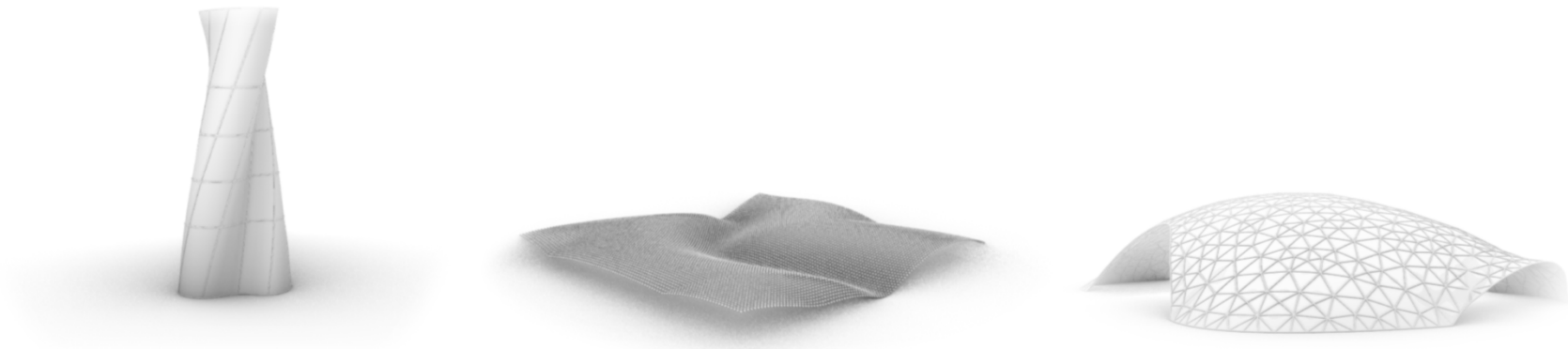




Att Undersöka Arkitektur 2

ARK452 VT2020

Lärare



Emil Adiels

emil.adiels@chalmers.se

Architecture and Engineering Research Group

PhD Student

Bsc Architecture and Engineering

Msc Structural Engineering Building Tech.



Mattias Udén

mattias.uden@gmail.com

Bsc Architecture and Engineering

Internship Knippers Helbig



Axel Svensson

axel94svensson@gmail.com

Bsc Architecture and Engineering

Internship Knippers Helbig

Not secure | www.archeng.se

ArchEng Group

ARCHITECTURE AND ENGINEERING RESEARCH GROUP

ABOUT ▾ RESEARCH ▾ TOOLS ARTISTIC EXPLORATIONS TEACHING 🔍

Emil Adiels and Isak Näslund hosted a workshop where a geodesic gridshell was constructed.

Geodesic Gridshell Workshop

CONTINUE READING



Emil Adiels
Project assistant



Jonas Carlsson
Artistic Senior Lecturer



Erica Hörteborn
PhD Student



Morten Lund
Artistic Professor



Karl-Gunnar Olsson
Professor



Chris J. K. Williams
Artistic Professor



Mats Ander
Senior Lecturer



Peter Christensson
Lecturer/Artist



Lars Hesselgren
Guest Professor



Jens Olsson
PhD Student



Alexander Sehlström
PhD Student



Singapore Jewel

Singapore Jewel will be an extension to the already existing airport in Singapore. It will work as a terminal for shopping and recreation for the passengers. The structure will be steel and has a span of 100 meters. The middle there will be a hole with a waterfall.

The project is runned by the Buro Happold office in New York. the Smart team was asked to be consultants with regard to optimising the shape and the buildability.

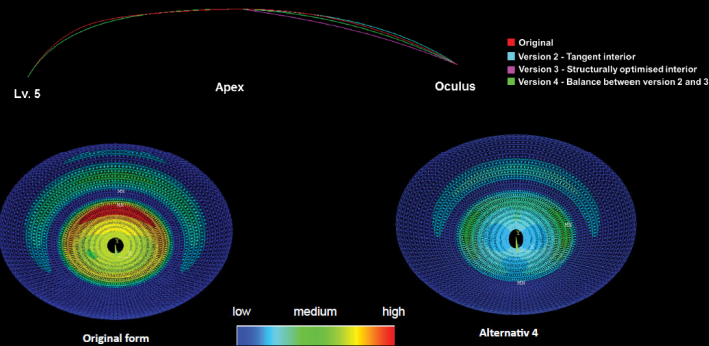
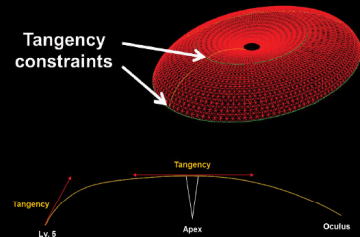
Team: Emil Adiels, James Ramsden, Isak Näslund, Johanna Riad.

Form optimisation

The Structure is divided into to parts. The outer will be in compression and the inner will be in tension since it is cantilevering into the middle.

There was many geometrical constraints for the shape and especially at the transition zones. It was crucial to have a continuity at the transition zones. This made the traditional formfinding methods hard to apply and less effective. Therefore we had to experiment with a lot of different shapes and different alternatives, where the structural efficiency had to stand against the desired expression.

The option we choose was an interpolation of the most effective and the one that was most true to the original shape. A linear analysis ANSYS showed great improvement for the new proposal.

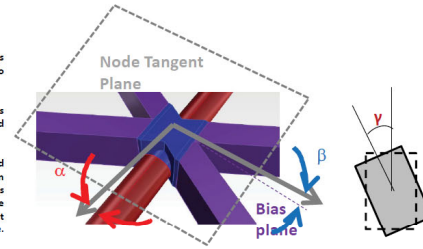


Node Clustering

The structure will consist of a lot of different elements. During that time it was about 10000 panels and 5000 nodes. To be able to finance this it is crucial to reduce the number of unique elements.

The nodes needed to be evaluated based on three different properties or angles, picture to the left. It was also important to have a generalized code that would be easily changed when the design of the node changes.

We needed to create an algorithm that could group similar nodes together based on a tolerance and for each group create one node. We implemented an algorithm called k-means which allows you search in a big data space and group combinations that are alike. We implemented it in our software so we could create and place the generated nodes at the actual node position. The grasshopper component is available for download at food4rhino and is part of the Smartform package.



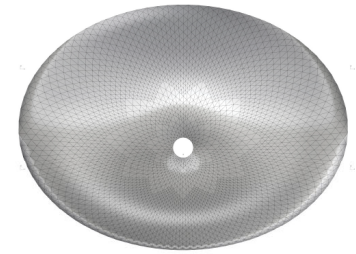
Alternative grid

When analysing the original grid it showed that a lot of unique nodes needed to be created. We got the question if there was a way to optimise the grid layout with regard to reduce the number of unique nodes.

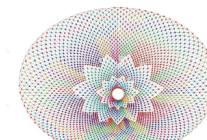
Since it was such a huge span it was a problem how to handle that the elements became so small in the middle.

The first thing we did was to create a grid of points that was based on equal proportions. This made it possible to get much more alike panels. Then I got inspired of the roof at Kings Cross and applied a similar panel reduction. This solution became more dynamic than the option provided which created a static transition.

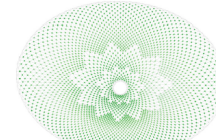
The analysis shows great improvement since the number of unique nodes could be reduced from 334 to 56.



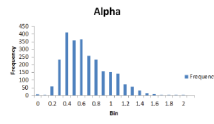
Alternative grid viewed from above.



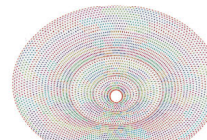
Alternative grid: 56 unique nodes



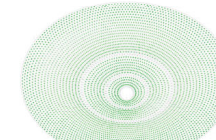
Grid with the created nodes



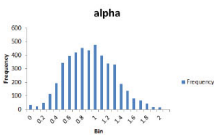
Graph showing the variation of the maximum alpha angle for each node.



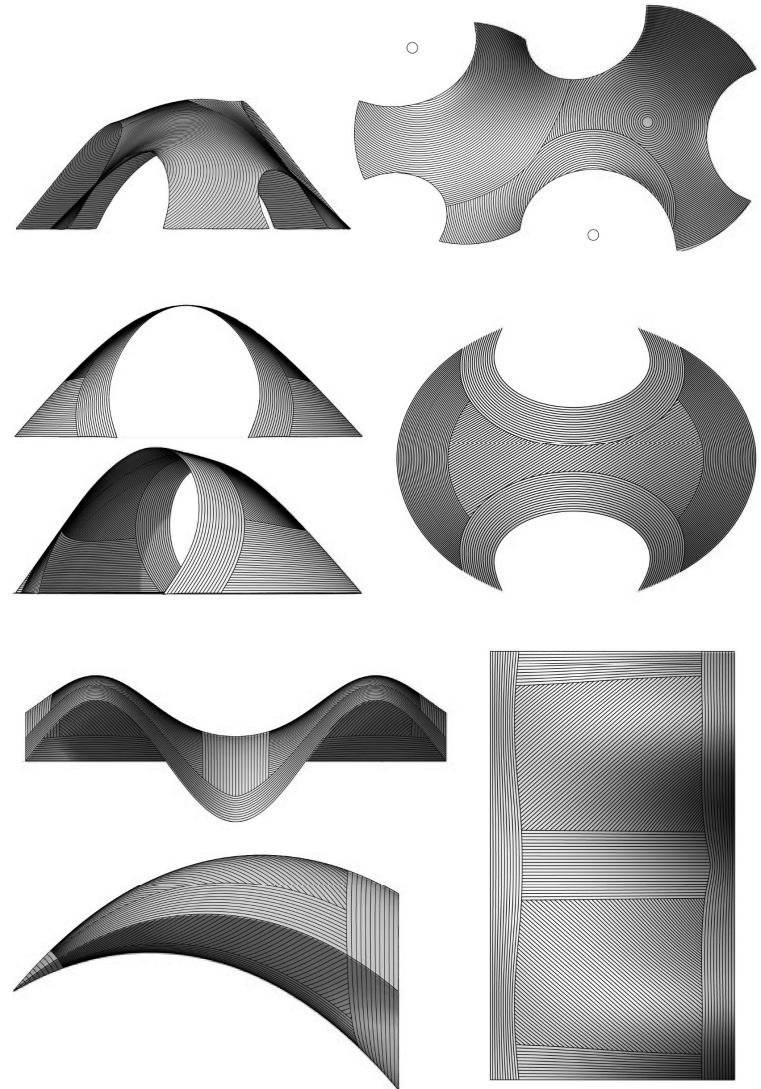
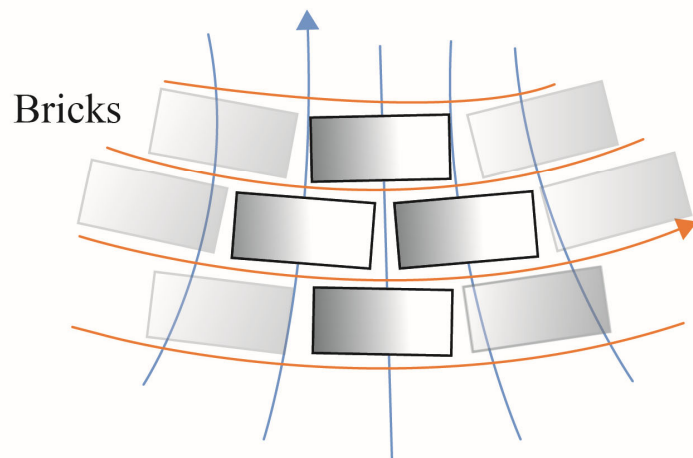
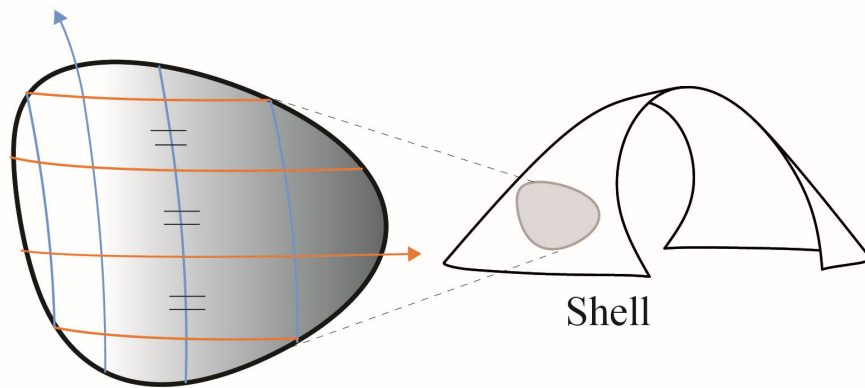
Original grid: 334 unique nodes



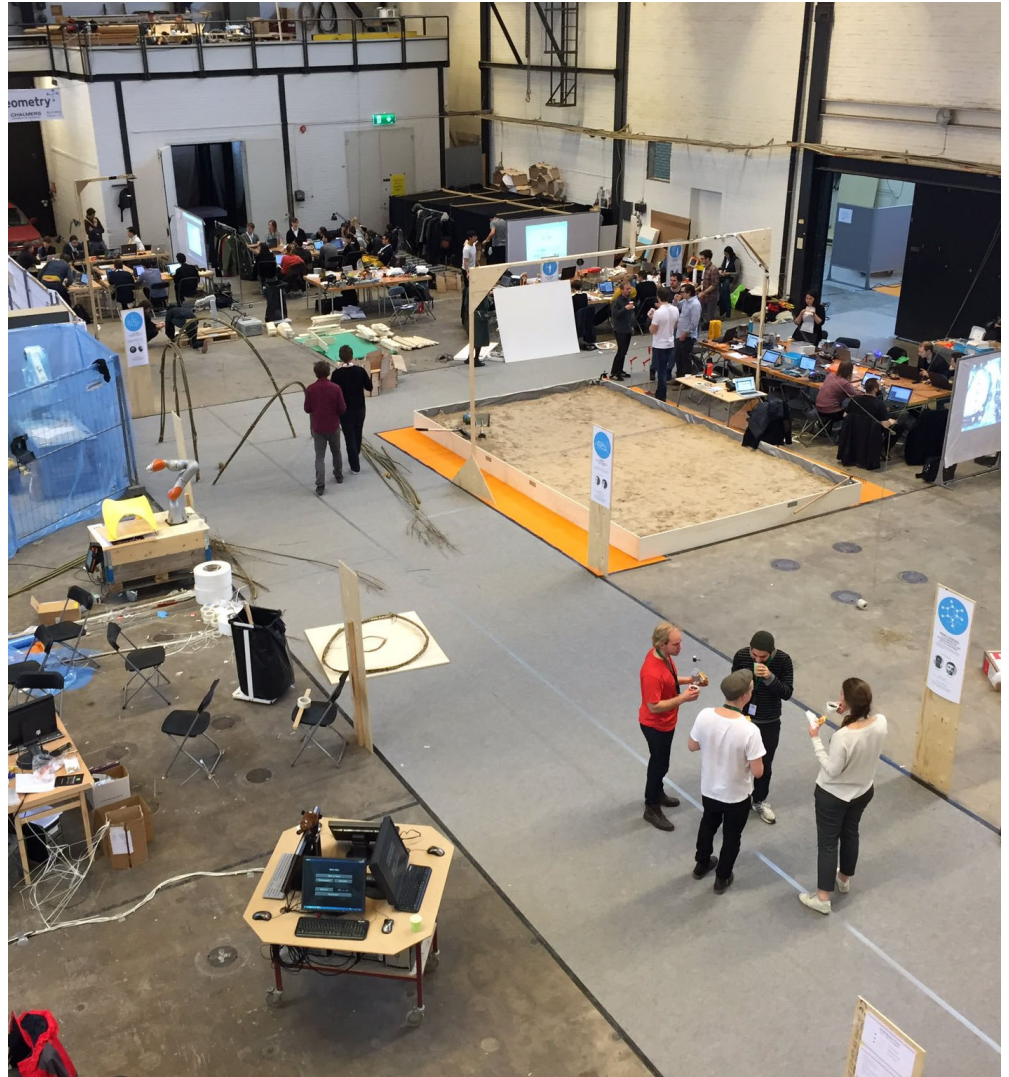
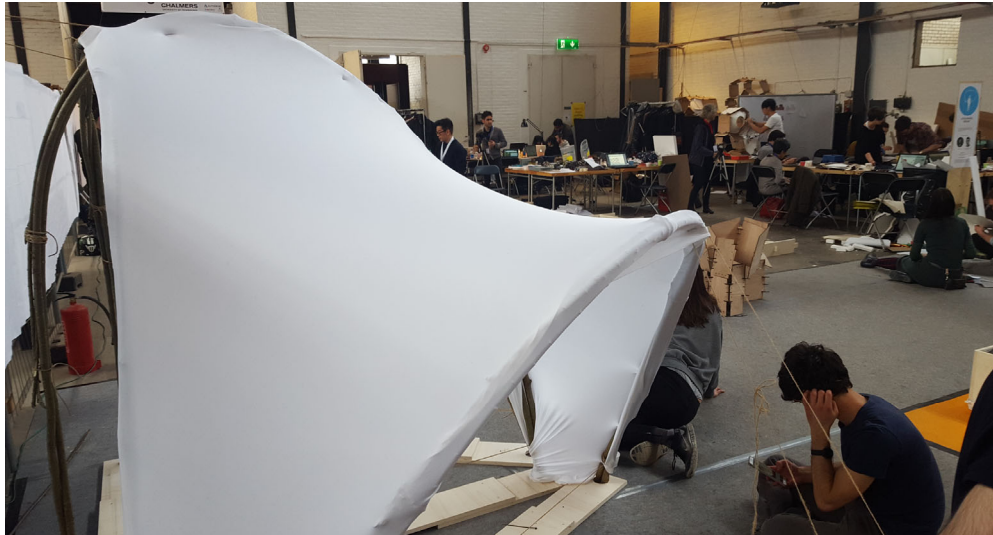
Grid with the created nodes.



Graph showing the variation of the maximum alpha angle for each node.



Brick patterns on shells using geodesic coordinates(2017), Adiels, Ander, Williams





ARK452 – Undersöka Arkitektur 2., E. Adiels

Kurs PM

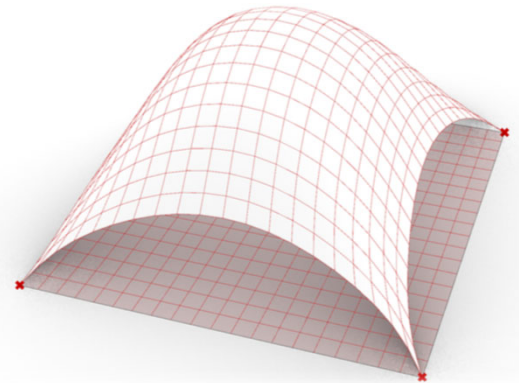
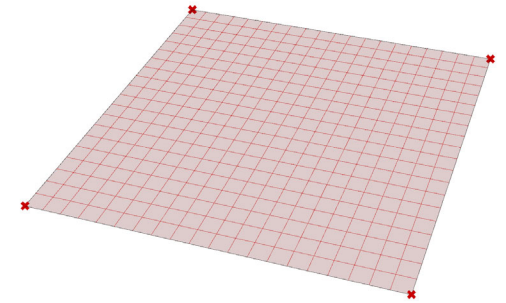
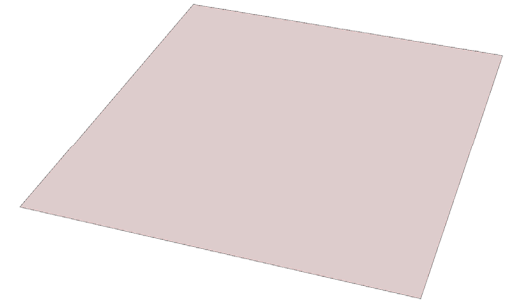
Kursens syfte

Kursens syfte är att träna en arbetsprocess där objekt och rum undersöks, bearbetas och materialiseras med hjälp av digitala och manuella verktyg och metoder.

Lärandemål

Efter fullgjord kurs ska studenten kunna:

- Gestalta slutsatser och resultat av undersökningar inom kursens tema med digitala och manuella verktyg och metoder.
- Pröva att arbeta med experimentella kombinationer av digitala verktyg och metoder
- Analysera och generera perspektiv på kursens tema.
- Planera, genomföra och presentera en undersökning i grupp.
- Analysera sin egen roll och skapandeprocess i gruppen.



Kurs PM

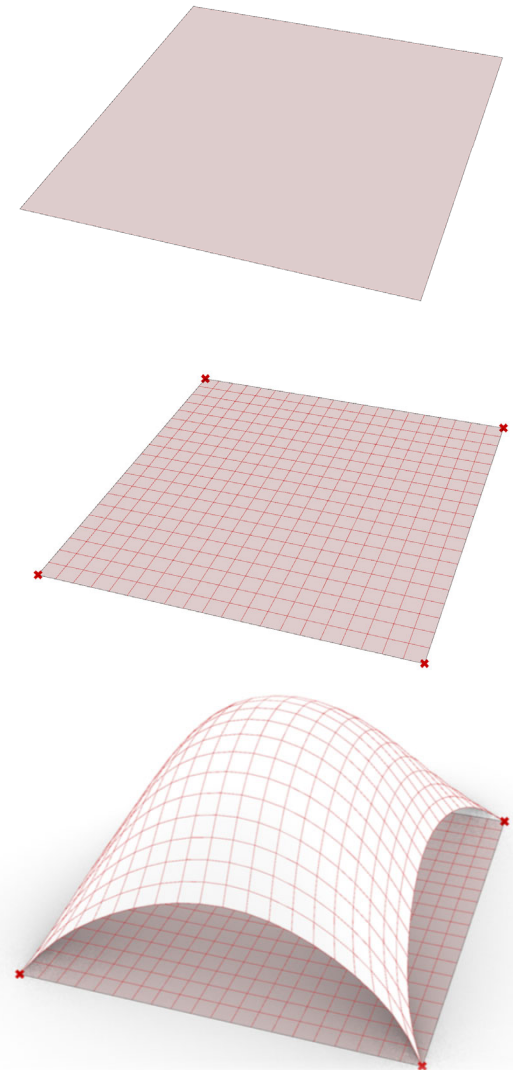
Förkunskaper

- Kursen utgår från grundläggande kunskaper i Rhino från ARK063 .
Det mest väsentliga kunskaperna för denna kurs Rhino är:
- Navigering i Rhino fönster (zoom, pan etc)
- Skapa och modifiera enkla geometrier så som punkter, kurvor och ytor.
- Flytta och rotera geometri

För den som känner sig osäker finns en snabbrepetition (ca 1h) att tillgå på hemsidan Introducing Rhino 6 (Länkar till en externa sida.) och Grasshopper Essential Training (Länkar till en externa sida.) . Se kurslitteratur.

Vi kommer att arbeta med grundläggande vektor matematik från Matte 1 i gymnasiet.

<https://www.matteboken.se/lektioner/matte-1/geometri/rakna-med-vektorer>



Kurs PM

Kurslitteratur

Linkedin Learning

Linkedin Learning (tidigare Lynda) är hemsida som erbjuder kurser online i genom videoformat. Vi kommer att använda det som ett komplement till undervisning. Dels för dem som vill lära sig mer, dels för dom som känner sig lite osäkra och känner att de behöver en repetition.

Linkedin Learning finns inte tillgängligt via Chalmers och det är något ni får betala själva, det kostar 250 kr i månaden men det går också att utnyttja *en gratis månad* ifall man inte använt tjänsten innan. <https://www.linkedin.com/learning/>

Litteratur(Gratis)

Mode Lab Grasshopper Primer Third Edition

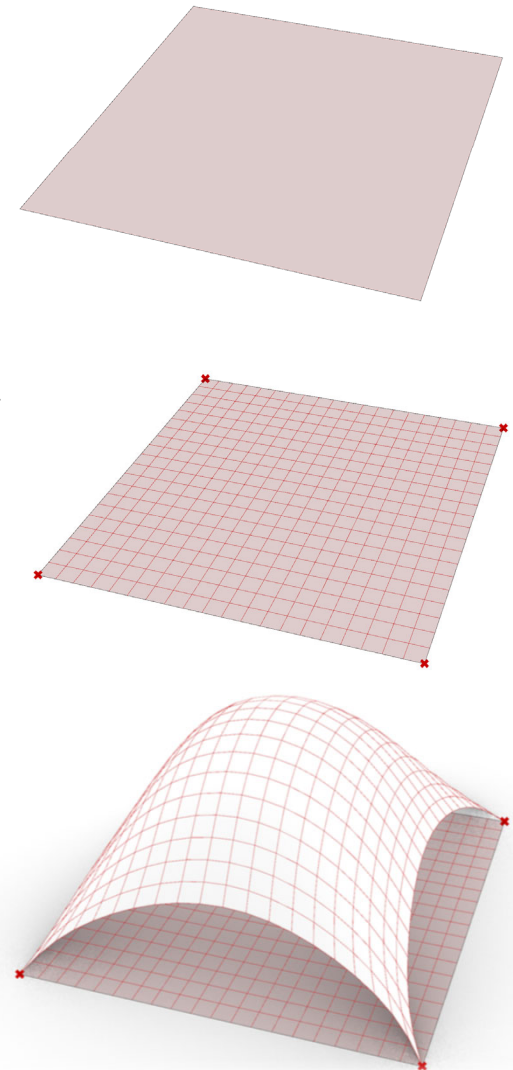
<https://aae280.files.wordpress.com/2014/10/mode-lab-grasshopper-primer-third-edition.pdf> (Links to an external site.)

Grasshopper Learning Material by Woojae Sung (Syracuse Architecture)

https://issuu.com/pabloherrera/docs/grasshopper_workshop_syracuse_woojae_sung_part_1 (Links to an external site.)

Essential Mathematics for Computational Design, Rajaa Issa, McNeel

[TheEssentialMathematicsForComputationalDesign_4thEdition2019.doc.pdf](#)



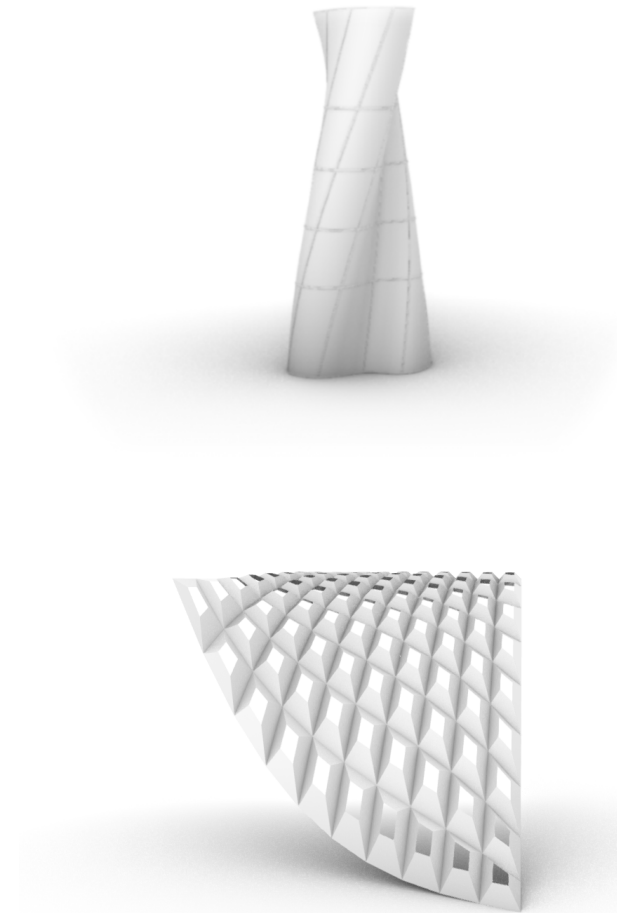
Kursstruktur

Del 1: Parametrisk Design - Form

Genom föreläsningar och övningar i Grasshopper 3d kommer vi att lära oss grunderna i paramaterisk design. Grunder innefattar skapande och analys av geometri, transformationer(translationer, rotationer), datahantering och visualisering. Det kommer också att finnas seminarier med inlämningsuppgifter kopplat på olika sätt att jobba med form: Friform - NURBS, Matematiska ytor – Point Cloud & Kraft driva former - Mesh.

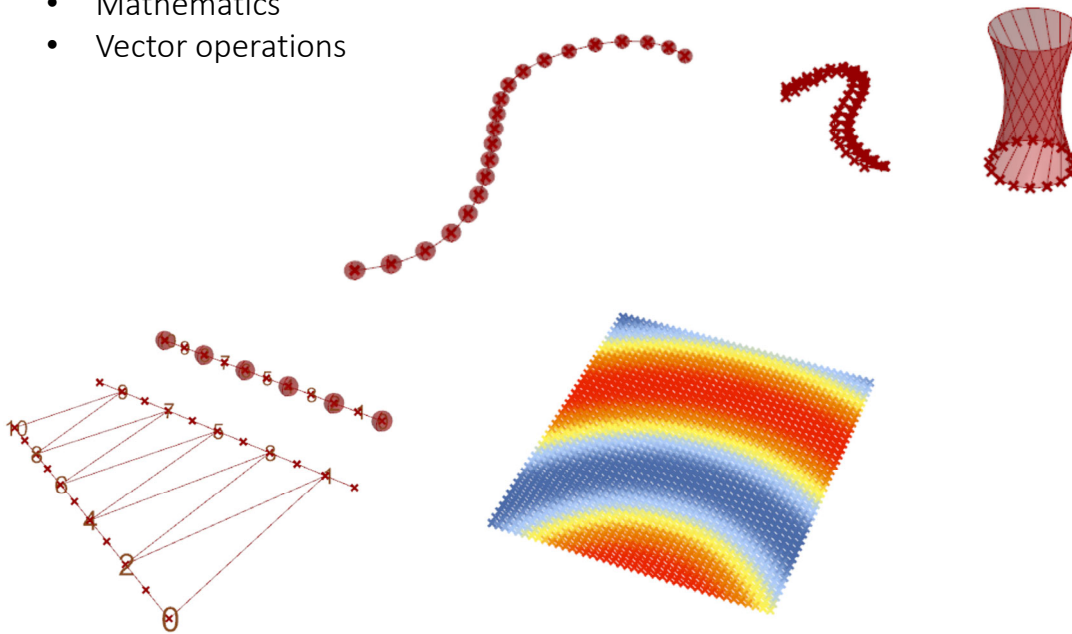
Del 2: Projektarbete – Fasad och Analys.

Här kommer vi att koppla form och mönster genom att titta på hur vi kan skapa en repetativ fasad. Vi kommer även att titta på hur man kan göra enklare solstudier av dessa strukturer.



Grasshopper grunder

- Basic Transformations
- Geometry creation and access
- Data structure
- Visualization
- Mathematics
- Vector operations



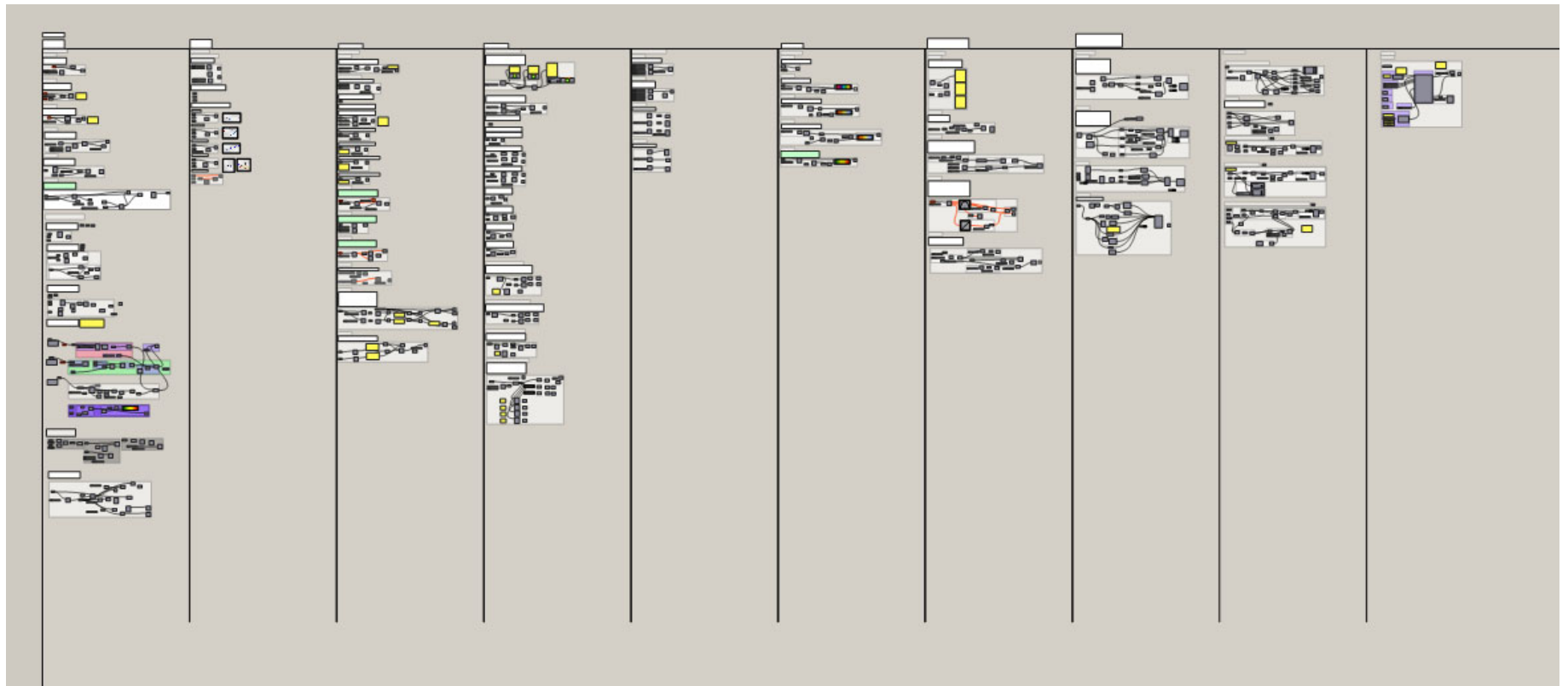
Part 1: Basic transformations

Assignment 1:1

- Reference a point from rhino
- Construct a vector
- Use the vector to move the point
- Create a line between the two points



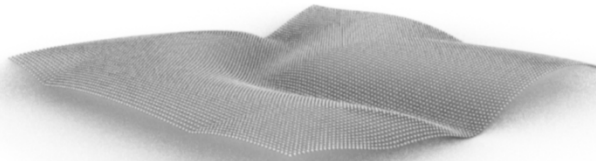
Grasshopper grunder



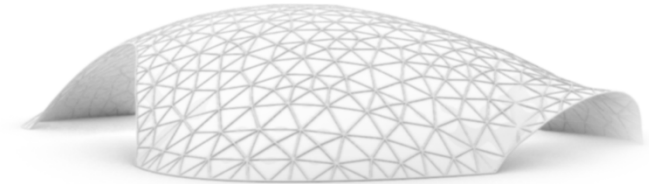
Olika sätt att jobba med form



Sculptural sketching - NURBS

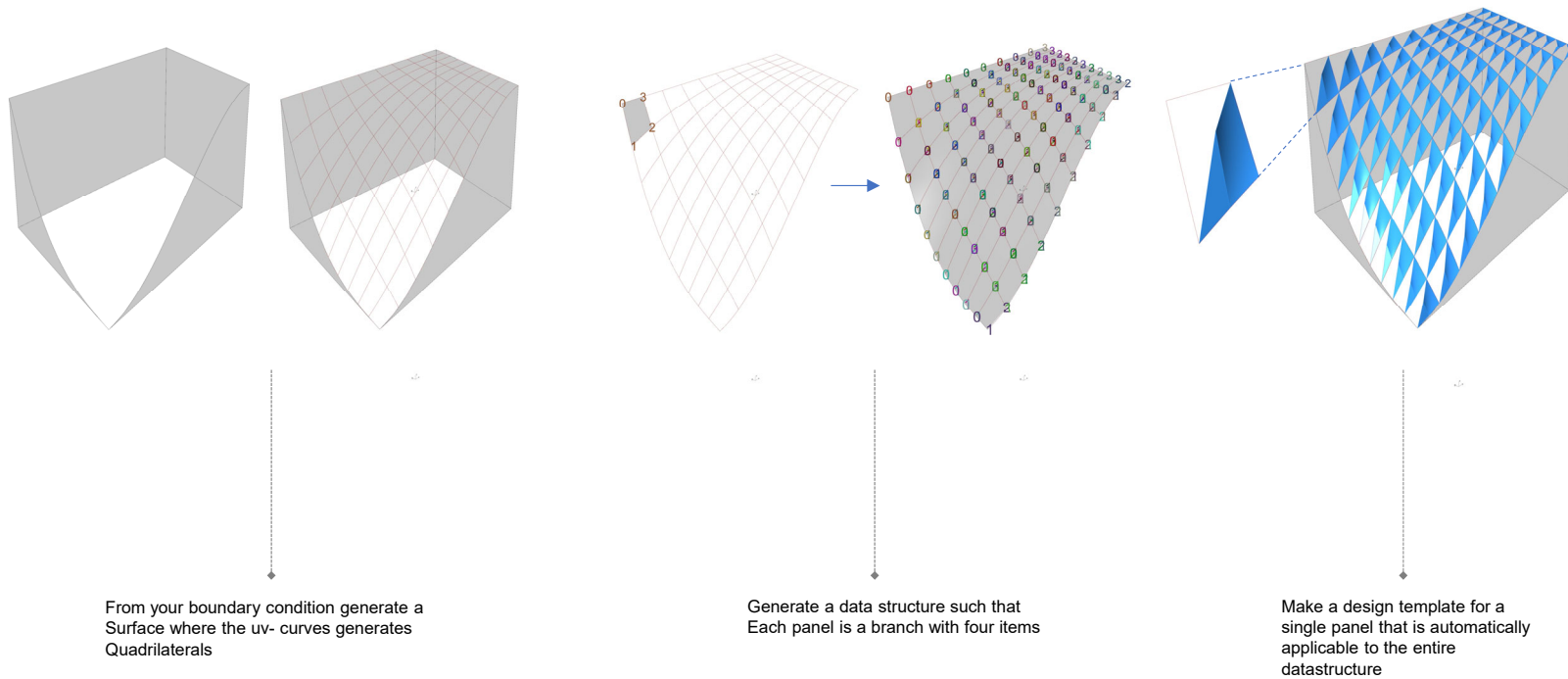


Harmonic sketching - Point cloud

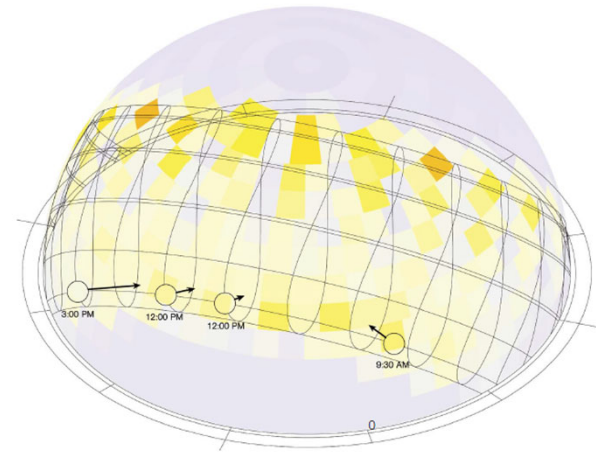
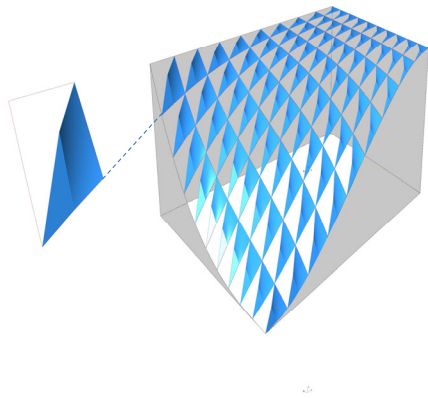


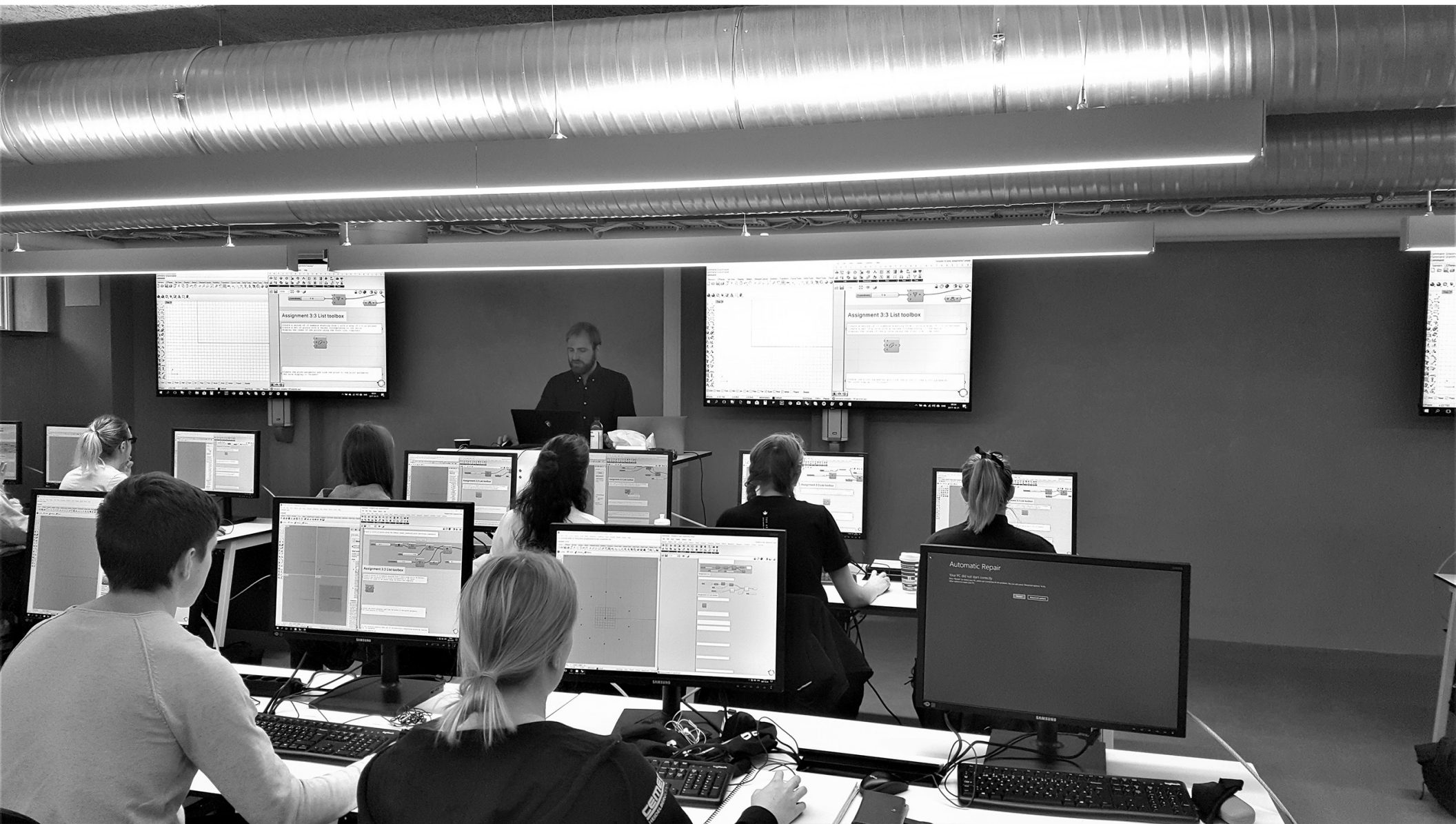
Force based sketching - Mesh

Repatativa mönster

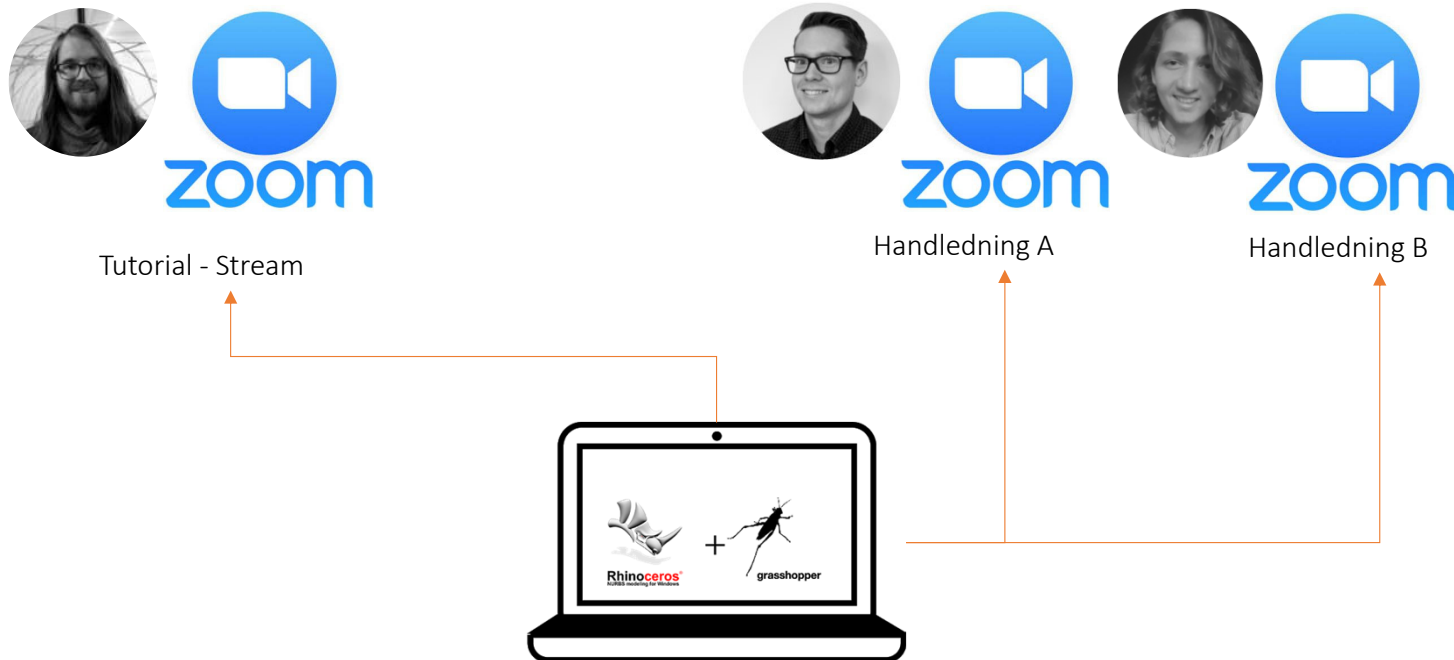


Solstudier i Ladybug





Övningsformatet



<https://chalmers.instructure.com/courses/9328/pages/arbete-via-zoom>

Arbetsstation – Alternativ för setup

Jobba på distans



alt 1. Två stycken skärmar



alt 2. En laptop och en sekundär skärm



alt 3. En laptop där man använder TV som skärm



alt4. Dela upp en skärm i två stycken delar.

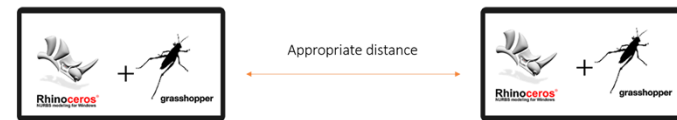
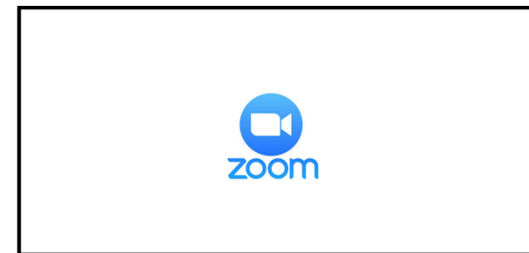
Jobba på Campus



Student 1

Student 2

alt 1. Logga in på två stycken datorer/skrmar



Student 1

Student 2

alt 2. En student loggar in sig på både vanlig dator och på datorn längst fram i klassrummet.

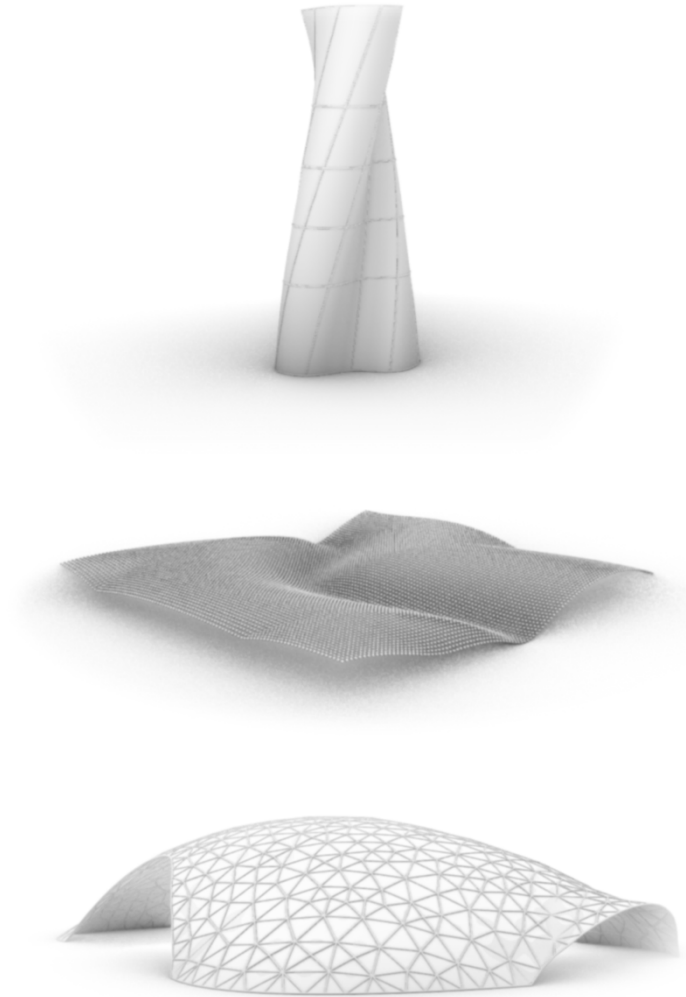
<https://chalmers.instructure.com/courses/9328/pages/arbetssation-slash-setup-skarmar>

Examination

Kursen examineras enligt följande:

- Inlämning av två uppgifter, aktiv närvaro och redovisning på seminariet fredagen den **29/5**.
OBS: Dessa uppgifter skall göras och lämnas in individuellt. Man får ta hjälp och stöd av varandra men ingen kopiering är tillåten.
- Inlämning av projektuppgift, aktiv närvaro och redovisning på seminariet **torsdagen den 4/6**
- Individuell inlämning av en komplett processdagbok (oredigerad) senast fredag den **5/6 klockan 17.00**.
- Individuell inlämning av tre portföljsidor senast fredag den **5/6 klockan 17.00**.

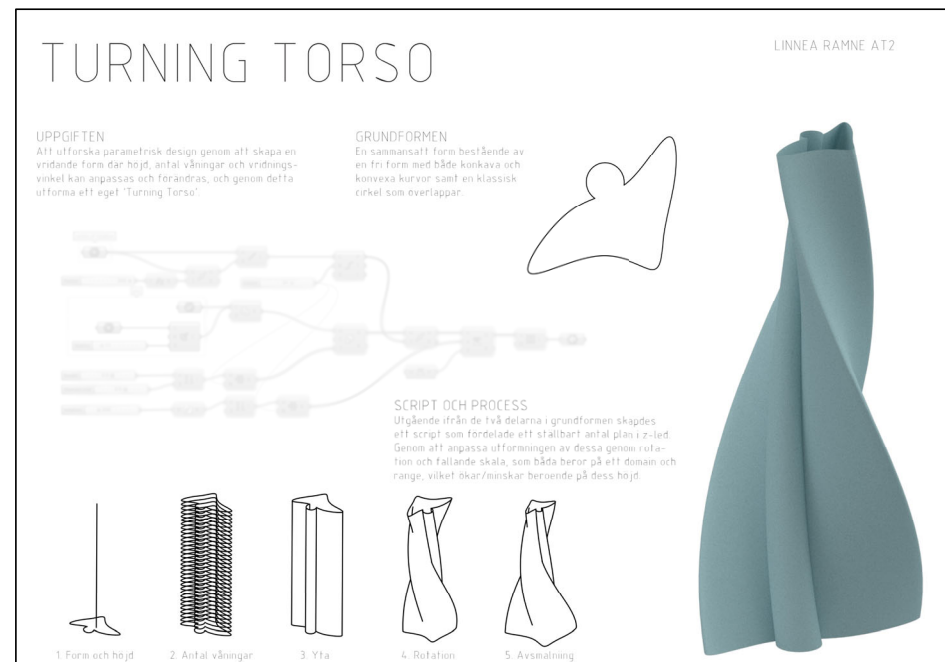
Mer information finns på Canvas sidan



Examination – Inlämningsformat individuella uppgifter

Inlämning bör innehålla:

- Uppgiftsbeskrivning
- Angreppssätt, hur tog jag mig an uppgiften.
- "Designen var uppbyggd med de här parametrarna... som kontrollerade designen på detta sätt" etc etc
- Bild av koden/scriptet, eller delar av den om det är för mycket kod för att kunna läsa (Use high res export in Grasshopper)
- Diagram eller bilder på olika variationer av din design möjlig med de parametrar ni har satt upp.
- Grasshopper koden lämnas in separat.



Exempel på inlämning, A3 format

Kursutvärdering

The following (lucky) students have been randomly selected to be student representatives for the course evaluation:

XX från Ritsal 1

XX från Ritsal 2

XX från Ritsal 3

XX från Ritsal 4

XX från Ritsal 5

You will be called for two gatherings. The first will be in the beginning of the course and the last will be after the course to go through and discuss the results from the course evaluation.

Schema Vecka 1 (Uppdateringar görs på Canvas)

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning		Grasshopper basics: - Transformations: Translations, Rotations - Extract properties of geometrical objects: curve tangents and surface normals. - Create geometry - Vector operations: Add, subtract, multiply, cross product - List operations: Create a list from a domain. Access data from list. Get an item, shift list, cull list	Own Work	Seminar: Mathematical sketching - Write a function in grasshopper - Use the graph mapper. Handout A2	Own work
			Data structures in grasshopper: - Tree management toolbox - Make a net - Visualization	Seminar: Form finding in architecture. - Hanging chain principles. Dynamic relaxation basics - Model a net. A gravity based structure and prestressing. Handout A3	
Afternoon	L01: Introduction to computational design	1h Seminar: Freeform design L02: Parametric design and how we can apply it into a design process			Own work/ Prepare for seminar
	3d modelling Rhino Repetition.	2h Dynamic free form design using Rhino and Grasshopper, - Lofting - Boolean intersection 3d bench - Geometry pipe line Handout A1	Seminar: Mathematical sketching Write a function inside grasshopper	Own work	Seminar
	Introduction to Grasshopper				

Schema Vecka 2 (Uppdateringar görs på Canvas)

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	Patterns Create a façade Own work	Introduction Project: Group assignment	Project: Group assignment	Project: Group assignment	Portfolio work
Afternoon	Ladybug Tools	Project: Group assignment	Project: Group assignment	Seminar	