
APPENDICES C-0

DESIGNING A WASHING MACHINE FOR THE SERVICE ECONOMY

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MSc Integrated Product Design
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***Appendices A and B**
Contain confidential information and are not part of this document.

APPENDIX C

User Insights from Interviews and observations

About the process

Interview were performed with 7 users in total. The 7 users selected for the interviews offered a diversity of business models, ages and living situation. Different interview scripts were prepared based on the different business models, however, all scripts covered similar topics in order to simplify the analysis of the answers. With the exception of Bundles users, the interview was conducted together with an observation exercise in order to obtain more information and confirm user behaviour.

A transcription of the answers to the questions and summary of the observation with screenshots of videos and photographs was made in order to collect all insights. A manual analysis and coding was performed considering the interview scripts as guides. Most relevant insights are collectively listed in the following chapter. The complete script of the interviews, observations, results and answers can be found in the last chapter of this section.

List of performed interviews:

Type of Business Model	Age range and gender	Living situation
1. Leasing service. Bundles.	27-30 Male	Recently started living with his girlfriend. Small apartment.
2. Leasing service. Bundles.	27-30 Female	Lives alone in a studio.
3. Leasing service. Other. (Interview and observation)	24 Female	Lives and shares a student apartment with other 7 people.
4. Ownership.	60 and 62 Couple	Live together in a house. Their 3 children moved out.
5. Ownership.	47 and 50 Couple	Live together in a house with their 2 sons. 18 and 14 years old approx.
6. Part of home rent.	27 and 28 Couple	Live together in a studio
7. Shared Laundry Facility.	24 Female	Lives in a big student building with shared laundry facilities at the basement.

List of performed interviews and observations

Initial research questions

The interviews and observation exercises were used to understand the different layers that configure the user interaction with the washing machine: Technological, economical, cultural, sociological, psychological, ecological, biological and demographical and how these have an influence in the PSS.

What do people find valuable when doing laundry? What could influence people's choice for PSS over ownership? What aspects influence people's washing decisions and habits?

Where does user behaviour have most impact on the circular PSS? Where can this behaviour be influenced?

How is the service or product responding to user needs and influencing their behaviour?

Takeaways and insights from interviews and observations.

About influences in washing needs and behaviour.

User's living situation is strictly related to their laundry needs, behaviour and circumstances.

Other factors that influence user's actions and behaviour when washing are related to their knowledge and experience.

Users typically wash clothes as a routine or if they ran out of clothes that have direct contact with sweaty parts of the body or genitals. Users develop routines and habits in response to what technology is available. They adapt to the machine or facility they have at hand or is possible for them to acquire.

Laundry is part of the user's daily life routine. Routines help to navigate everyday life by automating and easing decision-making (Gram-Hanssen K., 2007). The lack of reflection and conscious decision making in routines has negative consequences for consumption of energy, water and soap in households. (Gram-Hanssen K., 2007)

Users are also subjects of "hidden" social

norms regarding cleaningness. Collective conventions are active in a variety of daily practices. Cultural expectations of cleanliness are not explicit, yet people have an intangible sense of a 'right' way of doing laundry, and presenting the self to Others. (Tullia J., 2013).

Since washing is mostly delegated to the machine, the user's decisions are limited to when, what and why clothes and others are laundered. (Shove E., 2003).

General Insights about the interaction with the washing machine.

The user today adapts to their machine. Users have specific needs a machine with static different options. User does the best match of their knowledge and what the machine offers to meet needs. When adapting needs and machine capabilities the user simplifies the use of the machine by selecting the 3 to 5 programs they like best. However, users like having options "just in case". User's life situations change with time, however, machines are all the same for everybody and are always static.

Input (these factors change over time)	Output
-Type of house. (spacewise). -No of people they live with and relationships. -Age. -Occupation and activities. -Stability. -Available resources and time.	-Type of machine or laundry facility they have access to. -Amount of dirty clothes. -Type of materials and amount of those materials. -How dirty clothes are. -Frequency of wash and washing schedule. -Size of loads. -Type of soap. -Type of programs that are most used.

Input	Output
-Previous Experience. -Immediate available information. Such as advice, feedback from the machine or tags (e.g. names of programs).	-Sense or evaluation of how dirty clothes are. -Frequency of wash and washing schedule. -Size of loads. -Type of soap. -Type of programs that are most used.

About leasing services and ownership.

The decision and motivation to obtain a leasing service is very related to living conditions. This type of users look for flexibility and comfort.

Leasing services are perceived as more expensive in the longer term. Suitable for short periods in most cases. The PSS should enhance its added value over the ownership model. The decision should not only be based on the comparison of the overall price of both options but in the potential extra benefits of the PSS to attract users that would typically buy a machine.

Service models can have powerful implications on the frequency of use and behaviour. E.g. "I stopped doing more than one load and separating my clothes because each cycle is too expensive". Total cost of ownership is not something users typically think of when deciding to purchase a machine. Specifically Miele machines since they are supposed to be durable and efficient.

About space and machine positioning.

The machine is typically positioned in places accessible to everyone in the household. Washing machines are not particularly perceived to have an appealing aesthetic and are preferably hidden. Sometimes the position of the machine is bounded to the size or characteristics of the user's home.

The position of the machine has a great influence on its state. The positioning also influences the frequency of use or the use schedule. E.g. "We can't use it at night because when it shakes it is very noisy and it is right next to our room".

About Information and Experience.

Users typically don't read the manual of the machine or clothes or soap instruction labels. They assume it is a simple task and that they can just intuitively understand how it works. The intuitive use of the machine and soap derives in a lack of information causing one of the following: Damage of the machine, damage or lack of cleaning of the clothes, excessive use of resources: water, soap, time and energy. Users rely on immediate pieces of

information and feedback. Soap cap for measurement, program names, etc. The user actions are also influenced by information obtained from other people. The phrase "this is what my mom said was better" was mentioned in all interviews. Word of mouth and "common believes" are a powerful influencer of actions. E.g. The best for the environment is to wash without heat and to fill up the machine as much as possible".

There are different commonly believed guidelines regarding materials and types of clothes that should be washed in a specific way. These typically correspond to some recommendations from the washing machine manual. These guidelines can also be shaped by bad previous experiences damaging clothes.

About Perception and expectations from the washing machine

Washing machines are perceived as normal everyday objects that complete a chore but don't add anything special to the everyday routine.

When purchased or leased, the user typically looks for parameters like capacity, available programs, top loader or front loader, efficiency (water and electricity), price, durability and quality based on brand reputation.

Result is the most important aspect for most interviewees. If the machine doesn't break or damage the clothes and delivers the sensation of being clean, that is enough and all that is expected and it is sufficient. Users trust their clothes are fresh and clean after being in the machine. The only pieces of evidence that users look for at times are smells or visible traces like stains.

Time is the second most important aspect. Time is perceived differently depending on the living conditions. Some users expect to have immediate results and others don't mind if the laundry is slow as long as they can do something else in between. Regarding the perception of used machines, many users don't notice as long as the machine works correctly and there are no highly visible exterior damages or dirt.

About the process.

Planning

Urgency overrules planning. Frequency is influenced by living situation and activities.

Users who plan wash less often and make it part of the cleaning activities or fill up time in between. Users who don't plan typically wash everyday.

Gathering and separating

Users typically put everything together in one bin and sort clothes afterwards. Sorting could be done by materials, colors or level of dirt.

Separation can be influenced by knowledge and experience, available time, volume of a certain color or material (due to activities, e.g. sports clothes) or value and attachment to the clothes.

Loading

Users typically try to fill up the machine as much as possible (recommendation that this is better for the environment).

The drum size and capacity is defined but the user can't really measure it. Needs to do so intuitively.

The machine has a specific size but the loads, specially considering separation, may cause variations in volume.

Set up

The user intuitively chooses the program based on its name and considering the following: Time, temperature and and in some cases spinning speed.

Soap

Users either use one single detergent for everything or use several types depending on the materials or colors they want to wash.

The measurement of the soap is done intuitively using the cap but it is not a very precise system.

Cycle

User typically uses the in between time for other activities.

If the machine is shared the user likes to be near the machine or keep track on when to get their clothes back to avoid other people touching them.

In most cases users don't like having their recently washed clothes to stay damped for long. The user is then bounded to stay around or keep track of the machine to be able to take out clothes immediately.

Unload

Users don't look for results unless they receive other indicators like smells or stains.

About positive environmental actions

The following actions are recommendations that users follow to virtually reduce their environmental impact (received in publications or word of mouth):

Fill up machine as much as possible.

Reduce frequency.

Reduce use of hot water.

Use eco program (most resource efficient).

Use of automatic dosing of soap and use of ecological soap.

Buying a high efficiency machine.

Avoid using the dryer.

These recommendations are limited and bounded to the user needs and living conditions. The recommendations are also contradicting to recommendations for machine care and clothing care.

About repairs and care

When the machine has a problem the user typically (most interviewees) intuitively looks for feedback (like smells or sounds) and runs experiments to identify the problem.

Although the machine is not made for the user to repair it, the user will typically identify the problem and asses if he/she can solve it on their own. The user is prone to looking for solutions. If the problem still doesn't stop they will asses to go further on it or call a service.

If their expertise and experience allows it the user will go further into the problem and repair the machine on their own eby replacing parts.

Users don't consider important to give the machine constant care and maintenance. They count with little information about it and only look for solutions when problems are present. Machines with feedback regarding prevention measures work very well (e.g. light indication in new Miele machine to use hot water machine cleaning process).

Interview scripts per type of washing machine (subscription, ownership, shared, etc.) with answers.

**Leasing service Bundles.
User current PSS BUNDLES interaction.
User no. 1. Young Male, working and living with partner.**

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
It changed recently. A couple, boyfriend and girlfriend.

What kind of membership do you have? (monthly, monthly+per use)? What kind of washing machine? Why? TWINDOS FIXED FEE
Didn't know the machine would be Twindos. Chose fixed fee, to make sure of what he would pay every month. Bigger machine possible. It has a big capacity. Chose the bigger machine because previously they lived with 3 people, they had to wash a lot.

About the Order and service.

1. What is the main reason for you to obtain a membership with Bundles? (flexibility, cost, environment)
Mainly because they didn't want to possess something that big. The situation was not secure or stable. Renting allowed them to avoid having to move the machine. Renting also avoided situations of shared ownership of the machine. It was a big fee to consider buying one.

2. Did you own a machine before? What are the advantages and disadvantages now that you rent?
The service allows fixing when something is wrong without having to worry about it. This is a big plus. No worries about leaking etc. If it doesn't work you just get a new one or get it repaired.

3. What is your impression over the service overall is there anything you don't like or would change? He likes the service but there is not enough information given. The app is very basic and doesn't really support him.

4. What do you think of the price?
It is on the expensive side. Worth it because the machine is efficient and durable and high quality. Fee covers best machine available and service costs. The girlfriend has high quality clothing that she would like to preserve as best as possible.

About the delivery and use

1. What was your first impression when you first saw the machine?
When it first arrived it was new. Sounds were charming when the cycle was done. The users even gave it a name, R2D2. Beeping sound and looks of fancy machine.

In the future people might get a used machine.
2. How was the first use of the machine? Did you have all the information and knew how to use it? Did you have support to do it?
They read the manual. Not entirely but the parts that seemed relevant. No support from installation people except for some tips. Emails from Bundles were also received. Tried to install Bundles App but it was not good quality so stopped using it.

About the recurrent use and environment

1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan. What do you wash? How often?
Clothes are separated by color, some Wool or delicate fabrics go on the wool program. Eco friendly soap before but took Twindos discount and started using Twindos and miele detergent. If the amount of clothes is enough "" they put it in the washing machine. They wash almost every 2 days. Sometimes two in a day if it is a lot.

2. Which program or programs do you usually use for washing? Why?
They only use a couple of programs. Dark program for dark clothing. Cotton program for bed sheets and towels because you can increase to really high temperature and so you also clean the machine. Wool programme and fine program. Express 20 that's a quick program for when it is not very dirty.
3. What is the most important thing for you when doing laundry? (result, time, environment)
It needs to get cleaned. It needs to not use more water than necessary. Twindos is nice because it doses exactly what you need. No waste. That's what they think the future should be like. It uses what it needs to use.
3. What characteristics do you appreciate from your washing machine? What characteristics do you not appreciate?
The machine is silent and centrifuge it never longer than 10 min and in stages. It is annoying to have a very noisy machine. It is a quick machine. Short button is used a lot. Very easy to use (navigation and menu). With the manual mode you can do a lot of things.

The machine is really heavy. Washing machines should be heavy though.. For stability. I would rather have a heavy washing machine than one that walks. A

minus point is Twindos breaks.
4. Are you cautious about you environmental impact whilst doing laundry? Do you think the Bundles and the Miele machine help you do this? Fill it up. Do short program and sometimes use biological soap.

About Repairings.

1. Did your machine ever needed a repair? What was the problem?
REPAIR OF THE TWINDOS. They figured it out because of a weird sound. They also saw there was no soap coming out.
2. Is this repair something you would feel capable of doing yourself?
They tried to clean it with water and the empty Twindos capsule, but didn't succeed, still got weird sounds. Because they knew it was the Twindos they went straight to Bundles.

**User current PSS BUNDLES interaction.
User no 2. Young Female, working, living alone.**

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
She lives on her own. Lives in a studio. 1 Bedroom apartment.
What kind of membership do you have? (monthly, monthly+per use)? What kind of washing machine? Why? TWINDOS pay per wash and bundles plug.
14 euros = 20 cents per wash. Wash two times a week. Cheaper option for her. April 2017.

About the Order and service.

1. What is the main reason for you to obtain a membership with Bundles? (flexibility, cost, environment)
If you rent a place is a lot of money up front. No money to buy a washing machine. Small amount of money instead of a big expense. Repairs cost a lot of money and it was better for her to have someone else doing this for her.

2. Did you own a machine before? What are the advantages and disadvantages now that you rent?
She used to wash with her clothes at her family home with her mom. Repairs are expensive and it is better to have somebody else taking care of the cost and work.
3. What is your impression over the service overall is there anything you don't like or would change?
They don't call her or email her. She

appreciates not having spam and only being able to communicate with Bundles when needed. If there is a change in the payment she would like to be informed but she does not want constant communication from Bundles unless it is very necessary.
4. What do you think of the price?
It increased in 2019. But it is fine, she can manage to pay it.

About the delivery and use

1. What was your first impression when you first saw the machine?
She always says that washing machines are ugly. She also chose this machine because it has a lot of programs but she only uses the 20 min program. It is ridiculous to have a wash for 3 hours, in 20 min it is already clean. She chose this one instead of the other one for the short program. She is not aware if she either got a used machine or a new machine.

2. How was the first use of the machine? Did you have all the information and knew how to use it? Did you have support to do it?
She didn't really read the manual. She had a washing machine at home before so she already knew how it worked.

About the recurrent use and environment

1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan. What do you wash? How often? She washes her clothes once a week. She does that in the weekend because it is cheaper then. Saving money for water. Sge separates in two different colors and she does black and grey and lighter colors. 2 loads in one day for the 20 min program. Every other week there is a load of bedsheets.

2. Which program or programs do you usually use for washing? Why?
She only uses the 20 min program. 30 or 40 degrees. Even though she received information from her mother to wash at 60 degrees for the bedsheets, she thinks there is no difference in the result.
3. What is the most important thing for you when doing laundry? (result, time, environment)
Time is the most important thing. She is on her own and doesn't have a lot of laundry, so when she does it she wants to do it fast. She cares about her free time. The environment is important and she cares about that with using less hot water. She doesn't think temperature has a great effect on the result. She expects clothes to be cleaned but she doesn't care about it smelling good or if it is wrinkle free. If she feels it is clean it is clean.
3. What characteristics do you appreciate from your washing machine? What

characteristics do you not appreciate?
She likes that she has a lot of programs in case she needs it. Like the delicates program for expensive clothes. My mom always had a Miele and she said it is good brand. You have Twindos which is nice to have to use only what you need to use. But she actually use powder. She use very little soap, if the clothes smell a lot like detergent it is an indicator for her that she used a lot of detergent so she uses less in the following washes. She doesn't measure it.
4. Are you cautious about you environmental impact whilst doing laundry? Do you think the Bundles and the Miele machine help you do this?
No high temperatures.

About Repairings.

1. Did your machine ever needed a repair? What was the problem?
The machine she has now never needed a repair. But she has noticed a smell.
2. Is this repair something you would feel capable of doing yourself?
To avoid the smell she opens the door because she thinks the bad smell comes from the drum for water accumulation. If something is wrong that doesn't categorize as broken they still could be things that are unpleasant. But they don't give you information about that. She was not aware of any of the materials she has available. SHe wishes to have more information of common things happening to the washing machine (like smells).

OTHER LEASE interaction. Young female, Master student living with 8 people. All inhabitants are students.

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
Role. What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
8 + people are washing their clothes with that washing machine. They are leasing the washing machine. 18 euros per month. They are also leasing the dryer and a dishwasher.

About the Order and service.

What kind of washing machine did you choose? Why?
They picked the biggest machine possible 8 kg that was still within the budget.
What is the main reason for you to lease a machine? (flexibility, cost, environment)
Flexibility
Did you own a machine before? What are the advantages and disadvantages now that

you rent?
For the living situation is best to lease something because buying is a big investment one time that should last for a while. But because the people in the house keep moving in and out it is better to share the leasing costs than solving the costs of investment. Paying per month is most comfortable.
What do you think of the price? It is very cheap. Specially divided by 8 people.

About the delivery and use

What was your first impression when you first got your machine?
The washing machine was used. For them, getting a used machine is a positive thing. Was it a new machine?No, I think it was used, I hope so...
How was the first use of the machine?
Did you have all the information and knew how to use it? Did you have support to do it? They didn't read the manual they just intuitively used it. They didn't receive support.

About the recurrent use and environment

What is the most important thing for you when doing laundry? (result, time, environment)
She wouldn't want a machine that was good for the environment but that clothes don't come out clean. Result is most important. Practices to reduce environmental impact are taken into account. She really takes care of her clothes because she doesn't want to buy any more clothes. Whatever she has she gets very attached to it and takes care of it.
What characteristics do you appreciate from your washing machine? What characteristics do you not appreciate?
They like that you can set the timer. You can make it last 10 hours if you want to. It has a fast program. If you don't use the fast program it can take up to 4 hours.
They don't like that the machine is on the ground. The machine is installed in the bathroom so it gets wet quite often, it is rusted from the sides and the back. Because 8 people or more use the machine, it gets dirty pretty fast. The machine is quite noisy.

Are you cautious about you environmental impact whilst doing laundry? If Yes, How?
If people have the time they put the machine in cotton eco, with 30 or 40 degrees.
The machine is subject to washing practices of 8 different people. It was only possible to interview one person of the 8.

Laundry Journey and observation

1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan.
Observation and simultaneous Interview:

Step	Important Observations	Notes
1. Planning the washing.	How do you plan for laundry? How often do you wash? <i>What are the reasons behind these decisions?</i> <i>Depends on the activities and the type of clothes she has been using and will need in the future.</i> <i>Depends on time availability. Planning helps.</i> <i>Depends also on the size of the after washing. Is there a dryer? A hanger? Is it big enough for all?</i>	The machine is used 2 times a day with 8 people. She plans to have enough time to be around home when doing laundry. If laundry is done she wants to get the load out as soon as possible to avoid smells. She washes 2 to 3 loads every 3 weeks or so. It depends on the activities she does. If there is too much to wash she has to put a load in and wait for that first load to dry (hanging) to put the next load to have enough room.
2. Gathering laundry	Do you separate the clothes? Why? <i>Does this influence the size and frequency?</i> <i>She cares about her clothes. Separating reduces the frequency for some materials. Sometimes she will try to use more of a material to get more dirty clothes of the same category.</i> <i>She follows her mom's indications.</i>	She separates whites, light colors, dark, all of these cotton and synthetic. Dark wool and light wool. Silk goes with the wool. Bed linen and towels.
3. Loading and setting up the washing machine	How big are the loads? Which program or programs do you usually use for washing? Why? What kind of detergent? How much and why? <i>Is there enough knowledge behind the decision?</i> <i>The loads of the cotton and synthetic clothes are quite big because of the waiting period to do laundry. Bed linen loads are also big but inly because of the normal size of the items.</i> <i>The information comes from family (mom) and from the feedback, immediate information given by the machine and the soap container.</i> <i>There is no information considering the working principle of the machine and the considerations needed for the size of loads.</i>	Because of how often she washes she has very big loads. The programs she uses differ. Usually uses long program and plans for it and uses 30 to 40 degrees. Except for bed linen and towels. She uses 3 different detergents. Color, light and wool. She looks for a brand that allows her to use less. She measures the soap with the lid. If she just pours it straight in the machine she is not able to measure or notice the amount. She reads the instructions of the soap. She has different types of soap to make the clothes last as long as possible. The machine is used with all kinds of detergent because each person has their own detergent.
4. Wash cycle	What happens during this stage? Do you wait at home? <i>She waits or goes somewhere near like the supermarket but likes being back home for the unloading to avoid having smells from wet clothes left standing.</i>	She waits at home or goes to the supermarket or other.
5. End of cycle and Unload	What are your expectations when you unload? What do you look for?	She smells the clothes to make sure the clothes didn't get humidity smell or something. She doesn't check the clothes unless there was a stain. Usually pre washes stains by hand.

About Repairings and Care.

How do you take care of your machine? Do you clean it?
People that share this machine are not cleaning it. If they notice it smells, sometimes in rare cases they clean it. The machine gets cleaned inside because some people are used to washing with high temperature programs.
Did your machine ever needed a repair? What was the problem?
The machine was not landed properly and

would give people shocks while using or while in the shower.
Did you consider the repair to be expensive?
Is this repair something you would feel capable of doing yourself?
They fixed the problem themselves. Attached the original wire to a landed socket. They knew what was wrong after the shocks.
Thank you! We are done!

Observations from pictures and videos:



All clothes are stored together in a single container and separated afterwards.



Great variety of detergents are used with 8 different people



The machine is on the floor right next to the shower. There is no other space for it in the house. The dryer on the top of the washing machine doesn't seem to have the accessory to support it.



The soap is measured with the top cap of the soap bottle. The soap tray is dirty.



The machine is deteriorated by the water from the shower.

User **OWNERSHIP** interaction. **Middle age couple, children moved out. The father works and the mother is retired.**

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
Role. What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
Before it was 5 people, 2 adults 3 kids. Today is 2 adults and sometimes 1 extra person in the summertime.

About the Purchase.

What kind of washing machine do you have? How old is it? Where did you buy it? They used to have a machine for 20 years. Then got a quite high end machine that only lasted 3 years. They finally chose a Miele because of its good reputation of quality and longevity. It was the only machine with an iron support and counterweights. It is now 1 year old. They bought it in the internet.
What were the characteristics that made you buy this washing machine?
The longevity of the machine was the most important. They don't do "difficult" things. They don't need special programs.
What was the main reason for you to buy your own machine? (flexibility, cost, environment, convenience).
The price of renting turns out to be more expensive. They have the money to buy a machine upfront so they do it.
What do you think of the price?
They think the price of the machine is reasonable as long as it lasts as long as it is supposed to. At least 15 years. They expect to be careful with their purchase and get informed in order to make the best choice and invest in something good.

About the delivery and use

How was the first use of the machine? Did you have all the information and knew how to use it? Did you have support to do it? They read the manual. People who installed it gave a few recommendations.

About the recurrent use and environment

What is the most important thing for you when doing laundry? (result, time, environment)
They want to have their clothes cleaned. They always use the environmental cycle. It takes longer but it is better for the environment.
What characteristics do you appreciate from your washing machine? What characteristics do you not appreciate?
A machine is a machine. There is nothing very special they appreciate. They also don't notice anything negative.
The machine notifies the user if they

haven't washed with a hot cycle for a very long time with a light. They advice the user to do the hot wash or run the machine cleaning program so you can avoid smells. Are you cautious about you environmental impact whilst doing laundry? If Yes, How? They try fill it up as much as possible never do small loads and not use too much soap or buy eco soap.

Laundry Journey and observation

1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan.
Observation and simultaneous Interview:

About Repairings and Care.

How long do you expect your machine to last?
They expect the machine to last at least 15 years.
How do you take care of your machine? Do you clean it?
They always try to clean and check the rubber ring. They always leave the door open to release humidity. Sometimes they release dirty water from the pumps.
Did your machine ever needed a repair?
What was the problem?
The previous machine needed a repair and the father of the family took care of it. They had to buy a replacement for the heating element and installed it themselves.
Did you consider the repair to be expensive?
They never use technicians.
Is this repair something you would feel capable of doing yourself?
The father of this family is very experienced with other kinds of manual labor and is the person in charge of repairing things around the house. The family always avoids calling technicians because most of the times they are capable of doing it themselves.

Thank you! We are done!

Step	Important Observations	Notes
1. Planning the washing.	How do you plan for laundry? How often do you wash? <i>What are the reasons behind these decisions?</i> <i>This has chance significantly with time. There are big differences between having kids and not having.</i>	They plan for bed linen every morning. Try to put the load in the morning, leave home for the market or sports and then come back to get the load out. This is the only load they plan the rest they do whenever the laundry basket is full. They try to avoid the chore of doing laundry. They wash 2 times a week and before they used to do it 2 times a day.
2. Gathering laundry	Do you separate the clothes? Why? <i>Does this influence the size and frequency?</i> <i>Highly influenced in the type of activities people do. And the amount of clothes they have available.</i>	They separate their clothes in dark, wool, silk goes with wool, or if there are enough they do delicate wash, they do white and light color. If they have been camping or doing other activities they also separate those.
3. Loading and setting up the washing machine	How big are the loads? Which program or programs do you usually use for washing? Why? What kind of detergent? How much and why? Also depends on the kind of people who use the machine. It is not a decision the user spends too much time on and it can be influenced by other people living in the house or the price or the availability in the store. <i>Is there enough knowledge behind the decision?</i> <i>There seems to be knowledge out of previous experience or parents recommendations. There was some reading or scanning of the manual.</i>	They use the fist rule. Not totally filled but quite full. For some fabrics it is less volume. They use the long eco cotton program and choose 40 degrees. Bed linen and towels they do at 60 degrees. They use eco soap but in the past, some of their kids wanted clothes to smell nice, so they started buying other types of soaps with more perfume. They also use pods, or whatever is available at the store. Preferably eco brands but sometimes it is very expensive. They measure the soap with the cap and try to follow the instructions of the soap tag. They don't feel, however, the need to be very precise. They memorize and approximate amount of soap they are supposed to be using and adapt it to the volume of clothes they are washing at the moment.
4. Wash cycle	What happens during this stage? Do you wait at home?	
5. End of cycle and Unload	What are your expectations when you unload? What do you look for?	



The machine is installed inside a cabinet together with the dryer. They installation does not have an adapter to hold and maintain the dryer in place.



Many different kinds of soap are used. They all have their own measuring cap system. It is unclear if whether the user uses each cap specifically for each type of soap or if they are accidentally combined.

User OWNERSHIP interaction. Middle age couple with kids. The father works, the mother works and stays half time at home and the children study.

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
Role. What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
The whole family uses this washing machine 3-4 people. 2 Adults 2 children (14-18 years).

About the Purchase.

What kind of washing machine do you have? How old is it? Where did you buy it? They have a new Miele machine and had a Miele before for 18 years. More 'electronic'. They bought it in the internet with cool blue. They installed it for them.



They bought the Miele W1 the most simple version, no Twindos or XL or extra pump. What were the characteristics that made you buy this washing machine?
The main thing is that they wanted a Miele again because it is very durable. They doubted for a higher centrifuge but in the shop they recommended that it doesn't make a lot of a difference but it seemed more convenient to have higher centrifuge because they don't have a dryer. They tried to buy the same version as 18 years ago.
What was the main reason for you to buy your own machine? (flexibility, cost, environment, convenience).
Convenience, high intensity use. They didn't know they had other options.
Decided to buy another Miele because of durability. Because of living situation, having their own machine is cheaper.
What do you think of the price?
It is a very reasonable price for the quality they get.

User OWNERSHIP interaction. Middle age couple with kids. The father works, the mother works and stays half time at home and the children study.

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
Role. What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
The whole family uses this washing machine 3-4 people. 2 Adults 2 children (14-18 years).

About the Purchase.

What kind of washing machine do you have? How old is it? Where did you buy it? They have a new Miele machine and had a Miele before for 18 years. More 'electronic'. They bought it in the internet with cool blue. They installed it for them.

About the delivery and use

How was the first use of the machine? Did you have all the information and knew how to use it? Did you have support to do it? They didn't really receive any information when the machine was installed. They left a booklet with the information. It seemed easy for them to understand only using previous experiences with previous machines. They do notice it is different than their previous machine, it is more 'electronic' and this gives them more options.

About the recurrent use and environment

What is the most important thing for you when doing laundry? (result, time, environment)
They take care of their clothes and they try to separate their clothes into materials and look for what is the best program for that type of material specifically.
The result is most important, whatever is most appropriate for the clothes. The most important thing is not ruin the clothes.
They think that the previous machine was not as good for the environment as they thought because. They have noticed that the programs are a little bit longer and think that saves energy to slowly heat up the water. Shorter programs without heat are perceived by them to be better for the environment and also save time.
What characteristics do you appreciate from your washing machine? What characteristics do you not appreciate? They do not appreciate not being able to

stop the program once it started. If they forget to put something in they can't do it anymore. You can only open it after 1 minute after starting. With the older machine you could do a soaking program. Since there is no option for this, the owners do their own soaking program by turning the machine off and back on after 1 or 2 hours. They could control it with Wifi but they weren't aware of this.

In some cases, the machine doesn't do the centrifuge very well. They believe it could be because it is too full or not very well balanced. They wish they could have more feedback concerning these errors.

Are you cautious about you environmental impact whilst doing laundry? If Yes, How? Washing with high temperatures is not good for the environment and also not good with your clothes.
They try to avoid it unless it is towels or kitchen napkins. They wash these at 60 degrees. It is totally unnecessary to clean with 90 degrees except if the machine requires it.

Laundry Journey and observation

1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan.
Observation and simultaneous Interview:

About Repairings and Care.

How long do you expect your machine to last?
At least the same as the previous Miele they had.
How do you take care of your machine? Do you clean it?
They don't really take care of the machine or clean it. They read some parts of the manual but don't really follow it.
Did your machine ever needed a repair? What was the problem?
The repairs were 3 done by Miele technicians. One of the repairs lasted for 5 years after being done.
Did you consider the repair to be expensive?
The price of repairs was reasonable. The repairs were not due to the machine, they were needed because of misuse.
Is this repair something you would feel capable of doing yourself?
No, they never thought of repairing it themselves.

Thank you! We are done!

Step	Important Observations	Notes
6. Planning the washing.	How do you plan for laundry? How often do you wash? <i>What are the reasons behind these decisions?</i> <i>They have the time to wash and have the need to wash often due to number of people and activities.</i>	They wash whenever it is necessary. They was nearly everyday.
7. Gathering laundry	Do you separate the clothes? Why? <i>Does this influence the size and frequency?</i> <i>They follow their mothers and their own experience.</i>	They separate their clothes by type of materials.
8. Loading and setting up the washing machine	How big are the loads? Which program or programs do you usually use for washing? Why? What kind of detergent? How much and why? <i>Is there enough knowledge behind the decision?</i> <i>They trust the machine and exclusively follow what the program indicates.</i>	They machine is over 50% full in all loads. They use the wool program a lot because it is cold and only 38 min. If clothes are not too dirty this seems to be a good option. They also use cotton and color (for jeans). They trust the machine. They trust and just follow the name of the program. Special fluid for sports clothes. Wool detergent. White wash and color. They use powder (bio). They use a spoon to measure it. They always use less than indicated. Vanish for spots.
9. Wash cycle	What happens during this stage? Do you wait at home?	They are usually at home and can wait for the washing machine to be ready.
10. End of cycle and Unload	What are your expectations when you unload? What do you look for? <i>They only look for specific results depending on the state of the clothes when they went in.</i>	They only look if the spots are gone when they knew there were spots before.



The family uses several types of detergent depending on the type of clothing they are washing. They also use stain remover.



The soap tray is not cleaned very often. And has traces of soap and water.



The washing machine has a special cabinet. It keeps it quiet and protected.

Part of home rent.

PART OF HOME RENT interaction. Young couple living together. They are both PHD students.

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
Role. What type of household do you live in, number of people and general use of machine? Example answer: it's just me and I wash for myself.
2 young people in a couple. The washing machine is used to clean clothes for the both of them. He does most of the washing, they split the house chores.

About the Order and service.

What kind of washing machine do you have? Why?
They have an Electrolux machine 6 kg that was already installed in their house when they started renting it. They do not own the washing machine.

This is convenient because they don't think their situation is stable enough to buy a machine. If they have to move to a different house they wouldn't want to have to move a machine with them.

About the delivery and use

How was the first use of the machine? Did you have all the information and knew how to use it? Did you have support to do it? There was no explanation of how to use the machine. The machine was already installed. They received a manual but didn't read it. They assumed they knew how to use a washing machine.

About the recurrent use and environment

What is the most important thing for you when doing laundry? (result, time, environment)
The result is important, having the clothes cleaned and maintained, and not broken from the washing. They don't really mind if it takes a little longer. They are not there when it is running. They would prefer if it is too much energy consuming.

What characteristics do you appreciate from your washing machine? What characteristics do you not appreciate? They mentioned they don't have experience with washing machines to know what would be good or bad.

The machine they have is not as efficient as they would probably choose it to be if they would buy it themselves. But since it is the machine they have at the moment, it is sufficient.
The machine is easy to use. Only one button.

It is a very loud machine. It bothers them when they try to sleep.

You can't see a timer that tells you the remaining time of the program.

Are you cautious about you environmental impact whilst doing laundry? If Yes, How? They try to use the eco program if there is enough time. Usually wash with cold or 40 degrees water.

Laundry Journey and observation

1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan.
Observation and simultaneous Interview:

Step	Important Observations	Notes
1. Planning the washing.	How do you plan for laundry? How often do you wash? <i>What are the reasons behind these decisions?</i> <i>It is defined also by the type of activities they are doing at the moment and the amount of clothes they have available.</i>	They don't really plan for it. Unless they really need something for the following day. They wash almost every 2 days. 3 times a week because of all the sport they are doing.
2. Gathering laundry	Do you separate the clothes? Why? <i>Does this influence the size and frequency?</i> <i>They don't think they could be able to separate by colors or similar colors because they don't have enough clothes of the same color or same characteristics to have enough volume for a load.</i>	They just separate 30 and 40 degrees like pants, shirts, jumpers. Underwear towels and bed sheets are washed on 60 degrees. They do not separate the colors and have had bad experiences before from this decision.
3. Loading and setting up the washing machine	How big are the loads? Which program or programs do you usually use for washing? Why? What kind of detergent? How much and why? <i>Is there enough knowledge behind the decision?</i> <i>They are not aware of the functioning principle of the washing machine. They do not read the manual and don't have a lot of experience. They are not aware of what is best for their clothes.</i>	The loads they do are always at a 100% capacity. It is completely full. They started to fill it less because they noticed it smelled. They use the cotton program and sometimes the wool program if they had enough sweaters to clean. They use liquid detergent and a single type for all clothes. They measure with the lid of the bottle. Didn't read the detergent instructions. They always fill up the cap of the soap bottle and put that in.
4. Wash cycle	What happens during this stage? Do you wait at home? If people have the time or no concerns to get the load out immediately, they don't mind using longer cycles. Time is not really about only the length of the cycle but also How automated should the process be? Why are people washing so often.	They are usually never there while the cycle is running and don't really care if the clothes are left there after the cycle is done. They usually never care about the length of the cycle. However, if they want to sleep, they do care about the length because the machine is too loud.
5. End of cycle and Unload	What are your expectations when you unload? What do you look for? People only look for specific results with specific input. Stains can be a measurement of result but if there is no stains previous to the cycle they most of the times not look for any result reference.	No expectations for the result only notice if there are weird smells. Only look for results if something was in the clothes before putting them in like a stain.

About Repairings and Care.

How do you take care of your machine? Do you clean it?
They never clean the machine or give it any maintenance. There is no knowledge or idea of what you could do to keep it clean.
Did your machine ever needed a repair?
What was the problem?
The machine never needed a repair.
Did you consider the repair to be expensive?
No repairs.
Is this repair something you would feel capable of doing yourself?
No repairs.

Thank you! We are done!



The soap tray is quite dirty, evidence of lack of maintenance. They do not have interest on reading instructions. Washing seems like a side chore that shouldn't require too much mental effort.



There are at least 20 variations of programs for this machine. From which they use 2 programs with some variants in temperature. 40 degrees is used for normal clothes. Wool is washed in 30 degrees and 60 or 90 are for towels underwear, etc.



Shared Laundry Facility.
User Shared interaction. Young female, Master student. Student housing shared facility.

*Explain the project and process. Privacy. Authorization for recording. Length of interview: 15 min.
How many people you share with?
5 washing machines and 3 dryers. They have a separate paying system that works with a separate account and a QR code on your phone or printed. These are shared between 170 people approx.
Does it bother you to share? System? Clean?
The setup is annoying. When you are doing your laundry everybody is at the same room, near the entrance. When she was in Sweden she also shared a laundry facility but she could rent a whole room with a washing machine and dryer. You would be the only person with access to that room. No one could enter to the room you were using.
Everybody leaves a bag behind. If the cycle is done and she is not there, others can take out her clothes. She does not appreciate that.

What do you think of the price?
1 euro for drying and 2 euros per wash. It is quite expensive.
You are also bounded to use that system and you are only allowed to deposit a minimum of 20 euros every time you recharge.

Own washing machine advantages and disadvantages?
The advantage is for now, there is not enough space at her place for a washing machine of her own. The shared washing machines have a defined set of programs that do not offer enough information to know if it would be the most suitable one for her clothes.

Because there is not enough information she washes her delicates by hand.

About the delivery and use
How was the first use of the machine?
Did you have all the information and knew how to use it? Did you have support to do it? She did not count with any information about the washing. There are only operating instructions on the walls of the laundry room and she received an email with payment information. These indicate the temperature and the length of the programs but nothing about the speed of spin which is important for her to know to not ruin her clothes.

About the recurrent use and environment

What is the most important thing for you when doing laundry? (result, time, environment)
Efficiency is important. She likes being able to dry her clothes right after washing and not having to wait for availability. The weather influences her actions. If it is cold she will most likely use the dryer. If it is hot she doesn't mind hanging her clothes.
Result is very important, she wants to be able to take care of her clothes. Because she doesn't have that certainty, she has to check the result every time.
What characteristics do you appreciate from your washing machine system? What characteristics do you not appreciate?
She doesn't like not knowing exactly what the program will do and She doesn't like not having the certainty that her clothes will be ok. In a different place and living situation she would try to have her own machine.
Are you cautious about you environmental impact whilst doing laundry? If Yes, How? Yes and no. Laundry is something I need to do. I don't like doing it by hand and it is not very resource and time efficient. Washing clothes is impactful, and she likes having the automated dosing to not waste and overuse soap.

She doesn't do it very often due to the price and she tries reusing clothes to reduce the frequency of washing.

Laundry Journey and observation
1. Please briefly describe your usual process for laundry. Starting with how you prepare and plan.
Observation and simultaneous Interview:

Step	Important Observations	Notes
1. Planning the washing.	<p>How do you plan for laundry? How often do you wash? <i>What are the reasons behind these decisions?</i></p> <p>The system is very annoying so it is an annoying task. She limits the use due to the cost, this has negative consequences on her clothes quality. She doesn't separate anymore.</p> <p>There are busier hours. Specially weekends are difficult so bookings are needed.</p> <p>The way the system is framed defines the fact that she needs to be around for the whole laundry process.</p>	<p>Every two weeks. She does it during the week.</p> <p>She books the machine according to the time when she wants to do laundry.</p> <p>She needs quite some time to do it because she needs to wait for it to be done and the timer is not precise. She doesn't want other people getting her clothes out. But also she doesn't want to keep her clothes damped.</p>
2. Gathering laundry	<p>Do you separate the clothes? Why? <i>Does this influence the size and frequency?</i></p> <p>The no separation makes loads quite big but reduces the frequency. Although she is quite organized and typically separates her clothes she is limited by the pricing of the service.</p>	<p>She doesn't separate anymore. Because it is expensive.</p> <p>She thinks separating is also more hygienic for some types of fabrics etc.</p>
3. Loading and setting up the washing machine	<p>How big are the loads? Which program or programs do you usually use for washing? Why? What kind of detergent? How much and why? <i>Is there enough knowledge behind the decision?</i></p> <p>There is not enough knowledge behind these decisions. The information provided by the company is more related to the rules or etiquette and the feedback provided by the machine is limited to temperature time and name of program. She uses the 'average' program.</p>	<p>Loads are really big. The washing machine has about a 5.5 kg capacity (recommended).</p> <p>She uses a very generic cycle. The synthetic is the most popular.</p> <p>She uses automated soap dispenser. She doesn't mind cause she doesn't have to pay extra.</p>
4. Wash cycle	<p>What happens during this stage? Do you wait at home? If the machines weren't public she would feel more comfortable and maybe do something else non related to cleaning. In this case the system limits the users activities.</p>	<p>She usually combines tasks. She goes back upstairs and cleans while the load is ready. Typically takes up to 45 min.</p>
5. End of cycle and Unload	<p>What are your expectations when you unload? What do you look for?</p> <p>Since she can't control the characteristics of the program too much because of lack of information and high prices she is constantly concerned about her clothes deterioration. She ALWAYS checks her clothes when unloading.</p>	<p>She doesn't want her clothes standing wet too long. She doesn't trust the machine because she hasn't received much information about the programs si everytime, she checks for the result on her clothes.</p>



Different washing machines are available in the same facility. This confuses users and generates a lack of consistency making decisions slower and less informed..



Information cartels remind users not to use soap since there is no other type of feedback indicating automated soap dispensing.



The machine interface only shows the temperature and amount of rinsings. The other pieces of information available are limited to rules and expected sharing behaviour



The payment system is complicated and is possible through different steps. From uploading credits through a computer and having to use a QR code afterwards to activate the machines.



The user has to go down and back up to the laundry room for loading and unloading. The amount of programs is limited to 4. 30, 40, 60 and 90 degrees.



APPENDIX D

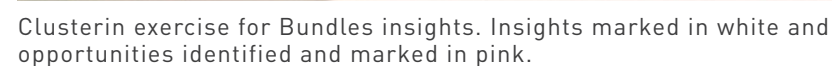
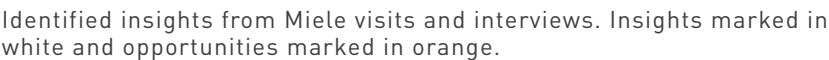
Analysis and clustering of findings.

In order to analyse all insights obtained through the research phase several clustering exercises were used. The exercises were done by stakeholder considering and prioritizing all insights obtained and listed above. After identifying the clusters of insights and doing a selection of the most relevant ones, opportunities for design were identified.

Both, relevant insights and opportunities were later analyzed and mapped using the system map in order to make connections between the different stakeholders and identify similarities and lines of communication between them.



User insights clustering exercise. Most relevant insights marked by green notes and opportunities identified marked in blue.



Creative session with students. Ideation and Future Vision

The following is a short description of the process of the workshop. The workshop lasted 1.5 hours and had 6 participants in total between the ages of 24 and 29. All participants are students from the TU Delft with different backgrounds.

This first exercise was useful to rectify some of the results obtained and interpreted from the interviews with users. Specifically regarding the steps of the washing process and the identified pain points.

Following the creative session a first draft of the possible design future vision was developed using the results and discussions derived from the workshop. The following image shows a synthesis of the first thoughts and draft of the vision. Using the ViP-Vision in design framework as a base (Hekkert P., 2011).

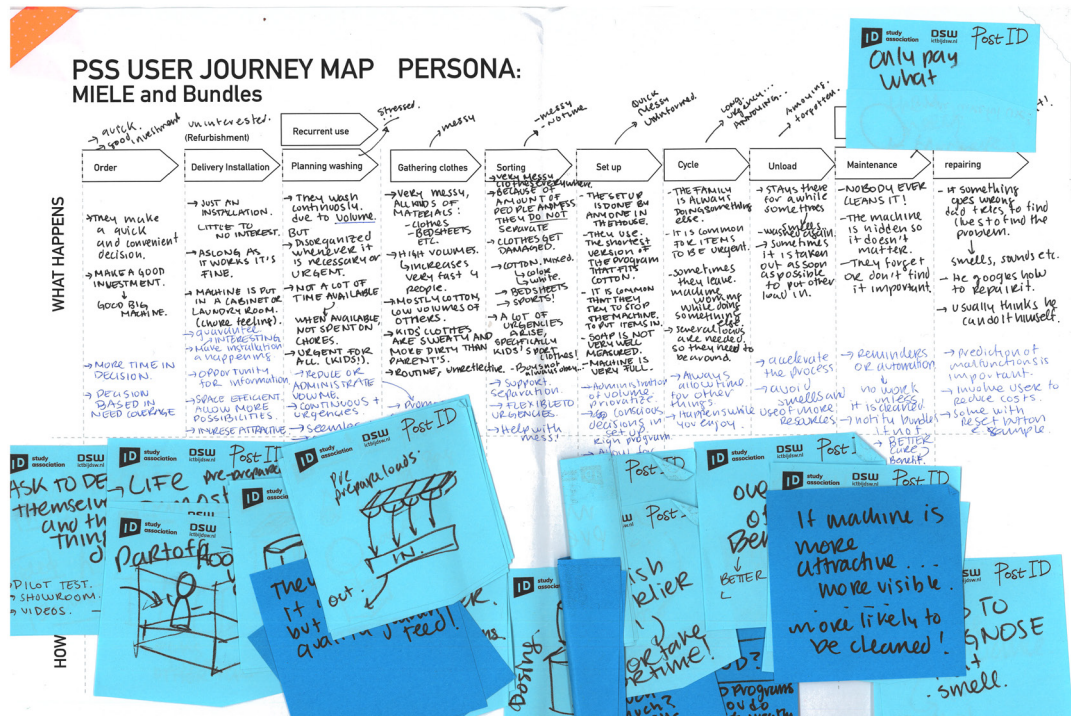
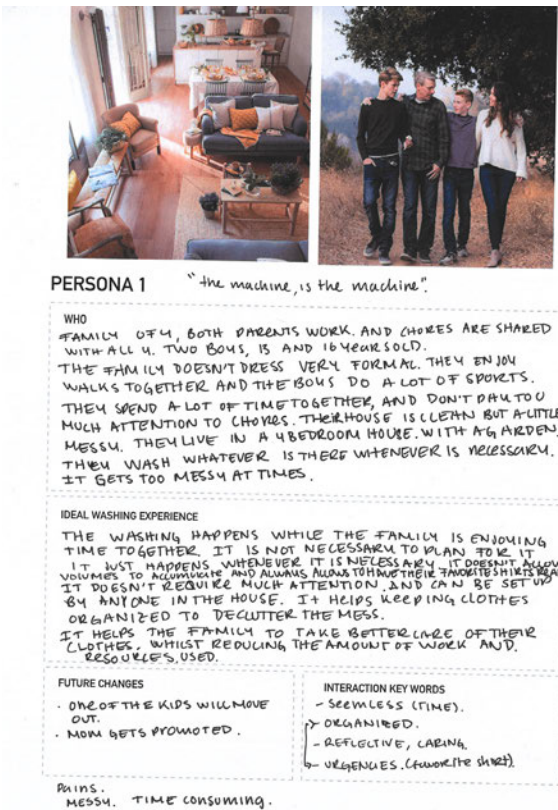
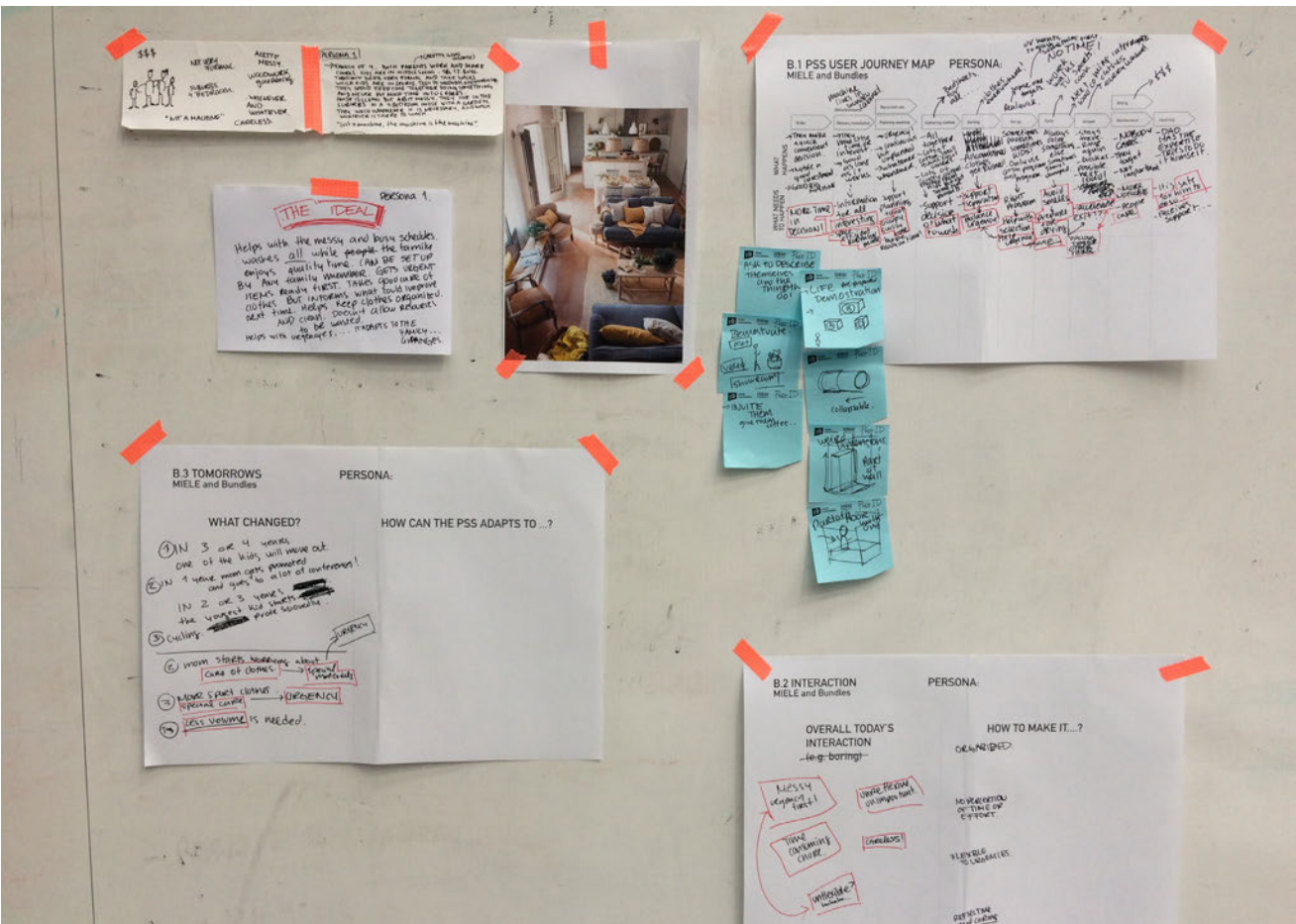
29

Personas and User journey maps.

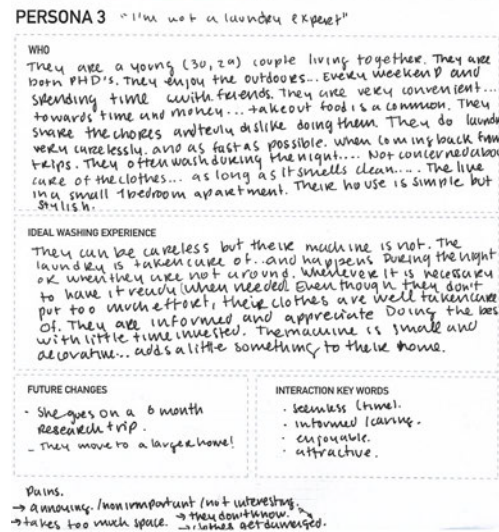
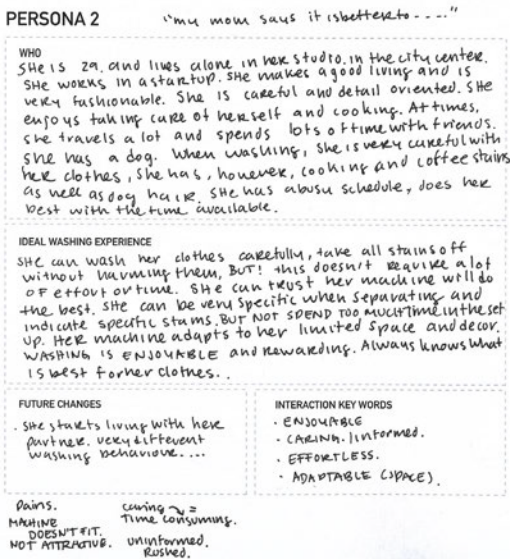
In order to understand the user experience better and find more opportunities to add value through the PSS three personas were developed. The personas were created based on the people interviewed and their answers. The three personas represent extreme characters of potential users of the PSS in order to visualize their extensive variety and differences in needs. The personas included the description of their washing needs considering number of members, type of activities, schedules and availability and personal characteristics such as being messy. A fictional paragraph of their ideal washing experience was also included, as well as the description

of possible future changes in their lives, the identified pains from their current interaction, and a set of key words to summarize the ideal washing experience.

For each persona, a fictional user journey map was created. These user journey maps show a high level of detail regarding possible user behaviour or actions. From this exercise it was possible to derive several insights for a desired washing experience. The resulting Personas and User journey maps were then used as a base tool for ideation where ideas for each step of the journey were generated.



Persona 1 and User Journey map of Persona 1.



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APPENDIX G

Ideation support. Moodboards

Mood boards were made to support the first ideation process. The three moodboards include analogies for the desired interaction, possibilities of placement of a washing machine inside a home and examples of Circular products and Product service systems.

MOODBOARD A
Desired interaction

ENJOYABLE

CONSCIOUS (INFORMED)

CARING

SEEMLESS (EFFORTLESS)

FUN (RELAXED)



MOODBOARD B
Several lifecycles

MODULAR

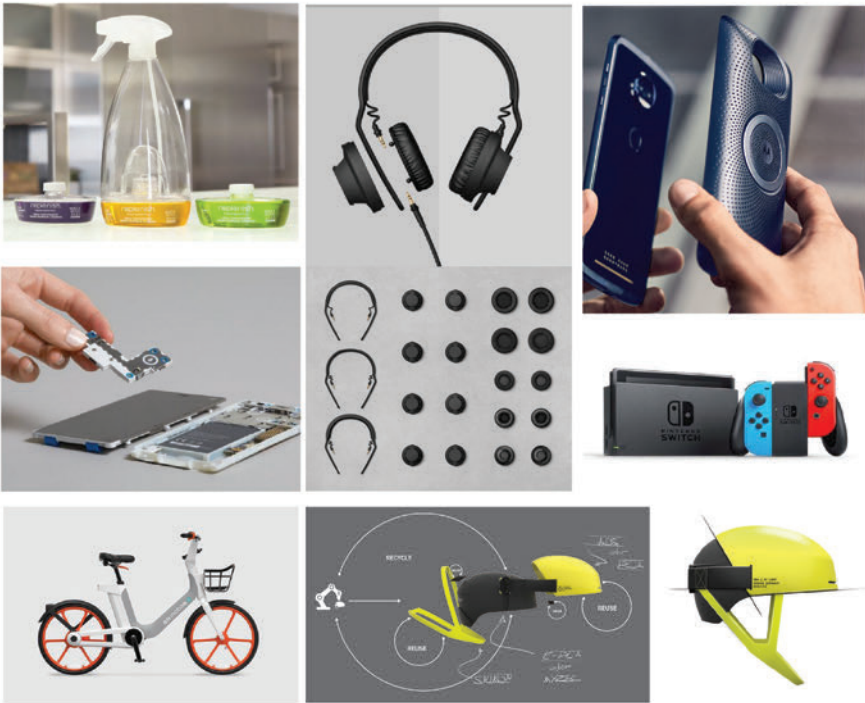
DURABLE

REPLACEABLE

REPAIRABLE

REFURBISHED

UPDATABLE



MOODBOARD C
Location and space Interaction

ATTRACTIVE

ADAPTABLE (FLEXIBLE)

SEEMLESS

ORGANIZED (EASY)

MOVABLE



APPENDIX H

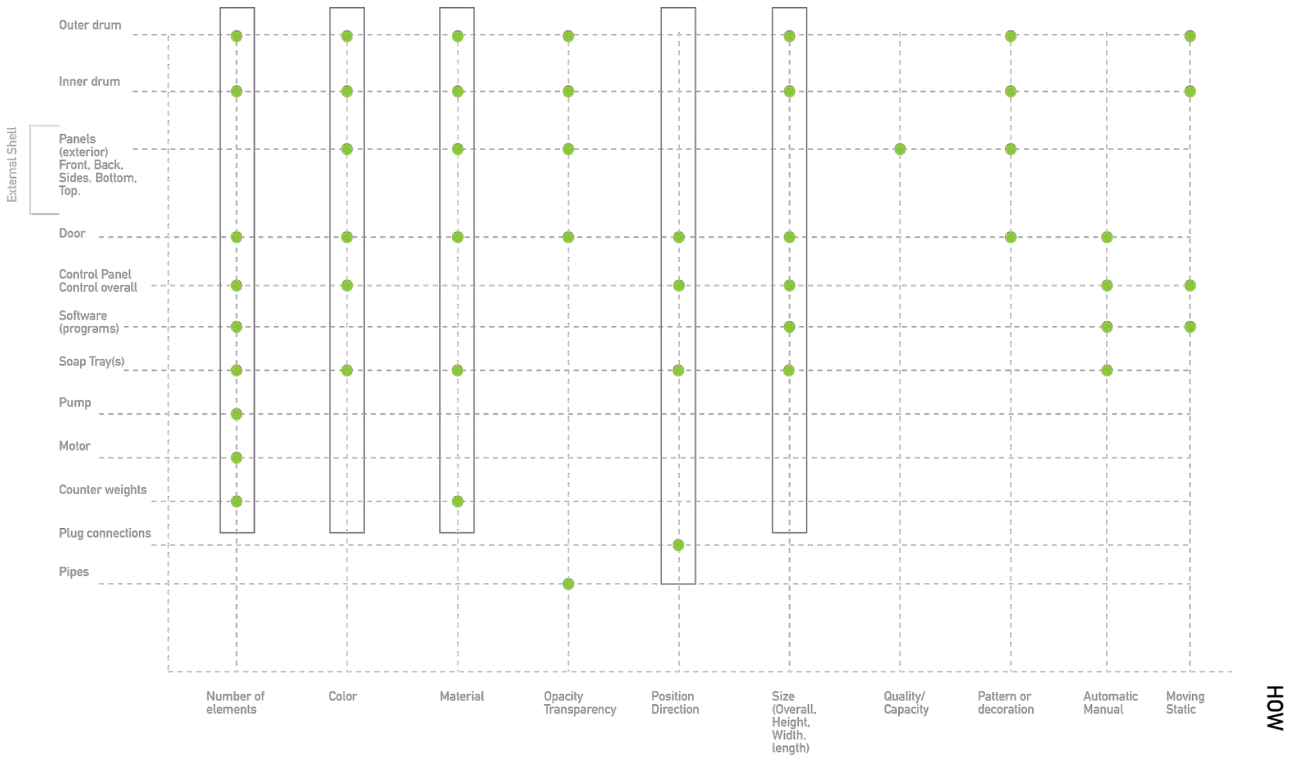
Ideation support. Morphological Charts.

Three morphological charts (ideation method that generates a matrix where the functions or components of a product are listed vertically and the possible solutions horizontally) were developed, one for each one of the three core values derived from the Focus Areas: Personalization, Communication and Refurbishment. On the vertical axis the components that were relevant to the value were listed. On the

horizontal axis the How to's (E.g. How to personalize the drum?) were listed. The morphological charts were used to diverge in the ideation phase, one idea was made for almost every marked point (Green). The marked boxes indicate the points of most interest, or the points where more ideas were generated from each morphological chart. See Appendix I result set 2 for the ideas derived from the morphological charts.

Personalization Morphological Chart

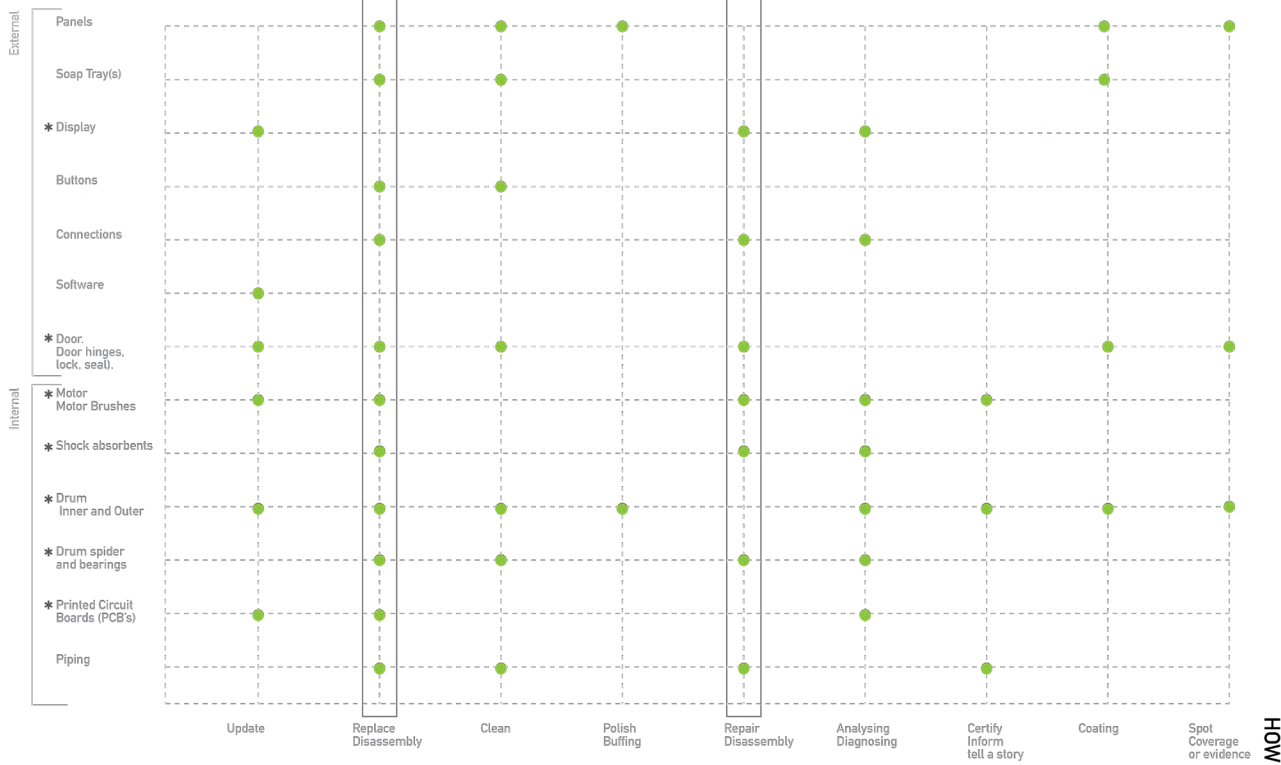
WHAT



Refurbishing Morphological Chart

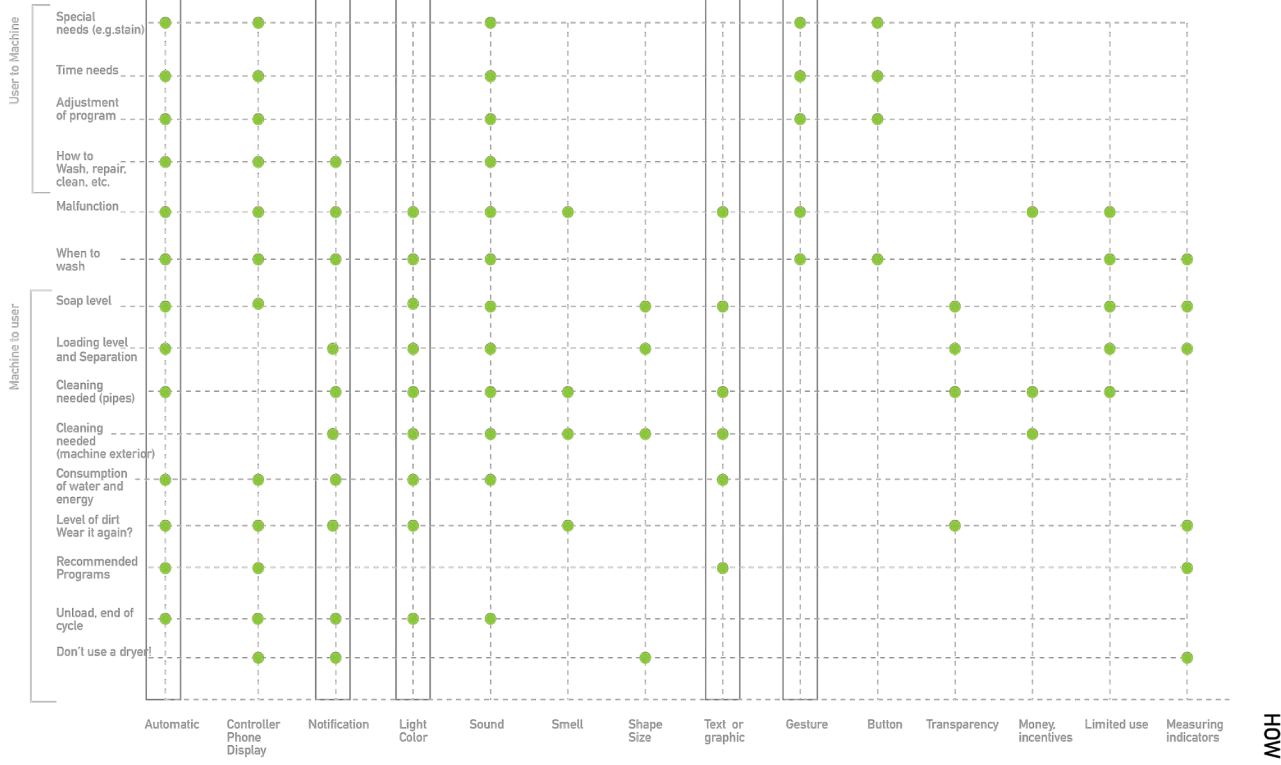
* Critical components
European Commission. (2019). Analysis and development of a scoring system for repair and upgrade of products.
Other components chosen according to the observations done in Bundles, Vonk and users' homes.

WHAT



Communication Morphological Chart

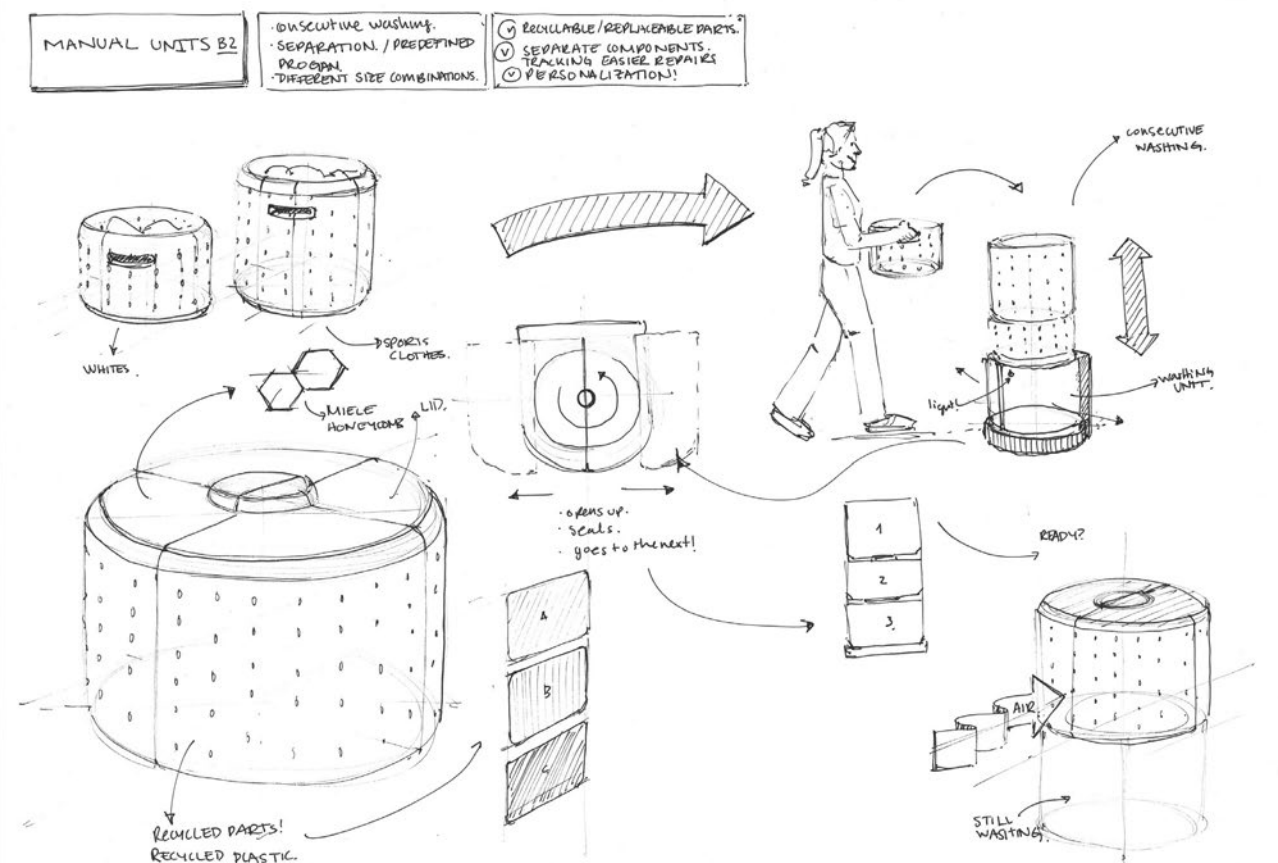
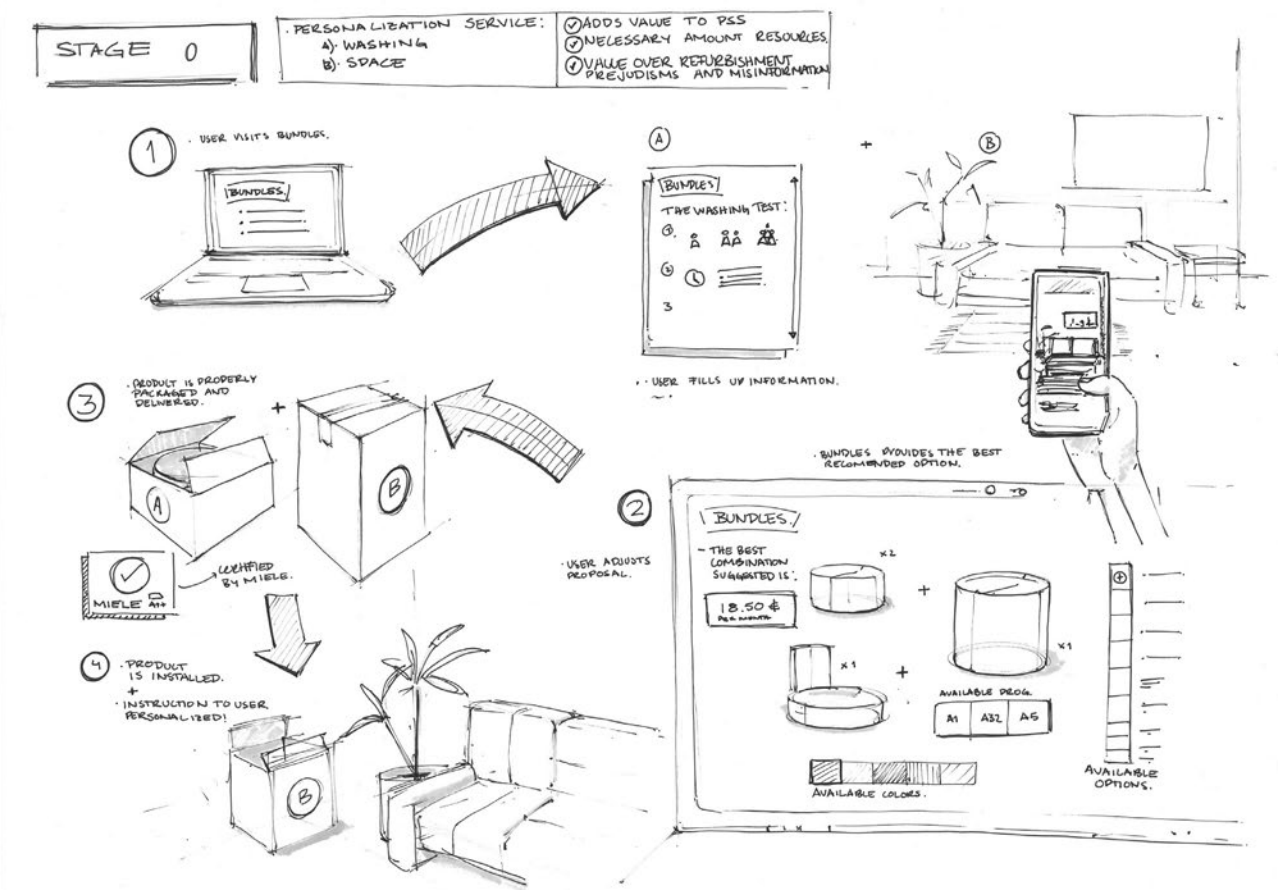
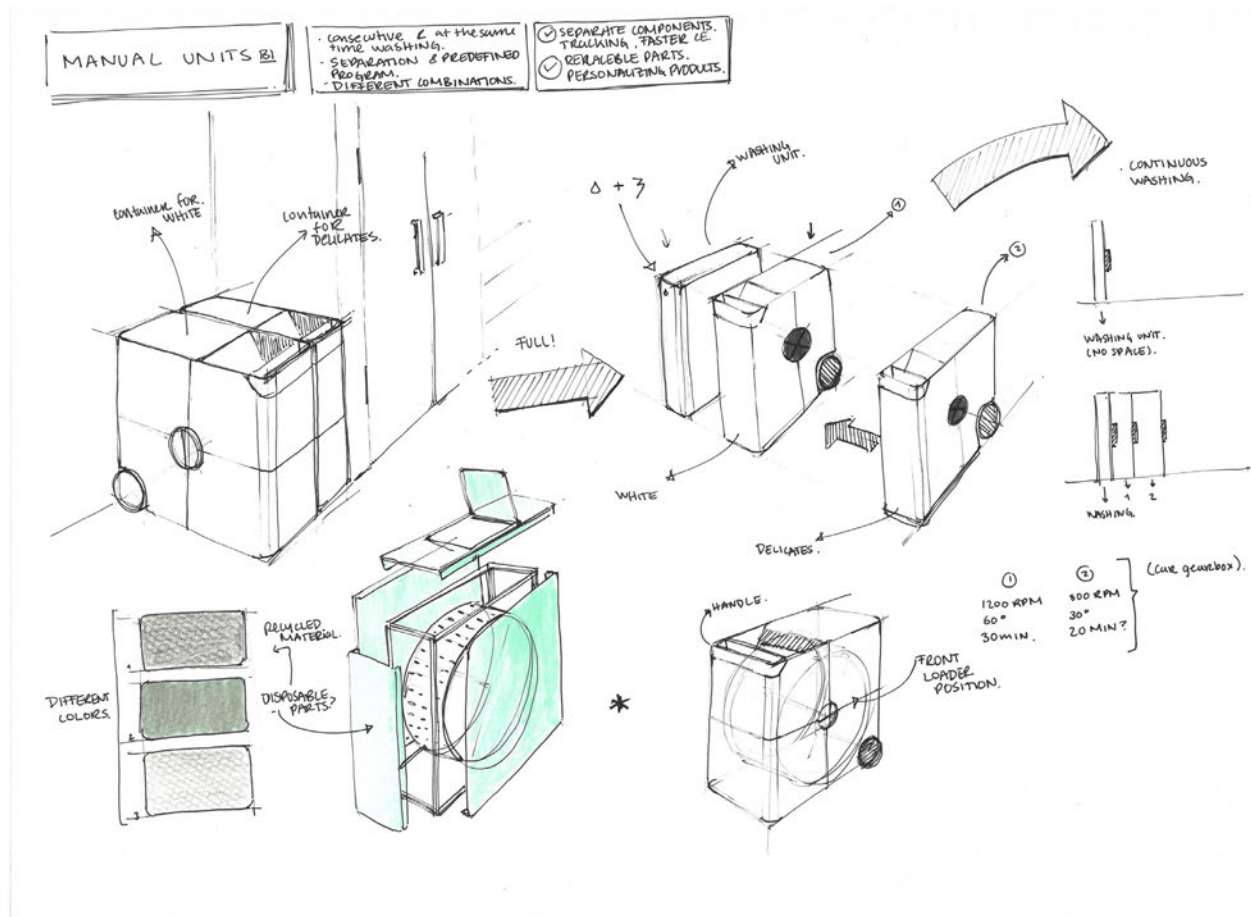
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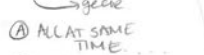
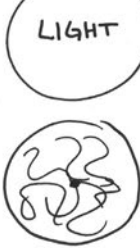


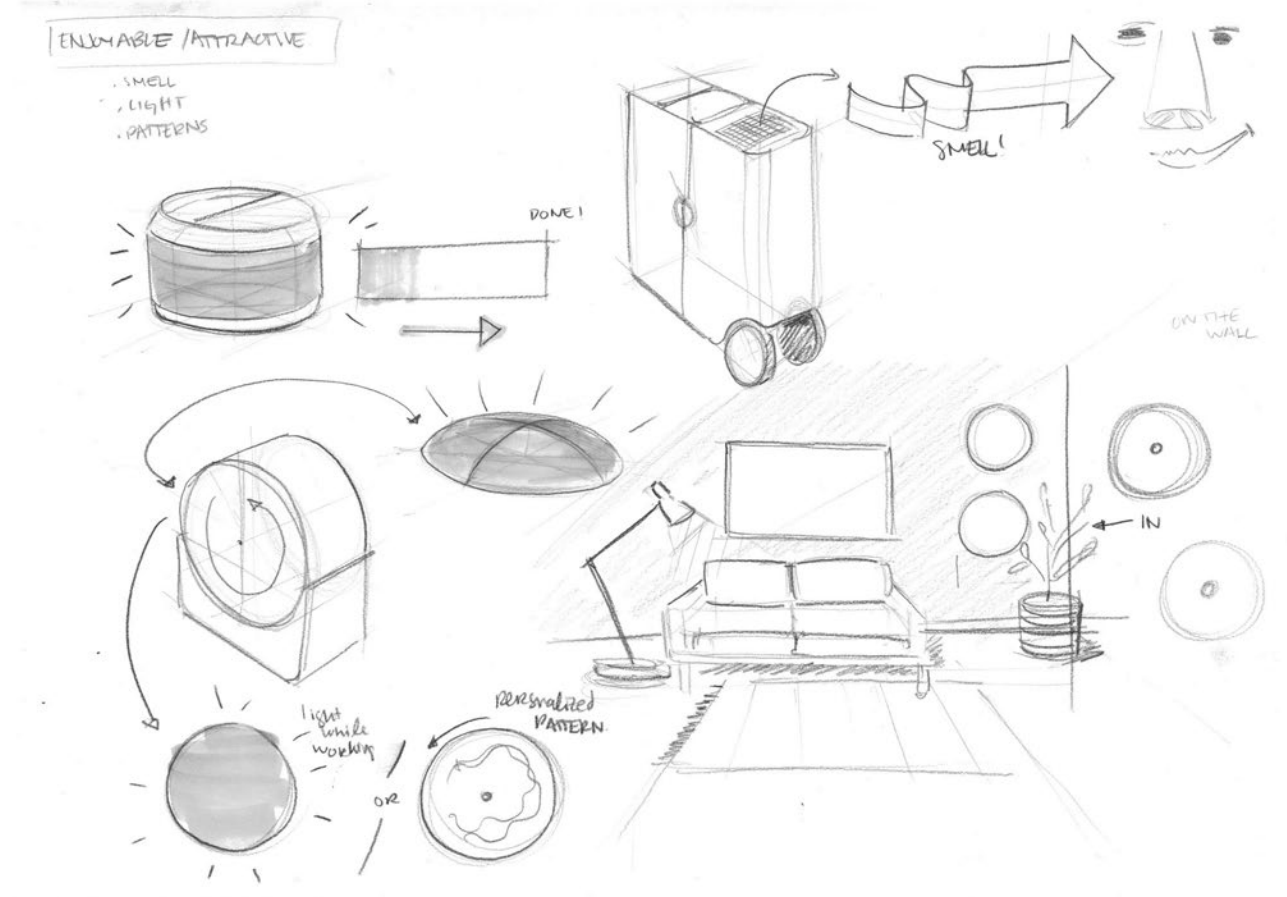
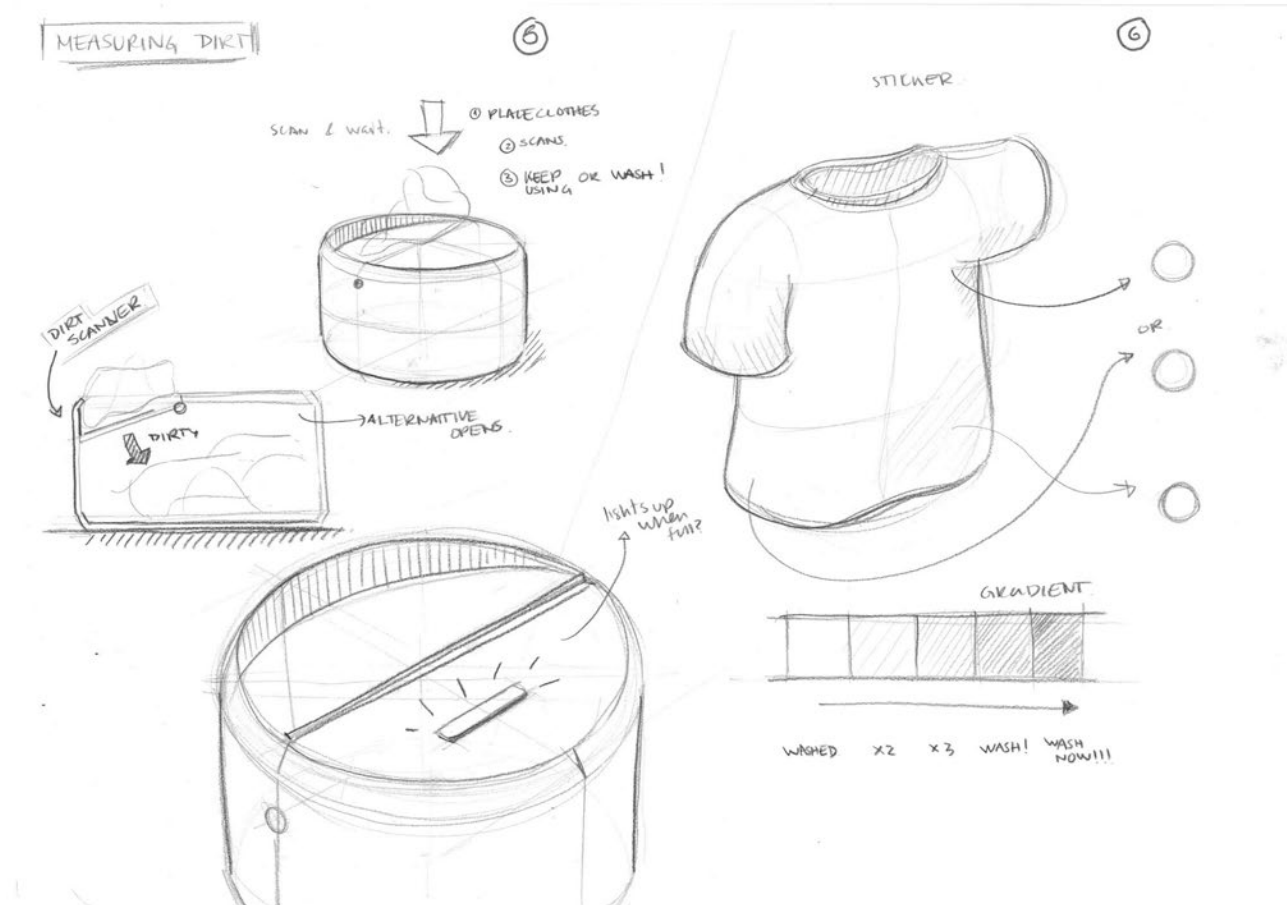
APPENDIX I

Ideation results set 1.

Set 1 of ideas resulted from ideation exercises using the created Personas (Appendix F) and their corresponding User Journey Maps. The overall goal of all the resulting ideas was to create the 'Ideal Washing Experience' in order to explore alternatives for the PSS to increase its perceived value in comparison with product based business models. The ideas considered 3 main values: Making the washing experience enjoyable, Making the washing experience more caring in order to have less environmental impact and a better sense of care, and making the washing experience less time and effort consuming.

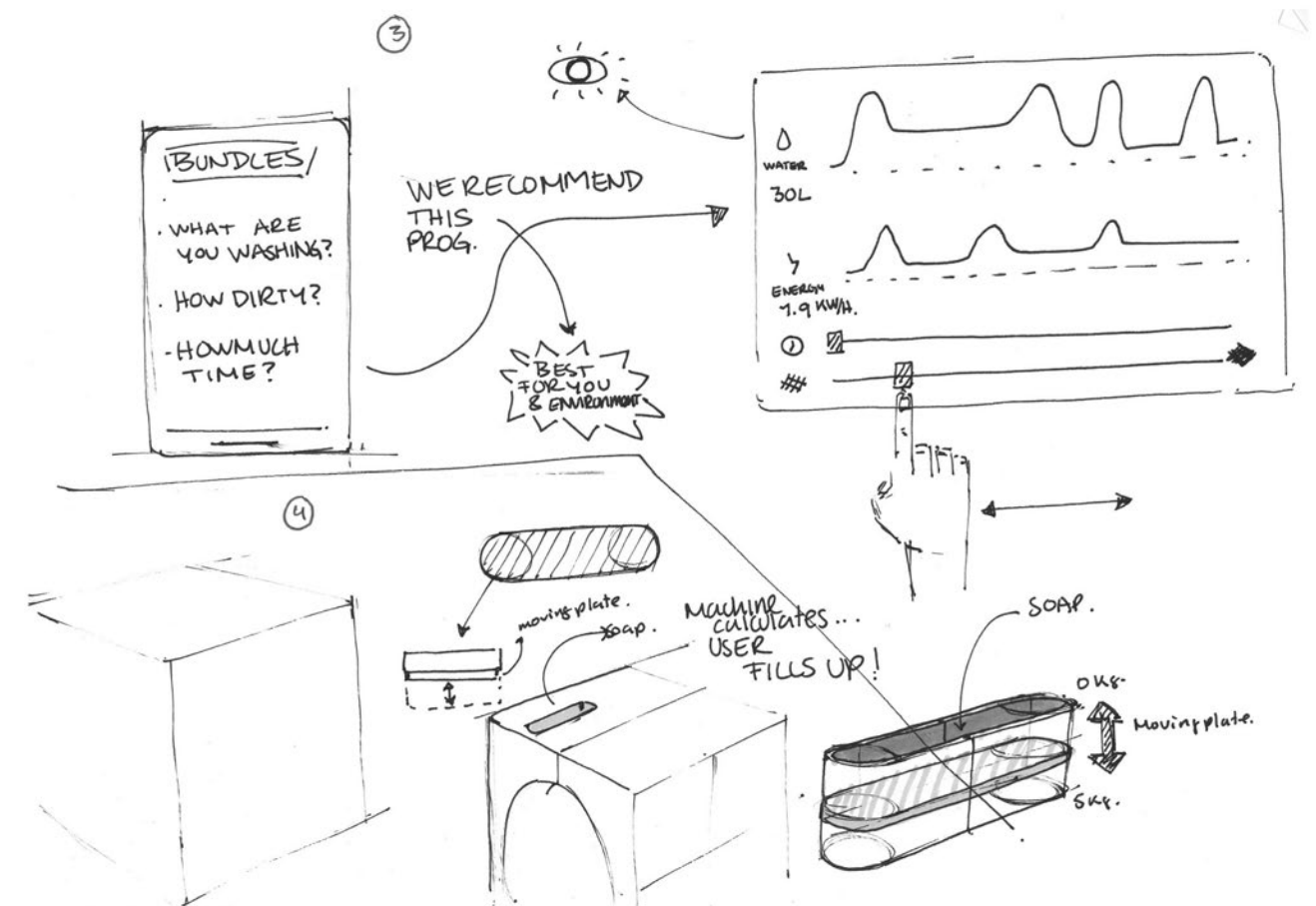


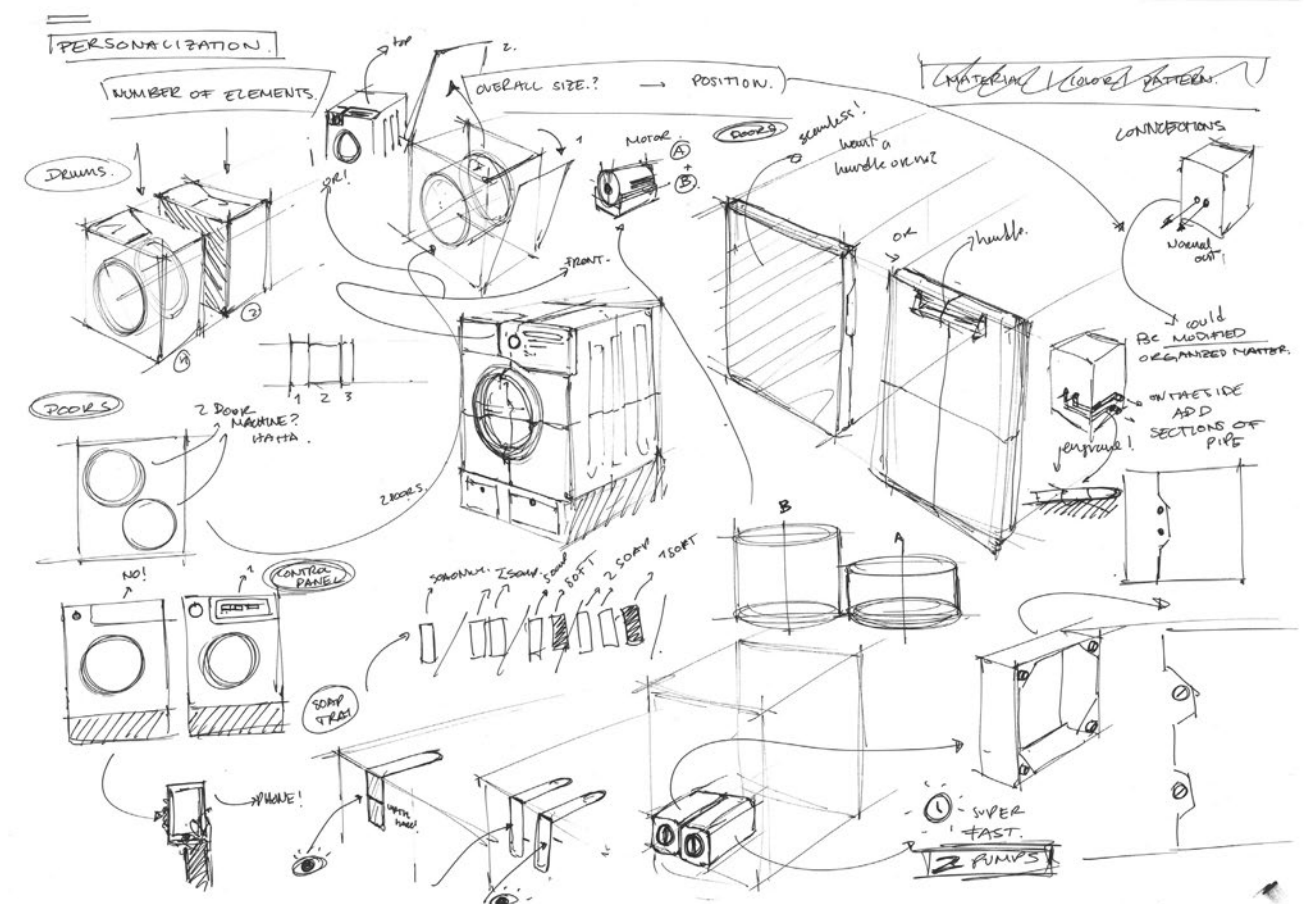
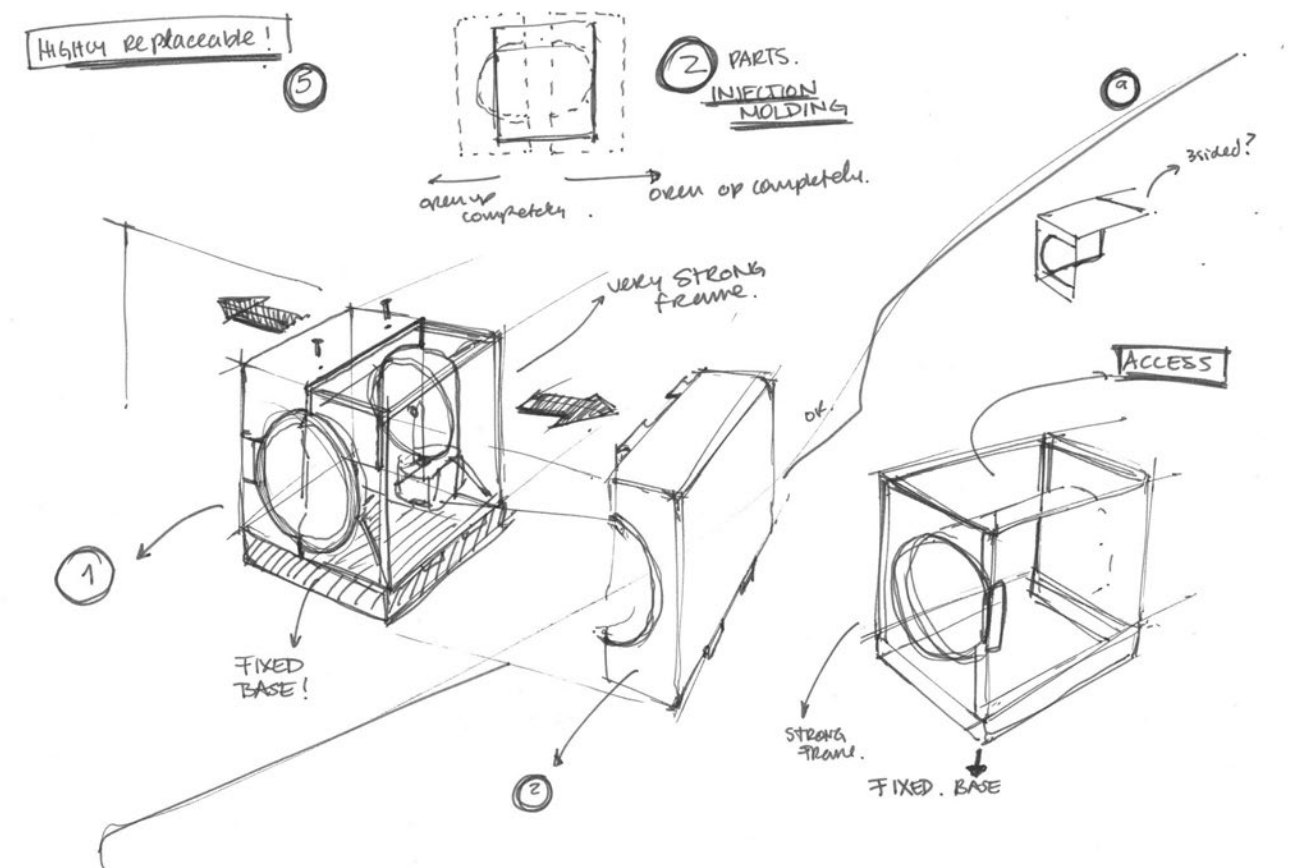
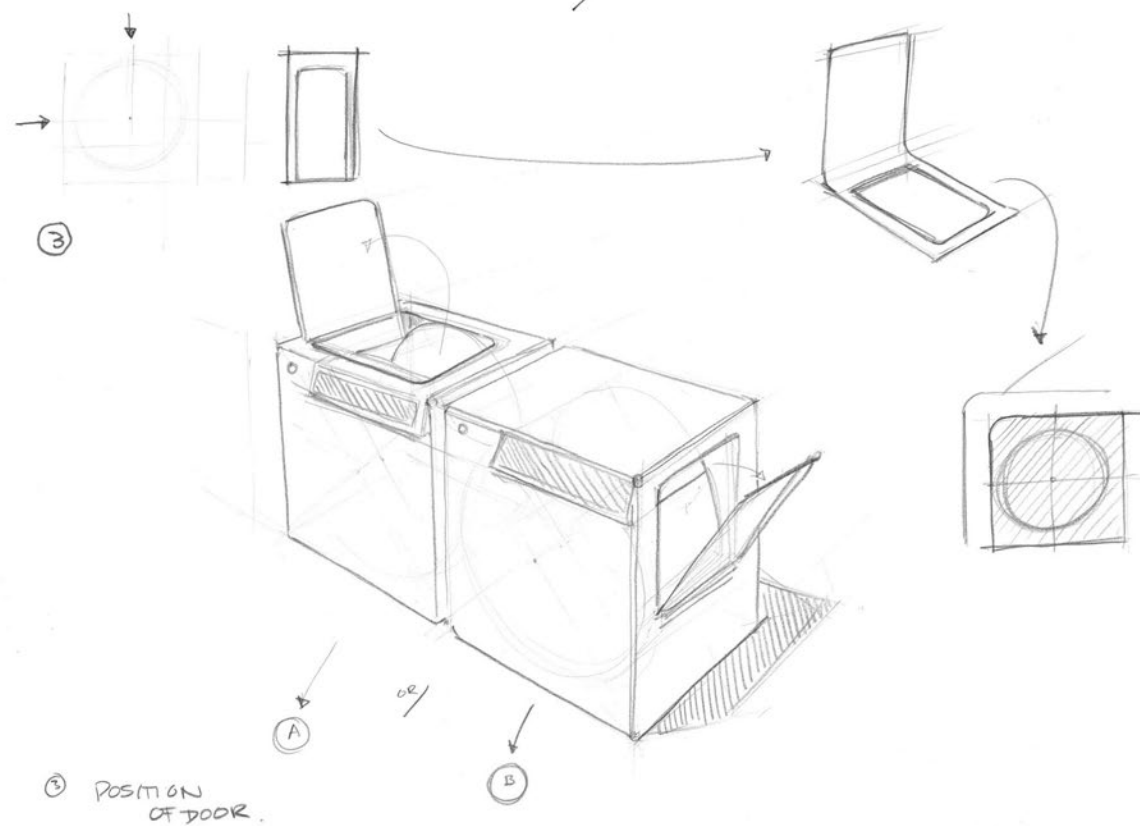
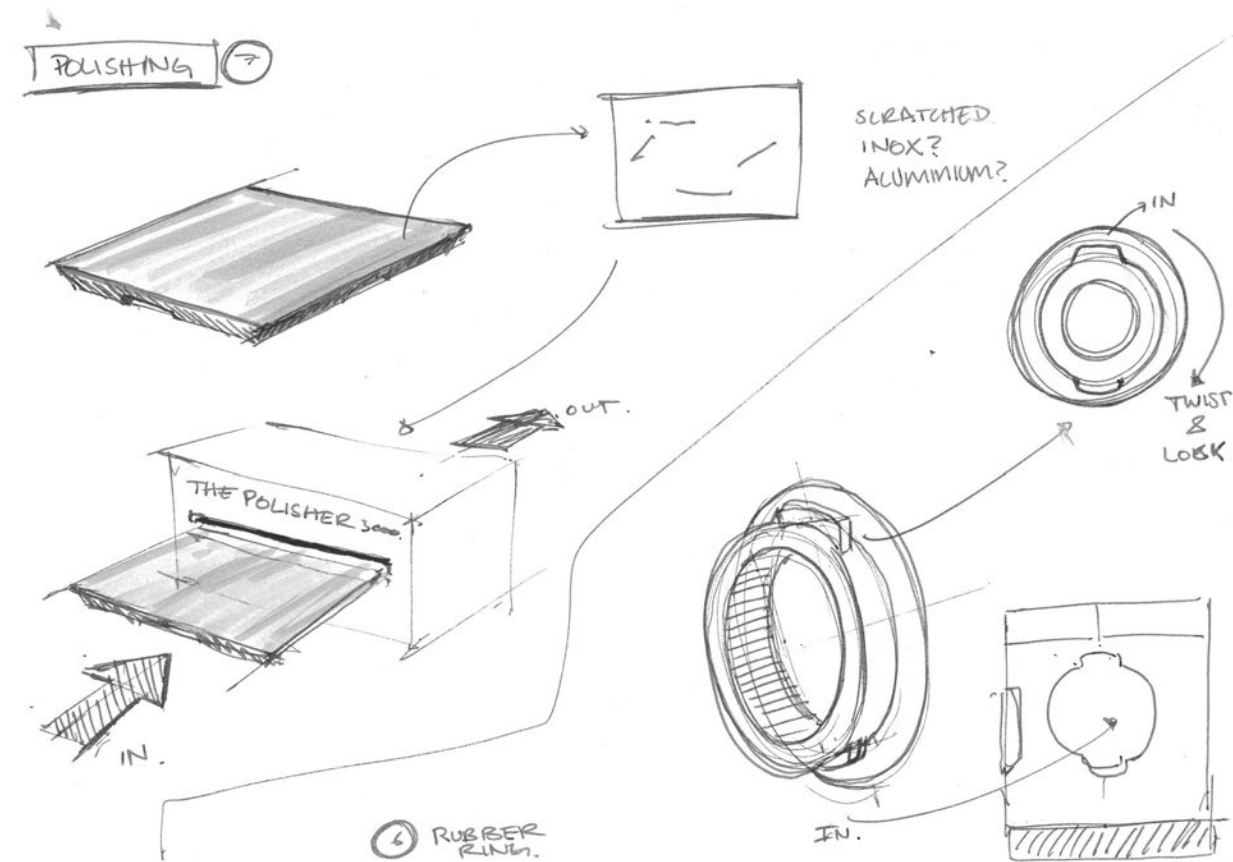




Ideation results set 2.

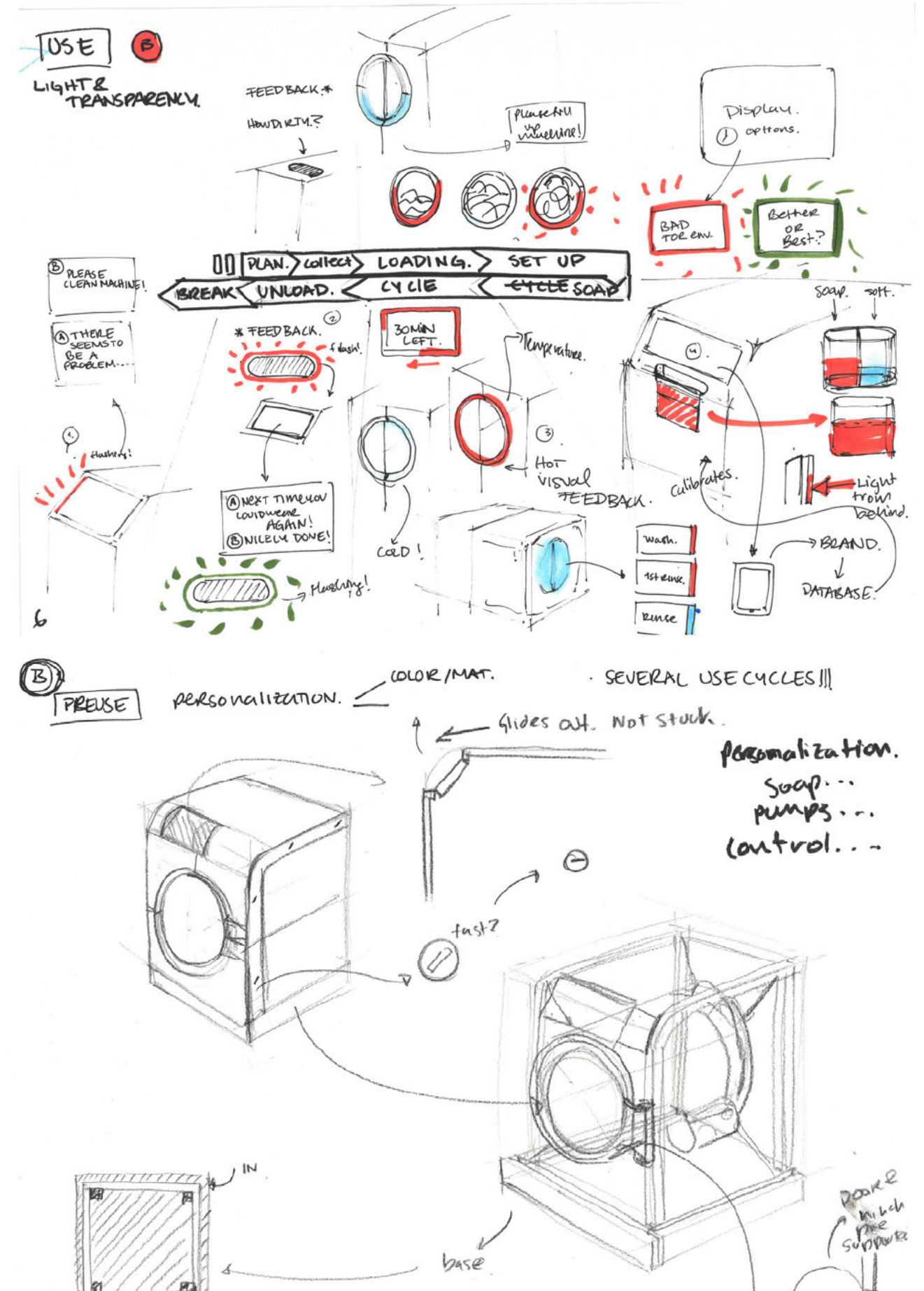
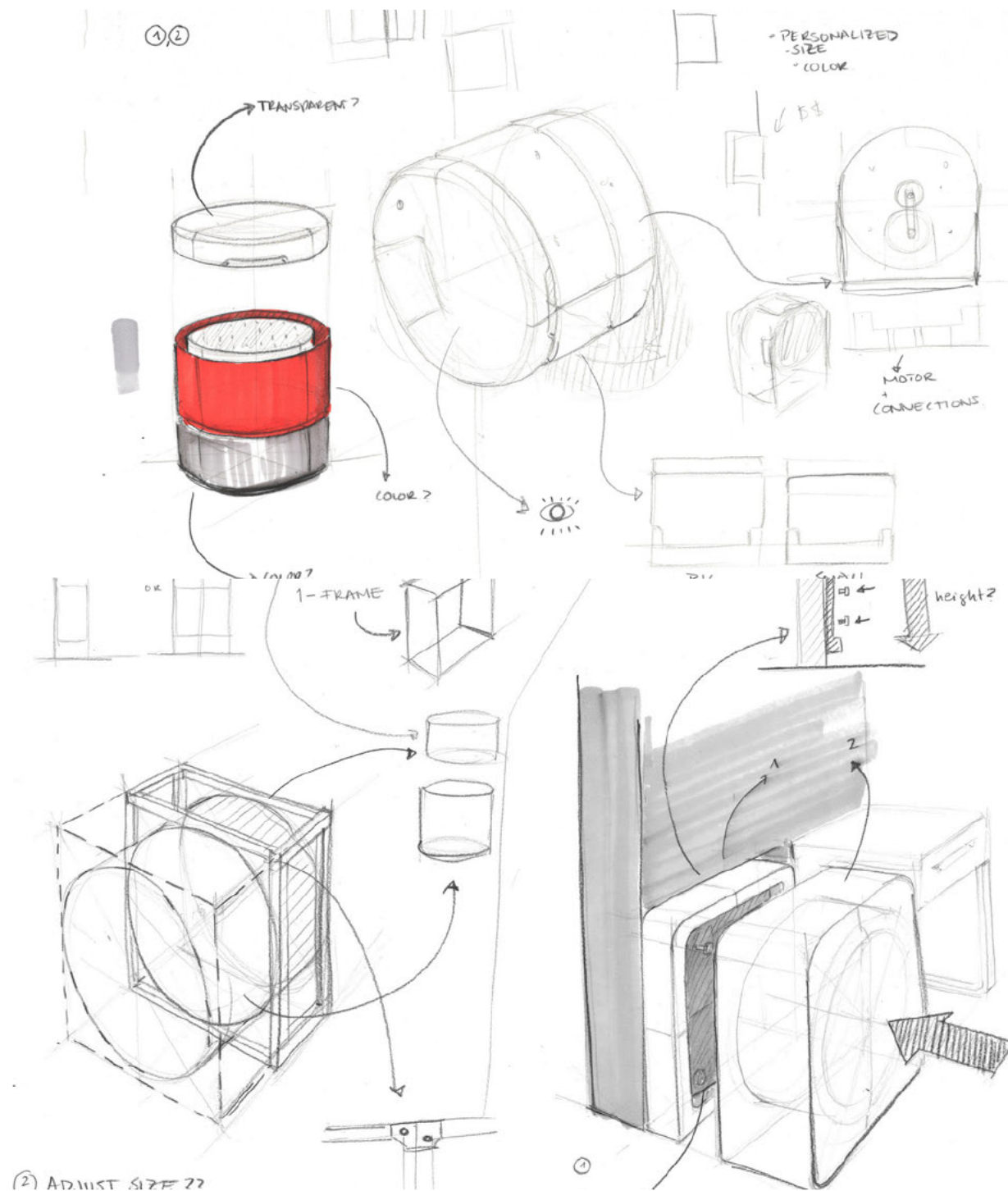
Set 2 of ideas is the result of the use of the Morphological charts (Appendix H). These ideas are specific to each one of the identified points. This exercise was useful to identify the most interesting points for further ideation and development. The following images show a few of the ideas that were generated through the exercise. There are approximately 2 or more ideas per sketch.

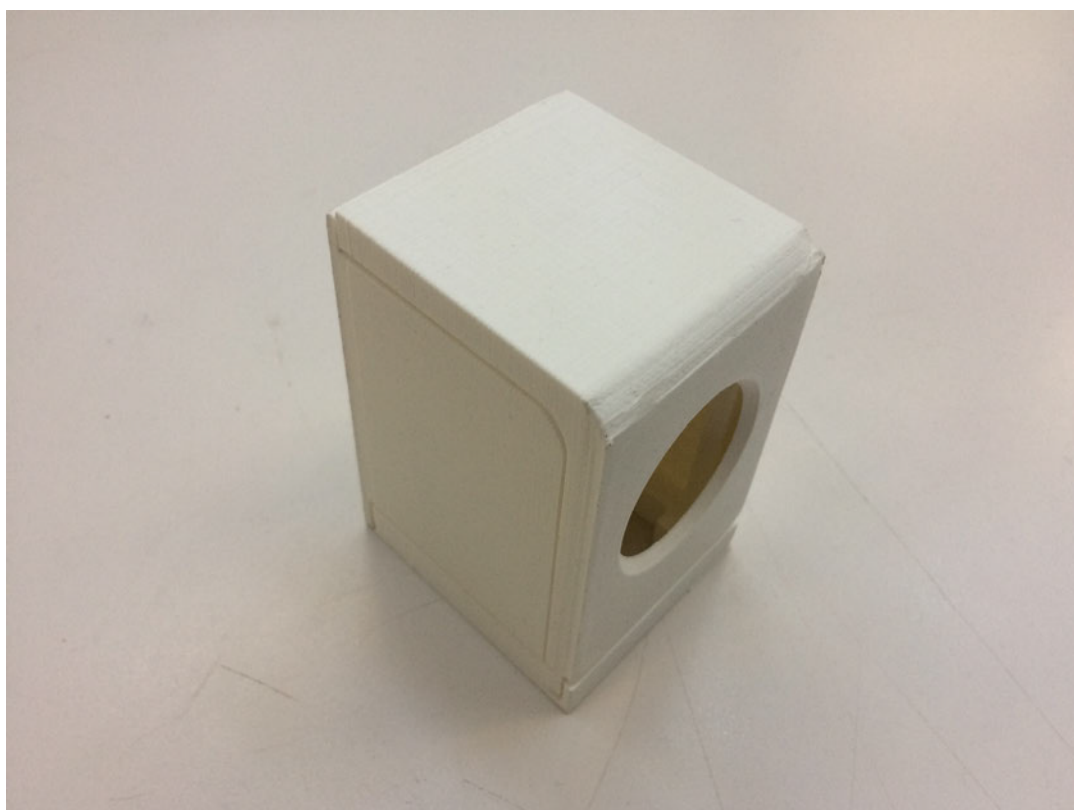
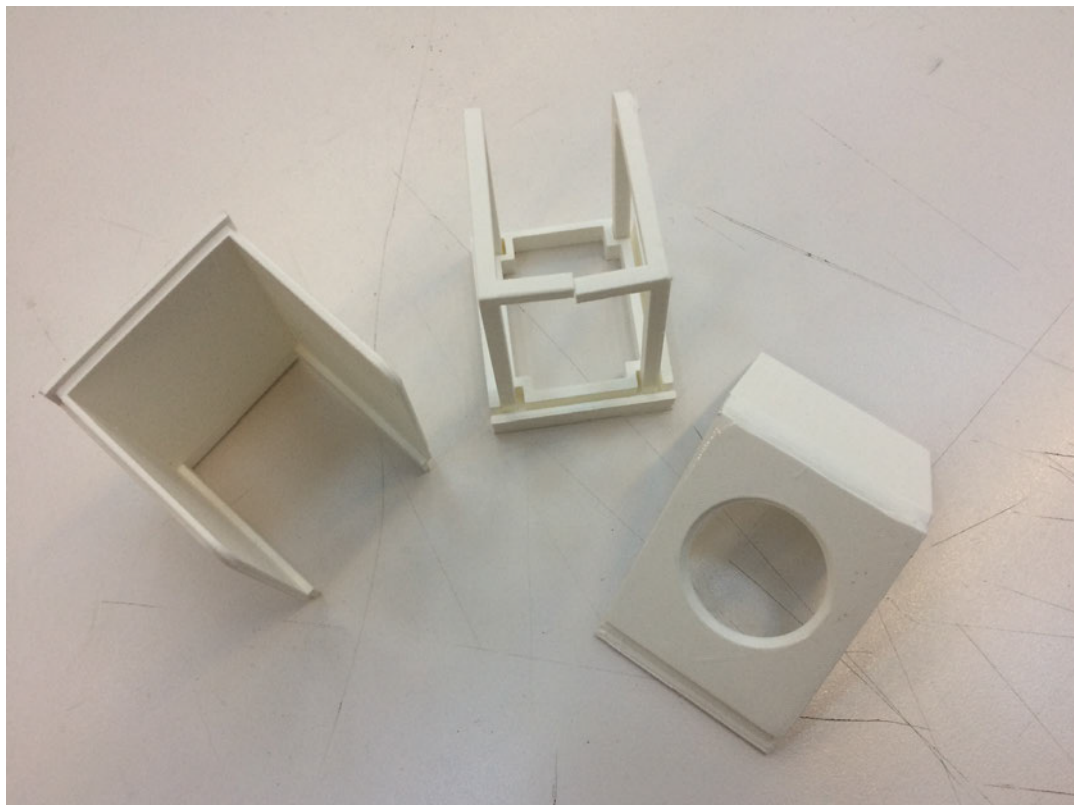




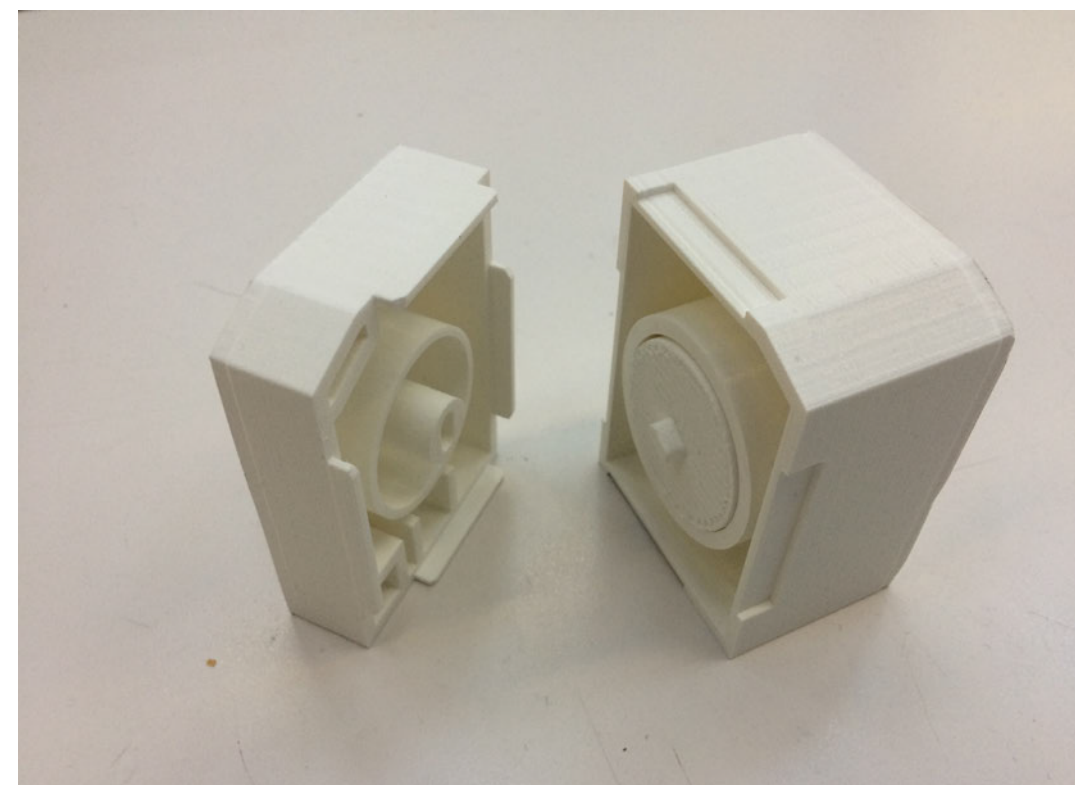
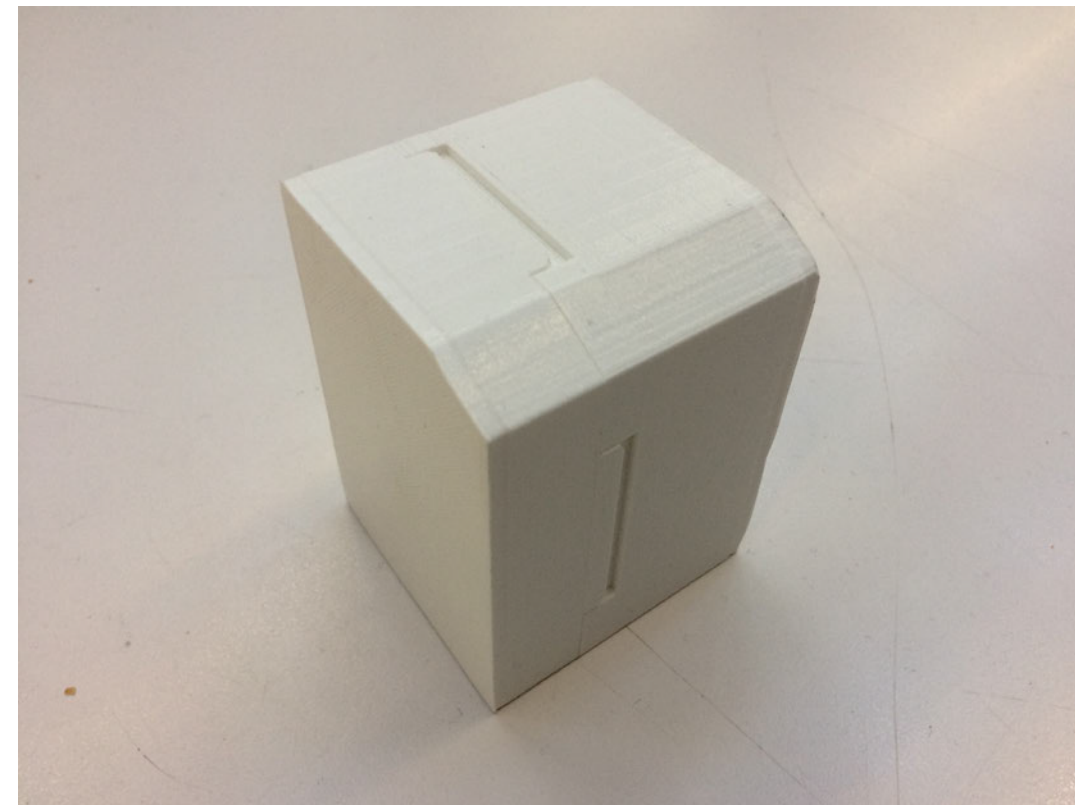
Ideation results set 3.

Idea set 3 is the result from the clustering of ideas from set 2 and from the identification of the points of interest from the Morphological Charts.





Fast 3d printed models for ideation. Replaceable layer and disassembly.



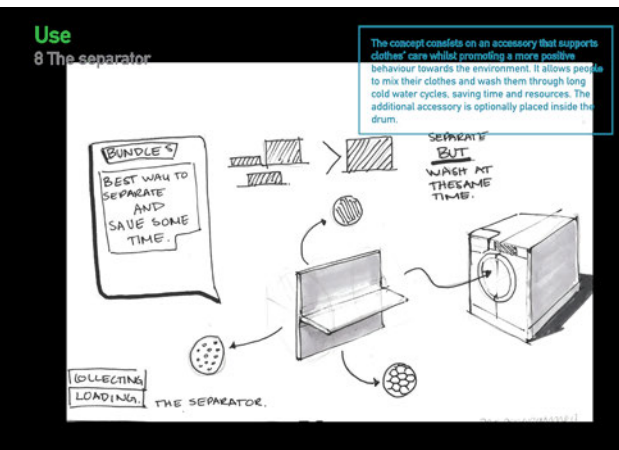
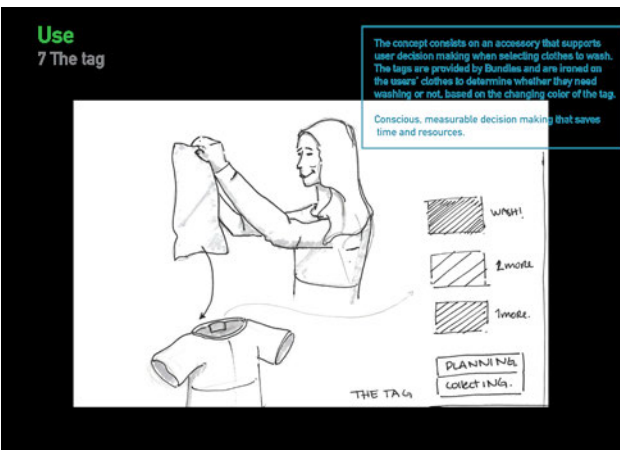
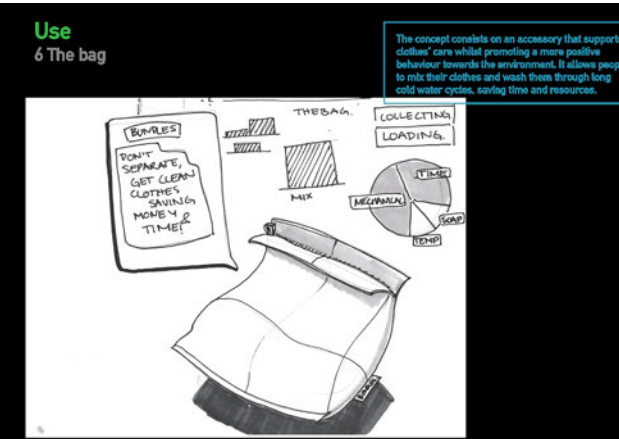
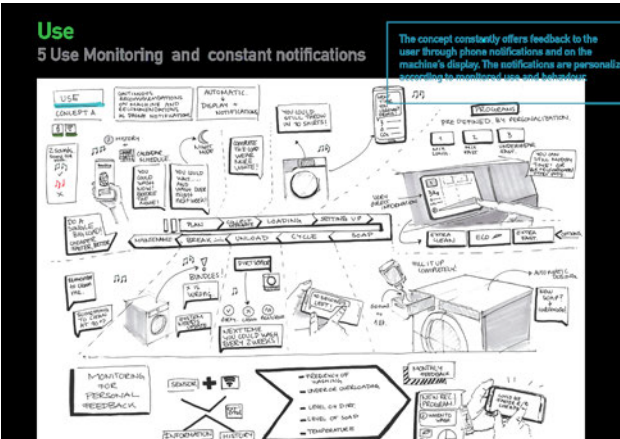
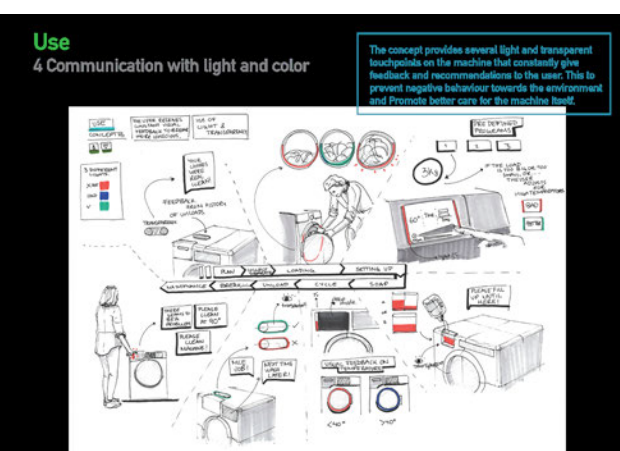
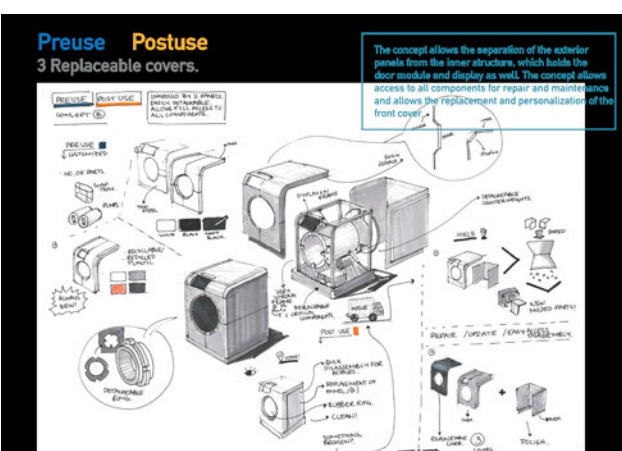
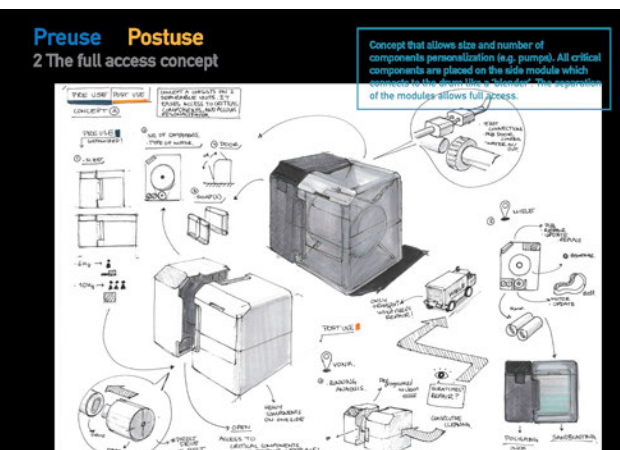
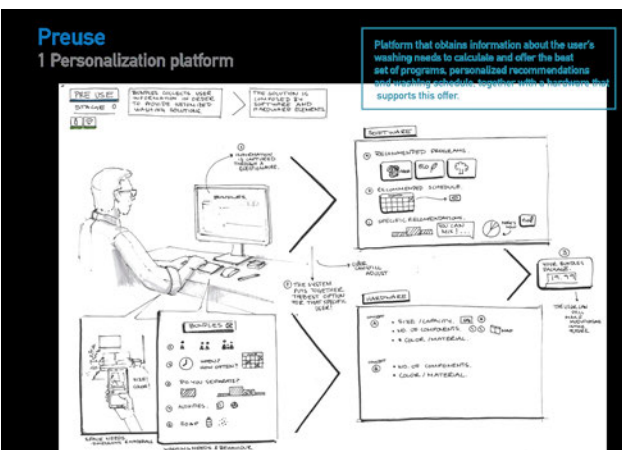
Fast 3d printed models for ideation. Acces to all critical components in one step.

APPENDIX J

Selection feedback session with students. The 2 perspectives.

The following eight concepts were presented to seven different students in order to obtain feedback and external input. After presenting the concepts, the participants were asked to choose one concept from the 'User point of view' and one more from the 'Service provider point of view'. In order to help them understand their position as either users or service

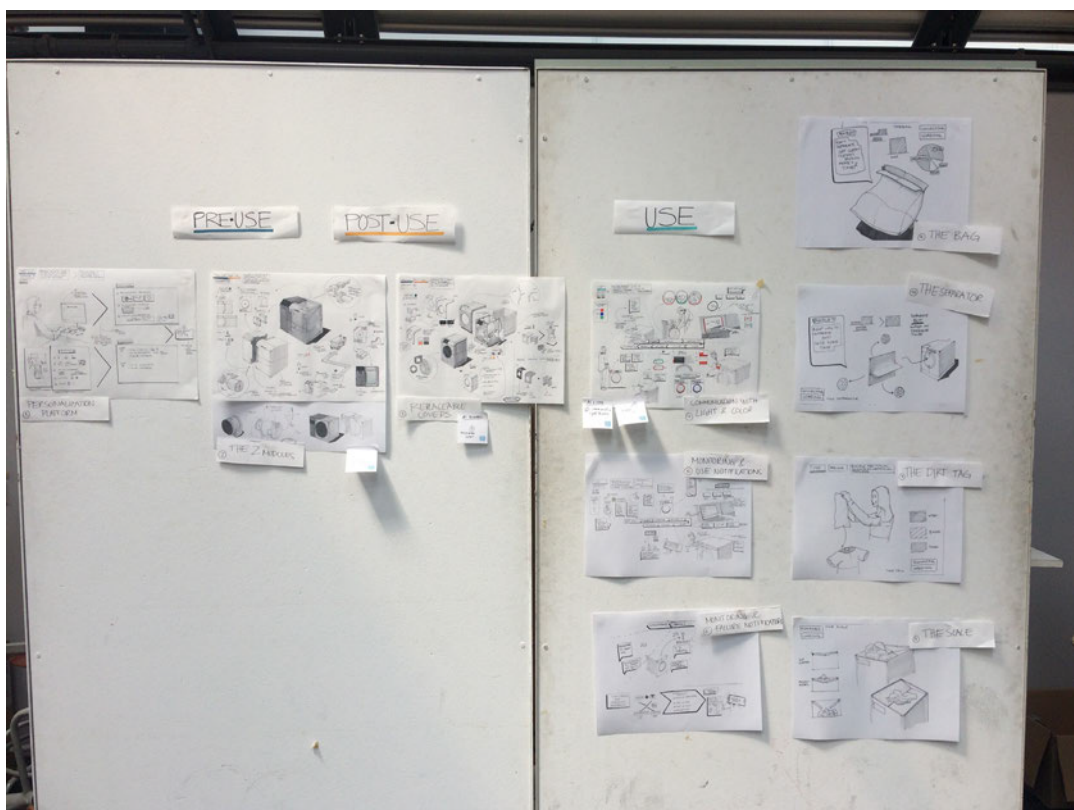
providers, an explanation of possible priorities for each one of these characters was provided prior to the decision making. The following images show the format in which the eight concepts were presented to the students and the definition of possible priorities for the user and service provider.



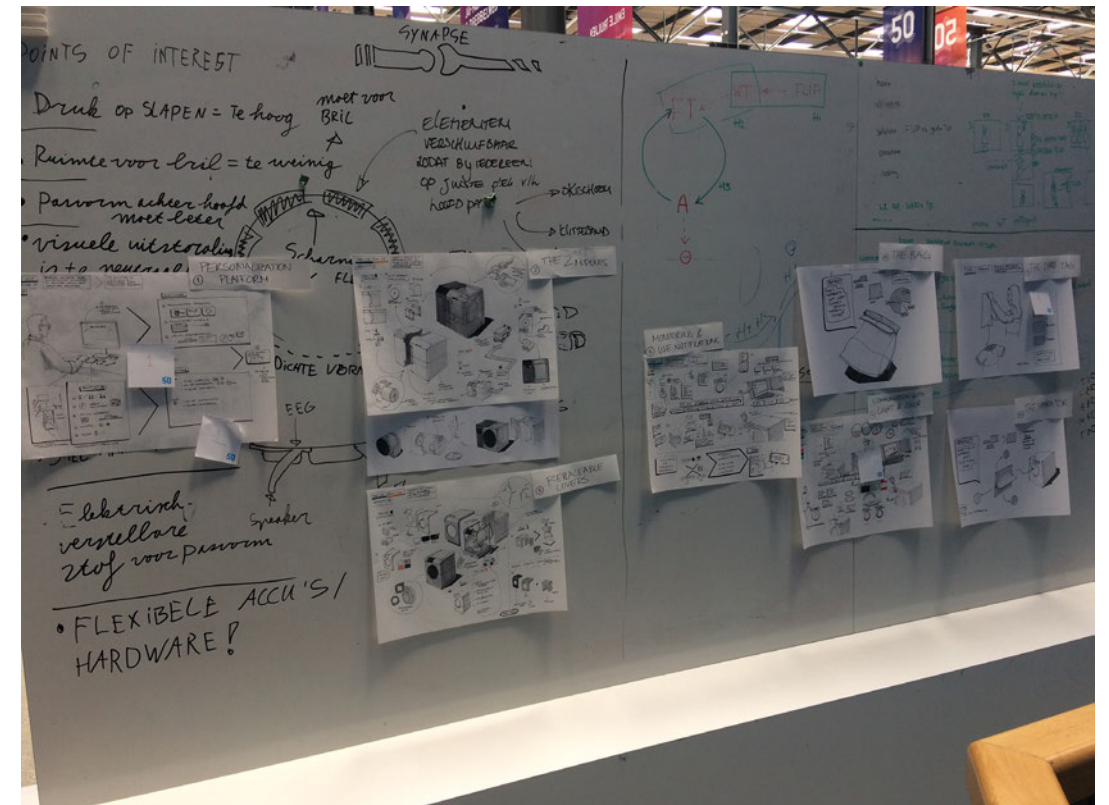
You want a better washing experience. You want to be informed. You want it to look nice. You maybe want to be more sustainable. You want to meet your needs better.

You want it to support several use cycles. You want the refurbishment to be cheap and fast. You want to grow and attract more customers.

The user and service provider perspective.



Presentation and voting session with students



2nd presentation and voting session.

APPENDIX K

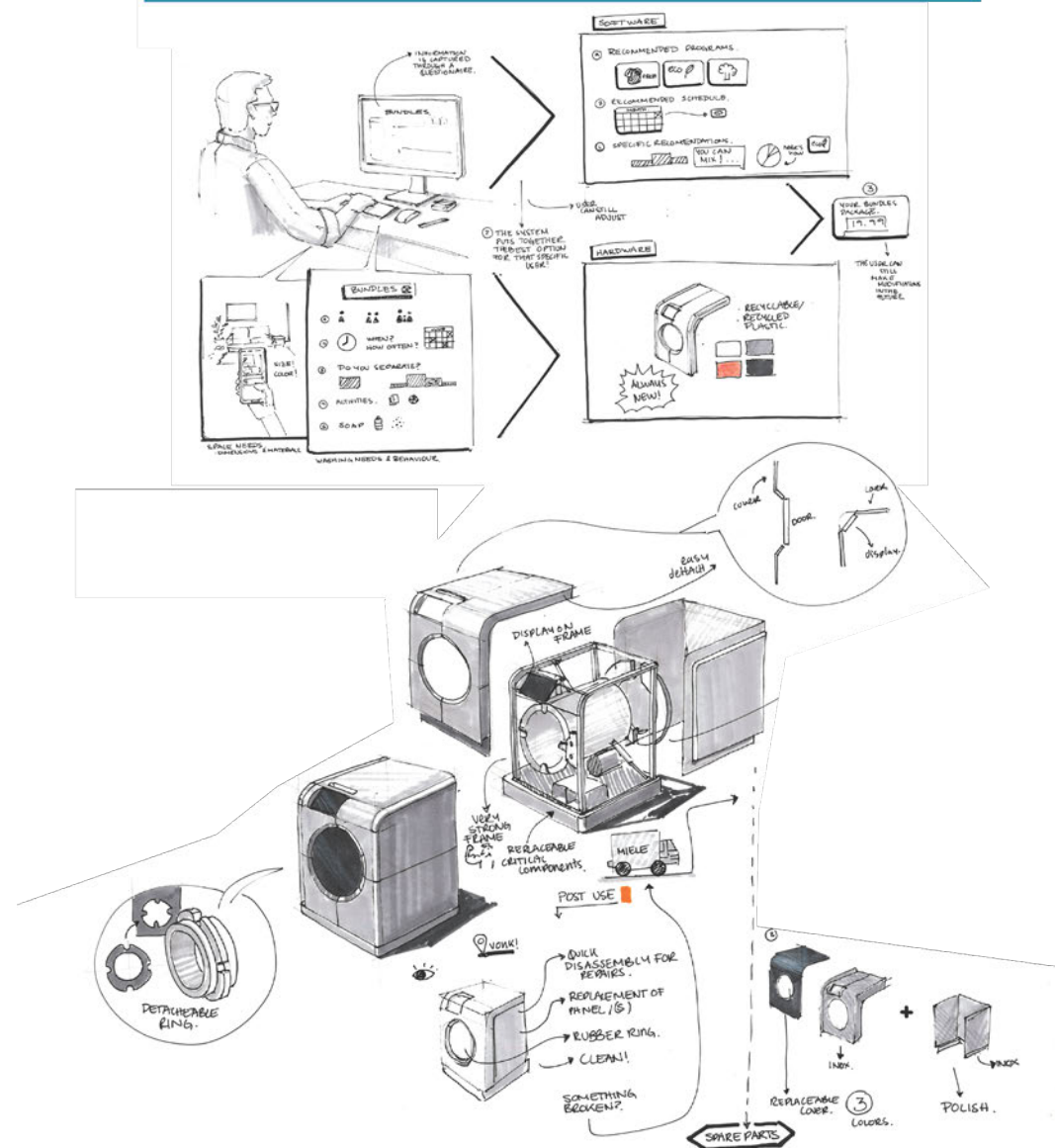
Selection feedback material for Bundles and Miele.

After the first selection exercise with students and expert, as well as the evaluation of the concepts with the list requirements, two concept combinations resulted. These were presented to both

Miele and Bundle in order to obtain more feedback and input. The following images show the material presented to the companies.

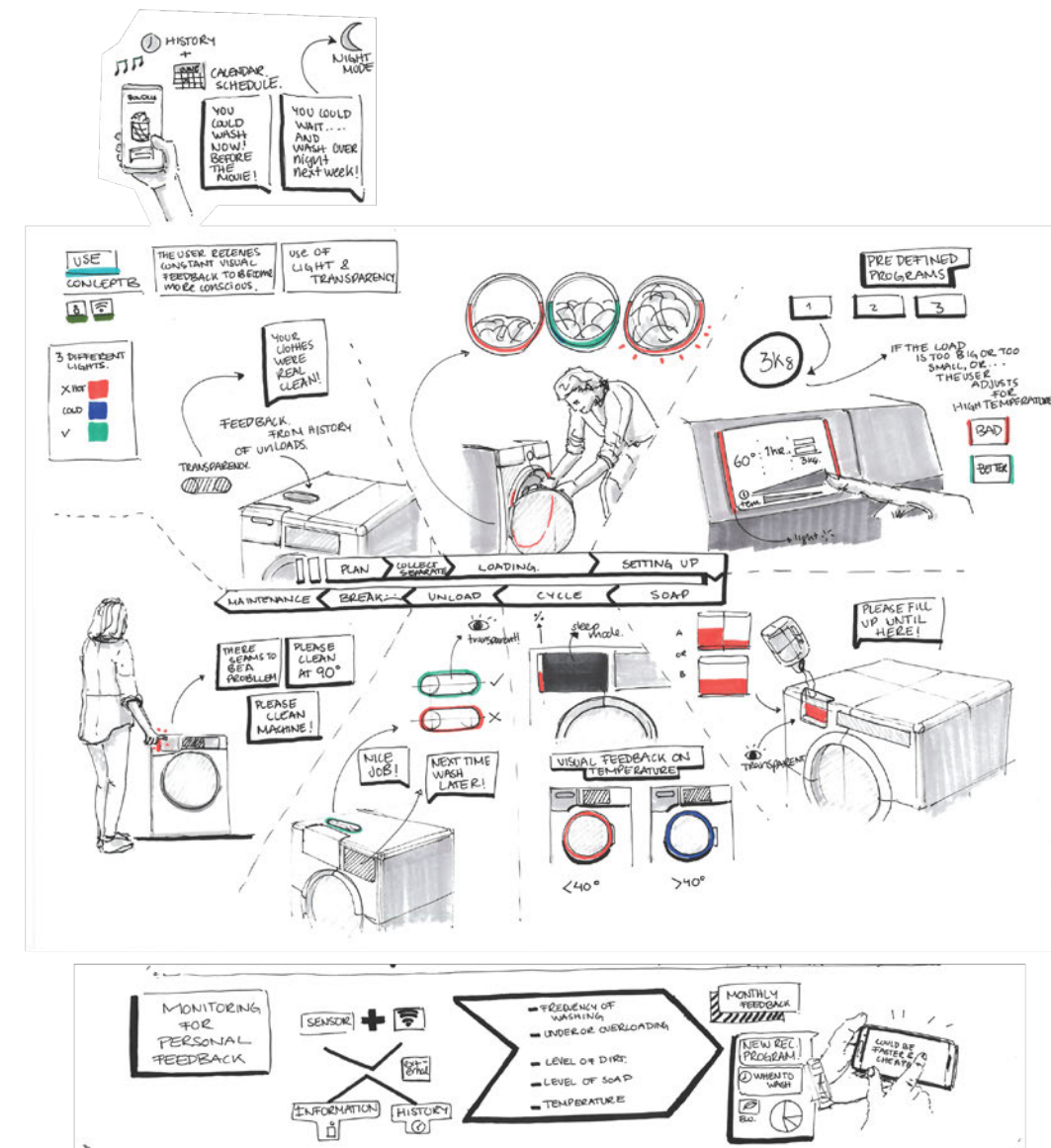
Combined Concept A Preuse Postuse Use

The combination of the concepts provides a platform that obtains information about the user's washing needs to calculate and offer the best set of programs and personalized recommendations, together with the personalization of the washing machine front material/color. The configuration of the panels makes access to components easier for repair and part replacement/update. The stainless steel panels allow for brushing as a refurbishment possibility and the thinner top/front cover is highly replaceable allowing personalization. The concept involves the user a lot during the preuse phase creating a closer relationship that delivers a better experience whilst reducing the environmental impact of the use phase.



Combined Concept B Use Preuse Postuse

This combination of concepts is less intensive during the preuse and post use phases and very intense during the use phase. The machine provides several light and transparent touchpoints on the machine that constantly give feedback and recommendations to the user supported by a constant monitoring of use and phone notifications. It promotes positive behaviour towards the environment, and personalized feedback and information for a better experience and better care of clothes. It adopts a preventive profile to ensure the best care of the machine to avoid excessive repairing and refurbishment costs.



APPENDIX L

Results of observation exercise with Miele NL technician of the disassembly of identified critical components.

The table shows the results of the observations derived from the assessment of the disassembly and repairability of the current washing machine through the selected parameters. Four priority components of the washing machine were selected to be disassembled (based on the priority components lists of Chapter 2.3.3):

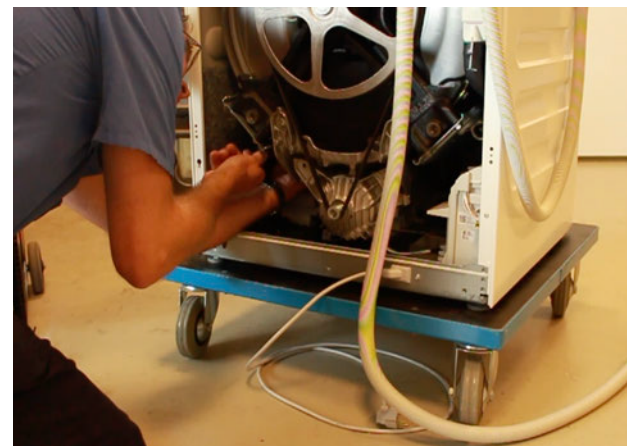
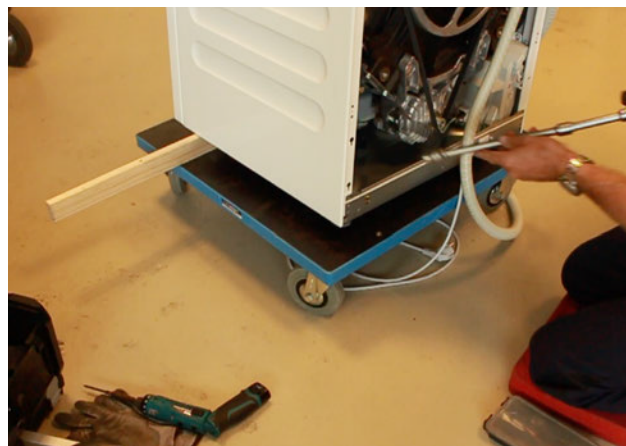
the shock absorbent, the door seal and lock, the motors and drive belt, and the electronic module for the power control. The available model for the assessment was: PowerWash 2.0 & Twindos XL. Wificonnect and the disassembly was performed by an experienced Miele technician at Miele NL.

<p>General notes.</p> <p>-Safety, skills and working environment. *The disassembly was performed by a professional Miele technician with 18+ years of experience. The architecture and complexity of the machine require extensive (1.5 yrs) preparation to obtain the necessary knowledge to perform repairs. Not all professional technicians have the same time of experience.</p> <p>*During the observation the machine was on an elevated (approx 15cm) platform with wheels, which facilitates mobility and manipulation of the machine. This is not always the case with repairs done in other locations.</p> <p>-Diagnosis support and interfaces. Type and availability of info. Miele washing machines, specifically those with an integrated Wifi module provide the technician with information related to the malfunction and an estimated diagnosis. Additionally the technician counts with extensive preparation and supportive documentation. This information is not publicly available.</p> <p>-Necessary tools. All tools used for the disassembly of the components are commercial tools. No product exclusive tools are used. Five different tools plus a support element on the side were used in total.</p> <p>-The measurements only consider disassembly and reassembly times, leaving out the time that diagnosis and precaution measurements take during a normal service procedure.</p>				
Component	Disassembly and reassembly time (min).	Disassembly sequence. No. of steps	Notes on Fasteners. No. and type.	Notes on conditions. Ease of access, light, position, manipulation.
Shock absorbent. Images 1-4	Disassembly: 3 min 4 seg Reassembly: 2 min 56 seg	1. Remove back panel. 2. Remove internal screw and external nut (bottom). 3. Manipulate the component to release.	Torx 20 screw: 9 pcs Hexagonal screw: 1pcs Hexagonal nut: 1pcs	A) Limited mobility and visibility. The component is far from access point. Needs arm extension and both hands. Needs tool extension. No space for tool manipulation. B) Lifting is necessary from the side. Supporting element necessary.
Electronic module, Printed Circuit Board (Power control). Images 5-8	Disassembly: 3 min 44 seg Reassembly: 4 min 11 seg	1. Remove back panel. 2. Manipulate and remove the cover of the module housing. 3. Unplug all connections to other components. 4. Remove top element of the control module. 5. Remove the screw and manipulate to release PCB.	Torx 20 screw: 9 pcs	A) Limited mobility and visibility. The housing of the electronic module always stays in. Limited space to manipulate cover. Even with lamp visibility is limited for connections. B) Sharp edges and limited space. The technician got a cut in the process. Gloves are recommended but limit sensitivity and mobility.
Drive belt. 9-12	Disassembly: 1 min Reassembly: 1 min 30 seg	1. Remove back panel. 2. Manipulate to release the belt.	Torx 20screw: 9 pcs	A) Good visibility and space for manipulation.

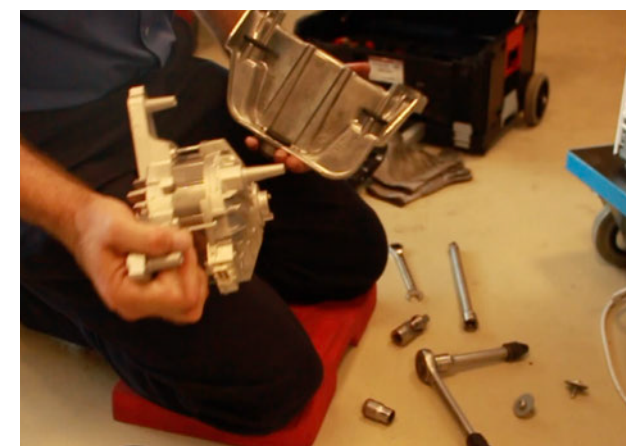
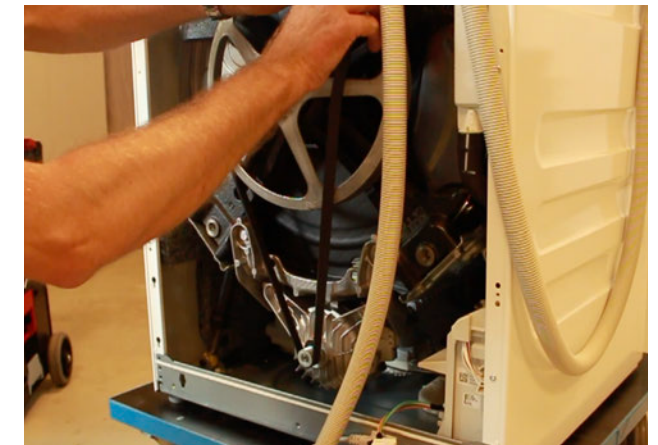
Motor.	Disassembly: 2 min 56 seg Reassembly: 4 min 26 seg	1. Remove back panel. 2. Manipulate and release belt. 3. Remove screws and release motor housing. 4. Unplug all connections to power control. 5. Remove screws to release motor from housing.	Torx 20screw: 9 pcs Hexagonal screw: 2pcs Torx 40screw: 2 pcs	A) Good visibility and easy to access. Subassembly makes process easier. B) Space is limited for tool use.
Door Lock.	Disassembly: 4 min 11 seg Reassembly: 5 min 48 seg	1. Remove tip panel. 2. Remove Soap drawer. 3. Remove control panel. 4. Remove lock cover. 5. Remove door seal external fastener. 6. Remove front panel. 7. Manipulate to release the lock module.	Screw covers: 2pcs. Always need to be replaced. Torx 20 screw: 2 pcs Torx 20 screw: 1 pcs Fastener seal: 1pcs Torx 20 screw: 2 pcs Torx 60 screw: 1 pcs	A) Good visibility.
Door seal (rubber ring).	Disassembly: 6 min 8 seg Reassembly: 8 min 31 seg	1. Remove tip panel. 2. Remove Soap drawer. 3. Remove control panel. 4. Remove lock cover. 5. Remove door seal external fastener. 6. Remove front panel. 7. Unplug control, pipes, and light. Release door seal internal fastener. 8. Manipulate to liberate door seal.	Screw covers: 2pcs Torx 20 screw: 2 pcs Torx 20 screw: 1 pcs Fastener seal: 1pcs Torx 20 screw: 2 pcs Torx 60 screw: 1 pcs Fastener seal: 1pcs.	A) Good visibility. B) Connections to the door seal are too short and hard to manipulate. C) Extraction and insertion of the seal is complex. D) Sharp edges require the use of gloves, limiting sensitivity.

The following images illustrate the identified complications of the disassembly of the components mentioned above. The images were extracted from the original video taken from the

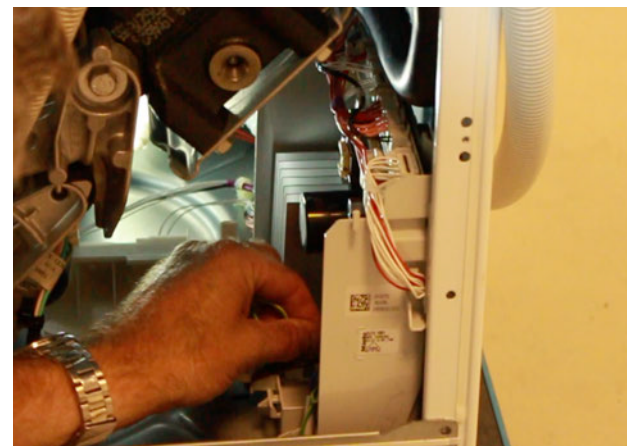
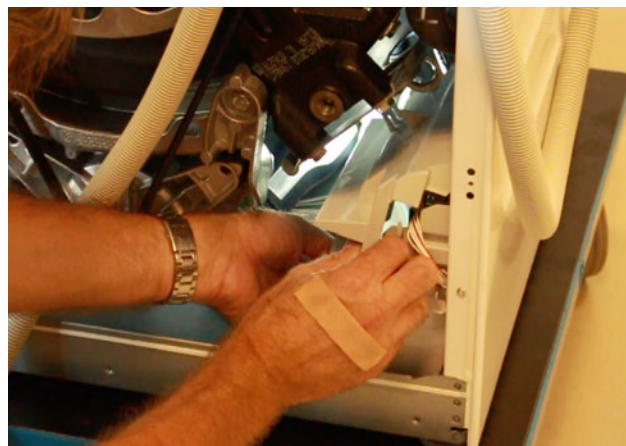
Images obtained from the video of the
disassembly and reassembly of the shock
absorbent:



Images obtained from the video of the
disassembly and reassembly of the motor
and belt:



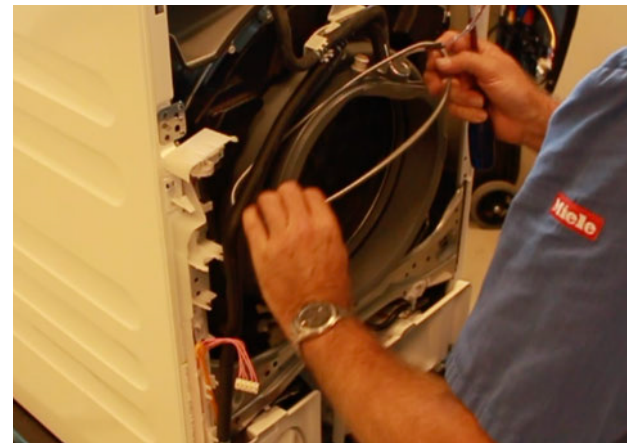
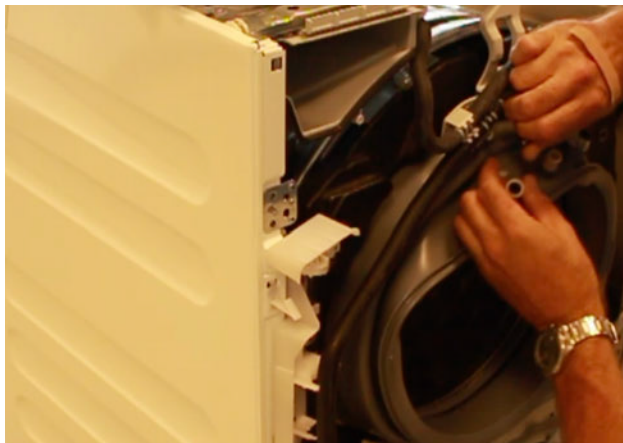
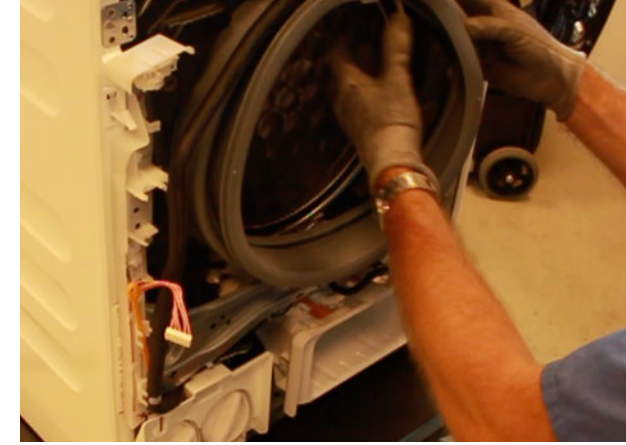
Images obtained from the video of
the disassembly and reassembly of
the electronic module of the power control:



Images obtained from the video of
the disassembly and reassembly of
the electronic module of the door lock and
door seal:



Images obtained from the video of
the disassembly and reassembly of
the electronic module of the door lock and
door seal:



Results of evaluation of concepts with scoring system against the list of requirements.

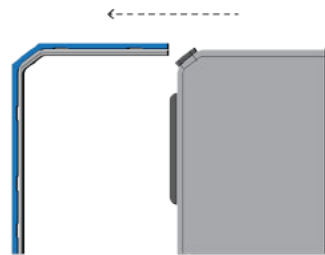
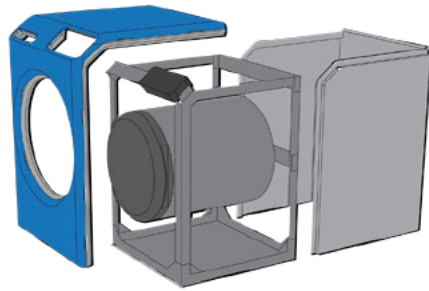
Initial Requirements Introduction Chapter. Assignment 1.2						
		Concept 1 Personalization platform	Concept 2 The 2 module machine	Concept 3 The replaceable cover machine	Concept 4 Communication through light and transparency	Concept 5 Communication through notifications and monitoring.
	COULD	Score	Score	Score	Score	Score
	The design could deliver new opportunities for collaboration between Miele and Bundles.	2	2	2	2	2
	The design could maintain the Use Oriented PSS model of Bundles. Chapter 2.3.1.1 and Chapter 2.1.1	2	2	2	2	2
		4	4	4	4	4
Design Criteria. Result from analysis.						
	COULD	Score	Score	Score	Score	Score
RE USE. Personalization	The design could aim to expand the pool of targeted customers. Chapter 2.3.1.1	1	1	2	2	1
	The design could increase the volumes and value for Bundles and Miele. Chapter 2.3.1.2 The increase in volumes could increase interest in CE procedures as a business strategy. Considering the recovery and recycling of materials as well as service and spare parts services. Chapter 2.3.1.2 Chapter 2.1.2	1	1	2	2	1
	The design could attract customers through emotion. Chapter 2.3.1.4 and Chapter 2.3.2.3	2	1	2	2	1
	The delivery of customized washing solutions could be a strategy to avoid overuse of resources or materials, and reduce overall environmental impact.	2	0	0	2	2
		6	3	6	8	5
	COULD	Score	Score	Score	Score	Score
POST USE Refurbishment	The design could increase the opportunities for a Miele and Bundles collaboration through refurbishment and part replacement. Chapter 2.3.1.2 and Chapter 2.3.3.1 2.3.1.1	0	2	2	1	1
	The design could monitor the intensity of use through IoT for repair and refurbishment purposes. Chapter 2.3.1.2	0	2	2	1	1
	The design could reduce material input by reusing and recycling. Chapter 2.1.2	0	2	2	0	0
		0	6	6	2	2
	COULD	Score	Score	Score	Score	Score
RE USE Communication	The design could be resilient to misuse. Chapter 2.3.2.3	1	1	1	1	1
	The design could monitor the user activities through IoT technologies in order to deliver a better experience. Chapter 2.1.1 and Chapter 2.3.2.3	2	1	1	2	2
	The design could monitor the user behaviour through IoT and use the information to deliver feedback related to maintenance and care. Chapter 2.3.2.1, Chapter 2.3.2.3 and Chapter 2.3.2.2	0	1	1	2	2
	The design of the PSS could monitor the user behaviour and use the information to reduce environmental impact. Chapter 2.3.2.1 and Chapter 2.1.3	2	1	1	2	2
		5	4	4	7	7
		Concept 1 Personalization platform	Concept 2 The 2 module machine	Concept 3 The replaceable cover machine	Concept 4 Communication through light and transparency	Concept 5 Communication through notifications and monitoring.
	Overall total	Overall total	Overall total	Overall total	Overall total	Overall total
		15	17	20	21	28

	Concept 1 Personalization platform	Concept 2 The 2 module machine	Concept 3 The replaceable cover machine	Concept 4 Communication through light and transparency	Concept 5 Communication through notifications and monitoring.
	Score	Score	Score	Score	Score
on between	2	2	2	2	2
Bundles.	2	2	2	2	2
	4	4	4	4	4
	Score	Score	Score	Score	Score
g. Chapter	1	1	2	2	1
and Miele.	1	1	2	2	1
res as a aterials as aster 2.1.2	2	1	2	2	1
gy to avoid mental impact.	2	0	0	2	2
	6	3	6	8	5
	Score	Score	Score	Score	Score
ndles pter 2.3.1.2	0	2	2	1	1
pair and	0	2	2	1	1
g. Chapter	0	2	2	0	0
	0	6	6	2	2
	Score	Score	Score	Score	Score
ologies in order	1	1	1	1	1
	2	1	1	2	2
use the e. Chapter	0	1	1	2	2
use the nd Chapter	2	1	1	2	2
	5	4	4	7	7
	Concept 1 Personalization platform	Concept 2 The 2 module machine	Concept 3 The replaceable cover machine	Concept 4 Communication through light and transparency	Concept 5 Communication through notifications and monitoring.
	Overall total	Overall total	Overall total	Overall total	Overall total
	15	17	20	21	18

APPENDIX N

Material used for the concept presentation and evaluation with Miele, Bundles and user

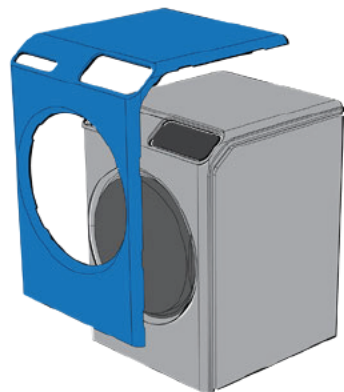
The following material was used as a preliminary presentation of the final concept in order to obtain feedback and comments from Miele, Bundles and user.



1. Access and repairability

The product is composed by a strong inner frame that holds all components (including door module and display) and 2 stainless steel panels. This configuration reduces the number steps to access components for repair or replacement, and creates space for mobility.

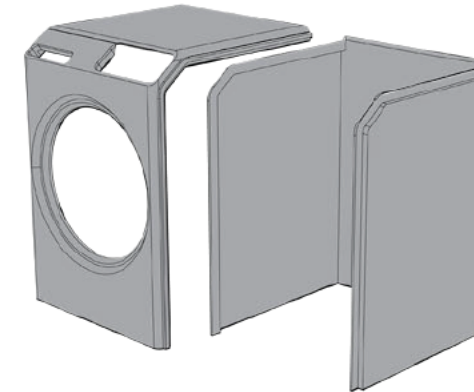
Additionally, it has a rear access point attached to the back/sides panel.



2. Personalization.

The product has a replaceable thin steel layer fit fixed to the top/front panel. The panel is painted to the user's preference.

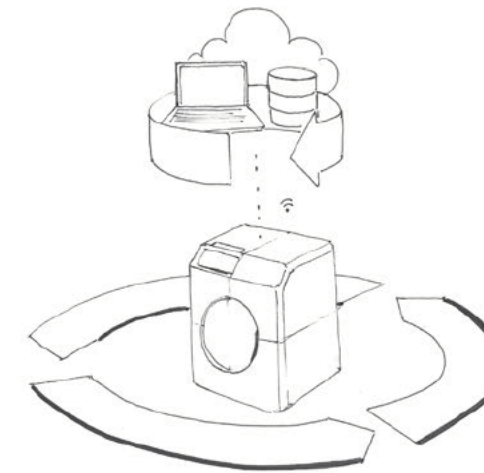
Personalized layers are sandblasted and painted again making them reusable and refurbishable.



3. Refurbishable.

If scratched or stained the stainless steel panels can be refurbished by brushing them.

Platform and Database Functions



Personalization of the 'Washing Package' (programmes, frequency, personal tips). The package is configured by an algorithm that compares the user needs (obtained from a questionnaire to each user) vs desired actions (to reduce env. impact).

User profile and product profile. The system generates profiles that can be used for installation, repairs and refurbishment. The profiles include information of expected behaviour of the user and overall use of the machine.

Adjust and update of the washing package based on the results from monitoring of use. The data of the monitored use is compared to the initial data of the expected behaviour of the user; if changes are detected the user obtains a notification to change or update their Washing Package (new program needed, reduce frequency, etc).

Personalization of the exterior color of the machine and the desired user interface for the control panel. The selected controller is loaded into the display through the IoT module.

APPENDIX 0

Master graduation brief

DESIGN
FOR OUR
future

3191

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according to the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1!

family name		Your master programme (only select the options that apply to you):
initials		IDE master(s): <input checked="" type="checkbox"/> IPD <input type="checkbox"/> DFI <input type="checkbox"/> SPD
student number		2 nd non-IDE master: _____
street & no.		individual programme: _____ (give date of approval)
zipcode & city		honours programme: <input type="checkbox"/> Honours Programme Master
country		specialisation / annotation: <input type="checkbox"/> Medisign
phone		<input checked="" type="checkbox"/> Tech. in Sustainable Design
email		<input type="checkbox"/> Entrepreneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right!

** chair	Jotte de Koning	dept. / section:	DE / DFS
** mentor	Mark Sypesteyn	dept. / section:	ID / HICD
2 nd mentor	Andreas Enslin		
	organisation:	Miele	
	city:	Gütersloh	country: Germany
comments (optional)	The project will be done in collaboration with companies Bundles and Miele. The role of company supervisor will be taken by Miele while keeping Bundles as a strong advisor.		

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

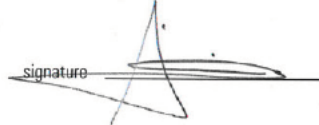
Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF


To be filled in by the chair of the supervisory team.

chair Jotte de Koning date 22-03-2019 signature 

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.


Master electives no. of EC accumulated in total:	<u>35</u> EC	<input checked="" type="checkbox"/> YES all 1 st year master courses passed
Of which, taking the conditional requirements into account, can be part of the exam programme	<u>32</u> EC	<input type="checkbox"/> NO missing 1 st year master courses are
List of electives obtained before the third semester without approval of the BoE	<div></div>	

name D. Huisman date 27-3-19 signature 

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?	Content: <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> NOT APPROVED
Is the level of the project challenging enough for a MSc IDE graduating student?	Procedure: <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> NOT APPROVED
Is the project expected to be doable within 100 working days/20 weeks?	
Does the composition of the supervisory team comply with the regulations and fit the assignment?	
<div>Planning should be 20 weeks instead of 23 weeks</div>	
comments	

name A. Huwae date 1-4-2019 signature 

Designing a washing machine for the service economy project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 06 - 03 - 2019 23 - 08 - 2019 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

With the transition from a linear (take, make, waste) to a Circular Economy, more and more industries are adopting business models that maintain products and materials in use, regenerate natural systems and eliminate waste and pollution (Ellen Macarthur Foundation, 2011). An example of this is the shift from product-oriented to service-oriented business models. Within this perspective, Product Service Systems (PSS) are considered to be a promising approach towards a sustainable, resource efficient economy (Tukker, A., 2015). A PSS can be defined as 'a mix of tangible products and intangible services designed and combined so that they are jointly capable of fulfilling final customer needs' (Tukker, A. & Tischner, 2006). PSS deliver satisfaction to customers through functions instead of products. Within the PSS category of use-oriented services, the ownership of the product remains with the providers, motivating them to extend the life of their products as much as possible. Since all elements necessary to deliver satisfaction to the user become costs for the provider, there is an incentive to reduce the resources needed to do it.

This project involves the companies Bundles and Miele. Bundles is a Dutch company that aims to make high quality home appliances available to everybody through subscription plans. Their service-based business model provides high quality washing machines to reduce the negative environmental impact caused by the use and disposal of low-end machines. They are responsible for maintenance, repairing and installation processes and aim to increase the lifetime of the products by refurbishing them for reuse. Supported by IoT (all their machines come with an IoT module), they currently monitor the use phase (to control pay per per wash or monthly fees) and are now interested in extending the possibilities of these technologies for refurbishment, reuse, and recycling processes to transition into a more circular business model (see figure1). Bundles is a flexible option for users to obtain high quality appliances with a small investment, while reducing the costs of energy use and obtaining support through installation and maintenance. It is an attractive service for users who could be incentivised to buy low-cost washing machines due to high up-front costs of high-end machines and a standard 2 year guarantee period (high-end machines do not have a longer guarantees than low-end machines even though they are more expensive). Users buying low-end machines probably do not consider durable machines have positive ecological and economic implications in the longer term (Ellen Macarthur Foundation, 2012).

Miele is an international home appliances supplier with a focus on high quality and long lasting products. Bundles exclusively uses Miele's washing machines for their services, but these machines are not designed for a service-based business model. Originally designed for a linear product-based business model, the machines are not suitable for continuous refurbishment or disassembly; processes Bundles is currently doing and desires to improve in the future (improvement and implementation of processes like reuse and repairing). Miele and Bundles are only currently related through the sales of the washing machine. They design and deliver their services independently from each other. There is an opportunity for design to improve the synergy between Miele's product and Bundle's service (see figure2).

Having two companies whose economic and competitive interest leads to the reduction of environmental impact, there is an opportunity to implement a PSS design approach in this project. Specifically considering the economic and environmental dimensions of sustainability to create new interactions between the stakeholders and generate a new PSS that fulfills customers needs based on delivering satisfaction. Specifically regarding the design of the product, and to ensure the delivery of a sustainable PSS, Circular Product Design strategies such as design for repairability, maintenance and upgradability will be implemented (Bakker, C. & den Hollander, 2014).

space available for images / figures on next page

introduction (continued): space for images

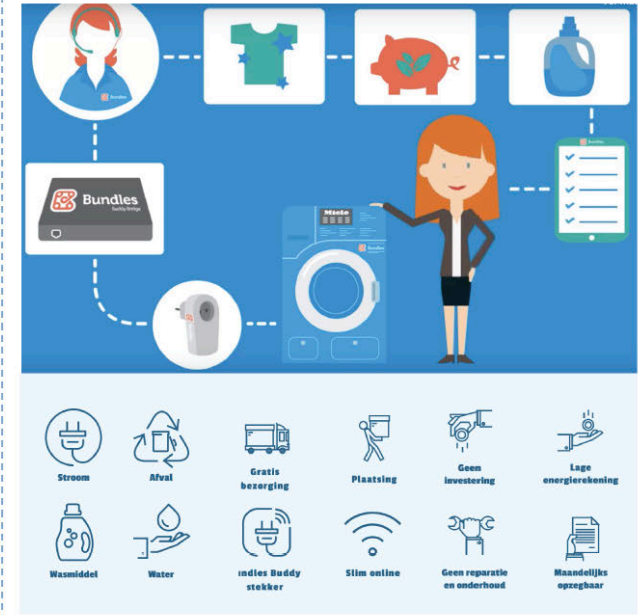


image / figure 1: Bundles description of their service. Retrieved from: <https://www.bundles.nl/en/how-it-works/>

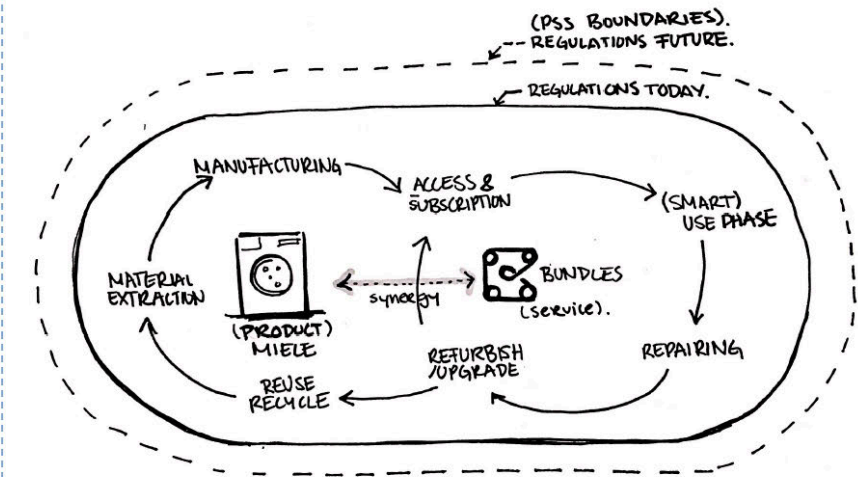


image / figure 2: Visualization of context for the assignment. Own visualization.

Personal Project Brief - IDE Master Graduation

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The design of PSS requires a systemic approach that considers the product, services, infrastructure and the network of actors that are part of it simultaneously. As mentioned in the introduction, in the case of Bundles and Miele, the two companies design and deliver their services/products independently from each other. Bundles is working and delivering its service under the limitations and conditions of the available Miele products, since Miele's washing machines are not specifically designed to meet circular service models. The machines were originally designed under a long lasting, product based business model. Although high quality and long lasting products could suffice a big part of the service-based business model, there are several opportunities to improve the synergy between Miele's product and Bundle's service to enhance the economic and environmental possibilities of the current PSS.

This synergy can be achieved through the design of a new PSS that considers the improvement of the current service and simultaneously focuses on the (re)design of a product that fits it. This new PSS should, ideally, provide a more resource-efficient, circular model, reduce the environmental impact in comparison to the current model and provide new business opportunities for involved stakeholders. Other aspects and key issues to be considered when designing PSS according to literature are: implications on regulations; and a strong attention to user satisfaction and user acceptance.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

In this project I will develop a PSS for the Miele and Bundles washing machine case to generate opportunities for business collaboration between the two companies. After identifying opportunities in the analysis of the current PSS and user practices, I will focus on the (re)design of a product that supports and enhances the service, whilst also taking into account circularity and reducing environmental impact.

The design project will result in a product service combination concept for the Miele and Bundles washing machine case study. The concept will entail the re-design of the washing machine for optimal use in a service setting. Improvements and adjustments in the service will also be considered part of the concept. The approach will be systemic throughout the design process. In order to achieve this and considering a 20 week time frame, the goal is to cover the following research points and challenges:

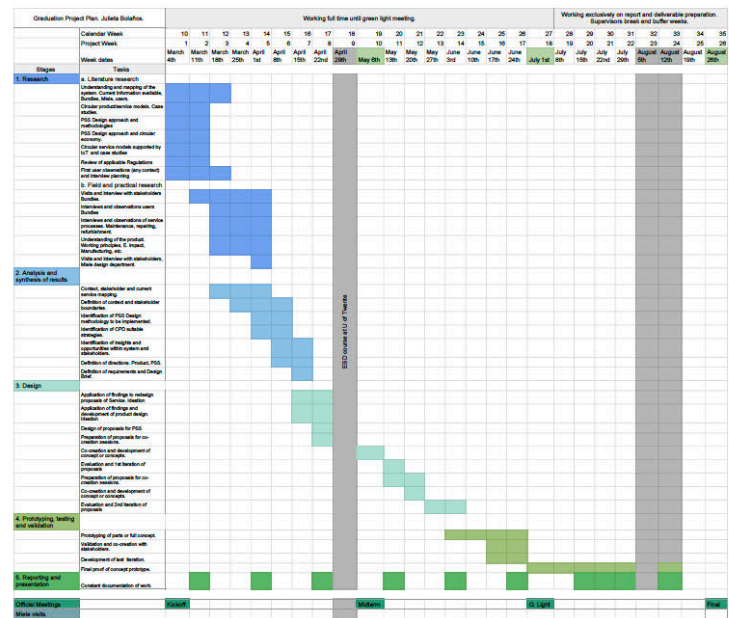
1. The current architecture and use context of the PSS will be evaluated and analyzed to identify pain points and positive aspects of the system currently in practice. This evaluation will consider all main stakeholders and relationships between them. The emphasis lies on the role of the product within the existing service. Within this analysis the user will have a primary focus. The needs, practices and behavior will be studied to identify new opportunities that can deliver value through a PSS construction and increase possibilities for user acceptance. This analysis will result in identified opportunities for the improvement and redesign of the service, the product and the synergy between them.
2. Second, an overview of current PSS systems and CPD strategies will be made to inform the design of the concept.
3. Third, a combination of a PSS design approach and CPD strategies will be applied specifically to the (re)design of the washing machine itself. The goal of the final concept is to improve the synergy between the service and product and increase circularity.

Personal Project Brief - IDE Master Graduation

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 6 - 3 - 2019 end date 23 - 8 - 2019



The planning shows the main steps of the design process I will follow. It is fairly detailed for the research stage but lacks detail and definition of iterations and further stages. These will be detailed later in the process with information obtained during the first research stages and throughout the development of the project.

I will be working in this project full time. The project is envisioned to start at the beginning of March and have a concluding approval meeting at the beginning of July. The following weeks after approval will be destined to work on the finalization of the report and other deliverables preparation. The final presentation is expected to happen towards the middle or end of August considering tentative vacation times of the supervisors. Other than this, there are no other break periods considered.

A full week of work is exclusively destined for the Engineering in Sustainable Development course, the 'Bubble week' at University of Twente, is a mandatory requirement in order to obtain the Annotation in Sustainable Development. This week is tentative to be from April 29th to May 3rd.

The project should conclude and be presented before the end of August. This plan considers some weeks of room for unexpected requirements.

There are visits to the Miele design department in Germany that are not stipulated in this planning and will be defined in the following weeks together with the supervisory team, Bundles and Miele.

Personal Project Brief - IDE Master Graduation



MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, Stick to no more than five ambitions.

By pursuing the Annotation in Sustainable Development, I have been part of several courses where I have been learning a diversity of approaches towards sustainability, from which I find Circular Economy to be the most interesting. My research elective allowed me to dive very deeply into this topic and understand to some extent, my role as a designer within it. I have been exploring Circular Design and other models such as Cradle to Cradle extensively in a very theoretical approach but have only been able to apply them in short practical projects.

The application of this previously obtained knowledge in a practical assignment within a real context is my strongest motivation in this project. Working together with two companies will allow me to improve my stakeholder management skills and learn from both of them to give a realistic, feasible and measurable scope to the project. This will allow me to dive in deeply into the topic of Circular Product Design.

Understanding the opportunities of positive impact through the design or redesign of products and the translation of the complexity of circular systems into tangible design solutions is what I'd like to base this project on.

I would also like to take advantage of the complexity of the project and learn how to further organize and communicate my research insights, using sketching as a communication tool. The use of prototypes for validation and as a co-creation assets is a tool that I would like to repeatedly use throughout my design process.

List of References.

Bakker, C. & den Hollander, M. (2014). Products that last. Delft, The Netherlands.

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Ellen Macarthur Foundation. (2011). Concept of Circular Economy. Retrieved from:
<https://www.ellenmacarthurfoundation.org/circular-economy/concept>

Tukker, A. (2015). Product services for a resource-efficient and circular economy—a review. Journal of cleaner production, 97, 76-91.

Tukker, A., & Tischner, U. (2006). New business for old Europe. Product services, sustainability and competitiveness. Sheffield, UK: Greenleaf Publishing Ltd.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

DESIGNING A
WASHING MACHINE FOR
THE SERVICE ECONOMY

Julieta Bolaños Arriola
MSc Integrated Product Design
Master Thesis
TU Delft, 2019

