

Future Laundry



MSc04- ID2 2016
Process report

Nicoline Sofie Jensen & Hanne Petrine Verner

SYNOPSIS



This master's thesis takes starting point in a Miele competition, where the task is to create a proposal for 'Future Miele'. The project team has decided to deal with the topic 'laundry', which has led to investigations of today's laundry behavior as well as the background and history of washing clothes. The project team discovered an increase in cleanliness standards and a decrease in the amount of wears before clothes is washed since the automatic machine was available in the early-mid 1900. This leads to worn out clothes and unnecessary frequent laundry activities. Therefore, the solution, 1st Choice, helps the user recycle the clothes and cleans it by using liquid CO₂ technology, which doesn't wear and tear the clothes. It might not clean bad stains, which is one of the reasons why it shouldn't replace the washing machine.

2

TITLE PAGE

Project title	Future Laundry
Theme	Future Miele Laundry
Period	01.02.2016– 25.05.2016
Study programme	Master's thesis
Team	MSc04 - ID2
Main supervisor	Christian Tollestrup
Technical supervisor	Karl Brian Nielsen
Issues	6
Number of pages	99 (64 standard pages)
Appendix	104

Reading guide

This project is documented in two reports and an appendix.

Product report: The product report presents our product; the context, the use, and the driving technology. Technical drawing are presented along with this.

Process report: The process report is telling the story of how the product came to be, and is, for the most part, told chronologically. It is supported by various documents in appendix.

Appendix: The appendix consists of documentation of the process. It consists of two parts: 1. Worksheets and 2. Various documents. These will be referred to as [Worksheet #, name of worksheet] and [Appendix #, name of appendix].

The process of developing the product does not stop when these reports are handed in on the 25th of May. The development is continued up until examination on June 24th. And in this case, material for the Miele 2016 competition is subsequently created.

3



Hanne Petrine Verner



Nicoline Sofie Jensen

The references are noted in the text as [Reference title, Year of publication] and is referring to the complete list of references in page 95.

Acknowledgments

Kyrni Rens, for having opened their business and helping us by sharing their knowledge of CO₂ dry cleaning.

Main supervisor, Christian Tollestrup, for not only scheduling supervision once every week, but also being present in our study environment on a daily basis, which has resulted in many short and informal supervisions. These 'pit stops' have sometimes caught some potential mistakes in time to rectify.

Friends and family for support and contribution with the project. We have dealt with a topic that require us to step inside of the user's bedrooms, which can be a very private subject, but they have opened up and provided us with important insights.

2

3

CONTENT

This report is divided in 5 overall chapters. Each chapter has it's own introduction in order to give the reader an overview.

0. Intro				
Synopsis	2			
Title page	3			
Content	4			
Process	6			
1. Align & research	8			
Introduction	9			
Miele	10			
Washing machines	12			
Development	13			
What is laundry	14			
Deconstruction	16			
The use	16			
Problems	18			
2. Creating Opportunities	20			
Design Brief	21			
Requirements #1	21			
Trends research	22			
Ideation	23			
Status 1	24			
Turning point	27			
User research	30			
Survey	30			
Interviews	30			
Observation	30			
'Fresh' Framing	32			
3. Define	34			
Requirements #2	34			
Ideation 1	35			
Research	36			
Considerations	37			
Entire wardrobe	37			
Storage	37			
Insert to existing wardrobe	37			
Free-standing	37			
In relation to washing machine	37			
Function	37			
Hand held device	37			
Dirt	38			
Requirements #3	40			
Effect	41			
Experiments	42			
Value creation	44			
Vision	45			
Technology shift	46			
Kymi Rens	47			
CO ₂ Dry-cleaning	48			
Important terms	50			
Walk in closet	52			
Requirements #4	53			
Similar products	54			
Sum-up	55			
4. Develop & Refine	56			
Context	57			
Personas	58			
Tower Fresh	60			
Purchase process	62			
Mock up	63			
2nd Status seminar	64			
Alternatives to tall	67			
Dewrinkling	68			
Requirements # 5	69			
Current CO ₂ cleaning process	70			
Components	72			
Cleaning chamber	74			
Alternative solutions	76			
Brief supply chain	78			
Identity	79			
Shaping	80			
Loose ends	82			
Inspiration boards	84			
Refining shape	86			
5. Outro	88			
Miele 1st Choice 3.0	89			
Conclusion	90			
Further work	92			
Reflection	92			
Perspective	94			
References	95			
List of illustrations	97			
References for illustrations	98			

PROCESS

Project team

This team was originally developed with three team members, but due to problems with another master thesis team, it was decided to split the team up, which meant losing the technical guy. This resulted in the team, SOP. However, this decision ensured a project team with more aligning interests. What we both have in interest, and wish to demonstrate with our master's thesis is the initial part of the project with framing, user involvement and development, and none of us have high interest in the very last phase where the product/components are made ready for production. This is very much in line with the first line from the objectives in the semester description:

"The aim of this project is to provide students with the opportunity to demonstrate their mastery of key competencies in a design engineering based self-driven process." [Appendix 01, MA4-ID semester description 2016]



Logo (SOP)

Deadlines and activities

Illustration 1 shows an overview of deadlines and important activities. It can be viewed prior to the report, but it can also be used to understand the order of the activities during- or after reading the report. The team will use it for reflection which can be read in the end of the report.

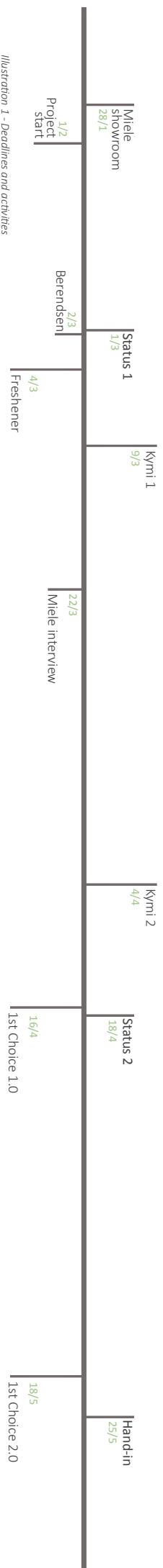


Illustration 1 - Deadlines and activities

Tracking

Illustration 2 shows the 6 phases, the project has been operating within. In order for the team to be aware of the phases, it was decided to track our work every day. The brown color indicates when both team members work within same phase, and the blue and green shows an individual person has worked within that phase.

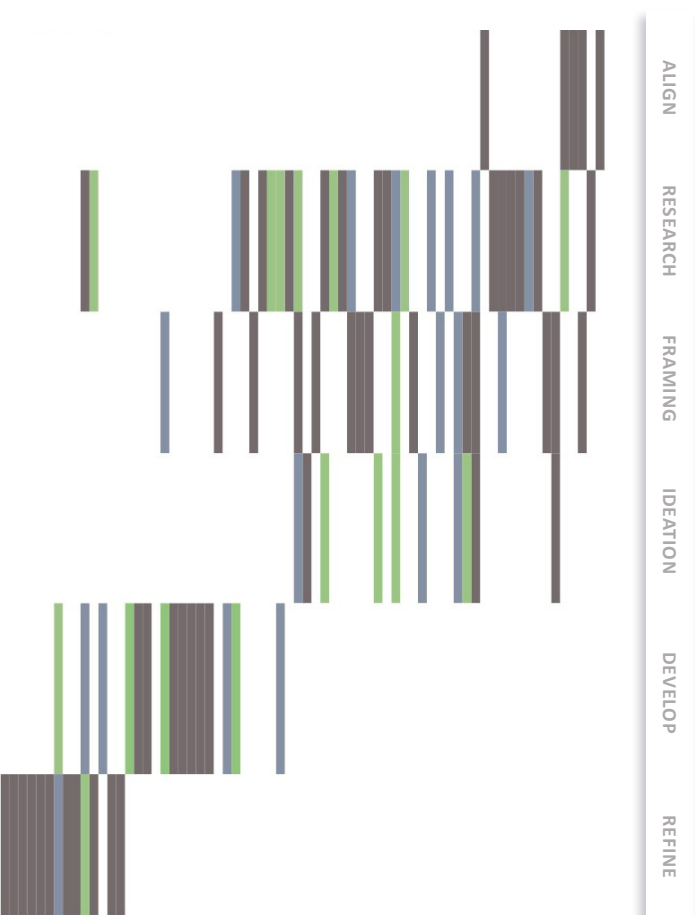


Illustration 2 - Process tracking. Brown = both team members activity, Green and Blue = individual activity

1. ALIGN & RESEARCH



INTRODUCTION

Miele competition

The project is formed around the participation in a competition that Miele Denmark is conducting in the context of their 50th anniversary. They are asking for a proposal for 'Future Miele'. They have a wide product portfolio within domestic appliances and several different categories, so to choose an area of interest, the following Miele product categories have been investigated: coffee machines, ovens, washing machines, dryers, fridges, dishwashers, range hoods, and hoppers. See Ill. 3.

The washing machines and dryers do not seem to have gone through the same radical development as some of the other categories. Further more, looking at IKEA's home-setups, **"The room-sets are required to resemble the Danish homes"** - Lars Gade, Department Manager, (KEA Aalborg) several other opportunities have been detected within this field, e.g. the machines do not appear integrated in the general household interior arrangement. [Worksheet 03, Visiting IKEA] As a result of these observations, laundry is the chosen topic.

FOCUS AREA



Illustration 3 - Investigated Miele product categories

This section, along with the previous pages, provides an overview of the project background and initial research.

The team has sought to create a research section that is providing the needed overview, but at the same time kept as short and precise as possible. Therefore, there will be a lot of information and work which is left out. This information will be referred to, and found in various worksheets. Information, that is vital for understanding the process and choices, is to find in the following.

MIELE

In order to create a future Miele product, it is important to understand which kind of company it is and how it has developed throughout the years.

First of all, Miele is a German company, which produces high-end domestic appliances. Quality is important for them and they emphasize that their products are produced in Germany, presupposing and hoping that this is something their costumers are willing to pay the extra cost for.



Illustration 4 - Miele logo with sloping dash since 1920

History of Miele

The company was founded in 1899 and has produced washing machines since 1903. [Miele.com/history, 2016] From the beginning they have focused on the products, but within the last 10-15 years, they have begun to offer system solutions or package solutions, offering not only the machine but also their soaps, detergent, etc.

Miele has previously produced cars, bicycles, motorcycles and more, but are now focusing on the domestic appliances. Since 1924, Miele Professional has delivered industrial washing machines and dishwashers. [Miele.com/prof, 2016]

Miele today

Their central motto is Forever Better (Immer Besser), and they are highly dedicated to meet this promise, e.g. they have their own standard system [Miele.com/standards, 2016], which among other things mean that their suppliers have to meet certain criteria in order to collaborate.

The products are tested to have a service life of 20 years, **which requires the products to be highly adaptable** to follow the fast pace of the technological development. One way they are handling this now is by having updatable software systems in their machines. For this purpose, they use their interface **MyMiele**, which is an application they are beginning to integrate in all their products. They want to create a base for their customers, where all their Miele products are gathered, connected and controlled, and where software for e.g. ovens can be updated, so the customer gets the newest cooking features. The customers additionally have the possibility of updating the hardware by a Miele technician.

Miele has a monolithic branding strategy, which means that all of their products share the same value and motto. This requires a future product to stay in line with the overall branding.

The product design seem overall conservative and low risk taking, which goes hand in hand in their wish to signal high quality and durability. [Worksheet 48, Miele interview]



Illustration 5 - Miele info control

Following the trend

Following the smart home trend, Miele has a system called Info Control [Miele.com/history, 2016], which allows the user to control and follow all devices from their smart phone, see ill. 5.



Miele Showroom, Vejle

Miele has two showrooms in Denmark (Glostrup and Vejle), which allows customers to see the products and receive expert counseling. Furthermore, if you have a new Miele oven, you can participate in cooking classes, which will teach you to use the oven. The showroom is not meant for selling products, but to help the customer buying the right product. Therefore, they will show the customer to a retailer.

When looking at their portfolio of washing machines, it was very difficult to tell the cheap models from the expensive ones. They all look more or less the same, but the features are very different and so is the pricing. Some of the newest features are:

- Automatic dosing of detergent (when using Miales detergent) called twin dos.
- Targeted washing programs to remove certain stains, e.g. make-up.
- Less spins, so the clothes gets less wrinkled.
- 1-9 kilo machines, which means that it only uses water and soap for the specific amount that is put in. Read more in [Worksheet 02, Miele Showroom]

Expected impact

Having chosen to participate in a design competition definitely has an impact on the project. However, we will be in charge of how and to which extent it is going to affect the project. What we wish for the competition is to create some frames for the project, but it is not going to be based on what Miele needs. **Instead the project will be based on, what people need in their homes to take care of their laundry.** Of course, the product category should stay within the area of Miele, which is high-end domestic appliances. This leads to our initial problem statement:



INITIAL PROBLEM STATEMENT

“How can we design a future Miele high-end domestic appliance within the laundry category?”

To answer this, the project team started off by researching on the washing machine and investigating different use scenarios. These investigations were followed by many more, however the initial part of the research is presented in an aggregated matter, and not how it was chronologically obtained, to improve understanding. The initial research consist of following topics: Market, Development, What is laundry, The Machine and The Use. These chapters are condensed, highlighting the most important findings. Additional research is found in the worksheets referred to.

WASHING MACHINES



Illustration 6 - 2016 Washing Machines: Built-in sink, AddiWash, Orange, Twin. Today's washing machines focus on self-dosing, gentle cycles performance, speed and intelligence.



New machines

Illustration 6 shows some of the latest developed washing machines presented at appliance fairs. Some of the new features shown is:

- Addi-wash which makes it possible to add clothes to a load that has already been started.
- Twin, which enables you to wash two loads at the same time, e.g. white and colored. [Worksheet 23, Washing Machine Market]

These machines have new and interesting features, but it seems that they are just trying to solve the problems by adding on to the old 'square product' with a drum inside, without considering the shape, interaction or current way of handling clothes.

The Danish consumers are still offered the traditional looking machines, see pictures 7 and 8, that do not seem to have gone through a lot of development.



Illustration 7 - Kvik Køkkener



Illustration 8 - Scouzen



Illustration 9 - The real world



DEVELOPMENT

The market, of traditional washing machines, is very competitive. On Whiteaway.com, there are 21 different manufacturers to choose from when looking at a front-loaded washing machine. There are 3 types of washing machines: front-loaded, top-loaded and wash/dry. The most common in Europe, which is also spreading to America, is the front-loaded. [Worksheet 23, Washing Machine Market.]

Future

There is a very big difference on what is on the market now, and what futuristic concepts suggest. Electrolux conducts a design competition every year within the themes 'Air purification', 'Cooking', and 'Fabric care'. [Electroluxdesignlab.com, 2016] When looking at the theme, 'Fabric care', the focus of the 2015 entries seem to focus on making the laundry activity more fun and playful. [Worksheet 14, Electrolux design lab] We believe that this is the wrong way to go if you want to solve the real problem. An example is shown in ill. 10, where the clothes gets washed while the person plays music with their feet. But who is this product helping? Are these people going to be happy every time they do laundry? Or are they quickly going to be tired of that same activity that forces them to work extra hard when doing their laundry? **We believe to have found a track here, that we do NOT want to follow.**



Illustration 10 - Electrolux design lab 2015 entry, 'Musical washing machine'

Alternative needs

Besides the traditional machine, there are markets for alternative washing-needs. Ill. 11-13 show some of the products that meet different needs than home washing.



Illustration 12 - Hand washer. Foot pedal makes sphere rotate to perform mechanical action.



Illustration 13 - Dolfi ultra sonic technology.



Illustration 11 - Scrubba. Washing bag for backpacking.

These alternative needs are highlighted in [Worksheet 37, Laundry needs]. There seems to be alternative washing needs within the categories of:

- Small and portable
- Travel (ill. 12)
- Backpacking (ill. 13)
- Hand wash (ill. 11)

The scaling possibilities of the ultra sonic washing technology used in the product, Dolfi (ill. 12), could be interesting to investigate. However, a current drawback is the fact that the clothes has to flow freely in the water for the technology to work.

QUESTION

The knowledge of various products on the market today as well as the futuristic washing machine concepts, raises the question: **What is laundry actually?**

WHAT IS LAUNDRY



To answer this question, the history of laundry has been investigated as well as the human needs associated with it. Statistics of today's laundry behavior is also helping illuminate the topic.

History


 Rock until 1700	 Washboard 1800
 Bat until 1700	 Electrical 1920
 Bucket until 1900	 Full automatic 1950
 Dolly 1800	 Today's 2016

Illustration 14 - Social activity



The different tools seen on the far left are expressing some of the different techniques that can be used to cleaning clothes: scrubbing, beating and trampling. More information in [Worksheet 09, History of laundry]. The machine has not changed much in appearance or in the way you interact with it the last 66 years. Up until the middle of the 20th century, laundry was a very social activity. (ill 14)

"When I was young, we did laundry once a month, it would take all day and I had to cancel all spare time activities"
- Ruth, 76*




"It has become physically easier to wash clothes, but the standards have just increased simultaneously"
- Ruth, 76*

Laundry today

Today, laundry is a very solitary and private activity, that we would rather not share with anybody. This is among others supported by a statement from a 25 year old who has a washer and a dryer in her scullery. She would not like to leave traces of her laundry activity visible for any visitors in her house. Her concern/behavior is not unusual and is shared with many others.

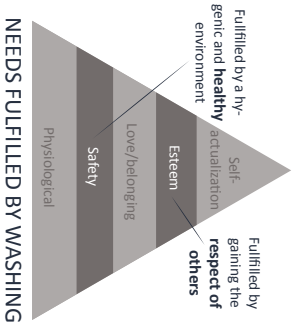
Illustration 15 - Today, laundry is a solitary activity



"I never do laundry on the day or the day before I expect guests"
- Caroline, 25*



*Quotes from Ruth are from Worksheet 19, Interview, Ruth) and quote from Caroline is from [Appendix 02, Interview Caroline]



Human needs

Keeping yourself and your clothes clean, you are fulfilling two basic human needs in Maslow's hierarchy of needs [Simplypsychology.org, 2014]. In ill. 16, the two needs that are fulfilled are highlighted: Safety and esteem. By keeping yourself clean, you are eliminating dirt that can grow to be harmful, but you are also gaining the respect by others by looking decent and not smelling.

Statistics

Statistics show that women usually do the laundry (ill. 17) and study shows that are generally happy about that. However, we found out that **men are usually the ones who purchase the machines**. We have multiple suggestions of why that is:

1. Men are interested in the performance of products whereas women are usually not. [Worksheet 29, Female interaction]
2. The washing machine is very heavy, and weather it is ordered online or bought at a retailer, some lifting and installation has to be done. Although the men are the

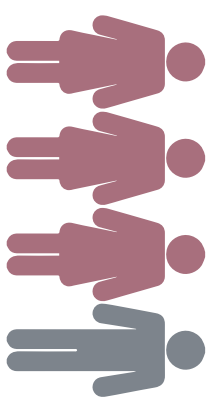


Illustration 17 - 75% of women do the laundry

ones doing the purchasing, "they often have to check with the wife at home" - Sales woman, Whiteaway.com [Worksheet 30, Men buying the machine]

≤40°C

Illustration 18 - Usual washing temperature: 40°C or less.

Statistics show that 87% typically wash their clothes on 40°C or less [gov.uk, 2011]. Being afraid of ruining the clothes seem to part of the reason. We found that bacteria in the washing machine die at 60°C. 68% of the Danish people have tried ruining their clothes in the washing machine. People don't feel certain of how to wash clothes and uses no more than 3 programs on the machine. [Nordjyske.dk, 2016] [Worksheet 17, Statistics]

SUGGESTION FOR ANSWER

Cleaning clothes fulfills some of the basic human needs and is an ancient activity that has developed rapidly, like many other processes and technologies in the last century. Statistics show that laundry is still primarily the domain of women and that many people are uncertain of how to do it right.

DECONSTRUCTION THE USE

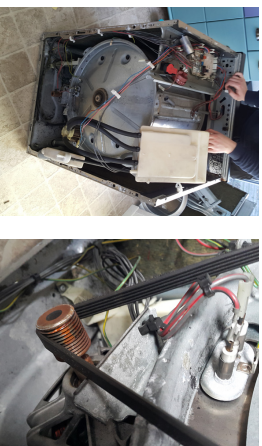


Illustration 20 - Disassembly of washing machine

When the automatic machine was first introduced, people were not sure that it could do the job properly:

“The early marketing of electric washing machines met with some resistance from homemakers who believed mechanical devices could not be trusted to do the wash as well as their own hands could do it.” [Worksheet 35, Paper A]

Nonetheless, the machine has become an essential part of households, so we wanted to find out what is inside of it. We disassembled an Asko washing machine, in order to understand more (Ill. 20). The entire overview and explanation of some of the components can be found in [Worksheet 18, Disassembly]. The internal components were relatively simple and did not take up very much space. The drum was very large, and had to be held in place by two 3kg weights, which gives an indication of the large amount of mechanical force that is needed in this machine.

In order to understand the process of washing clothes, pre-assumptions combined with interviews were turned into laundry journeys. This will later help identify problematic situations and steps.

Coping strategies

Laundry is an activity that most people do every week, and when dealing with the same problem over and over again, people develop strategies to handle or avoid the problem. One problem found (see problems on pages 17-19), is that the detergent drawer gets nasty. A solution for this is already developed in new washing machines (the drawer is sprayed after every wash) but has not yet reached all consumers. Ill. 19 shows how Lene Pix is avoiding this problem by using a plastic cup to put the detergent directly in the machine every time. A coping strategy for another problem is that people wash their clothes on low temperatures, because they are uncertain of the recommendations and therefore play it safe.¹

“I always put the detergent directly in the machine because the detergent-drawer gets so nasty”

- Lene Pix, 47



Illustration 19 - Lene Pix doing laundry

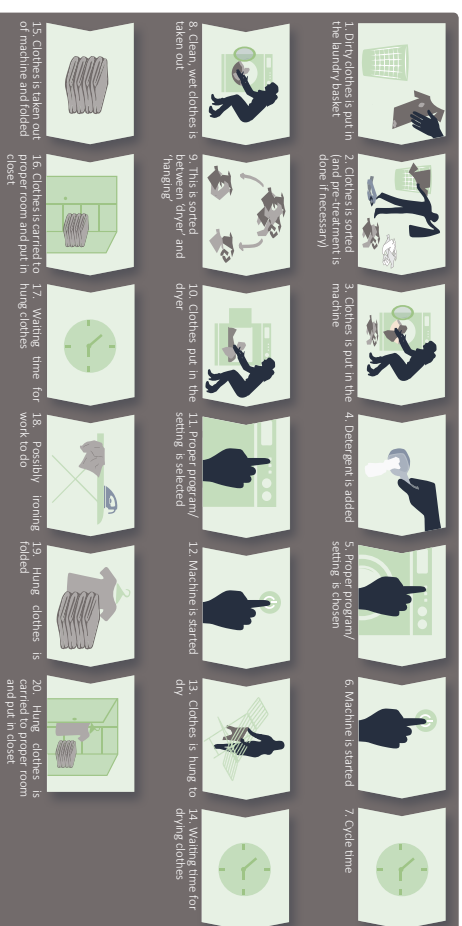


Illustration 21 - Laundry journey in a home setting (A more detailed home process can be found in [Worksheet 11, Laundry journey general].)

Laundry journey

This journey is showing the many steps that the user has to go through with every wash. Besides time and multiple steps, a lot of decisions and judgment also have to be made. Larger judgments take place in steps 2, 4, 5, 9, and 11. And even before step 1, the user has to determine if it should go in the laundry basket. The decisions are related to:

- Before step 1: How **dirty** is the laundry- can I wear it again?
- Step 2: How is the clothes sorted the best way? By **color or material**?
- Step 4: Which kind of **detergent** is best for this load? and how much is the proper amount?
- Step 5: Which **setting** is proper for this load? Temperature, rotations?
- Step 9: Should this be **dried or hangd**? And is some clothes supposed to LAY DOWN and dry?
- Step 11: Which setting is proper for this load? What is the **difference** between the settings anyway?

These are only some of the decisions that has to be made in the process of doing laundry. The laundry journey is made from [Worksheets 07 and 08, Laundry journey A and B]

A laundry day often consists of more than just one washing load. That means that you have to do the process all over again. 60% washes 1-3 times per week. Even though a single step might not take very long, the problem is that you have to go through many small steps, take a lot of decisions, and go back and forth many times [Worksheet 34, Laundry path].

Due to focus changing (from washing to freshing) later in the process, the use scenarios of people without private washing machines are not presented in the report, but can be seen in [Worksheets 10 and 16, Laundry journey C and D]

PROBLEMS

Integration

The washing machine does not seem to be well integrated in any of the studies made [Worksheet 05, Laundry context] and [Worksheet 03, Visiting IKEA]. People seem to want to hide it away and place it in rooms, where guests do not come. It's not aligned with the rest of the room- in some cases it actually seems that people make the room fit the washing machine instead of the other way around. That tells us that the machine does not fit into its context. These two problems are shown in ill 22 below.

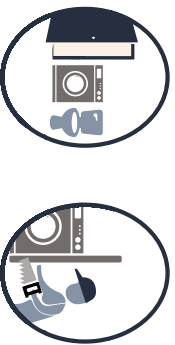


Illustration 22 - Washing machine integration problems

Process

Ill. 24 shows some of the problems found in relation to the process of doing laundry. They are not allelaborated here, due to focus changing, but can be found in [Worksheet 05, General problems]. However, problem 2 and 4 is some of the problems that have been in mind throughout the process. Problem 2: The washing

	Problem 1		Problem 2		Problem 3		Problem 4		Problem 5		Problem 6		Problem 7
Handling dirty clothes		Bad working position		Nasty detergent drawer		Lack of knowledge/confusion		Forgotten clothes turns smelly		Time consuming		Space consuming	

Illustration 24 - Problems in relation to home-laundry. Problems related to basements and wash-houses can be found in [worksheet 06]

IKEA room set

Even when the washing machines have a polished setup, the machines still do not seem to fit in (ill.23).



Illustration 23 - Photos from IKEA's room-sets

The washing machine seems to become the messy area/room. Despite the attempt to integrate it, the machine does not seem aligned with the curves of the room. The same situation is seen in the Danish homes (page 12, ill. 9)

machines are generally designed in a way that creates a bad working position, forcing people to use coping strategies such as elevating them, stacking washer and dryer, and sitting on the floor doing laundry. Problem 4: this was mentioned on page 17 in relation to the journey- the user has too many decisions to make and often lacks the needed knowledge.

Health

As mentioned on page 15, most people wash their clothes on 40°C or less. They do this because they are afraid of ruining it (ill. 25), but this could be a problem: "Low temperature washing may be good for clothes and the environment but it may not necessarily be good for our health" [Worksheet 41, Washing standards].

Wrinkles

In order to have least wrinkles, it is important to take out the clothes right away when the wash is done. However, it often occurs that an in-between activity takes longer than the cycle, and the user might not be ready to take it out right away.

Before entering the next chapter, a brief sum-up is provided:



Illustration 25 - Bacteria do not die before the temperature reaches 60°C, which is why the shirt might smell after a 40°C wash, using no-scent detergent and fabric softener.

RESEARCH & ALIGN SUM-UP

Miele Denmark is conducting a competition centering around a future Miele product. This project focuses on laundry.

People don't wash their clothes on high enough degrees to kill most bacteria.

Women are more likely to handle the laundry than men.

The current washing machine does not seem to fit into our homes.

A lot of decision making that the user has no knowledge about.

Laundry has gone from being a social to a private and solitary activity.

Washing machines today mainly compete on self-dosing, gentle cycles, performance, speed and intelligence.

2. CREATING OPPORTUNITIES

In order to create a product that has future value, it is important that the present (and somehow insignificant) problems are not the focal point. Current washing machine manufacturers are already working on solving these problems, but what they do not seem to be working on, is how to get the washing machine 'out of the box' figuratively and literally meaning.

The strategy is to search for clues and create opportunities that will be relevant in a future context. It is important for the team to not just try to predict the future and make a solution fit - we want to contribute to the future.

Prior to what will be presented in the following, the team had done some initial ideation in order to get ideas cleared from the head. For interest, these can be found in [Worksheet 04, Initial Ideation]

DESIGN BRIEF

This design brief is summing up some of the findings and decisions that have been highlighted in the previous chapter.

Project background

The project will be submitted for a Mielele competition where the challenge is to make a proposal for FUTURE MIELE. The deadline is October 2016, but this project will be handed in shortly after project examination at the end of June.

Category

Domestic appliances within the topic, laundry. The focus will primarily be on washing machines, and perhaps later go towards dryers too. At this point in the process, it is uncertain whether the focus will be on professional machines for laundry rooms or on machines for private homes.

Target audience

The initial research did not open up for any certain direction, which means that the target audience is still uncertain. We do not expect to propose a product for Miele that is far from their current product portfolio, so

the target audience so far is:

people who can afford high-end domestic appliances, and are willing to pay extra money for good quality. Mielele is currently operating in Europe, and we wish to target Europe as well, but perhaps also other western areas, such as USA. It is assumed that the majority of the users are adults and young adults - not children under the age of 15.

Miele

Mielele is a German, family owned manufacturer of high-end domestic appliances. They have produced washing machines since 1914, and their slogan is 'Forever Better'. Their washing machines are found in the price range of 7.500 DKK - 19.000 DKK.

Design strategy

Designing a future product, the team will focus on developing opportunities rather than improving the current machine. Dozens of manufacturers today are already working on solving these problems on a daily basis, which makes it less alluring to focus on these. The strategy is therefore to look for clues that can lead to future needs and behavior.

REQUIREMENTS #1

These requirements are created on basis of the Mielele competition and the way laundry is currently handled.

Mielele

Has to be a Mielele product.

A1

- It should be presented as a Mielele product.
- It should stay within the category of domestic appliances. (If this is not met, a thorough analysis of Mielele's business should be basis of this choice)

2025

Be a future product: Meet the needs of people 8-10 years from now.

A2

- This will be difficult to prove, but analysis behavior should be presented.

A3

Has to be able to make clothes as clean as current products.

- For this to be evaluated, an understanding of the term 'clean' needs to be presented.
- It has not yet been determined if 'current products' are home- or professional machines.

TRENDS RESEARCH

In order to discover opportunities, the internet as well as our surroundings are searched for clues. Ill. 26 shows how this information was dealt with; anything of interest was printed and put in the group room and categorized. This helped to keep findings present in our awareness, which made it easier to act on. The information did not necessarily relate to laundry, but general behavior, which could be projected into people's laundry habits. The information found is documented in [Worksheet 13, Desktop research], [Worksheet 15, Households statistics], and [Worksheet 17, Statistics]

At the beginning, we were waiting for a direction to stand out clearly from the findings, but this did not happen, and almost three weeks into the project, we struggled to find a path. We tried to be more systematic, and used the model shown in ill. 27, which helped us categorize our findings into three topics: the

Forecasting

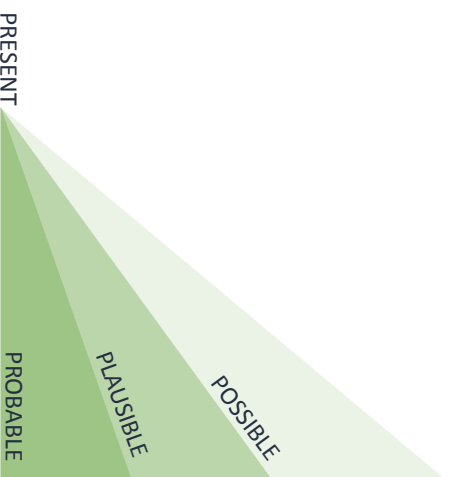


Illustration 27 - Future forecasting using model with inspiration from Stuart Candy. [Worksheet 21, Future forecast]

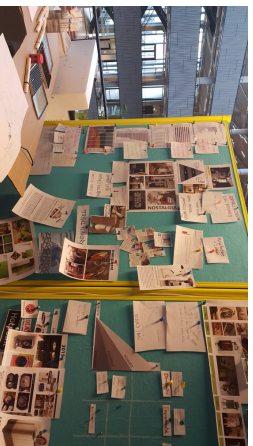


Illustration 26 - Group room with trend investigation in focus

probable future, the plausible future and the possible future. These topics made it possible to distinguish between what will with most certainty happen, and what is more doubtful to happen.

Less machines - less focus on amount of features, more focus on quality of features-

More will share household - Owning less - Time is in, money is out - More practical less aesthetics - Less features, more simplicity

More will live alone - Hiding the ugly- Wanting soul in products - Identity through products - More sharing - Adaptability - Craft revival - Cheap things that look expensive - Nostalgia

IDEATION

From previous projects at AAU, we have been used to working problem based, which has usually provided some kind of tangible direction to pursue. However, this project is different and it took a little while for us to realize. It seemed that we were waiting for the direction to appear all by itself, and since it did not, we had to change mindset and take charge of the project direction. And so we did.

Hypothesis development

In [Worksheet 20, Hypothesis development], it is illustrated how clues of the future were picked out, put together and turned into possible project directions. (ill. 28)



Illustration 28 - Clues. Respectively, more simplicity in products, increase in single households, and sharing economy.

After a creative process with testing different hypothesis, three directions stand out. [Worksheet 22, Ideation direction] Ill. 29 shows the directions, which are:

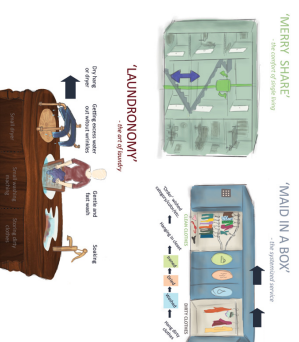


Illustration 29 - 3 Concepts [Worksheet, 25,3 directions]

1. Single living: Single households have increased to over one million in Denmark, and will probably continue to increase [Worksheet 15, Household statistics]. The focus is to create a product that will ease the laundry process for people that are living alone, perhaps in apartments.
2. Complete system, which focus on a product that will fully automate the laundry process.
3. Luxury: With inspiration in things such as shaving tools that are branded as luxurious and made out of exquisite materials, "Shaving should never be on the to-do list" [theversatilegent.com, 2013]

These topics are diverged through ideation where possible concepts are opened up for. Subsequent, they are evaluated and converged into one concept for each direction, ill. 30.

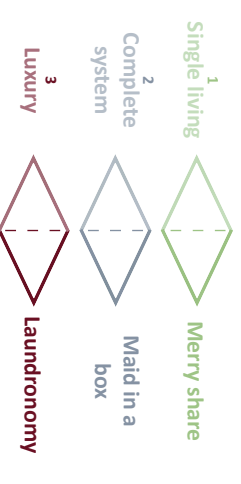


Illustration 30 - 3 Directions are diverged and converged with the result of three concepts: 'Merry share', 'Maid in a box', and 'Laundronomy'. [Worksheet 25, 3 directions]

These 3 concepts were presented in an internal status seminar see presentation in [Appendix 03, Internal Status]. The feedback from the other master team helped making it clear, which concepts would be interesting to continue to work with. Being one week from 1st formal status seminar out of two, we were determined to choose only two concepts to further develop and present. Discussing our own personal interests as well as the economy of single households vs. Miele prices, we decided to discontinue to work with the theme, 'single living'.

STATUS 1

The two directions that were continued developed were presented in the first status seminar on March 1st. The concepts will be presented here, and the entire presentation can be found in [Appendix 06, Status 1]. The presentation of these concepts will be followed by an evaluation of the concepts as well as the feedback that was given at the seminar:

Smalls

The concept called *smalls* (in Danish: *katvask*) is a suggestion for the direction, 'luxury', and is named after the common laundry activity 50 years ago:

"Between the monthly washday's, we did 'smalls' where we washed small amounts of clothes that couldn't handle to - or didn't need to be boiled"

- Ruth, 76



Illustration 31 - Concept 'smalls' when not in use

The concept uses the gentle technology, ultrasonic waves, seen in the product *Dolph* (page 13) to remove dirt. The concept is illustrated in ill. 31, 33, 34. The target audience is shown in ill. 32.

The point of the concept is to make laundry a more luxury activity that does not feel like a burden, but something that could give the user supplementing experience. It should work for the clothing that are more delicate and not dirty enough for the washing machine.

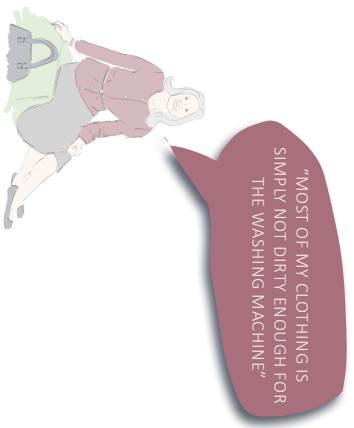


Illustration 32 - Illustration of target audience for 'smalls' concept



Illustration 34 - Reference product



Illustration 33 - Drying

Maid in a Box

The concept called *Maid in a Box* is a suggestion for the direction 'complete system'.

"I am the only one who can wash our clothes: the washing directions are either cut off or washed away"

- Karen, 49

Maid in a box is a machine that is not only washing your clothes, but is combining the entire laundry process. The process handles washing, drying, and dewrinkling of the clothes. Clothes is placed on hangers making the dewrinkling possible, and prevents you from folding it afterwards. See ill. 35.

A chipping system makes the user able to code the clothes with the washing direction. That makes the machine able to wash the clothes without further direction. It solves the problem of women having a hard time leaving the responsibility to someone else, see ill. 36.



Illustration 35 - Concept 'Maid in a box'

"ONLY I REMEMBER HOW EACH SHIRT NEEDS TO BE WASHED"

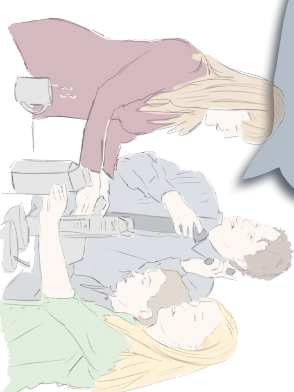


Illustration 36 - Target audience, busy family

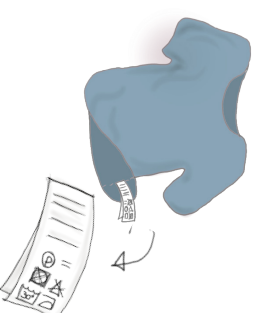
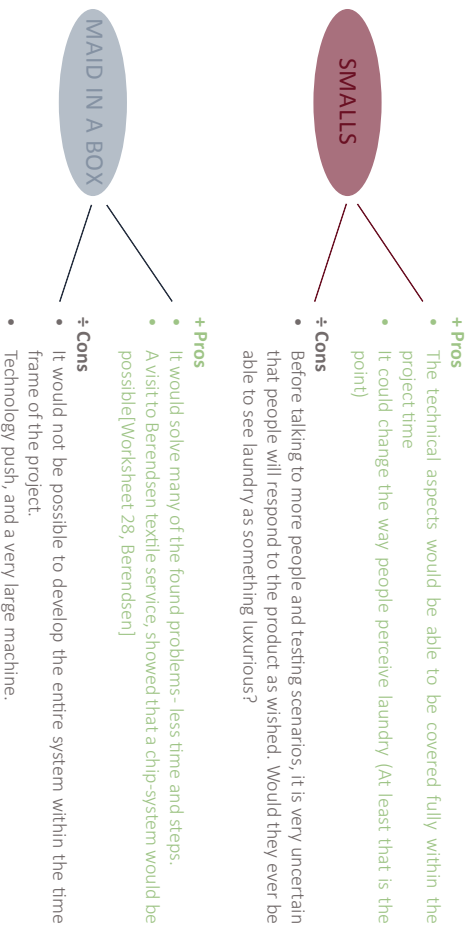


Illustration 37 - Process controlled by chip system in clothes tags

The chip is coded with washing directions and for instance the owner's name on it. It is placed inside on the washing directions. (Ill. 37)

Another possibility is to implement the chips at the clothes company, letting them put the chips in the clothes. The advantage for them is a better service experience. A drawback is that you still have to put in chips in all your current clothes, which might take a while.

Evaluation



At this point, there are no requirements that can tell us which direction to choose, because this is a question of what the project team would be interested in and find most relevant. Both directions would be fit for the design competition but they are very different. One is very technically advanced, while the other is more fluffy and perhaps difficult to turn into a convincing product. Both of them seem difficult to realize, but in different ways.

Feedback from status

The feedback on our presentation was mostly directed towards the framing, which was next what we were hoping for - we were hoping for clues that could lead us in one of the directions. Some of the feedback was:

- Good framing
- Would like to know more about problems

- Be more visionary- predictions on technology
- Missing criteria
- Try to predict the development by making a timeline
- Look into female interaction

The team struggles with making a choice, knowing that the project is soon going to reach a point where there, time wise, is no return.

It was decided to proceed with both directions in parallel for a little longer, in order to be sure to make the right decision. [Worksheet 27, Two directions]

But this strategy didn't go on for more than 3 days, where the unexpected turning point came, see next page.



'Fresh' direction

'Back in the days', doing laundry was a difficult task, which meant that they wore clothes more times before washing it than we do today. In an interview with a 76 year old [Worksheet 32, Interview (leading to hypothesis)] She explained that the 'trend' with changing clothes more frequently began when her children were school-aged. This trend follows the convenience of doing the task - the use of automatic machines. Ever since the automatic machine was introduced in Danish homes, the amount of wears have decreased. Since then, machines have become more and more automatic, requiring less effort from the user. *Could a product be created, that freshes the clothes, and make people wear the clothes more times before washing it?*

But why should people start to wear clothes more times before washing it? Some of the benefits are:

- Clothes will **last longer**
- **Less energy and chemical consumption**
- The two above reasons will result in (perhaps only minor) **money savings**
- **Less housework** (washing, drying, folding, putting back)
- The term **'washed out'** will be extinct

Previous research throughout the process has indicated that people today wash too often - but at this point, the pieces just came together, see ill 40.

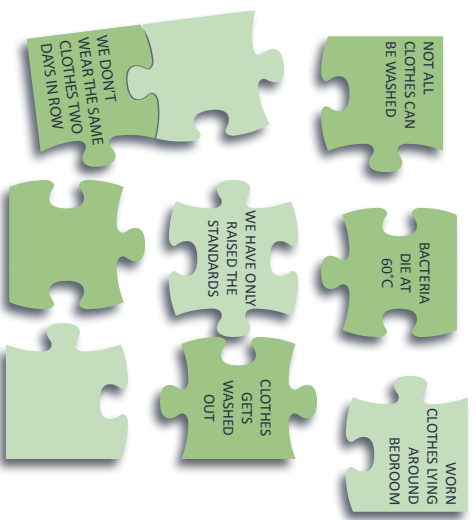


Illustration 40 - The pieces that came together

The pieces seemed to fit together and the team decided to follow their gut feeling and pursue the 'fresh' direction. This leads to requirement B1, page 34.

GUT FEELING

How to freshen clothes

Questions

Assuming that freshening used clothes is the answer to change peoples behavior, the new direction was kicked off by investigating methods of freshening clothes. In relation to this, many questions were raised:

- Is there any methods of freshening clothes? (At this point, our perception of 'freshing' clothes meant removing the smell)
- What is causing body odor?
- What makes people wash their clothes? Smell, stains, amount of wears or other reasons?
- The new direction started with the question: "what is keeping people from wearing the same clothes two days in a row", and we have yet to answer that.

Keeping fresh

The first thing that was investigated was ways of freshening or keeping clothes fresh. The internet was searched for advice [Worksheet 33, Keep clothes fresh]. Some of the advice to prevent clothes from getting smelly was:

- Wear a t-shirt underneath to take the sweat and skin cells. (Easily washable)
 - Hang clothes between wears instead of throwing them on a chair or on the floor.
 - Spot-treat instead of washing entire item.
 - Put fabric softener sheets in the pockets when they hang in the closet.
- Illustration 41 shows some of the ways to remove the smell.

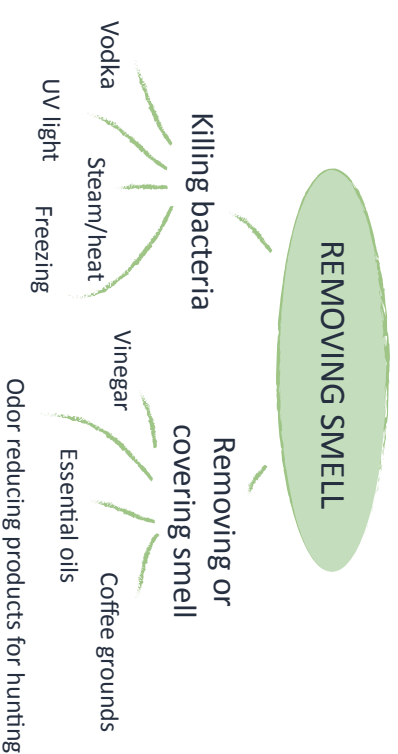


Illustration 41 - Methods of refreshing clothes that has gotten smelly

To answer the questions related to people's behavior, we went and talked to people [Worksheet 36, Laundry habits]. At least 12 people were interviewed, and we found that the answers were very individual as well as being complex. To get more quantitative information

and to see if we could find a pattern, we made a survey. [Worksheet 39, Survey]. The findings from interviews, observation, and the survey are presented in the three following pages.

USER RESEARCH

Throughout the entire process, talking to users have been one of the driving factors. The theme has made reaching users very easy, since wearing and washing clothes is something that everyone does or have a relation to. The information gathered is collected both in structured processes, such as prepared interviews and a survey, but a lot of information is also gained from various friends and family during private activities, such as birthday parties and such. Bringing several people into the discussion really highlights the differences in people's habits.

Survey

Pre-information to understand the results: 76% of the respondents were women, which did not give us the diversity that we wanted. 87% did the laundry themselves. [Worksheet 39, Survey]

Findings

- T-shirts, tops and exercise clothing is the clothes that people wear fewest times before washing
- Jeans, pants, and pajamas are the clothing that people wear most times before washing.

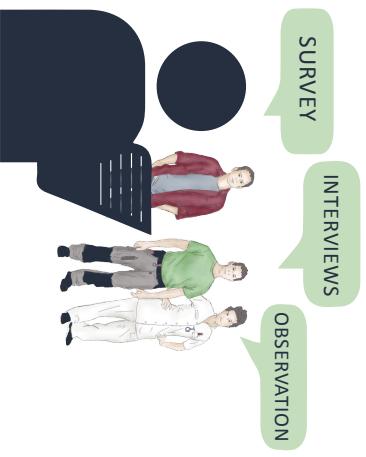


Illustration 43 - Channels of user insights

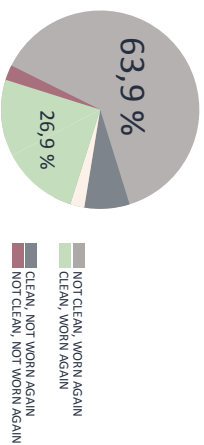


Illustration 42 - How do you perceive the clothes after worn?"

- The most common way that people determine of the clothes should be washed is:
 1. It is visibly dirty (72%)
 2. It has been used several times (69%)
 3. It smells (62%)
- 51% states that the worn clothes is put back in the closet on the original spot, but 38% states that it hangs somewhere in the bedroom.

"How do people perceive their clothes after only 1 wear?" Ill. 42 shows how people responded. Most people perceive it as unclean, but they wear it anyway. 27% still perceives it as clean.

We wanted to get an answer to the question of: 'what is keeping people from wearing the same clothes two days in a row?' We asked them if they would wear the same shirt two days in a row if it was clean both days? The answers were very different.

A lot of people said yes, but also stated that they were aware that it would send a signal to other people, e.g.:
 "Yes, but I understand why other people wouldn't, since others wouldn't might think that it wasn't clean, but that doesn't mean anything to me"

Other people said no, but reasoned differently: some stated that it had to do with the norm, others wanted to look different every day, and some worried that people would think of it as being dirty.

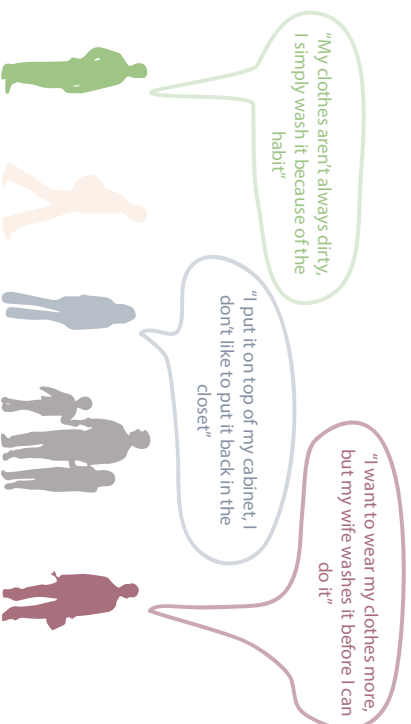


Illustration 44 - Quotes from users [Worksheet 36, Laundry habits]

Interviews

Most interesting findings from interviews that are not mentioned in relation to the survey:

- People that have working clothes changes when they get home. E.g. "I only wash my working pants once a week because I only have one pair"
- People are not sure what they mean when they say that their clothes is dirty:
 - "It feels dirty"
 - "I wash it again if it smells stuffy"
- Most of them said that they wash their re-worn clothes because of smell and "That's just what you do."
- Some people wear a top underneath their dress shirts and sweaters so it will take the sweat. Not many of them said that they wash their re-worn clothes because of smell and "That's just what you do, seem to be the ones with more delicate clothes that cannot go in the washing machine."

[Worksheet 36, Laundry habits]

Observations

A lot of informal observations were made when visiting family members and friends, which helped get a better understanding of the complexity. However, lacking of structural gathering of the information. Only one observation session is documented with both pictures and notes. This can be found in [Worksheet 67, Interview Lene Pix].

What was overall learned from observations: Even though we were discussing the topic informally and with people with close relations, we are dealing with a very personal and individual topic. It sometimes even **seemed like they were embarrassed to admit their habits to themselves**, e.g. throwing the clothes on the floor before going to bed, and wearing them the next day.

What was also discovered was the **many decisions and evaluations** that had to be done when simply getting ready for bed.

'FRESH' FRAMING

Overall impression

An overall picture from survey, interviews, and observations is obtained. What was discovered was, that people's habits are very much dependent on these factors:

- What you were taught from home
- The preferences of partner (e.g. some of the users mentioned that they put their clothes outside of the closet, but the partner wanted it inside, because it was looking messy)
- The character of your clothing, e.g. if you have much delicate clothes, you are more aware of airing it.
- Your age and family situation. But this actually seemed less determining than the other factors.

Smelling

It seems that a lot of people smells the clothes to determine if it should go in the laundry basket, but a lot of people also determine it on the basis of how many days it has been worn (Ill. 46). So, would removing smell and 'reset' the amount of wears somehow satisfy these people?



Illustration 46 - Washing because of worn too many times'

People are aware that their clothes will last longer if they wash less, but this does not seem to make them do it. Some of them see it as a possibility to buy more clothes: "Well, that's just an excuse to buy new!".

However, the fact that people are aware of the shorter lifetime of their clothes, and still does not make an effort to change their laundry habits, indicates that a possible solution should be as easy and convenient as possible, in order for the user to actually use it. This leads to requirement B5, page 34.

The assumption that people wash their clothes too much is shared by an associate professor and textile designer:

"Vibeke Risberg works with sustainability as ph.d. textile designer and associate professor at the Designskolen Kolding. Her experience is that we have developed a culture, where we are afraid of smell and dirt, and therefore wash the clothes much more than we need"

[Politikken.dk, 2014]

Achieved by washing

Things that are achieved when washing clothes:

- Removal of stains
- Reshaping
- Killing contamination
- Softness

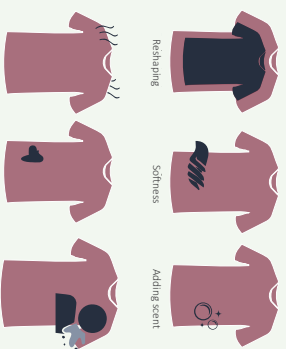


Illustration 45 - Achieved by washing clothes

Since these elements are what people achieve by washing their clothes, a clothes freshener should be able to perform as many of these as possible, to decrease the washing. This leads to requirement B2, page 34. Some of the negative sides of washing is explored.



Illustration 47 - Ruined

Ruined

The elastics in the jeans are ruined in the washing machine. They are "Tiger of Sweeden" jeans, and considered better quality. These are only 6 months old.



Illustration 48 - Shrinkage

Shrinkage

People are afraid of washing their clothes at high degrees in risk of ruining it.

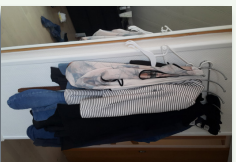


Illustration 50 - Recirculated clothes - unstructured and messy

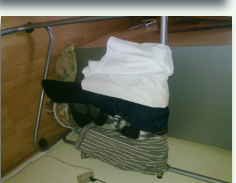


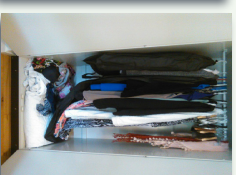
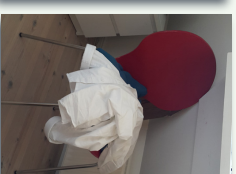
Illustration 49 - Washed out

Washed out

Dark clothes tend to lose their "original" color after only a few washes. Detergent manufacturers are trying to solve this with chemistry.

Recirculating

Although the amount of wears before washing clothing has decreased, people are still recirculating much of their clothes. However, this usually leads to messy bedrooms and confusion. Ill. 50 shows some of the ways people recycle their clothes if they do not put it back in the closet. **Therefore, the team would like a solution to provide storage for the recirculated clothes.** This leads to requirement B3 and B4, page 34.



INTERACTION VISION

Our goal is to create a product which freshens the users worn clothes (that is not visibly dirty), so they can wear it multiple times before washing it. This will result in less time spend doing laundry. By creating this, we also wish to free them from the everyday decisions of 'could I wear this again?'

VALUE MISSION

We aim to provide a solution which releases the users from unnecessary laundry activities and prolong the life of their clothing.

The previous 6 pages have led to a temporary value mission and interaction vision:

3. DEFINE

This chapter goes through the initial ideation of the fresh direction as well as the process of finding the proper technology and defining the needs and requirements. The chapter strives to be as chronological authored as possible, without compromising with the understanding and the transparency of the project

REQUIREMENTS #2



Freshen clothes by first of all **removing smell** (Page 28)

B1



Decrease washing by fulfill as many aspects on ill. 45 as possible.

B2



Help the user **recirculate** the clothes. (page 33)
(Currently not sure how this is achieved)

B3



Provide **storage** for the recirculated clothes. (page 33)

B4



Make it as easy and convenient as possible. (page 32)
(This demand is currently not measurable, but works as a guide)

B5



IDEATION 1

Without any requirements other than 'a product that refreshes clothes', ideation was started. Knowing that people's recycled clothes is usually in the bedroom, it seemed predefined that a new product should be in this room. (We later suggested bathrooms, since this is where many people gets undressed)

Closet-solution

Ill 51,53, and 54 show some of the ideas for a freshener integrated- or placed as a prolonging of the closet. For a long time, this is believed to be the best way for a clothes-freshening product, however, looking at the advantages and disadvantages, it causes some problems. [Worksheet 51, Closet-solution]

Pros:

- Having the product where the rest of the clothes is.
- It could be a built-in system, that fits any closet
- Cons:
- There are no standard closet sizes, which makes it difficult to make a product that fits size-wise.
- How to deal with the aesthetics when people have different closet looks.

Free-standing product

Ill. 52 shows proposal for a free-standing product that eventually could be placed anywhere. In the beginning, we did not believe in this idea, since it would be difficult to integrate in the house and the wish to provide storage seemed unfulfilled.

Walk-in closet

Ill. 55 shows a proposal for a walk-in closet, since these are getting increasingly popular. The product could be a kind of closet inside the walk-in.

General problems with bedrooms:

- Noise level is uncertain
- Does multiple family members share the product, and should they have one in each bedroom then?
- If the product needs water-supply to run, that will be difficult to apply in the bedroom.

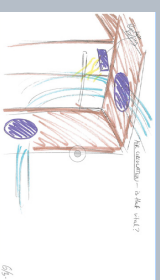


Illustration 51 - Air stream through closet

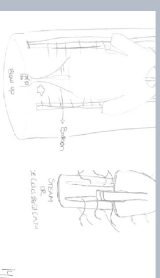


Illustration 53 - Blow iron inspired freshener



Illustration 52 - In relation to closet



Illustration 54 - Prolongation of closet



Illustration 55 - Solution incorporated in walk-in closet

RESEARCH

A lot of research have been made in order to understand, what can be done to refresh clothes. This page will provide an overview of the investigated areas. A full description can be found in the corresponding worksheets.

Body Odor

Body odor is caused when the fatty acid chains from our sweat is broken down to shorter chains by the bacteria on our skin. [Worksheet 42, Body odor] Leads to requirement C1, page 40.

Textiles

In clothing alone, there are a great variety in the textiles used. Textiles are responding to water, heat, chemicals and mechanical action in many different ways as known from the guides in the laundry tags. Not only the type of textile has influence on how it should be treated, the way the clothes is shaped is very important too, which is seen in e.g. suits. Wool is self-cleaning and should only be aired instead of washed.

Some of the most common textiles used today are:

- Polyester
- Cotton
- Acrylic
- Linen
- Nylon
- Silk
- Wool
- Viscose

This leads to requirement C4, which can be seen on page 40.

Clothes tag

Ill. 56 shows an example on a clothing tag where the item is made of acrylic, nylon and mohair. The Mohair is the reason that this item should not be tumble dried,

but instead be laid flat to air-dry. Otherwise, the fibers will shrink and be harmed. [Worksheet 60, Washing direction] and [Worksheet 43, Vero Moda steaming]

Washing recommendations

There are very different views on, how often clothes should be washed.

People working in the clothing business, states that jeans should never be washed or the most, every 6th months. They are also not fond of using fabric softener:

People writing in fashion magazines states that clothes should be washed pretty often:

- Jeans, blazers and jackets: 5-6 wears
 - PJ: 3-4 wears
 - Underwear and sportswear: after every use
 - Tops, dresses, leggings: 1-2 wears
 - Bras and pants: 3-4 wears
 - Coats: after 2 months' use
- [Worksheet 12, What is washing]

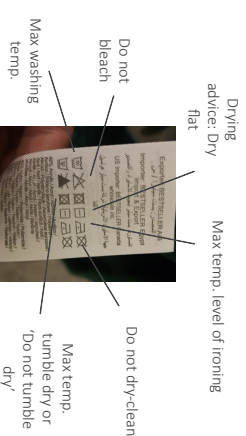


Illustration 56 - Example on clothes tag and its meaning

CONSIDERATIONS

Considered technology

Different technologies are being tested, which will be reviewed in page 42-43. However, at this point, the team is considering using freezing-cold steam. The steam should provide a freshness to the clothes and hopefully remove smells like food and cigarettes - similar to airing clothes outside, which some people with delicates do. The cold temperature should kill the bacteria, hoping that this will result in removal of the sweat smell.



Illustration 57 - Current considered technology to freshen clothes: Freezing cold steam.

Considered directions

After unstructured ideation in different directions (Page 35), there was a need to clarify the possible directions for this product type. Ill. 58 shows five possible directions:

1. Making an entire wardrobe system.
2. Making a product that can be inserted to existing wardrobe. (Flexible)
3. Create a free-standing product that can be placed wherever the user wants (With possibility of power supply and maybe water)
4. A product that goes in relation to the existing

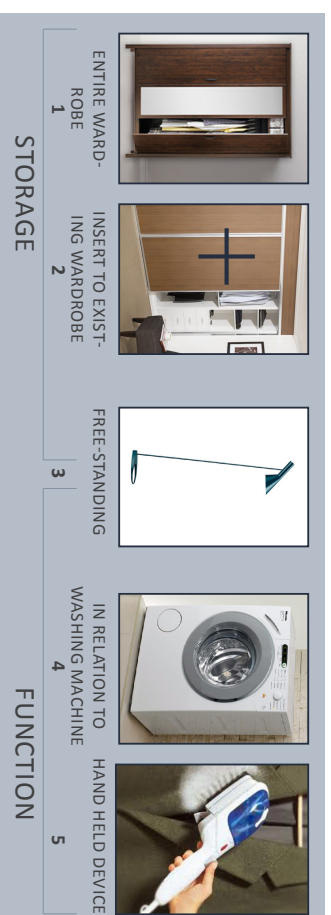


Illustration 58 - Considered directions

washing machine somehow (Integrated or just supposed to be in same room)

5. A hand-held device, that the user can use when needed and then hide away. These directions are presented in an internal status seminar [Appendix 04, Internal Status2]. After the feedback, the team decided to work with direction 2 and 3, since direction 1 would require Miele to create entirely different closet-looks that follows the fashion, which is very much out of line with their current business. And direction 4 and 5 would require too much work from the user, which is not in line with requirement B5.

DIRT

Dirt scale

Laundry has been investigated in order to categorize types of dirt. Four types of dirt are studied: stain, smell, fur and contamination. Illustration 60 shows four different kinds of dirt and the subcategories. To better understand how these types of dirt have impact on the laundry activities, a dirt scale is made (ill. 59). It shows the type of dirt and shows what is typically done with this. It is either worn again, put in laundry baskets and washed, or treated with stain removal.

Smell is not just smell, and it is very different if the clothes smells of food or sweat. This scale tries to include this perspective. The categories are leveled in 1 and 2 considering that a little smell of sweat is different from only a little smell of sweat.

This scale enables more specific requirements to be identified: instead of requirement B1- 'Freshen clothes by first of all removing smell', the requirement C2 and C5 is made, these will be shown on page 40.

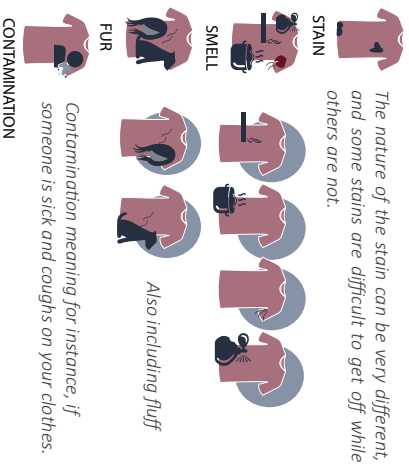


Illustration 60 - Different kinds of dirt

SCALE OF DIRT		WEAR AGAIN	LAUNDRY BASKET	STAIN REMOVAL
SERIOUS	16	Stains (2)		■ ■
	15	Stains (1)		
	14	Contamination (2)		■ ■
	13	Sweat (2)		
MEDIUM	12	Smoke (2)		■ ■
	11	Sweat (1)		
	10	Food smell (2)		■ ■
	9	Contamination (1)		■ ■
MILD	8	Fur (2)		■ ■
	7	Worn 3 times (2)		■ ■
	6	Smoke smell (1)		
	5	Hair/Fur (1)		■ ■
	4	Parfume (2)		■ ■
	3	Parfume (1)		■ ■
	2	Food smell (1)		■ ■
	1	Worn once (1)		■ ■

Illustration 59 - Dirt scale

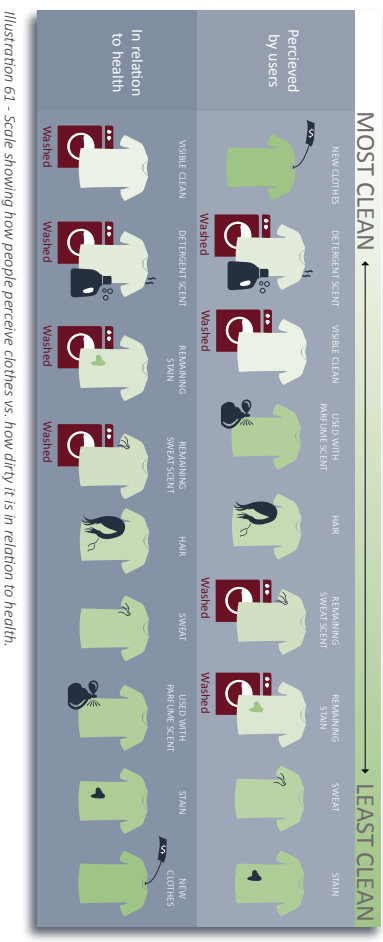


Illustration 61 - Scale showing how people perceive clothes vs. how dirty it is in relation to health.

Perception

Ill. 61 shows the way 'dirt' and 'cleanness' is perceived by users versus how it is related to the health perspective. Clothes is not just dirty and perceived in a fixed way. As shown here, cleanness is a complex subject to grasp, since it does not have to do with bacteria and dirt as much as **perception**. In order to make people perceive the clothes coming out of the 'freshener' as clean, the product itself has to signal cleanness. This leads to requirement C6, see page 40. [Worksheet 40, Cleanness- and Dirt scale]

Dirt Frequency

Most adults (not considering working clothes) do not get many stains in their daily lives. However, having small children or pets will most likely increase the rate. Smell and 'amount of wears' has shown to be the most frequent reason for washing clothes. Ill. 62 shows the types of dirt and how frequently clothes is exposed to it. (Knowing that there is a lot of variety between different people)



Illustration 62 - Dirt frequency - no focus on stains

REQUIREMENTS #3

Created March 11th and are not yet prioritized

From previous:



Quantitative

- C1** The product must kill bacteria in at least the same degree as a 60°C wash (which kills most bacteria - [Worksheet 41, Washing standards]). The point of this is to get rid of contamination and smells associated or caused by bacteria, such as sweat [Worksheet 42, Body odor].
- C2** The product should be able to eliminate the following smells: (Prioritized list) 1. Body odor, 2. Smoke, 3. Food, 4. Pets, 5. Perfume.
- C3** Knowing that requirement B5 was too difficult to evaluate, this requirement is created to ensure convenience: The process of using the product should maximum contain 1 more step than the current process of recirculating clothes [Worksheet 11, Laundry Journey].
- C4** The product should be able to handle the following textiles: (not prioritized yet) Wool, Polyester, Cotton, Acrylic, Viscose, Rayon, Silk, Denim, Leather.
This list is not done yet, but the point is to target as many types as possible- if that is not possible within the project, we will prioritize everyday clothes, delicates (but specified more clearly, e.g. silk, wool - some of the more common)

Qualitative

- C5** After being 'treated' in/with the product, the user should perceive it as 1 on the dirt-scale (ill. 59). This could be evaluated by asking people to rate it according to the scale.
- C6** The product should signal cleanliness to enhance the user's perception of the clothes coming out of it. (We would like them to perceive it as clean as possible to make them wear it as many times possible before washing it) This will be difficult to evaluate, however, it works as a guide.

Wishes

- To make the refresher more eco-friendly than the current washing machine
 - By reducing chemicals
 - By reducing power
- Knowing that these factors can be complex to evaluate:

Missing aspect

Next step is to define how these requirements should be evaluated, and to put them in a prioritized order with numbers.

EFFECT

Since washing clothes with water and high temperature is tearing the clothes and making it worn out, other ways of cleaning clothes are investigated. Some of these are listed in illustration 63. Some of the methods have been tested [w: Methods removing smells] Some of the testings will be shown in the following:

The illustration gives an overview of how the method effects the clothes. Methods where smell is overwritten with scents are not interesting for the project, since the clothes should be perceived as clean.

	Removing Dirt*	Removing Stain**	Removing Smell	Overwriting Smell	Killing Bacteria
Chemistry	DETERGENT	●	●	●	●
	BLEACH	●	●	●	●
	FABRIC SOFTENER	●	●	●	●
Force	SPOT REMOVER	●	●	●	●
	PERFUME/SCENT	●	●	●	●
	SCRUBBING/BEATING	●	●	●	●
Temperature	ROTATING	●	●	●	●
	AIRING/ BLOWING	●	●	●	●
	STEAM	●	●	●	●
Alternative	FREEZING	●	●	●	●
	BOILING WATER	●	●	●	●
	ULTRA SOUND	●	●	●	●
Alternative	UV LIGHTING	●	●	●	●
	VODKA	●	●	●	●

* Physical objects that are unwanted on the clothes but are not in liquid form
** Substances (usually contains liquids) that are dyeing the textile

Illustration 63 - Different techniques/methods and their impact on dirt, smell and bacteria.

EXPERIMENTS

In order to find a proper technology to refresh clothes, a lot of experimenting is done. [Worksheet 44, Methods removing smell]

Washing (Ill. 64)

This experiment was done before deciding on the 'fresh' direction. The full experiment can be seen in [Worksheet 24, Experiment A]. In the experiment, it was tested, how to remove blackberry marmalade (This was chosen because of the known stain-making) in different ways, using detergent, mechanical action, boiling water, and soaking in cold water. The interesting parts were:

- The soaked clothes was more difficult to clean than the clothes with dry blackberry marmalade.
- Soaking in detergent using cold water in 15 minutes worked best of all the tested approaches. No mechanical action or heat was needed.

This finding could lead in a direction of using more chemicals because of the obvious efficiency, however, this is not consistent with the wishes of the team.

Freezing (Ill. 65)

Freezing clothes is a well-known household remedy, which is said to kill bacteria and thereby remove smell. Therefore, this was an obvious method to test. Various sweaty and smelly clothing items were put in the freezer for different periods of time. It was found



Illustration 64 - Washing



Illustration 65 - Steam



Illustration 66 - Freezing

that very smelly clothes or shoes needed to stay in the freezer longer in order to be smell free. Even though the clothes were smell-free, when it was taken out of the freezer it slowly began smelling to the same extent as it had done before the freezing experiment.

When the clothes is worn again, the smell returns even faster, perhaps because the body heat warms it up. The bacteria seem to be in some kind of hibernation, wakened by the body temperature. The temperature in the freezer, -18°C, might not be enough in order to obtain full effect. Knowing that some textiles cannot handle very cold temperatures and clothes containing a tiny bit of water will make the fabric crack and shatter at any kind of shock. New experiments with much lower temperature are not performed since it will have negative consequences for the fabric and the result is not likely to change. [Worksheet 50, Sock freezing]

Steam (Ill. 65)

Steam could potentially be good for several reasons. The heat could kill bacteria, the light amount of water could remove smell and the combination could dewrinkle the clothing. Vero Moda (clothing store) let us come and try their steamer, which they use to dewrinkle clothing weekly. The focus was on de-wrinkling, but a pair of frozen socks that had stopped smelling were also brought there. The results for the dewrinkling were not as expected - it

took a lot of time and 'spot' treating in order to obtain the desired result. This could hardly be giving the same results as the industrial blow-iron method [Worksheet 31, Blow iron]. However, time could have an impact on the result but was not tested, but it did not seem to remove any smells.

The sock was brought and was also steamed. Before steaming it, we smelled it and it was not smelly at all. After steaming the sock, we were shocked when smelling it again, since it then had become very smelly. It is uncertain what caused this, but the idea of freezing the clothes into freshness seemed much less attractive, as mentioned in the previous. [Worksheet 43, Vero Moda steaming]

UV light (Ill. 67)

UV light is tried out. A shirt is put in a closed closet where no light from the outside is entering. It is placed in there with a UV light bulb that is supposed to kill bacteria. After 24 hours the shirt was taken out, but the smell was not seemingly reduced at all, which is why it is not further investigated more thoroughly.

Vodka (Ill. 68)

Vodka is supposed to remove smell from clothes according to an old house trick. The vodka was sprayed on a shirt, but the clothes seemed no different. The smell of sweat had not seemingly been reduced at all.



Illustration 67 - UV lighting



Illustration 68 - Vodka

Summing up

Freezing clothes seemed as a possible solution to remove smell, but after freezing it and making it smell free, the clothes started smelling immediately after wearing it again.

Steaming the clothes did not work as intended either. It required a lot of manual effort (Spot treatment) and did not, according to the experiment, remove the smell.

In general, using the methods tested in the product would be a half solution and unlikely to be convincing. [Worksheet 57, Overview - smell removal]

INADEQUATE TECHNOLOGIES
All of the investigated methods are INADEQUATE for the desired solution.

Other technologies have to be found and investigated!

VALUE CREATION

The previous value mission and interaction vision (page 33) were expressed too 'grounded' and on practical level, focusing on the functionalities. Therefore, the team needed to find out the real value of the product.

What are we making?

The question "what are we making" was asked, in order to understand which kind of value this product should give. Some of the answers were:

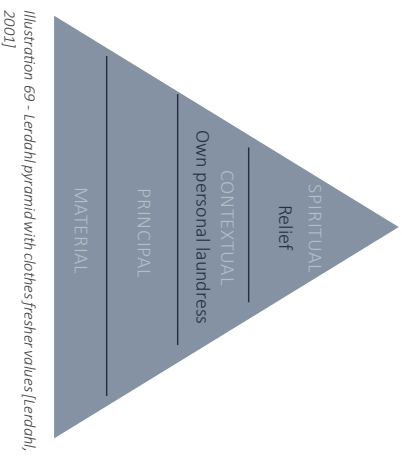
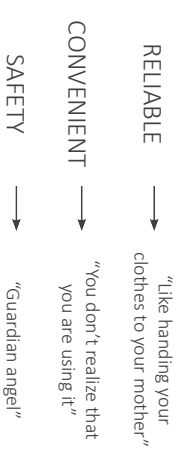
- Making user do less housework
- Does not have to hang clothes outside
- Less washing, drying, folding, ironing, putting back the clothes
- Prevent clothes from wearing out
- Avoid dry-cleaning
- No risk of cleaning clothes wrong - No considerations, just do it.
- Help to clean up bedroom from recycled clothes

From these points, it was found that what we really want to do is something that is **convenient** for the user. So what is convenience? A brainstorm, with help of dictionaries, providing antonyms and synonyms, is made in order to figure this out. In the context of this project, convenience is elaborated in the following.

Convenience

- Always the right place at the right time
 - Takes no skills to operate
 - Does not require extra time or struggle to operate
 - Dictionary: "the state of being able to proceed with something with little effort or difficulty"
 - Usefulness, Beneficial
 - Gives the user an advantage
 - Suitable
- What does the term convenience tell about the product?
- A closet aid, decision aid, lifestyle aid.
 - A relief for the user, who does not have to take on the 'responsibility' of the clothes
 - An accessory for the clothing/closet/room

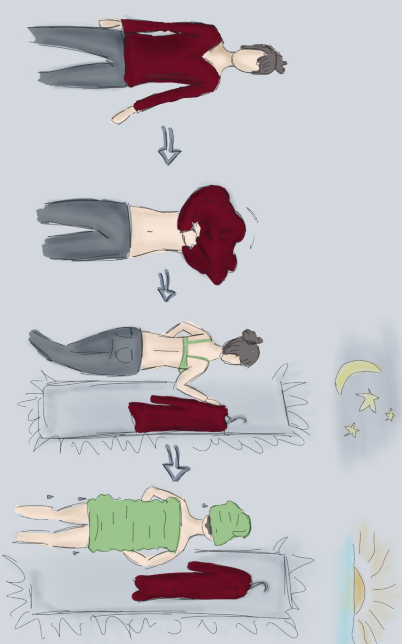
- Not allowing restrictions of what to wear when
 - Contributing to the family/household. Contribution. A product that contributes with the laundry?
 - Discreet and helpful
 - Not noticeable or feature full - but essential part of clothing routine.
 - Like the clothing's 'safe-place'. Where clothes can come and feel safe and taken care of - maybe like home or luxury or spa for the clothing.
- This activity ended up with the terms below, which created the foundation for the new value mission and interaction vision on page 45. [Worksheet 44, Value Creation]



VISION

Value Mission

"DAILY LIFE CONVENIENCE AND CARE TAKING"



Interaction Vision

"AN EFFORTLESS RELATIONSHIP WITH YOUR PERSONAL LAUNDRESS, WHO IS AN EXPERT WITHIN HER FIELD"

Creating a trustworthy 'personal laundress' requires the clothing to come out of the machine, ready to wear - this leads to requirement D1, D2, and D4 (page 51)

TECHNOLOGY SHIFT

TECHNOLOGY

In order to meet the needs and the requirements properly, the team has decided to use liquid CO₂ as the technology. This leads to requirement D3, see page 51.

This decision was not made in one day, and an explanation thereof will be provided in the following.

"What are some of the concerns when applying this technology in private homes?" [Worksheet 75, M. Porsmose interview]

"If the machine can be completely automated, then I don't see any major challenges"

- M. Porsmose

Lack of adequate technologies

Last time technology was mentioned, it was decided that none of the known technologies would be adequate (page 43). This made the team consider the technology seen at Kymi Rens on March 9th. This visit was scheduled for the team to investigate methods for the 'complete system' concept (page 25). Multiple methods for automation was discovered, but never brought to use, since the 'fresh' framing turned around the project a few days earlier. The reason this was not investigated further in the first place, was because this technology seemed over the top for the desired purpose, with a very large machine. However, in the time of need, the team took a chance and scheduled another meeting with Kymi, which can be read on page 47. Before deciding completely on the CO₂ technology, nitrogen was also investigated, because it could be

used in the same way as CO₂ but with a much lower pressure - all the way down to around 2 bar, but the problem was that making the nitrogen fluid required it to be very cold, around -210°C, which would ruin most textiles. [Worksheet 47, Technology trail]

CO₂ cleaning is used in the industry of professional dry-cleaning. As mentioned, it was not investigated further in the beginning, since the machine is very big and consists of complex processes. It contains CO₂, pressure chamber, high pressure compressor, pressure tanks and more.

However, the team believes that this technology has potential for a 'future concept' which this project addresses.

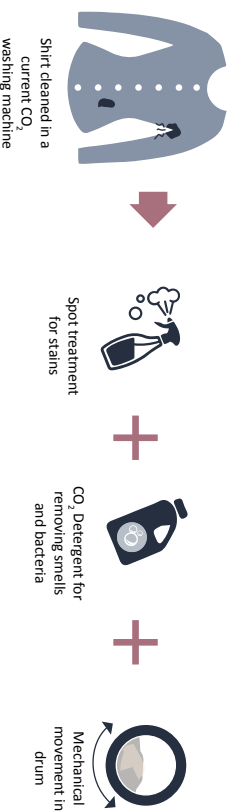


Illustration 70 - Basic explanation of how the liquid CO₂ cleans the clothes

KYMI RENS

Kymi Rens is a dry-clean company, located in Aalborg. Since 2000, it is lead and owned by the 3rd generation in the family, Michael Porsmose. [Kymi.dk, 2016] They are using both traditional dry-cleaners with high amounts of chemicals (PER), but they also have two CO₂ dry cleaners, that are not using highly dangerous chemicals like PER. The development of the CO₂ dry cleaners are still under development, and Michael Porsmose has been one of the few in Europe to support this technology by testing it in his company. He has previously worked at the R&D in Electrolux, but is now back in the family company. In relation to the CO₂ dry cleaning, Kymi has been involved in the EU life project, "Detective" [Appendix 11, Detective] and is referred to in several studies, among others [Sutanto, 2014]

The following information is obtained from the visit to Kymi and the interview with Michael Porsmose. [Worksheet 59, Kymi 2]

CO₂ Dry cleaning

CO₂ dry cleaning uses liquid CO₂ at a temperature of around 5-10°C and a pressure of 55 bar. The clothes is tumbled like in a regular washing machine but much slower and less rough. It is only 'wet' from the CO₂ around 2 seconds at the time. The reason for this is that the liquid only takes up 1/3 of the chamber, and when the clothes is rotated, the CO₂ evaporates.

Even though CO₂ dry cleaning is better for the health and environment and is cheaper in operating costs, there are still lack of interest due to the high investment costs. This prevents the technology to be optimized even further. As it is now, the machine is built with standard components, making it very large. It weighs 3.8 ton, since it is made out of standard components, but it also has to have a certain weight in order to stay where it is in case of a leak (because of the high pressure)

Liquid CO₂ has the same characteristics as butane,

which has an degreasing effect, which makes water solvent stains less attractive to put into the machine, as well as certain materials such as polyethylene.

Detergent

In order to kill bacteria and release dirt, a special detergent is used. It is called CLIP COO and is delivered by the German company, Kreussler [Kreussler-chemie.com, 2016]. They only produce it for this purpose. Michael states that they would likely be interested in developing a product for private use. The team wishes to contact this company.

In the following three pages, the further investigation of the topic is presented.



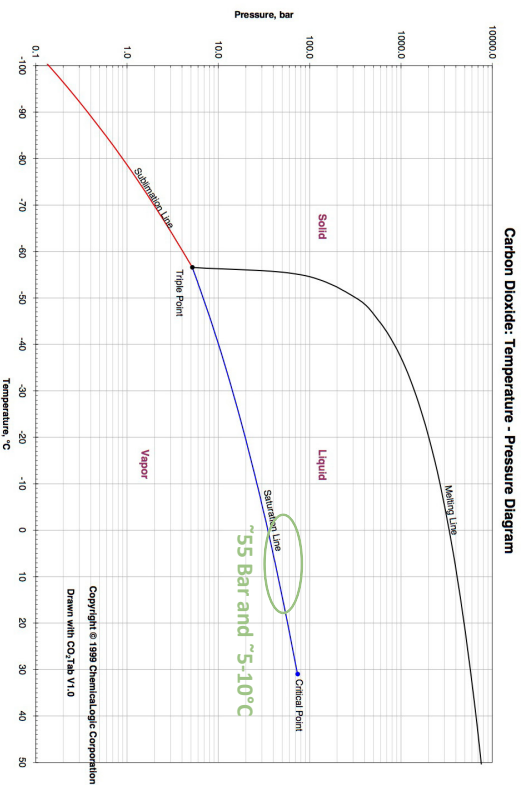
Illustration 71 - Pictures from second visit where focus was on the CO₂ dry cleaner. (Not Michael Porsmose in the picture)

CO₂ DRY-CLEANING

What is CO₂ ?

CO₂ is what we exhale. It is non-combustible, odorless and colorless. It contributes to global warming. The CO₂ used for the current CO₂ washing machine is a waste product made in relation to processes that extracts it (e.g. beer brewing). In every cycle 1,5-2 kg CO₂ is depleted, which means that a supply-vessel (CO₂ pressure tank) is connected to provide new. (118 kg CO₂ is cleaned and reused) Knowing that it requires more energy, **The team wish to make a closed system, where all of the CO₂ is reused**, in order to release the user of providing new CO₂.

The CO₂ phase diagram in ill. 72 shows the different states of the CO₂ and the corresponding temperature and pressure. The process works at ~55 Bar and ~5-



48

10°C which, as shown in ill. 72, is on the line between liquid and vapor, which is the wanted states in order to utilize the mechanical action caused by continuous liquid-vaporizing shifting. [Worksheet 53, CO₂] and [Worksheet 61, Paper B]

Rules and regulations

Anyone are allowed to store pressure tanks with a gathered volume up to 12L without any restrictions than normal caution behavior. Pressure tanks with a total volume at 30 L at 200 bar can be put in sculleries, sheds if no flammable things are in there. [Worksheet 85, Rules and Regulations]

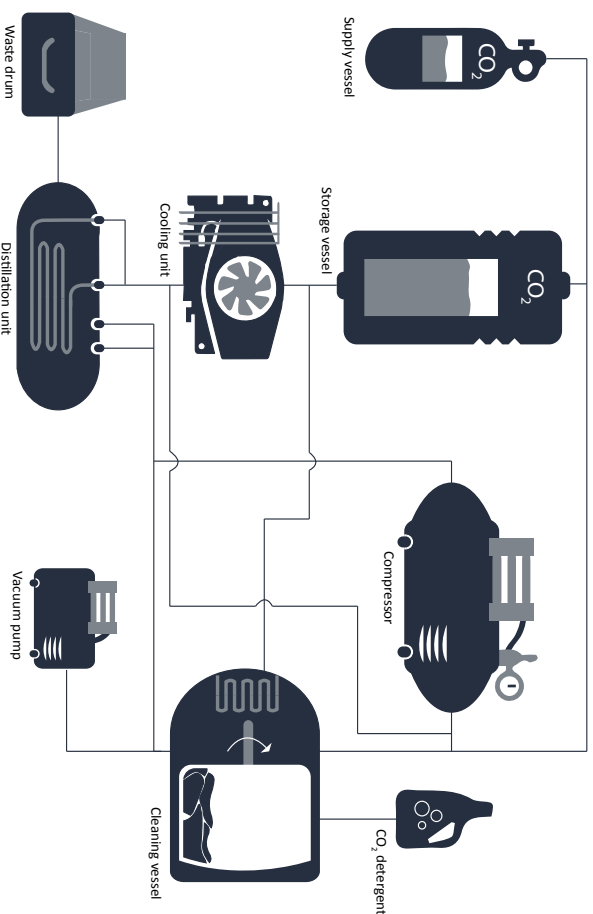


Illustration 73 - Components of current CO₂ dry-cleaning machine, Electroflux S35

Components

- Ill. 73 shows the components in the current machine at Kymi, and how these are connected (The process will be explained later in the report). A short explanation of each component as it is in the current product:
- **Supply vessel:** Consist of 300 kg CO₂ which is delivered every 3rd week since 1,5 kg are lost for every cycle.
 - **Storage vessel:** Consists of 200 liters CO₂ and is where the reused CO₂ goes after each use. [Worksheet 75, M. Porrmose interview]
 - **Cleaning vessel:** Where the garments are placed and washed.
 - **Vacuum pump:** Takes the air out of the cleaning vessel before beginning of washing so it does not get mixed with the CO₂.
 - **Compressor:** Fills the cleaning vessel with CO₂ making a pressure around 55 bar.
 - **CO₂ detergent:** (not component)
 - **Distillation unit:** Cleans the CO₂ after use by making it gaseous.
 - **Cooling unit:** Cools down the CO₂, making it liquid?
 - **Waste drum:** Collects the dirt and detergent after use. Is emptied manually.
 - Besides this, there are filters too.

49

IMPORTANT TERMS

These are some of the terms that are important for the product. These two pages are providing an overview of the terms and how they have an impact on the product and the user.

Delicates

Delicate clothes is clothes that is more fragile than regular clothes, e.g. washable silk, wool or suits. Wool is self-cleaning, but spilling something on it may require it to be washed. Other delicates can be washed, but are better off without. Some of the ways people handle their delicates:

Airing

Many people air their delicates outside. It is told to be most sufficient when the weather is humid or below the freezing point.

Gentle cycles

However, the airing it not enough in order to remove a stain (which is why people try to avoid stains on their delicates). For this purpose, many washing machines have gentle cycles. These often require extra work from the user; being ready to take it out when the cycle is done and removing the stain manually afterwards.

Dry cleaning

Dry cleaning is used both for severe stains, but also for getting a stain-free suit ready before wear.

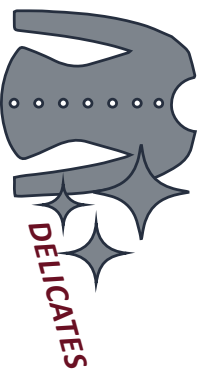


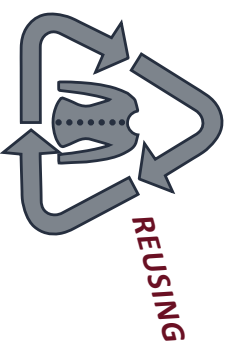
Illustration 74 - Reusing: Working clothes - used and clean in one closet. Sorting: before washing, all laundry has to be sorted.

Recirculation

Recirculation is a **copying strategy** to the modern behavior of not wearing the same outfit two days in a row. Although the washing of clothing has increased, most people still do not wash their clothes after every wear, but usually after 2-3 wears. This requires people to continuously recirculate multiple clothing items. For some people, it means that the bedroom is a mess, for others it means that they have a special system in their closet. Depending on the type of clothing, there is difference in the way it is handled:

Regular clothing

Regular clothing is typically not very dirty when it is recirculated. It is very individual how this recirculation



is done, but some of the strategies are: hanging in the bedroom, putting on top of the washing machine, putting back in the closet, laying on a chair. However, most people state that they keep it somewhere in the bedroom.

Working clothes

Working clothes can be dirty, and some people have even customized their closet in order for the dirty working clothes to hang without affecting the clean working clothes. See ill. 83.

Formal clothing

Formal clothing can have long time between wears, therefore, if it is not washed right away, it is put back in the closet.

Convenience

Convenience is a term used frequently in this project. It can be interpreted in several ways, but a description of what the team does in order to make the process and product more convenient is described in this brief section.

Short journey

The team is dedicated to make the journey of using the product very short, and at the same time, decreasing the long journey of washing clothes in the traditional washing machine. This journey can be seen on page 17, ill. 21, but it requires sorting, washing, folding, transportation of clothes between several rooms [Worksheet 34, Laundry path], and many more steps. By reducing the need for the traditional washing machine, the frequency of these steps are cut down as well, which is convenient for the user. (See sorting on ill. 82) This convenience relates to the overall use of the product, while in each step of using the product, it should be convenient as well. Putting the clothes on/

into the product, decisions, getting the clothes out, getting the right feedback, etc. The major focus areas are elaborated below.

Easy to put clothes on

In order for the user to actually use this product instead of throwing the clothes in the laundry basket, it is very important that the clothes is easy to put into the product. At the same time it is also seen as a requirement to prevent wrinkles. Therefore, the clothes should be placed on hangers, that are easy and fast to use. Traditional hangers have been investigated [Worksheet 55, Hangers], and it might be necessary to develop a hanger specifically for this purpose.

No transportation

Another point that is convenient for the user is the fact that he or she does not have to transport the clothes between rooms, which is also mentioned previously (page 55).

Decisions

In current machines and with the Styler (page 52, ill. 76), a lot of decisions have to be made just in order to start the machine. There are too many functions in order for most users to grasp. Therefore, a convenience for the user is that the product only has one type of cycle.

Besides the convenience of using the product, it is also convenient for the user that the usual 'chair' (see ill. 50 and 78) is being replaced with a product made for the purpose.



WALK IN CLOSET

Dr. Sinner's circle

In relation to the CO₂ dry-cleaning, we became familiar with Dr. Sinner's circle (from 1959), which is a model that represents the 4 factors that are usually involved in laundry. It shows that if one factor is reduced, it can be compensated by the three others. [Europeancleaningjournal.com, 2010] Ill. 74 shows two circles: the top one shows when the four parameters are evenly distributed, and the bottom circle shows the distribution in the CO₂ process.

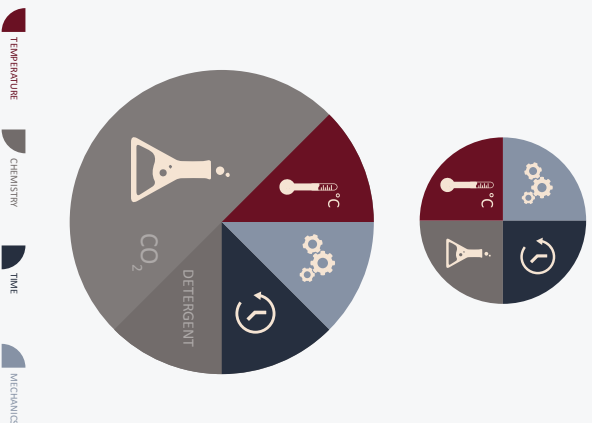


Illustration 75 - Dr. Sinner's circle. Top: When all parameters are evenly distributed. Bottom: Distribution for the CO₂ process. CO₂ is not really perceived as a chemical, therefore, it is shown separated from detergent.

Trying to get closer to a framing, it is decided to look into a solution that would fit into a walk-in closet. The walk-in closet is getting increasingly popular, and belongs to people who have bigger houses and more money, which fits Miele's current customer base. [Worksheet 38, Walk-in closet] To get an understanding of the sizes, the square meters were drawn on the floor. [Worksheet 49, Walk-in size]. A walk-in closet with washer and dryer is seen on ill. 75, and seems to be well-incorporated, however, it is uncertain how many people have or will get a walk-in closet that large.

The decision of targeting a specific context was an attempt to narrow down the options, making it easier to create a product within the remaining time frame. However, the arguments against choosing this VERY specific context overruled:

- Consequences for choosing very small target audience. e.g. can market the demand very small.
- Uncertain if the amount of walk-in closets will increase in the future.
- Many different kinds of walk-in closets, which can make it difficult to make the integrated solution that was wished.
- Making a walk-in closet solution fit in other rooms will be difficult, but the other way around is more realistic.

This led the team back to an unspecified context but within the frame of bedroom, bathroom, clothing areas.



Illustration 76 - Walk-in closet with washer and dryer

REQUIREMENTS #4

Newly added

D1 	The treatment should not leave any visible traces.	D2 	Dewrinkle or prevent wrinkles	CO₂ D3 	Use liquid CO ₂ technology to clean clothes	D4 	Separate inlet(dirty) and outlet(clean) for the clothes
---------------	--	---------------	-------------------------------	--	--	---------------	---

Prioritized

The requirements have finally been officially prioritized, which means that the further work can concentrate on solving the highest priorities first.

1 	B2	Decrease washing	6 	C4	Include all textiles	11 	D2	Prevent wrinkles
2 	B3	Recirculate clothes	7 	B4	Provide storage	12 	D3	Liquid CO ₂
3 	C1	Eliminate bacteria	8 	C5	Perceived as 1 on clean-scale	13 	D4	Inlet and outlet separately
4 	C2	Remove smell	9 	C6	Signal cleanliness	14 	A1	Miele product
5 	C3	Maximum 1 extra step	10 	D1	Leave no traces	15 	A2	Future concept

The user should not have the feeling of using a product, but just the feeling of doing the daily routine as usual. The reason for this is that USING a product will automatically add more steps to the process, which, according to the requirements can be no more than one.

SIMILAR PRODUCTS

Far into the process of creating a clothes fresher, two products with similar selling points were discovered. At first, it was very discouraging that, what we thought would be a new product category was already out there. However, looking more closely, these products **can hardly be counted as competition.**



Illustration 78 - 'Whirlpool Swash' from 2014



Illustration 77 - 'LG styler' from November 2015

Product

The Swash(ill. 77) contains one item at the time, but the cycle only takes 10 minutes. Each cycle requires a pod, which costs \$7 for 12 pcs. The selling points are 'saves your time, money and clothes'. They state that the product will dewrinkle, refresh, restore and preserve the clothes. It uses steam in the process. The person has to hang the clothes and fasten it with clips 3-4 places or more. It was found at \$325 at [abt.com/swash, 2016]. The size is 42x130x76(138 with door open) cm (WXHXD) and weighs 36 kg.

Review

Cnet review comments:

"It is heavy. 400\$ is expensive. Made out of plastic, not very elegant looking. Requires expensive pods which adds up. Doesn't clean, doesn't remove stains or dirt. Leaves some wrinkles behind. Only takes one piece of clothes at the time.

Good. Takes only 10 minutes. LED cycle count-down." [Cnet.com/Swash, 2015]

Product

Lg Styler(ill. 76) uses steam(They call it TruSteam), Aroma, and a motor to shake the clothes back and forth. It states that it removes smell, sanitizes and makes pants crisp. There is space for 3 pieces of clothes hanging + one pair of pants. The water has to be manually filled and drained water has to be emptied. It is found at the price of \$1799 at [abt.com/Styler, 2016]. The size is 45x184x58 cm (WXHXD) and weighs 83 kg.

Review

Apparently, the functions are separated into different modes, so you have to choose if you want to dewrinkle, sanitize or deodorize. Comments from review:

"It doesn't work that well"

"\$1,999 is a lot to spend on something that's supposed to "refresh" your clothes-- and it doesn't really get the job done. You can't check on the cycle's status from the app."

"The best tech enriches your day-to-day, **adding convenience and peace of mind when you need it most.** Unfortunately, not every product rises to that standard. Some gadgets actually complicate your life by introducing shiny solutions to nonexistent problems." -Megan Wollerton [Cnet.com/Styler, 2016]

How we can differentiate

What they are doing

- Both of them seem to refresh the clothes by **OVERWRITING** the smell with perfume instead of removing it.
 - Both of them are focusing on the product being an "in-between" dry cleans.
 - They both focus on the dewrinkling, but they do a poor job (Swash is much better than Styler, but also requires much more pre-work)
 - They are very different in pricing(2000\$ vs. 400\$), but what you get more for the money with LG styler is: More clothes at one time, more features, smartphone connection, no need to buy pods, easier use- just hang it in there.
 - None of them are removing any kind of soil, dirt or stains.
- [Worksheet 66, LG styler and Swash]

What we wish to do

- No add-on buying products (The user has to buy new pods for the Swash)
- Easier and shorter process (a lot of steps for inly one item with Swash)
- Simpler interface (Styler has a lot of different setting that the user has to asses every time)
- No fake freshness with the use of perfume- actual removal of the sweat.
- Actual dirt and spot-removal (just not any spot)
- Want to make the product the user's first choice and the washing machine come as second.

SUM-UP

Before entering the 'Develop & Refine' chapter, a brief sum-up is provided:

SUM-UP

- The project is framed towards freshing clothes, making people wear their clothes more times before washing it- decreasing the laundry activity
- Various technologies have been tested and evaluated, but the team has decided to use CO₂ for the purpose.
- Liquid CO₂ is used in dry cleaning today, but very few are using it, due to high investment costs and lack of mass-production.
- The team wants the product to create 'Daily life convenience and care taking'.



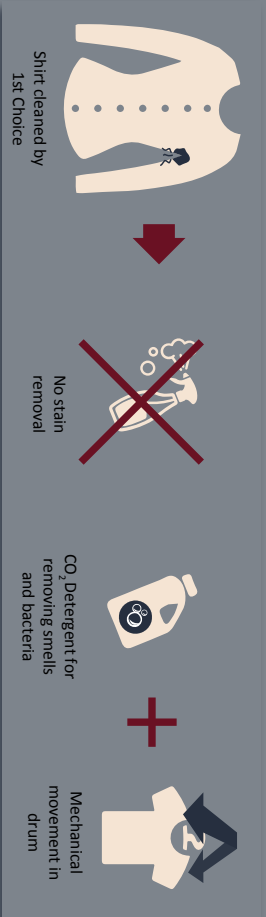
"The Chair"

Illustration 79 - 'The Chair' - Interesting chair design which shows how well-known it is to have a chair for either clean or recirculated clothes.

4. DEVELOP & REFININE

This section shows the development of different concepts and how the product is refined. The final shaping of the 1st Choice 2.0 will not be shown here, but can be seen in the product report. However, the final thoughts and the core of it is described.

The illustration below shows that the spot-treating, which is currently used at Kymi and removes severe stains from the clothes, is left out for this product, since it is done manually and requires many decisions and knowledge.



CONTEXT

Target room

Different contexts for the product have been discussed and evaluated. Here is an overview of the thoughts as well as pros and cons.

Bedroom

This is where almost all people in the survey store their recirculated clothes. Making the product fit into the bedroom, it is almost unavoidable to place it next to the closets. In order for the product to fit next to these, the dimensions of usual closets were investigated. [Worksheet 52, Closet dimensions] It was found that there are no given standard height since the height of the ceiling varies a lot, but it is normally around 2 meters. The depth is around 58 centimeters for closets with space for hangers.

- Placed where many people gets dressed and undressed- making it convenient
- Noise from the machine could be disturbing (25 minutes for a cycle)
- Is domestic appliances appropriate in bedrooms?
- CO₂ leaking risks, where you sleep

Bathroom

Discussing the subject with people, it is discovered, that the bathroom is where some people get dressed and undressed.

- Pros:
- Convenient for the users who undresses there
 - Cons:
 - Typically smaller or less space than bedrooms.

Landry room/Scullery

In relation to the washing machine- where people do their laundry already.

- Pros:
- All laundry activities are gathered one place
 - More fit for the use of several people

- Cons:
- Can be inconvenient when recirculating clothes that is taking off before bedtime.

Decision

In order to meet the requirement B2 (help to recirculate clothes), the bedroom seems as the most sufficient room for a product. However, making the product as flexible as possible in order to meet requirement B1 (decrease washing), it is decided to go with solution 3 on page 37, a free-standing product (added to requirements as E2, page 68). This enables the user to determine where it should be placed for it to be present where they need it in order to have to sufficiently circulate their worn clothes.

On basis of the desire to deliver convenience and the fact that 'just' putting the clothes back in the closet can be an annoying task for the user (see quote from below), requirement E3 is added (page68).

"The clothes is washed, folded and stacked neatly, but sometimes half of the stack is worn before being put back in closet"

- Christina

FREE STANDING PRODUCT

After evaluation, it was decided that the product should be free-standing and be able to fit in the specific room that the user desires. However, during the development, the bedroom is considered as the most convenient room, based on knowledge from the survey.

PERSONAS



Mona



Camilla and Mark



John

The clothes freshener has not yet targeted any specific group of people. Given the required abilities, the product is a meeting point for different behavior and could help a variety of people. 3 kinds of discovered behavior is turned into 3 personas:

Camilla and Mark

They both have jobs that requires them to wear uniforms. Therefore, they change into their private clothing when getting home, which means that they at times only wear it for a few hours. They each have a spot in the bedroom where their clothes is placed to be used again, but the pile grows due to the need of clothing variety.



Illustration 80 - Mona in her bedroom

Behavior

Looking at the quotes and the condition of the bedroom, some of their behavior should be decoded. Mona needs something to help her spend less time on airing and caring for her delicate clothes. Camilla and Mark need something to help them recycle their clothing after wears, since they do not want to put dirty clothes

back in the closet. John needs something to prevent the clothes from being all over the bedroom and to prevent the washing of clean but wrinkled clothes. These are stereotypes and many of the people that were interviewed, behaved as a mix of these.

Mona

Mona works at a jewelry shop and wears her regular clothes to work. She spends more time than the average woman to take care of her clothings, owning a lot of delicatses. She loves her delicate clothes, but she would like to spend less time maintaining it.

John

Unstructured and busy, John travels a lot, which means that he has to pack and unpack a lot of clothing. When unpacking, the unworn, clean (as well as the dirty) clothes is often scrunched in a pile. John does not iron, so he washes his clean clothes to remove the wrinkles.



Illustration 81 - Camilla and Mark in their bedroom

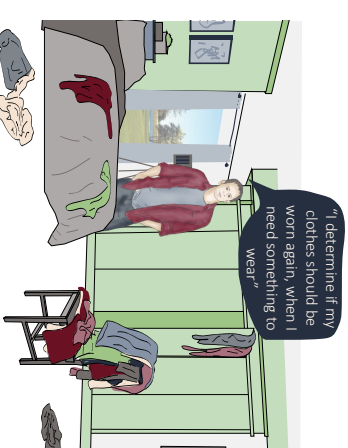


Illustration 82 - John in his bedroom

TOWER FRESH

Tower Fresh was presented at an internal status seminar. The product itself was not evaluated or discussed, but the framing and focus was. Among other things, a topic that the team had previously touched, was mentioned: **"how about the newly created problems"**. These newly created problems are:

- Does the person need more socks and underwear in order to wash clothes?
 - You now have to put the clothes on a hanger when undressing. This is more work than throwing it on a chair.
 - The clothes has to be removed from the product to the closet.
 - Could it cause the user to deal with even more decisions to be made than before?
 - The safety when dealing with high pressure.
- These topics are going to be dealt with later in the process.

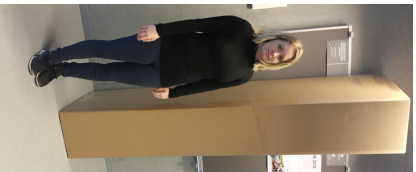


Illustration 83 - Mock up 1

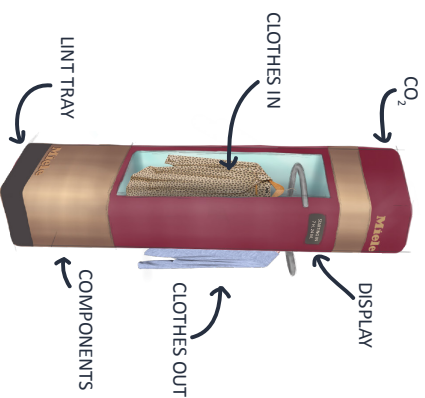


Illustration 84 - Tower Fresh explained

Size

At this time, the sizes of the components were unknown and the product was therefore made on assumptions (2m H, 58cm D and 35cmW). However, the reason for the tall product is that the hangers should be in a comfortable height for the user + the components should be in the bottom. The Mock-up (ill. 84) shows that this size would be nice to reduce. [Worksheet 62, Mock up 1]



Illustration 85 - Monus Tower Fresh



Tower Fresh refreshes clothes using liquid CO₂. It automatically leads the worn clothes from the left side where it is placed, to the right side, where it can be picked up and worn or hung into the closet right beside it.

Flow chart

In order to plan the process, a flowchart is made (ill. 87). The flowchart is focusing on the basic flow of the main process that has influence on the user, and is not detailing elements such as the washing process. This will be explained later. As it shows, the user has to define their own settings in relation to: how many

pieces of clothes should be hanging before starting the process and what time of the day should the process start, e.g. always start when holding 2 pieces of clothes and during the hours of 8am-3pm. Some of the work that has led to the concept can be seen in [Worksheet 58, Tjelve]

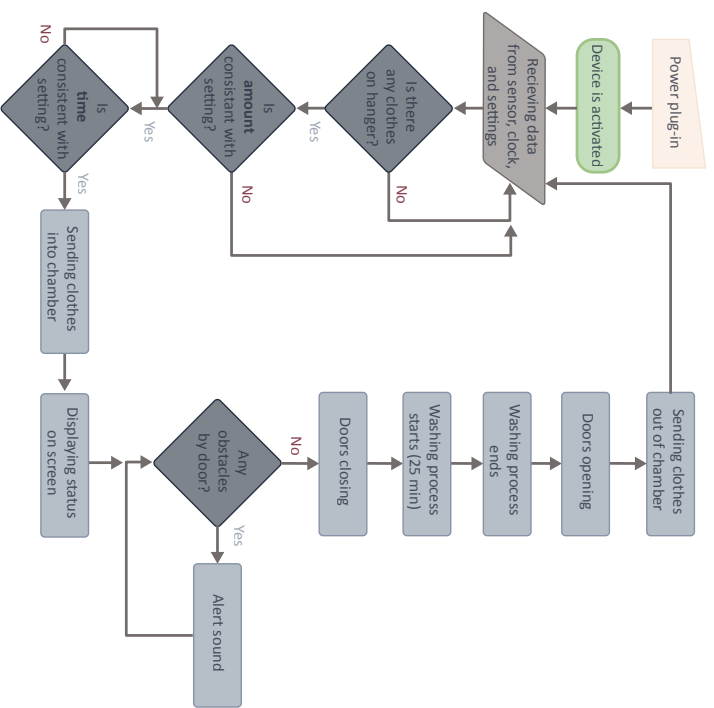


Illustration 86 - Flowchart, Tower Fresh

PURCHASE PROCESS

The product itself and the interaction is not the only thing that has to be considered. The process of purchasing, transporting and installing is also a big part of how well the product will do. In order to know how to optimize it for the various scenarios, we need to understand which scenarios the product goes through before being ready for use. Illustration 88 shows six major steps in the process. Even though the process

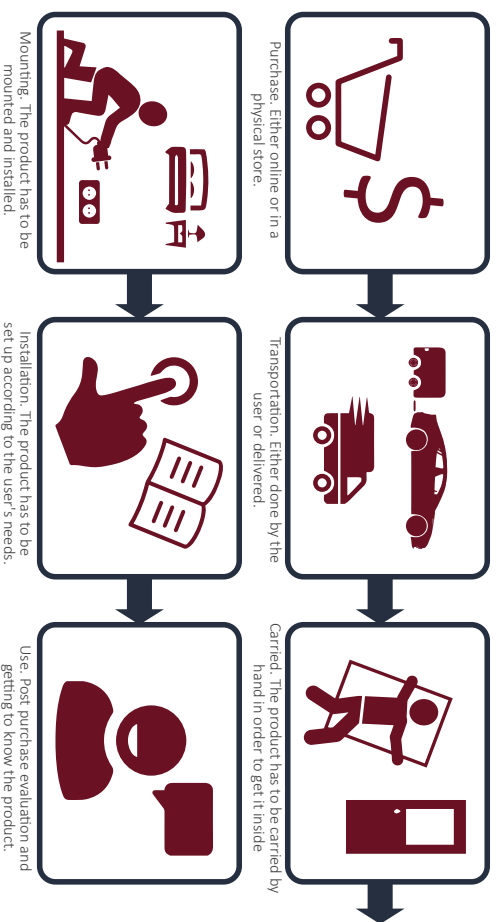


Illustration 87 - Purchasing process

and completely correct. It should also be possible to handle for one person alone. This could be both the assembling of the product and mounting it onto the wall. The **installation** part should also be possible to do by the user itself, with the help of an instruction guide. The after process is everything that happens after the process is ready to use. On the current machine at Kymi, they have inspections in order to be sure that the machine runs properly. There are not any products for private homes that requires this, and therefore it might

consist on many more, the six steps are going to be the base of this evaluation.

For the **transportation** and the **carrying**, the way the product is wrapped is important. Some of the requirements for this wrapping are: Protection of the product, handles, and dimensions that allows it to enter standard doors. For the mounting, it is important that it is possible for the user to do it relatively easy

be difficult to adopt. However, since high pressure is associated with safety risks, there should instead be a system that prevents the pressure tanks from exploding if the pressure gets too high - it should be let out in the room, which leads to requirement EI, see page 68, that a safety alarm should warn you that the room will be filled with large amounts of CO₂. The user can then leave the room/house and come back when the CO₂ level is back to a regular level. [Worksheet 85, Rules and regulations]

MOCK UP

Having determined that the product should be free-standing but very likely in the relation of a closet, the height of the product is kept (reduced from 2 m in Tower Fresh to around 1,8 m). Therefore, the shaping experiments are performed, hoping to create a shape that seems lighter and smaller than it is.

This work leads to the second mock up, which is created on the basis of an intense sketching process where 2D sketches and later 3D sketches were used. One of the illustrations that led to the wave shape is seen in ill. 89. The entire process can be seen in [Worksheet 69, Mock up 2]. The sketching was done with and without proportions, and every time a sketch was done without the right relationship between height and width, it completely changed appearance and was often to no use. Therefore, the shift to 3D was important.

The mock up was made in order to experience the size and shape physically. It seemed to tip more than what it felt like in the 3D drawing. When seen in perspective from a distance, it seems less tipping, compared to when it is physically right in front of you. When the clothes was placed on the mock up it was clear that the dirty clothes had to lean up against the curved shape. That made the shape appear lazy compared to if the clothes was hanging freely all the way down. (See ill. 90) The mock up also made us questioning whether the product is capable of standing separately.

The shape, with little alterations, was the base for the product presented at the second status seminar, see next page. The flat top made the product seem more like a closet and made it seem like it was possible to store and place boxes on top of it (like closets). If the product was only supposed to stand up against closets, that might have been okay, but since it is also supposed to be capable of standing separately, it does not seem as an appropriate solution. Since closets have all kind of heights, the product will never be aligned and fit anyway, which is why the top is reconsidered on the next page. [Worksheet 69, Mock up 2]

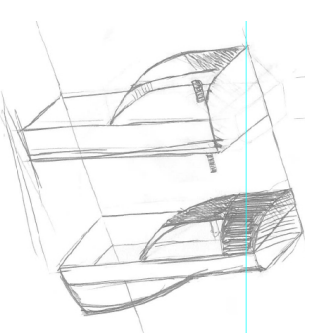


Illustration 88 - One of the sketches leading to the slope-shape



Illustration 89 - Cardboard Mock up

2ND STATUS SEMINAR

1st Choice 1.0

At the second and final status seminar on April 18th, the concept 1st Choice was presented. See the status presentation in [Appendix 07: Status 2] and clips from the videos in [Worksheet 70: 2: Status seminar]

The product is called '1st Choice' because the intention is that the product should **not replace the washing machine, but be the first choice, when cleaning clothes**. 1st Choice is not made to remove stains, which is why the washing machine is still needed in the household (as well as for bed sheets and such).

Illustration 91 explains some of the product parts. The input is the hanger bar to the left, where the clothes automatically gets in when the process starts, see ill. 92. The clean clothes gets out of the output to the right. The height of the clothes is placed so the user does

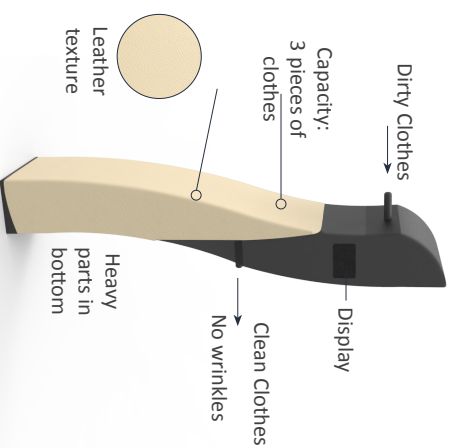


Illustration 90 - Product details

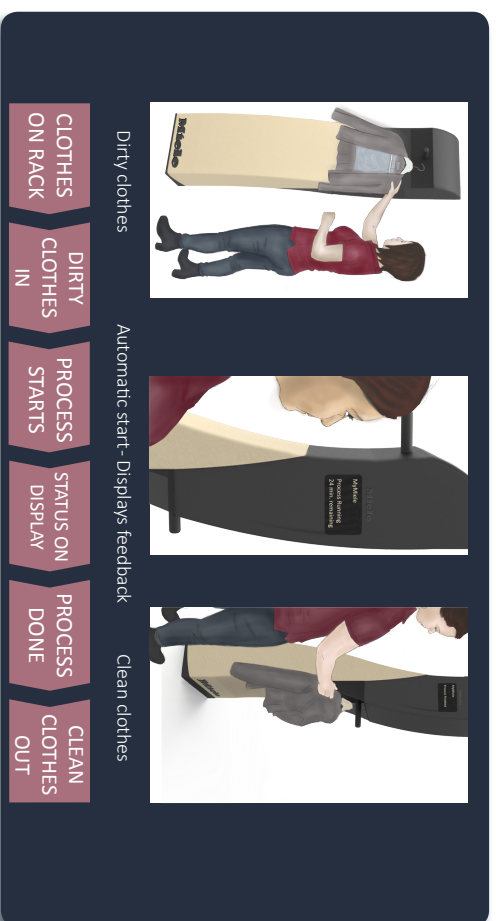


Illustration 91 - Mornings interaction and product process

not have to bend down to. The size of the product is 200x25x45cm (HxWxD). It is made to contain 3 clothing items at the time.

The clothes need to be easy to place on and take off the product. An input and output has to be integrated in the product to make the user able to **place their dirty clothes on the product immediately after use**. It is important for the clothes not to be placed on another temporary spot, messing up the room. The clothes output is also important for you, because you do not have to move the clean clothes immediately. Since the product might only start once a day or so, the product will often be seen with the clothes on it. Requirement C3, 'maximum one extra step', causes the clothes to be placed outside the product, so no door has to be opened first, making it easy and convenient to place the clothes on it and take it off again. One extra step is already added since the clothes has to be put on a hanger.

In the beginning of the shape-exploration, many of the shapes seemed very box- and closet like, perhaps because the bedroom was too much in focus. That was until the free hanging clothes was considered a part of the shape. Before, the product seemed a little bit like it was tipping. It is almost like the product is telling you to put clothes on it, in order to make balance and keep it from tipping. Clothes on the output (to the right) is making it tip a little again telling you to remove the clothes. See ill. 93.

The wavy shape of the product almost symbolizes hanging clothes. The heavy components are placed in the bottom keeping the product from tipping.

MIELE 1ST CHOICE Balanced with clothes

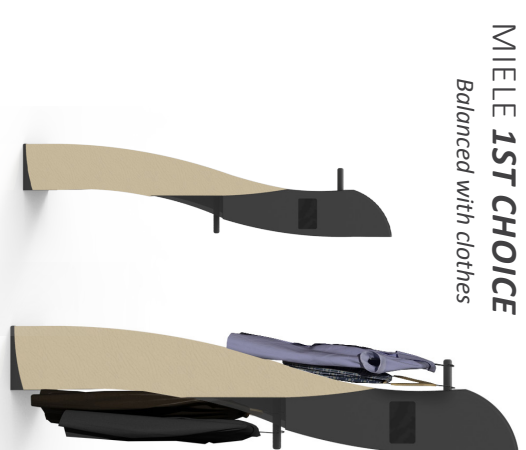


Illustration 92 - Miele 1st choice version 1.0 with clothes

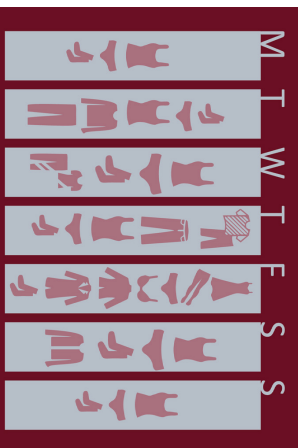


Illustration 93 - Miele 1st choice version 1.0 in context

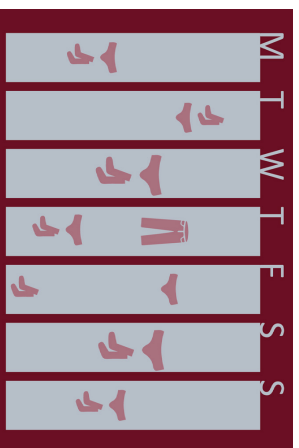
ALTERNATIVES TO TALL

Mona's Week

The illustration 95 on page 66 shows the clothes that Mona washes in the washing machine in one week. She is very aware of cutting down her washing, but she still manage to assemble this amount of clothes that need to be cleaned, which is shown below.



Ill. 96 shows how 1st Choice affects the amount of clothes put in the washing machine. 1st Choice enables her to only wash socks and underwear. They do not need the time consuming aftercare of folding and ironing. An item with a rough stain is occasionally washed in the washing machine too.



Status feedback

Comments from supervisors:

- Technical overview of how the product functions.
- How the hanger system functions.
- How is dirt removed from clothes (intro)
- Shaping: "What is that melting onto my closet?"
- No product semantic.

It became clear that the shaping of first choice was not suitable to stand separately, because it seems too much like it is tipping, even though the hanging clothes was supposed to add balance to the product.

Further work

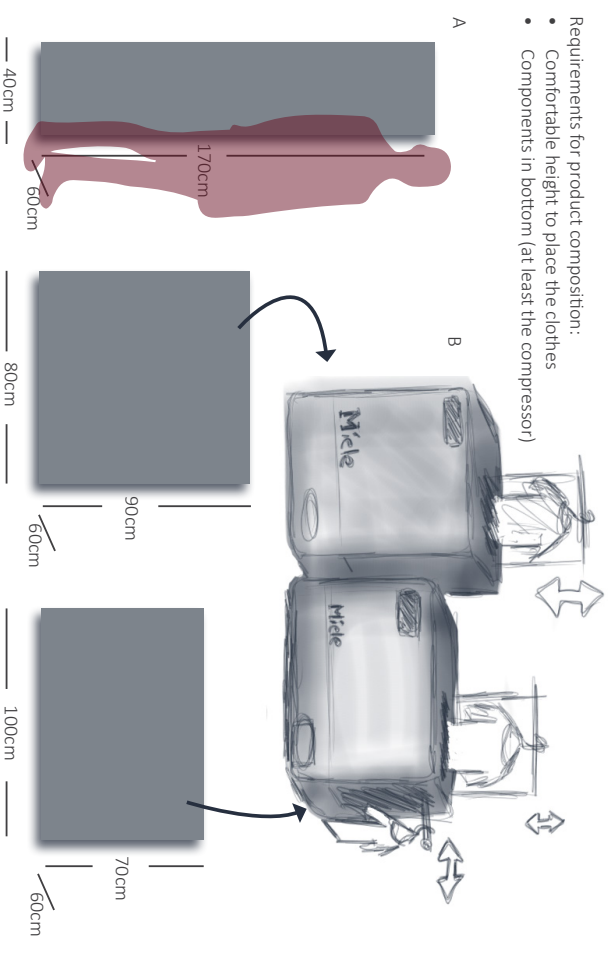
- Working with a shape that is able to stand separately and up against something, like a closet.
- The product's semantic area needs to be considered - the product needs to tell the user, what it is, and for instance that the product treats the clothes delicately.

NEXT STEP

After striving to make a tall product in order to, among other things, reach a comfortable height (compared to the traditional washing machine), **alternative compositions have to be explored.**

Requirements for product composition:

- Comfortable height to place the clothes
- Components in bottom (at least the compressor)



- A**
- + Pros**
 - Takes up less space on the floor.

- + Cons**
 - Intimidating and can seem bigger when there is no 'air' above.

- B**
- + Pros**
 - The free space could be used as a table for handling clothes. Folding it for instance.

- + Cons**
 - Takes up more space on the floor.
 - Seem very big and massive

The product takes up more floor space, when it is wider and deeper. Comfortable height for placing the clothes is just as possible to integrate on a tall product as a low one. Since none of the benefits with a wide and deep product is not seen as valid, **that leads to continuous work with the tall product.**

DEWRINKLING

Requirement D2 stated that the product should 'dewrinkle or prevent wrinkles'. Industrial dewrinkling methods had been seen at Kymi, and another method was tested in Verò Moda, using a steamer [Worksheet 43, Verò Moda steaming].

'No wrinkles' has been an area of interest from the beginning, due to the protracted activity of ironing. Some people even avoid certain types of clothing in order to avoid it:

"I don't buy clothes that wrinkles easily
- I don't want to iron!"
- Anette

This indicates that in order for the product to be convenient, the wrinkles should disappear. However, the main focus of the product has been to find a

technology to refreshen the clothes. This means that not enough time has been spend in order to find a way to easily dewrinkle. The steaming tests (ill 97, 98, and 99) showed that it was difficult to remove wrinkles fast by only using steam.

Since it is of lower priority than making the cleaning technology and interaction function properly, it is not desired to create a way to dewrinkle clothes. However, it is still an important topic, which is why the requirement is changed to 'prevent wrinkles':

WRINKLES
The focus of the project is not to remove wrinkles, but they are desired to be prevented.
Avoiding wrinkles, not fixing



Illustration 96 - Steamed shirt, half done

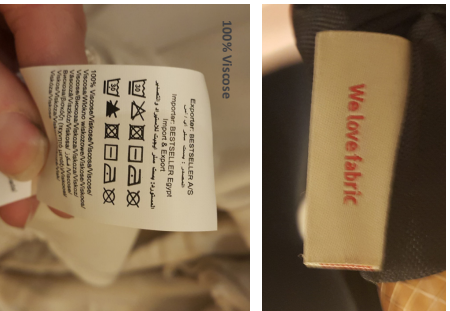


Illustration 97 - Material of steamed shirt



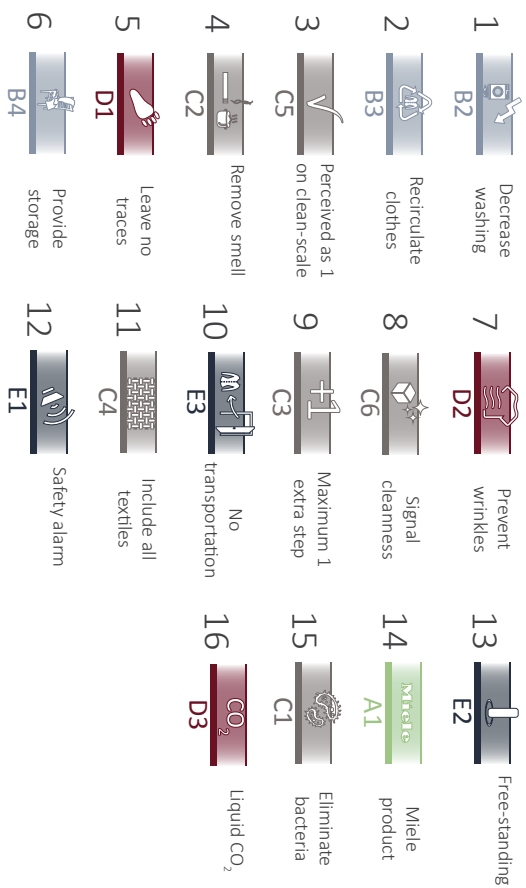
Illustration 98 - Professional steamer

REQUIREMENTS # 5

New requirements:



Prioritized



CURRENT CO₂ CLEANING PROCESS



Human action  **Machine process** 

Page 70 and 71 shows the current process of CO₂ dry-cleaning. For the future-private product that the team is developing, the processes within the machine are going to very similar, but the components are going to be changed in size and performance. The process is not changed because the need for better performance is not present in this situation, and the competences needed go beyond the ones of the team members'.

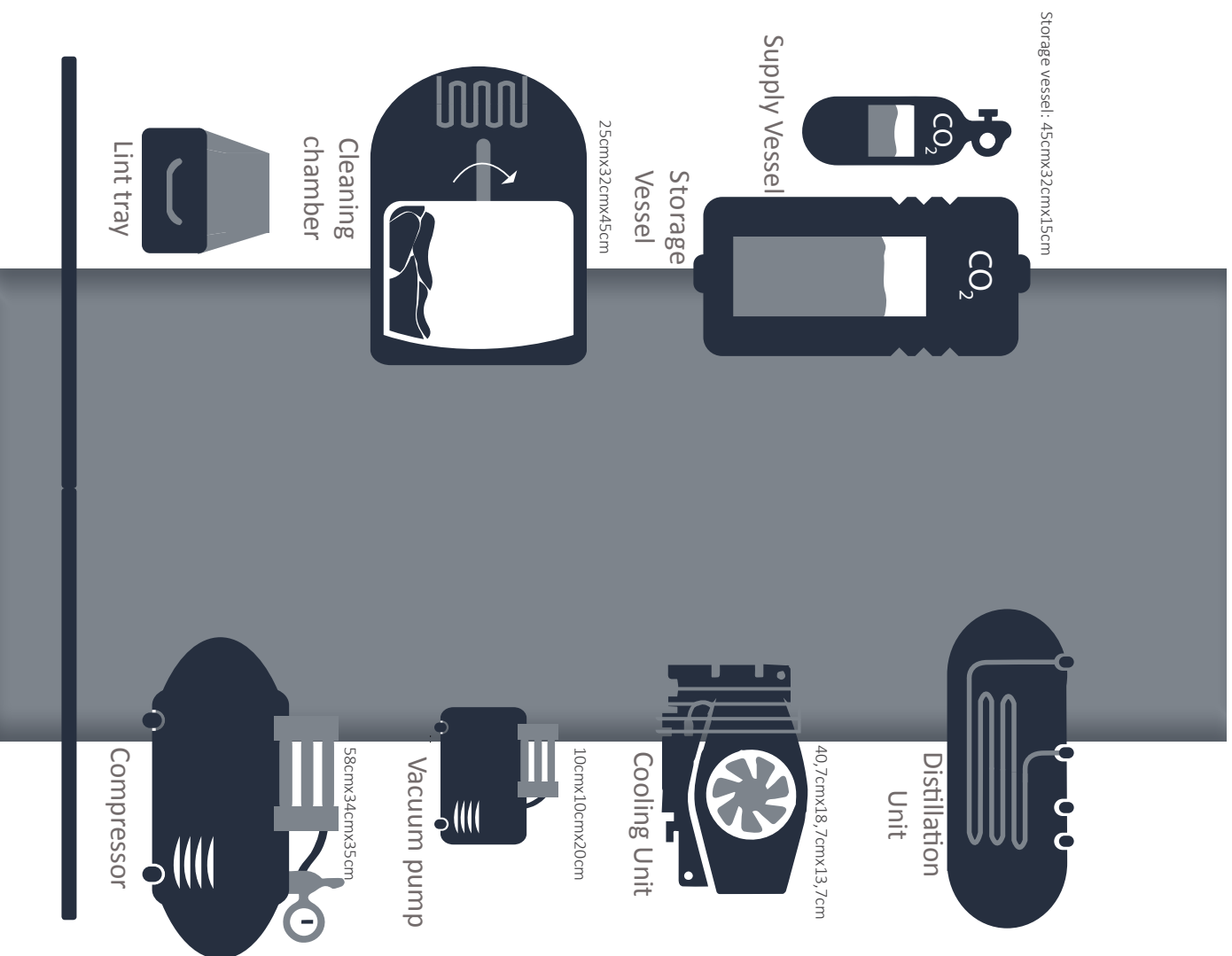
COMPONENTS

CO₂ storage

The components in the current industrial version of the CO₂ washing machine are shown in the graphics on this spread. Description, usage, size and relevance in the new product is investigated. Focus is on the storage vessel and cleaning chamber because those are seen as the most critical component units in order to make the product function safely. The compressor and vacuum pump are standard components and not seen as critical in relation to whether the product could work or not. [Worksheet 72, Components], [Appendix 10, Stevia Sutaranto]

The CO₂ is stored in liquid form in the pressure tanks because it takes up less space than in gaseous form. According to safercylinders.dk's head of command, Michael Meyer, the security of the pressure tanks in privates should not be a problem. It is not much different from what already exists now. Sodastream pressure tanks with CO₂ contains a 250 bar pressure. [Worksheet 77, Safercylinders interview] However filling up the CO₂ storage should be an automatic solution, because right now regular people do not know how to do it. It could be done like it is with the sodastream machine. The pressure tank should be emptied in the storage vessel immediately, because then the pressure tank will not be any kind of danger factor. Pressure tanks like the ones for sodastream are bought in e.g. Elgiganten or Harald Nyborg. The stores trades empty pressure tanks for new full ones.

As previously stated (page 48), a closed CO₂ system is desired to keep the user from refilling the machine with CO₂ and also to minimize the costs pr. cycle. Michael from Kymi tells us that it is possible. In order for this to be achieved, the CO₂ is simply not let out, but pumped back into the storage vessel (vacuum pump) before the cleaning chamber is opened. However, he seems to think that a tiny amount of CO₂ will go to waste anyway. A solution could be that the machine captures the CO₂ from the bedroom and fills up with that.



Cleaning chamber

The cleaning chamber is a drum that is tipping forth and back slowly. It is doing that in order to clean mechanically. The cleaning chamber is not made as a drum but as a box, where the clothes is placed on a hanger and then moves slowly from side to side like a fan to reach mechanical cleaning [Worksheet 72, Components] [Worksheet 86, Cleaning Chamber].

Distillation unit

The distillation unit is a special made component, that is made for the CO₂ washing machine. The CO₂ is let out in the unit. When it becomes gas, the dirt and detergent falls to the bottom separating it from the CO₂. The waste product is about 1,5 dl pr. cycle now, but less in this. It is not possible to find the certain size.

Cooling unit

The cooling unit cools down the CO₂ to 5-10°C in order to recycle the CO₂ and put it back into the CO₂ storage vessel.

Vacuum pump

The vacuum pump sucks out the air in the cleaning chamber after the clothes is put in there with 0.1 ATM pressure, which is very little. You can almost do that with your lungs. The size of the component is very small. The Vacuum pump is considered to be changed to a larger one, so it is able to also suck out the last CO₂ not wasting it.

Compressor

High pressure compressor is needed to create a 60 bar pressure. The noise is 72 db, which can be compared to a washing machine, when it is centrifuging. [toppryktuft.dk, 2016] [Worksheet: 72, Compressor]

CLEANING CHAMBER

The cleaning chamber is a drum that rotates very slowly from side to side with the clothes inside. It is important with a little mechanical movement in order to clean the clothes. Instead of having the standard drum other ways of mechanical movements are explored.

Solution A is like a drawer that goes up and down to get the liquid CO₂ in and out of the clothes. The cleaning chamber needs to be as big as the clothes, which will take up more space for the CO₂ storage. The mechanical movement might not be enough.

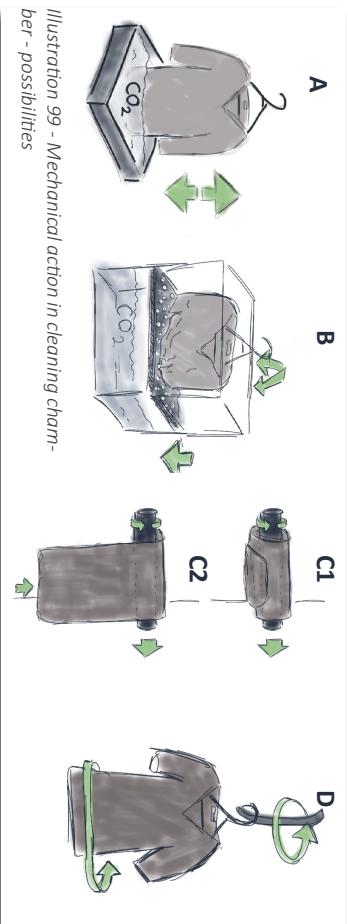


Illustration 99 - Mechanical action in cleaning chamber - possibilities

The components are not all on during the whole cleaning cycle. For instance the compressor is only on to pressurize the chamber a few minutes in the beginning and in the middle. That keeps the user from

Solution C: Will not work with shirts and so on. It will make foldings wrong places.

Solution D: Takes up more space than necessary compared to solution B.

Solution B is chosen to work on with, because it takes up least possible space and makes the cleaning chamber smaller not needing as much CO₂ and thereby making the CO₂ storage smaller.

having to listen to the product making noise in all 25 min. However, the compressor is still making more noise than desired in those minutes. [Worksheet 84, Operation Costs]

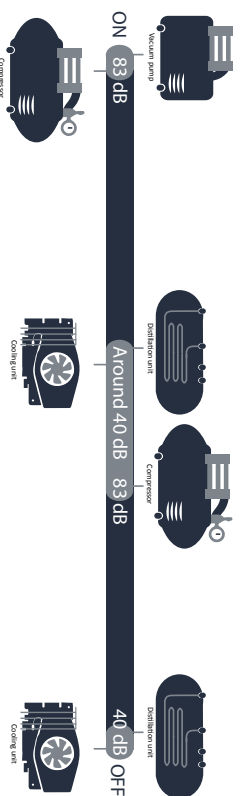


Illustration 100 - Showing, when each component is on and making noise.

Activating the product

The product's compressor makes noise of around 83 dB [Worksheet 72, Component] which can be compared to a vacuum cleaner. The product can be started at any time the user wants, but in order to prevent this from being a problem for the user, different ways of coping with the noise is considered:

- Splitting the system, putting the compressor somewhere else in the house.
- Sound isolation. But if the product should be on when people are going to sleep, the noise has to be eliminated in order for it to not disturb.
- Time setting - the user programs the product to start at a specific time every day, where no one is home or using the bedroom. (Ill. 100)
- Distance - starting the product when all smartphones(or what kind of device will be used in 2025) are out of the house. (Ill. 101)

Time setting

The product is set to start according to a schedule made by the user. An example could be that the product is set to start every other day at 9 am, where everyone has left for work/school. The weekends could be set at a different time. This solution is also proposed in the flowchart on page 61. It does not seem to matter that the clothes you want cleaned is not cleaned immediately, since investigation tell us that people are not likely to wear the same clothes two days in a row anyway [Worksheet 39, survey]. However, the user should always be able to start the product manually. A drawback could be that people need to have a consistent daily life, in order for the time setting to make sense.

Distance

Another alternative is that the product starts when everyone has left the house, by connecting the phones to the product through My Miele. This solution presupposes that people get even more 'connected'

than they are today. A good thing is that the product cleans the clothes at first opportunity when people has left the house. Some drawbacks could be:

- It requires people to leave the house. If someone is always home, the product is never able to clean the clothes without manual activation.
- People could also leave for just a short time.
- The location/bluetooth might need to be on all the time on all the phones.
- If you are home and the phone is out, the product will start.

None of these solutions are spot on. However, taking into consideration that the bedroom is usually not occupied during the day, and if the product is soundless unless it is in the beginning or middle of a cycle, it should be possible to cope with.

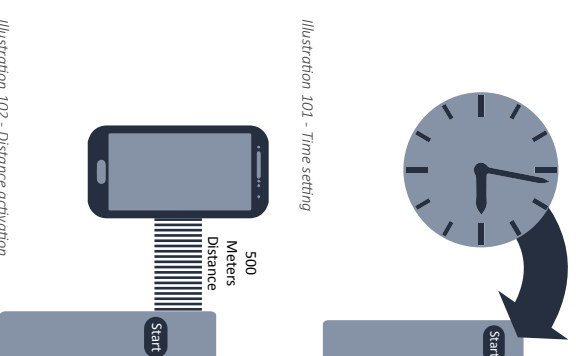


Illustration 101 - Time setting

Illustration 102 - Distance activation

ALTERNATIVE SOLUTIONS

CO₂ LEAKING

In case the CO₂ leaks from the machine three options are considered: If the machine leaks, the liquid CO₂ will become gaseous and expand in the room the product is placed. Trying to make a failsafe solution three options are considered in case of failure, see: ill. 103.

1. A CO₂ alarm is placed inside the product detecting any leaks: If leaks are detected an alarm similar to a smoke alarm starts. A high sharp tone is made, making everyone aware of the leak.
2. Having a tube from the inside of the machine to the outside, releasing the CO₂ into the atmosphere.
3. Having a tube out the window.
4. To use already installed ventilation in new houses

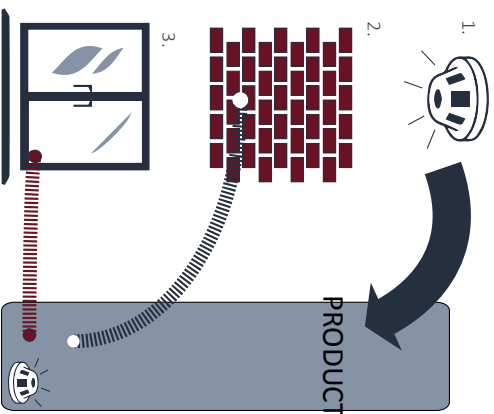


Illustration 103 - Three options for safety



Illustration 104 - Solution 4 - Genvex ventilation

for instance a Genvex, see: ill. 103. Building regulation requires that all of the air in a house should be switched out in two hours. [Bolius.dk, 2016]

In this case the Genvex should be placed near the ground instead of on the top of the wall. Another solution is to make visible pipelining/reaching near the ground. The ventilation unit should be connected to a CO₂ alarm. If the alarm detects larger amount of CO₂, the ventilation suck the air in and out faster in order to clear the room for CO₂ as fast as possible. It is not further researched how fast the room can be cleared for CO₂ if corrections were made on the convex.

Solution 1 with the alarm seems to be preferable towards the product but has the biggest risk, since the CO₂ leaks in the room. Solution 2 could be handled like the outlet in current dryers. Such kind of a solution will make the product seem more as an installation, which is at this moment not desirable. Solution 3, with the tube out of the window, seems as an incomplete solution. Solution 4 could be combined with solution 1. That would at least clear the room for CO₂ in a short amount of time.

Solution 1 is chosen. Furthermore, the alarm should be connected to the My Miele application and warn you that the product has leaked and what to do next. The ventilation solution is considered as a possible combined solution, but is prioritized not to be investigated further at this point.

Less Noise

The compressor makes noise equivalent to a vacuum cleaner. Solutions are explored to make it less noisy and smaller. 1. Joint compressor and 2. Modules.

Joint compressor (ill. 105)

Joint compressor in a separate room, shed, shaft or other places. A compressor is used for several products in the home. In the future you could consider having a build-in compressor in the house. The compressor should be placed where no one can hear it, maybe in an isolated room. It will be connected like when you are connecting a washing machine to power.

Pros:

- The size of the product is smaller
- No noise

Cons:

- It becomes an installation
- You need a pre-installed compressor.
- The other products need to be setup the same way.
- Suddenly it is the user's responsibility to connect it.

Modules (ill. 106)

Trying to make the product fit in the given situation, modules are considered.

This will enable the user to customize the product according to the housing situation. If it is possible to place the compressor somewhere else than the product, the noise will not disturb people. The modules need to be able to be put together and still appear as a whole product weather it is two separate parts or one part. Some of the drawbacks could be:

- Need an extra room or place for the compressor.
- The user is responsible of connecting the modules.

Later in the process, the team realized that it was too big of an assignment to make the product modular, which means that, in spite of many advantages, it is no longer explored in this project.

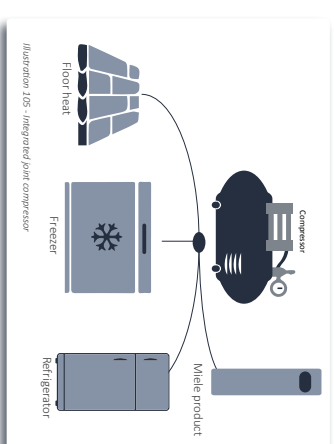


Illustration 105 - Integrated joint compressor

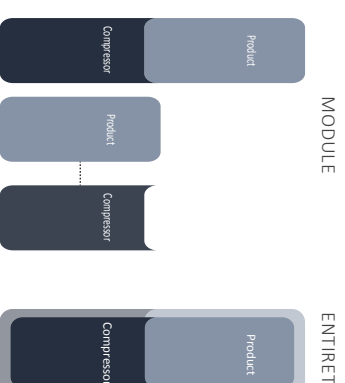


Illustration 106 - Modular product vs. entirety

BRIEF SUPPLY CHAIN

Miele is currently producing all their products themselves. However, they have realized that it is better for them to outsource the software [Worksheet 48, Miele Interview] Illustration 105 shows a brief overview of how 1st Choice is going to be realized. The software and feedstocks are going to be delivered from suppliers, the way it is now. The CO₂ can be delivered from various suppliers. Yara Praxair is an example on, where the CO₂ could be delivered from [Yarapraxair.dk, 2016]. The detergent is either delivered from Kreussler, as shown, or they will develop their own. Miele makes their own detergent for washing machines now, but they have not always done that, and it is uncertain if they would do it for the CO₂ machine. The components are custom made and are produced by Miele, where

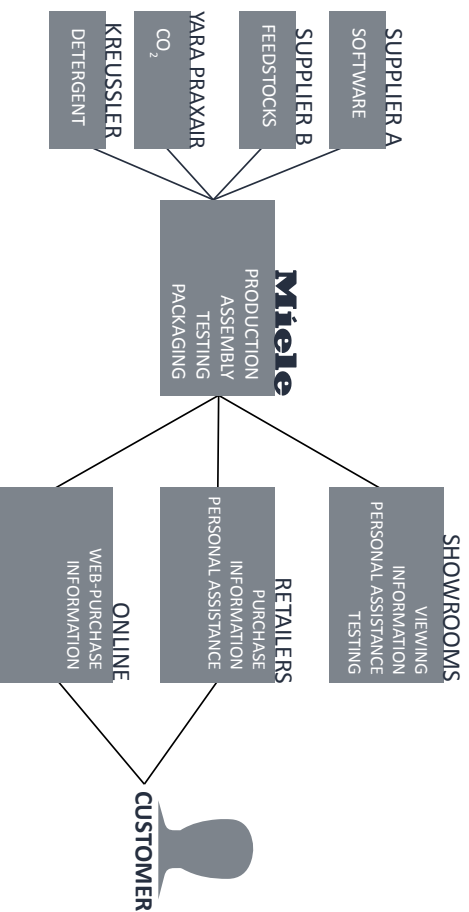


Illustration 107 - 1st Choice - From production to customer

everything else is produced and assembled. When the products are ready to go, they are assembled and sent out to retailers. Some of the products are also displayed in various showrooms around the world. It is uncertain whether the products sold online are shipped from the facilities in Germany, or whether each country has a stock.

The business is not elaborated further in the process report, since the idea is that this product is developed for Miele. However, to mention the real-life business from the perspective of the students, the probable situation (if Miele is interested in the concept) will be that the idea is sold to Miele and the students are out of the further development.

IDENTITY

Semiotics

To figure out how the product should look, it is important to know what it should signal. To figure this out, questions were asked: "WHO is the product?", "WHAT does it do?", "HOW does it interact with the user?", "Which STORY should it tell?", and more. [Worksheet 80, Product semiotical] To make it easy to grasp, a list of words were developed from the answers. The list below shows the desired expression of the overall product:

- Freshness
- Cleanness
- Care taking
- Trustworthiness
- Professionalism
- Miele
- Organizing
- Femininity



It was found that in order to create a reliable product that reflects the function properly, it has to signal cleanliness and professionalism - otherwise, people will not trust it to clean their clothes.

To make it possible for the user to interact properly with the product, each interaction-spot is briefly described as well as the desired expression.

Input

The function of it is to receive the clothes and, at this point, it should be full automatic, which means that it should send the clothes into the machine. The input bar should signal: "I'll take it from here, don't worry".

Output

The function is connected to the input and should work automatically. Furthermore, it should store the clean clothes until it is put back in closet. It should signal: "Here you go" and perhaps something like "Please accept this gift".

Display

The display should show information and make it possible to control the system. The most important functions are: display the process status and when to take the clean clothes, access to My Miele, access various settings such as starting time and if detergent needs to be refilled - order it automatically. The display should signal: "This is where you gain information" and "Take control here".

Lint tray

The function of the lint tray is to gather the dirt/waste. It should be able to seal the dirt when the user takes it out, in order for the user not to get in contact with the dirt. This could mean that the trays should be disposable, and probably be made out of reused material. If not disposable, the user should empty it every time and get in contact with the sticky substance. It should be discrete and at the same time be visible for the user when looking for it. It should clearly show the spots of interaction and the places where it could be dirty.

Temporary spot

The temporary spot is where the clothes is placed between wears and if not needed to go into the machine. It should signal that this is "only temporary".

Detergent container

Self-dosing, but it should be refilled every once in a while. It should, as well as the lint tray, be discrete, but be visible when needed to be found.

Due to the large components and the fact that the clothes it not scrunched into a pile, but put in as full size, before anything else, it is important to figure out how **to make the product look smaller than it is** (or as small as possible), which is explored on the next two pages.

SHAPING



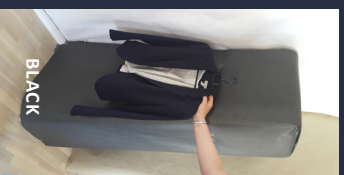
1



2



3



4



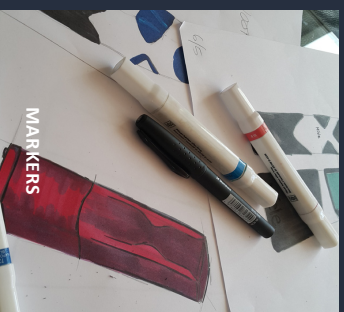
5



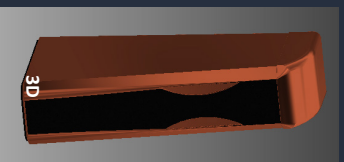
6



7



8



9

Illustration 108 - Mock ups - shape, size and color investigation

Purpose

- Make product look smaller than it is
- Discover the shape in full size
- The effect of convex and concave shaping
- See the effect of different colors

Looking smaller

Some of the techniques that were found to make a product appear smaller was:

- Black or dark colors
- Shiny (Reflective material)
- Chamfer or fillets

Activity

The pictures in ill. 108 are placed and numbered in chronological order. More pictures can be seen in [Worksheet 90, Mock up 3]. All the models are build in relation to cardboard components, build in full size.

Each image will be explained independently, in order to explain what was learned.

1. Testing the convex shaping when placed in eye height. This was just as intimidating as expected, however it was found that the eyes were led downwards, following the narrowing of the shape. (This was tested with max height of 2 meters)
2. Testing the minimum height and the effect of having a waist. The waist was tested in a lot of different heights, and it was found that it was very annoying when it was placed too low - maybe because the eyes were drawn to the narrow point and when placed low, it was further away from the eye.
3. Which effect inclination would have. Both when tilting away from face and towards face. The product became more open when tilting slightly away from face, rather than being completely vertical.
4. Testing another color than light brown cardboard and with the inclination that was found to be efficient.

The black color was tested prior to the white, hoping that it would seem much smaller. However, it did not have much effect.

5. The indoor models were build next to another model which should resemble the size of a regular closet on around 190 cm.
6. The blue color was tested as well, but when starting to cut into it, it was discovered how much impact this had on the size-perception! Just adding another element or contrast, it seemed like the eye only focused on the white and left out the darker color - making the overall shape look smaller.
7. This strategy was further tested, however, the result came out looking sporty rather than feminine, clean and care taking.
8. In order to get away from the sporty look, markers were used. Adding the red color and eliminating the contrasts definitely helped, however, using markers made it difficult to test the effect of chamfers and fillets, which led to 3D.

9. Modeling in 3D was much faster than with the markers in order to experience a product with the correct dimensions, surfaces, materials and chamfers and fillets. Moreover, it is really fast to change the color of various parts instead of having to make a new marker drawing. What was learned from the 3D was that the plain sides could easily make the product look clumsy, and that the chamfers made the product look better.

At this point it really made sense to use 3D modeling, but in order to proceed with the development of the shape, inspiration boards were needed. Finding products that signal what this product is supposed to (see page 79), should make it easier to achieve. See pages 84 and 85.

Before proceeding to that, the next two pages consists of a closing off many of the loose ends that are currently holding back the development. A lot of decisions have to be made and remade within a short period of time.

LOOSE ENDS

A lot of decisions have been postponed, forgotten to be reevaluated or recently appeared. With very short time before hand in, the team dedicatas a session for all loose ends to be clarified: After these decisions are made, the final shape can be designed. The brief explanation of the decisions will be presented here and further explanation can be read in the corresponding worksheets.

Decisions

Cleared off may 9th

- The system should work by having the **clothes on hangers**. The reason for this is that the process should be easy for the user - if clothes is not on a hanger that can be put directly in the closet when cleaned, then the user has to fold it and put it back afterwards, like when doing laundry.
- This hanger should be designed specifically for this purpose/product. The reason for a **special hanger** is that it should be easy to use and be made of the best suited material for the process. Requirements for this hanger can be seen in [Worksheet 81, Hanger!]
- The hangers that are not in use should have a **storage place** integrated in the product. Otherwise, the user has to keep them in their closet or elsewhere, which is an unwanted situation, that makes it less convenient for the user.
- **Input-output is now the same**. This will be placed on the left side, since the dirty clothes going into the machine will follow the 'play' direction. A more detailed explanation of this decision and process can be found in [Worksheet 82, Form!].
- There is a need for a place to put **used clothes temporarily**. Weather if it is clothes that should be used again or clothes that is on the way into the machine. This spot could be on the front or on the right side, but it is currently chosen to be on the right side, since it will stand less out than on the front. (We expect people to want a more discrete

display of their clothes on basis of conversations with users). For the temporary spot, there are different possible options. Option C is chosen, which can be seen on the product shaping on page 86-87. The other options can be seen in [Worksheet 83, Temporary spot]. It is the solution that takes up less space.

- The 'door' should be **both manual and automatic:**

The hanger part with clothes on will be closed by the user when full or if wanted to. If the user wants to hide away the clothes that hangs there, it can also be closed. The automated closing will happen when the bar is pushed in- also in order to prevent children and pets to get in. The automatic door can be opened again if more clothes needs to be put on before start. This could be done by a simple button or on the display. [Worksheet 87, Door!]

- The manual 'door'/hanger bar is pushed in like a drawer. When the process is done, it could be pushed out automatically with a spring. [Worksheet 87, Door!]
- There should be **predefined space on hanger bar for 4 items**. This will indicate that only 4 items can be put on, and remind the user to push it in. These 4 predefined spots will also make it possible to make the display tell or show how many items are on. [Worksheet 81, Hanger!]
- The need for automatic start and the large opening created the need for safety alarms. In case of pets and children crawling into the product, there should be an alarm going off- or **prevent the product from starting**.

Uncertainties

In order to substantiate that the liquid CO₂ dry cleaning technology can be applied in private homes in the future, it is important to be aware of the uncertainties within the product, in order for them to be solved.

Heat

It is still uncertain, how much heat the machine will produce and if it will be/can be used to heat up the clothes after the cold process. This is not something that cannot be solved, but it is currently an uncertainty.

Pricing

The prices on the components are purely guesstimates since some of them have been special-made for the current industrial CO₂ washing machine and are not possible to find as standard components. For instance, it has not been possible to find out what the distillation unit will cost.

Cleaning chamber

At this point, it is uncertain weather the cleaning chamber can be as small as wished in a consumer setting. However, size-compromises can probably be made if the product fulfills a value high enough.

Noise

The compressor will make a lot of noise, and sound proofing it with be difficult since it has to let air in and out. At this point, the team has focused on solutions on how to make the noise less disturbing, and not less noisy.

Further work, exceeding project

Every product category within domestic appliances has some kind of related equipment or accessory: oven mittens for the cooking area, containers and ice makers for the fridge/freezer, and laundry bags for the washing machines. For this new product category of refreshing

and organizing clothing, the accessory is going to be the **hangers**. These are not developed in this project, as mentioned on page 82.

A business aspect that could be further explored and developed is scent-packages. The clothes has no scent when it has been cleaned, since the CO₂ is odor free and the detergent does not contain detergent. So since investigations told us that some people wash their clothes because they like the detergent scent, it seems relevant to give the users the possibility to scent their cleaned clothes.

Another sub product for 1st Choice that could be explored is spot treatment detergent. The industrial CO₂ washing machine is also removing stains. Some of the problems are that in order to use this, the user need knowledge about: what, how much, where, when and how long. The process becomes very complicated (as the current laundry process is). However it is an aspect that could be explored.

Other things that are exceeding the abilities, priorities and time frame of this project is the further development of the:

- Cleaning chamber
- Optimization of the components
- Automatic door to cleaning chamber

INSPIRATION BOARDS

Style board - CLEAN



Illustration 109 - Inspirational pictures signaling cleanliness

Materials

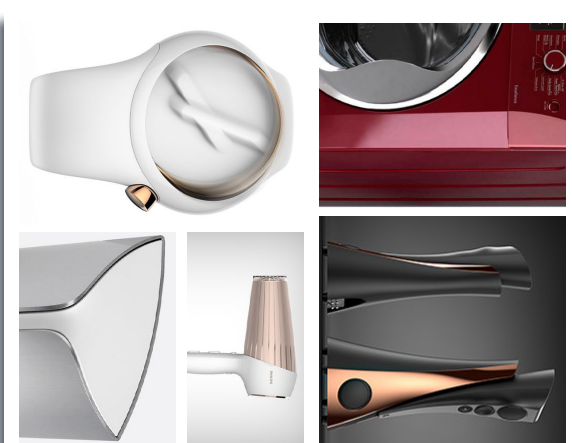


Illustration 110 - Inspirational pictures for materials

Features

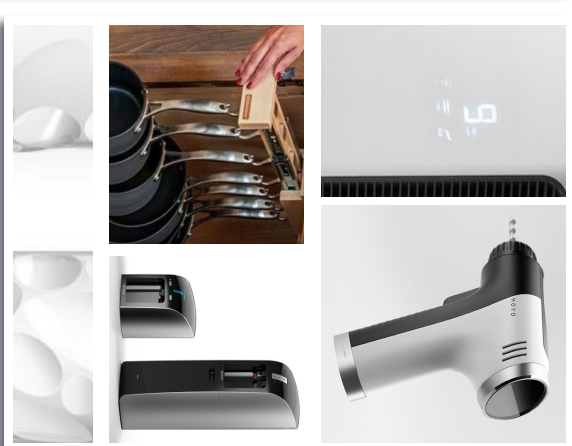
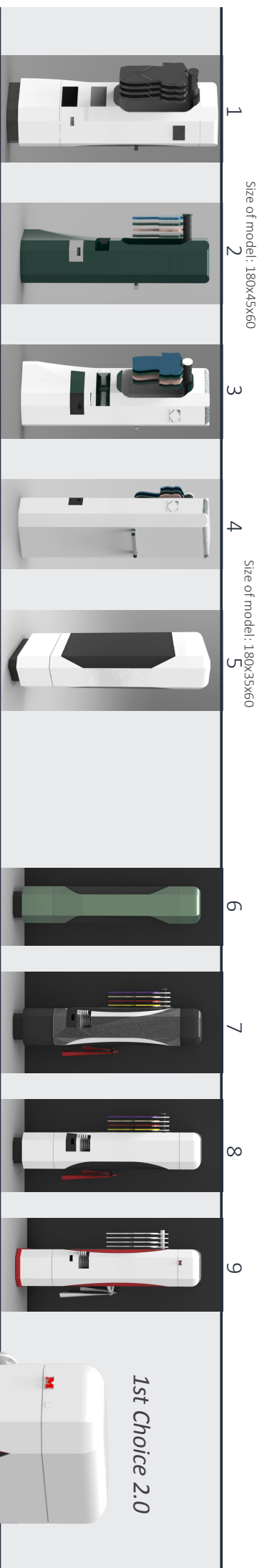


Illustration 111 - Inspirational pictures for features

Challenge

After finding products of inspiration, the challenge is to get the elements integrated in the shape and achieve the desired look(which is described in page 79). The approach is to sketch in 3D, which enables the materials and surfaces to be shown right away, hopefully making the process faster than sketching by hand.

REFINING SHAPE



Size of model : 180x45x60

Size of model : 180x35x60

Illustration 112 - 3D models of the product in developing



Illustration 113 - Physical mock up of the product.



Illustration 114 - Contextual product view considering height of waste.

Model 1,2,3,4, ill. 112 was trying to balance the product with a leg-like "foot". It did not seem as unbalanced, but the product seemed heavy and big. The product started out with a width on 45cm, which was also the width for the compressor. Since the compressor was able to be made smaller(Worksheet 92, Components 2), the width on products from model 5 has a width on only 35 cm. The reason is how much space 4 items of clothes takes up plus extra for the material.

Models 5,6 in ill. 112 and ill. 113 show a product with a waste-looking shape with sharp edges. The waste is reaching its narrowest point near the user's breast height, which was investigated in previous physical mock ups. The waste makes it seem smaller from the front, but the exaggerated waste makes it look unrealistically small. That meant we did not believe the smaller shape and in the end the exaggerated waste made it look

bigger. Chamfers are made all around the product. In the front, because notches make the product appear smaller. In the back, the chamfers are made to make the depth seem smaller. This works because the user will almost never see it directly from the side, only in perspective. However, it seems to be conflicting with the direction of the product- making the user confused of where the back of the product is and how to place it.

Model 6 shows the product with a foot that is smaller in circumference than the top. It makes the overall product seem lighter compared to model 3, where the product has no foot, or model 9, where the foot is bigger than the product. Model 9 shows the product with clothes on the input hanger and on the temporary spot. When the temporary spot is placed on the opposite side of the hanger, it makes the product seem more in balance.

Customizable placing of the temporary spot is considered(making the user choose on which side it should be placed), since it is preferable to make it able to stand up against either a wall or a closet. See ill. 114 It takes up less space, but the hanger has to be placed somewhere else on the product. Either underneath the current hanger or on the front. Of these two alternatives the hanger is prioritized to be placed on the side, since the recycled clothes should not be placed on the front, making it the first thing you visually see, when you look at the product.

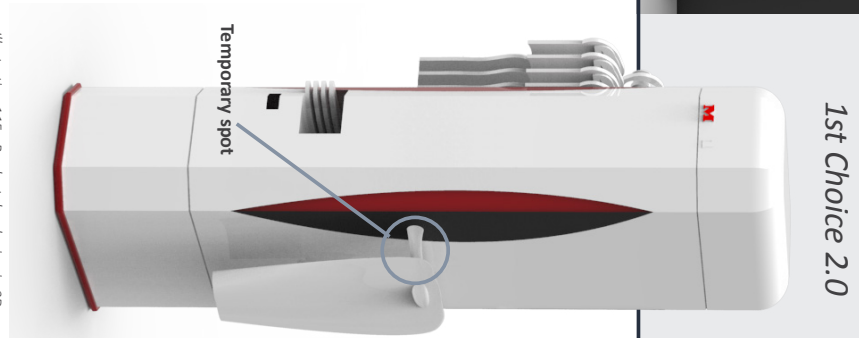


Illustration 115 - Product developing in 3D

5. OUTRO

The last pages of the report will provide the reader with an overview of the last changes made to the model before reaching the final product. A conclusion, reflection and perspective on the process and the created product will be provided as well.

MIELE 1ST CHOICE 3.0

The final concept will not be presented in this report, but can be seen (if not already) in the product report. The changes that is made since Miele 1st Choice version 2.0 (pages 86-87) are explained in the following points and the process that led to them can be seen in [Worksheet 89, Shape refinement]

- 1. Sloping top:** In order to make the product have a direction, the top is sloping. Also, this prevents people from storing items on top of the product, which would be less flattering.
- 2. Size (200x60x35cm):** The height has been changed to 2 meters, which enables the cleaning chamber to become larger, in order to prevent the clothes from getting crunched and wrinkled.
- 3. Lint tray and hanger room on front:** These have been placed in front in order to make sure the user has easy access to these, even if the product is placed next to a closet.
- 4. No visible display:** The display will appear when the system has a message, or when the user needs it and presses the button. This should help eliminate confusing interfaces by only displaying what the user needs to know/do at the specific time.
- 5. Temporary spot** on either left or right side: The temporary spot can be placed on either left or right side, depending on the need of the user.
- 6. Color vs chamfer:** After experimenting with two colors: one for the base and one for the waist, the team has come to the conclusion that it is too sporty and has no real purpose. Therefore, the version 3.0 has one base color and the waist is created by chamfer/fillet.

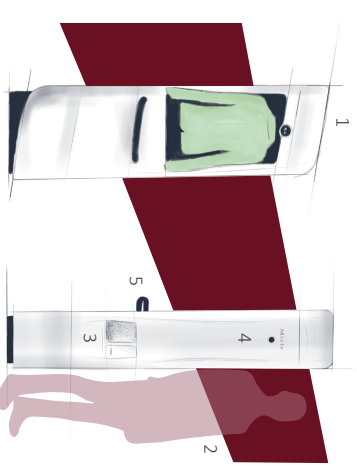


Illustration 116 – Sketch of final detailing, version 3.0

CONCLUSION

This project has had an opportunity based focus, although solving problems. This approach is somewhat new compared to the previous projects written, who have usually had a clear problem based focus. So in order to make a conclusion, three parts are included:

1. Did the process choices and activities enable the learning objectives in the semester description to be met?
2. Does the product meet the value mission?
3. Can the product meet the goal of the initial starting point, the Miele competition, and have a chance of being in top 5?

1. Learning objectives

"The aim of this project is to provide students with the opportunity to demonstrate their mastery of key competencies in a design engineering based self-driven process." [Appendix 01. MA4-ID semester description 2016]

The list of learning objectives in the semester description is long, but the focus points seem to be:

- Accounting and awareness.
- Ability to select and navigate relevantly:

"Must demonstrate the ability to navigate a design process, by continuously driving the design process forward by focusing on the most relevant part of the project and delimit the scope accordingly"

Conclusion

Throughout the project, the team has made multiple decisions every day in order to navigate the process in the right direction. All decisions have not been correct, but the team has been highly aware of validating and verifying the decisions and subsequently changed them when they were unjustified. The project framing has from the beginning been very broad with the possibility of going in multiple directions. In order to demonstrate key competencies, the process has been navigated accordingly, towards a user and value driven solution. It has been very necessary to delimit the process very precisely in order to not lose track.

The team has been very strict in delimiting, and has navigated a clear direction for the project, creating a product concept that will provide great value to the user, but lacks detailing and refinement.

2. Value mission

The team has created a value mission and interaction vision for the product.

The value mission
"DAILY LIFE CONVENIENCE AND CARE TAKING"

Interaction vision
"AN EFFORTLESS RELATIONSHIP WITH YOUR PERSONAL LAUNDRESS, WHO IS AN EXPERT WITHIN HER FIELD"

By subsequently defining requirements according to these, the team was able to approach the development with more tangible issues.


So did the team succeed in creating a product that meets the requirements defined by the team itself? The product fulfills or does not fulfill each requirement by:


1  B2
Decrease washing
Cleaning the clothes (except bad stains) with less effort from the user.

2  B3
Recirculate clothes
Designing a product for the purpose, raising the awareness.

3  C5
Perceived as 1 on clean-scale
The CO₂ technology will make it as clean, but it has to be tested whether the user will perceive it as being clean too. (Knowing from previous research that perception and actual cleanliness is very different)

4  C2
Remove smell
The CO₂ technology will remove smell.


5  D1
Leave no traces
This requirement is not fulfilled until the hanger has been designed and it should be in a way that the clothes can hang in the most appropriate shape.

6  B4
Provide storage
Having the temporary spot enables the user to store the clothes

7  D2
Prevent wrinkles
Hanging the clothes prevents wrinkles from occurring.

8  C6
Signal cleanness
This requirement has to be evaluated by the users and can not be concluded here.

9  C3
Maximum 1 extra step
This requirement has not been met since at least 3 new steps have been added to the recirculation- Having compromised with the product automation level.


10  E3
No transportation
Having the product right next to clothing storage, no transportation is needed


11  C4
Include all textiles
Liquid CO₂ can handle all textiles and also leather

12  E1
Safety alarm
This is a thing that has to be included, however, not looked into

13  E2
Free-standing
Fulfilled by the shaping of the product and the easy installation

14  A1
Miele product
Being a high-end domestic appliance

15  C1
Eliminate bacteria
By the CO₂ cleaning

16  D3
Liquid CO₂
This technology has been applied and has large consequences for the product size and shaping. It is the only found technology that can fulfill the previous requirements at the same time

After going through the requirements, it is concluded that the product is fulfilling the value mission and interaction vision. However, the product development has some drawbacks, since the components and the cleaning chamber is not yet detailed and verified. (The main verification is statements from M. Porsmose, saying that it has high potential in private homes)

3. Competition

The team is asking the question: "Did we create a product that is realistic for being in the future Miele portfolio, and will Miele consider it as a contribution with potential?"

First of all, the need of the product is existing already, and the team worries that the increased washing activities are only getting worse in the future. Therefore, the design meets a need that is real and existing - not made up by predicting future behavior. Second of all the targeted user is consistent with the current Miele customer base, people with good economy.

Moreover, the technology chosen is already existing and though it needs time to be refined for the new purpose, it is still believed to have high potential, hoping that rules and regulations will follow the development of safer materials and technologies.

Therefore, the team strongly believes that Miele will find the proposal interesting.

FURTHER WORK

Some of the elements that are important to be worked on in order for the product to work is mentioned on page 83, but this section of 'further work' is outlining the activities that the students will be doing in the period from product hand-in until the examination.

Testing

- First of all, the team will test if the product aesthetics are as intended, signaling cleanliness, professionalism and more.
- Furthermore, the design and size will be tested by the team in relation to the desired interaction scenarios. This will be done with a full size model.
- The process will also be simulated, in order for test persons to experience the entire process and discover any potential drawbacks.

REFLECTION

The reflection is divided into two parts even though many overlaps between the product and process reflection occurs.

Product

Some of the relevant reflections have been written throughout the report, so in order to avoid these last words to be drawn out, only the most conspicuous elements will be mentioned here.

Extensiveness

We are very satisfied with the overall outcome of the project. However, it has been confusing to create a

product that is not refined in the way that we have been used to throughout the education. We went into the project with the expectation of creating a product that would be highly detailed. In retrospect, this has been an unrealistic expectation when choosing to make domestic appliances, which are large and relatively complex. At this point, it is not even the components and the production aspects that are lacking attention; the detailing of the interaction spots, such as the lint tray and changing the detergent are being created in the last minutes. But having mentioned that, we believe that we would not change priorities if we should do it again! If we had prioritized to spend more time on optimizing the technical aspects of the 'future laundry', we would have ended up with another washing machine. Spending time listening to the users and designing for value is what hastled us in the direction of a new product category.

Reflecting on the project has made us feel better about the product, realizing that most decisions made have been rightful, and that most of the time has been spend wisely and productive- Following the right track.

Size

The product is very large and is difficult to place in many bedrooms as they are now. However, the benefits of the product overshadow this issue; the product can actually clean your clothes and your delicates. It might not replace the washing machine and therefore the user will have just another large product in their home. However, this product can be compared to current closets and spaces that people have for their recirculated clothes. This product will create one gathered spot where recirculated clothes and most laundry is present. Yes, it creates another laundry-zone in the house, but a zone that consists of very few steps compared to the traditional laundry process. The two main reasons for the product to be so large is that: 1. the components are large, and 2. the clothes are hanging while being cleaned and not scrunched in a pile-avoiding wrinkles.

Hanging
By using hangers for the product causes people to hang more of their clothes in their current wardrobe - redecorating many current closets that consists of much folded clothes. The user can avoid this by folding the clothes after it is cleaned, however, we hope that the wardrobe-layouts will follow this new product category, making it more attractive to hang clothes.

Process

We started out the project with a plan to track our common and individual activities in relation to overall process steps, see page 7. This gave an indication of our ability to work in parallel as well as iteratively; going back and forth in the process. The approach created awareness of the importance of working more dynamic in the process, but we are not certain if it really was worth spending the time on it - even if it was only a minute or two every day.

Team

In mid-process, the entire semester on Architecture and Design was offered to attend a program facilitated by the career center. Among other things, we had a DISC profile made, which made us realize that we were a team consisting of similar behavior - we are both working well with interruptions, which made us realize why we could tend to talk a lot in our group room. We are both 'thinking as we speak' and doesn't have the need to be in quiet surroundings to concentrate. This increased knowledge about our personal competencies and behavior was used to optimize our work surroundings and-situations.

Prioritizing

Not all subjects have been investigated as deeply as wished. When looking at the report, there are clear drawbacks. However, the team believes that they have prioritized appropriately in order to reach the desired goal. It has been difficult to show all the things that has

been given low priority and not looked into - it is much easier to show what we actually have looked into and found out. Every step in the process, we have had the feeling of "if only we had more resources", because we have been very eager to investigate many relevant topics. However, we know that we don't have more resources and in the 'real world' there are not going to be unlimited resources either, therefore, we have been forced to really prioritize the important things first. But in order to make valid decisions, the alternatives have often had to be investigated shortly too. This ongoing and endless prioritizing and decision making has been very tough and we have felt more responsible and pressured than ever.

Worksheets

A way for us to cope with the high amount of decisions and work being done in different directions has been to make worksheets. These were used as a way to collect the activities done, weather these were thorough investigations or just 'searching the internet', which helped us keeping track of current activities and of previous thoughts and directions. Previous experience show that it can often be really difficult to remember what was done two weeks ago, and difficult to understand that a certain direction or point of view was once sustained.

This strategy has led to many worksheets, and perhaps, we should have had a different system, where we could differentiate between 'regular activities' documentation and 'actual investigations and tests'. The difference could be that the system for the regular activities could be used as a way to document the process in a structured way, which is highly needed in order to write a report and later reflect on own *actual* actions. The system for the more academic content could be used to refer to in the report and ensure that these are more thoroughly written and more presentable. We haven't previously been introduced to this way of working,

PERSPECTIVE

and we were not presented to worksheets before 8th semester, making it yet a new tool for us to use.

Future

It has been a challenge to imagine how everything will be in about 10 years. Furthermore, to then design for it has made it even more challenging. Nonetheless, it has been an interesting and instructive experience to create a product where a predetermined problem hasn't been dictating the direction. We have used research and insights to *create* and select opportunities of our own. This has also contributed to making this project even more intimidating than previous - knowing that all inputs in the project are found, investigated and selected by no others than ourselves.

1st Choice is developed for private houses, but what this product does could eventually be used in more settings:

Offices are often places where people dress nicely. It is also, where the guests come around. Having 1st choice at your office would keep you from wearing a sweaty suit to a meeting with the boss or a client.

1st choice would be perfect for a hotel, or even airports. The hotel will be able to provide their guests with professional cleaning of their clothes. It is might be desired by the guests since they are traveling and it can be difficult to find a place to clean the used clothes.

The fashion industry has all kind of textiles including much delicate clothes in need of gentle cleaning. 1st choice could be handling it.

The project team will continue the reflection and perspectvation after hand-in. Spending a little time away from the project will emphasize the understanding.

REFERENCES

- [abt.com/styler, 2016] <http://www.abt.com/product/94769/LG-Styler-Stream-Clothing-Care-System-S3RERB.html> [Accessed 13.05.2016]
- [abt.com/swash, 2016] <http://www.abt.com/product/84384/swash-Beige-Clothing-Care-System-SF1000CLN.html> [Accessed 13.05.2016]
- [Bolius.dk, 2016] Available at: <https://www.bolius.dk/saadan-undgaar-du-stoel-og-traek-fra-dit-ventilationsanlaeg-19745/> [Accessed 15.05.2016]
- [Cnet.com/Styler, 2016] <http://www.cnet.com/products/lg-styler-s3rerb/> [Accessed 05.04.1016]
- [Cnet.com/Swash, 2015] <http://www.cnet.com/products/whirlpool-swash/> [Accessed 05.04.1016]
- [Electroluxdesignlab.com, 2016] <http://electroluxdesignlab.com> [2016] [online] Available at: <http://electroluxdesignlab.com> [Accessed 07.02.1016]
- [Europeancleaningjournal.com, 2010] <http://www.europeancleaningjournal.com/magazine/articles/special-features/water-a-most-powerful-detergent>
- [Gov.uk, 2011] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/274778/9_Domestic_appliances_cooking_and_cooling_equipment.pdf [Accessed 17.02.2016]
- [Kreussler-chemie.com, 2016] <http://en.kreussler-chemie.com/home.html>
- [Kymi.dk, 2016] <http://www.kymi.dk/om-kymi-rens/>
- [Lerdahl, 2001] Lerdahl, E., 2001, Staging for creative collaboration in design teams. Thesis, NTNU, Trondheim, Department of Product Design Engineering
- [Miele.com/history, 2016] <http://www.miele.com/en/history-2089.htm> [Accessed 05.02.2016]
- [Miele.com/standards, 2016] <http://www.miele.com/en/com/environmental-and-social-standards-2996.htm> [Accessed 12.02.2016]

LIST OF ILLUSTRATIONS

[Miele.com/prof, 2016]	Miele.com, (2016) [online] Available at: http://www.miele-professional.dk/dk/prof/2.htm [Accessed 17.02.2016]	Illustration 1-2	Own illustrations	Illustration 83	Own picture
[Nordjyske.dk, 2016]	Nordjyske.dk (2016) [online] Available at: http://nordjyske.dk/nyheder/nordjyder-daarliger-e-til-at-vaske-toej/ [Accessed 25.03.2016]	Illustration 3	[e]lgangen.dk], [kelko.dk], [appliancist.com], [skusen.dk], [miele.dk/koele], [powerd], [isevel.dk], [miele.dk/kogel]	Illustration 84-88	Own illustrations
[Politikken.dk, 2014]	Politikken.dk (2016) [online] Available at: http://politikken.dk/forbrugsgliv/livsstil/ECE2178330/vi-vaske-vores-toej-for-maget-og-vi-geet-det-forker/#loggedin [Accessed 20.03.2016]	Illustration 4	[dc-kuechenpartner.de]	Illustration 89	Own picture
[Sik.dk, 2013]	Sik.dk, (2013) [online] Available at: https://www.sik.dk/global/publikationer/artikler/Oevrige-artikler/2013/Goerdin-campingvoern-gas-sikker [Accessed 17.05.2016]	Illustration 5	[miele.dk/hist]	Illustration 90-95	Own illustrations
[Simplypsychology.org, 2014]	Simplypsychology.org, (2014) [online] Available at: http://www.simplypsychology.org/maslow.html [Accessed 20.02.2016]	Illustration 6	[samsung.com], [digitaltrends.com], [koreaherald.com]	Illustration 96-98	Own pictures
[Sutanto, 2014]	Sutanto, S. (2014), Textile Dry Cleaning Using Carbon Dioxide: Process, Apparatus and Mechanical Action. TU Delft University	Illustration 7	[koreaherald.com]	Illustration 99-103	Own illustrations
[Theversatilegent.com, 2013]	Theversatilegent.com, (2015) [online] http://www.theversatilegent.com/the-classic-shave-brands-to-know/ [Accessed 03.03.2016]	Illustration 8	[own pictures]	Illustration 104	[Boilius.dk]
[Thelaundress.com, 2016]	Thelaundress.com (2016) [online] http://www.thelaundress.com/asklaundress/ [Accessed 17.05.2016]	Illustration 9	Received pictures from users	Illustration 105-108	Own pictures and illustrations
[Toptrykluft.dk, 2016]	Toptrykluft.dk, (2016) [online] Available at: http://www.toptrykluft.dk/files/manager/dykkerkompressor/005.pdf [Accessed 01.05.2016]	Illustration 10	[electroluxdesignlab.com]	Illustration 109	[houzz.dk], [trendhunter.com], [tustadreviews.com], [anetge.com], [yourwatermatters.com], [pinterest.com/watch], [pinterest.com/air], [postbrk.dk]
[Varapraxair.dk, 2016]	Varapraxair.dk, (2016) [online] Available at: http://www.varapraxair.dk/gasser/kuldioxid?tab=forsyningsmuligheder [Accessed 17.05.2016]	Illustration 11	[interestingengineering.com]	Illustration 110	[com1.acor.com], [estelon.com], [pinterest.com/watch], [pinterest.com/hair], [pinterest.com/BBQ], [pinterest.com/right], [pinterest.com/drill], [pinterest.com/closing], [epiazza.net], [pinterest.com/bubbles]
		Illustration 12	[ohgzrno.com]	Illustration 111	[pinterest.com/right], [pinterest.com/hair], [pinterest.com/BBQ], [pinterest.com/watch], [pinterest.com/bubbles]
		Illustration 13	[oldandinteresting.com]	Illustration 112	Own illustrations
		Illustration 14	[hercampus.com]	Illustration 113	Own pictures
		Illustration 15	[own illustrations]	Illustration 114	Own illustrations
		Illustration 16-18	[own illustrations]	Illustration 115	Own illustrations
		Illustration 19-20	[own pictures]	Illustration 116	Own illustrations
		Illustration 21-22	[own illustrations]		
		Illustration 23	[own pictures]		
		Illustration 24-25	[own illustrations]		
		Illustration 26	[own picture]		
		Illustration 27-33	[own illustrations]		
		Illustration 34	[trendimr.dk]		
		Illustration 35-37	[own illustrations]		
		Illustration 38	[ilsuburbanhomestead.com]		
		Illustration 39-46	[own illustrations]		
		Illustration 47	[own picture]		
		Illustration 48	[thetoddandern.com]		
		Illustration 49	[own picture]		
		Illustration 50	[own and received pictures]		
		Illustration 51-54	[own illustrations]		
		Illustration 55	[pinterest.com/walk] modified		
		Illustration 56	[own picture]		
		Illustration 57	[jawsraekernyc]		
		Illustration 58	[ikea.com/closet], [homeimprove.com], [casanovafurniture.dk], [appliancist.com], [shopclues.com]		
		Illustration 59-63	[own illustrations]		
		Illustration 64-68	[own pictures]		
		Illustration 69-70	[own illustrations]		
		Illustration 71	[own pictures]		
		Illustration 72	[chemicallogic.com]		
		Illustration 73-74	[own illustrations]		
		Illustration 75	[closetdeas.dk]		
		Illustration 76	[mandesager.dk]		
		Illustration 77	[thegadgetflow.com]		
		Illustration 78	[oxot.com]		
		Illustration 79-82	[own illustrations]		

REFERENCES FOR ILLUSTRATIONS

(in chronological order)

[elgiganten.dk]	http://www.elgiganten.dk/product/husholdning/esspressomaskiner/CM6100BLACK/miele-cm6100-esspressomaskine	[homeimprove.com]	http://www.homeimprovementpages.com.au/photos/wardrobes
[kelkoo.dk]	http://www.kelkoo.dk/p-ovne-146301/miele-h2561-19869118	[casanovafurniture.dk]	http://www.casanovafurniture.dk/shop/aj-gulv-hvid-826p.html
[appliancist.com]	http://www.appliancist.com/washers_dryers/miele-liquidwash-eco-friendly-washing-machines.html	[shopclues.com]	http://www.shopclues.com/hand-garment-steamers-for-garments-fabrics-clothes-silk-steam-iron-1.html
[skousen.dk]	http://blog.skousen.dk/loerreturner-test/	[chemicalogic.com]	http://www.chemicalogic.com/Documents/co2_phase_diagram.pdf
[miele.dk/koel]	http://www.miele.dk/privat/koel-fryse-og-vinskaabe-2497.htm?mat=09499800&name=R_12421_SD-1	[closetideas.dk]	http://closetideas.blogspot.dk/2009/03/unique-and-crazy-closet-ideas.html
[power.dk]	https://www.power.dk/nvidevarer/opvaskemaskiner/miele-g4912scurf-opvaskemaskine/p-231347/	[mandesager.dk]	http://mandesager.dk/ig-styler-truestream/#1
[slev-el.dk]	http://www.slev-el.dk/miele-da-416-6-emhite	[thegadgetflow.com]	http://thegadgetflow.com/blog/swash-refreshes-delicate-clothes-dry-cleaning/
[miele.dk/koge]	http://www.miele.dk/privat/kogepalder-2473.htm?mat=10266000&name=KM_5600	[oxot.com]	http://oxot.com/clothing-rack-chair/
[dc-kuechenpartner.de]	http://www.dc-kuechenpartner.de/Elektrogeraete.htm	[bolius.dk]	https://www.bolius.dk/sadan-undgaar-du-stoej-og-traek-fra-dit-ventilationssanlaeg-19745/
[miele.dk/hist]	https://www.miele.dk/privat/historie-494.htm	[houzz.dk]	http://www.houzz.dk/photos/35197879/high-end-water-coolers-new-york
[samsung.com]	http://www.samsung.com/nz/discover/home-appliances/introducing-addwash-front-loader-washing-machine/	[trendhunter.com]	http://www.trendhunter.com/trends/ishe-water-dispenser
[digitaltrends.com]	http://www.digitaltrends.com/home/cool-washers-and-dryers-from-fig-2015/	[trustedreviews.com]	http://www.trustedreviews.com/4-best-washing-machines-you-can-buy-round-up
[koreaherald.com]	http://www.koreaherald.com/view.php?ud=20151104001093	[laneige.com]	http://www.laneige.com/my/en/product/skinare/category/all.html
[electroluxdesignlab.com]	http://www.electroluxdesignlab.com/2015/	[yourwatermatters.com]	http://yourwatermatters.com/products/water-dispensers/aquaovv/details/
[interestingengineering.com]	http://interestingengineering.com/the-scrubba-travel-daypack-is-also-a-washing-machine/	[pinterest.com/air]	https://dk.pinterest.com/pin/540220917783460485/
[ohgizmo.com]	http://www.ohgizmo.com/2015/04/29/foot-powered-washing-machine-works-off-the-grid/	[ostbirK.dk]	http://8752-ostbirK.dk/elektronik/buirk/bilg-philips-h-1387-saladmaker-fra-philips/
[indiegogo.com]	https://www.indiegogo.com/projects/dolfin-next-gen-washing-device#/story	[homeharmonizing.com]	http://www.homeharmonizing.com/2012/06/28/family-microwave-oven-circular-in-shape-with-luminous-shell/
[oldandinteresting.com]	http://www.oldandinteresting.com/history-of-laundry.aspx	[com1acorc.com]	http://www.com1acorc.com/index.php/2015/10/20/how-to-choose-a-washing-machine/
[hercampus.com]	http://www.hercampus.com/school/rochester/10-ways-youre-doing-laundry-wrong	[estelon.com]	http://www.estelon.com/349/
[trendhim.dk]	https://www.trendhim.dk/komplet-metal-barbersæt-p.html	[pinterest.com/watch]	https://dk.pinterest.com/pin/464504149044959488/
[ilsuburbanhomestead.com]	http://www.ilsuburbanhomestead.com/2012/02/16/homesteading-when-your-not-in-the-mood/	[pinterest.com/watch]	https://dk.pinterest.com/pin/362962051195580193/
[thetoddanderin.com]	http://www.thetoddanderinfartofive.com/how-to-un-shrink-clothes/	[pinterest.com/B&O]	https://dk.pinterest.com/pin/406942516311652435/
[pinterest.com/walk]	https://dk.pinterest.com/pin/431290101793895604/	[pinterest.com/light]	https://dk.pinterest.com/pin/477663104209931563/
[jawbreaker.nyc]	http://jawbreaker.nyc/2015/06/the-vagina-steam-what-the-hells-it/	[pinterest.com/drill]	https://dk.pinterest.com/pin/330662797616979303/
[ikea.com/closet]	http://www.ikea.com/ca/en/catalog/categories/departments/bedroom/19053/	[pinterest.com/dosing]	https://dk.pinterest.com/pin/AeVf%US53024yS-B-yFm1EUDLk0rWwKkH9DKRTG08LXHDOA3YaWg/
		[ecplaza.net]	http://paragon.en.ecplaza.net/premium-plus-water-cooler--326667-2536623.html
		[pinterest.com/bobles]	https://dk.pinterest.com/pin/530932243545404250/



AALBORG UNIVERSITY
STUDENT REPORT

Future Laundry



MSc04 - ID2 2016

Product report

Nicoline Sofie Jensen & Hanne Petrine Verner

TITLE PAGE

Project title	Future Laundry
Theme	Future Miele Laundry
Period	01.02.2016- 25.05.2016
Study programme	Master's thesis
Team	MSC04-ID2
Main supervisor	Christian Tollestrup
Technical supervisor	Karl Bran Nielsen
Issues	8
Number of pages	25



Hanne Petrine Verner



Nicoline Sofie Jensen

Reading guide

This project is documented in two reports and an appendix.

Product report: The product report presents our product; the context, the use, and the driving technology. Technical drawing are presented along with this.

Process report: The process report is telling the story of how the product came to be, and is, for the most part, told chronologically. It is supported by various documents in appendix.

Appendix: The appendix consists of documentation of the process. It consists of two parts: 1. Worksheets and 2. Various documents. These will be referred to as [Worksheet #, name of worksheet] and [Appendix #, name of appendix].

The process of developing the product does not stop when these reports are handed in on the 25th of May. The development is continued up until examination on June 24th. And in this case, material for the Miele 2016 competition is subsequently created.

ABSTRACT

This master's thesis takes starting point in a Miele competition, where the task is to create a proposal for 'Future Miele'. The project team has decided to deal with the topic 'laundry', which has led to investigations of today's laundry behavior as well as the background and history of washing clothes. The project team discovered an increase in cleanliness standards and a decrease in the amount of wears before clothes is washed since the automatic machine was available in the early-mid 1900. This leads to worn out clothes and unnecessary frequent laundry activities. Therefore, the solution, 1st Choice, helps the user recycle the clothes and cleans it by using liquid CO₂ technology, which doesn't wear and tear the clothes. It might not clean bad stains, which is one of the reasons why it shouldn't replace the washing machine.

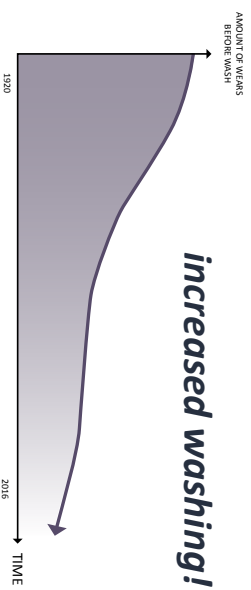
CONTENT

TITLE PAGE	2
ABSTRACT	3
PROBLEM	4
1ST CHOICE	5
CONTEXT	8
BENEFITS	10
PROCESS	12
BEFORE AND AFTER	13
USE SITUATIONS	14
OTHER SITUATIONS	18
INSTALLATION	19
MAINTENANCE	20
COMPONENTS	22
FLOWCHART	24
PARTS	25

PROBLEM

Higher cleanness standards have led to
less wears before washing, which has led to

increased washing!



Since the introduction of the automatic washing machine, it has become easier to do laundry, but the cleanness standards have increased simultaneously - increasing the laundry activities. This increase leads to multiple problems, such as worn out clothes and extra time spend doing laundry.

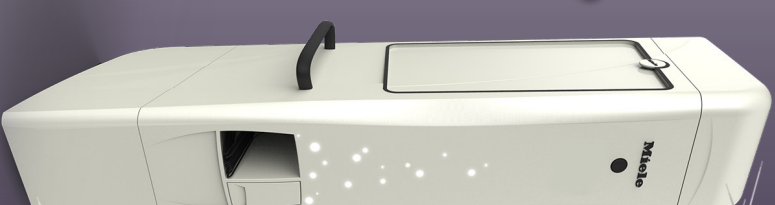
Current washing machine manufacturers are working on making it easier to do laundry, but following this path will only result in further increase in cleanness standards- ***1st Choice will break the curve!***

1st Choice

- wash smart not hard

*Let 1st Choice be your
personal laundress
- and experience the effortless
relationship with an expert
within the field.*

*Follow her path towards daily
life convenience and
care taking*





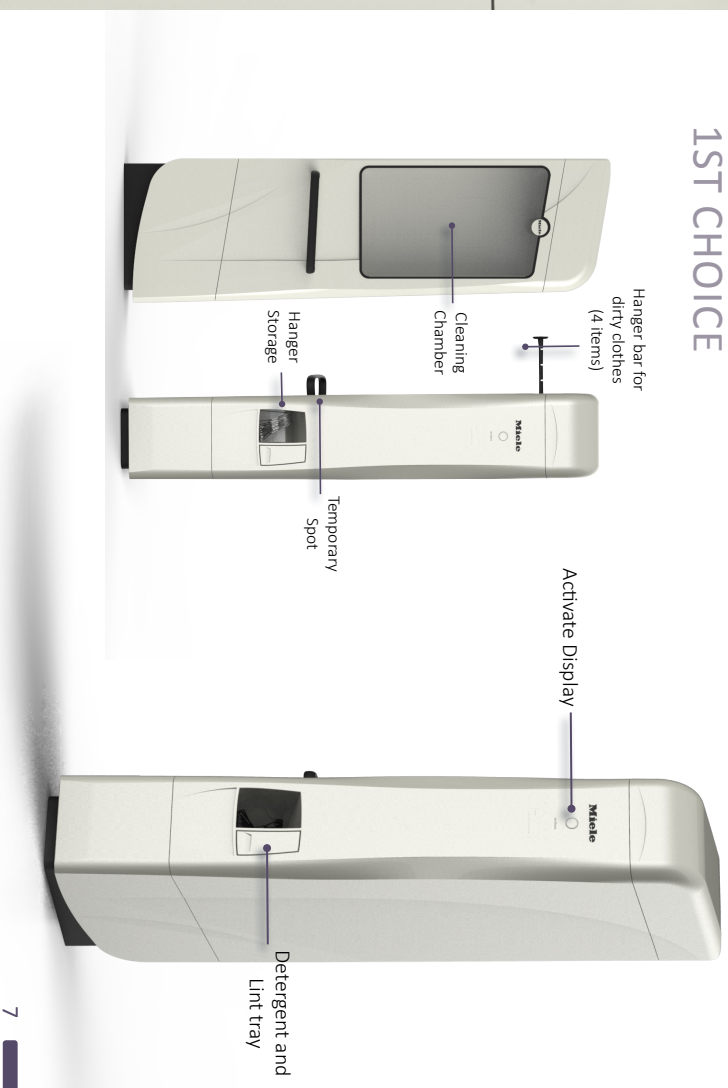
1st Choice is not a replacement of the washing machine, but a way to cut down on the use of it. It helps you clean your everyday clothes, which is usually not severely stained. It cleans the clothes with liquid CO₂, which is a technology also used in professional dry cleaning. The technology cleans the clothes, however, some severe stains are removed better in the traditional washing machine.

Most people have their own personal way of recirculating their clothes, since many clothing items are worn multiple times before washing them. 1st Choice will help organize and create space for the purpose, making the bedroom.

Taking care of delicate clothing is difficult today, and requires hand wash, airing, and dry cleaning. 1st Choice will provide the user with easy and convenient cleaning of all types of clothing. Regular clothes will not be torn and washed out by the gentle, waterless system.



1ST CHOICE





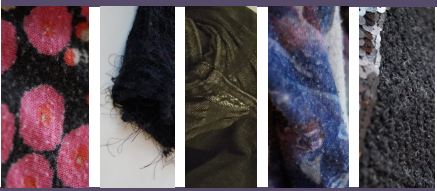
CONTEXT

Image of the bedroom in the context of the overall design of the house. The image shows a white tufted bed, a large window, and a white dresser.

<http://photo.net/photos/11111111>

BENEFITS

CAUSED BY THE WASHING MACHINE



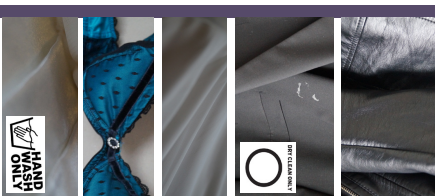
No more washed out and ruined clothes

10

BEHAVIOR



Avoiding unstructured and messy recirculation of used clothes



Caretaking of delicates - no more visits to the drycleaning and no more handwashing

Activation button

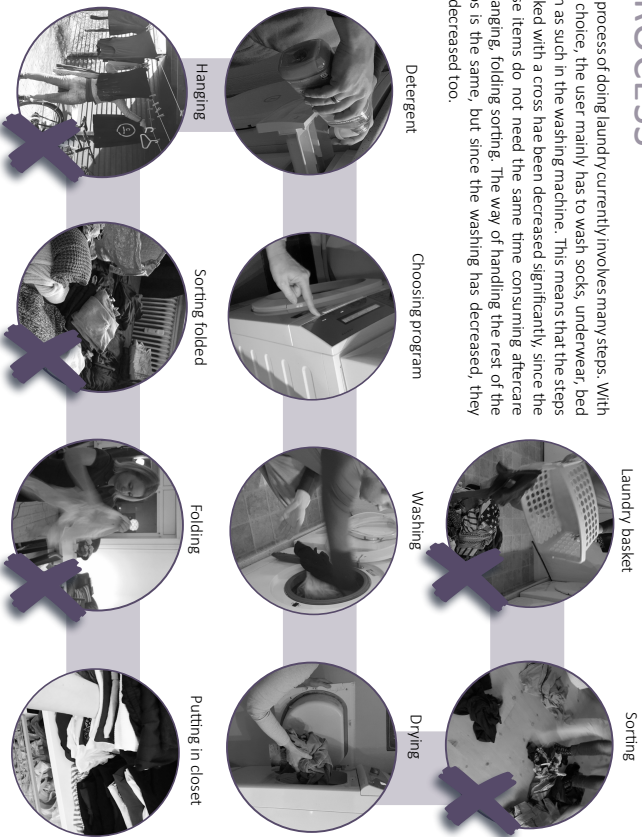
Display activated



11

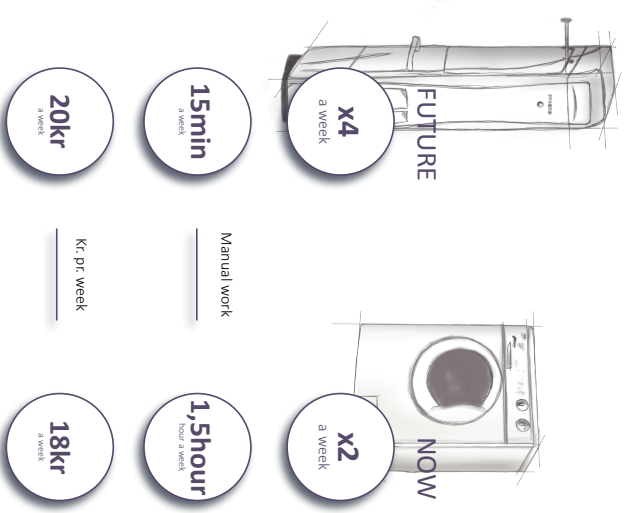
PROCESS

The process of doing laundry currently involves many steps. With first choice, the user mainly has to wash socks, underwear, bed linen as such in the washing machine. This means that the steps marked with a cross have been decreased significantly since the those items do not need the same time consuming aftercare of hanging, folding sorting. The way of handling the rest of the steps is the same, but since the washing has decreased, they are decreased too.



BEFORE AND AFTER

The user is doing laundry every week. The current week is compared to a future week with 1st Choice. Doing laundry is currently taking 1,5 hour manual work. With 1st Choice the manual work is cut down to around 15 min a week. The manual work consists of washing socks, underwear and roughly stained clothes every other week in the washing machine. Manual work is only, when the user has to do something for instance sorting, folding or filling the machine. The time it takes the machine to clean the clothes is not counted in.



USE SITUATIONS



1

The user takes of her dirty blazer.



2

She puts the blazer on a hanger from 1st Choice.



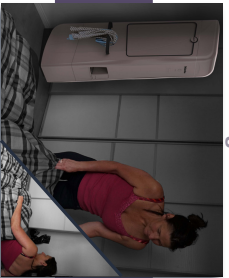
3

The blazer is placed on 1st Choice to be cleaned along with 3 other items that are already hanging there.



7

She puts the recirculated clothes on the temporary spot. It is not smelly enough to be washed.



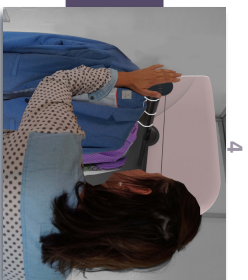
8

The user goes to sleep, wakes up and goes to work. She feels comfortable knowing that 1st Choice will start cleaning her clothes tomorrow, not disturbing her tonight.



9

1st Choice cleans the clothes every other day, when the user is at work. The starting time is preset by the user depending on her schedule.



4

The hanger is full. She pushes the clothes into the cleaning chamber. It will be cleaned at a preset starting time.



10

When the user comes home from work, the clothes is cleaned and ready to be put into her closet.



5

She checks the starting time making sure it is consistent with her plans, allowing her to be out of the bedroom when the noise starts.



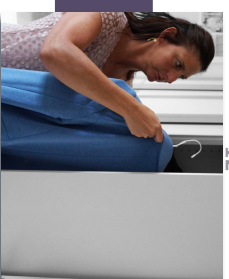
11

She tooked her cleaned clothes.



6

She puts on her pyjamas, which has been stored on 1st Choice's temporary spot.



12

She puts the clothes in her closet.

Home Products Shop Promotions & Events Customer Support About Us

Miele
IMMER BESSER

Baking and Steam Cooking Hobs and CombiSets Cooker Hoods Coffee Machines Refrigerators, Freezers and Wine Units Dishwashers Washers, Washing Machines, Tumble Dryers, Ironers Vacuum Cleaners

Washing machines Tumble Dryers Washer-dryers

Ironers Freshers

Relax while 1st Choice does the caretaking of your laundry

Go to appliance visualiser

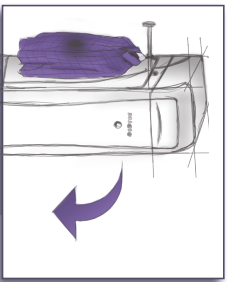
Now you can experience Miele 1st Choice in virtual reality
- allow yourself to be inspired!

5

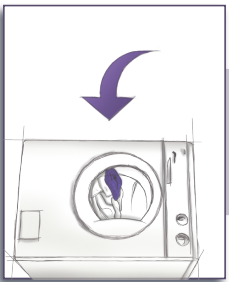


1st Choice is sold through retailers and through Miele's own webpage. It is displayed in Miele's showrooms around the world in order for the customers to receive information and guidance. The customer can choose between 3 colors.

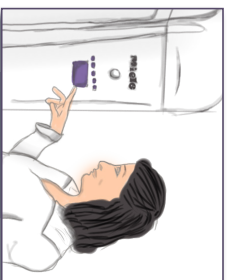
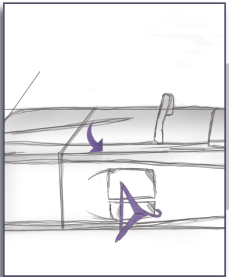
OTHER SITUATIONS



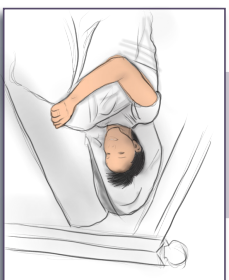
If a shirt is stained, it is put in 1st Choice. If it's still stained after, it's put in the washing machine.



When putting on clothes from closet, the hanger is stored in 1st Choice, ready for the next item to be washed.



Tomorrow she is off from work and plans on sleeping in, so she changes the start settings from 8 to 11 am.



INSTALLATION



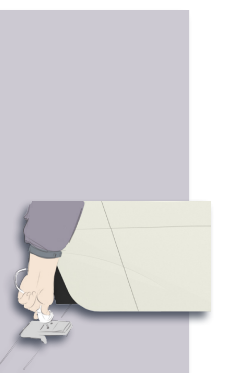
Buy



Carry in



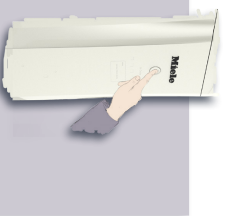
Open



Plug in



Reading guide



Customization and ready for use

MAINTENANCE

CO₂ Refill



Service check



When 1st Choice is running low on CO₂, you are notified on your MyMiele application. Miele is proposing a date for the refill. An authorized employee comes by and fills 1st Choice up with CO₂. It is approximately once a year. When the expert is already there, he is checking the system (CO₂ alarm and cleaning chamber).

Cleaning



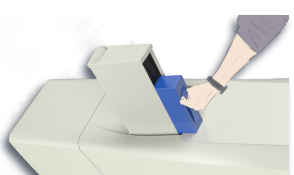
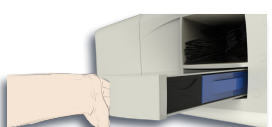
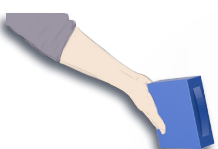
No sharp corners on the product makes it easy to wipe it off with a cloth. The hanger storage is deep and a little bit narrow. The end is made round, so dirt will not stay in the corners.

Empty lint tray



The lint-tray is emptied in the garbage can and placed back in the detergent and lint drawer.

The detergent is bought in boxes made to fit directly in the 1st choice's lint- and detergent drawer. This is how Miele does it, with their current detergent.



Refilling detergent

COMPONENTS

Storage vessel

Consist of 27 liters CO₂ which is refilled every year, since most CO₂ is reused for every cycle.

Cleaning chamber

Where the garments are placed and cleaned. Four items at the time is in the machine, hanging. The chamber is then filled with liquid CO₂ in the bottom of the chamber. The clothes is lowered and is moving slowly up and down, soaking and drying the clothes continuously (the clothes dries instantly when it is lifted from the liquid CO₂ in the bottom) This process is necessary in order to clean the clothes.

Vacuum pump

Takes the air out of the cleaning vessel before beginning of washing so it does not get mixed with the CO₂. This is performed by the vacuum pump, that makes the cleaning chamber reach a pressure at around 0,1 atm.

Compressor

Fills the cleaning vessel with liquid CO₂, making a pressure around 55 bar.

Distillation unit

Cleans the CO₂ that has been used in the cleaning process by making it gaseous. The dirt and left over from detergent stays down and ending up in the lint tray.

Cooling unit

Cools down the CO₂, making it liquid and ready to enter the storage chamber again - ready for the next cycle.

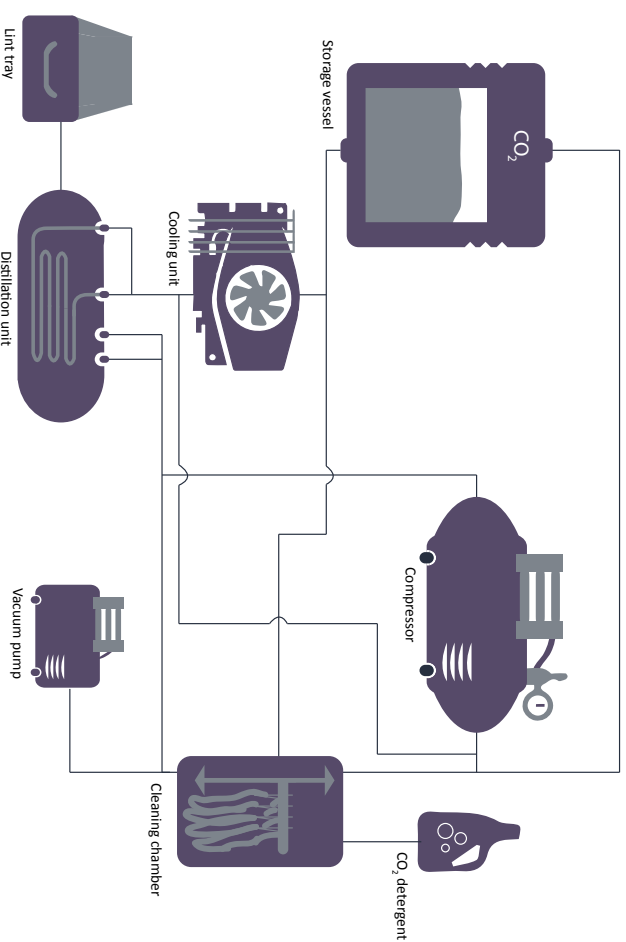
Lint tray

Collects the dirt and detergent after a cycle. The tray is emptied manually every month or two, depending on the use of the product.

Detergent

The CO₂ detergent is biodegradable and is kept in a self-dosing container. New detergent is ordered automatically when almost empty through MWMiele.

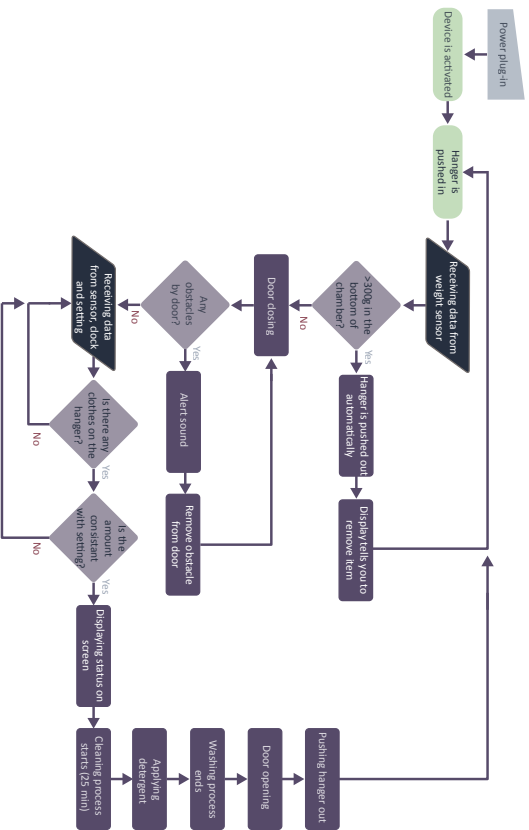
Liquid CO₂ cleaning
technology



FLOWCHART

This system is semi automated, starting when the user has pushed in the hanger bar and when the given settings are fulfilled. This chart gives a brief overview of the system when no interruptions are made by the user - e.g. postponing the

next starting time or making the product start with less than the suggested 4 items. An alarm goes off if something is placed in the cleaning chamber weighing more than 300 grams, which will prevent living creatures from being caught in there.



PARTS



HANGER

Carries a maximum of four pieces of clothes and has a sensor for each hanger-spot, enabling it to detect the amount of clothing items.



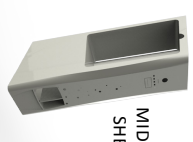
TEMPORARY SPOT

It can be placed on either right or left side, or the user can have two - depending on how much space is available. The clothes is placed there if not used enough to be cleaned.



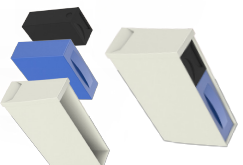
TOP SHELL

The top shell is removed when the CO₂ has to be refilled every one or two years.



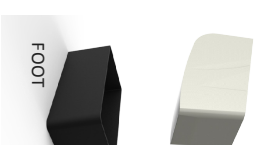
MIDDLE SHELL

The middle shell is the assembly point of the components and the electronics. It also holds the cleaning chamber, which is a separate component. Also, the sliding doors attached to this part



DETERGENT AND LINT TRAY

The drawer for the lint tray and the self-dosing detergent container. The lint tray(black) is emptied in the garbage, while the detergent container(blue) is replaced with a new when emptied. (This is ordered automatically through WVMiele)



BOTTOM SHELL

The bottom shell connects the upper parts with the foot

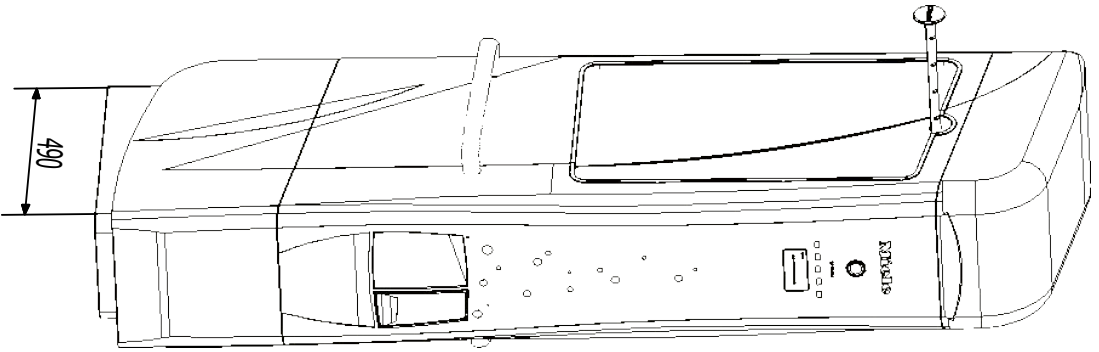
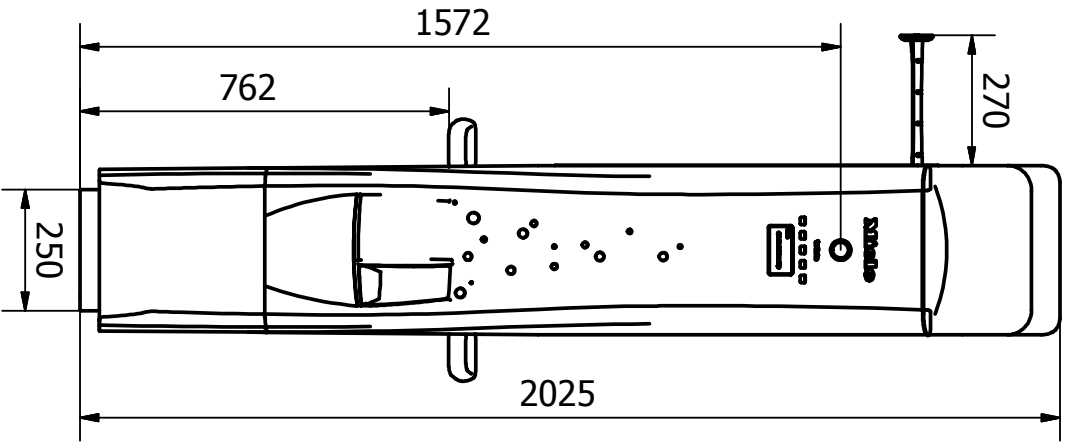


FOOT

The foot is where the compressor is resting and where the product meets the floor.




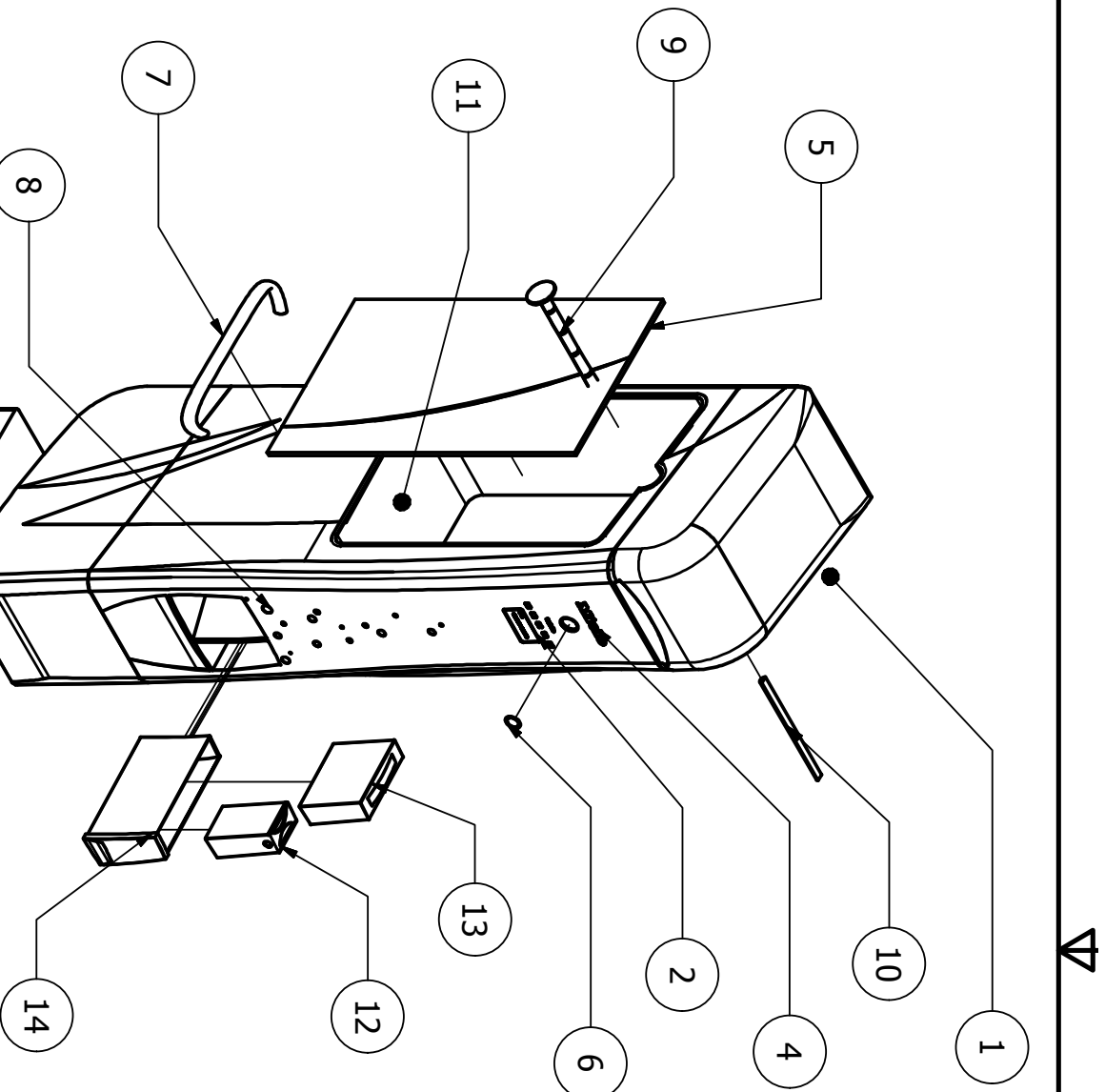
AALBORG UNIVERSITY
STUDENT REPORT



Designed by	Sheet	Scale	Dimensions	Date
MSC04-ID2 2016	A4	1:15	Millimeter	24-05-2016

Future Laundry

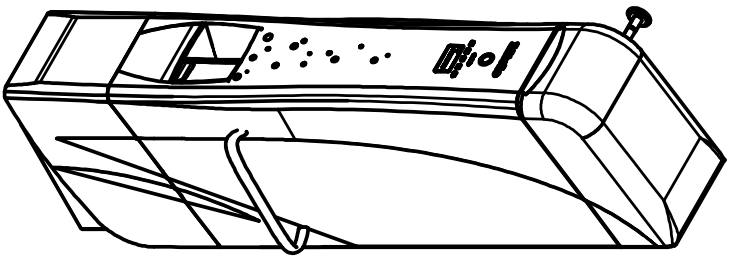
	1st Choice	Edition	Sheet
		1	1 / 4



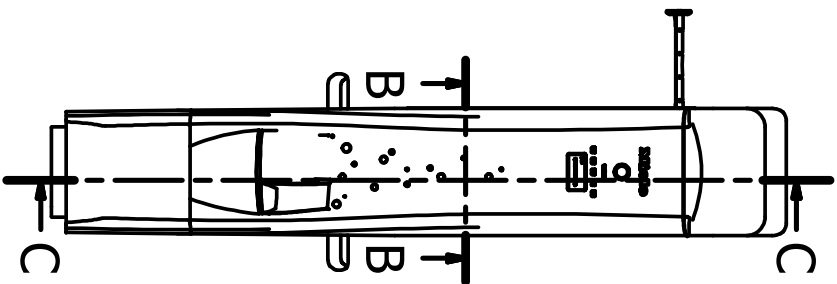
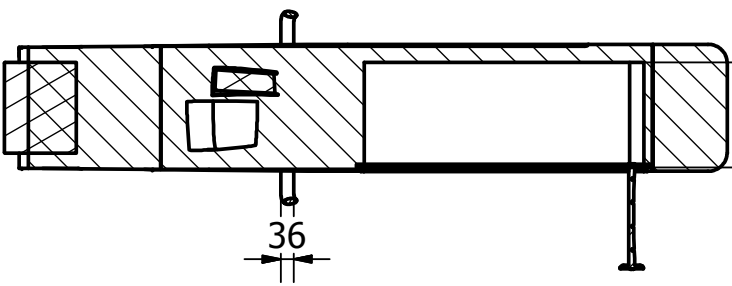
PARTS LIST		
ITEM	QTY	PART NUMBER
1	1	Body shell
2	1	Touch display
3	1	Bottom shell
4	2	Miele logo
5	1	Door
6	1	Button
7	1	Temporary spot
8	1	Light
9	1	Hanger bar
10	1	Inner hanger bar
11	1	Cleaning chamber
12	1	Lint tray
13	1	Detergent container
14	1	Drawer

Designed by		MSC04-ID2 2016	
Sheet	A4	Scale	1:1.15
Dimensions		Millimeter	
Date		24-05-2016	
Future Laundry			
1st Choice		Edition	1
		Sheet	2 / 4

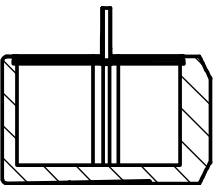




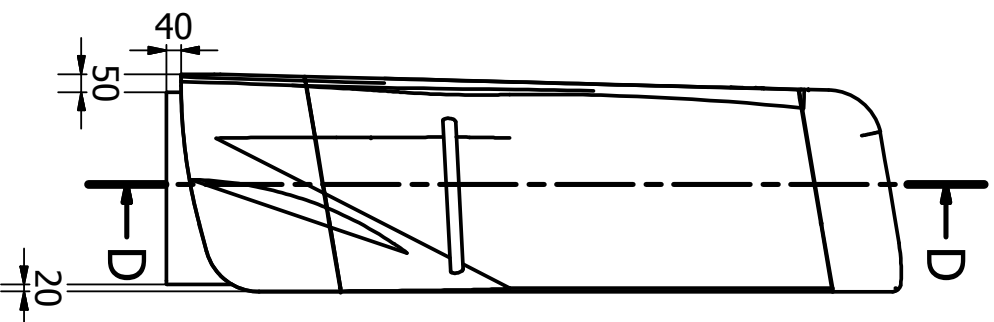
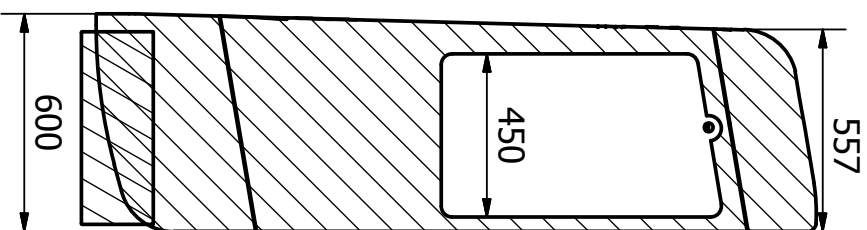
D-D (1:20)




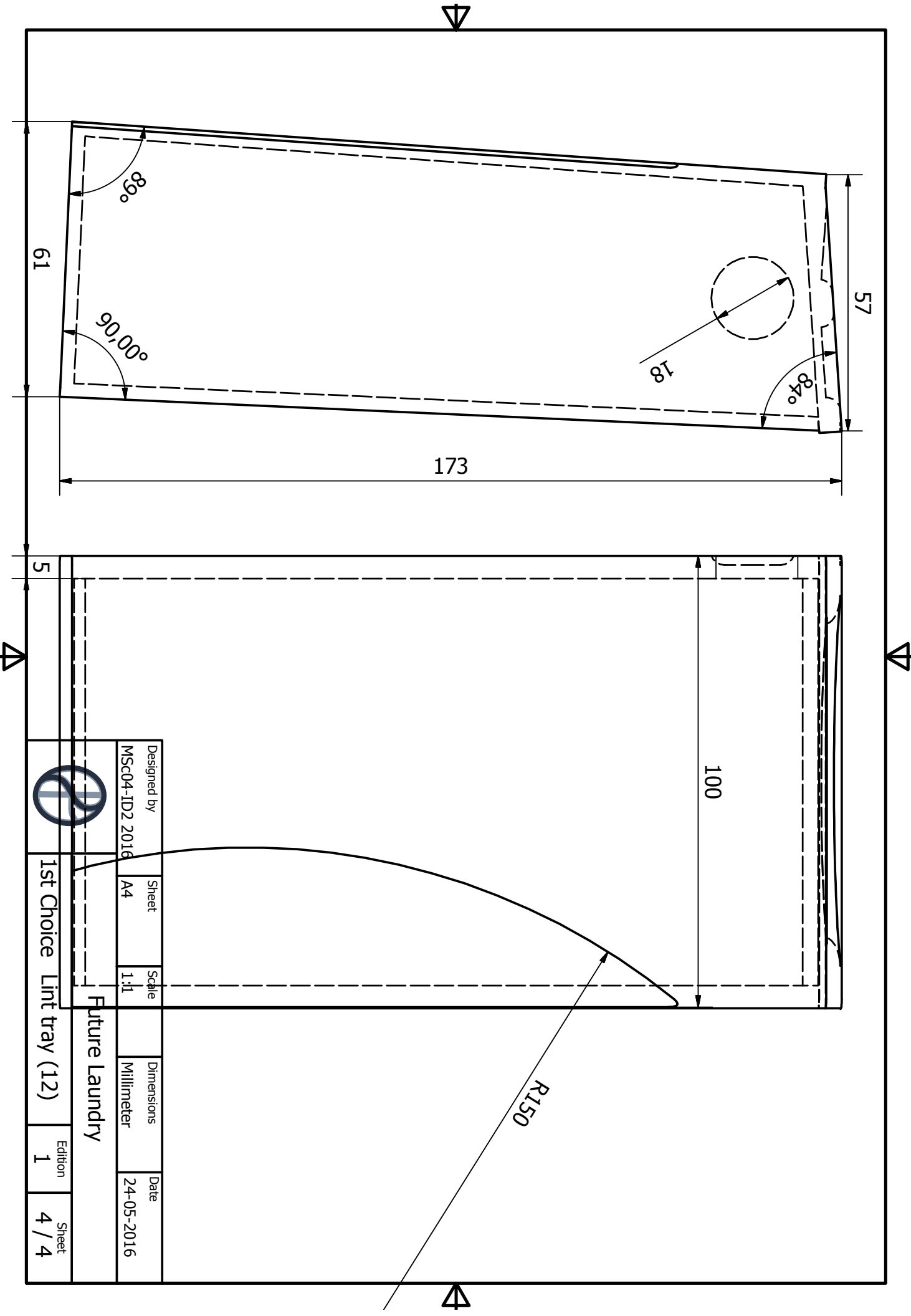
B-B (1:20)



C-C (1:20)



	Designed by	MSC04-ID2 2016	Sheet	A4	Scale	1:20	Dimensions	Millimeter	Date	24-05-2016
	Future Laundry			1st Choice	Edition	1	Sheet	3 / 4		



Designed by	Sheet	Scale	Dimensions	Date
MSC04-ID2 2016	A4	1:1	Millimeter	24-05-2016



1st Choice Lint tray (12)

Edition 1

Sheet 4 / 4

Future Laundry