

digital design

in urban environments
fall 2018

DIGITAL DESIGN IN URBAN ENVIRONMENTS 2018

ARK-54208 Digital Design in Urban Environments

Autumn Semester, 2nd period 2018.

AUTHORS: Adeline Simon, Glenn Cadoret, Mirko Carpineta, Ananda Frigiére, Guillherme Garcia, Alejandra Gutierrez, Tang Jie, Joffrey Leseur, Benoit Martin, Elise Mullens, Maena Cha, Thanh Nguyen Giulia Rizzo, Miguel Serantes, Asier Sertutxa, Manon Servieres, Joachim Westheim, Lisa Voigtländer

TAMPERE UNIVERSITY
School of Architecture

Department of Urban Planning and Design

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Layout:

Mirko Carpineta, Tang Jie, Giulia Rizzo, Miguel Serantes, Asier Sertutxa, Joachim Westheim, Lisa Voigtländer

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introduction

This publication is the fifth edition in a series of booklets presenting a selection of architecture students' design explorations undertaken during the *Digital Design in Urban Environments* course, at Tampere University of Technology (now Tampere University).

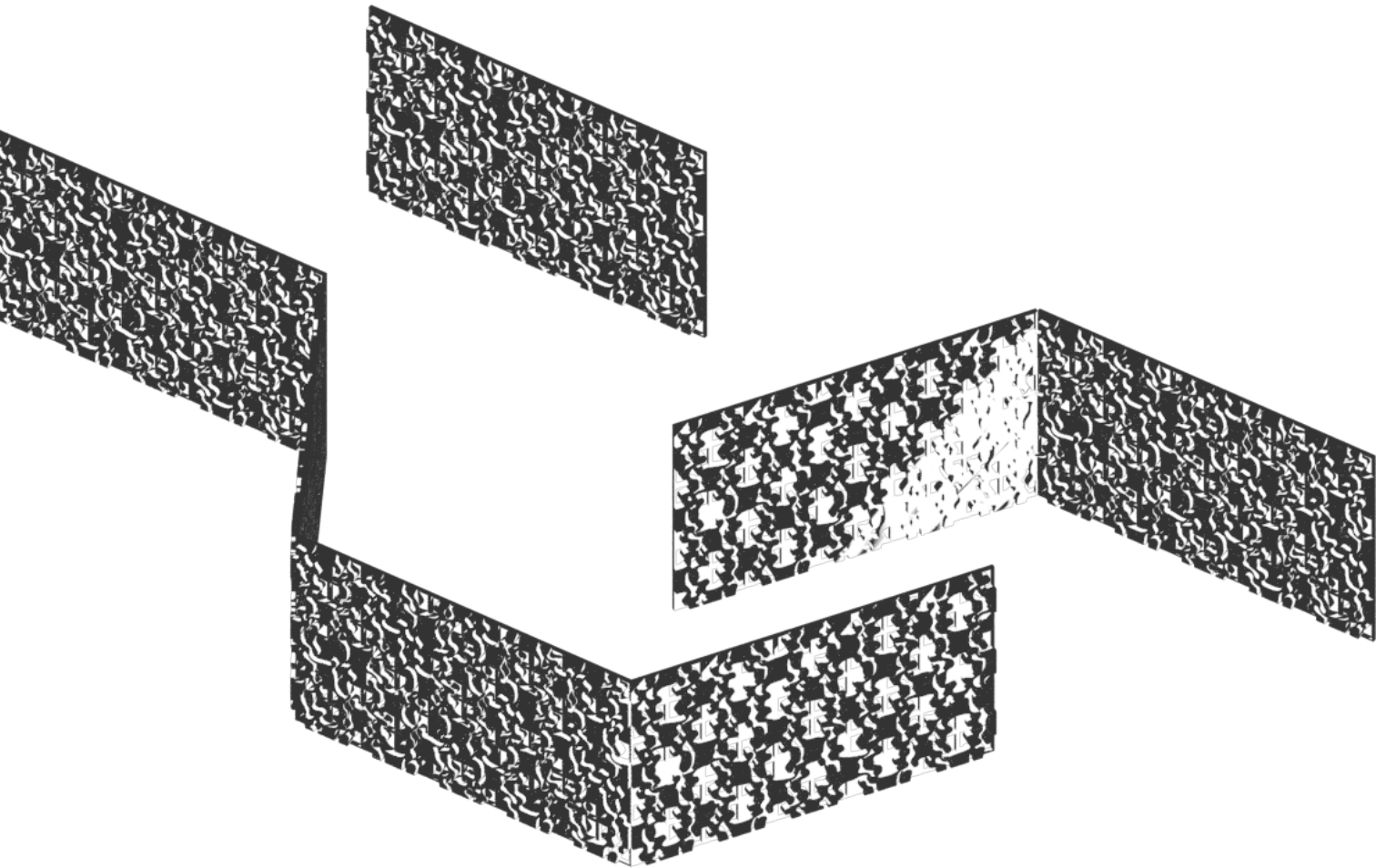
The objective of the course is to introduce and familiarize the students with the possibilities of computational design and parametric modelling. The course explores the use of algorithms in architectural design processes with a focus on their applicability in the context of urban environments.

Various design methods and analytic strategies were presented in weekly lecture sessions, during the last seven weeks of the term. Additionally, the students had to accomplish five design tasks chosen out of seven different assignments. These assignments aimed to encourage the students to investigate and implement these new possibilities in their design processes and allow for flexibility regarding the students' own initiative and individual application.

As the teacher, it is astonishing to observe the learning development of the students and the broad utilization possibilities the students discover in that very short time period and mostly without any former experience in that field. Fortunately, we once again have the pleasure to show and share some of the discoveries within this booklet. The selection of projects represented, follow the order of the given assignments.

I want to thank all the students who were involved in creating this publication as well as Professor Panu Lehtovuori and the Department of Urban Planning for their support. Special thanks to SungBok Song for his assistance during the lectures and Toni Österlund, Partner of Geometria Architecture Ltd, for sharing his expertise and supporting the course as the assistant teacher this year.

Lisa Voigtländer



01 lists

The assignment is based on a tutorial by *MODE LAB*. It demonstrates how to create and manipulate a repetitious pattern of a geometry. The aim was to draw and test repeatable geometries and manipulating the pattern of repetition to achieve a new design and aesthetic solution, for example for a three-dimensional facade.

01

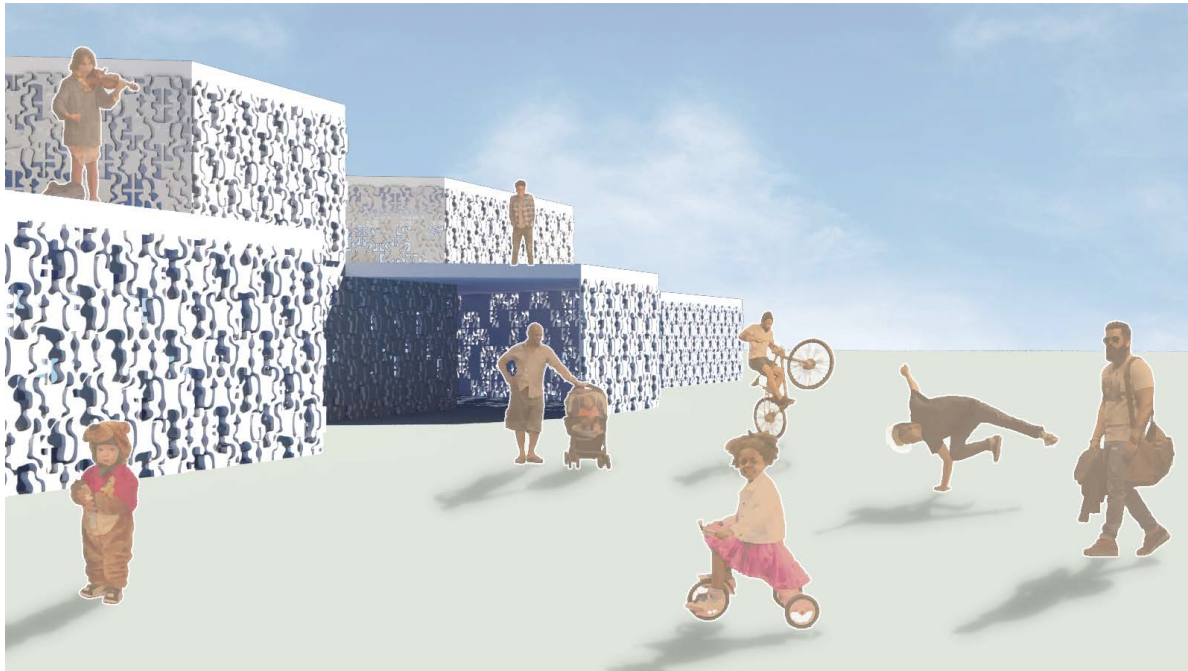
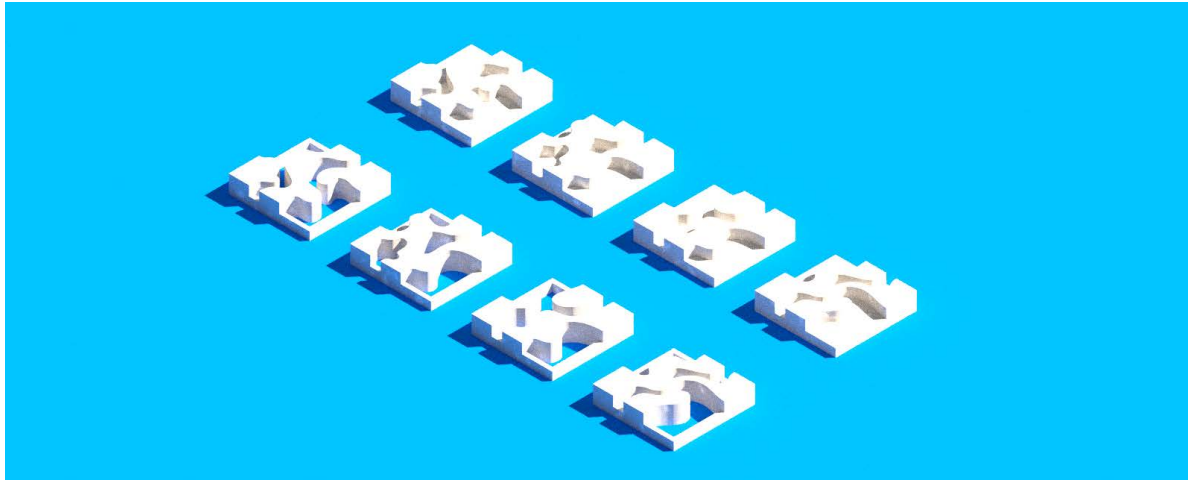


miguel serantes 8

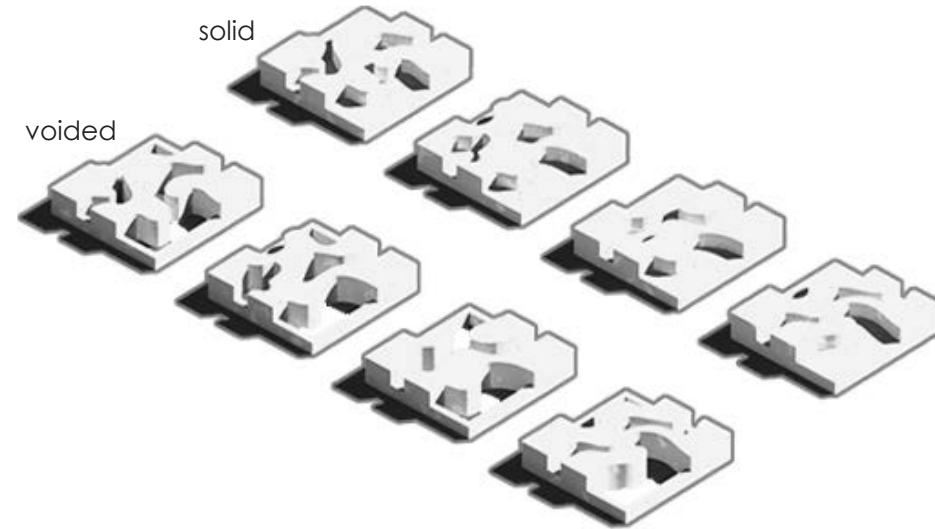
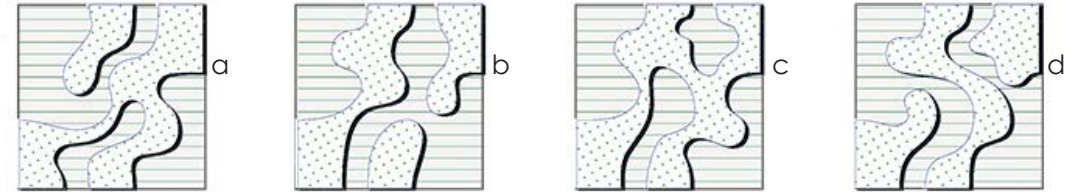


adeline simon 10

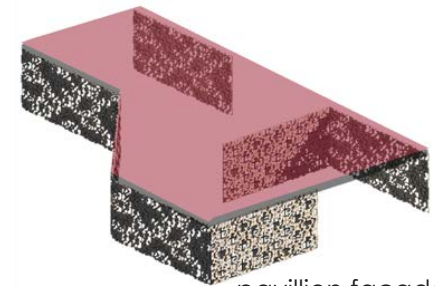
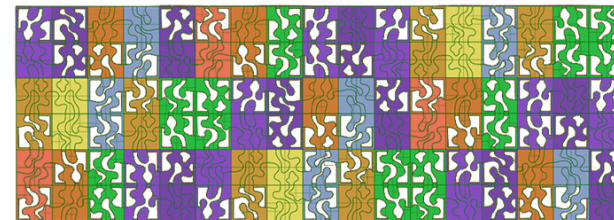
visualisation



idea



placing pattern



pavilion facade arrangement

01_lists



miguel serantes

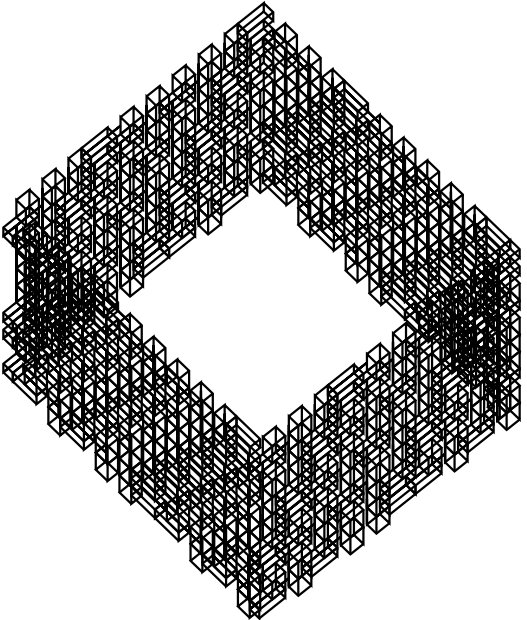
The aim was to generate a tool to fill a facade with a variety of pieces. The algorithm will shuffle and randomly place them. Some of them are opaque and some others let light through. In this way, it is possible to experiment with several facade arrangements and see how permeable they are to light or not.

visualisation

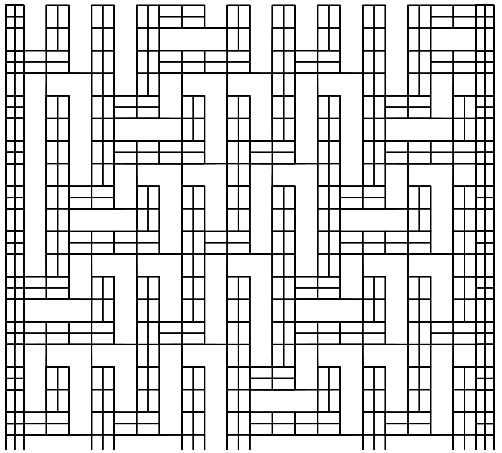


idea

woven structure



facade pattern



01_lists



adeline
simon

The idea was to create a facade for a small pavilion with a woven structure to create an interesting light and shadow pattern inside the pavilion. While preventing visual exposure to the interior from the outside, this dynamic pattern structure allows a natural illumination of the pavilion.



02

function(al)
architeture

This assignment requested to solve a design task through the usage of mathematics. Different mathematical expressions and functions can be employed to create geometrical figures, such as curves and surfaces. These can provide the basis to design a roof structure, urban plan or landscape architecture among others.

02



benoit martin14

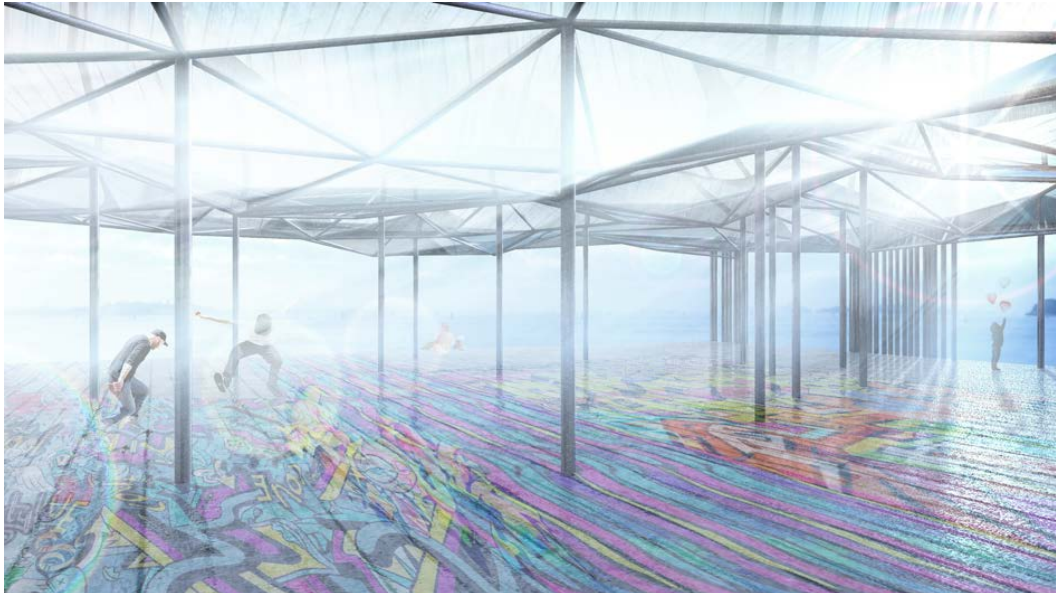


giulia rizzo16

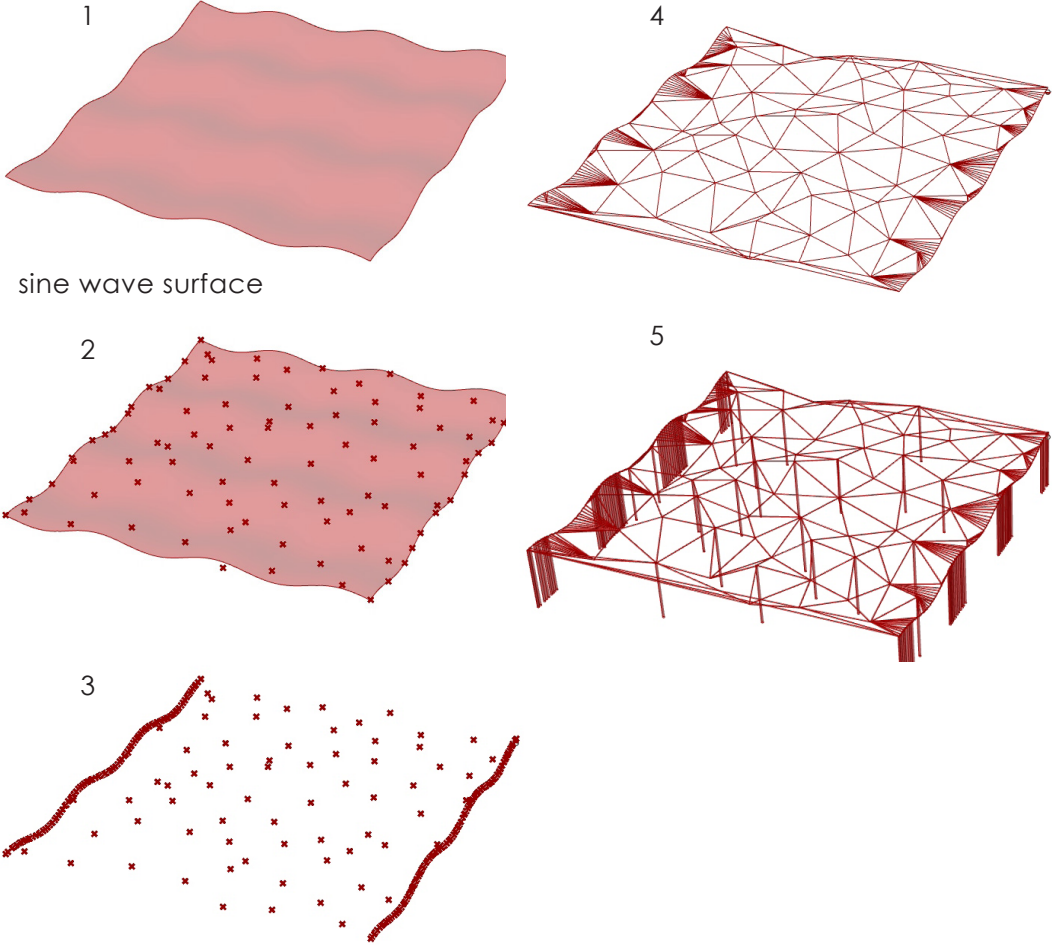


mirko carpineta18

visualisation



idea



02_function(al) architetcture



benoit martin

The operation of diverse numeric tools defined this trigonometric roof structure. A perfect canopy was imagined, moving according to the time of the day based on irregular and broken-waved shapes.

visualisation



idea



side view of geometry



top view of geometry

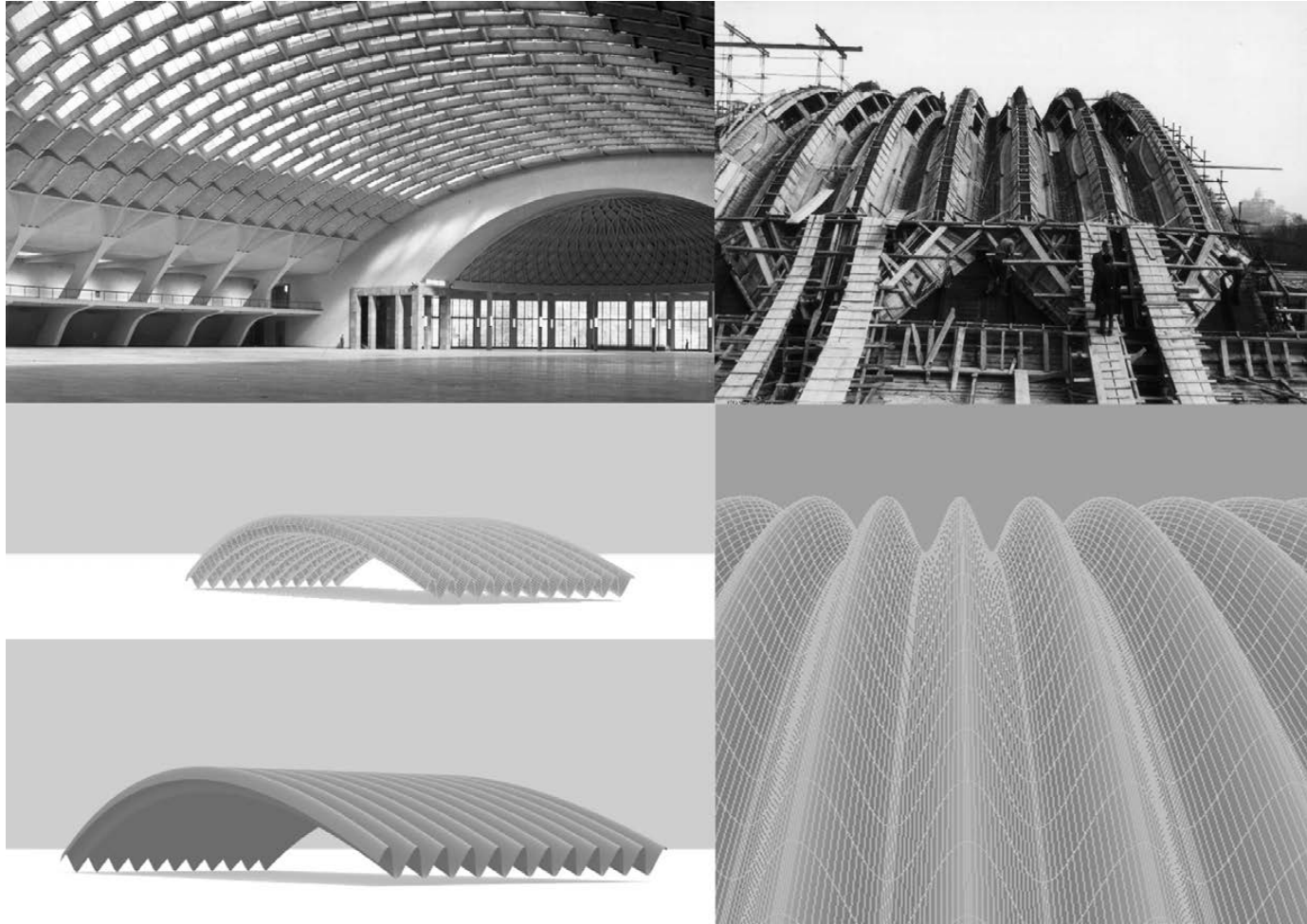
02_function(al) architecture



giulia
rizzo

Having decided to construct trigonometric curves as geometry using mathematical expressions, a spiral provided the perfect base. Sine and cosine functions using x value as the variable were used to create this shape.

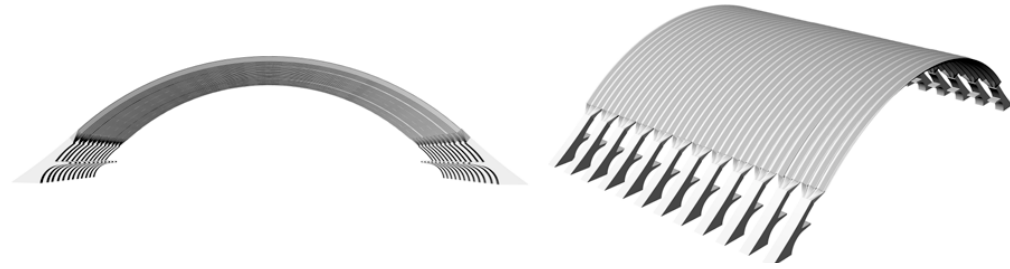
visualisation



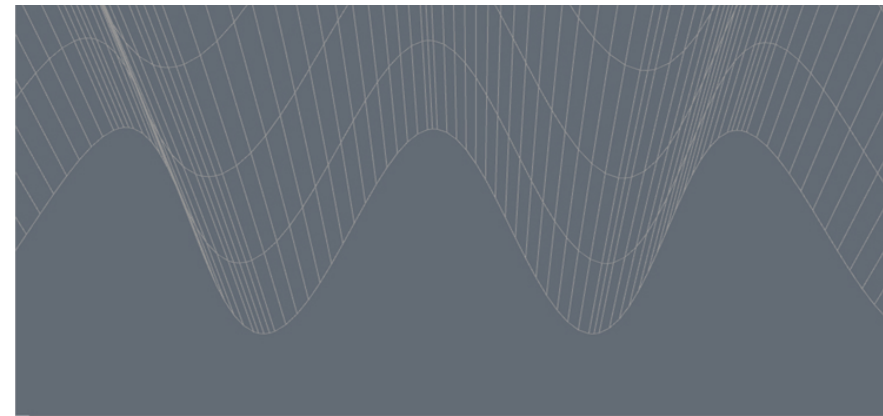
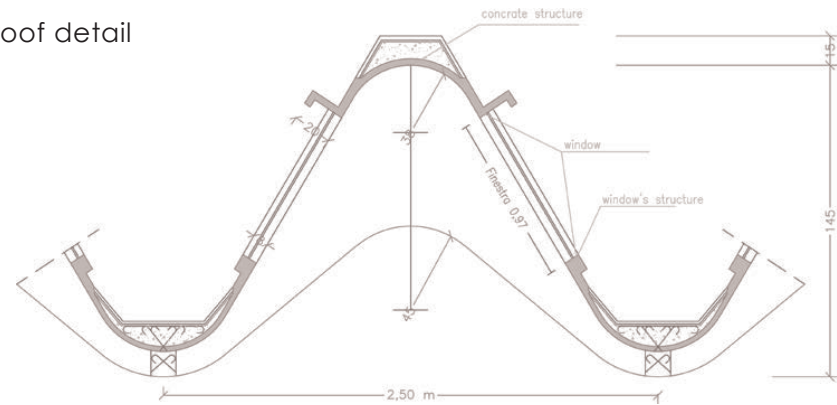
top: reference images

bottom: 3D-model

idea



roof detail



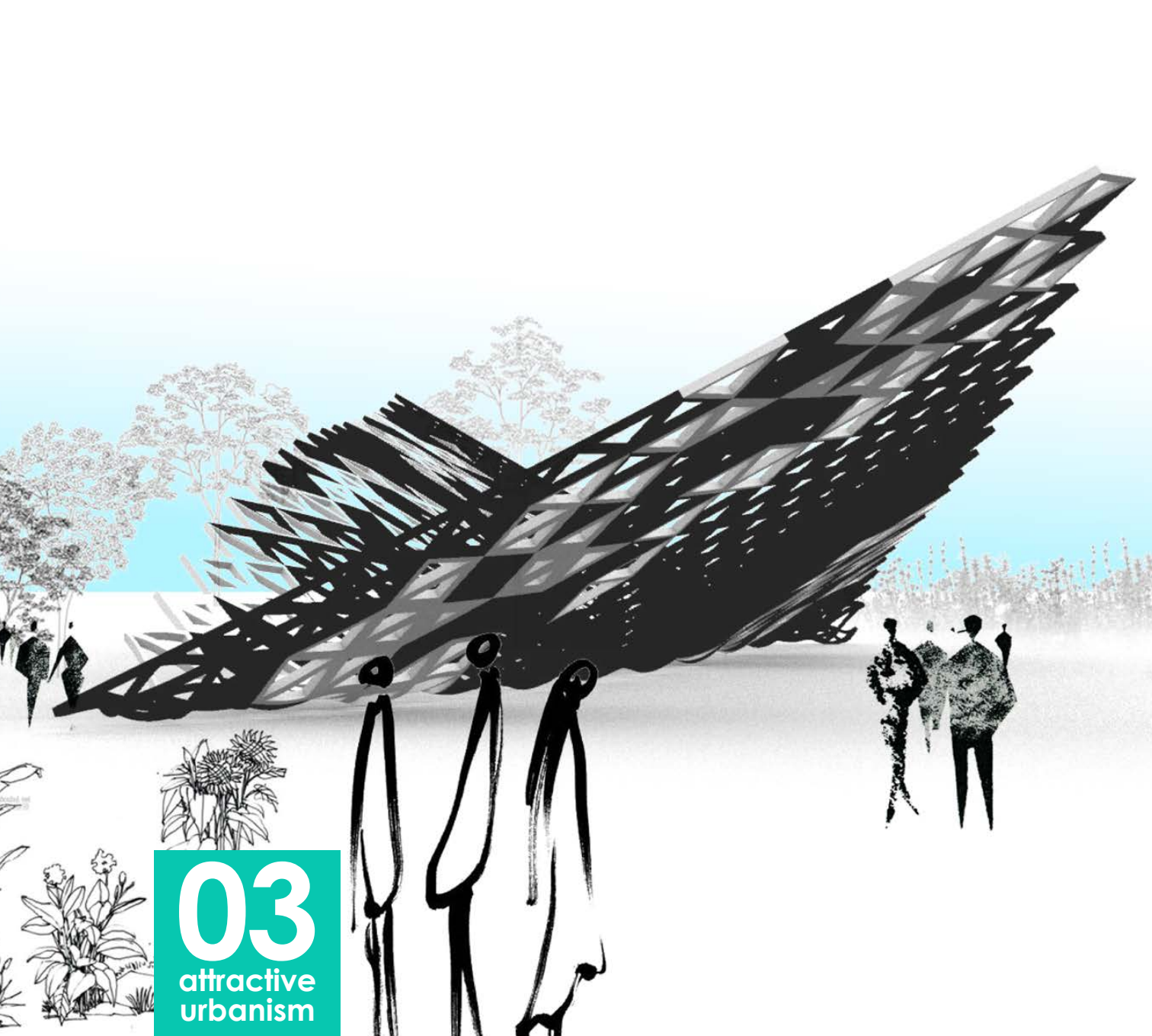
roof shape made with sine wave

02_function(al) architecture



mirko
carpineta

The geometry is a recreation of the roof from Salone B, Palazzo di Torino Esposizioni, Torino, 1947-1954. It is built in concrete, and uses the shape for structural resistance, with a thickness of just 30 cm.



03

attractive urbanism

This assignment explores the usage of attractors. Points and curves are set as attractors to determine geometry transformation. The transformation is based on the distance of e.g. a generated geometry to these attractors. The distances can be used for example, to define an according height development, or a rotation, as well as creating openings through scaling. This process can be iterated and modified to achieve multiple design variations.

03



ananda frigerie..... 22

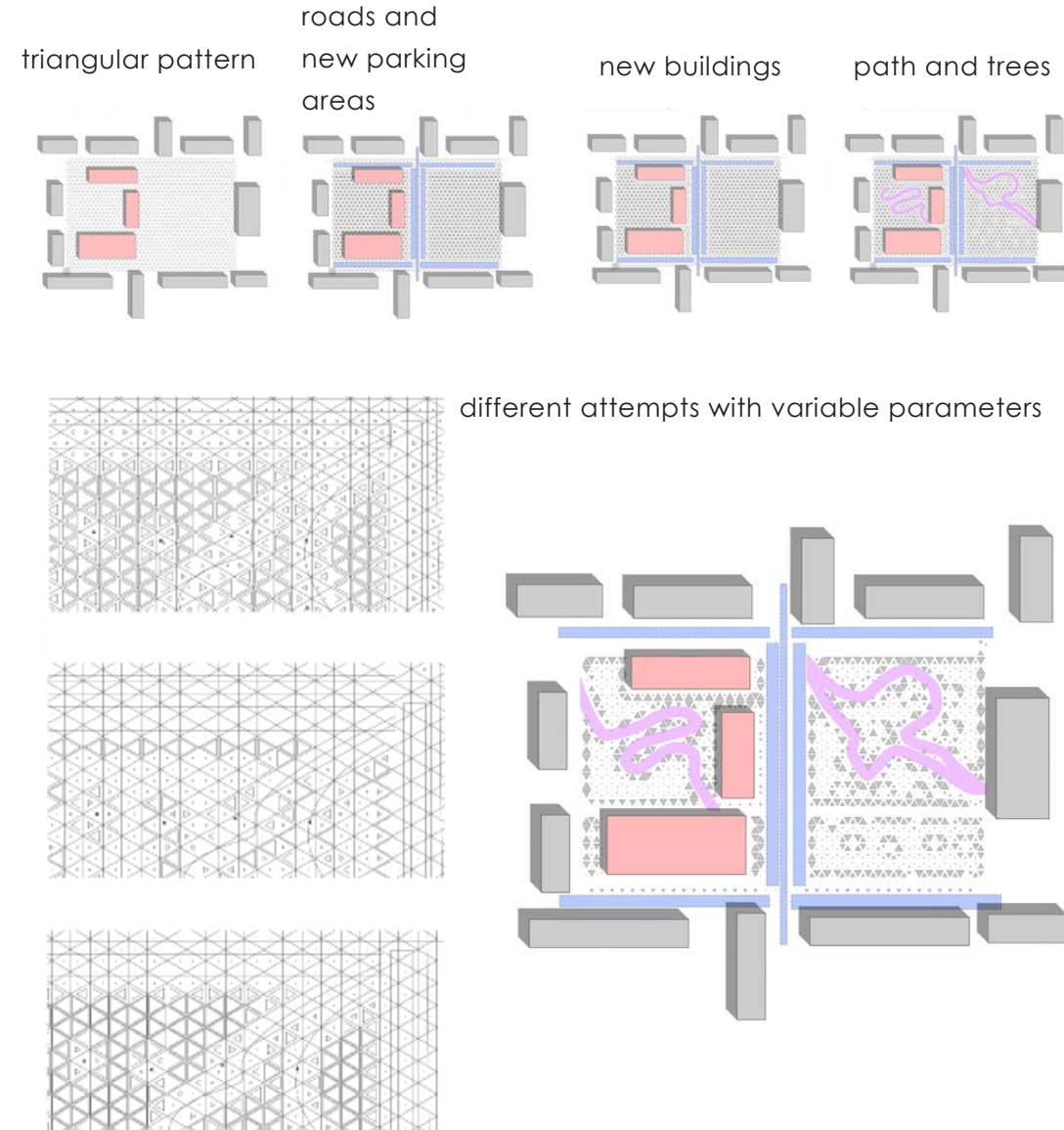


tang jie..... 24

visualisation



idea



03_attractive urbanism



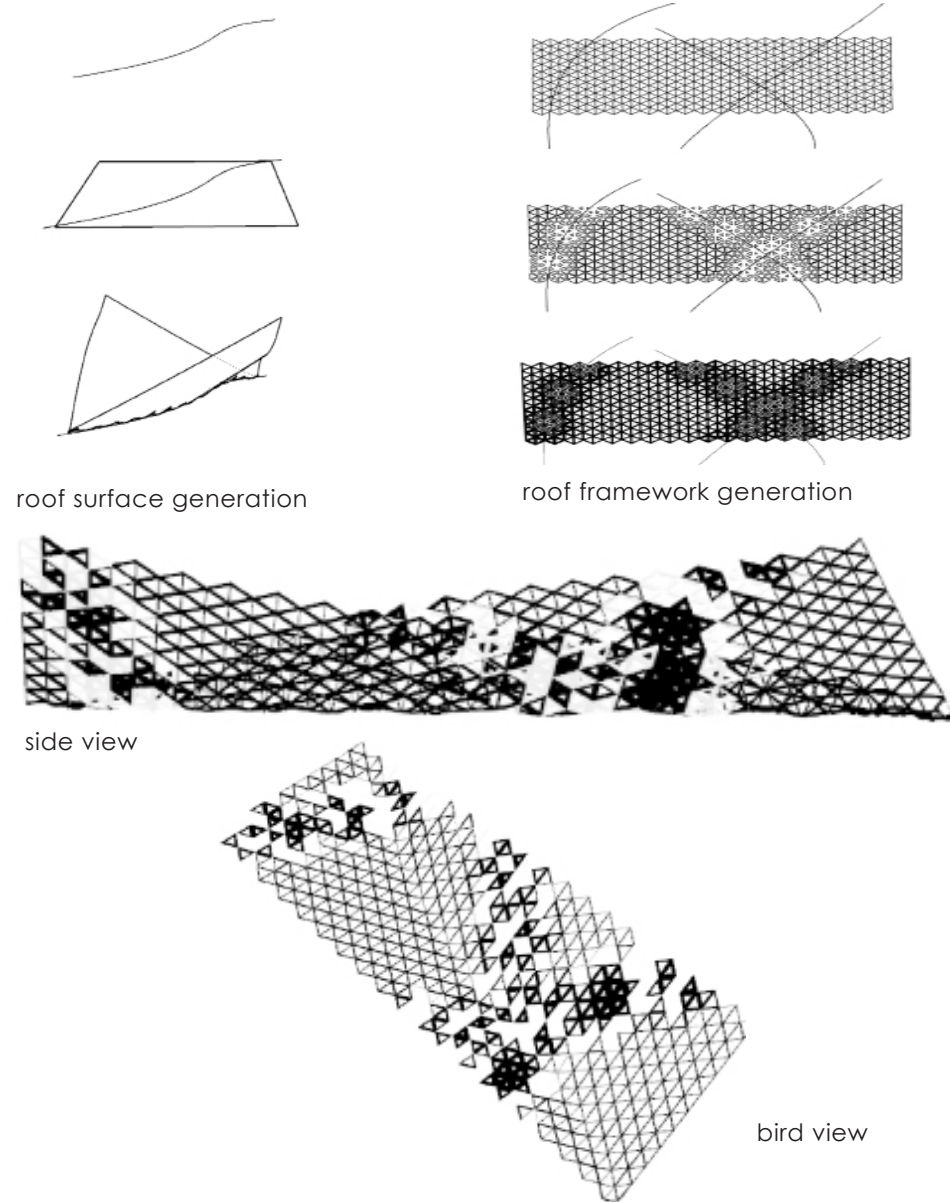
ananda frigiere

A public space was created by a function, using the different possibilities brought by Grasshopper. Once the perimetral and new buildings were set as constrictions, a trial and error process assisted in the completion of the park. The choice of a structural grid and paths helped with navigation. Finally, a visualisation was done to give the feeling of this cosy new park.

visualisation



idea



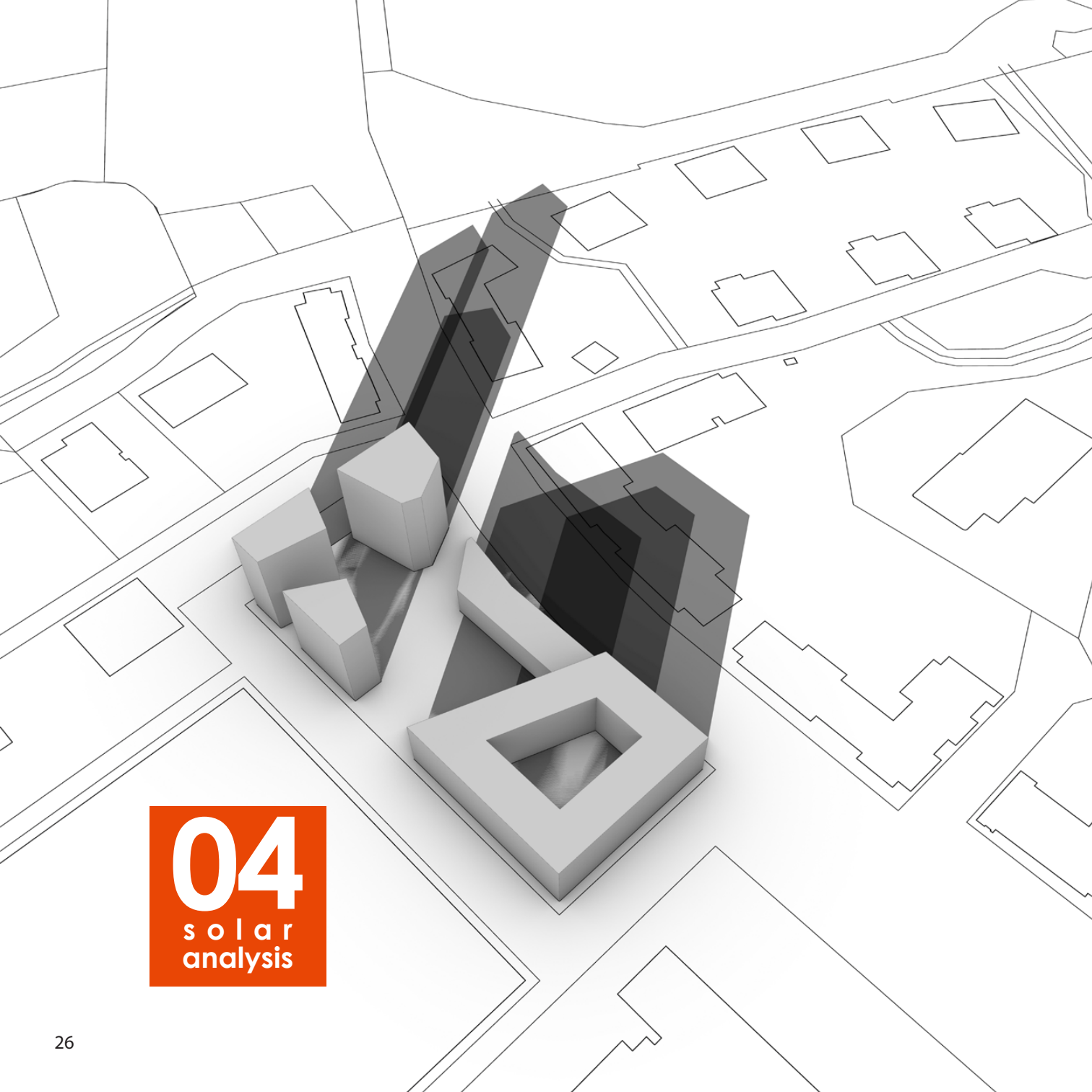
03_attractive urbanism



tang jie

The idea was to generate a roof skeleton pattern using a curve. After creating the roof surface with an adjustable fill angle the following step was to create the triangular grid and an attractor, dividing the curve and using the distance between the triangles and the curve. This results in different unit types.

Then the roof surface was mapped, using the same steps for the gradient colouring in Grasshopper.



04

solar
analysis

The exploration of solar analysis with a solar vector is the core subject of this assignment. The aim is to find a beneficial use of the solar analysis to improve, alter or even generate a design with the influence of sunlight and shadow. The following works are based on the “attractive urbanism” exercise work and individual design projects, demonstrating the utility of this analysis in different scenarios.

04



alejandra gutierrez28



asier sertutxa30



guillherme garcia32



elise mullens34

visualisation



idea



shade from the pergola different months of the year



0	0.166667
1	0.166667
2	0.166667
3	0.166667
4	0.166667
5	0.166667
6	0.166667
7	0.166667
8	0.166667
9	0.166667
10	0.166667
11	0.166667
12	0.166667

% shaded

0	36.262199
1	115.682769
2	36.262155
3	115.682685
4	121.678491
5	121.678242
6	121.678397
7	121.678491
8	121.678444
9	121.678369
10	121.678444
11	121.678397
12	36.262179
13	36.262192
14	84.134703
15	141.059748

shadow calculation

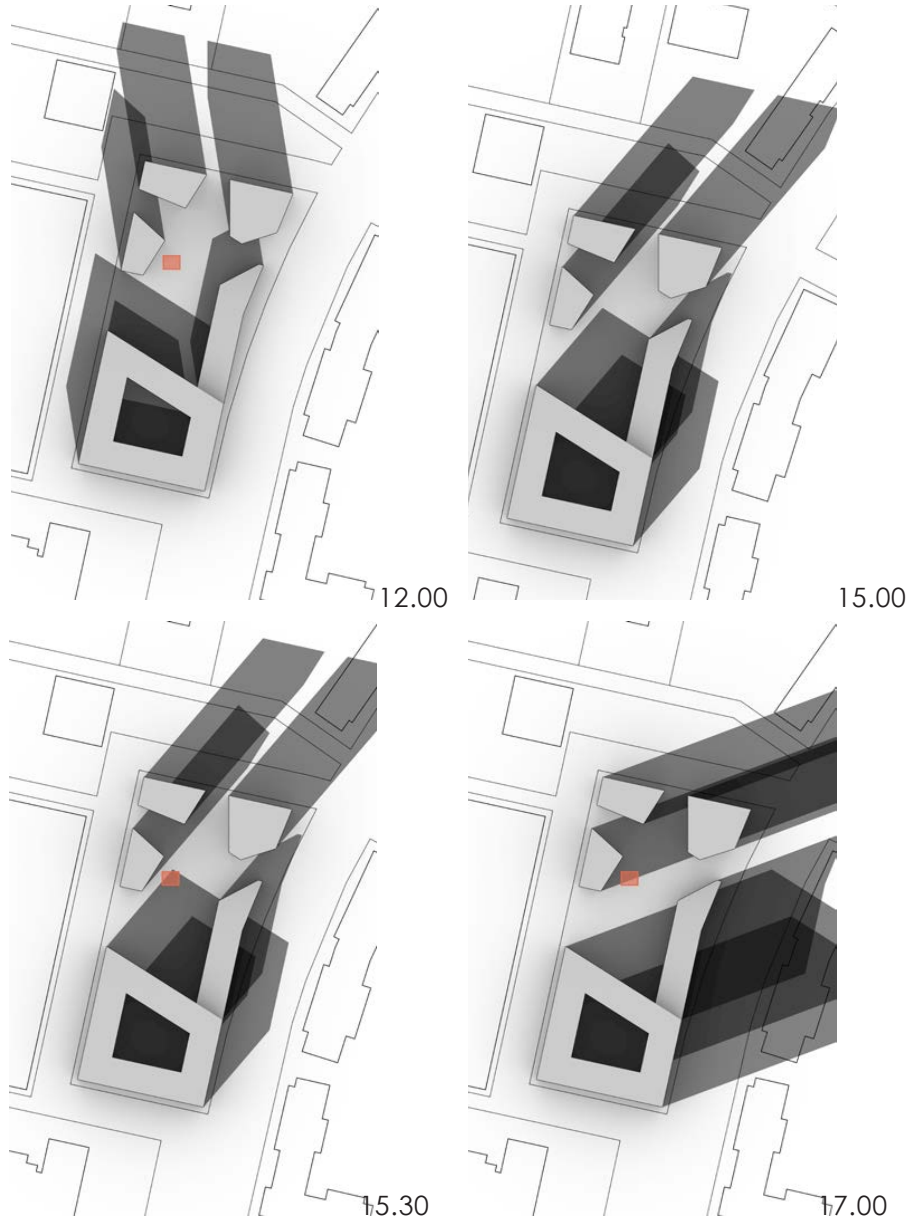
04_solar analysis



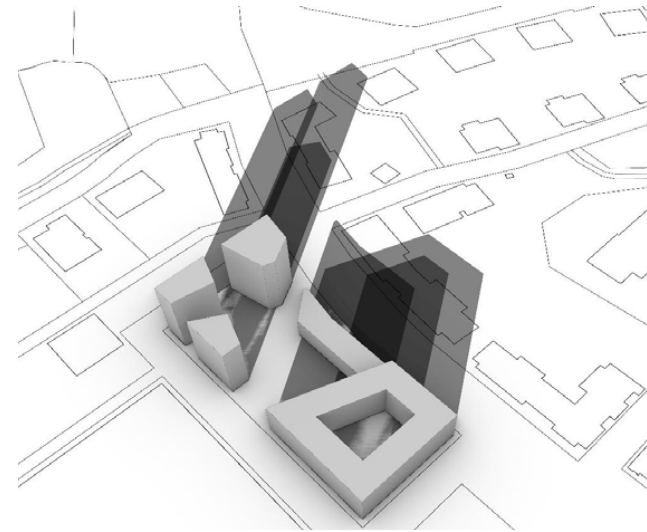
alejandra gutierrez

This was a study of solar energy recieved as well as the shadows casted by a garden pergola. This was conducted on the 21st of every month of the year.

visualisation

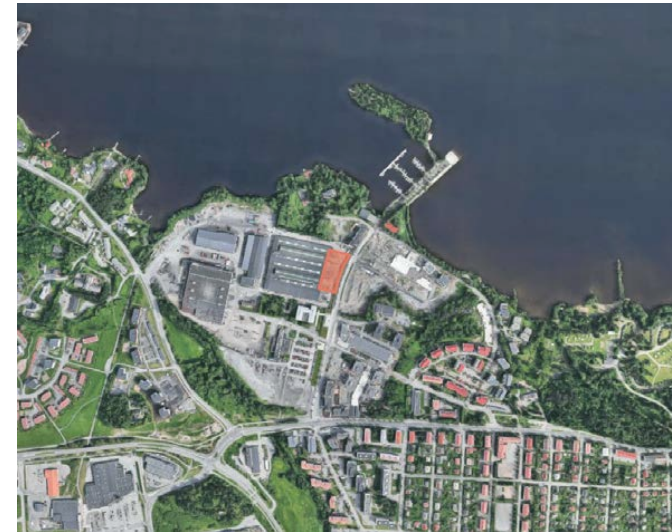


idea



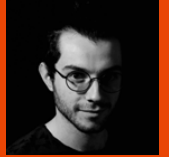
The party will come to an end when the shadows overtake the entire location area, at 17:00 exactly.

site in Tampere



The party will start at 12:00. There will be a shaded half an hour . For this reason moving to a nearby sunny spot from 15:00 to 15:30 is recommended.

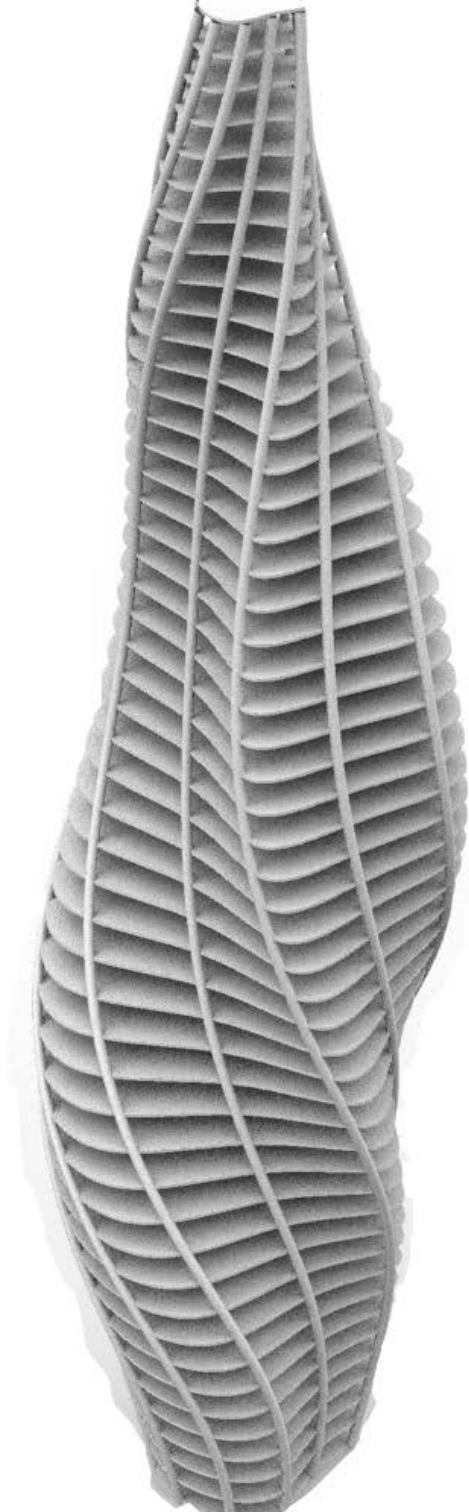
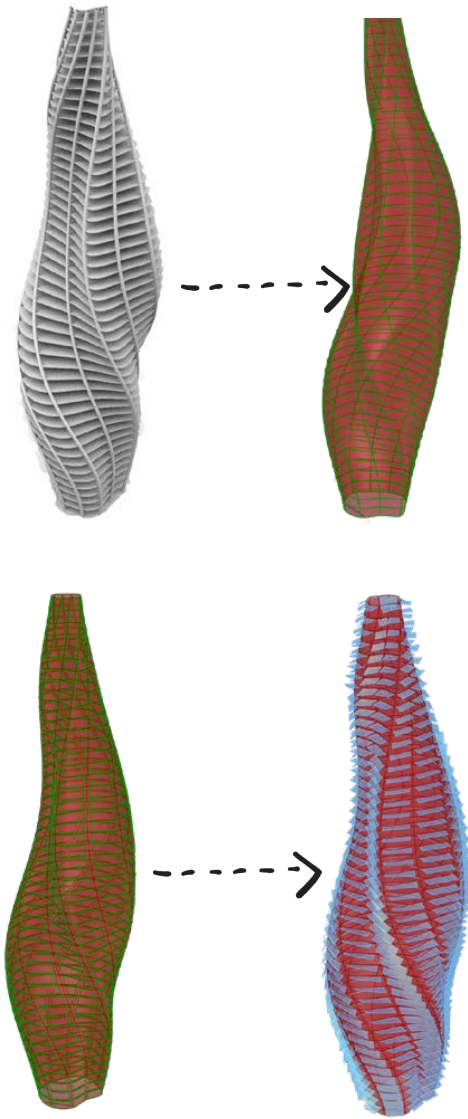
04_solar analysis



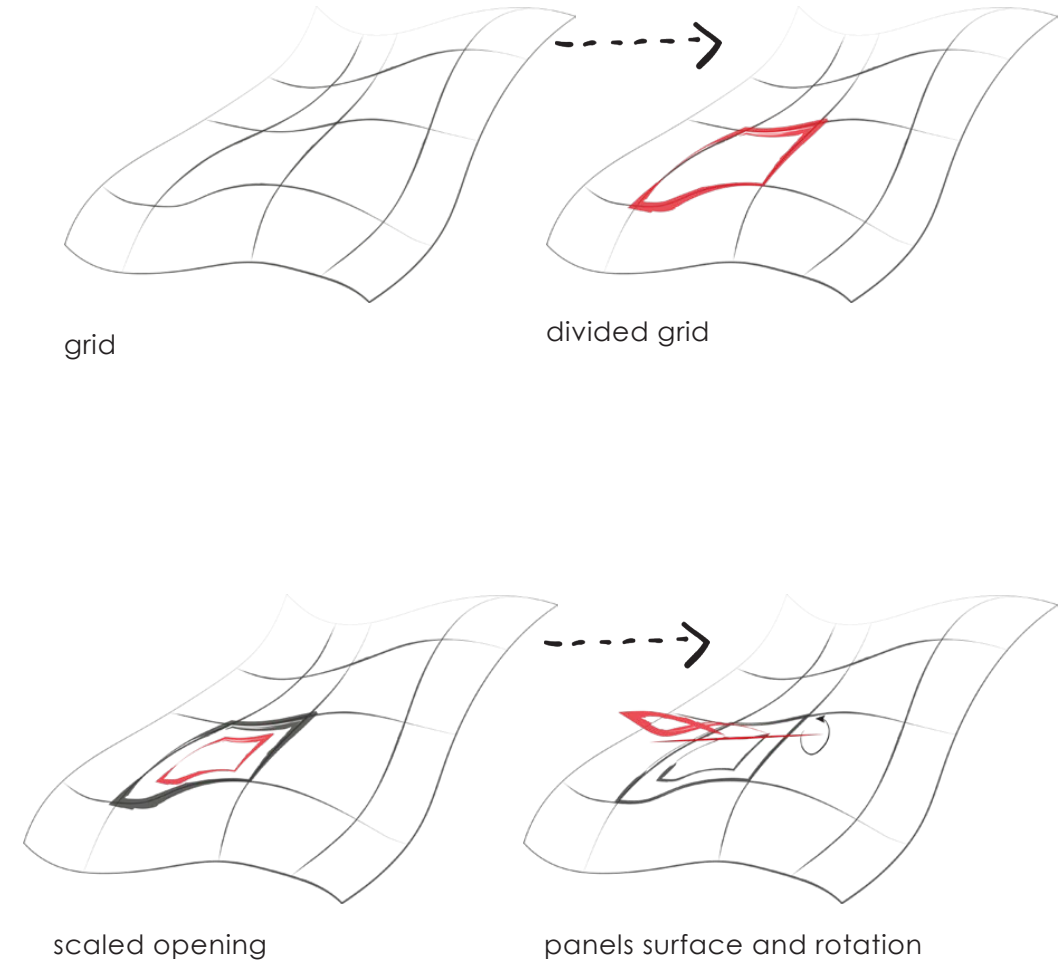
asier sertutxa

This analysis seeks for the most suitable corner in the selected area for a celebration event. The criteria to find the best spot was to avoid the casted shadows in the cold month of March on the 20th in Tampere. With the results, not only the location was defined, but the schedule for the celebration had been set.

visualisation



idea



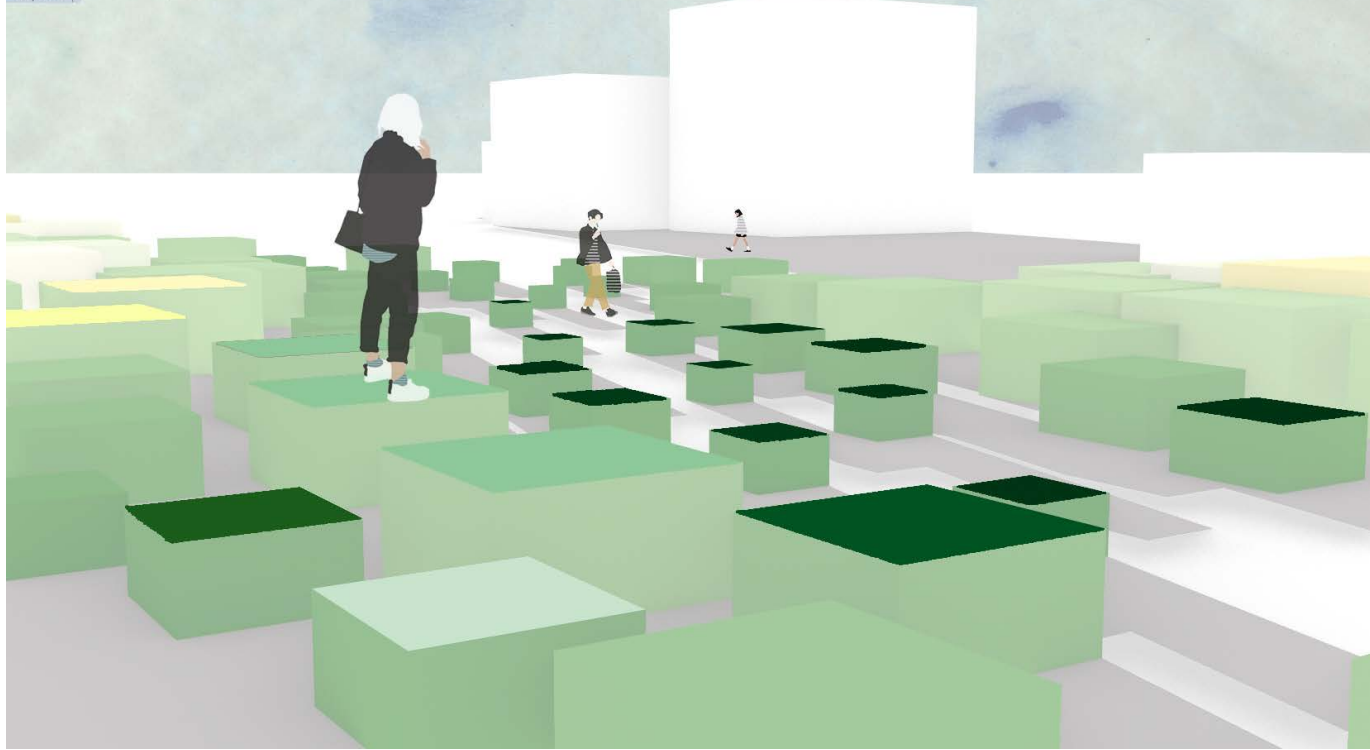
04_solar analysis



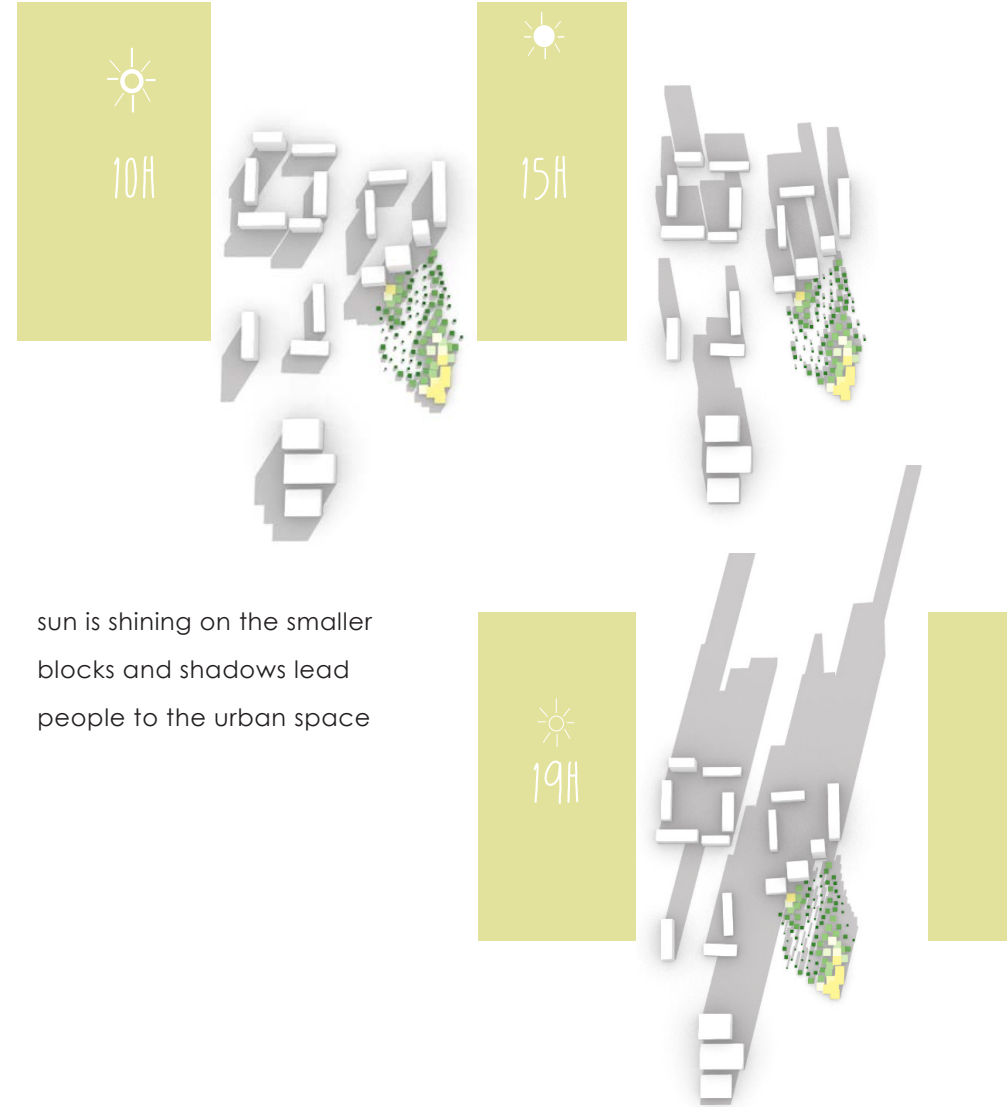
guilherme garcia

This was the description of how an automatic shading device was implemented on a tower. In order to function properly, the shading device needed to open whenever the sun was not directly on the panels and then closed when facing the sun.

visualisation



idea



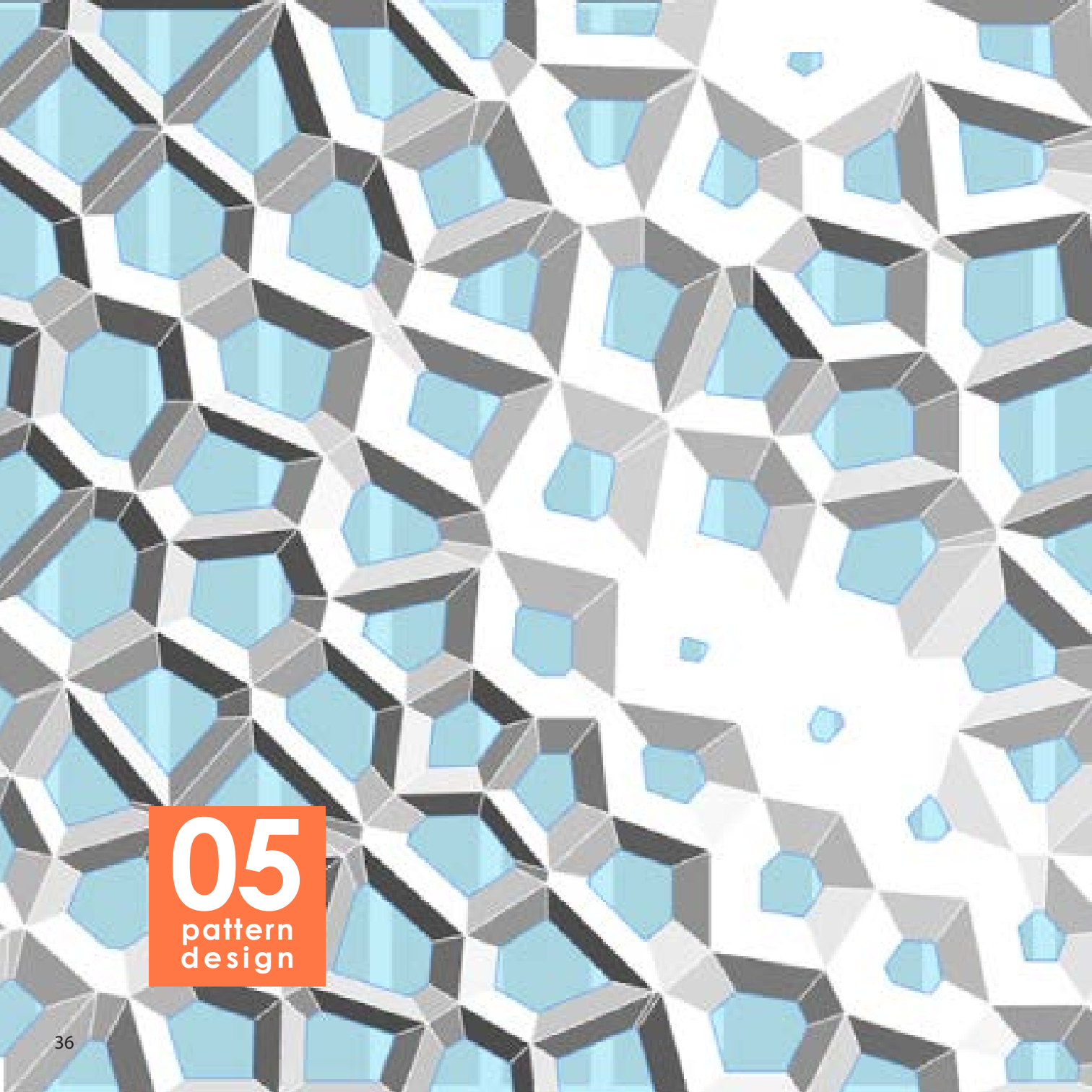
sun is shining on the smaller blocks and shadows lead people to the urban space

04_solar analysis



elise mullens

In this design for an urban installation, created for a previous exercise, the casted shadows strengthen the intention of marking a main path through which directed to the nearby spaces. This effect was perceived while analyzing the lit and shadowed areas: pure serendipity.



05

05 pattern design

The aim of the following assignment is to familiarise with the creation of patterns. Grasshopper is offering several methods to generate patterns, for example, by different meshes or grids. Very popular is the pattern of the Voronoi mesh, which is based on points that can be set manually or randomly generated. The pattern design allows to explore and develop different options and variations for a design project. These patterns can be used as the basis of a geometry or a reference grid for several design concepts.



glenn cadoret 38



jeffrey leseur 40

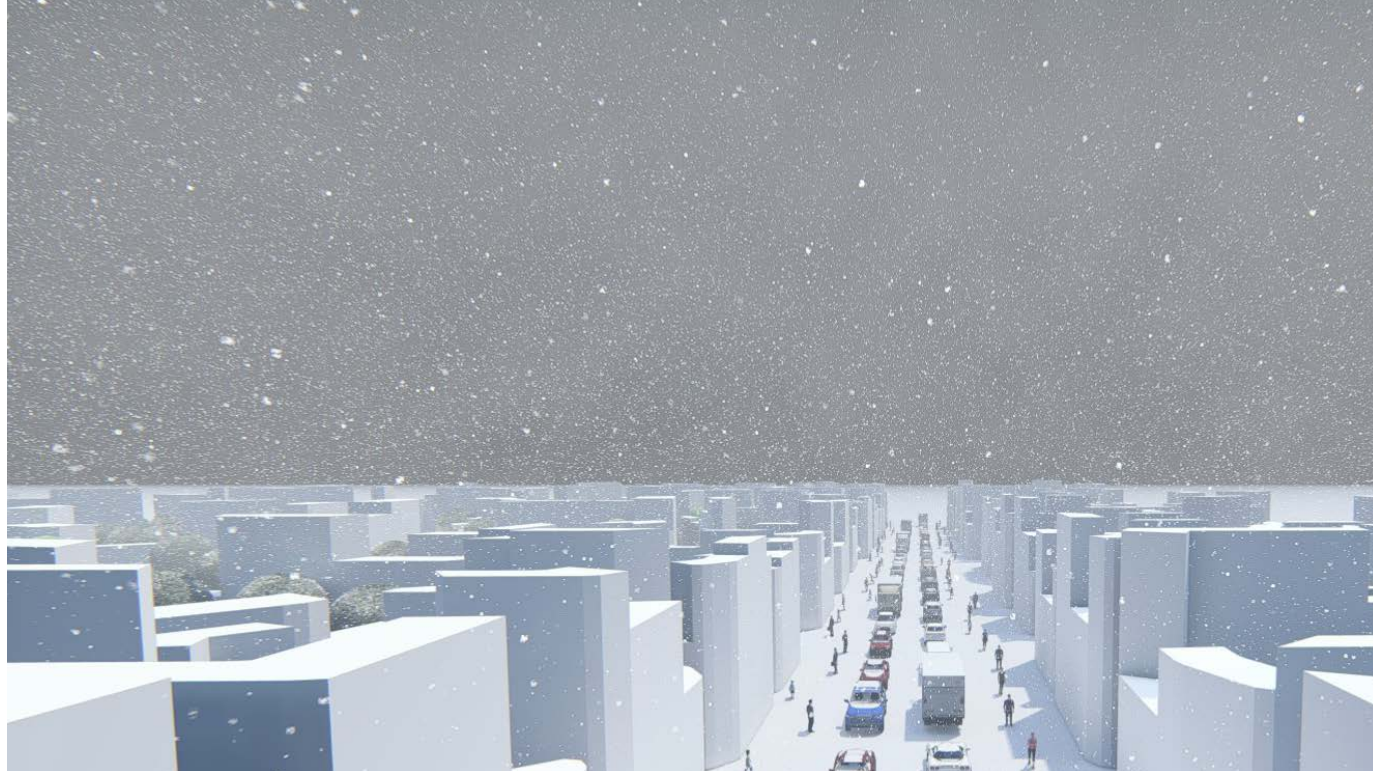


thanh nguyen 42



manon servieres 44

visualisation



idea



axonometric view



top view



section

05_pattern design



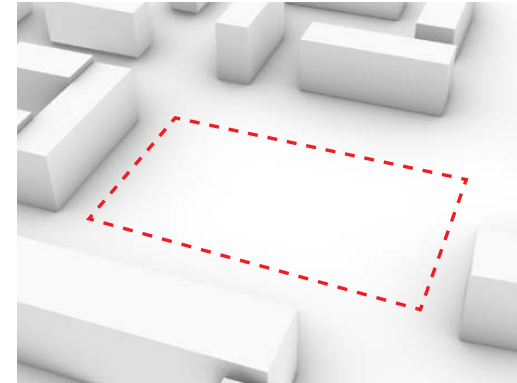
glenn cadoret

The main idea was to redraw the urban street network along a boulevard in Rennes, France. To define the new 'isles' frame a Voronoi mesh was projected along the location. The focus was on the creation of different layouts of density, green areas and a variation on height along the boulevard.

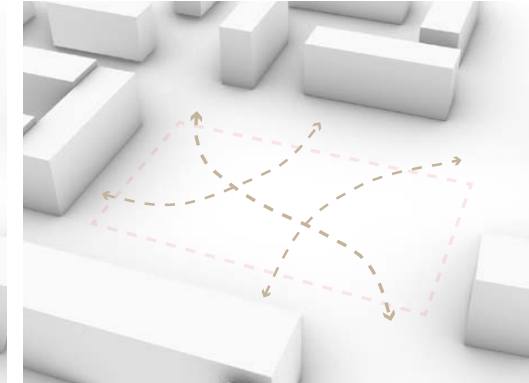
visualisation



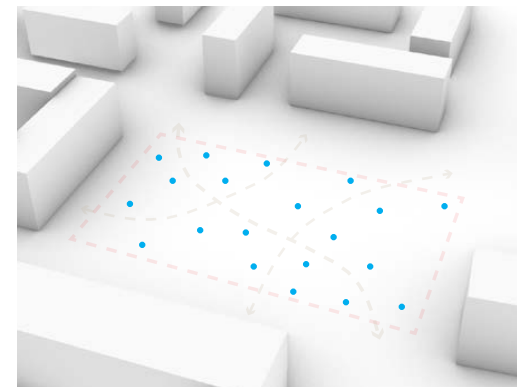
idea



site



circulation paths



placement of benches



result

05_pattern design



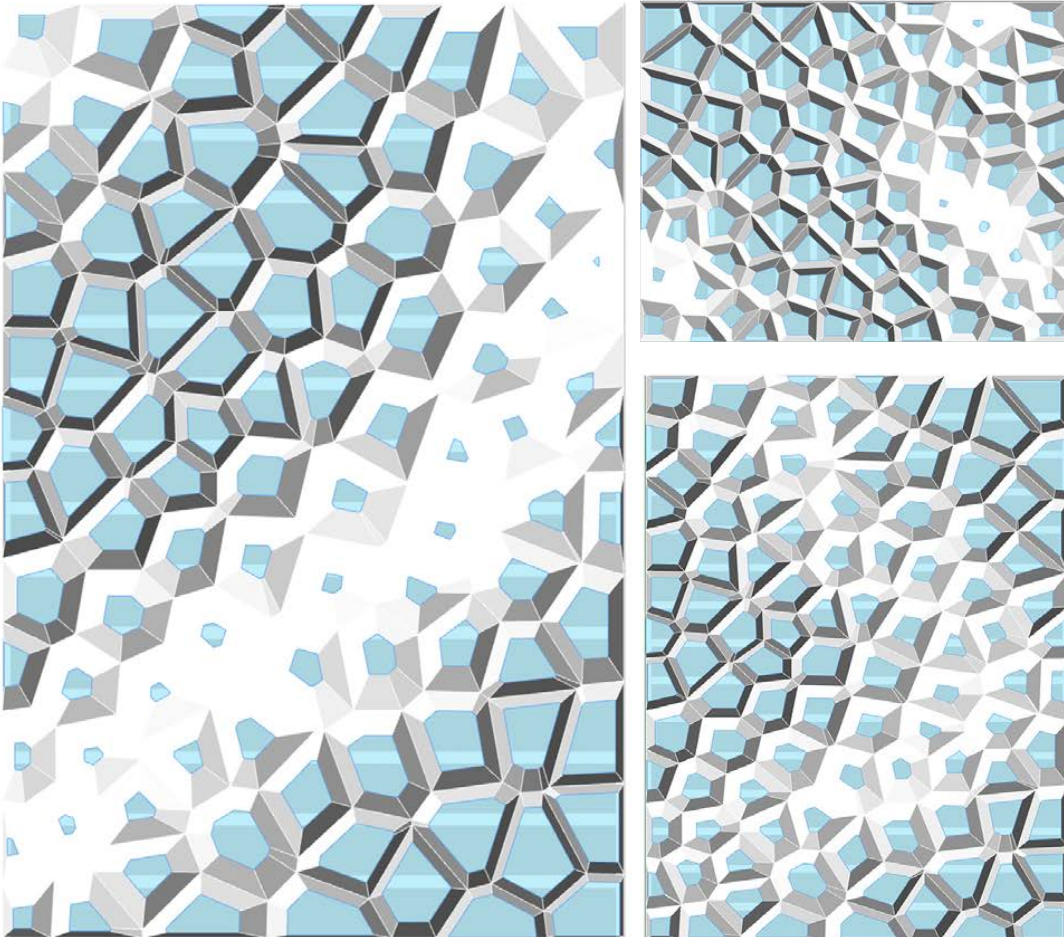
joffrey leseur

This was an intervention in a site in Hervanta to create public benches of different sizes. The goal was to maintain three paths that cross the delimited area. These paths were created by the positioning and morphology of the benches, that were round and they enclosed small spaces for either planting some greenery or placing a pond.

visualisation



idea



facade pattern

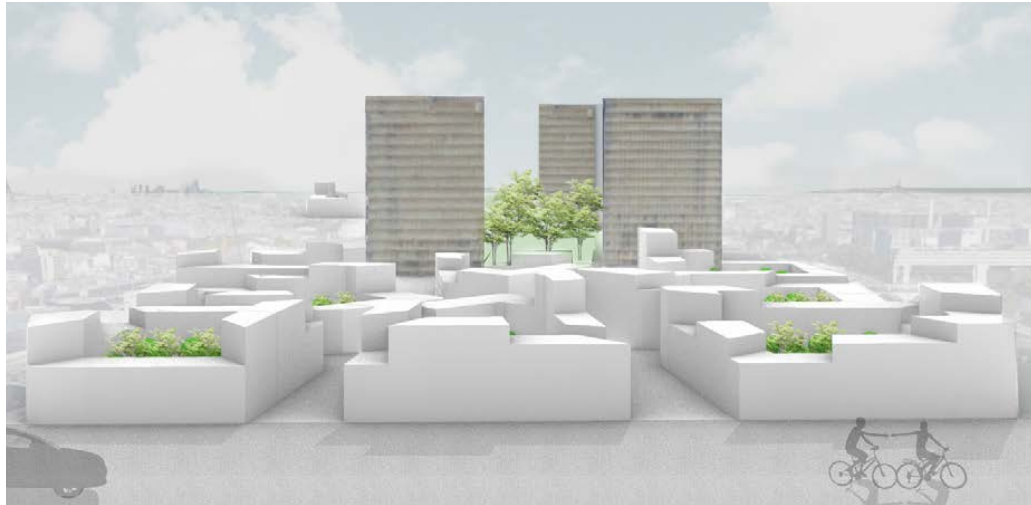
05_pattern design



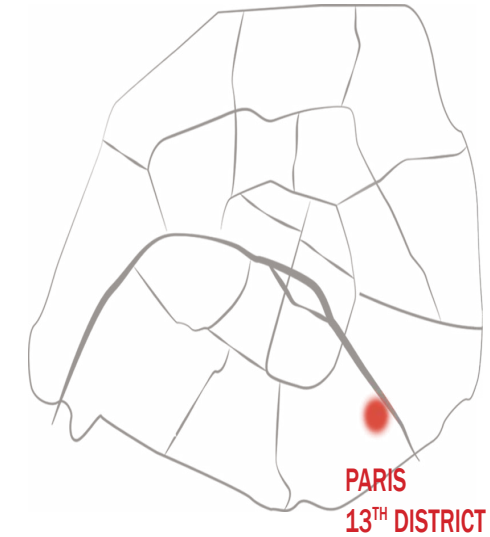
thanh nguyen

This is a remodeling of a facade created using a curve attractor for a previous exercise. For this new skin, a Voronoi pattern was combined with the old creation process. Many variations and combinations were created.

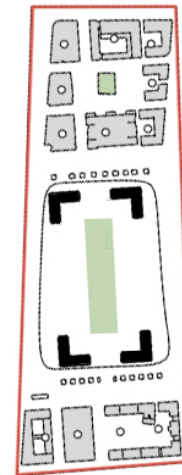
visualisation



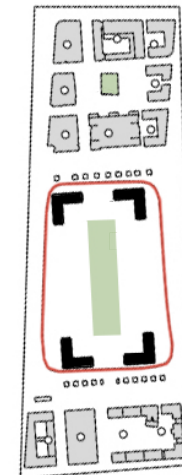
idea



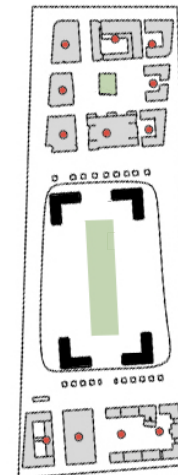
location



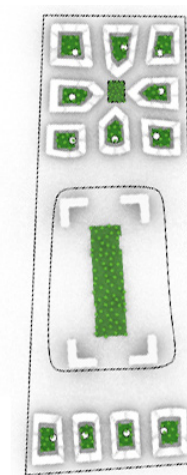
area



road



points



new plan

05_pattern design



manon servieres

Here is a proposal for remodelling the street network around the National Library of France in Paris. The intention of it was to give a new fresh atmosphere to the appearance as well as provide a structure to bring order within it. The four main buildings were kept as they are nowadays, as a central main area. The northern and Southern blocks were organized in order to highlight this important cultural landmark.



06

isovist
analysis

The purpose of this assignment is to explore and make use of the Isovist -field of view- analysis. Several routines can be generated, to show a graphical representation of the visual range in the analysed area. This is a useful tool to evaluate different proposals of new projects or to contrast perspectives in existing public spaces.

06

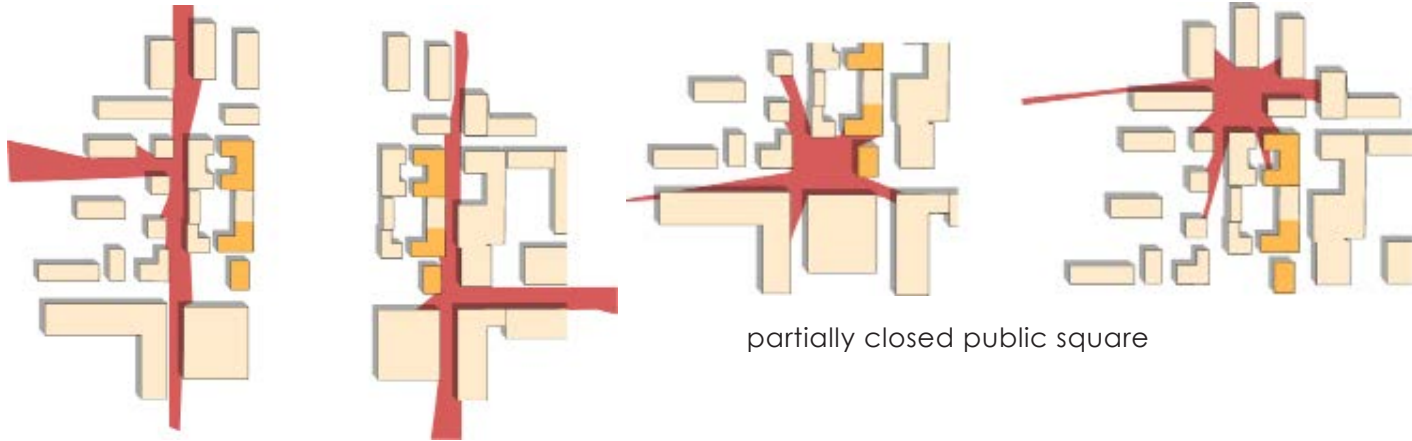


ananda frigerie 48



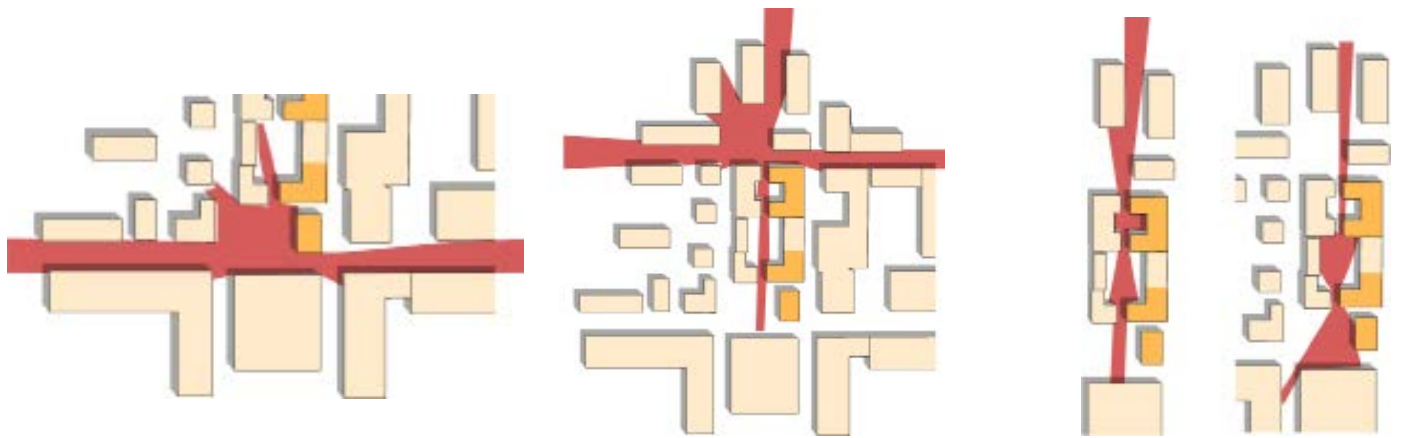
miguel serantes 50

visualisation



partially closed public square

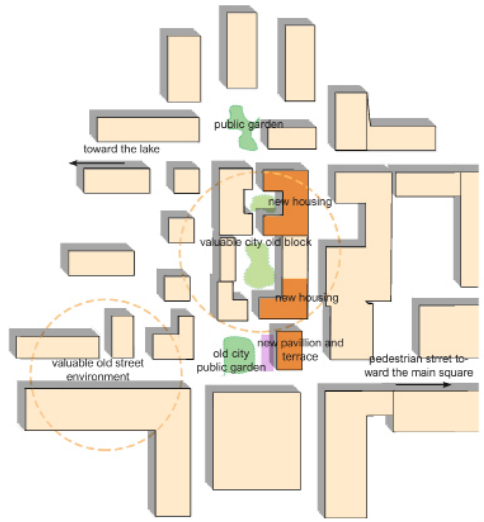
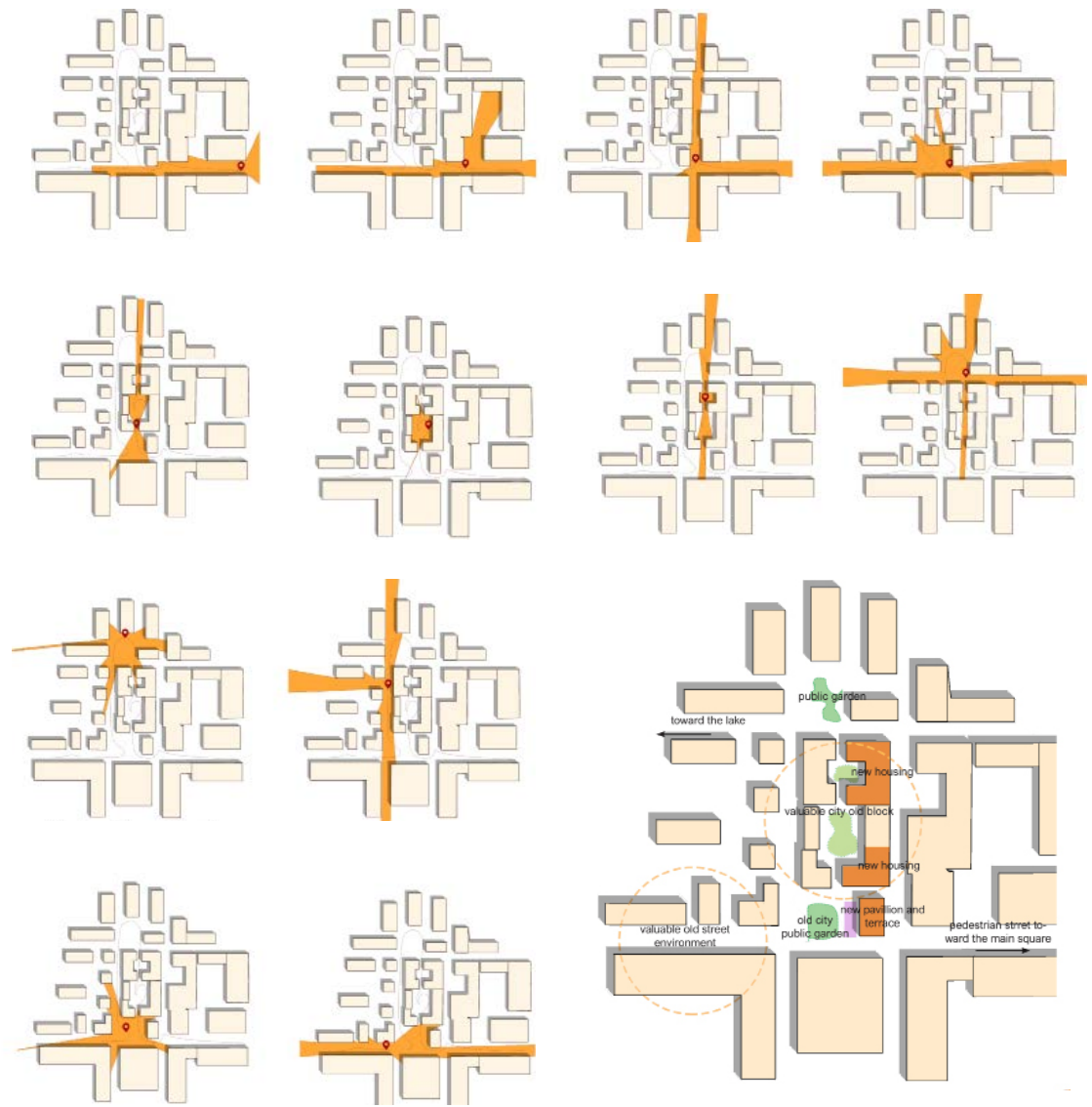
crossing roads long perspective



streets with side dilation and long perspectives

inside city block narrowing and widening presenting some long perspectives

idea



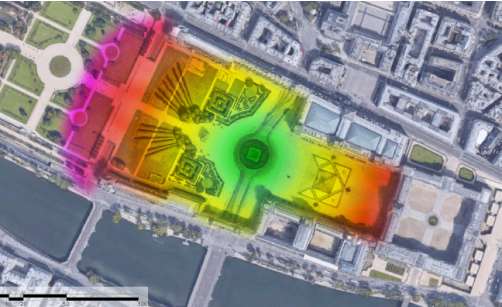
06_isovist analysis



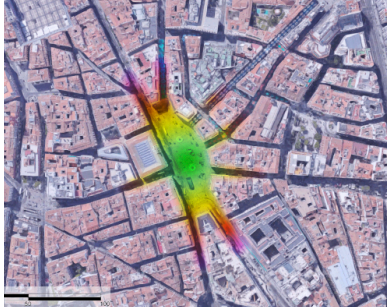
ananda frigiere

The isovist analysis was based on a competition proposal for an infill in a historical environment in Lappeenranta. It is a walk through the old and the new, using Grasshopper to presenting different urban atmospheres.

visualisation



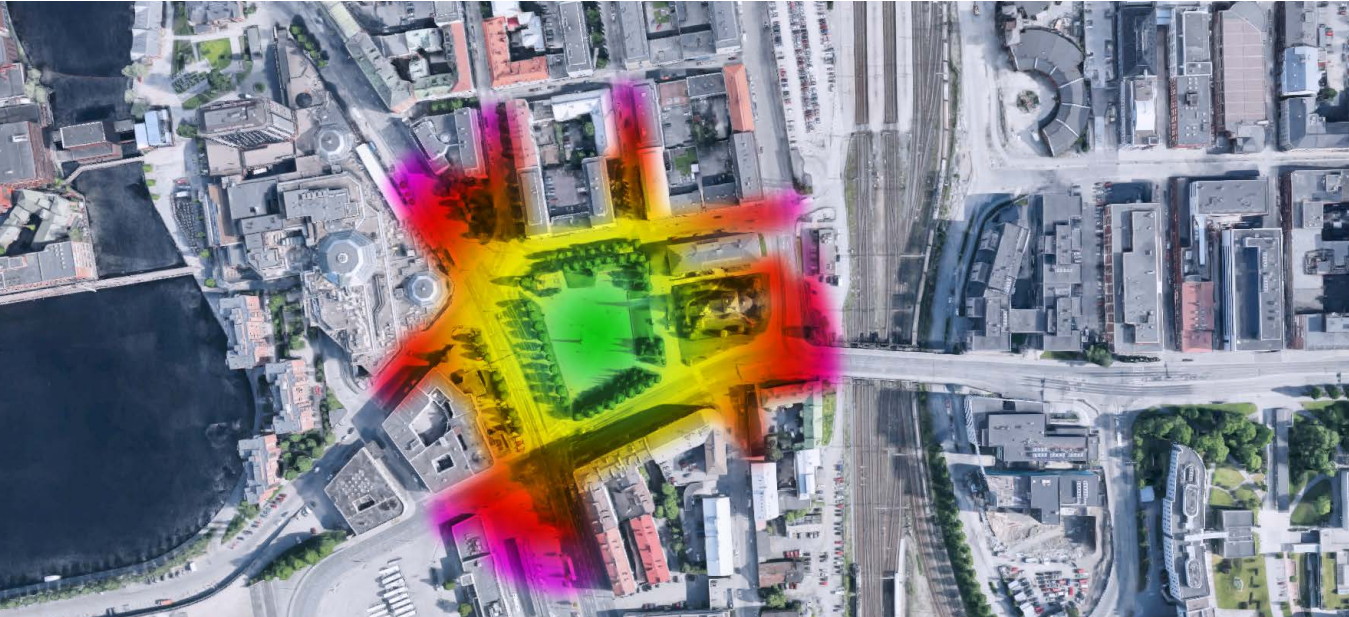
paris



madrid



helsinki



tampere

idea

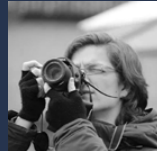


isovist field from superposition of several layers of an animated slider



gradient results of overlapping isovist fields

06_isovist analysis



miguel serantes

The goal was to generate Isovist displays, defined by squares.

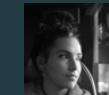
Initially, it could be done with an animation through a square outline. It became easier to make a definition that builds an Isovist field, coloured by distance to the centre of the square outline.



07
 bitmap
 mayhem

The following works are various approaches to the bitmap assignment. Bitmap images and their values, such as brightness and contrast, colour tone or saturation, are used as parameters to influence the generation of geometry. Most frequently the image brightness is employed, for example to define the height development of a geometry. Any kind of image can be used or self created for design processes, providing inspiration for architecture, urban design or landscape design.

07



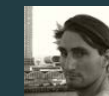
maena cha 54



thanh nguyen 56



tang jie 58

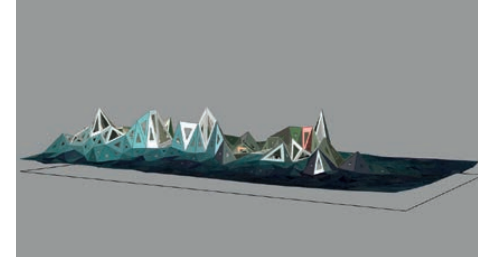
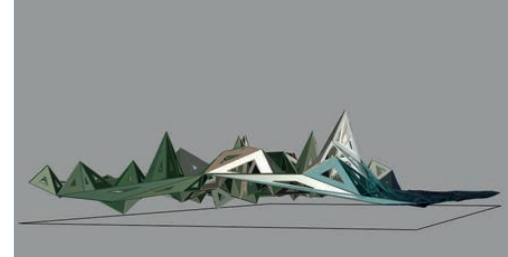


joachim westheim 60

visualisation

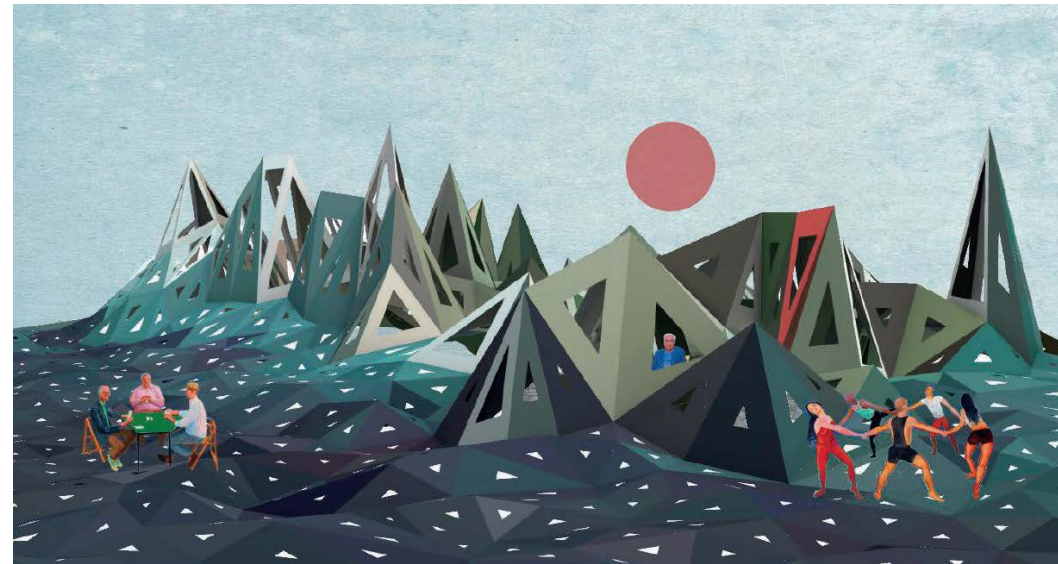


idea

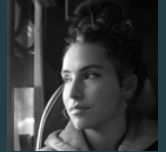


This triangulated floor moving with the most bright units creates cave shelters, in which the oblique walls are mixed with some stalactite pillars.

The holes in the middle of the triangles are windows, where you can appreciate the view.



07_bitmap mayhem



maena
cha

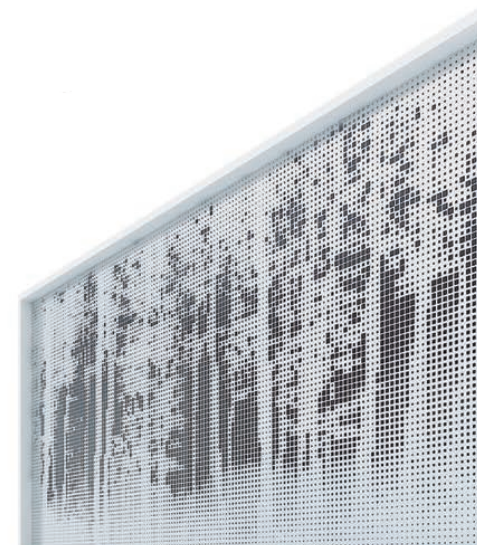
An aerial photograph of a vacation location in the Finistère in Bretagne (France) gave the foundations and the guidelines for the process of creating this structure.

There was an intention to emphasize the difference of heights considering the water's depth. An interesting point of the design, due to the structure and expressivity given by the caption, is how it represents a certain peak, a goal or an attractive point.

visualisation



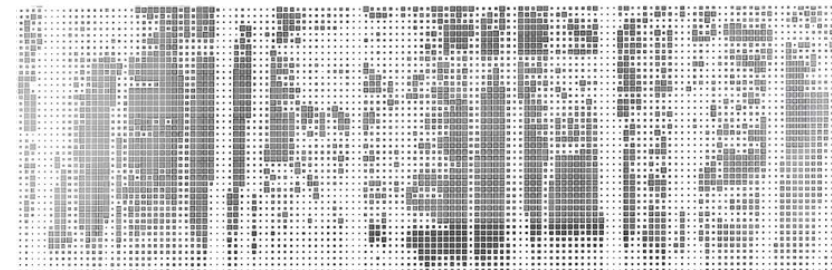
idea



facade arrangement



image reference



07_bitmap mayhem

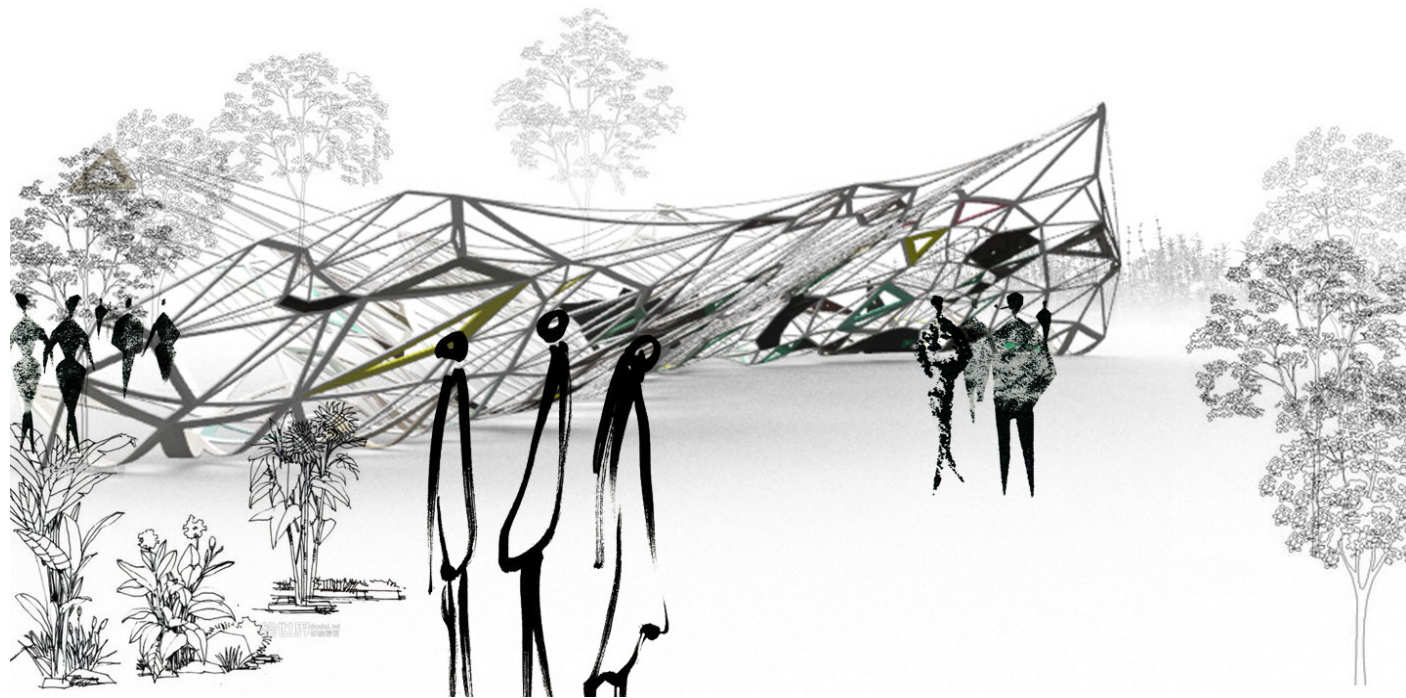


thanh
nguyen

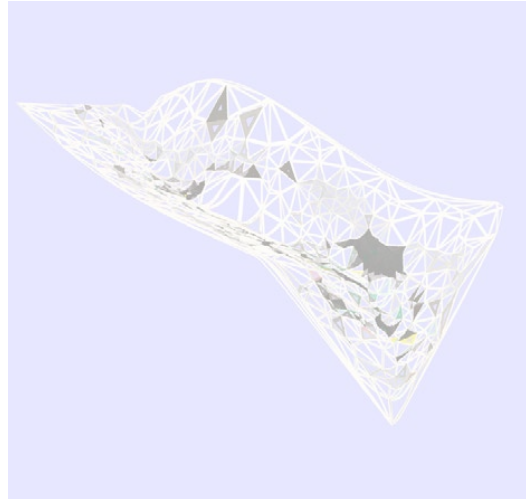
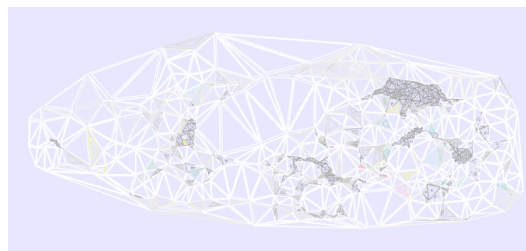
The goal was to design a sun screen facade from an image in an alternative way and to create a special atmosphere for a building.

An abstract photograph of a forest was used as the image source. This was an interesting photo as the brightness itself creates the depth of field. The opening of the screen was also determined by the brightness, having the bitmap as the scale factor.

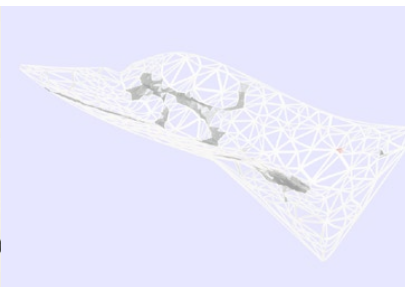
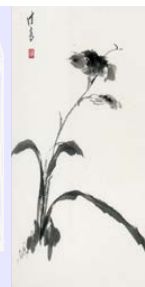
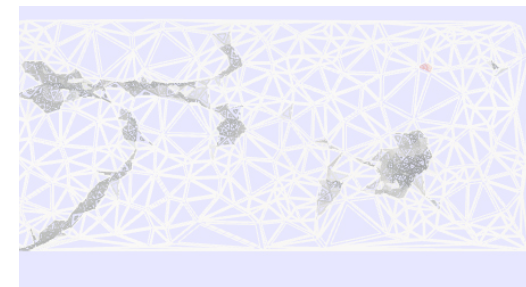
visualisation



idea

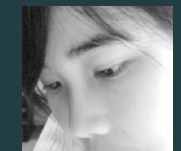


Wuguangchong's



Zhuda's

07_bitmap mayhem



tang
jie

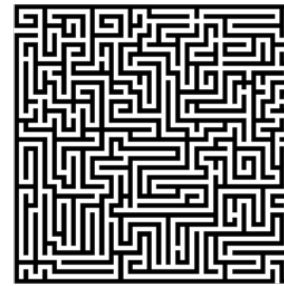
The idea was to use a bitmap image to generate a pattern and apply it to the roof of a butterfly pavilion created in a previous exercise.

The bitmap generates an artistic-looking structure. The colouring of the roof was taken from different paintings to create various design deviations.

visualisation

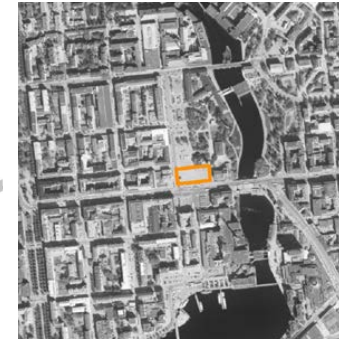
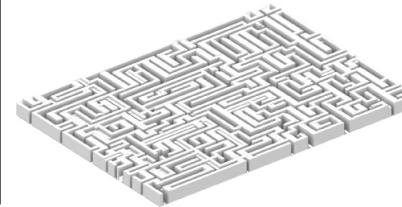


idea



bitmap

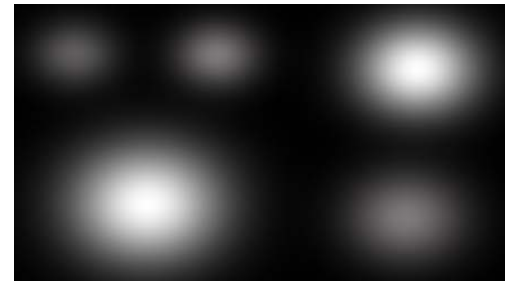
the maze



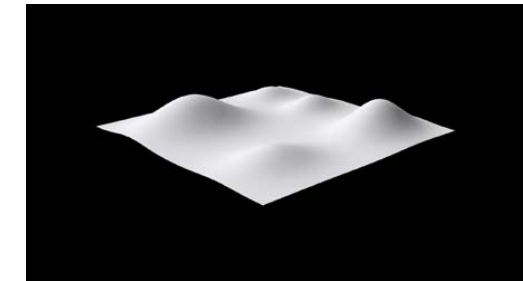
site

the playground

gradient circles made in photoshop



baked design



07_bitmap mayhem



joachim
westheim

Tampere's Keskustori was selected as the site for this bitmap investigation. A green labyrinth was created from a maze pattern. An alternative design was a playground area developed from a different image. Both images were taken from the Image Sampler in Grasshopper in order to explore what that feature could bring to the design process and output.

biography



glenn cadoret

architecture student from Rennes, in France. Studied for three years at ENSAB and spends one year at TUT as an exchange student.



benoit martin

architecture student coming from ENSA Nantes, France.



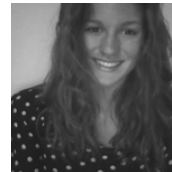
giulia rizzo

born in Catania, Sicily. Currently in 4th year as an Architecture student at the University of Florence, Italy.



joffrey leseur

exchange student for one year at TUT. From France, studying in Liège, Belgium. Currently in 4th year at University of Liège.



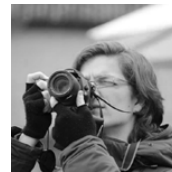
adeline simon

born and raised in France, completed bachelors in architecture in Liège, Belgium. Now doing her masters at Tampere University.



thanh nguyen

2nd year of Master degree at TUT (now TUNI). From Vietnam and currently working in Tampere, Finland.



miguel serantes

architecture student from Madrid, Spain. In 5th and last year of degree back at Spain. From the school of architecture of Polytechnics UPM. Studying for one year in TUT in Erasmus exchange program.



mirko carpineta

born in Palestrina, Rome. Spending last year of Building Engineering-Architecture at TUT as an exchange student. Plans to graduate next year at the University of Rome.



joachim westheim

architecture student from Oslo, Norway. Studies at the Oslo School of Architecture and Design.



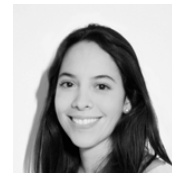
ananda frigiére

architecture student from France. Studies at the Saint-Etienne school. Now moved to Finland and continued architecture studies here.



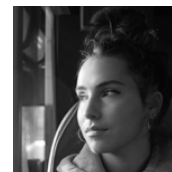
tang jie

architecture student from China, graduated at Hunan University. Now in 2nd year of master at TUT.



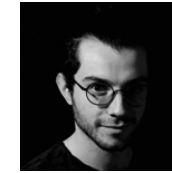
alejandra gutierrez

born in Ecuador but currently studying at KIT, Germany. Exchange student for one semester at TUT.



maena cha

studies architecture at ENSAB, France. Decided to spend her first year of master at TUT.



asier sertutxa

born in Bilbao, Basque Country, started studies at Euskal Herriko Unibertsitatea. Changed to Deakin University, Melbourne. Now studying at TUT.



manon servieres

born in France and studies in Paris Val de Seine national school of Architecture. Currently in 4th year and Exchange student for one year in TUT.



elise mullens

erasmus student for the whole year at TUT, from Liege University in Belgium and currently on 2nd year of master in architecture.



guilherme garcia

from Lisbon, Portugal. Erasmus student for the first semester at TUT. Currently on the 4th year at Faculdade de arquitetura Universidade de Lisboa.



lisa voigtländer

architect (Tampere University of Technology, 2016). Teacher of the Digital Design in Urban Environments course.

