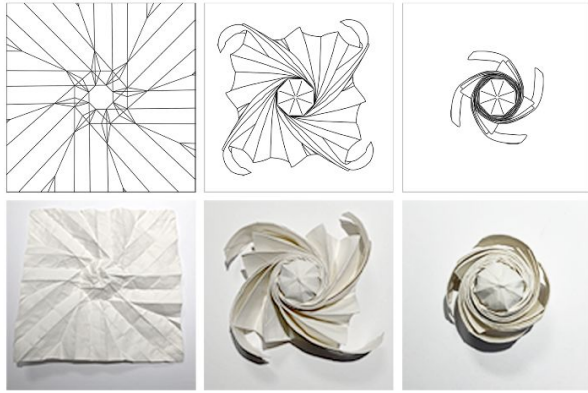# chiasmus

groton school colin kim

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Heifer Hut

**Roof Geometry Diagram**

Scale Comparison

When shipping, the tent and its poles can be contracted into a 1.25 meter wide square, a quarter of its full size. When installing the tent, its rail foundations must first be embedded into the ground. Then, the roof can be expanded with minimal force, and the legs are able to clip onto the rails and slide to adjust their position. Once installation is complete, the structure is 5 meters wide and tall, and provides ample space for an average sized Holstein cattle to move around.

1.25m · 1.25m · 1.75m · 2.50m · 1.50m · 5.00m · 5.00m

Leg Mechanism Diagram
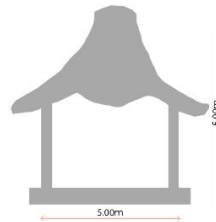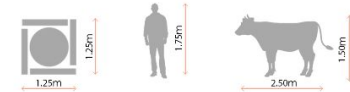
The Heifer Hut is a flexible structure specifically designed for the purpose of housing cows in developing areas. Its origami-inspired roof allows it to be transported in mass to such areas by contracting and expanding easily. The roof is also treated with water repellant, and its natural slope combats heavy rain during monsoon seasons by directing water towards its outside edges. Furthermore, the Heifer Hut features four adjustable legs, which allow the multipurpose tent to fit varying terrain. It's easy to assemble: once the foundation tracks are embedded into the ground, the legs' rail mechanisms allow them to easily slide in and out to fit various positions. No matter the weather, space, and landscape, the Heifer Hut is able to keep its cows safe inside whilst preserving portability and cost efficiency.
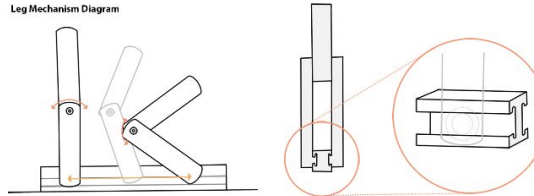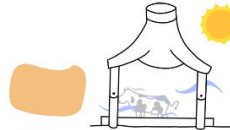
Adaptable Design

Case #1
In the case of heavy rain, the legs can be bent further. This formation both shields the cow and directs waterflow better by lowering the slope of the roof.

Case #2
When the weather is more forgiving, the legs can be completely extended, providing the most space and encouraging healthy windflow.

Case #3
Hybrid formations can be utilized to adapt to tight spaces. In other situations, a larger opening can be made on one side to allow drinking and feeding.
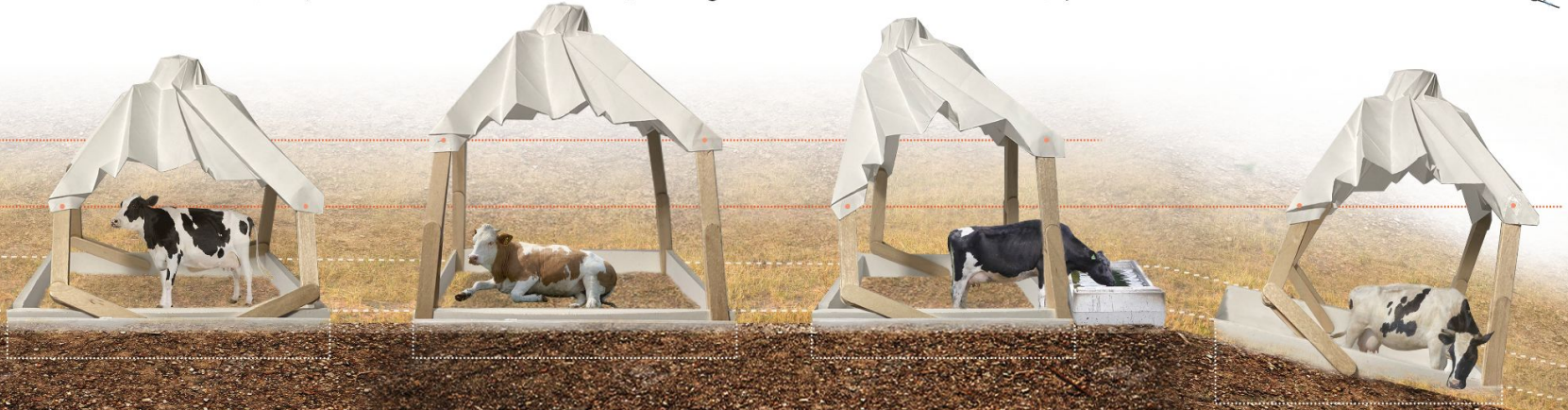
Case #4
The uneven water flow of sloped landforms can be alleviated with hybrid leg positions. By setting the roof parallel to the horizon, rainfall can be regularly spread to all corners.

High · Low

Agritecture

Inspiration

With humanity rapidly filling up our world's limited space, vertical planting has caught recent attention as an environmentally friendly solution for efficient architecture. Inspired by kinetic origami models, I envisioned a collapsible, mobile vertical planting system that revisits fundamental designs and applies them towards innovation.

Design Process
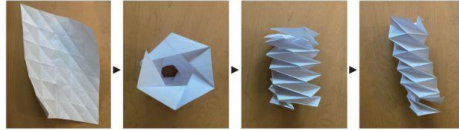
1) I experimented with kinetic origami, including the Spring into Action, to come up with my own modified design that was suited for actual construction.
2) I also experimented with a variety of materials; envisioning an energy-saving greenhouse, I chose transparent vinyl sheets.
3) To highlight the unique aesthetics of folded structure, I added thin wooden sticks at the outer edges of the model.
4) Through different foliage layouts on each floor space, I emphasized the planter's multi-layered structure and flexibility in usage.
5) I attached wheels to the collapsed, compact model for increased portability and ease of installation.
6) The complete models were placed in a sample environment to demonstrate how the planter interacts with the people and landscape around it.
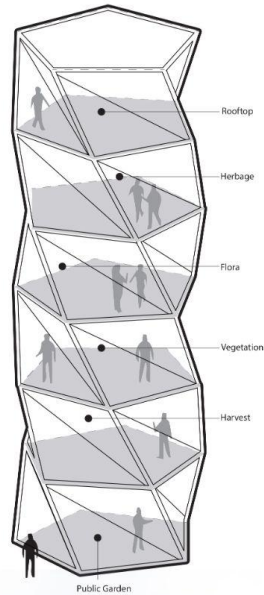
Installation Process

Step_1   Step_2   Step_3   Step_4

Rooftop

Herbage

Flora

Vegetation
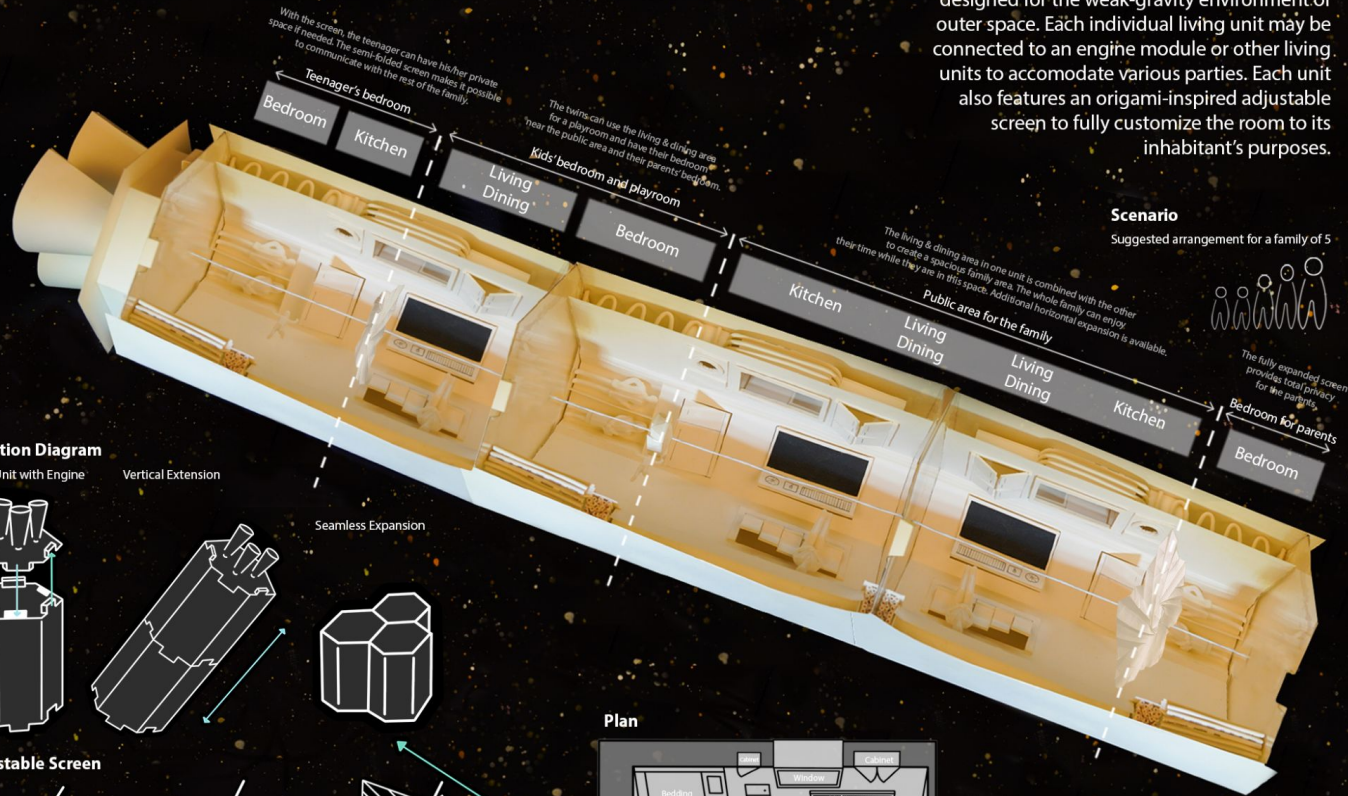
Harvest

Public Garden

Model

Astrobode

The Astrobode is a modular apartment system designed for the weak-gravity environment of outer space. Each individual living unit may be connected to an engine module or other living units to accomodate various parties. Each unit also features an origami-inspired adjustable screen to fully customize the room to its inhabitant's purposes.
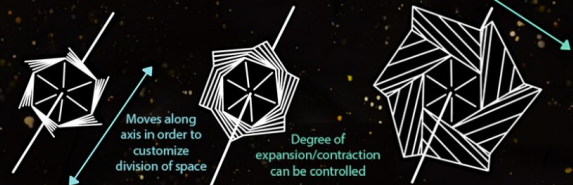
With the screen, the teenager can have his/her private space if needed. The semi-folded screen makes it possible to communicate with the rest of the family.

Teenager's bedroom

| Bedroom | Kitchen |

The twins can use the living & dining area for a playroom and have their bedroom near the public area and their parents' bedroom.

Kids' bedroom and playroom

Living Dining

Bedroom

The living & dining area in one unit is combined with the other to create a spacious family area. The whole family can enjoy their time while they are in this space. Additional horizontal expansion is available.

Public area for the family

| Kitchen | Living Dining | Living Dining | Kitchen |

Scenario

Suggested arrangement for a family of 5

The fully-expanded screen provides total privacy for the parents.

Bedroom for parents

| Bedroom |

Variation Diagram

Room Unit with Engine   **Vertical Extension**

Seamless Expansion

Adjustable Screen

Moves along axis in order to customize division of space

Degree of expansion/contraction can be controlled

Plan

Bedding

Window

Cabinet

Fridge

Multipurpose Monitor

Bathroom

Flexible Seating

Couch Area

# *Roots*

acrylic paint, pen / 20 x 15 inch / 2022

As my life moves into unexplored territory with education regarding unique, novel concepts, I wanted to have a chance to explore my roots. My country, Korea, is built upon geometric webs and structural efficiency. I focused on these ancient teachings with fine pen lines while utilizing rough paint strokes to contrast my life in the Information Age and the ancient architectural landscape that the present day originated from. Specifically, using rudimentary geometric shapes including lines and angles, I dissected and studied the forms of traditional Korean architecture. Through these explorations, I decided to define what the roots that have shaped my past are now set to influence me in the present and future.

Creasing

As I observed the ever-growing collection of origami models on my bookshelf, I noticed that the assortment of angles and surfaces that each model featured created variances in the way light reflected off of them. Each origami model I depict in this paragraph offers a novel and symmetrical three-dimensional construction, emphasizing both chaos and order within natural mathematics. In an attempt to capture this beautiful inconsistency, I focused on detailing every surface on a mountain of geometric structures, ultimately creating a meticulous study of texture and light from perhaps the most fundamental material in art paper.
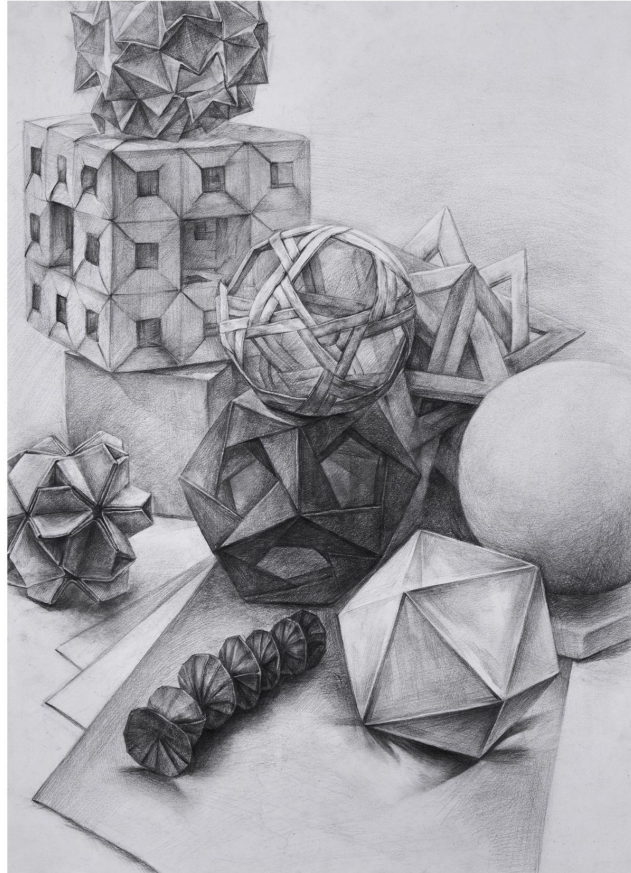
Tensegrity

conte, charcoal, foamboard, canvas fabric, string / 30 x 21 x 5 inch / 2022

Every lecture I'm listening to or bus ride I'm awaiting is defined by the chair I sit on. In a way, the chair is the most fundamental architectural structure: a home for people in their most comfortable position. After exploring the chair as a shape and its potential extensions in a series of sketches, I sought out to envision a novel construction of chairs, creating an innovative new three-dimensional composition out of architecture's building blocks. To add a touch of engineering to this technological novelty, I drew upon the concept of tensegrity, a relatively newfound physical study that examines structures held together with tension rather than gravity.
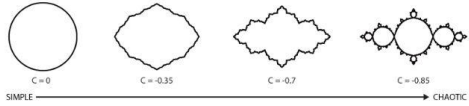
Details
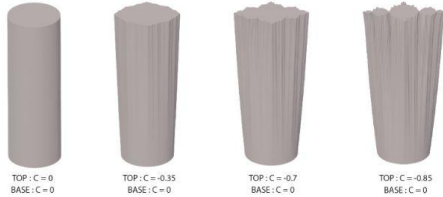

Observational Sketches

Julia

Design Principles

▶ Compiling 2D images

With Python, I generated and compiled images of the Julia sets of functions $f(x)=x^2+c$. The c value ranged from 0 to -0.85.

C = 0   C = -0.35   C = -0.7   C = -0.85

SIMPLE ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━▶ CHAOTIC

▶ Composing a 3D model

With the added element of a third dimension, I utilized the compiled images to create an object that I could 3D-print. I used Inkscape to trace the bitmaps for each image, creating a set of scalar vector images that I then imported into Fusion 360. Stacking thin slices of each Julia set image, I modeled a single tall three-dimensional object that contained the range of Julia sets I compiled.

TOP : C = 0   TOP : C = -0.35   TOP : C = -0.7   TOP : C = -0.85
BASE : C = 0   BASE : C = 0   BASE : C = 0   BASE : C = 0

3D-Printed Models

In addition to printing a set of models with variations in dimensions, I came up with a practical functional design with holes for various storage uses (staying faithful to the original hollow definition of a Julia set). All models were 3D-printed with acrylic resin on a Stratasys J750. The completed model is well balanced, allowing it to naturally remain upright.

Application to Interior Design
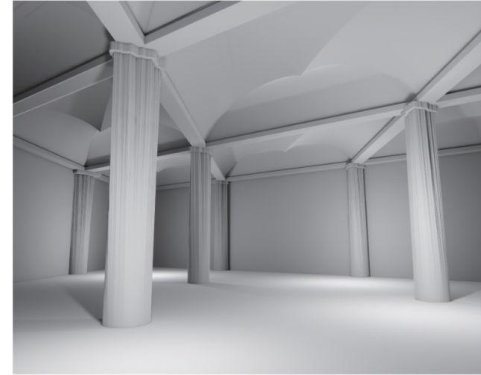
The three-dimensional design captures the the essential aesthetic intricacies of the Julia set – i.e., the gradual emergence of chaos. The unique model can be used as a structural element of an interior or exterior side of a building. For example, it can be a point of attention in an interior design by being used as a column. I rendered a visualization of this idea in Enscape.

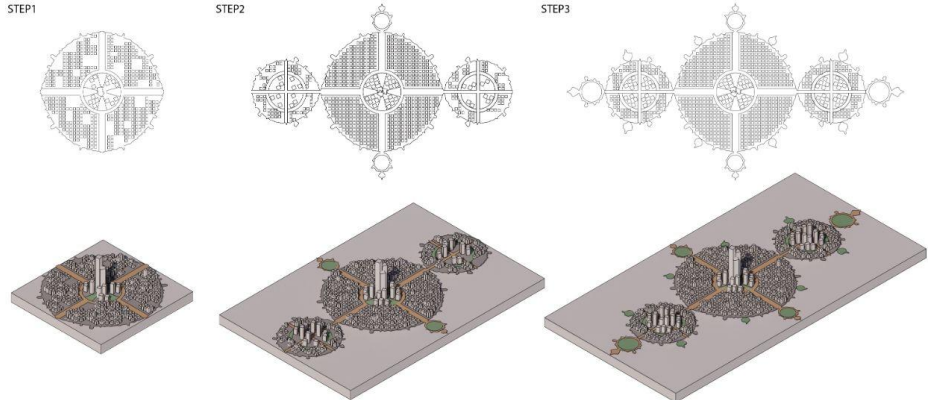## Application to Aerial Port Concept

The model can be utilized in a sky terminal building for drone taxis, a concept recently planned in major cities. The design of the top face with its storage units is well suited for the simultaneous takeoff and landing of several drone taxis. The circular base offers sufficient room for multiple purposes of the building. In between the top and the base, multiple layers can be installed as modules to meet the needs of the city. Each layer can take on a shape with gradual changes in symmetry, allowing the whole building to function as a multifunctional landmark.

Application to Urban Planning

STEP1   STEP2   STEP3

The principles of the Julia set can also be modified for urban planning, since fractals have been established as ubiquitous signatures of urban form and socioeconomic function. As a city grows from a simple arrangement into a complex community, functional organization is necessary. The Julia set provides symmetric shapes with modular divisions, which can be adapted for planning a multifunctional cityscape.
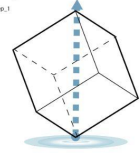
Seven Sins
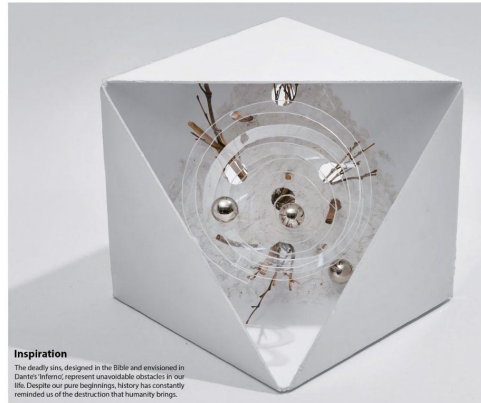
Inspiration

The deadly sins, designed in the Bible and envisioned in Dante's 'Inferno', represent unavoidable obstacles in our life. Despite our pure beginnings, history has constantly reminded us of the destruction that humanity brings.

Design Process

Step_1

Step_2

Step_3

Step_4

I start with the cube, a fundamental geometrical object, modeled with transparent media to envision the world we reside in. The orientation of the cube and its balance on a single vertex visually represents the precarious fate of human life.

A downward spiral depicts the dwindling course of mortal life. Each revolution comes with its own deadly sin, with seven rings in total, symbolizing the inevitable encounter we have with the sin around us. This spiral design was partly inspired by Dante's vision of the deadly sins in his Inferno.
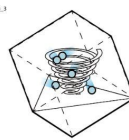
Each metal marble corresponds to an individual life, rolling down the predetermined path of life. The movement of the marble over time is evident in the multiple marbles in different positions.
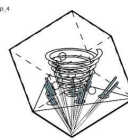
The bottom of the cube, and the certain destination for every marble on the path, is catastrophe. With each encounter with sin, the human life is tainted and ultimately veers off its path and into failure. The underworld is constructed by a haphazard collection of dry tree branches and dark pebbles that point to the imminent destruction of the mortal soul.

Program

Step_1
: a precarious fate

Step_2
: seven deadly sins

Step_3
: paths to life

Step_4
: the destruction of the soul
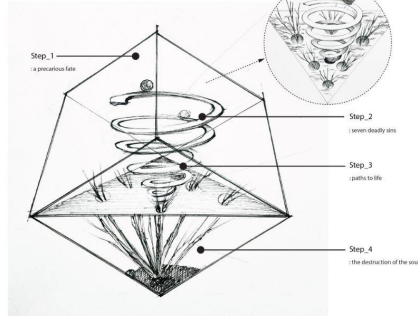
Erechtheion Study

*pen, pencil, tracing paper, adobe photoshop / A3 / 2022*

Having experienced ancient Greek language and culture in school, I attempted to concentrate my focus on one particular structure, the Erechtheion, and research the cultural and architectural elements that made the place what it was. In particular, I investigated its proportions and symmetry, mathematical characteristics that defined the unique aesthetics of ancient Greek architecture. I also studied fine details such as curvature to explore how such factors influence the novelty of the structure. Through this process, I completed the extensive process of approaching the Erechtheion from a variety of angles and perspectives including a bird-eye view and a close-up view, , which enabled me to discover the points of interest that inspired modern architecture.
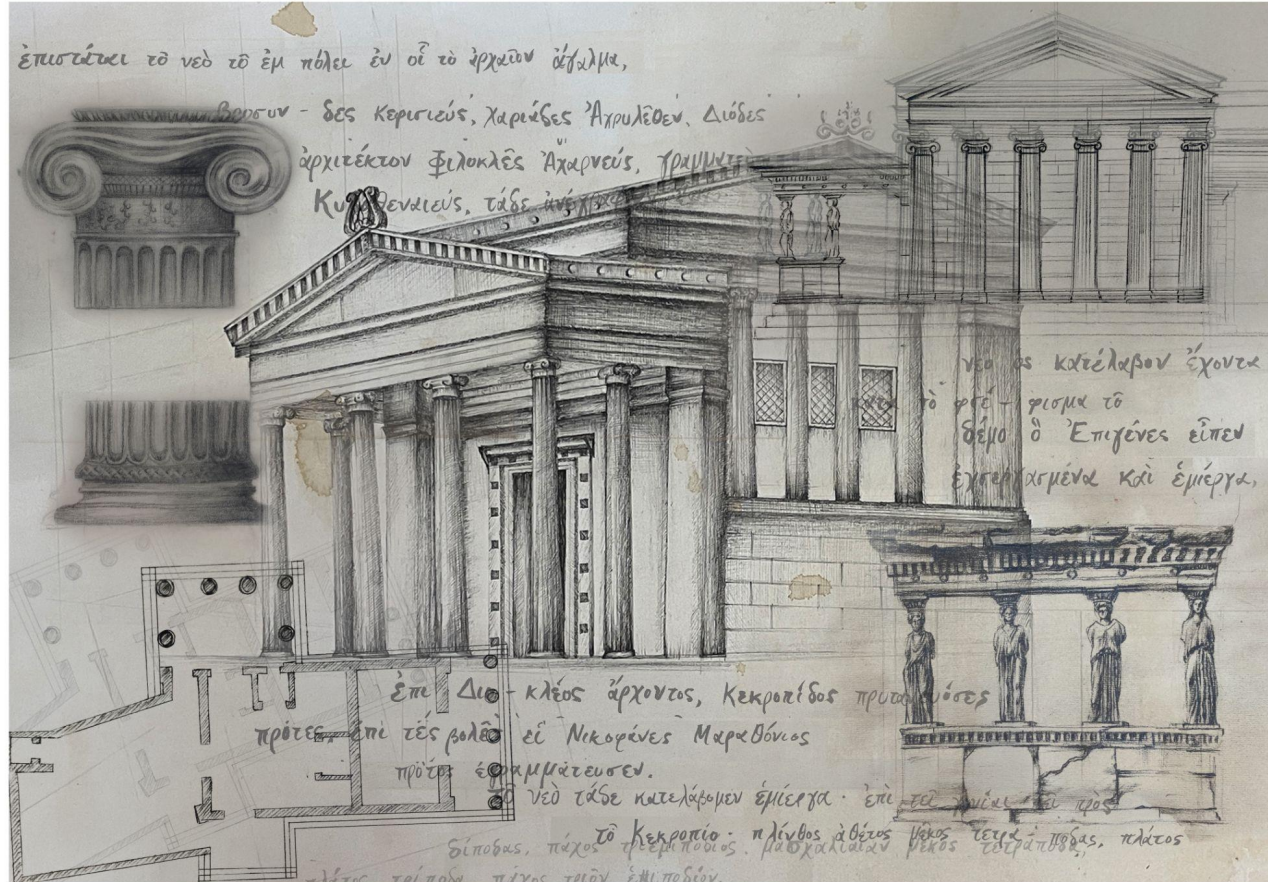
Fishbowl

pen, watercolor paint / 10 x 15 inch / 2022

Bogwang-dong, the neighborhood I live in, is a community rich with historical perspective. Built upon the land around the Bogwang temple from the 6th-century Silla dynasty, the neighborhood has long been a symbol of Korean urban development. Recent advancements and the newfound popularity of compact, tall apartments in Seoul led Bogwang-dong to be populated by these skyscrapers. Taking pictures from behind my own apartment, I noticed that the skyscrapers began to form a backdrop against the older buildings that have survived in this neighborhood for a decade. With the choice of a calculated and detailed 5-point perspective drawing and my faithfulness to the fundamental media of pen and paint, I honor Bogwang-dong, its long history, and the future it will bring.
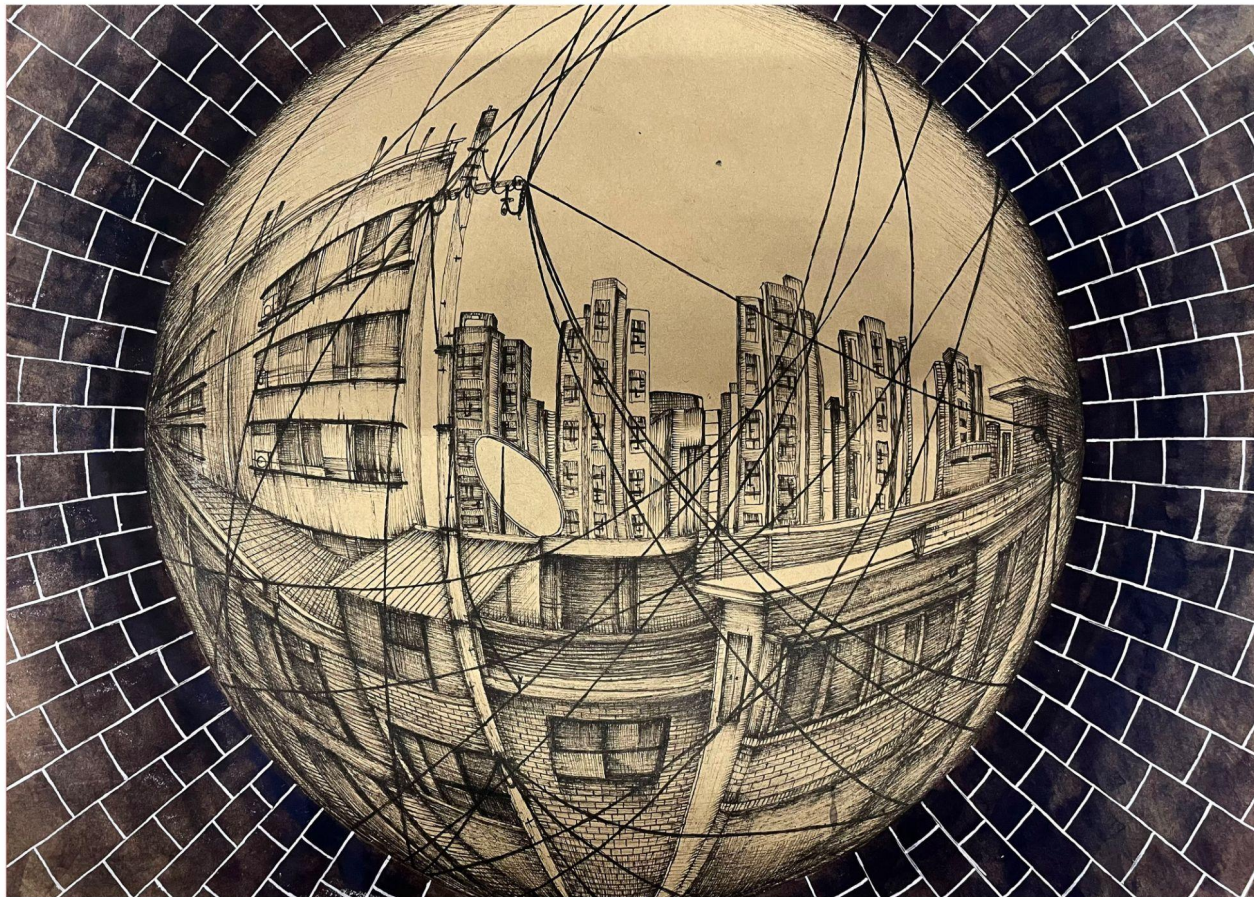
Pandora's Box - Euljiro

mixed media, led matrix, raspberry pi / 21 x 30 x 6 inch / 2022

A snapshot of the past in the center of Seoul's frenzied array of neon signs and apartment complexes, Euljiro is a historic neighborhood that's home to a selection of welders and antique sellers. Recent advances by the city, however, have begun to intrude upon this sanctuary, polluting its air of authenticity with pavement and buildings. In Greek mythology, Pandora opened a box containing plagues and sins, releasing them across the world, under the false assumption that it contained a gift. In a retelling of this classical tragedy, I depicted a lone plaza in the midst of an Euljiro riddled by debris. I extracted relevant headlines from live news and powered scrolling displays on an LED matrix using a Raspberry Pi, technology that contrasts the fundamental methods of fine arts I used in the backdrop. What's in the plaza may seem like a gift, but closer inspection reveals the dire truth of destruction behind those concrete walls.

Photos of Euljiro, Seoul, Korea

**Observational Sketch
[Metalsmith in Euljiro]**