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A user centered approach to circular product design

Proposing guidelines and using them to design furniture as a service

Master of Science Thesis in the Master Degree Program, Industrial Design Engineering

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CHALMERS UNIVERSITY OF TECHNOLOGY
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Department of Industrial & Materials Science
Division of Design & Human Factors

Master of Science Thesis

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Preface

The report discourses a master thesis project initiated by the research project Use2Use, carried out at the department of Industrial & Materials Science within the division of Design & Human Factors at Chalmers University of Technology during the spring of 2018.

Large gratitude is directed to all the people who have been participating in the questionnaires carried out during the project. You are too many to mention by name, but you mean a lot to me.

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Finally, I would like to say thank you to Oskar Rexfelt for co-initiating the project and for allowing me to pass this graduation project.

Gothenburg June 14th 2018
Jonatan Rosman

Abstract

The demand for sustainable products is high and rising due to increased household consumption creating environmental pressure. One way to improve the product sustainability is to increase the use of the product by intensifying the use and prolonging the life cycle. Increasing the use creates a lower need for large quantities of produced products which reduces the environmental footprint. One way to increase the use is to allow the product to be reused over and over again for as long as possible. Currently the material reuse rate is as low as 6,7% in Sweden and 11,4% in all of EU which is far away from a circular economy.

With the previously explained background this master thesis was initiated inside the current research project Use2Use, which main purpose is to develop and provide a tool to support design and development processes for reusable products. The purpose of this project was to create a better understanding of the exchange situation of products, the moment when a product is made rid of by one user and is obtained by another, to provide guidance and an example of how this can be done. The main purpose was split into three objectives: to provide an understanding of the exchange situation, illustrate with a design case and present guidelines suitable for design for exchange.

Initially, product circularity was explored and a user journey was created to understand the pain points for different paths of obtainment and riddance for products in general. Sustainability design guidelines were gathered, sorted and guidelines specifically applicable to design for exchange were created. Based on all this a vision was formed of how a reusable product should be like. It was found through the initial research that one product group suitable for circular use is "products which are used often, but only for a certain period in life". Through this, home furnishing for uncertain future living conditions was chosen. By evaluating all of the activities in the user journey for different obtainment paths, the circular path of subscription was chosen. Based on this, the design case was established with the goal to provide furniture as a service.

The concept developed in this design case is a modular sofa system offered through a subscription service which allows the user to access a sofa during a time in life with uncertain future living conditions. The modular sofa system allows the user to build a sofa which suits like a glove to the current and future living space, allowing the user to express personality through the way it is assembled and may also be adapted for different occasions. By offering the sofa through the subscription service all who want a sofa that suit their needs, but do not want to commit because of an uncertain living situation, will find what they need.

This project provides an understanding of the exchange situation by mapping out all activities related to the obtainment and the riddance of a product in a user journey. A collection of 46 guidelines are presented as guidance for anybody looking to design product circularity from a user perspective. How these guidelines can be used are illustrated through the design case which developed a sofa suitable to be offered through a subscription business model. Through this, the project provides an example of a user centered approach to circular product design.

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1. Introduction

This initial chapter provides a background to the project. It describes purpose and objectives, as well as specific research questions investigated during the design case. It also specifies the limitations and provides a brief overview of the project process.

1.1. Background

The demand for sustainable products is high and rising due to increased household consumption creating environmental pressure (UNEP, 2016). One way to improve the sustainability of a product is to increase the use of the product, by intensifying the use, prolonging the life cycle of the product or a combination of the two (Bocken et al., 2016). This gives each product produced a higher value, benefit and profit. Increasing the use of products creates a lower need for large quantities of produced products which reduces the environmental footprint. One way to increase the use of products is to allow the product to be reused over and over again for as long as possible. Currently the material reuse rate is as low as 6,7% in Sweden and 11,4% in all of EU (Eurostat, 2014) which is far away from a circular economy. This thesis tries to do something about it. The idea behind this project was that by making it easier to transfer a product from one user to another the probability of a sustainable product life cycle increases. Because of this, the project aimed to intensify the use and prolonging the lifespan of the product by facilitating product re-use.

There is currently, and have been for a long time, a big need for this user centered approach as highlighted by Rexfelt & Hiort (2009) supported by multiple sources (Halme et al., 2005; Hertwich, 2006; Mont, 2004; Scholl, 2006; Schrader, 1999; Tukker and Tischner, 2006; Williams, 2007; Zaring et al., 2001; Östlin et al., 2005). This since most previous research has focused on circularity from a production or business perspective and how to make users accept circular business models instead of looking how to design the products and the business so that it suits the user.

1.2. Project initiator

The project “Design for Exchange” was initiated inside the current research project Use2Use at the department of Industrial & Materials Science within the division of Design & Human Factors at Chalmers University of Technology. The main purpose of Use2Use is to develop and provide a tool to support design and development processes within sustainable consumption. The tool will facilitate the development of products and services which enable alternative consumption such as shared use, product pools, rentals, second hand shops etc. Early results showed that a crucial component is support and guidelines for designing products that facilitate the exchange between users. To develop the tool further, a concrete design case needed to be carried out which addresses the transition from one user to another and the challenges this causes for the parties involved.

This project was initiated within the Use2Use project to provide a deeper understanding about the important part of transferring a product from one user to another. This understanding will serve as a part of the Use2Use project contributing to a more sustainable consumption in society. This deeper understanding of “Design for Exchange” mainly needs to address the obtainment and the riddance of the product. This since designing for reuse is common in literature, but how the transfer of access between users is carried out was not yet investigated.

1.3. Purpose and aim

The purpose of this project was to create a better understanding of the exchange situation of a product from one user to the next, provide guidance and an example of how this can be done. For larger investments such as cars, boats and houses most people already consider

that somebody else will use it when they do not need it anymore. This project wants to bring this kind of thinking also to comparably smaller investments and every day products. If the project is successful, the guidance is implemented and/or the developed example is realized. A successful project will in the long run lead to tightened user cycles for the developed products. This since the increased use of products will come out of increased numbers of exchange occasions as well as an increase of users per product. This is based on the assumption that products are in general used closer to the obtainment than later.

The aim of this project is to design for product-life extension by facilitating product re-use. This will be done through a user centered approach to circular product design with focus on facilitating the exchange between one user and another.

1.4. Objectives

The main objective was to design a product designed to facilitate the exchange of the product between users. The project addressed different types of challenges that arise in such an exchange situation. Examples of these challenges could be user adaptability, how to inspect the condition of a product or reducing unwanted activities within the exchange situation through design. The main objective was split into three objectives:

1. Provide understanding of the exchange situation
2. Present design guidelines suitable for design for exchange
3. Clarify how the guidelines may be used through a design case

The project was expected to increase the understanding of the exchange situation and result in a concrete design case with an innovation which supports the exchange of products between multiple users. The design case was to originate out of preliminary guidelines to be developed initially in the project and later refined after the carrying out of the design case.

1.5. Design case research questions

The aim and objective of this project led to the following research questions to specify what the design case should investigate. The word facilitate was used frequently since the way of how to facilitate was yet to be discovered, this could be done through e.g. supporting, enabling or motivating the user.

- How can product design facilitate for people in the obtainment stage to choose sustainable consumption alternatives?
- How can product design facilitate for people to enter the riddance stage, so that they are motivated and enabled to make their things available for other users instead of hoarding them?
- How can products be designed so that they are in good condition and attractive to multiple users over time, not just for one user during one single use cycle?

1.6. Demarcations

This project focused on how to make a consumer product more sustainable by increasing the use of each product, thus providing a higher value of the product. In this, the chosen product will be redesigned since it need to stay the same product to be able to provide an understandable example. The focus was on developing the design to benefit the exchange situation which contains three parts; the obtainment, the riddance and the actual exchange of the product. Some parts of the design benefit other parts of the product life cycle, such as

the production and recycling of a product and keeping the product in a better condition during each use cycle. However, these parts were not the focus of the project even though they are strongly related. The result is also applicable outside of consumer products even though it was not within the scope of the project.

1.7. Overall process and report structure

Over all, the process consisted of three diamond shaped stages. A rough illustration of this process is shown below in figure 1. The first diamond explores the exchange situation and product circularity in general and ends with defining a suitable product type based on the vision formed. Subsequently the second diamond explores the chosen product type and later the specific product. The last and third diamond generates concepts, develops the parts and concludes with the final concept.

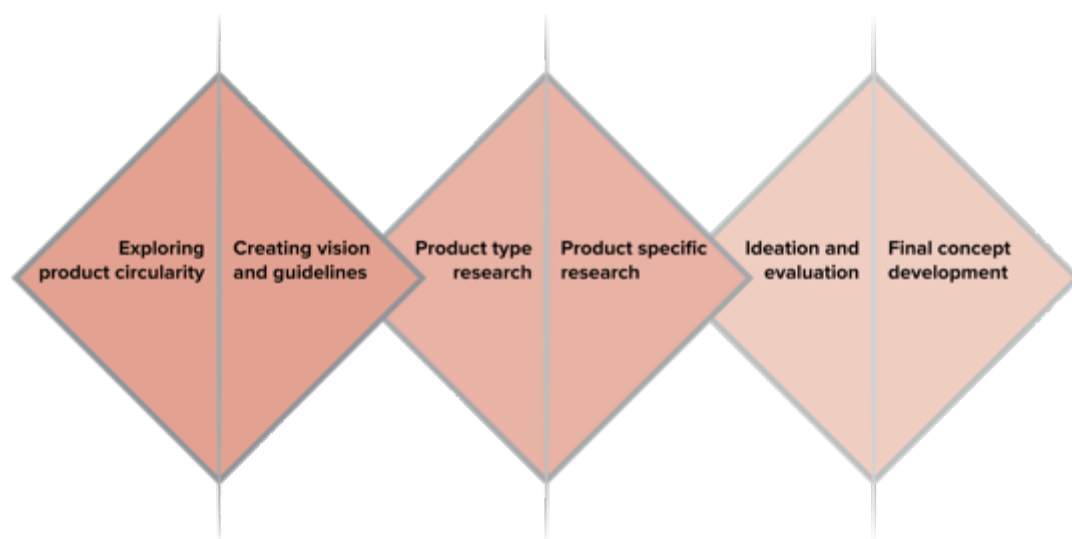


Figure 1. An illustration of how the process of the project was carried out

The beginning of the project investigated what types of challenges arise in an exchange situation. This provided a view of the exchange situation out of a user-, market-, theory-, and trend perspective. A clear view of the situation from different angles was created. Based on this a vision of what kind of needed interaction was created according to the “Vision in product design”-methodology (Hekkert et al., 2011). This vision was translated into one product through an iterative design process.

The report after this introducing chapter will follow the project process, followed by a discussion of the project process, a conclusion and recommendations for further research.

1.8. Ethical considerations

The project aim created a desire to make people choose products which strengthen sustainable consumption. It might be considered unethical to influence people's choices without their knowledge or push a specific way of purchasing a product onto them. Therefore, this project strived to enable and persuade people to make conscious and informed decisions. Hopefully this will lead them into sustainable consumption. One could also argue that user centered and context driven design such as this project is the most ethical way to do design work since it uses the perspective of the user to find out what is best for the user.

The ethical decisions during the implementation of this project mainly involved the handling of personal data which was done carefully. The participants were not compromised and were always allowed to leave the study or deny usage of data. Furthermore, the outcome of this project hoped to lead to a more sustainable consumption in the future even though it is hard to determine to what extent. Sustainable consumption of household products leads to a reduced human environmental footprint and in the long run to a better world for earth's current and future inhabitants.

If the ethics concern is elevated one level it might lead to future work opportunities if the final guidelines will be implemented by companies. This could lead to the start of new companies which use these guidelines, and to create new business models. However, it might also lead to less production of existing products which might reduce work opportunities if existing companies that do not implement these guidelines do run out of business because of the new competition.

1.9. Project report target group

This project wanted to inspire company leaders and designers into creating products that are made to be used by several users, either by sharing temporarily, co-using or passing it on to the next user more permanently. By providing a design case, similar businesses will be able to directly transfer some of the design to their products, while businesses further away have to do a bit more translation but can follow and learn the process of how to apply a user centered approach to circular product design.

2. Exploration of product circularity

Initially in the project this exploration phase was conducted in order to investigate the field of exchangeable products. To achieve this, three areas were explored; Circular economy understanding, mapping of the user experience and circular product market exploration.

This part is called “exploration” since initially the knowledge was low and the covered area gets wider and wider throughout this part. This exploration phase served as a foundation for the upcoming outlook phase which gathered and structured insights to provide a vision for the rest of the project.

2.1. Introduction to circular economy

The circular economy research discovered various ways of explaining and mapping out different approaches to circular economy. One renowned way to look at it is through the butterfly diagram created by the Ellen McArthur Foundation which is presented in figure 2.

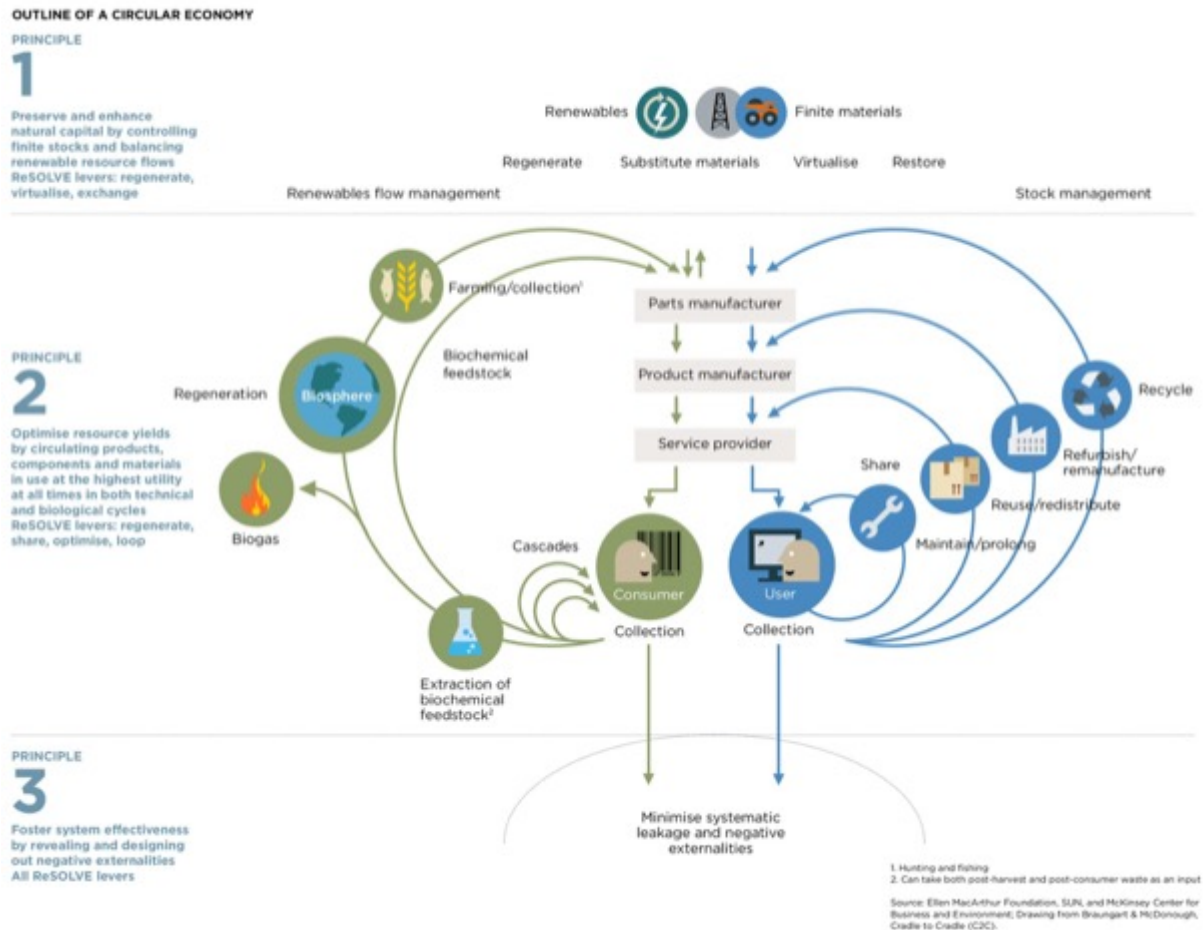


Figure 2. The butterfly diagram which describes the circular economy

The green, left wing of the butterfly diagram is about the biological cycle to use environmentally friendly and recyclable materials. This part is mostly about choosing materials and is highly important but will not be in focus of this project. The blue, right wing of the butterfly diagram is about how the product or parts of the product return to the supply chain. Staying as close to the user as possible is better, maintaining/prolonging being the best since it is implied that the product is used. Recycle is the least good since all the energy put into building a product is taken away and only the value of the material itself is contained (Ellen McArthur Foundation, 2017). Recycling is of course better than disposing since all of the material value is wasted and only the heat may be used as a consumable resource and hence is no longer circular. Even worse is landfill since not even the energy within the product is used. If a product is forgotten and not used, it is halted which makes it no longer circular since it does not return to the user or the supply chain.

Similarly to how there are many ways of looking at circular economy, there are also multiple schools of thought of how to work with how producing businesses can make their products more sustainable through circular economy. One that seems clear, easy to understand and

applicable for the functions of a product is the one by Bocken et al. (2016) presented in their “Product design and business model strategies for a circular economy”. Their way of looking at it defines three ways to create more sustainable resource cycles: slowing, closing, and narrowing loops.

Slowing resource loops aims to design long-life products and the extension of product-life, e.g. service loops through repair or remanufacturing, but can also be that the products’ utilization period is extended and/or intensified since this slows down the flow of resources. An interpretation of this would be that this way aims at making as much possible use of the amount of resources needed to create the product. There are currently five approaches to this, two design approaches and three business model approaches.

The two design approaches consist of designing long-life products which aim at creating attachment and trust, and the other is design for product-life extension, aiming for designing product re-use, maintenance and upgradability which is the approach this project set out to do. There are also the three business model approaches; access and performance model creating Product Service Systems (PPS), extending product value by enabling remanufacturing and the classic long-life model to encourage sufficiency through ensuring durability and simple repairs.

Closing resource loops is focusing on achieving sustainability through recycling which means that the loop between post-use and production is closed, resulting in a circular flow of resources. Here there are three design approaches and two business model approaches. One design approach is to design for a technological cycle, create products of service and make sure products that are not consumed stay within the loop. Secondly there is a possibility to design for a biological cycle which is targeting products of consumption, and design them so they easily biodegrade or are easily recycled. The third way is to design for disassembly and reassembly and make sure that this is possible. The business model approach is; extending resource value through collection or sourcing of “wasted” materials or capturing capacity through industrial symbiosis by turning waste outputs from one process into feedstock for another process.

The two approaches of slowing and closing resource loops are distinctly different from the third approach which aims to reduce resource flows by narrowing resource flows. This approach aims for resource efficiency and using fewer resources per product.

As noted in the initial background description there is currently, and have been for a long time, a big need for this user centered approach as highlighted by Rexfelt & Hiort (2009). Therefore, this project aims to design for product-life extension by facilitating product re-use and the exchange situation, which is part of the approach of slowing resource loops.

2.2. Mapping of user journey

The goal of the user research was to understand and map out the activities related to the user journey during the process of access or ownership of a product. This was done with focus on the exchange situation, splitting the journey into three major phases; *Obtainment phase*, *Use phase* and *Riddance phase* based on the Use2Use parent project’s previous research as seen in figure 3. The two major tools to map out these activities were workshops and a questionnaire.

THE CONSUMPTION CYCLE

OBTAINMENT > USE > RIDDANCE

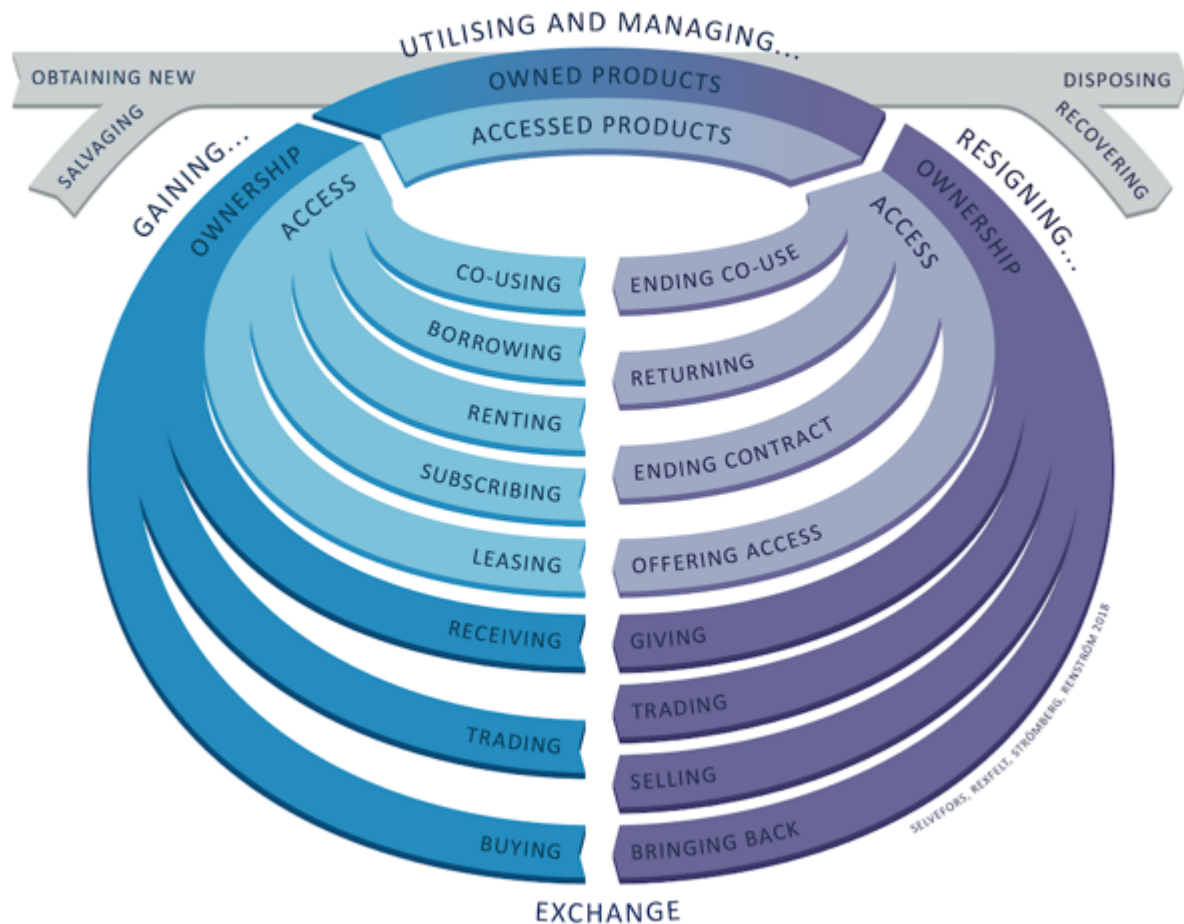


Figure 3. A visualization of the exchange situation within Use2Use

2.2.1. Method

Workshops were carried out by Oscar Rexfelt and Anneli Selvfors in the parent research project to identify the activities relating to the different ways of obtaining and getting rid of a product. Rexfelt and Selvfors initiated and participated together with the author, but also Lisa Wendt and Elin Hagman participated since they carried out a sister project to this one with the same origin but with a different approach. The process of the workshops was to write down activities on post it's and stick them to the related path, sometimes individually and sometimes by verbally describing the activity and discussing the formulation before writing it down and placing it.

In order to get insight in what users think about circular use paths a questionnaire (Laugwitz et al. 2008) was created. The form was spread publicly by the author on a social media platform, mainly reaching the authors network, which generated about half of the responses. To receive more answers about other obtainment paths than "buy" it was also spread in a social media group about collaborative economy and one about aware consumption with the encouragement to provide more answers about circular paths which gave the result of 60

participants in total. The participants were spread throughout the ages, but most within the target group range of young adults. More specifically 26,7% were below the age of 25, 41,7% between 25-35, 23,3% between 36-45 and 8,3% above 45.

In the beginning of the questionnaire the participant was asked to choose a recently obtained product, which about 67% of the following questions would be about. The first part tried to identify why the obtainment path was chosen, what other would be more or less possible. The second part related to the use phase and mapped out problems associated with owning a product, acceptance to sharing the product and probable ways of riddance. In the third and last part of the questionnaire the user answered questions about what hinders or enables them to get rid of a product in general.

When all the insights from the workshops and the questionnaire were gathered, the author sorted all mapped out activities in chronological order and filled out the gaps found looking at the new order of activities. This was done by a mental walkthrough of the activities to make sure that no major activity was left out, similar to the cognitive walkthrough (Bligård et.al., 2010)

2.2.2. Circular access to products insights

The large majority of the users filled out the form about a product they recently bought, but some received it as a gift, leased or borrowed the product. Unfortunately, no responses were collected about trade, rent or subscription which also shows the current situation of how products are obtained in general. Participants chose freely to enter products which they were very pleased with, which turned out to be mainly within the categories of vehicles, home electronics, wearable electronics, kitchen products and clothes.

The vast majority had purchased their products. When asked about what other way they could consider to obtain this product, "to receive as a gift" was obviously on top. A bit surprisingly trade was second, followed by borrowing. Least probable paths of obtainment were subscribing, leasing and renting, showing the general situation on the market today.

Looking at what is important to people, the function and specifications are most important, followed by the opinion that the need/use was justifying the cost, that it is a good deal. Considering this is products that they are very pleased with, people do not want to compromise the function, a bit more open to discussing what performance is needed, but they are open to compromise about the looks and especially the cost to get a product they are very pleased with.

Even though 67% answer that they consider themselves to own too many products, the majority do not think it is a problem to have these products. If they are worried about their products, they consider the product to be fragile, but also that they seldom/never use the product. Based on this, 80% may consider to share / lend away / rent away their products. The motivation for why or why not the user can consider to share their products is shown in table 1. The result is presented in no particular order, but more common answers are presented in **bold** and opposite words are placed on the same row. The answers may be product properties, types of use and user mindsets.

Table 1. Products suitability for exchange design. More common answers in bold.

More suitable for circular use		Less suitable for circular use	
Product properties			
Mobile		Stationary	
Hygienic		Intimate / Unhygienic	
Long lasting		Consumable	
Durable		Fragile (sometimes hard to inspect)	
Adaptable		Permanent individual	
Sustains value when used		Lose value when used	
Types of use			
Occasional / Seasonal use		Frequent use	
Forgotten		Frequently considered	
Life situation specific		Lifelong suitability	
Used by several users simultaneously		Single person use	
Not everybody has one		Everybody have their own	
Own the right to distribute		Do not own the right to distribute	
User mindsets			
Trusted enough to be used by others		Not anybody is trusted to use it	
Ok if product is unavailable for a while		Product needs to be always available	
Like to make it available for others		Private	

Based on the answers about the most probable way of getting rid of a product, people seem to choose what appears to them as the best balance of time, effort and money, with time being the very most important of these three. This shows that they prefer ways where they are usually not required to put too much time themselves, resulting in a preference of giving away. They have a wish of selling but often end up just simply storing it at home, sometimes because of a too strong emotional connection to the product.

All the time and effort needed to eventually retrieve some value out of it leads to an inactivity, which is why 67% think they own too much, and 95% can admit that they have a few or many products that they do not use at home. When asked what is needed to actually get rid of a redundant product, the realization that the product is redundant is most important closely followed by that the user should be bothered by it for some reason, it occupies space or does no longer suit the user. It is also very hard to determine the economic loss of no longer having access, and what it can be worth to somebody else. On top of this is the mentioned emotional bond to the product, the dreams and hopes connected to the thing,

such as the book that never got read or the tennis racket which you never have time to play with. To actually get rid of the product, it seems like a combination of the following, with the most important on top, are the way to go:

1. Somebody else should be able to use the product
2. Considered environmentally friendly
3. Quick and efficient
4. Retrieve the product value
5. Not do any work myself

2.2.3. User journey insights

Based on the activities mapped out during the workshop and gaps filled by insight from the questionnaire, a user journey with activities related to the obtainment and riddance of a product was formed. An illustration of the full user experience journey will be presented later in figure 7. That illustration shows how the obtainment, use and riddance may look for one user. Each activity in the illustration is a cluster of activities which is presented in full in appendix 1, since this list in full is used during the development process presented later in this report. To make each phase more graspable, each of the three parts will be explained separately first. When reading this, keep in mind that each activity may be the reason why a certain path is chosen but also a reason for not going through with the obtainment or the riddance. Some activities may also be the reason why the product is not used as much as desired in the use phase.

Obtainment phase

In the obtainment phase which is shown in figure 4, the entire user journey starts with the **ignition** which commonly is started in one of three ways: a want and/or need of a product is created, an opportunity to obtain a specific product appears or a want to obtain something from a certain provider. Through this ignition a **product want/need** is created, which is a notion in the back of the mind of what you want/need which often develops into an aware notion of what you need. This can be a weak or a strong need.

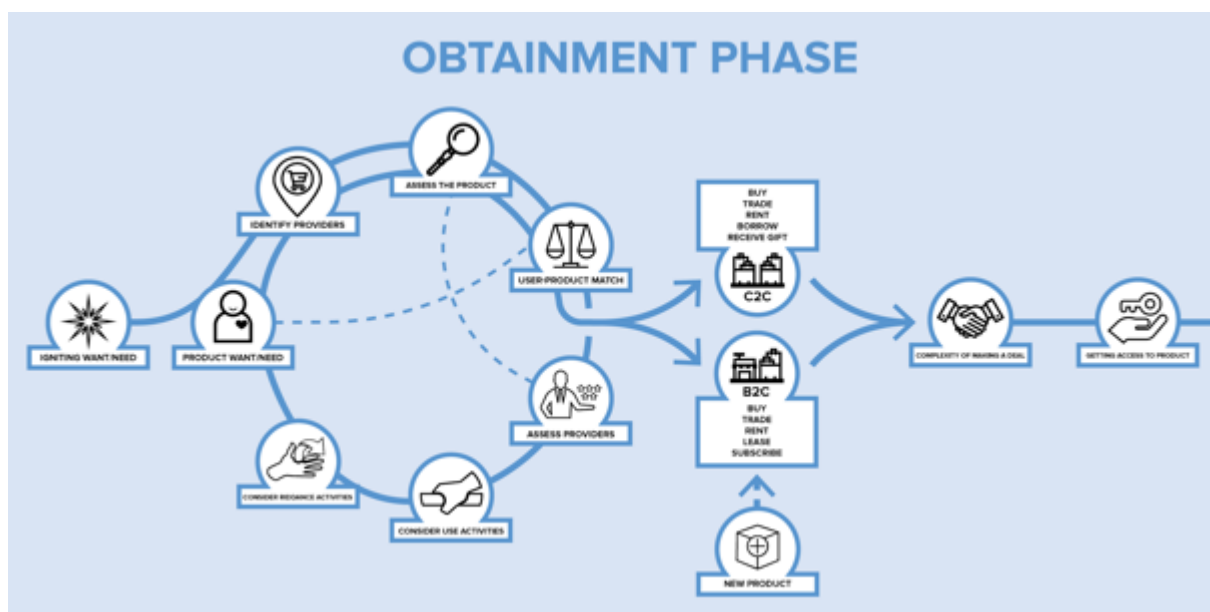


Figure 4. Visualization of the clustered activities of the obtainment phase

When the product want/need is created, the user has entered the spiral of activities that may occur one or several times, in any order, and different effort and thought may be put into the different activities based on what product will be obtained. Some of these activities might be subconscious if an obtainment path is habitual. When the user **identifies providers** she first casually browses the range of products, to then continue into browsing the product range with focus. This usually develops into an exploration of preferences, and that she identifies more specific needs.

To **assess the product**, the user may search for bargains and good deals or search for specific product with regards to the identified needs. For certain products, it might be important to experience the product hands on, feel the quality, test out the function and get an overall impression of the product. For important or more difficult obtainments it is common to read reviews, value ratings or even ask a friend for advice about the product. Sometimes this goes hand in hand with being convinced by the provider, either by talking to salesmen or reading product descriptions. The assessing of the product is completed when the user has decided upon which product she wants.

The activity that always ends the spiral is the **user-product match**, whose last step is to come to a conclusion about the Use/Cost ratio, $\text{Use} > \text{Cost} = \text{Good obtainment}$. To reach this subjective and highly influenced decision, questions like “How much am I going to use it?”, “When and for how long am I going to use it?” and “Is it worth it?” might occur in the users’ mind. It’s about estimating the need over time. Also to match identified needs to functions in the product, how well the product meets the desired function and consider if the appearance is close enough to personal preferences. On top of this the user needs to decide the consequences for the economic loss during use period, how this affects the own and family economy, impact on the environment and sometimes even social risks of going through with the deal.

The user might be done with the user-product match or getting back to it, however the user needs to **assess providers**. Are there multiple options? Does one provide access to the product when desired, better delivery options, bring added value, more suitable contract time or is much cheaper than others? To get help upon which provider to choose, reviews, ratings and friend’s advice about the provider might be valuable. After choosing the desired provider, making contact might vary largely in difficulty, as much as the complexity of establishing trust for the provider. Sometimes the user has a strong need to communicate her needs to the provider, feel that the provider understands her needs and provide confirmation that the product fits her needs.

For some products, the use phase may be significantly different depending on which obtainment path is chosen, which prompts the user to **consider use activities** already in the obtainment phase. The differences might be the possibility to a trial period, the responsibility distribution of service and maintenance, and the simplicity to make a complaint or return the product. Those are more connected to which provider the user chooses, but also the possibility to show off the product to others, if it means an implicit social debt or even an expected counter-performance because of social constructs, might swing the user from one obtainment path to another.

In the same manner, the user might need to **consider riddance activities** since the chosen obtainment path might require a desired or undesired agreement of how to end the use

period before first access. The user might also need to consider means of transport needed to get rid of it and what help is needed to get rid of the product. Even more hypothetical questions like “Does it create a problem to not have the product if you have had it once?” might become highly relevant.

When more or less effort have been put in by the user in all these activities within the spiral, the outcome based on all the considerations within the spiral have decided which path to go. At first glance, the step of deciding which obtainment path mainly consists only of this step of choosing consumer-to-consumer (**C2C**) or business-to-consumer (**B2C**) but it is heavily influenced by activities before and after, which is why this entire user journey is created. In this step, the actual product is presented to the user. It is introduced either through a used, refurbished or **new product** through the business, or a used, sometimes refurbished, product from another user.

The user is now faced with the challenge and the **complexity of making a deal**, which also might vary largely in complexity depending on obtainment path, mainly if the deal requires both parties in agreement or not. But the user might need to convince the seller that she is the right buyer, confirm her identity to the provider or make the provider trust her, sometimes through a credit check. Also, transactional events like bargaining, deciding payment method and possible counter-performance or value difference. When this is done, the user needs to make the crucial decision; “Go” or “No go” before signing the deal.

In one last step before the product can serve its purpose of being used, when the user is **getting access to product**, some unexpected obstacles might occur. First the user need to define when access is needed the first time and make sure access is available when needed by ordering, booking, checking availability, reserving or asking for permission depending on which path is chosen. It might be complicated depending on the provider to decide for time and place if you need to find a match in both parties’ schedules. The user also needs to plan the delivery and sometimes determine the end of access. Depending on which provider, the execution of the delivery plan may include packing and there is also a possible delivery waiting time. Bringing the product home from the provider, the package delivery service point or just from outside the door might be an important factor. As a final step the user needs to review the condition of the product to determine if she also needs to file complaints or renounce responsibility of damage to product upon return.

Use phase

Now the user is leaving the obtainment phase and entering the use phase which is illustrated in figure 5. It starts with the “**unboxing**” which is carried out quite differently depending on which obtainment path the user chose. The activity contains the first contact with the product, with or without an actual box since the product may be ready for use and just handed to the user. It also contains the installing of the product into the user situation, adapting it to the user’s preferences. A natural part of this is also to handle the eventual wrapping and consider if current inventory needs to be adjusted because of this newly accessed product.

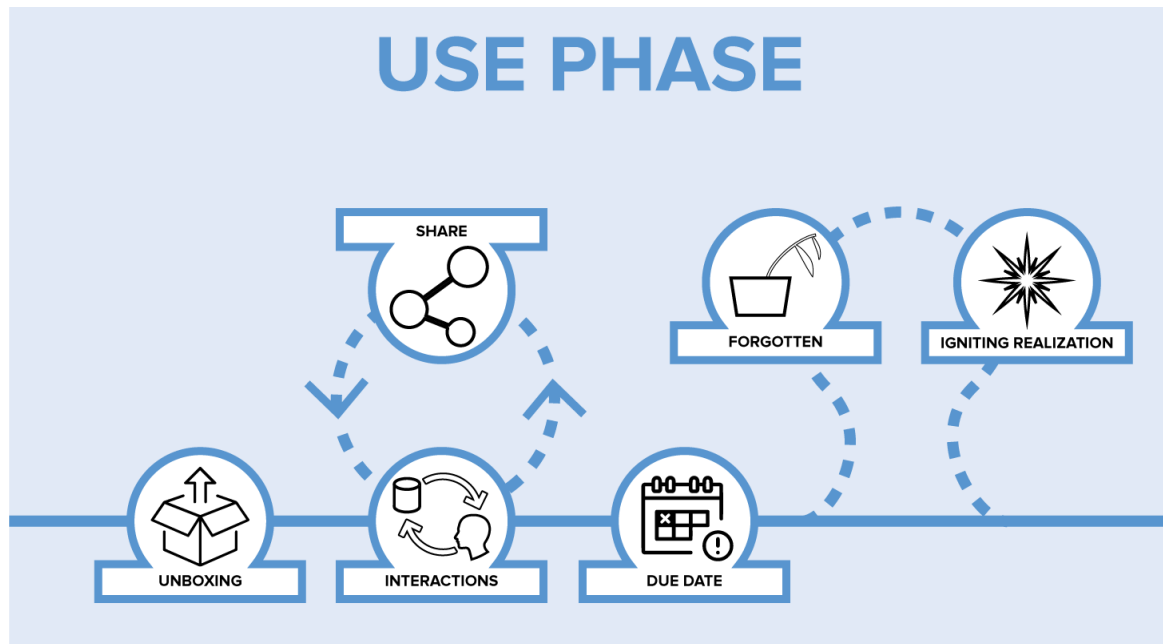


Figure 5. Visualization of the clustered activities of the obtainment phase

The **interaction** is following, it is the main part of the use phase and contains user-product interactions but also interaction with service staff, co-users and other possible temporary users. This activity may have a duration for as short as minutes or up to several years. Essentially the user checks the availability before use, uses the product, determines if the use needs have been fulfilled and evaluates if the product was suitable for the need after use. Each use situation might also lead to an evaluation if the user should keep the product or return it to make use of a possible trial period, complain, consider service and maintenance, or give the provider feedback. Some obtainment paths also make it more likely that the user feels that she can show off the product to others.

During the activity of *interactions*, the user might **share** the product with others. One way is by co-using it which means that both the user and some other user uses the product simultaneously. Other ways are to make the product available through any obtainment path for another user, e.g. lending or renting it out.

Now the user has reached the moment where the product is **due time**, which essentially is when the user does not need the product anymore. This can occur when the user is annoyed by the product for any reason e.g. occupying space, being worn out or similar, but can also be based on a prior agreement of when the access period is due. Here the user needs to realize the redundancy of a product and consider effects of no longer having access to this product. Questions that might pass through the user's mind is "Is it a bad deal economically to get rid of the product and to regain access?", "Is it hard and time consuming to regain access to this product?".

Dwelling in these questions might lead to a sidetrack marked by the dashed line in the figure. It is easy that the product becomes **forgotten**, which might happen in several ways. A typical way is the thought that "it might come in handy" which leads to that the product is actively stored away for potential further use. One way is that it just ends up somewhere, without further thought about it with high probability that it is stored away in a rush some

time, or is put away by somebody else leading to that it ends up being lost. Another way is that there is not enough time or it requires too much effort to get rid of it at the moment.

If the product is *forgotten* it needs some kind of **igniting realization** to get back on track to continue into the riddance phase. This typically happens when the user clears storage space/garage/wardrobe/attic which might be initiated because of outer pressure to get rid of the product, because of a changing living situation such as the user moving to another living space with different storage space available. Other common ignition is large financial changes, both positive and negative, but also marriage or separation. It can be that somebody else wants it gone or economical pressure to get rid of it. Another way is when the user identifies redundant products because of new or planned purchase, sometimes to rectify the new consumption. It may also be when the user is obtaining a replacing or similar product which can be an adjustment or upgrade of the product contract. Sometimes the user ceases an opportunity by identifying and engaging in spontaneous riddance opportunities, such as when a relative is going to a fair or to the recycling station with spare transport space. Among many ways to ignite the realization, it might also ignite because of a reflection about who you are and how keeping this product align with that identity.

Riddance phase

Sometime in the past, recent or a long time ago, the decision has been made to actually get rid of the product, that means we have entered the riddance phase which is illustrated in figure 6. The phase starts with the user **realizing redundancy**, which at first might be a notion of redundancy in the back of the user's mind, but is usually more aware for every encounter with the product, or some other reminder which makes you aware of the redundant product.

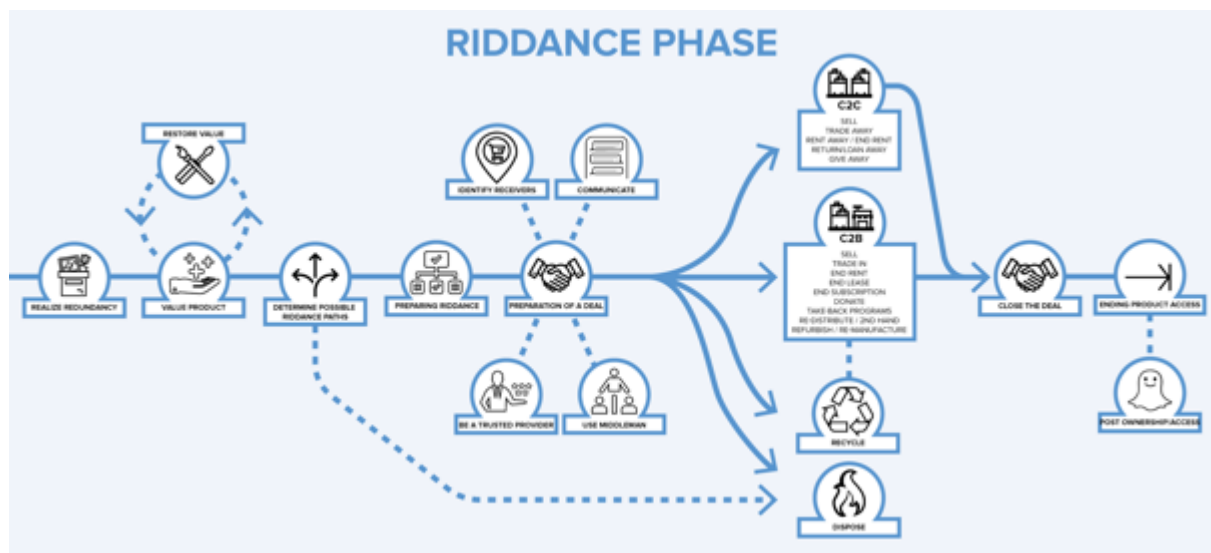


Figure 6. Visualization of the clustered activities of the obtainment phase

Following the realization is the next important step to **value the product** which essentially is about the user needing to screen the product to determine the condition, continued need and to rate the economical or need value of the product for someone else to be able to determine pricing. This might also include to determine the price and effort to pay to get help with the riddance of the product. To reach this value estimate the user might need to sort out products to get rid of, rate the economical profit or loss and consider the product's sensitivity

to trends. If a riddance path is chosen which returns the product to the user after a while, the user needs to weigh the risk of wear and tear compared to returned emotional or economical value.

When the value is established, if needed the user may consider activities to increase or **restore value** and compare it to the effort and cost of the activity. A simple way is to gather accessories; the manual, add-ons, packaging and receipt. Something that might be a bit trickier depending on the product is to clean it, and if a bit more effort is put into the value restoration it can also be repaired or refurbished.

After the valuing and possible value restoration, it is time for the user to **determine possible riddance paths**. For a low value product, the easiest way is to determine the value to zero and dispose it, which avoids several riddance activities and abruptly ends the product life cycle. If the product will be handed to someone else the user might need to browse the range of riddance services and consider how high cost and how much time/effort each path requires. Some paths and receivers provide extra value so the user needs to weigh pros and cons for different paths and receivers, e.g. to decide if the cost of the middle-man is worth the added value or value certain receivers return-deal-offers. Ethical and moral values might come in here and make the user reflect about who she is and what she wants to do. After this it is time to choose path, "Go" or "No go" to decide that she does not want the product anymore.

Now that the decision upon which riddance path have been made, the user is **preparing riddance** which might include to consider what help is needed to get rid of product, what means of transport is needed but also save, transfer and remove data. Some might want to save memories of the product, use it one last time or take a picture of it. Depending if the riddance is permanent or temporary the user needs to plan the personal product unavailability, the start and stop of access. If the user does not know the receiver, she needs to create promotional material, take pictures for advertising, write description or prepare an oral explanation and publish this advertisement.

The user has reached the other side of the *complexity of making a deal* which is the often complex **preparation of a deal** from the provider side. From this activity, several or all of the surrounding activities are needed to reach the next activity of *closing the deal*.

Within the activity to **identify receivers** the user needs to establish some kind of connection with the receiver, identify possible middle man, make contact with receiver and most often establish trust for the receiver. This can go really smooth sometimes but also be frustratingly hard sometimes.

For some participants in the user questionnaire the most frustrating part of the entire riddance phase was to **communicate with receivers**. This includes correspondence, to answer questions, communicate flaws and the condition of the product but also to communicate instructions about use and rules to avoid misuse of the product. If value is transferred between the provider and receiver there is a possible need to ask for a deposition, negotiation is common and sometimes offers of counter performance services. All in all, it is about reaching a both party agreement.

Many organizations provide services which lets the user avoid many of the activities during the riddance phase, all these are gathered under the activity of **collaborate with middle**

man which can be really simple. It can also be a bit complex depending on what activities are handed over. The user might need to understand terms and conditions, consider insurance options and decide on price together with the middle man.

If the user chooses not to use a middle man she needs to **establish trust as a provider** which means that she needs to convince the receiver that she is the right provider, which includes the sometimes uncomfortable step of making her personal data and contact information available to the receiver. The user might also need to provide proof of ownership, the right to provide the product and also prove her identity to the receiver.

After putting more or less effort and time into the activities surrounding the *preparation of a deal*, the output is one of the four riddance activities, either **C2C**, **B2C**, **recycle** or **dispose**. As you can see, the user might spend time and effort into the previous activities but the product still ends up being recycled or disposed if previous activities fail in some way.

If the user chooses to bring the product through any of the C2C or B2C activities it is time to **close the deal**. Here the user needs to choose payment method, execute the payment, register transfer of ownership/access and create a receipt. The product might need a screening before hand-off and the delivery needs to be planned. It can be by shipping it, to be available for pick-up or meet-up with receiver. This is also to get a return of eventual deposition and possibly to pay the middleman. Somewhere in all of this, the decision of “Go” or “No go” for the riddance phase has been achieved.

The deal is settled and the user needs to be **ending product access** to make it available for the receiver. Some of these activities might have been carried out before based on the belief that the closing of the deal would go all right. The user might need to uninstall the product and wrap it for delivery. The user will decide for time and place to close the deal, find a match in both parties' schedules, decide logistics, delivery method and cost for delivery and execute the delivery plan. Within some riddance paths it is also more or less required to provide a reason to terminate or pause the access to the product.

After all these activities, one might think that the user is done with activities related to the product, but during the time **post ownership / access**, several activities may occur which might encourage or discourage the user to use the same riddance path again. First the user might need to restore the product's context, e.g. fill in holes in the wall. If the product now is used by another, the user might need to stay available when the other user is using the product. If it is returned to somebody it might be expected that the user provides a counter performance service and evaluate the social outcome. Depending on the obtainment and riddance path the user might rate the new user or provider, give feedback, evaluate new offers and handle complaints or returns. The user may also receive confirmation of accomplished exchange, receive feedback that the product now serves a purpose with someone else.

Complete user journey

To get the bigger picture, the three parts are illustrated together in figure 7. Here you can see that the obtainment phase has a lot of activities that are simultaneous or repeated but is in general quite linear and simple to follow. The use phase is not the focus of this project and since only the activities related to the obtainment and riddance phase is illustrated it is quite simple to follow. However, it contains the crucial possibility that the product ends up being

forgotten, which needs to be avoided or challenged to enter the riddance phase. The riddance phase itself is a bit more complex and have many optional ways to do things, since a lot of the activities depends on product and choice of riddance path.

In the upper left corner of the figure there is a legend explaining the differences in the activities. The red activities just seem to happen, without further thought, which means that they happen with little mental and physical activity. The purple activities happen with more mental activity and less physical activity meaning that the user might do this activity in the back of their mind, over a short or a longer period of time. The blue activities require less mental activity but something need to be executed in the physical world, some hands-on action is required.

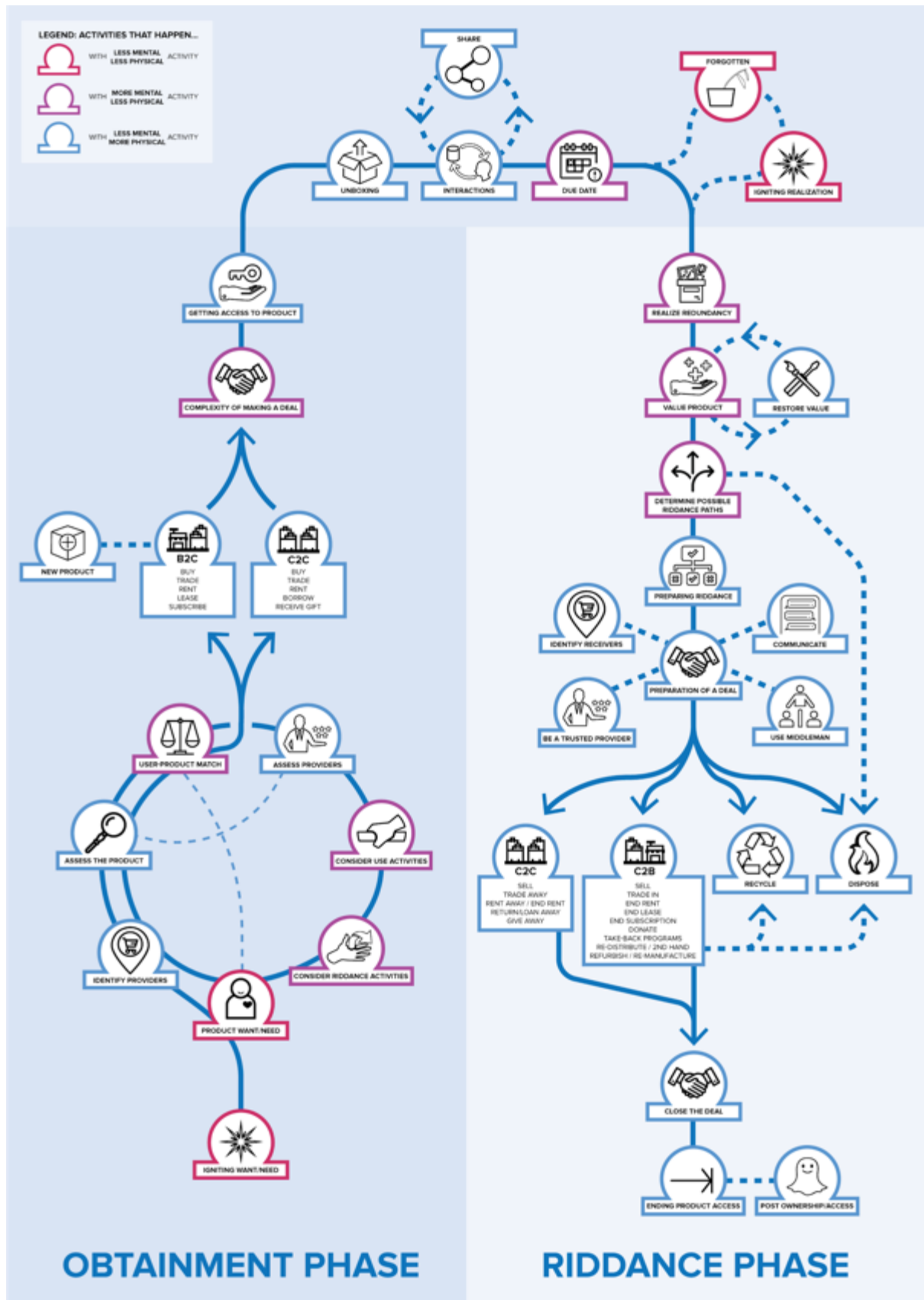


Figure 7. Visualization of the entire user journey with the three phases; Obtainment, Use and Riddance.

In addition to this, since the goal of this project is that a product will be passed on from one user to another, an illustration of the product journey is presented below in figure 8, which shows a hypothetical way of how this could be done. The shades of blue/green lines are the different users journey in relation to the product, and the red line is how the product is introduced, moves from one user to another until it is recycled and hence no longer is the same product.

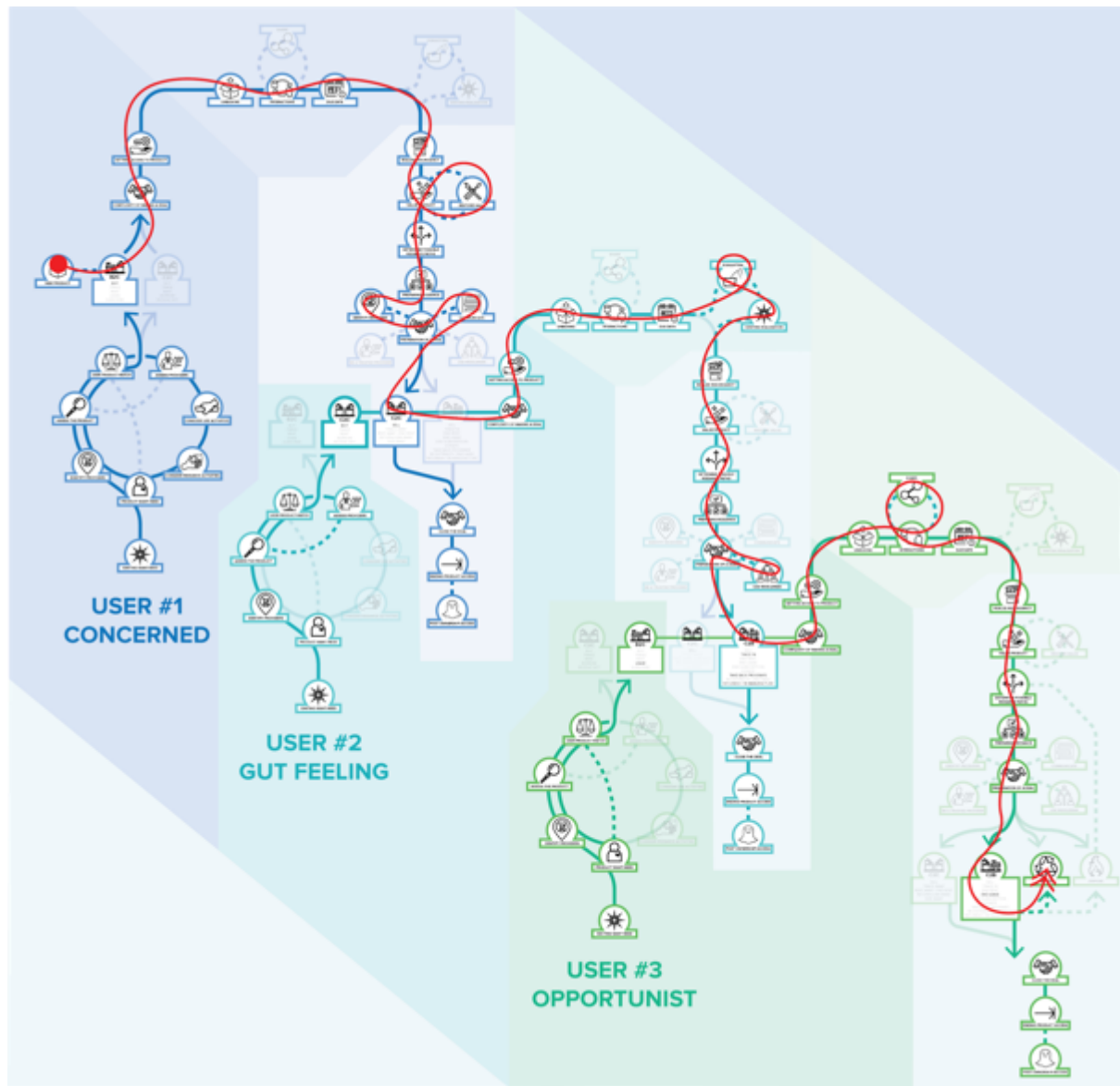


Figure 8. Visualization of how one product may travel through several users and how each user relates to the product all through the user journey.

This illustration can be used to realize many things, one is that there are a lot of activities before you make the deal to obtain a product and even some after the deal to get rid of it is done. Depending on what personality the user has, the user journey can look very different. The more concerned user may spend more time in the initial spiral and more effort is spent keeping the product in good condition. A user basing many decisions on gut-feeling may care less about future activities, paying no or little attention to the use or riddance activities before obtainment. This kind of behavior might result in the product being forgotten for a

while and less effort is put into the riddance phase. The third user might jump on an opportunity about a good offer, not even paying attention to what provider is offering the product. In this case it was a leasing option and since everything is predetermined the riddance phase goes very straight through. Beside different user types, of course all this also depends on which kind of product is being analyzed.

2.3. Circular product market exploration

In order to know what was out there in the beginning of this project the circular products available on the market was explored. This was done to be able to not repeat work already done but also to gain inspiration about circular product systems.

2.3.1. Method

When performing the circular product market exploration many companies, services or platforms that provide users with circular use options were found as examples in the theory research. Some other examples were found in various articles about circular economy found while searching the web for insights using keywords such as circular economy, sustainable consumption, consumption trends etc. Additional providers were added from the author's previous knowledge.

The providers were organized in a list, grouped together depending on what obtainment path the providers use to distribute their products. While visiting the websites of the different providers two lists were compiled, one with what those who succeed have in common and the other with what those who do not succeed do. All these providers were also mapped onto where in the user journey they offer value to the user, the activities without any providers attached were established as gaps in the market.

2.3.2. Results

The current well-known range of services providing users with circular use options are found in the most common path of buy/sell with providers such as Ebay (USA and spread global), Blocket (Sweden and spread global), Tradera (Sweden) and Craigslist (USA and spread global). These big online marketplaces are connecting users and do usually not provide any extra value except providing with logistics alternatives or safe payments. This way of consuming is also the target for many recent startups aiming to reduce the hassle of riddance. Examples of these new providers are Sellpy (Redistribute clothes, Sweden) and thredUP (Redistribute clothes, USA). These new providers offer some added value by relieving the user of riddance activities, e.g. taking care of valuing the product, promoting and market it.

There is also a lot of companies providing even more relief, but also keep a bit more of the profit. The most common is that in addition to valuing, marketing and selling, they also clean and refurbish if necessary. Examples of this is Gazelle (Refurbishment of phones, USA) and Furnishare (Furniture, USA).

Another uprising market is around other circular businesses such as AirBnB (Housing, Global), Snappcar (Cars, Netherlands), Zopa (Peer-to-peer loans, UK) and Hygglo (Home products, Sweden) which allows users to rent out what they own when they do not use it. These organizations provide the connecting platform, create trust through verification of identity, insurance and safe payments but do not do anything with the product itself.

Providing products as a service have also been proven to work very well in recent years. Companies allows temporary access to things they need for a limited period of time and return it when not needed anymore. Sunfleet (Cars, Sweden), Klädoteket (Clothes, Sweden) and Toronto Tool Library (Tools, Canada) all have a pool of things available, and users access it when needed for a monthly fee. Everything seem to be able to be provided as a service, Philips now provides lighting as a service and Kaer provide air conditioning as a service.

Among many other services there are also many platforms providing things for free to others, either as lending/borrowing or giving/receiving things. Couchsurfing (Housing, Global) and Grannsaker (Home products, Sweden) offer different things for little to no money.

2.3.3. Analysis and insights

There are plenty of companies out there trying to make business out of circular use, with varying motivation. Some are in it for the money, some want to save the environment and some do it just out of solidarity. Some succeed more than others, and below is an analysis of what the ones that succeed do well and what those who have not made it do not do.

To increase the probability of succeeding with circular business models with the approach of looking of what others do good start by having a professional interface and marketing, as in any business. There are plenty of circular use organizations which just simply do not put enough money and effort to make it appeal to users, just having a green, good intention do not help if the users do not understand how to use it. That means that you need to keep the terms and conditions simple, preferably offer some extra value and make it more beneficial than the traditional buy/sell. Try to include costs which might feel like “extra”.

The organizations that fail do not reach enough volume and customers because they have a difficult process with low usability and it is clear that they have not put enough money into it and maybe based it too much on volunteer work. This reduces the trust to use the service and reduces the will to learn a new system that might not be there the next time the user want to use it if the organization no longer have any volunteers.

Since people in general think that new things are a bit scary, make sure to create safety. Identity verification, insurance options and rating / review-system by other users seem to be working for this purpose. Something that also make people feel daring enough to try is to provide easy returns for possible regrets, but also simplify return of the previous product if the user gets something replaced. This flexibility is highly appreciated, such as offering different options for different needs, upgrades and adaptation.

Make sure to stay true to the green brand since people examine companies that claim to be green closer. One of the key features for strong green brands is that they re-use what is possible, if not possible to re-use, refurbish, if not possible to refurbish, recycle. This provides an appreciated feeling of making use of unused resources.

From a business perspective, it is also beneficial to make sure to actually compete with the buy/sell market by providing unique things. Make sure not to fall behind the buy/sell competition and provide a large range of products and the ability to widen and limit the search. Provide access points close to where the user wants the product, or easy logistic

options. Also make sure to have great customer service to not provide circular use with a bad reputation, this includes to have a high up-time which provides high accessibility. Try to simplify the use phase, e.g. automatic refill of consumables inside product, free repairs and service & maintenance included.

If it is possible, try to reduce difficult steps in the riddance phase such as simplifying the difficult activity of finding a receiver, reduce bargaining, maybe provide the user with an offer and have the user decide “go”/”no go”. Also predetermined end of access conditions seem to be appreciated. However, no matter how good you do all of this, if it is disruptive you might need to adapt to new legislations trying to stop the business model.

2.3.4. Conclusions

There are currently no companies that were found during this market research which address the activities from the user journey ‘user-product match’, ‘make the customer realize redundancy’ and ‘determine riddance path’. In the following section are some thoughts about how to address that. Most other activities are partly or fully covered by one or several companies. In the riddance phase, most companies addressing this are very product specific and started recently. However not many companies simultaneously care for all phases, obtainment, use and riddance, and those who do are not paying much effort into it. No company seem to see the full picture of all activities.

There seem to be no companies providing user-product match on a deeper level than just assuming that the user wants a new smart phone and then ask three questions about what kind or other companies just simply comparing price between different providers. There seem to be a possibility to ask on a higher level, to ask about what service the user is after. Asking what kind of transport, not what kind of car. This could be used to offer circular options, not just the cheapest price for the same product. Maybe show similar products that provide the user needs and show providers which provide the desired services together with the obtainment.

No companies currently seem to make the customer realize redundancy. If the company should stay true to being a green brand, tell the customer when they have too much and ask them if their subscription still fits their needs or if the product should be offered to somebody else. It should also be possible to help the user determine riddance path by asking what is important for the user and present which options are available.

3. Product circularity outlook

This product circularity outlook part concludes the information gathered in the previous part and turn it into a useful foundation for the rest of this project. The insights from the exploration of product circularity part is narrowed down, converging from the widest part and presenting the important stepping stones for the future of this project. This is done through mapping of guidelines, clustering trends & insights, creating a vision and concluding in possible choices for the rest of this project which lead into the upcoming phase of investigating the product type specific research.

3.1. Mapping of guidelines

Initially, guidelines which supports sustainability in general were compiled, sorted and refined into guidelines for product circularity in particular. This was done to fulfill one of the three objectives of this project. These guidelines compiled and presented below served as inspiration for the upcoming design case and were later refined after the completion of the design case, in the end of the entire project.

3.1.1. Method

Current sustainability guidelines were investigated of how to design products for circular use. A majority of the guidelines were collected in bulk by Bergstrand & Jönsson (2017) but were sorted by the author and duplicates were eliminated. Some gaps were filled in by the theory researched in the beginning of the project. Additional gaps were filled in using insights from the market research and the questionnaire, these are the contribution by the author. The guidelines are divided into three major parts, “mindset guidelines”, “business guidelines” and “designer guidelines”. The designer guidelines are in the full final guideline list presented in appendix 2 split into “design for longevity” and “design for re-use” but here they are presented together since they share the same subheadings.

3.1.2. Mindset guidelines

Mindset guidelines include the guidelines which might help everybody in the product development process, no matter if you are a businessman, service designer or product designer. It contains guidelines which allows you to open your mind and provide the need of the user in a sustainable and innovative way. An example is the guideline of “Consider providing the product as a service”. All the mindset guidelines are derived from the guidelines collected by Bergstrand & Jönsson (2017).

3.1.3. Business guidelines

The business guidelines are divided into four parts, business model, business perception, marketing and distribution. About half of the guidelines under business guidelines are new, created by the author with inspiration from market and user research together with literature. The business guidelines are mostly applicable for businessmen and service designers.

The business model part is about general guidelines which apply to create trust and things to consider to not be a less desired business compared to buy/sell businesses e.g. “Test all products that have been used before they continue to the next user”.

Within the business perception part, you find guidelines about how the user should perceive the service and things which might promote circular business even above the reputation of buy/sell businesses. An example is the guideline of “Keep in mind customers transaction costs in terms of both time, money and energy. Investing time, money and energy contributes to making consumers approving and loyal”.

In the marketing part the direct communication with the customer is considered to make sure that the business stays competitive e.g. “Ease the perception of fixed and variable costs, insight in total life-cycle costs”. The distribution part provides guidelines which brings the circularity of your business also into the distribution closely connected with the product which is favorable in order to be considered a green brand e.g. “Develop reusable packing systems”.

3.1.4. Designer guidelines

This is the largest part of the guidelines which contains 14 steps of the product journey, from material choices all the way through the user journey into how it will be handled in the product's end of life. The majority of the author's contribution to this list is during the riddance phase where almost every guideline is created by the author based on user research.

Initially there are guidelines about how to choose materials e.g. "Use materials that age gracefully" followed by reasons why the design should be mounted in a modular way e.g. "Design modularity to be able to upgrade the function". Also, guidelines for marking of products are available e.g. "Publish manuals public and digital".

The majority of the guidelines are gathered under the headline "Form and appearance". Within these guidelines you find guidelines that trigger the desire to care for product long term e.g. "Support personalization and adaptation to each user", guidelines about creating a strong timeless look and also how to design for trust. Rounding up there is a guideline about why the design should keep a uniform design language throughout the product range.

Guidelines under "Design for shared use / re-use" are particularly relevant for this project since the project is all about making people reuse products. This part contains some less hands on guidelines such as "Enable value addition with every user" but also more hands-on suggestions are available under controllability e.g. "Design possibilities for easy screening, e.g. visually through attrition markings"

Classical design fields are included such as the usability guidelines from Nielsen and Norman which have been reduced to only contain the ones that provide an impact on circular use such as "Visibility of system status". Even the most classical sustainability design guidelines are included such as those for product life extension e.g. "Design for durability". But to balance it out also new thoughts such as design for detachment is presented as "Design so that people are able to let go of products they no longer need"

Following are the designer guidelines for the riddance phase since circular products need to consider guidelines for hygiene such as "Encapsulate dirty processes". Here there are also guidelines which will trigger and facilitate the riddance such as "Permit rapid and irreversible erasure of all personal data that may be on a product". The riddance guidelines round up with guidelines regarding the logistics of the riddance such as "Design the product so it is easy to move and/or carry".

Guidelines previously not considered in literature are presented for the user to experience solace in the end of the riddance e.g. "Counter regrets by soothing emotional connection to the product". All the guidelines within this part are created within the project based on the user journey. Here there are also some hands-on examples of how this could be done such as "If the product is redistributed, offer a possibility to borrow the product back". After this part, the guideline list end with some more traditional guidelines of disassembly such as "The product should be demountable with as few standard tools as possible".

3.2. Trends and insights

The following trends and insights based on the understanding of product circularity result in more comprehensible clusters. These clusters form the basis for a vision about how a circular product should be designed.

3.2.1. Method

Throughout the pre-study insights and trends have been collected and written down. This work was done to provide a better overview for the upcoming ideation. The trends and insights encompass at least one in each of the following areas with regard to the user in relation to circular use of products; Cultural, Psychological, Demographic, Sociological, Economic, Biological, Evolutionary and Technological. These categories are chosen based on the "Vision in product design"-methodology (Hekkert et al., 2011) and also trend institutes usually cover these areas. After all these insights were collected, they were clustered into clusters since they make more sense together. Below the cluster titles together with a description of their content is presented. The clusters with all the insights they are based on are presented in appendix 3.

3.2.2. Identified trends

People want to do good, and are starting to do so

On one side, people are selfish and care mostly about themselves and their closest family and friends, but on the other side people are prone to altruistic behavior and want to do what is good for the larger picture (Okasha, 2013). People are also ashamed of their behavior that is harmful for the environment (Kaiser et al., 1999). Recent trends show that people are in general more concerned about and aware of the environment, purchasing ecological products, buying second hand and donate more money to charity (Roos, 2017). This kind of prosocial consumption of spending our money on others instead of ourselves have shown to provide the giver with raised wellbeing (Fors et al., 2011). New environmentally friendly delivery services are growing rapidly, especially bike messengers (Fri Köpenskap, 2016).

Circular business models are booming

There is a current business trend of capacity capture which means that many companies start to use all their capacity and not let anything unnecessarily go to waste (Trendwatching, 2017). Together with this the global sharing economy is growing rapidly, with many of the world's most valuable startups emerging in this sector (Trend-monitor #1, 2018), this market was estimated to 2013 be worth 35 billion dollars (Botsman et al., 2010). Since 2012 the second-hand market is growing rapidly in Sweden, where clothing is the largest category, followed by cookware, porcelain, books and furniture (Roos, 2017). It is also widely spread among the Swedish people since 7 out of 10 swedes have purchased or sold something on Blocket, a Swedish site for buying/selling used goods. Among families with children even more, 9 out of 10 (Blocket, 2018).

The trend is to design for circularity, focusing on business models and offering access over ownership, not yet so much the design itself (Mont et al., 2003). With the rise of new business models offering circular options, people are exploring new revenue streams and supplementing their income by unlocking new levels of value in their excess resources (Trend-monitor #1, 2018). And since governments are starting initiatives to strengthen circular economy it seems to be a trend that will last. Some examples are that Sweden introduced lower taxes on small repairs (Finansdepartementet, 2016) and there were also

successful attempts to make public transport used more by offering it for free (Wilson, 2015). All around the world and throughout Europe there are more examples, Scotland being one with their Zero Waste Scotland initiative “Revolve”. An initiative which includes the Revolve certification which guarantees the quality of second-hand products (Zero Waste Scotland, 2018).

People are bad at estimating their needs

People rarely know the causes of their own behavior (Lench et al., 2015) and hoarding things becomes a psychological problem in many industrial countries with consequences for the wellbeing, not just for hoarders, but also their family and friends (Mont et al., 2013). People also seem to be bad at estimating their needs since the Swedes throw away almost ½ million tons of eatable food each year, per person that equals 46 kilos per year or 130g per day (Roos, 2016). This buying without really needing have led to that the storage industry has been one of the fastest growing segments in the commercial real estate business during the last 30 years (Mont et al, 2013). The bad need estimation is also showing that the actual usage time for many products is decreasing, e.g. the average European car is used 29 minutes a day and stays still the rest of the day; 23,5h daily. A power drill is in average used 15 minutes a year and is commonly designed to last for about 90 minutes of use (ibid). One way to measure this could be with sensors and currently small sensors are getting cheaper and are getting more widespread (Techcrunch, 2015).

Time is tradeable

Consumers are in practice most concerned about time followed by effort and money (Roos, 2017). With the appreciation of time as valuable as it was way back, the trading economy is coming back and new platforms allow people to exchange intangible assets such as time, space and skills, without any transaction of money (Botsman et al., 2011). Since money is still important Swedish consumers use special offers more and more (Roos, 2017) and splitting gas money through carpooling is increasing, one of the most well-known carpooling organizations in Sweden has increased from 35.000 members in 2013 to more than 50.000 now in 2018 (Skjutsgruppen, 2018). An increasing value change can be observed in the transit some people do from product owning to product access through the collaborative economy paths such as trade, loan and commerce through online communities (ibid).

People have a deep need for a sense of control

People are calmed by knowing how other handle similar experiences (Robinson, 1993) and the loss of sense of control may lead to powerlessness and inability. Not being able to control and that no one else can help either is hard. A sense of control is achieved by certainty, completion of tasks, understanding, prediction and consistency (Straker, 2008). When it is hard to predict, anticipated regrets occur leading to that people are afraid of making wrong decisions (Kaufmann, 1973). Because of this, people don't want too many options (Straker, 2008), but if not any available option feels right, then more options should be presented (Birkett, 2016).

We express ourselves through our things

Consumption is a way of building your identity through money, possessions, status and standard (Stiles, 2005). Humans have an urge to collect things and hoard them (Neuman, 2013) but are afraid to have less things, afraid to let go. Research show that the total number of products per household is steadily increasing and that people today tend to own

more than one product in the same product category. Examples of such categories can be computers, cell phones and TV's (Mont et al, 2013).

However, those who strive to earn much money and buy things often suffer from anxiety and depression. They also have more problems in their relations. Materialistic life goals and overconsumption is connected to psychological and physical health issues (Kasser, 2002). According to Maslow's Hierarchy of Needs humans first need to have their physical need fulfilled, then security, social, ego and last self-actualization. The ego is about building self-esteem, feel powerful and prestige. Self-actualization is about personal development and creativity (Burton, 2015).

People want to be recognized as individuals within a group

There is a current trend of individualism which means that consumers have an increasing desire to be recognized as individuals, having personal needs, rather than being treated as part of the mass market (Trend-monitor #2, 2018). These raised demands for adaptation lead to a culture of 'me first', which create an engaged, vocal and confident consumer (ibid). This search for more unique products that no one else have move consumers away from traditional and consistent brands (Trend-monitor #3, 2018).

When companies communicate directly with the user instead of through a middle-man, they have the possibility to use this information to adapt it to the user. A desire to fit everything to your own individual is also showing in the increasing appreciation for self-employment and that people want flexibility and adaptation to suit their needs. In the UK only 13% of people working 'nine-to-five' expect to be doing so in 10 years' time, they desire more control over their work/spare time balance (Trend-monitor, 2015).

Single households are increasing rapidly, by more than 30% before 2030. This is a part of the reason why the population is getting more and more lonely. Living alone make many feel they need to have their own of everything that is usually shared between several if they live together, e.g. vacuum cleaner (Euromonitor, 2017). The individualism extends to this trend of living alone as society encourages self-reliance (Trend-monitor #2, 2018). The desire to be seen and served as a unique individual also shows in a saturated consumer market, since customization and personalization benefit producers which is looking to differentiate their product range. Brands seek out new ways to allow customers to adapt a product or service to respond to the user's individual needs (Trend-monitor, 2015).

On the other side people want to belong to a group, some want to belong to a smaller group which is breaking away from the larger group, but still be part of some group (Baumeister et al., 1995). In some way people also want to be like others, people envy to some extent and are affected by group pressure and want what other people have (Schoeck, 1969). Somehow a balance needs to be found between being recognized as individuals but still belong to a group.

Swedes are prone and able to consume

Swedes currently have the best private economy in the EU (SBAB, 2016) which shows clearly since between 2010-2016 the consumption increased with 12,3 percent. At the same time, they believe themselves they only have increased their consumption with 2,3 percent (Roos 2017). The internet enables people's consumption since payment methods such as Swish and Paypal makes it easier than ever to safely transfer money (Swish, 2018 & Paypal,

2018) and e-commerce is steadily increasing year by year (Roos 2017). To get a rough idea about how much things is consumed, more than 50 million large and 200 million small electrical products is sold in Europe each year (Haase, 2001).

Consumption of experiences makes you happier

Consumption of experiences better define who you are as a person and consumption of experiences make you happier. Experience consumption generate more happiness in general in people's lives and it is also considered a better investment than a product purchase since less regret money spent on experiences (Airaksinen, 2009). Products can contribute to happiness, but to do so, the purpose with the purchase must be to do something rather than just owning something (van Boven & Gilovich). Correlation or not, but Swedes are increasing their investments in experiences and the Swedish people is increasingly happier. (Roos, 2016). The sharing economy brings new opportunities and allows people to access things they normally would not be able to afford or would be interesting enough to invest in for long term use (Trend-monitor #1, 2018).

Glocalization

The population of the world is moving into the cities, in 2016, 54,5% of the population lived in cities. By 2030, this is estimated to increase up to 60% (UN, 2016). When people move in to cities, they are also better connected with others which is a part of the globalization, which is the current trend about "when national and regional economies, societies, and cultures have become integrated through the global network of trade" (Lexicon, 2018). These global networks allow users to use more and more ratings and reviews from across the globe to create an opinion about a specific product. People like to involve several people, research a lot and find out other opinions (Trendwatching, 2017). In synergy with this globalization, people have a love for, and a need of a local context (Trend-monitor, 2015). This lead to the glocalization of products, which is "a product or service that is developed and distributed globally, but is also adjusted to accommodate the user or consumer in a local market." (Investopedia, 2018).

3.3. Vision for circular product design

Based on the trends and insights, with the aim to create a circular product the following vision was created. It serves as an alternative and/or a complement to the guidelines about how to design for product circularity. The vision consists of three main parts, the worldview, the statement and the qualities. The qualities which contains product and interaction qualities is made into a metaphor through an analogy. All these parts are created as a stepping stone to sum up the pre-study since it might be hard to keep in mind all parts of it and through this serve as a foundation for the following ideation.

3.3.1. Method

The worldview is the author's view on the world around based on the trends and insights and may include some slightly provocative thoughts. It is simply written as a summary of the clusters with the things closest to the heart of the author as prominent. The statement is what the author wants to achieve as a conclusion of the pre-study which might be a bit more emotional and focused than the initial research questions. The product qualities describe what qualities the product should assess and the interaction qualities describe how an interaction with such a product would be experienced by the user. To provide something

more graspable, these qualities are summed up in an analogy. All these steps are parts of the “Vision in product design”-methodology (Hekkert, 2011).

3.3.2. Worldview

In Sweden today we are living in a time of individualism where everyone is looking after themselves. With short term thinking, the industrialism and the linear capitalistic way of “take, make and dispose”-mindset the environment will soon be suffering from depletion of resources and pollution. Despite a common knowledge about environmental challenges, with a flourishing economy, the Swedes have never consumed as much as they do today.

With this new wealth, the basic needs of food and shelter is covered and more complex needs of expressing ourselves and self-actualization is prominent in the market. This urge for self-expression sometimes lead to purchase of things we do not really need. People with materialistic life goals and excessive consumption tend to lead to physical and mental problems such as anxiety and depression. The industry, financial system and the infrastructure is built around this linear model, leading to that buying things currently is the most common and most time efficient way to access things we might need. Owning things provides a sense of control. In the market, an urge to stand out from the crowd is rising, people want to be recognized as individuals with personal needs but at the same time, they still have a strong need to belong to a group.

However, the general opinion is that you are supposed to do what is good for others and for the environment, and people are starting to do so. More and more people are engaging in environmentally friendly activities and are donating money to charity. This kind of prosocial consumption leads to an increased wellbeing for the giver. Research about that consumption of experiences and purposeful consumption lead to happiness give a promising direction for the future. The urbanization brings people physically closer together and the globalization makes it easier than ever to connect with people you have not met before. All this provides a great opportunity for circular business models.

3.3.3. Statement

In order to provide a mission statement, the following statement was created to provide a direction in the project. This is based on the worldview and is more personal and emotional which makes it more specific than the initial research questions. The vision statement of this project after the pre-study is the following:

“I want to enable people to choose circular consumption paths by facilitating the obtainment and the riddance of products.”

3.3.4. Product and interaction qualities

To provide an understanding of what a product that supports circular use should be like qualities were derived which can serve as inspiration for an upcoming ideation process. These qualities are divided in product qualities and interaction qualities shown in table 2. The product qualities describe what qualities the product should assess with words used similar to how one may describe another person. The interaction qualities describe how an interaction with such a person would be like, describing how the interaction with the product should be experienced by the user.

Table 2. The interaction and product qualities for how a circular product should be like

Interaction qualities	Product qualities
Trusting	Honest
Intellectual	Preventive
Igniting	Understanding
Dutiful	Flexible

Based mostly on the reasons provided by the participants in the questionnaire, the qualities of the product should be honest, preventive, understanding and flexible. By providing these qualities the interaction can be described as trusting, intellectual, dutiful and igniting. These qualities influence each other, go both ways and may lead to multiple connections. If the product is honest it brings trust into the interaction. When the interaction is intellectual the product is experienced as preventive and dutiful.

The product should be honest to be as green as it claims to be, and be preventive if user behavior may reduce the reusability of the product. It should understand that the user may not always be acting sustainable all the time and be flexible to allow the user to adapt the product to the user's needs and stay as sustainable as possible throughout the use. By providing a trusting interaction the user is encouraged to continue the interaction. If the interaction also is intellectual it provides with an ensuring feeling that this is the way to go. When the interaction is dutiful it allows for the user to bond and feel a connection to the product but at the same time the user will be able to let go when it is time. If the interaction also is igniting the improved or sustainable behavior might be initiated or increased throughout the use period.

3.3.5. Analogy

A way to provide an image of how this person would be like, which you as a reader should be able to relate back to the qualities presented above. The analogy used to describe the interaction with this envisioned product is "Like a beloved butler". The user may bond with the product, the product serves the user but when it is time for the product to move on, it is allowed to do so.

3.4. Possible choices to design for exchange

The initial research found three natural ways why a product is no longer used.

1. The product is changing
 - a. Technically / Objectively: Broken, worn, consumed or outdated
 - b. Visually / Subjectively: Aged, out of fashion, worn or stale
2. The need is disappearing or changing
 - a. E.g. a child outgrows its pushchair
3. The circumstances change
 - a. E.g. a new law against carpool services without taxi license

With regards to this together with what was found throughout the entire pre-study five possible ways forward in this project were considered.

1. Products which is not used often

2. Products which is used often every day, but have a need/wish for regular upgrades
3. Products which is used often, but only for a certain period in life or during certain circumstances
4. Develop a new product which stimulates circular economy, e.g. a product which makes the user realize when already owned products are redundant and would be of use for someone else
5. Products that people would usually not have access to, but thanks to shared economy they will be able to

3.5. Choice of product type for the design case

Since another project with the same project initiator was running in parallel and working with “1. Products which is not used often” this was left out of the future for this project. During an initial ideation about products in the category of “2. Regularly updated everyday products” mainly involve quite technically complicated (e.g. smartphones) or fashion sensitive (clothes) products where concepts for circularity is common and under development e.g. second-hand shops for clothes or Phonebloks modular smartphone concept (Phonebloks, 2018).

The third option is promising, “3. Products which is used often, but only for a certain period in life or during certain circumstances”, and during further investigation this provided two interesting options. First it can be products available for a certain time of life, e.g. baby/children products, products for students or elderly products. The second way to approach it is publically available products which is used in everyday life but only during certain circumstances. There are currently plenty of car and bike-sharing services which could be investigated and improved, an alternative approach would be to see what other products could be appreciated in the public. Brief ideation suggested umbrellas or power banks.

The fourth option is difficult since it provides one huge benefit but also one backside. The large benefit is that it allows to make already produced products more easily into circular use loops. The backside is the paradox that we create more products using more of the world's resources to reduce spending unnecessary resources. If the product fails or is also forgotten and stored away, only resources is spent and nothing is gained. The fifth is really promising but only targets a really narrow target group which does not provide an example that people can easily relate to which is important for what this project want to achieve.

3.5.1. Narrowing down the alternatives

The third option “3. Products which is used often, but only for a certain period in life or during certain circumstances” was chosen, leading up to a crossroad. Either publicly accessible products which would be accessible on the go when the user need it could be investigated or home products for a certain time period in life. The publicly accessible sharing considered umbrellas (it's raining a lot in Gothenburg) and power banks but most possibility to actually design the product and not only the service were found in bike or car pools. They tend to provide many things suitable for the circular economy; multiple use, frequent use, showing the benefits of circular use models to the public and it is easy to get wide publicity.

One hope was to contribute to the “Sunfleet+” project which combines Sunfleet carpools, public transport for the three largest regions in Sweden and bike sharing in all these regions on one card. Unfortunately, there was no product development there. Another consideration was to contribute to the introduction of electric bike pools to the residents of Stockholm, but

responsible parties were unreachable. Because of how a collaborating partner would be beneficial and almost necessary within these complex systems and features of a bike sharing system, this path was abandoned.

The other path within the third option is “Products which is used often, but only for a certain period in life”. The most common “period in life” to design for is children's products which is only suitable for the child for a few years and then is ready to be used by another child. However, plenty of reuse is already done within this field through collaborating parents by passing on the clothes out of solidarity. Also new services such as Hyber (2018), is popping up providing subscription of premium children's clothes. Since much is already done for children's design, this period of time in life was not paid more attention.

3.5.2. Final choice of product type

The chosen alternative was to design a product which is used often, but only for a certain period in life. During the youth years or the time as a young adult many are moving frequently depending on changing life situation such as studies or new work but also because of a difficult housing market making subleases with short term contracts common in Sweden. A product for this market could be student (or any temporary housing) furniture, kitchen supplies and decorations. This is good from a circular economy perspective with huge potential in changing the mindset of young people to consider circular economy also later in life. It is also a possibility to make it more financially beneficial, multiple users, frequent use and reduce unnecessary use. It also provides the possibility to combine with other circular businesses like home sharing; if a bed is not used for more than a month, maybe offer somebody else to access it? Also growing businesses are a potential market for this kind of access to furniture as a service. To focus on something that everybody has a connection to, the most basic furniture such as beds, sofas, tables and chairs were investigated during the next part of this project.

3.6. Choice of circularity path for the design case

To make the project process more efficient, a circularity path was chosen for the rest of the project. This mainly provided guidance on what to focus on during the design process.

3.6.1. Method

A matrix was created with each of the about 180 activities from the user journey in rows and the possible obtainment and riddance paths in the columns. The matrix was filled out by the author reasoning with insights from the user research. A summary of the matrix is presented in appendix 4.

Each obtainment/riddance path was considered for each activity and was given the value of 0, 1 or 2 representing the probability for the user to choose this path based on each activity where “0 = Negative”, “1 = Neutral” and “2 = Positive”. Each activity was lined up under the corresponding heading. The headings were the ones previously illustrated in the user journey. The matrix was filled out by the author, reasoning with insights from the user research but still there were some more and less obvious biases. One of the obvious biases is that the author sees activities of owning a product e.g. responsibility for service and maintenance as something negative while others claim that ownership of products is important to users and hinders the acceptance of circular use paths as noted by Littig (2000).

For each heading, a mean value was derived and a grading system was applied where 0 to 0,67 equals low probability, 0,67 to 1,33 a neutral probability and 1,33 to 2 a positive probability that this path would be chosen by the user over others for this particular activity cluster. Those activities which would not be considered for a certain path were simply left out of the mean calculation e.g. “communicating instructions about use and rules to the next user” was left out for the path of “dispose” since there is no next user within that path. The result of what the paths scored and an analysis of why they scored as they did is presented below.

3.6.2. Result and analysis

The path of *buy* was heavily favored during the obtainment part of the user journey because of its current exposure, availability, large range of products and providers which provides the user with a high possibility to find a product fulfilling the needs with little effort. *Subscribing* ended up in a second place mainly because how this is considered during the use and riddance phase. *Trade* scored last because of the complexity of finding agreement between two parts with different interests. Second to last was *borrowing* due to the often one-sided win situation and the somewhat complex responsibility distribution.

The author who filled out the matrix appreciates when other parties take most responsibility for the products, the flexible access periods and possibility to adjust the product to changed needs. Because of this the path of *subscribe* was top rated for the use phase. Second and third scored *renting* and *leasing* due to similar reasons. Last even here scored *trade* due to the low probability of being able to return or complain if something breaks. Second to last scored *buy* due to the responsibility for service and the many tough choices to make when the product have reached due date.

During the riddance phase, it became really clear why it currently is so easy to get rid of the product by either *disposing* or *recycling* the product which scored the best, if the product actually makes it to the riddance phase and don't end up being forgotten. This because most of the activities of the riddance phase are something considered tiresome and is not wanted. Disposing and recycling were closely followed by *bringing back* the product and *give away* since many activities go away for these too. These paths were followed by *returning to rent/lease/subscription service* in the scoring. On the bottom of the scale was to *offer access via renting/leasing/subscription* due to all the complicated decisions the user have to make, which service to use, how much to do yourself and valuing all different services. All these activities, but still a part of responsibility of the product stays or returns to you. Second and third to last were trade and sell due to the similar amount of activities but since the responsibility of the product go away after the deal they scored slightly higher.

3.6.3. Final choice of circularity path

Based on the reasoning in the result and analysis the circular path of *subscription* seemed most promising and was the one circular path which was investigated further during the rest of this project.

4. Design case direction: Product type research

The two previous parts lead up to the decision to look deeper into furniture as a service through subscription in the design case within this project. Based on this decision, the second diamond in the triple-diamond process was entered and thereby also the product type specific research begun which contained market-, user- and trend-research. Also, further attention was paid to subscription as a business model.

4.1. Furniture market research

During the market research the access based furniture market was investigated, mainly focusing on the leasing and rental furniture market.

4.1.1. Method

To find out what kind of products and services there are out there the web was searched with key words like “furniture as a service”, “rent furniture” and similar. To get insight about what is done within modular furniture also “modular furniture” and similar were searched to find out different ways of putting furniture together. This since putting things together in modules is present in a few of the previously presented guidelines. Everything found were divided into four chapters; “Current situation in Europe”, “Hot market”, “Upcoming projects in Europe” and “Modular products on the market”.

4.1.2. Current situation in Europe

The market of temporary access to home furniture have been almost non-existent in Europe, especially in Sweden. In Europe there are some, like In-lease (2018) which is providing rental furniture and is in collaboration with the global furniture rental company Cort. However, they have been on the market for more than 25 years and their furniture sure shows it, as TechCrunch tells it “most of the inventory will make your apartment look like a dorm room” (TechCrunch #1, 2018).

4.1.3. Hot market

As with most gaps in the market, others have also found it and trying to make something work. Two hot startups are growing rapidly in USA. The first being Swivelfly which raised 7,5m USD addressing office furniture for growing businesses, making it cheaper than to buy if the lease time is between 1-6 years (Silicon Angle, 2016). For the private market the company Feather raised 3,5m USD to provide modern furniture for 3-12 month rentals (TechCrunch #1, 2017). On the other side of the earth some companies raise even more money for a similar business. Furlenco raised 30m USD showing that furniture rental is working for Indian millennials (TechCrunch, 2016). Also, the most complete service can be found through Rentomojo which raised 10m USD by providing a flexible rental service for the Indian market (TechCrunch #2, 2017).

4.1.4. Upcoming furniture as a service projects in Europe

In Stockholm, Sweden a hackathon under the name of Re:invent & Re:make aimed at increasing the reuse of furnishing. The winners pitched the idea of furniture as a service winning money to develop a business plan for the idea by the governmental innovation fund Vinnova. They aim at creating a circular system of furniture which also is trackable through a digital mark (Link Arkitektur, 2017). Currently the development is on ice waiting for the people behind the idea to graduate.

A company called STRATA also came up with the idea to design furniture for the circular economy. The background insight is that people throw out furniture on the street because they are hard to get rid of, difficult to recycle and the furniture often end up as landfill. Even if it would be handed to a recycle center, the furniture is not worth recycling because they consist of so many parts and materials. The current furniture manufacturing requires a lot of work to disassemble and it is usually not worth the materials that come out.

STRATA is based on the idea to provide products created in layers. A recyclable skin layer which is the top layer of products that are changed often, such as sofa covers, bed sheets and lamp shades. There is also a durable base layer which is the long-lasting parts, containing the structural parts of a product which can be the inner structure of a sofa, a bed frame or the shelf structure. There are also often middle layers which is everything in between the skin and base layer, meaning foam in sofas or mattresses. The main idea is that skin layers are fast and super recyclable in the system. Base layers are slow and can be reused and repaired. "It's about less material going into and out of the system, we really want to have less bulky waste." says one of the founders (Deezen, 2017).

4.1.5. Modular products on the furniture market

STRATA is aiming to create their own products which truly supports their idea about furniture within circular economy. As a starting point, they are trying out a furniture leasing service for 3-5 years using modular furniture such as the sofa Delaktig created by IKEA and Tom Dixon (STRATA, 2018). This sofa is probably the most suitable sofa, which is currently on the market, for the purpose of the circular economy. It is easy to assemble and suit most users since it is very easy to put together in a way that suits the user, and can change over time.

STRATA also have a way of thinking about using the same building blocks to create the base layer for many different furniture which may be a source of inspiration. Similarly, Vitsoe and the 620 Chair Programme allows for changing user needs since separate sofa chairs may turn into a sofa or the other way around with only one tool, any time the user want (Vitsoe #1, 2018).

Other modular systems that could serve as a starting point is the bed Auronde by Auping which provides a true timeless design. It has been around for 40 years but looks like it could have been created last year. Even though it does not provide as many possibilities as Delaktig, it allows for some user adoption by allowing three different heights for the bed. Through the simple construction it allows for all standard sizes on the market, four single bed sizes and four double bed sizes. It is 100% recyclable and Cradle 2 Cradle basic certified for the choice in materials which means that a minimum of 50% of the bed is made from recycled and recyclable materials (Auping, 2018).

Looking at tables Mehes by Ahrend provide a modular desk which enables easy and quick assembly, adjustment, expansion and efficient storage. For the end of life, the materials are also easy to separate for reuse/recycling. (Ahrend, 2018).

Vitsoe also provide the example of the 606 Universal Shelf system (Vitsoe #2, 2018) which is a modular shelf system. More common in Sweden is the Elfa shelf system which provide similar modularity and adaptability (Elfa, 2018). Both systems provide the flexibility to be able to adapt the system to the current living conditions and since they have been around very long they are trusted that the user may be able to order more parts if the needs change.

4.2. Circular access to furniture user research

Within the user research the user journey was investigated further to bring a deeper understanding of how it would be like to subscribe to furniture and also compare it to the current standard option of buying furniture. Also, another questionnaire was conducted probing insights about the current general opinion regarding subscribing to furniture.

4.2.1. Method

A concept weighting matrix (Wikberg, 2015) was used to determine which obtainment/riddance path to focus on was revisited with the new aim of subscription and furniture in mind. Each activity in the previous stated user journey was weighed from 1-3 (1 = less important, 2 = normal importance, 3 = more important) to create a truer apprehension about each cluster of activities from the user journey. This was done for the obtainment/riddance paths of “buying/selling” and “subscription/return subscribed product” since the path of subscription is the desired path and the path of buying is the current largest competition.

The same grading system was used as in the previous matrix evaluation but also colors were assigned to the values; 0 to 0,67 equals red and a low probability that this path would be chosen over others for this particular activity cluster, 0,67 to 1,33 equals yellow and a neutral probability and 1,33 to 2 equals green and a positive probability. Also, this matrix was filled out by the author, reasoning with insights from the user research leading to biases. One bias was that the grades were given based on the author’s previous experiences about these paths and assumptions about how it would be to subscribe to a sofa, even though have never been experienced by the author.

Regarding the second questionnaire, this time about circular access to home furniture, the same method and format were used as for the previous questionnaire. The 101 participants were spread throughout the ages, but mostly within the target group range of young adults. More specifically 26,5% were below the age of 25, 48% between 25-35, 15,3% between 36-45 and 10,2% above 45. Looking at the household situation 32,3% lived in single households, 64,6% smaller families with 2-4 people and 3% in large families with 5+ people. The spread of current occupation was 47,5% working and 46,5% students. The other 6% were in between jobs or on parental leave.

The questionnaire this time focused on finding out people’s different attitudes towards traditional buying versus circular subscribing access to home furnishing. The main focus was on the four most common pieces offered by furniture rental services; Bed, sofa, table and chair. Initially some assumptions about people’s current living situation were investigated. This was followed by questions about the general attitude towards subscribing to the different furniture pieces. Finally, the questionnaire investigated what is hindering and what is the benefits of subscribing to home furnishing.

4.2.2. Circular access to furniture user journey

By investigating the path of buy/sell in figure 9 it is clear to see that businesses operating within this obtainment path have been and still is focused on the obtainment part, some attention is given to the beginning of the use phase to help the user get going, which reduces returns and complaints. It is common that the furniture ends up being forgotten in a storage space somewhere. If the furniture and the user make it into the riddance process it is much red and yellow, the only green you can find is when a middle man relieves you from one or several of the activities associated with the riddance. Also, a lot of the options are still available in white, this causes many users to choose the dashed quick path down to dispose/recycling if the value of the product is close enough to zero.

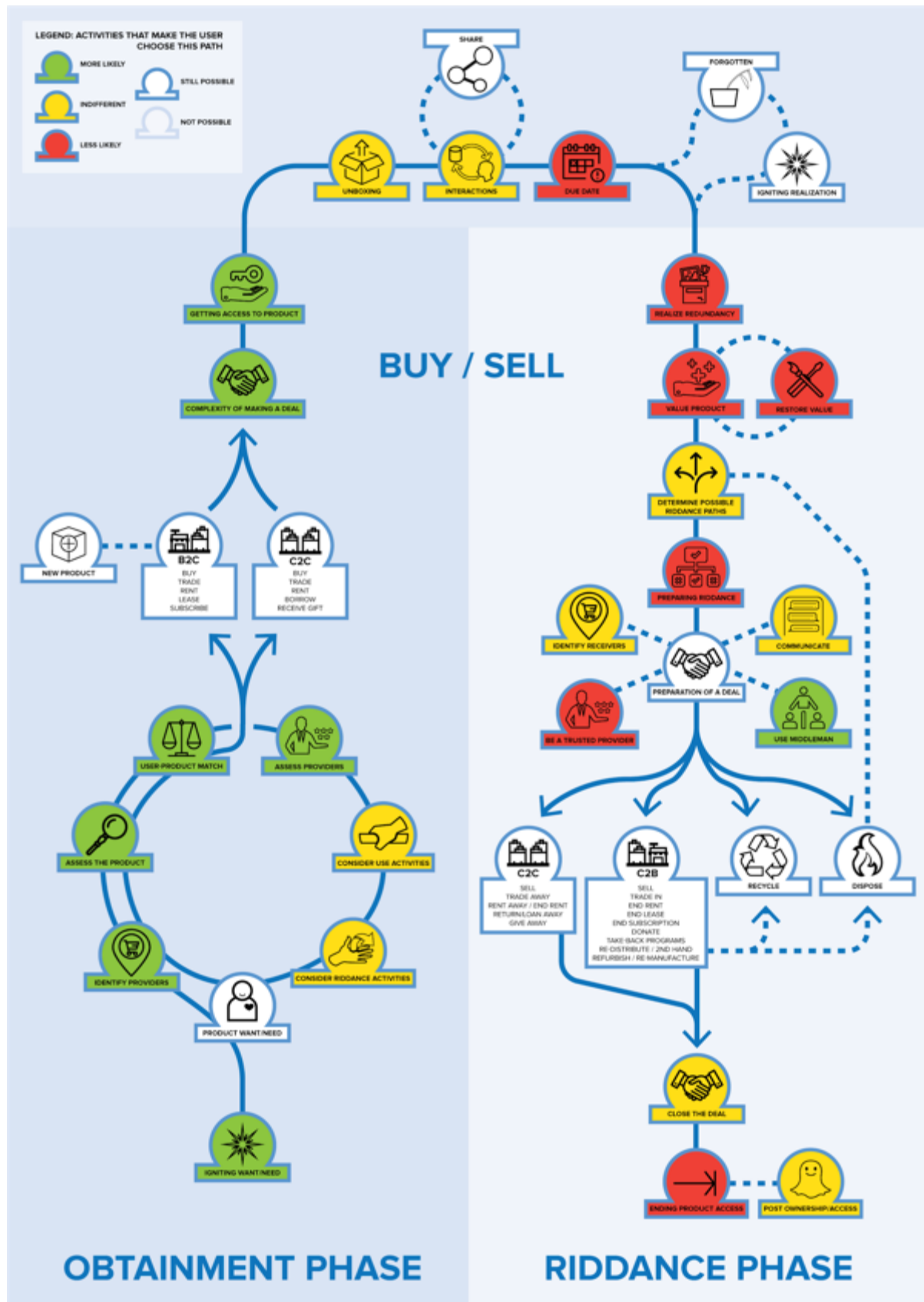


Figure 9. An illustration of the user journey for buying/selling furniture with the weighted average projected onto it

The second illustration contain the obtainment path of subscribe and the riddance path of returning subscribed furniture, which sums up being called subscription which is shown in figure 10. There are a lot of pain activities in the beginning of the obtainment because of less exposure, less providers and less product range than buying. However, there are heavy gains during the use phase since the user can typically focus on just utilizing the product, not think so much about delivery, service and maintenance. Especially big gains are after due date since subscribing will allow the user to be aware of when it is time to end and everything about the riddance is predetermined which make the forgetting loop and some other options fade out, since they are not really an option anymore. This also leads to all the gains during the riddance phase which makes it even easier than to dispose due to the fact that the logistics is already decided.

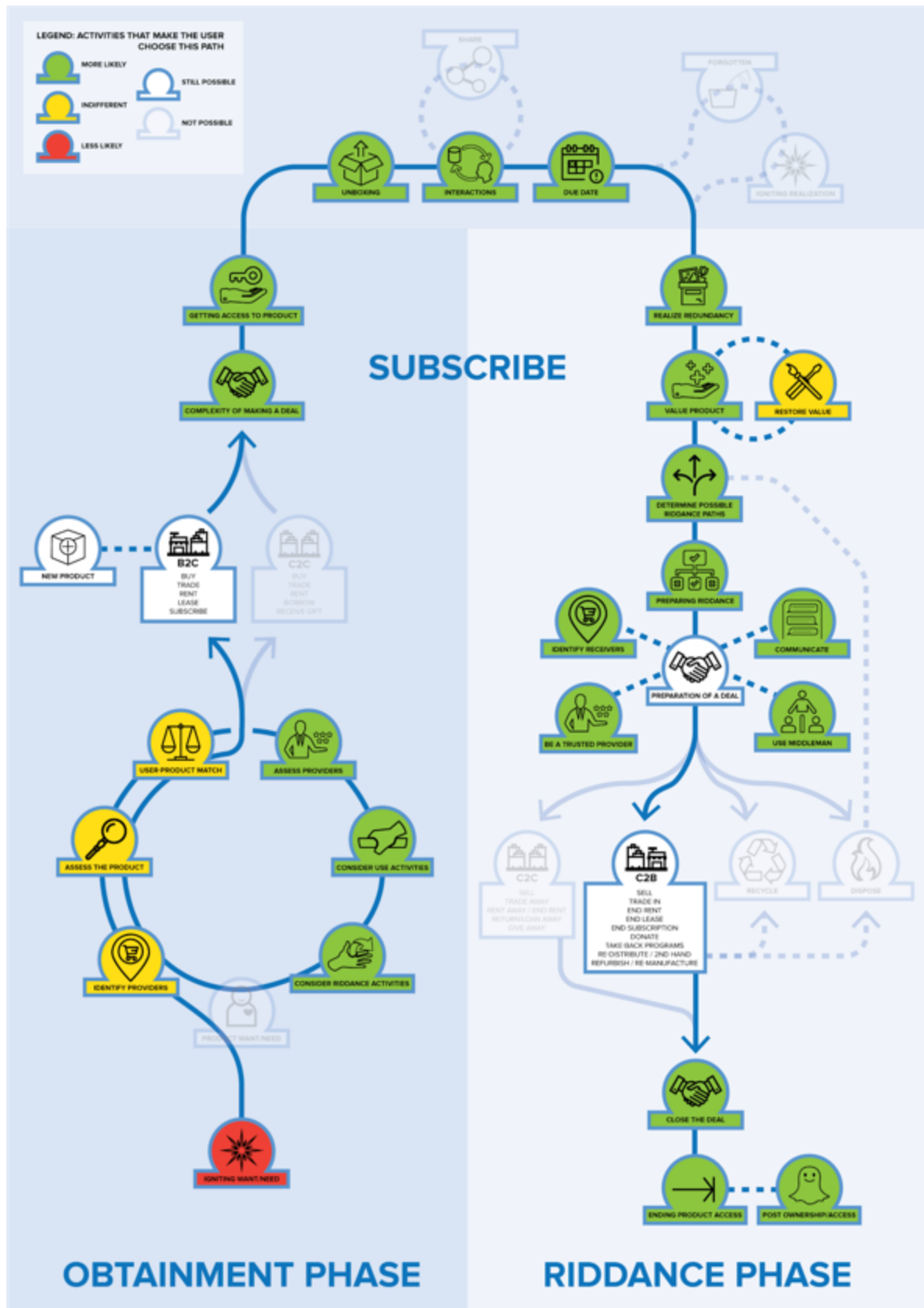


Figure 10. An illustration of the user journey for subscribing furniture with the weighted average projected onto it

4.2.3. Circular access to home furnishing insights

The questionnaire provided insights about the end user's attitudes towards circular access to home furniture. Initially in the questionnaire, assumptions were confirmed. An assumption was confirmed that a large majority, 79,2%, do not know where they will move next. One major assumption to choose this project direction was that people at some part in life move frequently. This was established since a majority of 59% will have to move within 5 years from moving in, 73,3% have previously been in such a situation and 88,1% believe they will or might end up in such a situation in the future. Looking at what is essential in a home almost everybody have both a bed and a chair. Almost as important is the sofa and the dining table. A bit less the coffee table and least prioritized among these things is the desk. This might be due to that a large majority use tables as a multi-purpose table, even though it is mainly a dining table, homework or work may be carried out there. Some also see a multi-purpose for their beds, sofas and chairs, but not to the same extent.

To see how people, respond to traditional marketing an offer of a sofa was presented similar to how traditional marketing looks like, a price together with one service which brings extra value to the obtainment. A picture of a sofa was displayed on top and the participant was asked to choose whichever obtainment option shown in figure 11 that seem most appealing.

<p>SOFFA FAGER 2-sitssoffa med sidobord, vit/svart</p> <p>5 995 kr / styck Den blir din (4 796 kr exkl. moms)</p> <p>Artikelnummer: 375.241.29 I den här kombinationen har du allt: en bekväm och kompakt 2-sits soffa med ett sidobord där du kan ha tekopp, bok och glasögon nära till hands. Perfekt på en liten yta.</p> <p> Inburen hemleverans från 399kr</p> <p> Köp</p>	<p>SOFFA FAGER 2-sitssoffa med sidobord, vit/svart</p> <p>199 kr / mån Så länge du vill Minst 3 månader (159 kr exkl. moms)</p> <p>Artikelnummer: 375.241.29 I den här kombinationen har du allt: en bekväm och kompakt 2-sits soffa med ett sidobord där du kan ha tekopp, bok och glasögon nära till hands. Perfekt på en liten yta.</p> <p> Inburen hemleverans inkluderat</p> <p> Abonnera</p>
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Figure 11. The two obtainment options made available for the questionnaire participants

The initial assumption was that people like to own things which was somewhat shown since 79% preferred buying over subscribing. Together with the options the participants were asked to motivate why they chose as they chose together with the probing question of "what else would you want to know to make a decision?".

Attitudes towards buying versus subscribing to home furniture

Some things regarding buying versus subscribing home furniture seem to be the key origin in the user's attitude. No matter if they seem to be pro buying, anti-subscribing or pro subscribing, people seem to see it through these key areas from their perspective. The first major key is about economic security and belief that the chosen option is the most economically beneficial. Secondly there seem to be a lack of trust for the new, a habit of always having it as it always has been and almost a stubbornness like "that's just the way it is". Third there seem to be a perceived freedom and flexibility with the decision they have made, no matter if the decision is pro buying or pro subscribing. The last key area which was nonexistent in the pro buying and the anti-subscribing is the people realizing how much less work the chosen obtainment path brings. These four key areas will be mentioned for the three different point of views below.

Pro buying

The main argument for those who were pro buying just did the simple math that it takes roughly 30 months to exceed the price to just purchase the sofa and assumed that they will use it for a longer period of time or be able to sell it for a few bucks to make it more economically viable. This came together with the arguments of wanting to own, it brings a feeling of safety and if something happens to the sofa it only affects the owner, making the user able to care less if she would feel like it.

Purchasing brand new brings a feeling of trust for the condition and hygiene of the product. If the product is purchased second hand the furniture also is accessed really cheap, and this price is sometimes compared to the subscription price since the furniture have been used. What the participants seem to appreciate about owning is that they can do whatever they like with the product, enjoy it in whatever way pleases them; care for it, care less about it, can keep it, store it, sell it, give it away or simply dispose it. This romance about what you could do, but most of the time do not do, just because you own it seem to be a reason why people also tend to store and forget products.

People who are pro-buying seem to be certain that their taste will not change for as long as the sofa is still functional, or simply do not care much about the taste, or they believe the furniture itself is flexible enough to suit into the next living space.

Another aspect is the simplicity of a one-time payment, it provides a simple overview of expenses, a certainty that I can afford buying now, but do not know if I can afford the monthly pay in the future. It is seen as a long-time investment and is part of the habit of buying as the only obtainment path. For some this habit is so strong they barely considered the other option before choosing:

"I am used to buying and keeping for a long time, so I chose to buy instantly, but the more I think about it, I become less certain".

Some also strengthen their choice by spending a lot of energy and thought into the "right" purchase, making them feel content about the decision.

Anti-subscribing

Plenty of the participants also are highly skeptical to monthly payment, mainly because they do not get a grip of the economy, leading that they are not sure if it is the better economical option or not. Reasons behind are that the user is certain to afford it when paying once, less thought is required or just simply "do not like monthly payments". The feeling is that the user lose control over how much money is spent, a fear that the subscription fee become more expensive than buying and the feeling of paying for something that you do not use.

If the user follows the habit of buying a lot about how the obtainment process works is already subconscious and do not require much thought capacity. The new way of obtaining by subscribing creates a feeling of unsafety and a risk that other family members do not want to subscribe. The new responsibility distribution provides an uncertainty about the consequences if something happens to the sofa, the user is afraid of complications, damage, cat scratches or stains causing problems or economical backlashes upon return. If the user buys, there is no worry to wear and tear it since the loss of function or value falls upon the user, no one else is affected. On the other hand, some users know that they will take well

care of things but have less trust in others. Summing this up, buying provides a feeling that you can care as much or as little you want about the product.

The current standard obtainment path of buying pushes a lot of decision making into the future, making it a more comfortable option. People do not want to spend energy thinking about how long or how much they will use it right now, that's a problem for later. Together with buying as the standard option, some users have bad previous experiences of subscribing to other things; gym, telephone, TV etc. Those subscriptions sometimes provide a feeling of bad terms & conditions, binding period, cancellation period and confusing fees. This leads to an expression from one users stating:

"Renting a sofa, silly"

Pro subscribing

Even though the majority of the participants were pro buying or anti subscribing, some were also pro subscribing. Initially people appreciated the free delivery and pick-up since it reduces the need of a car and carrying heavy furniture. Some also saw the economic benefits of no large initial payment and the availability to a bit more expensive furniture than what they usually would consider. Some saw it as economically beneficial since they usually give away or dispose furniture when done with it or since they will only need the sofa for a short period of time and thereby only pay for the time they use it.

Many also see the possibility to see it as an extended trial period, able to try out if it is comfortable, suits the home and serve its needs, to see if the sofa actually fits the home as imagined over time. This provides a simplicity to make interior design changes since the user may change style when she wants to. Some tend to get tired of furniture's looks after a while or just change their mind. The flexibility is appreciated as one user puts it:

"I do not feel forced to have the same piece for 15 years for it to pay off, taste and need is changing during different living conditions".

One thing highlighted by a participant that might be really important is the possibility to create a new home from scratch without the need to adapt it to previous furniture. It provides a freedom to fulfill the needs for a short term even though it might not be the most economical option in the long run;

"In my current living situation, I do not care so much what sofa I have, making subscription very interesting even if the product range is small, but when I own my own house I will be looking for the Sofa with the big S".

Other users see the clear benefits of the reduced hassle during the riddance phase. When subscribing to furniture it is easy to get rid of the sofa, there is no need to consider selling during the riddance, no need to list the item, find the next user, no stressful situation when the receiver wants to bargain nor stress of people not showing up during appointments. This increases the probability of good timing with delivery of a new sofa, reducing risk of being without a sofa or have to store two for a week. What stands out is the flexibility provided, allowing not knowing where to move next, if the sofa will fit the next living space and no need to store it if it do not fit the next living space. Even though these comments about how the riddance hassle would be easier, some participants were even more enthusiastic about the circular economy, one expressing it like: "I want to subscribe, it's the future".

Raised concerns about subscribing to furniture

Since the offer was not really complete with all terms and conditions, several wishes and questions arose among the participants. Some positive participants were suggesting that the user may subscribe to it and later have the possibility to buy it, that it would be great if the sofa get cheaper the older it gets and that it would be nice to have the opportunity to change the outer layer of the sofa when change is wanted. All these ideas were already in the proposed business model but were not made available in the questionnaire.

Also, some skepticism was raised by users that don't want to be forced to change if they don't want to. They don't want to be tied down to a contract and assumptions that there is probably some kind of fee associated with stains upon return even though nothing was mentioned about this in the offer. Another user would appreciate "to know who have had it before to decide if it feels ok".

Some of the users also reached some logical conclusions to discard the subscription alternative which might need attention in the development of the service. One got the feeling of paying for something that you do not use is only wasteful for monthly payments. Another think that splitting the price with family makes it cheaper only if buying. Some only see the value of the actual sofa and do not see any extra value in added services. The word subscription in is also a bit tricky since for some it means that the user will receive new furniture periodically even though it is explained what is meant.

Probability to subscribe to different kinds of furniture

With the current mindset about how furniture is manufactured beds are least likely to be subscribed by the participants, followed by sofa. This is probably because how they are not as simple to keep clean nor have the possibility to be repainted as they are manufactured today, leading to an unhygienic feel for the end user. The harder and less personal furniture, chair, coffee table, dining table and desk were more probable to be subscribed. People seem to be more eager to subscribe to furniture which is less intimate. This is confirmed when the participants were asked to rank the highest probability to subscribe which gave the result; Table, chair, sofa and bed.

When asked about things related to sofa access it is clear that owning is mainly seen as a greatly positive thing, probably because it usually mean that the user own a certain economical value stored in the sofa. But the linked responsibility for maintenance is mainly negative, even though some still see it as a greatly positive thing. Most join the opinion that knowing how to get rid of the sofa when it is no longer needed is seen as strongly positive. The unboxing of the furniture shows less strong opinions, but people are slightly negative to this experience for furniture.

Opinions about the features of the business model

To be able to form a business model, the participants were asked to provide their opinion about what is considered important as a service feature to be able to consider subscribing to furniture. Opposing to how rental furniture is marketed abroad, Swedish people seem to want to design their home according to their style, piece by piece and do not require any interior design help, package deals nor known brands. They are not that picky about payment options and are used to assemble their furniture themselves and do not require mounting assistance. What is important on the other hand is that the furniture is picked up

for free at the end of access but they still want it to be cheaper than buying and preferably no cancellation time.

To accept furniture that previously have been in another home the vast majority accept some minor visible usage, some even allow major visible usage as long as the furniture serves its purpose but 15% require the furniture to be entirely damage free. Looking at how picky people are in style 35,6% require the furniture to be exactly the users style, about half of the participants thinks “close to my style” is enough while the small rest are satisfied as long as it is a nice style, but maybe not the users style.

Looking at what is the largest hinders for subscription the most concern is that the users are uncertain if it is an economical advantage, uncertain about damage consequences, they consider it as unhygienic and have little trust in previous users. A small voice also raised concerns about how the upcoming users will be protected against lice and other vermin.

When asked about what is seen as clear benefits of subscribing to furniture a few do not see any benefits. Many see the environmental benefits and that it feels good that the products return to the provider, knowing that the furniture continue in a new life. Many also see the benefit of less responsibility, the simplicity, that it makes moving easier because of easier transports during both delivery and pick-up. It allows minimal commitment with less risk, no need for storage of furniture that does not fit next living space and no thought about what to do when the product is no longer needed. It provides the user with less risk, help with maintenance and mounting and no hassle to sell after due date.

The participants appreciate the flexibility in size, style, upgrades and that the subscription is adaptable to new needs such as a new hobby or the birth of a child. The flexibility allows the users to have furniture when they need them, makes it easier to vary the home and the ability to find their own style which makes it great for students but also for furnishing apartments for temporary work out of town.

Some also see subscribing as economically beneficial because it does not require a large startup cost and brings higher liquidity since the user do not need to lock up assets in furniture. It also provides the possibility to obtain a high-end sofa that the user would not usually afford if wanted. For some scenarios, it is also cheaper. The participants highlighted that this would also be really interesting for companies, and ideas about that the product range should include decorative furnishing such as larger paintings and mats. Several also wanted to see this for children’s furniture such as cribs and children’s seats.

Rounding up this questionnaire results some users really saw the potential of a circular business for furnishing. There seem to be a strong correlation between the positivity towards subscribing to furniture to people who do not know where they will move next, have been in a situation where they have to move and believe that they will be in such a situation again. There also seem to be a correlation with being in such a situation right now, even though it is not as prominent as the previous mentioned. However there do not seem to be any correlation to current occupation, size of household nor age group.

4.3. Digging deeper into the subscription business model

The choice of subscription as a business model requires some extra enlightenment. Subscription belong to the “access model” in Products that last by C. Bakker et.al, (2014).

During the upcoming design process, there are a few things to be aware of. There are five strategies to consider in particular when designing a product for an access model; Relative affordability, perception of freedom, identity, time and accessibility.

Talking about relative affordability means that if temporary access is the same price or just slightly cheaper than buying, chances are big that products such as a cheap sofa will be bought rather than accessed. On top of that, the furniture offered must be appealing and well maintained. The buying provides a feeling of freedom to perform the associated activity whenever the user wants to. This perception of freedom leads many people to own a screwdriver just to be able to hang a picture in the living room whenever they want to. This ownership also builds identity and status. Some belongings contribute to self-confirmation rather than to actually carry out their function. People purchase to create a statement about who they are. Temporary access of a product somehow need to find its way in to create this self-confirmation.

The concept of time need to be considered, it can be expressed in duration, but also in number of times. This is somehow connected to the perception of freedom since this concerns functionality. If a user needs a hammer-drill just once or a trailer for a few days or something else for a short period of time the user may be inclined to only gain temporary access. The user realizes that the product is obvious redundant since she cannot see the moment when she will need it the next time. This also lead into the accessibility which also is linked to the perceived freedom. For users, it should be easy to gain access to what they need. A good example can be the Sunfleet +, when the same card can be used for both carpool, public transport and bike pool (Sunfleet, 2018). Automated payment and no questions to gain access, that is good accessibility for the user.

4.3.1. Comparison between questionnaire results and theory

As mentioned the perceived freedom is a big deal for the users. The theory in the previous chapter states that only buying brings a perception of freedom. However, the questionnaire shows that the flexibility that subscribing may bring can also bring a feeling of freedom which might sway the user to choose the more sustainable option. The notion of how time is important to the user was obvious in both the theory and in the questionnaire. Those of the participants who saw the great benefits of subscribing were mainly happy about how much less work they will have, saving both effort and time.

In the book Products that last the graduation project by Sarah Bork is mentioned to have defined three users for product-service-systems: “High image”, “True Green and functional” and “Fast movers”. This goes well together with what is seen in the questionnaire where some users that could be classified as “High Image” want brand new furniture without any sign of previous users, concerned about furniture not being hygienic and do not trust previous users. The “True Green and functional” appreciate the environmental benefits and care less about what features the sofa actually have. The “Fast movers” mainly appreciate the flexibility that the service brings. This idea about three user types also goes well together with the three payment levels of the business model which will presented further down in this report.

4.4. Furniture fashion trend research

The trend research tried to get a grasp on the current situation of the rapidly changing furniture fashion trends to find out how the development of a sofa with “timeless” design would fit into the current trends.

4.4.1. Method

During the furniture fashion trend research trends were found by searching the web for insights using keywords such as “furniture trends 2018” and similar providing a range of online furniture fashion trend magazines with their analysis of what the current trends are.

4.4.2. Insights

The approach of timeless design may fit into the furniture fashion trends quite well. Based on the assumption that if some specific retro furnishing always seem to stay modern, they may be considered timeless. There is a trend for retro shapes (Ideal Home, 2018). One observed trend is the classic chairs with a change of the outer layer into bright colors, like these porter chairs by Brabbu (HGTV, 2018) shown in figure 12.



Figure 12. Bright colored porter chairs by Brabbu

Adding to the traditional material choices Seetal Solanki, founder and director of design studio Ma.tt.er, believes that we will increasingly see sustainable yet sleek surfaces that do not resemble the stereotypical recycled look (Interior Design, 2018).

“The biggest trend is the overall need for flexibility within interiors,” says Allyson Rees, senior retail lifestyle editor at the World’s Global Style Network. “Styles are changing a lot now,

people are renting more ... there's a need for furniture and decor to be more flexible." (LA-times, 2018). Another trend that seem to be ongoing is that the boundaries between home and work furnishing are becoming blurred with examples of retail stores including coffee shops and workspaces looking like living rooms (Interior Design, 2018). All these insights from renowned names and papers make it seem like the timing for what this project try to achieve is good.

4.5. Final choice of product to design

Through the previous product type specific research, it was found that all basic furnishing would be great to offer through a subscriptions service. However, since this project is time limited only one could be chosen to be developed. In the project five categories of products were found to be suitable to design for circularity. The chosen alternative for this design case was to design a product which is used often, but only for a certain period in life. During the youth years or the time as a young adult, many are moving frequently depending on changing life situation such as studies, or new work. People also move because of a harsh urban housing market, making subleases with short term contracts common in Sweden.

If furniture can be offered as a service for this target group, there is a huge potential in changing the mindset of young people to consider circular products and appreciate the circular economy also later in life. It can be financially beneficial, allow multiple users for the same product and also ensure frequent use since the furniture will not be unnecessarily stored away just because it does not fit the current living space.

Among the four different considered furniture pieces sofa, bed, chair and table; sofa was considered the most difficult furniture piece to design because it is quite a large piece, and more properties to consider than a bed, chair or a table. It was decided to design a sofa since if it is possible to design a sofa for the exchange situation, the other ones would also be possible. Therefore, a sofa offered through a subscription service was decided to be the design case for the rest of this project.

5. Proposed business model

In order to design a product which fits a circular economy, an initial image about what the service it will be a part of was designed. This was done to be able to know how large part the end user has in the interaction with the sofa. Through this business model one can find the responsibility distribution between the three user groups; repairing upholsterers, professional movers and the end user.

5.1. Method

The questionnaire together with the user journey provided inspiration to decide upon a target group and what kind of payment model will be offered. Other than this, the features the service would provide needed to be determined. This was done through looking at how other rental furniture businesses market themselves and what services they offer. The businesses investigated were the ones found with a similar business model, presented in the chapter “Hot market” in the previous part. During the questionnaire, the participants were asked to rate how important all features of the service were to provide insight in how this would be appreciated by the Swedish market. The features that the majority of the participants considered important were to be offered initially. The ones that scored highest were being shown prominently, a bit lower score would be shown when the user want to know more. The features that a majority of the participants considered unimportant would either be offered for an additional fee or will simply not be offered initially depending on their score.

5.2. Identified target group

Based on the initial research of this project, the furniture design would target people who will move within 5 years from when they moved in and do not know where they will move next. They want to furnish their home but do not want to commit to such a large furniture piece because of their uncertain future living conditions. They are people who see the value of not having to deliver, repair, relocate, find the next user etc. which were found as the main pain activities in the user journey. They also see and appreciate what makes this service environmentally sustainable.

5.3. Features of service

Below the features of the service are presented, with what is most important on top under each headline. Initially it is presented what need to be made clear for the customer from the beginning followed by what they will find out when they explore the service a bit more. In addition, add-on services are presented and also a few things to develop as the service grows.

Will be offered initially and shown prominently

- Free pickup at end of access
- Cheaper than buying
- No cancellation time
- Large product range
- Free repairs
- Subscribe to own
- Simple economic overview
- No binding period
- Awareness that it is environmentally friendly
- Low startup cost
- Free delivery

Will be offered initially but only shown when the user wants to know more

- Always available in stock
- Adjustment of accessed furniture
- Timeless style
- Style change of accessed furniture

- Possibility to upgrade accessed furniture
- Package deals (not requested by the users, but good for business)

Will be offered initially for an additional fee

- Moving
- Fast delivery
- Mounting

Will not be offered initially but maybe later

- Multiple payment options
- Known brands (collaborations with known designers)
- Wide product range
- Interior design help

5.4. Payment model

Based on what was found during the user research questionnaire the user will be offered three choices presented in table 3. The top one will be there for those who are extra caring about hygiene. The middle one will have a new fresh feeling since the skin layer is new but the base layer have previously been used and can be used over and over again. The last one is for those who just want to get a sofa as cheap and simple as possible and do not mind that somebody else have used the sofa before. The skin layer has been washed and have no major stains or tears. Skin layers which have major stains or tears will be recycled.

Table 3. The three options within the payment model

Brand new	Good as new	Functional
New base layer	Base layer has been used	Base layer has been used
New skin layer	New skin layer	Skin layer have been used

6. Research of chosen product

In this part, the process is once again converging, from all the insights brought by the previous product type specific research. Initially the business model in which the circular product will be provided is established. Some further product and service specific user research were conducted ensuring the holistic approach of this project which points out the three user groups; repairing upholsterers, professional movers and the end user.

6.1. Product specific user research

To gather insights about the sofa end user another questionnaire was conducted, now the third in order. This one was carried out to get a better idea about what kind of relation people, within the target group, have to their sofa today. How one might stand in the idea to pay per month to get access to a sofa which in the end of the use period return to the provider, without a prior decided end date. Alongside this, interviews were carried out with professional movers to get insights about what is hard and easy about moving a sofa. Interviews and observations were made with upholsterers to gain insight about the issues of repairing and refurbishing a sofa.

6.1.1. Method

End user research method

The same method as previous questionnaires were used. Also, an end user interview was carried out using the questionnaire questions to get a better awareness of how the participant might reason back and forth while answering the questionnaire. The questionnaire was spread publically and promoted in several groups on social media for student housing. This resulted in 15 responses. To increase this number everybody that had offered to help out in previous questionnaires were asked to participate via email, this raised the amount of responses to 18 participants.

The respondents were within the typical target group user, 44% between 25-35 and 56% below 25 years old. A small majority were 2 in the household, one respondent lived with 3 others and the rest lived alone. A large majority were students and the rest were working. The spread was good about how long the participants would live in their current living space. Most, 39%, will live three years in their living space, 1/6 each will live 2, 4 and 5 years and the remaining 11% will live less than one year before they are forced to move.

Initially two questions verified that the questionnaire participant was a part of the target group by two questions. The first was “Do you have a sofa in your home which you own*?” where own* was explained as *owned by you or somebody you live with and is not part of the rent. The second was “Do you live in a time restricted living space?” which was clarified with the text “E.g. a sublease with uncertain future, a student apartment which you only are allowed to stay in as long as you study or any other kind of time limited lease”. These two questions had to be answered with yes to participate in the questionnaire. This with the intention to only get answers from people who are in the desired target group.

Professional mover research method

Interviews were carried out with professional movers to better understand what is easy and what is hard or complicated about moving a sofa. A semi-structured interview approach was used (Wikberg et al., 2015). The prepared questions, available in appendix 5 were open asking about the difficulties about moving a sofa, making it easy to ask probing questions. Three different professional movers at three different agencies were contacted and interviews were done over phone. The professional movers were all men and had 2, 7 and 12 years of experience within the business.

Upholsterer research method

Three interviews were carried out with upholsterers to understand what is easy and what is hard or complicated about repairing or refurbishing a sofa. Three different upholsterers at

three different companies were contacted. A semi-structured interview approach was used (Wikberg et al., 2015). The prepared questions, available in appendix 6 were open asking about the common ways sofas break down, difficulties about repairing a sofa and what kind of damages make it more probable that the sofa end up being disposed. One interview was done over phone, the other two were done at the companies and were followed by observations which allowed for many probing questions. Two observations were carried out, one at a company who only refurbish the soft parts of the sofa as in padding and fabric replacement, the other one at a furniture carpenter who repairs everything about the sofa. The upholsterers were two men and one woman, all with over 30 years of experience.

6.1.2. Sofa end user insights

Initially some questions were asked to see if the participants were familiar with the uncertain living situation. The participants recognize the situation where they have uncertain living conditions and often have to move a lot within short periods of time since 83% do not know where they will move the next time they move, 89% have been in such a situation before and all of them believe that they will or might be in such a situation again in the future.

Current relation to sofas

When the participants were asked about how the specific sofa model ended up in their living space about half of the participants answered that the sofa was available to a good price. The second most common was that the sofa was conveniently available, commonly left behind by the person living in the apartment before for a reasonable price or the sofa was simply easily accessible and available at the time of need. After this the third most important thing was that it was a good-looking sofa with various reasons behind the argument; that it suits the place, a style icon, a famous design or a retro design. About a third of the participants also mentioned the size of the sofa being a reason for this particular sofa. Others are mentioning a need of specific functions, such as a sofa bed, but also that it was a coincidence, for free, good weight or good condition.

The most common way to obtain the sofa was to purchase it second hand, closely followed by purchasing it brand new and some also received it as a gift. However, only 17% consider their sofa to be exactly their style, a vast majority think it is close to their style, some think it has a style, but not their style, and one participant even think it doesn't even have style, but keeps it anyway.

Regarding the properties of the sofa, 72% of the participants owned a 2-seater and 33% had a 3-seater. A surprisingly large part of 39% of the sofas were sofa beds. If the sofa is considered a cheap alternative seem to be the thing that makes the user decide upon the sofa since 78% did not consider they needed to compromise on the price. The "cost" is the least likely to be compromised, leading the priority order of how the participants compromise, followed by "function", "looks", "size" and the participants are most likely to compromise about the "quality".

When asked about how the participants care about their sofa 67% answered that "It is a bit sad if something happens to the sofa, but what happens, it happens". 22% cared more than this but a few also cared even less. A vast majority were pleased or very pleased with their current sofa. However, possibly a bit contradictory, as many as 83% want to change something about their sofa. The most common they want to change is the size, mostly to a larger sofa, increase the softness, add a chaise lounge, sofa bed functionality, possibility to

change skin layer, corner sofa, no sliding cushions, more hygienic, higher to allow easier cleaning underneath and the possibility to lie down. About 65% have had the same wish since the sofa entered their home.

Even though such a large part of the participants wants to change their sofa and that change have been so since it entered the home 67% still will move it with them to their next living space and as much as half of the participants will even move it with them when they move into a more permanent living space. If it would not be possible to move it with them, they would try to sell it, and if that does not succeed they would give it away or recycle it.

A vast majority considered it painful to move a sofa between one living space to another. Most of the participants have not spent a lot of money on their sofa, 55% have spent less than 2000 SEK, 39% have spent between 2000-5000 SEK and only one has spent more than 10000 on the sofa. The previous notion that people care about the cost a lot is proven since 67% have spent less than 500 SEK to get the sofa into their home, but some have spent between 2000-5000 SEK. Regarding how much time they have spent on getting the sofa into their home, 50% have spent less than 2 hours and 50% have spent more, one mentioned spending more than 15 hours to finish the process.

Acceptance to the proposed alternative way of accessing a sofa

The proposed business model was explained to the questionnaire participant as in the previous chapter. Since people have spent as little time as possible on getting their sofa into their home, 44% thought they could save less than 1 hour on this kind of service. 28% think they could save 1-3 hours and equally many think they can save 3-5 hours.

What they appreciate most about the service is the possibility to change when a style change is wanted, the free delivery and pickup and that it is environmentally friendly. Also, the flexibility to adapt the sofa after change needs and the possibility to keep the sofa without paying for the sofa when the value of the sofa is paid. Other things mentioned which some users picked up between the lines is the economic advantage of only paying for the time the sofa is used, that the sofa becomes available when not used anymore and that there is no need to find a buyer.

When asked about what they would be skeptical about, 27% answered that they saw no flaw with expressions that it sounds “like a dream”, “almost too good” and “brilliant”. However, some concerns were raised by others, such as that they believe it will be more expensive than buying and a general dislike for monthly costs. Also, there seem to be a lack of trust that it will feel truly fresh and a fear that lice or vermin will spread by sharing a sofa.

The participants were asked to imagine that they are in a situation where they do not have a sofa but do want a sofa, and in that case, how much would they be willing to pay for such a service as described. The answers indicate that the will to pay for such a service is widely spread. To make it more graspable, half of the participants can consider to pay more than 90 SEK/month and the other half less. But the answers were spread throughout the range, willing to pay between 270-299 SEK/month on one side and on the other side of the spectrum they are not interested of such a service even if it was free. Even though some extreme answers were received the responses were quite evenly spread from 30 up to 179 SEK/month with a median answer of 90-119 SEK/month.

After this, three options were presented. The middle one was “Good as new”, the one introduced earlier with a previously used sofa framework but a brand-new skin layer. The price for this was determined to be the answered price per month from the previous question. Alongside this option two other options were presented. The “Brand new” option offered both brand new framework and skin layer which would cost 50% more. The other option “Functional” offered both previously used framework and skin layer, where the skin layer is washed, which would cost 50% less. This approach led 67% to keep the hygiene level, 28% could consider a used but washed skin layer in order to pay less and only one was willing to pay more to get a new framework.

When asked to motivate their choice, those who chose functional reason that “If the sofa is whole and clean I see no reason why not to?”, that it will be worn anyway, it’s low cost and because it is like buying second hand. Some who chose “Good as new” reason that they could have considered “Functional” if there is a possibility to inspect the skin layer before choosing, if they could feel the cushions and if they could get insight in how the washing procedure works. Others reason that it is cost efficient, cheaper than “brand new”, considers it fresh and “it feels new to me with the new skin layer”. It brings enough trust that it keeps whole, a feeling of second hand and environmental benefits but fights the fear of vermin. The one choosing “Brand new” considered it worth to pay more to not have to consider vermin, or chemicals to treat them.

The participants were provided with some features that the sofa will possess. Confirming what was found during the initial trend research and in the furniture fashion trend research, the majority of the participants the flexibility of the system, the possibility to change after changing needs and style and the modularity. Other benefits lifted were the environmental benefits, that it is easy move and have an easy assembly. However only 22% could consider to pay more for this functionality, a vast majority could consider to pay what they previously were willing to pay for the service. One thought that these features would make the sofa look awful without even seeing any sketch of what it would look like, reducing to pay for the service with as much as 75%.

One of the described features were an optional sensor which would help the user to realize their needs, this was received with skepticism by several of the participants. However, an even larger part was not skeptical to anything about the sofa features. Other concerns were raised that these features would reduce the comfort or the style, that it might be complicated to fit all the features into one sofa and a risk that it will be impersonal through the risk that all student friends have the same sofa.

General opinions

Rounding up the questionnaire with general opinions several comments were very positive, such as “really great idea” and “would like to see a company like this as soon as possible”. Some concerns were raised that the looks of the sofa would be very important, that some would like to be able to touch the sofa before signing up and that they hope that there would be offered a product range with the same features, not just one sofa model.

Outcome

- The most common reasons why a specific sofa is chosen is because of the cost, conveniently available both regarding location and time and that it looks appealing.
- A two seater which function as a sofa bed seem to be highly desirable

- The target group do not care so much about their sofa when in use
- People want to change size, mostly to a larger sofa, increase the softness, add a chaise lounge and have sofa bed compatibility.
- People are pleased with their sofa even though it is not exactly what they want, they want to change it but they still want to move it with them until they find another sofa they want more.
- People appreciate the flexibility and the possibility to change together with free delivery and pickup
- The target group is cost sensitive
- A part of the target group is afraid of hygiene issues; however, this issue is negotiable by a low price
- If the most expensive offer of the service can be offered for less than 179 SEK/month and the cheapest about 79 SEK/month it should be possible to make this proposition fly
- The idea about offering three different price and hygiene levels seem to be appreciated as anticipated to reach a larger part of the target group
- The sofa system need to be flexible enough to offer some personality
- About ⅓ of the participants love everything about this proposal

6.1.3. Professional mover insights

The overall attitude of these professional movers was positive, that everything is easy to move (except pianos and grand pianos) since it is their job and they are good at it, and that moving a sofa is not that hard. They all also considered that there was nothing wrong with the sofa, it was just some houses that were the problem.

Asking further questions about what in particular could be hard however resulted in quite many situations where it is hard to move a sofa. Most of the complications occur when the sofa is large in volume or heavy, and get increasingly complicated when the sofa is both large and heavy at the same time. The main problem occurs when there is a narrow passage such as a door, which can be really narrow if the building was built earlier than the 1950's. This situation gets even more complicated if there is a sharp turn right after the passage. In these situations, it is easy that the sofa scratches something protruding, creating a tear on the stretched fabric on the fragile sofa or touches something else that leave a stain. But these are only problems depending on the weight and volume of the sofa.

Some moving companies always wrap sofas before they are moved since they are fragile and easily stained or torn if it touches something on the way in or out of the living space. When the sofa need to get moved up or down a spiral staircase for several floors the plastic get slippery against the sweaty arms and hands, if there is no place to get a good grip this might get really difficult.

Also, large, soft, sometimes heavy and often light-colored cushions or mattresses are really difficult to move since they do not have any built-in structure which makes them fold or tilt one way or the other. There are no real handles and since they are often light colored they are often wrapped in plastic to prevent stains during the move. This makes it one of the nightmares of some professional movers, preferring to carry a piano every day of the week than to carry a large, heavy, white mattress.

A feature of a sofa that can facilitate the moving is when there are two surfaces which are quite flat, with a 90° angle between them enabling the sofa to be loaded onto a cart enabling the sofa to be moved by only one person which makes the moving more efficient.

Outcome

- The sofa should not have too large volume. It need to allow passing through narrow passages both with and without packaging.
- Possibility to move a reasonable amount at the time, to reduce the amount of runs in and out of the living space.
- All parts have their place during the moving process, no loose parts that may disappear.
- No protruding parts which may get stuck in narrow passages and damage the home.
- Edges which may function as handles
- At least one 90° edge which may rest against a cart
- Minimize the fragile outer parts during the move
- As few different building blocks as possible to make it easier to optimize the packing volume.

6.1.4. Upholsterer insights

The overall attitude of the upholsterers where similar to the professional movers, very positive that everything is possible to repair since it is their job and they are good at it. The only issue was that sometimes it might take a lot of time and therefore not be economically viable to do upholstery work because it would be cheaper to build or buy a new sofa than to repair it. But for some furniture the sentimental value, nostalgia or antique value might be almost priceless making it hard to tell where the line goes.

The most common reason to why a sofa need to visit the upholsterer is that the skin layer need to be refurbished or replaced. Worn, stained or simply outdated skin layer is the most common reason. It is also common that the skin layer is changed because the customer thinks it is the wrong color or just want to personalize an inherited or second hand bought piece. Some sofas return with intervals of about 10-15 years just because the user want it to fit into a new style in their home.

Teared or sun stained skin layers but also fatigue in the construction are also issues regularly addressed. The parts of the construction most commonly addressed are the dampening parts, such as webbing or nozag fatigue. However, all upholsterers interviewed argue that each furniture piece is unique and have special needs, so that there is no common problem.

What was found during the observations and confirmed by questions are that most attachments are currently made quite permanent, the most typical is to use many metal staples to attach fabric to a wooden frame which is not easy to disassemble, nor recycle. Other ways that are quite common is to use glue, but also nails, to assemble the furniture. This way to remanufacture sofas which are assembled with rather permanent measures create a rather time-consuming profession where about 67% of the cost for the upholstering in general is for the work time and 33% is for the materials used.

One way which makes it hard to refurbish is when the broken part inside is inaccessible without disassembling the entire sofa which most of the time have permanent attachment methods. Sometimes the entire skin need to be made loose just to access the parts inside

and might be attached with screws, washer and bolts making it tricky to keep track of all tiny parts. Another way is when a small damage might require the exchange of a large part, such as when the entire sofa cover is made from only one piece of fabric and not smaller parts.

The main thing to make a sofa with a timeless design look nice according to an upholsterer is that the fabric or the leather is tight all the way, that it is to make it fit “as it should”.

Outcome

- Easily replaceable skin layer
- As many parts as possible should be exchangeable on site at the end user
- All parts of the sofa, even the base layer should be able to replace without disassembling a majority of the sofa and allow exchange of only the part that is damaged.
- As few different kind of building blocks as possible to streamline the refurbishing process
- Use as few mechanical parts as possible which requires maintenance

7. Concept generation and evaluation

This chapter explains the concept generation process and the evaluation of the concepts.

7.1. Product ideation

7.1.1. Method

The ideation was done with different inspiration sources. Initially brain draining (Wikberg et al., 2015) was used to get rid of the thoughts that have been stuck in the head during all the initial research. After this a list of previous work that could serve as inspiration carried out previously in this project was created. The research questions, results from the first questionnaire, guidelines, trend clusters, interaction and product qualities, worldview and results from the second questionnaire and the user journey were the main things on this list. The ideas were generated individually by the author, brainstorming (ibid) and brain drawing (ibid) were mainly used for this part of the list.

A key inspiration was the user journey which intended to generate ideas about good mobility in and out of apartment, easy assembly, disassembly, reassembly, ways to create few different parts, repairable parts with separate materials, how the user should realize redundancy and become aware of needs. Also, the different parts of a traditional sofa were ideated piece by piece, such as how to create legs or how to provide the benefit of the elastic spring system. Also, a bit more value increasing show off features were invented. For the user journey and the parts of the sofa a morphological matrix (ibid) were used.

Ideas questioning the current concept of a sofa were created but were also later sorted away when concepts were to be created. This because a demarcation of this project was to challenge how current products may be made circular, a redesign of a product which would increase the acceptance to people in general and not only early adopters. Through the two first questionnaires there seemed to be a skepticism of things too much out of the ordinary, if the user is looking for a sofa they want something that works and looks like a sofa, not a metallic suit and a levitation pad that might fill the same relaxing purpose. Therefore, the methods used for ideation were kept on a relative low level of the crazy idea scale.

The morphological matrix used when ideating the user journey and the matrix used for the partial functions were merged into one matrix. Out of this matrix different solutions were picked and protruding were four main concepts which were named Skid Grid, Tweak Peak, Modulation Tradition and Soul Pole.

The concepts are presented through sketches which are focusing on showing the functions, the features and how they are put together. Overall, they show the boundaries of the design space, e.g. most soft cushion parts are simplified as cuboids even though they might have a curvature later on. This was done in order to work faster and make it easier to differentiate the concept. It also provides a more efficient method to keep the concepts comparable and only create an appealing design for the chosen concept.

7.1.2. Concept: Skid Grid

Skid Grid concept, presented in figure 13, have the main idea that the base layer provides a foundation created by a grid of multiple base layer modules on which the soft elements are put to create a sofa. The base layer modules are all the same kind but may be adjusted in height to create a seat, armrest or a backrest, only by alternating the height of the arc. You skid these bases around on the grid to build the desired sofa and fasten them so they stay tight together with metal clamps. The height may be adjusted to three different levels with a mechanism similar to the ones found in suitcases with retractable telescoping handles but stays way sturdier due to its dimensions and four poles.

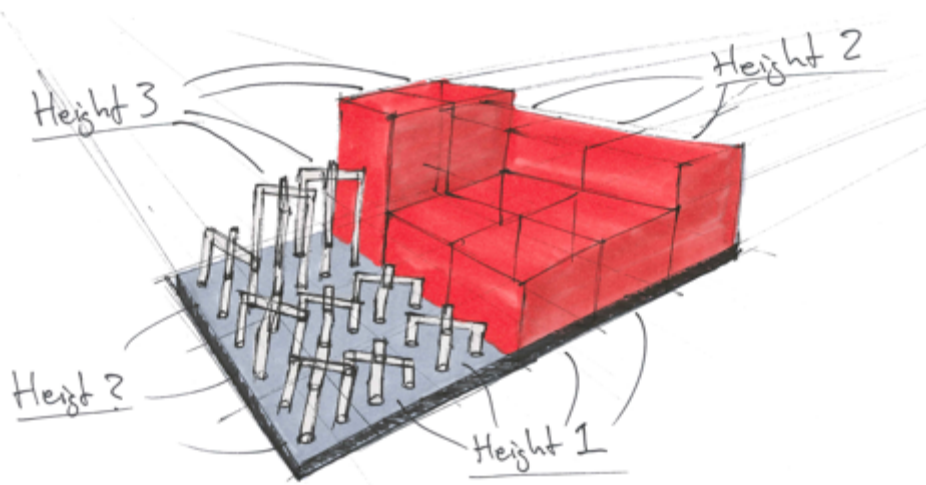


Figure 13. The Skid Grid concept with the three different heights

The soft parts come in three different heights to fit the three different possible heights of the grid base modules. In possible further development, these cushions may be expanded to create a larger cushion which fits over more than one grid module.

Advantages of the concept:

- The long-lasting part of the sofa is the same piece throughout the sofa system. This brings:
 - Efficient production
 - Streamlined maintenance
 - Simplified logistics
 - Allows the more short-term middle layer to follow market trends to create more variations in shape over time.
 - Allows the user to configure the sofa system as desired

Disadvantages of the concept:

- The middle layer and skin layer need to be several different shapes and sizes to create even the simplest version of a sofa
- Requires many base layer modules to create even a small sofa
- As formed now, it requires metal clamps to keep the grid modules together
- Uncertain comfort level

7.1.3. Concept: Tweak Peak

The main idea about the *Tweak Peak* concept is that each module is the same shape and size even though it is a seating, armrest or a back rest. It is just the way they are assembled that makes the individual part one of the three supports. The skin layer and the middle layer is attached to a hard surface which covers two of the six sides of the cuboid and is a part of the base layer, as shown in figure 14. The middle layer may be a cushion all the way through or with a cut out which allows for a pocket spring structure. In the center of the hard surfaces there are holes on each side which allows for poles to fixate the module to the framework. To allow each of these connection points to attach a connecting pole in all three directions if needed, a special joint hole was created. This hole fits the pie shaped part that is going into the joint which is shown in figure 15. They are pie shaped in order to get closer to the center point without being the same point. There is a pole connecting two of these pie shaped parts.

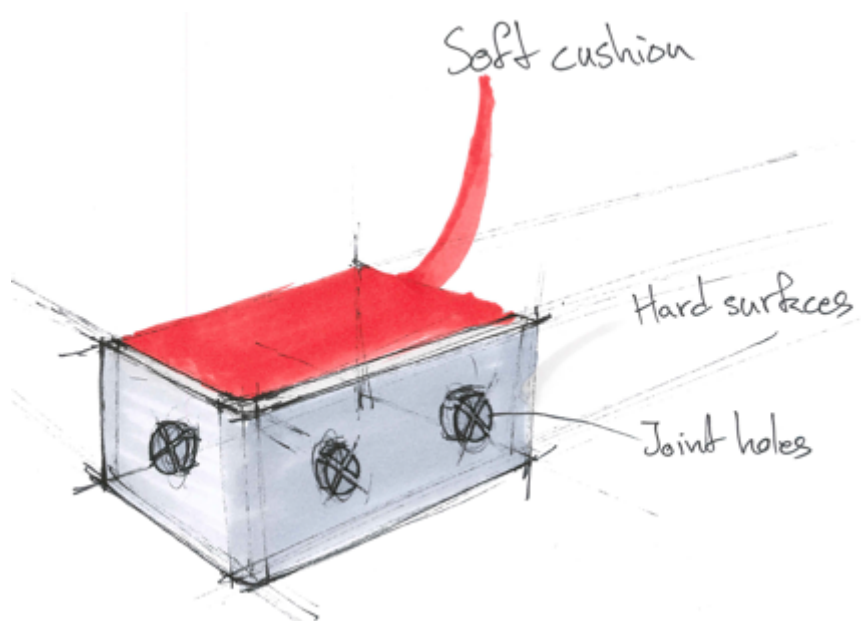


Figure 14. Two hard surfaces with joint holes which the pie shaped poles fit into

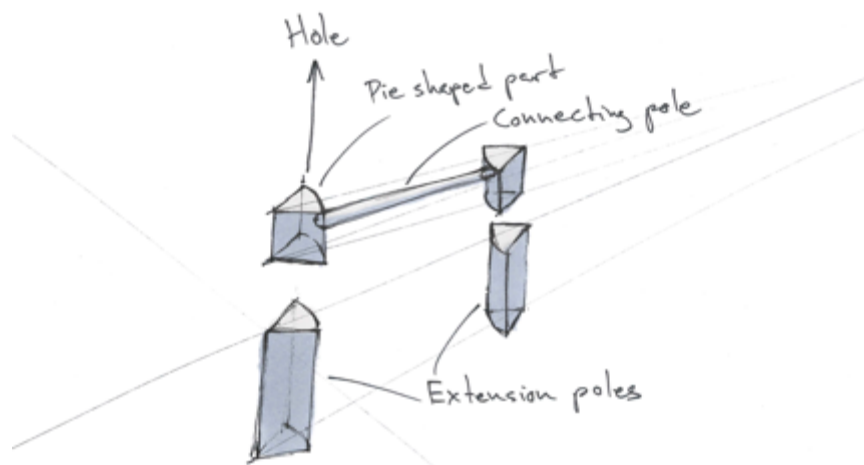


Figure 15. The pie shaped part going into the joint hole and the extension parts

The hard cushion base part of each module gives the structural support of the sofa when used, and the connection poles is what keeps the modules together as visible in figure 16. The distance between one cushion and another is always the same no matter how they are put together as long as two hard surfaces are aligned. This allows the connection pole to be only one length. In order to adjust the height of the sofa but also allow to put the modules at different height there is a separate part that adds to the joint and extends it. These extension poles may also serve as legs of the sofa. The different height and rotation enables each module to become either a seat, armrest or a backrest. That is how you tweak each peak to suit your needs. An example of how a Tweak Peak 2-seater sofa could look like is shown in figure 17. The armrests can be lowered one level and the backrests could be put in line with the seat to rebuild the sofa into a 10 module long sofa bed with no need for extra parts which is visible in figure 18.

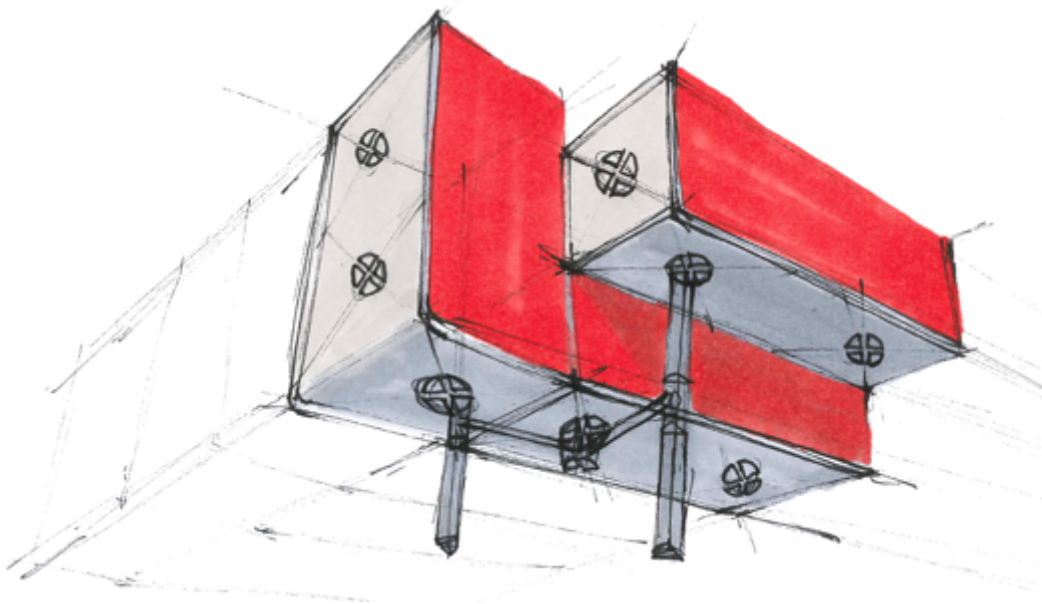


Figure 16. Showing how the different parts are put together, bottom surfaces from behind

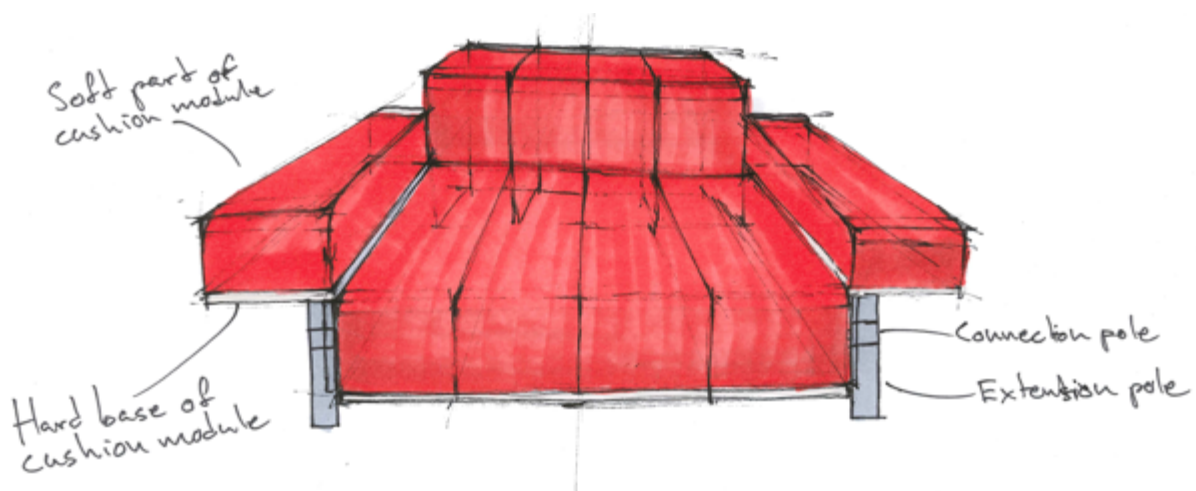


Figure 17. An example of how a Tweak Peak 2-seat sofa is put together, one way of many

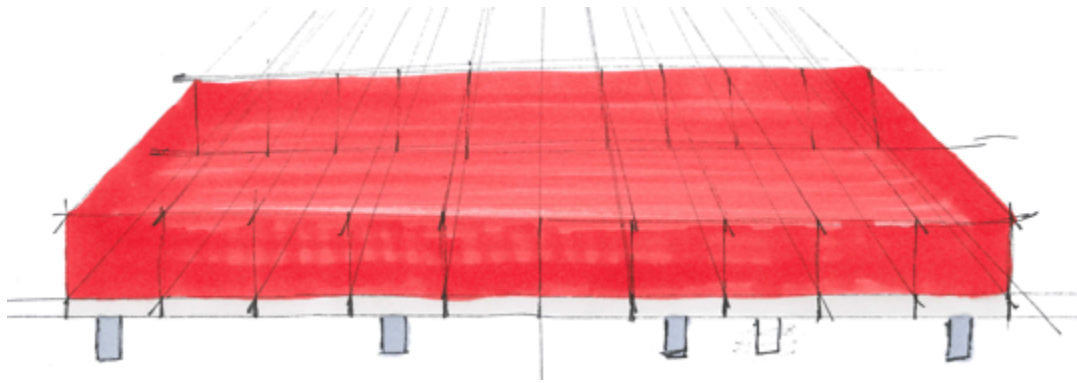


Figure 18. How the same 10 modules can turn into a sofa bed

Advantages of the concept:

- Allows large flexibility to expand the sofa in whatever way wanted
- Uses a low number of modules of both base, middle and skin layer.
- Two hard surfaces reduce the risk of tear and stains during transport
- Two hard surfaces reduce the troubles of moving parts which are only soft
- Only one skin layer model allows for good logistics
- Only one skin layer model allows for fast skin layer replacement
- Possibility to choose between two different comfort levels in the middle layer
- Possibility to rebuild the sofa on site, e.g. to create a sofa bed

Disadvantages of the concept:

- It might be complicated for a first-time user to understand how to assemble the sofa and how the different parts may be varied to create another sofa style or change it into a sofa bed.
- Quite many joints and assembly steps
- The design space is reduced if the module is offered in one size only, might not be as appealing to the eye
- Might be not as stable since the legs of the sofa is not all the way out to the edge if not an extra foot part is added

7.1.4. Concept: Modulation Tradition

The *Modulation Tradition* concept is based on the assumption that a modular sofa system is in quite handy pieces and allows for some flexibility. It is based on that the traditional modular sofa is just a wooden frame where foam rubber and textile is fixed upon. In this concept version, the framework is instead a metal frame which the middle layer may slide on from the top to create the sofa. In the same manner, the skin layer is slid on from the top. On top of this loose cushions are put as seating and back rest. All this is shown in figure 19. In the figure, the skin layer of the soft cushions is already attached, another skin is also attached to the padding in the middle of the figure. At the bottom of the figure the metal framework is shown with the possibilities of different dampening such as nozag or dampening ribs.

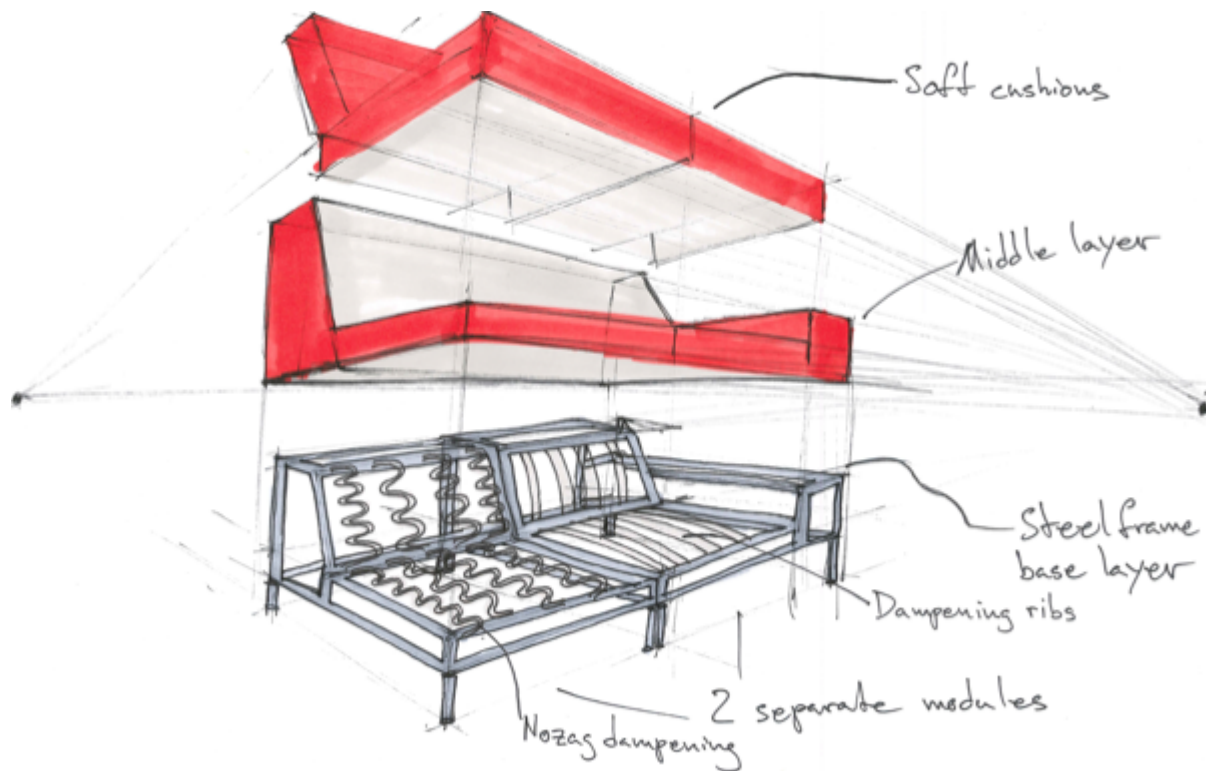


Figure 19. The Modulation Tradition concept

Modulation is the possibility to change frequency, to change parts with different frequency, and bringing this back to the traditional modular sofa system creates the Modulation Tradition. Underneath the sofa a strap is stored which during a move may be strapped around the sofa to keep the cushions in place so they do not fall out when the sofa is tilted to get through a doorway. The legs can be folded into the base structure to keep them from protruding during transport.

Advantages of the concept:

- Users recognize how the modules are connected and of what parts the sofa system contains since it is very similar to what is on the market today. Less effort to explain to the users how it works.
- Allows high comfort level
- Strap which keeps the loose parts in place
- Provides a very large design space since it gives almost the same freedom as traditional sofa craftsmanship

Disadvantages of the concept:

- Numerous variants of both base-, middle- and skin-layer is needed to make it happen
- The modules might be a bit too large in volume to be moved easily
- Low adjustability in width, height and depth of the sofa
- No adjustability on site

7.1.5. Concept: Soul Pole

Soul Pole concept provides two corner poles with a support pole in between on which cushion modules rest upon or against. The support poles are the soul of the construction body and is attached between the two corner poles and provides support for armrest and backrest. Each corner pole allows to mount a support pole in four directions at the same time if wanted, allowing it to support both in depth and in width of the sofa simultaneously. There is also an inner structure hooked on these support poles to support the seating cushions from below. The corner poles may be stacked on top of each other with support poles in between which creates support for the armrests and the backrests, which rest against the support poles without being attached. What this looks like is shown in figure 20.

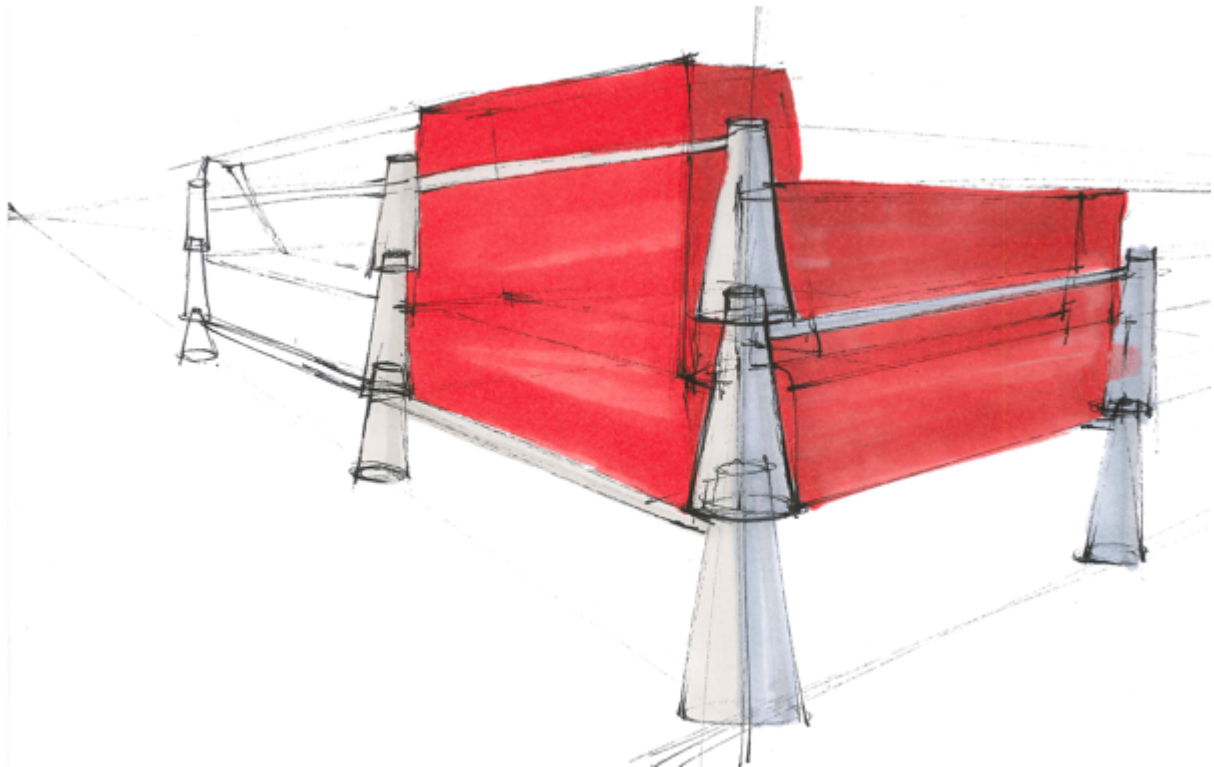


Figure 20. How the corner poles are stacked on top of each other to support all three kinds of cushions

The inner structure has a square shaped base which may be filled with slightly bent dampening ribs but could also be filled with a traditional rubber webbing which brings good comfort. The comfort may be increased even more by adding springs which turns into a pocket spring system together with the middle layer. All three variants are shown next to each other in figure 21.

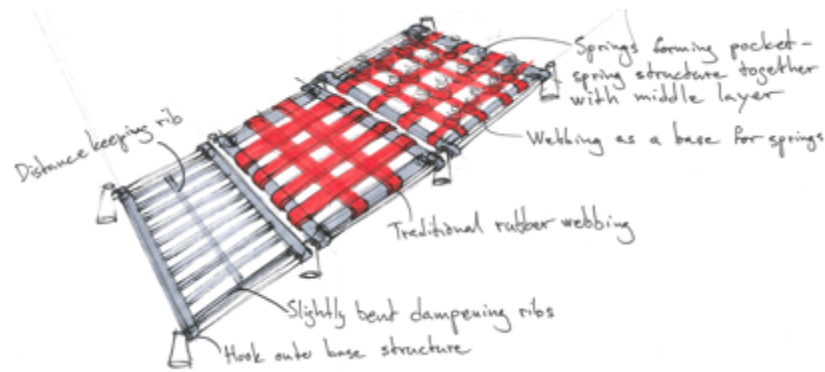


Figure 21. Three versions of how the square shaped inner structure may provide different comfort based on what dampening is used

On top of this square base the seat cushion is placed. The base is provided a 5°-angle tilt backwards to prevent the cushion from slipping of the square base forward. The support from the support poles and the corner poles keeps it from slipping off in all other directions. The armrests and the backrests are placed loose on top of the seat cushion but leaned towards the support poles which holds them in place, just as any backrest cushions found on a regular sofa on the market today. An example of how a Soul Pole 2-seater sofa could look like is shown in figure 22.

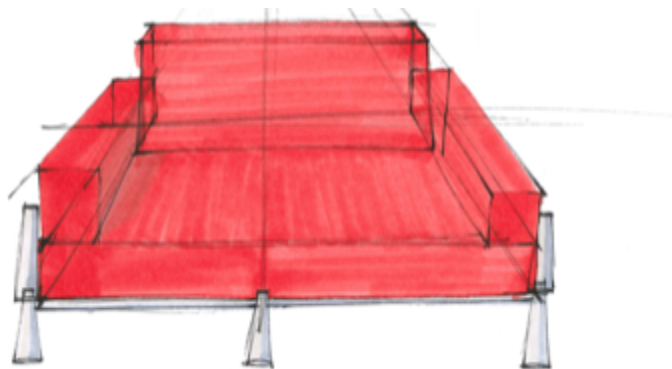


Figure 22. How a Soul Pole 2-seat sofa would look like when assembled

Advantages of the concept:

- Allows for multiple comfort options through the different options of the squared shaped inner structure
- Easy assembly with one part for the construction and one part for seating support
- Few joints and assembly steps
- A discrete foundation allows for a large design space for the armrests and backrests since they are only placed on top.

Disadvantages of the concept:

- Needs separate base modules for the seating
- Multiple soft only cushions may make it hard to transport without tears and stains.
- Low on-site adjustability

7.2. Evaluation of concepts

To continue the project with only one final concept to focus on, the concepts were evaluated.

7.2.1. Method

A list with evaluation criteria was put together based on previous research. This list is presented below in table 4. These criteria were put into a concept weighting matrix (Wikberg, 2015). Each criterion was put on one row each and given a weight between 1-3. The concepts were put in one column each. Alongside the four concepts a traditional sofa was considered and rated to see that these concepts actually make a difference compared to a traditional sofa. The four concepts and the traditional sofa were evaluated with a 5-grade scale of 0-4 where 2 is the neutral value where it is not really good nor bad, 1 is somewhat negative, 0 is really negative, 3 is somewhat positive, 4 is really positive. This scale was chosen to be able to rate fast but still with enough variety to create some kind of difference between the concepts. To use a 5 grade instead of 4 which is common for this method was decided to be able to leave a neutral value. The assigned value was determined by how well the concept achieve the criteria. Some criteria are equally possible for all concepts and can thus score equally high, it is not a ranking system. For each headline, an average score was calculated by the average of the score for each criterion under the heading. The entire evaluation matrix is presented in appendix 4.

Table 4. Evaluation criteria for the sofa design based on previous research

Evaluation criteria
Sustainability
Easy to disassemble into all separate materials for recycling in end of life
It should be obvious for everybody that might dispose the sofa in end of life that all materials are separable
Reusable packaging, easy to store until next use
Sustainable materials, preferably recycled
Measurements suitable to optimize the freight volume
Assembly / Disassembly / Reassembly
As few permanent fasteners as possible
As few joints as possible
As few assembly / disassembly steps as possible
No tools or few standard tools
A logical assembly / disassembly order, preferably packed in that order in the packaging
Moveable
Not too large volume, allowing passing through narrow passages both with and without packaging.
Possibility to move a reasonable amount at the time, to reduce the amount of runs in and out of the living space.
All parts have their place during the moving process, no loose parts that may disappear.
No protruding parts which may get stuck in narrow passages and damage the home.
Edges which may function as handles

At least one 90° edge which may rest against a cart		
Minimize the fragile outer parts during the move		
As few different building blocks as possible to make it easier to optimize the packing volume.		
Repairable		
Easily replaceable skin layer		
As many parts as possible exchangeable on site at the end user		
All parts of the sofa, even the base layer should be able to be replaced without disassembling a majority of the sofa and allow exchange of only the part that is damaged.		
As few different kind of building blocks as possible to simplify the refurbishing process		
As few mechanical parts as possible which requires maintenance		
Adjustable for different users		
Adjustable for different moments	Adjustable between different homes	Timeless design
Everyday use	Adjust comfort level	Tight skin layer
Fancy visitors	Adjust width / depth / height	Simple form, mostly straight lines but some continuous curvature is also welcome
Relax mode	Adjust form	Fluffy cushions
		Preferably no visible joints

7.2.2. Result

The traditional sofa compared to all other four concepts scored last on all points except the possibility to make it into a timeless design, since the traditional sofa practice of permanent attachment and joining of different materials do not limit the design space at all. Since the traditional sofa and the Modulation Tradition scored last and second to last on all other criteria they will not be analyzed as much as the others in this result chapter.

Looking at the sustainability criteria the Soul Pole concept scored the highest average because it brings the highest probability to be obvious of how to recycle. It was closely followed by Tweak Peak and Skid Grid. The Modulation Tradition scored quite average and the traditional sofa scored zero since none of these parameters are commonly considered on the market today. For the assembly part the same order was found, Soul Pole mainly coming out on top because it has least joints and less amount of base layer parts.

The Tweak Peak was coming out on top looking at the movability criteria, mainly because of its hard sides and the possibility to move individually desired amount per run. It was closely followed by Soul Pole and a then Skid Grid. Also for the reparability Tweak Peak scored highest, because of the use of only one way to attach the skin layer to the base layer for all modules no matter if it will be used as seating, backrest or armrest. Since the skin layer is the part of the sofa which will be changed most frequently this made Tweak Peak come out strong. Soul Pole and Skid Grid followed equally close.

For the adaptability for each user the Soul Pole came out on top once again because of the adjustable base module, allowing flexibility and more personalization. The Tweak Peak followed close but Skid Grid fell behind since it is hard to provide different suspension systems and thereby comfort level. Also for the timeless design criteria the Soul Pole concept scored highest thank to its possibility to hide the connection points and make long lines in the form language.

7.3. Chosen concept

In the evaluation matrix, the concept of Tweak Peak and Soul Pole both scored high on all criteria and if one came out on top for one criteria, the other followed closely. Therefore, they will be merged by keeping the benefits of both concepts in an attempt to eliminate most of the negative aspects.

What is kept from the Soul Pole concept is the assembly, user adoption and the timeless design benefits. Assembly benefits bringing less base layer parts and less joints, user adoption benefits bringing adjustable base modules and the timeless design benefits bringing the possibility to hide the connection points and make long lines in the form language. From the Tweak Peak concept the movability and the reparability is kept. Movability benefits bringing the hard sides and the possibility to move individually desired amount per run, reparability benefits bringing the same way to attach the skin layer to the base layer for all modules no matter if it will be used as seating, backrest or armrest. For the sustainability criteria, a compromise will be found.

8. Final concept product parts

In the previous part, several concepts were created and a mix of the Tweak Peak concept and the Soul Pole concept was chosen to be the final concept. In this part of the process the different sofa parts will be presented. This in order to understand why each solution was chosen as the way to achieve the design goals. Initially the cushion module will be presented, starting from the bottom with the hard surfaces, adding the middle layer and the skin layer on top. After this, the different sizes are presented. The base layer parts are explained, what purpose they fulfill, how they work and what parts are connecting to the cushion module. This chapter explains how each function work in order to understand the user experience presented in the following part.

8.1. Cushion module

The cushion module consists of a structural hard part, a dampening middle layer and a protecting and aesthetic skin layer. How they function will now be presented below.

8.1.1. Hard cushion base

The hard part is shaped like an L to cover two out of the six sides of the cushion, as shown in figure 23. The longer part of the two is the one where the human body rests against and carries most of its weight, no matter if the cushion serves as a seating or a backrest. The load is put on the long side in most cases also for the armrest but in some configurations the weight of the human arm or head might be rested on top of the short side.

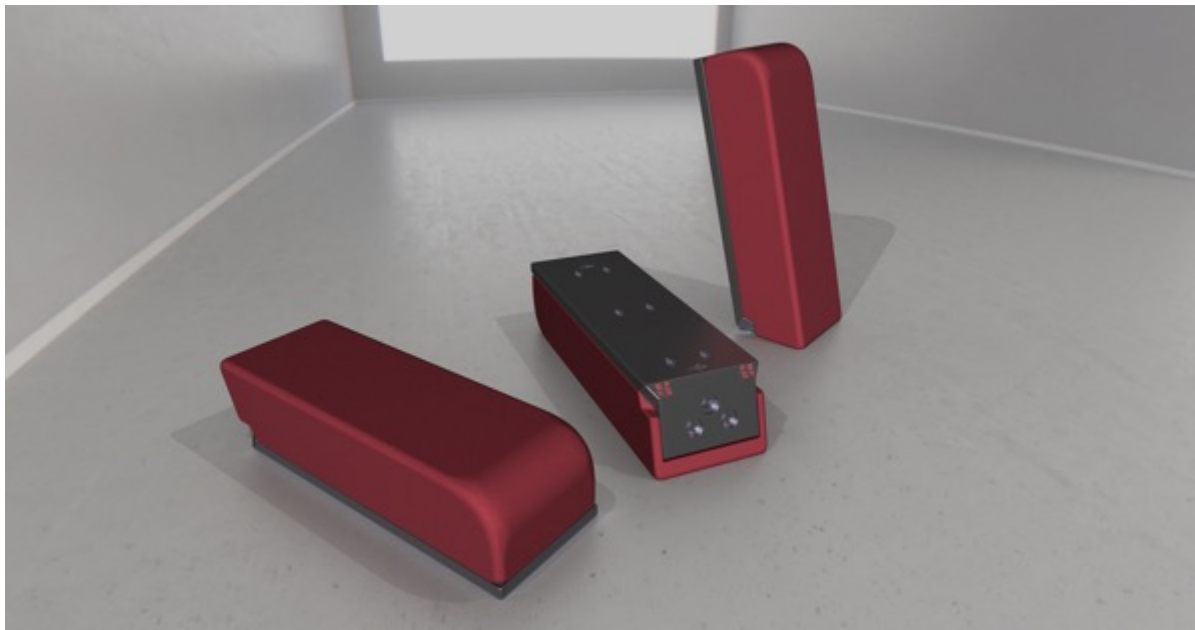


Figure 23. The L-shaped hard part of the cushion module

Each side of the L have joint holes to allow the base layer poles to fixate to the cushion module and thereby to another cushion module. As seen in the figure, the long side got eight holes, three holes close to each end and two holes along the edges on the middle part. The short side have three holes close to the center of the squared surface. If you look at the close up of the hole in figure 24, there are squared indents which fixates the incoming pole rotation to prevent undesired rotation and wiggle.

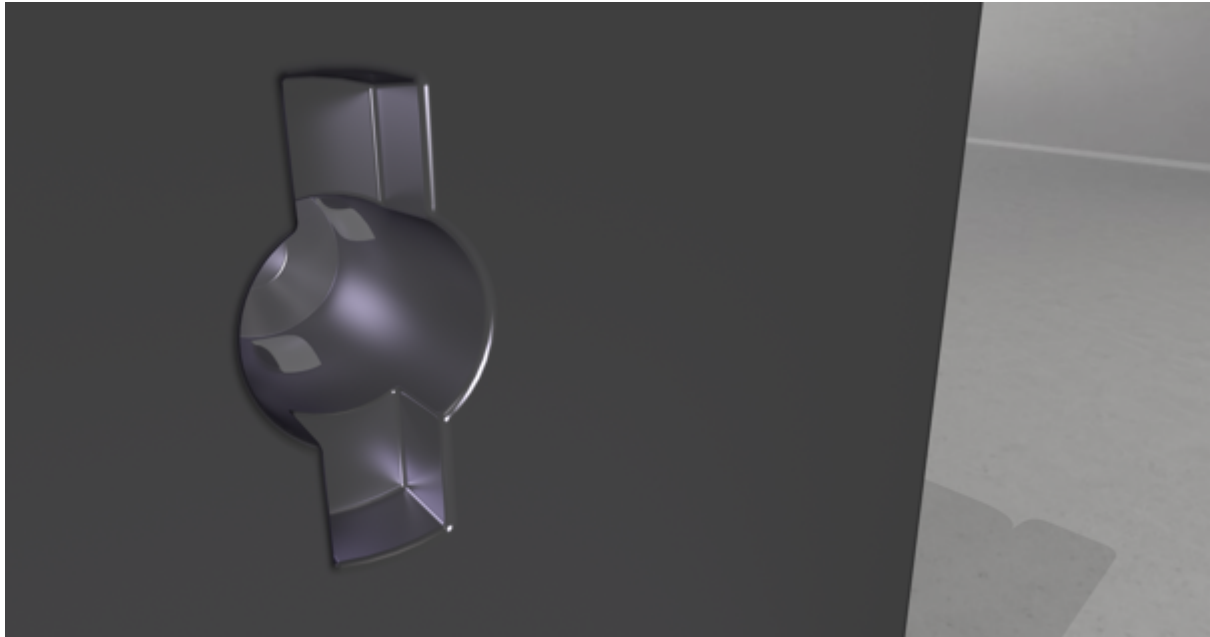


Figure 24. The joint hole with the springs allowing the poles to snap into place

On the inside of the joint holes small springs are placed which are the slightly brighter colored steel parts inside of the hole. These springs retreat while a pole is entered until it reaches the groove on the pole which allows the springs to snap back out, making the pole click into place. This mechanism works very much like a headphone jack, but scaled up big time. Other methods considered caused different difficulties. Placing rubber on the inside surface of the hole would create friction between the entering pole and the hole, but it would require the joining of two materials that would not separate easily upon recycling. A sort of enter and twist lock could be applied, but this might cause problems during assembly for inexperienced users, reducing the usability. The chosen joint option allows the user to assemble the parts almost like LEGO, but with some extra friction to keep it in place.

The hard cushion surfaces have a straight edge along the width of the cushion to be able to merge visually when placed next to each other. The inside of the edge has a small tilt in order to cover a possible gap between the soft part and the hard part of the cushion when looking from the side.

Besides the holes for the poles there are other holes allowing straps from the skin layer to come from the inside through the hard surface out on the back. These straps are visible in figure 25, two on each module. The straps are lit up in bright pink in the image to show how the straps go through loops of the skin layer and how both ends of each strap is fixated on the outside of the hard base module. One strap fixates the short part of the skin layer and one fixates the long part.

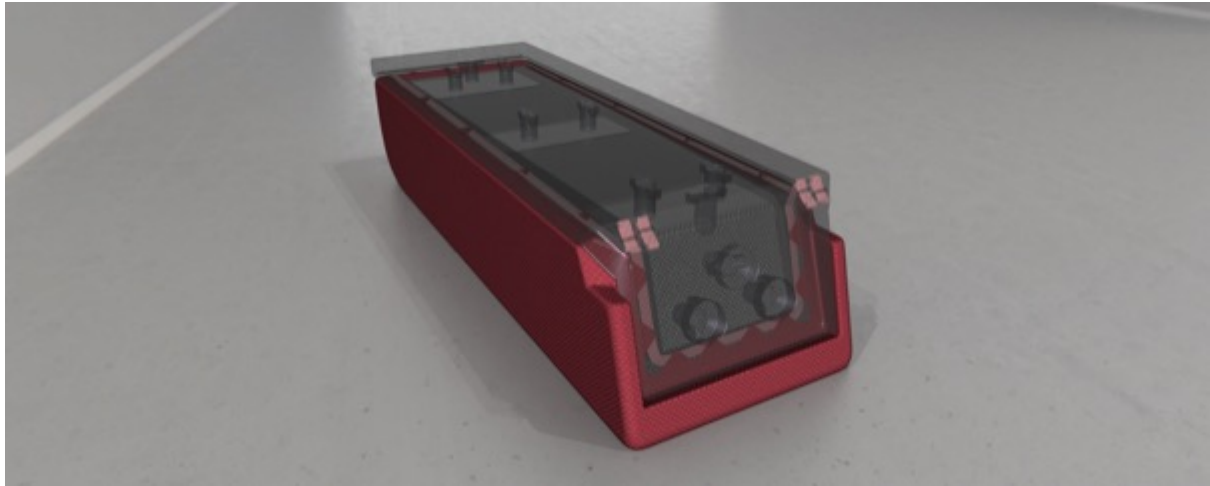


Figure 25. How the straps fixate all soft parts to the hard base module

8.1.2. Middle layer

The middle layer consists of the soft, comfort creating, dampening part of the cushion. The main ambition for the middle layer in this project was to use recyclable, separable materials but still create great comfort. The most common kind on the market with layers of soft materials all the way through provides great comfort and will be used in this concept.

The middle layer is divided into different layers to achieve a great level of comfort as shown in figure 26. The cushion core is a 13-cm thick foam made from 100% natural latex. Around the core, to achieve softer feel and a fluffy appearance, there is a 3cm wool batting layer that wraps the latex core on all sides. To reduce the wool barbs possibility to work its way out to cause pilling on the skin layer or irritate the human skin a tightly woven ticking fabric made from organic cotton is put between the wool and cover fabric. The cover fabric is mostly mentioned as skin layer throughout this report.

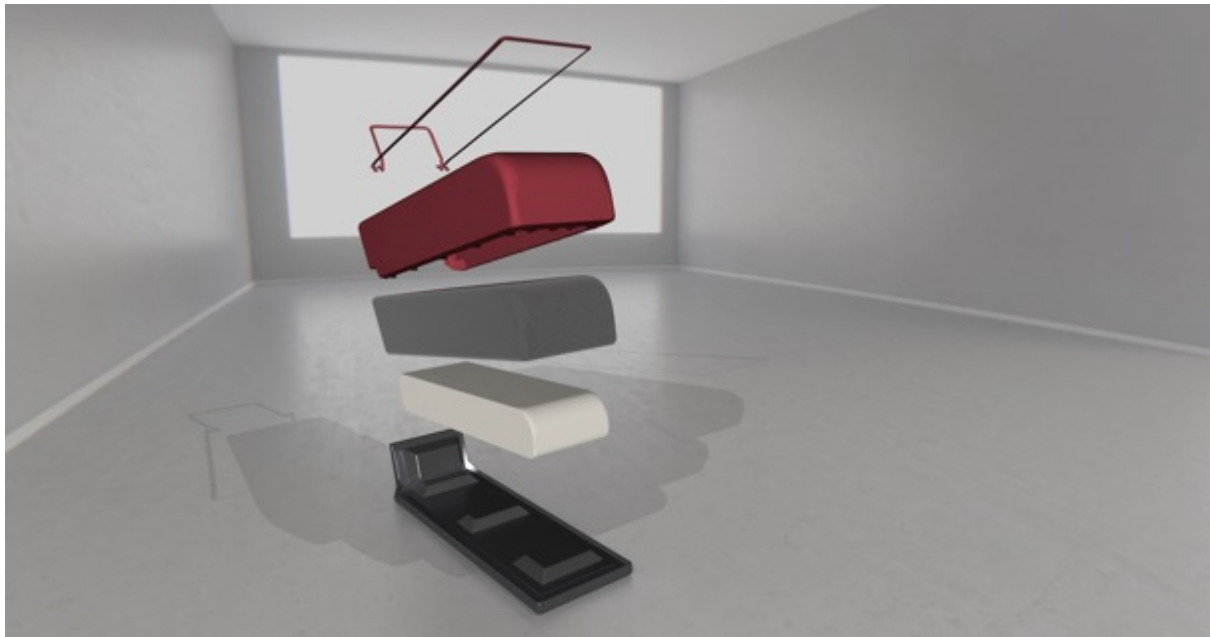


Figure 26. The different layers of the cushion module

8.1.3. Skin layer

The skin layer was designed with two important main missions. The first is to be able to provide a tight fit for a long time, also after many years of use, several washes and multiple times of attaching and removing the skin layer. This tight fit is important to provide a long-lasting high-quality design impression. The other mission was to simplify the attaching and removing of the skin layer, but without using permanent attachment methods such as glue and metal staples commonly used in the furniture industry today.

To simplify the replacement of the skin layer the entire skin layer is sewn in one piece of fabric. This also allows for the fabric to go around the edge opposite of the hard cushion base which is the edge that the neck or back rest against or the legs rest against, therefore this provides good comfort. The seams of the fabric cover go along the edges of the middle layer, and when the cover is tightened downwards, these seams move along this edge, making sure the seams stay where they should be visually.

To provide the tight fit, straps going through loops of the skin layer are put through the hard cushion base and fastened on the backside as shown in figure 27. By doing so, the skin layer wraps the middle layer and holds it in place. The skin layer is attached to the hard cushion base by pulling it through the holes from the inside to the backside. The strap is pulled through the first arc, through and back around the next arc and in through the first arc again to lock it in place. When it is attached, it is tightened just by pulling the strap. To loosen it, the strap is pushed back through the arcs, very much like a strap on a backpack.

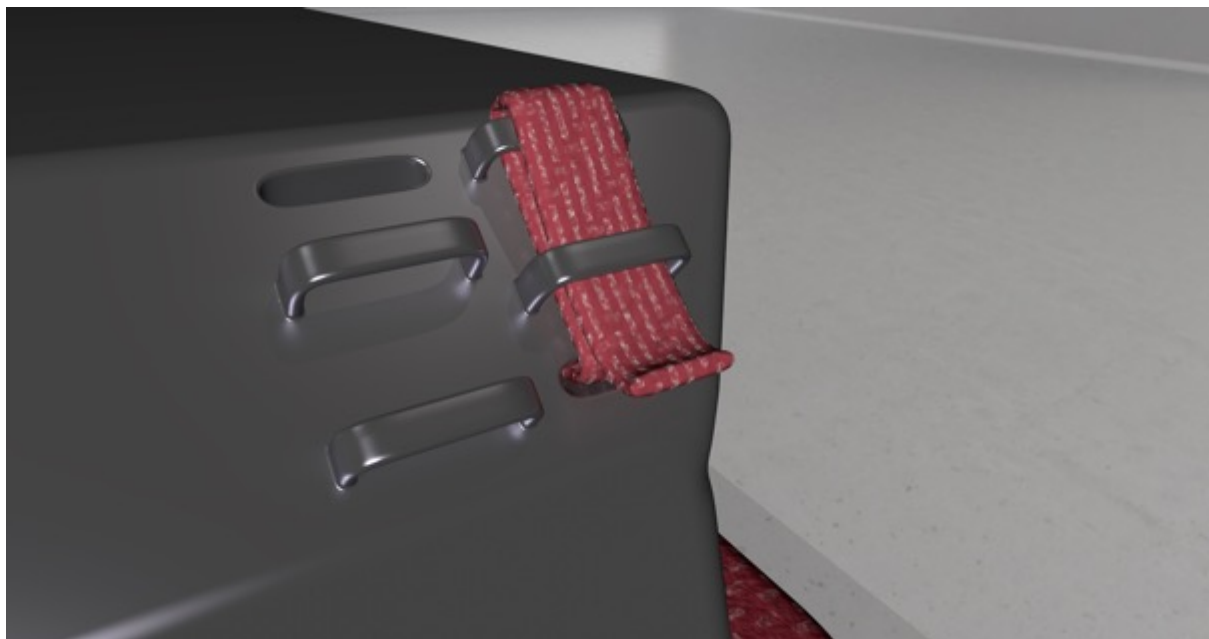


Figure 27. How the straps of the skin layer attach to the hard cushion base

In order to provide the user with possibility to personalize the sofa as much as possible a wide range of skin layer materials are offered. A high quality, recyclable, washable fabric is the standard option, but also leather alternative called Piñatex which is a more ethical and environmentally responsible sustainable option to traditional leather. The material has already been used for vehicle upholstery because of its high durability and fire-retardant

properties (Wired, 2016) and should be able to serve well for the upholstery of these cushions.

To increase the possibility to personalize the sofa even more the template of how this skin layer is sewn is available on the subscription service website to allow the user to customize the sofa even more and sew own skin layers. If these are returned together with the sofa upon cancellation the user will receive a voucher for the support of local, small scale production.

8.1.4. Available sizes

A larger number of smaller building blocks leads to more assembly steps, compared to a lower number of larger building blocks for the same volume. Because of this and how much a low number of joints and a low number of assembly steps is desired, the cushion module will be available in three different sizes as shown in figure 28.

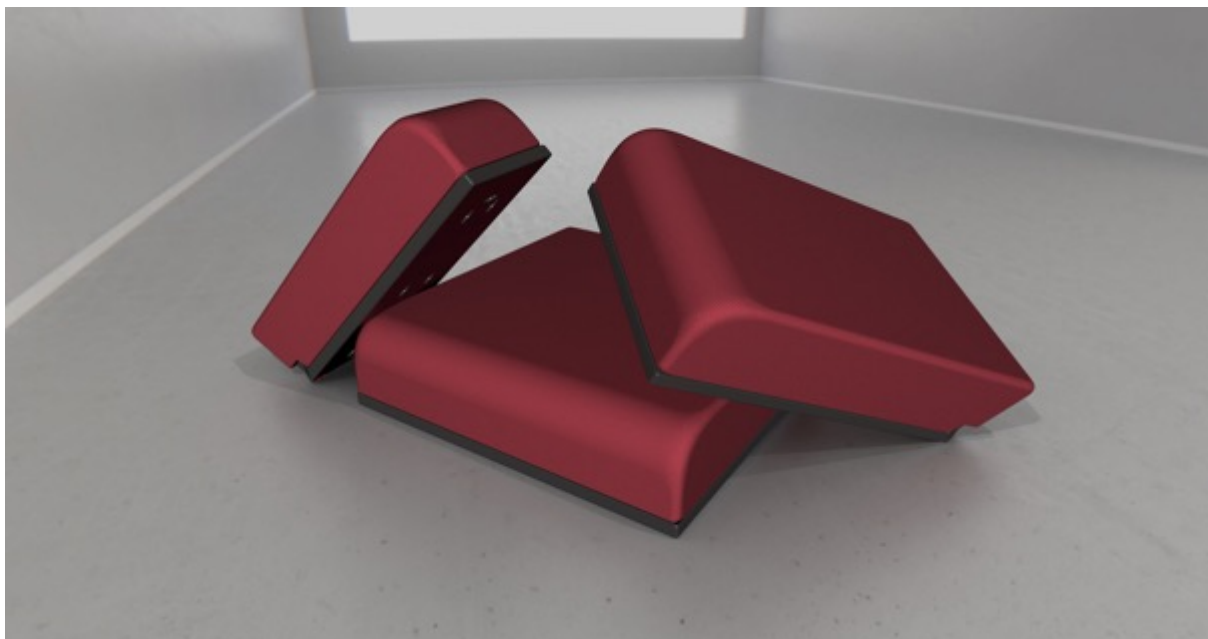


Figure 28. The three different sizes of the cushion module

The one that have been shown in all previous steps is the 26-cm wide $\frac{1}{2}$ -seat size which allows for a great flexibility but requires quite many assembly steps if only this module is used for a large sofa. Therefore, also the 52-cm wide 1-seat size and the 78-cm wide $1\frac{1}{2}$ -seat size is available, which brings an even greater possibility for the user to build its own personalized sofa experience. The functional change for these sizes are that they have a few more holes on the hard cushion base surfaces to still provide the same flexibility.

8.2. Base layer parts

The foundation of the sofa consists of the base layer parts which are connection poles, extension poles and feet. The connection poles keep the module parts together. In order to get the sofa up from the ground and provide some variations in height, such as if you want the arm rest to be another height than the seat or the backrest, the extension poles may be used. To not scratch or damage the floor with the metal poles, feet are attached to the poles that touch the floor.

8.2.1. Connection poles

The connection poles' main purpose is to connect one cushion module to another. The poles, visible in figure 29, consist of two joint holes, two joint poles and one center pole. To the right in the figure the joint holes are up, that have the same springs as the hard cushion base providing the possibility for the poles to snap in place. To the left in the figure the joint poles that goes into the joint holes are made visible. Here you can see the grooves allowing the joint pole to snap in place and also the rectangular shapes which keeps the poles from rotating. The poles are similar to the Tweak Peak concept, but are now round to provide higher flexibility and usability.

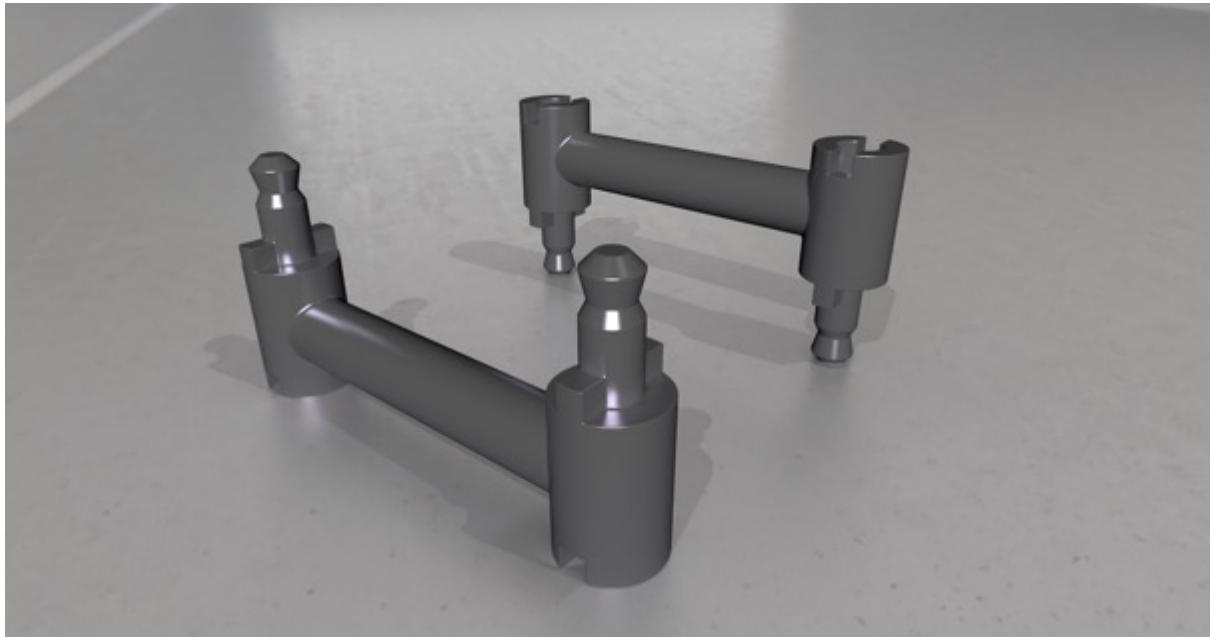


Figure 29. Two connection poles, one turned upside down

In order to allow less assembly steps, the connection poles, in similarity to the cushion modules, are also available in three different sizes. The standard one is the 18-cm model, which is the length required to attach one cushion module to the adjacent one. Another is the 44-cm model allows to bridge one $\frac{1}{2}$ -seat cushion module between without having to connect to it. The last one is the 70-cm model which allows to bridge two $\frac{1}{2}$ -seat cushion modules or one 1-seat cushion module. Longer that this will not be needed and will probably lead to complications with the dimensioning. All the sizes are shown in figure 30.

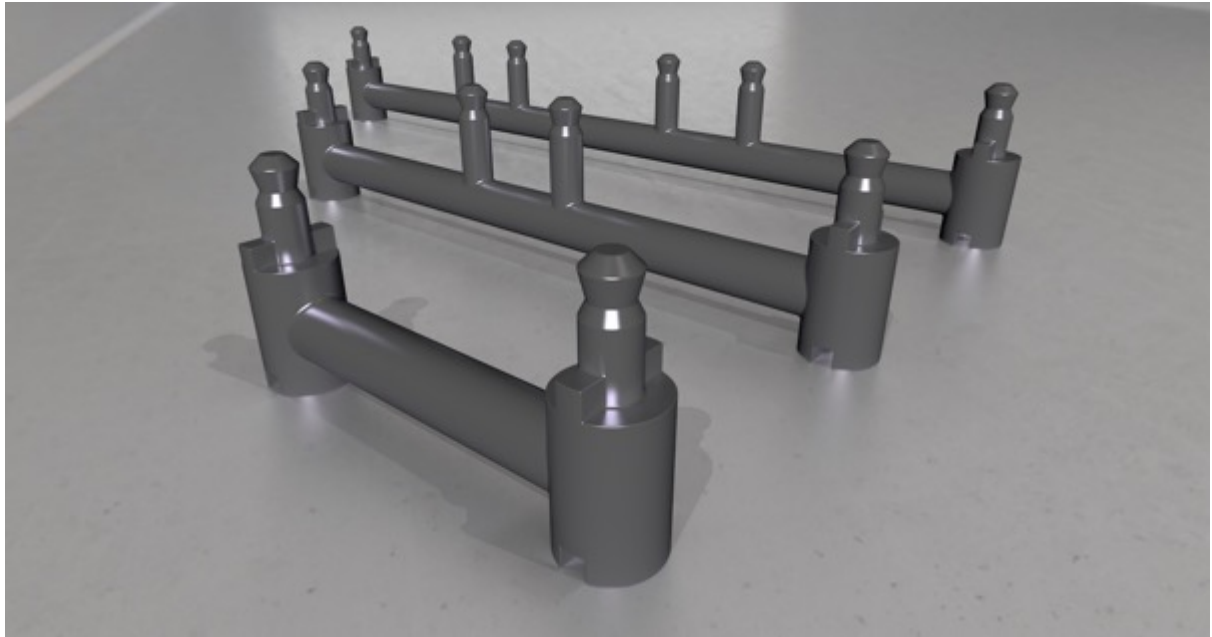


Figure 30. The three sizes of the connection poles

8.2.2. Extension poles

The extension poles are the poles which allow the user to bring the sofa up from the floor, but also creates the possibility for multiple cushion module configurations. The pole is visualized in figure 31. The cushion module is 26 cm high, the connection poles builds 6 cm and the foot is 1 cm. To achieve the standard sofa seat height of 43 cm (Stemgoods, 2016), one extension pole is 10 cm. To be able to sustain the long time use and be able to withstand the forces put on top, without making the dimensions of the base layer unnecessarily large, stainless steel will be used.



Figure 31. An extension pole

8.2.3. Feet

The feet provide a functionality that could not be designed into the main parts without compromising other features or design guidelines such as keeping the materials separate. The foot allows the user to attach this fully recyclable ABS plastic part, made out of recycled ABS, to protect the floor from the hard steel extension poles. Also, the user experience is enhanced if the sofa is pushed or moved on the floor because of how it feels and how it sounds compared to sliding metal poles over the floor. This part may be seen in figure 32.

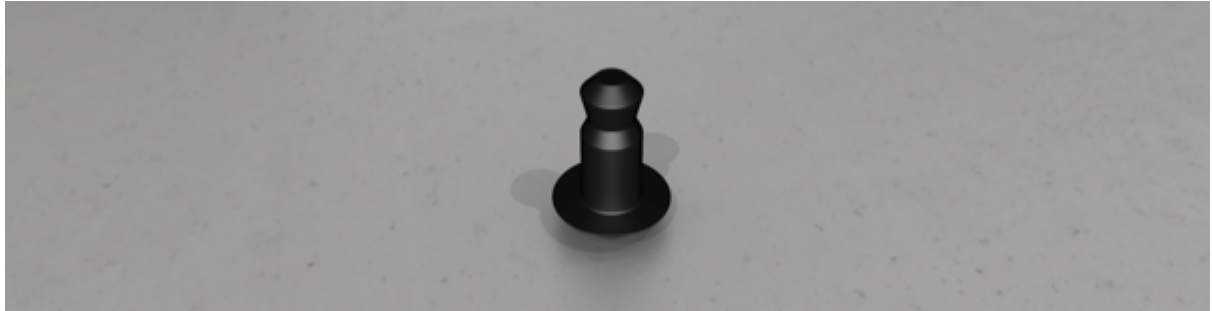


Figure 32. The foot

9. Final concept user experience

The previous part described different building blocks of the final concept product. In this part the experience of the product, together with the service it is a part of, will be explained. Initially the user experience will be presented chronologically, followed by the details of the refined business model. This chapter will end with the evaluation of how the design for exchange guidelines were used within the design case and explain how these were refined with insights from the design case.

9.1. Service user experience



Figure 33. The final concept sofa in an apartment

The final concept presented in this chapter is a modular sofa system offered through a subscription service which allows the user to build it so it aligns with the user's needs and liking. One way to assemble this system is presented above in figure 33. The subscription service allows the user to access a sofa during an uncertain time in their life. It targets people that will move within 5 years from when they moved in and do not know where they will move next, common people within this target group are students in student housing. By offering the sofa through the subscription service all who want a high-quality sofa that suit their needs, but do not want to commit to buying a sofa because of an uncertain living situation, will find what they need.

The modular sofa system allows the user to build a sofa which suits like a glove to the current living space. When moving to a new living space, larger or smaller, the sofa system will be adapted to the new living space by retrieving or returning modules to the subscription service. Since no tools are required and the parts don't weigh much the sofa itself may be adapted for different occasions in only a few minutes. It can become a lounge landscape during a movie night, the divan modules be used as a loose stool or the sofa may turn into an extra bed for the couch crashing friend.

9.1.1. First interaction with the subscription service

The main interaction with the service is available for the end user through the subscription service website. When entering the website, the user encounters the title "Need a sofa for a while, but not forever?" with the subtitle "Just the sofa you need, no commitment." together with the "explore why" button on the bottom of the page as visible in figure 34. Based on the user research the top three unique selling points are presented: 1. Free delivery and pickup, 2. Economically safe with maximum cost limit, and 3. No commitment. The option to click to know more about the promises is available, to explore these benefits and more benefits offered by the subscription service.



Figure 34. A mockup of what the landing page of the website could look like

Free delivery and pickup means that the sofa system is delivered into your living space when signing up and picked up when the subscription is cancelled. The service is economically safe. This since if the user realizes she likes the sofa for more than five years, there is no more charge for the sofa. There is still a small cost for the service to still provide repair parts and to ensure that the sofa returns when there is no need for it anymore. No commitment means that there is no cancellation time, no need to commit to a large sofa purchase and only pay as long as you need the sofa.

Below these selling points three standard configurations of the sofa are presented in three different environments to show how different sofas may suit different living spaces. Underneath this the question; "Want to make it fit into your living space? Try out the Sofa-planner". If this is clicked the Sofa-planner ask if the user wants to build the sofa from scratch or to modify one of the three previously shown standard configurations. In this Sofa-

planner the user is allowed to drag and drop the cushion modules, rotate and elevate to create the desired sofa. It allows the user to sketch, plan and dream. To be creative and build the sofa that fits just this specific user. The connection poles and extension poles needed to create this particular sofa are added automatically and the user is able to see how many parts are needed of each element.

The price is determined on the amount of parts needed, cushion modules, extension poles, connection poles and extra parts have their individual price per month, and they all simply add up to the monthly cost for the user's specific configuration. All the different parts are packed into a reusable packaging in the order that it will be assembled upon delivery.

When the user has decided what kind of sofa is wanted, the user is presented with two payment methods. The first is "Pay as you go" which allows the user to pay monthly with an undetermined ending. The second is "Pay in advance" which asks the user for how many months ahead they want to pay. For this option, the user is also asked what should happen when that time has come, either the user is asked if she want to continue when the date is close or the subscription auto terminates. These options were developed to attract a larger part of the user group.

9.1.2. Home delivery

The sofa system is delivered on bikes that allow a volume of 2 m³ and up to 200kg to make sure the sustainability values are considered throughout the entire service. Since the packaging and the sofa system are designed to facilitate the move in and out of the apartment the biking messenger always helps the customer to get it inside the living space. The assembly is left for the user to do since it was not considered important during the user research and it keeps down the cost of the service. This is still considered to be true even though the number of assembly steps are more for this concept compared to a traditional sofa, since the assembly is easy with no tools required.

9.1.3. Assembly

Since the package is packed in the order the sofa will be assembled, the user assembles the sofa fast and simple. This specific user chose a two-seat sofa, with 10 ½-seat sized cushion modules which requires 11 connection poles and 14 extension poles visible in figure 35.

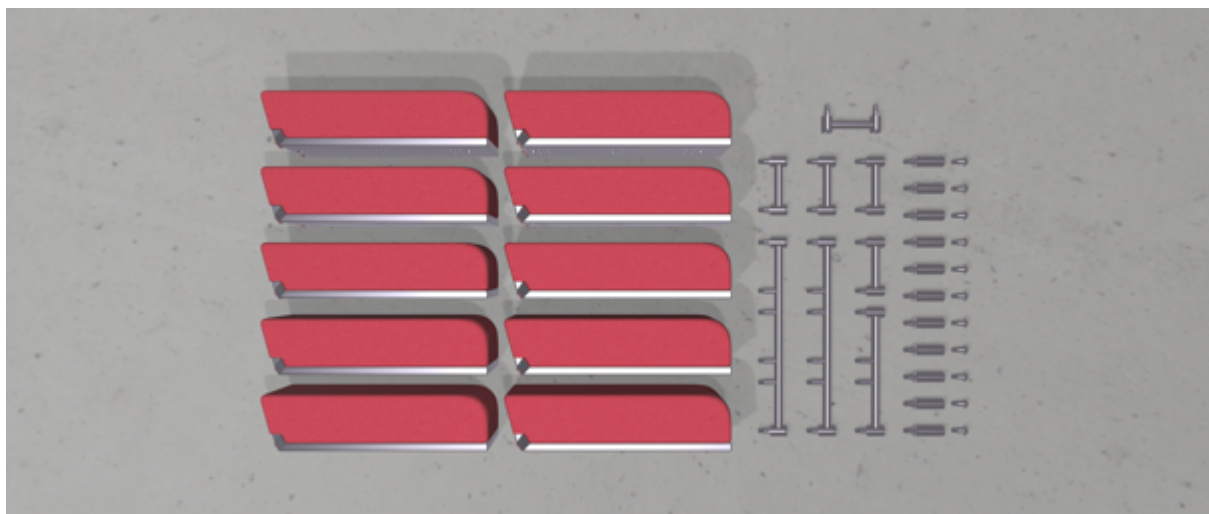


Figure 35. The building blocks needed to assemble a two-seat sofa

The user ordered the two-seat sofa in $\frac{1}{2}$ -seat sized cushions only since she wants full flexibility, in case she changes her mind about how it should be assembled. If she would change her mind, other configurations are available from the same building parts, examples of this is shown in figure 36.



Figure 36. Different versions built out of the same number of pieces

All the variations are possible due to the flexible base layer framework consisting of the extension poles and the connection poles. Both the extension poles and the connection poles may be fastened into the hard cushion base joint hole. The same connection poles may be used to make the sofa both wider and deeper since the distance between the holes are always the same. The poles only connect to the closest side of the adjacent module and thereby always makes sure that there is no gap in between. The extension poles and connection poles may be stacked on top of each other, one way visible in figure 37, to create all versions of the sofa.

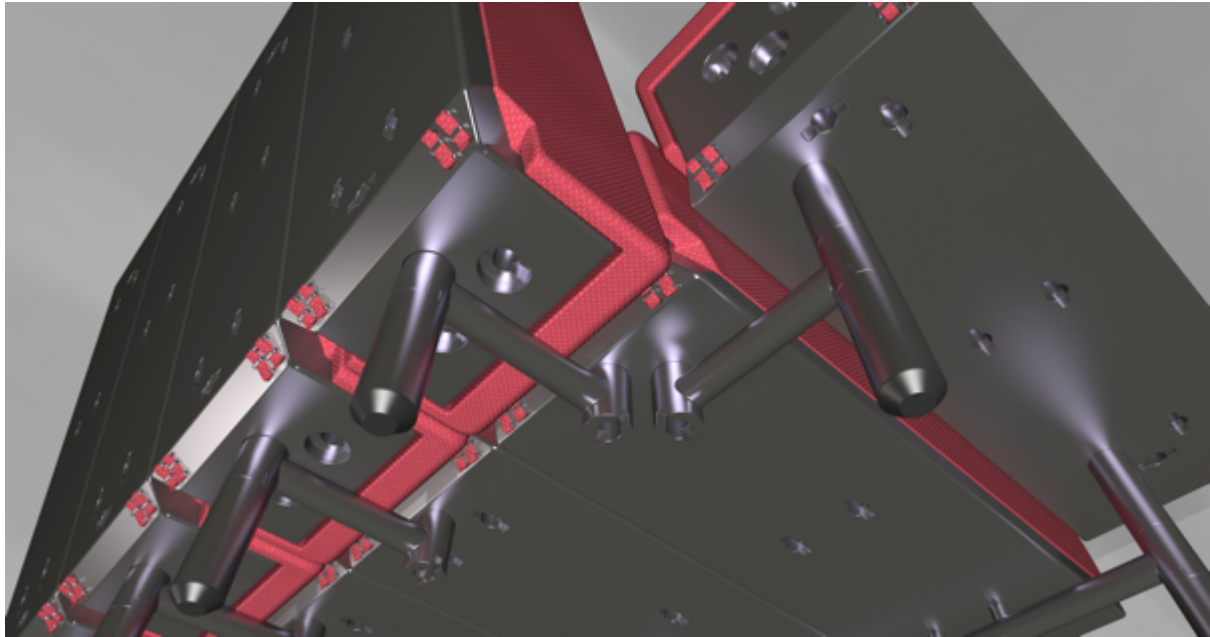


Figure 37. The foot, extension poles and the connection pole stacked on top of each other

Figure 38 show how the base layer parts are assembled to create the sofas shown in previous configurations.

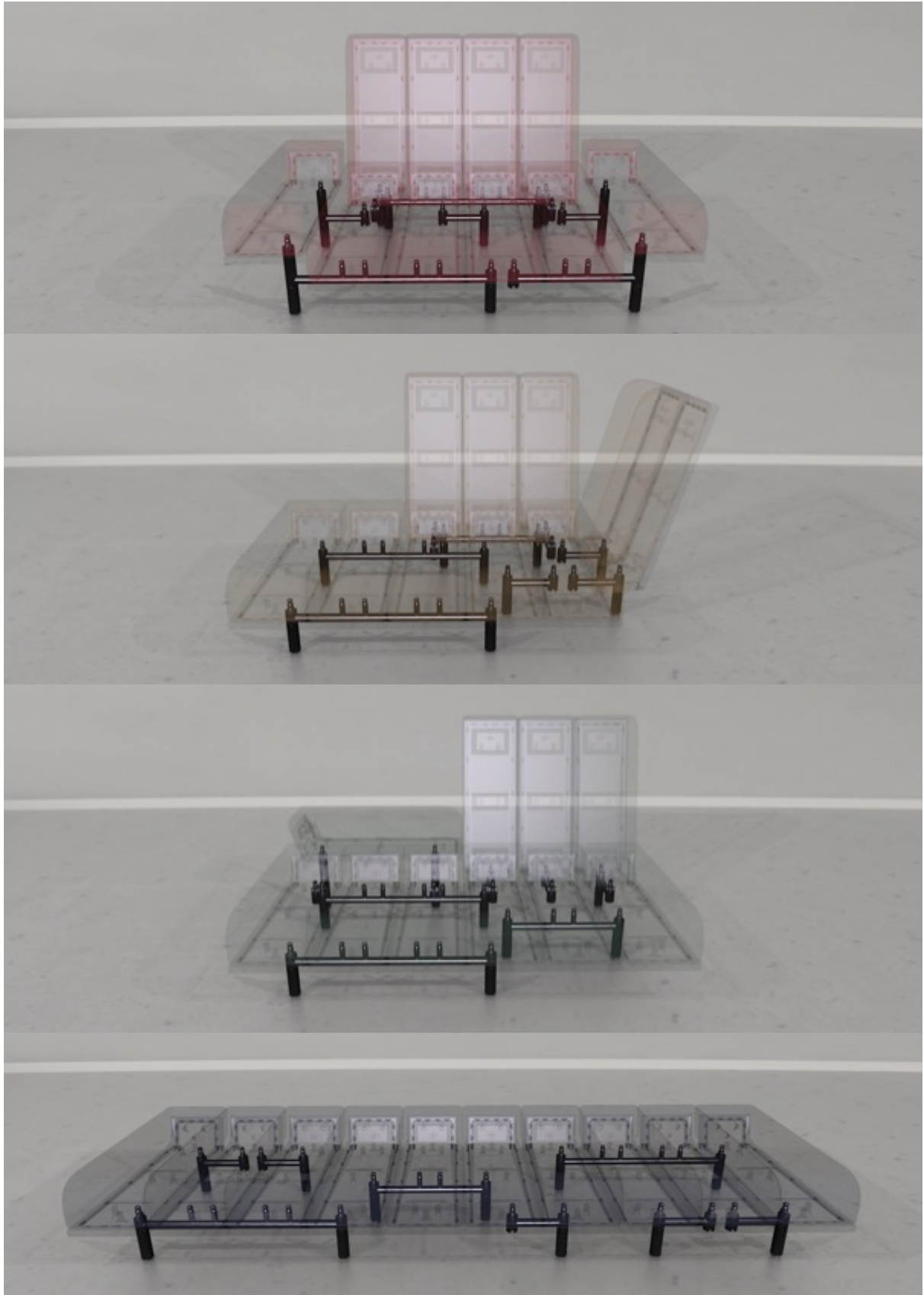


Figure 38. How the base parts are assembled to create the sofas out of the same pieces

A feature of the service is to let the sofa tell a story. To make the sofa tell a story each user will be asked if they would like to contribute to tell the story of the sofa. This is done through a voluntary photo upon assembly at every new house. If the user agrees, all personal data is handled according to the GDPR, the photo is taken of the sofa in its new home and made available to people who subscribe to the same sofa parts in the future. The picture is taken, preferably from the same front angle, preferably with the new sofa user in it.

9.1.4. Use period

Now it is just for the user to use the sofa as she pleases, adjust it for certain occasions by moving the cushion modules around or rotate them into the desired configuration. However, if anything is broken while using the sofa, there is no need to worry for the user since minor wear and tear is included in the monthly service cost, and repair parts are included in the price of the service. If a user manages to keep the skin layer in such a good condition that it may be reused after a wash, a voucher is offered to gain returning customers.

If some part need replacing the user contact the subscription service and a replacement part is delivered to the user. The broken part is fetched and brought back to the provider to make sure that it is refurbished or recycled the right way. Since the user assembled the sofa from the beginning she knows how to replace most parts. The skin layer is already assembled upon delivery, but if this need replacing there are thorough tutorials available on the subscription service website.

The user may move the sofa with her. If the new living space require a smaller sofa, the modules that is no longer wanted is returned to the service provider. In the same way if the new living space allows for a larger sofa, the user may add some modules to the service. However, there is currently nothing stopping the user from cancelling the entire service on one address and signing up for a new one at the new address, then the user is relieved of moving the sofa herself.

During the use period the reusable packaging which the sofa was delivered in is folded and stored away until the user no longer wants the sofa. If the storage of the packaging is a problem for the user, it will be picked up by a messenger. When the time comes when the user no longer wants the sofa, she cancels the service with no cancellation period by contacting the service provider and a time and date for pick-up is determined, no other questions asked. The user disassembles the sofa and in the order, it is disassembled it is possible to put it back into the reusable packaging.

9.1.5. Making it ready for the next user

When parts or an entire sofa system is returned to the service provider each part is inspected and tested. This is assisted by a QR-code engraved on all parts which works very much like a serial number. If the user scans this code they get information about what sofa system it belongs to and a digital manual. But this code also allows the service provider to keep track of how many times and for how long the specific part have been in use. It also keeps track if any previous users have had pets making sure that a part that have been in a house with a cat never arrives to a person allergic to cats. Even though the skin layer is washed, it may be hard to clean the middle layer so allergens are removed. This quality check includes checking for fatigue, lice, vermin and reek smell check. If any problem is encountered it is addressed depending on the problem; repaired, washed, or recycled if it is

beyond repair. When the quality check is done, the modules are stored, awaiting the next user to order the sofa system.

When a new order comes, the new user is allowed to see the picture of the previous owner with a short description such as “Camilla, 24 y/o. Studied Political Science and lived in Vasa, Gothenburg”. An example of what this picture may look like is presented in figure 39.

Through this the user may connect to the sofa on a new level and also notice the sustainability that the sofa has only been used in a specific part of the city for the last 7 years or some other facts that the user might find interesting or amusing.



Figure 39. An illustration of how the next user may learn about the story of the sofa

After this, it is delivered to the new user and another photo is taken to continue the story. When this picture is taken and uploaded to the service the previous users, including “Camilla”, get a notification that the sofa now has arrived in a new home. This should provide her with a good feeling, maybe even joy or pride, knowing that the sofa has come to use for somebody else.

9.1.6. Versions

The sofa system is possible to assemble in many ways. Three standard configurations are offered on the website which the user is allowed to customize in any desired way or start building a new one from scratch. The standard configurations are the 2-seater, 3-seat with a chaise lounge (shown in figure 40) and the 2+3 corner sofa.

It is also possible for the user to express personality by using different pieces and assemble the sofa in a way such as the corner sofa with a chaise lounge, a wider model with backrests only in the middle or a lounge landscape as shown in figure 41.

It is also possible to express your personality by choosing from the large range of sofa covers. Many colors of the cotton fabric, the leather alternative Piñatex and the possibility to sew a cover of your own provides the user with large personalization possibilities.



Figure 40. How a 3-seat with a chaise lounge sofa may look like



Figure 41. Three custom configurations of the sofa system with wide cushion modules

9.2. Final business model

In this chapter, the final business model will be described. The initial business model was presented before since it was part of the product development. After additional research and during the ideation some things have been adjusted, removed and added. Here follows the target group, the features of the service and the proposed payment model.

9.2.1. Target group

The target group consists of people that will move within 5 years from when they moved in and do not know where they will move next, typically students in student housing and subleasing tenants in urban areas. They want to furnish their home but do not want to commit to such a large furniture piece because of their uncertain future living conditions. They are people who see the value of not having to deliver, repair and redistribute since these were found to be the main pain activities in the user journey. Hopefully, the users also see and appreciate what makes this service environmentally sustainable.

9.2.2. Features of service

Below the features of the service are presented in table 5, with what is most important on top under each headline. Initially it is presented what need to be made clear for the customer from the beginning followed by benefits of paying per module, the responsibilities of the end user and what features will be offered in the future as the service grows. To make it more likely to be economically viable compared to the initial business model, responsibility for certain activities are moved from the company to the end user. Since these activities are designed to be as easy as possible one can argue that anyone can do it, especially in the target group since they are cost sensitive.

Table 5. The proposed business model

Proposed business model	
The business offer	Pay per module makes it easy to
Free delivery and pickup at end of access	Adjust accessed furniture
Do not pay for the sofa itself longer than 5 years	Style change accessed furniture
No cancellation time	Upgrade accessed furniture
Free repair parts	
Simple economic overview	Will be done by the end user
No binding period	Moving
Awareness that it is beneficial for the environment	Assembly

No investment to get started	Repairing during use period
Fast delivery	Adjustment, upgrade and style change
Always available in stock	
Timeless design	

After the service is launched, the product range will widen and offer a product range with the same features, based on the same design thinking. Possibly the previous concepts may be developed further to allow a variety in shapes and sizes. A developed version of the Skid Grid concept could be one, the original Soul Pole concept may be another. There could also be one with more loose cushions. Even though it becomes less movable than the final concept, it is highly adaptable and repairable.

9.2.3. Payment model

The user will be offered three choices, shown in table 6, which differ in how new the parts of the product are and how much each choice cost. The top one called “All new” will be there for those who are extra caring about hygiene. The middle one, “New skin”, will have a new fresh feeling since the skin layer is new, but the base layer has been used and will be used again. The last one, “Functional”, is for those who just want to get a sofa as cheap and simple as possible and do not mind that somebody else have used the sofa before.

A suggested price point is that the “New skin” will initially be offered for 90 SEK/month, based on what the participants of the survey said they would be willing to pay for such a service. The “All new” option would cost 50% more and the “Functional” would cost 50% less. At least this price point could be offered initially to gain traction and build up a reputation.

Table 6. The three options within the payment model

All new	New skin	Functional
New base layer	Base layer has been used	Base layer has been used
New skin layer	New skin layer	Skin layer have been used

9.3. Evaluation of the guidelines for the design case

All guidelines which were suitable for this specific design case within this report are presented below in table 7 under the corresponding heading together with a short explanation of how each was implemented. The guidelines are presented to the left in the table and explanations of how they were used in the project are presented to the right.

Table 7. Guidelines which were suitable for this specific design case to the left together with how they were implemented to the right

Guidelines	How they were implemented
Mindset guidelines	
Provide product as service	Offer access to sofas through a subscription service
Business guidelines	
Business model	
Provide user with possibility to access it for somebody else to use, as if she would own the thing.	There are no restrictions like this in the service.
Provide support for things that might be troubling, e.g. insurance in a simple way.	Minor wear and tear is included in the service, and repair parts are included in the price of the service.
Offer some extra value compared to traditional buy/sell	The developed concept reduces hassle of ownership and provide flexible upgrades within the service
Test all products that have been used before they continue to the next user	A quality check is a part of the subscription service
Business perception - how the user perceives the service	
Keep in mind customers transaction costs in terms of both time, money and energy. Investing time, money and energy contributes to making consumers approving and loyal.	By allowing the user to carry out assembly, repairs and moving of the sofa they invest time and energy in the sofa system. These steps are as facilitated as possible to reduce the time required to do so.
Put effort into maintaining a high reputation and image of the service provider	Surely the service will follow this guideline when up and running
Reduce conservative thoughts about ownership since it is currently important to consumers and hinders the acceptance of PSS	By targeting young people, they learn already in their young adult lives that even a traditional thing to buy such as a sofa can be accessed
Provide a customer service equivalent to that of new products	Surely the service will follow this guideline when up and running
Marketing - communication to customer	
Non-circular consuming ways are now the standard option, make a circular consumption option the standard option.	This sofa design is intended to only be offered through the subscription model
Make circular business model offers as accessible as traditional ones	This is largely depending on which scale this subscription service will be able to reach, but yes.
Make circular business models more favorable and/or financially beneficial than traditional ones	For those who see value in the time spent on gaining access, maintaining and getting rid of a sofa, this circular business model should be more favorable than traditional ones
Ease the perception of fixed and variable costs, insight in total life-cycle costs	The service provides clear insight about both fixed and variable costs throughout the subscription period.
Reduce uncertainties regarding risks, costs and responsibility	The ownership of the sofa stays with the provider, most costs are included in the monthly fee, so no worry for minor wear and tear.

Put energy into the communication between supplier and consumer, build a relationship.	Checkups is offered through the service
Distribution	
Develop reusable packing systems	A reusable package is developed
Consider to transport new products in modules for mounting by reseller or customer	The sofa is transported in modules for mounting by the end user to increase knowledge about repairs
Reduce packaging weight	The reusable package is developed to be as lightweight as possible
Design for longevity guidelines	
Material	
Use materials that age gracefully	Metal framework age gracefully. Other visible parts are replaced and recycled frequently
Mounting / Modularity	
Design modularity to be able to upgrade the function	Cushion modules can upgrade from normal comfort to pocket spring comfort through further development
Design modularity to be able to upgrade the aesthetics	Skin layer may be replaced as frequently as wanted
Form and appearance	
Design for a personal connection	Possibility to follow the sofa as it is passed on to later users
Create a strong product-customer relationship	The personalization to assemble the sofa to fit exactly your living space and possibility to choose skin layer
Classic lines and proportions	Harmony in squared sides, long sides three times as long as the short sides together with long lines
Adopt a neutral design that does not go out of style	An attempt to fulfill this was done
Controllability	
Design possibilities for easy screening	All parts are easily examined since they are easy to take apart and inspect
Provide screening instructions	As a part of the regular checkups
Design for product life extension	
Design for durability	Generous dimensions of base layer parts and two hard sides of the modules provides good durability
Engineer to reduce maintenance	As few mechanical parts, as possible to facilitate maintenance
Design products for easy on-site maintenance	All parts are easily maintained on site
Support modifications	Third party add-ons attachable to a pole is supported
Allow hardware upgrades	The modular system allows for hardware upgrades
Cleanability	

Cleanable to a Microbiological Level	The majority of the design is large, easily cleanable surfaces. All corners and holes are rounded in order to reduce the number of crevices.
Accessible for Inspection, Maintenance, Cleaning and Sanitation	All parts are easily examined since they are easy to take apart, inspect and maintain on site. The majority of the design is large, easily cleanable surfaces.
Design for reuse	
Material	
Reduce product weight	Only functional parts are created, nothing more than what is needed to create the function.
Mounting / Modularity	
Design modules for different user needs	Two different comfort levels are offered depending on the user's needs. The flexibility of the sofa system enables the fulfillment of different user needs.
Marking	
Every detail should be marked	Each part has a QR-code engraved, when scanned it opens a website which shows which kind of sofa system the part belongs to with assembly instructions
Publish public, digital manuals	Available on the subscription service website
Form and appearance	
Support personalization and adaptation to each user	The ability to assemble the sofa to fit exactly your living space and possibility to choose skin layer
Make a detail in your product/service unique	Possibility to use each cushion module as seat, backrest or armrest is unique
Make sure users feel that they are in control, they can stay on top of the situation and dominate the product	The user may build the sofa and configure after changed needs, leading her to always stay in control
Keep a uniform design language throughout the product range	No matter if one module or spare part is replaced, they all behave and look the same.
Design for multiple users	
Reduce risk for misuse to keep a good condition despite multiple users	The way the pieces are assembled should be simple to understand, even for a first-time user.
Map out all possible user's needs and adapt the design to these	Done through the user journey, interviews and observations.
Design products for collective use. Multiple users simultaneously if possible and desirable	The modular design enables users to share their sofa with others, the choice to do so is individual
Enable value addition with every user	Each photo taken adds history and value of the sofa
Usability	
Affordance	The way the pieces are assembled should be simple to understand, even for a first-time user.
Recognition rather than recall	The way the pieces are assembled are similar to Lego, this should allow the user to feel recognition

Flexibility and efficiency of use	The system allows flexible assembly
Design for detachment	
Design so that people are able to let go of products they no longer need	The user personalizes it by adding their own skin layer and make it more personal with cushions and blankets. When cushions and blankets are removed, it should be easier to let go. A photo as memory might provide some kind of solace. The possibility to follow the sofa in the future might also give solace.
Cleanability	
Make sure that the product is cleaned before it is obtained by a new user	Skin layers are either brand new or washed before they arrive to a new user
Trigger/Facilitate riddance	
Trigger the users will that others will make use of the product when the user's need have ceased	The possibility to follow the sofa in the future might be a reason to let go
Make it possible for the product to carry certain history about previous use/user	The possibility to see photos of what home the sofa has been in previously if allowed by previous users
Facilitate the process	Free, assisted pickup of the sofa system
Make the process more efficient	Free, assisted pickup of the sofa system designed for easy disassembly and high movability
Help the user to make the riddance happen	Assisted pickup of the sofa system
Riddance logistics	
Design the product so it is easy to move and/or carry	Not to large volume, no protruding parts, edges and holes that works as handles etc.
Try to keep the receiving party as close as possible to the product before riddance	Local storage rooms in student housing complexes where the user may drop off upon cancellation
Communicate to users the possibilities of reuse of their product in the end-of-life.	Part of a subscription model
Facilitate redistribution to other users	Subscription service provider ensures this
Facilitate to locate and to establish contact with receiving party	The user only need to contact the provider which contact already is established with upon sign up
Minimize undesired contact with the receiving part, e.g. by facilitating negotiation	The user only need to establish contact with the service provider, no negotiation needed/possible
Riddance solace	
Help the user know that the product make use for somebody	The possibility to follow the sofa in the future should provide this certainty
Help the user to make sure the value of the product does not go to waste	The entire subscription service is based on it, the possibility to follow the sofa in the future ensures it
Minimize the cost to get rid of the product	Pickup is included in the cost of the service
Counter regrets by soothing emotional connection to the product	There is always the possibility to once again subscribe to the service
Disassembly	

The product should be demountable with as few standard tools as possible	No tools needed for assembly nor disassembly
Choose fasteners which is easy separable, even after long time duty	The joints designed should be easy to disassemble even after long time
Consider where in the product the user should have access and where only authorized workshops should have access	None of the parts are restricted since the user is allowed to do repairs by herself and also to ensure material separability

In this specific design case 63 of the design guidelines were used in the development process. Another 28 were not applicable for this project but were considered to be applicable to many others, mainly because they are guidelines for partly digital products and for things the user interacts with more frequently and get feedback from. These 28 are presented in the discussion together with reasons for why they were not used. The in total 91 guidelines might have been a bit too many to be able to focus on all of them. In order to make them more comprehensible and make it easier to actually make use of the guidelines, they were after the project reworked. The final version of these guidelines is presented in order to be used in future projects, where only the most important 46 guidelines are chosen. This final guideline list with sources to all guidelines and specification of the authors contribution is presented in appendix 5.

10. Discussion

In this chapter, the result of the project is discussed. Initially the fulfillment of the project is discussed considering the purpose, aim, objectives and the research questions. This is followed by how the presence of design for exchange guidelines affected the project, both in terms of how it was to work with them and why some guidelines were not possible to use within the design case. The process is discussed in detail, also the final concept and how the project might have been affected by the fact that it was carried out single handed.

10.1. Fulfillment of the project

The project contributed to fulfill the purpose of the project initiating Use2Use project which was *“to develop and provide a tool to support design and development processes for reusable products”*. This project supported the knowledge development which contributes to making circular consumption into reality. This through the fulfillment of the purpose, aim, objectives and by answering the research questions, how this was done is presented below.

10.1.1. Fulfillment of purpose and aim

The purpose of this project was *“to create a better understanding of the exchange situation of a product from one user to the next and provide guidance and an example of how this can be done”*. This created the three sub objectives, *“provide understanding of the exchange situation”*, *“present design guidelines suitable for design for exchange”* and *“clarify with a design case”*. Initially an elaborated understanding of the exchange situation was provided through the user journey. Guidance for how this could be done was provided in the guidelines and in the vision. An example of how these guidelines may be adapted was provided through the design case which developed a sofa as a part of a subscription service.

The aim of this project was *“to design for product-life extension by facilitating product re-use”*. This was fulfilled through designing a sofa with a user centered approach to circular product design with focus on facilitating the exchange between one user and another. The design aims for the product to be used over and over again and ensures it through the business model. The service addresses the most painful activities in the user journey and the product was designed to fit the service, which led to a facilitated exchange situation.

10.1.2. Answers to design case research questions

The majority of each answer is based on how the research question is answered through the design case that created a sofa for the subscription service. The rest of the answer is an analysis of what could be done if other products and obtainment paths would have been chosen.

How can product design facilitate for people in the obtainment stage to choose sustainable consumption alternatives?

A lot of the pain activities of the subscription model during the obtainment phase are about scale, availability of physical access points and a wide range of multiple providers, which is not a part of the product design. Therefore, it is hard to influence the consumption choice through product design. The hope of this project is that this will be addressed by business design, that a large, global furniture chain with well visited warehouses will pick up on this idea and thereby address the initial pain activities in the user journey. It is only the last activity of *“getting access to product”* which may be facilitated by product design under the obtainment stage in the user journey. In this project, it was done by offering a packaging that allows for easy delivery all the way inside the home together with easy assembly on site.

If another obtainment path or if the provider would be decided before the product development, a lot could be done within the early user experience and marketing. A good marketing campaign would do much to ignite the want/need and also create a product want/need. The user experience of assessing the product increases greatly if there is a possibility to experience the product in store.

How can product design facilitate for people to enter the riddance stage, so that they are motivated and enabled to make their things available for other users instead of hoarding them?

The product design within this project makes it easy to disassemble and facilitate moving the sofa out of the living space. However, in this project the obtainment path of subscription was chosen. Since subscription has a running monthly cost, this issue is in this project mainly addressed through service design rather than product design. The running monthly cost together with no cancellation time and free pickup is considered incitement enough to make the user enter the riddance stage. Even though there is a part in the business model which reduces the monthly fee after a certain amount of time, the ownership still stays with the provider, making sure that the sofa will be used by somebody else at some time in the future.

This question is more suitable to investigate further if an obtainment method which does not have a predetermined ending is chosen, since the predetermined ending brings much more reason for the user to enter the riddance stage. This since there is usually some kind of punishment if the product is not returned to the provider, either economic or social guilt. If “buying” or “non-time limited loans” were to be investigated, it would probably be easier to address this riddance facilitation through product design.

How can products be designed so that they are in good condition and attractive to multiple users over time, not just for one user during one single use cycle?

In general, this is achieved by applying the designer guidelines, with special focus on the design for longevity and reuse guidelines presented in appendix 5. In this project, these are applied by designing easy replacement through separate material modularity, choosing materials that lasts and dimensioning the parts with a large safety margin. To find out more in detail about how these guidelines were applied in this project, read the “Evaluation of the guidelines for the design case” chapter in the end of the presentation of the final concept.

For other products and obtainment paths it might be more important to design the possibility for the end user to do the quality check. As the sofa system is offered through a subscription service, it feels like a too large step for the current market to ask the user to quality check before making rid or obtaining the sofa. Maybe this will be possible in a future where product circularity is more common.

10.2. Working with design for exchange guidelines

A hope for this project was that design for exchange guidelines would bring a different way of thinking during the design process. The design process from when a product was determined to be redesigned was not very different from traditional user centered product development. The stakeholder's needs were investigated and tried to be fulfilled. Typically, the main focus is on fulfilling the end users need. By using the design for exchange guidelines within this project, the typical focus on the use time of the end user became more nuanced since larger attention was paid to the obtainment and the riddance of the product. This provided significantly more functionality for assembly, disassembly, reassembly, repairs and movability compared to what a standard procedure product development project would presumably do.

This user centered approach to circular product design was considered applicable for the sofa designed in this project, which is a product not exchanged very often. However, it is

probably even more important for a product which is passed on between users more often, since a larger number of exchange situations make the exchange functions more desirable. For a product less often exchanged, these guidelines would be of less importance. For future product circularity design projects, it would be proposed to look into how large proportions of the interaction with the product is actual exchange interactions and prioritize the focus on the user needs during the ideation process based on this.

10.3. Evaluation of use of guidelines based on the design case

The guidelines which were not considered to be suitable explicitly for the specific design case within this report are presented below in table 8 together with a short explanation of why each was not considered suitable for this specific design case. The guidelines are presented to the left and the explanations why they were not used in the project are presented to the right.

Table 8. Guidelines not considered to be suitable for this specific design case to the left together with reasons why they were not used to the right

Guidelines	Why they were not used in this project
Mindset guidelines	
Rethink how to provide the benefit	To provide an example of how a product can be redesigned which this project set out to do, the sofa should stay a sofa and not just a resting product
Consider what function you shall create, not which product	In this redesign project, the sofa should stay a sofa and not just a resting product
Mimic biological systems since they are always circular	An attempt was made to use this one, but no idea turned out to be useful enough to continue to develop
Business guidelines	
Business model	
Create a market to allow the users to exchange modular components based on user needs	Since all modules are offered through a subscription service there is no need for a separate market
Keep the up-time as high as possible to differ as little as possible from owning a product	There is nothing within the developed product which requires up-time
Provide sufficient ID-verification when users interact	Since there is a company offering a subscription service, there is no direct communication between users
Provide guidance in areas where an access-providing user might feel lost	There is no end user providing access within this design case
Business perception - how the user perceives the service	
PSS must be easily available wherever and whenever needed	This is not an on-demand PSS system that need wherever whenever access
Design for longevity guidelines	
Material	
Design for wear and let the wear create a new aesthetic experience	Did not find any good idea to apply this guideline within this design case
Form and appearance	
Create emotional durability according to Chapman's five elements	It seems easier to apply this for a product you interact with more frequently and more face to face
Controllability	
Equip products with automatic damage diagnostics system	According to the third user questionnaire, people seem skeptical to implement electronics into a product which usually do not have electronics
Help users understand when their use is hurting the product long term	The generous dimensions of the product make it hard for the user to use the product in a way which is hurting the product long term
Usability	

Constraints	The sofa system does not enable this interaction
Visibility of system status	The sofa system does not enable this interaction
Error prevention	The sofa system does not enable this interaction
Help users recognize, diagnose, and recover from errors	The sofa system does not enable this interaction
Design for product life extension	
Make the user aware when it is time for maintenance	The service system should be able to make sure that the user does not need to care about standard maintenance
Allow software upgrades	There is no software within the software system
Allow for flexibility during future technological change	There is no technological change for sofas within imminent future
Cleanability	
Encapsulate dirty processes	There are no dirty processes within the sofa system
Design for reuse	
Form and appearance	
If applicable, provide possibility to save personal data	No personal data is available
Aim to reduce the “impact on everyday life”, and “uncertainties” in anticipating such consequences	Uncertain of how to apply this guideline to this design case
Trigger/Facilitate riddance	
Facilitate to determine when it is time to pass the product forward	The subscription service model provides economical pressure to cancel the subscription when the user no longer need the sofa
Help the user find out what options are available to get rid of the product	The subscription service model only allows the user to return the sofa
Permit rapid and irreversible erasure of all personal data that may be on a product.	There is no personal data in the sofa system
Riddance solace	
Support retailers to offer take-back services of their product range	Not applicable for a subscription service

10.4. Final concept

The final concept truly fulfills the objective of why the design case was carried out. It shows how the proposed guidelines for exchange might help in the development process of a circular product design. It features several innovations which facilitate the exchange situation, for assembly, maintenance and movability.

Also the service, the business model which the sofa is set out to be a part of, facilitates the exchange situation. The subscription model was chosen since it provides the flexibility and low commitment rate found in the trend research in the beginning of the project. This suits the target group that does not want to commit to such a large furniture piece because of their uncertain future living situation.

Apart from this, there was a misjudgment in the planning of the project. The final concept was planned to be developed during three weeks while splitting the time worked evenly between the report writing and the product development. The ambition of the previous parts of the project might have been too high resulting in a large need of documentation in the report. This led to less time to develop the final concept than anticipated.

10.5. Process

The methods used within this project were based on a general Industrial Design Engineering methodology which provided a structured way of working throughout the process. This even though the process itself was not common Industrial Design Engineering practice since the process of this project was more explorative.

Questionnaires as main user input

Questionnaires were used three times in this project since most of the questions raised in the project were about finding out if a certain opinion is a general opinion or not. This was a time efficient way but in hindsight, more time and energy should have been spent on observations and interviews in people's home with their sofa as mediating object to gain deeper insights about the use phase of the sofa. Insights gathered for product circularity and furnishing as a service in general, were also assumed to be true during the development of the sofa, it would be preferred to gather those insights specifically for the sofa.

The questionnaires were spread publically online which makes it hard to know how polarized the responses were. The title of the questionnaires; "Circular access to products", "Circular access to home furnishing" and "Circular access to a sofa" might have attracted a type of people that consider circularity to be a good thing. The spread to social media groups about collaborative economy and about aware consumption might also have made the proportion of the participants that care for the environment larger than what is general for the entire population.

Business model development

To look at as similar businesses as possible seemed to be the best way to go. However, the choice to let the participants tell if it was important and then strictly follow their opinion, might have been a questionable choice. Some interpretation to make it a bit more business feasible would have been good. However, this business model was adjusted for the final concept to make it more feasible. Attempts were made to get in contact with companies which could point out strengths and weaknesses about the business model, if these attempts would have been successful, the result would have been more certain to be feasible.

10.6. Working alone

During the project, many decisions were made, also evaluations and putting a weight to a certain criterion. Based on previous experience it is easier to stay more objective when making these decisions and ratings if you are not alone. By looking through the matrices, weights and ratings, the opinion and the mindset of the author is made quite clear, making it easy to analyze the result and evaluate if the opinion aligns with you as a reader.

Working alone also required less scribbling down of ideas and thoughts along the way since there was no one else there during most of the process. This might have also made the ideation process longer than it could have been since there was no one there to say stop or “what if we think like this instead?”. Thankfully the supervisor was available for almost weekly tutoring sessions, serving as a sounding board to be able to ventilate some ideas. Since not much were scribbled down, also less were prepared for the final report which led to more time needed to finish it in the end of the project.

Working alone with such a wide and loose project was also a bit difficult since it is harder to “kill your darlings” when no one else helps you to do it. It is easy to see the beauty of the function since a lot of work has been spent on it, so much that it is hard to take a step back and objectively see if the form language and appearance is any good at all. In hindsight, it was noticed that the process got stuck for too long sometimes, wanting to solve things that did not really need solving right then. There was a too strong desire to make everything work together. In group work more compromises are done, allowing some criteria to fail in order to reach higher innovation via another criterion.

Both the process and the result were affected largely by the personality and the mindset of the author. This created an exploratory process where all major decisions were made by the author. This became clear when the result of this project was compared to the result of the sister project with the exact same brief.

11. Conclusion

This chapter features conclusions that could be drawn from the project, both with respect to the result and the process of using design for exchange guidelines as a tool for designing product circularity.

11.1. The result of the project

The result of the project consisted of three parts: Understanding of the exchange situation, guidelines for circular product design and a design case resulting in a sofa.

Understanding of the exchange situation through the user journey

The exchange situation for a product was thoroughly examined. The deep understanding of the situation resulted in a tool, which can be used to understand where in the user journey the user may encounter pain activities for a certain obtainment path. The user journey is mapping out activities of the user activities related to the obtainment, use and riddance phase for a product. Hopefully this understanding may be of value for future circular product development processes.

Guidelines to use for circular product design

A final list of 46 guidelines suitable for circular product design was compiled. Initially, these guidelines cover the mindset for the entire business, service and product design. Business model guidelines are provided but the majority of the guidelines are proposed for the designer, with main focus on design for longevity and design for re-use. The authors' contribution were 21 guidelines mainly providing guidance for the business model and the riddance part with insights from the user centered design approach to circular product design.

Design case: A sofa offered through a subscription business model

A sofa was developed, highly suitable for a subscription business model. This was done through putting high focus on the needs of all those who come in contact with the product, the end user, the upholsterer and the professional mover. This provided a modular system which provides high flexibility for the end user, good reparability and movability. The design provided easy interaction with the sofa, which allowed some responsibility to fall upon the end user to make the proposed service more attractive in a revisited business model.

11.2. Designing product circularity using exchange guidelines

By gathering sustainability guidelines and creating new design for exchange guidelines, the typical focus on the use time of the end user became nuanced since larger attention was paid to the obtainment and the riddance of the product. This provided presumably significantly more functionality for assembly, disassembly, reassembly, repairs and movability compared to a standard procedure product development project. This approach was considered applicable for the sofa designed in this project, which is a product currently not exchanged very often. However, this methodology is probably even more important for a product which is passed on between users more often, since a larger number of exchange situations makes the exchange functions more desirable.

12. Recommendations for further development

For future development of this user centered approach to product circularity design, it would be proposed to look into how large proportions of the interaction with the product is actual exchange interactions. Based on this, the focus could be prioritized on the user needs during the ideation process and also when evaluating the ideas.

The guidelines could be refined if a project would be carried out with the guidelines as a foundation. If this project would continue all the way through the design process and actually be tested on users, this would bring great insight in how to refine the guidelines.

Regarding the design case, it would be recommended to develop several sofa systems with the same basic thought and features to be able to please all user nuances. It would also be important to do proper dimensioning of each part and test the different sizes of the cushion module with users to verify what sizes should be offered.

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Appendix

Appendix 1. All user journey activities within their clusters

Obtainment phase

- Initiation
 - A want and/or need of a product is created
 - An opportunity to obtain a specific product appears
 - A want to obtain something from a certain provider
- A want and/or need is created
 - Notion in back of mind what I want/need
 - An aware notion of what I need (weak or strong need)
- Identify providers
 - Casual browsing range of products
 - Browse the product range with focus
 - Explore preferences / Identify needs
- Assessing the product
 - Search for bargains, good deals
 - Search for specific product
 - Get a feel for the quality, test out the function and overall impression of product
 - Read reviews / Ratings / Friend advice about the product
 - Get convinced by provider (talk to salesmen, read product description)
 - Decide upon which product you want
- User-product match
 - How much am I going to use it?
 - When do I need it?
 - For how long am I going to use it?
 - Estimate need over time
 - Determine Use/Cost ratio - if $\text{Use} > \text{Cost} = \text{Good obtainment}$
 - Match identified needs to functions in product
 - Consider consequences for
 - economical loss during use period
 - own economy
 - family economy
 - the environment
 - social risks of going through with the deal
 - Consider product precision to fit the needs
 - is the appearance close enough?
 - How well does the product meet desired function needs?
 - Is it worth it? Is it a good enough deal?
- Assessing providers
 - Notion of what kind of delivery is needed
 - Compare different providers offers
 - Read reviews / Ratings / Friend advice about the provider
 - Decide upon which provider to use
 - Make contact with provider (visit webpage, store or similar)
 - Establish trust for provider
 - Communicate needs to provider, feel that the provider understands your needs
 - Review terms and conditions
 - Availability of access
 - Contract time / Binding period
 - Responsibility distribution

- Consider activities that will occur during use phase based on obtainment path choice
 - Possible trial period
 - Show off product for others
 - Simplicity to make a complaint / return product
 - Implicit social dept. Expected counterperformance from social constructs
 - Service and maintenance
- Consider activities that relate to the riddance phase
 - Agreement of how to end the use period before first access
 - Consider means of transport needed to get rid of it
 - Consider what help is needed to get rid of product
 - Does it create a problem to not have the product if you have had it once?
- Complexity of making a deal
 - Both parties' agreement
 - Decide counter performance (value difference)
 - Convince the seller that you are the right buyer
 - Confirm your identity to provider
 - Credit check / Make provider trust you
 - Negotiation
 - Decide payment method
 - Make a decision; Go/No go
 - Sign the deal
- Getting access to product
 - Define time when access is needed the first time
 - Make sure access is available when needed (order / book / reserve / ask for permission)
 - Decide for time and place to close the deal, find a match in both parties' schedule
 - Plan delivery / Choose delivery method
 - Determine start and end of access
 - Execute delivery plan (may include packing)
 - Possible delivery waiting time
 - Bring product home (from provider / package delivery service point / outside the door)
 - Review condition of product (to file complaints or renounce responsibility of damage to product upon return)

Use phase

- Unboxing
 - First contact with product
 - Unbox
 - Install
 - Adapt to user preferences
 - Handle wrapping
 - Consider if current inventory need to be adjusted
- Interactions
 - Check availability before use
 - Use the product
 - Determine if the use need have been fulfilled
 - Evaluate if the product was suitable for the need
 - Possible trial period
 - Decide if you should keep/continue
 - Show off product for others
 - Give feedback to provider
 - Make a complaint / return product

- Service and maintenance
 - Interaction with co-users and possible temporary users
- Due time
 - The user does not need the product anymore
 - Prior agreement
 - Decide if you should buy out the product or not after leasing period end
 - Be annoyed by a product
 - Realize the redundancy of a product
 - Consider effects of no longer having access to this product
 - Is it a bad deal economically to get rid of the product and to regain access?
 - Is it hard to regain access to this product?
 - Is it time consuming to regain access to this product?
- Forgotten
 - The product might be forgotten in several ways
 - Actively stored away
 - Ends up somewhere
 - Not enough time/effort to get rid of it now
 - Is lost
- Possible catalyst activities / Igniting realization
 - Clear storage space/garage/wardrobe/attic
 - Identify redundant products because of new or planned purchase
 - To rectify new consumption
 - Purchasing/ordering a replacing product
 - Identify and engage in spontaneous riddance opportunities (e.g. a relative is going to a fair or to the recycling station)
 - Reflection about who you are what you want to do
 - Adjustment or upgrade of product contract
 - Outer pressure to get rid of product
 - Somebody else wants it gone
 - Economical pressure
 - Changing living situation
 - Moving to another living space with different storage space
 - Large financial change, positive or negative
 - Marriage / Separation

Riddance phase

- Realize redundancy
 - Notion in back of mind of redundancy
 - Encounter / Reminder / Awareness of redundant product
- Value product
 - Determine condition of / screen product
 - Determine continuous need
 - Sort
 - Rate economical profit / loss
 - Consider product's sensitivity to trends
 - Rate economical- or need value of product for someone else
 - Weigh risk of wear and tear
 - Determine pricing
 - Determine price / effort to pay to get help to get rid of product
- Restoring value
 - Repair
 - Clean

- Gather accessories; manual, add-ons, packaging, receipt
- Determine possible riddance paths
 - Browse range of riddance services
 - Consider how much time/effort each path requires
 - Consider cost for each considered path
 - Weigh pro's and con's
 - Reflect about who you are and what you want to do
 - Decide if the cost of the middle-man is worth it
 - Value the return-deal
 - Choose path
 - Go/No go, decide that you don't want the product anymore
- Preparing riddance
 - Plan personal product unavailability, start and stop of access
 - Save / transfer data
 - Remove data
 - Consider means of transport
 - Consider what help is needed to get rid of product
 - Save memories of product
 - Create PR-material, take pictures for advertising, write description / oral explanation
 - Publish advertisement
 - Decide on what help will be requested
 - Decide if more products should go out together with this one
- Complexity of making a deal / Preparation of a deal
 - Establish connection with receiver
 - Identify receiver
 - Identify possible middle man
 - Make contact with receiver
 - Establish trust for receiver
 - Communicate with receiver
 - Correspondence / Answer questions, communicate flaws / condition
 - Communicate flaws / condition
 - Communicate instructions about use and rules
 - Negotiation
 - Offer counter performance service
 - Ask for deposition
 - Both parties' agreement
 - Collaborate with middle man
 - Decide on price together with middle man
 - Understand terms and conditions
 - Consider insurance options
 - Establish trust as a provider
 - Convince the receiver that you are the right provider
 - Make your personal data / contact information available to receiver
 - Provide proof of identity to receiver
 - Provide proof of ownership / Right to provide
- Closing the deal
 - Choose payment method
 - Execute payment
 - Register transfer of ownership/access
 - Create receipt
 - Pay middleman
 - Screening before hand-off

- Plan delivery (post, pick-up, meet-up/store)
- Return of deposition
- Close the deal
- Go/No go, decide to get rid of it
- Ending access of product
 - Uninstall the product
 - Provide reason to pause/terminate access
 - Wrap it for delivery
 - Decide for time and place to close the deal, find a match in both parties' schedule
 - Decide logistics, delivery method and cost
 - Execute delivery plan
- Post ownership / access
 - Receive confirmation of accomplished exchange
 - Receive feedback that the product now serves a purpose with someone else
 - Restore the product's context (e.g. fill in holes in the wall)
 - Provide counter performance service
 - Availability when another user uses the product
 - Rate new user/provider
 - Give feedback
 - Evaluate social outcome
 - Evaluate new offers
 - Handle complaints / returns

Appendix 2. Final iteration of guidelines

Final design guidelines for exchange	Source	Inspired by
Mindset guidelines		
Consider how the users needs may be fulfilled, not which product	Rosman	Bombardier pamplet, OKALA, eko strategy wheel (Okala 2012)
Consider providing the product as a service	OKALA, eko strategy wheel (Okala 2012)	
Mimic biological systems since they are always circular	OKALA, eko strategy wheel (Okala 2012)	
Business guidelines		
Business model in general		
Keep the up-time as high as possible to differ as little as possible from owning a product	Rexfelt, Ormåns (2009)	
Provide user with as much flexibility as possible to provide a freedom similar to owning the product	Rosman	User research, Nielsen
Offer some extra value compared to traditional buy/sell, e.g. financially competitive, reduced hassle, flexible upgrades	Rosman	Market research
Provide guidance in areas where an access-providing or accessing user might feel lost if used to buying, e.g. common monthly price for this kind of product	Rosman	Market research
Make sure the condition of the product is known and certain for both providing user and accessing user	Rosman	Scotland Zero Waste
Business perception (how the user perceive the service)		
Keep in mind customers transaction costs in terms of all currencies; time, money and energy. Make sure the user understand the full value of the service in all currencies and allow the user to invest time, money and energy since it contributes to making the user approving and loyal.	Rosman	Rexfelt, Ormåns (2009)
Marketing (communication to customer)		
Reduce uncertainties regarding risks, costs and responsibility distribution	Rexfelt, Ormåns (2009)	
Distribution		
Consider to transport new products in modules for mounting by the end user, this makes the user more aware of how to replace spare parts	Rosman	Stena konstruktionshandboken
Design for longevity guidelines		
Material		
Use materials that age gracefully	Kopierat från Use2Use-verktyget, 2016	
Let materials that need to be regularly replaced to be easy separable and recyclable	Rosman	Design case
Mounting / Modularity		
Design modularity to be able to upgrade the function and aesthetics	Stena konstruktionshandboken	
Form and appearance		
Design for a personal connection to trigger desire to care for product long term	Chapman	
Create a strong timeless look	(Jönbrink et al. 2011) pg. 70	
Controllability		
Design possibilities for easy screening, e.g. visually through attrition markings, and provide screening instructions	Stena konstruktionshandboken	
Usability		
Constraints	Norman	
Error prevention	Norman	
Design for product life extension		
Design for durability, use materials and dimensions that keeps its function throughout the long lasting use period	Rosman	OKALA, eko strategy wheel (Okala 2012) (Bocken et al. 2016)
Engineer to reduce maintenance	Stena konstruktionshandboken	
Design products for easy on-site maintenance	AvCarlo Arnaldo Vezzoli, Ezio Manzini	
Design for upgradability and adaptability	(Bocken et al. 2016)	
Cleanability		
Cleanable to a microbiological level	10 principles of sanitary design, https://www.meatinstitute.org/ht/a/GetDocumentAction/1/97261	
Design for reuse		
Material		
Reduce product weight	OKALA, eko strategy wheel (Okala 2012), Bombardier pamplet, AvCarlo Arnaldo Vezzoli, Ezio Manzini, Kopierat från Use2Use-verktyget, 2016	
Make sure that all materials are separable into recyclable raw material parts	Rosman	Design case
Mounting / Modularity		
Design exchangeable modules for different user needs	Rosman	Design case
Marking		
Every detail should be marked to be able to predict maintenance and providing public, digital manuals.	Rosman	(Jönbrink et al. 2011) pg. 74, FAAS Sthlm
Form and appearance		
Support personalisation and adaptation to each user	Rosman	(Bocken et al. 2016)
Keep an uniform design language throughout the product range	Adèle Gruen	
Design for multiple users		
Reduce risk for misuse	Stena konstruktionshandboken	
Map out all possible stakeholders and user type needs and adapt the design to these	Rosman	
Enable value addition with every user	Kopierat från Use2Use-verktyget, 2016	
Usability		
Affordance	Norman	
Design for detachment		
Design so that people are able to let go of products they no longer need	Rosman 2018	Selvfors, Rexfelt
Cleanability		
Make sure that the product is cleaned and feel hygienic before it is obtained by a new user	Camacho-Otero, J (2017)	
Trigger/Facilitate riddance		
Trigger the users will that others will make use of the product when the user's need have ceased	Rosman 2018	User research
Permit rapid and irreversible erasure of all personal data that may be on a product	http://eco3e.eu/toolbox/design-for-reusage-reparability/#1	
Make it possible for the product to carry certain history, optionally anonymously, about previous use/user to tell a story and/or to predict maintenance	Rosman 2018	Rexfelt
Help the user to make the riddance happen	Rosman 2018	User research
Riddance logistics		
Facilitate redistribution to other users	Kopierat från Use2Use-verktyget, 2016	
Riddance solace		
Help the user know that the value of the product is maintained and come into use for somebody else	Rosman 2018	User research
Minimize the cost to get rid of the product	Rosman 2018	User research
Counter regrets by soothing emotional connection to the product, e.g. offer a possibility to borrow the product back	Rosman 2018	User research
Disassembly		
The product should be demountable with as few standard tools as possible	Stena konstruktionshandboken, AvCarlo Arnaldo Vezzoli, Ezio Manzini	
Choose fasteners which is easy separable, even after long time duty	(Jönbrink et al. 2011) pg. 106	

Appendix 3. Trend and insights clusters

People want to do good, and are starting to do so

- People are prone to altruistic behavior
 - (<https://plato.stanford.edu/entries/altruism-biological/>)
- People are in general more concerned about and aware of the environment
 - (Konsumtionsrapporten 2017)
- Ekologiska produkter, second-hand, donationer till hjälporganisationer och prutande ökar rejält i Sverige under de senaste åren
 - (Konsumtionsrapporten 2017)
- Prosocial konsumtion är när vi spenderar våra pengar på andra i stället för på oss själva, t.ex. donera pengar till hjälporganisationer eller köpa presenter till andra. Sådan konsumtion har visat sig leda till ökat välbefinnande hos givaren
 - (Fors & Brölde, 2011)
- Nya miljövänliga transporttjänster växer enormt, framförallt cykelbud
 - (https://www.fri-kopenskap.se/article/view/384510/restaurangmat_pa_cykel_vaxer_snabbt)
- People are ashamed of their behavior that is harmful for the environment
 - (Kaiser, F. G., Ranney, M., Hartig, T., & Bowler, P. A. (1999). Ecological behavior, environmental attitude, and feelings of responsibility for the environment. *European Psychologist*, 4(2), 59-74.)

Circular business models are booming

- Business trend: Capacity capture
 - trendwatching.com/trends/5-trends-for-2017/
- The global sharing economy is growing rapidly, with many of the world's most valuable start-ups emerging in this sector.
 - Trend-monitor #1, 2018
- Kollaborativa konsumtionsföretag och -system har vuxit snabbt och man uppskattar att den globala marknaden för dessa system uppgår till 35 miljarder dollar år 2013
 - (Botsman 94 Förbättra nordiskt beslutsfattande and Rogers 2010)
- Sedan 2012 har konsumtionen av second-hand fått ordentlig fart i Sverige
 - Kläder och skor är den största kategorin. Andra varor som köps mycket på second hand är husgeråd och porslin, böcker och möbler
 - (Roos, 2017).
 - 7 av 10 svenskar har köpt eller sålt någonting på Blocket. Bland barnfamiljer är det ännu vanligare, 9 av 10 barnfamiljer har köpt eller sålt någonting på Blocket.
 - <http://www.blocket.se/omblocket.htm>
- Många nya företag försöker utnyttja hållbarhetstrenden genom att skapa tjänster som är bra för den cirkulära ekonomin.
 - Erbjuder produkter som en service
 - Resursdelning
 - Bli av med skräp som inte är värt något
 - Rensa ur, sortera, prissätta, annonsera, sälja och användaren får behålla en del själv
 - Skapar en plattform där privatpersoner kan annonsera det de vill bli av med
- The trend is to design for circularity, focusing on business models and offering access over ownership, not yet so much the design itself.
 - Mont and Plepys, 2003
- People are exploring new revenue streams and supplementing their income by unlocking new levels of value in their excess resources.
 - Trend-monitor, 2018
- Governments are starting initiatives to strengthen circular economy
 - In Sweden: Sänkt skatt på mindre reparationer

- <http://www.regeringen.se/rattsdokument/departementsserien-och-promemorior/2016/03/sankt-mervardesskatt-pa-mindre-reparationer/>
- In Scotland: Zero Waste Scotland, initiative which includes the revolve certification which guarantees the quality of second hand products
 - Zero waste Scotland
- Free public transport initiatives
 - Etc, 2015

People are bad at estimating their needs

- People rarely know the causes of their own behavior
 - Psychology today, 2015
- Svenska folket slänger nästan en halv miljon ton ätbar mat varje år. Per person uppskattas matsvinnet till 46 kilo per år (130 gram per dag)
 - Konsumtionsrapporten 2016, från Centrum för konsumtionsvetenskap vid Handelshögskolan, Göteborgs universitet.
- Den faktiska användningstiden för många kapitalvaror minskar, t.ex. används en genomsnittlig europeisk bil 29 minuter per dag, den är stillastående resten av dagen – 23,5 timmar; en borr används i genomsnitt 15 minuter per år och är också ofta utformad för att hålla för 90 minuters användning.
 - Oksana Mont et al, 2013
- Lagringsindustrin har blivit ett av de snabbast växande segmenten i den kommersiella fastighetsbranschen under de senaste 30 åren.
 - Oksana Mont et al, 2013
- Hamstring blir ett psykologiskt problem i många industriländer med konsekvenser för välbefinnandet, inte bara för hamstrare, utan även deras familjer och vänner.
 - Oksana Mont et al, 2013
- Small sensors are getting cheaper and are getting more widespread.
 - Techcrunch, 2015; <https://beta.techcrunch.com/2015/03/10/cheaper-sensors-will-fuel-the-age-of-smart-everything/>

Time is tradeable

- People are most concerned about time and effort, after that money
 - (Konsumtionsrapporten, 2017)
- I praktiken är tid en av de viktigaste sakerna för den moderna konsumenten.
 - (Konsumtionsrapporten, 2017)
- People are able to exchange less tangible assets such as time, space and skills, with no transaction of money.
 - (Botsman & Rogers, 2011, p. 73)
- Svenska konsumenter använder priserbjudanden betydligt oftare
 - (Konsumtionsrapporten, 2017)
- One of the most well known carpooling organizations in Sweden has increased from 35.000 members in 2013 to more than 50.000 now in 2018
 - Skjutsgruppen, 2018
- En växande värdeförändring kan observeras i den övergång vissa människor gör från produktäggande till produkttillgång genom samarbetskonsumtion (byte, utlåning och handel via nätgemenskaper) eller "sambruksekonomin".
 - Oksana Mont et al, 2013

People have a deep need for a sense of control

- People are calmed by knowing how other handle similar experiences
 - Authors opinion
- Loss of sense of control may lead to powerlessness, inability. Not being able to control and that no one else can help either is hard. (Forgotten products)

- (Changing minds, 2018)
- A sense of control is achieved by certainty, completion of tasks, understanding, prediction and consistency.
 - (Changing minds, 2018)
- Anticipated regrets: People are afraid of making wrong decisions
 - W.A. Kaufmann (1973)
 - People don't want to many options
 - (Changing minds, 2018)
 - If not any available option feels right, then they want more options
 - (CXL, 2016)

We express ourselves through our things

- Consumption is a way of building your identity through money, possessions, status and "standard".
 - (Paul Stiles, 2005)
- Humans have an urge to collect things and hoard them
 - (Psychology today, 2013)
- "Vi är rädda för att ha färre saker, rädda för att släppa taget."
 - (Oksana Mont et al, 2013)
- De som strävar efter att tjäna mycket pengar och köpa många saker lider oftare av oro och depression. De har också mer problemfyllda kärleks- och vänskapsrelationer. Materialistiska livsmål och överkonsumtion är kopplat till en överrepresentation av psykisk och fysisk ohälsa.
 - (Tim Kasser, 2002)
- Undersökningar visar att det totala antalet produkter per hushåll är på ständig uppgång (IEA 2009) och människor idag tenderar att äga mer än en produkt i en viss produktkategori (datorer, mobiltelefoner, TV-apparater)
 - (Oksana Mont et al, 2013)
- According to Maslow's Hierarchy of Needs humans first need to have their physical need fulfilled, then security, social, ego and last self actualization.
 - Physical: Food, water, health
 - Security: Safety, shelter, stability
 - Social: Being loved, belonging, inclusion
 - Ego: Self-esteem, power, prestige
 - Self actualization: Personal development, creativity
 - (<https://www.psychologytoday.com/blog/hide-and-seek/201509/philosophical-cure-anxiety>)
 - Consumption is somewhat social, but now a days mostly addressing the ego and self actualization.
- (Authors opinion)

People want to be recognized as individuals with personal needs but still belong to a group

- "Individualism refers to consumers' increasing desire to be recognized as having 'personal needs' rather than being part of the 'mass market'."
 - (Trend-monitor #2, 2018)
- "a culture of 'me first', creating a more engaged, confident and vocal consumer"
- "consumers move away from safe, consistent brands in favor of seeking out the unique products and services that nobody else has"
 - (Trend-monitor #3, 2018)
- "companies who communicate directly with their customers rather than via a middle-man have a definite advantage as they are able to use this information to tailor products and services to the individual."
 - Trend-monitor, 2015
- There is an increasing appreciation for self-employment

- Trend-monitor, 2015
- Living alone is an extension of individualism as society encourages self-reliance, and this has been influential in the rise of the single person household.
 - (Trend-monitor #2, 2018)
- The number of single households is expected to increase by more than 30% before 2030. The population is getting more and more lonely and many feel they need to have their own of everything that is usually shared between several, e.g. vacuum cleaner.
 - (Euromonitor, 2017)
- Vi vill vara som alla andra. Vi påverkas av grupstryck och vill ha det som alla andra har.
 - (Helmut Schoeck, 1969)
- People want to belong to a group
 - Baumeister, R. F. et al (1995)
- In a saturated consumer market, personalisation and customisation are benefiting producers looking to differentiate their offering. Brands are actively seeking out ways that allow their customers to personalise a product or service and make it bespoke to their individual needs and requirements.
 - Trend-monitor, 2015
 - The desire to be seen and served as a unique individual
- People want flexibility and adaptation to suit their needs
 - Only 13% of 'nine-to-five' workers expect to be in such a role in 10 years time, instead desiring more control over their working patterns
- Trend-monitor, 2015

Swedes are prone and able to consume

- Swedes have the best private economy in the EU
 - <https://www.sbab.se/download/18.4e49e65b1574d179da211a/1475496461684/161004+Svenska+hush%C3%A5ll+har+det+b%C3%A4st+i+EU.pdf>
- Mellan 2010-2016 ökade konsumtionen med 12,3 procent. Samtidigt visar mätningar över hur mycket konsumenter upplever att de spenderar endast en ökning på 2,3 procent.
 - (Konsumtionsrapporten 2017)
- Mer än 50 miljoner stora och 200 miljoner små apparater säljs i Europa varje år
 - (Haase 2001)
- Nya betaltjänster såsom swish och paypal gör det enklare än någonsin att säkert föra över pengar
 - <https://www.getswish.se/> and <https://www.paypal.com>
- Internethandel ökar
 - (Konsumtionsrapporten 2017)

Consumption of experiences makes you happier

- Konsumtion av upplevelser definierar bättre vem man är som person och konsumtion av upplevelser gör en lyckligare
 - (Psykologifabriken 2009)
- Konsumtion av upplevelser var det som genererade mest lycka, gjorde dem lyckligare rent generellt i sina liv, samt att det även uppfattades som en bättre investering av ens pengar än ett materiellt inköp (färre ångrade sig i efterhand).
 - (Psykologifabriken 2009)
- Prylar kan bidra till att vi blir lyckligare, men syftet med köpet måste då ha varit att göra något snarare än att enbart äga något.
 - van Boven och Gilovich
- The sharing economy provides people with access to goods who otherwise wouldn't be able to afford them, or who have no interest in long-term use.
 - (Trend-monitor #1, 2018)

- Svenska folket blir överlag allt lyckligare och det är statistiskt säkerställt att kvinnor är mer nöjda med sina liv än vad män är.
 - (Konsumtionsrapporten 2016)

Glocalisation

- in 2016 54,5% of the world's population resided in cities. By 2030, it is estimated that 60% of the world's population will be residing in cities.
 - http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2016_data_booklet.pdf
- People have a love for, and a need of a local context
 - (Trend-monitor, 2015)
- Globalisation = National and regional economies, societies, and cultures have become integrated through the global network of trade
 - <http://lexicon.ft.com/term?term=globalisation>
- Folk använder mer och mer betyg och omdömen från hela världen för en specifik produkt för att skapa sig en uppfattning. Man involverar gärna fler människor, söker mycket information och läser vad andra tycker och tänker.
 - <http://trendwatching.com/trends/5-trends-for-2017/>

Appendix 4. Choice of circularity path matrix

Each activity was given the value of 0, 1 or 2 representing the probability for the user to choose this path based on each activity where “0 = Negative”, “1 = Neutral” and “2 = Positive”. Each activity was lined up under the corresponding heading. For each heading, a mean value was derived and a grading system was applied where 0 to 0,67 equals low probability (red), 0,67 to 1,33 a neutral probability (yellow) and 1,33 to 2 a positive probability (green) that this path would be chosen by the user over others for this particular activity cluster.

Obtainment phase		Buy	Subscribe	Sell	Return R/L/S	offer acces	Dispose
Initiation		2.00	0.50				
Identify possible provider(s)		2.00	0.71				
Assessing/Valuing the product itself		1.85	0.85				
Is the product a good match for the user		1.65	1.05				
Assessing the provider benefits		1.90	1.43				
Complexity of making a deal		1.50	1.50				
Getting access to product		2.00	1.67				
Consider activities that will occur during use phase based on obtainment path choice		1.00	1.40				
Consider activities that relate to the riddance phase		0.80	2.00				
	GREEN	7	5				
	YELLOW	2	3				
	RED	0	1				
	RESULT / RANKING	1	2				
Use phase							
Unboxing		1.00	1.33				
Interactions		1.00	1.60				
Due date		0.2	2				
	GREEN	0	3				
	YELLOW	2	0				
	RED	1	0				
	RESULT / RANKING	2	1				
Riddance phase							
Realize redundancy		0	2				
Value product				0.56	1.72	0.56	1.39
Restoring value				0.00	1.17	0.00	2.00
Determine possible riddance paths				0.83	1.67	1.33	0.67
Preparing riddance				0.56	1.56	0.33	1.67
Establish connection with receiver				0.80	2.00	0.10	1.90
Communicate with receiver				0.85	1.67	0.44	1.89
Collaborate with middle man				2.00	2.00	1.00	1.00
Establish trust as a provider				0.25	1.50	0.50	2.00
Ending access of product				0.57	1.57	1.00	0.86
Closing the deal				1.00	1.78	0.78	1.67
Post ownership / access				1.00	1.63	0.75	1.25
	GREEN			1	10	1	7
	YELLOW			5	1	4	3
	RED			5	0	6	1
	RANKING			4	1	3	2

Appendix 5. Evaluation of concepts matrix

Each column is summarized upwards to align with the row of each heading.

	Vikt (1-3)	Soffa från dagens marknad	Koncept: Traditionell	Pålad	Stängvila	Bygel
Miljövänlighet		0	2.5	3.75	4	3.75
Enkel att ta isär i alla separata material för återvinning i end of life	2	0	3	4	4	4
Skin layer -> Middle layer	-					
Skin layer -> Runt Middle layer -> Base layer	-					
Base layer - olika delar/material fäster i varandra	-					
Det ska vara uppenbart för alla som eventuellt kommer slänga den i end of life att alla material är separata	2	0	2	3	4	4
Hur lätt det är att utforma en återanvändningsbar förpackning	2	0	1	4	4	3
Hållbara material, gärna återvunna	1	0	4	4	4	4
Montera/demontera/återmontera		2	3	3.4	3.6	3.4
Så få permanenta fästelement som möjligt	3	0	3	4	4	4
Så få sammansättningspunkter som möjligt	2	0	2	3	4	3
Så få sammansättningssteg som möjligt	3	4	4	3	3	2
Inga verktyg eller få standardverktyg	2	2	2	4	4	4
En logisk sammansättningsordning, gärna packad i den ordningen i förpackningen	2	4	4	3	3	4
Flyttbar		1.0	2.0	4.0	3.7	3.1
Inte för stor volym, ska gå genom dörrar och sväng direkt efter dörr osv, både med förpackning och utan om förpackningen saknas.	3	0	2	4	4	4
Möjlighet att frakta lagom mängd åt gången, man ska inte behöva gå allt för många gånger	2	0	3	4	3	3
Alla delar har sin plats under frakt, inga lösa delar som kan försvinna	2	3	3	4	4	3
Inga utstickande delar som kan fastna i dörröppningar eller skada hemmet	2	0	1	4	4	3
Kanter som kan fungera som handtag	1	2	2	4	4	3
Minst en kant som kan vara vinkelrät mot en pirra	2	2	2	4	4	3
Ej ömtåligt yttre vid flytt, soffor är ofta lätta att skära igenom tyget osv	3	0	1	4	3	3
Reparerbar		0.5	2.5	4.0	3.8	3.8
Utbytbar klädsel	3	2	3	4	4	4
Så mycket som möjligt är utbytbar på plats	2	0	3	4	4	4
Alla soffans delar, även stommens delar går att byta ut utan att behöva byta ut en hel sektion, endast den metallbit som är trasig, endast den bit av stoppning etc.	2	0	3	4	4	4
Så få olika byggstenar som möjligt	3	0	1	4	3	3
Anpassningsbar för olika användare		0.5	1.5	3.5	3.8	2.3
Möjlighet till spontan förändring	1	0	0	3	4	3
Ändra komfortnivå	2	0	4	3	3	0
Ändra bredd/djup/höjd	3	1	1	4	4	3
Ändra utformning	2	1	1	4	4	3
Tidlös design		3.8	3.3	2.8	3.5	3.3
Tight yttre tyg	3	3	2	4	4	4
Enkla grundlinjer, lite sväng, men mycket rakt	2	4	3	2	3	2
Bulliga kuddar	1	4	4	3	4	3
Helst inga synliga sammansättningspunkter	1	4	4	2	3	4

Appendix 6. Professional mover interview form

- Hur länge har du jobbat med att flytta möbler?
- Hur problematiskt är det att flytta en soffa jämfört med alla andra saker i hemmet?
 - Inte alls 1-6 Väldigt problematiskt
- Vad är jobbigt med att flytta en soffa?
- Av dessa grejer, vad är det jobbigaste med att flytta en soffa?

Appendix 7. Upholsterer interview form

- Hur länge har du jobbat med att reparera möbler?
- Kan du förklara vanliga sätt som soffor går sönder på?
 - Går det att laga?
 - Vilket är vanligast?
- Kan du förklara vanliga sätt som soffor slits ut på?
 - Vilket är vanligast?
- Av dessa grejer, vad är det jobbigaste med att reparera en soffa?
- På vilka sätt går en soffa sönder som inte går att laga?
 - Vilka reparationer väljer ni att inte göra?