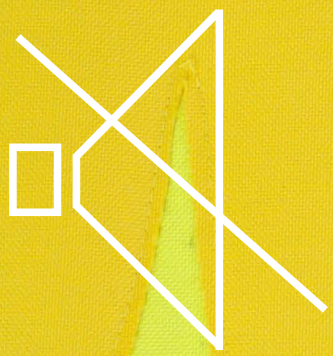
Bachelors project

- No more noise -



Degree Project for
Bachelor of fine Arts in Design
Main field of study Industrial Design

Lund University
School of Industrial Design
Department of Design Sciences

Examiner
Professor Claus-Christian Eckhardt

Supervisors
Professor Claus-Christian Eckhardt
Lecturer Anna Persson
Professor Jasjit Singh
Senior Lecturer Charlotte Sjödell

Author
Axel Engström

2018

ISRN-Number

LUT-DVIDE/ EX--18/50413-SE

LUND
UNIVERSITY

Abstract

The project started out with me wanting to improving peoples lives in the public space. Through initial research I encountered several articles about the awful sound environment in kindergartens and subsequently the health problems it causes on children in general. I took on the project and set out to make a product that helps lower the noise levels in kindergartens.

Information about sound and the behaviors was done through general research and visits to kindergartens. A concept was developed, tested and a visual identity was established.

The result is a interactive sound absorbant panel that creates a room within the room that sections of the children from the surroundings.

Background

Research

Ideation

Model making

Realisation

Result

Reflections

References

Background

Motivation

When I started out with this project I was interested in public spaces and how people feel about them. I came across reports about noise pollution and harmful sound levels related to some of these places. I liked the subject because noise is a tangible subject that we all experience to some degree and something that I feel as a designer I could do something about. Next step was to find an environment or target group to work with. I chose to work with the kindergarten environment as I believe it is a place where noise has a tremendous negative impact.

To me kindergarten is one of the most important institutions in a society. It is where children learn to socialize and play with each other for the first time. It can function as a way of leveling the playing field where children from all kind of backgrounds gets the same support and attention so that they can evolve. In many ways it is the starting point in their process of learning how to read and use logic and many other skills that will become essential when they enter in to the school environment later on in life.

Problem

Improving the sound environment in the kindergarten is an intresting problem to solve. On one hand the noise levels created have the potential to damage our children.
But on the other hand it is a place where there is full of activities on a concentrated area where creating noise is unavoidable. With that in mind I did not want to introduce a solution to the problem that restricted ones abitilty to play and be active.

Common symptoms among children who have been exposed to too much noise is that they feel tired faster, are more irritable, have a harder time concentrating and also have a harder time to learn new things. Higher sound levels also leads to worse communication which greatly increases the risk of accidents.

Teachers as a group are often forgotten in this conversation. Many have long careers in this profession and deals with loud children on a daily basis. Common symptoms for them are high blood pressure, stress, difficult to sleep and permanent hearing loss.

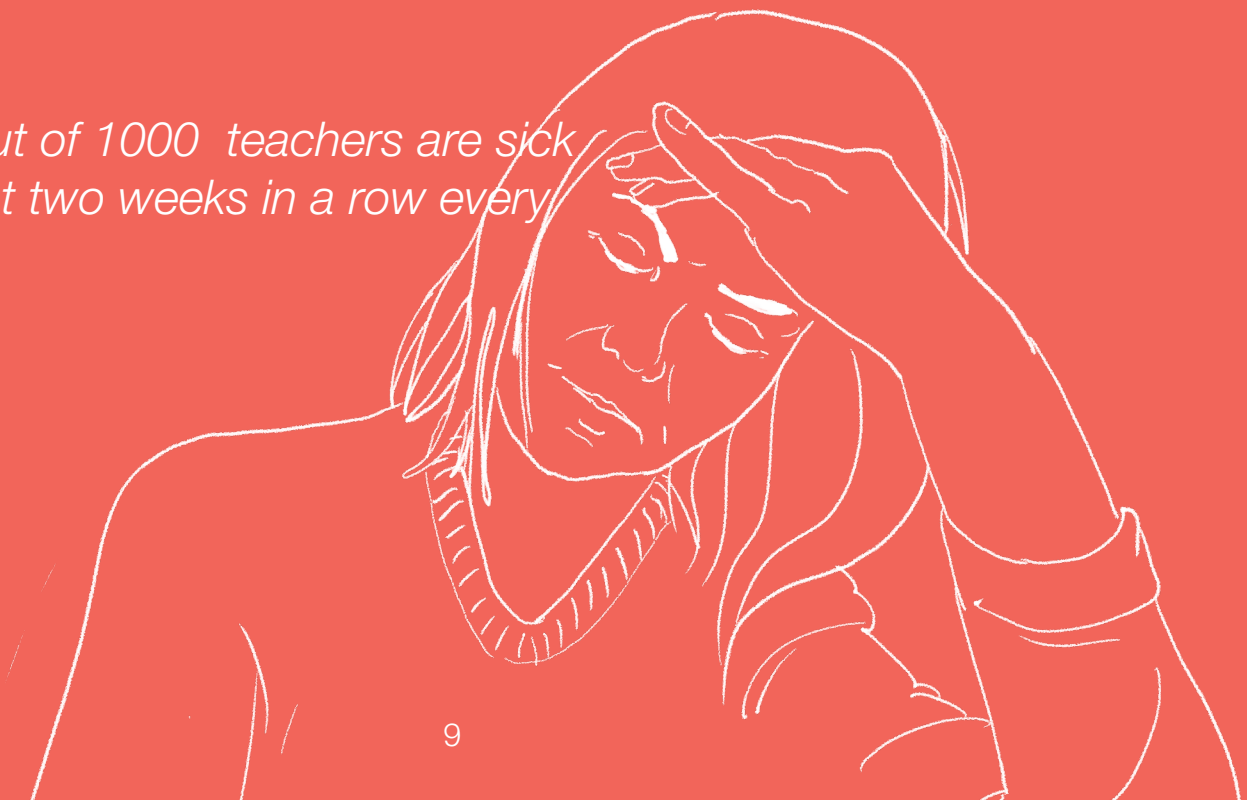
In a study done by Försäkringskassan between 2011 to 2014 showed that kindergarten teachers ranks fourth in most sick leave. Many of them have complained about there being too many children in each group to take care of. They have tried to solve this by hiring more teachers but this has resulted in some being hired without a proper education. Another common complaint is that the buildings are too small and does not meet todays standards and needs when it comes to acoustic performance.

Brief

To improve the sound environment for children and teachers at the kindergarten.

It is easy to get angry when the noise level is high.

160 out of 1000 teachers are sick at least two weeks in a row every year

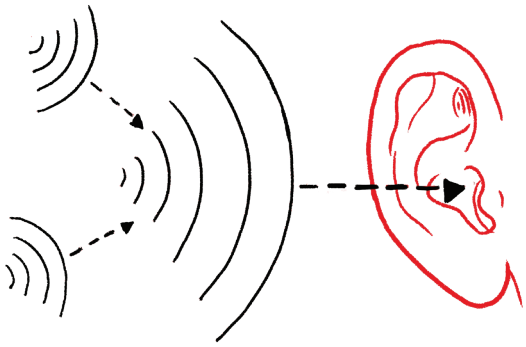


Research

The research was conducted by reading published books and PDFs about sound related to the public environment and two field trips to kindergartens where interview with the teachers took place. The goal was to get a basic understanding of acoustics and how it is applied to the kindergarten environment. It was also important to understand the childrens behaviour and activities as well as looking into what tools and solutions they are already using.

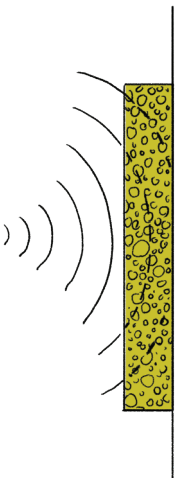
What is noise?

Sound can be described as pressure differences that travels in waves through gas, liquids and solid bodies. Noise is often described as many sound sources mixed together that creates a sound that is unwanted and often harmful.
The sound sources are at this point indistinguishable and are often described as a constant sound in the background. This means that even weaker sound sources such as ventilation can in combination with other relatively quite sources create a harmful sound environment. If a person is exposed to stronger noise that exceeds 80 dB for a long duration the hair cells in the ear can get damaged which results in permanent hearing loss.



Reverberation is another aspect of sound that is important. It is the phenomenon where sound reflects on surfaces until it loses its energy. It bounces around creating the illusion of multiple sound sources.

There are however solutions to help combat the noise levels. One way is to use sound absorbing materials that helps mitigate reverberation. It is often a porous material that converts some of the energy from the sound into heat and the rest is absorbed by the dampening material.



How children view noise

Kindergarten is a place where noise and reverberation is always a factor. Children are running around the place, some are singing, some are building and others are just communicating with each other in different ways. All of this is happening in a relatively small space without the children thinking to much about it.

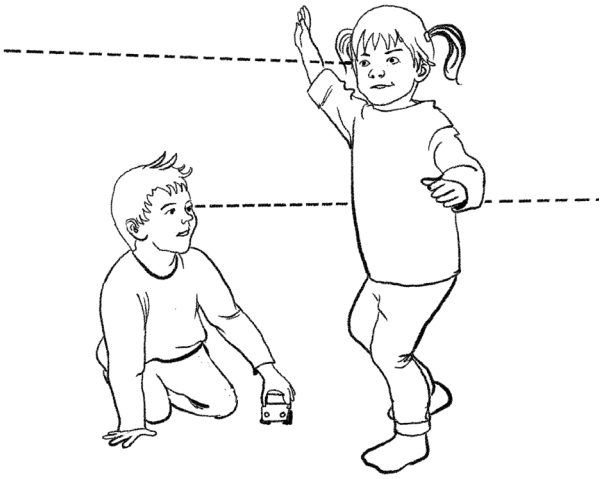
Children are in many ways more susceptible to noise then the rest of us. They lack the protective instinct that adults have when the sound levels get too high. It is often said that most childen does not have the ability to know when they or someone else around them are being too loud.

This creates an environment where the overall noise level makes communicating more difficult. This phenomenon is referred to as masked sound where sound from the environment cancels out some of the conversation. It leads to the children talking even louder in order to get heard.

What causes the noise?

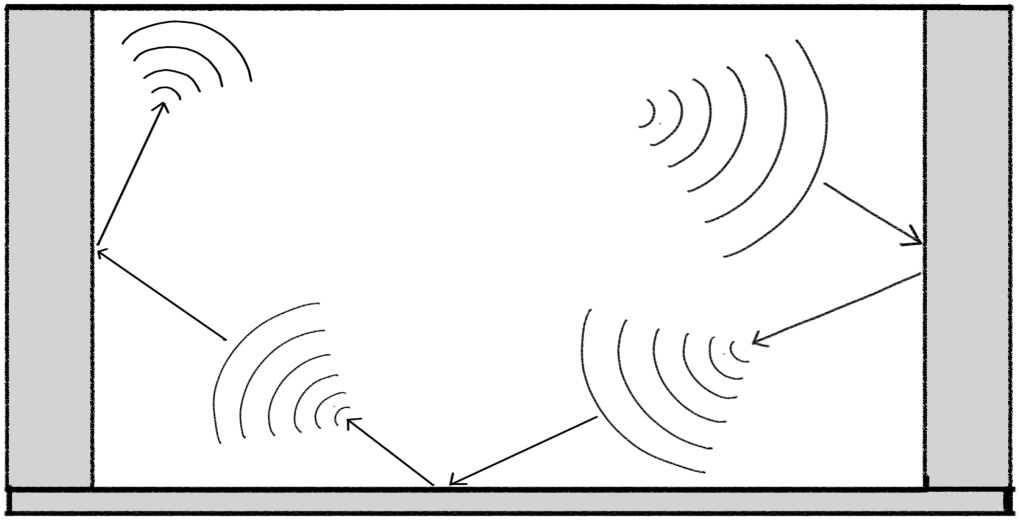
Teachers feel that the noise level is the highest when there is no planned activity and when the children decides themselves what to do. This is referred to as free play time which often results in several different types of activities being done at the same time.

This leads to a lack of focus amongst the children. Instead of focusing on their current activity they start playing with others around them and often they end up interupting each other. This can create a chaotic environment where it is harder for the teachers to keep everyone calm.

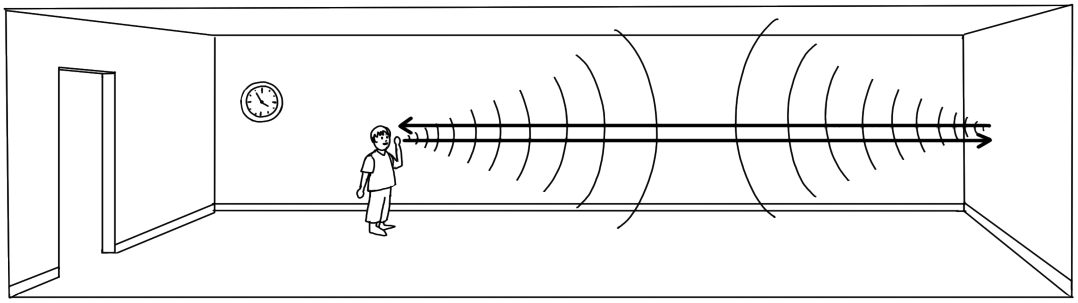


Doing several activities at the same time also means that more toys and equipment are being used. This makes the tidy up process more difficullt and creates potential for more noise.

While this is a major problem for the kindergartens it is at the same time believed that having this type of free activity is importatant to the childs development. It can therefore not be completely replaced by planned activity by the teachers.



The building and the interior also has a big impact on the overall noise levels. Kindergartens that were built with concrete or brick walls suffer from a lot of reverberation. The dense walls are great at keeping noise from getting in to the building. The problem is on the inside where sound waves from the children bounces right off the hard surfaces. Unlike porous absorbing material there is next to nothing that brakes down the energy of the sound wave as it continuous to collide with other sufaces in the room. This means that the sound will bounce multiple times before it fades out.



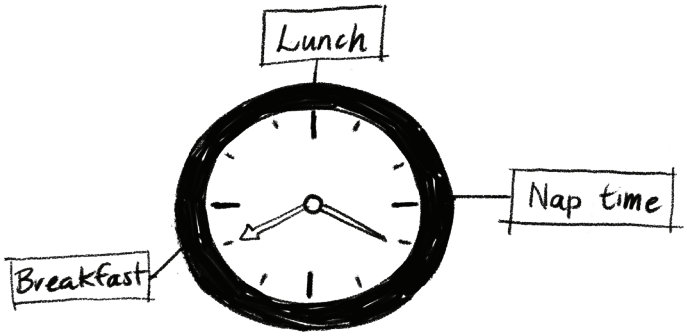
Another factor that makes the acoustics even worse is that most kindergartens have large rooms where they can all gather. These larger rooms are affected by long reverberation times. What it means is that the sound waves take a longer time to bounce back due to the distance between the surfaces in the room. This means that the sound waves created stays in the room for a longer period of time adding to the existing noise level.

The difference between long and short reverberation times can be described by imagine someone clapping their hands in a old church and then do the same thing in a bathroom. The difference is remarkable and that is why

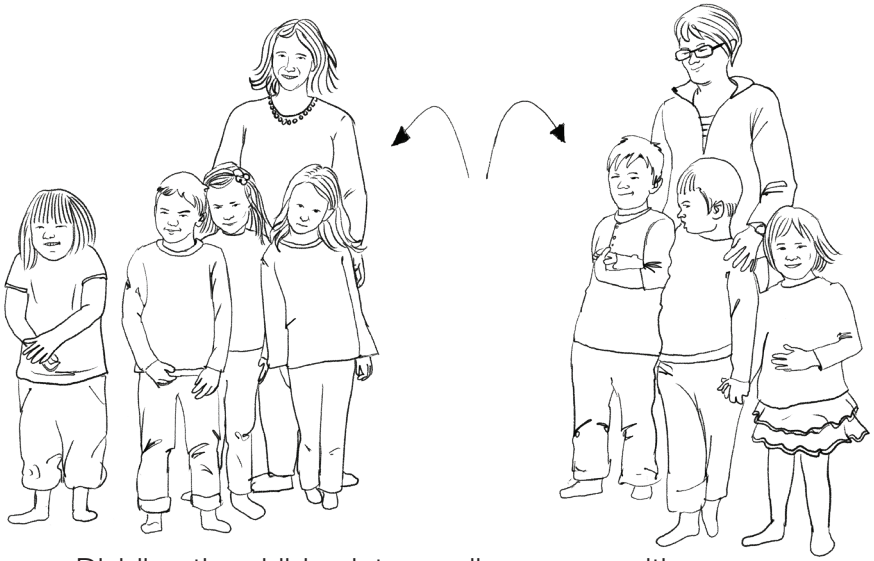
Behavioral solutions

In this part I present the current behavioral solutions that some of the kindergartens use to keep the noise levels down.

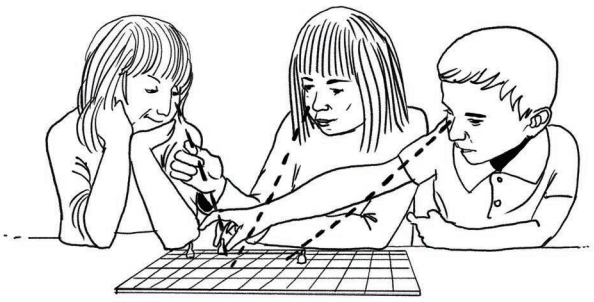
Having routines is a good way of keeping everybody calm by letting the children learn whats next. It can be as simple as eating at the same time each day. It can also be more involved such as having surtain theme days every week.



Another method that is commonly used is to section off parts of the building or a room. It limits where the children can go and their visual intake. It keeps everybody in a group where it is easy to communicate.

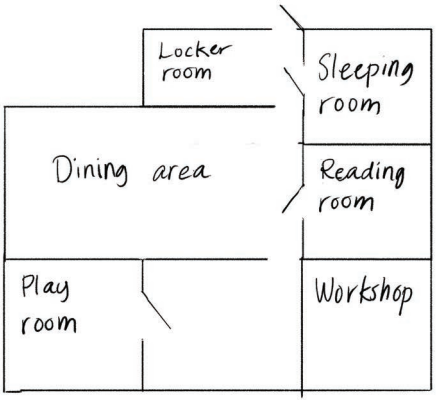


Dividing the childen into smaller groups with one teacher makes everybody involved direct their attention to eachother. This makes it easier to communicate and you can do some activities that would not be suitable in a larger group.



By having an activity that requires focus makes the children forget about who is in the other room and instead point the attention toward the chosen activity. Sometimes it is the teacher that creates focus by using a game as a tool. But the best thing is when the product immerses you and keep you occupied by itself.

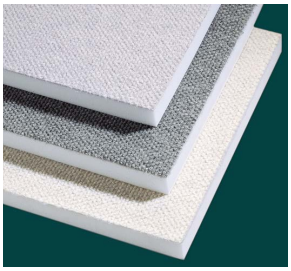
Dividing the building into dedicated rooms is another way to keep the children calm. They know the rules that applies to the sleeping room and how to behave in the workshop. It also makes it easier to find eachother which eliminates alot of potential noise.



To prevent the children from running around too much and being loud you have to seperate between inside activities and outside activities. If someone has high energy and want to run around they will do it outside.

Technical solutions

Here are some of the most common products and materials that are bieng used to improve the sound environment.

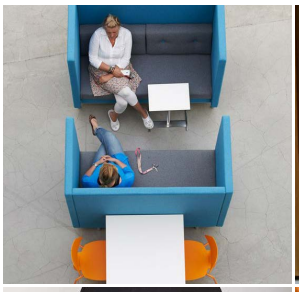


Sound insulating materials

Isolating materials relies on density to stop sound waves from passing through. In most cases it is the walls of the building that have these properties. Modern composive walls can both insulte sound and absorb some of aswell. There are interesting trends happening such as the office booth that keeps sound out and creates a calm workspace for one person.

Sound proofing furniture and storage

This includes both purpose built products and modified products that helps dampen the sound mainly by preventing impact noise.



Visual dividers and sound absorbers

In this category we have both simple products like cloth and curtains that dampens some of the reverberation but is mainly used as a divider of sorts. Then there is dedicated absorbing materials that is mounted on the wall.

Sensors

These kinds of products are meant to measure and inform the surroundings of the current noise levels. It is a relatively new type of product and the effectivess is sometime questioned. Kindergarten teachers have reported that kids likes to trigger the sensor by being intentionally loud in order to get the ear to light up.

Field trips

In order to get a better understanding of the kindergarten environment I went and visited two kindergartens in Malmö. One was built decades ago and the other one had a fairly new facility. I wanted to see how they compared in terms of buildings, tools, routines and how they prevent noise.

Stock och Sten

I went to visit the kindergarten Stock och Sten in Malmö. The reason why I chose to visit them was because the people working there felt that the building produced alot of reverberation creating noise levels that was unbearable at times. They believed that the problem was the acoustic properties of the facility and the lack of indoor space. Luckily Stock och Sten is situated in Pildammsparken which is one of the bigger parks in the city.
This grants them access to an amazing outdoor environment. They therefore try to spend most of thier time outside which is something that they have become known for. They play with eachother outside, eat lunch outside and the younger children even have thier nap outside.

My impression of Stock och Sten was that the children had a lot of freedom. During my limited time there I saw children playing a lot independently which was nice to see. Some were inside by themselves building stuff while the majority was outside. They had two of these big wooden sheds that they gathered around when they had group activites. It was however also apparent that they relied on being outside in order to be a functional kindergarten and at some point they need to deal with the lack of indoor space.

"Our goal is to be outside as much as possible. From there we let them choose what ever they like to do that day. If they want to eat lunch next to the sand box we let them do that."

"The amount of children has grown alot from when i started working here. We are now one of biggest schools in Malmö."

"The noise levels are the worst when everybody is inside at the same time. This building is simply not made for it."

The building consisted of one big general area that was connected to several smaller rooms. Some of these room were dedicated to a particular activity like the ones below. The walls were made of thick concrete and the floor were covered with a plastic film. This meant that there was a lot of potential for reverberation.

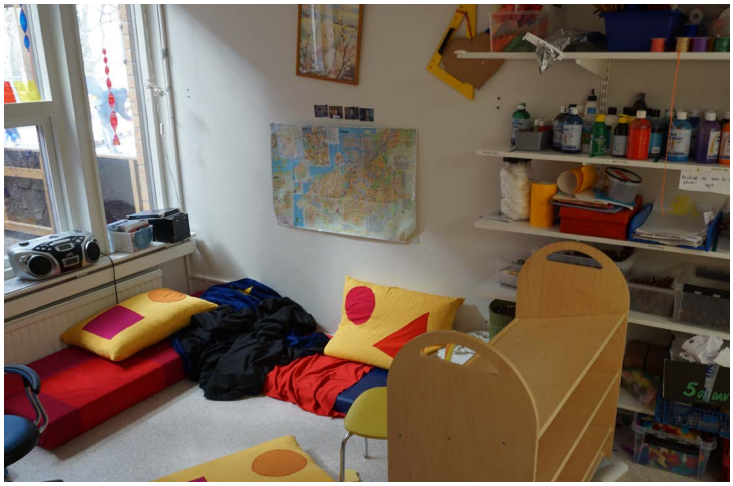
Here we have the building room which they considered the room with the worst sound environment.
Each impact from the hard building blocks creates a strong sound that bounces of the walls.

When the children want to be creative they could paint and create art in this room. This kind of activity had to be lead by a teacher during a planned activity.

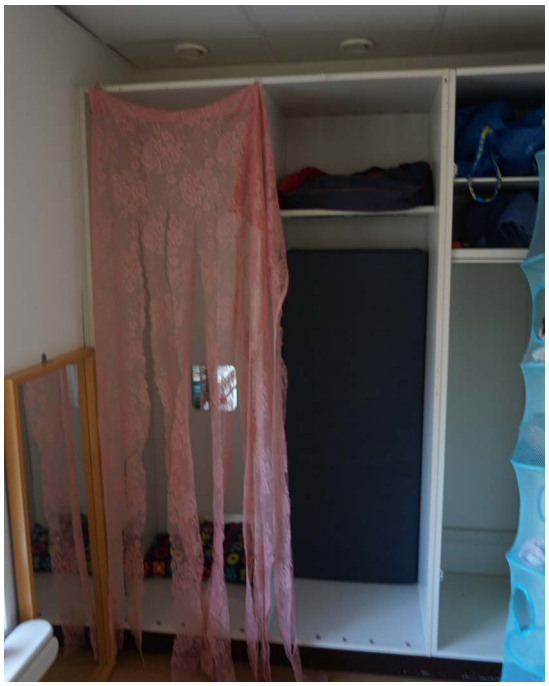
This was the dedicated reading room where most of the books are stored.
Here the children could look through their favourite books or a teacher could read for a small group. They sit mostly on the pillows on the floor.

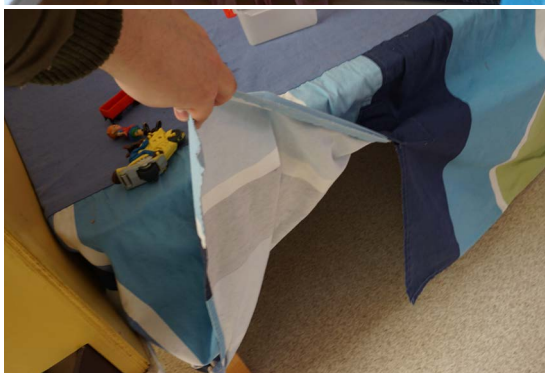
This space connects a lot of the smaller rooms and the main corridor. Children pass through here all the time and this is a typical space where sound travel from the smaller rooms and create noise. In order to get proper vision of the children the doors have to stay open.

Here was a typical multi functional room. In the left corner there was a bed and in the middle we have a drum set among several other things. In a room like this many different activities can happen at the same time and again create noise.



Yet again we have a room that connect to the other rooms and with similar problems. The mattresses and pillows served as a place to relax, read and nap. The teachers said however that they get dirty very fast.





In some of the rooms existing furniture had been modified to fit the current need of the kindergarten. Creating a hide out seemed like a popular choice.

In order to reduce the noise they tried their best to introduce soft materials to cover up the hard surfaces. They also had these building blocks that look like wood but was soft and did not produce any sounds on impact.

I had a chat with one of the teachers and asked some questions regarding their routines and how they relate to the noise levels.

How does a typical day look like?

- We start with breakfast at 8.00. We section off the building and dim down the light. It is fairly calm at this point. Then there is a planned activity. We have lunch at about 11.30 where we eat outside in groups of 10. Following that the kids aged 1-3 takes a nap and the older ones relax and do calm activies. There is a snack break at 14.00. After that there is free activity for the children until closing time where we gather inside in one of the groups.

Where do you feel that the noise levels are the worst?

- I think the corridors are the worst place in our building. We can not close the doors in the smaller rooms so the sound travels around and mixes with other sounds from other room.

What do you think is the main cause that add to the noise levels?

- Probably when children are yelling and screaming. It can be them being upset but most of the time it is them trying to communicate with each other. It is hard to prevent when you have a lot of kids in a small area like our building.

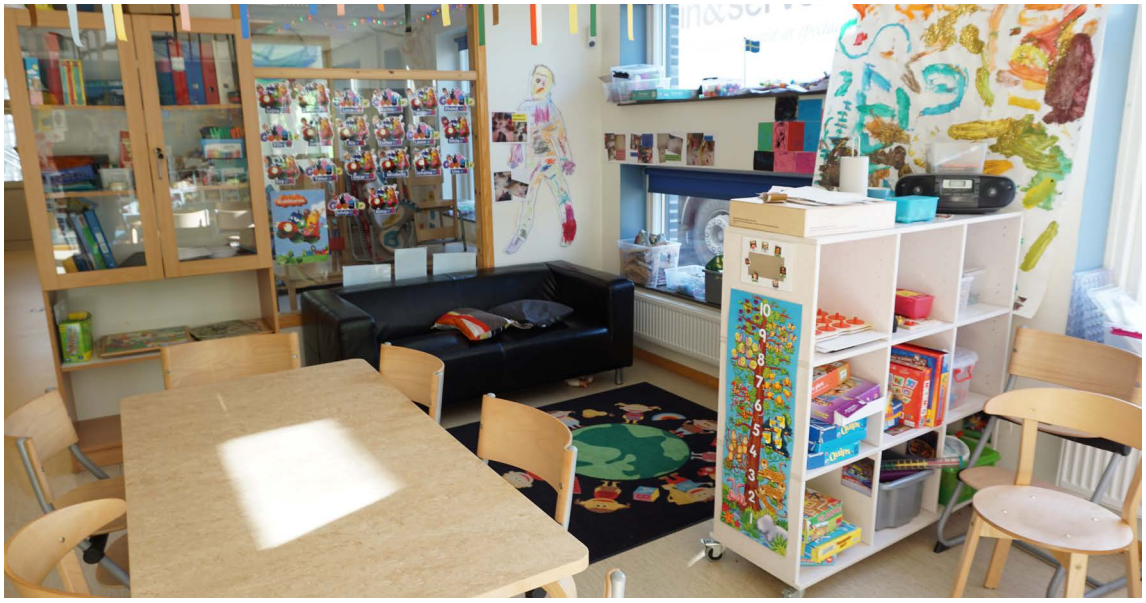
Do you have dedicated room for certain activities?

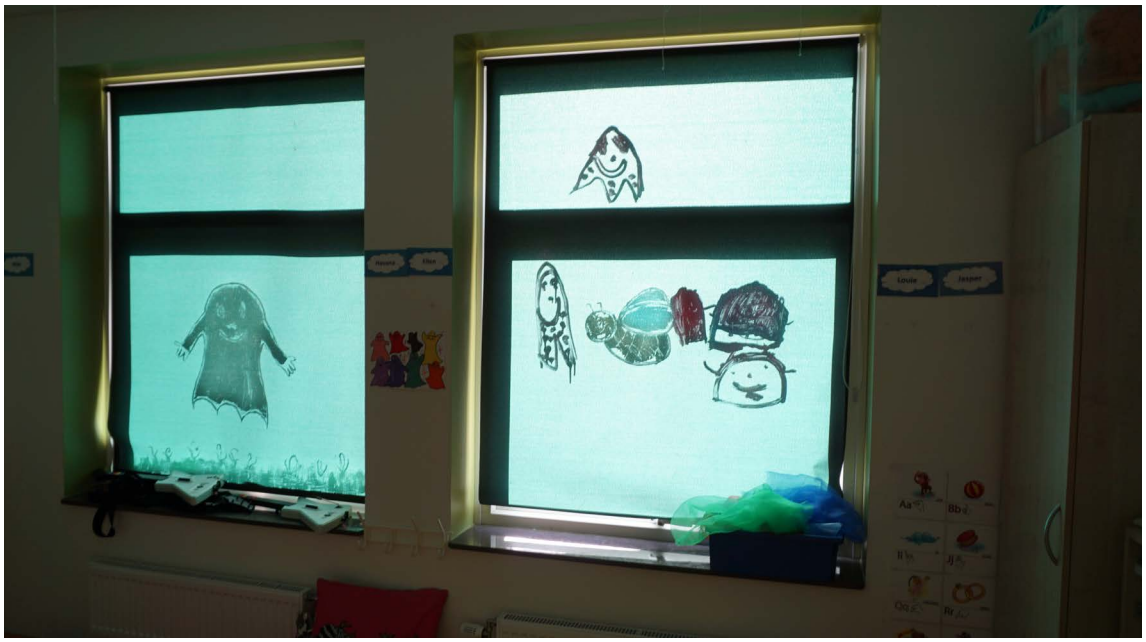
- Yes and no. We have a rooms like the paint room and a building room but most spaces are used for everything. It is important to be flexible because children wants to do different things everyday.

Gullkragen

My next visit was to Gullkragen which is situated in the outskirts of Malmö. As mentioned it is a relatively new facility that opened in 2014. They had six groups with eighteen children in each one. My impression of the place was that it felt a lot more organized then my previous visit. There was a clearer division between the groups. The layout of the building was symmetrical meaning all groups had the identical rooms as eachother. From a acoustics stand point it was a big difference between here and the small rooms with concrete walls found at Stock och sten. With a more modern way of constructing walls and the more open plan meant that reverberation was way less apparent.

Here we can clearly see how open the indoors environment is. The top picture shows the main room that connects to the smaller ones. The walls between the rooms have large windows that makes it easier for the teachers to look after the children. The teachers also felt that the children yell less and spend less time looking for eachother.





With all that open space it was still important to have some kind of way to section of part of a room. They dimmed down the light by rolling down blinds when the younger children where sleeping. Sometimes they kept them down as it helped the children calm down.

I also talked to the teachers about how they view the sound environment and what they do to prevent noise.

How does a typical day look like?

- We start with breakfast at 7.30. Then at 9.30 we have a planned activity that takes place either inside or outside depending on the weather and mood. At 11.00 each group have lunch on there own in their respective main room. During the afternoon we usually have another planned activity. Later in the day the children have time to play on their own.

Where do you feel that the noise levels are the worst?

- At the entrance when the children are getting dressed to go outside. It can also be very loud in the main room right before lunch when the children are waiting the the food. Everybody is gathered and plates and cutlery are hitting the table and everybody is gathered in the same area.

Have you done anything specific to prevent noise?

- Yes we split the children into smaller groups with one teacher and six children.

Do you have dedicated room for certain activities?

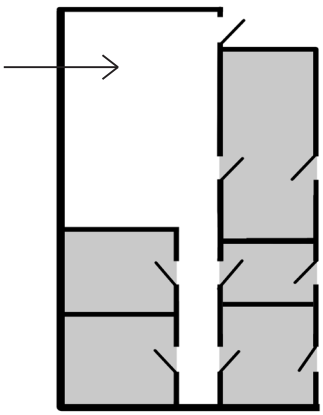
- Yes, each group has access to a room where they can do art and crafts and a room where the children rests or sleep. But most activies takes place in the main room which is used for all kinds of things.

Research conclusion

I think one the most important information from the research was that children do not view the sound environment the same way adults do. They are only interested in having fun while playing and that will always generate noise to some extent. That means that products within the playing area should always promote playfulness first while also address the noise issues.

While it is clear that the most effective way of keeping the children calm is by planning around them I still felt that their free activity time was the most important thing to focus my project on. It is widely regarded as a crucial part of the childrens development and will remain part of most kindergartens daily schedule.

While areas like the building room can be loud it only happens there and does not effect the rest of the building. That is why I wanted to address the noise in the big multi purpose room where everybody gathers in.



This big main room at kindergarten Gullkragen fits that desciption. It is a room where everybody can play together as well as doing indiviual activities. It is a valueble playing area that serves different roles during the day and connects all the other rooms with each other. This is the type of room that I think is very important and where I would like to improve the sound environment.

Function analysis

My product should have these following features.
They are ranked in order of importance.

1. Decreace reverberation

2. Promote a calm activity

3. Inspire playfulness

4. Be applicable to alot of situations and room layouts

5. Enable individual use

6. Create a focus activity around the product

7. Have a playful aesthetic

Market research

After having decided to work with some kind of sound absorbant I went and took a look at Kinnarps show room.They sell primarely to public institutions and corporations which is how I intended my product to be sold.

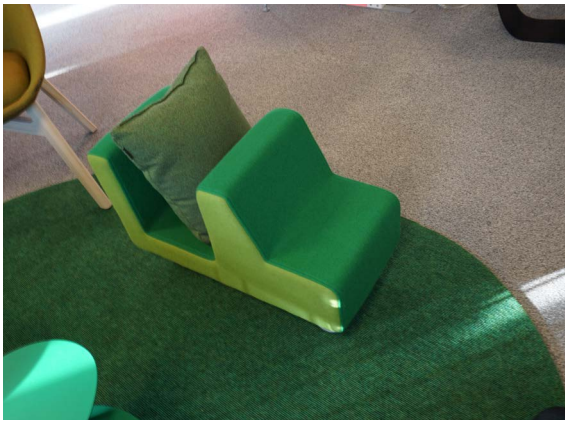





Most of these products were made for the office environment. They are all made to reduce noise in some way, most commonly by absorbing the sound. Many of the products also functioned as dividers either by sectioning off rooms or by creating a place that is more private.

The products on this page were aimed at children. They were in many ways similar to the other interior products. They shared the same general estetic with bright colours and simplistic shapes.

The two products above inspired me the most. They function as dividers for a child sitting by a table and are made out of materials with some sound absorbing properties. I liked the construction of the product on the left in perticular. It had some kind of tubing inside the fabric that made the product easy to fold and light enoght for a child to move it around.

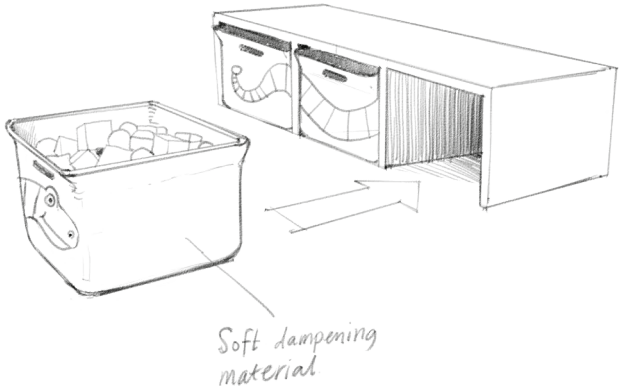


I thought that this chair was interesting because of the shape representing a car. Having a product like a furniture taking a shape of something fun that thr children are familiar with can create a visual intrest and help explain the product better.

Other products in this segment like this sound absorbing panel were just variations of the office products but with a more playful look.

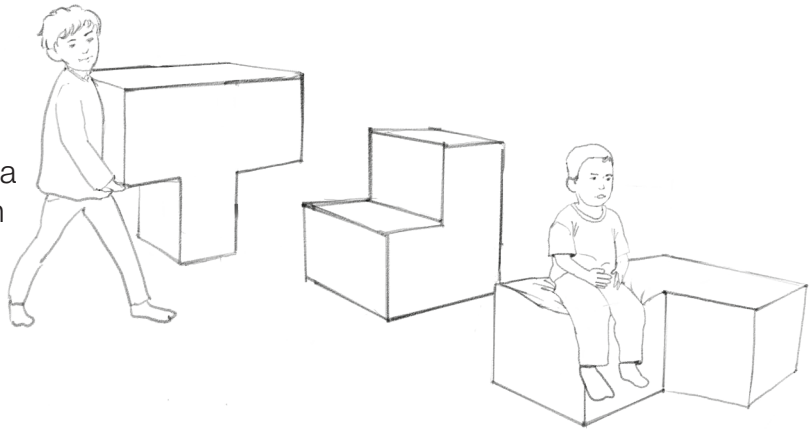
Ideation

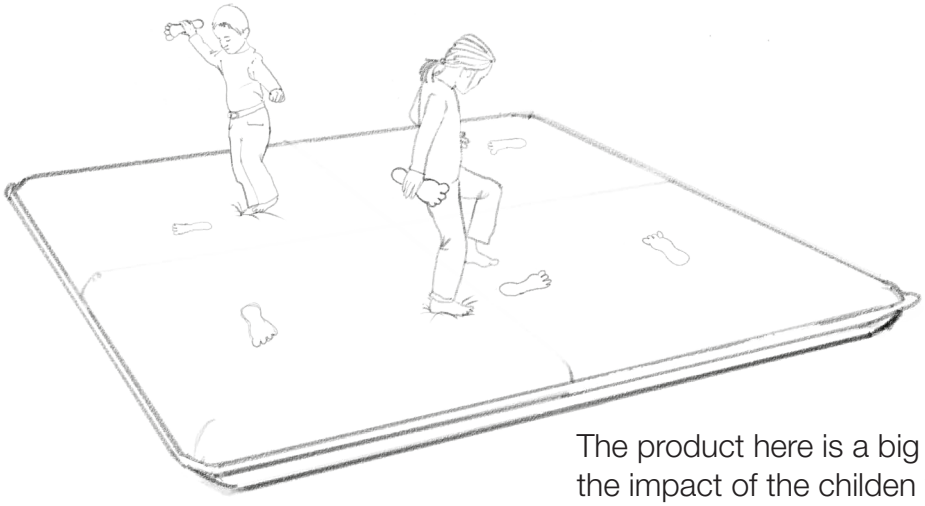
Initial concepts



This idea is a storage solution that aims to make it more fun to put the toys back where they belong. The containers are made out of a soft material that absorbs the impact.

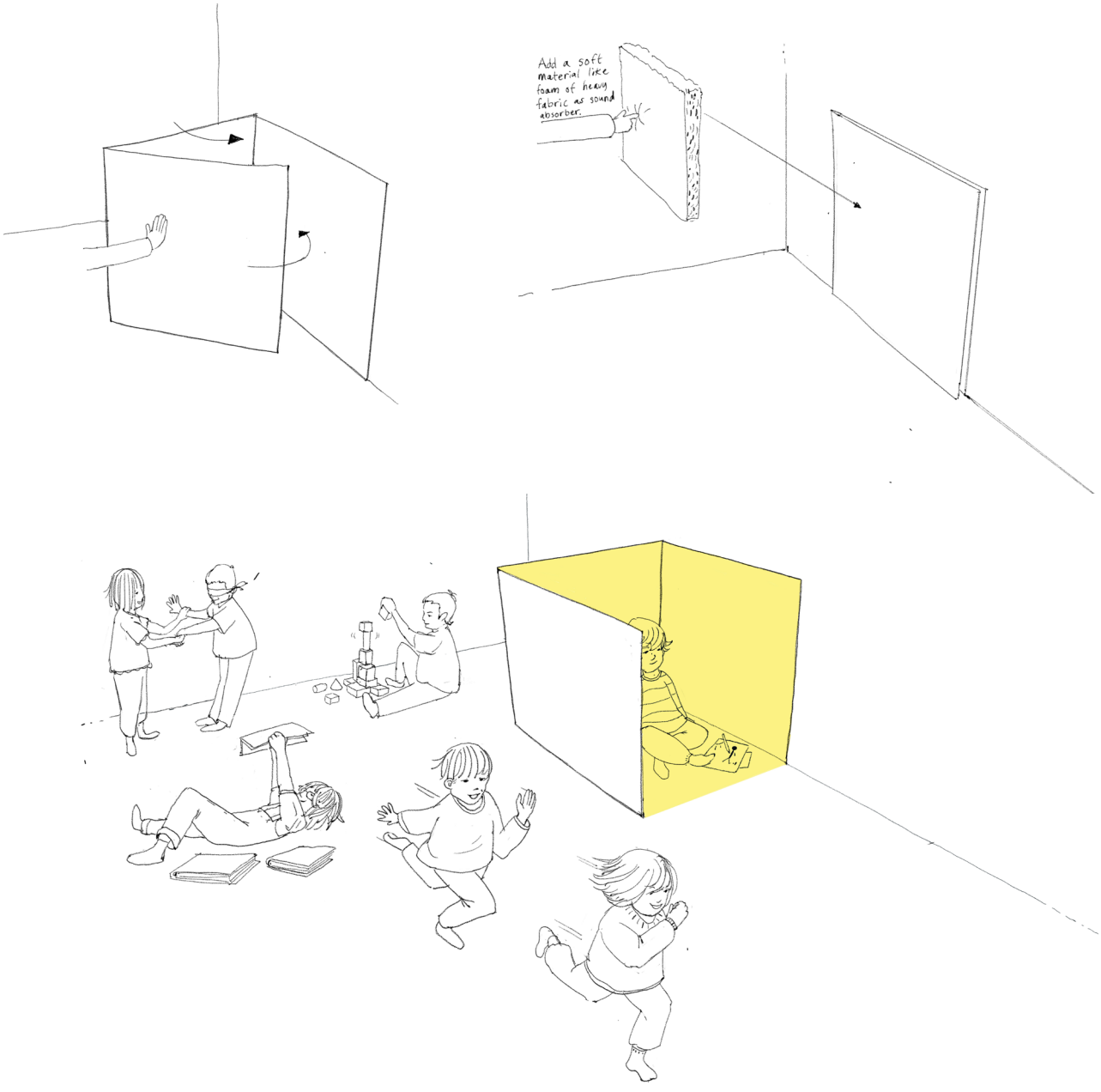
Here is a concept of cushions that are shapes like building blocks. The children can section of part of a room or find new ways of sitting on them.





The product here is a big mattress that absorbs the impact of the childen while the are being active jumping around. Cut outs of footprints can be attached to the surface to create a track that the children can follow. This creates focus within the area of the product.

Interactive sound absorber.



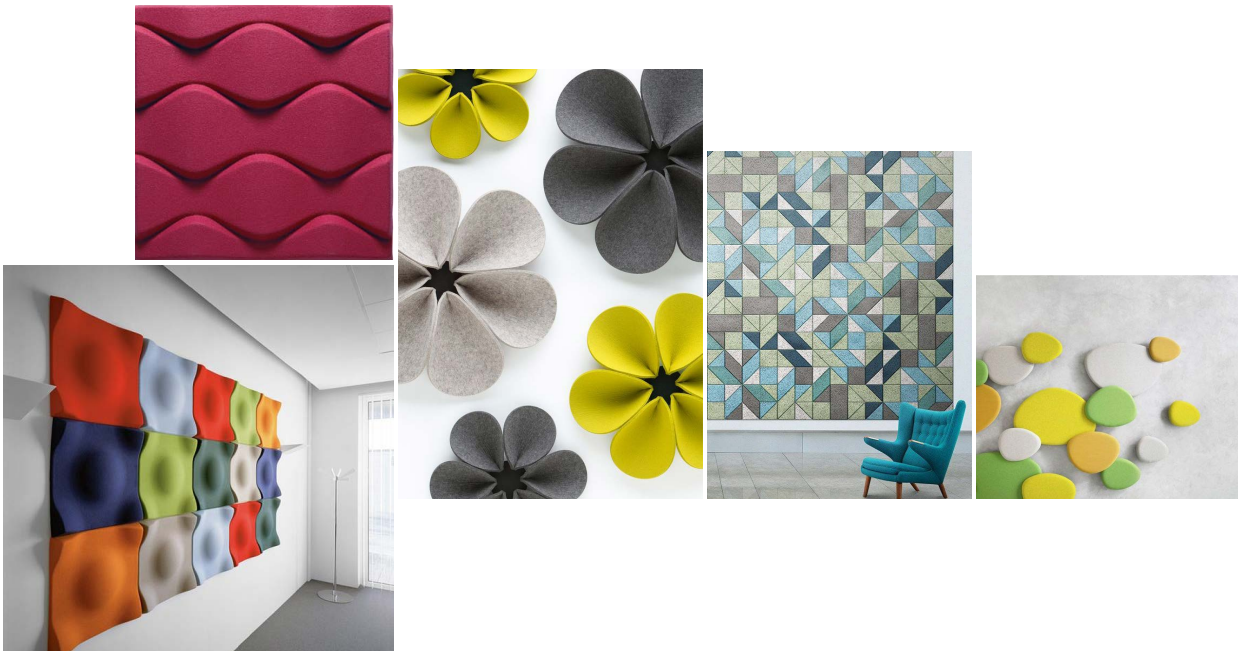
I chose to go with the interactive sound absorber. It is perfect for multi purpose rooms where activity change all the time. It can be folded in to make room for other activities while still serving as a sound absorbent. It can also function as a hide out for one or more children.

Inspiration

What if the product could be a combination of a tent and a sound absorbing panel?

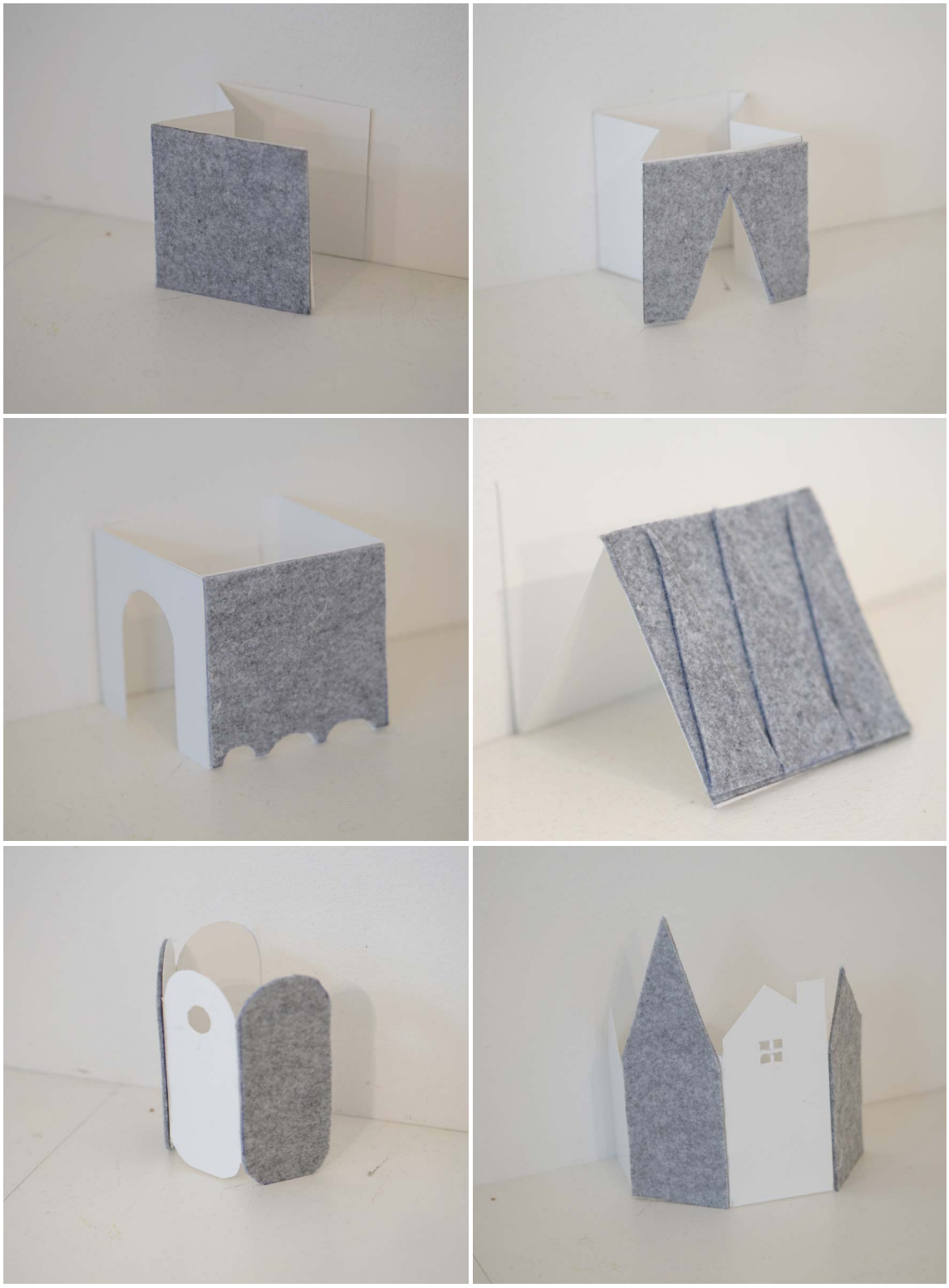
I wanted to make a product that created a room within a room for one individual or a small group of kids. This feature would help with the behavioural aspect by providing a focus on the inside and limits visual distractions from outside. I further looked at tents and similiar product.

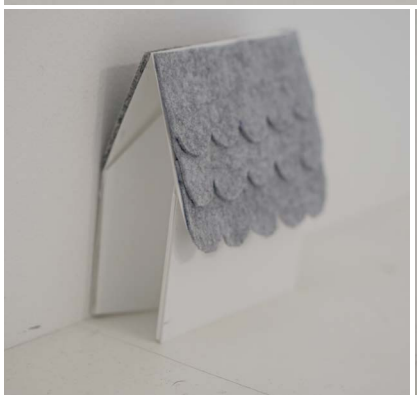
Further Inspiration



A part from reducing the echo in the building the sound absorbing panels brings a decorative element to the room. I was inspired by the bright colours and three dimentional patterns. Some of the inspirations includes the red acoustic panel Soundwave by Offect and the beautiful felt flowers called Silent flower by HEY-SIGN. These products are made for offices but I could see something simular being used in a kindergarten where they can be both a decorative element and take up next to none of the valuable space.

Form evulotion



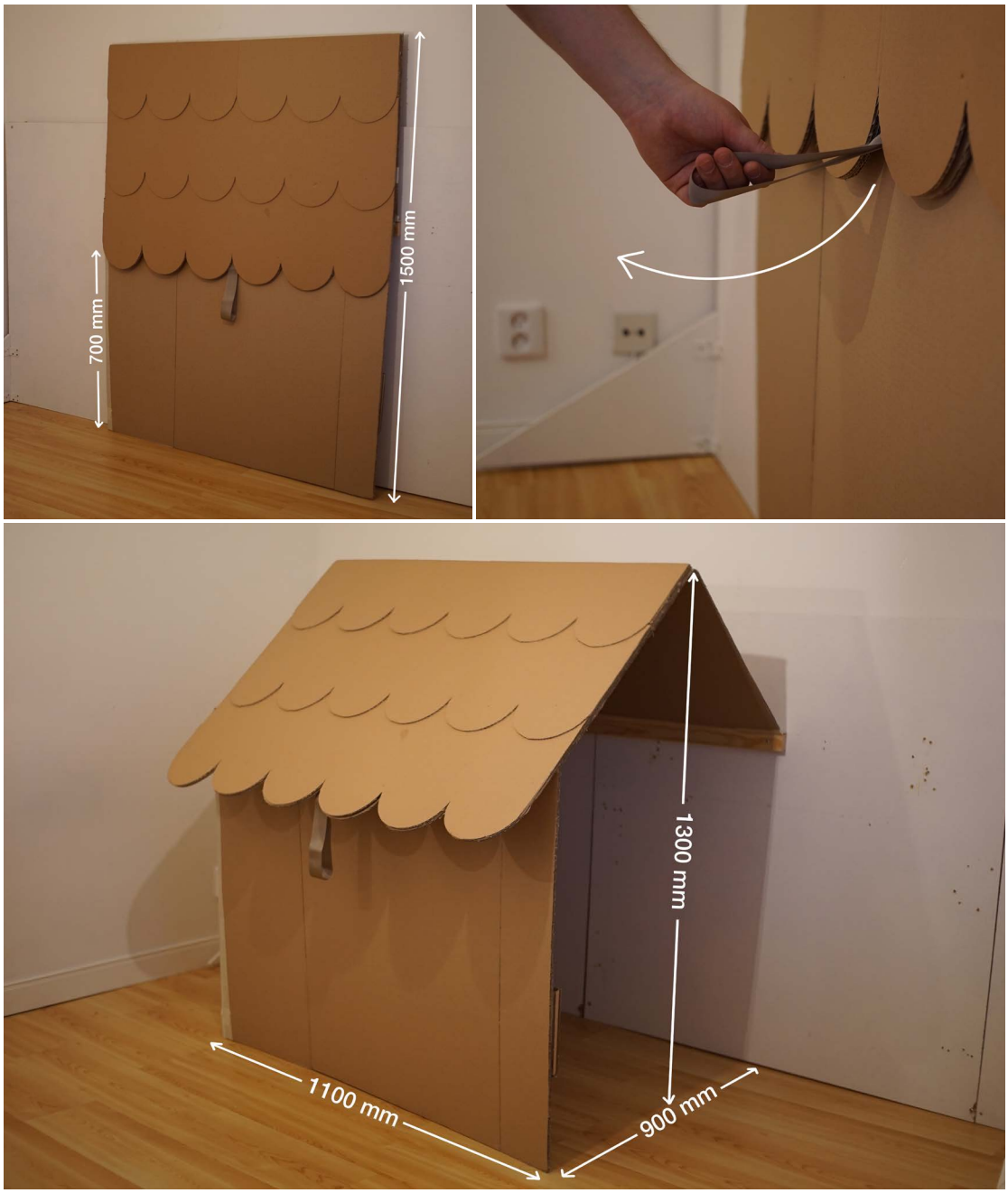


During this stage I was developing a construction that would be mounted on a wall and be able to fold out and back in again with a simple motion.
I finally went with a product that folds out and creates a house that 1-4 children can play in. It is a familiar shape that the children can relate to and it explains the use of the product well.

The roof is covered with sound absorbing material and when the house is not in use it can be folded back against the wall. It is the strongest visual element that that adds colour and texture to the room in a playful manner. The construction is suppose to be light weight, similar to a tent and be of the appropriate size in order for children to use the product independently.

Model making

Full scale model



I made a full scale model out of cardboard. It was a fast way of getting the proportions down. The idea was to make the ledge that forms on the bottom of the roof the part that you use to drag out and pull in the house. Due to the brittle material opening and closing the model felt awkward. I tried to add a rope as a way to initiate the use of the product but it was not practical. It was obvious that I needed a more natural way of opening and closing the product.

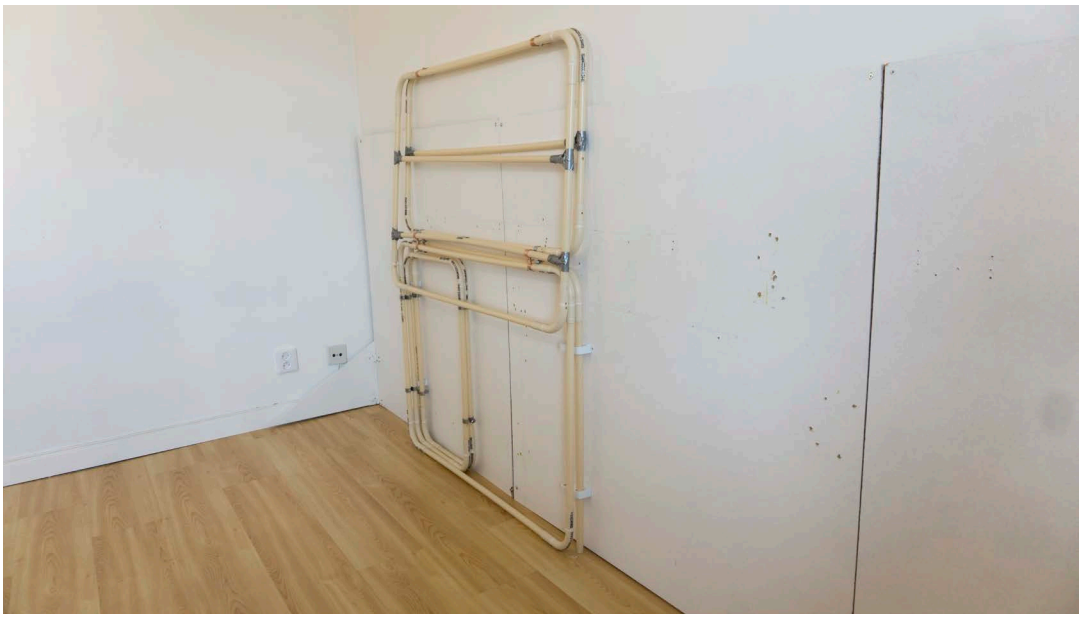
User testing

I did some user testing with a five year old. Five is the oldest target group i considered for the product. The goal was to determine if the product had any appeal and if the size was right. She seemed to understand the product and started decorating with pillows right at the start. She could also stand tall in the middle and I felt that the model was a bit to tall. The lamp did not provide enough light to make the space good for reading and adding electronics would over complicate the product.

Mock up

With a model that was foldable it was important that the construction felt safe and inviting. I used a frame out of a plasic pipe and attached fabric on to it. You get a very light weight construction and with the fabric adding tension from all sides it becomes surprisingly durable.

The first thing I did was add a back frame that is mounted on the wall. It makes it easier to install the product and helps support the rest of the construction. Between each frame are two hinges that keeps everything together and allows the product to fold.



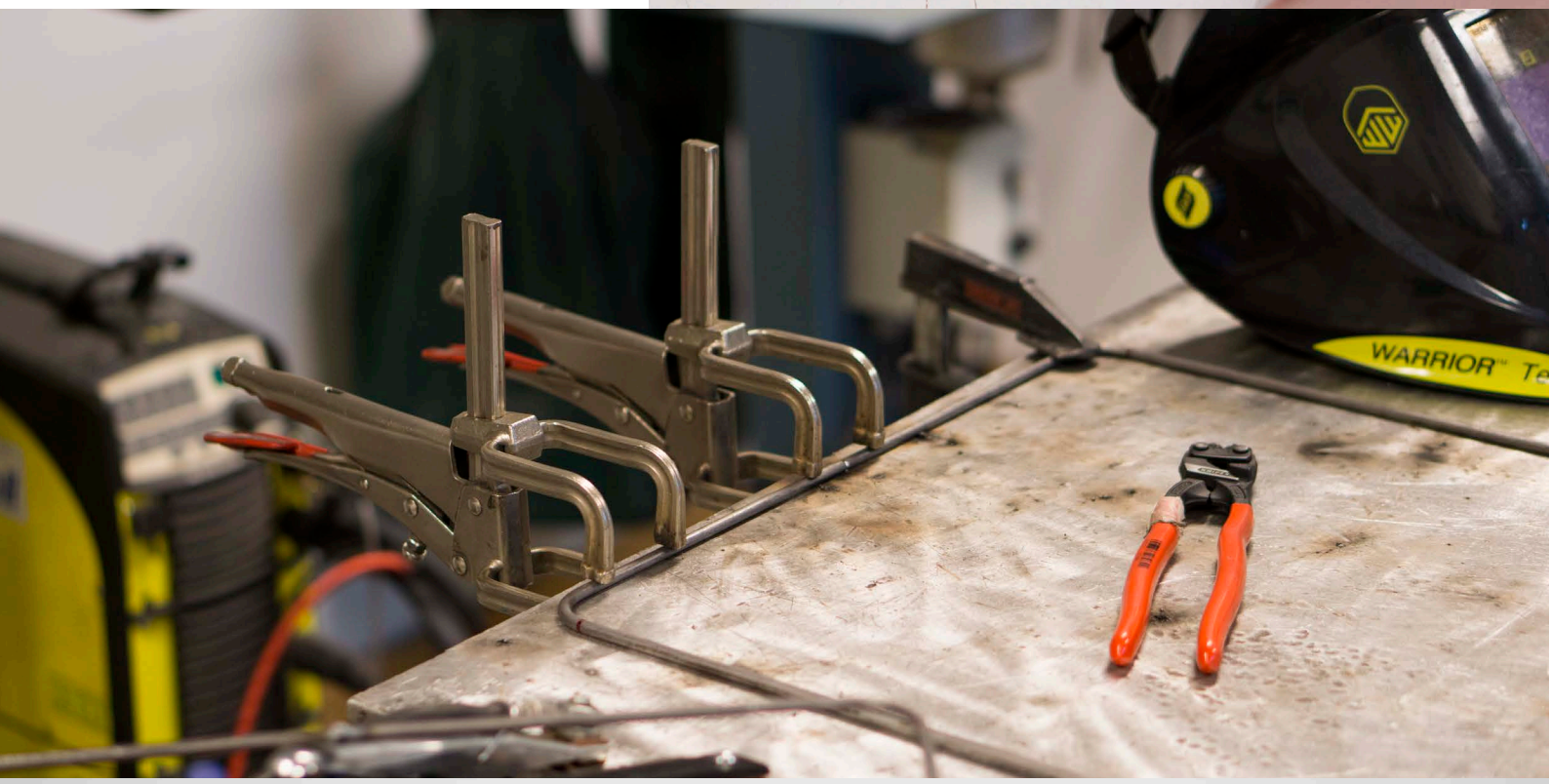
With this model the a handle forms more naturaly. It is positioned around 700 mm from the ground to make it accessible to children but also suitable for teachers.

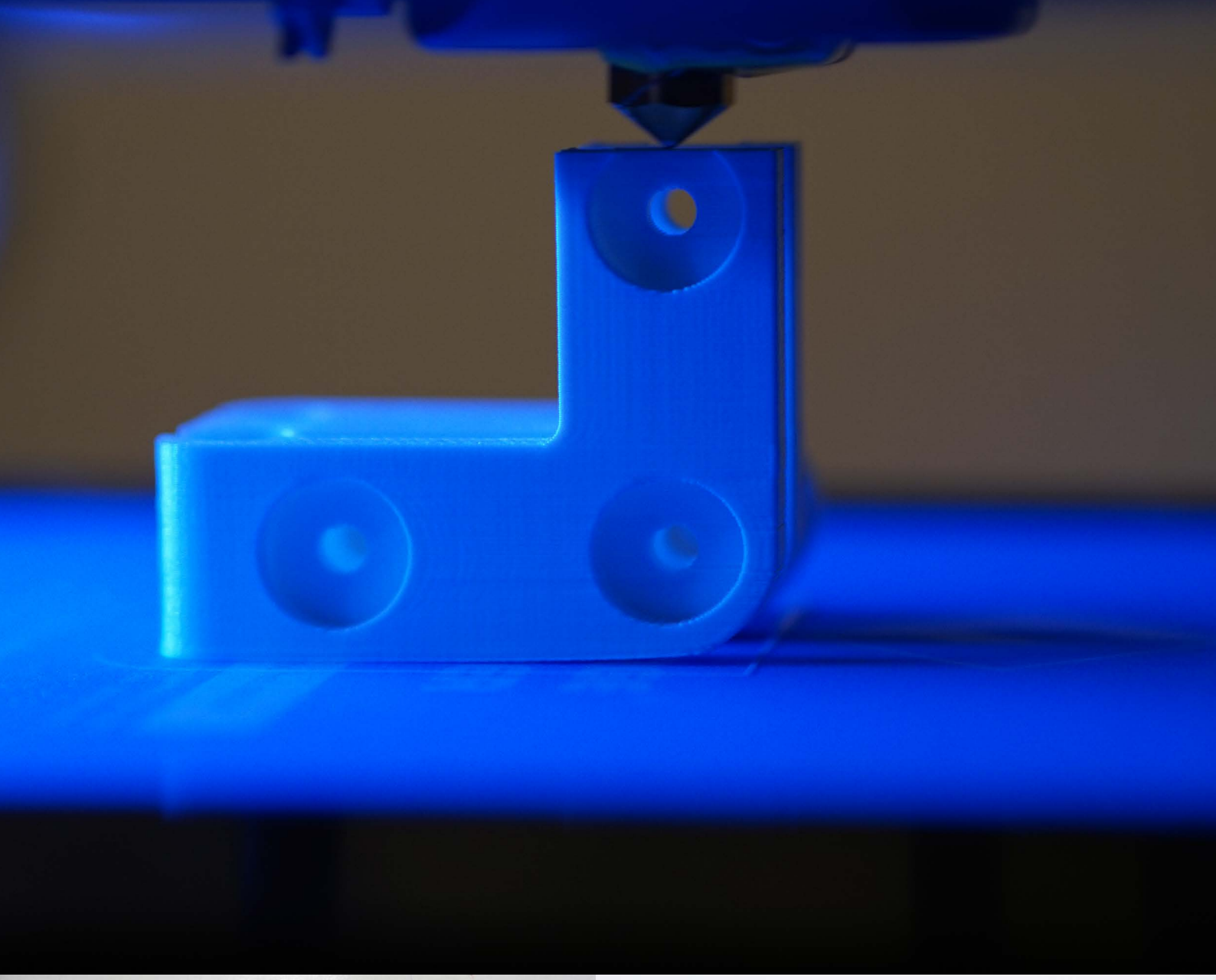
Here is the product fully covered in fabric.I simplified the roof design from previous itteration. With this design the gaps formed between the fabric created great handles for folding the product.

Realisation

Framework

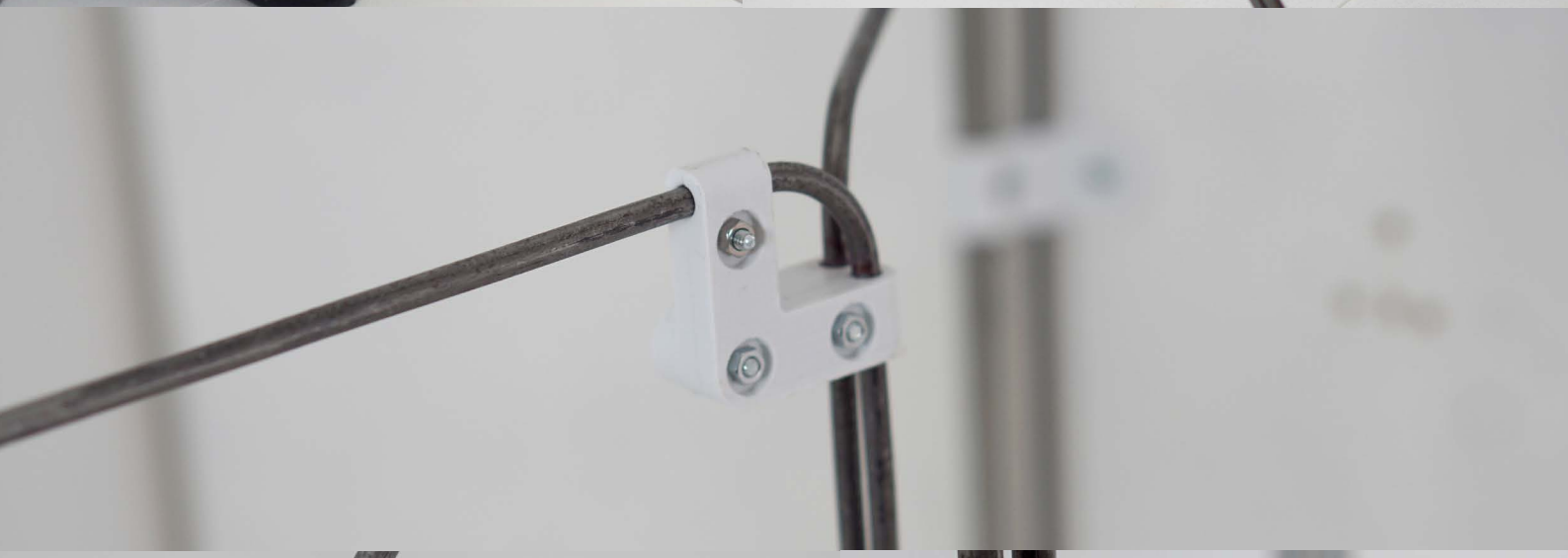
For the final model I began construction on the frame.
I chose 6 mm steel tread as the core material. It is strong and thin which helps the product retain a tent like appearance.
The mounting frame that connects everything to the wall was made with a 16 mm pipe to ensure stability.

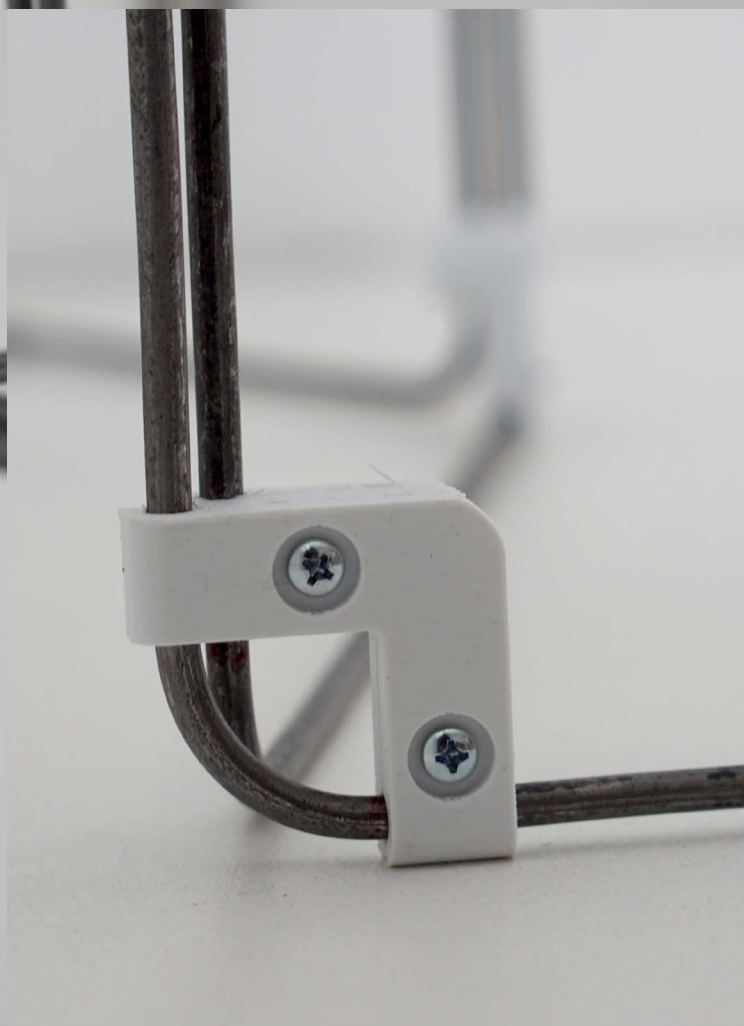




Connecting the steel construction are hinges that was 3d printed in PLA. Each hinge held together with 3 mm screws. The hinges were sanded and spray painted in the same colour as the fabric in order to blend in.

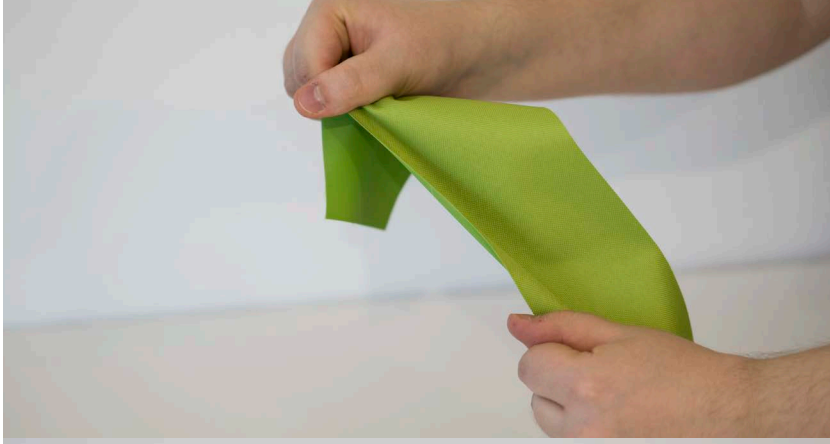

12 V
1.5 Ah

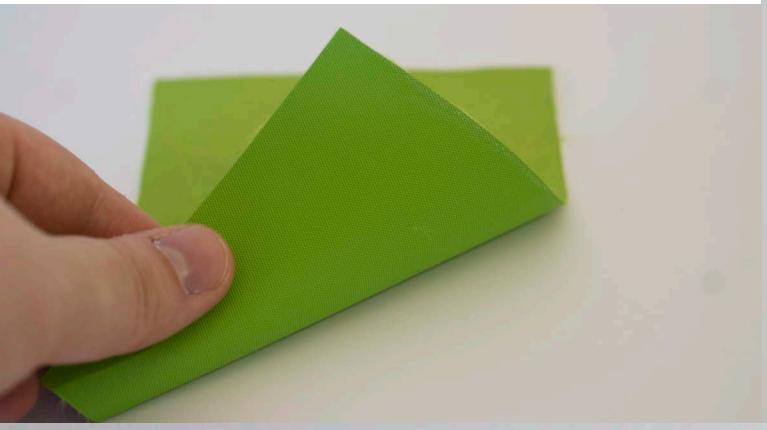


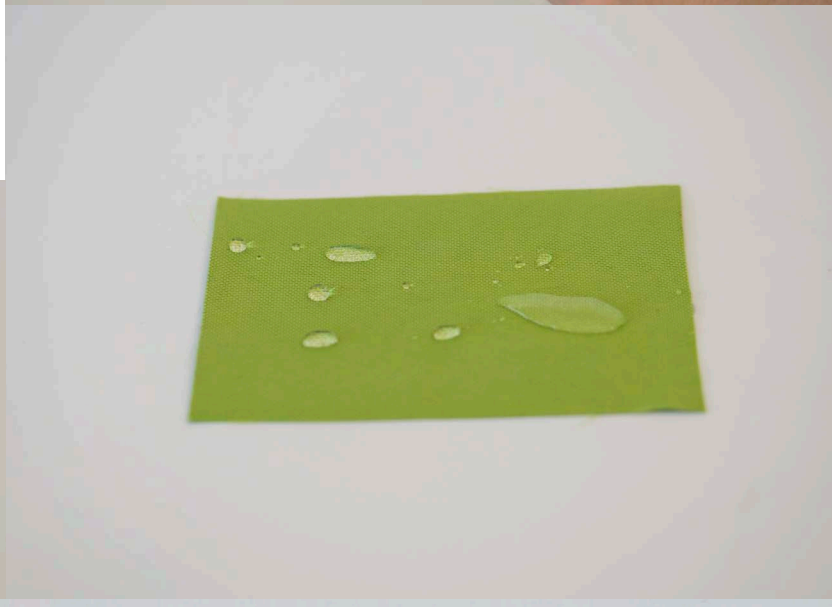


Fabric

I chose a fabric called Oxford Canvas. It has a acrylic base that makes it water proof and extremly tear resistant. This enables you to wash potential dirt right of the surface with a rag. It still retains a pleasing fabric texure on the top layer.







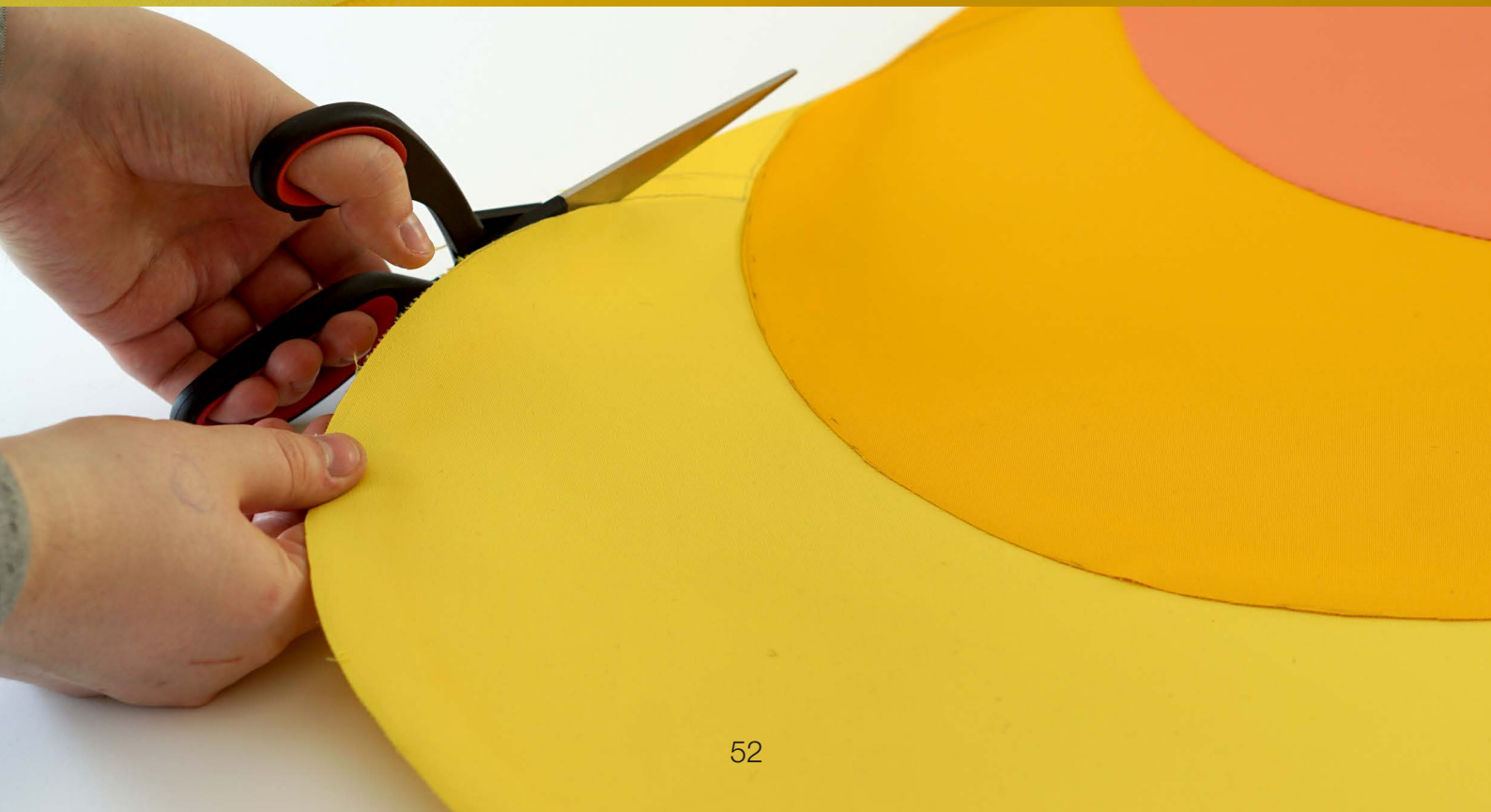
I wanted to have four colours, three for the roof and one for the walls. Due to the familiar shape I wanted to be a bit more adventurous with the colours. The final combination is bright and colourful yet fits well together.

Acoustic Foam

I chose an absorbant called Basotect plain acoustic panel. It is flame retardant which is important for a kindergarten. The foam is very light but also more rigid then normal foam. The thickness is 30 mm which helps it absorb a wide range of frequencies.

The heavy fabric compliments the foam well. It protects it from dirt and prevents it from tearing.

Sewing



Result

Final model

Here is my final model. When in use it creates a wonderful room that captures the childrens imagination. When not in use it folds against the wall taking up practically no space while functioning as a sound absorbant.

Material specifications

Framework

Type:	Steel rod, S235JR
Dimentions:	6 millimeter
Weight:	0.22 kilogram/meter

Treatment

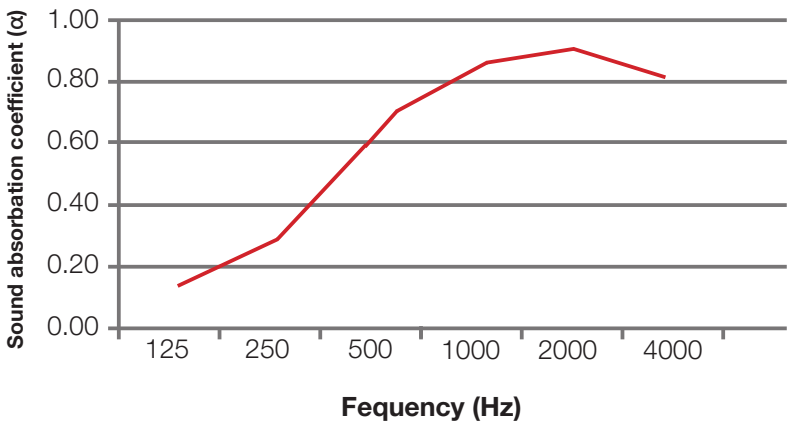
Colour 1:	Poison green spraypaint, opaque
Colour 2 :	Yellow light spraypaint, opaque

CL6320 POISON	PIGMENTS: PY 184 PW 6 CMYK: C29 M1 Y95 K1 RGB: R200 G210 B24 HEX: #C8D215
SH1000 YELLOW LIGHT	PIGMENTS: PW 6 PY 184 PY 83 CMYK: C0 M10 Y91 K0 RGB: R255 G222 B9 HEX: ##FFDE09

Finish:	lacquer spray paint, semi gloss

Acoustic foam

Type:	Plain acoustic panel Basotect
Thickness:	30 millimeter
Density:	9-11 kilograms/cubic meter
Thermal coductivity:	0.035 W/mK
Temperature range:	-40° to +150°C
Fire Safety Class:	B1 Flame retardant



Sound absorbation coefficient 0-1 represents 0-100% sound absorbed. The panel is efficient in a wide range of frequencies and reaches peak absorbation performance with sound that are 2000 Hz.

Fabric

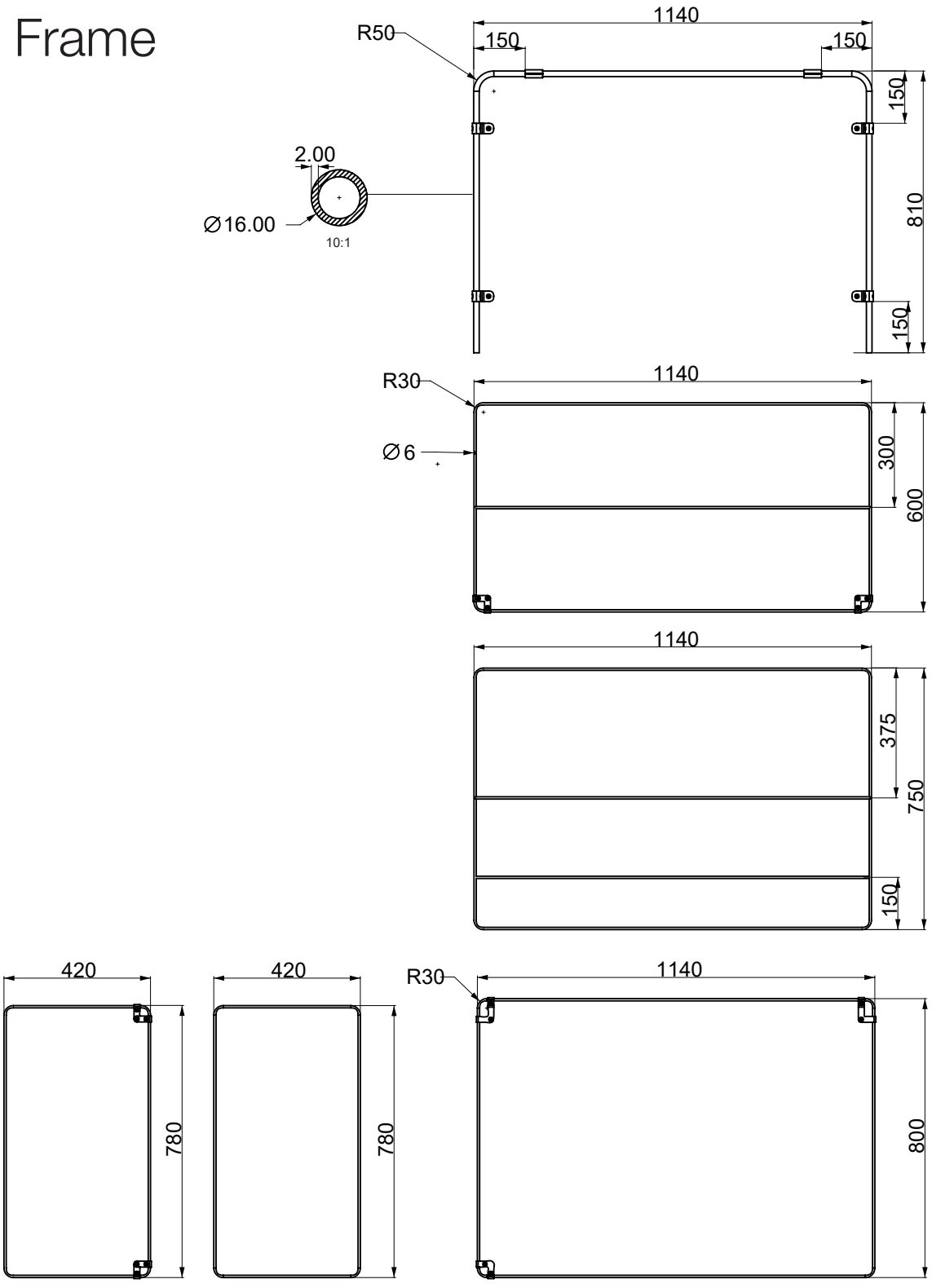
Type:	Oxford-215
Material:	100% polyester
Fiber thickness:	600 denier
Weight:	215 gram/square meter
Thickness	0.55 millimeter
Tensile strength:	warp 1500 neuton, weft 1400 neuton
Tearing strength:	warp 68 neuton, weft 80 neuton
Finishes:	PVC backing
Coating:	PU (Polyurethane)
Feature:	Water proof, Tear-resistant, Mold-resistant

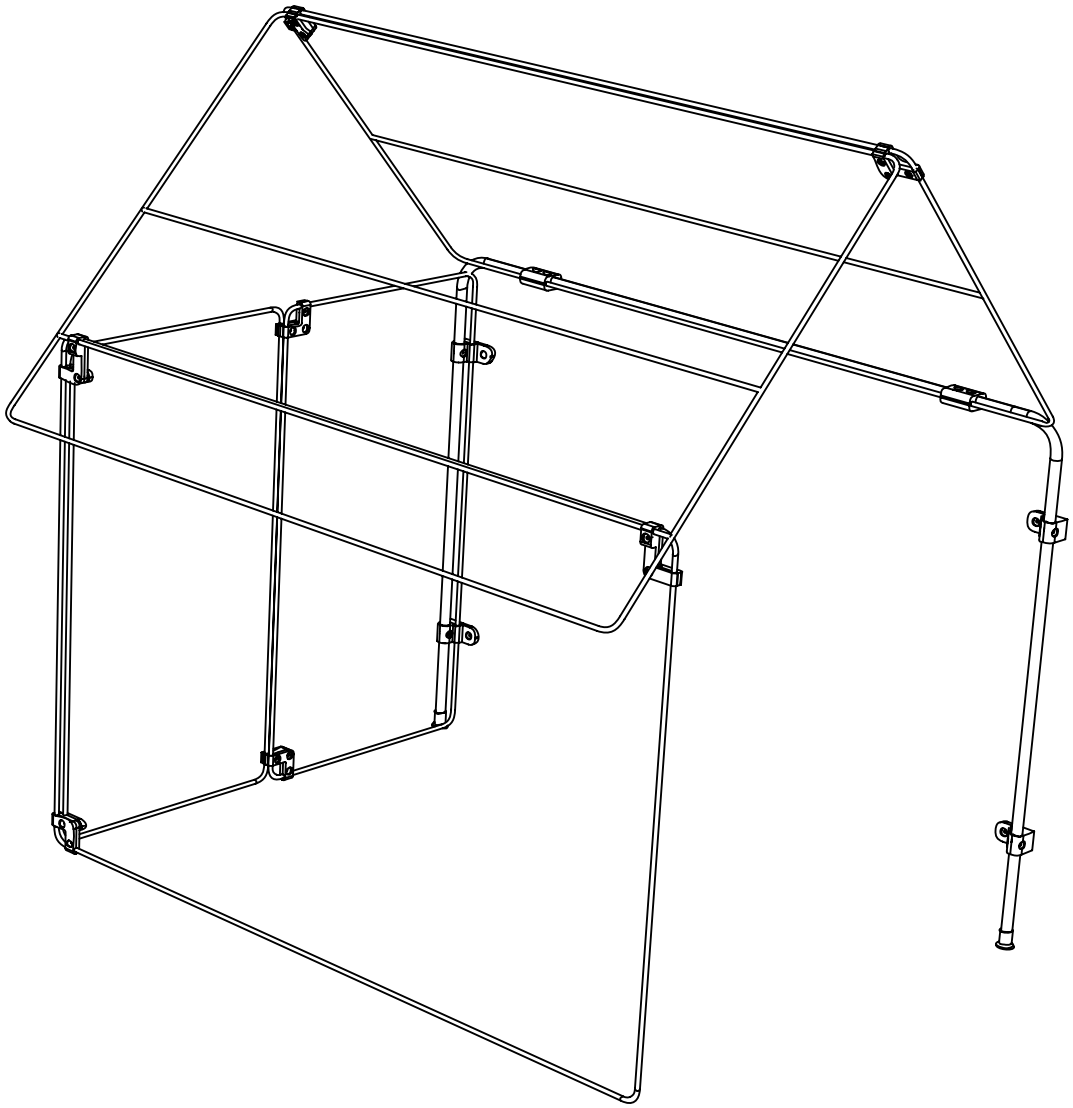
Colours:

Yellow Green	CMYK: C25 M0 Y75 K20 RGB: R154 G205 B50 HEX: ##9ACC32
Lemon	CMYK: C0 M3 Y100 K0 RGB: R255 G247 B0 HEX: ##FFF700
Sunglow	CMYK: C0 M20 Y80 K0 RGB: R255 G 204 B51 HEX: #FFCC33
Coral	CMYK: C0 M50 Y69 K0 RGB: R255 G127 B80 HEX: ##FF7F50

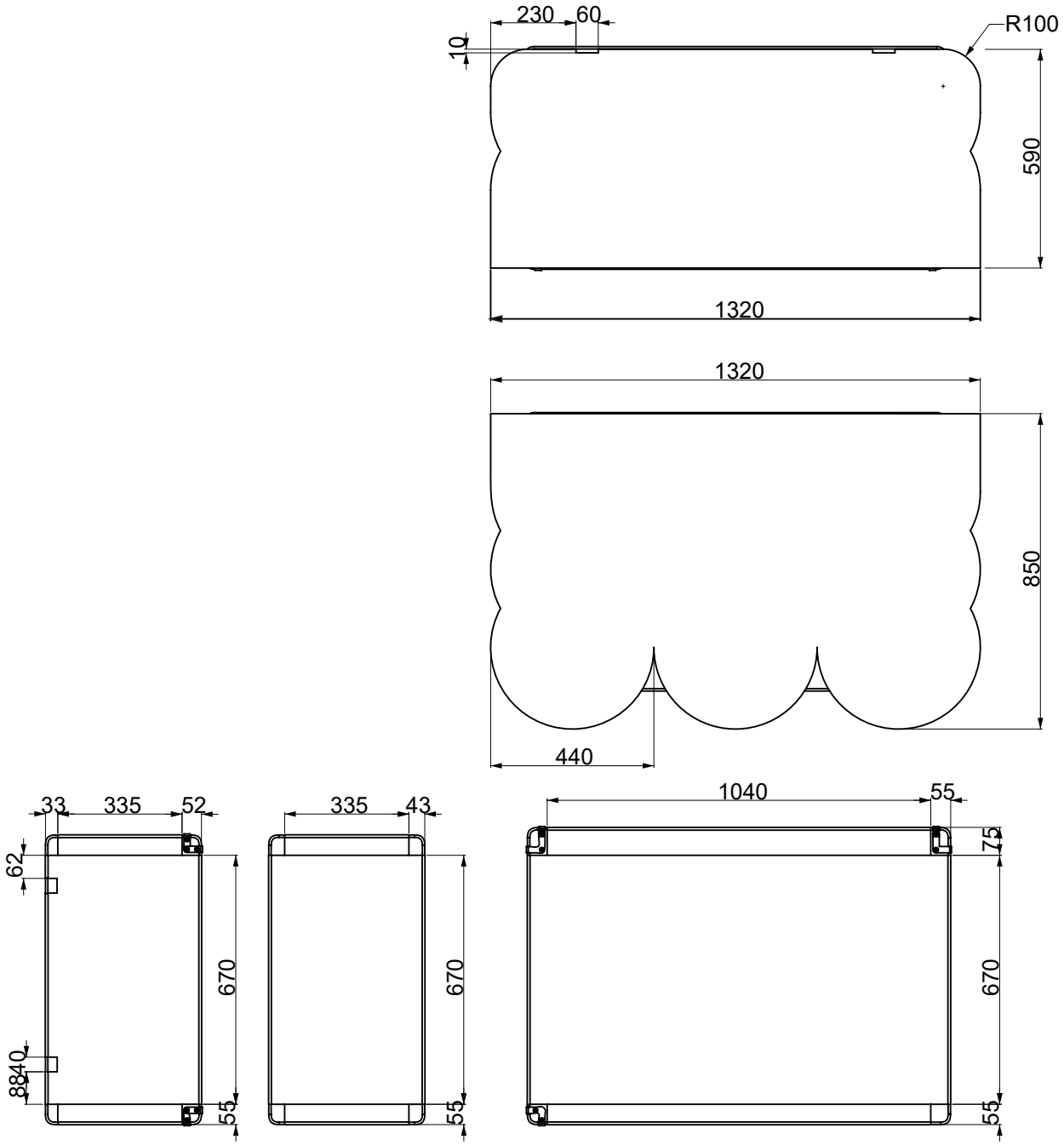
Technical drawing

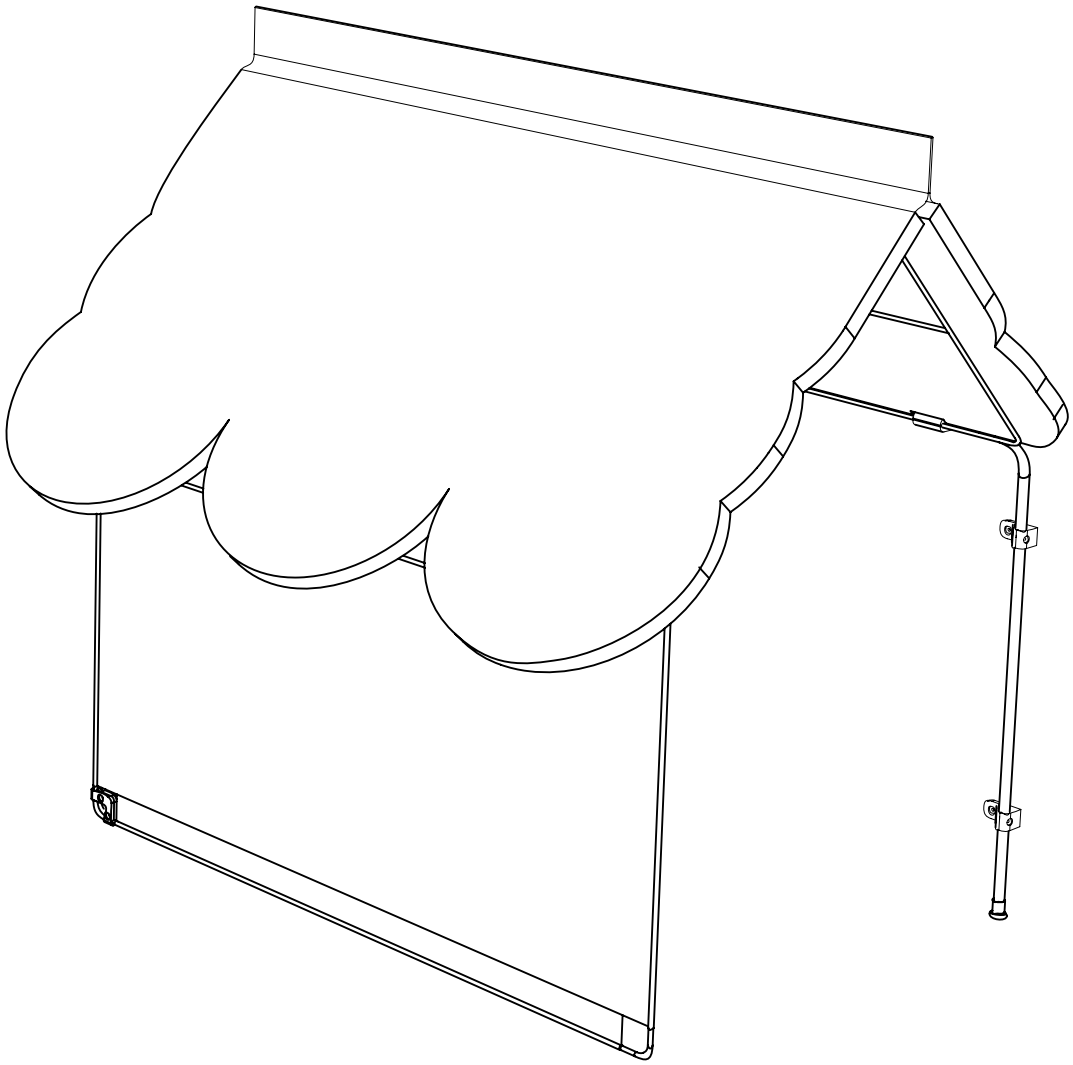
Frame

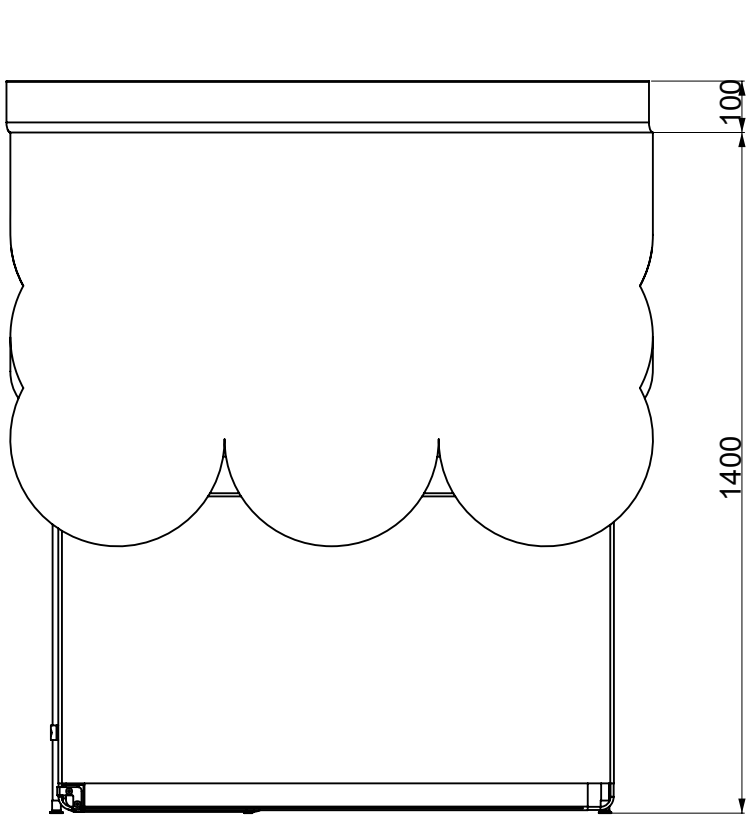


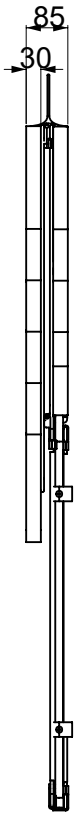


Frame and fabric

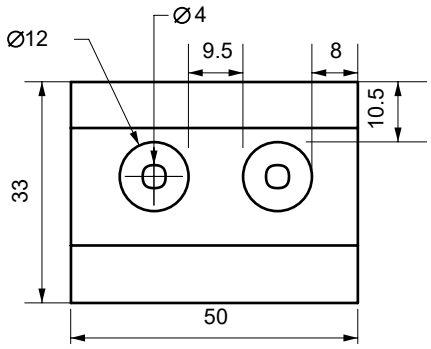


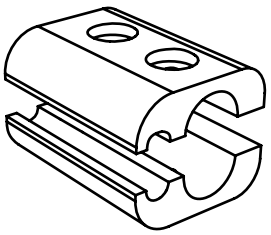


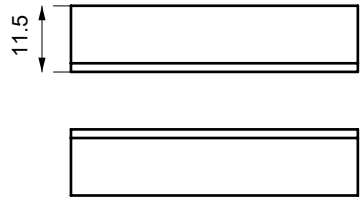

100
1400

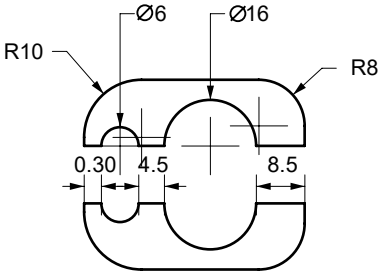

85
30

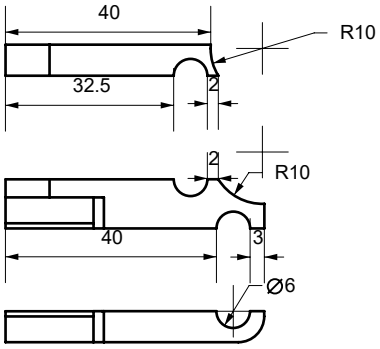
3D prints

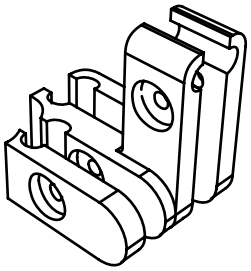

Ø12
Ø4
9.5
8
10.5
33
50

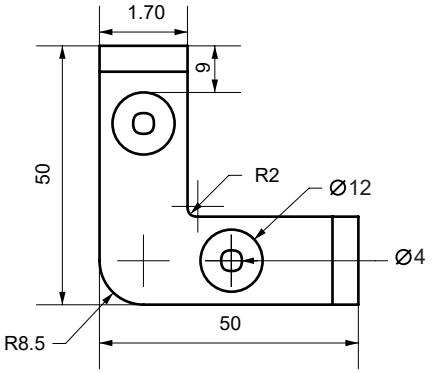


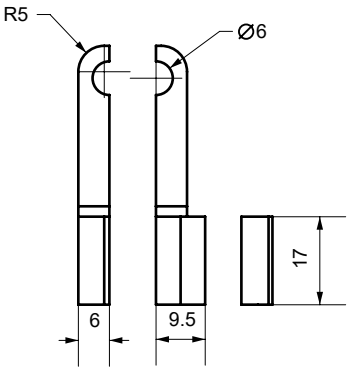

11.5

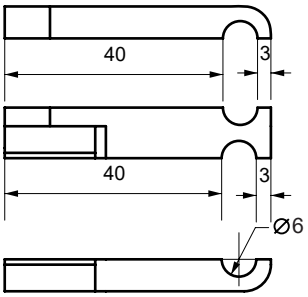

Ø6
Ø16
R10
R8
0.30
4.5
8.5

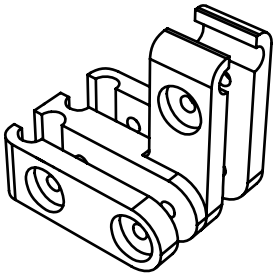

40
R10
32.5
2
2
R10
40
3
Ø6

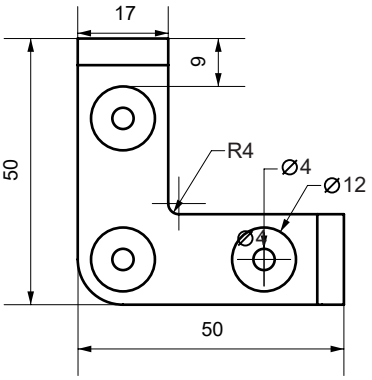


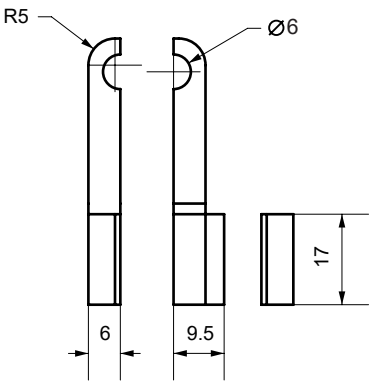

1.70
9
50
R2
Ø12
Ø4
R8.5
50

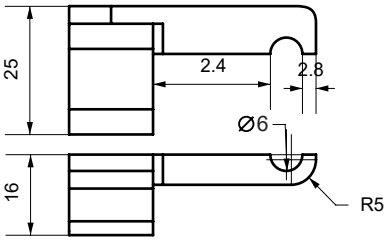

R5
Ø6
17
6
9.5

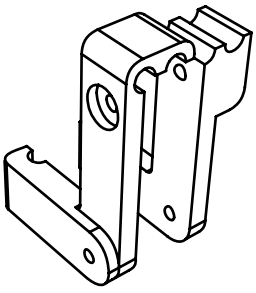

40
3
40
3
Ø6

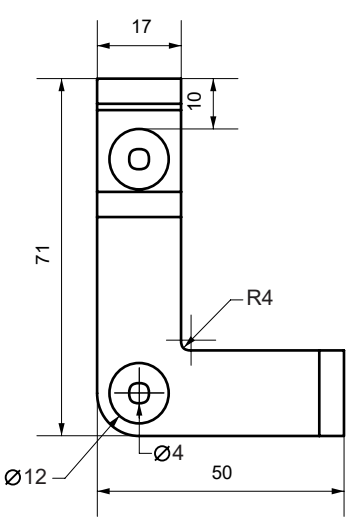


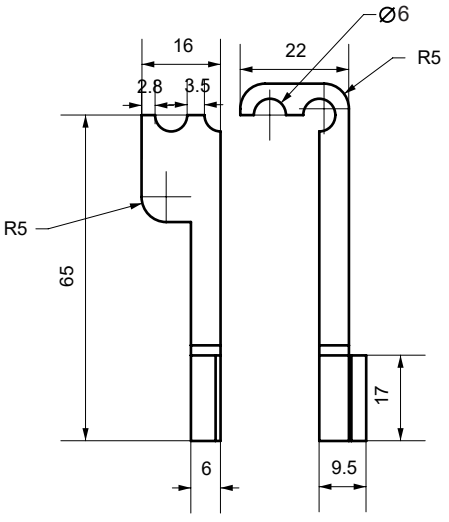

17
9
50
R4
Ø4
Ø12
Ø4
50

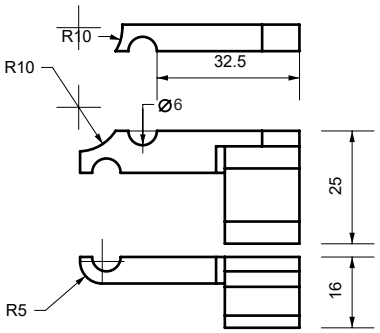

R5
Ø6
17
6
9.5

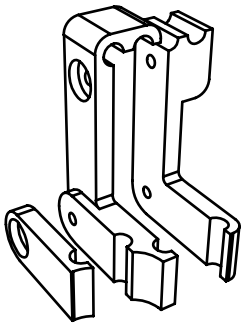

25
2.4
2.8
Ø6
16
R5

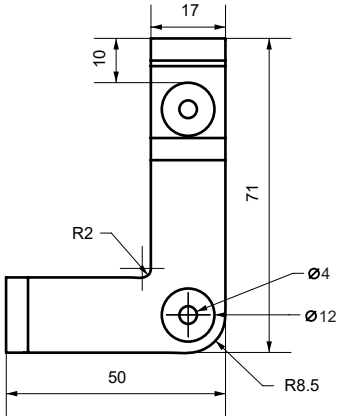


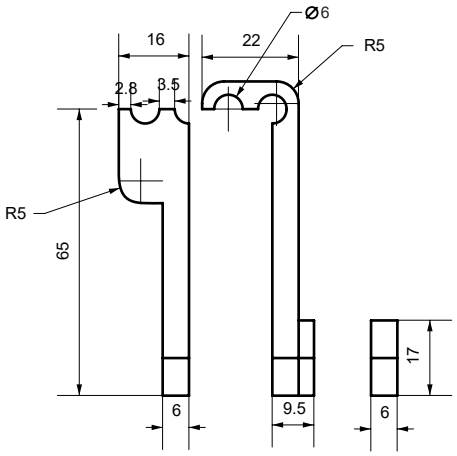

17
10
71
R4
Ø4
Ø12
50

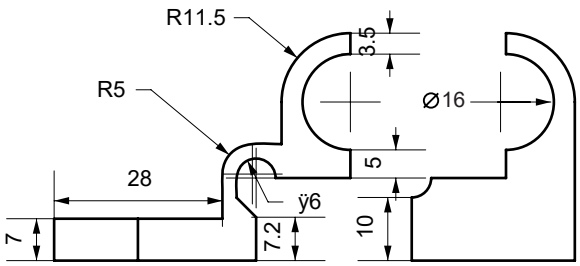

Ø6
16
22
R5
2.8
3.5
R5
65
17
6
9.5

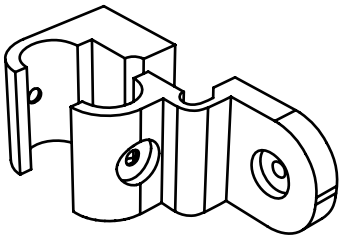

R10
R10
32.5
Ø6
25
16
R5

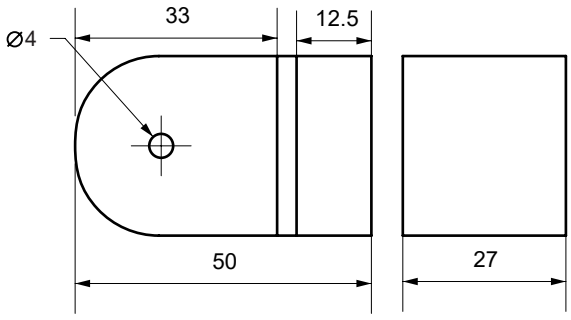


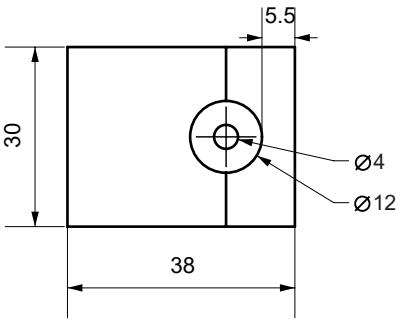

17
10
71
R2
Ø4
Ø12
50
R8.5

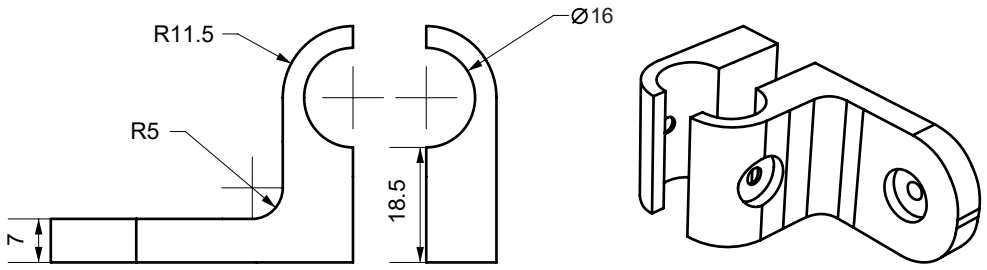

Ø6
16
22
R5
2.8
3.5
R5
65
17
6
9.5
6

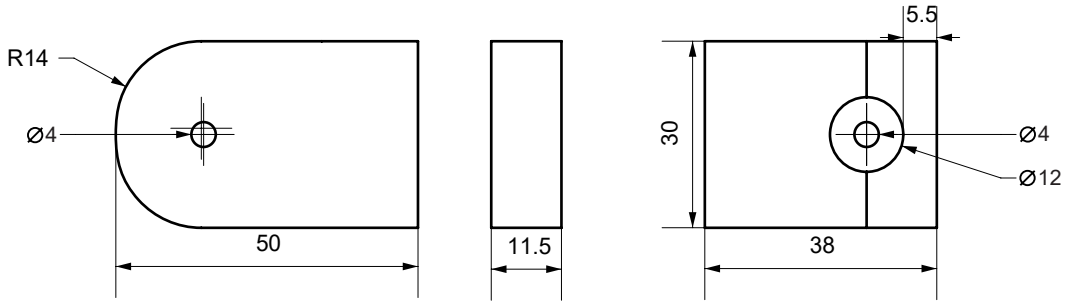

R11.5
3.5
R5
Ø16
5
28
ÿ6
7
7.2
10

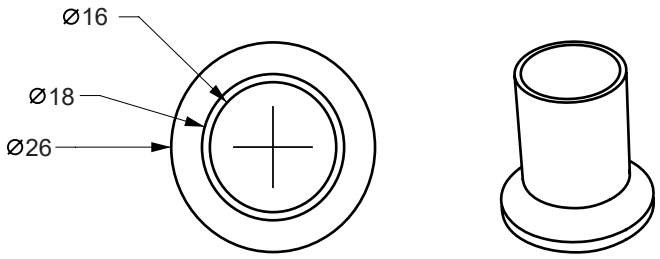


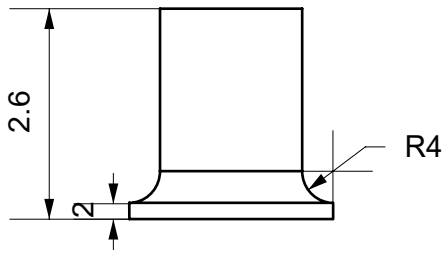

Ø4
33
12.5
50
27


5.5
30
Ø4
Ø12
38


R11.5
Ø16
R5
18.5
7


R14
Ø4
50
11.5
5.5
30
Ø4
Ø12
38


Ø16
Ø18
Ø26


2.6
2
R4

Reflections

Process

The process of my project had a lot of ups and downs. In the beginning my project was about public areas and personal space. My research was at this point very broad and I struggled to find a solid foundation to work with. It was not until I encountered reports about noise in the kindergarten that felt that I had found real problem that needed to be solved. It was also a subject that I was more comfortable to work with as it centered around sound and behaviour that relates to producing sound. There was also a lot of good research that had previously been done in that area.

But due to the fact that I chose my target group late in the initial research phase meant that I was behind. This meant that my visit to the kindergarten was severly delayed. Regardless the visits were very helpful. I got a good look into what it is like being a teacher and a child at a kindergarten. Analyzing the tools and the overall floor plan of the buildings gave me the most valuable information. Together with the interviews with the teachers it gave me a good sense of what kind of product that was plausible to implement. What I learned from my field trips is that it is important to ask few but concise questions. This was important due to the fact that the teachers did not have a lot of time to talk to me due to their busy work.

When it was time for kick of presentation I had a initial concept ready. It was a interactive sound panel that could form a room within the room. I felt good about the concept and that it was a fitting product for the breif. What I did lack was any kind of development futher than a cardboard model. This meant that time that was meant for creating the final model was spent doing shape exporation and later finding out what type of material and construction I needed to realize the product.

Another thing that I would have liked to improve is user testing. I had a test early in the process and would have liked one more with a more developed prototype later in the process. The thing that made this difficult was that my product was big and had to be mounted on a wall in order to be tested in a safe manner. It was also hard to find kids to test the product as the kindergartens did not allow me to bring it to them without the parents written approval.

But considering all the challenges I still managed to include all the major steps in the process that helped contribute to a project that I am proud of.

Result

Overall I am happy with how the product turned out. What I came up with is something innovative in the sense that there is nothing quite like it.
The product take both sound absorption and the children's play into consideration in a way that other product in this segment have not done before.

I am most satisfied with the choice of the fabric. It solved the problems of durability and hygiene while also making the overall construction look better. There are things that could have been done better such as the execution of the sewing. But considering that this was the first time that I made anything with fabric I am satisfied with the how it came together and have learned a lot in the process.

References

Literary sources

Bengt Johansson, *Buller och bullerbekämpning,* 2002, Arbetsmiljöverket

Socialstyrelsen, *Bullerbort!- En liten bok om god ljudmiljö i förskolan*, 2010, Socialstyrelsen

Online sources

forskolan.se/allt-fler-blir-sjuka-av-stress/

https://en.wikipedia.org/wiki/Absorption_(acoustics)