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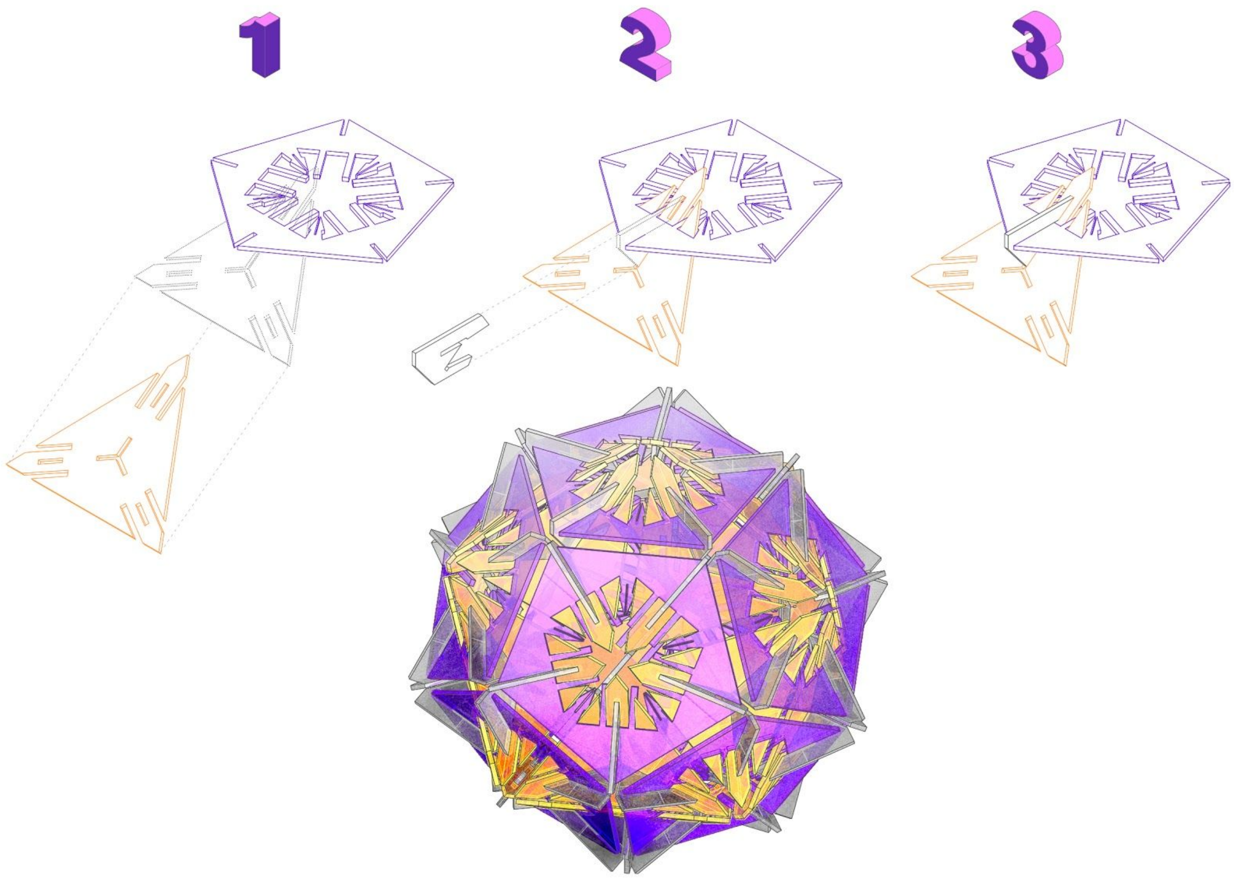
The Mathematical Garden

https://math.aalto.fi/en/research/analysis/dg/cfhm/exhibitions/2017/7/

The Mathematical Garden



DESIGN OVERVIEW

What is more sensual than a garden in full bloom? From our starting point knowing only the name of the exhibition in Heureka, Sensual Mathematics, we started grabbing for mathematical imagery to express sensuality with art. These figures were then brought together and narrowed down to a concept idea to express both a scientific abstraction as well as express beauty and awe. Further work produced sketches of an installation with three dimensional solids to form a mathematical garden. Holding true to our idea we present to you the Mathematical Garden.

MATHEMATICAL SPECIFICATIONS

We started our journey to the Mathematical Garden with the five Platonic solids, named after the ancient Greek philosopher Plato who described them in one of his dialogues, *Timaeus* (53a-55d) ca. 360 B.C. Plato thought that these five regular and convex polyhedrons, namely *tetrahedron,* *cube, octahedron, dodecahedron* and *icosahedron* were the most beautiful solids on the Earth and, in fact, correspond the four basic elements and the whole cosmos.

From these five solids we chose two different solids to play with: dodecahedron, consisting of 12 pentagonal faces, and icosahedron which consists of 20 triangular faces. At first glance these two solids appear quite different from each other. However, they are related in many ways, especially because they are *duals* of each other. That is, for each pentagonal face of a dodecahedron, there is a vertex of an icosahedron where five triangular faces meet. Of course, this goes also vice versa: for every vertex of a dodecahedron where three pentagonal faces meet, there is corresponding face of the icosahedron. In other words, one can pair all the faces of one solid with the vertices of the other solid.

If you look closely at the ball-like solids in the garden you can see that there is a dodecahedron and a tetrahedron overlapping so that in the each face of one solid there is exactly one vertex of the other solid overlapping.

Finally one can count all the vertices and faces and end up with these numbers:

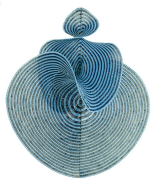
Dodecahedron:	12 faces - 20 vertices - 3 meeting edges per vertex - 5 edges per face
Icosahedron:	20 faces - 12 vertices - 5 meeting edges per vertex - 3 edges per face

Now you can easily see how these two solids are related to each other! Similar relations apply among the other Platonic solids: cube and octahedron are duals of each other and, tetrahedron is a dual of itself.

In the Mathematical Garden one can find some icosahedrons and dodecahedrons and then see how their triangular and pentagonal building blocks abandon the original Platonic shape and start to grow in variety of directions and forms.

MILESTONES 2017

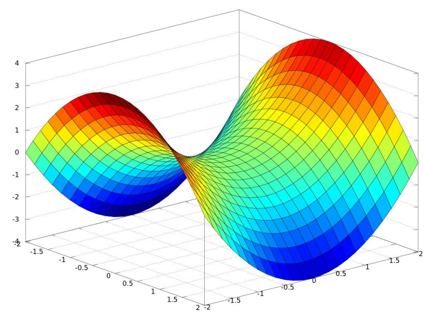
1st Stage of Planning (January - February)


Starting with only images we narrowed down our idea to a more solid idea of a garden from 3 preliminary images.

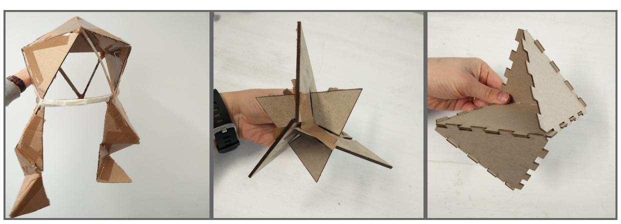
Idea: nature, growing, colors

2nd Stage of Planning (February - March)



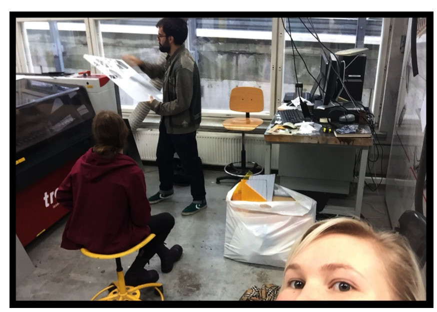
Next we wanted to focus our understanding on how exactly to define our mathematical idea. Here key concepts are hyperbolical shapes, symmetrical patterns, repetition, parametric growth that simulate random and chaotic growth.

Final Stage of Planning (March - April)



Prototyping and more modeling of our pieces that would start to grow into a garden.

Implementation (April 10th - 27th)



Managing and scheduling laser cutter times was a challenge. Also setback where there plenty with the laser cutter malfunctioning and having throwing out perfectly good material do to cutting errors. But we got through it.

Hanging the Artwork (April 28th - May 5th)

Thousands of shapes had to be both hang and their protective film peeled from both sides of the laser cut pieces. This involved a complete week of working on site and hanging from fishing cord individually.

Finished Product (May 8th - August)

The shining of crystal pieces will hopefully inspire kids of all ages to comprehend the organic growth that’s so common in nature and its mathematical structured existence.

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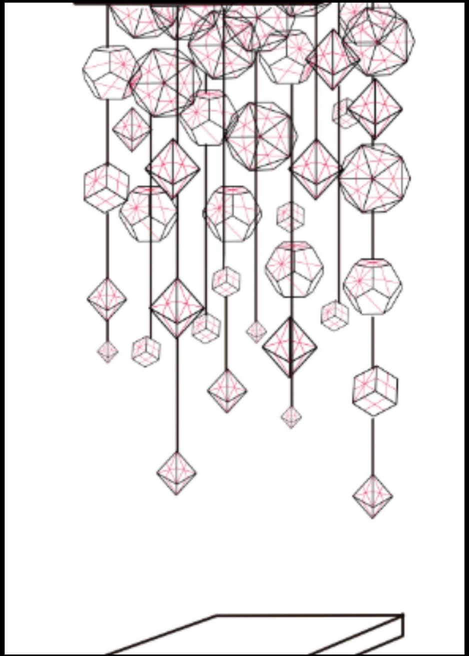
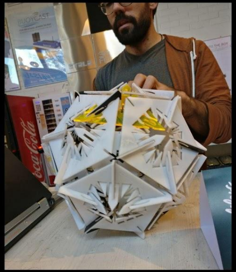
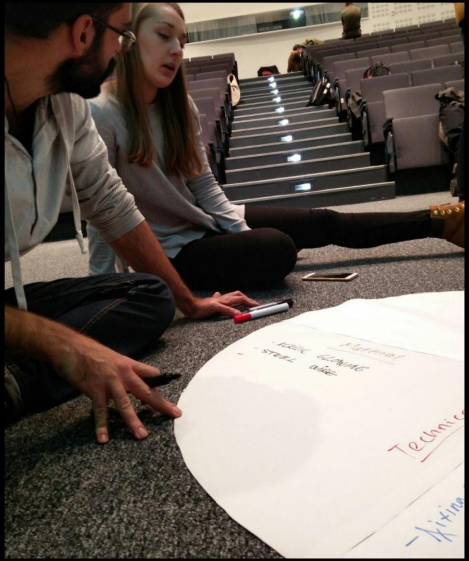
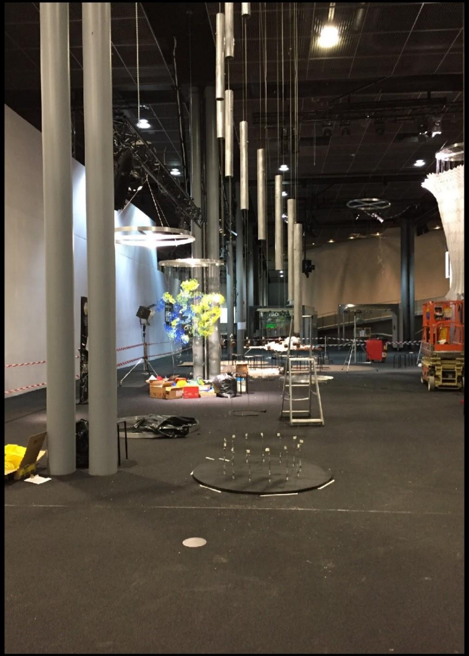
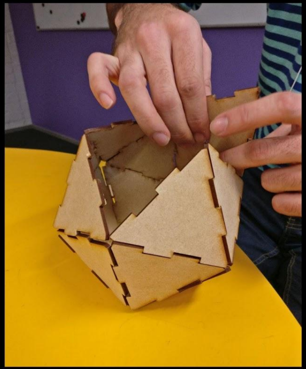
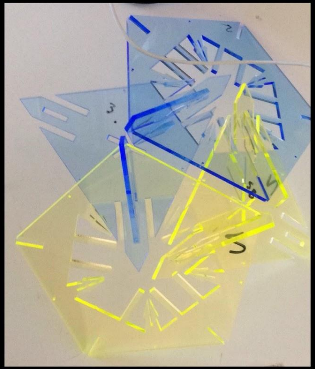
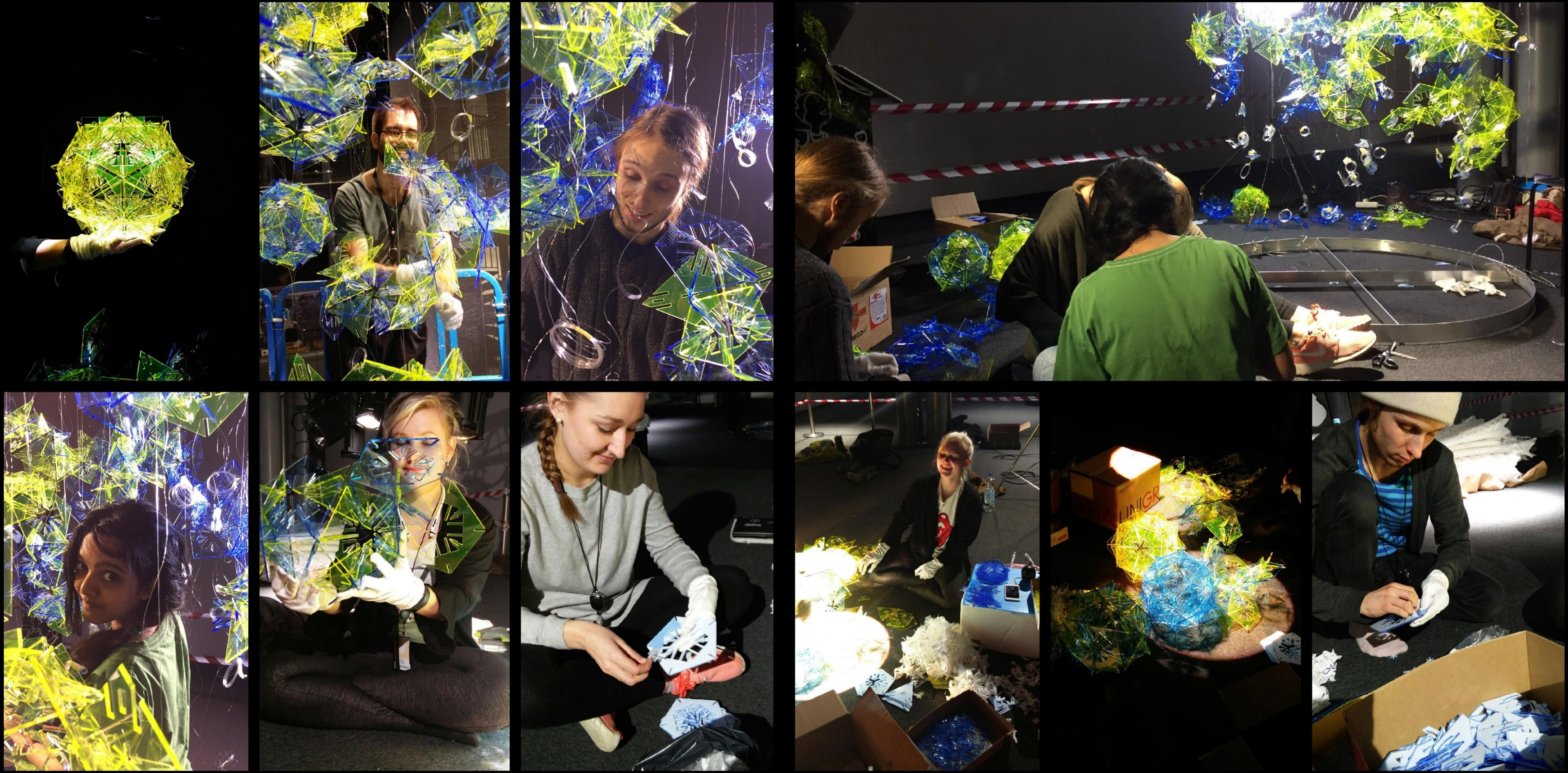



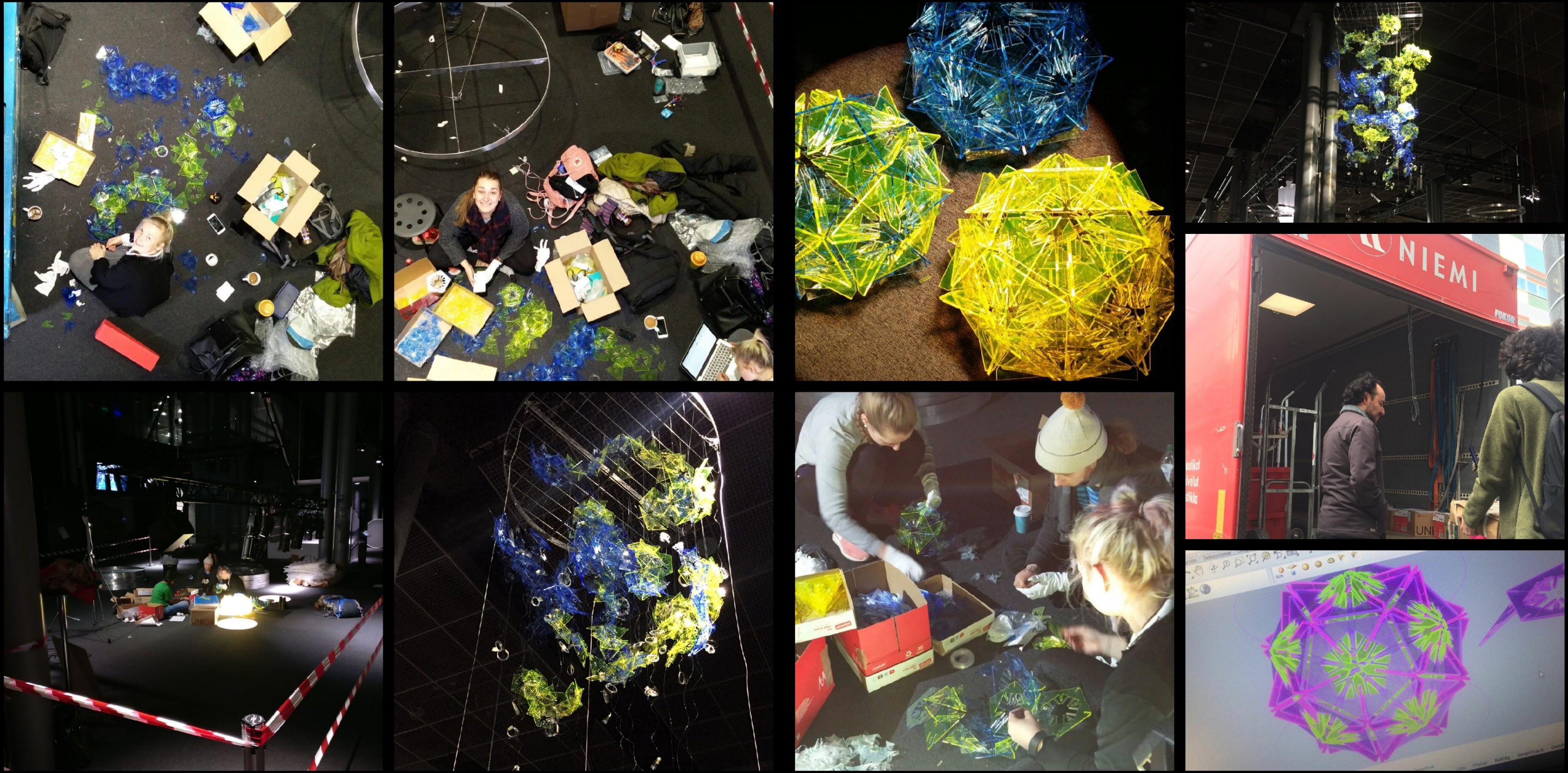









NIEMI

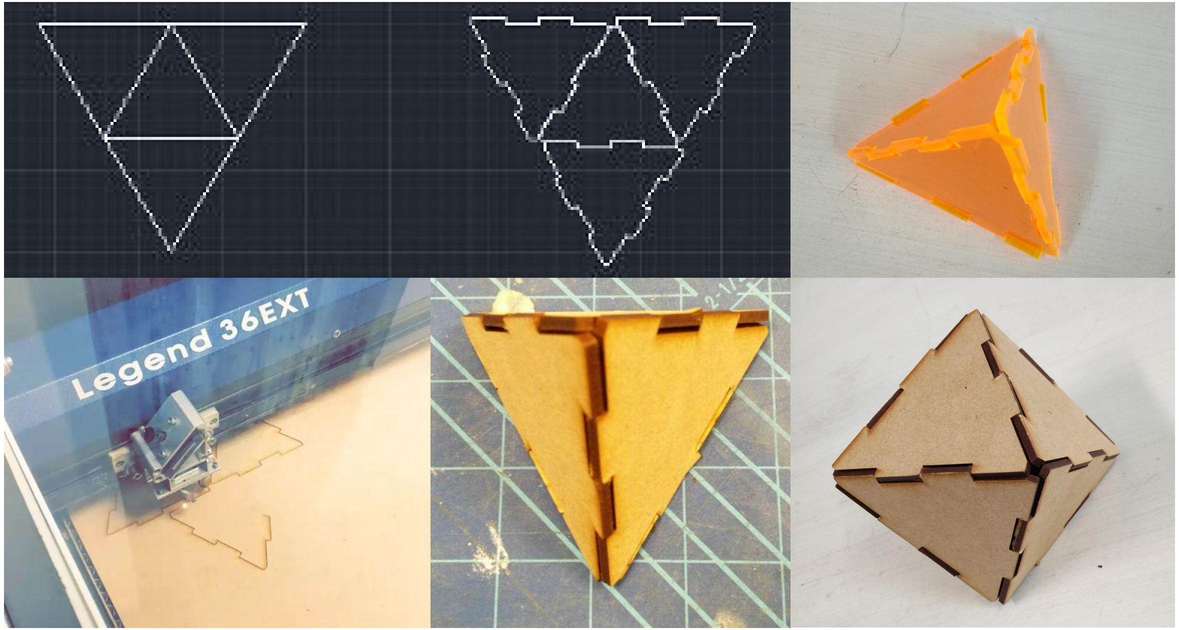
Mathematical Garden

Pedro Pablo Garcia Alcazar (ARTS), Julia Isotalo (SCI),
Laura Meskanen-Kundu (ARTS), Parvati Pillai (ARTS), Ville Romanov (SCI)

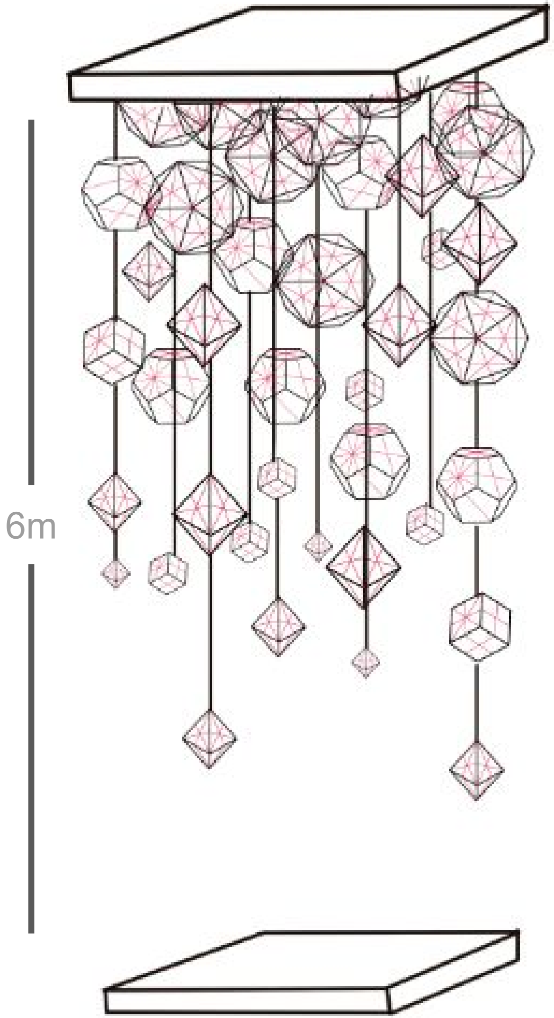
Statement

- What is more sensual than a garden in full bloom?
- We wanted something that looks like a garden but has a mathematical twist to it
- Creating an installation with three dimensional solids to form a mathematical garden

Prototyping

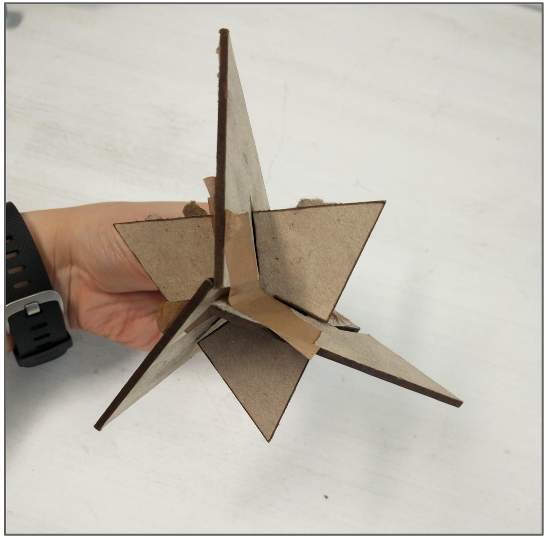


Initial concept was to create the mathematical garden with platonic solids



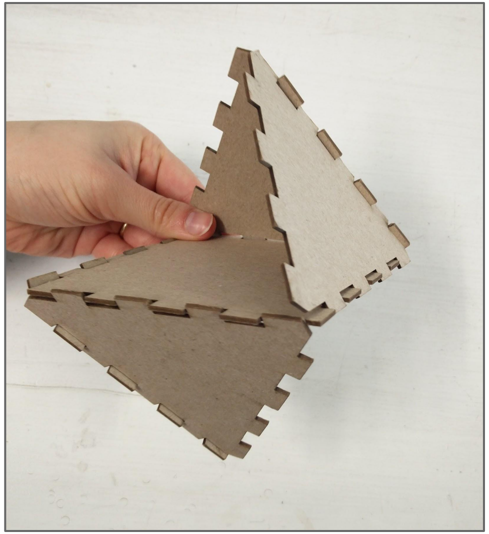
Prototyping

Creating new iterations based on platonic shapes



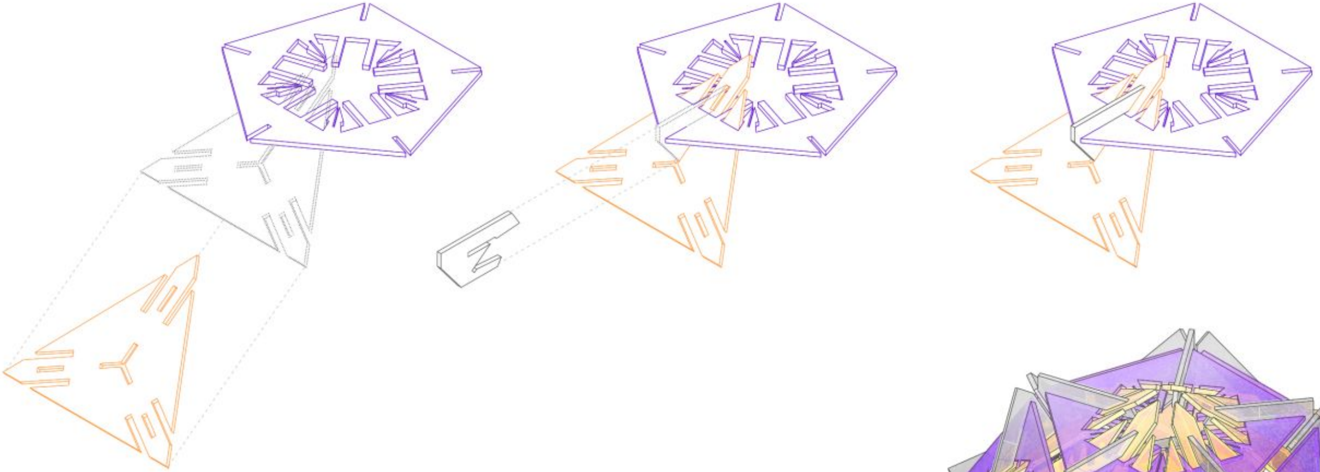
Exploring the form by deleting the faces

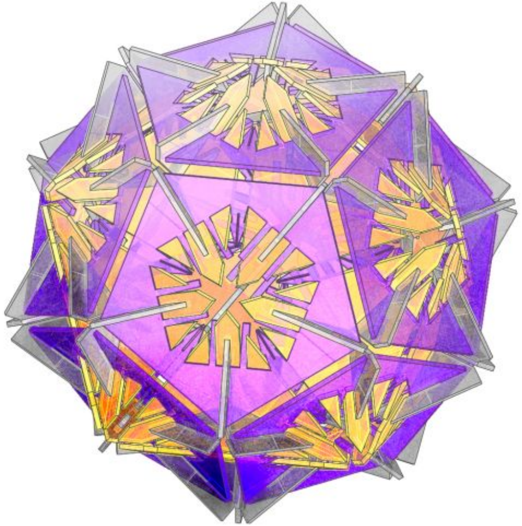
Unwrapping the platonic solid



Creating the 3dimensional solid by adding different shapes for each face

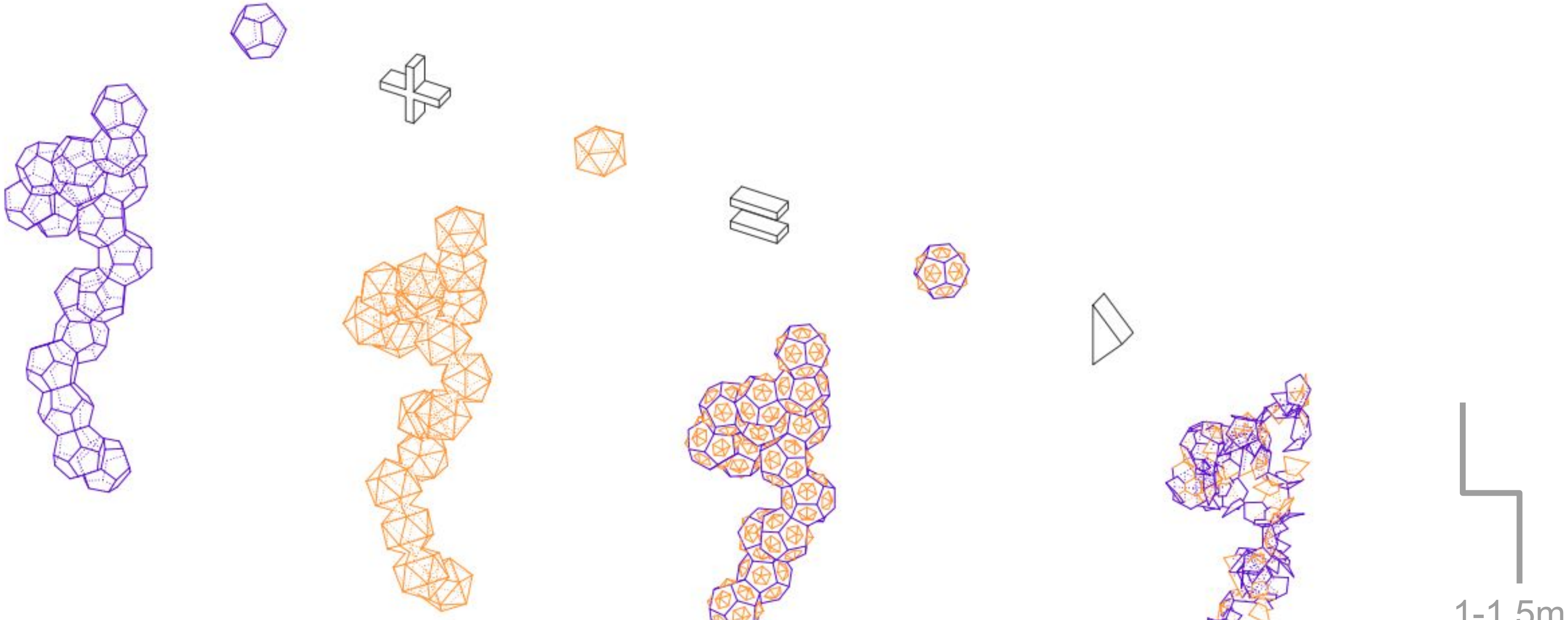
Technical Drawing

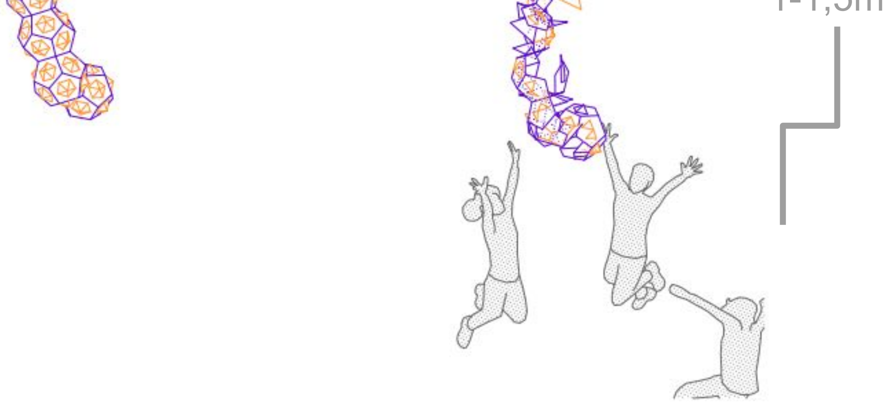




Final form based on the intersection of two faces.

Understanding and exploring relationship between icosahedron and dodecahedron





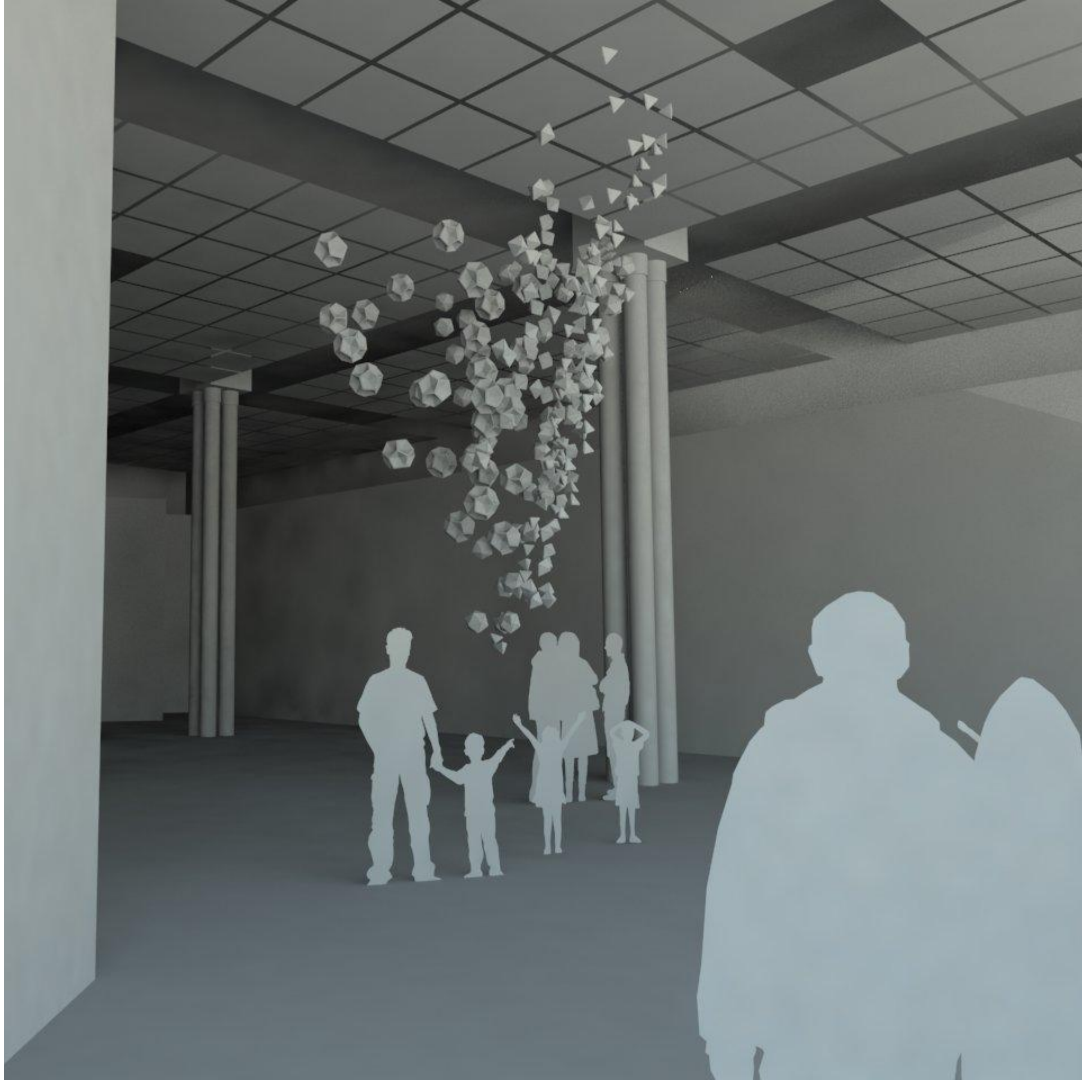
Technical Drawing

Permutation and combination for the each unit to be hung.

Each unit is 1 to 1.5 meter in height and there will be multiple forms hanging to form the final installation.

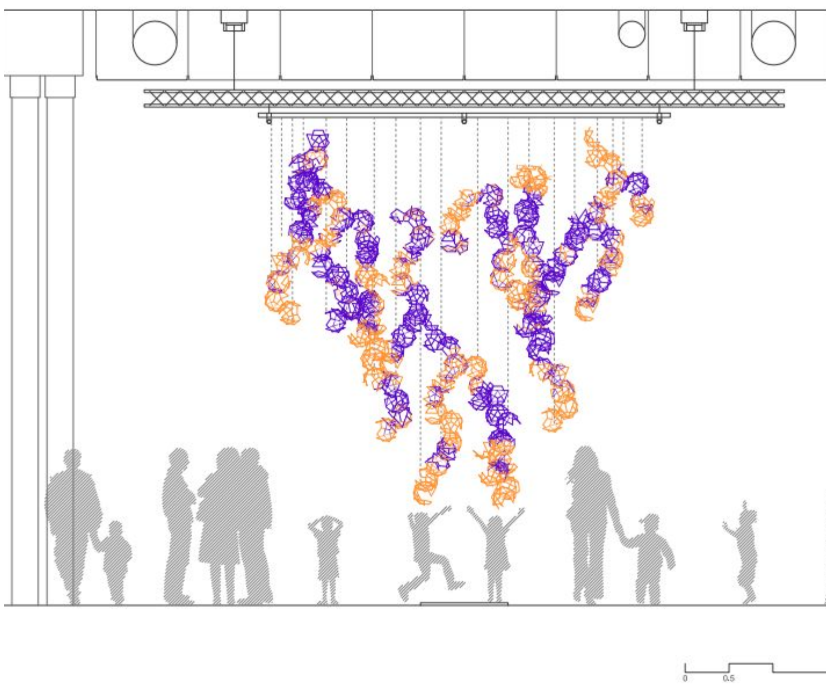
Visualizations with human scale

The installation is designed keeping in mind the audience at Hureka which is majorly kids, so it will be hung 2 meters above the floor so that it is out of reach.

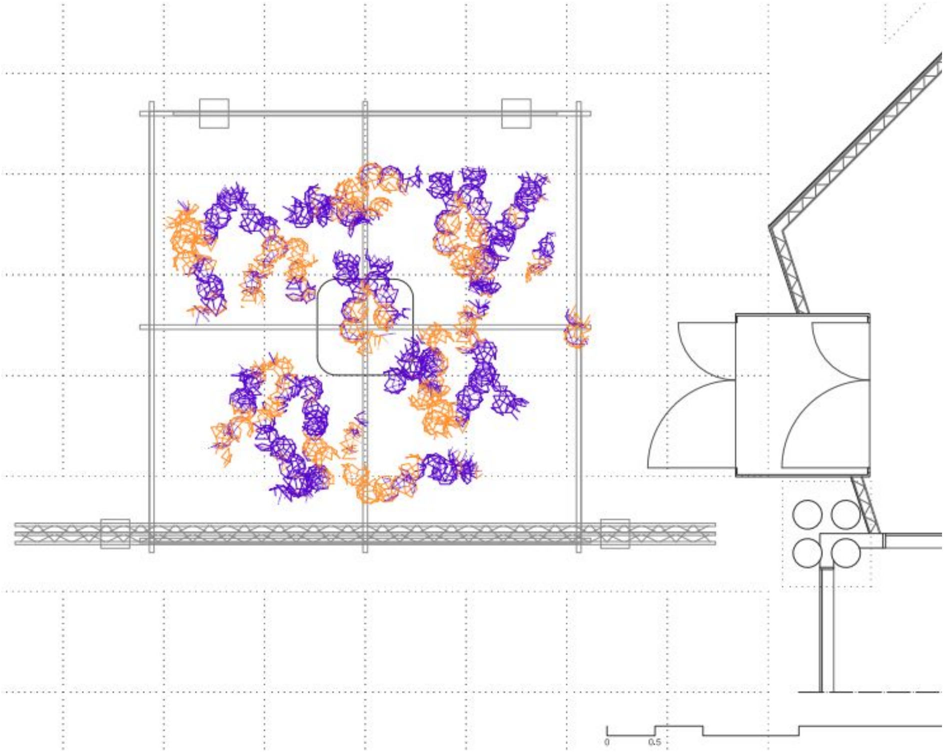


Technical Drawings

Elevation



Floor Plan

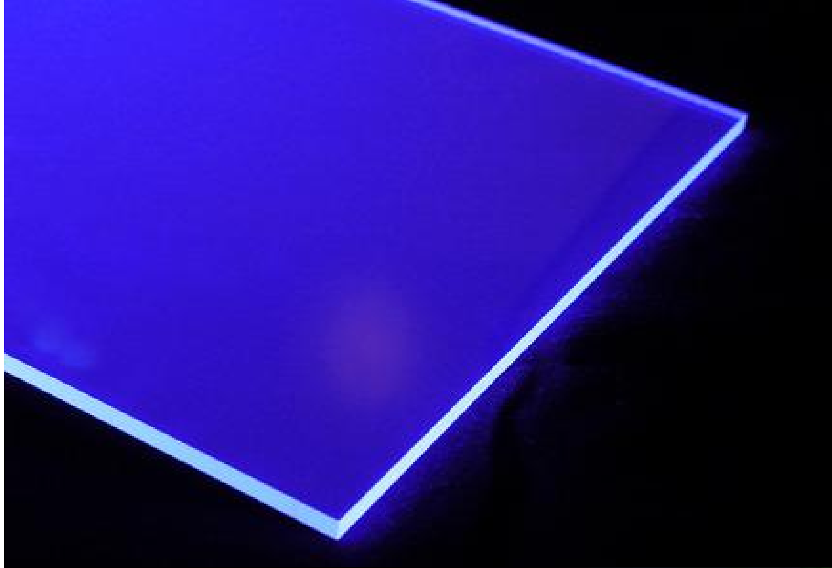


Materiality and technical implementation

- Acrylic (crystals)
  - Main color blue, smaller areas in yellow
  - Laser cutting from our files
  - Acrylic glue (only if needed)

- Wire (hanging)

- Individual led lights (if needed)



Thank you