Ornament & Structure

a reconnection to ornament through knitted formwork

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Abstract

The classical ornament has a long tradition of being one of the key elements of a building, designed in close collaboration with a craftsperson, the result would have its unique fingerprint. With the advancement in mass production, ornaments became replicas with no visible craft. This ended up with a strong critique by Adolf Loos in his book Ornament & Crime, 1908, ornament has since then been debated. Today digital technologies have been surfacing in architecture for many years, achieving things we earlier did not find possible. Contemporary ornaments have a strong connection to digital technologies and new fabrication methods, though it is contributing to today's image consumption society, which may not reflect on its symbolic meaning.

This thesis looks at ornament in a way where digital craft, design freedom, and structure work together. Ornament in architecture used to appear after certain orders and had a strong symbolic meaning. Today contemporary ornament lacks a clear definition and appears in many different shapes. This thesis takes its standpoint out of structural and tectonic aspects, where structural elements become ornamental, and the structure can benefit from the ornamental features. How structures could evolve and be developed through ornaments. The theoretical definition of ornament has based its perspective upon texts about contemporary ornament.

The thesis uses knitted formwork for casting concrete as a fabrication method. The focus is on the column as a design archetype. And as a demonstrator is an example of the column produced in a larger scale, as well implemented in an architectural context. The use of knitted structures demonstrates how the formwork interacts with the form and becomes part of the final expression in a way where structure and ornament meet and become an argument from design.

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INTRODUCTION

Student background

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Academic Background

2019-2021 Chalmers University of Technology
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Material & Detail
Nordic Architecture
Resistant Architecture: 1968 and beyond
Architectural Heritage & Transformation
Matter, Space, Structure

2015-2018 Chalmers University of Technology
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Professional Background

2018-2019 Herzog & de Meuron
Basel, Switzerland

Thesis background

The debate on ornament in a contemporary setting has just begun, though it has been going on for the last 14 years, considering Farshad Moussavi's book *The Function of Ornament* as the starting point. Contemporary ornament is still in a vague status, it lacks a clear definition and has therefore been explored with tools within digital fabrication. Qualities as tactility, strong texture, porosity, complexity, organic, hypnotic, symbolisms, senses, order, beauty have been attributes it has contributed with. The many different associations evoke questions, what role could ornament have today? How could it be rooted in a deeper sense of meaning?

As Robert Levit states in his paper *The Return of the Symbolic Repressed* (2008), projects that work with ornaments or express ornamental qualities do not m ake explicit claims to be ornamental. Maybe claiming to be ornamental is a step forward in the debate, setting an example for what could be represented as ornaments. The thesis strives to challenge what is generally known to be an ornament, in a classical way, which was "banned" by modernism, rooted in the book *Ornament & Crime* by Adolf Loos, 1908. The aim is not to look back on ornament as it was, resurrect symbols from the past. But to find something deeper than just affect, going towards an abstraction of the lost art of craft situated in a digital era, where the hand of the worker has moved from a physical site to the computer. The ornament of this thesis is to be understood through its fabrication method, concrete cast in a flexible formwork. The ornament represents the structural lines organically discovered through the element. Not only giving a strong sense of material and geometrical qualities but also raising the question if it is needed from a functional point of view or if it is merely a pleasure for the eye, however giving an irresistible urge to be touched.

The idea of where design emerges from and what it represents is crucial in a world where we are overwhelmed with parametric design, like the image-consumption society we live in. The freedom of design is always present, and when having control of the design of a structural element can be a powerful design tool. Flexible formwork as the method of shaping concrete opens a lot of possibilities, but it also puts a lot of pressure on the precision of the geometric shape which is generated. Creating ornaments connected to structure feels like a natural way to justify a complex shape if meaning could simply be explained in the performance of the shape. Nevertheless, will it always be perceived as something else, something more, depending on the perception of the observer it can inherit many meanings, hopefully giving a sense of beauty to the observer.

Thesis questions

How could the use of knitted formwork figure as contemporary ornament?

How could structural performance be the driver of the ornament?

What could contemporary ornament aim to communicate to a broader audience?

Aim

The thesis aims to find a connection between ornament and structure, striving for both beauty and function. The thesis will question ornament the way we probably know it and turn to contemporary understandings rather than classical. The type of ornament that will be investigated will spring from a structural perspective and the chosen fabrication method.

The ornament does not seek to mimic an already existing symbol, resurrected from the past, or for that matter any obvious symbolism. It searches to engage the observer to something else, an abstraction that will make the observer appreciate the space more. The intriguing ornamental qualities sought do not lie in the obvious and blunt, rather imaginary and irrational, material and form reinterpreted by the viewer.

By working interdisciplinary with structural engineering student Vera Sehlstedt, the aim is to reach further into the structural part ornaments could have and intertwine the topics further.

Method & Delimitations

The method of this thesis is generally based on a research by design method. The thesis is initially divided into three parts, a theoretical background obtaining contemporary views on ornament.

A second part, the process part, where the fabrication method is explored through a workflow that is iterated and later evaluated.

The third part is the design proposal where the fabrication method and theory are tested and demonstrated in different architectural situations. The implementations are connected to a context and a site but are not developed as a conventional project, only presented individually. A conclusion summarizes and evaluate the process. The design proposal is a conceptual project and does not take into consideration accessibility or building permissions and so forth.

THEORY

Contemporary ornament

Today new architecture often lacks soul and character, and when trying to communicate to the bigger audience through ornamentation it fails abruptly, according to Edwin Heathcote in the Architectural Review (Heathcote, 2015). But do buildings have the ability to communicate? Antoine Picon answers, in The politics of Architecture and Subjectivity, “buildings never speak, but part of their appeal lies in the impression that they could if the proper conditions were met” (Picon, 2013).

With the rise of ornament enabled by digital technologies, in particular, the possibilities of ornament have increased to new levels. One of the effects has been that it now lacks a simple definition, it cannot be understood as it was in classical terms (Picon, 2013). The development of digital tools is often loosely referred to as parametric design, which symbolically often lacks a deeper meaning and can only be described as an affect. This has been compared to the image-consumption society we now live in, where images are flicked by quickly with little or no reflection (Balik & Allmer, 2016).

Affect is one thing that Farshid Moussavi brings up as the function in her book The Function of Ornament (Moussavi, 2006) that started the debate of contemporary ornament in the 21st century. Moussavi may have a point when she sees the difficulties to reach a consensus on symbols and icons in a multi-cultured society. But her book makes a simple explanation of ornament, looking at it as only another function to the building, referring to it as an affect. This reduction of the symbolic meaning is something Levit gives his response to in The Return of the Symbolic Repressed (Levit, 2008).

The taboo of ornament due to modernist ideology is discussed in many texts on the subject, as Levit points out that few if any architects claim ornament and their project to be ornamental (Levit, 2008). Architects during the modernistic era turned to ornaments but rather subtle, only expressed in the veins of the marble or by leaving the traces of the concrete formwork visible. Susan Yelavich writes that a more acceptable ornament today are patterns emerging from a structure, like the diamond-shaped-liked glass panes of Rem Koolhaas’s Seattle Library, because it follows the modernist’s dictum “form follows function” (Yelavich, 2012). Edwin Heathcote points out several times how architects today have not passed the taboo of ornament, and when aspiring to ornament do, they hire artists to legitimate the integration of ornament, to perhaps free themselves from the responsibility (Heathcote, 2015).

ˈɔː.nə.mənt

An object that is beautiful rather than useful. (Cambridge dictionary)

Definition

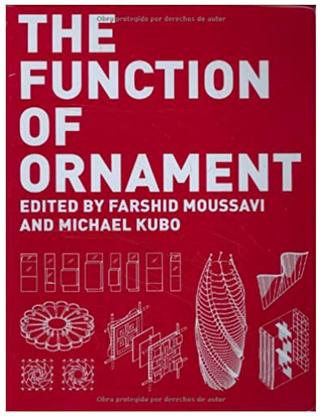
When searching for a definition of ornament you sense that the whole field of architecture is now searching the area of ornament. Two recent exhibitions, What is ornament? (Lisbon Architecture Triennale 2019) and Am I An Ornament (ARCAM, Amsterdam, 2020), both open their exhibition by asking the visitor what an ornament is as if asking for their possible contribution. In the ARCAM the exhibition, they aim to examine the significance of ornament today and in the future, relating to material shortage, sustainability, and new techniques. They show several projects in the exhibition demonstrating different functions of the ornament, stating that in each case it is the ornament that allows a building to speak and seek connection to its viewer.

The importance of connecting to a broader public is something Edwin Heathcote brings up, affirming that Antoni Gaudi’s lifework Sagrada Familia is by far the most popular building in history just by looking at the amount of sold entry tickets, but his point is that Sagrada Familia also stands out in the level of ornamentation (Heathcote, 2015). Mentioned in the final debate at Lisbon Triennale 2019, is that ornament could help to give a building a more human scale, and in that sense communicating to a broader public. Ghada Mohammad Elrayies, associate professor at the Port Said University, Egypt, states two types of ornaments in her study from the book Cities’ Identity through Architecture and Arts, the first being integrated and the second to be applied ornaments (Elrayies, 2018). Where the first is somehow integrated into the framework of the building, whether it is the façade, ceiling, roof, or the entire building. Ornaments that would stem from the structure or materials would be the most appropriate since they are not masking the real building. The applied ornament is an architectural detail, compared to the scale of the building they often appear very small, they often appear as carvings, tiles, sculptures, paintings, etc. This definition of ornament differentiates itself from the ancient Roman law that ornament was somewhere between furniture and structural elements, the ornament would be fixed but could in theory be detached (Picon, 2013).

Picon gives a more abstract reflection on the contemporary ornament, he talks about the blurring between ornament and structure, image and texture. Appealing the whole sensorium, attracting both touch and sight, it is like it wants to be felt and interacted with. That it also can appear almost hypnotic and even fading the distinction of ornament and décor. (Picon, 2013).

The Function of Ornament

Farshid Moussavi edited by
Michael Kubo, 2006



The book The Function of Ornament is presented as a guide of Farshid's research, clarifying that ornaments are closely tied to architectural affects. Just to describe one example: "The Seagram headquarters carefully attaches I-beams to its cladding layer to build a vertical affect". Their aim is to graphically explain the reasons behind these affects.

The introduction text written by Farshid, edited by Michael Kubo, is sort of a manifesto on ornament. Declaring that architecture's materiality is a composite, consisting of visible and invisible forces. While the role of the architect is getting increasingly specialized in designing the outer shell, the architect must in the effect of environmental control give the building an expression that is independent of the interior but also contributing to the urban fabric. Yet in a multicultural and increasingly cosmopolitan society, it is hard to enact a symbolic communication since it is difficult to find a consensus on symbols.

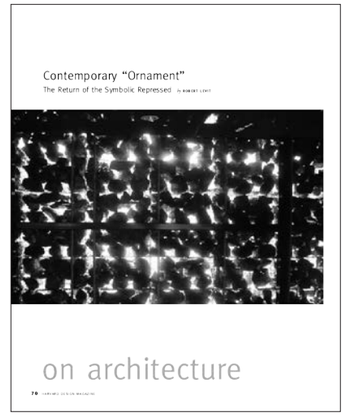
"If architecture is to remain convergent with culture, it needs to build mechanisms by which culture can constantly produce new images and concepts rather than recycle existing ones".

Farshid critiques postmodernism's use of ornament as a mask to create specific meanings. She states that ornament emerges from the material itself, being inseparable, and it is through ornament materials transmit affects.

"It has no intention to decorate, and there is in it no hidden meaning. At the best of times, ornament becomes an "empty sign" capable of generating an unlimited number of resonances"

Contemporary "Ornament", The Return of the Symbolic Repressed

Robert Levit, 2008



This text is basically a response to the book The Function of Ornament. Levit states the claim, that ornament would be back from exile is troubling on many levels. To be more precise is pattern back according to him, the only difference now is that ornament must function, the openly symbolic nature of ornament is to be put behind. Levit asserts from Farshid's book that she is only interested in the determination of form. Questioning why she in the first place brought ornament to the table.

"Ornament can never be reduced to a question of function and is incomparable as a category with that which simply functions or is the product of the technical logic of construction or craftmanship".
Essentially does Levit thinks that reducing ornament only to the matters of functionality and material is not possible. "It would be better to say that ornament may function, but, in my view, the motivations for its forms can never be reduced to functional or material foundations".

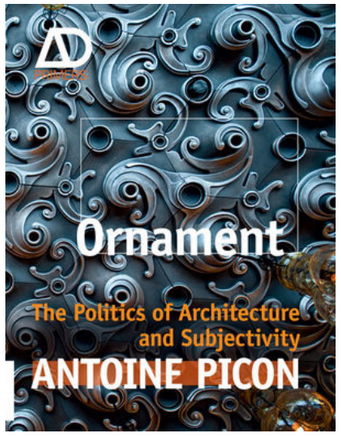
Levit suggests that Farshid makes a too simple explanation on ornament, trying to free the individual from socially constructed regimes of the symbol. While according to Levit is affect a socially constructed symbolic practice if you are to understand the term correctly.

Levit further speculates on symbolism in contemporary ornament as to have both social and sustainability motivations and to have a new view on individuality.

"… it is clear that for some thinkers there is no such thing as an unornamented architecture, and this ornament is never not symbolic and never merely functional. Ornament, in other words, if it is to be redefined, is not some sort of added doodad, but the condition of architecture itself".

Ornament, the politics of Architecture and Subjectivity

Ornament, the politics of Architecture and Subjectivity , 2013



This is only a summary of Picons arguments of contemporary ornament in the final chapter Reinventing the Meaning of Ornament of his book Ornament, the politics of Architecture and Subjectivity. Picon argues for a revisit to the five orders of architecture for inspiration. He is not saying that we should advocate their return similar to how postmodernism did, he seeks for the abstraction yet well definite symbolic content they possessed. He advocates instead for rules, not styles, something to attribute meaning to our actions.

“Just as architecture should always look as if it were about to speak, all the while remaining utterly silent, the most powerful architectural symbols are perhaps those engaged in the process of representing something”

Antoine points towards affect to be a shortcoming of the gap between contemporary ornaments and knowledge, compared to the way classical ornaments spoke of social rank and hierarchy between buildings. Contemporary ornaments have so far adopted the pleasurable affects but there are missing dimensions. Picon clears that meaning in architecture is officially taboo, though many projects have an almost naïve form of symbolism. In an earlier chapter, Picon asks if the architect’s role today merely has decreased to be solving environmental issues like indoor climate control than any deeper meaning.

When the return of the symbolic repressed remains unacknowledged and untheorized it is a big risk that it will fall back into simple symbolism and historicizing. According to Picon should the question of meaning in architecture be reexamined to avoid the wrong pitfalls.

A critical review of ornament in contemporary architectural theory and practice

Deniz Balik, Acalya Allmer, 2015

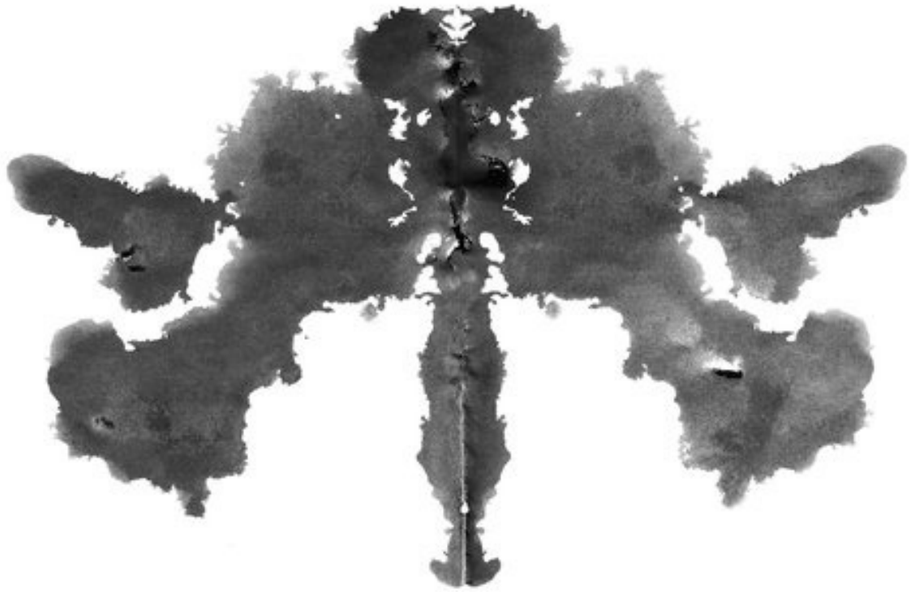

A critical review of ornament in contemporary architectural theory and practice

This paper takes into consideration the previously mentioned texts among others aiming to create a framework for contemporary ornament in the twenty-first century. It is stated that contemporary ornament does not contain the same interwoven link to historic style and that set of rules, ornament has not yet emerged into architectural theory and practice as it was historically. The idea of ornament could today appear between different scales, from architectural detail to the urban fabric.

Balik and Allmer show the recent large interest in ornament, with a long list of texts and exhibitions from 2005 to 2015. They agree that contemporary ornament has emerged from digital technology, and that ornament becomes a justification to experiment with form, structure, and surface. The lack of definitions also justifies this elaboration within digital technologies. Balik and Allmer state that architecture strongly relates to its client and the ornamental façade emerges thereafter.

“Accordingly, contemporary application of ornament does not discriminate between a public building and a housing complex. Ornament becomes a symbol of prestige and an instrument of power, in addition to being a representation of building function or program.”

They predict that the future will contain contemporary ornament as a critical discursive field for theorists and a challenging instrument for practitioners.



01. *Rorshach test developed by Hermann Rorshach early 1900.*

Perception

A structure in an architectural context has primarily a basic function, but can also be the subject of adding something else.
Jacques Herzog said in an interview 2006: “When ornament and structure become a single thing, strangely enough, the result is a new feeling of freedom. Suddenly, you no longer need to explain or apologize for this or that decorative detail”.
(El Croquis N.129/130, 2006)

Ornaments have had many purposes over the years, the symbolic meaning behind them has been both obvious and speculative. Robert Levit writes that ornament may be a result of a function or be functional, but it can never not be symbolic and never merely functional. If ornament is to reemerge, Levit thinks the magic effects on our imagination would disappear if the recognition of symbols would be too obviously understood. It should rather invite our engagement with the representation (Levit, 2008).

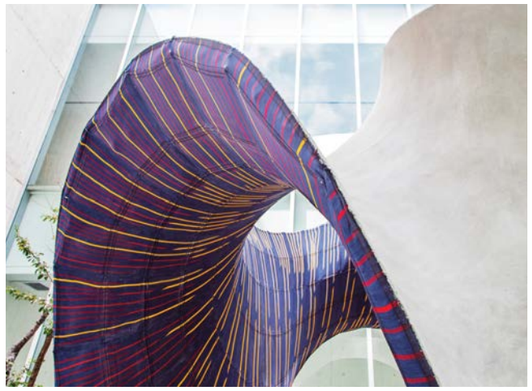
In this thesis the idea of perception will be tested, thinking of architectural symbols the way architecture historian Antoine Picon describes it, looking at it like it were about to speak, being in the process of representing something, (Picon, 2013).

The idea that something can always be re-examined and reinterpreted is what Dutch architect Anne Holtrop uses in his practice as an architect. Using the tests of the swiss psychologist Rorschach from 1915 as a reference, created by putting ink on a piece of paper and then fold it, and new shapes will appear.

“In reality, it is only material and form, but it is a human compulsion to always want to identify and relate to something, even if what we are seeing is entirely new to us.”
Anne Holtrop, Material Gestures
(Holtrop, 2016)

Though structure is used as the driver of the ornament in this thesis, and for the knowledgeable observer it will tell a story of the construction, but it will also have the power to be reinterpreted and be individually triggering the imagination the way we can read shapes out of the clouds. The ornament will be a gesture to enrich space with qualities like texture, form, and tactility, attracting the different senses.

PROCESS



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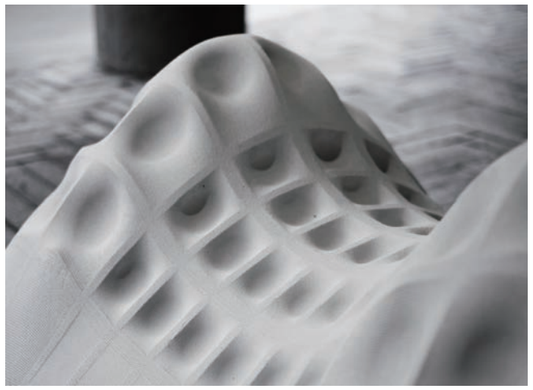

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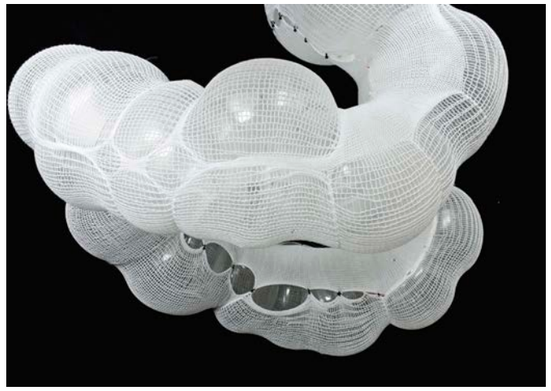

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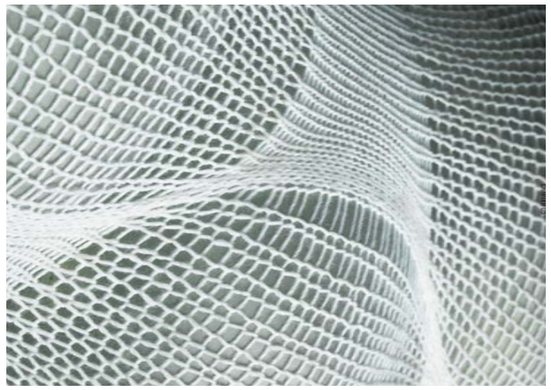
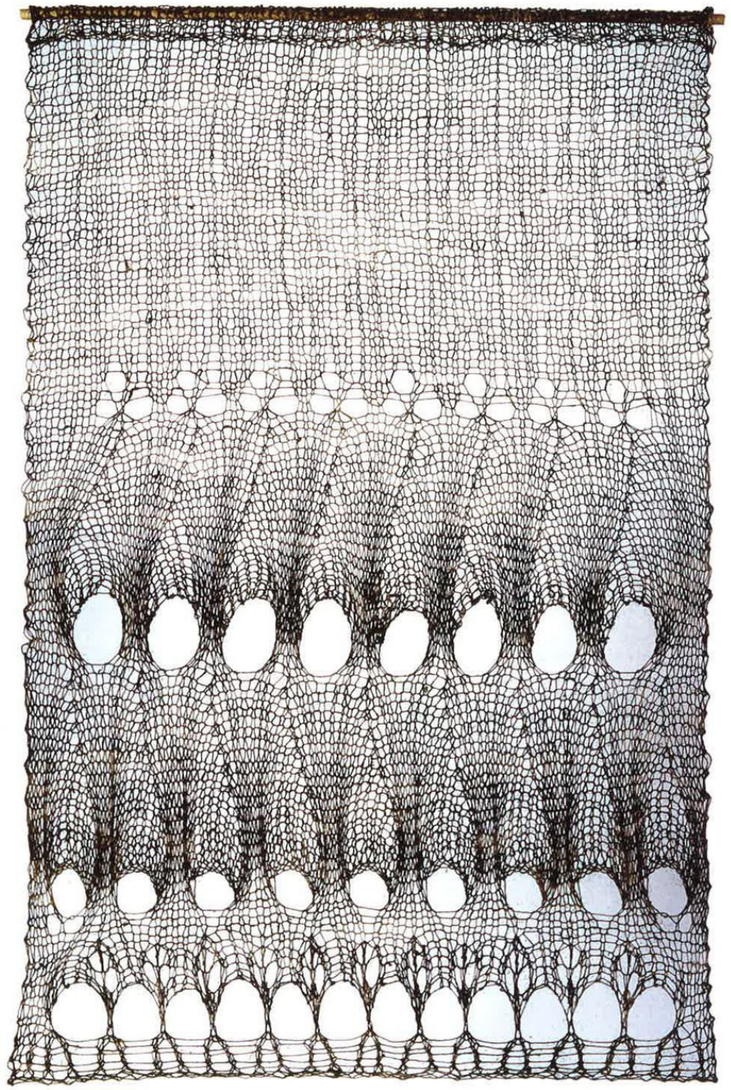


07

09

Various references to the process part of the thesis.
02-03. *Knit Candela, Zaha Hadid Architects & BRG, 2019. Knitted shell structure covered in concrete.* 04-05. *Kneu-Crete, University of Michigan. Machine knitted formwork for spray casted panels.* 06-07. *Knitflatable Architecture, University of Stuttgart.* 08.09. *75.9, Omer Arbler Office. Fabric formwork casted columns in a housing project in Canada.*



10. *Lace, Mary Walker Phillips*

11. *Unfolded Nike flyknit shoes*

Previous work

Initial work in the Matter, Space, Structure prep studio leading up to the fabrication method of knitting. The work was focused on exploring fabrication methods possible to work within the discourse and also find a connection to structure. The use of flexible formwork in the form of fabric was a first step towards the thesis. Using a more simplified process of sewing together planar sheets and casting as solid models. The work consisted of exploring the field and its possibilities, creating engaging shapes together with a strong materiality.

Casting experiments from Matter, Space, Structure studio 3

Potentials with knitting

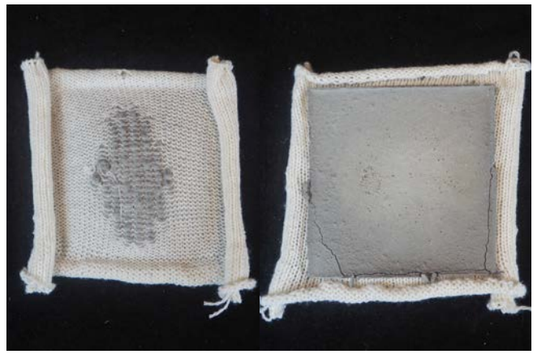
The technique of knitted formwork compared to fabric formwork increases the possibilities of what could be constructed. The knit pattern can include various data to construct for example double-curved surfaces, pockets, and channels. These could be used in various ways to manipulate the resulted cast. The knit could also consist of different density and be manipulated to stretch differently when under pressure. The knit can serve as a stay-in-place formwork and therefore be left visible and become part of the interior design.

Knitting as a fabrication method has the potential in being fully digital, where machines in clothing factories could be used for production. In this thesis, a much simpler machine is used, which does not do provide anything by pressing a button, but it does still serve as a good tool for producing knits for smaller models.

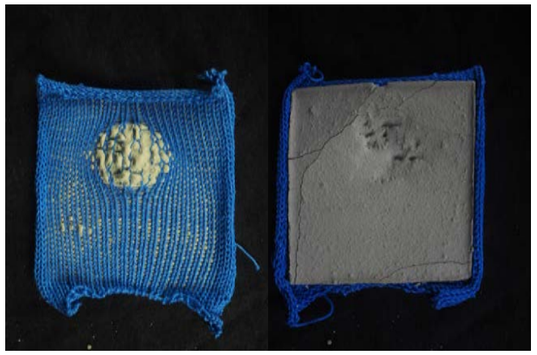
Knitting machine, Silver Reed SK840 with ribbing attachment SRP 60N.

#1 Tight knit, cotton yarn, concrete

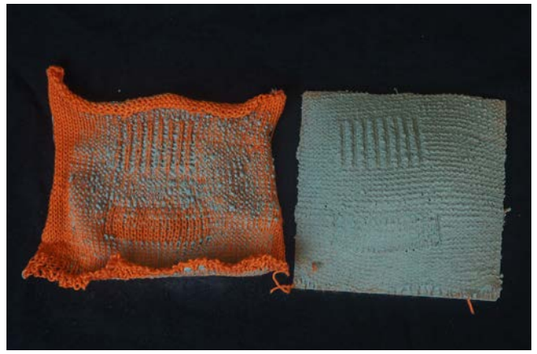
#2 Loose knit, cotton yarn, concrete



#4 Combined loose and tight knit, cotton yarn, concrete

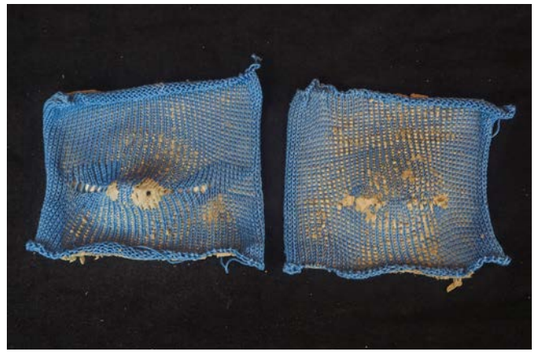


#5 Drop stitch, cotton yarn, concrete



#6 Rib knitted combined with tight knit, cotton yarn, concrete

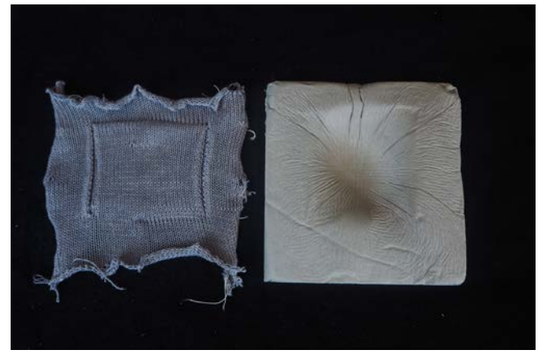
#7 Tight knit with stiffeners, cotton yarn, concrete



#8 Short row, medium thick yarn, concrete

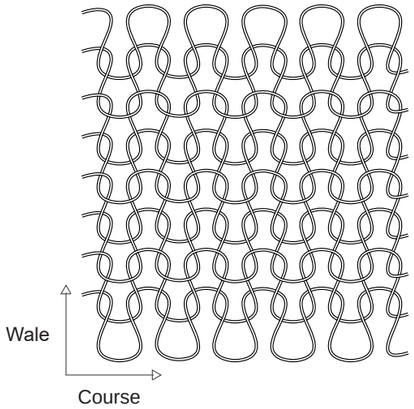
#9 Drop stitch, medium thick yarn, concrete with nylon membrane

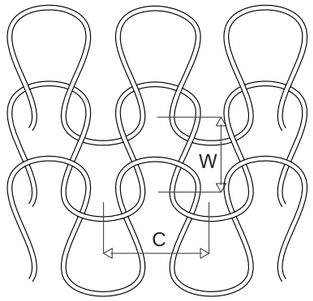
#10 Drop stitch, medium thick yarn, concrete with plastic membrane



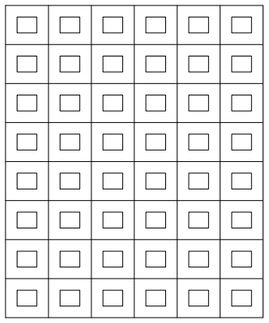
#11 Integrated pocket with inflated balloon, thin cotton yarn, concrete with plastic membrane

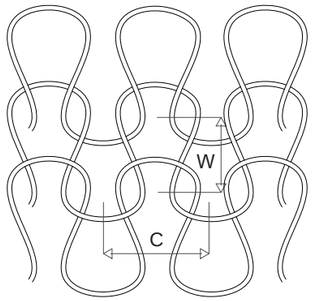
Material studies of how the knit could manipulate the casted result with different techniques.



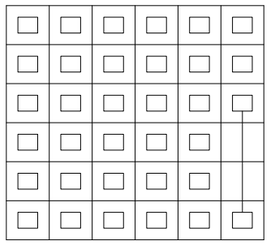


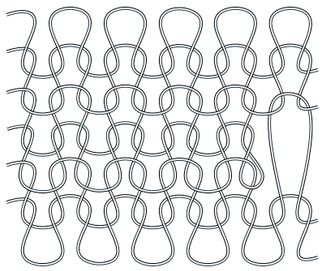
Stockinette knitting





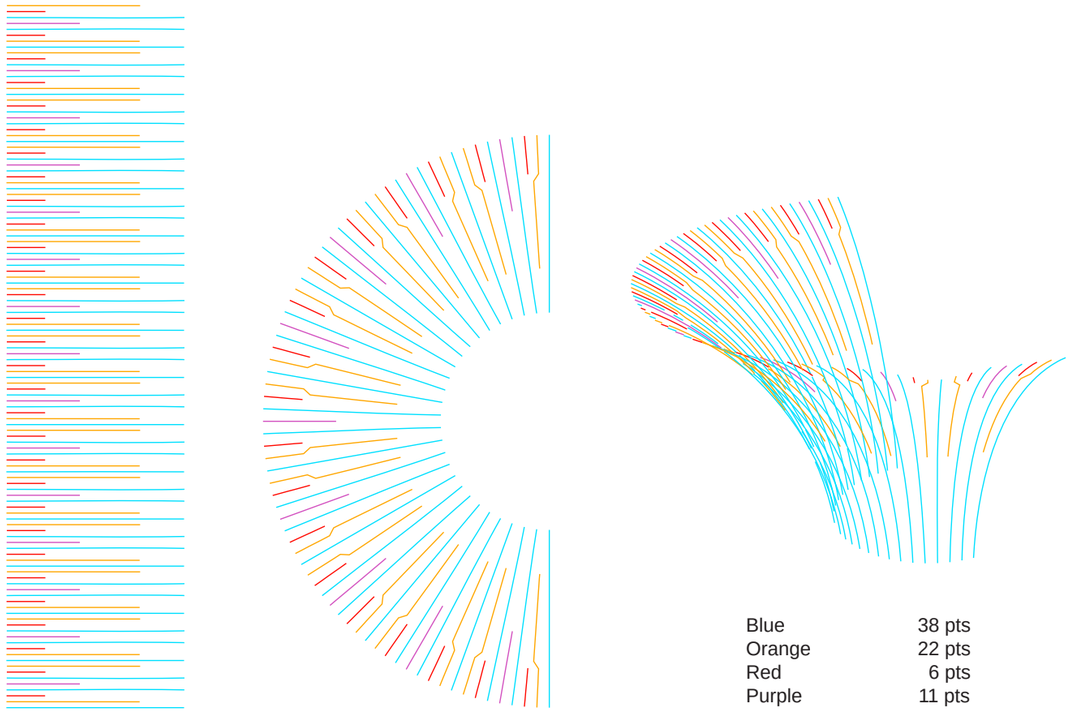
Stockinette knitting
as matrix system





Short row knitting
as matrix system

Knitting patterns, showing how the knit can be translated to a matrix system with columns and rows.
Squares above symbolizes stockinette knitting.



Blue	38 pts
Orange	22 pts
Red	6 pts
Purple	11 pts

Translated geometry to a knitting pattern.
Where each colour represents a number of stitches for the knitted row.

Structural principles

The use of knitted formwork imposes a set of rules on the geometry, which is a result of the behavior of membranes. A membrane can carry great loads even though it is a very lightweight structure. This is done through curvature and pretension. As the membrane can only carry tension loads the shape must be anticlastic. When under tensile load the membrane will strive for a minimal shape and if it is not already adopted to the membrane it will wrinkle (Olsson, 2020). Knitted shapes that are slightly deviating from a true minimal surface do not reveal any wrinkles due to the elasticity of the material, giving the design a bit more freedom.

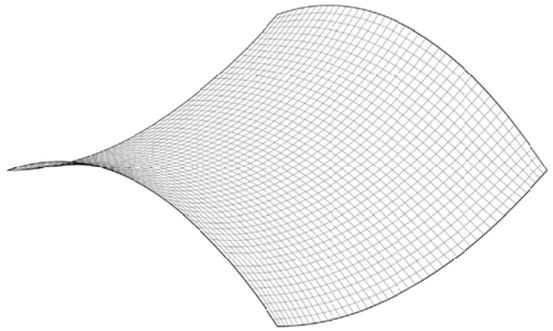
The concrete is cast in the pre-tensioned knit. The force that tensioned the formwork is inverted and replaced by the weight of the concrete resulting in a shell structure that is in compression. The pure construction shell does however only exist in our imagination, in reality, must the structure withstand imperfections that will likely impose bending moments. This can be handled by having a thicker shell or introducing stiffeners.

Anticlastic
A surface curved in two opposite directions.

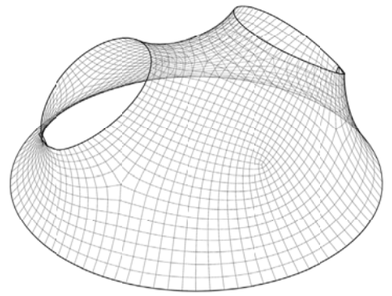
Minimal surface
A surface with the least possible surface area, given by some boundary conditions.

Boundary controlled
A set of boundary conditions.

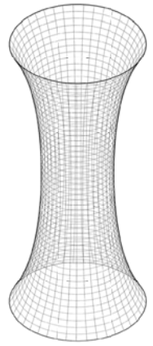
The column is chosen as an architectural archetype to work within this thesis. With the rules of the formwork behavior, by changing the boundaries can it easily be transformed into a mushroom structure just as well.



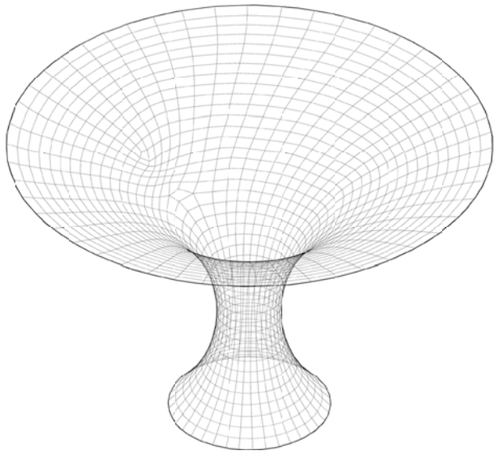
Anticlastic



Minimal surface



Column



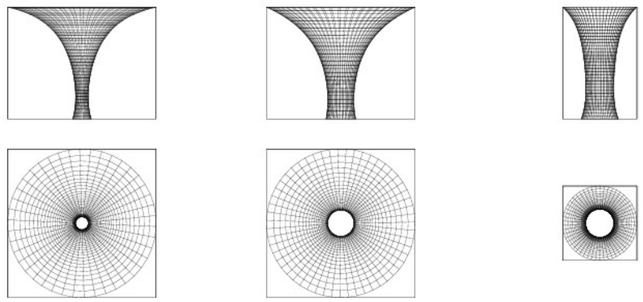
Mushroom

Material behaviour models

Anticlastic models

A.

B.



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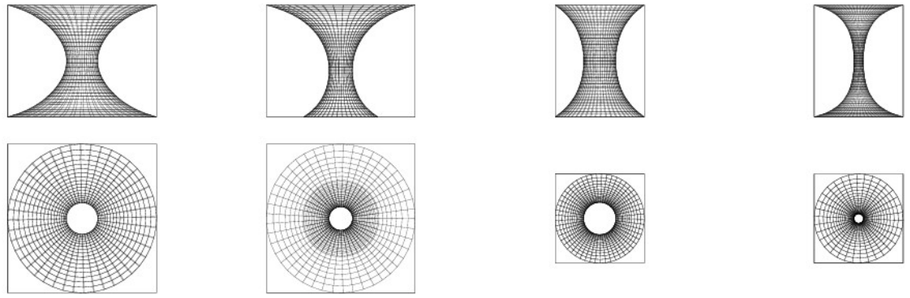
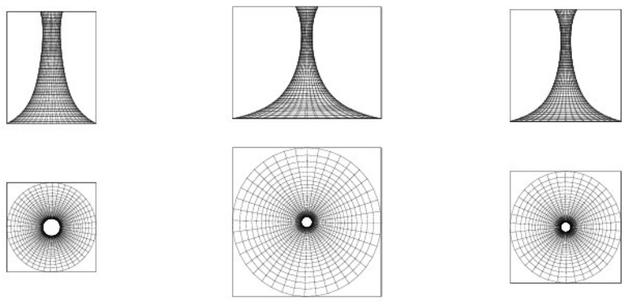
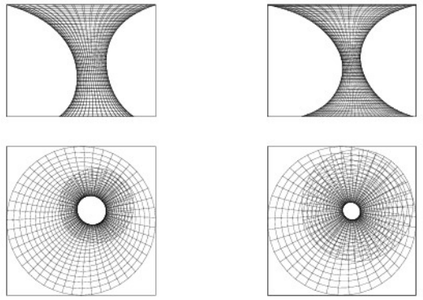


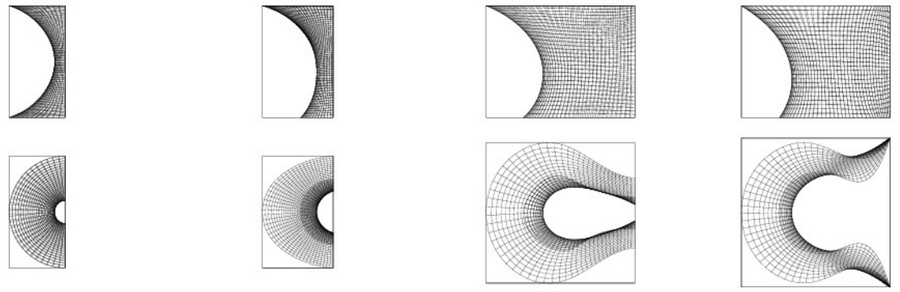
D.



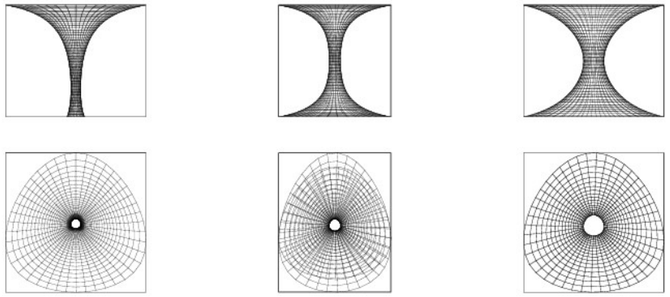
E.



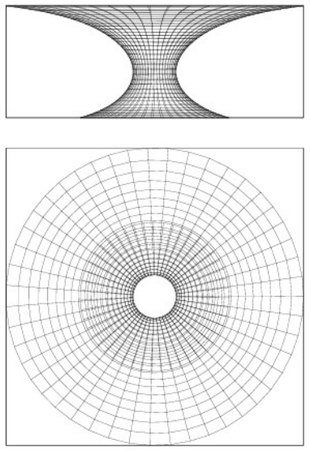
F.



G.

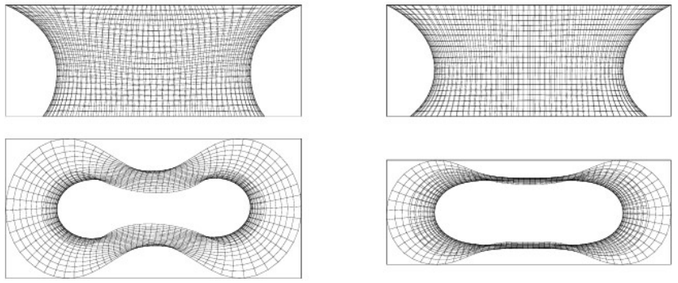


H.

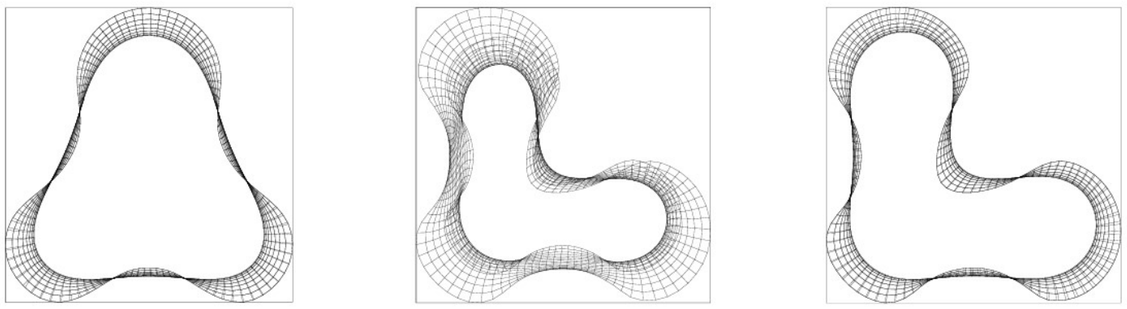


Iterations of typoligies

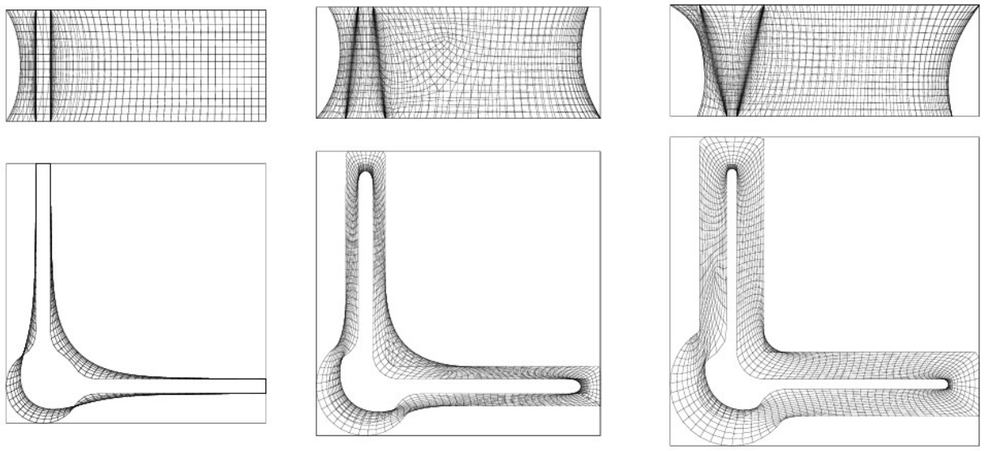
I.



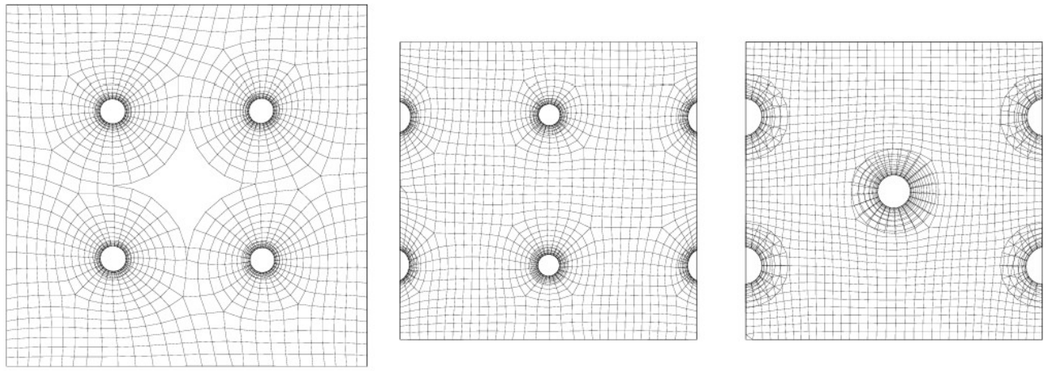
J.



K.



L.

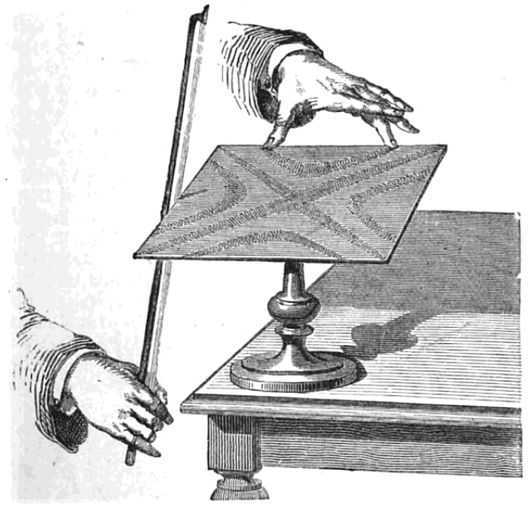


Iterations of typologies

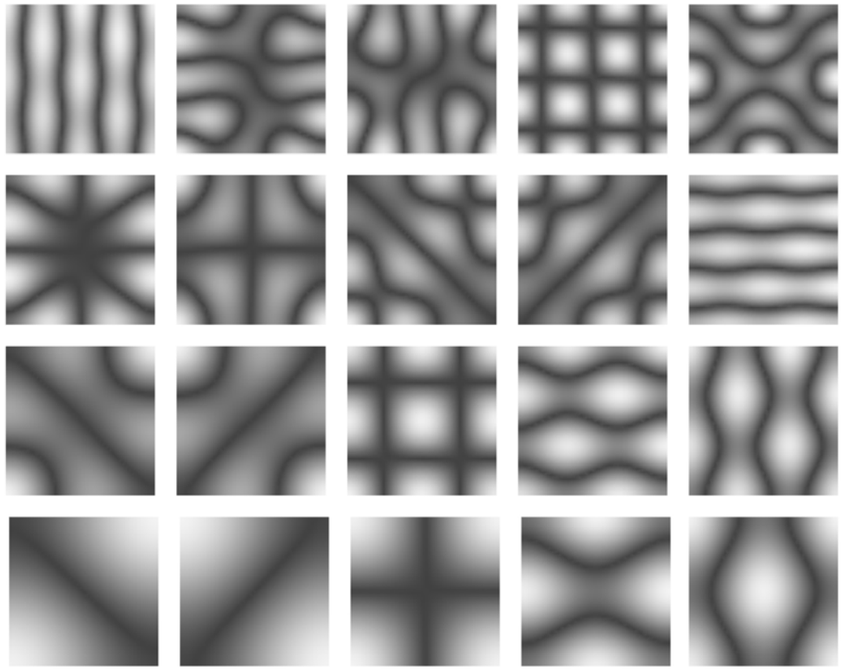
Eigenmode pattern

The musician Ernst Chladni discovered how to visualize vibrations patterns, by having sand on a flat square plate, when applying a the frequency with a violin string the plate will vibrate and the sand moves into the specific nodal lines.

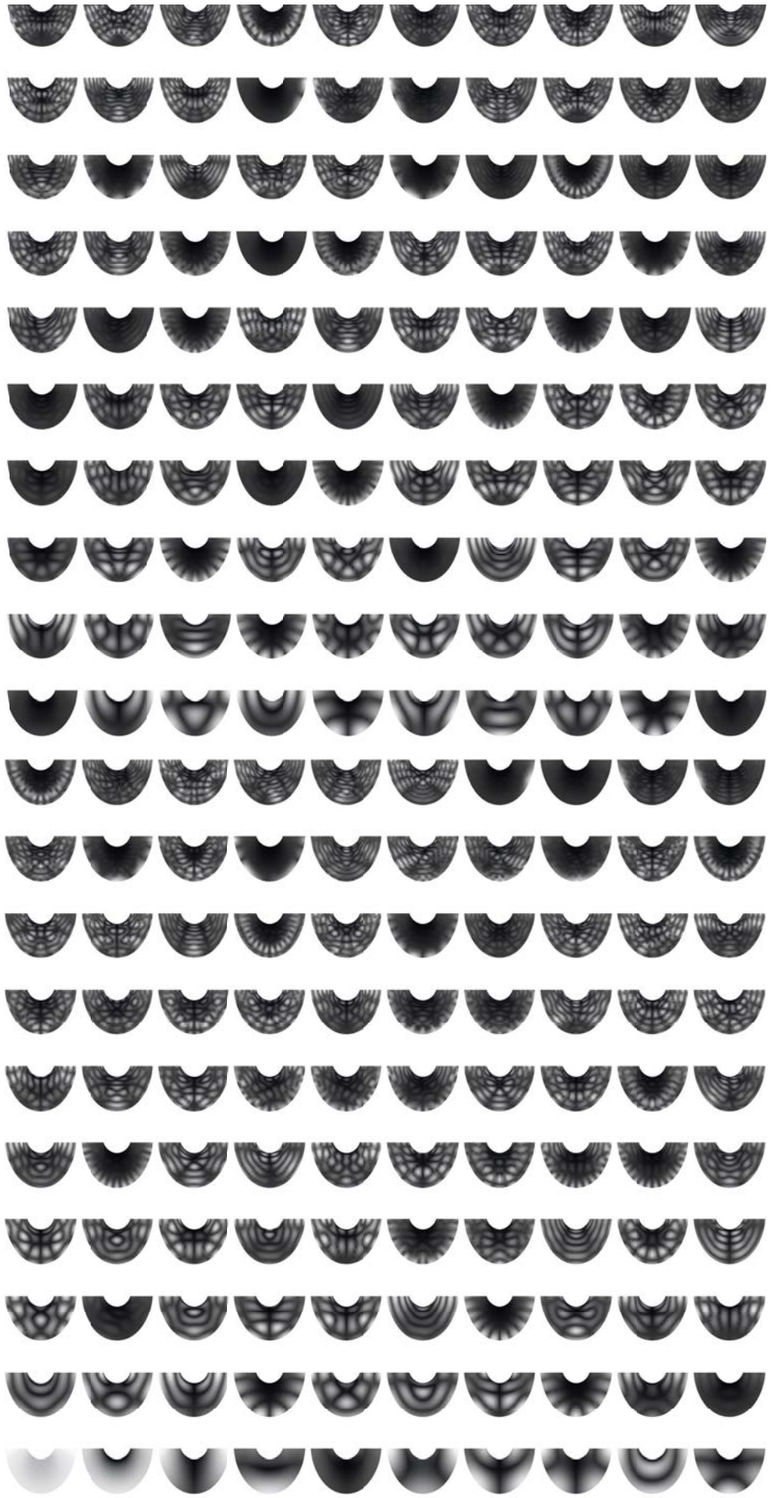
Shell structures that diverge from the pure compression geometry or when taken into account imperfections need to be stiffened, which could either be done by thicken the shell or add ribs to the geometry. One way of finding a placement of these ribs would be to use the method of vibration eigenmode patterns. Since not all the patterns are per default an optimal solution, a post-process needs to be done to find the best performing. This thesis, however, does not use any post-processing tool, only choosing one of the higher modes since they likely would be stiffer than the lower ones. The focus is rather on the expression and the ornamental qualities the ribs contribute with. The mass of the shell is distributed to the darker areas decided by the pattern. When constructed, a pocket is integrated into the knitted formwork and filled with a balloon to create a cavity. Structurally does this not only stiffens the shell but also reduces the amount of concrete needed.



12

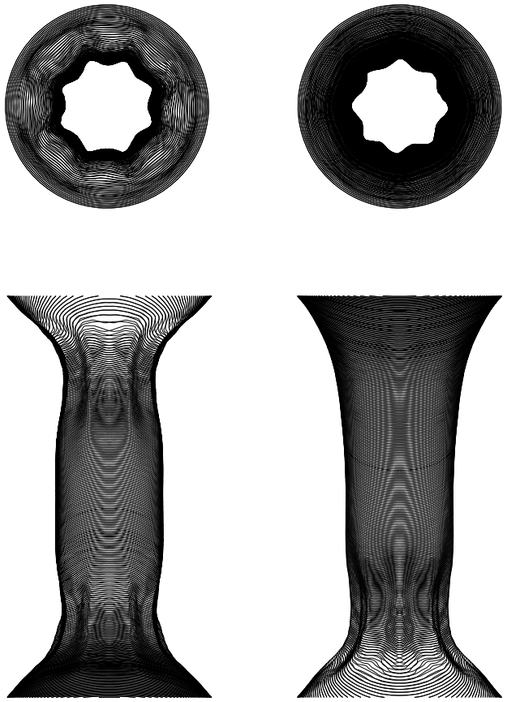


Eigenmode patterns of a flat square.

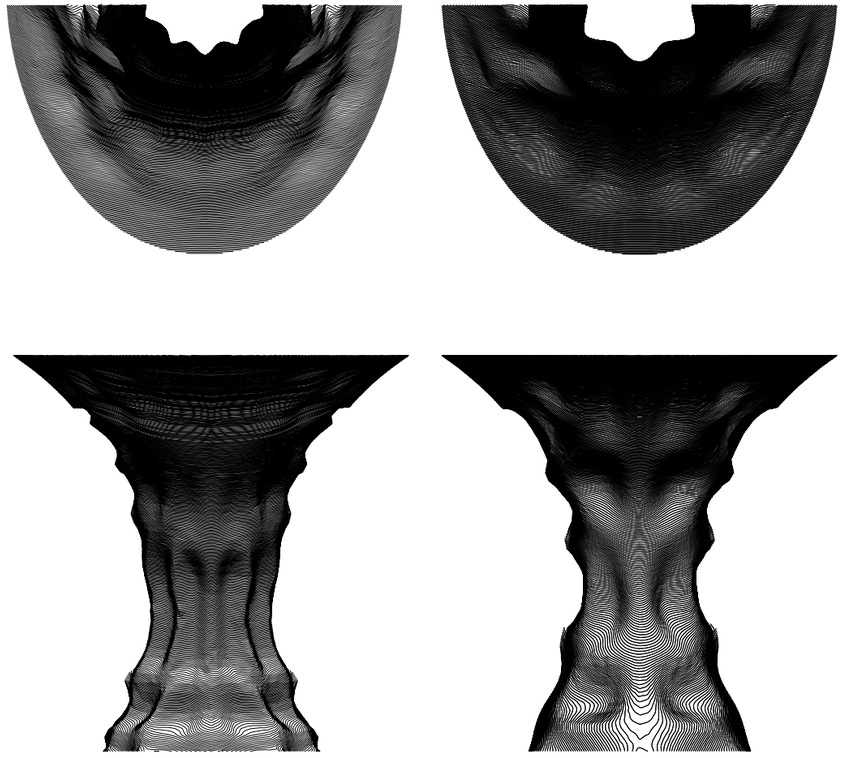


The first 200 eigenmodes of the wall element.

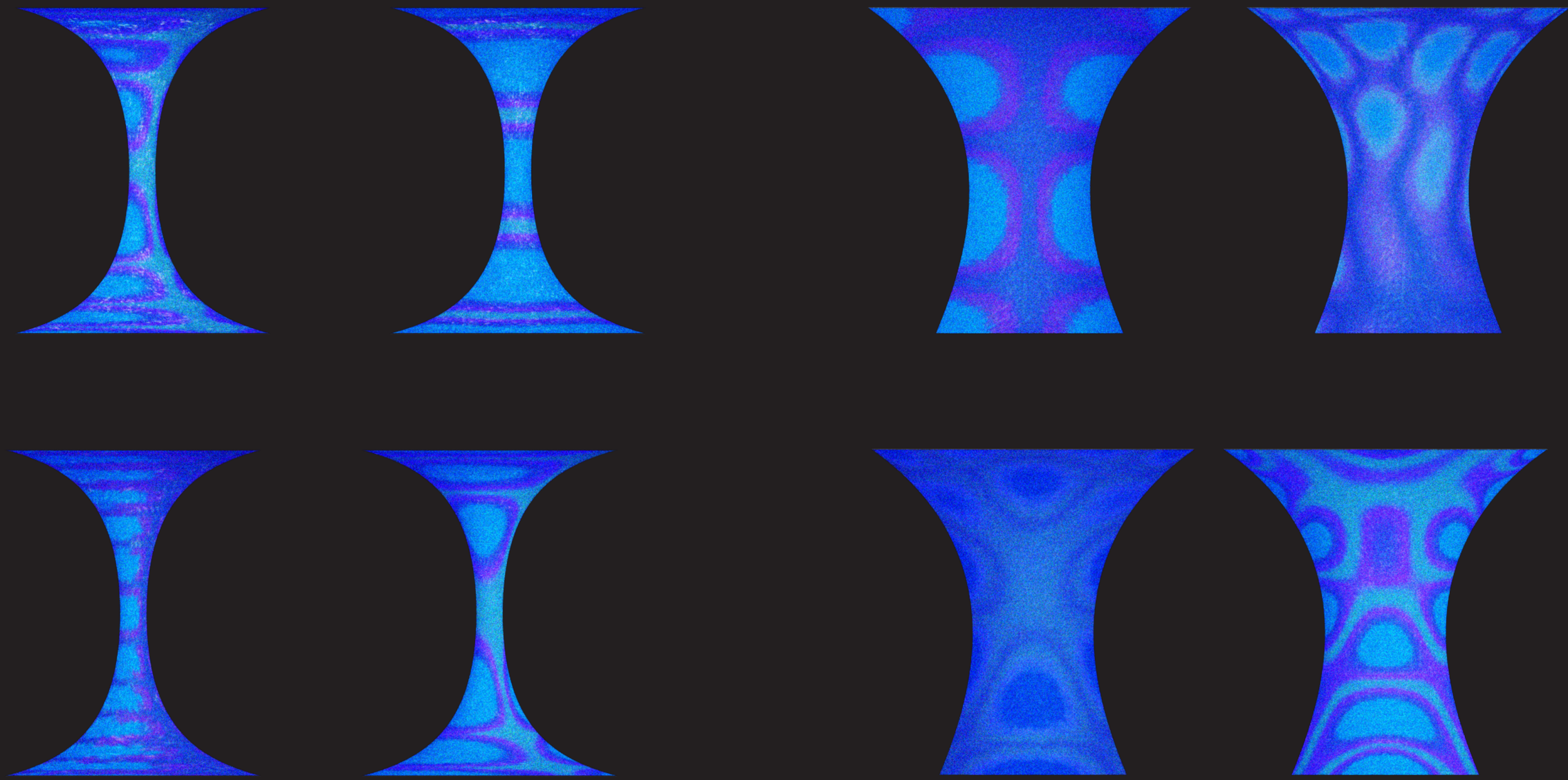
An estimation of the displaced result
based on the geomtruy of F1 typology.



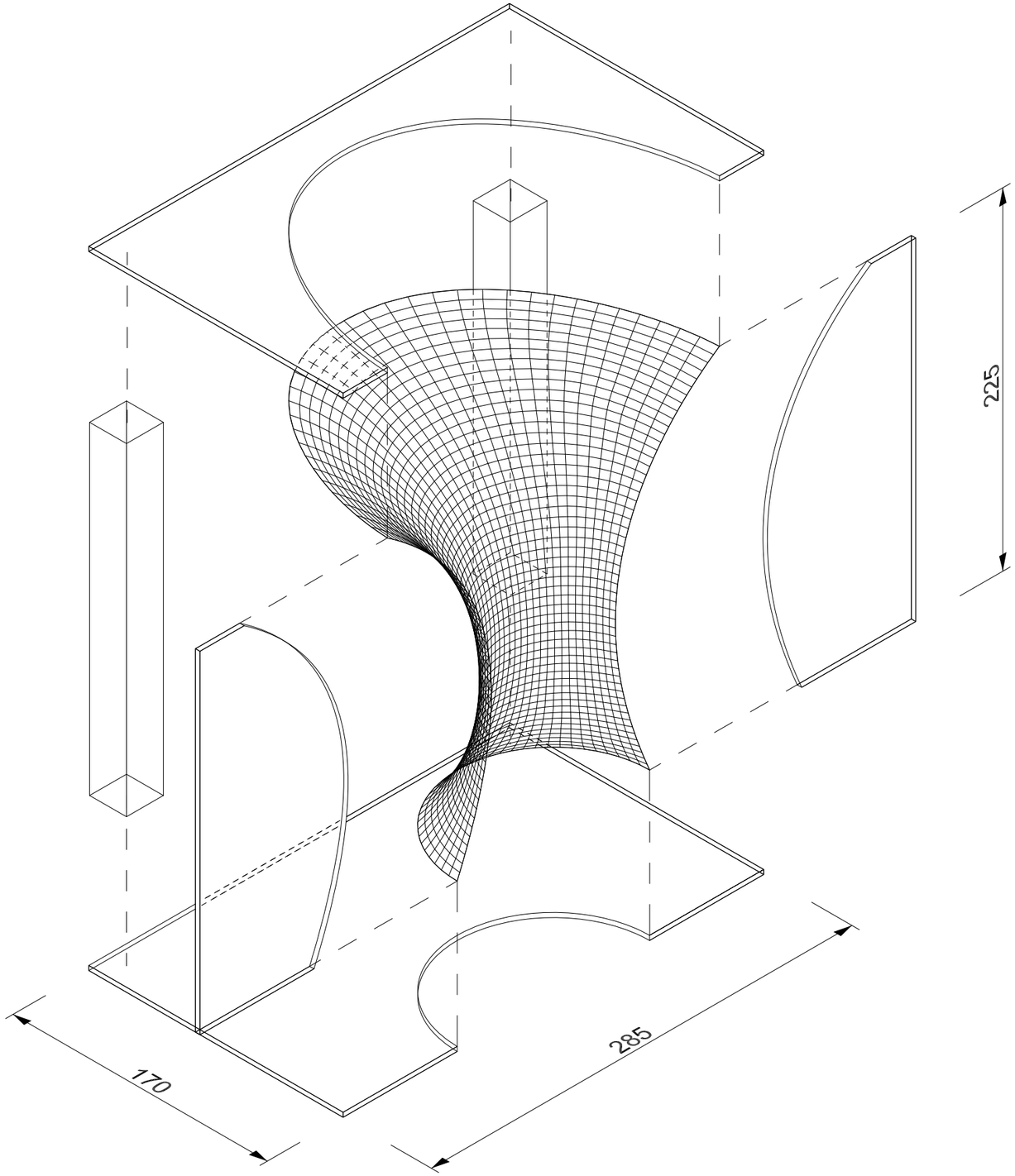
Geometry based on typology A1.



Geometry based on typology F3.



The eigenmode pattern as a knitted colour pattern to be left after casting, becoming part of the interior design.



Axonometry of 1.20 framework

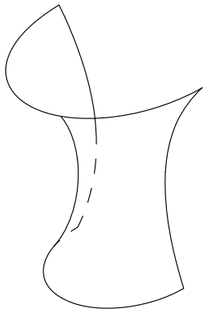
1.20 model

1:20 model showing the displaced cavities of irregular sized pockets.
See appendix to see all model iterations.

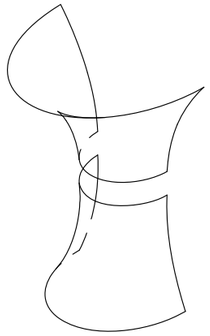
Process of casting 1:5 model with inflated pockets. *See appendix for all process images.*

Final cast uncovered of its formwork.

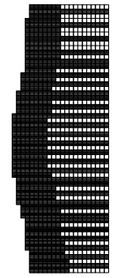
Final cast uncovered of its formwork.



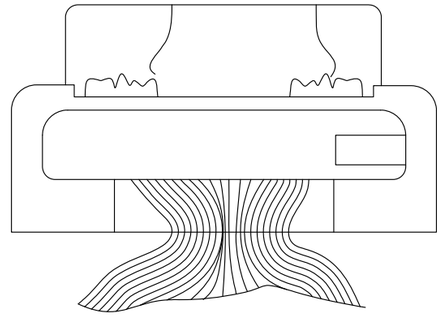
Geometry



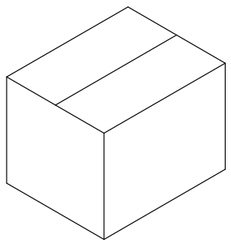
Splitting geometry



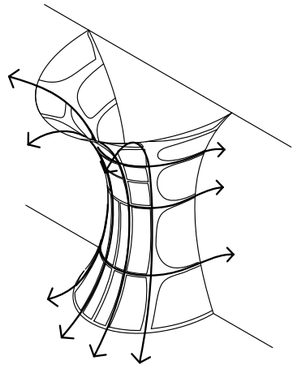
Generating 2d knitting pattern



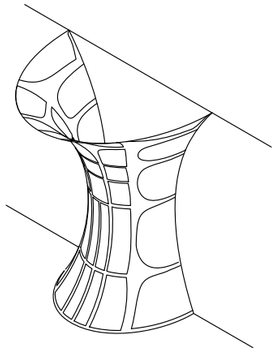
Knitting



Packing & Transport



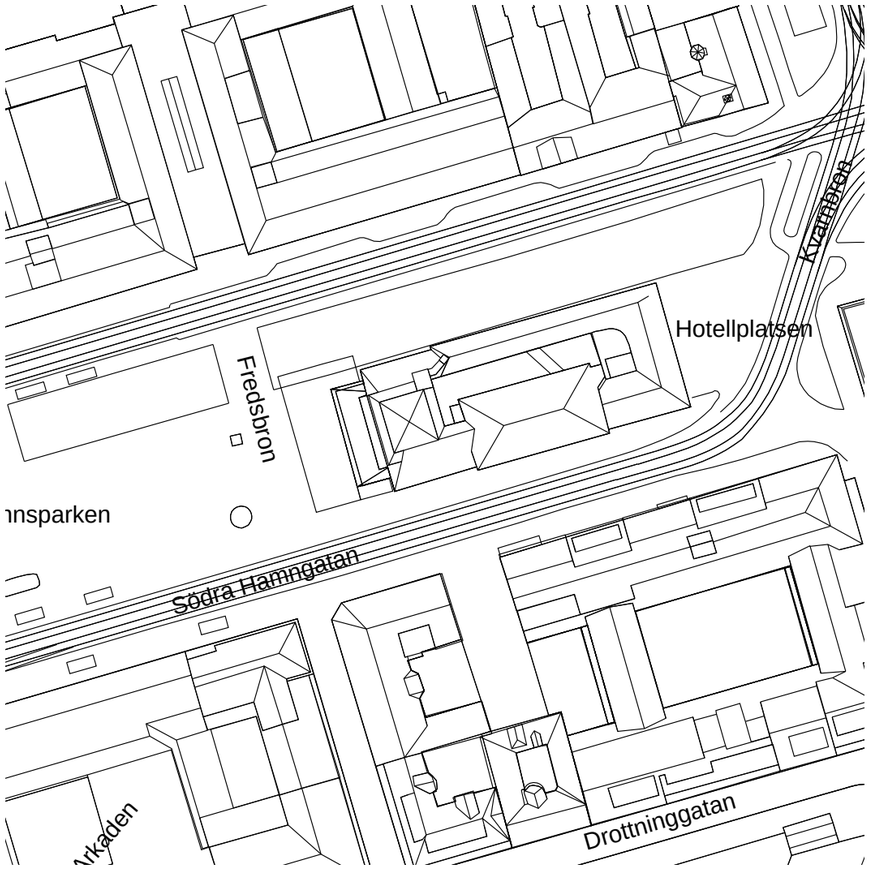
Pre-tensioning and inflating
on site



Ready for casting

General workflow, digital model to finished formwork

DESIGN PROPOSAL

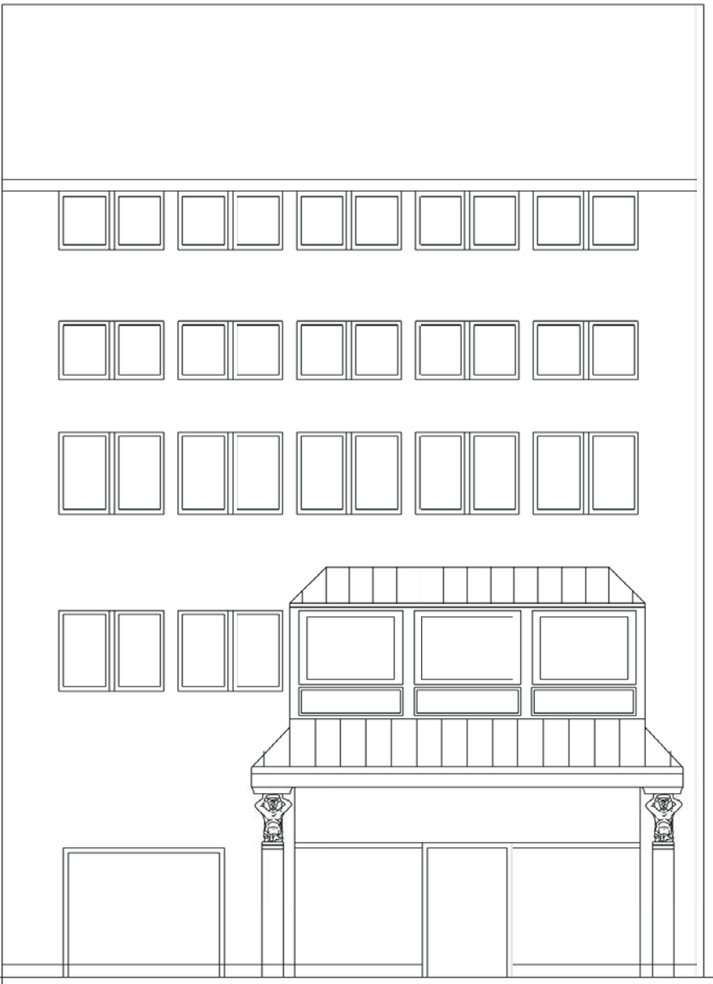


Site

The site called “Johannatomten” is situated on Södra Hamngatan 47 in the very central part of Gothenburg. Adjacent buildings are of cultural and historical importance with many different styles and expressions. The chosen site is an empty plot in the central city, its former occupant was built in 1887 with many decorative details and is to be thought of in the cultural importance of the site. The former house was later burnt down in the early years of 2000. The site funcitions as something for the design to relate to.

Master plan

13. Gothenburg, city center



Street facade, Södra Hamngatan 47

Site inventory

Gesims / Cornice
A ornamental horizontal band on the facade, sometimes found at the top of the entablature.

Arkitrav / Architrave
Is the beam or lintel that rests on the capitals of columns.

Fris / Frieze
Is the wide central part of a entablature.

Akroterion / Acroterion
Freestanding ornaments often placed on a flat surface or on corners.

Baluster
Vertical moulded shaft, or lathe-turned form.

Festong / Festoon
Often a carved ornament of flowers, fruits etc hanging like a garland.

Rusticering / Rustication
Masonry that is left in a raw cut fashion often raised from the wall surface.

Atlant / Atlas
Sculpture of a male figure taking the place for a column, a pier or a pilaster.

Pilaster
Architectural element giving the appearance of a supporting column, usually treated as it was column with a capital and a plinth.

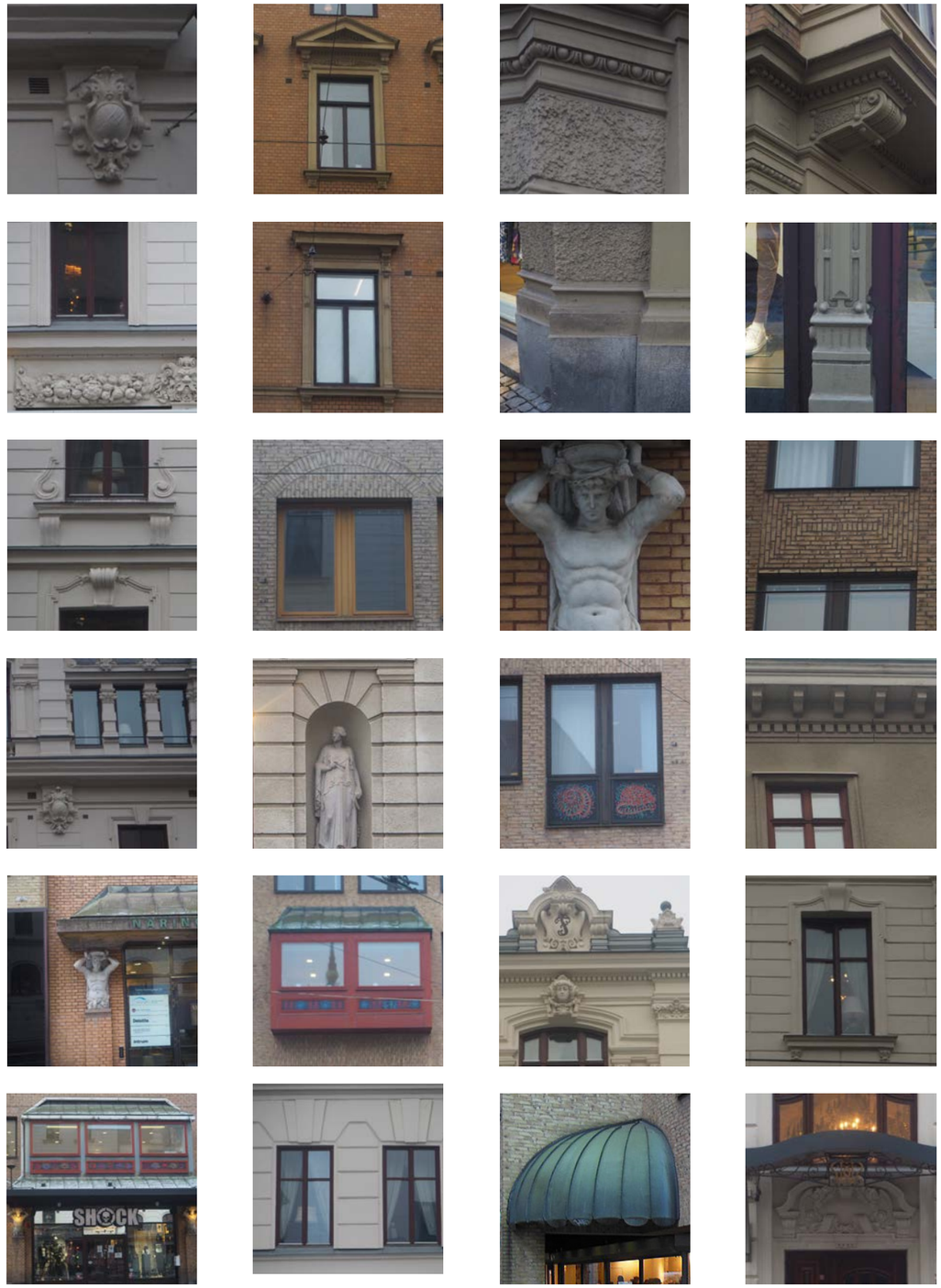
Fronton / Pediment
Triangular gable above a door or window often with decorations.

Överliggare / Lintel
A horizontal block that spans the space between two vertical supports, often found above doors, windows, portals or fireplaces.

Sockel / Plinth
Refers to the bottom of a building or a piedestal etc.

Gördellist / Belt list
Horisontal list dividing two floors from each other showing in the facade.

Piano nobile
The noble floor, usually with larger windows and with more decorations.



Collection of ornaments from site

14

15

16

17

18

19

20

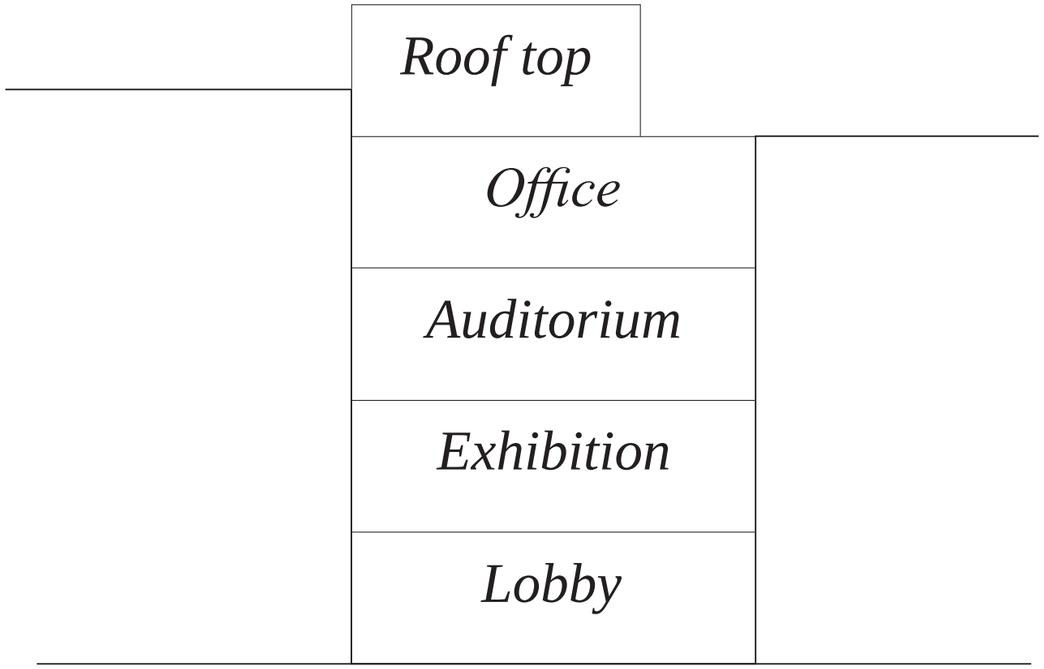
21

22

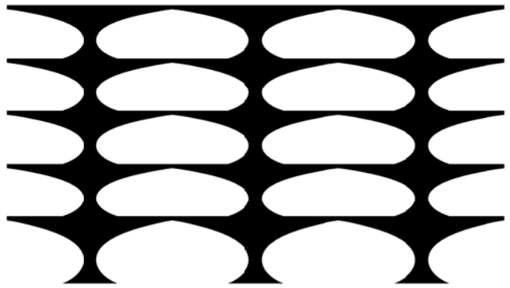
Various references to the design proposal in the thesis.
14-15. *Schützenmattsstrasse, Herzog & de Meuron, 1993.* 16-17. *Stadt Casino, Herzog & de Meuron. 2020* 18. *Red room, Twin Peaks, David Lynch, 1990.* 19. *Grand Central Oyster Bar, Rafael Gaustavino, 1913.* 20. *Green Corner Building, Studio Anne Holtrop, 2020.* 21. *Restaurant Varna, Verner Panton, 1971.* 22. *Barbican Centre, Chamberlin, Powell & Bon, 1982.*

Program

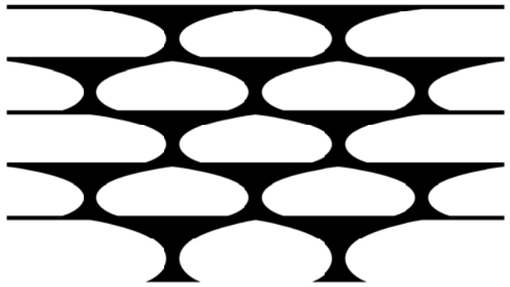
The proposal is consisting of a program for many purposes, giving the possibility for the public to enter. The proposal is situated in an area where the public areas are mainly centered around commercial purposes, this program will contain an open lobby, connected to an auditorium, an exhibition space, and flexible office spaces. The lobby is not a space that requires purchasing something, it is where you can socialize, have a drink, or just sit around, waiting for other activities in the building The proposal will be presented through these different situations of the program.



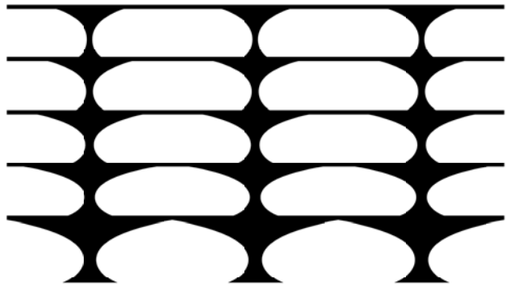
Program



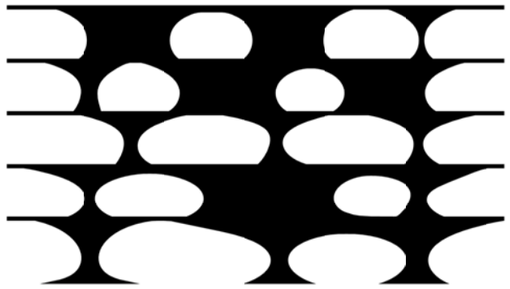
A. *Regular*



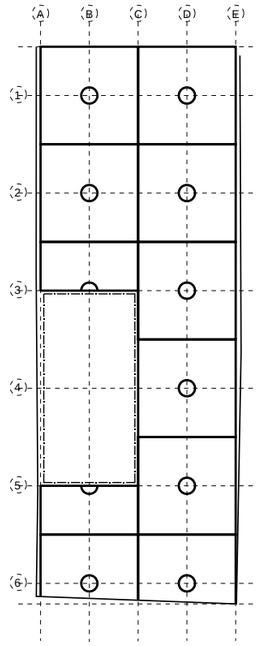
B. *Shifted*



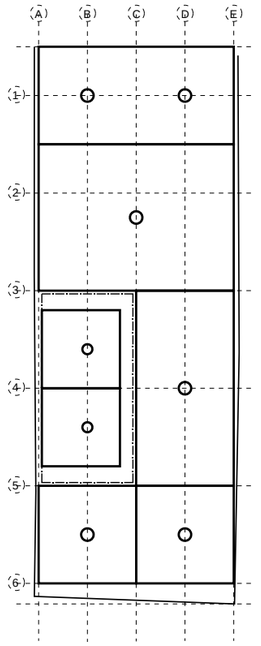
C. *Level specific*



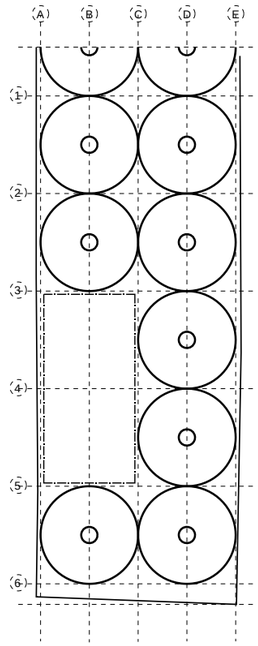
D. *Cell*



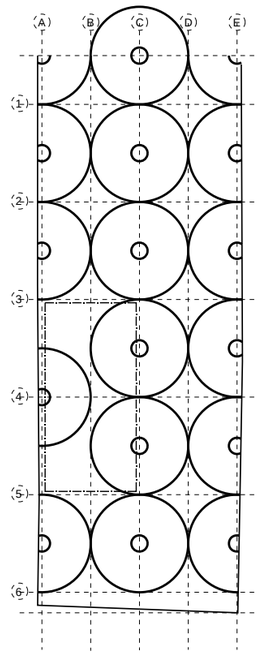
I. *Square regular*



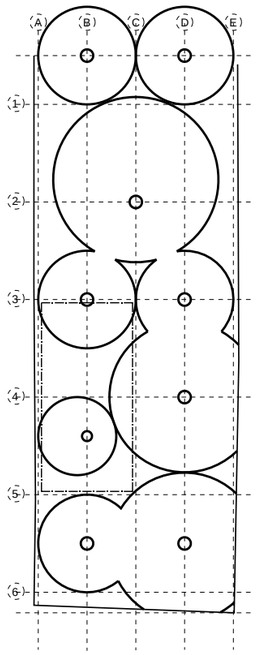
II. *Square irregular*



III. *Circular shifted*



IV. *Circular double-shifted*



V. *Circular irregular*

Design study of structural concepts in section and plan,
based on a grid system of 6 by 6 meters.

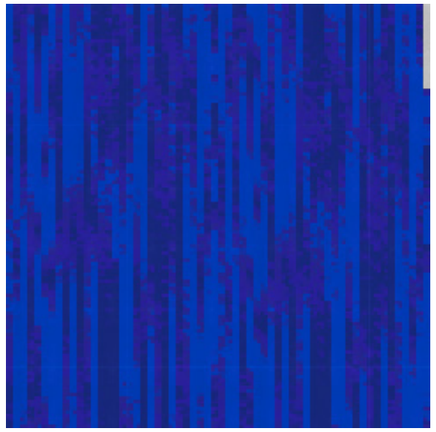
Facade model 1:50

The façade

The façade is in constant conversation with its neighboring buildings. As Alejandro Zaera-Polo writes in *The Politics of the Envelope* (2008), the envelope is what materializes the separation between the interior and the exterior, the private and public. The envelope is a joint that is loaded with political content, “At a time when energy and security concerns have replaced an earlier fo-cus on circulation and flow as the contents of architectural expression, the building envelope becomes a key political subject” (Zaera-Polo 2008).

In *The Function of the Ornament* does Farshad Moussavi describes the façade as independent of the interior. As oppose to Moussavi, does this part of the façade rather want to connect the interior and exterior by extending the structure outside of the datum, becoming part of the expression.

The façade does also relate to its adjacent buildings, picking up characteristics from the site inventory. These are for example articulated levels, rhythm in apertures, and a Piano Nobile, a more decorated floor containing the more important rooms. These characteristics are expressed with the knitted structures by varying the slimness and the displacement of the columns. The loosely hanging curtain is to be seen as a symbol for the formwork of the columns, once being a loose fabric as well.



A

B

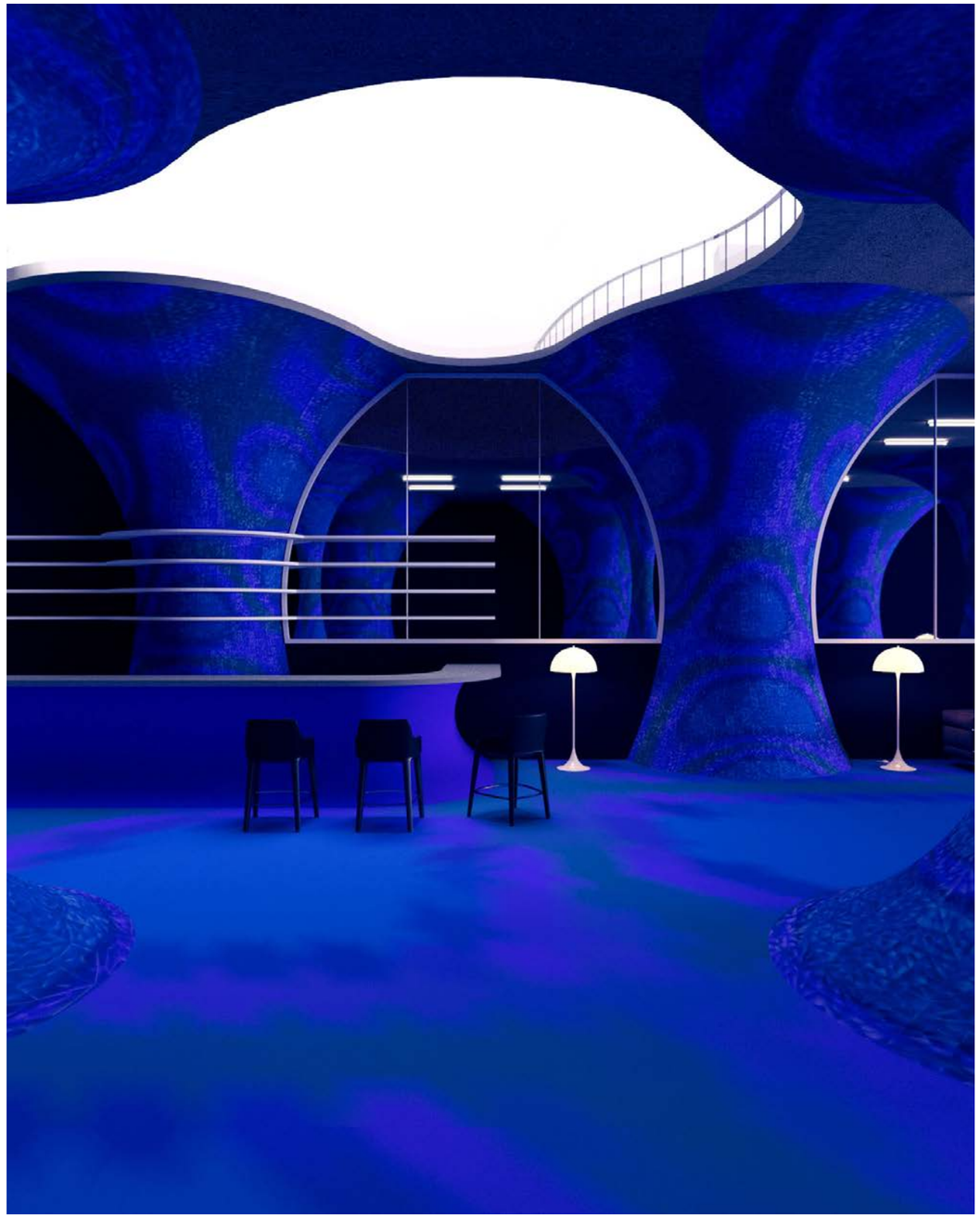
Implementations

The ornament strives to appeal to the whole sensorium as Antoine Picon describes it (Picon, 2013), attracting both the eye and the hand. It is discovered through its texture and shape, the unevenly shaped geometries as a result of the cavities trigger the imagination to see human shapes or faces in the structures.

When the formwork is left the same patterns are shown in the knitted as a colour gradient instead of becoming part of the interior. Here does the ornament serves as the ribs of a gothic church, supporting the structure while constructed, the ribs as scaffolding, and the knitted fabric as formwork. Once the last stone of the vault is placed the ribs lose their load caring function (Aghaei Meibodi, Aghaiemeybodi, 2012). Just as the knitted formwork does not longer support the structure as soon as the concrete has hardened. They then become something else, an ornament, referring to the story of the construction. The interior could then be dressed in a colour, sparking the atmosphere of the space.

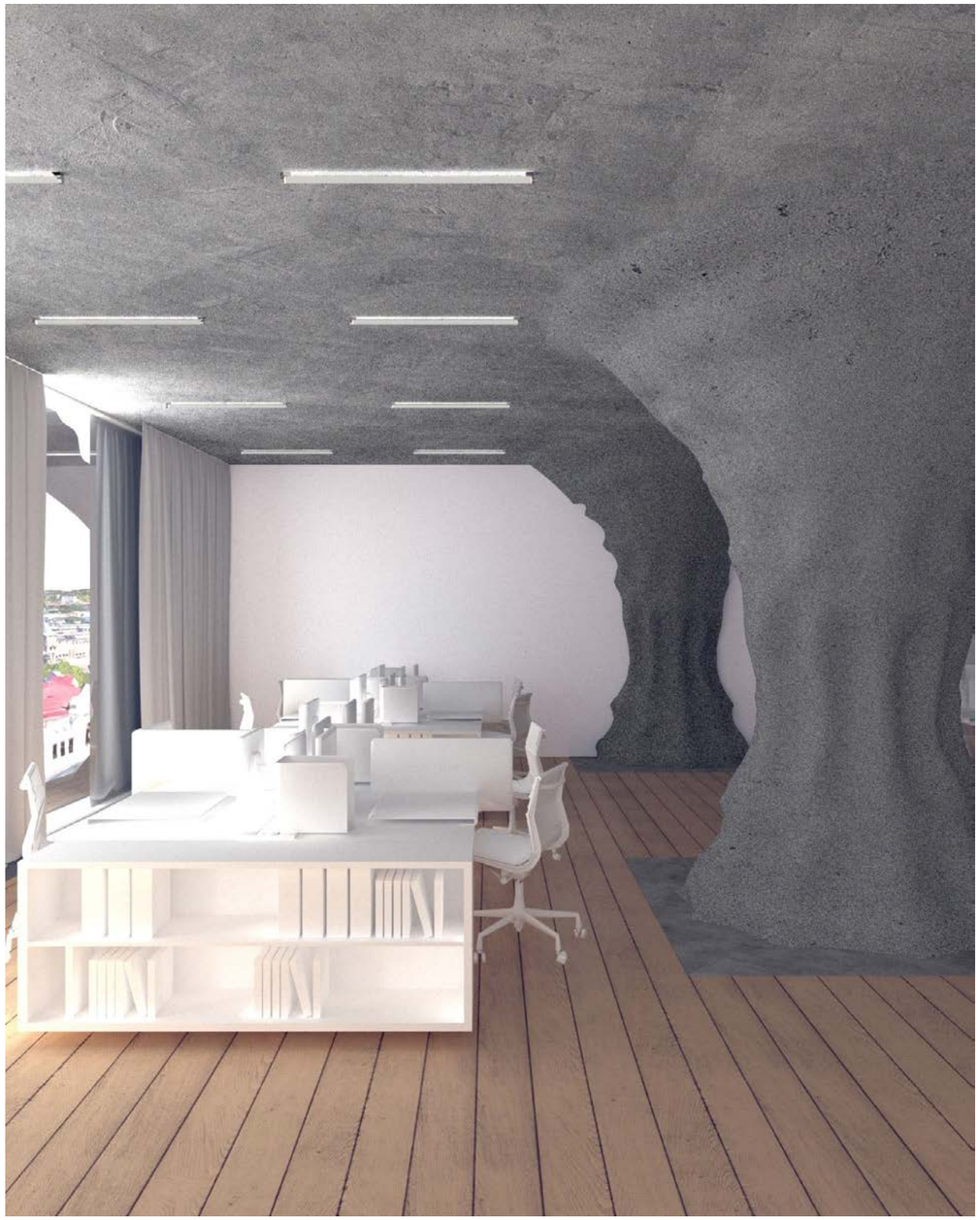
The following implementations show various situations to demonstrate the structures in a spatial context, to exemplify spatial qualities they could have.

A. *Render bitmap.* B. *Sample piece of a Fair Isle knitted gradient*

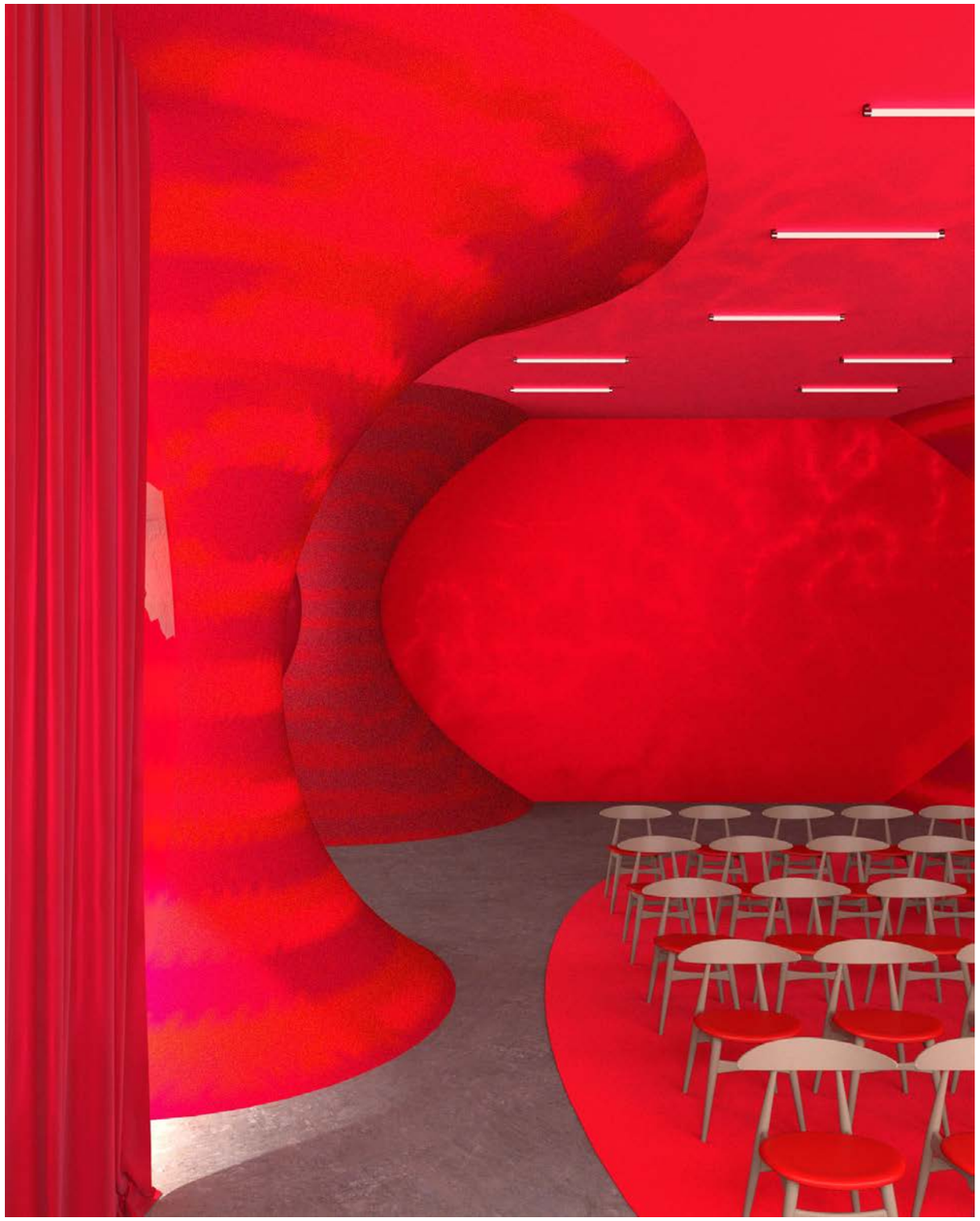


Lobby situation

Lobby situation



Interior view of an office situation



The auditorium covered in fabric

Exterior image from the courtyard balcony

SUMMARY

Conclusion

The thesis aims to address structure and ornament as an articulated jointed design. Intrigued by using structural principles as a driver for ornaments the thesis wants to represent contemporary ornament in a new setting.

The work has been a research-by-design process, exploring what could be done within one chosen fabrication method. There was early on a decision whether going in a direction to work deeper with either the prototype part or the application. Developing the fabrication method further felt more exciting in this case than solving an architectural plan. Though the design proposal is presented in fragments, as a thesis project does it show strength by the various ways it is presented.

Our knowledge of using a knitting machine was limited from the start. That forced us to learn by trial and error, developing an intimate relationship with the knitting machine. The work became somewhere between digital craft and handcraft since the machine was more analog than expected. This forced us to understand the knitted fabric better.
The work has balanced between being only a pure exploration of knitted formwork and connected to the theoretical discourse. Since craft is a large part of my definition of ornament has it been necessary to deviate from the ornament track, focusing on the craft itself.

Where this thesis aimed to have structural purposes as the driver, the structural performance has not been analyzed and is only to be considered conceptual. The thesis rather focused on the aesthetic values that could spring from using structure as a driver, expanding the discussion on ornaments together with structure. Connecting ornament to structure increases the value of the ornament to be easier to motivate, referring back to Jacques Herzogs's feeling of new freedom.

In a time where digital fabrication methods are rapidly developing it is crucial for the architect to get control of the process, to avoid the history repeating itself of mass-produced ornaments, as critiqued by Adolf Loos in Ornament & Crime. When the fabrication method is reflected in the design the sense of craft can remain, even though the process is digital. The limitations of the fabrication method are also what gives its characteristics, removing some of its anonymity that could be the consequences of a digital process.

Contemporary ornament moves away from communicating any clear symbolism like in the past, it rather communicates through other means. In conclusion, the design in the thesis opens for the observer to reinterpret the shapes as their own, as a way to free itself from any historic symbolism. The abstract ornament, rooted in structure strives to enrich and give the space its own identity.

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Images

Figure 1.

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Figure 18.

Figure 19.

Figure 20.

Figure 21.

Figure 22.

CHALMERS