RAM.

Degree Project for Master of Fine Arts in Design
Main field of study Industrial Design

Daniel Larsson & Linnéa Hagborg

2022

RAM.

A modular storage system for longevity

Ram

Daniel Larsson & Linnéa Hagborg

Degree Project for Master of Fine Arts in Design

Main field of study Industrial Design from Lund University
School of Industrial Design, Department of Design Sciences

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Abstract

In this project, RAM, we wanted to question today's consumption of furniture and create furniture with longevity in mind. Explore the possibilities of designing furniture that would grow with you through life to avoid having the need to buy new in different stages of life.

The project resulted in a storage system that can adapt to different living situations which can accrue through life. Once the system becomes too small or too big it can easily be upscaled or downscaled. This makes it possible for the user to adapt the size of the system to the current living situation, from a student flat to a family home or vice versa. The storage interior consists of shelves, room dividers, cabinets, secretaire and drawers that enable the user to customize the system after their current needs. A twisting hook is used to smoothly place the interior into the profiles, which also functions as the main construction to keep the storage system stable. RAM's modularity allows the user to freely design the system according to personal taste and needs.

Sustainable design strategies have been applied in the design process, creating a long-lasting design solution which contributes to a circular economy. RAM provides a service allowing the user to buy spare parts and offer repairs to prolong the product's lifetime. The long term goal is to create a service enabling users to switch components with each other. The aim is to save material resources and prevent users from throwing away fully functional material.

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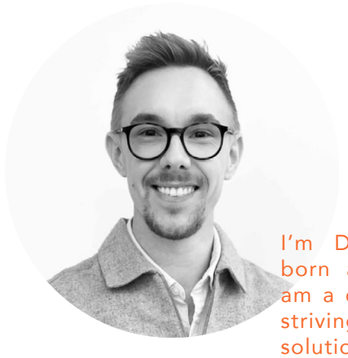
Who are we?



I'm Daniel, an industrial designer born and based in Lund, Sweden.I am a creative problem solver, always striving for the simplest yet beautiful solution possible. Growing up in my grandparent's bakery and my dad's metal workshop is probably why I truly love the hands-on part of the design profession. In addition to industrial design my knowledge stretches from interior design to concept design to graphic design.

My name is Linnéa Hagborg. I have been creative for as long as I can remember, thats the reason why I ended up exploring the creative world. Design for me is the coherence of functionality and aesthetics. As a designer, I strive to make functional products with a minimalistic and playful approach. What drives me within design is not only industrial design, I also have a passion for creating concepts and graphic design.

mmm....

Background

Investigate the phenomenon of long-lasting furniture design from an emotional, technical and aesthetic perspective. This project is a master thesis carried out at the School of Industrial design at Lund University, Sweden. The project started with a desire to design furniture that questions today's consumption of furniture.

The goal was to create a realistic design solution that could be set into production after the end of the project. All steps including design, material, detailing, production, distribution, promotion, and sales could be evaluated. We wanted to take the opportunity to learn as much as possible about bringing an idea to a finalized product that can be set to market.

Motivation

Within the last few years, we have started to see the negative effect of our consumer society. Today, consumer habits are one of the most decisive criterias for how we judge people. Some scientists claim that consumption has replaced work status as the most central sign of success[1]. To be able to keep up with a glorious facade and to follow current trends has, as a result of social media, never been more important. The pressure to follow trends becomes especially essential when it comes to physical objects like houses, interior designs, cars, home electronics, and food. Apart from social media, mass media have similar power to reinforce norms and consumer habits.

The behavior of overconsumption has to stop now. To make a difference for the environment, we have to include sustainable thinking in the products of our everyday life. As designers, we are responsible for including sustainable thinking at all stages of the design process and working toward more circular solutions. Focus on the products that reach a broad target group and influence customers to consume more sustainably.

In this project, the goal is to challenge ourselves as designers to make a product that should last for up to 50 years. By researching how we valued and treated our belongings before the era of consumption and fast trends, we hope to identify what makes people want to keep an object for a long time.

Overall, we wish to determine strategies and approaches for sustainable design to bring with us into our future design projects and inform and enlighten the issues of today's unsustainable consumption behaviors.

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1 Karin M Ekström & Torbjörn Hjort, "Sociala medier ökar trycket att konsumera", Svenska Dagbladet (2017-09-13).https://www.svd.se/a/mAJjq/sociala-medier-okar-trycket-att-konsumera [2022-02-07]

Initial brief

We want to question today's consumption of furniture and create furniture with longevity in mind. Explore the possibilities of designing furniture that would grow with you through life to avoid having the need to buy new in different chapters of your life.

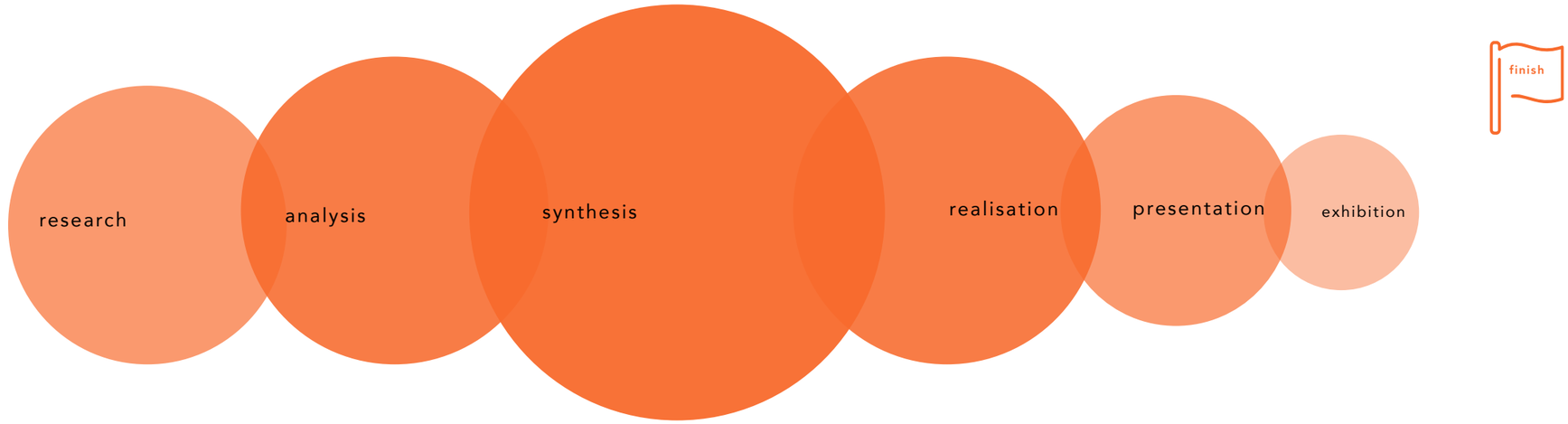
Method

This master's thesis in industrial design is based on qualitative and quantitative research. In order for us to get a deeper understanding of the more specific research three methods were implemented; interviews, questionnaires, and a probe. This gave us the insight to identify existing problems and needs. Reading books and articles gave us a comprehensive insight into our chosen subject.

A big variety of material samples was collected in the early stage of the design process for inspiration in the project moving forward. This was an essential step of the process for us to find a suitable material that played an important part in our project.

To evaluate and develop our ideas we sketched, made mockups, and used 3d-modeling as well as 3d-printing and CNC milling. 3d-printing was a valuable tool for us to try out functions. Discussion and meetings with the supervisor and examiner, helped us move forward in our design process.

Project timeline



Chapter two
Research

RAM.

History

When looking as far back as the 1950's up to now, we can see that the consumption of products has escalated a lot, especially in the last 10 years. Between 2009 and 2019 the consumption of furniture and household products increased by much as 47%[1]. What's causing the increased consumption and what categories people spend the most money on varies, which we can see comparing each decade. Most often it is influenced by what's happening in society, for example in the '50s did each household spend 50% of its income on groceries, clothes, and shoes[2]. This was the postwar era, the people had just been relieved from the ration during the war. Comparing this period to the 70s and 80s, when Sweden starts getting more affected by the outside world. The import from other countries increased during this period, and you can see the categories people spend the most money on had changed. By this time, vehicles, furniture, and culture were the categories most spent.

However, we can also see an influence of other parts of society changing which affects the consumption and production of products. Traditions in culture is one, brides were given a coffin("brudkista" in Swedish) before they got married[3]. It was a tradition that the bride used this coffin to keep linens and other textiles when moving from their parental home to the new home shared with their husband. This tradition disappeared when women began moving away from their parental homes to their own homes, without a husband. Another example is the little table where people kept their landline, called "telefonbord". Then the technology modernized and the landline was more or less extinguished, which means there was no need for a "telefonbord". The same thing happened with the so-called grandfather clock ("golvur" in Swedish"). The technology caught up and there was no longer a need for long vertical lines, which is the reason for the long empty body[1]. That empty space made it possible not to have the need to pull up the clock as much as before. Again, the technology modernized and the need to pull up clocks at all disappeared - therefore the grandfather's clock was not a given piece of furniture in every household.

We can also see one specific person who influenced Swedish society regarding how we consume. Lena Larsson, the 1960s version of Greta Thunberg, an interior architect who already back in that day influenced the more sustainable way of consuming products. What Lena Larsson advocated was wear and tear ("slit-och-släng"), you should use the products until you no longer can. She also introduced the concept of recycling. This was way before the behavior of buying and throwing away ("köp-och-släng") had become the new normal.

1 Naturskyddsföreningen; Ny rapport: Så stor miljöpåverkan har din nya soffa, Naturskyddsföreningen.se(2021).https://www.naturskyddsforeningen.se/artiklar/ny-rapport-sa-stor-miljopaverkan-har-din-nya-soffa/ [2022-03-01]

2 Stadsmyndigheten; Vår konsumtion speglar samhällets utveckling, scb.se (2020-12-21). https://www.scb.se/hitta-statistikartiklar/2020/var-konsumtion-speglar-samhallets-utveckling/ [2022-03-04]

3 Wikipedia; Brudkista, Wikipedia.se (2018-11-16). https://sv.wikipedia.org/wiki/Brudkista [2022-03-04]

1 Wikipedia; Golvur, Wikipedia.se (2011-7-03). https://sv.wikipedia.org/wiki/Golvur [2022-03-04]

Photo: Bertil Norberg, Formens rörelse, tidskriften Form, Wikipedia, https://sv.wikipedia.org/wiki/Lena_Larsson

Today's concept of buy and throw away has never been as bad as it is currently. We have to learn from Lena Larsson, all products need to be worn out before thrown out. We exceed the planet's resources every year and climate change are increasing uncontrollably. The way we consume products needs to get smarter and more sustainable. A circular economy, encouraging recycling and renovating existing products could be a good way to try changing the direction of the ball - our planet - from rolling downhill. Honestly, it will be extremely hard to change people's behaviors and somewhere we have to make exceptions for times when you don't need your existing furniture, your needs may have changed. In cases like this, there should be sustainable ways to get rid of your furniture, sell it or donate it to second-hand stores. What if there was an integrated way of selling/exchanging your furniture, with other people with the same type of furniture/ brand? Almost like a community connected to your furniture. The companies should take more responsibility for the entire lifespan of their products, from production to end of life. How will it be recycled or what happens when someone doesn't want it anymore?

"Lena Larsson, the 1960s version of Greta Thunberg"

What is considered a furniture?

A furniture is a product that is intended for the interior design of spaces indoors and outdoors, where it can function as a sitting and lying area, unloading area or storage, etc.

Design strategies

Design for longevity

Within the last 20 years, we have started to see the negative impacts of what is called the linear economy[1]. According to United Nations, the global population fears to grow up to 8.5 billion by 2030 and up to 9.7 billion by 2050[2]. This scenario will require three planets in order to provide the natural recourse needed to sustain the way we are living today. What we design and produce is a part of the economic system that aims for consumption and economic growth. Due to the limitation of resources, we need to find ways to produce products with less. We have to stop making products with a linear lifetime and start working towards more sustainable solutions and take responsibility for all stages of a product's life.

As much as 80% of a product's total environmental impact is based on decisions taken in the early stage of the design process[3]. That's why it is important to apply sustainable design strategies at the beginning of a design project. The sustainable design strategies are best known starting off with Victor Papanek in the 1970s and have since then been approached in various ways[4].

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1 Acaroglu Leyla; Quick Guide to Sustainable Design Strategies, medium.com (2022). https://medium.com/disruptive-design/quick-guide-to-sustainable-design-strategies-641765a86fb8 [2022-02-01].

2 United Nation; Sustainable development goals, goal12 Ensure sustainablr consumption and production petterns, un.org. https://medium.com/disruptive-design/quick-guide-to-sustainable-design-strategies-641765a86fb8 [2022-02-02]

3,4 Acaroglu Leyla; Quick Guide to Sustainable Design Strategies, medium.com (2022). https://medium.com/disruptive-design/quick-guide-to-sustainable-design-strategies-641765a86fb8 [2022-02-01].

Design for attachment and trust

A long-life business model requires a product that evokes attachment and trust. An emotional bond between the user and a product makes the user want to keep their products for a long time.

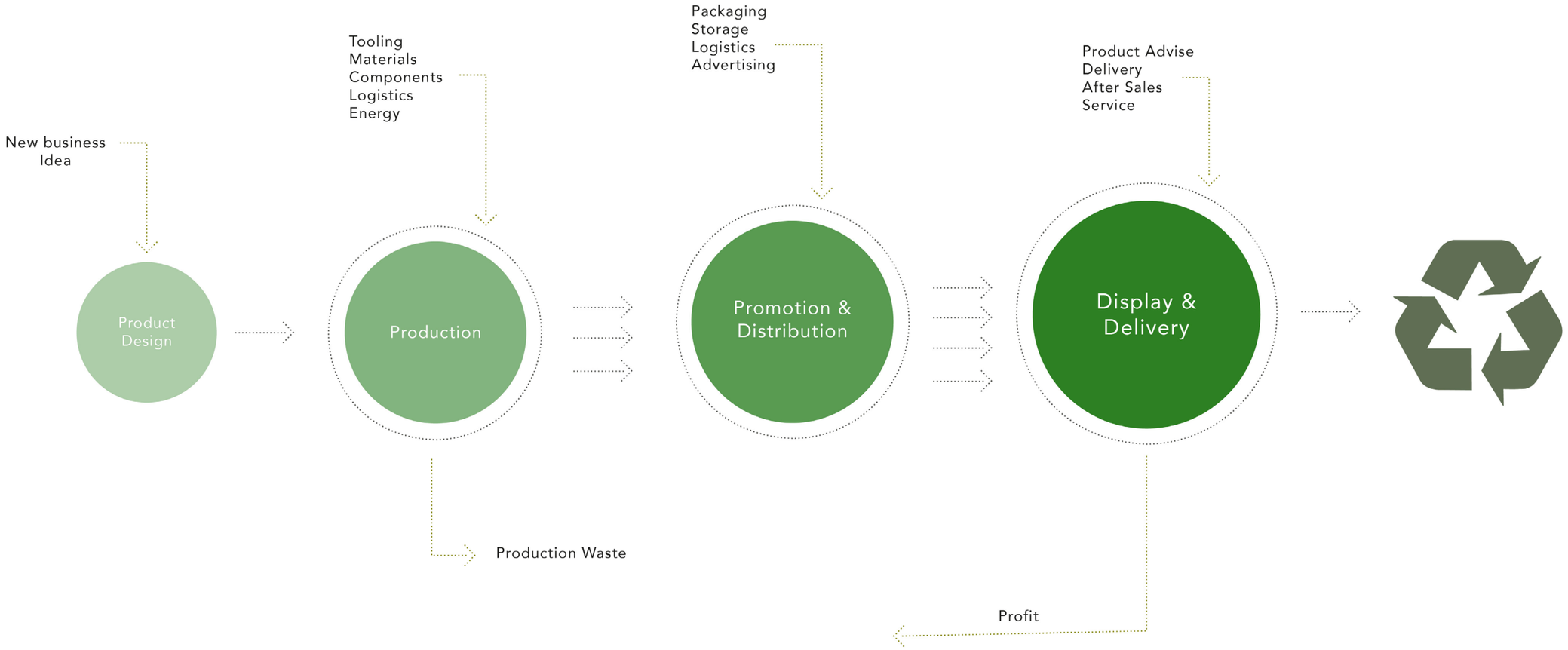
Customization: Enable the customer to influence the final product. The customer can in that way make a product that meet their individual needs and aesthetic preferences. This might lead to product longevity through stronger attachment and trust. A risk with this strategy is that the customer might create a product influenced by trends which do not support product longevity. A customized product system requires a user-friendly system that allows for easy access for the user. Furthermore, the production system has to be able to adapt upon request.

Product honesty: Transparency and honest products can generate an emotional attachment between a product and the user. By informing the customer about the development, manufacturing, and potential former user can increase reliability. One example is the brand Lovia Collection which works with the concept of "Product DNA" where they are completely honest about the reality behind their product (Lovia Collection, 2022).

Aesthetics: Aesthetic features can contribute to product longevity. This can be done by implementing sustainable materials that age without losing aesthetic value. Knowing what features will contribute to a long aesthetic lifetime can be hard to predict.

Embedded storytelling: "Narratives embedded in a product, either by the designer or by the user via use, aiming at generating emotional value. The storytelling can be supported by a product's ecosystem, e.g. through specific brand communication or services." The emotional connection to a product can prolong the lifespan of a product. But what is and what is not valuable factor can be hard to predict.

Informal sharing and heritage: Sharing or passing a product to the next generation have multiple benefits. Through sharing and heritage, the user can save money and material resources as well as it has an emotional and historical value. On the other hand, it can be hard to produce products that suit a wide target group. It will be important that the material and construction are well made to serve a long life.


New business
Idea
Tooling
Materials
Components
Logistics
Energy
Packaging
Storage
Logistics
Advertising
Product Advise
Delivery
After Sales
Service
Product
Design
Production
Promotion &
Distribution
Display &
Delivery
Production Waste
Profit

Design for a sustainable future

The principle of circular design requires sustainable manufacturing and production solutions.

Environmentally Friendly Materials: To make environmentally friendly choices when choosing materials is crucial to minimize pollution and reduce resources. Working with environmentally friendly materials can be difficult. It can be hard to predict what is sustainable and what is not.

Local production: The manufacturing process in taken place within the same area as the development, material production, and retail. By having a local production, it is possible to reduce transportation resulting in reduced carbon oxide emission. It facilitates for a company to control the manufacturing process more easily as well as supports transparency in the supply chain.

Zero-waste: By including a zero-waste approach throughout the design process it is possible to minimize the waste. This can be done by using the material to its full potential and re-use material scraps from production and manufacturing. A challenge with this approach can be that it demands aesthetic and technical compromises. It can also be hard to find material leftovers that fulfill the required quality.

Technical duration: Material duration is an important factor to take into consideration when making a new product. It is crucial to find a material that meets the needs of the intended lifespan. The needs for a product can vary from one product to another. For example, a table's needs vary a lot compared to a disposable cup since their life cycle is very different. A challenge with this strategy is to predict the wear and tear in the use context.

Design for ease of maintenance and repair

Design for disassembly: Construct the product to be easily taken apart when it is no longer in use or in need of reparation. This way of constructing products can ease and support the re-use of materials which can support longevity. One well-known is Fairphone which enables the user to dissemble the phone and exchange the directed prices.

Maintenance: Construct the product in a manner that allows the user to maintain the product without investing a lot of time and energy. This can be done by choosing materials that can easily be maintained. These kinds of materials are usually more expensive but the ability to maintain a product will prolong its lifespan of the product. The challenge of applying this method is to motivate the user to maintain their products. It can be difficult to get hold of spare parts, and overall product structure might discourage repair initiatives.

Design for attachment and trust

Customization

Product honesty

Embedded storytelling

Informal sharing and heritage

Design for sustainable future

Enviromental Friendly Materials

Local production

Zero waste

Technical duration

Design for ease of maintenance and repair

Design for disassembly

Maintenance


White chair
1
Couch
2
Couch
Couch
4
White chair
1
Hay
Lamp
Lamp
White chair
1
Oak chair
2
Oak chair
2
Borge Mogensen
Brown chair
3
Oak chair
3
Mio
Brown chair
3
1 795
Brown chair
4
Oak chair
4
Takt CPH
By Pearson Lloyd
Brown chair
4
2 895
Brown chair

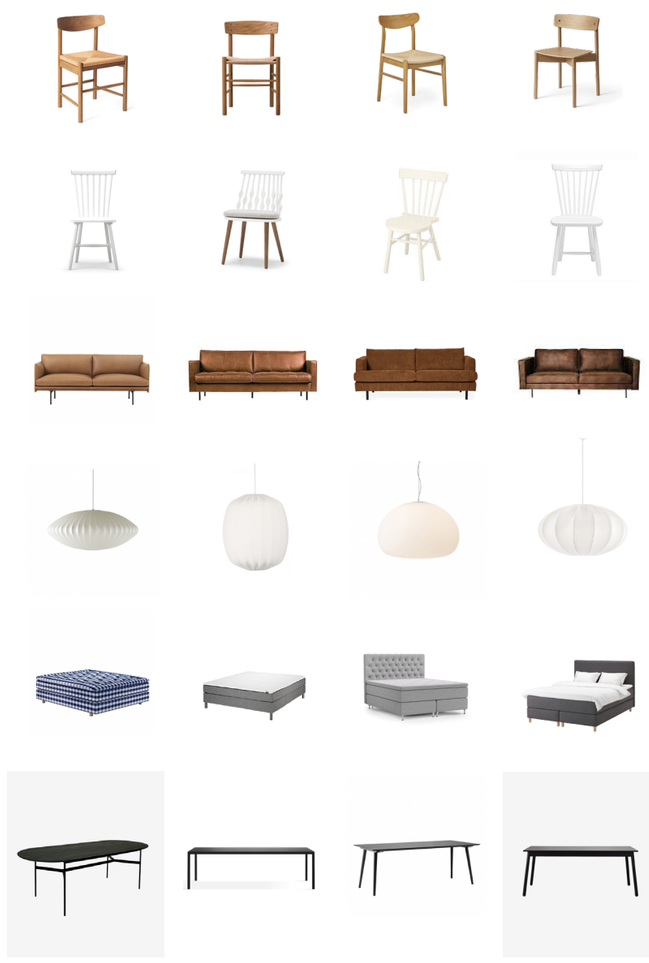
Research methods

Four research methods were conducted to get a deeper understanding of how people value furniture. A questionnaire, interviews, a probe, and a photo collection were executed. Individuals of different ages and socioeconomic backgrounds were participating. The applied methods were mainly carried out remotely due to Covid-19 restrictions.

4 pictures
This method aimed to investigate how people evaluate furniture considering aesthetics, price, and brand. A light, bed, sofa, table, and two chairs were selected to be evaluated in this probe since they are the most common furniture in a household. Each piece of furniture was presented with four pictures, the object looked similar at first sight, but details, price, and brand made them different from each other. In the first stage of the examination, the participants got four pictures of furniture and were asked to choose one as their favorite. After this procedure, the brand was revealed and in the last step, the product's price was presented. During the test, notes and discussions were taken to understand the thoughts behind the decisions. The different versions of furniture used in the test can be found to the right.

The collected information from the test demonstrated that aesthetics, price, and brand substantially impact people's choice of furniture. A clear tendency throughout the process was that people outsourced the cheapest option. Cheap furniture was associated with instability, discomfort, and a "cheap look." The more expensive options were instead associated with long-lasting and durable.

In the last step, the participants were presented with the brand. Most participants selected the furniture from a well-known brand they knew before. They consider this furniture to have a good second-hand value and an investment for the future.



The following furniture's were presented to the participants to be evaluated.

100%

One hundred percent answered that they would buy more expensive furniture with better quality rather than buy something cheaper with poor quality.

Interview

Interviews are an effective method for doing qualitative research. The interview aimed to understand how people perceive and value the types of furniture in their homes. Open questions were generated to allow the participants to speak freely. This was done to get as much information as possible and prevent the candidates from only answering with yes or no.

The following question was used as a guiding tool throughout the interviews:

Name, age & current living situation

What is your favorite furniture? Why is that your favorite? How old is it? How much does it cost?

Which is your oldest furniture? Why?

Which furniture would you consider tossing/changing?

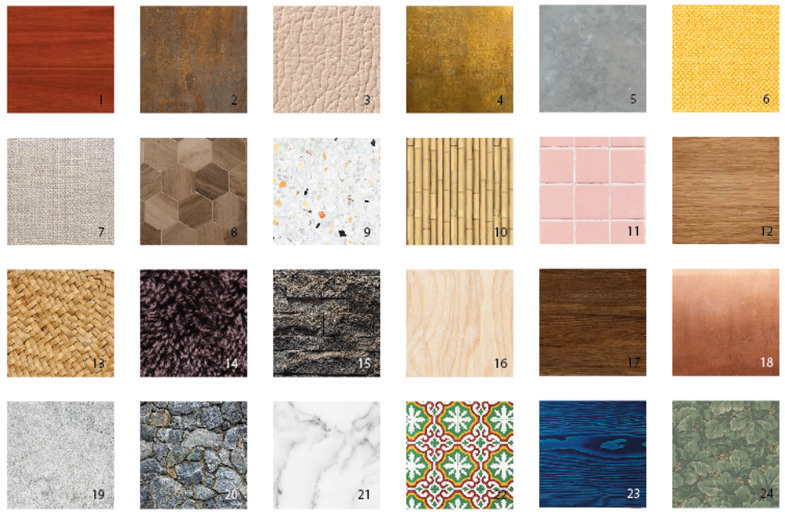
Do you prefer to buy something that is considered to be classic or modern?

On a scale from one to ten, how do you value function/aesthetics?

How do you resonate when it comes to price and quality? Would you consider buying something expensive with good quality or cheaper with worse quality?

If you were about to buy new furniture that is supposed to stay in your household for ten years, what colors would you choose? (choose 3)

If you were about to buy new furniture that is supposed to stay in your household for ten years, what material would you choose? (choose 3)



Eligible individuals were born between 1939 to 1996 and mainly lived in apartments or houses. The furniture that the participants wanted to keep for many years was a storage system while chairs were the furniture that most people wanted to exchange regularly. The sofa and bed were considered the two favorite pieces of furniture due to their comfort and the many hours spent on this furniture. Furthermore, based on the conducted research, we determined that 70% preferred to buy classic design items rather than modern designs.

When it comes to the value of function and aesthetics, the result clearly shows that the most important factor considered when buying new furniture is aesthetics. It is more important that the furniture looks good than that it functions well. But the function is still a valuable factor, 100% would choose to pay more to get a product with good quality rather than buying something less expensive that might have poor quality.

The participant was presented with the colors and materials; see pictures to the left. They were asked to choose three colors and three materials that they would choose if they were buying new furniture. Nature-influenced colors and materials like beige, warm white, brow, wood, linen, and stone were the primary material and colors chosen.

Workshop

Take five photos of furniture in your home

In this method, we asked people around us to take pictures of the furniture* they had at home including a short explanation of why they chose that particular piece. They were told to take five photos of the following: their favorite furniture, inherited furniture, furniture which they've hacked/restored, furniture they don't like and the furniture they've had for the longest period of time.

This was a very interesting method and the response varied a lot but there were some patterns found throughout the answers. Most people's favorite furniture was their couch, bed, or shelving. Which are all the more expensive pieces of furniture to buy and something you don't change out very often.

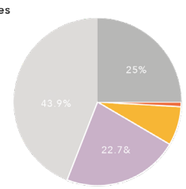
The hacked/restored furniture common denominator was that they changed the furniture to make it fit new needs which often was achieved by repainting or re-arranging their furniture. This piece of furniture was also sometimes one they've inherited, but felt the need to change it a bit, again, to make it fit their new needs.

When analyzing peoples' unfavorable furniture, we found that they don't like the cheaper furniture due to the quality, they get worn out very quickly and are made of a material that is nearly impossible to restore. In one case, the same furniture that was the unfavorable furniture also the piece of furniture she had had for the longest time. When asked why she hadn't changed it out she answered that it fulfilled its purpose, i.e. storing her things (shelving unit), and it would cost too much to buy a new one.

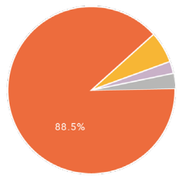
Chairs, tables, and storage units were the type of furniture people kept for the longest period of time. The common explanation was that it is expensive to buy a new one and that it is still in good condition.

132 responses

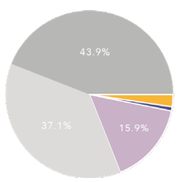
Purchase of furniture



What furniture could you consider to buy second hand?
(If you only had to pick one)



What furniture would you not consider to buy second hand?
(If you had to pick one)



What furniture could you see yourself keep for 50 years?
(having wear/tear and hygine in mind)

- Bed
- Couch / Sofa
- Chair
- Table
- Shelving / Storage unit

Purchase of furniture

As the last step of the research, we reach out to a broad target group to ask questions that could guide and give direction to what furniture we should consider to make as our final products to apply our findings. An online questionnaire was completed and sent through mail and Facebook. Our goal was to create a concise, easy and quick survey for the participant to execute.

132 response was revived. This gave us a clear indication of how people purchase furniture. The table was the furniture that most people would consider buying second-hand. Shelving/storage units and chairs were the following furniture to be chosen as potential second-hand goods. Based on this result, it is clear that the majority would prefer to buy solid furniture second-hand rather than furniture including padding and textiles.

The last question "What furniture could you see yourself keep for 50 years?" aimed to identify what furniture people would consider keeping for 50 years. As the diagram clearly shows, the table and storage system were the furniture to be deemed to have throughout the whole life.

Workshop week

During one week we decided to conduct a workshop to explore and experiment with various techniques to help get the creativity going. Also, to erase the feeling of slight anxiety going down to the workshops, which sometimes can be difficult after being away from the workshops for a long time.

Natural coloring of wood

The decision to use natural and renewable materials which the end-user could easily restore themselves by simple means was more or less already set. We quickly found that wood would be the perfect material, which we access locally here in Sweden and surrounding countries. This leads us to this part of the workshop where we questioned how we could color wood with natural products if the end-user would feel the need of changing the color. Could it be possible to use food that you often already have at home for coloring/staining the wood into the desired color? We cut out several pieces of three different types of wood (birch, pine, and oak) to try coloring them with the following foods:

Tomatoes, coffee, cacao, tea, spirulina, blueberries, turmeric, red beet, soy, bicarbonate, and carrots.

Most foods were really great at staining wood and the results were beautiful. We found that it differed somewhat between the harder type of wood (oak) and the softer (birch). The softer wood was easier to get a deeper color, while the harder wood was more difficult since it didn't stick to the wood as much. Also, the roughly sanded wood got a deeper color too. Even if the wood got a rich color right after coloring, it is difficult to know what it will look like 1 year from now or even 30 years from now. Will the color even hold for that long, or how often would you need to do it for it to look good and not bleached?

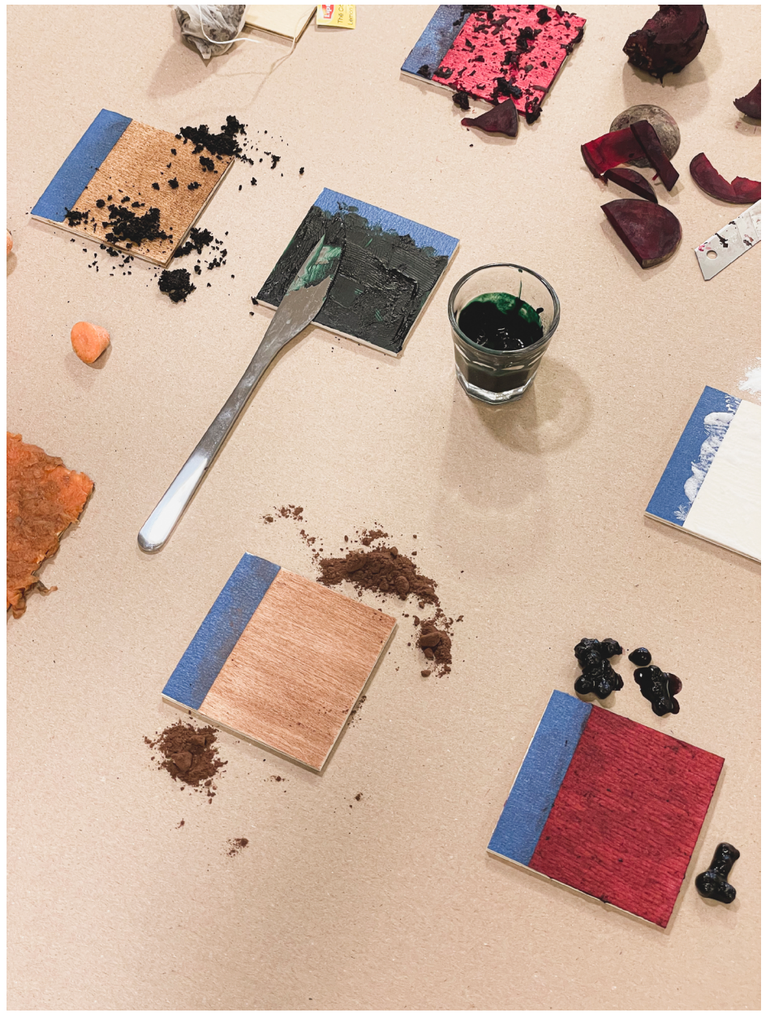
Wood joinery

The purpose was to better understand the craftsmanship of wood carpentry and get a grasp of how difficult and time-consuming it can be. Since we preferably wanted to make our product as analog as possible and with few parts and pieces this would help us when designing to fathom what is reasonable in production and what's not. It also got our creative minds spinning when looking at all the beautiful possibilities with wood.

We found it, as expected, very time-consuming. The tolerances were extremely important to make all parts fit seamlessly, something which could be a huge problem going into mass production. If choosing any of these joineries, we'd have to really consider how much value this would add to the product, is it worth the time and money. These details could make or break a product/concept.

Material library

When the workshops were closed the time was spent collecting materials for a small material library. The idea was to have this library support as a reference during our ideation part further in the design process. We managed to gather quite a lot of materials, both known and unknown materials we'd never worked with before. It turned out that this was a great help when deciding materials and material combinations for the final product.



Chapter three
Ideation

Brief

What are we doing?

What are we doing?

Vision

Storage system

Market research

Construction, storage & small storage

Scenarios

Profile

Ash veneered MDF

Treatment

RAM.

Brief

Design a storage system that would grow with you through life to avoid having the need to buy new in different chapters of your life.
It should last for at least 50 years.

What are we doing?
Storage system

Why are we doing a storage system?
Based on our research, storage system is the piece of furniture most people consider keeping for at least 50 years and could consider buying second-hand. It can also contain several functions; desk, shelving, drawers, and cabinets which enables modality that supports circular design solutions.

Who will buy this system?
People who want to invest in their furniture, have a long perspective in mind including the following generations.

How/where will they buy this system?
In-house sales.

Why will they buy this system?
The system offers:
- repairs
- refurbishes
- modularity
- replaceable parts
- versatility

What will happen if it's not wanted anymore?
The system should have a "resale value". It is made of renewable materials that easily can be disassembled for recycling.

How much will this system cost?
- The price should be on a level that attracts a wide target group
- Good enough quality to last for 50 years.

When will this system be available to purchase?
In July 2022

Vision checklist:

- Modular ▫
- Versatile ▫
- Second-hand value ▫
- Free-standing ▫
- Wall-mounted ▫
- Possible room divider ▫
- Manufactured in neighboring countries ▫
- Individual components ▫
- Easy to assemble/disassemble ▫
- Flat package ▫
- Renewable materials ▫

A storage system

This project aims to make a storage system, a modular system that should be able to be refurbished based on a current need. To meet this need, it was essential to making a system that can be customized. This will be done by including a variety of storage interiors consisting of self, cabinet, drawers, room dividers, and a secretaire. The goal is to create a versatile system that can be arranged to fit all types of rooms, from big to small.

A product that should last up to fifty years sets high expectations on the design and construction. The construction and material need to be able to be assembled and disassembled without our losing their quality. That is why we worked towards a timeless and long-lasting approach throughout the design process.

Based on the research, the decision was made to use wood as the central material in the project. It was the material that most people consider to have in their home for at least ten years. Furthermore, it is a renewable material that can easily be treated and restored.

Market research

There is a wide range of storage systems on the market. To identify a gap in the market where we could place our product, market research was done. The examined storage systems from String, Mob, Elfa, and Montana were randomly selected based on their different qualities.

String

+ Modular
+ Versatile
+ Designed in Sweden
+ Second-hand value
+ Standing / Hung on wall

- Wall required (exc. outdoor)
- Manufactured outside Scandinavia
- Not true to material
- Not transparent about sustainability
- Don’t sell all parts separately

MOEBE

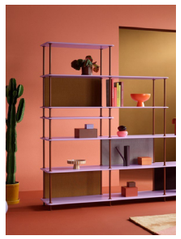
+ Modular
+ Versatile
+ Designed in Denmark
+ Standing / Hung on wall
+ Free-standing
+ Sell parts separately
+ Not height specific

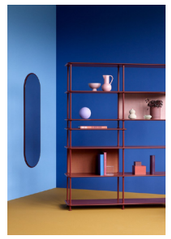
- Manufactured outside Scandinavia
- Difficult to build / Re-structure
- Quite unstable
- No shelves next to each other

Elfa

+ Modular
+ Hung on wall
+ Sell parts separately
+ Not height specific
+ Easy to re-structure
+ Sustainably aware
+ Affordable

- Manufactured outside Scandinavia
- Wall required
- Ugly





WOUD - Elevate shelving

+ Modular
+ Designed in Norway
+ Transparent about sustainability
+ Social responsibility
+ Standing
+ Free-standing
+ True to material
+ Parts sold induvidually

- Manufactured outside Scandinavia
- Height specific
- Not super versatile (only shelves)

Montana - Free

+ Modular
+ Versatile
+ Designed in Denmark
+ Transparent about sustainability
+ Standing / Hung on wall
+ Free-standing
+ Colorful

- Manufactured outside Scandinavia
- Not renewable material
- Don’t sell all parts separately

Montana - Selection

+ Modular
+ Designed in Denmark
+ Transparent about sustainability
+ Standing
+ Free-standing
+ Colorful

- Manufactured outside Scandinavia
- Not renewable material
- Don’t sell all parts separately
- Specific shelf spacing
- Not versatile

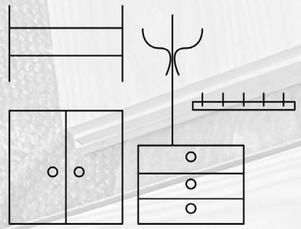
Construction

Console
- Floor
- Wall

Attachment
- Floor
- Wall
- Ceiling

Horisontal stabiliza-tion
- Shelf?
- Rule?
- Wire?

Feet



Storage

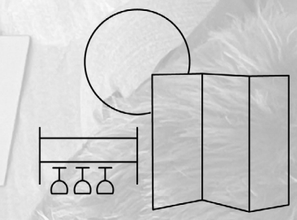
Shelf
- Plane
- Plane with edge
- Magazine shelf
- Picture shelf
- Shoe shelf
- Washbasin

Cabinet
- Regular cabinet
- Display cabinet
- Bar cabinet
- TV/Tech cabinet
- Wardrobe
- Vanity unit

Drawers
- Dresser
- Drawer unit
- Box
- Laundry basket

Hanger
- Clothes hanger
  - Wardrobe
  - Front
  - Pants hanger
- Drying rack
- Towel rack
- Hooks

Table
- Desk
- Changing table
- Dressing table
- Console table
- Bedside table



Small parts

Room screening
- Backplate
- Billboard
  - Pin
  - Slate
  - Whiteboard

Small storage
- Organizers
- Umbrella stand/hanger
- Glass display (hanging)
- Plate display
- Accessory display
- Cable management
- Dish rack

Mirror

Scenarios

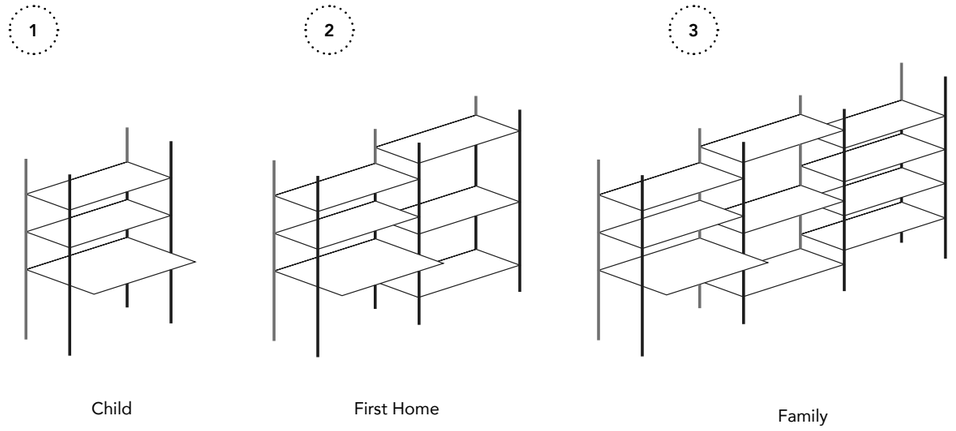
In the conducted market research, we found that there are several different ways to go when it comes to the storage system being constructed. The construction plays a significant role in how the system will look if it is floating above the ground or standing heavy on the floor, the construction decides if that will work or not. By setting some guidelines through scenarios of how it is going to be used, making it possible to narrow it down which gave us a framework to relate to. Should it be free-standing, wall mounted, or both? Who is going to use it? Where it is going to be and how much freedom do we give the consumer for customization?

First of all, to be able to have furniture for at least 50 years there must be some space for a change of needs. Imagine, you as parents might buy a storage system for your baby's nursery, where you need to be able to change diapers, store diapers and toys, and such. This need changes when the child gets older and doesn't need diapers anymore, then the changing table turns into a desk and you might add a drawer or two. The need changes again when your child is a young adult and moving away from home, one more section is added for storing school books and their favorite memories perhaps. A few years later your child has a family of their own and the need changes yet again.

A storage system can either be needing a wall, a ceiling, or free-standing. Since we wanted to enable the storage system to be used as a room divider but not demand the entire ceiling height, we made the demarcation that the system needs to have four feet.
The system could also be constructed in various ways e.g. as stacked modules, a grid on the wall, or a closed frame. The first example could work but it requires quite a lot of material, even double material in the sides that sits side-by-side, something we wanted to avoid. Considering that the system should be able to be standing on its own, the second example didn't make the cut. The third example was more like how we imagined it could function, i.e. the chosen direction moving forward.

Our market analysis concluded that a storage system consisting of four legs/feet has three different ways of how the construction and shelving would work. One: The shelves can be adjusted along the entire leg and the connection between the leg and shelves creates stability. Two: The legs define the distance between each shelf and they also create stability. Three: There are consoles on the short sides which are somehow connected with horizontal rules and along each side, there are holes for shelves. We wanted to move away from having plenty of visible holes along the consoles, giving a lot of freedom when building the storage system. This freedom can sometimes have a negative effect on the looks of the storage system. Therefore, we decided to give the user some space for customization but within given distances. This would make sure that the storage system will always look good no matter how the user customizes it. At the same time limiting the number of visible holes along the legs to a minimum.

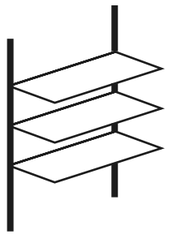
Scenario 1



Size

Scenario 2

1



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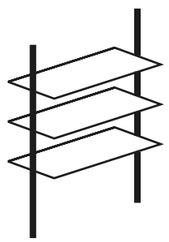

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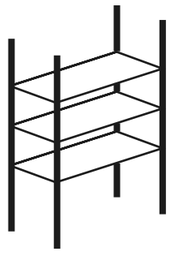
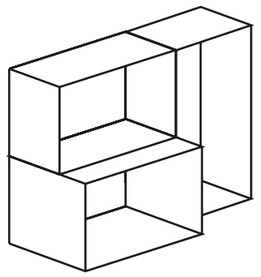


Shelf placement

Scenario 3

1



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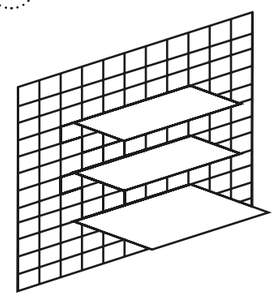

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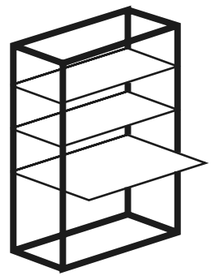
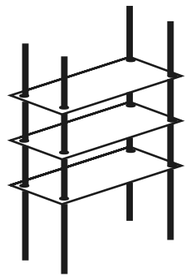


Construction

Scenario 4

1



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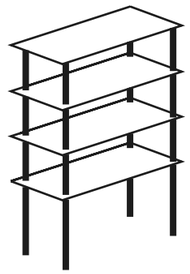

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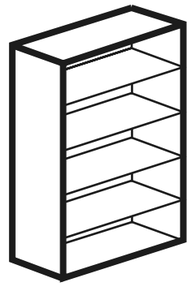
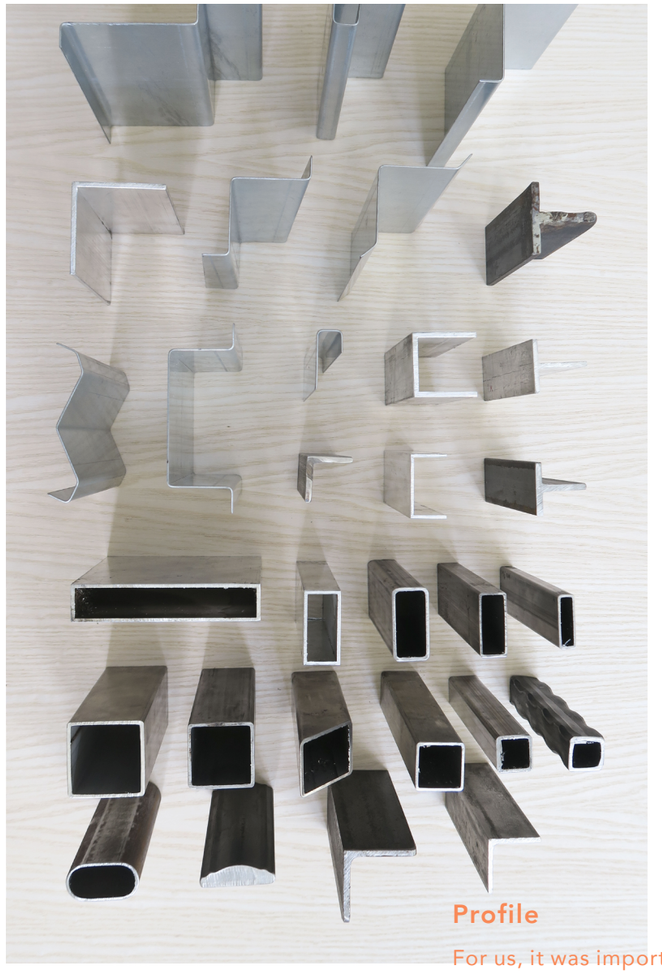


Structure



Profile

For us, it was important to create a system that looks effortless and simple. At the same time open up the possibility for the user to be able to self customize the system according to their needs, yet with some constraints. What you often see in mass-produced products like IKEA have chosen a fairly easy and cheap solution for this which is holes along an entire side of a shelving system. We wanted to avoid this because of the same reasons, it is an easy solution and it looks cheap. Therefore, initial research for different types of profiles was made. Started off by designing our own profiles, which would be doable in mass production, but we felt like we wanted to try and find an existing standardized profile. By using an existing profile, we avoid adding more products to production which would create even more emissions, this while lowering manufacturing costs since we don't need to pay for tooling. When choosing the material for the profile it was important to us that the profile gives the user a durable and trustworthy feeling, you shouldn't hesitate that this would hold for a long time. Wood could have been an option, but it didn't feel right to mill or lathe out a bunch of material to hide eventual holes or fastening details. Extruded metal was therefore a much better option since you barely waste any valuable material in the process and there are tons of different standardized profiles existing. It would also convey the very sturdy feel and look that we were looking for. Hence metal is quite heavy and thinking about transport costs, where weight is crucial, we settled on aluminum.

Aluminum
Aluminum is a lightweight, fairly soft, and non-toxic metal. It is one of the easiest metals to recycle and requires only 5% of the energy used for producing aluminum from raw materials. 95-98% of aluminum can be recycled, therefore about 75% of all aluminum products ever made are still in use[1].

Anodizing
Anodizing is a water-based process. The process helps increase the thickness of the natural oxide layer on the surface of metal parts making the metal more scratch-resistant and corrosion safe. It is one of the more environmentally friendly metal finishing processes, the by-products only contain small amounts of heavy metals, halogens, and VOC (volatile organic compound). Also, it doesn't intervene with the recycling process. Dyeing the aluminum when anodizing is also an option and the colors to choose from are endless, even though we found that to be a bit limited here in Sweden[2].

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1 Wikipedia; Aluminum, wikipedia.se (2022-08-04). https://en.wikipedia.org/wiki/Aluminium [2022-05-06].

Alumeco; Recycling of Aluminum. https://www.alumeco.com/knowledge-technique/general/recycling-of-aluminium [2022-04-12]

2 Wikipedia; Anodizing, wikipedia.se (2022-07-22). https://en.wikipedia.org/wiki/Anodizing#Environmental_impact [2022-05-06].

Ash veneered MDF

For the shelves and the parts for the cabinet, secretaire, and drawers, the discussion about using massive wood was made. After talking to the instructors in the wood workshop at school, Peder, Karl and David, the conclusion was made to use veneered MDF. This is commonly used for indoor products where tolerances are important and the material won't change or move as massive wood would do. When talking about production and production costs, veneered MDF is a lot cheaper than massive wood and easier to handle. It is also possible to re-finishing the surface if needed, a factor very important in our project.

Ask
Ash is one of the most common woods to find in Sweden, especially in the southern parts around Skåne and Skaraborg. Ash is a hard, heavy, and tough material with a slight tone of yellow. Despite that, it is still experienced as being more of a cold light color. Due to its durable properties, it is often used in furniture and flooring indoors since it will rot if not kept dry. The ash veneer comes in different thicknesses, 0.6, 1.5, and 2.5 mm. To enable re-finishing of the surface and maintain a reasonable price, the chosen thickness is 1.5mm[1].

MDF
MDF is an industrial product made from a dry process of softwood that gets grounded down to fiber level and then mixed with glue and wax. The mixture is then, under heat, pressed into a sheet material which in the end has great properties for cutting and milling[2].

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1 Träcentru, Ask, träcentrum.se. https://www.tracentrum.se/sv/publikationer/traslagsinformation/ask/ [2022-05-03]

Holm trävaror, Fanér, ehandel.holmtravaror.se. https://ehandel.holmtravaror.se/category/510/products [2022-05-03]

2 CEOS, MDF Fanerad, ceos.se. https://ceos.se/produkter/mdf93/mdffanerad13.html/ [2022-05-03]

Treatment

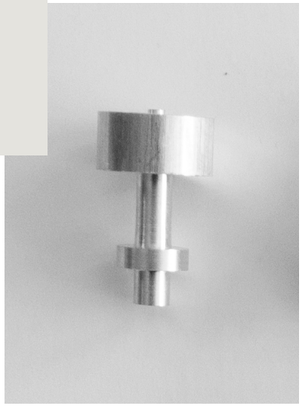
With time wood changes color and even with proper treatment, it will get a yellow and warmer tone. Therefore, we researched treatments that would keep the light colder tone of the ash. The conclusion that it is nearly impossible to avoid the wood to change color, was made. Some treatments like linseed oil even speed up the process.

Hard wax oil
When talking to professional painters, they recommended we do one layer of Osmo's decor wax (3111, white) and then two layers of hard wax oil (3041, natural matte) from the same brand. The decor wax is a white pigmented wax which will help tone down the yellow tone without it becoming all white. This will help the ash to keep its colder tone longer. The two layers of hard wax oil will encapsulate the decor wax and protect the wood from dirt and liquid stains. Hard wax oil is produced by hardened natural oil, unlike linseed oil, which means that it is classified as environmentally friendly. The added wax in the oil gives it a water-resistant surface and the combination of oil and wax gives an extremely durable result[1].

1 Dinbyggare.se; Hårdvaxolja - Ger naturliga och tårliga golv, Dinbyggare.se. https://www.dinbyggare.se/hardvaxolja-ger-naturliga-och-taliga-golv/. [2022-05-08]

Chapter four
Design process

RAM.



This was one of the first profiles we went further with and tried to make it in wood instead of metal since we strived for using renewable materials. But after talking to the guys in the wood workshop this idea was disregarded because it wouldn't be that durable and it didn't feel right to mill out that much material just to get that H-profile.

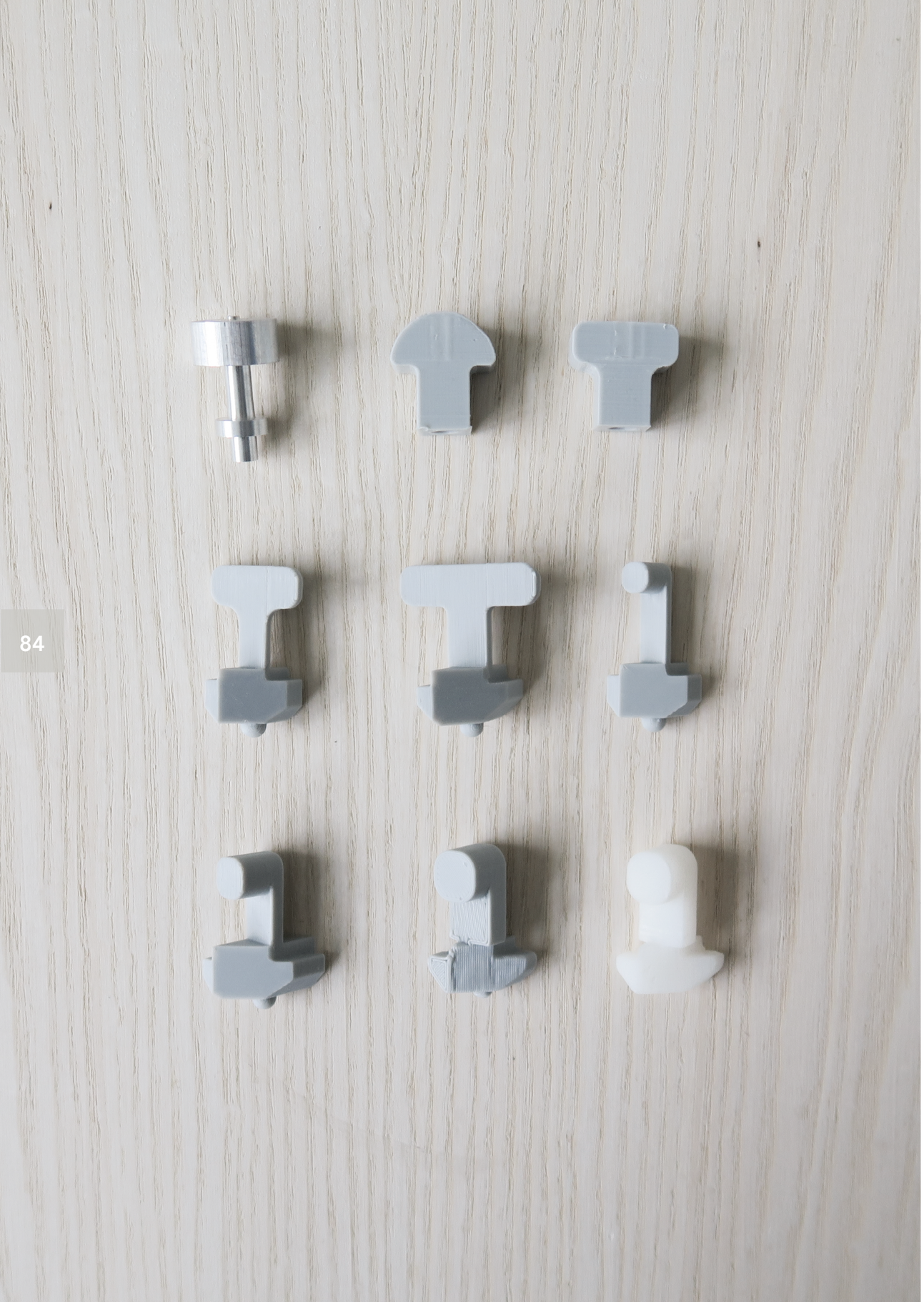

BLANKET

Why this profile?

Having a profile in metal is a lot more durable, it doesn't change shape as wood does and it is material efficient since this is an extruded metal profile meaning there's barely any waste material from production. It is made from aluminum which is one of the easiest materials to recycle and more than 70% of all aluminum ever made is still in use.
This is a standardized profile already in production, which means we don't add more new types of products in production. That's great!

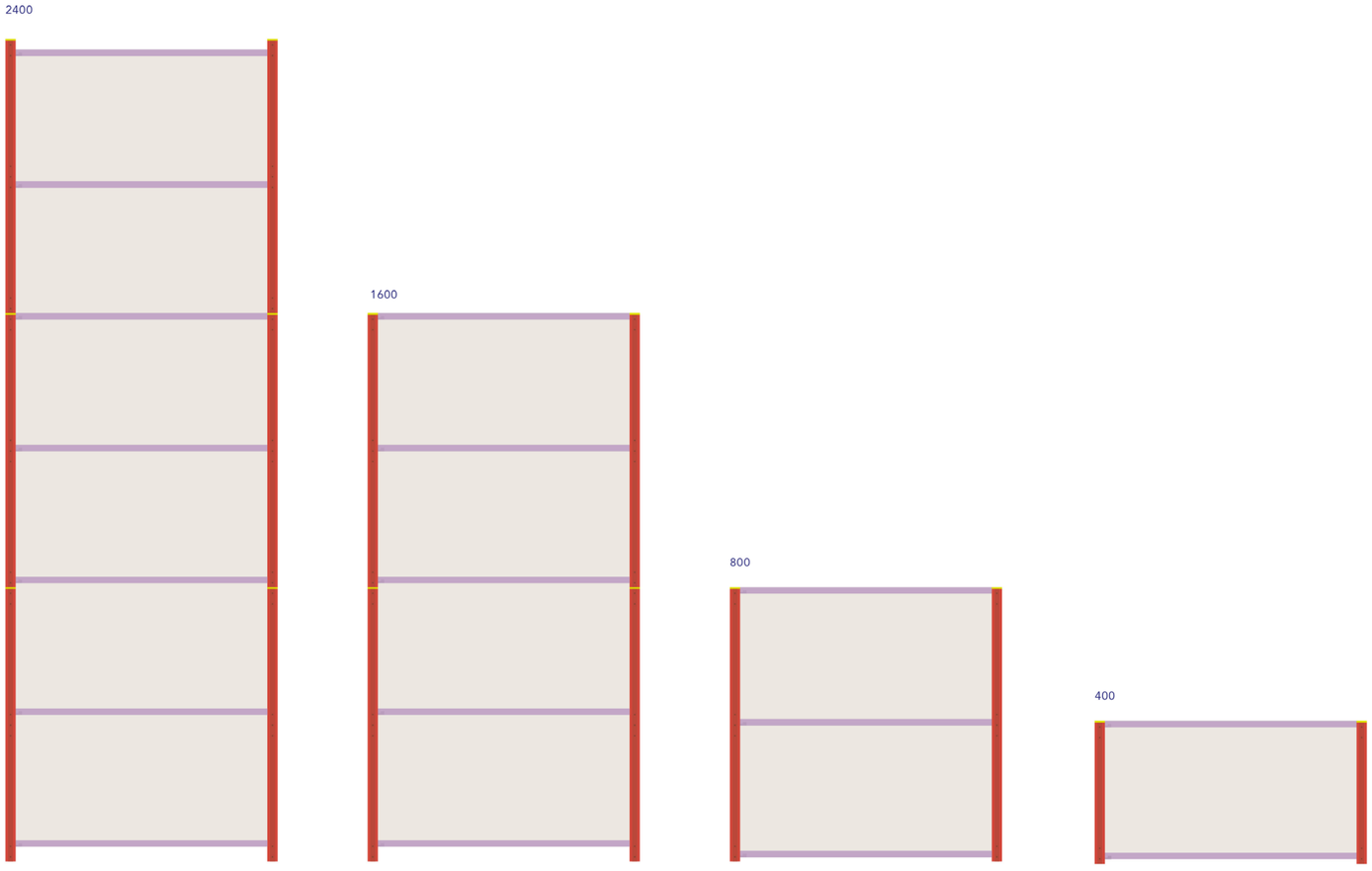
It comes in different variations, from 1 open groove to 4 open grooves, square-shaped and round shaped profile. The round profile didn't look as good as the square one did, it couldn't get as flush along the shelves as we wanted. We chose the square one with 3 open grooves, this gives us the possibility to always have one clean surface forward and still have the option of building it in 3 directions. We also saw the potential with the grooves to somehow create a smart solution to fasten the shelves or hide eventual holes inside.

Proof of concept; decided on that profile we moved forward with trying out different connectors. In the picture above is the first well-working connector made. The structure was surprisingly stable, this was really a breakthrough, and the proof of concept needed to move even further with this profile.



Connection

This is the evolution of the connector starting from the top left and ending on the final white connector on the bottom right. Right now, they’re made of 3D-printed plastic (SLS), but we would like to try out other types of material for this like injection molded aluminum or another type of plastic that is not as flexible as the SLS print. We think this could add even more stability to the structure.



Height

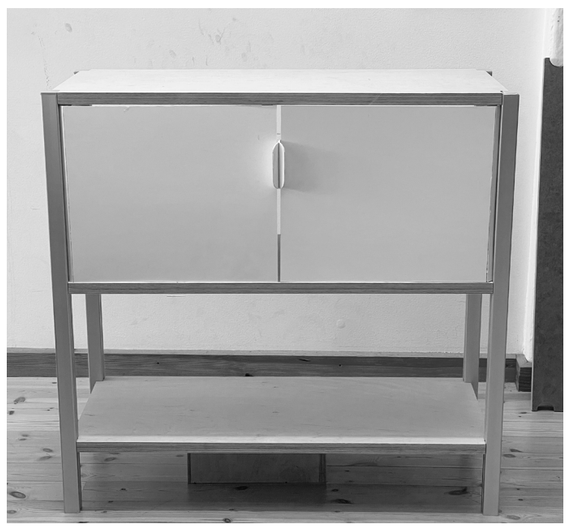
The standard ceiling height in Sweden is 2,5 meters. This was our starting point when deciding on the height of the legs. We made the legs 800mm and created a small connector between the legs making it possible to stack them on top of each other, meaning that stacking 3 units on top of each other covers the standard ceiling height perfectly with some tolerance for feet and end-caps. This adds to the whole modularity of the system. The leg also comes in 400mm, which adds some more variety of heights.











Handles

Different opening solutions were evaluated throughout the design process. This resulted in the decision to exclude handles to make a cleaner and minimalistic look to attract a wide target group.

Feet

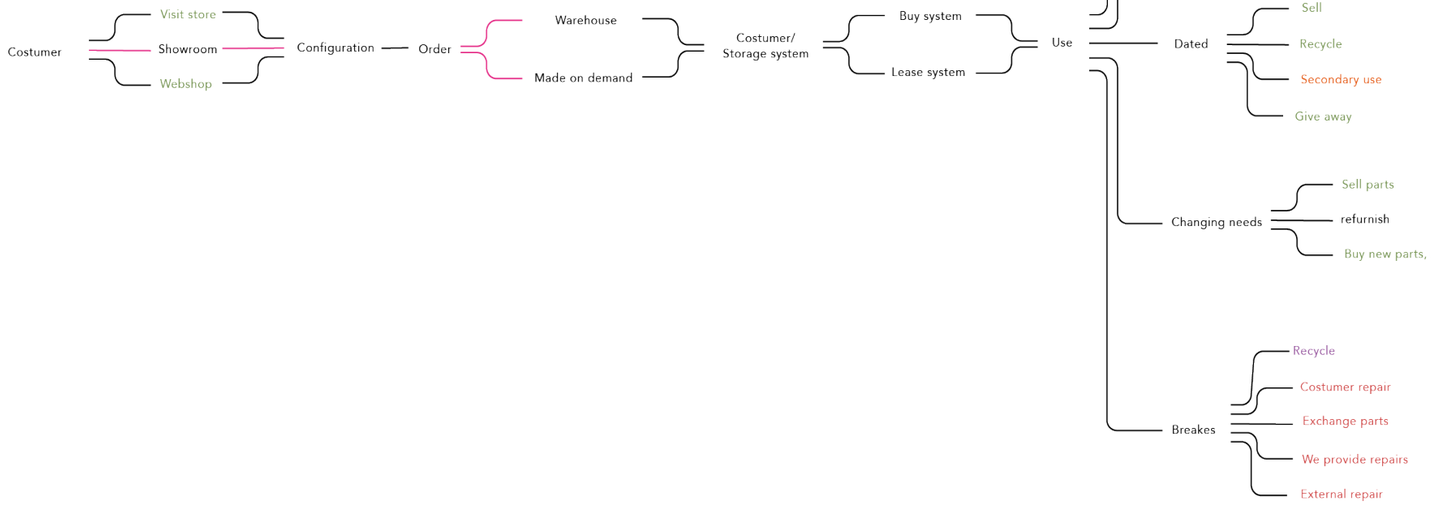
To make something long-lasting you have to pay close attention to detail. To avoid having the system feel heavy and to create a clear visual end of the leg, feet were added. The feet are adjustable making sure that the storage system is always leveled no matter how uneven the floor is.

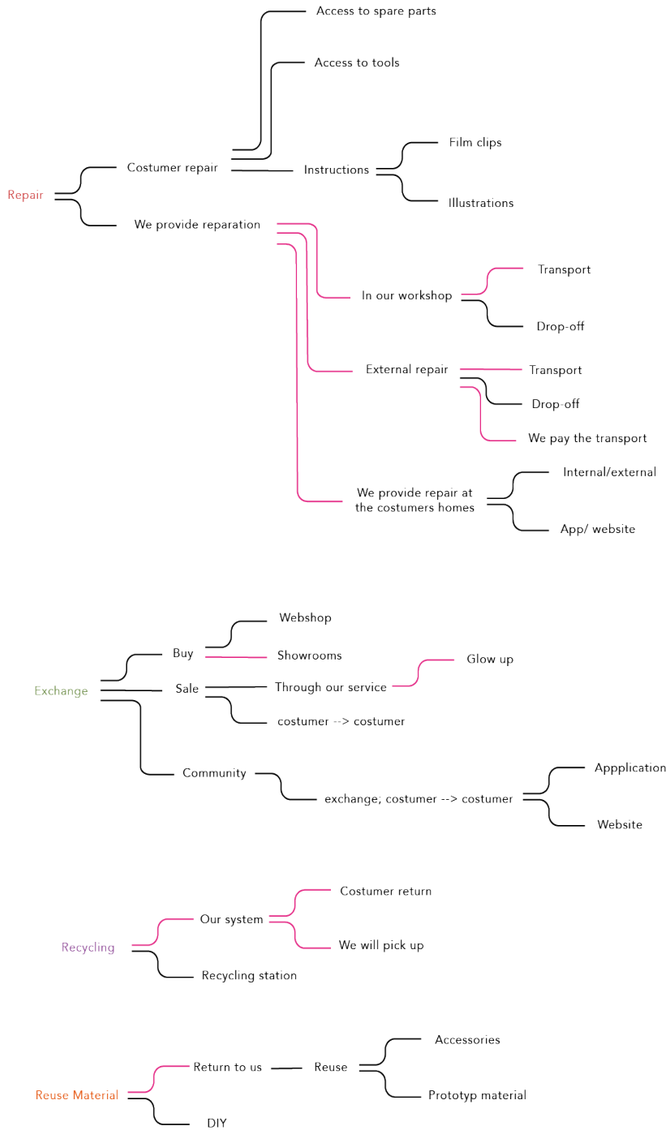
Details

These are the smaller details of the storage system. Small but highly important. The end-caps on the left picture, function as a cover of the profile to help maintain a clean overall look of the system. These along with the feet are supposed to be made in powder-coated steel, to maintain a premium feel throughout the product.

RAM service

To enable a circularity and long lifetime for RAM it was essential to add a service. The service will provide the customers with customization of the system, spare parts, and reparations if needed. A long-term goal for this service is to enable customers to exchange and sell spare parts from the system within a community created and driven by RAM.





Chapter five
Result

RAM.

Context: Childrens room

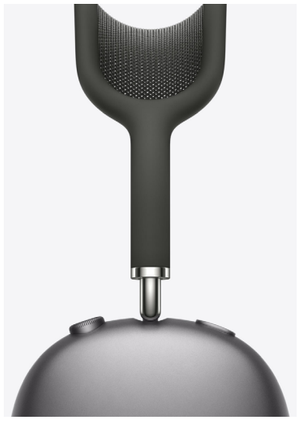
Context: Teenagers room

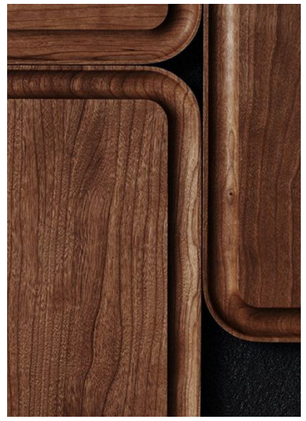
Context: Oldies living room

CMF

Color, material, and finishes were chosen to attract a wide customer range. Based on the results conducted in the survey the decision was then taken to work with earth tones and natural materials. Earth tones and natural materials were the materials and colors most people considered to choose for a piece of furniture to have in their home for at least fifty years. Furthermore, it was crucial to provide a CMF that supports product longevity in terms of aesthetics, durability, and sustainability. Ash, oak, and walnut was the chosen wood, they can all be found locally in Sweden. The benefit of using wood is that it can be treated and maintained if it gets tears out over time, that is why wood fits RAM very well. By offering three different types of wood with a color palette from light to dark, we believe we can attract a broad audience.

The aluminum legs will be available in three different colors: light grey (white), dark grey, and green to enable customer customization. The natural color palette was selected based on the survey conducted in the research.





Room divider

Once the system is placed in the middle of the room we saw a potential to include a room divider as a substitute to the backplate. The room divider is made of frosted plexiglass that allow the light through.

Storing

Ram systems offer a wide range of storage units. The collection consists of shelves, two-size cabinets, drawers, and a secretaire. We believe that the chosen storage units are essential for a storage system, but we also see enormous potential in developing more storage possibilities.

Secretaire

Today, a lot more people have started to work from home. From our own experience and talking to people working from home, we found that a lot of people find it difficult to draw a line when the work day begins and end. This is due to people often working from their kitchen table and ending up having work visible and accessible all hours of the day. We wanted to take back the old secretaire, which was a very common piece of furniture back in the day. The great thing is that when you're done with work, you can close the secretaire and make work disappear, visibly at least. We found that the secretaire could also double as a changing table and bar cabinet, which makes it possible to adapt through life.

Reflection

This project has been very fun and rewarding, meanwhile different in the way we went about it. During the entire project, we've tried to use materials that are already in production, strived for using as little material as possible, and have the components be universal throughout the system. Because we chose to use a standardized profile this had to be the driving force behind both the visual appearance and the overall structure of the system, since this profile was set we had to design around it. It had to be stable yet beautiful. This was the trickiest part due to the fact that this profile was most often used in industrial environments as structures for machines and such. One challenge in this project was to get this to look sleek, minimalistic, and not at all industrial or have an office furniture feel to it. It should feel like it belongs in anyone's Scandinavian home. We really feel like we succeeded with this and went almost overboard avoiding this storage system to not feel like office furniture, even though it could be used in an office. Something we definitely shouldn't exclude.

Another challenge was to make this very easy to assemble without any screws and with as few components as possible. In the first proof of concept, the connectors were fastened with screws which made them really sturdy. There were many downsides to this version e.g. annoying to assemble, several small components, and difficult to get leveled shelves to name a few. Since we wanted to avoid screws we designed the other connector that you "click-in-place". It made the assembly a lot easier, with lesser components. What we realized was that tolerances were extremely important for this to work. The extruded profile has a +- tolerance of 0.3mm and the 3D print also varies some between batches. Some further iterations of the connector need to be done for this to work in mass production.

A third challenge we took on was to make the system modular, another success according to us. Except for the bottom part of the secretaire (shelf + front) and the two cabinet doors, all other parts are universal, meaning e.g. all shelves could also be used as either the top or the bottom of the cabinet. The sides and backplates have a front and back but no up or down direction. The legs are all the same, you can twist and turn them however you want. They are even stackable, to create any desired height, although for this to work there need to be some improvements made on the connecting component for it to be stable. The height connections need to be tighter and made with a stronger material than the SLS plastic 3D print.

What we consider to be the fourth challenge is the service part of the project. Something we wish we had more time to figure out, contacting the logistics department and really wrapping up the entire circular economy aspect of our product. This will be the next step in further development.

What we have learned during this process is that product development is a long time-consuming process, it is all about iterations trying to find the perfect solution.

Sources

Acaroglu Leyla; Quick Guide to Sustainable Design Strategies, medium.com (2022). https://medium.com/disruptive-design/quick-guide-to-sustainable-design-strategies-641765a86fb8 [2022-02-01].

Alumeco; Recycling of Aluminum. https://www.alumeco.com/knowledge-technique/general/recycling-of-aluminium [2022-04-12]

CEOS, MDF Fanerad, ceos.se. https://ceos.se/produkter/mdf93/mdffanerad13.html/ [2022-05-03]

Dinbyggare.se; Hårdvaxolja - Ger naturliga och tårliga golv, Dinbyggare.se. https://www.dinbyggare.se/hardvaxolja-ger-naturliga-och-taliga-golv/. [2022-05-08]

Holm trävaror, Fanér, ehandel.holmtravaror.se. https://ehandel.holmtravaror.se/category/510/products [2022-05-03]

Karin M Ekström & Torbjörn Hjort, “Sociala medier ökar trycket att konsumera”, Svenska Dagbladet (2017-09-13).https://www.svd.se/a/mAJjq/sociala-medier-okar-trycket-att-konsumera [2022-02-07]

Naturskyddsföreningen; Ny rapport: Så stor miljöpåverkan har din nya soffa, Naturskyddsföreningen.se(2021).https://www.naturskyddsforeningen.se/artiklar/ny-rapport-sa-stor-miljopaverkan-har-din-nya-soffa/ [2022-03-01]

Stadsmyndigheten; Vår konsumtion speglar samhällets utveckling, scb.se (2020-12-21). https://www.scb.se/hitta-statistikartiklar/2020/var-konsumtion-speglar-samhallets-utveckling/ [2022-03-04]

Träcentru, Ask, träcentrum.se. https://www.tracentrum.se/sv/publikationer/traslagsinformation/ask/ [2022-05-03]

United Nation; Sustainable development goals, goal12 Ensure sustainablr consumption and production petterns, un.org. https://medium.com/disruptive-design/quick-guide-to-sustainable-design-strategies-641765a86fb8 [2022-02-02]

Wikipedia; Golvur, Wikipedia.se (2011-7-03). https://sv.wikipedia.org/wiki/Golvur [2022-03-04]

Wikipedia; Brudkista, Wikipedia.se (2018-11-16). https://sv.wikipedia.org/wiki/Brudkista [2022-03-04]

Wikipedia; Aluminum, wikipedia.se (2022-08-04). https://en.wikipedia.org/wiki/Aluminium [2022-05-06].

Wikipedia; Anodizing, wikipedia.se (2022-07-22). https://en.wikipedia.org/wiki/Anodizing#Environmental_impact [2022-05-06].

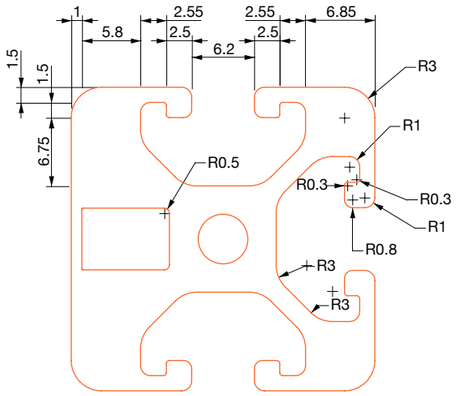
Photos

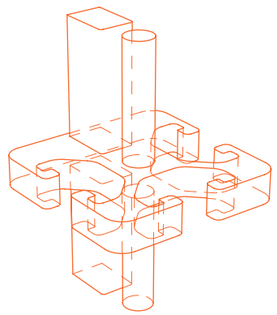
Bertil Norberg; Formens rörelse, tidskriften FOR, Wikipedia.se. https://sv.wikipedia.org/wiki/Lena_Larsson

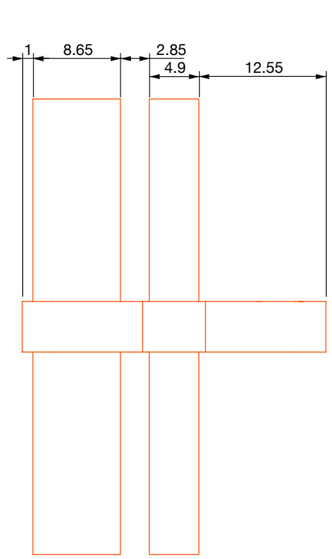
Nuddle; Unsplash, unsplash.com. https://unsplash.com/es/fotos/jMNiQTEEkYs

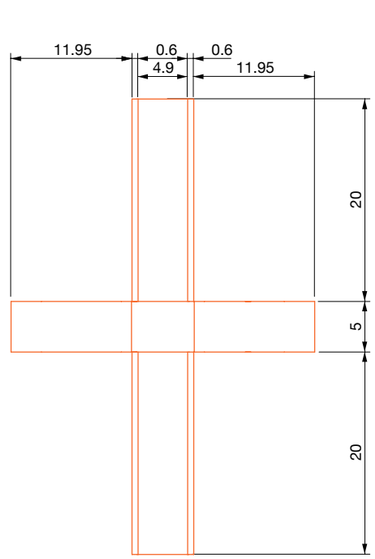
Item; Profile 6 30x30 1N light, natural, item24.com Phttps://www.item24.com/en-de/profile-6-30x30-1n-light-natural-43943/

Leg connector
(mm)

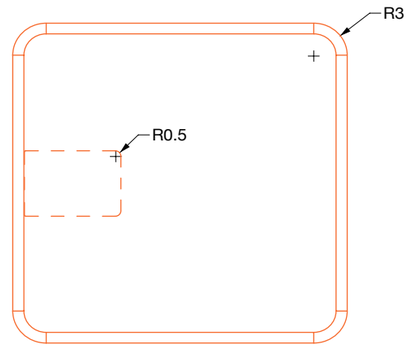


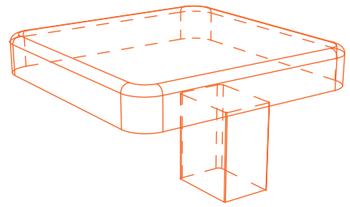


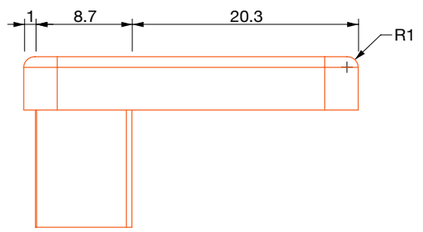


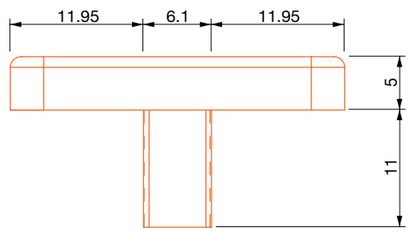


End cap
(mm)

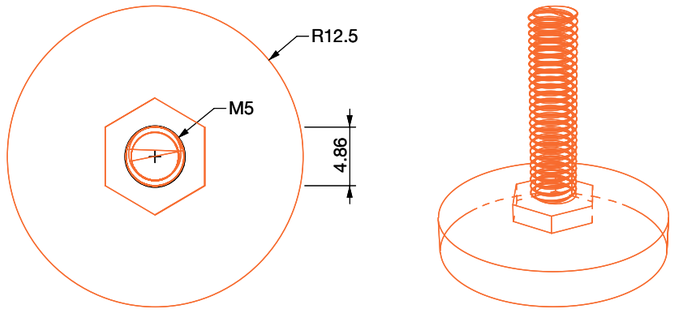


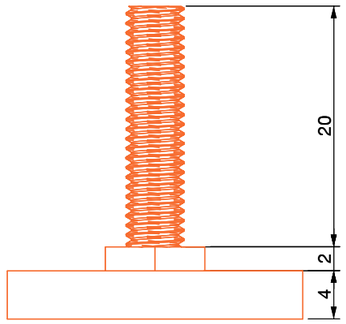




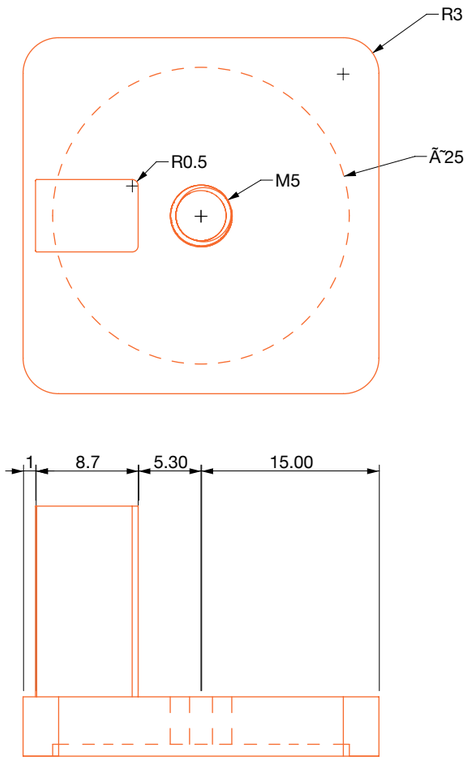


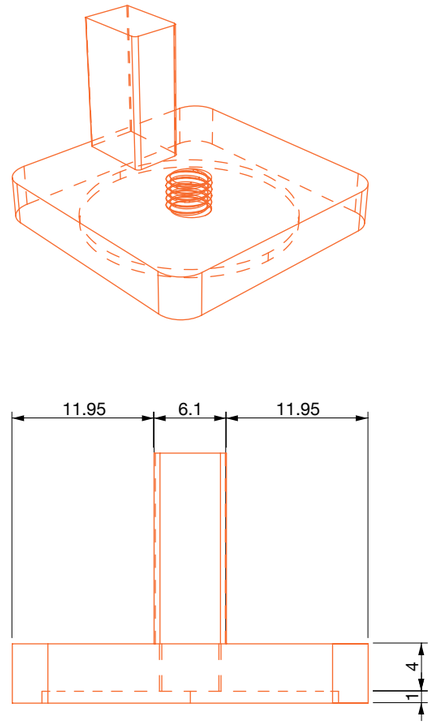
Feet - Screw
(mm)



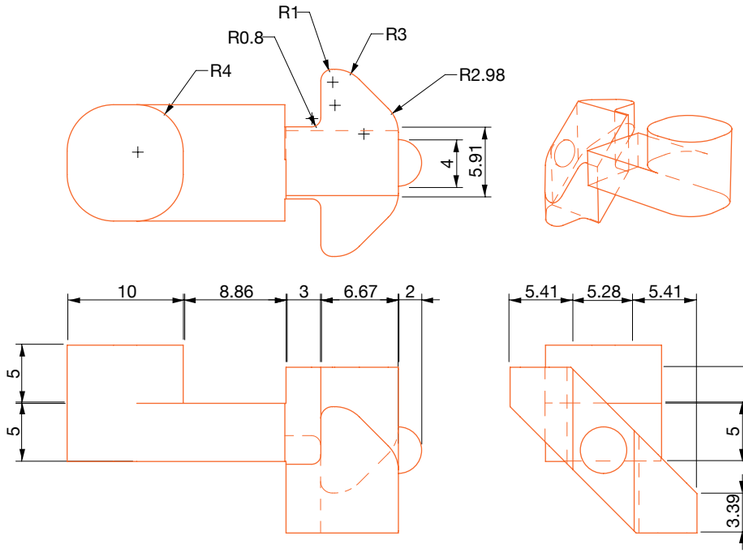


Feet - Cap
(mm)

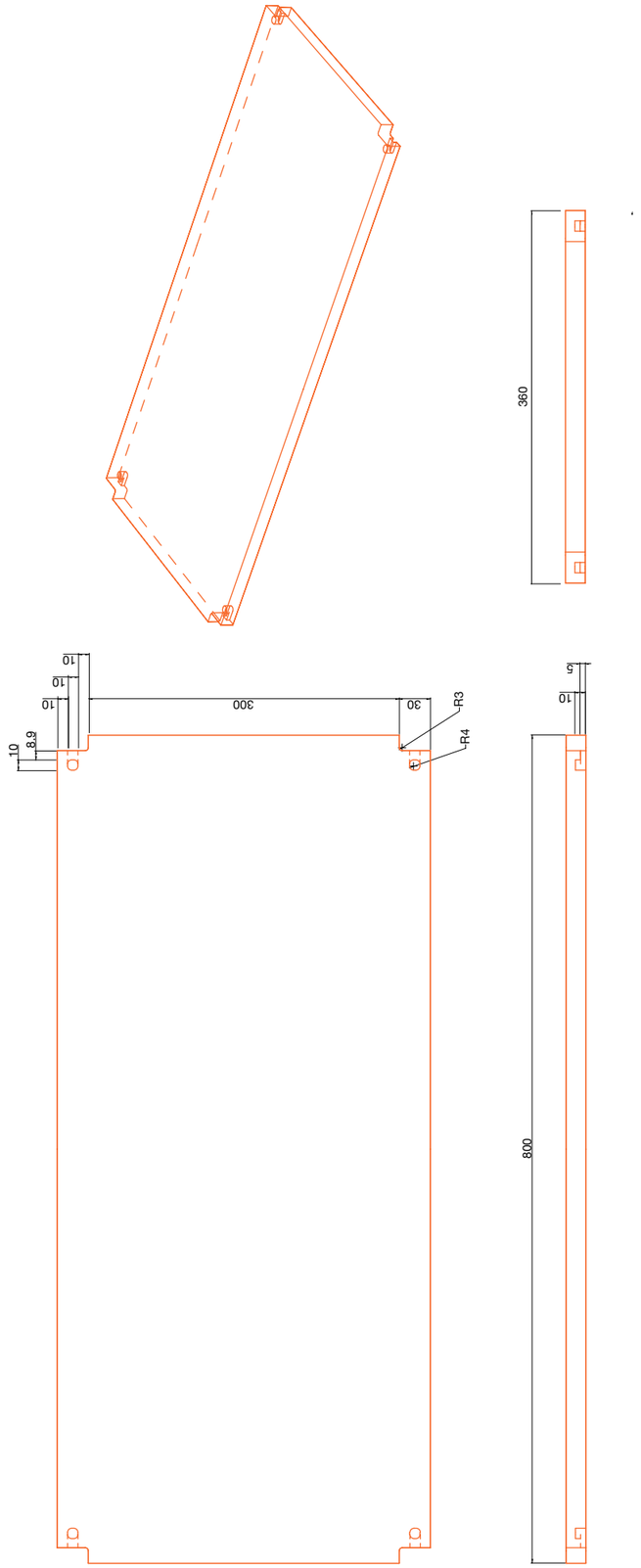




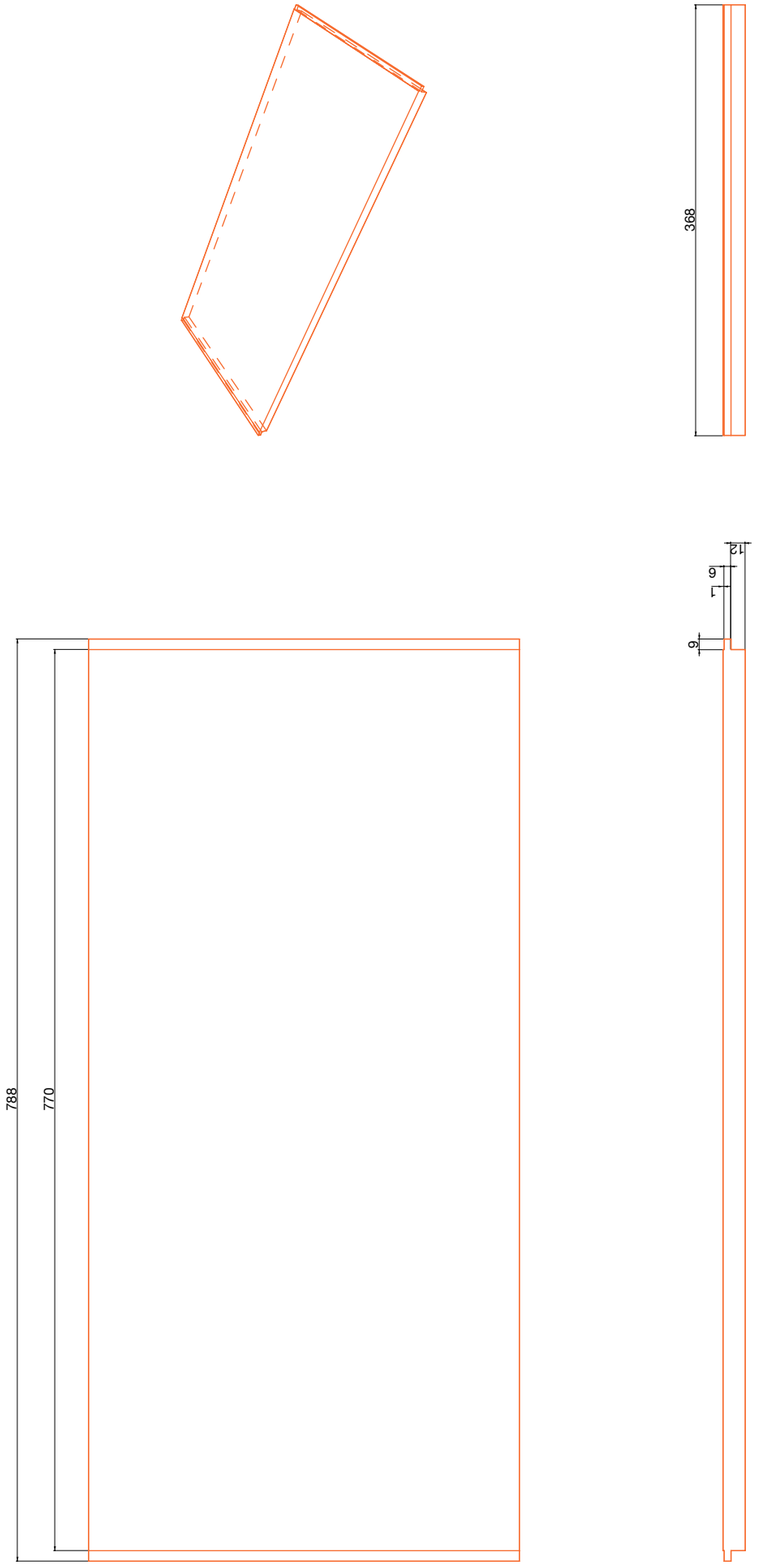
Shelf connector
(mm)



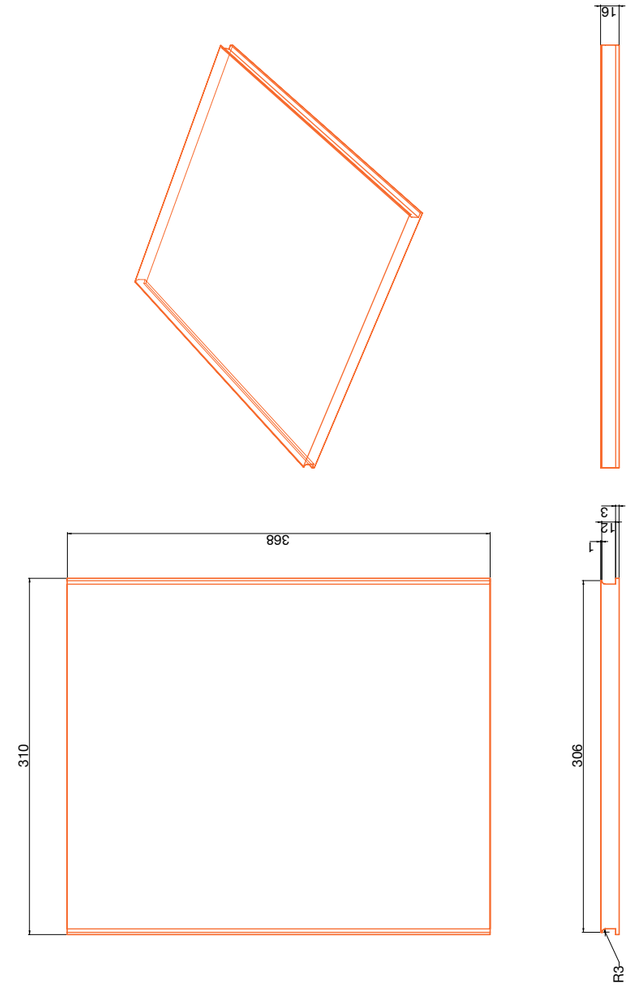
Shelf
(mm)



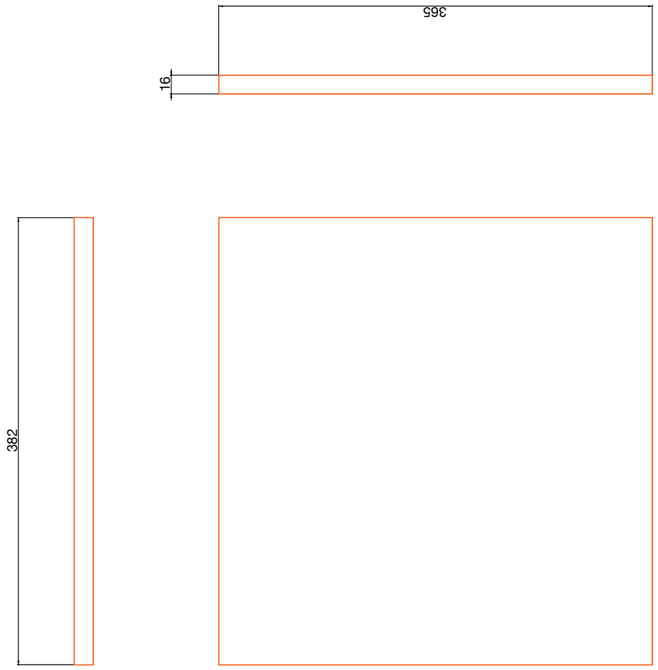
Backplate
(mm)



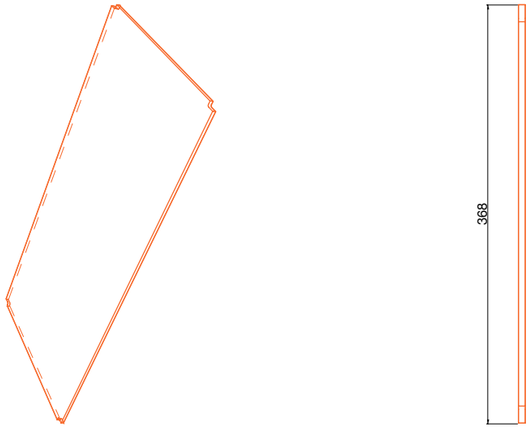
Side
(mm)

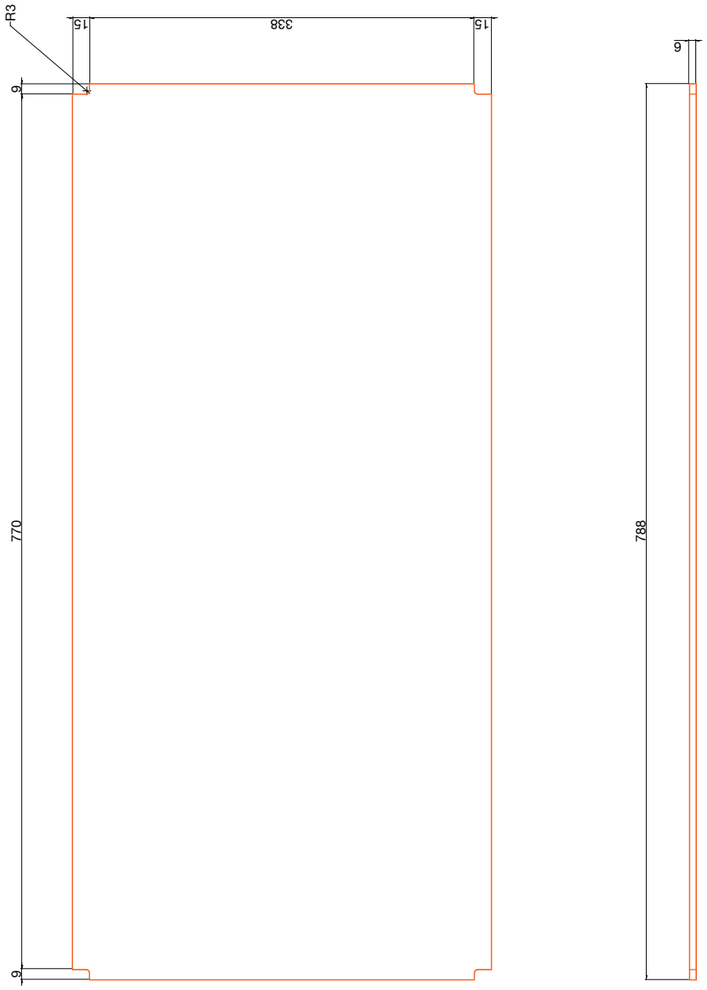


Cabinet door
(mm)

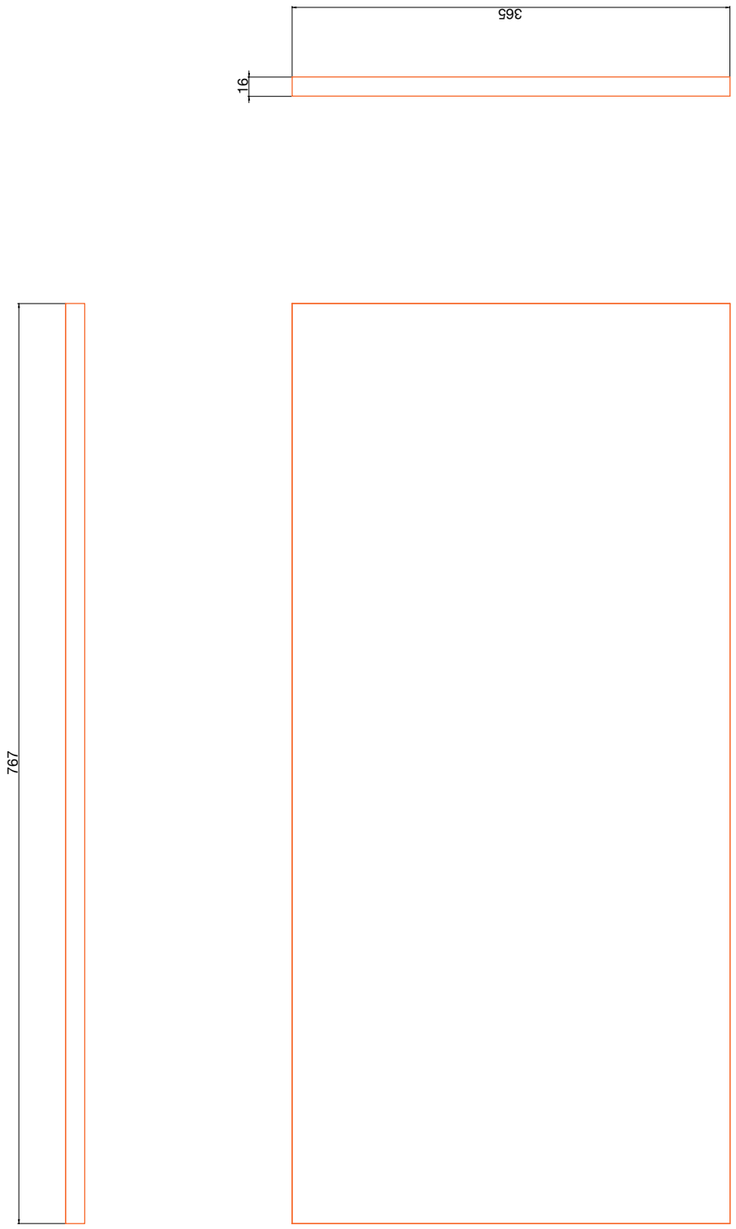


Room divider
(mm)

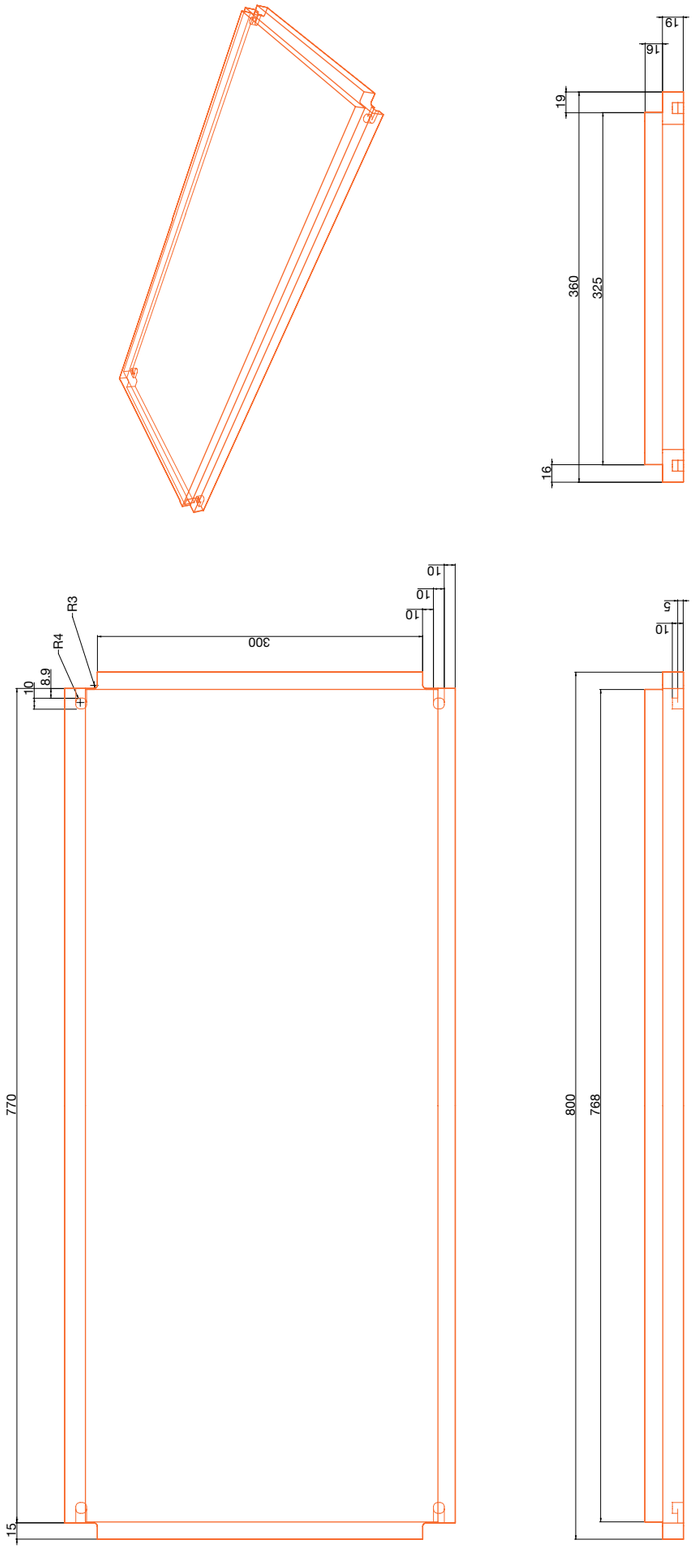




Secretaire front
(mm)



Secretaire shelf
(mm)



The project resulted in a storage system that can adapt to different living situations which can accrue through life. Once the system becomes too small or too big it can easily be upscaled or downscaled. This makes it possible for the user to adapt the size of the system to the current living situation, from a student flat to a family home or vice versa.