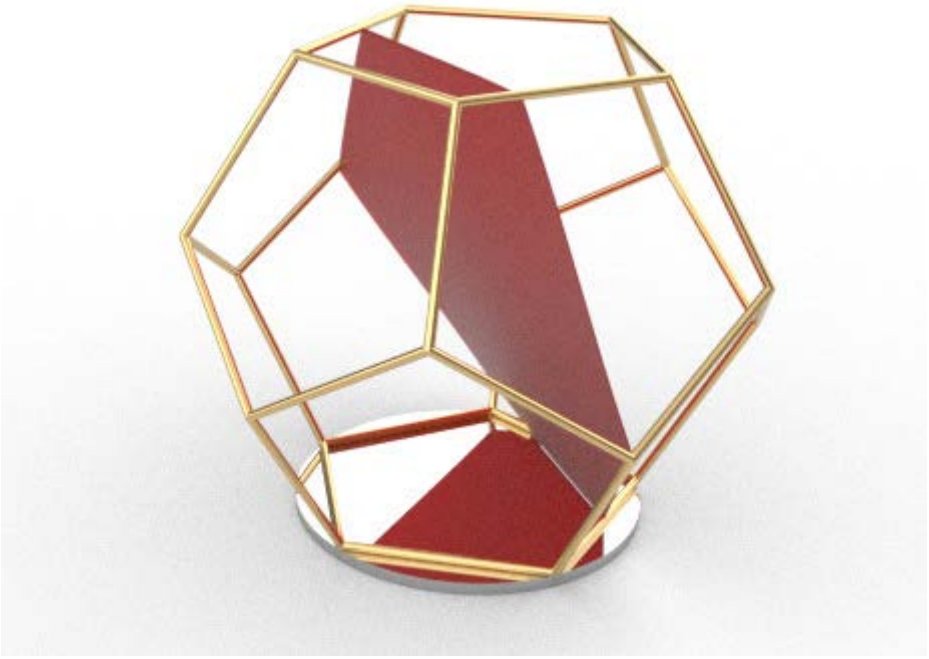


The Unexpected Journey

Lumi Alastalo, ARTS
Tom Henriksson, ARTS
Otso Hyvärinen, SCI
Riitta Matikainen, MA
Viljami Virolainen, SCI

Aalto University

Statement

Platonic solids are often considered thoroughly explored with little new to discover. In our artwork, *The Unexpected Journey*, we introduce a recent discovery concerning a family of straight paths around the dodecahedron by Jayadev S. Athreya, David Aulicino, and W. Patrick Hooper. What is fascinating about mathematics, however, is that solutions bring forth new questions. With our work, we explore what kind of a surface is created by one of the solutions.

Design Overview

At the start of the course, we explored both mathematical and artistic references that inspired us. Some of the overarching themes of interest were novel mathematical discoveries, sensitivity, dimensions, projections, movement, metamorphosis, nature.

In the selection process, we ended up with three candidate concepts: 1) “The Anti-Social Jogger”, based on a new mathematical proof about paths on dodecahedron, 2) “The Metamorphosis”, utilizing the catenoid in visualizing transformation, artistically inspired by the life cycle of butterflies, and 3) “The Grail”, which would use stereographic projection to project shadows onto a flat surface from a light source above.

Having made a decision on the concept (“The Anti-Social Jogger” which eventually resulted in “The Unexpected Journey”), we considered different implementation options and materialities: for example, creating the illusion of a dodecahedral shape by presenting a number of different path solutions or engraving the paths on a solid dodecahedron.

One of the strongest options was building two solid halves of the dodecahedron, cut by the simplest solution for the joggers’ path. During a tutoring session, we discovered an interesting question: what kind of a surface section would be created if the dodecahedron was cut this way?

Eventually, however, we decided to focus on the surface, scrapping the two halves and opting to show the surface shape within a skeletal dodecahedron frame. We cut the parts for the frame from steel with a water jet cutter, using bolts and screws to connect them, and created the surface by weaving copper wire.

Mathematical Idea

The Platonic solids were discovered over two thousand years ago, and they are among the most studied geometric shapes of all time. There are five Platonic solids: *the tetrahedron, the cube, the octahedron, the icosahedron and the dodecahedron.*

Is it possible to go around a Platonic solid along a straight path, starting from a vertex, avoiding a collision with another vertex and finishing precisely in the vertex where you started? With other Platonic solids, the answer is no, because the nets of the solids tessellate a 2D surface. However, the dodecahedron does not; this is why the problem of the “anti-social jogger” had long remained an open question for the dodecahedron.

In 2019 this problem was answered, when Jayadev S. Athreya, David Aulicino and W. Patrick Hooper published a paper: *Platonic solids and high genus covers of lattice surfaces,* where the problem was first solved for the “trivial cases” and finally, for the dodecahedron.

The authors of the paper found out that there are 31 different classes of solutions to the problem on a dodecahedron, but the first, the simplest one was the most interesting for us to explore. In hindsight, the simplest seems a very obvious solution, since it never crosses its own path, only passing through 7 pentagons.

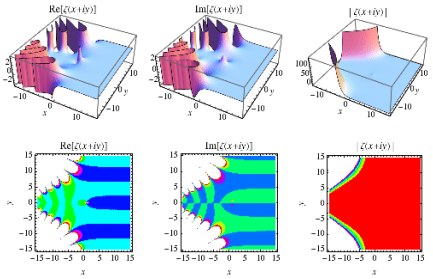
We took so much fancy to that path that we started studying how the path divides the dodecahedron and what kind of surface the path defines. The surface created this way happens to be the solution to Laplacian with boundaries on the paths. Furthermore, the maximums and minimums on the paths will always be found on the edges of the dodecahedron.

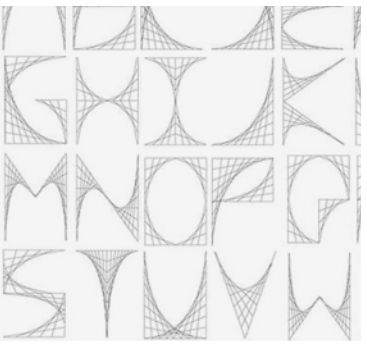
Our plan with the art piece was to show that even old known pieces and concepts of our world are full of unknown mysteries and adventure.

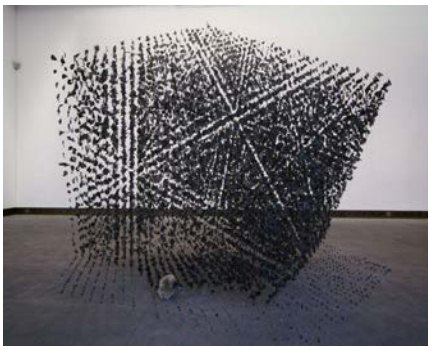
Milestones during the course

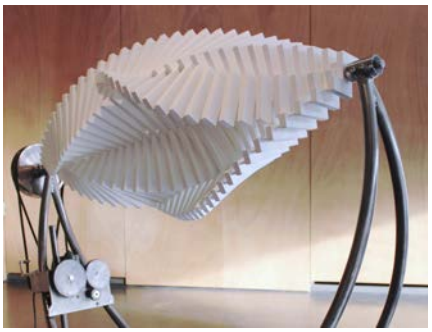
Stage 01 / January – February: References

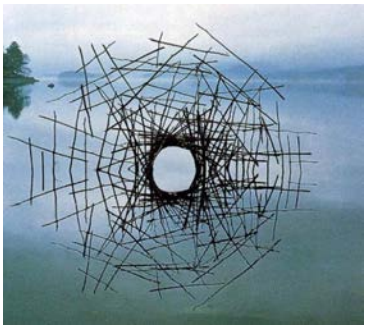
Ideas and references



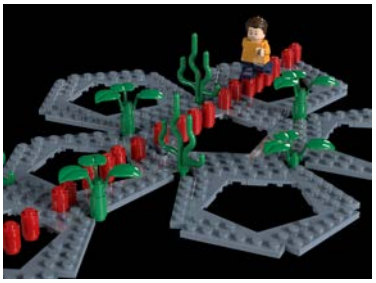
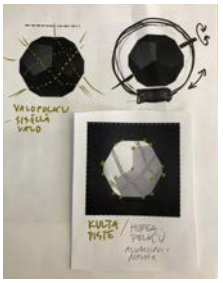




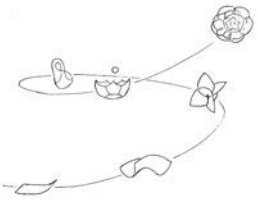




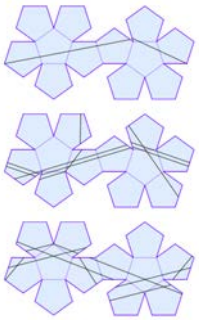
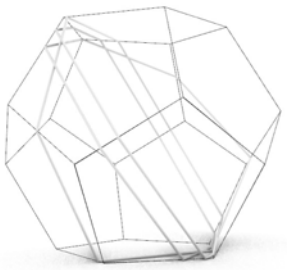
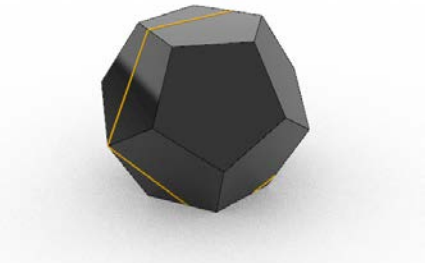
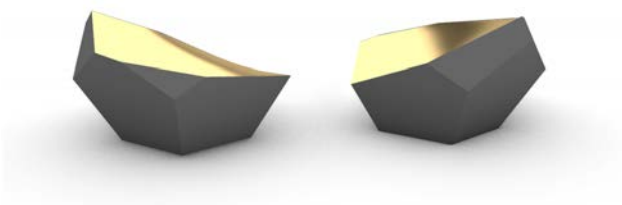
Stage 02 / February – March
Preliminary concept





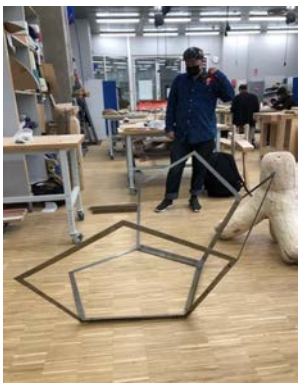
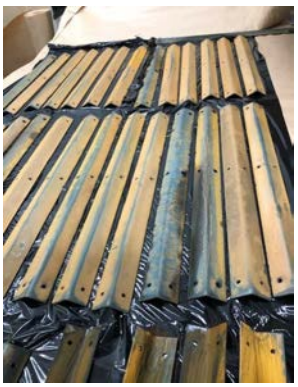
Stage 03 / March - April
Planning (materials, budget, timetable) and prototyping



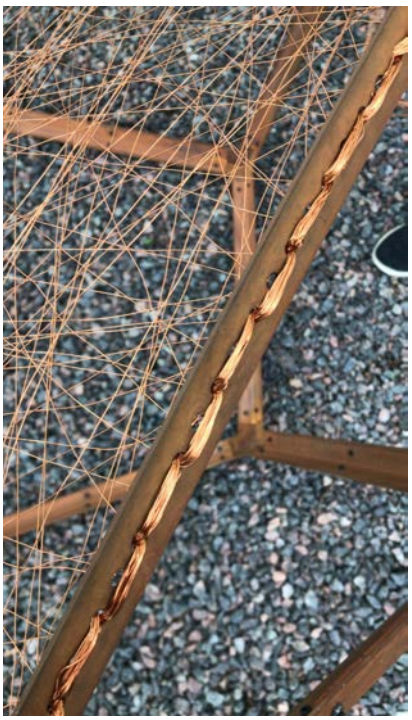


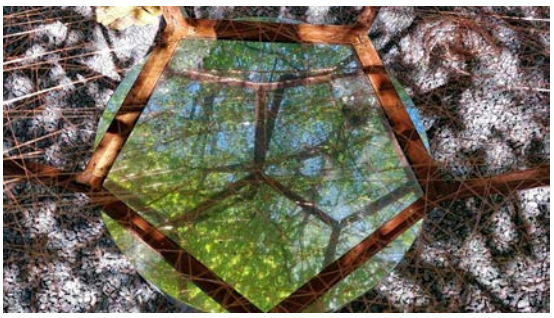
Stage 04 / April – May
Implementation, building the artwork

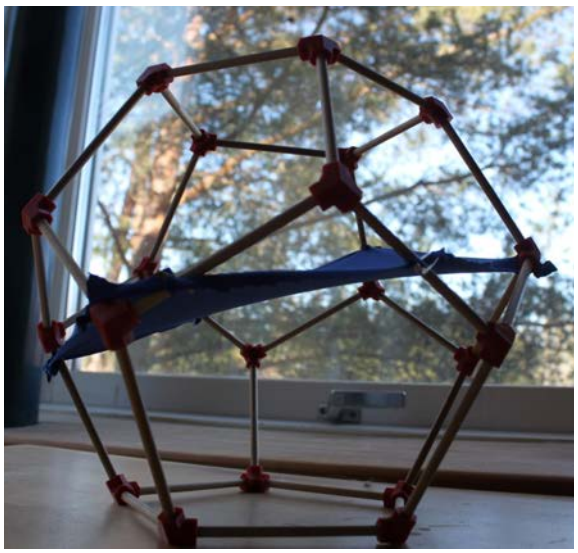


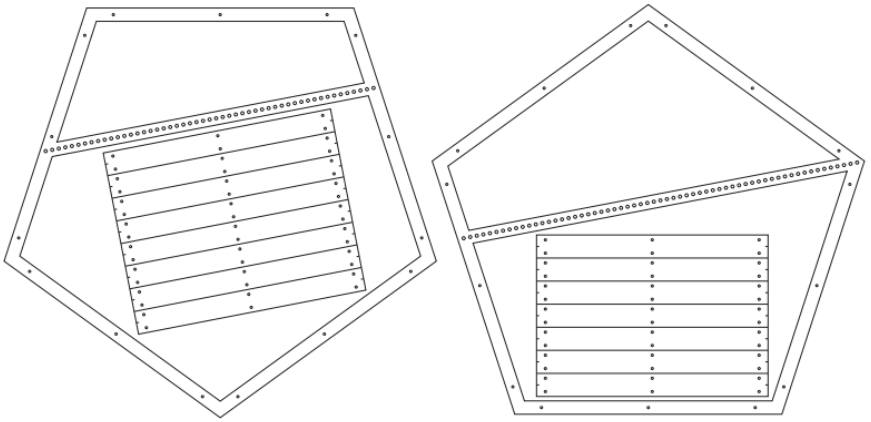

Stage 05 / May -
Finished artwork

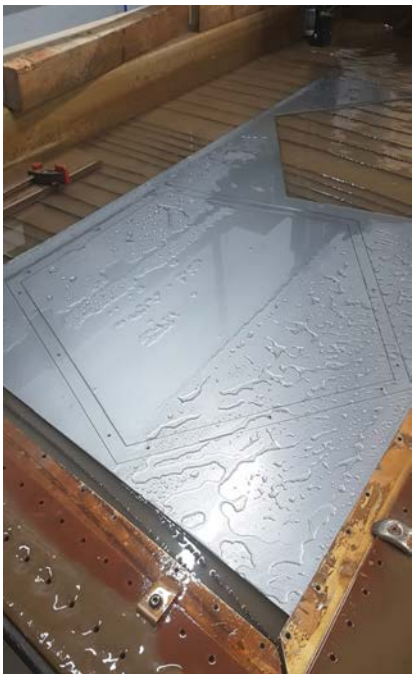




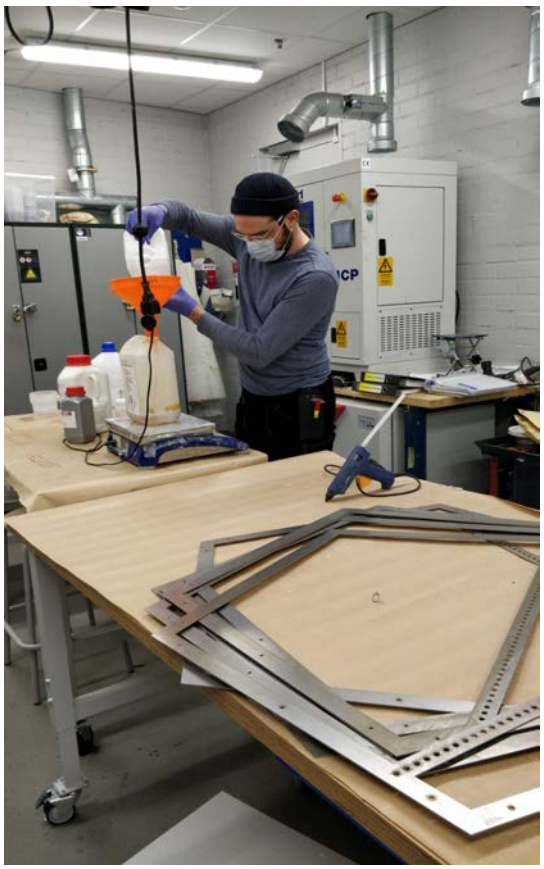
Design Development and Outcomes

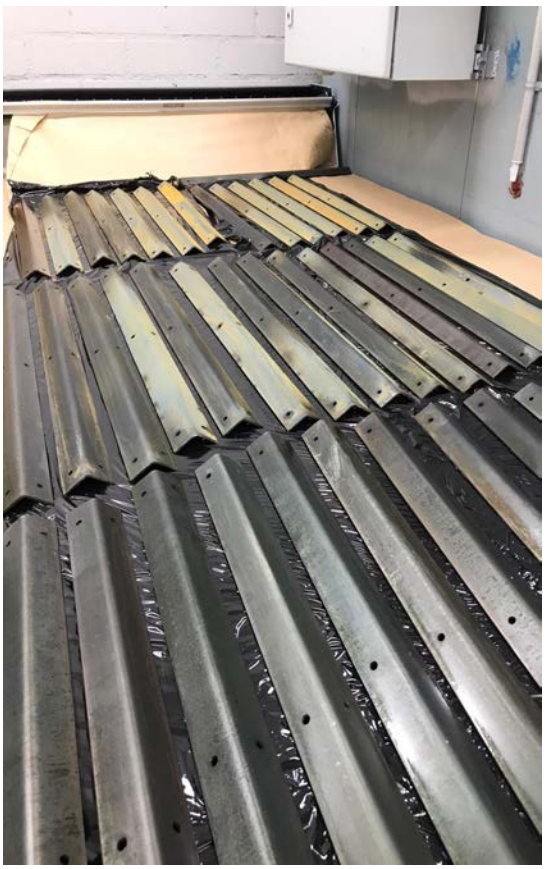










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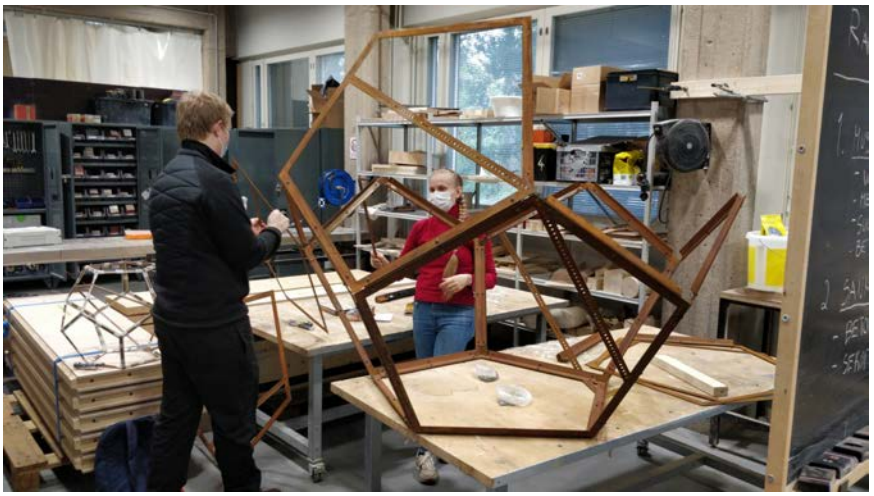


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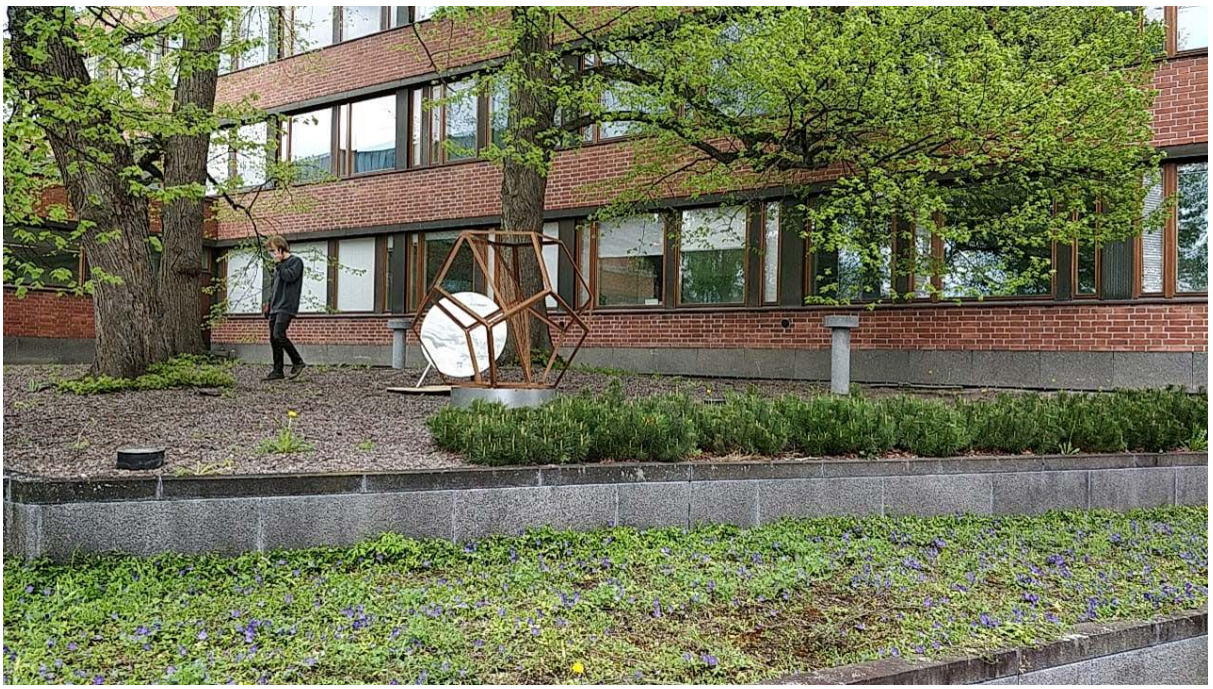

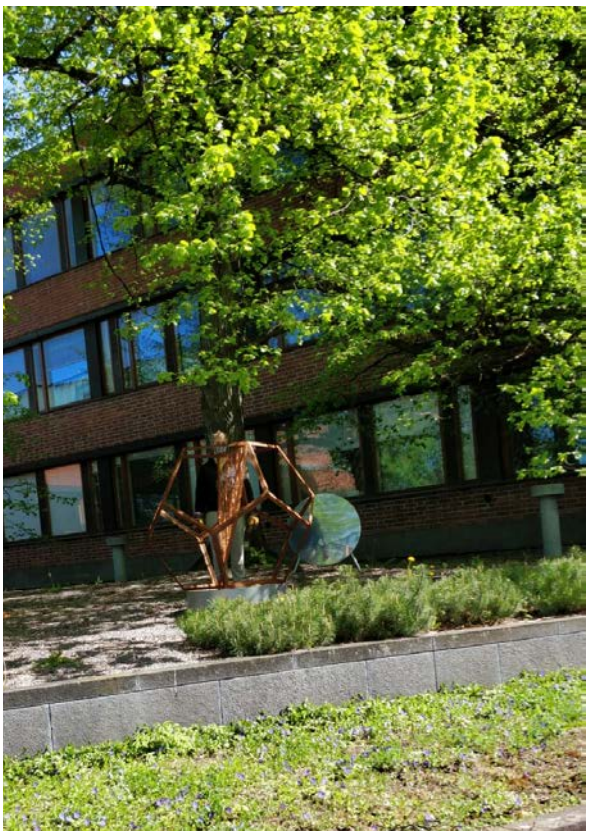

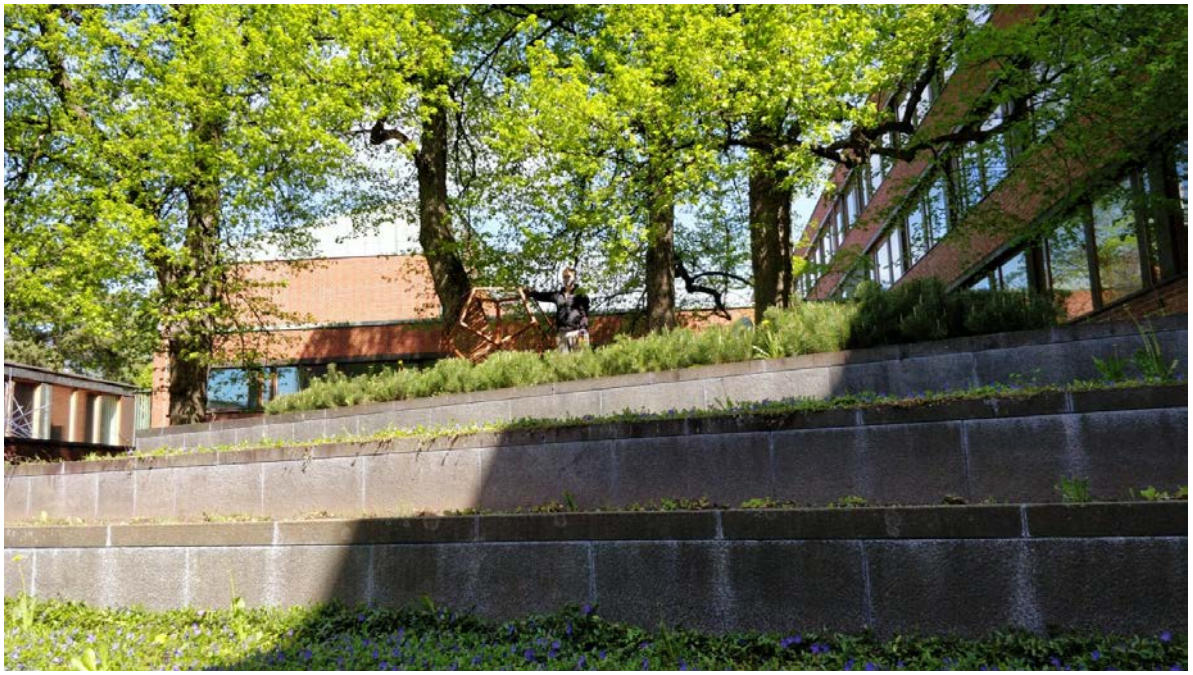

Team Info

Tom Henriksson, Architecture student at Aalto University, Master of Social Sciences (World Politics, University of Helsinki)

Otso Hyvärinen, Physics student at Aalto University

Riitta Matikainen, Teacher of Arts and Crafts (Wetterhoff), Master of Arts (UIAH)

Lumi Alastalo, Architecture student at Aalto University, Violin teacher (Conservatory of Middle Finland), Kindergarten teacher (University of Helsinki)

Viljami Virolainen, Information networks student at Aalto University

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Tutoring

…on creating the artwork: Markus Holste, Taneli Luotoniemi, Marco Rodriguez, Luiza Sevele
…on the mathematical proof: Jayadev S. Athreya
...on thinking about curved surfaces: Günther Filz
…on weaving the net: Laura Isoniemi

The Workshop Staff

…Ville Arkonkoski
…Topi Falckenberg
…Janne Hirvonen
…Hannu Paajanen
…Jari Simanainen

3D Printing Services

…Mika Väyrynen

Responsible Teacher

….Kirsi Peltonen