I am the least diverse element.

Origin

I used to consider myself ***woke***. I read critical theory in graduate school; bell hooks was cited in my thesis, along with Foucault and Derrida. My thesis chair at Miami University, the late Tom Dutton, wrote extensively on power dynamics in design, and helped found a community-oriented outreach studio in the Over-The-Rhine neighborhood of Cincinnati. But as I learned more about my colleagues in the academy, I began to challenge what I assumed were my woke bona fides.

I also began to notice that my students--zero percent of whom are architects—consistently cited architects as their design role models. I decided to test this anecdotal observation.

Each year in a senior seminar, I ask the students to develop their own design ethos by rooting it in principles they can observe in practices or designers they admire (these role models were labeled as design mentors). I collected this information, and then compared the students to the mentors they followed. I found that the students primarily citing white male architects (like me) who were no longer alive (unlike me).

Why would this group of dynamic, diverse, *living* interior design students be drawn primarily to mentors who did not reflect their own lived experience? Might I have some role in this (spoiler alert: yes).

To test this hypothesis, I performed an audit of my own teaching, choosing to focus on an introductory lecture on design principles and elements I give to incoming graduate students (this lecture, although given to a different

population, mirrors other talks in terms of precedents and designers to emulate given less formally to undergraduates). Examining these three factors together points a finger directly back at me:

students, designers they admire, & my role
an analysis of three undergraduate senior cohorts

	quantity	% interior designers	% architects	% women	% non-white	% asian	% african-american	% latinx	% dead
students	80	100	0	83.8	52.5	28.8	18.8	5	**0**
design mentors	62	**9.7**	**77.4**	**14.5**	**16.1**	11.3	1.6	3.2	**43.5**
lecture images	94	**3.2**	**77.6**	**11.7**	**8.5**	5.3	1.1	1.1	**39.4**

Figure 2: The lecture images presented by faculty suggest they bias student perceptions. If faculty were to introduce a more diverse array of precedents, might student perceptions change?

One can infer the influence faculty have on how students perceive excellence in design. Despite my best intentions, my citations of design exemplars not only failed to acknowledge interior design practice, but reinforced the traditional canon which has excluded diverse representations and their contributions and value to the understanding of design. Like my own eyesight, my view of design had gradually become increasingly myopic, despite my wishes for the opposite.

Expansion

Interior design distinguishes itself by focusing on the interaction of the person to space. Given the need to understand the ways we inhabit space, it follows that we also need to understand the breadth of how the design of interior space manifests globally. Restricting our understanding of precedents, philosophy, and ideation inadvertently through habit or by promoting models we already know or fancy puts the teaching of design at risk of becoming increasingly exclusive (I am assuming no one in true pursuit of design excellence would deliberately exclude people or ideas for the purpose of advancing some other more sinister agenda). Therefore, expanding the design canon--understood here as a vetted collection of people, projects, and ideas of value to the study of design--is critical to positioning it as a study of all humans and how they conceive of and use interior space.

Traditionally, historic precedents have been heavily weighted towards Europe and North America. Continuing to reinforce this tradition without opening the canon to other viewpoints at best suggests a narrowness of thought. At worst, this exclusionary behavior, unintended or otherwise, contributes to the implication of a non-western inferiority.

Importance

The importance of this is not trivial. In the current Professional Standards established by the Council for Interior Design Accreditation (CIDA), two standards reinforce the value of a more inclusive canon. In Section II. Knowledge Acquisition and Application, Standard 4. Global Context, the accreditation board mandates the interior design programs expose students to ideas that inform contemporary society, including various cultural practices and broadening multicultural understanding. An expanded canon facilitates the understanding of this information. Furthermore, in Standard 6, Business Practices and Professionalism, interior design programs are required to provide students with the understanding of the importance of diversity, equity and inclusion in the workplace. An inclusive canon could provide tangible examples to satisfy these needs.

Beyond administrative requirements, design students and practitioners are "influenced by what has gone before...and...draw inspiration and learning from leaders past and present in (their) own identity development" (Sealy & Singh, p. 208, 2008). We build upon knowledge we gain, so it follows that a broader source for this information, i.e., a broader canon, would provide a wider base from which students and faculty could construct their practice. More diverse precedents could support a richer, more inclusive profession. Digging into new sources for precedents involves forays into terra incognito

ISSUE

In order to broaden a canon, we need to look at sources that critically provide a pool of potential candidates or precedents. In my own teaching, critical areas of improvement include increasing the number of precedents that reflect contemporary interior design practitioners (specifically those who are interior designers developing interior space, as opposed to architects designing interiors), women designers, and designers identifying as underrepresented races and ethnicities. Design periodicals are the most accessible, peer-reviewed sources for current design. In the interior design field, the most high-profile publication is *Interior Design* magazine.

Best of the Year Awards, Interior Design

Annually, Interior Design sponsors a year-end program celebrating the top design work in the world, the Best of the Year (BOY) Awards. If interior design students and faculty are to look for a reputable publication as a source to expand their pool of precedents and design role models, the BOY awards would be an ideal place to begin.

Currently, the BOY awards offer honors in seventy-four categories, ranging from "Budget" to "Office Transformation" to "On the Boards" projects. Each category has a winner and three honorees. This collection annually represents some of the best interior design work in the world.

Testing

However, examining *Interior Design* magazine's BOY Awards in 2016 and 2020 reveals that western—particularly American—designers dominate. A research team including five VCU undergraduate and two graduate students reviewed online presentations of *Interior Design's* BOY program representing a five-cycle spread, 2016 and 2020 to gauge inclusion from a disciplinary and geographic perspective. Category winners and honorees were audited to determine two pieces of information: location, and discipline. The research team did not try to determine ethnicity, race or gender in this study because ideally that information should be disclosed by an individual and not inferred through photographs or name traditions.

The location of the design office primarily responsible for the works in question was identified in order to gauge geographic diversity. The research team also identified the project designer(s) in each office. In cases where actual team leaders were not identifiable, principles of design firms were recorded; if no information was available—for example the practice dissolved, or had been absorbed by another practice—the firm was left out of the calculations. Each of these individuals was then researched to determine their disciplinary background.

In all, 535 projects—249 from 2016 and 286 from 2020--were recorded and sorted.

Disciplinary & Geographic Spread

With respect to disciplinary diversity, the percentage of designers identified as having interior design specific practice shrunk in the interval between 2016 and 2020. Despite an increase in the number of categories and recipients of BOY recognition, the amount of interior design firms recognized dropped thirteen percent from forty-one (out of 211, or 19.4%) in 2016 to thirty-six (out of 249 or 14.5%) in 2020. Relative to overall numbers, this resulted more than a 25% decrease. Architecture was the most widely awarded discipline in 2016 (52.7%) and in 2020, increasing to 59.5%. Relying on *Interior Design* as the primary source for new interior designers to include in the canon appears to be a limited strategy.

Geographically, award-winning practices were heavily concentrated in the United States and Asia. In 2016, 154 of recognized practices were from the U.S. (62.8%). Of that, 72 were from the greater New York City area; this total exceeded that of all of Asia, the second-highest geographic concentration (44). In 2020, this trend began to transform slightly: of the 286 awardees, 53.4% were located in the U.S. Of this number, 64 were located in New York City, but Asian firms increased their representation to 82. In total, 73% of honored firms in 2016 were American; four years later, the United States still led (59%). In both years, China's influence on the awards was strong and growing.

In contrast, in both years only one firm from South America was recognized; not a single African practice was. In light of this, if an alien studied Earth only by using *Interior Design* BOY award winners as geographic touchpoints—admittedly, a very specific type of alien—its map of earth would have looked like this in 2016:

Figure 3: An alien making a map based on Interior Design BOY award winner locations would not look like Earth. Is it true no interior design of merit happens elsewhere in the world?

There may be many factors impacting these findings. Interior Design magazine is an American publication, so its readership and its target audience would naturally skew, towards North America. International firms looking to expand and grow rapidly domestically and abroad particularly in China, might also target *Interior Design* to broaden their reputation and reach. Submitting project packages for these award competitions not only demands financial resources for expert photography (an expense often not easily obtained by smaller practices) but expertise and human resources dedicated to marketing, as well as an understanding of the system for positioning work well for these competitions. In essence, firms that are familiar or well-versed for these mechanisms are at an inherent advantage. Practices that are familiar are typically firms that have been well-established in the design arena, one that has traditionally been a small club. Outsiders to this club lack the institutional knowledge to enter it. Although it is not impossible to penetrate it, this context has been built by the status quo, which has traditionally been narrowly constructed (again, inadvertently or not).

Expanding the canon by using current peer-reviewed sources appears problematic. Opening the canon may mean in part breaking this older system. Or, it may necessitate the development of a different system all together.

CONTEXT

Design blogs—an academic terra incognito—might offer a way to diversify the canon, but concerns surround their use. The promise of the blog is that it circumvents traditional modes of dissemination. Submitting projects through blogs presents itself as more accessible, varied, and voluminous. Consider a print issue of *Interior Design*. In the October 2022 issue, *Interior Design* published six project features; one main project in a section called City Living, along with five smaller profiles (one-page spreads); and one Centerfold project. Twelve projects were introduced as part of this issue.

By contrast, ArchDaily, one of the world's top design blogs, published *forty projects per day*.

The processes through which established journals disseminate works can be opaque and uncertain. However, there is a tradition that suggests the projects a given periodical presents have been critically vetted, and are worthy of consideration, and hence they are traditionally viewed as superior to blogs. Print journals are inherently more critical and have more quality than blogs because of their editorial rigor. This is a context that blogs have difficulty conquering. By examining the first five project posts from March 7, 2023, one would note that each profile of the project begins with the italicized sentence "*Text description provided by the architects.*" The critical reader—or perhaps, merely a reader who is awake—will note this text as unreliable. The author has neither the basis for being nor the motivation to be objective or critical. No textual information can be relied upon without investigation. Additional posts may have authors listed who are not the project designers, but knowing their bona fides can be a research project in itself.

Yet, the sheer volume of projects one design blog produces—and this is independent of other sources like Architizer and Dezeen—suggests an ability to cover more of the world than a print journal could. If indeed blogs could present a more diverse geographic array of design practices to study, they could be key gateways for expanding and diversifying the design canon. The questions before us therefore are two-fold: do blogs offer a more diverse spread of projects and designers; and second, how can we vet them critically so thy are useful for academic study?

METHOD

Collecting Data

The first 66 projects posted to ArchDaily on September 19, 2022 were recorded and sorted by geographic location and featured image (i.e., interior or exterior). As in the Interior Design BOY study, the focus in this case was geography and not perceived race, ethnicity, and gender. Further studies into individual project designers and how they self-identify could be take on in order to understand this, but assuming identity introduces considerable unreliability.

Additionally, the feature image for each article was categorized simply as interior or exterior. This does not provide insight into the actual professional backgrounds of each practice, but does suggest a practice focus. The feature image can be understood as the largest image at the beginning of the article (Fig. 4).

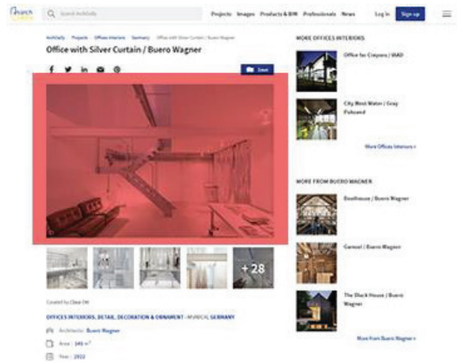


Figure 4. The red area represents the featured image for this article.

Looking for a Road Map

Traditionally, I have discounted or disqualified the use of blogs for citations in design research because of the lack of critical rigor. I perceived student reliance on blogs for precedents more indicative of a lack of curiosity or willingness to put in the necessary detective work to grind through the Avery Index and library or Interlibrary Loan holdings (my eyes often roll as I remembered the cumbersome nature of researching pre-internet and pre-digital databases or library catalogs). But as the power of these blogs to diversify precedent pools became undeniably obvious, the question became more of how one might be able to use these resources critically. In library sciences in particular, writing and research on new media and blogs has been an important topic. Turning there might provide clues as to how blogs could be thoughtfully utilized in design research.

CONCLUSIONS

An Option for Expanding the Canon

The results of the survey of ArchDaily blog entries revealed a wide geographic section of design practices and a greater percentage of projects that presented interior images. Regarding the interior imagery, over 27% of posts featured interior spaces as the principal image. In contrast, in the *Interior Design* BOY Awards, representation peaked in 2016 at under 20%. It is important to note these two figures are slightly misaligned, as the BOY numbers reflect the percentage of honorees with interior design specific disciplinary backgrounds and the ArchDaily results relate to what images were presented most prominently. With more investigation, these numbers may be refined, but this preliminary observation suggests that sites like ArchDaily might offer significant quantities of interior design precedents.

Geographically, the distribution observed in this random survey was tremendously broad. Of the 66 entries surveyed, 92% were from unique cities (i.e., they were not represented more than twice). Every continent (aside from Antarctica) was represented. The two most heavily represented nations in the BOY Awards, the United States and China, saw their respective influences reduced significantly. While China was the home to most projects in the sample, the number was only five; American projects numbered only two, one less than Vietnam. Interestingly, New York City—home to 29% of BOY honorees in 2016 and 21% in 2020—was absent from this survey.

This broad geographic base is an exciting revelation for those seeking to expand a traditional canon that is steeped in North American and European work. Of the 66 entries, 34 were from North America and Europe. In comparison, over 56% of 2020 BOY honorees were from North America alone.

Given this information, blogs appear to have the potential to play important roles in design research. The question becomes how these sources can be evaluated for validity. Entries may lack critical text or feature project descriptions provided from the designers, casting skepticism on their reliability.

Librarians to the Rescue

Library science has examining blogs in relation to academic legitimacy. The critical question is a systematic ethos for evaluating these sources. Some critics dismiss their usage completely due to slapdash filtering of misinformation, or worse, disinformation (Beckerle, et al, 2021). This certainly is valid when the content source (project descriptions) is the designer who is seeking notice for their work. Discounting the other benefits of these project sources outright, however, seems like an overcorrection provided the information is carefully examined.

Opportunities exist for this systematic evaluation of nontraditional sources by the use of critical frameworks. Three distinct models have been described for this work, and researchers argue that employing these as complementary frameworks could be effective in developing the critical skills necessary to navigate this medium. Three of the most common tools include CRAAP (Currency,

Relevance, Authority, Accuracy, and Purpose) assessments, BEAM (Background, Exhibit, Argument, Method) categorizations, and Journalistic analyses. Although each provides imperfect bulwarks against undisciplined sources, a combination of these tools may open sources like blogs to student researchers provided they apply them to address the shortcomings articulated by Beckerle, et al.

CRAAP

CRAAP tests, established by Sarah Blakeslee in 2004, target information sources and filters them through five channels. This framework provides a quick, unsophisticated process to evaluate sources. While the first three headings—Currency, Relevance and Authority--are relatively easy for the student researcher to gauge, the last two do require more critical analyses. Accuracy implies the necessity of seeing other sources to support or contradict information. Purpose demands the researcher examine potential motivations for the information and/or of the author. As Elmwood writes, CRAAP tests generally support less analytical engagement of higher order thinking skills (HOTs) like (2020), but it is a useful first step in examining a source like ArchDaily. A quick review of the text included in a typical post, for example, can alert students to the conflicts of interest inherent in the promotion of one's own work. This source, therefore, might be an useful vehicle for project drawings, materiality, and spatial composition, but a critical reading of the project would need to occur independently of a given post.

BEAM

The BEAM assessment schema demand that students reflect on their own critique of a source (Roach-Freiman, 2021). Whereas CRAAP tests focus on the validity of a source, BEAM tests help students understand what to do with the information. In short, Background sources are objective; Exhibit sources necessitate investigation and analysis; Arguments are dialogues with ideas or content; and Methods relate to thinking processes. As students engage a source, they categorize it into one of these four areas, and then can criticize it based on what the category demands. In the case of design blog posts, they are most likely analogous to Exhibit sources. Text from the designer could be viewed as an artist's statement; the student would then need to examine the work through that lens. Argument factors in here as well, as designers often engage in philosophical foundations for their work. The BEAM framework allows the student to understand the nature of their critique strategy. Joseph Bizup, creator of the BEAM framework, summarizes it neatly:

> "..writers *rely on* background sources, *interpret* or *analyze* exhibits, *engage* arguments, and *follow* methods" (2008).

Journalistic Analyses

The journalistic approach borrows from the tradition of the five Ws: Who, What, When, Where, and Why? (Elmwood, 2020). This method focuses on analyzing source material. The *What* component relates to the type of material (primary source, an interview, etc). *Who* questions focus less on the authority of an author and more on their background. *When* questions are typically the easiest to answer, but may be more complicated as undated web sources, like those of ArchDaily, are more commonplace in web sources than in traditional academic ones. *Where* relates not to geographic locations but the platform or medium of the information. Finally, *Why* questions may be the most complicated, as the motives of the author as well as the platform should be assessed. The combination of the five layers of investigation make the journalistic process more difficult and involved (Elmwood, 2020).

In Combination

Ideally, a combination of all three methods—CRAAP, BEAM and the journalistic approach—is in order if one is to approach blog posts with a critical mindset. Each process provides complementary value. Albeit cursory in nature, CRAAP tests can bring into sharp focus important characteristics of a source. BEAM frameworks permit students to catalog the type of information present, and the journalistic method suggests deeper analyses. Roach-Freiman further notes that this hybridization of methods is in line with the best practices articulated by the Association of College & Research Libraries's (ACRL) *Framework for Information Literacy for Higher Education*.

One More Filter

One humble augmentation to this hybridization would be to first ask the student to articulate their motivation for examining a given project found on a blog post. Should the needs be objective in nature, a blog post may pose a smaller critical risk. As needs become more subjective, more attention to the thoroughness of the investigation must be paid.

SIGNIFICANCE

Promise

Blogs promise the critical researcher paths to grow a more diverse and inclusive design canon. In comparing *Interior Design's* BOY programs from 2016 and 2020 with a random sample from ArchDaily, one can observe a significantly wider geographic spread of project locations. This breadth challenges the North American and European hegemony in the established canon. The data also suggests a fertile ground for expanding the canon for interior design projects in particular, although a more rigorous filtering is needed to build confidence in this claim.

Additionally, the accessibility of the design blog in terms of the quantity of projects and practices that can be highlighted is powerful. In the interval between issues in a monthly publication, a blog like ArchDaily can publish 100 times as many projects. This volume implies greater access for smaller practices. This pool of firms could be reasoned to include younger practices, which, by virtue of the changing demographic landscape in design, should also necessarily include more women and traditionally underrepresented populations. Blogs appear to have a real potential to diversify the design canon.

Roudbari (2018) also notes that the symbolic capital that blogs afford young, diverse practices democratizes the traditional channels for promotion and recognition. By providing more opportunities for these designers to be seen and acknowledged, the role models that minority students have traditionally lacked become more visible and numerous. The challenge to the traditional hierarchy promises to invert historic structures.

Next Steps

Going forward, this exploration needs to grow in three areas. First, the data needs to be further filtered to provide more apples-to-apples comparison of project type and discipline. Until then, the confidence in the claim that interior design practices are increasingly featured in design blogs needs to be tempered.

Second, a broader swath of design blogs should be examined, For interior design in particular, it would be instructive to learn if one source provides more precedents than others.

Additionally, demographic information related to race, ethnicity and gender would most likely provide eye-opening insights into the composition of each pool of projects. The focus on assigning these identities will need to rely on sources where the researchers can confidently identify instances of self-identification.

In terms of refining a methodology for assessing design blog posts, the formulation and testing of a workflow for integrating the CRAAP, BEAM and journalistic methods would be of great value.

Why

As an academic, I am responsible for providing my students a critical design education. In reviewing my teaching, I recognized I became complacent. I cannot expect my students to resist complacency when I have fallen victim to it.

As a designer, I steadfastly follow Harry Bertoia's notion that the pursuit of design is predicated on the belief that there is a better way of doing things. Bringing more voices into the design discourse will make design better. Students will feel seen and feel like they belong when they can see their experiences reflected in the people we hold up as exemplars. The confidence gained by this cannot be understated. It will make student experiences richer, and it will result in better spaces for our communities. Ultimately, the critical parsing of blogs empowers beginning students to diversify their conception of design, while developing habits and ethics vital to functioning within the context of the contemporary media landscape.

I do not know where our design students will go with their studies, but I do know they will all be citizens. Their design education should prepare them for that certainty. Having the capability to critically examine their world, in the face of existential threats like mass disinformation, is one of the greatest tools we can gift them. Our environments, built or otherwise, will depend on that.

Bibliography

2022-2023 University Rankings by ethnic diversity | US news rankings. (n.d.). Retrieved March 8, 2023, from https://www.usnews.com/best-colleges/rankings/national-universities/campus-ethnic-diversity

Beckerle, H., Finston, R., & Sussman, B. (2021). Social Media Debate position 1: Against the use of social media as a

credible source of information. Internet Reference Services Quarterly, 25(1-2), 25–35. https://doi.org/10.1080/10875301.2021.1937438

Bizup, J. (2008). BEAM: A rhetorical vocabulary for teaching research-based writing. Rhetoric Review, 27(1), 72–86.

Elmwood, V. (2020). The journalistic approach: Evaluating web sources in an age of mass disinformation. Communications in Information Literacy, 14(2). https://doi.org/10.15760/comminfolit.2020.14.2.6

Interior Design. Data USA. (n.d.). Retrieved March 7, 2023, from https://datausa.io/profile/cip/interior-design#ethnicity_degrees

Office of the vice president for research and innovation. Minority Serving Institutions designation - Virginia Commonwealth University. (n.d.). Retrieved March 7, 2023, from https://research.vcu.edu/resources/msi/

Roach-Freiman, A. (2021). Beam me up: Teaching rhetorical methods for source use and synthesis. Communications in Information Literacy. https://doi.org/10.15760/comminfolit.2021.15.2.5

Roudbari, S. (2017). Crowdsourced and crowd-pleasing: The New Architectural Awards and the city. Journal of Urban Design, 23(2), 206–222. https://doi.org/10.1080/13574809.2017.1340799

Sealy, R., & Singh, V. (2008). The importance of role models in the development of leaders' professional identities. Leadership Perspectives, 208–222. https://doi.org/10.1057/9780230584068_15

Pedagogies Toward Sovereign Indigenous Futures: Ten Strategies for Early Design Educators

Bailey Morgan Brown Mitchell, Oklahoma State University School of Architecture

Introduction

This paper includes ten strategies for supporting tribal sovereignty in early design education. Incorporating "indigenous ways of thinking" or "indigenous building techniques/technologies" as solutions for the climate crisis, private property, resource consumption, etc. is an increasingly common topic in design education; however, many briefs fail to support tribal sovereignty thereby relegating Indigenous people into a primitivist past rather than a sovereign future. Inclusion of Indigenous peoples into design briefs, courses, methods, etc. is a worthwhile goal; however, inclusion without the furthering of sovereignty is a point of harm.

Although brief, this paper outlines goals and actionable steps toward reduction of that harm and increases in tribal sovereignty. The strategies are as follows: (01) We Give the Land Back, (02) We Build Nations, (03) We Spatialize Laws, (04) We House All People, (05) We Don't Primitivize, (06) We Stop Racializing, (07) We Design for the Eighth Generation, (08) We Garner Communal Practices, (09) We Cultivate Hope, and (10) We Project Indigenous Futures. This paper provides speculative narratives related to these strategies via a selection of the following: (a) studio briefs - site, context, deliverables, (b) courses - topics, structure, content, (c) methods - drawing, image-making, modeling, (d) pedagogy - instruction, process, assessment, and (e) extensions - outreach, community, context. These techniques are conceived as being incorporated into existing teaching structures while encouraging entirely new ones.

Context

Tribal Nations in the United States have been regaining their power, wealth, and sovereignty since the passing of the "Indian Self-Determination and Education Assistance Act" of 1975.[1] With control over their own finances, elections, and strategic decision-making, tribal nations are poised to continue to garner additional power in the coming years. [2] The status of historic, current, and future tribal power is a topic ripe for inclusion in early design education. Instead of students dealing with only federal or state power, tribal nations are a third power and therefore an intermediary

Fig. 1 Cherokee Nation Gift Shop in Tahlequah, Oklahoma

space, place, and governance structure - a prime opportunity to address not only what is but what could be. Regardless of the proximity of tribal nations near an academic institution, acknowledgment and action related to this "other" power allows other possibilities of architectural intervention to develop that are neither racialized nor primitivist. In this third space of power, issues related to binary politics are usurped by a helpful third space of knowledge; epistemologies beyond that of the majority are able to undergird projects for beginning design students.

Sovereignty

Dr. Kouslaa T. Kessler-Mata writes that sovereignty is "the rights retained and exercised by tribes through their own governments and recognized by other polities, as well as the right to self-determination, the condition of freedom from arbitrary interference and which enables future-- oriented visioning." [3] Tribal sovereignty, in simple terms, is the right to self-govern held by American Indian tribal nations (located in what is currently known as the United States) since time immemorial. Support for tribal sovereignty is an acknowledgement of and support for the present and future self-determination of native people.

Despite the immense unique cultural, religious, language, geographic realities of tribal nations, sovereignty as exercised by tribal nations in the U.S. is generally supported through control and ownership over contiguous lands[4] and decision-making authority over issues of economic development and nation building.[5] Furthermore,

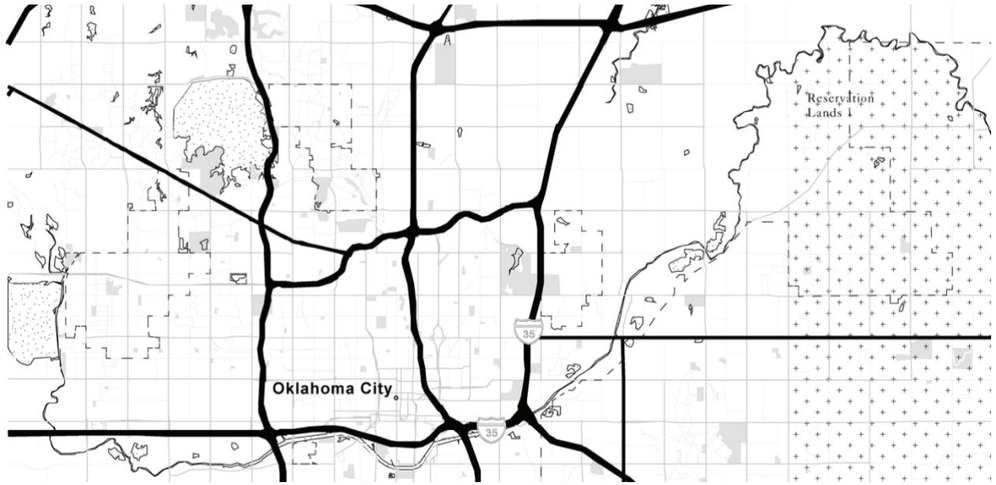


Fig. 2 *Reservation Lands indicated as part of a project brief.*

sovereignty is supported through mapping[6] and other spatial illustrations that depict the sovereign space. Political sovereignty is bolstered through control over policies and programs related to education,[7] health,[8] and housing.[9] Combating myths is another key component of sovereignty such as furthering perceptions of engaged contemporaneity rather than primitivist stereotypes and myths[10] and control over determination of political citizenship rather than racialized blood quantum.[11] Tribes enact methods in the support of tribal sovereignty including prioritizing multi-generational investment,[12] persistent furthering of collectivity within culture despite assimilationist histories, [13] projecting hope toward increased sovereignty,[14] and supporting provocations toward futurity that further resist primitivizing myths.[15]

Known and Unknown Territories: 10 Stories

Tribal sovereignty is a generally unknown territory in beginning design education. This paper is intended to be a preliminary map told through ten stories of how to chart this unknown territory. Perhaps you have native students that you want to support. Perhaps you are native yourself and intent on learning more about how others are thinking about this issue. Perhaps you're curious about headlines and U.S. Supreme Court rulings that seem to oscillate between insistent support for tribal sovereignty[16] and sheer undermining disregard.[17] Perhaps you have been considering indigenous ways of building as topics in your teaching but are unsure how to connect these issues with contemporary sovereignty. Regardless of your reasons, my hope is that the following ten stories help us imagine new potentials for supporting sovereignty in beginning design education.

01. We Give the Land Back

A young native student cautiously walks into the auditorium - hesitant but earnest. Pick up the project brief. Sit down - too nervous to speak to others. They read the following, “this project presupposes that the site of our project has been purchased by an American Indian tribe, the Chickasaw Nation . . .” The student’s eyes alight. While the land back movement is being supported, the student additionally feels supported and acknowledged by their professor and the school. Another student, non-native, reads the same phrase. They pause. Consider (maybe for the first time) that this tribal nation would have the authority, financial security, and inclination to purchase land. They learn something new. Maybe a stereotype or misconception frays, fractures. Presuming control and ownership over land by a specific tribal nation is a furthering of that tribe's sovereignty.[18]

02. We Build Nations

Perhaps the brief continues, “The Choctaw Nation plans to develop 20 row houses on the parcel to be sold to native and non-native citizens as an economic development tool. Despite the surrounding zoning limiting density per lot, this land is now a part of Indian Country and is no longer under the authority of local zoning. By increasing density and striving for high quality design on the parcel, the tribe aims to establish a new standard of development in the community and region. The tribal council has hired twenty esteemed young architects to design row-houses within this development; you have been chosen as one of those twenty.” This rather short brief and background narrative for the project has done two things quite efficiently - increased tribal sovereignty by drawing awareness to the nation building capacity of a tribal nation, introduced ideas related to zoning,[19] included a helpful vocabulary term, “Indian Country”[20] into their lexicon, while establishing firm parameters for a project brief.

Perhaps the introduction presentation takes things a bit farther: “When we imagine the United States as a nation. What comes to mind? The White House? The capitol? L’Enfant’s plan for D.C.? The Washington Monument? Westward expansion and wild west towns? Suburban landscapes of self-similar homes? Chicago’s skyscrapers? The ideas of nationhood are mediated through works of architecture. This project looks to support tribal nation building by mediating that nationhood through works of architecture.”

Presuming and prescribing a tribal nation as having decision-making authority over issues of economic development and nation building related to a project is a furthering of that tribe’s sovereignty.

A small row-house is a project not-uncommon in beginning design education; these first two short narratives aim to inspire how project briefs, introductions, and descriptions can be leveraged to support tribal sovereignty in the beginning design studio.

03. We Spatialize Laws

A student walks the site. Dirt under feet. Examine. Note. Measure. Every tree, curb cut. We take out the tape measure. What is the boundary? Where does it end? Where does it begin? What invisible line is the edge? The survey complete, the student sits with their laptop. Map the site. Draw. Document. We ask, “how can boundaries or property lines” be understood? The student responds “they are only lines that show who owns what. Lines that tell us where we can and cannot build.” We push back - “Are they just lines? What does the inscription of lines on the earth mean? These lines you are drawing make laws legible.” You see when you draw this property line, you are inscribing legal descriptions onto the paper and into the architecture. These are lines that have meaning. On one side of the line, you are in the two places at once - the Creek Nation reservation and Tulsa, OK. On the other side of the line, you are solely in Tulsa, Oklahoma. Depending on my citizenship, when I cross that line, my rights and responsibilities change. I am now a part of a “hybrid political space”. [21] If I, as a native citizen, were inside the line, I have access to additional healthcare benefits, housing benefits, education benefits, but on the other side of the line, many of those rights disappear. Similarly, to how my rights would change as a U.S. citizen on either side of the U.S. Mexico border. Does this change how we think about lines? Did you ever know they could hold so much power?” An interrogation and spatialization of tribal law is a furthering of sovereignty. Documentation of a site can be a moment of increased sovereignty through knowledge and awareness.

A student reads the brief. Underlines details. Makes a list. Opens a laptop. Ready. Research. “within this R-2 phase, we are going to complete what is known as site research. During this phase of the project, we gather, analyze, synthesize, and document pertinent knowledge that we need in order to design the project in an effective manner. The research needed to be completed as follows: climate data, wind patterns, solar diagram . . . mapping of historical and contemporary tribal land tenure (please see native-lands.ca) [22] . . .”

These two narratives illustrate a conversation between student and faculty and a research deliverable. At the level of one-on-one crit discussion, even small amounts of knowledge about tribal law can be communicated as students are beginning to learn about lines, surveying, and site in beginning design education. Within the deliverables, including native land tenure as a topic of concern begins to establish the legal and historical frames of sovereignty into the minds of young designers.

04. We House All People

New project day! The students beam, feeling confident after the success of their previous projects that were more abstract illustrating 2D and 3D compositional techniques. The students whisper “our first real project” - of course we know that they mean “our first real project”. Nevertheless, the energy is palpable as they squirm in their seats. You introduce the overall brief and then begin to outline the upcoming phase - precedent research. The assignment

brief printed front and back - at the top - a phase: "precedent studies". Something to be regarded. To study deeply. To learn from. To intimately know and to perform logics into the upcoming projects. You provide a list - possible precedents with which the students will engage. Within the list are projects designed by native people or designed specifically for a tribal nation by a non-native architect. Depending on the project type, the precedent could be a school - one of the numerous native owned and operated language-immersion schools; [23] the precedent could be housing[24] - rural or urban - projects ranging from large scale single-family developments to mid-rise urban infill to tiny houses for elders and wisdom-keepers to high-rise residential and mixed-use developments[25]. Or it could be a medical center, clinic, hospital, or school of medicine. With sovereign self-determination over policies and programs related to education, health, and housing, (in concert with the Indian Health Service (HIS), Bureau of Indian Affairs (BIA)) tribal nations have amassed a vast quantity of architectural work that supports aims of sovereign governance. Granted, these projects are less published; there is a significant need for documentation and publishing of this work, but an initiative that supports this endeavor is outside the scope of this paper. Noting, acknowledging, and curating contemporary native projects is a furthering of sovereignty.

05. We Refuse to Primitivize

Maybe the precedent is far older. A hut, *a teepee*, a wattle-and-daub longhouse. An "indigenous building technique". You've seen them. The illustrations. The architecture of the first peoples of North America. A village of small huts, dirt on the ground, a communal building - a bit larger than the others toward the center - a bit of smoke rising out of a fire on which spits perpetually rotate to cook the deer, boar, etc. Maybe there is a dog, an anachronistic horse. There is always a little girl holding a corn husk doll. These are the primitivizing representations that we have. The project of sovereignty calls for new representations of its architecture - the medium through which governance and culture are enacted. Instead, you invite a guest - a native expert on the Osage's construction of native structures; the narrative is in the mouth of the memory-keeper, in the history of the people. This is a gift - an expression of cultural sovereignty that is being shared by choice not coercion. The native students in the studio get to see cultural expressions within the studio context; their existence as a native person is not subjugated to a primitivized past but brought into a living, breathing, thriving, present. This is sovereignty. The non-native students have access to learn. To respect. To garner new knowledge.

Many indigenous building technologies and techniques are seen as a necessary future in the face of impending climate change and as a key component toward the aims of decarbonization in the built environment. Walls that breathe. Material from the earth. *Low impact. Low-tech.* Technologies and techniques in the hands and under the sovereign authority of native leadership and people are an expression of cultural continuity - of demonstrable control over their own histories; however, application of- and precedents based on- these technologies without the involvement of or power executed by native people is a point of tremendous harm. Demonstrating native presentism is a furthering of perceptions of engaged contemporaneity rather than primitivist stereotypes and myths that can inflict harm on efforts toward contemporary sovereignty.

06. We Stop Racializing

"Tribes, at least rhetorically, claim to organize themselves according to their inherent sovereignty and the idea of the tribal nation. If this is the goal, then racializing the tribe (naming that entity as only a biological entity) undermines both tribal cultural and political authorities."[26]
– Kim Tallbear

What if citizenship of the country of France, or Mexico, or the United States for that matter required you to have a specific amount of national blood - or DNA? Tribes are inherently non-racial.

Today, some tribal membership/citizenship is based on the Dawes Roll record-keeping while other tribes utilize other criteria. Established during the early 20th century, the claims toward citizenship were documented as blood percentages by federal record keepers on proto-census sheets that asked for names, and degree of "Indian blood" (such as ¼, ¾, etc.) but had no genetic and or ancestral proof to that end – these percentages were cultural but were *racialized*. These are the metrics Native citizenship had never been racial but political. Contemporary sovereignty is predicated on tribal control over political citizenship rather than racialized blood quantum. Yes, many issues are intersectional, but I urge you to hesitate when being tempted to use a phrase such as: "As we continue our designs for class remember that we are designing a racial reconciliation center for black and indigenous youth." The political implications of this racial flattening can cause harm to the sovereignty of native people. Refusing to further racialize native people furthers native sovereignty.

07. We Design for the Eighth Generation

Reservations are geographically bounded. Sovereignty exists only in part outside of that boundary; full sovereignty occurs within the boundary. There are spatial constraints within this legal frame. The architecture that is constructed on and for tribal nations is by necessity - local. There is no outsourcing. Architecture is part of a narrative of continual and persistent place-making and identity-forming.

A student logs into their computer. Grades are posted! Yay! A 92. Not bad. I wonder where I missed points. They examine the rubric once again: Criteria Number 04 - *"The student considered the impact of the work on at least eight future generations and evaluated possible schemes based on multi-generational investments. The design effectively considers and responds to future inheritors of the work, refusing to cause harm to future generations."* This doesn't mean that the work is permanent; no architecture is. What this means is that the architecture refuses to be a burden. It refuses to be static within the ever-evolving context of nation building. The student has learned to draw. To inscribe. To place lines on paper. Maybe to model. Considering the long-term flexibility and role of the design within the community; long-term design thinking helps to enable the future successes of nation building and tribal governance thereby supporting tribal sovereignty.

08. We Garner Communal Practices

The students host a potluck or a game night. Food. Laughter. Connection. Faculty are invited. A few attend. Stories are shared. Experiences in common are found. A Comanche student learns that you or perhaps another is native as well. The stories change. Conversation about community and the true cost of upward mobility occur. A non-native student has a casual conversation about the hunting rights of the Apache with another student. Both students leave feeling less alone and more informed at the same time. It shouldn't be radical, but the possibility of true and earnest community with our students is not a point of harm but one of growth, understanding, and mentorship. Architecture has an incredibly intimate pedagogy. The desk crit. The pin-up. The critique. We interrogate, but how often do we join in the community and learn something along the way? Learning is an inherently communal act. Perhaps one of the most radical acts of furthered sovereignty is true community.

09. We Cultivate Hope

Students shuffle into class. The video call is already on the screen. Four representatives from tribes across the nation have accepted your offer to participate in this symposium on hope. On hope?! The stories of land loss are difficult conversations full of pain and violence. But cultural *survivance* is worthy of celebration - worthy of hope. Each speaks of the programs, strategies, and commitments intended to serve their people. How is the community healthcare system reducing incarceration rates? What mental health facilities are allowing socio-emotional freedom for hundreds of citizens? What cultural programming is being shared with young kids? How have language programs increased high school graduation rates? The stories told about native people are often those of divorce, diabetes, and crime, but there is a resurgence of hope occurring as tribes continue their path of self-determination. One of the most provocative things that can be done to support tribal sovereignty is proactively providing space for the telling of stories of indigenous survivance as models for hope against cynicism.

10. We Project Indigenous Futures

A student is caught in "climate despair" or "eco-dread". The planet is warming. But I'm an architecture student. How can I make a change as the apocalypse comes my way?

"Indigenous people are post-apocalyptic . . . But if there is something you can learn from Indigenous people, it's what it's like to live in a post-apocalyptic society."[]

Despite land loss, genocide, assimilationist policies, child theft, native people have survived. They are here. There is an increasingly large genre of work on *indigenous futurisms* or *indigenous science fiction*. These works refuse to primitivize as tales are told of futures by, for, and with native people. The provocative ideas embedded in these genres have yet to gain traction in architecture, but what field can better project, represent, and otherwise design future worlds? We quite literally design future worlds. We project into being worlds that are otherwise unknown. We design, model, render, and thereby represent. Representations can support tribal sovereignty. Considering the unequivocal futurity of native people is one of the most radical acts in the support of tribal sovereignty. Perhaps it's an image, a model, perhaps it's a tower, a sculpture, but the sheer

futurity of a tribal nation is supported through the production of architectural knowledge. Leak the images to the press. Let the images speak to the future of native people.

We are here. And we aren't going anywhere. We remain.

Conclusion

These stories work to illustrate support for tribal sovereignty. Maybe they seem too small, but I firmly hold to the idea that big change doesn't have to be earth shattering. If each of us works to establish pro-sovereign methods within early design education then perhaps the world can be filled with a little bit more hope, joy, and belief that another future is possible. These stories are meant to illustrate small, yet impactful, ways in which beginning design educators can further tribal sovereignty.

End Notes

1 Strommer and Kickingbird, "Indian Self-Determination," 2.
2 Strommer and Osborne, "The History, Status, and Future of Tribal Self-Governance Under the Indian Self-Determination and Education Assistance Act," 2.
3 Kessler-Mata, *American Indians and the Trouble with Sovereignty*, 30.
4 Anonymous, "Government Rolls out $1.9B Indian Land Buyback Program."
5 Cornell and Kalt, "Sovereignty and Nation-Building," 194–95.
6 Field, Leventhal, and Cambra, "Mapping Erasure," 873.
7 Meza, "Indian Education," 353.
8 Eddie et al., "Practicing Tribal Sovereignty Through a Tribal Health Policy."
9 Edmunds et al., "Tribal Housing, Codesign, and Cultural Sovereignty," 727.
10 Deloria, *Indians in Unexpected Places*, I.
11 TallBear, *Native American DNA*, 28.
12 United States Congress Senate Committee on Indian Affairs), "From Languages to Homelands," 4.
13 Lima, "Individual Protagonists, Literary Communities, and the Collective Rights of Tribal Nations in Louise Erdrich's Love Medicine," 325.
14 Jorgensen, *Rebuilding Native Nations*.
15 Dillon and Neves-Marques, "Taking the Fiction Out of Science Fiction."
16 McGirt v. Oklahoma.
17 Oklahoma v. Castro-Huerta.
18 Shoemaker, "Complexity's Shadow," 487.
19 Bryan, "A 'Most Essential' Power."
20 Pevar, *The Rights of Indians and Tribes*, 338.
21 Biolsi, "Imagined Geographies," 250.
22 "Native Lands."
23 Walton, "Education Center in Alaska with a Facade That Resembles Salmon Skin."
24 Bula, "Squamish Nation, Vancouver Sign Deal for City Services at New Senakw Development."
25 TallBear, "DNA, Blood, and Racializing the Tribe," 84.
26 Serpe, "Indigenous Resistance Is Post-Apocalyptic, with Nick Estes."

Bibliography

Anonymous. "Government Rolls out $1.9B Indian Land Buyback Program." *Sho - Ban News*. December 27, 2012, sec. REGIONAL.

Biolsi, Thomas. "Imagined Geographies: Sovereignty, Indigenous Space, and American Indian Struggle." *American Ethnologist* 32, no. 2 (2005): 239–59. https://doi.org/10.1525/ae.2005.32.2.239.

Bryan, Michelle. "A 'Most Essential' Power: The Case for Comprehensive Tribal Sovereignty Over Land Use in Indian Country." SSRN Scholarly Paper. Rochester, NY, December 20, 2022. https://doi.org/10.2139/ssrn.4308236.

Bula, Frances. "Squamish Nation, Vancouver Sign Deal for City Services at New Senakw Development." *The Globe and Mail*. May 26, 2022, British Columbia edition, sec. News.

Cornell, Stephen, and Joseph P. Kalt. "Sovereignty and Nation-Building: The Development Challenge in Indian Country Today." *American Indian Culture and Research Journal* 22, no. 3 (October 1, 2007): 187–214. https://doi.org/10.17953/aicr.22.3.lv45536553vn7j78.

Deloria, Philip Joseph. *Indians in Unexpected Places*. CultureAmerica. Lawrence, Kan: University Press of Kansas, 2004.

Dillon, Grace, and Pedro Neves-Marques. "Taking the Fiction Out of Science Fiction: A Conversation about Indigenous Futurisms - Journal #120 September 2021 - e-Flux." Accessed March 12, 2023. https://www.e-flux.com/journal/120/417043/taking-the-fiction-out-of-science-fiction-a-conversation-about-indigenous-futurisms/.

Eddie, Regina, Caleigh Curley, Del Yazzie, Simental Francisco, Ramona Antone-Nez, Gloria Ann Begay, Priscilla R. Sanderson, et al. "Practicing Tribal Sovereignty Through a Tribal Health Policy: Implementation of the Healthy Diné Nation Act on the Navajo Nation." *Preventing Chronic Disease* 19 (November 23, 2022): E78. https://doi.org/10.5888/pcd19.220106.

Edmunds, David S., Ryan Shelby, Angela James, Lenora Steele, Michelle Baker, Yael Valerie Perez, and Kim TallBear. "Tribal Housing, Codesign, and Cultural Sovereignty." *Science, Technology, & Human Values* 38, no. 6 (November 1, 2013): 801–28. https://doi.org/10.1177/0162243913490812.

Field, Les W., Alan Leventhal, and Rosemary Cambra. "Mapping Erasure: The Power of Nominative Cartography in the Past and Present of the Muwekma Ohlones of the San Francisco Bay Area." In *Recognition, Sovereignty Struggles, and Indigenous Rights in the United States*, edited by Amy. E. Den Ouden and Jean M. O'Brien, 287–310. A Sourcebook. University of North Carolina Press, 2013. https://www.jstor.org/stable/10.5149/9781469602172_obrien.14.

Jorgensen, Miriam. *Rebuilding Native Nations: Strategies for Governance and Development*. Tucson: University of Arizona Press, 2007.

Kessler-Mata, Kouslaa T. *American Indians and the Trouble with Sovereignty: A Turn Toward Structural Self-Determination*. New York, UNITED STATES: Cambridge University Press, 2017. http://ebookcentral.proquest.com/lib/oks-ebooks/detail.action?docID=5101540.

Lima, Enrique. "Individual Protagonists, Literary Communities, and the Collective Rights of Tribal Nations in Louise Erdrich's Love Medicine." *Modern Fiction Studies* 62, no. 2 (2016): 307–29.

McGirt v. Oklahoma. Accessed March 12, 2023.

Meza, Nizhone. "Indian Education: Maintaining Tribal Sovereignty Through Native American Culture and Language Preservation." *Brigham Young University Education & Law Journal* 2015, no. 1 (January 2015): 353–66.

Native-Land.ca. "Native Lands." Accessed March 12, 2023. https://native-land.ca/.

Oklahoma v. Castro-Huerta. Accessed March 12, 2023.

Pevar, Stephen L. *The Rights of Indians and Tribes: The Basic ACLU Guide to Indian and Tribal Rights*. 2d ed., Completely rev. and Up-To-date. American Civil Liberties Union Handbook. Carbondale, IL: Southern Illinois University Press, 1992.

Serpe, Nick. "Indigenous Resistance Is Post-Apocalyptic, with Nick Estes." *Dissent Magazine*, July 31, 2019. https://www.dissentmagazine.org/online_articles/booked-indigenous-resistance-is-post-apocalyptic-with-nick-estes.

Shoemaker, Jessica A. "Complexity's Shadow: American Indian Property, Sovereignty, and the Future." *Michigan Law Review* 115, no. 4 (2017): 487–552.

Strommer, Geoff, and Kirke Kickingbird. "Indian Self-Determination: Four Decades of Extraordinary Success." *Human Rights* 40, no. 4 (2015): 2–6.

Strommer, Geoffrey D., and Stephen D. Osborne. "The History, Status, and Future of Tribal Self-Governance Under the Indian Self-Determination and Education Assistance Act." *American Indian Law Review* 39, no. 1 (2014): 1–75.

TallBear, Kimberly. "DNA, Blood, and Racializing the Tribe." *Wicazo Sa Review* 18, no. 1 (2003): 81–107.

———. *Native American DNA: Tribal Belonging and the False Promise of Genetic Science*. Minneapolis, MN: University of Minnesota Press, 2013. United States Congress Senate Committee on Indian Affairs). "From Languages to Homelands: Advancing Tribal Self-Governance and Cultural Sovereignty for Future Generations : Hearing before the Committee on Indian Affairs, United States Senate, One Hundred Sixteenth Congress, Second Session, December 9, 2020." S. Hrg. 116. Washington: U.S. Government Publishing Office, 2021.

Walton, Chris. "Education Center in Alaska with a Facade That Resembles Salmon Skin." *The Architect's Newspaper* (blog), October 14, 2022. https://www.archpaper.com/2022/10/facade-resembles-salmon-skin-kenaitze-indian-tribe-education-center-alaska/.

Before the people came.
The shift from empathy words to design action on land-grant University campuses.

Hala Barakat, University of Idaho

Abstract

This research project responds to acknowledgment statements by Land-Grant Universities and challenges the use of empathy words as acknowledgment statements to the injustices endured by Indigenous Tribes. The Morrill Acts caused not only the loss of home but also the disruption of income for tribal nations, affecting their communities until today (Morrill Act, 2020)
Urban changes are physical traces of the injustice and abuse witnessed by the land over time. The buildings on campus are shifts in the landscape's memory that was once home to Indigenous nations. This research aims to explore different methods for turning empathy words into machines for early design students, while questioning ways architecture can aid in historical reclamation. The project proposes an experimentation of nodes within a land-grant University campus that raise awareness of the injustice and harm endured by tribal nations.

As we start to explore rapprochement ideas, the context serves as the starting point. Similar to how Samir Harb dissects the landmark inside the political wall in the article 'The [Arch] Comicologies: How to Construct a Narrative,' the starting point is fragmented into three axes: vertical, horizontal, and the point of intersection. Vertically, it involves the material transformation of the history, politics, and economics of the urban fabric. Horizontally, it concerns the methods of distributing materials within a city. Finally, the point of intersection represents the disintegration of the narrative into singular events (Harb). This point becomes a relief in the injustice and the most current node of space and time.

Machines of acknowledgement for the Nimiipuu Nez Percé Community
Through a process of continuous iteration and improvisation, students were encouraged to practice flexibility in their design by maintaining an open-ended form expectation throughout the process. As part of this project, students collectively read the book 'Decolonizing Methodologies – Research and Indigenous Peoples' by Linda Tuhiwai Smith, which taught them how history has been falsely structured and presented on behalf of tribal nations over the years. Starting with collage making, the students defined narratives of appreciation for the Nimiipuu Nez Percé community. The project is divided into four scales: the city as the place of Indigenous land, the territory as the boundary of lost space, the landscape as the connection between structures built and the land, and the idea as the purpose of cognizance in preserving cultures. The main question the project addresses is: how can we design spaces of belonging and reclamation for the Nez Percé tribe on the land-grant campus of the University of Idaho?"

Introduction

The Morrill Act of 1862 established land-grant universities in each state and territory of the United States. The act granted federal lands to the states to fund the creation of colleges and universities focused on agriculture, engineering, and military science. As a result of the Morrill Act, 52 land-grant universities were created. However, in many cases, tribes were forcibly pressured to sign treaties and their stories were often negated from educational and governmental systems by the federal government (Morrill Act, 2020).

"UofI Moscow is located on the homelands of the Nimiipuu (Nez Perce), Palus (Palouse) and Schitsu'umsh (Coeur d'Alene) tribes. We extend gratitude to the indigenous people that call this place home, since time immemorial. UofI recognizes that it is our academic responsibility to build relationships with the Indigenous people to ensure integrity of tribal voices."

The above statement is an Acknowledgment by the University of Idaho, recognizing the loss and injustices suffered by Indigenous tribes of which the university is situated on their land due to the Morrill Acts that led to the establishment of land-grant universities. This research acknowledges that no statement can undo the injustice caused, this paper aims to revitalize Indigenous knowledge through research and design proposals at the beginning design studio level.

The project focused on researching and discovering hidden narratives in history, practicing sensitivity in decision-making guided by the research and statements of the tribe, and acknowledging faults and injustices inflicted on the tribe. Through transparency in research and design, the student projects aimed to highlight the extent of loss

suffered by the Nez Percé tribe. The process throughout the project involved intensive layering, where thoughts, emotions, stories, and maps provided organization to the students' understanding of land usage.

Understanding Impacts of Land- Grant Universities

The Land-grant universities project has uncovered the expropriation of Indigenous land as the foundation of the land-grant university system through extensive research and reporting. The project has developed a unique database that presents exploitative information related to the universities and the Morrill Act, which affected 245 Tribal nations and displaced the majority, resulting in the seizure of 10.7 million acres as 79,410 parcels granted and distributed to the benefit of 52 universities. One of the universities that benefited from the Morrill Act was the University of Idaho, which received 87,445 acres from the state after paying only $1,214 for Indigenous title. The university made $452,113 in endowment principal raised from the grant, with 33,526.85 acres of the seized land remaining unsold to this day. In essence, the University of Idaho made an endowment return of 372 times the amount paid to the tribes (Lee, Robert, 2021).

Knowns and Unknowns

Today, otherness is a prevalent issue, evident at various levels through the influence of social media. According to the book "Decolonizing Methodologies," the crux of the problem lies in the misrepresentation of information and the falsification of history. Smith also mentions otherness as a process by which a privileged group constructs one or many subservient fragments by stigmatizing a difference, often misrepresenting it, presenting it as a repudiation of identity and a reason for potential racism.In class, students collectively defined otherness as a method of magnifying differences, disregarding the fact that we, as humans, have more in common than we realize. Achieving justice on a land-grant campus requires removing systematic boundaries imposed on people and the environment. The system requires a reversal effect and an immediate need to offer equal access to tools, opportunities, and accountability through mediation. Students examined treaties and celebrated Nimiipuu culture and provided the tribe a platform to share their own story. However, the knowns and unknowns of the struggles of the tribal nations are not well documented, and the threat of erasure and fear of sovereignty loss continue today. For tribal nations, the future of their nations is uncertain, and the land reclamation progress is unpredictable.

Space of Acknowledgment

Pedagogical Approach

Against this backdrop, students engaged in a 4-week beginning design studio project that sought to acknowledge the injustices faced by the Nez Percé, Nimiipuu Tribe in North Central Idaho. The project encouraged students to experiment with methods of designing that could serve as actions of acknowledgment. The studio project's aim was to sensitize the students to the loss of land and resources experienced by the tribe, as well as to foster empathy and grace in approaching the design process. (Lee, Robert, 2020)

In the student projects, transparency in research and design revealed the extent of loss suffered by the Nez Percé tribe. The design proposals are meant to be experimental with a speculative program selected by the students. The tribe not only lost their land but also a crucial source of economic resources. The Nez Percé were among the larger and more powerful tribes of the Plateau Indians, known for their fishing, hunting, and gathering of wild plants for food, as well as raising large herds of horses. The Nimiipuu, which means "We the People," have a long-standing connection to the lands and waters of what is now Idaho, Washington, Oregon, and Montana, long before the creation of the Nez Percé Reservation (“Who We are”).

The project had multiple goals that were meant to be pursued simultaneously and in a nonlinear fashion. These objectives included uncovering and highlighting hidden narratives in history, being sensitive and responsive to the input and guidance provided by the Nez Percé community, and approaching the design process with empathy, love and grace, while also acknowledging past injustices and wrongdoings that affected the tribe.

Project Structure

The project was guided by four scales that match with conceptual layers from Smith’s book. Students were required to address the following scales:

+ **City and place** - Imperialism: To properly examine the city and place layer, it is essential to acknowledge the displacement stories and mapping of tribal uprooting journeys that occurred due to imperialism on a national level. Smith's research reveals how imperialism has affected the collection, organization, and communication of Indigenous knowledge to the Western world, often resulting in misinformation and reinforcement of the power imbalance between Western and Indigenous knowledge systems. It is critical to recognize and address the impact of imperialism on Indigenous communities and their histories when analyzing the city and place layer at a national level. The city and place is represented with gestural 2-Dimensional models, combining injustice with Harb’s moment of intersection.
+ **Territory and boundary**- when studying history: By tracing boundaries, students examined the original land vs. reservation areas and focused on the loss of land experienced by the tribes. Highlighting the lost land allows students to visualize the fragmentation of culture. Through collage making, students were able to capture the fragmentation and struggles experienced by the Nez Percé communities.
+ **Landscape and context**- in writing: Connection to the site and land emphasizes the relationship between Indigenous peoples and nature, as well as the struggles of self-determination faced by Indigenous nations as they rewrite and reclaim narratives about their communities. Linda Tuhiwai Smith explains that decolonization is not simply rejecting all Western knowledge, theory, or research. Instead, it involves prioritizing their own perspectives and values, and then approaching theory and research in a way that is relevant and useful to Indigenous communities. In writing, students composed narrative statements to reflect on their intentions towards the spatial structure and selected a location on campus to host their interventions.
+ **Idea and purpose**- when exploring theory. As Smith explained in her book, it is essential to recognize how Indigenous peoples use theory to deal with contradictions and uncertainties. This layer can present challenges of decision-making for students as they attempt to design spaces that allow Indigenous people to assert their autonomy and make their own decisions. To successfully explore this stage, students work with a defined scale and develop several configurations of 3-Dimensional detailed models. (Smith, 2021)

Accountability and Empathy in Early Design

Responsibility towards identifying how the media and history books unjustly practice otherness on Native American Tribal nations. In the book Ruined by Design, the author Mike Monteiro discusses craft, ethics and how design is a political act. “What we choose to design and more importantly, what we choose *not* to design and, even more importantly, who we exclude from the design process- these are all political acts. “As part of the project students were given the responsibility to conduct their own research and accountability to understand the power of design and the statement they aim to imprint on the landscape. Monteiro also quotes *Victor Papanek*:

> *“You are responsible for what you put into the world. And you are responsible for the effects those things have upon the world*.”
> (Monteiro, 2019)

Accountability was emphasized as an empowering skill in the studio project. After conducting their own research, students took ownership of the design with confidence in reporting their findings.

Empathy in design involves a high level of sensitivity and accountability towards the spaces and users, where the designer and inhabitant become one. As the project was situated on a land-grant University, students felt a high level of responsibility and used this opportunity to express gratitude to the Indigenous people of the land. In the context of decolonization, empathy plays a crucial role in dismantling colonialist and imperialist forces and generating equitable relationships between different communities. By acknowledging the historical and ongoing injustices faced by Indigenous people, institutions and individuals can build new frameworks grounded in empathy and respect. (Smith, 2021)

Results

This paper presents 5 projects that respond to and divest from falsified histories in a beginning design studio. By the end of the semester, students demonstrated a higher awareness and sensitivity towards their concepts, approaching their design processes with more grace. When words fail to express social injustice, students in the studio generated spaces of reclamation with love and gratitude.

Discussion of our campus and community

The proposed project is a community center and amphitheater for the Nez Percé community on the University of Idaho campus. It demonstrates how architecture can be utilized to celebrate and honor a community's cultural identity. The community center and amphitheater will serve as a platform for community events, cultural performances, and educational programs, which can aid in the preservation and celebration of Nez Percé culture and history. The designs are motivated by a shared interest in the Landback Movement, which is a political statement advocating for the return of native lands to the tribes. (Landback, 2021)

Fig. 1 *Nugyen, Hoa, 2022. Physical Model Tower, Space of Acknowledgment, University of Idaho*

The design by Hoa Nguyen focuses on the recognition phase of the reconciliation process by proposing an observation tower that offers extensive views of the Palouse region, which was once home to the tribe. The tower is located between the old arboretum and the University of Idaho library, with a pathway connecting the two to create a promenade leading to the tower from the core to the outside edge of campus. To honor the tribe's connection to water sources, the design incorporates a water pathway as an element. The decision to connect the tower to the library is symbolic, as the library serves as a repository of historical records that allows the tribe to recenter their story. Physical model shown in Figure 1 and renderings of the design is shown in Figure 2.

Fig. 1 *Nugyen, Hoa, 2022.Floor plans, Journey collage and rendered views. Space of Acknowledgment, University of Idaho.*

Celebration of Traditions; the Confluence Project

The Confluence Project is a notable example of a community-driven effort to reconnect with the history and ecology of the land through art and education. The project serves as a model for how design can facilitate reconciliation and healing by honoring Indigenous traditions and perspectives. Maya Lin's Listening Circle at Chief Timothy Park is a powerful testament to the project's success, as it seamlessly integrates Native culture and natural elements into the landscape. The circular amphitheater design incorporates the wisdom and traditions of the Nez Percé tribe, creating a sacred space that respects the natural environment and engages visitors in a multi-sensory experience. By highlighting the history and ecology of the land, the project encourages visitors to reflect on the past and consider the future, promoting empathy and understanding between cultures. As Maya Lin explained:

> *"When we look at this place, we reflect back in time, not just 200 years but deeper, we look at it from the different cultures that have lived here as well as the ecological history of these places."*
> (Chief Timothy Park, 2015)

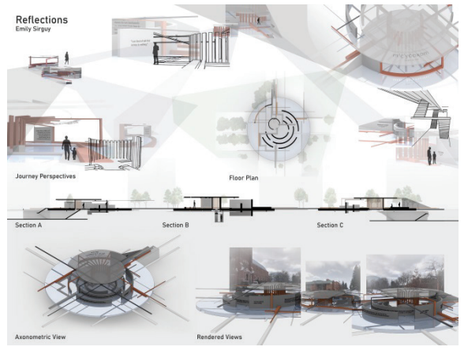


Fig. 3 *Sirguy, Emily 2022."Reflcetions" project Drawings, Space of Acknowledgment, University of Idaho.*

"Reflections," a project by Emily Sirguy, focuses on the role of the designer as a creator and the responsibility that comes with this power. As builders of history, designers have the ability to shape how future generations understand the past. This responsibility is particularly important when working with the cultural footprints of communities like the Nez Percé tribe. The Nez Percé tribe has a rich and complex history that includes both periods of prosperity and resilience, as well as traumatic experiences of displacement, forced assimilation, and cultural loss. As such, it is crucial for designers to approach their work with a mindset of preservation and awareness. The Nez Percé tribe's history and culture are not just relics of the past, but rather living and evolving aspects of their identity and worldview.

Sirguy's project, shown in Figure 3, enforces the importance of awareness in design as a method of creating structures and projects that celebrate the Nez Percé tribe's heritage, elevate their narratives, and affirm their place in our collective history. The Listening Circle, a part of the "Reflections" project, is not just a structure, but rather a living tribute to the Nez Percé tribe's cultural heritage and a place for them to tell their story for generations to come.

The Listening Circle is a circular structure that serves as a gathering space for the Nez Percé tribe and visitors to the University of Idaho campus. The structure is situated on the edge of a pond, creating a space of contemplation and reflection. The structure is made of local wood, a nod to the traditional use of wood in Nez Percé culture. The roof is made of copper, which will patina over time and serve as a symbol of the structure's evolution and the tribe's resilience.
The Listening Circle is not just a structure; it is a space for storytelling, education, and community-building. It is a place where the Nez Percé tribe can share their history, culture, and perspectives with visitors and future generations. The structure also serves as a physical reminder of the importance of preserving and honoring the cultural footprints of indigenous communities.

Designers have a responsibility to approach their work with a mindset of preservation and awareness, particularly when working with the cultural footprints of communities like the Nez Percé tribe. Sirguy's "Reflections" project and the Listening Circle serve as an example of how designers can create structures and spaces that celebrate and honor cultural heritage, elevate narratives, and affirm a community's place in our collective history.

Researching Indigenous Traditions

Paige Headman's project exemplifies the importance of respecting the wishes and needs of the tribal nations. As Headman points out, assuming we know what they want and need can be a major challenge. The Nez Percé tribe, like many other indigenous communities, have their own unique cultural heritage and values that must be acknowledged and respected. This is particularly important when it comes to the design of spaces that are intended to honor and celebrate their history and contributions.

Headman's project in Figure 4, offers a thoughtful and intentional approach to designing a space that not only recognizes the Nez Percé tribe's immense sacrifice but also acknowledges their desire for control over their own narrative. By creating an outdoor classroom that spans three levels, the project seeks to provide visitors with a deeper understanding of the tribe's past, present, and future aspirations. The use of locally sourced pine wood, community-created concrete, glass for self-reflection, and handmade adobe bricks is a testament to the importance of conscious material selection and the consideration of the tribe's values in the design process.

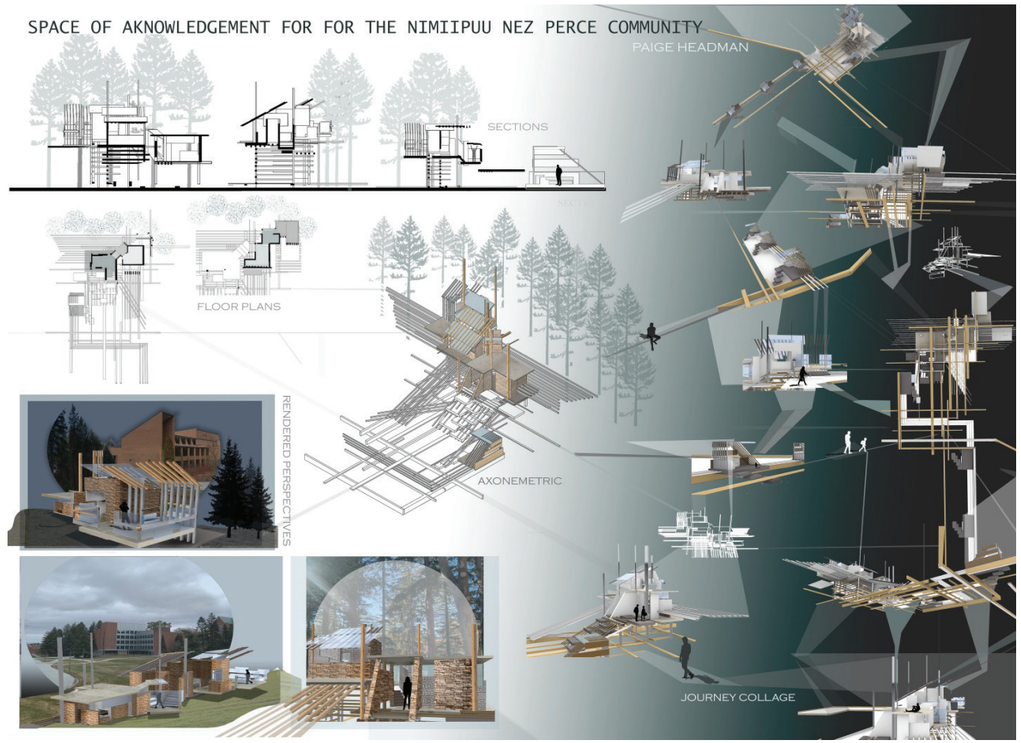


Fig. 4 *Headman, Paige 2022."Space of Acknowledgment for the Niumiipuu Nez Perce Community" project Drawings, Space of Acknowledgment, University of Idaho.*

Moreover, the project is not just about recognizing the past; it also seeks to highlight current events, customs, and traditions that are still relevant to the tribe today. By featuring stories and details that the tribe wishes to tell the world, the project serves as a platform for the tribe to share their history and cultural heritage in their own way. The balcony overlooking the Snake River, a significant part of the tribe's culture, is a fitting culmination of the space, providing visitors with a connection to the land and the tribe's deep connection to it.

In summary, Headman's project serves as a reminder of the importance of listening to and respecting the wishes and needs of tribal nations when designing spaces that aim to honor and celebrate their cultural heritage. The project also showcases the significance of conscious material selection, community involvement, and thoughtful design in creating spaces that are not just aesthetically pleasing but also culturally meaningful and respectful.

Collage making – Constructing a narrative

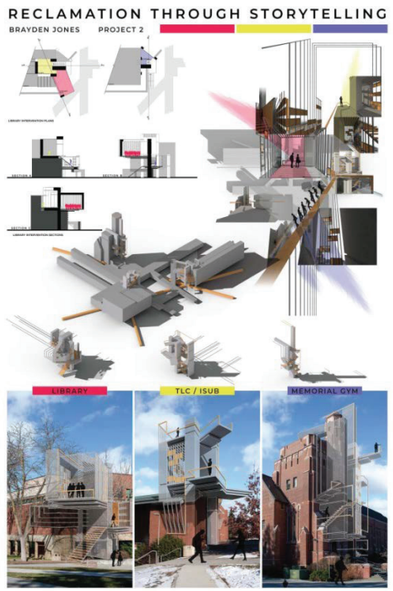


Fig. 5 *Jones, Brayden 2022."Reclamation through storytelling" project Drawing and renderings on campus, Space of Acknowledgment, University of Idaho.*

Collage making can be seen as a powerful tool for reconnecting Indigenous communities with their past and reclaiming their cultural heritage. For many years, Indigenous communities have been subjected to the trauma of cultural suppression and assimilation as a result of colonization and imperialism. Through collage making, students are able to engage with the experiences of Indigenous peoples and to explore the complexities of their cultural history.

The process of creating a collage requires careful selection and composition of images, texts, and other visual elements that can represent different aspects of Indigenous culture. By selecting and arranging these elements, students are able to create a visual narrative that speaks to the unique experiences and histories of Indigenous peoples. In doing so, they are able to reflect on the complex ways in which Indigenous culture has been impacted by colonization and imperialism.

In addition to reattaching fragments of Indigenous history, collage making can also be seen as a method of healing and empowerment. By reclaiming their cultural heritage through visual storytelling, Indigenous communities can assert their identity and challenge dominant narratives that have sought to erase their history. Collage making can also foster a sense of community and belonging by allowing individuals to come together to share their experiences and perspectives.

In the project “Reclamation through storytelling”, Brayden Jones narrates the origin story of the Nimiipuu tribe called 'Coyote and Monster,' where a Coyote saves the people from a monster that had eaten them all. The story is adopted into smaller machines growing on campus, reclaiming important buildings on the University of Idaho campus, situated on traditional Nimiipuu land. The library now serves as a community center, kitchen, and bathroom, while the Teaching and Learning Center (TLC) and Memorial Gym host mountainous structures that allow visitors to observe the campus and Nimiipuu land from above. Each intervention provides a unique journey to discover the history and tradition of the Nimiipuu tribe, similar to the journey young people go on to discover their spiritual guide, weyekin, in Nimiipuu tradition shown in figure 5.

The final project discussed, shown in figure 6, by Quinn Anderson focuses on creating an environment that encourages learning, instills a feeling of peace, and promotes personal reflection. The design magnifies the division of land, prompting a direct confrontation with past wrongdoings. Anderson uses fire as the main element of the boundary engraved into the landscape. This project reflects upon the design thinking process of a student. Anderson mentions that a line drawn by an architect possesses the power to violently interrupt what is, to force the imaginative concoction of what could be, upon the unknowing. Rather than continuing the personification of an architect’s line, the amphitheater proposes to expand the conversation to consider the underlying egotistic nature of humans that shaped the Nez Percé’s destiny today.

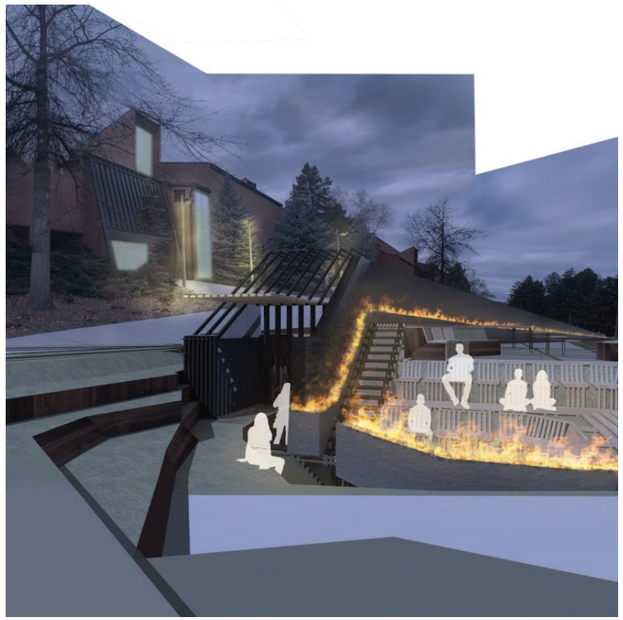


Fig. 6 Anderson, Quinn *2022.“Reflcetions” project Drawings, Space of Acknowledgment, University of Idaho.*

Conclusion

It is important to respect and remember the connection the Nez Percé tribe have with the land on which the campus is located. The projects mentioned in the paper, approach the assignment with responsibility and love. While the topic of injustice can be hard to introduce in early design, being a land-grant university helped students relate to the Tribe as we occupy the land today. Treating the entire project as a process, by having less dimensions and expectations to the final design allowed them to picture scenarios of peace and courage to start the conversation.

In future iterations of the project, it is important to prioritize the experiences of Indigenous students on campus and actively seek their input, as their communities work towards recentering Indigenous identity on a larger scale.

“When the blood in your veins returns to the sea, and the earth in your bones returns to the ground, perhaps then you will remember that this land does not belong to you, it is you who belong to this land.”
-Anonymous

Bibliography

"Chief Timothy Park." Confluence Project, 2015 https://www.confluenceproject.org/river-site/chief-timothy-park/.

Harb, Samir. "[Arch]Comicologies: How to Construct a Narrative." southasastateofmind. SOUTH AS A STATE OF MIND ARTS AND CULTURE PUBLICATION. Accessed February 12, 2023. https://southasastateofmind.com/article/archcomicologies-how-to-construct-a-narrative/.

"Landback." LANDBACK. NDN Collectives , 2021. https://landback.org/.

Lee, Robert, and Tristan Ahtone. "How They Did It: Exposing How U.S. Universities Profited from Indigenous Land." Pulitzer Center, May 19, 2020. https://pulitzercenter.org/stories/how-they-did-it-exposing-how-us-universities-profited-indigenous-land.

Lee, Robert, Tristan Ahtone, and Margaret Pearce. "Land-Grab Universities. A High Country News Investigation." Landgrabu.org. This project was created in partnership with the Fund for Investigative Journalism and the Pulitzer Center for Crisis Reporting. Accessed February 15, 2023. https://www.landgrabu.org/.

Monteiro, Mike. Ruined by Design: How Designers Destroyed the World, and What We Can Do to Fix It. SFCA: Mule Design, 2019.

"Morrill Act (1862)." National Archives and Records Administration, May 20, 2020. https://www.archives.gov/milestone-documents/morrill-act.

Smith, Linda Tuhiwai. Decolonizing Methodologies: Research and Indigenous Peoples. 3rd ed. London: Zed Books, 2021.

"Who We Are." Nez Perce Tribe, n.d. https://nezperce.org/about/.

A Place of Value: Creating through Introspection and Communication.

Jonathon Kenneday Stevens, Florida A&M University, School of Architecture and Engineering Technology

Introduction

This paper reviews a unique space created by an – out-of-sequence – third-year architecture design studio and the pedagogy that facilitated the re-emergence and place for understanding personal values, dialogue, observations, and relevance. This qualitative inquiry looks into emphasizing empathy and human-centered design in a post-pandemic architectural design studio.

In the spring of 2022, an atypical architectural design studio was developed for young – out-of-sequence – designers who had transferred or missed a studio and were interested in participating in the upcoming fourth-year class. Along with bringing the students up to speed with the architecture department's curriculum, there was also a unique obstacle; these students were also returning to an in-person studio environment after being a part of the pandemic virtual - completely remote - education generation. Florida A&M University's Department of Architecture, like 84 percent of University Programs across the United States[1], was forced to move teaching and learning to online-only instruction due to the Covid-19 pandemic. Along with the tragic events during the pandemic, this change in the typical academic system disrupted many students' education and in-person educational experiences. One of these students expressed their experience this way:

> *Design online was not enjoyable at all so I was definitely looking forward to in-person classes, but I also felt that being online for so long would have adverse effects on my education in some way.* (Course Survey 01)

During the pandemic, online learning did push the education system to adapt. And though online learning may have been a means to an end, virtual education can continue to help bridge some diversity, equity, and inclusion (DEI) education gaps. Being one of the core courses for an architecture student's academic semester, the architectural design studio continually encounters the challenges of a changing education environment and the transition of known and unknown social environments. So as architectural education evolved and was questioned during and after the Covid-19 pandemic, so have the roles of educators and students. And once the World opened up and in-person University courses began, we all entered into our familiar places with new visions of reality. Environments that held the lingering effects of the pandemic produced a wide variety of personal and, by proxy, anxiety. With these pandemic experiences added to personal stories, students and educators had to remember the stowed-away elements of a changed path that engaged the demands of remembering the skills and discernment; while re-engaging in new surroundings that require diversified communication, empathy, and mutual respect. And with this re-discovery of stowed-away knowledge, a unique challenge emerged. How can a teaching method be adapted to facilitate the growth of student opportunities stalled by a changing social and educational system? Or, in this particular case, a pandemic.

Re-engaging Values

To imagine a possible solution to re-engagement challenges, I relied on past inquiries regarding group communication and feedback. Pre-pandemic, I guided students through conversations about value systems and communal participation. Through these experiences, I began to propose that by creating spaces that provide equality and the use of cultural values – to bolster fundamental design principles – our built environment can promote an improved human experience. To attempt this endeavor in a post-pandemic in-person architectural design studio, inclusion and communication were once again used in a philosophy that focused on personal values in a transformative way. And by using a redefined pedagogy to emphasize individual and group conversations, empathy, and introspection, we as a group would begin to understand how values and communication should be used to create our built environment to promote equality and human-centered design.

To support the student's return to an architectural design studio environment and the re-engagement with their classmates, the course's first exercise proposed that the students quantify their values before presenting them to the class. And though the need to wear masks provided a veil of personal separation, the students seemed willing to reconnect once in the studio space. Here is one student's account:

> *Returning to an in-person studio, was worrisome, due to many reasons. Firstly, health and safety, as we were still adjusting to pandemic policies and procedures. Secondly, readjusting to the hours of studio and knocking off design rust. Lastly, adjusting to a more competitive feeling environment, as zoom created a more relaxed and "pressure free" environment. However, regardless of*

these "concerns," I was still eager to return to the work environment of a design studio. (Course Survey 02)

From pre-pandemic assignment outcomes, I learned that students were willing to freely share what they believed to be memorable or valuable. The exercise prompt is simplistic, but I've found that it works well to help the students open up while presenting them with alternate views about value systems and opinions. And for this post-pandemic design studio, I thought it would be a poignant entry point into critical thought and reflection. The list they create has 15 common and uncommon values – a length where they generally need to stretch beyond the typical comments – to get to values that can be taken for granted. After creating their list and during the sharing process, the students become aware that they share many of the same values while discovering unique elements about their colleagues. A transformation of perspective. During the subsequent conversations, there are often statements of agreement and comments similar to:

I think sharing personal values allows a deeper insight into who you are, and coming off of a year of "isolation" this type of topic allowed a personal connection between peers, that would have been missing. It was great to hear about others and what mattered to them. (Course Survey 02)

The sharing of values continues to be a low-risk exercise where the students can divulge as much as they're comfortable with before discussing the possible assumptions they bring to the studio. Some students knew each other, but a few were new to the FAMU culture. So, this personal engagement was the first step in our group communication. And from previous studios, I knew communication had a significant role in developing comradery. Still, I had no idea if there would be a willingness to share personal views or listen to alternative vantage points during this post-pandemic studio. Fortunately, there was an eagerness to have a personal connection with their peers. And these conversations about values began to produce a shared dialogue between each member engaged in the process. The re-engagement, reduction of assumptions, and the manifestation of a transformed pedagogy had begun.

Communication and Dialogue in an Architectural Design Studio

The sharing process was the first step in contributing to the student's understanding of the strengths of values and shared meaning. The intent was to have the students learn to express their values while listening and possibly understanding other people's points of view. The early outcomes of the conversations about values were fruitful, but it felt like we were walking at the edge of some boundaries. As a group, we were only just returning to an in-person academic environment, so I felt some apprehensions about creating something new. To guide them through the process of affirming their emerging voice, I adapted my pedagogy to use elements from David Bohm's dialogue method while having in-studio conversations. During the course, we read "On Dialogue," where Bohm describes the importance of communication and dialogue in helping to remove assumptions in our contemporary society.[2] And though Bohm's implementations were documented before the events of 2020, I believe his comments have become hyper-relevant following the Covid-19 pandemic. Here are Bohm's written thoughts about the need for communication in our contemporary society along with the academic environment:

"… in spite of this worldwide system of linkages, there is, at this very moment, a general feeling that communication is breaking down everywhere, on an unparalleled scale. … Moreover, in schools and universities, students tend to feel that their teachers are overwhelming them with a flood of information which they suspect is irrelevant to actual life."[3]

As defined by David Bohm, communication is used in a way "to make something common," to bring together a common direction to create something new together — a common act of creation.

"Is it not possible that our crude and insensitive manner of thinking about communication and talking about it is a major factor behind our inability to see what would be an intelligent action that would end the present difficulties?
It may be useful to begin to discuss the question by considering the meaning of the word "communication." This is based on the Latin commun and the suffix "ie" which is similar to "fie," in that it means "to make or to do." So one meaning of "to communicate" is "to make something common," i.e. to convey information or knowledge from one person to another in as accurate a way as possible.

…

Nevertheless, this meaning does not cover all that is signified by communication. For example, consider dialogue. In such a dialogue, when one person says something, the other person does not generally respond with exactly the same meaning as the first person. Rather, the meanings are only similar and not identical. Thus, when the second person replies, the first person sees a difference between what he meant to say and what the other person understood. On considering this difference, he may then be able to see something new, which is relevant to his own views and those of the other person. And so it can go back and forth, with the continual emergence of a new content that is common to both participants. Thus, in dialogue, each person does not attempt to make common certain ideas or items of information that are already know to him. Rather, it may be said that the two people are making something in common, i.e., creating something new together.
But of course such communication can lead to the creation of something new only if people are able freely to listen to each other, without prejudice, and without trying to influence each other."[4]

I find the possibility of both (or multiple) participants seeing something new particularly relevant for a design course. Especially when the goals are to listen without prejudice and without pushing your opinions on others. Additionally, communication is necessary to share personal and common values. Still, as defined by David Bohm, dialogue is used to develop a level of communication that allows the designer and user to set aside assumptions to create something new together.

"I give meaning to the word "dialogue" that is somewhat different from what is commonly used. The derivations of words often help to suggest a deeper meaning. "Dialogue" comes from the Greek word dialogos. Logos means "the word," or in our case we would think of the "meaning of the word." And dia means "through" – it doesn't mean "two." A dialogue can be among any number of people, not just two. … The picture or image that this derivation suggests is of a stream of meaning flowing among and through us and between us. This will make possible a flow of meaning in the whole group, out of which may emerge some new understanding. … And this shared meaning is the "glue" or "cement" that holds people and societies together."[5]

I've found that using dialogue in a design studio can also contribute to reducing the pressures behind assumptions. The type of opinions can lead to anxiety, mixed messages, intense reactions, and/or loss of time. Possibly, by alleviating some of these pressures or distractions, conversations can lead to better dialogue about the student's critical thought processes and the work they produce.

"We could also call these assumptions "opinions." An opinion is an assumption. The word "opinion" is used in several senses. When a doctor has an opinion, that's the best assumption that he can make based on the evidence. … But most are not of this nature – mostly they are defended with a strong reaction. In other words, a person identifies himself with them. They are tied up with his investment in self-interest.

…

The point is that dialogue has to go into all the pressures that are behind our assumptions. It goes into the process of thought behind the assumptions, not just the assumptions themselves."[6]

The removal of assumptions became one of the recurring commentaries in the course. Whether we were talking about project designs, presentation developments, or mile-stone reviews, the feedback became about limiting assumptions to contribute to the clarity of meaning. One of the course students described whether or not the review of communication and the removal of assumptions helped them better understand the designing process and engage with the possible user.

Yes. This exploration of "communication and removal of assumptions," allowed me to start to understand and practice design from concept to user at a more personal level and to consider the individuality of end users instead of general designing. (Course Survey 02)

And as the student pointed out, the design process was also considered from the view and possible opinions of the user. The course discussed the possibility of a designer or user's 'programmed memory.' In 2020, other tragedies, in addition to the pandemic, exemplified the need to participate in better dialogue to resolve implicit bias.

"It is important to see that the different opinions that you have are the result of past thought: all your experiences, what other people have said, and what not. That is all programmed into your memory. You may then identify with those opinions and react to defend them. But it doesn't make sense to do this. If the opinion is right, it doesn't need such a reaction. And if it is wrong, why should you defend it?"[7]

"In a dialogue, people are coming from different backgrounds typically have different basic assumptions and opinions. In almost any group you will probably find a great many different assumptions and opinions of which we are not aware at the moment."[8]

Personal and outside assumptions can lead in several directions, but with dialogue, a critical effort is not trying to change anything but being aware of it. And the central aspect I wanted to gain from introducing dialogue and the idea of reducing assumptions is the ability to help the student learn to comfortably express their thoughts while also considering the point of view of others in the conversation. Both of these conditions are important in creating architecture but also critically important in a post-pandemic society. Communication elements are always an element of design representation, but the information conveyed by academia is often only remedial and applied to appease the assignment. I wanted the students to learn the hang-ups that can happen when design communication (verbal and visual) limits meaningful feedback. Values can

be applied beyond personal opinion, but if a reviewer needs help understanding what is represented, whether, through their assumptions or not, the conversation between the presenter and reviewer will be limited. Quality feedback was the goal.

Developing a Communal Meaning

As mentioned earlier, many students were beginning to return to in-person classes emotionally. And as we started the first design assignment, there was still a palatable sense of apprehension – among the students and me. The experience felt familiar but off and a little surreal. We had the challenge of remembering the skills and discernment. This remembering process was also happening while engaging in new surroundings that require a higher level of communication, empathy, and critical thought to complete an architectural design project. Once we started the in-studio dialogue about values and limiting assumptions, we stepped into the next project. The basis of the exercises was developed to be funneled into two essential cultural elements: shared values and meaningful communication. To emphasize these elements in this post-pandemic architectural design studio, a nuanced early semester 5-week design exercise became an entry point to challenge these architecture students to step into the unknown and discover a personal design process defined by their values, and opinions; while facilitating a venue to communicate and discuss their values through dialogue and into an interactive object. During this analytical design challenge, the students created physical expressions of values, awareness, and presence – A Place of Value.

The project prompt was an inquiry into the assumptions made due to personal values:

> We continually make judgments about our spatial and mental presence. These assumptions rationalize our imagination, guide our views, and lead us to position ourselves in society. We also use our values, awareness, and presence to navigate design assumptions and create our voice, but vocation or systemic pressures can also try to influence our thoughts about personal and shared experiences. To quell these influences, designers use communication as a tool to create a dialogue between the vantage points and environments inhabited by the Designer, Object, and User. So, as designers, how do we communicate our values to the shared environments around us?
>
> For this exercise, create a temporarily placed object that embodies a human-scaled moment in time. An object that symbolizes being present and a mark of value, i.e., memory, thought, location, vision, perspective. This project is an aesthetic exercise, and you should be expressing a voice through design, whether it is yours or a fictitious character, that adds value to the creation of your object.
>
> The purpose of this project is to develop a level of communication that can allow viewer/user/consumer assumptions to develop into a dialogue. During this analytical design challenge, you will need to make a physical expression that evokes communication between two inquisitors, the user and the creator.

I wasn't sure if the students would be able to leap into a theoretical exercise, so we referenced Designers/Architects/Artists Ettore Sottsass (Metaphors), Alan Wexler, Donald Judd (Objects), Andrea Zittel (AZ West), and Bernard Tschumi. And from the initial value exercise and theoretical discussions, dialogue and the removal of assumptions were put into action. Each student communicated their translation of values to the class and began proposing a design. The students chose to convey their own views with group and individual dialogue. Some students presented ideas engaging light, sound, movement, and time whereas others told personal stories. I felt this prompt diverged from other beginning architectural studio projects when the student started to analyze the user's point of view. Conversations about shared meaning within society were brought back to the surface. As Bohm suggests, to listen, suspend opinions, and see what it all means. And if you see what the options mean, you may be able to develop common content:

> *"The point is that dialogue has to go into all the pressures that are behind our assumptions. It goes into the process of thought behind the assumptions, not just the assumptions themselves.*
>
> …
>
> *I'm saying that it is necessary to share meaning. A society is a link of relationships among people and institutions, so that we can live together. But it only works if we have a culture – which implies that we share meaning; i.e., significance, purpose, and value. Otherwise it falls apart. Our society is incoherent, and doesn't do that very well; it hasn't for a long time, if it ever did. The different assumptions that people have are tacitly affecting the whole meaning of what we are doing."*[9]

After reviewing our positions as architectural designers in contemporary society, the students began to create their Place of Value. The students were asked to select a place, scale, and perspective. A level of reality was suspended to help convey their story. Their objects ranged from a suspended single-occupant urban structure to a time-based light-capturing structure in the desert. Material and environmental experiments were developing into shared experiences. The students gathered memories of their experiences and skill sets through this exercise. Beyond their competence in forgotten programs, like 3D modeling or presentation software, the students recalled the methods of in-person presentations while building skills through explanations and representation. If social conversations were changing, so was the requested or offered feedback.

As the students reached a level of implementation of their critical ideas and began to set up their presentations, we once again incorporated dialogue into our creative process. This time, dialogue would be used to understand the information exchange during a project review. To facilitate valuable feedback, full class presentations – commonly called critiques – were used to help point out areas of the project and presentation that made assumptions, were ambiguous or were left open to interpretation. Outside critiques are also valuable for testing and conveying design ideas. So, to understand the possibility of external assumptions, we referred to conversations about shared meaning. Design and presentation assumptions were continually discussed to direct the talking points in the direction the student wanted the conversation to move forward. To promote quality in-studio and outside feedback, post-pandemic, I incorporated a response process that focuses on the students having more agency in project reviews. This feedback technique was derived from the 'Critical Response Process developed by Liz Lerman. The key elements of a Critical Response Process session are the four core steps of the Process and the participants in three roles: a designer (student/artist) showing work, a group of responders (colleagues/ outside reviewers), and a facilitator (leader)[10] Below is a summary of the Roles and the Process:

The Roles

The Designer: Their work is the essential focus of a Critical Response session, and the Process typically relies on the designer's contribution. How a designer approaches the review will contribute to the efficiency of the conversations and the dialogue their work creates.

The Responder: Much like the typical jurors' part of an architecture critique, the Responders, in a Critical Response session, are a group of people who watch, read, listen to, and/or experience the work being reviewed. Depending on choice and circumstance, respondents can be friends or strangers, peers or public, experts or novices. Whoever they are, it is essential that those observers want the designer to do excellent work.

The Facilitator: A translator who understands the process, keeps the process on track, and helps to support an effective outcome — a coach of the various roles.

The Process (begins after a presentation)

Step 01: Statements of Meaning

For this step, the Responder is asked to provide comments and observations in a positive tone while searching for the meaning. *"It is in that moment the group reflection that responders first become aware of the numerous ways people see art [design], and the array of value systems underlying their different visions."*[11]

Step 02: Artist [Designer] as Questioner

"This step is the first of two rounds of questions and answers. The creator asks questions first. The more artists [designers] clarify their focus, the more intense and deep the dialogue becomes. … Specific questions, naturally, bring forth a more focused and precise commentary. … Artists [designers] can always broaden or narrow their exploration with a follow-up question if the original query doesn't yield the information they seek. … Often we observe that the artist [designer] has the same questions as those watching. When the artist [designer] starts the dialogue, the opportunity for honesty increases."[12]

Step 03: Neutral Questions from Responders

For this step, the responder asks for information and factual questions about the designer's presentation. The process suggests that the responder forms their opinion into a neutral question. *"The neutral question presents another aspect of the Process in which the facilitator needs to be active. For many people, forming a neutral question is not only difficult, but a seemingly ridiculous task if criticism is the point. But the actual process of trying to form opinions into neutral questions enables the responder to recognize and acknowledge the personal values at play."*[13] The formulation of neutral questions were common hang-ups.

Step 04: Permissioned Opinions

"Now the facilitator invites opinions, but specifies that opinions must be offered with a particular protocol: Responders first name the topic of the opinion and ask the artist [designer] for permission to state it."[14]
The designer may say yes or no depending on whether they've already received the feedback they're interested in or want to continue focusing the conversation on a specific part of their work.

I've begun to transform my studio feedback process to incorporate the general values of the Critical Response Process. After a functional process, the designer should have gained useful information, and the responders feel invested and engaged. And as Lerman suggests, this process can be used at any stage of the development of a project and is successful when integrated at a point when the designer can learn something of value to apply to future projects. With the realities of post-pandemic social and economic change, I believe that as educators, we are at a

time and place where we can better facilitate our student's voices — at the same time, allowing them to express or question opinions by giving them more agency in the review process of their work.

With consistent personal and educational environments, the project reviews became more open. The students not only began to express their interpretations of values but began to provide open feedback to their colleagues during preparatory and final project reviews. Using draft pin-up sessions as venues to discuss the designer's intentions, the students understood that their opinions could be vetted before a final presentation. And their questions could facilitate valuable feedback within a dialogue.

This process of feedback wasn't always positive. Lessons were learned, especially when outside reviewers were involved in the feedback process during project critiques. There were moments when the reviewers of the students' work made assumptions leaving the students disappointed and let down by the process. Sometimes the opinions of responders were overly specific, didactic, or technical. But the listening and procession of another person's perspective allowed the student to limit those assumptions in later projects and presentations.

Bohm's Dialogue method and Lerman's Critical Response Process created tangible support for a pedagogy that wanted the students to develop projects based on their personal values. I plan to continue implementing both going forward. The observation and feedback from the responders gave the students agency with their work. Each project manifested a unique perspective to discuss, and the dialogue before, during, and after reviews became a venue for the students to analyze and galvanize their value systems critically.

Review

Though there had been a mountain of change before remembering the know and returning to an architecture design studio environment, the group could engage in critical thought and conversation by pulling together pre- and post-pandemic experiences. With these insights, a transformed pedagogy was created that expanded on including communication, dialogue, and perspective. It was also encouraging to learn that introducing values and introspection in the opening stages and projects can set a reassuring tone for the rest of the semester. And each following phase of the studio continued to reassure the student's commitment to a communal dialogue process focused on values that evaluated and communicated a sense of personal relevance. The core elements promoted during the beginning introspective project supported the goal of facilitating young designers' growth after the extreme experience of a pandemic. Communication and observation grew to take significant roles in the studio, along with the student's engagement and agency. Here are a student's comments about whether they have used the ideas about equitable communication and dialogue during their following architectural design studio courses:

> *Yes, I have. Since Design 3.1, I have learned to get a better understanding of what is being asked of me, or what is being asked by the program and exactly how it affects not just design but end user (whether it enhances or not).* (Course Survey 02)

And as mentioned before, Bohm's theories and techniques encouraged communication without assumption. They became a part of the studio process in ways that helped the students understand and possibly suspend their judgments to get to the center of an inquiry. With the repeated use of the process, the students began to ask meaningful questions of their colleagues and me. Through practice, the students could move beyond their nervousness about asking questions and began to add critical thought to the conversations. These questions started to permeate into project reviews. Using elements of Lerman's 'Critical Response Process,' the students began to ask their colleagues supportive questions that helped the responders to discuss their thoughts in another way. The use of the Critical Response Process added to an empathetic studio environment based on inclusion rather than assumption. Presenters and their colleagues supported each other while having agency in the conversation with the responders. As the course progressed, a community of empathy and support grew within the studio environment. The general conversations about architecture increased from a limited amount to an occurrence in every class. And my faith in an evolving and expanding architecture community can, without prejudice, continue to promote a better human experience during this out-of-sequence architecture design studio.

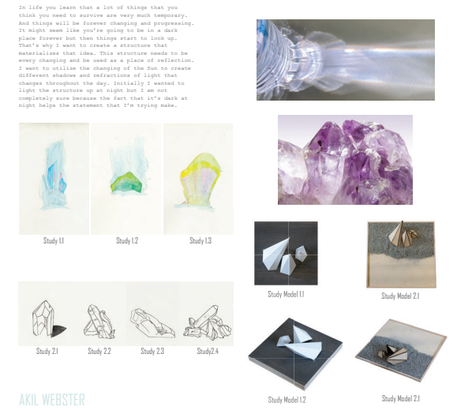
The unknown was re-established as known, and the student's confidence in explaining their process, their interest in hearing and questioning constructive feedback, and a supportive space emerged. Though challenges still occurred, as a group, they shed some of the communication hang-ups created by remote learning. The course concluded with a robust studio environment that had grown interested in defining personal values through listening, observing, and communicating their observations to others. By emphasizing inclusion and communication, a teaching method exposes something to the student and educator, a re-discovery of one's value.

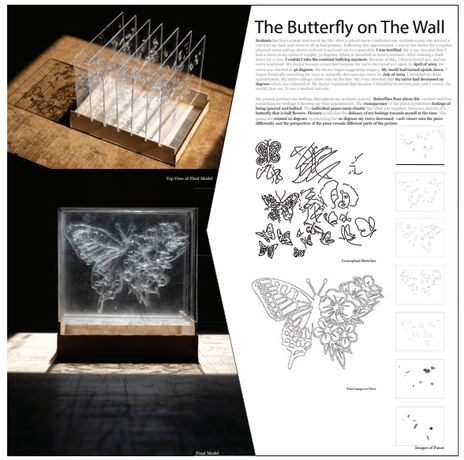
End Notes

1 Margaux Cameron, T. Austin Lacy, Peter Siegel, Joanna Wu, Ashley Wilson, Ruby Johnson, Rachel Burns, Jennifer Wine, RTI International "2019–20 National Postsecondary Student Aid Study (NPSAS:20)," NCES. 2021
2 Bohm, David. "On Dialogue" Routledge. 1996. p 01-54
3 Ibid., 01
4 Ibid., 02-03
5 Ibid., 06
6 Ibid., 09
7 Ibid., 09
8 Ibid., 12
9 Ibid., 9 & 22
10 Lerman, Liz "Critical Response Process" Dance Exchange. 2003. p 6-25
11 Ibid., 19
12 Ibid., 19-20
13 Ibid., 20-21
14 Ibid., 22
Course Survey 01, Anonymous Student, Design 3.1. Spring 2022
Course Survey 02, Anonymous Student, Design 3.1. Spring 2022

Bibliography

Bohm, David. On Dialogue. Routledge. 1996.
Lerman, Liz. Critical Response Process. Dance Exchange. 2003.





Solar Observatory in Two Acts: Familiar Performance and Polar Extremes

Victoria McReynolds, Texas Tech University

> "Recognizing the 'other' as an important part of the discipline, Le Corbusier suggested that when a window is to large or too small for a room - that is, when it is not as it is expected to be - it signifies the presence of architecture."[1]

Regardless of where you are in the world sunlight arrives to each and every latitude, yet the quality and duration of this light varies as one moves closer to the poles and the earth rotates around the sun. I introduce my second year second semester beginning design students to the otherness of arctic sunlight through an initial design of familiar sunlight. Familiar sunlight is the sunlight of our temperate regions as a majority of the world's population, according to Bill Rankin's population histogram[2] lives within 60 degrees from the equator. The typical global citizen experiences one sunrise and one sunset everyday.

This paper reflects on the semester work produced during two six-week design exercises in which students are charged with developing a solar observatory visitor center for each of the two idiosyncratic sites: one within familiar temperate region of 33 degrees latitude, the other approximates the poles at 78 degrees latitude. Reflections upon the work are organized within three sections: Semester Framework, Animating Sunlight, Terrain Characteristics. Semester Framework outlines the logic behind each site, and considers how moving from a familiar to an unfamiliar setting builds upon previous observations. Animating Sunlight considers the role tools for visualizing light shadow, both in the digital and physical realm, enhance formal and spatial development, while Terrain Characteristics looks at examples of how projects engage shallow and steep contours. Additionally, work is considered in sequence, exploring the operations completed by a single author as they adopt their work to varying site characteristics. In the concluding section reflections are made evaluating the framework with consideration given to emerging tools and areas of development.

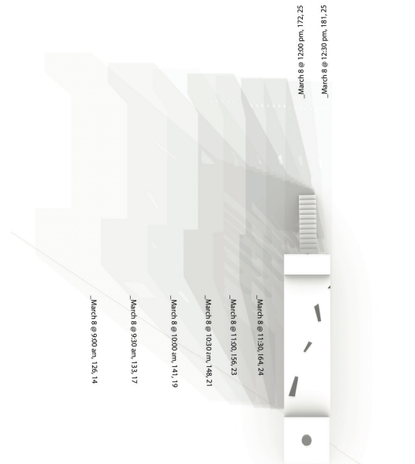


Fig. 1 Animating shadows over three hour duration.

---

[1] Peter Eisenman with Matt Roman. *Palladio Virtuel* (New Haven: Yale, 2015), 11.

[2] Bill Rankin, "The World's Population in 2000, by Latitude", Radical Cartography, 2008, http://www.radicalcartography.net/

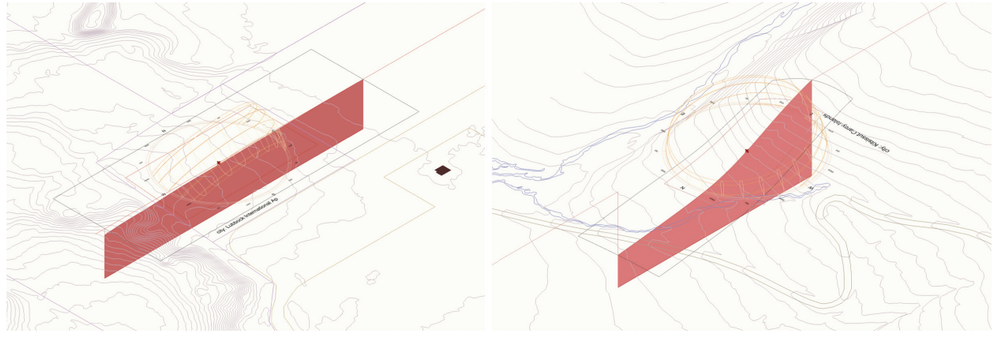


Fig. 2 Familiar and Polar Sites with single site section and corresponding sun polar charts.

Seeing light is challenging. Making sense of sunlight behavior for a remote location can be a daunting obstacle for beginning design students. By introducing light tools that demonstrate sunlight affect at a proximate site, such as the sun polar chart, sun peg diagram, and light & shadow studies, students test and assess their own imaginary assumptions of light performance. Repeating the design prompt at two different latitudes first supports students' introduction of such light tools, then depends upon students utilizing those vary light tools to develop forms in orchestration with sunlight accurate of each latitude performance. More successful work demonstrates an increase use and application of the light tools to test their own design development. The unexpected sunlight of 78 degree latitude is a site condition accessed through the initial method of working within their familiar 33 degree latitude where light performance is immediate in their physical environment and accessible through digital simulations. The aim of focusing on two fundamentally different locations is to make evident a clear line of design thinking that tracks their observation, analysis, and performance of sunlight within architecture. And the hope is that by coupling the familiar sunlight with proximate site and the distant location with an "other" seasonal light students will grasp the spatial importance of designing architecture with natural light.

Framework:

Accessing "other," as Peter Eisenman references in his quote above on Le Corbusier's window exaggeration, depends upon curating the expected. The student's awareness of unexpected seasonal arctic light is heighten through their initial tracking and analysis of expected diurnal sunlight that encourages closer readings of solar performance and illumination effects. Students repeat the course structured design methodology for both *Solar Observatory Visitor Centers* to emphasize comparisons between the familiar and unfamiliar. For example, the initial site, "Familiar Latitude," is a tabula rasa topography with shadowless sunlight organized around core learning objectives; (1) develop contextual response that addresses various orientation (solar, front & back, and shallow terrain); and (2) generate solar effects appropriate for the activity and purpose (i.e., grand hall, exhibition, offices, etc). Their second site, "Polar Extreme," located in Svalbard, Norway repeats the program while introducing new solar patterns requiring students to simulate the season horizontal sunlight.

Pedagogy of weather is an inescapable part of life for West Texas students. They might begin their day with a clear sky only to trek home in a dust storm or wade through a downpour. While beginning design students may start this studio not knowing how to calculating the location of the sun they are aware of the climate, and this project relies upon their familiarity with West Texas and more specifically the Llano Estacado region to introduce a design methodology that ties together architecture form in relation to light volumes. For some, asking them to consider solar patterns in itself is new and therefore reframes their way of seeing even familiar sites and context. Regardless of their previous awareness to terrain and sunlight, these students move through a process of design that relies upon physical and digital tools to close a design loop (or design feedback) with regards to light performance. Either the light is illuminating the space or creating the effect their intended or it is not. By prioritizing performance the student realizes design agency in their own development able to take confidence in their design decision rather than verbal cues by instructors.

Familiar Latitude builds upon the unique characteristics of the Llano Estacado as a place perceived as flat. General Randolph Marcy is quoted in 1852 as observing, "When we were upon the high table-land, a view presented itself as boundless as the ocean. Not a tree, shrub, or an other object, either animate or inanimate, relieved … a vast-ilimitable expanse of desert prairie." The first prompt leans into the perception of the Llano Estacado as a tabula rasa by maintaining an open horizon, yet challenges the reality of "flatness" by introducing a subtle shallow slope. Familiar Latitude also relies upon students' connection to diurnal patterns of sunrise and sunset, as well as the passing of overhead light. Expansive horizon and diurnal sunlight are site features the students are able to conveniently access.

Polar Extreme contrasts the familiar with unfamiliar sunlight and terrain conditions. At seventy eight degrees latitude, sunlight occurs in seasonal patterns, appearing for midnight sun and disappearing into polar nights for roughly four months at a time. This light is horizontal and more challenging to visualize. Additionally in the second prompt, the landscape is steep with a slope ranging from thirty to sixty degrees. The terrain is extremely challenging with vertical circulation operating as a design opportunity. Additionally, the dominant orientation of the site runs North-South while the primary site axis of the familiar latitude aligns East-West.

Changing sunlight patterns, site orientation, and terrain steepness are placed in relief through

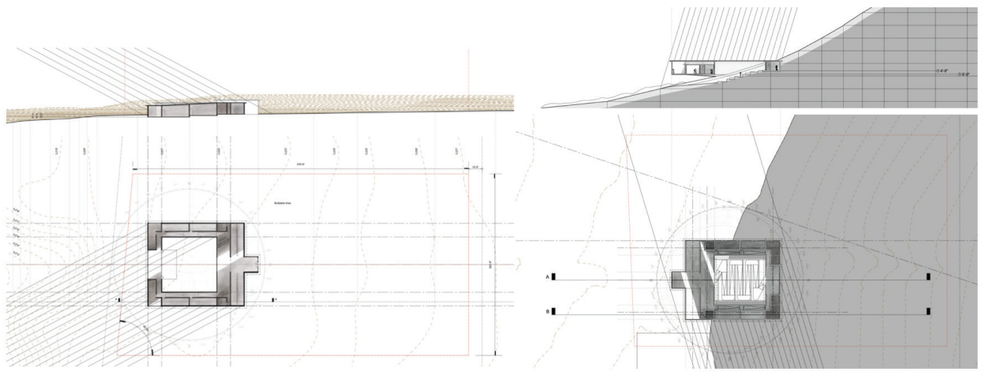


Fig. 3 Student design for 33 degrees (left) and 78 degree (right) site conditions.

their comparison. An additional point of comparison moving from a familiar to polar latitude is the adjustment of the Coordinate Reference System (CRS). Dominant North - South orientation assumes an orthogonal Cartesian matrix which is challenged when one relocates to the polar region where North-South longitude lines converge. Few students reflected upon this point within their projects, however it lent itself an opportunity to critique dominant modes of geo-positioning and viewpoints, such as the Western orientation of North being up, or the arrival to the limits of orthogonal grid logics.

Animating Sunlight:

Animating Sunlight: demonstration light in motion, tracking shadows cast upon site. Visual relationship between form and context. Became an opportunity to identify unique events, unexpected surprises or exceptional alignments. The Sun polar chart engages physical models to track light events occurring within the model and for tracking shadow conditions projected outside the physical model onto the site. Further shadow studies were accomplished using digital tools to reveal unique and surprising shadows occurring within the landscape.

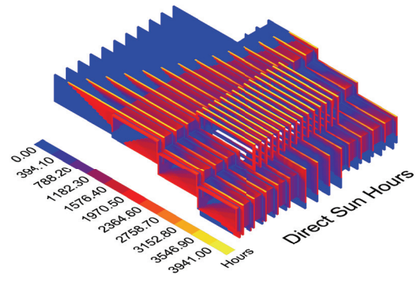


Fig. 4 Sun hour simulation as additional method for tracking sunlight.

thermal consideration. via scripting solar radiance and thermal properties.

This paper considers the students capacity to respond to “other” sunlight by comparing and contrasting their projects for 33 degree and 78 degree latitudes. The aim of focusing on two fundamentally different locations is to make evident a clear line of design thinking that tracks their observation, analysis, and performance of sunlight within architecture. And the hope is that by coupling the familiar sunlight with proximate site and the distant location with an “other” seasonal light students will grasp the spatial importance of designing architecture with natural light.

Conclusion:

Students explore architecture in relation to sunlight by developing two *Solar Observatory Visitor Centers* for two idiosyncratic sites: one within familiar temperate region of 33 degrees latitude, the other approximates the poles at 78 degrees latitude. Tools, such as the sun peg, solar polar chart, and timelapse imagery facilitated their light specific testing to support designs that address direct and indirect natural lighting as it relates to orientation, scale, and interiority. There exist opportunities for early introduction of solar radiance performance and

The Known and Unknown Past: Decolonizing the Canon for an Inclusive Future

Kristin M. Barry, PhD, Ball State University

Introduction

The symbiosis of architectural training and the study of architectural history is as old as the architectural professional itself. Ancient Greek architects traveled extensively to see the work of previous designers and build on the canon that would eventually be used by the Romans, "Renaissance Men" and contemporary Classicists. The historiography of architectural history is transparent in the western canon, and largely based on the canon itself. While precedent study and the perpetuation of building traditions is evident in most places around the world, western architectural education has historically had little need for looking outside the western canon, particularly in the study of Modernisms. The study of 19th and 20th century non-western architects, female architects, BIPOC architects, and LGBTQ+ architects has traditionally been relegated to single lectures in a semester architectural history survey or special courses devoted to these groups as "others" to avoid taking time away from canonical architects.

While great strides are being made toward a more inclusive study of architecture, decolonizing the traditional architectural history survey course to include work by marginalized communities can help beginning designers appreciate lesser-known histories that have impacted the built environment, and diversify the profession in the future.

The Beaux-Arts vs. Bauhaus Traditions in Architectural History Education

For a time, the French École des Beaux-Arts in Paris was the most prominent school of art and architecture in Europe, even drawing emerging American architects such as Richard Morris Hunt, Henry Hobson Richardson, and Julia Morgan in the early to mid-19th century. The Beaux-Art tradition, born initially out of the Académie Royale d'Architecture, a monarchy-funded school to teach design of royal buildings, focused heavily on the teaching of architecture and art from the perspective of the classical tradition, tracing European roots back to the architecture of ancient Greece and Rome. Similar to ancient architects, the École des Beaux-Arts curriculum engaged repeated precedent study as a way of understanding the built environment [Fig.1] and educating students in *architecture parlante* (French, "speaking architecture"). Derived from its initial roots in the Académie, the École des Beaux-Arts sought to enhance academic and professional understanding of classical principles, such as proportion, symmetry, and architectural Orders, that came together to form the Canon. David Leroy, one of the first educators to see through the transition from Académie to École described his weekly lectures as:

> "…the history of architecture and of the theory of the different branches of this art, the Orders, the buildings erected by the peoples of antiquity and the works of Vitruvius, Palladio, Scamozzi and Vignola…" [1].

The Beaux-Art education culminated in the Grand Prix de Rome, a competition for a scholarship to study in Rome itself, surrounded by these influential antiquities.

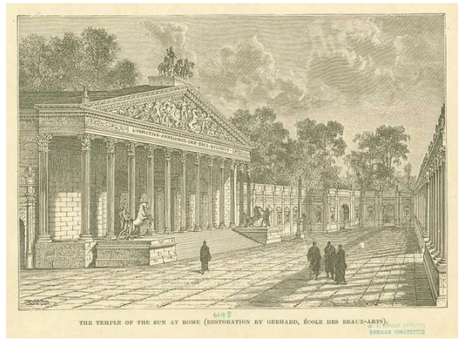


Figure 1 The Temple of the Sun at Rome, restoration by Gerhard, École des Beaux-Arts, ca. 1890.

This French tradition presented architecture as a system of signs and symbols—a language that was translated through historical knowledge and design application. Those who understood the tradition understood how to create new architecture that could be "read" by future architects. Students were required to prove what they know through drawing assignments, hand-rendering, traditional scholarship, and design projects. The partnership between the *atelier* (studio) and the lecture courses meant that

students garnered both a theoretical and entrepreneurial education, enabling them to translate these ideas into professional practice.

The Beaux-Arts pedagogical conversation with the past resulted in students who were well-versed in classical elements and their applications in a Neoclassical style of building, but not anything that would be considered contemporary or modern in approach. The curriculum at the École prepared students specifically for designing landmark buildings for the government or large private organizations, but not any architecture of necessity. The expense of including traditional classical forms on buildings meant that the commissions for this type of design were minimal, but as the school was considered the preeminent architecture school in the world, it continued to attract top international talent, which resulted in students bringing Beaux-Arts principles back to their home countries [Fig. 2]. The École des Beaux-Arts remains a prominent and influential design school (referred to as École Nationale Supérieure des Beaux-Arts after 1968), but was unable to keep up with emerging modernist ideas in the late 19th and early 20th centuries, encouraging potential applicants to go elsewhere to find modernist ideas.

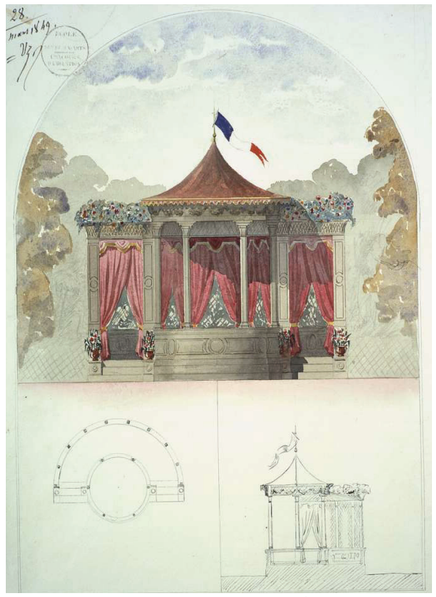


Figure 2 Bandstand design, Richard Morris Hunt École des Beaux-Arts, ca. 1849.

The Grand-Ducal Saxon Art School was founded in 1860, and concentrated its curriculum on the Barbizon School tradition of nature as inspiration. It eventually merged with two other important art schools to become the Grand-Ducal Saxon School for Fine Arts, which was supported through patronage of the William Ernest, Grand Duke of Saxe-Weimar-Eisenach. With the dissolution of the German Empire following World War I, the private patronage of the school was also suspended and the school was incorporated into the new German State.

In the vacuum of the first World War, the time was right to significantly change fine art and architectural education in Germany, centered on the juxtaposition of art and industry in Post-WWI Germany. The Staatliches Bauhaus (German, "building house") was founded by Walter Gropius, a member of the Deustcher Werkbund (founded by Hermann Muthesius in 1907), who sought to combine an arts and crafts education with an industrial production. His approach to design pedagogy was *gesamkunstwerk*, or "total work of art," which would be applied to modern design through architecture, industrial design, graphic design, and interior design. Through the Bauhaus curriculum, students were versed in every form of art before dedicating their study to their singular medium, providing a well-rounded education in visual arts ahead of the more practical education of construction. Additionally, the Bauhaus curriculum also encouraged the mass production of individual ideas, or artistic spirit—instead of "one off" buildings, architects graduating from the Bauhaus were encouraged to look at solutions for the masses.

As with the École des Beaux-Arts, contemporary politics had a significant impact on the curriculum. While the French Revolution sparked the transition from Académie to École, the creation of the Weimar Republic, and the wish to strengthen emerging German industries led Methusius to explore a Nationalistic approach to design by "[expressing] architectonically the dignity and calm endeavour of a new, confident national German spirit" through the Deustcher Werkbund [2]. Gropius translated this approach to the new Bauhaus curriculum through *Neues Bauen* ("New Building"), which in itself was a translation of Neue Sachlichkeit ("New Sobriety/New Objectivity"). Seeking an objective architecture meant that the Bauhaus curriculum had no use for historical study—according to Gropius, looking forward did not require looking back.

The formal study of architecture also evolved with this difference in pedagogy; instead of Classical ornament adorning every design, students were encouraged to view architecture from the perspective of function, in line with the Deutscher Werkbund. This produced simplified architectural forms [Fig. 3], more aesthetically related to factories than palaces, and an expanded use of newer materials, such as concrete and steel. The Bauhaus curriculum was purposefully designed to contrast that of the École, and attracted several architects who went on to be prominent members of various modernist movements, including Ludwig Mies van der Rohe and Marcel Breuer. The school was closed and relocated several times due to political turmoil and new construction, and was eventually rebranded Bauhaus-Universität Weimar in 1996.

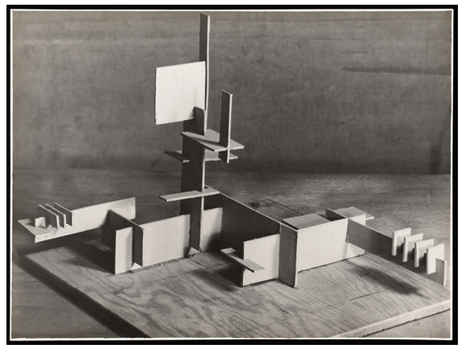


Figure 3 *Materialübung* (Material Study) by Albert Renger-Patzsch, from the Bauhaus ca. 1927–28. The Getty Research Institute, 850514.54. © 2019 Albert Renger-Patzsch Archiv / Ann u. Jürgen Wilde, Zülpich / Artists Rights Society (ARS), New York

Teaching Architectural History in the United States

The Bauhaus and École des Beaux-Arts used almost adversarial approaches to studying history in the curriculum, the École relying exclusively on the past, and the Bauhaus reacting entirely against it. The rise of the National Socialist German Workers' (Nazi) Party in Germany and their takeover of France during World War II resulted in many prominent educators from both schools leaving Europe in favor of resettlement in the United States. After a stay in Britain in the 1930s, Walter Gropius was eventually hired at the Harvard Graduate School of Design along with Marcel Breuer. Ludwig Mies van der Rohe landed in Chicago, becoming an integral educator at the Illinois Institute of Technology. László Moholy-Nagy, who had originally worked with Gropius in Britain, also settled in Chicago and founded the New Bauhaus, which eventually transformed into the Institute of Design under IIT. Werner Drewes, a former pupil of Moholy-Nagy and Wassily Kandinsky at the Bauhaus, was also impacted by the Nazi crackdown on non-traditional art and eventually emigrated to the United States teaching at Columbia University and Washington University (St. Louis).

These pioneers of Modernism brought the Bauhaus ideas across the Atlantic, where the Beaux-Arts tradition was already having a significant impact, through famous alumni like Louis Sullivan and the translation of the atelier tradition to the American educational system. As the École was the premier design school model by the late 19th century, the translation of the atelier in America (characterized by partnerships with agreeable firms) was accompanied by significant study in historical precedent, including classical elements. Alumni of the École formed the Beaux-Arts Society of Architects in America who developed coursework based on the Parisian model that could be employed through architecture schools in the US [3]. The arrival of Bauhaus educators to this deeply-entrenched educational system created a split relationship with architectural schools in the United States, which eventually become a conglomeration of the two pedagogies with emphasis toward either the Beaux-Arts or the Bauhaus. The foundations of these prominent schools of architecture continue to be influential on teaching design in the United States, which uses a combination of the studio approach along with the teaching of history and theory in various forms.

Decolonizing and Neutral Gendering the Canon

Architecture's history in relation to both the École des Beaux-Arts and Bauhaus was heavily focused on male traditions, meaning that the curricula in the American system followed suit. Initially, women were not permitted to study architecture, creating a self-perpetuating history of male voices studying previous male voices. Women were admitted into the École des Beaux-Arts in 1897, but continued to be marginalized early on. As quoted by François Benoit, David Leroy:

> …applied [himself] to making known the kind of male architecture [architecture mâle] he had for a long time admired in Greece, the architecture the Athenians had put to great use during the centuries when they were proud to be a free people…[4]

Figure 4: Group photo of Bauhaus masters in Dessau (1926): From Left to Right: Josef Albers, Hinnerk Scheper, Georg Muche, László Moholy-Nagy, Herbert Bayer, Joost Schmidt, Walter Gropius, Marcel Breuer, Wassily Kandinsky, Paul Klee, Lyonel Feininger, Gunta Stölzl und Oskar Schlemmer. © picture alliance akg images.

By denoting "male architecture," Leroy effectively alienated any other gender not only from the historical narrative, but potentially that of the future. Only teaching "male architecture," even after the admittance of women to the program further marginalized those students as "other," and suggested that the architectural traditions of the classical past were gendered with the male architecture as more prominent.

In the founding of the Bauhaus in 1919, Gropius famously declared that "any person of good repute, regardless of age or sex…" would be welcome at the Bauhaus and that "[there are] no differences between the fairer sex and the stronger sex" [5] as a way to clarify his stance on equality in Bauhaus education [Fig. 4]. Yet, Gropius also famously did not believe that men's and women's brains operated in the same way: men were able to think in three dimensions, whereas women were not. This theory relegated women to certain disciplines within the school that only relied on two-dimensional thinking, namely textiles and weaving [6]. Despite the fact that women applied to the school in droves, this sexism would go on to haunt some of the best female designers in history.

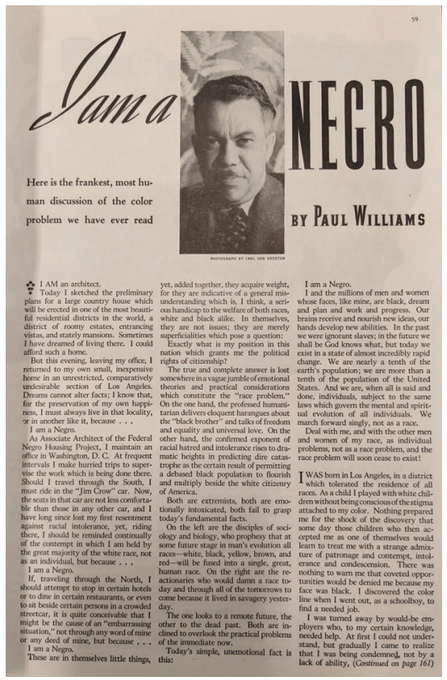
Anja Baumhoff's dissertation-turned-book about the women of the Bauhaus in particular addresses the issue of sexism in understanding Modernism and, consequently, the continuing education of female students. She writes:

> "...if feminine is the negative of masculine and masculine is dominant, how do women artists see themselves and how do they produce meanings of their own in a language make up by a dominant group which affirms men's dominance and power and reproduces their supremacy?" [7]

The history of architecture as taught from the perspective both of the École and Bauhaus descendants overlooks the feminine in part because of limited permission to participate, but also in the dismissal of feminine as a negative attribute.

Similarly, people who were not of European descent were treated in much the same way as women, with little opportunity for formal study, therefore delegitimizing their work. For much of the history of the modern United States African-Americans were not afforded the same rights as white Americans, and are arguably still suffering the repercussions of slavery, and segregation. The ability of these individuals to study architecture or design was significantly harder, with a few notable exceptions. Nathan Lerner and Hin Bredenieck, two New Bauhaus-associated professionals instituted the South Side Community Art Center in Chicago in 1941, bringing Bauhaus design ideas to a historical building and giving a space to the local black community to study art and design. The project was funded by the Works Progress Administration, and building opened by Eleanor Roosevelt [8]. Historically Black Colleges and Universities (HBCUs), including Tuskegee University, also provided an education for Black students, but these opportunities paled in comparison to white counterparts.

While HBCUs were accessible to black students, black professional architects still faced significant discrimination. In an essay titled "I am a Nego", published in The American Magazine in 1937, Paul Revere Williams [Fig. 5] begins with the statement "I am an architect." Encapsulated within the backdrop of the Jim Crow laws and significant racial prejudice, Williams defines his experiences working with clients in Los Angeles and Washington DC, first mentioning his desire to become an architect in high school. His instructor in response asks "Who ever heard of a Negro being an architect? You have an ability—but use it some other way. Don't butt your head futilely against the stone wall of race prejudice." Through this and other anecdotes, Williams exemplifies the difficulty that African American not only had in becoming architects, but in the prejudices faced after their education [9]. His consistent refrain, "I am a Negro," highlights the dismissive attitude toward this idea of "other" in the wake of Emancipation—that he is seen more for the color of his skin than his ability.



I am a NEGRO

Here is the frankest, most human discussion of the color problem we have ever read

BY PAUL WILLIAMS

I AM an architect.

Today I sketched the preliminary plans for a large country house which will be erected in one of the most beautiful residential districts in the world, a district of roomy estates, entrancing vistas, and stately mansions. Sometimes I have dreamed of living there. I could afford such a home.

But this evening, leaving my office, I returned to my own small, inexpensive home in an unrestricted, comparatively undesirable section of Los Angeles. Dreams cannot alter facts; I know that, for the preservation of my own happiness, I must always live in that locality, or in another like it, because . . .

I am a Negro.

As Associate Architect of the Federal Negro Housing Project, I maintain an office in Washington, D. C. At frequent intervals I make hurried trips to supervise the work which is being done there. Should I travel through the South, I must ride in the "Jim Crow" car. Now, the seats in that car are not less comfortable than those in any other car, and I have long since lost my first resentment against racial intolerance, yet, riding there, I should be reminded continually of the contempt in which I am held by the great majority of the white race, not as an individual, but because . . .

I am a Negro.

If, traveling through the North, I should attempt to stop in certain hotels or to dine in certain restaurants, or even to sit beside certain persons in a crowded streetcar, it is quite conceivable that I might be the cause of an "embarrassing situation," not through any word of mine or any deed of mine, but because . . .

I am a Negro.

These are in themselves little things, yet, added together, they acquire weight, for they are indicative of a general misunderstanding which is, I think, a serious handicap to the welfare of both races, white and black alike. In themselves, they are not issues; they are merely superficialities which pose a question:

Exactly what is my position in this nation which grants me the political rights of citizenship?

The true and complete answer is lost somewhere in a vague jumble of emotional theories and practical considerations which constitute the "race problem." On the one hand, the professed humanitarian delivers eloquent harangues about the "black brother" and talks of freedom and equality and universal love. On the other hand, the confirmed exponent of racial hatred and intolerance rises to dramatic heights in predicting dire catastrophe as the certain result of permitting a debased black population to flourish and multiply beside the white citizenry of America.

Both are extremists, both are emotionally intoxicated, both fail to grasp today's fundamental facts.

On the left are the disciples of sociology and biology, who prophesy that at some future stage in man's evolution all races—white, black, yellow, brown, and red—will be fused into a single, great, human race. On the right are the reactionaries who would damn a race today and through all of the tomorrows to come because it lived in savagery yesterday.

The one looks to a remote future, the other to the dead past. Both are inclined to overlook the practical problems of the immediate now.

Today's simple, unemotional fact is this:

I am a Negro.

I and the millions of men and women whose faces, like mine, are black, dream and plan and work and progress. Our brains receive and nourish new ideas, our hands develop new abilities. In the past we were ignorant slaves; in the future we shall be God knows what, but today we exist in a state of almost incredibly rapid change. We are nearly a tenth of the earth's population; we are more than a tenth of the population of the United States. And we are, when all is said and done, individuals, subject to the same laws which govern the mental and spiritual evolution of all individuals. We march forward singly, not as a race.

Deal with me, and with the other men and women of my race, as individual problems, not as a race problem, and the race problem will soon cease to exist!

I WAS born in Los Angeles, in a district which tolerated the residence of all races. As a child I played with white children without being conscious of the stigma attached to my color. Nothing prepared me for the shock of the discovery that some day those children who then accepted me as one of themselves would learn to treat me with a strange admixture of patronage and contempt, intolerance and condescension. There was nothing to warn me that coveted opportunities would be denied me because my face was black. I discovered the color line when I went out, as a schoolboy, to find a needed job.

I was turned away by would-be employers who, to my certain knowledge, needed help. At first I could not understand, but gradually I came to realize that I was being condemned, not by a lack of ability, (Continued on page 161)

Figure 5 Paul Revere Williams' "I am a Negro" article in The American Magazine,1937. p 161.

Williams' struggle is not unique, nor are those of the women exposed for sexist practices as a result of the "traditional" views on architecture. It is important, however, to ensure that students today do not suffer the same consequences as education evolves along with the Bauhaus and École traditions in the United States.

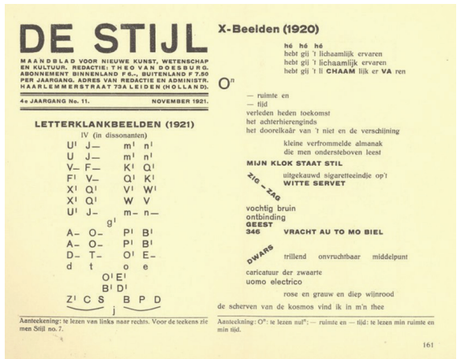
Elevating New Voices / In an Architect's Words

With less than a century since racial desegregation and a little bit more than a century since women were allowed to study architecture, the primary sources that are available for study are still predominantly white and male. Therefore, significant attention and effort should be paid to decolonizing and neutral gendering the voices and projects that are presented to students, diversifying the ideas that they are exposed to, and ensuring that their experience with history and theory is global and well-rounded. This acknowledges that the historical canon should consistently evolve as new histories come to light, particularly those of marginalized communities within the architectural profession.

Paul Revere Williams makes the argument for visibility as integral to encouraging new students, highlighting the hundreds of yearly graduates from Howard University in Washington DC as "example[s]" for future generations [10]. Having role models who subscribe to a same gender and race demonstrates to students that their own dreams are achievable, and helps to validate the experiences of those previously relegated to the periphery of the profession. The first step in identifying these role models for students is introducing them through the course of study, and supporting first generation, minority, and marginalized students through their education journey.

The history sequence at Ball State University consists of two history/theory courses in a fall/spring sequence. The second course in the sequence teaches varying Modernisms, beginning at the Industrial Revolution, and presenting contemporary histories and theories. Individual faculty are given academic autonomy in what is taught in each course in the sequence, and the loading of courses is shared differently each year, providing opportunity for innovation and reworking a fluid curriculum. The history sequences occurs within the first full year of architectural study, when students are just beginning to formulate impressions and personal ideas about design, making it an idea opportunity to open their eyes to a diversity of thought over the course of the architectural profession.

With the rising cost in history textbooks and in response to student interest in hearing from “actual” architects in their own words as opposed to fellow historians or theorists, restructuring the Modernism course around the architectural manifesto gives students the opportunity to interrogate primary source ideas and their connection to the built environment. With the rise in architectural writing and its distribution around the world following the availability of the printing press, the architectural manifesto became a mainstream method of testing ideas in the late 19th and early 20th centuries, providing an oeuvre of written work from which to understand motivations behind some of the most famous architects and buildings in the world. Additionally, as many of the manifestos are open source or in the public domain, this brings down the cost of course materials, giving students important readings for a fraction of the traditional cost. The course requires students to read manifestos or rhetorical writing by multiple architects per week to contextualize the designs that are analyzed in the lectures.


DE STIJL

MAANDBLAD VOOR NIEUWE KUNST, WETENSCHAP EN KULTUUR. REDACTIE: THEO VAN DOESBURG. ABONNEMENT BINNENLAND F 6.-, BUITENLAND F 7.50 PER JAARGANG. ADRES VAN REDACTIE EN ADMINISTR. HAARLEMMERSTRAAT 75A LEIDEN (HOLLAND).

4e JAARGANG No. 11. NOVEMBER 1921.

LETTERKLANKBEELDEN (1921)

IV (in dissonanten)

X-Beelden (1920)

hé hé hé
hebt gij 't lichaamlijk ervaren
hebt gij 't lichaamlijk ervaren
hebt gij 't ll CHAAM lijk er VA ren

— ruimte en
— tijd
verleden heden toekomst
het achterhierengindsbeen
het doorelkaar van 't niet en de verschijning
kleine verfrommelde almanak
die men ondersteboven leest

MIJN KLOK STAAT STIL
uitgekauwd sigaretteeindje op't
WITTE SERVET

210 – 240
vochtig bruin
ontbinding
GEEST
346 VRACHT AU TO MO BIEL

DWARS trillend onvruchtbaar middelpunt

caricatuur der zwaarte
uomo electrico
rose en grauw en diep wijnrood
de scherven van de kosmos vind ik in m'n thee

Aanteekening: te lezen van links naar rechts. Voor de teekens zie mon Stijl no. 7.

Aanteekening: O°: te lezen nul°; — ruimte en — tijd: te lezen min ruimte en min tijd.

161

Figure 6 De Stijl Manifesto in the De Stijl Magazine, 1921.

For the first several iterations of the course, the manifestos were heavily focused on European male architects, as these were the most readily accessible for free to a wide audience. In an effort to elevate the voices behind some of these powerful men, and elevate lesser-known voices the instructor partnered with the Architecture Librarian to identify women, people of color, and people of a spectrum of sexual orientations in architecture, and find writings by these communities in order to expose their architectural ideas to students. By 2023, the manifestos were expanded not only to include writing and interviews by more mainstream women to study such as Denise Scott Brown, Jane Drew, Zaha Hadid, and Eileen Gray, but also Charlotte Perriand, Norma Merrick Sklarek, Lina Bo Bardi and several other contemporary women. These are accompanied by manifestos from Paul Revere Williams, Hassan Fathy, Shigeru Ban, Moshe Safdie, César Pelli, Bernard Tschumi, I.M. Pei, and David Adjaye. At the same time, they are exposed to controversial designers such as Adolf Loos, Le Corbusier, Phillip Johnson and Albert Speer to provide additional context.

This list is consistently evolving as the librarian and instructor identify new sources of research into disregarded communities and their impact on architecture, but providing these resources to students helps to reject the stigma of architecture as only white male, while providing role models for a modern classroom of design students.

Legacies of Sexism and Racism

Among the challenges in teaching a more diverse range of architects in the 19th, 20th, and 21st centuries is the perpetual racism and sexism presented not only by the accounts of architects such as Paul Revere Williams, but even in the interpretation of built projects after the fact. As women, people of color, indigenous communities, etc. were disregarded in both the École and Bauhaus traditions, the study of these populations continued to be absent at best, and purposefully dismissed at worst in western architectural education.

A prominent example of this ignorance is Eileen Gray’s perhaps most significant contribution to the world of architecture, E.1027, which is forever marked by her connection to Le Corbusier, who desecrated her carefully-designed white walls with his own paintings, and eventually drowned in the waters below it. Of particular note was his mural, which he titled *Sous les pilotis* or *Graffite à Cap Martin*, reportedly depicting Eileen Gray, ‘Badou’ (interpreted to be her partner, Jean Badovici), and “the desired child, which was never born to them” [11]. Le Corbusier’s slight at Gray’s openly gay sexuality was problematic enough, but his dismissal of Gray’s work (only referring to the house as “the house in Cap-Martin” and never mentioning the designer) when he published a book of his murals meant that Gray would be lost to obscurity for a number of years after [12]. Gray not given credit for the architectural work until relatively recently, as credit was given to Baldovici and many assumed Le Corbusier’s obsession with the house meant that he had contributed. An effort to restore the house began in 2015 and was completed in 2021. The restoration uncharacteristically brought back Gray’s original design, with conservators removing the Le Corbusier murals. Until the restoration was complete, they had remained. Most available images of the building still feature Le Corbusier’s work prominently on the walls.

As with the E.1027 house, research in recent years has begun to address many of these lesser-known identities in the history of architecture, making their inclusion easier in the development of a new or fluid canon. In 2020, *Charlotte Perriand: Inventing a New World* opened in conjunction with a symposium dedicated to the French architect. The exhibit and discussion brought forward publicly unknown, but significant contributions that Perriand had made, not only to the work of Le Corbusier, but in her own right as a designer [Fig. 6].

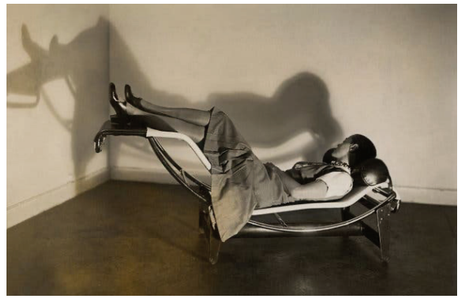


Figure 7 Charlotte Perriand lounging in “Chaise longue basculante B 306,” a design credited to Le Corbusier, Pierre Jeanneret and Perriand in 1929, drawn by Perriand in 1928. F.L.C./ADAGP, Paris.

Paul Revere Williams was also the subject of his first exhibit in 2010, approximately 90 years after he began working, and was awarded the AIA gold medal in 2017, 37 years after his death. Despite the challenges that he faced in his career, in 1963 Williams wrote:

> “I have often been asked if I would change my scheme of life if I had to do it all over again. My answer is—‘Architecture is the most fascinating profession in the world and one which I thoroughly enjoy’” [13]

With these pioneers of Modernism, why do the legacies of sexism and racism remain present in the profession of architecture? The registration of both women and people of color in the American Institute of Architects pales in comparison to that of their counterparts, according to the 2014-2021 Where Are My People? research project by ACSA. The project includes data and visualizations about women, Black, Hispanic, Latinx, Asian, Native Hawaiian, Pacific Islander, Native, Indigenous, Middle Eastern, and North African identifying architects, and the road blocks that these groups have traditionally faced in becoming professionals. One of the most common challenges appears to remain the lack of visible role models, with one participant, a female Dominican participant writing “I feel that it is my responsibility to represent my culture through my work and teach the world about Hispanic culture through architecture” [14]. While an architectural education is stressful enough, the added pressure to be representative of an entire group of people may inspire some to forgo the pursuit altogether. Similarly, an Indigenous participant sought “More recognition and acknowledgement of indigenous architecture in books and educational platforms, such as educational classes and projects that highlight indigenous architecture” [15]. Lack of acknowledgement in contribution to the built environment of the United States in particular presents Native or Indigenous students with the idea that even though their traditions have existed in the country longer, they are not as relevant to the oeuvre of design as those born out of the European traditions.

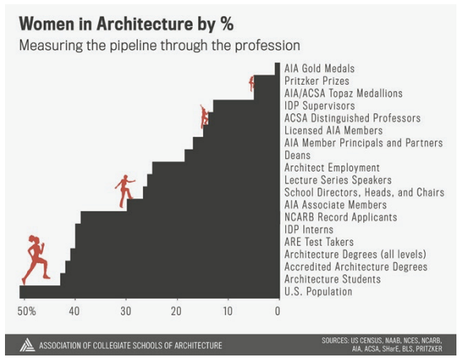


Figure 8 Graphic illustration of the percentages of women at varying levels of architectural distinction by ACSA, 2014.

In 2018, ACSA Education Committee published a white paper on “Moving Toward an Equitable Future” [16] with best practices for equity-driven architectural education. Though the report acknowledges areas of improvement for encouraging a diversity of students to enter the profession, it does little with changing the traditional curriculum that these students are faced with at the university level. This leaves the responsibility up to individual programs to research and reflect on the significant historical narratives that would be beneficial and of interest to their students.

Future Architectures / Manifesting New Ideas

A key pedagogical strategy to encouraging students to understand and analyze a diversity of voices is have the students themselves conceptualize their own experiences after a semester of hearing from prominent architects. At the end of the Modernism course, students are asked to produce their own visual and written manifesto, employing visual and written rhetoric to illustrate their motivations related to architecture. Students produce Visual Notes over the course of the semester to practice making critical connections between words and design, and rehearsing their beginning design own communication skills. These manifestos transition students from the beginning design year into more practical coursework in their third year, requiring careful thought behind what the students find most influential so that they can construct a defensible design ideology. The assignment requires students to draw from historical examples to explicitly describe their ideas, declare important practices, influences, and policies, and announce their positions on architectural design.

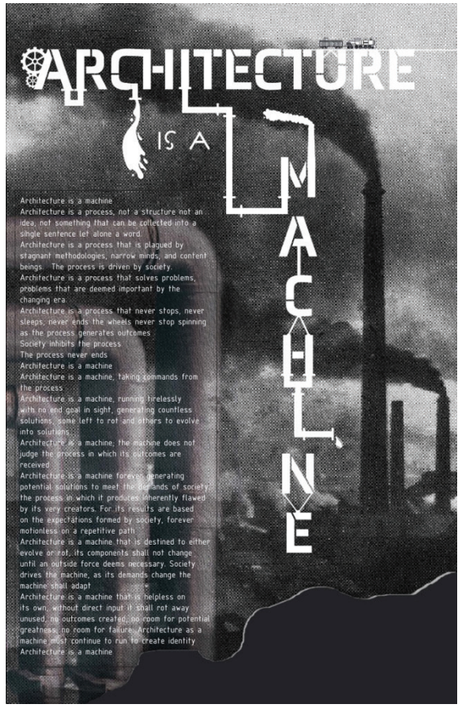


Figure 9 Manifesto written and designed by student Matthew Holman, 2021.

Students have regularly reported that this project is their favorite of the history course, because it encourages them to think in both words and images, as well as actually sit and reflect on their feelings about architecture as a profession. Pedagogically, by publishing their own writing, they are becoming part of the future historical and theoretical narrative of architecture, acting as role models to future students, and securing their place in the new canon.

Figure 10 Manifesto written and designed by student Ricardo Ayala, 2021.

End Notes

[1] Benoit, François. *L 'Art français sous la révolution et l'empire*. Paris. 1897. p 208.
[2] Ching, Frank, Mark M. Jarzombek, and Vikramaditya Prakash. *A Global History of Architecture*. Wiley: Hoboken, NJ. 2007. p 703.
[3] Simon, Madlen. "The Beaux-Arts Atelier in America." *84th ACSA Annual Meeting*. 1996. p 319.
[4] Benoit, 1897, p. 208.
[5] Bunting, Geoffrey. "Gunta Stölzl and the Women of the Bauhaus." *Daily Art Magazine*. 2022.
[6] Billard, Jillian "The Other Art History: The Forgotten Women of Bauhaus," *ArtSpace*. 2018.
[7] Baumhoff, Anja. *The Gendered World of the Bauhaus*. Peter Lang: Frankfurt. 2001.
[8] National Trust for Historic Preservation. "Southside Community Art Center." *Tracking Weimar's Bauhaus School in America*. n.d. Available at: https://savingplaces.org/guides/tracking-weimars-bauhaus-school-in-america
[9] Williams, Paul. "I am a Negro." *The American Magazine* 59. 1937. p 161-163.
[10] Ibid.
[11] Colomina, Beatriz. "War on Architecture: E.1027." *Assemblage* 20. 1993. p 28-29
[12] Ibid.
[13] Williams, Paul R. "If I Were Young Today," *Ebony Magazine.* August 1963. p 56.
[14] Participant 98. "Where Are My People?" American Collegiate Schools of Architecture. 2020. Available at https://www.acsa-arch.org/resource/where-are-my-people-hispanic-latinx-in-architecture/
[15] Participant 36. "Where Are My People?" American Collegiate Schools of Architecture. 2021. Available at https://www.acsa-arch.org/resource/where-are-my-people-native-indigenous-in-architecture/
[16] American Collegiate Schools of Architecture. "Moving Towards an Equitable Future." 2018. Available at: https://www.acsa-arch.org/resources/equity-diversity-and-inclusion/

Curriculum Junkspace: Reconciling Past and Future Pedagogies at UW-Milwaukee

Lindsey Krug, University of Wisconsin-Milwaukee
Kyle Reynolds, University of Wisconsin-Milwaukee
Sam Schuermann, University of Wisconsin-Milwaukee
Alex Timmer, University of Wisconsin-Milwaukee

Introduction

How should a 21st-century school of architecture forge futures for its beginning design students in the face of urgent and evolving social, economic, and environmental conditions? How can a 21st-century school of architecture accommodate a growing student body, a new BArch degree program, a university merger with the School of Art, shifting state politics and funding allocations, regional climate migration, and its status as the only school of architecture state-wide while clarifying its pedagogical agenda and institutional mission? The Department of Architecture within the School of Architecture and Urban Planning (SARUP) at the University of Wisconsin-Milwaukee (UWM) is attempting to address these complex questions via an active, ongoing exercise of restructuring its core curriculum to mediate the push-and-pull of contemporary conditions. The Department finds itself square at the intersection of known and unknown territories and must grapple with past identities and future ambitions.

As the University wades through these particularities, SARUP becomes a fruitful site for investigating an architecture school's past, present, and future and may glean insight from peer institutions as well as offer lessons learned to those facing similar circumstances. Within this context, a working committee was formed for the 2022-2023 academic year to confront–specifically–the first two years of the architecture curriculum. Meeting weekly to disassemble, re-think, re-work, and reassemble pedagogical goals, the committee worked to outline possible futures by asking how certain aspects of the past endure and how these characteristics shape the future. This bottom-up, team-based approach seeks to streamline and improve the school's degree program and cater to the evolving needs and values of incoming generations of beginning design students.

The process of exploding architectural discourse at our institution has brought illegibility into focus. The beginning design sequence at SARUP is characterized by amorphousness, incoherence, and instability - qualities that have only emerged in recent years as faculty-to-student ratios have skewed unfavorably and pandemic-era learning has gutted sociality in our physical spaces. Reminiscent of the seminal essay "Junkspace" written by Rem Koolhaas 20 years ago, another kind of *junkspace* has emerged as the construction site for the working group: *curricular junkspace*. Presented here is a reflection on the current condition of design pedagogy from the University of Wisconsin-Milwaukee; this paper will define curriculum junkspace using the framework of Rem Koolhaas' 2001 essay, and, after pinpointing school-specific accelerating factors and observations of the crisis, offer possible methods to initiate pedagogical defibrillation to set the school on a promising track to deliver a complete 21st-century design education.

Revisiting Koolhaas: curricular junkspace

Curricular junkspace is a place of formlessness. By evaluating UWM SARUP's beginning design curriculum introduced above, the working committee has found The Department of Architecture's pedagogical approach and—as a result—the courses have become formless: without clear rules, no decipherable order, lacking theoretical through-lines, and limited connection across design, technology, and history/theory sequences. It is unclear exactly when the curriculum turned the corner into formlessness, but the forces leading to this position have parallels with what Koolhaas discusses in his seminal essay. While Koolhaas implicates the professional sector in the early 2000s, he does not explicitly discuss the academy. The junkspace language and lens are particularly useful and salient in assessing current pedagogical concerns. The design school is both culpable in the perpetuation of formlessness and an apt site to address Koolhaas' original concerns, which still ring true and relevant 20 years later:

"Junkspace is the body double of space, a territory of impaired vision, limited expectation, reduced earnestness. Junkspace is a Bermuda Triangle of concepts, an

abandoned petri dish: it cancels distinctions, undermines resolve, confuses intention with realization. It replaces hierarchy with accumulation, composition with addition. Junkspace is overripe and undernourishing at the same time."[1]

Twenty years after Koolhaas' scathing analysis of the state of professional practice, the field continues to grapple with the hangover of modernism and an ecosystem of growing crises related to climate, economics, demographics, and labor. Couple these crises with pedagogical formlessness, and students' perceived widening gap between practice and academia becomes insurmountably chasmic. This tenuous relationship, exacerbated by the concurrent crisis of late capitalism, is evidenced in the most recent issue of the Journal of Architectural Education, aptly titled "Pedagogies for a Broken World." There must be a pedagogical paradigm shift if the field is to continue productively operating within the conditions of the 21st century. While all design schools are grappling with curricular modifications and excising unproductive nostalgia, UWM SARUP provides a case study as a very large, public program explicitly re-designing beginning design curriculum catalyzed by the addition of a B.Arch. Once clear but now frankenstein-esque, simultaneously comprehensive but surface-level, woefully lacking in inclusive and diverse knowledge production, SARUP's beginning design curriculum working committee is attempting to help redefine the school's values and priorities and depart the Koolhaas-coined condition.

The SARUP condition

The SARUP curriculum is the byproduct of several external and internal forces that the committee has been able to pinpoint and is working to address. For one, the school has—especially for its size—a small yet pluralistic faculty. The pluralistic research agendas and expertise of the faculty are further siloed and disintegrated through faculty governance which forms the bottom-up decision-making structure at the school. The resulting pedagogy is a scatterplot of disconnected ideas and methodologies—, producing a discourse of compromise at best and evidencing a lack of oversight at worst. The curriculum reveals the anxiety of individual faculty members' concerns about students' preparedness for practice in which many courses tend toward the comprehensive—which is necessarily shallow given the semester structure and prohibits students' ability to deep dive into specific disciplinary issues.

The internal challenges of SARUP's program, particularly faculty governance, result in a broadening and shallowing of the curriculum. There is an overarching professionalization of the studio courses in which each studio feels the intrinsic need to be comprehensive— producing a simulacrum of comprehensiveness. Driven in part by the faculty's lack of trust in the curricular sequence, each coordinator feels the need for students to design an entire building with little to no disciplinary agenda. Resulting projects resemble buildings but fail to engage deeper questions about the practice, methodology, and responsibility of architecture. Faculty governance empowers this process through bottom-up organizational and governing structure, prioritizing the individual over a collective pedagogical approach. Individual faculty have an immense amount of control and authority over course content, exacerbated by the lack of coherent course sequencing. The result is curricular junk space: courses cover an immense amount of content without building upon one another or encouraging deeper, more specific knowledge production. For example, a typical housing studio requires students to design a multi-unit building but never asks them to contemplate the political and social implications of collective living.

The other pressures on the curriculum emerge from three external, interwoven conditions: 1) UWM is the only school of architecture in the state of Wisconsin, 2) the architecture student body is growing, and 3) SARUP is facing budget cuts due to the system-wide reduction in enrolled students. Being the only architecture school in the state of Wisconsin, SARUP has adopted an imperative to teach the whole of architecture from multiple, disconnected agendas. This impossible task results in many classes that are necessarily shallow in scope, repeatedly touching on content beyond the requirements of NAAB, and never with enough specificity. This necessitated plurality, bolstered by a lack of oversight for the curriculum, reinforces a lack of coordination between faculty. Simultaneously, the Department of Architecture at UWM is admitting and serving an ever-increasing number of students. SARUP has experienced a dramatic increase in enrollments in recent years while being subjected to budget cuts related to the declining enrollments campus-wide, putting immense pressure on the already understaffed and under-resourced school. These three conditions intersect and respond to one another, producing anxiety around teaching architecture with any particular disciplinary agenda.

The University recently underwent a revisioning and reorganization of all its colleges while the above pressures catalyzed the condition of curricular junk space. The result of that university-scale exercise is the quickly approaching merger of the Peck School of the Arts and the School of Architecture and Urban Planning into the College of Arts and Architecture. While SARUP recognizes the immense interdisciplinary benefits of such a merger, the actual reorganization was imposed upon these two schools under the guise of financial benefit for the University.

Given these conditions, the Department of Architecture proposed the introduction of a BARCH. The new Bachelor of Architecture degree addressed the concerns of the perceived mandate from the state's professionals and allowed the Department to differentiate itself from the arts programs soon to be under the purview of the same school. The B.Arch. addition required curricular discussions about the course sequence and allowed the reorganization and overlap of content based on the themes of beginning design, user/program, ecology, integrated systems, and developing expertise. The intent of this reorganization was to engineer deeper dives in studio through shared themes with the technology, history theory, and professional practice courses.

Commoning the curriculum

The beginning design curriculum re-design was headed by a working group made up of faculty from the Department of Architecture, including the Department Chair, two Assistant Professors, and one Fellow—highlighting an effort to include expert voices from various levels in the Department. Beginning in the summer of 2022, the committee's work played out via weekly meetings. Initially, these meetings took a proverbial 'throw things at the wall and see what sticks' approach – using a Miro board to collect as much information as possible—current syllabi and exercises, lists of modeling materials and drawing types, types of learning formats along with the desired skills they impart, buckets of architecture jargon, values, ethics, and ideas—SARUP's own internal junkspace. The committee had five clear goals in this process: 1) assess the current curricular conditions of the school, honing in on the first four semesters, 2) find places where the current curriculum is lacking, 3) locate both historical and contemporary critical discourse on pedagogy and intersectionality, 4) tease out clear pedagogical ambitions, and finally, 5) synthesize into a clear curricular direction for the school.

As a holistic view of the school at present emerged, the slow departure from a clear agenda resulting from SARUP's casting of an ever-widening net became clear. In some ways, the desire of the school to 'do everything' is admirable and required of the only school of architecture in the state. However, this comprehensive approach has left students—perhaps counterintuitively—with limited comprehension, stifled critical curiosity, and a body of work that operates at the surface level.

The committee consulted the writing of Paulo Freire, Kimberle Crenshaw, bell hooks, and the Journal of Architecture Education as evaluative lenses for studying previous iterations of the school's ethos and pedagogy to better understand the underlying logic of the beginning design sequence and its evolution into this current state. SARUP's most recent manifesto, still advertised on the website and evidenced in certain areas of the curriculum, is "PLAN, MAKE, BUILD." This action-oriented string of verbs communicates the school's emphasis on the importance of conducting architectural education beyond the campus building and impacting the city of Milwaukee through thoughtfully designed and executed interventions. PLAN, MAKE, BUILD's impact on the current curriculum, however, is unclear and lacks explicit recognition of the issues facing a 21st-century design education, perpetuating SARUP's curricular junkspace. The committee worked to simultaneously expand and specify PLAN, MAKE, BUILD by creating a series of non-hierarchical, non-linear taxonomies of curricular content: organizing groups of course mission statements, studio briefs, lists of skills and tools, and final deliverables. The committee utilized a workflow of constant reordering to produce groupings of knowledge production and goals of the beginning design curriculum. This approach of 'brain-dump, explode, re-order, repeat' created a series of intellectual sieves that produced logic and clarity within the muddy array of words. (See Fig. 2 and Fig 3)

As these sieves emerged, the committee was able to tease out two layers of definition. One layer confronts the big-picture issues facing contemporary design education, while the other clarifies the means and mechanisms of disciplinary deployment. After assessing several iterations, the disciplinary and organizational notion of "The Commons" became the operative umbrella under which we would situate the SARUP curriculum and the ethos we wish

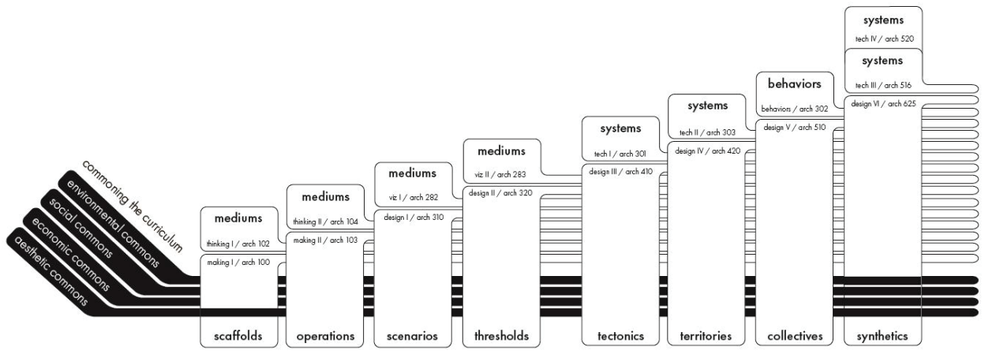
to communicate to current and prospective students. By structuring the new curriculum and school ethics around taxonomies of collective sites and efforts, the working group is advocating for an intersectional, integrated approach to architectural curriculum. Overall, we have defined our process and our proposed changes as "Commoning the Curriculum."

Charting a new pedagogical path

Through this process, three types of outcomes have emerged. The committee has outlined a set of principles and ethics to govern the pedagogy, a collection of deployment tactics to articulate the goals of each semester, and a plan for next steps, implementation, and evaluation.

Principles and Ethics

The following principles and ethics are the four core "Commons" within which we hope to situate the SARUP community and a SARUP education. Using PLAN, MAKE, BUILD as a common starting point for the SARUP community, each of these three tenets is redefined, and a fourth is added. PLAN grows and adjusts to include contemporary social issues, requiring thoughtfulness around bodies in space, implicating race, gender, class, and



other socio-economic concerns. MAKE grows to include means of production, implicating issues of labor and economics. BUILD grows to include issues of site, the natural environment, and sustainable methods of design and construction. Reflecting a missing piece, the fourth tenet and ethic that has been added is Aesthetics. Aesthetics is a historical, theoretical, and philosophical framework, a system of evaluation implicating visual and material culture. The four Commons are further explicated as follows:

The Social Commons (formerly PLAN): The Social Commons is a space where people bring their identities, priorities, and attitudes with an expectation to participate equally and be met with generosity. This Commons can only be enacted when people of all identities and origins can contribute to the construction of this place. SARUP is committed to confronting legacies of exclusion in the profession, the academy, and the built world.

The Economic Commons (formerly MAKE): The Economic Commons is a space where different forms of production and exchange occur. This Commons can only be enacted through a shared understanding of the tools, skills, and assets available to architects. The Economic Commons facilitates awareness of contemporary means of production and requires them to be respected and valued as they are deployed. SARUP is committed to uplifting all forms of labor and production, equipping students to critically participate in the local economy, and questioning architecture as a capital commodity.

The Environmental Commons (formerly BUILD): The Environmental Commons encompasses the greater networks of land, climate, natural resources, and human and non-human communities that constitute the Anthropocene. The Environmental Commons can only be enacted through an acknowledgment of and engagement with histories of land stewardship, economies of extraction, and understanding of Milwaukee's and Wisconsin's physical and social ground. SARUP is committed to teaching site and

context as ecosystem and network. SARUP will continue its commitment to building with and alongside communities while embracing alternative forms of construction to include critical conservation and adaptive re-use.

The Aesthetic Commons (NEW): The Aesthetic Commons offers a disciplinary space where we may consider the potential and role of architecture and adjacent fields to address the social, the economic, and the environmental, and to understand how these lenses re-frame disciplinary topics. The Aesthetic Commons is where disciplinary language is defined, and re-defined. SARUP acknowledges the value of architectural tools, procedures, and methods for evaluation from historical, theoretical, philosophical, and visual perspectives and is committed to nurturing and developing our disciplinary culture within contemporary discourse.

Deployment Tactics

If the four Commons present the school's mission—the why—the committee worked to propose how these are deployed and communicated. The second outcome from the working group's process is a set of pedagogical proposals, specifically, eight forms of deployment—operative lenses—assigned to the first eight semesters of the B.Arch curriculum. Engaging with eight semesters presents some scope creep from our goal of addressing only the first two years of the curriculum, or four semesters. However, with the introduction of the B.Arch, we acknowledge that the third and fourth years are considered an extension of beginning design. The eighth semester, when students will enroll in a Synthetics Studio (formerly Comprehensive Studio), is considered the capstone course of the beginning design sequence where students synthesize the complex facets of architectural design before embarking on elective studios in their final year. To facilitate consistent participation within our four Commons each semester, we have applied the following eight filters in sequence: Scaffolds, Operations, Scenarios, Thresholds, Tectonics, Territories, Collectives, and Synthetics. Named after various collective actions or collective bodies, each semester focuses on a typology of relationship between two or more things. These terms carry—intentionally—disciplinary and relational definitions, evoking architectural image and alternative meaning, open to a variety of interpretations.

Semester 1: SCAFFOLDS
Primary design course: ARCH 100 Architectural Making I
Additional courses: ARCH 102 Architectural Thinking I
Scaffolds are the structures that support growth and give shape. Scaffolds are framework rather than form, didactic rather than pedantic, and accommodate their own future of being removed, reconfigured, or redefined.

Semester 2: OPERATIONS
Primary design course: ARCH 103 Architectural Making II
Additional courses: ARCH 104 Architectural Thinking II
Operations are the intentional actions one takes within the scaffolds. Operations require traceability and repeatability, and creative decision-making in order to achieve variable ends. Operations introduce students to questions of aesthetics and facilitate play and experimentation within clear logics.

Semester 3: SCENARIOS
Primary design course: ARCH 310 Design Studio I
Additional courses: ARCH 282 Visualization I
Scenarios take the universality of operative choices and apply them to a specific set of conditions and inert actors. Scenarios require an understanding of a localized and framed context and testing creative solutions and interventions. Scenarios offer students site-less design problems and processes of design thinking before introducing the critical complexities of site and place.

Semester 4: THRESHOLDS
Primary design course: ARCH 320 Design Studio II
Additional courses: ARCH 283 Visualization II
Thresholds define an architectural element and boundary that negotiates relationships between users and is specifically scaled to the human body. After working with inert actors in semester 3, students learn how design must critically interact with human bodies and their surroundings. Thresholds address histories of malignant design and emphasize engagement with both normalized and othered physicality.

Semester 5: TECTONICS
Primary design course: ARCH 410 Design Studio III
Additional courses: ARCH 301 Systems I
Tectonics position material, geometry, primary systems, and assembly as a driver for spatial logic.

Tectonic choices give way to interior and exterior expressions of architectural form, which in turn facilitate or deny different types of activities and program. Tectonics acknowledges construction and labor and the social and environmental impacts of building.

Semester 6: TERRITORIES
Primary design course: ARCH 420 Design Studio IV
Additional courses: ARCH 303 Systems II
Territories explore the ground, landscape, material ecologies, networks, and temporality. Territories acknowledge histories of land dispossession and colonialism, and students learn to synthesize the macro and the micro, and the historical and the contemporary through multi-scalar research and representation. Territory design promotes land stewardship, mitigates harm to human and non-human residents and ecosystems, and confronts the realities of the climate crisis.

Semester 7: COLLECTIVES
Primary design course: ARCH 510 (NEW) Design Studio V
Additional courses: ARCH 302 Human Behavior
Collectives engage community and spatial justice through the design of one of the most pressing issues of our time: housing. The urgency of confronting the housing crisis requires the creation of an entirely new studio, resisting shallow engagement with housing as program. Collectives acknowledge housing policy, embrace all family structures, and position design as a radical catalyst for housing in the 21st century.

Semester 8: SYNTHETICS
Primary design course: ARCH 625 Comprehensive Design Studio
Additional courses: ARCH 510 Systems III, ARCH 520 Systems IV
Synthetics facilitate a comprehensive approach to design thinking with the goal of transitioning students from the core curricula into upper-level elective coursework and preparing them for office-based professional practice. NAAB accreditation criteria are covered while also being integrated with larger questions of architectural ethics and practice.

Next Steps

The next steps in the process of re-designing the SARUP curriculum are adding additional layers of specificity and reference content for each course, followed by implementation, and evaluation. The committee will continue its work through the upcoming summer to outline very specific learning outcomes for each course, distribute site, typology, and program types, and make recommendations for types of design exercises. Additionally, a working group of faculty and undergraduate research assistants will conduct a literature review for each of the eight deployment tactics to create a kind of SARUP reader that will make the school's agenda legible to students, faculty, staff, industry partners, and the discipline-at-large.

Conclusion

The conclusions about the impact of this new curriculum remain speculative as implementation can only begin next academic year, and the implementation of the ideas set forth in this paper is entirely dependent on the faculty teaching these courses. The school's structure of operating through bottom-up change provides an opportunity to test ideas and track their effectiveness as students move through the curriculum. Student work from both core and elective studios will be evaluated against the clear set of outcomes and principles defined in the beginning design sequence and the outcomes will be made visible and communicated to faculty and students alike. The SUPERjury event at the end of the year, which showcases all studio design work and invites guest critics to comment on the pedagogy and work of the school, is an existing process that will allow both internal and external reflection on the state of the curriculum. This yearly process of taking measure of the beginning design curriculum can allow the core faculty team time over the summer to evaluate, revise, and redeploy strategies and adjustments for the following year. At major milestones, every 5 years, the team will take the academic year to follow a similar process as our current working group to break down the curriculum and rethink from the ground up.

If successful, this process of critical evaluation should inspire other focus areas in the school to develop similar pedagogical agendas with processes of evaluation and alteration. The challenge within bottom-up structures such as those at UWM is always the method of developing clear disciplinary clarity within areas of the curriculum and defining the projects of the school as a whole. The committee's hope is to institutionalize these methods such that if faculty, courses, and focus areas change, the spirit of working toward a common set of themes remains present. The committee also sees the potential of this methodology to be deployed at other schools and for different curricular objectives. This process and the outcomes can become part of a collaborative network of architecture schools all looking at the key characteristics and outcomes of a beginning design curriculum. UWM SARUP welcomes the opportunity to collaborate with peer institutions to seek out robust pedagogical ideas and share knowledge, obstacles, and achievements within the curriculum.

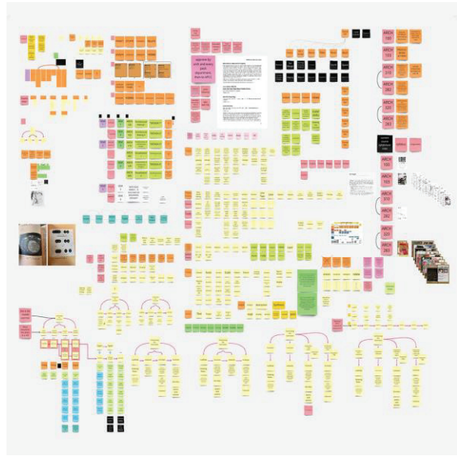


Fig. 2: Documentation of Miro process

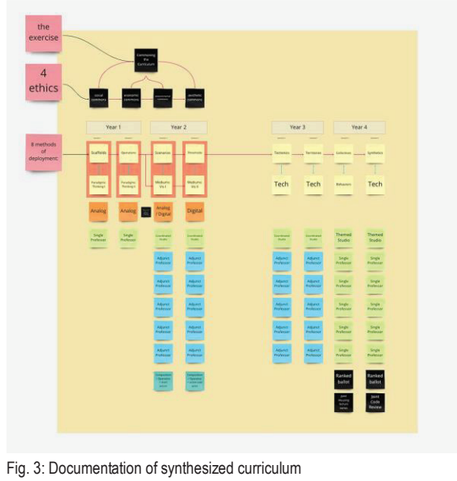


Fig. 3: Documentation of synthesized curriculum

End Notes

Rem Koolhaas, "Junkspace," *October* 100 (2002): 176.

Bibliography

Koolhaas, Rem. "Junkspace." *October* 100 (2002): 175-190.

Modernism as a Springboard for Beginning Architecture Students

Cesar A. Cruz, PhD, Ball State University

At some point in their education, an architecture student would have encountered the notion that the Modern Architecture movement engendered within the design disciplines new modes of thinking at a scale and speed in the Western world that were unprecedented throughout history.[1] In broad terms, a student would come to realize that the impetus for modern architects' fresh perspectives on design included the following:

— emerging building materials and fabrication technologies
— new conceptions of space, form, and the expressive possibilities of buildings
— new building types resulting from great societal shifts across several aspects of daily life, i.e., manufacturing, urbanization, transportation, art, education, entertainment, and culture
— safe and healthy living environments, from the single-family home to the dense urban context
— reconsiderations of architecture's relationship to its past, present, and future
— emerging and evolving political ideologies and cultural interests
— bold, experimental, and even radical aesthetics

These many factors led the modern architect to the realization that they faced a decidedly new era in world history, that is, an era that set these architects on decades-long professional pursuits in opposition to the cultural and professional status quo that preceded them. Because these same challenges have persisted into our town times, today's architecture students have much in common with their predecessors in the Modern Architecture era.

Today's students bring into their classrooms a yearning for cultural and social relevance. They wish to be at the leading edges of technology, materials, and innovative forms. They are also mindful of architecture's ability to address trends and world views that have heretofore been underserved or were altogether nonexistent in the minds of most designers. As educators, we can leverage the mindset of the modern architect to shepherd our students in the acquisition of the new skills and mental processes that they will need to give voice to their varied creative, personal, and ethical interests.

This paper posits that as architecture students strive to be culturally conscious, socially relevant, and at the forefront of today's creative and technological trends, the Modern Architecture movement can be shown to act as a way forward for such students. As evidence, this paper presents a number of studio projects that rely on the successes of modern architects in order to steer our students' thinking in ways that were previously unfamiliar to them.[2]

One set of projects has focused on residential architecture for multiple historical reasons. One such project asked students to draw from both modern and ancient concepts of space and circulation in order to design a house unlike any they have conceived of before now – a house with no interior doors. Another residential project dealt with an issue that was as timely as it was unexpected. In response to the COVID-19 global pandemic, students were to design a house that was simultaneously a home office, school, entertainment center, and family refuge.

Another project type asked students to delve into culturally, socially, and personally consequential topics so as to then create an edifice for that topic's communal remembrance and honor. One final project put students into the mindset of those designers who provided some of modern architecture's boldest and most radical and experimental structures, structures as varied as the Crystal Palace, Eiffel Tower, and the New York City Guggenheim.

After discussing these projects, this paper aims to draw general conclusions on how the studio professor can draw upon our architectural heritage to conceive new, relevant, and engaging studio projects. I hope that students will likewise find themselves following in the paths of the great masters as they navigate the complexities of design. To begin with this discussion, we will delve into two residential projects and their origins in modern architectural thinking.

The Modern House: An Experimental Testbed and a Vehicle for Social Relevance

Various architectural historians have pointed to housing and its many implications as one of the chief preoccupations of the Modern Architecture movement and its practitioners. Thus, it is rare to find a distinguished modern architect

without a notable contribution to the field of residential architecture, whether the single-family home, apartment building, or living community.[3] To these architects, the modern dwelling or house served as a platform for innovation in numerous ways that challenged and advanced the field architecture as a whole. These innovations included, though they were not limited to, building forms, new materials and construction techniques, free and open floor plans, opacity and transparency, relationship to the landscape, healthy and affordable living, and mass housing. In similar ways, the design of a "modern" house can stimulate beginning design students to think in terms far beyond their idiosyncratic and common experiences revolving around houses, space, form, and function. Two such projects are "The Free-Flowing Modern House" and "The 2020 (or 2021) House."

The Free-Flowing Modern House / A House With No Interior Doors

The aims of "The House With No Interior Doors" projects have been twofold. First was for students to conceive of space, specifically domestic space, in ways they had likely never thought of before now. In that regards, some general questions that the students had to face included the following:

- How can a mix of varied personal spaces effectively coexist without fully enclosing any one space other than the hard separation between a house's exterior and interior?
- How can you ensure privacy in key places within a house, particularly in the bedrooms and bathrooms?
- What are the specific micro and macro circulation issues related to thresholds, walls, and the interior design of spaces all within a fully flow-through space?

A particularly helpful mental paradigm when taking on these issues is the modern or contemporary museum and its *en suite* or serial arrangement of space. As a person makes their way through a museum today they often move casually from one room to another interconnected room, turning a corner from one exhibit space to another, rarely having to push open door or exert any energy beyond what is required for a comfortable walking pace. In turn, a person seems to casually move, as if unconsciously compelled, through a procession of spaces. And while this analogy is an easily relatable starting point, there are other mental paradigms that comprise the second major aim of this project.

The second aim of the project is to learn about and apply historical lessons related to these sorts of spatial arrangements. The primary examples of such spatial conditions emanate from the works of Mies van der Rohe. When we delve into some of Mies's most iconic works, we see spaces that are as subtly unorthodox as they are extremely simple. Consider as primary examples the Country House in Brick and the Barcelona Pavilion, among many other relevant examples.[4] In examples such as these, Mies achieves the desired effect of a free-flowing space through a limited palette of wall types and the solid-void interrelation between those walls. Mies's palette of wall types in his iconic works consists of the following (see Figure 1):

- The straight line |
- The L, with legs of equal or unequal lengths
- The T, with the stem usually offset or off-center
- The U or end bracket, usually capping the end of a building or pavilion
- The Z or zig-zag, with its component lines orthogonal to one another

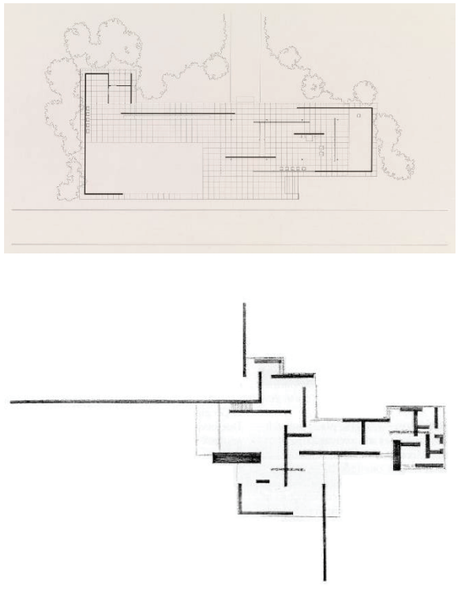


Figure 1. Samples of Mies van der Rohe's wall configurations in two widely published works – top, the Barcelona Pavilion (1929), and bottom, the Country House in Brick (1924).

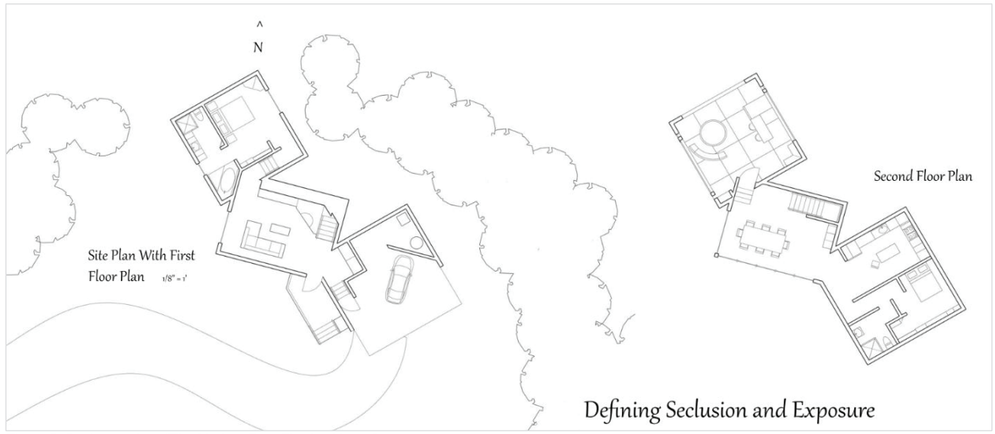


Figure 2. Student project, "The Modern Free-Flowing House".

When placing these walls on a floor plan, the walls invariably fell on a rectilinear planning-structural grid, with the walls either in-line or orthogonal to one another. Furthermore, the voids in the building (i.e., the windows, doors, or connections between spaces or rooms) consisted simply of one wall being pulled away from another wall. Circulation throughout a building remains a simple act of moving along the length of a wall, or walking around a wall to turn a corner into an adjacent space.

Another conception of space that closely aligns with the characteristics of Miesian space described above is the ancient concept of a spirit wall, which Norbert Schoenauer details in his book *6,000 Years of Housing*. Writing about a dwelling type that is thousands of years old and have be found from Egypt, Syria, and Iraq to China and Japan, Schoenauer explains,

> "An intrinsic feature of many court-garden houses is the design of the entryway with a wall positioned to ensure visual privacy of the interior. Increased density coupled with the desire to retain some sense of privacy resulted in the evolution of the spirit wall, a screen that clocks the view from the outside into the house and the court. […] This screen wall…prevents the entry of evil spirits, which are reportedly unable to travel around corners."[5]

To successfully implement the ideas above, students had to be particularly mindful of (1) circulation at the macro and micro levels within the house, (2) the sequence and adjacencies between spaces, and (3) public-private spheres within a house (see Figure 2). A potential pitfall in handling these two issues was a convoluted arrangement of walls required to separate two critical spaces that would normally and simply have a door in between them. The stu-dents who were able to resolve all of these issues most successfully did so in ways that went entirely unnoticed by the project reviewers when the students presented their designs at the end of the assignment. To this end, the students and faculty who were asked to judge the projects at their final reviews were kept unaware of each student's true intent, that is, design a house with no interior doors. The judges were only told that they were reviewing "modern houses", and no reviewer to date has asked, "Where are your doors?"

The 2020/2021 House

Another residential project asked students to design for a timely, highly unexpected, and elusive goal – a house that responds to the challenges of COVID-19.[6] This project aligned itself with three components of modern architectural designs: residential architecture, a safe and healthy living environment, and social relevance. The project sprung up within days of the Fall 2020 semester, the same time in which students and faculty around the country were making their final determinations on how to approach the new school year at the same time that the specter of COVID-19 was looming over all of our planned activities. Students

were also adapting, often in real time, to fluctuating home, school, and work environments.

In hindsight, the studio would have benefitted from the lessons learned in the areas of wellness design and historic responses to health crises. Instead, we relied chiefly on our own experiences since our worlds had been upended in March 2020 and over the subsequent summer. Common approaches focused on gathering several functions at the family home: rest, entertainment, work, school, physical activity, and quarantine, among others (see Figure 3). Some students opted for the idea of "walking to school" or "going to work." This entailed physical separations between the home and those spaces normally associated with being away from home. Nealy all projects took advantage of the house plot so as to include outdoor spaces for the new conglomeration of residential spaces previously mentioned.

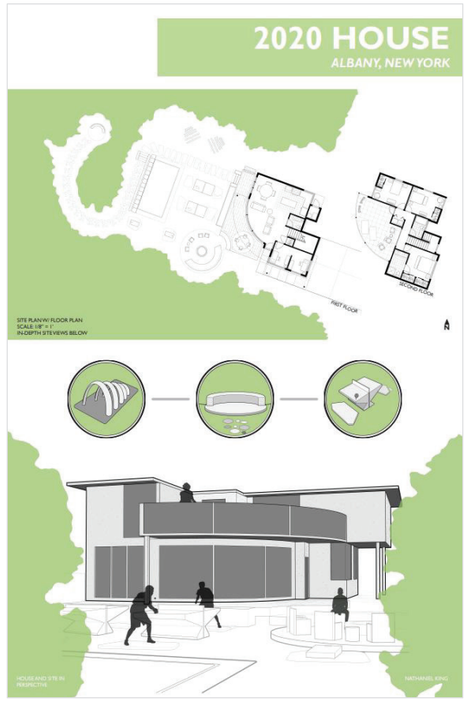


Figure 3. The 2020 House. Mixing many personal, work, and school functions in a common site and home.

The Monument: Remembering, Celebrating, Commemorating

A second kind of project drawing inspiration from modern architectural sensibilities is an assignment entitled "A Commemorative Place." The assignment brief asked students to design a building and site dedicated to a person, people, event, and/or historic place. As a mental primer to this project, students were asked to consider the meanings and implications of contemporary monuments, chapels, and shrines, and to then study and analyze precedents relating to such architectural works.

Examples of monumental and religious architecture are as old as recorded history. Past eras have been replete with the triumphal arch and column, the obelisk, and the temple and cathedral. Inspired by technology, by new building materials, and by trends in modern art, architects (particularly in the early twentieth century) brought innovative and increasingly abstract ways to symbolize recent memory, experiences, and people. These architects also charted new directions of relevant topics worth celebrating or commemorating. Not as interested in the triumphs or acquisitions of emperors or generals, modern architects turned their attentions to the kinds of individuals who had been less heralded in the past, and to emerging ideologies or institutions.[7]

Consider, for example, the case of Vladimir Tatlin's Tower (unbuilt, 1920), also known as the Monument to the Third International. The tapered, spiraling, multilevel, and exposed-frame structure was not just a reinterpretation of the industrial aesthetic popular at the time (famously evident in Walter Gropius' Fagus Factory of 1914 or Bauhaus school building of 1926). It was also, as Kenneth Frampton points out in his *Modern Architecture: A Critical History*, both a showcase of the multifaceted Russian Constructivist movement and a tribute to a new polis – the Soviet industrial proletariat.[8] Thus, new material and aesthetic interpretations were turned towards a novel focus – not the celebration of the past or a leading historical figure, but rather the future political and artistic aspirations of a people.

Also consider a lesser-known counterpart to Tatlin's Tower. Not to overindulge in Marxist tributes or particular German architects, Mies van der Rohe's Monument to the November Revolution (1926) – a memorial to two political (i.e., Communist) martyrs and their associates buried in a Berlin cemetery – was a sculptural piece befitting the Modern Art movement that was evolving at that time.[9] Cubist, asymmetrical, protruding and recessing, cantilevered, stereotomic, and rough-textured, the monument defied what, who, and how to commemorate in the modern era (see Figure 4).

Figure 4. Mies van der Rohe's Monument to the November Revolution.

Along the lines of Mies and Talin's works cited here, "A Commemorative Place" sought to instill in students new subjects worthy of considerations due to their social, cultural, historical, and even personal significance. Students were to also explore forms, spaces, and aesthetics informed by precedents yet worthy of our own times.

Students selected an admirable array of subjects. In doing so, they set a tone for the sobriety of the assignment, and reflected the depth of their thinking about contemporary issues. The choices – which explored activism, faith, and profound loss in diverse ways – consisting of the following thirteen historical and contemporary figures:

1. Ernestine Eckstein (an Indiana native, and a Black, lesbian, political activist)
2. Le Corbusier
3. Navy SEAL Chris Kyle
4. Malcolm X
5. Saint Anthony (the patron saint of lost things)
6. Saint Cecilia (the patron saint of music)
7. The Apostle Paul
8. The Apostle Peter
9. The American service members who died during the withdrawal from Afghanistan
10. The grandmothers of the disappeared in Argentina's "Dirty War"
11. The victims of the Deepwater Horizon explosion
12. The victims of Japan's Fukushima nuclear disaster
13. The victims of the Space Shuttle Challenger Disaster

Out of these varied selections, the students set about creating sites and buildings that were equally distinctive, imaginative, and meaningful. To highlight only one student design out of thirteen quality submissions, a commemorative place dedicated to Saint Anthony (the Patron Saint of Lost Things) was among the best work in the studio (see Figure 5).

Figure 5. A Commemorative Place for Saint Anthony, the Patron Saint of Lost Things.

The site chosen was a moderate, uphill, walking journey west and within view of Bologna, Italy. This physical separation from the world was purposeful – a pilgrimage to honor a highly consequential personal loss. Walking around the building to enter from the rear (i.e., the side farthest from Bologna), a visitor winds around corners and spaces of varying sizes. Some spaces are meant for quiet comtemplation alone, while others allow for shared experiences. All of the spaces, however, are subtly screened from one another, save for the circuitous route a visitor takes through the building. There is one part of the building that facilitates reflection with a view of the surriounding landscape, but in the end all visitors are gently ushered back onto the landscape for their return to the word and having hopefully advanced on their personal healing process. Formally, the commemorative place is the epitome of simplicity, with a sparse material palette, and an open-air, pavilion-like composition of solids and voids that allow for ample natural light and different experiences on this personal journey.

The Radical Edifice: The Bold Leap Forward in Architecture

The final studio project under consideration – titled "Thesis, Antithesis, Synthesis" – relied on the notion that great leaps forward in the development of the built environment have come from architects and their buildings that defied, whether purposefully or coincidentally, their existing contexts. Modern architecture in the 19th and 20th centuries is replete with relevant examples, including Frank Lloyd Wright's Guggenheim Museum, Gerrit Rietveld's Schroeder House, and two skyscraper projects – Mies van der Rohe's Friedrichstrasse skyscraper and Walter Gropius' entry in the Chicago Tribune Tower competition. Whether fully realized or only conceived on paper, prior to each of these designs no other buildings like them had been seen before each of their times. In the 19th century, three cases stand out, literally and figuratively, even more so than their successors in the next century. First, the Eiffel Tower, an international icon since it's completion in 1889, becomes all the more impressive when we consider that it was the tallest building in the world until surpassed forty-two years later by the Empire State Building.

The historian Leland Roth helps us to understand the next two examples. Of the Crystal Palace (1851), Roth writes, "As in no building before, Paxton [the designer] had created a building in which the volume enclosed far surpassed the mass of the builging."[10] Also worth noting are that the building was fully prefabricated and consequently its accelerated construction time. This oversized glass box (really a glass behemoth) presaged all modernist glass boxes of the next century, predating the Farnsworth House by a full 100 years. A third project, Paris' Gallery of Machines, was the Eiffel Tower's horizontal counterpart at the 1889 World's Fair. Roth called it "cavernous," and "nearly pure structure" that was "the logical extension of […] rationalism in design."[11] Roth further lists the gallery's massive proportions: 1,407.5 feet long, "a clear span of 377.25 feet," and 142.5 feet tall.[12] In these latter three examples, each building had technological precedents (greenhouses, iron bridges, and railway stations), though nowhere near to them in terms of their grand scales and creators' bold visions.

The studio assignment "Thesis, Antithesis, Synthesis" asked students to design in these same bold, experimental, even defiant fashion. Students took on a contemporary precedent first for analysis. Then the students designed an artist's residence and visitor's center for their precedent. Lastly, the students were to fuse together their precedent and their original designs. One of the most successful projects was designed in opposition to the Notre-Dame Cathedral in Paris (see Figure 6).

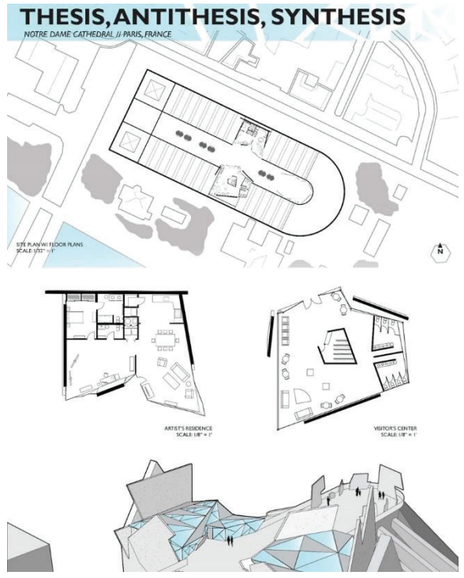


Figure 6. Student project atop the Notre-Dame Cathedral in Paris.

The Notre-Dame additions led the instructor to caution the entire studio section, in a half joking manner, that their projects were so revolutionary, they may actually offend some of the project reviewers. This bode well in terms of the level of experimentation of the projects. Regardless, the visitor's center and artist's residence sat atop cathedral's roof, and assumed a jagged, angular, opaque and transparent, and deconstructed shell over both the residence and visitor's center. A small plaza area for visitors sat atop the cathedral, too. And the material palette consisted mainly of concrete and glass.

Just like Wright's Guggenheim and Rietveld's Schroeder House, designing in stark opposition to the imposing presences of the students' chosen precedents demanded and led to radical thinking. This mindset led to a mix of forms, geometries, and materials. Both at Chicago's Willis Tower and near IIT's Crown Hall, the sinuous contrasted the straight, and strictly vertical or horizontal. At the Notre-Dame Cathedral, the highly ordered opposed the irregular, jagged, and angular. In the vicinity of either a Medieval church in Norway or Zaha Hadid's Olympic Aquatic Center in London, the simple contrasted the complex. Both near a towering Palladian villa and the Lotus Temple in New Delhi, it led to a curvilinear, underground habitat for an artist.

General remarks on the application of modern architectural lessons in the design studio

When faced with the responsibility of developing my own studio assignments as a primary instructor in Fall 2018, I immediately turned to the ideal reservoir of ideas for any intellectual pursuit – the history of one's chosen profession. Our Modern Era predecessors have demonstrated to us how to handle the greatest infusion of new paradigms in the design disciplines. Researching and teaching modern architectural history has compelled me to turn to the following:

- Functional types: residences, transportation facilities, public institutions (e.g., libraries, art galleries, entertainment)
- Contemporary relevance: technology, materials, construction methods, socio/economic/political trajectories
- Creative expressionism: forms, geometries, free plans, multi-height interior volumes

Beyond these general considerations, I delve into the specific projects of the modern masters for highly specific lessons in the built environment: the sort of sites those architects designed and built upon, and how to interact with them; figure-ground relationships; and indoor-outdoor interaction; among other instructive factors. Personally, the process began in earnest with that first project, "The Free-Flowing Modern House," in which I put great mental efforts as to "what would modern architects do?" Over the years, subsequent hours invested in our history books have proved invaluable. Dig into the monographs or latest interpretations of your favored architect. They will provide invaluable guidance on your next studio course.

End Notes

1 Throughout this paper, the word "modern" will specifically refer to the time associated with the Modern Architecture movement, which will loosely span between the late 1800s to the Late Modern Era of the 1950s/60s. As alluded to in the paper, however, we do not accept that the Modern Architecture movement ever entirely passed. It's influences continue to hold a very strong influence upon our thinking and teaching today, whether we academics are open to accepting that fact or not.

2 The students who undertook these projects were college sophomores in their first year in our Architecture Program at Ball State University in Muncie, Indiana.

3 Some architects contributed either a vast number of residential projects, a set of highly influential designs, or both to the field of residential architecture. In doing so, they had a great influence in broadly defining the modern home. Among these we can include such modern masters as Frank Lloyd Wright, Mies van der Rohe, and Le Corbusier. The contributions of others were much more modest in terms of quantity, though their small output belies the level of innovation and high quality behind their home designs. To this group of designers we may include Louis Kahn, Eileen Gray, Charles and Ray Eames, Marcel Brauer, and Jørn Utzon.

4 Other examples include Mies's Courtyard Houses (1929, 1934, and 1938), the Lange and Esters houses (1930), the Tugendhat House (1930, with a rare Miesian curved wall), the Hubbe House (unbuilt, 1935), and the Resor House (unbuilt, 1938).

5 See Schoenauer, *6,000 Years of Housing*, 99.

6 The project was run in the Fall 2020 and Spring 2021 semesters. The assignment took its name from the time of the assignment, as the name "The COVID House" would have had less than desirable implications.

7 Notable exceptions to the trends in modern monuments and memorials are Louis Sullivan's tombs. Arguably, the ornate and imposing edifices designed and built for powerful and wealthy industrialists is not a far departure from the historic monuments to past conquerors, colonizers, emperors, and kings.

8 See Frampton, *Modern Architecture: A Critical History*, 170-171.

9 See Bergdoll, *Mies in Berlin*, 218.

10 See Roth, *Understanding Architecture*, 437.

11 Ibid., 438-9.

12 Ibid.

Works Cited

Bergdoll, Riley. *Mies in Berlin*. New York: The Museum of Modern Art, 2002.

Frampton, Kenneth. *Modern Architecture: A Critical History*. London: Thames and Hudson, 1992.

Roth, Leland. *Understanding Architecture*. Boulder, Colorado: Westview Press, 1993.

Schoenauer, Norbert. *6,000 Years of Housing*. New York: W.W. Norton and Company, 2000.

Learning to Defer Judgment

Taryn Mudge, PhD., Temple University, Tyler School of Art and Architecture

Introduction

When students of architecture approach a project site for the first time, they are confronted with an array of information, whether visual, cultural, or environmental. Some site information is known or self-evident, yet often a great deal is unknown or latent. Typically, students approach a project site as an outsider with a lack of intimate knowledge of the customs, characteristics, and qualities of that place. The tendency in studio education, I would argue, is to rapidly acquire information deemed essential – to ostensibly bridge the gap between the unknown and the known – so that the process of design, a process of asserting judgment and making plans for change, can begin. I believe that in haste students make assumptions and ultimately overlook the most enriching design solutions. In other words, they tend to project their world views onto that place rather than methodically learn from the existing context.

This paper is a theoretical and historical analysis of a "less judgmental" and more observant approach to architectural site research. It situates the theory and design methods of Alison and Peter Smithson in relation to that of Denise Scott Brown and Robert Venturi (SBV) to reveal a shared attitude toward "the real." I have found that in their attempt to "defer judgment" and embrace reality on its own terms, each of these practices borrowed methodological lessons from the social sciences and were visually inspired by straightforward or deadpan photographic documentation.

Central to this research is the issue of the architect's point-of-view or, more specifically, the physical distance from their research subject. Both the Smithsons and SBV commonly strove for impartiality and unbiased vision, and, as I have learned, their desired neutrality informed their chosen vantage: the Smithsons preferred to study a site as pedestrians while SBV relied on the view through the windshield. In each scenario, their chosen vantage reflected a sensitivity to existing site context and exposed their critique of contemporary architecture and urban discourse.

The Smithsons

Attitudes and Vantages

Alison and Peter Smithsons were an architect-couple practicing in London following the Second World War. Throughout their career, they produced several notable buildings, however, I would argue that their most significant contribution was their less-biased attitude and pedestrian-approach to visually analyzing existing site context. Central to their design theory was the idea of deferring academic judgment to enable a more objective understanding of reality. Their manifesto from 1957 titled "The New Brutalism," for example, called for a new, more "ethical" way of thinking about architecture and the city. It did not altogether reject the past, but rather aimed to shift the philosophies of 1930s modernism to better address contemporary needs and cultural issues by drawing upon so-called "reality" as a new source for design:

Any discussion of Brutalism will miss the point if it does not take into account Brutalism's attempt to be objective about "reality" – the cultural objectives of society, its urges, its techniques, and so on…Up to now Brutalism has been discussed stylistically, whereas its essence is ethical.[1]

The New Brutalism manifesto was concerned with more than a 'brut' aesthetic in architecture, it reflected a new attitude toward the everyday and a new way to cope with social realities. The social reality in London in the 1950s was disconsolate: reconstruction was slow and scars from a violent war remained visible across the city. In considering how to rebuild, designers and planners alike questioned whether to return to strategies popular before the war – Le Corbusier's rational urban schemes being the most widely accepted – or to adopt a new approach.

During the interwar period, there was an increase in availability of aerial photography, and Le Corbusier, as many historians have noted, relied on the aerial vantage when planning for the city.[2] Flight, he believed, provided an observational advantage that both exposed the failures of cities and "enlightened" the city planner. His popular

"functional city" schemes, such as Ville Radieuse, were imagined from above and sought to ameliorate the "appalling" conditions in which people were forced to live by tearing down the dysfunctional city to make way for a new, more rational urban system, one that he believed was the blueprint for social reform.[3]

By the end of the Second World War, however, the "enlightened" aerial perspective and Le Corbusier's prevailing Modernist planning principles were under scrutiny. The view from above had been weaponized; the distance provided by aviation enabled pilots to decimate whole neighborhoods with little consequence and, for a younger generation of architects in England with firsthand experience of this destruction, Le Corbusier's *tabula rasa* urbanism was now considered an analogous form of destruction.

The Smithsons were at the helm of this critique. They considered his aerial method of observing and planning for cities to be overly elitist and felt that his desire to erase the existing urban fabric neglected the social and historical value of a community. They responded by adopting a more grounded methodology: they preferred to witness the city as pedestrians. The close-range sidewalk view brought them into proximity with the "reality" on the ground and enabled them, physically and metaphorically, to get close enough to the subject that they could reach out and touch it: "We were people picking up and quizzically turning things over in our hands, reconsidering everything."[4] To position themselves closer to everyday life, in their eyes, was more ethical than flying overhead at great distances and inspired more sensitive design solutions.

The process of getting closer to the physical reality on the street and embracing qualities of everyday life is something they referred to as the As Found. The As Found was a theoretical framework that maintained a deep appreciation for the remnants of everyday life and encouraged designers to look to ordinary objects as new sources for design. In a postwar society that had limited resources, they explained, "You reached for what there was, previously unthought of things."[5]

Their close-range pedestrian mode of observation was foremost a reaction to the aerial destruction caused during the war and to Le Corbusier's *tabula rasa* planning principles. In conceiving this new approach, they looked to other fields for ideas about how to participate in close observations and to generate ideas from the ground up.

Throughout the 1950s, they gravitated toward artists, like Nigel Henderson, who were walking the streets and engaging with everyday places and artifacts, and they learned from social scientists, like Patrick Geddes, who were rigorously surveying everyday life.

Interdisciplinary Influences

Patrick Geddes was a sociologist, biologist, and town planner who believed that the improvement of the physical environment was vital to the advancement of civilization.[6] He was a champion of regionalism; he called for a better understanding of historical evolution; and he advocated for close observation as the means to discover relationships among place, work, and people. He felt it was critical to collect detailed information – via the civic survey – and to share this information with the public – via the civic museum. The civic survey was defined as a close study of cities by documenting their origins and evolutions via carefully prepared maps, plans, drawings, photographs, and engravings. As one historian dubbed, the civic survey was an "encyclopedic meta-view of all available knowledge."[7] The goal of the civic survey was to guide planners toward meaningful design decisions and to address a question central to social studies, "What is our relationship to practical life?"[8]

Notably, he encouraged a non-judgmental method of observation by asking his civic researchers to practice a "wise detachment" and suggested that mediations be "prolonged and impartial."[9] He called for surveyors to record unfiltered observations and to refrain from making aesthetic judgements. He was interested in both the "present beauty and ugliness" of each city and felt that deteriorated and blighted urban areas maintained a cultural value.[10]

The Smithsons featured the work of Geddes during a preparatory CIAM meeting in Doorn in January 1954 when they presented, with their peers, a "Declaration of Habitat." In this declaration was a diagram titled "Geddes Valley Section" which directly referenced Geddes' philosophy of social evolution and the idea that settlements – from "hilltop to sea" – corresponded to geography as well as types of labor and cultural formations. The Doorn meeting was reserved for a young faction of CIAM members, soon to call themselves Team 10, that wished to see the organization move in a new direction. This research suggests that Geddes' town planning philosophies were fundamental to this postwar shift in design discourse.

Figure 1 Nigel Henderson, Bethnal Green, c.1951

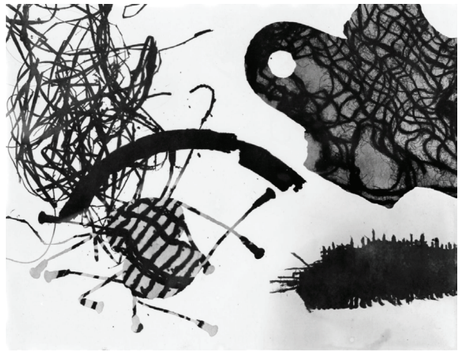


Figure 2 Nigel Henderson, "Hendograms," c.1949.

Another important source of inspiration for the Smithsons was artist Nigel Henderson. Henderson, while recovering from war-induced post-traumatic stress, developed a habit of visually documenting the physical conditions of London's East End via photography and photograms starting in 1945. With "nerves stripped like wires," he found relief in taking long walks through the streets of his neighborhood in Bethnal Green. His "compulsive" perambulations were a form of therapy: "for walking around – always taking streets unfamiliar to me had become a soothing experience for a restless and anxious mind."[11] Soon, he started to bring along a camera to record his observations. His images ranged from straightforward to abstracted representations of everyday life in his neighborhood.

In 1949, he began experimenting with a photographic enlarger, a device that enabled him to produce a series of photograms, or camera-less imprints of physical objects found during his walks. He would collect various domestic materials or bomb debris and bring them back to his dark room, "like a dog with a bone."[12] His photograms were an acknowledgment of the reciprocity between the objective nature of material objects and the artist's subjective manipulation. The artist controlled the exposure time and the composition, but the physical object and its inherent density determined the silhouette and the amount of light able to pass to the photo paper below.

For Henderson, walking the streets with a camera in hand and lugging bomb debris back to his dark room to be analyzed within the frame of his enlarger – "a technique of close scrutiny" – was a way of rediscovering meaning and finding artistic inspiration. The Smithsons unequivocally identified his postwar images as the primary visual inspiration for the As Found aesthetic in architecture. They claimed:

In architecture, the "as found" aesthetic was something we thought we named in the early 1950s when we first knew Nigel Henderson and saw in his photographs a perceptive recognition of the actuality around his house in Bethnal Green…the items in the detritus on bombed sites, such as the old boot, heaps of nails, fragments of sack or mesh and so on.[13]


Figure 3 Nigel Henderson, Bethnal Green, c.1951, Image used by the Smithsons during CIAM IX in 1953

Like Geddes, the Smithsons featured Henderson's work at a CIAM meeting to help shift the focus of postwar architecture culture from the functionalist tenets of the older generation towards a more human-centered approach.[14] Their seminal Urban Re-Identification Grille, presented at

CIAM's ninth congress in Aix-en-Provence in 1953, heavily featured his images of Bethnal Green. Each image was shot in a similar fashion, from the top step of the stoop of his row home gazing down toward children playing on the sidewalk. There was no sky or horizon visible, and little or no evidence of surrounding buildings. Instead, the frame was filled with the rough texture of concrete, hopscotch chalk markings, and children smiling and actively engaged in play.

Henderson's photographs and photograms emphasized a closeness to the subject, the tactility of materials, and the possibility of chance encounters. Geddes, on the other hand, was less preoccupied with the experience of the individual and more focused on the "meta view," or the all-compassing civic survey. Each of these influences helped to shape the Smithsons' new design methodology. Geddes encouraged them to practice a "wise detachment" and to consider the full scope of the project site, while Henderson reminded them to carefully consider the physical details.

Practical Application

Backed by their interdisciplinary influences, they learned to be mindful observers and to rigorously document their observations on the ground via photography. They believed that being on the street with a camera in hand enabled them to actively engage their surroundings and allowed the existing environment to mold their architectural proposals. This was, for them, the methodological solution to New Brutalism and theory of the As Found.

Apropos their architectural practice, they tended to begin their commissioned work by first methodically photographing the project site. They would walk the grounds with a camera in hand, recording textures, materials, and forms. One could imagine that their site excursions were comparable in many ways to Nigel Henderson's discovery tours in Bethnal Green in the 1950s.[15] Similarly, the images were taken from a pedestrian point of view – the camera was held at eye-height and the photographer walked along a sidewalk or down the center of a street looking back at the streetscape.

Their site photographs were then developed into small high-gloss black and white photographs and glued to large sheets of white drawing paper. When documenting long building elevations or continuous landscapes, they stitched a series of still images together to generate a more encompassing panoramic view. The presentation of these images was messy and unpolished, suggesting they were used internally as reference material and not shared publicly. In other words, the images were not valued as a final product, like Henderson's art practice, but rather served as a Geddesian survey of past experiences of the site.

Fig. 4 Peter Smithson's site photography, Magdalen College, Oxford, 1974

Figure 5 Peter Smithson's joined site photography, Robin Hood Lane, 1963

I believe that the Smithsons' photographic site surveys served as a critical link between their theory and practice. Furthermore, it synthesized the influence of Geddes and Henderson by attempting to counter explicit shortfalls of each. Geddes survey methods embraced an objectivity that was admirable, yet his attempt to be comprehensive and wide-reaching arguably started to resemble the Corbusian aerial image of a neighborhood. Conversely, Henderson's on-the-street perspective provided a closer view of the site and its inhabitants but did so at the expense of objectivity by privileging the curator-artist vantage.

The Smithsons attempted to overcome the shortfalls of one with the other. In doing so, they generated a new, rather than borrowed, method of design that shifted the discourse of architecture away from high-flying Modernist principles and toward a less-biased, more empathetic consideration of existing site conditions.

Scott Brown and Venturi

Attitudes and Vantages

Denise Scott Brown and Robert Venturi (SBV) were an architect couple who produced a long list of canonical buildings and, like the Smithsons, were responsible for steering architecture and planning in a radically new direction in the latter half of the twentieth century. Undeniably, there are clear cultural and temporal differences between these two well-known architect couples: the Smithsons' practice began in the postwar context in England in the 1950s while SBV's practice followed and took place during a period of rapid suburbanization in the United States in the 1960s and 1970s. Yet despite their differences, they each exuberantly embraced the banality of everyday life and popular culture and promoted a less-judgmental, more open-minded approach to researching existing site conditions.

This research has demonstrated that the Smithsons' ideology was propelled by a desire to challenge Le Corbusier's aerial mode of planning after the Second World War. They sought to bring architectural analysis back down to the ground by establishing a pedestrian perception of the built environment. Transitioning the narrative to the United States in the 1960s and 1970s identifies another significant shift in perception: SBV's architectural philosophy was stimulated by a desire to contemplate the speed at which American cities were expanding and to understand the contemporary perception of the consumer, who experienced the urban environment not by walking but by driving. If Le Corbusier was aligned to the aerial view and the Smithsons to the pedestrian view, then SBV were foremost associated with the view through the windshield, and they directed their inquisitive gaze toward suburbia, the commercial strip, and the conditions of the American Main Street.

Their embrace of the windshield vantage was a reaction to the contemporary criticisms of commercialization and suburbanization. By the 1960s, a sprawling network of highways, commercial strips, shopping malls, and tract housing consumed the American landscape, initiating frenzied debates in architecture and planning regarding how to manage the visual effects of capitalism on the built environment. Issues such as the universalization of suburbia, the excess of billboards and junkyards, and the honky-tonk aesthetic of roadside attractions were at the forefront of such debates. Not everyone, however, was a vehement opponent of this new condition. Scott Brown and Venturi pushed back by polemically asking, "is not Main Street almost alright?"[16] Rather than condemn, they gazed upon the burgeoning landscape with curiosity and proposed that architects and urban planners similarly defer judgment to better learn from the increasingly auto-centric and consumer oriented environment. As Scott Brown explained:

This is not to abandon judgement, for planned action implies judgement. Judgement is merely deferred a while in order to make it more sensitive. Liking what you hate is exhilarating and liberating, but finally reaffirming for judgement.[17]

It is difficult to separate the individual contributions of Scott Brown and Venturi; they both polemically celebrated the "ugly and the ordinary" in the American landscape; they co-taught the now-famous Yale studio, "Learning From Las Vegas, or Formal Analysis as Design Research," in 1968 and co-authored, with Steven Izenour, the book that followed in 1972. Still, I believe that Scott Brown, more than Venturi, was responsible for the development of a "less judgmental" and "non-directive" attitude as it relates to design. Specifically, her role as a photographer, and her relationship to sociological analysis was essential in creating an original method of observation.

Scott Brown was born in 1931 in Johannesburg, South Africa, a place, and time that was fraught with racism and extreme inequities. This contentious environment deeply impacted her intellectual and creative development. It caused her to reflect upon issues of cultural difference and privilege and caused her to develop a sensitivity to context. When asked about her adolescence in South Africa, she often references a question posed by her art teacher: *"How can you be a creative artist if you don't respond to the landscape directly around you?"*[19]

In 1952, she traveled to London to complete her undergraduate degree at the Architectural Association. Here, she was exposed to postwar debates regarding reconstruction and learned of the Smithsons' burgeoning theory of New Brutalism. After completing her degree in architecture at the AA, she decided to study urban planning at the University of Pennsylvania. In 1958, she arrived in

Philadelphia, as she described, “backed by a new brutalist rhetoric and the hope to do good.”[19]

While at Penn, she began to formulate her theory of “deferred judgment” in architecture as well as her “learning from” studio pedagogy. Like the Smithsons, she looked to other disciplines for methodological and aesthetic inspiration. She drew from urban planners and sociologists, such as Herbert Gans, who similarly claimed to withhold judgment to better learn from everyday life, and was inspired by artists, such as Ed Ruscha, who adopted a deadpan approach to recording mundane American landscapes.

Interdisciplinary Inspiration

Herbert Gans is a sociologist who polemically challenged the popular depiction that postwar suburbs were sterile, conformist, and pathological. He joined Penn’s faculty in the City Planning department after completing his PhD in 1957 and taught Scott Brown in 1958 while working on her master’s degree. According to Scott Brown, Gans’ teachings directly influenced the development of her “Learning From” attitude as well as her interest in American suburbanization. The same semester that Gans taught Scott Brown, he moved to Levittown, New Jersey to be a participant observer in the suburban community recently built by the Levitt & Sons. For two years, he lived on-site and documented the ways in which a collection of strangers ultimately became a community and observed how people’s lives changed when they left the city. His research challenged the idea that suburban life was predictable and easily definable. Instead, he found that Levittowners lived nuanced lives and engaged in a process of adapting their needs to new social and environmental situations.

More broadly, his teachings passionately debated issues of fairness and justice and showed support for the rights of society’s “underdogs.” According to Scott Brown, he was skeptical of the architect’s ability to “save the world” and saw planning experts, including the likes of Jane Jacobs, as “elitists caught up in upper-middle-class and personal value systems of which they were unaware.”[20] He also stood adamantly against urban renewal and disputed modernism’s idea of functionalism by asking: functional for whom? Reflecting on the lessons learned from Gans, she stated:

I have not denied being an ‘elitist’ but have tried to make myself aware of other people’s values, especially of those for whom I plan to build. I agree with Gans that planners should ask the essentially political questions: who benefits? who loses? how far should the ‘ought’ diverge from the ‘is’? who decides?[21]

In this context, being mindful of other people’s values meant temporarily setting aside one’s privileged vantage and education to learn from the ‘is’ – the existing culture, politics, ways of living – in a community. Planners were asked to be “nondirective, leaving choices open to people of diverse needs and tastes,” and the notion of “reserving judgment” was borrowed from Freudian psychiatry, as she described, “at least at first, to make subsequent judgment more sensitive.”[22] Architecture and planning – fields grounded in criticism – were now being asked to hold back their initial decrees in service of a more suitable design response.

In an essay in 1969, she described the non-judgmental attitude as “the greatest invention of the twentieth century” and claimed that “everywhere – in literature, the arts, the social sciences, the humanities, in planning, and now in architecture and urban design – it is making inroads.” She further discussed the concept of “nondirective” by referencing Gans’ sociological methods, Freudian psychiatry, Tom Wolfe’s prose style journalism, Corbusier’s images of grain silos, as well as Ed Ruscha’s photographic series of gasoline stations. She depicted a “new, more receptive way of seeing the environment” and claimed it was “desperately important to architects or planners who hope to stay relevant.”[23]

Ed Ruscha was a Los Angeles based visual artist that, by the mid-1960s, had established an attentive and arguably non-judgmental approach to photographing ordinary American landscapes, such as gas stations, swimming pools, and parking lots. His book, “Every Building on the Sunset Strip” from 1966, ostensibly embodied this non-judgmental approach. By photographing “every building” with equal measure, he was not offering a critique of the environment, but merely recording it.

In 1968, when SBV traveled west with their Yale students, they first stopped in Los Angeles to visit Ruscha’s studio where they learned how he mounted a camera in the back of his pickup truck to produce the images of the Sunset Strip. They would go on to adapt this method in Las Vegas by mounting a camera to the hood and side windows of their rental car, a technique that Scott Brown later referred to as “3-camera deadpan.”

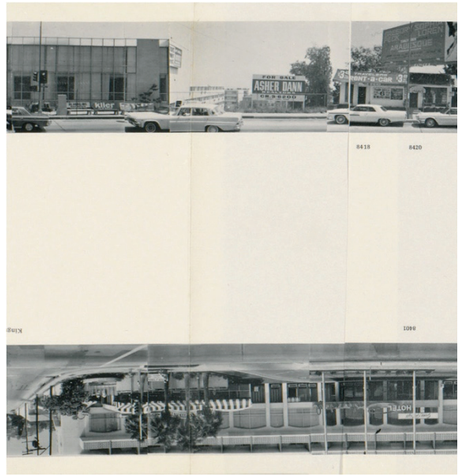


Figure 6 Ed Ruscha, “Every Building on the Sunset Strip,” 1966

Figure 7 Ed Ruscha, "Twentysix Gasoline Stations," 1963

Scott Brown looked to Ruscha as the pioneer of deadpan and felt that his candid representations of American landscapes stylistically embodied her less judgmental – see it for what it is – attitude. Her 1970 studio handbook for “Remedial Housing for Architects, or Learning from Levittown,” described the desired way of looking at America’s spatial realities:

We should aim to dead pan the material so it speaks for itself. Ruscha has pioneered this treatment in his monographs (The Sunset Strip, Some Los Angeles Apartments). It is a way to avoid being upstaged by our own subject matter. It can lead too toward the methodical rigor which will be required of architectural formal analysis once it is recognized as a legitimate activity.[24]

Here, she indicated a process of transmuting Ruscha’s influence into a studio pedagogy. His deadpan photographic techniques enabled the existing site context to “speak for itself,” which in turn provided students a more honest presentation of architectural forms to then analyze back in studio.

In developing her novel design pedagogy, she thoughtfully blended the influence of Gans and Ruscha: Gans taught Scott Brown to be mindful of one’s bias and refrain from judgement, while Ruscha’s photographic techniques encouraged her to remove the subjective gaze and simply record the context, however ugly or ordinary it may be.

Practical Application

Scott Brown was provided a unique opportunity to implement her theory in the field in 1968 when social activist, Alice Lipscomb, invited her to join the efforts of the Crosstown Community in Philadelphia. The Crosstown Community was a grassroots organization whose aim was to generate a counterproposal to the Crosstown Expressway, a federally funded highway planned to replace South and Lombard Street, effectively destroying whole neighborhoods in its path. The group needed to prove that South Street, which had admittedly fallen into disrepair, was still viable and should be repaired rather than destroyed. The social planner responsible for getting her acquainted with the project stated, “If you can like the Las Vegas strip, we trust you not to try to neaten up South Street at the expense of its occupants.”[25]

South Street was an active commercial corridor and the historic heart of Philadelphia’s African American community. Recent efforts to revive the neighborhood were thwarted by the prospect of a highway: real estate values were plummeting, and investors were abandoning the area. Critics were also concerned that the expressway would displace large populations of low- and fixed-income residents and further segregate the poor African American neighborhoods to the South from the wealthy White neighborhoods to the North.[26]

Figure 10 Denise Scott Brown, Philadelphia, c.1961

Figure 11 Denise Scott Brown, South Street, Philadelphia, c.1968

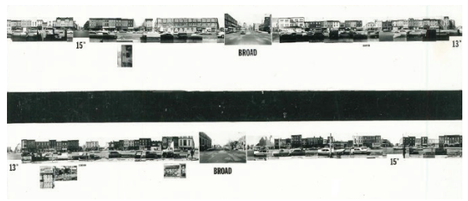


Figure 12 Denise Scott Brown, Ruscha-style Strip Collage, South Street, Philadelphia, c.1968

Scott Brown, who was sensitive to issues of diversity, racism, and classism from her time in South Africa, worked without a fee for the Crosstown Community from 1968 to 1972 to help them meet their three primary goals: 1) Provide physical evidence of progress for the corridor; 2) Provide needed low-income housing as well as cultural, commercial, and recreational facilities; 3) Provide an effective physical deterrent to the construction of the expressway.[27]

South Street was her first real 'Main Street' project and the first community project undertaken as a practitioner rather than an academic. In many ways, her research strategies mimicked the Learning From methodology deployed in Las Vegas: she relied on sociological surveys as well as direct observation and produced maps, drawings, and photographic analysis. Still, the South Street assignment was not hypothetical, but was in service of change that would directly impact the lives of many residents, families, and business-owners.

Photography played a central role in her research; she produced two types of images for South Street: a Ruscha-style strip collage, which emphasized the view from the road, and a series of pedestrian-oriented street photographs. Her strip collage was an elevational study of the entire length of South Street from the Delaware to the Schuylkill; it included both the north and south side of the street – one mirroring the other, with Broad Street, a major North South artery at the center. Her street photos, on the other hand, were taken while walking through the neighborhood with a camera in hand. She captured eye-catching street signage, unique storefronts, and people actively engaging the street. Many of the buildings were in poor condition, however, her photographs seemed to look beyond the peeling paint to acknowledge the history of the place and to reveal its latent potential.

Together with the civic community groups, she helped to defeat the planned Expressway. The counterproposal put forth by the Crosstown Community provided alternative visions for the future of the neighborhood. And, as a result, the City Planning Commission shifted their position from pro- to anti-expressway in the early 1970s. South Street had been saved. Her proposed redevelopment plans unfortunately were never implemented. Still, her analysis and counterproposal for South Street clearly demonstrated her "less-judgmental attitude" and "Learning from" pedagogy, derived from the teachings of Herbert Gans. As well, it provided her the opportunity to visually analyze a Main Street condition using Ruscha's deadpan photographic techniques.

Reflections

In comparing the design process of the Smithsons to that of SBV, I have discovered a shared attitude of neutrality and a common set of interdisciplinary influences: the social sciences and the photographic arts. For these figures, their design theory was linked to their mode of visual inquiry which was in turn associated with the way they approached design projects. I believe that the questions central to the figures featured in this research are similarly relevant to design education today: how to contend with personal bias; how to honestly observe and record site context; and how to draw inspiration from other disciplines.

In an era of data driven information, it is easy to operate at a great physical distance from the places and people we are designing for. Frequently, we rely on the internet to help bridge the gap between the known and the unknown aspects of a project site. I believe, in doing so, we miss an opportunity to familiarize ourselves with the existing context and to observe a community more directly.

To counteract this tendency, I advocate that we borrow lessons from the Smithsons and Scott Brown and Venturi, embrace an attitude of reserved judgement, and look to other disciplines – the social sciences, the visual arts, and more – for observational or analytical inspiration. Importantly, the aim is not to mimic alternative methodologies but rather adapt them to our contemporary situation.

End Notes

1. Alison and Peter Smithson, "The New Brutalism," in *Architecture Culture, 1943-1968: A Documentary Anthology*, ed. Joan Ockman (New York: Rizzoli, 1993), 241.
2. For more on Le Corbusier and the aerial view see Anthony Vidler, "Photourbanism: Planning the City from Above and from Below," *A Companion to the City* (2000); and M. Christine Boyer, "Aviation and the Aerial View: Le Corbusier's Spatial Transformations in the 1930s and 1940s," (2003).
3. Le Corbusier, *Air Craft,* (1935), 102.
4. Alison and Peter Smithson, *The Shift,* Architectural Monographs 7 (London: Architectural Monographs and Academy Editions, 1982), 9.
5. Alison and Peter Smithson, "The "As Found" and the "Found," Claude Lichtenstein and Thomas Schregenberger, *As Found: The Discovery of the Ordinary* (Baden, Switzerland: Lars Müller, 2001), 40.
6. For more on Patrick Geddes see A. H. Halsey, "Sociology Before 1950", *A History of Sociology in Britain: Science Literature, and Society* (Oxford University Press, 2004), 47–69.
7. Philip Crowe and Karen Foley, "Patrick Geddes as Social Ecologist: A Century of Mapping Underused Spaces in Dublin," *The Urban Fabric*, 17th IPHS Conference, Delft, 2 (2016).
8. Patrick Geddes, *Cities in Evolution: An Introduction to the Town Planning Movement and to the Study of Civics* (London: Williams & Norgate, 1915), 317.
9. Ibid.
10. Ibid., 330.
11. Lichtenstein and Schregenberger, *As Found: The Discovery of the Ordinary* (Baden, Switzerland: Lars Müller, 2001), 93.
12. Ibid.
13. Ibid., 40.
14. For more on the Smithsons contributions to CIAM in the 1950s see Christine Boyer's Not Quite Architecture: Writing Around Alison and Peter Smithson (MIT Press, 2017), as well as Alison Smithson and Team 10, eds., *The Emergence of Team 10 out of C.I.A.M: Documents* (London: Architectural Association, Graduate School, 1982).
15. The Smithsons "discovery tours" were discussed in the transcripts of an interview of the Smithsons by Reyner Banham for an Arts Council film, "Fathers of Pop," (1979). Transcript found in Victoria Walsh's *Nigel Henderson : Parallel of Life and Art,* 1st Ed. edition (Thames & Hudson: London, 2001), 54.
16. Robert Venturi, *Complexity and Contradiction in Architecture* (MoMA, 1966).
17. Denise Scott Brown, "On Pop Art, Permissiveness and Planning," *Having Words* (Architectural Association, 2009), 56.
18. Ibid.
19. Ibid., 27.
20. Ibid., 29.
21. Ibid.
22. Ibid., 30.
23. Scott Brown, "On Pop Art, Permissiveness, and Planning," *Having Words* (Architectural Association, 2009), 58.
24. University of Pennsylvania Architectural Archives, Venturi and Scott Brown Collection, Box: 225.II.A.6812.1-24 (September 2020).
25. Denise Scott Brown, "The Rise and Fall of Community Architecture," *Urban Concepts* (Architectural Design, 1990), 34.
26. For more on African American History in Philadelphia see Marcus Anthony Hunter, *Black City Makers: How the Philadelphia Negro Changed Urban America,* Oxford University Press (2013).
27. University of Pennsylvania Architectural Archives, Venturi and Scott Brown Collection, Box: 225.II.A.6812.1-24 (September 2020).

Bibliography

Boyer, Christine, "Aviation and the Aerial View: Le Corbusier's Spatial Transformations in the 1930s and 1940s," (2003).

———. *Not Quite Architecture: Writing Around Alison and Peter Smithson* (MIT Press, 2017).

Geddes, Patrick, *Cities in Evolution: An Introduction to the Town Planning Movement and to the Study of Civics* (London: Williams & Norgate, 1915).

Le Corbusier, *AirCraft* (London: The Studio,1935).

Lichtenstein, Claude and Thomas Schregenberger, *As Found: The Discovery of the Ordinary* (Baden, Switzerland: Lars Müller, 2001).

Massey, Anne, *The Independent Group : modernism and mass culture in Britain, 1945-1959* (Manchester University Press: New York, 1995).

Smithson, Alison and Team 10, eds., *The Emergence of Team 10 out of C.I.A.M: Documents* (London: Architectural Association, Graduate School, 1982).
Smithson, Alison and Peter, *Ordinariness and Light: Urban Theories, 1952-1960 and Their Application in a Building Project, 1963-1970*, First Edition (Cambridge, Mass: The MIT Press, 1970).
Smithson, Peter, *Peter Smithson: Conversations with Students* (Princeton Architectural Press, 2005).
Gans, Herbert, *Levittowners* (Columbia University Press, 1967).
———. "Relativism, Equality, and Popular Culture," *Authors of Their Own Lives: Intellectual Autobiographies by Twenty American Sociologists,* (UC Berkeley Press, 1990).
Hunter, Marcus Anthony, *Black City Makers: How the Philadelphia Negro Changed Urban America,* Oxford University Press (2013).
Scott Brown, Denise, *Having Words* (London: Architectural Association, 2009).
———. "On Pop Art, Permissiveness, and Planning," *Journal of the American Institute of Planners* 35, no. 3 (May 1, 1969), 184–85.
———. "The Rise and Fall of Community Architecture," *Urban Concepts* (Architectural Design, 1990).
Stierli, Martino, *Las Vegas in the Rearview Mirror: the city in theory, photography, and film* (Getty Research Institute, 2013).
Venturi, Robert, *Complexity and Contradiction in Architecture* (MoMA, 1966).
Venturi, Scott Brown and Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form* (MIT Press, 1977).
Vidler, Anthony, "Photourbanism: Planning the City from Above and from Below," *A Companion to the City* (2000).
Walsh, Victoria, *Nigel Henderson : Parallel of Life and Art*, 1st Ed. edition (London: Thames & Hudson, 2001).

Soul of the Squiggle

Kaden Beilman
Louisiana Tech University

"After all, if the drawing is not to lead the way, what else?" [1]

- Sir Peter Cook

To find success in design school, one must pay equal attention to both the technical details, and their interpretation. Students frequently enter design school with the expectation that they will be bound by formalities, most likely because that is all they have ever known: technicalities, objectivity, and clear answers. So architecture should be no different, right? There's a building there, it has a front door, and it stands up. What could be so subjective about that?

Fig. 1 Opposite-handed drawing of still life.

Those who read this will understand that the objective, definite answers are only a small part of the whole amount of information we must transmit to aspiring designers. As the author, hearing mentors' advice on a loop in my head saying "know your audience," it actually feels condescending. There is objective truth, the technicalities that many students expect to master, and there are subjective, phenomenological, unknowable, soft truths that are the driving force behind the spirit of architecture, the building of places, and the experience of being there.

Louisiana Tech University in Ruston, Louisiana, is home to the School of Design (SOD for short), which combines Architecture, Studio Art, Interior Design, and Graphic Design. Because Louisiana Tech is a technical institution, students are more likely to arrive with preconceived assumptions about design that lean toward the pragmatic. Students are frequently drawn from engineering, physics, or have past construction experience on their resume. Many of the students entering the SOD expect architecture to be no different than the subjects they studied in high school - not an uncommon sentiment, but in rural Louisiana, where mind-altering, soul-connecting spaces are not readily available, student ambition for architecture being anything other than cold, hard fact typically begins at zero.

Start from Scratch

Fortunately, most students are overjoyed when they discover the wiggle room. For many, that realization occurs on the first day of school. In the brief time I've been teaching in Ruston, classes start on a Thursday in the fall. Thursday is freehand drawing studio, which is a prerequisite for foundation studio, which is each student's first introduction to the discipline of design. Students learn about their pencils, the newsprint on which they practice, their intrinsic qualities, and what they allow and prohibit pupils from sketching in this first lesson.

Students begin by drawing various still life layouts, with some prospering and others quickly losing hope that they're in the proper location. After drawing a still life arrangements, students are thrown a curveball, drawing with their non-dominant hand.

The resulting drawings are frequently livelier than their dominant hand counterparts. Lines are drawn in a single stroke, students become aware of their body's movement in relation to the paper, and the soul of the squiggle comes to

life. They're wonderfully hazy drawings of something otherwise commonplace.

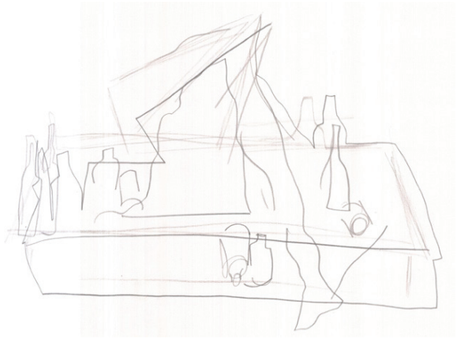


Fig. 2 Opposite-handed drawing of still life.

Of course, the pupils are unlikely to see it in this light. Together with my distinguished colleagues, I reiterate our observation that these drawings are more interesting, precisely because of their vagueness, that is, their possibility to be read in more ways than the actuality of duplication. We can make suggestions, but ultimately it is up to the students to believe. It's a direct test of respect for our position - we'll just say it's humbling.

the Squiggle

But what in this non-dominant hand drawing suggests the presence of the soul in the architectural design process? My argument to the students is that the spirit, in all of its manifestations, first appears in the design process as vagueness. Most architectural drawings are vague because of what we affectionately call the "squiggle." The squiggle is that beautiful, semi-intentional wavering of the line. The squiggle avoids the illusion of finished, factual data and instead enables a variety of interpretations, playfulness in depiction, and honesty in imperfection.

The foundation courses are constantly evolving, but a recent emphasis has been focused on reinforcing student awareness of this "squiggle," the allowance for interpretation, re-interpretation, and pivoting to totally new ideas based on the ambiguity of the happenstance. The squiggle does not always literally mean "a line that wiggles back and forth," but is a term coined to speak about rule bending, intentional vagueness, and non-technical, soulful acts of creation.

While it is our role to educate students the technicalities of the profession, it is also our responsibility to teach students the subjectivity of these technicalities - and how to exploit them. The foundation curriculum seeks to show the known territory of technique in its various forms, and unknown territory of interpretation, play, and subjectivity.

Hopefully, this paper will address some organizational strategies between drawing and studio courses, exercises that attempt to reveal and exploit ambiguity, and open discussion for the purpose and trajectory of educating young design students about architecture's ability to reveal things that numbers, data, and computerized information cannot, through the power of the squiggle.

What it's all about

As previously mentioned, the program is structured to include classes that teach basics and techniques of drawing in freehand drawing, drafting courses (taken sequentially,) and a foundation studio that covers typical foundational studio topics. This division is critical, it allows students to focus entirely on technique in the drawing courses, then on the intricacies of those skills and how they might be used in the studio course.

The coexistence of technical and speculative courses in the foundation curriculum allows students to obtain a knowledge of the utility of drawing in a variety of applications. Students are taught that drawing, like design as a whole, is open to interpretation. Students are taught that in order to draw properly, they must be explicit about their objectives, in order to have a little control over this interpretation. Drawing for largely representational communication is the subject of drafting and drawing classes, hence their names - Communications I and II. Studio courses emphasize imaginative, evocative, and passionate drawing.

The goal of this writing is to compare activities in both of these classes, show their relationship, and demonstrate their capacity to unveil the subjective wiggle room of architecture via the manipulation of technique, to students who may not enter into the school with a dynamic view of the field.

Freehand Drawing, and the Studio

Seeing, not Looking

One of the most important tasks in any drawing class is teaching students to see rather than just look. Students who attempt to draw a basketball by looking will most likely wind up with a generic, flat basketball, the same orange orb they've been drawing their entire lives. However, students who "see" the basketball will be aware of its nuances, such as the way the material joints disappear at the ball's borders, the little depression of the leather as it approaches that joint, and any little scuffs from outdoor play, all of which form the true, spirited image of the ball. Students who look believe a shadow is black, whereas students who see believe a shadow on a yellow surface is still yellow. Students who look draw based on an image they created in their heads, but students who see draw what is actually in front of them. Getting students to see rather than look is a significant challenge.

Students often start design school having already decided whether or not they can draw. It seems that they need to be shaken out of their decision, regardless. Students who already believe they can draw are too comfortable in their drawing style, whereas students who believe they cannot lack confidence. In either case, most pupils are guilty of looking rather than seeing. The student has decided they can draw, and need not pay attention, or they cannot draw, and there's no point.

In either case, most pupils are guilty of looking rather than seeing. The student has decided they can draw, and need not pay attention, or they cannot draw, and there's no point.

Telephone

The attempts to break down the students begin with a game of drawing telephone in the very first drawing class. One student is given a visual of an object that isn't exactly recorded in the student's brain, usually upside down, and asked to sketch the image exactly as it appears. Students form a single line behind the first, each peering over the shoulder of the person in front of them. Each pupil is instructed to imitate the drawing of the student in front of them. As the drawing reaches the last individual, it has likely undergone a significant transformation.

Students typically start out frustrated, but end up excited about this exercise. The exercise asks students to see what the person in front of them is drawing, because they have no choice to look. Because they have no idea what the original artwork is, they must pay close attention to every minute detail drawn on the paper in front of them. Because the original thing being drawn is usually unclear and difficult to identify, students are unlikely to decide what the object is and draw it from memory.

Although this appears to be a broad, non-technical skill, I've discovered that it's really quite fundamental in the students' ability to hypothesize, to draw from reality rather than what they think they're looking at.

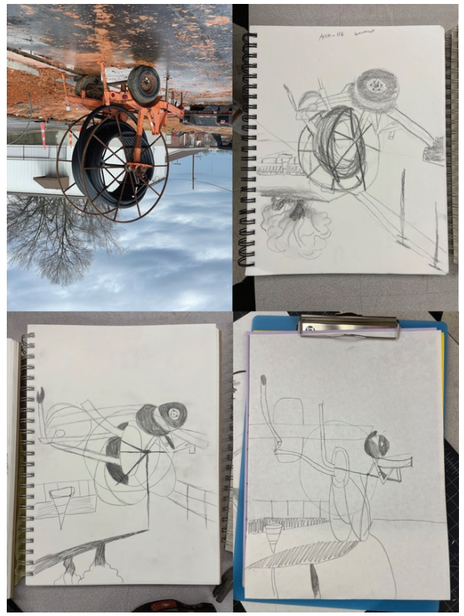


Fig. 3 Telephone drawing. Original photo in top left, end of telephone line in lower right. Drawing becomes wonderfully distorted.

Poking Studio

This talent is regularly poked at and challenged throughout the studio by asking students to elaborate on models they've constructed. The objective here is to get students to look at the models, but also at how the components relate to each other, how shadows create new shapes, lines expand outward, all to create new drawn compositions.

In studio, students are asked to construct a speculative drawing based on a recently completed model that focuses

on Francis DK Ching's organizational techniques - radial, linear, grid, and cluster. The instructions for the drawing urge students to photograph the model in a way that throws shadows, which makes the picture more dynamic. Students are then instructed to sketch these things, focusing on the composition of the model on the page, as well as the shape of the shadows.

Students photograph their models and begin to notice shapes their models are making that were never intended. Lines extend from one side of the model to affect the opposite side, light peeking through accidental cavities reveals additional caverns, and the shadow produces a strange figure on the ground when held at the proper angle. Students are encouraged to experiment with the photos in order to make the drawing more lively. They are practicing seeing rather than looking.

the Thrill of Extrapolation

They must begin drawing after selecting their photographs to draw. Students are encouraged to deduce the spirit of the model they photographed. Students are only prompted with the question, "What does the soul of this model look like?" They are then invited to lengthen lines, duplicate shadows, crop, and otherwise edit the model in order to generate a sense of passion about the object.

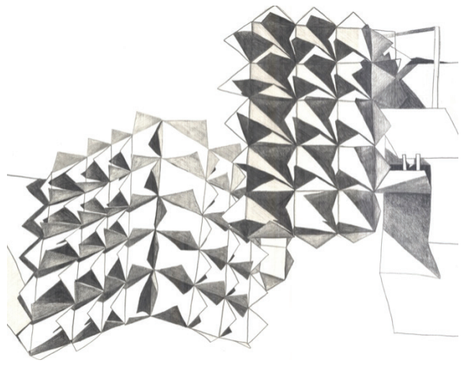


Fig. 4 Focusing on shadows, layering

This sketch seemed to pique the students' interest more than the model. When the students were asked why, their responses revealed that they looked at the drawing not as a documentation tool, but rather as the next step in the design. This drawing, in a way, was similar to the game of drawing telephone. The drawing is revealed to be the student sitting behind them, making the drawing just a bit more vague.

Drafting, and the Studio

Preconceptions

in the second quarter, students take 'Visual communications II,' more commonly known as 'drafting.' drafting again takes the role of technique-based teaching, as drafting courses typically do. The drafting course teaches students the foundations of orthographic drawing as well as more abstract representational techniques such as obliques and measured perspectives.

Some students may have preconceived beliefs about drafting, because they were taught to draft in high school, worked on a construction site, or had a family member who used to draft. Again, as with the freehand sketching course, pupils must be shaken from their prejudices and relearned in some way.

Geometry

One of the first lessons in the drafting class is about using geometry, rather than measurements to make. Students are instructed to create a two-inch border on their paper, measuring the two-inch margin only once. Students gradually learn they can make a square out of their 45-degree triangle and project the two-inch measurement to the opposite axis. This short exercise offers a lot to help students think about various ways objects might be built using geometry rather than measurements.

Paying Close Attention

One brief field trip we take in the drafting studio is to a small courtyard within George T. Madison Hall, a building just west of the place the drafting studio is housed.

The courtyard is less of a display of architectural marvel and more of a discreet location to enjoy the first half of your coffee without being bothered by anyone. There is a small stage, 6 benches, a few planter beds, and 4 level changes in the courtyard. Most crucially for us, this courtyard was skillfully constructed on a grid. It was not just built on a grid, but it was also expressed in component alignments and material joints. Before they are distracted by the stress of a new task, the students are urged to study the ways in which the courtyard aligns. They were unusually pleased to uncover modest ways in which alignments occur. They are reminded of the purity of geometry, the slowness of the eye as it trails from the concrete joint to the edge of the brick wall, to the edge of the stair, and up to a small Shakespeare sculpture.

Fig. 5 George T. Madison Hall's Shakespeare Court

Without a doubt, the purpose of drafting is to teach technique. The lesson of paying attention is inevitably related to the instruction of technique. Slowing down and paying attention are essential for student success in drafting. A quick and instantaneous trip to the building next-door can assist with this.

Projecting

Students also concentrate on drawing projection. Their first exposure to projecting occurs in the project that teaches students floorplan, section, and elevation. The assignment requires students to take precise measurements of a room they frequent and create an accurate, scaled drawing of it. Throughout the demonstration, I constantly encourage students to resist the urge to measure everything. The main focus of this project is projecting using construction lines.

Students are encouraged to keep construction lines as light as possible, but to never erase them. the evidence of the construction process must be apparent for a successful score on the project. As students learn the technical purpose of construction lines, and allow themselves to appreciate the visual evidence they provide, they appear to develop a greater appreciation for the notion that our tools are the primary cause of the way we design. In particular, instruments allow for the drafting of perfectly horizontal and vertical lines. Their adjustable triangle becomes much more efficient when locked to a specific angle. The construction l Lines are easier to project, more difficult to misalign, and quicker because they require less movement. Students begin to comprehend the economy of construction.

Fig. 6 Extending construction lines

Loosening up

Students' approaches to drawing in the studio are influenced by the methods they learn in drafting class. The studio is an attempt to loosen up some of the technical constraints imposed by the drafting course, much like freehand drawing was in the first studio. What happens if a student smears the graphite in studio versus drafting class is not the same.

During the second quarter, the studio focuses on the tectonics of space. Students are initially asked to design a 9x5 box that interlocks with itself. Students then construct a tower for this box, which they then morph into an occupiable space. Drawings are needed of the students at various points throughout the procedure. Because the box must remain orthographic, the drawings are drafted.

The drawings for these towers follow the format of the first quarter studio - drafting techniques should be pushed, bent,

and used for their subjectivities in the studio setting. The model they have must be interrogated using orthographic drawing, oblique representation, and projection techniques.

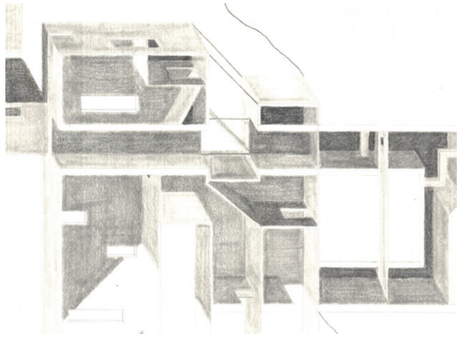


Fig. 7 Underground drafting in studio

The models evolve from tetris-like blocks to layered, composited abstract representations of the architectural process of creating space. Students are asked to visualize the pieces in floorplan, section, and elevation at the same time. Successful students rose to the occasion, creating spaces that were not exactly inhabitable but communicated an architectural concept with spirit.

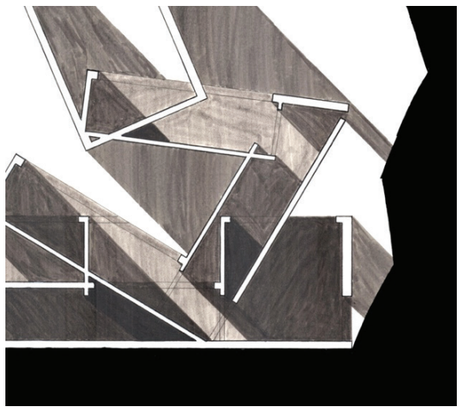


Fig. 8 Layering in studio

This exercise taught students the thrill of more improvisational drafting. The goal is to demonstrate to students that drafting is not strictly objective, that there is subjectivity in the way projects are represented, even when using traditional drafting methods. The drawings, like the model, are tools for discovery.

For myself and the rest of the foundational faculty at Louisiana Tech University, folding drawing into the design process is a way to get students thinking speculatively about an object they've made via things like construction lines and composition. It's far from perfect, but it appears to be working to get students to incorporate hand drawing into their process in later years of schooling.

the Second-Year

Computers are introduced in the second-year curriculum, and students quickly forget the fun they had speculating via drawing to discover. Students can use technology to connect a perfectly straight line by clicking anywhere on their screen. The tools that made building lines second nature are no longer in use. Because the constraints are looser, the game becomes less strategic and more senseless. The projects that result are frequently clunky, sporadic, and unpolished.

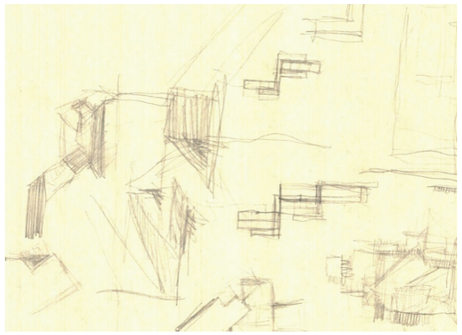


Fig. 9 Working loosely

Second year studio's job is to keep the spirit of the hand alive, and to do so, it keeps hand-drawn drawings as a constant filter of the design process. The drawing must pass through the speculative drawing to reveal the design's unknown territory. Designing solely in the computer dulls students' ability to elicit new compositions, interesting alignments, and projections that result in novel outcomes. Students spend their first year becoming acquainted with this process, but it is frequently overlooked because learning to operate a computer is a large task that consumes all of the young students' time.

The battle of the second year is to teach students how to use drafting and drawing techniques and combine them with the computer at the proper moment. Because students are bombarded with technology and believe that computers can complete both the technical and the ambiguous at the same time, it is critical that the squiggle make its way into the second year of the architectural studio.

Look, it's "real"

The second-year students in the architecture program are inundated with technology on the very first day of the studio. The responsibility of understanding technique, and the squiggle of that technique now lies in one single class, as opposed to the first year, where the two are kept separate. This proves to be a challenge for students.

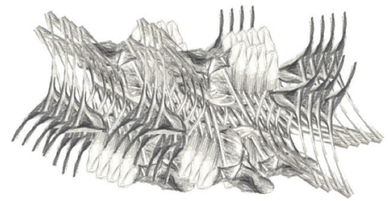


Fig 10 Example of digitally layering and superimposision

Previously, the second-year studio focused heavily on technique, on teaching students the buttons to click, the appropriate hotkeys, the boxes to check before sending the collection of lines to the plotter. Students quickly become wrapped up in the computer's ability to remove the "I can't draw"-ness from their process. Without even thinking about it, they've lost the squiggle. Computer's inability to represent vagueness, prevent chance, resist the layering of information.

There seems to be some magic veil that computer's pull over the heads of prospective architects, which tricks them into mistaking the computer's objectiveness for subjectiveness. In my short career as an instructor, I've yet to figure out what exactly this is. My best hypothesis is that students become intrigued by the fact they can now rapidly visualize, with some "realism" their ideas. The computer's ability to remove this gap of vagueness means students are allowed to "see" the project more quickly. Expediting of the process removes the vagueness of drawing. Vagueness is so last year.

Step-Dance

The Arch 225 (second quarter, second year) studio was tasked with lifting the wheel from this rut. An introductory project, affectionately called the "plant container container" by students, brought students through a process of "ping-ponging." Students were asked to create 4 containers, for 4 herbs, and a container which held these 4 containers in place.

Students began by drawing their herb with as much realism possible. Students focused on the exact appearance of their herb, asked to capture the visual textures, the shape, the shadows the herb casted on itself. These drawings focused on the technical skill of drawing, which students reported being refreshing, after a quarter spent in the computer.
The students then scanned the herbs, and transformed the drawing from a singular herb, to a composition, made from duplicating, layering, cropping, and pattern making. students were asked to act intuitively, treat the digital document as if it were physical.

Fig. 11 "container container"

Following this exercise, students printed their new herb images, and extracted grids and patterns which dominated their compositions. These grids were drawn by hand, with

various liveweights, and scanned back into the computer. Students used these grids to inform the way they created their containers, once again by way of digitally layering, superimposing, extending, making patterns. From here, the containers were made, and a paper trail of process was behind the outcome.

Ping-Pong

The procedure itself is certainly up for some adjusting, it seemed some students began to misplace the origin of their process, and only focus on the task at hand, not the relationship to the entire process. Successful students were able to keep in touch with this very initial herb drawing, and find proportional relationships between their eventual final product and the initial drawing.

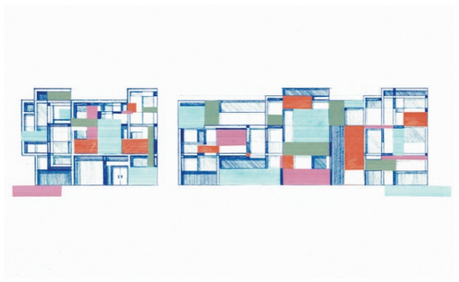


Fig 12 Second-year hybrid elevation

The real takeaway from this project for myself, and for other faculty, was the process of 'ping-ponging' between digital and analogue methods of discovery. There is a benefit to getting students out of the computer. In this case, the benefit was the loss in translation when moving from one mode of representation to the other. The movement from hand, to digital, back to hand, and onward into delirium gave students the desired wiggle. The soul of the projects came from the vagueness of the loss of data, the opening up of possibilities when the scanner left unwanted trails of graphite from the project scanned in before, combined with the smudge of chocolate from the late-night Snickers bar, combined with the grid line which went a bit awry because the trace paper moved a bit. The movement from physical to digital, and back again, allows for the squiggle.

Wrapping Up

While the technicalities are undoubtedly crucial to make the Architect, they only cover half, probably less, of the topic. We must remind students, the soul of the squiggle (in all of its forms) must remain in order to generate novel ideals about the environments which we design. Should we fail to do so, we will become nothing more than a technical profession, obsessed with making our computers do the work for us.

There is a certain fear of this paper being discounted to pure nostalgia, or pinned up under the "luddite" section of the mental cork board. I humbly ask the reader to consider the "squiggle" as the allowance of chance, the acceptance of imperfection, and consider the ways which the squiggle is being allowed into their own lives, whether that be applied to a curriculum or not.

For beginning design students, communicating that this sometimes-unexpected outcome is really tied to the human spirit is essential. The embrasure of this ambiguity, the embrasure of this unknown territory, the "happenstance" has a connection to the recognition: the more interesting things in our world reveal a truth about the human condition. Should we allow these moments of miraculous human spirit into our design process, we may continue to connect with the humans who interact with the things we design. We do design for humans, after all.

End Notes

Cook, Peter. Drawing: The Motive Force of Architecture. John Wiley & Sons, 2014. P 71.

Bibliography

Cook, Peter. Drawing: The Motive Force of Architecture. John Wiley & Sons, 2014.

Kahn, Louis I., Michael Merrill, and Michael Merrill. “The More One Looks, the More One Will Come to See: Louis I. Kahn's ‘The Value and Aim in Sketching.’” Essay. In Louis Kahn: The Importance of a Drawing, 42–47. Zurich, Switzerland: Lars Müller Publishers, 2022.

Pallasmaa, Juhani. “In Praise of Vagueness.” Encounters 2, 2012.

Pallasmaa, Juhani. The Thinking Hand: Existential and Embodied Wisdom in Architecture. Chichester: Wiley, 2009.

Scheer, David Ross. The Death of Drawing: Architecture in the Age of Simulation. Routledge, 2014.

Acknowledgments

All images are work of first- and second-year students at Louisiana Tech University.

Thank you, Will Doss, Daniel Moore, Bob Condia, and Karl Puljak, for your guidance; whether you knew it or not.

Cultivating Curiosity: speculation in rubrics

Mira Woodson, CU Denver College of Architecture and Planning

Imagination is shaped by our entire life experiences, our socialization, the concepts we are exposed to, where we fall in global hierarchies of society.[1]

adrienne maree brown

Imagination is a key component in speculation. Speculation is a key component in design education and practice. As brown situates each of us in our evolving experience, how we seek additional perspectives expand the world of creative visioning. A space where possibility resides, and speculation may occur. Self-awareness of this context allows a point of departure for cultivating curiosity as an elemental design tool and to keep imagination potent. The ability to reflect on one's life experiences and the context brought to the pursuit of architectural design education can be difficult to ascertain. However, taking the time to build this foundation with students honors what skills they already possess, in relation to speculation, and can be quickly leveraged in their ability to grow.

I am exploring rubrics in early design education as a tool that has potential to support speculation and to foster imagination, curiosity, and self-awareness. In support of this, I desire to include an assessment of character development into my grading rubrics. How a student approaches a process is just as important to their development as the skills of a design process. My hope is that being explicit and transparent about the layers of simultaneous element being explored, young designers will intentionally cultivate themselves as individuals, designers, and change agents.

Skill-based assignment rubric is an excellent tool for data collection as they are intrinsically quantitative and easy to use for grading assignments. They can be helpful to offset the obsession with grades and maintain transparency in deliverables and course learning objectives. However, it is the quantitative aspects of design education that are missing in that assessment. These quantitative elements are far more nuanced, individualistic, and difficult to score yet truly prepare our students to be successful. A series of questions has emerged for me: How does a holistic rubric support a student's growth? Could rubrics facilitate perspective expansion in young designers obsessed with grades? Would a dynamic rubric help transform them into self-driven explorers seeking satisfaction instead? Should there be a matrix for reliance, tenacity, and grit[2]?

Obstacles of Speculation

Fear of Failure

The first elements I found standing in the way of cultivating curiosity were fear of failure and its good friend, anxiety. Grades activate both and can lead to paralysis and obsession without the project work being done or even attempted. It's fascinating that doing nothing is more desirable than trying anything for a project. Author and educational advisor Sir Ken Robinson said, "If you're not prepared to be wrong, you'll never come up with anything original"[3]. Where ideation and iteration are seen first as failure is a difficult place to start teaching the elements needed to build a design process. As John C Maxwell said "Fail early, fail often, but always fail forward"[4] has been useful in combating the cultural negativity failure has. Erick Kessels book FAILED IT![5] utilizes humorous and artistic lens to inspire and normalize failure as a desirable approach to both character and design development.

Focusing on the generative process of ideation and refinement through iteration begins to stimulate curiosity and builds confidence in the students growing abilities. However, it takes diligence to stay present in the potential discomfort of doing or thinking in new ways. Rosamund Stone and Benjamin Zander in The Art of Possibility say, "If we include mistakes in our definition of performance, we are likely to glide through them and appreciate the beauty of the longer run."[6] Could incorporating the words mistakes and failure not just iterations in grading assessment help students value the process in a new way and possibly changing their perspectives into a growth mindset?

It has been my observation that the general anxiety throughout the incoming design students has become rampant. It is a barrier that must be lowered if any learning

opportunities are to be available beyond a surface completion. I have realized that I need to explicitly teach them grappling. A 'how to' push on through the perceived "hard" times of not understanding something. It seems we (culturally) no longer have to work through discomfort, which I see hindering our young designers' abilities to push at all, let alone all the way into absurd whimsy. The speculative place that cultivates the best possibility and often leads to true innovation. One might say this is akin to design thinking, however I believe this might be the precursor to accepting the components and process of design thinking. It is challenging to think while standing in one's own way.

Fostering/Developing Skills/Qualities/Attitudes
Grappling

I started beta testing this mode of engagement in studio and class contexts in the Fall of 2022. These experiments have highlighted the importance of grappling as a central component in developing a personal design process. In the context of these engaged spaces of design studio, speculative innovations and possibilities are created. Framing inquiries in new ways could leave space for acknowledgment of potential discomfort from nervousness, self-doubt, and conflicting feelings and ideas. If and when those aspects are recognized, felt, and valued, then project breakthroughs flow in abundancy.

Turning to the New Oxford American Dictionary to define a group of character-building attributes: Grapple: struggle with or work hard to deal with or overcome (a difficulty or challenge). Resiliency: the capacity to withstand or to recover quickly from difficulties, toughness; tenacity: the quality or fact of being very determined (determination, persistence); grit: courage and resolve; strength of character.[7]

In Angela Duckworth's book Grit,[8] she identified the elements or perspectives that propel successful people forward they are passion, courage, and perseverance. So simple yet fleeting in a culture of instant gratification. These are the attributes I want a student to develop to fight their fear and anxiety. Developing grit, a student strengthens their resiliency and tenacity, both cornerstones in architecture education and practice. I ask students: did you grapple with discomfort with a passionate hunger and enthusiasm? Did you fall in love with your project? It seems that when a student is "all in" the grade follows. If a student has never felt the satisfaction of grappling, why would they believe it's worth it?

Towards a New Rubric
Previous Beta Testing

My first attempts to create dynamic holistic rubrics were met with confusion and a desire for additional parameters. The students worry became amplified. Obviously, it was not my intention to create additional anxiety. In the next iteration, I simplified my approach and divided them into quantitative and quantitative areas. If I could get any elements to structure the assessment rubrics more holistically, I would have something to analyze. I continue to refine hard-skill-based criteria by adding multiple categories, per skill and sub-descriptions for all. This has helped mediate general anxiety and grade anxiety therefore allowing the energy to be used on developing or grappling with their ideas.

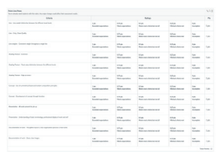


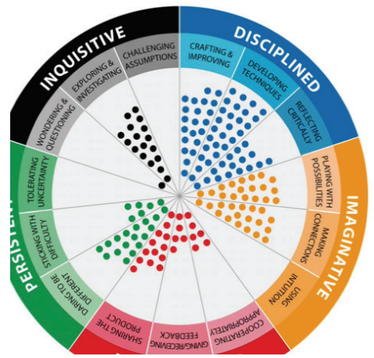
Fig. 1 Studio I first assignment with multiple categories per skill.

The first quantitative, soft-skill-based rubric includes elements needed for project presentation. These criteria are based on building self-awareness, time management, and verbal presentation delivery. The combination of rubrics has allowed the teaching team to have another layer of transparency with all the elements we are attempting to weave together for student success. Although anecdotal at this time, student verbally express gratitude for the clarity and support addressing their individual nervousness in presenting their ideas and respect the practice it takes to get comfortable being uncomfortable. Students recognize that these skills take practice, which has been a wonderful step forward in this investigation. The more transparent and vulnerable I am in my pursuits, the more honest the students have been in sharing their perspectives, asking questions, and participating. As we practice different approaches, the design students can verbally express an increased personal awareness, intention, and satisfaction in their work.

Developing a supple mind takes practice. Practice that may have just started in the studio context. Watching and experiencing growth are extremely different for each student. It is something that needs time, space, and thoughtfulness to reflect. It requires them to get comfortable evolving as a person and designer, no matter the context. This could be the point where self-awareness and self-assessment begin.

Subsequent Beta Testing Ingredients

One new assessment approach is the work of Eve Lutnaes, in her paper, 'Creativity in assessment rubrics', she focused on field trials of habits and sub-habits of creativity in Norwegian students. The five habits are: Inquisitive (uncovering and pursing interesting and worthwhile questions) Persistent (daring to take risks and determination when facing difficulties) Imaginative (ability to come up with imaginative solutions and possibilities) Collaborative (social and collaborative aspects of the creative process) and Disciplined (knowledge and craft in shaping the creative product).[9] The corresponding figure showcases the habit levels and assessment of each.



! Creative habits traced in assessment rubrics from 27 schools s the counties of Norway.

I am interested in attribute clustering as well as the diagram's ability to show growth through time. The specificity of habit titles and sub-habits blend skill and character development. Removing the language of level performance judgment allows it to move solely from instructor evaluation to a student's self-awareness growth indicator.

The American Association of Colleges and Universities has developed VALUE Rubrics an open educational resource. The rubrics are intended for institutional-level use in evaluating and discussing student learning, not for grading.[10] AAC&U's work address the foundational value of mistakes and failure by including Taking Risks, Solving Problems, and Embracing Contradictions.

Out of the sixteen rubrics they developed see Creative Thinking fig 3. Their use of engagement language for transparent expectations is a helpful president. Blending these different approaches gives me hope for the next iterations to begin to incorporate the dynamic qualities of the multitude of skills being developed. The creation of a set of rubrics that can thoughtfully guide and grade students

REATIVE HINKING UBRIC
For more information, please contact value@aacu.org

JE rubrics were developed by teams of faculty experts representing colleges and universities across the United States through a hat examined many existing campus rubrics and related documents for each learning outcome and incorporated additional feedback ity. The rubrics articulate fundamental criteria for each learning outcome, with performance descriptors demonstrating progressively ihdicated levels of attainment. The rubrics are intended for institutional-level use in evaluating and discussing student learning, not ig. The core expectations articulated in all 16 of the VALUE rubrics can and should be translated into the language of individual s, disciplines, and even courses. The utility of the VALUE rubrics is to position learning at all undergraduate levels within a basic ik of expectations such that evidence of learning can by shared nationally through a common dialog and understanding of student

Definition
thinking is both the capacity to combine or synthesize existing ideas, images, or expertise in original ways and the experience of reacting, and working in an imaginative way characterized by a high degree of innovation, divergent thinking, and risk taking.

Framing Language
thinking, as it is fostered within higher education, must be distinguished from less focused types of creativity such as, for example, ivity exhibited by a small child's drawing, which stems not from an understanding of connections, but from an ignorance of es. Creative thinking in higher education can only be expressed productively within a particular domain. The student must have a undation in the strategies and skills of the domain in order to make connections and synthesize. While demonstrating solid pe of the domain's parameters, the creative thinker, at the highest levels of performance, pushes beyond those boundaries in new, r atypical recombinations, uncovering or critically perceiving new syntheses and using or recognizing creative risk-taking to achieve t.

tive Thinking VALUE Rubric is intended to help faculty assess creative thinking in a broad range of transdisciplinary or plinary work samples or collections of work. The rubric is made up of a set of attributes that are common to creative thinking across s. Examples of work samples or collections of work that could be assessed for creative thinking may include research papers, lab nusical compositions, a mathematical equation that solves a problem, a prototype design, a reflective piece about the final product of vment, or other academic works. The work samples or collections of work may be completed by an individual student or a group of

Glossary
The definitions that follow were developed to clarify terms and concepts used in this rubric only.
exemplar: A model or pattern to be copied or imitated (quoted from www.dictionary.reference.com/browse/exemplar).

CREATIVE THINKING VALUE RUBRIC
For more information, please contact value@aacu.org

Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (cell one) level performance.

refers to acquiring and skills within a	process and product using domain-appropriate criteria.	object, solution, or idea that is appropriate to the domain.	appropriate exemplar to his/her own specifications.	an appropriate exemplar.
de personal risk (fear asement or rejection) ieture in successfully g assignment (i.e., ional original 's of assignment g new materials and kking controversial violating unpopular	through an untested and potentially risky directions or approaches to the assignment in the final product.	approaches to the assignment in the final product.	approaches without going beyond the guidelines of the assignment.	guidelines of the assignment.
	Not only develops a logical, consistent plan to solve problem, but recognizes consequences of solution and can articulate reason for choosing solution.	aving selected from among alternatives, develops a logical, consistent plan to solve the problem.	acceptable approaches to solving problem.	Only a single approach is considered and is used to solve the problem.
	or contradictory perspectives or ideas fully.	divergent, or contradictory perspectives or ideas in an	ef) alternate, divergent, or contradictory perspectives or	passing) alternate, divergent, or contradictory perspectives or
uniqueness (of idea, ation, form, etc.)	question, format, or product to create new knowledge or knowledge that crosses	question, format, or product.	novel or unique idea, question, format, or product.	available ideas.
	into entirely new forms.	into a coherent whole.	novel ways.	among ideas or solutions.

Fig. 3 From "Creative Thinking VALUE Rubric" by the Association of American Colleges and Universities, 2009, https://www.aacu.org/initiatives/value. CC BY-NC-SA 4.0

and projects throughout a semester is an exciting challenge. Until this project I had only used rubrics as a grading tool but will now be embedding them in the assignment brief as well as the overarching semester self-awareness success rubric. They will need to inform one another to reinforce the personal mental space needed for cultivating curiosity. It seems to be taking shape….as a map of maps.

Students building confidence in being uncomfortable has become critical to my teaching as well as reevaluating the relationship with assessment. To help me transform my assessment relationship I am interested in hearing CU Denver colleague Dr. Lisa Forbes's perspective on incorporating play into the design rubric framework. Her paper on The Process of Play in Learning in Higher Education: A Phenomenological Study[11] holds potential keys to addressing fear and anxiety in students developing a design process. Her lens of play may transform the growth experience into one of iterative output unbound by apprehensiveness. Her teaching in the School of Education & Human Development brings added layers of interest to assessment strategies.

I believe speculation is an invitation to reframe the fear of failure into a life of curiosity first in design studio and subsequently throughout a student's education and into

their life beyond. By exploring the intersections of the multi-layered elements in the role of assessment in beginning design education, the rubric may have the potential to cultivating curiosity if developed in a holistic approach. One that leverages a student's life experience and utilizes the imagination they have fostered within that context; as their design education expands and cultivates new possibilities. The next iterations will focus on those holistic outcomes. I am excited to co-author a rigorous educational experience and the assessment of that experience by incorporating or transforming the elements being assessed and at what duration. My hope is that this exploration develops each students' individual feelings of satisfaction and agency which is a direct line to curiosity, resiliency, tenacity, and grit. "Our radical imagination is a tool for decolonization, for reclaiming our right to shape our lived reality."[12] Sounds like architecture to me. Thank you, adrienne maree brown.

End Notes

1 Brown, Adrienne M. *Emergent Strategy: Shaping Change, Changing Worlds*. Narrated by the author, Audible, 2021

2 Duckworth, Angela. "Grit: The Power of Passion and Perseverance." TED Talk, https://www.ted.com/talks/angela_lee_duckworth_grit_the_power_of_passion_and_perseverance/comments.

3 Robinson, Sir Ken. "Do Schools Kill Creativity?" TED Talk, https://www.ted.com/talks/sir_ken_robinson_do_schools_kill_creativity/comments.

4 John C Maxwell's famous quote from Failing Forward: Turning Mistakes Into Stepping Stones for Success. Thomas Nelson, 2007

5 Kessels, Erik. FAILED IT!. Phaidon, 2016 p 15-20

6 Zander, Rosamund Stone, and Benjamin Zander. The Art of Possibility: Transforming Professional and Personal Life. Narrated by the authors. Audible, 2011

7 New Oxford American Dictionary, Apple Inc. Version 2.3.0

8 Duckworth, Angela. *Grit: The Power of Passion and Perseverance.* New York: Scribner, 2016

9 Lutnæs, Eva. 2018. "Creativity in Assessment Rubrics." Paper presented at Engineering and Product Design Education International Conference, Imperial College, London, September 6-7, 2018. https://www.designsociety.org/publication/40842/CREATIVITY+IN+ASSESSMENT+RUBRICS

10 From "Valid Assessment of Learning in Undergraduate Education (VALUE)" by the Association of American Colleges and Universities, 2009, https://www.aacu.org/initiatives/value. CC BY-NC-SA 4.0

11 Forbes, Lisa K. "The Process of Play in Learning in Higher Education: A Phenomenological Study." Journal Of Teaching and Learning Vol. 15, No 1 (2021): 57-73. https://jtl.uwindsor.ca/index.php/jtl/article/view/6515/5264

12 Brown, Adrienne M. *Pleasure Activism: The Politics of Feeling Good*. Narrated by the author, Audible, 2020

Bibliography

Association of American Colleges and Universities. 2009. "Inquiry and Analysis VALUE Rubric." https://www.aacu.org/initiatives/value-initiative/value-rubrics/value-rubrics-inquiry-and-analysis.

Brown, Adrienne M. *Pleasure Activism: The Politics of Feeling Good.* Chico: AK Press, 2019

Brown, Adrienne M. *Emergent Strategy: Shaping Change, Changing Worlds*. Chico: AK Press, 2017

Duckworth, Angela. *Grit: The Power of Passion and Perseverance.* New York: Scribner, 2016.

Duckworth, Angela. "Grit: The Power of Passion and Perseverance." TED Talk, https://www.ted.com/talks/angela_lee_duckworth_grit_the_power_of_passion_and_perseverance/comments.

Forbes, Lisa K. "The Process of Play in Learning in Higher Education: A Phenomenological Study." Journal Of Teaching and Learning Vol. 15, No 1 (2021): 57-73. https://jtl.uwindsor.ca/index.php/jtl/article/view/6515/5264

Kelley, Tom. Art of Innovation. Profile Books Ltd, 2016.

Lutnæs, Eva. 2018. "Creativity in Assessment Rubrics." Paper presented at Engineering and Product Design Education International Conference, Imperial College, London, September 6-7, 2018. https://www.designsociety.org/publication/40842/CREATIVITY+IN+ASSESSMENT+RUBRICS

Robinson, Ken, and Lou Aronica. *The Element: How Finding Your Passion Changes Everything*. New York: Penguin Books, 2009

Robinson, Ken. *Out of Our Minds: Learning to be Creative.* Oxford: [New York]: Capstone; John Wiley, 2001

Robinson, Sir Ken. "Bring on the Learning Revolution!" TED Talk, https://www.ted.com/talks/sir_ken_robinson_bring_on_the_learning_revolution.

Robinson, Sir Ken. "Do Schools Kill Creativity?" TED Talk, https://www.ted.com/talks/sir_ken_robinson_do_schools_kill_creativity/comments.

Robinson, Sir Ken. "Bring on the Learning Revolution!" TED Talk, https://www.ted.com/talks/sir_ken_robinson_bring_on_the_learning_revolution.

Solnit, Rebecca. A Field Guide to Getting Lost. New York: Viking, 2005

Zander, Rosamund Stone, and Benjamin Zander. The Art of Possibility: Transforming Professional and Personal Life. New York: Penguin Books, 2002

Beginning of the End: 8x8x8

Malini Srivastava, University of Minnesota

Abstract

This paper describes a beginning exercise for students in the final semester of a professional architecture degree program. The exercise provides a transition for students from early-semester writing exercises to generative drawing, through a multi-step process. This marks the beginning of the end or the initial steps into the program's final project, where students for the first time define their own agenda for change they seek to cause, research they hope to pursue, or knowledge they wish to contribute, in terms of architectural components of site and program. The exercise asks them to concretize unknown and unfamiliar territory, setting them on a path where they have to "define the blank space." The exercise's goal is to propel the students into new research territory even as it causes them to look backwards and rethink earlier propositions.

Curricular Background

The University of Minnesota's professional M. Arch. program takes three years to complete. However, students holding pre-professional degrees in architecture may be eligible for advanced placement, allowing them to commence their professional education in the second year of the program ("Master of Architecture sample program plans" 2023). As a result, the final-semester studio, known as Master's Final Project or MFP, serves as the final semester of either the second or third year of students' professional graduate education.

The MFP is not aimed to be a comprehensive project, as the accreditation requirement for Integrated Design is met elsewhere in the curriculum, specifically, one year earlier ("Master of Architecture sample program plans" 2023). While this positioning frees the MFP from an obligation to demonstrate specific technical competencies, nevertheless the MFP is positioned as cumulative, in the sense that it is aimed to assess students on their competency in architecture, research, critical thinking, and communication ("Arch 8299 Master's Final Project Syllabus" 2022). Given its overall aims, its position as the final course in the professional degree curriculum prior to graduation, and the prevailing disciplinary culture informing final projects (Jemtrud 2011), the MFP's curricular position and role is similar to Salomon's view of the "independent design thesis," namely, as a critical moment in architectural education demanding an intersection between students' individual aspirations and aptitudes with the field's internal and external disciplinary duties (Salomon 2011). However, unlike Salomon's "independent design thesis," the MFP is situated in a studio led by a studio critic. In that respect, it is more similar to a faculty-led research studio (a culminating project in some institutions) where students are guided by individual instructors rather than by a faculty committee typically made up of at least three members. Therefore, the University of Minnesota MFP exists in a critical space of "both/and" and "neither this nor that", borrowing concepts of individual aspirations and aptitudes from the "independent design thesis" tradition and the single-instructor tradition more typical of the research studio.

The MFP requires each student to work independently with the support of a studio instructor to create a "well-considered design proposition," developing specific inquiries and research questions. In this respect, the aims of the MFP studio align closely with Ameri's assertion about the "design thesis," i. e, that it must take on an analytical posture or critical stance towards the theorem that is (or should be) the focus of investigation (Ameri 2015). In a related way, Jemtrud (2011) suggests that architecture students, in their culminating project, are necessarily engaged in forming independent positions, requiring the self-sufficient formulation of questions, the discovery or innovation of methodologies, and a consistent self-guided process of evaluative analysis.

Although the investigative and design processes differ for each MFP student, instructors establish shared expectations for the semester's work by means of a syllabus outlining the studio's overall expectations, learning objectives, milestones, and core competencies. In particular, MFP instructors expect students to develop their projects by considering site, program, circumstance, and assembly (SPCA), all of which serve as critical lenses to inform their design decisions. Secondly, instructors expect students to engage in iterative making, using both physical and digital means, while reflecting critically on each decision. These representations not only serve as evidence and logic for the evolving design propositions; they also demonstrate critical design thinking ability. Finally, the MFP

instructors stress the importance of writing as a form of abstract thinking in support of physical making; with this in mind, instructors require students to provide concise summaries of their most significant findings at regular intervals ("Arch 8299 Master's Final Project Syllabus" 2022). It is important to acknowledge that the MFP syllabus was originally authored by J. Stephen Weeks, and updated in 2010 by the School of Architecture faculty and subsequently updated by Gayla Lindt during the years she led the coordination and teaching of the Masters Final Project.

Because the number of students in a typical graduating class has ranged from 25-48 in the past few years, instructors have used a ranked-choice process to divide the students into roughly equally-sized groups assigned to specific instructors. The two-part need to have the students form and articulate independent positions and provide a ranking of their instructor choices, leads to a series of exercises in the first three weeks of a 15-week semester, where each exercise is led by individual instructors for the entire group of students. After this three-week period, students rank their choices of instructors, organizing manageable student groups (in terms of numbers) per instructor. From this point forward, instructors work independently with students, albeit in the framework of a common syllabus, schedule, learning and grading criteria. This particular studio included three instructors, Gayla Lindt (Coordinator + Instructor 1), Jody McGuire (Instructor 2) and Malini Srivastava (Instructor 3).

Pedagogical approach

Two major interests, arising from the author's previous work, aligned to inform the exercise described in this paper. The first is an interest in pedagogies of full-scale design. in an early work (Christenson and Srivastava 2005), the author identified the category of generative full-scale investigations:

> *"Playing in sand does not substitute for explicit instruction into component systems, nor for rigorous experiment. However, the connection of generative full-scale investigations to promising processes of architectural design is deep and abiding. The cycle of seeing-thinking-acting-judging recurs at every level of architectural design from the most base and fundamental to the most sublime and complex."* (Christenson and Srivastava 2005)

Voulgarelis (2012) describes the author's category of generative full-scale investigations as "open-ended and very experimental building projects which do not in essence have to be completed or even be functional." Similarly, Mohareb and Maassarani (2018) describe generative full-scale investigations as experiments that do "not necessarily signify the finality of a given project."

The second major interest concerns cognitive diversity in the studio environment. The author's past efforts in this area acknowledge the inadequacies of traditional design studio pedagogies that prioritize individual ownership of projects over cooperation and collaboration. The author argues that the traditional approach minimizes the cognitive diversity that could be brought to bear within the development of projects (Srivastava 2020). To address this issue, the author proposed a pedagogical approach emphasizing group work and shifting student groupings, or allegiances. The core of the shifting allegiances approach involves periodic discussions which shift the focus from individual ownership of work to shared student authorship, cooperative structures, and collaboration. In this approach, students view all studio work as being held in shared authorship. Individual artifact development is followed by students sharing and presenting artifacts in all-studio group discussions (Srivastava 2020). In these discussions, students distribute individual work into evolving categories, develop common terminology to identify and categorize work, and form new allegiances, work groups, and collaborative opportunities (Srivastava, Barton, and Christenson 2019; Srivastava and Christenson 2021). Evidence from past implementation of the shifting allegiances approach has shown that it leads to the creation of new knowledge in a short period of time. In a recently published study, students working within this approach achieved a 70% reduction in energy demand over an existing baseline (Srivastava 2020). The approach is suitable for a variety of topical areas and does not require significant curricular or program changes and can be implemented by an individual instructor in a single studio section.

Methods

In this section of the paper, we describe a series of exercises culminating in the 8x8x8 exercise, this paper's major focus. As context for this discussion we can consider the MFP as the "beginning of the end," in the sense that it is the final semester prior to the students' professional graduation. To begin the MFP semester is to set out on a culminating experience. Also, due to their position at the beginning of the MFP semester, the series of exercises we describe here can also be seen as the "beginning of the end."

At the same time, the MFP considered as a whole can be understood as the "end of the beginning." The students' academic experience, ending with MFP, can be seen as preparatory to their professional careers. To state this idea differently, MFP happens at the moment in their education when the students move out of the academy: at this moment, they are assumed to be ready to rely on their architectural education as they find ways to operate critically and productively in the world. Thus, the "beginning" -- their professional education -- comes to an end with MFP. The series of exercises we describe here addresses this dual position of "beginning of the end' and "end of the beginning."

The first exercise, led by the MFP Coordinator and Instructor 1, proceeded in three parts.The first part asked the incoming MFP students to express their curiosity, to identify the issues that mattered to them, and to relate their interests to the architectural discipline as well as to current local and global contexts. The prompt included questions gauging the students' ability to understand their own "design research territory," asking them to make reference to architects working in related areas -- but also asking them about non-architects, scholars, artists, and scientists. Similarly, the exercise asked them to consider how their curiosity could be enhanced by their project's context, allowing for the possibility of a wide range of human activities. The exercise also included methodological questions, asking the students to speculate on possible ways of working, with a specific focus on methods that could be unique to remote learning in the then-current and now persistent pandemic context.

The next part of the exercise further developed the curiosity documents, this time asking students to share selections from the previous part of the exercise on a shared class Miro board, highlighting any areas where they felt they needed peer feedback. Students had to be specific about the type of feedback they felt was necessary to move forward (e. g., help identifying additional related projects, practitioners, or case studies). The cohort was then asked to give post-it feedback to at least two other items posted by other students. Finally, the students organized the feedback requests and replies on the Miro board to identify emerging patterns and relationships -- all with the aim of improving their understanding of both the feedback and their peers' work.

The third part of the Curiosity exercise connected students' past work to the Curiosity documents, asking them to reflect on past projects that captured their attention and to elaborate on why these projects were interesting to them, specifically using the lenses of site, program, circumstance, and assembly. The students were asked to speculatively diagram or write about an attribute or quality from the other projects that could alter their own thinking. Finally, the exercise asked them to summarize their evolving thought processes in a brief revision memo for each of two "curiosities" emerging from the first exercise. After they posted the memos on Miro, we once again asked them to engage in a sorting and grouping response to identify emerging patterns.

The second exercise, led by Instructor 2, involved both writing and making. The students were asked to identify two recurring notions in their work, and to select two nouns related to each notion -- for example, nouns relating to a site, program, circumstance, or assembly. Then, each student was asked to choose three verbs from Richard Serra's work *Verb List* (Serra 1967), and to consider the combination of each Serra verb with each of their two nouns. This exercise resulted in six unique pairs of verb-noun combinations, for each of which the students created a small concept model. The exercise was structured so that three of the word-pairs reflected embedded notions in the students' thinking, while the other three pairs responded to making. The physical models resulting from this exercise served as conceptual diagrams rather than specific design proposals. Once again, the students were asked to share their work on Miro (in this case, by submitting model photographs) for larger group discussion and commentary. This exercise began the process of translation from words to conceptual diagrams using models.

The third and final exercise, led by Instructor 3 and the author of this paper, was the 8x8x8 exercise. As a first step in testing concepts contained in their writings and conceptual models, we asked the students to imagine a full-scale investigation that they would conduct within a cube measuring 8'x8'x8'. They were asked, "How would you physically infiltrate this space? What would you make,

assemble, or build to begin a conversation about your master's final project? What question will you test in your experiment? What equipment, tools, expertise and laboratory environment will you need to conduct the experiment?"

Students were asked to proceed with five principles. First, *concretize* (how would your 8x8x8 become physical, substantive, resistive); second, *collaborate* (how would your 8x8x8 become a site for collective action, agency and interaction); third, *represent* (how would your 8x8x8 construct a form of knowledge that can deal with multiple and changing realities); fourth, *iterate* (assuming your 8x8x8 need not emerge all at once); and finally, *experiment* (experiments can prompt essential insights even if they fail).

Students were asked to draw (not build) the experiment contained in an 8'x8'x8' cube at the scale of 1"=1'0". Despite not requiring full-scale construction the exercise asked the students to contemplate what a full-scale construction could look like.

The 8x8x8 Exercise

Each student produced a drawing that summarized previous curiosity documents. Some included precedents and translated current ideas into sketches and then into scaled 8x8x8 drawings. Each student placed these drawings on the collective Miro board. Students conducted a commenting practice (begun in Exercise 1 suggested by Gayla Lindt) where yellow Miro post-it notes were used to ask questions to a student about their work, blue post-it notes were used by that student to respond to the questions, and green post-it notes were used to provide comments.

Figure 1. Drawing by Gabriel Guarin.

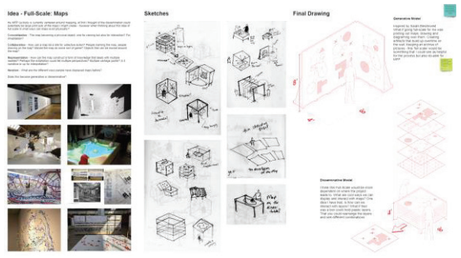


Figure 2. Drawing by Jakob Mahla.

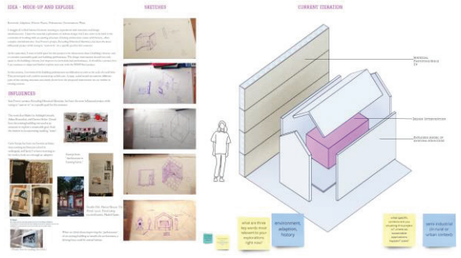


Figure 3. Drawing by Madeline Juve.

After the commenting period, students were asked to conduct the shifting allegiances exercise, moving each person's work into groupings naming (and noting) an emergent issue, theme or concept that they saw as being embodied in that work. Students could move any work to a grouping, they could start a new grouping or join an existing group already initiated by another student (Figure 4).

Three groupings emerged as a result of this exercise. (a) Drawings that were concerned with Construction (assembly, materiality, process of constructing, exploring process of making); (b) Drawings that were concerned with Waste (Different scales of confronting waste, waste in systems, types of waste, revealing / calling attention to waste, visualization / education about systems that produce waste, process of waste); (c) Drawings that embodied Interactivity & Play (an artifact that people could interact with, an artifact that had the ability to engage people).

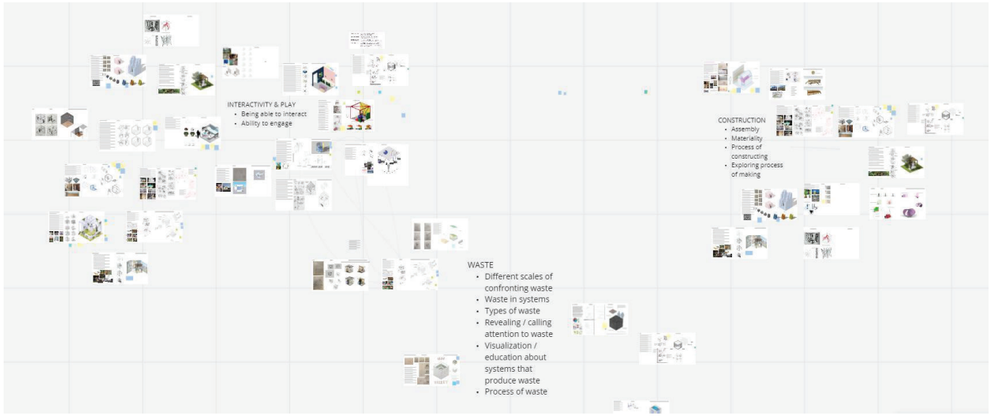


Figure 4. Miro board showing groupings of student work.

Discussion

Above all else, the 8x8x8 exercise was a collaborative endeavor, set at a time in the students' professional education where collaboration is often overlooked due to the expectations of individual success culminating in graduation. The collaborative nature of the exercise was largely due to the sorting exercise. We see this as having similar effects to the exercise described in (Srivastava 2020) conducted by students to identify common emergent themes such as production of resource waste, materiality of construction, and interactivity of a built form (in this case the 8x8x8 cube) as a method of engagement.

Several themes emerged from the group sorting exercise. First, the drawings allowed students to create comparisons and groupings, see overlaps, potential layerings, differences and similarities. They were conducting "readings" of each other's work, and the work of the studio was positioned as a collection of ideas that could be acted on as combinations, adjacencies or a reference catalog of queries or possible questions pertaining to their own work.

Some of the student comments were simply acknowledgements of memories or associations: "this reminds [me] of Japanese screens and how they are placed based on programing, privacy and procedure," wrote one. Another: "Super clear drawings - they remind me of Ikea instructions!"

Beyond simply remarking on associations, students began to ask questions. One student commented that "It'd be really cool to see how seasonality could affect something like this. How could you use that to change this up in summer, spring, fall, winter?" Another student asked their peer directly about collaboration opportunities: "ahh!! this is so clever ...! About collaboration...could we not extend the idea of collaboration beyond human to human interaction? I'm thinking about the human-scale operability of the design itself and the relationship with the changing sun throughout the day. Can one be in collaboration with a design and their environment?"

In fact, a few early collaborations resulted from the exercise. One resulted in a merger of two projects, layering or intersected with each other (Figures 5, 6, and 7). Another resulted in the adoption of one student's 8x8x8 drawing as encapsulating two students' concepts (Figure 8) and yet another placed two students' ideas side by side, seeing possibilities of comparative investigations in different locations building from similar concerns (Figure 9).

Figure 5. Drawing by Bailey Barber.

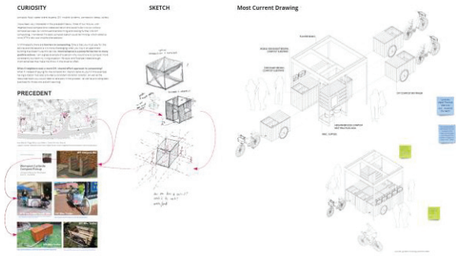


Figure 6. Drawing by Madelyn Gulon.

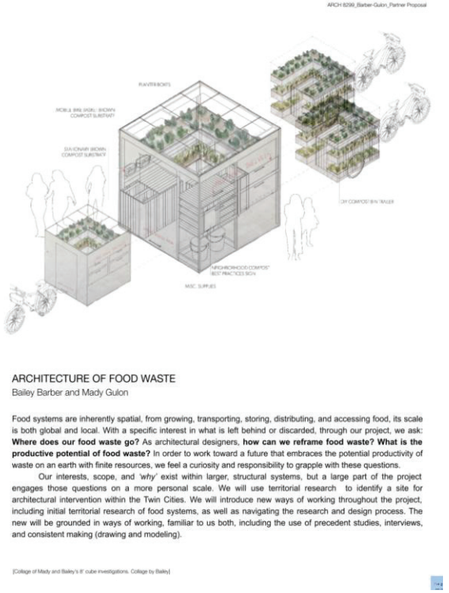


Figure 7. Combined drawing and proposal by Bailey Barber and Madelyn Gulon.

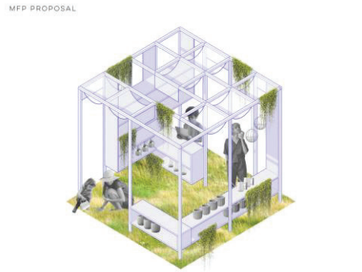


Figure 8. Combined proposal by Jill Gelle and Grace Kelly (including the 8x8x8 drawing by Jill Gelle).

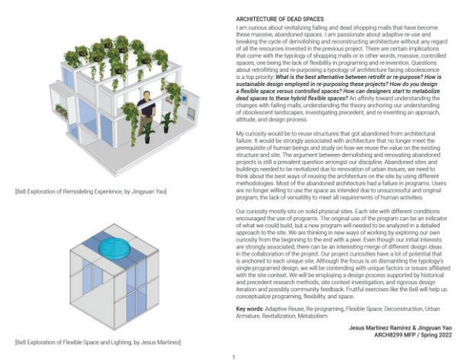


Figure 9. Combined proposal by Jesus Martinez and Jeff Yao (including the 8x8x8 drawings by both students).

The second theme that emerged from the sorting was the representing and seeing multiple possibilities for students' own work through specific questions about site, program, and context, made visible. Some of the comments in this theme involved students testing limits -- whether these limits were ones they recognized as explicit, or otherwise. For example, one student wrote: "The program of this space is less defined, not sure if it matters as much, but it should have some use other than its own deconstruction and reconstruction. What extra space could we have, at what time of year? Maybe the idea shouldn't be so rigid...." Another student acknowledged that "my design may break the rules of the prompt. The playfulness of the design and authorship users may result in the form reaching outside of the 8' x 8' x 8' cube, however, the total massing will always be the 8' x 8' x 8' starting point." Another: "... my thinking on the cube pivoted to more of an educational (maybe interactive?) installation/pavilion about energy production in the US, focusing on nuclear energy."

Some of the comments involved students reporting on their own thought processes in responding to the exercise prompt. "I've been thinking about my housing/homes/adaptable spaces for my curiosities," wrote one student; "From the previous assignment and really thinking about what is the meaning of my words, what do I think when I think about my words and why am I choosing those words." Not all of the self-reflective comments were uniformly positive. For example, one student wrote: "I think my sketches get at the 'interaction' relationship between humans/nature/frame better than my final. The shift to a pop up shop program kind of derailed my exploration!" Similarly, a student acknowledged that "I'm not particularly happy with how this idea came out, I was really struggling to scale down from something I've been thinking about on the scale of a larger landscape and millions of years of time into a 8'x8'x8' cube. Any idea/edits greatly appreciated!" One student optimistically commented that "Assemblage has infinite possibilities. I'm interested in what themes or patterns will arise as I create more assemblages." And still others were directly ready to speculate about future possibilities for their own work. One student wrote of their own approach: "[this] should be a project that I can continue to adapt and further explore next year with the MSSD final project" -- making reference to another degree program in the School of Architecture, which they planned to complete after graduation from the M.Arch.

Finally, the sorting exercise prompted students to define and concretize in specific terms the ideas that were previously without any explicit form. This involved asking questions about the material realities of their evolving ideas about program, site, climate and context. Questions regarding materials, context, location emerged, "How might a basic frame structure begin to allow nature to interact with it? What form may this structure take? Is it open or enclosed? Where might it be sited? What is the retail experience versus the natural setting? How might people interact with the program versus the setting? Is there an opportunity for the biophilic elements to foster an inclusive/universally-accessible retail experience?" In the post-it commentary, one student began with "Great diagram," and went on to ask: "what would be the wall thickness for this specific assembly?" In a similar way, another student led with "I do like the full-scale as a visualization ... I think it is a really cool idea," and then went on to ask about specific material approaches: "Pehaps [sic] something that could give more weight to the box itself? A material quality that could be like a section of the earth that would show your design of a nuclear waste disposal or something?"

Technical questions arose in the exercise, such as "How to create water from condensation in arid climates?" Some questions coupled speculations about materiality with inquiries into their peers' design approach. "I wonder if the melding of these materials is the result of chance, roots, etc.," wrote a student; "is there a specific attitude with certain materials...difference in attitude with wood vs. metal or even porous material vs. solid materials". Another student wrote of their interest in "how this technology integrates with houses/homes and sustainable technology - Designing with existing home and new home."

In the case of the 2022 MFP, the mechanics and procedures of group sorting were impacted by the fact of remote learning. In response to students returning from travels over winter break and the re-emergence of COVID in the form of Omicron, the studio relied on remote work for the first few days so that the entire group would not gather in close proximity with each other. In particular, remote learning required the use of Miro. Especially in the context of the pandemic and remote learning, with students working outside of the traditional studio environment, it was difficult for them to make physical models in a traditional way. For this reason, we decided on exercises that could be carried out digitally -- both in terms of production and critique. Even when physical models were built (as in the second exercise, immediately preceding 8x8x8), we relied on photography and Miro to facilitate sharing and discussion. The post-it notes function, mentioned above, made it possible for students to comment on each other's ideas in a systematic way. Even more critically, Miro provided the ability for students to spatially rearrange each others' ideas. Figure 4 shows the Miro board after the students were asked to work in real-time to rearrange and group their peers' ideas. The sorting exercise resulted in emergent patterns -- patterns that emerged due to the effects of cognitive diversity gained

from receiving a quick understanding of each other's current works through first three exercises but also from knowledge of each others interests and inclinations built up over at least three semesters of working together in various groupings in previous studios, prior to MFP.

In conclusion, the 8x8x8 exercise is simultaneously a pedagogical device for bringing together past ideas and for speculating about future possibilities. Past ideas come from previous studio works, precedents, and readings as incorporated in the students' curiosity writings, while the future speculations involve imagining, iterating, and representing new possibilities in a low-stakes manageable drawing exercise. The exercise can be iterated and is the first of many; it is positioned both as "partial" in that it need not incorporate every idea and also as "whole" in that it is a defined and stand-alone construction of a particular size (8'x8'x8') drawn at a particular scale.

Like the MFP considered as a whole, the exercise can be seen as *reflective* in that it provides an opportunity for students to engage and highlight aspects of their past learning, manifest in their 8x8x8 work as embodiments of their proposals. At the same time, the exercise is also *projective* in the sense that it can hint at the graduating students' future disciplinary or professional interests by asking the students to describe specifics of their concepts.

Acknowledgements

The author acknowledges the partnership with her co-instructors, Gayla Lindt and Jody McGuire, in the teaching of the studio as well as their input in this writing. She also acknowledges that the syllabus for Arch 8299 was authored by J. Stephen Weeks, updated in 2010 by the School of Architecture faculty. In its current form, it carries the imprint of multiple faculty members, including several updates by Gayla Lindt during the years she led the coordination and teaching of the Masters Final Project.

Bibliography

"Arch 8299 Master's Final Project Syllabus." 2022. University of Minnesota. (See Acknowledgements.)

Ameri, Amir. 2015. "The thesis, the pendulum and the battlefield." *International Journal of Art & Design Education* 34, no. 1: 121-131. https://doi.org/10.1111/jade.12015.

Christenson, Mike, and Malini Srivastava. 2005. "A proposal for a cross-disciplinary design pedagogy: Generative full-scale investigations." In *International Conference on Design Education: Tradition and Modernity,* p. 232.

Jemtrud, Michael. 2011. "The end of design and the architectural final project." *Journal of Architectural Education* 65, no. 1: 3-5. https://doi.org/10.1111/j.1531-314X.2011.01173.x

"Master of Architecture sample program plans." 2023. University of Minnesota. Accessed March 7, 2023. https://design.umn.edu/academics/programs/architecture/master-architecture/master-architecture-sample-program-plans.

Mohareb, Nabil, and Sara Maassarani. 2018. "Design-build: An effective approach for architecture studio education." *Archnet-IJAR: International Journal of Architectural Research* 12, no. 2: 146-161. https://doi.org/10.26687/archnet-ijar.v12i2.1570

Salomon, David. 2011. "Experimental cultures: On the 'end' of the design thesis and the rise of the research studio." *Journal of Architectural Education* 65, no. 1: 33-44. https://doi.org/10.1111/j.1531-314X.2011.01172.x

Serra, Richard. 1967. *Verb List.* https://www.moma.org/collection/works/152793

Srivastava, Malini, and Mike Christenson. 2021. "Play in Architectural Pedagogy: Shifting Allegiances and Trading Projects." In *Proceedings, 2018 Fall Conference of the Association of Collegiate Schools of Architecture,* 16–19. https://www.acsa-arch.org/chapter/play-in-architectural-pedagogy-shift-ing-allegiances-and-trading-projects/

Srivastava, Malini, John Barton, and Mike Christenson. 2019. "The death of the desk crit." In Proceedings, 2019 ACSA/EAAE Teachers' Conference. https://doi.org/10.35483/ACSA.Teach.2019.27

Srivastava, Malini. 2020. "Cooperative Learning in Design Studios: A Pedagogy for Net-Positive Performance." *Buildings and Cities* 1, no. 1: 594. https://doi.org/10.5334/bc.45.

Voulgarelis, Hermie. 2012. "Investigating design-build as an alternative model for architectural education." *Proceedings, 2012 ACSA International Conference (Change, Architecture, Education, Practices:* 263-267.

Mnémosynē and the Hybrid Experiments on Tradition *)

Alejandro Borges, Texas A&M University
Livia Loureiro, Texas A&M University
Davi Xavier, Texas A&M University

Introduction

History shows us that the vital works of Architecture, those that still take our breath away today despite the time that has elapsed since their construction, are those which managed to integrate the spirit of their time with tradition and cultural specificity, those that managed to fuse individual creativity with established tectonic and spatial values, and those which achieved the coincidence of local and foreign aspects, the new and the existing, the present and the past in a single specific moment. In Greek mythology, Mnemosyne is the goddess of memory and the mother of the nine Muses, who were the patron goddesses of the arts and sciences. As the goddess of memory, Mnemosyne was responsible for preserving the stories and knowledge of the past, and for passing them down to future generations. [1]

Fig. 1 - Mnémosynē, Greco-Roman Antioch mosaic C2nd A.D., Hatay Archeology Museum.

The importance of remembering is evident in all aspects of our lives. Without memory, we would not be able to learn, grow, or make progress. Memory helps us to remember significant events, facts, and people, and to make connections between them. It allows us to reflect on our past experiences, learn from our mistakes, and envision the future. In addition, memory plays a crucial role in our personal identities. Our memories shape our understanding of who we are, where we come from, and what we value. They allow us to build relationships and connect with others, by sharing stories and experiences.

Thus, memory is essential for many cognitive processes, such as language, reasoning, and problem-solving. It is a crucial tool for learning, personal growth, and identity formation, enabling us to make sense of the world around us. Without memory, we would not be able to process and interpret new information or make decisions based on past experiences. The capacity of remembering is significant in all aspects of our lives.

From Liquid Modernity to Liquid Learning

Liquid modernity is a term coined in 2000 by sociologist Zygmunt Bauman to describe the condition of contemporary society, which he argues is characterized by a constant state of change, instability, and uncertainty (Bauman, 2000) [2]. According to Bauman, the modern world has undergone a profound transformation, from the solid, stable world of modernity to a more fluid, constantly shifting reality. The author proposes that the transition to liquid modernity is the result of several interconnected factors, including globalization, the rise of new communication technologies, and the erosion of traditional social structures. In this new reality, people are constantly forced to adapt to new situations and environments and are often left feeling disoriented and disconnected from their communities and the world around them.

One of the key features of liquid modernity is the speed at which change occurs. In the past, social and cultural norms were relatively stable and enduring, providing a sense of predictability and security.

However, in the liquid modern world, social norms and cultural values are in a constant state of flux and are subjected to rapid change. Another important feature of liquid modernity is the rise of new forms of individualism. In the past, people often derived their sense of identity and purpose from their connection to traditional social structures, such as family, religion, or community. Still, in the liquid modern world, these structures are less stable, and people are forced to rely more on their own individual agency to navigate their way through life.

Bauman (2000) argues that this new form of individualism is both liberating and disorienting. On one hand, it allows people to be more flexible and adaptable in the face of change. On the other hand, it can also create a sense of isolation and disconnection, as people are left to fend for themselves in an ever-changing world. Hence, liquid modernity represents a fundamental shift in the way we understand and navigate the world around us. As the pace of change continues to accelerate, it is likely that its features will become even more pronounced, forcing us to adapt to a world that is increasingly unpredictable, uncertain, and fast-moving.

Because of its existential gloom, lack of certainty, and disregard for order, liquid modernity as proposed by Bauman, is unable to comprehend traditional institutional pedagogy, which is created for what Prof. Todd Rose refers to as the “average student” [3]. Rose proposes that there is no such thing as the average. Standardization, as a direct result of the industrial age's fascination, placed most of the population in average conditions and standard jobs. Liquid modernity celebrates the individual as a unique potential rather than as a standard. As a result, the main question for architecture and pedagogy is how to teach design and creativity in a fluid society made up of individuals.

The goal of contemporary educational systems is still to prepare students to live and grow in an unstable world. Solid generations are radically confronted by the liquidity's abruptness of current times. The challenge of contemporary architecture education lies in the conflict between the latent uncertainties of the liquid society and the overt dogmas of the solid. Thus, what happens to architecture when society disregards established boundaries? What methods can be used to change architectural education to reflect the Liquid Society? How can architectural pedagogies use a kind of liquid learning to advance diversity, equity, and inclusion? Finally, for the Liquid Modernity to be able to meet the demands of modern society, what fundamental ideas, concepts, and formal notions of "solid" architectural knowledge must be transmitted to them?

The Liquid Studio as the Strategy [Method]

Contemporary architecture pedagogy is constantly trying to respond to new developments in architecture, technology, and society. As a discipline, architecture education has traditionally been focused on developing technical skills and design proficiency. However, contemporary architecture pedagogy is increasingly recognizing the importance of interdisciplinary knowledge, collaborative skills, and social responsibility in architectural practice. As discussed by Pallasmaa (2009), today's architectural practice has grown too specialized, isolated, and disassociated from real, thriving culture, the arts, knowledge, and life in general. He believes that everything is interconnected, and that as an architect you can feed your mind through philosophy, poetry, art, and the sciences. One of the key aspects in Architecture, is the integration of new technologies into the design process. With the advent of digital tools and advanced manufacturing techniques, architects can produce complex and innovative structures. This requires a new set of technical skills, which are being incorporated into architecture programs around the world.

Since architecture is an inherently interdisciplinary field, contemporary architecture pedagogy is progressively recognizing the importance of collaboration between different disciplines. This collaboration includes fields such as engineering, construction management, environmental science, and urban planning. By working across disciplinary boundaries, architects are better equipped to create more innovative and sustainable designs that respond to the complex – liquid - challenges facing our society. Moreover, another aspect of contemporary architecture pedagogy is the emphasis on social responsibility. Architects have a unique role to play in shaping the built environment, and contemporary architecture pedagogy is continuously emphasizing the importance of designing for the public good. This includes designing buildings and spaces that are accessible, sustainable, and responsive to the needs of diverse communities. It also involves working collaboratively with stakeholders, including clients, communities, and government agencies, to ensure that designs are responsive to the needs of all users.

In addition to these broad trends, contemporary architecture pedagogy is also characterized by a focus on experiential learning and student-centered approaches. All this development around the teaching of architecture is very often focused mainly on tools and skills, leaving aside the conceptual approaches and the recognition of design as a haptic discipline, in which the perception of space plays an essential role in our interaction with an architectural object.

Thus, considering the broad aspects of contemporary architectural pedagogy, the ***Liquid Studio*** emerges as an approach situated at the intersection of our beginning design studios' pre-conceived [solid] notions of space and basic design principles, and emerging [liquid] elements. The creation of fiction is the place where architecture gets its origin. The creative process emerges from a fantasy that incorporates the distinct elements that generate an architectural problem. Furthermore, Art and Architecture share fundamental principles as architecture begins as representation, where its goal is to exist in the physical world and be perceived and experienced as a manifestation of certain social conditions. Within this intriguing intersection of various aspects that permeate both Art and Architecture, we adopt this interchange as a new strategy to liquify the solid notions of architectural learning.

Beaux-Arts + Bauhaus + Phenomenal Transparency = *Liquid Studio*

This pedagogical strategy proposes to identify the solid notions of the basic principles of design and composition that need to be transmitted to the liquid society’s learning process. First, we propose the basic design composition principles present in the Beaux-Art School as representatives of architecture’s classical tradition: proportion, hierarchy, sequence, scale, and positive / negative.

Fig. 2 – Architecture Atelier, École des Beaux-Arts, 1937. Livre Grande Masse des Beaux-Arts 1937, Paris.

Second, we incorporate the Bauhaus' approach and Walter Gropius' idea of creating a new type of artist-architect, capable of achieving a higher balance between the beaux-arts and skilled making through the incorporation of color theory and its spatial interpretations. Third, we integrate Collin Rowe and Robert Slutsky’s (1963) phenomenal transparency concept, which is based on the idea that architecture can be understood as an experiential phenomenon based on perception and connected through movement and time, as opposed to being a physical construction independent from the observer, as the most significant pieces of knowledge and memory to be the foundation of beginning design studios.

To integrate Beaux-Arts principles with Bauhaus tradition, our approach is to focus on creating a synthesis between the two movements, by identifying and emphasizing the common aspects and the specificities of each one. Both styles, for instance, share a commitment to craftsmanship and attention to detail.

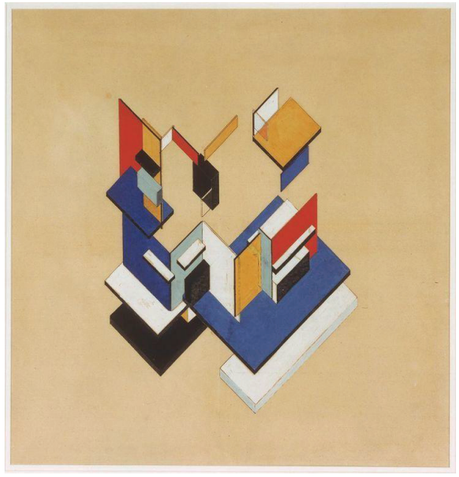


Fig. 3 – Theo Van Doesburg, The Construction of space-time III, 1924.

The Beaux-Arts school of architecture, which emerged in France in the 19th century, is characterized by its emphasis on classical forms, ornamentation, and symmetry [4], while the Bauhaus School of architecture, which originated in Germany in the early 20th century, is known for its emphasis on modernism, functionality, minimalism and abstraction [5]

Teaching Methodologies of the Beaux-Arts

The Beaux-Arts School was initially founded as a training ground for painters, sculptors, and architects who would work in the classical style. The teaching methodologies used in the school were highly structured and focused on the study of the classical tradition. The curriculum included courses in drawing, sculpture, perspective, and history, as well as courses in technical subjects such as engineering and mathematics. The teaching strategies used in the school were designed to develop a strong foundation in classical architectural and design principles and to prepare students for careers as architects and designers.

One of the most important teaching strategies used in the Beaux-Arts School was the atelier system. The atelier system was a highly structured approach to teaching that emphasized close collaboration between students and teachers. Each atelier was led by a master architect or designer who worked closely with a group of students. The master architect or designer was responsible for developing a curriculum that emphasized the classical tradition and for providing individual instruction and guidance to each student. The atelier system was highly effective in developing a strong foundation in classical architectural and design principles which would translate into students' professional trajectory.

The Beaux-Arts placed a strong emphasis on historical precedents as a teaching strategy. The history of architectural and design styles, such as Renaissance and Baroque architecture, as well as ancient Greek and Roman architecture, were extensively covered in the school's curricula. The use of historical precedents in one's own work was encouraged, as well as their analysis. When it came to laying a solid foundation in traditional architectural and design principles and preparing students for careers as architects and designers, the emphasis on historical precedents was very effective.

Drawing and the study of perspective were also emphasized by the Beaux-Arts School of Architecture and Design. The curriculum included in-depth courses in technical drafting, perspective, and drawing. With an emphasis on accuracy and precision, students were taught to draw in a very technical and detailed way. This pedagogy led to a solid foundation in traditional architectural and design principles, making students proficient for their professional endeavors.

Global knowledge of architecture and design has been greatly influenced by the Beaux-Arts School of Architecture and Design. The school's instructional strategies had a significant global impact and were widely adopted by other educational organizations. The way architecture and design were taught in the United States was significantly impacted, particularly by the atelier system. The atelier system was adopted by many American universities, and American architecture and design schools largely used it as a teaching method.

The focus on historical precedents had a significant impact on the world's knowledge of architecture and design. The Beaux-Arts School made a substantial contribution to the revival of classical architecture and design in the late 19th and early 20th centuries. The significant impact of this revival on architecture and design is evident in many of the structures and patterns from that era. The world's understanding of architecture and design has been significantly impacted by the study of historical precedents.

Teaching Methodologies of the Bauhaus

In 1919, Walter Gropius established the Bauhaus School in Weimar, Germany. The school's objective was to combine art, craft, and technology to produce a brand-new type of design that would be both aesthetically pleasing and functional. The *Gesamtkunstwerk*, or "total work of art," served as the cornerstone of the Bauhaus School's educational philosophy. According to this rule, every component of a design, from the smallest element to the overall form, must complement one another.

Johann Heinrich Pestalozzi, a Swiss educational reformer, had a significant impact on the teaching methods used at the Bauhaus School [6]. According to Pestalozzi, education should be based on a student's natural development, with a focus on experiential learning and the practical application of knowledge. This approach was reflected in the Bauhaus School's teaching methods, which stressed the importance of experimentation, practical training, and collaboration. The fundamental ideas of architectural design from the Bauhaus School concentrated on the practical aspects of buildings. The architecture program stressed the importance of functionality over aesthetics and the need for simplicity, efficiency, and economy in design. The curriculum of the Bauhaus School placed a strong emphasis on using standardization and modular design principles to accomplish this goal. The creation of a new design language that was characterized by simplicity, clarity, and functionalism was one of the most important outcomes of the teaching methods used by the Bauhaus School. The development of modern architecture was significantly influenced by this design aesthetic, which later came to be referenced as the International Style.

The formation of a group of designers and artists who spoke the same language and had similar design philosophies was another significant result of the Bauhaus School's instructional methods. This group, which included luminaries like Ludwig Mies van der Rohe and Marcel Breuer, had a significant influence on the advancement of modern design in the 20th century.

Phenomenal Transparency as a Strategy for a Hybrid approach

Phenomenal Transparency is a theoretical concept that describes the experience of perceiving two or more layers of space simultaneously, creating a sense of depth and transparency. This concept was first introduced by Collin Rowe and Robert Slutzky in their influential essay *"Transparency: Literal and Phenomenal"* published in the journal Perspecta in 1963 [7]. They argued that through layering, framing, and the careful placement of forms, architects could create a sense of depth and visual complexity that could engage and captivate viewers for its simultaneity of perceptions.

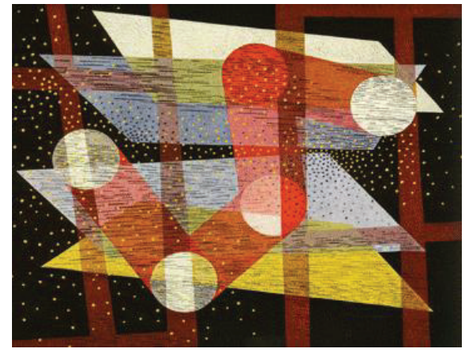


Fig. 4 – Moholy-Nagy, La Sarraz. 1930.

In our Liquid Studio, we introduce phenomenal transparency as a design strategy that aims to create a sense of depth and complexity using layering, framing, and the careful placement of volumes. This approach requires a deep understanding of spatial perception and the relationship between form, space, and light.

One of the most relevant teaching strategies that incorporate and analyze phenomenal transparency is the use of design exercises that explore the concept of layering. In the liquid studio, students are challenged to create designs that incorporate multiple layers of space, using techniques such as layering of materials, overlapping of forms and volumes, and the use of transparency and translucency. Through this exercise, students can explore how the layering of space can create a sense of depth, simultaneity of perception and visual complexity.

Another important teaching strategy in our studio that incorporates phenomenal transparency is the use of framing and a perspectival understanding of space as a series of collisions or juxtapositions. Students are encouraged to experiment with the placement of volumes and the use of the grid as a framing device, in which solid and void, positive and negative create a sense of an articulated depth and visual complexity. This exercise helps students to understand the importance of the relationship between the viewer and the viewed, and how the careful placement of forms and closed and opened spaces, based on movement, can affect the perception of space.

In addition to layering and framing, another important teaching strategy that incorporates phenomenal transparency is the use of light. Light is used to enhance the understanding of perception of space. Students are also challenged to experiment with the use of light and shadow in their three-dimensional physical models to create dramatic effects and enhance the perception of space. Through this exercise, students learn how to use light as a design tool to explore the complexities of phenomenal transparency.

Furthermore, our liquid studio also introduces phenomenal transparency in architecture to study historical and contemporary precedents. Students are challenged to analyze and critique buildings that incorporate the concept of phenomenal transparency, such as the Glass House by Philip Johnson (1949), the Barcelona Pavilion (1929) and Farnsworth House (1945-51) by Mies van der Rohe, as well as Corbusier's Villa Savoye (1929), the Maison du Dr. Curutchet (1949), and Villa Shodhan (1951). Through this analysis, students gain a deeper understanding of how the concept has been used in practice and how it can be applied to their own designs.

Architectural drawing as a mechanism of mediation in the Liquid Studio

In Art and Architecture, there is an exchange of emotions and associations between the work and the observer that depends on specific experiences and particular interpretations. A work of architecture is not perceived as an isolated collection of images, but rather, as an integrated haptic series of perceptions and emotions. Architectural space is the place in which physical structures, tectonic elements, and external perceptions overlap with internal images and symbols that produce meaning. Architectural drawing is a powerful tool for students to learn basic principles of composition. In the Liquid Studio, hand, digital, and hybrid drawing act as mediators to understand the following principles: hierarchy, proportion, scale, rhythm, and harmony. This approach provides a concrete and measurable framework for evaluating the success of a student's composition. According to Pérez-Gómez [8], the line separating an architectural drawing from a completed structure has always been vague and opaque. He examines how, for example, Vitruvius saw the drawing as a minor aspect of the practice and how, during the Renaissance, an architect's drawings indicated a symbolic intention to be realized in the built environment while remaining an independent object of representation. We use drawing not only as a tool for representation, but as a tactic of interpretation of spatial explorations.

The introduction of the concept of space to students is among the most challenging. The goal of the first-year design studio is to help students understand and visualize space. In order to introduce the fundamental concepts of spatial composition, the Liquid Studio employs a series of exercises designed to encourage students to put aside their preconceived notions of what architecture is. We create several introductory exercises about composition and spatial approach, focusing on hierarchy, positive and negative space, the concept of poche, figure-ground, among other topics. The students are also encouraged to investigate abstraction, and to interpret composition as derived from the idea of space.

There is an emphasis on the design process itself, developing and expanding on procedures and instruments previously explored (i.e.: geometric analysis), which allows a different approach from the problem of the genesis of the form and the production of space. In addition, all investigations are focused on an analog and structural understanding of the architectural artifact and its graphical representation. The sequence of exercises defines the design process. It is based on concepts ranging from three main spectrums: the abstract, the functionally specific, and the contextually and programmatically located.

This experimental design process places an emphasis on critical thinking and subjective research, enhances conceptualization of architectural fact, introduces concepts of exploratory spatial research, and aids individuals in understanding concepts of phenomenal transparency, fluid space, compartment space, grouping, sequence, and architectural composition. Hence, the core of the Liquid Studio is a programmatic synthesis process that uses these distinct concepts enabling students to transit from the immaterial to the concrete, from ideation to translation.

Projects descriptions

In the Liquid Studio, the main objective is two-fold. First, it aims to contribute to the definition of the architectural space by emphasizing the commitment between the object and its generating process, maintaining a broad notion of various aspects that work in such relationship, such as: physical, historical, technological. Second, it includes research in architectural design by introducing architectural precedents as an additional component in the design process, using canonical works as a path to reinforce analytical thinking and notions of theme and program in architecture. Also, the studio aims to foster students' reasoning not only in general terms, but also within the design process in which critical thinking represents a link in all decisions made. The studio must be a place for discussion of the different ideas and attitudes generated by the individual processes of students and a place for confrontation as an academic strategy. Each project is an opportunity to investigate a particular theme or concept, and through critical thinking we develop a conceptual framework which is the fundamental base for the studio. Theoretical foundation is an essential part of the dynamics of the studio and the development of critical thinking. Each studio is enhanced by a series of fundamental readings with the purpose of constructing a solid theoretical base from which to operate.

Fig. 5 – Phenomenal Transparency composition. Understanding layering and simultaneity using color theory to communicate spatial intensions. Student Work: Farida Shehata.

From two-dimensional drawings to three-dimensional space

Students are encouraged to experiment in this exercise with Space, Sequence, Hierarchy, and Transparency from two dimensional compositions to its translation to three dimensions, investigating the same ideas and concepts from various angles. Each student generates a series of iterations as a process of understanding the basic principles of composition, as well as the notions on phenomenal transparency, through the development and application of Bauhaus's color theory hand compositions. These color compositions are then re-interpreted as three-

Fig. 6 - From two-dimensional composition to three-dimensional translation. Phenomenal transparency as a tool to interpret ideas of space, sequence, simultaneity and layering. Student work.

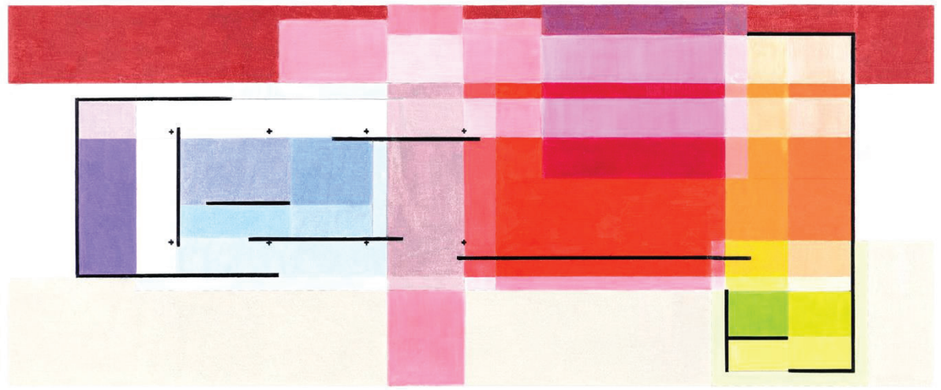


Fig. 7 – Precedent Analysis. We use color theory and phenomenal transparency to explore spatial conditions and to learn about complex relationships, simultaneity, layering and container/contained dichotomies. Student work: Caitlin Garcia, Miguel Perez.

dimensional space through digital and physical model explorations.

Precedent analysis

We analyze in detail a series of relevant projects in the history of architecture with the idea of exposing and interpreting the distinct conceptual and operational design present in such projects. Through the production of a detailed set of drawings of plans, sections, elevations, digital and physical modeling we can understand the basic principles of composition and reinterpret them in the individual projects. In addition, basic notions of transparency literal/phenomenal are introduced. Thus, Phenomenal Transparency becomes a lens for analysis and interpretation.

Each precedent is redrawn by the students as a first step of the process of translation. Plans, sections, elevations and three-dimensional digital models represent the first approach for analysis. Then, students re-interpret the concepts learned through the first exercise and generate a series of hand drawings based on their own phenomenal transparency readings of the precedents. The objective is to identify and communicate spatial systems of order present in their objects of analysis, in order to be consequently applied in their final projects.

Conclusions

The nine Muses, who served as the patron goddesses of the humanities and sciences, descended from Mnemosyne, the goddess of memory. Mnemosyne oversaw preserving historical knowledge and passing it on to subsequent generations. In every area of our lives, we see how important memory is. The strategy developed in our Liquid Studio not only represents an attempt to understand the very foundation of Architectural knowledge but is also determined by our integration of tradition as fundamental expertise of design and composition with contemporary approaches to the discipline and the profession of Architecture. The Liquid Studio embodies the collision of three schools of thought in one pedagogical strategy. Its main objective is to convey to the new generations of Architects the true values of what it means to be an Architect in the twenty-first century.

End Notes

1 Grimal, Pierre. The Dictionary of Classical Mythology. Oxford, UK:_Blackwell Publishers, 1986. 2 Zygmunt Bauman. Liquid Times, Living in an Age of Uncertainty. (Cambridge, MA, 2007), 25-66.
3 Todd Rose. The End of Average, October 8th, 2014, Harvard Graduate School of Education Website: http://www.gse.harvard.edu, https://youtu.be/9GcJi4eaSeY
4 Morrison, Hugh. "Beaux Arts Pedagogy in America: A Historical Overview." Journal of Architectural Education 46, no. 1 (1992): 14-20.https://doi.org/10.1080/10464883.1992.11102668.
5 Gropius, Walter. "The Theory and Organization of the Bauhaus." The Bauhaus: Masters and Students by Themselves. Ed. Frank Whitford. London: Conran Octopus, 1988. 6 Colvin, R. A. & King, K. M. (2018). Dewey's educational heritage: The influence of Pestalozzi. Journal of Philosophy and History of Education, 68(1), 45-54.
7 Spencer, Michael. "Phenomenal Transparency in Architecture: A Critical Review." Journal of Architecture 22, no. 3 (2017): 451-465.
8 Alberto Pérez-Gómez, "Architecture as Drawing," JAE, Vol. 36, No. 2, (1982).

Bibliography

Allen, David Grayson. "The Beaux-Arts Curriculum and American Regionalism." Journal of the Society of Architectural Historians 44, no._1_(1985):_19-29._doi:10.2307/990774. Attoe, Wayne. The Architecture of Community. Chicago: University_of Chicago_Press,_1998. Bauman, Zygmunt. Liquid Modernity. Polity Press, 2000. Bauman, Zygmunt. Liquid Times: Living in an Age of Uncertainty. Polity Press, 2007. Braham, Allan. The Architecture of the French Enlightenment. Berkeley:_University_of_California Press, 1980. Cohen, Jean-Louis, and Christiane Lorgues-Lapouge. The Beaux-Arts Tradition in French Architecture. Philadelphia: University of Pennsylvania_Press,_1990. Collins, George R. The Beaux-Arts and Nineteenth-Century French Architecture. Cambridge, MA: MIT Press, 1982. Davis, F. Kevin. "The Beaux-Arts Curriculum: A Reinterpretation." Journal of Architectural Education 38, no. 3 (1985): 2-9. doi:10.1080/10464883.1985.10758313.
Giddens, Anthony. The Consequences of Modernity. Polity Press, 1990.
Grimal, Pierre. The Dictionary of Classical Mythology. Oxford, UK: Blackwell_Publishers,_1986. Gropius, Walter. The Theory and Organization of the Bauhaus. Cambridge,_MA:_MIT Press,_1965. Moholy-Nagy, László. The New Vision: Fundamentals of Bauhaus Design, Painting, Sculpture, and Architecture. New York: Dover Publications, 2005.
Pallasmaa, Juhani. The Thinking Hand: Existential and Embodied Wisdom_in_Architecture._Wiley,_2009. Perez-Gomez, Alberto. "Transparency and the Irreducible in Architecture." Perspecta,_vol._32,_2001, Rowe, Collin, and Robert Slutzky. "Transparency: Literal and Phenomenal." Perspecta, vol. 8,_1963,_Rowe,_Collin. "Transparency: Literal and Phenomenal Revisited." Architectural Design, vol. 54, no. 3-4, 1984.
Schlemmer, Oskar. The Bauhaus and its Teaching Methods. London: Lund Humphries, 1961. Vidler, Anthony. "The Phenomenal and the Literal: Transparency and the Crisis of Representation in Architecture." Assemblage, no. 4,1987.

The Anxiety of Influencers

Jared Macken, Oklahoma State University
Keith Peiffer, Oklahoma State University

"To discount the anxiety of influence is to commit oneself to the idealizing process that is canonization, and that leads to canonical misreading, so that strong readers become weaker than they need be."[1] *- Harold Bloom*

"Many people would be disposed to say that it was not the machine, but what one did with the machine, that was its meaning or message."[2] *- Marshall McLuhan*

"[The internet] is anything and everything, all of the time."[3] *- Bo Burnham*

The desk crit began like many others during the first week of an undergraduate studio project. The professor takes a seat on a round metal studio stool and begins a conversation to discuss the student's initial thoughts about the project, a proposal for a public space on the university's campus. In order to describe the mix of hardscape and landscape features being considered, the student shows an image they found of an existing completed park design and printed it on an 11x17 sheet of paper. Despite conducting a precedent study while preparing the project brief, the professor has not seen this particular park before, so she mentions some of the characteristic design elements evident in the image before asking, "So where is this park located? And who designed it?" The student, seemingly perplexed at the question, hesitates before answering, "Oh, I don't know. I found it online, but I don't remember where."

Medium Anxiety, Precedent Anxiety

The internet is a vast treasure-trove for design inspiration. Bo Burnham describes its potential as offering "anything and everything, all of the time."[4] This virtual reality is so enmeshed in our contemporary experience that the fullness of its impact can often go unexamined, even while also being much maligned. In mainstream news media we hear many examples of how image and media saturation are affecting culture at large, but their implications for the discipline of architecture seem much less considered. In the example noted above, educators are often more provoked by the content of a "bad" precedent found by a student which, in turn, "blinds us to the character of the medium"[5] itself. While the internet, as a medium, is a source of so much information and precedent opportunities, it is different from the format of the traditional architectural canon. It is in both the character of this medium, but also the nature of how source material is perceived and used in an architectural project, where we can find new opportunities. We do not want to simply dismiss this new media landscape as a source of "bad" precedent, but rather use it to help us develop better methodologies for designing with antecedents, no matter where they come from. In this paper, we will consider the idea that the medium itself is its own content and, if we embrace this idea instead of run from it, we can develop more ways of engaging students in the design process. This in turn will help us influence and shape the use of content that currently causes anxiety within the process of instruction.

Of course, we should note that the use of architectural precedents in the design process is not new. Designers have been referencing historical precedent—through embodied experience and analog forms of media—as a way of developing their own designs for centuries. This process is a form of repetition that utilizes the idea of an "antecedent"—a preceding disciplinary idea—as a way of determining how to carry forward ideas from the past in order to transform them into something new. This paper is not so much about the use of architectural precedent, but rather the dramatic shift in access to precedents during the last few decades: from mostly print sources to digital ones. This shift in medium opens up new scales, paces, or patterns[6] for architectural production and education. By identifying these changes, we can develop methodologies of design and instruction that embrace online media. This paper, in the end, will posit possible ways of engaging with repetition in a more conscious and direct manner, imagining methods that are no longer anxious about the source and content of the image, but more intrigued by how students can engage it architecturally.

Media is the Message

To better understand this relationship between a precedent and its online source, and to assuage any instructor anxiety about this seemingly uncontrollable situation, it is useful to remind ourselves that the discipline of architecture is aware

Fig. 1 These screenshots document a search conducted through three common databases showing the keyword, filters, and image results. Source: authors

of different fields of study which help us better understand and engage the contemporary environment we work within. For example, we have a long working relationship with the great media theorist Marshall McLuhan, whose seminal contributions on the subject coupled with his mantra "the medium is the message," can be aptly applied in this situation to make sense of this omnipotent media presence. The internet is better understood by considering it through McLuhan's inquiries as a medium. Like the Bo Burnham quote above, McLuhan imagined a media landscape as ubiquitous and prevalent as the light bulb. In the first chapter of his seminal text *Understanding Media*, McLuhan argues that the medium through which ideas and content are communicated becomes a kind of message itself.[7]

In a well-known example, he theorizes the lightbulb,[8] a technology that can be used to spell out messages literally—as in a marquee—but can also be used to make other content available for human consumption through the act of illumination. A book read by a lamp at night is an obvious example. While seemingly benign in its effect, the content of that illuminated book can carry any number of different messages. It could, for example, be an architecture monograph which inspires a student to explore new architectural ideas. This inspired student could then go into the studio and communicate those ideas through architectural modes of representation, thereby inspiring and creating dialogue with other students while learning how to engage with a larger architectural culture. It could also be a completely different book being illuminated, one whose content espouses some kind of destructive ideology, which could inspire the reader to rally more people around these ideas. We can then imagine the lightbulb's impact at a larger scale: illuminating a stadium gathering many people together, perhaps rallying around those harmful ideas found in the second book. In contrast, illuminating that same stadium could bring together many different people from a diverse set of backgrounds to enjoy a baseball game. At these different scales of illumination, the ideas have completely different impacts. According to McLuhan, the lightbulb becomes the content and message as it makes any number of activities and ideas available that would not have been possible without its light. The lightbulb in this case is not directly communicating ideologies and values, but offers itself up as a medium that is able to illuminate messages being produced by different people. McLuhan concludes that the medium in this context provides its own message independent of content; it rearranged how humans interact and produce messages in a fundamental way. McLuhan, however, would also place some of the blame for the shaping of the message on the people who are utilizing the media machine. While media becomes the message, there are still ways in which people can find agency within that medium.

This is to say that media, as a non-human actor, has its own agency in the design process, whether it is a lightbulb or the internet. This is especially the case when it comes to finding precedents and understanding the impact these source images and ideas have on the design process. The medium is also situated within a complex cultural matrix, creating a mutually constitutive relationship—digital media affects the design process, and the design process affects the media. To be clear, the shift we are noting is the replacement of a reliance on printed architectural publications like books and peer-reviewed journals with digital sources accessed through the internet. In this way, we see the card catalog replaced by online databases which provide access to printed materials, as well as digital content that is either new or appropriated from other sources. Platforms like Instagram and YouTube allow individual users to generate content while they are also able to promote and popularize other content. While we can feel anxiety about this relationship between precedent and the media that students access, and the fact that these platforms supply students with content not curated using intellectual disciplinary ideas, we can rest assured there are examples from our architectural past where new media landscapes and their affects have been embraced in productive ways.

An obvious example is Denise Scott-Brown and Robert Venturi's Las Vegas studio. This studio, and the subsequent book, have made such a significant impact in the discipline of architecture for a number of reasons. Perhaps most importantly, it embraced a major change in the technology of transportation in the city, the immense proliferation of advertising and consumer culture, and the ways in which these two changes greatly affected the morphology and resulting architecture of the 20th century city. The car is engrained with messaging: it changed the relationship between social space in the city and human interaction with signs, and increased the speed with which one could suddenly travel with their own automobile to access consumer goods across an expanding urban form. As a result, this medium impacted the social fabric of society dramatically. The pairing of consumer culture and the media landscape it influenced—signage, billboards, television, and magazine subscriptions—with the car has had a huge

impact. Scott-Brown and Venturi embraced these media—car culture and advertising—not only as a source of architectural ideas, but also as a way of conducting research. They then used architectural modes of representation and diagramming to architecturalize the ways these media were impacting the morphology of the city. They were at once critical of the medium's limitations, in particular the way it affected architecture and the city, but also utilized it as a resource for better incorporating the ever-changing media landscape into an architectural project.

Fig. 2 Photograph taken during the Las Vegas studio showing the medium as research methodology. Source: Venturi, Scott Brown & Associates

A Change in Access

Given this example of how architectural instructors have embraced a rapidly expanding media landscape to better understand how these changes impact architecture and its instruction, we can consider ways the internet acts as a medium to help us understand how it effects studio instruction. We are also not suggesting that we overlook the differences between how car and consumer culture influenced media in the mid 1900's and how the rise of the internet and social media platforms are shaping the ways our current students learn. There are, however, some important correlations. One critical shift is how we access of images used in a precedent study. Through the logic of the database, vast amounts of content are now easily searchable. Beyond the limitations of a single library's resources, we can search digitized card catalog systems not only linking to printed content from libraries around the world, but also expanding our resources to digital content outside these physical worlds. This reach is enabled through the search engine, pouring over sources word by word, a capability which has become a default assumption for new media. Our access to content is no longer spatially limited; vast collections from institutions like the Library of Congress are available through our smartphone, which is always close at hand. As many advocates of open source and digital commons champion, this removal of barriers has the potential for radical democratization of information. We saw this accelerate even further during the early days of the COVID-19 pandemic as many sources were made available digitally for free to allow our institutions to continue to function during necessary social distancing and lockdown measures. Adding to the changes in access is the acceleration of the addition of new content. Many databases like ArchDaily post new content every day, a rapid increase from slower, monthly journal publications of the past. All of this points to an incredible acceleration of the scale (more content) and the pace (faster access) of content access, leading to the availability of more architectural precedents in a fraction of the time. This reality creates amazing opportunities for the design studio.

Authority of Architectural Examples

Another significant shift is a change in authority over what content is important. The use of various social media platforms has dramatically affected the nature and level of content curation. In the past, we could expect that established publishing houses like El Croquis, Rizzoli, Routledge, Phaidon, etc. were producing books through peer review conducted by noted experts in the discipline. A defined process led to publishing work that was filtered through institutional power, but also through disciplinary-specific discourse related to architecture. The work presented through this media was validated by the assumed legitimacy of these institutions, situated firmly within the discipline or architecture. Through digital platforms, we see the rise of the influencer, a user who generates a notable following through their creation of content. The platform lends its own "soft" legitimacy to the work, but legitimacy is established primarily through "clout," a perception of impact measured through metrics of engagement such as "likes" and "views." Through this framework, a user may gain significant clout without having any of the traditional indicators of expertise like educational background or other credentials. These users often acquire their authority outside the boundaries of the discipline. Again, there is the potential here for a democratization of the content creation process, an opportunity to decolonize established power structures and spread influence by removing traditional barriers that served a "gatekeeping" role. This system

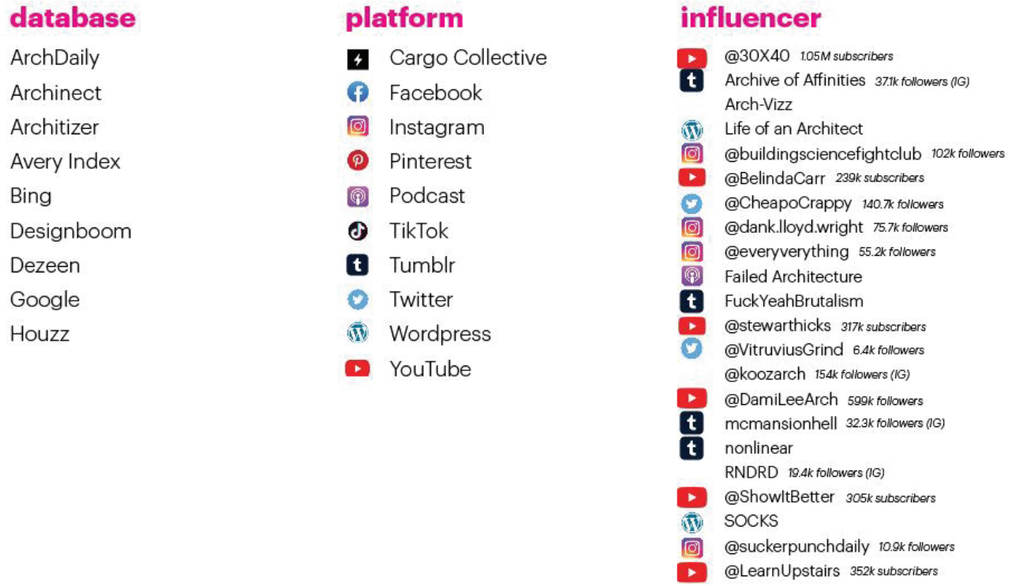


Fig. 3 Collection from an informal survey of undergraduate students to identify common sources for architectural precedent research. Source: authors

provides a different, expanded form of peer review, more distributed among various anonymous users rather than concentrated in certain institutions. This redistribution of authority connects a much broader audience with the discipline.

Speed as Content

The combination of this speed of access and shift in authority, proliferated through platforms, creates different rules of engagement. Keywords take on agency, as they provide access to specific content available in a database. Search engine optimization (SEO) is a method to ensure keywords are actively managed to produce desired access. Because keywords are so critical to reaching content, they assume authority. Within the endless stream of content on platforms and seemingly infinite sources available from almost anywhere, we have access to the internet's "anything and everything, all of the time." This glut of information creates its own issues concerning attention. In popular media like the recent documentary, *The Social Dilemma*, our technologies' relationship to attention is especially highlighted. Tristan Harris, former design ethicist for Google, notes that our platforms are engaged in a feverish "race to the bottom of the brain stem."[9] Bo Burnham argues that through a capitalist logic of constant growth, social media platforms are oriented around capturing attention, a new frontier for colonization.[10] The medium, then, creates a system fueled by attention that is trying to capture as much of it as possible. The race to the bottom of the brain stem highlights the tendency to appeal to humankind's basest instincts, popularly referred to as our "lizard brain," that offers small physiological responses that spur ongoing engagement with the platform.

Despite the utopian promise of the increased speed of access and shift in authority from traditional power structures, the result is a refocusing of media and content with different values. During recent discussions of social media's impact on American politics, the concept of the "echo chamber" has become part of our contemporary parlance. Through prioritizing our engagement and vying for our attention, media presents content that accesses powerful responses like outrage, often filtering content and creating enclaves of like-minded users. This phenomena has also produced the rise of ever more polarized extremes like white nationalism. These damaging effects on culture writ large are common knowledge at this point. However, we are concerned here with identifying the anxiety that the medium as content creates for the discipline and design educators especially. These processes can create their own echo chamber, which may be either disciplinary in origin or

not. While many educators support the broader project of decolonizing our educational structures, the idea that users outside of the discipline could generate significant clout among our students is a radical shift in authority. In particular, entities with dubious goals can range from the allure of holding the "megaphone"[11] of social media for a while to generating ad revenue at the expense of vulnerable minds. To summarize, students' access to architectural precedents are no longer filtered directly by a faculty member suggesting they check out a particular monograph from the architecture library on campus, but rather is immediate and vast, accessed through their own personal searches, and optimized by their past viewing habits to ensure their continual engagement. Further, the precedents accessed are significantly estranged from their disciplinary framing. For example, Pinterest filters images by keyword, resulting in images often completely decontextualized from their source which is difficult to even trace back to where they came from.

Medium Dictates the Message

While we acknowledge the negative impacts the medium itself can have within society, we would like to argue that this does not render the medium categorically "bad." Indeed, all media have positive and negative characteristics. However, we think it is important to acknowledge the large shift in how the medium through internet platforms today is dictating how we manifest our own content. If the medium is the message, then what does that mean we, the users of this medium, have become? Has it started to fundamentally change us as well? Similar to the lightbulb and the car, social media posts have reshaped the way in which we communicate messages. Messages communicated through social media can have character limitations and any number of other app-developer constraints, which make effective communication of nuanced conceptual ideas deliverable only if they fit within this extreme content restriction. These limitations have their own set of reasons behind them. Many are ambiguously related to any number of different ideas about social engineering; if not explicitly dubious in nature, they definitely serve economic ends. Author George Saunders, in a conversation with journalist Ezra Klein likens this sea change in messaging and idea dissemination to what it is like spending 40 minutes on Twitter versus 40 minutes reading Anton Chekov. He makes the interesting observation:

> So, my thing is just look at your mind when you're doing the one and when you're looking at the other. Look at your mind when you begin a Chekhov story and when you finish it. What kind of things have been evoked?
>
> Go on Twitter for 40 minutes, the same time it takes read a Chekhov. Where's your mind there? The medium is a message because if I have said to you, here's the way in which you can communicate, that's going to limit what you can say. It's going to limit the state of your mind while you're saying it. If you think about the sheer volume of our social media interactions, it's got to change the national moment. We can see that it as kind of fun, affable toxin, really.[12]

This example in the quote is almost comical—what architecture student is going to spend any time with great works of literature in-between structures classes and studio? However, the same point can be made about reading an introductory essay in an issue of *El Croquis* and then spending 40 minutes "reading" the plans, sections, and renders that accompany those ideas. The difference is drastic. In addition, Saunders also talks about how writing an essay allows him to edit over and over again. Through many hours and iterations, he claims that he is able to shape an idea into something that feels like it is beyond his own intelligence. The speed and immediacy of social media bypass this possibility. The change in access, authority, and speed has fundamentally changed both how content is delivered and how it is crafted. While we need to address the tendency toward more cursory engagement, we still believe it is more productive to explore ways it can enhance how we spend our time inventing new architectural ideas.

Methods of Repeating: Architecture Becomes the Message Freed from Medium

If one of the discipline's sources of anxiety is about what students locate as "architecture" in a precedent study, then we can develop architectural methodologies that help them engage with the process of repetition in an intelligent and intentional way. There are examples outside of our discipline that can assist us in this endeavor. Literary critic Harold Bloom in his book *The Anxiety of Influence* speaks of a different kind of unsettling feeling that occurs during artistic expression: the influence that occurs between generations of artists afraid of being accused of copying.[13] The idea is that influence is going to occur, so why not engage with it directly? Bloom's examples observe how poets have operated within a disciplinary process of influence and notices different types of repetition that take place. These forms of repetition can take and/or leave different intellectual and formal aspects of preceding poetic figures to invent new literary ideas and methodologies of artistic generation. Bloom identifies what he calls six "revisionary ratios," or methods of repetition. These include *clinamen*, an act of "swerving" specific characteristics and ideas from a past figure in an intentionally new direction; *tessera*, is a completion of a predecessor's project to form an antithetical concept positing that the preceding project was not fully realized; *kenosis*, the idea of "discontinuity of a precursor" that manifests an "emptying out" of previous ideation to attempt a new invention; *daemonization*, in which the poet imagines being possessed by a predecessor as a way of imagining a new version of that original; *askesis*, a "self-purgation" that allows the poet to restrict and/or deprive the creative process of specific elements from both the precursor and their own ideas in order to assume a state of invention; and finally *apophrades*, which imagines a "return of the dead," a reanimation of the previous ideas and imagine them operating within an "uncanny" environment of creativity.

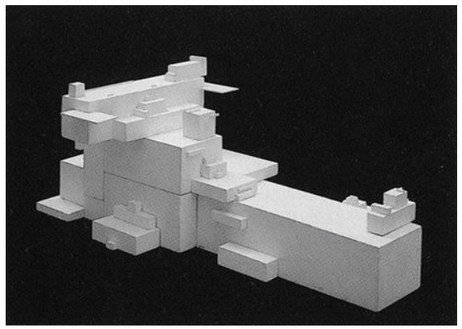


Fig. 4 Model of Malevich's architekton.

Within architecture, in which outside influence is equally unavoidable, we see examples of Bloom's methods in use. For instance, we have examples like Zaha Hadid's early project "Malevich's Tectonik" in which the Russian avant-garde architect's architekton is imagined having landed on a bridge in London. In this repetition of Malevich's project, Hadid engages with the conceptual and disciplinary method of tessera, Bloom's revisionary ratio that imagines that the Russian architect's exploration of the architekton was cut short and is completed through this new instantiation.

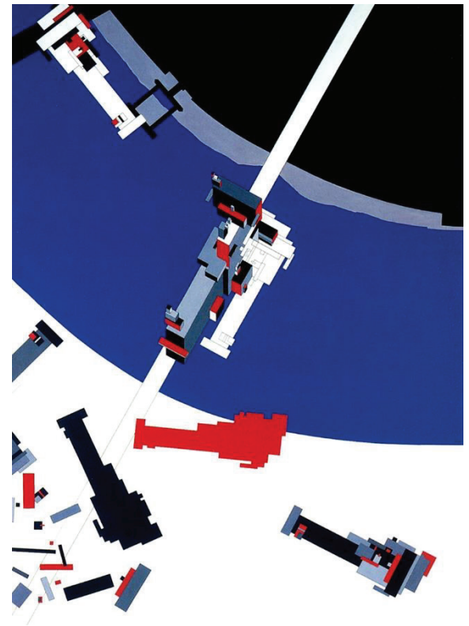


Fig. 5 Conceptual painting of Hadid's *Malevich Tektonik*. Source: Zaha Hadid Architects

Hadid has invented something new—concept and form rethinking Malevich, not as a way of creating a facsimile of his past project, but as a way of pushing the idea forward. The disciplinary ideas of Malevich are combined with a contemporary architectural problematic, creating a design methodology described by Bloom's literary theory, but also absorbed by architecture using it as a lens for inventing new effects for society. The space of the hotel is reimagined, completing a past architectural project as a way of jumpstarting an architectural project of her own.

We think that identifying different modalities of repetition can allow us to utilize the resources of the internet more productively. In fact, these types of repetition could even be applied to a more traditionally controlled precedent study, one that utilizes only monographs and print material, and still be a more intentional and discursive way of working. In this way, the starting material is completely irrelevant; the mode of repetition starts to wrest control back from mediums that dictate message and content complexity, imbuing even the most basic subject matter with architectural meaning. *Or, in other words, architecture becomes a medium through which to process and view the world.*

Two Methods of Teaching Architecture

We found that among the two of us we developed slightly different ways to engage students in the act of repetition. Both methods build into the process architectural- and disciplinary-specific ideas, and both can be described as architectural lenses to view the world and process it into an architectural project. The structure of the first does this as an intellectual and theoretical structure that occurs behind the scenes of the course, allowing the instructor to organize course content with the expectation that most of the knowledge being generated is going to occur more from a collaborative "research" environment and dialogue with the students, and less from a single flow of knowledge from the instructor to the students. The second is a methodology the students engage in more directly, a type of design filter that automatically charts and diagrams the students' ideas as they engage with this more explicit design tool. The students see the different categories of the process and fill them in with their own research and work.

The first example creates an architectural lens with the intention of generating new "architectural intelligence" from source material that come from many different contexts. Architecture then becomes a cultural intelligence on the city, but can easily be applied to virtual contexts as well. The methodology is subdivided into three modes of inquiry: 1) the history of art, architecture, and design as it relates to the city; 2) disciplinary discourse and concerns, or a kind of theoretical bank of ideas; and 3) medium, or the ways architecture, especially in the studio environment, is not merely professionally driven and is not medium specific but a series of ideas and ideologies that engage with society through physical and visual artifacts. These three categories of inquiry are based on the idea that cultural artifacts exist within an expanded field of artistic production. Books, pamphlets, drawings, models, exhibitions, websites, and performance are only a fraction of the different ways architectural ideas can communicate. This mode of working assumes that media is in continuous flux, that source material will not always be architectural or even vetted by architects, and that the media landscape's complexity will greatly influence access to ideas. Therefore, it is important that design education equips students with ideas and techniques required to make critical arguments independent of the ever-changing media landscape.

The second approach uses the format of Inspiration, Methods, and Tactics[14] as a tool to allow the students to self-structure their investigations. The Inspiration phase purposely begins outside traditional disciplinary boundaries with areas like history, economics, social and cultural context, urbanism, and the client's needs. Students are asked to find points of connection between their own interests and the project being designed. In the second phase, students select from a list of design Methods to situate their work on the project within disciplinary methodologies. The method becomes a way to use architectural inquiry to consider their inspiration material more deliberately. Finally, the students use Tactics, or explicitly architectural qualities and features, to translate their ideas architecturally. Similarly to the first approach, this mode of working assumes that source material will not always be architectural, but the way that we engage the material will be. What we choose to do with that source material will also be architectural, translated into explicitly architectural features. An architectural precedent itself can be seen as a combination of multiple tactics that produce a specific effect.

Conclusion

In both teaching methods, the discipline of architecture becomes a lens for interpreting the world around us, drawing from a diverse set of mediums, including the internet. Both methods embrace the idea that sources do not have to be limited by a narrow view of what materials can be used to develop the projects. For instance, neither limits the students' research to printed sources, allowing these methodologies of instruction and design to absorb any images that come into the project, creating an indifference to the concept of "bad" sources and no longer feeling threatened by them. In this way, the medium is viewed as being a part of the message, and this idea, as it is observed through the disciplinary-specific architectural lenses, comments on this condition. Instead of being anxious about where source material for precedent study comes from, these methods care more about how the students bring outside content from the internet or other sources—which is a part of the cultural, social, and political context of contemporary society—and process them architecturally. If we start to understand that the internet is just another series of mediums that carry with them powerful messaging content, then we can start to utilize architecture in the same way. The discipline in this way is not limited by a narrow view of itself as a medium tied to the notion of buildings constructed within the world, but an intelligence that can help us analyze, interpret, and design content that makes sense of the very digital confusion that challenges our pedagogies. In this way, the architectural design studio uses architecture as a medium that can comment on the very condition that caused the initial anxiety in the opening narrative of the paper, and in the process use architecture as an intelligence through which ideas can be filtered.

End Notes

1 Harold Bloom, *William Wordsworth, Updated Edition* (Infobase Publishing, 2009), 38.
2 Marshall McLuhan, "The Medium is the Message," in *Understanding Media: The Extensions of Man* (New York: McGraw-Hill, 1964), 7-21.
3 Bo Burnham. "Welcome to the Internet." 2022.
4 Burnham.
5 McLuhan, 9.
6 McLuhan, 8.
7 McLuhan, 7-21.
8 McLuhan, 8-9.
9 Tristan Harris, "How a handful of tech companies control billions of minds every day," filmed April 2017 at TEDx, Vancouver, BC, video,16:52, https://www.ted.com/talks/tristan_harris_how_a_handful_of_tech_companies_control_billions_of_minds_every_day
10 Bo Burnham, "Self-Esteem in the Age of Social Media," filmed January 9, 2019 at Child Mind Institute, video, 3:18, https://www.youtube.com/watch?v=SUTbnjIHfkg
11 George Saunders, *The Braindead Megaphone* (New York: Penguin, 2007).
12 The New York Times. "Transcript: Ezra Klein Interviews George Saunders," November 8, 2022, sec. Podcasts. https://www.nytimes.com/2022/11/08/podcasts/ezra-klein-interviews-george-saunders.html.
13 Harold Bloom, *The Anxiety of Influence* (London: Oxford University Press, 1975), 5-16.
14 "Tactics" here is a working term, and is not necessarily referring to the term's use in Michel deCerteau's work *The Practice of Everyday Life*.

Bibliography

Bloom, Harold. *The Anxiety of Influence.* London: Oxford University Press, 2009.
Bloom, Harold. *William Wordsworth, Updated Edition*. Infobase Publishing, 2009.
McLuhan, Marshall. "The Medium is the Message." In *Understanding Media: The Extensions of Man*. New York: McGraw-Hill, 1964.

Session 6

Developing Rituals of Fabrication: Bridging the Digital and Physical

Brian K. Lee, Assistant Professor, Kansas State University

Bridging the digital and Physical

As we continue to embrace the digital the physical becomes increasingly unknown to beginning design students. The university design studio may be a student's first introduction to physical means of making or representation. How are students to understand the eventual translation of their designs into the physical if they don't become practiced at it? One bridge between digital and physical is digital fabrication.

Although most things "digital" have become synonymous with speed and convenience, the translation of a digitally produced design into physical material is not magic. It takes time and understanding of the process to achieve desired results consistently. Working with any tools or processes require patience and consistency. Learning this process is not about the expedient execution of a product. If expediency is the focus students will learn expediency and lack understanding, leading to outcomes that lack craft and refinement. Courses in fabrication should allow for a slow and deliberate process of observing and learning from mistakes.[1]

Through a series of fabrication based classes taught over six years at South Dakota State University Department of Architecture, *SDSU DoArch*, a set of guidelines were developed for introducing ways of physical making to students.

Start with the understanding and use of analog predecessors to make initial mockups.

Many digital tools and processes are informed by analog predecessors. In the courses presented here, the analog process of pattern making informs a digital process of cutting and perforation which allows for and informs an analog process of folding and assembly that requires a minimal amount of infrastructure and produces an extremely low amount of waste. The analog process of folding and assembly engages the body and removes the abstraction of working in representations, developing a direct understanding of the material and how it reacts to the forces that act upon it.[2]

If course time allows, introduce the analog predecessor to the digital method under study at the beginning of a course to make the same or similar work that will be made with the digital process. For example hand held routers can be used with templates to make repeated profile cut parts

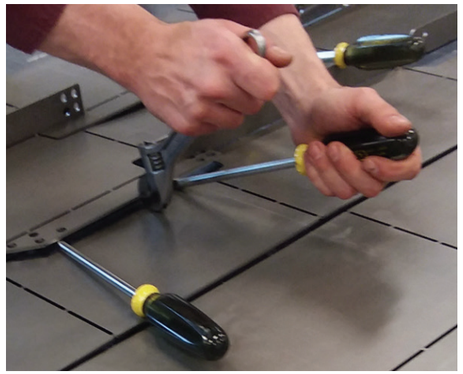


Fig. 1 A digital process of cutting and perforation allows for and informs an analog process of folding.

before moving to a CNC router. Ceramic coil building methods can be explored before moving to 3d printing. In the work presented here, pattern making for clothing is related to cut file patterns for the CNC plasma cutter. Emphasize the the similarities and differences of each method as well as their advantages, disadvantages and potentials as the digital methods and their analog predecessors are not entirely interchangeable.[3]

Set limits and gradually expand them.

Have students work within a material limit or provide an initial design to be translated. Limit the scope of the project brief so the focus is on developing the design through the fabrication process.[4] Limits prevent scope creep and focus attention on the iterative nature of the making process. This is intended to avoid a free for all where students get lost in the design instead of learning to design through the fabrication process. Dimensional material limits may be set based on available material covered by student fees, material left over from another project, material cost per student or the dimensional limits of the machine.

The first version of the CNC plasma courses at SDSU offered through the Department of Architecture's Building Shop sequence, *Arch 431/531 Metal Origami* limited each student to (2) 12"x12" pieces of sheet steel to be manipulated through cutting and folding and then connected together through welding or slotting to create a 3 dimensional object from flat sheets. Students developed their objects at scale through paper models and then translated them into 2d cut pattern files for the CNC

Fig. 2 Work from Arch 461/561 Metal Origami by Nicole Pommier.

plasma cutter. Additionally students were llmited to a set number of cut/fold paths to reduce cut time and consumable use.

In the second offering of the course, *Arch 461/561 Metal Origami,* the basic prompt and material limitations remained the same but the cut path limitation was removed. Although this opened up more opportunities for experimentation, the lack of limitation on cut and fold paths produced designs with an excessive number of cuts and perforations, introducing enough heat to warp the material causing collisions with the plasma torch. Excessive stopping and starting of the plasma torch from multiple short cuts and perforations also burns through consumables at a much faster rate. This was taken into consideration in the development of subsequent versions of the course.

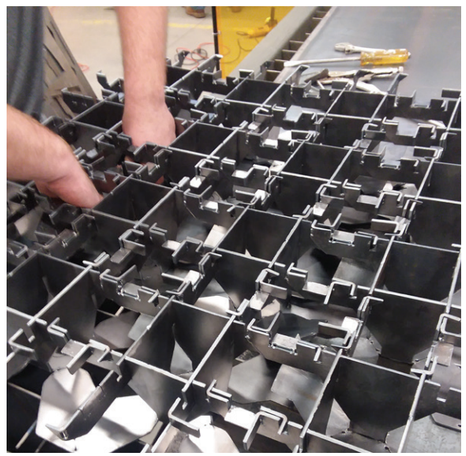


Fig. 3 Joining repeated units through self secured connections. Work by Nathaniel Krueger

In the third and fourth iterations of the course, self secured corners, connections and unit based facade systems were developed from a 12”x12” CNC plasma cut unit of 11ga sheet steel focusing on a more detail oriented material manipulation instead of the primarily formal investigations of the initial course offerings. No bolts, screws, or welding were used to make connections and no steel was to be removed from the given 12”x12” sheet module. Through iterative rapid prototyping, students were able to experiment and refine their work as they learned the tolerances of the material and plasma cutting process. The capabilities of a New 4’x8’ CNC Plasma cutter acquired over the summer of 2019 allowed for more iterations and inspired two students in the course to purchase their own material and build full scale sections of their unit based facade prototypes.

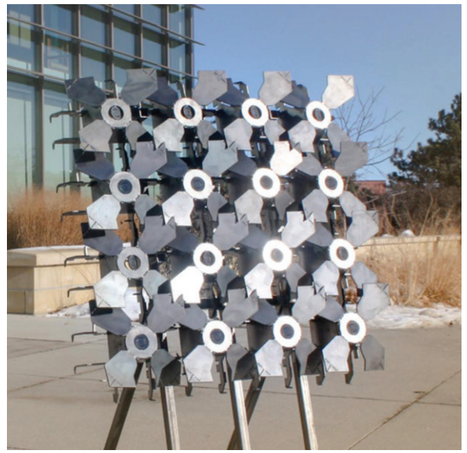


Fig. 4 Unit based facade prototyper by Nathaniel Krueger

An approach that can be paired with a material limit or on its own is to provide an initial design to be altered or translated for a specific process. This is ideal for courses with short timelines where there is little time to develop designs from scratch or for large or ambitious projects that place focus on the process of making over design.

In March of 2020, during the beginning of the Covid-19 lockdown, artist David Umemoto started posting his series of Paper Works on Instagram and made each of their corresponding patterns available to everyone for free online.[5] In preparation for *Arch 461/561: Digital Kitigami* to be delivered in a hybrid format due to Covid-19 protocols in the Fall of 2020 and an ambition to push the capabilities of a new 4’x8' CNC plasma cutter, Umemoto’s work presented an opportunity to translate his original 4”x4” paper patterns into 4’x4’ CNC plasma cut sheet steel. Working in pairs, students studied the original patterns and digitally re-created them to fit the scale and materiality of the steel. These patterns were then cut on the CNC plasma cutter from continuous steel sheets in an intentionally low waste process. No pieces were removed from the continuous sheets. In phase two of the project, students were challenged to stretch and elaborate on their digital pattern in order to use an entire continuous 4’x8’ sheet of steel and incorporate a seating element into the final piece. Because of the hybrid format, student time in the shop was staggered to limit the number of the people in the shop at one time. Although we were able to produce physical work at a time when access to the shop was limited, the nature of this process removed the kind of deep focused learning from multiple iterations that the smaller detail oriented projects provide.

Fig. 5 Umemoto patten translated to a continuous 4’x8’ steel sheet by Hermela Above and Alec Berg

Developing the details of a large cut pattern should not rely on cutting out an entire 4’x8’ pattern for each iteration. Specific details may be cut from smaller amounts of material that when resolved are applied to the full cut pattern. This detail to full sheet method was used in the final version of the course expanded into a full semester long studio open to 3rd through 5th year architecture students at SDSU. *Arch 355/455/555 Flat Force Fold Form* research studio focused on the development of patterns for the digital fabrication and assembly of architectural elements from sheet steel where the logic of form, structure and assembly is embedded in the pattern and guided by the limitations of single steel sheets. Basic digital and analog fabrication processes were used to create form and develop structural strength through the strategic weakening and bending of sheet steel to produce self supporting architectural elements such as floors, roofs, columns, beams and stairs.

Fig. 6 Column to roof detail from Flat Force Fold Form research studio Fall 2021 by Alec Berg, Victoria Dubbeldee, Karly Novy and Daniel Pauley.

Working in teams of 3 or 4, students developed architectural elements from sheet steel to create a structure to span at least 8’-0” at a height of 7’-0” from (3) 4’x8’ sheets of 11ga steel with one end of the span supported by an existing precast concrete wall in the AME Fabrication yard at SDSU. Students developed columns beam roofs and stairs through 1”=1’-0” paper models then moved to testing full scale CNC plasma cut details through iterative design development. Once the details were worked out they were applied to the full sheet cut pattern, executed and installed. Several errors in the designs were revealed during and after installation. A high amount of precise control over the assembly of a detail in the shop led to an inappropriately tight tolerance on site during installation of the entire component. The weight, size and movement of the full sized components made it difficult to align and connect the tightly designed details. Final installation revealed errors in adapting the designs to the site as well, creating an inability to square and plumb the components exacerbating the alignment and connection issues. The remaining weeks of the semester focused on observing the installed proposals through images, sketches, measurements and 3D scanning to determine locations of error in the design, fabrication and installation

process and propose revisions to the design or process to resolve or accommodate error.

Provide sufficient guidelines for success.

Provide all information that has been learned about the process to be successful. As a course develops and the collective familiarity with the process develops this list of guidelines may grow. Provide basic parameters that will produce successful and consistent results, as well as the understanding that deviating from these basic parameters may lead to error. Eventually these parameters become part of a ritual. An established ritual reveals the locations of error and failure providing a baseline that if followed correctly allow for the discovery of error caused by issues outside of that ritual. Did you deviate from the ritual or did you discover another type of error?[6]

Fig. 7 Students in Flat Force Fold Form research studio preparing to move a 360lb a roof piece prior to installation.

Engage in the entire process.

Physical making extends beyond the machine process and the final product. Consider the entire process from the arrival of raw material all the way though to the scrap pile. Include basic maintenance and set up of the equipment as part of the process. Establish the process of material movement to and from the machine, how to start the machine, ready it for use and shut it down to leave it for the next person that uses it. Basic clean up procedures should be expected every time the machine is used. Material size is a big factor in the physical manageability of the work. The smaller material sizes used in the early offerings of these courses allow for multiple iterations per student and are of a manageable size to work with. They also reduce the risk of material waste from mis-cuts and iterations beyond the scope of the project brief. Smaller project sizes are highly portable and are easily carried by hand by one person. Students can easily take their work home so it does not end up in the scrap pile.

Ranging from 90 to 360 lbs, the larger sized pieces produced in the later courses presented issues of weight, movement and where the work goes after completion. Where does it live after the course or final exhibit is over other than going into the scrap pile or the dumpster? Large projects may be difficult for students to not only move without assistance but to find a place for after completion. Establishing where the work goes and how it gets there when developing a project brief may save a lot of unexpected work and waste. The final destination of the work is not something that should be overlooked. Educate students to think through and plan the entire process before doing. As a course instructor, lead by example.

Understand that digital equipment is not infallible.

Most issues that lead to failure in digital fabrication are operator error. This is a frustrating proposition for those that expect the flawless “magic” plug and play operation they are accustomed to when using digital technology. Students experiencing error in the digital fabrication process were quick to declare “the plasma cutter is broken” or “its a piece of junk”. The ripple effect among the students in the course lead to unnecessary down time when upon further investigation it was usually user error, an incorrect setting or deviation from the established ritual. Even when the basic operation guidelines are properly followed there may be issues that need to be addressed that are outside of the scope of the guidelines.

Understand the quirks of the machine and process and how to resolve them.

Communicate how to avoid common errors and how to resolve them when they occur. Some equipment may have known defects that the manufacturer is aware of and has not yet been able to resolve. Issues may be in the design, translation into code or malfunction of the physical equipment. Others may be in the processing software or electronics. “It just does that” is not an ideal answer to an issue, especially when that answer comes directly from the manufacturer of the machine, but unfortunately it may be the case. These types of glitches or quirks may be exacerbated by the age of the equipment. The repetitive use and lack of proper maintenance may wear down the equipment to the point these problems are made even worse. Ingenuity may lead to reasonable work arounds for some issues but ultimately the machine, if beyond the point of repair, may need to be replaced. Communicate with the fabrication lab managers about known issues, regular errors and advice on operation. Relay these known issues to students and provide information on how to avoid or resolve them.

Allow for failure.

Even though the steps of the process are given the execution of the process leaves a lot of room for error. Students must understand that if there is failure, the process was incorrectly executed or the design needs to be revised to align with the machine process. Even though guidelines are provided, common errors understood and a ritual established, they are sometimes overlooked and assumptions are made that may not work with the process at hand.

Upon completion to their first iteration a common conversation with students takes place:

Student: I did it, now what?

Instructor: Did it work?

Student: Well, not really.

Instructor: Why not?

Student: (describes issues)

Instructor: What would you do to fix it?

Student: (Describes potential remedy to issue)

Instructor: Revise it and do it again.

Error and failure are the at the core of learning fabrication, rapid prototyping and iterative design development. Allow students to confront error, malfunction and failure to develop to autonomy in the operation of the machine and the use of it as part of the design process. Walk them through it, talk them through it, make suggestions but, don’t do it for them. In introductory courses require a set number of iterations of the design. A built in number of iterations should be established to allow for and set the expectation of multiple failures and revisions to the design. It has been observed that many students end up going beyond the set minimum number of iterations in order to reach a final prototype. Being able to trouble shoot and revise their design even with the frustration that comes with failing multiple times is seen as the indication that they understand the process and its benefits. Many students come to the realization that they don’t really learn and understand the process until they fail.[7]

This learn from failure approach is rooted in a view of fabrication as a means of experimentation, invention and customization, not the facsimile of consumer products or the output of products. This approach frames fabrication equipment as a design tool and requires direct engagement by students instead of the process being performed by an intermediary lab technician. Direct engagement with fabrication expands the students skillset and understanding of the full design process, how design decisions meet the physical world and informs those decisions to better their designs.[8]

Fig. 8 Early detail iteration from Flat Force Fold Form research studio Fall 2021 by Paul Monson

Fig. 9 Final detail iteration before adding to full sheet pattern from Flat Force Fold Form research studio Fall 2021 by Paul Monson

Use developed guidelines to establish a ritual of use.

In many design schools the opportunity to truly experiment and learn by doing in the fabrication lab has been removed. Fabrication equipment is a large capital investment that serves a number of students and faculty. Multiple users approaching the equipment inconsistently can lead to damage. In early versions of these courses, students that did have a familiarity with the shop somehow developed an aggressive physicality toward making, leading to abuse and inappropriate misuse of shop equipment as well as injury.

To protect their investment, avoid down time and reduce injury, educational settings may establish specific users of the equipment that perform the execution of a file or process for the students. This approach may be necessary during periods of high volume production of multiple projects, particularly when students, and even faculty, have a habit of “running” at the machine expecting immediate production of their file without consideration for the time it takes to properly set up and process it. Although this approach may be more directly related to a design process found in a professional setting where a design is outsourced to be produced by a fabricator, the opportunity for student learning and designing though a direct iterative feedback loop is lost. If engagement with fabrication equipment is reserved for only staff, faculty or a small group of trained students, its use as an educational design tool is greatly diminished and reduces it to a means of production not a means of design inquiry and development.

To ensure that everyone can approach a machine the same way every time it is used, develop a ritual of use for each piece of equipment. Like prayer or entering your pin number at an ATM, a repeated series of actions is performed to consistently achieve a desired result. A collective ritual reduces wear and tear on the equipment while reinforcing the collective institutional knowledge that has been built around the equipment and process. Work with the lab managers to develop and institute rituals as common practice in the lab. As part of the ritual, calmness and patience needs to be established to address aggressive physicality that damages equipment and creates an unsafe working environment. Establish and teach "rituals" of use to increase direct student engagement with fabrication. Direct engagement with fabrication deepens understanding of the work and nuance that goes into the production of a design to better inform design decisions.

The Ritual

Developed for CNC Plasma Cutting on 4’x8’ ShopSabre Sidekick 8 at the South Dakota State University Architecture Math and Engineering Production Lab to be preformed at the beginning of class or before first use of the day.

- Purge moisture from air line (if system has no air dryer or desiccant, moisture in the air line can cause the cutting process to stall)
- Turn on ventilation equipment
- Wipe down cables to remove metal dust that may produce high frequency disturbances to control signals
- Clean off machine to make sure accumulation of metal debris does not disrupt travel of the gantry and torch

(For water table machines: Fill water table)

- Turn on Computer and control box
- -Home machine if required
- -Check torch Consumables, clean torch shield if used, replace consumables if necessary.
- Drive gantry and torch around perimeter extents of table to make sure there are no obstacles and torch will reach all areas of sheet. (This is particularly important when the torch cable hangs from above the table to make sure the cable has enough slack to reach all corners of the table without disturbing torch angle and verify there are no obstacles in the path of the hanging torch cable.)
- -Drive gantry to one end of gantry to make room for loading sheet material
- Load sheet material
- -Make sure sheet is properly aligned and square with table
- -Make sure torch is square/vertical relative to top face of sheet (When working with large sheet cut patterns it is advisable to double check the gantry and torch travel around the perimeter of the table to make sure all areas of the cut will occur on the sheet)
- -Load G-Code in control software (some control software can check for errors in the G-Code)
- -Check settings. Make sure speed rate and power settings are appropriate for thickness of material and application.
- -Set zero on sheet
- -Start file

(To double check that the G-Code runs correctly a dry run may be made with the plasma torch turned off. Depending on the machine this may be done though the control software or a manual switch on the plasma cutting torch itself.)

The ritual may be repeated affect long periods of continuous use when errors increase due to accumulation of moisture in the air supply or accumulation of metal debris on the consumables or gantry mechanisms.

The ritual then extends into material prep and manipulation towards completion of each iteration. In this cleaning the metal, removing any dross or slag produced in the cutting process before folding and manipulating the cut piece.

Rituals can be developed for any machine in the shop and are not reserved only for digital fabrication equipment.

Outcomes

Over the course of 6 years at South Dakota State University the CNC plasma cutter went form a seldom used machine to one of the most use pieces of equipment in the AME shop. The established ritual led to a more approachable and user friendly experience. A slowed down iterative approach focused on design development instead of production, lead to deeper understanding of the process and ability to autonomously trouble shoot issues among students in these courses. This is something that cannot be attained through the one off use of a machine or having a lab technician cut files for them. Students in the final studio version of the course at SDSU were able to reverse engineer the work of previous students to re-produce and execute cut files that had been lost and re-make their final prototypes. Leading by example, the increased use of the CNC plasma cutter attracted attention to the machine and piqued interest in others outside of the course. The process and ritual developed through these courses was informed and adopted by SDSU AME fabrication lab coordinators Garrett Walter and Tyler Hanks. Their application of the developed ritual in the lab increased the level of use by mechanical engineering students who the shop is shared with. One graduate student in architecture that had seen the entire evolution of the CNC plasma cutting course, and participated in the *Arch 355/455/555 Flat Force Fold Form* research studio used the CNC plasma cutting process as the primary means of investigation in their final independent studio project.

After accepting a position at Kansas State University (*KSU)* the process developed at SDSU was applied to a similar CNC plasma cutting based seminar course in the Fall of 2022. *Arch 715 Metal Fabrication for Architecture* required students to develop a demountable connection from (1) 12”x12” piece of 11ga sheet steel. This course presented the opportunity to apply and test the use of ritual in a new setting and build a culture of engagement with the CNC plasma cutter. Working with yet another (3rd) CNC plasma cutter required learning a new approach specific to the machine that informed alterations to the approach developed for SDSU. Similar initial issues as encountered in previous courses at SDSU were met at KSU as well. KSU APDesign Fabrication Lab manager Joe Hornung was consulted with to better understand the quirks and nuances of the machine. As this particular machine

Fig. 10 Demountable corner connection from the initial offering of *ARCH 715 Metal Fabrication for Architecture* at Kansas State University, Fall 2020 by Katherine Dulohery.

became better understood the ritual was adjusted resulting in a smoother more user friendly process of engagement. Through use of the new ritual and iterative design process in the seminar course students again displayed an observable deepening of their understanding of the process as the course played out. Students in the seminar course were able to take the process learned in the seminar and immediately apply it the following semester in a digital fabrication based studio taught by Associate Professor Genevieve Beaudoin.

“Generally, I am a strong proponent of fabrication research (as opposed to larger design-build projects) in the studio environment. When students can focus specifically on a material or system and see first-hand the way a material responds, they learn so much so quickly about how to adapt their design sensibilities to what they are confronted by with that material. The process learned in Lee’s seminar by several of the students in my year-long studio has had a trickle-down effect. Rarely is the impact direct, where you see the exact detail or process that they may have learned in a seminar appears in that form in a studio project, but their sensibility has shifted in response to what they were working with. This has been particularly true moving from a digital file into an analog process. Their basic awareness of the imperfections of the plasma cutter and how they can make adjustments in the digital sphere to achieve a better analog result has prepared them well moving into a broader focus on fabrication in my studio and in their individual projects.” -Associate Professor Genevieve Beaudoin. Kansas State University

These guidelines are part of a fuller understanding of how to formulate productive introductory fabrication courses and have served to develop a successful series of courses that have grown in ambition as the collective knowledge

around the making process grows. Although these guidelines have been found to work in the classroom setting, rituals of fabrication are intended to promote engagement and autonomous use by students during the design process, they are not a magic key to one-off use by the uninitiated. Full competency in any process requires repetitive use to achieve deep learning and understanding of how to incorporate fabrication equipment as a tool in the design process not just a means of production. This approach generates an observable increase in the level of student comfort and confidence in using the equipment and is most beneficial early in a student's education where they can gain an understanding of it and be able to apply it later as part of their design tool kit. Unfortunately most design courses that allow for a deep direct engagement with fabrication are reserved for upper level students toward the end or their education, leading to students, faculty and staff wondering why the shop isn't used more often. Spontaneous engagement with physical means of making by students requires direct access to the equipment and an instigator, champion or required use in order to establish a culture of making beyond one off courses. It takes time and consistency to grow this culture to the point that students apply it in other course work and it becomes ubiquitous within a department, program or design school.

End Notes

[1] Sennett, Richard. *The Craftsman.* New Haven & London: Yale University Press, 2008. p 295.
[2] Sennett, Richard. *The Craftsman.* p 119-120.
[3] Doyle, Shelby. "Edges: an Introduction to Analog + Digital Fabrication." Chicago: Illinois Institute of Technology, 2014. p 451.
[4] Doyle, Shelby. "Edges: an Introduction to Analog + Digital Fabrication." p 451.
[5] Umemoto, David. https://davidumemoto.com/product/architectural-set-no1/
[6] Sennett, Richard. *The Craftsman.* p 38-39.
[7] Blikstein, Paulo. "Digital Fabrication and 'Making' in Education: The Democratization of Invention" , 2013. p 7-8.
[8] Agribas, Asli. "The use of Digital Fabrication as a Sketching Tool in the Architectural Design Process" Vienna: Faculty of Architecture and Urban Planning, TU Wein, 2015. p 321.

Bibliography

Agribas, Asli. 2015. "The use of Digital Fabrication as a Sketching Tool in the Architectural Design Process" in *Real Time: Proceedings of the 33rd International Conference on Education and Research in Computer Aided Architectural Design in Europe Volume 2,* TU Wien, 16-18 Sep 2015, pp. 319-324 Vienna: Faculty of Architecture and Urban Planning, TU Wein.

Blikstein, Paulo. 2013. "Digital Fabrication and 'Making' in Education: The Democratization of Invention", in *Fab Labs: Of machines, makers and inventors*, pp. 203-222 Wetzlar : Mejuskel Medienproduktion GmbH, 2013

Doyle, Shelby. 2014. "Edges: an Introduction to Analog + Digital Fabrication." *in 30th National Conference on the Beginning Design Student: Materiality: Essence + Substance, Illinois Institute of Technology, 3-5 Apr 2014,* pp. 451-457 Chicago: Illinois Institute of Technology.

Sennett, Richard. The *Craftsman.* New Haven & London: Yale University Press, 2008.

Umemoto, David. Accessed March 5, 2023. https://davidumemoto.com/product/architectural-set-no1/

Active Learnings in Architectural Studios: A Comparative Study of Foundation Design Curriculum in the US, China and Jordan

Xiao Hu, University of Idaho
Hala Barakat, University of Idaho

Abstract

Foundation Design studios play a vital role in architectural education as they introduce the basic conceptual processes towards space-related problems to students who have no prior design skills, knowledge, and experience. Design studios, supported by many other courses in different subjects, are dominant components of the architectural curriculum in the beginning level. How to integrate those curricular subjects into studio-based learning and how to identify effective ways to encourage students' creativity are always the fundamental challenge for faculty members teaching foundation design studios around the world. Teaching approaches and architectural curricula in different countries reflect their different educational views, values, needs, goals and outcomes. Schools in the US have hosted the largest number of international students studying architecture in the world and the majority of them are from China and the Middle East. With the growing globalization in higher education, it becomes critical to develop a better understanding of different approaches and international contexts.

This paper focuses on comparing the architectural foundation curricula from seven universities with accredited architecture programs in three countries (two universities in the US, three in China and two in Jordan) to analyze how certain subjects are integrated into studio learnings for the 1st year and 2nd year architectural students. As an exploratory study, this paper examines the integration of three important subjects in architecture: sustainability, technology, and human behavior. Courses related to those three subjects are identified, classified and summarized in qualitative and quantitative methods. The main research question is how similar and different subjects of sustainability, technology, and human behavior are integrated with design studios for the 1st and 2nd year architectural students.

The goal of this study is to develop a understanding of the alternative approaches of teaching beginning level architecture by demonstrating the similarities and differences among the curricula in those three countries. This will help educators around the world to develop a "second view" to assess their teaching approaches and to learn from others' practices. In addition, understanding of the differences in curricula among different countries that international students may be exposed to will contribute to the improvement of curricula and teaching approaches to generate better student outcomes. Although there are many published studies about architectural curriculum models, few attentions are given to comparative studies of architectural curriculum in different countries, particularly in the beginning levels.

1. Introduction

Architectural schools in different countries develop curricula with different focuses, formats and outcomes, responding to their different needs and priorities of architectural education. However, the increasing globalization and internationalization since the 1980s have promoted the dominated influences of Western approaches.

Integrating technology subjects with design studio teaching: comparing curriculum of architecture education in Australia and Iran by Mahmoud Reza Saghafi, Philip Crowther, compares the curriculum of architecture education in Australia and Iran by analyzing how technology and design studio subjects are integrated together. The authors discuss that while both countries have similar goals for their architecture education, they approach the integration of technology subjects with design studio teaching is different. In Australia, there is a

stronger emphasis on technology subjects, and they are often taught separately from design studio courses, allowing students to focus on the technical skills of the program and avoids the misuse of digital programs. In contrast, in Iran, technology subjects are integrated into the design studio courses, and there is a strong emphasis on the use of traditional tools and techniques.

As our world rapidly changes on multiple fronts, there is a compelling case for radical change in the educational and professional structures of the built environment disciplines. This research categorizes beginning design courses into three platforms—Sustainability, Human Behavior, and Technology—based on four key elements presented by an ongoing examination of an emergent architecture program at Te Wānanga Aronui o Tāmaki Makau Rau / Auckland University of Technology (AUT) in designing transformative pedagogies. In the paper, "A Transformative Architectural Pedagogy and Tool for a Time of Converging Crises," the authors argue that the following four factors are transferable to multiple learning institutions and support pedagogies for cultural, social, and ecological well-being. The four factors are: 1) the value of a collectively held and articulated vision, 2) the commitment of an academic team to support the vision, 3) the vision's alignment with place-specific values, and 4) the inclusion of an action research component that is established in real-world interactions. (Yates, 2023)

This paper reflects on the architectural curricula across three countries. This research argues different points of priorities including technological, Human behavior, and sustainable courses in early design pedagogy. The comparative study is a commitment to understanding multiple approaches to beginning design courses while showcasing curricula that prepare students to think about responsive architectural solutions to local social and environmental issues facing the built environment. The curricula studied are divided into three categories: Human Behavior, Sustainability, and Technology. In a fast-moving world challenging traditional assumptions in architectural pedagogy is a necessary procedure in evaluating architectural thinking and the relevance to the practice. The main aim is to examine the opportunities and challenges across an architectural education scene in comparing and changing curricula in sustainability, human behavior and building technology delivery for beginning design students.

2. Materials and Methods

This paper focuses on comparing the architectural foundation curricula from China, the US, and Jordan to analyze how subjects of sustainability, building technology, and human behaviors are delivered to 1st year and 2nd year architectural students.

The curricula and course plans from seven universities are analyzed and evaluated, including three in China (Chang'an University, Xi'an University of Architecture & Technology, and Chengdu University of Technology), two in the US (University of Idaho and Washington State University), and two in Jordan (University of Jordan and German Jordan University).

This study uses both qualitative and quantitative studies to evaluate the curricula. The qualitative study focuses on how the specific issues of sustainability, building technology and human behaviors are addressed and delivered, while the quantitative study explains how deep certain subjects are addressed and delivered.

Subjects of building technology are an essential part of architectural learning. Those subjects, often integrated or associated with studio projects, provide an engineering perspective of building design that allow students to develop a holistic understanding on how a building can be constructed and structured as well as the possibilities and limitations of design ideas. Traditionally, building technology refers to the particular technical aspects of various building issues, such as structure, materials, lighting, heating & cooling, and construction (Smith, 1987) and is considered one of the four main areas of architectural training along with design studios, history & humanities, and professional practices (Kucker, 1997).

In this paper, any course whose main focus is placed on the theoretical knowledge and principles of building structure, materials, construction, lighting, acoustics, heating & cooling, or mechanics is considered a building technology course. For a course which teaches multiple subjects, it is considered a building technology course as long as it offers more than 50% of course time on building technology issues.

Teaching sustainability and human behaviors in architecture has been an active practice worldwide for the last few decades, reflecting the global calls for sustainable future. Schools have reformed or revised their course syllabuses to introduce sustainability-related and human-centered contents and to develop students' knowledge and skills for sustainable and inclusive approaches. However, the term of "sustainability" and "human behaviors" include so many dimensions and has been interpreted in so many different ways in the built environment that it is hard to achieve a precise meaning accepted and agreed by everyone, which make it complicated to explicitly indicate sustainability and human behaviors in architectural curricula in different schools. This presents a challenge to educators to decide what subjects of sustainability or human behaviors are considered important and should be included into curricula (Altomonte, Rutherford, & Wilson, 2012).

Due to the various definitions and interpretations on sustainability and human behaviors, this study employs the student performance criteria (SPC) from the accreditation agencies as a tool to decide if a course is sustainability-related or human behavior-related. Architectural schools in China and the US operate their degree programs based on the requirements of their national architectural accreditation agencies, while Jordan has no its own accreditation. Most Jordanian schools use the accreditation documents from the US as a reference. Therefore, all SPCs from China's National Board of Architectural Accreditation (NBAA) and the National Architectural Accreditation Board (NAAB) in the US are analyzed to find out if any of them addresses the three areas of sustainability: environmental, economic, sociocultural, and the impact of physical spaces on human perceptions and /or behaviors. If a title and/or a description of a SPC addresses issues in those areas, that SPC will be selected as a sustainability-related or human behavior-related SPC. All courses and credits from the studied schools are analyzed according to those SPCs. If any course contains at least one of those SPCs, it will be considered sustainability-related or human behavior-related course.

Since the 2014 NAAB SPC matrix is still being used by the Jordanian schools and the American schools, this study focuses on the 2014 version of SPCs by NAAB. Most Chinese schools are guided by the 2018 Version of SPCs defined by China's NBAA. As a result, this study use the 2018 Version NBAA SPCs for analysis.

The NBAA's matrix used in China has defined three levels of SPCs, including two first-levels SPCs (the Basic Requirements, reflecting non-architectural education requirements such as PE and moral training, and the Professional Education Requirements). Within the Professional Education Requirements, there are four 2nd level SPCs, such as Architectural Design, Building Technology, Professional Practices, and Knowledge Related to Architecture. Each of them includes multiple 3rd level SPCs. Among the total 34 3rd level SPCs under the Professional Education Requirements, this study has identified three Sustainability SPCs, including Sustainability, Preservation, and Building Engineering & Green Building Design, and one SPC for Human Behaviors, Built Environment & Human Behaviors.

In the NAAB matrix, three SPCs for Sustainability are identified: B-3 Sustainability, B-8 Environmental Systems, and C-9 Community and Social Responsibility. Also, three SPCs for Human Behaviors were identified: A-9 Historical Traditions & Global Culture, A-10 Cultural Diversity, and C-2 Human Behaviors

Three indicators, the numbers of courses in a certain area, the academic credits assigned to each course, and the total number of credits required to complete a professional degree in each school, are studied. Since the academic credits are defined differently in different schools, this study only use relative values of percentages to indicate the comparison results.

3. Findings and Discussions

In the article "De-colonising Architectural Education," Toma Berlanda highlights the widening gap between architectural history that encapsulates cultural, contextual, and political courses, and the architectural production questioning urban conditions. Berlanda suggests that architectural education should cover local experiences, transitions, and methodologies in the school's curriculum including the three defined categories for the study. The academic structure should be in collaboration with local communities and architects, allowing students to take ownership of their architectural heritage. (Berlanda, 2019)

Education in the United States

In the first year of the architecture program at Washington State University, students focus on both human behavior and building technology. The program includes a

Foundation Studio course in human behavior, which provides students with a fundamental understanding of design principles and techniques. Through hands-on instruction and practical projects, students develop their creative and critical thinking skills, as well as their ability to communicate design concepts through various mediums. In the building technology track, students take a course in World of Design and Construction, which introduces students to the technical aspects of building technology, including materials, methods, and systems. Through this course, students gain an understanding of the various factors that influence building design, construction, and sustainability. In the second year of the architecture program at Washington State University, students continue to build their knowledge and skills in human behavior, sustainability, and building technology. The program includes courses in global history of design and design theory, providing students with a deeper understanding of the historical and theoretical contexts of architecture. Students also take two architectural design courses, which provide them with opportunities to apply their design skills and knowledge in the context of more complex design challenges. The program includes a course in issues in sustainable architecture, which focuses on the critical role of sustainability in contemporary architecture. Students also study materials and fabrication methods, gaining an understanding of the technical aspects of building technology, as well as an introduction to fabrication labs.

In the first year of the University of Idaho's architecture program, students take courses in both human behavior and building technology. In the human behavior track, students take courses in Integrated Design Process, Integrated Art & Design Communication, and Drawing as Design Thinking. These courses focus on developing the creative and critical thinking skills needed for effective design, as well as the ability to communicate design concepts through various mediums. In the building technology track, students take courses in Intro to the Built Environment and Materials and Methods. These courses provide students with a foundation in the technical aspects of building technology, including materials, methods, and systems. In the second year of the University of Idaho's architecture program, students continue their studies in human behavior, with a focus on architectural design. The program includes two courses in architectural design foundations that focus on the traditional pedagogical approaches including formal principles, ordering systems, conceptualization, experimentation, design making, and design communication for the resolution of given architectural design problems while emphasizing on conceptual and tectonics methods of design thinking.

3.1 Comparison of Sustainability Teaching

In the US, the study examines the curricula of two accredited programs. However, one being in the School of Design + Construction under the Voiland College of Engineering and Architecture and the other one within the College of Art and Architecture plays a role in the integration of sustainability courses. Each school's architecture pedagogy is influenced by the larger college umbrella. Washington State Universities offers larger emphasis on sustainability and technology in early design while the University of Idaho focuses on the creative and drawing techniques within human behavior.

Education in China

In China, this study selects three influential and well established architectural programs, each of which has accredited programs. Founded in 1928, the Architectural Program at Xi'an University of Architecture & Technology (XUAT) is one of the oldest and most influential programs in China and Asia, with five year B.Arch programs, M.Arch, and PhD programs, Chang'an University's (CU) Architectural Program is influential in Northwest China with its five year B. Arch, three year M. Arch and PhD Program. The five year B. Arch Program at Chengdu University of Technology (CUT) is relatively young, founded in 2005, and is also the smallest among the three schools.

3.2 Comparison of Sustainability Teaching

In general, all three Chinese schools indicate a consistent similarity in their 1st year curricula, which have a strong load on general education courses such as Advanced Mathematics and ideological trainings. Each has roughly same numbers of credits and teaching hours in general education courses as those in architectural courses. All three schools has courses to introduce design principles in their first year curricula. In the first semester, XUAT and CU introduce the fundamental principles of human settlements, which takes a tiny percentage of the whole courseload (7% at XUAT, 2% at CU). CUT delivers the same subject at the 2nd semester with a relatively heavier load (14% of all courseload that semester).

It is critical to note that XUAT brings the course of "Green Building Design Foundation" into the 2nd semester of the first year, which becomes the earliest to introduce green building designs among the three Chinese schools. However, this course only carries 1 credit, reflecting 3.3% of the whole semester load.

Education in Jordan

The School of Architecture and Built Environment (SABE) at the German Jordanian University includes a diverse range of subjects that enable students to gain a deeper understanding of the humanities and the built environment. As part of the humanities curriculum, students' complete courses in Arts' Appreciation, Leadership, and Emotional Intelligence and Intercultural Communications. Additionally, students are introduced to building technology related topics through basic multidimensional analysis of the built environment at the levels of urban, architectural, landscape, building systems and material, design process and implementations at human scale. By providing courses that are structured based on soft-numerical teaching methods, focusing on morphology and behavior rather than complex calculations, such as Physics for Architects, where students cover topics of mechanics and dynamics, electrostatics and electricity, heat transfer, climatology, gases and vapor.
In the second year of study students take a range of courses covering topics related to historical and regional influences; the Islamic context, including a focus on visual arts and comparative history of architecture. Students also study the methods and typologies of architectural design, as well as building technology, with a specific emphasis on building construction materials, processes, and structural systems. Under the track of Sustainability, students take courses on utility planning and design. By introducing the operational performance and design of building systems for electrical supply, illumination and transportation. Students also conduct construction cost and operational efficiency calculations.

In the first year of the University of Jordan's architecture program, the human behavior courses include Free Hand Sketching, which are taught through a combination of theoretical instruction and practical labs. The program also includes courses in Basic Design 1 and 2, which provide students with foundational methods of design focusing on aesthetic appreciation, plastic art and Architecture. In addition, students take a course in Building Workshop, which introduces them to the practical aspects of building technology. Using small scale applications, students prepare technical reports with analysis of local construction technology.

In the second year of the University of Jordan's architecture program, students continue their studies in human behavior and building technology. Through courses on History & Theory of Architecture, through the analysis of Historical buildings from ancient civilizations such as the Greek, Roman, Egyptian, Byzantine, Romanesque, Gothic and Renaissance. In addition, students take courses in Architectural Design 1 and 2, which build upon the design principles and techniques learned in the first year with emphasis on structures by designing an elementary architectural project on a plain site and exploring the role of environmental and climatic implications on buildings. The building technology courses include Building Construction 1 and 2, which focus on properties of natural and building materials. In addition to the building components and finishing details, with heat and noise insulation systems. Finally, students study prefabricated construction and building elements from around the world.

3.3 Comparison of Sustainability Teaching

The University of Jordan architecture program started in the academic year 1975/1976 while the German Jordanian University started in 2006. This allowed us to examine traditional methods at the University of Jordan and a new pedagogy influenced by Dutch educational structure and mandatory internship experience in year 5. The German Jordanian University introduces sustainability through two Utility Planning and Design ocurses,6 credits in year 2. The University of Jordan relies on practitioners to integrate the local methodologies into classes, with a Building workshop course in year 1 and Building construction classes in year 2.

It is evident that all school collectively utilize Human behavior courses to focus on regional traditions, building techniques and historical understandings. Human behavior courses are taught in Two and Three-Dimensional configurations, using different model making materials often assigned for experimental processes. Sustainable courses seem to be lacking in the majority of schools, not

only in specific courses but also the integration of sustainable methodologies into foundational studios. The building technology seems to reflect local building systems and tectonics, in the United States there is a large emphasis on wood structures while schools in Jordan focus on natural material found in the area including reinforced concrete structures.

Bibliography

Abdullah, Hardi K. and Badiossadat Hassanpour. "Digital design implications: a comparative study of architecture education curriculum and practices in leading architecture firms." International Journal of Architectural Research: ArchNet-IJAR 14, no. 1 (2020): 126-143.

Berlanda, Toma. "De-colonising Architectural Education: Thoughts from Cape Town." Journal of Architecture and Urbanism 43, no. 3 (2019): 129-139.

Devanathan, S., Ramanujan, D., Bernstein, W. Z., Zhao, F., and Ramani, K. (July 21, 2010). "Integration of Sustainability Into Early Design Through the Function Impact Matrix." ASME. J. Mech. Des. August 2010; 132(8): 081004. https://doi.org/10.1115/1.4001890

Saghafi, Mahmoud Reza and Philip Crowther. "Integrating technology subjects with design studio teaching: comparing curriculum of architecture education in Australia and Iran." Design and Technology Education: an International Journal 24, no. 1 (2019): 40-53.

Grazer, Brian, and Charles Fishman. A Curious Mind: The Secret to a Bigger Life. New York: Simon & Schuster, 2015.

Lahiri, Jhumpa. In Other Words. Translated by Ann Goldstein. New York: Alfred A. Knopf, 2016.

LaSalle, Peter. “Conundrum: A Story about Reading.” New England Review 38, no. 1 (2017): 95–109. Project MUSE.

Saghafi, Mahmoud Reza and Philip Crowther. "Integrating technology subjects with design studio teaching: comparing curriculum of architecture education in Australia and Iran." Design and Technology Education: an International Journal 24, no. 1 (2019): 40-53.

Satterfield, Susan. “Livy and the Pax Deum.” Classical Philology 111, no. 2 (April 2016): 165–76.

Smith, Zadie. Swing Time. New York: Penguin Press, 2016.

Thoreau, Henry David. “Walking.” In The Making of the American Essay, edited by John D’Agata, 167–95. Minneapolis: Graywolf Press, 2016.

Yates, A., Pedersen Zari, M., Bloomfield, S., Burgess, A., Walker, C., Waghorn, K., Besen, P., Sargent, N., & Palmer, F. (2023, January 7). *A transformative architectural pedagogy and tool for a time of converging crises*. MDPI. Retrieved from https://www.mdpi.com/2413-8851/7/1/1

Parametric Drawing

Meg Jackson, University of Houston
Michael Gonzales, University of Houston

Parametric Thinking in the Beginning Design Process

Parametric thinking is a method of relating tangible and intangible systems in which designers start with parameters and not preconceived or predetermined design solutions. (Karle, Kelly, 2011) The case studies presented in this paper examine the relationship between making, drawing, and parametric thinking.

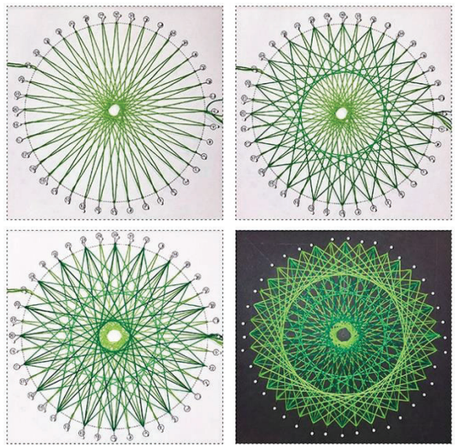


Fig. 1 Parametric Drawing (Student Work)

The authors teach foundation level studios in Architecture, Interior Architecture and Industrial Design as well as digital media introductory courses. The authors emphasize parametric thinking as a computational -based, generative design strategy for form and performance and as a method for developing graphic, haptic, and spatial strategies. These exercises shift away from objects to systems. Recent investigations in our courses have focused on ideas of logic, performance, and geometric relationships as the primary devices used to introduce drawing fundamentals.

Algorithmic strategies are both pragmatic and abstract. These systems allow beginning design students to develop complex and intricate results by analyzing the design problem as a series of simple rule-based systems. The design process is understood as a system of procedures, constraints and variables. This type of rule-based system follows a process of precise ordering systems, however, both organizational and operational, it also has the ability to be highly calibrated yet adaptable. Understanding form, geometries, and materials as sets of procedures as opposed to objects, allows the designer to have more control over variations, the iterative process, analysis, performance, and experimentation. This process is a systematic presentation of form as opposed to a digital representation of form. Its interactivity reveals the latent potential and possibilities of the system while retaining control of the process.

While introducing beginning design students to parametric thinking is a shift from the intuitive, this also forces beginning design students away from their perceived notions of design and facilitates an understanding of cause and effect in problem solving. As the design process unfolds, students create a set of conditional statements and recursive formulas to create a procedural outcome and not a specific answer. Algorithmic thinking solves how to create a replicable process. The students define the rules which lead to a natural conclusion and simultaneously design the parts and the whole. Rigor is in the deliberate creation and exploitation of the structure. These systems have an enormous capacity for variance within a strict organization of constraints. Logic provides necessary limits while at the same time the flexibility provides potential for individual exploration. Training designers to logically analyze the iterative process instills that they have both rigorous order and parametric potential.

Used as a method of problem solving, parametric approaches have proven to be an effective strategy for teaching fundamental design processes in several contexts. Logic can adapt in scale and it can anticipate many design applications. It has the potential to be both endlessly variable yet accessible to beginning design students. The authors rely on algorithmic thinking as a multi-scalar tool to introduce the rigor of the design process and as a way to explore methods of drawing as well as form, space, and material.

Parametric Drawing

For the case studies in this paper, we use drawing as the catalyst for exploration. Each of the exercises described in this paper use parametric data as input. The drawing is a map of the numerical sequence. Instead of replicating the drawing, students have to analyze and reproduce the logic of the numerical system by controlling a series of known parameters.

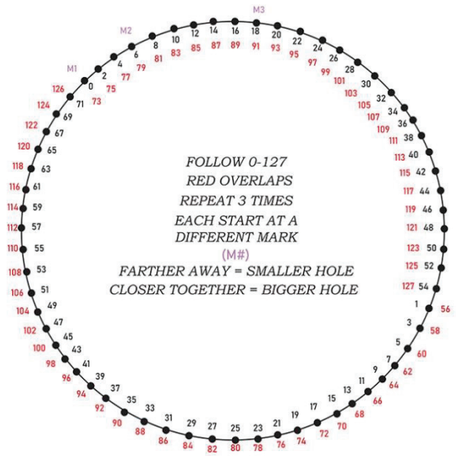


Fig. 2 Recipe (Student Work)

The repetitive nature of the exercises gives the ability for students to compare and contrast different outputs based on the variations of inputs. Translating between analog and digital methods of making within a similar sub-set of parameters, helps students develop their algorithmic thinking skills. In the first few exercises, students only control parameters within a fixed system. Additional exercises, allow the students to create the rules for the parameters and subsequent exercises build on that knowledge as the students design the system.

The drawing exercises oscillate between analog and digital explorations. However, all the exercises purposefully anticipate digital processes of making. The projects are not designed as translations from analog techniques to digital media. Instead, these projects are designed as problem solving exercises which foster a conceptual understanding of computation as a medium. The opportunity of these case studies is the focus on the performance, procedures, and

Many of these exercises evolved out of the challenge to teach beginning design students how to understand the concepts of computer-aided design as well as the potential of more advanced computational-based design including generating drawings with parametric design processes. In order for a designer to have control over their medium, they must first understand the procedural logic behind the interface.

Computational thinking can be introduced to beginning design students in critical ways independent of the medium. Introducing drawing as a parametric performance, encourages the beginning design student to see drawings not as flattened representations but as complex, living spatial ideas. Students should develop ways of thinking in which choices of *how* to draw are as vital to design as *what* is being drawn.

While drawing methods should anticipate computational logic, all drawing exercises should also be designed to increase the ability to think and to understand the visceral and iterative power of the craft of drawing. Parametric drawing increases the potential and agility of thinking through drawing.

The advantages of parametric design processes within design practice are well documented. Parametric drawing is a valuable tool for any iterative design process. However, designing a parametric system with associative geometric and dimensional inputs is an abstract concept for beginning designers. In this generative system, parameters control the connection between design intent and response. Because the drawing is the geometric output of an algorithmic process, designers have to design a strategy for drawing prior to drawing. Developing designers might not yet have the knowledge to create an informed parametric system. It is also a distinct way of thinking. As instructors, we are not interested in computer generated design, but in user-defined, algorithmically controlled design which means that we need to teach designers how to first understand procedural relationships.

Fig. 3 Variations (Student Work)

Case Studies

Part 1

These exercises introduce beginning designers to specific software, however, in order to use computational thinking as a means of designing, software is integrated into the design process. As a means to teach the fundamentals of computational thinking to beginning design students and to introduce students to the logic of parametric workflows, interdisciplinary design students begin by making a series of geometric drawings in different mediums.

As an introduction to the parametric design process, students create recursive geometric drawings in Rhino and Grasshopper (GH) by using the continuous rotation of one circle inside or outside a fixed circle. Each drawing is a consequence of the geometric relationships. Students can easily visualize the link between the available variables and the variations produced using an algorithmic process.

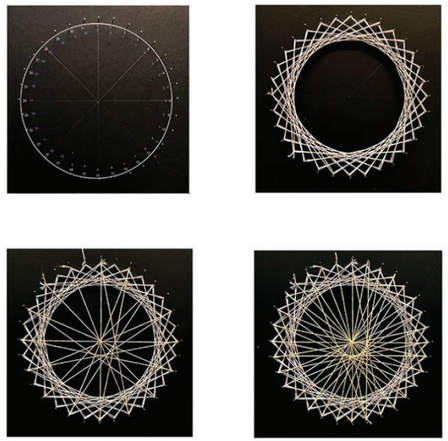


Fig. 4 Sequential Drawing (Student Work)

In a subsequent analog exercise, students define a geometric boundary with pins in foam and then weave string in sequential paths to create the drawing artifact. The drawing is revealed as a result of the chosen logic constraints.

Students are then challenged with translating their string drawings into a Grasshopper definition in which parameters can be controlled and the variations can be explored. Students write a "recipe" as instructions on how to replicate the pattern that resulted based on the sequential system they created. Students use the logic and sequence of their analog mappings to develop an algorithmic approach to drawing by creating a procedural system in Grasshopper. In this exercise, they do not create the drawing, they build the relationships that produce the drawing. The physical drawings serve both as artifact and notation for the parametric process.

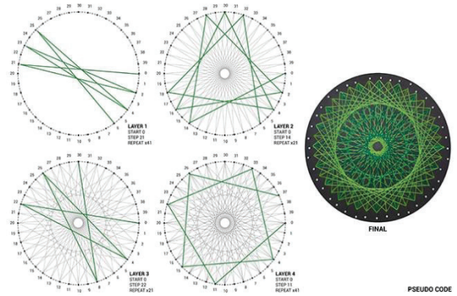


Fig. 5 Procedural Recipe (Student Work)

Students are tasked with applying the same logic to a Grasshopper definition that would digitally remake the same pattern that they wove. The physical act of making helps eliminate the abstractness of the software. By breaking down the drawing into a set of sequences, students understand the complexity of the drawing as a set of smaller processes and layers that mirror the parametric workflow. Lists, indices, series, and Boolean logic are understood as sets of points, vertices, lines, and patterns.

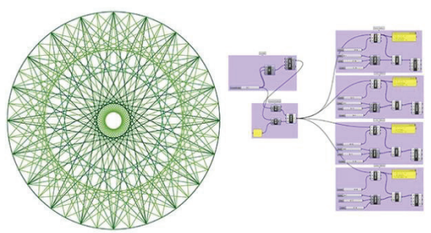


Fig. 6 Drawing in Grasshopper (Student Work)

Part 2

The students further explore the performance of drawing by designing drawing machines that automate the recursive drawing process. This translation exercise asks students to create a drawing and then analyze the process of drawing through a series of sequential diagrams. These diagrams are then translated and simulated as a parametric solution. This series of exercises explores the spatial performance of drawing and purposefully anticipates the algorithmic and digital process of making. The opportunity of this case study is the simultaneous focus on drawing as a process and as an artifact. The use of the machine and drawing as an extension of the algorithmic process reinforces computational thinking with hands-on processes that allow students to connect the abstract to the real.

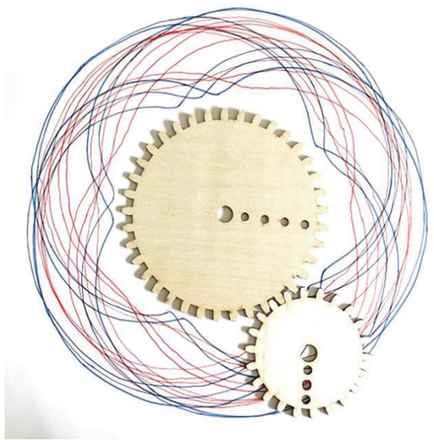


Fig. 7 Drawing Machine (Student Work)

Using their recursive drawing explorations as the starting point, the students use the same logic to create a set of interrelated gears connected to a stylus that when rotated will produce a similar drawing to the original design. They first do this physically by laser cutting a set of gears that they can connect to a pen. They then test the same logic digitally by simulating the gears and the drawing through Rhino and Grasshopper. Like in the previous exercises, in order to create the procedural formula, the students have to understand the flow of information. The drawing is understood as a procedural system and is the mapping of relationships between points in time, rather than as an object.

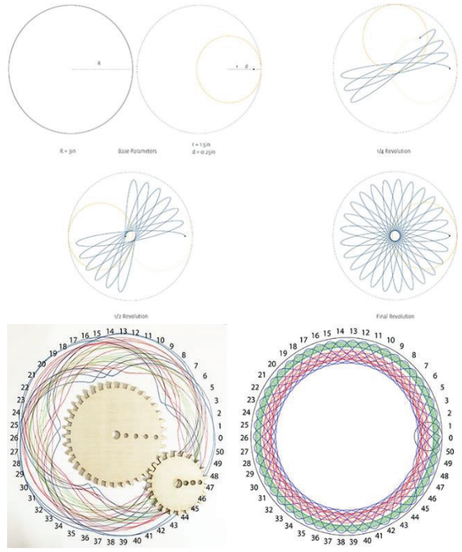


Fig. 8 Drawing Machine in Grasshopper (Student Work)

Part 3

In addition to introducing students to parametric software, the semester long project also serves as an introduction to digital fabrication tools like the laser cutter, the CNC, and understanding 1:1 material testing and tolerances. The objective is that the students develop and understand the non-linear digital workflow and feedback loops between tools.

In a parallel assignment, students abstract the drawings defined by Grasshopper as catalysts for designing CNC surfaces. In Grasshopper, they explore the potential of applying the Z-axis to their drawings. While primarily used as an introduction to fabrication tools, this exercise begins with the students diagramming the original pattern, adjusting linework in the Z-axis, and developing surfaces based on the accumulation of points and lines. This allows students to explore their drawings as spatial systems by manipulating the parameters of the definition to create a three-dimensional variant of that linework.

In another exercise, students use their exploration of the Z-axis to create a dimensional version of their recursive drawing using physical contours and weaving referenced from their original “recipe”. In this iteration, the “recipe” was used to inform the connections between the sequential unfolding of each contour.

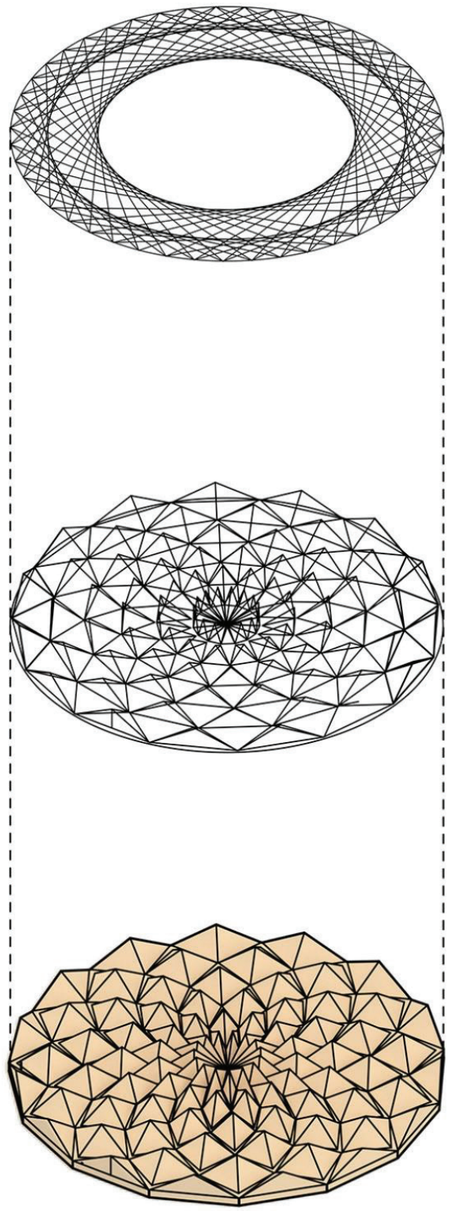


Fig. 9 Applying the Z-axis (Student Work)

Additional Variations

Advanced exercises build upon the previous case studies understanding drawing as data with the added dimensions of time, motion, and interaction. Variations on the drawing machines reveal the algorithmic choreography of drawing. In these exercises, students must first design a system of drawing through understanding the geometric relationships between a set of gears. They can then adjust the drawing by changing the geometric parameters of the gears. As with the other case studies, the process of drawing is revealed through actual efforts of making.

This variation of the exercise begins with a more in-depth introduction into simple machines and the mechanics of motion. Developed in a workshop setting, students are asked to design a gear train exploring the relationship between kinetic motion and drawing. The drawing machine, which uniquely reveals process, time, and motion, is an opportunity for the students to directly experience the mechanics of drawing as a spatial condition. As an exercise in exploratory design, the drawing machine results in two equally important physical outcomes: the machine and the drawing. Done in tandem, physical studies and simulations provide visual feedback between the geometric relationships between the gears, the stylus and the consequence on the drawing.

In the first few iterations of this exercise, constraints are restricted to geometric relationships, dimensions, number of revolutions, location of the stylus, and gear types and shapes. Students also explore material variables in the working models. Each drawing is a consequence of its mechanical system. Students adapt the geometric relationships in both physical modeling and digital simulations to control the drawing output.

In subsequent variations, more advanced applications and parameters are introduced which build on the initial drawing machine designs. Modifications to the original definition are added and parameters are controlled by user interaction, sensors, event, and/or environmental data. These full-scale, interactive prototypes allow students to process digital data through a physical interface. Through this process, students are challenged to rethink the mechanics and user interface through this added layer of interaction.

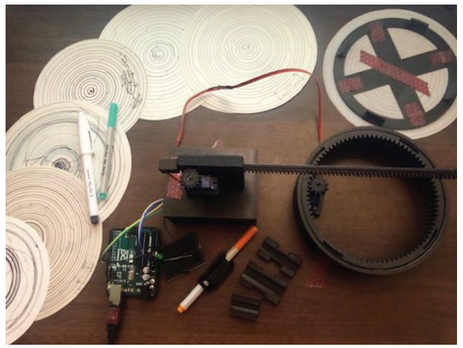


Fig. 10 Interactive Drawing Machine Prototype (Student Work)

These responsive drawing machines advance the expression of drawing, medium, and material. These investigations explore drawing not only as a consequence of a geometric system but also a mapping - a recording of behavior, data, event, and time. These artifacts can then be analyzed as a memory of an event through time. Variations on the drawing machine exercises empower design students to first observe and engineer drawing mechanics and then reimagine the potential of drawing.

As part of the larger design curriculum, the design, construction, and analysis of these simple machines allow students to experiment and expand their thinking about the process of drawing and the drawing as an effect of that process. Physically designing the machine – a system for drawing- is a productive method for introducing parametric thinking to beginning design students. These instruments are also useful in exploring basic mechanics and engineering, as well as interaction design and basic programming.

Conclusion

In this series of case studies, the design process is intentionally circular and referential alternating between analog and digital methods of making. While, it is not intuitive for beginning design students to design a procedural system in order to produce a drawing, thinking parametrically is a valuable design skill.

With this series of exercises, students can compare the diversity and efficiencies between mediums. These exercises also help the students learn collaboratively. Despite what appears to be limits and constraints, there are many variations. Once the system is established, students can see how valuable this method is to an iterative design process. Since the exercises are purposefully repetitive, as the students become more agile with the software and gain control over the system, they independently put more demands on the definition. It becomes clear that those who understand the procedural logic can innovate within the system.

Parametric design thinking can be defined as having three characteristics - thinking with abstraction; thinking mathematically; and thinking algorithmically. (Woodbury, 2010) Each of these exercises addresses those three characteristics. Building parametric systems requires students to design digital data flows. The design thinking is these logical relationships. However, for the designer to be in control of this process there must be a balance between the manipulation of the tool and an understanding of how this method of design relates to the larger disciplinary practice.

After exploring the capabilities of the software and developing fundamental parametric design thinking skills, most students can articulate the value of the process and its application to design. Independently integrating parametric thinking into their own design processes outside of this course often depends on how established their own processes are.

Parametric thinking reinforces design as a non-linear work flow. Instead of focusing on design as an effect, thinking algorithmically within a dynamic system defines design as procedural processes. This paradigm shift from traditional methods forces beginning designers not to generate a product but a set of questions.

Notes and Bibliography

Ahlquist, S. and Menges, A.: 2011, Computational Design Thinking, in S. Ahlquist and A. Menges (eds.), Computational Design Thinking, Wiley, 224.

Karle, D. and Kelly, B.: 2011, Parametric Thinking, ACADIA Regional 2011: Parametricism

Mori, T. (ed.): 2002, Immaterial Ultramaterial, George Braziller, Inc, New York, NY

Terzidis, K.: 2006, Algorithmic Architecture, 1st ed., Routledge, New York, NY.

Woodbury, R: 2010, Elements of Parametric Design, Routledge, N.Y

Iterative Experiments: Transforming Case Study Pedagogy in Beginning Design

Deborah Ku, Auburn University

BACKGROUND

Upper-level architecture students might typically approach or inaugurate design ideation by analyzing a relevant existing piece of architecture at the beginning of a project. This method depends on understanding and leveraging ways that lessons from the past may help us reimagine new futures. But such studies easily devolve into copy-paste exercises: if it worked there, it can work here. This impulse to imitate makes sense, cognitively: humans learn by copying. A young child mirrors facial expressions and actions based on context clues and interactions with a parent. But in architecture, imitation is not enough. This strategy denies the unique importance of site and context. Beginning design students must learn how to see, understand, abstract, and extract the conceptual foundations of an existing building and translate, adapt, and apply that lesson to their own work through transformation and experimentation.

École des Beaux-Arts

Prior to the emergence of the Bauhaus School in 1919, the École des Beaux-Arts in France was the leading model for Architectural education. The Academy of Architecture at the École ran from 1819 until 1968 and was composed of four primary areas: the École, the Atelier, the Salon, and the Café. The École's rigid study and competition awarded the Prix de Rome scholarship for immersive, classical study in Rome. The workshop-based studios of the Atelier were led by "masters" of the profession. Student success depended on and directly related to the success of the "master." The yearly exhibition of work in the Salon was chosen by an elite jury and was a reflection of the successes within the Ateliers. And finally, the Café were places where many people gathered to discuss design work. The influence of each of these areas can still be seen in modern academic studios.

This pedagogical system led to a strict and linear hierarchy. "Masters" were the source of answers and enlightenment, classical Roman and Greek styles were superior, and everything was framed as a competition–even the smallest pencil marks were evaluated.[1] Admission into and graduation from the "Academy" led to a more elite social status as those who succeeded became Architects to the King. This hierarchical and absolute attitude within the Beaux-Arts pedagogy emphasized learning through imitation: perfection depended on copying both the "masters" of the Ateliers and the Roman and Greek styles.[2]

Although modern design education owes much of its fundamental structure to the École, the priority on absolute hierarchy and imitation as measures of success has greatly shifted.[3]

Building on but also debating the value of these complicated origins, Iterative Experiments embraces the importance of development and retention of a central idea, which would have been important to winners of the Prix de Rome, but frames success through the quality of exploration rather than the precision of imitation.

The Case against Precedent

In contemporary education, this almost-imitative exercise of researching and referencing previous built work is commonly referred to as a "precedent study." For several reasons, including the associations described above, the notion of using "precedents" to guide creative inquiry is problematic: it tends to imply a hierarchy of design quality and also assign high value to a few so-called canonical works.[4]

Beyond the École, "precedent" is widely associated with the law. The use of previous court cases can be used to help make decisions for future trials. This practice helps create regularity, order, and predictability for a society depending on rules to guide behaviors. Consequently, these precedents can guide future outcomes as judges, who help interpret laws, are considered authoritative representatives of society-at-large. However, these precedent cases and court decisions are made by a select few individuals and, in turn, are accepted as rule by an entire community–or must be, by virtue of the legal implications. So, precedents wield an enormous amount of power. It becomes difficult to overturn precedents without strong motive or justification to reinterpret or re-write laws.

Similarly, designers might use the precedents derived from study of completed buildings in order to learn from the past and apply similar principles to their future projects. The use of precedent studies in architectural design is most notably associated with that École des Beaux-Arts pedagogical model. The order, proportion, symmetry, and detail of the Classical style was regarded as the highest form of architectural beauty. And so, the classic "antiquities" were repeatedly copied across the western world well into the twentieth century, promoting a hierarchical style as the prominent solution for spatial form and relationships in the

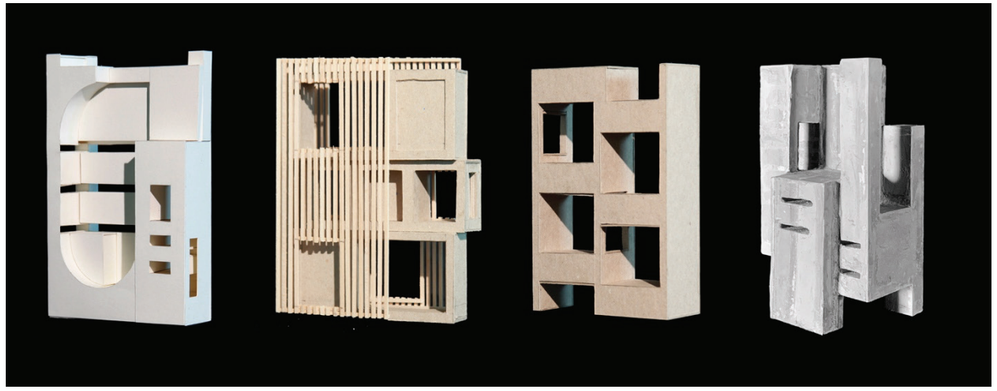


Fig. 1 Geometric logic concept models focus on explicit and implied relationships with an underlying order derived from a case study. Student work from Spring 2022 and 2023: Reyna Foslien, Shanna Fortier, Layla Harbison, Alyssa Luo.

built environment. Here, the rules of architectural precedent are closely aligned with legal precedent: breaking from existing precedent, or establishing a new one, becomes increasingly difficult the longer the established canon holds authority.

Expanding the Canon

Careful examination of "precedent" uncovers the aforementioned histories and associations with a dominant culture that is limited and necessarily limiting. Although the terms "case study" and "precedent study" are often used interchangeably in an architecture studio, the term "precedent" maintains vestiges of the hierarchical approach of the Beaux-Arts pedagogy and also its emphasis on copying as a central practice of creation. So, Iterative Experiments intentionally avoids the term. Instead, we refer to this method as "case study" to prioritize a more democratic approach to teaching and learning and also to emphasize a critical expansiveness in culture. The "case study" depends on the study of particular examples in order to abstract general lessons. It is free from the historical pressure to superficially copy a style. We do not assume that the architectural canon is or should be an accepted and authoritative body of work. The use of "case study" recognizes that non-dominant cultures across the spaces and times of history have something to teach us all.

PEDAGOGICAL GOALS

Catalogical not Canonical

One primary objective of this case study project is to expose first year students to a broad range of work rooted in cultures across the globe and from both established and emergent practices. The first-year architecture curriculum at Auburn University does not include a dedicated architectural history or theory course. Iterative Experiments is by no means a replacement for a history or theory course, but it capitalizes on the collaborative and collective studio environment to quickly explore nearly 100 projects in only a few weeks. Further, each student researches, interprets, and presents three projects to the class, therefore becoming, briefly, a master of the topic, teaching their classmates and so breaking the classical, hierarchical model of instruction and learning.[5]

It is problematic to rely on a single body of accepted and valued work and repeatedly use the same references time and time again. Architecture adds to a living narrative of storied sites and cultures that are always evolving and transforming. So, why would the body of referenced work remain static and authoritative? The canon must always be questioned. It can and should evolve to reflect contextually specific parameters.

A Case for Critical Design Thinking

The built environment is not only the result of socio-cultural and environmental interaction but also a powerful agent that continues to shape how humans interact with each other and their surroundings. It has the ability to embody and represent values inherent to the culture within which it exists and also to impact future social and physical contexts. Designers must learn to anticipate possible outcomes within specific contextual constraints by thinking critically. And a case study model of learning aids this critical design thinking. Both models of thinking and learning reference the past in order to inform the future. Critical thinking depends on observing, analyzing, and judging or evaluating multiple points of view. Design thinking expands this critical thinking process by requiring that this analysis be applied to a new

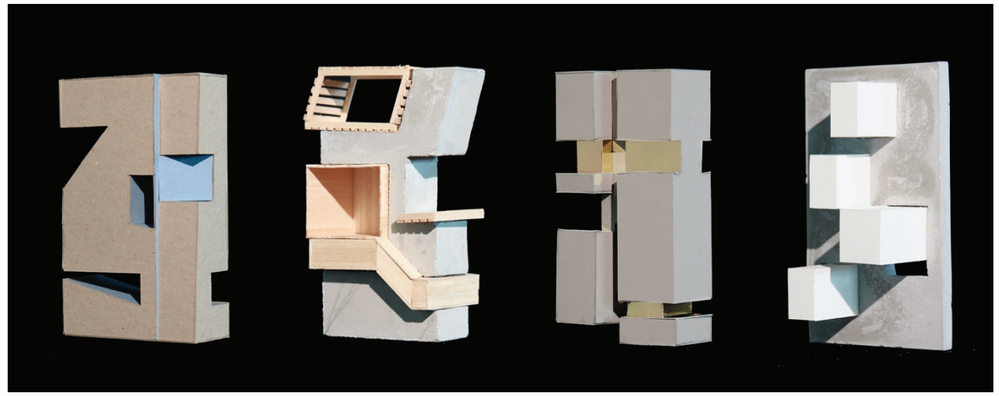


Fig. 2 Applied actions generate novel form. One action was conceptually applied up to four times to a thickened plane: fracture, skew, inscribe, extrude. Student work from Spring 2022: Megan Shupp, Shanna Fortier, Eliza Wilkens, Katie Zou.

and relevant situation. In the sort of self-reflexive and non-intuitive approach that exemplifies a non-linear design process, design thinking proposes a mode of inquiry without presupposing a question. Students propose answers to help identify a range of questions about the work under study but also about their own individual or collective thought processes.[6]

Iterative Practice

Many design studios use their own specific methodologies, but most modern architectural education includes a cycle of work that involves: understanding context; exploring and experimenting with design processes, approaches, and forms; thinking critically; receiving feedback; making artifacts–and then repeating some or all of all of this sequence. "Designing happens not simply from an inspired moment, but as a result of rigorous transformative interactions between thinking and making in which concepts are discovered, transformed, and realized in concrete form."[7] Iterative Experiments emphasizes this constructivist approach and uses the act of making as the primary instructional mode.[8]

APPROACH

First year architecture students are introduced to case studies as an integral and collaborative part of the design process. Based on the goals described above, Iterative Experiments generates a collective catalog of nearly 100 case studies across three themes. These themes focus on form and space as defined by geometric relationships, action-verbs, and constructional logics. Over a series of three one-week "study sprint" intervals, students research, document, extract, and transform case study concepts into abstract models and drawings within each theme. With each week, students select a new case study and a new category–and repeat the process of experimental research through concept models and ink-wash drawing compositions.[9]

Basic Geometry

Considering form, basic geometric relationships often define clear, strong, and repeatable spatial relationships. Because basic geometry can describe even the most complex spaces, a focus on geometry can also create novel forms with traditional analog drawing techniques. These can be either explicit and visible connections or implied relationships.

Le Corbusier popularized the use of regulating lines to define the consistency and rationale within geometric and proportional relationships.[10] Lines of a drawing do not always indicate lines that will appear in the built form. Instead, regulating lines within the drawing help make physical connections visible and conceptual relationships clear. So within the organizational logic of geometry, the drawing is a critical component for advancing the design process.

As a limit to this first theme in the Iterative sequence, form and space strictly adhering to a geometric logic can be static and predictable. As Robin Evans points out: "From the point of view of the architect seeking firmness and stability, the best geometry is surely a dead geometry…Dead geometry is an inoculation against uncertainty."[11] Derivative geometry that is repeated across multiple projects–like the golden rectangle in the Classical styles, becomes rote. Its predictability does not leave room for variation.

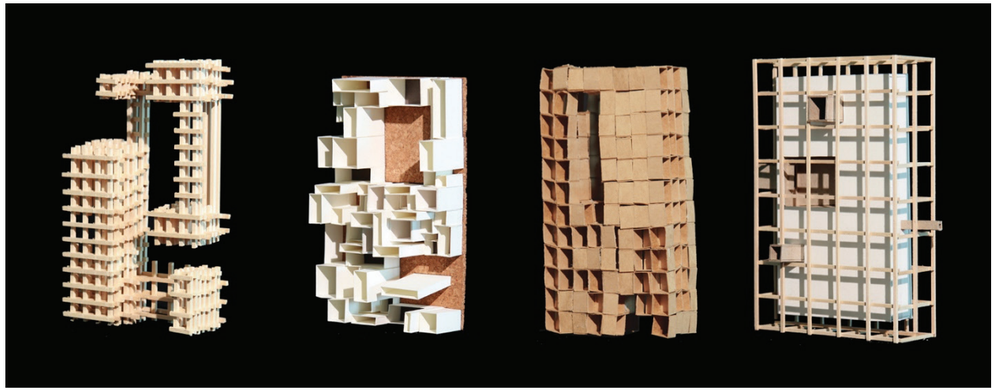


Fig. 3 Constructional logics explore form by experimenting with the system of how things are made. Each of the above examples explore a tectonic approach to construction characterized by the multiplicity of constructional relationship of a multitude of smaller members. Student work from Spring 2022: Katie Zou, Bliss Boyle, Megan Shupp, Emma Johnson.

Transformative Actions

Instead, relational geometry is a more robust and resilient technique to define space. If forms are related based on an imagined action or procedure, then this conceptual approach clearly defines novel space using precise but abstract vocabulary. Traditional drawings such as plans and sections are often superseded by a diagram explicating a sequence of actions. This second technique in the Iterative series synthesizes complex practical and conceptual concerns into confounding spaces. Single word actions such as "to wrap," "to fold," and "to split" are easy for a mass public audience to recognize. However, in stark contrast to an ordered geometric logic, space derived from an action is unpredictable and variations in form can be infinite. Limitations within this modality of formal experimentation tends to favor architecture as a volumetric object rather than an occupiable space.

Constructional Logics

Experiments in making can become a clear method to create novel form with rigor not just randomness. Dedicated to the expressive potential of constructional technique, this third method in the Iterative sequence focuses on details, joints, and "how things are made" in order to renew or refresh time-worn vocabulary such as floor, ceiling, wall, door and window with poetic meaning. Tectonic and stereotomic construction techniques propose that labor and material add value to space. With that value, such techniques are indelibly linked to a particular site as a physical, social and cultural materialization. Kengo Kuma reinterprets but celebrates Japan's rich cultural history through intricate timber joinery and craft. So his tectonic work is recognizably Japanese. On the other hand, SANAA primarily utilizes stereotomic construction symbolizing minimalism and restraint. This aspect is also tied to Japanese culture, despite a stark contrast in architectural approach.

Experimental Procedure

Within each organizational category, students choose projects from a given list of 5-10 design practices. This limit helps steer the students' research to be most effective in the short time allotted and helps "guide and set limits on design decision-making."[12] The list is carefully curated but also propositional, adding global and contemporary perspectives often overlooked or undervalued in conventional architectural history or theory curricula, and so reinforces the pedagogical goal to not only expand but also experiment with the question of what is or is not (and what should be) canonical architecture. Listed practices include firms and designers from Latin America (Lina Bo Bardi), Africa (Francis Kéré), Asia (SANAA) and Europe (MvRdV). In addition to this global representation, list of design practices also includes several woman- and minority-owned firms. Our first-year courses enroll 50-75% female students, so a list that demonstrates the increasing diversity of the architecture profession may help students envision their own professional trajectory. This is a living and ever-adaptive list. It has the flexibility to evolve, grow, shrink, or change to meet the needs of both the focus of study and the students doing the work.

If the list of case study practices is somewhat experimental, so too is the students' work. Every week, students use a different method to define architectural space. In other words, over the three-week assignment, each student tests ideas through three distinct drawings and three new models. However, the methods are not absolute or isolated, and hybrid logics are not only common but encouraged. Because of the pedagogical interest and intention to expose students to many projects, reference projects may not be repeated during the three-week assignment. Students work together to share resources and also collaborate on, negotiate, and ultimately define a collective list of projects. This constraint intends to generate some reaction and, ideally, unlock unexpected creativity. These are experiments, after all, and experiments require curiosity and ambition but also controls or restrictions.

Curiosity and Creativity

The term "experiment" most widely references a scientific procedure that is conducted to test a hypothesis, often leading to new discoveries. An experiment tests an unknown. The results may answer questions or prompt new ones that require further testing–further iterations. Within the scientific method, variables are controlled so cause and effect are reliably connected. Studies focus on testing a single hypothesis at a time, and grow in complexity as data and results are compounded.

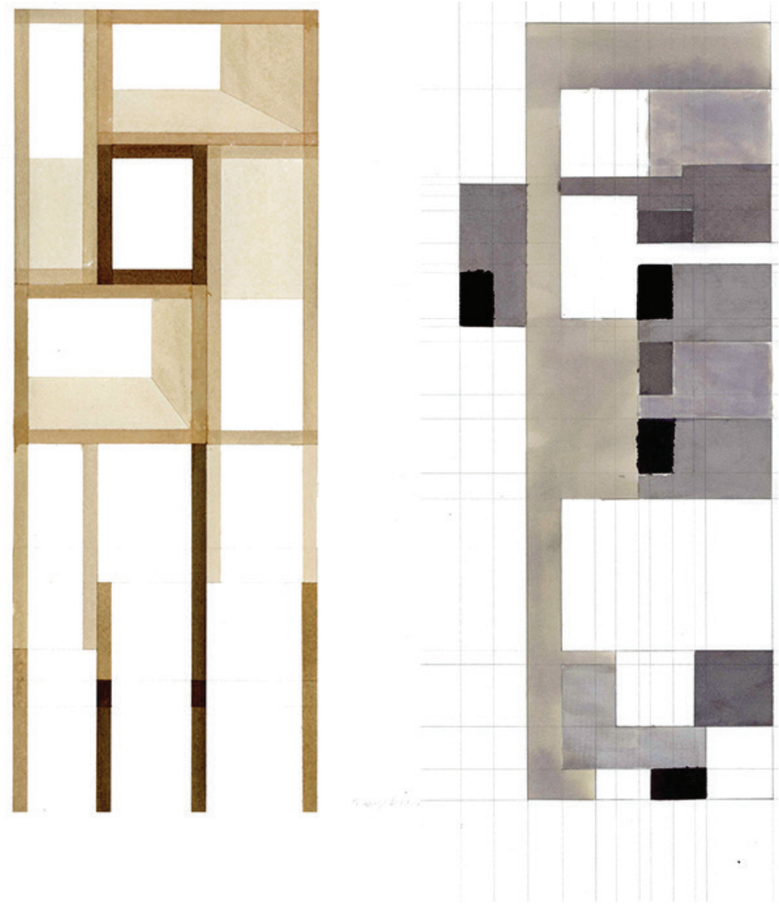


Fig. 4 Geometric logic concept ink-wash drawings help students make implied relationships visible. Light construction lines act as the regulating framework and ink wash tones create spatial depth within the two-dimensional studies. Student work Spring 2023: Maddie Brockman, Sarah Conaway.

Experiments connote risk and the possibility of failure. But failures are simply “discoveries that open new doors.”13 A failed experiment does not devalue the procedure, but instead is just an unexpected but highly valued result. In contrast to the Beaux-Arts pedagogy that relies on imitating the known and accepted Classical styles, Iterative Experiments embraces the unknown and the unexpected discoveries that follow. The risk of an unexpected result and the assurance that failures are an asset can foster creativity in the minds of beginning design students.

Collecting a Conceptual Catalog

The project has several constraints in order to help students develop an idea into a physical and conceptual artifact rather than merely reverting to replicating what they see in photographs and drawings of the case study. The primary constraint within the project are the parameters defining the two- and three-dimensional deliverables. The three-dimensional artifacts are defined as “thickened planes” with at least two apertures and a recess and meeting dimensions of 8” x 5” x 2”. These thick planes straddle the realm of two- and three-dimensions and so are characteristic of both a plane and a volume. At this stage, the artifacts are intentionally left scaleless and without program so students may feel the freedom to explore ideas embedded in geometric relationships, actions (verbs), or constructional logics. The artifacts become abstract forms of the extracted ideas and resist easy transformation into expected building forms. (This transformation comes with a subsequent phase of study).

Ink-wash drawings help further explore the generation of form for the thickened plane. These drawings also help students visualize an idea that first may only exist abstractly in their minds because they are relatively quick to execute. The simplicity of a two-dimensional composition fosters clarity before adding complexity in the third dimension. Drawings do not always have to be the first iteration in the design process. Sometimes, especially for beginning designers, they can more easily see ideas through a model because of their concrete properties instead of a drawing’s inherent abstractness. But whichever method of making comes precedes the other, each are iterations of the other, and so require intermediate transformations as mediating modalities rather than simply final, representative artifacts.

The collection of these abstract translations through model and drawing form a “Conceptual Catalog” that complements and redefines the Case Study Catalog. So at the end of the three-week sequence, the studio of 30 students has amassed a reference library of nearly 100 case studies, 100 abstract conceptual models, and 100 drawings that each student can reference and apply to a subsequent building project within the studio.

APPLICATION AND CONCLUSIONS

Within the first-year studios, all work within the semester builds upon each other chronologically. Each drawing and model created in the semester is intended as an iteration of a previous idea–or at least a piece of it. With each weekly cycle of Iterative Experiments, students choose an idea or technique from the physical artifacts to redeploy and hybridize with the next round of artifacts. The physical artifacts allow students to apply design thinking strategies by reflecting on what they made, learning from experience, and self-correcting as they try again. Design thinking and the iterative process of these experiments build explicit connections from the implied links between abstract ideas and direct experience.

Learning from the past is useful when it can change the future. With the collective conceptual catalog, students then apply these abstractions to their next design project–a social space for one group and three individuals that references an extracted and transformed idea from one of the cataloged case studies.

New Futures

These experiments build on but transform classical instruction modes and so generate an atypical approach to case study pedagogy within the beginning design sequence. Students learn common research and documentation skills but do not apply the case study lessons directly to a design project. Instead, students generate multiple transformations before applying the ideas to a building project and its particular program and context. So, Iterative Experiments diverges from and defies a copy-paste model. Transformation and translation are valued instead of imitation. Architectural ideas transcend mere form and instead bridge the knowable lessons of the past to unknown possibilities for the future.

End Notes

1 Julien Gaudet. *Éléments et Théorie de l’Architecture* (Paris: Librairie de la Construction Moderne, 1906)
2 Arthur Drexler and Richard Chafee, *The Architecture of the Ecole des Beaux-Arts* (New York: The Museum of Modern Art, 1977).
3 Anecdotally, I have seen the pedagogical needle shift even in the last 20 years since my own academic tenure as a student. Academia today, seems to have an empathetic approach towards the mental and physical well-being of the students rather than merely perpetuating a façade of success with long hours and personal sacrifices.
4 It seems particularly important to for beginning design studios to address the problematic and potentially ethical dilemma of authorship and plagiarism with a copy-paste model. Although at this point, few ideas are completely unique, first-year students are still getting acclimated to a higher standard of accountability in terms of giving credit to sources of inspiration.
5 A positive influence from the École was the development of the Cafés as places to discuss design work and thinking. Discussions in modern education is critical to a students’ development. And since we learn best when we teach others, students drive the presentation and discussion surrounding important concepts gleaned from the case studies.
6 Design education is unique because we constantly ask students to do and make things they do not know how to do. But, just as one learns to play the piano, by playing the piano, architecture students also learn how to design by making design decisions. Students do not always know what or why they are making particular artifacts until after they have completed the exercise—these often become answers to questions not yet asked.
7 Stephen Temple, *Making Thinking: Beginning Architectural Design Education*. (Dubaque, IA: Kendall Hunt Publishing Company, 2011), 9.
8 Derived from the constructivist theory of learning by Jean Piaget, John Dewey, and Jerome Bruner. At its core, the constructivist pedagogy is based on the connecting abstract learning through concrete experience—or in the case of an architecture studio, learning by making.
9 The projects for the 2021-2022 Foundation Studios at Auburn University were developed in collaboration with co-instructor and Associate Professor, Kevin Moore.
10 Le Corbusier, *Towards a New Architecture.* (New York: Dover Publications, 1986).
11 Robin Evans, *The Projective Cast: Architecture and its Three Geometries* (Cambridge, MA: MIT Press, 1995), xxvii.
12 Temple, Making Thinking, 30.
13 Temple, Making Thinking, 18.

Bibliography

Brooks, Van Wyck. “On Creating a Usable Past,” *The* Dial 64, no. 7 (11 April 1918): 337-341.
Clark, Roger H. *Precedents in Architecture: Analytical Diagrams, Formative Ideas, and Partis,* 4th ed. Hoboken, NJ: John Wiley & Sons, 2012.
Di Mari, Anthony and Nora Yoo. *Operative Design: A Catalogue of Spatial Verbs.* Amsterdam: BIS Publishers, 2012.
Doll, Larry. *Drawing on Uncertainty*. Austin: Center for American Architecture and Design at The University of Texas at Austin, 2009.
Doczi, György. *The Power of Limits: Proportional Harmonies in Nature, Art & Architecture.* Boulder, CO: Shambhala Publications, Inc, 1981.
Drexler, Arthur and Richard Chafee. *The Architecture of the Ecole des Beaux-Arts*. New York: The Museum of Modern Art, 1977.
Evans, Robin. *The Projective Cast: Architecture and its Three Geometries.* Cambridge, MA: MIT Press, 1995.
Gaudet, Julien. *Éléments et Théorie de l’Architecture*. Paris: Librairie de la Construction Moderne, 1906
Iliescu, Sanda. *Experiencing Art and Architecture: Lessons on Looking.* London: Routledge, 2022.
Lawson, Bryan. *How Designers Think: The Design Process Demystified,* 4th ed. Oxford, Engalnd: Architectural Press Elsevier, 2006.
Le Corbusier. *Towards a New Architecture*. New York: Dover Publications, 1986.
Schwartz, Chad. *Introducing Architectural Tectonics: Exploring the Intersection of Design and Construction.* New York: Routledge, 2017.
Temple, Stephen. *Making Thinking: Beginning Architectural Design Education.* Dubaque, IA: Kendall Hunt Publishing Company, 2011.

Introducing Computational Design and Digital Fabrication to Architecture Students

Erin Hunt, Texas Tech University Huckabee College of Architecture

Introduction

Many architectural firms have started to introduce digital fabrication and computational design into their workflows. Students with this knowledge can increase their marketability. New fabrication methods, including the 3D printing of housing[1], are starting to question current methods of making architecture requiring students to gain an understanding of these new technologies. An introduction to parametric design tools has become necessary to prepare students for industry.[2,3] Although computational design is becoming more common within architectural design, the best methods for teaching it to students still need to be established.[4,5]

While digital fabrication and computational design are often taught as separate courses, this course introduces the two topics. It starts by teaching the students the history and current practices of this architectural niche. The students are introduced to digital fabrication through lectures regarding various techniques and then with hands-on assignments using a variety of tools. Computational design is presented through lectures. The first part teaches concepts and then live, recorded Grasshopper demonstrations within the same class. Each topic has its own Grasshopper workout, which is Grasshopper-based logic puzzles and design challenges meant to increase in complexity throughout the semester to grow the students' skills.

This course is only an introduction to these topics and will give the students a basic understanding. They can pursue these concepts further by enrolling in a design, computation, and fabrication (DCF) certificate. The hope is that the students gain insights into how they could use these strategies and tools to expedite their digital workflows and create more refined physical models. This paper will discuss the course, show the results of the student work, and reflect on its outcomes, as well as explore ideas for future iterations of the course.

Methods

This section outlines the course structure, digital fabrication, and computational design assignments.

Course Overview

This course is a three-credit hour, required first-year graduate seminar for Master of Architecture (MArch) students. The class introduces students to the history and fundamentals of computational design and digital fabrication within architecture. It is designed for students with little to no knowledge of these topics.

Course Organization

While most computational design and digital fabrication courses are taught separately, this course introduces both simultaneously. The two topics are not intertwined in the first half of the semester. Since the course meets twice weekly, one session is geared toward introducing computational methods, while the other focuses on digital fabrication. As the semester progresses, the two topics start to become interwoven. The course increase in complexity as the semester progresses. Below is a list of topics that are covered each week.

1. Introduction to the Course
2. 3D Printing + Grasshopper's User Interface
3. CNC Milling + Communication between Rhino and Grasshopper
4. Robotic Milling + Points, Vectors, Planes, and Mathematical Expressions
5. History of Digital Fabrication 1760s- 1980s + Lists, their Operations and Management
6. History of Digital Fabrication 1980s- Present + Data Structures
7. Introduction to Ceramic and Concrete 3D Printing + 2D Grasshopper Transformations
8. Introduction to Robotics I + 3D Transformations
9. Introduction to Robotics II + Surface Geometries and Meshes
10. Clay Tile Slump Workshop + Compound Transformations
11. How do these skills translate to practices + Synthesis
12. Grasshopper Plugins
13. Grasshopper Plugins

14. Final Project Production
15. Final Project Production
16. Final Project Production
17. Final Exhibition

Means of Evaluation

The evaluation for the course is based on assignments, workouts, and a final project. These deliverables will be discussed further in this section.

Assignments

Six assignments are given throughout the course. The assignments allow for experimentation with digital fabrication methods such as 3D printing, robotic milling, and hot wire cutting. The students are asked to develop a research question for each fabrication assignment. This question is explored throughout the assignment. The research question is addressed in a 500-word written reflection. A general Adobe InDesign template is provided to the students. They must submit all the required drawings and photos listed within the file. These drawings include plans, axonometric drawings, details, and speculative renders. Additional drawings, photos, and renders are strongly encouraged. The students must create a minimum of three iterations of their designs and are urged to document all work, including fabrication failures. The emphasis of the assignments is to take risks and learn with each iteration, providing the students a venue to experiment and test new computational design skills, materials, and fabrication methods without the fear of failure or the constraints of a studio model. All the groups are provided with the same quantity of materials for each fabrication assignment to ensure equity. The Hucakbee College of Architecture (HCoA) covers these costs so that it does not impact the students.

Assignment 00 – Precedent Study and Design Profiles

This assignment is completed independently. The students are asked to find six precedents within the architectural niche of digital fabrication and computational design. It is recommended that these precedents be academically published. The students are encouraged to use CuminCAD[6], a cumulative index of publications about computer-aided architectural design. They are urged to find a diverse selection of work by looking into a wide range of materials and manufacturing techniques. In addition to the precedents study, the students are asked to profile two designers who focus on this work in their academic research or practice.

Assignment 01 – 3D Printed Joints

This assignment is the first fabrication assignment. As a result of the large size of the seminar (between 35-40 students), the work is completed in groups of 5 students. The students are given twenty 3/16" x 12" dowels for this assignment. They are asked to design a singular or series of 3D-printed joints to connect at least ten dowels (Figure 1). The connections can be rigid or flexible. The design could have a function like a truss or could be abstract. The assignment's goal is for the students to get comfortable with 3D printing and learn its associated tolerances and challenges. Since the project is assigned at the beginning of the semester, students are not required to integrate Grasshopper.

Fig. 1 The photos in this figure are of multiple projects completed for assignment 01.

Before this assignment, most students have never used a 3D printer, so many have to create a series of iterations. While the initial failures are frustrating, the students get excited when the project works and are proud of the results. The last cohort of students to complete this assignment added additional materials, such as colorful vinyl or acrylic panels and fabric. These additions brought an exciting new feature to the assignment that I had not considered requesting previously.

Assignment 02 – 3D Printed Formwork

For this assignment, each student group is tasked with designing a 3D-printed, multipart, reusable formwork (Figure 2). The formwork must be smaller than three cubic inches. The block or tile produced should aggregate to create a façade design which must be documented in a speculative rendering. Each group is required to cast three modules with their final formwork. This assignment usually takes three or more iterations of the formwork design before the students obtain a successful cast. This can result in much frustration. Therefore, it is critical that we discuss why the cast failed and how to move forward with a new design. The student casting takes place within the seminar classroom. This not only allows for the fabrication and the clean-up to be monitored but for there to be discussions between student groups regarding their designs' successes and failures. This has proved very productive for the students with regard to learning and building a culture of collaboration within the course.

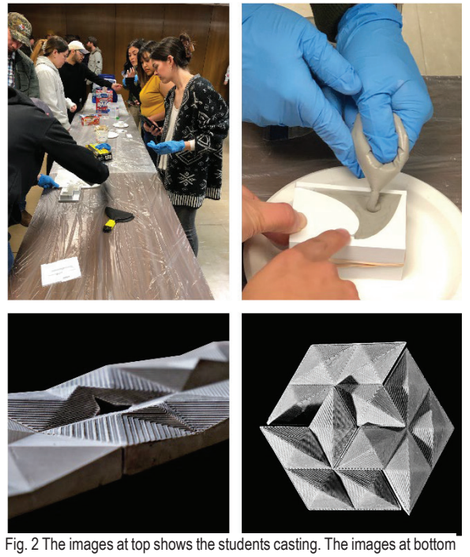


Fig. 2 The images at top shows the students casting. The images at bottom are a few of the final casts.

Assignment 03 – Robotically Milled Formwork

This assignment asks the student groups to design a robotically milled formwork using 1-inch-thick polystyrene insulation (Figure 3).

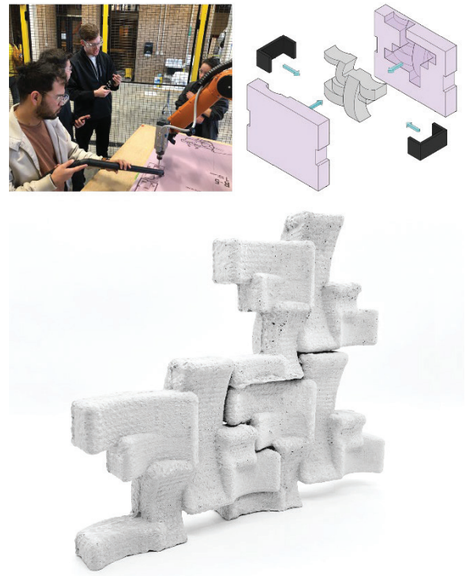


Fig. 3 The photo at the top left shows the robotic arm cutting the foam, and the image at the top right is a diagram of the formwork. The photo at the bottom shows the resulting blocks and how they tesselate.

This project aims to introduce robotic fabrication and milling to the students. Robotic milling is presented in class, covering the digital workflow with a live demonstration of the robot milling foam. The instructor has created a Grasshopper definition specifically designed for the assignment. This is a tool for the students to use to create toolpaths to mill their designs. Often this is reviewed when each group meets with their instructor to mill their formwork. Furthermore, during this fabrication meeting, they are reintroduced to the process. The instructor encourages the students to be engaged and operate the robotic arm independently. Although this assignment introduces the students to the robotic arm and a potential application for its use, the students are still not prepared to use it solo or to create their own toolpaths for the robotic arms. This is something that the students would learn if they chose to take higher-level graduate electives focused on robotics. It has been observed that many students, especially those who lack an interest in robotic fabrication, are not interested

in the process but rather in the fabricated output or watching the robotic arm perform the task. Since this is a required course, it can be challenging to get all students engaged in each aspect of the course.

Assignment 04 – Slump Cast Clay Tiles

This assignment has two phases. The first phase asks the students to create a polystyrene slump mold (6 x 6 x 2 inches) using the robotic arm and its hotwire cutter tool. In addition, each team will design a 3D-printed rolling pin (6 inches in length and 0.5-2 inches in diameter) or stamp (6 x 6 inches). These 3D prints will apply texture to the clay tiles before slumping them over the wire-cut foam slump molds. The second phase of this assignment is an in-class workshop. This workshop instructs the student on how to roll out a tile properly using guides, apply texture with a 3D-printed rolling pin or stamp, cut the tile to size, and slump it over the polystyrene mold (Figure 4). The goal of this assignment is to encourage not only digital fabrication but also integrate it with traditional ceramic techniques. This allows the students to see how digital fabrication can augment hand fabrication processes. When this assignment is reviewed, it is clear that students are starting to incorporate Grasshopper and computational methods into the generation of their rolling pin designs. This is not an assignment requirement but seems to be a result of increased confidence, knowledge, and interest.

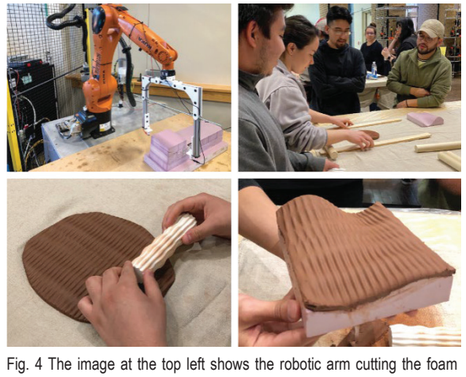


Fig. 4 The image at the top left shows the robotic arm cutting the foam mold. The image at the top right shows the student rolling out their clay using wooden guides to get a consistent thickness. The image at the bottom left shows a student using their 3D-printed rolling pin to mark the clay. The image at the bottom right shows the clay slumped on the foam mold and cut to its desired size.

Assignment 05 – 3D Printing Clay Blocks

For this assignment, the students must design a single-block design that tessellates (Figure 5). The block is fabricated using a clay 3D printer. Each group is required to print three blocks. The maximum dimensions for one block are 3 in (width) x 6 in (length) x 3 in (height). The assignment's aim is to allow the students to see the different scales and resolutions possible with the 3D printing of a viscous material rather than a heated polymer. They can see the limitation resulting from a much larger nozzle diameter of 0.08 inches (2 mm), the fragility of the damp clay, and the lack of material retraction or supports. These challenges create a series of parameters that inform each group's design. This assignment introduces the students to methods for creating novel toolpaths for 3D printing through the creation of custom GCode (the coding language used to control the 3D printers and other Computer Numeric Controlled, CNC, machines). A simple GCode generator tool was created in Grasshopper. This assignment coincides with the more complex Grasshopper topics that relate to the creation of these forms. As a result, almost all groups are generating their block designs, not only their GCode within Grasshopper, for this assignment. Although the use of Grasshopper is encouraged throughout the course within the assignment briefs, it is never required.

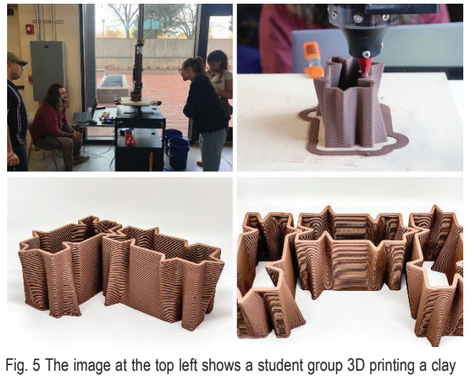


Fig. 5 The image at the top left shows a student group 3D printing a clay block. The image at the top right is an up-close photo of the printer printing. The images on the bottom row show the blocks and how they tesselate.

Fig. 6 The images on the top row show a student project that focused on 2-part CNC milled formwork to create custom tiles with variable opening sizes to control daylighting. The aperture sizes were informed by computational analysis of daylighting. The bottom row of images shows a project that utilized robotic hot wire cut foam as a mold for fiberglass louvers.

Final Project

This course was a corequisite, with the MArch's studio course requiring it to be connected to their integrated building design project (Figure 6). This curriculum requirement has since been changed, so this final project was only implemented once. The final project necessitated incorporating computational design and digital fabrication into the façade of the building proposal. The students could use fabrication and computational design approaches that were introduced during the semester through the course or propose alternative methods that they were interested in investigating. This assignment was composed of two phases. The first phase was the development of a proposal. The students were asked to choose a computational and or fabrication method, write a proposal, and include sketches or speculative renderings of their proposed design. This section of the course had 35 students, so this proposal allowed for the logistical organization of equipment and material needs. Additionally, it allowed each studio project to be introduced to the instructor, which gave a better understanding of the key priorities for each student's project. Once this proposal was submitted, the faculty met with each student to discuss the scale and method for designing and fabricating the model.

Final Exhibition

A final exhibition was held within the robotic fabrication lab. This allowed the students to display all their assignments and final projects. The students were asked to talk to one another about their work and the various struggles they encountered in the fabrication process of their final projects as well as anything they learned from the experience. Faculty, staff, friends, and family were invited to see the work. This allowed the students to share their work with a diverse group. This proved to be a successful exercise and will be repeated in future iterations of the course.

Introducing Grasshopper

The visual scripting language Grasshopper is introduced to the students. This course is required for the entire first-year MArch cohort. This is the only course within the graduate curriculum that covers computational design or digital fabrication. Therefore, the inclusion of both topics is critical. "Although computational tools and methodologies are shaping the evolution of architecture, many graduating students remain underprepared to take advantage of them."[4] Many students enter this course never having used Grasshopper or engaged with computational thinking. Each year the course is taught, I have the students complete an anonymous survey. It is clear from the results that there is a high level of concern regarding computational design. In the most recent iteration of the course (Spring 2023), 33% of the students had no interest in computational design.

Consequently, it is often challenging and necessary to attempt to get students' acceptance. This is why it is critical that the homework that students complete with this software is fun and engaging. These assignments are called workouts and will be further discussed in the next section.

Grasshopper Lectures + Workouts

Each Grasshopper-based lecture starts with introducing a new topic and the computational logic through a set of slides. The second half of the lecture shows the students how these concepts are applied through a tutorial in Grasshopper. These tutorials are recorded so that the students can revisit them. The Grasshopper definitions created in these tutorials are highly annotated to increase the students' understanding and are shared. After each new topic is introduced, a Grasshopper workout is assigned. The workouts ask students to create novel Grasshopper definitions and document their various outputs, Initial workouts only produce numbers or text as outputs. The basic nature of the results allows the students to focus and learn the fundamentals of computational thinking without being distracted by the design opportunities Grasshopper affords. These workouts are fun logic puzzles that dive deep into computational concepts, such as the recreation of curves using points based on parametric equations, Boolean operations, and list creation. The first workout introduces the graphical user interface (GUI) while allowing the students to create their first definition. As student comfort with the software grows, they are given more complex concepts and tasks that involve 2D vector drawings and 3D models. These workouts show the students how to complete multiple transformations such as move, scale, rotate, and shear within the same definition allowing for infinite variations of complex drawings and forms that would take substantial time to create in Rhinoceros. The goal of these assignments is to show students how they could potentially integrate Grasshopper into their Rhinoceros workflow to expedite their modeling. In an attempt to cover all learning types, additional readings, and video tutorials are given to augment the lecture and workout content.

Results and Discussion

This seminar is large, with an average of 35 students per semester. The class size impacts the assignments since they are completed in groups of 5 students. Often students find tasks like writing or diagramming comfortable, so they only perform those tasks throughout the semester, allowing others to engage with the fabrication. Therefore, some students are missing critical experiences using a variety of fabrication equipment.

The course is required for all MArch students. As a result, there is a range of student commitment. In their evaluations, many students have mentioned that the assignments have provided them with good portfolio content regardless of their interest in the course's topics. Many students have asked for additional assignments since they have enjoyed creating them and working with a wide range of equipment they might not normally have the opportunity to engage with since much of it is reserved primarily for faculty research.

In the student evaluations, the students stated that Grasshopper workouts have made computational design more fun and attractive. They asked that more workouts be included throughout the semester. This is something that is currently being implemented in the present iteration of the course. The hope is that through increased engagement with this software, students will be better prepared for more advanced courses in computational design and robotics. It has been noted first cohort of students lacked general knowledge of the GUI and the basics of Grasshopper. As a direct result of this concern, an additional two workouts have been added to compensate for this deficit. Additionally, a comprehensive cheat sheet was made so that the students would have something to look back on to remember all the shortcuts and software-specific tricks. This was a great help to the students as they were learning the software.

The final project was an individual assignment. This required the advisement of many students' assignments. It proved too difficult to manage. Unless enrollment is decreased or another section of the course is created, this does not seem feasible. Additionally, some students had no desire to use computational design or digital fabrication in the creation of their studio project's façade design. If this project were to continue, it would be critical that studio faculty buy into the assignment so that it would result in mutually beneficial results. Unfortunately, many students did the least amount of work possible to pass the assignment as a direct result of their focus on studio drawings and other representation methods, not seeing the possible benefits of this project for their studio reviews.

Conclusion

This paper proposes a methodology for introducing digital fabrication and computational design to architecture students. It introduces both topics, but they are not intertwined until the end of the semester. Digital fabrication is not only introduced through lectures but through workshops, live demos, and hands-on assignments. Computational design is introduced through the use of Grasshopper. Concepts and live demonstrations are given in lecture form, accompanied by assignments called workouts for students to get hands-on experience with the software. This course is taught annually and is currently in its second iteration. While the content has not been altered substantially, it is continuing to grow and evolve. As computational design and digital fabrication increase in use and popularity within architecture, these fundamental courses become more critical.

End Notes

1 Monroe, Rachel. "Can 3-D Printing Help Solve the Housing Crisis?" The New Yorker, January 16, 2023.
2 Hui, Vincent, et. al. "9th Annual International Conference of Education." In 9th Annual International Conference of Education, Research and Innovation, Seville, p 8599–8608.
3 Gerber, David, et al. "Surveying the Evolution of Computing in Architecture, Engineering, and Construction Education." *Journal of Computing in Civil Engineering* 29, no. 5 (2015).
4 Senske, Nick. "Association for Computing Machinery." In *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*, 525–30. SIGCSE '17. New York, NY: Association for Computing Machinery, 2017.
5 Doyle, Shelby, and Nick Senske. "Research Based Education: Proceedings of the 2016 Association of Architectural Educators (AAE) International Conference." In Charrette 4, 4:192–209. London: Association of Architectural Educators, 2016.
6 Cumincad. Accessed February 1, 2023. http://cumincad.scix.net/.

Bibliography

Cumincad. Accessed February 1, 2023. http://cumincad.scix.net/.

Doyle, Shelby, and Nick Senske. "Research Based Education: Proceedings of the 2016 Association of Architectural Educators (AAE) International Conference." In *Charrette* 4, 4:192–209. London: Association of Architectural Educators, 2016.

Gerber, David J., Saba Khashe, and Ian F. Smith. "Surveying the Evolution of Computing in Architecture, Engineering, and Construction Education." *Journal of Computing in Civil Engineering* 29, no. 5 (2015). https://doi.org/10.1061/(asce)cp.1943-5487.0000361.

Hui, Vincent, Shivathmikha Kumar, Hrishikesh Tailor, Jason Brijraj, David Luong, and Brandon Bortuluzzi. "9th Annual International Conference of Education." In *9th Annual International Conference of Education, Research and Innovation*, 8599–8608. Seville, 2016.

Monroe, Rachel. "Can 3-D Printing Help Solve the Housing Crisis?" The New Yorker, January 16, 2023. https://www.newyorker.com/magazine/2023/01/23/can-3-d-printing-help-solve-the-housing-crisis.

Senske, Nick. "Association for Computing Machinery." In *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*, 525–30. SIGCSE '17. New York, NY: Association for Computing Machinery, 2017. https://doi.org/10.1145/3017680.3017750.

Successfully Exploring and Navigating the Unknown Technology Territories

Ben Bernard, North Dakota State University

Abstract

New technologies are impacting the design disciplines at an exponential pace, presenting significant challenges to design educators. How can instructors keep up with the latest technologies and know which to incorporate in the classroom? How can beginning design students receive a strong foundation of technology skills to draw from while still having time to explore new and emerging technologies as tools for design, documentation, and ideation? These questions can be answered by utilizing open source intelligence (OSINT) techniques to identify emerging technologies, new course resources, and student learning needs.

Digital fabrication, virtual reality, 3D modeling, parametric design, building information modeling (BIM), photorealistic rendering, and artificial intelligence design tools can all be introduced to beginning design students to inform and enhance their workflows. To examine how existing and new design technologies can be explored and implemented into the classroom, this paper will study the technology infrastructure, staffing, curriculum, and pedagogy applied in the Architecture 232 Design Technology course offered by the School of Design, Architecture, and Art at North Dakota State University.

Open Source Intelligence for Design Technology

The Information Age we live in is defined by exponential growth in information and increasingly sophisticated hardware and software to process and create new information (Broadbent and Cross 2010). As such, it is increasingly difficult for design educators to both keep up with the latest technologies and know how to implement them in design curriculum. The applied use of open source intelligence (OSINT) techniques and tradecraft empowers design educators with the ability to quickly identify and implement new technologies.

Open source intelligence is the collection and analysis of data gathered from publicly available information to produce actionable intelligence (Glassman and Kang 2012). Key sources of OSINT for design educators are design professionals, fellow design educators, technology news, design technology vendors, and design students.

Design Professionals & Alumni

Design professional sources can be quickly cultivated by attending campus job fairs that target design students. Design educators can quickly survey many design professionals with targeted questions such as:

What design technology skills do you expect from interns and new graduates?
What new technologies and design workflows are you utilizing in your organization and at which stages in the design and documentation process?
What skills do you expect to see demonstrated in student portfolios?
May I follow up with a design technology specialist in your organization?

This valuable OSINT can be used to determine how much course time should be spent on which technologies and what new technologies are in demand.

Taking advantage of campus events to network with design alumni is another important way to develop sources within the design professions. The School of Design, Architecture, and Art at North Dakota State University hosts a professional alumni board twice per year. Alumni can provide significant insight on which design technologies are emerging in the profession and how well their design technology education prepared them for professional opportunities. Cultivating relationships with design professionals with key technology talents is also valuable for recruiting guest lecturers, critics, and adjuncts to be deployed in design courses across the curriculum.

Design Educators & Online Sources

Design educators and their journals, conferences, and proceedings are natural sources of OSINT to mine for new

technologies, curriculum, and pedagogy (Christenson 2022).

Websites specializing in news for design technologists and educators are valuable for spotting new trends and innovations in design software, digital fabrication, and artificial intelligence. Examples of such include:

https://arstechnica.com
https://news.ycombinator.com
https://www.architecturalrecord.com
https://bimchapters.blogspot.com
https://all3dp.com

Key design software vendors are critical sources of information, particularly for how to provide students with the technology infrastructure needed to teach different design technologies. Examples of such include:

https://helpx.adobe.com/creative-cloud/release-note/cc-release-notes.html
https://blogs.autodesk.com/revit/2023/04/04/whats-new-in-autodesk-revit-2024
https://support.lumion.com/hc/en-us/articles/7441741355804-Lumion-2023-0-Release-Notes

Prior to each semester, each software package that will be implemented in the curriculum requires OSINT research to determine:

What features have been added or removed?
Are release notes available?
What system requirements, internet access, and software licensing are needed to use the software?
What patches or software updates are needed?
Where can tech support for the product be found?

Frequently, the answers to these questions can be rolled into elements of design technology curriculum to teach technology research and problem solving skills.

Design Students

Senior design students can be the most valuable OSINT source available, as some will choose to specialize in digital fabrication, advanced 3d modeling & BIM techniques, new photorealistic rendering technologies, novel ways to assemble design portfolios, or other new design technologies as they develop their design interests and seek to differentiate their skills from competitors in the job market.

Important questions to gather actionable OSINT from senior design students are:

What design technologies have been most useful in your student career? Which helped most to acquire a design internship?
What design technologies did you use in your internship and why were they used? What digital workflows were used?
What design technologies have not been useful?
What design technologies did you wish you would have learned earlier in the design curriculum?
What new technologies should be incorporated into the design curriculum?

Additionally, senior design student sources can be developed into personnel that can host workshops, answer student design technology questions, and be recruited to Teaching Assistant positions that require demonstrating and sharing advanced design technology skills.

Design students currently enrolled in a course are naturally critical OSINT sources. In the Architecture 232 Design Technology course, students are given a brief software proficiency survey prior to the start of the course, prior to midterms, and at the conclusion of the course. Students are asked questions such as:

How would you rate your skill level with specific design technologies?
How interested are you in spending course time on specific design technologies?
What assignments or activities would be helpful in this course?

Student feedback is therefore used to customize the curriculum to the changing needs of the enrolled students.

OODA Loop: Observe, Orient, Decide, Act

Gathering and making use of such open source intelligence is an important part of a decision cycle process known as the OODA loop (Richards 2011). Air Force Colonel John Boyd developed the OODA loop, made of the phases Observe, Orient, Decide, and Act to improve the combat operations process and guide military strategy (Osinga 2007). Gathering OSINT information and observations makes up the Observe phase, while acting on key OSINT findings makes up the Orient and Decide phases of the OODA loop model.

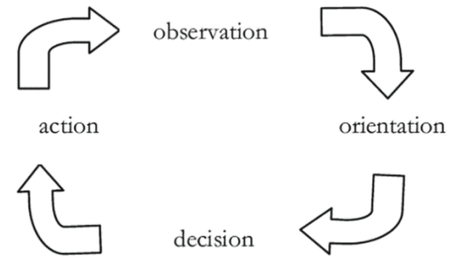


Fig. 1 OODA loop model. (Osinga 2007)

The more frequently design educators process OSINT, the quicker they can complete the decision cycle of Observe, Orient, Decide, and Act to respond quickly to the changing technologies and needs of the students. This process is used both to prepare and update curriculum prior to offering the course and to adjust curriculum as needed during the semester.

HyFlex Course Delivery Model

To collect student OSINT and to deliver design technology curriculum in the HyFlex course delivery model, Microsoft Teams is used to communicate with students with instant messaging, create a course wiki, and to record and deliver course lectures. The HyFlex course delivery model, originally developed to help increase enrollment by allowing students to participate in a class without being physically present in a classroom (Lederman n.d.), has become widely implemented in the wake of the coronavirus pandemic because of the flexibility it offers both students and faculty. Using the HyFlex model, instructors build content for both a fully online course and for a 'face-to-face' classroom environment. The HyFlex course uses both learning environments in tandem, sharing the same learning outcomes each week so that students can move between online and in-person experiences in the course seamlessly. The HyFlex course delivery model offers many advantages to delivering design technology curriculum.

In 2005, the Instructional Technologies graduate program at San Francisco State University was challenged with increasing enrollment and providing more participation opportunities for students (Lederman n.d.). Rather than adopt a learning model that required students to choose between the traditional classroom environment and a pure online class or a blended model in which the instructor chooses which course activities are placed in a physical classroom or online, Dr. Brian Beatty created and implemented a 'hybrid-flexible' learning environment in which students decide for themselves if they wish to participate in the course in the classroom, face-to-face, or online, synchronously or asynchronously, freely throughout the course in 2006 (B. (San F. S. U. Beatty n.d.). Each class offered in this HyFlex delivery format has the classroom, synchronous and asynchronous online content running simultaneously with students choosing to attend as many or as few of the classroom sessions as they want and complete the rest of the course online. The course objectives are structured so that students can complete them in the classroom or online; the instructor does not favor or require one course delivery format over the other.

The HyFlex model offers several advantages to both students and faculty (B. J. Beatty 2019). Students receive increased access to courses and more control over how and when to access the courses. Courses only offered in the traditional classroom model sometimes create course conflicts in which a student is forced to choose one class over another. Students juggling the responsibilities of part-time or full-time employment may not be able to regularly attend a scheduled classroom course. Students also benefit from more learning resources and opportunities, as HyFlex allows students to review the online course content on demand while still being able to take advantage of face-to-face instruction.

Frequently, a challenge with teaching design technology curriculum is finding the compromise between diving deep into many design technologies without overwhelming beginning design students who struggle with following along with the instructor in real-time. Recording design technology lectures allows students to learn at their own pace and review content as needed outside of the scheduled classroom time, enabling the design technology course instructor to cover significantly more course content. Faculty get the opportunity to develop experience teaching online without giving up traditional classroom instruction and are able to serve more students with the same resources. Students and faculty are both able to take advantage of the HyFlex model to take absences from the classroom without falling behind in the course material – a key advantage in the age of the COVID-19 pandemic ("School Closures Caused by Coronavirus (Covid-19)" n.d.).

Some faculty are concerned that providing the opportunity for students to complete the course materials online will result in significantly fewer students who choose to be present in the classroom, but some studies have indicated a higher number of course materials provided online was associated with fewer student classroom absences (Kinlaw, Dunlap, and D'Angelo 2012). Students value recorded lectures, also known as 'lecture capture', have good awareness of the technology functionality, and use the recorded lectures both for reviewing course content and making up for classroom absences (Dommett, Gardner, and van Tilburg 2020). Making lecture slides available online prior to a classroom lecture can improve classroom attendance (Babb and Ross 2009).

Implementation Example, Architecture 232 Design Technology, Spring 2023

Course Overview

Arch 232 Design Technology is a three credit hour, required second year course for students pursuing an degree in Architecture. This class provides an introductory exploration of digital design media and environmental technology in architecture. The course objectives are for students to obtain the ability to use selected software applications at an introductory level for defined production purposes, the ability to effectively select among digital drawing and modeling tools in a manner appropriate to developing a specific architectural concept or completing a specific task, and the ability to understand and apply established and emerging design technologies to design exercises and workflows.

The course is typically composed of 65-70 students. Students are required to obtain a laptop computer capable of running the course software and to install the course software. Two design technology computer labs are also available for student use. Based on OSINT collected from a variety of design professionals, design educators, senior design students, and prior course surveys, the course software consisted of:

Adobe Creative Cloud
Bluebeam
Enscape
Lumion
Revit
Rhino
SketchUp Studio
TwinMotion

Course Personnel

To properly support a large number of students with a wide variety of design technology skills, the course is resourced with two co-instructors, a local design professional and the School Design Technologist. The co-instructors gather OSINT to create and update the curriculum and offer the lectures. The design professional leads course lectures on 3d modeling, BIM (Building Information Modeling), and photorealistic rendering. The Design Technologist is responsible for implementation of the HyFlex course lecture recordings, course hardware and software support, coordinates curriculum and assignment needs with design studio faculty, and leads course lectures and workshops on digital fabrication, digital workflows, artificial intelligence and new technologies.

Supporting the two co-instructors is an Graduate Teaching Assistant (GTA) and an undergraduate Teaching Assistant (TA). The GTA will lead course lectures on advanced 3d modeling and photorealistic rendering, digital presentation board layout, professional portfolio creation, and additional topics as assigned. The TA will assist the GTA and the co-instructors with the expectation that the TA will serve as the course GTA the following year.

During course lectures, the Design Technologist, GTA, and TA provide one-on-one student assistance both in the classroom and over Teams software as needed, serving both in classroom and remote students.

The four course personnel share grading, student critique responsibilities, and answering student inquiries as needed.

Course Organization

The course meets twice weekly. After each course lecture, an assignment is provided to give students the opportunity to practice their new design technology skills unless students are simultaneously working on a design studio deadline, in which case students are expected to be applying their design technology knowledge for their studio work. OSINT is gathered weekly from second year studio faculty to assess assignment deadlines and to set the pace and topics for the weekly curriculum goals.

Means of Evaluation

The evaluation for the course is based on student performance of assignments completed and a final design portfolio demonstrating the cumulative design technology skills learned throughout the course.

Assignments, Lectures, and Surveys

Fifteen assignments and the design portfolio final were provided to students to complete throughout the course. Assignments are designed to achieve the course objectives and for students to immediately practice and implement design technology skills taught in lecture.

Assignments 1-4 focus on teaching students how to use Rhino 7 for 3d modeling, with students submitting screenshots documenting their work replicating a model of the Farnsworth House. Students are introduced to the Rhino user interface and command line, how to create manifold 3d geometry, how to use layers and reference sheets, and how to create custom furniture elements. The cumulative fourth Rhino assignment requires students to provide perspective exterior and interior views of the completed Farnsworth House, with complete columns, mullions, walls, stairs, doors, windows, floors, and roof. Boolean commands are used to create the fireplace and wall recession, and a minimum of five custom furniture elements must be created. A screenshot of the organized layers used in the model must be submitted.

Assignments 5-8 provide an introduction to building information modeling software with Autodesk Revit by replicating a model of the Kensington Rune Stone Center. Students learn how to create worksets, curtain walls, section views, and advanced modeling techniques.

Assignment 9 requires students to create a photorealistic rendering of the Kensington Rune Stone Center with Lumion and the Lumion LiveSync plugin.

Assignment 10 assigns students to create three photorealistic renderings of the Kensington Rune Stone Center with Enscape, using different skyboxes.

Assignment 11 is provided in coordination with the second year design studio, requiring students to provide a digital presentation board demonstrating their use of design technology skills learned in the course. Lectures on how to use Adobe Creative Cloud software to lay out presentation boards is provided and students are provided workshop time and one-on-one mentoring prior to the assignment deadline.

A midterm assessment survey is provided to assess student design technology skill levels, future course content, and student satisfaction with the course to guide the second half of the course. This demonstrates the use of student and studio faculty OSINT to quickly move through the OODA loop phases to customize course content to the needs of the students.

Assignments 12 and 13 cover advanced Rhino content. Assignment 12 requires students to create a custom staircase. Assignment 13 delves into the use of the Rhino SubD geometry tools to quickly model a building and apply custom materials to the model.

Assignment 14 requires students to create two custom Revit families, a couch and a reception desk.

Assignment 15 is coordinated with the MArch design thesis presentations. Students are required to attend a minimum of two architecture thesis presentations and answer the following questions:
Which thesis presentation did you attend?
What were the thesis presentations about?
What did you learn from the thesis presentations?
What was the best graphic illustration / drawing in the thesis show and why did it leave an impact?
What will you take away from this year's thesis show and put in your back pocket for the future?

The final requires students to submit a curated digital portfolio consisting of 10-20 pages demonstrating design technology skills applied to student work outside of the fifteen Arch 232 assignments. Prior to the final, students are provided lectures on how to layout and create a digital portfolio and a workshop on advanced rendering and board presentation techniques.

An exit survey is provided to students to assess the design technology skills learned and gather student feedback to be utilized in the next iteration of the course.

Lectures on 3d modeling with SketchUp Studio, AutoCAD for digital fabrication with laser cutters, 3d modeling for 3d printing, rendering with TwinMotion, an introduction to

Bluebeam, and image generation with artificial intelligence tools were also provided with skill reinforcement provided via assignments in design studio.

Conclusion

This paper proposes a methodology for utilizing open source intelligence gathering paired with the strategy of rapid decision cycles utilizing the OODA loop to ensure the latest design technologies are taught with the aid of the HyFlex course delivery model in collaboration with design studio faculty. This methodology is implemented in an introductory design technology course for architecture students. The course is deeply integrated with the corresponding design studio to ensure students are implementing skills learned in the course immediately for greater student learning and skill retention.

Bibliography

Babb, Kimberley A., and Craig Ross. 2009. "The Timing of Online Lecture Slide Availability and Its Effect on Attendance, Participation, and Exam Performance." *Computers and Education* 52 (4): 868–81. https://doi.org/10.1016/j.compedu.2008.12.009.

Beatty, Brian (San Francisco State University). n.d. "Beginnings - Hybrid-Flexible Course Design." Accessed September 7, 2020. https://edtechbooks.org/hyflex/book_intro.

Beatty, Brian J. 2019. "Hybrid-Flexible Course Design Values and Principles of Hybrid-Flexible Course Design." *Hybrid-Flexible Course Design*. EdTech Books. https://edtechbooks.org/hyflex/hyflex_values.

Broadbent, John A, and Nigel Cross. 2010. "Design Education in the Information Age." https://doi.org/10.1080/09544820310001606867.

Christenson, Mike. 2022. *A Beginning Course in Building Technology*. Bookitem. *Proceedings, National Conference on the Beginning Design Student*.

Dommett, Eleanor J., Benjamin Gardner, and Wijnand van Tilburg. 2020. "Staff and Students Perception of Lecture Capture." *Internet and Higher Education* 46 (July): 100732. https://doi.org/10.1016/j.iheduc.2020.100732.

Glassman, Michael, and Min Ju Kang. 2012. "Intelligence in the Internet Age: The Emergence and Evolution of Open Source Intelligence (OSINT)." *Computers in Human Behavior* 28 (2): 673–82. https://doi.org/10.1016/J.CHB.2011.11.014.

Kinlaw, C. Ryan, Linda L. Dunlap, and Jeffrey A. D'Angelo. 2012. "Relations between Faculty Use of Online Academic Resources and Student Class Attendance." *Computers and Education* 59 (2): 167–72. https://doi.org/10.1016/j.compedu.2011.12.028.

Lederman, Doug. n.d. "One Option for Delivering Instruction If Campuses Open This Fall: HyFlex." Accessed September 7, 2020. https://www.insidehighered.com/digital-learning/article/2020/05/13/one-option-delivering-instruction-if-campuses-open-fall-hyflex.

Osinga, Frans P.B. 2007. "Science, Strategy and War: The Strategic Theory of John Boyd." *Science, Strategy and War: The Strategic Theory of John Boyd*, 1–313. https://doi.org/10.4324/9780203088869.

Richards, Chet. 2011. "Boyd's OODA Loop (It's Not What You Think) Introduction: A Non-School of Strategy," 127–36.

"School Closures Caused by Coronavirus (Covid-19)." n.d. Accessed September 7, 2020. https://en.unesco.org/covid19/educationresponse.

Are our current methods of rendering architecture already dated? Looking at the unknown future of Artificial Intelligence (AI) in architectural design and representation

Andrea Melgarejo de Berry, University of Illinois at Urbana Champaign, School of Architecture, USA

Yadi Xie, Tongji University, College of Design and Innovation, China

Yun K. Yi, University of Illinois at Urbana Champaign. School of Architecture, USA

Introduction

> *"Drawings are still the currency of the architect. It's difficult to convince the world of the intrinsic value of design if it is not represented in a manner adequate to its worth. The logic of drawing is, has been, and continues to be a core aspect of how architecture is both envisioned and represented"* (McMorrough, 2015).

Within the schematic phase of design, architects are often challenged with translating their conceptual ideas into a series of graphics that define and represent spatial dimension and organization. These drawings and three-dimensional representation are created according to architectural standards that represents, a miniaturized version if you will, of an imagined structure and form.

This paper will evaluate recent students' outputs for rendering and the relationship to different methods of representation introduced to sophomore level students in a 3 hour credit class of Architectural Representation at a Public University in the United States. This paper will describe and analyze the approaches for three-dimensional representation and digital tools used during the Spring Semester of 2019, 2020, 2021, and 2022 when the co-authors of this paper taught this

class.

Then, the capabilities and potential use and application of Artificial Intelligence (AI) in the architecture field will be presented, as these new tools are shaking not only the visual arts but could also impact the future of architecture and architectural education. The design capacities and advanced level of realistic representation of these new engines pose these questions: would the educational program even need to teach the software currently used for representation? and, would the expertise of architects still be needed?

By looking at the current methodology and outcomes for rendering taught in most architectural education programs in contrast with the capabilities and potential application of AI in architecture education, this paper will evaluate the advantages (or disadvantages) of introducing AI to replace or complement the current approach to representation and visualization.

Definition and evolution of rendering in Architecture

The word "rendering" is used in this paper as the process involved to generate depth, texture, light and shadow, and add value and life to the image to generate a visualization of the project or idea. It is an indispensable part of architectural design and works not only as a visual product, which presents and summarizes the final desired characteristics of the design, but also conveys the design concepts and thinking of the author. Mediums of rendering can vary from hand drawings and coloring techniques, various analog and digital collage, to very sophisticated digital representation such as, 3D rendering and real time 3D rendering and animation.

Hand sketches, drawings, and coloring were the primary means in terms of rendering tools for architectural representation before computers. They are still extensively used in the initial schematic design as they are simple and economical, design ideas and concepts can be expressed very fast in free hands (Goldschmidt, 1994). Regardless how vague the new-born ideas are, they can be transformed onto papers and later developed into mature and solid answers or solutions to design problems (Suwa, Gero, & Prucell, 2006).

Collage methodologies were introduced in the field of architectural representation by early twenty century architects, like Le Corbusier, who used it in the design process to experiment with spatial and material juxtaposition (Shields, 2014). This methodology has since been widely used by architects to represent conceptual expectations and materiality. Now, it can be done digitally

by creating a two-dimensional drawing of a three-dimensional space; then texture, photomontage, entourage, and spatial effects are added digitally. It continues to be used to synthesize spatial and material conditions, creating a multiplicity of interpretations and experiences in the design as it brings with it a number of dualities including representational/abstract, gestural/precise, field/figure, surface/depth, and literal/metaphorical (Shields, 2014)

Even before the modern personal computer was available in the late 1970s, computing machines were used by designers in the aerospace and automotive industries to perform complex calculations and simulations. This efficiency was later extended in the architectural field to produce blueprints and allowed the possibility to create complex geometry far more quickly than the conventional techniques (Reas, McWilliams & LUST, 2010). Today, computer aided design, drafting and visualization has become the standard in architectural practice and new ways of rendering have opened.

Realistic and Abstract Rendering

> *"Grow- ing computational power was harnessed to produce rendered images—glossy visions of soon-to-be-built projects, usually blue-skyed, lush-leafed, and populated by groups of groomed and grinning clip-art figures, where buildings appeared with a polished sheen and lens flares proliferated. Postcards from the near future."* (Jacob, 2017)

Computer generated graphics have prioritized a realistic depiction of the natural world. Over time, new and better software have developed to accurately depict depth, textures, light and reflections and renderings assume the language of photography. The parameters of these models imitate those of real lenses and when the image is rendered, it depicts a realistic visualization of the environment (Reas, McWilliams & LUST, 2010). This type of representation leaves very little to the imagination as every detail is depicted.

Digital rendering has become the preferred method of visualization in architecture, as these tools can easily assign materiality to the 3D model and produce a rendering of the space in real time as we navigate through the model. The advantage of this methodology is that the output of the final visualization of a 3D space or building could be very close to how the project will look in real life, as texture, materiality and light effects can be carefully manipulated to achieve a realistic appearance. But, to achieve a high-quality realistic visualization with impactful effect, it requires proficiency and more time to produce the rendering.

The development of ultra realistic techniques continues but, especially in recent years, there has been a renewed interest in non-photorealistic rendering. What once was done as a collage by cutting out and juxtaposing one thing to another, now it is done digitally, allowing for smoother joints between textures and as a result a more indivisible graphic that can be conveyed in any graphic style. This technique can also be called abstract, as it has a strong expressive capacity that allows the main concept to be expressed in a less photo-like visualization.

Analysis of Student Work

In the first part of this paper, we are looking at the methodologies, process, tools and students' outcomes over the course of four years, 2019-2022, at a sophomore level design class. In the institution where these classes were taught, the second semester of that year is the main period where students are introduced to digital representation.

This sophomore design class is a 3 credit hour class that meets two times a week for 1.5 hours. One of those sessions is dedicated to lectures and the other is their lab sessions to work. The outcome of the work analyzed in this paper is part of the visualization exercise of a design architectural project. The time allocated to this assignment was 1 week in the Spring of 2019 and 2 weeks in the following semesters. In all four semesters, the students were asked to create a 1- point and 2- point perspective that aligned with the conceptual idea of the project. It was also required to accurately use entourage and background context to explain the use of the space and the characteristics of the site location.

The scale and scope of the projects is different in each semester. In the Spring of 2019, the context was more rural, and students had to design a building for "Prospect and Refuge" located on a natural site in Allerton Park in Monticello, IL. In the Spring of 2020, the assignment asked students to design a space for "Shade from the sun and Shelter from storms" on the Campus of a University in Illinois. And in the last two years, the context was more urban and dense; in the Spring of 2021, students had to design an "Extension to the Museum of Modern Art" in Chicago, IL., and the project for the Spring of 2022 was a three-story new "Infill Commercial Building" in the same city.

The requirements for the attributes and methodologies for the renderings also changed though these three semesters, from a higher emphasis on the expression to a more realistic representation. In the Spring 2019 the characteristics of the rendering were focused on the experience of the space, how light enters the space using a collage technique. In the Spring 2020 and 2021 the rendering could be photo-realistic to represent the design, materiality, texture, scale and daylighting; and/ or abstract representation to capture the desired atmosphere of a space, ambience and mood that are sometimes hard to express with photorealistic rendering. The abstract representation had to be inspired by a painting that used the similar desired atmosphere and was done using a collage technique. And the Spring of 2022 semester only required a photo-realistic rendering.

Main reason for the change in the project scale and scope was based on the evaluation of the outcomes, needs and feedback from previous years' teaching. The studio tried to support students in areas that the authors felt were lacking each year.

Evaluation of Criteria

The evaluation of all images is based on six criteria: texture and materials, vegetation, lighting, entourage, context, and overall rendering effects. Each criterion is evaluated on a scale of 1 to 3 to assess the work as underdeveloped, developing, and successful. When a rendered image meets one criterion successfully, it will get 3 points. Accordingly, a rendering considered as developing will get 2 points, and 1 point for an underdeveloped outcome. A final score of each criterion is calculated by taking the sum of the total points under each criterion and dividing the value by the number of samples.

The definition of successful for each criterion is based on the grading rubric and indications given to students on the assignments and is as follow: texture and material should convey the nature and definition of the matter and the characteristics of the textures at appropriate scales; vegetation should represent a careful placement, tones, and types of greenery and foliage that do not overpower the design itself but rather compliments it; lighting should be used to convey clarity and depth (luminosity), and characteristics of space (shade and shadow); entourage should show appropriate scales and selections of styles or tones while not overpower the design itself but rather describe the use and scale of the scape; context should be represented in a way that helps situate the location and scale of the project and does not overpower the design; lastly, the overall criteria stands for a general representation on the use (program) and characteristics (quality) of the space.

The samples for the evaluation were selected using the medium scores of each year's rendering assignments were calculated, and 10 projects that were close to the median score were selected for the evaluation. Figure 1 shows a comprehensive view of the analysis and evaluation of criteria and Figure 2 shows the sample of student work.

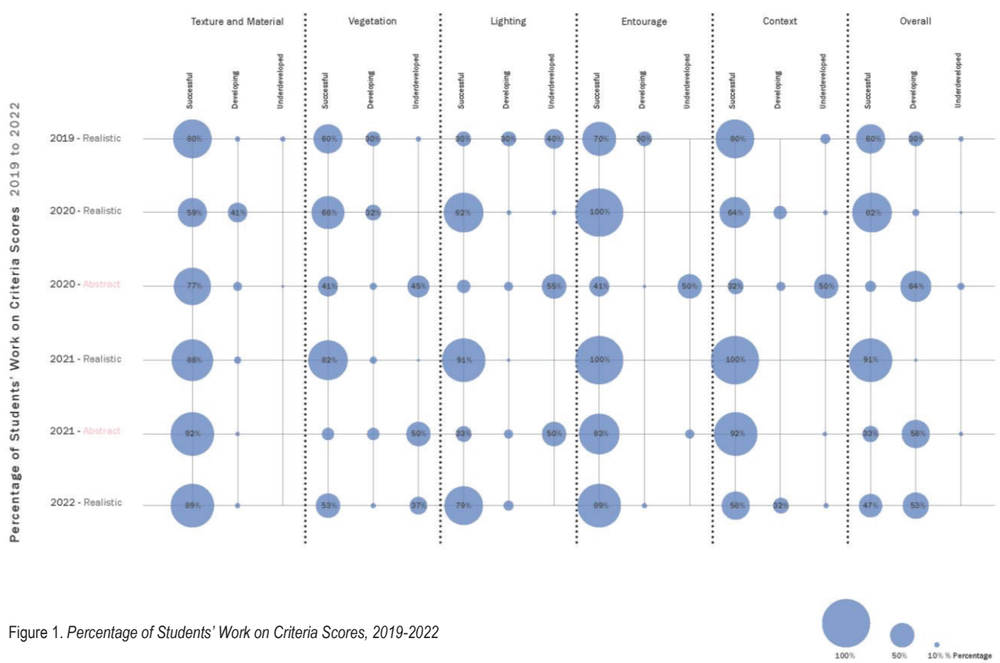


Figure 1. *Percentage of Students' Work on Criteria Scores, 2019-2022*

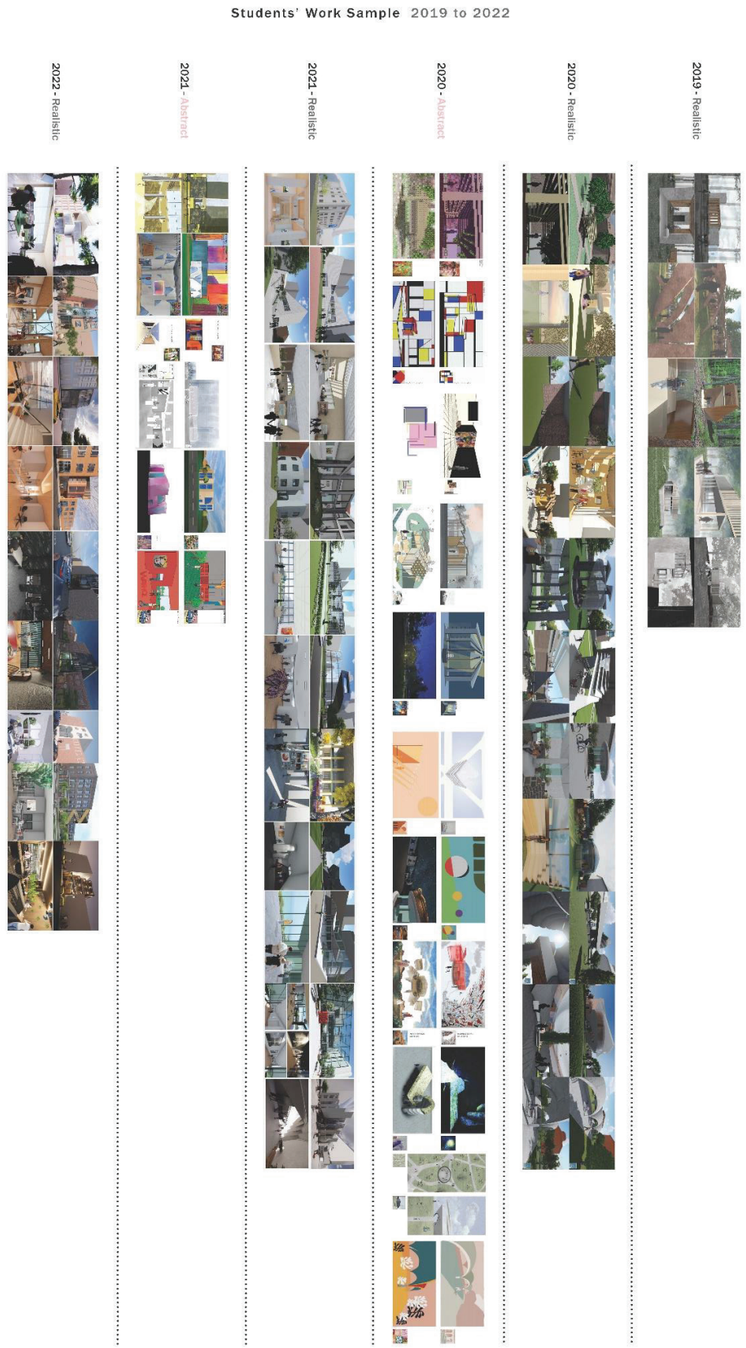


Figure 2. *Students' Work Sample from 2019 to 2022*

Findings

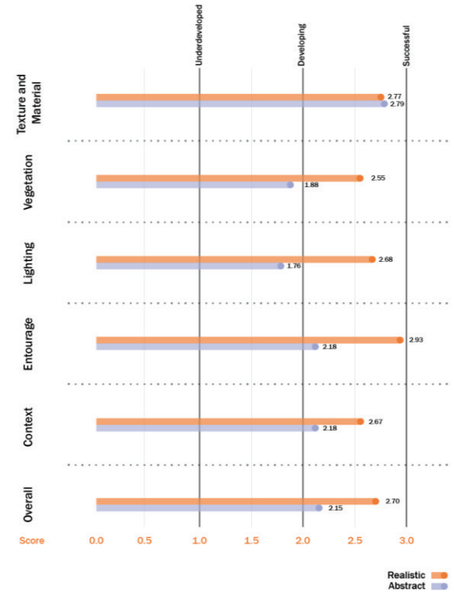


Figure 3. *Average Scores of Realistic and Abstract Renderings*

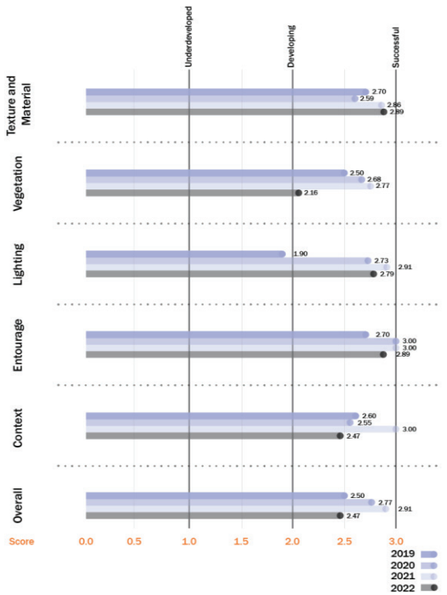


Figure 4. *Evaluation on Realistic Renderings*

Figure 1 represents the percentage of student work samples corresponding to each level (successful, developing, underdeveloped) of every criterion being evaluated. Essentially, it measures the number of student work for each factor. As shown in the analysis, texture and material appears to be the rendering element that most students complete successfully, regardless of the tools or final effects. It is also observed that, when using Photoshop as the rendering tool in 2019-Realistic, 2020-Abstract, and 2021-Abstract, the number of students with developing or underdeveloped rendering results has increased. For lighting particularly, a higher percentage of students ends up with underdeveloped rendering outcomes.

When comparing the general success of the rendering to meet the required criteria between the realistic and abstract renderings through all four semesters, it is found that realistic renderings have higher overall scores than abstract renderings. The overall score of the realistic group is 2.70, while the abstract group only has an overall score of 2.15 (Fig. 3). This reflects the power of the current rendering tools, like Lumion, to generate more real like images relatively with less effort than using Photoshop, and without fully mastering the software.

When looking at rendering tools for only realistic renderings, results show that, in 2019, where Photoshop was used as

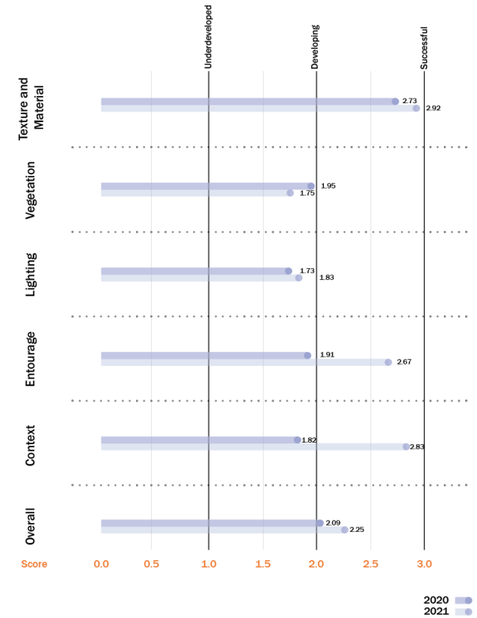


Figure 5. *Evaluation on Abstract Renderings*

the rendering tool, lighting scored much lower than the other years using Lumion, with a score of 1.90 while others are above 2.70 (Fig. 4). For the abstract rendering group where Photoshop was the only rendering tool, both years appear to have low scores for lighting, with 1.73 in 2020 and 1.83 in 2021 (Fig. 5). This reflects the difficulty students face to represent lighting when using Photoshop.

When looking at all the criteria, it is found that vegetation and lighting appears to be less developed for both realistic and abstract renderings, with a score of 2.55 in vegetation and 2.68 in lighting for realistic, and 1.88 and 1.76 respectively for abstract (Fig. 3). On the other hand, texture and material is the most successful in both cases, with 2.77 points for realistic and 2.79 points for abstract (Fig. 3).

Artificial Intelligence Tools

Software for 3D modeling and rendering are quickly developing and expanding the possibilities of representation. Recently, the development and easy access of AI tool is not only revolutionizing the graphic industries and visual art field but also opening new possibilities in the Architecture field with its capability to generate 3D spaces and forms, as well as a rendering tool.

Open AI tools like Giga Manga, DALL-E, and Midjourney make it possible to generate images without skillful experts. Users can simply type a text that describes the scene or desired characteristics, and the computer generates images that match the description in just a few minutes.

For instance, DALL-E trained on a text-image pairing database, combines unrelated concepts in convincing ways to produce images (Bolojan, Vermisso, & Yousif, 2022). With the assistance of Generative Adversarial Networks (GAN), the interconnected networks have taken architectural representation to a higher level, (Bolojan, Vermisso, & Yousif, 2022) offering an infinite possibilities of styles and a very high level of expression in the visualization, the use of lighting, entourage and vegetation.

Figure 6 shows an example of the process used to create a rendered image of a building using DALL·E. Initially, a 3D building image and a text prompt were used to describe the surrounding environment. In this case, the prompt "realistic green grass lawn, city background" was used. The following steps involved adding different human activities and specific background prompts to create a more realistic rendering. The results showed that the human figures matched the scale of the building, and the perspectives were not distorted. These are common errors that students make when using Photoshop to add context and life to their projects.

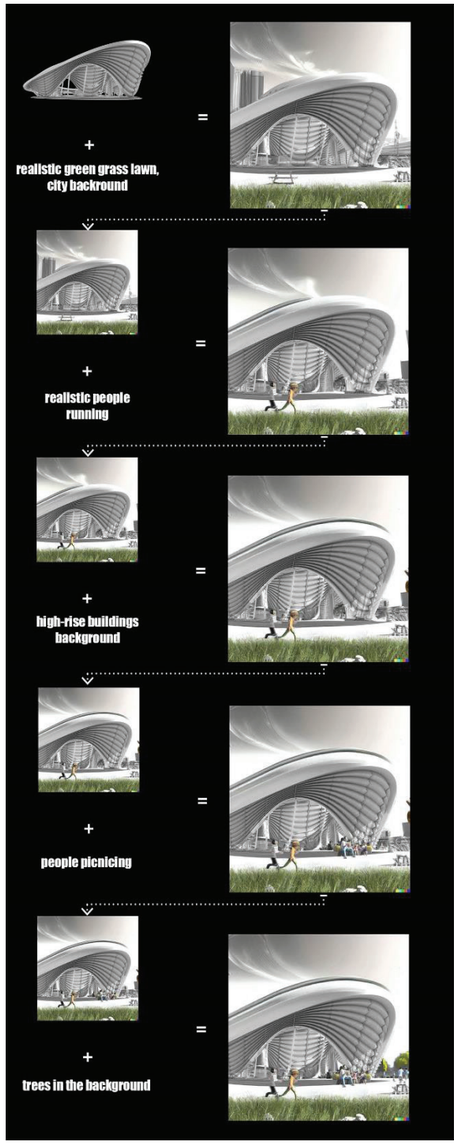


Figure 6. *Rendering process examples using DALL-E*

Different possibilities in which AI tools can be used to render in a variety of styles and to assist in the design process is shown in Figure 7. The top left and right images were generated by feeding two images to the AI. The first image is the building shape that would like to be placed, The Ronchamp by Lecorbusier, and the second image is the background or the style of the representation desired, a watercolor cartoon from a kid's book. The result shows a very interesting and well rendered outcome, the AI generated an image that has the intended style with the building not only placed in it but also represented in the selected style. Although the building shapes were varied by AI, this AI-generated image can be useful to get inspiration for the type of rendering style that will support the design idea and can be easily replaced with the actual building design.

The bottom left image shows how two floor plans, the Ronchamp with more curvilinear expression and a generic orthogonal one, can be used to generate a new blended floor plan. The result shows floor variations that can be used for further study and exploration to generate different floor layouts. And the bottom right images show a facade study designed by AI. One exterior rendering image was fed into the AI and it generates the variation of facade design that has the same architectural language, providing almost instantly a source of iteration and study.

Use of AI in Architectural Education

The design capacities and possibilities that AI offers of generating renderings with just text, in many ways might sound appealing. In schools, we will not need to teach software as learning to write prompts is much easier, faster, and yields better visualizations in less time than when learning software to render from a 3D model.

Figure 7. *Rendering styles and design possibilities using AI*

But architecture is more than just producing pretty images. When generating an image in AI, the user has less control over the outcome. There is no control over the exact location to describe the context, or types of components. We cannot edit, add, or remove parts of the rendering as it is presented as a seamless image. Another limitation is that images generated by AI adhere to the traditional values of beauty, so creating something new and supporting other models of visualization that do not adhere to the "traditional" is hard.

The strong design capacities can also pose a threat to architectural education and the role of the architect. But in the current state of development, AI can only offer a glimpse or a look, and is not able to resolve the complexity or an entire architectural project.

Nonetheless, AI tools can be great support for the design process as a way to quickly create iterations to study. As shown in Figure 7, these tools can generate different rendering styles alternatives, and further explore variations of floor plans and elevation designs that can support the creative design process. As this technology is rapidly infiltrating in our field, we can, and we should, welcome it and have it work for us in architectural education. If we see it as a new way of sketching and understand that the output is not fully formed, it then it becomes a powerful tool for exploration and visualization.

Conclusion

As a main method of communication, architects developed various visual mediums of representation and digital rendering skills through the years. An intrinsic part of architectural education is to teach the current methods of representation to communicate ideas and design and expect that along their architectural education students become proficient at it. As technology evolves, the importance of hand drafting, sketches, and painting gets less attention in architectural education as more emphasis is given to the use of current digital technologies like computational drawings and digital renderings. These digital methods of representation imply a linear design process where the main designer is still the student and the rendering outcome reflects tools and options selected by the designer. Students will typically explore different representation methods such as realistic or abstract graphics and collage, and with more fluency in the software, some will develop a personal style of representation thought their academic career.

We can anticipate that with the development of AI software, some of the limitations that we found above, like the lack of control over the outcome and editing possibilities could be overcome. But, at its current state, AI offers great compliment to traditional representation possibilities and design investigation in Architectural education. Not as a tool to provide a finished outcome, but as a tool of exploration.

We found that the use of AI tools in education can reduce the time required to generate renderings significantly, allowing for more focus on the design process itself. This is particularly beneficial as it allows more time to be spent with students on critical thinking and design rather than simply on the techniques for generating high-quality renderings. It can also enrich architectural visualization, as it can easily test other non-realistic expressions that capture different styles and moods.

Similarly, when digital representation started to evolved and invade the hand drawing techniques, a hybrid collage technique was largely used in architectural representation, this time we see that a new way of going about the design process and representation can be successfully adopted in our field when we accept AI as an outline, hybridizing traditional techniques and AI generated outcomes, where the architect is still in control of selecting tools and pieces from each digital media to design and express its own design and rendering style.

Acknowledgement

We thank the sophomore students from the Spring semester of 2019, 2020, 2021, and 2022, and graduate students from theSpring of 2023 from the University of Illinois at Urbana-Champaign for their rendering work used in this paper.

Bibliography

Bolojan, D., Vermisso, E., & Yousif, S. "Is Language All We Need? A Query Into Architectural Semantics Using a Multimodal Generative Workflow." Proceedings of the 27th CAADRIA Conference, Sydney, 9-15 April 2022, pp. 353-362.

Goldschmidt, Gabriela. "On Visual Design Thinking: The Vis Kids of Architecture." Design Studies, no. 2, Elsevier BV, April 1994, pp. 158-174. doi: 10.1016/0142-694X(94)90022-1.

Jacob, Sam. "Architecture Enters the Age of Post-Digital Drawing." Metropolis, no. 21, March 2017.

McMorrough, Julia. Drawings for Architects. Rockport Pub, 2015.

Suwa, M., Gero, J., Purcell, T. "Unexpected Discoveries: How Designers Discover Hidden Features In Sketches." In Visual and Spatial Reasoning in Design, edited by J.S. Gero and B. Tversky, 145-162. Sydney, Australia: Key Centre of Design Computing and Cognition, University of Sydney, 2006.

Reas, Casey, Chandler McWilliams, and LUST. Form+Code in Design, Art, and Architecture: A Guide to Computational Aesthetics. Princeton Architectural Press, 2010.

Shields, Jennifer A. E. Collage and Architecture. Routledge, 2014.

Dwelling on Climate: Using Comparative Design Methodologies to Develop Responsive Architectures in Hot and Cold Climates

Bradley Walters, University of Florida
Chang He, University of Florida

Introduction

“A well-designed house not only fits its context well but also illuminates the problem of just what the context is, and thereby clarifies the life which it accommodates.”[1] In his *Notes on the Synthesis of Form*, Christopher Alexander frames the work of design as moving beyond solutions, allowing us to consider and understand *the problem* itself. Operating within expansive, open-ended, and speculative territories can be difficult for beginning design students. The vast unknown can be overwhelming. It is common for students to seek comfort in that which might be more readily known and measured: structure, building materials, and related technical considerations. Facing more tangible and known concerns, like functionality, durability, and stability, students can find ready solutions through study of precedent and relevant literature. However, the crucial understanding of relationships between people and architecture still remains unknown and inaccessible to many beginning students. Mortals do not merely sleep within and/or occupy given architectural spaces. When an architect considers the scale of the body, shapes the spatial atmosphere, creates a firm structure, and selects comfortable materials, architecture can both be more responsive and convey the essence of what it means to be human by satisfying the needs and pleasures of dwelling.

In many programs, these phenomenological aspects of architectural theory are taught within distinct history or theory coursework, remote from the work of design. While these classes can illuminate the problems of how to build and dwell, it is difficult for students to bridge between technical and theoretical concerns. Although the students learn a great deal from prior cultural case studies, there is still a gap separating the student’s ability to realize and formalize humanity through studio design coursework. Unfortunately, considering the three principles of good architecture as proclaimed by Vitruvius in *De Architectura*, many student design projects are principally focused on “firmitas” and “utilitas,” relying on technical concepts and functional specificity when designing for an unknown and unfamiliar context. Absent is “venustas” or the creation of spaces that attract humans and encourage dwelling.[2] Although aspects of the work may be reasonable and sound, there is an absence of delight. We lose the opportunity to celebrate humanity and the lives that are accommodated and represented through the work.

Beginning design education should provide an opportunity to explore these unknown fields by offering both theoretical study and practical design approaches. *Dwelling* can serve as a central focus of design education, making it possible for students to perceive the humanity within design and building processes. This allows them, over time, to develop a more balanced and sophisticated understanding of their work.

In the design studios discussed in this paper, we are revisiting the work of German philosopher Martin Heidegger as a framework and conceptual reference. We then engage in a comparative study of two live projects in the dramatically different climates of Tyonek, Alaska and south Florida. Students are challenged to adopt a critical attitude towards architectural form, design strategies, and building technique. In the group discussion and project reviews, students discuss the essence of architecture itself, how it relates to building and dwelling in different sites and contexts, and topics ranging from the relationship between different building materials and specific cultural influence, how building and dwelling these two behaviors influence human’s lives and recognition of being. This pedagogy attempt to lead students to reflect not only on functionality, durability and materiality, but also the significance of culture, history, beliefs, and social structures in architectural design, realizing that architecture can be considered one of the most profoundly important reflections of humanity.

A Critical Approach to the Unknown: Heidegger’s Building / Dwelling

Building and dwelling are fundamental concepts in architecture. First presented at a conference in Darmstadt, Germany in 1951, Martin Heidegger’s “Building Dwelling Thinking” has had a huge influence on architectural theory

and practice and has become one of the most well-known philosophical texts in our discipline. For Heidegger, to "be dwelled" is the ultimate purpose of every building, because "to build," "to be," and "to dwell," share the same root in ancient German etymology. Therefore, Heidegger inferred that "building" and "dwelling" represented the same activity in ancient times.[3] Dwelling should not only be understood as a form of human behavior as living at a specified place, but also represents the essential character of human existence: cherishing, protection, preservation, cultivation, and care. "Building as dwelling unfolds into the building that cultivates growing things and the building that erects buildings."[4] When Heidegger expresses that humans "dwell", it should be ontologically interpreted as "be." A man or women "dwells" has a same meaning as "a man or woman is" for Heidegger. Thus, dwelling and being are one and the same in his essay.

Heidegger further suggests that "Bauen originally means to dwell. Where the word bauen still speaks in its original sense it also says how far the essence of dwelling reaches...The old word bauen, which says that man is insofar as he dwells, this word meanings bauen, however, also means at the same time to cherish and to protect, to preserve and to care for, specifically to till the soil, to cultivate the vine."[5] His statements also revealed other origins of the term "bauen," which indicates the meaning of building and dwelling in old German. Building is a dweller's way of creating a space into which he or she not only can stay for a while, but make this space more habitable from protecting, cultivating, the way human take care of the world. In this case, building entails a vision of dwelling: we need to remain in peace and stay in a place as our protecting and sparing, and this place we build and dwell, accommodate its form to its subject and the subject gathers itself within architecture and reflects its identity.[6] Architecture was constructed by humans, and finally represents the human's essence by making space for the human's presence.

In today's predicament of "spiritual homelessness" (in Heidegger's term), the interactive and integral relationship between building, dwelling, and architectural design is torn apart by excessive pursuit of technological and commercial benefits. In architectural education, architecture has in some conditions been reduced to more elemental and immediate concerns. Meeting what some might consider to be the "basic" needs of humans, students may design arechitecture as a "shelter" (providing spaces for short-term stays) rather than places for "dwelling."

Young architects paid more attention on design to cope with variations in temperature and different climates, but lack of concerns on human's dwelling between memory and reality, desire and leisure. High thermal mass or functional insulation are regarded as a criterion of whether it is a good

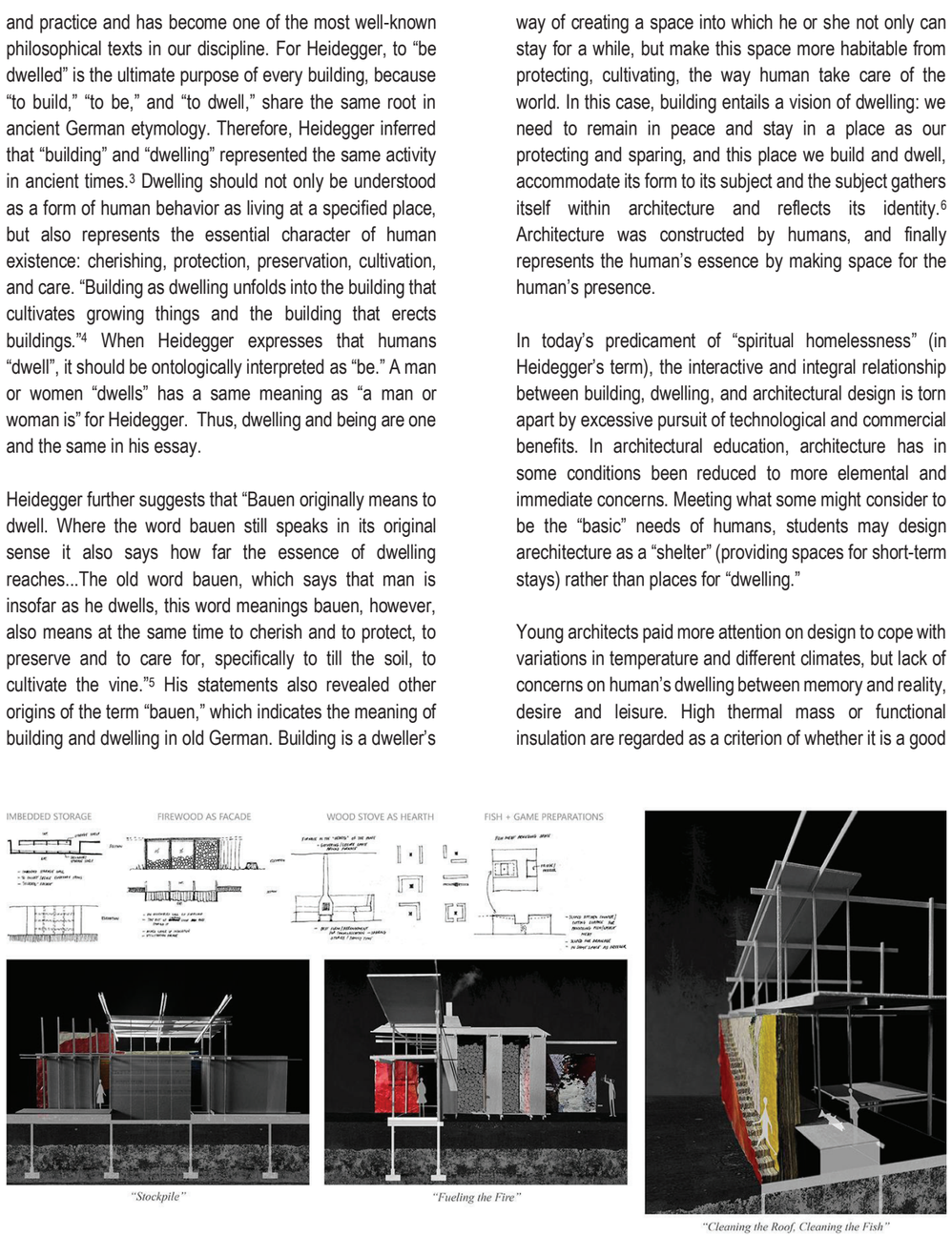


Fig. 1 Dwelling and the rituals of life in Tyonek, Alaska. Work by Marla Stephens, University of Florida, Fall 2022.

building in areas with cold climates, and cross-ventilation and shading screen system are widely designed as significant elements for buildings in hot areas, as a symbol of vernacular architecture. It is meaningful work. However, this is only one of the purposes of why human builds, and the meaning of architecture is more than just building a shelter as in the narrower sense. The building satisfied human's needs is closely related to the way how does he/she "dwells," inevitably implied human's essence, because dwelling is the manner in which mortals are on the earth.[7]

For building and dwelling, Heidegger creates an ontologically association with the human's "being." In his writing, he stated building represents the "means" and dwelling represents the "ends": "we attain to dwelling…only by means of building."[8] Humans can only dwell through building behavior, and building can be considered as a formal representation of one's dwelling. In short, building is dwelling. Building and dwelling reveal the human's being. For beginning design students, Heidegger's statements provide a purpose for design: when we design and build, it is not only about creating physical spaces of occupation. Building is a formal expression of man's dwelling in the world. Heidegger's essay provides a new perspective for our design project, to give form to dwelling in its presence, and to represent the presence of humans in one's building. To reach the nature of dwelling, architects must consider building as cultivating, a method to bring humanity and the true meaning of "living on earth" to human beings through building. Beyond the limitation of pragmatic purposes and technical means, this brings human beings back to the enlightenment of truly dwelling. Students are expected to develop their ideas philosophically, conceptually, and architecturally to provide a strong foundation in critical thinking and architectural design after reading.

Explore the Unknown: Poetic Measuring

To reach the realm of the ideal dwelling, Heidegger suggested that people should always attempt to make sense of self-existence through building and dwelling. These attempts only occurred "properly and poetically through measuring." Heidegger's "measuring" was not one of mere mathematics or data analysis. He writes that "measure-taking is no science. Measure-taking gauges the between, which brings the two, heaven and earth, to one another. This measure-taking has its own metron and thus its own metric."[9] The measuring that Heidegger advocated attained through a constitutive unity connecting men with things and the world, a poetic measure-taking with the fourfold: earth and sky, divinities and mortals as the oneness. For Heidegger, the critical idea for human's dwelling is to create and preserve the unity of the fourfold. Heidegger calls the "the poetic measure" by which human measure one's dwelling, his stay on earth under the sky, and human are only able to be correspondingly with one's nature if they measure of their dwelling in the fourfold in this way. As he claimed, "…in this realm, man is allowed to look up, out of it, through it, toward the divinities. The upward glance passes aloft toward the sky, and yet it remains below on the earth. The upward glance spans the between of sky and earth. This between is measured out for the dwelling of man. We now call the span thus meted out the dimension. This dimension does not arise from the fact that sky and earth are turned toward one another. Rather, their facing each other itself depends on the dimension. Nor is the dimension a stretch of space as ordinarily understood; for everything spatial, as something for which space is made, is already in need of the dimension, that is, that into which it is admitted."[10]

Heidegger's writing indicated that a basic element of this comparative measuring is the divinity, the poetic concept from "Kindness" and The Pure," as the means through which the divinity can be perceived by people. Heidegger wrote: "As long as this arrival of kindness endures, so long does man succeed in measuring himself not unhappily against the godhead. When this measuring appropriately comes to light, man creates poetry from the very nature of the poetic. When the poetic appropriately comes to light, then man dwells humanly on this earth." Poetic dwelling becomes as the measurement that human use to project themselves into the fourfold. Indeed, here we take measure with human's dwelling, we shall use poetry to explore this unknown territory, an inhabited space built by human presenting within the divinity through a poetic measure. We need to study architecture phenomenologically, from literature, history, cultural identity, drawings, sketches, photography, music, to find its concrete evidence of the values of poetic dwelling, rather than mere study on chart of temperature or topo-analysis.

Hot and Cold: A Studio Project

Building on preparatory undergraduate work, Advanced Graduate Architectural Design 1 ("G1") introduces students to the challenges and rigors of developing a philosophical

position and research-based design process as the foundation for architectural design and practice. Emphasis concentrates on cultivating self-directed speculation, analytical thinking, and synthetic design exploration within the framework of an organized studio program. Students are expected to develop their ideas philosophically, conceptually, and architecturally to provide a strong foundation in critical thinking and architectural design. Students are encouraged to use this course to germinate scholarship and personal perspectives that will be expanded in future studios and the Thesis or Project-in-lieu-of-Thesis (PILOT).

Introductory exercises serve as catalysts to provoke a sequence of investigations and establish issues to be addressed throughout the term. Research and analysis, framed and reframed through design synthesis, provided an intellectual foundation from which the studio develops architectural responses to program, place, and time.

Project work investigates spatial and material relationships between insides and outsides, negotiating the complexities of a rich program and site at the building scale. While centered initially on materiality and the tectonics of construction, students are also encouraged to seek out opportunities to engage history, socio-cultural relationships, phenomenology, and ecology in their work. Students are charged with developing philosophical approaches that can be transformed into and through architecture.
The first part of the semester was focused on a modest project in the rural community of Okahumpka, Florida working with close input of the residents and community leaders in a historic African American community. The second part of the semester was focused around projects in Alaska and Florida.

This project requires students to develop architectural proposals that respond to two very different social and climatic contexts, defined broadly as “hot” and “cold.” More precisely, we are working on single-family housing for the Native Village of Tyonek in Tyonek, Alaska and multi-student dormitory housing for the University of Florida Institute of Food and Agricultural Sciences (IFAS) at multiple locations in Florida.

Indigenous Native Village of Tyonek

The indigenous Native Village of Tyonek is located approximately 40 miles from Anchorage, Alaska. Although Tyonek only has a population of 184, the Dena’ina Athabascan people trace their history back 10,000 years. Tyonek’s current housing inventory is 50 years old and was constructed with only minimal insulation. Residents struggle with exorbitant utility costs while living on very modest incomes. The people of Tyonek live a subsistence lifestyle, hunting and fishing throughout the summer months to sustain themselves through the long, dark winter months. The residents of the Village are looking for housing that is more responsive to their climate, ideally including 3 bedrooms, 2 bathrooms, electric utilities, a wood stove, and sufficient storage of food and goods to allow them to survive and thrive in the winter months.

Graduate Student Housing in Florida

The student housing for the University of Florida’s Institute of Food and Agricultural Sciences (“IFAS”) has emerged as the single most important issue facing the research institution in recent years. Graduate students (both PhD and Masters) often spend 4-6 years of their studies living and working at remote research sites located around the state of Florida, and have expressed a yearning for housing that better supports their diverse social and cultural communities. In addition, the institute is challenged by the high-cost of providing this housing, currently approximately $125,000 per bed. IFAS is seeking assistance in developing new models for housing at these research sites that facilitate the creation of community while hopefully reducing the costs of new construction. IFAS has asked for multi-student buildings, with 8 single-student rooms, 4 shared bathrooms, one oversized kitchen, living area, laundry, and recreational space. Although all of their sites are in need of assistance, IFAS has asked us to begin with their sites in Vero Beach, Fort Pierce, and Marianna FL.

The students began their investigations by working collectively to research the climates and physical parameters of each of these sites. They then began to individually develop proposals for Tyonek and IFAS. For Tyonek, the particular sites were to be selected from currently dilapidated and abandoned houses located in the village. For IFAS, students were allowed to choose from any of the 3 research site locations, and then were allowed to identify particular sites for intervention based on the local site conditions.

While each student was tasked with creating separate architectural proposals for Tyonek and IFAS, we were most interested in the architectural "project" that might be beyond conventional "problem/solution" methodologies. The students were asked to develop and test a thesis as a conceptual approach operating across both sites. As a particular student outcome, this is something that they were asked to articulate during their reviews, providing evidence for how they developed their thesis through the different architectural proposals.

The proposals developed during the fall 2022 semester provided a range of possible approaches that will be further developed in the Spring 2023 semester. The housing for the Native Village of Tyonek will be developed for the Solar Decathlon 2023 Design Challenge. Housing prototypes for IFAS will be developed for construction in 2023 and 2024.

While it was not possible for the entire studio group to travel to Alaska, a small group of faculty and students was able to conduct field work in Tyonek. The full studio group was able to travel to the sites of study within Florida, allowing for direct, first-hand experiences to inform their work. The trips and site tours were instrumental for the student work that followed, as they allowed the students to measure building and dwelling in the unknown land through their own experience. Site tours provided students with a chance to observe the buildings with care and understand their relationships to fields, forests, mountains, and rivers. Dwelling contains compressed time, intimate memories, and the being, which is cast into an unfamiliar or unknown world. Interpretating Maurice Merleau-Ponty’s perceptive theory, this journey began with phenomenological exploring the between (das Zwischen[11]), to extend the dimension where the Being both presented “known” un-concealment and “unknown” concealment. One main reference is Rockwell Kent’s celebrated work with beautiful writings and author’s sketches, *Wilderness, A Journal of Quiet Adventure in Alaska*, which depicted a real wonder-world in which human dwelled.[12] In this book, Kent’s illustrations and descriptions of his dwelling in wild landscape and seascape from Alaska conveyed a transcendentalist spirit evoking human’s mysteries and cosmic wonders of the wild northern land. Students were allowed to have an intimate and unselfconscious attitude same as Kent, to observe and record the two different sites, using sensible and poetic words and sketches to measure the sky and ground. This measure taking is not relevant with Descartes analytic geometry, but an upward glance which spans the between of sky and earth toward the divinities.

Alaska and Florida, from a snow-covered village to warm and humid hammock, both of these two beautiful lands show the sense of “the between” among sky, earth and mortal, representing an elemental and infinite world of wilderness. In Tyonek, the Tebughna people shared a respectful interaction with the nonhuman world. The relationships among sky and ground, animals and plants, mortals and ancestor spirits, are central to the Tebughna (or “beach people” of Tyonek).[13] The tranquility and wonder of wilderness inspired numbers of artists and architects to record human’s dwelling in the wild freedom between heaven and earth: Sydney Laurence, Louis Choris, Fred Machetanz, Sam McClaim, Laura Woodward, Marion

Fig. 2 Comparative proposals for Tyonek, Alaska and Vero Beach, Florida. Work by Ulfa Kun Aulia, University of Florida, Fall 2022.

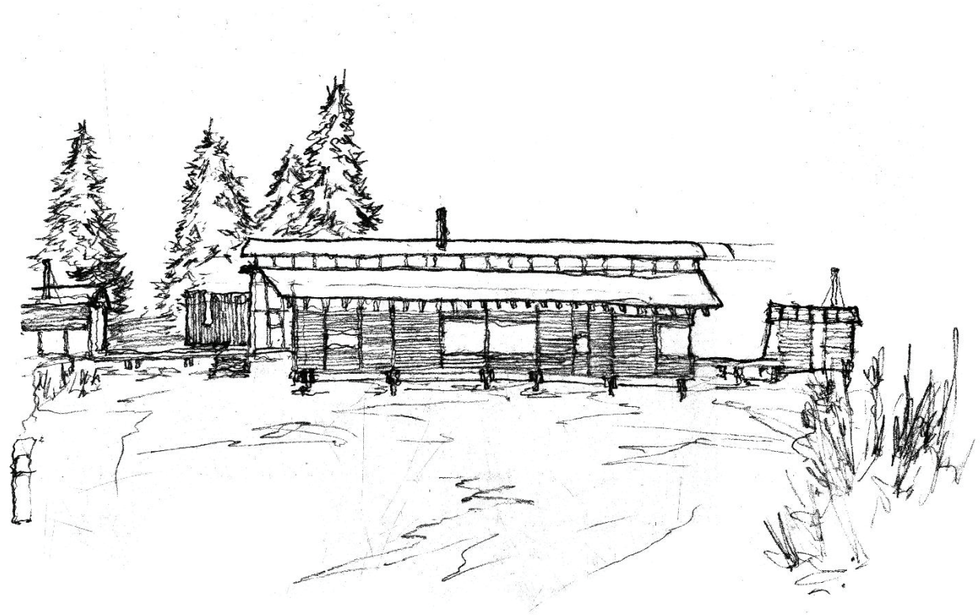


Fig. 3 A house for the Native Village of Tyonek, Alaska. Work by Raymond Wincko, University of Florida, Fall 2022.

Greenwood, and Albert Ernest Backus. In their paintings, as case studies of our design studio, the poetic dwelling in the rustic cottages and simple huts always lie precisely in the human's care of our cosmic world, the ultimate sky, the starry night, the beaches, the rivers, the savanna, and human's simple hut, the peaceful poetic dwelling in between sky and earth. To have a same visual experience as these great artists, field trips provide a rare opportunity to introduce students to perceive and poetic measure the timeless beauty of nature where life builds and dwells. As the precedent research, students are expected to not only examine the implications of material and spatial studies in the context of contrasting climates, but also have an ontological measurement between heaven and earth to reach and explore the unknown—human's poetic dwelling.

Building/Dwelling in Unknown: Representation in Comparative Design Methodologies

One notable research method in this studio is comparative architectural study. For this project, beginning design students measure and explore the different natural and social environments found in two very different climates: a hot equatorial climate, studied in parallel with a very cold polar climate. This allows students to perceive the essence of dwelling in these very different geographical and cultural backgrounds. The application of comparative study method will be implemented in textual and image analysis for theoretical cultural study, with specific functionality and adaptability analysis for vernacular architecture study. With the defined topic of studio design project, the research and field-trips offered a new perspective to analyze the difference and similarity of architecture and landscape from different climates, historical contexts, cultures, ideologies and architectural forms, in order to uncover the same significant meaning of building and dwelling even in very different contexts. Comparative architectural study does not seek a scientific, rational and instructive principle of architecture through the general comparative methodology, but strategically studies the meaning and poetic power in architectural space through the comparative analysis. Although represents the same significant meaning of human's building and dwelling behavior, architectural space has its different ethical, political, philosophical and cultural embodiment, and to understand the cultural meanings of architecture requires comparative studies between two different locations.[14] From Heidegger's writing, he suggested that things that do not have the fourfold, it will not have a location. Therefore, the two different locations represented two different methods we human protect and preserve what we cherish from building and dwelling. Taking comparison as a starting point of methodology, this studio encourages student looks for comparative operational fragments from history, socio-cultural relationships, phenomenology, ecology, design practice and other relevant disciplines to deliberate on the key concepts related to different climate and cultural backgrounds. Through the perspective of comparison, students will be charged with developing philosophical approaches from comparative study that can be transformed into and through design project.

Meanwhile, the concept of comparison is not limited in two different sites. The comparative study contains two comparative aspects and thus "echoes the contrastive structure of metaphysical dualism." However, the difference of traditional and original local philosophy such as the system of dichotomies in Alaskan Dena'ina's holistic world of view and sacred power as their "religion of nature", with modern ideologies and design methodology, should be thought through comparative process, consciously distancing the nihilism of metaphysical dualism.[15] The philosophical interpretation of local traditions in Alaska and Florida, and the modern architectural theory and praxis, will be another important comparative design fragments with convincible comparability in this studio projects. It shows an interdisciplinary character, which determined that theoretical construction accomplished in architecture design must be a special kind of discourse. This discourse requires a comparative reading of important texts in traditional local philosophy and modern sense of time and space, architectural history and practice in both past and present time. In this case, comparative architectural praxis can introduce students to build a new design strategy after exploring the critical design including significant cases in different eras, and cross-cultural design. In addition to formal and technical and/or performative criteria, students are expected to engage socio-cultural and historical considerations in an earnest and meaningful manner, recognizing the rich possibilities of architecture in the service of people and culture. Challenge the status quo and expand "the canon" of design approaches and historical precedent to better respond to a diverse, multi-gendered, multi-racial, and multi-cultural world.

Taking the design project in Alaska as an example, Dena'ina, the native American group who occupied Kenai area in southeastern Alaska, has very unique and well-organized regional culture, religion and philosophy, which indicated the way they viewed and interacted with the Heideggerian fourfold. They are simple and pious animalist with integrating Russian Orthodox Christianity, following and responding the natural harmony emerged in between sky and ground, contained kernels of Dena own primitive worldview and syncretized the Christian sense of time and space. For these native dwellers, "each river, hill, and lake was endowed with its master-spirits."[16] Meanwhile, Dena'ina tribe also insists a view of dichotomies when dwelling in the northern wild lands, especially implied their traditional and original sense of space. Forbidding dark forest and opening brightly sea constitute the harmonious and ideal oneness as their view of the world, and their dwelling, the classic wooden buildings show the compliment of dichotomic harmony.

Facing the wet, cold and harsh climate, warmness, dryness and coziness become the main characters of Dena'ina tribe's ideal dwelling space, mirror their unique cosmic value and architectural expression of dwelling: "there also was a house and so I also arrived by there. And there I ascended above, into 'the high country'."[17] Facing the traditional attitudes of dwelling, the way these indigenous residents protect, cultivate and care their homeland, tracing and gathering the comparative fragments between traditional and modern architectural theories will be the main challenge for be beginning design students, because the house should be considered as a sacred concept for Dena'ina tribe rather than only a wooden construction. The analyzed cases and texts can provide an opened place for comparative thinking and historical reflection, and finally help students to translate philosophical ideas and meanings into modern architectural language and form that embodied the encounter and connection between two different cultures.

In addition to the solid red cedar material that constituted the Dena'ina classic cottage, students engaged other materials to reproduce the ideal dwelling spatial atmosphere in model architectural language, as a dialogue of comparative historical discourse. By the end of the process, students in the design studio used physical and digital models to represent suitable structural and material systems,[18] while presented their understanding of building

and dwelling in texts, drawings and collage. Student's work, included physical material and detail tests with materials at an enlarged scale. Student drawings visualized expression and interpretation of gathering, the way gathers the landscape and seascape into architectural thought producing the meaningful location for human's building and dwelling. One main challenge for students will be to use reasonable design language to build the connection between cosmological schemata and the concept of Heideggerian Being and location. For students, two different sites provided abundant spatial characteristics and historical identities, will question them that how to use Heideggerian "building" to symbolically create/make an architectural space which are capable of evoking local people's sense of "dwelling" and "Being" in between skyward spirituality and earthward mortal identification, to reach Yi-Fu Tuan's idea of "microcosm shelter,"[19]

Fig. 4 Fireweed *(Chamaenerion angustifolium)* in Tyonek, Alaska during late summer. Photo by Bradley Walters, University of Florida, Fall 2022.

an architectural space can implied the manner of gathering heaven and earth, divinities and mortals to itself in in human's anticipation and interpretation.

Learning from the Unknown

The role of the architect has become complicated by diverse demands and intense technological development. Creating new connections between technical and theoretical concerns was a key pedagogical objective.

Canadian architectural theorist Alberto Perez-Gomez emphasized the importance and creative power of practical philosophy, or praxis, in the both physical and spiritual adventures of architect: "Drawing on relevant sources from antiquity to modernity may help us reconsider our current role as 'creators' and may advance our practice in ways that avoid dead-end debates over formal or functional questions."[20] In this case, the term "unknown" for beginning design students not only means remoted and unfamiliar lands with contrasting climates, but also the unknown philosophical realm implied Heidegger's significant interpretation of dwelling, as preservation of the fourfold. When we see the skylight reflected brightly off the lake in Alaska, the summertime twilight scattered on the boundless Florida prairie, the isolated hut stands on a poetic location as "the form to dwelling in its presence and house this presence," can we really realize the true meaning of Heideggerian dwelling appeared in the real building? For this design studio project, the pedagogic objective is always about inspiring people's thinking, attempting to think of dwelling and building through the whole theoretical and practical study will indicate that building belongs to dwelling, and how it perceived building's nature from dwelling.

As an architect, as a human dwells in the world, one should learn how to trace in thought the nature of dwelling, and learn how to dwell. In this way, the unfamiliar is made familiar, and the familiar is made unfamiliar anew.

End Notes

1 Alexander, Christopher. *Notes on the Synthesis of Form* (Cambridge MA: Harvard University Press, 1964), 90.
2 Vitruvius, *The Ten Books on Architecture*, trans. Morris Hicky Morgan (New York: Dover Publications, Inc., 2018), 17.
3 Martin Heidegger, "Building dwelling thinking" in Poetry, language, thought (London: Harper and Row, 1971), 145-147. For the related analysis of the relationship between building and dwelling, see Adam Sharr, *Thinkers for architects: Heidegger for architects* (New York: Routledge, 2007), 27.
4 Heidegger, 146.
5 Heidegger, 145.
6 Liz Fagundes Oliveira Valente and Luciana Bosco e Silva, "Art dwells: Heidegger's concept of dwelling and the spatial relations between architecture and contemporary art in two artworks at Instituto Inhotim (Brazil)," *Oculum Ensaios* 16, no.3 (2019), 603. 7 Heidegger, 147.
8 Heidegger, 143.
9 Martin Heidegger, "…Poetically Man Dwells…" in *Poetry, language, thought* (London: Harper and Row, 1971), 219.
10 Heidegger, 218.
11 About the analysis on "the between" or das Zwischen, see Frank Schalow and Alfred Denker, *Historical Dictionary of Heidegger's Philosophy* (Lanham: Scarecrow Press, 2010), 72-73. 12 Rockwell Kent, *Wilderness, A Journal of Quiet Adventure in Alaska* (Los Angeles: Wilderness Press, 1970), 3-5.
13 Alan Boraas, "What is Good, What is No Good: The Tradition Dena'ian Worldview," in *The Dena'ina Way of Living*, ed. Suzi Jones, James A. Fall, and Aaron Leggett (Fairbanks: University of Alaska Press, 2013), 104-110.
14 About the concept of comparative architecture, see Hui Zou, "Poetic Meandering of Comparative Architecture" in *Architecture, Culture, Interpretation* (Brucuresti: Paideia, 2005), 242-243.
15 Andrei A. Znamenski, *Shamanism and Christianity: Native Encounters with Russian Orthodox Missions in Siberia and Alaska, 1820-1917* (London: Greenwood Press, 1999), 24-27.
16 Andrei, 25.
17 Andrew Balluta, *My forefathers are still walking with me: verbal essays on Qizhjeh and Tsaynen Dena'ina traditions*, trans. Jams Kari (Anchorage, AK: Lake Clark National Park and Preserve, 2008), 26.
18 For the pedagogic analysis of physical model in graduate design studio, see Bradley Walters and Lisa Huang, "Oculata Manus: On the Role of the Body in the Making of Creative Minds," in *Promoting Creative Thinking in Beginning Design Studios*, ed. Stephen A. Temple (New York: Routledge, 2019), 230-233.
19 Yi-fu Tuan, *Topophilia: A Study of Environmental Perception, Attitudes, and Values* (New York: Columbia University Press, 1974), 75-91.
20 Alberto Perez-Gomez, *Built Upon Love* (Cambridge: The MIT Press, 2006), 11.

Bibliography

Alexander, Christopher. Notes on the Synthesis of Form. Cambridge: Harvard University Press, 1964.

Balluta, Andrew. My forefathers are still walking with me: verbal *essays on Qizhjeh and Tsaynen Dena'ina traditions*. Translated by Jams Kari. Anchorage, AK: Lake Clark National Park and Preserve, 2008.

Heidegger, Martin. *Poetry, language, thought.* London: Harper and Row, 1971.

Kent, Rockwell. *Wilderness, A Journal of Quiet Adventure in Alaska*. Los Angeles: Wilderness Press, 1970.

Perez-Gomez, Alberto, *Built Upon Love.* Cambridge: The MIT Press, 2006.

Schalow, Frank, and Alfred Denker, *Historical Dictionary of Heidegger's Philosophy*. Lanham: Scarecrow Press, 2010.

Sharr, Adam. *Thinkers for architects: Heidegger for architects*. New York: Routledge, 2007.

The Dena'ina Way of Living. Edited by Suzi Jones, James A. Fall, and Aaron Leggett. Fairbanks: University of Alaska Press, 2013.

Tuan, Yi-fu. *Topophilia: A Study of Environmental Perception, Attitudes, and Values*. New York: Columbia University Press, 1974.

Valente Liz Fagundes, Oliveira, and Luciana Bosco e Silva, "Art dwells: Heidegger's concept of dwelling and the spatial relations between architecture and contemporary art in two artworks at Instituto Inhotim (Brazil)." *Oculum Ensaios* 16, no.3 (2019):603-621.

Vitruvius, *The Ten Books on Architecture*. Translated by Morris Hicky Morgan. New York: Dover Publications, Inc., 2018.

Walters, Bradley, and Lisa Huang, "Oculata Manus: On the Role of the Body in the Making of Creative Minds." In *Promoting Creative Thinking in Beginning Design Studios*. Edited by Stephen A. Temple, 225-238. New York: Routledge, 2019.

Znamenski, Andrei A.. *Shamanism and Christianity: Native Encounters with Russian Orthodox Missions in Siberia and Alaska, 1820-1917.* London: Greenwood Press, 1999.

Zou, Hui. "Poetic Meandering of Comparative Architecture" In *Architecture, Culture, Interpretation*. 233-248. Brucuresti: Paideia, 2005.

Session 7

Space Junk: Digital Assemblage as Site

Trace Gainey, Assistant Professor of Architecture, Kennesaw State University

Introduction

This paper presents a project titled *Space Junk*, which was run in an online first year graduate studio in spring of 2021. Through a process-based digital workflow, Space Junk questions notions of site. The basis of the project is a speculative construct assembled from digital junk, found parts on the internet. Students are tasked with constructing their own site, and then responding to the site with an architectural intervention. The creation of a speculative site frees up notions of ground and encourages exploration while the task of responding to the site gestures towards the reality of a practicing architect.

Background

The Studio

The structure of the first year of the MArch program at the University of South Florida (USF) is defined by a rigorous 9-credit hour studio course. The course is divided into two parts: the primary component is led by the faculty and the secondary component is led by a graduate teaching assistant. The primary component meets Mondays, Wednesdays, and Fridays much like an ordinary studio. The secondary component led by the GTA meets Tuesdays and Thursdays. This secondary "graphics" support allows studio production to be fast tracked. Ideas, concepts, and tools can be introduced during studio time and then troubleshot during graphics, which keeps the students moving forward with their work every day of the week. For this project, the studio was online. This meant that digital modeling and representation were being pushed to the forefront. Given the amount of facetime available, the students were able to quickly improve their digital modeling skills in Rhino and explore the production of digital drawings. The GTA for the course, Luis Antonio Hernandez contributed immensly to success of the project.

The Assignment

Part 1 is to gather digital junk and assemble it into an artifact. A digital assemblage that forms a world within which an architectural intervention may exist. Part 2 is to construct a research center dedicated to the understanding of the junk assemblage. With a bare bones program of laboratories and a small dorm, the student was posed with the task of creating occupiable and scaled space in reaction to the digital assemblage. In doing so, the digital assemblage becomes site and its rules, geometry, and gravity become the rules of the intervention. Figure 1 is an exploded axonometric showing the site assemblage and architectural intervention for one of the projects.

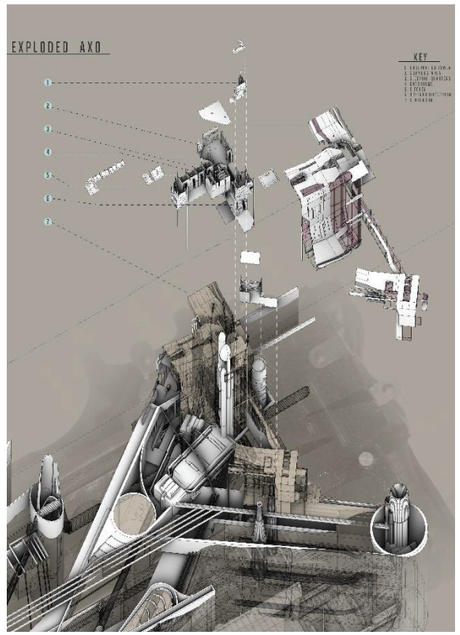


Fig. 1 Exploded Axo, *Vicente Fernandez, 2021*

Defining (digital) Junk

What is space junk? Within the context of the USF, "junk models" go hand in hand with the work in Professor Jan Wampler's urban design studios. Jan Wampler is Professor Emertius from MIT and holds the Marcborough Endowed Professorship at USF. He uses junk models in studio to quickly achieve a sense of human scale within an urban site model (See fig. 2.) The models are sprawling urban realms and through the use of existing junk, the students are able to assemble an urban model quickly,

thinking about the relationships of the spaces and scale of the object through natural instincts. They are freed from the creation of the existing geometry but instead challenged with navigating the relationships between the junk and the existing framework of the city. While this may seem simply like form generation, it is a critical tool for exploration within the studio. It allows the student to focus on composition and spatial relationships first. The junk geometry sparks ideas and fosters a playful environment in which preconceptions of urban design fall away in favor of architectural, spatial relationships. Given that Space Junk was run remotely, the students would not have encountered models from Jan Wampler's studios, however the similarity in the digital assemblages is striking.

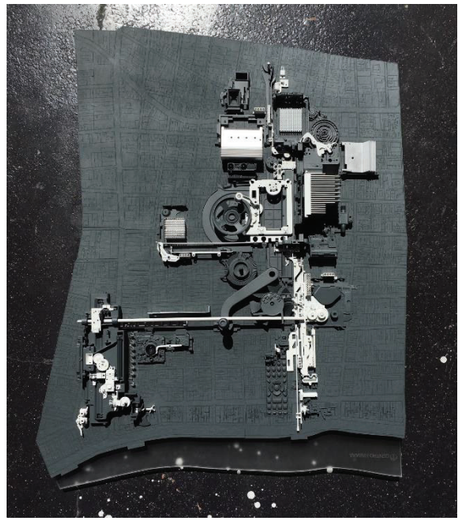


Fig. 2 "A Design for a Neighborhood in Habana" Junk model of Centro Habana, Cuba. Audrey Alai, Kimberly Fowke, Victoria Statzer, USF School of Architecture + Community Design, 2016.

In her work on early childhood education, Nina Odegard discusses the potential of junk materials and models to "lead to the discovery of new 'hidden' rooms in pedagogy" in which "materials break boundaries, open up realms of thought and create new connections."[1] Through working with graduate students, the same opportunity for newness emerges from junk models no matter the age of the maker.

Odegard constructs the following narrative to illustrate the observations she found in her study:

> Bea, 2 years old, is heading for a room in the basement where there are thousands of different kinds of junk materials. For a moment she hovers on the threshold. Her eyes scan the shelves. Her body appears almost to be trembling with all the impressions. She closes her eyes for a moment as if to protect herself or to preserve or refine the moment. She takes a deep breath before moving towards one of the shelves. Her hand moves towards one shelf and then another, she touches, she absorbs, she moves and is moved by the encounter between herself and the materials. The materials work with her, around her and inside her. One of the shelves, with many different colours and many different objects in all the colours of the rainbow and all kinds of shapes, draws the attention of the two-year-old. Her gaze, body, arms and hands turn to the different containers on this shelf. She touches different things, turns them around, lifts them up for a closer look, smells them, keeps them in her hand for a moment and puts them back.
>
> But some things have particularly attracted her attention, and the child collects things individually according to her interest in their colour, shape, texture and size. An outsider may believe that things have been chosen at random but, after observing the little energetic body and the deep concentration that the child radiates, you will find that this is far from the case.

Physical junk models can foster this enthusiasm seen in Bea. But how can we capture this intuitive process in digital making? Digital artifacts may not have tactility, but they can spark intrigue in a similar manner. Since most of the media we encounter in our everyday world is digital, we are already practicing digital gathering. From digital collages in Photoshop to audio visual collages in TikTok, most media we encounter is already some form of layered collage. Space junk is searching for the energy and opportunity physical junk models create, but through 3-dimensional digital media and modeling.

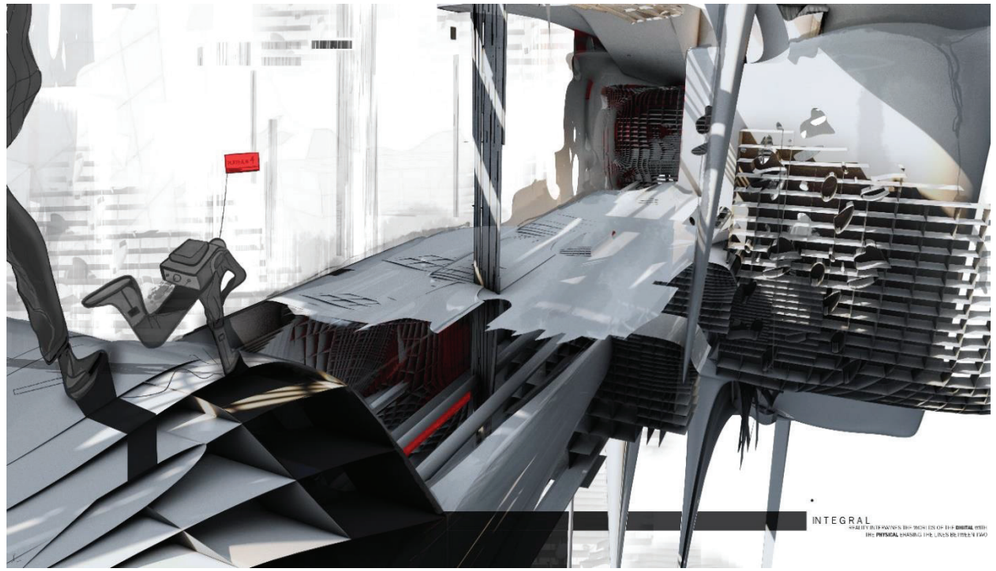


Fig. 3 Perspective of site construct, Lilit Uzunyan. 2021

Mining the Internet

Though the conceptual basis of the project is an amalgamation of space junk, the geometry of true space junk is only marginally accessible. The studio broadened its search for junk, looking to the endless supply of media available on the internet. Much like dumpster diving for materials, the students mined open-source websites for the junk – from machines to widgets, the students were met with a barrage of existing geometry with which to work. Much like the scavengers in Fallout, a popular post-apocalyptic video game, the students collected, arranged, deconstructed and repurposed found objects. Scale and materiality of digital junk is particularly flexible. Digital artifacts can be scaled up or down easily, allowing the artifacts to transform. Their original form and use to fade away as they are integrated into the assemblage. Digital materiality is fluid. The scale and geometry of the junk suggests materiality, but new materials and textures can be mapped onto the artifacts.

Assembling – Digital Craft

Pre-pandemic, the core curriculum at USF was largely analog. The sequence relied on a process-orientated approach to physical making: draw, construct, fold, shift, envelop, duplicate, shift, etc. Through a sequence of drawings and models, an architecture would arise. Through the craft of making and the incremental improvements in craft, large scale physical models were the norm. As this curriculum shifted towards digital means of production, the question became what is digital craft? How does that physical process reliant on the hands, and thinking and making, translate into digital production.

Conversation surrounding digital craft often involves the discussion on "clean models," models whose digital construction has been rigorously organized into layers and whose geometry is watertight and cleanly constructed. (See Summers 2016 for a thoughtful defense of clean modeling.) Junk models are by their very nature not clean, they are made of rag-tag parts that come together through intuitive construction. In physical model making, craft is extraordinarily important, but there is a range of craft expectations. Sketch models or maquettes are meant to be tools for understanding; thus they may be messy and heavily worked on. They are a physical artifact of the thinking of the maker. The question this project poses of digital craft, is not how to make a perfectly crafted digital

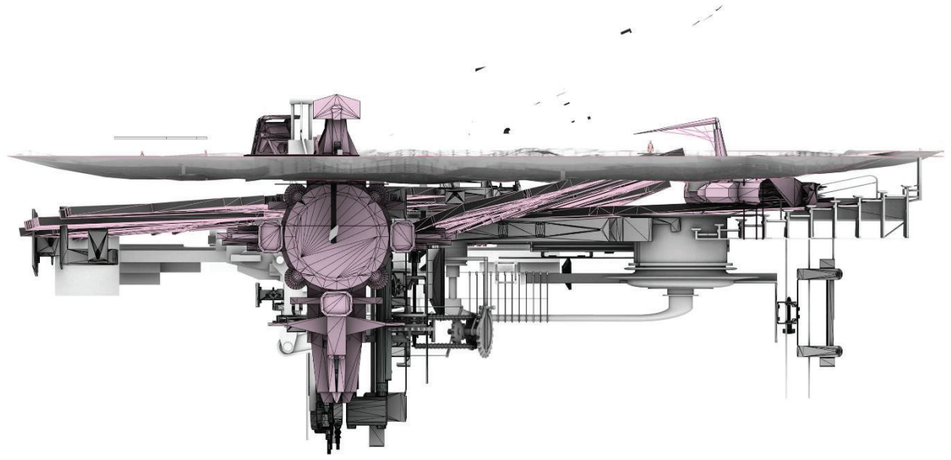


Fig. 4 Elevation of site construct, Karina Deschamps. 2021

model, but how to capture the energy of a sketch model within the digital workspace. Slicing up cardboard and hot glue can sometimes make for the most interesting and provocative models. Messiness works in their favor, the maker is actively thinking through making. The materiality of the model and the quickness with which the glue dries allow for a call and response to occur. Each new piece, cut, or fold is a response to the last, all weaving together into something new. The new-ness is not preconceived, but instead emerges from the crafting of the composition.

When speaking about her writing process, Jane Hirshfield describes poems as "vessels of transformation… the glass crucible that a chemical reaction takes place in."[2] She is suggesting that the poem is not a simple sum of its parts, but through the construction of the poem, its contents have been transformed into something new. When successful, digital models can be a place of transformation. They can be a medium within which preconceived notions can fall away, and new-ness can emerge through making. Hirschfield continues:

> The only thing I knew when I started this poem was the opening words of it. *Let them not say*. Those words came into my mind, and then the next words came into my mind. *We did not see it*, and then the next words came into my mind, *we saw*. I had some sense that during that time, this was written in 2014, writing into the crisis of the biosphere was much on my mind. So that was in my unconscious. But consciously, when I write a poem, I listen. I almost never have a preconceived idea of what I'm trying to do or how I'm trying to do it. I have something that troubles me, that fractures me, that requires a different kind of thought and feeling in order to be worked through. And out of that sense, some words will come. I think a poem is a collaboration of conscious and unconscious minds, the way a dream is.

Hirshfield is thinking and making, or rather thinking through making. Space Junk as a project attempts to foster this approach in a digital studio through the construction of a digital assemblage.

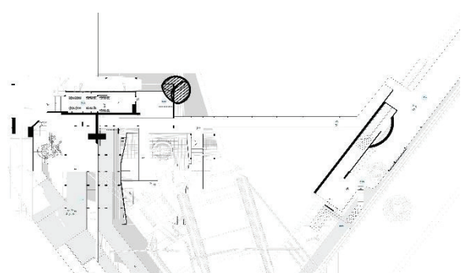


Fig. 5 First floor plan, Vicente Fernandez, 2021

Constructing Site

The digital assemblage allows the students to create a matrix of experiential space with an overarching conceptual narrative. The assemblage's incompleteness and fragmented nature present opportunity for them to be occupied at various scales, times, or ways. When writing about architectural drawings, Perry Kulper describes this openness he allows himself as "…a belief that in drawings material is conceptual, temporality is malleable, and gravity might go missing, have afforded alternative design considerations that value both the language of architecture and the language of representation."[3]

Utilizing the digital assemblage as site provides opportunity to speculate on the nature of site, and allow opportunity for architectural languages to emerge. The matrix of the site becomes an open world, not unlike a video game, within which the occupant can move about. An "open world" video game is one in which the player can roam freely, approaching tasks as they wish. The event, or storyline, is constructed by the decisions of the play, the decision to walk left or right at a fork in the road changes the narrative of the game. Unlike strict storylines, or linear paths, the junk model site provides endless opportunity for engagement.

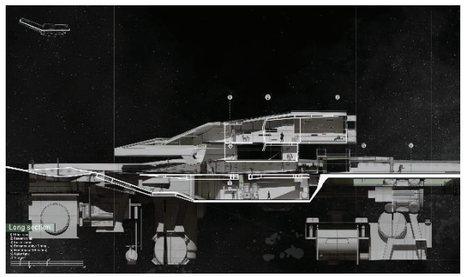


Fig. 6 Longitudinal Section, Jose Spence, 2021

Intervention – Towards Building

While the initial site assemblage was a speculative construction with fluctuating scales and orientations, the second component of the project was to respond to the site with the construction of an occupiable laboratory (see fig. 5.) This move towards a "building," though a gestural and loose design, created a situation in which the students were tasked with responding to their own speculative constructions. Through the creation of the

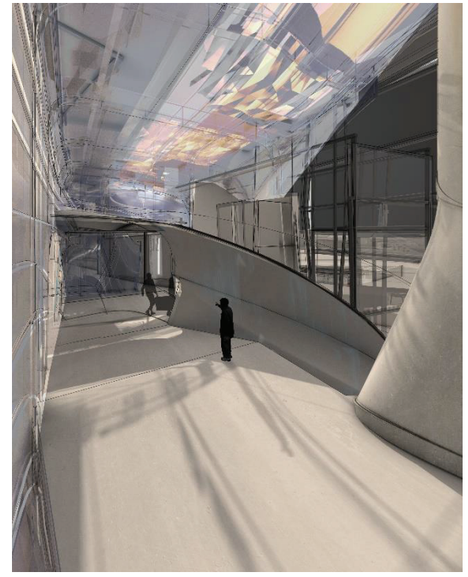


Fig. 7 Interior Perspective, Lilit Uzunyan. 2021

narrative of the site and the physical geometry, rhythm, space, etc, the students constructed their own world within which they could work. This opened both opportunities for speculation, but also created internal constraints within the project to which the students must respond. Unforeseen relationships and complexities arise when working with any site, and negotiating between your preconception of the place and the realities of the place once you begin to work within it. This allows the project to question notions of "site," acknowledging that all sites are constructed with underlying logics and relationships that architects are tasked with mediating and responding to.

Both the duality of the site and the intervention give the student agency to craft their own world but also burdens them with the task of responding to the internal logic of their creation. A constructed site floating in space solved several issues the online studio was facing: the inability to gather in an urban place and go on a site visit. The creation of a speculative site leveled the playing field between students with disparate backgrounds. It did not matter whether the student was raised in an urban or rural setting, whether they had traveled or not, it did not matter if they were attending the zoom lectures from their apartment or a farmhouse. The requirement to intervene within the site caused a rigorous examination of the speculative construction.

Resolution – Drawing for Screens

The strange nature of an online architecture studio is that no physical artifacts are created. The world within which the studio works is bound by the screen. Through use of the digital junk model, the project seeks to capture spirit of speculative physical model making, but what is the final product? Is the digital model the product? Should it be inhabited as an immersive environment through VR? The answer for the studio was to construct the drawings so that they conveyed the architecture and the conceptual narrative of the project. The final presentation included renderings, line drawings, GIFs and short video clips.

The studio referenced the representation of video games and virtual reality world-building to saturate the drawings with narrative and feelings, conveying the story of the projects. The goal was to balance clarity of the communication of the design intent, with the experiential and conceptual core of the project.

Conclusion

The construction of speculative digital assemblages is a useful exercise for capturing the intuitive quality of physical model building in a digital model space. Moreover, constructing the assemblage from “digital junk” provides a catalyst, jump-starting the assemblage through reuse of existing geometry. By constructing a digital assemblage from found parts (site) and then responding to it with an architectural intervention (building) Space Junk is a combination of exploration and reflection. Because the speculative assemblage becomes site, it must be rigorously analyzed for the construction of the architectural intervention. The project simultaneously looks to the industrial and mechanical past while gesturing towards the digital future.

End Notes

1. Odegard, “When Matter Comes to Matter – Working Pedagogically with Junk Materials.” 387-400.
2. Klein, “The Art of Noticing – and Appreciating – Our Dizzying World.”
3. Chard and Kulper, Pamphlet Architecture 34: Fathoming the Unfathomable.” 12.

Bibliography

Bethesda Game Studios. *Fallout 4.* Bethesda Softworks. Play Station 4. 2015.

Klein, Ezra. “The Art of Noticing - and Appreciating - Our Dizzying World.” The Ezra Klein Show (podcast), 2023. Accessed March 6, 2023. https://www.nytimes.com/2023/03/03/podcasts/ezra-klein-podcast-transcript-jane-hirshfield.html.

Nat Chard and Perry Kulper, Pamphlet Architecture 34: Fathoming the Unfathomable (Princeton Architectural Press, 2013).

Odegard, Nina. “When Matter Comes to Matter - Working Pedagogically with Junk Materials.” Education Inquiry 3, no. 3 (2012): 387–400. https://doi.org/10.3402/edui.v3i3.22042.

Summers, Martin. “Disruptive Continuity [Explorations in-Form].” TxA Emerging Design + Technology, 2016, 24–32.

Speculation and Spatialization: The Role of Gesture Drawing in Design School

Daniel Moore
Louisiana Tech University School of Design

Introduction

" 'Gesture' drawing is a technique of very rapid drawing, one drawing after another, perhaps fifteen scribbled drawings accomplished in fifteen minutes or less," (Edwards 139).

Gesture drawing, while used often as the preliminary step of figure drawing, can be applied to any kind of observational drawing. This process encourages the artist to quickly scan three-dimensional forms and plot the landmarks on the page while connecting them with lines that express the overall character of the subject. Some drawing instructors refer to the ninety / ten rule; ninety percent of the time we look at the subject, ten percent of the time we look at our page. Gesture drawing is pure response to the subject. This prevents us from erasing, pausing, or closely analyzing the marks we make.

Because of this, artists learn not only to ignore mistakes on the page, but use those mistakes to further inform the drawing - we move things and make corrections while leaving the history of the drawing visible. Forms emerge from the chaos of marks on the page and, with enough practice, those forms can be relatively accurate representations of the subject in terms of scale, proportion, and perspective.

"The movement of your hand should duplicate the movement of your eyes as you scan the figure for proportion and general disposition," (Rockman 105).

By making quick, loose, searching lines without erasing, making marks that move through the form helps artists create symmetrical shapes and maintain consistent perspective planes while drawing from observation. While drawing an ellipse at the bottom of a cylinder, for example, students are told to draw through the ellipse several times, while looking at the subject, until the form starts to emerge from the marks. During this process students are drawing surface landmarks not visible from their own vantage point. Gesture drawing is sometimes considered merely "part of the process," but it may be a beginning design student's first opportunity to surmise what happens to a form beyond their field of vision. This paper explores how observational drawing, specifically responsive, gestural mark-making, can encourage the next generation of designers to not merely look at a subject, but to see, feel, experience, and speculate what happens around and within three dimensional forms beyond the known side. It will explain specific changes made to Communication Skills 1, a foundations-level observational drawing course at the Louisiana Tech University School of Design, and how those changes impacted the work produced in consecutive design course in the first-year curriculum.

What We Did

In fall quarter, the foundations faculty chose to increase the role of drawing in all first-year classes in order to improve communication between students and faculty while designing projects throughout the school year. We wanted to emphasize drawing in the first year of design school so it would continue into second year, which is when our students begin computer-based courses. We wanted to see more thumbnails, more brain-storming, and more iterations from our students. Furthermore, we also wanted to see our students thrive as craftspeople during and after their college career.

We adapted the materials list for the course. Two sketchbooks were required for Communication Skills 1, a large, heavy weight mixed-media book and a small moleskin book. The students were required to have at least one book and and drawing tool with them at all times. Grade weights were adjusted. Sketchbooks made up approximately fifty percent of the total grade for the course, while midterm portfolio, final portfolio, and final project made up the rest. We also wanted to monitor student's progress in the sketchbooks; if students were working at an appropriate pace, if topics were understood, etc. The faculty graded sketchbooks about every two weeks. This resulted in earlier and more frequent feedback which lead to better communication between the students and faculty throughout the quarter. We knew what topics the students

were interested in, what topics the students needed to spend more time with, and what explanations needed to be repeated.

Classes frequently consisted of on-site drawings and the students individually decided which sketchbook, the larger or the smaller, they brought onto the location. Each sketchbook check we looked for a certain number of drawings (which had to be observation-based and related to the topic at hand. Students sometimes had to submit both sketchbooks to meet the required number. This made grading time-consuming but gave instructors tools to provide more guided feedback. Each day had a clear goal that was a response to the needs of the students.

The additional sketchbook was almost the only notable change to Communication Skills 1. The topics were mostly taught in the same order as previous years and the pacing was about the same. We spent more time outside, on-site, making more drawings. This process encouraged students to work faster. More than in previous years, some students purchased an additional sketchbook (beyond the required). Students are normally discourage erasing at the beginning of the drawing course; students get stuck perfecting the same line over and over. But this year some students expressed interest in drawing with ink pens. The students using pens worked faster and learned to work through the mistakes, staying on the same page and working over the marks rather than erasing or merely starting the drawing over.

It seemed like the drawings were less precious to the students, each page was treated like a stepping stone to something else. Students learned earlier in the course that mistakes are a good thing. In previous years, the majority of the grade has come from large drawings in newsprint or heavy drawing paper. The smaller sketchbooks this year felt less like a commitment, possibly. The drawings were more investigative, expressive, and communicated better. Our students were not discouraged by mistakes. If the drawing was not good, the students knew they could start over. The thing is, after a while, they started over less and less. More, smaller drawings allowed them to embrace the process.

We introduced all the topics in the same order as previous years, and the in-class assignments were generally the same except days when we went somewhere on campus. When we had "sketchbook days," however, the students primarily worked gesturally. As the quarter progressed, the gesture drawings included sighting and measuring techniques, and the use of landmarks became more apparent. Almost every week there was one class day dedicated to reiterating the idea of loose, gestural mark-making.

Fig. 1, Student Work.

The Outcome

The increased focus on fast mark-making resulted in more, immediate, and thoughtful feedback. Sometimes sketches were used as thumbnails for larger, polished drawings. On the larger works, while they should begin loose and gestural, students can be more selective with their marks, refining lines and including value shapes while still finding the forms. Smaller sketchbooks (and ink pens) allowed students to iterate faster and show teachers what they were planning on doing in the larger work. The instructors could trouble-shoot earlier, but, more importantly, we could identify gaps in instruction sooner, before larger drawings were made. We could not only identify these gaps sooner, but determine wether the issue was one student's misunderstanding the topic or assignment, or if multiple students needed assistance. We knew rather quickly if we needed to introduce a topic again, or differently, or in a different location with different examples to study from.

We have observed that this method of thinking, that small things are just iterations leading up to something bigger, has carried over into the next courses. We have always used iterations to construct models and drawings. What is new is that the iterations are now worth more points relative to the end result. Both the next drawing course and the next studio have seen improved communication between students and instructors. The studio is about making drawings that turn in to models. Building up drawings gesturally is not unlike constructing a three-dimensional form. We start with the bottom, add, cover up, add more, fill-in, remove, etc. The preliminary drawings we saw in Design 2, that would eventually lead to finished drawings, models, or both, were shape-based rather than line-based and contained value, volume, and depth. The students this year were also better at explaining drawings to their instructors. Students were thinking more volumetrically. The models were made faster and the drawings (the finished drawings) were overall cleaner with more expressive range in value and line weight.

Fig. 2, Student Work.

The iterations of models this year (compared to previous years) were also looser, more expressive, and more dynamic. Beginning design students often start by drawing closed shapes using single lines. This could be compared to drawings being either volume- or line- based. With models, sometimes students focus too much on planes, making single-walled solid shapes. These take too long, usually contain little expression, and do not always communicate what the designer's intention is (beyond making a closed, single-walled solid). Gesture drawing comes from figure drawing, where we study the underlying form to better understand the surface (and, ultimately, the lines and edge quality we should use to best describe moments of the body). We think about the form from the inside out. Where is the structure, where is the axis of symmetry, how much material is between it an the outermost layer, is that material hard or soft? Inside out. This drawing method gets taught in most drawing courses, but frequently students struggle to understand and implement it successfully until figure drawing or even advanced drawing courses. First-year students were using this method of thinking in Communication Skills 1 this year, and, perhaps without knowing, used it in their model-making the following quarter.

Models frequently consisted of found objects adhered, usually glued but sometimes held with string, tape, or drafting dots, to other objects, but growing outward from a central point the way planets are formed in outer space, clumping together a little, then consecutive layers all the way

around. Some sketch models had specific parameters and had to exist on a flat surface, a table or a large paper with at series of dots serving as a site. But sometimes the parameters were less strict. Models could be designed to be suspended from the ceiling or attach to a wall. One project consisted of gesture drawings on trace paper. The drawings were then cut out and hung from the ceiling. The goal was to think about the shadows on the wall and how they would impact the shadows of other drawings and shadows on other projects. The shadows on the wall became gestural drawings themselves, building their own densities and thinnesses. The shadows eventually merged and the shadow gesture on the wall became poetic in a sense, after a great deal of collaboration among the class. The students began looking or opportunities to enhance the rhythm or the intensity of the shadows. Everything is gesture and everything is drawing.

Fig. 3, Student Work.

Students were still thinking about projects gesturally. Loose, quick decisions made in response to the underlying layer. They stacked marks and subtracted marks and stacked more. Gestural mark-making, and in a sense, drawing, made its way into this three-dimensional coursework. Students' method of thinking and responsive mark-making bounced back and forth from two-dimensional working, to three- dimensions, and back. They were imaging and understanding the known layer (the underneath) and the next consecutive layer (one that at the time did not yet exist) simultaneously. The models were faster, more expressive, more investigative, and somehow more articulate. We made more models and they were better. The sketch models, like the thumbnails, became less precious. Foundation Design 2 is based around more refined drawings of designs, and

precise models addressing circulation, mood, and material of hypothetical buildings. The models this year were more adventurous.

There are other potential benefits to structuring a foundations corse around sketchbook practice that might be explored in the future. This could possibly shift the required materials course for that class to include either fewer materials or smaller sizes of the materials students are required to purchase. The instructors of Communication Skills 1 were careful not to disrupt the order of topics being taught and we do not want to remove content from the course. We are teaching young designers and craftspeople. A variety of techniques should be taught to the beginning design student.

But we want courses to be accessible to everyone and more affordable materials lists is worth consideration.
We are also considering what might happen if observational drawing classes, or perhaps even a conceptual drawing class, are introduced to the second and third year curricula. Future drawing projects in advanced classes could address topics like time and narrative and that research might inform larger projects.

Observational drawing might also serve as a productive way to break from larger design projects in upper-level courses. The ability to take a short, effective break before coming back to the studio is a difficult skill for students to master. Too often, short breaks turn into long breaks because of cell phones and social media. And those "breaks" can be so filled with constant input from screens that the designer is unable to use that time to rest. Loose, responsive drawing and model-making might be a solution.

Conclusion

The changes made to Communication Skills 1 caused immediate improvements in the course, both in terms of quality of work, quantity of work, and it improved communication between students and faculty. The instructors better understood what topics were understood and how to improve the pacing and instruction of course material in the future. Students learned to work quickly while making multiple iterations. This process improved work in this class.

The surprising change happened in the consecutive courses. Thinking about things quickly, responsively, and gesturally has had an impact on the current students' work since taking Communication Skills 1. Hopefully, those lessons will continue to have an impact. We aim to keep improving coursework and remain responsive to the needs of our students.

This paper is a response to the hard work of the foundations faculty at the Louisiana Tech University School of Design. Collaboration with colleagues Kaden Beilman, Will Doss, An Le, and Clark Malchow has led to a lot of great work. Special thanks to Nicole Duet, who taught me good sketchbook practice, whose classes inspired a lot of the changes mentioned in this paper, and who inspires me to be a better educator.

"Because its aims are gradual and cumulative, drawing is a discipline, an organizing and training and honing of the imagination so that one may be ready to work spontaneously whenever called upon," (Steinhart 23).

All work shown was created by students of the Louisiana Tech University School of Design.

Bibliography

Edwards, Betty. Drawing on the Artist Within. New York: Simon & Schuster, Inc., 1987.

Rockman, Deborah A. The Art of Teaching Art. New York: Oxford University Press, 2000.

Steinhart, Peter. The Undressed Art. Why We Draw. New York: Random House, Inc., 2004.

Choose Your Own Technology

Margaret McManus, Savannah College of Art and Design

The Introduction

In the spirit of mutual mentorship and embracing instructors' roles as facilitators of learning and not just professors of knowledge, this paper will look at engaging technology in design education as it ever-evolves while looking at aspects of choice in design assignments.

It is difficult for anyone to keep up with the pace in which technology changes, updates, or rolls out new software editions. In design education it can be a herculean effort to not only stay abreast of such changes but to also feel obligated to be an expert on it enough to teach it. In response, this paper looks at a prototypical assignment that fosters a CYOT approach (Choose Your Own Technology) that encourages groups of students to research various new (and not-so-new) technologies that advance their learning. In addition, they are tasked with applying their understanding through various outcomes of their design projects. Technology engaged ranges from 3D software to 3D physical modelling, employing laser cutter techniques and/or 3D printers to engaging motion media and virtual reality in their design manifestations. The evaluation and assessment of such an assignment facilitates and promotes peer-to-peer learning and mutual mentorship between faculty and students.

The Motivation

The pedagogy of this assignment stemmed from the covid break that removed students from many of the resources provided by universities that they may have typically encountered when on-ground in studio. Students likely missed the time necessary to study and incorporate different technology in their assignments while learning remotely. So, without putting the extra pressure (or burden) on teachers to introduce vast amounts of technology and/or resources that may have lapsed in the remote setting, an opportunity could be crafted that was beneficial to both students and teachers: a mutual mentorship assignment. The CYOT assignment was born, and it fulfilled a variety of needs in the post-pandemic course: it encouraged both

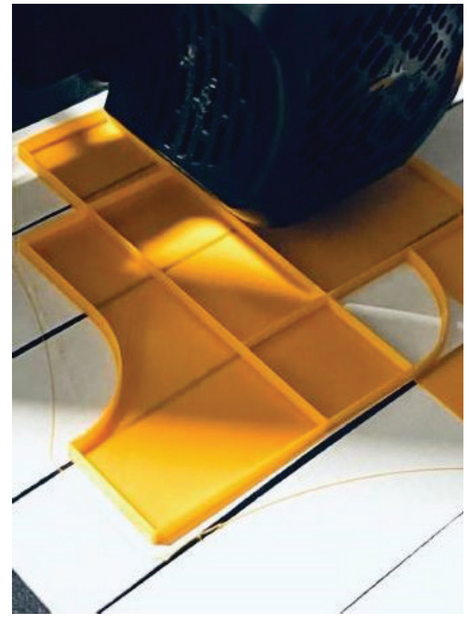


Fig. 1: Above is a process image of a student exploring 3D printing.

team and independent research; peer-to-peer engagement; it implemented personal choice which coincides with student engagement and risk-taking; and it considered both research and the implementation of research in an adjacent, parallel studio project.

For further context, this assignment took place in a fourth-year architecture studio with a cohort that spent up to two formative years of their design education at home, remote, away from university resources. And even prior to the pandemic break, benefits of mutual mentorship have been encouraged has been encouraged. This according to an article that Harvard University published in 2016 titled "Students as Teachers; Exploring the mutual benefits of peer-to-peer teaching — and strategies to encourage it." The article further notes that “students teaching students is an authentic way to build confidence, leadership, and empathy.”

The approach of the CYOT assignment fosters documented research on specific technology before implementing practices learned in their studio projects. Many students of this cohort felt behind in their knowledge of new technology having done much work siloed from their peers. This assignment tasked them with fast-tracking their understanding of various current trends of the architectural industry at large and it promoted more innovative designs and opportunities for physical fabrication in their own projects. Additionally, the assignment had both group and individual components so that peer-to-peer learning took place.

Student Choice in Education

According to an article from Wiley University Services in 2020 titled, “Addressing Student Choice in Assignment Submissions," author Adam Shaw states “newer instructional models and technology support [allow] students the opportunity to demonstrate their learning in unique ways that are relevant to their learning preferences, career goals, and more." While there was other motivation to invite student choice in this particular assignment (as mentioned above), the post-research done on the advantages for allowing choice in assignments can further this assignment and others to new avenues in the future. Shaw also mentions UDL or Universal Design Learning as a current framework for understanding that students inevitably learn differently and have a variety of preferences for demonstrating or applying learning. The CYOT approach responds to such a framework by allowing for freedom of process and implementation of research.

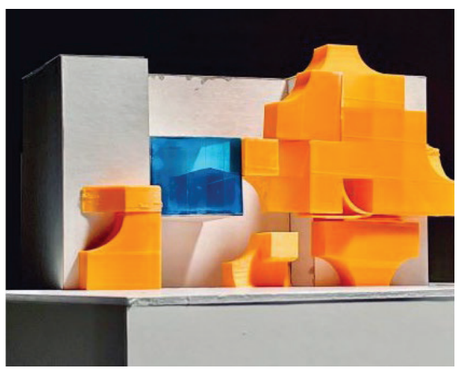


Fig. 2: The image above showcases a student's final model; highlighting modular elements of unusual shapes that have been 3D printed.

The Assignment

The CYOT: Choose your own technology research assignment facilitates individual and group research and brainstorming and is to be closely tied to the students' final studio work. Students will choose their own technology from a given list and apply it to their class project. The goal is not that students just ‘use’ the technology, but that they explore it with rigor and understand the strengths and value that the technology can bring to architecture and/or the representation of architecture. It is encouraged that the research be done with peers who have similar interests, yet each student will be required to include their own CYOT research and outcome as a deliverable of the assignment. Research should pertain to the inspiration, knowledge, and application of technology in their studio projects and should focus on the students' own interests and inspiration as well as current, innovative, industry applications of the topic(s). The relevance of the CYOT research it to be evident and presented in each students’ final studio project.

The Technology Topics:

- **Laser Cutter** (To be used in innovative ways that take advantage of the properties of the machine)
- **3D Printer / CNC** (To be used not as an output print of your "project" but as an integrated, intelligent component that takes advantage of the inherent properties of this methodology).
- **Animation / Motion Graphics or VR** (software such as Adobe After Effects, Adobe Premiere, Unreal Engine, etc. to be considered—free trials may be necessary)
- **Grasshopper** (Rhino plugin for complex algorithms: see tutorials on LinkedIn Learning)
- **Tech X**: Make a proposal. Let’s chat about new technology or software that could be implemented in the process, output, or presentation of the studio project.

Note: some students may be interested in more than one topic, and this is encouraged! However, for this assignment no extra credit was given for taking on more than one topic. Instead, the reward should come in the form of bonus portfolio work and desirable and hirable skills necessary for the profession!

Evaluation of the assignment came under four main topics: 1. Assignment Objective: Has the student engaged the assignment with critical thinking and visual, graphic analysis in the form of exploratory, informative, legible pages that including the required assignment content deliverables? 40/100 2. Documentation Clarity/Craft: Has the student presented their work in a professional manner: showcasing both manual and/or digital craft and attention to final professional quality output; consistent page spreads with attention to color, hierarchies, alignments, text/captions, and layout organizations where applicable. 30/100 3. Risk/Ambition: Did the student consider a range of possibilities/solutions relative to the assignment or use the easiest/most obvious (standard) approach? Does the work go beyond the parameters of the individual assignment in terms of creativity, and originality? 20/100 4. Professionalism/Participation/Timeliness: Has the student been prepared for class review and discussions related to the assignment and have they submitted the assignment in a complete and timely manner with proper naming convention? 10/10

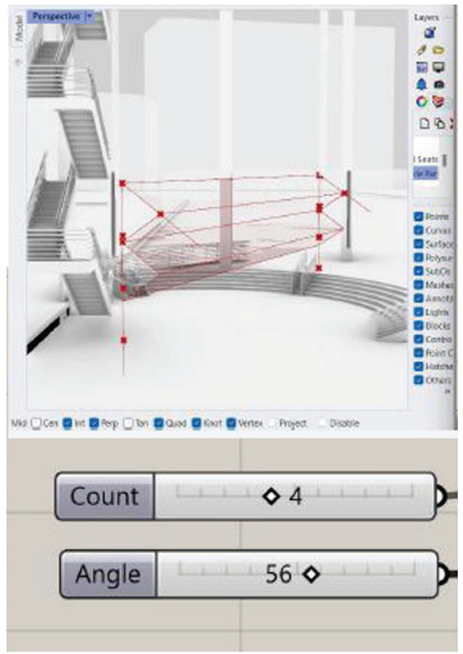


Fig. 3: The image above represents a screen shot of process work the student had captured as she was experimenting in Grasshopper with overhead retractable enclosures for her studio project.

Project Deliverables were in the form of captured and composed research pages and process images that were to be part of holistic studio Basis of Design Booklet for the entirety of the quarter. The Project Schedule from introduction to submission due dates was three days shy of a month. Despite what might appear to be a lengthy assignment, it was running parallel to design deliverables for their own architecture project. Additionally, as highlighted under The Results section below, time would prove to be a key factor in the successes, failures, and/or pivots of the student technology implementations.

The Results

In addition to the technology research and implementation choices given, the students also had to choose their own output scale for communicating specific intentions through physical models. All physical models were to take advantage of the specific benefits of digital fabrication methods and not meant for mere replication or likeness. Students could choose to focus on technology implementation at the scale of an urban condition, the scale of an interior, or perhaps the scale of a detail. Decisions and communication are of the utmost importance in the design education of students, and allowing students to choose from a variety of technology interests and outputs can further their learning and engagement of the unknown, it can give them the excuse they need to push themselves into developing skills they were unfamiliar with, and it can promote risk-taking and creativity in design.

A fairly consistent result of this assignment, was that most of the students ended up gravitating towards laser cutting. And while this is not a “new” technology, it is a resource that not many students had access to prior. Post-pandemic, it was paramount that all students get an opportunity to explore much of the resources that were inaccessible over the two-year remote learning. Another technology choice in the form of 3D printing can be seen in figures 1 and 2 where the student experimented with odd modular shapes as a primary design element in her project. The physical output of experimentation was complimented with graphic pages of research in which the student looked at the following printing methods of production: material extrusion, vat polymerization, power bed fusion, multi-jet fusion, material jetting, and sheet lamination. (Noting all of the above *could* be difficult to become an expert on as a design instructor). The students were also tasked with researching various

uses--whether industry or industry adjacent--of the various technology; noting that 3D printing plays a significant role in industrial and medical departments.

"While learning Grasshopper, I realize that it is a lot easier than I though. You're completing the same commands that you would in Rhino alone, but you are now making parameters that can allow you to easier change your creation. This saves a lot of time and can increase the growth of a design."

Above, a student reflects on her approach to Grasshopper software. The same student's work is evident in Figure 3 where she notes that Grasshopper and Rhino allowed her to design a retractable wall, and that the path allowed her to manipulate the folds of the wall. As for images 4 and 5, the student was able to capture characteristics of a weave for a façade study, however the time didn't allow for an iterative process where an actual weave could have been experimented with via laser cutter or more ideally via 3D printing. The image in figure 5 is a rendering of a prototype that was to be 3D printed. The print would interlock shapes and therefor allow for movement when released from support materials.

An article from Kappan Online titled "To engage students, give them meaningful choices in the classroom," stated a broad common result to that of giving choice in education: "When students associate feelings of autonomy, competence, and relatedness with choice, then choice is most likely to result in beneficial outcomes, such as student engagement." This quote rings true for the broad results of the assignment. But it should be noted that while there were logistical struggles throughout many student attempts, understanding that the assignment was premised on trial, error, and experimentation--rather than a successful output, the freedom of choice for this particular assignment allowed them to understand their own approaches and process to a creative solution.

The Afterthoughts

This particular CYOT assignment has been implemented just once as presented in this paper, and there are certainly varied approaches and improvements that should be considered if taking this on again. Time and ambition were big factors in the students' response to the assignment. While it appeared to be met with much enthusiasm, a (potential) downfall to this assignment had to do with real factors of time when considering school-wide shared equipment and learning curves with new software. Students interested in researching and implementing animation software and virtual reality aspects had to undergo some steep learning curves on the front end of the assignment. If time management wasn't successful, this could not be completed, as was the case for some students. At the other end of the spectrum, endeavors like 3D printing and laser cutting have in-school time constraints on the back end or production end that can be wildly unpredictable at the end of a quarter or semester (when the assignment was due). So once again, if time management wasn't accurate this hindered the output of the projects. Some ways students moved around this challenge was to use their own or classmates' 3D printers, or others jumped to software technology like Grasshopper (not reliant on a queue!) to fulfill their requirements of the assignment.

The latter--or the pivot in the chosen technology--was an unforeseen conclusion and it was not an ideal scenario for the project. Therefore, it should be noted that if attempting a CYOT assignment, perhaps it should be introduced sooner in the quarter or semester so that

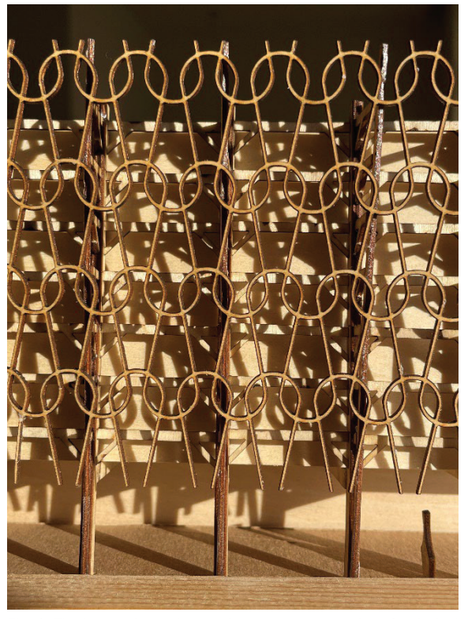


Fig. 4: The image above shows a laser cut representation of a desired weave-effect the student had designed for his studio project.

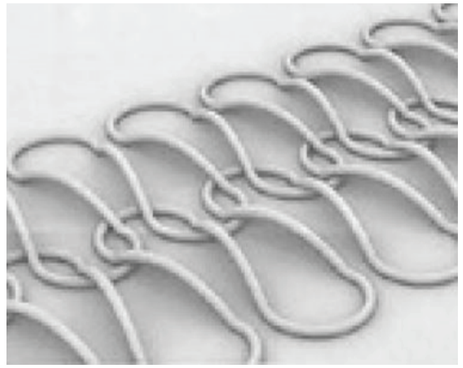


Fig. 5: The image above represents a 3D modeled portion of a skin façade that was to be 3D printed and applied to a physical architectural model.

there is time for students to consider the various technologies, the implementations of use, and the one-on-one computer engagement.

Referring to post-research on educational assignments that allow for student choice, Adam Shaw from Wiley University Services recommends two very important approaches: 1. "Allow Students to Choose their Medium." As this was the basis of the CYOT assignment --it assisted in various ways to cater to certain preferences of diverse modes of learning and experimenting. The second recommendation: "Build in Goal Setting," reinforces the aspect of time that would vary in the completion of such an assignment. This latter approach could help with overall time management of the project and ultimately, it is a real-world, professional component related to a world of "deadlines" in the architecture and design industry and that should not be understated.

"I have always wanted to use Grasshopper, but my fear limited me." We can take from this student's quote in reference to the CYOT assignment that there is a want and desire to learn new software and to experiment with (new) technology. But as instructors, we know there are often other primary course goals to meet in beginning design courses. Nonetheless, we can integrate these opportunities in an 'trial and error' manner by mandating that students "try." And with that, we can choose to evaluate such opportunities or assignments by rewarding research and trials and not necessarily successful outputs.

This idea of "choosing your own technology" is not about technology at all, it is really about encouraging experimentation and self-directed research that can benefit classmates, teachers, and self. And while this particular pedagogy was put into one assignment, it is meant to instill in students a courage to approach and to choose independent research well beyond a given assignment.

Bibliography

Bartell, Tonya, Novak, Jodie, and Parker, Frieda. "To Engage Students, Give Them Meaningful Choices in the Classroom." Kappanonline.Org (blog), October 2, 2017. https://kappanonline.org/engage-students-give-meaningful-choices-classroom/.

Lander, Jessica. Harvard Graduate School of Education. "Students as Teachers." Accessed March 9, 2023. https://www.gse.harvard.edu/uk/blog/students-teachers.

Lewis, Lindsay, Dworkin and Karyn. "To Help Students Recover from the Pandemic, Education Leaders Must Prioritize Equity and Evidence." Brookings (blog), October 13, 2021. https://www.brookings.edu/blog/brown-center-chalkboard/2021/10/13/to-help-students-recover-from-the-pandemic-education-leaders-must-prioritize-equity-and-evidence/.

Shaw, Adam, Center for Teaching and Learning | Wiley Education Services. "Addressing Student Choice in Assignment Submissions," May 19, 2020. https://ctl.wiley.com/addressing-student-choice-in-assignment-submissions/.

Turner, Cory. "6 Things We've Learned about How the Pandemic Disrupted Learning." NPR, June 22, 2022, sec. Education. https://www.npr.org/2022/06/22/1105970186/pandemic-learning-loss-findings.

Learning From Leftovers:
Integrating Scripting in Design Studios

Nate Imai, Texas Tech University
Matthew Conway, UCLA + USC

Introduction

This paper frames small-scale odd lots as a pedagogical territory for introducing and integrating foundational scripting skills in design studios. The investigation documents the methods and results of a second-year Master of Architecture studio in which students developed scripts to identify "leftover lots" as sites for innovative housing solutions in downtown urban areas.

Beginning with the question *"how can digital cartographic tools be leveraged to increase cities' density through small-scale odd lots?"* students in this course developed custom mapping tools for locating residual parcels. Lot searching software tools created in this class were used to analyze locational data as well as shape metrics to determine a set of parcels for testing and applying architectural strategies at an urban scale.

The studio focused on Lubbock—one of the fastest growing cities in the state of Texas—and responded to the city's 2040 Comprehensive Plan and proposed form-based Unified Development Code (UDC) that establishes parameters for future development. The topic of housing served as a design framework for informing the development of the digital cartographic tools within the class, giving form to the vision outlined in the 2040 Plan and UDC. The students' work additionally addressed Lubbock's need to diversify and expand its housing stock in response to the city's recent 12% population growth while reducing infrastructural strain through urban density.

In the studio's first phase, students worked in teams to conduct case studies on Gordon Matta-Clark's *Reality Properties: Fake Estates*, Atelier Bow-Wow's *Pet Architecture Guide Book*, Office Jonathan Tate's *The Starter Home**, and Nicholas de Monchaux's *Local Code: 3,659 Proposals About Data, Design, and the Nature of Cities* that served to ground the work and develop rule sets for describing and measuring odd lots. In the second phase students worked collectively to learn and develop computational cartographic tools for identifying and representing small-scale odd lots and their potential buildable massing throughout Downtown Lubbock. In the third phase students worked independently to customize the mapping tool developed by the class to identify and rank a set of thirty-six parcels that best addressed a housing demographic of their own choosing. In the final phase students developed a design intervention strategy that was applied at an urban scale across all thirty-six sites and at an architectural scale among two select parcels.

This studio was conducted in collaboration with the City of Lubbock, and the final projects were exhibited to a group of city officials that included Lubbock's Mayor, the City Council, the Tax Increment Financing (TIF) District Board, the Lubbock Downtown Development Corporation, and local real-estate professionals. This paper documents the studio's methodology, student outcomes, and discusses how the approach developed in the class can serve as an example for introducing and integrating scripting skills in architecture design studios.

Context

From a pedagogical standpoint this course identifies critical thinking about digital tools and foundational skills in computational design as two necessary areas of focus for today's students of architecture. This is due to the ubiquitous presence of digital tools that define contemporary modes of architectural production and the need to identify and understand why certain instruments are appropriate for a job considering the growing number of software applications available for designers. This attitude is reflected by Stan Allen who observes that an emerging direction in today's architecture schools is the "emphasis on sophisticated applied research in computation," and that "writing code is now mandatory for advanced academic work."[1] With the tethering of architectural modes of production to computational processes, a critical understanding of the attributes and shortcomings of specific digital tools can empower designers to not only be in control and leverage them for specified aims, but also identify gaps in which the creation of new software instruments can lead to novel ways of thinking about space and spacemaking. This sentiment is echoed by Galo Canizares who proposes a "close scrutiny of the biases and blind spots of software

would: (1) empower users (in our case, architects and designers) to better utilize or select their tools, (2) enable users to contribute to software design, (3) expand the critical discourse of these obscure technologies, and (4) support a skepticism of systems that obfuscate more than they reveal."[2] Canizares identifies Building Information Modeling (BIM) as one example of an application deserving of increased attention from a pedagogical perspective. While BIM is a powerful documentation tool, "it is actively dismantling some principal conventions on which architecture has relied for hundreds of years: namely orthographic drawing."[3] For architecture students who consider using BIM or any software application in their design work, it is essential that they understand its intended applications and how they align or misalign with how they expect to use the tool.

Casey Reas further elaborates on the design opportunities afforded by teaching students computational thinking skills and how to code by asserting, "using software is not only about increasing our ability to work with large volumes of information; it also encourages new and different ways of thinking."[4] Knowing "proprietary software products are general tools designed for the production of specific types of forms," Reas advocates for the writing of new software "to move beyond common data representations" with the understanding that "new visualization techniques emerge as researchers and designers write software to fulfill their growing needs."[5] Regarding how computational thinking may be integrated in a design studio setting, Reas observes how "repetition is deeply embedded into the language of computing and therefore intrinsic to the way people are taught to program."[6] Design education is inherently iterative and through the practice of students generating work to which instructors respond and operates as a recursive feedback loop. Understanding this context, this investigation advocates for an approach that emphasizes and leverages repetition and iteration not only as a tool for design, but as a method for introducing and teaching computational thinking and scripting skills for students of architecture.

Methodology

Architecture Design + Research III is a six-credit hour studio for second-year Master of Architecture students enrolled at Texas Tech University during spring semester. This course was entitled "Thirty-Six Views of Lubbock, Texas," and students were asked to develop custom digital cartographic tools for increasing cities' density through small-scale odd lots. Utilizing GIS data with custom scripts, lot searching tools developed through this class analyzed locational data and shape metrics to determine a set of parcels for testing and applying architectural strategies at an urban scale.

Students taking this studio entered with a basic understanding of computational design and parametric modeling tools and had limited experience applying these techniques in a design studio setting. In this course students used Rhino's parametric modeling tool Grasshopper to translate their small-scale odd lot and housing research into a set of criteria they used to search and rank potential sites for housing within the city. By integrating this tool in a design studio setting, this course established a framework for students to both learn cartographic scripting skills and develop a critical attitude towards computational tools through their application of these instruments in their research and design projects.

The student learning objectives for the course were as follows: 1) understand how digital cartography can be leveraged to engage the disciplines of landscape architecture, planning and urban design; 2) apply digital cartography methods to develop tools for mapping architectural and urban relationships across large scales; 3) analyze geospatial data using a set of design criteria to reveal latent design opportunities at the urban scale; 4) evaluate opportunities for architectural interventions through a well-developed research questions; and 5) create novel design strategies for increasing density within cities through small-scale odd lot developments.

Assignment 01: Case Study Analysis

In Assignment 01 students worked in groups to understand and analyze from a historical perspective the relationship between small-scale odd lots and their urban contexts. Teams studied assigned precedent projects and through their analysis developed a graphic and conceptual understanding of how cartography and mapping methods have been leveraged within architecture to engage the disciplines of art, landscape architecture, planning, and urban design. Before engaging Grasshopper and digital cartographic methods, this assignment asked students to understand and define what constitutes a small-scale odd lot through the investigation of precedent projects. From their analysis, teams sought to answer the following questions: 1) where are the lots located within their urban setting, 2) how are the lots' geometry and form determined by their urban conditions, 3) what are the defining constraints for each lot (ex. setbacks, infrastructure, view corridors, etc.), and 4) what potential contributions do these lots make to their surrounding urban context?

The assigned case studies for this assignment were Gordon Matta-Clark's *Reality Properties: Fake Estates* (1973), Atelier Bow-Wow's *Pet Architecture Guide Book* (2001), Office of Jonathan Tate's (OJT) *The Starter Home** (2015), and Nicholas de Monchaux's *Local Code: 3,659 Proposals*

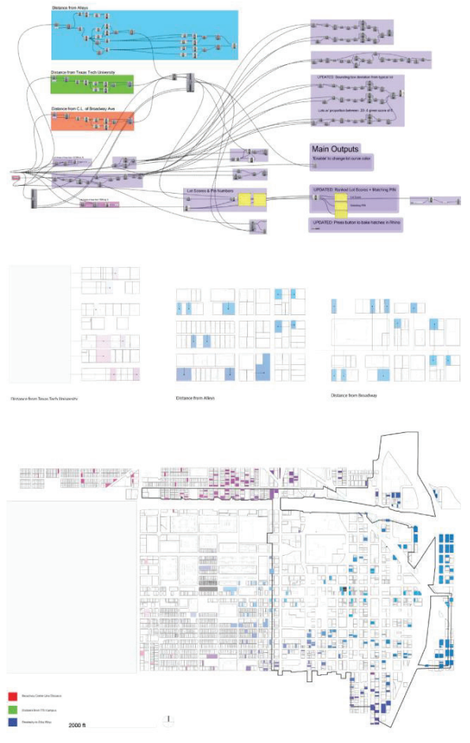


Fig. 1 Students used Grasshopper to develop customized mapping tools to locate a set of thirty-six parcels that addressed the housing needs of a demographic of their own choosing. Featured student work by Jose Herrera-Chavez.

About Data, Design, and the Nature of Cities (2016). Teams studied the assigned case studies through collected and curated reference images. They also generated site plans, plans, and isometrics of selected lots, as well as diagrams to understand common trends and reveal urban and architectural relationships. Teams collected, represented, and laid out their research using a standardized template file and drawing standards to establish comparative results across the studio. The collection of case study analyses served to establish a set of relationships and standards for defining small-scale odd lots for the subsequent phases of the semester.

Assignment 02: Odd Lot Atlas

In Assignment 02 students again worked in groups to identify and represent small-scale odd lot design opportunities in Downtown Lubbock. Teams researched specific areas of focus related to the overall aim of identifying odd lot parcels within the city. The four areas of research were: 1) the development of a custom script for finding odd lots within the city, 2) urban morphology and housing, 3) the City's 2040 Comprehensive Plan and Downtown Master Plan, and 4) zoning and the City's proposed Unified Development Code (UDC). Each team was responsible for understanding underlying issues through the research and collection of related information, applying knowledge through the production of synthesizing diagrams, and analyzing results in the form of a summarizing written statement.

Students also worked collectively as a class to generate an Odd Lot Atlas of the Downtown's Tax Increment Financing (TIF) District. Based upon the collective research, the class developed a quantifiable definition for small-scale odd lots. This definition was applied to create a customizable cartographic script that located and ranked lots within Lubbock's Downtown. The class then represented each lot and its buildable mass according to the UDC through a series of plan and isometric drawings.

Assignment 03: Thirty-Six Lots

In Assignment 03 students identified and documented a set of thirty-six small-scale lots as potential sites for future housing. Working individually, students developed a research question focused on how small-scale odd lots can be leveraged to provide innovative forms of housing and respond to contemporary urban issues. They were asked to

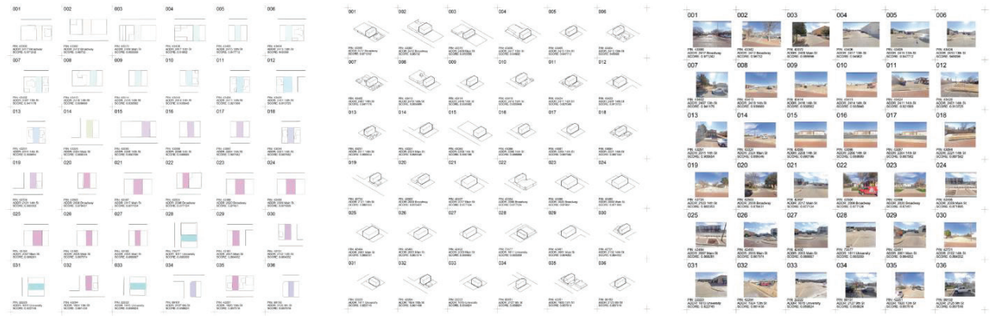


Fig. 2 The studio's emphasis on iteration and repetition encouraged students to think about their urban and architectural proposals systematically and provided a framework for building computational thinking. Featured student work by Jose Herrera-Chavez.

consider for whom they were designing for, what gaps in the housing market could be addressed, what architectural building types and programs may be engaged, and what impact their research will have on the surrounding urban context.

Students developed a definition for an optimum small-scale odd lot according to their research and translated their definition into a set of measurable criteria. This set of criteria was applied to create a customized script that identified and located thirty-six lots within Lubbock's Downtown (Figure 1). Students documented their set of thirty-six lots through site plans, street views, and isometrics (Figure 2). Additional research on each students' area of focus, synthesizing diagrams, and a summarizing written statement completed this phase of study.

Assignment 04: Thirty-Six Views

In Assignment 04 students developed an innovative architectural strategy to be applied on all thirty-six sites that addressed the issues related to their specific housing type. Working individually, they identified a set of architectural considerations in tandem with a tectonic system that served as a guiding logic for defining the building mass and its placement on each parcel. Students considered the needs of the demographic they were serving, the complexities of the sites, and the organization of the program associated with their housing type when designing their architectural strategy. This strategy was then applied on each site to develop a building massing that integrated the complex milieu of site, situation, and systems.

Students next identified a minimum of (2) parcels for (2) architectural proposals that developed the architectural strategy applied to all thirty-six sites in greater depth (Figure 3). Diagrams served to both inform and articulate the proposals' formal and organizational logics. Likewise, architectural drawing conventions were leveraged to both develop and document the projects' spatial organization and layout. Physical models served to test, evaluate, and represent the proposals' capacity to integrate the complexities of the project on separate sites.

As a set of proposals, the students' projects proposed thirty-six views for envisioning how small-scale odd lots could be leveraged to increase density and provide innovative forms of housing for Lubbock, Texas.

Results + Discussion

The overall effect of the studio's methodology that emphasized iteration and repetition was generally successful from both a teaching and learning perspective. Regarding the instruction of the class, the recursive nature of the course that both promoted iteration within the assigned deliverables and repetition from assignment to assignment not only facilitated teaching from instructor to students, but also from students to students. In Assignment 02 in which Grasshopper was introduced as a scripting tool, the author was able to work closely with two students to develop the customizable cartographic script for locating and ranking small-scale odd lots in the downtown area. In Assignment 03 where all students used Grasshopper to translate their housing research into a customized script for searching and ranking oddly shaped parcels, both the author and the students who worked on scripting in Assignment 02 served as teachers for the rest of the class. Furthermore, the shared set of deliverables assigned to

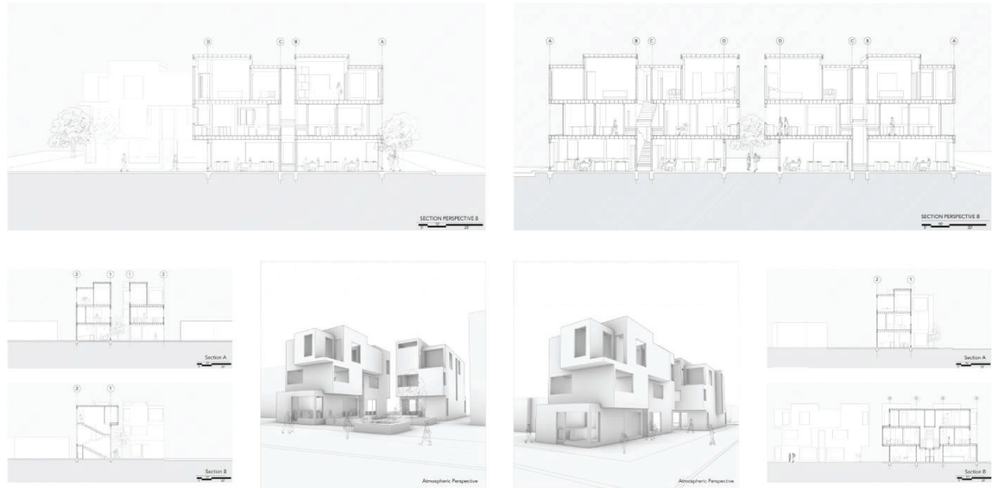


Fig. 3 After identifying their set of thirty-six parcels, students developed housing strategies that could adapt and respond to the variety of conditions presented by each odd lot. Featured student work by Jose Herrera-Chavez.

everyone enabled more advanced computational design students to help their peers with developing their cartographic tools, thereby creating a teaching network and support system for all members in the class.

Regarding student learning, the studio's methodology yielded comparable results that encouraged students to experiment and created a framework for understanding there are multiple correct solutions when it comes to computational design and scripting. By observing the work of their peers, students were exposed to multiple ways of approaching similar issues of quantitatively filtering data and were able to evaluate the merits and shortcomings of various approaches to the design problem. Another observed outcome was the students' increased understanding and skill level with scripting as the semester progressed. Researching the issues and opportunities afforded by small-scale odd lots and defining criteria for oddly shaped parcels through the manual drawing of case studies and existing conditions provided students a framework for thinking about design issues computationally prior to the introduction of Grasshopper. Assignments 01 and 02 furthermore provided a foundation on the how and why scripting was an appropriate tool for filtering and ranking the large quantity of lots in Lubbock's downtown. In Assignment 03 students were quickly and independently able to translate their research into operating scripts and articulate why and how their custom software tools were addressing the housing needs of the populations for which they were designing. A final observed outcome was that students were engaged and invested in their projects and specific areas of research. By framing scripting not as a main objective of the course, but rather a method for exploring contemporary housing issues, students were able to fold their own research interests into their work. As an example, many members of the class elected to focus on student housing as their area of focus, a topic that resonated with their own experiences as students and aligned with the university's and city's interests in increasing enrollment and housing options in the coming years.

Working with the City of Lubbock, students had the opportunity to engage with city officials over the course of the semester. Lubbock's Director of Planning, Neighborhood Planner, and Director of Business Development visited the studio to present current projects undertaken by the city and provide feedback on student work. At the end of the semester students presented their final projects to a group of city officials that included Lubbock's Mayor, the City Council, the Tax Increment Financing (TIF) District Board, the Lubbock Downtown Development Corporation, and local real-estate professionals (Figure 4). In this format students had an opportunity to not only apply their computational understanding and scripting skills in the development of

Fig. 4 This studio was conducted in collaboration with the City of Lubbock and students presented their final projects to a group of city officials that included Lubbock's Mayor, the City Council, the Tax Increment Financing (TIF) District Board, the Lubbock Downtown Development Corporation, and local real-estate professionals. Featured student work by Jose Herrera-Chavez.

their studio projects, but also engage with local stakeholders and officials through their design research.

One way the course could be improved further is by expanding the areas in which computation is integrated with assignment. One example is integrating the research done by students on Lubbock's form-based Unified Development Code (UDC) into the class's cartographic scripting tool, enabling students in Assignment 02 to visualize the maximum buildable area of reach vacant lot and utilize this information as an input in the development of their own lot searching tools in Assignment 03. In this iteration of the studio students manually calculated buildable areas on lots using the diagrams generated by their peers who studied the UDC. While this process familiarized students with the logics of the UDC, the scripting of this process would allow them to make more informed and intelligent decisions when searching for potential lots for future housing. With a better understanding of students' capacities in this class, the authors see opportunities to expand the moments where computation is integrated with assignments to not only further students' skill level but increase the intelligence of their research and design proposals. One of the advantages of software is its recursive nature and thus future iterations of this studio provide opportunities to both refine the teaching and research generated in this course.

Conclusion

This paper proposes a methodology that leverages small-scale odd lots as a pedagogical framework for introducing and integrating foundational scripting skills in design studios. By developing their own software, we can encourage students to think critically about the digital tools they use in their projects and research. In this sense small-scale odd lots are analogous to the gaps that exist between our proprietary software products, and by designing in those spaces in between we can not only provide novel solutions for addressing our contemporary urban issues, but also empower our students to develop new forms of architectural representation and approaches to spacemaking.

End Notes

1 Stan Allen, "1990-2012: The Future That Is Now," in *Architecture School: Three Centuries of Educating Architects in North America*, ed. Joan Ockman and Rebecca Williamson (Cambridge: MIT Press, 2012), 216.
2 Galo Canizares, *Digital Fabrications: Designer Stories for a Software-Based Planet* (Novato: ORO Editions/Applied Research & Design, 2019), 50.
3 Canizares, *Digital Fabrications*, 17.
4 Casey Reas, Chandler McWilliams, and Jeroen Barendse, *Form+Code in Design, Art, and Architecture* (New York: Princeton Architectural Press, 2010), 17.
5 Reas, McWilliams, and Barendse, *Form+Code*, 25, 125.
6 Reas, McWilliams, and Barendse, *Form+Code*, 45.

Bibliography

Allen, Stan. "1990-2012: The Future That Is Now." In *Architecture School: Three Centuries of Educating Architects in North America*, ed Joan Ockman and Rebecca Williamson. Cambridge: MIT Press, 2012.

Canizares, Galo. *Digital Fabrications: Designer Stories for a Software-Based Planet*. Novato: ORO Editions/Applied Research & Design, 2019.

Reas, Casey, Chandler McWilliams, and Jeroen Barendse. *Form+Code in Design, Art, and Architecture*. New York: Princeton Architectural Press, 2010.

How much does your digital model weigh? Introducing embodied carbon to beginning-design students in architecture

Mike Christenson, University of Minnesota
Malini Srivastava, University of Minnesota

Abstract

We describe a simple Rhino-based method for introducing embodied-carbon analysis in early design stages. The method produces visualizations comparing the relative quantity of materials, and estimates per-material weights to calculate the overall (simulated) weight of Rhino models. We position our method as a means of introducing architecture students to embodied-carbon concepts and digital modeling practices.

The context of embodied carbon

In our capacity as educators in a professional architecture degree program, we are interested in presenting an approach to professional practice wherein architects are commissioned to reconfigure existing buildings for improved performance. By "performance," we mean enhancing the quality of an existing building's function, comfort, and overall experience, and reducing its operational and embodied carbon footprints. Our immediate-term goals are to heighten student awareness of embodied-carbon concepts, and to emphasize their roles as beginning designers in having a measurable impact through early-stage design decisions. This includes introducing concepts of embodied carbon, and particularly its potential impacts and effects, at a fundamental level. The method we describe here is aimed to heighten student awareness of embodied carbon in design projects by using volume and weight as proxies. We expect that the exercise will prompt students to develop questions requiring greater precision as their design education progresses. In this way, we hope to have a triggering effect on student habits of thought, similar to that of Buckminster Fuller's question "how much does your building weigh?" (Zung 2001)

We use the term embodied carbon to refer to the total carbon equivalent (CO_2e) associated with constructing and maintaining a building during production, construction, operation (except utilities), and demolition and disposal, i. e., life-cycle embodied carbon (Hu and Esram 2021; De Wolf et al. 2017). Embodied carbon represents a significant share of existing buildings' contribution to global carbon emissions, with estimates of that contribution ranging from 25% to 75% of the total (International Energy Agency 2019; Pomponi and Moncaster 2016). Addressing this situation will require improvements to existing buildings' energy efficiency to reduce operational carbon, and finding ways to leverage or utilize buildings' embodied carbon as resources or for carbon sequestration (Elefante 2023; Lin et al. 2022; Gerfen 2020). For example, Far and Far (2019) suggest thermal-retrofit changes to the building envelope; Khadra et al. (2020) address modifications to installed HVAC systems; Paone and Bacher (2018) explore the potentials on occupant behavior changes; and Ruparathna et al. (2016) demonstrate the potential for such modifications to result in improved energy efficiency of existing buildings.

Following Bragança et al. (2014), Attia et al. (2012), and Kohler and Moffatt (2003), we assume that early-stage design decisions will be more impactful on life-cycle carbon costs than later-stage decisions.

The context of the studio

Our work is situated in a semester-long design studio, under our joint direction, in the professional Master of Architecture (M. Arch.) program at the University of Minnesota. Depending on individual students' undergraduate background, they enroll in the studio in either the first or second year of their graduate education (University of Minnesota 2023). The studio, which introduces students to design-decision processes related to environmental technology and high-performance regenerative practices, is divided into two half-semester modules: "Net Positive Design," in the first half, and "Integrated Design" in the second. The Net Positive pedagogy is informed by Mang and Reed (2015), who refer to net positive buildings as those that "add value" to ecological systems and generate more energy than they require to meet their own needs. The Integrated Design approach is aimed at educating students in the decision-making processes involved in integrating "building envelope systems and assemblies, structural systems, environmental control systems, life safety systems, and the measurable outcomes of building performance" (National Architectural Accrediting Board 2020).

In a typical academic year, a section of the studio enrolls nine to twelve students. The student groups remain intact for the duration of the semester. Each group is led by two instructors, one of whom has the primary responsibility for teaching Net Positive Design in the semester's first half, and the other for teaching Integrated Design in the second half. While sharing a unified, cohort-wide schedule (including attending common lectures, consultant workshops, and energy modeling training) each studio group has a distinct project. In Spring 2023, as studio co-instructors, we worked with one group of ten graduate students. In practice we equally shared responsibility for teaching Net Positive Design and Integrated Design.

The Net Positive studio was first implemented in our institution by our colleagues Mary Guzowski and Richard Graves, drawing inspiration from Mang and Reed's approach (Srivastava 2020). While the Net Positive studio emphasizes iterative modeling of net zero performance aligned with Architecture 2030 goals, net zero is only a part of the studio's agenda. In general, the studio engages a broad range of approaches to achieving net-positive impact, including biophilic design (Guzowski 2015; Guzowski 2022). Our approach to net-positive impact involved developing approaches to overall carbon reduction while emphasizing cognitive diversity. As a way of promoting "sustainable, resilient, and inclusive design," we assigned our students principles from the AIA Framework for Design Excellence (American Institute of Architects 2023). And as we have done elsewhere, we asked our students to establish cooperative work arrangements, exchanging drawings and models, and sharing concepts and skills for teaching and learning (Srivastava and Christenson 2021). In doing so, we hoped to promote "shifting allegiances" to ideas and concepts as they evolve over the course of the semester (Srivastava 2020).

Our studio brief required students to materially transform Nolte Center, an existing three-story building in Minneapolis, originally constructed in 1936 (Fig. 1). Rather than focusing the brief on a specific program, students could choose to either work with the building's current functions (university offices, classrooms, and study spaces), or to suggest alternative uses. We emphasized the potential to create a cold-climate courtyard.

Fig. 1. Nolte Center, University of Minnesota

We proposed to our students that the existing building could be regarded as a "congealed repository" of matter (material) and effort (labor and energy), capable of transformation into a mechanism of net positive impact. More specifically, we asked students to situate proposals for transformation relative to three strategic extremes: reincarnation (referring to the possibility of completely disassembling the existing building and reassembling a new building using the same materials), reconfiguration (referring to the possibility of adding volume within or atop the existing building), and as-is (referring to the possibility of leaving the existing building materially unchanged but transformed in other ways, e. g., operationally or behaviorally).

We assigned each student a discrete segment of the building, through which they conducted research, observation, and documentation. This process enabled a comprehensive understanding of the entire structure through a deep comprehension of its individual components. Students explored and investigate the building through a combination-drawing and combination-making method. They taught each other what they learned from the deep examination of their assigned segment.

Through the lenses of students' individual efforts, we expected them to second-guess and critique the design decisions that led to the building's construction and operation over its lifespan. We aimed to familiarize students with building science principles, systems, and performance frameworks, all within an overall framework of "Net Positive Design" and "Integrated Design."

Embodied carbon in beginning design education

Students in this studio may be encountering embodied-carbon concepts for the first time. In 2023, roughly half of our students held undergraduate degrees in non-architecture fields. Similarly, students may be new to the idea of working with digital models as design tools, and parametric tools such as Grasshopper may be completely unfamiliar. In 2023, in response to a questionnaire, three our ten students "strongly agreed" that they were familiar with Rhino as a design tool, while only one of the ten indicated the same level of familiarity with Grasshopper.

Digital tools can provide early-stage embodied carbon analysis (Alwan and Jones 2022; Cucuzza et al. 2022). Several popular tools exist for visualizing embodied carbon impacts, including EC3, Athena Impact Estimator, and the Tally Carbon Calculator (Yan et al. 2022). Building Information Modeling (BIM) and its connections to Life-Cycle Analysis (LCA) are frequently discussed in the literature (Farid Mohajer and Aksamija 2019). By examining LCA with the support of BIM, students can engage with sustainability assessments and incorporate them into their decision-making processes more readily (Gomes et al. 2022). We contend that parametric methods in general, and Grasshopper in particular, hold unique promise for beginning-design students. Customized parametric methods offer reliable techniques for interrogating digital models, e. g., involving the use of Dynamo (Hollberg, Genova, and Habert 2020) or Grasshopper (Hollberg et al. 2016). Moreover, custom parametric methods can make it possible for "non-experts [to]apply LCA during the design phase without much additional effort" (Hollberg et al. 2016).

Methods.

In this section of our paper, we consider the technical aspects of our method for assessing a digital model of an evolving design project in terms of material volume and (simulated) weight. We begin by considering the example of Nolte Center, the building our students examined in 2023. We constructed a Rhino model of Nolte Center model for our students' use (Figure 2).

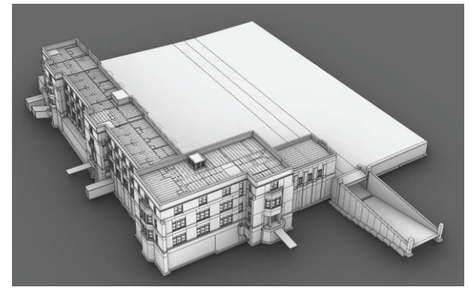


Fig. 2. Digital model of Nolte Center

For any Rhino model to be valid for our method, we require that two specific conditions be satisfied: first, that entities within the model are constructed as "closed polysurfaces" for which Rhino can calculate volume properties; and second, that each of the closed polysurfaces is assigned to a layer (i. e., a category) corresponding to a specific building material, ideally a material for which an approximate unit weight is known. Our model satisfies both conditions.

Our method relies on the use of Grasshopper within Rhino. Grasshopper is "a graphical algorithm editor tightly integrated with Rhino's 3-D modeling tools" (Davidson, 2023). Within Grasshopper, a closed polysurface is considered a *boundary representation,* a term which in this context refers to a data representation of a physically solid object. For Grasshopper, a boundary representation is considered as being composed of one or more mathematically modeled surfaces which are in turn represented by their bounding edges and vertices. Because the surfaces are joined at their edges, they collectively establish a boundary between the represented object's interior and its exterior, hence the term *boundary representation* (Requicha 1980; Mantyla and Sulonen 1982). To the extent that the boundary representations, or "b-reps," are unambiguous representations of solids, "any query whose answer depends solely on geometry and related attributes can in principle be answered" (Miller 1989). Thus, we depend on b-reps as the basic mechanism for computing volumes of entities representing building materials. However, because it is possible for b-reps to have a calculable volume equal to zero, for example in the case of an "open" b-rep such as a rectangular, planar surface, we distinguish b-reps with nonzero volume as "volume-compliant" b-reps.

Approaches to teaching Grasshopper in the context of architectural education continue to be debated, and their effectiveness questioned (Senske 2017). When the question is framed more generally in terms of teaching computer programming to architects, the debate assumes historical dimensions (Wurzer et al. 2011; Burry 1997; Schon 1988; Negroponte 1975). We chose to approach Grasshopper instruction through a conversational, question-answer format, which we attempt to summarizer here.

We begin by diagramming, in a simple linear form, what we would like Grasshopper to do:

take all the stuff in the model	→	add it all up

Next, we consider the meaning of "take all the stuff in the model" relative to how the software represents physical solids. In light of the background material on b-reps in the preceding section, what we mean is something more like this:

calculate the volume of each of the b-reps in the model	→	add it all up

We can be somewhat more precise:

calculate the volume of each of the b-reps in the model, one layer at a time	→	add the combined volumes into a single total

If we wish to visualize the combined volumes as a cube, we need to provide a specific instruction:

calculate the volume of each of the b-reps in the model, one layer at a time	→	add the combined volumes into a single total	→	construct a cube equal in volume to the total

Considering that Grasshopper demands a step-by-step algorithmic formulation, we look again at making our procedure more specific.

calculate the volume of each of the b-reps in the model, one layer at a time	→	add the combined volumes into a single total	→	calculate the numerical cube root of the combined total	→	construct a cube with a side length equal to the calculated cube root

And we can go one step more.

calculate the volume of each of the b-reps in the model, one layer at a time	→	add the combined volumes into a single total	→	calculate the numerical cube root of the combined total	→	construct a rectangle with four equal sides, each side equal to the calculated cube root	→	extrude the rectangle vertically to create a cube with a side length equal to the calculated cube root

We discuss all of this preliminary work with students before Grasshopper is opened.

The next step involves "translating" our linear diagram into specific Grasshopper components and connections. To the extent possible, we present Grasshopper components in terms of comparable Rhino commands. For example, Rhino's VOLUME command returns the calculated volume of a closed polysurface, and Grasshopper's Volume component provides the same with respect to one or more b-reps.

The Grasshopper definition (Fig. 3) is introduced to students from a blank canvas, with each component inserted and connected to parallel the diagrammatic process just discussed.

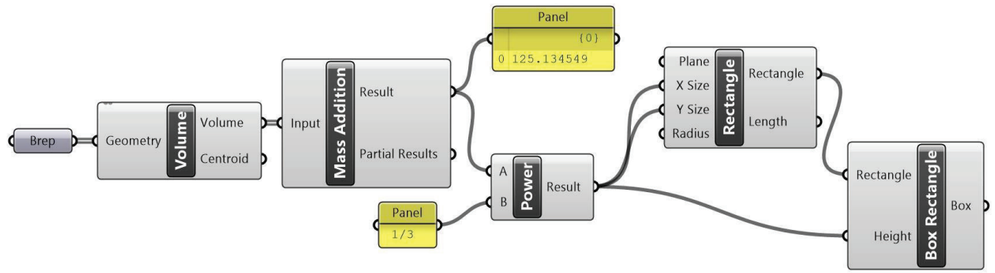


Fig. 3. Grasshopper definition.

Grasshopper's Brep container, at the far left of Fig. 3, is used to designate one or more b-reps from the Rhino model. The Volume component calculates the volume of the designated b-reps. The Mass Addition component provides the total volume of all b-reps referenced by the container. The result, when raised to the power of one-third (1/3), is the cube root of the calculated total, i. e., that number which when cubed will equal the total. It remains only to construct a cube using the cube root as a side length, which is done with a Rectangle component and a Rectangular Box component. (Other methods are possible, e. g., an Extrude Curve component could be used to extrude a cube from the rectangular curve).

Example

To illustrate the use of the Grasshopper definition, we tested a Rhino model of Nolte Center (Fig. 4). The model was organized into layers corresponding to building materials including concrete, brick, and stone.

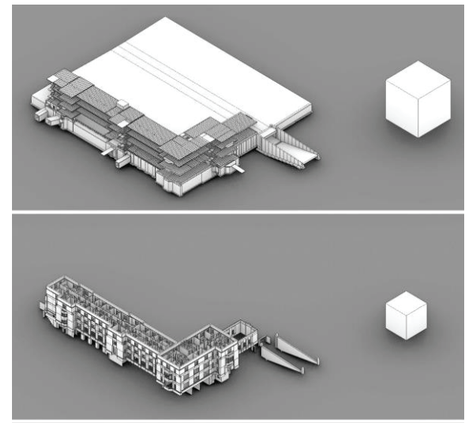


Fig. 4. From top: Concrete, brick, and stone in Nolte Center. Cubic-volume equivalents appear on the right.

Using the Grasshopper definition, and proceeding one layer at a time, the total volume of objects in each successive layer is calculated. Cubes are constructed corresponding to the calculated volumes. Finally, the cubes are reorganized on a plane for graphic comparison (Fig. 5).

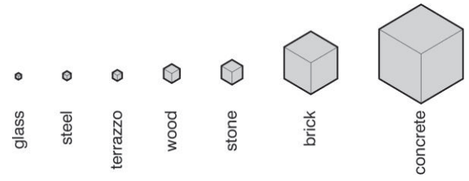


Fig. 5. Material cubes in proportion to their quantities in the Rhino model.

Table 1 summarizes the calculations of simulated material weight in the Rhino model of Nolte Center.

simulated material in Rhino model	cubic feet	approximate material weight (pounds per cubic foot)	totals (pounds)
concrete	152,786	150	22,917,964
brick	39,317	120	4,718,034
stone	2,449	150	367,394
wood	1,096	45	49,312
terrazzo	222	110	24,450
steel	134	500	67,210
glass	51	150	7,725
			28,144,363

Discussion

By limiting consideration to what appears in the digital model, we exempt students from having to directly account for embodied carbon associated with factors such as extraction, processing, or transportation of building materials. Rather than serving as a precise calculator, the exercise operates as a prompt for awareness and as a potential tool for comparison of alternatives.

We are left with several questions for our future work. Pedagogically, we are interested in whether a method involving concentrated individual focus on single issues, in combination with peer-to-peer teaching, could lead to some form of effective cognitive diversity. Specifically from the perspective of embodied carbon, we are interested in measuring impacts of our approach on students' awareness and understanding, and especially on their design decision-making processes.

Bibliography

Alwan, Zaid, and Bahriye Ilhan Jones. 2022. "IFC-Based Embodied Carbon Benchmarking for Early Design Analysis." *Automation in Construction* 142: 104505. https://doi.org/10.1016/j.autcon.2022.104505.

American Institute of Architects. 2023. "Framework for Design Excellence." Accessed February 19, 2023. https://www.aia.org/resources/6077668-framework-for-design-excellence.

Attia, Shady, Elisabeth Gratia, André De Herde, and Jan L.M. Hensen. 2012. "Simulation-Based Decision Support Tool for Early Stages of Zero-Energy Building Design." *Energy and Buildings* 49: 2–15. https://doi.org/10.1016/j.enbuild.2012.01.028.

Bragança, Luís, Susana M. Vieira, and Joana B. Andrade. 2014. "Early Stage Design Decisions: The Way to Achieve Sustainable Buildings at Lower Costs." *The Scientific World Journal* 2014: 1–8. https://doi.org/10.1155/2014/365364.

Burry, Mark. 1997. "Narrowing the Gap Between CAAD and Computer Programming: A Re-Examination of the Relationship Between Architects as Computer-Based Designers and Software Engineers, Authors of the CAAD Environment." In *Proceedings of the 2nd Conference on Computer Aided Architectural Design Research in Asia (CAADRIA),* edited by Yu-Tung Liu, Jin-Yeu Tsou, and June-Hao Hou, 491-498. Taipei, Taiwan: Hu's Publisher. http://papers.cumincad.org/cgi-bin/works/paper/4b42.

Cucuzza, M., A. G. Di Stefano, G. Iannaccone, and G. Masera. 2022. "A BIM-Enabled Decision Support System to Support Large-Scale Energy Retrofitting Processes and off-Site Solutions for Envelope Insulation." *IOP Conference Series: Earth and Environmental Science* 1101 (4): 042031. https://doi.org/10.1088/1755-1315/1101/4/042031.

Davidson, Scott. 2023. "Grasshopper: Algorithmic Modeling for Rhino." Accessed February 19, 2023. https://www.grasshopper3d.com.

De Wolf, Catherine, Francesco Pomponi, and Alice Moncaster. 2017. "Measuring Embodied Carbon Dioxide Equivalent of Buildings: A Review and Critique of Current Industry Practice." *Energy and Buildings* 140: 68–80. https://doi.org/10.1016/j.enbuild.2017.01.075.

Elefante, Carl. 2023. "The greenest building… is the one that is already built." Accessed February 19, 2023. https://carlelefante.com/insights/the-greenest-building-is.

Far, Claire, and Harry Far. 2018. "Improving Energy Efficiency of Existing Residential Buildings Using Effective Thermal Retrofit of Building Envelope." *Indoor and Built Environment* 28 (6): 744–60. https://doi.org/10.1177/1420326x18794010.

Farid Mohajer, Mahsa, and Ajla Aksamija. 2019. "Integration of Building Energy Modeling (BEM) and Building Information Modeling (BIM): Workflows and Case Study." In *Proceedings of the 2019 Building Technology Educators' Society Conference,* edited by Caryn Brause, Peggi L. Clouston, and Naomi Darling. https://doi.org/10.7275/bn9j-e183.

Gerfen, Katie. 2020. "Renovation, Restoration, and Adaptive Reuse: The Understated Value of Existing Buildings." Accessed February 19, 2023. https://www.architectmagazine.com/design/renovation-restoration-and-adaptive-reuse-the-understated-value-of-existing-buildings_o.

Gomes, Vanessa, Maristela Gomes da Silva, and Doris Catharine Kowaltowski. 2022. "Long-Term Experience of Teaching Life Cycle Assessment and Circular Design to Future Architects: A Learning by Doing Approach in a Design Studio Setting." *Sustainability* 14, no. 12: 7355. https://doi.org/10.3390/su14127355.

Guzowski, Mary. 2015. "Towards Net-Zero Energy: Lessons For Architectural Design Education." In *Proceedings, 2015 Conference of the Architectural Research Centers Consortium,* edited by Ajla Aksamija, John Haymaker, and Abbas Aminmansour, 231–238. Chicago: Perkins + Will.

Guzowski, Mary. 2022. "Integrating Biophilic, Net-Positive, and Resilient Design: A Framework for Architectural Education." In *Proceedings, 2022 International Conference of the Architectural Research Centers Consortium and the European Association for Architectural Education,* edited by Chris Jarrett and Adil Sharag-Eldin, 733-740. Washington, DC: Architectural Research Centers Consortium, Inc.

Hollberg, Alexander, Gianluca Genova, and Guillaume Habert. 2020. "Evaluation of BIM-Based LCA Results for Building Design." *Automation in Construction* 109: 102972. https://doi.org/10.1016/j.autcon.2019.102972.

Hollberg, Alexander, Marcel Ebert, Stephan Schütz, Burhan Cicek, Rainer Gumpp, and Jürgen Ruth. 2016. "Application of a Parametric LCA Tool in Students' Design Projects." In Proceedings, Sustainable Built Environment Conference 2016 in Hamburg, 72–81. https://doi.org/10.5445/IR/1000051699.

Hu, Ming, and Nora Wang Esram. 2021. "The Status of Embodied Carbon in Building Practice and Research in the United States: A Systematic Investigation." *Sustainability* 13, no. 23: 12961. https://doi.org/10.3390/su132312961.

International Energy Agency. 2019. *2019 Global Status Report for Buildings and Construction*. https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019.

Khadra, Alaa, Mårten Hugosson, Jan Akander, and Jonn Are Myhren. 2020. "Economic Performance Assessment of Three Renovated Multi-Family Buildings with Different HVAC Systems." *Energy and Buildings* 224: 110275. https://doi.org/10.1016/j.enbuild.2020.110275.

Kohler, N. and S. Moffatt. 2003. "Life-Cycle Analysis of the Built Environment." *UNEP Industry and Environment,* April – September 2003, 17-21.

Lin, Hankun, Shi Yin, Chao Xie, and Yaoguang Lin. 2022. "Research-Integrated Pedagogy with Climate-Responsive Strategies: Vernacular Building Renovation Design." *Buildings* 12, no. 9: 1294. https://doi.org/10.3390/buildings12091294.

Mang, Pamela, and Bill Reed. 2015. "The Nature of Positive." *Building Research & Information* 43, no. 1: 7–10. https://doi.org/10.1080/09613218.2014.911565.

Mantyla, Martti, and Reijo Sulonen. 1982. "GWB: A Solid Modeler with Euler Operators." *IEEE Computer Graphics and Applications* 2 (7): 17–31. https://doi.org/10.1109/mcg.1982.1674396.

Miller, J. R. 1989. "Architectural Issues in Solid Modelers." *IEEE Computer Graphics and Applications* 9, no. 5: 72–87. https://doi.org/10.1109/38.35539.

National Architectural Accrediting Board. 2020. *Conditions for Accreditation: 2020 Edition*. Washington DC: National Architectural Accrediting Board. https://www.naab.org/wp-content/uploads/2020-NAAB-Conditions-for-Accreditation.pdf.

Negroponte, Nicholas. 1975. "The Architecture Machine." *Computer-Aided Design* 7, no. 3: 190–95. https://doi.org/10.1016/0010-4485(75)90009-3.

Paone, Antonio, and Jean-Philippe Bacher. 2018. "The Impact of Building Occupant Behavior on Energy Efficiency and Methods to Influence It: A Review of the State of the Art." *Energies* 11, no. 4: 953. https://doi.org/10.3390/en11040953.

Pomponi, Francesco, and Alice Moncaster. 2016. "Embodied Carbon Mitigation and Reduction in the Built Environment – What Does the Evidence Say?" *Journal of Environmental Management* 181: 687–700. https://doi.org/10.1016/j.jenvman.2016.08.036.

Requicha, Aristides G. 1980. "Representations for Rigid Solids: Theory, Methods, and Systems." *ACM Computing Surveys* 12 (4): 437–64. https://doi.org/10.1145/356827.356833.

Ruparathna, Rajeev, Kasun Hewage, and Rehan Sadiq. 2016. "Improving the Energy Efficiency of the Existing Building Stock: A Critical Review of Commercial and Institutional Buildings." *Renewable and Sustainable Energy Reviews* 53: 1032–45. https://doi.org/10.1016/j.rser.2015.09.084.

Schön, Donald A. 1988. "Toward a Marriage of Artistry & Applied Science in the Architectural Design Studio." *Journal of Architectural Education* 41 (4): 4–10. https://doi.org/10.1080/10464883.1988.10758496.

Senske, Nick. 2017. "Evaluation and Impact of a Required Computational Thinking Course for Architecture Students." *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*. https://doi.org/10.1145/3017680.3017750.

Srivastava, Malini. 2020. "Cooperative Learning in Design Studios: A Pedagogy for Net-Positive Performance." *Buildings and Cities* 1, no. 1: 594. https://doi.org/10.5334/bc.45.

Srivastava, Malini, and Mike Christenson. 2021. "Play in Architectural Pedagogy: Shifting Allegiances and Trading Projects." In *Proceedings, 2018 Fall Conference of the Association of Collegiate Schools of Architecture,* 16–19. https://www.acsa-arch.org/chapter/play-in-architectural-pedagogy-shift-ing-allegiances-and-trading-projects/

University of Minnesota. 2023. “Master of Architecture Sample Program Plans.” Accessed February 26, 2023. https://design.umn.edu/academics/programs/architecture/master-architecture/master-architecture-sample-program-plans.

Wurzer, Gabriel, Sema Alacam, and Wolfgang Lorenz. 2011. “How to Teach Architects (Computer) Programming: A Case Study.” *Proceedings of the 29th International Conference on Education and Research in Computer Aided Architectural Design in Europe (ECAADe)*. https://doi.org/10.52842/conf.ecaade.2011.051.

Yan, Jiayi, Qiuchen Lu, Long Chen, Tim Broyd, and Michael Pitt. 2022. “SeeCarbon: A Review of Digital Approaches for Revealing and Reducing Infrastructure, Building and City's Carbon Footprint.” *IFAC-PapersOnLine* 55 (19): 223–28. https://doi.org/10.1016/j.ifacol.2022.09.211.

Zung, Thomas T. K. 2001. *Buckminster Fuller: Anthology for the New Millennium*. New York: St. Martin’s Press.

A Machine for Drawing: Uncovering Known and Unknown Forces in Foundation Design

Meghan Duda, North Dakota State University
Christopher Pritchett, Virginia Tech

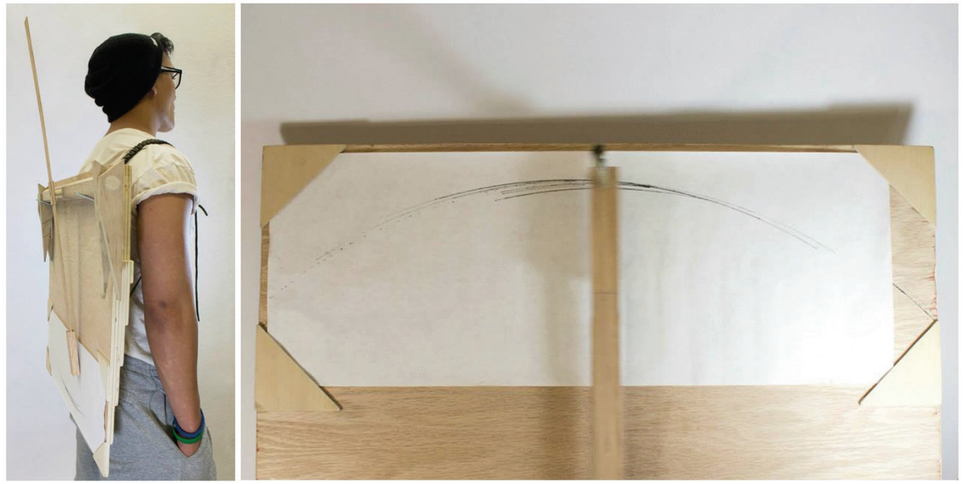


Figure 1. Architecture Student Al Farajdo with the streamflow recording drawing machine. In this example, the machine is carried to the site and placed in a stream. The paddle, which is attached to the pen, is directed in differing motions creating different drawings depending on where it is placed. *photo credit Austin Ledzian*

As a project for beginning designers, the ‘drawing machine’ assignment serves as a tool to study the known and unknown forces that provide work with resistances. This is the story of two different pedagogical approaches to the same project, with different student bodies, 1300 miles apart. The assignment, initially designed for a Foundation Architecture Studio, is later implemented in a Foundation Visual Art Studio. Although the prompts are similar, intended outcomes are different for each student body as a result of contextual considerations and the students' intended trajectory. The question is, what does an emerging visual artist carry away from an assignment developed for the beginning architect? How are their experiences the same, and how are they different? The paper will address these questions by describing the discoveries made by students and instructors, and document reflections of former participants from both programs.

The assignment was originally developed by Chris Pritchett, Foundation Chair and Associate Collegiate Professor in the School of Architecture at Virginia Tech in 2012 for the Foundation Architecture Studio at Virginia Tech. Chris began sharing students’ designs on social media, and the concept was quickly picked up by Meghan Duda, Assistant Professor of Visual Arts at North Dakota State University. After seeing the project unfold from a distance, Meghan began to imagine ways to introduce an iteration of the assignment to beginning Visual Artists in North Dakota. The following is a conversation between Chris and Meghan reflecting on the history, implementation, and results of the assignment to these two student bodies.

Origin Story

Meghan Duda: Chris, as you know, I simply fell in love with this assignment when you began posting the images online. As you and I have heavily discussed the outcomes of the assignment, I am now wondering about how you came upon the concept. Can we begin with a description of the Drawing Machine and what you were thinking about as you were developing the assignment?

Chris Pritchett: Absolutely! To begin with, the term ‘drawing machine’ serves as a placeholder for any student designed apparatus which transfers marks onto another surface. Marks are ‘automatic’ and in response to user

input, environmental forces, or other various, sometimes unknown factors. For young students, an understanding of scale is paramount and this project is a good entry point. Scale is only limited to the installation environments, materials explored, and students' abilities and/or personal limitations.

This project also, surprisingly, opens up interesting conversations about design philosophy. Most first year designers have not been introduced to the concept of taking a philosophical stance with their work. Through this project we begin the conversation about how they collect data and how the narratives they construct around data are likely subjective. Students quickly realize that designers need to use a combination of subjective and objective learning in their work. They rely on their own experiences and intuition to generate ideas, but also use research and testing to validate and refine their designs. The key is to find the right balance between the two approaches to create designs that are both innovative and effective. This allows students, in a very rudimentary way, to associate with a philosophical camp and determine who their allies are and whether or not they align with a modern or postmodern way of thinking.

I am sure you have thoughts on this, as someone who uses a camera in her creative work?

MD: Oh, so many! I can't help but reflect on how drawing and photography are intertwined, with photography essentially emerging from a desire to create a more efficient and objective process for documenting [recording] lived experiences.[1]

Historically, the 'drawing machine' was a tool for efficiency, often a means to transcribe or etch a hand drawn line onto a separate material subsequently used for image replication. Before early inventors of photography could resolve the fixing of light on a sensitized surface, many entrepreneurs were designing tools to replicate the world through tracing. The most obvious object that comes to mind is the camera obscura[2], which is not an object per se, but a room, however condensed and portable models were used to make landscape sketches.[3] There is overwhelming evidence that the phenomena of the camera obscura was used by Vermeer and other Dutch painters to make hyper realistic paintings in the seventeenth century.[4]

Other optical devices emerged like the *camera lucida* - a glass prism held at eye level, which allowed the user to simultaneously view a subject and a drawing surface - and the physionotrace, a crazy contraption that used a stylus to transfer drawing marks onto a copper plate for printmaking purposes.[5] Functionally, these tools were essentially copy machines; they removed subjective aspects from drawing, eliminated opportunities for human error thus allowing less skilled artisans to create drawings, and in turn democratized access to imagery and human likeness [portraits].

CP: I'm so happy you brought up Vermeer, as I was also thinking about how painting became more photo-realistic as the use of optical apparatuses prevalent in the 17th and 18th century. This stayed true until modernism rejected traditional representational styles and instead focused on abstraction, experimentation, and the use of new materials and techniques. They sought to create works that were purely aesthetic, and to challenge the notion that art should serve a specific function.

MD: Interestingly enough, I found that when converting the 'drawing machine' into a Foundation assignment, the drawing process became *less* efficient. However, this objective approach to mark making transforms the drawing practice from a mode of representation into an act and an expression of an idea. This is a paramount outcome for the beginning artist - the revelation that making marks is more than drawing a picture, but an act of expression, the exposition of an idea. Modernism in action!

Prompt + Expected Outcomes

CP: Perhaps we should talk about the project prompt and some of the outcomes we expected to see in the two approaches to the assignment?

MD: I could discuss the theory behind the assignment for at least a few more pages, but you're right, we should probably get to the good stuff.

CP: The drawing machine exercise in the design lab has taken two forms, one where the external forces applied are human driven and one where the external forces are environment driven. The outcomes for each have topics that are the same - collaboration, understanding tectonics, scale, material - and there are also outcomes which are somewhat unique to each project - ergonomics become a larger part of the conversation with the human driven machine and context becomes a larger part of the conversation in the environment driven machines.

With the environment driven machines, the goal was to translate a given condition of the landscape into marks on a page [Figure 1]. The pedagogical goal of the project was to 1. Have students develop tectonic skills while machine building 2. Have students develop a deeper understanding of a given site 3. Have students participate in data collection in hopes that their projects had a deeper sense of objectiveness as opposed to subjectiveness.

With the human driven machines, the goal was to allow human interaction with the machine to be converted into marks on a page. The pedagogical goals for this version was 1. Once again, tectonic skills 2. Have students develop a deeper understanding of how the human body moves in space 3. Have students really consider the interaction between the hand and the object.

We started with looking at the work of Desmond Paul Henry, Jean Tinguely and Theo Jansen. It was really a study of motion and capturing a recording of that motion. We even looked at the choreography of Anna Halprin[6], wife of landscape architect Lawerence Halprin. She had a way of talking about human movement that transcends dance. The Camera Obscura was also a heavy influence, although the evidence is not as obvious.

MD: In the Visual Art Studio, the 'Machine for Drawing' assignment was not delivered as a set of instructions, but as a list of questions. The prompt was simple: *Working in teams of three, design and build a Machine for Drawing. There are no restrictions to the scale of your Machine or the drawing surface. Please consider the scale of the space you are working in. Where will you begin your design? What are your most wild ideas? Can you achieve these in the time allotted?* A discussion of the prompt was followed by a web based visual presentation[7] introducing artists who design drawing machines in their own creative practice, including Eske Rex[8], Karina Smigla-Bobinski[9], James Nolan Gandy[10], Amenda Tate[11], and Jurg Lehni.[12]

As a means of establishing assignment objectives and suggesting potential outcomes, the prompt included a series of additional questions including; What element is primary in your design, the machine or the drawing?; What mechanisms will drive your machine? Human, mechanical, or electronic forces?; Will the Machine be self-perpetuating or will an outside force be needed to maintain movement?; Will the machine create a specific type of drawing or will you design for a serendipitous event?; Will the machine have the ability to make more than one mark at a time?; What kind of a surface will your machine make marks on?; What medium or material will your machine use to make marks?; Will you establish any rules for the materials used in the machine's construction?; Will the construction materials relate to the drawing surface or the drawing medium?; What role does gravity play in your design?; What role does time play in your design?

CP: From a pedagogical point of view, both approaches to the assignment touch on a list of 'need to knows', including construction techniques, material properties, limitations of scale, time management, group dynamics, and communication skills. This mixture of hard skills and soft skills is always a goal.

Figure 2. Sediment collection drawing machine. Different 'filters' were made with organic materials from the site. Water from the site is filtered and the sediment is transferred to small circular paper inserts. Different filters create different sediment patterns. *photo credit Austin Ledzian*

There is also a learning of the known forces that have an impact on the students' work which tend to be tactile and visually evident in response to the 'automatic drawings' the machines create. Expected outcomes that relate to both Foundation studios include discoveries addressing the forces that physically impact design such as gravity, friction, materiality, and visual composition.

MD: Another similar aspect in both studios is that the exercise required students, working in groups, to actively participate in all aspects of the project design, including concept development, construction techniques, time management, group dynamics, understanding of viewer relationships to artistic works, and application of artistic vocabulary when discussing their designs. For most of the course participants, this is the first time they are asked to embark on a project of this scale. While that may feel daunting at first, the playful nature of the activity was like a spoonful of sugar.

CP: I appreciate the way you discuss construction techniques and viewer relationships with artistic work in the same sentence. The education of an designer must include opportunities for both subjective decision making, where the student learns to use instinct, personal judgment, and forms personal opinions about the work and objective decision making, where the student learns to remove their personal viewpoints, collect data and analysis, and make decisions based on given information, context and situations. The understanding that these two things have an impact on one another is also a desired learning objective. The drawing machine exercise offers opportunities for both subjective and objective thought in making decisions. This is a pedagogical direction initiated in an Architectural Design studio.

MD: Perhaps I am wrong in differentiating the work in the Visual Arts Studio, but I would say that the expected outcomes in this group varies from the Architectural studio in that the goal is not about building a mind for human interaction with space, but a mind that will explore a variety of approaches to visual representation and media application. In most cases, the beginning artist enters the university setting with an idea about what it means to be an artist. Usually they find themselves attached to their comfort zone, often with a desire to exist in a realm of realism and representation. Many are also coming from an environment where they are guided through an educational experience, from beginning to end. While it is important to emphasize this is not wrong, it is exactly at this point in their education where a foundation teacher must work to break down those initial conceptions, and rebuild the mind to think more intuitively about process, concept, and visual expression.

By introducing the assignment as a list of questions and visual suggestions, the goal is to inspire without placing participants in a creative box. This is a formidable challenge to a group of students new to the studio environment; a space where instructions and expected outcomes are not laid out, but discovered through experimentation and trial and error. The drawing machine exercise is an excellent project in an introductory setting, because it helps with this process. When the drawing is broken down to a mark making process, the act of drawing can be limitless. It can be a splatter of paint from an exploding balloon, it can be a trail inscribed by a marble rolling across a piece of paper, it can be a drip of wax from a melted crayon.

CP: The comments on rebuilding and process are perhaps universal.

Thematic Design Strategies

MD: Unsurprisingly, themes emerged as the machines were revealed. Most machines required some form of human intervention, either to begin the process, or throughout the duration of the drawing. Some were self-propelled or responded to non-human forces. In the Visual Arts Studio, there were four main themes that emerged, and a variety of iterations in each theme. There was the 'container with marbles' machine, the 'pen holding device' machine, the 'propelling objects through space' machine, and the 'time based' machine. Do you enjoy my well-thought thematic titles??

CP: Oh, absolutely. Brevity in titling is a must. The projects that emerged from the Cartographic 'drawing machine' projects included a wind analyzing machine, a water filtration machine [Figure 2], a streamflow recording machine, a toolkit for collecting soil samples, and a machine to assist in the understanding of wind effects on sediment collection. The students were given the site of 'Heritage Park' to work with, which includes a variety of biomes including wetland, stream, grass field and forested area.

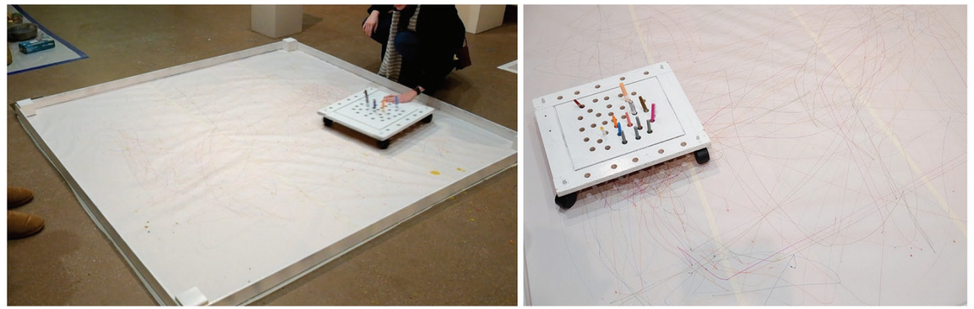


Figure 1. Students in the Visual Arts studio designed a 'pen holding device' machine to record movement in space. In this example, human forces drive a truck of markers across large sheets of paper, contained within a wooden frame. *photo credit Meghan Duda*

MD: While it is difficult to narrow down the most successful machines developed in the Visual Arts Studio, I would love to highlight a few of the iterations for each theme. The 'container with marbles' appeared in different variations in the Visual Arts studio, mostly through iterations of the clam shell with hinge lid and a paper base. There was a hand held version, made with embroidery hoops and circular cut paper. There was also a design modeled off of a tire swing, with a tray suspended from the ceiling by ropes. In this theme, participants were instructed to coat a handful of marbles with various hues of acrylic paint. The marbles were set on top of the paper in the container, the lid was shut, and some action was made to set the marbles rolling. The resulting drawings resemble a kind of dada Jackson Pollock.

CP: The design students also had a marble project. In all of the iterations I have seen this may have been the most complex: The marble would start in a mesh basket and through a series of mechanical actions would be dipped into a container of ink. The marble would then be 'walked' up a mechanical escalator onto a paper canvas where the user would drive the marble around the page. Eventually the marble would fall through a hole and return to the starting point in the basket. Extraordinarily complex. The biggest surprise for the students was when the moisture from the ink caused the oak around the mechanisms to swell which would temporarily render the machine useless, until the humidity went down. This was the students first experience with building tolerances.

MD: That is amazing, and sounds unbelievably intricate! I imagine the conversations around tolerances and unexpected consequences were really illuminating with that machine!

Although they were less intricate, decisions regarding tolerances and precision were quite present in the next common strategy: the 'pen holding device'. More than one group developed mechanisms to hold multiple markers of various hues, making simultaneous marks on a page. These machines were essentially devices that recorded movement in space, either of the object holding the pen, or of the surface below the mark making tool. In one iteration, human forces drive a truck of markers across large sheets of paper, contained within a wooden frame on the floor. [Figure 3] One variation featured an arm driven by gears and a motor, assembled from lego technic components. There was also a machine that would push the mark making tool with magnetic forces.

CP: It is interesting the commonalities that arise between the two groups. The design students had a similar strategy where they attached markers to an axis which was controlled by human input, a hand turning a crank. The markers would spin, the paper would spin, the outcome was a hurricane-like pattern with explosions of color. This machine also dealt with gears which were cut with a laser cutter to ensure precision. This required a good deal of tectonic understanding, analog tools and digital tools.

MD: A 'hurricane-like pattern with explosions of color' is such a vivid description, and makes me think of the two machines in the third strategy - the 'propelling objects through space' machines. One group in the Visual Arts studio built a large-scale slingshot to launch chalk-filled sponges at sheets of black paper. This was a full body experience, where the participant would pull back an exercise band stretched between two-by-fours, load it with the sponge, and let it rip in the general direction of the wall of paper.

Figure 2. The most memorable 'propelling objects through space' machine was a dart + paint-filled balloon installation. Emily Wrangler, former student and K-12 Art Educator participated in this machine design and went on to use similar concepts in her own art and teaching practice. *Photo credits Meghan Duda.*

The most memorable 'propelling objects through space' approach was a dart + paint filled balloon installation. In this 'machine', the group suspended 100+ balloons above a space lined with painter's canvas. The balloons were filled with air and acrylic paint in various hues. Drawing participants were given darts to cast at the balloons, which would subsequently break and send paint flying. This was a very popular and active machine, and may have had the largest pedagogical impact on the students that year. [Figure 4]

CP: The full body experience resonates. The design students experienced this also. They constructed a 7' tripod with a pendulum-like swing in the center. The paper would rest in the swing and ink would drip from above from a modified toilet apparatus the students built. The outcome drawings were Pollock like in appearance and spirit, extremely gestural. The interactive nature of this machine was extremely popular as it invited students to push and pull and dance around the ink covered pendulum.

MD: A final strategy is the 'time based' machine, and in the Visual Arts studio, this was the most surprising outcome for the instructor. In a machine called 'Land and Sea', students used water circulation and a pile of sand, contained within a tub, to 'draw with water'. The sand pile was staged below a bucket of water, fitted with a spigot, which would slowly drip water onto the pile. Over time the water would move the grains of sand, reshaping the pile into divots and eddies. An electronic water pump collected accumulating water, and sent it back into the bucket, providing a constant loop of water. Although the concept was simple, resolving the logistics was a formidable challenge, and was met with excellent results. As the instructor I could see all these amazing conceptual elements to this project - factors relating primarily to time on a range of scales [now, future, past, geologic, etc] but also matters of human impact, or lack thereof. This was the only machine that required no human input once the machine was initiated, and it was interesting to reflect on a human-less environment.

CP: This study of divots and eddies is reminiscent of the environment driven tools some of the students from the architecture studio studied. A map of the changes in a landscape that is constantly responding to itself and will continue to do so.

Known + Unknown Outcomes

MD: Reflecting on these student explorations, I must admit that the real excitement came in the unknown outcomes, for the students and the instructor. For one thing, by translating the drawing from a known entity to an act of haptic discovery, the activity upends expectations inherent in a drawing exercise, and the results enter the realm of the unexpected. Participants come to question the definition and purpose of drawing, discovering that a simple mark can be many things at once - an environmental record, an act of expression, or an exposition of an idea.

CP: In the design studio the unknown forces are less tactile and arise from conversations about site/context, materiality and expected interactions. In iterations where the site has direct impact on the expected outcome, questions of environmental issues arise. When the machine is documenting particular forces in the site (ie: wind, water movement, pedestrian traffic), environmental impact and change become evident. When a site is studied through a historic lens, the marks that man has made on the landscape become evident, as do the patinas that the built environment acquires. These observations bring up conversations about socio-economics and the impact it has on the design field.

This was an unexpected outcome for the students in the design studio - the conversations that arose about socio-political issues, environmental issues and economic issues. As one group of students discussed the proper size for a wooden handle, which participants would grasp, the question 'who is it for' came up. One the students began considering the differences in hand shape and size which led to a discussion of Henry Dreyfuss and inclusivity in design. When the students were using drawing machines to document wind patterns in Blacksburg, they learned that the campus is downwind of the Radford Army Ammunition Plant and the high level of pollution that the plant produces. This discovery led to conversation on cancer clusters and the impact the plant has on the New River.

Other conversations focused on community building. Introducing an 'act of play' into a common area created an atmosphere where the space and structure fostered a sense of belonging, connection, and engagement among the people who used the building and interacted with the student projects. This led to conversations about prioritizing human needs and social interaction over purely functional or aesthetic concerns.

MD: I love this idea, and saw common conversations in the Visual Arts studio. Although the participatory nature of the machines was encouraged, as established by the prompt and through classroom conversation, looking back it is impossible to ignore how this relates to contemporary Visual Arts practice. Emerging contemporary artists are finding their way toward Social Practice - an artistic discipline focusing on community engagement and social discourse. While most of the machines relied on human forces to drive the machine, a couple entered into this realm of social practice. One particular 'machine' that comes to mind generated a column of multicolored wax out of crayons suspended in air below a heat lamp. There was little human interaction, aside from introducing fresh crayons as the pile melted away. Participants were prompted to choose a color based on their personal preferences or mood at the time. In this way, the designers were seeking a construction that was a reflection of the community, a kind of collaborative recording. [Figure 5].

Figure 5. A multicolored wax column that is a collaborative recording of viewer preferences. As a 'time based' machine, it evolved and grew continuallty throughout the duration of the exhibition. *Photo credit Meghan Duda*

In the Future, Looking Back

MD: This has been a really enjoyable exercise; to reflect on this assignment with you, especially as we have discovered that there are more similarities to our experiences than I anticipated. It seems as if distance and discipline have little effect on the pedagogical outcomes of the assignment. So, with that in mind, what impact do you see this assignment having on the future architect, designer, and visual artist?

CP: As the design profession moves from a model of siloed paths to an open field of possibilities, utilizing more tools and collaborating with more professions than ever, I see collaborative projects in an educational environment becoming more relevant. By bringing students from different disciplines together to work on a shared assignment, it can lead to a cross-pollination of ideas, perspectives, and approaches, which can lead to unexpected outcomes.

MD: I agree, interdisciplinary thinking and shared assignments can also lead to the development of new material and theoretical approaches in architecture and in art. I recently connected with some former students about their experiences with the drawing machine and Raquel Mellegaard said,

"Looking back I don't think I would have developed the skills I did without this activity. Being with a group of similarly minded people and hearing what they thought helped me build my understanding of different perspectives for future projects."

Raquel completed her Bachelor of Fine Arts in 2021, producing a body of work titled *Emotion Shown*, in which she designed custom clothing as metaphors for personal and shared experiences of love. The installation involved a performance where the modified clothes were worn by a handful of people, and the participants engaged with each other and the audience to share the meaning of each piece. I believe that the abstract thinking she developed, beginning with the Drawing Machine activity, evolved to produce an amazing and thought provoking body of work.

CP: I too have been in contact with former students who participated in this project and that response is actually very similar to one made by Caleb Rancourt. He stated

"The experience surprised me in that it challenged my design approach and built empathy within me towards other design disciplines. Our programs of study placed emphasis on certain discipline specific approaches, and tackling a shared vision which required us to work towards a common understanding of each other to achieve our goal. Seeking common understanding is critical to operating successfully in the design industry and the "drawing machine" exercise provided me with a foundation to build upon outside of academia. The exercise was an opportunity to have philosophical conversations around the interplay of time, space, permanence, form and function."

Caleb graduated from Industrial Design in 2015 and went on to work in furniture design.

MD: Another student, Emily Wrangler, who went on to become an elementary Art Educator, was also impacted by this activity. For her Baccalaureate project, Emily made a collection of drawing tools in a body of work she titled *Rote*, an exploration of mark making through repurposed objects that encourage new discoveries and meanings. While Emily may not have recognized it at the time, the project was a reinvention of her experience with the Drawing Machine, which, by the way, was the balloon machine I spoke of earlier [Figure 4]. I reached out to Emily to see how she sees her experience with the drawing machine, five years later, and she said,

"[the] project fulfilled its pedagogical duty with me as a student and is now transforming my thinking as a teacher. Using expressions of art in an innovative way is something that I challenge my students with each project I teach them. There is so much to explore in the design field and the drawing machine helps open up the mind to new ways of thinking; working with peers, making a machine that is interactive and innovative, problem solving, building upon future artworks, and opening up this thought process to more and more students will ultimately change the world of design."

CP: I very much appreciate this comment from Emily. The idea that the things we do as teachers have a lasting resonance with the students is humbling and inspiring. As I was speaking with Ryan Myers recently he had this to say;

"The drawing machine project was the first time where I was asked to create an object that needed to actually do something specific. Eleven years removed from the Foundation Architecture Studio at Virginia Tech, the balance between functionality and aesthetics is something that I consider when designing. The drawing machine introduced me to this problem - What role does function have in aesthetics? Which of the two should be held as primary? These questions are inherent in almost every aspect of architecture. Certainly countless architects and designers have mulled over this same topic for years, and I will happily continue the tradition."

The lasting impact of this project with Ryan, like Emily, is evident. Ryan is now an architect at the architecture firm 3North in Richmond, Virginia.

MD: This has been great to discuss with you. Thank you so much for taking the time to share your experiences and compare the student experiences with me and discussing the similarities and differences between the two programs with this project.

End Notes

1. Giovanni Battista della Porta (1535-1615) describes the camera obscura in his treatise *Magiae naturalis (Natural Magic)*, specifically how the tool can make drawing easier, "The manner in which one can perceive in the dark the things which on the outside are illuminated by the sun, and with their colors…will make possible for anyone ignorant of the art of painting to draw with a pencil or pen the image [made by a camera obscura] of any object whatsoever." See Georges Potonniée, *The History of the Discovery of Photography*, pg 11.
2. A camera obscura [dark chamber] is a dark room with a small opening, or aperture, that allows outside light to enter the space. This light creates a projection on the opposite wall - a clear and distinct inverted live view of the space outside the aperture. If an artist were to enter this space, they could trace the image onto paper mounted within the boundaries of the projection. This is essentially the same technology as the modern photographic camera, which uses light sensitive material to record the projection. See Robert Hirsch, *Seizing the Light: A Social History of Photography*, 3.
3. Johannes Kepler built a portable camera obscura in the form of a human-sized tent that could be carried to any location for site specific drawing. By the mid-seventeenth century a scaled down version of the tent, one that did not require entry, projected the image onto a translucent window, or ground glass, for tracing. See Robert Hirsch, 3.
4. *Tim's Vermeer* is a documentary film chronicling Tim Jenison's efforts to unlock the mystery behind Johannes Vermeer's painting technique. Jenison, an inventor and 3D video pioneer, supposes that Vermeer painted with the help of optical devices like the camera obscura, and builds a replica of Vermeer's studio to test his hypothesis. See Teller, dir. *Tim's Vermeer*. New York, NY: Sony Pictures Classics, 2013, DVD.
5. Robert Hirsch, 4-5.
6. Ruedi Gruber, dir. *Breath Made Visible*. Zurich, Switzerland: ZAS Films, 2009, Vimeo, https://vimeo.com/409413518
7. Meghan Duda, "Machine for Making" https://express.adobe.com/page/6ijfqms2mFyWB/
8. https://www.eskerex.com/
9. https://smigla-bobinski.com/
10. https://www.jamesnolangandy.com/
11. https://www.amendatate.com/
12. https://juerglehni.com/works/hektor

Bibliography

Duda, Meghan. "Machine for Making.", 2019. https://express.adobe.com/page/6ijfqms2mFyWB/.

Gruber, Ruedi, dir. *Breath Made Visible.* Zurich, Switzerland: ZAS Films, 2009, Vimeo, https://vimeo.com/409413518.

Hirsch, Robert. *Seizing the Light: A Social History of Photography*. New York: McGraw Hill, 2009.

Teller, dir. *Tim's Vermeer*. New York, NY: Sony Pictures Classics, 2013, DVD.

Potonniée, Georges. *The History of the Discovery of Photography*.New York: Arno Press, 1973.

NDSU | SoDAA | NCBDS

NORTH DAKOTA STATE UNIVERSITY

NDSU was first NDAC

North Dakota State University came into existence in 1890 when it was first established through a land grant by the state of North Dakota as the North Dakota Agricultural College (NDAC). Thus, NDAC became the state's Land Grant College just one year after North Dakota became a state.

Under the auspices of the Morrill Land Grant Act, the institution was tasked with the mission of providing educational opportunities and research services to the people of the northern Great Plains. It is also recognized that this Act provided each state with "public" and federal lands, which are traced back to the disposition of Indigenous lands. Existing within the context of a place considered public, state, and native, this location is a ground for investigation, dialogue, and revelation. The first offered courses were in the disciplines of Agriculture, Engineering/Mechanic Arts, and Home Economics; a pharmacy program was later added; and eventually, in 1914, courses in architecture were begun under the Mechanic Arts program. With an amendment to the state's constitution in 1960, the school's official name was changed from NDAC to North Dakota State University (NDSU). The North Dakota State University comes under the purview of the Chancellor of the North Dakota University System (NDUS), which includes eleven academic institutions in different locations across the state of North Dakota. NDSU and the entire NDUS are governed by the State Board of Higher Education (SBHE).

History and Description of the Architecture-Related Programs

The first set of architecture-related courses related to architecture were offered in 1914 by the North Dakota Agricultural College through the Department of Civil Engineering and Mechanic Arts; and in 1922, NDAC granted its first Bachelor of Architectural Engineering degree. Thus, from its inception through World War II and beyond, the NDSU architectural program carried a strong engineering tilt. The centennial anniversary for its first architecture-related courses was celebrated by the Department of Architecture in 2014. Indeed, the department has remained focused on deepening and broadening its rich academic foundations and historical heritage.

A visiting committee of the NAAB undertook a tour of the school and its programs in 1969, thus resulting in initial NAAB accreditation for the five-year Bachelor of Architecture degree in 1971. Since then, the architecture program at NDSU has continued to receive NAAB's re-accreditation. In 2005, the Bachelor of Architecture degree program was replaced with a subsuming Master of Architecture degree program. With the approval of the NAAB, the department began in 2006 to offer the new Master of Architecture degree program as the accredited professional degree and the first set of NDSU 'M.Arch' graduates receiving their degrees in the spring of 2007.

The Architecture Department broadened its scope in 1983 by joining with the Landscape Architecture program to become the Department of Architecture and Landscape Architecture. The NDSU Landscape Architecture program evolved between 1970 and 1980 as a joint venture between the departments of Horticulture and Architecture. As the landscape-architecture profession matured along with the growth of the academic landscape-architecture program, NDSU began to offer the Bachelor of Landscape Architecture as a full and substantive degree program with its first set of students graduating in 1988.

Beginning in 2004, NDSU launched a major expansion into the downtown area of Fargo with both Renaissance Hall and Klai Hall housing the departments of Architecture, Landscape Architecture as well as Visual Arts. This mini campus started in 2004 with the acquisition and renovation of the Northern School Supply building (now Renaissance Hall) at NP Avenue and 8th Street North in downtown Fargo. This building initially served as the home of NDSU's Visual Arts program and also housed some sections of the architecture and landscape architecture programs. The remaining programs in architecture and landscape architecture were housed in the main campus in the Architecture Building and Ehly Hall.

The University facilitated a jurisdictional or disciplinary separation of the Department of Architecture from the College of Engineering and Architecture. This eventual detachment occurred in 2013 and became necessary as the Engineering departments had become more oriented toward research and less focused on the building sciences. Thus, the Department of Architecture was moved in 2013 to the College of Arts, Humanities, and Social Sciences.

As this publication is being printed in the summer of 2023 NDSU has consolidated the seven colleges at NDSU into five, setting in motion a plan to include the Department of Architecture in a new College of Art and Sciences.

SCHOOL OF DESIGN, ARCHITECTURE, & ART

In 2020, the new NDSU School of Design, Architecture and Art was established. The formation of the School formally established the program in Landscape Architecture as its own department, and joined the Departments of Architecture, Landscape Architecture, and the Visual Arts into one cohesive administrative unit, thereby facilitating collaborations on multiple levels. The 2023 transformation has moved additional programs into the School. Between the three departments, the School houses programs in Architecture, Interior Design, Landscape Architecture, Graphic Design, Studio Practice, Arts Education, and Apparel, Retail Merchandising and Design.

The Department of Architecture offers two main academic programs, namely: the five-year professional course of study that leads to a Master-of-Architecture (M.Arch) degree and the four-year undergraduate pre-professional Bachelor of Science in Architecture degree.

ABOUT THE CONFERENCE AND BEGINNINGS

The National Conference on the Beginning Design Student (NCBDS) is a national peer-review scholarly gathering dedicated to the study and practice of beginning design education. For over 25 years, the NCBDS has provided a forum for design educators to present papers and projects and hold discussions related to introductory design issues.

The NCBDS's origins reside in a small gathering entitled Beginnings. This gathering, held in 1972 at the University of Wisconsin, Milwaukee, and organized by Tim McGinty and Gerry Gast, brought together for the first time design educators to discuss introductory design education. Just over a decade later, after a second gathering held in 1983 at Cranbrook Academy, the first Beginning Design Conference was held in 1984 at Arizona State University. Since that conference in Arizona, the National Conference on the Beginning Design Student has been and continues to be the primary venue for discussion about the practice of and research into for beginning design.

Perhaps the most remarkable aspect of the NCBDS's longevity is that the conference has no formal organizational structure. It has no president, no treasurer, and no dues. Instead, the conference has a dedicated community of beginning design educators and faculty whose interest in the educational challenges and attendant pedagogies, projects, and curricular strategies associated with beginning design propel the conference.

CONFERENCE LEADERSHIP COMMITTE

NCBDS 38 CONFERENCE LEADERSHIP COMMITTEE

Jennifer Brandel, MFA, AIA, NCARB, NOMA

Jennifer Brandel is an Assistant Professor of Architecture in the School of Design, Architecture and Art at North Dakota State University where she teaches in the beginning and advanced design studios and lectures on speculative architecture and foundational design principles and processes. Prior to joining NDSU, she practiced professionally for 15 years with a focus in Healthcare architecture. Other topics of research and artistic making in ceramic and drawing include land use, human-nature relationships, regional indigenous architecture and healing space.

Charlott Greub, MA, MFA, Dipl.-Ing. NRW

Charlott Greub is an artist and registered architect in the European Union with 10 years of international professional experience. Currently she serves as Associate Professor of Architecture at North Dakota State University specialized in Urban Design and feasibility studies in metropolitan areas, a trans-disciplinary approach that addresses environmental, social and cultural factors within the city. Previously she taught architecture and art at the University of Utah in Salt Lake City, the Bauhaus University in Weimar, Germany and the Technical University Graz, Austria.

Susan Schaefer Kliman, Ph.D., FAIA

Susan is a registered architect with over 30 years of comprehensive industry and academic experience. Her recent focus has been on the academic side, where she has overseen architecture and sustainability programs at both North Dakota State University and the University of the District of Columbia. She has taught a variety of undergraduate and graduate classes, including design studios, research methods, ethics and practice, and construction systems. Her own research interests include the mitigation of the urban heat island effect through appropriate building design, and the integration of landscape with structures. She maintains a small practice, Klimatic Architecture, specializing in high performance buildings. Susan is involved in several professional organizations, focusing on the training of emerging professionals; the regulation of practice; and the accreditation process for architecture programs. She has dedicated her career to the development of the next generation of architects, and has a long-standing commitment to equity and diversity in the profession.

Regin Schwaen, MA, MAA, AIA Assoc.

Regin Schwaen is an associate professor of architecture at NDSU where he teaches and lectures in architecture, theory, and innovative concrete technology. He moved to the United States in 2000 after teaching architecture for 5 years at The Royal Academy in Copenhagen, Denmark. He received prizes and honorable mentions in domestic and international competitions and participated in curated exhibitions. Regin Schwaen studied as a visiting architecture student for two years at the Arts Academy of Düsseldorf, Germany, and began and completed his architecture education at Aarhus School of Architecture, Denmark. He has a huge curiosity for architecture, landscape, art, film, books, and travels vividly. His field of expertise are in the area of minimal structures in ferro-cement and casting concrete in fabric form. In 2020 he was granted an AIA ND professional award.

INDEX

INDEX

Post Script

North Dakota is a Great Plains state with repeating rolling hills and cloudscapes. It is where 'big sky country' begins. It is also the location of the geographical center of North America and home to the somewhat nebulous border at the International Peace Garden. These places are marked so we may find our way or define a location or place of being in the vastness of the open prairie. Of course, there are other ways that people have come to orient in this place, to define a known in a potential unknown.

From 1958 to 1963 architect Marcel Breuer designed and executed the University of Mary and the Annunciation Priory of the Sisters of St. Benedict in Bismarck, North Dakota. The primary choice of material is concrete, partly prefabricated, partly cast in situ. The campus is placed on a prominent site that overlooks the Missouri River which is part of the 4th longest river system in the world.

On the opposing bank of the river and slightly further upstream, one can find a site that contains the ruins of large Mandan and Hidatsa Indian earth lodge villages, including mounds and fortification ditches, which were inhabited from around 1500, or earlier, to the 1800's. This site overlooks the Missouri River as well and the community selected a site that is oriented towards the welcoming sunrise. This is in opposition to the site of the campus that has been designed to embrace the sunset.

The bell banner and the cloister arcade at the University of Mary embrace and frame the river, the surrounding prairie landscape, and the sun in an exceptionally beautiful way. Both constructions rely on the cadence of the sun to orient, selecting a phenomenon that itself is always shifting yet ever-present. Perhaps Marcel Breuer was inspired by those facts and this place. Overlooking the Missouri, or visiting the white sandy meandering riverbank, and looking back at campus, one thinks of ancient temples in Egypt, Greece, or South America. One may be reminded that we have always been navigating the current moment to define and redefine our own way of knowing past, present, and potential futures.

National Conference on the Beginning Design Student 2023

Hosted by

School of Design, Architecture & Art
North Dakota State University
Fargo, North Dakota

ISBN 987-1-312-29955-9