

Kean Hoe, Foo | 320702

Digital Design Application
Jules Moloney

Icosahedron Gallery



Contents

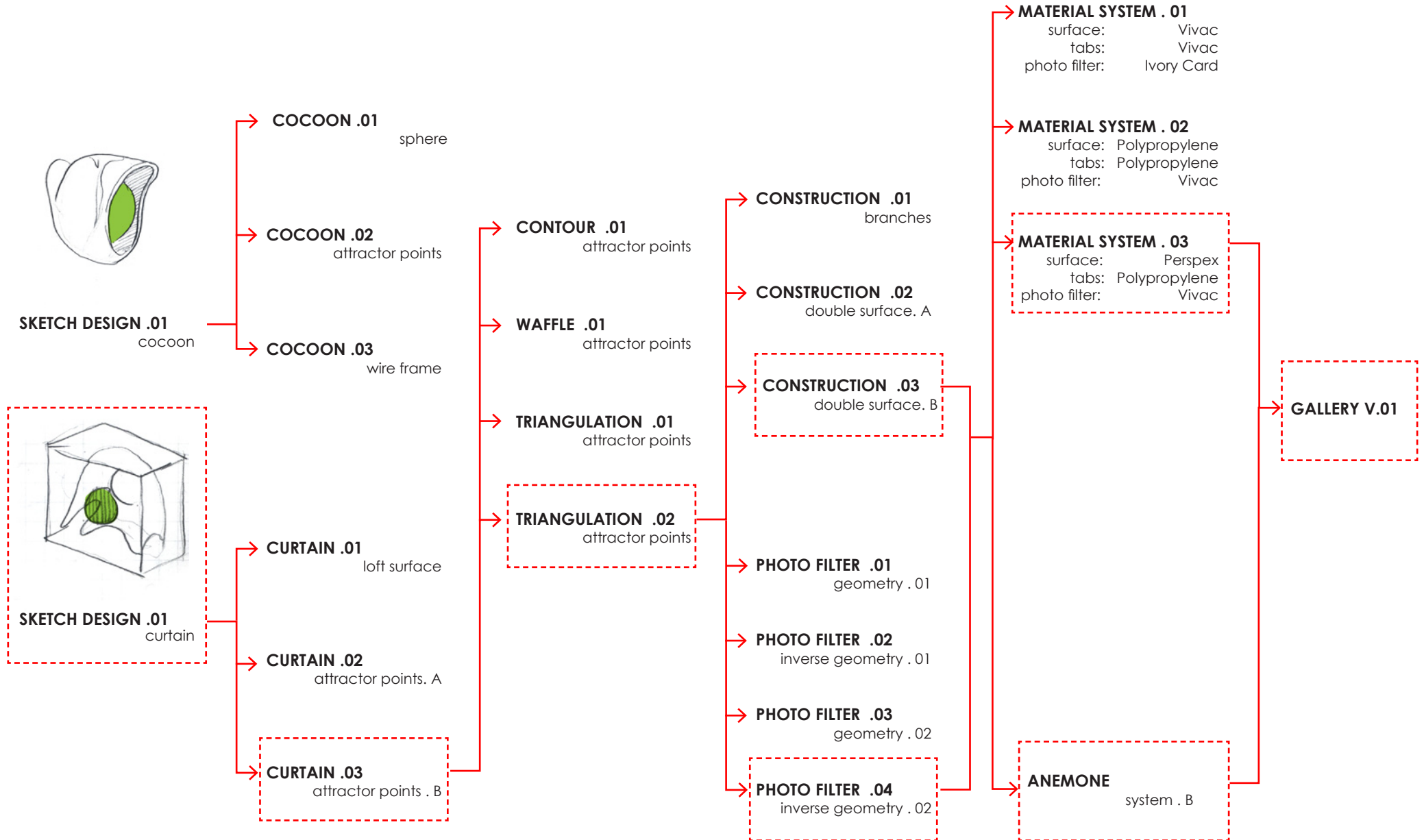
DESIGN DEVELOPMENT

SCRIPT EVOLUTION

ITERATIONS

FABRICATION

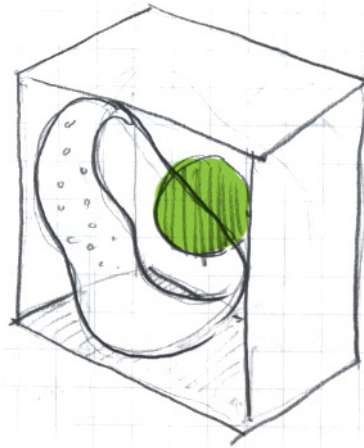
DESIGN DEVELOPMENT



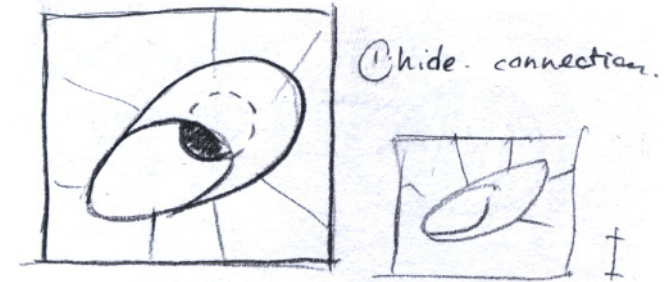
SKETCH DESIGN . 01



The cocoon as a light modulator

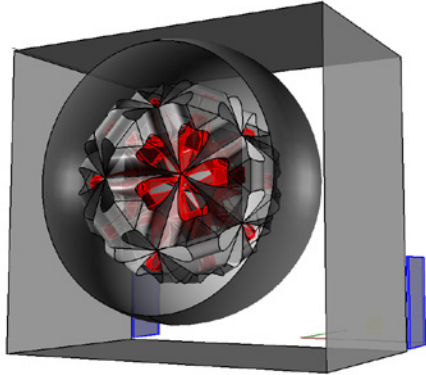


To play with the dialogue between icosahedron and the cocoon

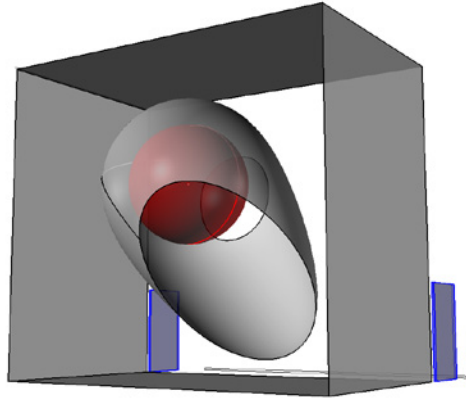


Cocoon to be suspended within the gallery encasing the icosahedron.

SCRIPT EVOLUTION

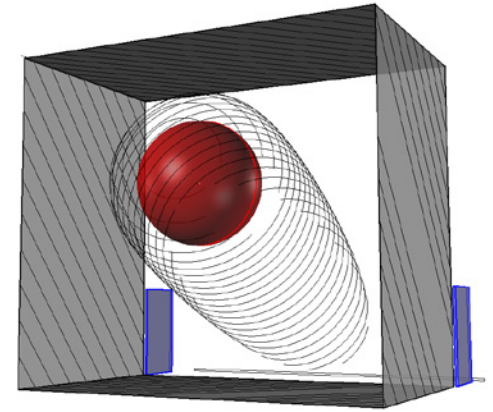


The icosahedron takes on a monumental role in the gallery. There is a lack of interaction between components.



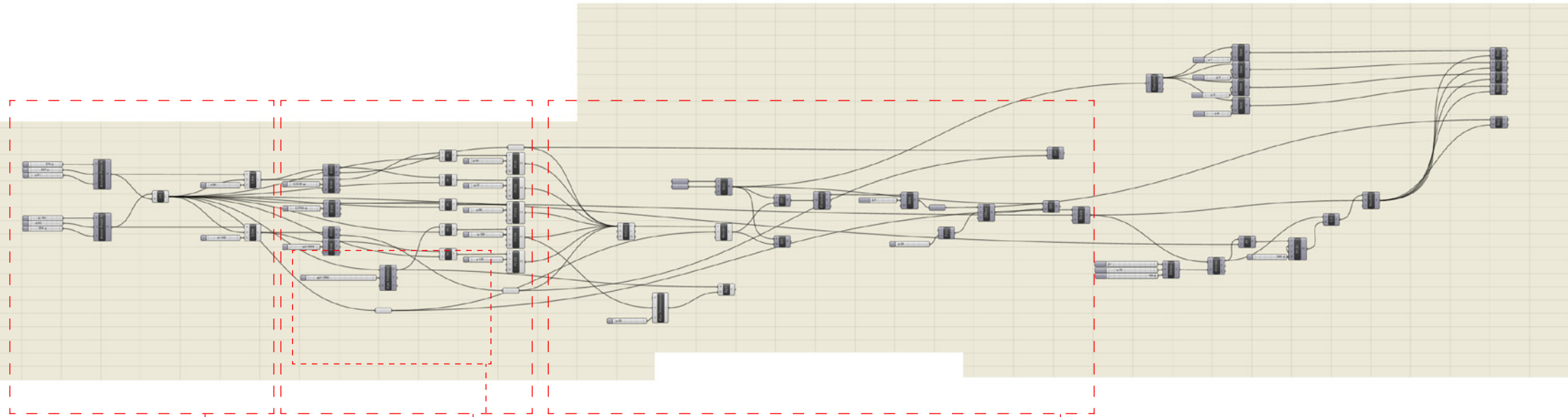
Offsetting the position of the icosahedron changes the shape of the cocoon.

The cuts of the cocoon also is effected by the position of the icosahedron

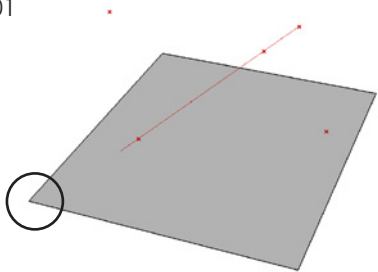


The idea of contouring the cocoon as a method of fabrication.

FINAL SCRIPT

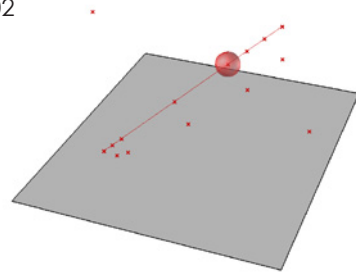


01



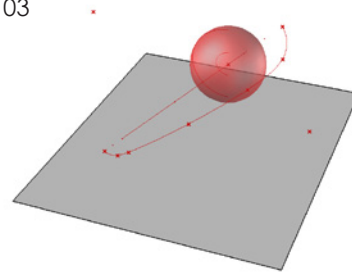
Points are placed to determine line of sight base on the entrance of gallery

02



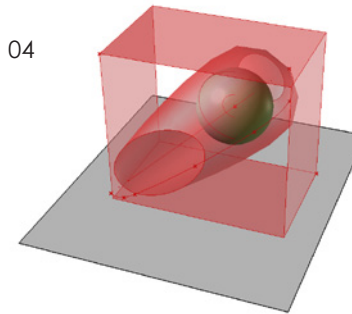
The main axis is divided into several points to determine cocoon curvature an position of icosahedron.

03



Curvature of cocoon is further influenced by the size of the icosahedron

04



The cocoon is sliced based on the parameters of the gallery space to reveal the icosahedron within.

SKETCH DESIGN . 01

ANALYSIS

The design intention was to have the viewer appreciate the cocoon before being able to view the icosahedron.

The visual barrier would entice the curiosity of the viewer.

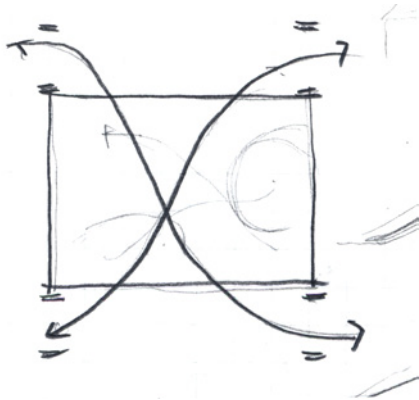
Although the cocoon can be further developed to become a light modulator for the icosahedron, it does not satisfy the design brief of having a landscape.

The cocoon has too much control on how the viewer views the icosahedron. The interaction is static and predictable.

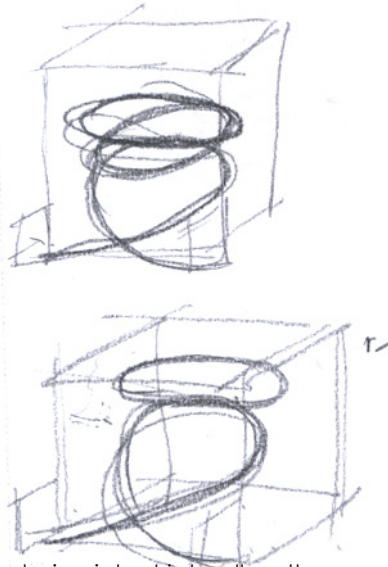
The direction of the design would lead to a simple contoured surface fabrication. Exploration of methods of fabrication would be difficult.

[RESTART WITH SKETCH DESIGN . 02]

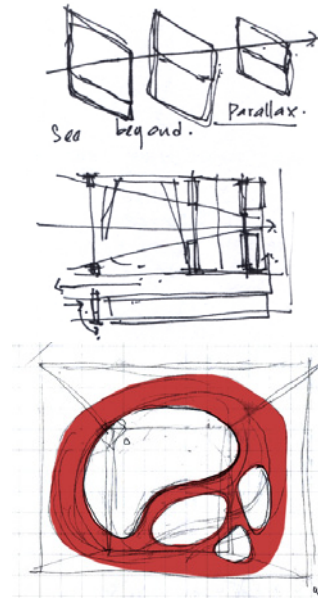
SKETCH DESIGN . 02



The revised design of the gallery takes strong consideration of the movements of the viewer within the gallery.

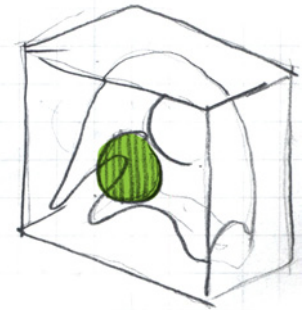


The design intent is to allow the viewer to travel vertically to appreciate the icosahedron.



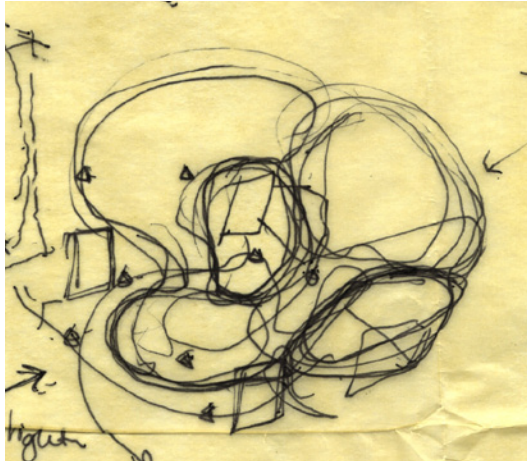
The light modulator would consist of several layers, to dynamically filter the light into the gallery.

The landscape is interpreted to have the light module integrated into it.

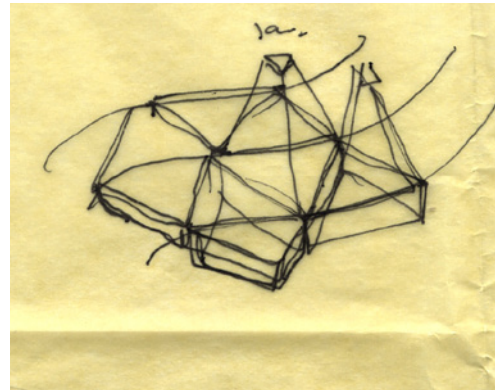


As a result, icosahedron gallery would represent a fabric that is influenced by the position of the icosahedron.

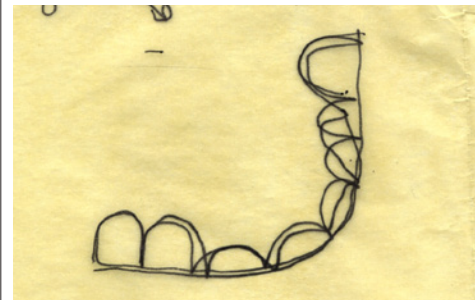
SKETCH DESIGN . 02



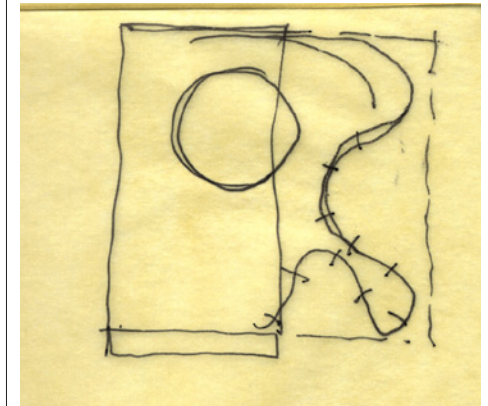
The proposed landscape fabric would be influenced by several attractors. One, the position of the icosahedron influencing the amount of light penetrating the landscape. Two, the composition of the landscape to allow viewers to move horizontally and vertically.



The light module component is an adaptation of the icosahedron ornamental component.

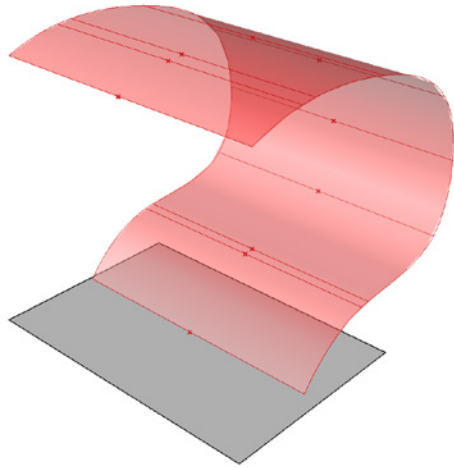


The fabric would stretch out to two or more surfaces.



Sectional sketch of the dynamic fabric.

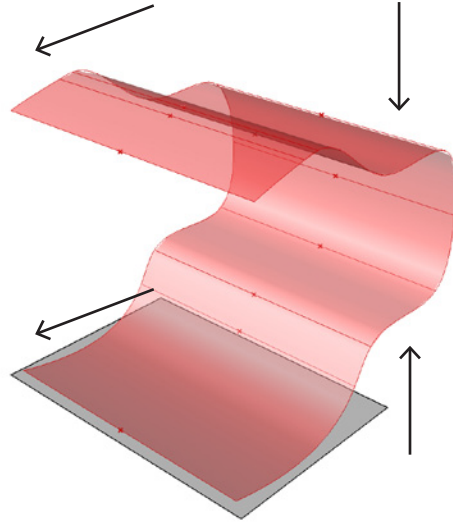
SCRIPT EVOLUTION



Curtain .00 - loft

Parameters:
A) Position of lines to loft

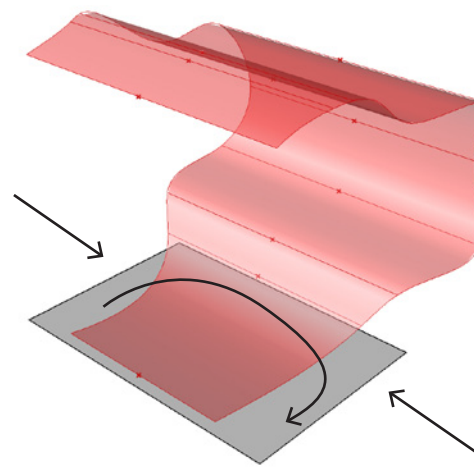
The loft surface remains static



Curtain .01 - iteration of loft

Parameters:
B) Position of lines to loft

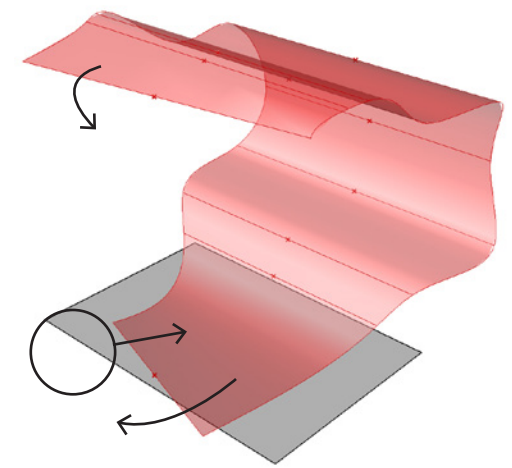
The loft surface starts to become dynamic.



Curtain .02 - various

Parameters:
C) Length of lines or loft

Playing with the edge profile allows a composition whereby the viewers can walk around the fabric within the gallery.

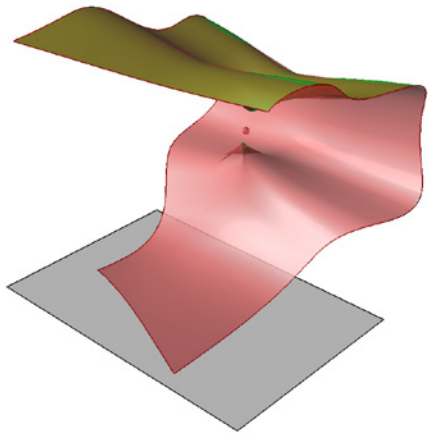


Curtain .03 - twist

Parameters:
D) Rotation of lines to loft

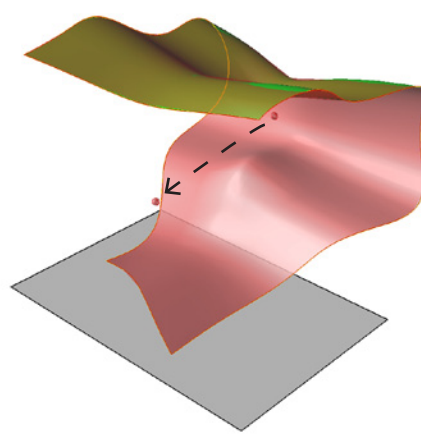
The twist orientates the fabric towards the entrance of the gallery

SKETCH DESIGN . 02



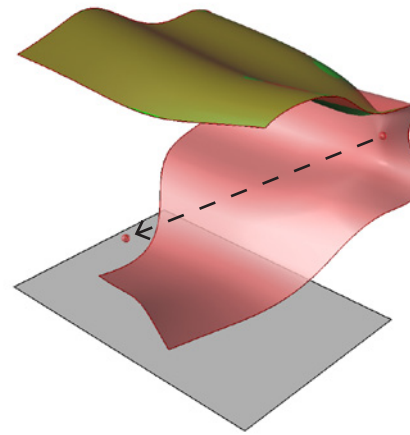
Curtain . 04 - 1 attractor

Adding a attractor point creates a more interesting surface.



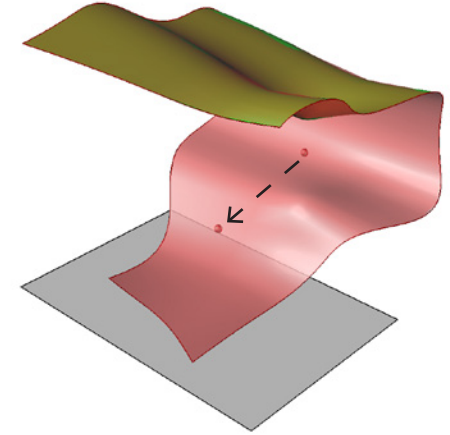
Curtain . 05 - 2 attractor, cantered

Increasing the number of attractor points distributes the pull of the surface, creating more gentle curves.



Curtain . 06 - 2 attractor, angled

Placing the attractor at an angle creates a more interactive surface. Having the attractor closer to the surface creates sharp curves would increase difficulty of fabrication.



Curtain . 07 - 2 attractor, angle reduced.

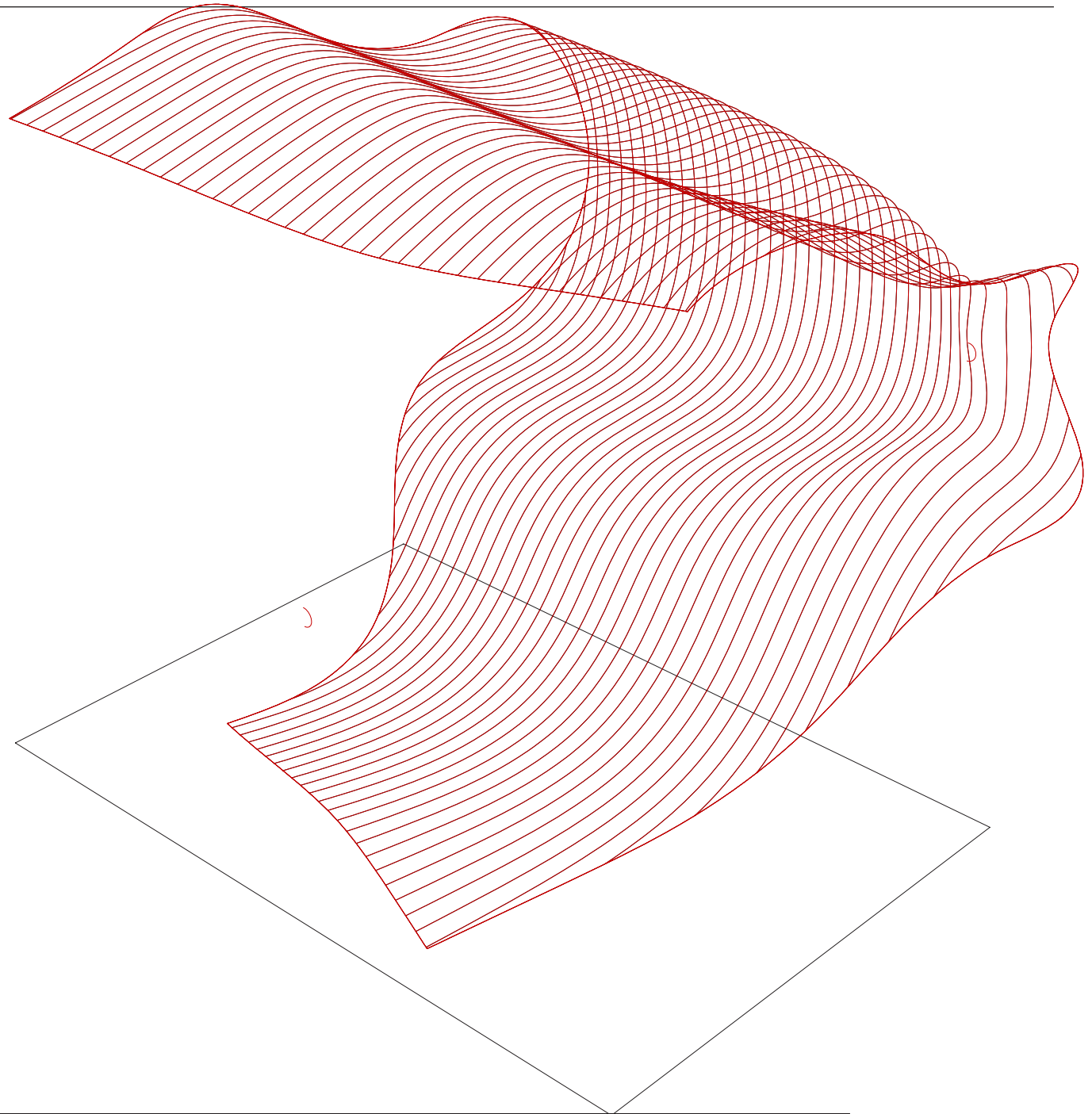
Reducing the complexity of the curve is preferred in order to proceed with fabrication to reduce complications.

FABRICATION . 01

contours

Contours

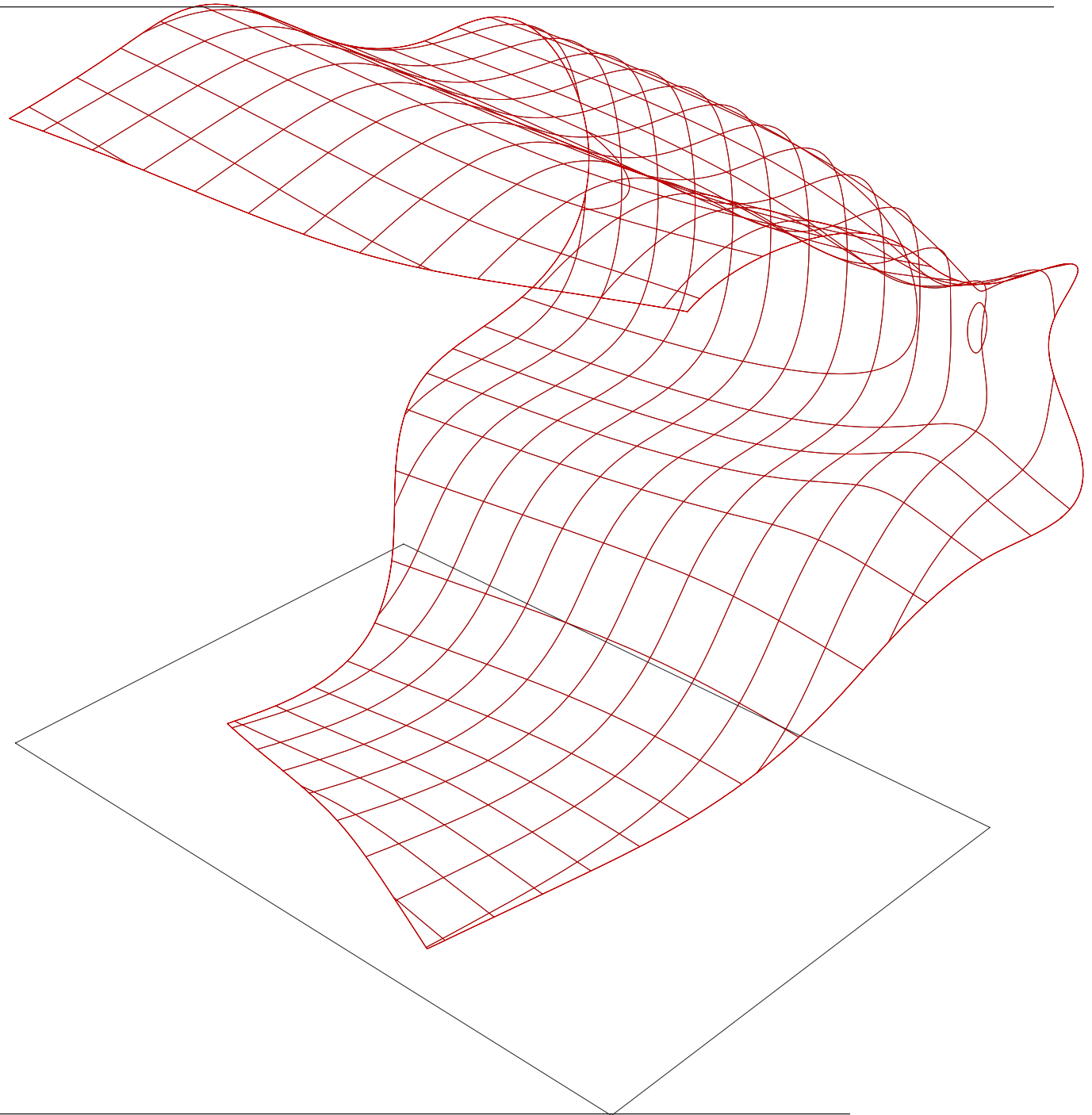
The use of contours to construct the surface would be possible but not suitable for the design intent. It would end up as a solid surface and has restrictions in filtering light through it.



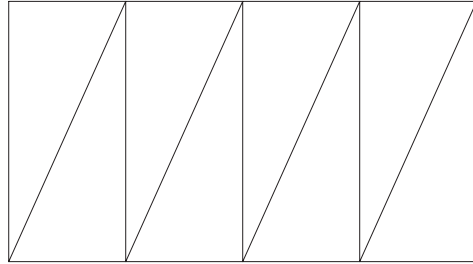
FABRICATION . 02

Waffle

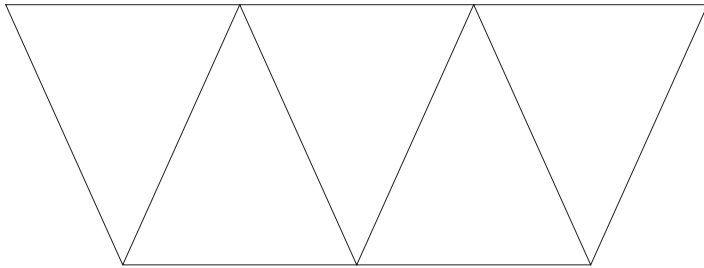
The waffle system proves to be a sturdy fabrication method for curved surfaces. The system will still allow light to pass through it easily but only in one direction.



SKETCH DESIGN . 03



Triangulation . 01



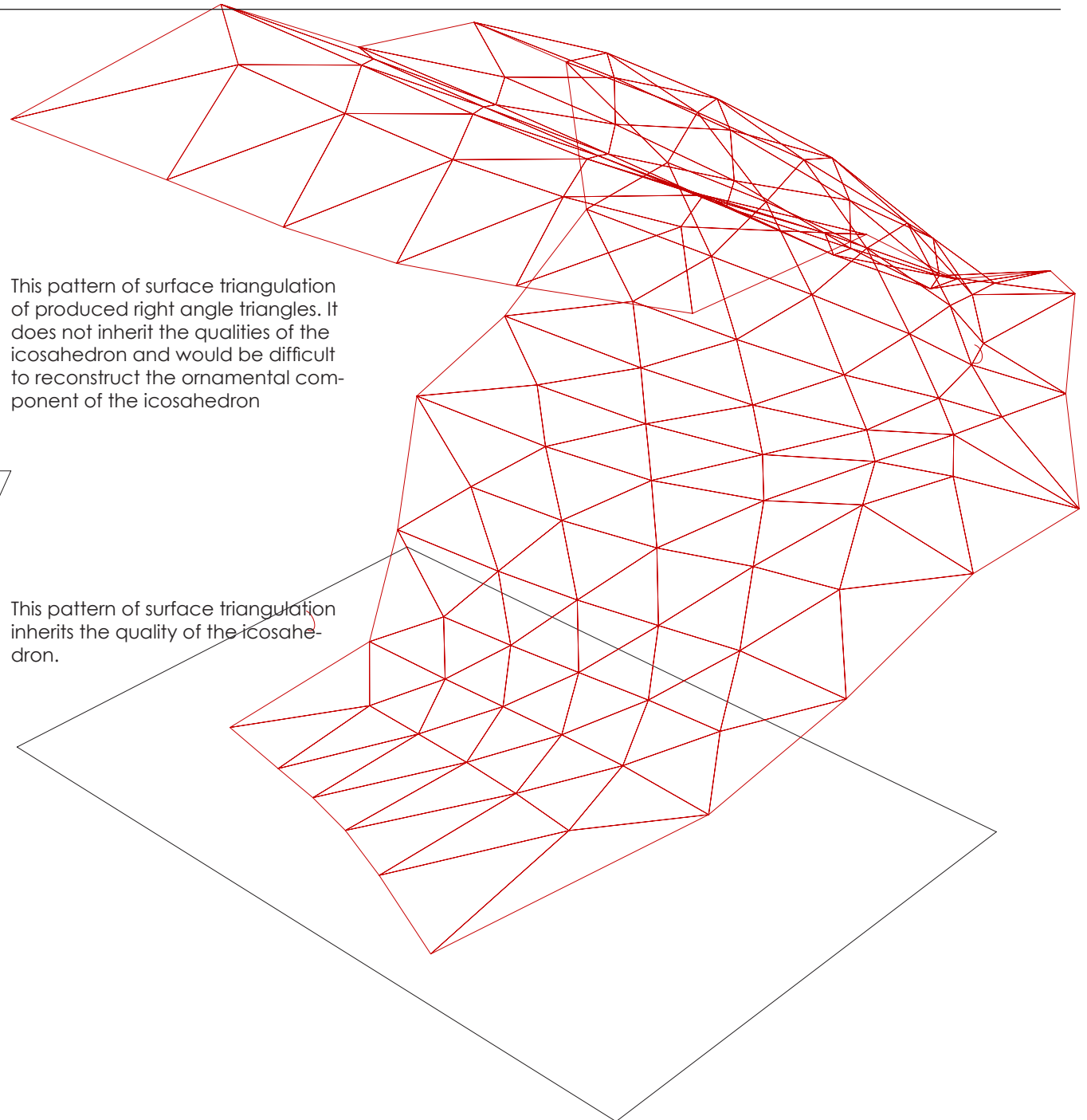
Triangulation . 02

Triangulated surface

The triangulated surface would inherit the characteristics of an icosahedron surface. By using the appropriate materials, Light can easily penetrate through the surface. The constraints is not able to hold its shape well without a secondary support.

This pattern of surface triangulation of produced right angle triangles. It does not inherit the qualities of the icosahedron and would be difficult to reconstruct the ornamental component of the icosahedron

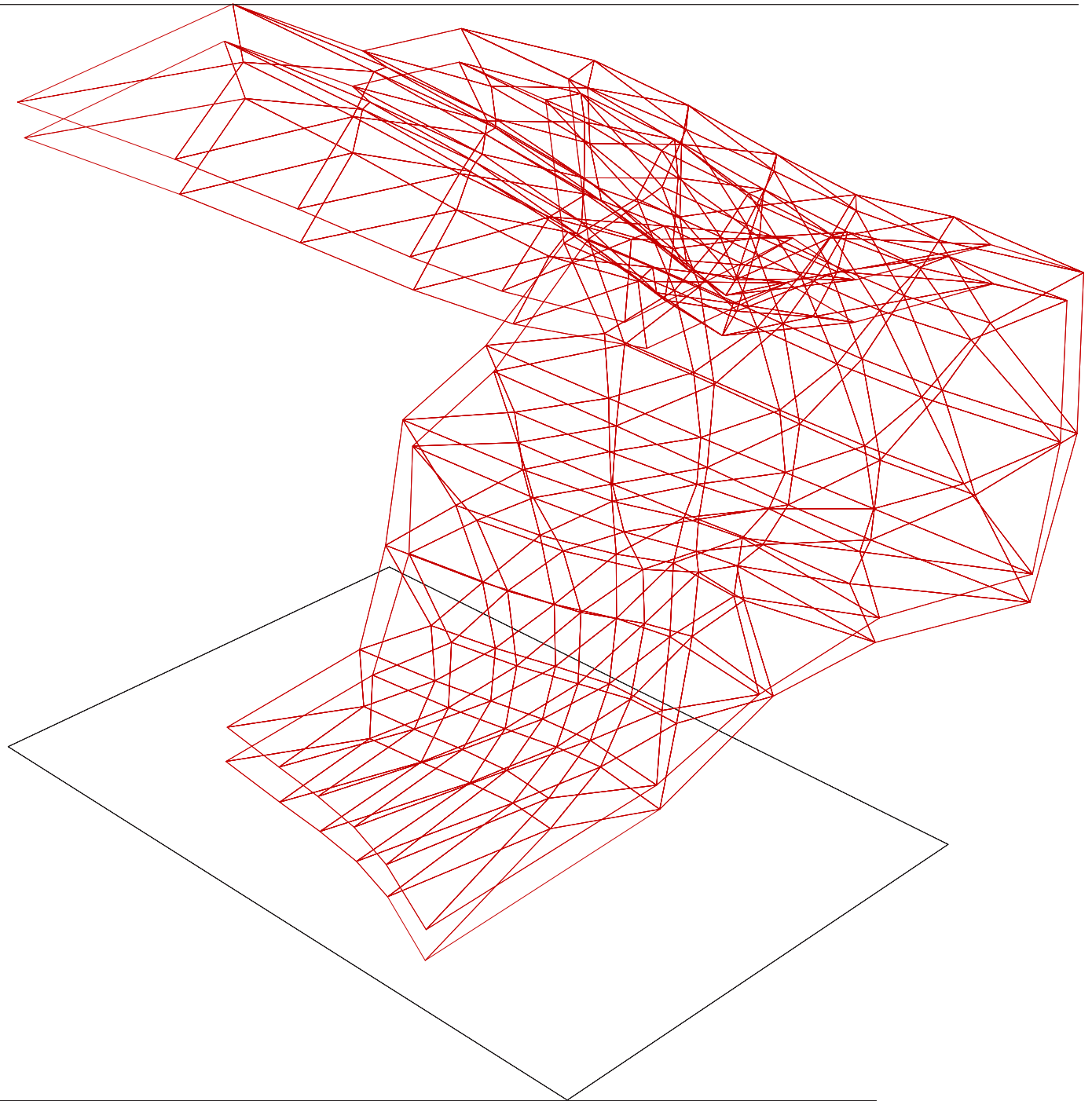
This pattern of surface triangulation inherits the quality of the icosahedron.



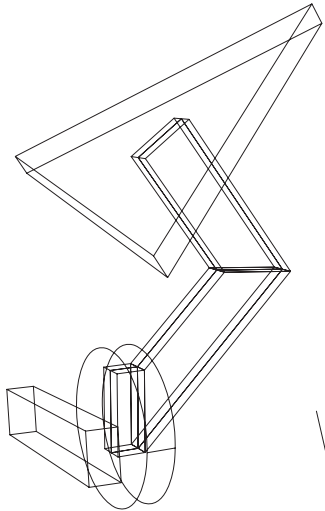
SKETCH DESIGN . 04

Double Triangulated Surface

With a double surface, the surface would be able to hold its shape better without a secondary supporting system.

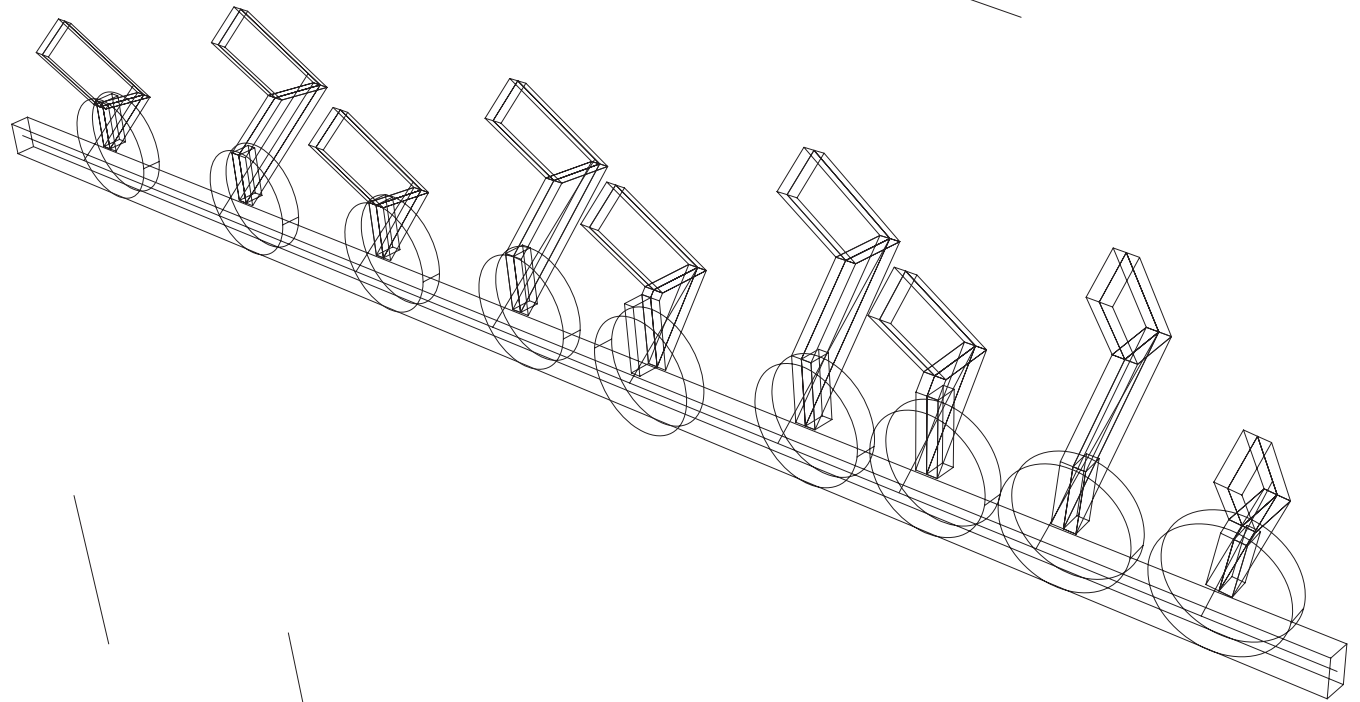


CONSTRUCTION . 01

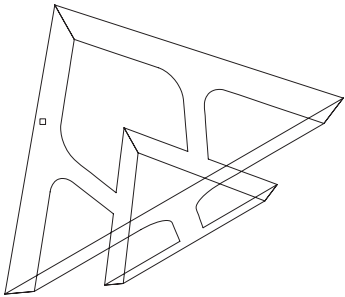


Branch System

The branch system holds the triangle faces into place effectively. However, the system involves a series of secondary and tertiary members. This additional members would convey a different language within the composition.



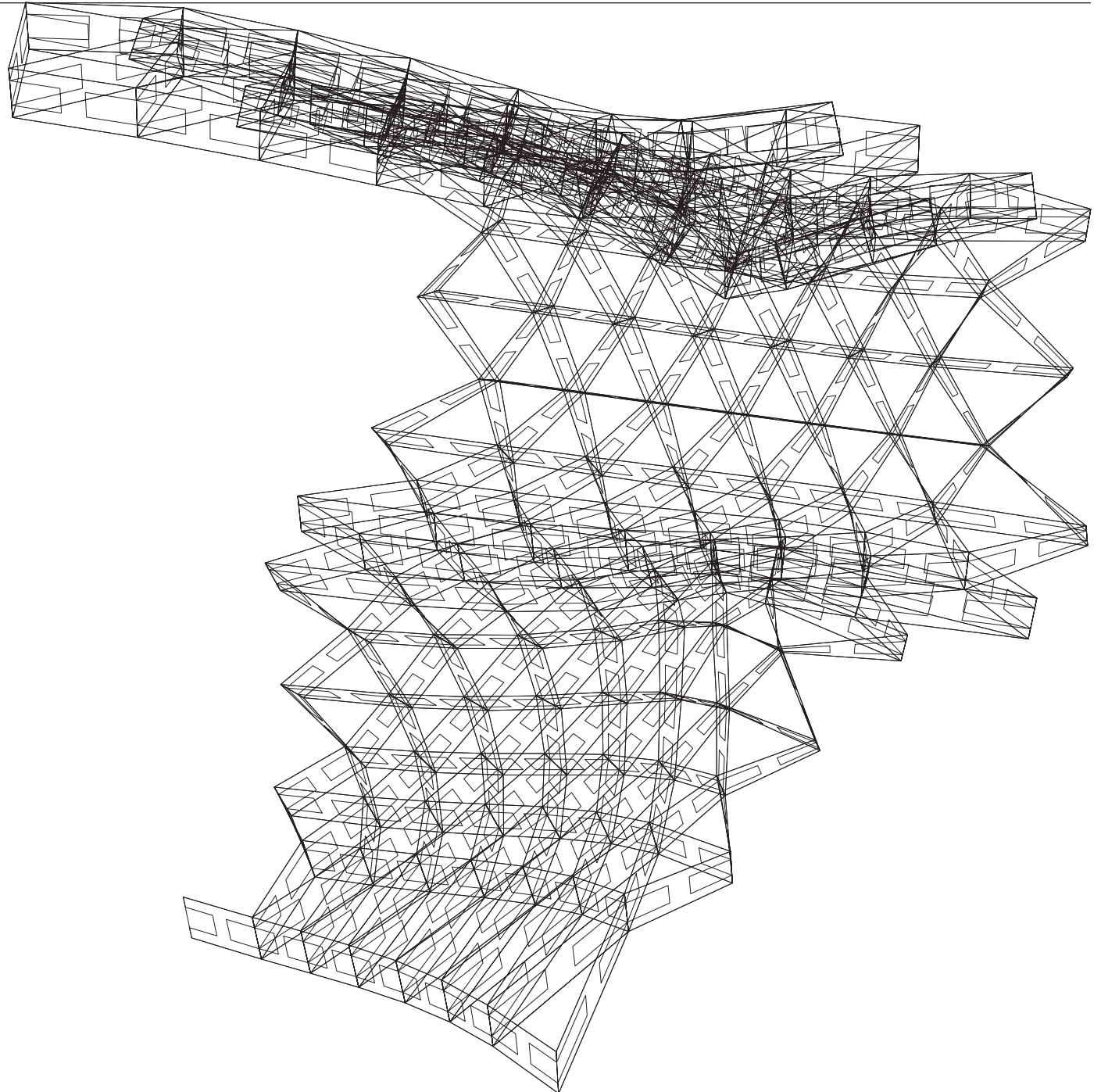
CONSTRUCTION . 02



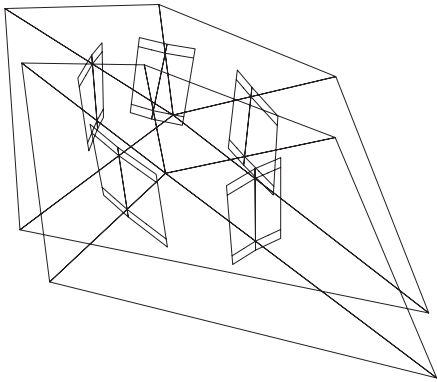
Tab System A

This tab system is inherited from the icosahedron. the intended material for this system was vivac.

This system was not successful because it would be difficult to attach the tabs to the triangular surface. the tabs were not rigid enough to hold the surface.

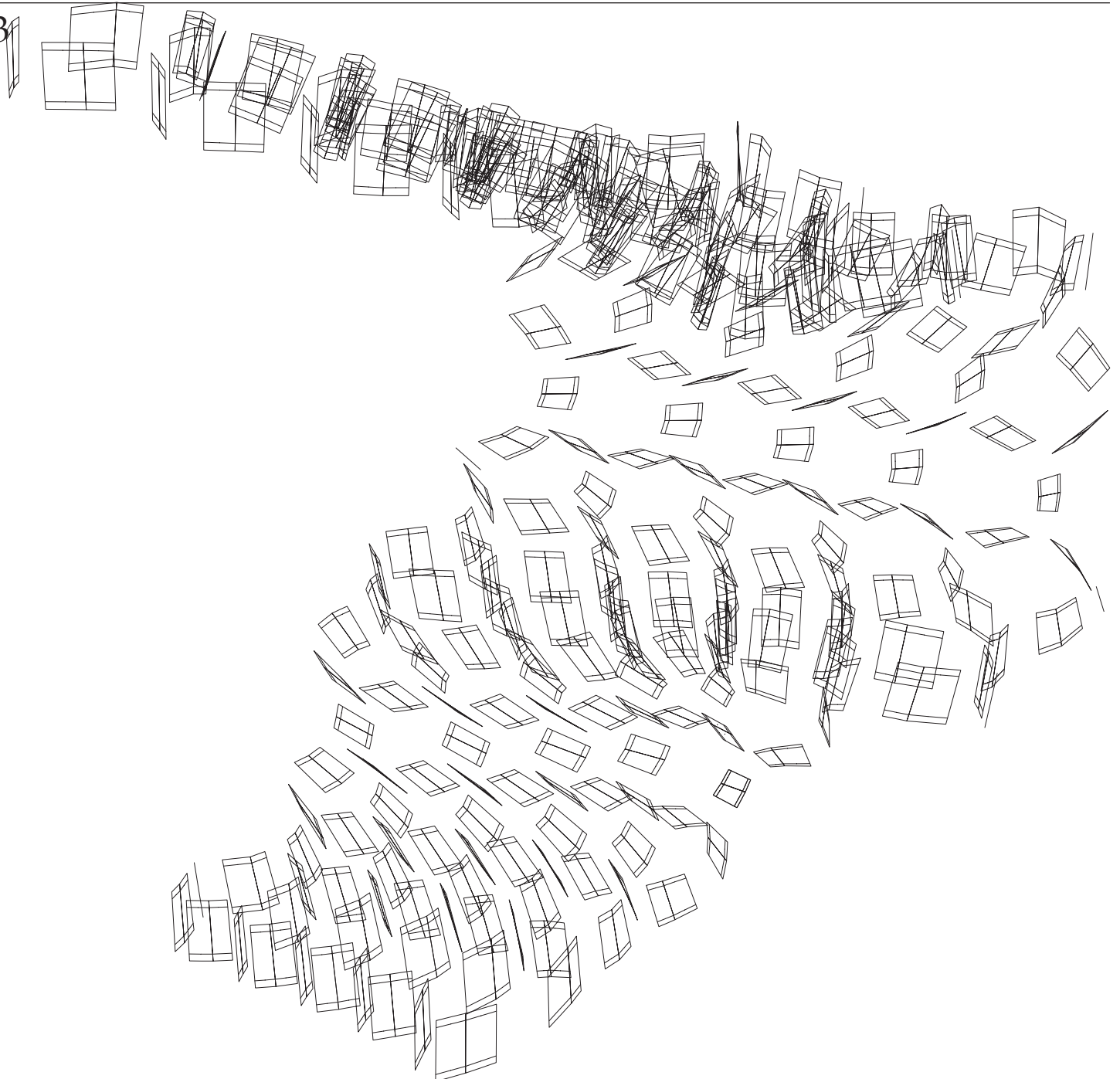


CONSTRUCTION . 03

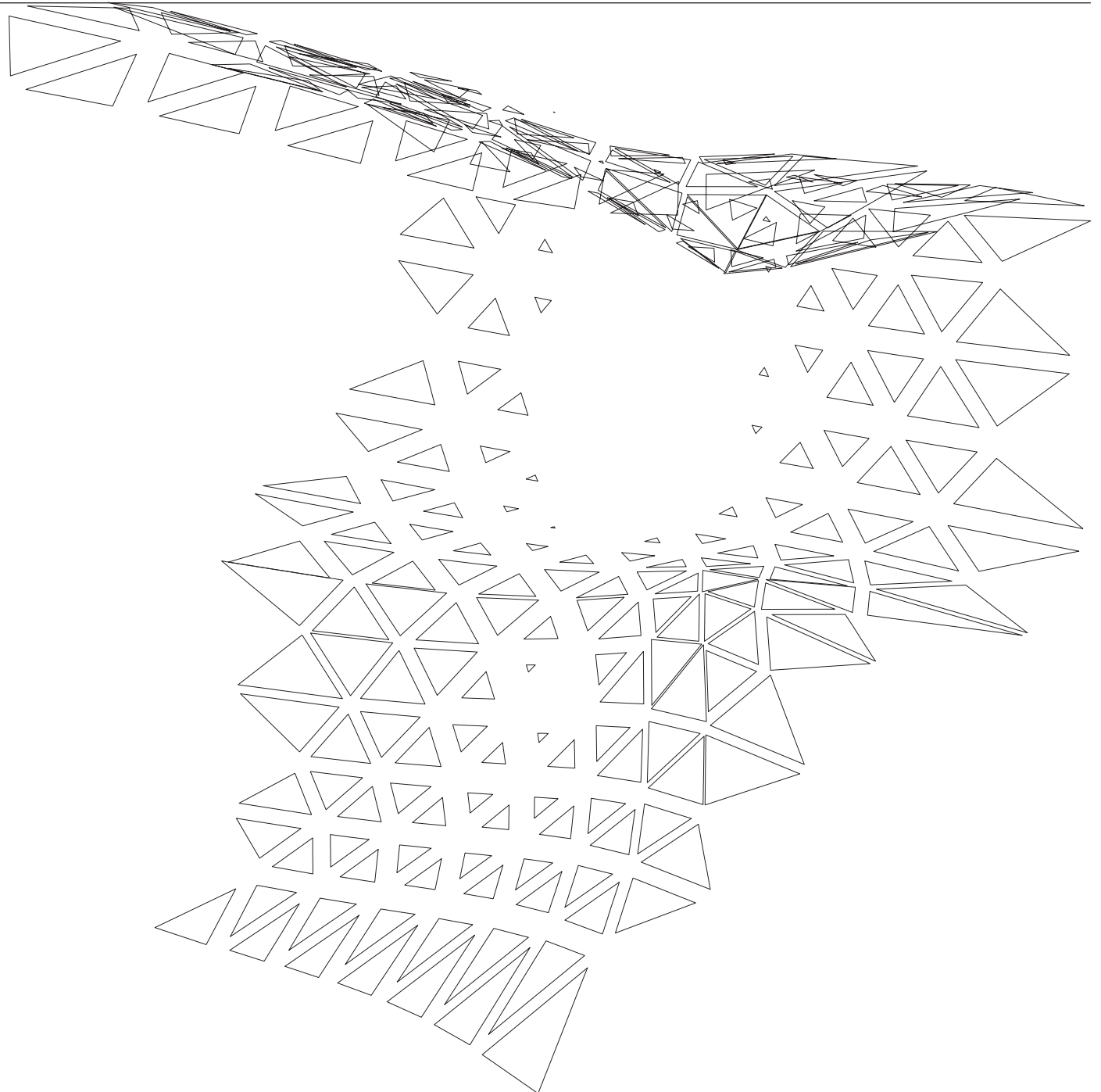


Tab System B

The tab system is revised and simplified. Using a slot mechanism, the triangle faces would be able to hold at the appropriate angles to hold its shape.



APERTURE . 01



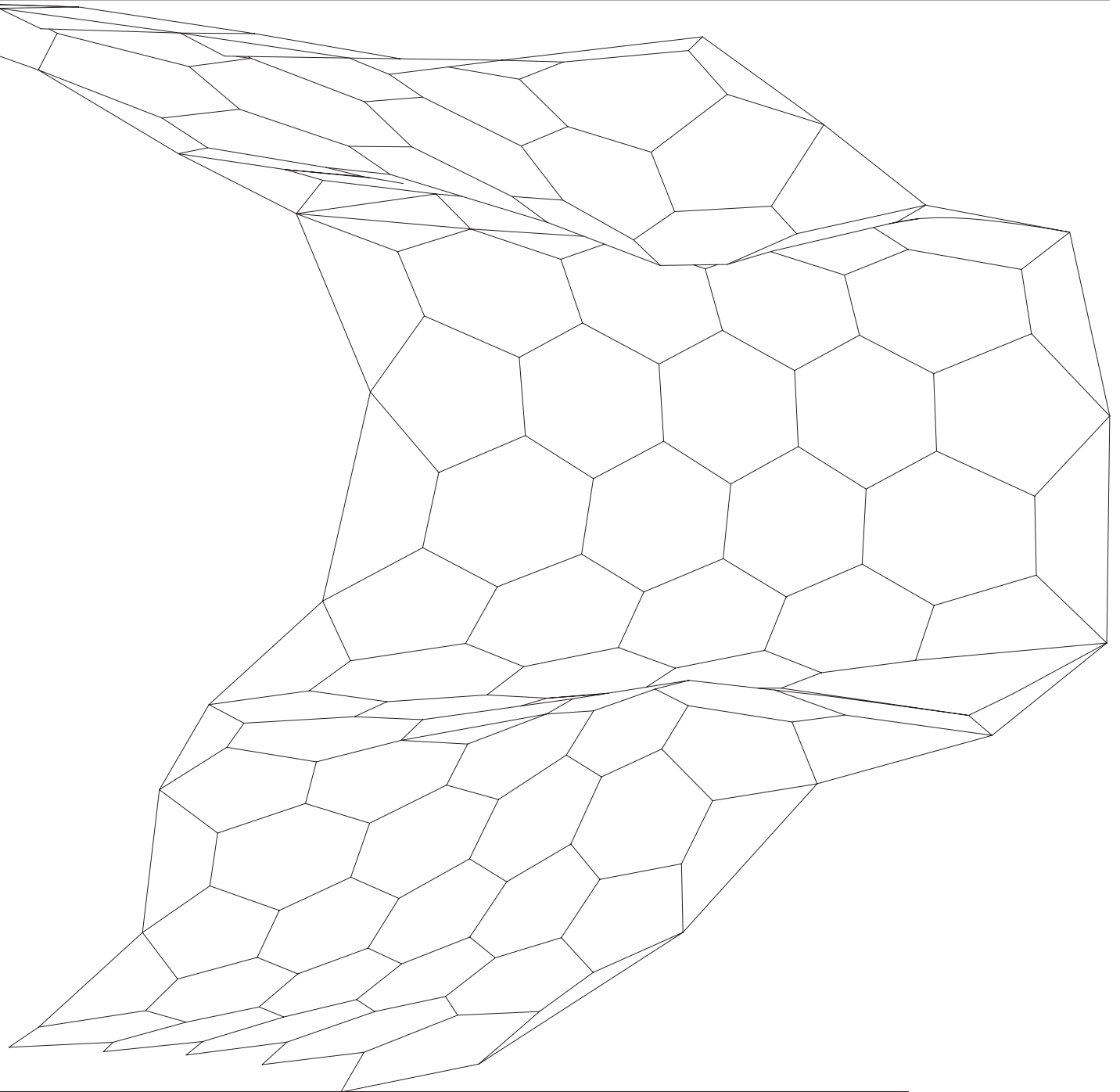
Geometry . 01

The photo filter starts out as deformation of the triangulated surface. Attractor points, representing the position of the icosahedron effects the size of the geometry, creating different apertures.

APERTURE . 02

Geometry . 02

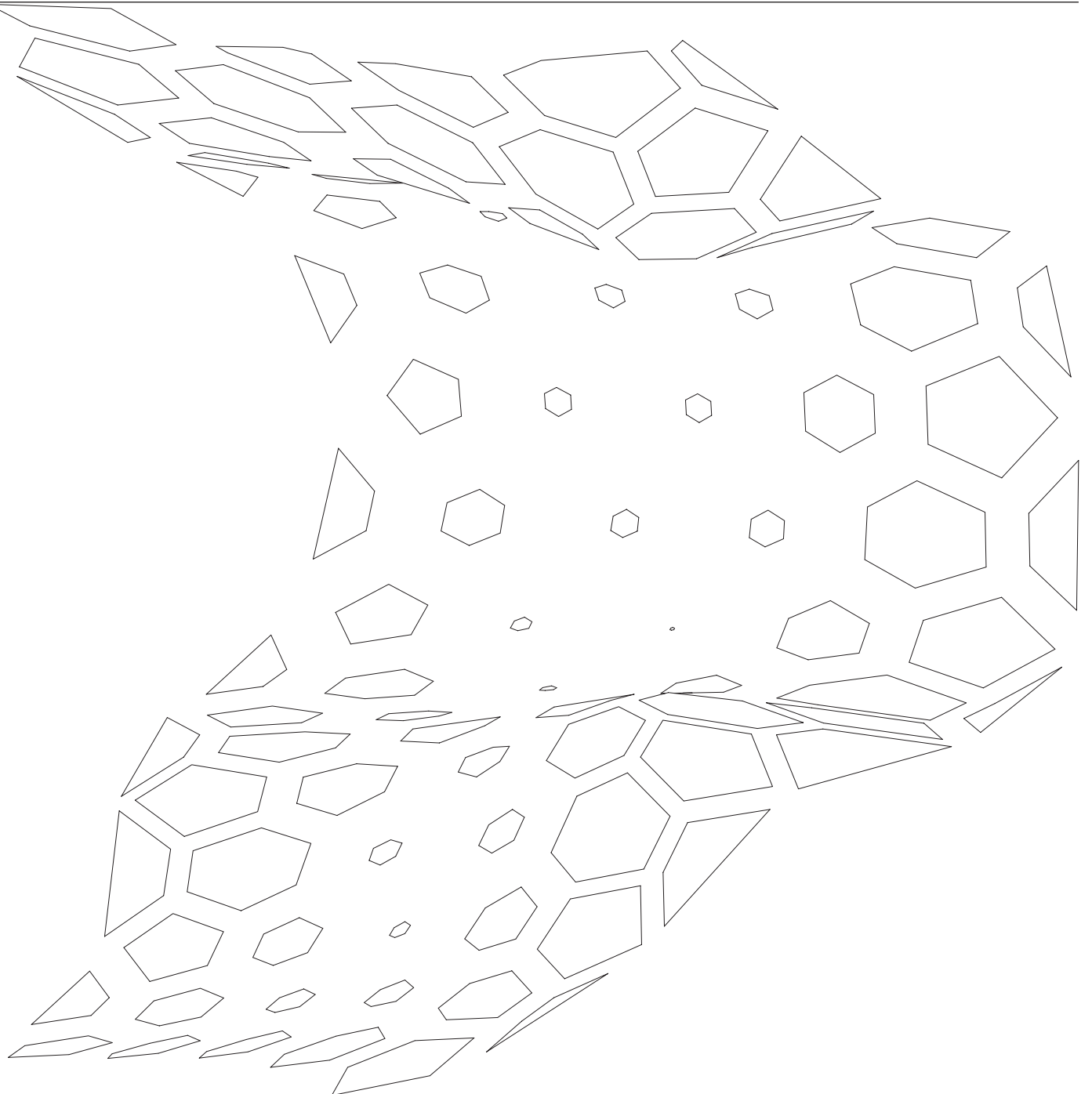
The number of photo filter faces are reduces by converting the triangles into hexagons. this is to ease the fabrication process.



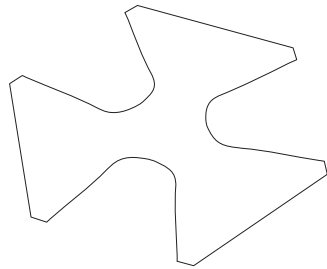
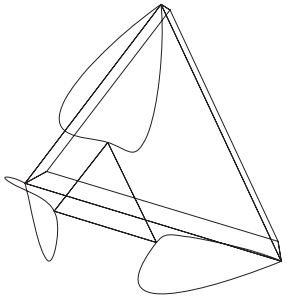
APERTURE . 03

Geometry . 03

The attractor points are applied to the hexagons to create different apertures.

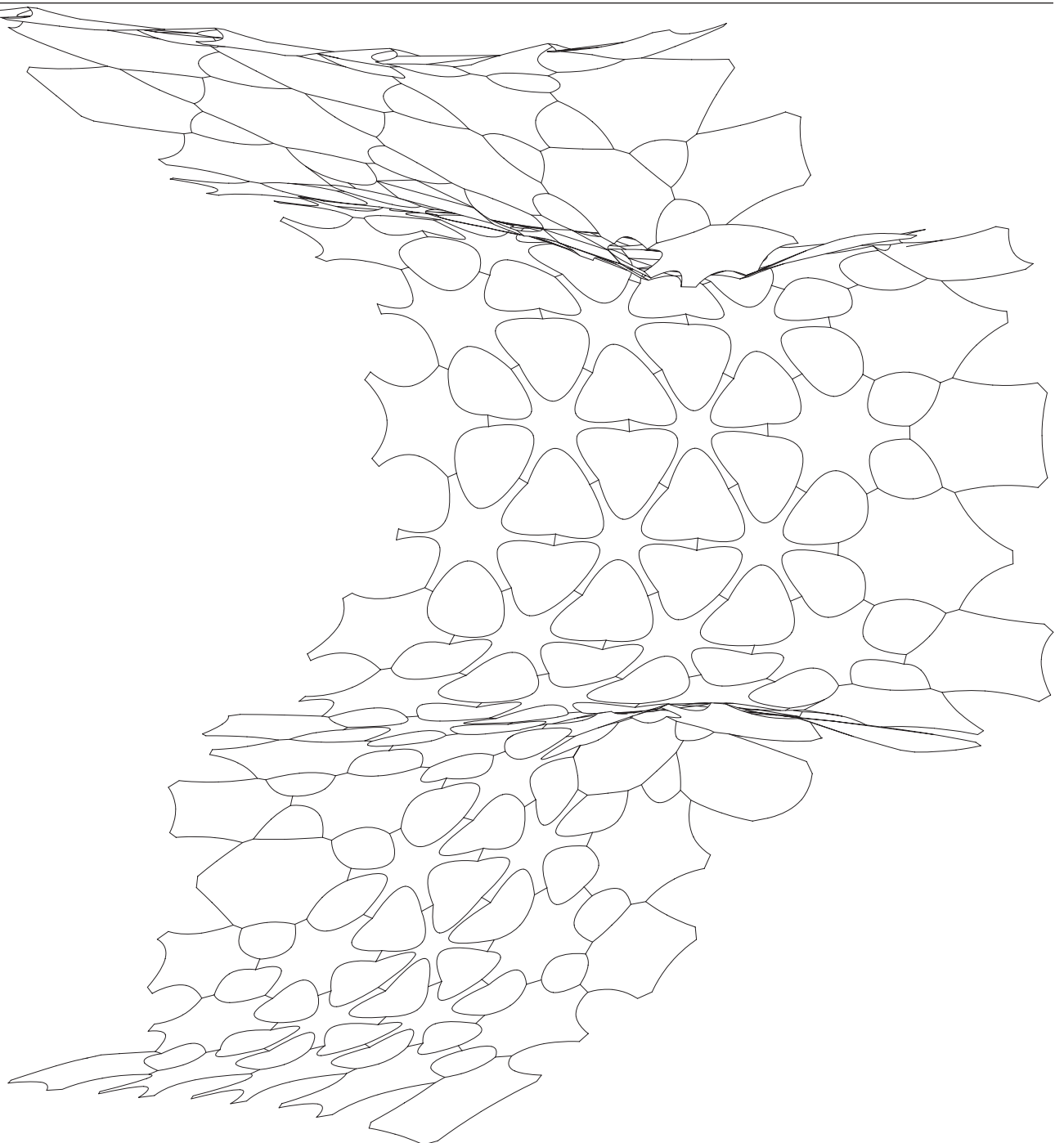


APERTURE . 03



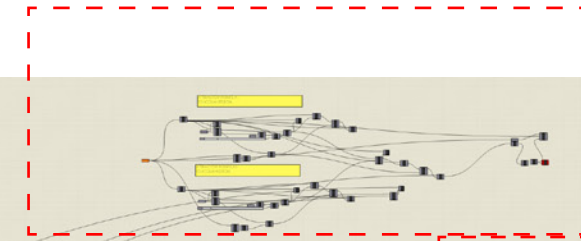
Anemone . 01

The hexagonal surfaces then inherit the characteristics of the ornamental component of the icosahedron.



FINAL SCRIPT . 03

Aperture . 02 Parameters

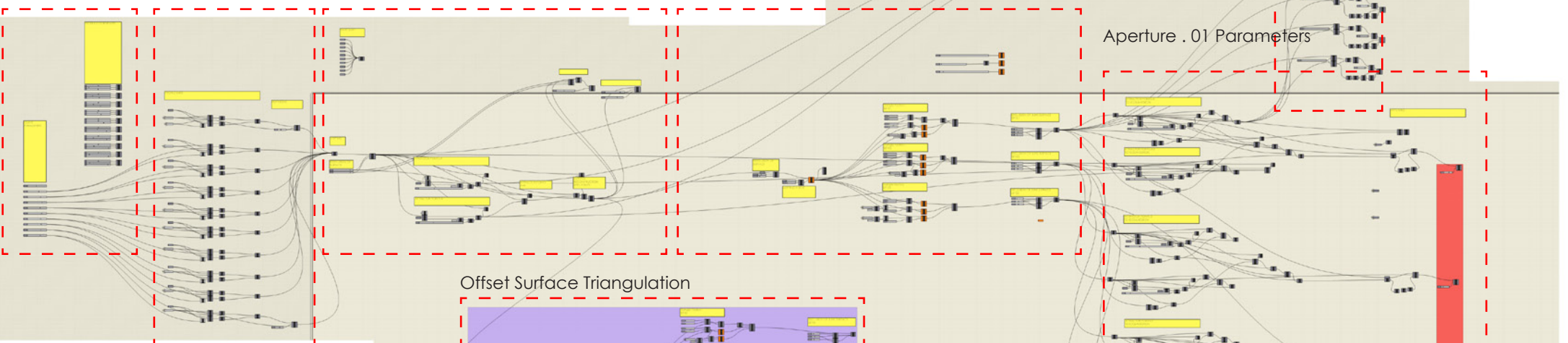


Curve Parameters

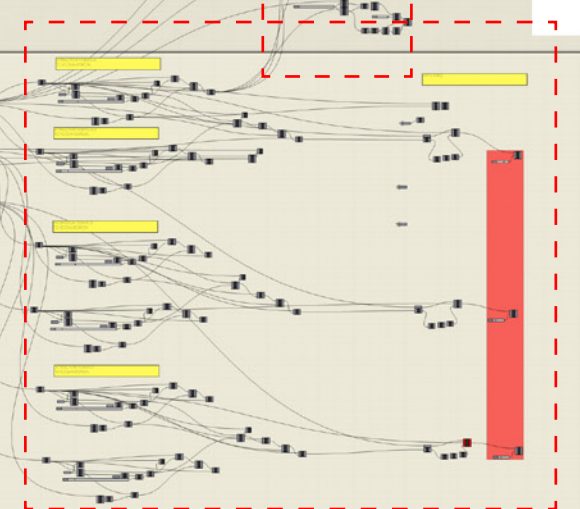
Curve Coordinates

Attractor Points

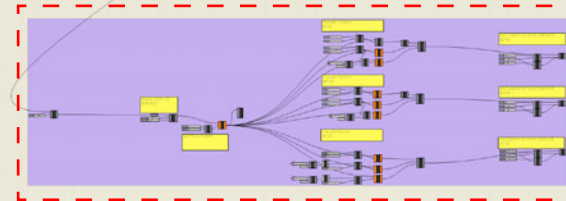
Surface Triangulation



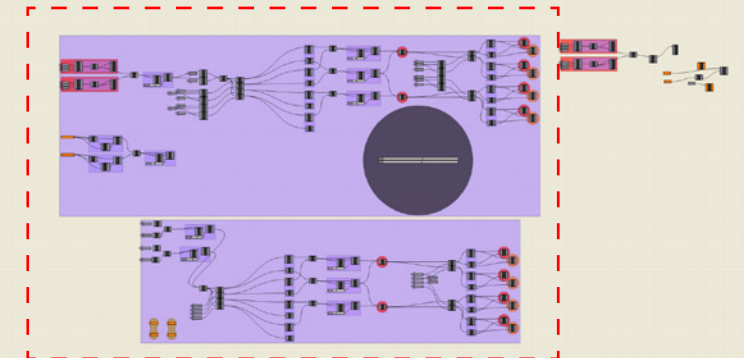
Aperture . 01 Parameters



Offset Surface Triangulation



Tab Construction



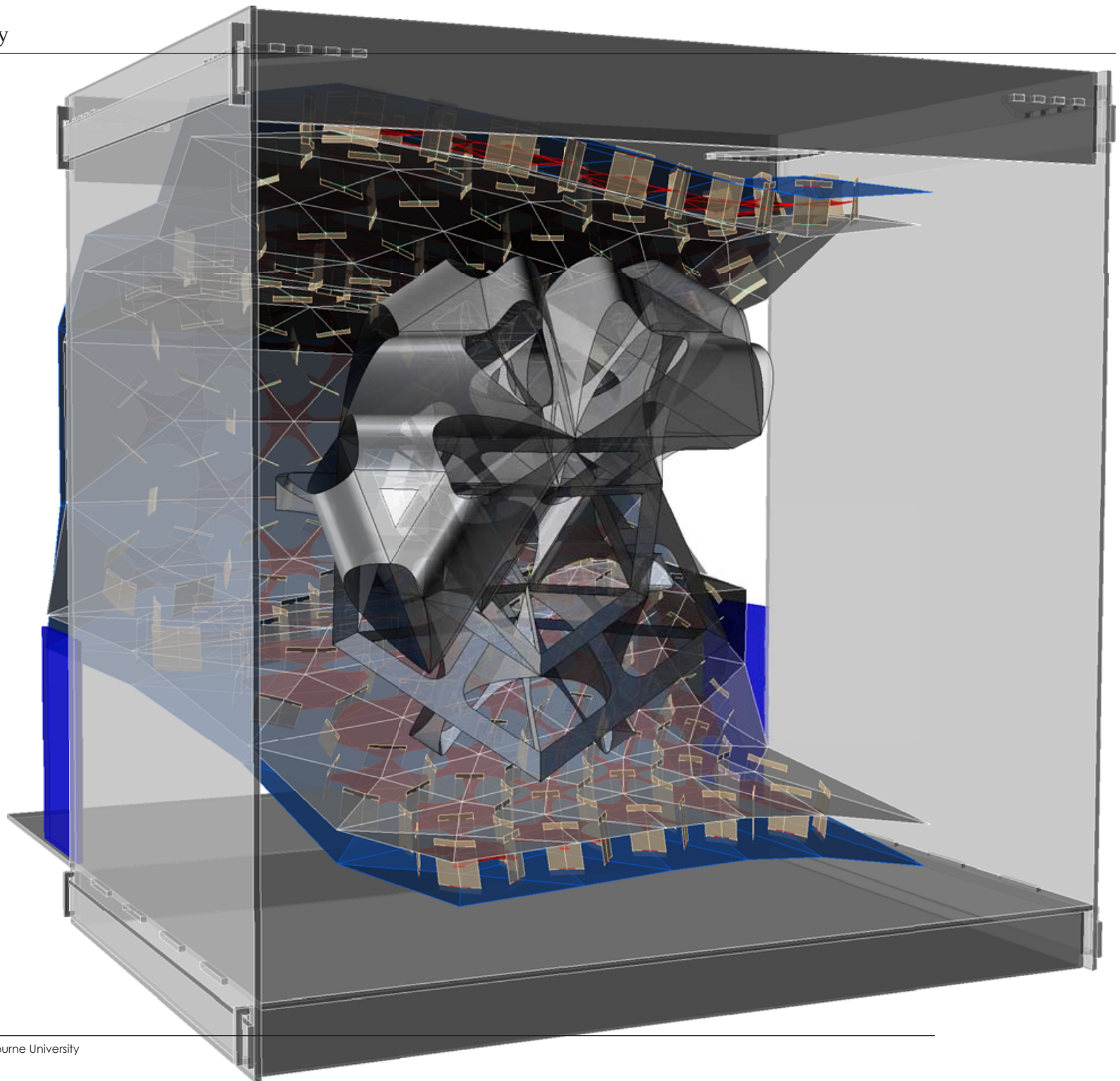
GRASSHOPPER SCRIPT

The concept of the script is to work with a point grid system obtained from a loft surface. The points are then create triangulated surface and all other components are built from that.

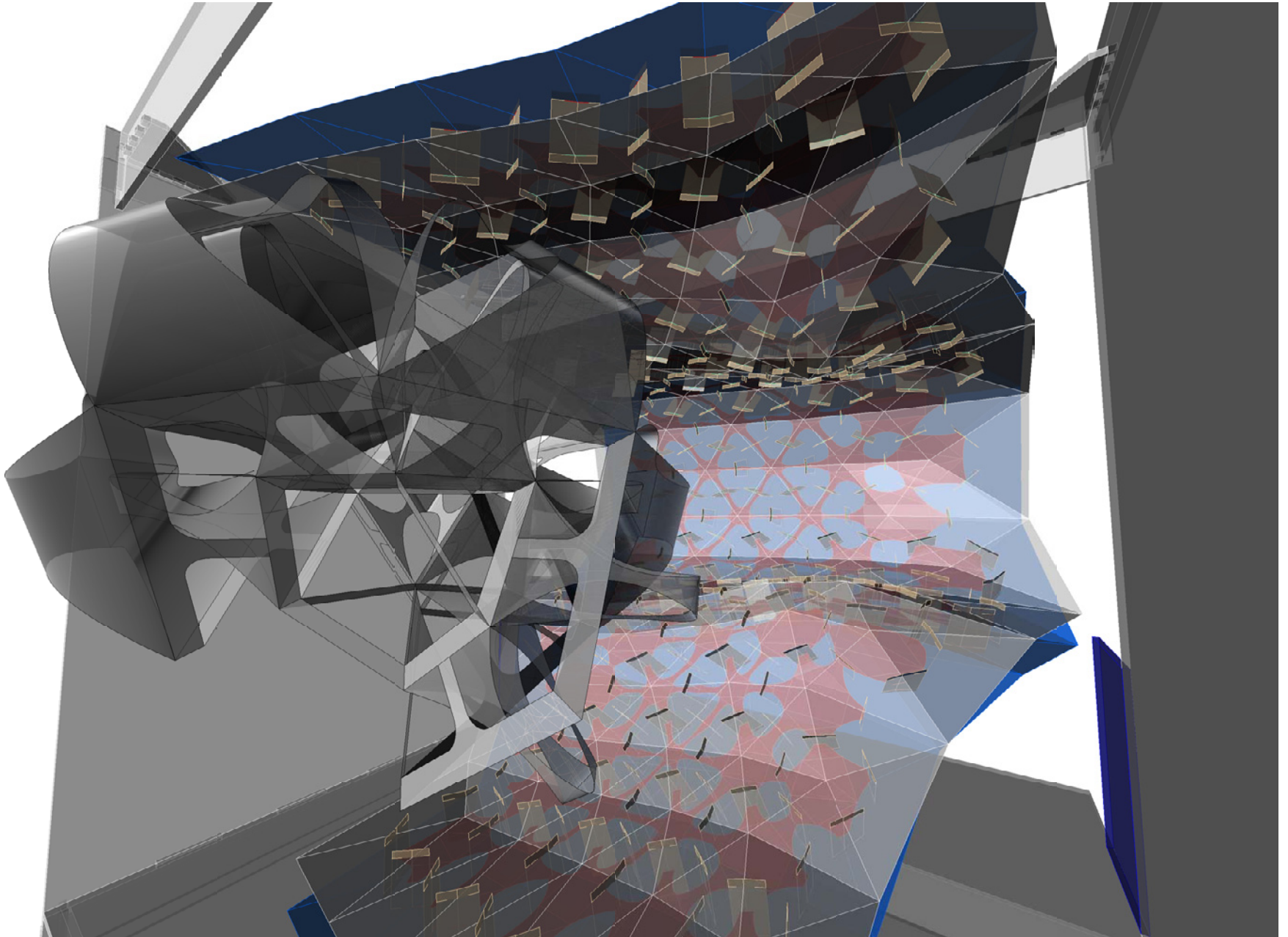
The crucial step within the script was to weaving the data from then grid into a sequential order.

The limitations were the suitable resolution of triangulated face in relation to feasibility of assembly.

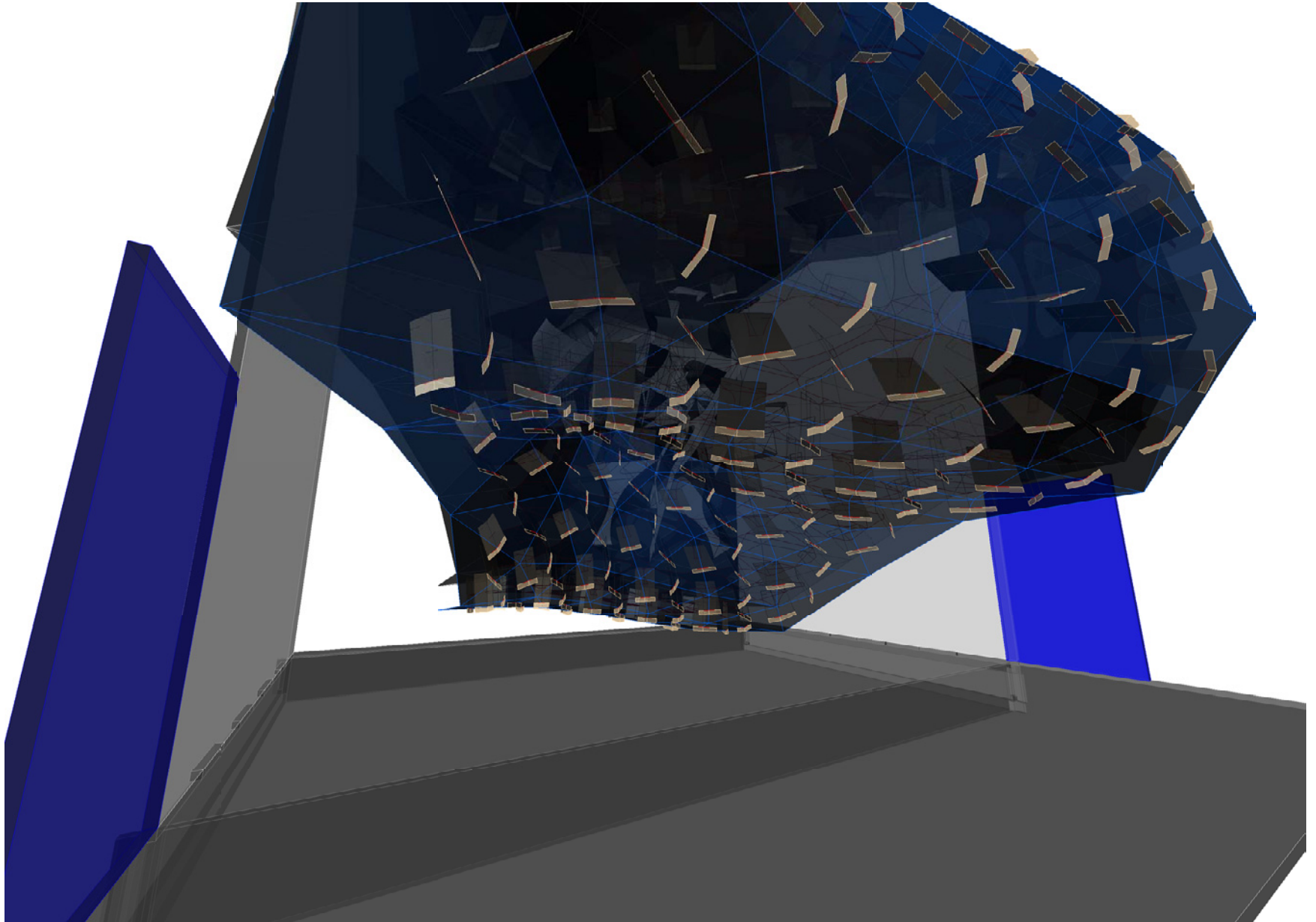
3D MODEL



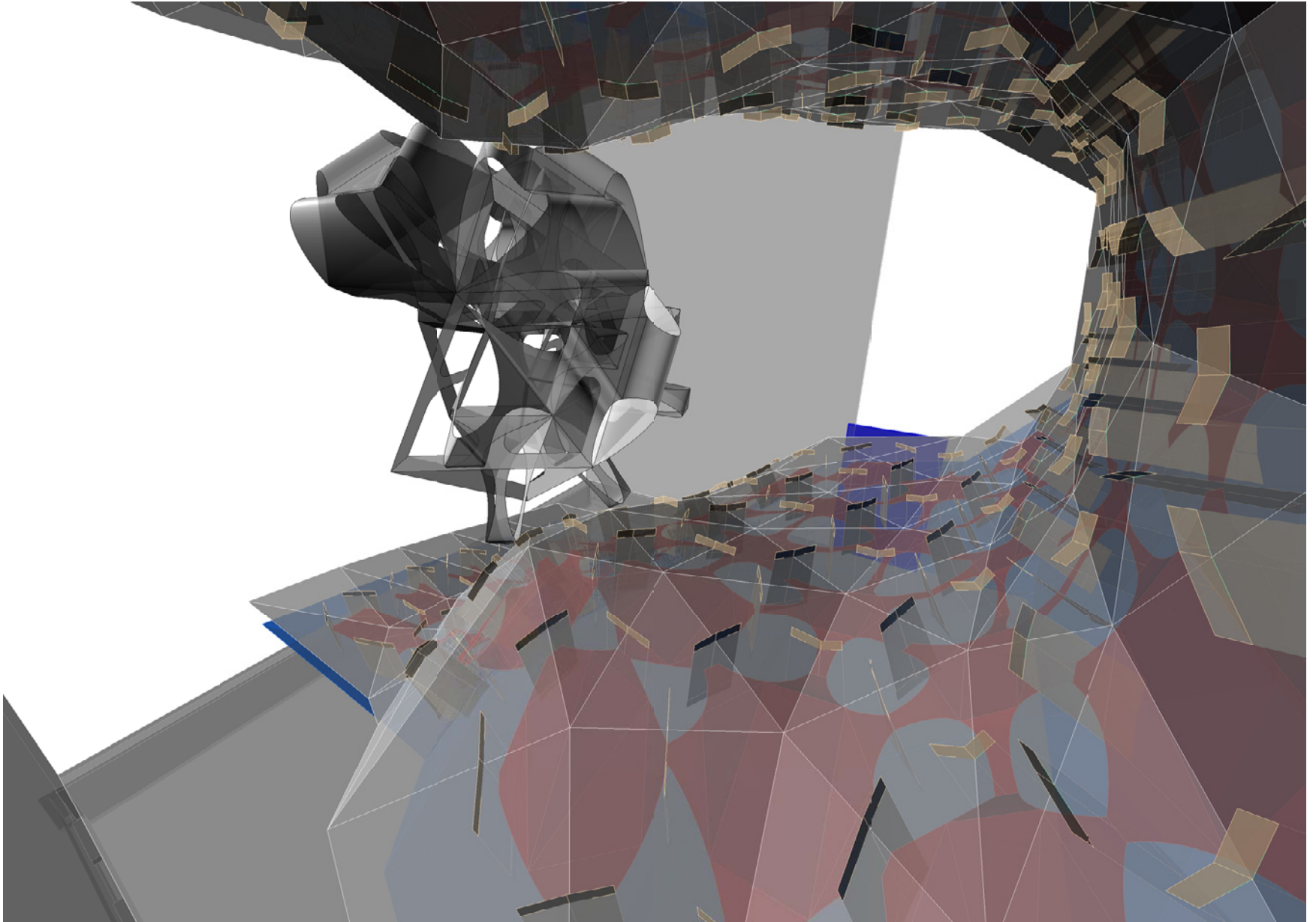
3D MODEL



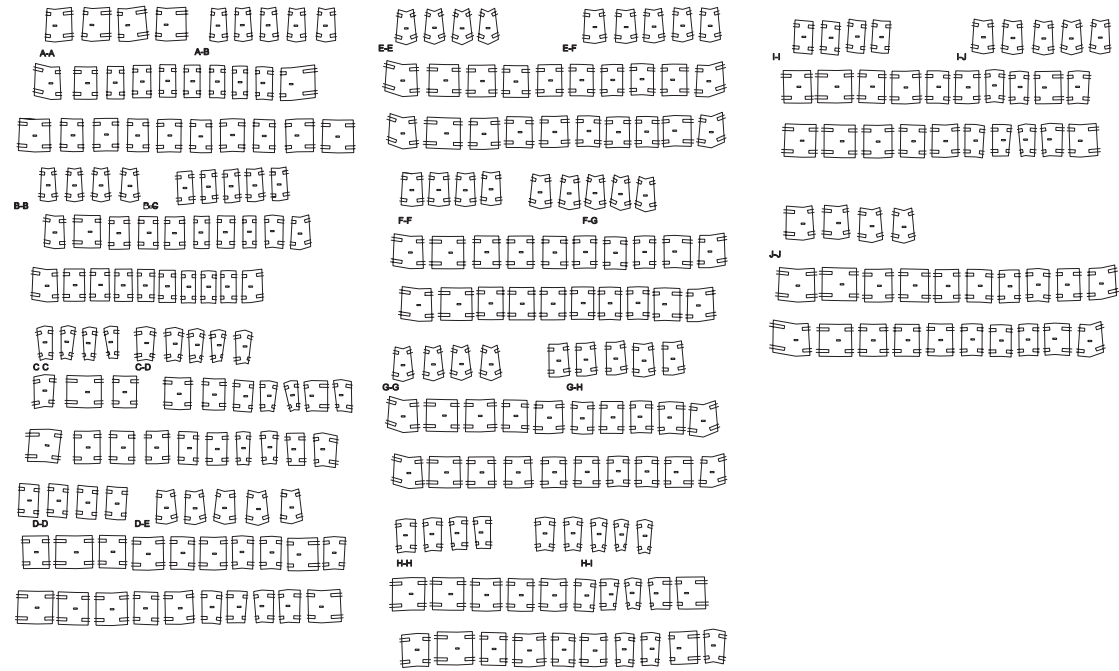
3D MODEL



3D MODEL



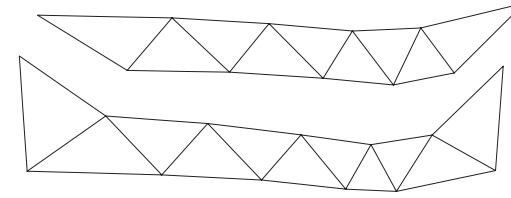
FABRICATION



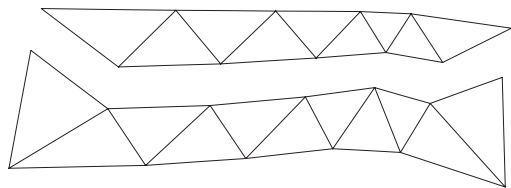
TABS

SURFACE PANELS

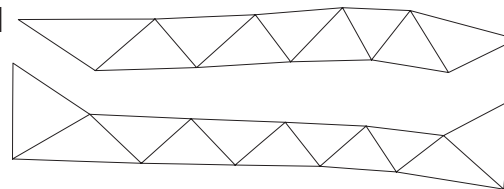
I1



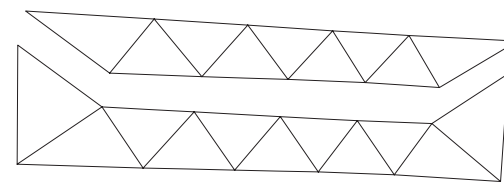
H1



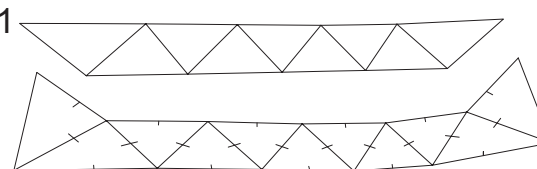
G1



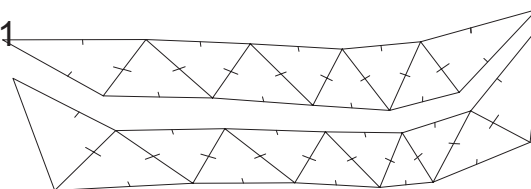
F1



E1



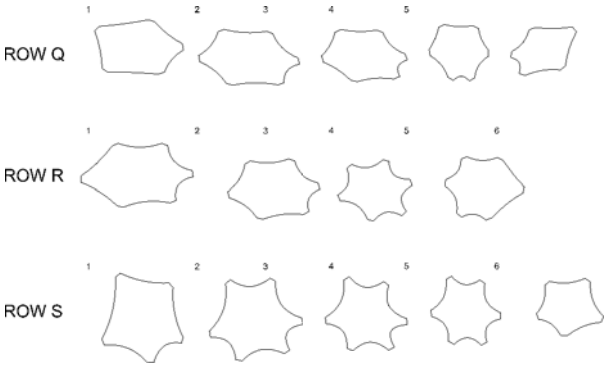
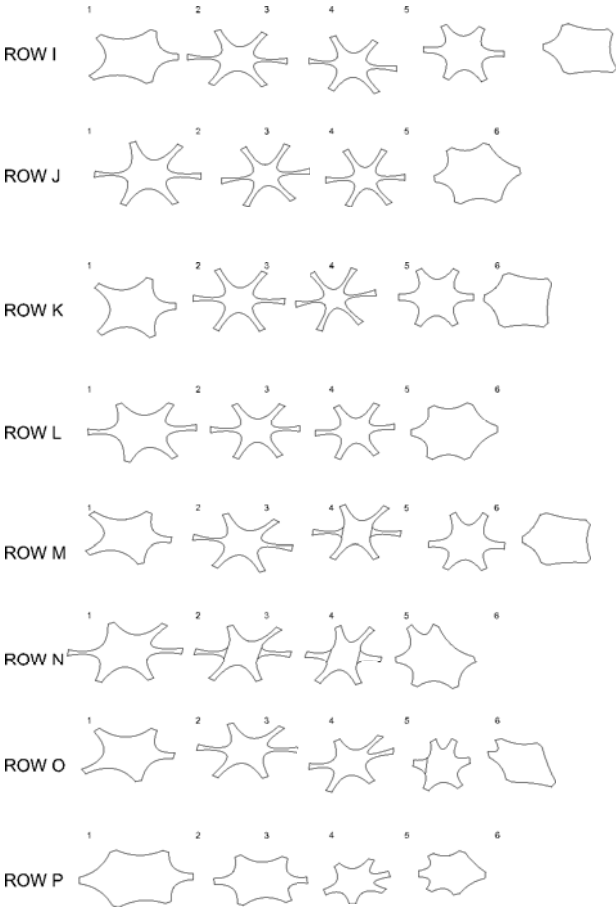
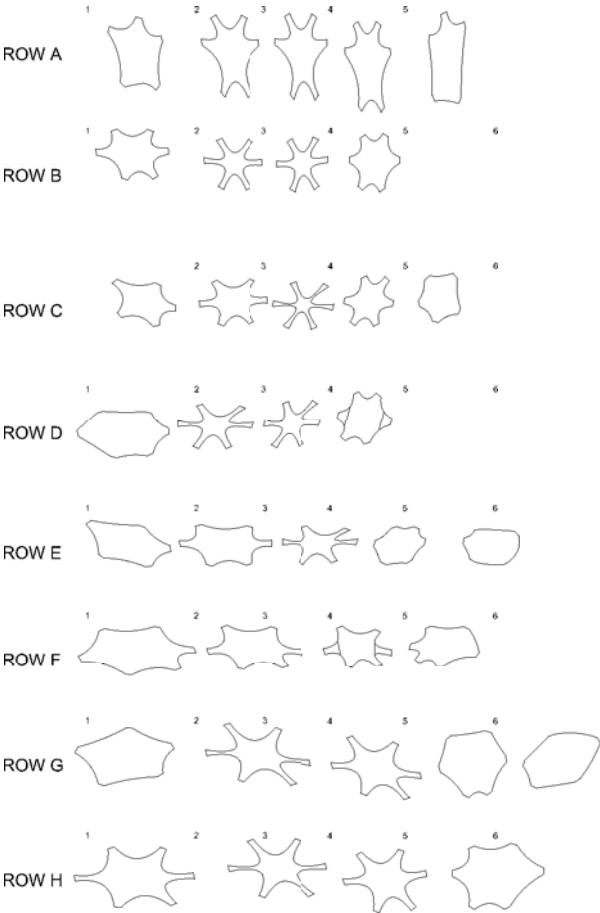
D1



C1



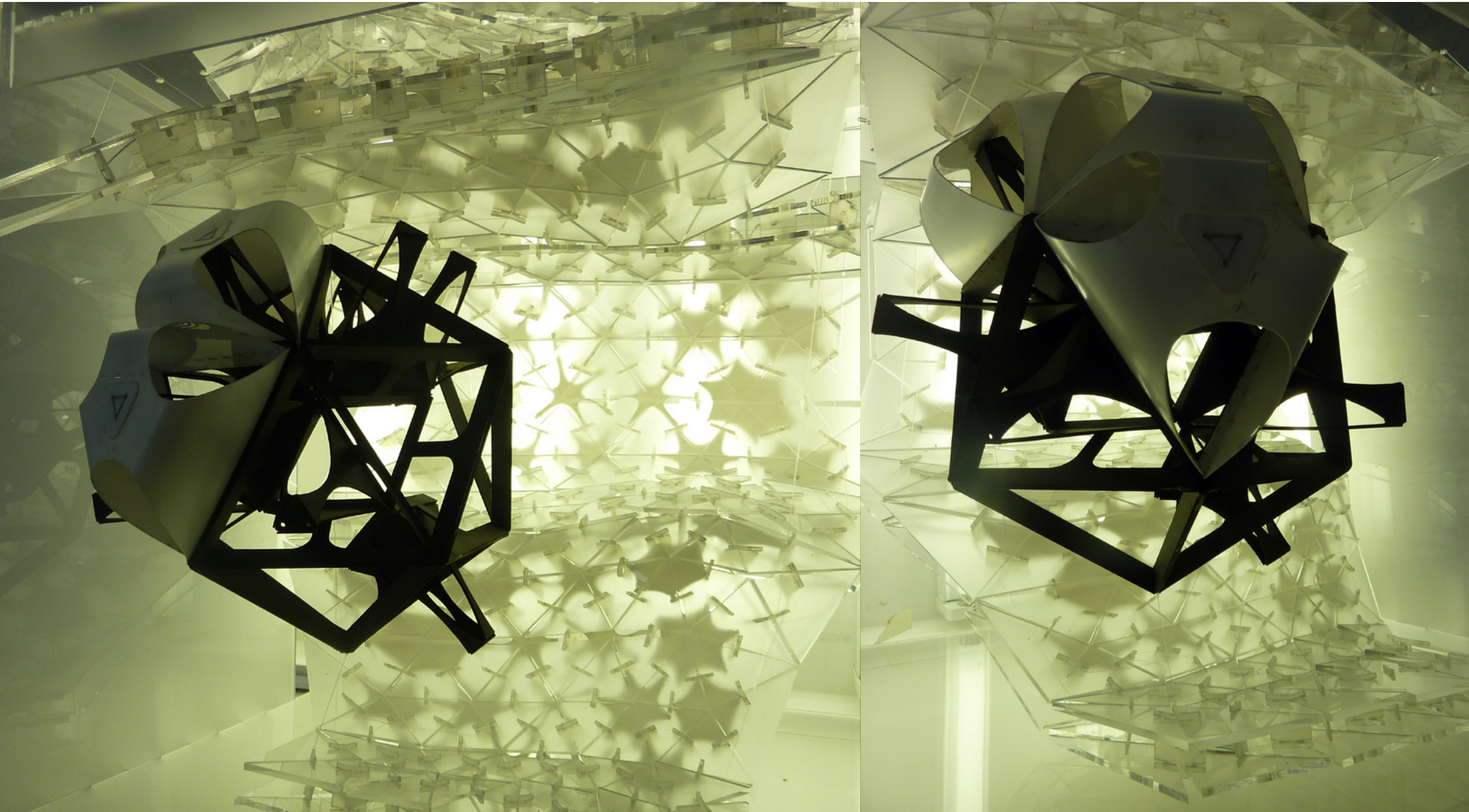
FABRICATION



Surface Panels	200
Tabs	180
Aperture	86
Total	366 Unique Components

APERTURE

PRODUCT



PRODUCT

FOCUS

The composition of the gallery involves the fabric wrapping around the icosahedron.

DUALITY

The surface give the gallery a duality of space, each with a unique experience



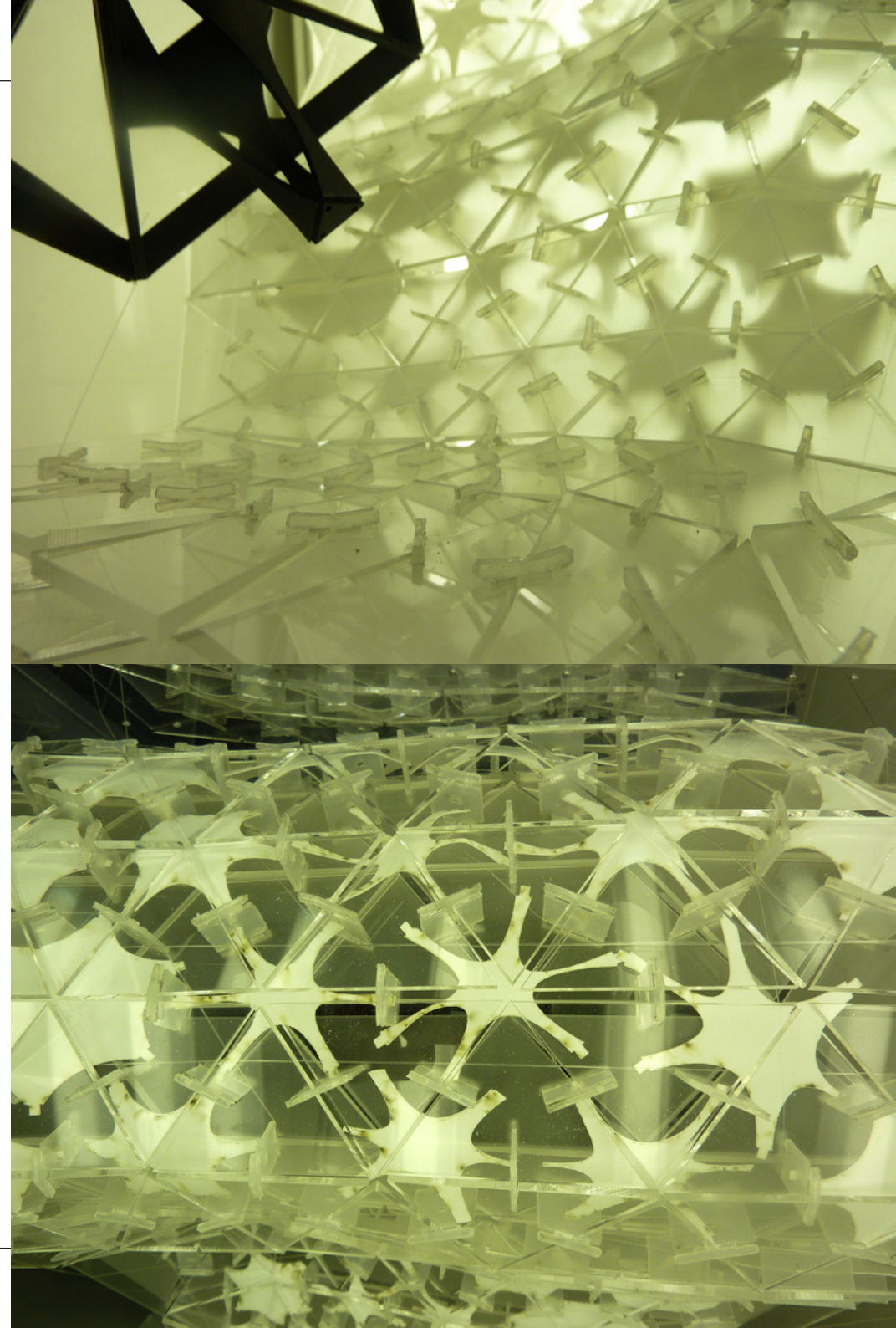
PRODUCT

SURFACE

The play of several layers creates a unique light experience. The achieved effect does not distract attention away from the icosahedron, but lends its aesthetics for a complete experience.

LIGHT MODULE

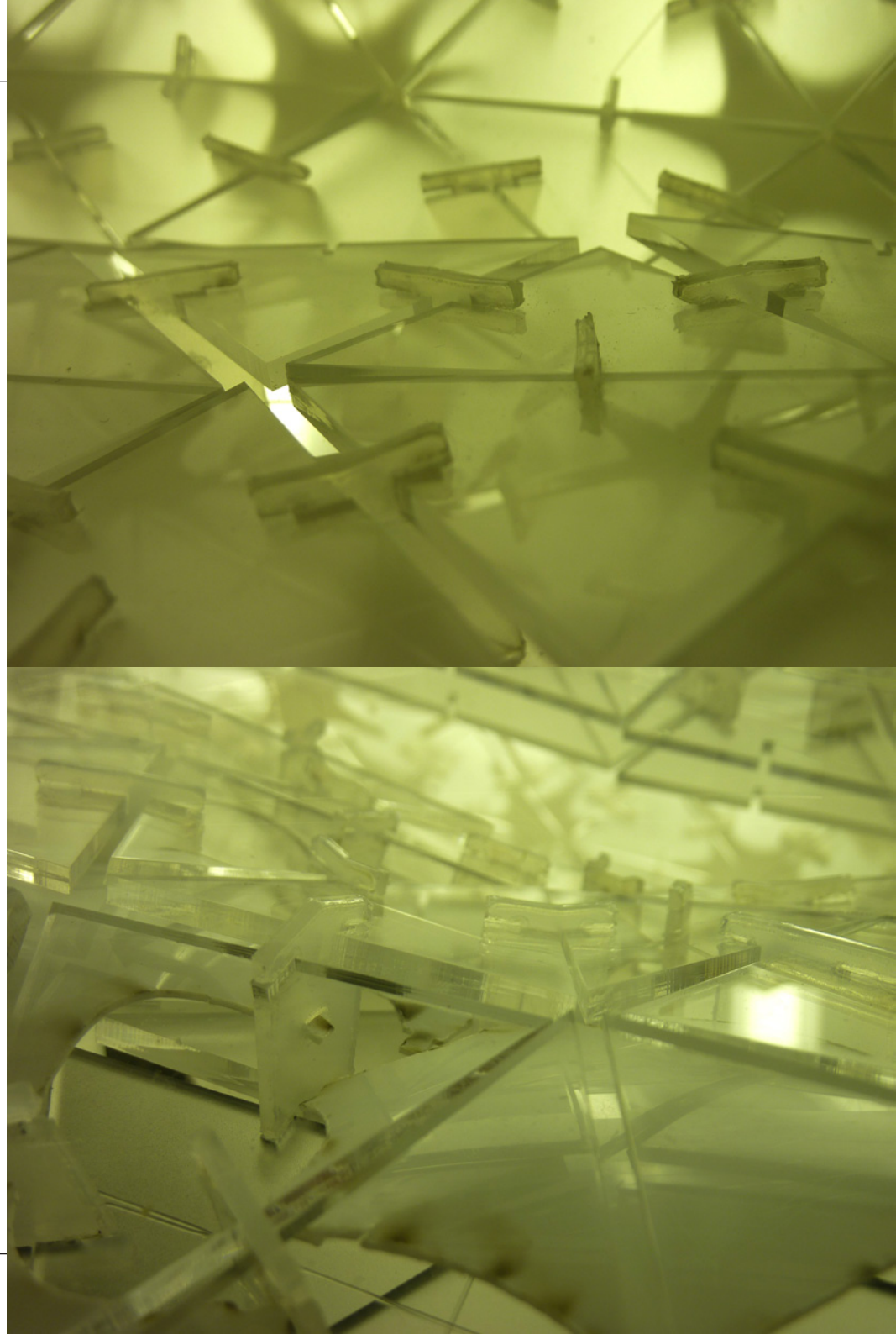
When the light module is viewed entirely, it reveals a different aesthetic dimension.



PRODUCT

MULTIPLE VISUAL LAYERS

The tabs used to support the structure of the surface did not act as a hindrance but gave a layer of visual experience. The system reveals a hexagonal grid overlaid behind a triangulate grid.



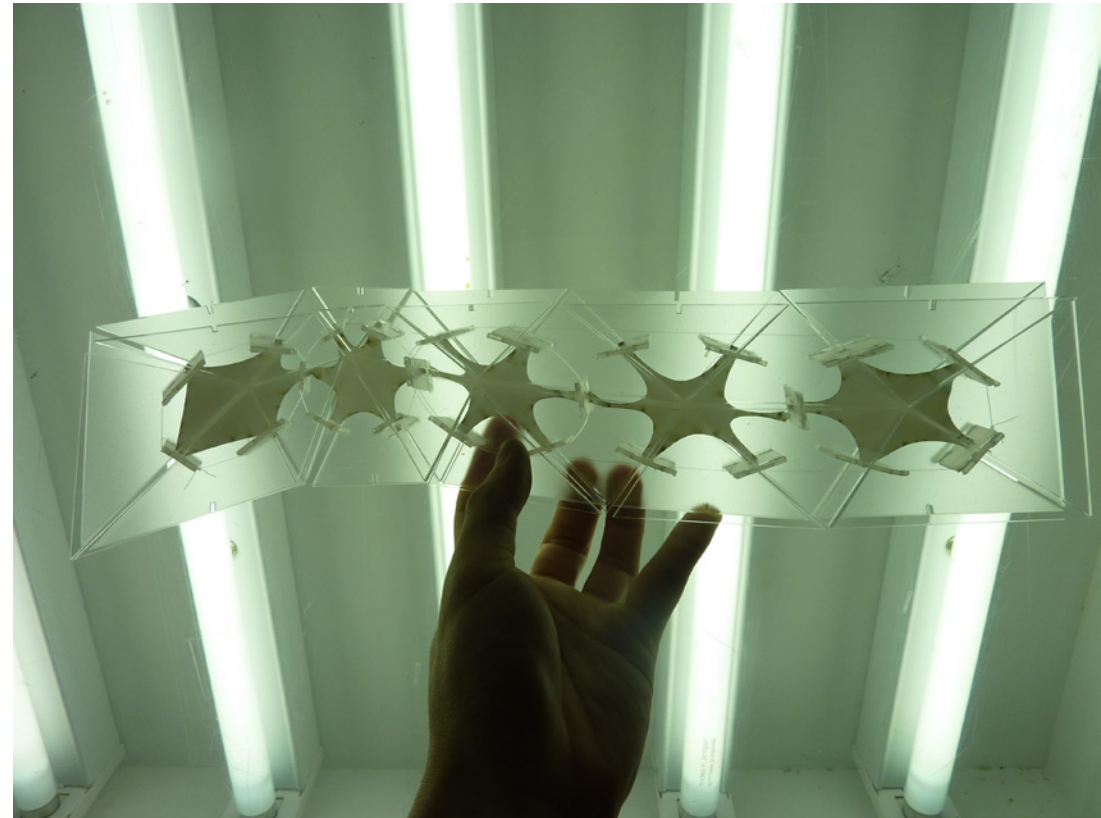
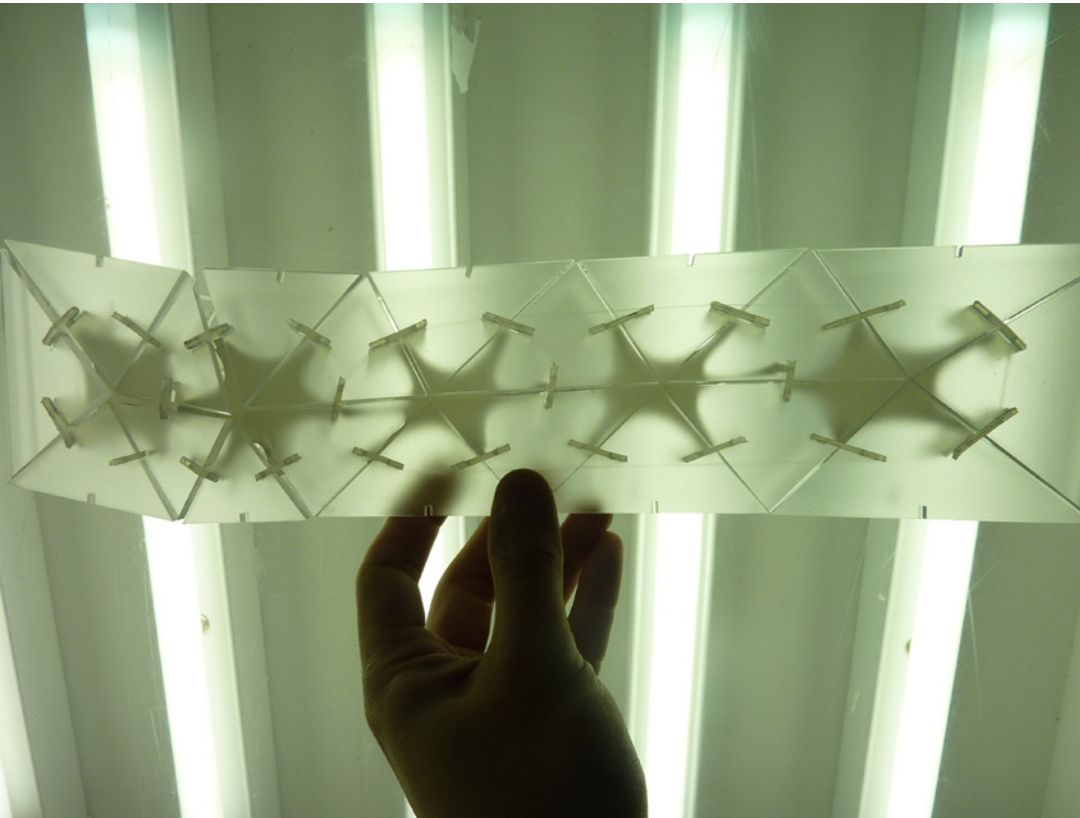
PRODUCT



SURFACE TRANSPARENCY

The change of transparency depending the angle of sight gave the gallery an additional aesthetic appeal.

PRODUCT

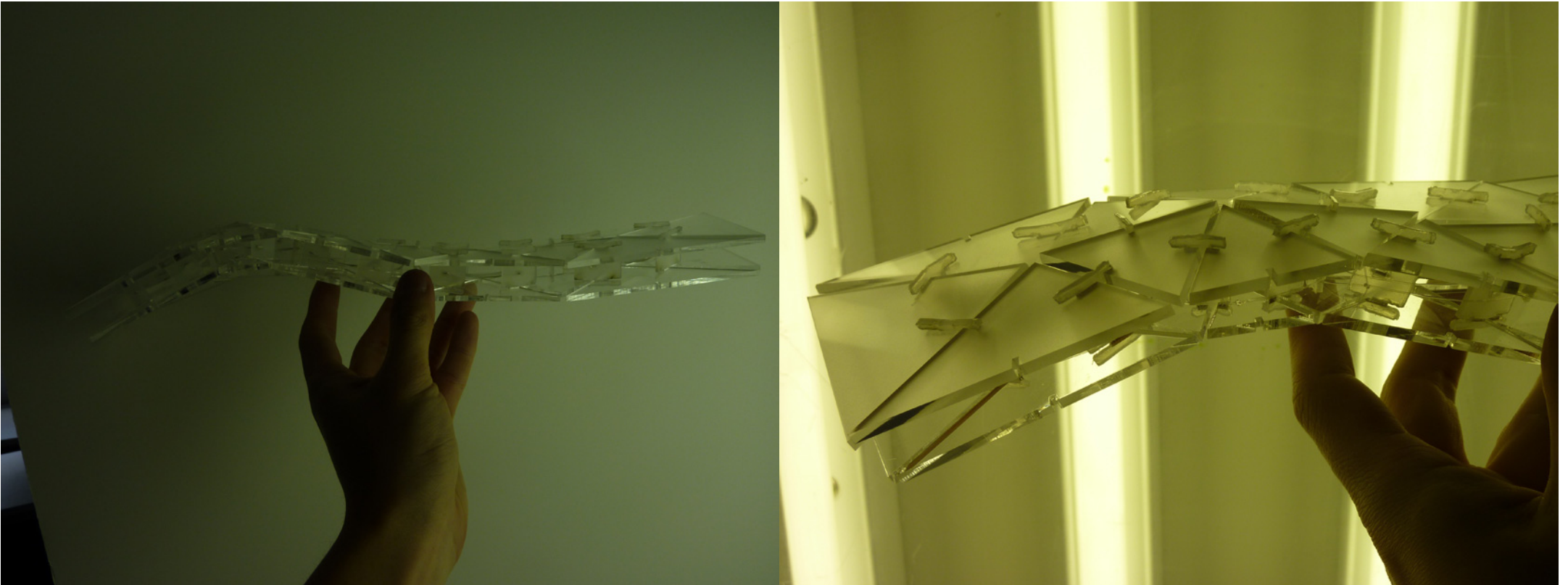


LIGHT MODULATOR

The aperture device gave unique aesthetics to the light modulator surface but failed to show a clearer contrast between opaque and translucent areas. Even though It did not compromise the overall composition of the gallery, it lacked accuracy of design intent.

Further refinement can be made to the geometry of the aperture and grasshopper script.

PRODUCT

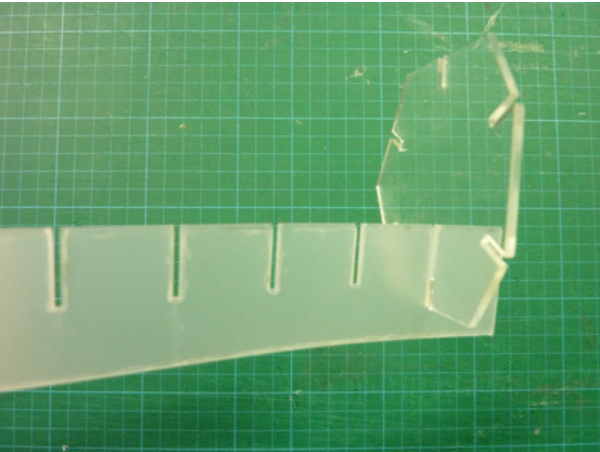


FABRICATION SYSTEM

The construction system allowed a double curved surface was able to support itself. However, there are limitations to how far it can span in relation to surface panel and tab size.

Deeper slots and wider tabs would increase structural span, but effect aesthetic qualities.

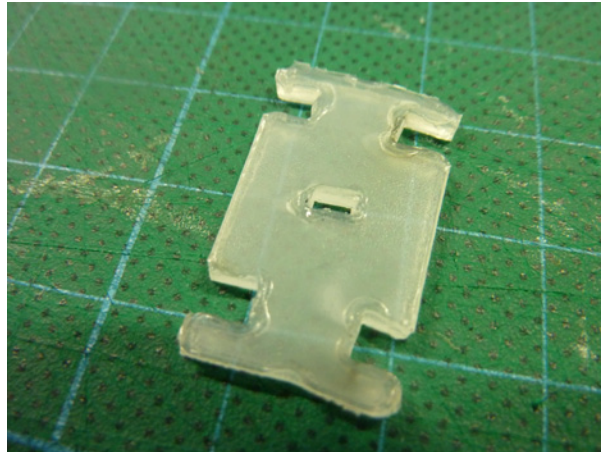
FABRICATION REVIEW



TEST RUNS - SLOTS

A series of test was conducted on the material to familiarize with its characteristics. The objective was to avoid the need of adhesives to construct the model.

Study:
2.0mm perspex would fit a 1.4mm polypropylene slot.

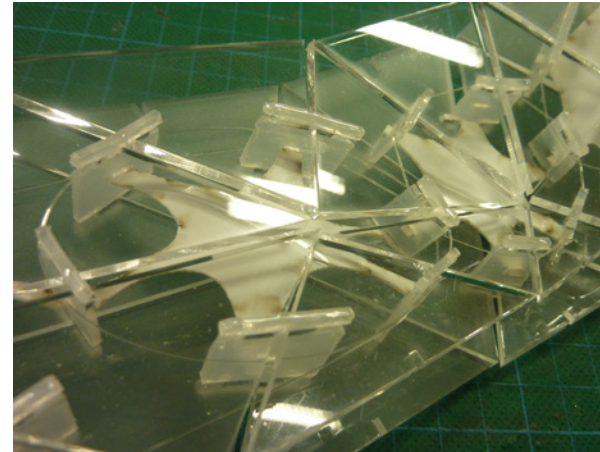


MATERIAL BEHAVIOUR - POLYPROPYLENE

The behaviour of the polypropylene as material proved difficult to predict.

The material melted more than what was observed in the test runs and made assembly difficult.

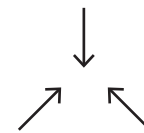
Due to the nature of polypropylene melting in low heat, it is a material that is tricky to work with the laser cutter.



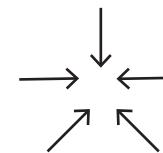
MATERIAL BEHAVIOUR - VIVAC

A better understanding on the bending behaviour of vivac was obtained along the way of assembly.

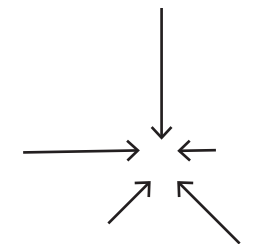
Analysis:



the bending of vivac works well when the bending force on all sides are equal

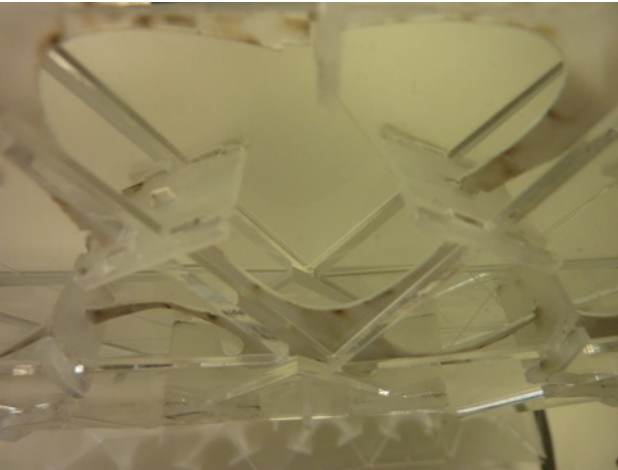


vivac starts to lose its integrity when more forces act upon it. It tends to fail structurally and tear.



the bending of was ineffective with uneven forces.

PRODUCT



TABS

A slot was allocated for neighbouring aperture tabs. The melting of polypropylene caused by the laser cutter decreased the size of the slot, allowing only one tab to fit at a time.

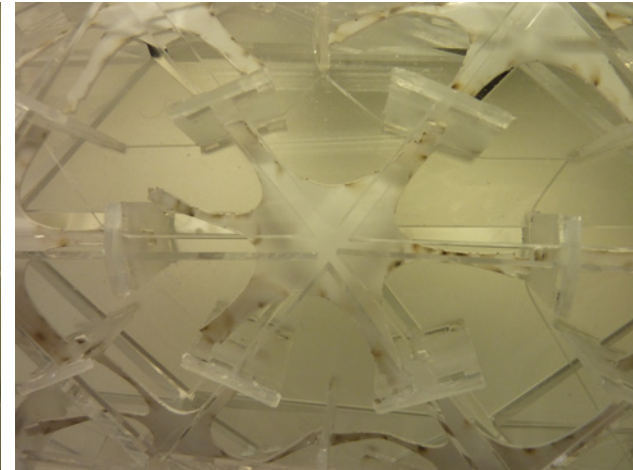
This resulted in several apertures detaching itself due to insufficient support from tabs.



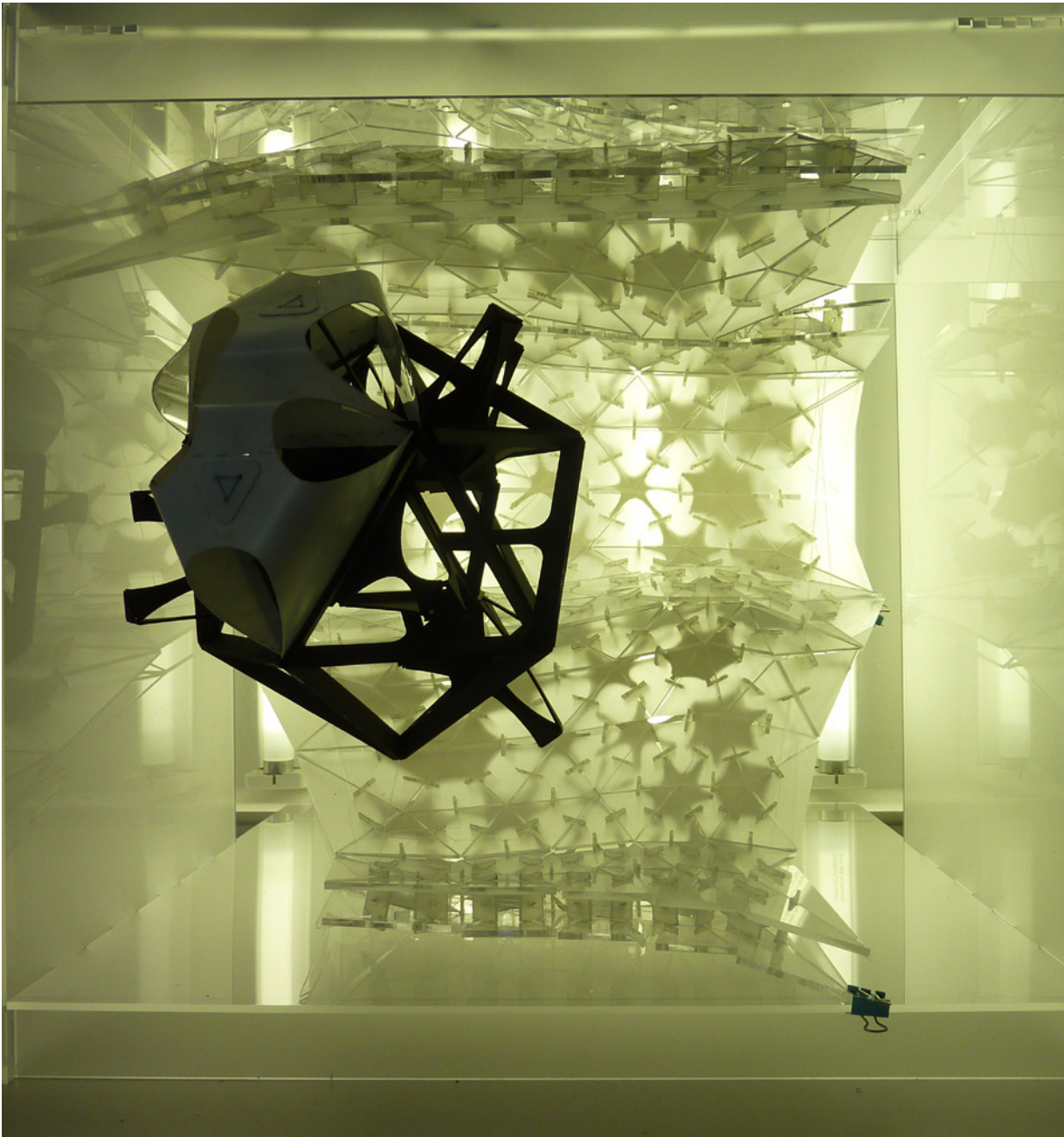
SURFACE PANELLING

The double surface structure works effectively at areas where the curvature of the surface was minimum and the resolution of surface triangulation was low.

At areas with intense curvature, the tabs were not able to hold the complex forces acting upon it and made it hard to achieve seamless panelling.



ANALYSIS



ANALYSIS

The design of the gallery with its light module effects were satisfactory.

The resolution of the end result was satisfactory except for certain areas of complications:

Deciding on a suitable structural system involved intensive investigation.

The contrast between opaque and translucent areas on the surface was less obvious as intended. This was due to limitations of the aperture geometry.

Assembly process was tedious and involved more hours than expected. This was due to the complexity of a double curved surface as well as the inaccuracy of tab and slot dimensions caused melting materials.

Overall surface did not support the overall form involved tensile support. The use of craft wire became crucial half-way during assembly.

A full understanding of the system was only achieved after completion of assembly. In order to produce an effective system, it is recommended that a series of prototypes to be fabricated before full assembly.

Greater access to the fabrication facilities would benefit the design process by quickly running tests on fabrication methods and materials. Current system of the fab lab provided restrictions to the digital fabrication design experience.

[END]

Kenny Foo
kh_foo@hotmail.com
www.kennyfoo.com