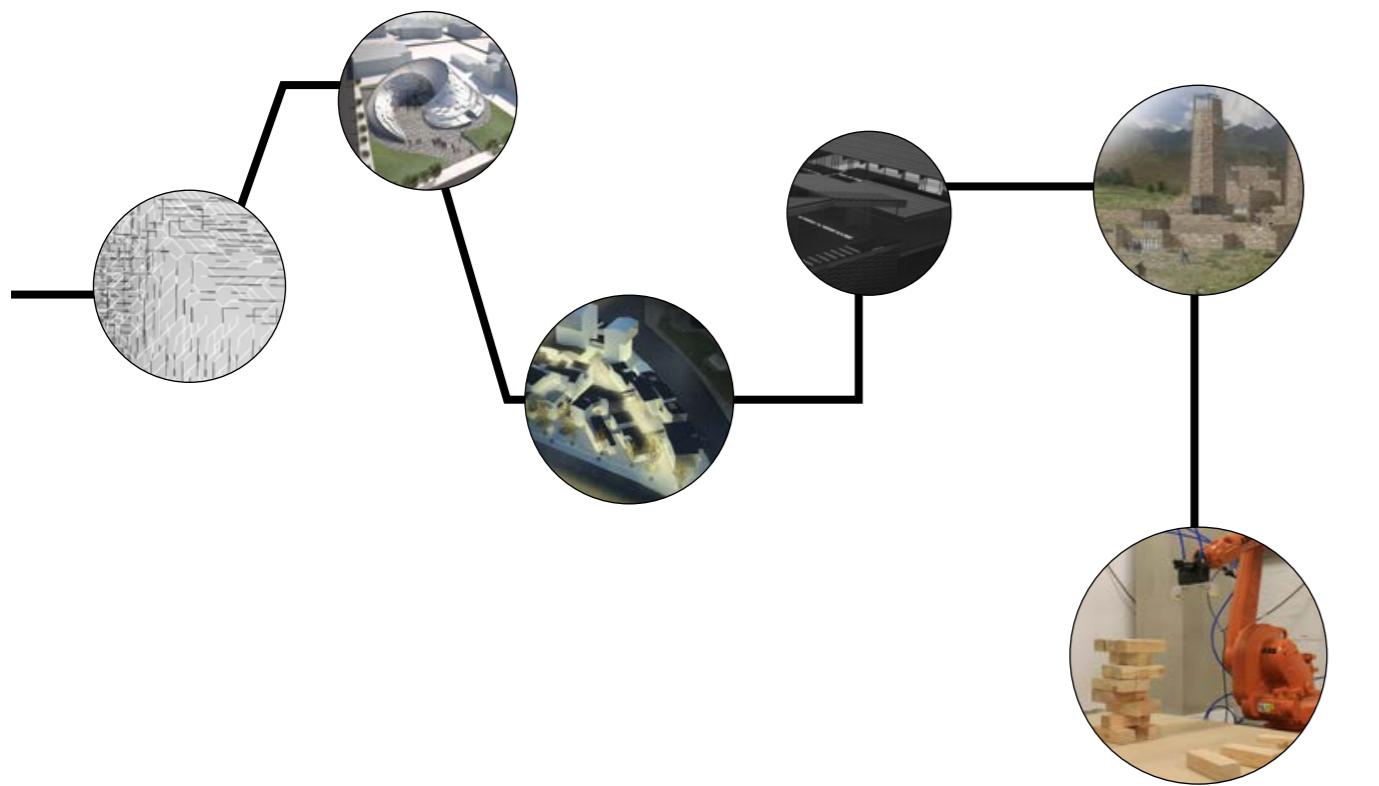




# PORTFOLIO

LU MIAO / ARCHITECTURE DESIGNER



1. Click Pipes
2. Art Museum
3. Urban Renewal
4. Library Design
5. Qiang Culture Experience Factory
6. Workshops
7. Appendix



## EDUCATION

- ⟨ Master of Architecture University College London / 2017. 09 - 2018. 09
- ⟨ Bachelor of Architecture Sichuan University / 2012. 09 - 2017. 06
- ⟨ Bachelor of Law (Double major) Sichuan University / 2015. 09 - 2017. 06



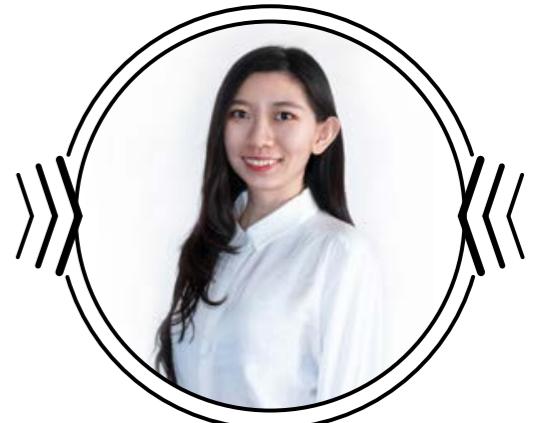
## WORK EXPERIENCE

- ⟨ Intern Architect **JZFZ Architectural Design Co., Ltd** / 2016. 09 - 2016. 11
  - Participated in the preliminary research, flat type design, construction district layout design and bid document making. (Huarun 24City Project)
  - Participated in the CAD engineering drawing and calculating the technology and economic indexes of two residential projects and one commercial complex project.
  - Finished the competitive analyzing, control plan drawing and modeling using SU and Rhino. (Huarun 24City Project & Baoli Xinchuan Project)
- ⟨ Assistant of Project Development Division **China Ocean Property Development Co., Ltd** / 2016. 06 - 2016. 09
  - Finished the report of city profile research and real estate analyze of Haikou.
  - Participated in the Renovation of Shantytowns Project in Beijing. Finished the development planning analysis, resource utilization analysis, environmental impact analysis and the engineering scheme design.
  - Participated in the research on Investment Feasibility Analysis Project of Beijing Courtyard. Finished the report on historical features research in Beijing (mainly about the regional distribution and characteristics of Beijing courtyards, the analysis of customer demand and market supply, the suggestions on site selection for the project).



## ACTIVITIES

- ⟨ Consultant for overseas study and portfolio / 2018. 09 - now
- ⟨ Independent photographer / 2017. 06 - now
- ⟨ Certified Photographer of G-photography. net / 2016. 06 - now
- ⟨ Director of Quality Development Center of Student Union / 2012. 09 - 2014. 09
  - Held two provincial level and four school level activities (like Provincial Student Union Training Camp and Welcome Party), including formulating the plan of activity, controlling the procedure, negotiating and cooperating with other departments.
  - Tracked and recorded the work of 32 student associations throughout the year. Evaluated top college students unions.
  - Enhanced my communication and coordination skills, as well as the ability to deal with emergencies.
- ⟨ Counselor Assistant of the college / 2012. 09 - 2017. 06
- ⟨ Member of College Volunteer Team, Sichuan University / 2013. 09 - 2014. 06



## CONTACT

- 📞 +86 13439571186
- ✉️ stacy\_lumiao@163.com
- ✉️ lumiao1005@gmail.com
- 📍 Fengtai District, Beijing

## LANGUAGES



## RESEARCHS

- ⟨ Member of the Design Computation Lab in UCL / 2017. 09 - 2018. 09
- ⟨ “Mountainous Scenery” Urban Space Design (cooperated with the visiting group from France) / 2016. 07
- ⟨ Research and Study Tour of Architecture in Suzhou, Hangzhou and Shanghai / 2016. 02
- ⟨ Ancient Building Surveying and Mapping of Tibetan & Research of People’s Livelihood in Garze Tibetan Autonomous Prefecture, Sichuan Province / 2014. 07
- ⟨ Conceptual Design of Experience Center for Cultures of Qiang Ethnic Minority (cooperated with visiting group from Japan) / 2014. 07
- ⟨ Fine Arts Practice and Research of People’s Livelihood in Shanxi Province / 2014. 06

# 1 CLICK PIPES

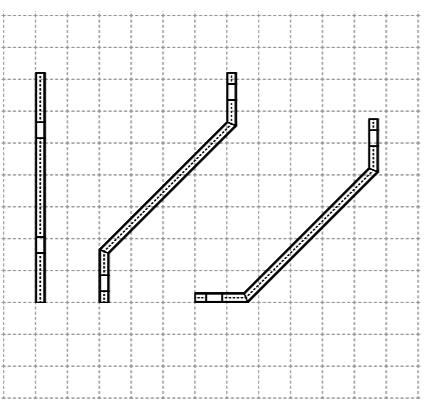
Group Work / 2017.08 - 2018.09



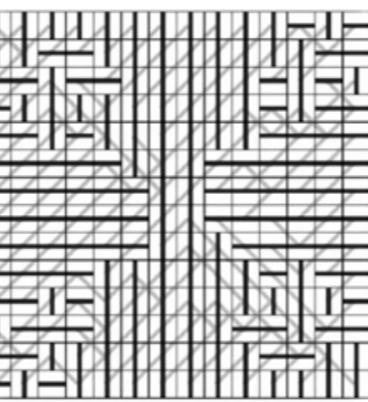
This project proposed a solution to fabricate a discrete building consisted of plastic tubes. By using light-weight, easy-shaping and reusable digital materials and a set of primitive structure singletons, the final structure could be low-cost and highly efficient. We analogized a determined computation system so that a deterministic structure could be produced. Moreover, this project would break the limitation of specific joints nowadays, and the newly designed joint would not be too complicated and expensive anymore. At last, this paper would propose a solution for fast fabricating a stiff structure in the large scale, by using discrete elements and highly efficient methods.

## [ Project Overview ]

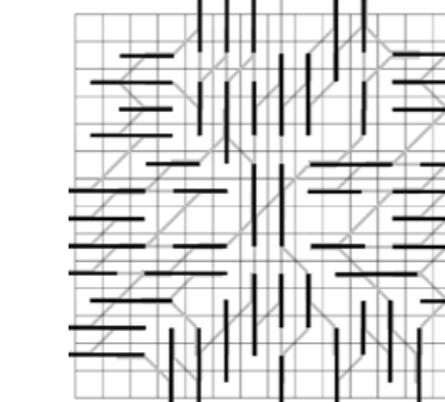
Discrete Pieces



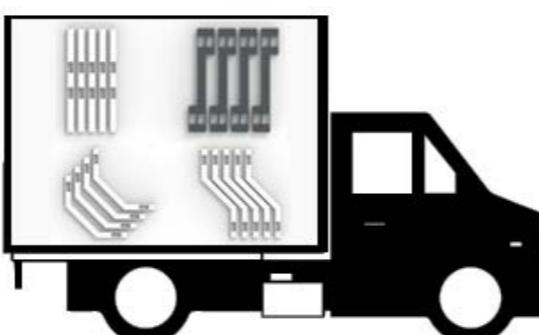
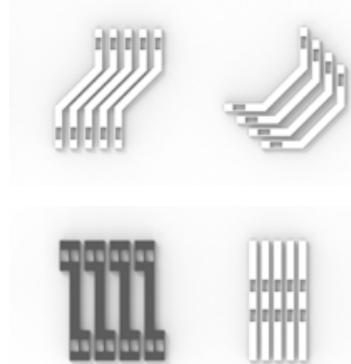
Combinatorial Rules



Fully Automated Fibre Steel Structure Display

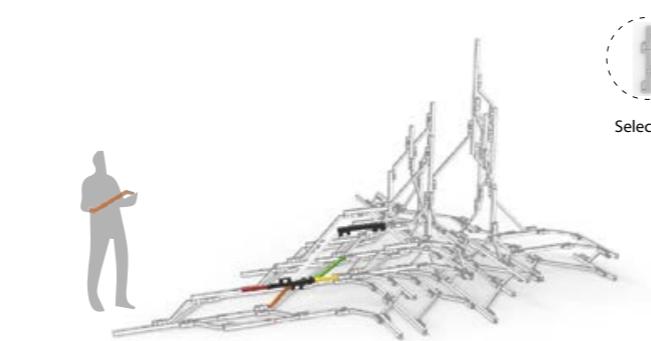


Prefabricated Joints



Prefabricated Tubes

Shipping

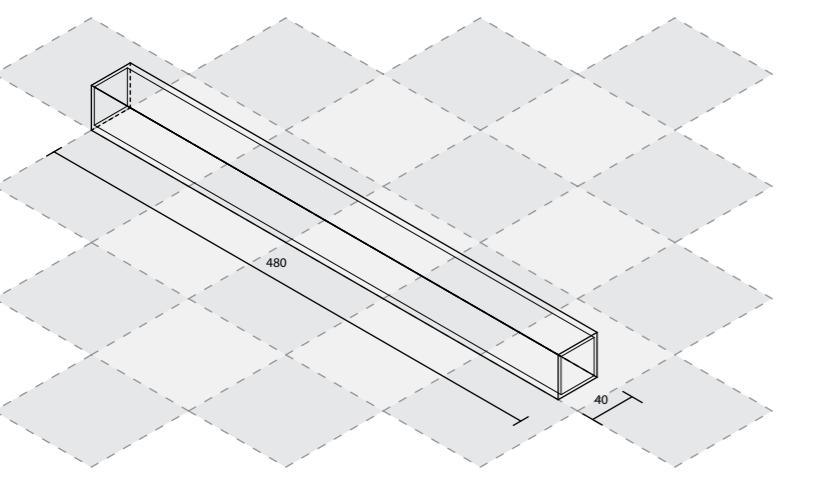


Assembly Tutorial

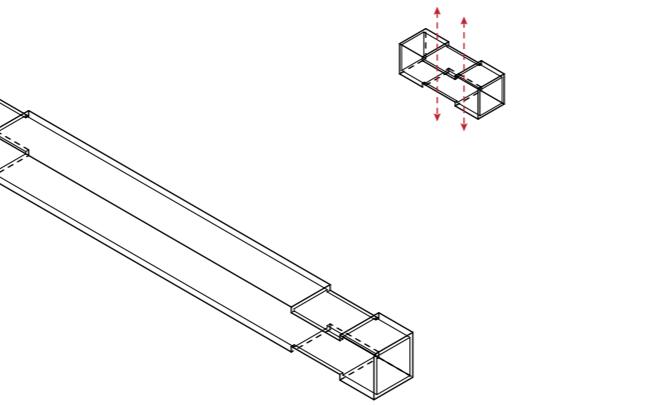


Human Manually Assembled/ Disassembled on Site

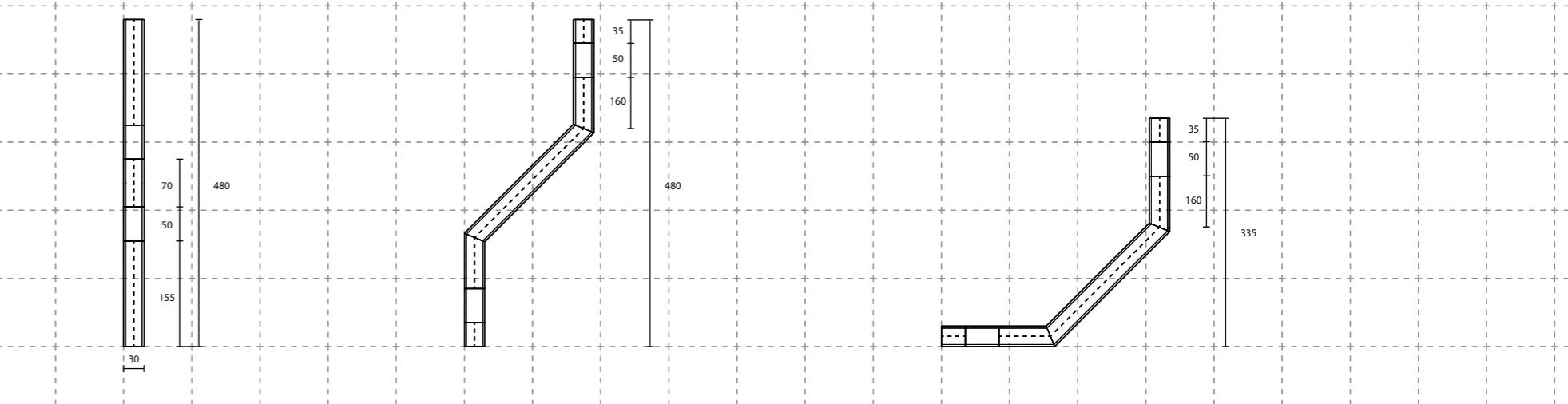
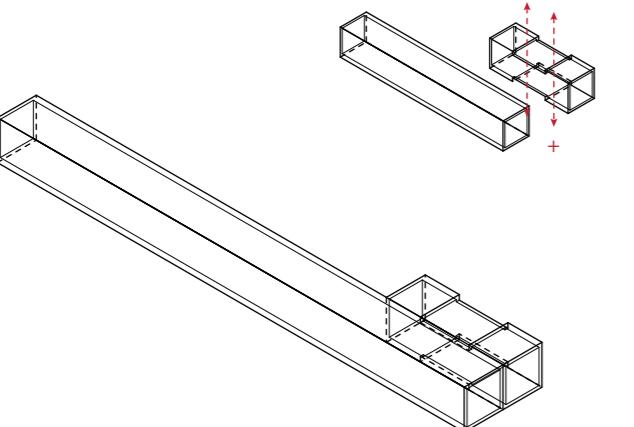
## [ UNIT DESIGN ]



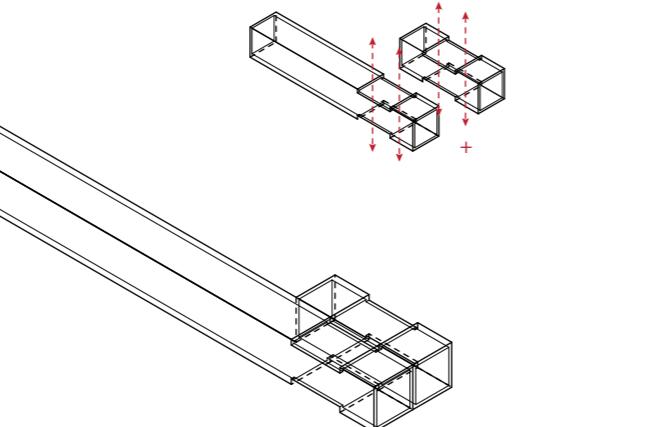
Basic Pipe



Adding Connector



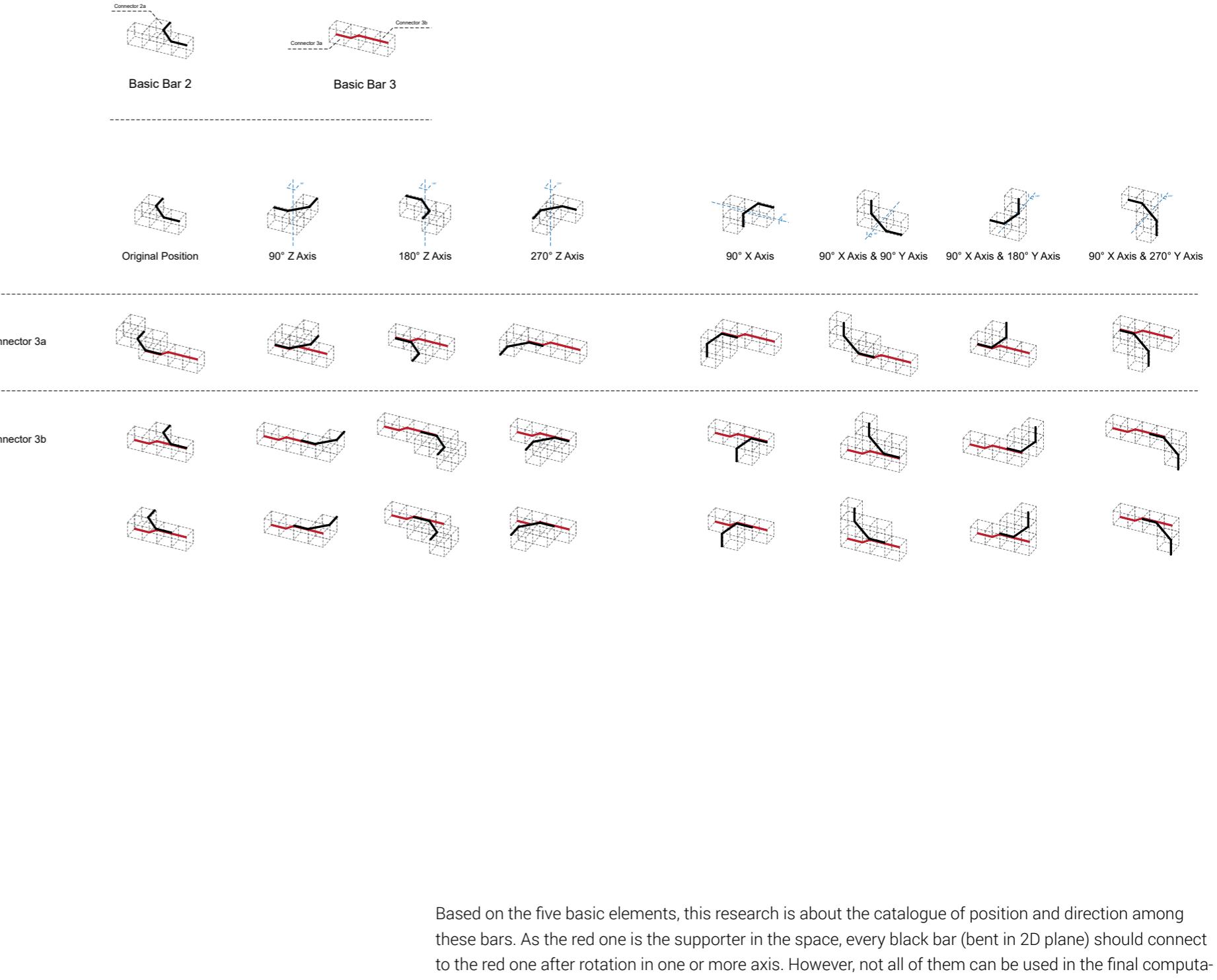
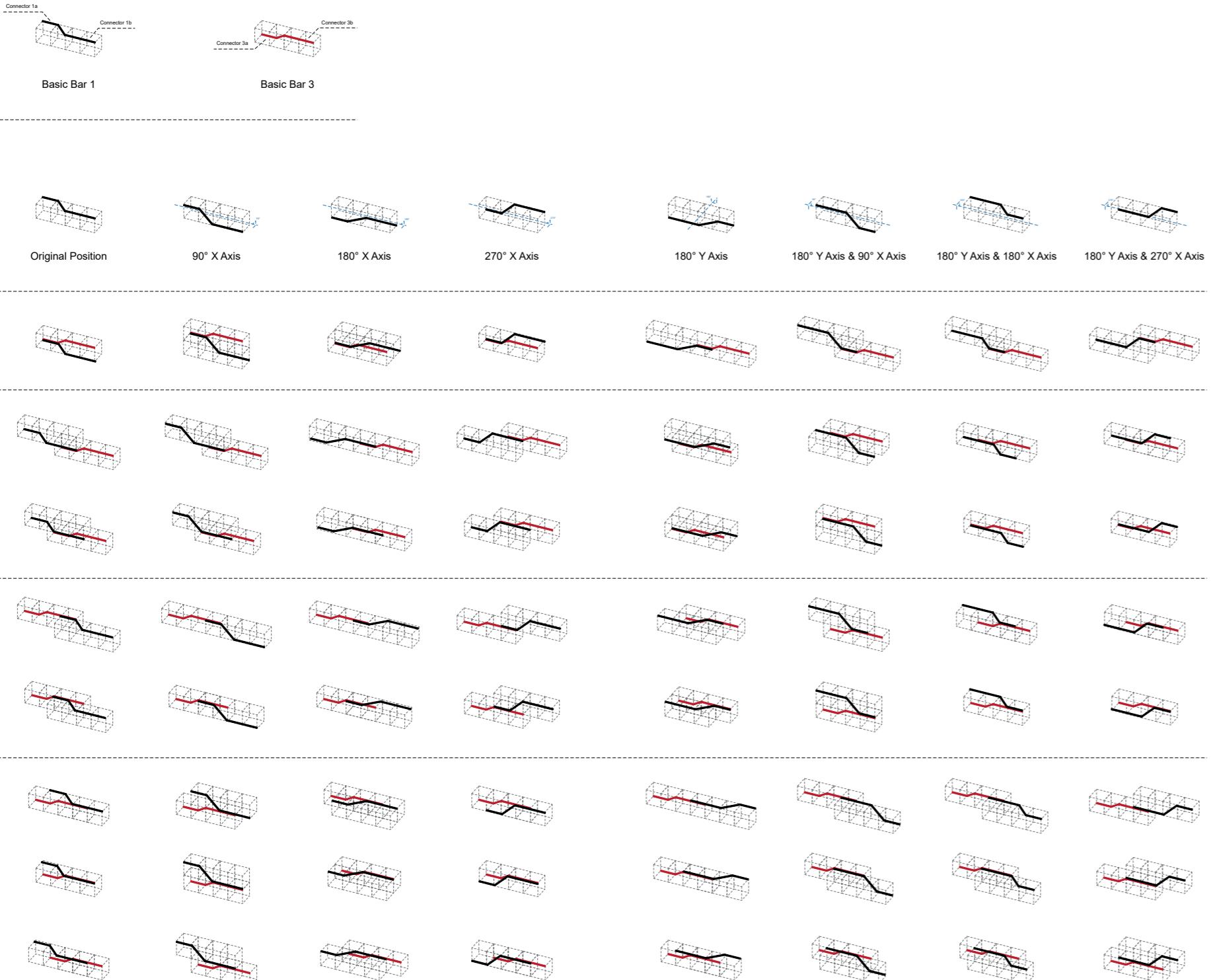
Basic Pipe



Different Scales

# [ UNIT DESIGN ]

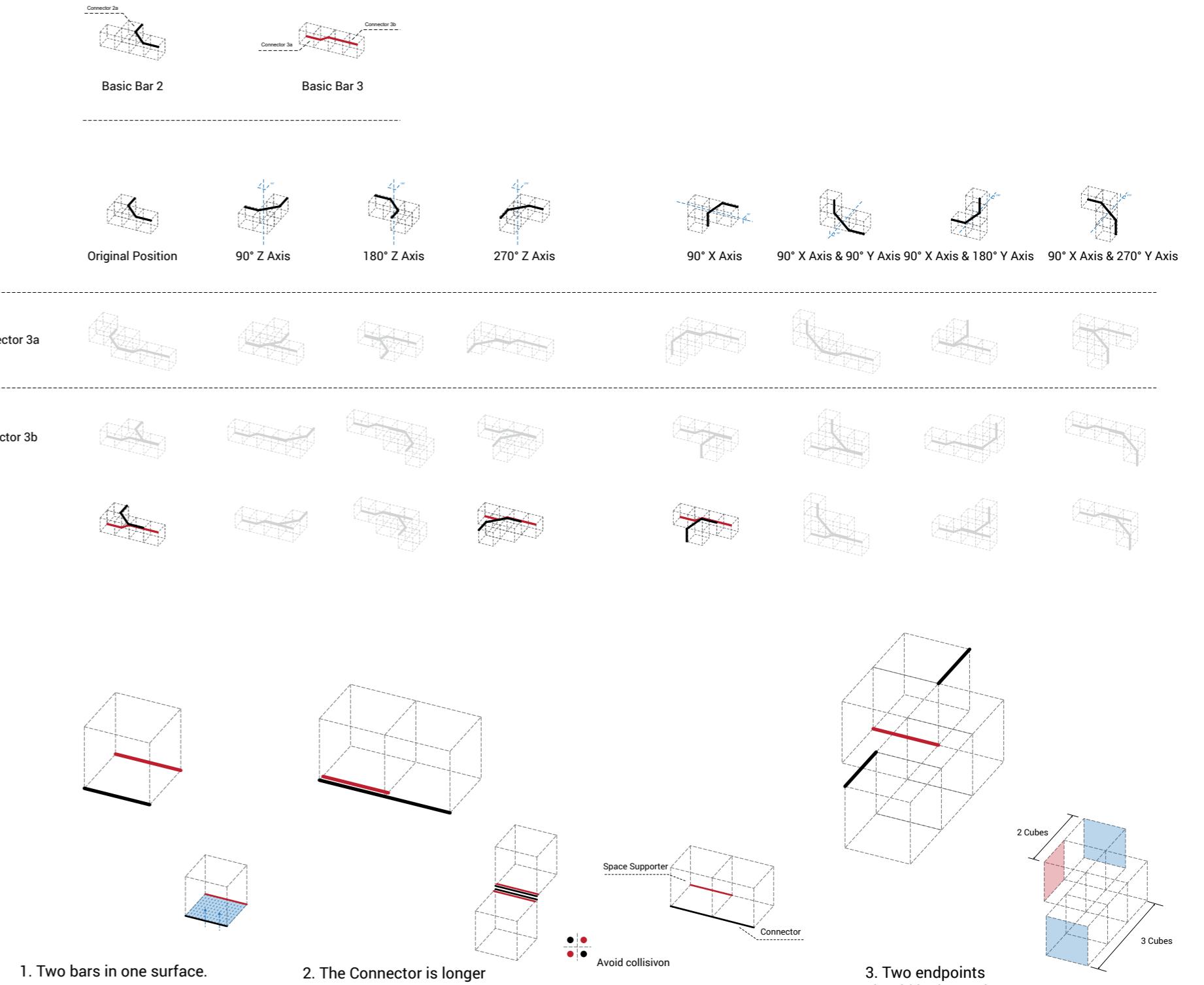
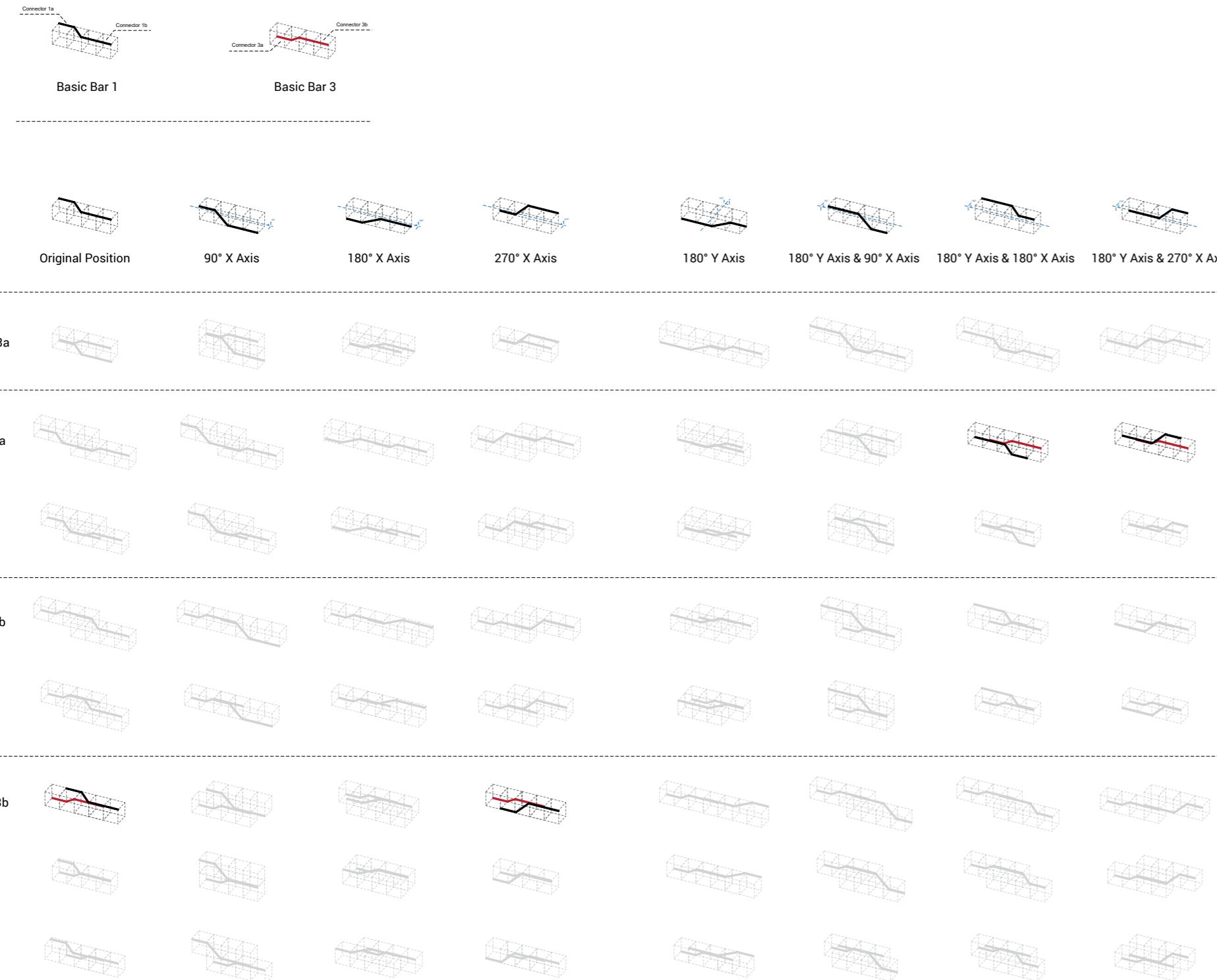
Combination of two basic bars



Based on the five basic elements, this research is about the catalogue of position and direction among these bars. As the red one is the supporter in the space, every black bar (bent in 2D plane) should connect to the red one after rotation in one or more axis. However, not all of them can be used in the final computation, every group should obey the following conditions.

# [ UNIT DESIGN ]

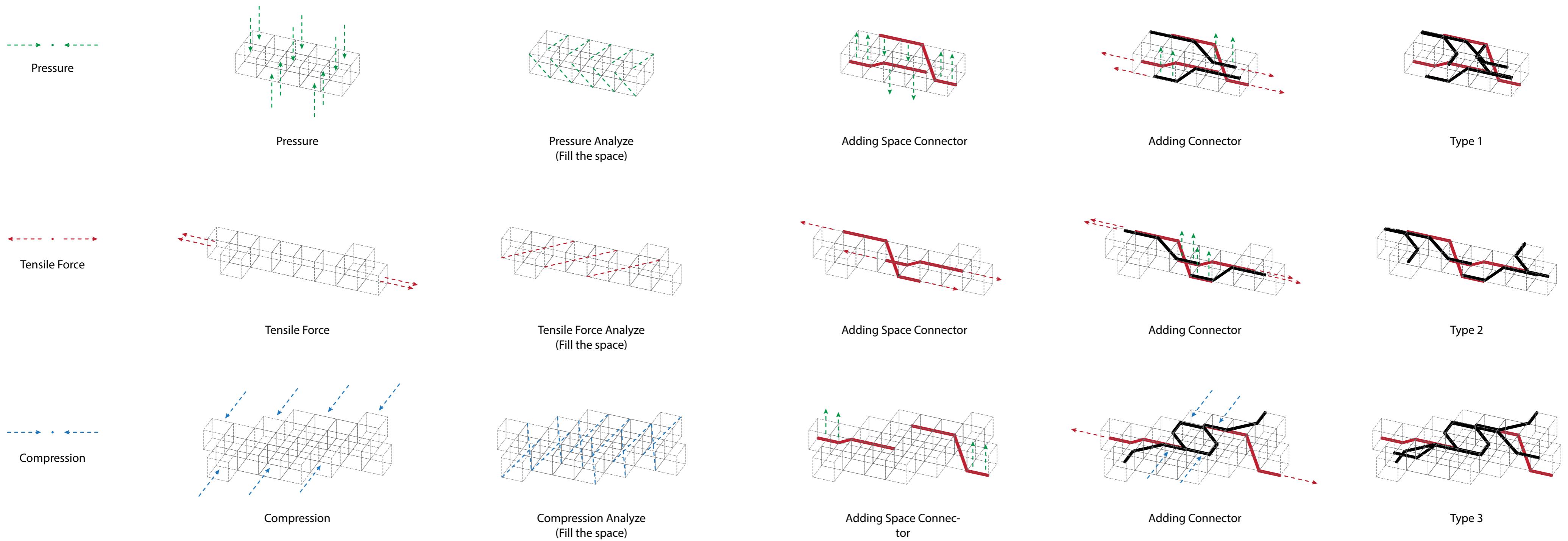
Combination of two basic bars



# [ COMBINATION ]

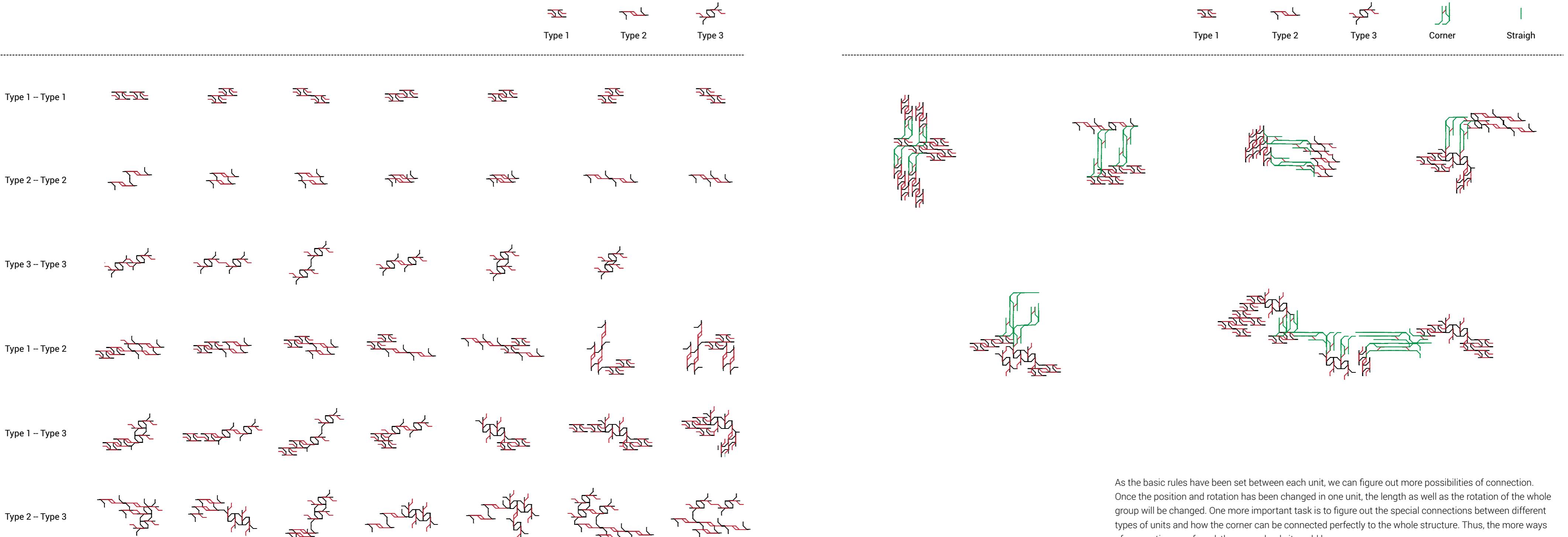
Unit Design based on Stress Analysis

When organizing the bars, this design tests different types of forces in the space first. Then put specific elements in the space to counteract the force. The space supporter (red bars) should always be the first one to put, then can be the 2D connector with rotation and different positions. Based on the best result of counteracting the force, three types of basic unit are found.



# [ COMBINATION ]

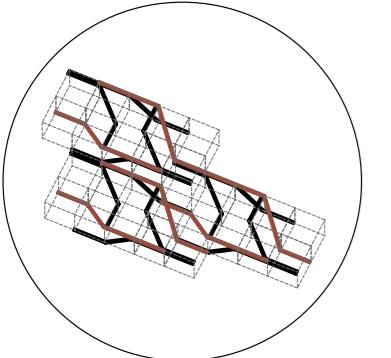
Connection of units



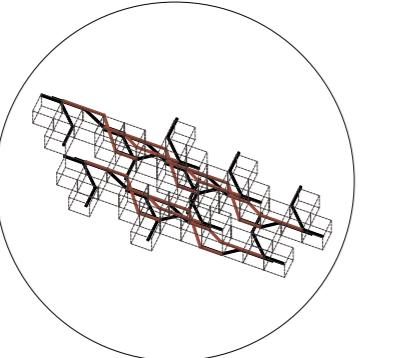
As the basic rules have been set between each unit, we can figure out more possibilities of connection. Once the position and rotation has been changed in one unit, the length as well as the rotation of the whole group will be changed. One more important task is to figure out the special connections between different types of units and how the corner can be connected perfectly to the whole structure. Thus, the more ways of connections we found, the more clearly it could be.

## [ COMBINATION ]

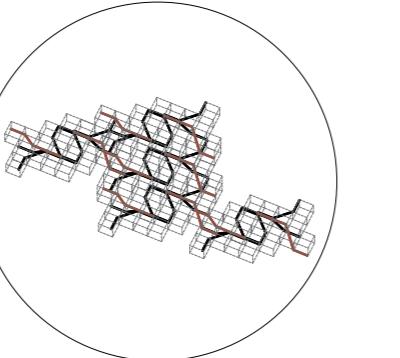
Combination based on Stress Analysis



Group 1

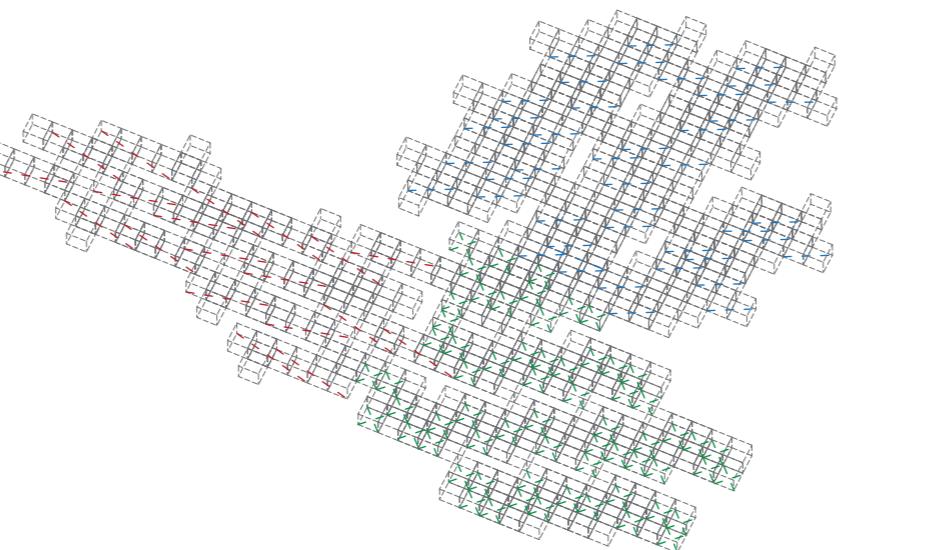
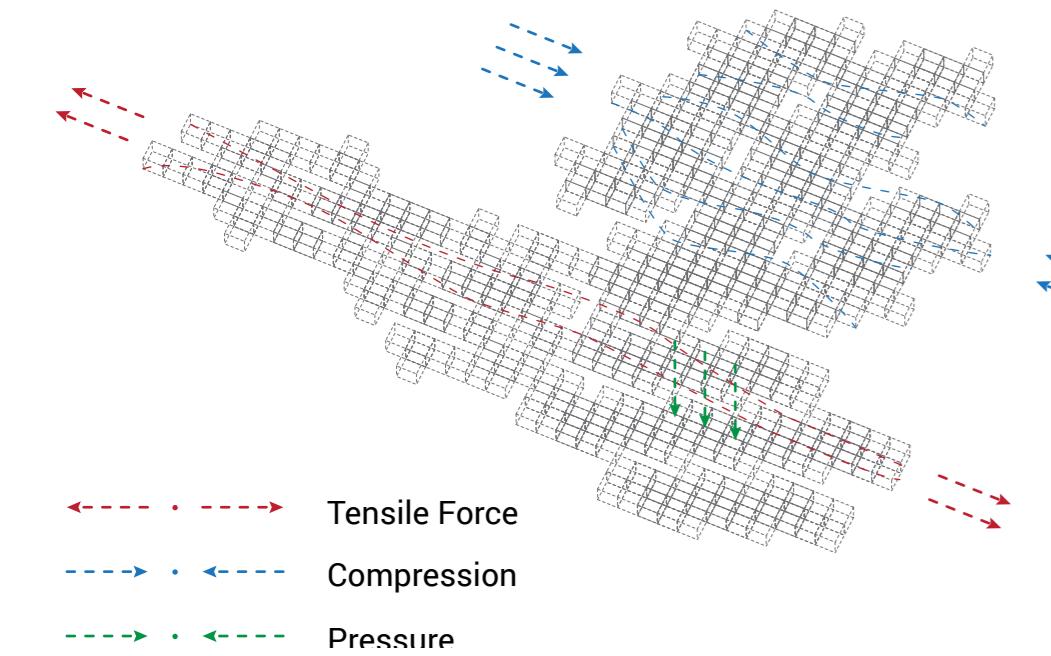


Group 2

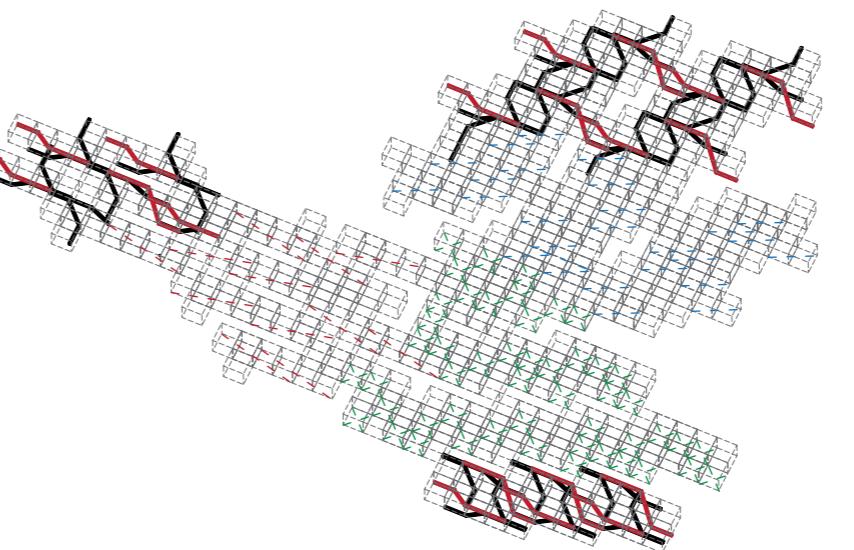


Group 3

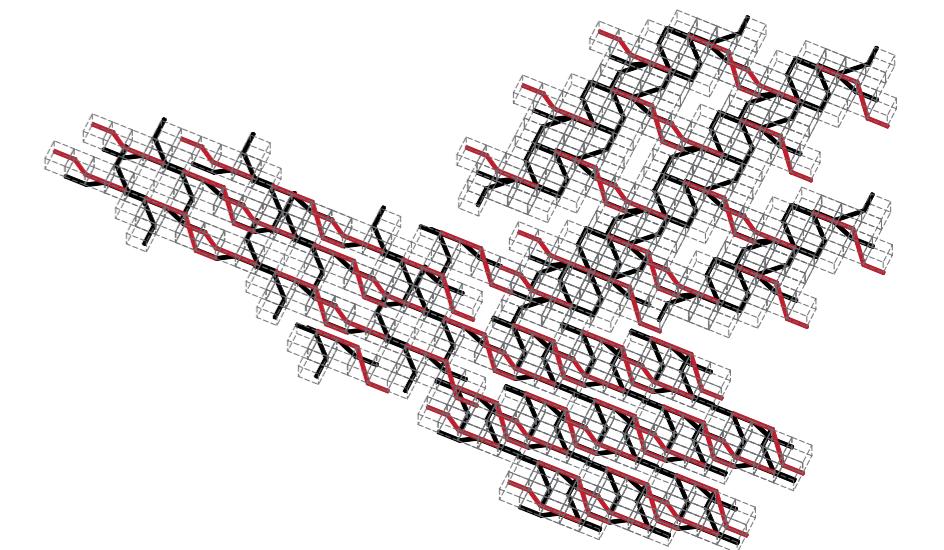
Three types of connections have been talked before. In the computation works, we analysed the space into different force types, including the Tensile Force, Compression and Pressure. Each unit has a different tendency to the forces. The whole structure is assembled based on the force analyse. As the possibilities of connections have been talked before, the structure can be considered into larger ones in the future.



Stress Analyze



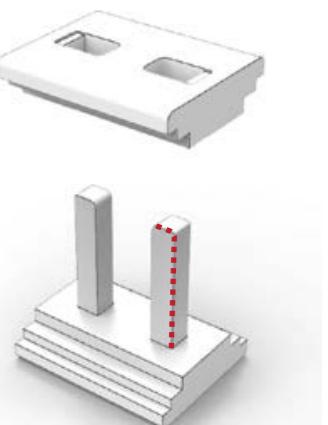
Tensile Analyze



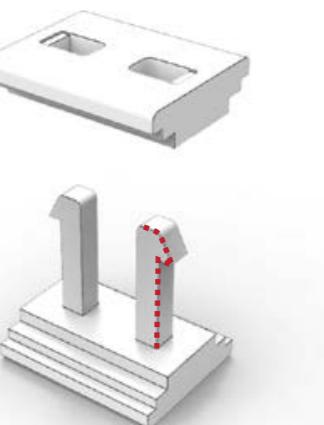
Whole Structure

# [ UNIT DESIGN ]

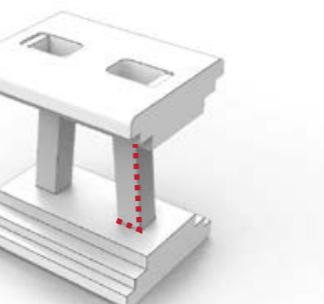
## Joint Design



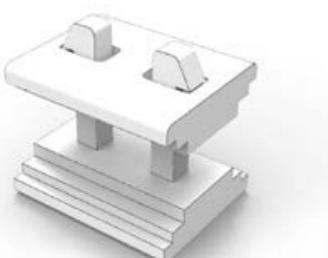
Basic Joint



Adding a Locker



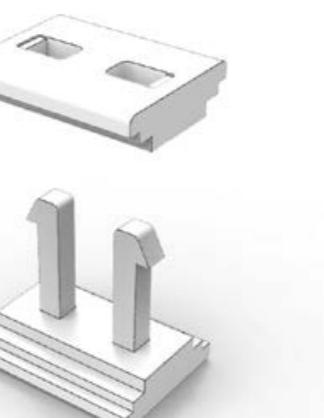
Shape change



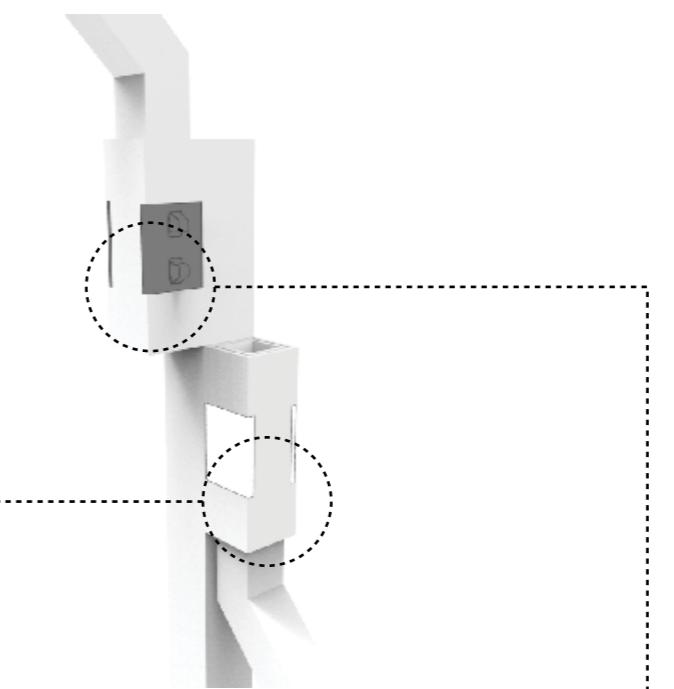
Insert the Joint



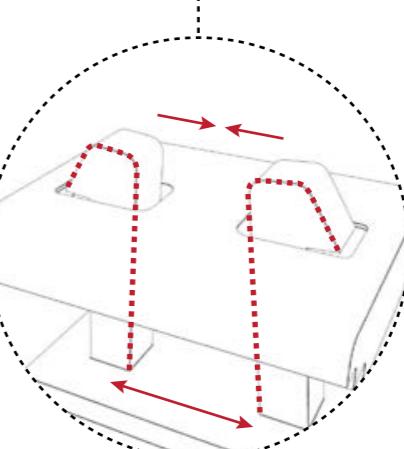
Press



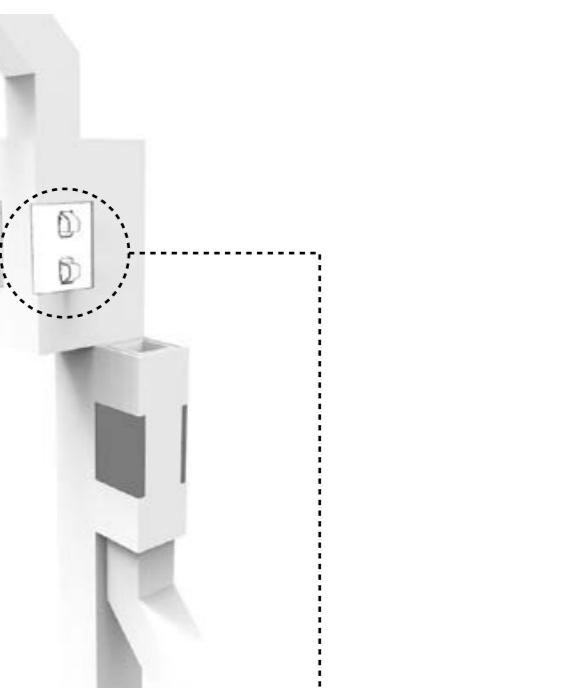
Take off the Joint



Fulfilling the space  
between the pipes



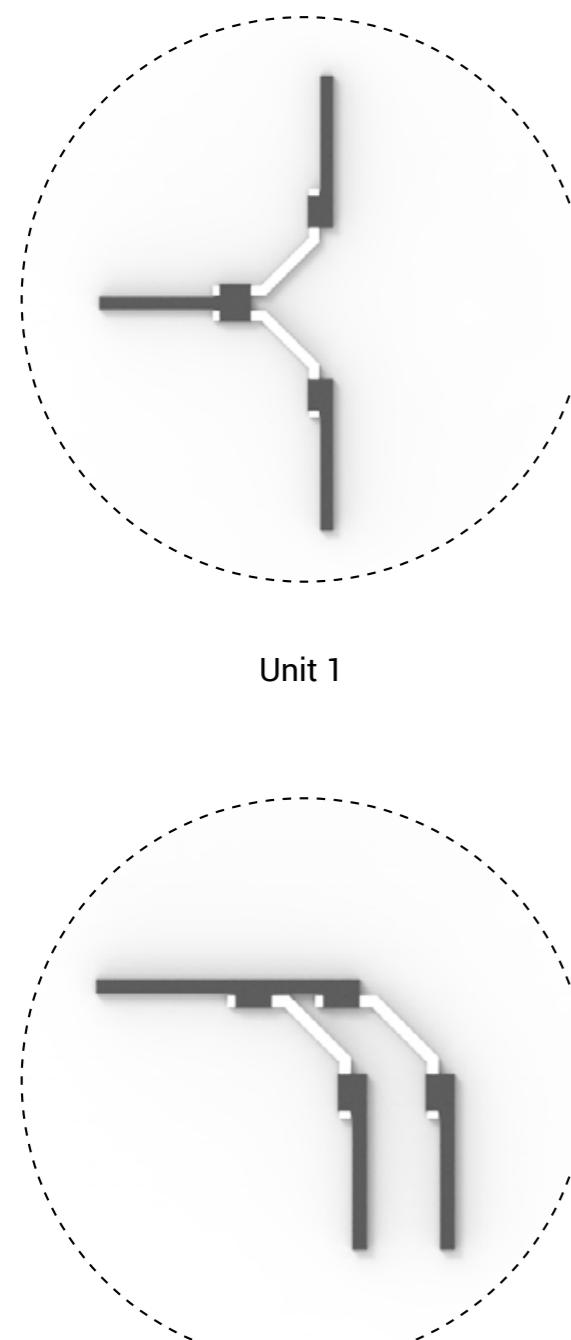
Using the shape  
change to lock the joint



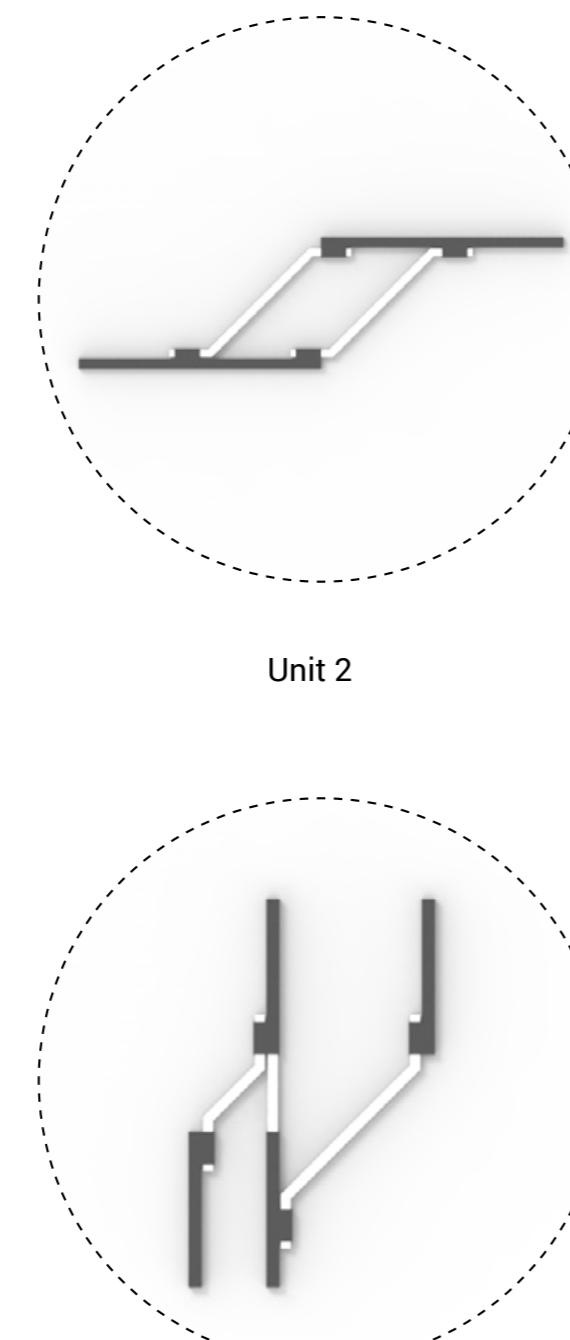
Modifying the toler-  
ance

## [ UNIT DESIGN ]

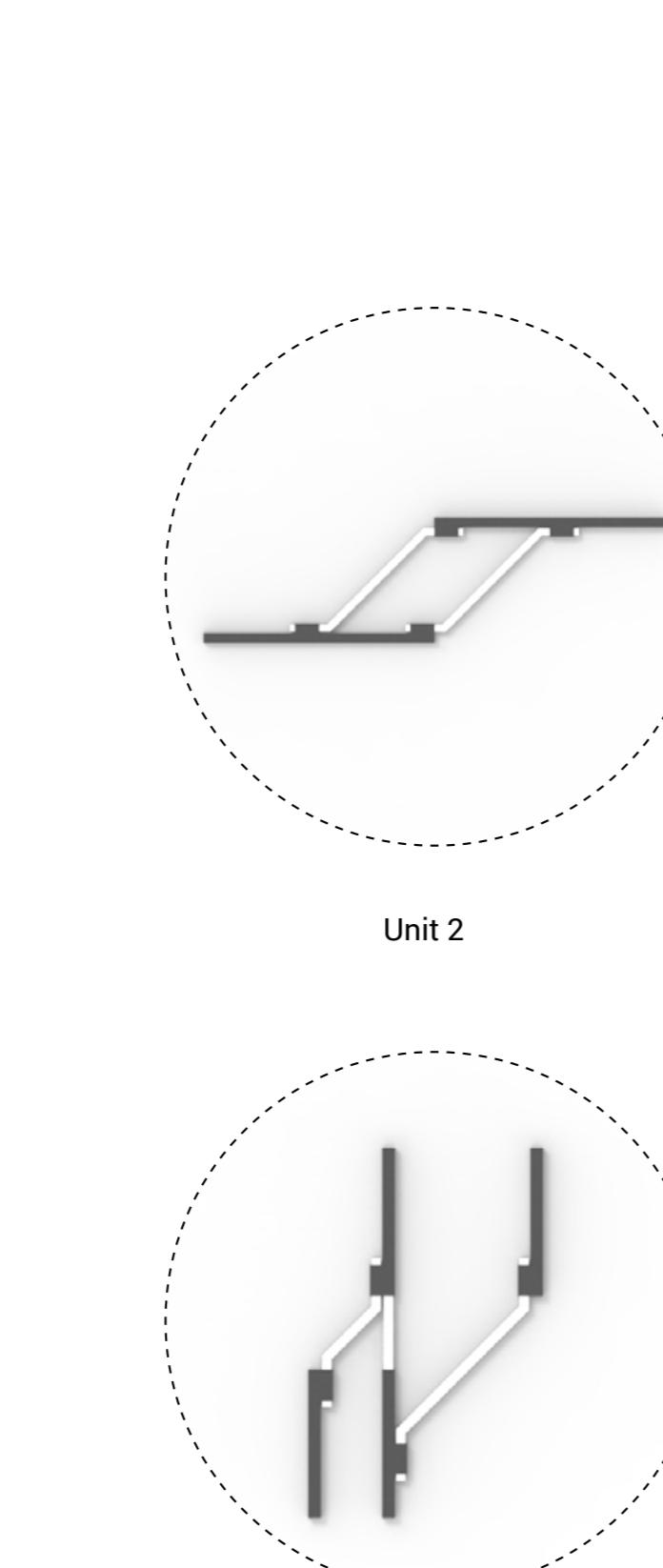
Small Scenario Aggregation



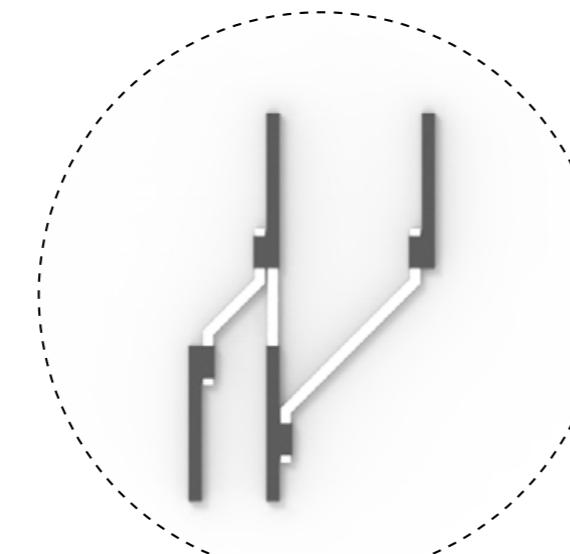
Unit 1



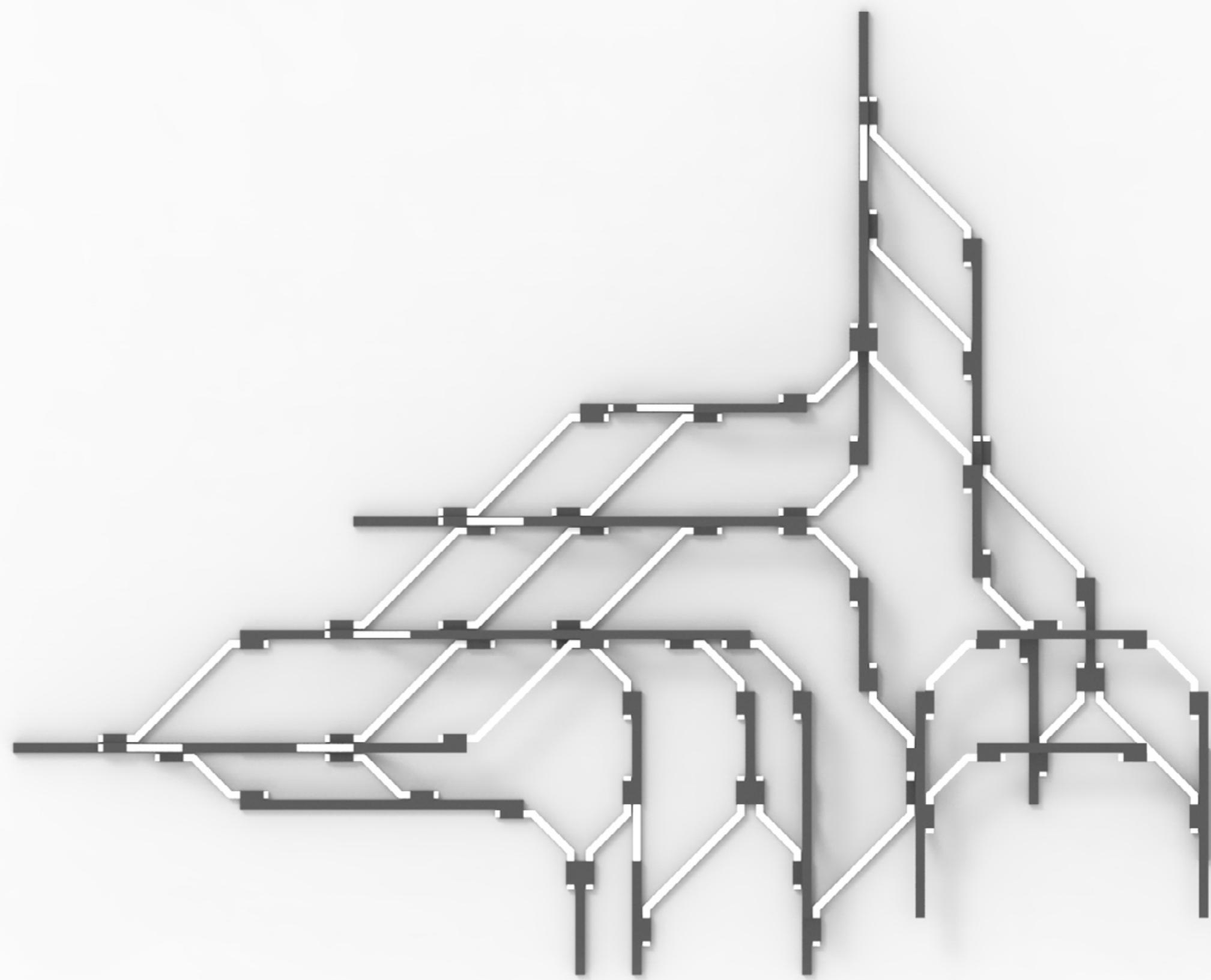
Unit 2

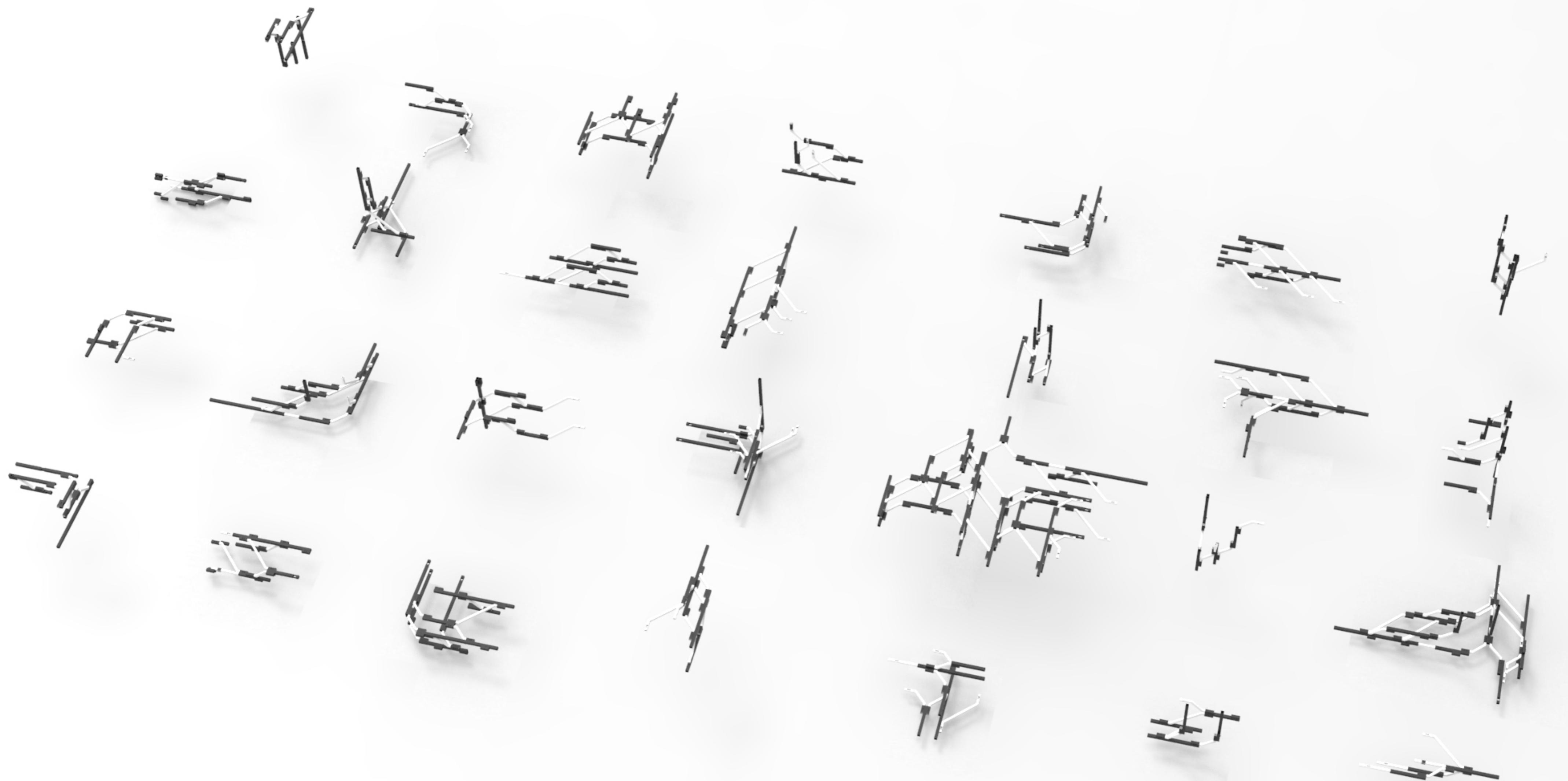


Unit 3

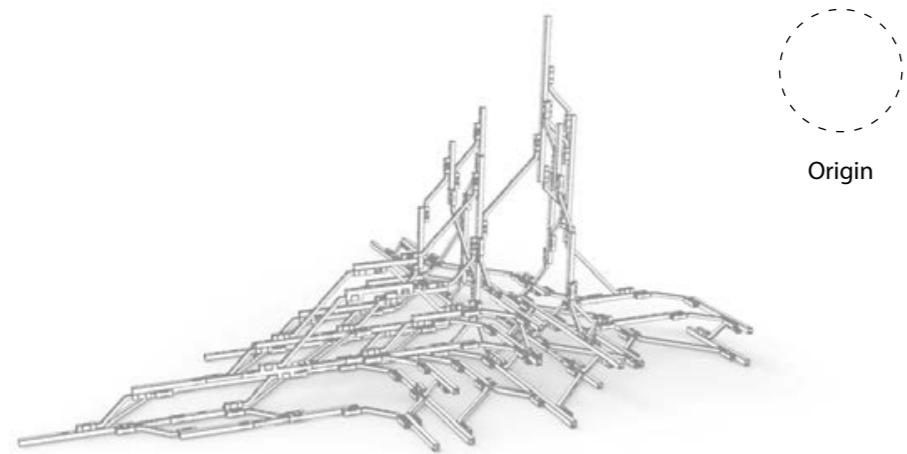


Unit 4

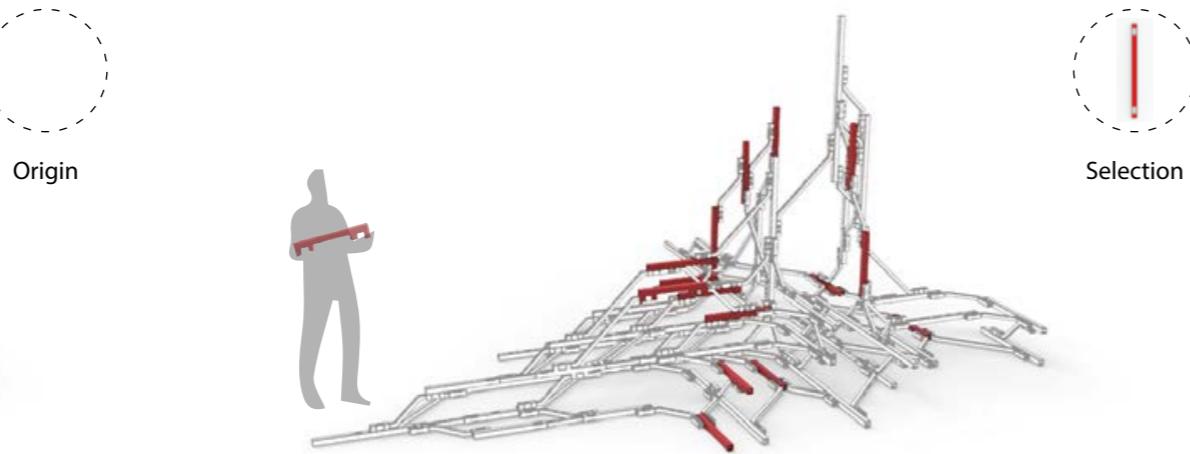




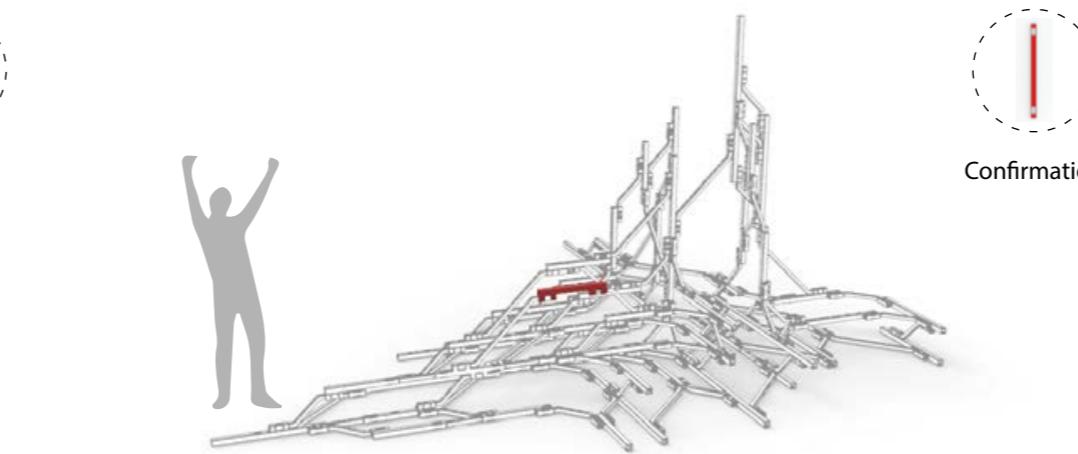
## [ ASSEMBLY TUTORIAL ]



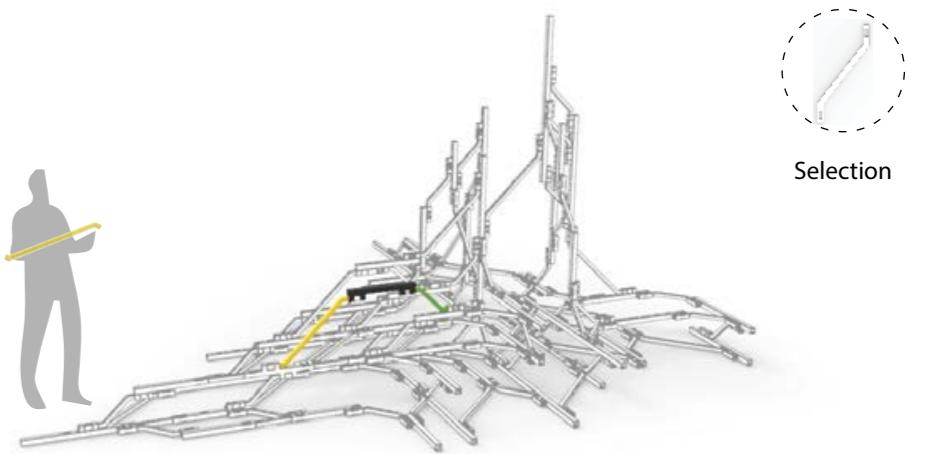
Original Set



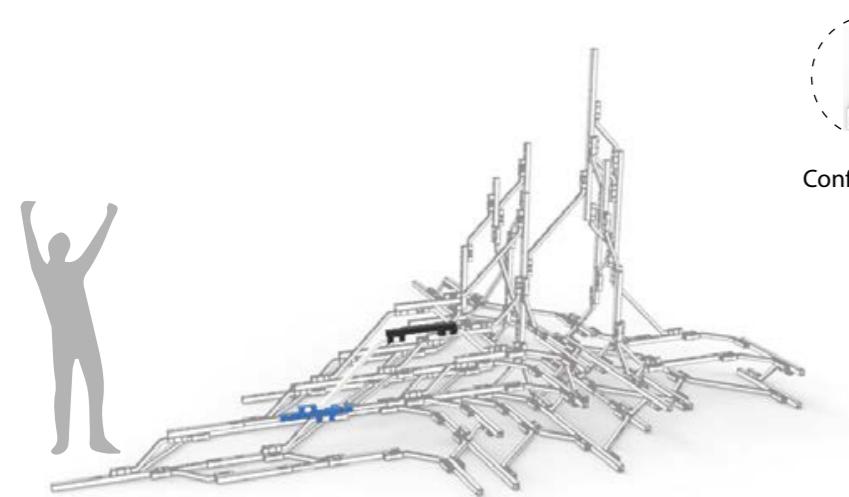
Possible Positions



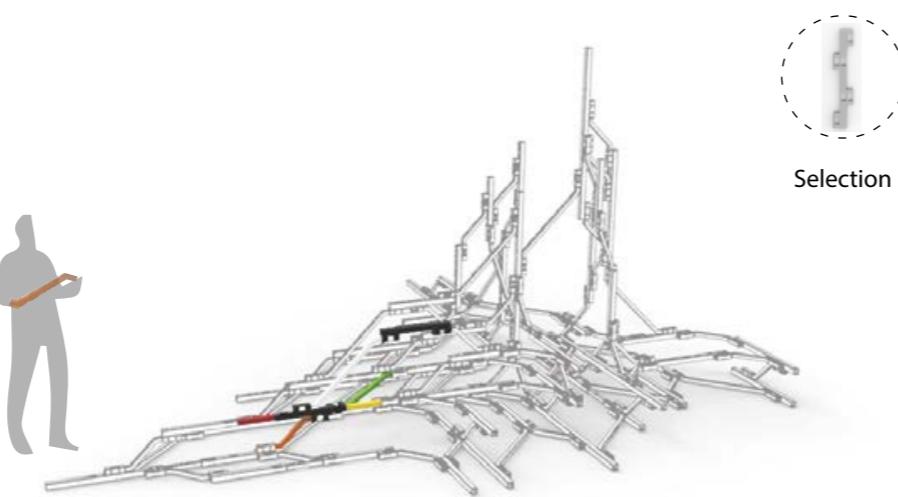
Choosing the first position



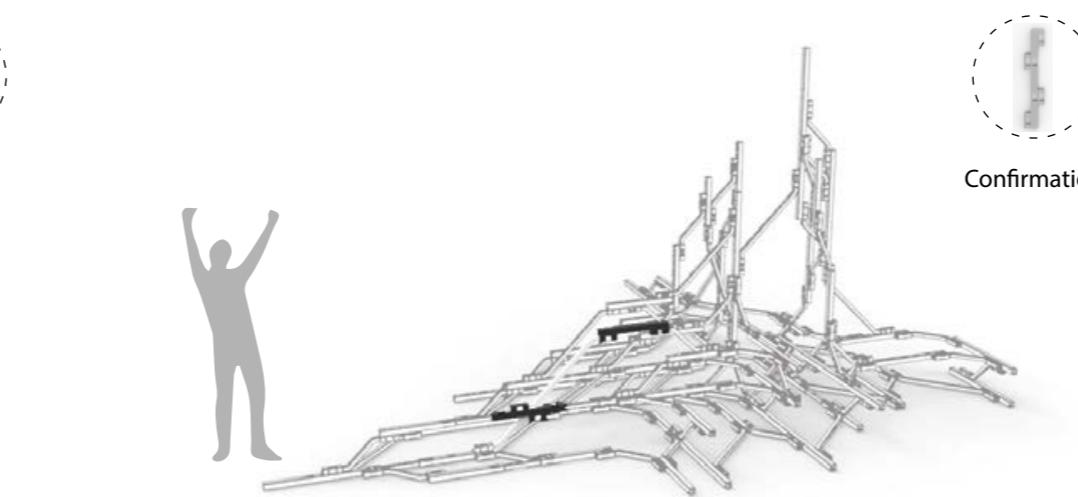
Showing the next possible positions



Choosing the second position



Showing the next possible positions



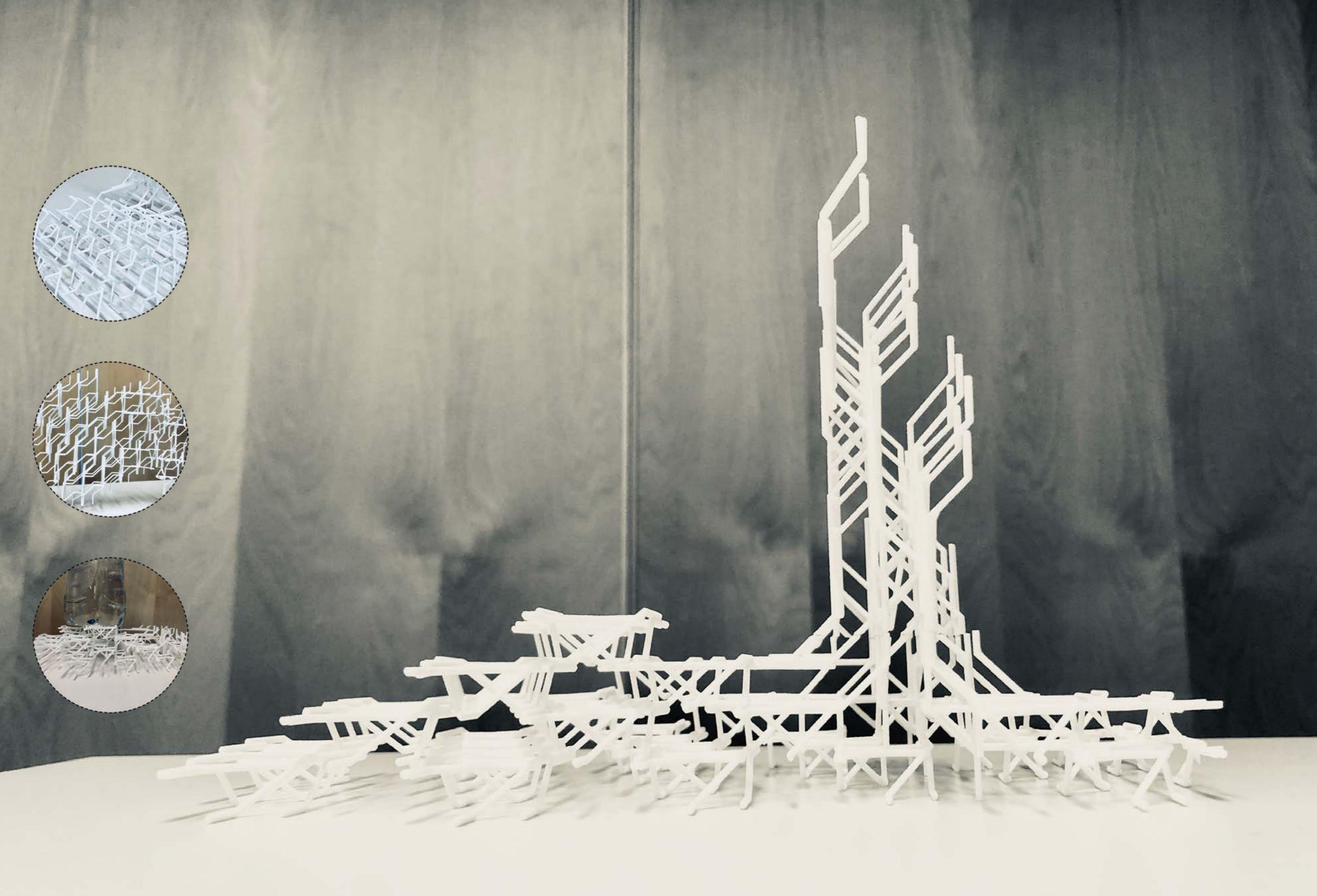
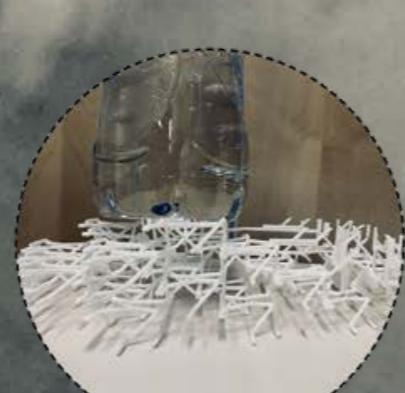
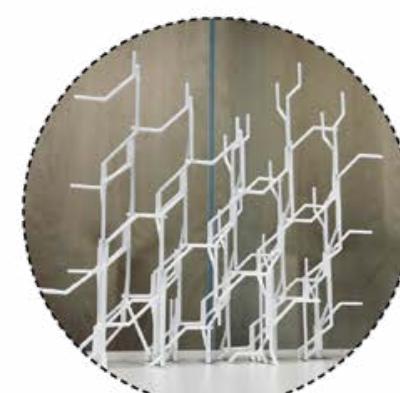
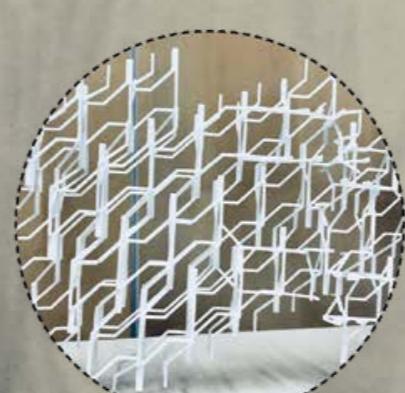
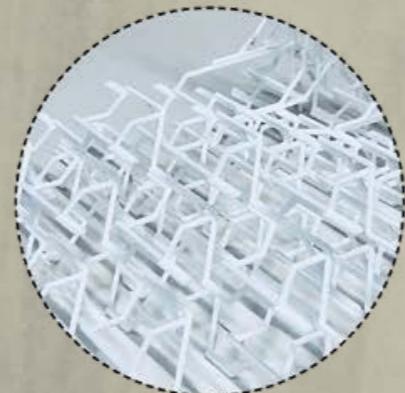
Choosing the next position



Final model

## [ UNIT DESIGN ]

3D Printing Test



## [ UNIT DESIGN ]

### Structure Improvement

In the 3D Printing test, we found that the single patterns may cause deformation, slant, tortuous and other structural problems.



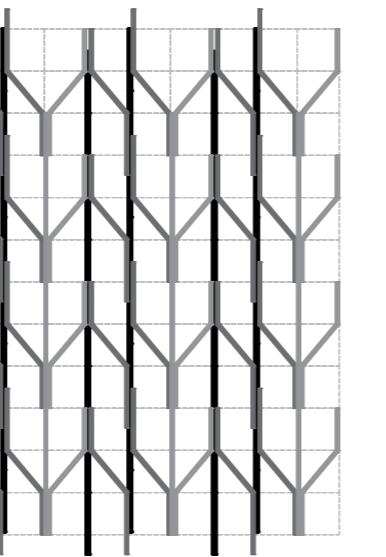
Deformation



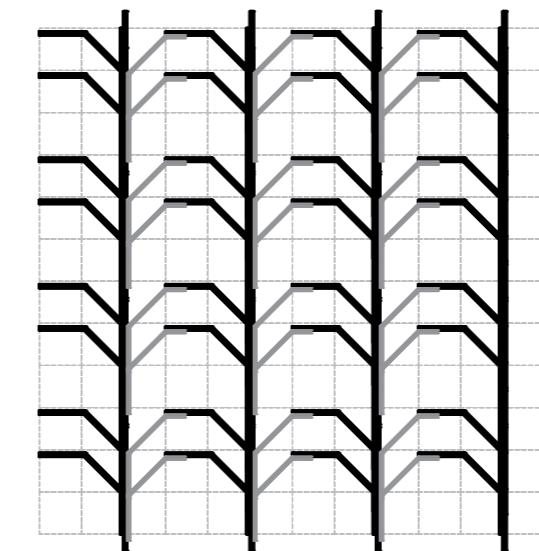
Slant



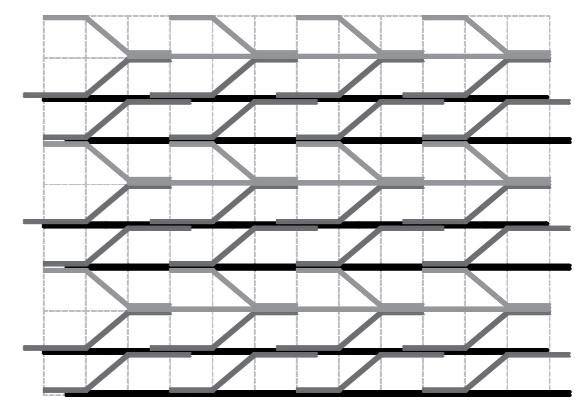
Tortuous



Horizontal Pattern



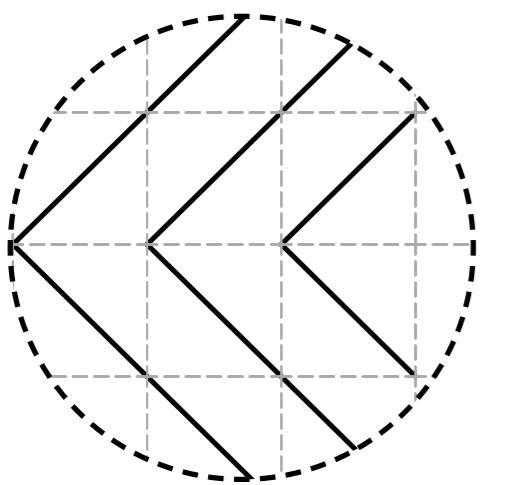
Corner Pattern



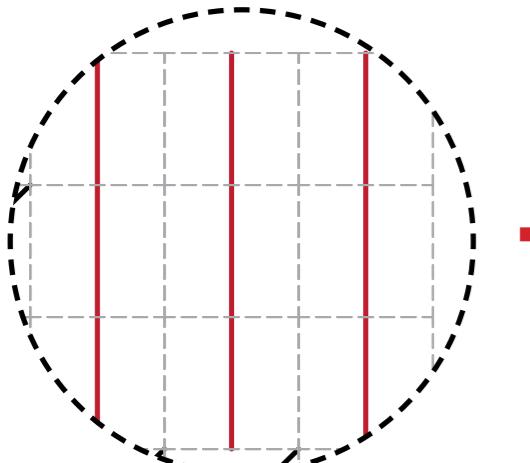
Vertical Pattern

# [ UNIT DESIGN ]

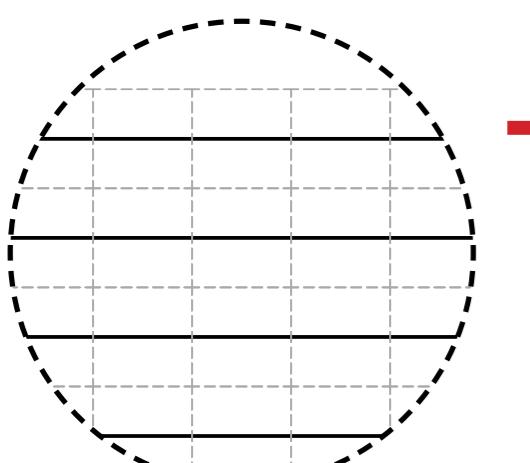
3D Printing Test



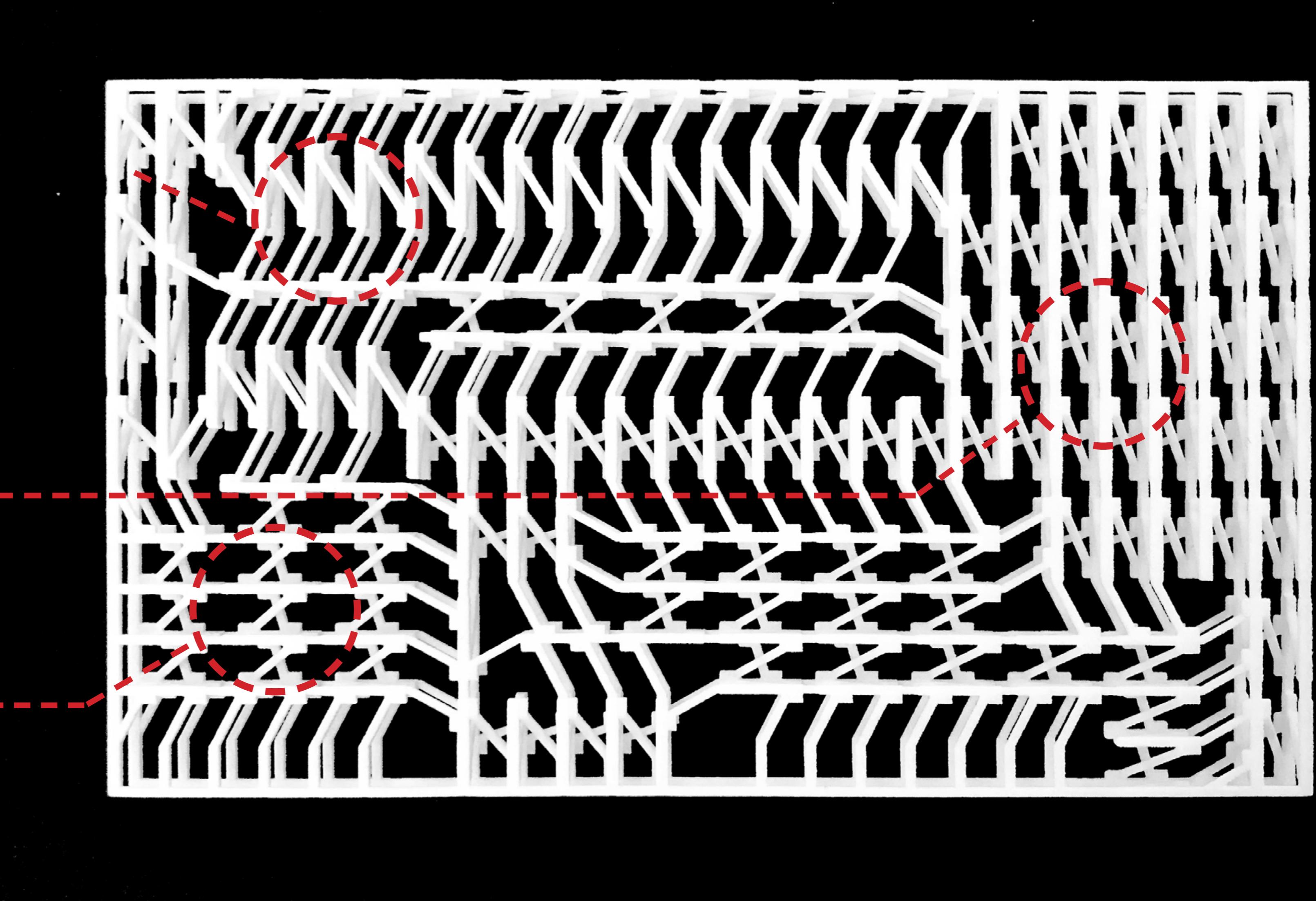
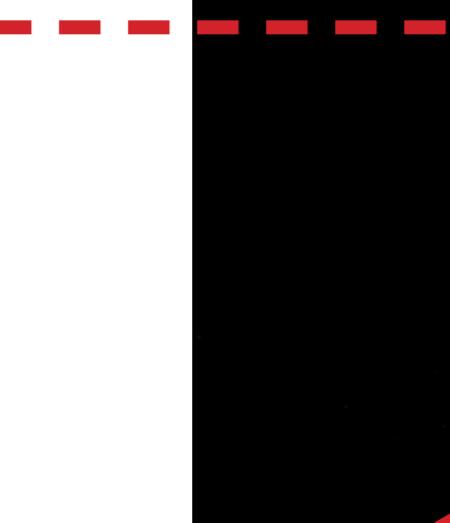
Corner Pattern



Horizontal Pattern

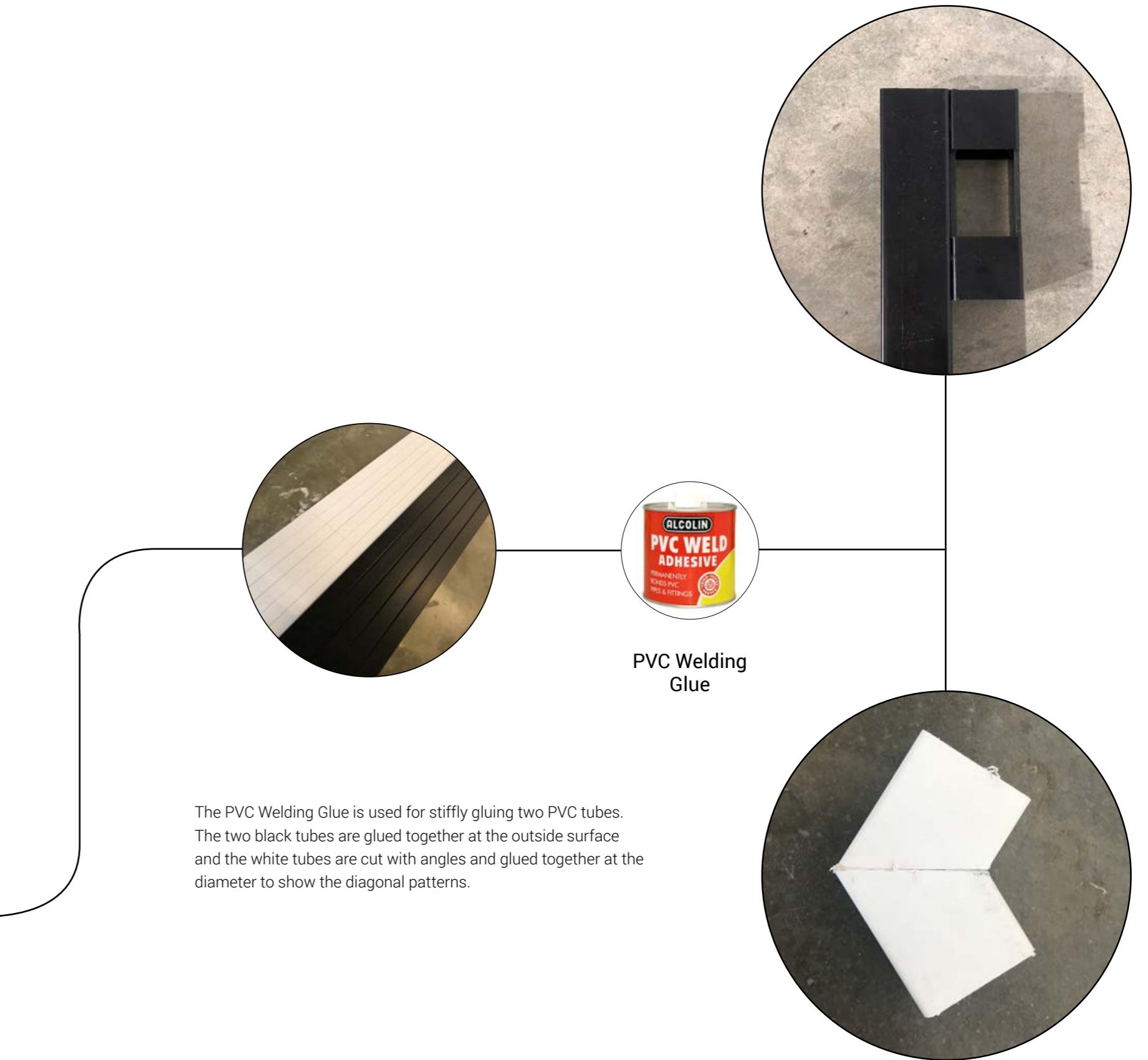
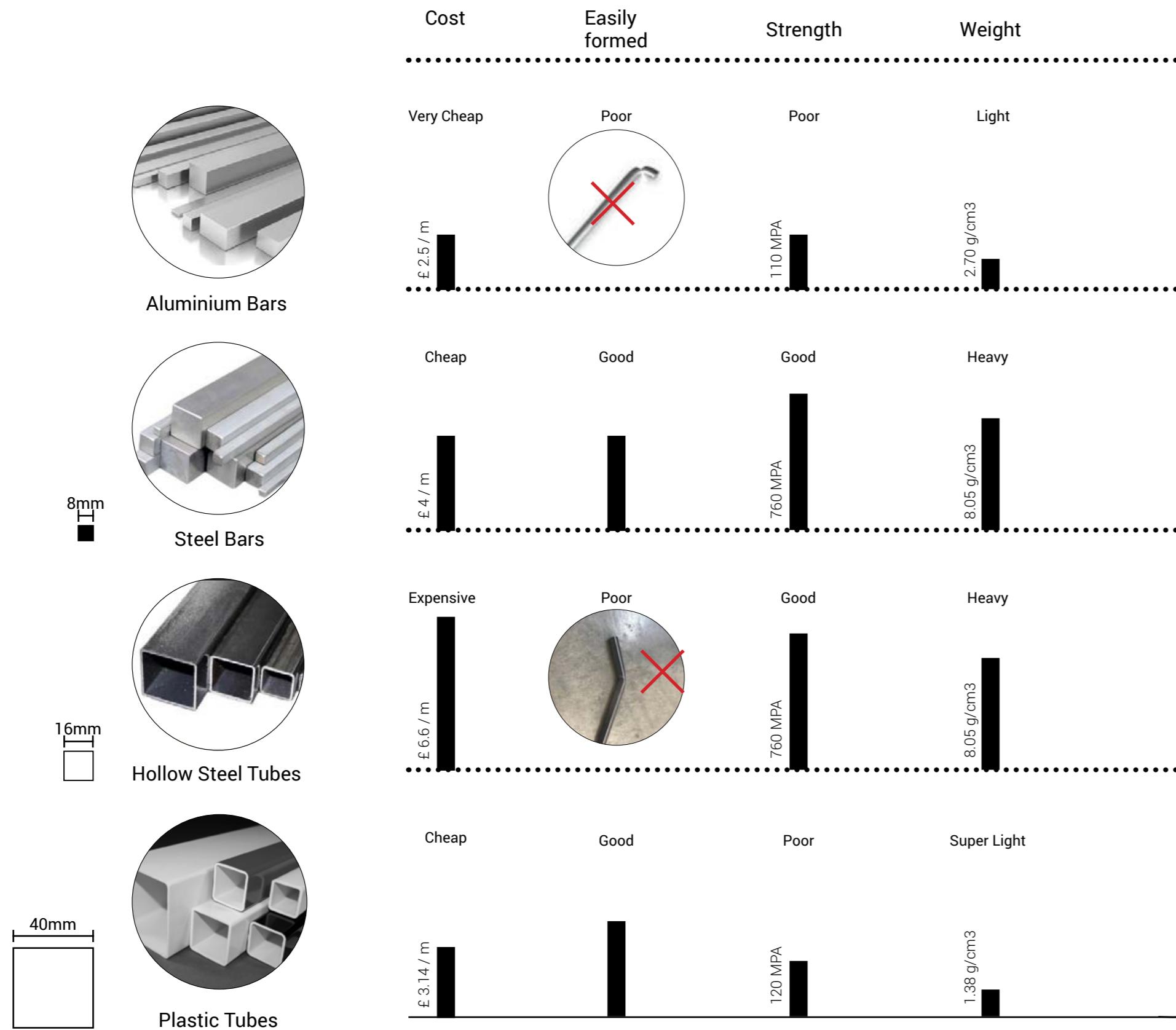


Vertical Pattern



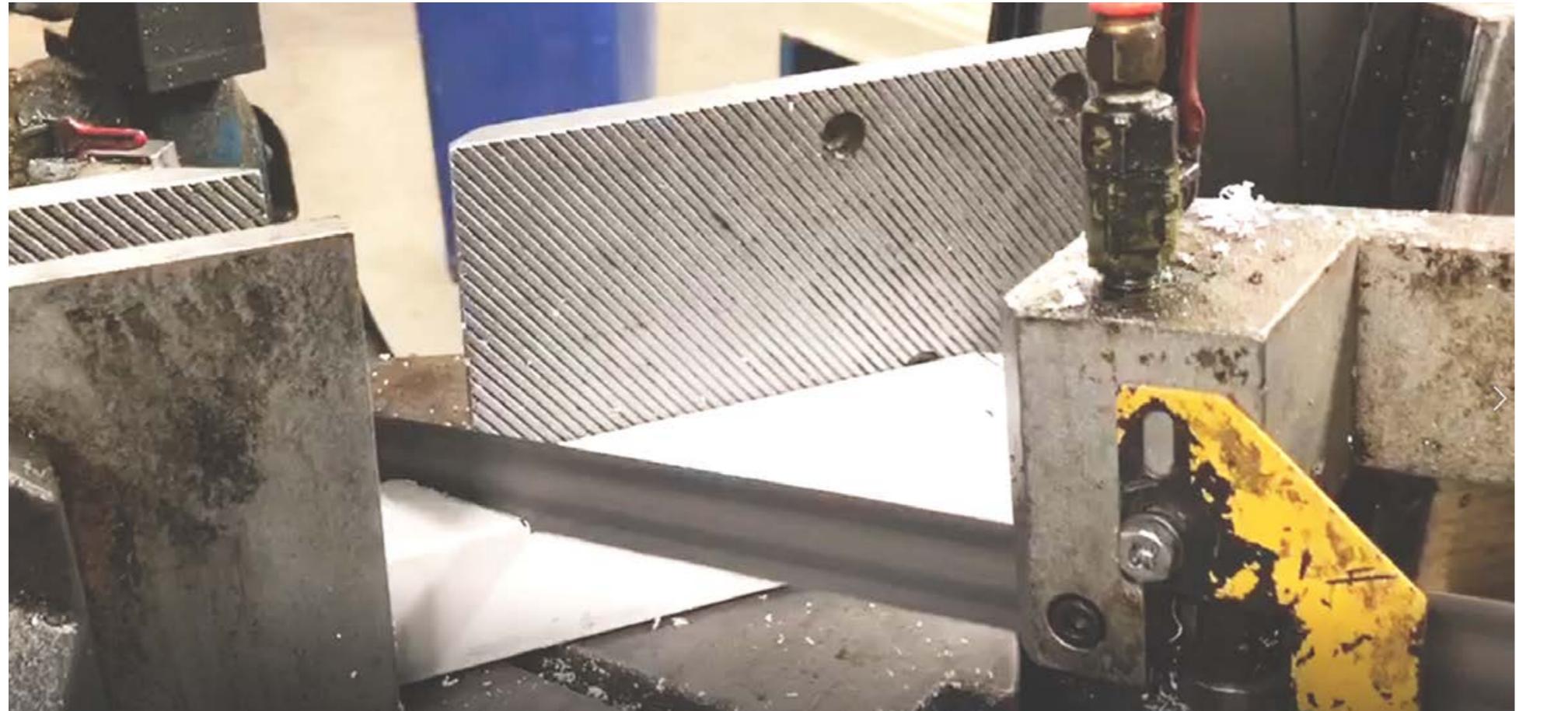
# [ FABRICATION ]

## Material Research



## [ FABRICATION ]

### Analog Fabrication



Both black and white plastic tubes are cut into pieces with angles with the machine.  
The holes are drill with milling machine in both sides of some of the tubes.



## [ FABRICATION ]

Physical Model Making



Single Unit Connection

Insert the Basic Elements

Connecting the Basement

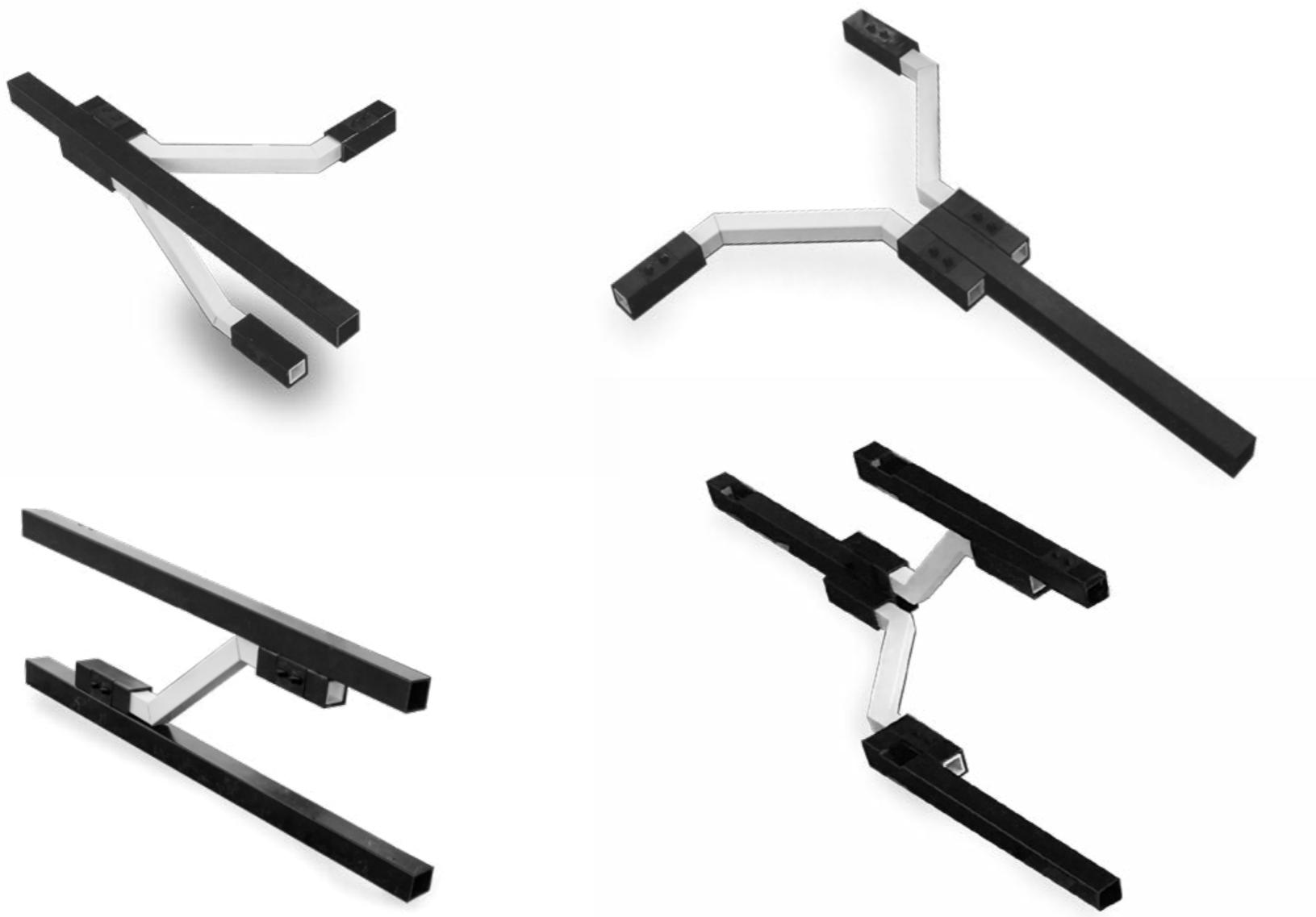
Hanging Up the Basement

Connecting the Column

Adjusting the Structure

## [ FABRICATION ]

### Physical Model



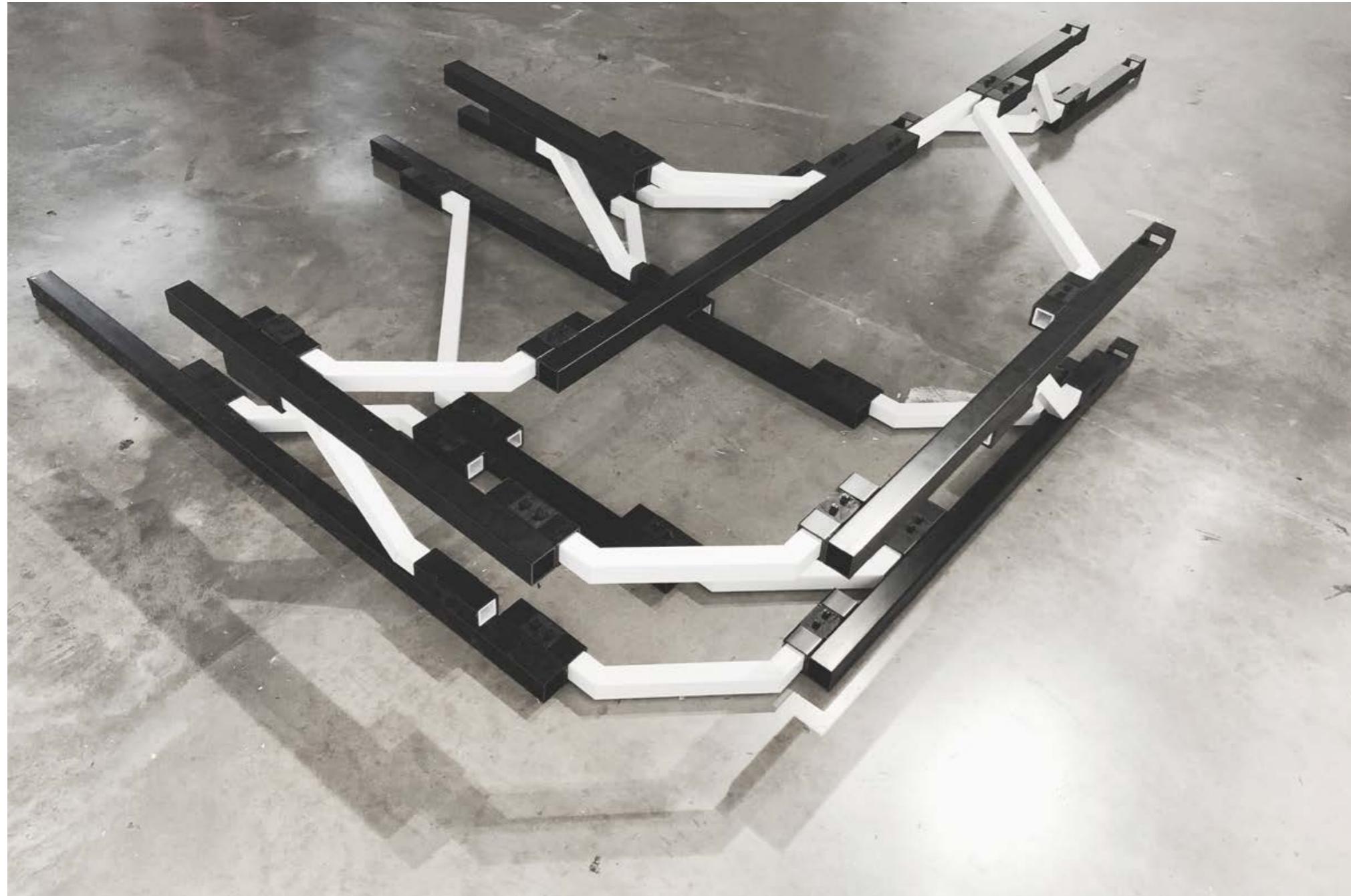
The physical model of some connections of black pipes with white ones.  
The final model is combined by the existing connections.



Plan of physical model

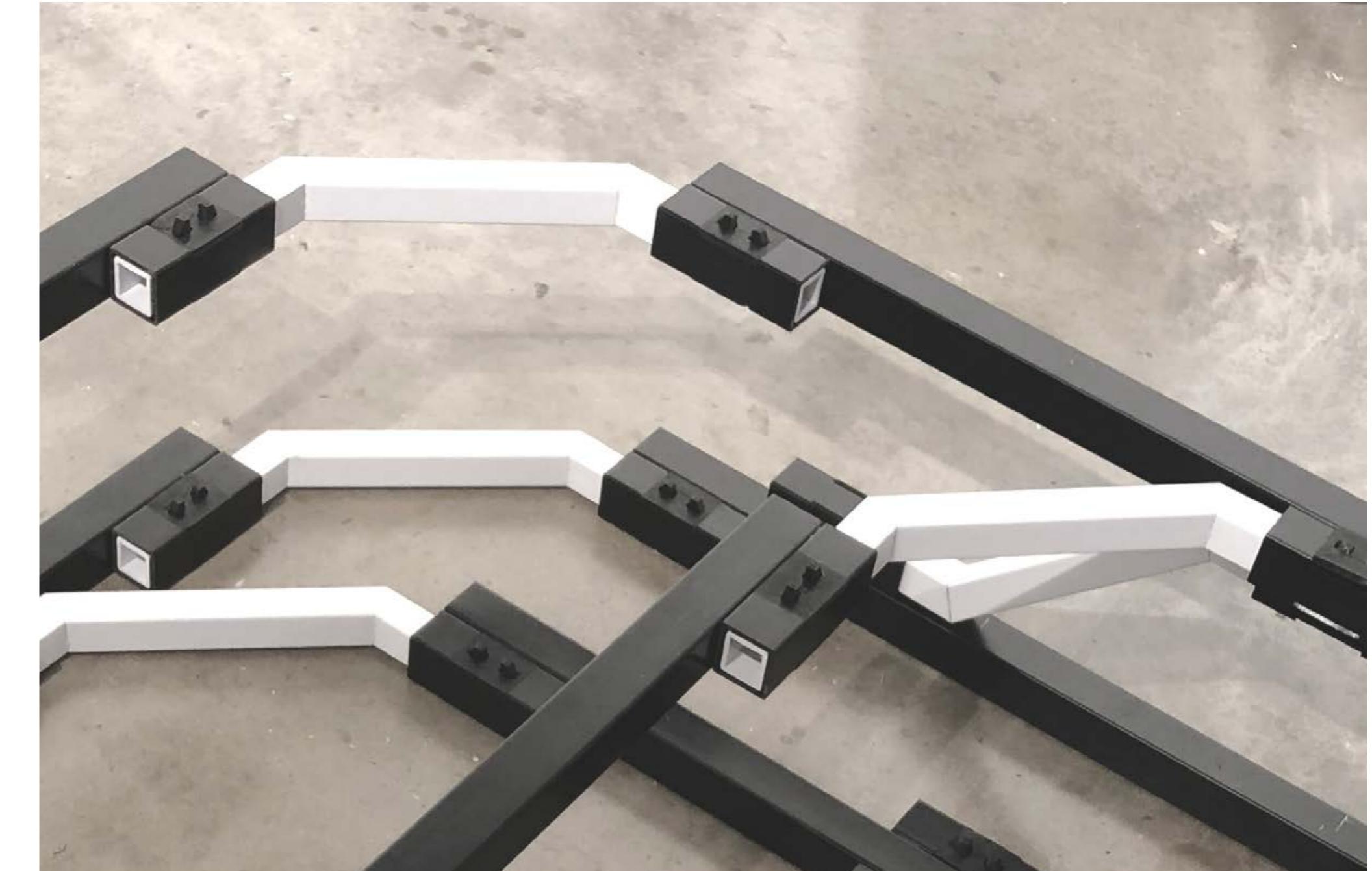
## [ FABRICATION ]

Physical Model



Physical model

42



Detail of connection of tubes with joints

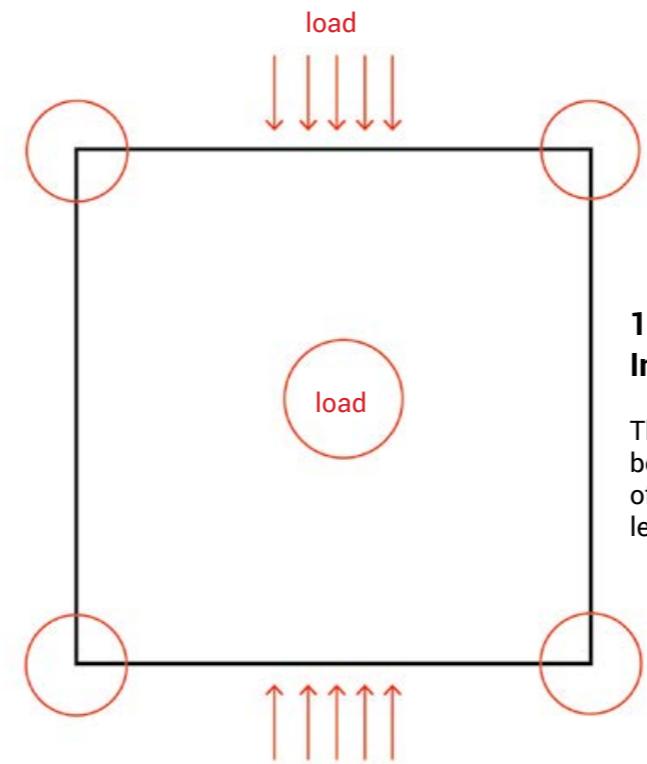
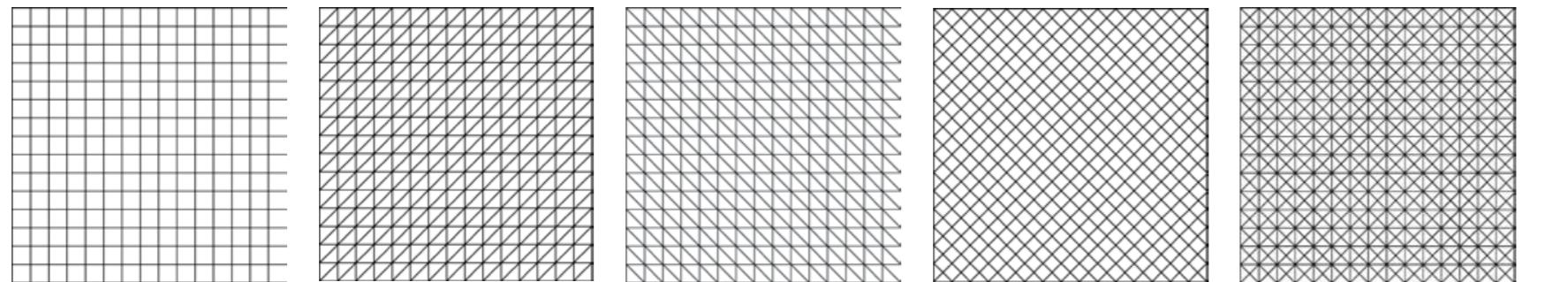
43

# [ AGGREGATION ]

## Aggregation Strategy

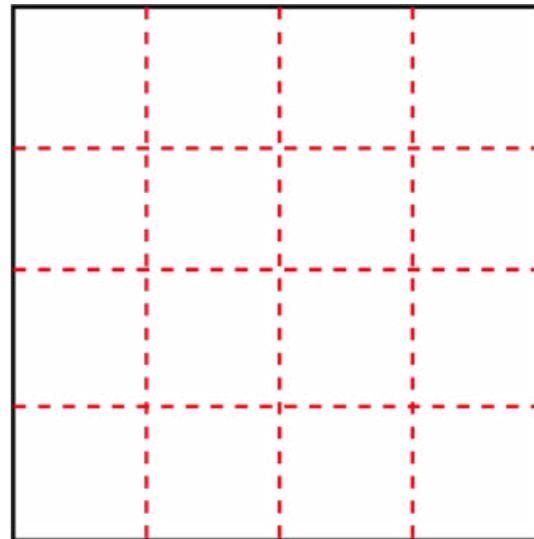
From initial design and development stages, aggregation methods have changed from different stress level elements to the same components with different directions.

In the final design stage, the research is based on the simplified units with directions to improve the efficiency of materials, but the structure still keep the assembly feasibility.



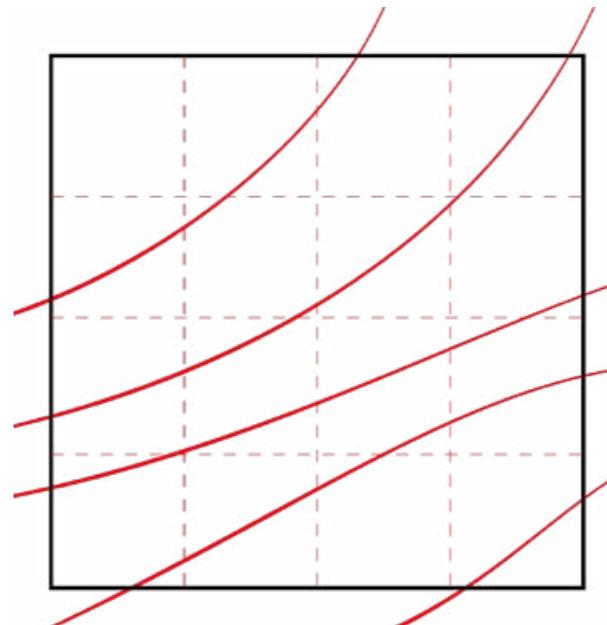
### 1. Basic Site with Initial Information

The size of the square to be built and the condition of the structure should be learned first.



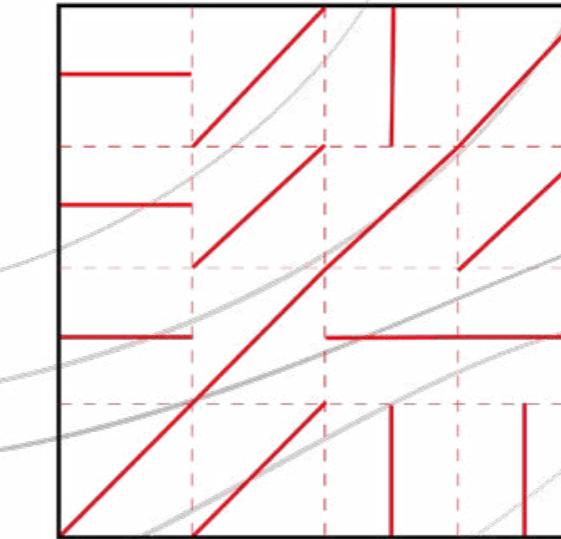
### 2. Grid Generation

In 2D condition, it is the grid generation in the space, and in 3D volume, it is voxelization of the structure.



### 3. Shear Forces & Stress Tensor (FEA)

Analysis of the stress forces of the site . The curves are showing the forces directions.

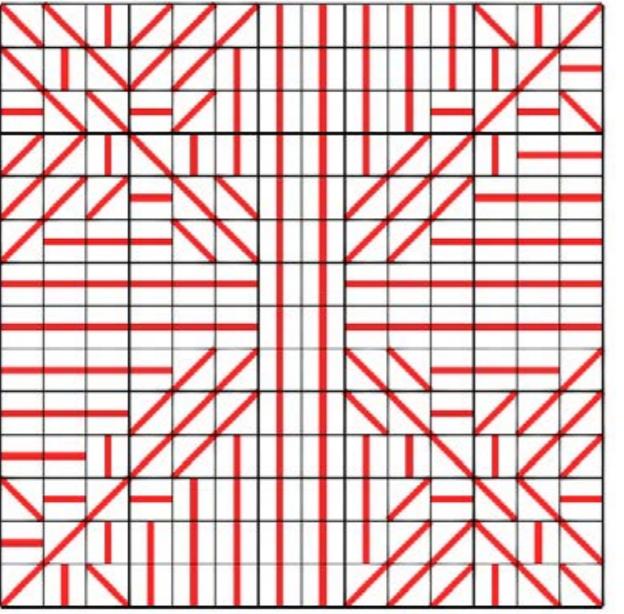
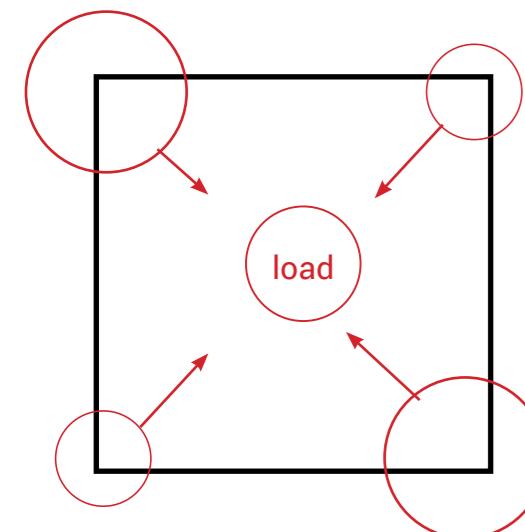


### 4. Discrete Direction

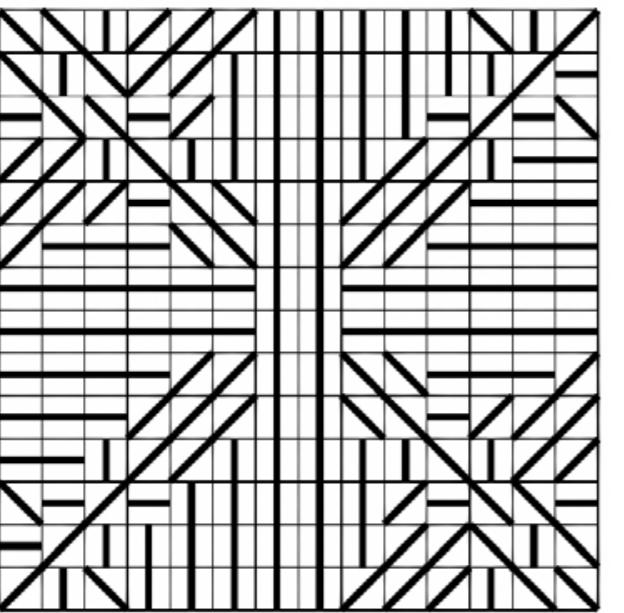
The data of each component is discretized in each grid and the discrete elements have finite directions with real directional elements.

## [ AGGREGATION ]

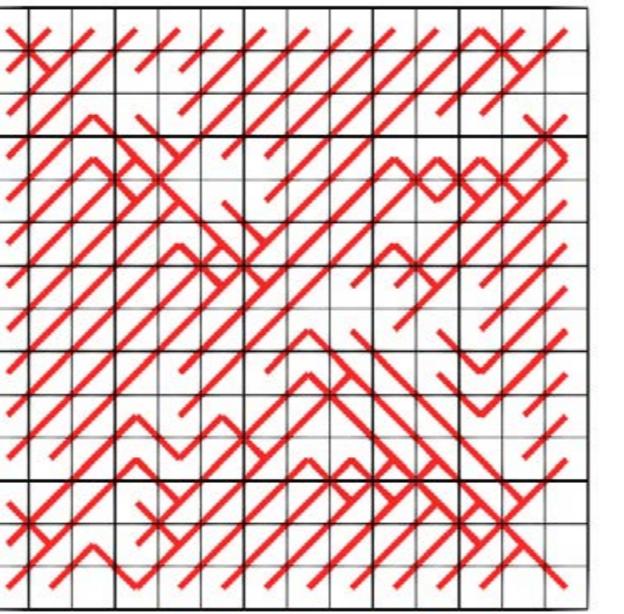
Stress Analysis in 2D



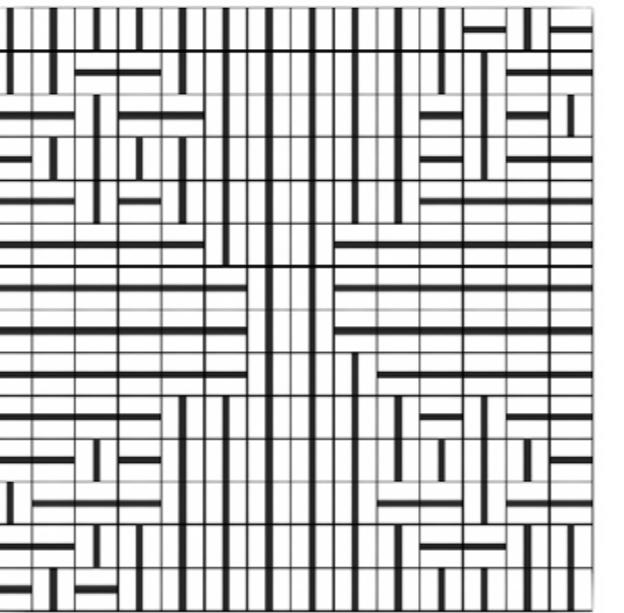
Shear force resistance in 4 directions



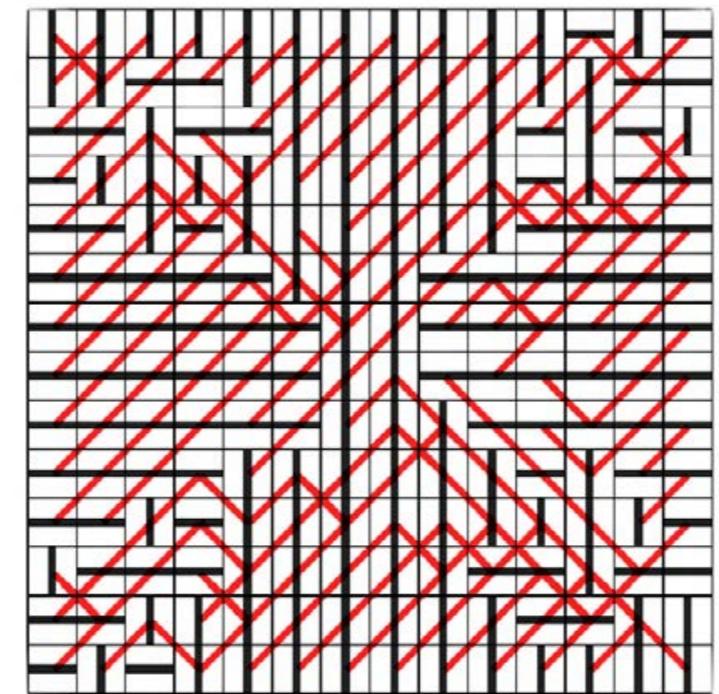
Stress Tensor in 4 directions



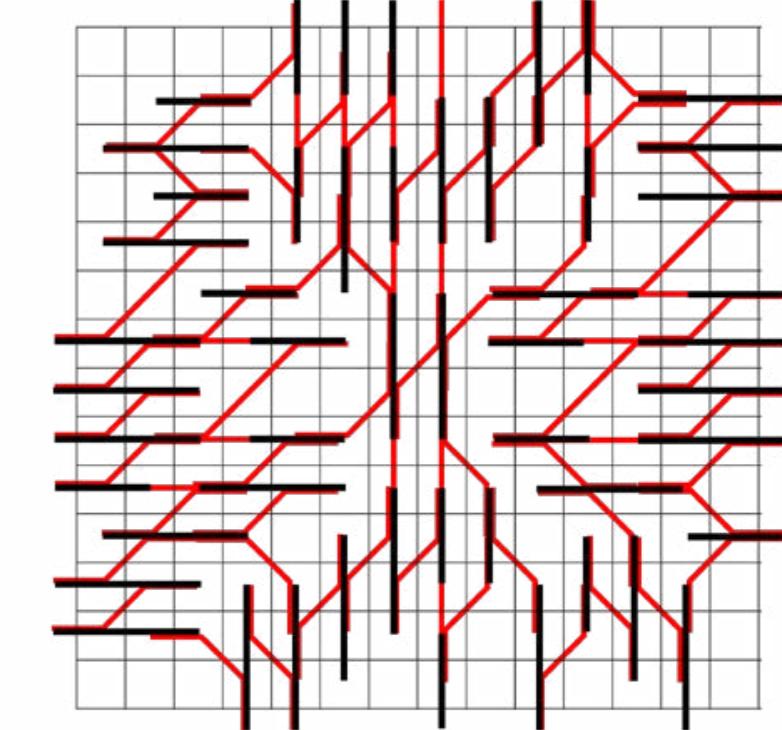
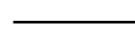
Shear force resistance in 2 diagonal directions



Stress Tensor in 2 straight directions



Stress-Shear forces 2D pattern



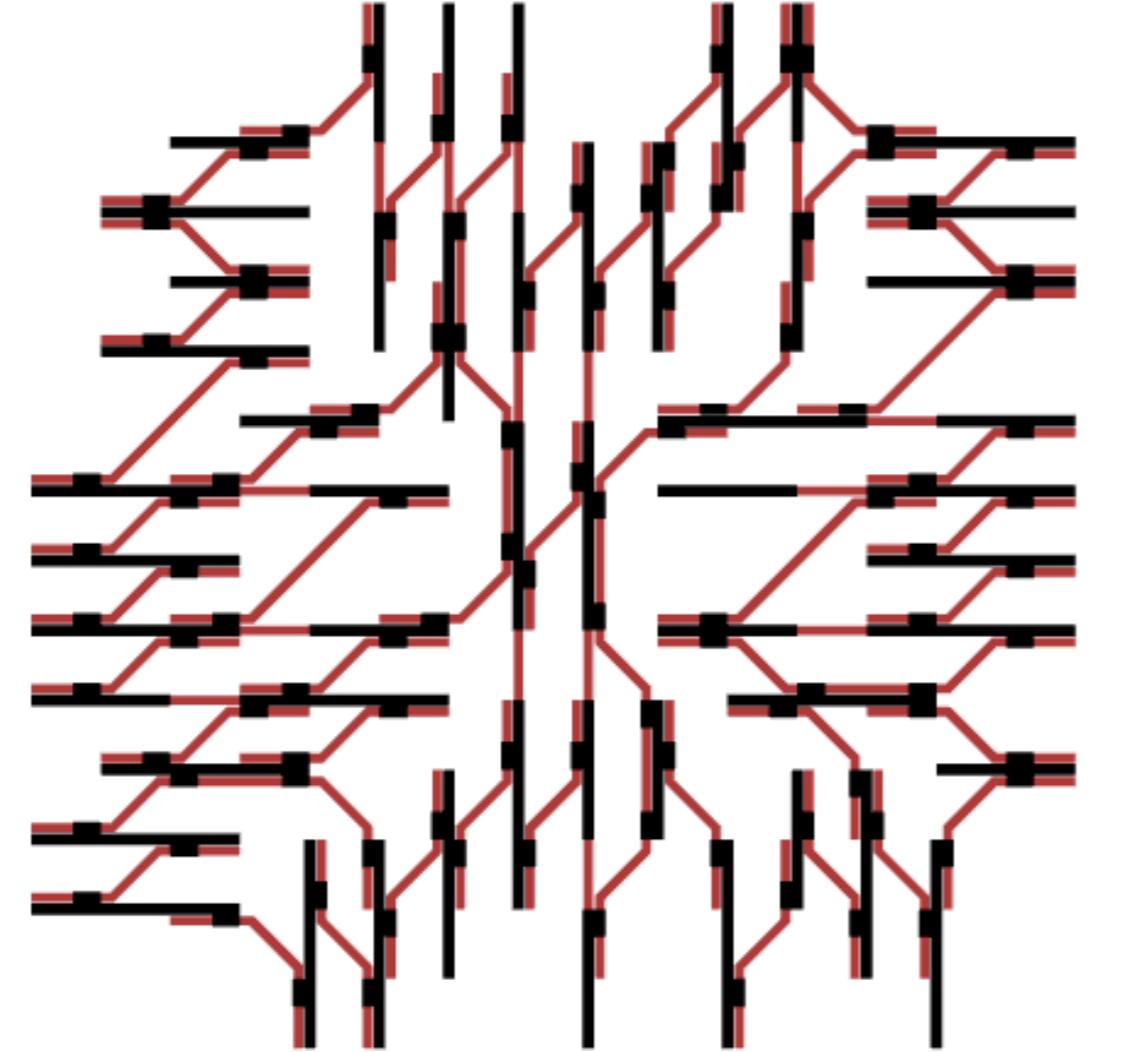
Discrete bars based on the stress analysis

# [ AGGREGATION ]

2D Pattern Generation Simulation

The pattern simulation of the pattern generation is following three steps of simulation:  
Firstly, in the centre of the plane pattern, the thicker pipe is generated based on the stress tensor. Then following the basic rule of the combination of discrete elements, the thinner pipes are connected based on the shear force resistance information.

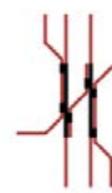
Finally, the connected black thicker bars are generated. This loop will continue until the pipes fill the bound of the pattern.



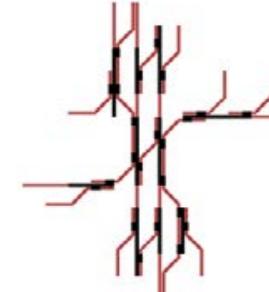
Iteration 1



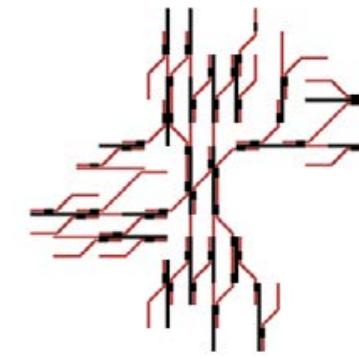
Iteration 2



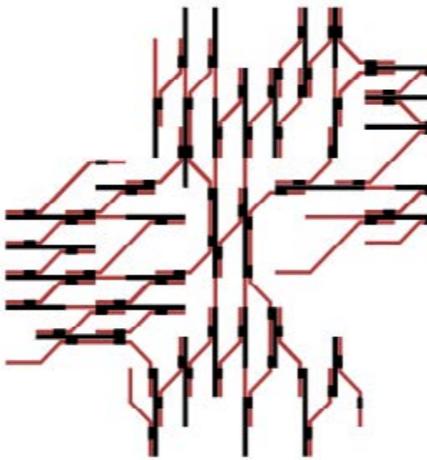
Iteration 3



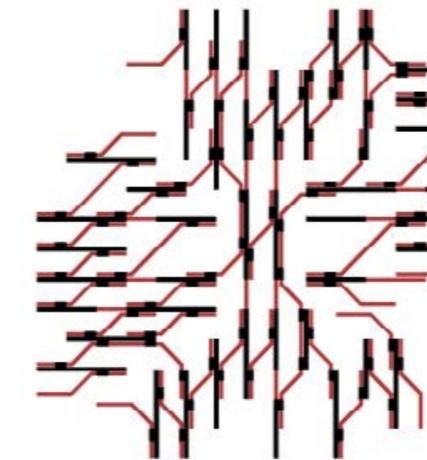
Iteration 4



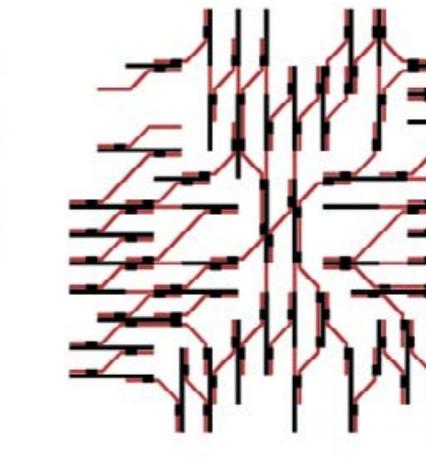
Iteration 5



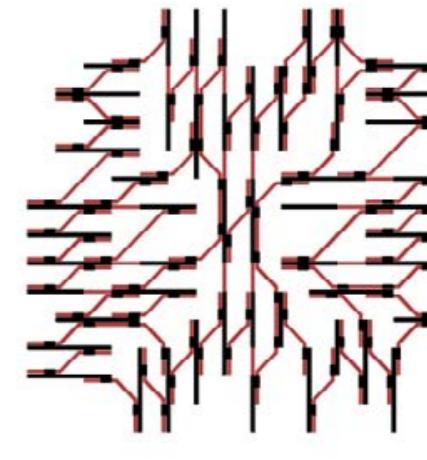
Iteration 6



Iteration 7

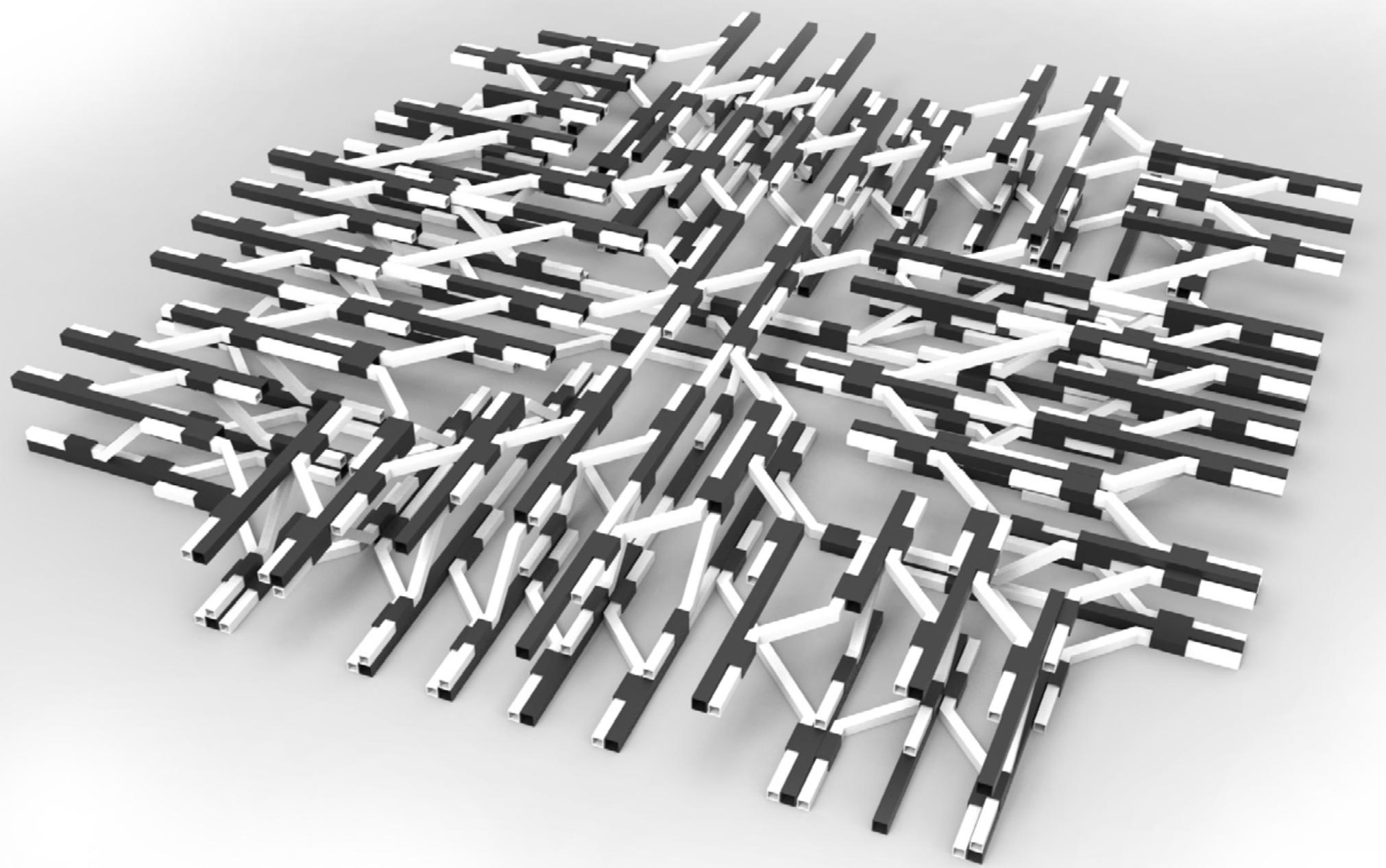
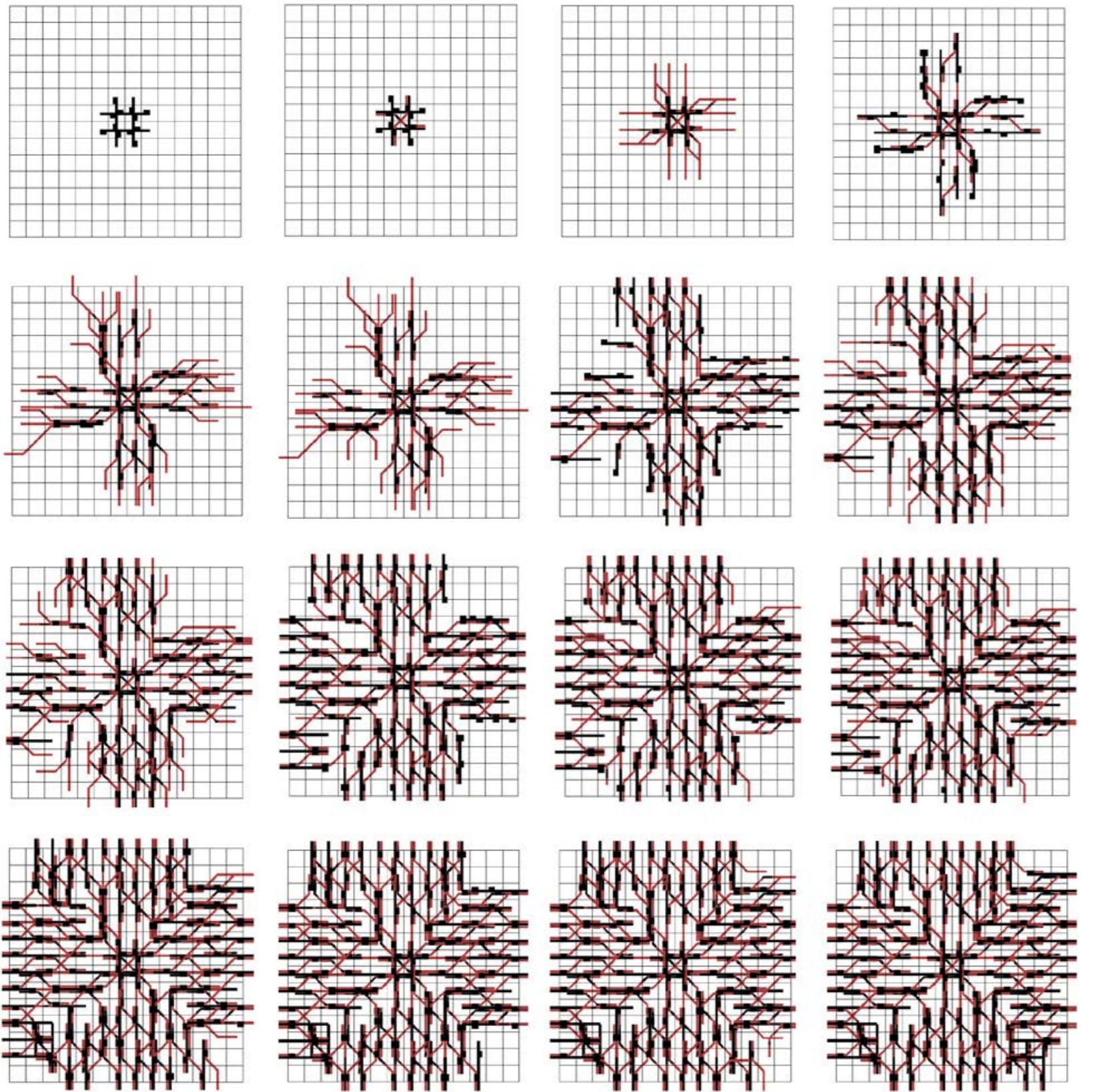


Iteration 8



## [ AGGREGATION ]

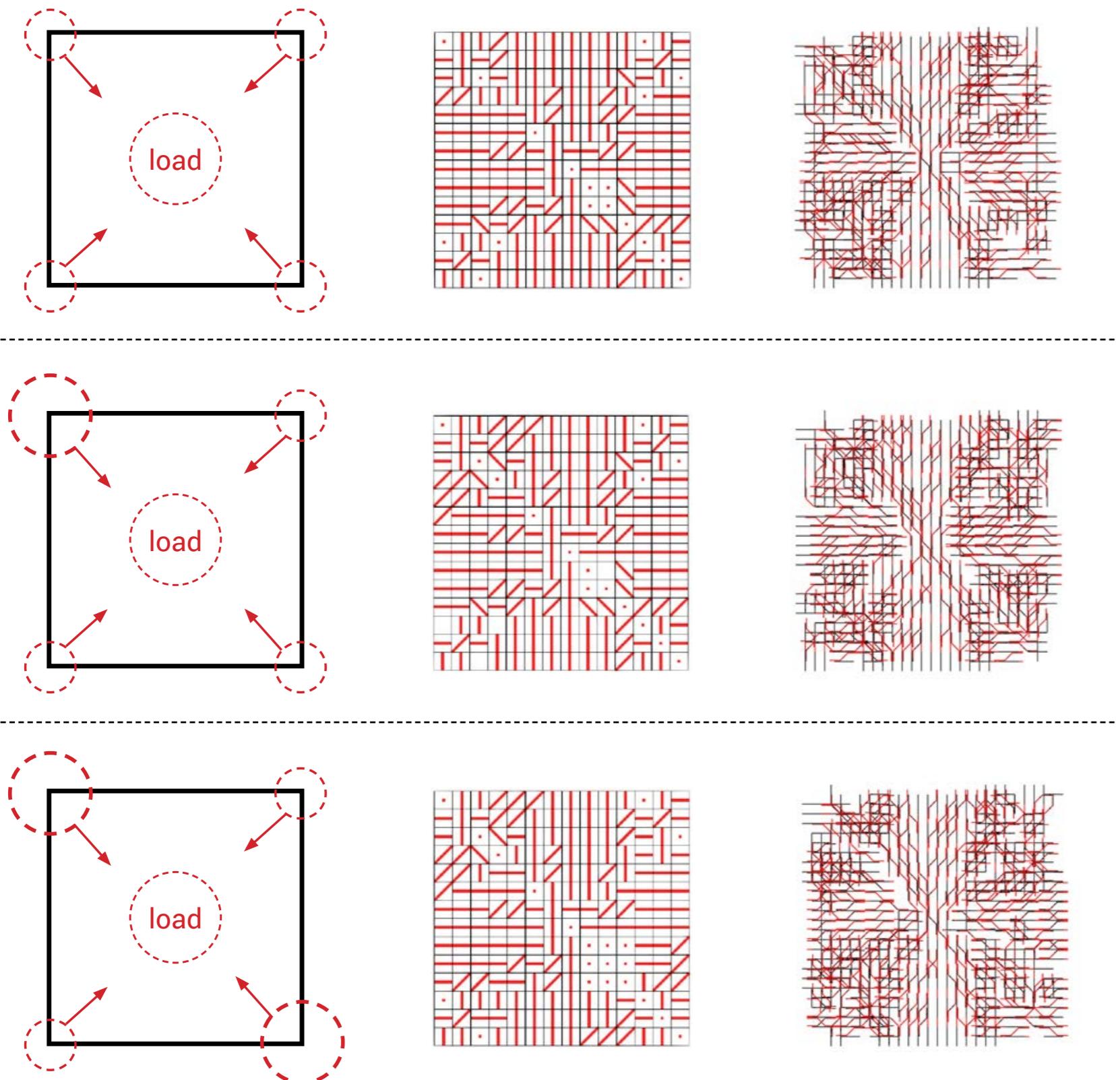
2D Pattern Generation Simulation



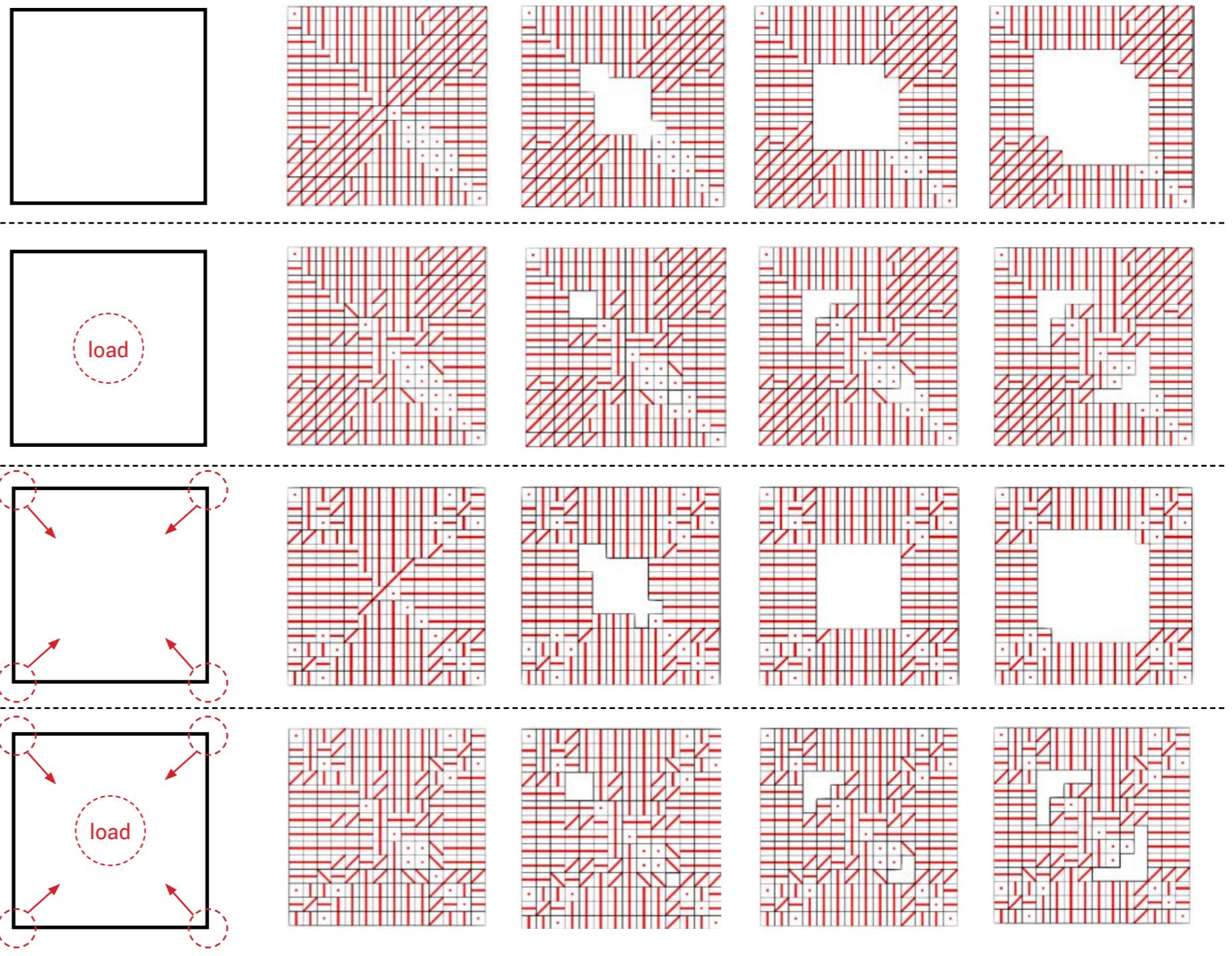
The aggregation of plane following  
the same method used in pattern  
simulation.

# [ AGGREGATION ]

## Patterns in Different Stress Conditions



Patterns with Topological Optimization



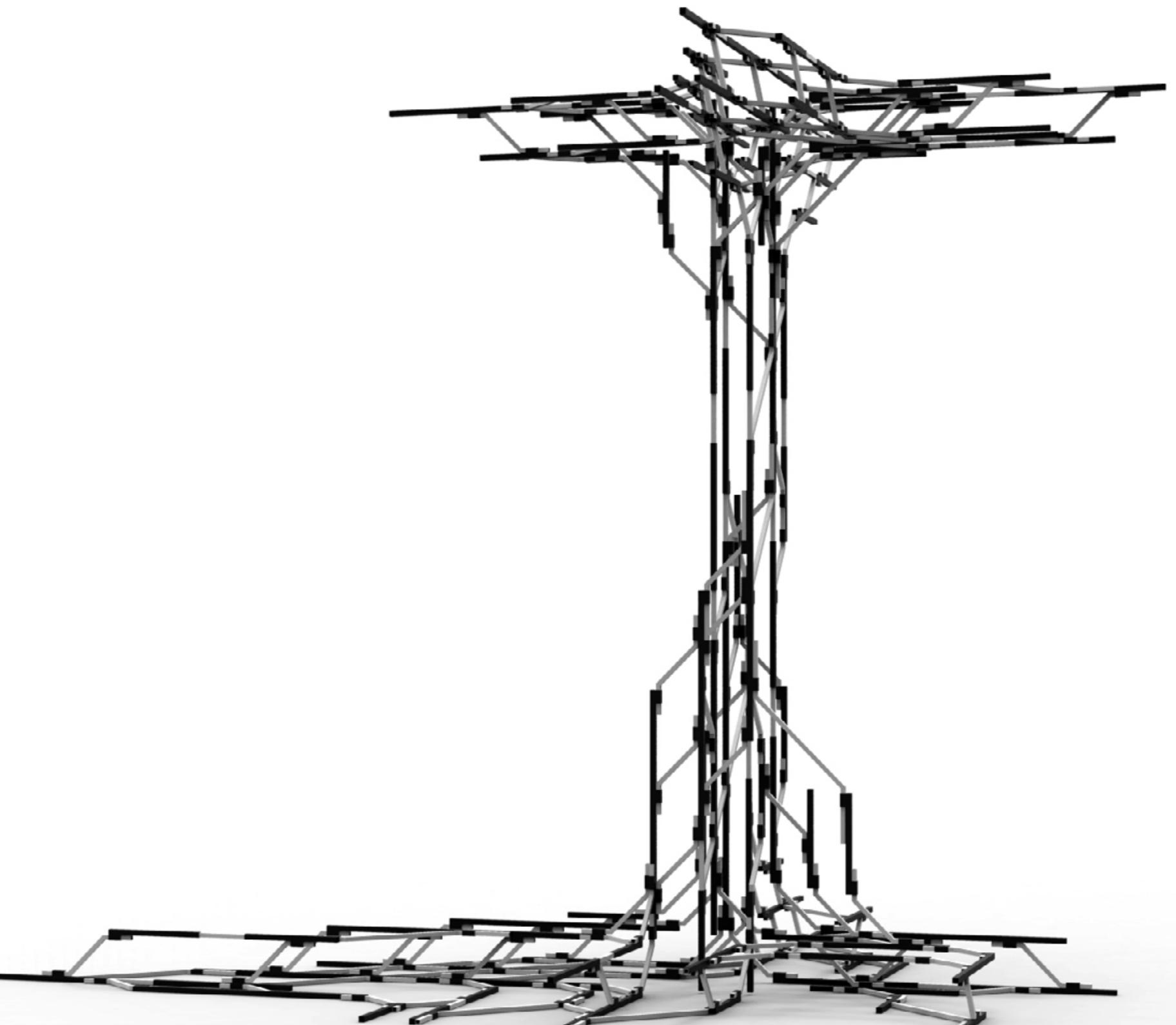
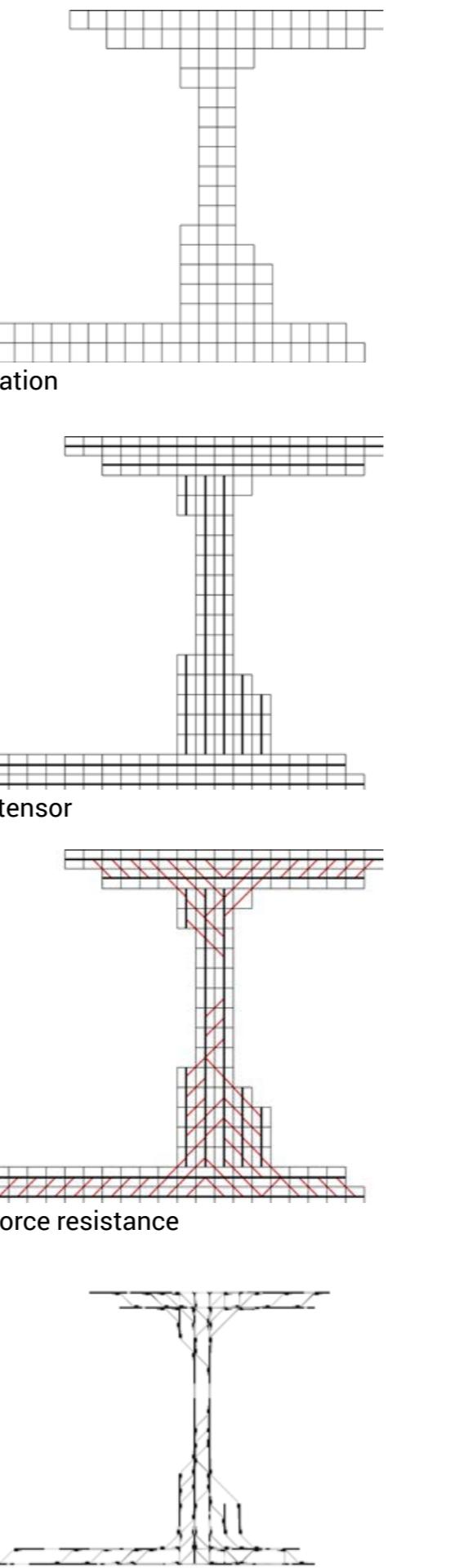
## [ AGGREGATION ]

### 3D Aggregation

When it comes to 3D aggregation, the assembly of bars are similar to the 2D pattern and planes. The difference of the aggregation is that the discrete elements have more directions.

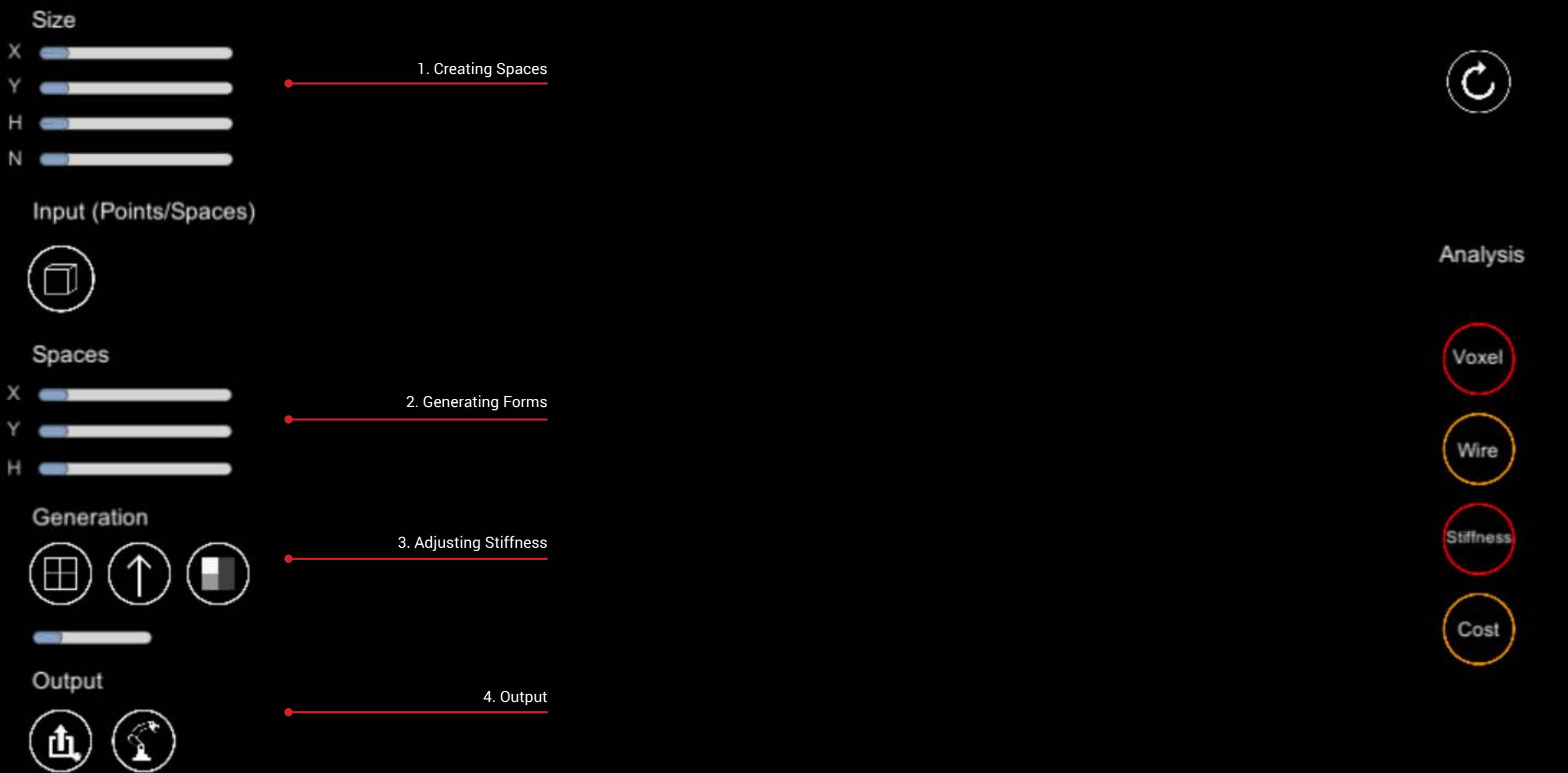
The left figures show the process of simulation of a 3D structure, first step is still the voxelization based on finite element analysis, and then the stress tensor in three dimensions will be calculated and discretized into 3 straight directions.

Following the same method, the resistance of shear forces will also be operated. Finally the data will transform into the assembly stage with original rules to assemble the real structure.



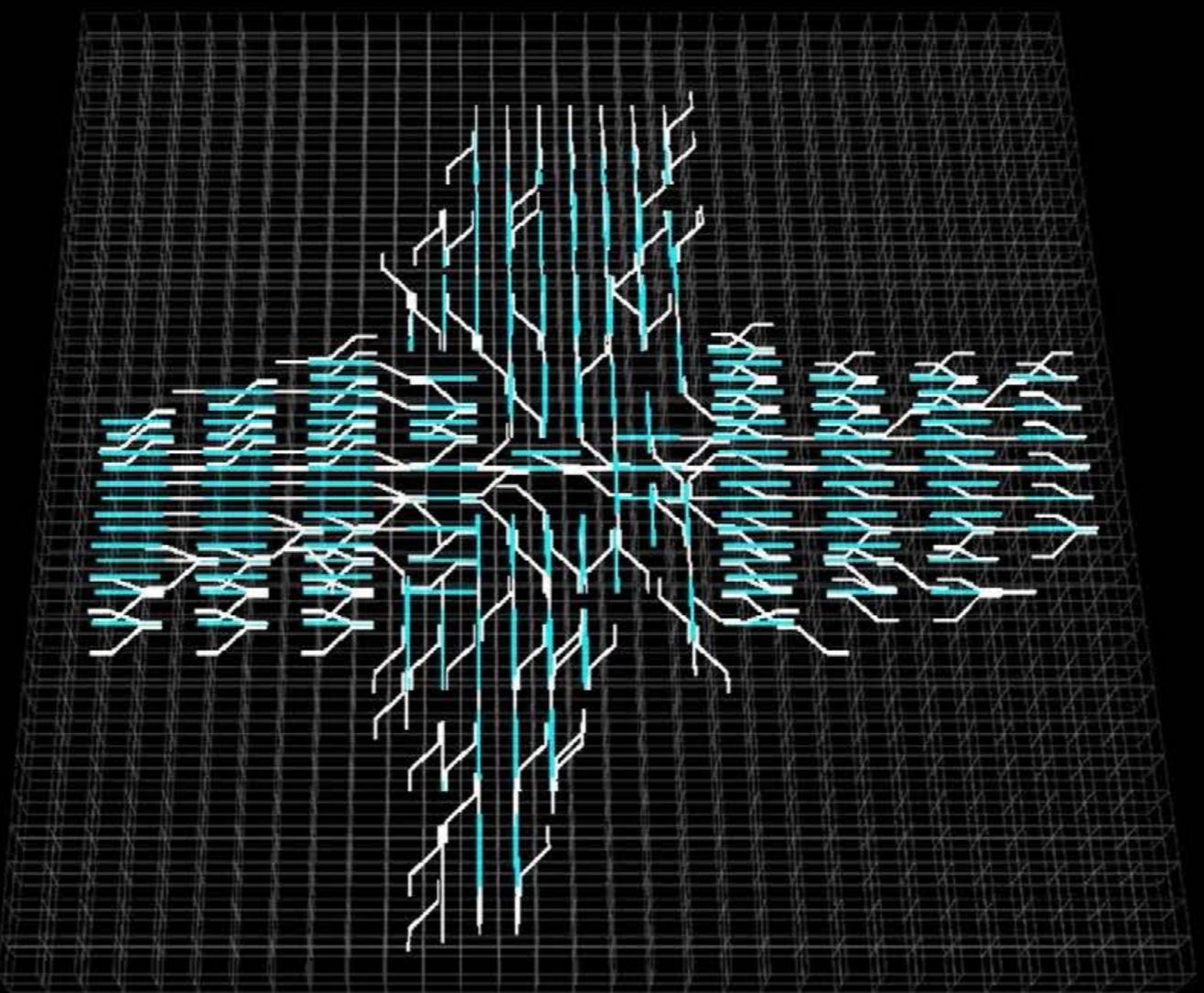
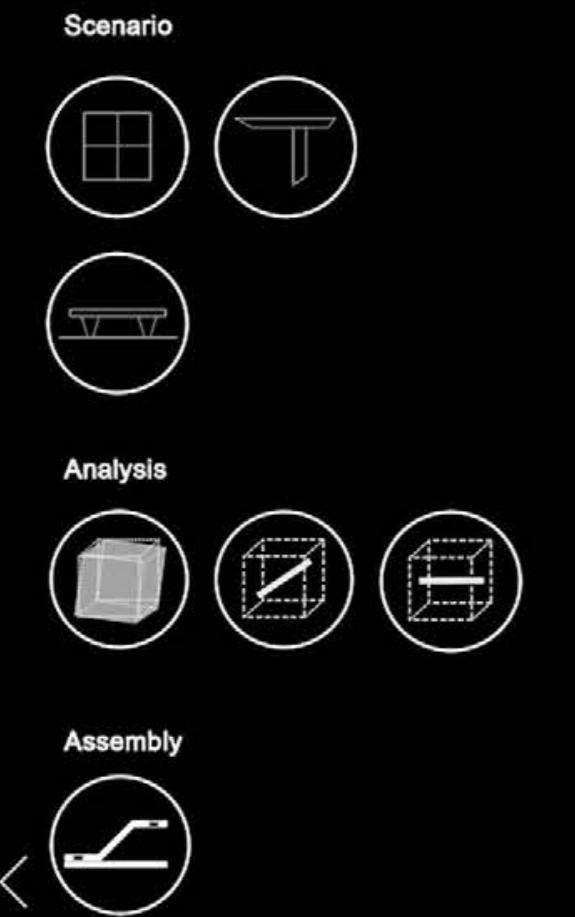
# [ AGGREGATION ]

Interface Design



# [ AGGREGATION ]

Simulation



TYPE A  
112

TYPE B  
100

TYPE C  
11

TYPE D  
158



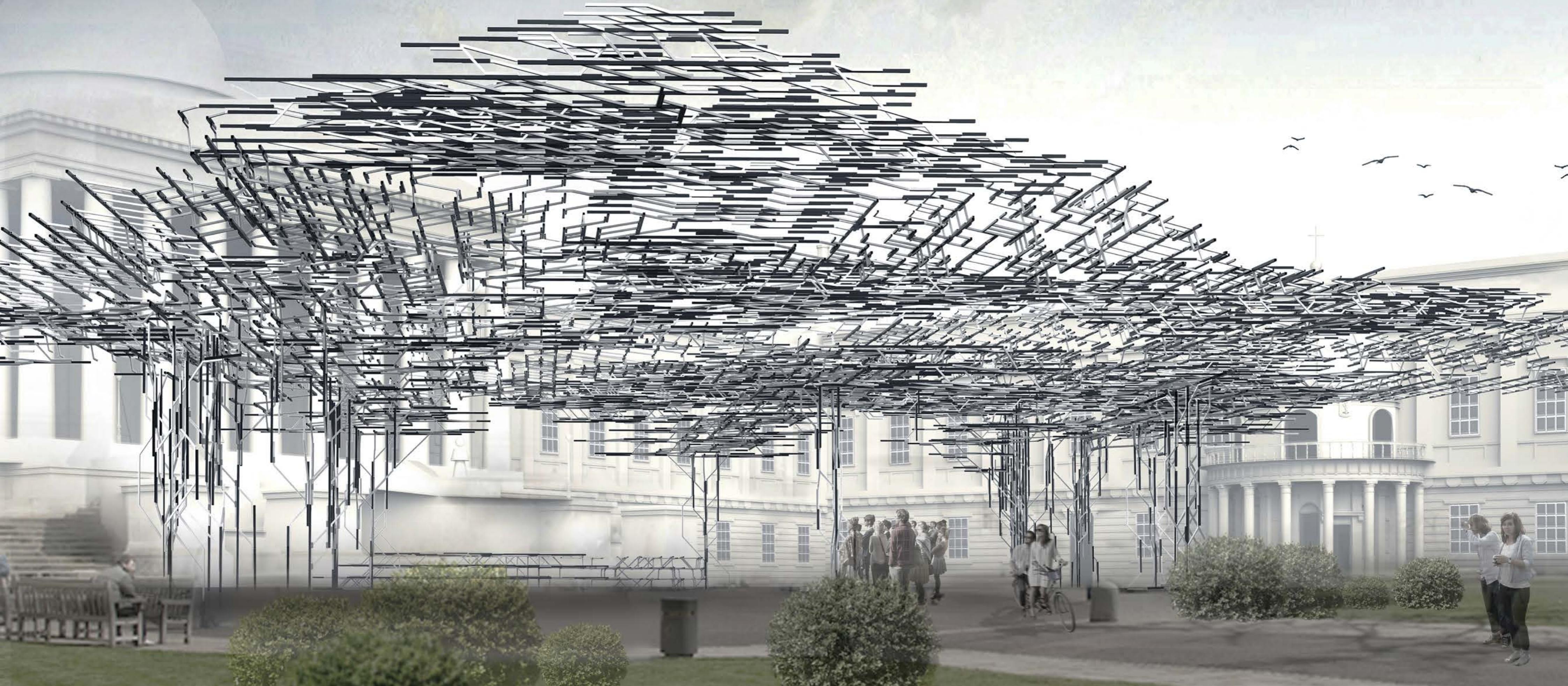
# [ RENDERING ]

Design in Architectural Scale



# [ RENDERING ]

Design in Architectural Scale





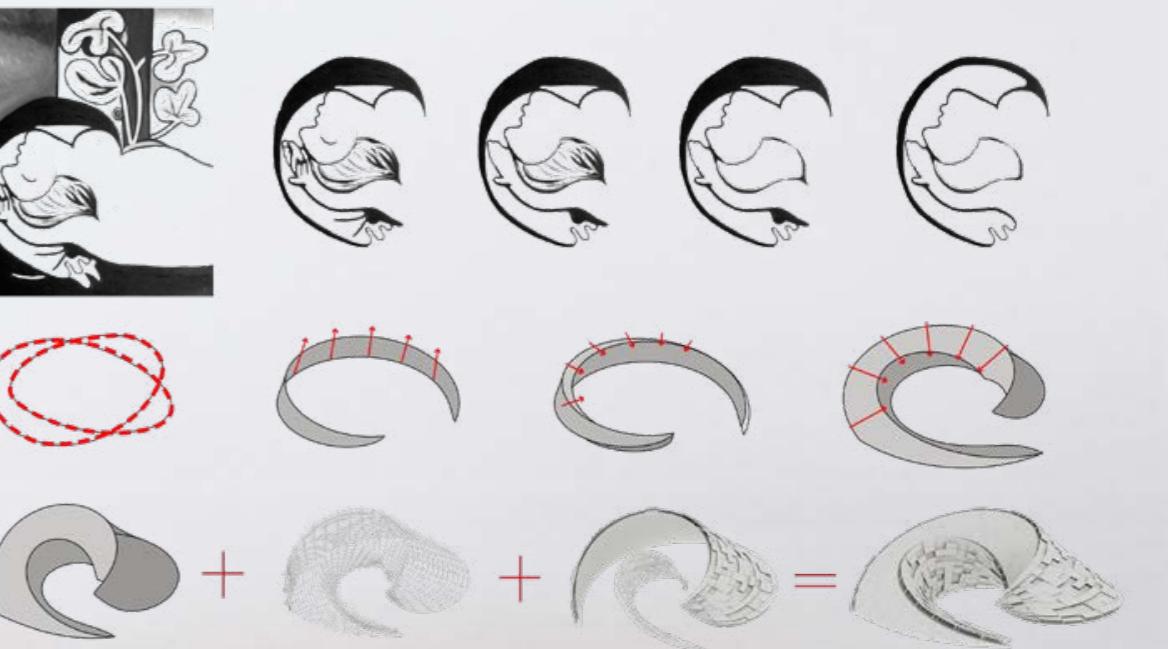
# 2 ART MUSEUM

Self Work / 2016.11

The Art Museum is a conceptual design based on deconstruction.

Inspiration from Pablo Picasso's "Nude in a Black Armchair", as one of the representative works of deconstruction. The whole picture is filled with Round, Square and Angle stability and instability. Cubist paintings of crushing, parsing, restructuring performance characteristics of deconstruction architecture.

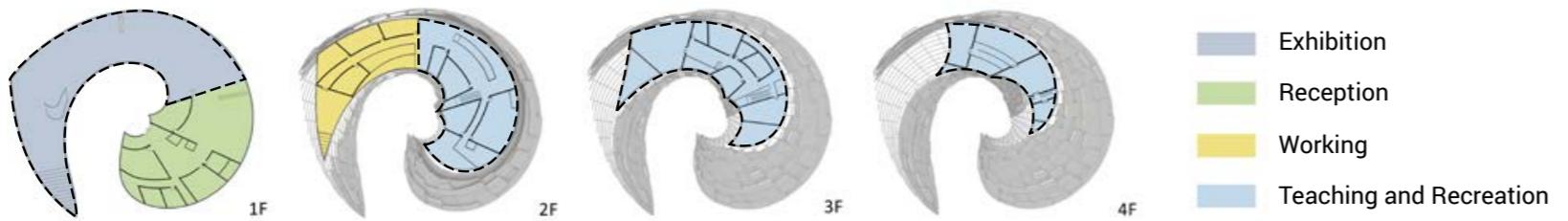
Using two dynamic instability lines to superpose, intersect, repetitive, expand and distort to get the prototype of the building.





#### FUNCTION ANALYSIS

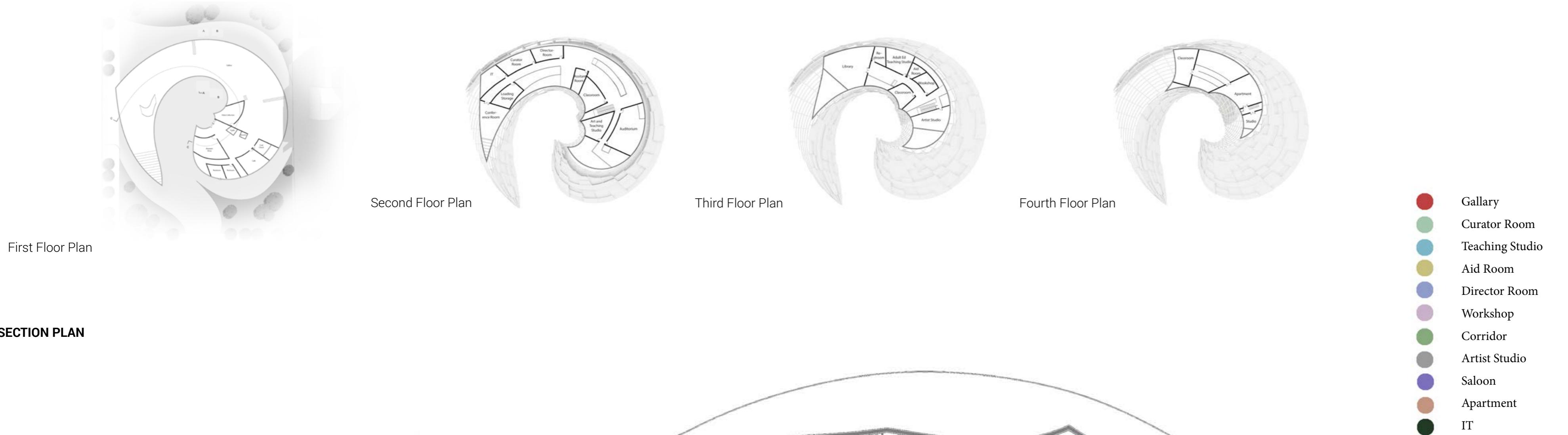
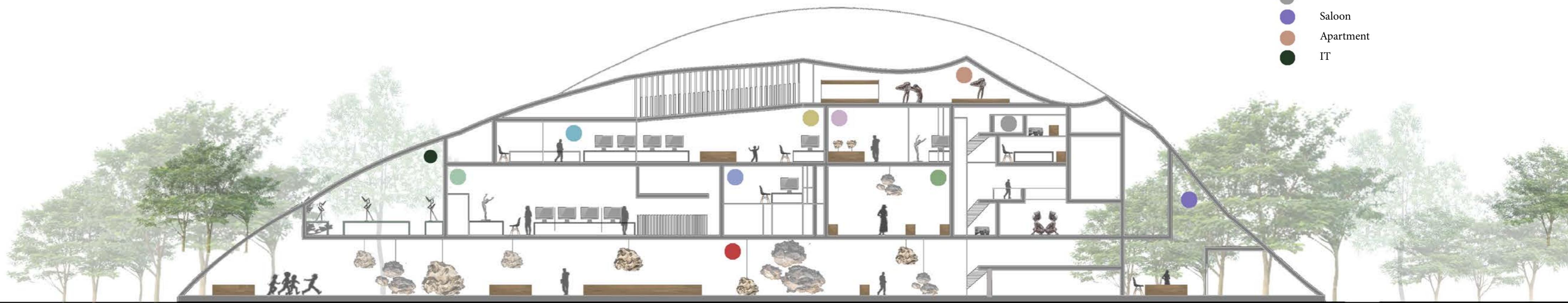
The interior space uses the Building Deconstruction technique, through the connection and staggered floors between the squares, each functional space has its own atmosphere.



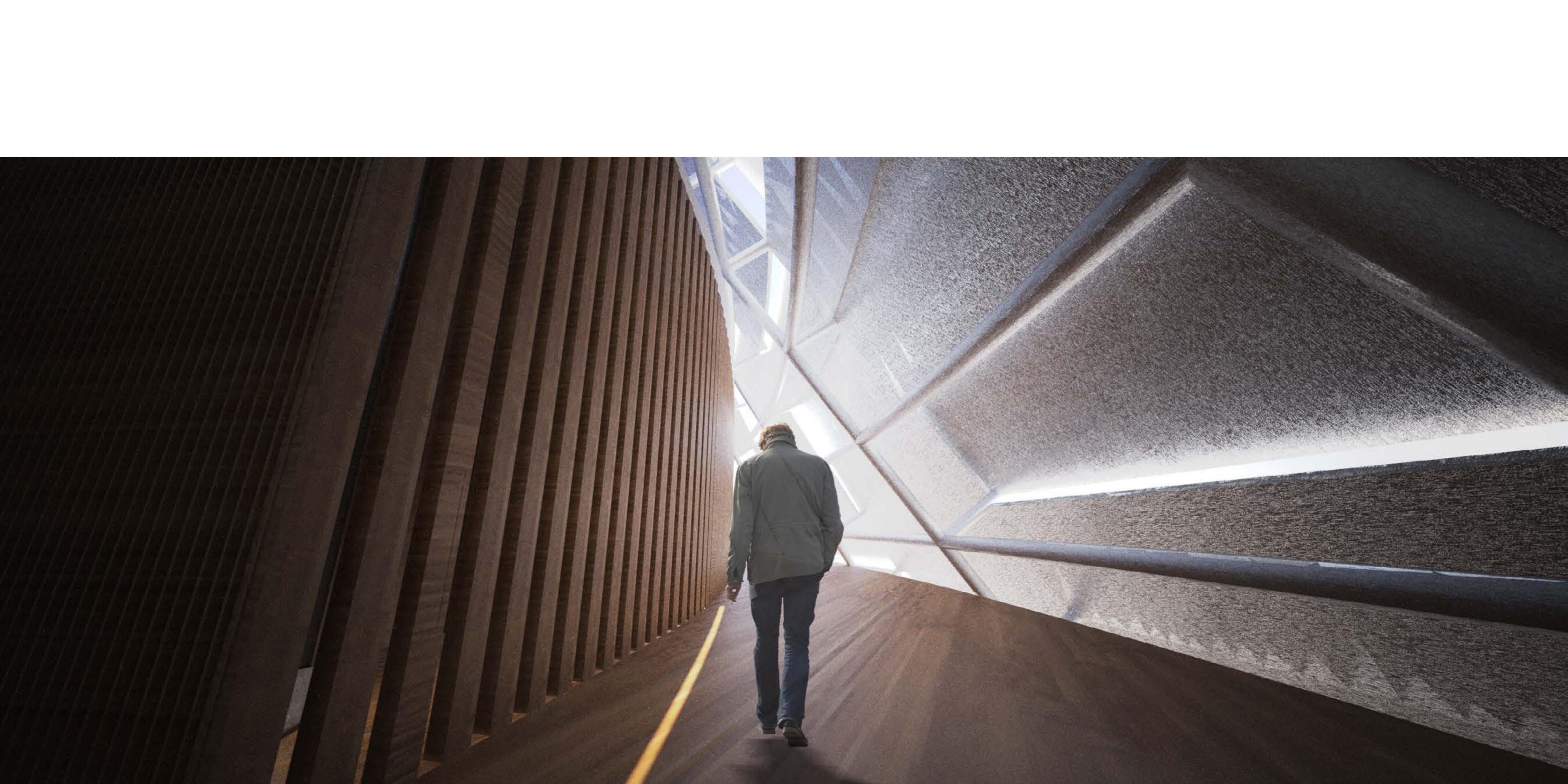
#### ROUTE ANALYSIS

Trying to start from the irregular plane, breaking the traditional approach, in order to use the stairs and fire channel to connect each function, making the space and dimension decomposed.



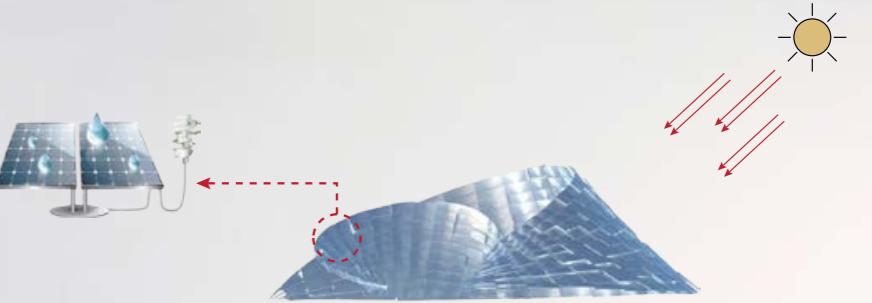
**PLAN****SECTION PLAN**







The solar heat absorbing plate can turn the heat energy into electrical energy.



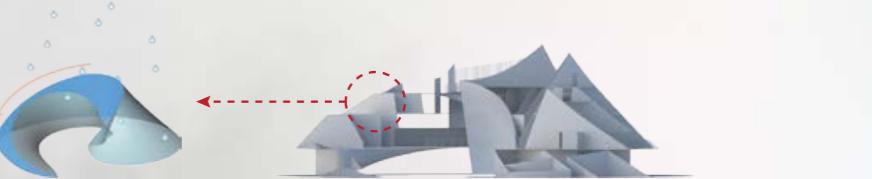
Building skin material

It is the truss structure to support the cambered surface structure of the building. A truss frame is formed by adjusting the joint angles between the components.



Building structure

The top surface of the arc-shaped structure form a nature rainwater collection system, making the water from the height directly into the lower.



Rainwater collection system

# 3 URBAN RENEWAL

Self Work / 2016.05



## RESEARCH



Passerby/Tourist



Workers



Restaurateur



Tranter



Residents

The street atmosphere has Chengdu characteristics, the original form of the street should be retained. But the old and new buildings mixed, there is a bit chaos, so the environment should be improved.

The construction in the site is too old, so it is short of the necessary living facilities. Besides, there is a huge amount of fluid population, but it is lack of management, so that there is a bit confusing.

Current situation of restaurant is old and shabby, hoping that through the reconstruction can improve regional living environment, and provide public venues for community residents. While the catering functions should be preserved.

There is a good street atmosphere, but too crowded between houses. Hoping to have space for the activities. In addition to the surrounding high prices, they need parity convenience facilities.

Living conditions are convenient, can not give up the traditional mode of living. Hoping to have some reservations about the street atmosphere.

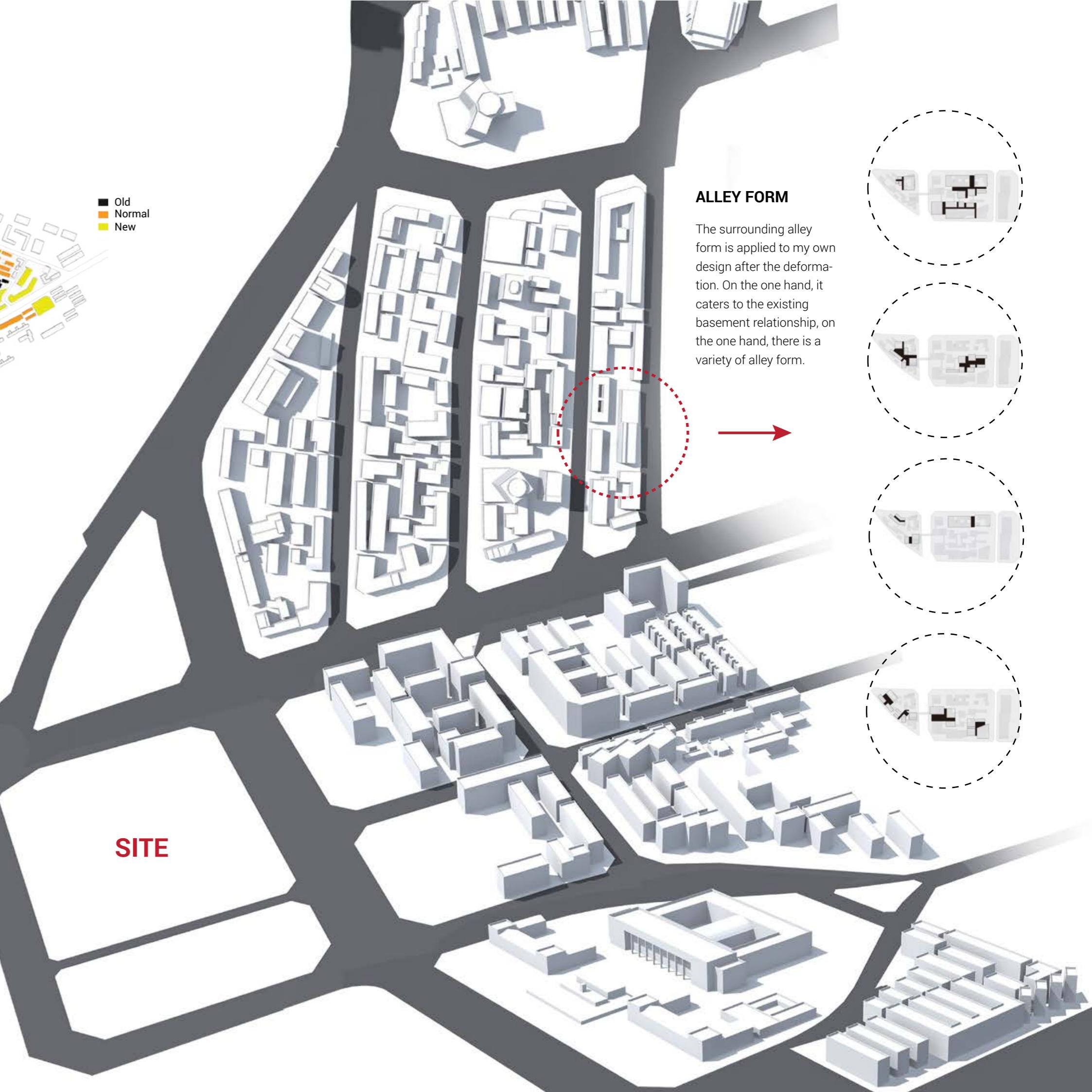
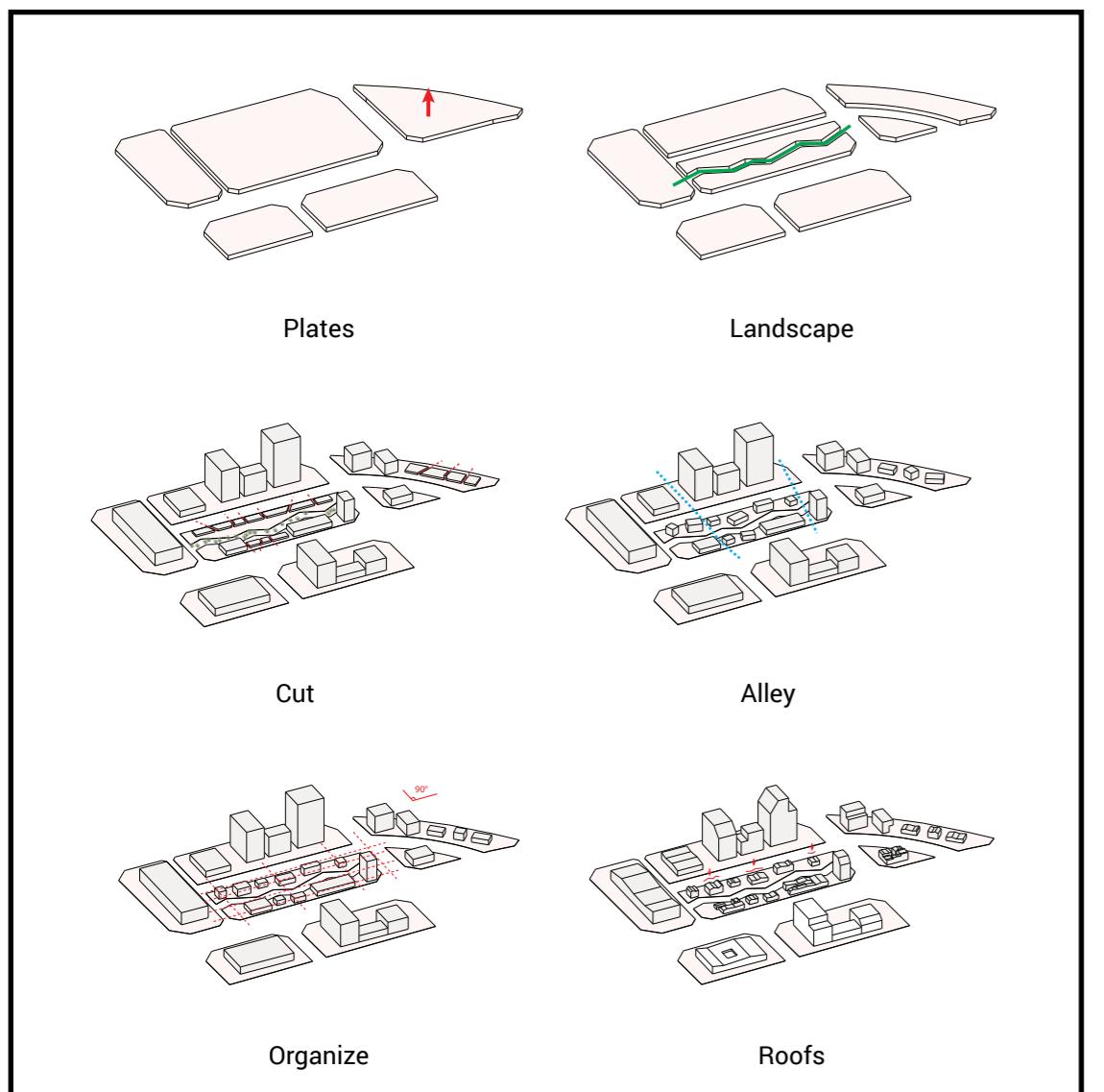


## RESEARCH

The site is located in the center of Chengdu. However there is a complex structure of the city features. Like various of functions, different kinds of people, and the old buildings are now mixed with the new ones. Therefore, I made a research to find the existing problems and people's demand of the city renewal.

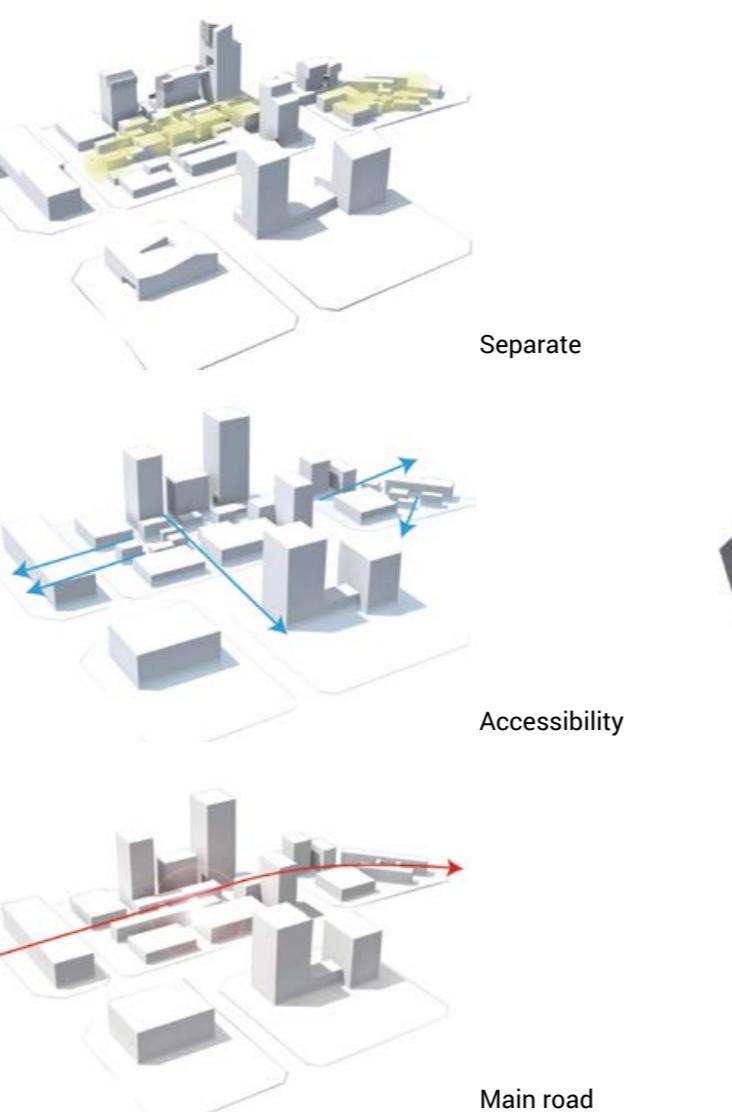
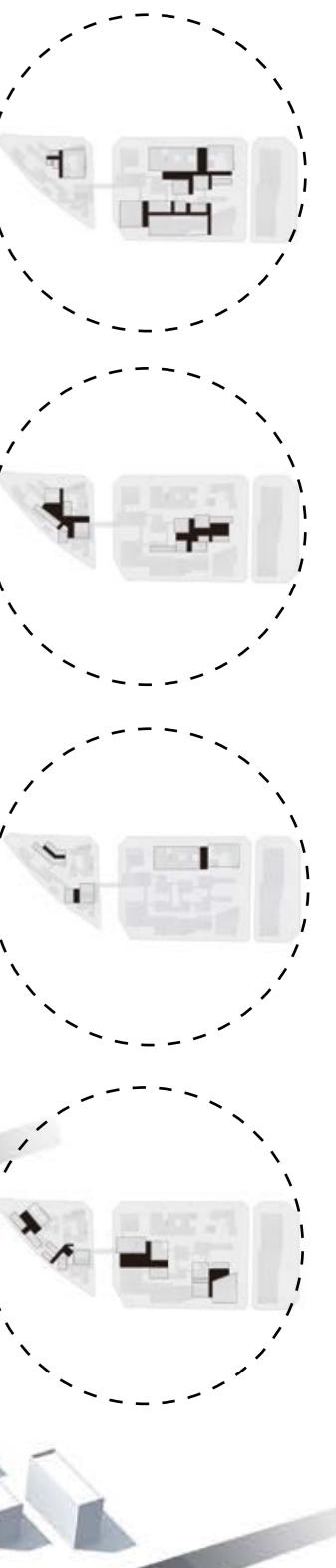


## GENERATE

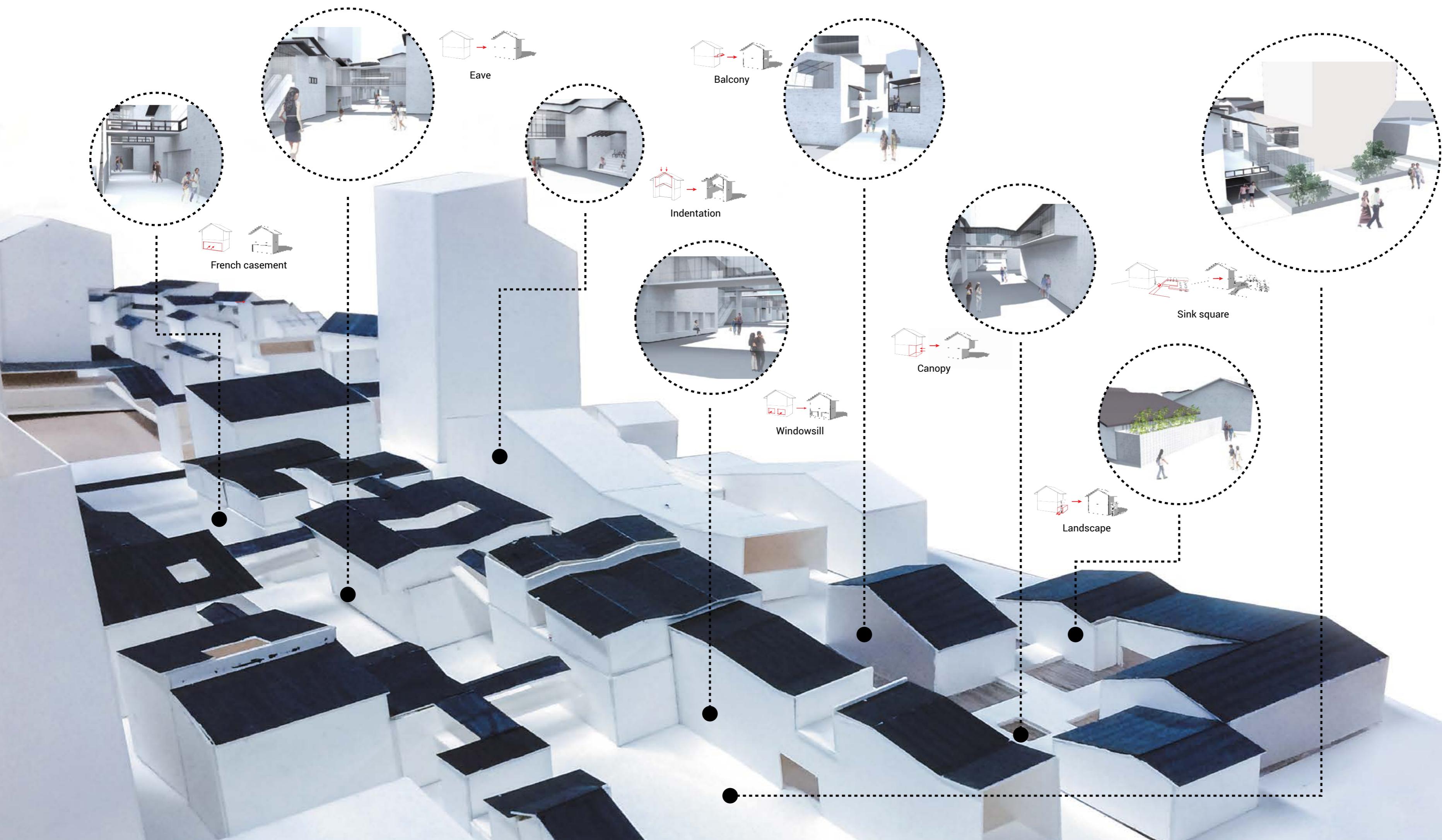


## ALLEY FORM

The surrounding alley form is applied to my own design after the deformation. On the one hand, it caters to the existing basement relationship, on the other hand, there is a variety of alley form.



## GRAY SPACE

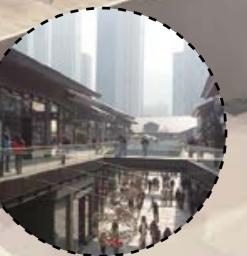
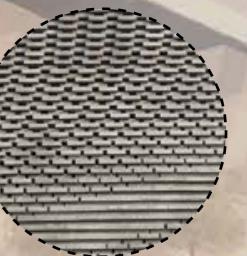


Gray space is one of the most important parts in this project. I created eight different types of gray spaces for all pedestrians. Each type provides a unique experience for people.



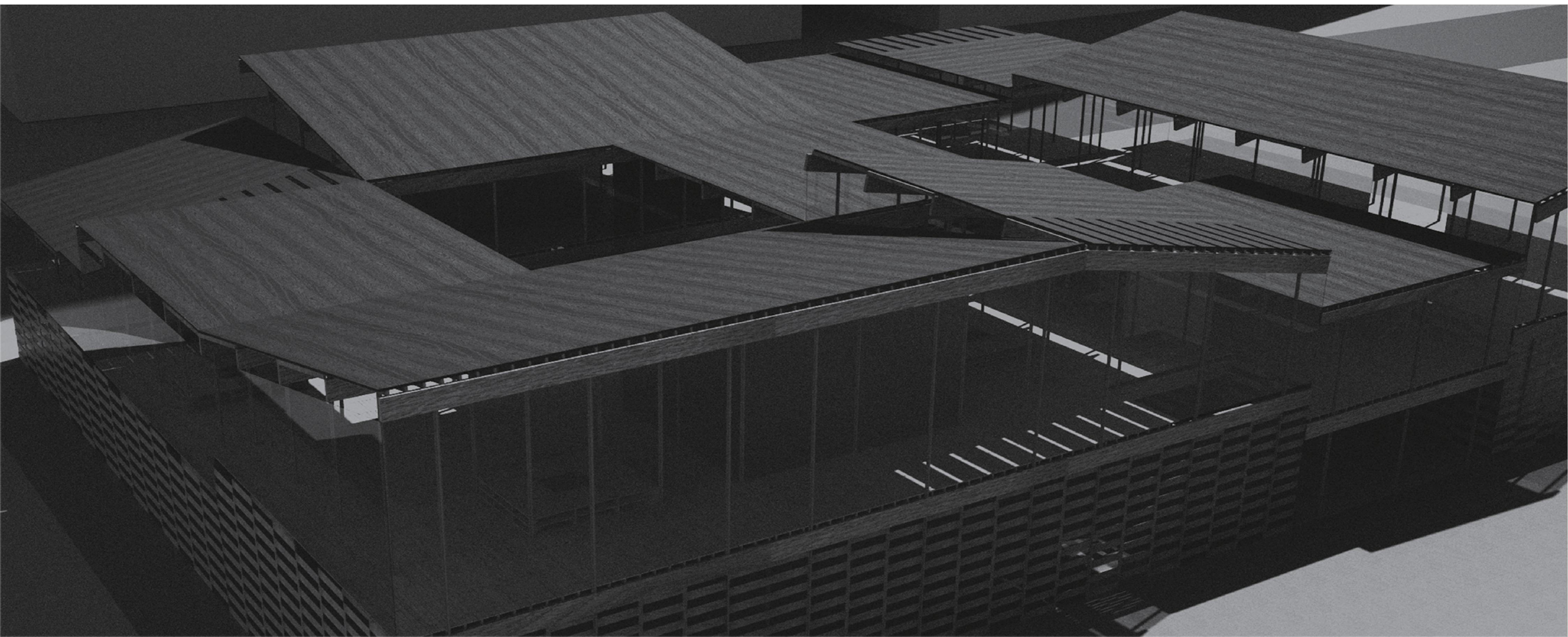
## ELEMENTS

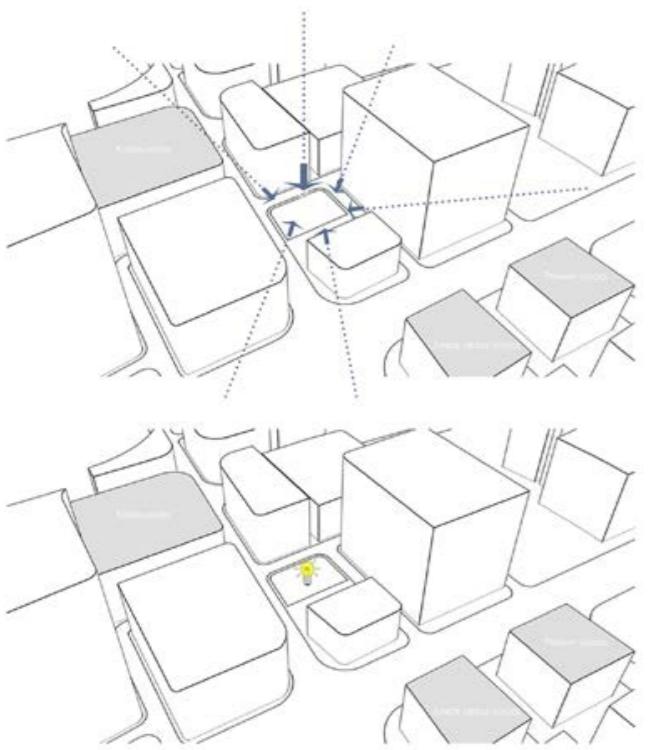
The design uses elements of Chengdu's traditional architecture. Such as Roof form, Alley, Bricks and Gallery.



# 4 LIBRARY DESIGN

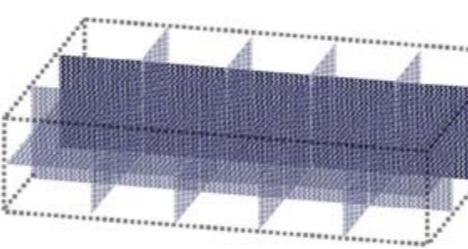
Self Work / 2015.03



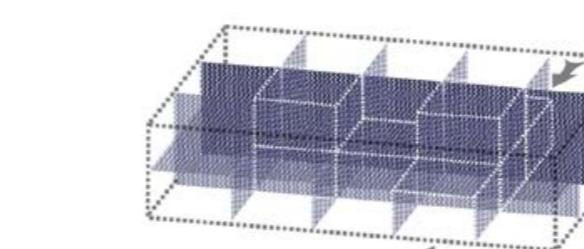
**SITE**

Do not wish to long kept in natural and artificial, but keep a harmonious relationship with nature. This idea also affect the layout and the image characteristics of the building.

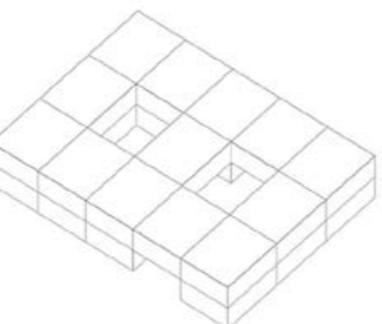
Building winning by groups, pay attention to mix, and concave curve of the attachment within the earth, and the characteristics of the lateral spread image adapted to express and nature, in harmony of artistic conception. It is embodied in the design of the building the same thoughts with nature.

**RESHAPE**

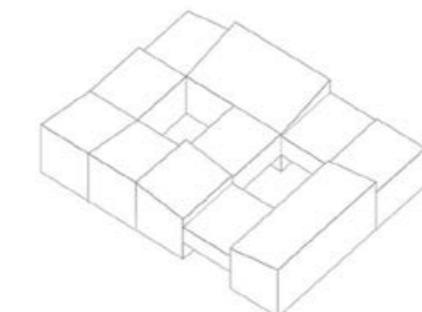
1. The same box, cloth 15 the same squares, stacked double.



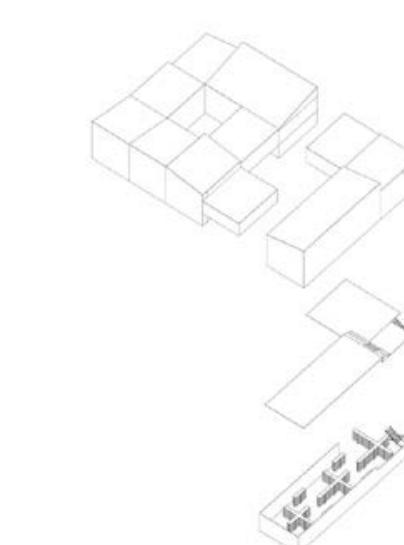
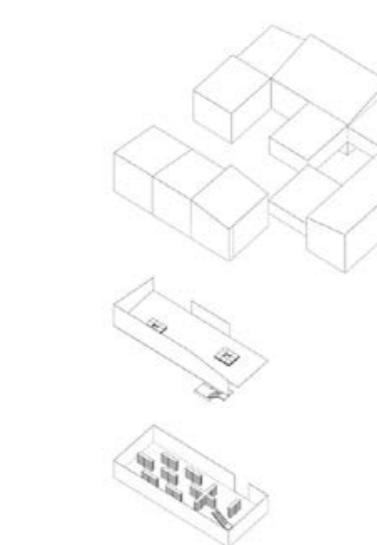
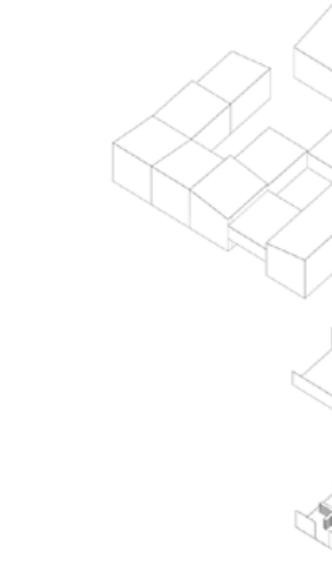
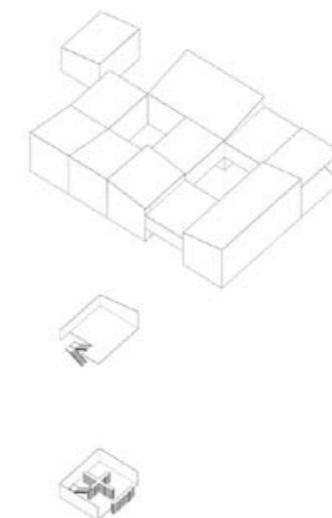
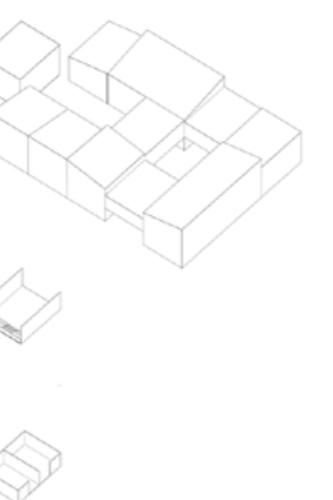
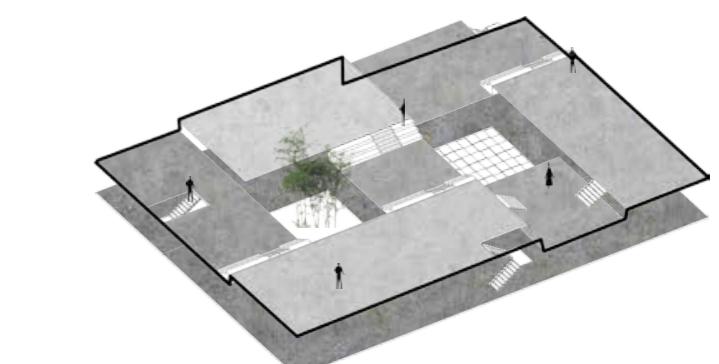
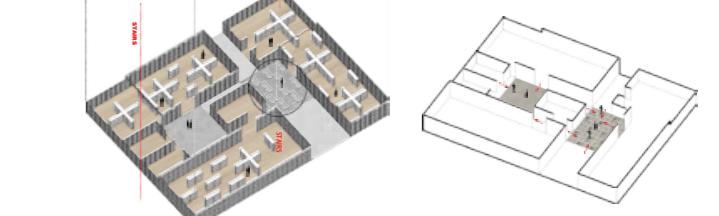
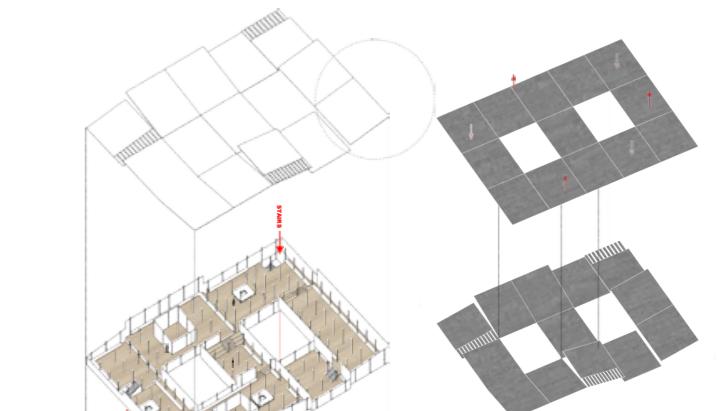
2. Extracting channel line, before and after opening. Pedestrians can move back and forth among them.



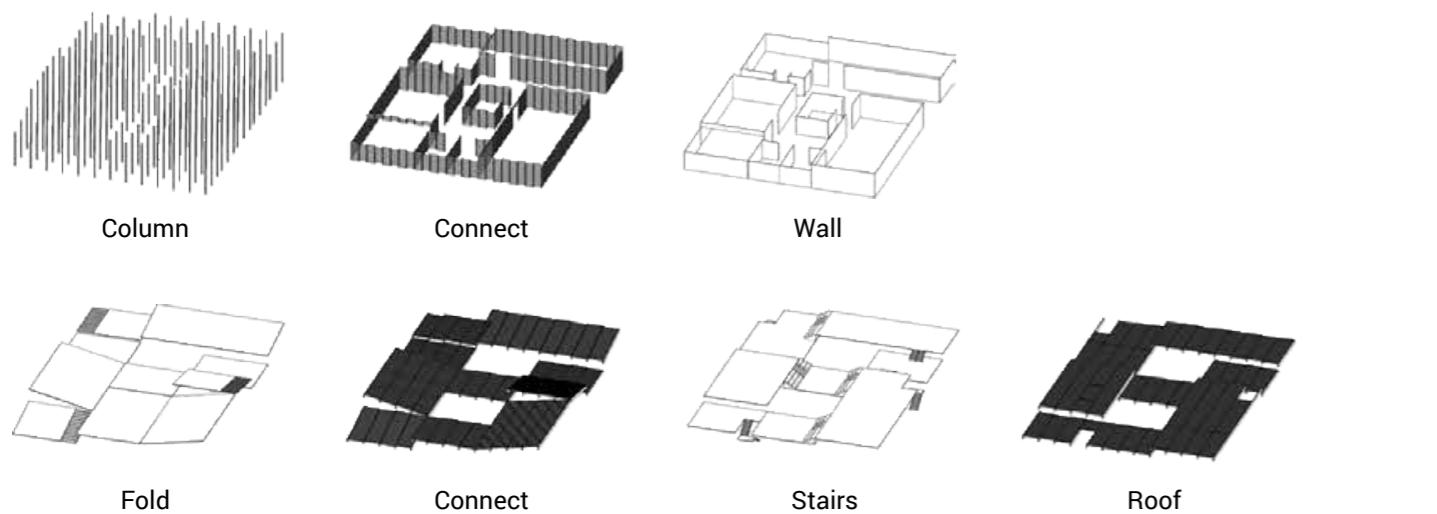
3. Draw surround close space, interior space to surround close, and the external space development and become a contradiction, fuzzy space.



4. According to surround close need, into the atrium, four class backwater, forming within the inclined or external oblique roof.

**GENERATE****ASSEMBLE**

## STRUCTURE



## MATERIAL



The reuse of wooden structure and modern steel column, the insertion of transition space, longitudinal and transverse space, as well as the intersection and expand space gives the view that it is not a closed block.

As the most important element, wood extends from the outdoor space to the interior space. Besides, woodiness floor Belong to the wood, and the overall architectural style

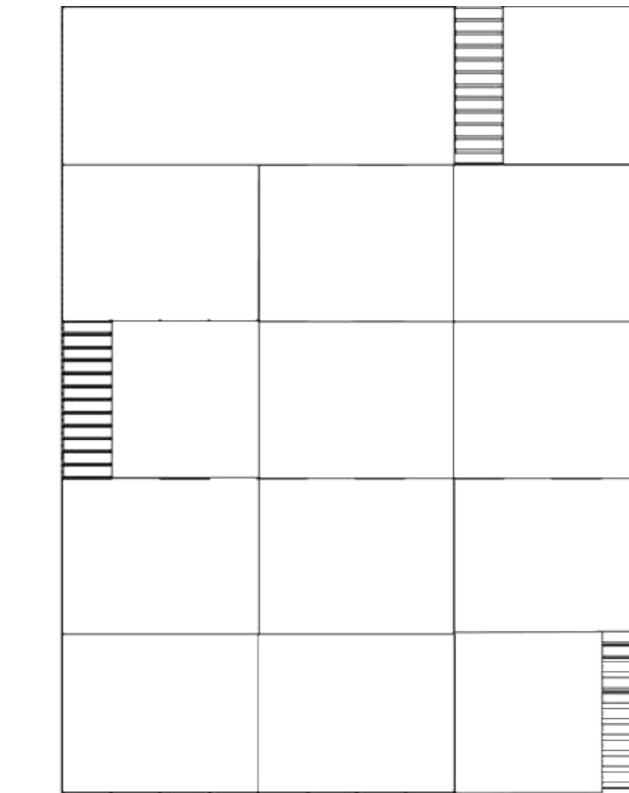
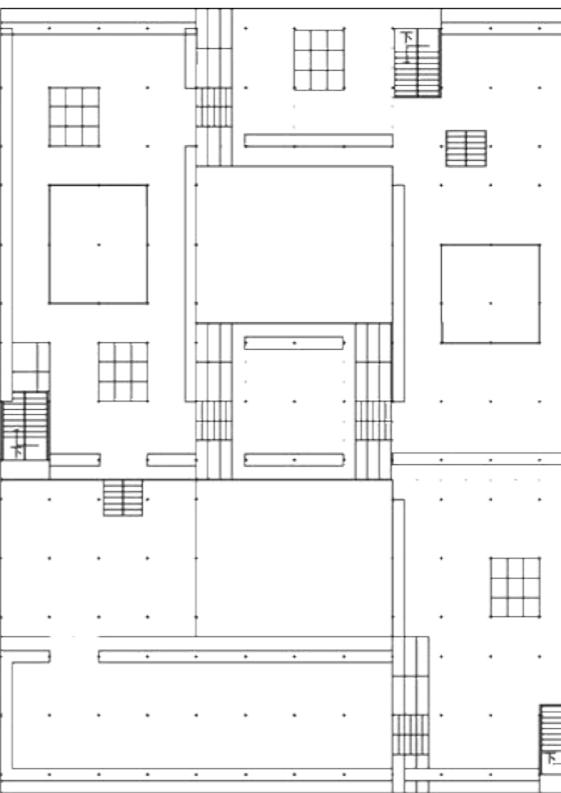
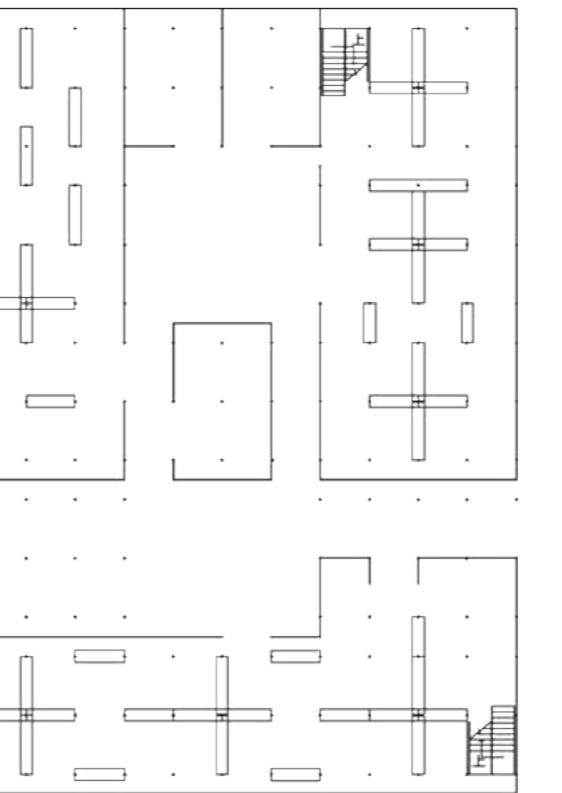
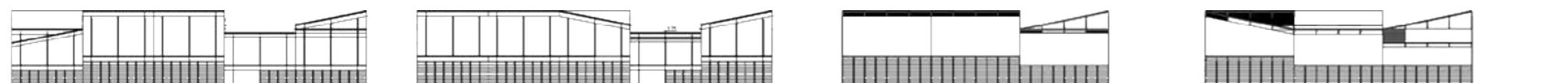
Frosted glass seems not important and also few configuration. But the truth is that, it is the third space over the actual space.

White steel column In order to use thin steel column open space. At the same time with the wooden grille, bookcase, desk divided different average space, be included in the unity of order.

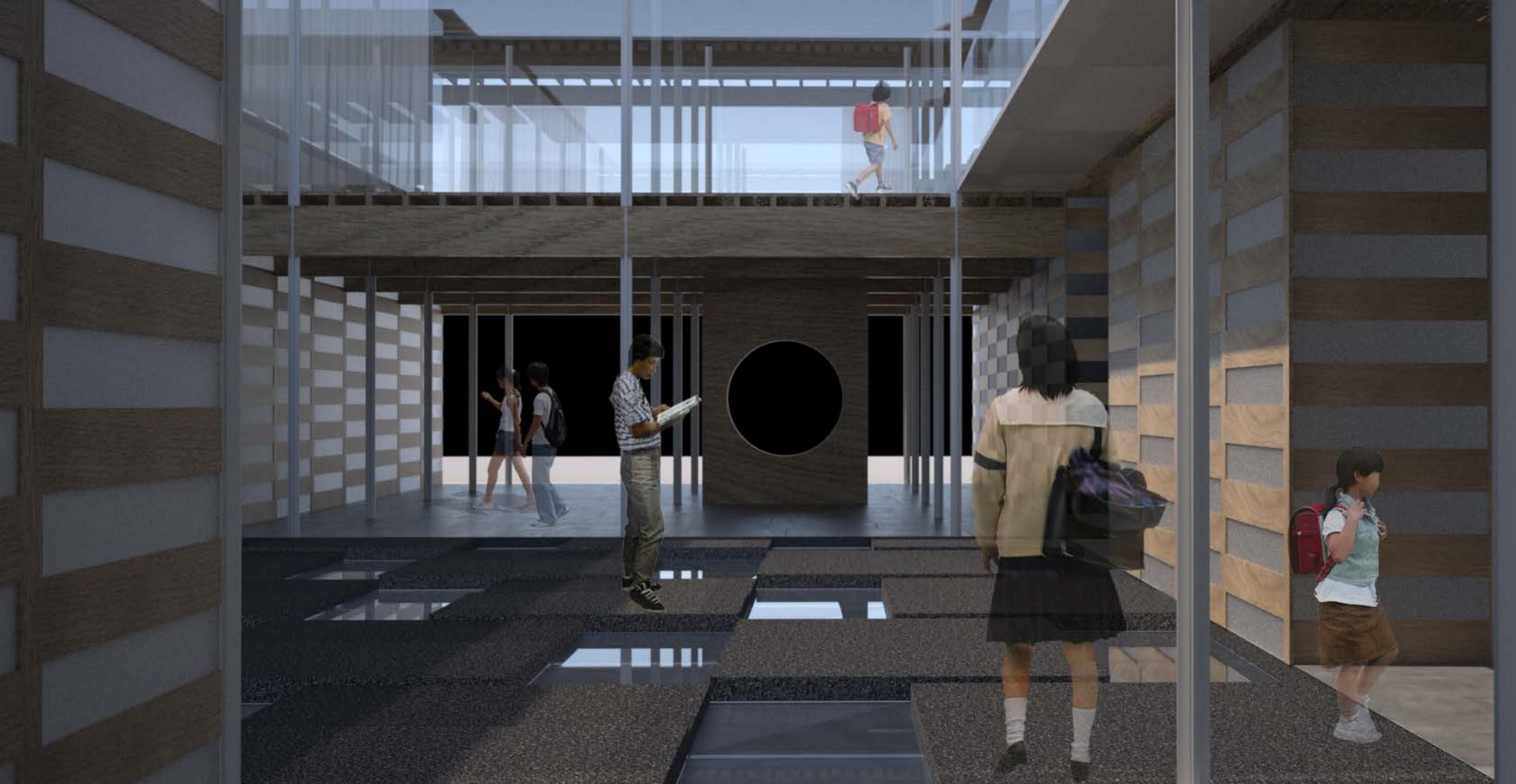
**Structure**  
Cross steel column longitudinal extension isometric clearance arrangement, tensile longitudinal space. Clearance order is the same.  
The first layer of exterior walls, wooden grille, semi-closed. Daylighting, introducing medium at the same time. Change ratio of transverse space  
The first layer of inner wall, wooden grille, semi-closed. Daylighting, introducing medium at the same time. Change ratio of transverse space  
Double beam, the most simple structures, staggered, with wooden grid order. Extend, affects the transverse space, proportion  
Floor, the floor, frame and double wooden beam, flat, entity. The transition form  
Double beam, the most simple structures, staggered, with wooden grid order. Extend, affects the transverse space, proportion  
Roof, wood quality.  
The whole material wood, wood dry time attribute cold. Easy to transmission medium. The nature and the nature, belong to honesty

First for real, grid and sunshine, under the shadow into a solid surface, intersect in the service space, on the second floor for the incorporeal, entity, incorporeal too much space to use ground glass, three space state. When the thermal properties of sunlight filtered dry property grid, mapping properties of glass in the cold, and wet properties on the ground. Various elements of the secondary property will change and transformation. See is a simple process, the viewer in the three space also happening subtle change. Thus standoff, external elements more space. Let viewers back to the nature of emotion, that is thinking.

## ELEVATION







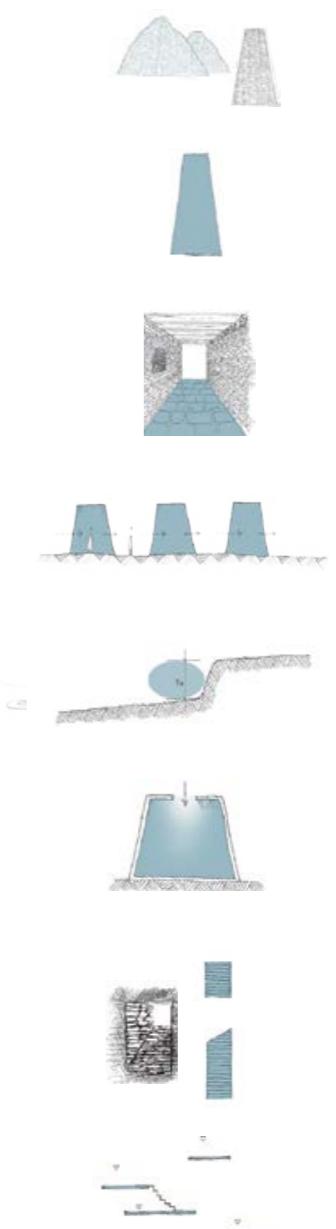
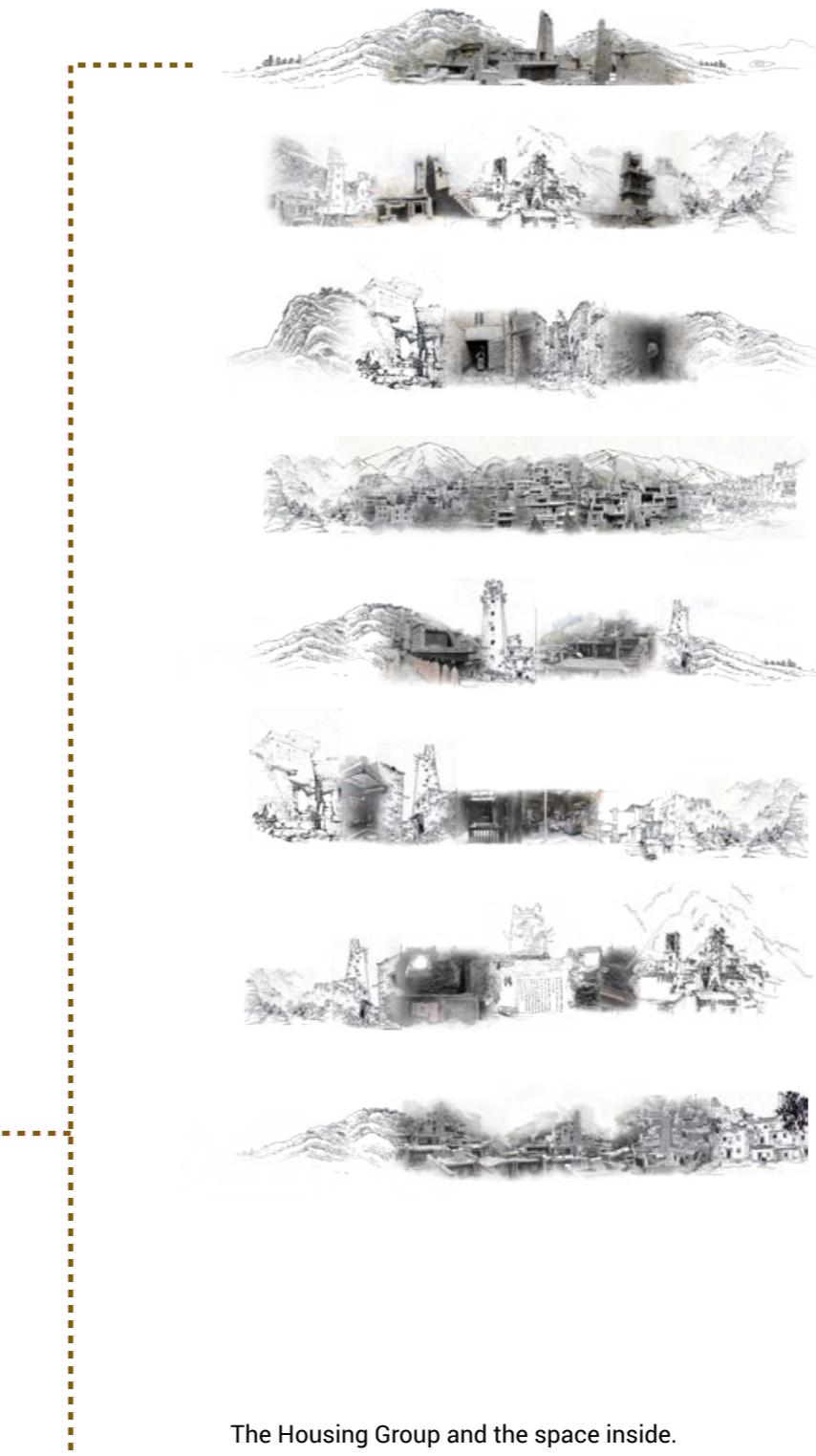
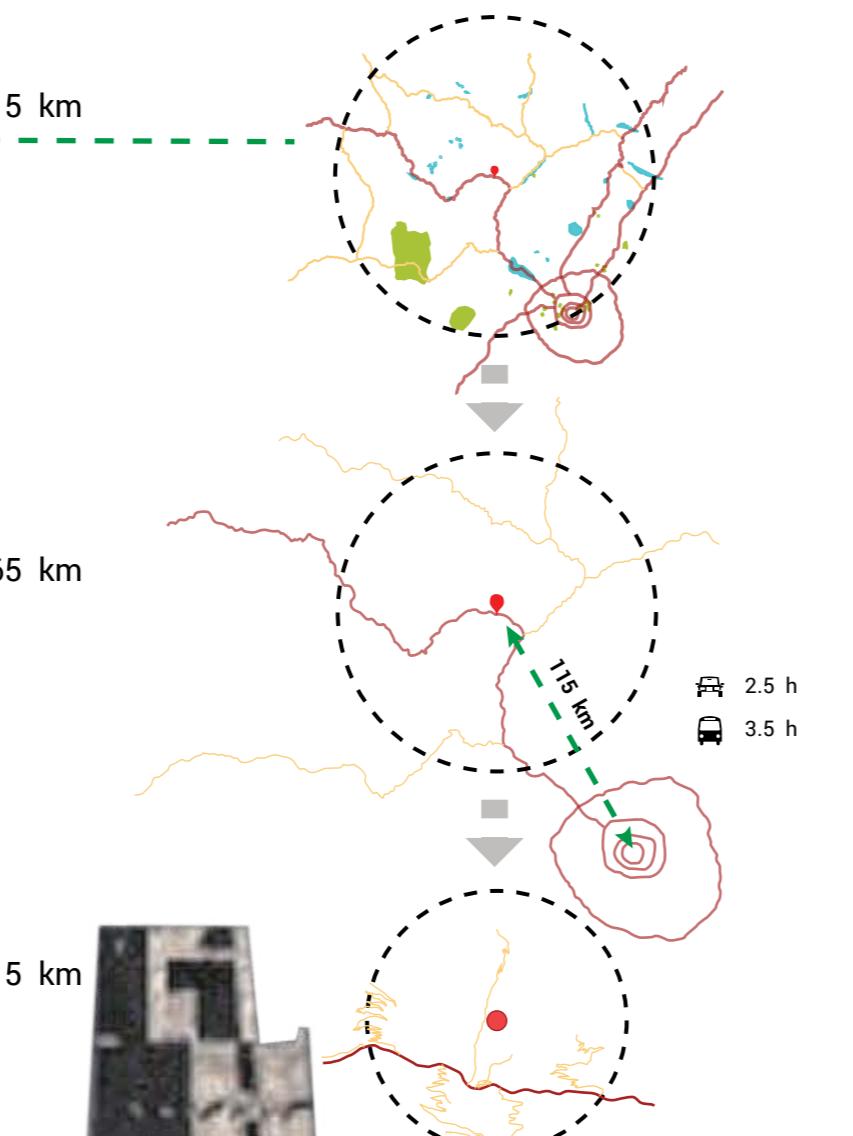
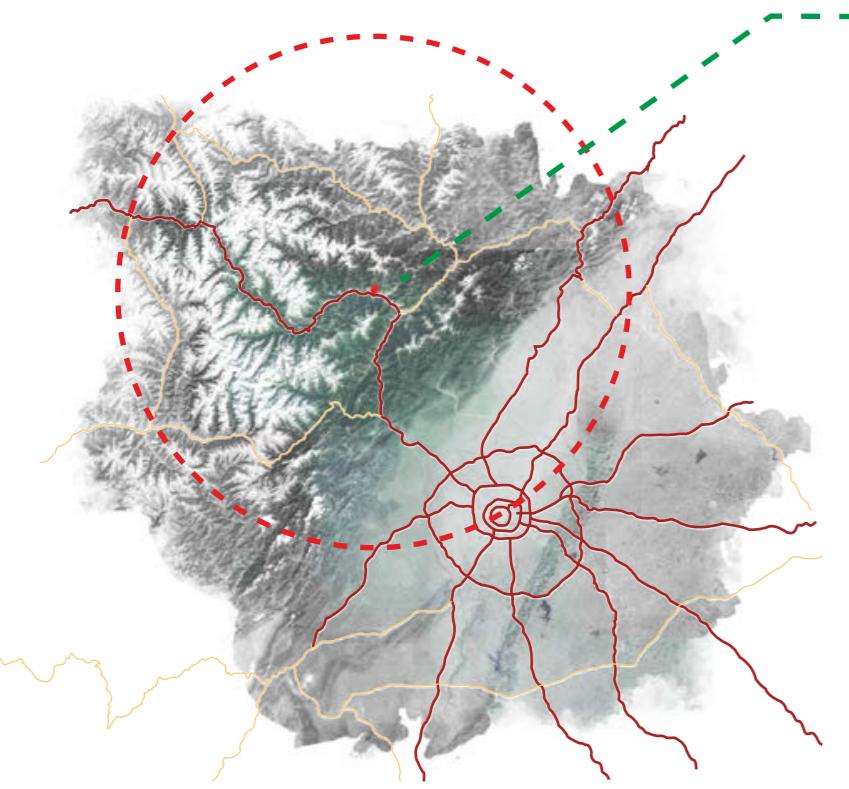
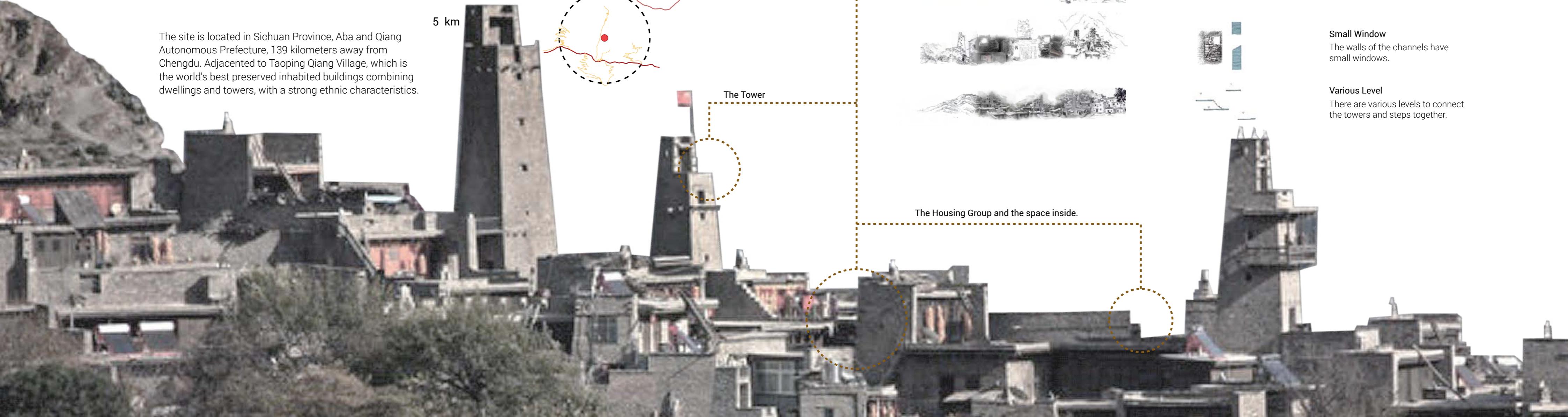
# 5 QIANG CULTURE EXPERIENCE FACTORY

Self Work / 2014.07

Taoping Qiang Village is the world's best preserved inhabited buildings combining dwellings and towers, with a strong ethnic characteristics. The buildings connect prefect groundwater network, accessible channels and the towers together. Both Chinese and foreign scholars call it "The living fossil of Qiang architectural art" and "The mystic Oriental castle."

The project aims to explore the characteristics of Qiang culture through the research, making preparation for the development of the commercial street to build a Qiang Culture Experience Factory.

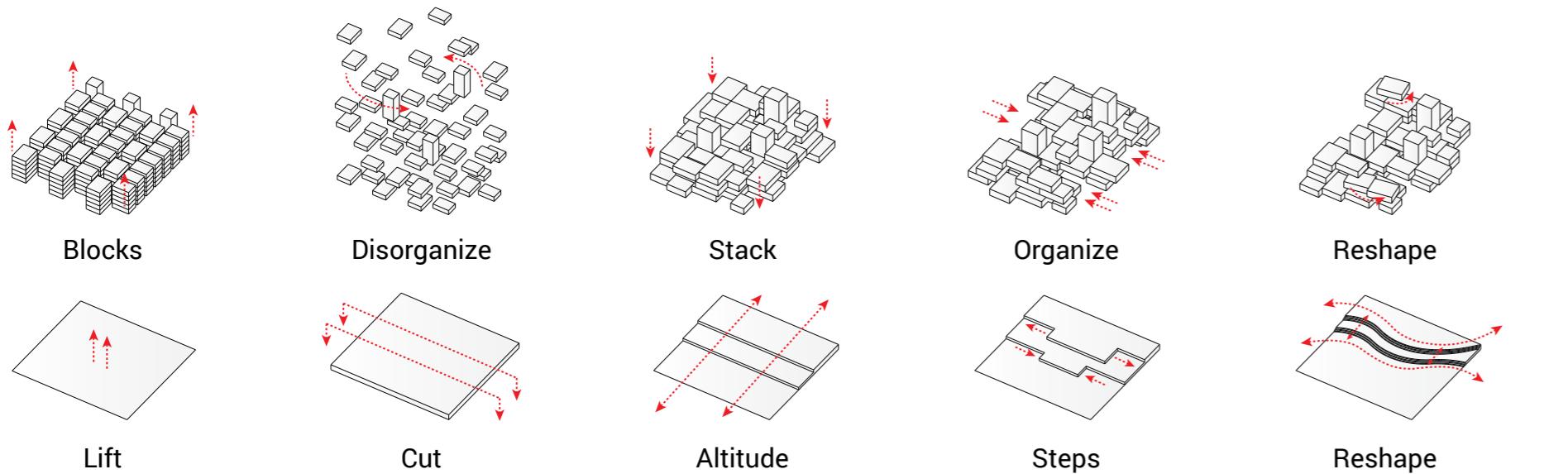




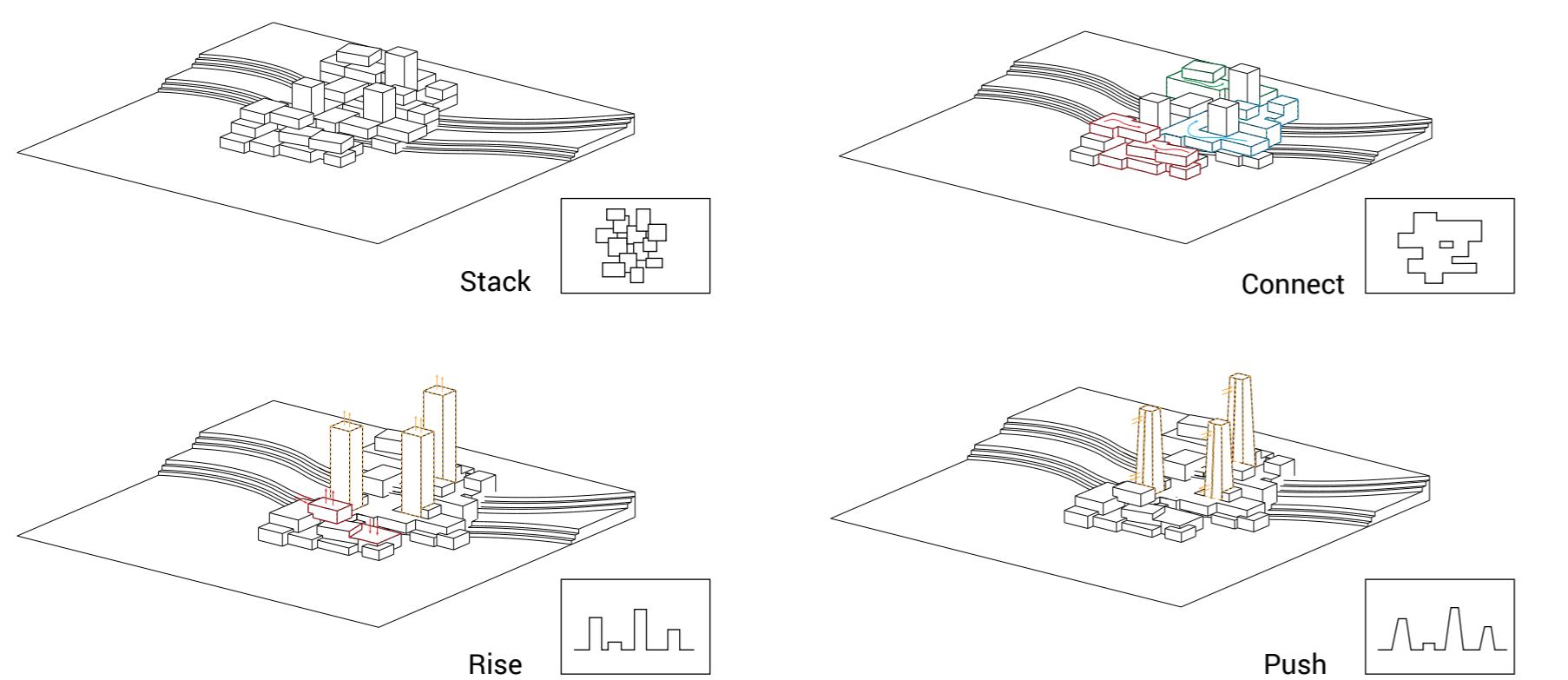
- Layer**  
Like the mountains, there is a sense of hierarchy.
- Form**  
The towers have a special form with thick bottom and the thin top.
- Narrow Road**  
The path as a passage is usually narrow, long and dark.
- Repetition**  
The Housing Group multiple repeat in similar form.
- Step**  
There are difference steps between most of the roofs.
- Well**  
The entrance room usually have a skylight.
- Small Window**  
The walls of the channels have small windows.
- Various Level**  
There are various levels to connect the towers and steps together.



### GENERATE



### RESHAPE

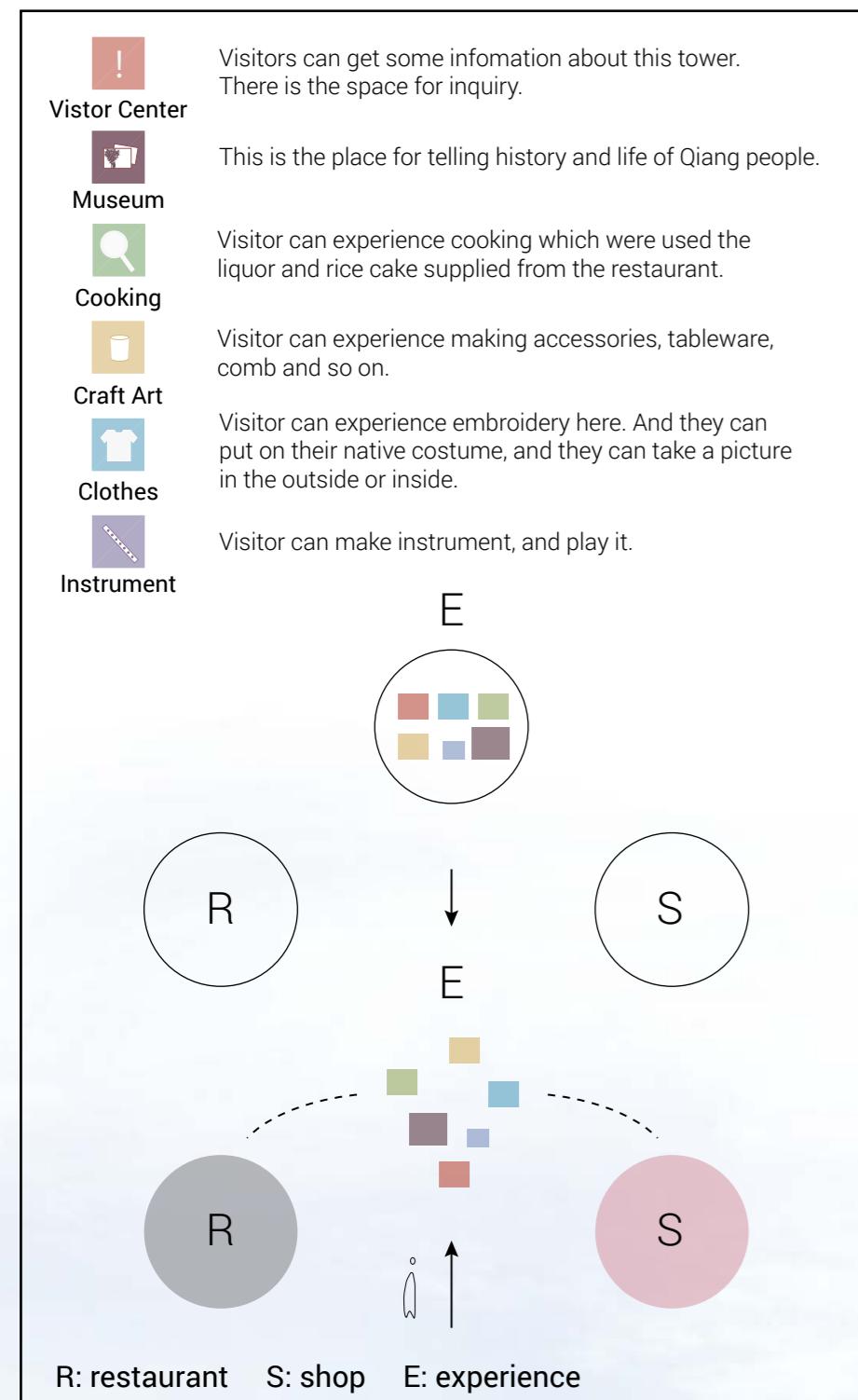


### SITE PLAN



## PROGRAM

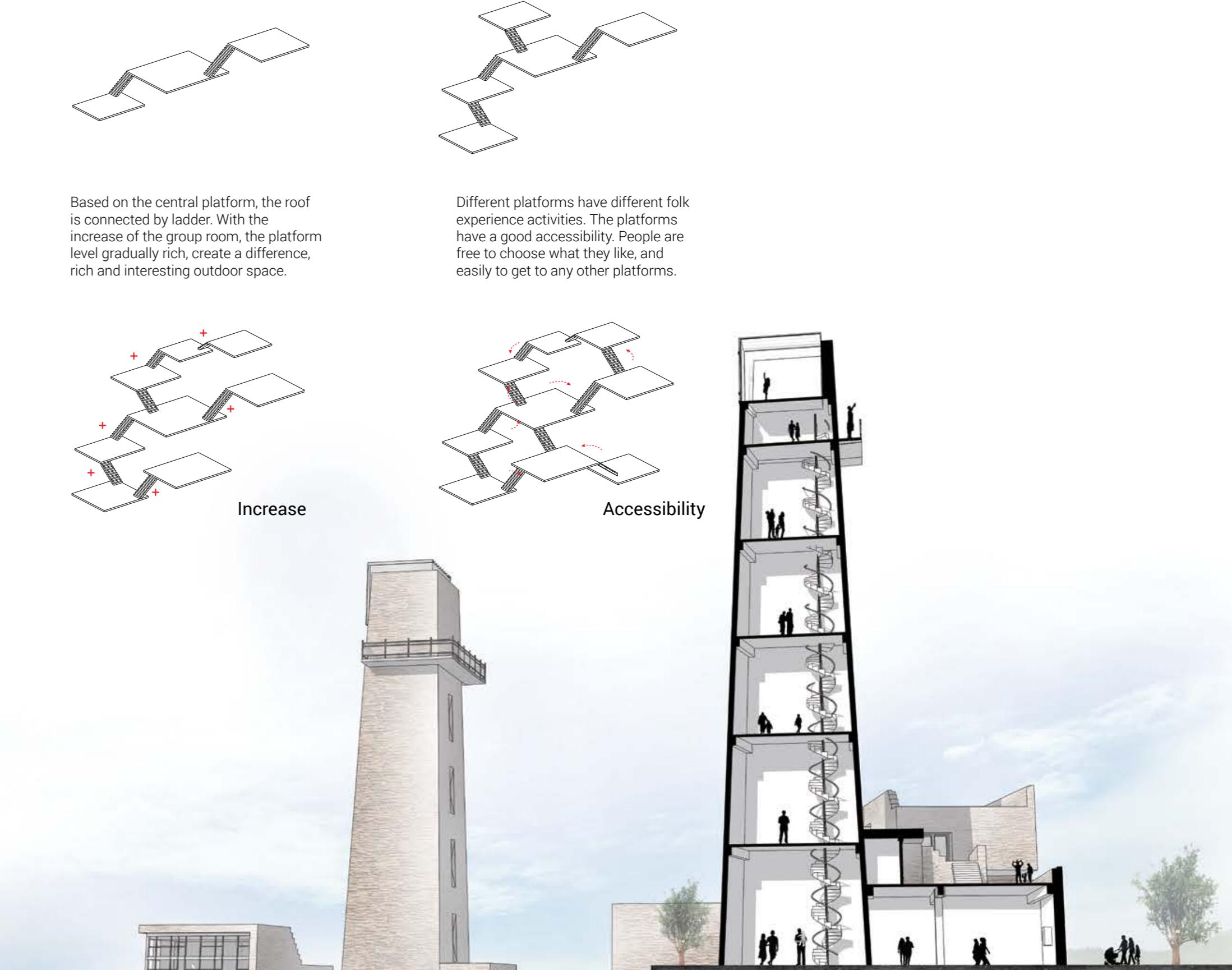
The material to make it here carried by the shop. At the platform, people can experience to be taught by craftsman directly.



## PLAN

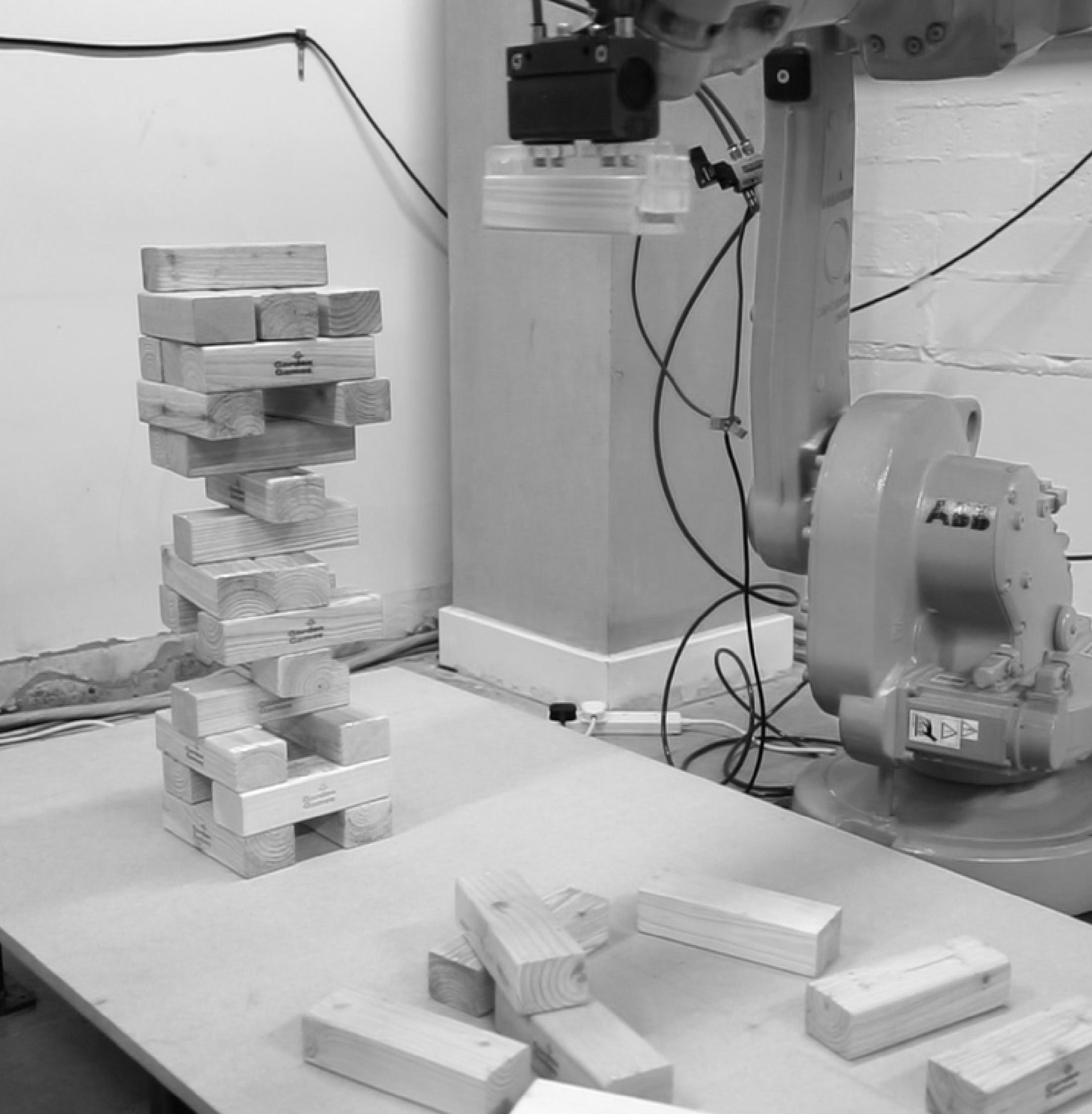


## DIAGRAM



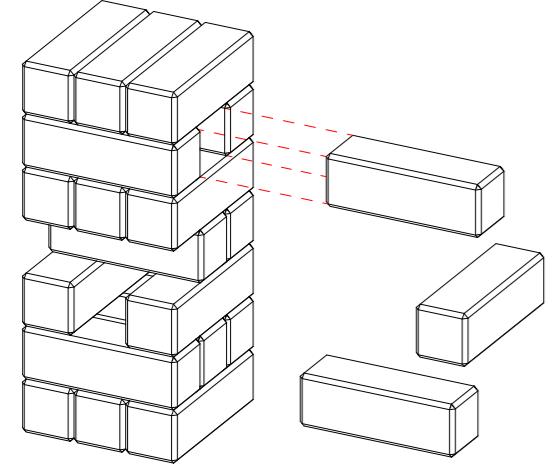
# 6 WORKSHOPS

Group Work / 2017.08 - 2018.09

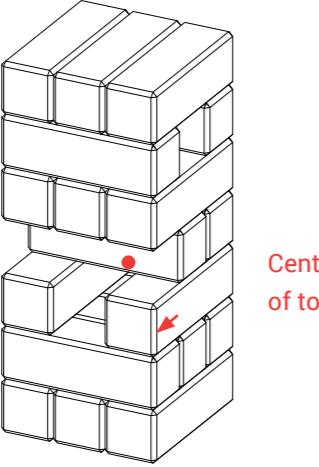


# [ ROBOTIC CONSTRUCTION ]

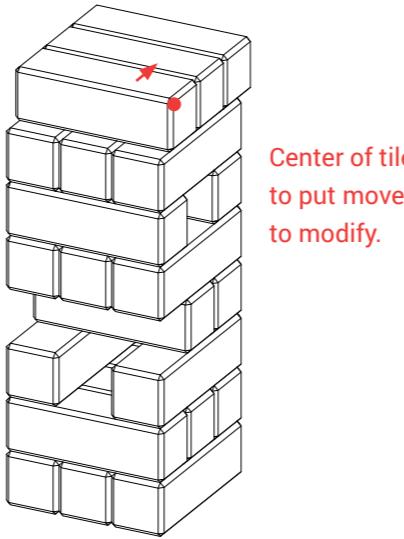
## Basic Logic



1. We took 3 tiles away manually each time.

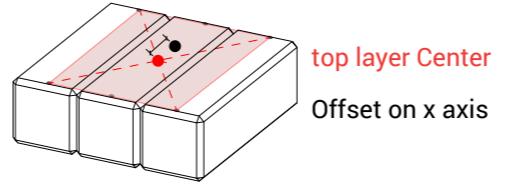


2. Then the gravity of the tower changed.

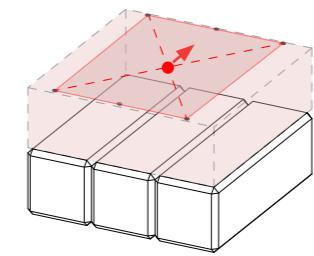


3. The tile removed will be put onto the top by robot to keep the tower balanced.

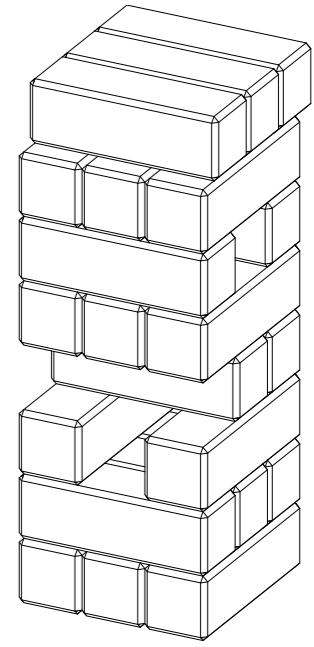
### How To Find Place to Put Tile



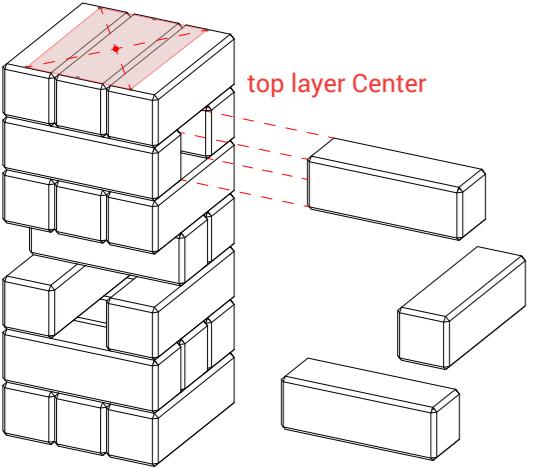
1. We set a rule that the layer of three tiles put onto the top would fix the offset by half of it.



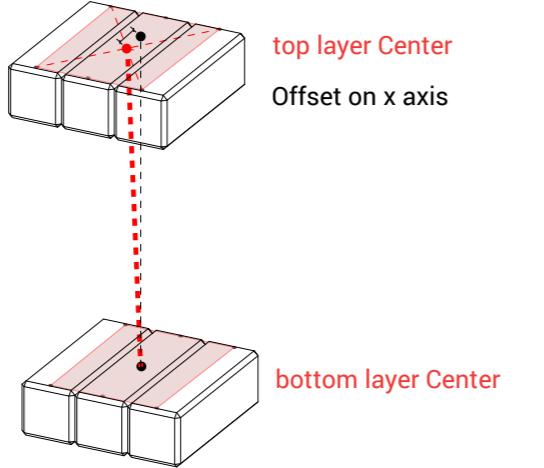
2. The tower was supposed to be created straight upward.



### How To Find Gravity Change

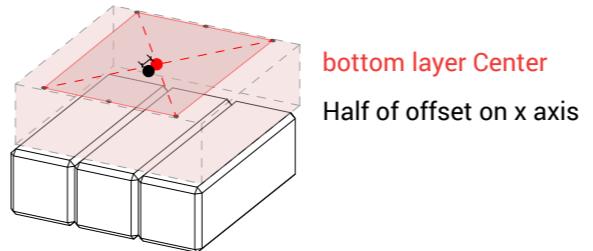


4. The top layer of tower will be scanned by camera and the center could be found.

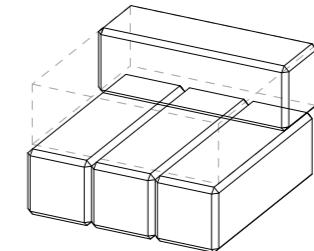


5. Then the offset of top layer center from bottom layer center can be worked out.

The center (x, z axis value) of top layer will be compared with that of bottom to find which direction is the tower tilting to. Offset on each axis will be worked out, which will affect the position of the tiles to put onto the top.



3. Now the put layer will move half of the existing offset on x axis to the opposite to modify the center of gravity of the tower.



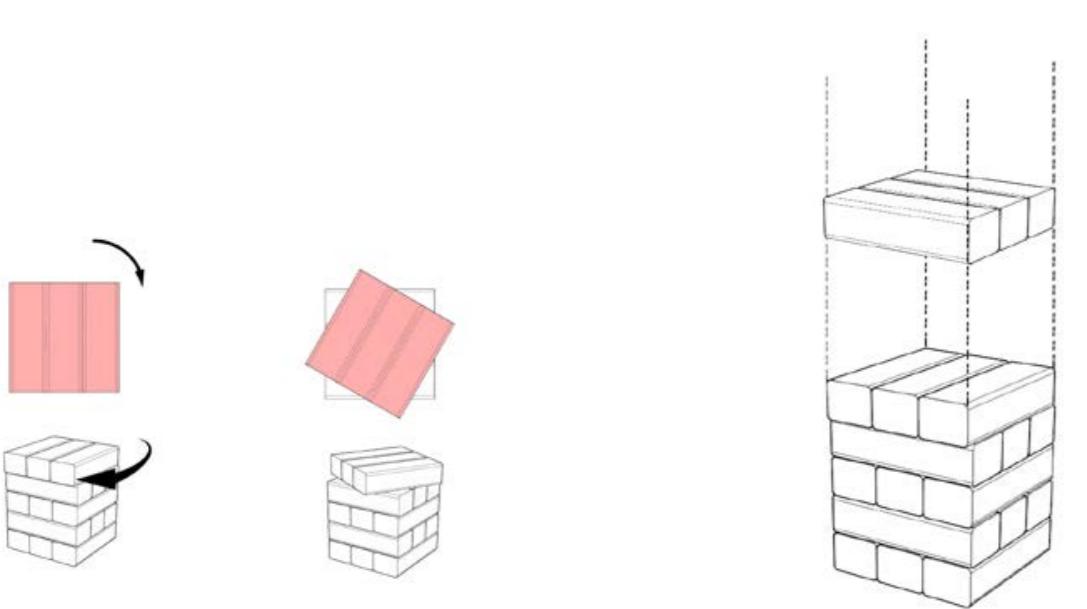
4. After determining the center of the layer of tiles which is going to be put onto the top, the first one to put is the very opposite one to the tilt direction.

5. Then after the first tile done, the second and third tile will be taken by us and put by robot next to the previous one. Then the three tiles become a new top layer.

# [ ROBOTIC CONSTRUCTION ]

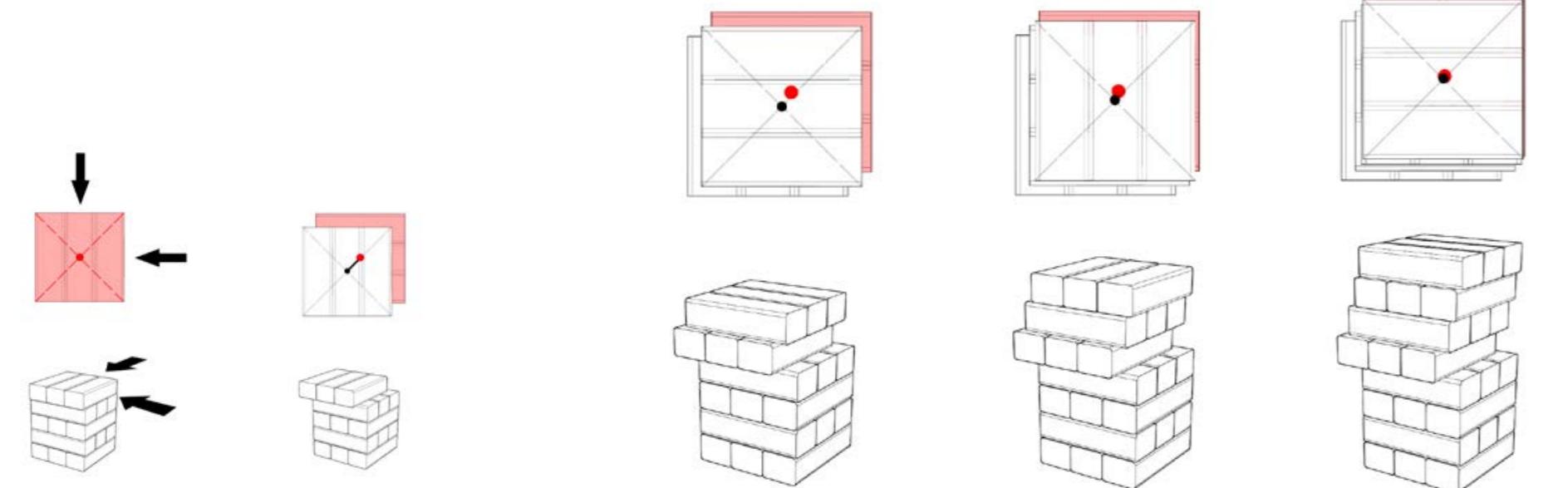
## Basic Logic

### Rotation Test



If the top layer rotate with an angle from the original layer, new layer should be placed following the new rotation in Jenga rules.

### Offset Test



When the top layer offset a distance from the original center,new layer should be placed toward the original center to make the tower stable.



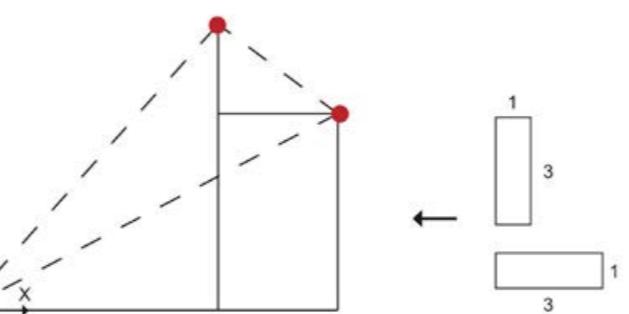
# [ PRINTING PATH ]

Travel Salesman Problem

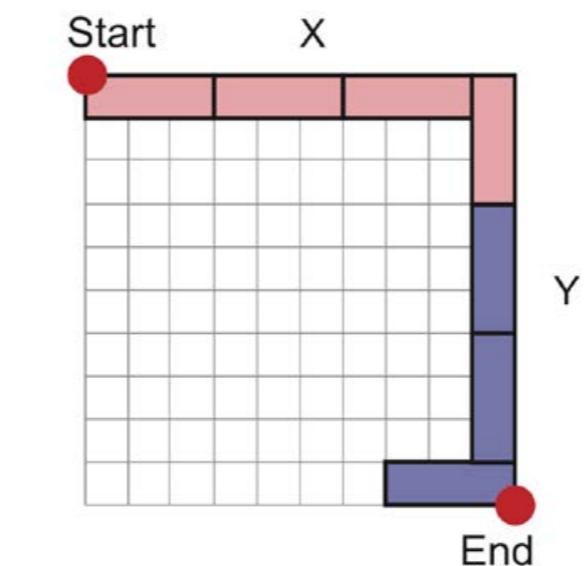
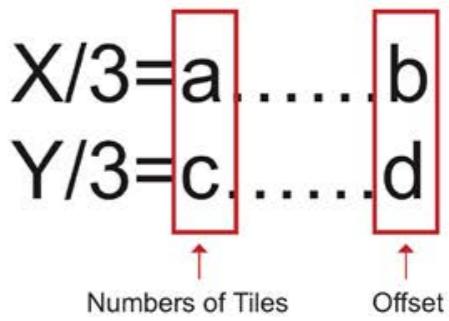
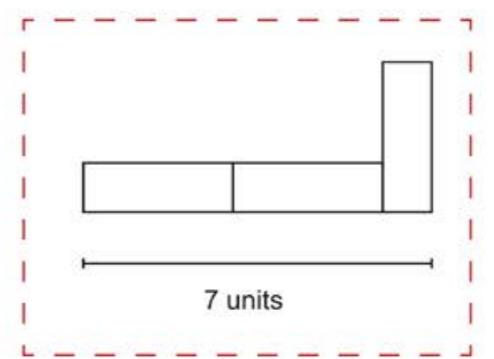
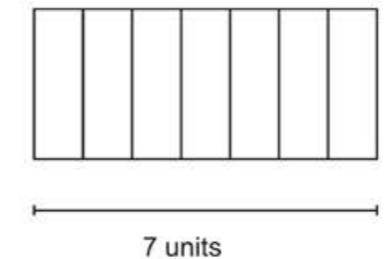
Build assembly using Jenga tiles to reveal the routine.

Tiles should be put in orthogonal direction, so that the assembly could be stable.

So we resolve the vector between 2 set points by x and y axis, along which the tiles should be assembled.



$X/3=2 \dots 0$	
$X/3=1 \dots 2$	
$X/3=1 \dots 1$	
$X/3=1 \dots 0$	
$X/3=0 \dots 2$	
$X/3=0 \dots 1$	



Goal

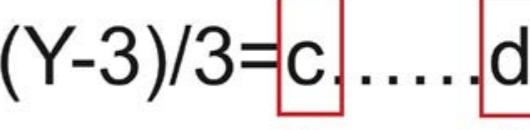
To minimize the number of tiles, according to Manhattan Distance Algorithm, we have to ensure that we use as many as 3-unit-length edges to fulfill the distance on both axis.

1. Choose one axis to put tiles along



When  $b=1$ ,

The verticle tile give 1 unit on x axis and 3 units on y axis



When  $b=2$ ,

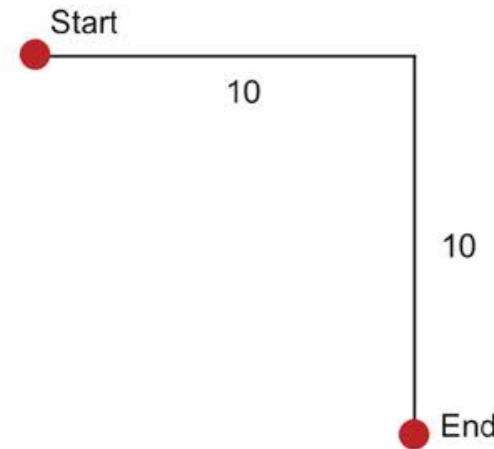
$(Y-2)/3=c \dots d$

When  $b=0$ ,

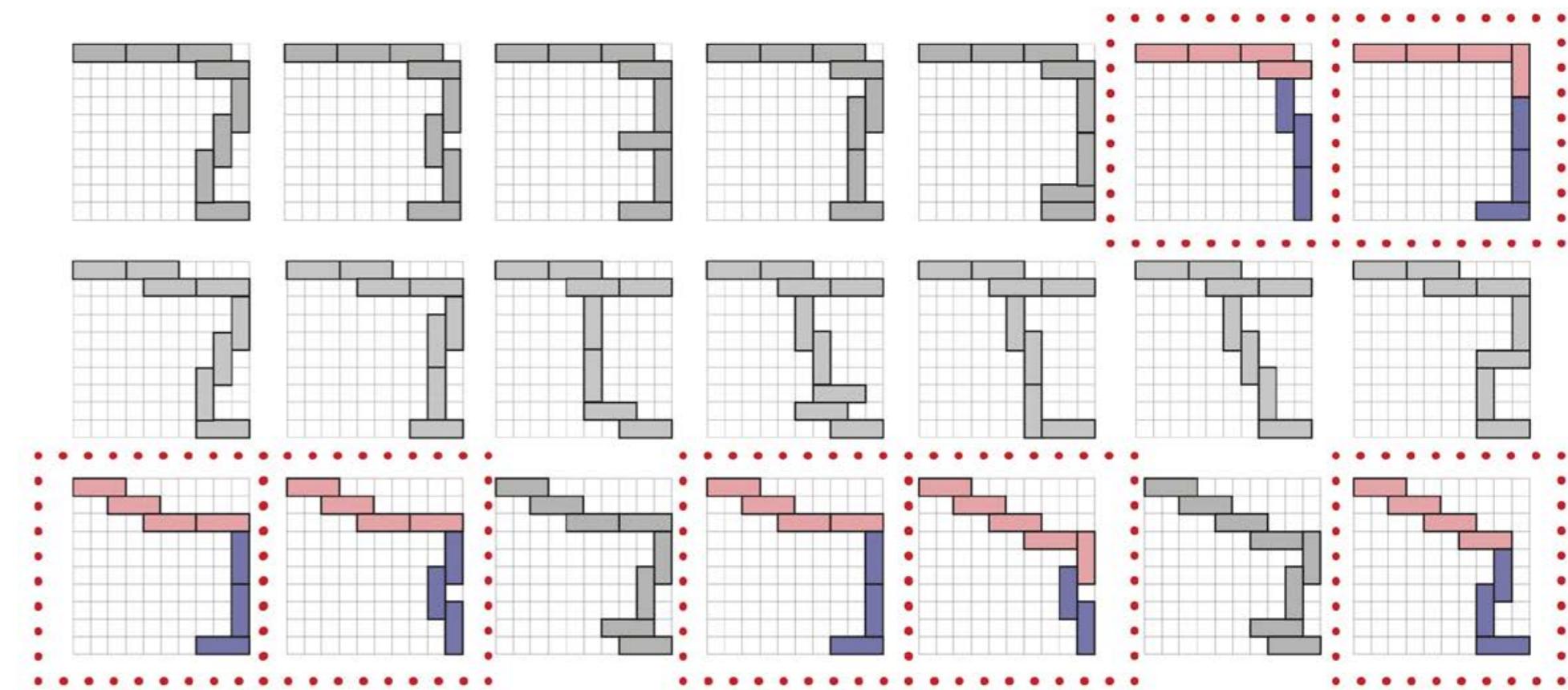
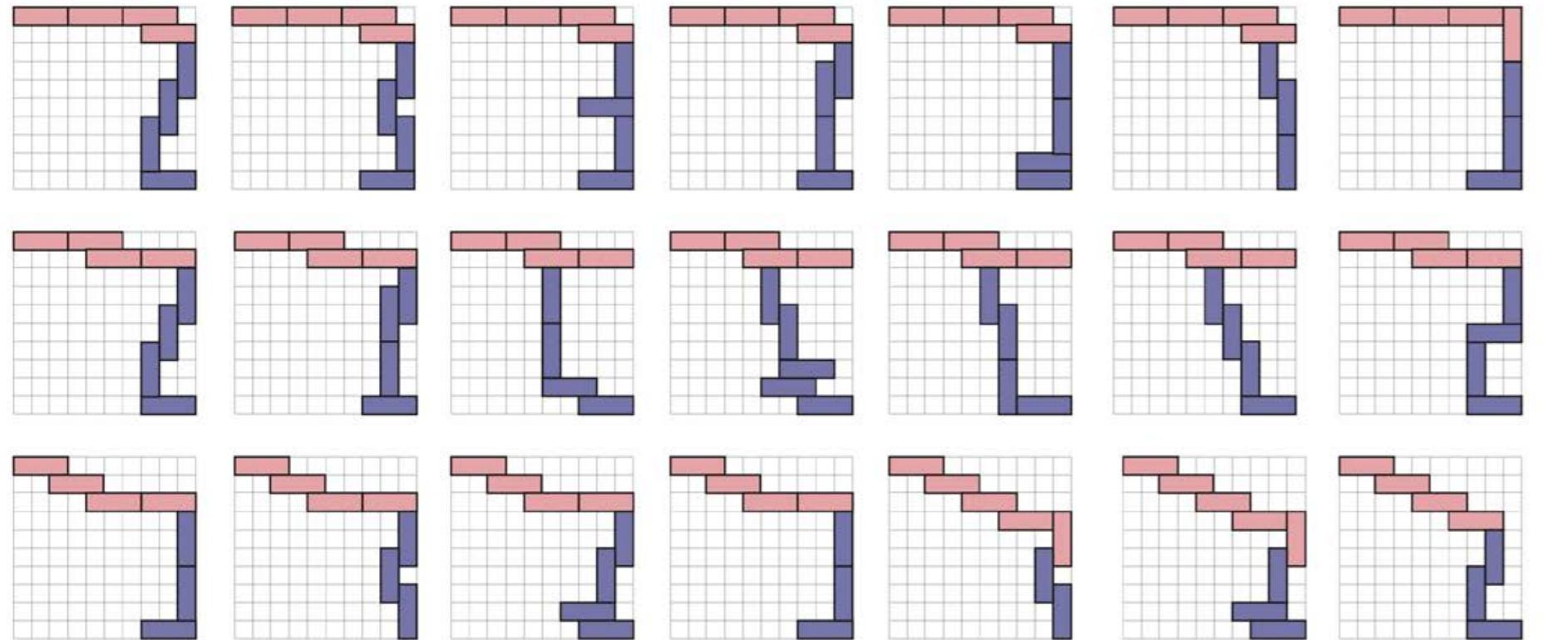
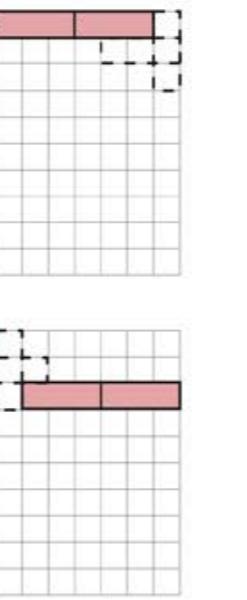
$(Y-1)/3=c \dots d$

## [ PRINTING PATH ]

Travel Salesman Problem

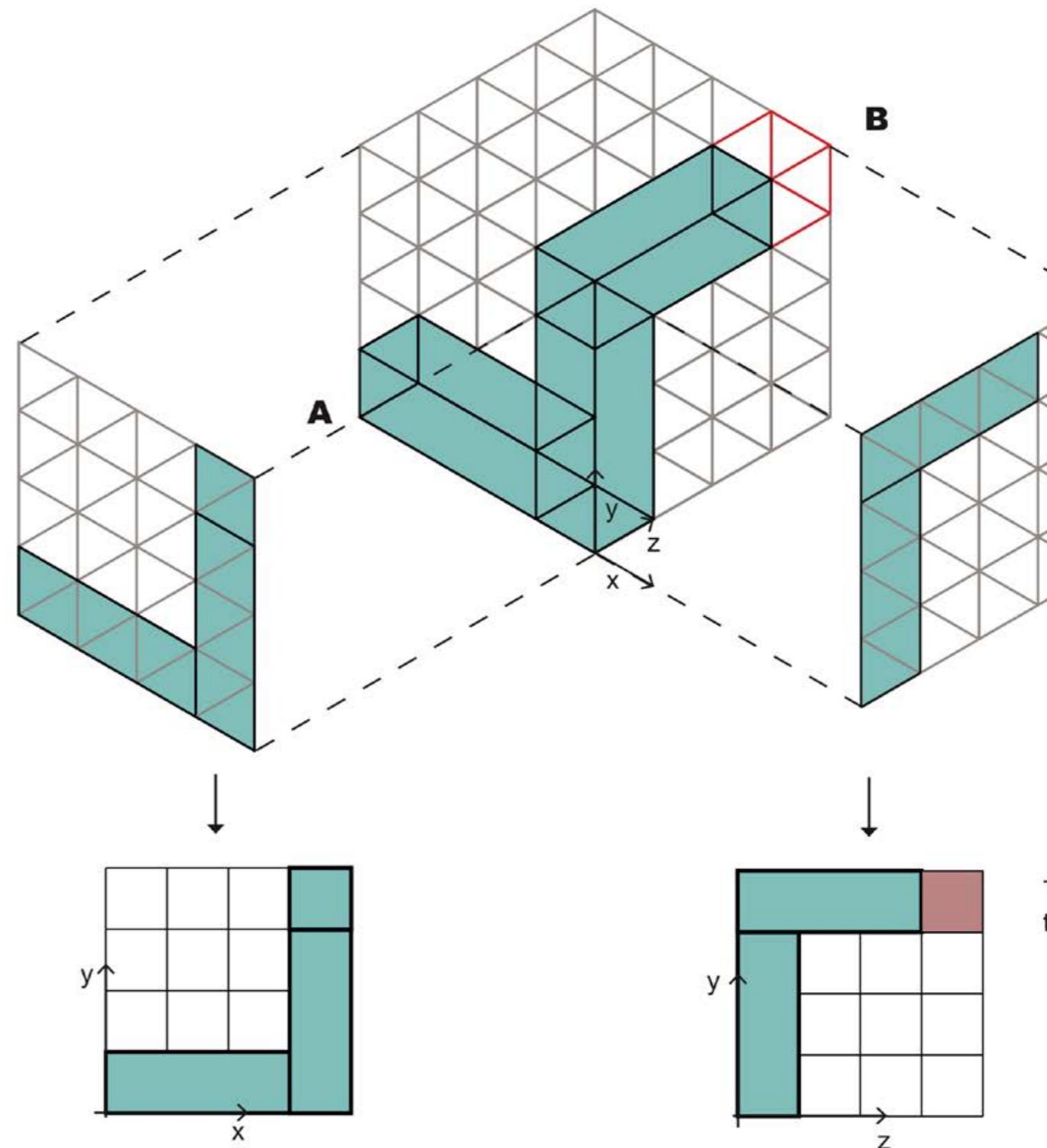
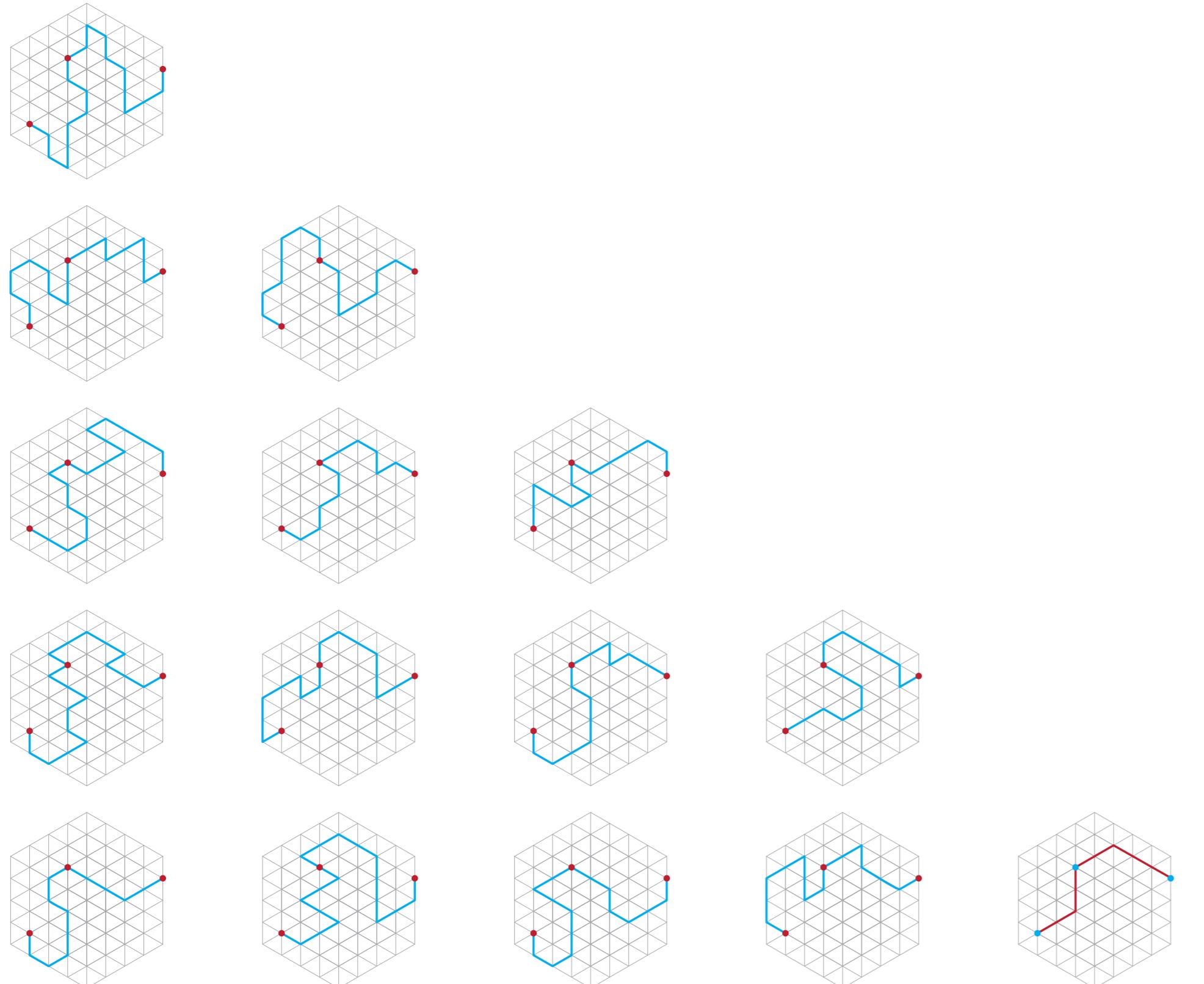


X axis  
 $10/3=3.....1$   
3 tiles with 1 unit offset



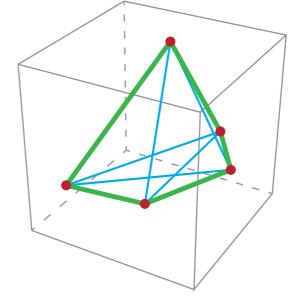
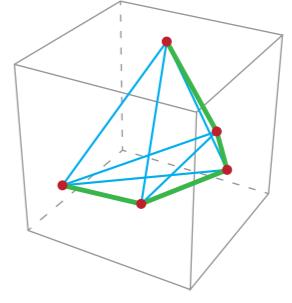
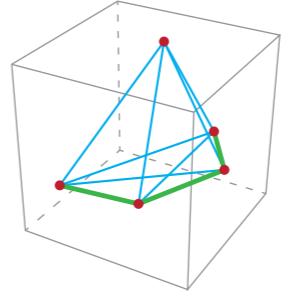
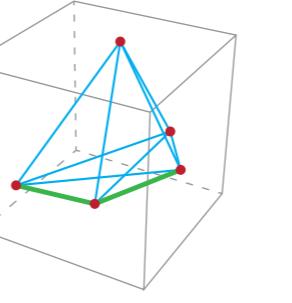
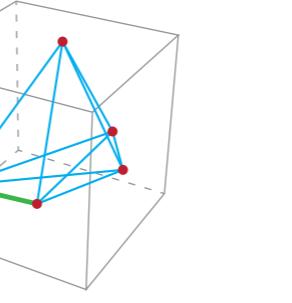
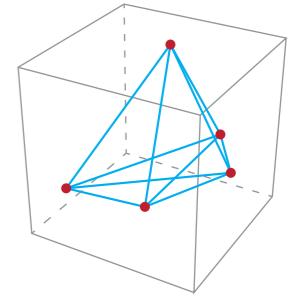
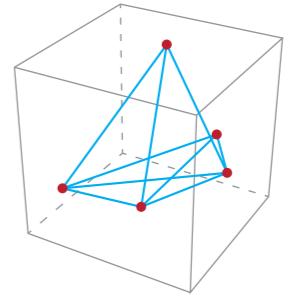
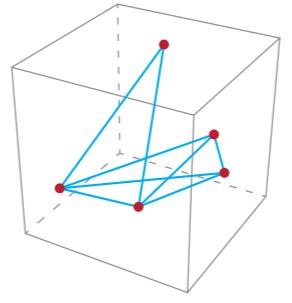
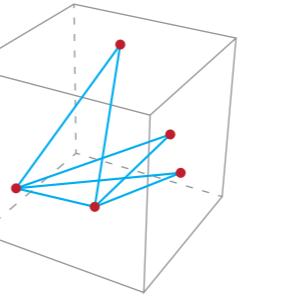
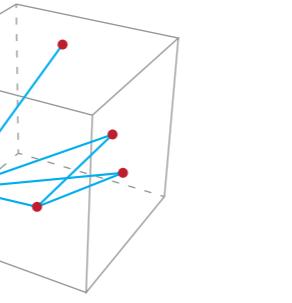
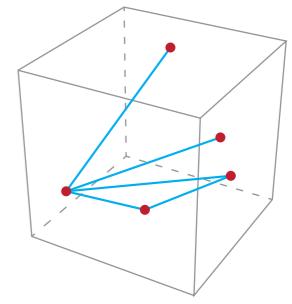
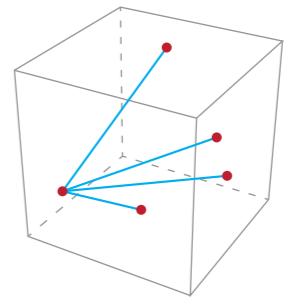
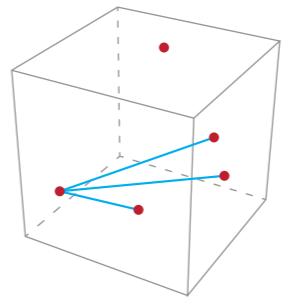
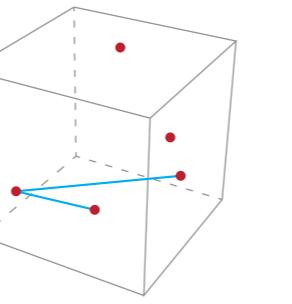
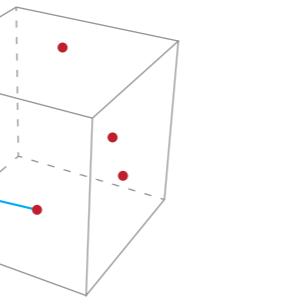
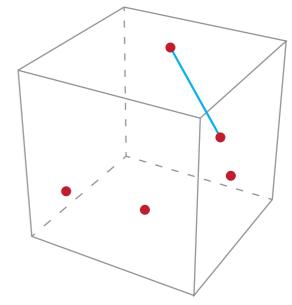
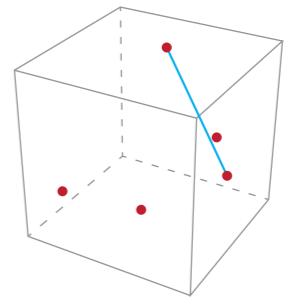
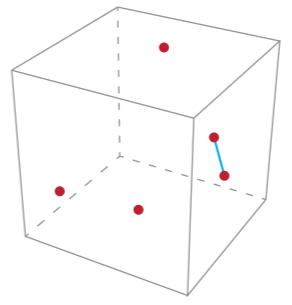
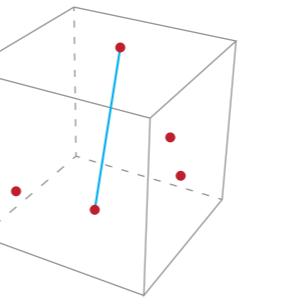
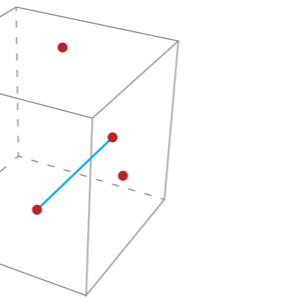
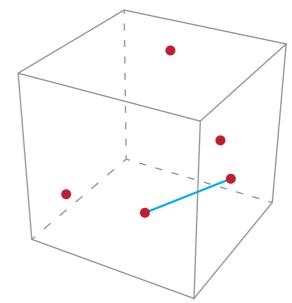
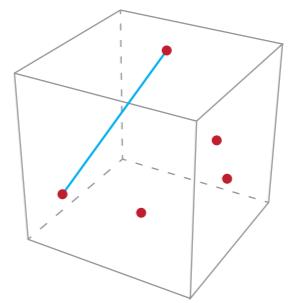
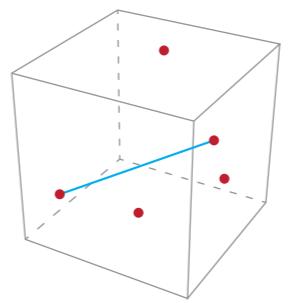
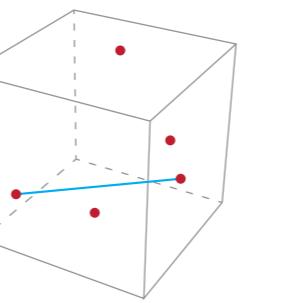
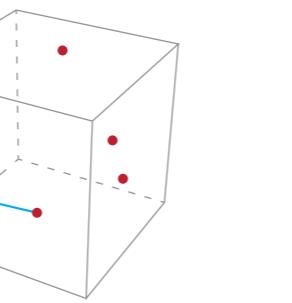
# [ PRINTING PATH ]

Travel Salesman Problem



# [ PRINTING PATH ]

Travel Salesman Problem

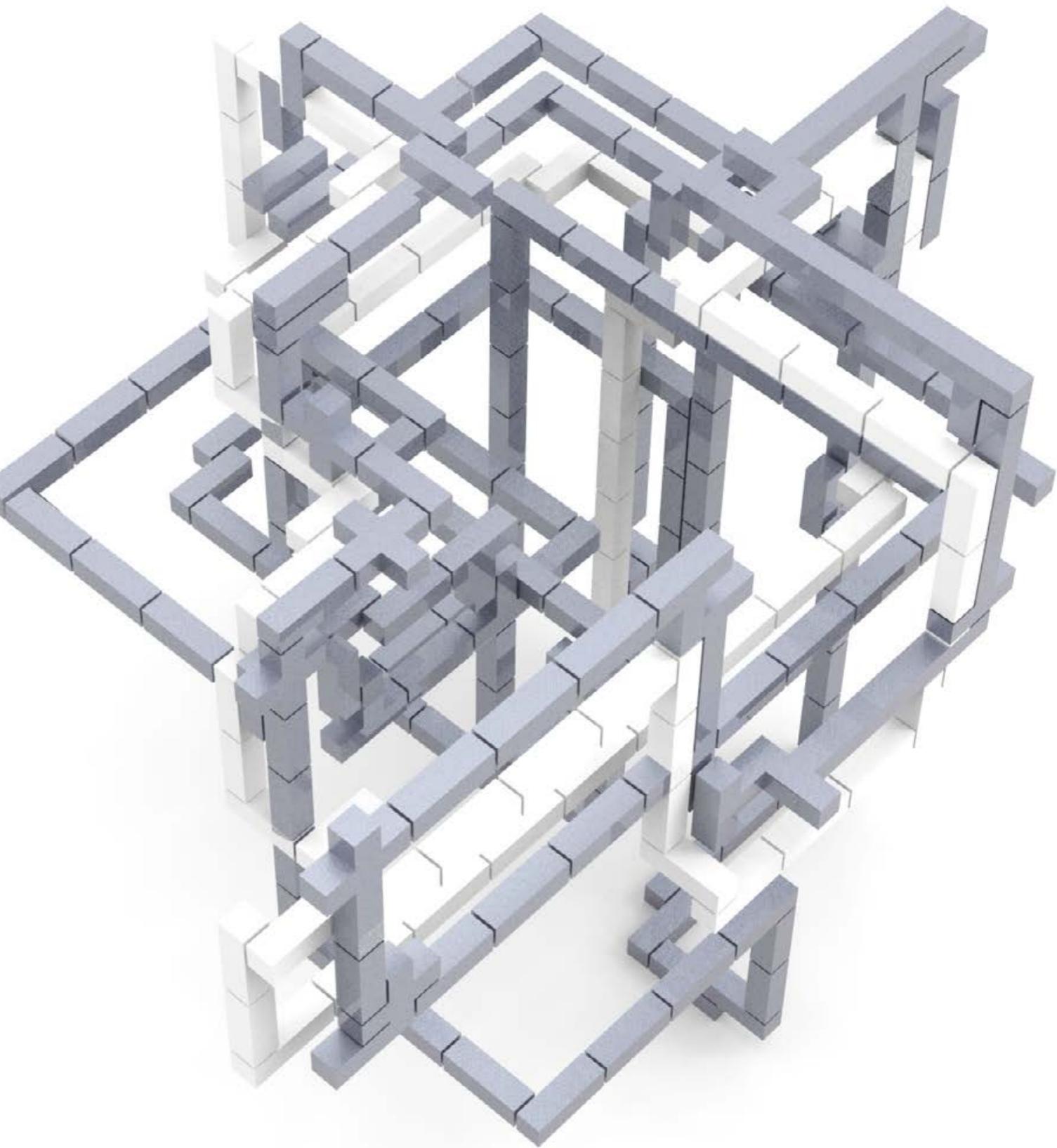
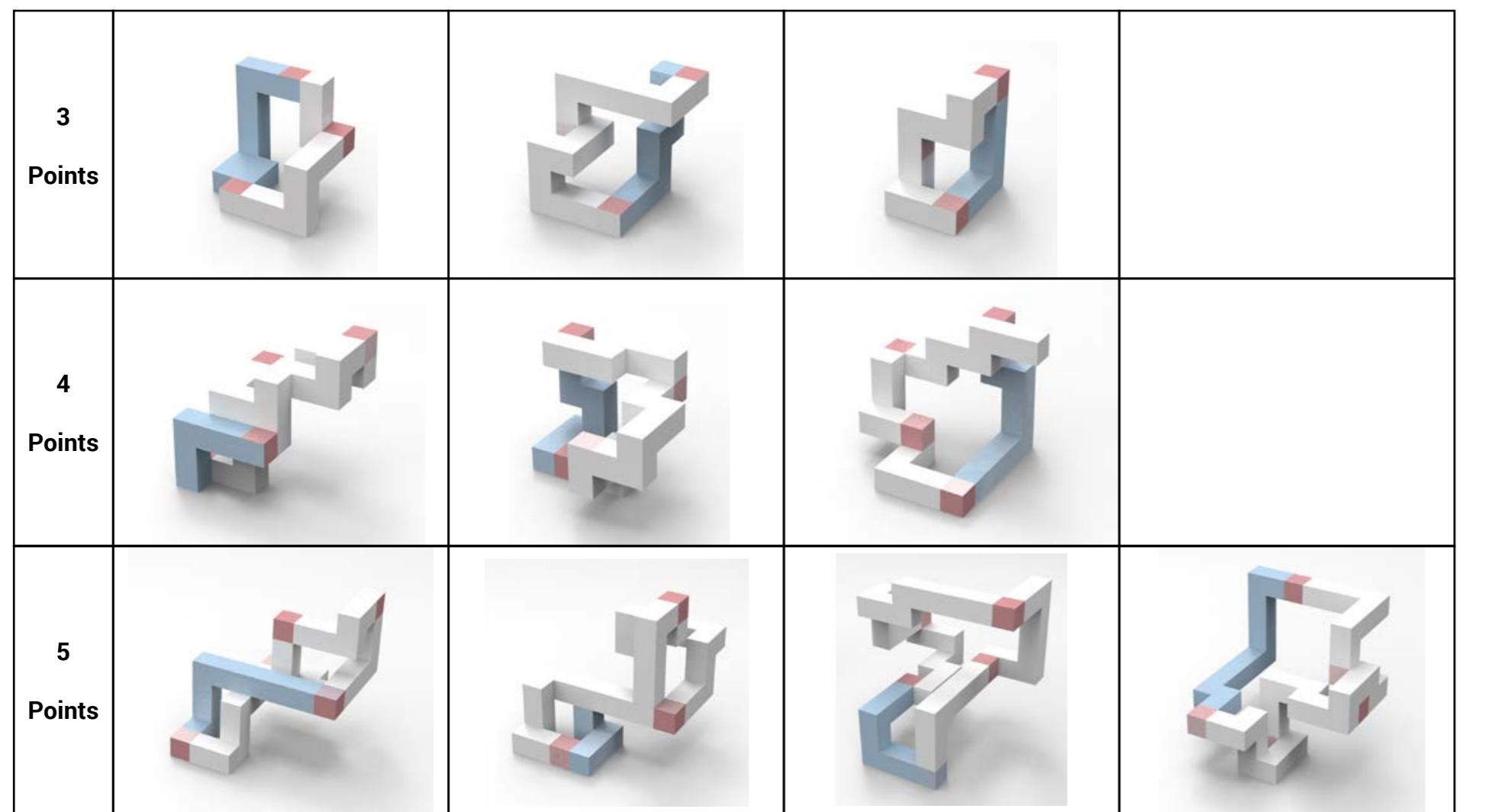


Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the origin city?

To find the shortest path to go through all the set points, and back to the start.

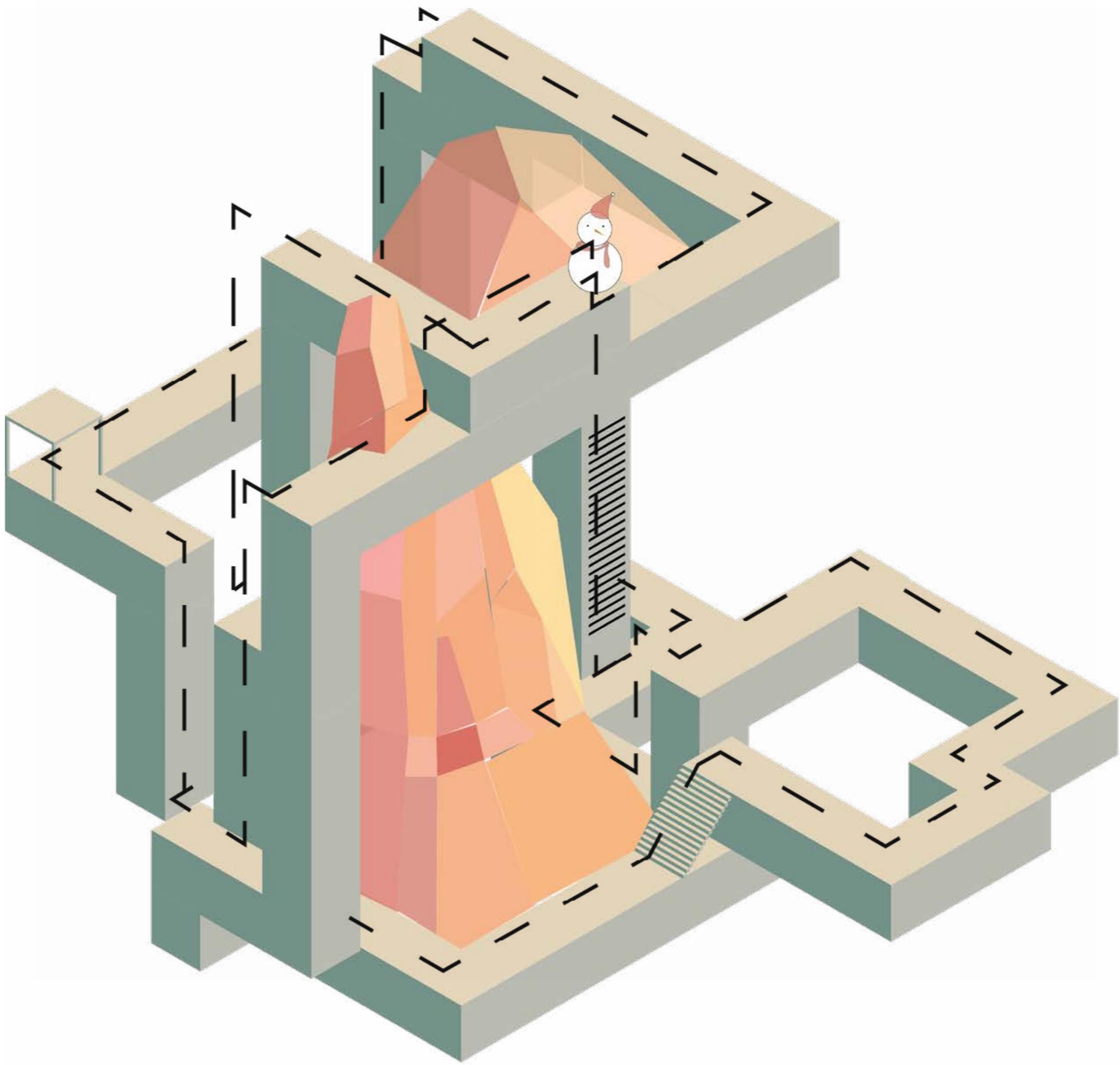
## [ PRINTING PATH ]

3D Simulation



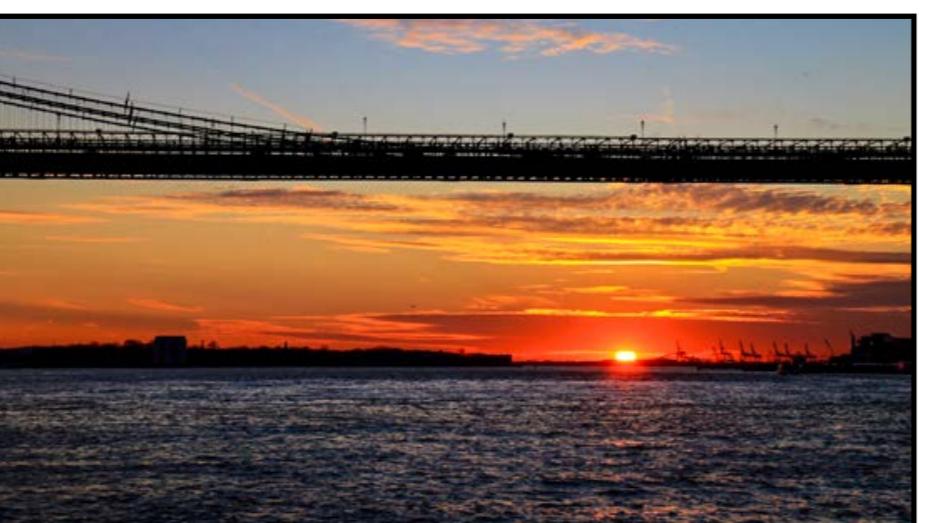
# [ PRINTING PATH ]

Future Design Thought



# 7 APPENDIX

Photography





**LU MIAO**

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