

Intersecting Elements

A transformation of Pumpestation Kløvermarken into a community space for cultural experiences

Project report

Thesis project report by

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Abstract

The project seeks to transform Pumpstation Kløvermarken on Amager into a cultural community space for the residents in the area and Copenhagen. We wish to give the old, historic building a new relevance, making it a part of people's cultural life in the city.

Our process started with a thorough registration of the existing building through an atlas, as we wanted to find inspiration within the architectural elements and details of the building. We investigated whether finding a starting point in the details of the building would lead to our addition finding a dialogue with the existing. By categorising the architectural elements into new operational themes, the atlas became an inspiration for our later concept development.

Research into the character of Amager, acoustics, the future scenarios, and the flexible character of textile spaces lead us to define the goals for the project.

Throughout our process, we found inspiration in the stage curtain as a spatial element. – Its symbolic meanings, the way it conceals and reveals, and the functional system of pulleys, creating movement. In the process, we have used physical models to understand the material properties of textile and the mechanical system for movement. This method has been crucial for the development of our design.

Our primary intervention is a flexible and moveable textile ceiling that can create different spatial divisions and atmospheres in the space. We introduce the textile because of its acoustics, soft and translucent properties. The textiles connect to the ground through a rope system gathering at four new interactive stands/machines. These new machines are the points of contact for the human to interact with the ceiling.



Pumpestation Kløvermarken, when arriving from Kløvermarksvej

Introduction

In the northern end of Amager, placed between two trafficked roads, we find the old Kløvermarken Pumpestation. On our first encounter with the building and the space inside, we immediately saw the potential for creating a beautiful space for cultural experiences.

The characteristic architectural expression of the building tells a story about a city in development. The building was constructed in 1901 to pump the spill-water of the city further out into Øresund. It used to be the biggest pump station in Denmark, but over the last century, technology outran the building. Consequently, the pump station was taken out of use in 2019 as a new station next to the old one took over its function, leaving the building empty.

When the original pump station was built, it was a lonely construction on the fields outside Christianshavn. However, over the years, a diverse neighbourhood of industry, housing and recreational areas has sprouted up around the plot. It is contradicting how the station once was a driver in the infrastructural development of the city, while it is now empty and without purpose in the current development of the area. Along with similar infrastructural buildings from a past time of development, the pump station needs a new purpose that reflects the city's current development.

Copenhagen's number of citizens is increasing more than ever, and the municipality of Copenhagen aims for strategies that use culture and history as a driver for developing new and existing neighbourhoods. In this development, it makes sense to use the historical architectural values to create identity and quality in the local areas.

Therefore, in this project, we seek to revitalise the pump station at Kløvermarken, transforming it into a cultural community space, giving the place a new relevance for the local citizens.



The pump station seen from Herjedalsgade. In the front to the right you see the access road through the tall fence. To the right you see the grey side building, an original, but heavy transformed building.

Thesis statement

The intention of the project has been to transform Pumpstation Kløvermarken into a community space for cultural experiences, with a starting point in the sensory experience and the human scale.

This has raised a series of complex questions that we over the course of the project have sought to answer:

What does it mean to work with and within a human scale in architecture and design?

How can we as humans inhabit a space originally dimensioned to accommodate machines?

How can we engage in a dialogue with the existing architecture in order to, in a respectful way, add a new layer to it?

What is a cultural house/community house, and why is it needed in this area?

Report structure

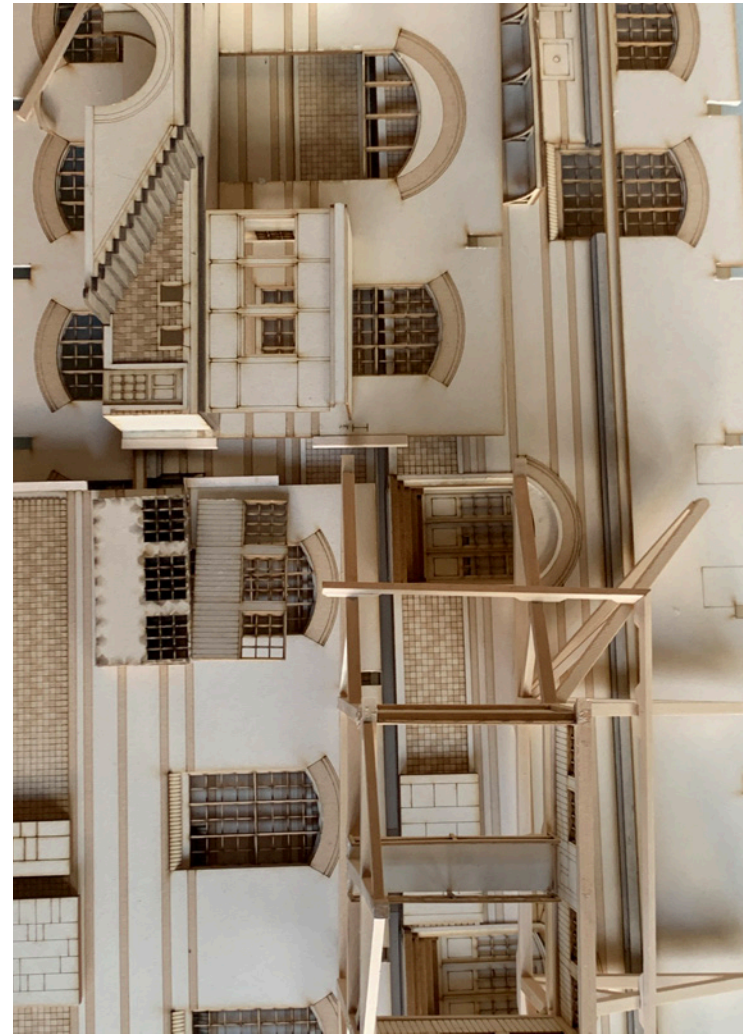
This report consists of four main parts.

The first part of the report introduces Pumpestation Kløvermarken and its context.

The second part of the report sums up our research into essential aspects that have informed the program and the following design process.

The third part contains our analysis through the formats of two atlases mapping the existing building and the stage curtain as a spatial element, both drivers that have informed the project. The first atlas, “Atlas of Pumpestation Kløvermarken”, analyses the existing architectural qualities and themes inherent at the site. These themes have had an impact on the following concept development. The second atlas, “The stage curtain as a spatial element”, points towards the spatial concept we want to introduce to the building and investigates the stage curtain from a theoretical, tectonic and historical/cultural perspective.

The fourth and last part of the report summarises essential findings from the design process, the design approach, and the chosen concept and solution, which we will develop further towards the exam.



Modelfragments from “Atlas of Pumpestation Kløvermarken”

Interdisciplinary collaboration

Benjamin has a BA in textile design, and Therese has a BA in furniture design. However, both of us have an interdisciplinary approach to our work. We started working together on our second-semester project, looking into the performing arts at Lynetten (Refshaleøen), creating a series of rammed-earth stage structures in the exterior landscape. In this thesis project, we have chosen to focus on interior space.

Throughout the process, we have discussed and worked closely together without dividing the work. However, towards the end of this project, we returned to our backgrounds, implementing both a furniture and a textile element in the project, each having our area of responsibility.

Dialogue has been an essential tool in our collaboration. The ongoing negotiations and cross-over-way of working have been a conscious part of the ideation process and helped us clarify the arguments when we made decisions. An idea that might seem simple to one of us suddenly becomes complex when describing it to the other. We believe that working in continuous dialogue with one another has strengthened the outcome, bringing depth to our design decisions and subsequent solutions. Through this dialogue, we have relied on and learned from each other's skills and competencies.

To set the framework for our collaborative work, we needed a neutral working space outside our apartments. This space has been the base we have returned to throughout the project. This must be seen in the light of the Covid restrictions, which have been effective while carrying out this thesis project.

Having restrictions on access to school workshops has caused the need for thoroughly planning our days ahead. But by structuring our time well, we have managed to embrace multiple varied working methods and phases within the project.



Method

When formulating the program for the project, we saw it divided into three main phases: *Fieldwork*, *atlas* and *experiment*, a process-driven project. During the process, there has been a continuous interaction between the phases. They have been overlapping and informing each other, e.g. the atlas of the stage curtain being an ongoing work simultaneously with the design process.

Each phase has brought new methods into the project. The fieldwork has consisted of interviews with two acoustics experts and locals from Amager, literature review, and desktop research.

Within the atlas phase, we have made registrations through photography, colour sketches, fragmented models, drawing in Rhino, and desktop research. In the experiment, a key element has been our ideation through a physical 1:20 model. In addition, we have sketched in hand and made collage- and computer visualisations to drive the project forward.

Working with physical models

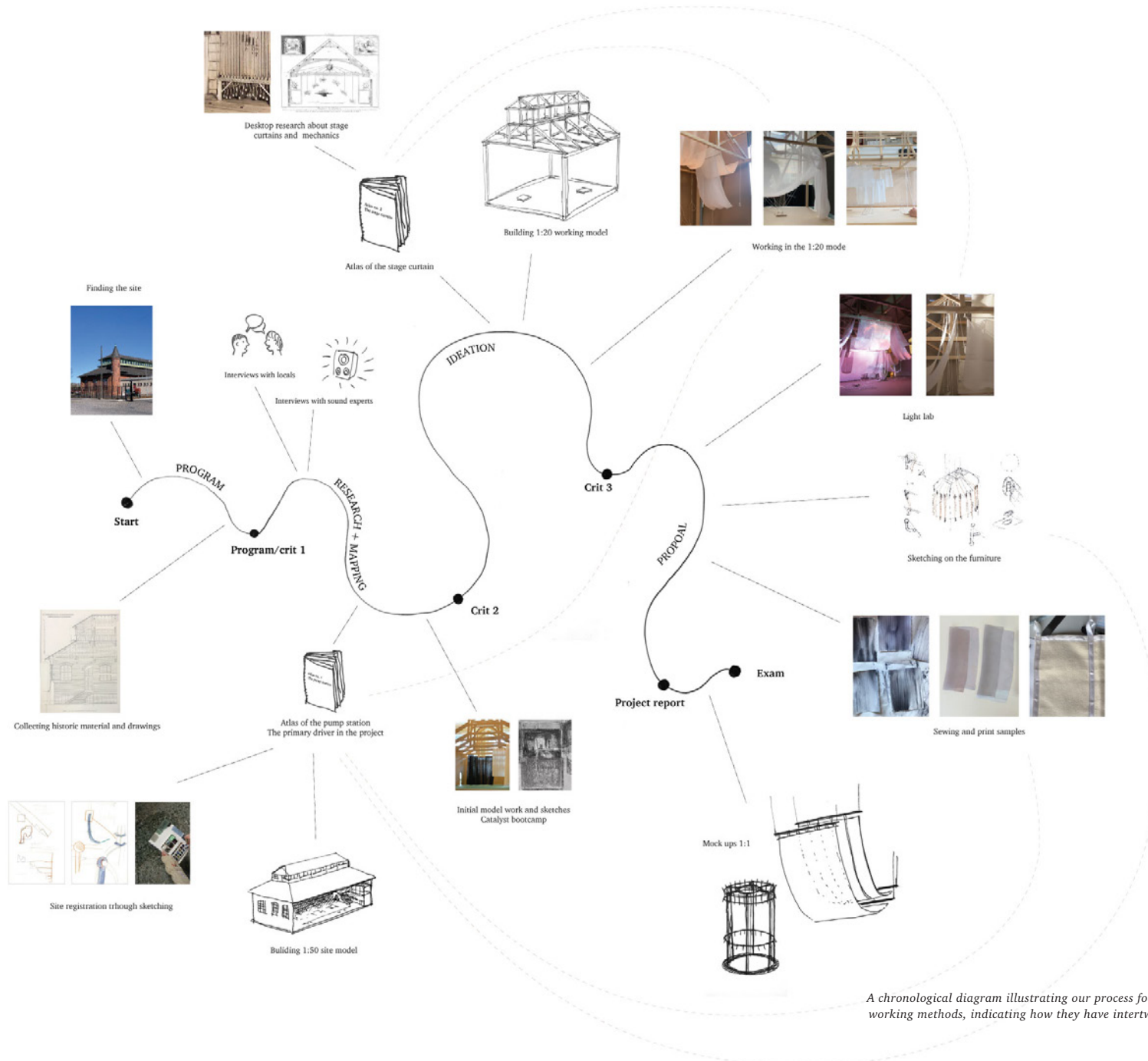
Both in the registration and design phase of the project, we have been working with scale models of the space as the primary tool of visualisation and ideation. They have been a way of translating initial hand-drawn sketches into functional concepts.

For the atlas and the initial design work, we produced a 1:50 model of the space in cardboard and wood - a rather detailed model with the most dominant ornaments represented with raster engravings. Later in the process, we produced a more schematic 1:20 model to work more in detail with our design solution.

Since our work has revolved around the movement and gravity of materials, it intuitively made sense to visualise our ideas through model work instead of computer software.



*Working with physical models in 1:20 investigation
movement and gravity in relation to textiles*



A chronological diagram illustrating our process focusing on phases and working methods, indicating how they have intertwined and overlapped

Site: *The pump station*

Kløvermarken Pumpestation is located on Kløvermarksvej in the northern end of Amager. The building was constructed in 1901, drawn by the state architect Ludvig Fenger.

The interior of the site

When you enter the main hall through the eastern gate, you are met by the vast cavity of the empty machine hall. The scale and materiality of the space give one an almost breathtaking experience. Along the walls runs a frieze of glazed tiles and on the yellow brick walls rests a wooden roof construction - A heavy and important architectural feature due to its dark colour, repeating structure and immense volume.

The dark-green terrazzo floor contains a patchwork of metal inlays - A trace of the replacement of the pump machines throughout the years. Scattered on the floor are also five podiums on which the pump engines used to stand. Now they too are traces of the building's former use.



The eastern gate, the current main entrance, on the backside of the building



The now empty main hall, formerly containing the spill water pumps. On the floor you can see the old podiums where the pump engines used to stand.



Frize of glazed tiles, green colour on stairs, vent door with red frame.



Metal inlays in the terazzo floor and the old machine podium - Traces from former use.



The characteristic roof construction

Historical context

The characteristic architectural expression of the building tells a story of a city in development around the turn of the last century. Copenhagen was transforming into an industrial city with new harbours, industrial areas and residential neighbourhoods. From 1850 to 1900, the Copenhagen population tripled (Pumpestation Kløvermarken, 2021), so that the city housed over 450,000 citizens in 1901.

During these years, the lack of proper sewerage became clear, partly in the form of cholera and other diseases and partly due to the smell of wastewater from the open sewers. New groundwater drillings ensured clean drinking water, masonry sewers were built, and finally, in 1897, the pumping system was established to carry the wastewater out into the ocean (Kloakpumpestation præstøgade, 2020). The pump station on Kløvermarksvej was part of this first pumping system.

The establishment of the sewer system can be seen in relation to other public utility systems, such as the electrification of the city and the distribution of gas and water. The buildings for these systems are the former machine rooms of the city, and they served the purpose of keeping the city running smoothly.



Cisternerne in Søndermarken
Frederiksberg, 1856
In use as an exhibition space.



P. Andersens Vandtårn
Frederiksberg, 1869, Vilhem Tvede
Shortly in use for cultural events. Today not in use.



Københavns Vandværk
København K, 1875, N.S. Nebelong
In use as a concert venue.



Østre Gasværk
Østerbro, 1878, Martin Nyrup
In use as a theatre



Kloakpumpestation
Østerbro, 1894, Ludvig Fenger
In use as a youth club



Vestre Elektricitetsværk
København K, 1898, Ludvig Fenger
In use as a cooling central



Valby Vandværk
Valby, 1901
In used for teaching about water



Vestre Pumpestation
Vesterbro, 1901, Ludvig Fenger
In use for cultural events



Østre Elektricitetsværk
Østerbro, 1902, Ludvig Fenger
Parts of it in use as office spaces (HOFOR)

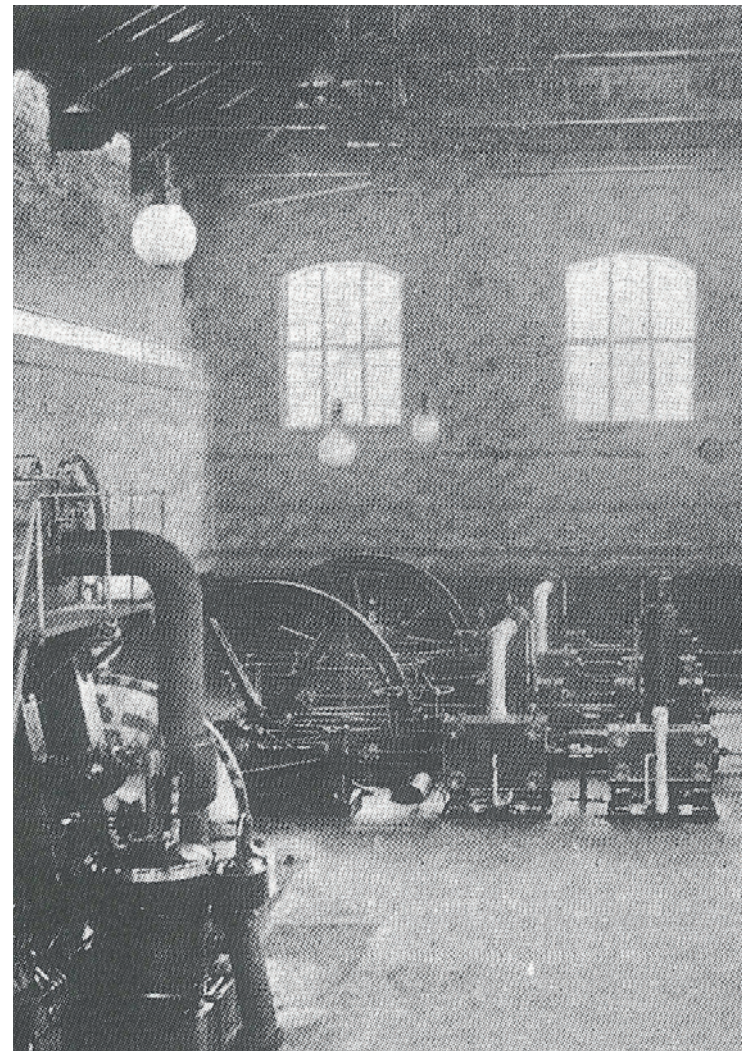


Københavns Godsbanevandtårn
Vesterbro, 1907, Henrich Wenck
Not in use



Brønshøj Vandtårn
Brønshøj, 1928, Ib Lunding
In use as a cultural venue

Mapping of other historic infrastructure-buildings that have been taken out of use, transformed and given a new purpose.



^ The main hall with the former spill water pumps, 1901
< Plan for the development of the sewerage system, 1897



The surrounding neighbourhood

The area around the pump station is a diverse mix of housing, shopping, industry and recreational areas. However, our site is placed in a void in between these active areas, and the unique architectural expression of the pump station makes it stand out compared to its surroundings.

Our site is located at the intersection of these different and varied neighbourhoods. Throughout the project, we have asked ourselves how this diversity can be included and reflected in the transformation of the pump station.

The pump station and the surrounding neighbourhood

The industrial scale and the human scale

“All fine architectural values are human values, else not valuable”

Frank Lloyd Wright

A fascinating characteristic of the building is the duality in scale and proportions: The ‘shell’ of the building is dimensioned and proportioned for the former pump machines. However, the details and ornaments are respectful to the human presence and body proportions.

The height, width and length of the room relate to the engines and the pump system. The floor is lowered 3 meters below ground to bring the pumps closer to the groundwater level. The gate and the windows are enormous to bring in light and new machinery, and the monitor on the roof is dimensioned to ventilate the room.

Contrasting the machine scale, parts of the building have details that relate in scale to the human body. For example, the glazed tile frieze that runs along the hall’s base frames a zone for human activity at ground level. Likewise, the rails, stairs, and doors are ornamented with profiles, knobs, and patterns proportioned for human use.

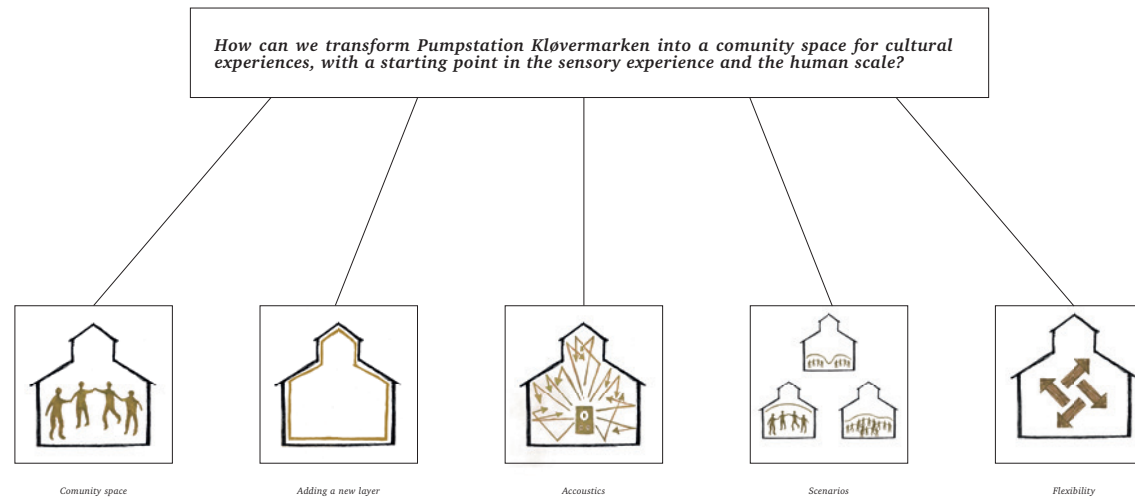
Seeing scale as something twofold has become an essential part of our approach and our design proposal. We intend to connect the human and the building through an interactive intervention that facilitates a spatial experience.



*A man in a sewer tube at Vanløse Byvej, 1943.
Source: kbhbilleder.dk/kbh-arkiv/92000*

Research

In the following part, we will elaborate on the five most important aspects of our research that have informed the design process. This phase of the project has helped formulate the requirements of our design proposal.



Culture as a driver in the city development

Amagerbro is one of Denmark's most densely populated areas, but it only has two public-owned culture-houses and one sport-culture-house, Prismen. The population of Amagerbro continues to grow. Therefore there are plans of developing former industrial areas in the northern part of Amagerbro into diverse areas with more housing. Some of those areas are located close to our site.

The municipality plan (København kommune, 2019) expresses that the tradition for having a dense city where housing, industry and culture are mixed in diverse neighbourhoods should be kept. [...] The city's historic buildings and cultural traces [...] should be protected and activated to create new values in the modern city. (København kommune, 2019, p. 7)

When looking at our mapping of cultural offers in Copenhagen (theatres, venues, dance-houses and cultural houses), we noticed a lack of cultural facilities in Amager when compared with other neighbourhoods.

We started seeing the pump station as a potential cultural gathering point in Amager, giving the area an enhanced cultural profile. The building should be a catalyst and driver in the future urban development within the area, creating coherence and anchoring within the local area.



Concert halls and venues



Cultural houses/folk houses/community houses



Theaters and Comedy venues



Dance venues

Initial mapping of cultural offers in Copenhagen

Addition

Utilising the historical structures in the cityscape makes sense from a sustainable point of view and emphasises the city's cultural heritage. The municipality also states that the cultural heritage should be used and made visible, forming the foundation for understanding and developing the city. Using the historical and architectural values can be seen as a method for creating identity and quality in existing urban neighbourhoods and development areas.

Over time, comparable infrastructural buildings from the same time have been taken out of use. However, due to their architectural and historical value, most have remained and been given a new purpose and function. Several of these places have transformed into places with a cultural aim, benefiting the local society. (Mapping of similar buildings)

In 2005 a similar pump station on Østerbro, build in 1894 by Ludvig Fenger, was transformed into a youth centre. In order to transform the building for this new purpose, the architects added a static construction that fills up the void, giving the transformation a permanent and lasting character. However, although the transformation is done well for the given program, we see the intervention as rather intrusive and inflexible.

Therefore, our intervention will be a more temporal addition to the space - a new layer free from the existing shell. In that way, we can maintain the beauty of the building, and it makes it possible to change the use of the building in the future.

This finding led us to take a starting point in registrations of the details of the existing shell, asking whether that can be a method towards creating a dialogue with the existing.



Amager as a place

To better understand the character of Amager, we interviewed six local residents aged 25-35 about their use of Amager and its cultural offerings. The number of interviews was set to make it achievable within our time-frame, and thus we are aware that it does not reflect all future user groups of the building. The interviews were conducted via zoom or phone due to the covid-19 situation.

The conversations touched upon different topics:

In general, the locals did not know the current cultural offers on Amager, both private and public places. Many mentioned having heard of Amager Kulturpunkt, which includes the venue space Amager Bio, but none of the interviewed had visited the venue.

Many also characterised Amager as an area in development, but currently without a good place to hang out or go for an event on a Friday night.

At the end of the interview, we asked what kind of event they could imagine would attract them to the building. Here, various ideas were brought up, including communal dining, dance performance, outdoor hang-out, gallery use and concerts, where you would be able to buy good beers.

Attractive factors about places they liked to visit were generally cosy atmospheres, several diverse events supporting each other and facilities with outdoor areas, to meet up with friends in the summer. As one respondent answered, “In Copenhagen, you are always looking for something bigger than your apartment”.



Slide from our zoom-interviews with local residents.



Prags have 2011



Artist Run 2014



Stage inside building 5



LAK festival for Nordic sound art



Google

Photos from PB43's website.
Pelican Self Storage 2020.

PB 43

One respondent told us about a former culture house, PB43, located a few streets from our site, which closed in 2015. The inclusive character of the place ended up having a significant influence on how we have viewed the program of the Pump Station.

PB43 arose on the initiative of local volunteers in an empty paint factory. Everyone interested in inhabiting a space was urged to contribute. The place had, for instance, a venue, gallery, workshops, satellite teaching for the school of architecture, city gardening, and they collaborated with different local organisations and the library. After being there for a few years, the owner decided to sell the place. Unfortunately, the municipality could not buy the place, so it went to Pelikan Storage, which demolished it to build on the plot.

For us, the story helped to substantiate the lack of a place with a multifaceted and diverse character in the area.

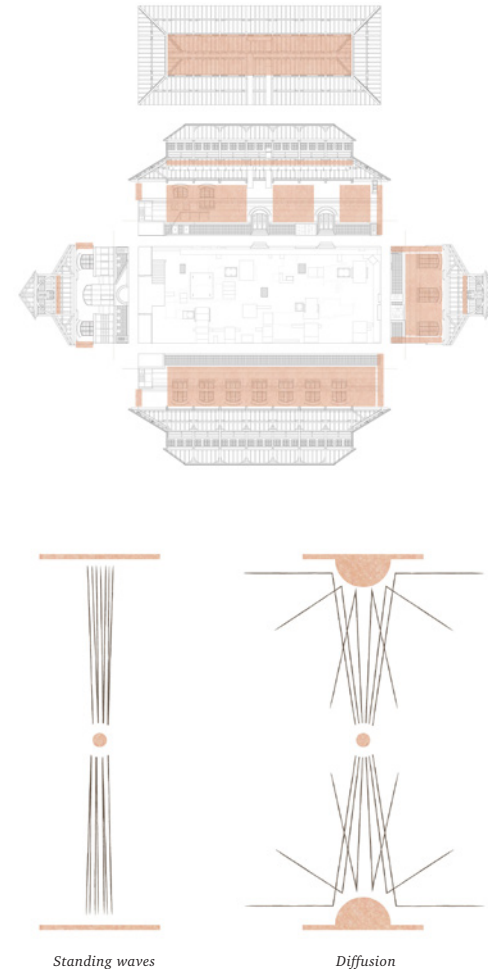
Acoustics

No matter what social use we imagine for the building, acoustics are an issue. We had a hard time communicating in the space on our site visits since the sound seems to disappear into the void.

In order to get to know more about general acoustic principles and get more specific advice for our site, we interviewed the acoustic engineer at Cowi Thea Mathilde Larsen and the sound designer Rasmus Juncker.

Like us, both Thea and Rasmus saw the potential to use the space for cultural events, but Thea did not find it possible to create state-of-the-art acoustics suited, e.g. concerts and performances. However, a decent acoustic environment should be obtainable, according to both Thea and Rasmus. They both pointed towards some obvious acoustic issues and solutions to consider, the main one being avoiding echo through standing waves. The best and easiest way to avoid echo is by placing absorbing materials along the hard, parallel surfaces. Therefore, the essential places to avoid echo are:

- The parallel brick walls (above head height)
- The roof (mainly the monitor, where the sound disappears up into)
- The corners (were sound bounces on the hard walls)



*Areas to focus our acoustic effort in space according to Thea and Rasmus
Illustration of two acoustic phenomena, standing waves and diffusion, both reflection of sound on materials*

In the PhD “Så vidt et rum: en undersøgelse af hvordan tekstil kan/skal formgives og placeres for samtidigt at absorbere lyd og danne rum” By Cecilie Bendixen, she concludes that the distance of the textile to the wall, the amount of textile, its degree of draping and folding, its spread in space and angle in relation to the direction of the sound waves are decisive for its sound-absorbing effect. This research has acted as background knowledge when starting working with our design of a textile element.

We are going to use the absorbing quality of textile in our project. All textiles (and other materials) can be graded in absorption class from A to E, A being the best, absorbing up to 100% of the sound hitting the material. For textiles, you measure the absorption coefficient for both the flat and the folded state of the textile, the folded usually having a higher value than the flat.

The insights from the two experts reassured us that our intervention needs to have an absorbing, acoustic impact in the space. But, at the same time, we want to accommodate a flexible use of the space, where different acoustic situations might be needed. Regarding acoustics, our question is, therefore, “how can we develop a flexible intervention that can create the acoustic regulation for the diverse social and cultural scenarios in the pump station.



Table 1. Practical sound absorption coefficient α_p according to DIN EN ISO 11654

Construction	Octave centre frequency f / Hz						Test certificate Appendix A, page
	125	250	500	1000	2000	4000	
Upholstery fabric Divina 2 973 Kvadrat A/S 100 mm air gap, not folded	0.05	0.30	0.70	0.90	0.70	0.70	1
Upholstery fabric Divina 2 973 Kvadrat A/S 100 mm air gap folded 100 %	0.15	0.40	0.85	0.95	0.95	1.00	2

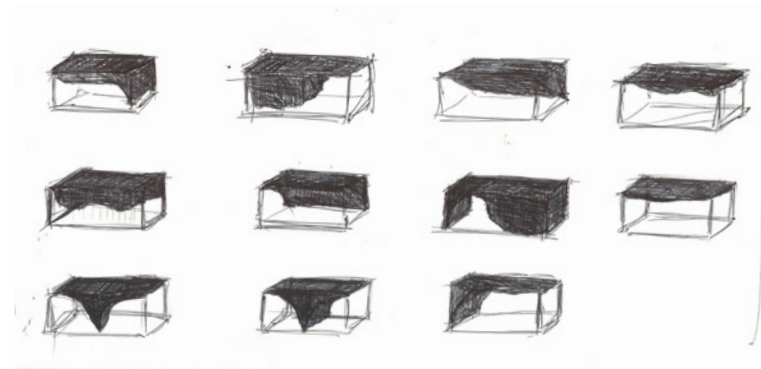
The table shows the absorption coefficient for the Divina Upholstery fabric by Kvadrat. Note that the value is especially high (0.70 - 0.90) in the frequency range of 500-4000 Hz, which is also the range of ordinary speech (Sundhed.dk, 2020)

Scenarios

“Rather than emphasising the permanence of architectural frame, it is the interior and the events taking place within it that are foregrounded”
(Thomsen & Bech, 2016, s. 54)

When we imagine that the pump station should be used for all sorts of social activities, we needed to get more specific about the situations in order to design a specific solution. We have chosen to develop three scenarios with each their spatial organisation, size and atmosphere. The intention is to unfold our idea within the three different scenarios to make sure our intervention is flexible. By fitting at least three different scenarios, we hope that the intervention will also be usable for other unforeseen scenarios based upon the wants and needs of future users. Thus, we see it as creating a flexible framework for opportunities for future users and their wishes and needs.

Throughout the design phase, we have worked on and with several scenarios and spatial configurations, influenced by the ideas that came up during the design process. So the scenarios have influenced the design, and the design influenced the scenarios.



Initial sketch of an amorph and fluid object being able to move within the space.

The Common Dinner: intimate and enclosed

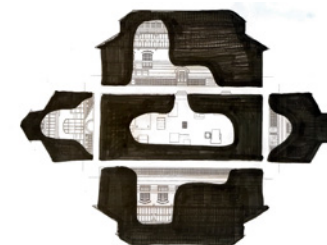
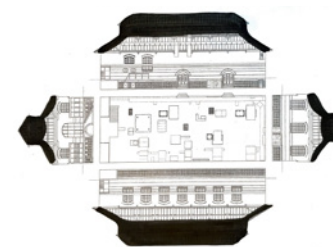
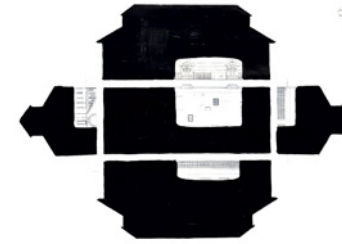
For the common dinner, we want to create a safe and cosy atmosphere where it feels natural to engage in new social interactions. We will do this by working with a lowered ceiling and a smaller, more enclosed space within the big void of the building.

The Market Hall: guiding the flow

For the market hall, we want to create a busy and intriguing atmosphere. To do so, we will utilise the idea of “a half-space” as described by Bendixen, playing with translucency, layers and divisions. Furthermore, we will investigate how to balance an overview of the situation and the building with hallway-like divisions.

The Concert: A place for experiences

For the concert, we will explore the potential of artificial light in combination with textile in order to create a radically different atmosphere in the hall. In addition, we will explore how translucent layers can give a fluid and performative sense of the space. For this scenario, we will also work with the orientation of the space – the placement of the audience in relation to the performers – and we will look into how our intervention can answer practical challenges, incorporating backdrops, acoustic regulation, and spatial separation.



Sum-up on research

Following up on our phase of fieldwork, we defined the following requirements or spatial specifications for our design proposal:

- The intervention should create a space of possibilities for the local community.
- The intervention should accommodate varied spatial uses and situations, from the small and intimate to the big and open. - Space for both the ordinary and the extraordinary.
- The intervention should not intrude on the existing architecture. Instead, it should be a removable addition to the existing shell.
- The intervention should consider scenarios that acquire different acoustic regulation and spatial organisation.
- The intervention should consider the use of the building throughout the day, the week and the year. - The rhythm of the building.
- The intervention should balance between being flexible yet manageable.

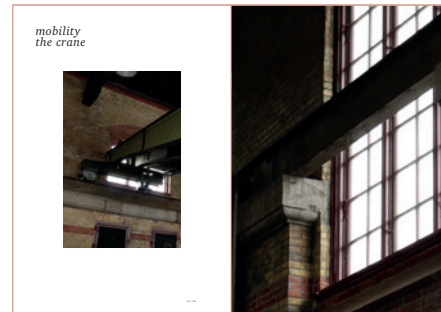
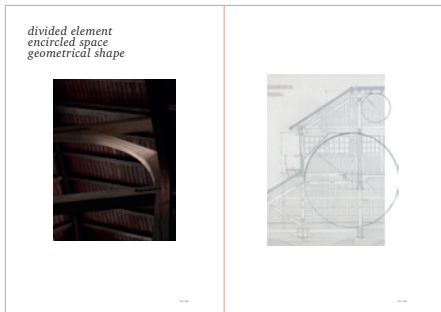
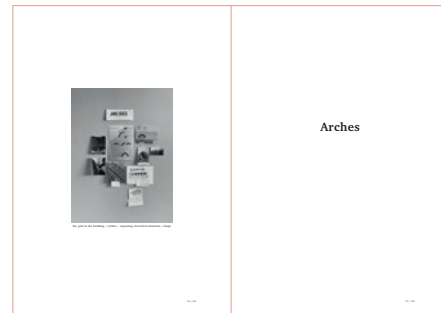
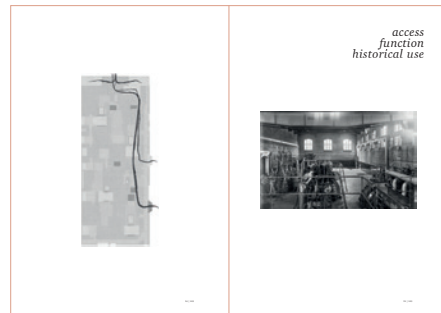
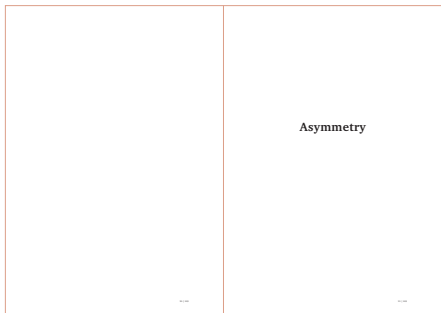
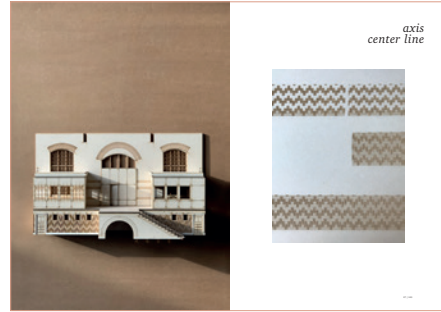
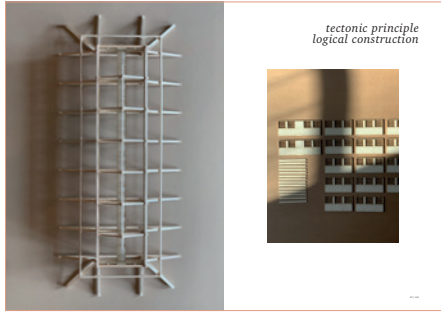


Initial concept sketch for the market place scenario.

Atlases

The following chapter will elaborate on our analysis of the pump station and the stage curtain as a spatial element. We analysed by producing two atlases, one concerning the existing building (representing the past and the context) and one concerning the stage curtain (representing the future use and added intervention).





Slides from the Atlas og the pump station.

Atlas no. 1: The pump station

In order to get to know the pump station better, we engaged in a site registration through the format of an atlas. The intention of making the atlas has been to create an inspirational and visual driver for the concept development and ensure a site-specific design solution, where our addition refers back to the existing.

Collecting elements

We produced the content for the atlas by mapping the architectural details and elements of the building, both the original details and the layers added unintentionally over time through the years of use. Through this dissection process, looking at the building in small elements, we gained a deeper understanding of the building's proportions, qualities and details.

Categorising and curating elements

After the registration process, we grouped the photos, drawings and sketches under new categories. In the process, we tested multiple concepts, describing shared characteristics between the building elements. Through this classification, we saw new intersections and connections, giving us new insights into our site.

As our work progressed, the atlas became both a collage of the retrospective and started hinting towards future potentials within the building. The result was a set of operational themes and concepts, which we brought further into the design process. These conceptual drivers fall into two different overall categories, one concerning the thematic properties and one concerning the more specific architectural motifs in the design of the building.

The atlas has been handy throughout the design process. Every time we were unsure about our ideas, the atlas provided us with answers, inspiration and references. Especially towards the end of the project, we have used the atlas to form the design of our intervention to the context, referencing materials, colours, patterns and details.

Thematic properties

Symmetry / asymmetry

Repetition / variation

Flow, movement

Layers



Drivers / conceptual principles

These themes each work on different scales within the building

Motifs

Segment of the circle

Zig-zag

Colours



Visual inspiration

These themes all possess a certain scale

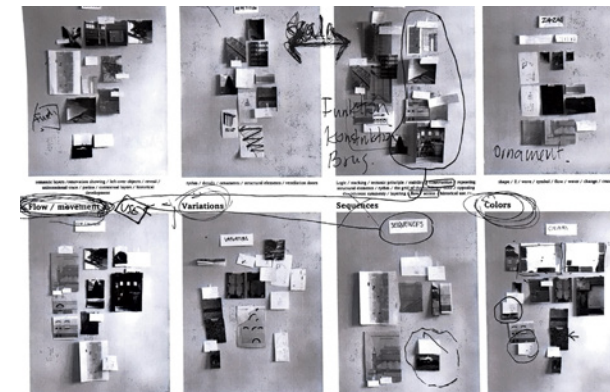


Diagram of the thematic properties and motifs.
Process of curating findings within the building.

Atlas no. 2: The stage curtain as a spatial element

This atlas was created alongside the design process. Therefore, its sections reflect the development of the final proposal.

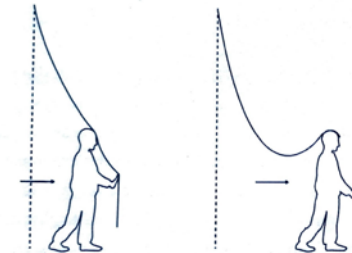
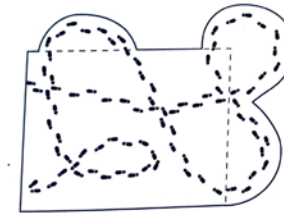
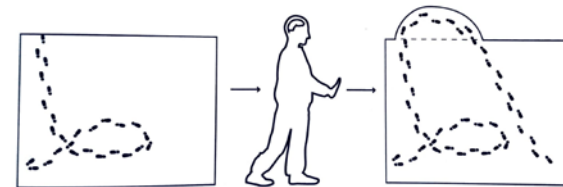
The curtain as a soft boundary and a half-space

Throughout the project, we have been interested in the spatial quality of a space defined by textiles in contrast to a space defined by solid, reflective materials present in the pump station. What does it do to the atmosphere and our feeling of the space surrounding us?

In the PhD “Så vidt et rum”, Bendixen defines a textile space as a “half-space” with a soft and moveable boundary. By “half-space”, she refers to it not being physically fully defined as well as the auditory experience being different from other spaces. Commonly, reflected sound creates an unconscious, auditory understanding of a closed space. Sound disappearing creates the opposite, a feeling of an opening, like when the sound disappears out a window. She argues that absorbing materials might create the same feeling as an opening, as the sound disappears into the material, and calls the textile space “a joker” in this matter. Bendixen concludes that sound absorption creates a more faint sense of space (Bendixen, 2012, s. 134)

However, she also concludes that the feeling of a more defined space can be obtained by adding haptic and visual elements, supporting or contrasting the auditory understanding.

These notions of textile spaces are something we have brought with us into the project.



Diagrams from “Så vidt et rum” (Bendixen, 2012).



Scenographic use of textiles to narrate and transport is used in the interiors for Queen Luise. The “tent room”, imitating a military tent, using textile as a scenographic tool (Thomsen & Bech, p.61-63, 2016).

The curtain as an transformative element within architecture

In the text “The textile interior: Imagining a transformative architecture” by Mette Ramsgaard Thomsen and Karin Bech, textiles in architecture are viewed as something that can transform a space.

Instead of engaging with the material properties of textile, like Bendixen, Ramsgaard and Bech view textiles as something used in culture to bear meaning, imagination and storytelling. Throughout time, textile in interiors has reflected our perception of self and our society through both its cultural role and the narrative it carries through its motifs. Here, textiles can invent spatial character through the added layer of patterns and motifs.

Ramsgaard and Bech also refer to textiles as being spatial elements that historically have linked to the scenographic. At times textiles have been used as “a theatrical staging of a situation” being given a role of illusion and the staged (Thomsen & Bech, 2016, s. 62). We saw an interesting link between the spatial use of textiles and the scenographic quality it can possess, completely transforming the existing architecture. When textiles are used in interiors like this, the separation between the textile interior and its architectural space is underlined.

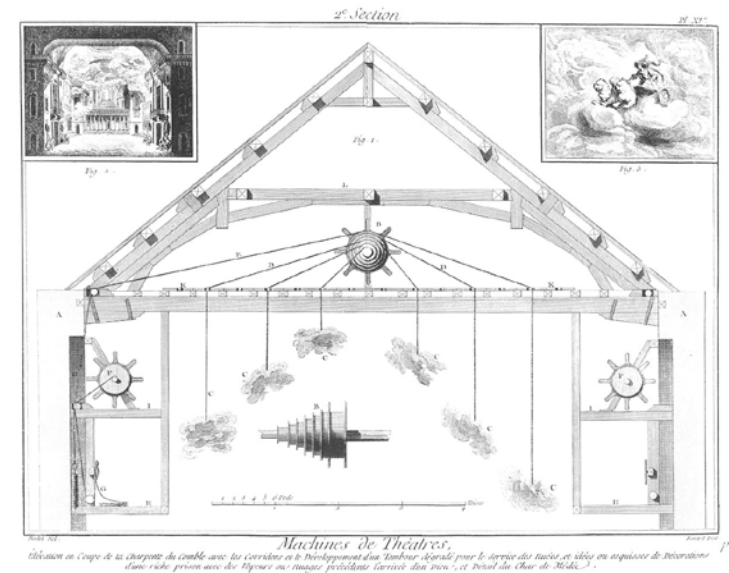
Thinking about our textile addition as something changing the existing character of the space, adding a new layer corresponds well with the notion of the textile as a transformative element. Following this line of thought, our addition will both correspond to the existing problem within the context, e.g. the need for sound absorption, and become an element that can change and adapt the spatial character.

The curtain and the stage - the machine of the theatre

Thinking of the curtain as a scenographic element, we were naturally led to investigating the stage curtain. The primary function of the stage curtain is to conceal or reveal the action on the stage, separating the actor from the audience. However, it also frames the performance when gathered on the side of the stage or used as a backdrop. Thus, it is a central medium through which the director can frame and guide the audience's perception of the performance.

We started looking into the different typologies of stage curtains and how they drape and move. A key insight in this part of the project was how the backstage of a performance space works. The backstage is inhabited by the mechanisms and pulley systems controlling the movement of the stage curtain. The insight about the pulley systems started influencing our design process at this point.

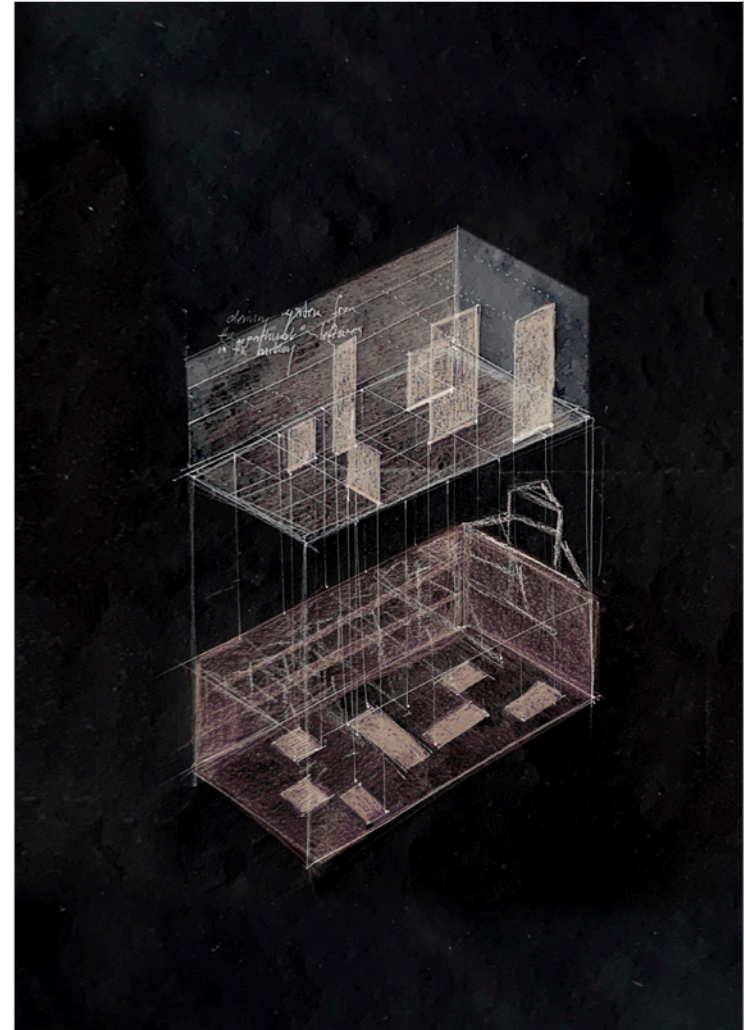
A pulley is a wheel that carries a rope or cable on its rim. They are used alone or in combination to transmit energy and motion, lifting loads. Pulleys are often used to gain a mechanical advantage against gravity to lift forces larger than those applied.



Illustration, *Machines des Theatres*, from *Theater machinery*, and historical pictures of backstage area.

“The extreme mobility of and understanding of spaces as something that is inherently reconfigurable defines a fluid thinking of space and site”

(Thomsen & Bech, 2016, s. 54)



Sketch from the catalyst boot-camp showing initial ideas for dividing wall elements.

Design process

Our process has taken the structure of multiple rows of experiments, which each have led to new realisations informing the final design.

Hanging dividing element

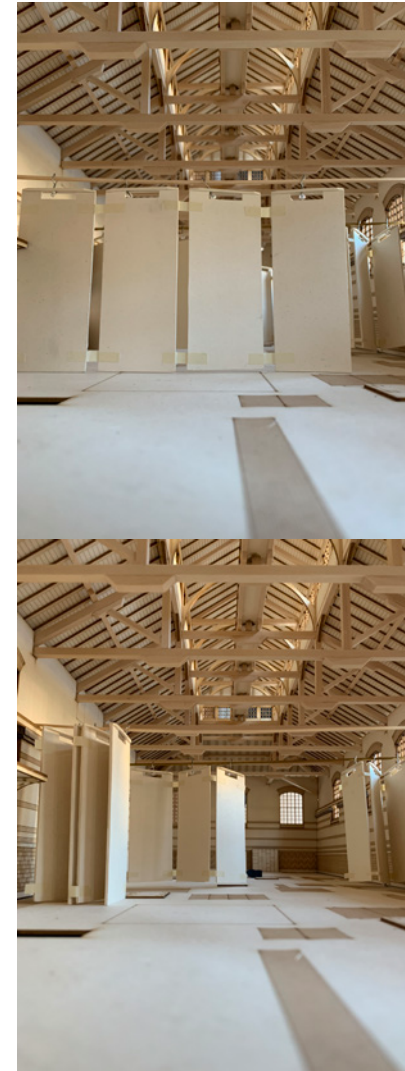
Our first sketches were concerned with hanging wall elements that would cause different configurations in the room through a moving system.

These initial experiments and sketches tested a textile boundary with a defined outer frame in our 1:50 model.

From these rows of sketches and model work, we concluded that the concept lacked the free movement of the textile. The moveable character was situated within the connecting metal joint instead.

Bendixen points out that we need spaces whose boundaries can be adapted to change “seamlessly” (Bendixen, 2012, p. 159). Bendixen understands “seamless” as the delimitation of space being an extension of one’s action, adapting to the body. The folding wall elements lacked this adaptability. Therefore, we concluded that the division should be easy to manoeuvre. Otherwise, it would, in reality, become the opposite; a static structure, obstructing space. Moreover, it did not solve the need for an intimate scenario, as the height of the ceiling remained unchanged.

This led us to an idea about a moveable element in the height of the room. Here we wanted to investigate the free-moving curtain, utilising its soft and moveable nature.



By placing the textile-frames in a row connected by a flexible connection joint, they created a folding line of elements.

An underlying structure for movement

Instead of fully controlling the textile boundary, we saw an opportunity in investigating an underlying structure guiding the textile and its movement.

This led to a row of experiments concerned with how to manipulate and control the textile. In order to do this, we build half the interior space in a 1:20 model so that we could work actively with the fastening and placement of the textile to the roof construction. At this point in the project, we brought in rigid elements and pulley systems to create a moveable curtain

Our experiments looked into four principles for an underlying structure, which could guide the textile, making the textile fold and unfold;

The hoist

The first principle simply hoisted a rail bearing the textile, up and down.

The rail

Here the textile was guided alongside a rigid element.

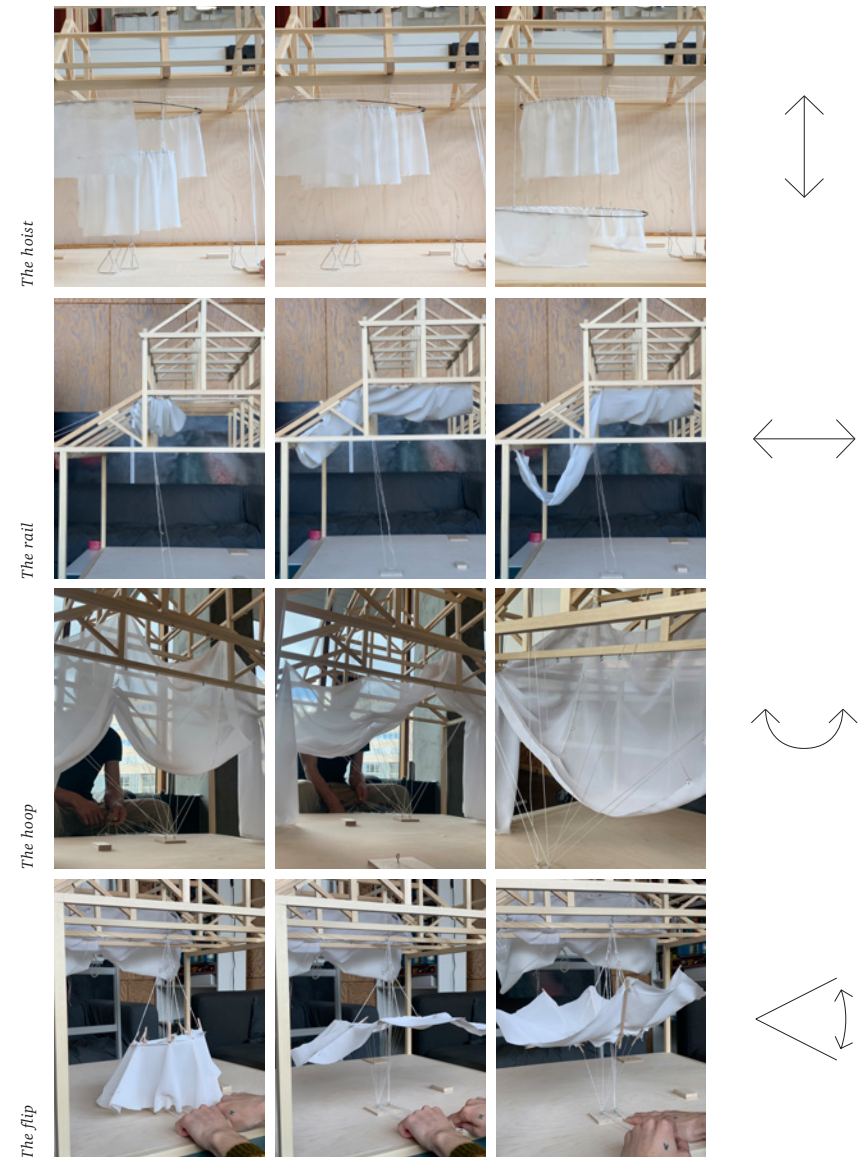
The hoop

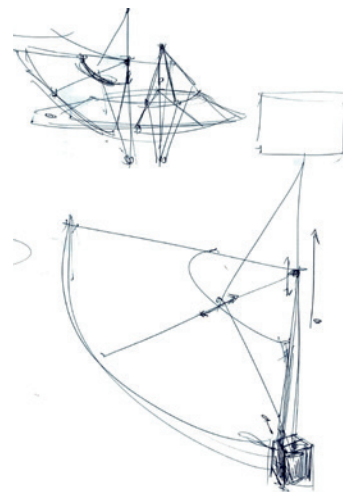
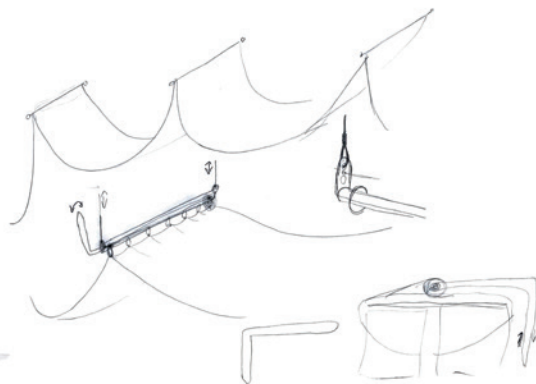
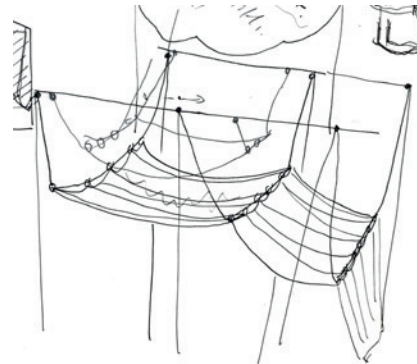
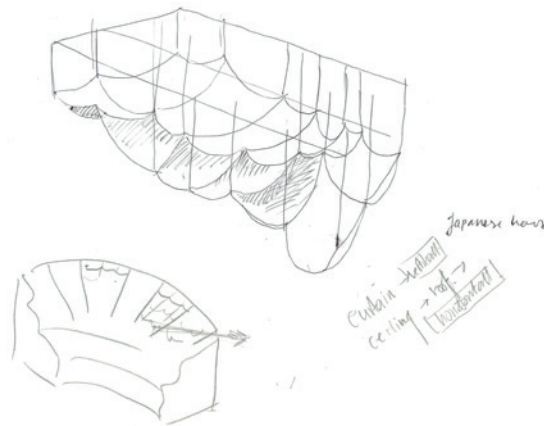
This was a contracting movement. When a hoop tightened, the curtain gathered upwards. Here we mounted rings on the back of the fabric to pass the rope through, like in an Austrian curtain.

The flip

This possessed an umbrella-like movement, where a rigid element flipped the textile changing its direction in space.

We found the pleating of the textile as well as the arch created from gravity interesting. Moreover, the layering of the textile possessed an aesthetic quality, and we started working on combining layering with a principle for moveability into a coherent concept.





Sketches for how an underlying structure would be able to guide the textile.



In a visualisation of multiple interlinked hangings, we investigated a textile layering in the length of the space, derived from one of the first hoisted tests in the 1:20 model.

Contextualisation of principle; the grid of the building

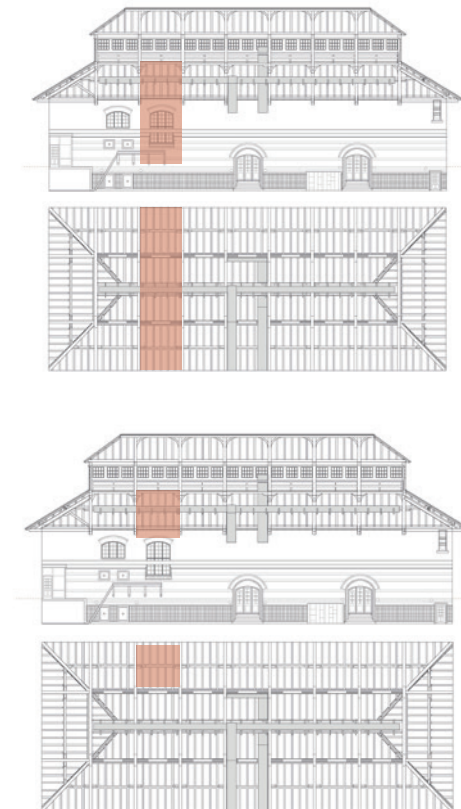
While working in the 1:20 model, we considered how to situate the intervention in the building, making it a site-specific concept. As we did not want to hide the roof, a characteristic element in the space, the ideas that enabled a roof view were the most interesting. Here a textile divided into smaller elements became relevant.

We tried out two different ways of relating the textile elements to the grid of the building: One where the textile would fit in between two beams, and one where the textile instead corresponded to a smaller rectangle section of the roof.

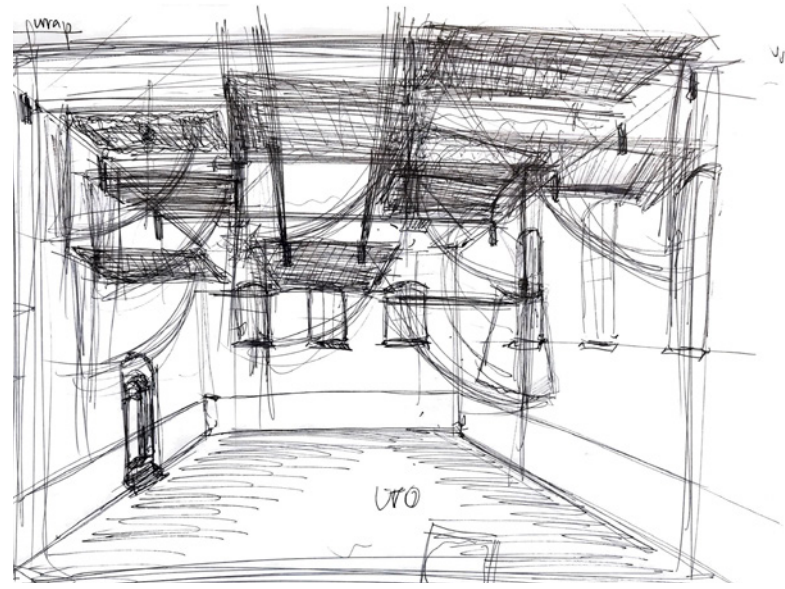
When hoisted down, the textile fitted in between two beams almost wrapped the building in a textile skin. This concept operated on an enormous scale, which was also our concern.

Instead, the second idea consisted of a smaller modular system of textiles. This idea used the soft, falling arch of the textile in one direction and the rigid movement of the rail in the other direction, as the textile was mounted on two parallel rails. In addition, we worked with lowering the rails, so they kept parallel to the floor.

>



*The top diagram showing how the textile elements is dimensioned in between two roof beams.
The lower diagram showing how the element is fitted within a square section of the roof.*



Concept sketches for the two ways of relating to the grid of the building.

>

In this iteration, we introduced two independently moving layers in each square; a thick layer for acoustic purposes and a thin, translucent layer beneath, interacting with both artificial and natural light. Both layers could be hoisted to the roof, almost hiding between the beams, and lowered towards the floor, working as space dividing elements.



The podium: centre of activity and points of contact

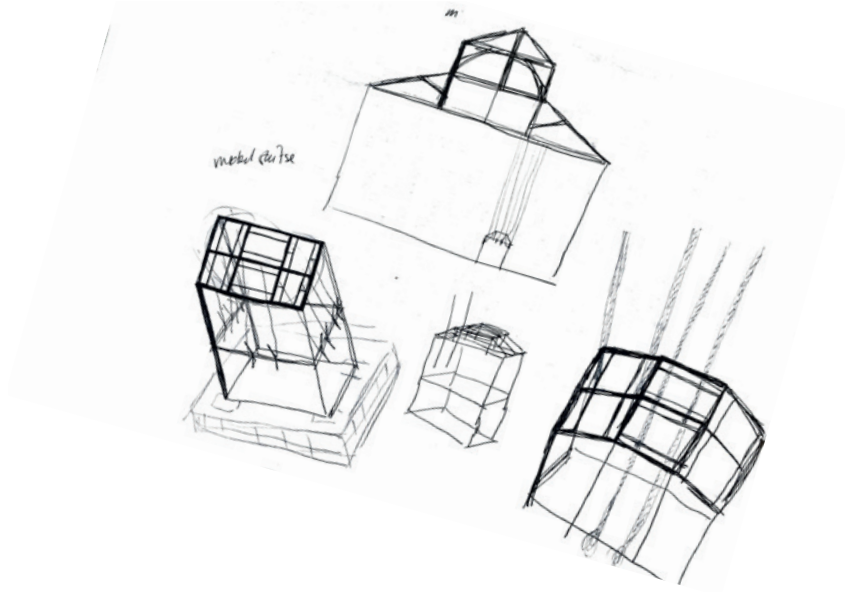
While working on the movable textile element, we considered where the ropes would go and how to fasten them within the interior. We reintroduced an old idea from the beginning of the project: The central concept utilised the old podiums from the machines as areas for the new activity in the space.

The design of the rope station/machine took a starting point in how to sort and logically order the ropes. The stands would be the mediator between the user and our textile ceiling, so it should be intuitive and straightforward in its construction and use. The idea was that the textiles would be configured by an employee or volunteer, together with the users.

We thought about two directions: finding inspiration in cleats from boats and old theatres v/s using drums and industrial details exposing the machine and the mechanics. However, returning to our starting point about the human scale within our intervention, we moved forward with the idea of using cleats for fastening. Here one would get an intuitive understanding of weight and volume when managing the ropes.



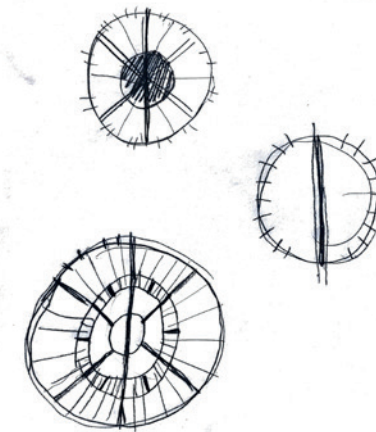
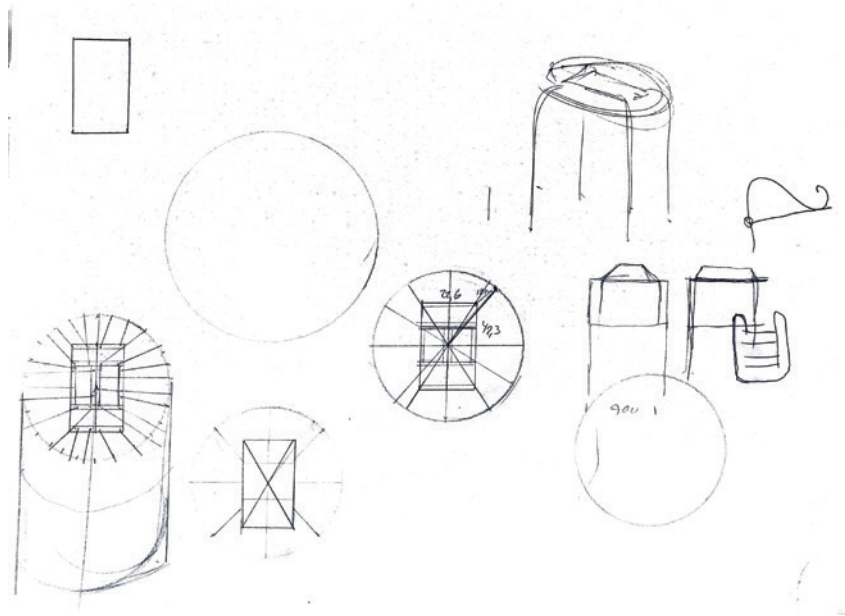
Trying out the fastening of rope with cleats.



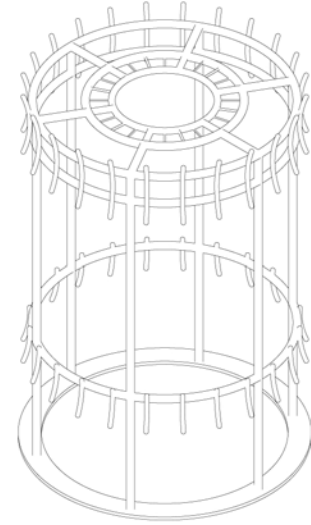
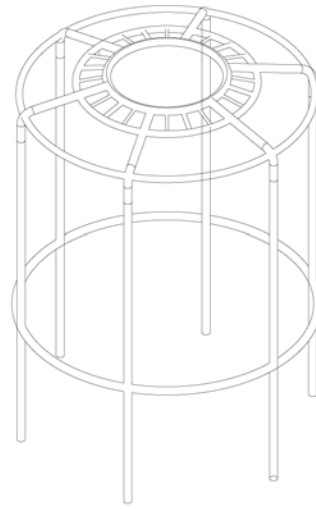
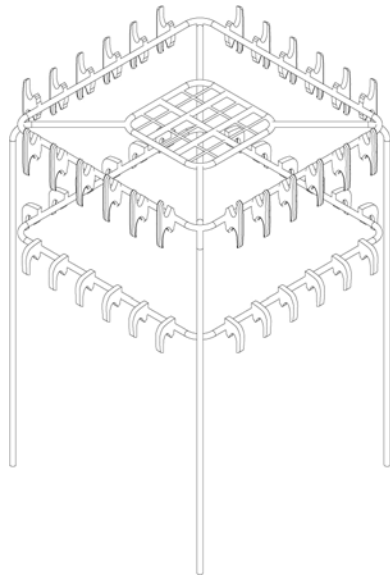
We sketched on creating a structure that would filter the ropes in a beautiful yet logical way. The first idea revolved around a rectangular shape that mimics the placement of textiles within each roof section. This way, the user would understand what textile rail the rope controlled when looking at the stand. However, we struggled to place the cleats and ropes on the stand in a logical way.

An idea with a circular shape language was introduced, causing symmetric diffusion of the ropes and forces from the middle. The 24 ropes are ordered around the circle, one half of the circle controlling one section of sails between two roof beams. The idea was to suspend the rope within a simple metal structure. The rope as the main aesthetic element giving the object its volume would be underlined.

Referencing the existing railing, we considered using oxidised metal, making the rope stand out from the structure when seen from afar. Furthermore, we found the wear marks appearing over time appealing. When designing the cleat, we tried finding a balance between making it stand out and merge with the round steel pipe.



Sketches from the podium process.



Iterations done i Rhino for the new machine - The stand for attaching the ropes.

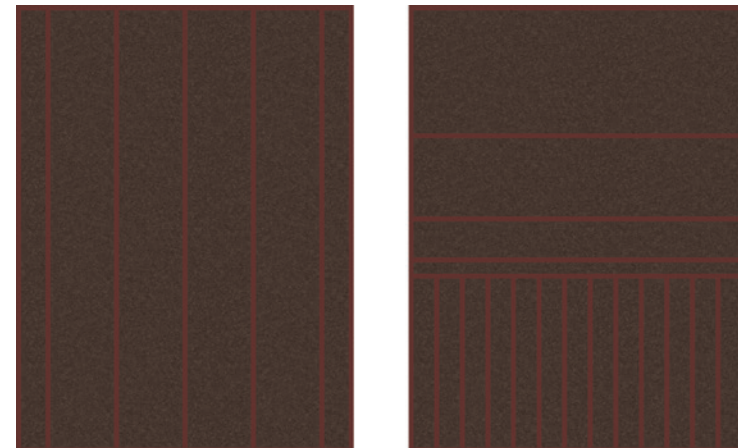
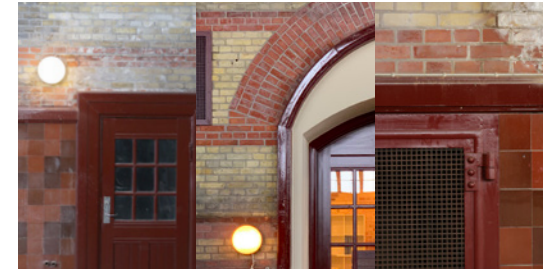
Merging the new with the old

The rope stands should be intuitive, functional and logical, making them easy to manoeuvre and handle. Contrary, the textile sails would be the staging elements in the space, having patterns and colours central in the design.

We began thinking that the textiles should become visible when unfolding. This led to the acoustic textile layer as a subtle interpretation of the ceiling, miming its rhythm and colour: On one side of the fabric, webbed seams were spaced according to the beams in the roof. On the other side, the webbing drew horizontal lines, spaced according to the red tile lines on the brick walls, forming a more detailed and smaller pattern towards the ground.

The webbing was first and foremost introduced as a functional element, stabilising the sails, preventing them from stretching over time, as well as creating hoops where snap hooks could attach the sail to the rail. Furthermore, we saw it as an ornamental element. The frames in the building (doors, window frames, panels, etc.) are painted in the same red ox-blood colour. Therefore, we used the same red colour for the webbing frames on our sails, tying them visually to the building.

We visited the Kvadrat showroom, where we found the brown wool felt Divina 3 with a high w-value/absorption class (0.60/Class C when flat and 0.70/Class C when folded). We settled on a dark brown colour, as it would blend in with the roof according to the concept.



*Red colour on framings in the buildings.
Red webbing on seams that are spaced according to the beams in the roof.*

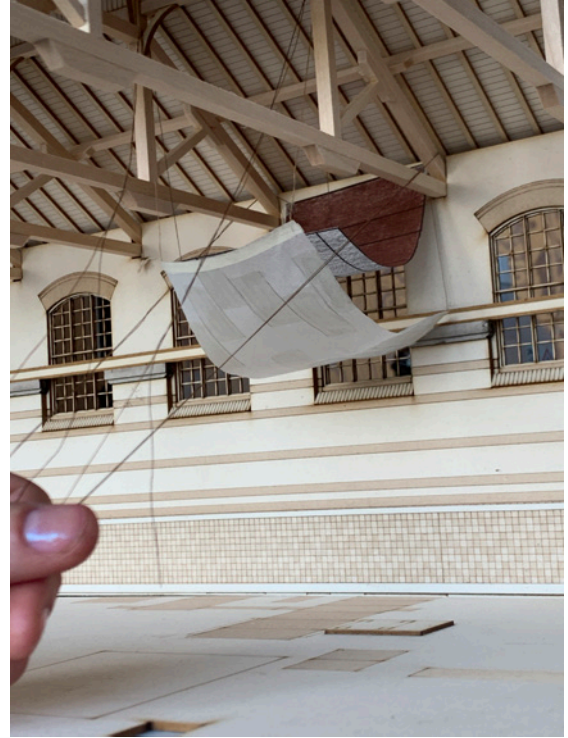
Simultaneously, we worked on the translucent textile layer. First, we thought about introducing a motif/pattern found in the building. The first idea was a light beige colour, blending with the broad colour scheme of the interior, with a subtle pattern referencing the zig-zag motif. The second idea was to introduce subtle patterns with colours bleeding into each other, referring to the movement and flow registered in the atlas. However, when combined with the webbing ornaments on the acoustic layer, the patterns on the translucent layer became too busy.

Therefore, we tried a more subtle idea about printing two different tones on each side of the sail. Thus, one side would have a warmer tone and the other side a colder. It would create a play of colour, depending on the configuration of the sails.

When we tried out darker greys and browns, we found a good balance between blending in with the acoustic sail and the existing space and standing out as an intervention. In addition, the darker hues turned out to work surprisingly well with projected visual. In order to enhance the play of light and colour, we will, towards the exam, work on having a subtle gradient on the translucent textile, going from a lighter to a darker tone of brown.



Ideas for pattern on the translucent textile.



Model photos showing the two layers and the two sides of the acoustic textile.



Visiting Kvadrat's showroom to settle on colours and to get sponsorship for the final mock-up.

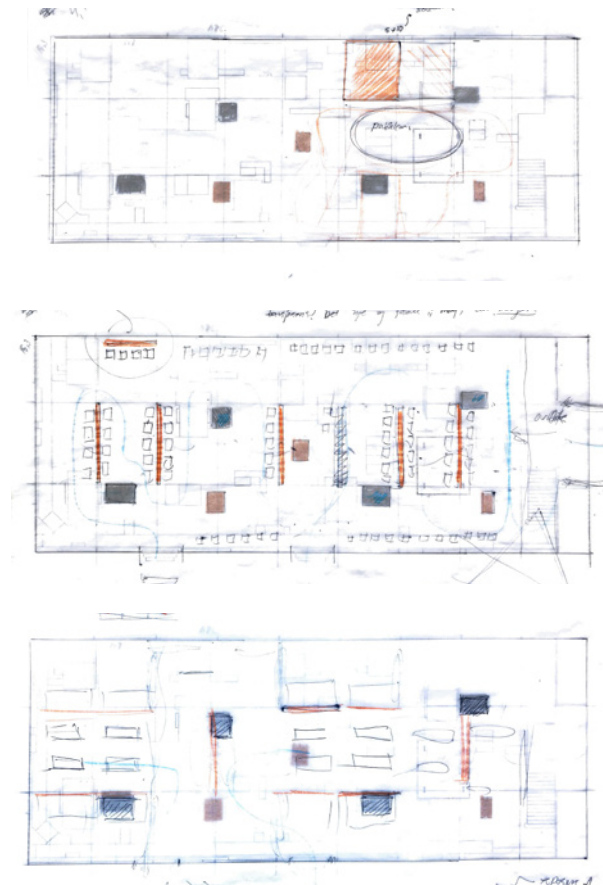
Configurations and transformation of space

While working with the design on a detailed level, we investigated the possible configurations of the textile ceiling in relation to our three scenarios and the transforming effect of lighting in relation to the textiles.

Already during our initial model work testing the concept, we came up with the concert scenario configuration. Here the textiles are used as both side walls, backdrop and ceiling in a dynamic, complex and fluid configuration.

For the market hall, we saw potential in lowering one railing to the ground, using the textile as a soft wall boundary. Moreover, we thought it could be interesting arranging the textiles repetitively to create hallways throughout the space. We tried out having only the translucent textile lowered, so walls would guide the flow but not obstruct the view through the room.

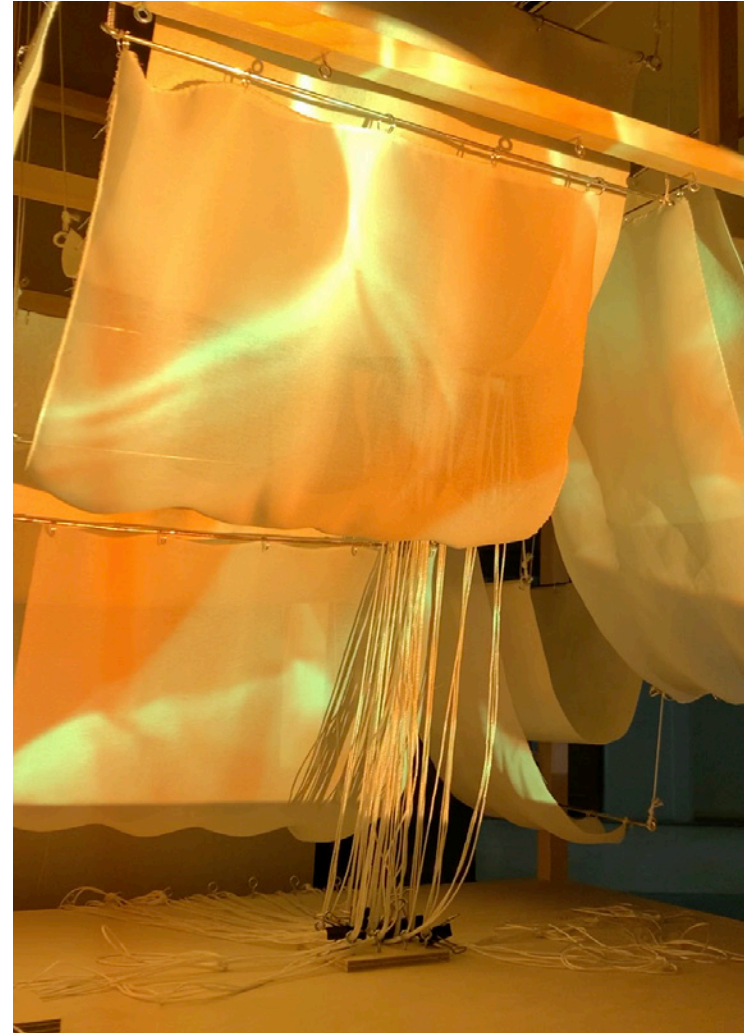
For the common dinner, we aimed for a smaller, enclosed space. Here we imagined lowering both textiles as walls and having the ceiling relatively low.



Sketches on ways to configure the textiles.



Different light setting in interaction with the textile simulated in the 1:20 model.



We tried projecting onto the textile, to see how that would work during events.



Testing how our textiles can divide space by lowering one rail all the way to the ground.



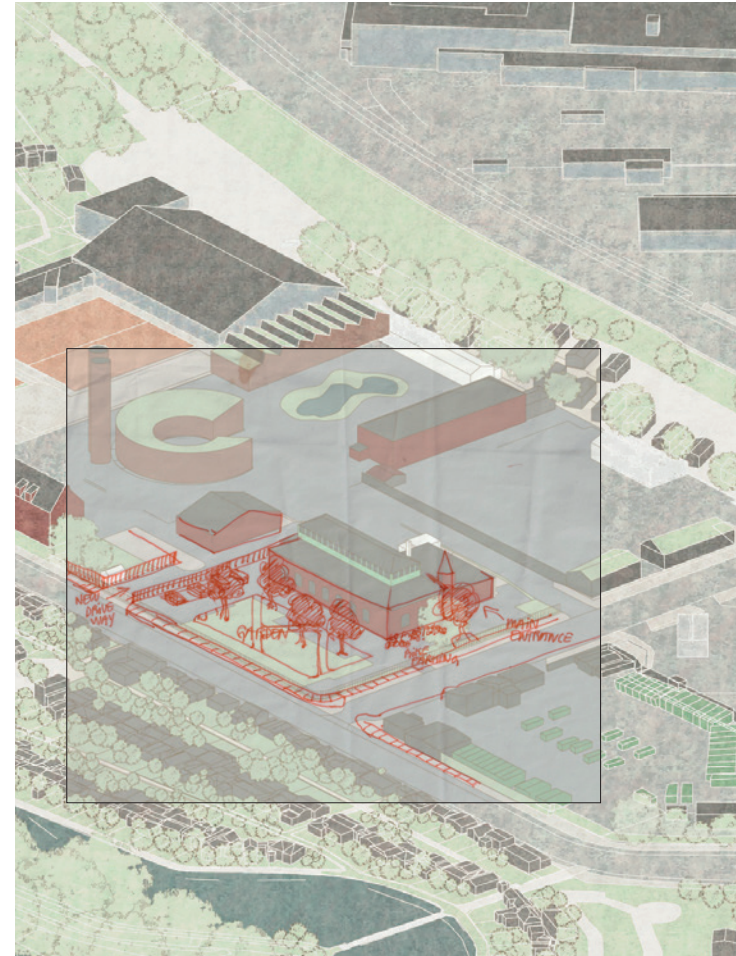
Proposal

In the following chapter, we will describe the final proposal and the supporting strategies.

Contextual strategy: A community space for cultural events

Our strategy on a contextual level answers the need for a cultural/community-based venue in the area. We imagine it will be a gathering point that can attract new activities and inspire future developments in the area.

On a strategic level, we will transform the exterior around the pump station and the side building to show in the exterior that it is a place for the community. We suggest moving the fence around the building to have open access to the site from the street. In front of the pump station, we propose making a small public park where outdoor gatherings (like markets and workshops) can take place. Towards Herjedalsgade, a new facade on the side building will give access to a foyer area. From the foyer, you would enter the main hall through the two side doors. They would then become the new main entrances to the event space. In the side building, we also place secondary functions such as toilets, changing rooms, meeting rooms, storage, etc.



Spatial strategy

Our main intervention in the space is the textile ceiling which consists of:

- A movable textile ceiling consisting of 48 sails arranged in two layers, one a wool felt and one translucent
- Two metal rods for each sail to be mounted on with snap hooks
- A rope and pulley system for configuring the sails
- Four rope stations/machines, from where the textiles can be managed. Each station controls two sections of the roof with 12 sails and 24 ropes.
- A lighting strategy that includes daylight, artificial general lighting, artificial artistic lighting and projections

The textile ceiling and the new machine

Referencing the performative aspects of the stage curtain, our textiles can conceal and reveal parts of the room and be configured to divide the space in various ways.

The intervention has been developed with three specific configurations in mind, showing its potential. However, as the system is inherently flexible, many unforeseen configurations and in-between states can (and should) potentially take place. Therefore, the spatial configuration depends on the human interaction and on what spatial character the person wants for the given event/situation.

In our final proposal, we strive to balance our intervention between free, unlimited movement/possibilities and guided, structural control. The proportions of the textiles in relation to the grid of the roof construction results in a manageable and understandable size of around 4,5 by 3,5 meters. Furthermore, the ropes, normally hidden in the backstage area, are exposed within our intervention, becoming a spatial element.



Lighting strategy

The way light interacts with our intervention is an essential aspect of the spatial experience. Therefore, we want to handle the lighting on a strategic level that supports the intervention and the scenarios.

Our light strategy revolves around the rhythm in the building throughout the day.

In daylight, the textiles are filtering and blurring the light. We want to embrace this unpredictable play of light during the daytime hours, only supporting the daylight by a diffuse general artificial lighting that can be lowered from the beams in the ceiling.

For the evening events, such as concerts, parties, dinners, etc., we want to use artificial light mounted on trusses alongside three of the beams and in the monitor so the textiles can be lit in colourful and creative ways. Furthermore, there will be the opportunity to project visuals onto the textiles. Together with the rigged lighting, the atmosphere of the space can be completely transformed from daytime to night-time. Furthermore, the artificial light in the monitor will make the building visible from afar, drawing public attention to the site, manifesting the building as a cultural centre in the area.



Lighting the building during day hours

Lighting the intervention during night hours

Daylight

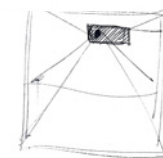


Spot lighting in between textile



lamps from above textile

Projection on textile



*The rhythm of the daylight
Overall diffuse artificial, functional lighting*

*-Lighting in interaction with the transparency
of the textiles*

Soft shadows

Hard Shadows

Conclusion and reflection

The project's goal formulated in the problem statement was to transform Pumpstation Kløvermarken into a community space for cultural experiences, becoming a gathering point for the diverse activities in the neighbourhood. We wanted to do this, starting from the sensory experience and the human scale.

The main intervention, the transformative textile ceiling, creates a space where a wide variety of cultural activities can unfold.

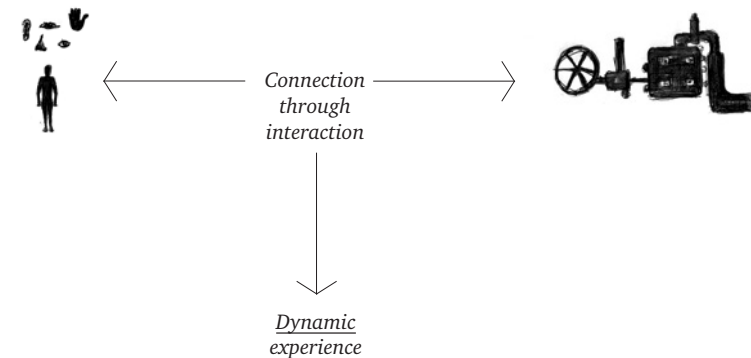
The ceiling can be configured through the new, interactive machines on the old podiums, causing different spatial experiences. Here the rope system is the connection between the human- and the industrial scale of the room.

However, we have also taken advantage of the repetitions of elements in our design, which has a human and manageable scale. This repetition enables us to expand our intervention coherently into the whole space while still designing on a detailed level.

Moreover, we have responded to the project statement by combining movement, gravity, light and textile, finding a starting point in the material's sensory properties, and how these work together and intersect.

At the beginning of the project, we asked what it means to in human scale when designing. The answer might be that by putting the details and experience of materials to the front, the human scale and sensory experience become the foundation for making decisions. Thus, we design starting from the human body and expand our ideas outwards towards the surroundings.

Through the interdisciplinary collaboration of this thesis project, we have learned a lot about our respective ways of working. Our backgrounds naturally influence our intuitive approach, but it is in the attempt to find a balance, embracing both ways of working, that an exciting contrast unfolds. It then becomes visible that none of us would have been able to do the project without the other.



As we have worked with a flexible solution, it becomes relevant to discuss whether a flexible design solution can leave too many opportunities open. Can you create something so flexible that you as a user do not know how to navigate the space of opportunity presented to you? By showcasing three possible configurations of our design, we aim to exemplify the opportunities but still leave it open for users to explore its potentials. We think we found the right balance, considering the complex composition of the neighbourhood and the future user.

Our work with physical models has been a consistent method in our process. Having the models tangible in front of us has been absolutely essential. Ideas have derived from the physical experiments, which have moved the project forward. These would not have arisen had we tried to visualise these in Rhino, as they were grounded in the textile properties (its structure, weight and translucency) and the mechanical possibilities for movement.

Throughout the process, we have returned to the atlases for inspiration and references. But the atlases have been more than just registration. They have also been a methodical way of arriving at a site-specific design solution, becoming a way for us to reference the building. It has provided us with an archive and a set of operational themes for the concept development.

Each series of experiments has taught us something new about the elements of the overall experience; first, the overall concept, then the operative principle of movement, then the interaction with light and the human being, and finally, the details linking the intervention to the site. Our work leading towards the exam will be to finalise the last decisions regarding the textile, the light, and the podium, balancing these with one another.



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