

# A?

Aalto University

# CF Get Together

*Kirsi Peltonen, Aalto SCI Mathematics  
Jan 12<sup>th</sup> 2021*

MS-E1000  
CRYSTAL FLOWERS  
IN HALLS OF MIRRORS:  
MATHEMATICS  
MEETS ART AND  
ARCHITECTURE



Spring 2021, 15cr

Course implementation in hybrid mode.

Call open 14th Dec 2020–10th Jan 2021 in Oodi.

Students are expected to send also a motivation letter through MyCourses by 10th Jan 2021.

Further information in  
<https://mycourses.aalto.fi/course/view.php?id=29638>

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# Contents 12.1.2021

## 15:15 Intro to Crystal Flowers:

- Course schedule in a nutshell
- Teachers of the course
- Content of the course

## 16:00 Break

## 16:15 An overview to earlier Crystal Flowers exhibitions

## 17:00 Break

## 17:15 Group work in breakout rooms

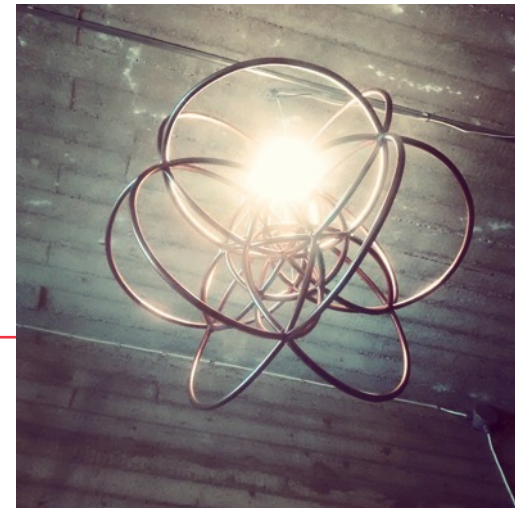
## 17:45 Wrap up

- Student group presentations



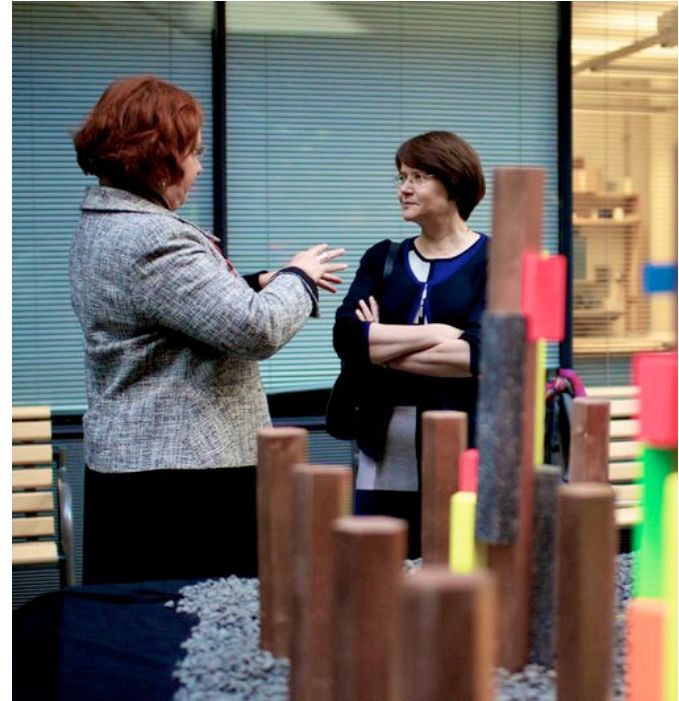
# Course schedule in a nutshell, 15cr

- **Jan 12<sup>th</sup> – Feb 18<sup>th</sup> (period III) lectures and groupwork on Tue & Thu 3pm - 6pm online**
- During evaluation week Feb 23<sup>th</sup> and Feb 25<sup>th</sup> tutoring possibility
- **March 2<sup>nd</sup> –April 4<sup>th</sup> (period IV) lectures and groupwork, Tue & Thu 3pm - 6pm online/DF, Workshops by Taneli & Laura**
- During evaluation week April 13<sup>th</sup> and April 15<sup>th</sup> tutoring possibility
- **April 20<sup>th</sup>- May 13<sup>th</sup> (period V) groupwork and tutoring**
- **Exhibition set up May 17<sup>th</sup> - 21<sup>st</sup>**
- **Opening Tue May 25<sup>th</sup> 5pm !**
- **Final tasks by the end of May**



# Lecturer in Mathematics: Kirsi Peltonen

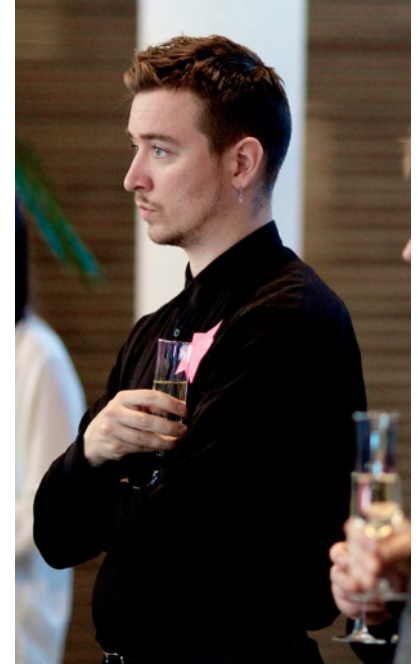
- **Responsible Teacher of the Course**
- **PhD, Docent in Math**
- **Geometric Analysis**
- **Mainstreaming Mathematics**
- **Visualizations**



*Photo: Eero Kaarlehto*

# Lecturer in Arts: Taneli Luotonieni

- **Doctor of Arts**
- **Postdoc researcher of Arts at Aalto**
- **Mathematics in Art**
- **Projective geometry, tilings, 4D, Knots**



*Photo: Eero Kaarlehto*

# Lecturer in Arts: Laura Isoniemi

- **Master of Arts (Textiles)**
- **Art Pedagogy**
- **IDBM Pro studies**
- **Multi-disciplinary freelance designer**
- **Part time teacher at Aalto**
- **Tilings, Patterns, Foldings, Knots**



# Teacher: Marco Rodriguez

- **Architect and Spatial designer**
- **Exhibition Architecture**
- **Spatial concepts and strategies**
- **Creative and design direction**
- **Teacher in Spatial design program/  
Architecture**



# Teacher: Markus Holste

- **Interior Architect**
- **Exhibition design**
- **Furniture design and construction**
- **Assisting in design process**



# Assistant: Luiza Sevele

- **Student at Interior Architecture**
- **Assisting in design process and tutoring**





# Visitors from EMMA

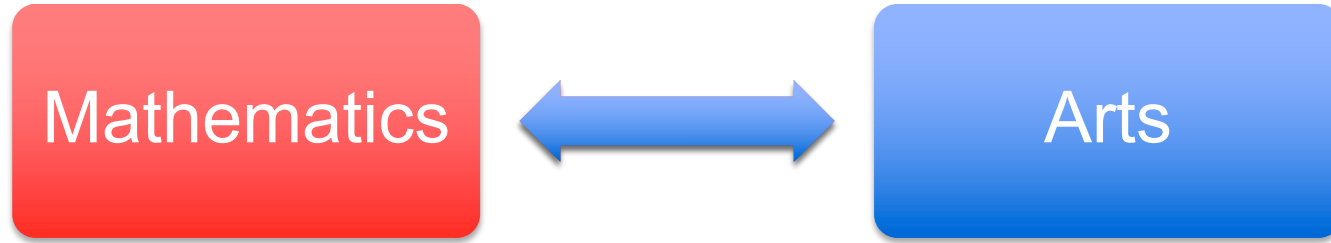


**Reetta Kalajo**  
Chief Curator

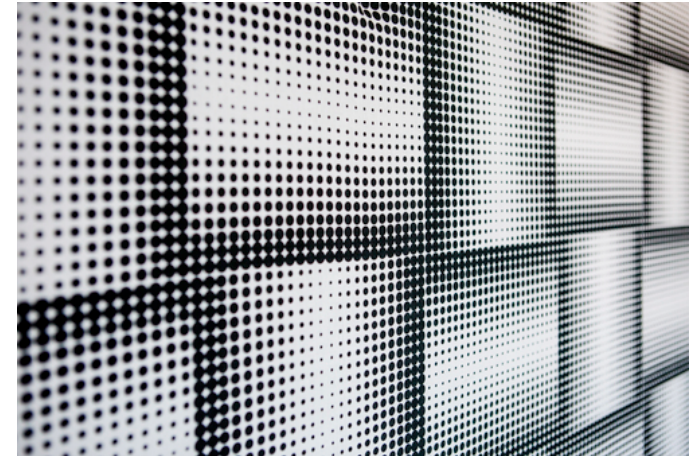


**Arja Miller**  
Chief Curator

# Goals



- **Interaction in both ways!**
- **Increase *understanding***
- **Useful tools (or recipes perhaps)**
- **New point of views and connections**
- **Current research perspective**
- **Critical point of view**

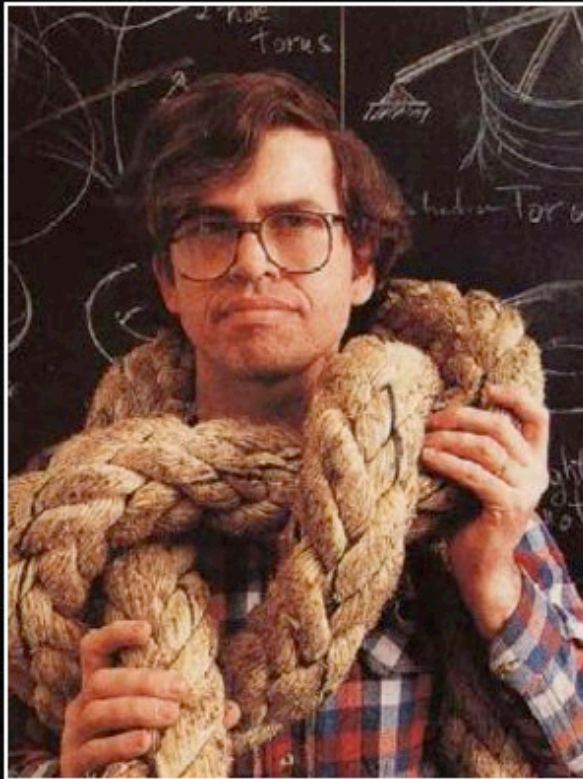


*Photo: Päivi Kiuru*

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# Bill Thurston, 1946-2012

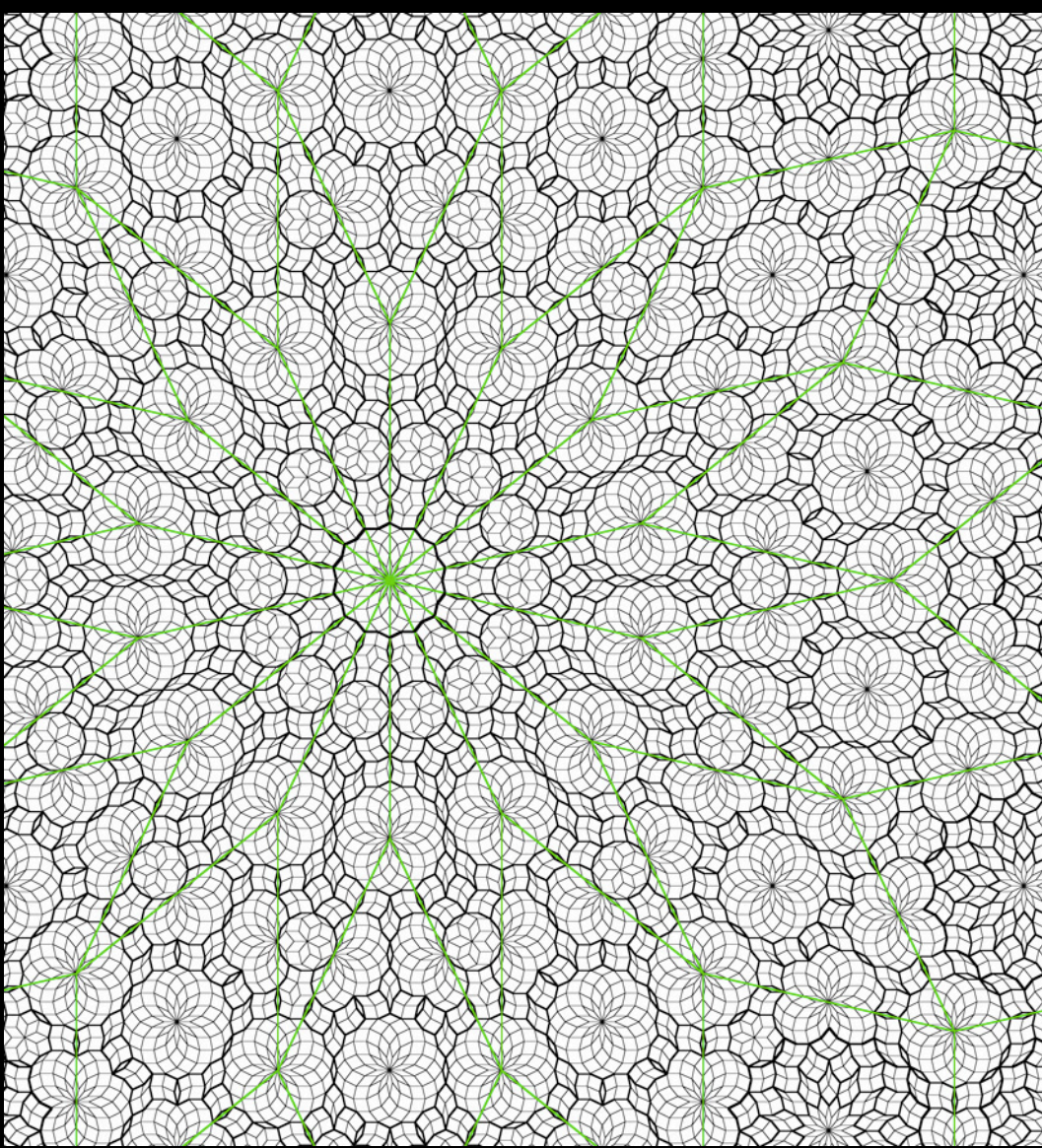


Math is really about the human mind, about how people can think effectively, and why curiosity is quite a good guide.

— *William Thurston* —

AZ QUOTES





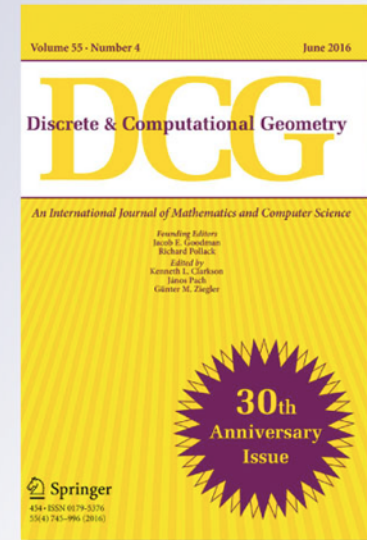
*Sub Rosa, A System of Quasiperiodic  
Rhombic Substitution Tilings with  $n$ -Fold  
Rotational Symmetry*

**Jarkko Kari & Markus Rissanen**

**Discrete & Computational Geometry**

ISSN 0179-5376  
Volume 55  
Number 4

Discrete Comput Geom (2016)  
55:972-996  
DOI 10.1007/s00454-016-9779-1





# Mathematics and Arts minor courses

**MS-E1000 Crystal Flowers in Halls of Mirrors (15cr, spring 2021)**

**UWAS-C0014 Spatial Structures (5 cr, period II fall 2021)**

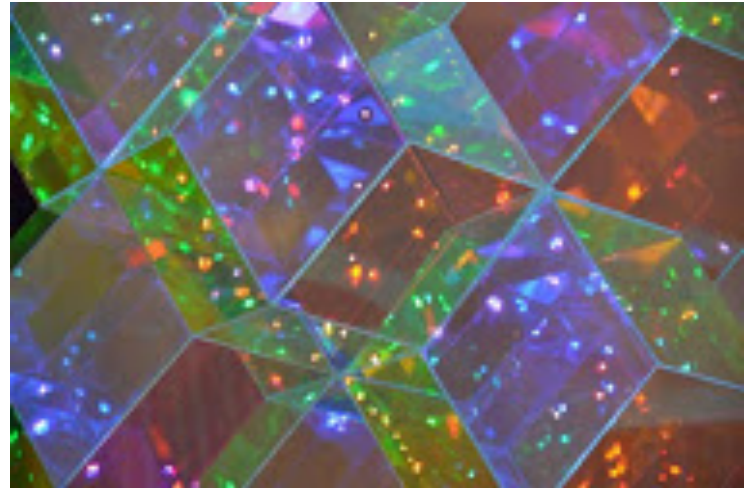
**MS-E1001 Shapes in Action (5 cr, period I fall 2022)**

*courses under continuous construction !*



# Math topics of the minor include

- Projective geometry
- Tilings (symmetries, classification)
- Polyhedrons (3D,4D)
- Models in geometry (spherical, Euclidean, hyperbolic)
- Surfaces
- Fractals and chaos
- Knots



# What are you supposed to do to gain 15cr?

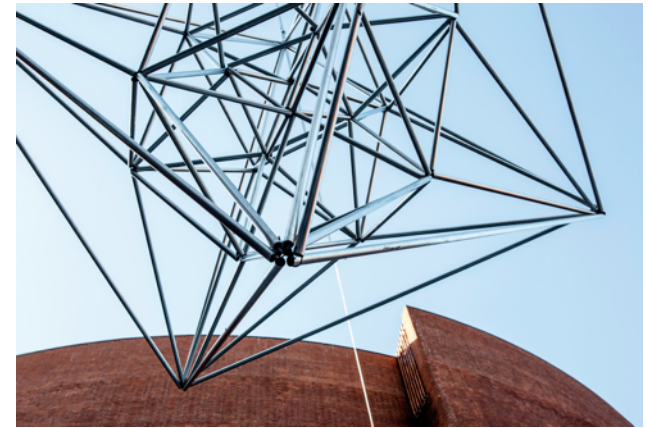
## Portfolio through MyCourses consisting:

1. **Diary** (=weekly reflections and summary) and individual assignments (1/3)

2. **Project works** (2/3) include

- A) Tasks and presentations
- B) Documentation
- C) Exhibition set up

**Assessment:** individual efforts, collaboration in groups, peer review...



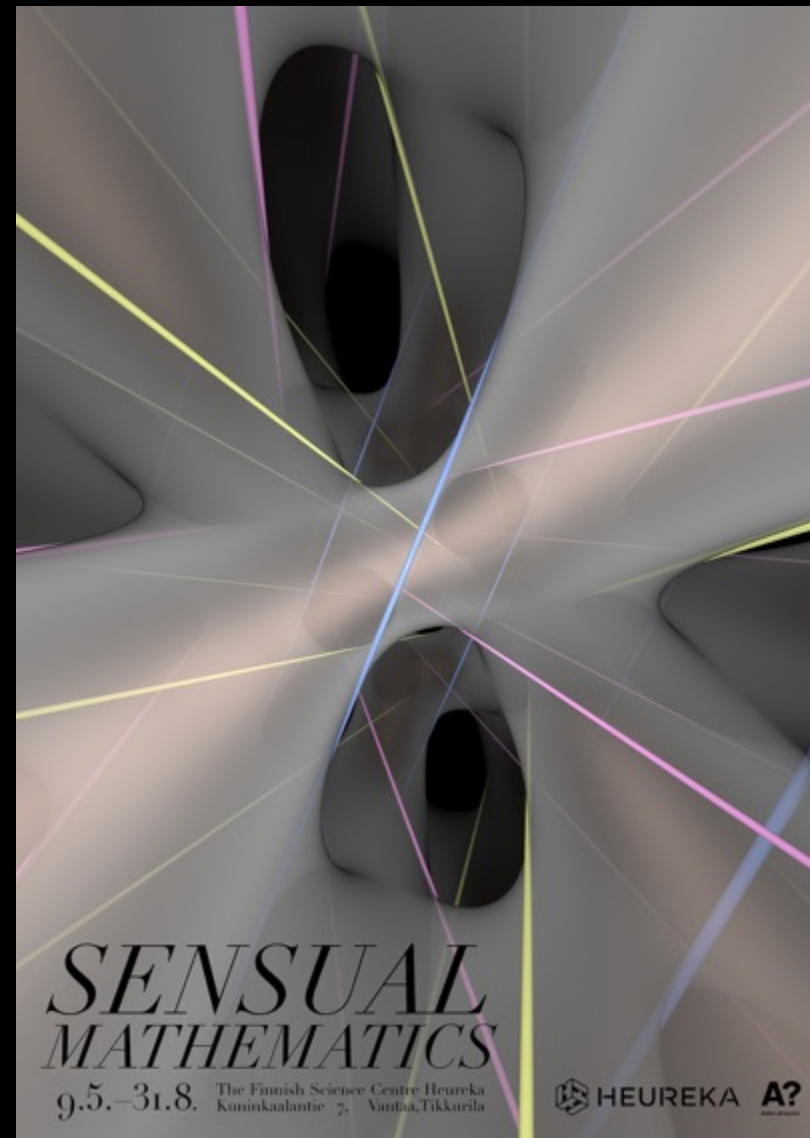


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# Crystal Flowers Exhibitions

2013, 2015, 2017, 2019  
approaches, strategies and  
outcomes





# Crystal Flowers 2013

Posters: *Taneli Luotonen*

Aalto-kurssi 10 op, kevät 2013 Lisätietoja: [noppa.aalto.fi/noppa/kurssi/Mat-1.3000/](http://noppa.aalto.fi/noppa/kurssi/Mat-1.3000/)

KRISTALLIKUKKIA  
PEILISALEISSA

MATEMATIIKKA KOHTAA  
TAITEEN JA ARKKITEHTUURIN



KRISTALLIKUKKIA  
PEILISALEISSA

MATEMATIIKKA KOHTAA TAITEEN JA ARKKITEHTUURIN



Aalto-kurssi 10 op, kevät 2013  
Lisätietoja:

[noppa.aalto.fi/noppa/kurssi/Mat-1.3000/](http://noppa.aalto.fi/noppa/kurssi/Mat-1.3000/)



# Workshop by George Hart

<http://www.georgehart.com//Aalto/aalto.html>



*Photo: Eero Kaarlehto*

*Poster: Taneli Luotoniemi*



KRISTALLIKUKKIA PEILISALEISSA /  
CRYSTAL FLOWERS IN HALLS OF MIRRORS

# NÄYTTELY / EXHIBITION

7.-31.5.2013  
OTANIEMENTIE 17





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## TUAS building 2013

Maarintie 8

Exhibition design: Jouko Koskinen

CRYSTAL FLOWERS  
IN HALLS OF MIRRORS  
Mathematics meets Art and Architecture  
exhibition 7.-31.5.2013



Photos: *Taina Hyppölä*

# Opening of the exhibition 2013 at TUAS



*Photo: Eero Kaarlehto*



# Student presentations and talks

<http://matharts.aalto.fi/exhibitions.html>

# Mathematics and Arts Colloquium talks

<http://matharts.aalto.fi/guests.html>

Poster: *Taneli Luotonen*

# AALTO

MATHEMATICS AND ARTS  
COLLOQUIUM



## PUBLIC LECTURES

Mellin Hall, Otakaari 1, M door

Jeff Weeks: *Shape of Space*  
Wednesday 20th February, 4:00-5pm  
Chair: Ilkka Niemelä

George Hart: *How Mathematics Leads to Sculpture*  
Friday 5th April, 3:00-4pm  
Chair: Martti Raevaara

<http://math.aalto.fi/conferences/math-art/>



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## One piece still left at TUAS 2021

Group Ents: Tomi Itäniemi, Minna Kuusela,  
Lauri Loiskekoski, Kai Salmi, Johanna  
Strandman, Miika Ullakko

### Ruled surface

- prototyping
- experimenting



*Photos: Eero Kaarlehto*



# Different approaches



# Some pieces found new life after the exhibition elsewhere



*Photos: Taina Hyppölä*





## B-hall, Otakaari 1

Group Hobbits: Otso Helenius, Jesper Jokilehto, Eero Kaarlehto, Juha-Matti Lappalainen, Pekka Lehtelä

**INNOTORUS Tensegrity structure**



# Challenges in recycling





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*Photo: Mikko Raskinen*

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## CF 2015



KRISTALLIKUKKIA PEILISALEISSA /  
CRYSTAL FLOWERS IN HALLS OF MIRRORS  
NÄYTTELY/EXHIBITION  
4.5. – 29.5. Otakaari 1

Vernissage May 4th, 5 p.m. Otakaari 1, B-hall. Opening words by Tuula Teeri

EXTENDED  
UNTIL THE END OF  
JUNE!

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# KRISTALLIKUKKIA PEILISALEISSA

MATEMATIIKKA KOHTAA  
TAITEEN JA ARKKITEHTUURIN

kevät 2015, 10 op [noppa.aalto.fi/mat-1.3000](http://noppa.aalto.fi/mat-1.3000)

# A!





# Exhibition 2015 at Otakaari 1

Exhibition design: Jouko Koskinen  
Workshop: Urs Roth



*Photos: Mikko Raskinen, Lauri Tervonen, Viivi Lívio*



# Folding workshop by Yves Klett



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## Exhibition piece inspired by folding

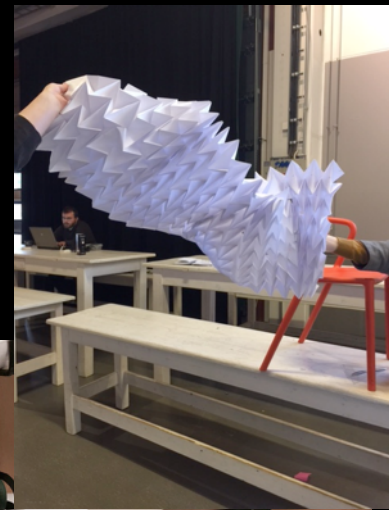
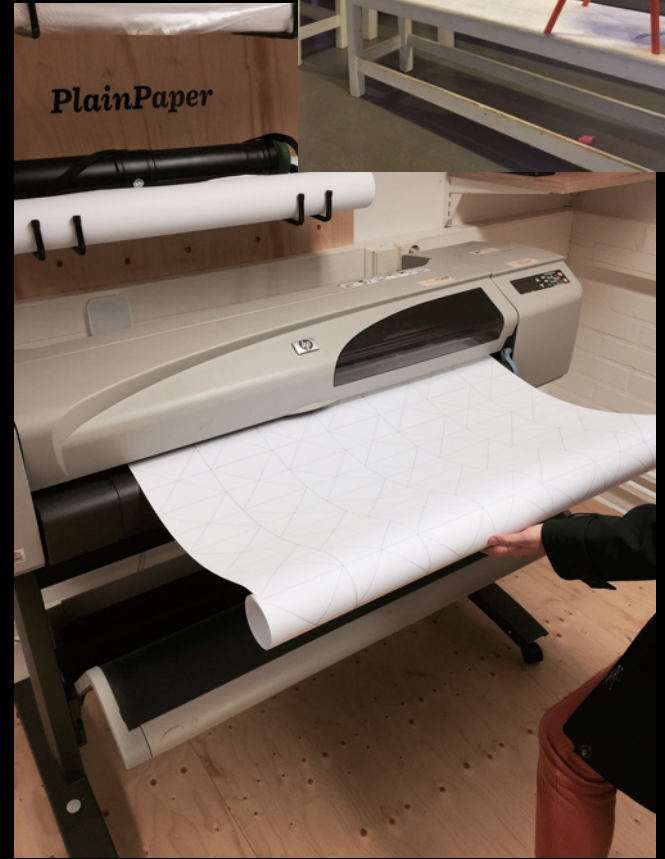
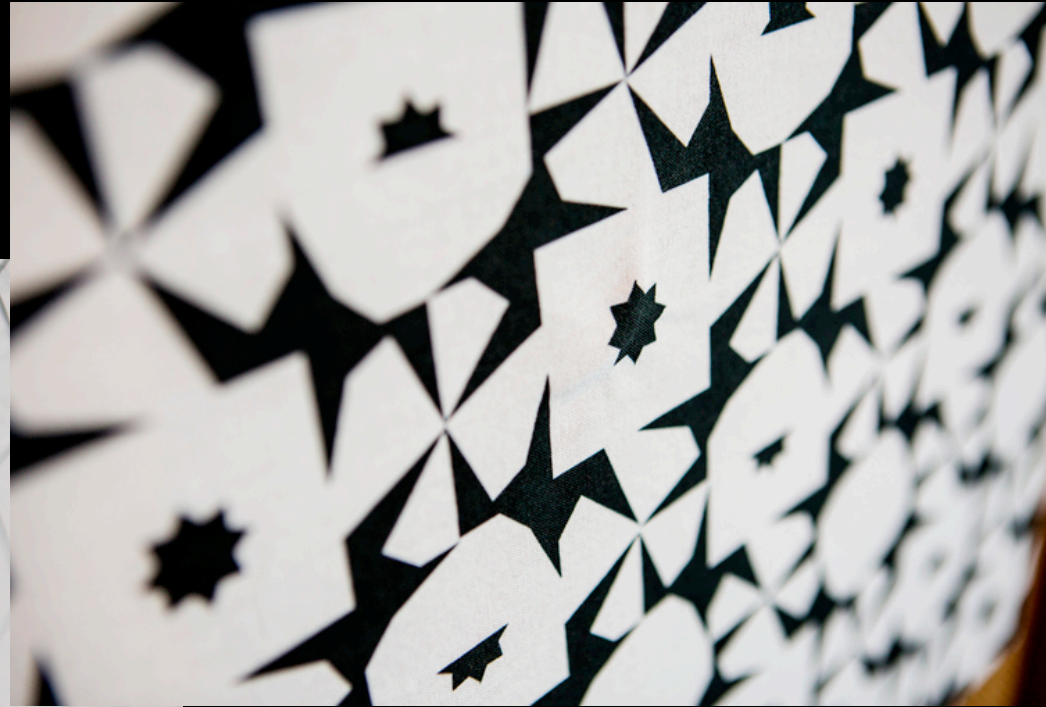


Photo: Adolfo Vera

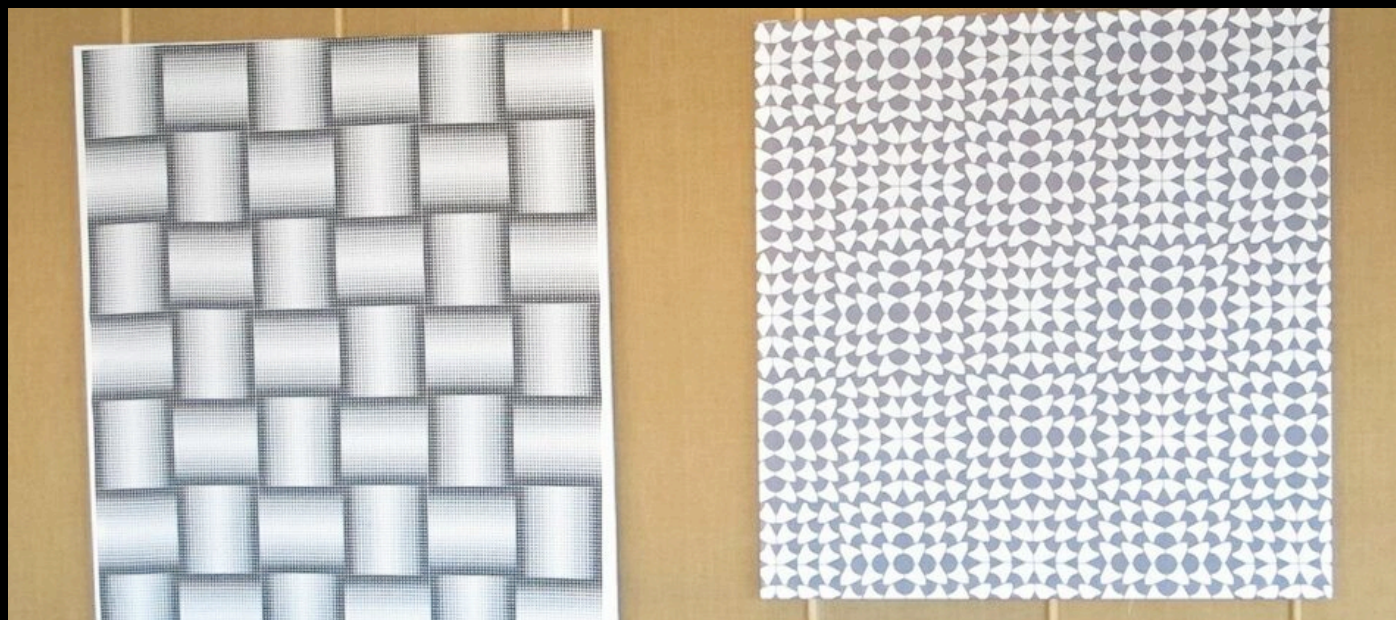
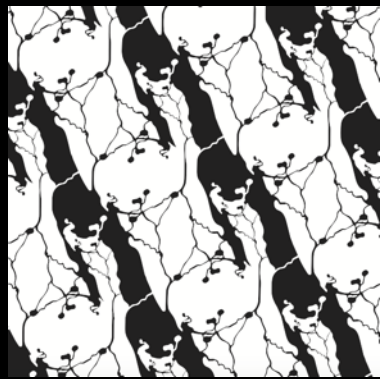
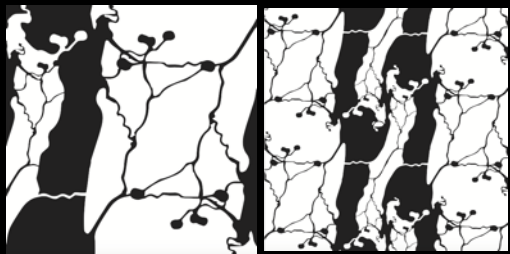
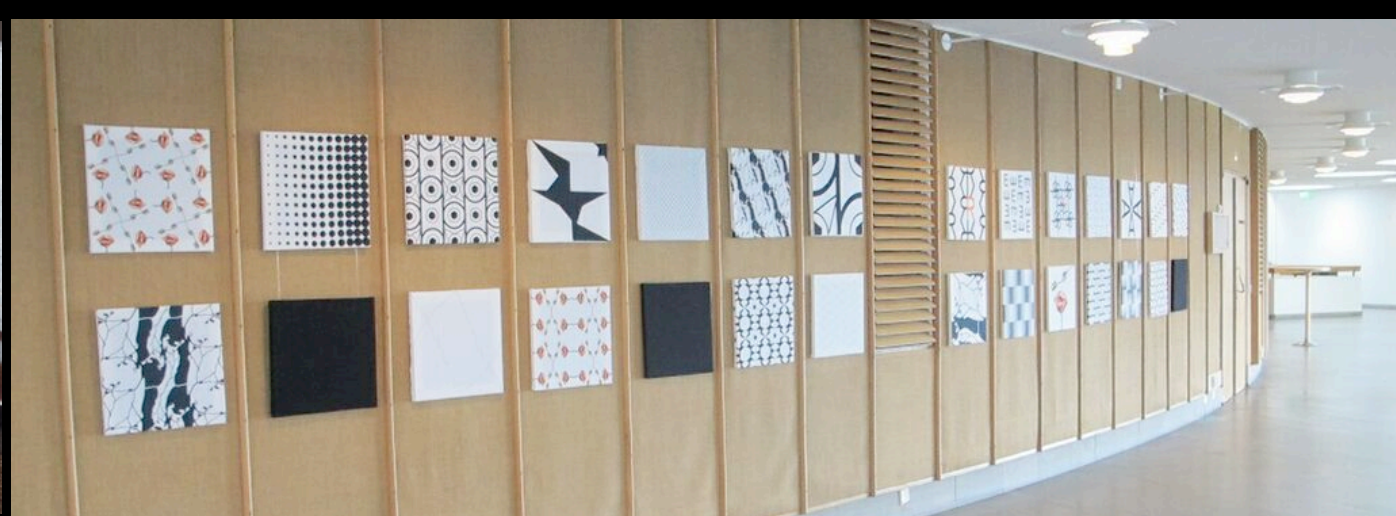


# Textile workshops by Laura



**Outcomes still in Otakaari 1**



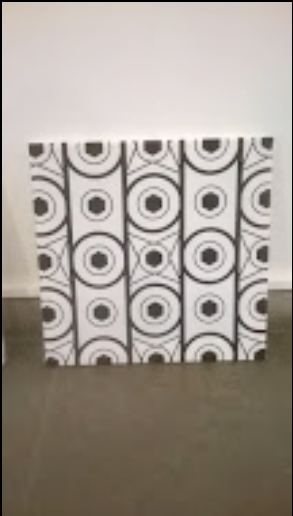




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## Digital printing



Photos: Viivi Lívio

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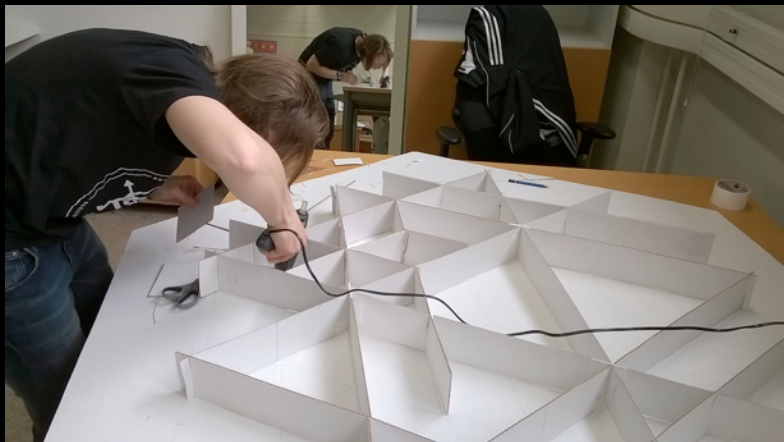


*Photo: Adolfo Vera*



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*Photos: Liisi Huotari*

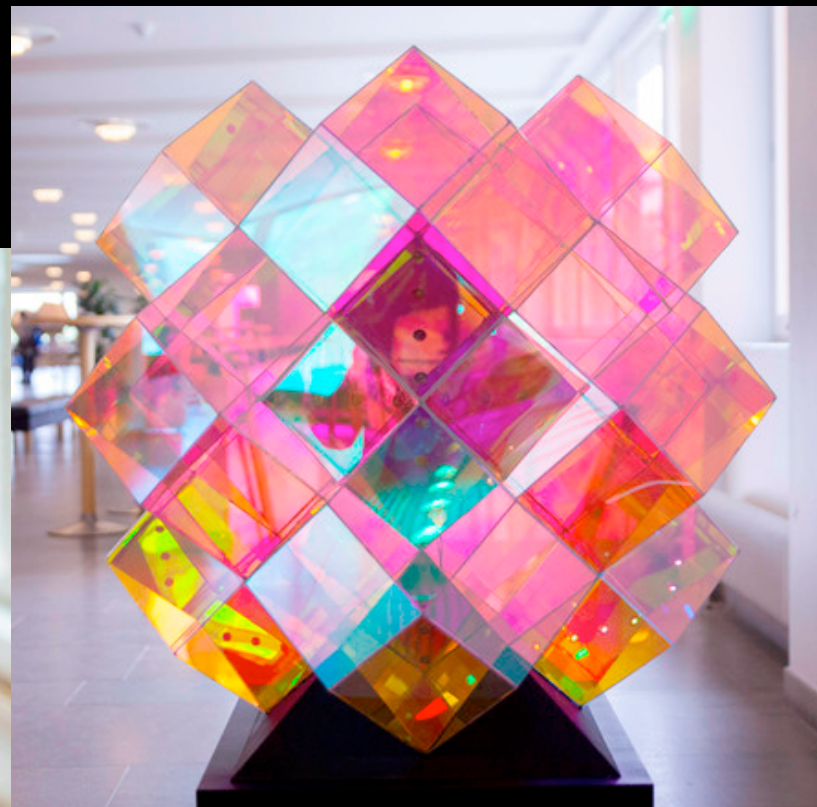


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*Photo: Adolfo Vera*

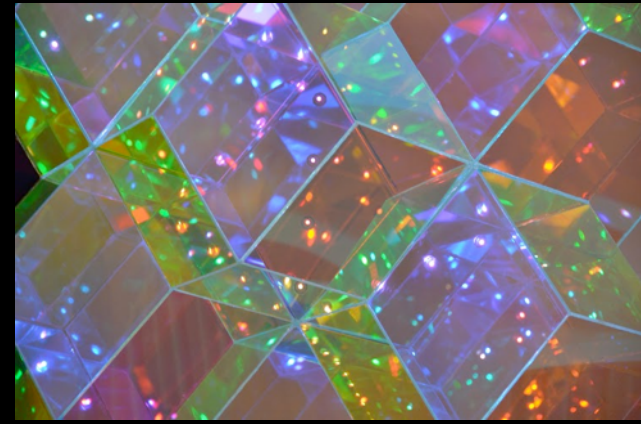


*Photo: Mikko Raskinen*

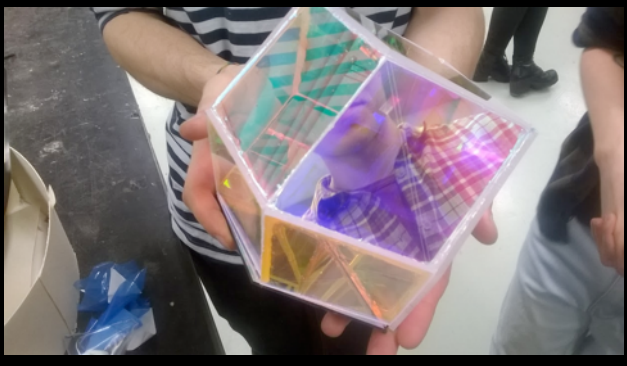
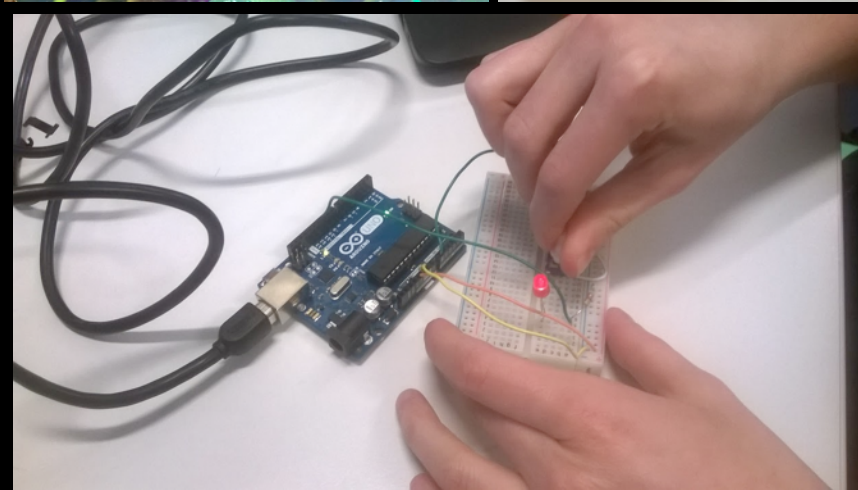
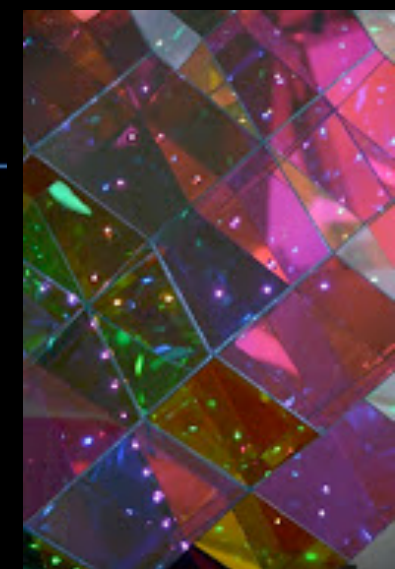
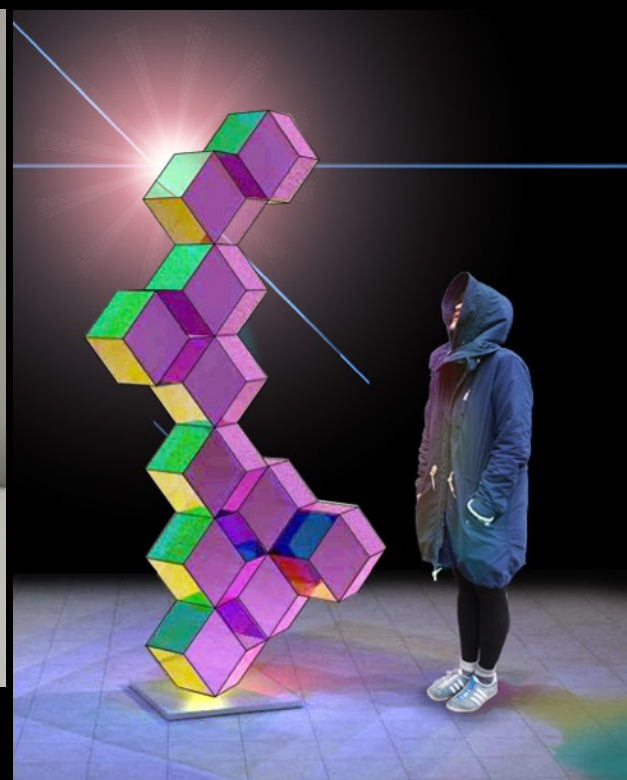
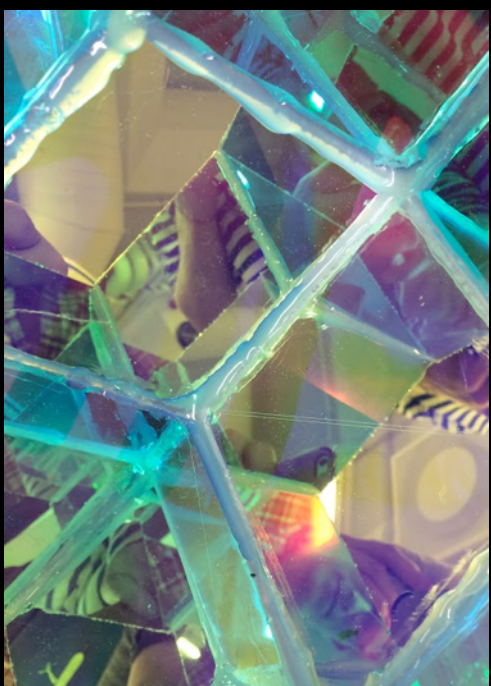


# Rhombic dodecacube

E. Axelsson (SCI), H. Fred (HU,  
Computer science), H. Judin (ARTS),  
V. Livio (SCI), M. Tuomela (ARTS)





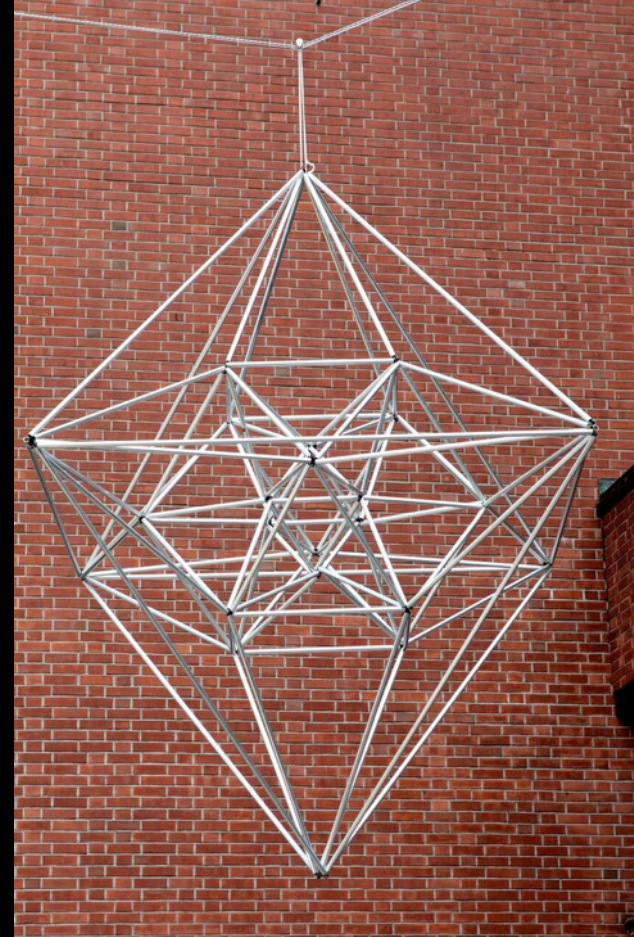




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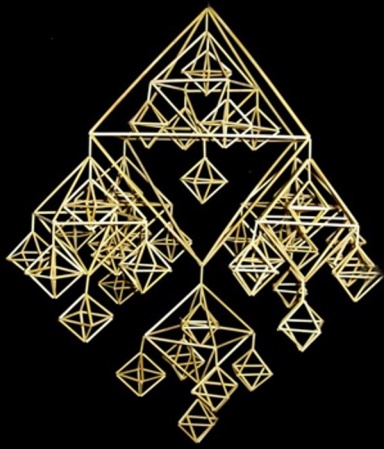
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**4D Himmeli** S.Björkman (ARTS), T.Hamel (ARTS) Z. Horvath (ARTS)  
K. Kangas (HY Math), S. Louhensalo (SCI)



*Photos: Adolfo Vera*





Ruled surface  
 through the windows!  
 Inside → Out  
 (Nylon mesh)  
 With something hanging on it  
 ↳ surface is materialized via hanging elements

4-Dimensional  
 himmeli  
 somewhere in the courtyard  
 (at the trees)

This is still 3D!  
 Some odd materials  
 Nice Shadows!

~~BIG!~~  
 HUGE!!

Equally  
 Unhappy  
 Tristan  
 Saara  
 Zuzanna  
 Sebastian

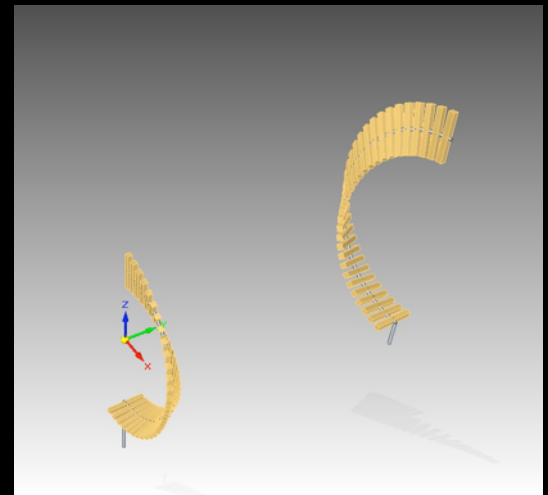


# Möb&ius

R. Landsdorff (ARTS), A. Ruohola (ELEC),  
S. Saukkonen (ENG), R. Schroderus (HY Math)



*Photos: Adolfo Vera*

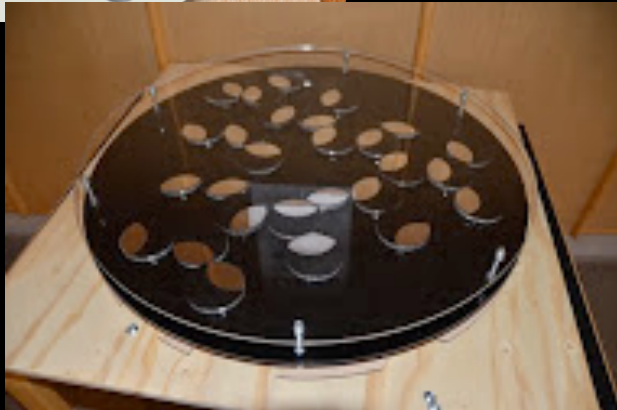
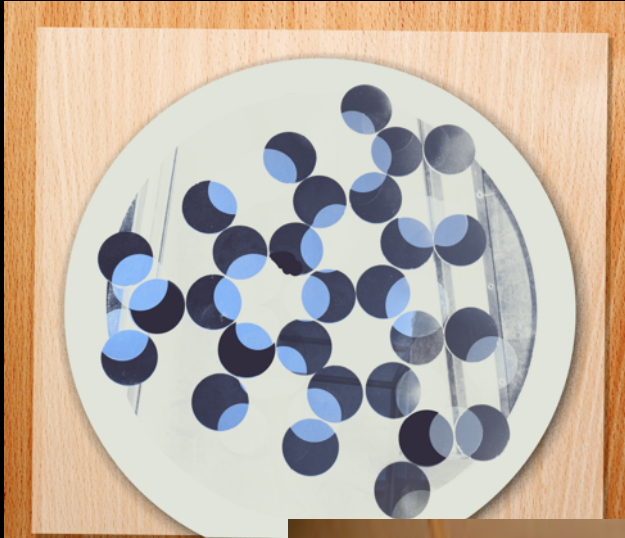






# Mutating surface

L. Anttila (ENG), E. Parr (ARTS), J. Raami (ARTS), U. Rimpiläinen (ARTS), L. Tervonen (SCI), E. M. Zamudio (ARTS)

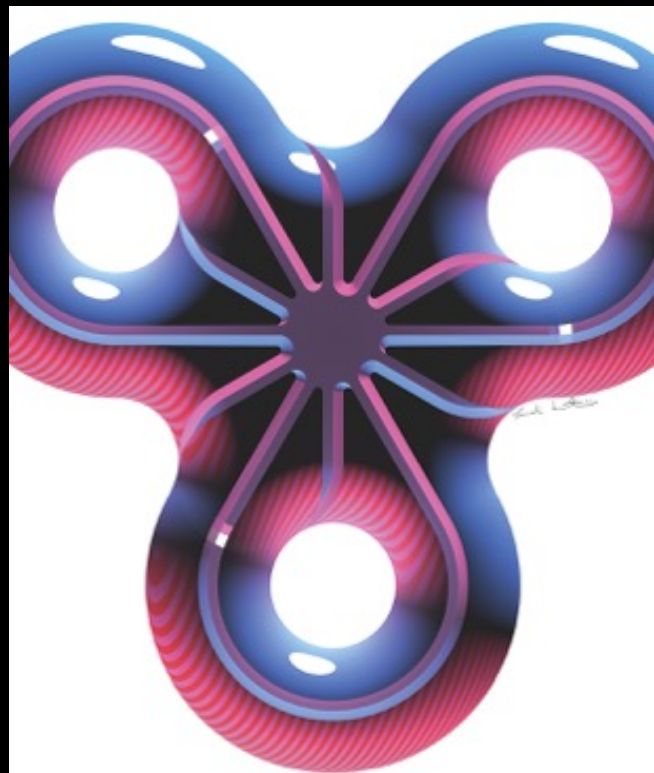




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# Crystal Flowers 2017



CRYSTAL FLOWERS IN HALLS OF MIRRORS

MATHEMATICS MEETS ART AND ARCHITECTURE

MS-E1000, Spring 2017, 15cr, math.aalto.fi/MS-E1000

A?  HEUREKA

## AALTO MATHEMATICS AND ARTS COLLOQUIUM

*Prof. Daina Taimina  
(Cornell University)*

*“Study mathematics and ... become an artist?”*

*Tuesday 16 May 2017, 15:00, C-hall (Y205)*

*Chair: Martti Raevaara*

*Abstract: When I was in middle school I was a good student and had very good grades in all subjects...except in art class where I was struggling to draw the way my teacher thought was the right way. I accepted my teacher's judgement that I can do anything but art and went to study mathematics. Could I imagine that some fifty years later I will be known as an artist? Mathematics and art are not too distant. In my talk, I will discuss the interplay between mathematics and art from my own perspective.*

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[www.math.cornell.edu/~dtaimina/](http://www.math.cornell.edu/~dtaimina/)



*Posters: Taneli Luotoniemi*



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**AALTO**  
MATHEMATICS  
AND ARTS  
COLLOQUIUM


*Public lectures*  
*Prof. Henry Segerman*  
*(Oklahoma State University)*  
[www.segerman.org](http://www.segerman.org)

*Wednesday, 15th March 16:00–17:00*  
*"Design of 3D Printed Mathematical Art"*  
*Aalto-yliopisto, Otakaari 1, B-sali, Espoo*  
*Chair: Anna Valtonen (Aalto)*

*Thursday, 16th March 18:30–19:30*  
*"3D Shadows: Casting Light on the Fourth Dimension"*  
*Tiedekeskus Heureka, Auditorio, Vantaa*  
*Chair: Jari Jokinen (TEK)*

[math.aalto.fi/conferences/math-art-2017](http://math.aalto.fi/conferences/math-art-2017)

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 **HEUREKA**


 NILO HELANDERIN  
SÄÄTIÖ

Photo: Wikimedia by H. Mark, Andrew Blachowicz and Henry Segerman

*Poster: Taneli Luotoniemi*

# Group presentations



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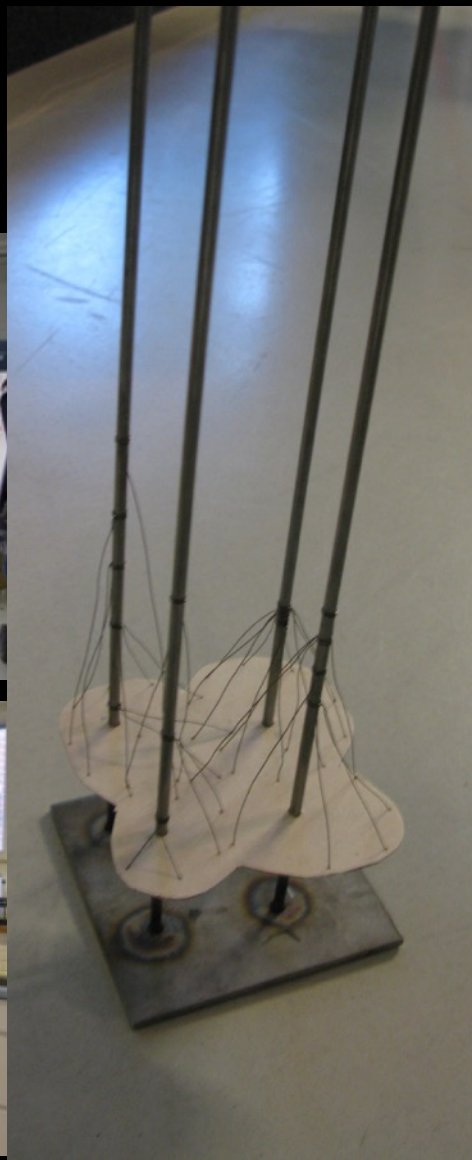
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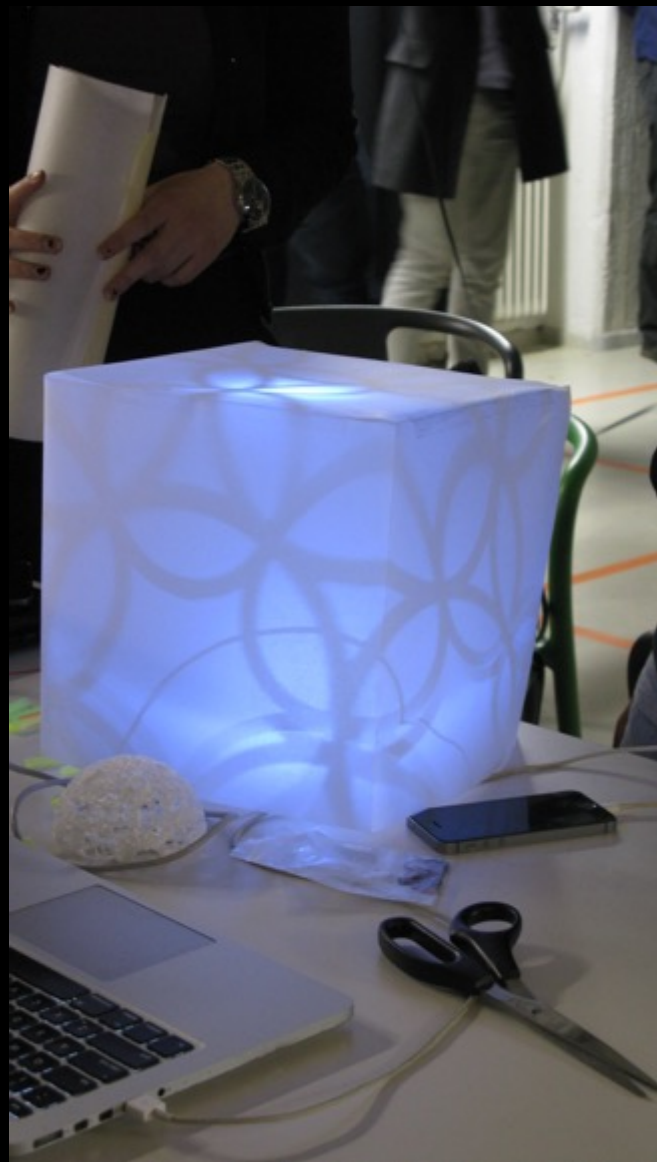
# A? Prototyping

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*Photos: Kilian Kottmeier*

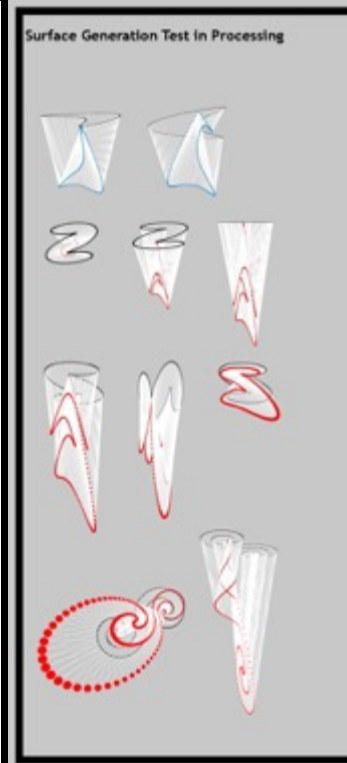
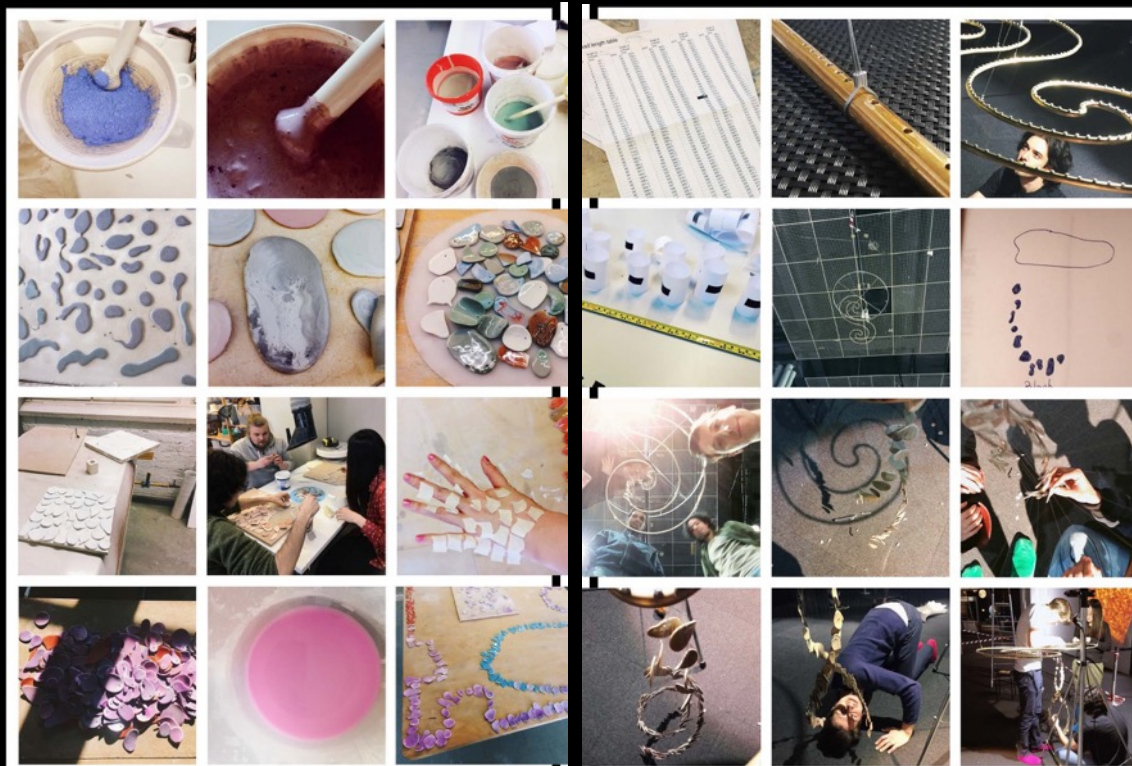






# Documentation

- **Tasks 1-4**



**Floating Something**



<https://mesh.aalto.fi/en/research/researcher/department/exhibitions/201718/>

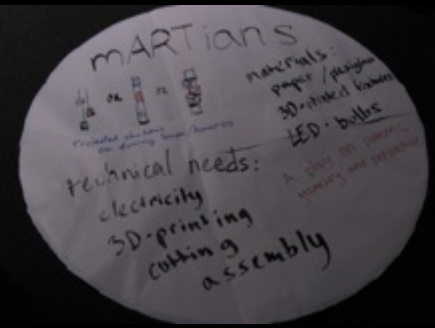
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(Aalto University School of Electrical Engineering / Communication Engineering) [kiran.raajaguru@aalto.fi](mailto:kiran.raajaguru@aalto.fi)



# A? Heureka visit

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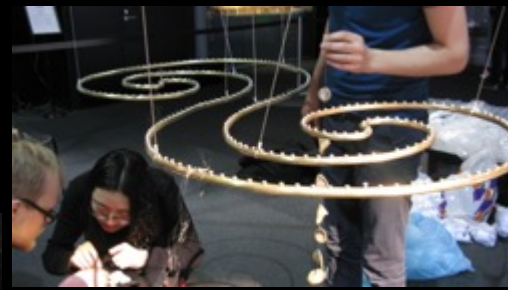




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## Exhibition set up



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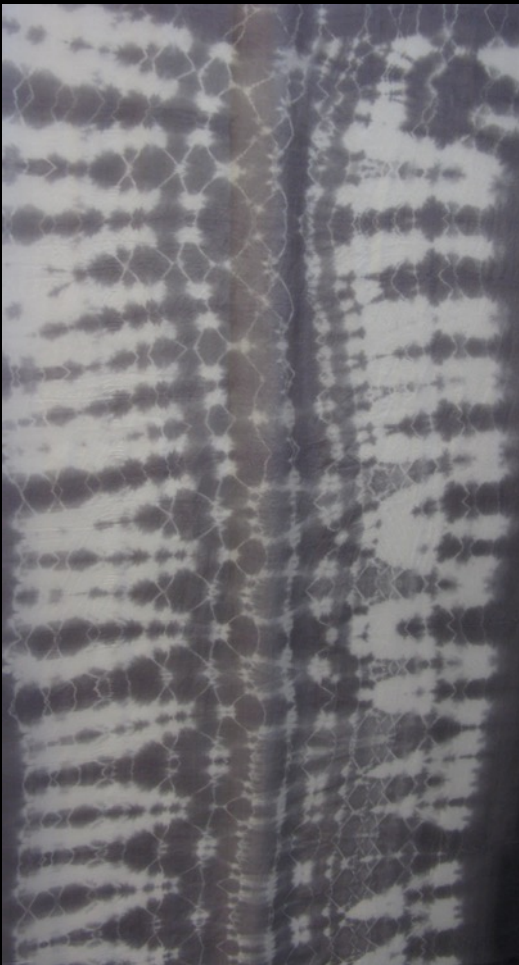
*Photos: Kilian Kottmeier*





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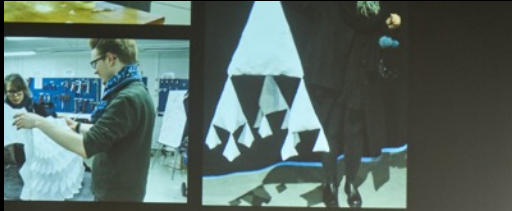


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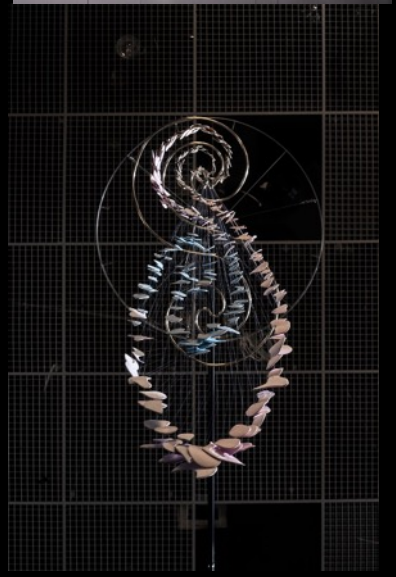
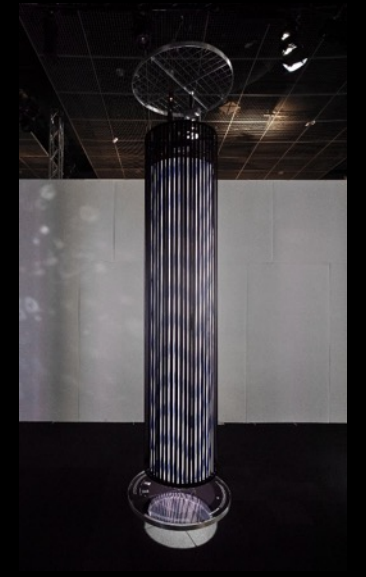
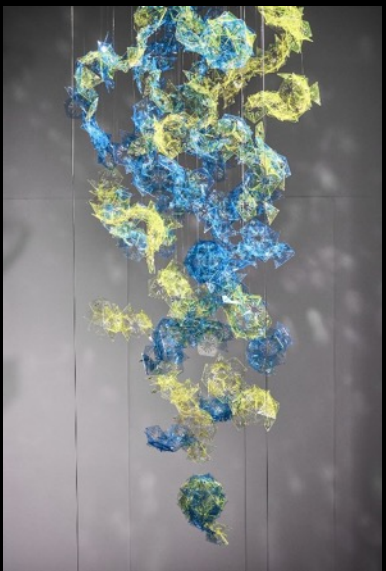




**Student interviews: <https://www.youtube.com/watch?v=Axj-0ZORNx4>**







Photos: Henri Vogt



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*Photo: Henri Vogt*



# IN TRANSITION – Mathematics and Art

From Espoo  
Cultural Centre to  
Shanghai



*Photo: J-P Virtanen*



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# Spring 2019 course at Design Factory

## Teachers:

- Kirsi Peltonen (Mathematics)
- Taneli Luotoniemi (Art Education)
- Laura Isoniemi (Surface Design)
- Toni Kotnik (Architecture)
- Tapio Takala (Algorithmic Art)



**Exhibition curation and tutoring:** Pablo Riquelme and Markus Holste (Spatial Design)

**EMMA support:** Reetta Kalajo, Sami Supply, Arja Miller

**Students:** From freshmen to PhD students in diverse fields

**Venue of the exhibition:** Espoo Cultural Centre



# Visit to EMMA Modern Art Museum

Alicja Kwade: Trans-For-Men





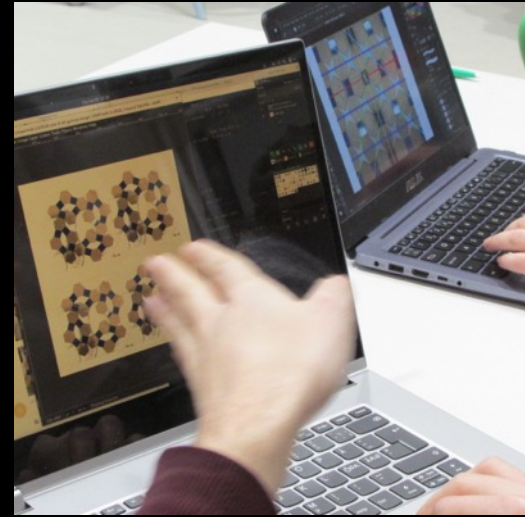
# Visit to Cultural Centre





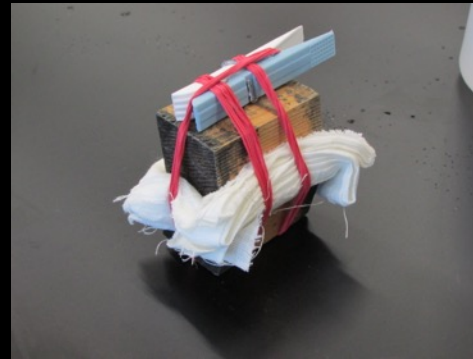
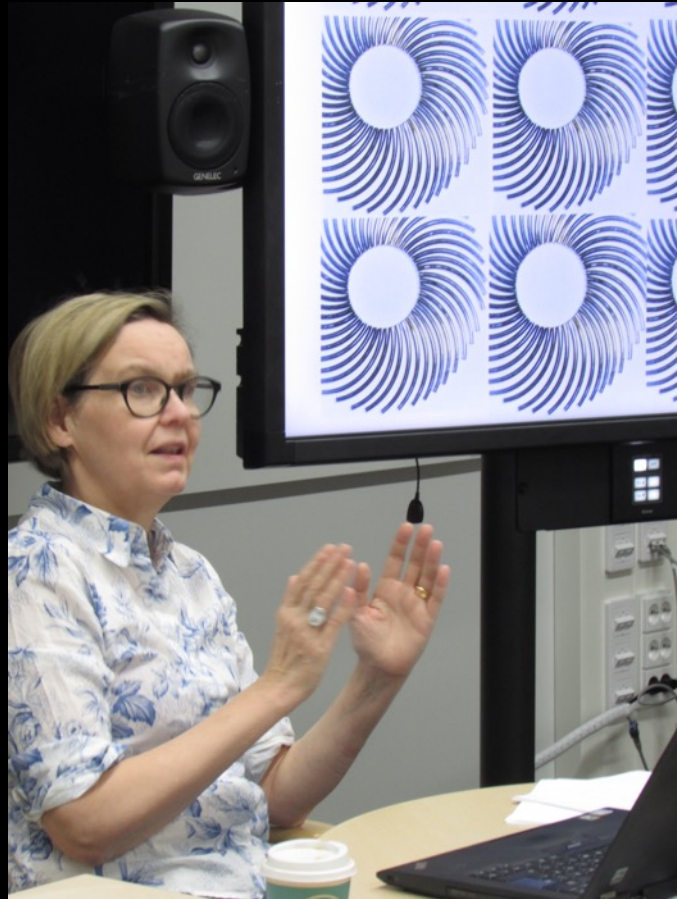


# Workshops and exercises



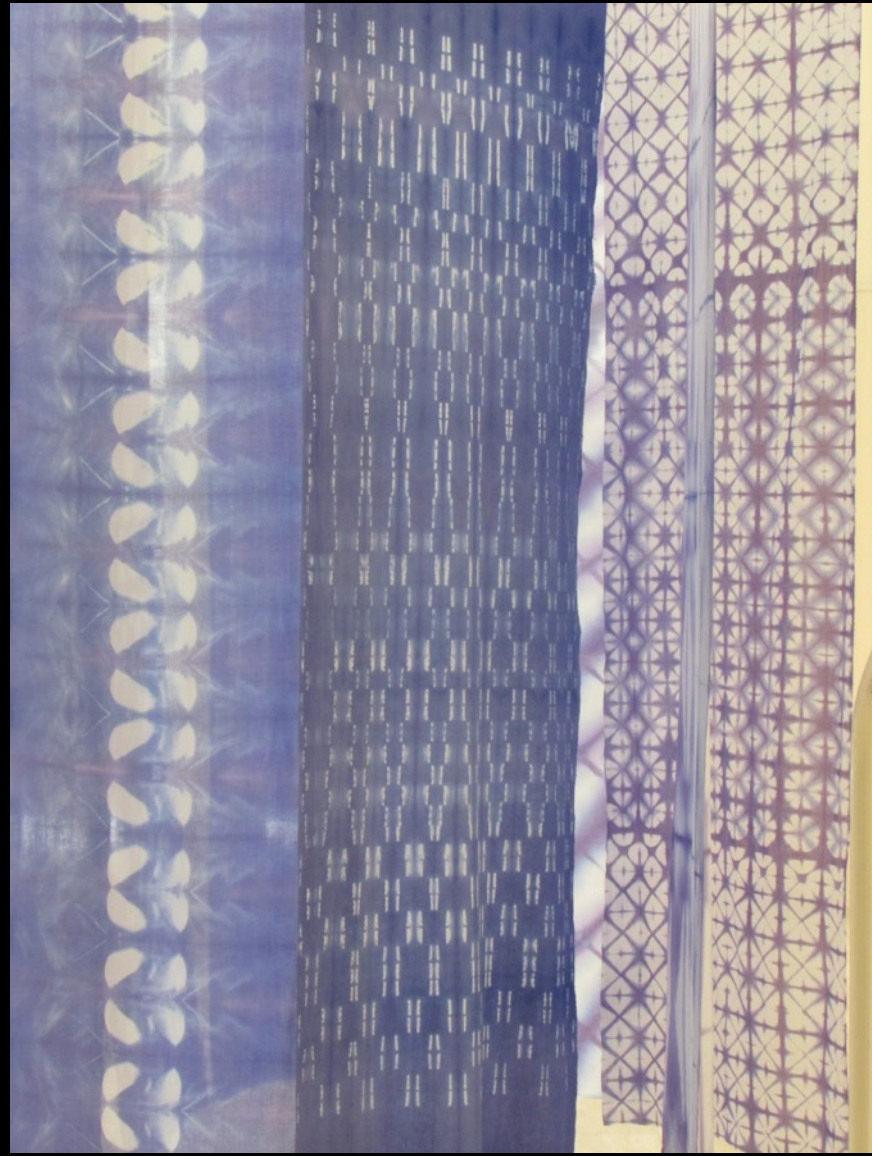


# Fold, Tie and Dye by Laura Isoniemi

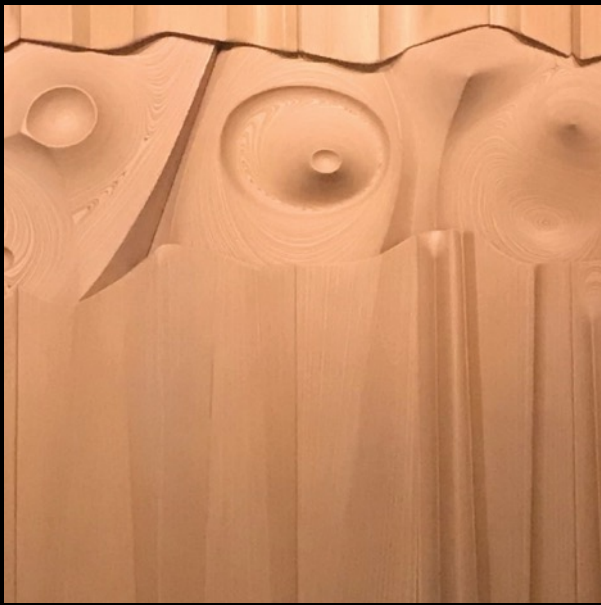












**Digital  
Printing  
Workshop  
by Laura  
Isoniemi**

Design:  
Yao Yuchen

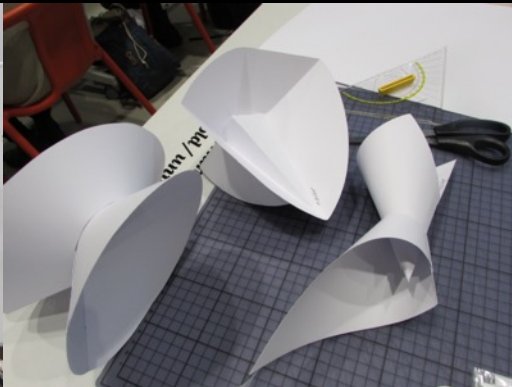
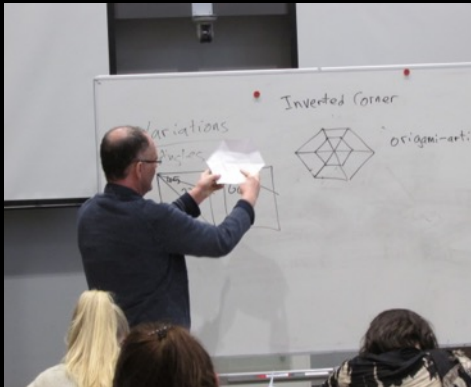




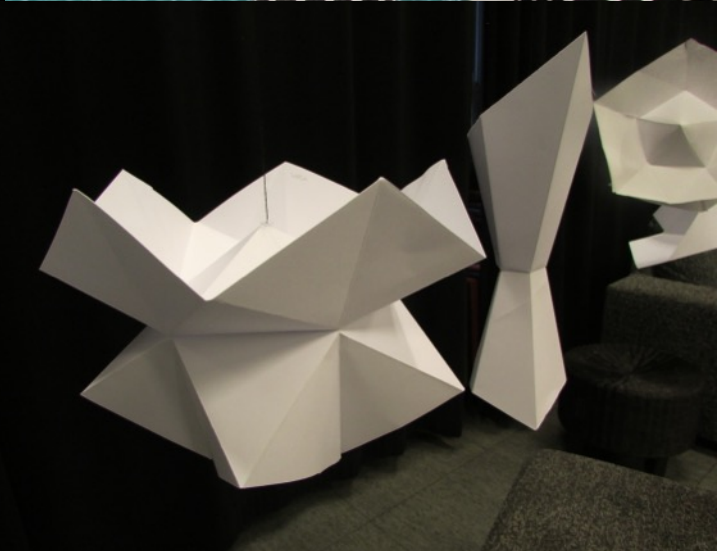
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# Paul Jackson workshop











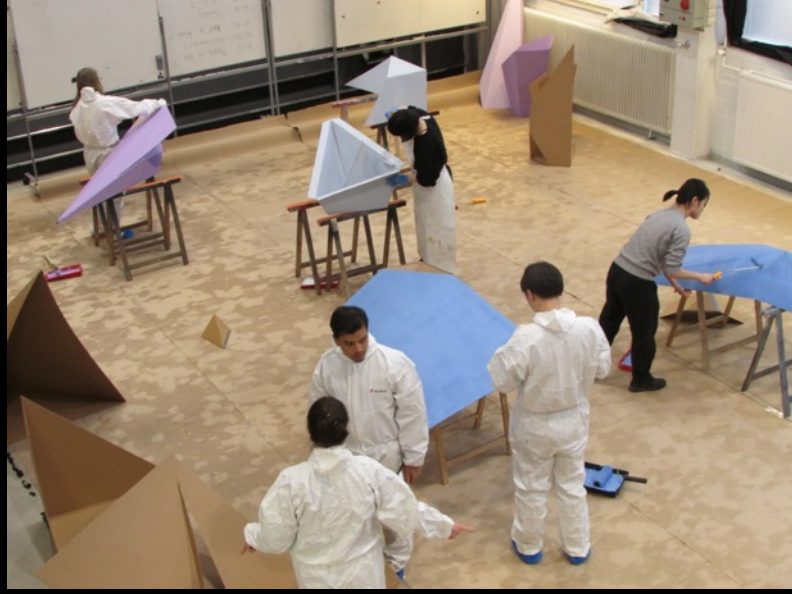
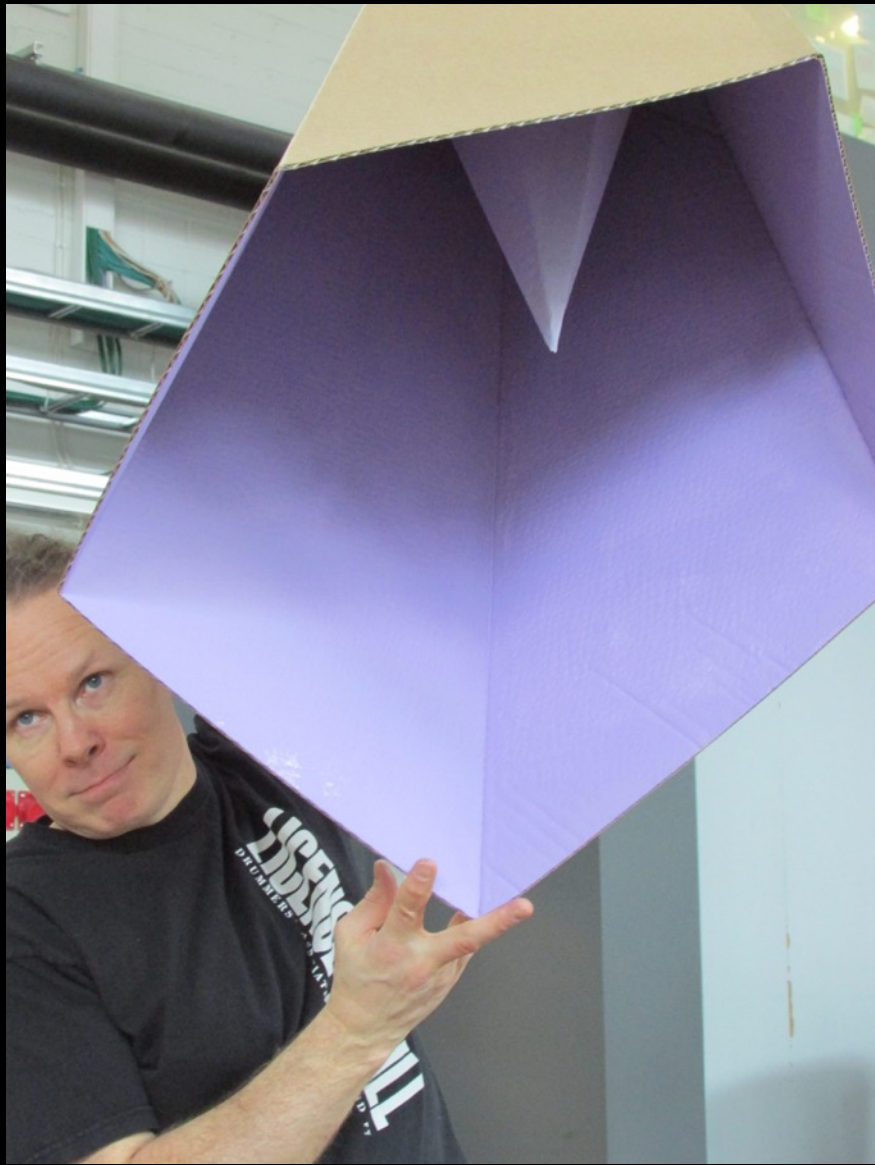


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*Photo: Kalle Kataila*

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## *Älvdans on the Moon Bridge*

Yi-Chiao Tien (ARTS)  
Jannica Savander (ELEC)  
Tomi Hyypä (ARTS)  
Alisa Kurganova (BIZ)

*Photo: Ilari Männistö*







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# *Älvdans on the Moon Bridge*

**From ideas to the final piece**

Yi-Chiao Tien (ARTS)

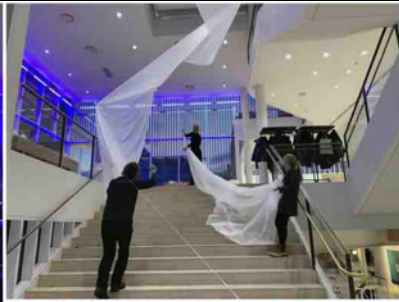
Jannica Savander (ELEC)

Tomi Hyyppä (ARTS)

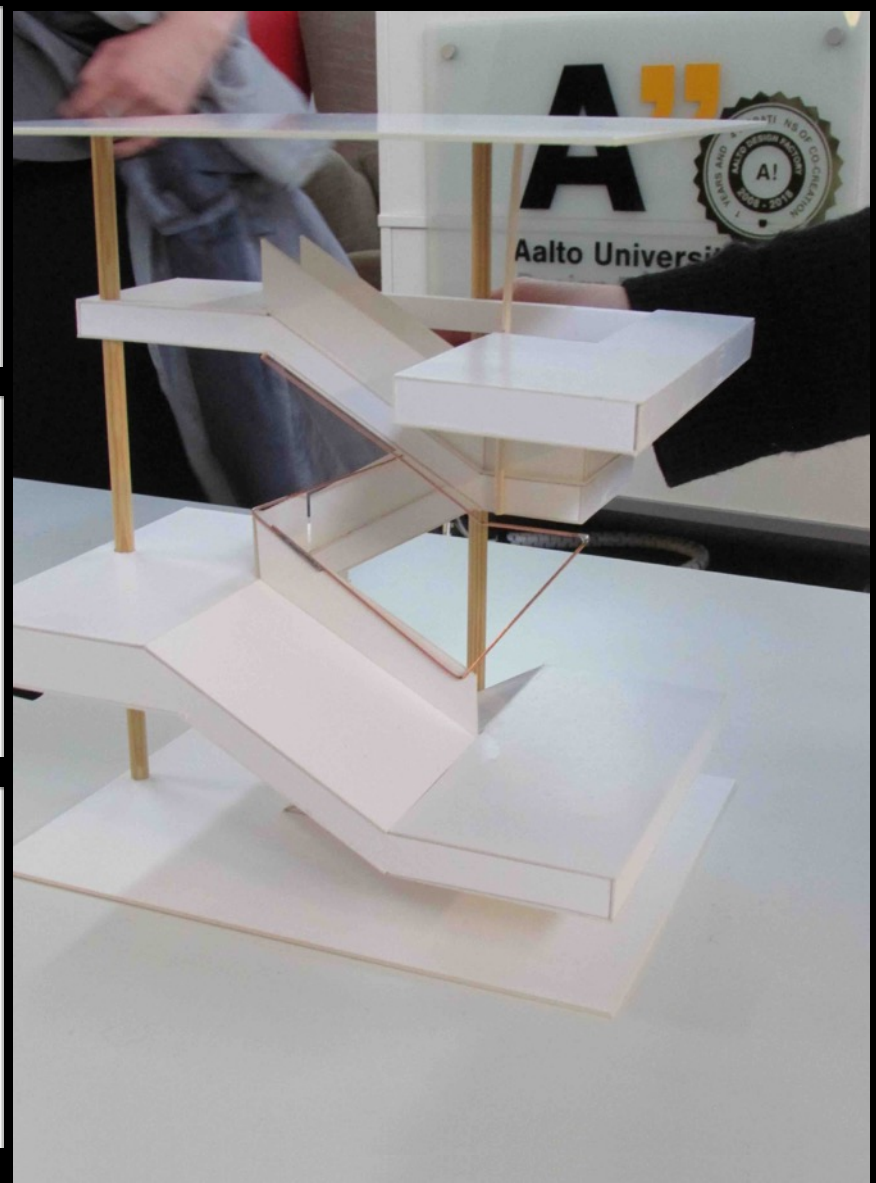
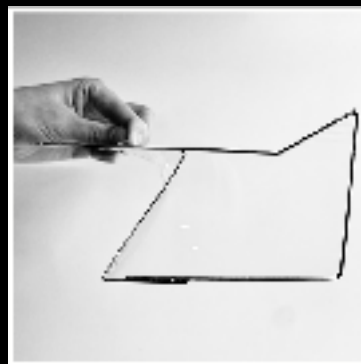
Alisa Kurganova (BIZ)

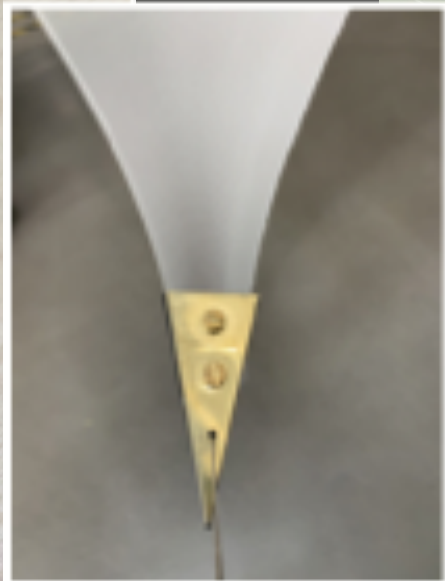
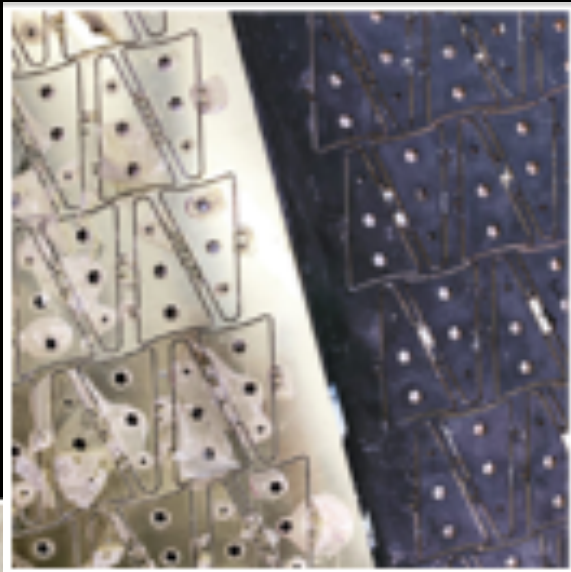


**Minimal surfaces**















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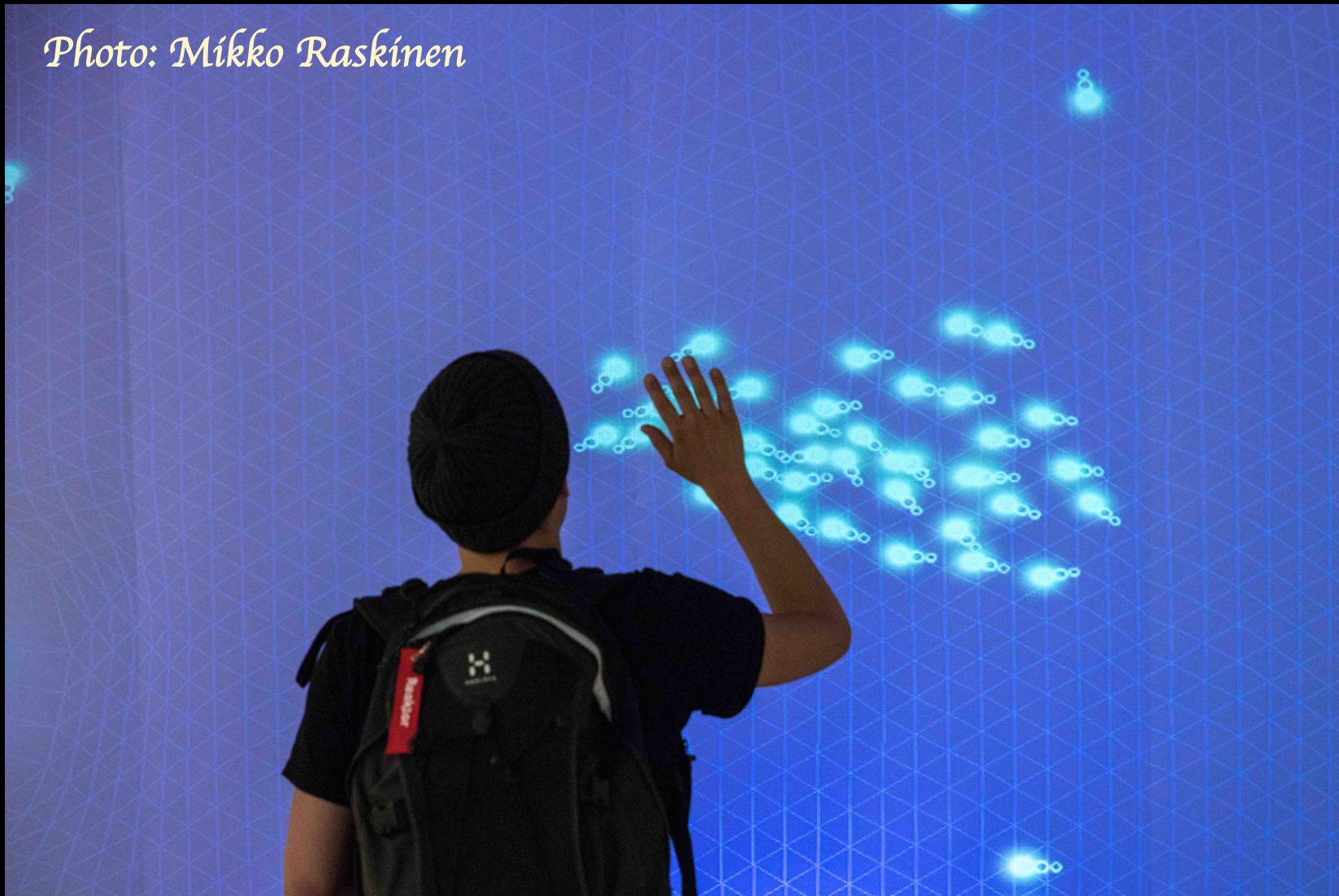


*Photos: Ilari Männistö*





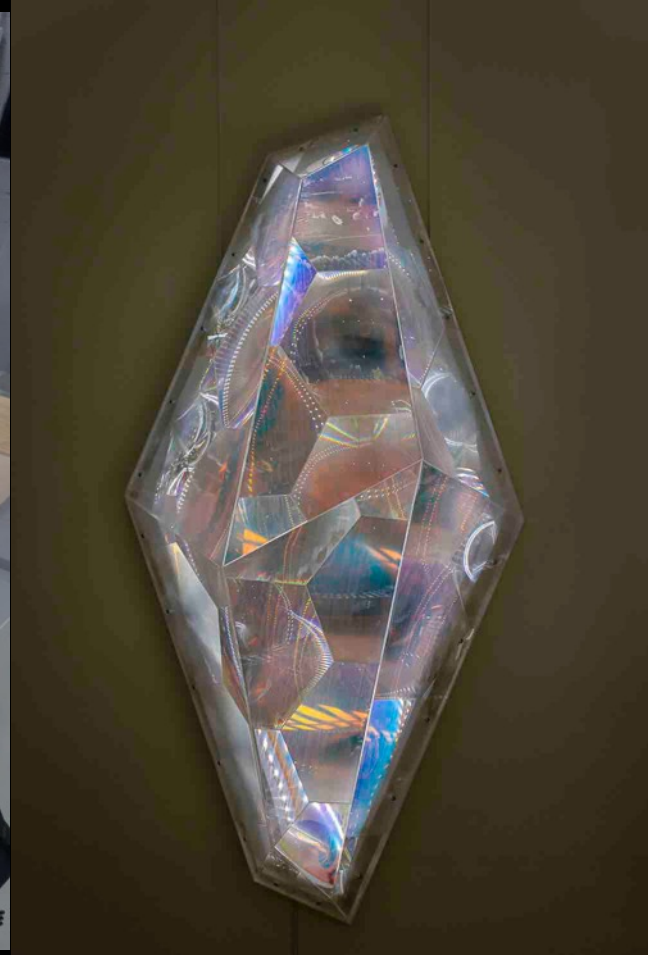
*Photo: Mikko Raskinen*



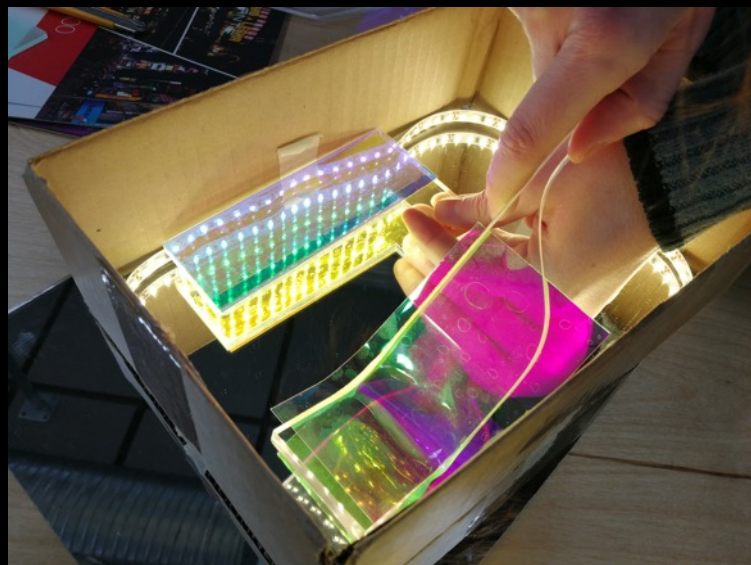
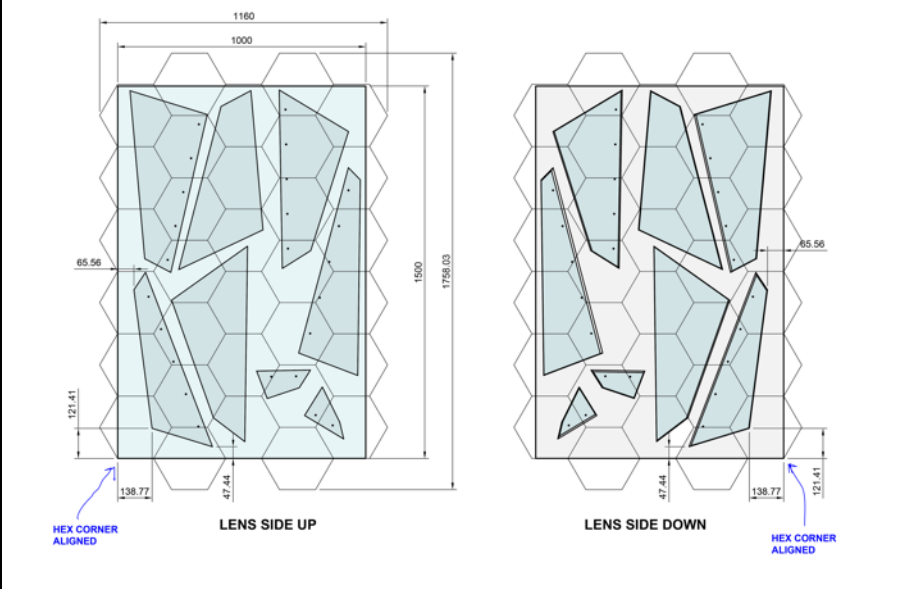
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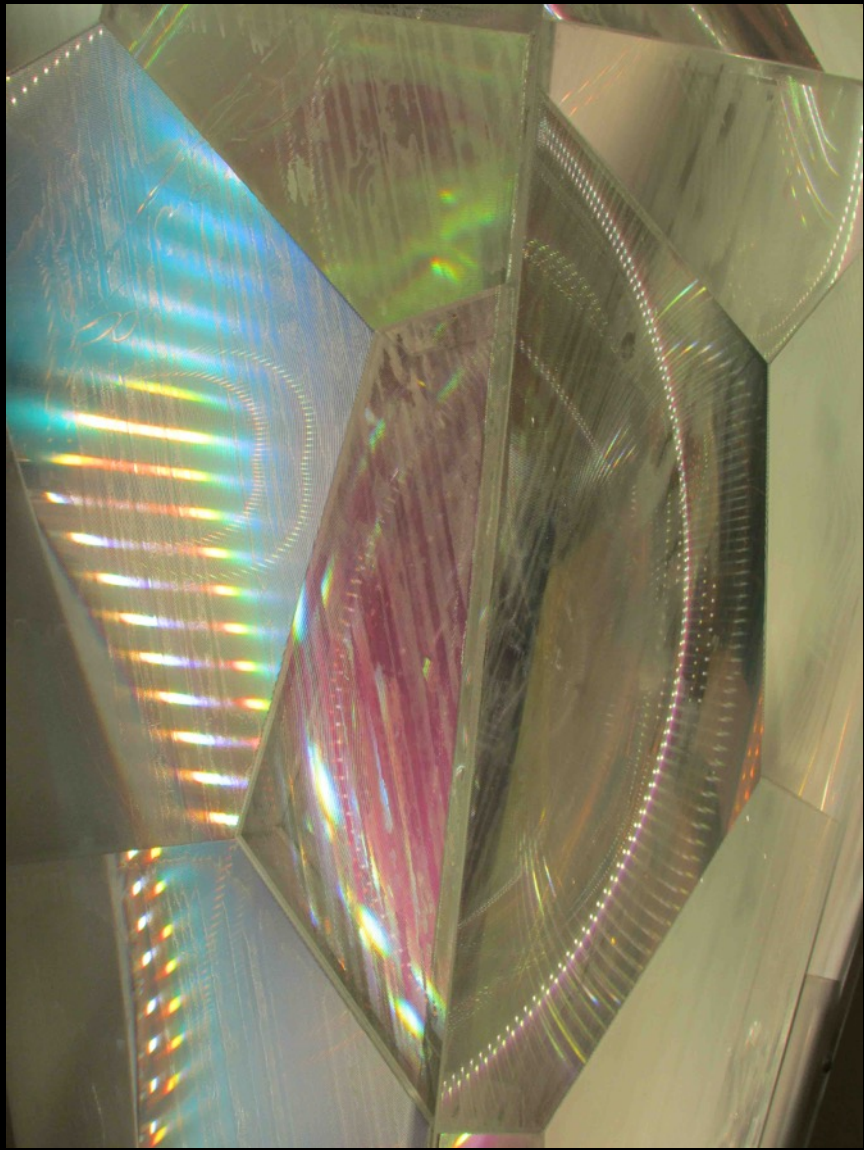
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## A Fragment of Infinity Heikki Humberg (ARTS), Megan McGlynn (ARTS), Topi Nieminen (SCI), Tuula Turunen (BIZ)











*Photo: Mikko Raskinen*



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Linda Mandell (ARTS)



*Photo: Ilari Männistö*



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## Mission in Shanghai



<http://www.ade-futurelab.com/>



**AALTO  
MATH&ARTS  
IN SHANGHAI 2019**

Aalto University  
F.L. Group  
Shanghai Science Museum

**KRISTALLIKUKKIA PEI-SALZBERG**  
KRYSTALLOIDIN KOKONAISUUS JA GEOMETRIA

**GEOMETRIAN  
KÄYTTÖ  
KÄSITTEELLÄ**

**GEOMETRIAN  
KÄYTTÖ  
KÄSITTEELLÄ**

**AALTO  
MATH&ARTS  
IN SHANGHAI 2019**

Aalto University  
F.L. Group  
Shanghai Science Museum











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Taneli Luotoneni

## SPACE HUG

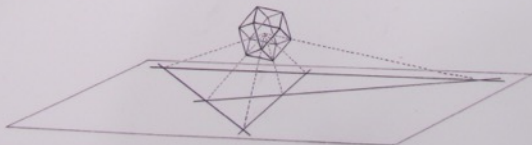
**Material:** Painted bamboo, wire

In their 1936 *Geometry and the Imagination*, Hilbert and Cohn-Vossen described how a four-dimensional polytope called the icositetrachoron, when projected from its center into our three-dimensional space, yields an elegant figure called the Reye configuration.

This structure, that shows up in many areas of mathematics, consists of twelve points, sixteen lines, and twelve planes:

- Each point is an intersection of four lines and six planes
- Each line goes through three points and is an intersection of three planes
- Each plane goes through six points and four lines

This regularity of the configuration allows a four-coloring, where none of the colors touch each other, but each of them appears at every point and in every plane.



*Each plane of the configuration is a projection of the icositetrachoron's three-dimensional cross-section*









# Laura Isoniemi workshops

- Digital printing
- Fold, Tie and Dye



# Virtual exhibition



<https://foto.aalto.fi/kristalli>

Supported by:

3D Cultural Hub (ERDF)

CoE-LaSR (Academy of Finland)

STN-Combat (Academy of Finland)

3D-Culture Hub (Aalto University)







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# Group Work in Zoom Breakout rooms

- Slides available via link

<https://docs.google.com/presentation/d/1BEV4Dk0GVzfh8WGfewOXdLE6AHOcYOQmpiABqkARxYI/edit?usp=sharing>

- Find the slide with the Breakout Room number your group has been assigned.  
**Make sure to only type on your group's slide!**
- Type your group members' names in the box provided.
- As a group, discuss the prompts below and **type your notes in the Group Notes** box. Add new slides when needed.

## Task 12.1.2021

- 1) Introduce yourself to your group mates and tell about your background and interests
- 2) List the things you find important in group work: challenges, strengths, development areas, possible roles etc.
- 3) Suggestions/good practises for online working

**Collect all data to Group Notes box and prepare to present major outcomes to others in 5 minutes/group**