

This is a collection about

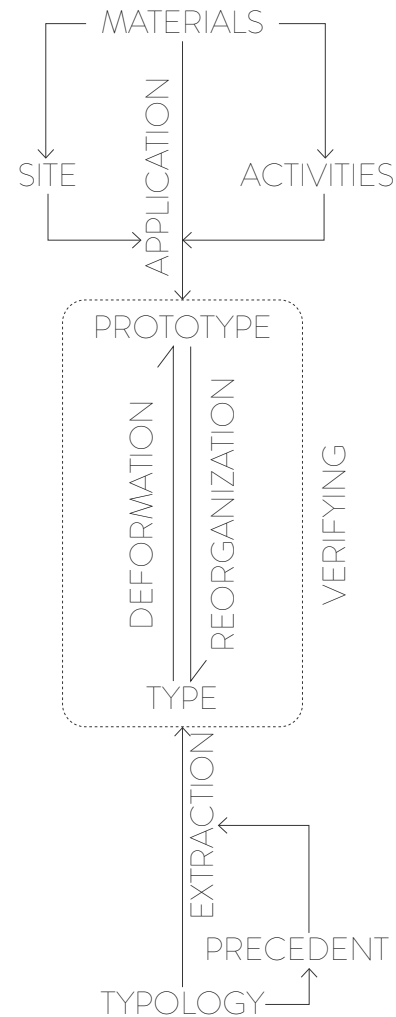
Materials  
&  
Typology

Zitao Yang

M. S. AAD  
GSAPP

Columbia University  
2023-2024

# FORWARD



Before coming to GSAPP, architectural typology served as a primary guiding tool in my design approach, helping me to make connections between space and culture. But where is the specific connection between design and specific site? How do abstract types relate to concrete individuals? I started the one-year AAD program with these questions in mind.

The materials were the objects of my research over the course of the year as I faced the specific problems of each different project. The production cycle, processing technology, and even the use cycle of different materials in buildings are closely related to the human and physical environment in which they are located. Materials therefore become the medium between my transition from the abstraction of typology to the concreteness of real sites.

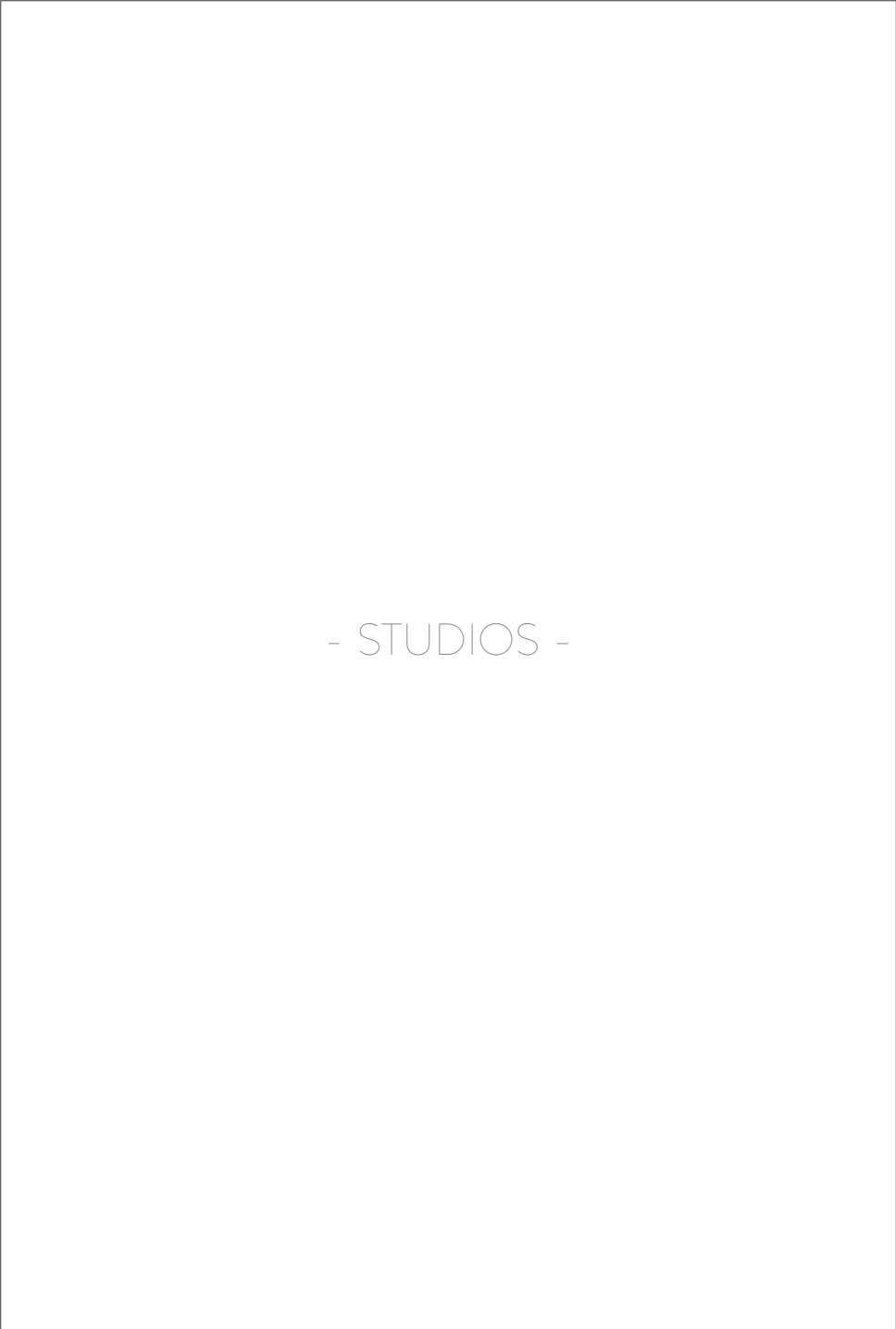
Therefore, typology and material research complement each other in my work. One comes from abstraction and one comes from concreteness. Sort out the macro while sorting out the micro.

## STUDIOS

-Stone For Living-	7
-Algae New York-	17
-(Un)stable Living-	33

## ELECTIVES

-Wood But Masonry-	47
-Rendering System-	57
-Weaving Her Work-	61
-Devonn Francis's Recipe-	65



- STUDIOS -

## -Stone For Living-

Time: 08/ 2023

Advisor: Yousef Anastas, Elias Anastas

Role: Individual work

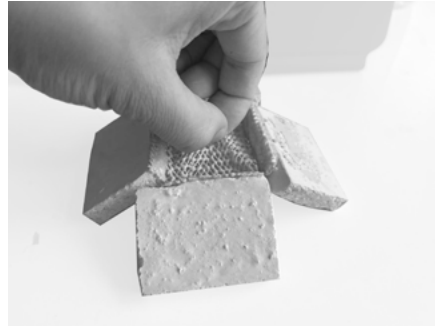
As a traditional low-carbon material, stone's potential in modern architecture remains to be developed. However, the large amount of labor required to construct stone buildings hindered the spread of stone construction. This project explores a rapid construction system based on stone, while trying to integrate it into the traditional background of Phnom Penh residential houses in Cambodia, proposing a new residential typology for local residents.

In order to cope with the hot climate, local Cambodian houses take the form of stilt houses. At the same time, their houses can be moved to the next settlement after they are built. This light life style inspired my stone construction system: How can I make the stone construction system show the same lightness in the local area?

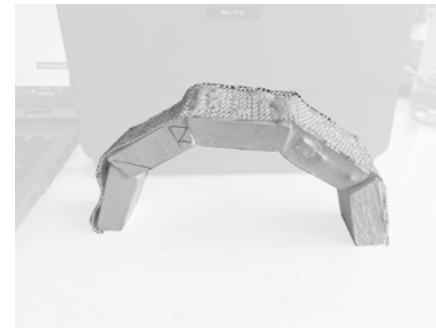
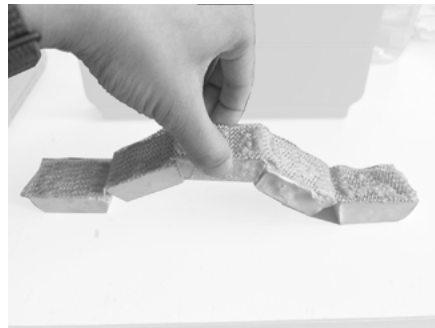


# THE EXPLORATION OF QUICK-BUILT STONE SYSTEM

Cube



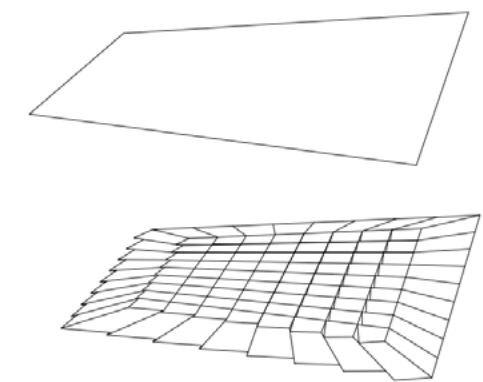
Arch



Hemisphere



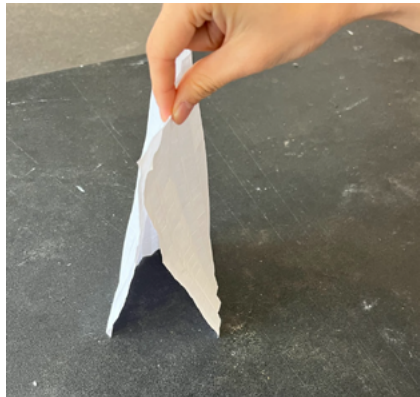
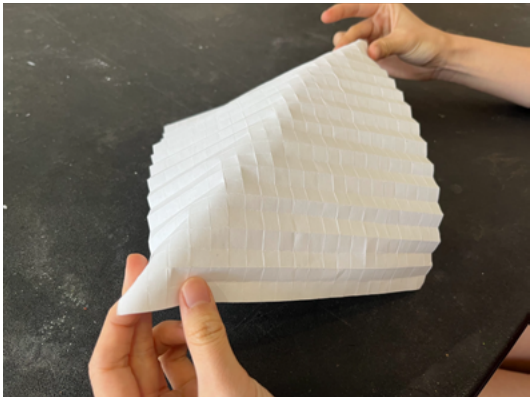
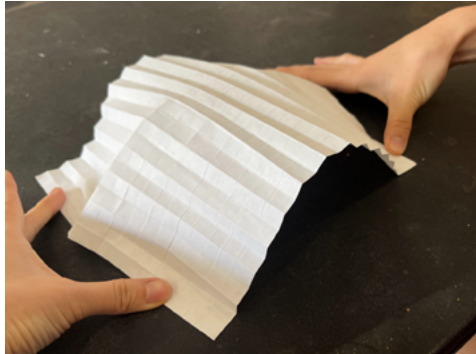
FORM-FINDING TRANSFORMATION



Stone with mesh

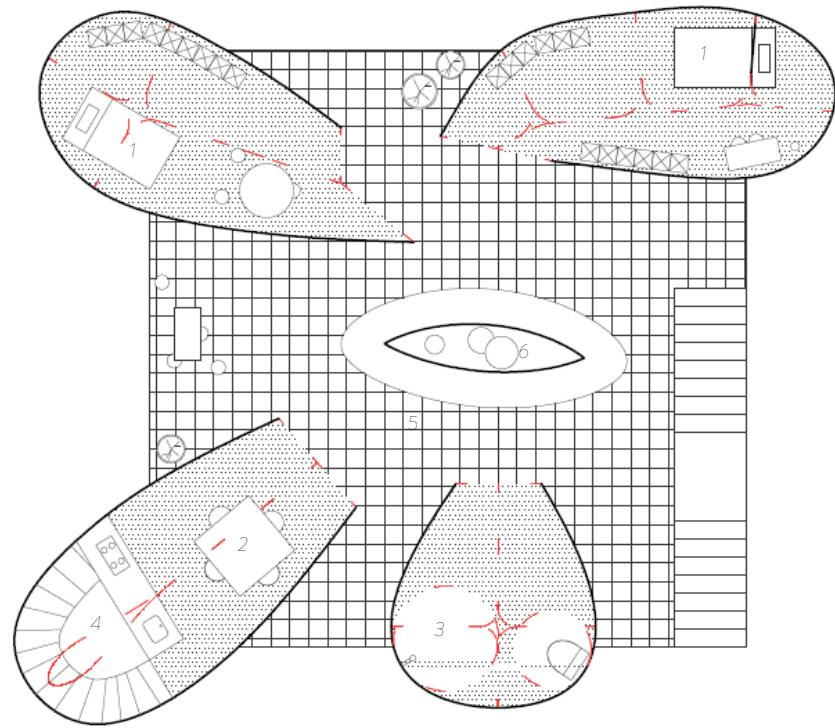


Paper with patterns



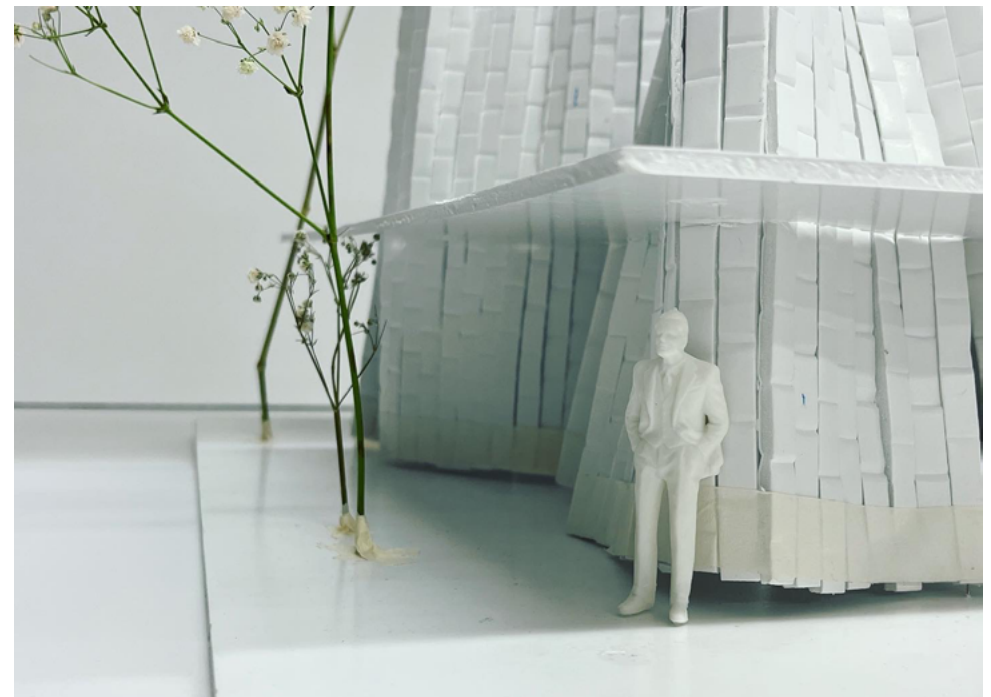
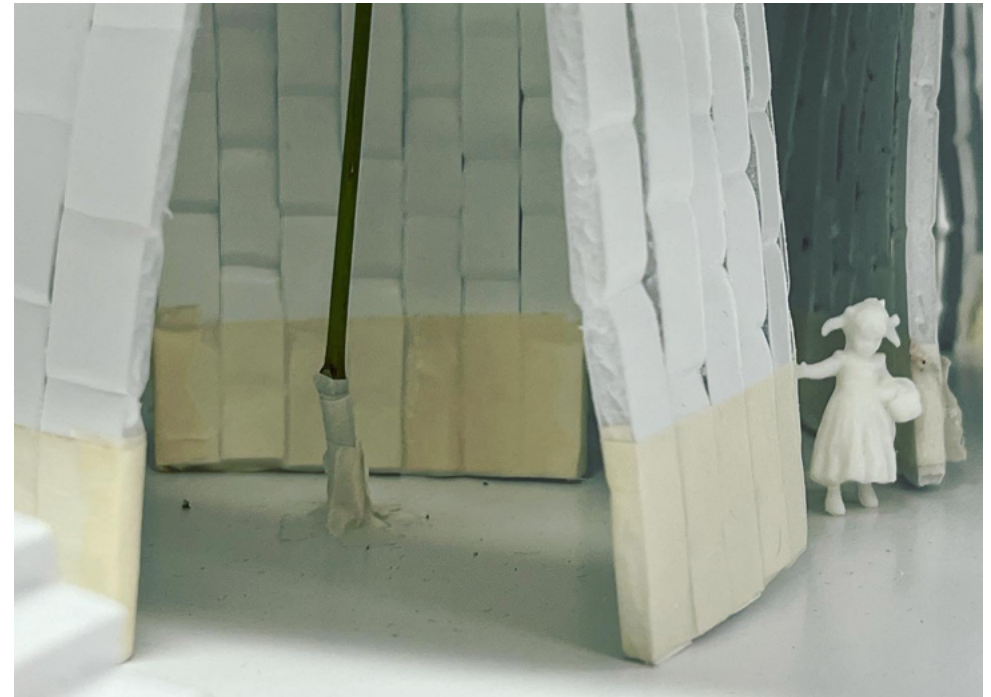






Typical Floor Plan

- 1. bedroom
- 2. livingroom
- 3. bathroom
- 4. kitchen
- 5. terrace
- 6. garden

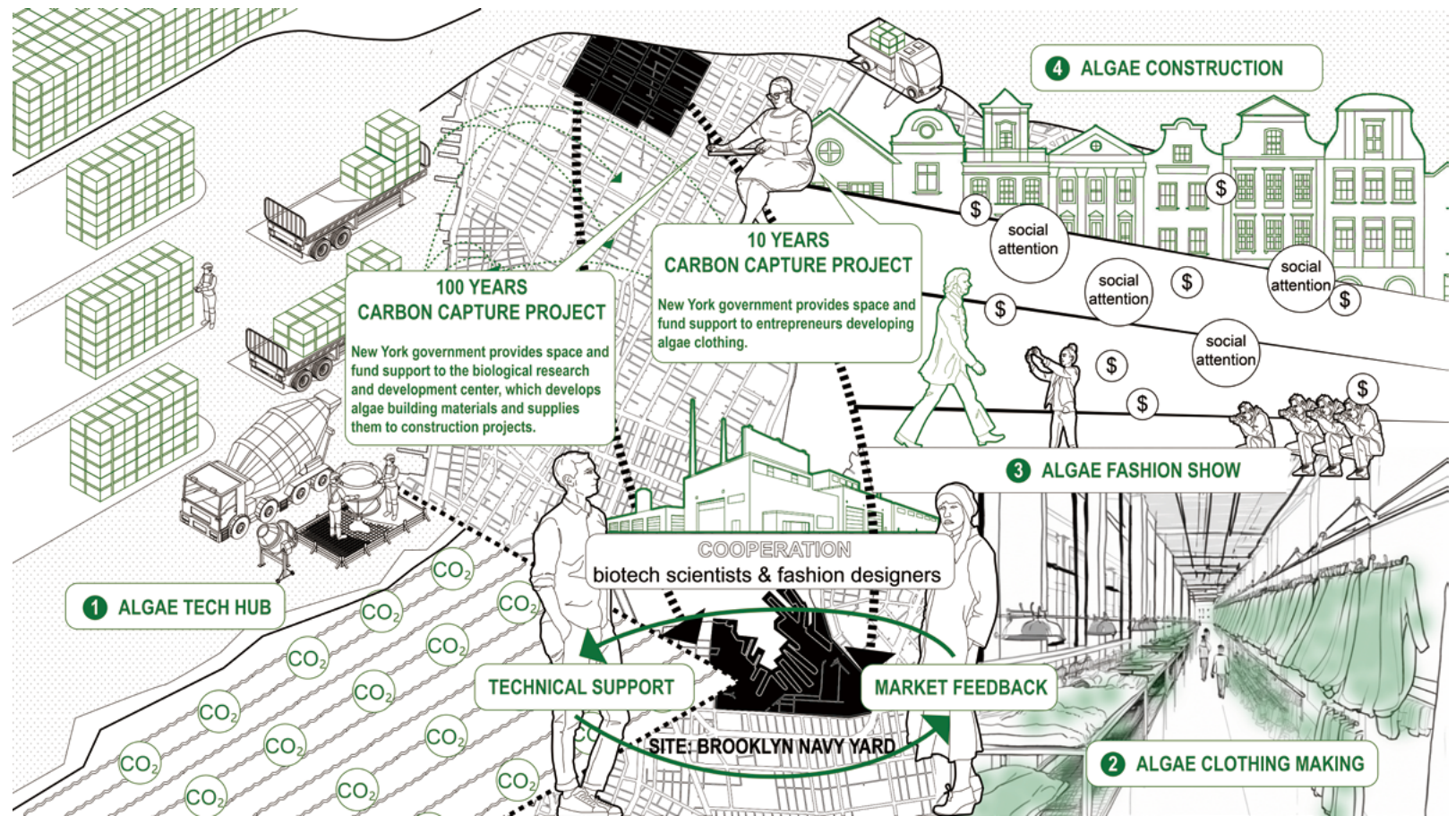


# -Algae New York-

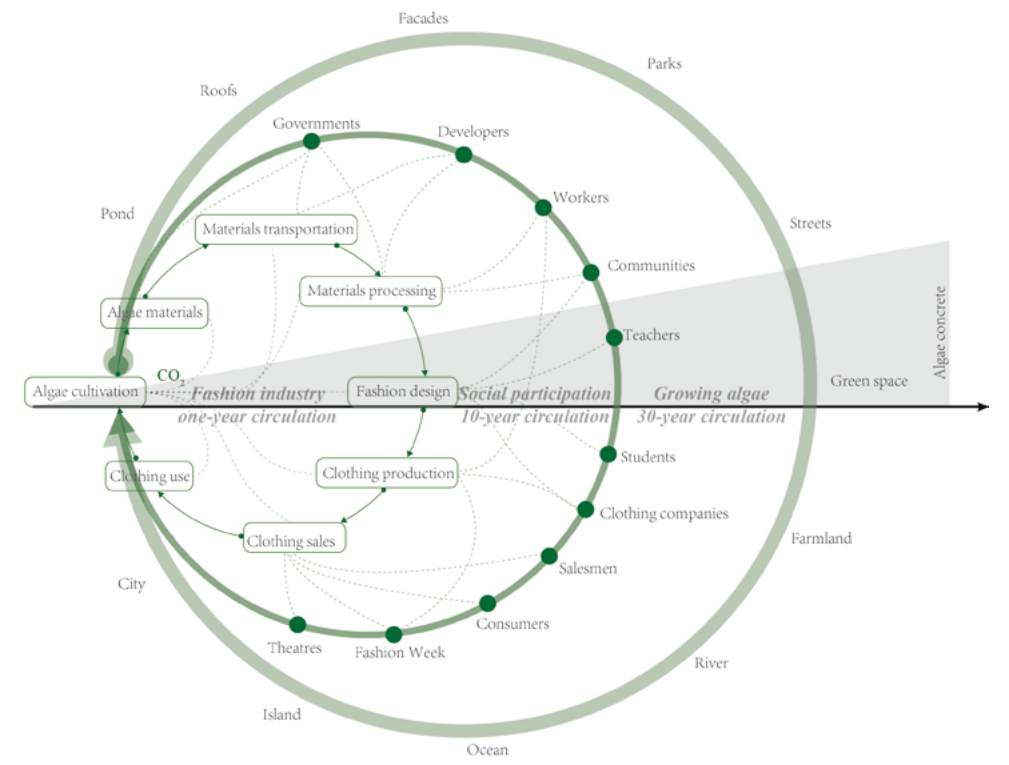
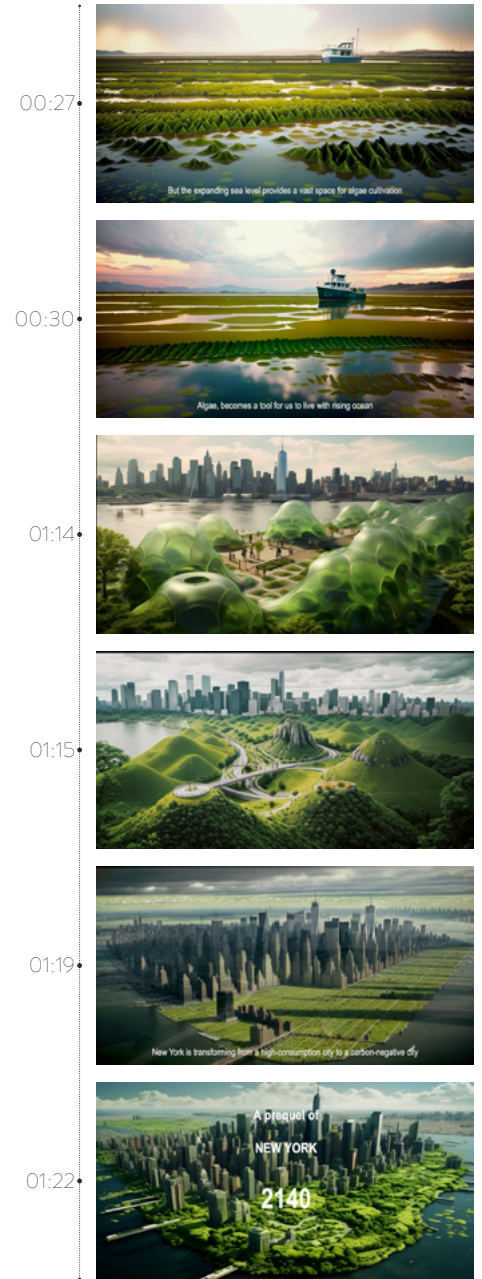
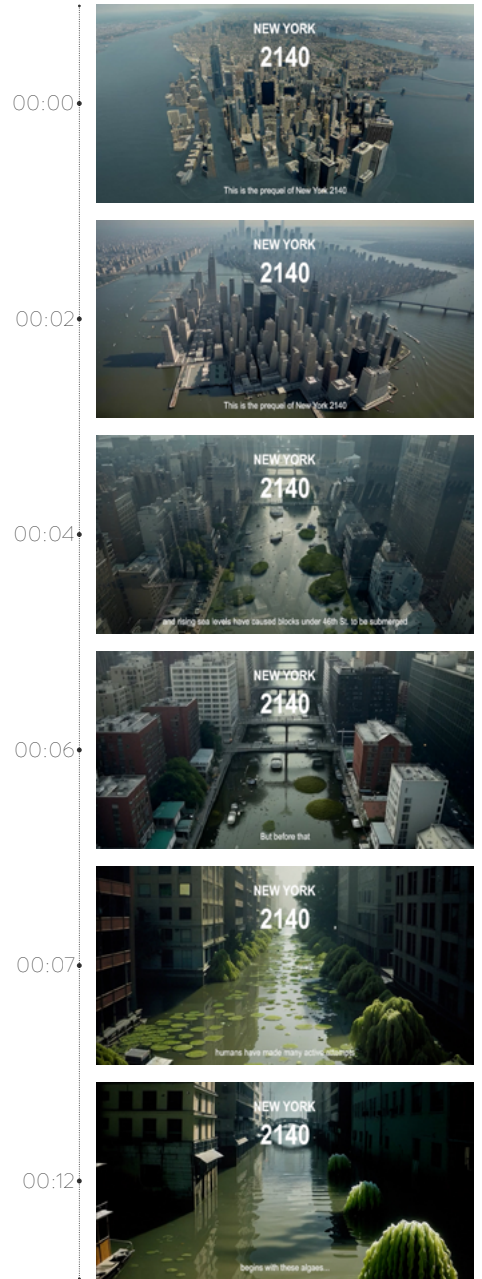
Time: 12/ 2023  
Advisor: David Benjamin  
Teammate: Zhihao Xu

This project started as a science fiction novel about the climate crisis of 2040. We borrowed the background of the novel *New York 2140: Lower Manhattan will be submerged in 2140 due to rising sea levels*. To prevent this future crisis, we launched a 100-year algae carbon sequestration plan.

As a potential carbon-fixing material, algae has been widely used in the production of paper, ink, clothing and other fields. But due to the obvious smell of algae itself, it has not been widely accepted by the public in 2023. We try to combine the algae clothing industry with architectural production, stimulate consumption through fashion, and inspire the public's enthusiasm for algae.



# Algae New York - - A Climate Fiction



Initial conceptual diagram for carbon removing project in algae



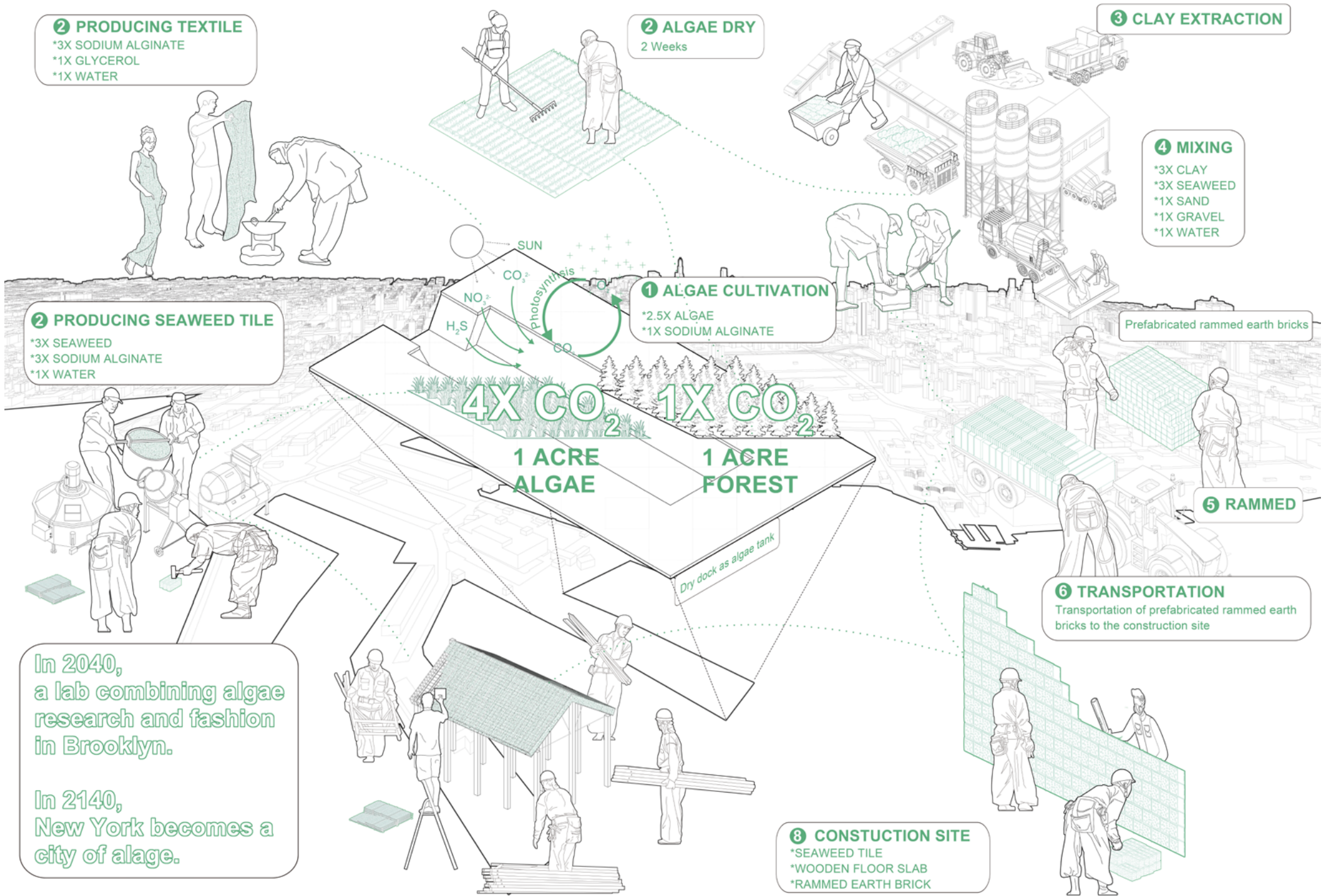
WALL MATERIAL PROTOTYPE

Rammed Earth  
Dried Algae  
Sands



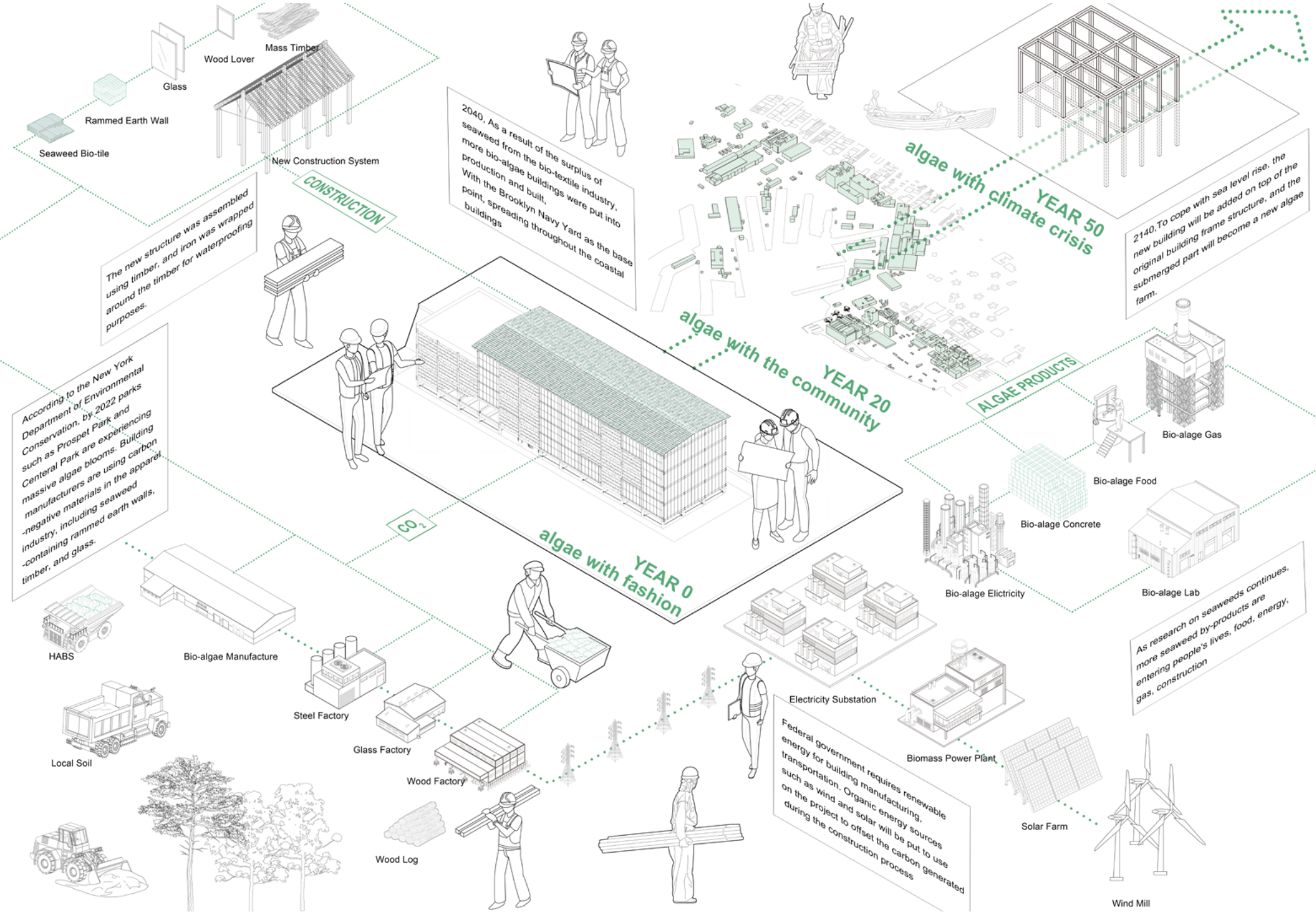
ROOF MATERIAL PROTOTYPE

Seaweed  
Sodium Alginate  
Water



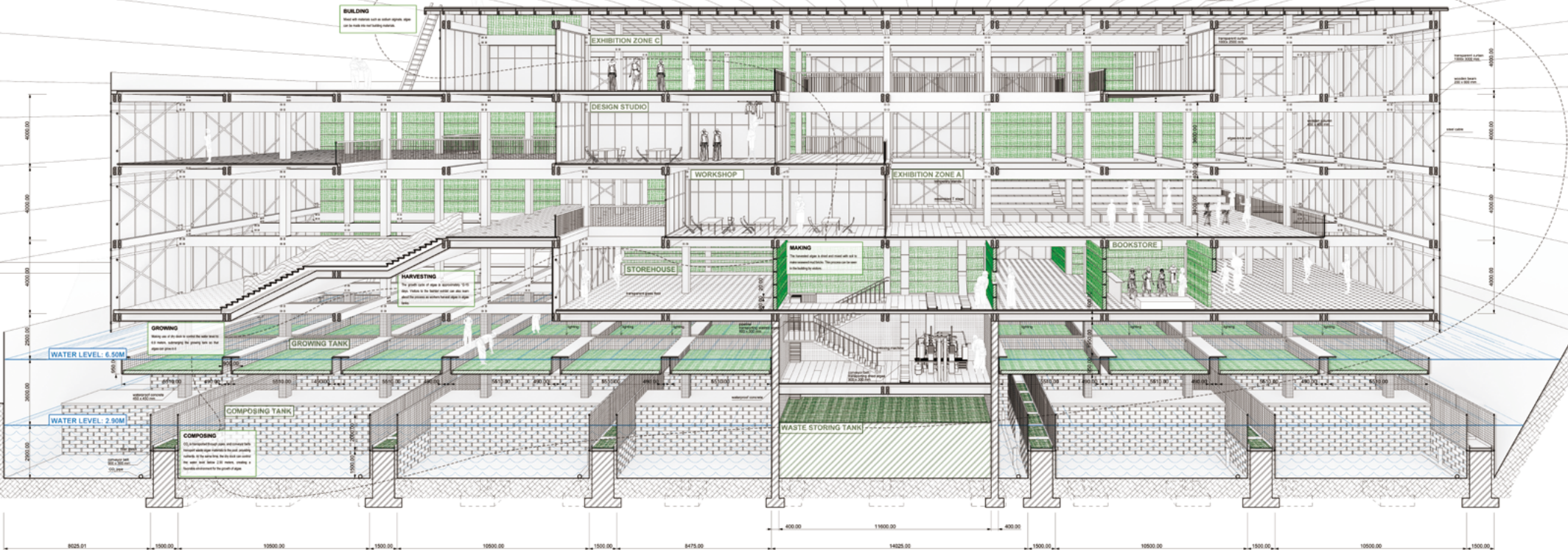
In 2040,  
 a lab combining algae  
 research and fashion  
 in Brooklyn.

In 2140,  
 New York becomes a  
 city of algae.



# ALGAE NEW YORK

"build a fashion community for algae"



Algae Circulation System + Fashion Show Mode







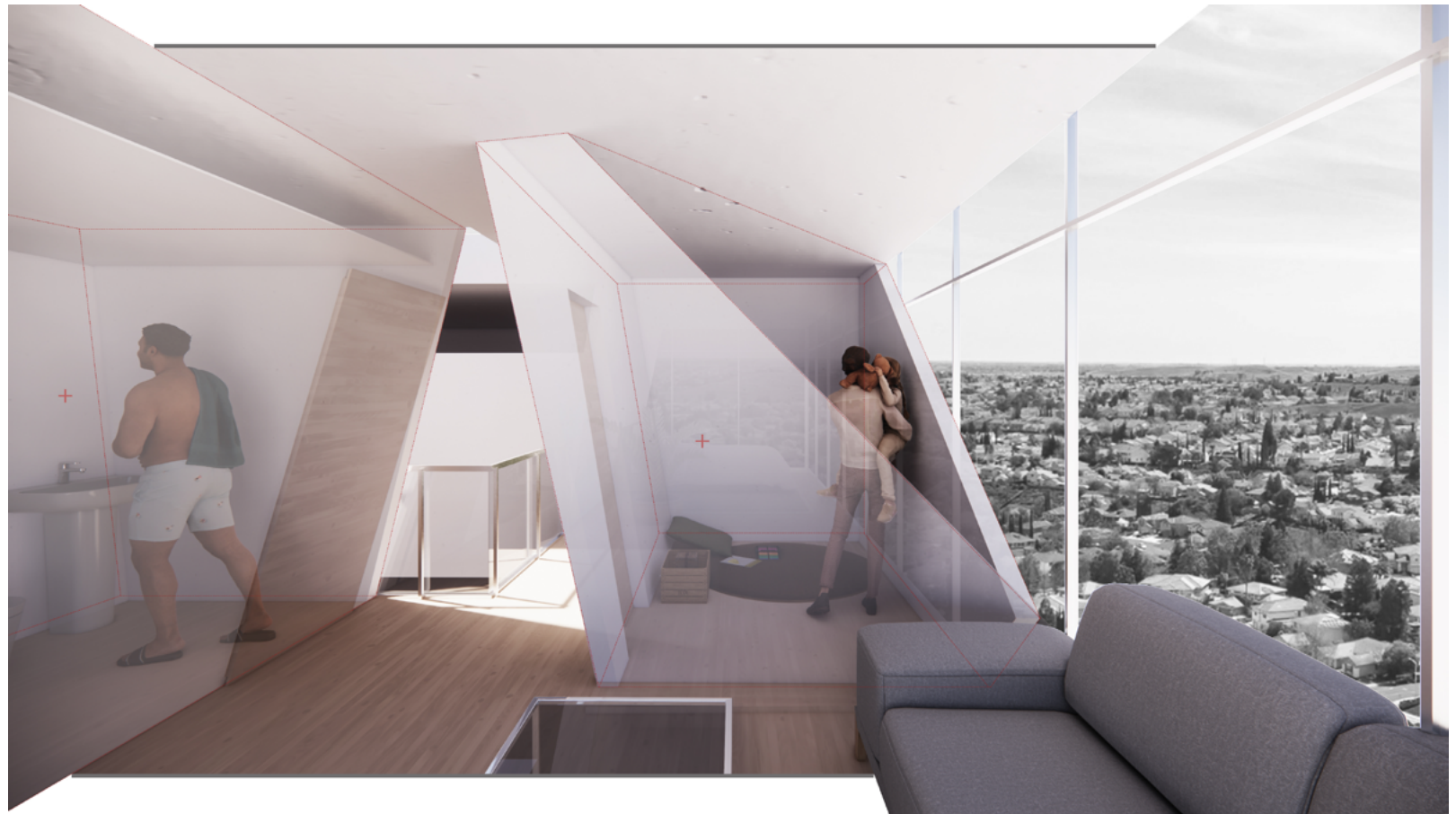
## -(Un)stable Sharing-

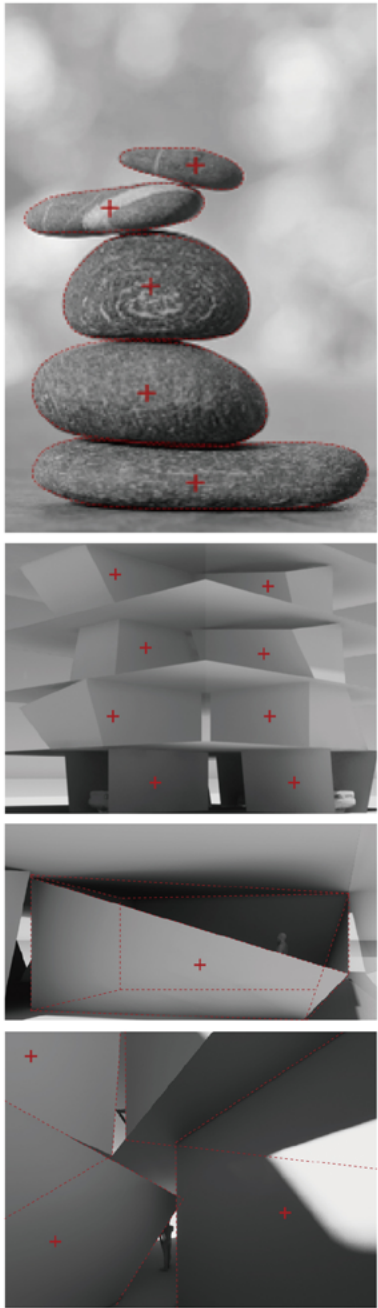
Time: 04/ 2024

Advisor: Michael Bell

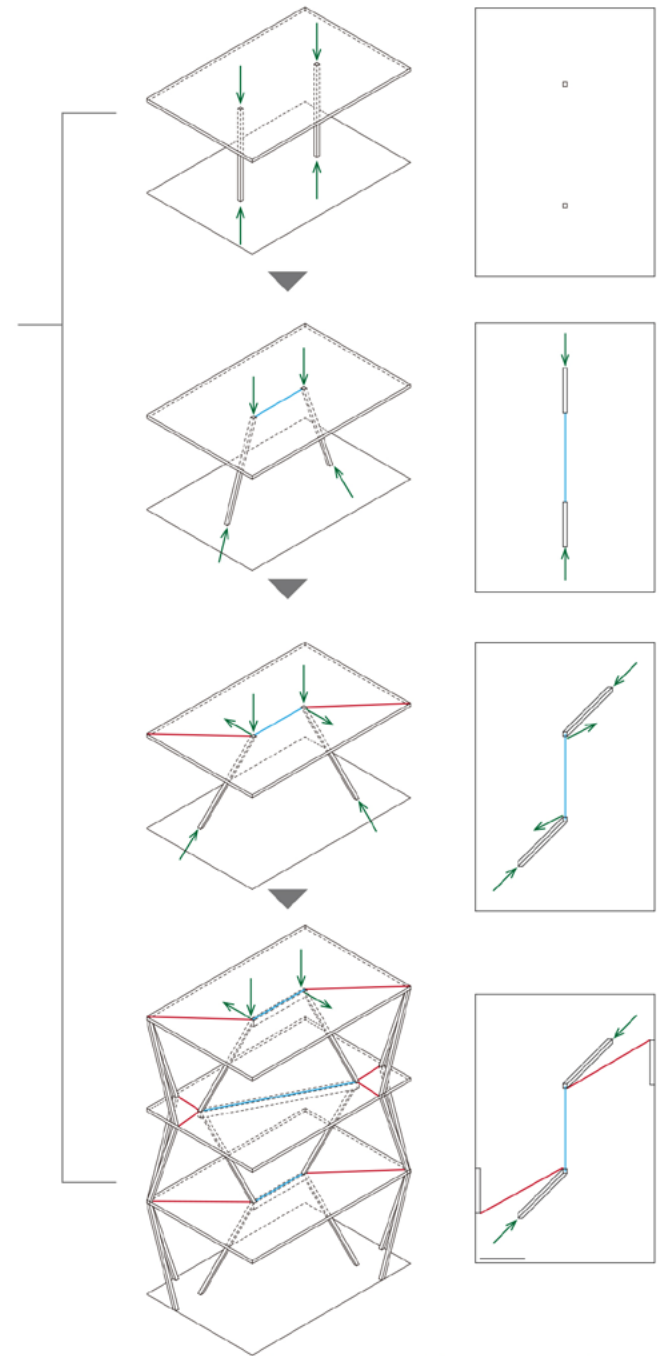
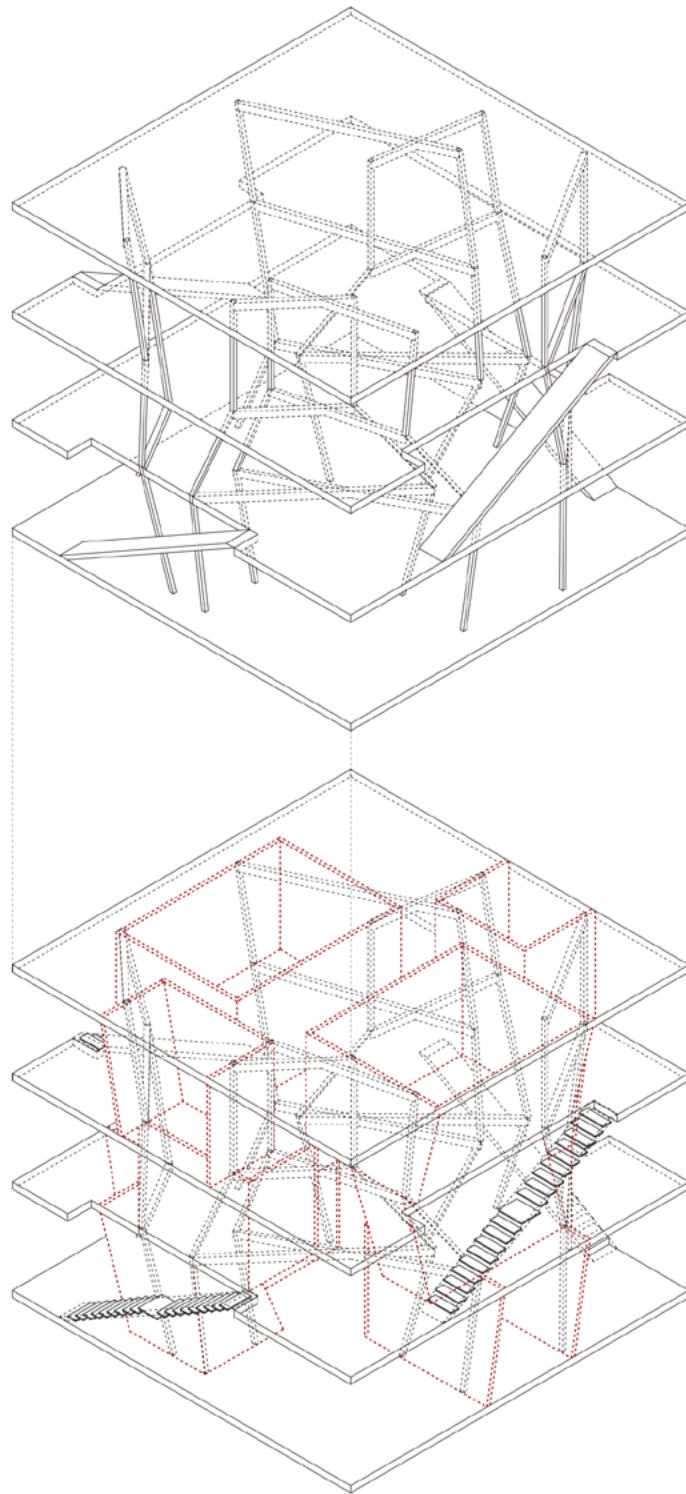
Role: Individual Work

This project began with the study of the Schindler House. The space, material, method of construction and social order of the Schindler House was and remains a hallmark of what modern architecture promised. If life in the modern era was less tied to agrarian family order the modern era demanded a new way to live. In the Schindler House that was achieved in abstract methods of a rotation, center of gravity, torque and centrifugal or centripetal force. All possible in the low density of then Los Angeles (West Hollywood) and almost home-made by the architects. I unfolded this to a new world almost 100 years later and carefully shows that the spatial principles at place at Schindler can be re-invented in new materials and at new scale and density. A multi-household structure emerges that offers daily inspiration in simply moving a few feet and gaining a diagonal vista in an otherwise congested and tightly packed house. With a neighbor immediately around and adjacent and intertwined. If this work asks a major question it be: "Does architectural space and structure induce change in social life—can new space and the physics of spatial order (COG et al) instigate a new willingness to live differently?"



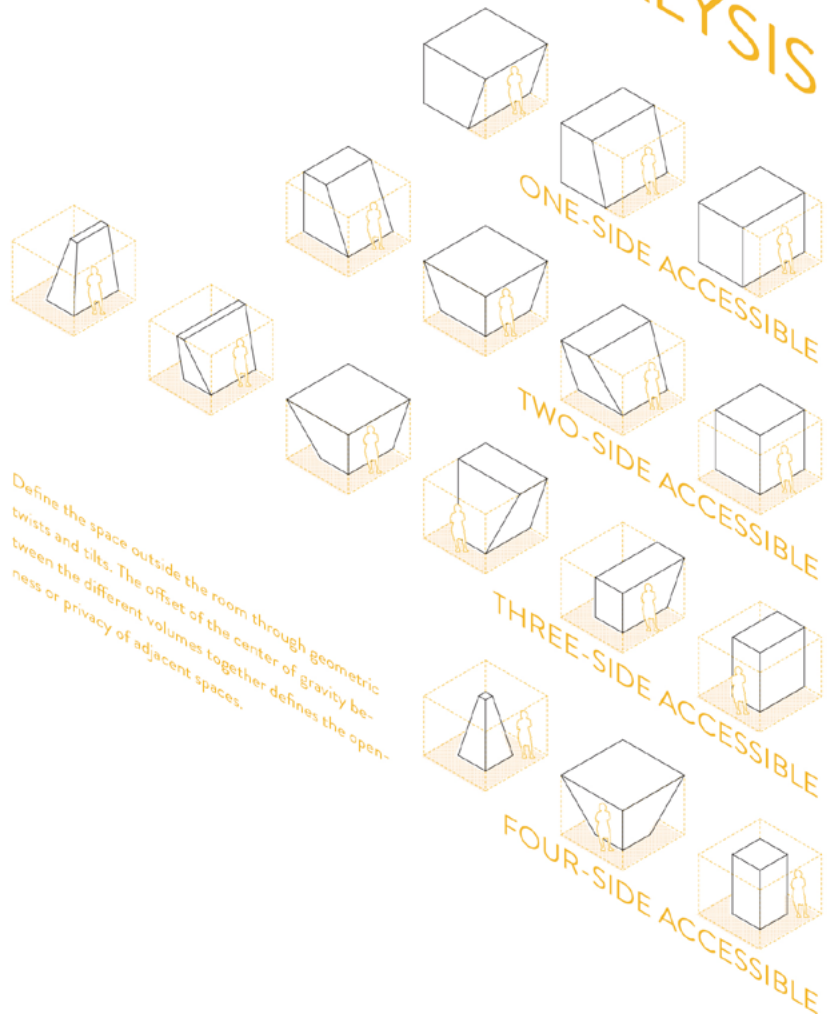
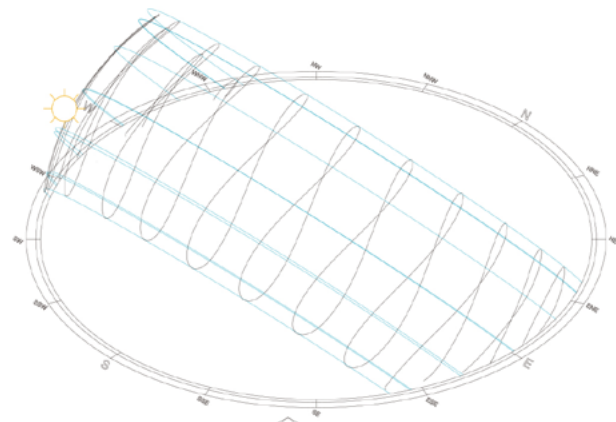


Mentally unstable moments with COG

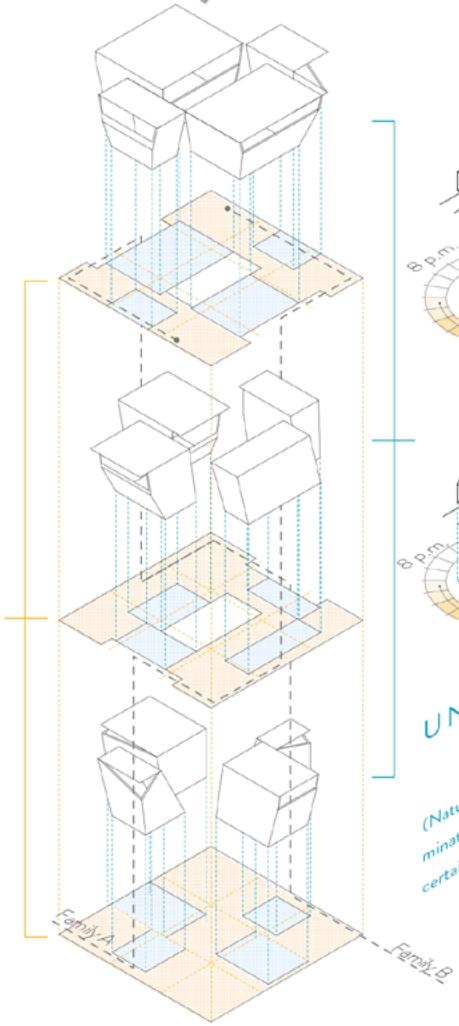


Physically stable structure hided

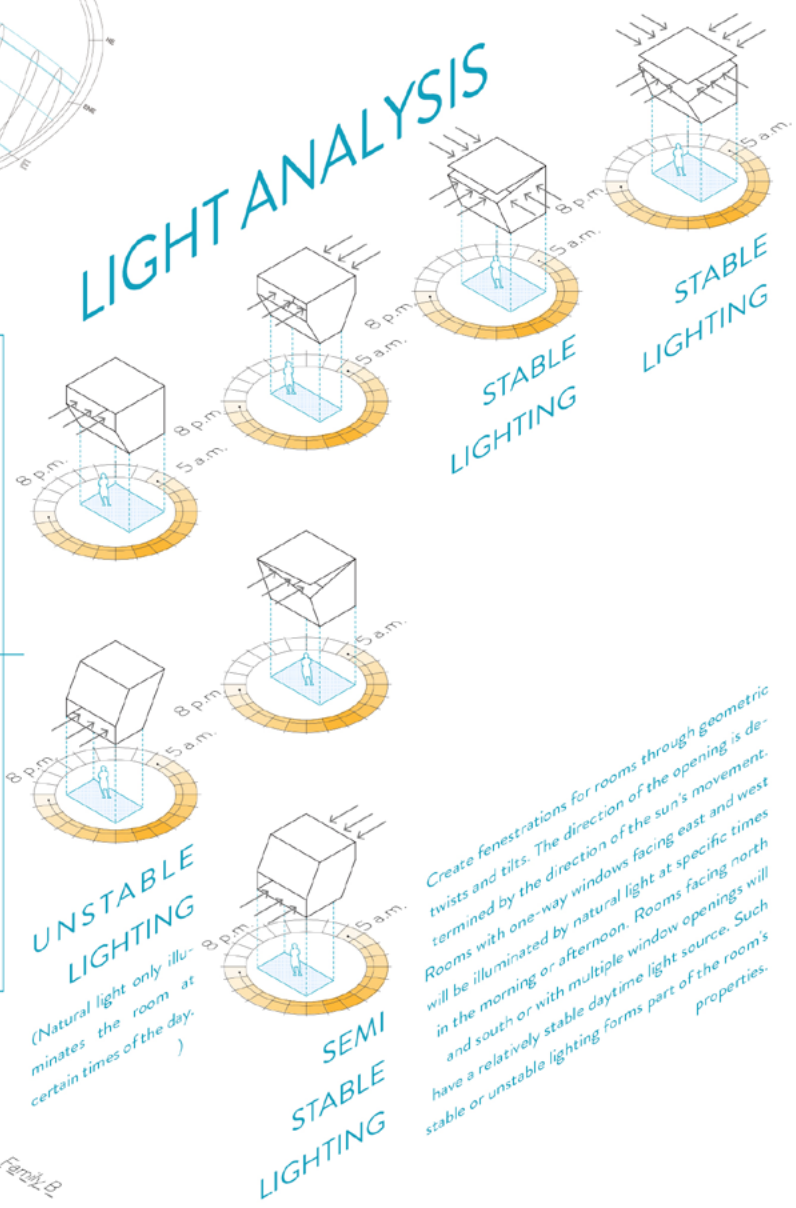
# SPACE SHAPE ANALYSIS



Define the space outside the room through geometric twists and tilts. The offset of the center of gravity between the different volumes together defines the openness or privacy of adjacent spaces.

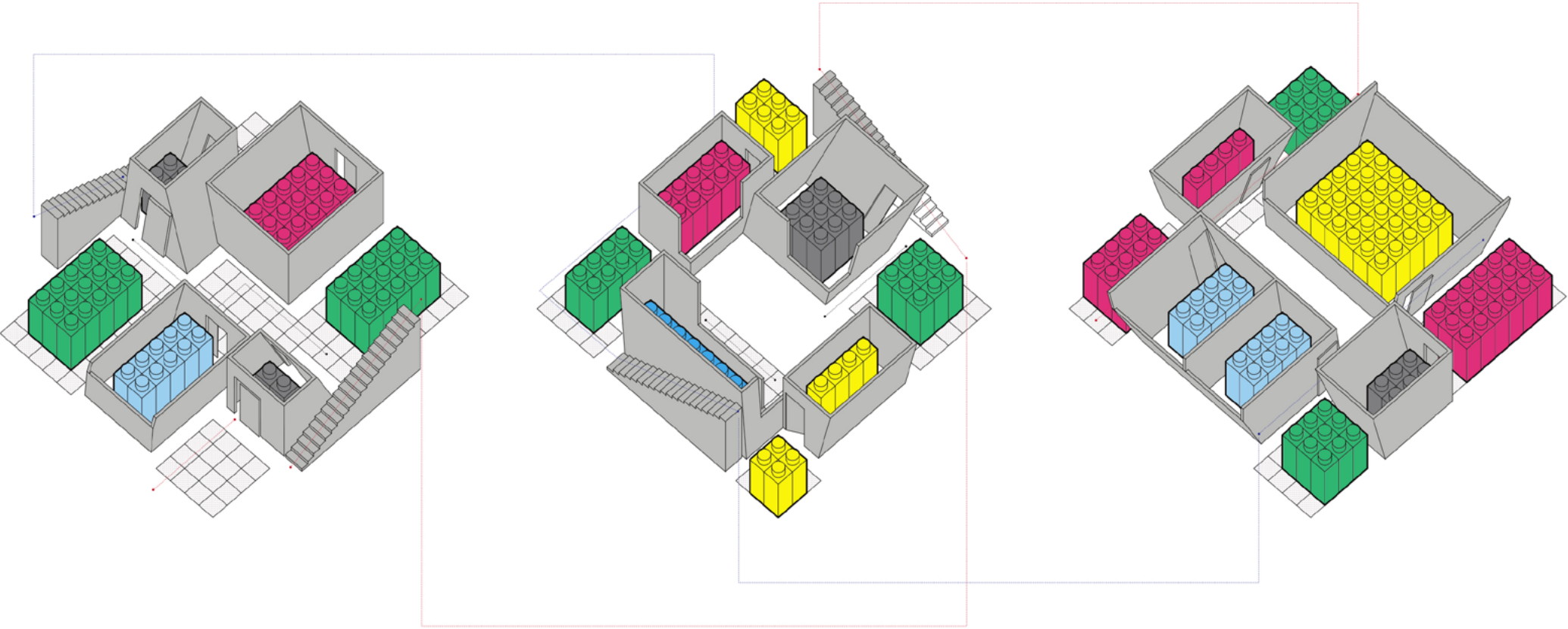


# LIGHT ANALYSIS



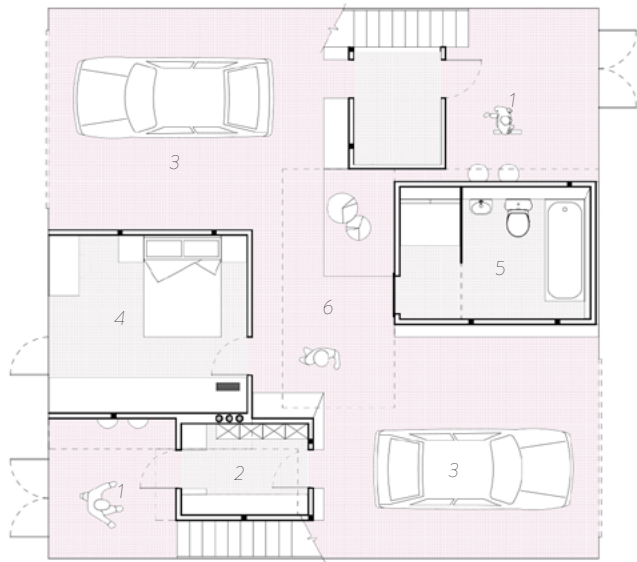
Create fenestrations for rooms through geometric twists and tilts. The direction of the opening is determined by the direction of the sun's movement. Rooms with one-way windows facing east and west will be illuminated by natural light at specific times in the morning or afternoon. Rooms facing north and south or with multiple window openings will have a relatively stable daytime light source. Such stable or unstable lighting forms part of the room's properties.

FUNCTIONAL STRUCTURE

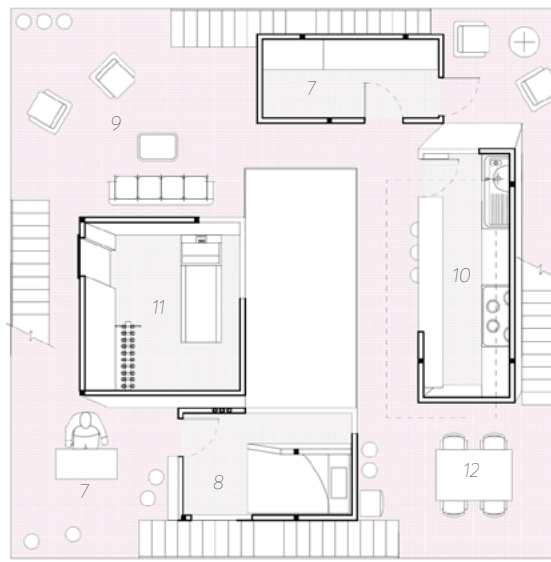


- bedroom private
- studio private / semi-public
- living / dining semi-private / semi-public
- kitchen public
- bathroom semi-private
- lounge private / semi-private

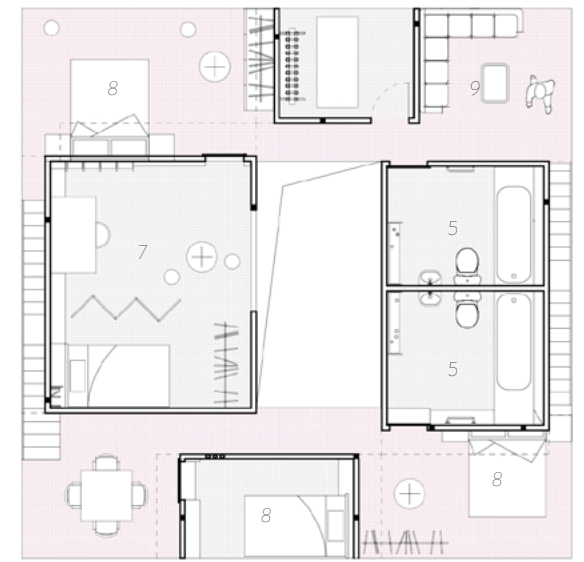
- family A circulation
- family B circulation
- public circulation



Ground floor



Second floor



Third floor

- 1. lobby
- 2. closet
- 3. garage
- 4. guest room
- 5. bathroom
- 6. courtyard
- 7. studio
- 8. bedroom
- 9. living room
- 10. kitchen
- 11. leisure room
- 12. dining





-ELECTIVES-



## -Wood But Masonry-

Time: 05/ 2024

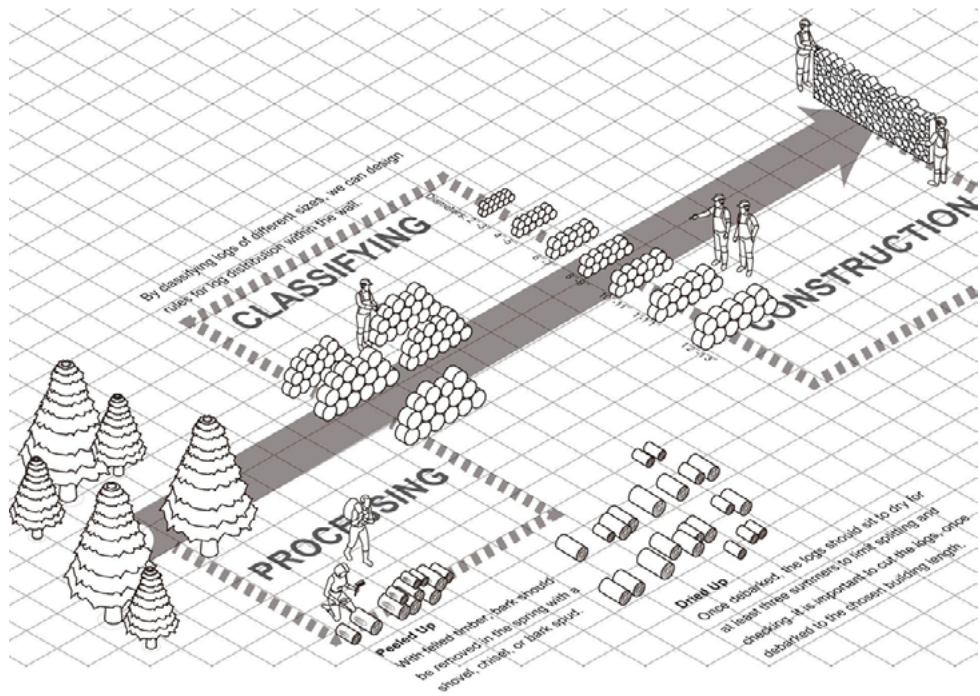
Advisor: Danniely A. Staback

Rodriguez

Teammate: Phoebe Lee

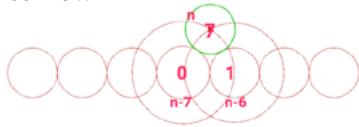
How can traditional materials be combined with modern computing technology? In this project, my teammates and I jointly explored how to combine the construction of traditional cordwood walls with grasshopper script, thereby breaking through the limitations of existing processes and seeking possibilities for further diverse use of materials. We iterate the physical model of the wall's porosity through the analysis of computational tools.



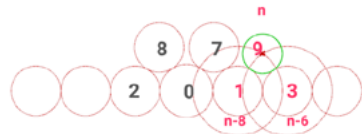
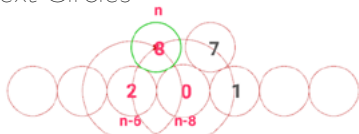


STACKING LOOPS

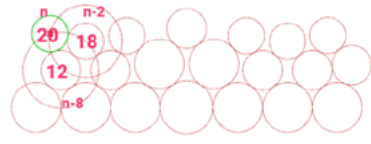
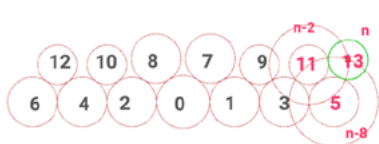
First Row



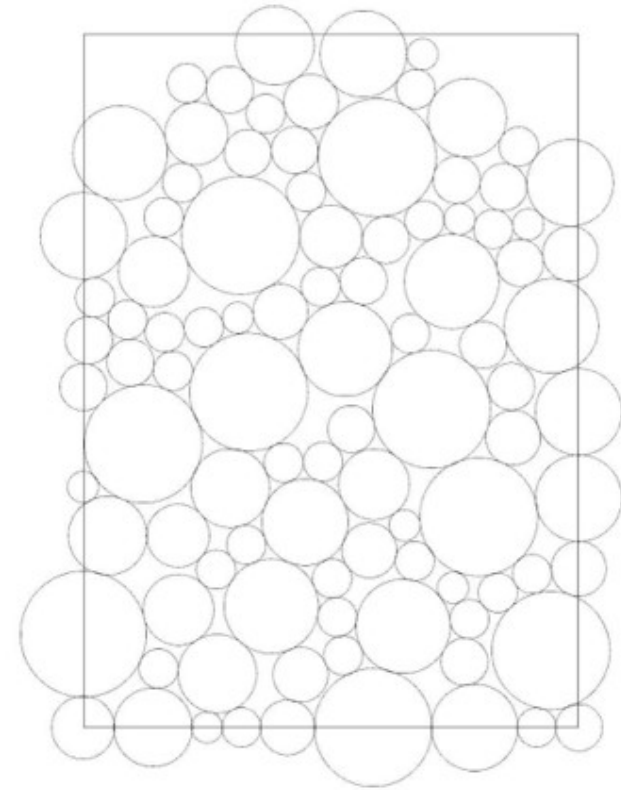
Next Circles



End of The Row



KANGAROO CIRCLE PACKING

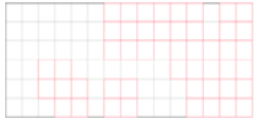


1. Define boundary of the wall
2. Total log radius list
  - Log Center List > Placing large logs from the bottom (with Jitter)
3. Kangaroo Physics Component
  - OnMesh: keep them inside boundary
  - Collider: make logs collide
  - Load: gravity
  - Floor: keep them above ground

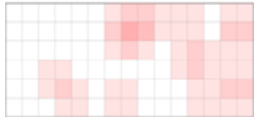
# ITERATION 1



Wall Divided Into Units



Culling Units Randomly but with Gradient



Combining 4 Units Together (Log Size)



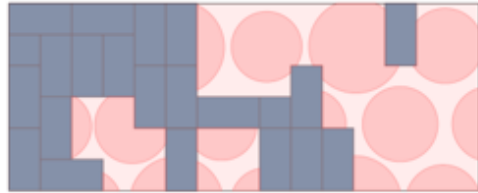
Combining Regions For Logs



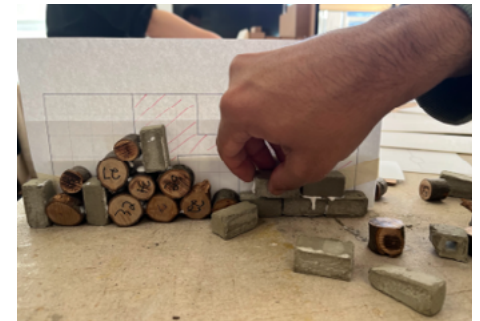
Fitting Logs Inside (Chopping the Edges)



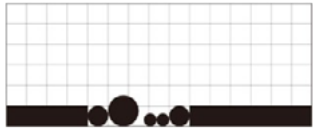
Loop of Selecting Blocks For Left Out Spaces



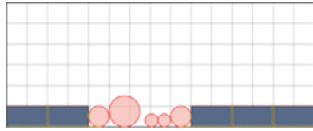
Final



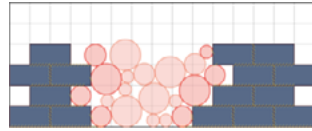
# ITERATION 2



Constructing Layer by Layer



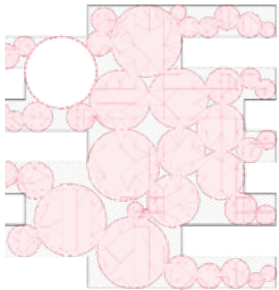
Classifying combination agencies between different materials.



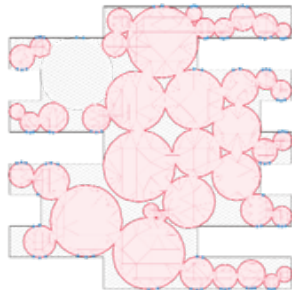
Unglued logs can be tested to see if they can be removed.

CMU - Logs & CMU - CMU : AdhesiveLogs -  
 Logs : Only Friction to Pull Unutilized Parts Later

For i in log list :  
 make a mesh without i



Define x supports

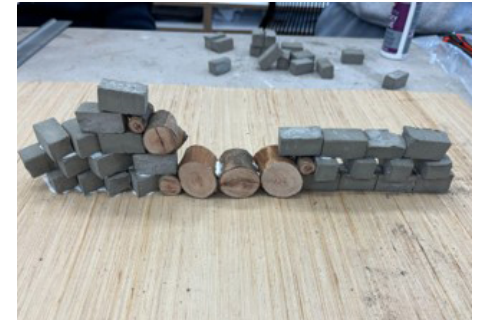
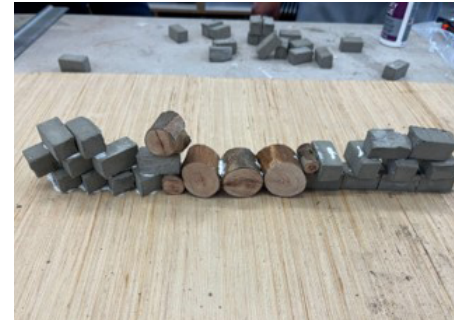


Define z supports

Choose the one  
 With least displacement



Loop



## -Rendering System-

Time: 12 / 2023

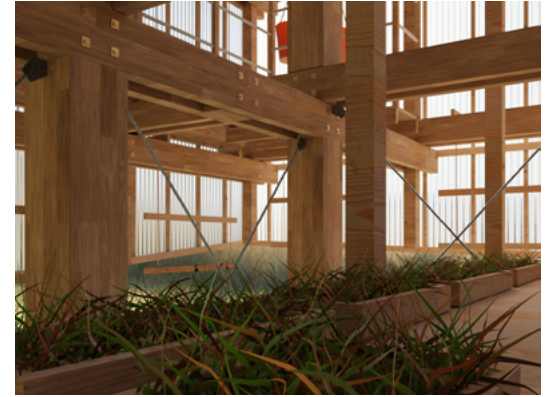
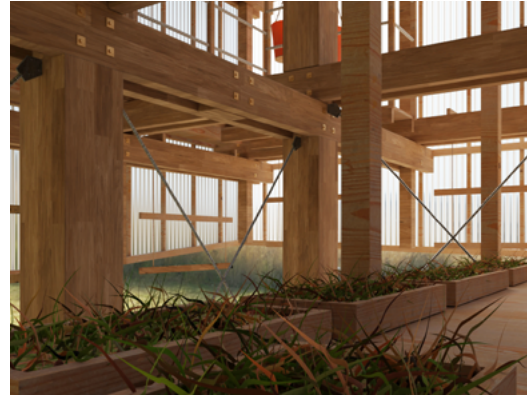
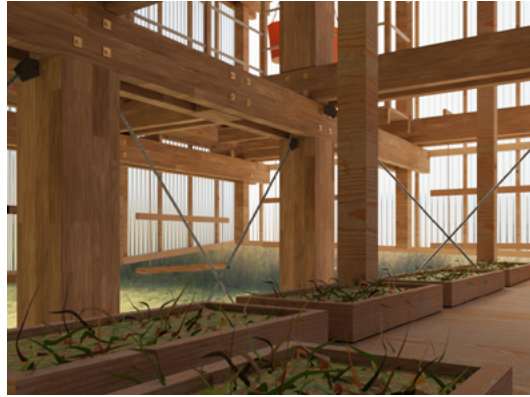
Advisor: Seth Thompson

Role: Individual Work

How do materials behave in Unreal Engine? I used Blender as the new renderer to render Kengo Kuma's work Nest We Grow Memu Meadows. The animation technology in Blender could show the different food cycles presented in the architectural space, and then present the core concept of architecture, which is to bring people closer to nature through the life cycle activities of local food.



GROWING



HVESTING



COOKING



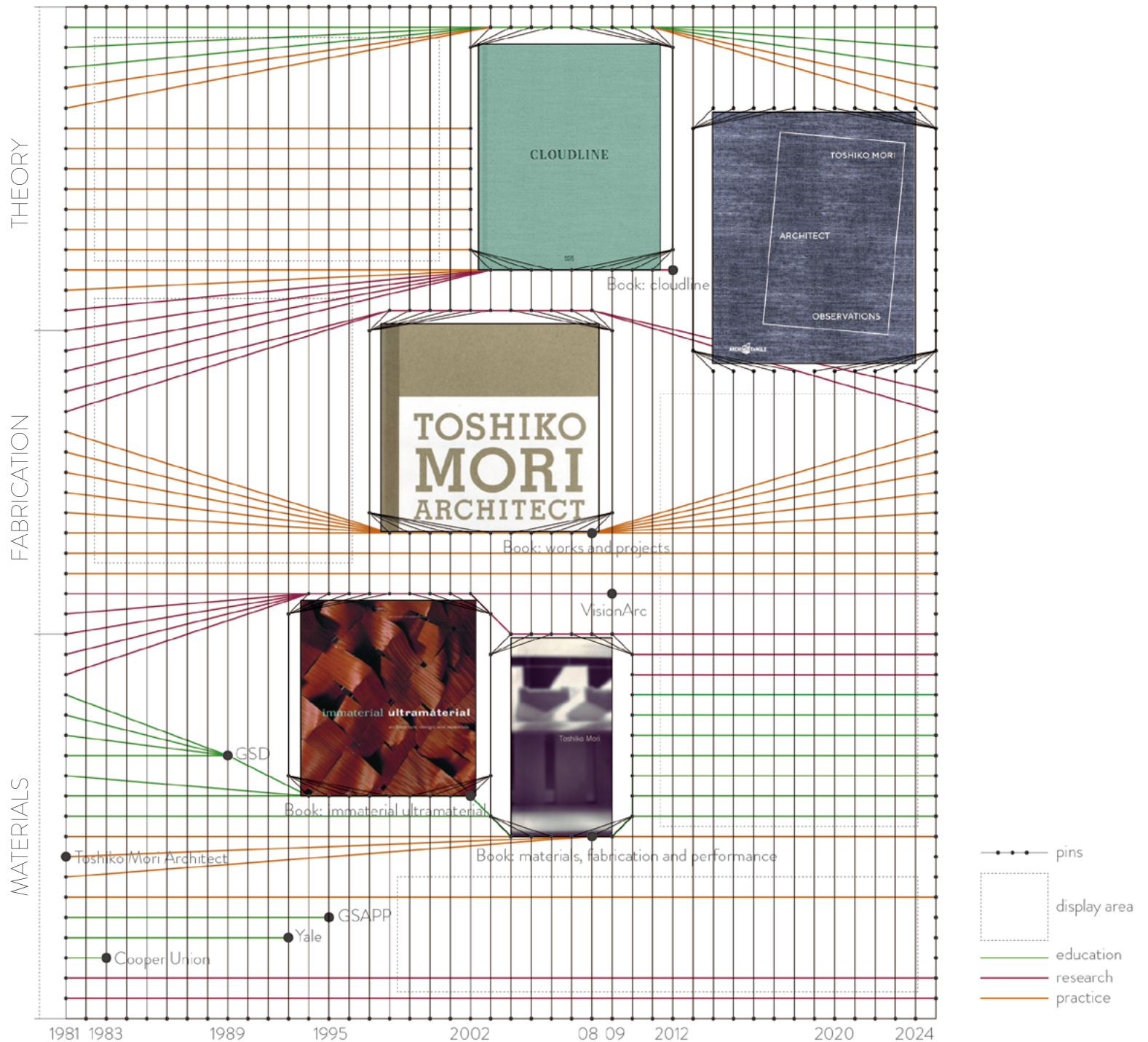
# -Weaving Her Work-



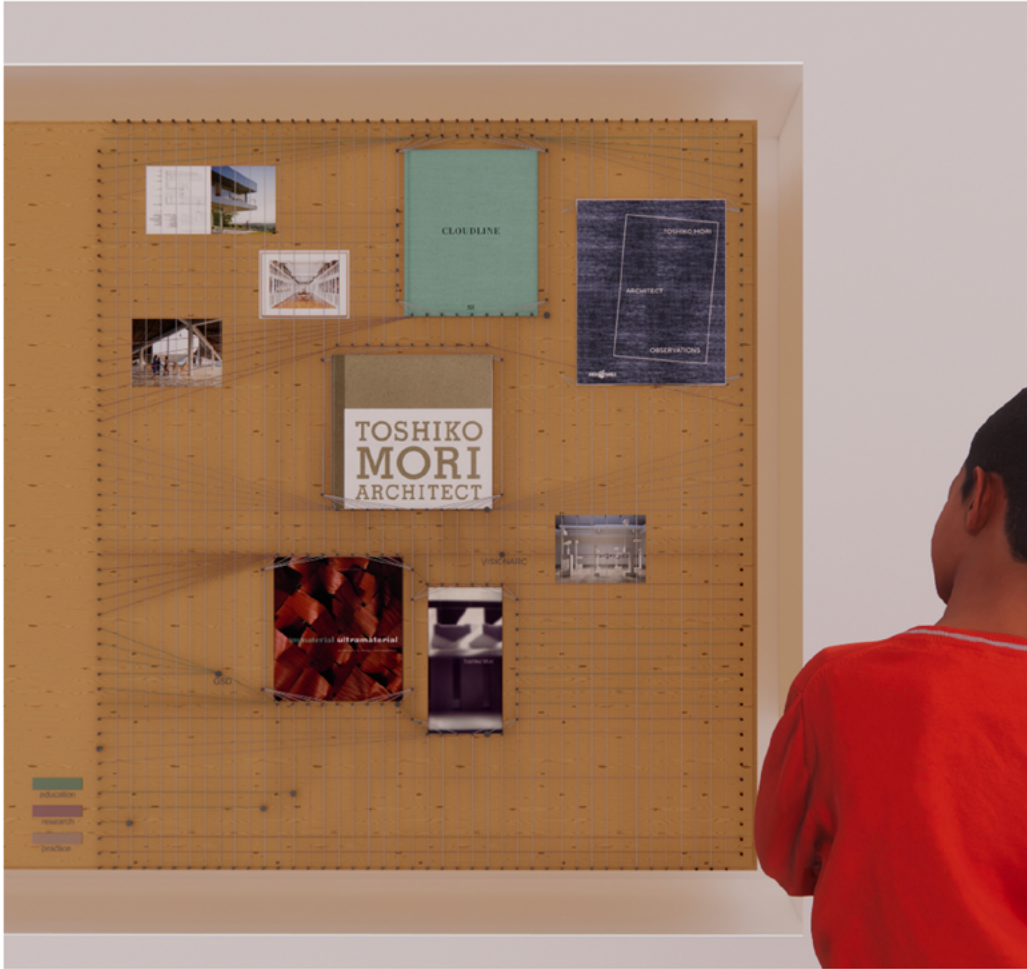
Time: 04 / 2024  
 Advisor: Hilary Sample  
 Role: Individual Work

The design was inspired by an interview Architizer conducted with Toshiko Mori, titled Weaving Her Practice. What's interesting to me is that the word "weave" not only expresses the intertwining of Toshiko Mori's multiple identities: architect, teacher, researcher, but also demonstrates her research and innovative use of textiles. Therefore, I wanted to visually use the weaving lines to display her work.

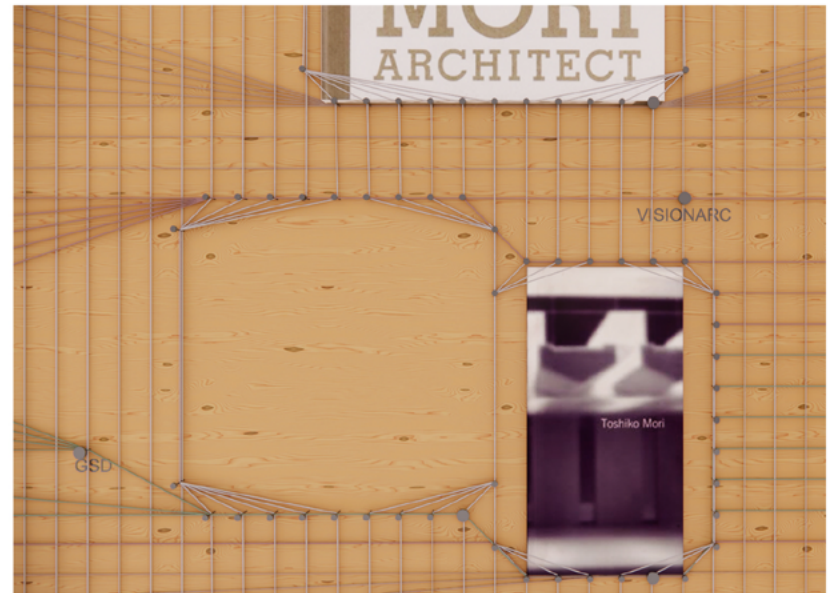
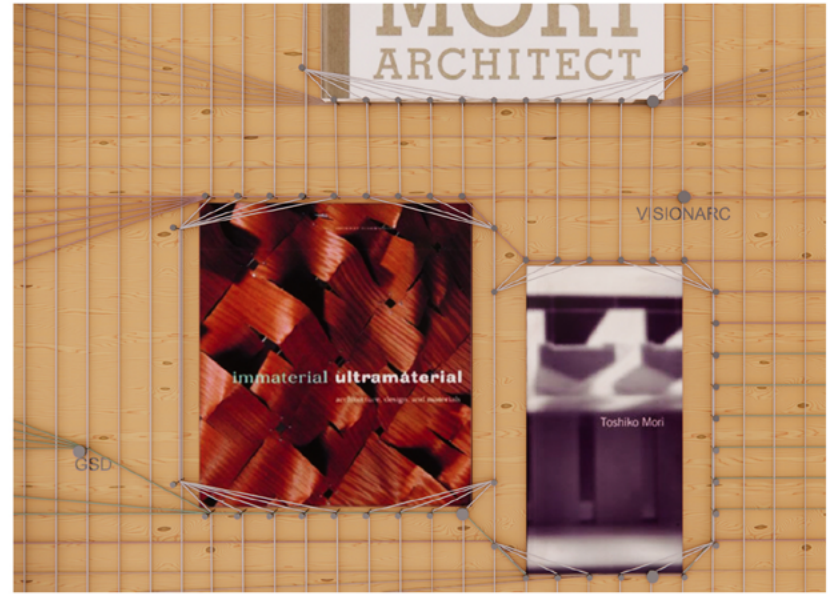
The horizontal axis unfolds in chronological order, and the vertical axis is divided into themes including materials, fabrication and theory. Different colored lines illustrate developments in her education, practice and research areas, together depicting how developments in these different areas collectively influenced her work.







Rendering



Detailed Rendering / Books can be taken out for reading or put back into the display area.

# -Devonn Francis's Recipe-

## COCONUT CHICKEN & CUCUMBER MOJO

1 HOUR 30 MINUTES  
JANUARY 12, 2024

1. Preparing chicken



The key to this dish is mastering the sauce while getting the benefit of chicken that is moist in the center with nicely crispy skin by slowly rendering the fat from the skin. Chicken fat is an important component to balancing the nutty and acidic sauce, as it imparts flavor from the baking process. You know you've perfected the density of the sauce if it sticks to the back of a spoon.

**Prep Time:** 30 minutes  
**Cook Time:** 1 hour 10 minutes

**Ingredients**

- 2 teaspoons of kosher salt
- 1 teaspoon of sugar
- 2 pounds skin-on chicken thighs (boneless preferred)
- ¼ cup almonds
- 1 pound Yukon gold potato, cut into ½ inch thick slices
- 1 tablespoon of coconut oil
- 1 tablespoon tamarind paste

- For cucumber mojo:**
- 2 cups english cucumber, sliced into ribbons with vegetable peeler
  - ¼ cup fresh lime juice
  - 1 teaspoon kosher salt
  - ¼ teaspoon ground cumin
  - ¼ teaspoon dried oregano
  - 5 cloves garlic, grated
  - ¼ cup fresh orange juice

**Equipment needed**  
12-inch metal skillet, vegetable peeler, microplane

**Procedure**

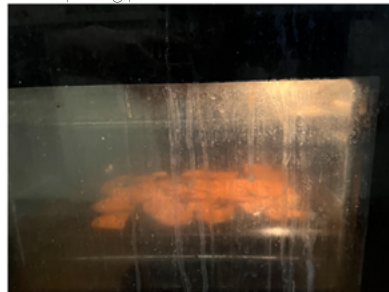
Heat oven to 375°F with wire rack placed at center.  
Mix salt and sugar in a bowl and sprinkle the mixture all over chicken thighs. Add chicken, skin-side down, into a large skillet set to medium heat. Cook chicken until golden brown, getting a nice sear and rendering fat (about 8 to 10 minutes).  
Remove chicken from pan, slice into 1-inch pieces and then brush chicken with 2 tablespoons of tamarind paste. Set aside.

Spread potato slices in an even layer into the same skillet with rendered chicken fat and cook over medium heat, allowing potato to brown (about 5 minutes). Add bay leaves, chili ole anbol, and shallots evenly around the skillet and then pour in coconut milk.

Place skillet back in the oven for 10 minutes to let coconut milk reduce and for potatoes to soften. Once the potatoes are mostly tender, add in chicken and cover with crushed almonds. Bake for another 8 to 12 minutes. Note: season with more salt and pepper as you go.



2. Preparing potatoes



3. Preparing cucumber mojo



Time: 03 / 2024  
Role: Individual Work

This project came from a lecture assignment on "Practice Uncertainty". When I was asked to follow a recipe to recreate an innovative traditional Jamaican dish, I suddenly realized whether the food was part of the material. In fact, food can give a more intuitive experience than the materials used in buildings and spaces. Its sweet, sour, bitter and spicy taste directly stimulates your sense of taste and awakens a part of your memory.

<https://yardy.world/blogs/blog/coconut-chicken-cucumber-moj>

Zitao Yang  
zy2596@columbia.edu  
(332)999-8229  
3147 Broadway, 10027