

**Zihan Sun**

[Architectural Promenade]

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My journey begins here...

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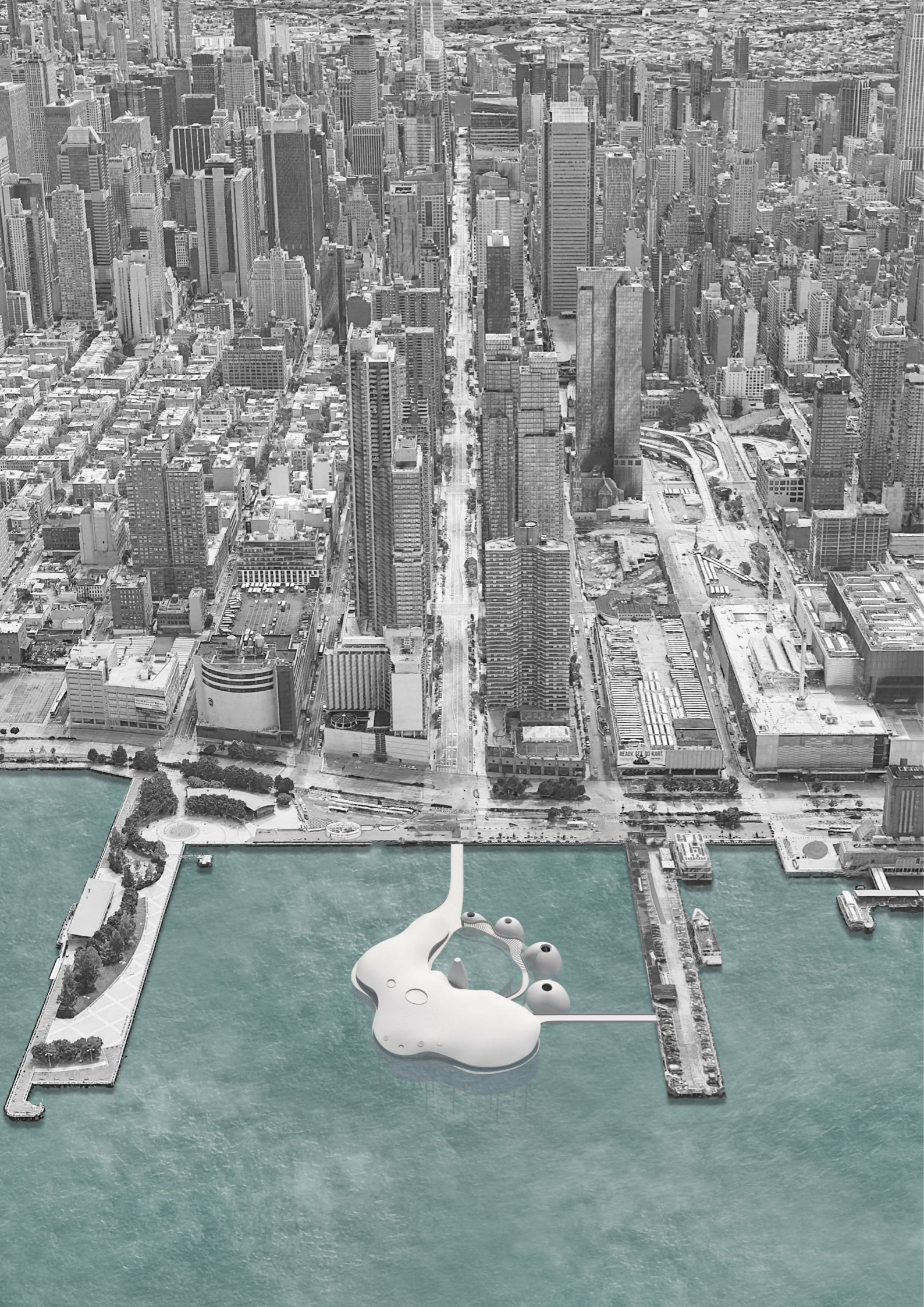
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# 01 SEISMIC FIELD

A Museum of Earthquakes

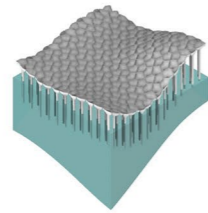


Fall 2021  
GSAPP Advanced Studio  
Instructor: Bernard Tschumi  
Partner: Risa Mimura, Enfeng Xie, Haozhen Yang  
Participation: Preliminary Research, 3D Modelling, Diagram  
& Architectural Drawing, Rendering

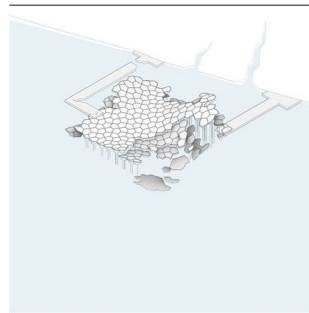
**Keywords: Earth & Earthquakes, Energy, Motion**

Inspired by 'Little Island', studio island confronted architecture with natural and human-driven disasters. A new island is proposed on the Hudson River, incorporating a 'museum' of catastrophes and experimental program/spaces. Throughout preliminary research on earthquakes, we define the phenomenon as the motion of earth or ground, with duality between creation and destruction. Then accordingly the island is divided into two parts, the water surface as the boundary. Above-water part serves as a recreational center, and below-water part as an educational museum. Kinetic floors are placed in both parts to harvest energy, which is stored in the battery tower. The island takes the form of an archipelago, providing a strong contrast to the 'concrete jungle' of Manhattan.

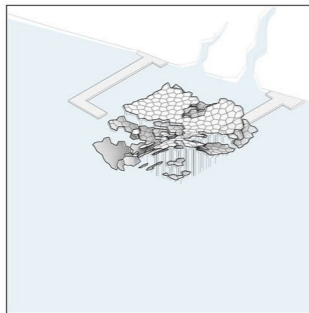
Original



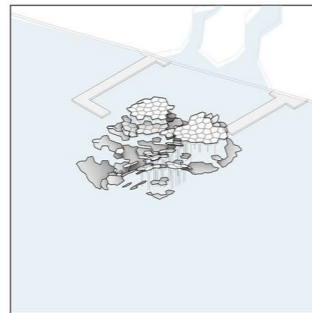
Mild  
Magnitude 2.5-5.5



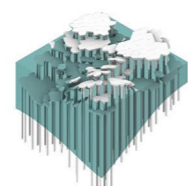
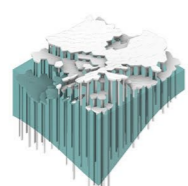
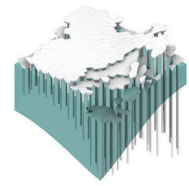
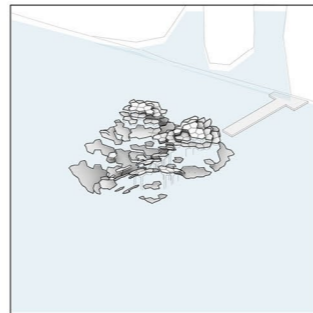
Moderate  
Magnitude 5.5-6.0



Strong  
Magnitude 6.0-6.9



Major  
Magnitude 7+



cnn.com, 2019 Searles Valley earthquake, CA



kqed.org, California-Nevada quake in 2021



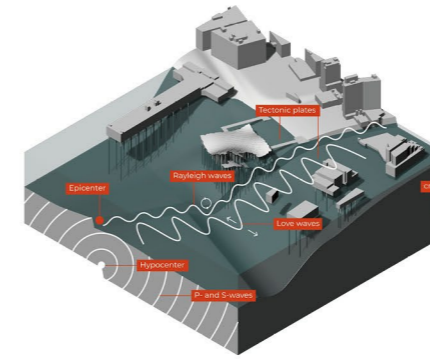
cnn.com, Strong Northern California earthquake in 2021



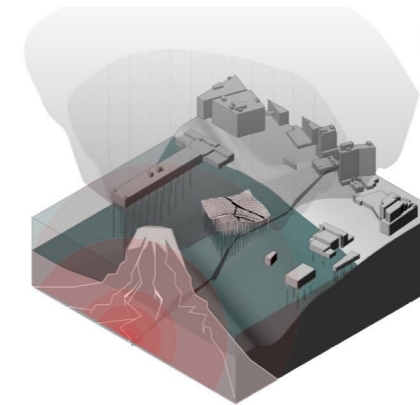
amlmalta.com, 2011 tohoku earthquake in Japan

### Magnitude and Damage

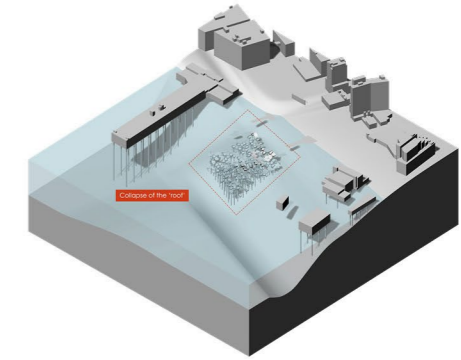
Earthquakes have different intensities, varying from magnitude 2 to 9, and the destructive impact an earthquake can bring about is related to its magnitude. There are earthquakes happening every day, most of which are too weak for people to sense.



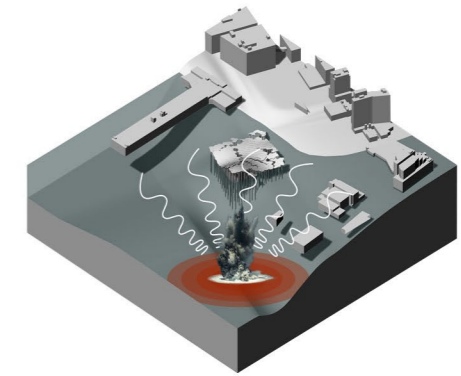
Tectonic Earthquakes



Volcanic Earthquake



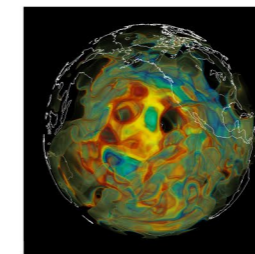
Collapse Earthquake



Explosion Earthquake

### 4 Types of Earthquakes

There are mainly 4 types of earthquakes: tectonic, volcanic, collapse, and explosion. The first two are natural events, caused by the movement of tectonic plate, and eruption of volcano, while the last two are human-driven.

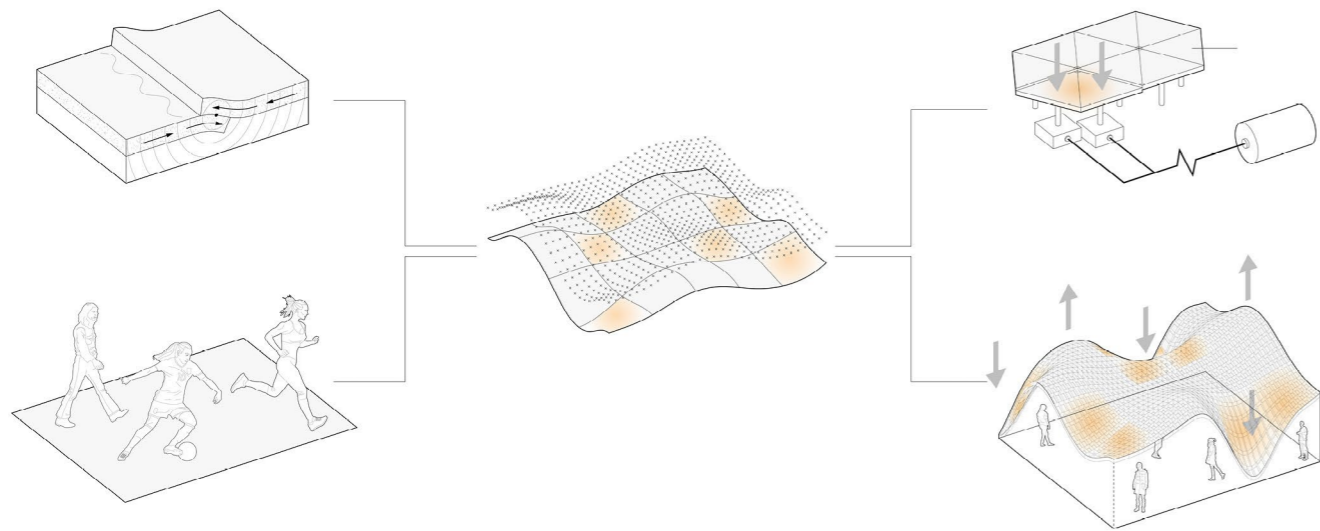


=

**CREATION**  
**DESTRUCTION**

### Duality of Earthquakes

Although earthquakes are perceived as devastating, destructive events. We propose that it is the motion of earth or ground, characterized by the energy that causes it and the destruction as a result of it.



### Seismic Field

Similar to the term magnetic field, we define a new term seismic field as the area that affected by the motion of nature or human. Then the field can be used for energy harvesting and motion experience.

$$\frac{\text{CREATION}}{\text{DESTRUCTION}} = \frac{\text{Creation of Motion}}{\text{Education of Destruction}} = \text{Recreation Battery Museum}$$

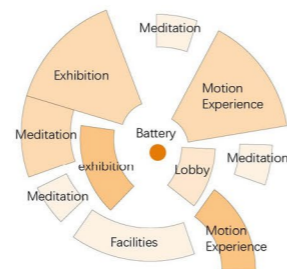
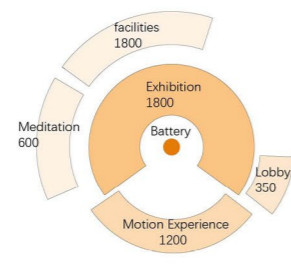
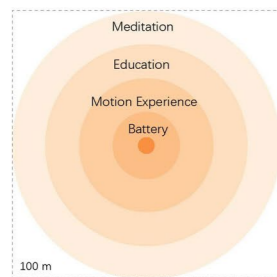
### Motion Magnitude



### Program Area

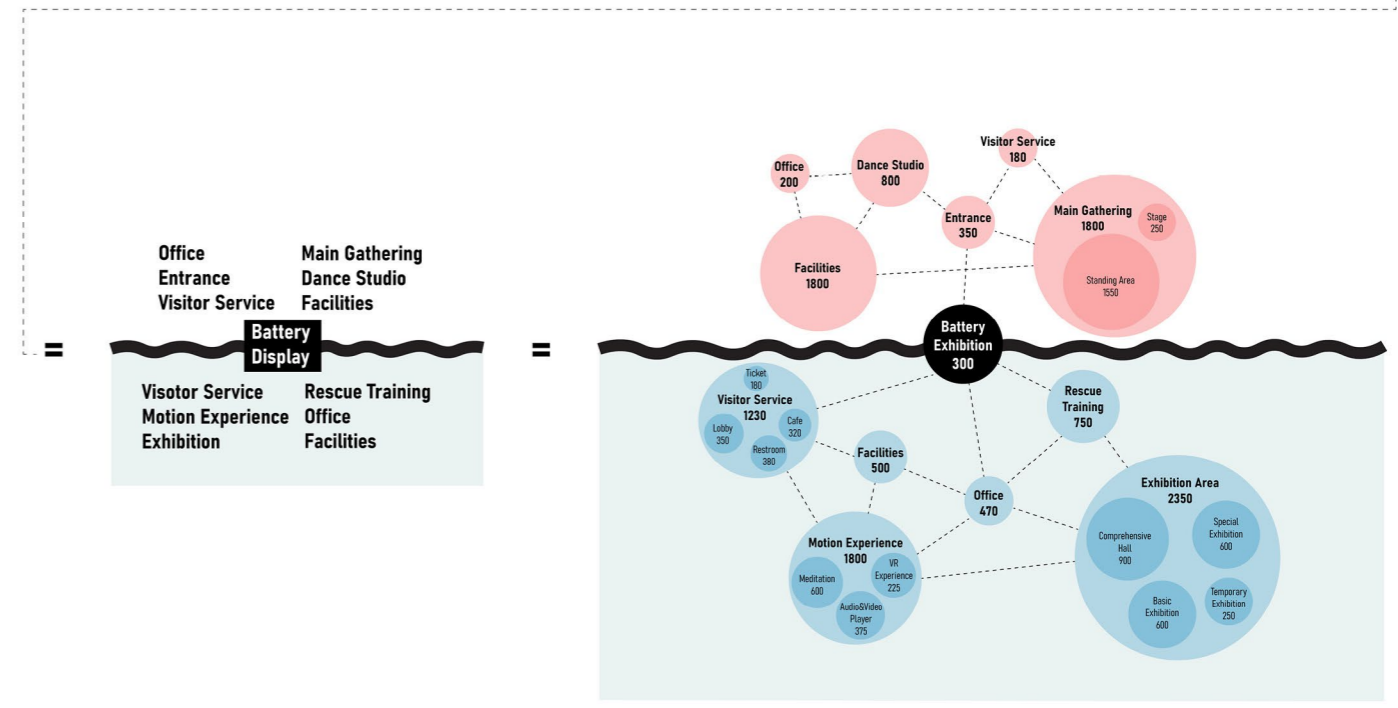


### Program Sequence



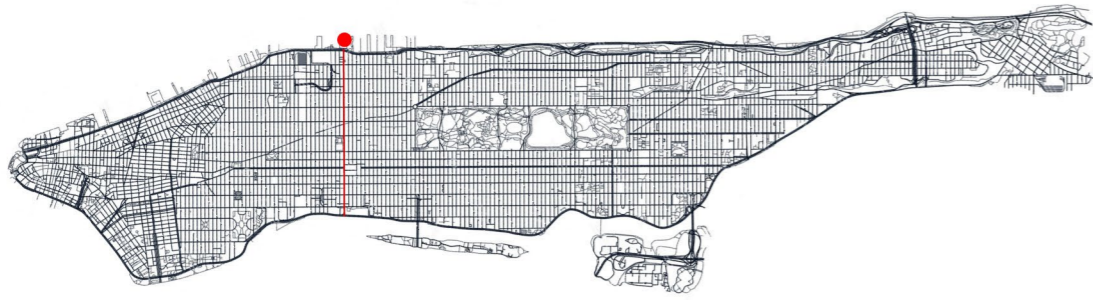
### Motion Intensity and Epicenter

Each program is arranged according to the motion it include. Battery tower lies in the center of the island, and the more motion it involves, the closer it is to the center.



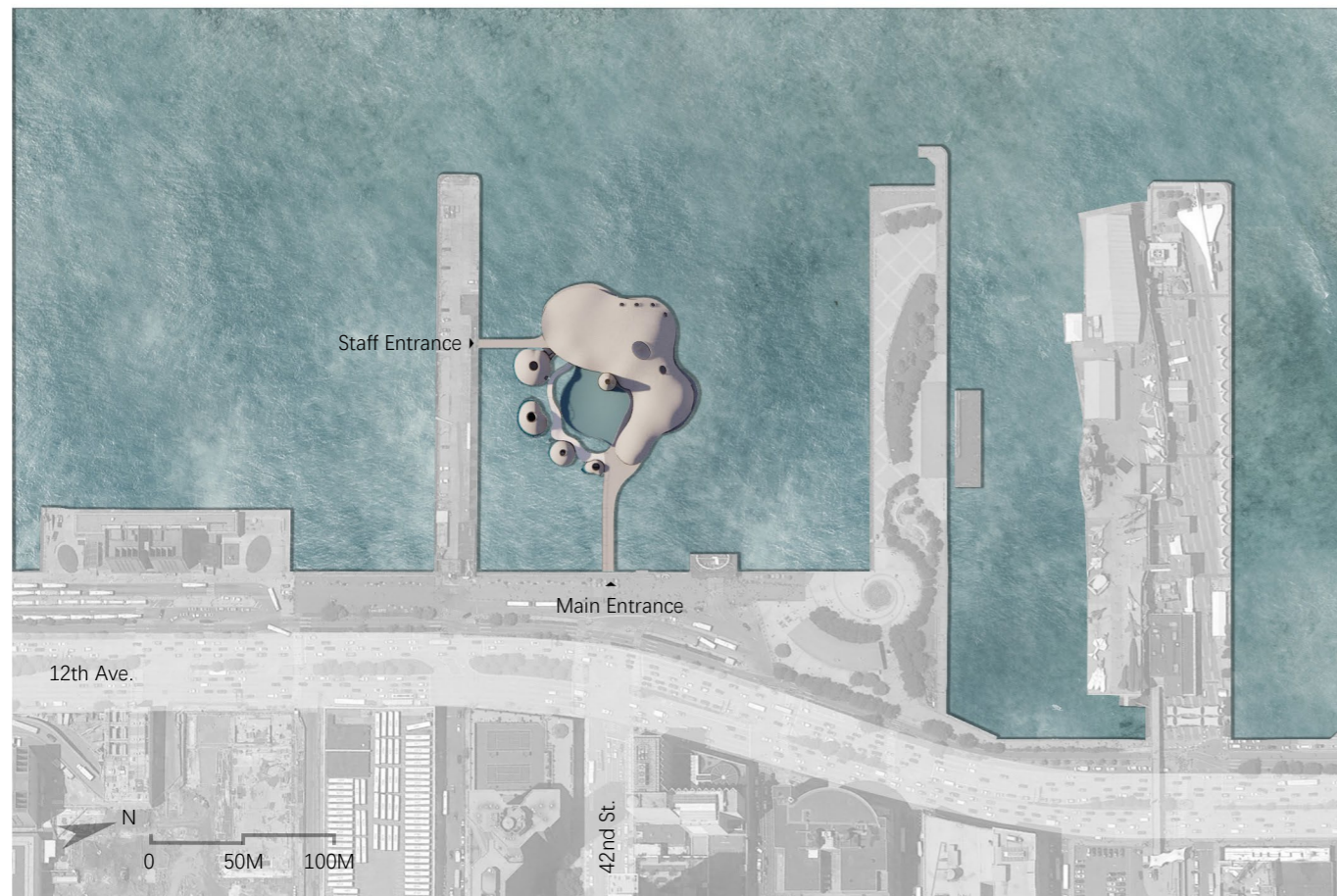
### Duality of Program

According to the duality of earthquakes, all programs are divided into two parts. The above-water part serves as a recreational center, including a main gathering space, rehearsal studios and backstage area. The below-water part educates the destruction of earthquake through galleries, motion experience spaces.



### Site: Extension of 42nd St.

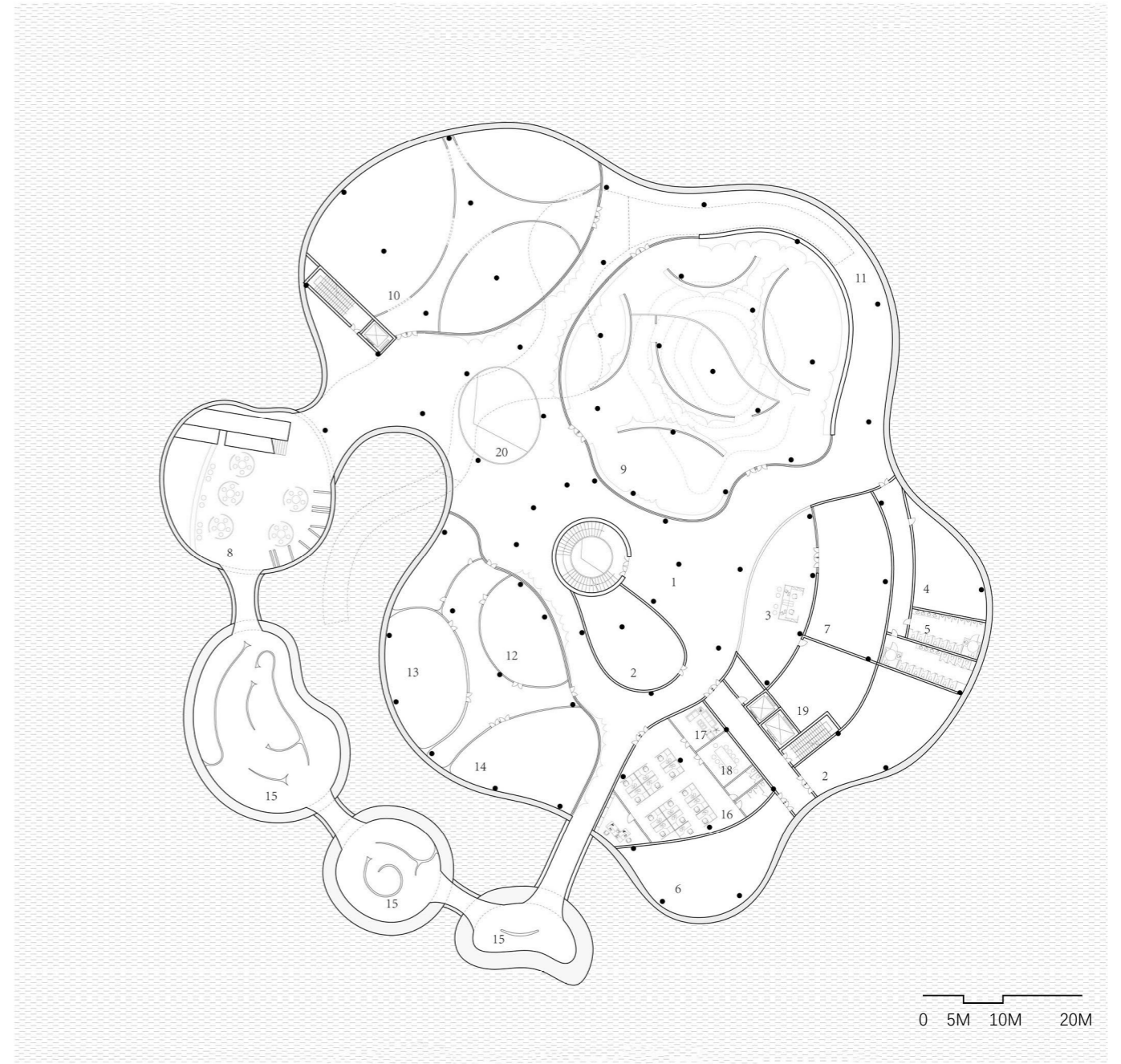
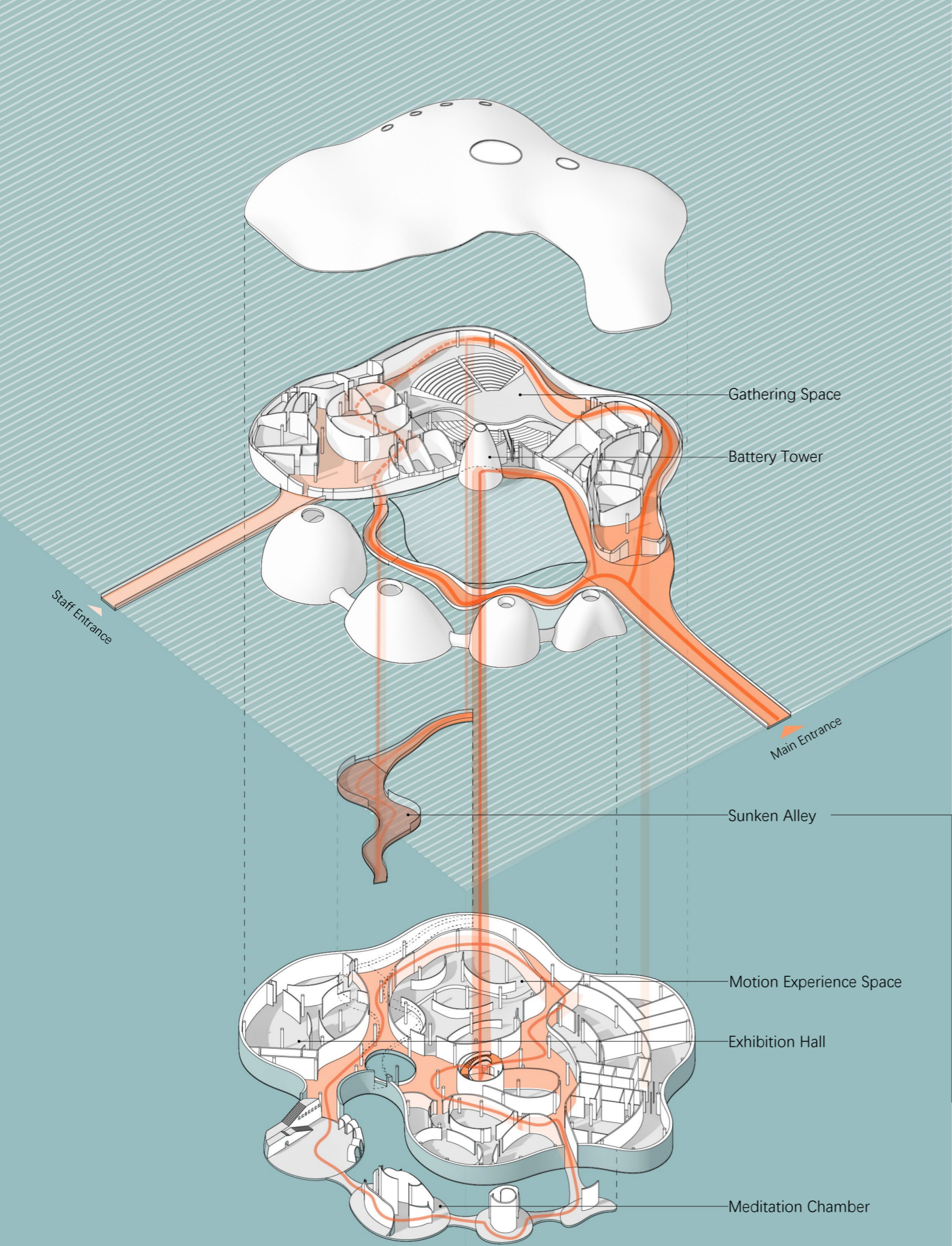
The site locates at the extension of 42nd St, between rows of high-rise buildings, where people have least perception of earth and ground.



### Archipelago

The island takes the form of an archipelago with curved roof, hoping to provide a different perception of earth in contrast to concrete jungle in Manhattan.

- 1 Lobby
- 2 Office
- 3 Rehearsal Room
- 4 Main Gathering Space
- 5 Facility
- 6 Storage Room
- 7 Security Guard
- 8 Sunken Alley
- 9 Reception Room
- 10 Meditation Chamber
- 11 Cafe



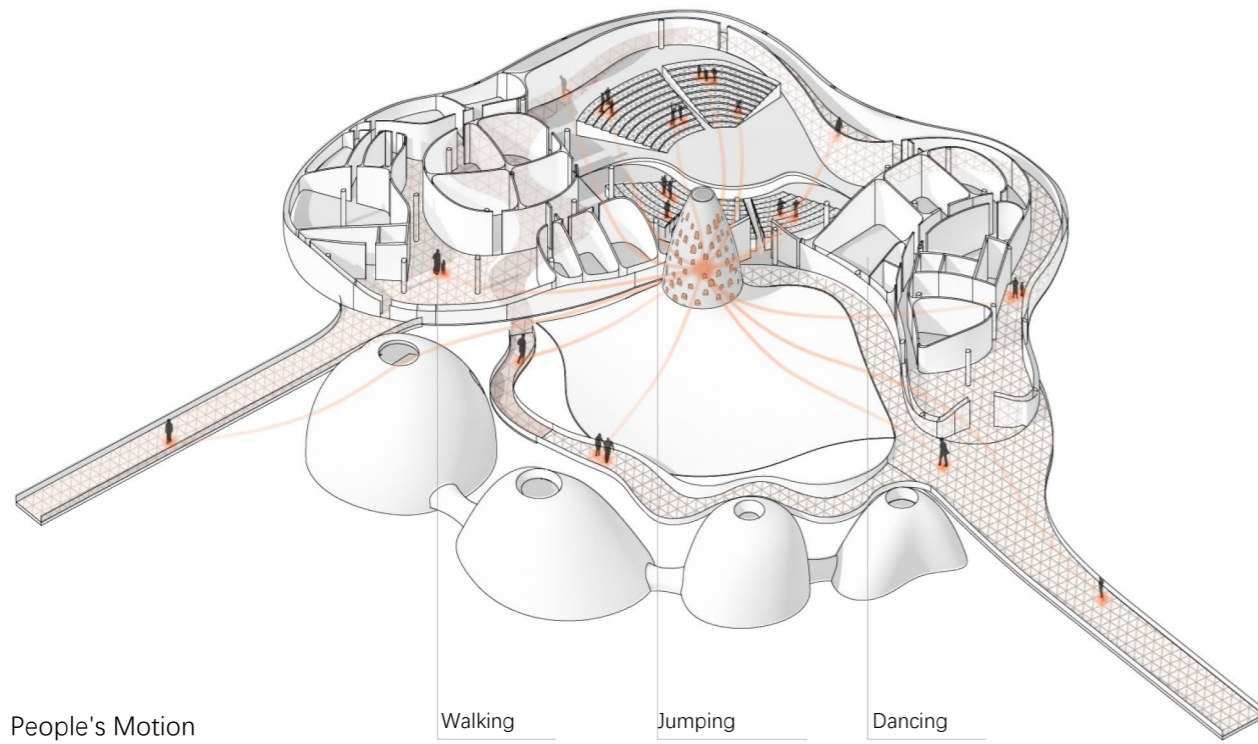
B1 Plan

**Sunken Alley**

Sunken alley extends downward from the circulation of ground floor, run through motion experience space and exhibition hall, and allows visual connection between two parts.

- |                          |                                |
|--------------------------|--------------------------------|
| 1 Lobby                  | 11 Special Exhibition Corridor |
| 2 Facilities             | 12 VR Experience Room          |
| 3 Ticket Office          | 13 AR Experience Room          |
| 4 Coat Room              | 14 Interactive Experience Room |
| 5 Restroom               | 15 Meditation Chamber          |
| 6 Storage Room           | 16 Office                      |
| 7 Bookstore              | 17 Reception Room              |
| 8 Teahouse               | 18 Conference Room             |
| 9 Motion Experience Hall | 19 Central Control Room        |
| 10 Basic Exhibition Hall | 20 Atrium                      |

# Energy Harvest & Storage

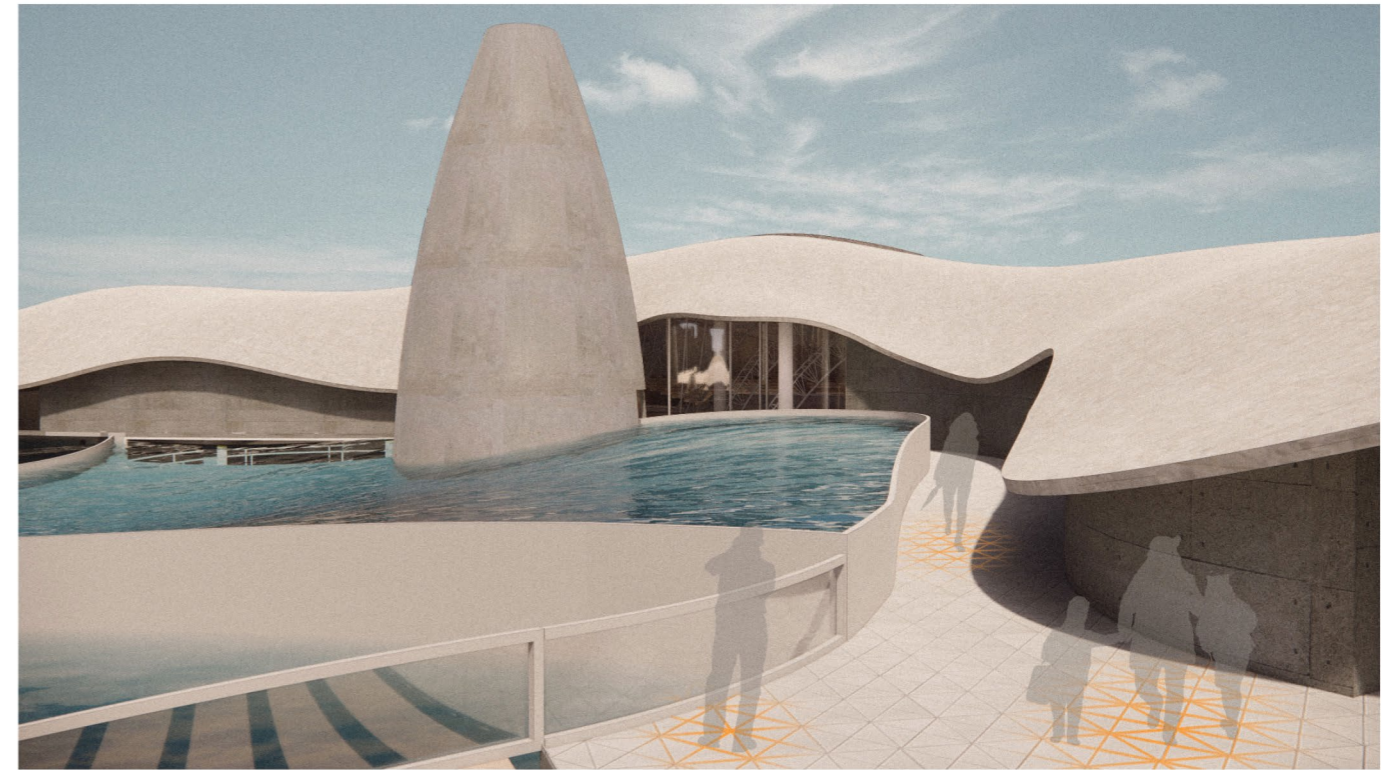
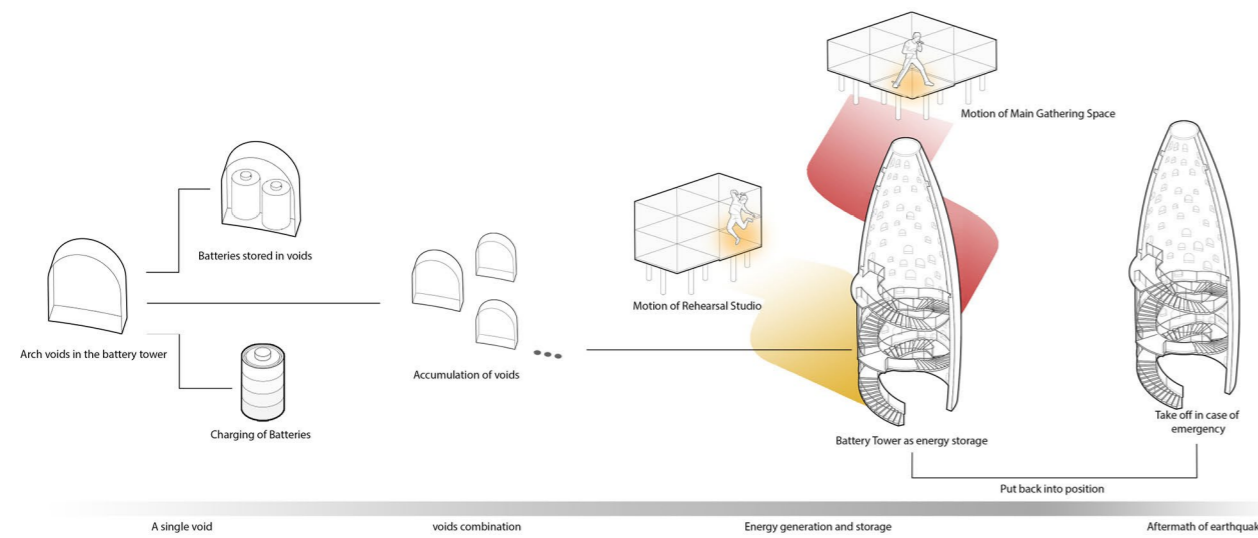


○ People's Motion

○ Kinetic Floor Activation



○ Energy Storage in Battery Tower



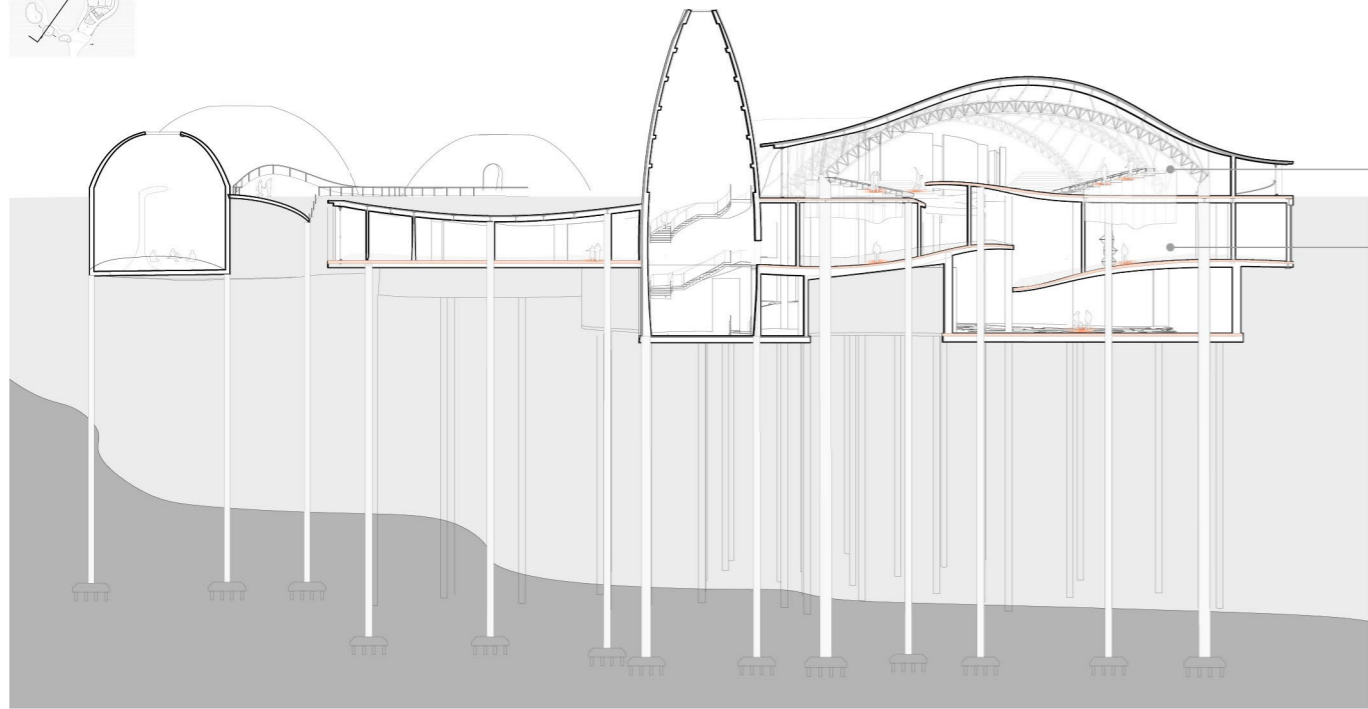
Battery Tower Exterior



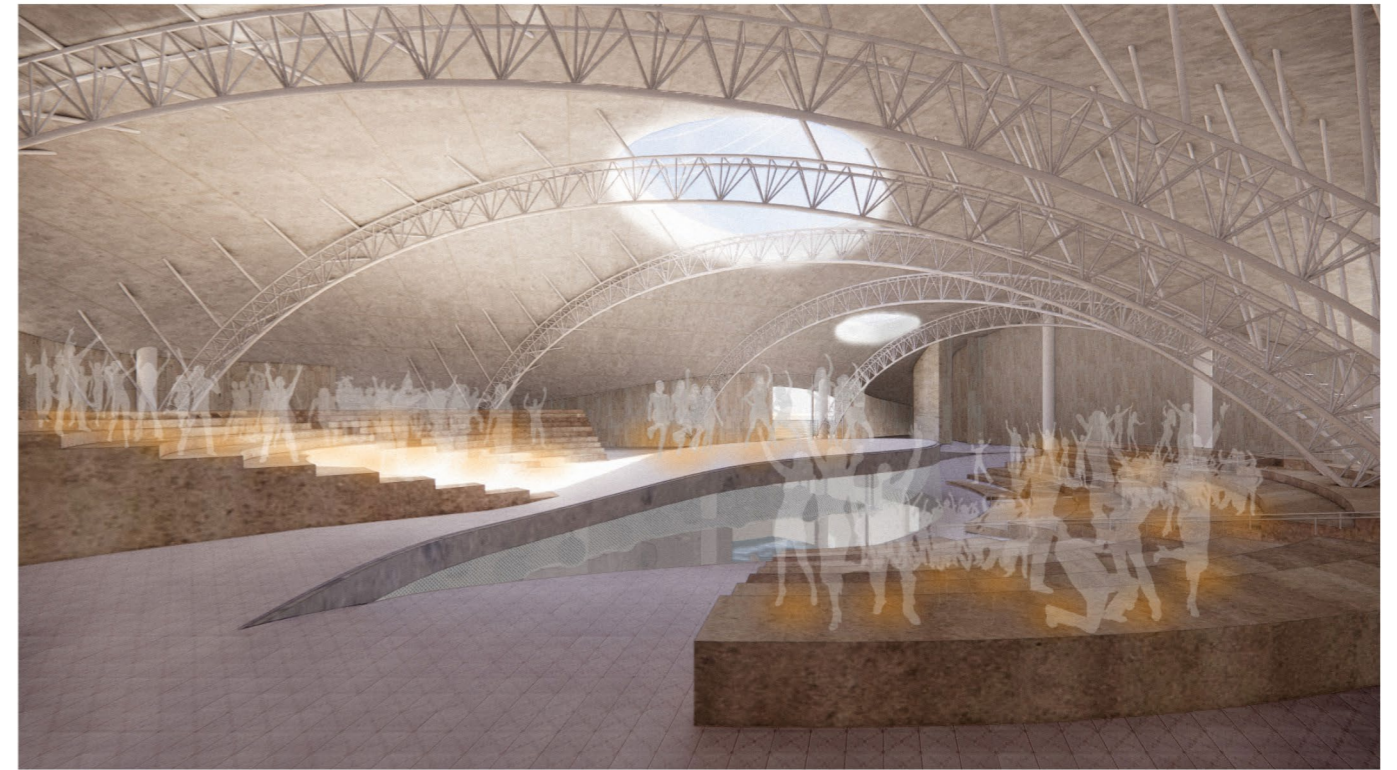
Battery Tower Interior



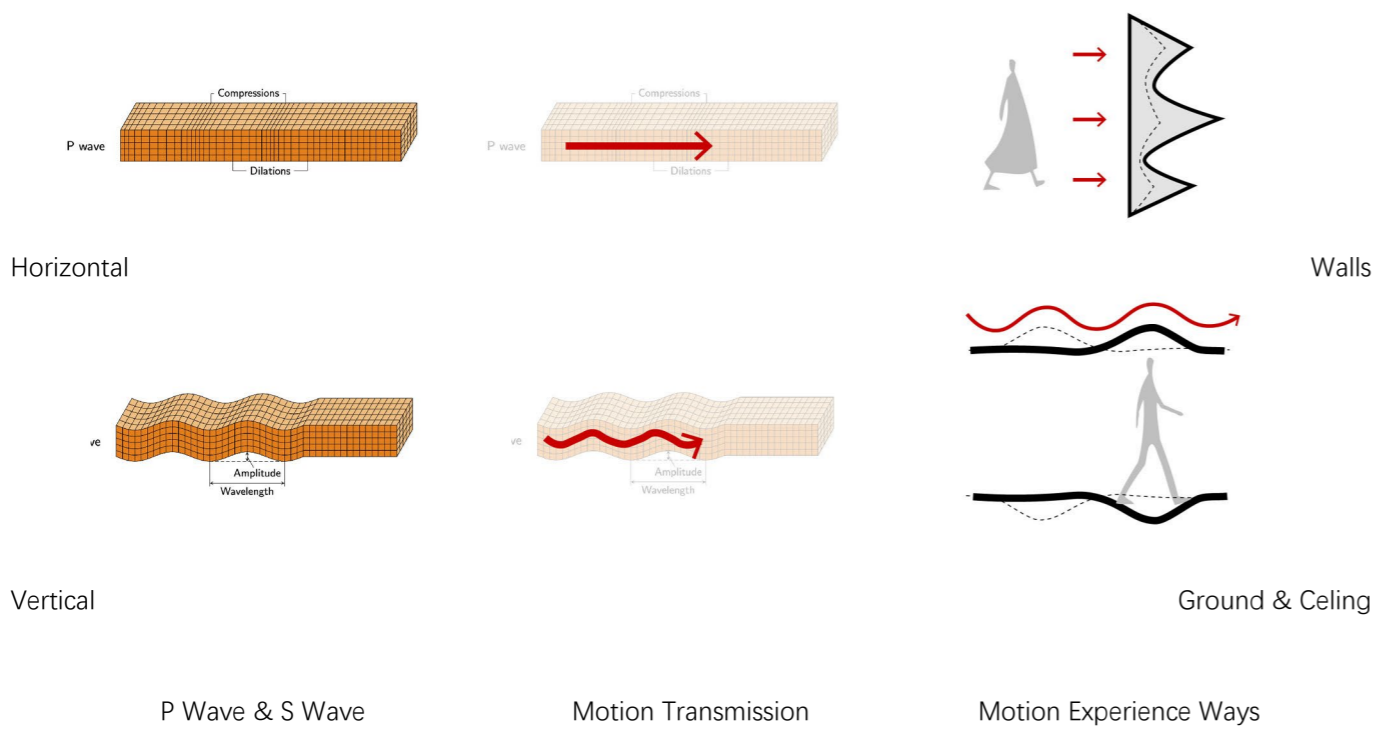
# Motion Experience



Section A-A



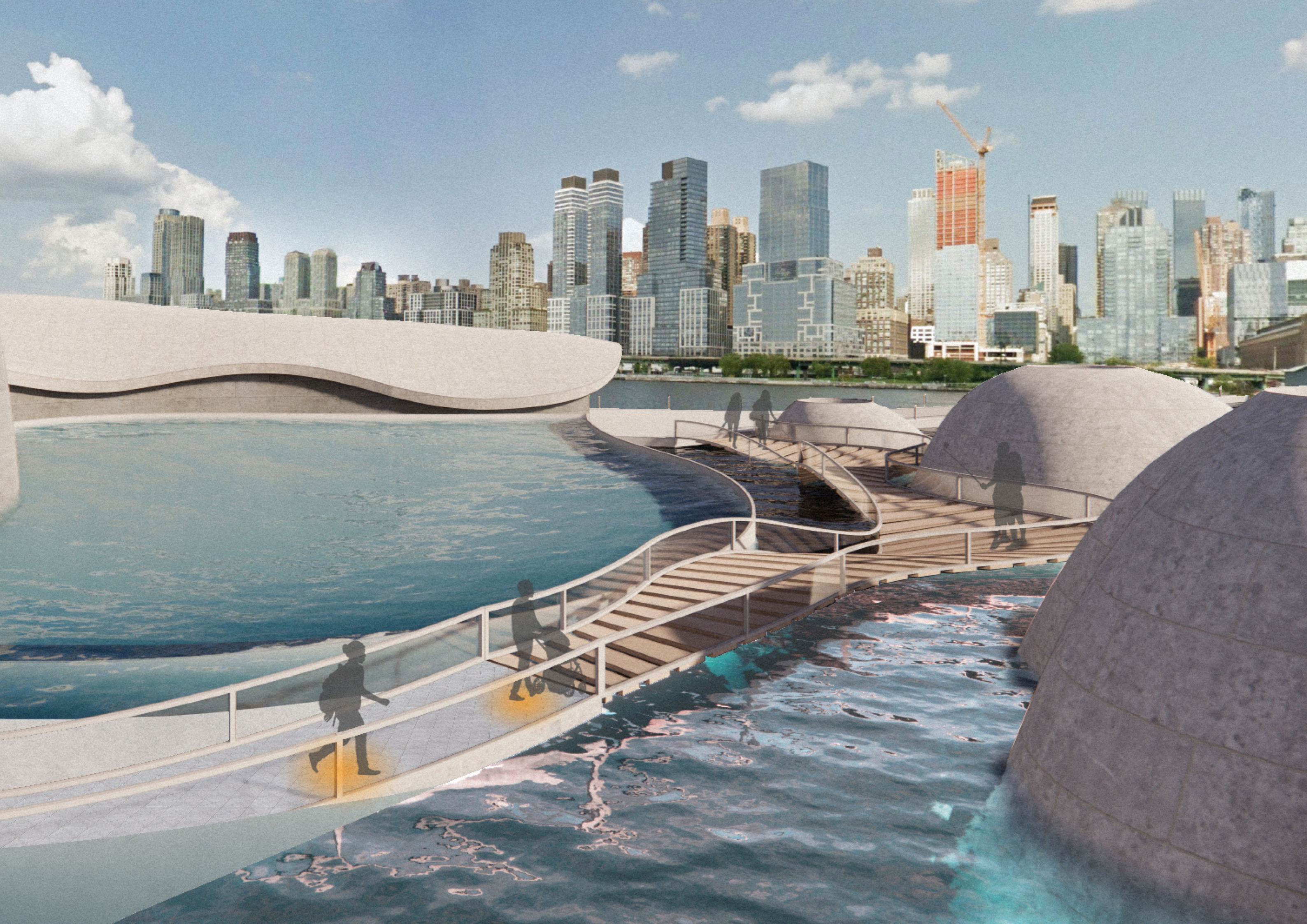
Gathering Space



Seismic Wave & Motion Visualization



Motion Experience Hall



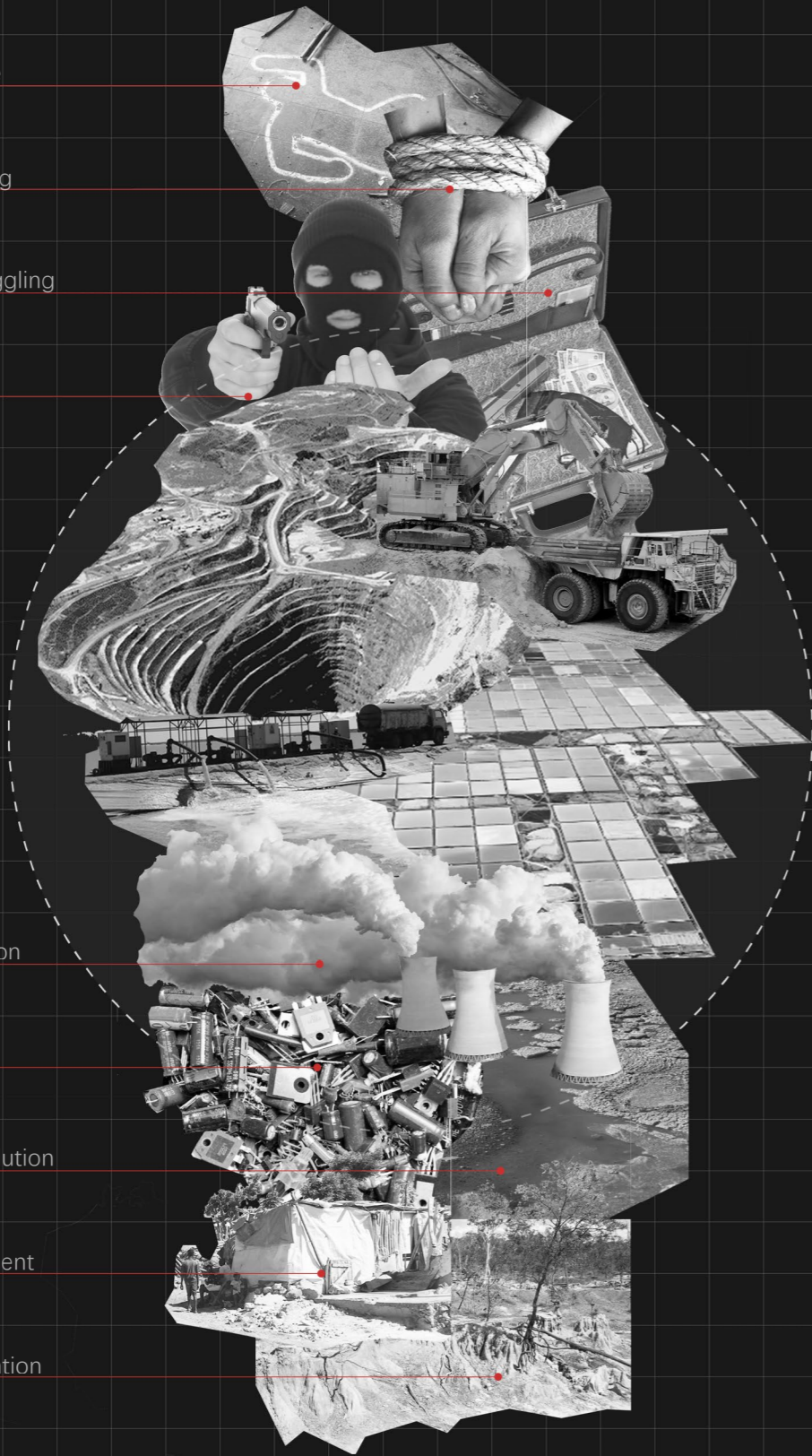
FAST VIOLENCE

Homocide

Kidnapping

Gun Smuggling

Robbery



Air Pollution

E-Waste

Water Pollution

Displacement

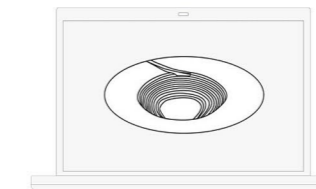
Desertification

SLOW VIOLENCE

02

## EXTRACTIVE TASKSCAPE

Lithium & Slow Violence in Sonora, Mexico



Summer 2021

GSAPP Entangled Studio

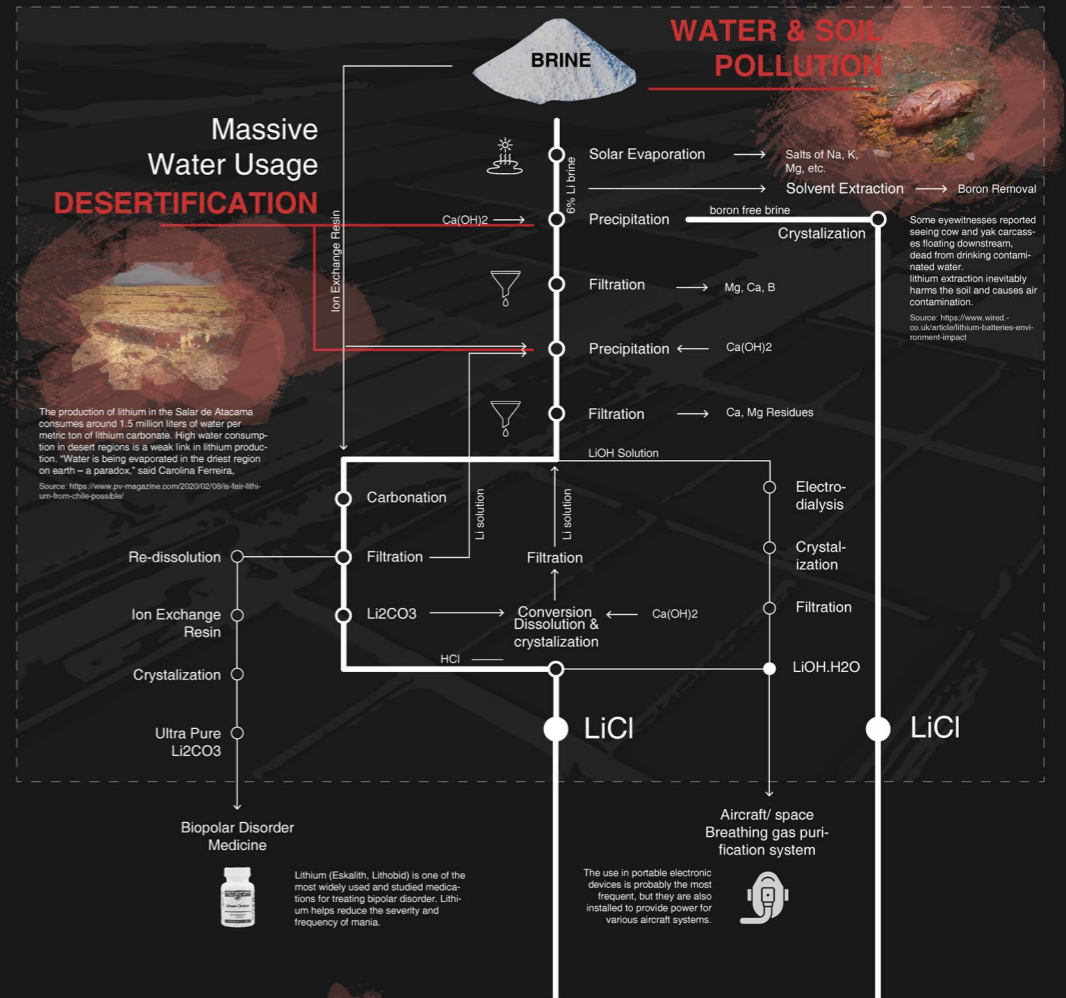
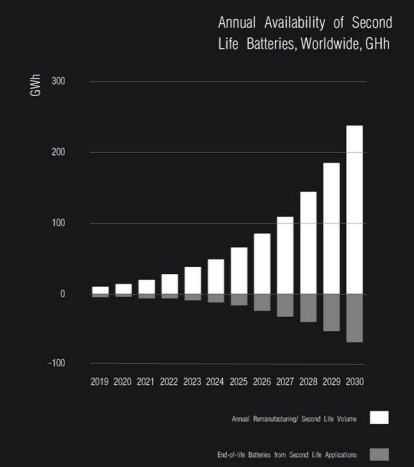
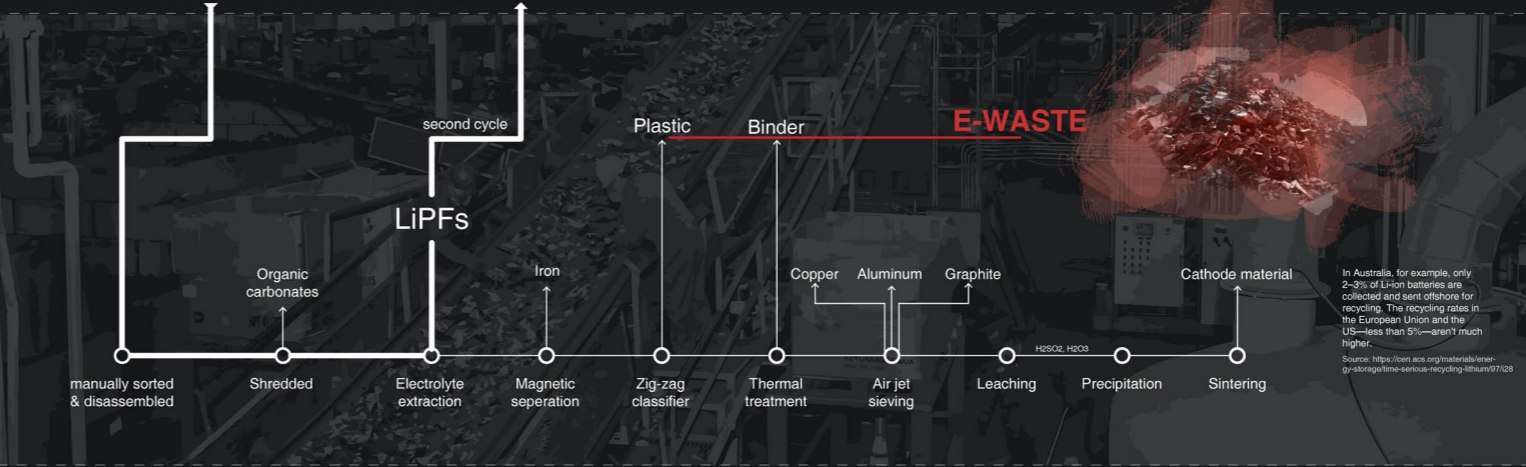
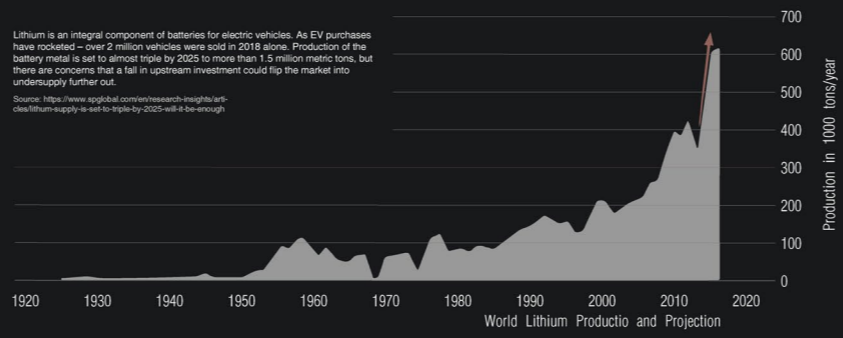
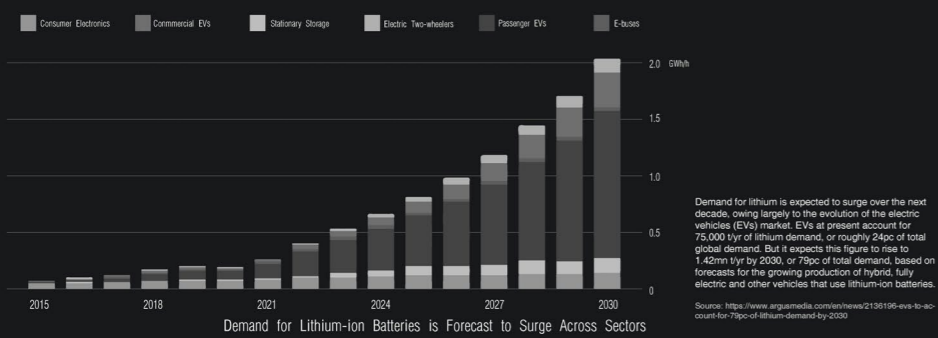
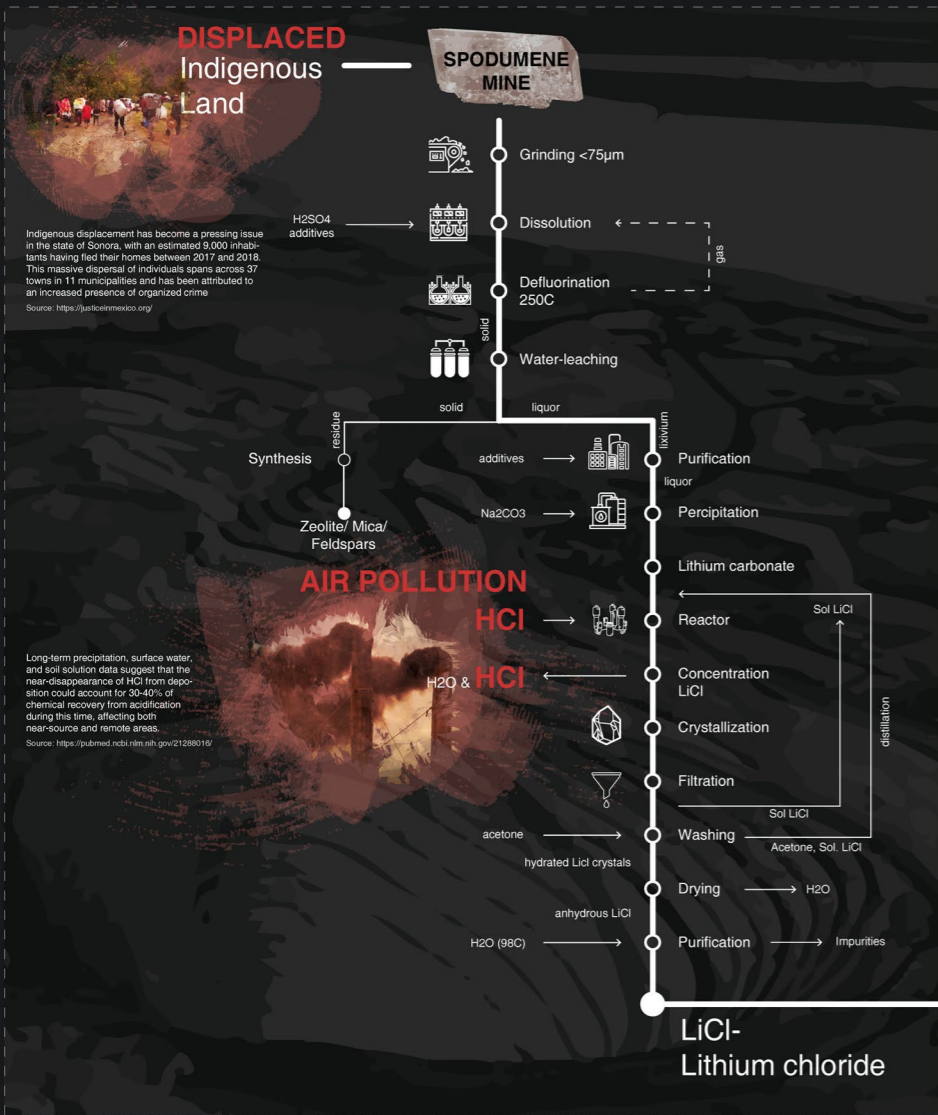
Instructor: Jorge Ambrosi, Gabriela Etchegaray

Partner: Yani Gao, Irmak Turanli

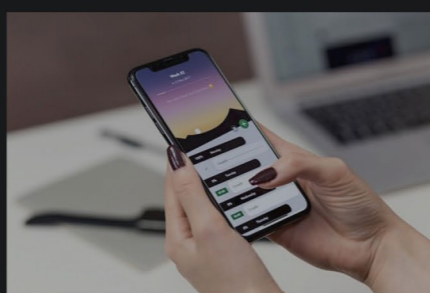
Participation: Preliminary Research, Diagram Drawing, Video Production

**Keywords: Lithium, Slow Violence, Sonora, Environmental & Social Impact**

Lithium, the main component of fast charging, electricity storing lithium-ion batteries, has become the most forthcoming mineral globally. The demand for lithium ore is growing triple folds, responding to our desire to be constantly connected on electronic devices and the worldwide transition to 'green' electric cars. In the hope to lead to a social consciousness of the invisible violence and shorten the distance between us and this industry's productional, environmental and societal impact, we are investigating the processes and relationships from the birthplace of lithium- the mining site. By drawing the taskscape of a new lithium mine in Sonora, Mexico, we examined the violence brought on by the production of this mineral, which lies hidden behind a facade that the developed world comfortably ignores. A mineral that supposedly helps construct a greener future for us while the burdens are imposed upon the invisible many.



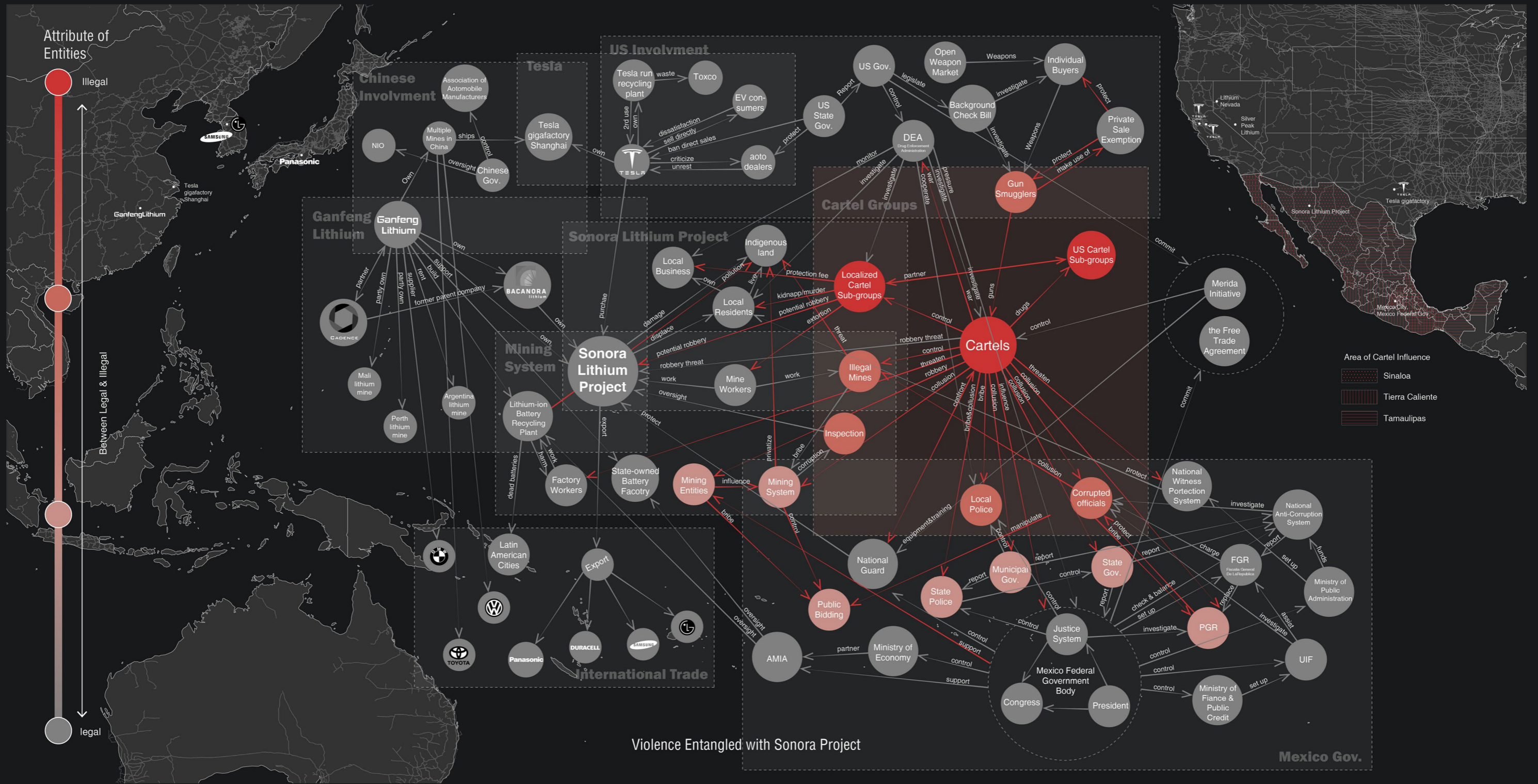
Cut cobalt cathodes are held over a barrel in the Netherlands. Photographer: Jasper Juinen/Bloomberg



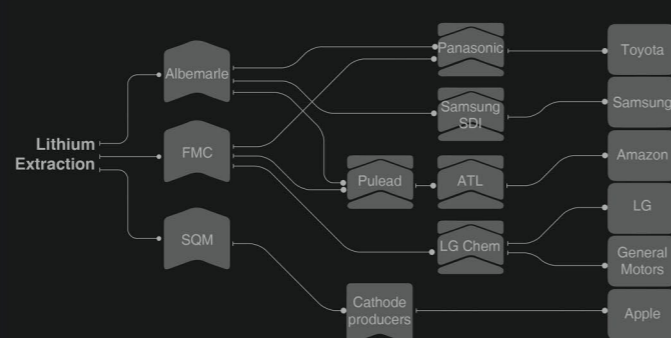
Smartphones and laptops are becoming more important in our daily lives. Technologywire.net

## Underbelly of What Powers Our Devices

The demand of lithium are mainly in the form of batteries for smartphones, electrical vehicles, laptops, and grid-level electricity storage. We investigated the different extraction methods and the potential environmental impact it has around the immediate taskscape. We found that Lithium prices has doubled between 2016 and 2018 due to exponentially increasing demand. Sonora Lithium will soon become the most productive mining site in the world. This global hunger for Lithium is creating a violence around the extraction site.



Global Lithium Reserves

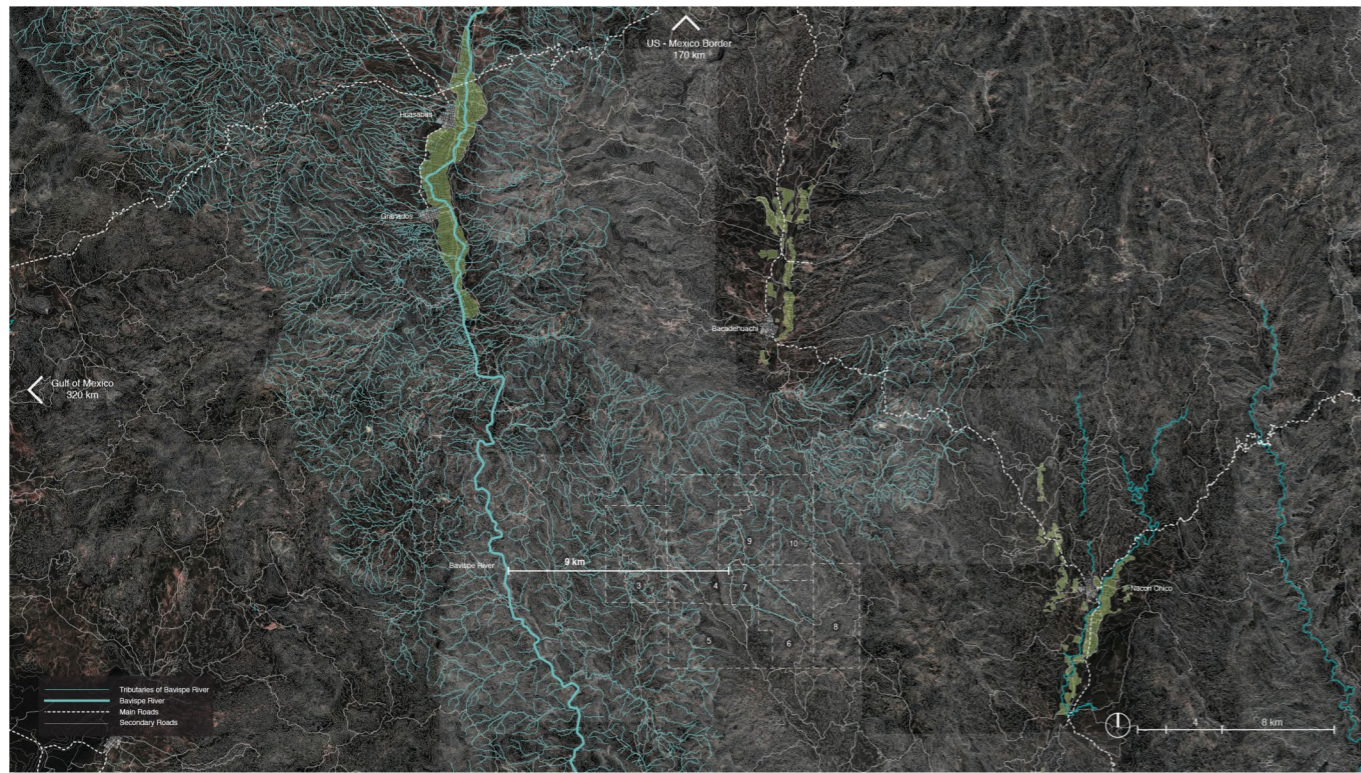


Corporations Involved in Battery Production

### Magnitude of Violence Across US and Mexico Border

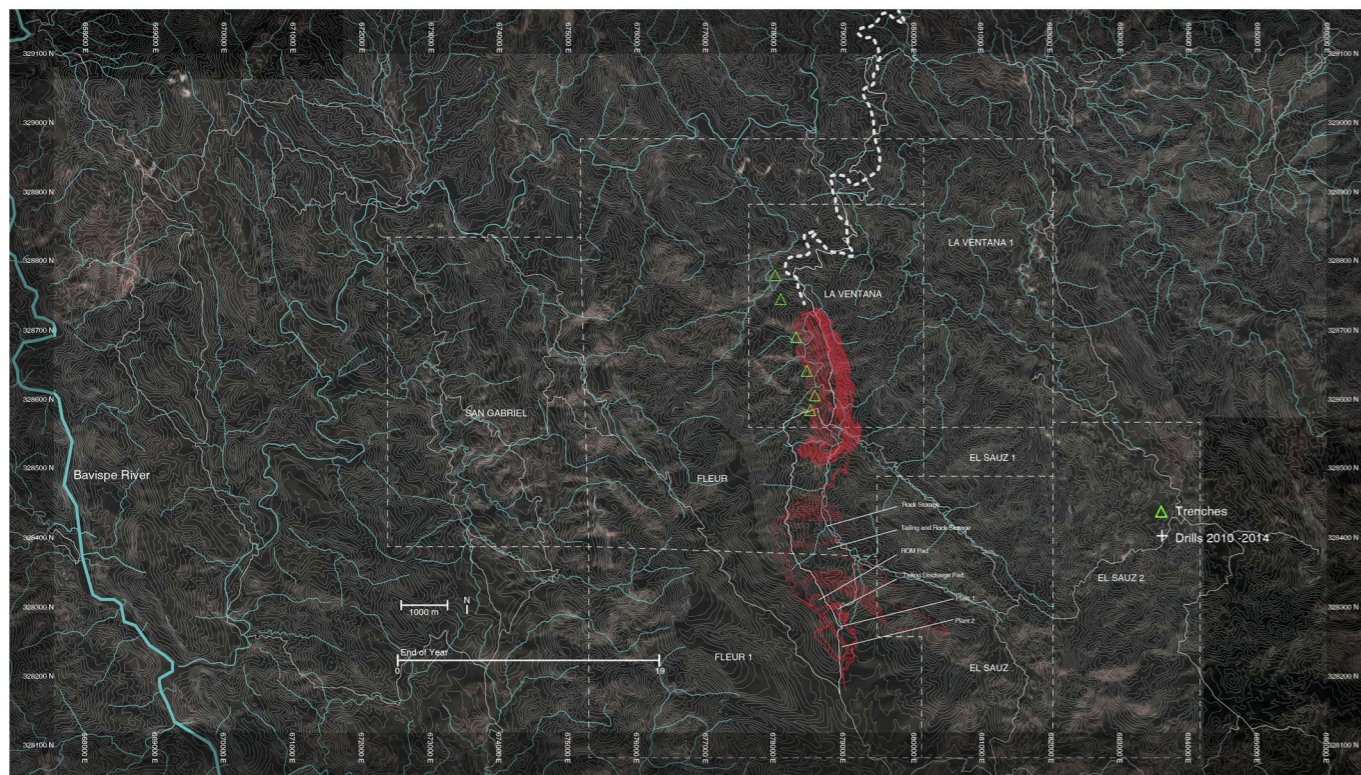
Lying in this complex landscape of that involves politics, economics and societies, Sonora Lithium Project is entangled with many companies, communities, and organizations, not only between Mexico, US, but also by overseas investments.

Therefore It will act as a catalyst eventually; intensifying the existing violence around site, and bringing on more violence slow to the point of invisibility. Impacting the local community and environment, we realize that legal and illegal economies cannot be analyzed separately as they are dependent on each other.



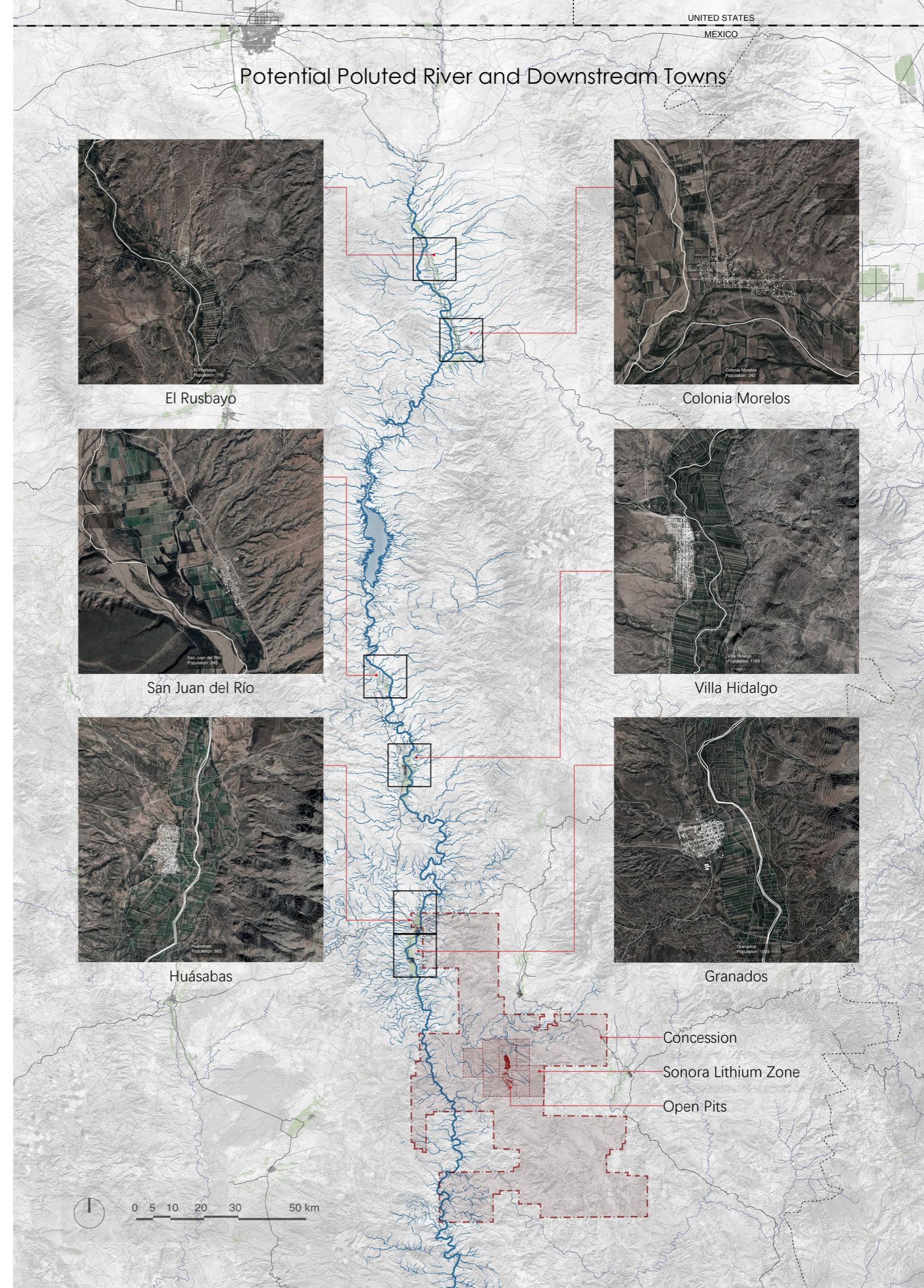
### Sonora Project Concession

Our investigation starts by looking at the immediate environmental and societal impact surrounding the proposed mine site. Sonora Lithium Project is planned to be developed within the boundaries of 4 towns, in an area of 8,000 hectares equivalent to 15,000 soccer fields. Access to the project area from the town of Bacadéhuachi is through an 11km-long secondary, dry-weather road. The first phase of the mining activity is located in the center of the concession, 9km away from the Bavispe river.

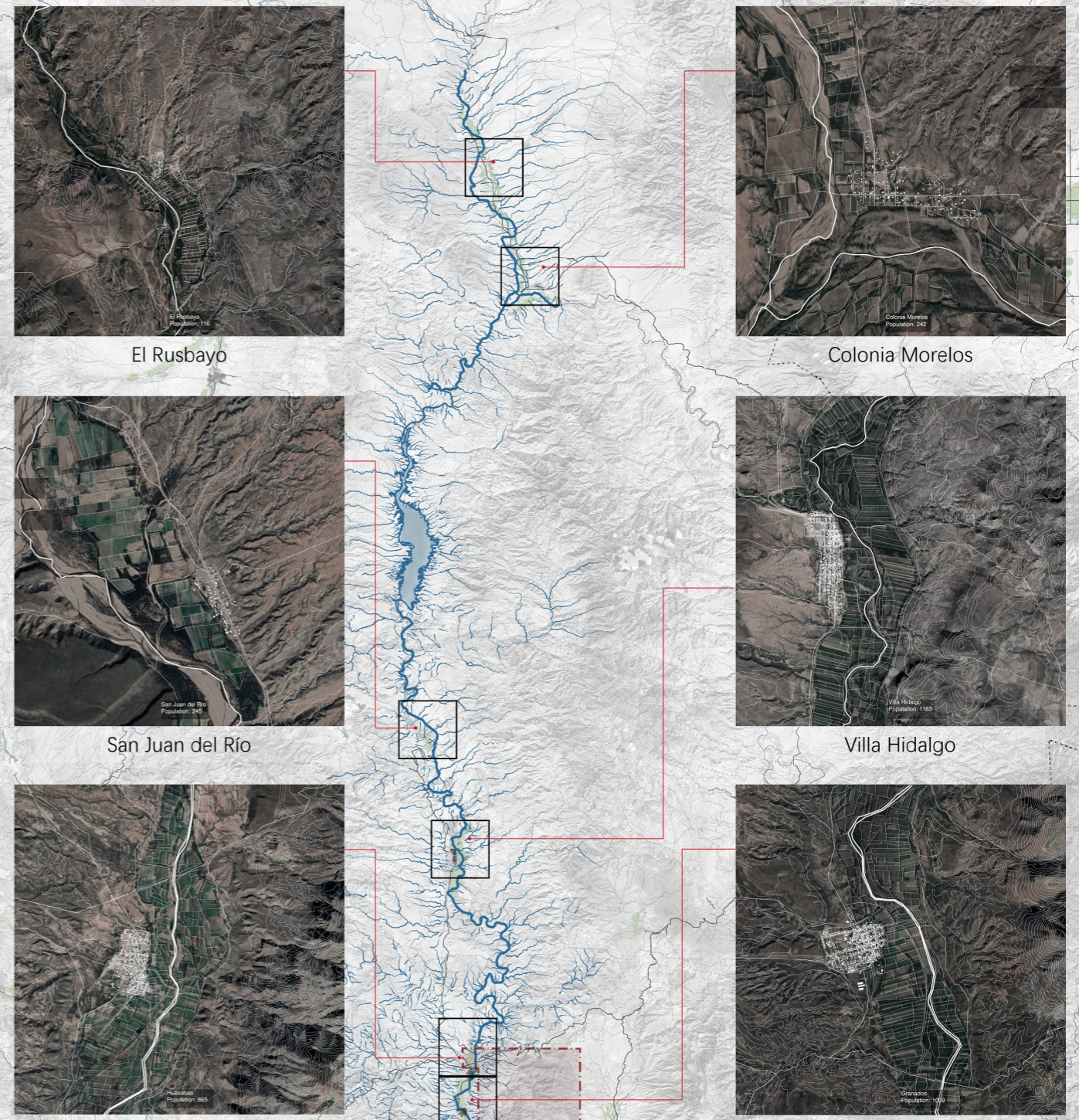


### Future Mine Plan

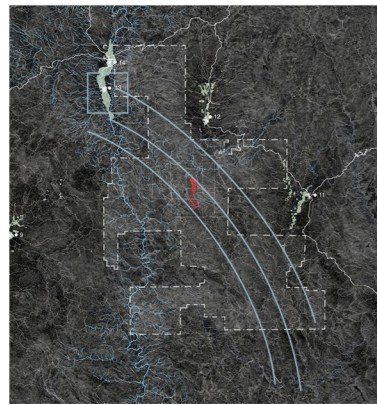
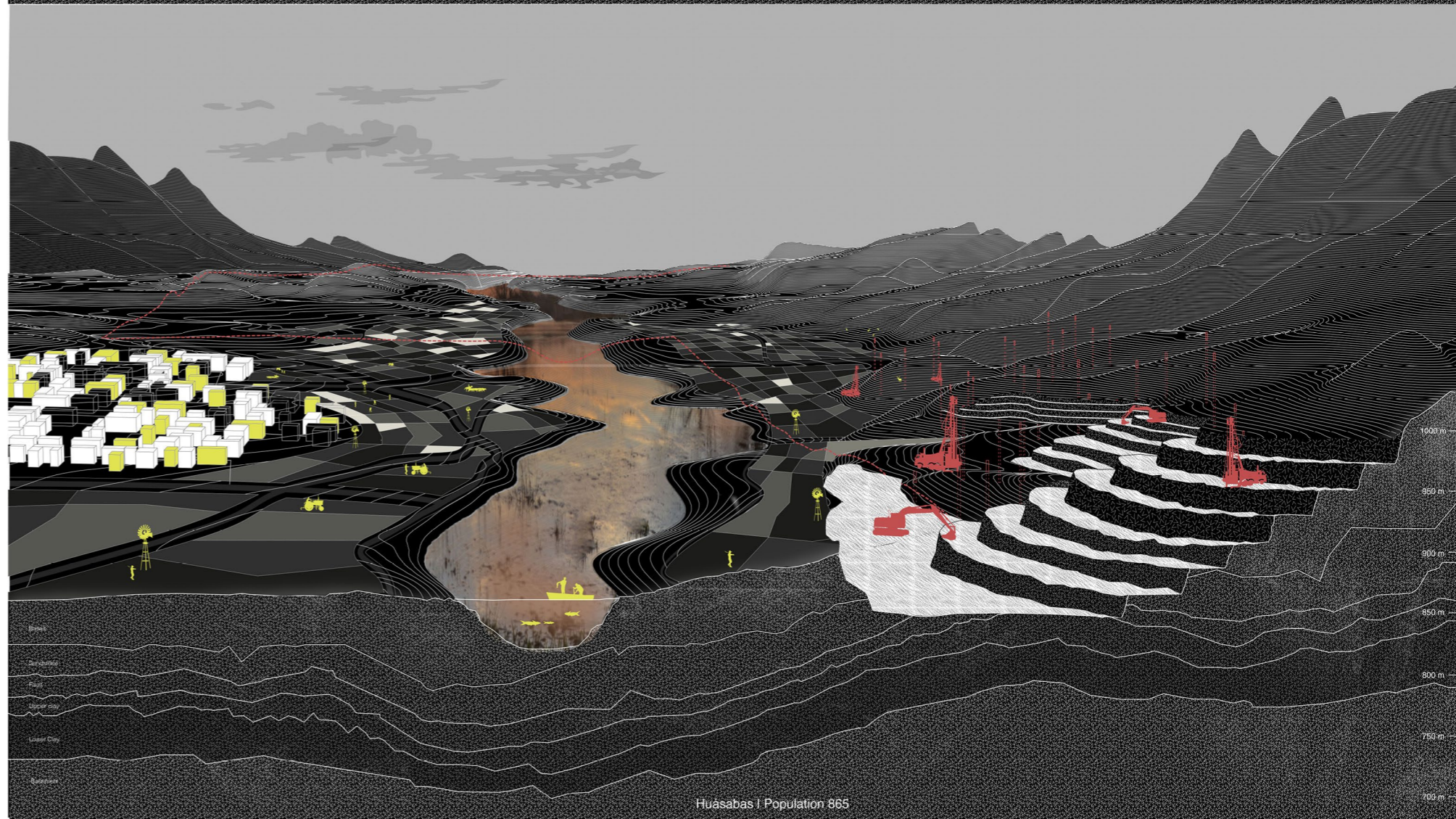
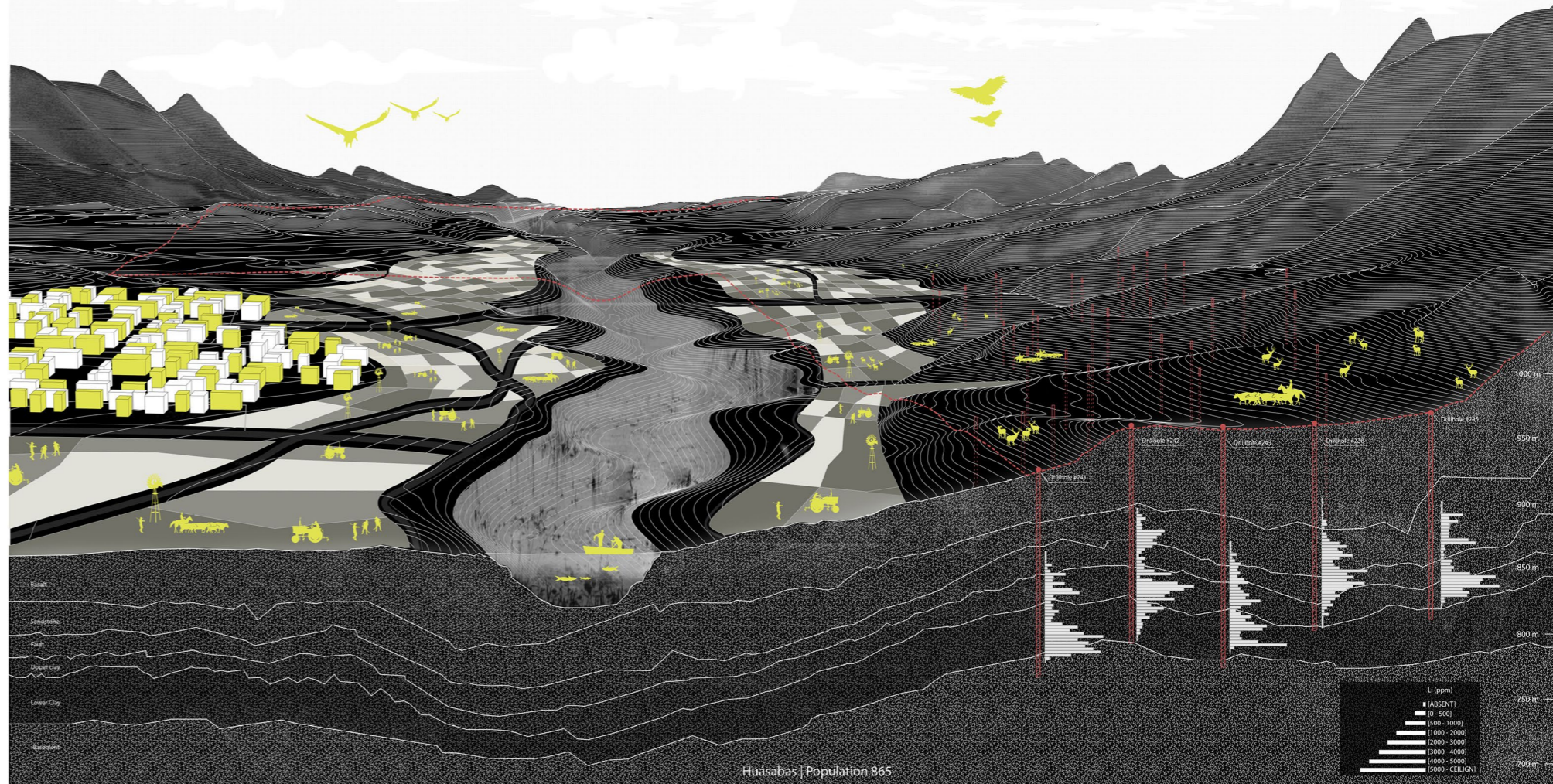
Early site work began in February 2020, the production of battery-grade lithium products is projected to start in 2023. In 2023, this 19-year plan will transform the landscape, excavating soil and transporting them, leaving an open pit the size of 800 soccer fields- a hole in the landscape, while flattening other parts of the earth with tailing and rock storage from the excavation, literally moving mountains. It is an eventual taskscape that we fear will impact the ecosystem and could potentially disrupt the environmental balance surrounding it.



### Potential Polluted River and Downstream Towns



- Concession
- Sonora Lithium Zone
- Open Pits



## What's Next?

According to the Bacanora mineral deposit study, they have determined along with the bands of rich lithium deposits, the town of Huasabas will be intersecting with the concession area. Therefore, we decided to zoom into Huasabas to look at the slow violence that could potentially appear.

## Future Transformation of Huásabas

Before soil stripping, the drilling rigs will come in for 3 to 5 years, silently impacting the geological layers from 100 to 200 meters deep to determine the exact location of the open pit in areas of wild animal habitat. Then the mining infrastructure and equipment will start occupying in close proximity to the tranquil farming town of Huasabas, stripping soil and opening landscapes. From what we have collected, the ecosystem, water system, employment, economics and most importantly, the societal balance of Huasabas would be significantly impacted for an extended period in the future.

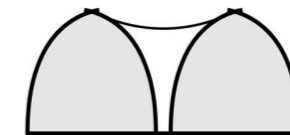
Here we have visually interpreted the violence brought on by the taskscapes to bring attention to these almost invisible slow acts of violence. Unfortunately, the Lithium production lies hidden behind a facade that the developed world comfortably ignores. As designers, we hope by breaking this facade to reveal this violence that all of us are participating in the open and reveal the uncomfortable truth that our technologies are burdens to invisible many.



03

## THE VAULT OF AVERY HALL

Avery Hall Renovation and Extension



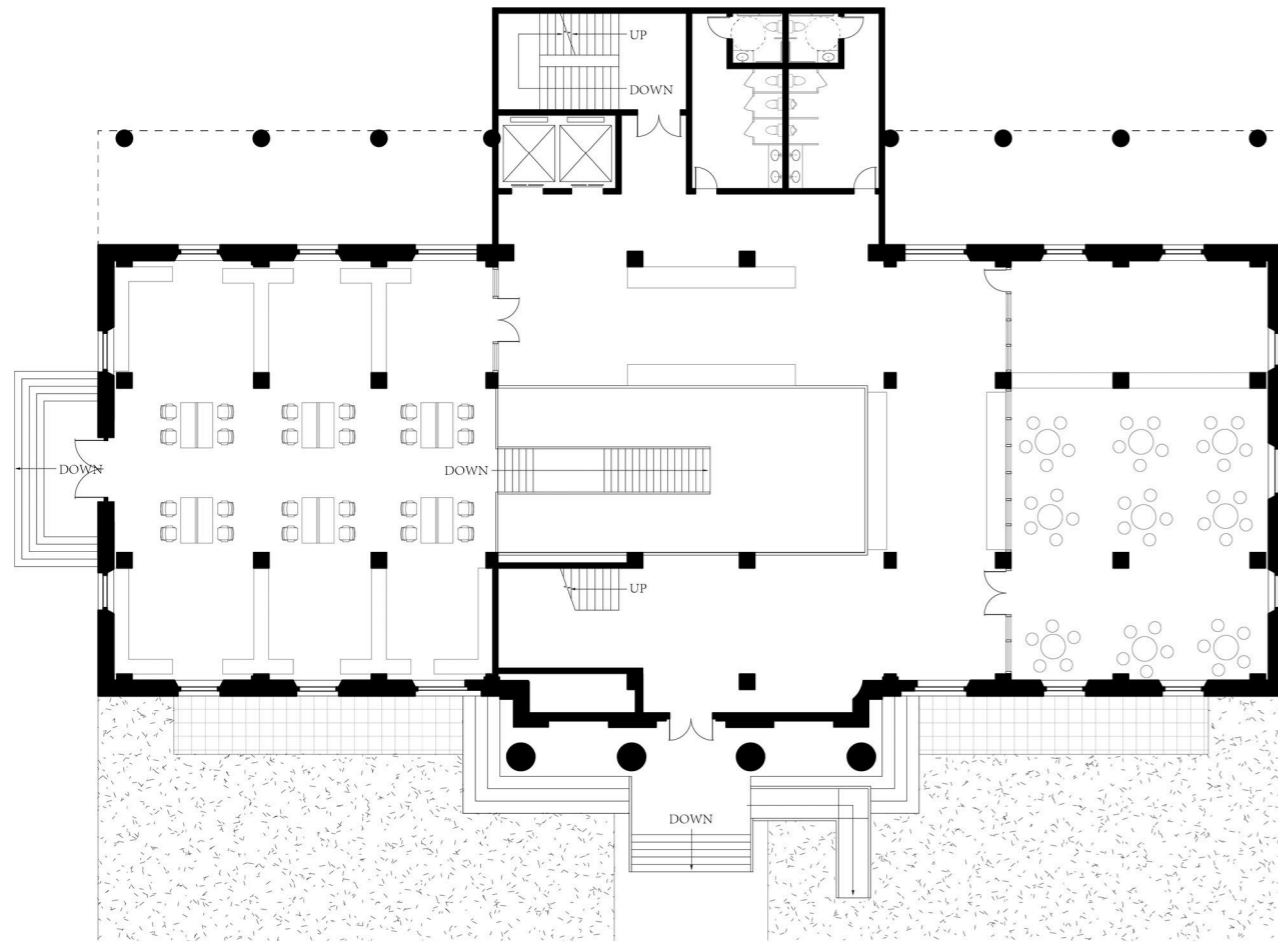
Spring 2022  
GSAPP Advanced Studio  
Instructor: Gordon Kipping  
Individual Work

**Keywords: Bamboo, Vault, Cross Laminated Timber**

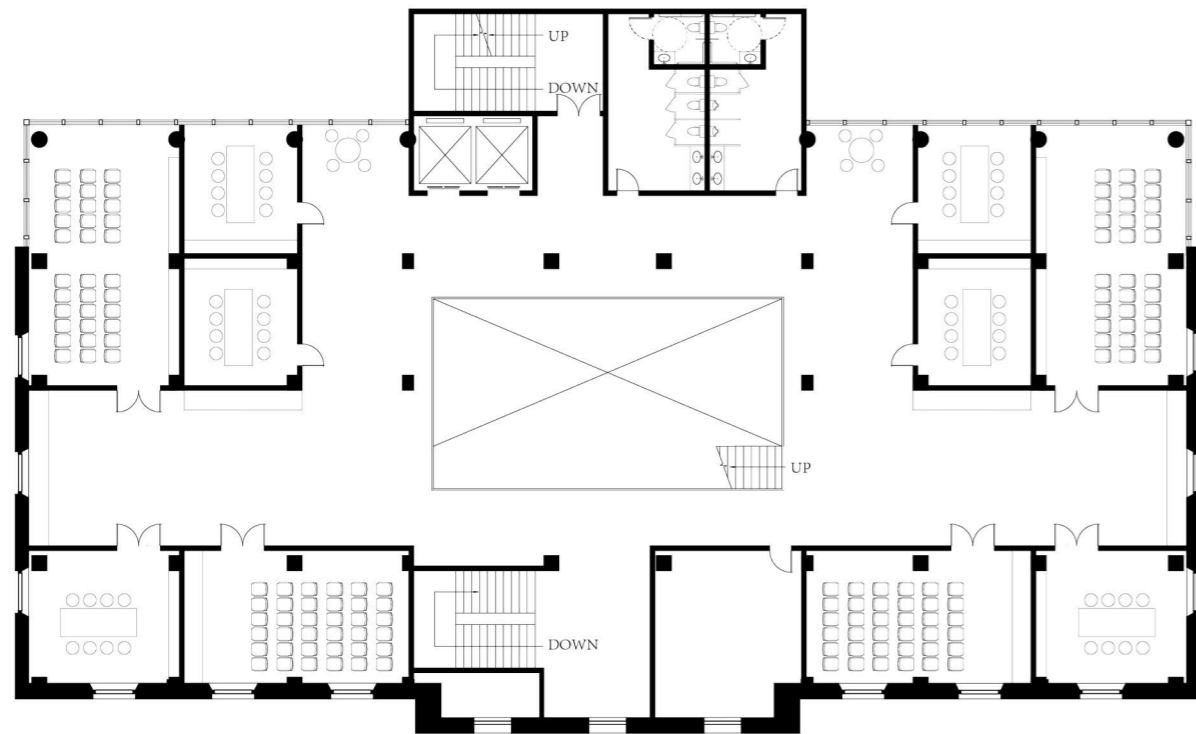
This studio investigates wood and plants as an alternative building material of concrete and steel with an attempt to define more integral architectural solution to a sustainable future. Bamboo grows extremely fast, has high compressive strength and low weight, which provides it with huge potential. Different from timber, Bamboo cannot carry the load along its length direction, but when it is bent, it could carry lateral load, which is similar to the idea of prestressing. The Vault of Avery Hall tries to explore the possibility of hybrid structure and engages bamboo, steel, and timber in the extension part.



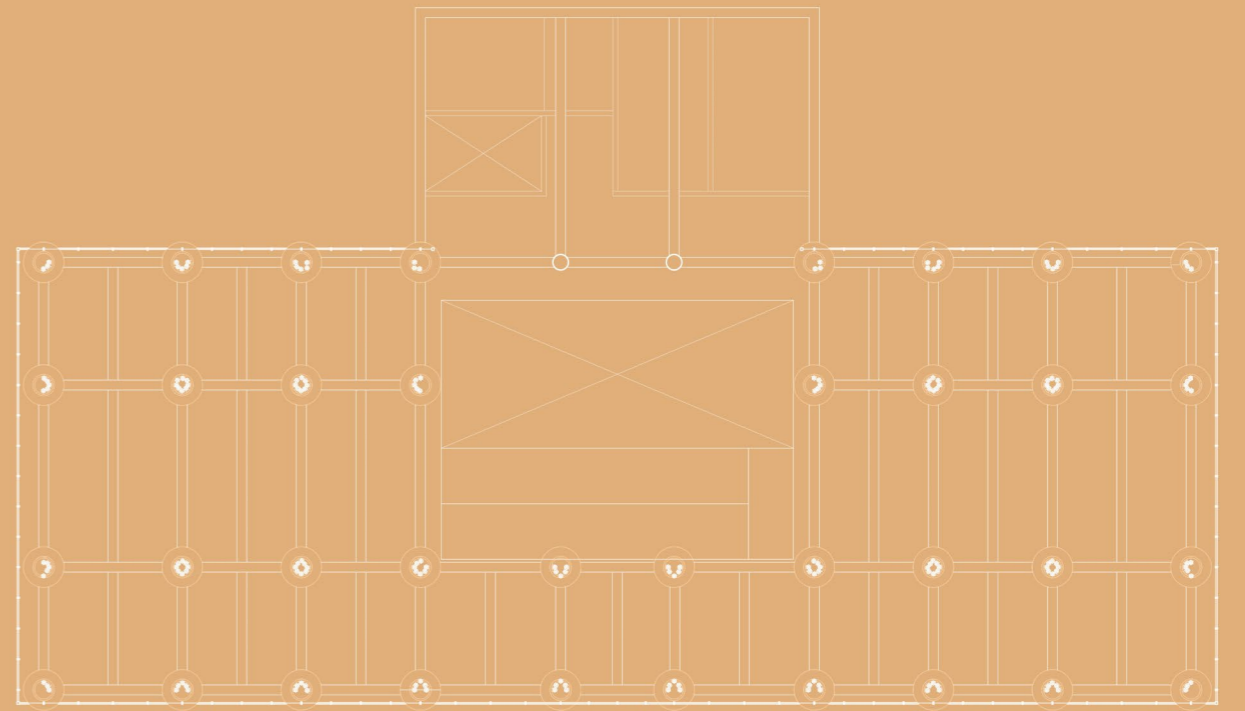
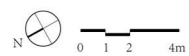




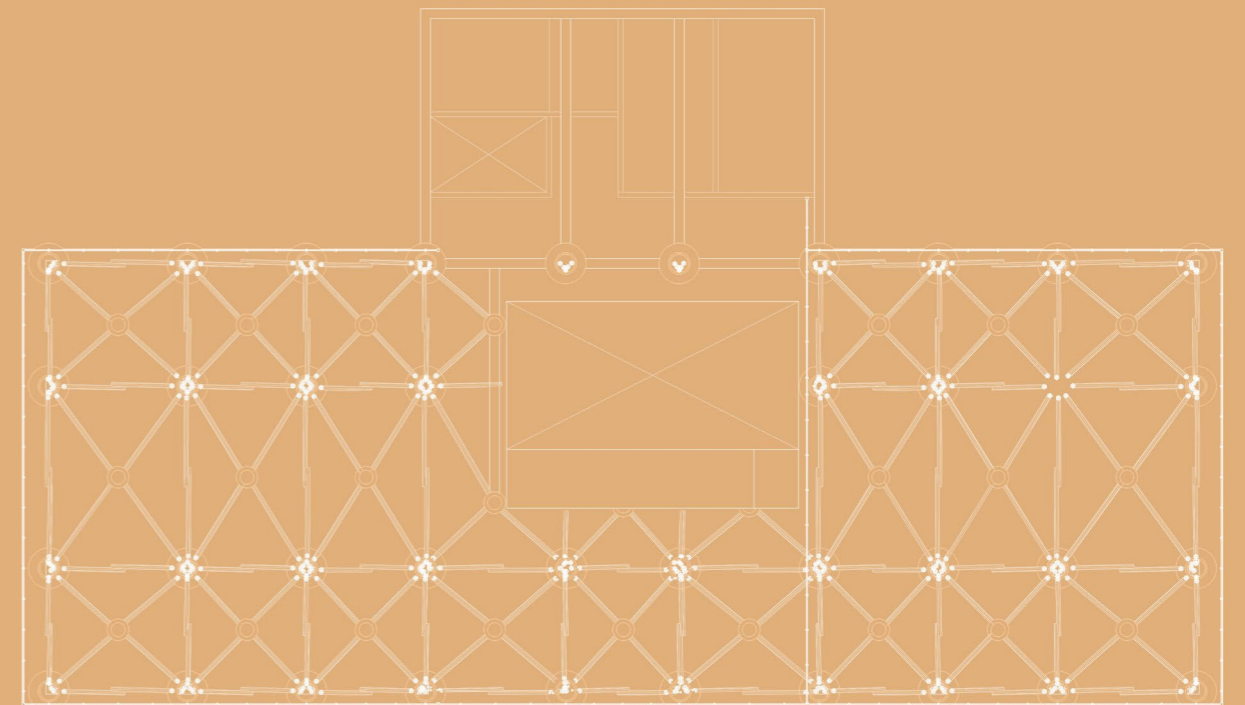
Ground Floor PLAN



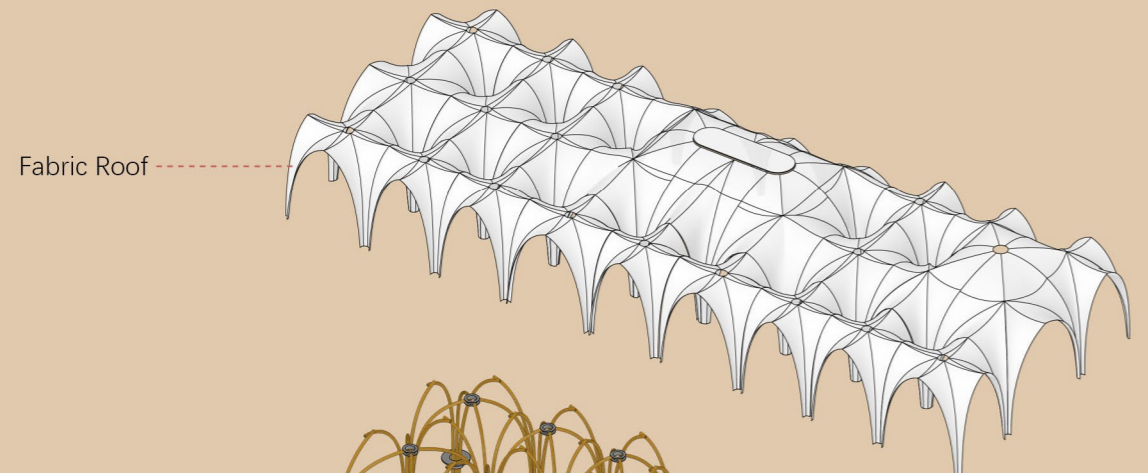
4th Floor PLAN



7th Floor Reflected Ceiling Plan



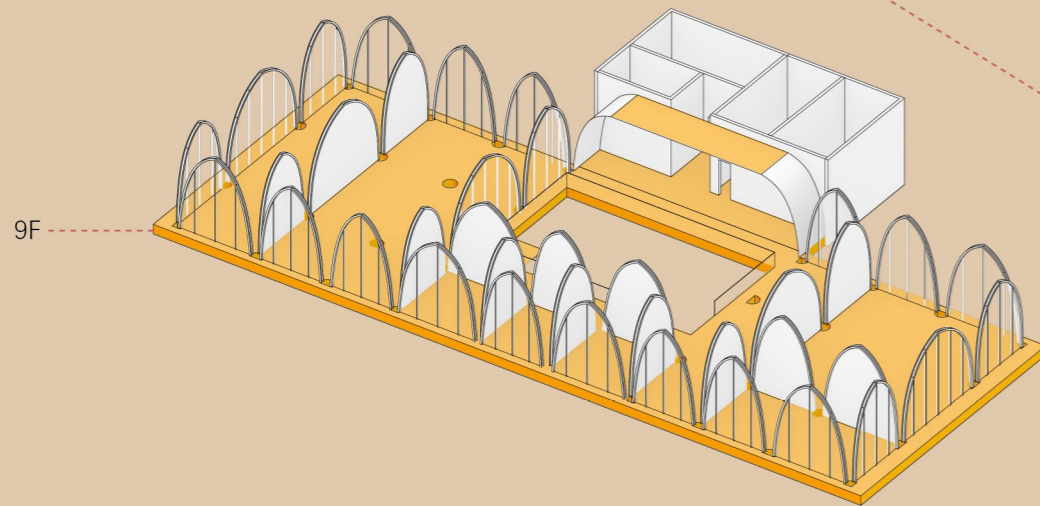
8th Floor Reflected Ceiling Plan



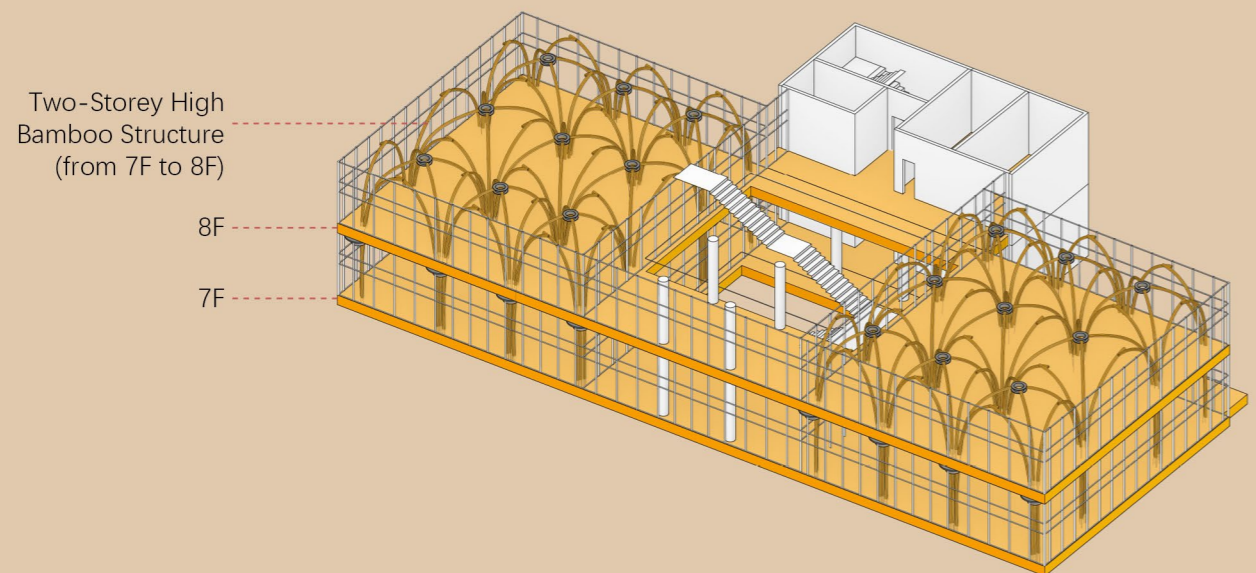
Fabric Roof



Two-Storey High Bamboo Structure (from 8F to 9F)



9F

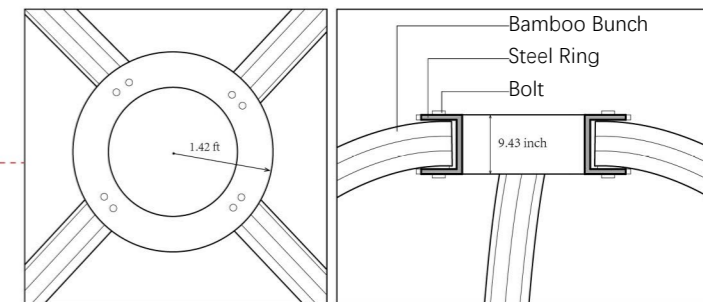
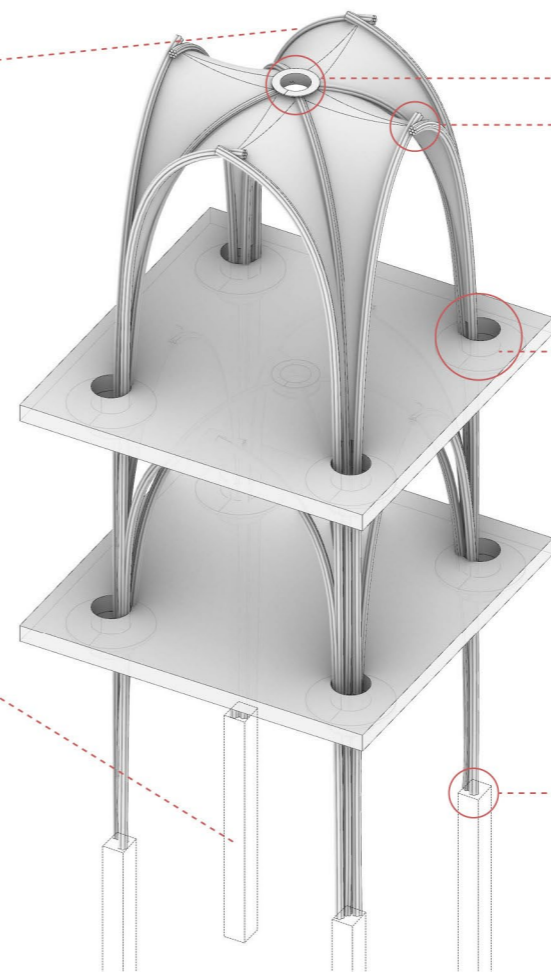


Two-Storey High Bamboo Structure (from 7F to 8F)

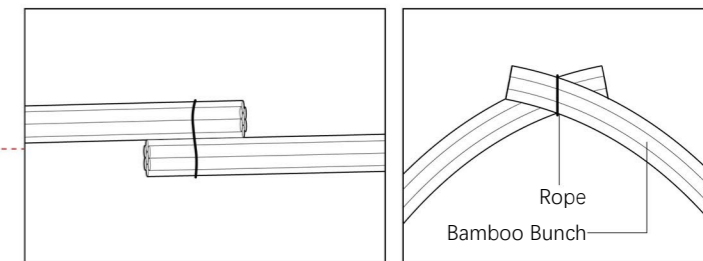
8F

7F

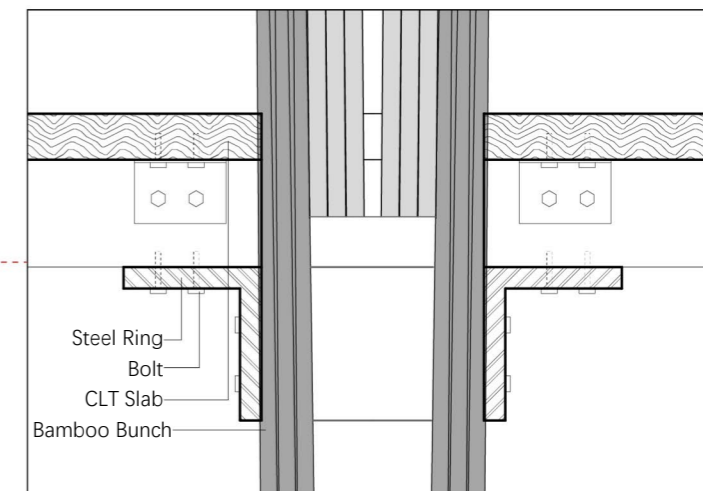
### Structure Unit and Details



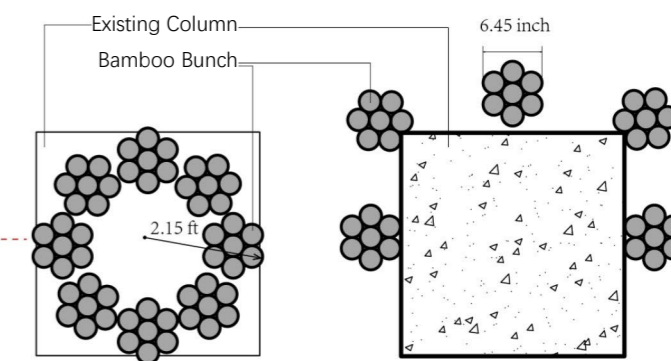
Connection between Bamboo Bunches and the Ring



Connection between Two Bamboo Bunches Using Rope



Connection between Bamboo Column and CLT Floor

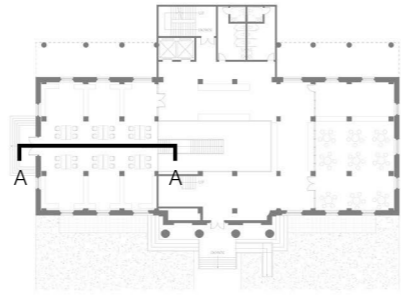
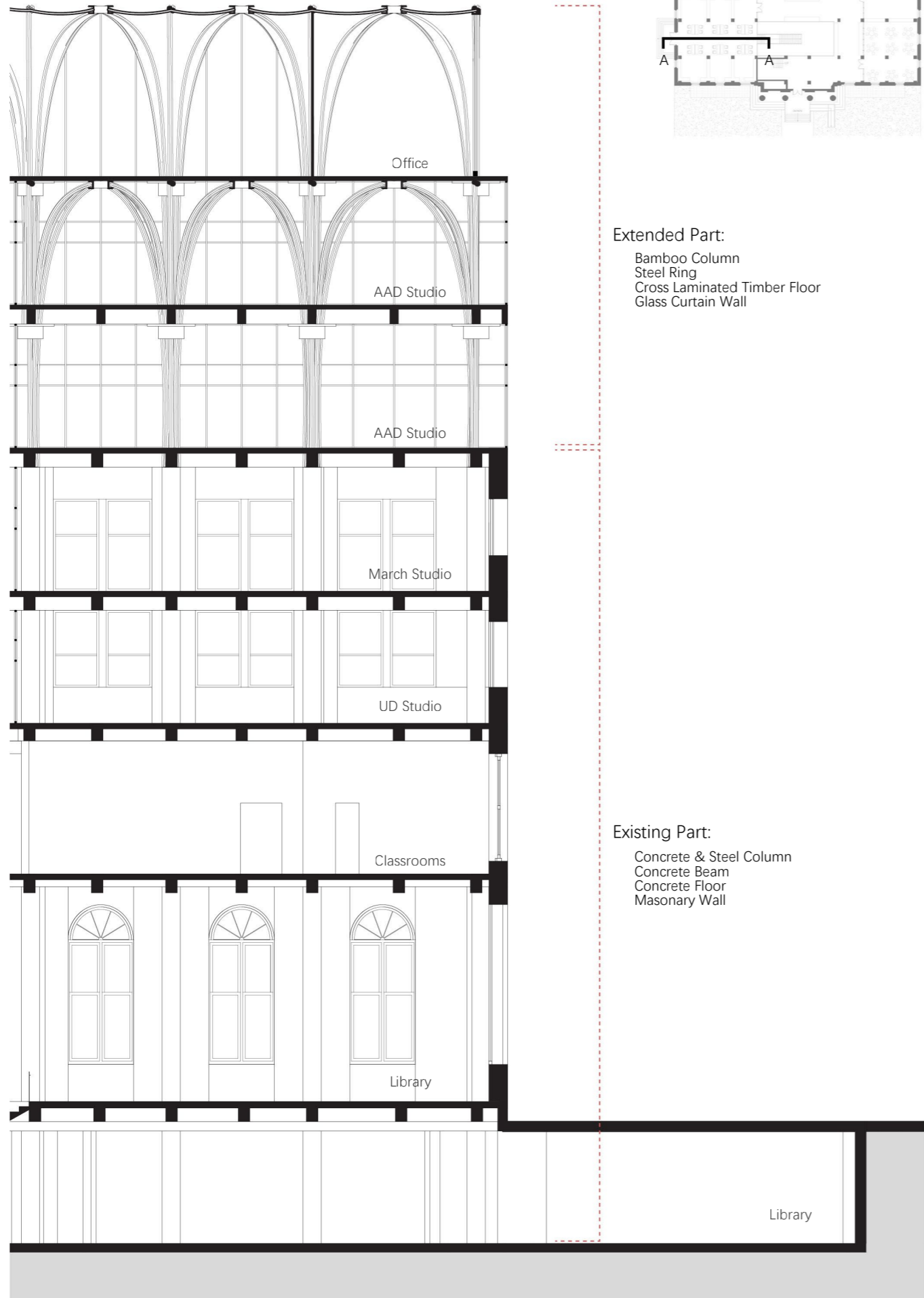


Type 1

Type 2

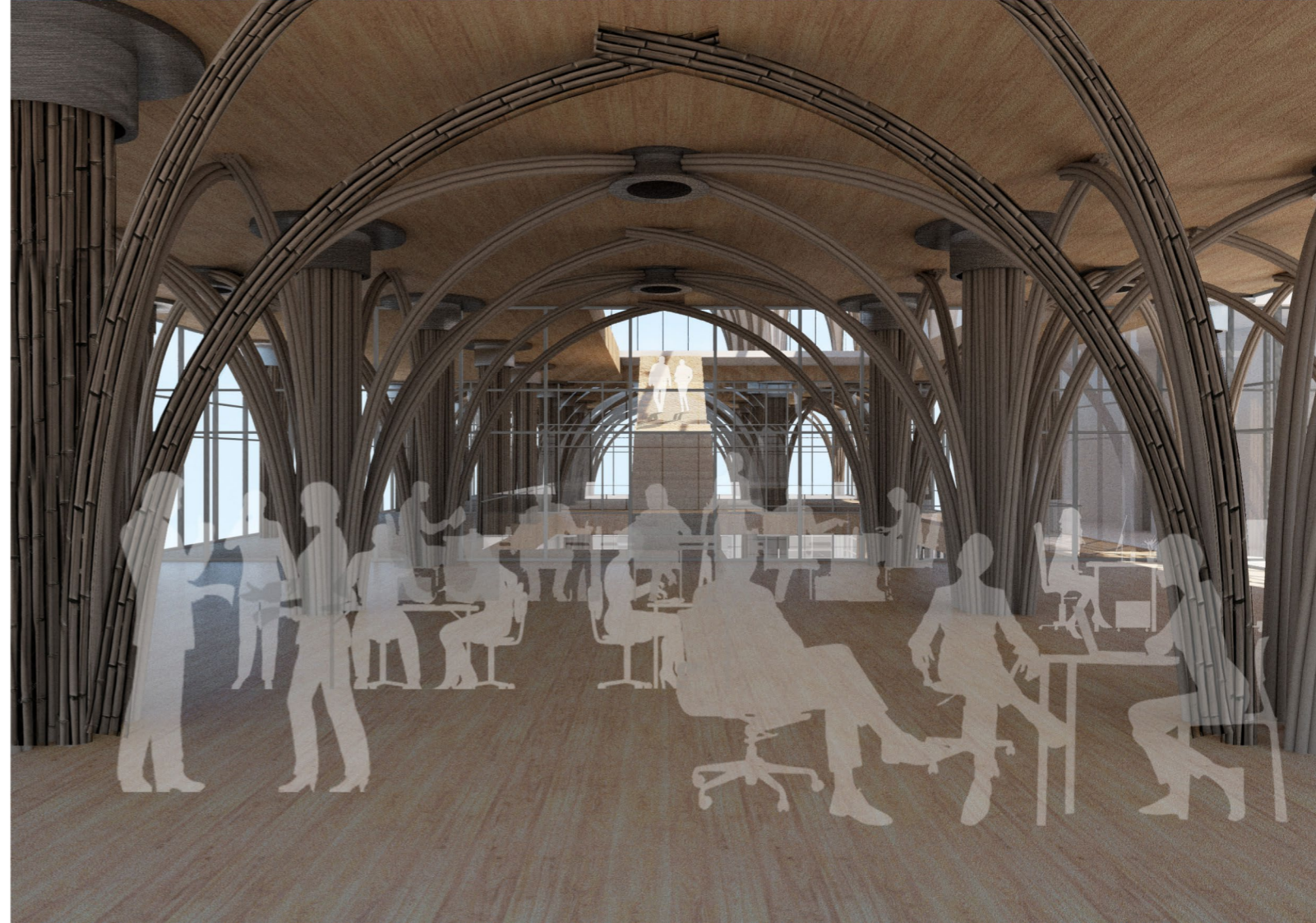
Bamboo Column

The two-storey high bamboo columns grow from the existing concrete column of current Avery Hall. Each bunch of bamboo vault towards different direction to connect with other bunch and layers overlap with higher layers to form a robust structure.



Extended Part:  
 Bamboo Column  
 Steel Ring  
 Cross Laminated Timber Floor  
 Glass Curtain Wall

Existing Part:  
 Concrete & Steel Column  
 Concrete Beam  
 Concrete Floor  
 Masonry Wall





## 04 MISCELLANEOUS COLLECTION

### 4-1 GENERATIVE DESIGN

Solar Mushroom in Central Park

### 4-2 TECHNIQUES OF THE ULTRAREAL

The Underworld

### 4-3 SEMINAR OF SECTION

The Arc at Green School

### 4-4 RETHINK BIM

Reimagine Seagram Building

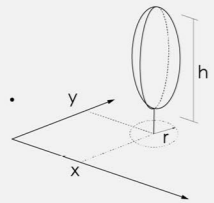
# 4-1 GENERATIVE DESIGN | Solar Mushroom in Central Park

Fall 2021  
GSAPP Building Science & Technology Elective  
Instructor: Danil Nagy

Partner: Risa Mimura, Gloria Zhu, Bingyu Xia, Yining Lai  
Participation: Concept Development, Grasshopper & Python Script, Diagram Drawing

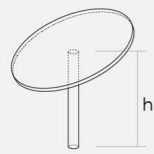
## Environmental Factors

Sunlight data of New York City

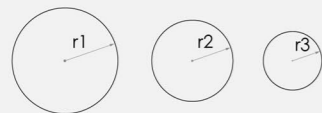


The height, size and location of trees

## Manual Inputs

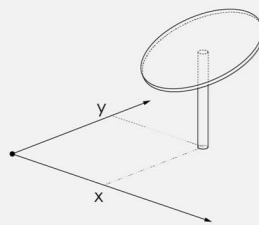


Height of solar panels



Radius of 3 types of solar panels

## GH Parameters

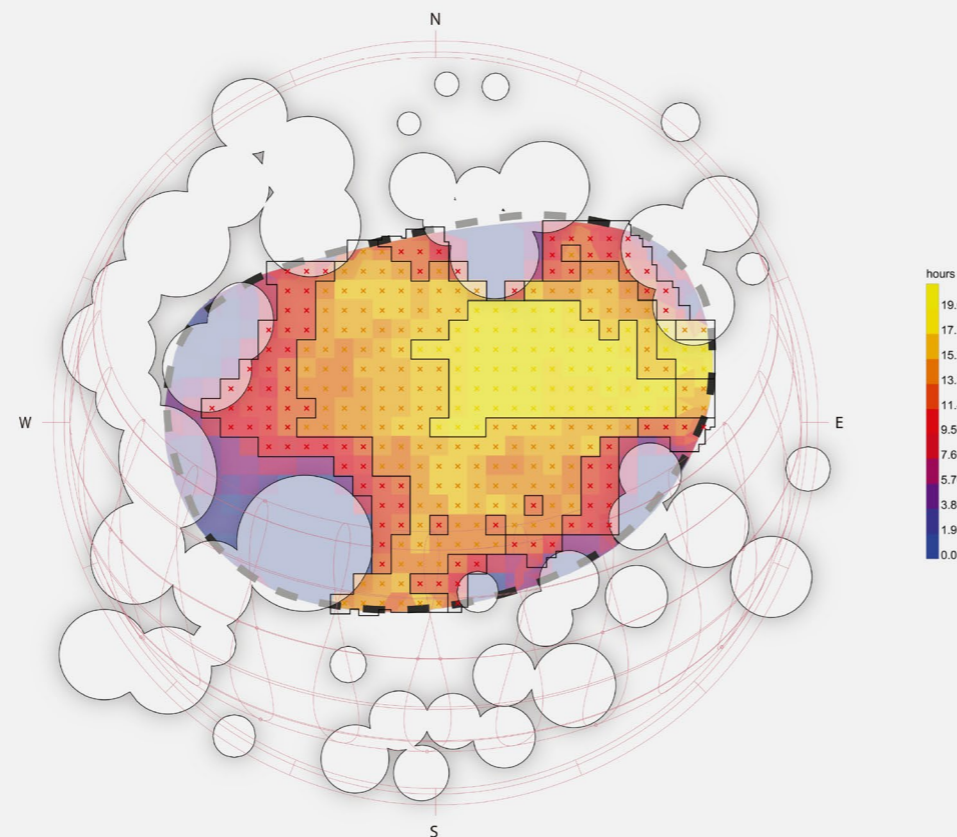


Coordinates of center of solar panels

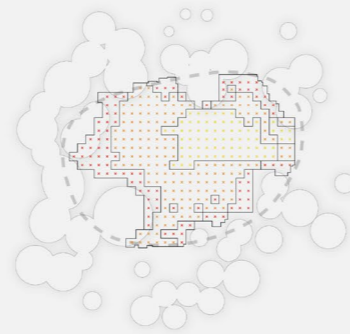


Rotation angle of each solar panel

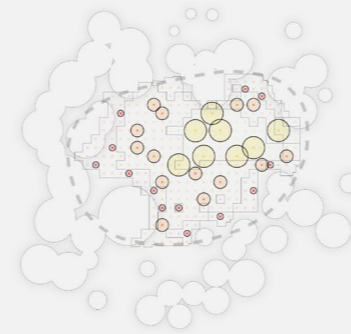
## 1. Sunlight analysis of site



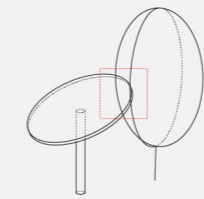
## 2. Area Division



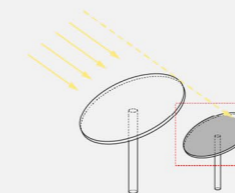
## 3. Place 3 types of panels



## 4. Set Objective & Constraints



No intersection with trees

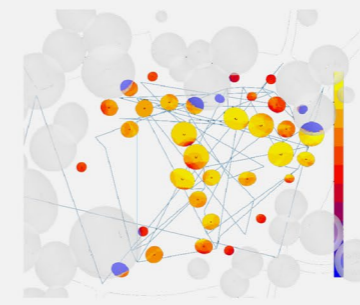


No overlapping with other panels

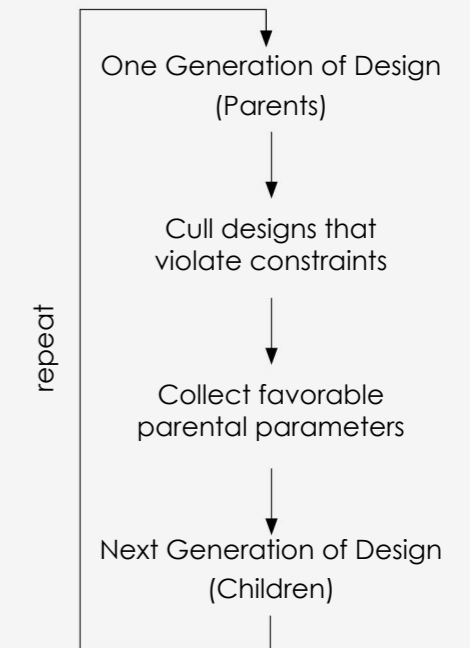


Maximum of Sunlight Hours

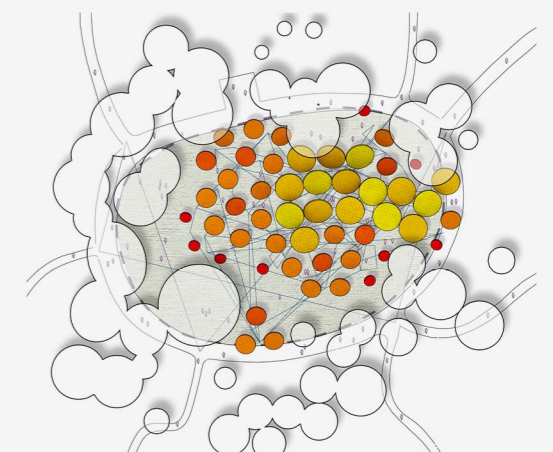
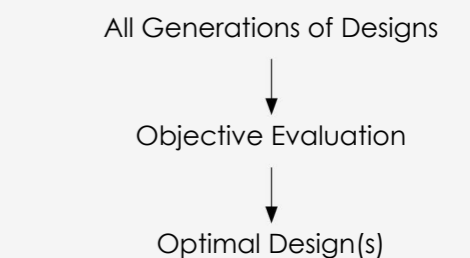
## 5. Sunlight Analysis of Solar Panels

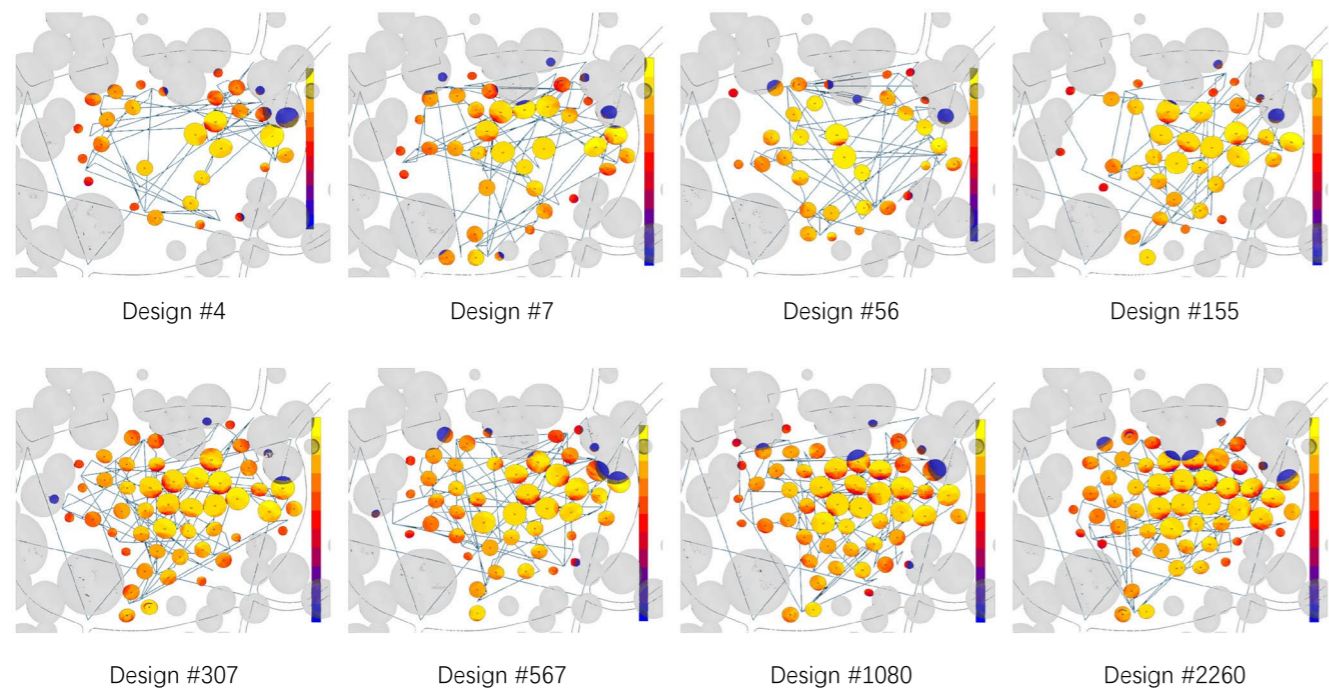


## 6. Iteration

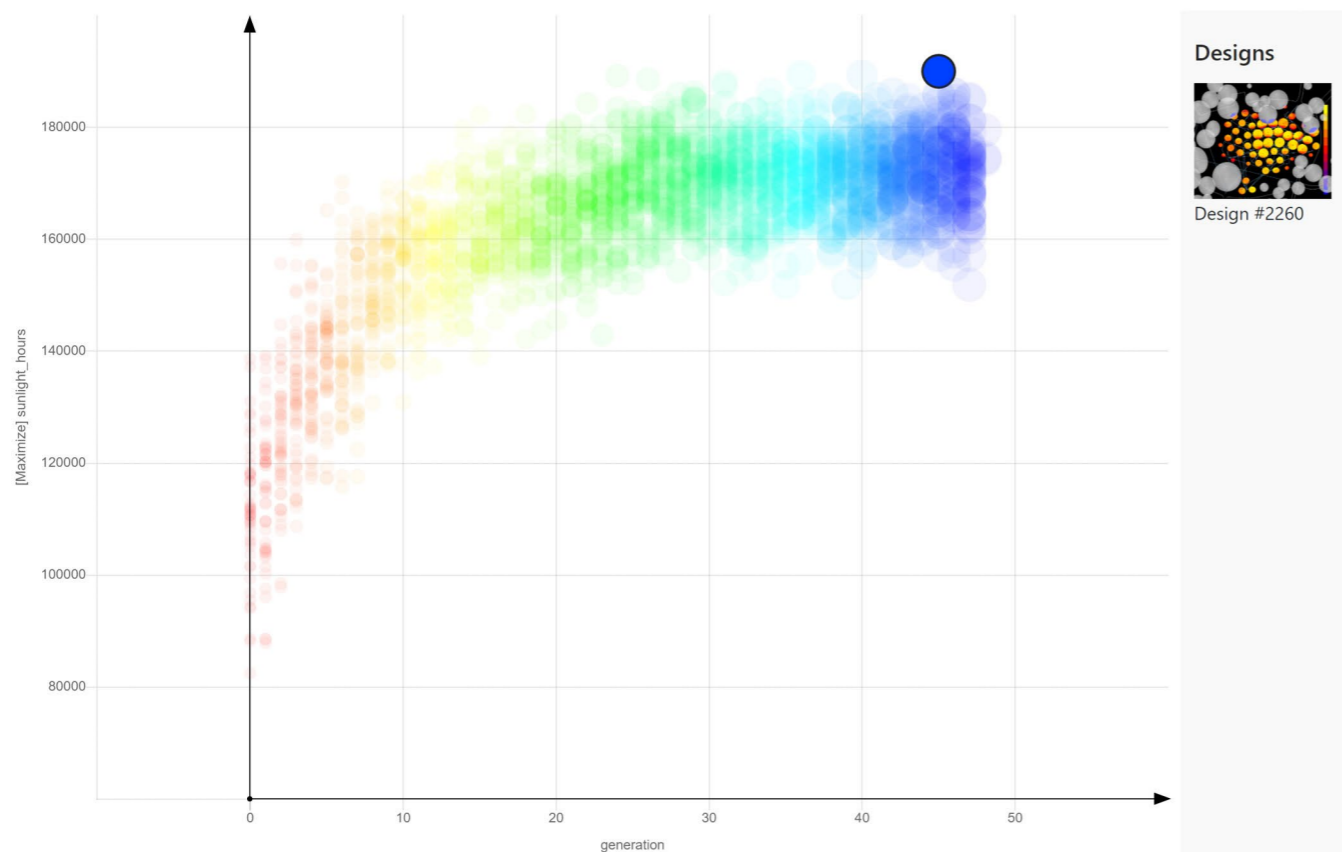
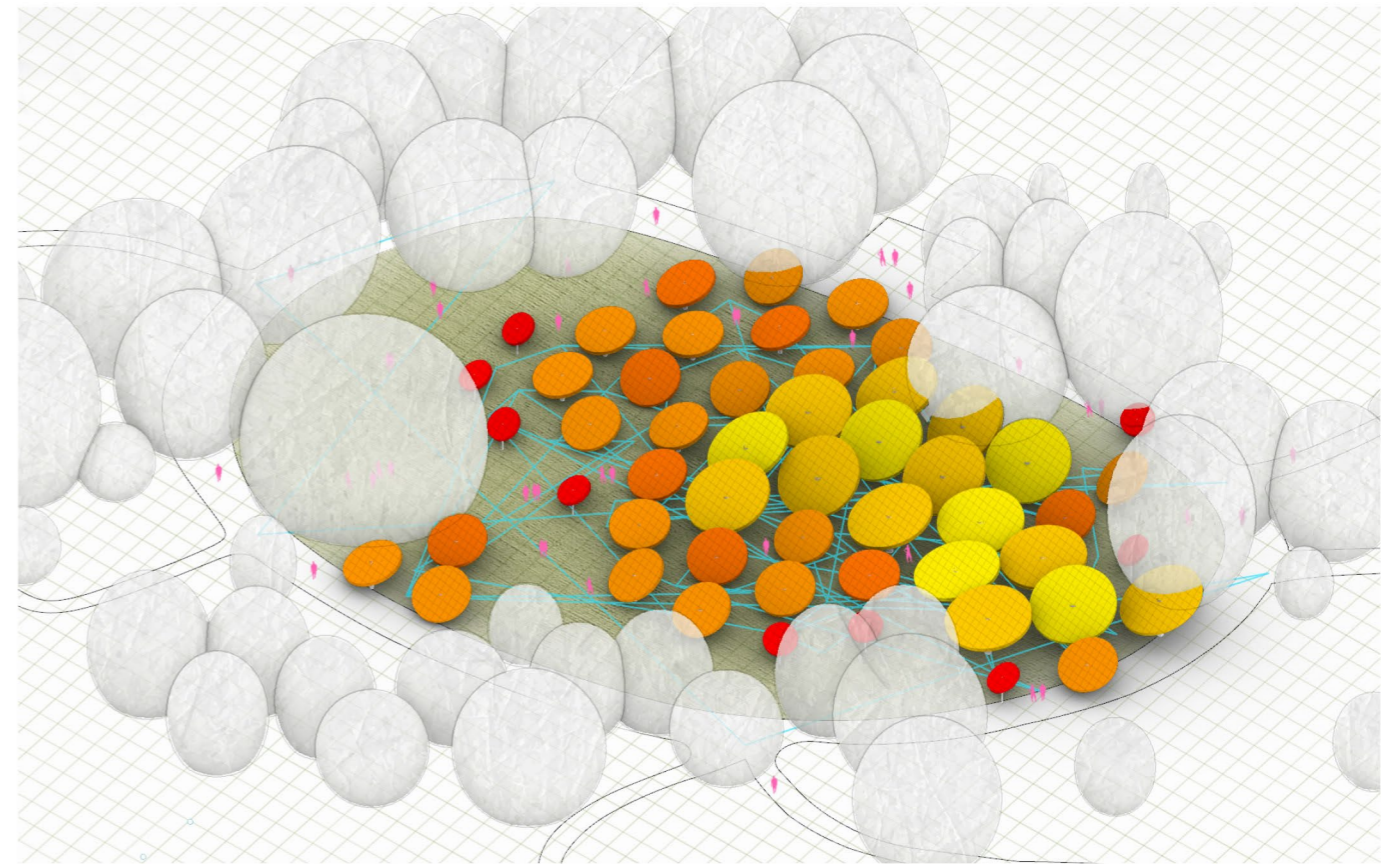


## 7. Optimal Design Generation





Selected Examples of Iteration



Visualization of Iteration & Evaluation



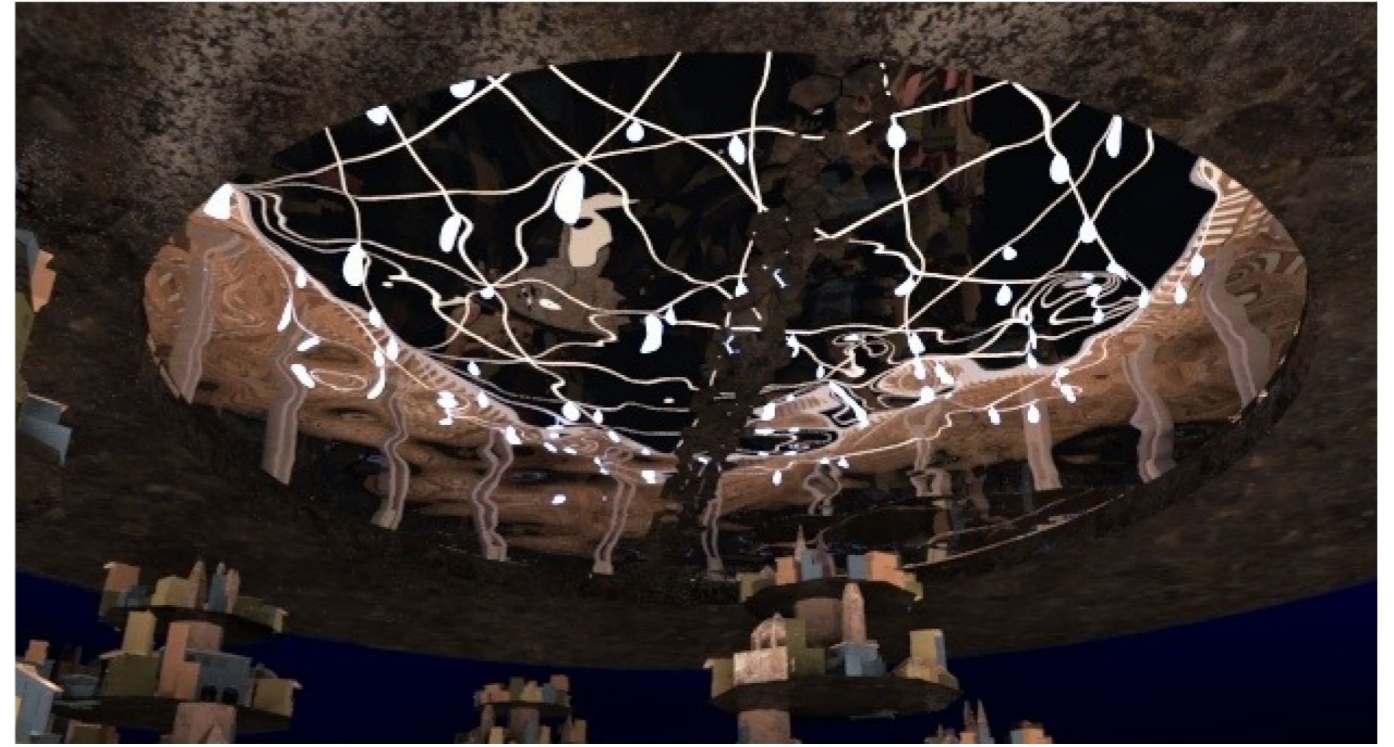
Optimal Design #2260

## 4-2 TECHNIQUES OF THE ULTRAREAL | The Underworld

Fall 2021  
GSAPP Visual Studies  
Instructor: Joseph Brennan, Phillip Crupi  
Partner: Risa Mimura  
Participation: Concept Development, 3D Modeling, Rendering



The Present World

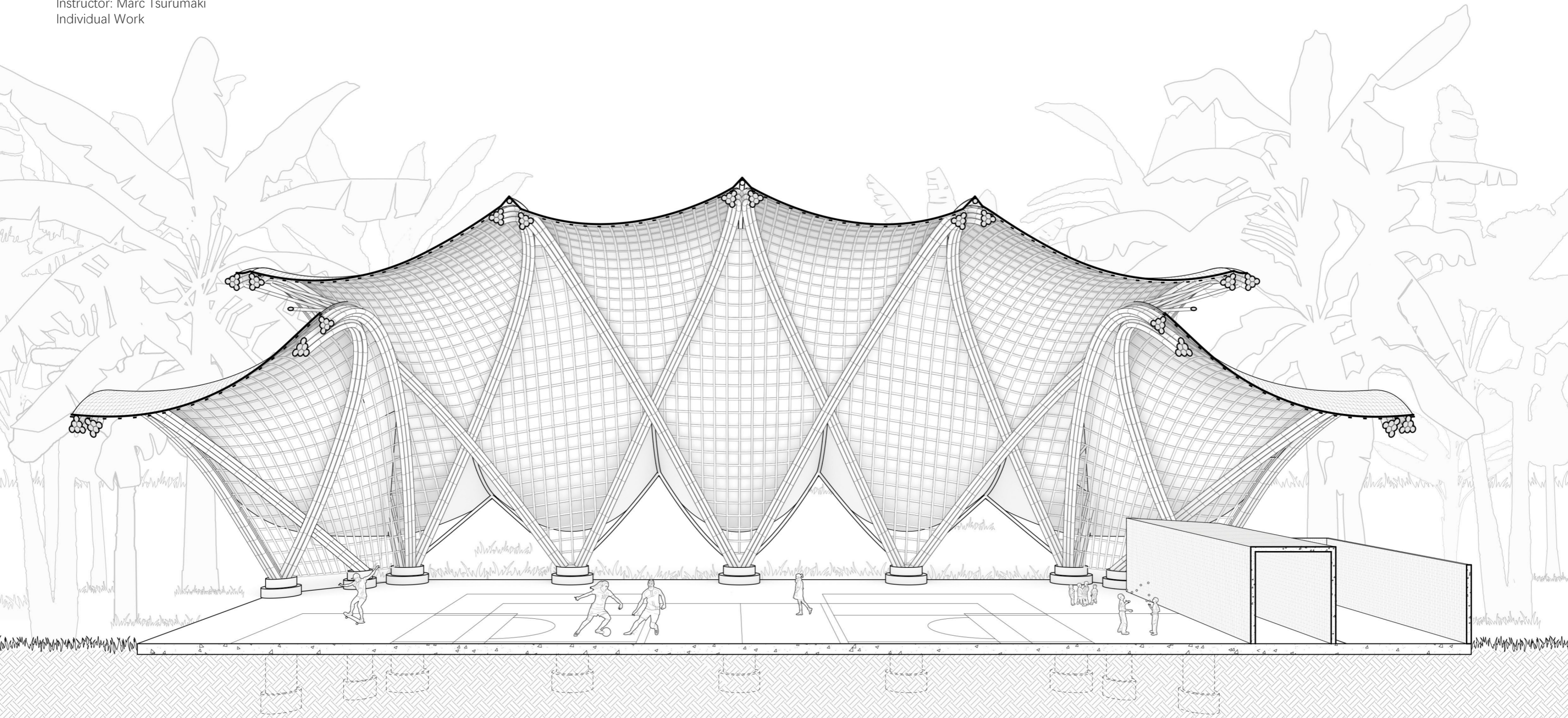


The Underworld



## 4-3 SEMINAR OF SECTION | The Arc at Green School

Spring 2022  
GSAPP Visual Studies  
Instructor: Marc Tsurumaki  
Individual Work

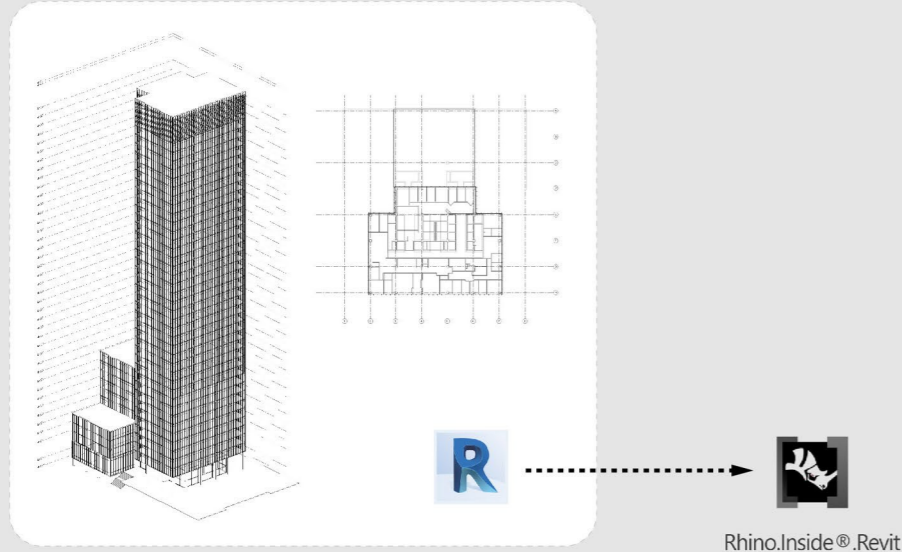


Lying in Indonesia, the arc at Green School is a bamboo architecture with unprecedented lightweight structure, designed by IBUKU. The unique structure features bamboo arches that support an organically shaped canopy. The 14-meter-tall bamboo arches, spanning 19 meters, are interconnected by anticlastic grid-shells which derive their strength from curving in two opposite directions to form a robust tensioned structure.

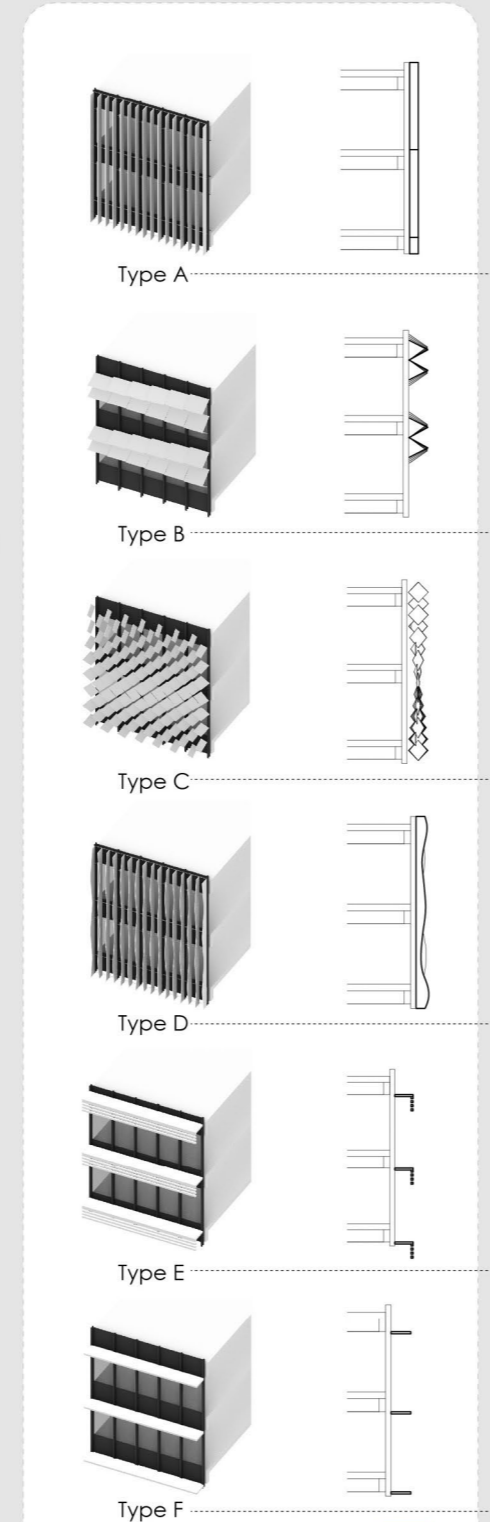
# 4-4 RETHINK BIM | Reimagine Seagram Building

Spring 2021  
 GSAPP Building Science & Technology Elective  
 Instructor: Joseph Brennan  
 Partner: Enfeng Xie, Yani Gao  
 Participation: Concept Development, Grasshopper Script, Revit Modeling, Diagram Drawing

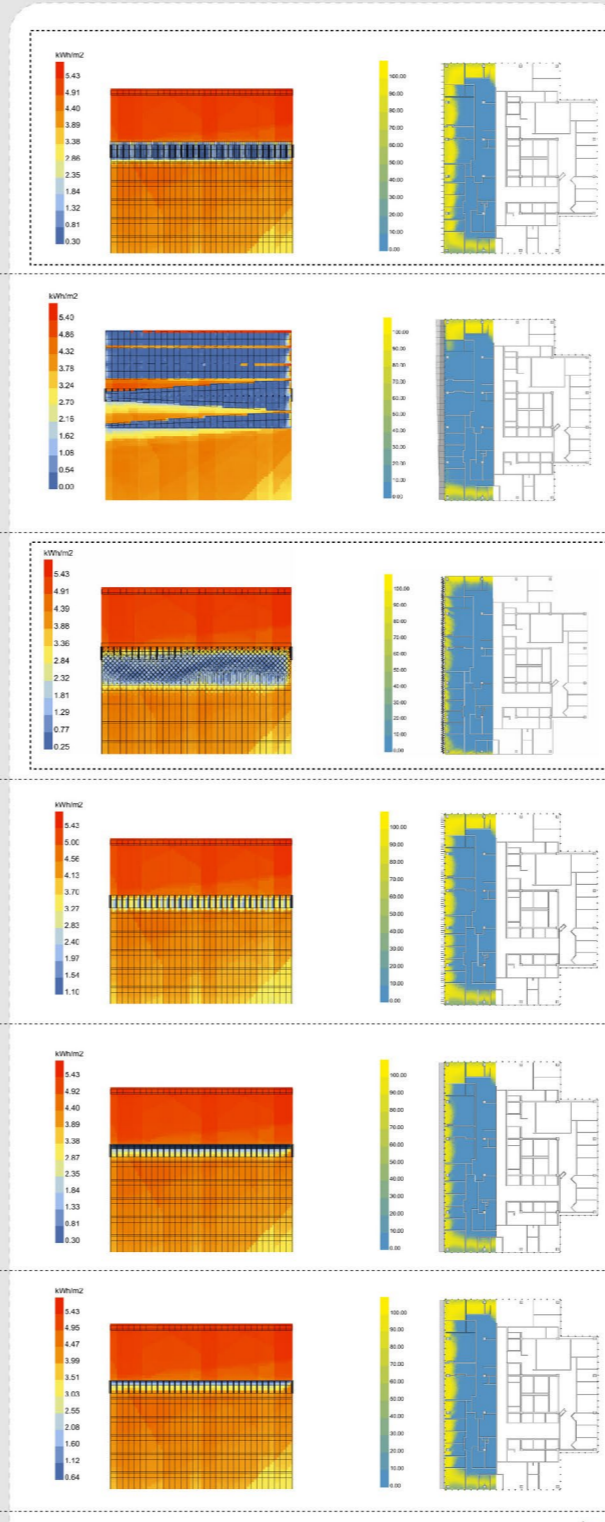
## 1. 3D Modeling



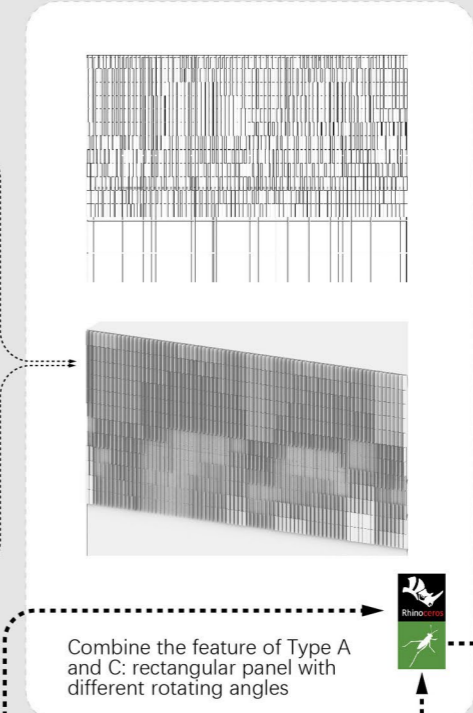
## 3. Examine Renovation Design Possibilities of West Facade



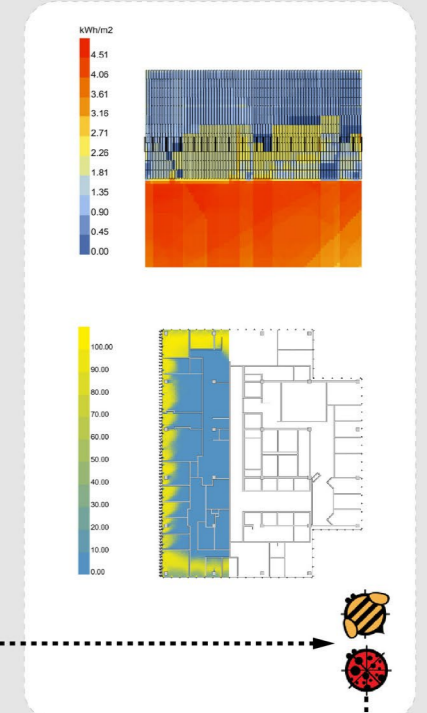
## 4. Batch Testing for Each Strategies Select the Best One



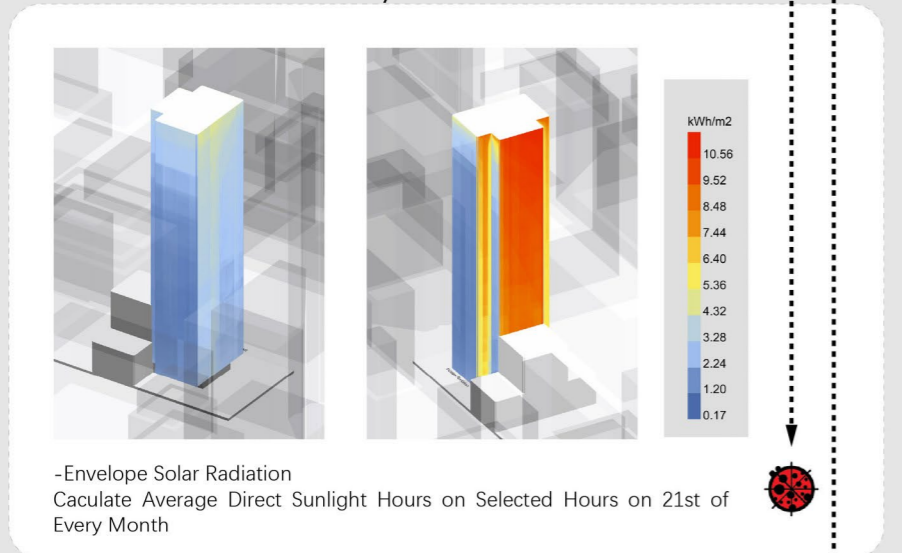
## 5. Hybrid Selected Strategies Produce Design Iterations



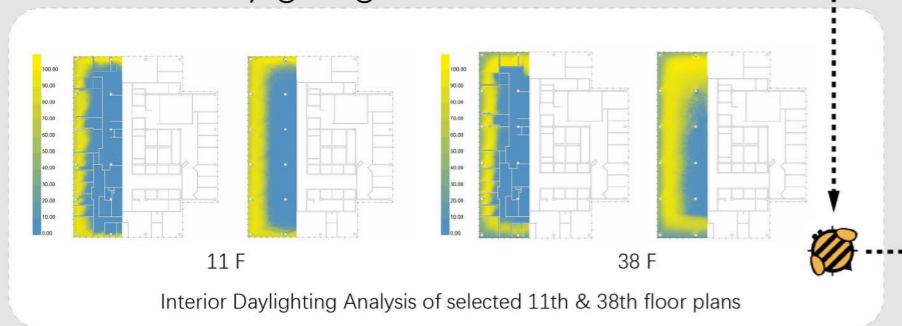
## 6. Evaluate & Improve Overall Performance



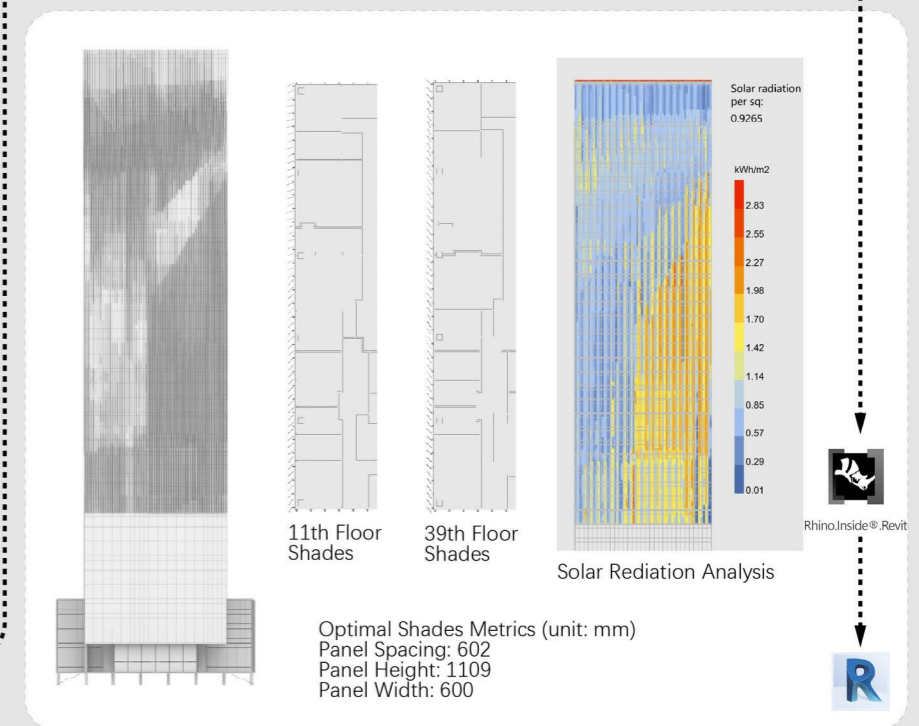
## 2.1 Benchmarking Facade Solar Analysis



## 2.2 Benchmarking Interior Daylighting Level



## 8. Optimal Design Generated



Combine the feature of Type A and C: rectangular panel with different rotating angles

7. Loop Optimization

Explore different shades: Horizontal/ Vertical / Rotating/ Wavy

Solar Radiation Simulation

Interior Daylighting Simulation

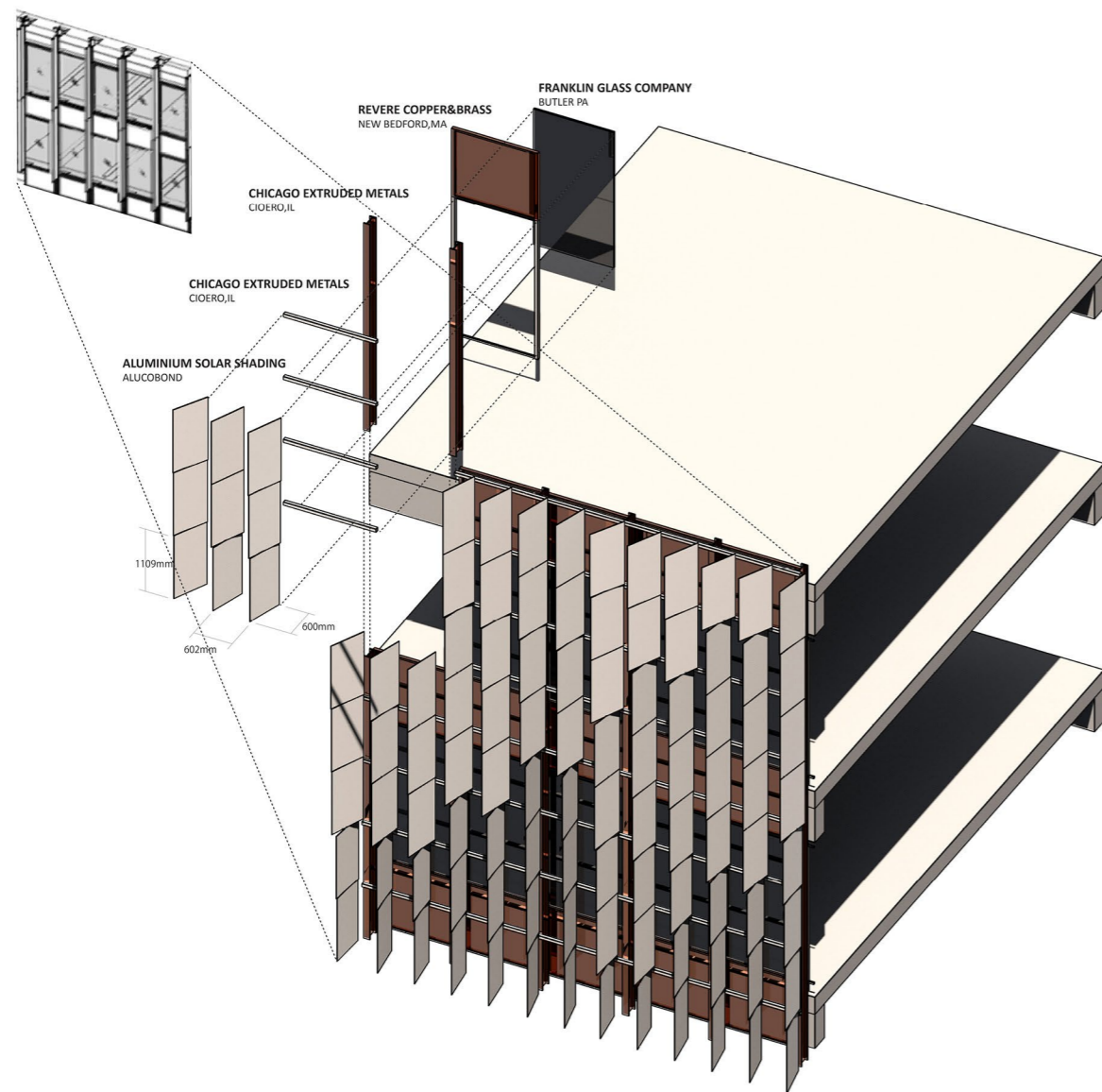


## Introduction

Seagram building is a 515 feet (157m) tall skyscraper at 375 Park Ave., designed by Mies van der Rohe and Philippe Johnson. Mies used non-structural bronze-toned I-beams to suggest structure instead. These are visible from the outside of the building, and run vertically, like mullions, surrounding the large glass windows. This method of construction using an interior reinforced concrete shell to support a larger non-structural edifice has since become commonplace.

As designed, the building used 1,500 tons of bronze in its construction. On completion, the construction costs of Seagram made it the world's most expensive skyscraper at the time, due to the use of expensive, high-quality materials and lavish interior decoration including bronze, travertine, and marble. The interior was designed to assure cohesion with the external features, repeated in the glass and bronze furnishings and decorative scheme.

Another interesting feature of the Seagram Building is the window blinds. One aspect of a façade which Mies disliked, was the disordered irregularity when window blinds are drawn. To reduce this disproportionate appearance, Mies specified window blinds which only operated in three positions – fully open, halfway open/closed, or fully closed.



The term 'technofossil' was coined by Professor Jan Zalasiewicz and colleagues at the University of Leicester, to describe the material footprints that humans will leave behind through their material goods.

The ratio of energy content to mass was identified as the most telling indicator of the construction ecology in this case. The technomass and technofossils are understood as the index of natural and social processes, and moreover how such processes mix to yield uneven and asymmetric world-system. The world's technomass — the sum of all the world's non-living technology and technologically-created production (and non-organic waste).

