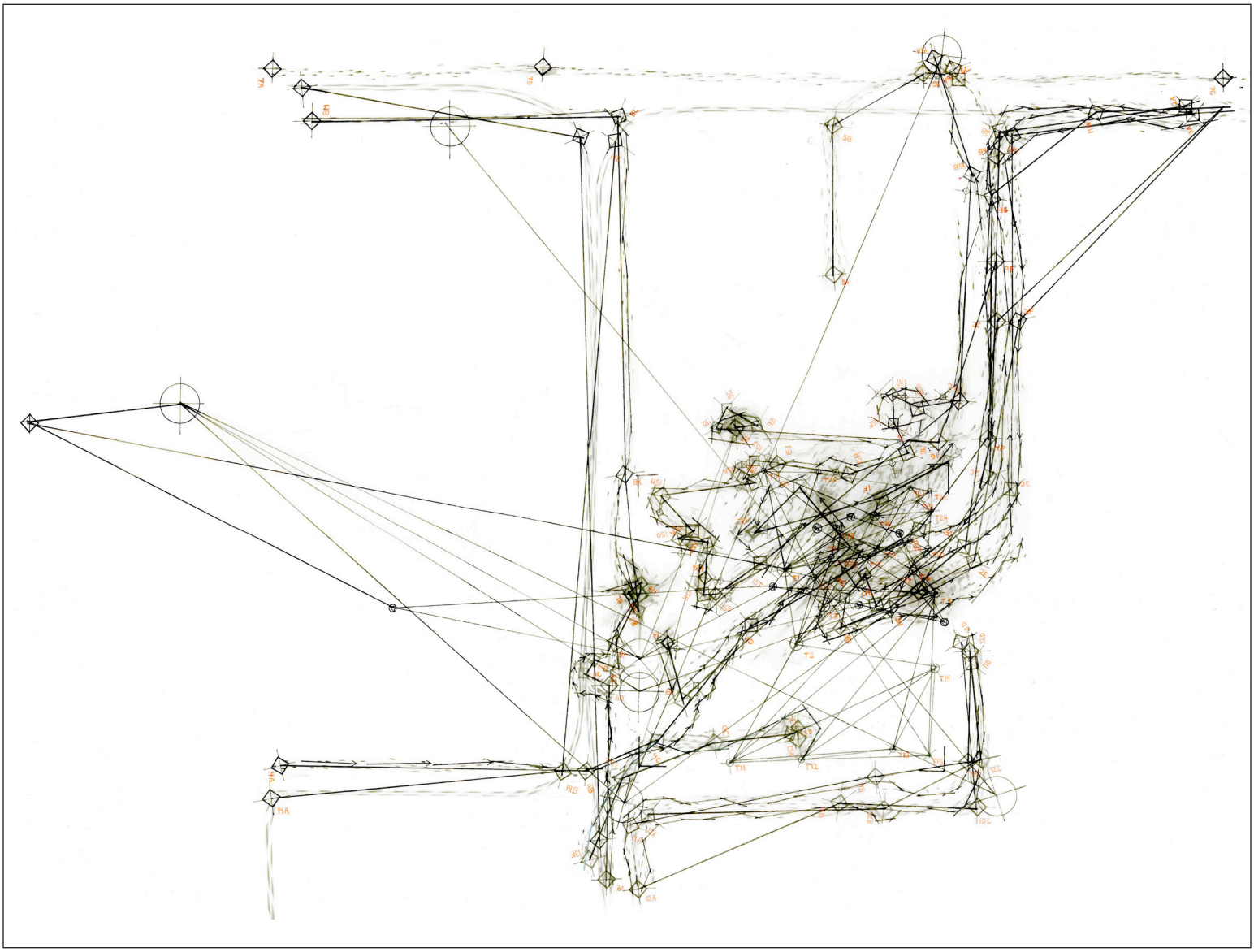


Christina Shivers

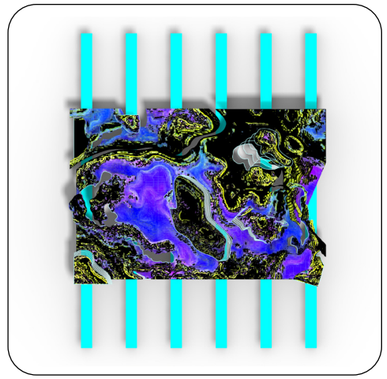
Research & Professional Portfolio

Design Research: How to Train Your Algorithm

Ventulett NEXT Fellowship Research–In Progress

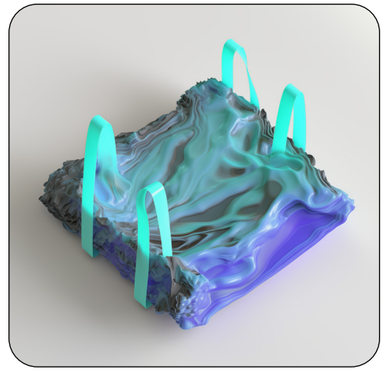
This research project sits at the intersection of architectural craft and construction, technology, and sustainability, and is focused considerably on the use of Artificial Intelligence in architectural production and representation. A primary question that motivates this work concerns what potential AI poses specifically related to new material and craft practices in architecture, and how these practices can become ecologically innovative. In exploring this question, I have developed a process of critical interrogation of AI algorithms used by popular programs like Midjourney and the visual data with which it is trained. As AI is continually marketed as a super-human, magical technology, it is easy forget that it is built upon an accumulation of immense amounts of data created by humans; an interrogation of this data provides insight into political, social, and environmental anxieties, and this insight was used as a basis for developing new craft and material methods for architectural fabrication.

Additionally, a major question guiding this research is: what is the aesthetic of AI? And, what does this aesthetic reveal about our society and political priorities? This project works to effectively move beyond the "money-shot" style renderings produced by architects using Midjourney and other AI programs, and my research is as much about uncovering an emerging AI aesthetic, as it is about developing new construction methods. AI representation and drawing programs like Midjourney consistently are used to create renderings inspired by science fiction or parametric forms of the last thirty years, but these programs—and the data underlying them—have not been significantly explored in terms of their aesthetic quality. In beginning to uncover uncanny material and formal representations that are uniquely tied to environmental issues, this work begins to theorize an emerging aesthetic for architects working with Artificial Intelligence.

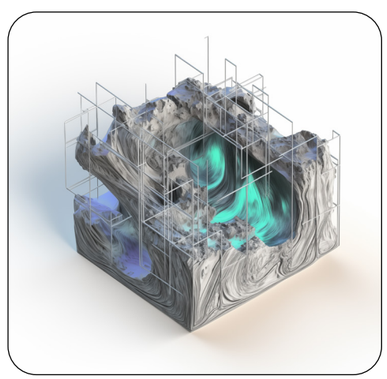


Camoflauge Model

A :"torqoise and green plastic bag", created using Canva AI



Hybrid Model, created using Midjourney



Pavilion, created using Midjourney

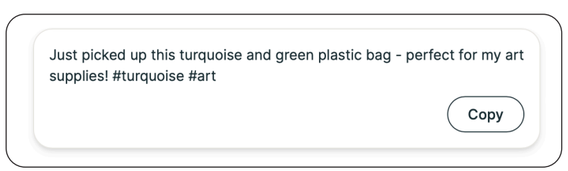
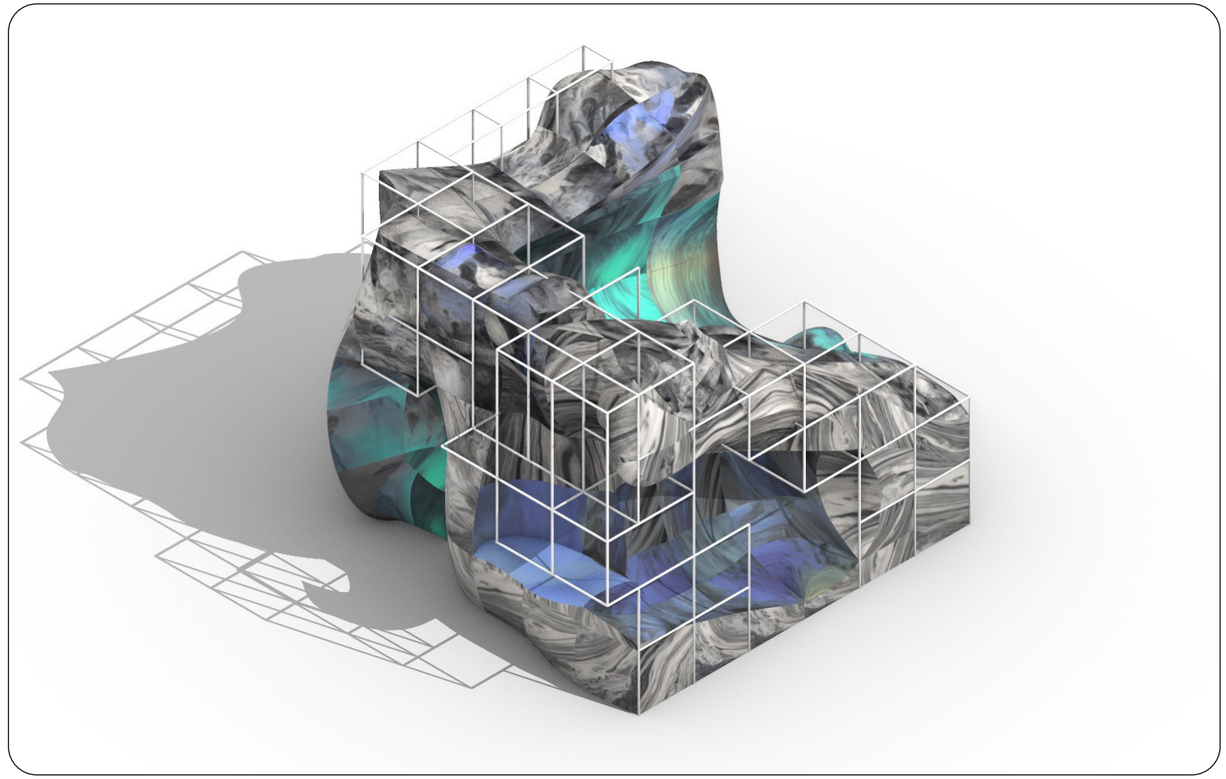


Image caption generator, from pally.com

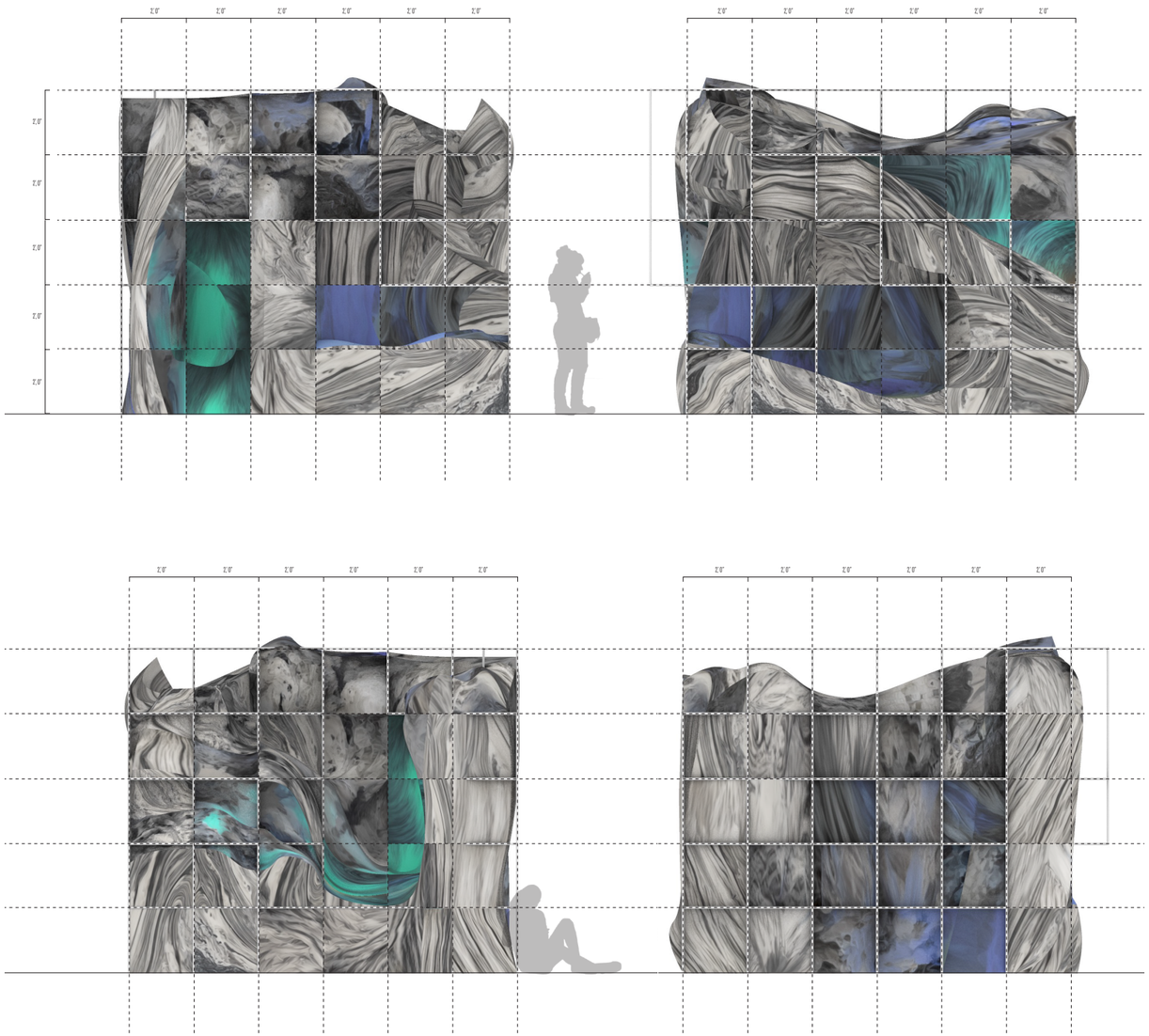


Isometric rendering of the pavilion, modeled and rendered in Rhino

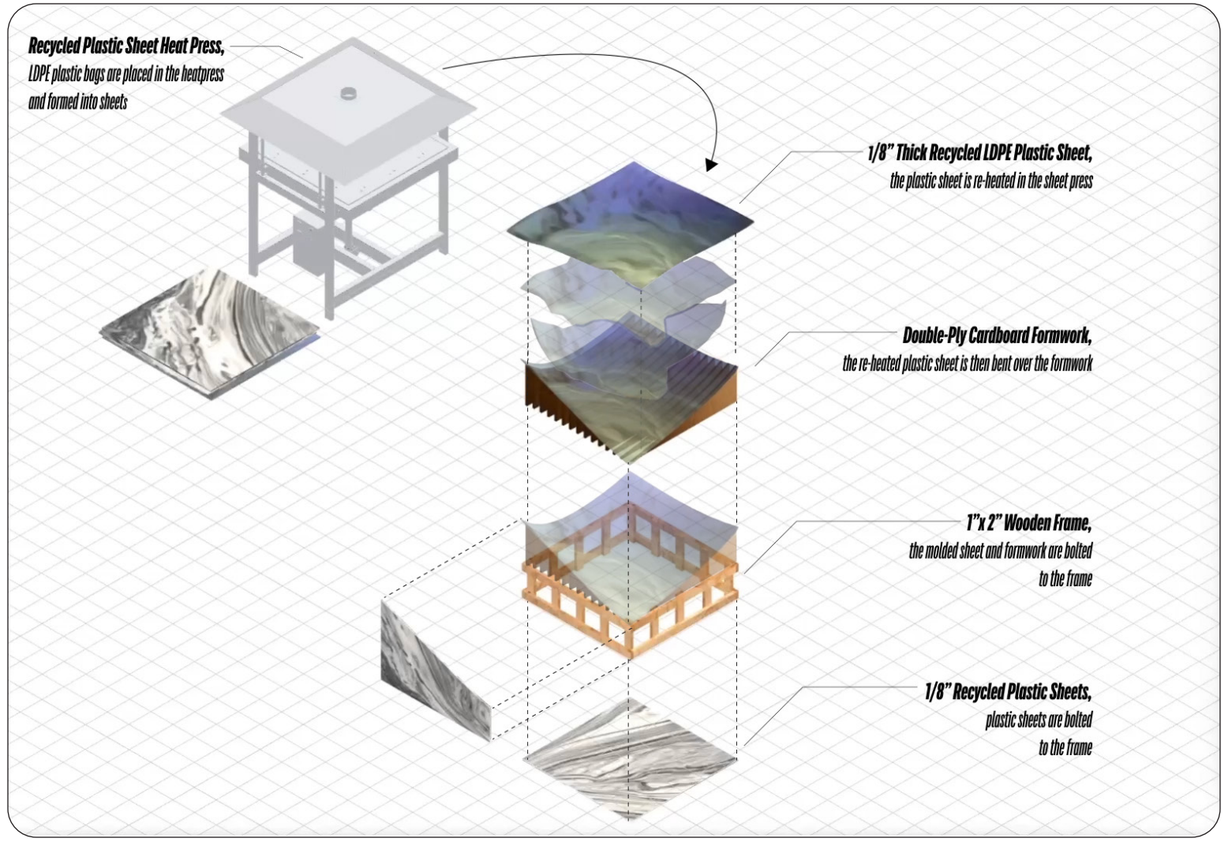
Research Pavilions: Pavilion 1—Recycled Plastic

This process began with the fabrication of a "camouflage model" designed using a combination of computational drawings created using "noise" algorithms and spatial manipulations in Rhino. Drawings produced with "noise" are capable of confusing AI image recognition and machine learning algorithms, causing incorrectly identified images. This technique was used in order to push the AI algorithms beyond the boundaries they are engineered to exist within. Additionally, the process of artifact making relied on spatial manipulations intended to introduce another unexpected visual element to confuse the algorithm.

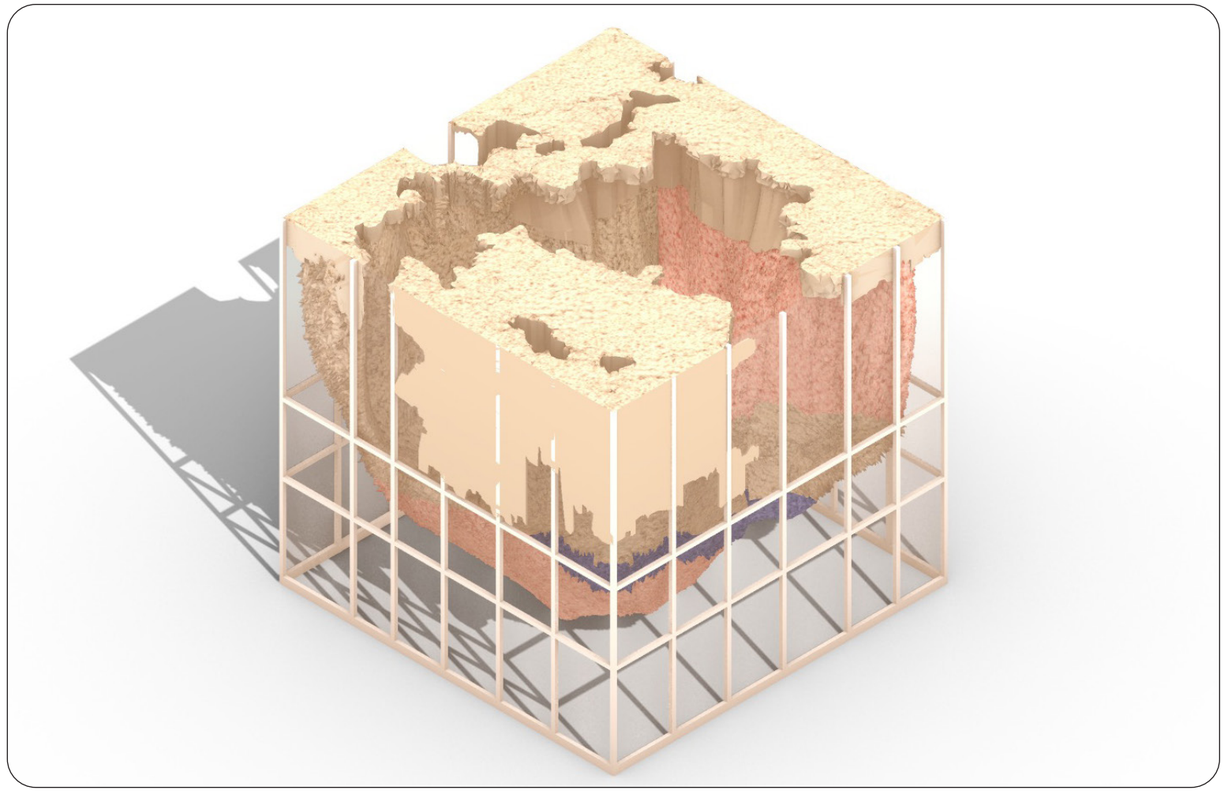
Once the "camouflage model" was completed, I asked an AI program to describe it. In this first exploration, the AI program presented several options but consistently labeled this image as a "turquoise and green plastic bag". While the camouflage model is an abstract construction, the AI algorithm consistently attempted to identify it as an object, and continuously defaulted to one of the most ubiquitous items littered across the earth: the plastic shopping bag. This result was particularly revealing, in that the default to the plastic bag provided a peak into the data upon which the algorithm was trained.
This process of cooperation with AI programs culminated in the creation of a "research pavilion", drawn by Midjourney. I then three-dimensionally modeled and rendered this image as a spatial construct in order to begin a process of physical fabrication. In working with AI, new avenues of material and craft exploration emerged, and this first pavilion will act as a process of exploring methods for fabrication using recycled LDPE plastic bags. The pavilion consists of a series of 2' x 2' modules constructed of individual recycled plastic sheets. As part of my work as the Ventulett NEXT Fellow, I am constructing a series of these modules to scale for display at an exhibition I am developing for the end of the academic year. The recycled plastic pavilion is one of three pavilions exploring this process of interrogation with AI as a method for developing new craft and material practices.



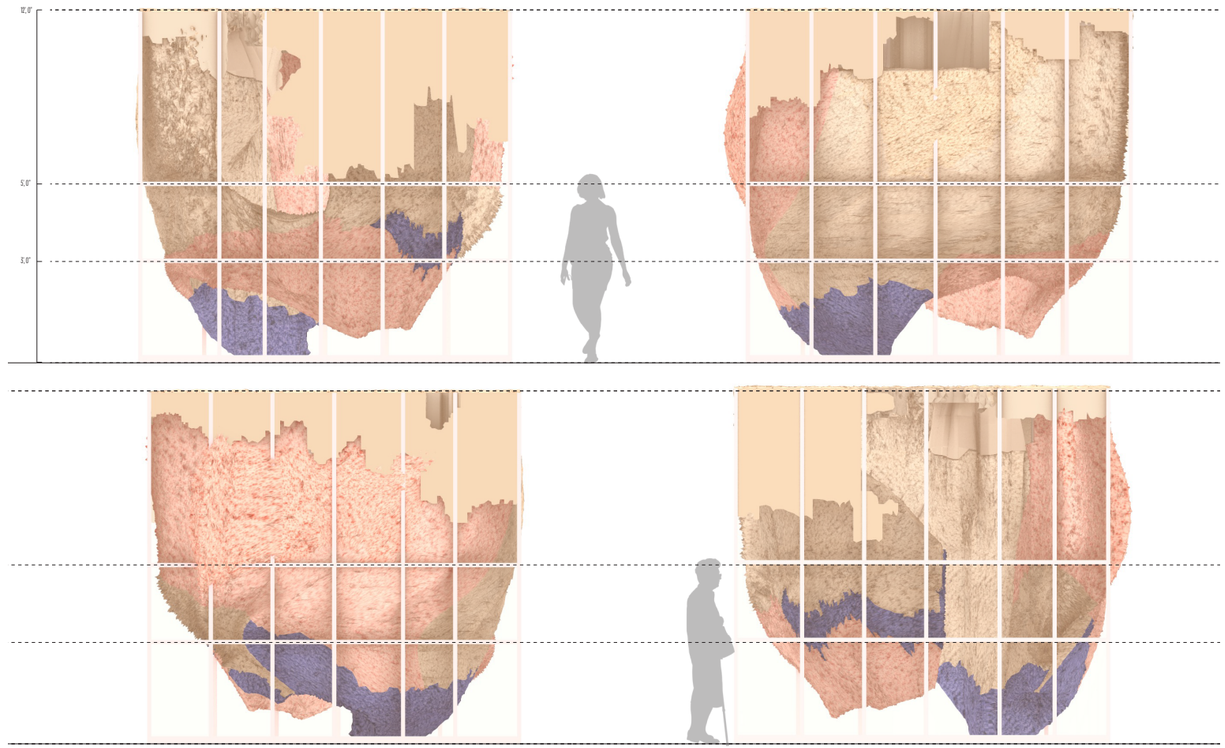
Elevations of Pavilion 1



Plastic Module Construction Diagram



Isometric rendering of the pavilion, modeled and rendered in Rhino



Elevations of Pavilion 2

Research Pavilions: Pavilion 2—Mycelium and Foam

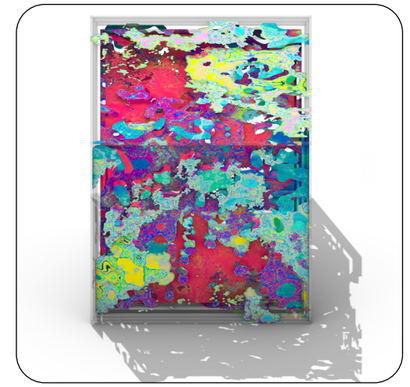
The second “research pavilion” designed for this project utilizes mushroom mycelium as a construction material; while mycelium has been used in several architectural research projects, this research utilizes a hybrid construction method using reused styrofoam and mycelium. The “camouflage model” in this case was interpreted as a “colorful computer monitor”, and in the process of hybridization, began to meld organic, mycelium-like growth with representations of computer monitors. In the final output, the resulting drawing portrayed an organic, mycelium or styrofoam-like construct sitting inside a frame.

The materiality of the final output will be explored through the creation of a 2’x 2’ true to scale module consisting of a styrofoam core surrounded by a thin layer of mycelium. Mycelium blocks researched in architectural practice currently require significant amounts of heat and electricity to bake; to avoid using significant amounts of electricity, this fabrication process relies on the reused styrofoam core to allow for a thinner membrane of mycelium, which can subsequently be baked in the sun. Additionally, the styrofoam cores become reused and kept out of the landfill for a much longer amount of time.

The Re-use Lab

The process above provided the preliminary research for the creation of a sustainable material research program called the Re-use Lab. This is accomplished through intensive material exploration and experimentation utilizing advanced research methods. This lab consists of a plastic recycling press designed and fabricated as part of my research, as well as a plastic sheet press. Additionally, this lab researches the use of bioplastics that are capable of being composted and made from food-grade materials; mycelium and mushroom mold-making; aluminum recycling and recasting using a crucible (a process already explored by a student in my Spring elective in 2024); and other material research processes.

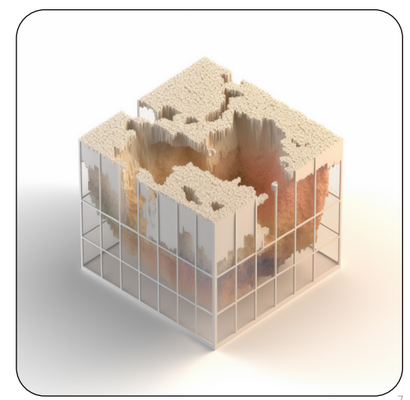
The goal of this lab is to combine existing knowledge pertaining to experimental materials and material reuse, and use this knowledge to develop a less environmentally harmful material culture in both architectural model making, and at the level of construction. Much of the research pertaining to plastics reuse, bioplastics, mycelium mold making, and other material reuse concerns how these materials can be used in product design and fabrication, and their use in architectural applications is significantly understudied and under-researched.



Camoflauge Model

A :"colorful computer monitor", created using Canva AI

Hybrid Model, created using Midjourney

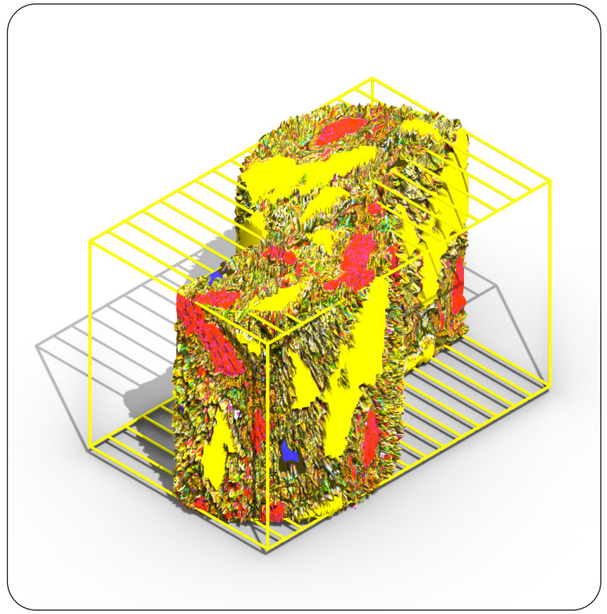


Pavilion, created using Midjourney

Research Pavilions: Pavilion 3—Laminated Paper

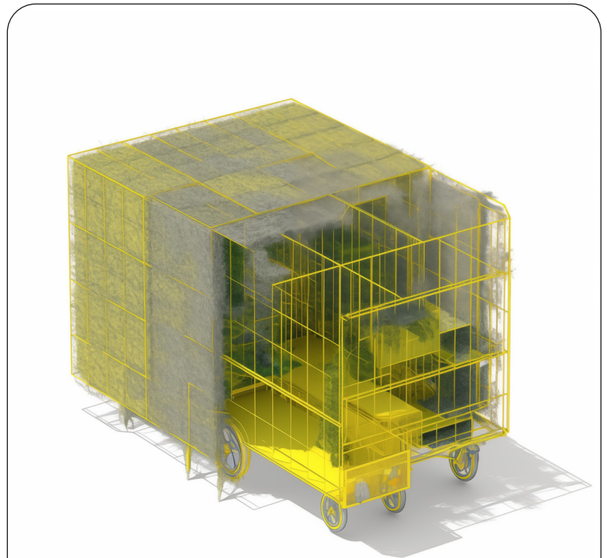
The third “research pavilion” explores recycled shredded paper which is subsequently laminated with glue, compressed in a mold, and machined on a CNC-mill to create a series of 2’x 2’ modules. The initial camouflage model was interpreted by the AI algorithm as a “cheery yellow and green shopping cart... not just for groceries; it is a canvas for imagination.” Through the same process explored above, this exploration resulted in a hybrid model that combined the shopping cart form with an organic, lightweight material that began to resemble the pulp-like texture of paper or textile materials. The default to the shopping cart, a symbol of endless consumerism—but increasingly becoming a relic of a bygone era as online shopping replaces shopping in physical stores—presents itself as a ghostly impression by the development of the final pavilion.

Paper is utilized as a material for construction as it is also a ubiquitous, but slowly disappearing relic of a bygone, pre-digital era. Today, paper is most commonly relegated to use in junk mail and political fliers, a massive waste to manufacture, mail, and recycle, but somehow, ubiquitous. This pavilion will collect this nuisance mail material and utilize it as a construction material.

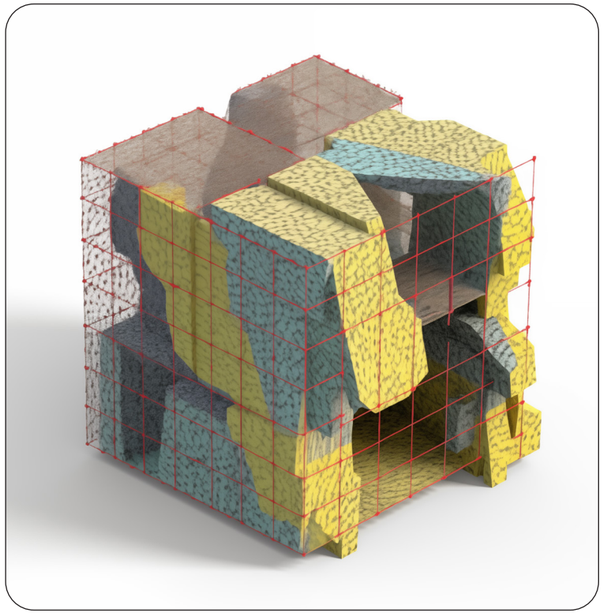


Camoflauge Model

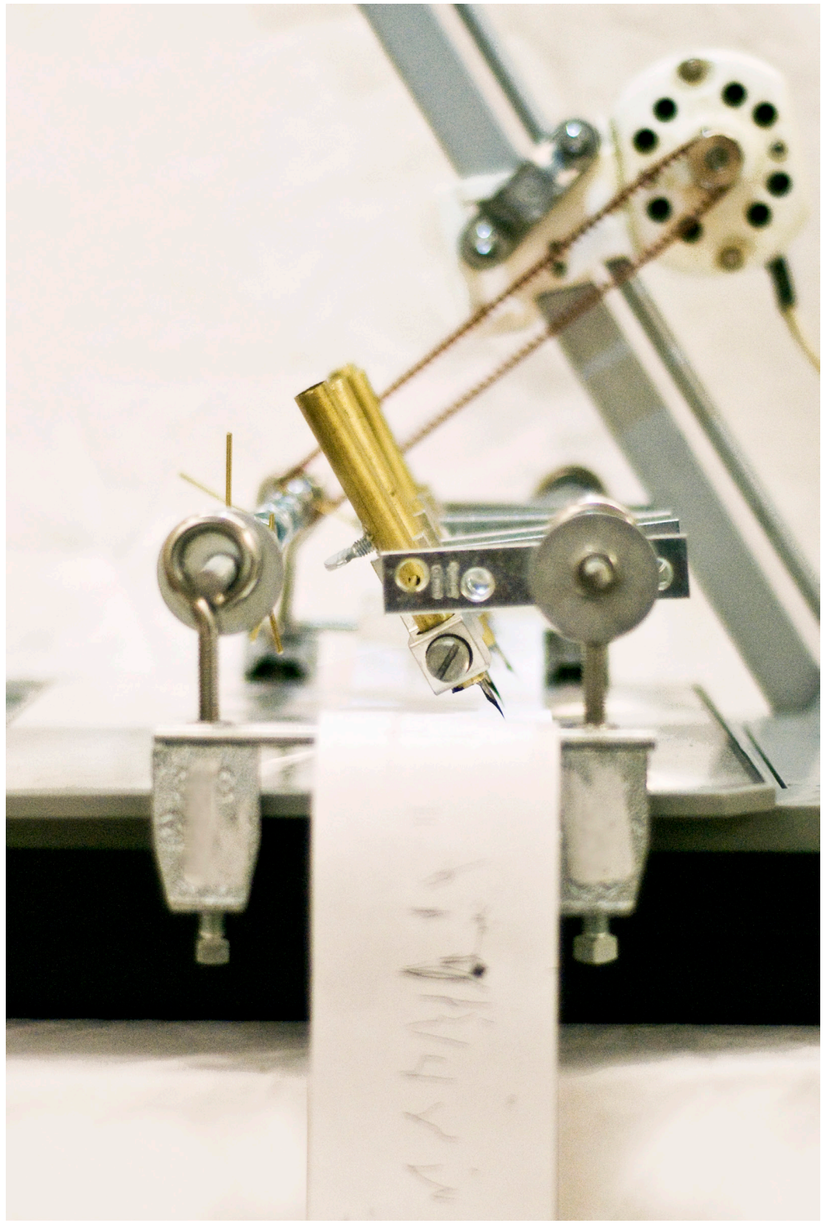
A “cheerful yellow and green shopping cart”, created using Midjourney



Hybrid Model, created using Midjourney



Pavilion, created using Midjourney



Design Research: Counter Spaces and Notation Machines

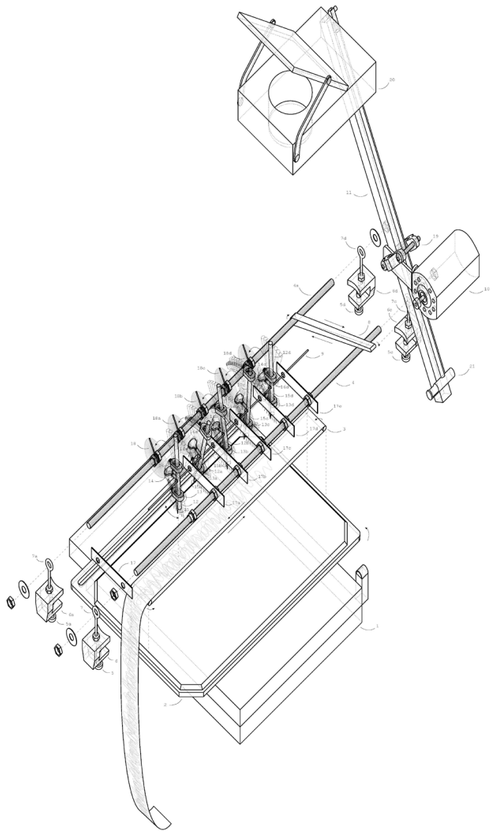
2015 Atlanta Young Architects Forum Emerging Voices Exhibition Project and Graduate Thesis Project
Thesis Advisor: Benjamin Flowers
Spring 2015 (thesis) – Spring 2017
Exhibited: ADAC, 351 Peachtree Hills Ave., Atlanta, GA,
Kennesaw State University School of Architecture, Kennesaw, GA
Harvard University, Graduate School of Design Fortyk Gallery, Cambridge, MA
Published: Mas Context, Debate issue no. 27

This project began as my M.Arch thesis in 2015 and continued after I received the Young Architects Forum of Atlanta's Emerging Voices Award in 2015. The project explored spaces leftover from the industrial, Fordist past of Atlanta, Georgia. These spaces were part of a landscape of ill-fitting pieces, some hyper-modern, others neglected and decaying amidst daily traffic jams. As part of my thesis, I coined the term counter-space to describe my sites of inquiry. Akin to slag, sludge and waste resulting from modern industrial processes, the counter-space is the left-over and neglected space of the city, resulting from continual processes of capitalist development/disinvestment. Hidden within plain site, abandoned and unused, these spaces exist everywhere.

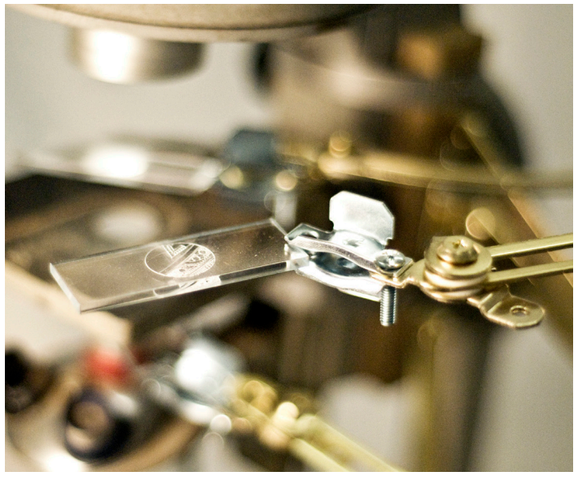
This thesis sought to understand and reveal these counter-spaces and their hidden lives within the city in order to bring an awareness to continued disinvestment in a once thriving city made up of many communities of color. The spatial-temporalities of counter-spaces were understood through a de-territorialization of representation using notation and mapping. Notation machines were designed in response to site stimuli and these machines created a "cartography of events" specific to each counter-space. Temporal stimuli from each site were used as inputs for the machines.

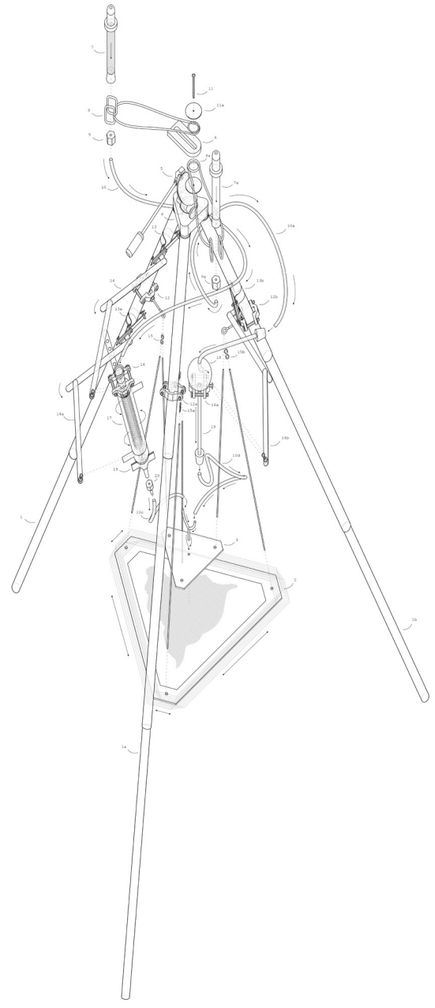
Over the course of the project, six total notation machines were created in response to six different sites in the city of Atlanta. These sites included: the abandoned GM factory in southwest Atlanta; the site of the decaying remains of the football stadium of Morris Brown College—an historically Black university in Atlanta that lost accreditation some years before; a median carved from the intersection of multiple interstates just south of Atlanta that sits on the site of once thriving African American neighborhoods destroyed by urban renewal; a cemetery for enslaved persons that was uncovered and moved during the construction of Interstate 75—today the cemetery lies in a median of an offramp; a family plot left in a parking lot of an abandoned mall; and lastly, the Gulch—the former site of the terminal point of the railroads that created Atlanta. Once abandoned and left to decay in the aftermath of white flight, urban renewal, de-industrialization, and Atlanta's long history of racism, today these spaces are threatened by rapid gentrification and development. The design of the notation machines and their respective drawings are a memorialization of the spaces these sites once were.

This project was exhibited as part of the YAF Atlanta Emerging Voices Award in 2015, and at Kennesaw State University and the Harvard University Graduate School of Design; it was published in Mas Context in 2016.

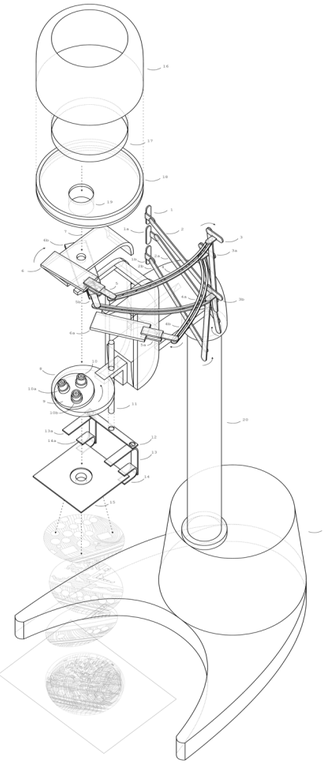


Temporograph Axon

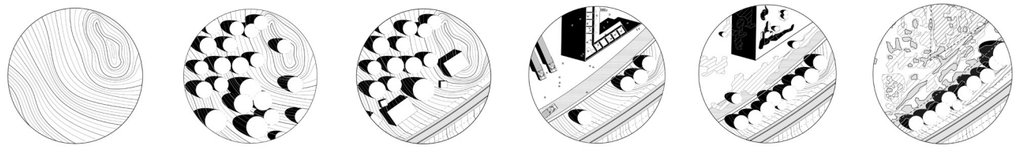




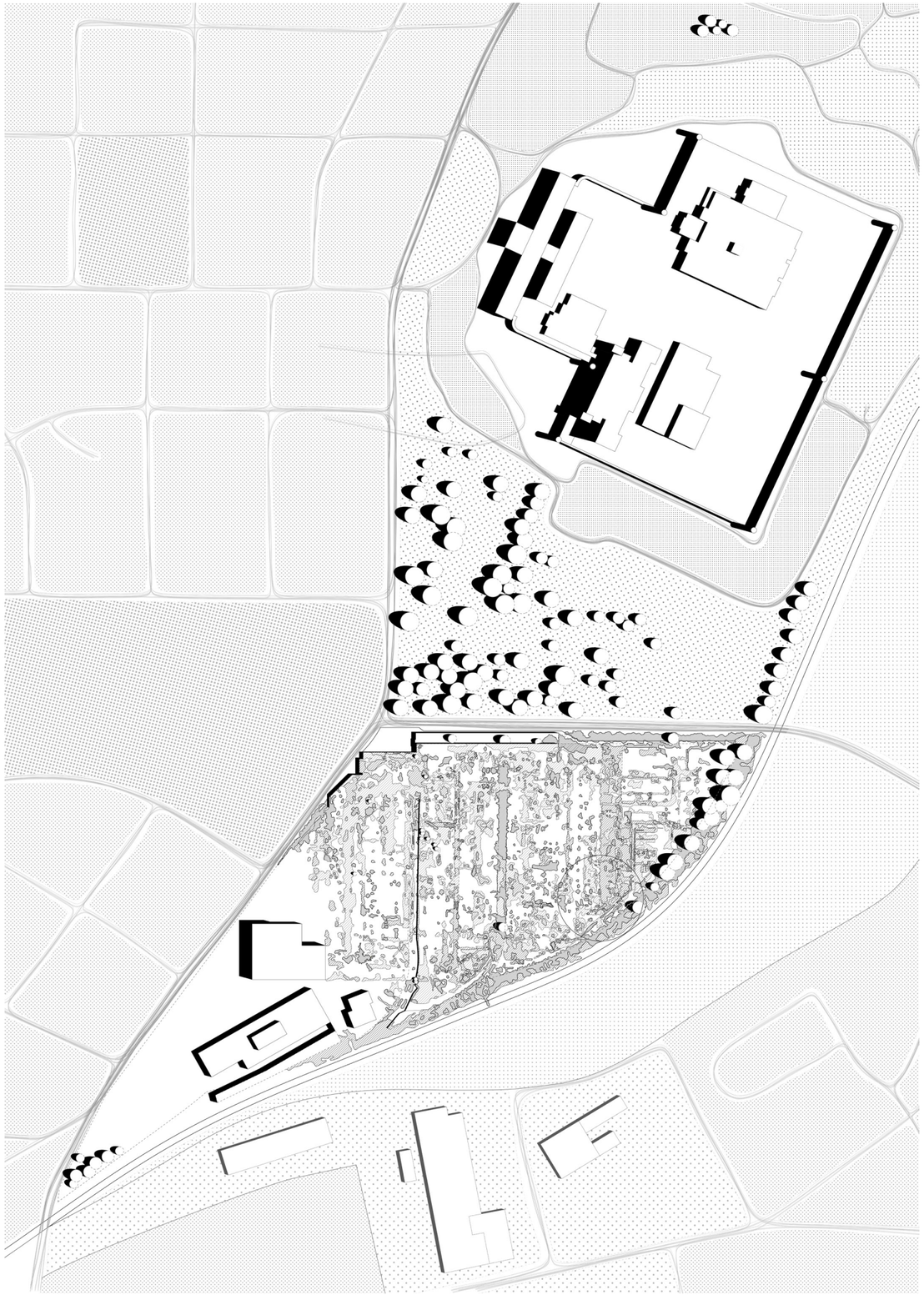
Displacement-graph Axon

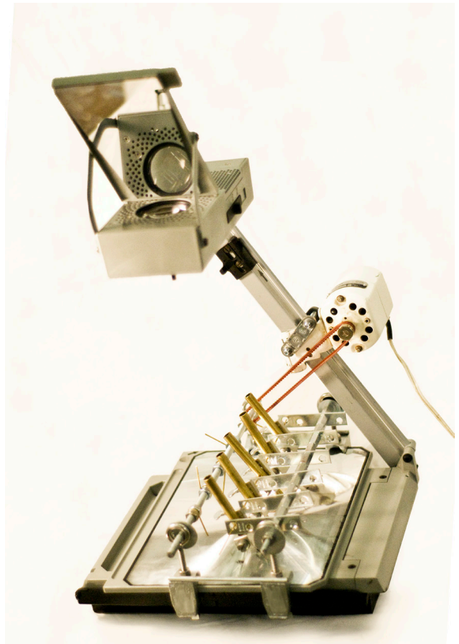


Stratograph Axon



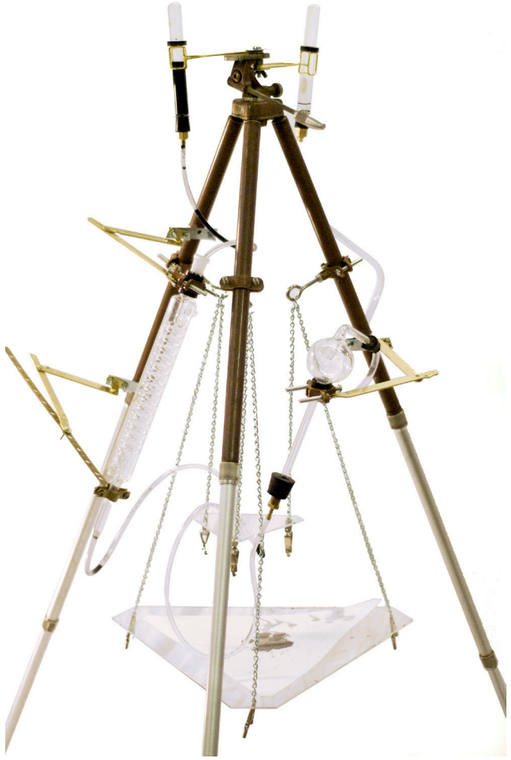
Stratograph Slide Images





Temporograph

Stratograph

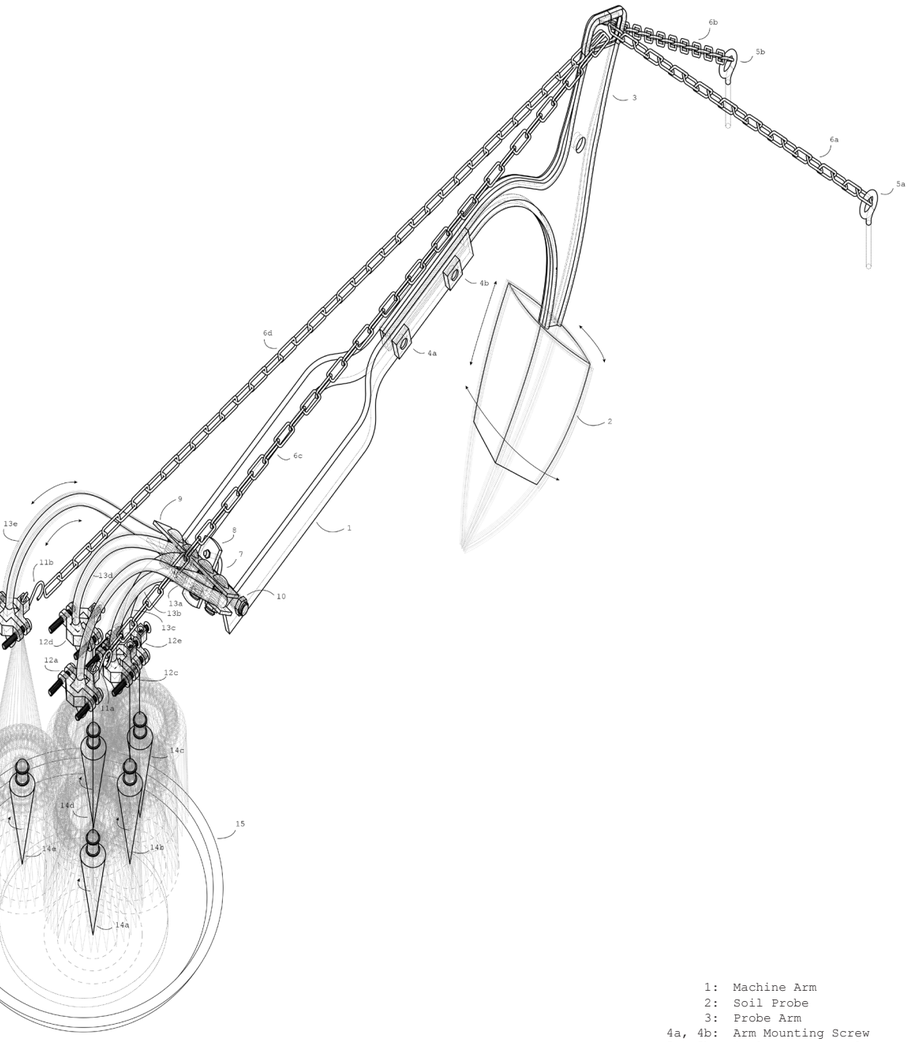


Displacement-graph

Dislocaregraph

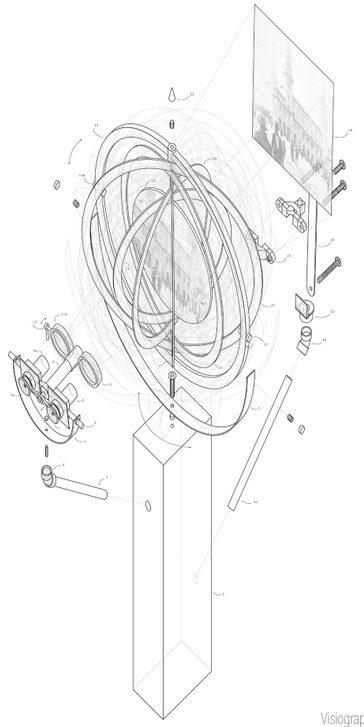
Inclinograph

Visiograph

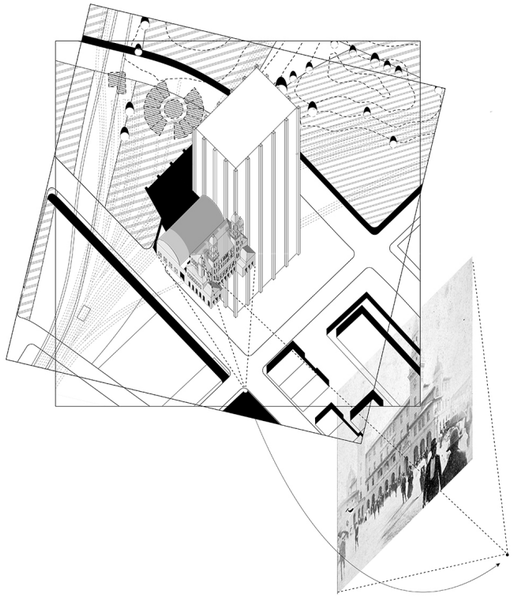


Dislocaregraph Axon

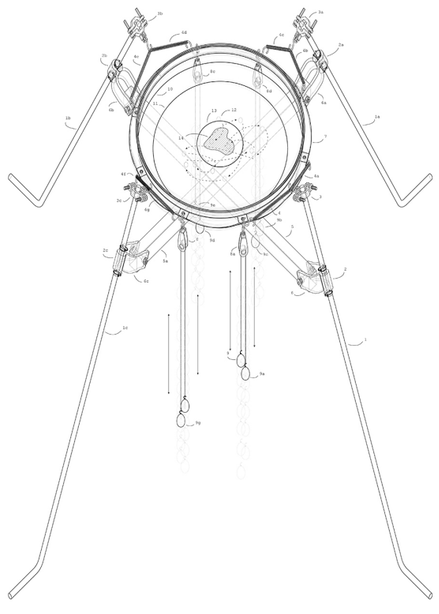
1: Machine Arm
2: Soil Probe
3: Probe Arm
4a, 4b: Arm Mounting Screw
5a, 5b: Soil Mounting Bolts
6, 6a, 6b, 6c: Machine Support Chain
7: Machine Mount U-Bolt
8: Mounting Flange
9: Vibration Arm Mounting Flange
10: Mounting Bolt
11a, 11b: Support Chain S- Hook
12a, 12b, 12c, 12d, 12e: Pendulum- to- Arm Connector
13a, 13b, 13c, 13d, 13e: Vibration Arms
14a, 14b, 14c, 14d, 14e: Drawing Pendulums
15: Drawing Base - Filled w/ Sand



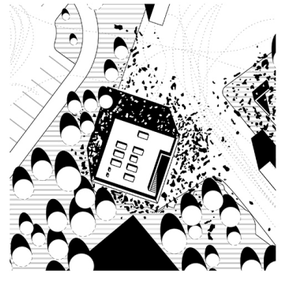
Visiograph Axon

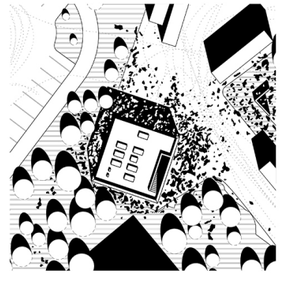


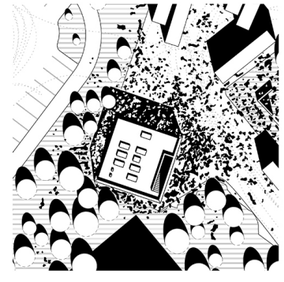
Visiograph Site Drawing



Inclinograph Axon







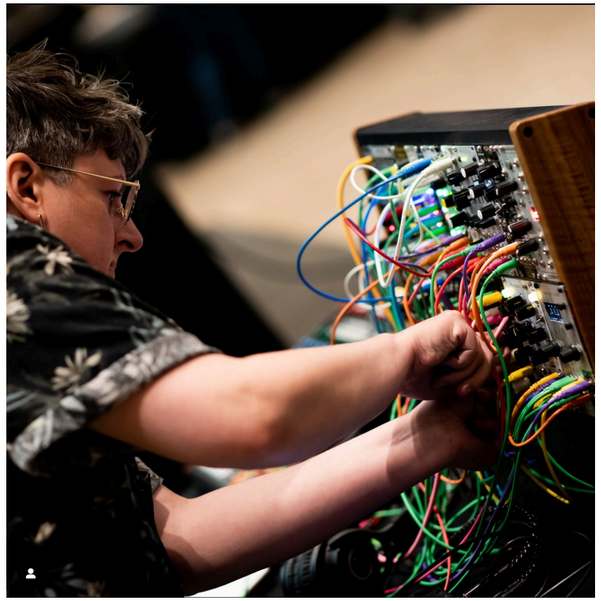
Inclinograph Site Drawings

Design Research and Practice through Music and Sound

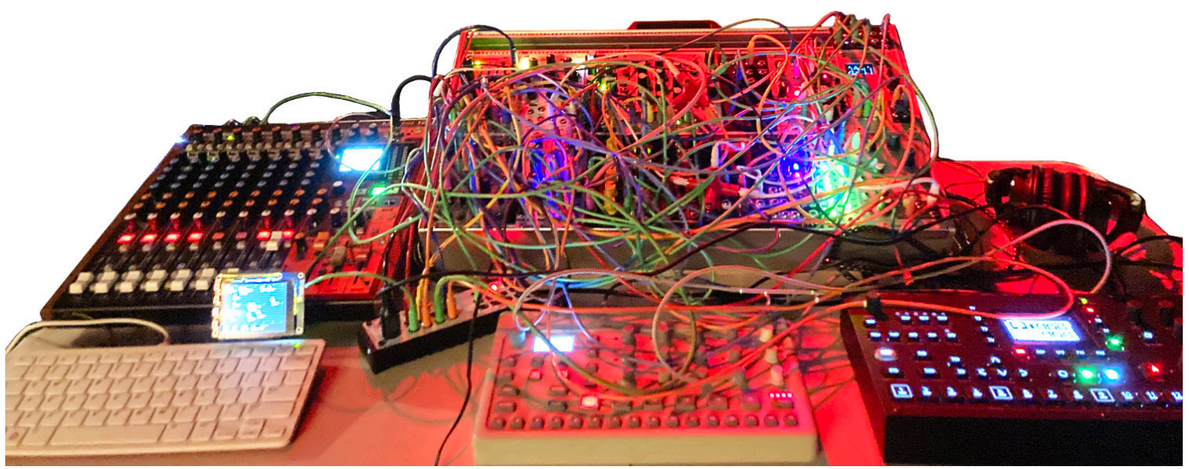
On-going Work
Multiple Locations
Personal Work

My design practice combines my academic interests with my background in architecture and music. I utilize electronic musical instruments in the creation of musical compositions and digital media and have performed at a number of venues in New England including the Boston Museum of Science for the New England Synth Fest; Mayday in Providence, RI; and at the First Church Jamaica Plain in an event featuring several local musicians and visual artists. This work challenges the boundaries of design practice and asks how architectural knowledge can be implemented in a larger project exploring the radical spatial potential of music.

My musical process relies on the generative potential of modular electronic musical instruments, shown below. Modular equipment provides the potential to create completely individualized and unique musical compositions based upon the exponential variability of the inputs and outputs provided by the instruments.

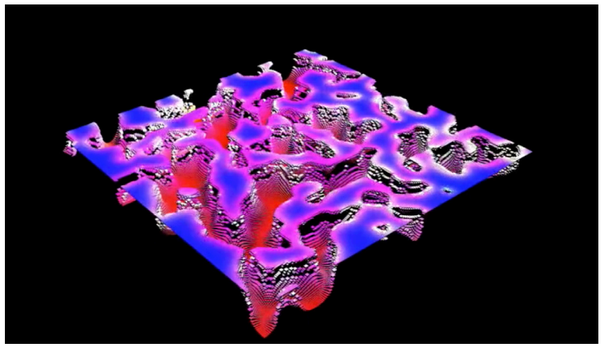


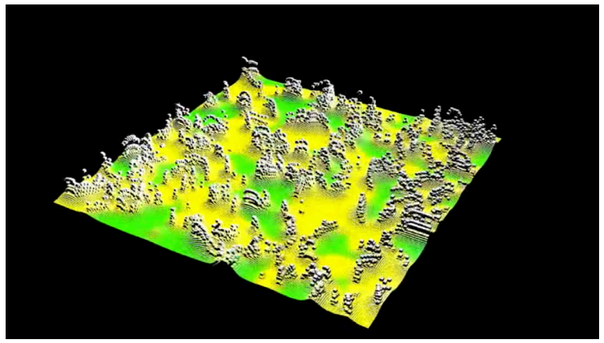
Performance at the Boston Museum of Science, 7.14.22
Photograph by: Jonathan Beckley

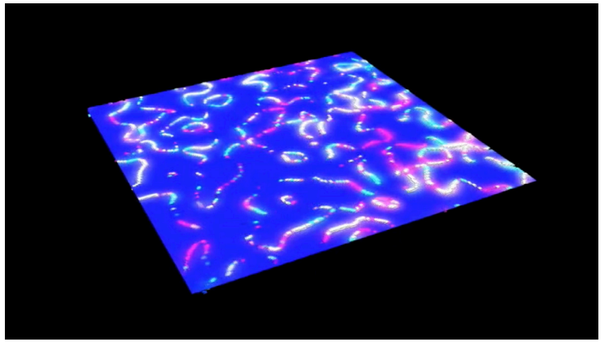


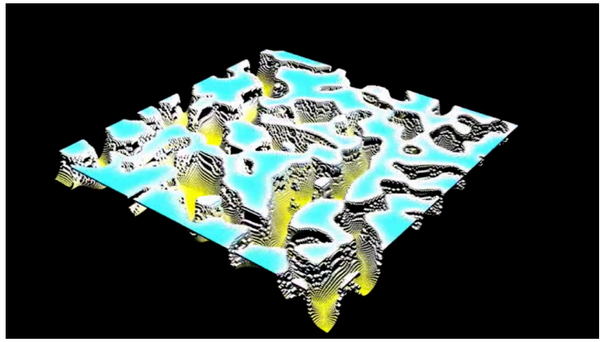
Video for 5ay11

https://vimeo.com/568581789?embedded=true&source=video_title&owner=108722491









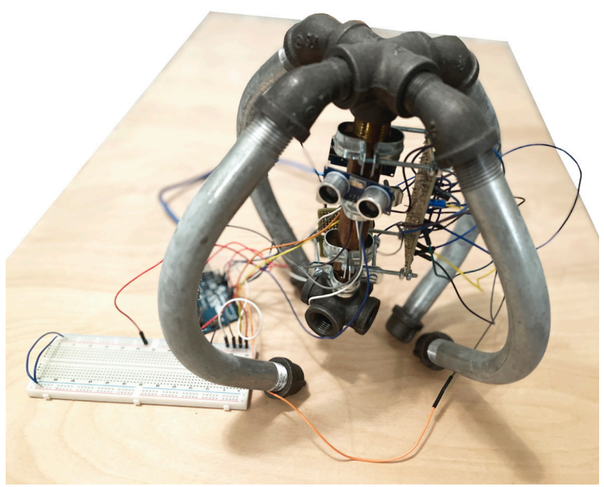
Video screenshots

Additionally, I have paired my physical musical instruments with algorithmic software to create musically responsive visual imagery. The images on the right side of this spread are taken from a video I created to accompany a composition I performed using my modular equipment. The video and accompanying music can be found at the link above the images.

My practice furthermore focuses on the design of electronic instruments built in response to environmental stimuli. These instruments utilize analog electronic components like clock sources, simple oscillators and low frequency oscillators.

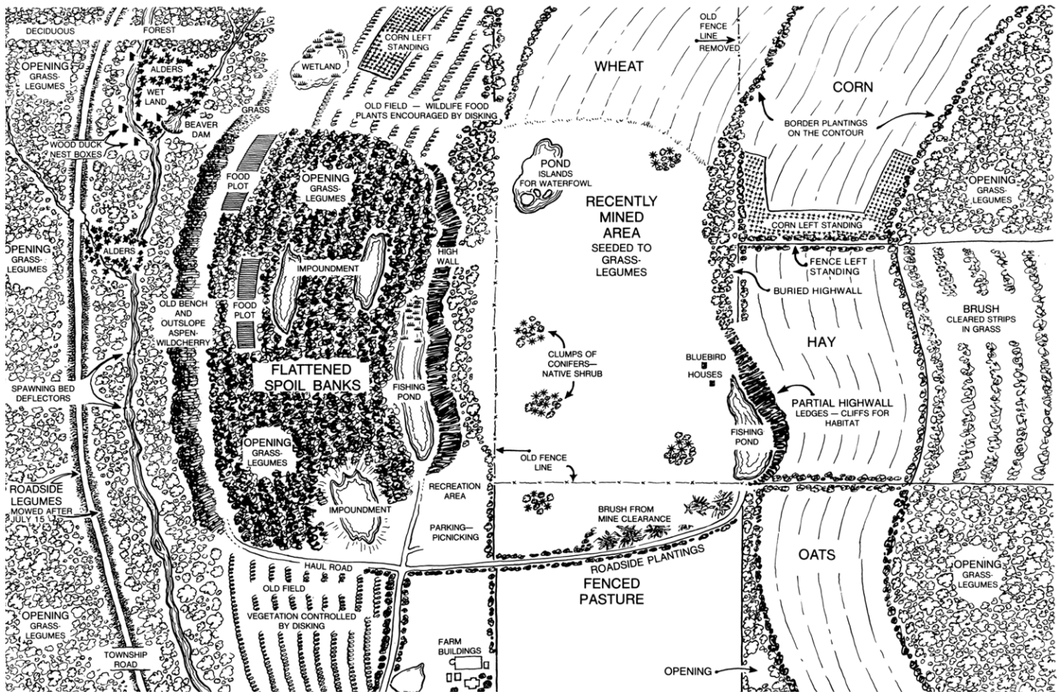
This work is built with digital chips, distance sensors, and photo-resistors that allow the instruments to create sound outputs in response to changes in light, movement, and rotation. This work explores impermanence and change in the surrounding environment.

The image below is an instrument built to respond motion in a gallery setting. The object consists of four oscillators whose frequency changes in accordance with levels of light. A wave of the hand in front of the distance sensors adds another element of frequency change. In this manner, the object acts as a generative chord machine that is activated by public engagement.



PhD Dissertation: Beneficial Use: The Political-Economy of Surface-mined Land Reclamation

Defended May 9, 2023
Harvard University
Cambridge, MA
Research Work



Composite diagram of multiple landscape uses on reclaimed land, Leedy, "Coal Surface Mining, Volume 2", 67.

Abstract:

This dissertation investigates how energy extraction since the 1970s enabled the birth of market-based policies for environmental protection. Through an investigation of surface mined land reclamation programs in Canada and the United States, I draw a connection between coal and oil extraction and larger shifts in environmental-economic thought. Scholars in critical geography have increasingly critiqued the capitalist motivations behind market-based environmental protection measures, however they have not addressed in detail the processes through which these measures emerged. My work contends that post-extractive land reclamation programs created a new political understanding of nature fundamental to the implementation of market-based environmental policy practiced today.

This dissertation uses mined land reclamation programs in North America as a historical practice through which to explore long term changes in the capitalist construction of nature over the latter half of the twentieth-century. As the only form of regulation for surface mining today, land reclamation is the act of restoring and rehabilitating environments destroyed by mining to a state equal to or better than their pre-mined state of productivity. These programs transformed the political conception of nature from an assemblage of natural resources to one consisting of "natural capital," in which qualities like aesthetics, ecosystems, and biodiversity imbue the environment with value. This process rendered landscapes amenable to new forms of market-based policies and regulatory instruments. My research necessarily emphasizes interdisciplinary connections, requiring investigations of economic theory, ecological techniques, and landscape design. I analyze the methods employed by reclamation professionals as political instruments used to enact legislative changes, develop new land uses, and undermine unionized labor practices. While this work is important to histories of environmental policy, my investigation also reveals how spatial and material histories are essential to understanding the politics of the environment.

Chapter Outline:

Chapter One: The Labor of Reclamation: Plants and Animals in the Development of a New Environmentalism

This chapter investigates the history of economically motivated environmental design practices for reclaiming mines that first emerged in Appalachia in the 1960s, and how these practice set a precedent for ecological restoration practices in use today. Amidst a growth of surface mining of coal, a political backlash ensued in which protesters demanded the outlawing of surface mining in the region. Fearing any loss in economic growth, the state and mining companies worked to develop reclamation knowledge to repair landscapes to satiate popular backlash. With the onset of the oil crises in the 1970s, surface mining grew exponentially, and mining companies moved to significantly larger coal seams in the western half of the United States and Canada, along with the surface mining of tar sands in northern Alberta. With this expansion, reclamation professionals working for Federal, state and provincial governments, and for mining companies, expanded their presence within extractive projects. Employing ecologists, biologists, plant scientists, landscape architects, and economists—among many other professions—reclamation programs developed an environmental knowledge amenable to economic growth, enabling extraction to continue and "greenwashing" its aftermath. Plants and animals were essential tools within reclamation, and through an investigation of their treatment and use in Appalachia, the western states of Montana and Wyoming, and Alberta, this chapter investigates how natural elements were enrolled and used within the larger economic motivations of reclamation and mining.

Chapter Two: Beyond the Urban Fringe?

Chapter two investigates the role of agricultural and resource economists in the reclamation community and their work assigning "value" to reclaimed landscapes. This work occurred in two phases: an early phase in which economists evaluated landscapes based on the production of commodities, and a second, environmentally-aware phase in which reclamation economists actively grappled with questions of pollution, environmental protection, and environmental/ecological value. Until the 1970s, the question of mined-land reclamation consistently involved the question of returning land to "economically viable" uses typically pertaining to agricultural, rangeland, forestry, and other commodity-producing acts. The act of producing commodities measured the success of landscapes. Beginning in the 1970's, environmental concerns – as discussed in the previous chapter – became a major focus of reclamation and mining, changing reclamation economists' roles. The question of pollution was already of concern for many economists after the publication of Ronald Coase's 1960 essay "The Problem of Social Cost", and work conducted by reclamation economists reveals the priorities of a burgeoning field of an environmentally focused subdiscipline of economics.

Chapter Three: The Economic Valuation of Landscape Aesthetics

Chapter Three investigates the role of ecologists within the reclamation community and focuses on the inherent political aspects of specific ecological techniques developed. Land use planning. While many of the scientists and ecologists researching reclamation claimed neutrality in their scientific goals, ecologists and plant scientists worked to design post-mined landscapes in service to the interests of the state and mining industry. For instance, afforestation – the planting of forests in landscapes where there previously were none – was used as a means of reclaiming landscapes due to the possibility of harvesting timber in the future. Afforestation creates completely new ecological systems quite different than its previous state, and is an ecological technique to make landscapes economically profitable for industry. A major subject of this research concerns the political nature of ecological techniques and concepts – not only afforestation, but biodiversity, sustainability, the introduction of non-native plant and animal species – used in the reclamation industry. This work was not neutral and instead, ecologists used their expertise to construct landscapes as stores of monetary value.

Chapter Four: Austerity Landscapes and Indigenous Labor in the "National Sacrifice Area"

Chapter Four investigates how land reclamation acted as a tool for consensus building on Indigenous reserves. In response to protest over surface-mining on sacred lands, the mining industry attempted to educate and enroll concerned Indigenous citizens into extractive efforts using landscape design as a tool of persuasion. Additionally, a vastly important program developed by the Argonne National Laboratory's Land Reclamation Program titled the "Energy Resources Technical Training and Development Programs for American Indians" will be extensively researched. This program worked with community colleges to develop an education program in land reclamation techniques for Indigenous citizens in the United States. Chapter Four will also investigate the manner in which ecology was used in the production of reclaimed landscapes on Indigenous lands in Alberta. Although afforestation and agricultural uses were extensively researched, ecologists designed landscapes not only for commodity production, and rather, used their expertise to help the industry achieve consensus with local indigenous communities and environmental groups. Following critical work conducted on oil extraction in the tar sands (see Joly, 2020; Wheatly and Westman, 2020), this chapter will discuss incidents in which nature reserves and ecosystems placed in reclaimed landscapes were used as political tools to enable extraction in opposition to local protest.