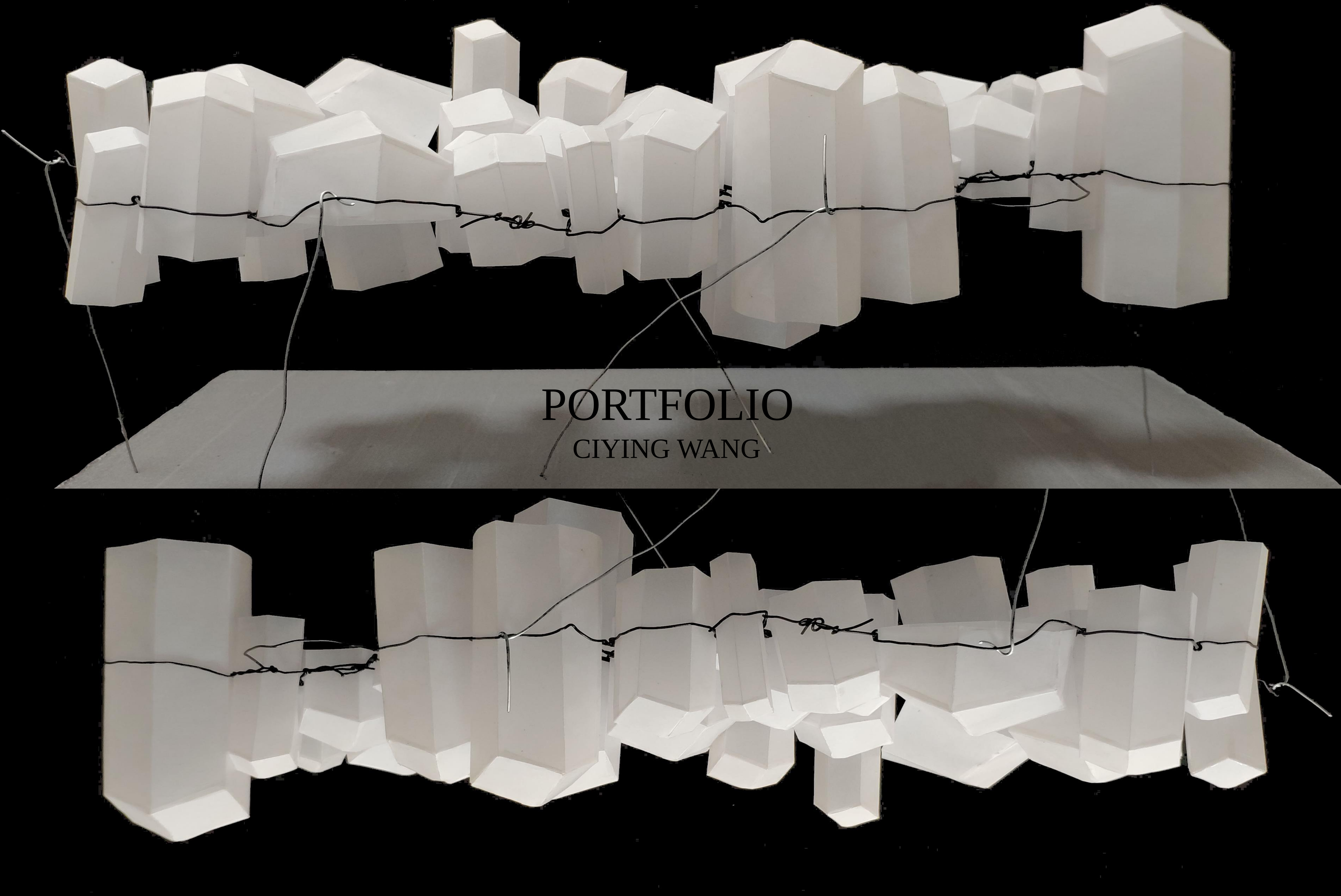
PORTFOLIO

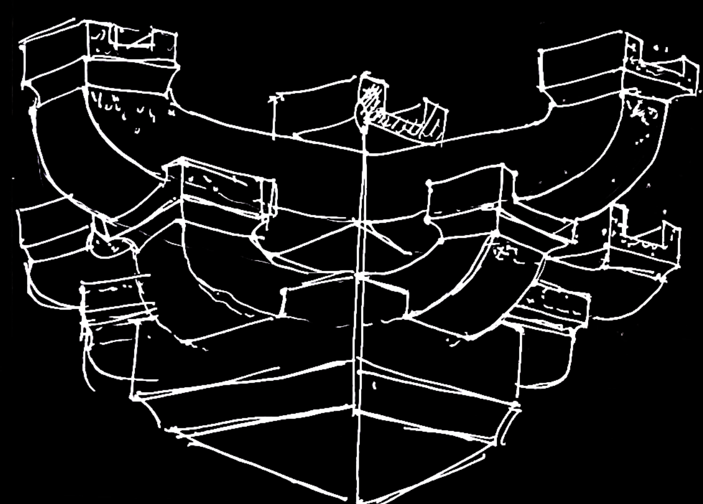
CIYING WANG



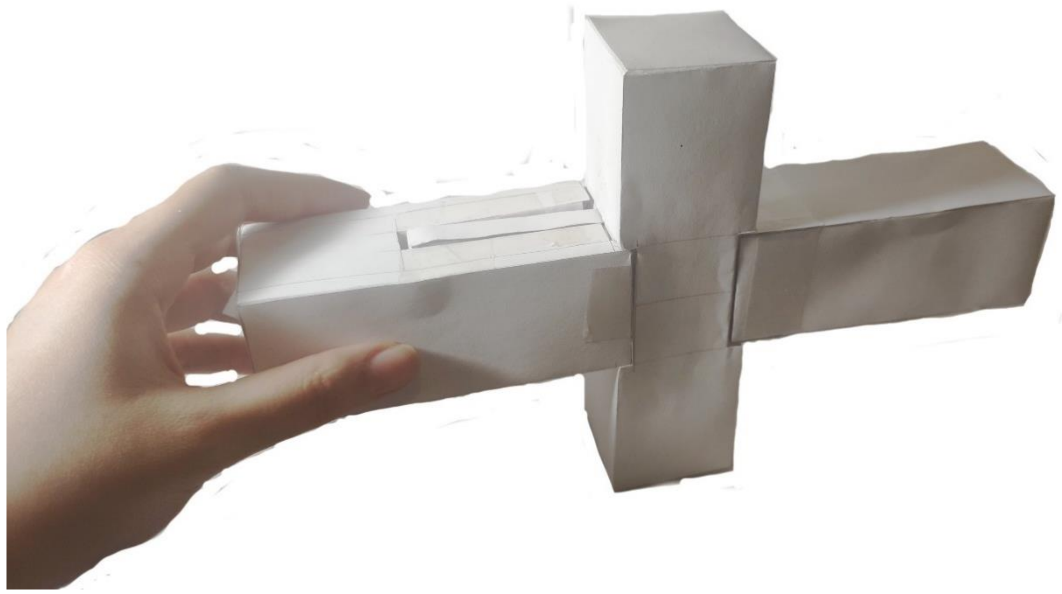
Contents.

Project 1: The Dou gong.

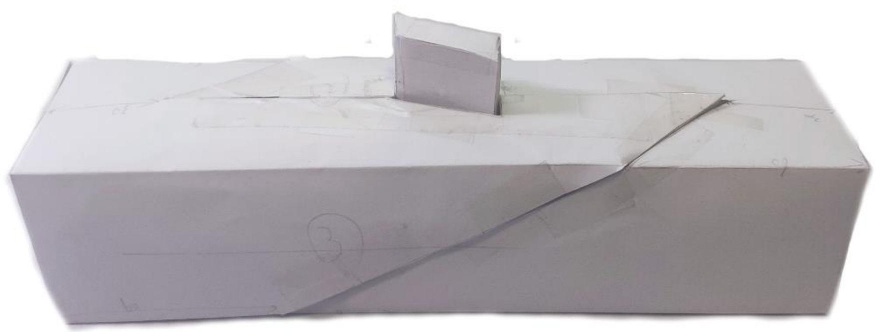
I am always fascinated by ancient architecture. In this project, I took inspiration from Dougong (brackets), which consist of various tenon-and-mortise joints. I firstly experimented with six different tenon-and-mortise structures by modelling them with paper. I then constructed an individual Dou gong which set a Dou gong that I sketched in 2015 as its prototype. When building the Dou gong from the base to the top, it looks as if it is growing.

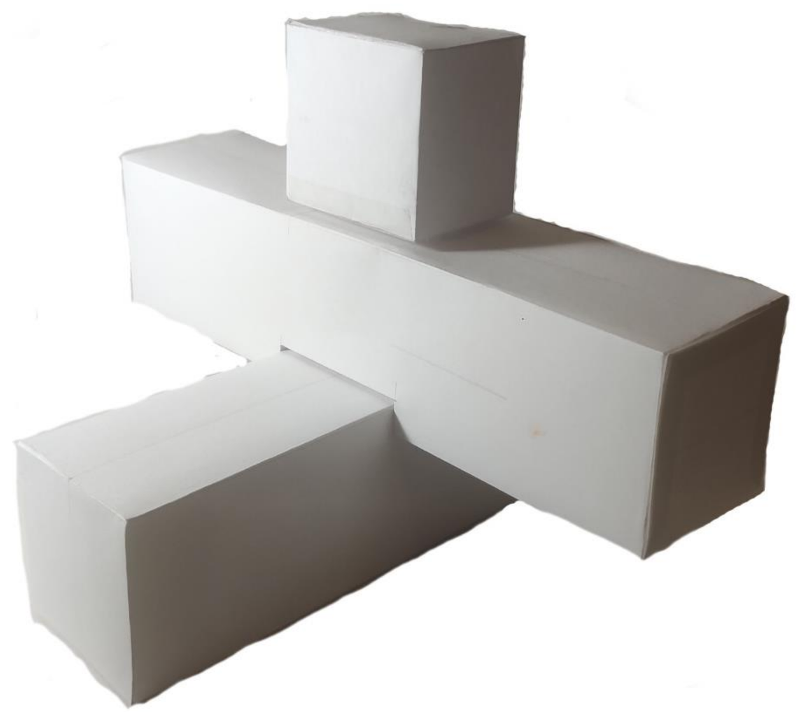


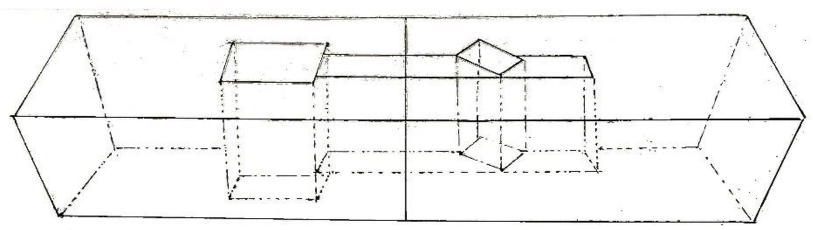
Sketch: A Dou gong.
2015.8 in Beijing.

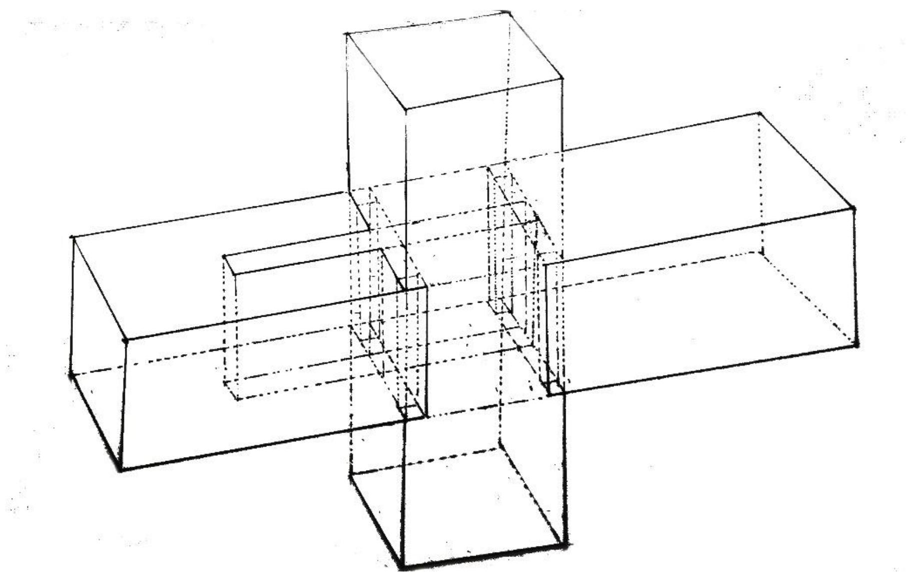


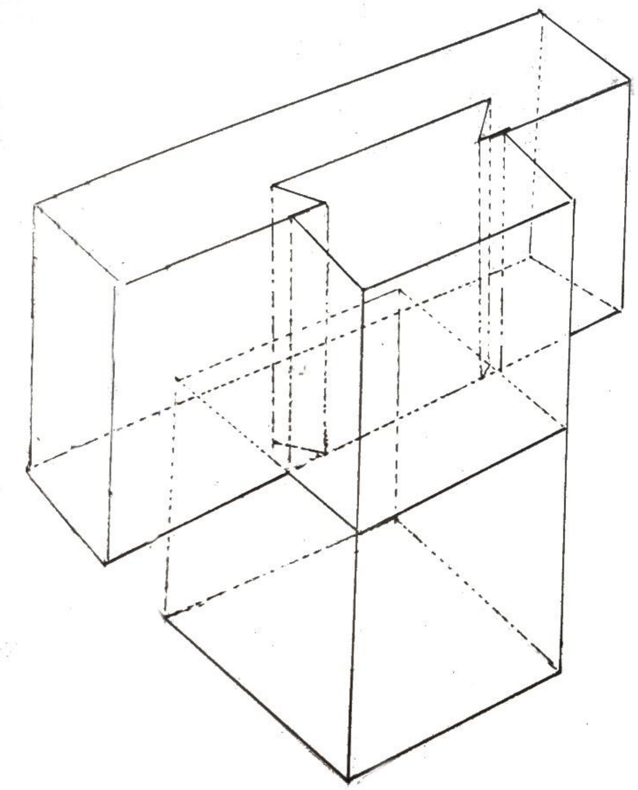
Tenon-and-mortise structure.



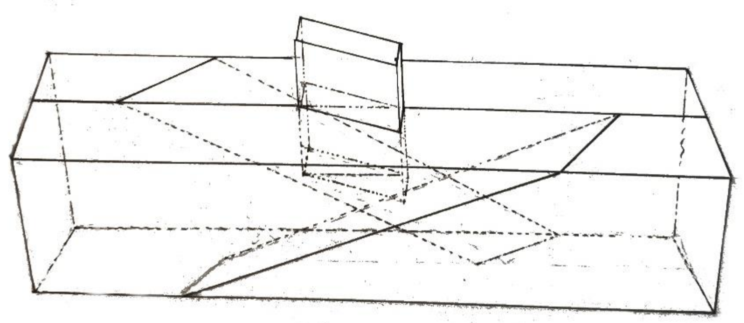


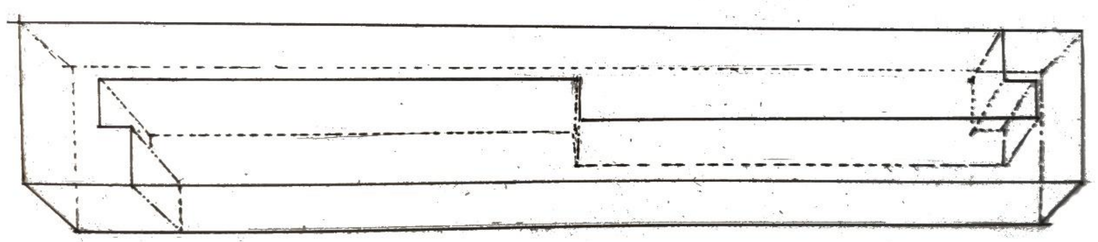


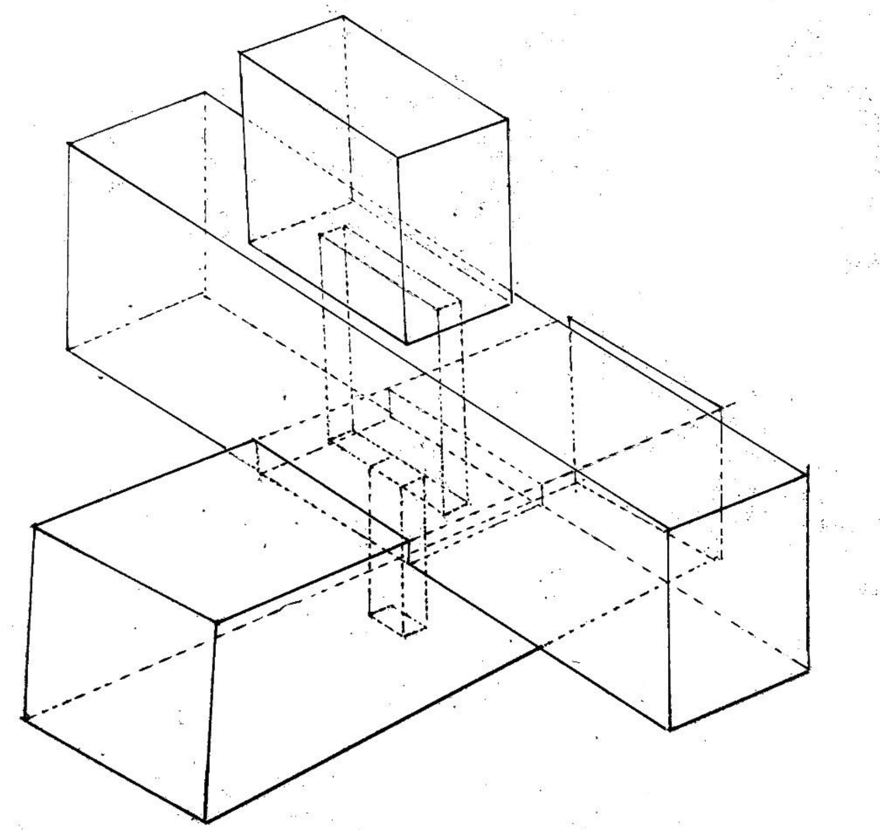




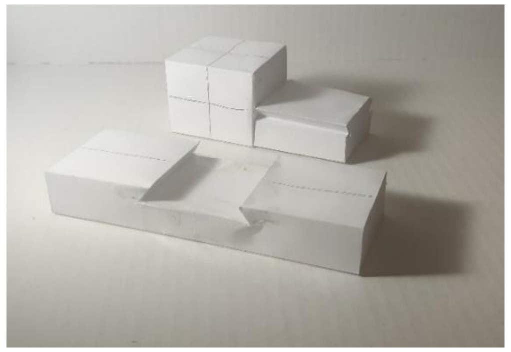
The tenon-and-mortise structure is an efficient way of joining materials together, which has been widely used in brackets (Dou gong). I selected six structures that are commonly used. Tenon-and-mortise structures are generally built with wood, but I constructed them with paper to make them conveniently cut and meanwhile to reach the effect of purity and elegant.

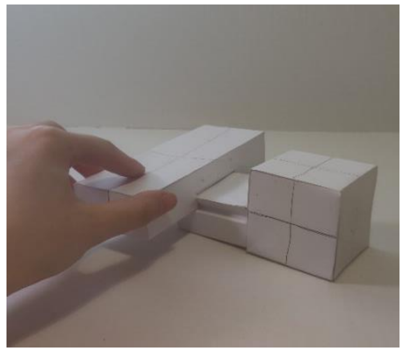


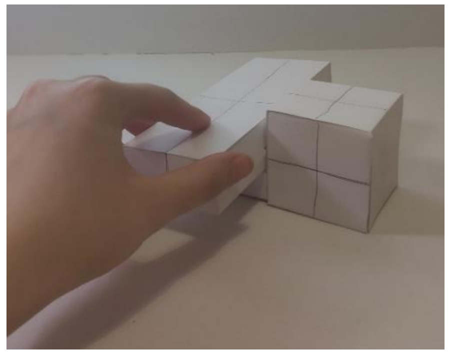


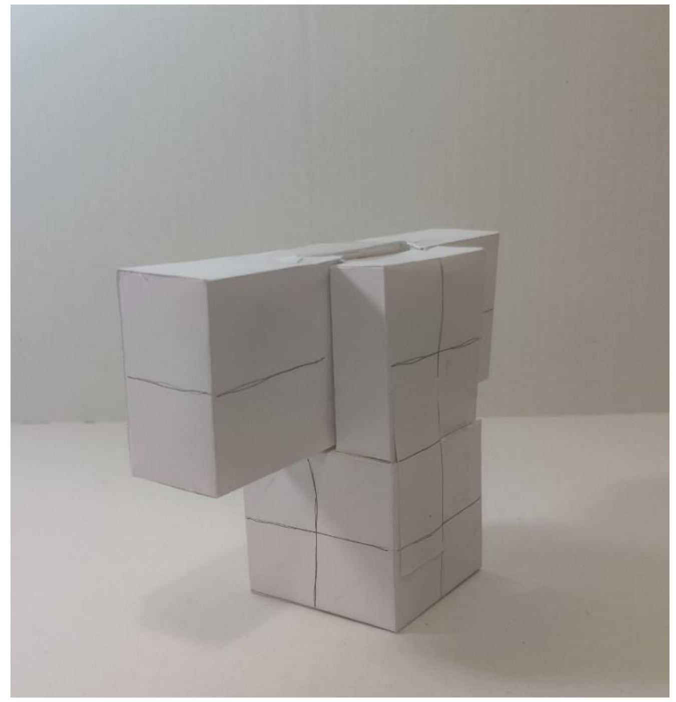


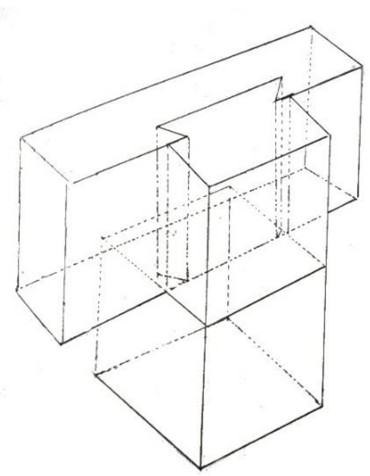
01. The Dou gong

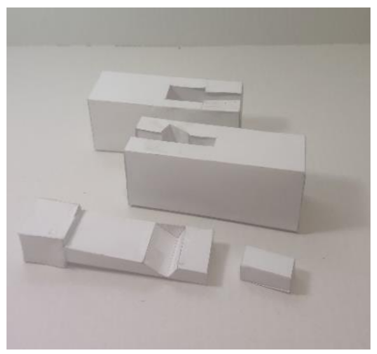


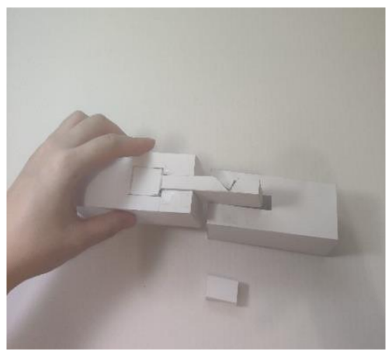


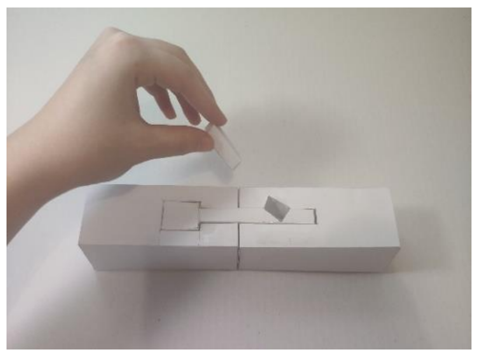


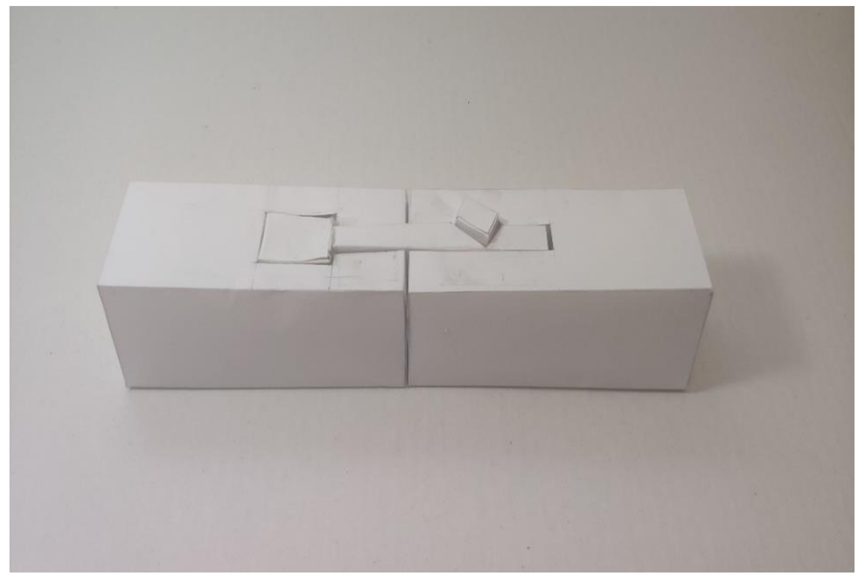


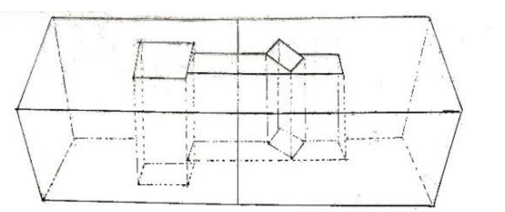


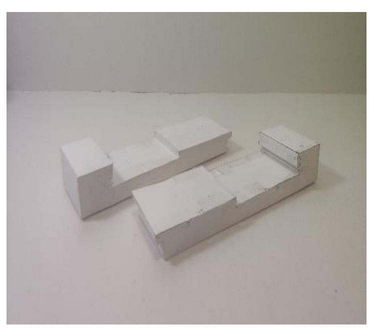


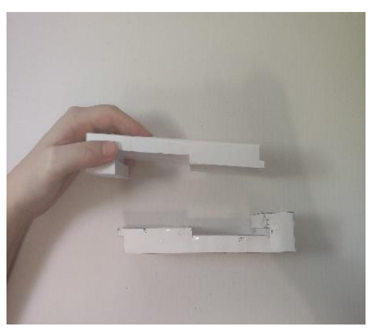


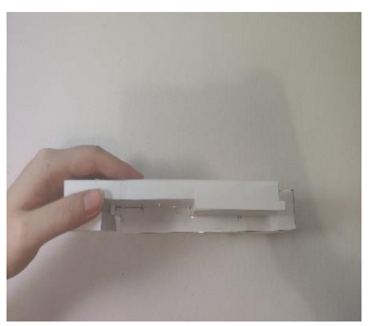


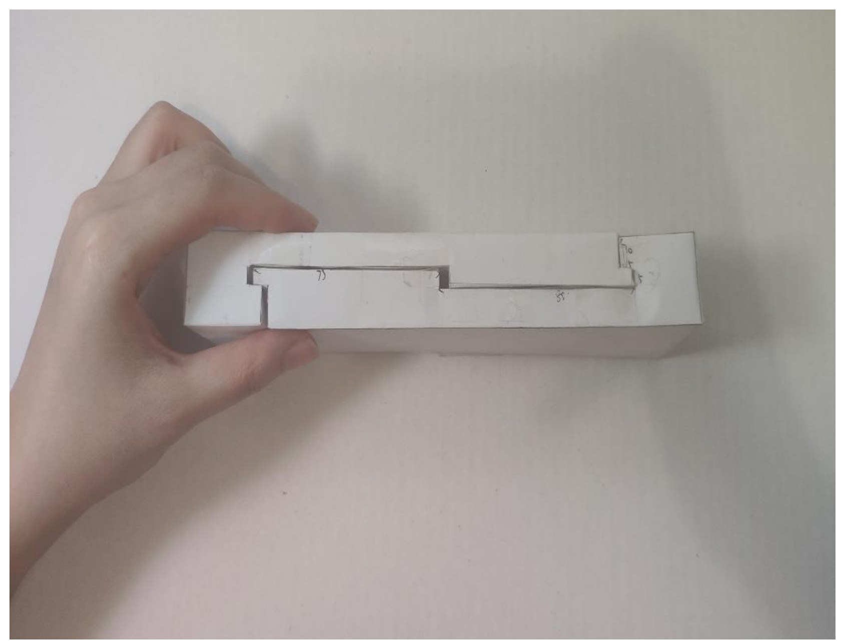


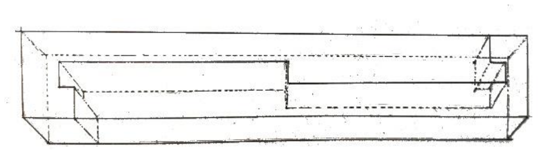


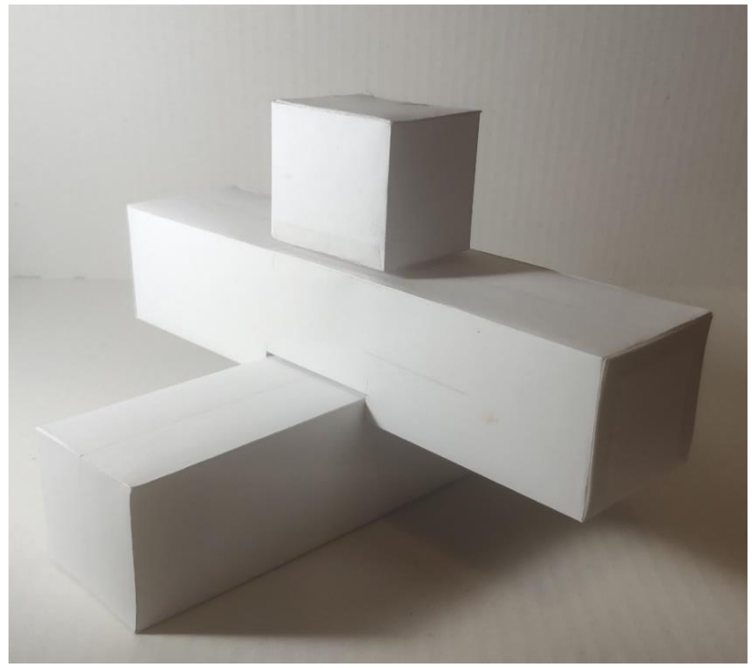
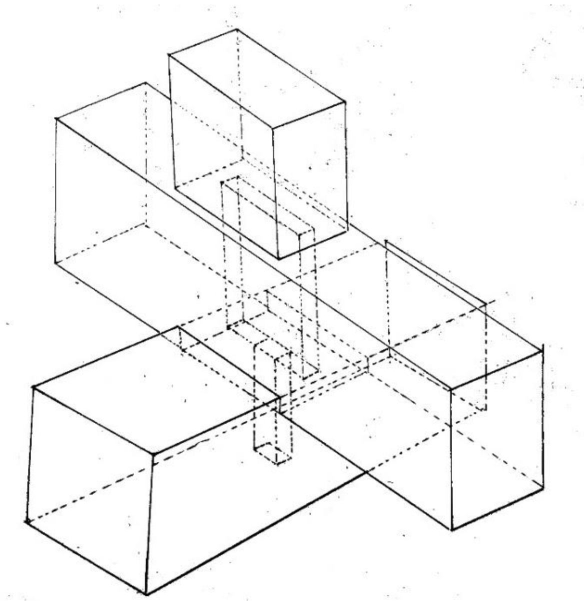
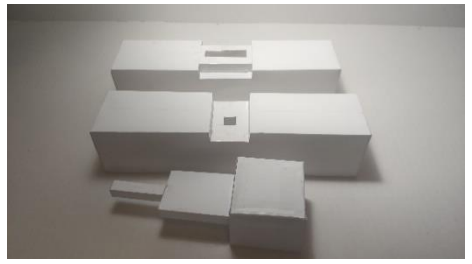
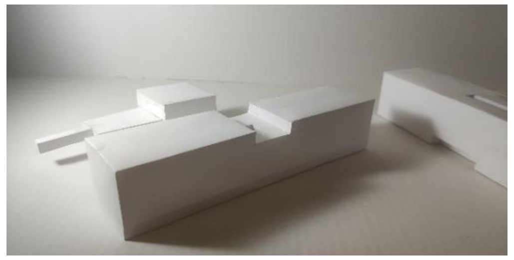
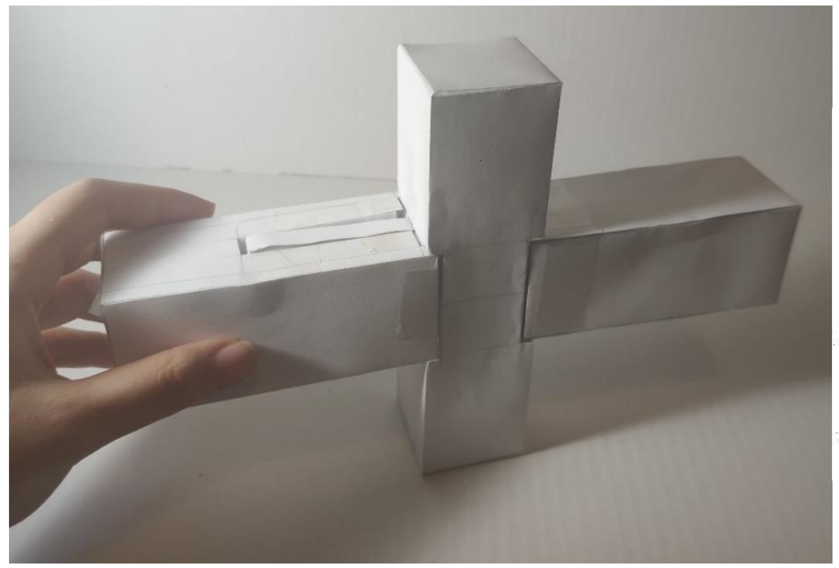
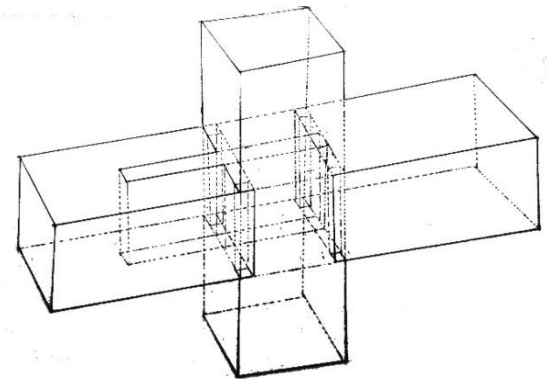
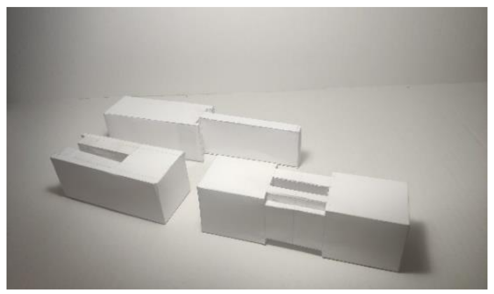
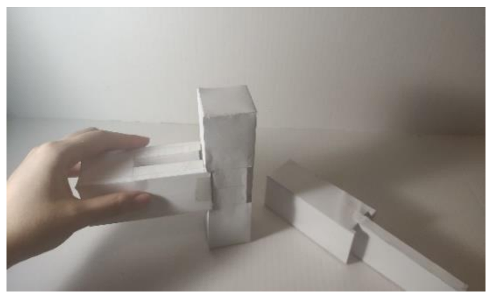
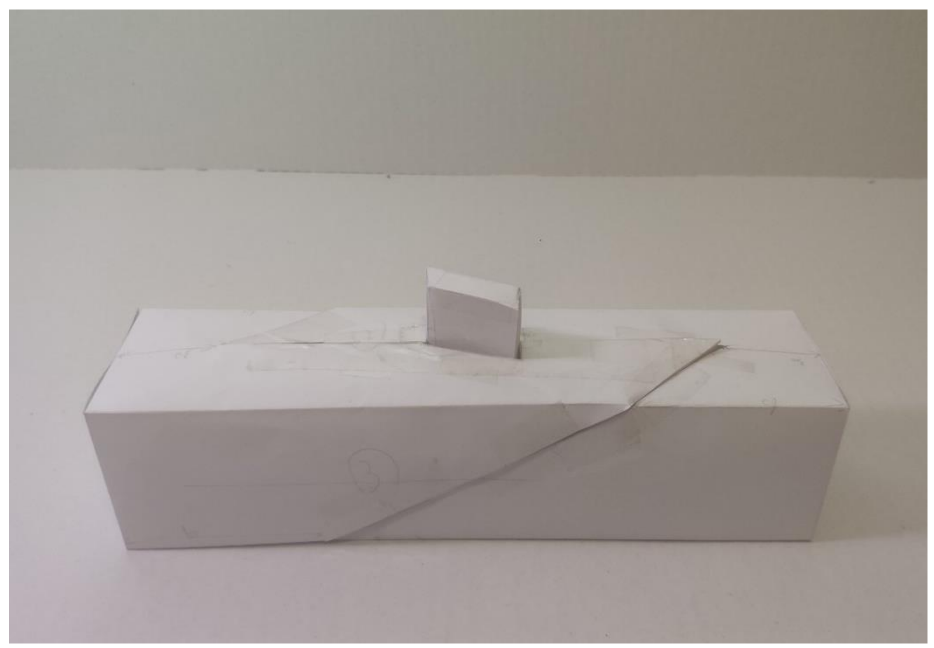
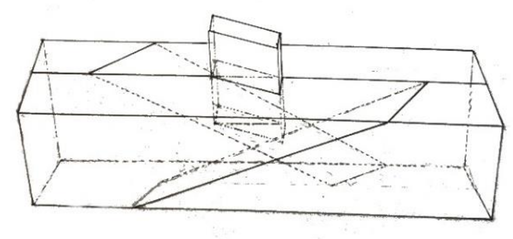
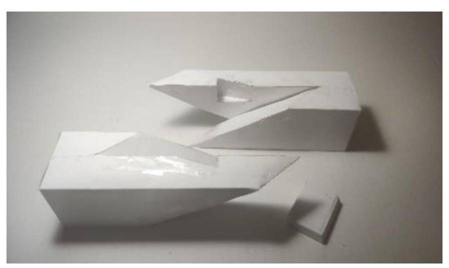




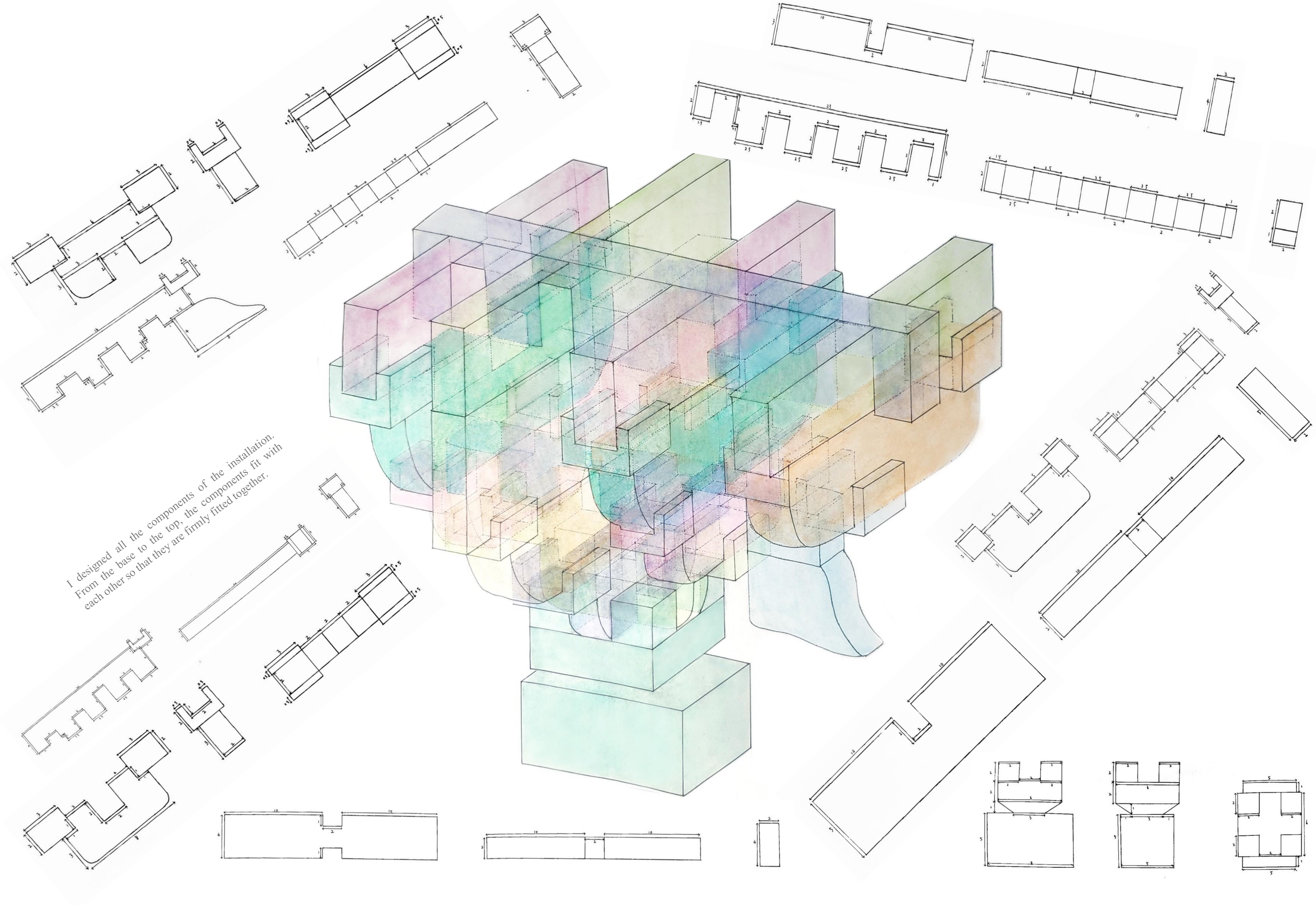




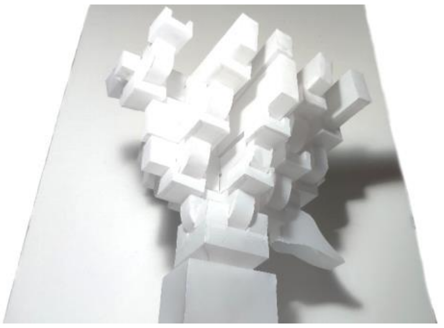


01. The Dou gong

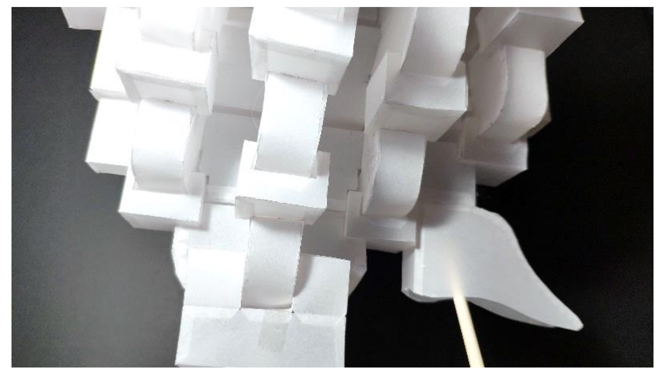


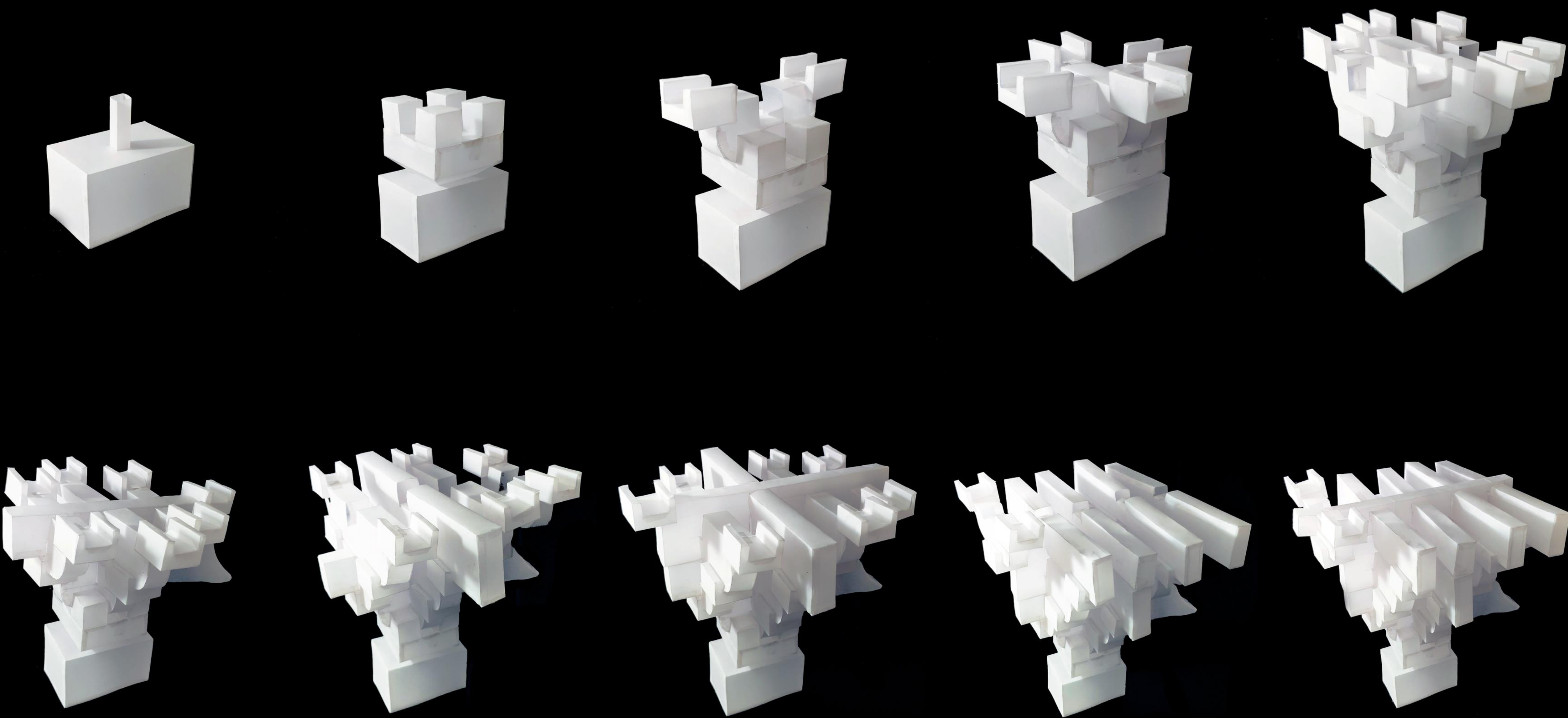
I designed all the components of the installation. From the base to the top, the components fit with each other so that they are firmly fitted together.

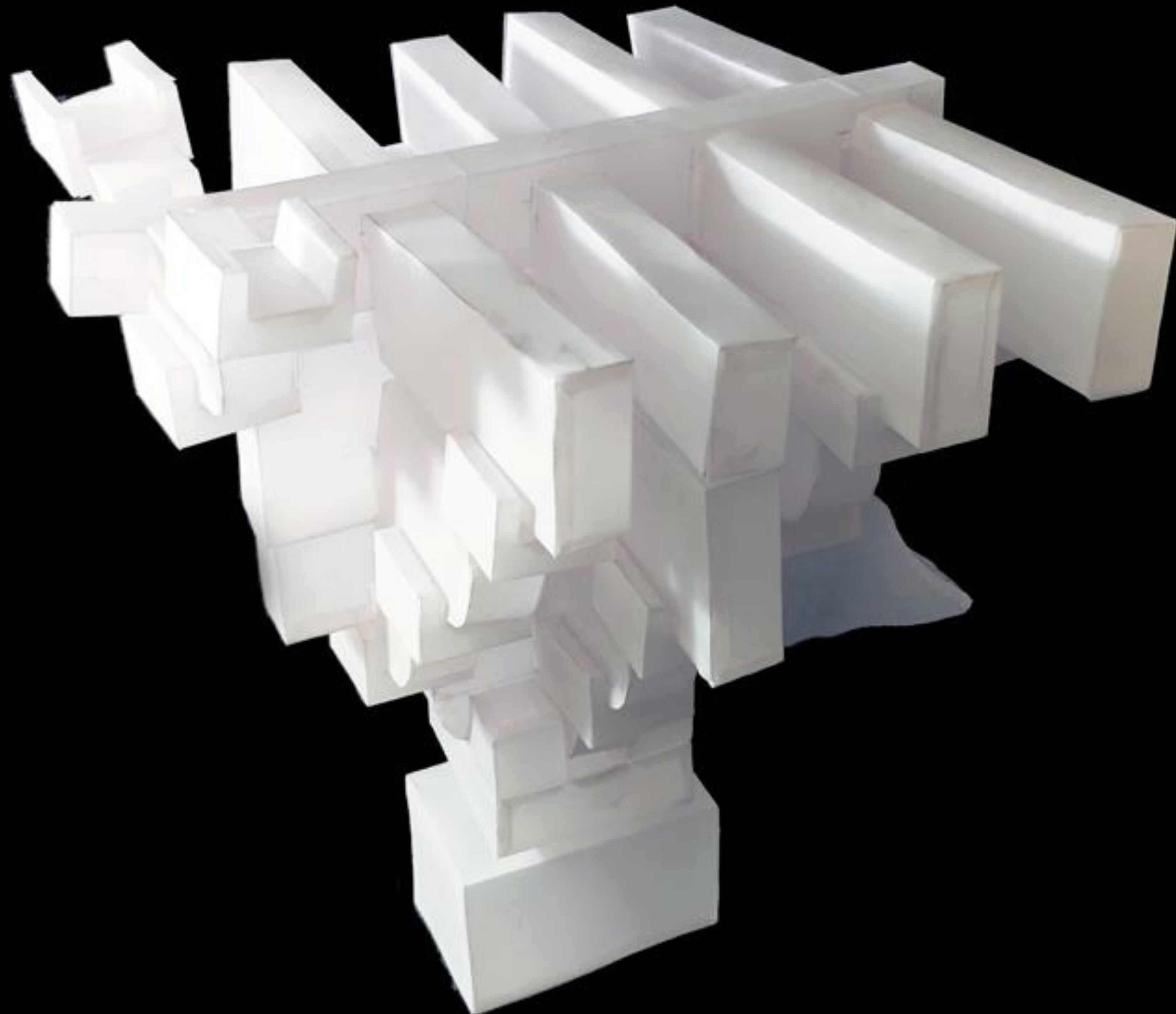






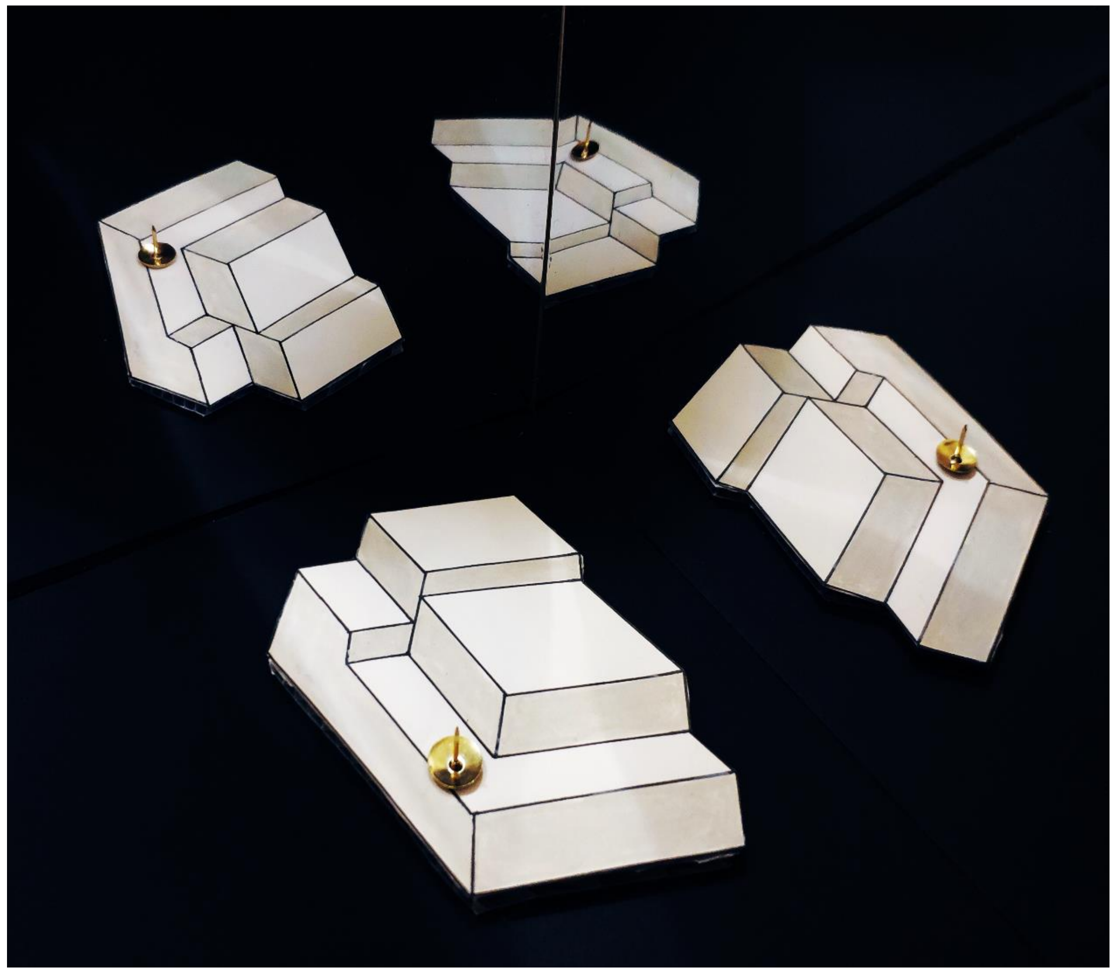


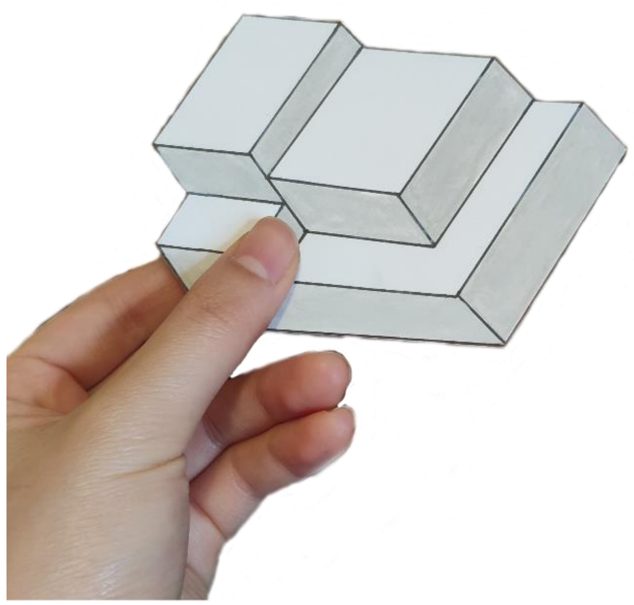




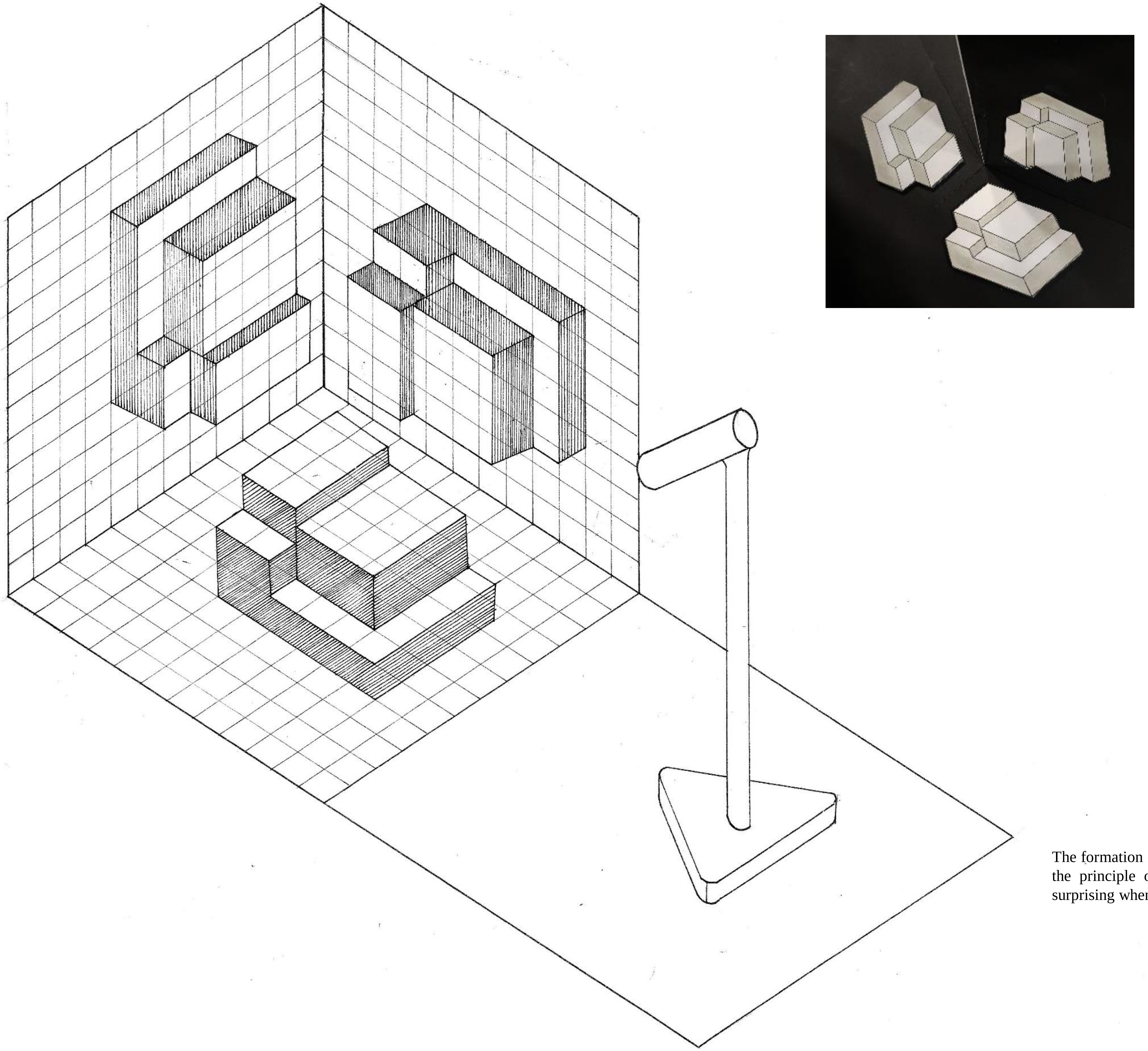
Project 2: Impossible possibilities.

The senses can no longer be the sole source of direct knowledge.
In this project, I conducted several experiments that used tricks to cheat views' eyes.

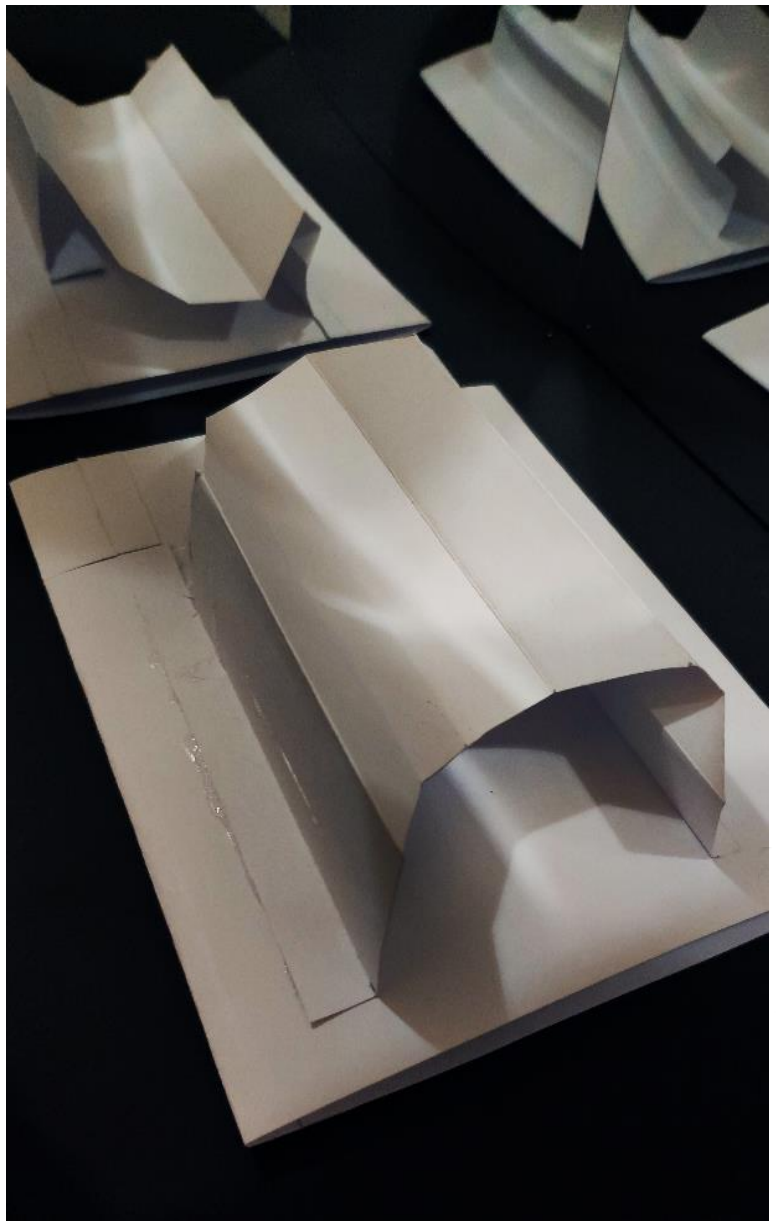




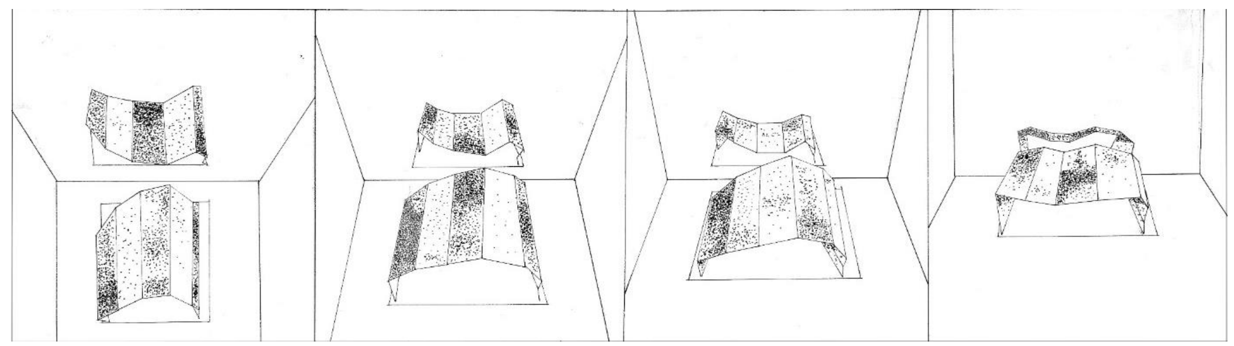
Pictures are paradoxes. They are both visibly flat and three-dimensional, which are infinitely ambiguous: any two-dimensional image could represent an infinity of possible three-dimensional shapes.

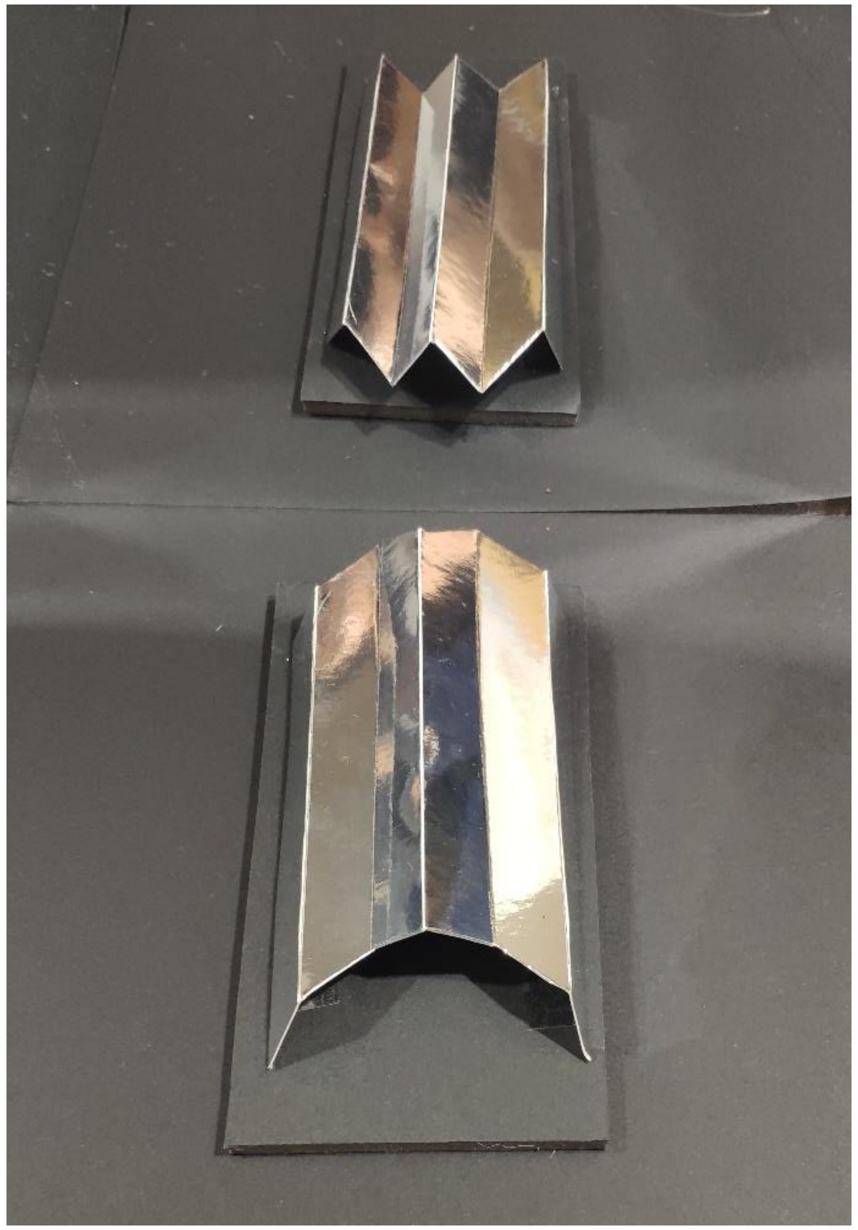


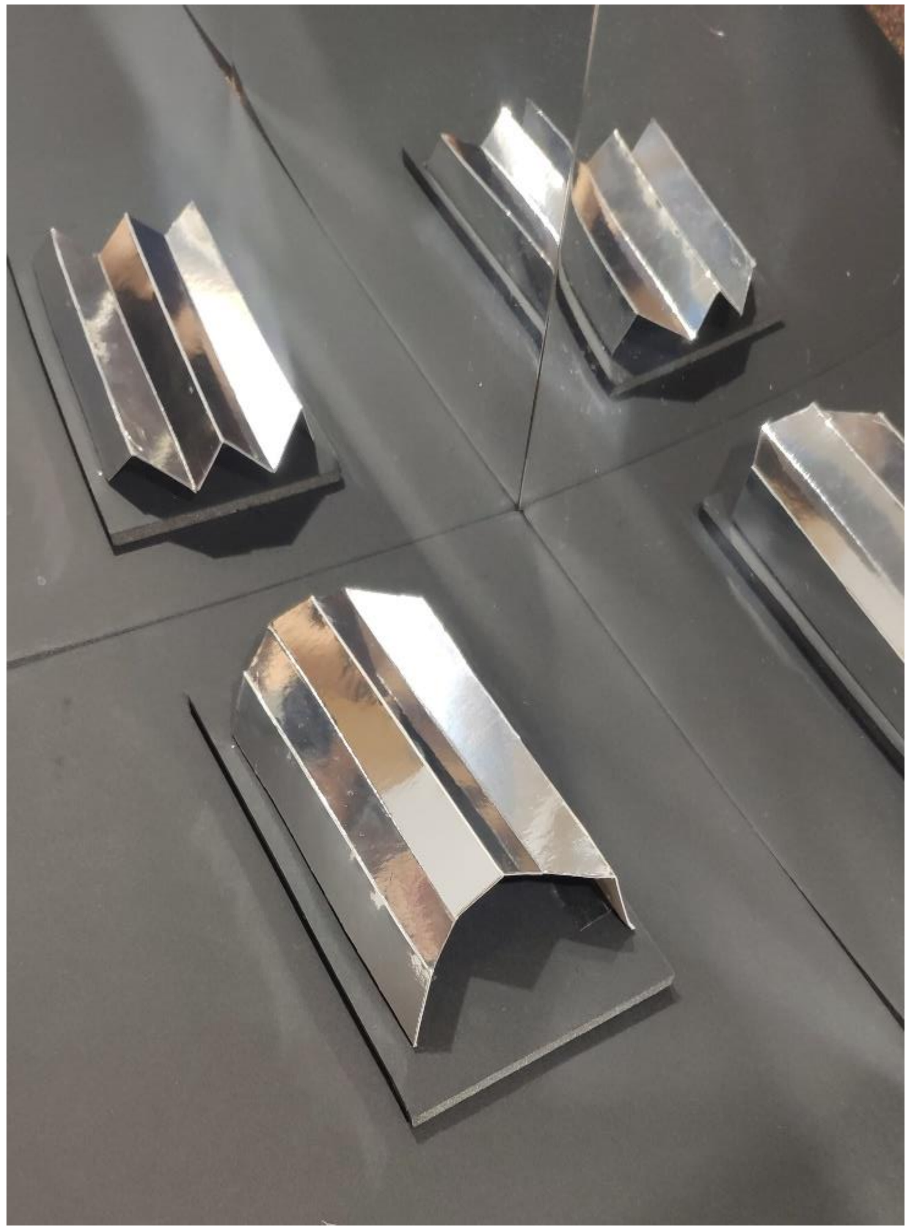
The formation of the varied pictures complies with the principle of reflection, but they still appear surprising when human eyes process the images.



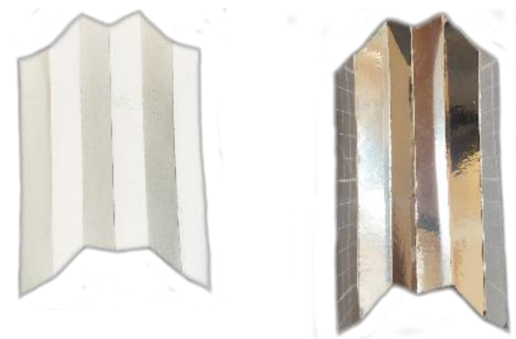
The reflection in the mirror seems total different from the original object.
One seems bending upward, and the other seems bending downward.

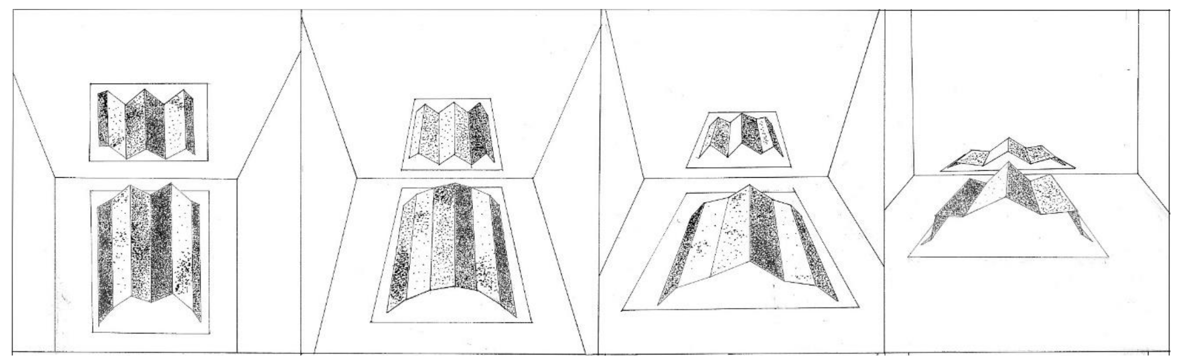




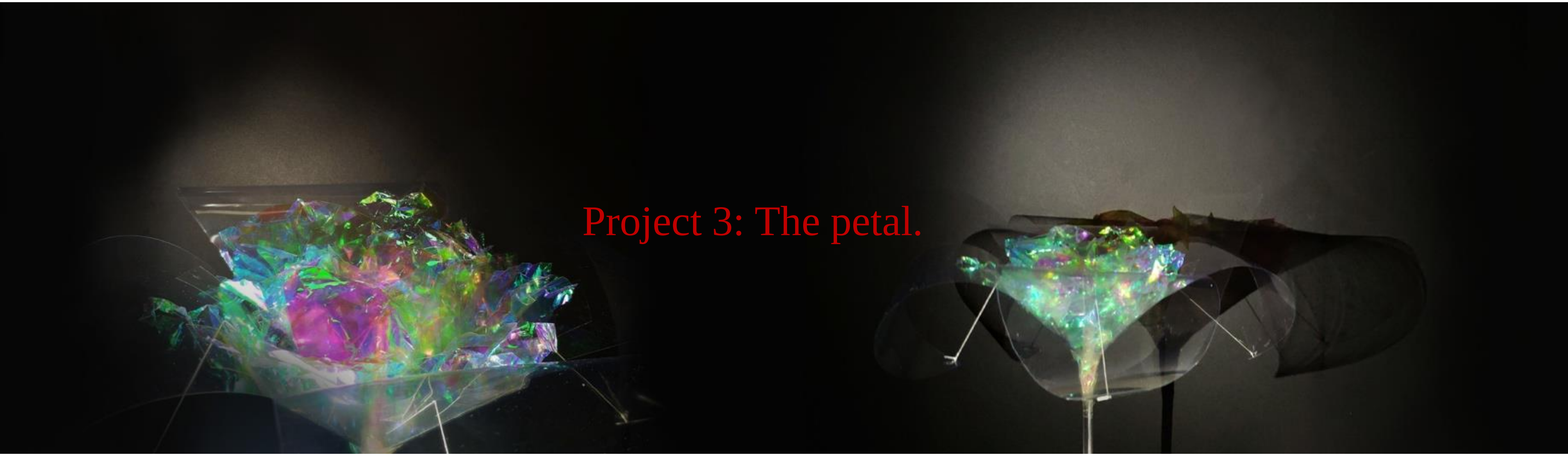


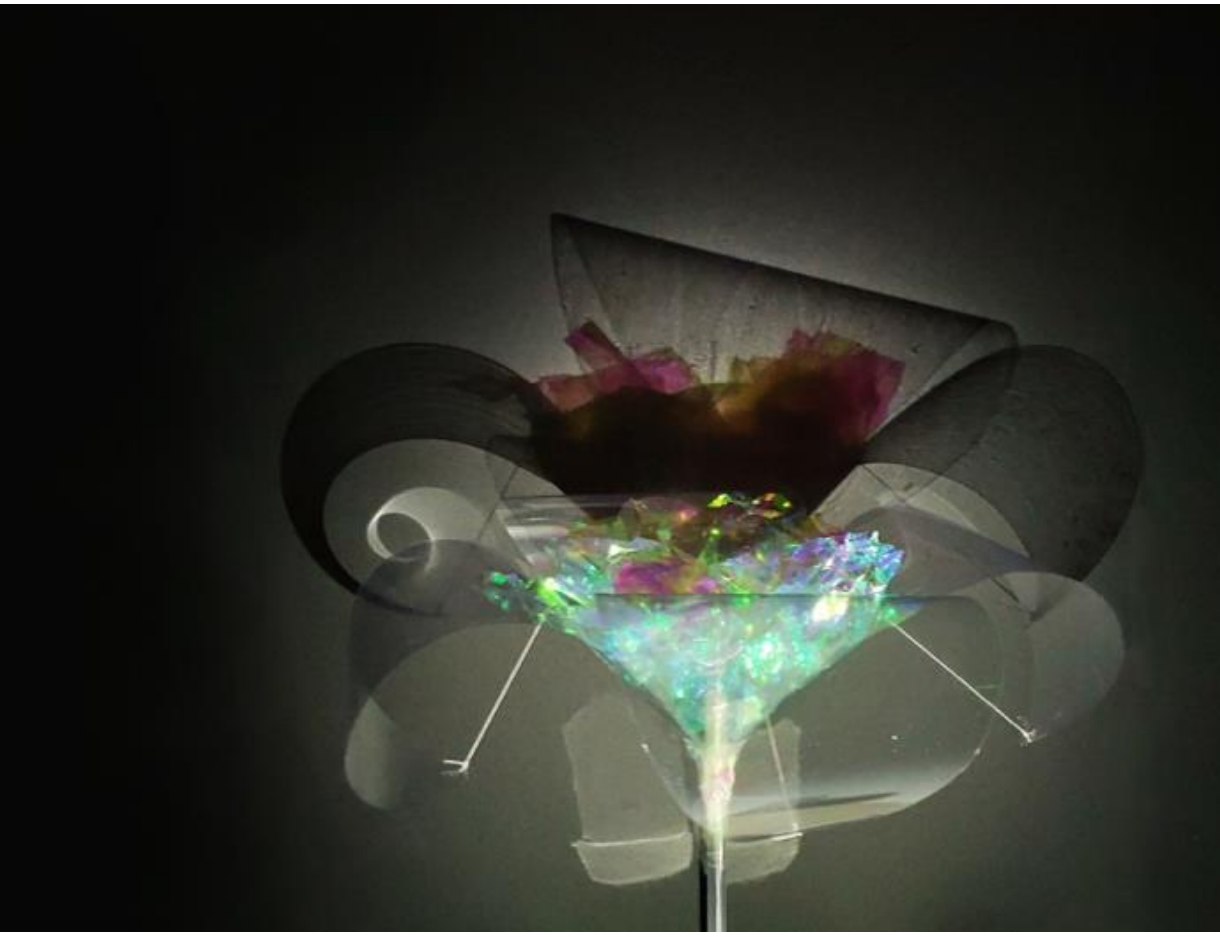
The original object looks like a continuous curve,
while its reflection in the mirror seems broken lines.





Project 3: The petal.

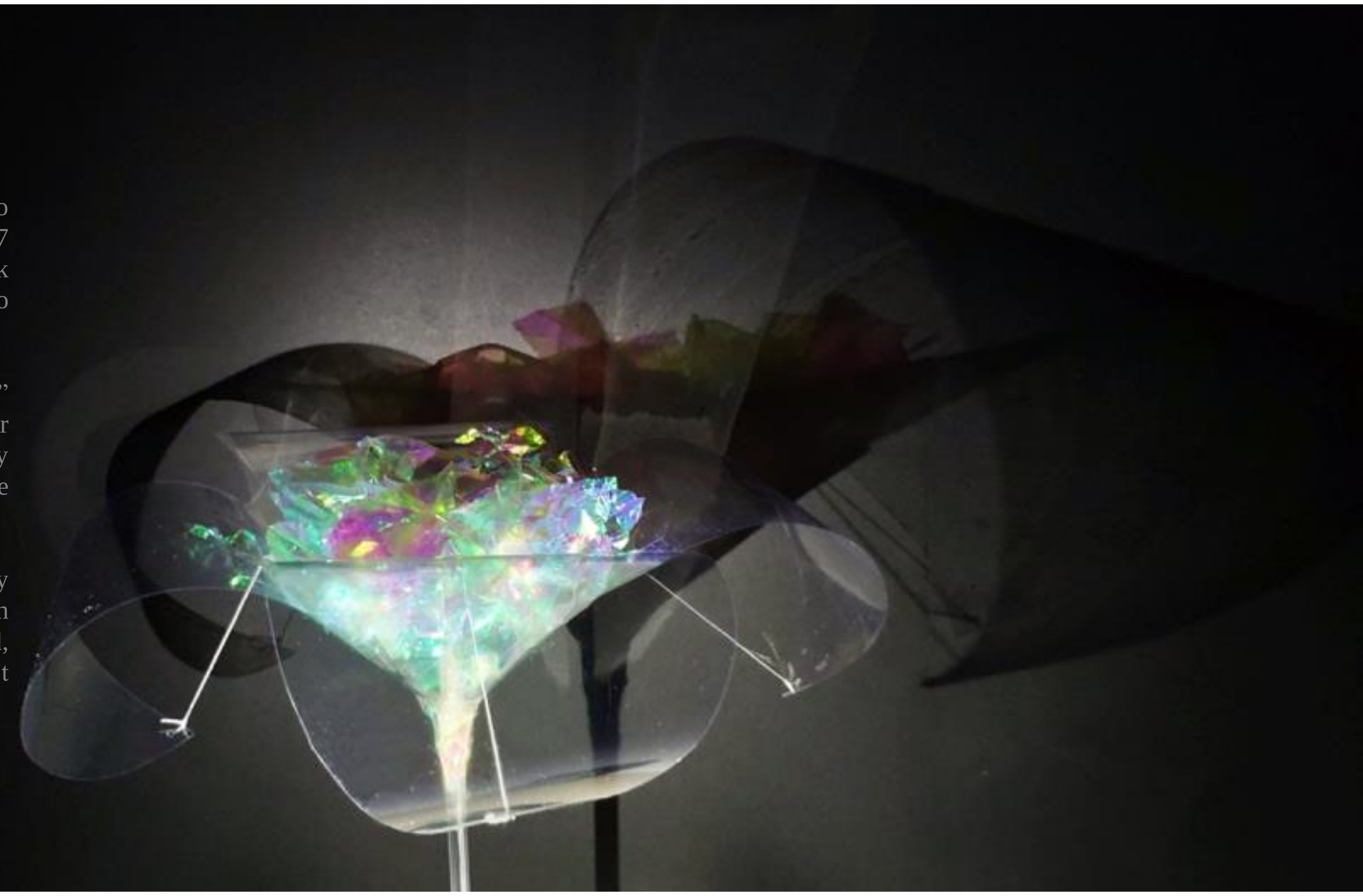


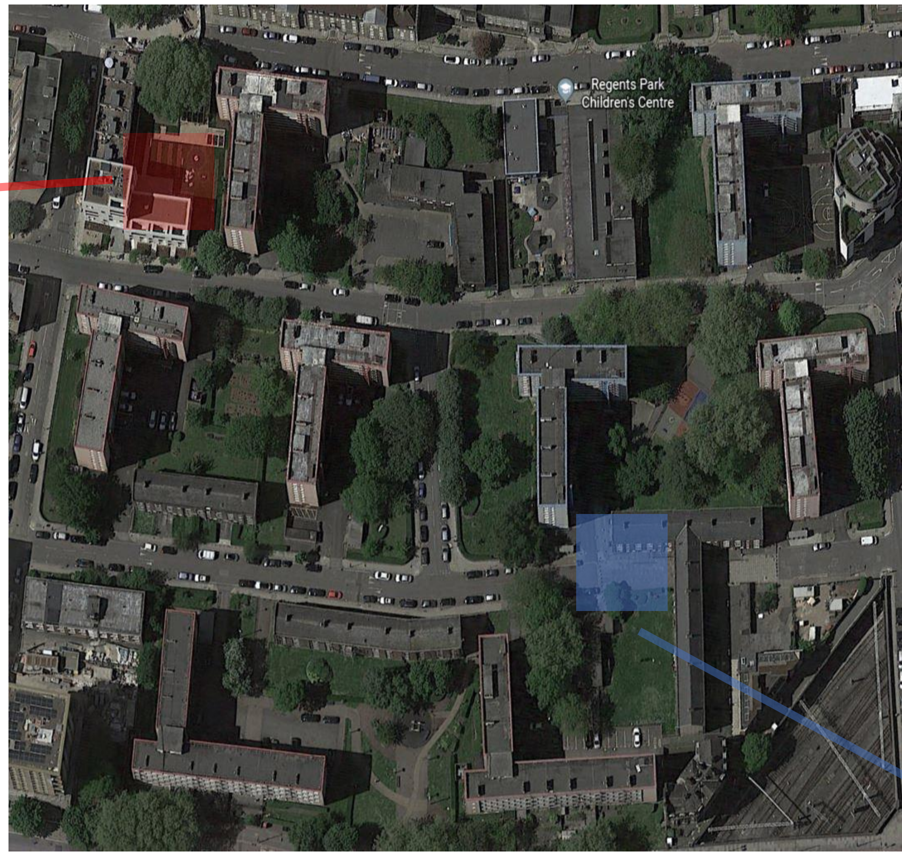


An installation was assigned to be built within two weeks in an estate near UCL during the 2017 summer school program. My team spent a week observing and seeking inspirations, and set out to realise our plan during the second week.

We set “increasing connectivity in the community” as our subject, and went to great lengths to fulfil our goal. We generated our creativity, gradually polished our ideas, made models and constructed the final installation.

After conquering all kinds of challenges, we finally managed to primitively realize our aims. An installation of a ‘sharing table’ was constructed, fulfilling our idea of building a table that wouldn’t function properly until everybody took part in .

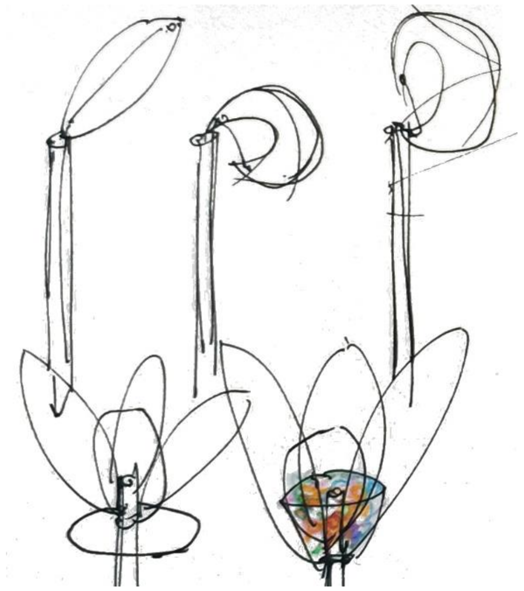


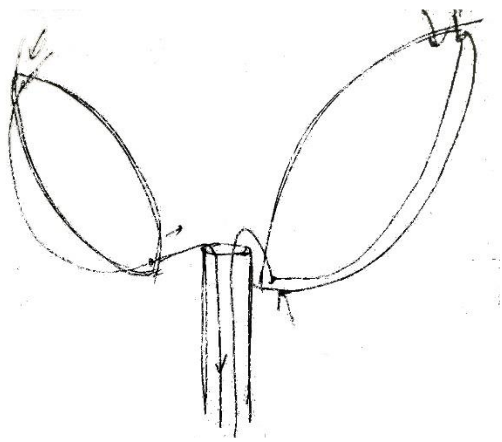


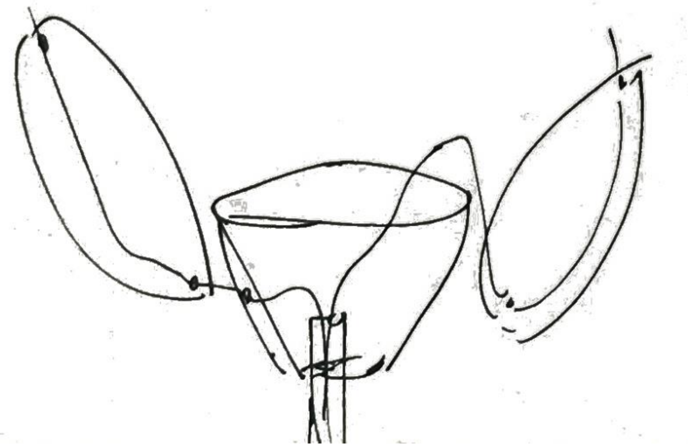
Two sites were considered for the installation. One was a disused concrete where the principle of “regeneration” could be fulfilled. The other was a grassland where the colour of the canopies could artfully reflect the patterns of the windowsills around. We finally chose the concrete site, after taking feasibility and practical functions into consideration.

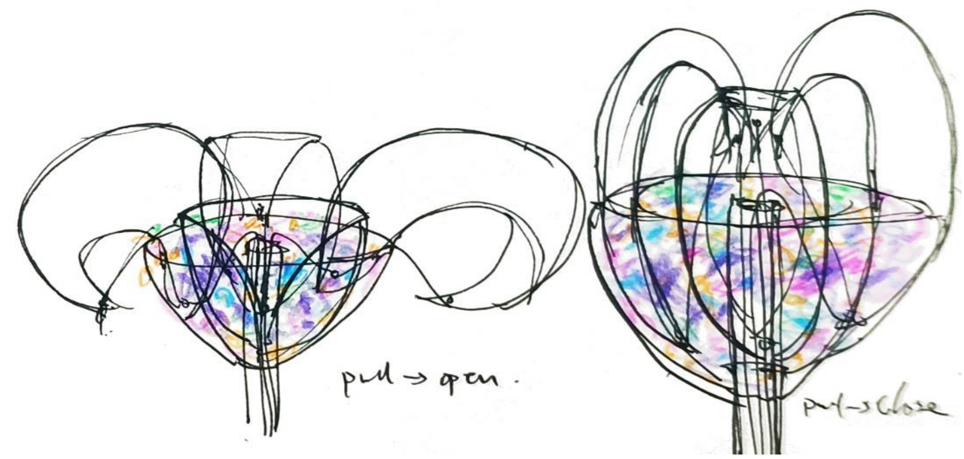
Considering that the adoption of light at the corner of the building was relatively poor, I came up with the idea that a colourful pavilion could be built around the existing tree. The reflecting material would provide light for the corridors of the building, and the canopy could form an interesting view when watched from above. The colourful glasses let sunlight could go through and shed gorgeous shadows, adding to the fun when people sit under the pavilion.

The idea of constructing an installation of ‘petals’ was bred during the designing process . Although it was given up because of the complexity of building it, it’s still regarded as the best plan among our ideas.

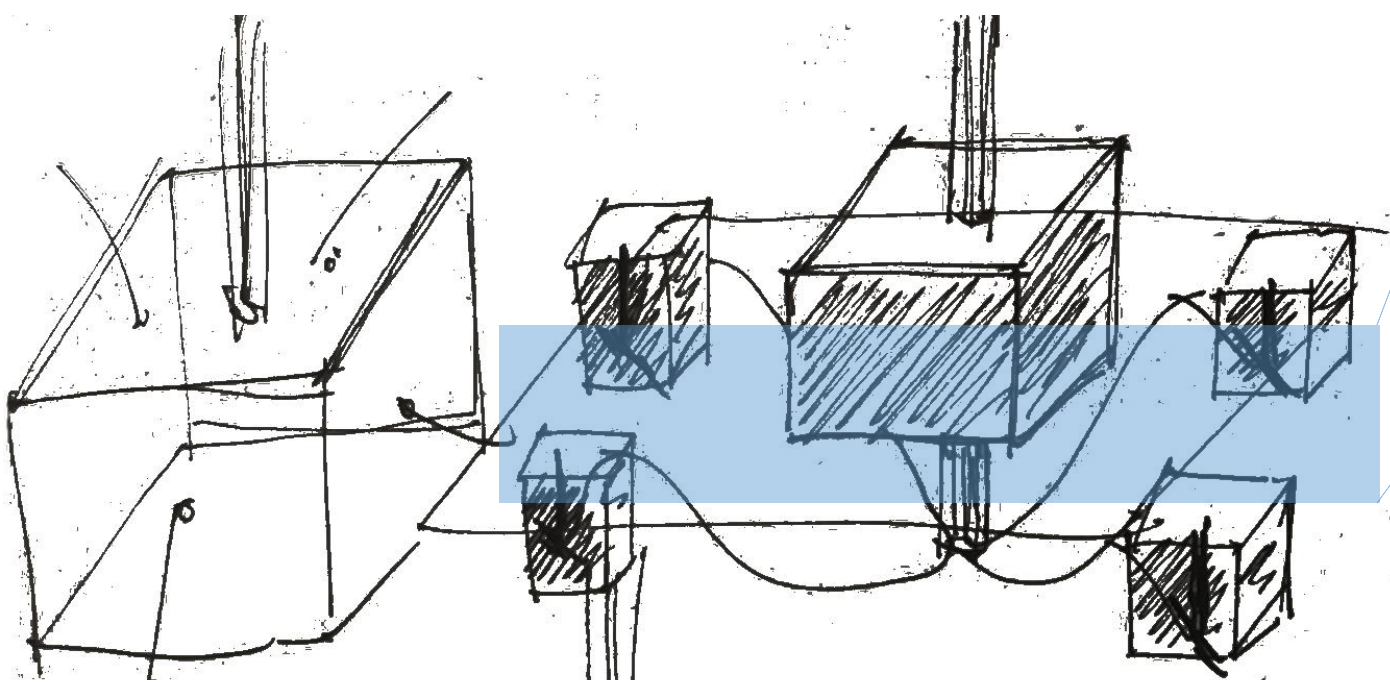


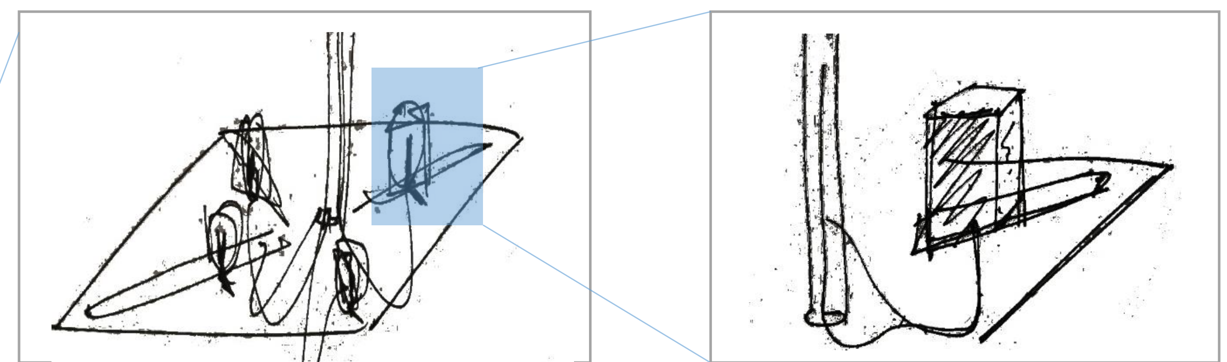






I experimented with several methods to build the petals. The original idea was to tie the petal directly to a tube, where the threads pass through and connect to the table. But the petals were extremely unstable and could not hold straight when no strings were pulled. Then I took the idea from flower receptacles, and then cut half of a prism to make the receptacle and stuck the petals to its edge. The strings were connected to both sides of the petals and then passed through a tube. Reflective materials were designed to cover the petals, but putting them in the receptacles could provide interesting look and beautiful shadows.





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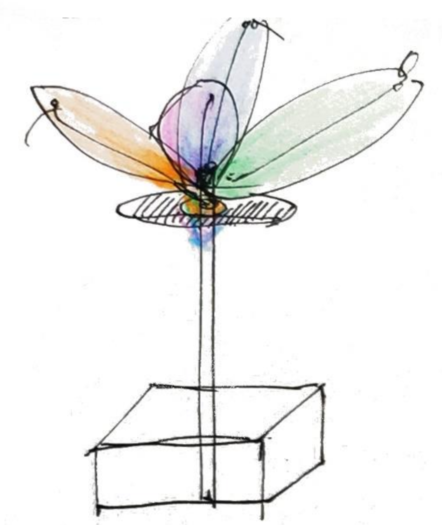
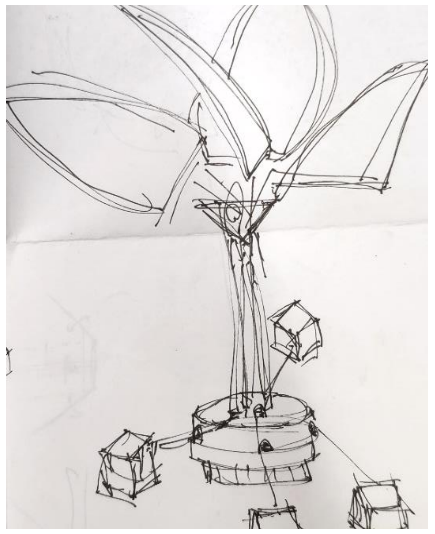
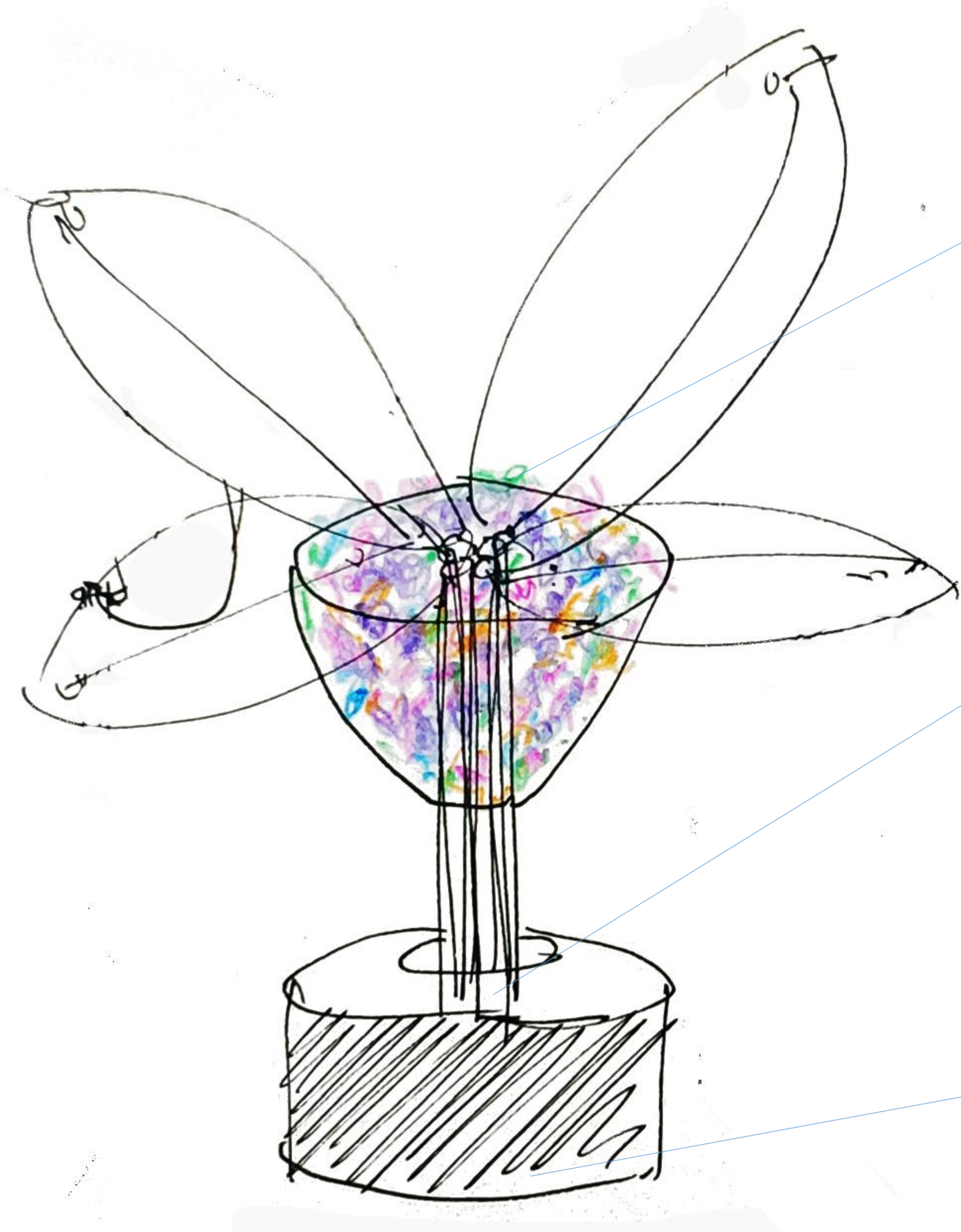
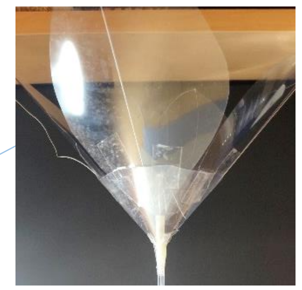
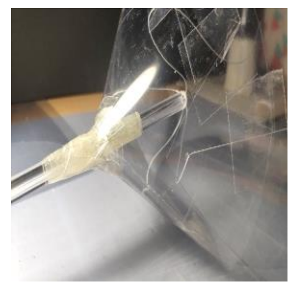
03. The petal

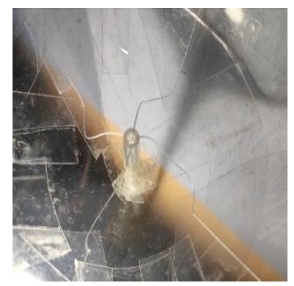


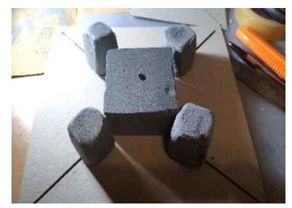


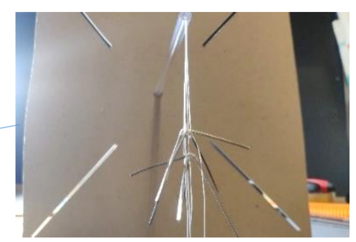


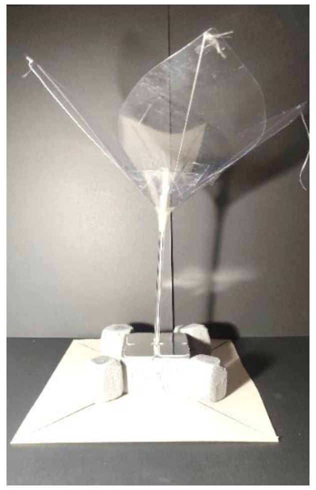


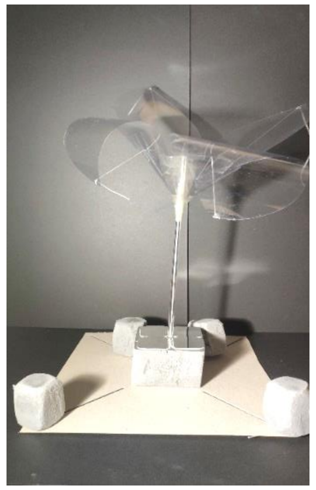


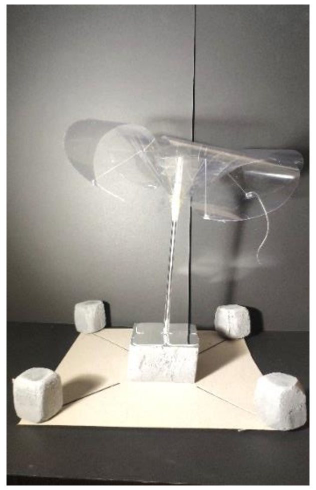


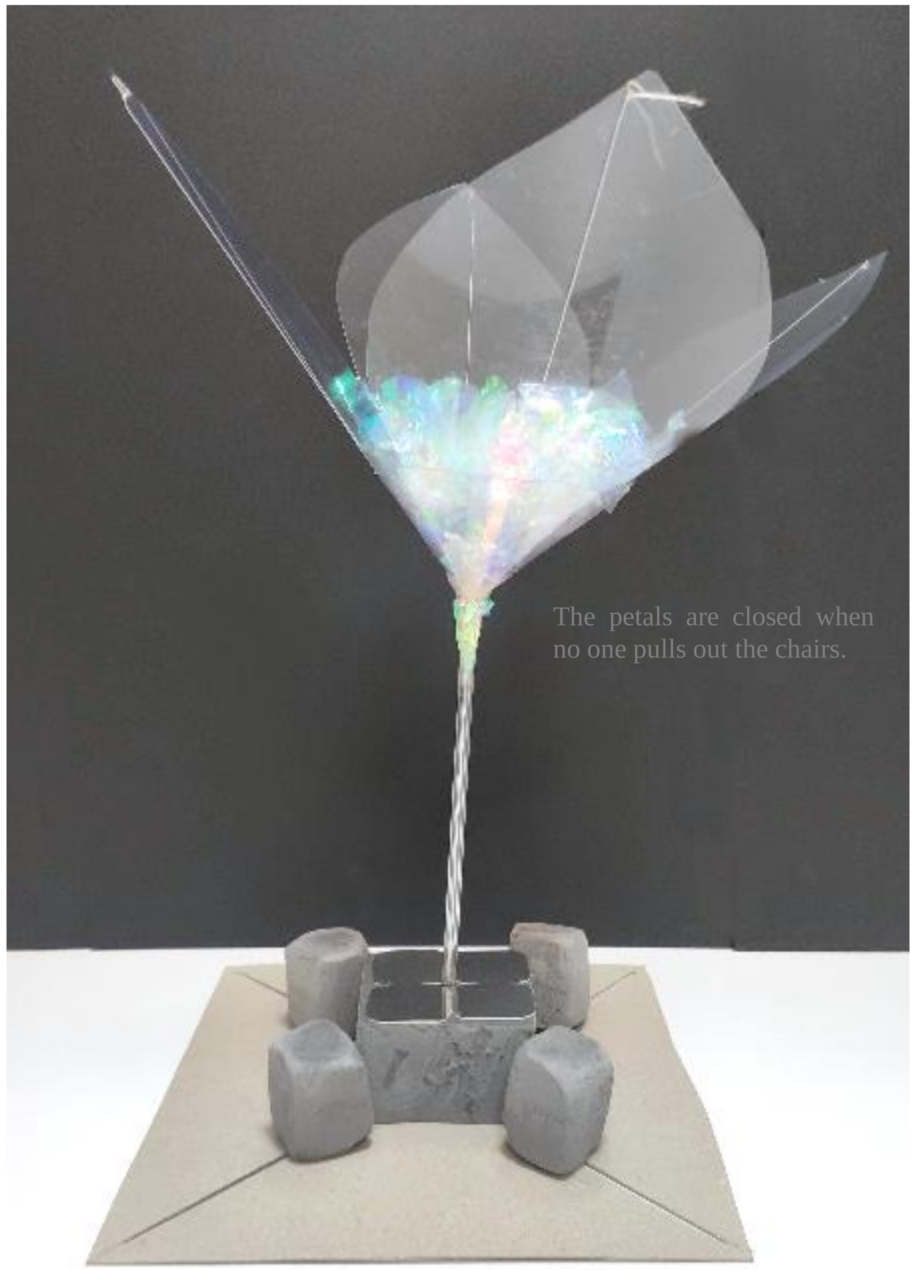












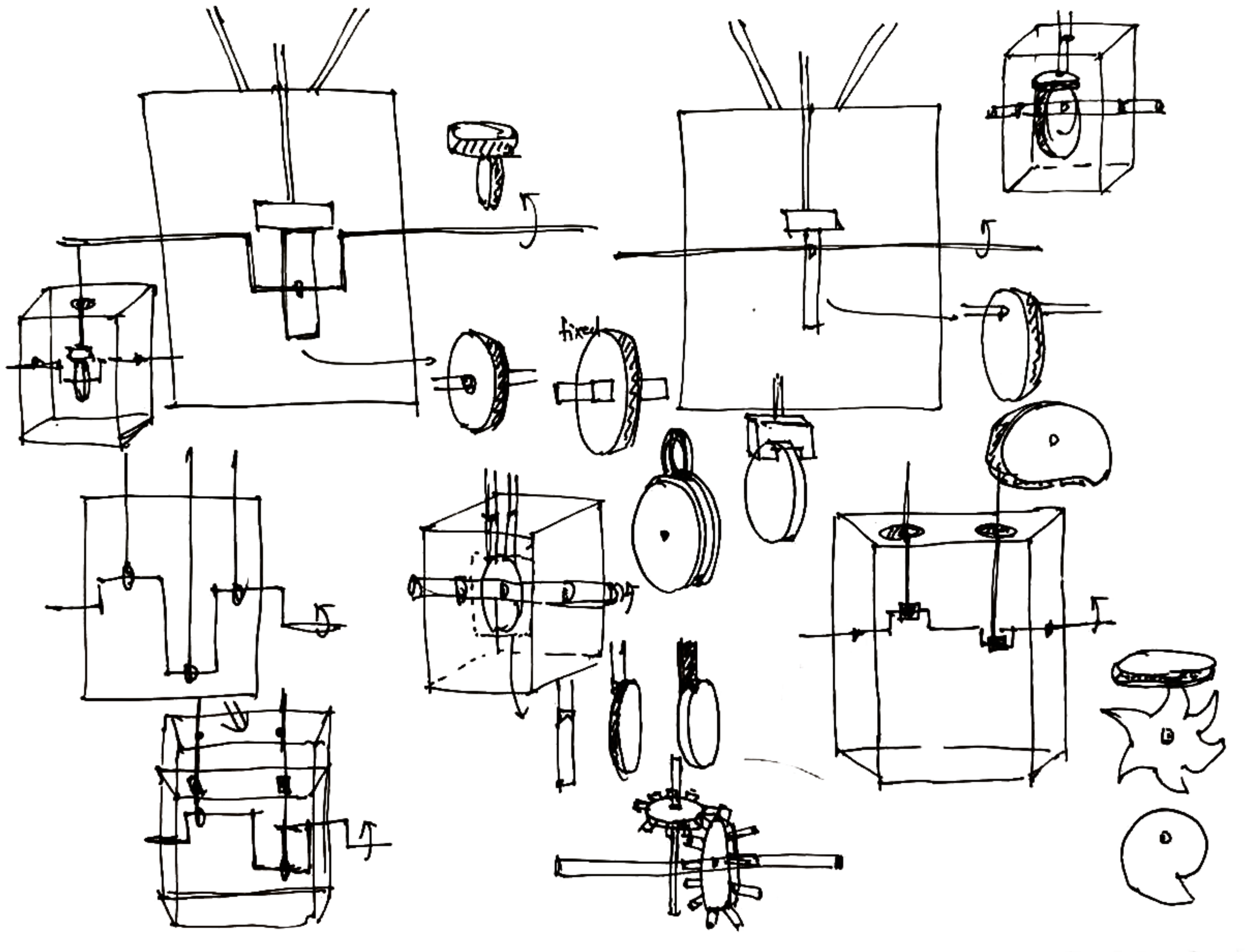
The petals are closed when no one pulls out the chairs.

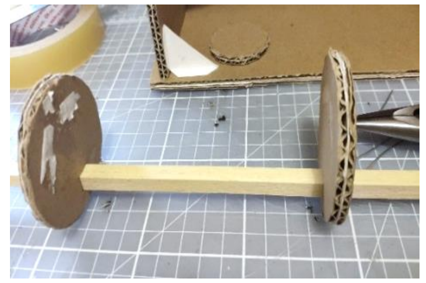
When pulling out the chairs, the strings connected with the canopies will bend the petals.

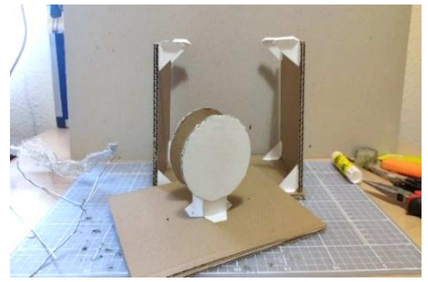
The flower blossoms when the four chairs are all pulled out.

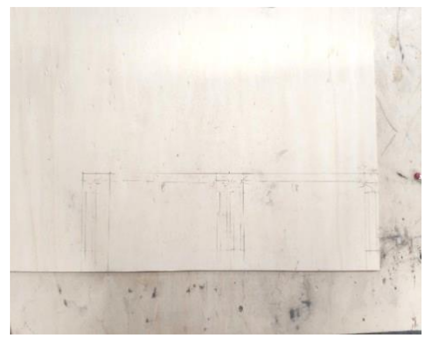
Project 4: Time flies.

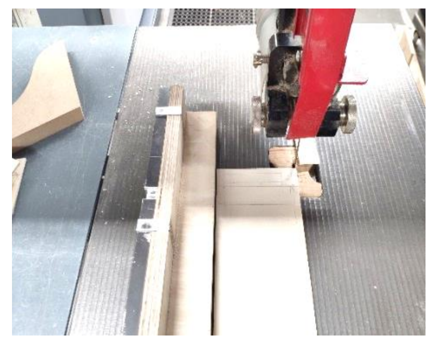
Since I was young, I have been enthusiastically interested in automata. This project includes a work of automata which was inspired by automata from other artists but was improved and changed function by myself.

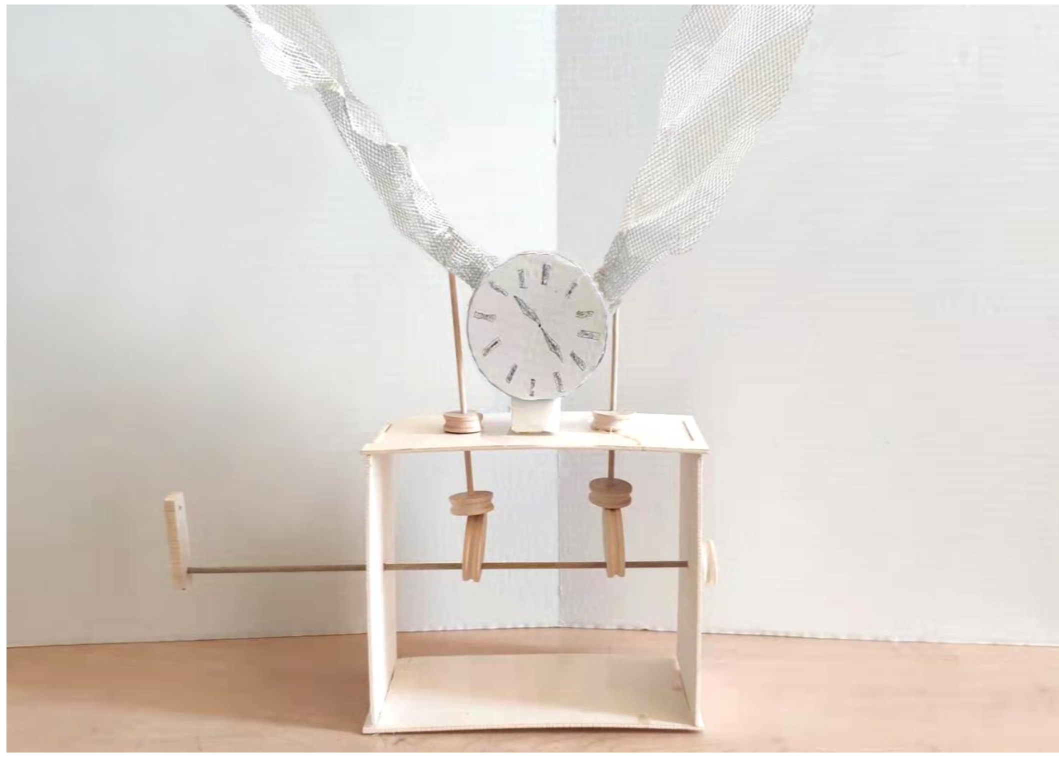


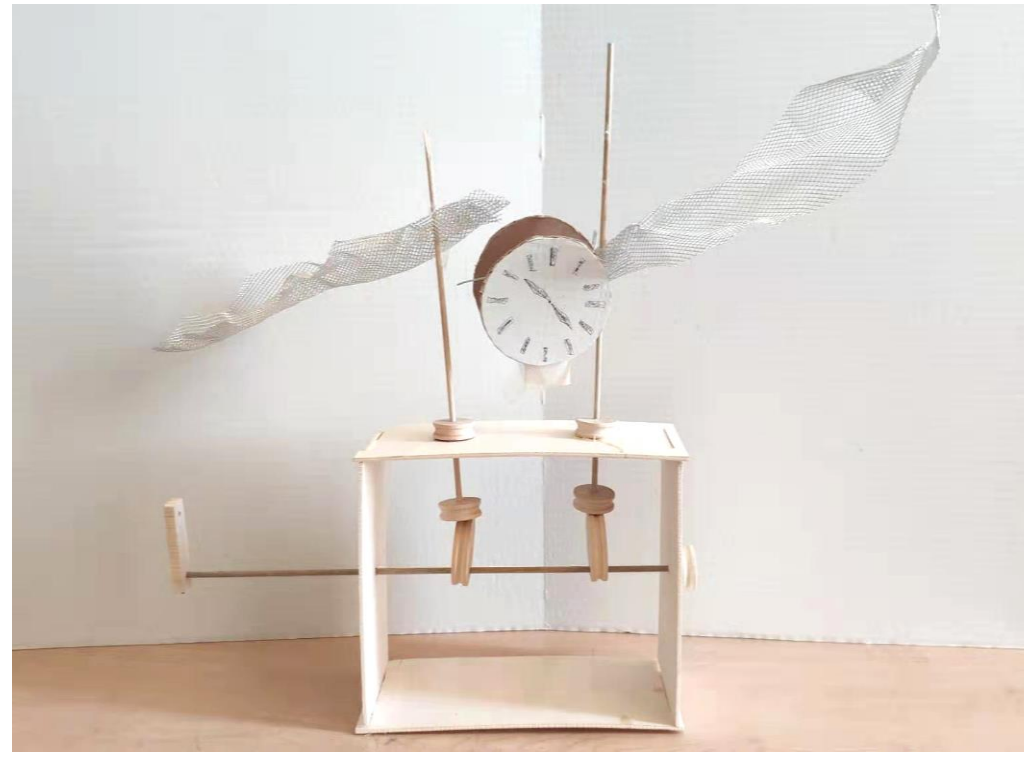


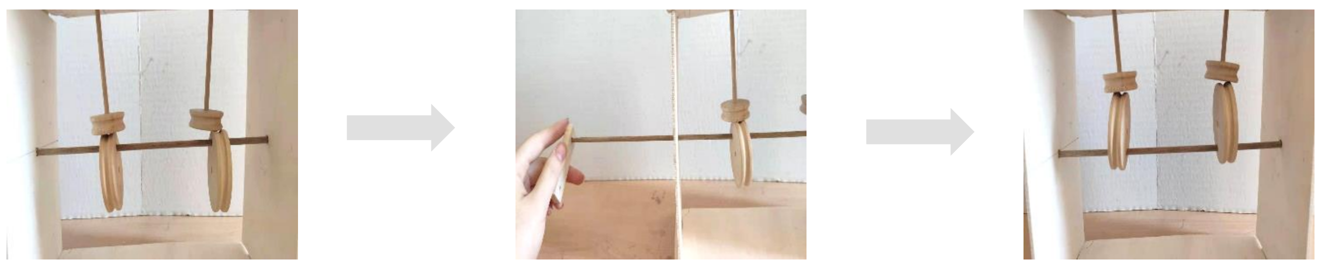












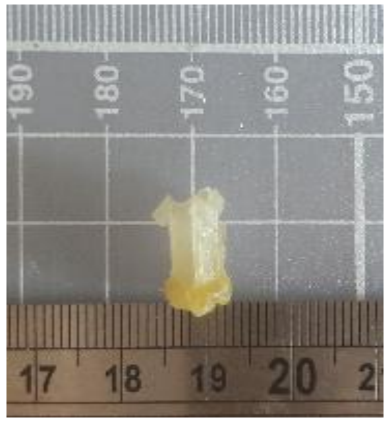
The final work functioned for a while but failed at last due to the great frictional force. Better design of conjunction system and smoother material should be used in future installations.

Project 5: Honeycomb as a society.

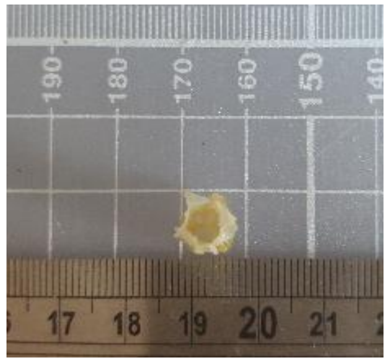
It was not until I bought a honeycomb in a supermarket did I realize the complexity and delicacy of its structure. In this project, I firstly scrutinized and measured the honeycomb, and mathematically explored the structure of it. I then tested various materials to construct a honeycomb to a one-to-ten scale. Two installations are built, one being 'the infinity' and the other's floating city'. They both detach the concept of honeycomb from bees to all communities and explore a new way of interpreting the shape of bees' society.

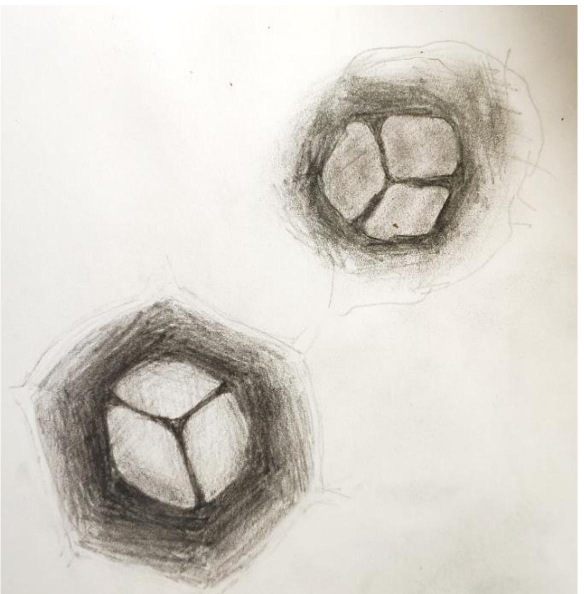
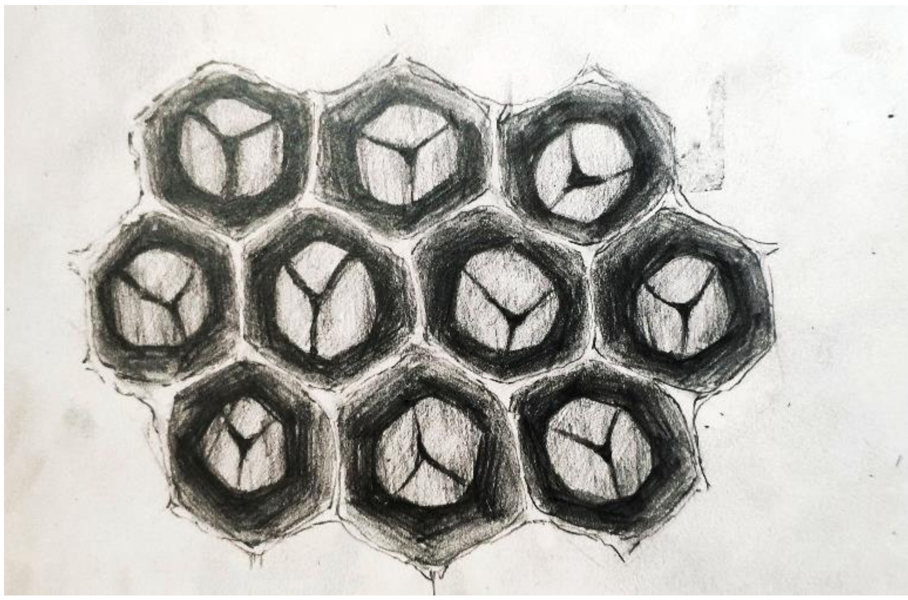
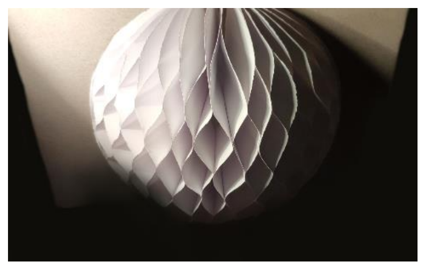
During the scrutiny and observation of the honeycomb structure, I was impressed by the delicacy and complexity of it. I carefully measured the height and width of the honeycomb as well as the units, so that I can explore the method of modelling it.

To model the real structure of a honeycomb , I tested many materials including paper, paperboard and wires.

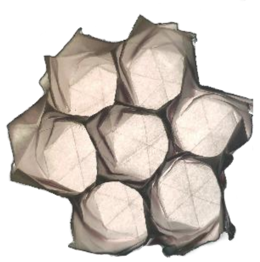


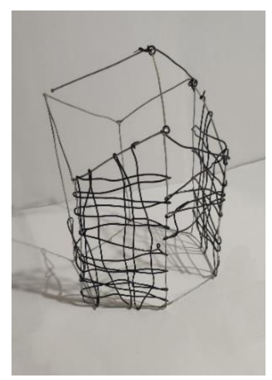


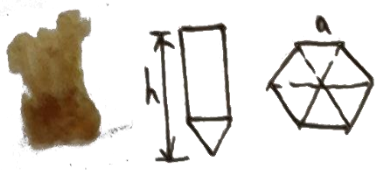






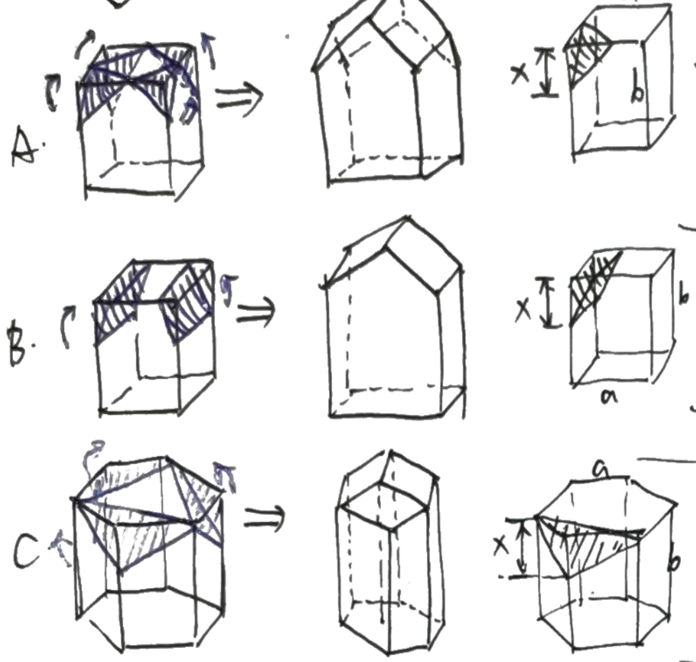





	a	h (mm)
1	3.0	~~0.77~~ 7.2
2	3.6	6.7
3	3.4	6.7
4	3.6	6.9
5	3.5	7.1
6	4.1	6.8
7	4.0	7.0
8	3.4	6.5
9	3.6	6.9
10	3.6	7.1
Average	3.6	6.9

A ~~tempered~~ tapered bottom is required.

impossible to fold.



$\Delta S = -2\cdot\frac{x}{2}\cdot\frac{1}{2} + 2\cdot\frac{1}{2}\cdot\frac{1}{\sqrt{2}}\sqrt{x^2+\left(\frac{1}{2}\right)^2-\left(\frac{1}{2\sqrt{2}}\right)^2} = -\frac{1}{2}x + \frac{1}{\sqrt{2}}\sqrt{x^2+\frac{1}{8}} = f(x)$

$f'(x)=0 \Rightarrow x=\sqrt{\frac{1}{8}}$. ∴ when $x=\sqrt{\frac{1}{8}}\cdot b$, ΔS min. $S_A = 4ab + 2\cdot\frac{\sqrt{2}}{4}a^2$

$= 4\cdot\frac{V}{a} + \frac{\sqrt{2}}{2}a^2 = \frac{2V}{a} + \frac{2V}{a} + \frac{\sqrt{2}}{2}a^2 \geq 3\cdot 2^{\frac{1}{2}}\cdot V^{\frac{2}{3}}$

∴ $(S_A)_{min} = 3\cdot 2^{\frac{1}{2}}\cdot V^{\frac{2}{3}} = 3\cdot\sqrt{2}\cdot V^{\frac{2}{3}} \approx 4.24\cdot V^{\frac{2}{3}}$

$\Delta S = -x + 2\sqrt{x^2+\frac{1}{48}} = f(x)$. $f'(x)=0 \Rightarrow x = \frac{1}{4\sqrt{3}}$

∴ when $x=\frac{1}{4\sqrt{3}}\cdot b$, ΔS min. $S_B = 4ab + \frac{\sqrt{3}}{2}a^2 = \frac{2V}{a} + \frac{2V}{a} + \frac{\sqrt{3}}{2}a^2 \geq 2^{\frac{1}{3}}\cdot 3^{\frac{7}{6}}\cdot V^{\frac{2}{3}}$

∴ $(S_B)_{min} = 3^{\frac{7}{6}}\cdot 2^{\frac{1}{3}}\cdot V^{\frac{2}{3}} \approx 4.54\cdot V^{\frac{2}{3}}$

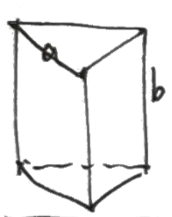
$\Delta S = -\frac{3}{2}x + \frac{3\sqrt{3}}{4}\sqrt{1+4x^2} = f(x)$. $f'(x)=0 \Rightarrow -\frac{3}{2} + \frac{3\sqrt{3}x}{\sqrt{1+4x^2}} = 0 \Rightarrow x = \sqrt{\frac{1}{8}}$

∴ when $x=\sqrt{\frac{1}{8}}\cdot b$, ΔS min. $S_C = 6ab + \frac{6}{\sqrt{8}}a^2 = \frac{4V}{\sqrt{3}a} + \frac{3\sqrt{2}}{2}a^2$

$\geq 3\sqrt{2}\cdot V^{\frac{2}{3}}$ ∴ $(S_C)_{min} = 2^{\frac{1}{2}}\cdot 3\cdot V^{\frac{2}{3}} \approx 4.24\, V^{\frac{2}{3}}$

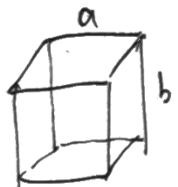
∴ $S_A = S_C > S_B$. ∴ Given the same volumn and requiring a ~~tempered~~ tapered bottom to decrease the surface, A&C uses the least material.

Given the same volumn V.



$V = \frac{\sqrt{3}}{4}a^2b$. $S = \frac{1}{2}\cdot a\cdot\frac{\sqrt{3}}{2}a + 3ab = \frac{\sqrt{3}}{4}a^2 + \frac{2\sqrt{3}}{a}V + \frac{2\sqrt{3}V}{a}$

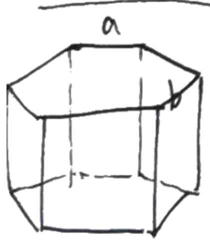
$(S_1)_{min} = (3\cdot 3\sqrt{3}V^2)^{\frac{1}{3}} \geq 3\cdot(3\sqrt{3}V^2)^{\frac{1}{3}}$



$V = a^2b$. $S = a^2 + 4ab = a^2 + \frac{2V}{a} + \frac{2V}{a}$

∴ $S \geq 3(4V^2)^{\frac{1}{3}}$

∴ $(S_2)_{min} = 3\cdot 4^{\frac{1}{3}}\cdot V^{\frac{2}{3}}$



$V = b\cdot 6\cdot\frac{1}{2}a\cdot\frac{\sqrt{3}}{2}a = \frac{3\sqrt{3}}{2}a^2b$

$S = \frac{3\sqrt{3}}{2}a^2 + \frac{2V}{\sqrt{3}a} + \frac{2V}{\sqrt{3}a} \geq 3\cdot(2\sqrt{3})^{\frac{1}{3}}\cdot V^{\frac{2}{3}}$

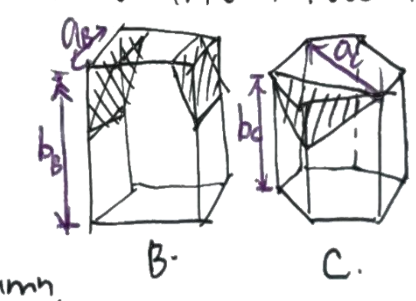
∴ $(S_3)_{min} = 3\cdot(2\sqrt{3})^{\frac{1}{3}}\cdot V^{\frac{2}{3}}$

$3^{\frac{7}{6}}\cdot 2^{\frac{1}{3}} < 3\cdot 4^{\frac{1}{3}} < 3^{\frac{3}{2}}$

∴ $(S_3)_{min}$ is min.

Given the same volumn, hexagonal column has the least surface. i.e. uses the least building materials.

TAKE THE SHAPE OF BEES INTO CONSIDERATION.



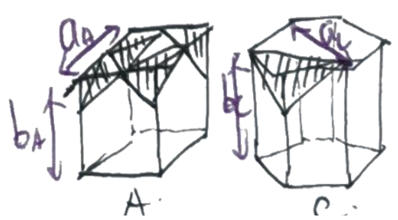
b_B & b_C: height. a_B & a_C: waist.

the height of B when it's folded into a ~~temp~~ tapered bottom is $b_B + \frac{1}{4\sqrt{3}}a_B$. of A is $b_C + \sqrt{\frac{1}{8}}a_C$.

let $\begin{cases}\sqrt{3}a_C = a_B \\ b_C + \sqrt{\frac{1}{8}}a_C = b_B + \frac{1}{4\sqrt{3}}a_B\end{cases} \Rightarrow S_B = 4a_B(b_B + \frac{\sqrt{3}}{8}a_B)$

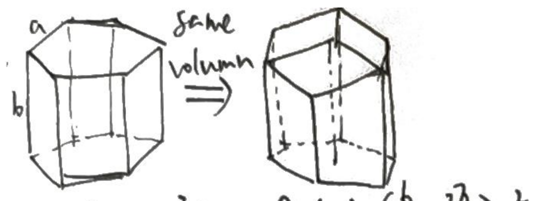
$S_B = 4a_B\cdot\left[\left(b_B + \frac{1}{4\sqrt{3}}a_B\right) + \left(\frac{\sqrt{3}}{8} - \frac{1}{4\sqrt{3}}a_B\right)\right] > 4\sqrt{3}a_C\left(b_C + \frac{1}{\sqrt{8}}a_C\right)$

$> 6a_C\left(b_C + \sqrt{\frac{1}{8}}a_C\right) = S_C$ ∴ $S_B > S_C$



similarly, $S_A > S_C$

∴ Given the same "waist" and "height", object C has the least surface i.e. uses the least building materials.

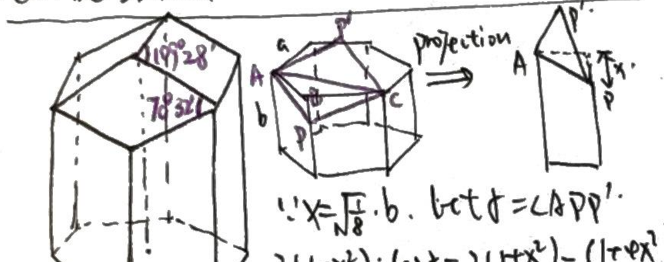


$S_1 = 6ab + 3\sqrt{3}a^2$. $S_2 = 6ab + \left(\frac{6}{\sqrt{8}} + \frac{3\sqrt{3}}{2}\right)a^2$.

$\Delta S = S_1 - S_2 = 0.4773a^2$.

$\frac{\Delta S}{S_1} = 0.0749 = 7.49\%$.

By building a hexagonal column into the shape of a beehive, 7.49% material can be saved.



∵ $x = \frac{1}{\sqrt{8}}\cdot b$. let $\theta = \angle APP'$.

$2(1+x^2)\cdot\cos\theta = 2(1+x^2) - (1+4x^2)$

$\Rightarrow \cos\theta = \frac{1-2x^2}{2(1+x^2)} = \frac{1}{3}$.

$\Rightarrow \theta = 70°32'$. $180° - \theta = 109°28'$.

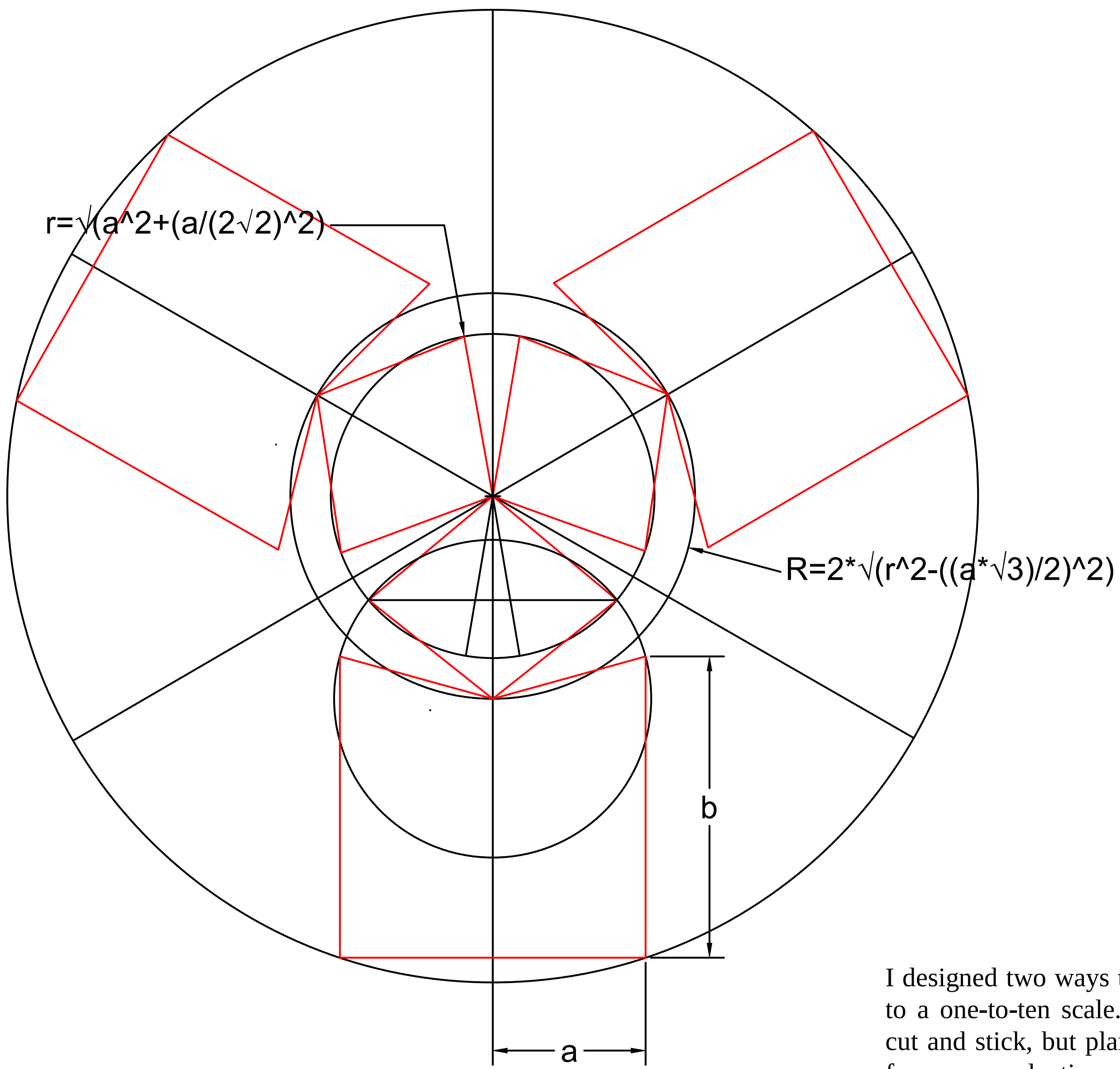
$\frac{a}{b\sqrt{\frac{1}{8}}a} = \frac{2}{\sqrt{3}\cdot\sqrt{2} + \sqrt{\frac{1}{8}}\cdot 2} = \cancel{0.52}\ 0.5190$

i.e. the theoretical proportion of the side and the height of the honeycomb is ~~0.52~~ 0.5190

By measurement, $\frac{\text{side}}{\text{height}} = \frac{3.6}{6.9} = 0.5217$

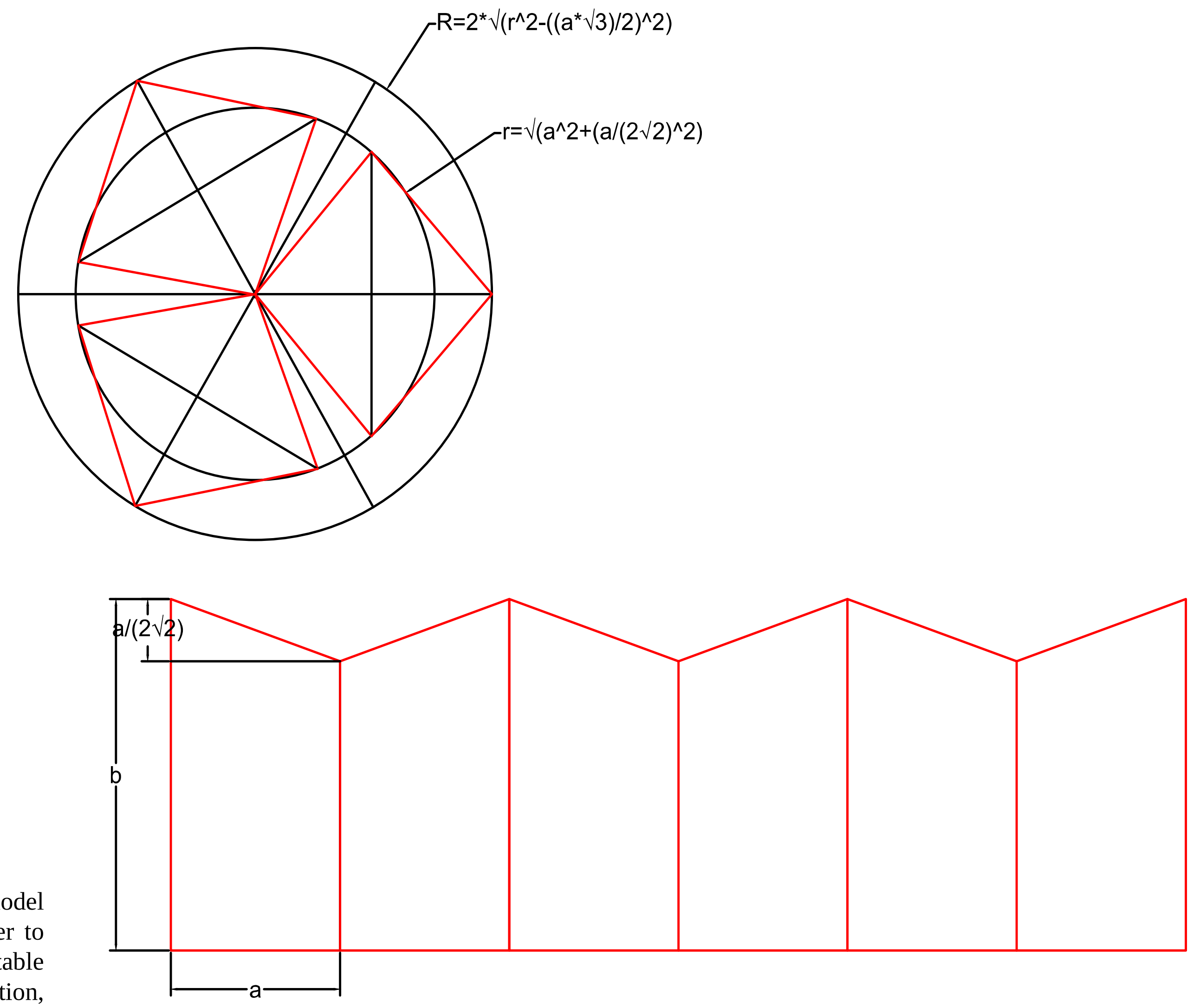
the proportions are very close!

Mathematical exploration into the structure of honeycomb: it is the best shape that can be arranged close together and has the least surface given a fixed volume.

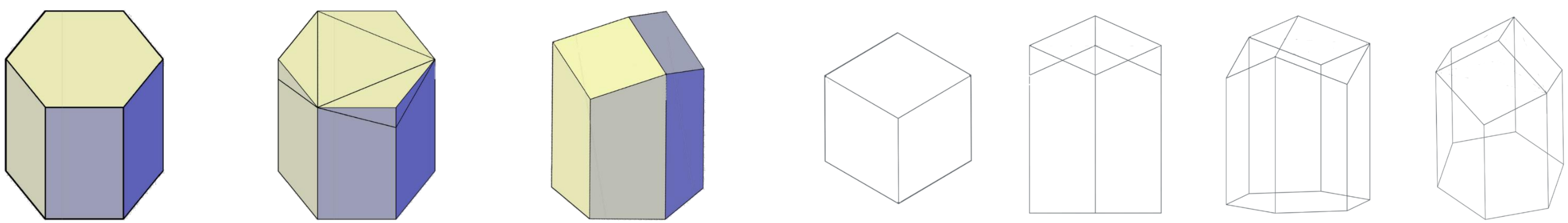


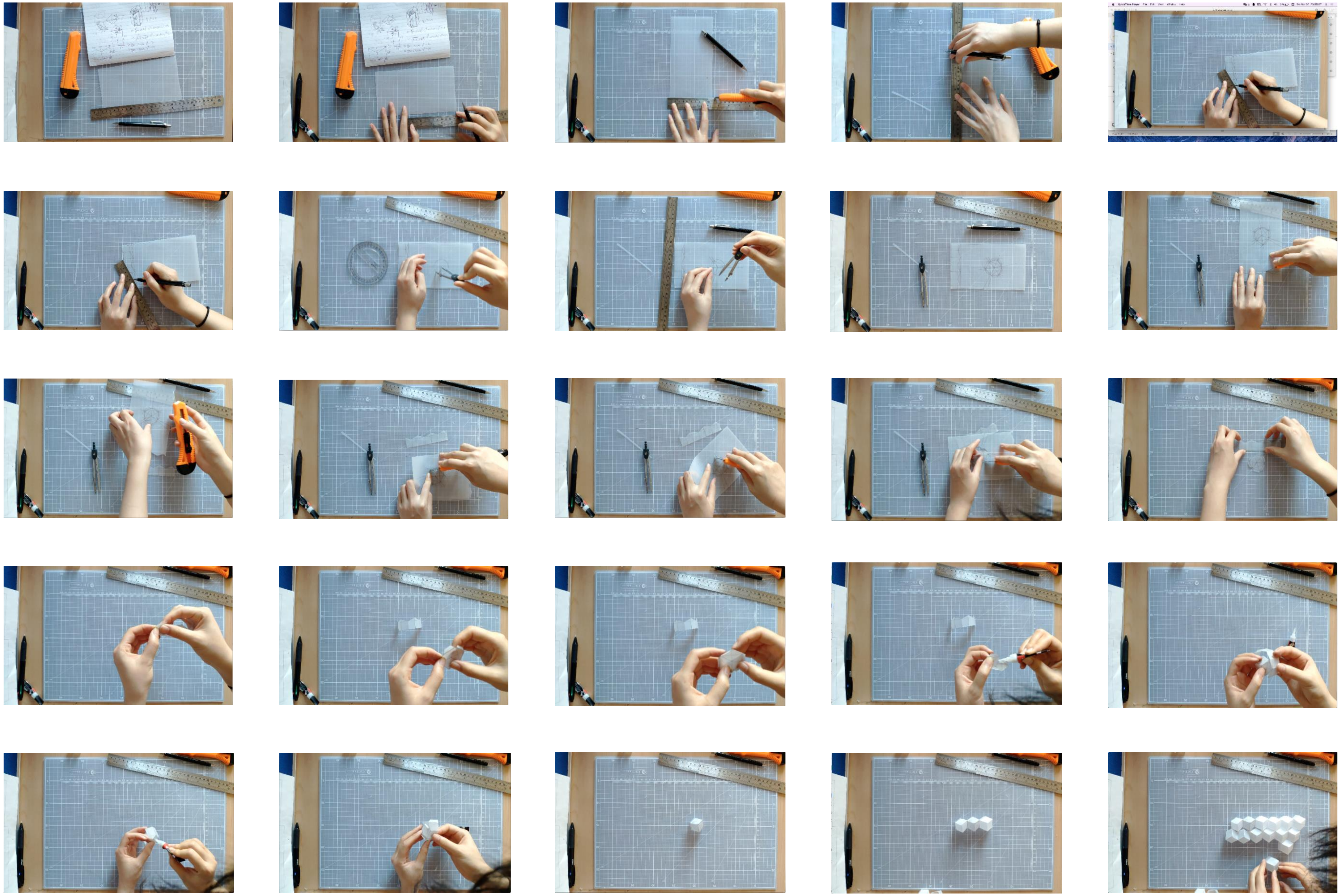
plan 1

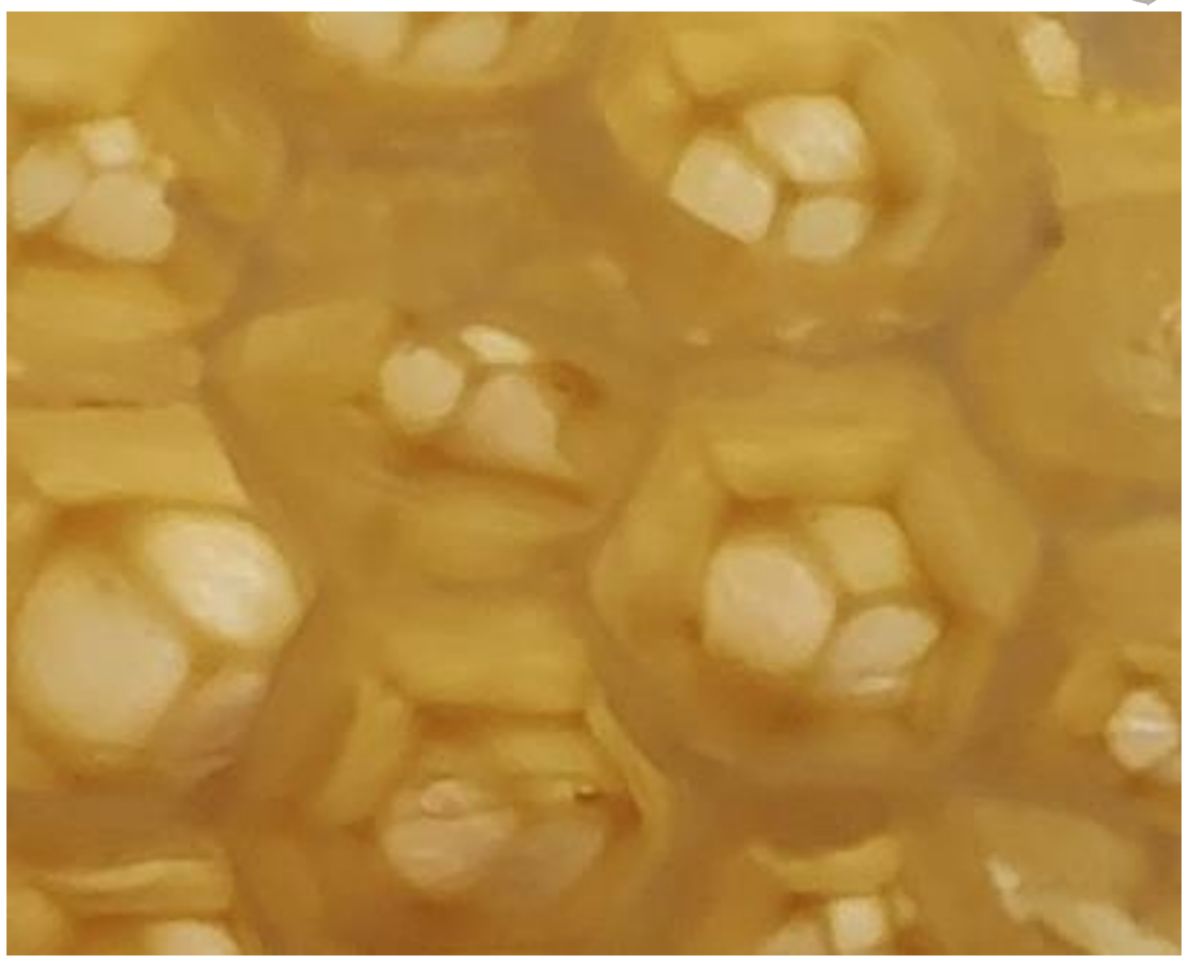
I designed two ways to construct the model to a one-to-ten scale. Plan 1 was easier to cut and stick, but plan 2 was more suitable for mass production. After experimentation, I chose plan 2.

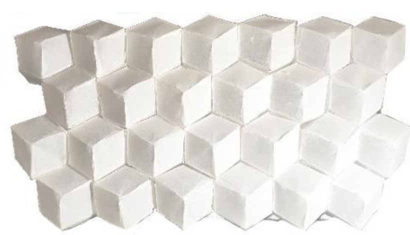


plan 2



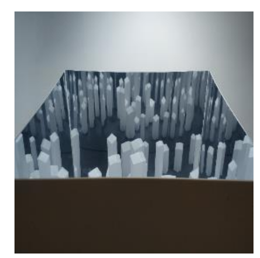




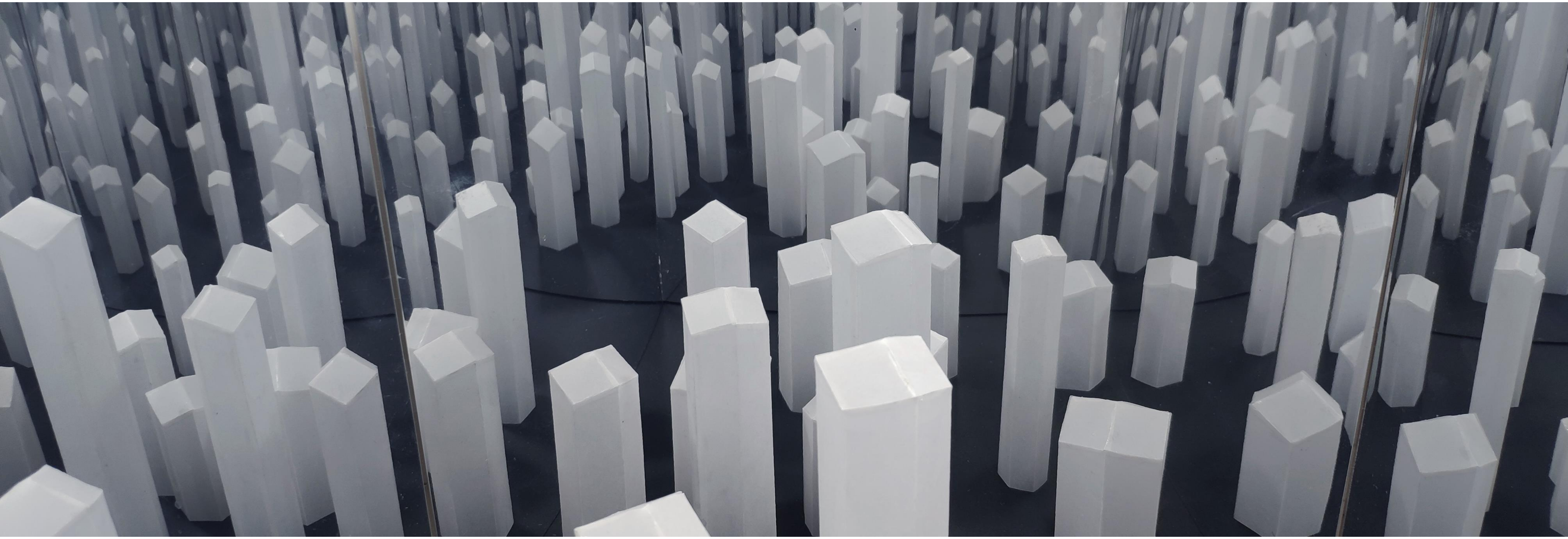


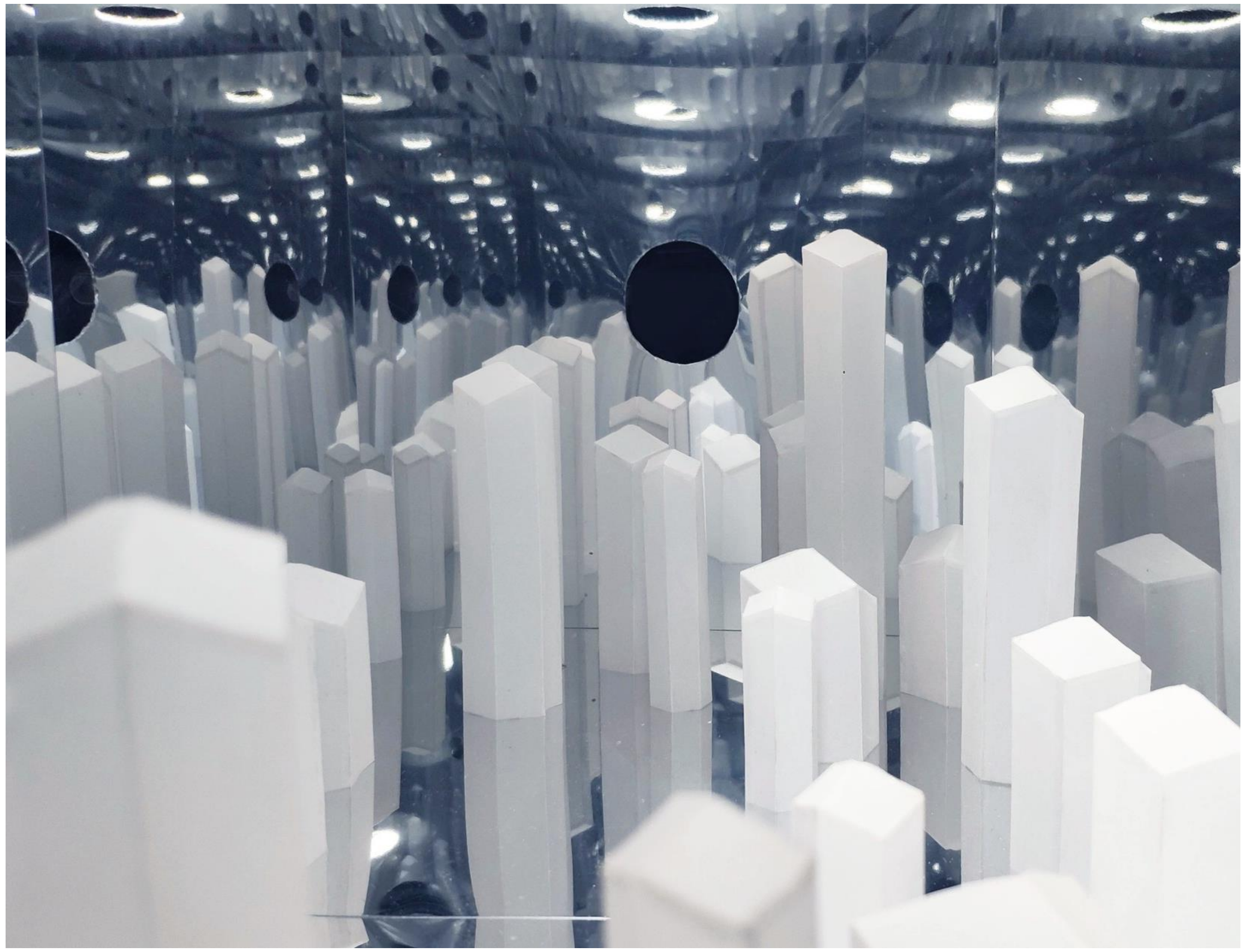
The vertical infinity.

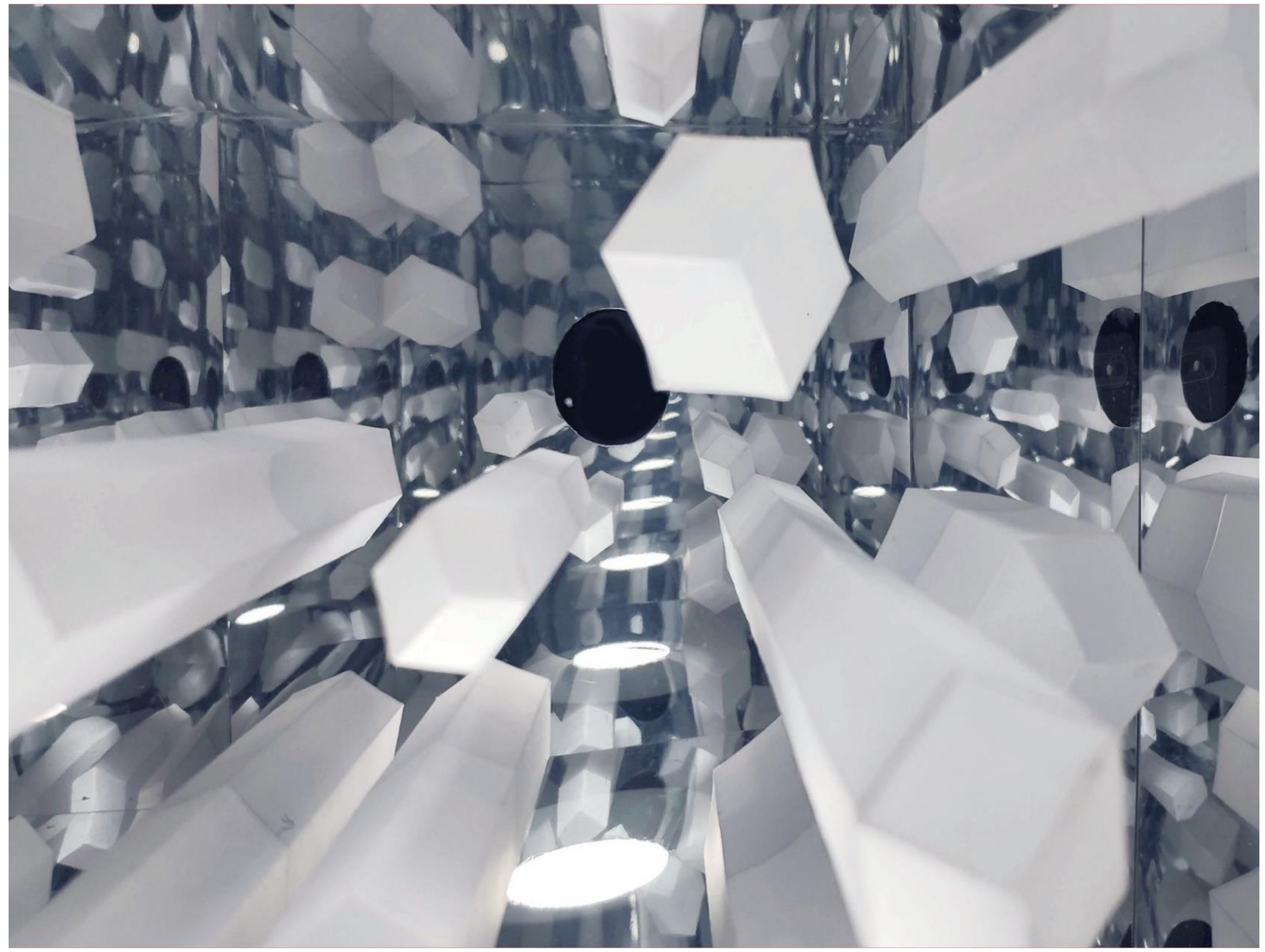
In this part, I put honeycomb units in a mirror box, which let light in from one hole and enabled photoing from the other hole. I sought inspirations from Yayoi's work: *The passing winter (2005).* While the artist built an infinite world with the inflections of holes in the mirror box, I put the honeycomb units inside to construct an infinite city of bees.



The passing winter (2005)
by Yayoi kusama

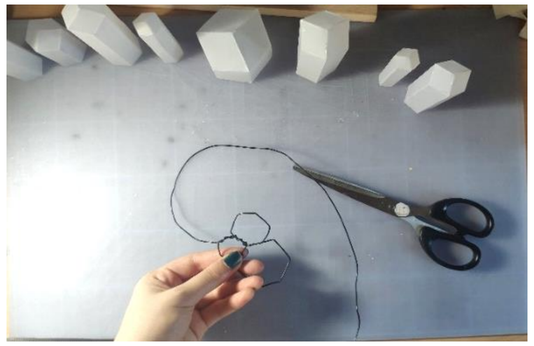


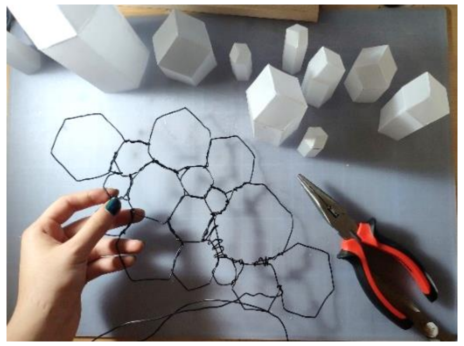


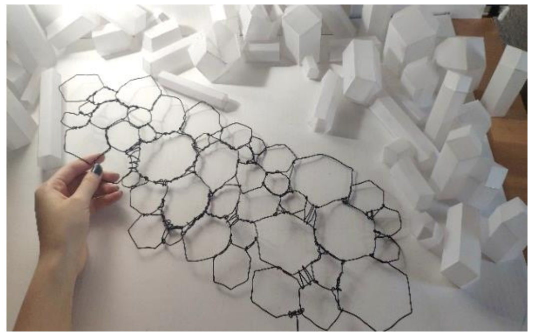


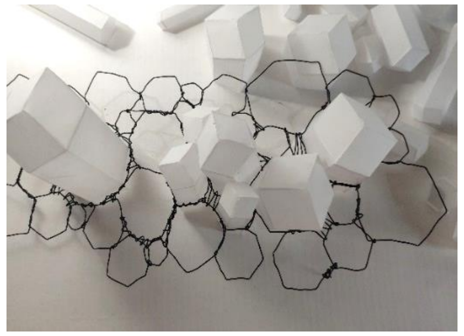
The floating city.

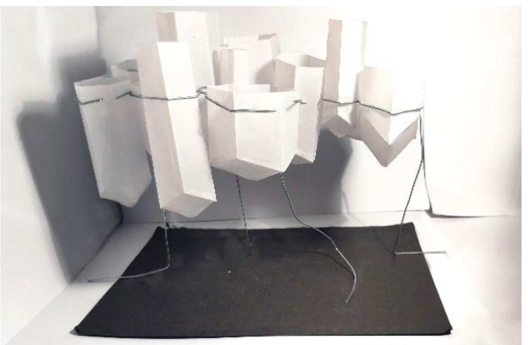
Units in honeycomb are uniform and equal, but they should be of varied height, width and status when applied to human society. I construct honeycomb units with different sizes, and hang them to a hexagon-shaped wire framework..

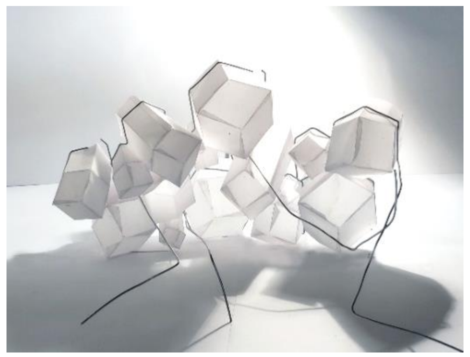


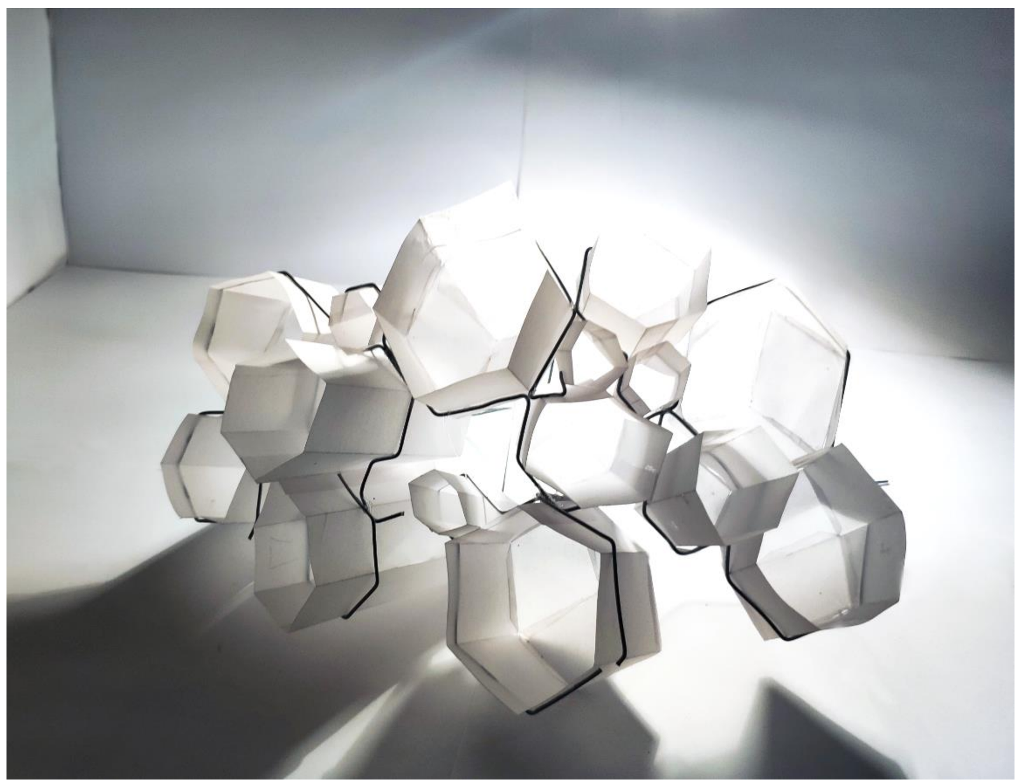


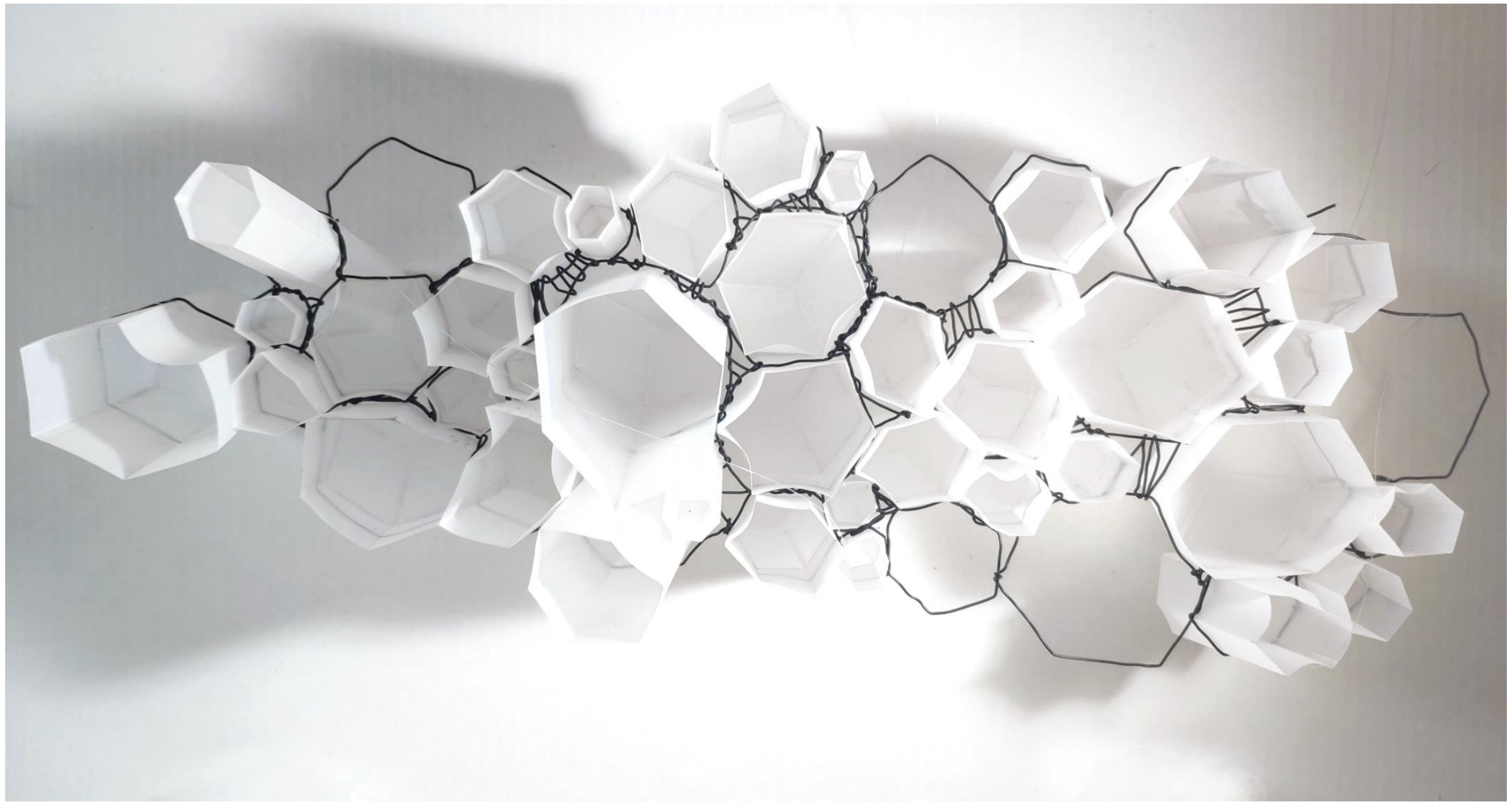


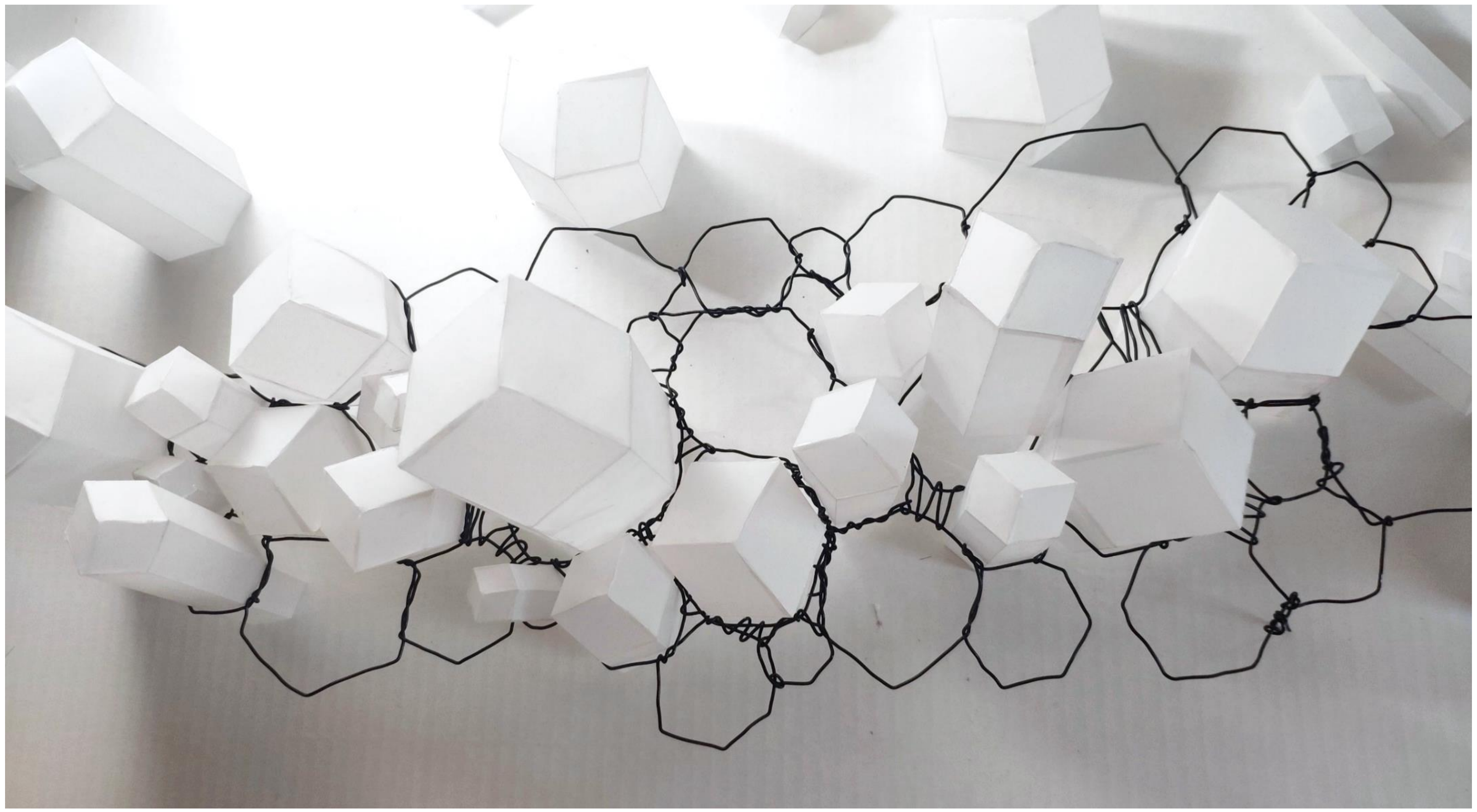


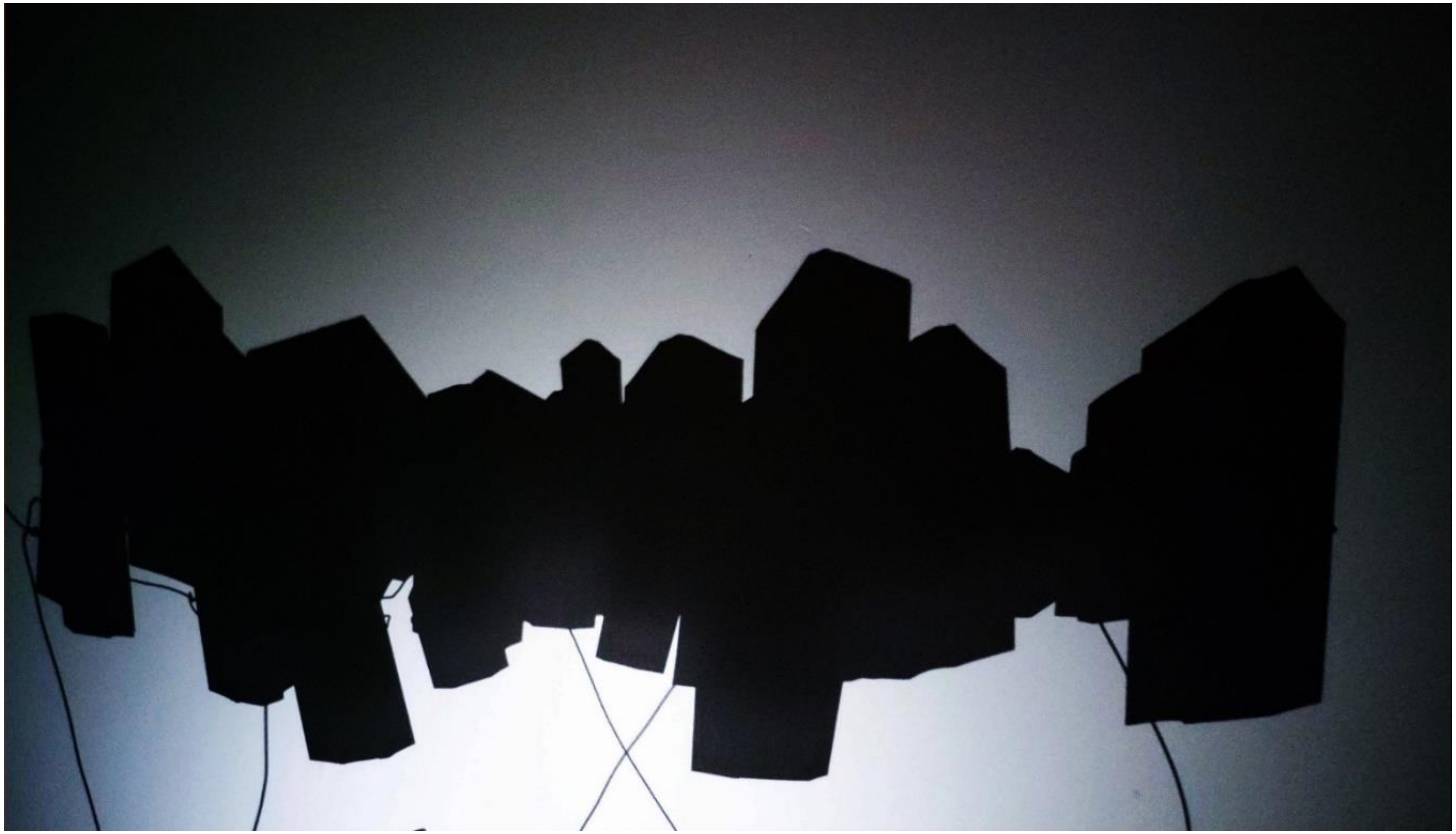


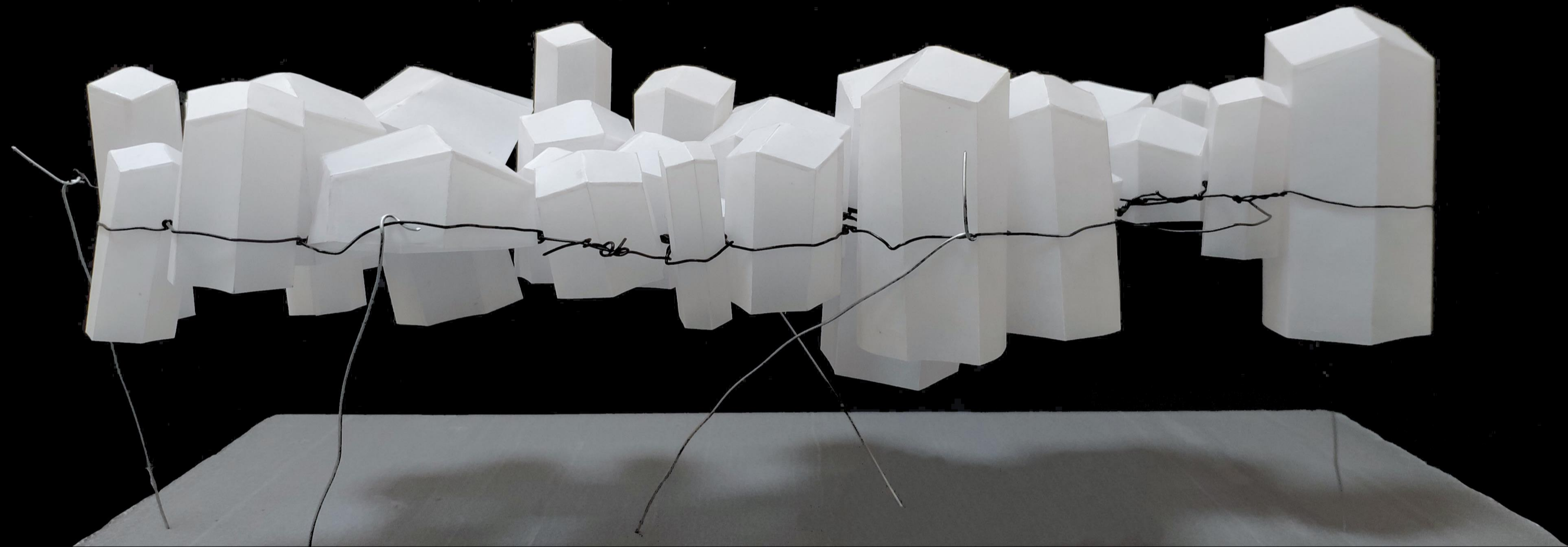


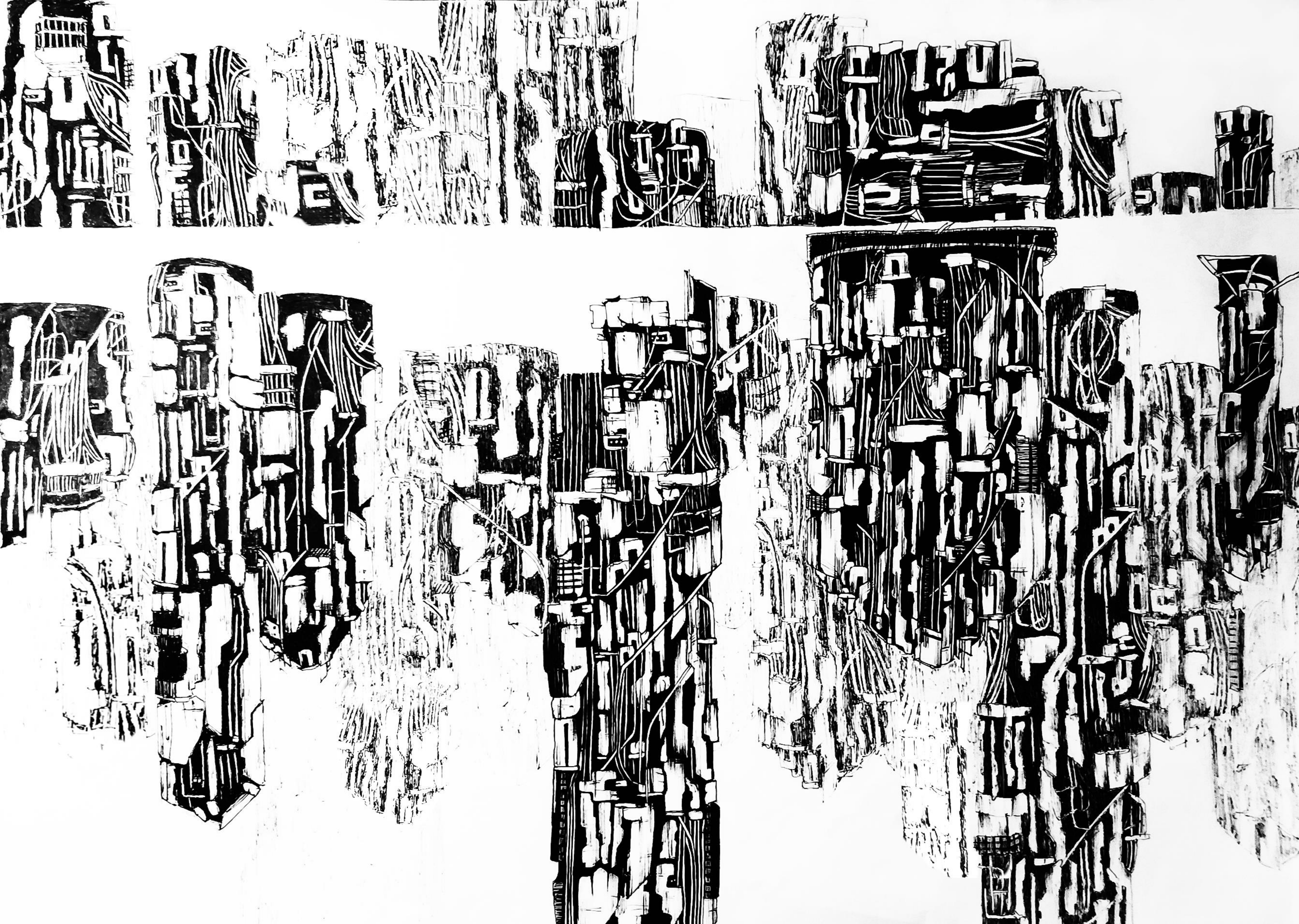








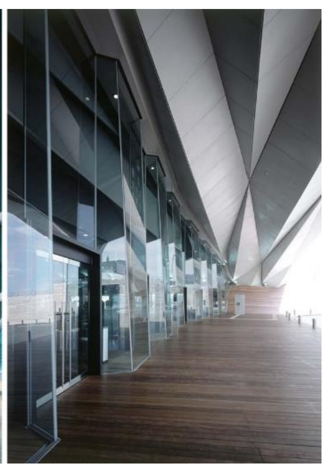


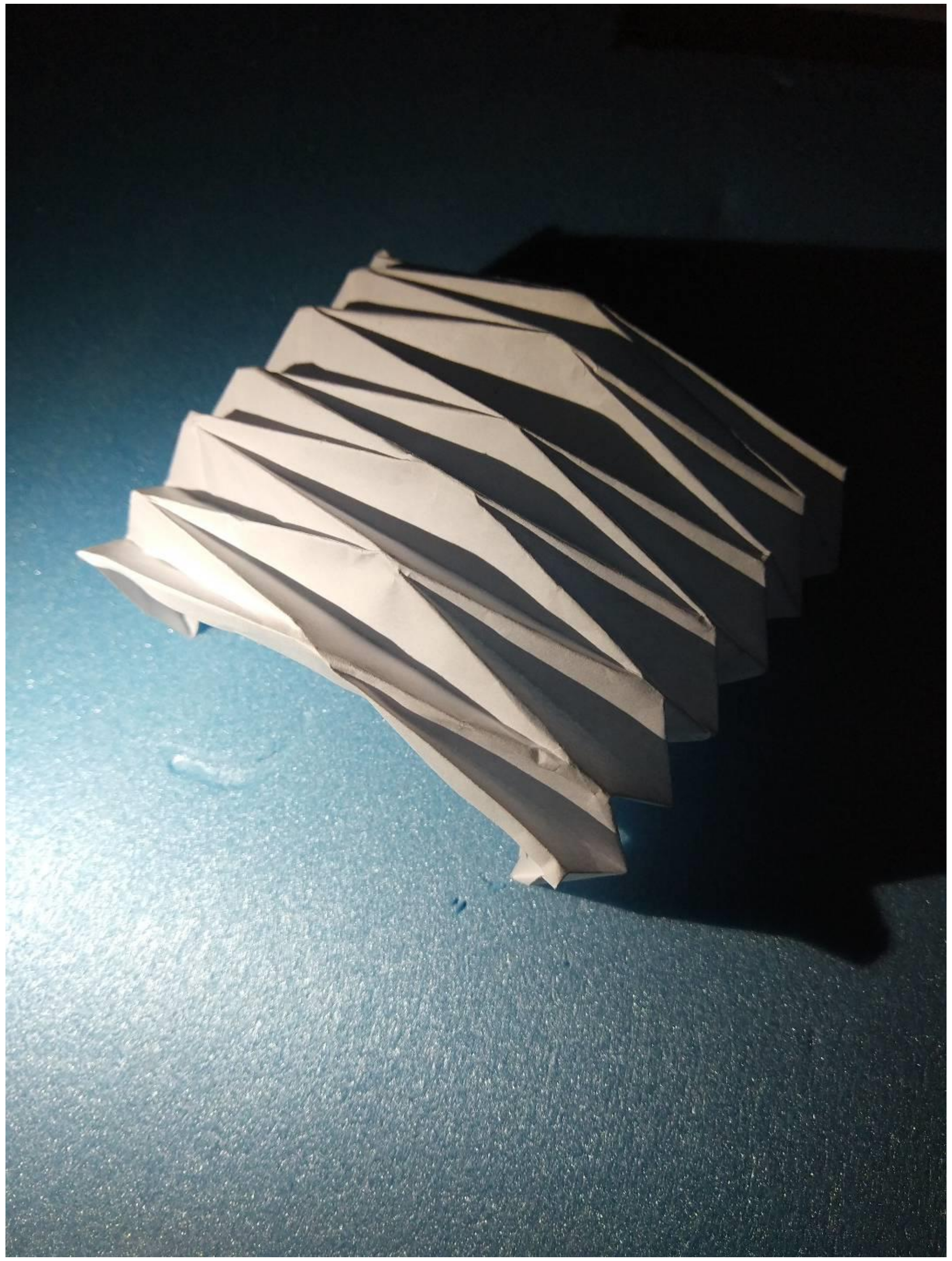


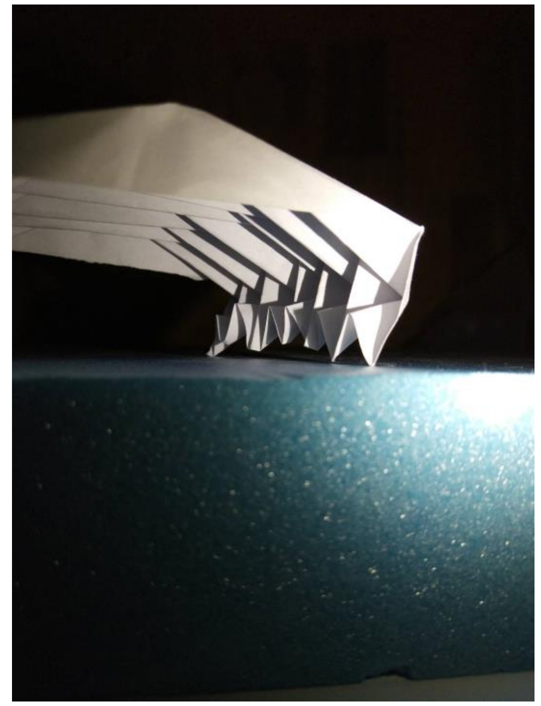
Other works.

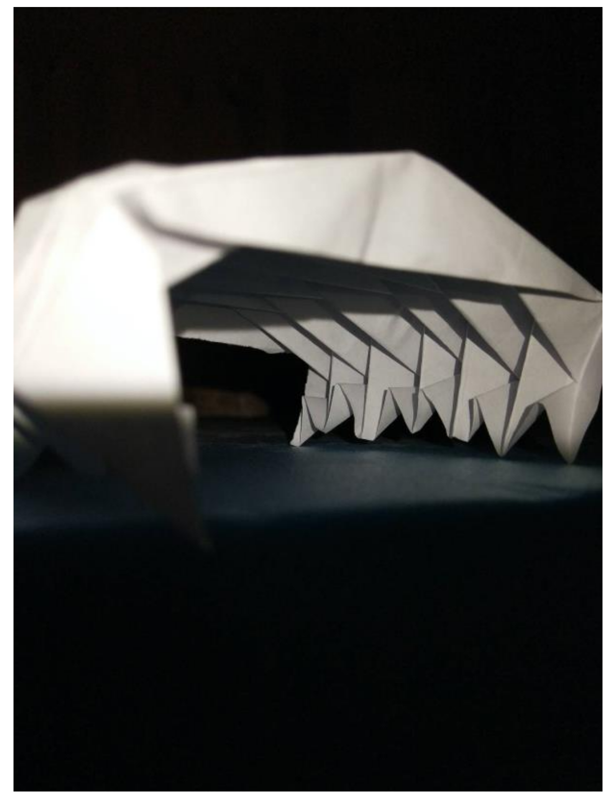
Sketches during trips.
2016-2017

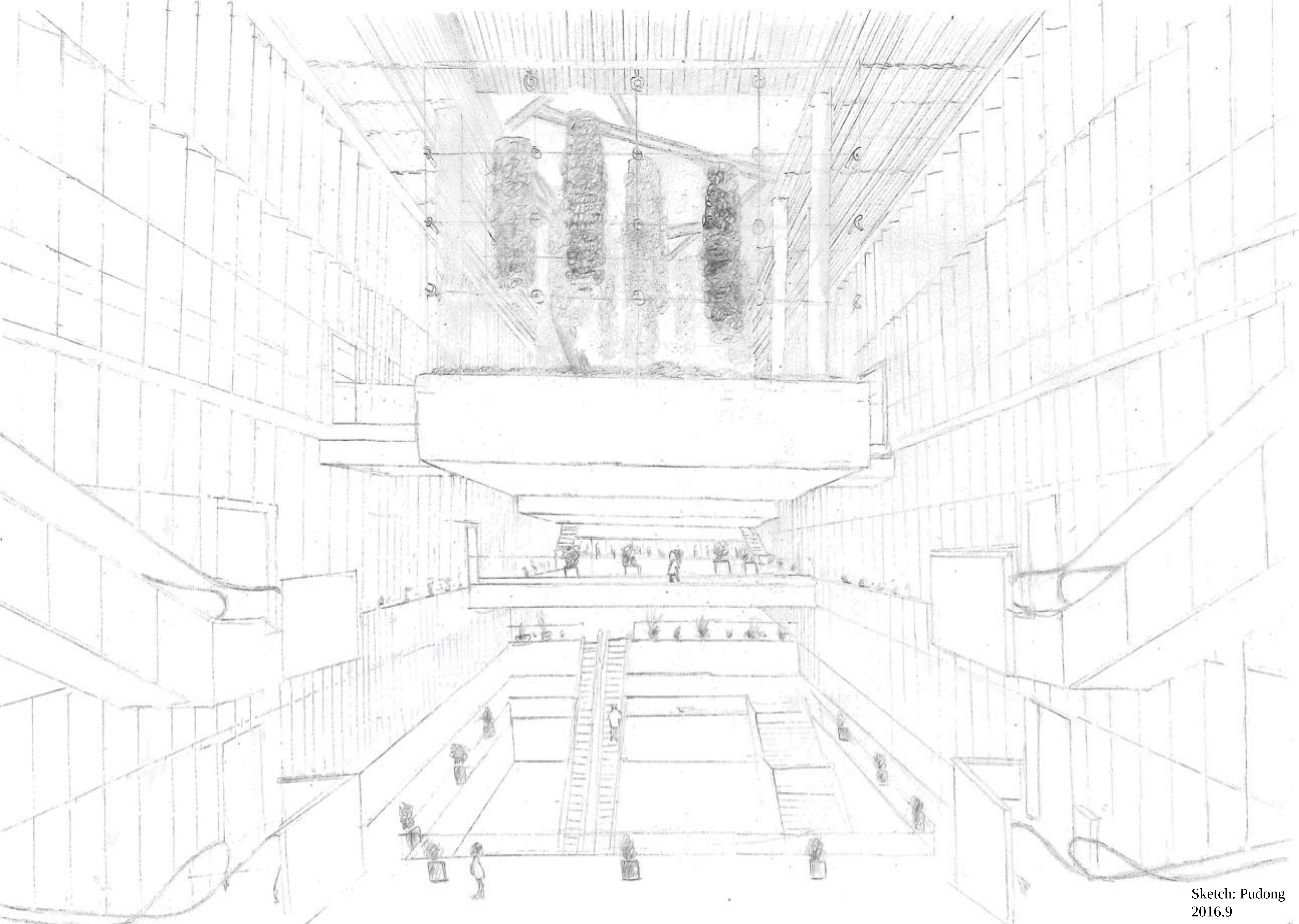
In this work, I used paper folding to model Yokohatma International Passenger Terminal. The architectural topography consists of a series of complex surfaces.











Sketch: Pudong
2016.9