

Philips Saeco Xelsis Redesign



Group B3



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1 Introduction

Dear reader,

In this report you will find the final redesign of the Philips Saeco Xelsis SM7580/00, a fully automatic coffee machine.

During the design process of this project there were three phases, this report will focus on the final phase and will explain the first two phases briefly to explain where the concept is coming from.

First the analysis phase will be explained. In this phase the coffee machine with its functionalities and the target group are explored and problems considering user experience are defined. This resulted in a design brief that contains the requirements for the redesign are set up.

In the second phase, the conceptualisation phase, three concepts are presented which are based on the design brief. These concepts are tested using paper mock-ups. Based on the findings in the user test, a conceptual redesign is set up.

In the third and last phase, detailing and testing, the conceptual redesign is worked out in detail. A prototype is made from this redesign which is then tested thoroughly. Based on the findings in this test a final redesign is presented.

Enjoy!



2 Analysis

During the first part of the project, the main focus was to do research about the Philips Saeco Xelsis fully automatic coffee machine. First, the machine itself and its functionalities were explored. This is done by making a description of all the components, making a flowchart of the machine, performing a cognitive jog through and an initial user test where ten people interacted with the machine. Besides this, the market of the machine was mapped.

Lastly, the needs and wishes of the target users were researched. This was done by visiting a store, reading online reviews and finally creating a Persona based on all the results from the research.

From this, a design goal and requirements have been set up.

2.1 Product Overview

2.1.1 Product buildup

On this page you can find the product build-up which gives an overview of the product and its functionalities. For this report, research based on the Saeco Xelsis SM7580/00. Compared to the other Saeco Xelsis machines, this machine has a LCD touch button display.

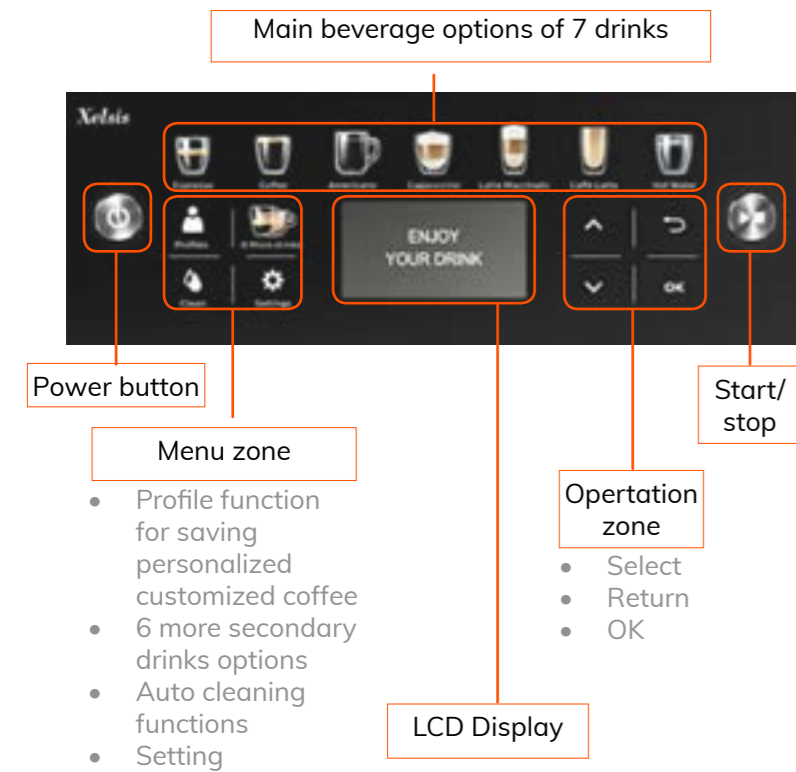


Figure 2-2 Physical components of the Saeco Xelsis SM7580/00

2.1 Product Overview

2.1.2 Persona and content of use

Persona and context of use are derived from the analysis phase. The persona and context of use give you an idea about the people using the machine and the interactions of the product in the intended context, mainly in a family home.

A Lazy coffee lover

Hans German/ Engineer/ 35 years old

6 cups of coffee per day ☕☕☕☕☕☕

Coffee knowledge level

"I am sensitive and picky with the taste of my coffee."

"I always have a busy life. I like starting my day with a coffee before I go to work."

"I like inviting friends to my place. And I would always serve them coffee with high-quality."

Figure 2-3 Persona

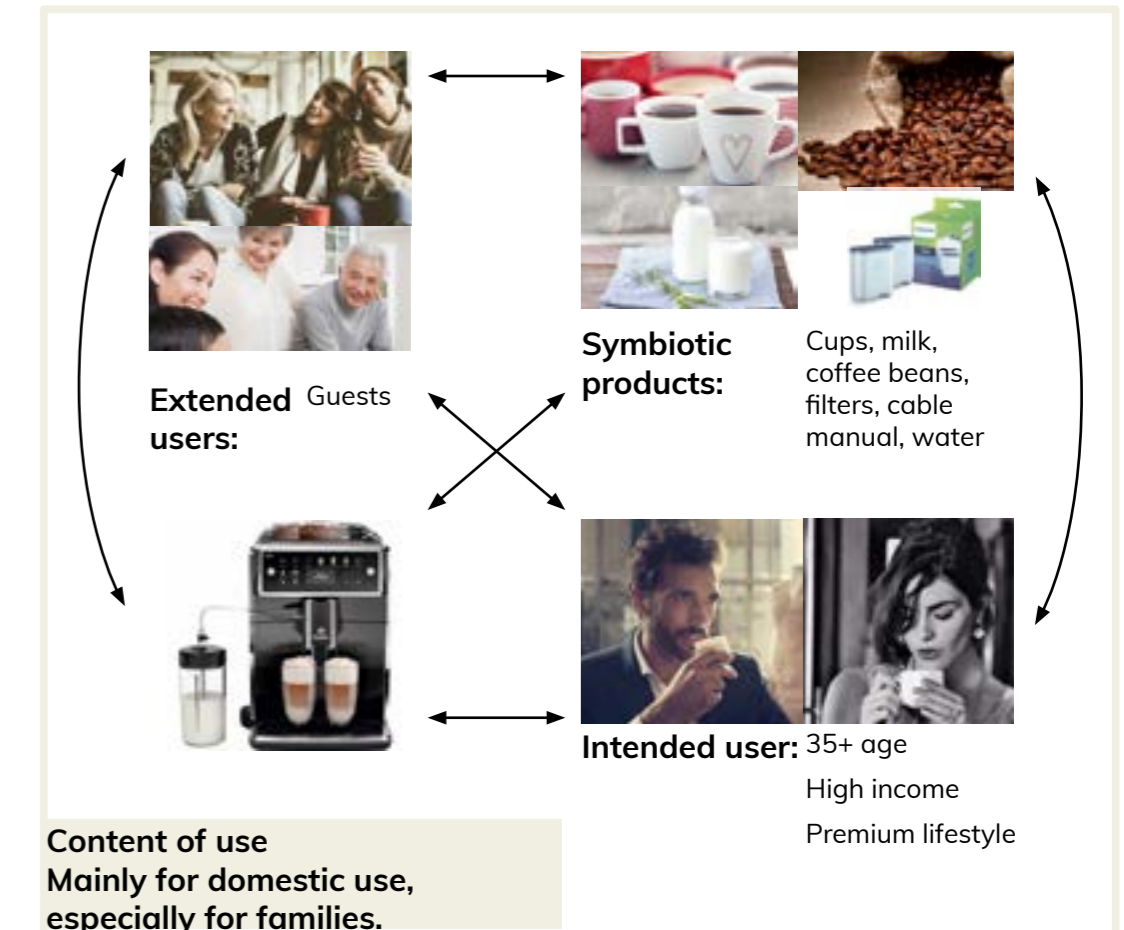


Figure 2-4 Content of use

2.2 Problem statement

Here you find the problems that are derived from the analysis phase. They are split in two groups, the maintenance and coffee making.

Problem with coffee making

The users do not have a clear idea of their customization process, customizing takes a lot of time as well.



"Too much setting. I just want to make sure that the tense of the coffee is the strongest I do not care the rest."

The users are not using the profile function, as they are confused about the link between the customization and profile function.



"So what is the next step after a profile is activated?"

"I've done with the profile, but How can I brew the coffee?"

Problem with maintenance

The maintenance is not integrated into the coffee making process flow and this tends to disturb the process of making coffee. Notifications about required maintenance pops up in at unexpected moments.

The users don't have an overview of what maintenance is required and when before the notification pops up.

"It is annoying that I am asked to refill the water after I pressed to brew and the machine has started grinding."



2.3 Design brief

Based on the analysis phase a design brief is set-up, it consists of one generic design goal, a strategy that shows three focus points and the detailed requirements for the redesign. This design brief is used as basis for the development of the redesign.

Design goal

“The design goal is to improve the interaction of the Saeco coffee machine by providing an intuitive and seamless on-screen and physical experience, where the user can enjoy the process of making coffee (including maintenance), making the user feel confident, guided and in control.

The user should feel in control of the machine while making a drink as well as during maintenance.”

Design strategy

Build a better link between the customization process and profile function.

Provide beforehand maintenance information.

Provide guides of the maintenance through the physical components of the machine.

Design requirements

1. Overview of navigation

- The hierarchy of information on the interface must be clear;
- People should always know where they are in the system and have an overview of all the steps taken or still needed to reach a goal;
- People should have the possibility to go back to their settings and easily change their previous choices.

2. Clear communication of the coffee settings

- The meaning of the different icons should be clear and easily understandable by the user without consulting the manual;
- The meaning of all the customization settings should be clear in order to allow the user to have full control over the taste of his coffee;
- The interface should provide the user with additional information in case icons are difficult to understand

3. Be able to constantly check the maintenance status

- People should have in advance an overview of the maintenance needed. So, they will not be unexpectedly disturbed during the process of making coffee.
- There should be clear feedback indicating when the particular maintenances are needed (refill water, coffee beans, empty coffee ground).

4. Save and have easy access to the preferred drinks in order to get quick drinks

- People should have the possibility to save quickly their preferences, avoiding to customize their drinks every time following all the steps;
- Completing a task should be as easy as possible, and take as little time as possible;
- People should find immediately their saved drinks and the profile section should be easy and quick to find;
- Coffee section and profile section should be integrated into a single path.

5. Aesthetically pleasing machine

- The target expects to buy a high-end product. So, it should look professional and appealing;
- The target is willing to show off the product to its guests.

3 Conceptualizing interaction

Introduction of chapter 3

On the basis of the knowledge and insights gained from the analysis phase, three concepts were designed and made into low fidelity paper mock-ups, followed by a comparative user testing session involving 8 participants.

In this chapter, all three concepts will be introduced and briefly explained in terms of their different focuses and highlights, and the user test results and insights will be discussed, serving as the foundation and iterative process towards to the redesign concept.

3.1 The 3 exploring concepts

Below the three concepts that are tested during the analysis phase can be found. All concepts focus on the control panel of the coffee machine. They all explore a different way of interaction with the machine.

Concept 1 - Basic screen

This concept focuses on the primary function of coffee making. The machine has a small touch screen with on the left and right of the screen are two buttons for turning the machine on and brewing coffee.

A mobile application is provided to access the other functions of the machine, like setting up a profile. This machine focuses primarily on making the coffee making process quick.



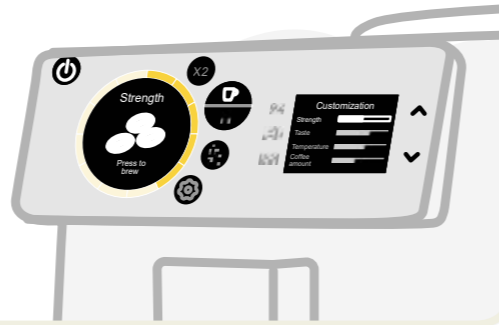
Concept 2 - Full touch screen

This concept has a complete touch screen where all functionalities are included. The screen gives a quick overview of all the functionalities, choosing a drink, customization and maintenance status of the machine. The machine always gives the user an overview of the maintenance status.



Concept 3 - Turning Knob

This concept has a more physical way of interacting with the machine. With a turning knob to control the main functions of the machine. There are two displays, one on the turning knob which is showing basic information that changes according to how you turn the knob and what settings you are controlling. The second display on the right to shows more detailed information.



3.2 Takeaway from the 3 concepts

Concept 1 - Basic screen

- The participants liked the maintenance information at the bottom of the screen, which shows how many cups can still be made.
- The icons on the containers guided people in finding the water and ground container.
- A small amount of functions made the machine easier to use, and the testers liked this simplicity.
- People didn't like this visual style, they said it looks cheap.
- The screen (Figure 3-1) was a bit too small for some actions, for example, to customize a drink.



Figure 3-1 Customization screen of concept1

Concept 2 - Full touch screen

- Participants liked the visual style of this concept above the other styles.
 - Easy customizing and saving of drinks. (Figure 3-2)
 - The big touchscreen made the product feel luxurious and gave people a good overview.
- The maintenance information page (Figure 3-3) which is the start screen in this concept, people just wanted to focus on coffee, not the maintenance.



Figure 3-2 Customization screen of concept2

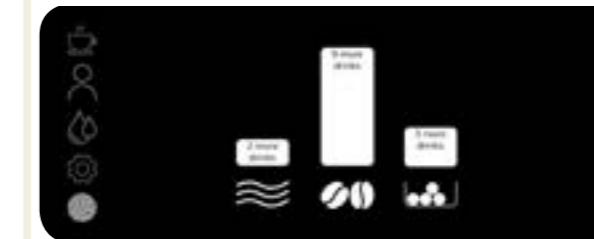


Figure 3-3 Maintenance information page

Concept 3 - Turning Knob

- People liked the physical experience and the visual style of this concept.
- Too many ways to control the machine, so users did not feel in control. An overview of the panel of this concept is shown in Figure 3-4
- too many buttons to control the different functions
- two separate screens are confusing for people. Because the information is split.



Figure 3-4 Panel of concept 3

4. Redesign Concept

Introduction of chapter 4

In this chapter, the redesign concept will be presented. This redesign is based on the findings from the three concepts. In this chapter first the highlights of the machine will be presented and then the design and design decisions will be explained into detail.

4.1 design highlights

On this page you find the redesign with its highlights explained. The focus of the redesign was on the digital interface which is connected with some physical parts on the product. An overview of the different screens is explained on figure XX on the next page.

Highlight 1: Coffee ID

The redesign makes the flow of making a coffee easier and saving a customized drink to a profile is integrated in the coffee making process.

Highlight 2: Maintenance forecast

To make doing maintenance more convenient, a bar in the interface is implemented, showing how many more drinks the user can still make before they have to perform maintenance. Clicking on this bar will give you an overview of the maintenance status.

Highlight 3: Physical light indication

Next to this light indicators are placed on the water, beans, and grounds containers to indicate when they need to be refilled/emptied. The location of these lights and the touchscreen panel are indicated in Figure4-1.



Figure4-1 New design components of the machine

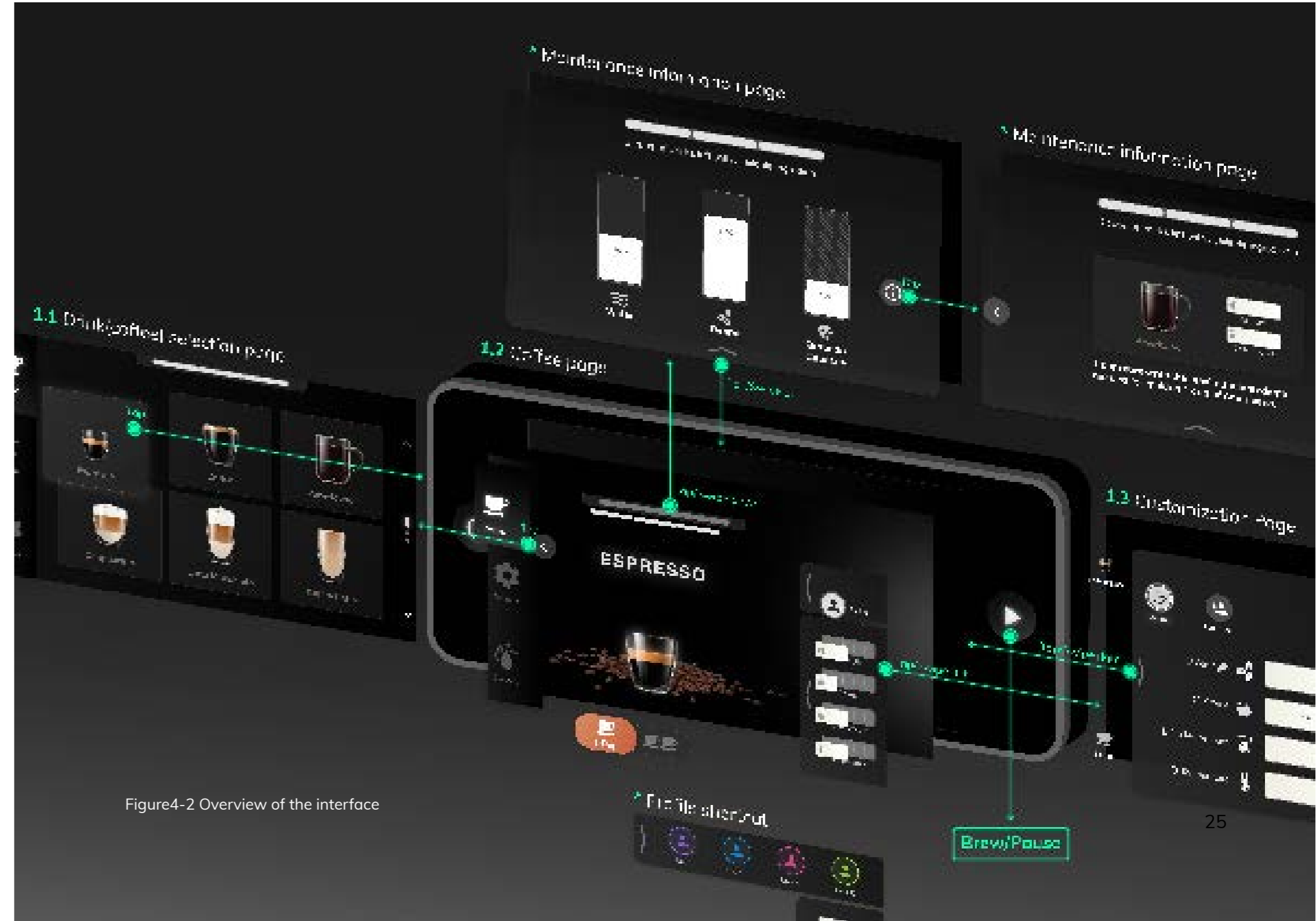


Figure4-2 Overview of the interface



Figure 4.3 Rendering picture of the machine in its usage environment

4.2 Main design features and decisions

4.2.1 Design highlight 1: Coffee ID

Coffee ID (Figure 4-4) is designed to **give quick access to the personal preference(profile)** of that drink from the drink page. It is designed to be non-intrusive, so it does not limit the coffee making experience. Using different colours, the user can quickly see which profile is theirs.

The profile panel and customization panel are both placed on the right side of the screen with the same visual style to show the connection between both functions. Each panel can be selected individually. Each panel is displayed in the collapsed view where the selected profile (or default) and an overview of drink settings are presented. They can be expanded to access profiles as a shortcut (Figure 4-5) and coffee customization where coffee settings and profiles are bonded to each other.

The design enables multiple ways to access the profiles and it is closely connected to customization because they are inseparable and in the home context profile is a more frequent feature for lazy coffee lovers to interact with than customization.



Figure 4-4 Profile & customization as a whole



Figure 4-5 Selecting or create profiles via the upper panel



Figure 4-6 Selecting or create profiles via the customization page

4.2 Main design features and decisions

4.2.2 Design highlight 2: Maintenance forecast

Maintenance forecast consists of two parts, the **maintenance indication bar** and the **maintenance information page**. It is designed to be the main place for monitoring and managing the frequent maintenance of the machine (e.g. Filling water/beans and emptying the coffee grounds tank), aimed at eliminating the hassle caused by maintenance and giving more control over maintenance to users.

Maintenance indication bar

The maintenance indication bar (Figure 4-7) represents the maintenance status so that users can quickly make a decision, whether to do maintenance or not, by showing the number of coffees that can be made with the ingredients left in the machine. It only shows up when the available ingredients can support three drinks or less. It is intended to work as a mild reminder when maintenance is almost required.

Maintenance information page

By tapping on the maintenance indication bar, the maintenance information page can be accessed. This page will also pop-up when maintenance is being done (e.g. water tank is taken out) and when there are not enough ingredients to make the desired drink.

In the maintenance information page, an overview of the amount of water, coffee beans and grounds capacity are displayed and converted to the number of drinks (Americano) that can be made with the available ingredients. By displaying all the information together, users can decide to do other maintenance



Figure 4-7 maintenance indication bar on the top



Figure 4-8 maintenance information page



Figure 4-9 Maintenance information (explanation page)

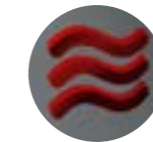
4.2 Main design features and decisions

4.2.3 Design highlight 3: Physical light indication

In the new redesign, there are LEDs on the water, coffee ground and coffee beans containers. The aim of these lights is to help the user to easily check and be advised about the maintenance status. In addition, the connection between the maintenance information on the interface and the physical lights will help the user to find the ingredients that need to be refilled.

The LEDs can have two different colours: white and red. The colours are linked with the maintenance urgency and when maintenance is not needed, there will be no light indication.

There are three different cases:



No notification on the interface

No light notification on the physical icons in case maintenance is not needed



3 cups (or more) available



2 coffees availables

Blinking white light (2s delay) that indicates the ingredient to refill/empty

The blinking light is supposed to be just a soft advice. For this reason, a lower blinking speed (2s) is used. This is because a higher blinking speed (1s) would be linked with a more serious and urgent situation.



1 coffees available

Red light that indicates the ingredient to refill / empty

The red light will not blink because the color will already indicate the need for urgent maintenance.



4.3 Design details and decisions

4.3.1 Physical light notification

On this page you find the inspiration for the physical light notification of the maintenance.



Figure 4-10 Moodboard inspirations (interior car, alarm devices, phone notification, other technological devices)

Existing light indicators

To find a suitable solution for the light indicator on the containers (water, coffee ground, coffee beans), products from different fields (dashboard car, alarm devices, phone notifications, other technological devices) were analyzed in order to find inspiration and check if there were certain notification systems that were always the same, in order to understand the reason behind it.

White lights

White lights were used to recall a non-serious attention signal. This is because, by analyzing the perception that white light has on people, it appears to be perceived as a soft notification signal, not a urgent one. Indeed, in our case, this type of luminous feedback wants to be only a slight reminder about the state of the ingredients (the ingredients are enough to make two drinks).

Red lights

In contrast, the light changes colour from white to red when maintenance becomes more urgent (ingredients for one drink left).

This is because, on a perceptive level, we associate this red colour with a strong sense of emergency. This light will grab the attention of the user and calls for action.

In this way, a hierarchy of importance was also created through the physical light notification.

4.3 Design details and decisions

4.3.2 Result of readability test of icons

A test, to improve the readability of the icons that are used in the redesign, was conducted. The test is conducted with seven participants which resulted in the improved icons below. Detail about the test can be found in Appendix 2.

Previous icons						
Improved icons						
Stars are added to the cleaning icon, to create the feeling of 'clean'. The straight line is changed into the curve in order to add more details.	3 beans are used for the strength icon to represent the strength is controlled by the number of beans.	The Aroma icon is combined with the pressure (the mechanism) element and the coffee cup.	Scale is added to the water glass and milk bottle. Then adapted the tyle of the temperature icon into the other two.	The icon of the bean changed into one bean. So, while the ground icon compares to the bean icon, the user can better understand what does the grounds icon means.		

4.3 Design details and decisions

4.3.3 Digital interface

Redesign of the control panel

The new design (Figure 4-11) of the control panel remains a similar orientation as the original one where two physical touch buttons of ON/OFF and Brew/Stop are placed on the left and right sides with a 16:9 full-colour touch screen in the middle.

The size of the control panel is similar but a bit larger than the original design because the screen needs to be big enough but still match the aesthetics of the machine.

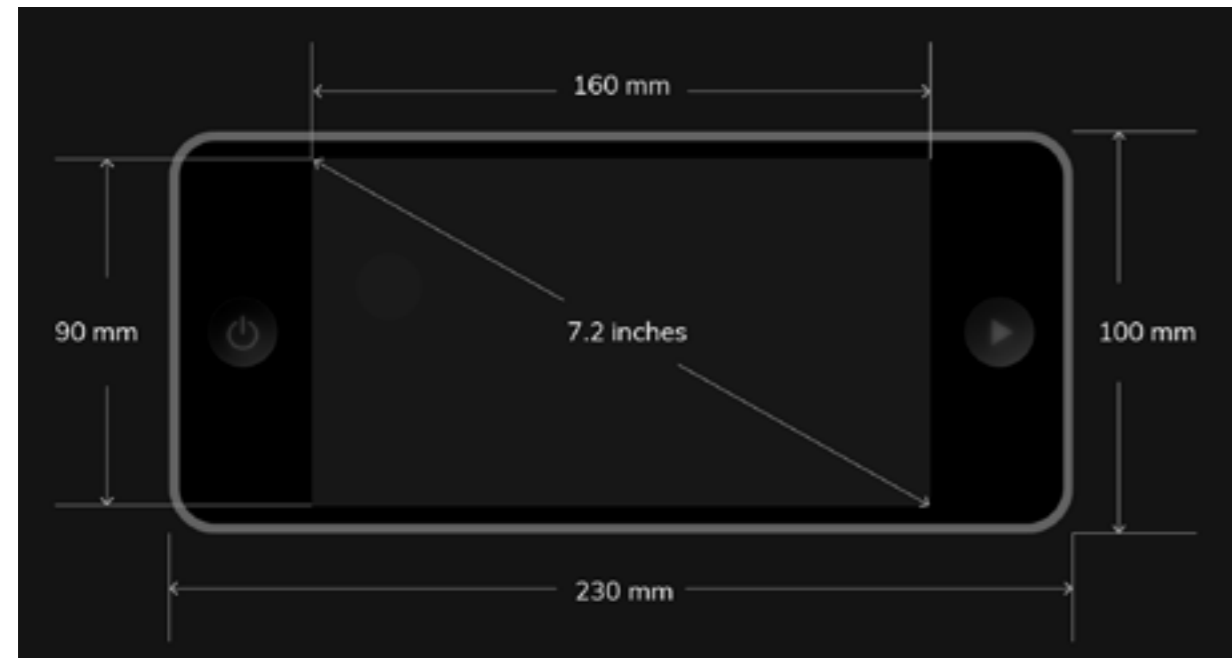


Figure 4-11 Dimensions of the control panel

4.3 Design details and decisions

4.3.4 Visual identity

The visual language

The visual language of the new design aims at creating an **elegant** and **high-end feeling** of the coffee machine. To achieve this, the visual language follows 3 main ideas. The first one is the use of a **dark and warm colour scheme** derived from the colour of coffee beans. The second is the use of **transparency** to create a rich-layer effect. Lastly, **illumination** was widely used in the design to strengthen and highlight content as well as indication.

Layout and navigation design

A grid system of rows and columns is used for displaying elements and content but mainly in columns since the display is landscape. The navigation of the interface is designed in a 3-dimensional way that **vertical navigation** (scrolling or tapping) is designed to navigate between options (e.g. Coffee selection page), the **horizontal navigation** is used to go through the system (e.g. to customize your drink) and **layering navigation** that especially designed for the maintenance. (e.g. by clicking on the maintenance indicator you find an overview of the maintenance)



Figure 4-12 Visual language

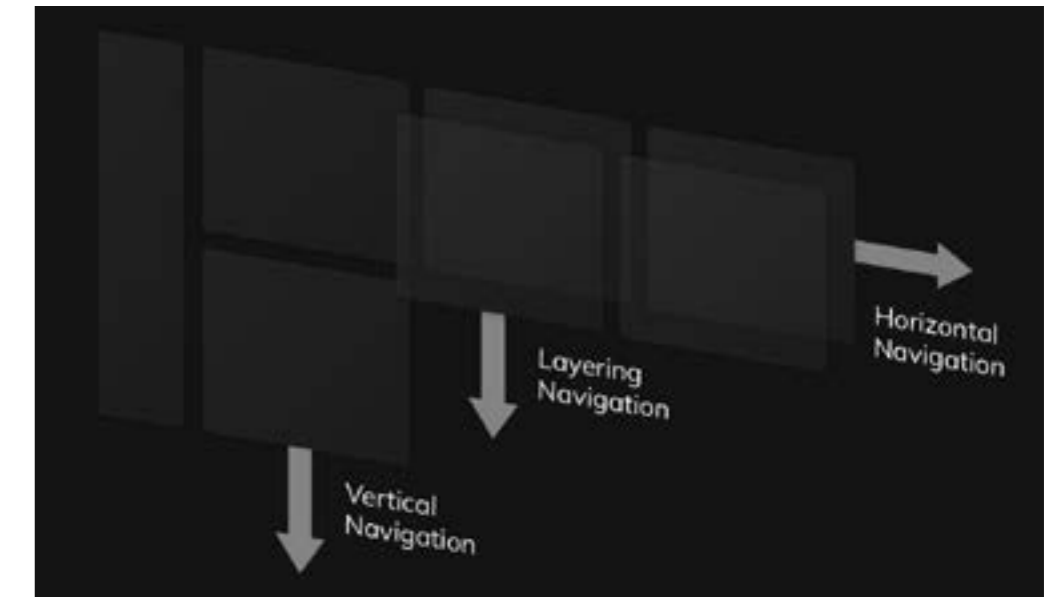


Figure 4-13 layout and navigation

5 Redesign test plan

Introduction of chapter 5

A test plan was made to identify issues in the redesign with regard to interaction and user experience. Further unforeseen problems are taken into account for the final redesign. The test plan consists of the overall design of the user test and the protocol which is followed throughout the user tests. The user test design states the goal of the test, the research questions which need to be answered and all the components needed for this. The test protocol is set up to execute the tests consistently across all participants.

During the tests, feedback is gathered about the experience and interaction of the participants. Later this data is analysed and conclusions are drawn based on these insights. More about the test results can be read in chapter 6.

5.1 Research goals

On this page you find the research goals. Research questions have been set-up to achieve the research goals, these can be found in Appendix 3. The research goals and research questions are based on the design requirements set up in the design brief. These research questions and the goals are the basis for the setup of the test. It is necessary to find out what went wrong with the prototype and why it went wrong to improve the concept.

Research goals about highlight features

- 1. Find out whether people have a fluent experience with the coffee machine**
- 2. Find out whether the maintenance is disturbing the coffee making process.**

Research goals about general usability and experience

- 3. Find out whether people understand the information, icons and interactions provided by the machine.**
- 4. Find out what people think about the aesthetics of the machine.**

5.2 Test procedure

5.2.1 Overview

Below, figure 5-1, you can find the procedure of the usability tests. This procedure is followed throughout all the tests to have a consistent approach for all the participants. A more detailed description and contents of the procedure can be found in Appendix 4. The set up of the test (setup room, task division, roles) can be found in Appendix 5.

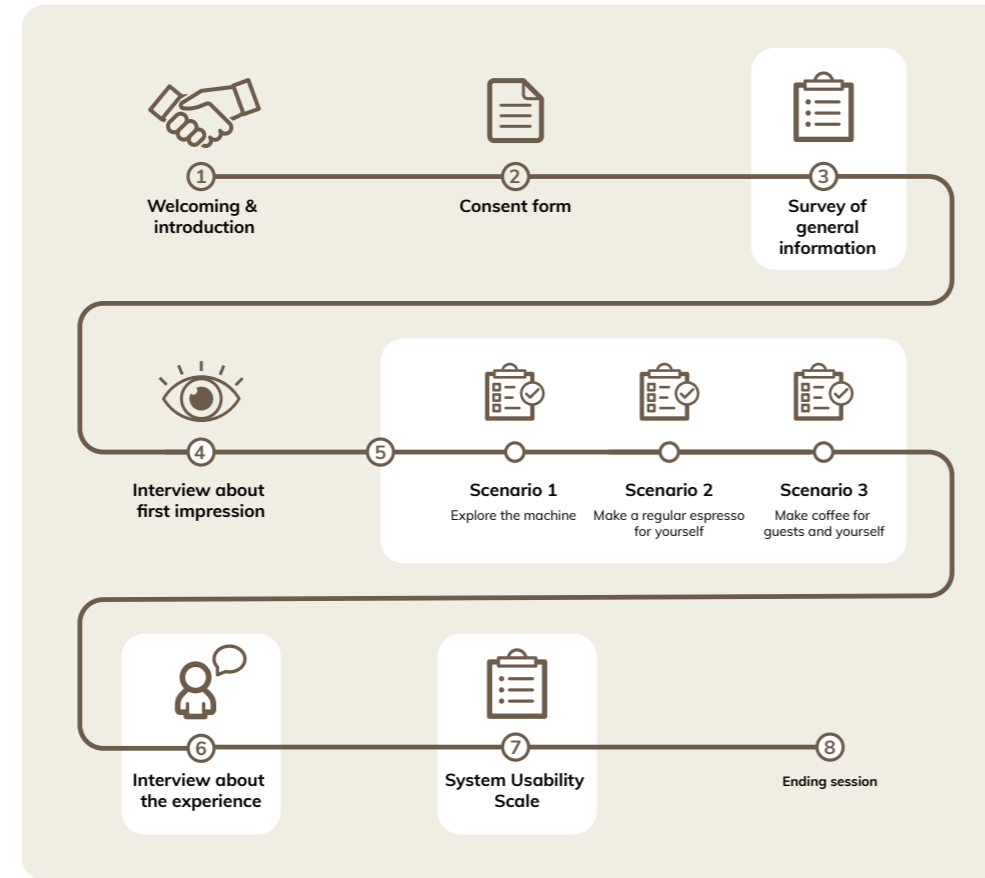


Figure 5-1. Procedure of the usability test.

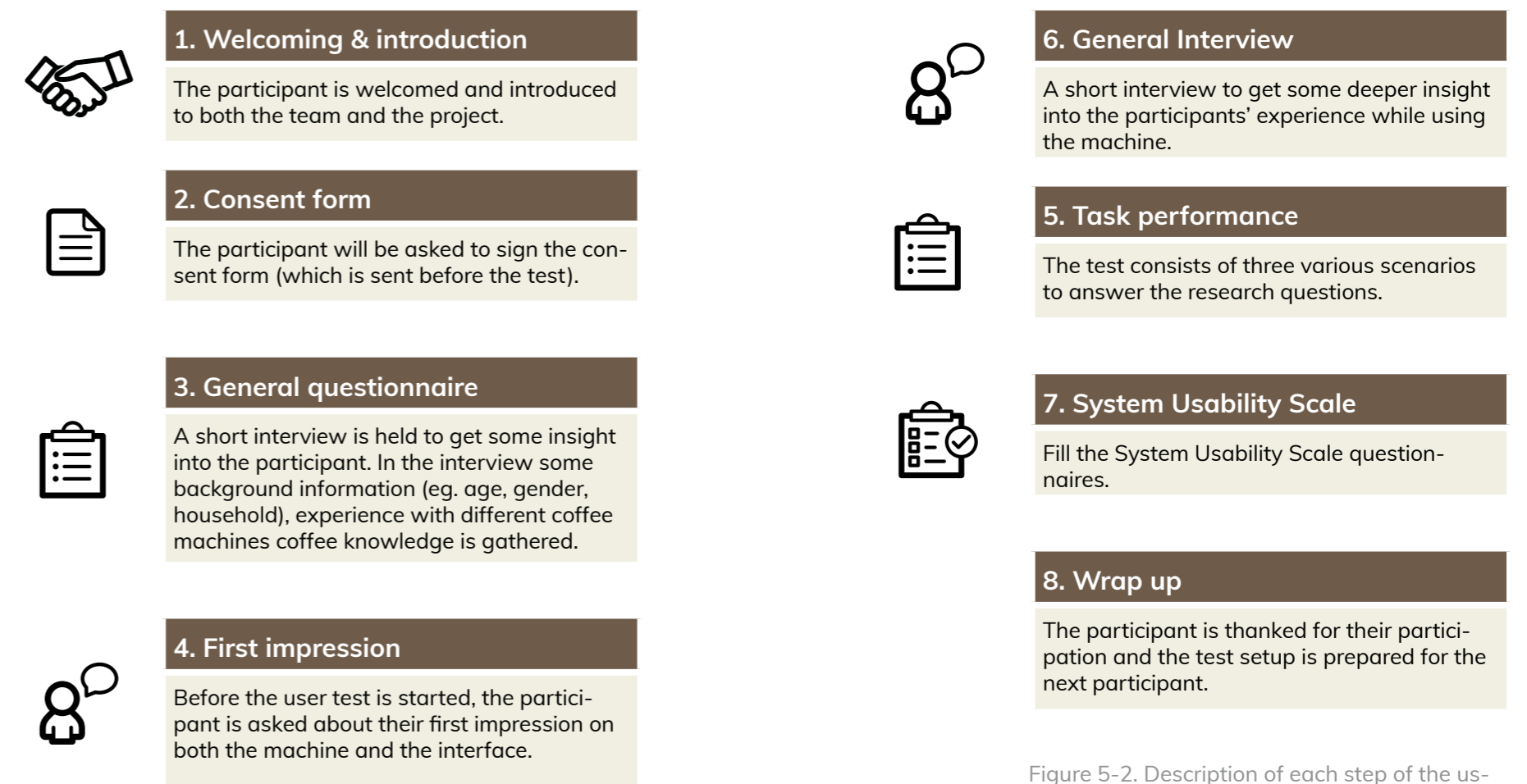


Figure 5-2. Description of each step of the usability test

5.2 Test procedure

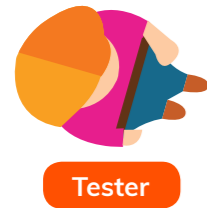
5.2.2 Tasks

In the user test three tasks are proposed to the participant, using a scenario to explain the situation. The scenario's contained three tasks the participant had to perform. This way the user is not guided too much in how to perform the tasks. To test the maintenance, this hidden task was part of task 3. A more detailed description with the scenario can be found in appendix 7.

Task 1 - Explore the functionalities of the machine

Goal of the task:
Let the user explore the different sections of the machine to get accustomed with the machine.

Scenario:
"You just bought the machine and did not yet try it out. Explore the functionalities of the machine. When you think you have a clear idea of the machine you can stop."



Tester

Task 2 - Make an espresso with customized taste

Goal of the task:
Let the participant prepare an espresso for themselves and customize the taste. And see if people will save the drink, and if they know how to save the drink to a profile.

Scenario:
"It is a sunday afternoon, you are going to make an espresso for yourself, you like your espresso a bit larger with a strong taste. You would like to drink this espresso more often, for example in the morning before going to work."



Host

Task 3 - Make two cappuccino and an espresso for yourself hidden task - do maintenance

Goal of the task:
Let the user make two the same cappuccinos for this they can use the two drinks buton.

During this task they will have to perform maintenance during the process of repairing coffee. The goal is to see if people link the lights to the icons on the display, and if the indication bar makes them aware that they need to perform maintenance soon.

Scenario:
"Two friends are visiting you you can ask them what they will drink and you would like to have your favourite espresso. First serve your friend and then serve yourself. Imagine "member A and B" are your friends."

5.3 Participants of the usability test

In order to gather valuable insights from the usability test, ten participants have been selected. The focus was to find a group of participants that represents the target group. A wide range of participants was gathered of which one represented the target group, two working people to represent the older generation of users and in total seven students (of which four design students).

As this group represented different nationalities, different age groups and different study/work background, this group is sufficient for testing the usability of the redesign.

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Gender	Female	Male	Female	Male	Male	Male	Female	Male	Female	Female
Age	23	23	23	23	23	33	23	56	55	27
Occupation	IPD student	Mechanical engineering student	DFI student	Applied Mathematics student	Management Engineering master student	Chemical engineer	DFI student	Service employee TUdelft	Pastor	DFI student
Nationality	Dutch	Chinese	Dutch	Dutch	Italian	German	Chinese	Dutch	Dutch	Korean
Owns a house	No	No	No	No	No	Yes	No	Yes	Yes	Yes
Amount of coffee they drink	1 cup per day.	Less than 3 times a month	3 or 4 cups per day	2 cups per day	3 - 5 cups per day	At least 2 cups a day	2 cups per day	15 cups per day	2 to 10 cups per day	10 cups per day
Knowledge about coffee	Moderate	Beginner	Moderate	Moderate	Moderate	Moderate	Beginner	Beginner	Beginner	Moderate
Experience with fully automatic coffee machines	Yes	No	Yes	A bit	A bit	No	Yes	No	No	No

Someone from the target group.

Figure 5-3. Characteristics of the participants

5.4 Prototype

The prototype (Figure 5-4) for the usability test includes both physical and digital parts. The main goal of the prototype was to support natural and realistic interactions as designed in the redesign phase. With the focus to have as little differences from the redesign.

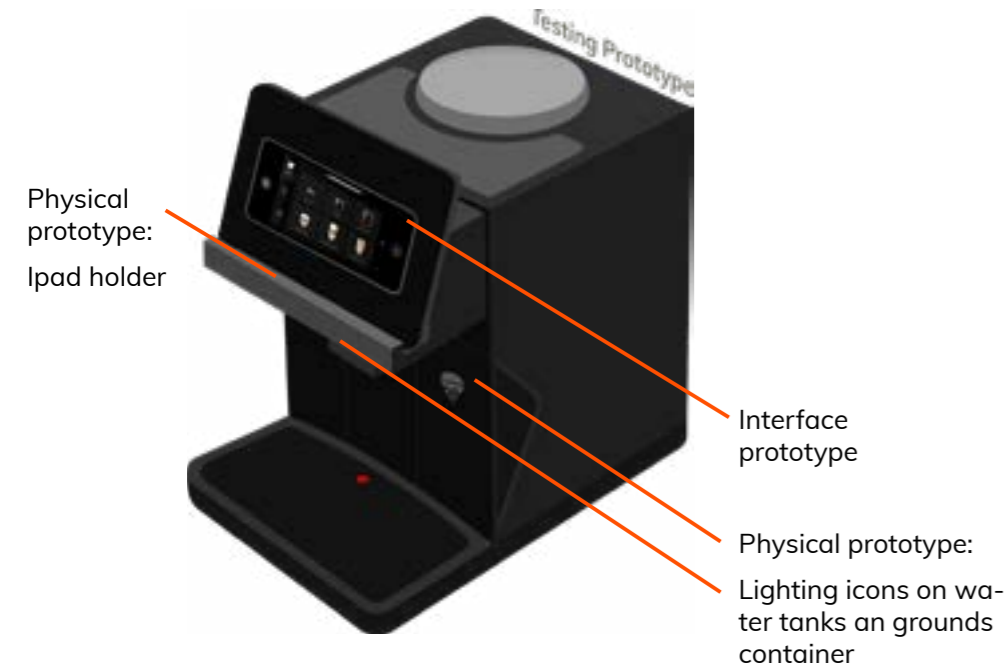


Figure 5-4. The main components of the prototype

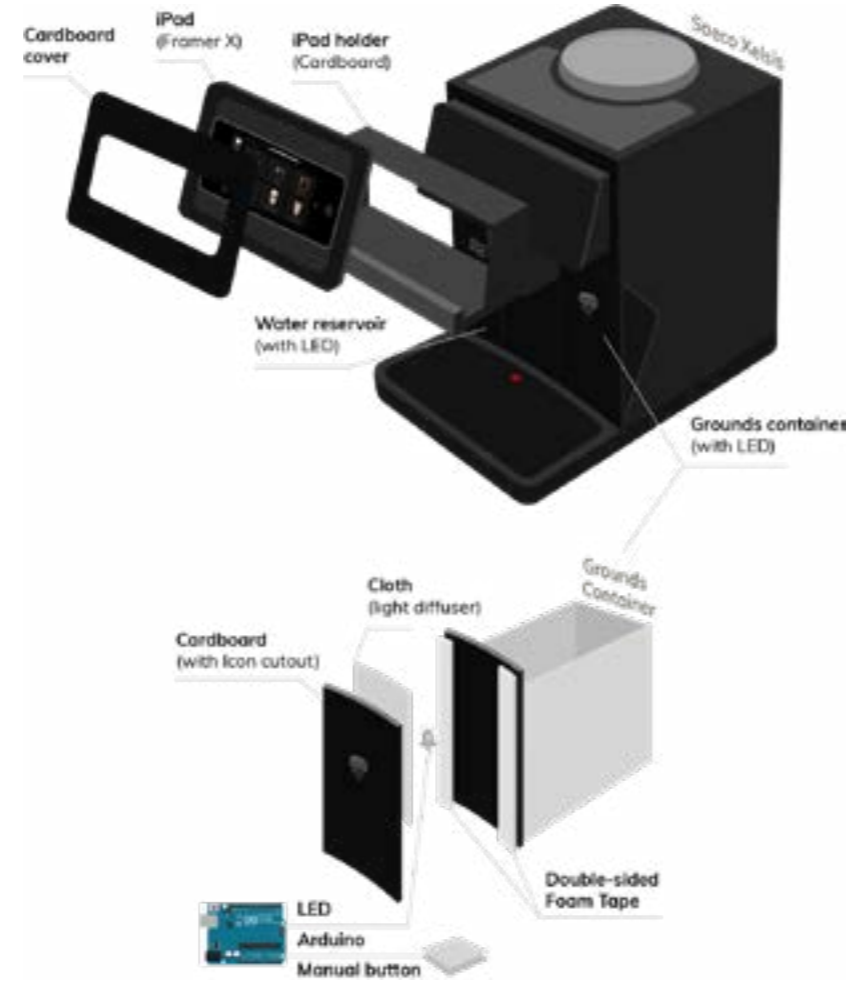


Figure 5-5. The structure of the prototype

5.4 Prototype

5.4.1 Physical prototype

The physical part consists of a cardboard iPad housing set (iPad holder and screen cover with cutout), see Figure 5-5, and the addition of lights to the water reservoir, coffee grounds tank and coffee beans container. These lights were connected to Arduino and were remotely controlled by one of the test assistants during user tests. In addition, the selection of material and colour was a major concern for making the prototype more realistic and less distracting.

5.4.2 Interface prototype

The digital prototype used during user tests was made with Framer X (Figure 5-7) and hosted in a 9.7 inches iPad running on Framer app (Figure 5-8). A piece of black cardboard with cutout was covered on the iPad to resemble the size of the interface and reduce distractions. Efforts were poured into designing a high fidelity user interface and fluent interaction flows, but due to the limitations and bugs of Framer X, animation effects and design components with code were not achieved. Therefore, the final digital prototype tested was merely a interaction within the pre-defined flows and was not explorative enough, and it also required manual controls from test assistant.

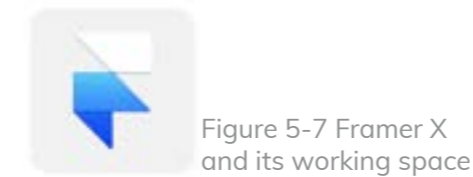


Figure 5-7 Framer X and its working space



Figure 5-8 Explosion view of digital prototype



Figure 5-6. Picture of the prototype



Figure 5-9. Picture of the prototype

6 Results of usability test

Introduction of chapter 6

In this chapter you find the results of the usability test. The gathered data is analysed and visualized in this chapter and conclusions are drawn based on the findings.

For the analysis of the data from the usability test, three methods were used for evaluating the test results: System Usability scale, Usage Pattern (detailed outcomes of the usage pattern can be found in appendix 8) and Observation & statement cards clustering.

In this chapter, the outcome of the test and the outcomes of all the methods combined, are presented. The findings from the usage pattern, observations and statement cards are visualized using the flow of a system. The insights gathered from this usability test form the basis of the re-redesign presented in chapter 7.

6.1 System usability scale

Result & discussion

The System Usability Scale (SUS) is used to rate the usability and learnability of the redesign concept. In the SUS the participants rate ten items from (1)strongly agree to (5)strongly disagree. The average SUS score of the group of participants is used to find a percentile score that measures the perceived usability.^{1,2} A score above 68 means that the perceived usability is above average.

Learnability

According to Measuring U 2, the learnability of the system is shown by items 4 and 10. When the participants rate these with a low score this means the system is easy to learn.

Looking at table XX (learnability system) it can be said that the system is easy to learn as the average scores are 1.3 and 1.7.

Participant	Score	Item 4*	Item 10**
1	87,5	1	1
2	72,5	1	2
3	82,5	1	1
4	87,5	1	1
5	90	1	2
6	66	1	2
7	87,5	1	1
8	66	3	4
9	62,5	2	2
10	70	1	1
Average	77,2	1,3	1,7

- non design students
- Design students
- Target user
- Employed people

* Item 4 - I think that I would need the support of a technical person to be able to use this system.

** Item 10 - I needed to learn a lot of things before I could get going with this system

Table 6-1 - SUS scores average + scores 1 & 4

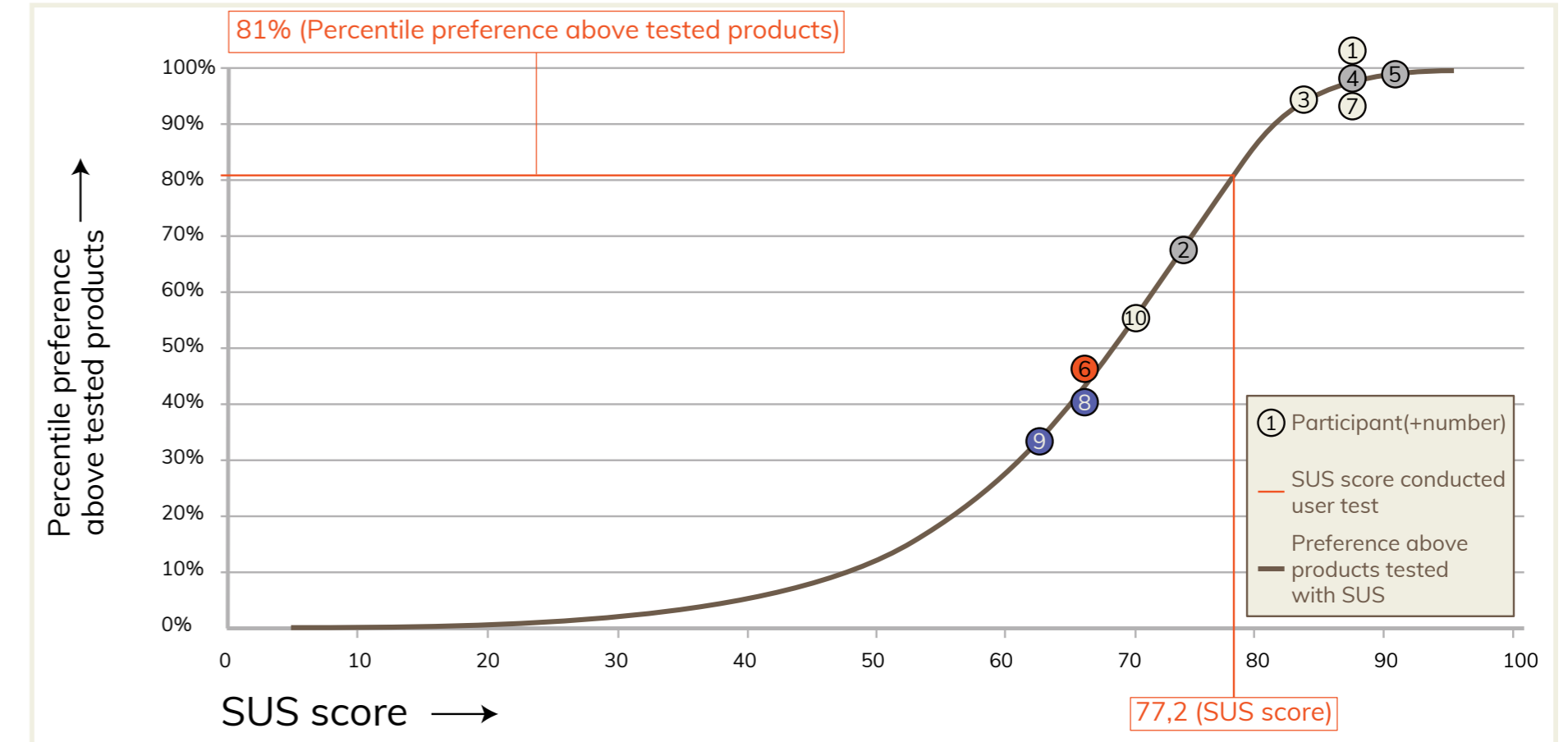


Table 6-2 - Graph to calculate the percentile ranking of the tested product

Conclusion and discussion

The SUS scores differ quite a lot (Table 6-2). For the students, this score is on average much higher than for the employed people. A reason for this could be that the students are more used to working with touch screen devices or are more interested in high-tech products.

There is not a big difference between design and non-design students.

46 https://cui.unige.ch/isi/icl-wiki/_media/ipm:test-sus-chapt.pdf Brooke, J., Quick, S. U. S. A., & Scale, D. U. URL: <http://www.itu.dk/courses/U.E2005/litteratur/sus.pdf> (9.4. 2012.). Sauro, J. (2011, feb). Measuring Usability with the System Usability Scale (SUS).<https://measuringu.com/sus/> consulted.

6.2 Insights grouping

Catogories of insights and the criteria of the hierarchy

The insights gained through interview, observations and usage pattern were first clustered into 8 groups using statement cards, see figure 6-1. The clusters are split into the severity of the problem(critical, serious and minor) or positive points about the concept. The rating took place after discussing the possible impact on the usability if this issue would not be resolved.

On the next page you can find an overview of the insights found. These insights are presented on the intended flow of the redesign. For a more elaborate explanation of the insights, you can go to chapter 6.4

8 groups of insights	
A	The physical brew button
B	Coffee customization setting
C	Save button (On the customization page)
D	Profile
E	Maintenance information
F	Led icons on the machine
G	Aesthetics
H	Others

4 hierarchies and their criteria

---Critical problems

Problems:
If we do not fix this, users will not be able to complete the scenario / task

--Serious problems

Problems:
Many users will be frustrated if we do not fix this

-Minor problems

Problems:
Users are annoyed, but this does not keep them from completing the scenario. This problem is not urgent

+ Positive points

Points:
Users find this helpful in completing the scenario. This should be kept like this.

6.3 Insights mapping

After having analyzed the 8 groups mentioned in chapter 6.2.1 in detail, the insights were summarized and shown in the flows on the next pages that serve to show the interaction between the interface pages and to compare the intended flow (as the interface flow had been thought and planned in the redesign phase) with the unintended flow (how users actually interacted with the interface) and the steps that have been skipped by people.

In addition, for each intended/unintended/skipped step, the number of users who showed the same behavior has been indicated and the linked group code (e.g. A1) was marked to reconnect the action to the analysis on the previous pages.

6.3.1 Insights from exploration stage and overall impression

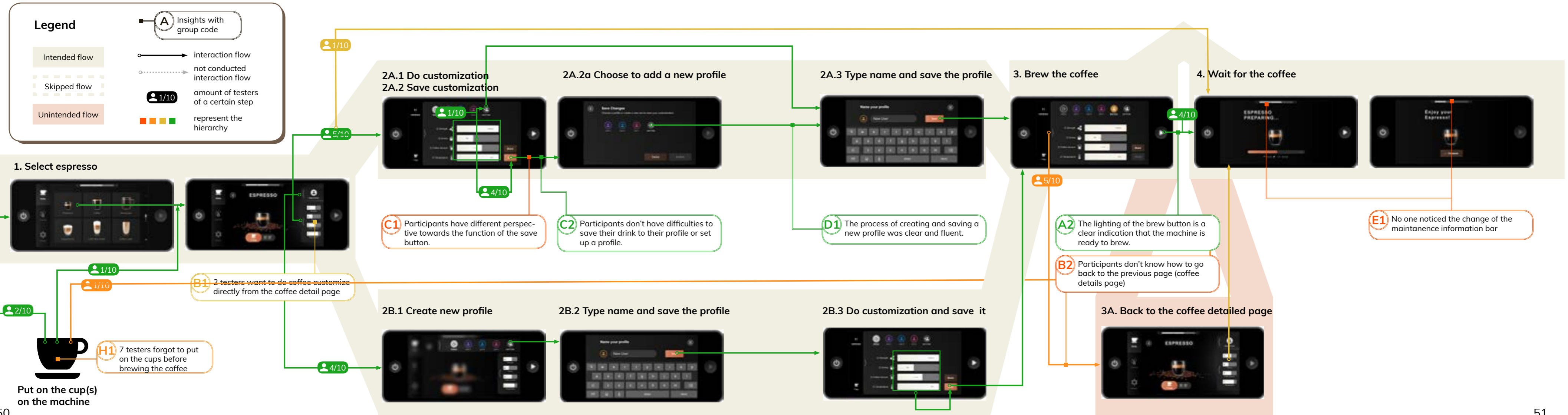
A1 The meaning icon of the brew button was unclear.



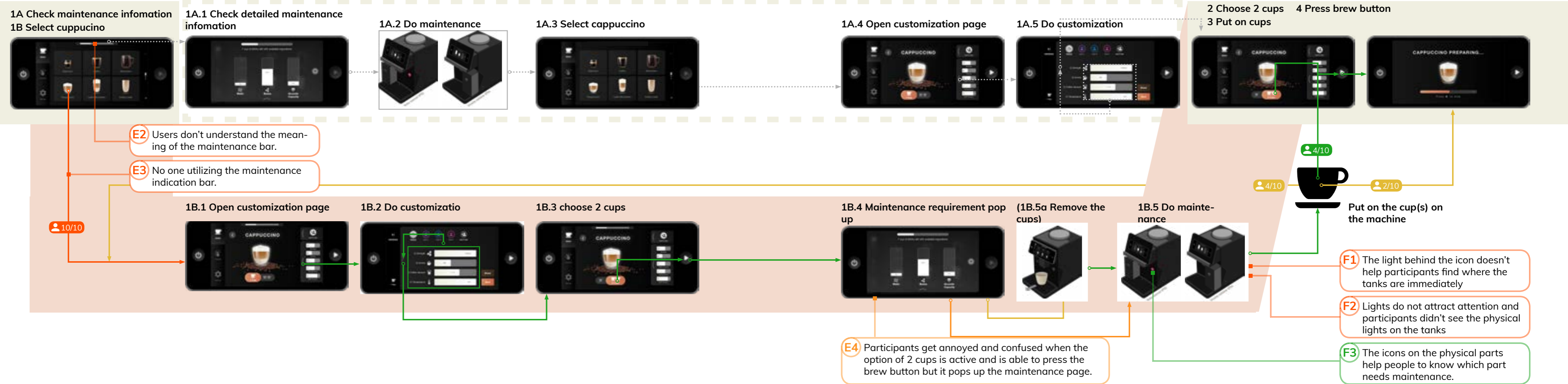
G1 Participants perceive this machine a high-end and professional.



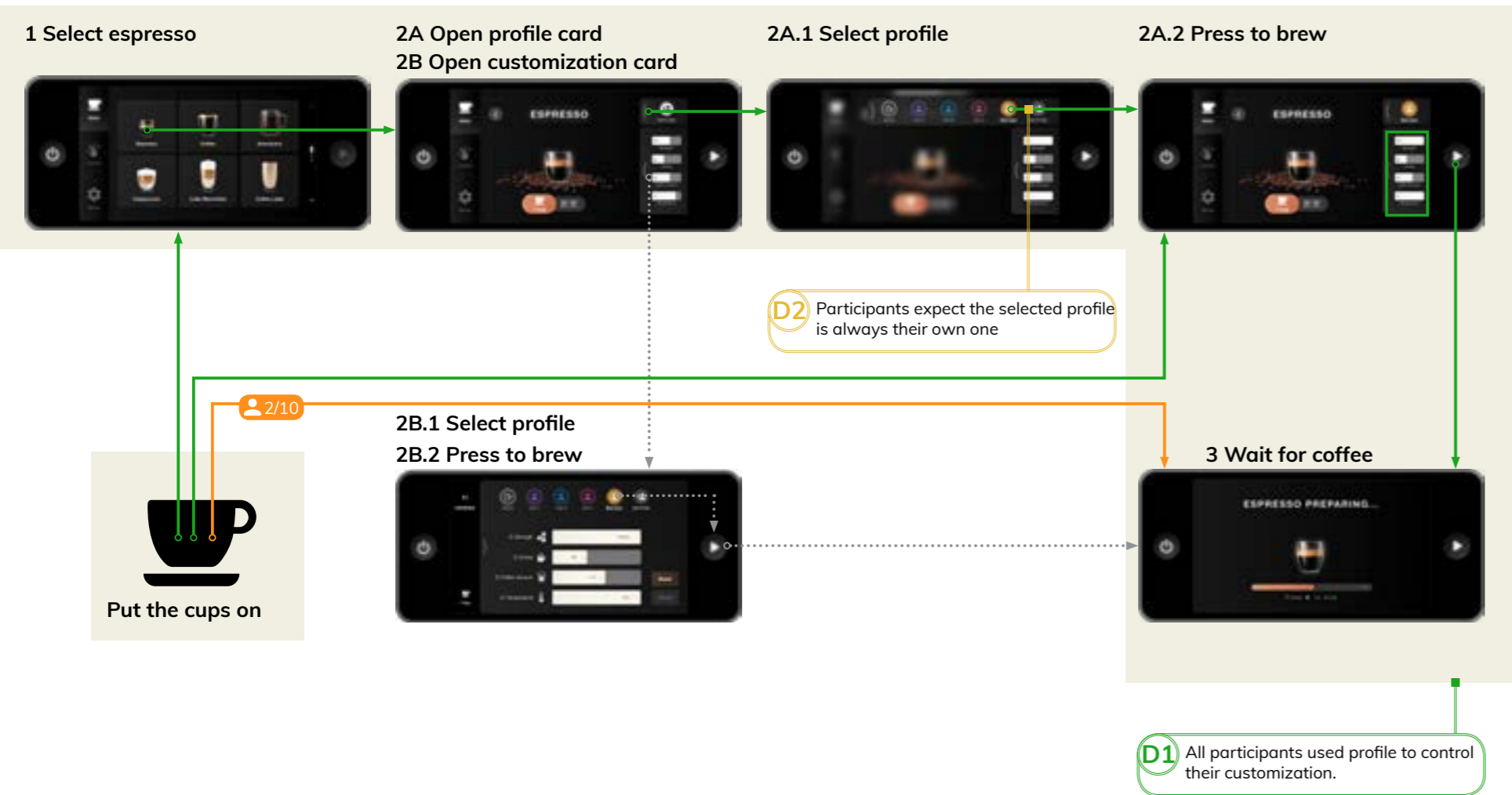
6.3.2 Insights from the process of making a regular espresso



6.3.3 Insights from the process of doing maintenance while making 2 cups of coffee



6.3.4 Insights from the process of making a cup of espresso from the user's profile



6.4 Discussion of insights

On the following pages an in depth explanation of the insights gained through the usability test. The insights are split according to the 8 groups, from A to H

Each insight was found through analyzing the data gathered during the user test (videos, notes, survey and observations).

For all the insights an explanation of the insight and discussion is given. In the discussion the reasoning behind the insight is given. The insights are supported by number of participants involved, observations or quotes from one of the participants.

A Insights about the physical brew button

A1:
The meaning of the icon of the brew button was unclear.

Quote:

"What's the meaning of this button?"
"The button seems like an arrow, it seems like it is going to a different page, not that you make the coffee"



Discussion:

The icon is similar to the play button of media like video and music so the participants don't expect the brew button to be used to brew the coffee.

A2:
The lighting of the brew button is a clear indication that the machine is ready to brew

Quote:

"I got that I had to press the button looking at the blinking"



Discussion:

Participants felt guided by the machine because the white light attracted their attention. In this way, they immediately understood that they needed to press that button to brew the coffee.



B Insights about customization (coffee settings)

B1:
Participants wanted to change/customize coffee settings directly from the coffee detail page.

Observation:



Some participant swiped from left to right on the customization bar to change the customization of the coffee.



Discussion:

This could be because people may want to change settings in the quickest and the most accessible way.

The bars look like they can directly be edited, even though they are small.

B2:
Participants don't know how to go back to the previous page (coffee details page).

Quote:

'I assume the after clicking the save, it will go back to the main page. The save button invites me more to click on rather than the arrow.'



Discussion:

This problem could have happened because the indication arrow is on the left of the page where is out of focus.

The prototype didn't include the animation of the pop up of the customization page which will influence the expectation of how to go back to the coffee detailed page.

The participants expect that the customization page will disappear after saving the drink to a profile.

C Insights about the save button (On the customization page)

C1
Participants have different expectations towards the function of the save button and what happens when they press it.



Quote:
"I think I have to necessarily save it before I can brew it"
"Oh, I pressed the save button but my coffee is not brewing!"



Discussion:
The meaning could be unclear because it was so close to the customization settings and so different from the other ones (red bright color). In that way, people thought that press it was a necessary step to follow in order to brew their coffee.
If the color and the contrast of the button was less evident, probably people would not have been attracted by it and they would be guided to press the brew button more.

C2:
Participants don't have difficulties to save their drink to their profile or set up a profile.

Quote:
"Yes, so now I save my coffee to a profile."



Discussion:
If the user is in the default mode, there is a guiding page to guide him/her to choose a profile or build a new one.
The save button lights up when settings changed, this is an easy indicator to save the drink.



D Insights about profile function



D1:
The process of creating and saving a new profile was clear and fluent.

Quote:
"It was nice, I had no problems, was clear."



Discussion:
After clicking the save button, a guide of selecting or creating profiles is provided to lead the user.
Also, the users have a clear mind about the function of the profile, because the profile was close to the customization settings on the screen and the users can easily understand the link between the profile and customization.

D2:
One participant expects the selected profile is always their own one.

Quote:
"I like that my profile is already there. But I assume that it is because I am the last one using it."



Discussion:
Because users want to have quick access to their own profile without searching, they expect the coffee machine remembers their settings.

E Insights about Maintenance information

E1:
No one noticed the change of the maintenance information bar

Observation:

No one pay attention to this changes after brewing the coffee



Discussion:

The participants pay more attention to preparing the coffee than to any other information on the screen.

The change is too small for the participants to notice.



E2:
Users don't understand the meaning of the maintenance bar.

Observation:

Some participants regard it as the indicator of different screens.



Discussion:

This kind of bars is more commonly used as the the indicator of different screens.

There is no explanation about the maintenance indicator and it's function, so people don't understand what it is about.

E3:
No one utilizing the maintenance indication bar.

Observation:

All the participants did maintenance after the maintenance requirement popped up instead of doing maintenance before they started making coffee.



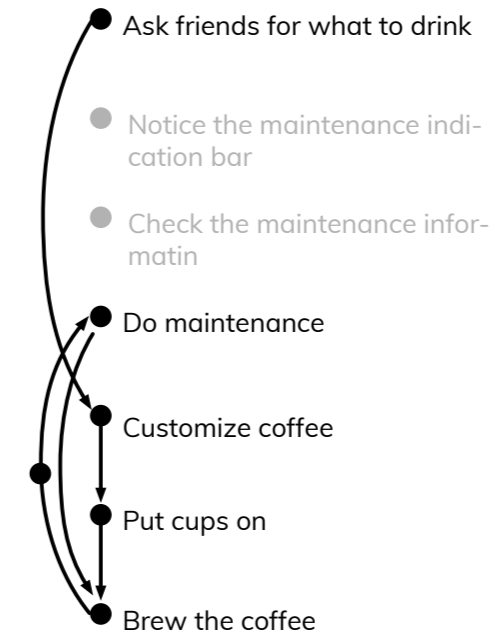
Discussion:

This may not because they did not want to do maintenance in advance but the maintenance bar failed to catch their attention.

The visual of the maintenance bar doesn't have any indication that it is related to the amount of coffee that the machine is able to make.

The users tended to ignore it because they cannot get any useful information with their first glance.

Maintenance requirement pops up



E4:
Participants get annoyed and confused when the maintenance required page pops up while they want to prepare two drinks.

Observation:

A few participants got stuck when the maintenance requirements pop-up after they chose to make 2 cups of coffee and click the brew button. (The machine is only available for 1 cup of coffee).



Discussion:

The users did not understand the maintenance indicator, so they were not updated about the maintenance status. The required maintenance came out of nowhere.

F Insights about Lights (On physical parts)

F1
The light behind the icon doesn't help participants find where the tanks are immediately.

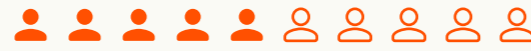
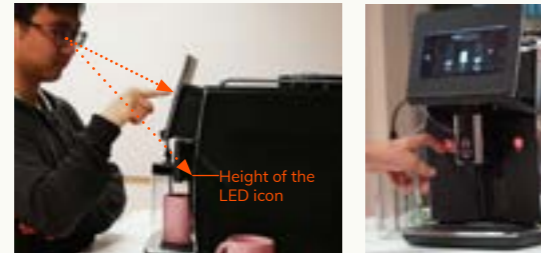
Quote:
"Where is the water tank? I can't find it"



Discussion:
The users had the perception that the water tank is at the back of the machine because they are used to finding the water tank there. They first didn't pay attention to the lights on the water tank at the front.

F2
Lights do not attract attention and participants didn't see the physical lights on the tanks

Quote:
"I didn't notice the lights, should I?"



Discussion:
While performing the tasks, people were completely focused on the interface and they didn't pay attention to the surroundings.
At the same time, the panel physically blocked the lights which are placed too high on the container.

F3
The icons on the physical parts help people to know which part (almost) needs maintenance.

Quote:
"Ok I understood that I might also need to clean the grounds because of this lights"



Discussion:
The users learned, from the experience of refilling water, that if the icons of the water tank/ grounds container lights up, they need to do maintenance for that part.

G Insight about Aesthetics

G1
Participants perceive this machine a high-end and professional.

Quote:
"It looks professional, fancy, I like it"



Discussion:
This could be because of the UI graphic, the black color that is linked with professionalism and the soft lights on the containers.
The machine itself is perceived as high-end and professional.

H Insight from others aspect

H1:
Participants forget to put cups before brewing coffee(s).

Observation:

The tester put the cup on the machine after the machine started brewing the coffee.



Discussion:
One of the main reason is during the test, the machine did not make the real coffee, so they did not hear the grinding or brewing of the coffee. These sounds could subconsciously trigger the user to put a cup under.
At the same time, there is not any notification from the interface that reminds the user to put on the cups.

6.5 Conclusions

With the results of the usability test the research questions are answered and also showed that the redesign achieves the design goal. According to the result of the test, there are still some parts that can be improved. Below these fields of improvement can be found. The next chapter is about the recommendations of how to improve the system.

General usability

The redesign is improved with regard to the usability, the user could more easily navigate through the system and the information provided by the machine improved (providing extra information when the user needs it). Most participants had no difficulties in understanding most of the icons and text. But the brew button and the save button remains a bit unclear.

General impression

From the result of the test, the user experienced the machine as a high-end product.

About the highlight 1: Coffee ID

The combination of the profile function and the customization function works well to able the users to quickly prepare their coffee. Users use the profile function to save and control their customization of coffee without extra effort.



About the highlight 2: Maintenance forecast

The maintenance forecast provided by the maintenance indication bar was not used by the users. The visual elements of the maintenance indicator were not clear to the user. However, the test still showed the potential needs of this function as a lot of participants expressed their impatience about doing maintenance in the middle of making 2 cups of coffee.



About the highlight 3: Physical light indication



The physical light icons on the tank and container failed to catch the attention at first, after understanding their meaning, the users immediately started to utilize it.

Potential improvement direction

Some potential directions for improvement were also found. Many testers forgot to put on their cups before pressing the brew button and they might need a reminder of putting their cups on the machine.

7 Recommendations & re-redesign

After the tests a lot was learned about the concept and the experience of people while interacting with the machine and the interface. Based on the results gathered from the usability test opportunities for improving the design were gathered. In chapter 7.1 these opportunities can be read and in chapter 7.2 the final re-redesign is described. The final re-redesign is based upon all the research done during this project.

7.1 Opportunities for improvement

During the usability test, many insights were gained about the redesign as can be read in chapter 6. From these insights, multiple opportunities for improvement of the design were created and listed in eight categories.

Within those categories, five of that have been selected as urgent ones (according to the severity rating mentioned in chapter 6.2) and implemented in the final redesign. (Highlighted with green outline)

The other three categories were not tackled because their implementation would not have had a critical impact on the usability.

Save button

- Change the name of the button into 'save to profile'.
- Change the colour to be a less bright one (less attention-catching).
- Change the position, closer to the profile section.

Brew button

- Change the "play" icon because unclear. Replace with a cup of coffee
- Add a text with a visual in the screen to indicate "press the button to brew"
- Narrow down the height
- Change the visual to be a "disabled-feel like" one (using greyish colour)

Maintenance indication bar

- Change the visualization and use coffee cup icons to indicate how many drinks left instead of bars
- Add text to indicate how many drinks can still be made. E.g. 2 drinks left
- Include an arrow indicating that people can slide down a new page

Wording on the maintenance information page

- Provide more specific requirements. Eg. 'Please add water' instead of '1 cup of coffee left with available ingredients'

Lower the position of the LED lights on the tank and the container.

- Position where the LEDs visual will not be blocked by the control panel

Auto-popping up of the maintenance information page before brewing

- This page should be triggered when "2 cups" is chosen, instead of pressing on the brew button
- Give a mild indication on the maintenance bar (blinking), and when then pop up when brew button is pressed (a progressive way)

Reorder the drinks on the selection page

- Provide users the chance of reordering the drinks on the selection page

A reminder of putting the cups on

- Add a visual indication of placing the cup after pressing the brew button.

7.2 Final Re-redesign

According to the test results and insights, four elements (The physical brew button, Maintenance indication bar, save button in customization page and a tip reminding placing the cup) were picked for re-redesigning because major problems fall on these elements identified in the user test analysis phase.

1. The brew button.

The icon of the brew button is changed to a cup with steam, as shown in Figure 7-1. During the test participants were not sure about the meaning of the icon and many could not link it to brewing coffee but they connected it to a play button or an arrow.

2. Maintenance indication bar

The maintenance indication bar is changed from 3 bars to 3 coffee icons accompanied by text explaining the meaning of these icons, also, the height of the indication bar is adjusted a bit higher than the previous one. (shown as the one on the top in Figure 7-2) There are many problems that fall on the design of maintenance indication bar, most participants do not understand the meaning and it did not catch their eyes during the user tests. Therefore, the re-redesign is meant to eliminate the unclarity of the 3 bars into a more clear image.

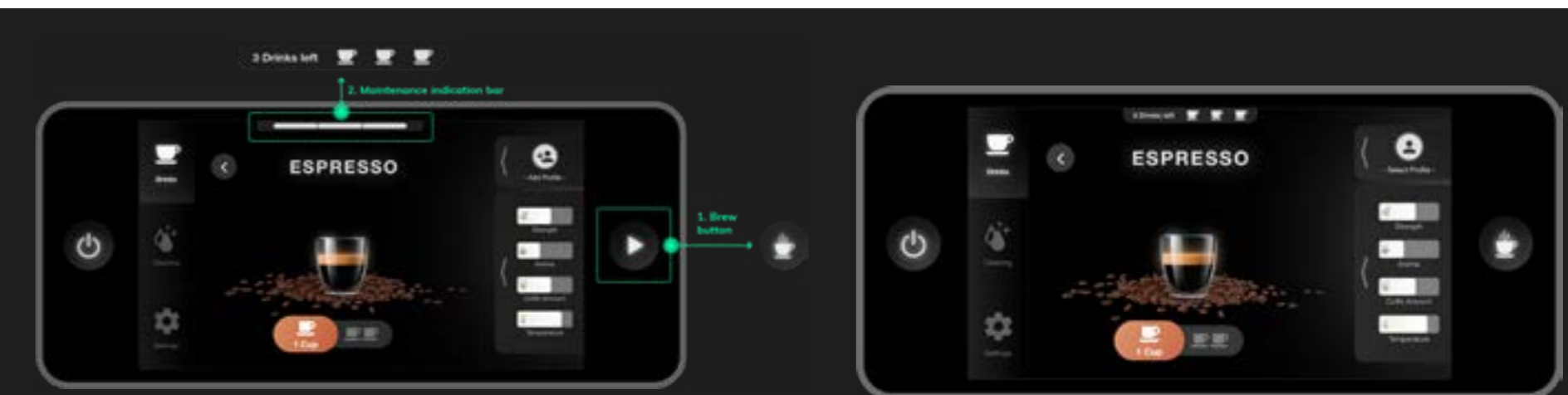


Figure 7-1. Visualization of the change in the brew button and maintenance indication bar.

Figure 7-2. Re-redesign of the coffee page



Figure 7-3. Visualization of the change of save button (inactive and active modes)



Figure 7-4. Re-redesign of customization page

3. Save customization

3. Save customization

In the Customization page, the wording of the Save button is changed from Save to the Save to profile (Figure 7-3). It aims to clarify the functionality of this save button (saving customization to profile) because participants' expectations of this button varied distinctively as the test results show, therefore caused their misunderstanding and confusion. With the new wording, the functionality is implied and it narrows down their expectations to the scope as it is designed to be.

Next to this the colour of the button is changed to make it less prominent in the screen. It is still clearly visible, but it does not seem like the button needs to always be pressed.

4. Lower the position of the LED lights on the tank and the container.

The position of the light icons on the containers (water and coffee grounds) has been lowered. This change was made in order to make the icons more visible to the user while interacting with the machine. Indeed, during the usability test, it became clear that the control panel hindered the view to the LED lights, even if only slightly. By making this change, the user can see the maintenance information on the interface and the connected lights at the same time, as was intended during the conceptualization phase.



Figure 7-5. the position of the icon of the previous redesign concept



Figure 7-6. the improvement of the position of the icon



Figure 7-7. Visualization of the change



Figure 7-8. Re-redesign of the coffee preparation page

5. Place the cup on

When the brew button is pressed, an illustration with text that reminds people to put the cup(s) in the right position is added before it brews the coffee, and it will automatically turn to the brewing page as the progress bar adds up (Figure 7-7).

The adjustment was not intended in the design brief, but it happened quite often during the user tests where participants forgot to place the cup. It was not just because participants were in the testing context but people do forget small things.

8 Conclusion

The overall project was challenging, stimulating and gave interesting learning opportunities for the team.

During the project the Human-centred design approach was used and this methodology helped the team to fully understand the importance of conducting a structured and in-depth user research to come up with a design that is truly relevant for the target.

The project gave the opportunity to not only design for the final users, but to also collaborate with them, including the target user in the design phase.

The insights gathered during the user tests helped to broaden the scope of the team and to come up with a challenging final redesign that was not expected at the beginning.

Another big learning point was working together with team members of different backgrounds. All team members have a background in design, but still all of them had a different approach to the design process. The fact that all team members have different backgrounds and nationalities made that there were some struggles during the work, but more importantly a lot was learned from the different strengths everyone brought to the team. The goal and challenge was to overcome the problems and to find the right balance in the team and work together to improve our weakness by learning from each other.

The final redesign made the team really proud because it is considered to be a relevant design that can figure out the actual problems of the Saeco coffee machine for it is based on depth insights gathered from usability testing.

9 Acknowledgments

We want to thank everyone that helped us during this project. We want to start by thanking Bart-Jan and Philips for given us the opportunity to work on the redesign of their coffee machine and for having provided us with stimulating feedback during the process.

We want to thank Anton, Marije and the other UXAD teachers for having guided us during the project, pushing us to always keep improving.

Last but not least we want to thank all the participants of our tests.

Appendix

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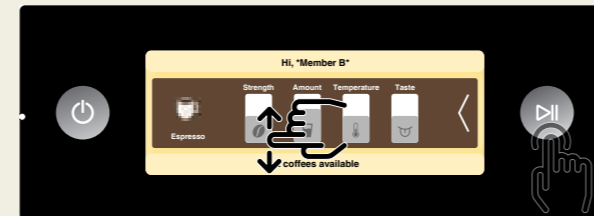
Appendix 1. Interaction flows of the 3 exploring concepts

Flow chart of Concept 1 - Basic screen

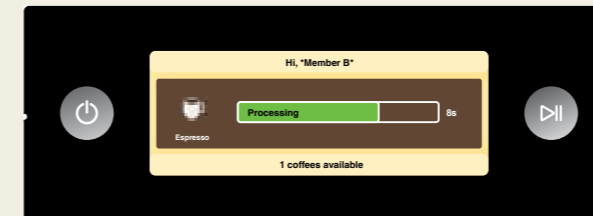
Make a quick coffee



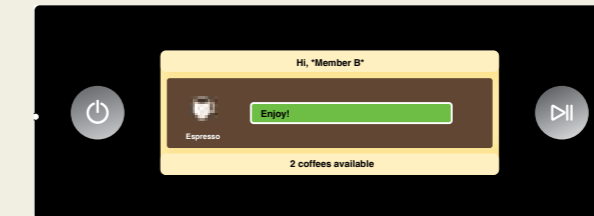
Swipe to browse and press to choose



Slide to customize and press the physical button to brew



Show the process of making coffee with process bar and the remaining time.

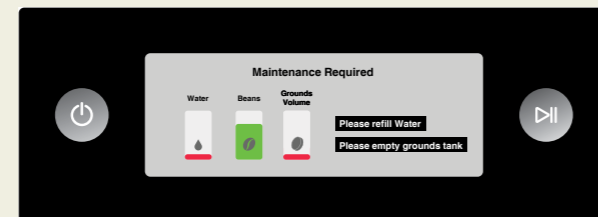


Show notification when the coffee is done.

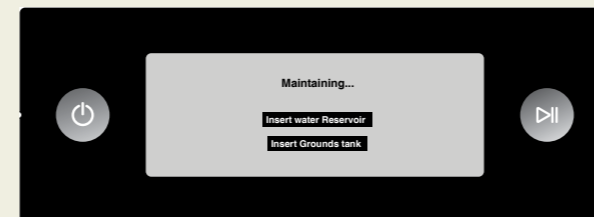


Goes back to the coffee selection page.

When maintenance is required



The maintenance requirement pops up



When the water tank and the grounds container are taken out



Updated maintenance information when it is done. It will remain 5s.

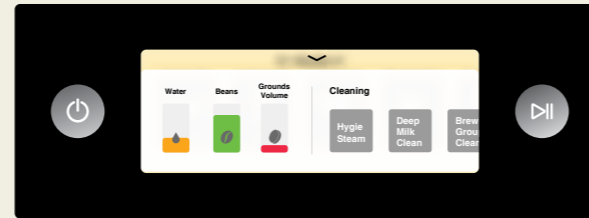


Go back to the coffee selection page automatically.

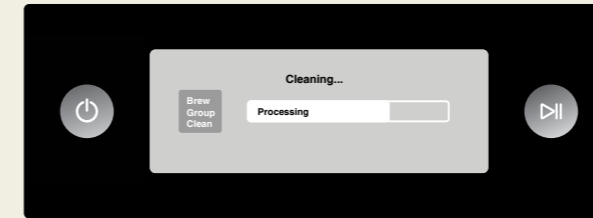
Do specific maintenance



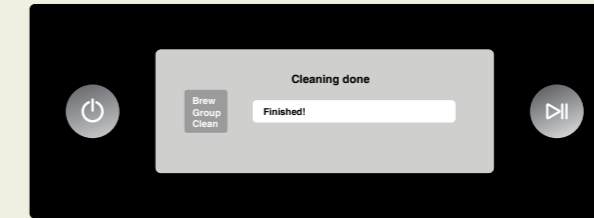
Swipe down to up to go to the maintenance page.



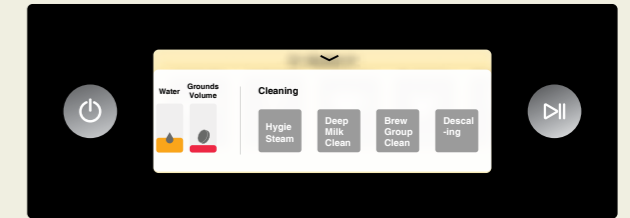
Swipe right to left to browse all the maintenance functions. Press to select the cleaning function.



Show the proccs of cleaning with process bar.



Show notification when the leaing is done,

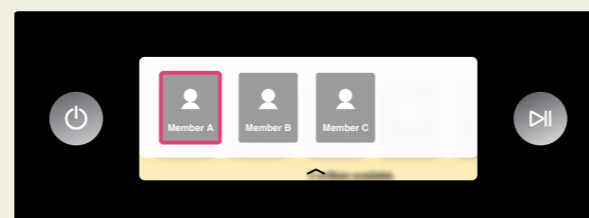


Go back to the maintenance page.

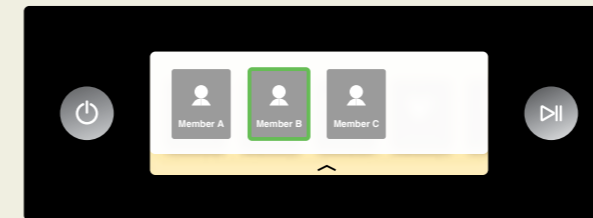
Change profile A into profile B



Swipe top to down to go to the profile page.



The page will show the activated profile A.



Press to select profile B.

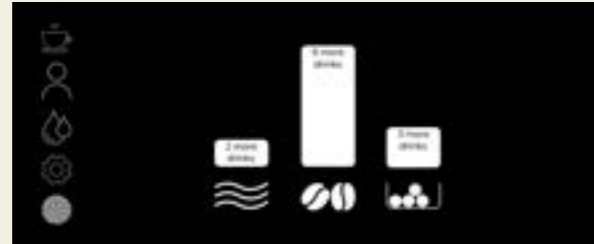


Swipe up to go back to the mainpage.

Appendix 1. Interaction flows of the 3 exploring concepts

Flow chart of Concept 2 - Full touch screen

Make a cup of Espresso



The start screen. See the maintenance status. Select the fingerprint to get a drink from your profile or select the coffee cup to make a drink.



Select the drink of your preference. In this case espresso.



1. Personalize the drink by moving the sliders.
2. Choose if you want one or two cups by selecting one or two.
3. Select brew to make the drink (Or select save to save drink to a profile.)



When maintenance is required

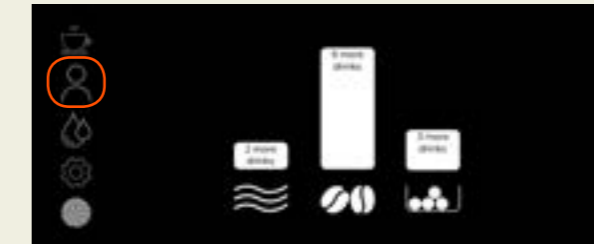


The maintenance requirement pops up when it is needed.



When the maintenance is done, it goes back to the previous page. And the status on the right bottom of the maintenance will be changed.

Select a profile



Select the profile icon on the left.



Select the drink of your preference. In this case espresso.

Appendix 1. Interaction flows of the 3 exploring concepts

Flow chart of Concept 3 - Turning knob

Make coffee



The start screen. See the maintenance status. Select the fingerprint to get a drink from your profile or select the coffee cup to make a drink.



The start screen, the user is currently in coffee mode. Here the user can select the preferred drink. On the right screen the contents of the drinks is shown to give the user an overview.



To make sure the user understands the steps of customization, a pop up will appear that explains the current step (ex. Taste, strength, etc.) When the user interacts with the machine, the pop up will disappear. When the user is satisfied with the customization, the turning knob can be pressed. (The turning knob can be pressed during the whole customization process, so the user does not need to set all the settings.



The process of brewing the coffee is visualised with the light pattern, so the user knows how long the coffee making process will take.



When the user turns the turning knob the light pattern will change. This way the user quickly can see the position of the drink in the coffee menu. The drink can be selected by pressing the turning knob.



The drink can be customized when it is selected. These settings can be changed by turning the knob. User can see the amount of change from both on the light pattern around the turning knob and the right screen. User can use the arrow buttons on the right side of the screen to change the other customization steps.



When the maintenance is done, it goes back to the previous page. And the status on the right bottom of the maintenance will change.

When maintenance is required



Appendix 1. Interaction flows of the 3 exploring concepts

Flow chart of Concept 3 - Turning knob

Profile



The user can press the profile button to access the profiles. The light pattern will change colors depending on the chosen profile. The profile can be selected by pressing the turning knob.



Within the selected profile the user can add their preferred drink and edit their preferences for each drink.



If the user wants to add a drink to the profile, the turning knob will be turned an extra step after the two drinks in the profile. When selected the user can choose from all the drink options and set them up for a profile.



Within the selected profile the user can add their preferred drink and edit their preferences for each drink.



The user can get a quick overview of the settings of the personalised drinks. With the turning knob the user can scroll through their personalised drinks. The user can press the turning knob to brew the selected drink or hold the turning knob to edit the drink.



When the user wants to edit the drink, the customization screen shows up. The blue light pattern and the "B-Espresso" show the user in what menu he is. The user can save the personalised drink by pressing the turning knob.



Now the user can add a drink to the selected profile by turning and pressing the turning knob.

Appendix 2. Questionnaire of icon readability test

Icon test 1

Drinks

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Setting

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Icon test 2

Profile

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Edit profile

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Icon test 3

Water

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Coffee beans

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Coffee Grounds

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Icon test 4

Strength: The strength of the coffee is defined by the amount of coffee beans that are used to brew the coffee. If the strength is higher, the coffee will have a stronger coffee taste.

How much do you think the icon can represent this meaning?

1 2 3 4 5

not at all ○○○○○ quiet well

Taste: The taste of the coffee is defined by the pressure that is used to make the coffee. Increased pressure will increase the intensity of the taste of the coffee.

How much do you think the icon can represent this meaning?

1 2 3 4 5

not at all ○○○○○ quiet well

Which of the three 'Words' do you think can represent this meaning better?

Taste

Aroma

Pressure

Other:

Which icons do you think can represent this meaning better?

Option 1

Option 2

Option 3

Water amount: The water amount is used to determine the amount of coffee that is being brewed. More water means more coffee.

How much do you think the icon matches its meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Temperature: The temperature of the coffee can vary between 91 and 96 degrees Celsius. Changing the temperature of the coffee does influence the taste of the coffee. A higher temperature will make sure the water extracts more from the grinded coffee beans.

How much do you think the icon can represent this meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Milk amount: The milk amount defines the amount of milk that is used to brew the milk containing drinks. This amount defines unprocessed milk.

How much do you think the icon can represent this meaning?

1 2 3 4 5

not at all ○○○○○ match quiet well

Never submit passwords through Google Forms.

Appendix 3. Research questions

Research questions about highlight features

- 1. Are the participants able to quickly prepare a coffee?**
 1. Does the profile section help to user to get a quick coffee?
 2. Do the participants understand when they are able to press the brew button? (to prepare the coffee)
- 2. Is the maintenance (the information and the activity of doing the maintenance) disturbing the coffee making process?**
 1. Do people understand the maintenance indication bar?
 2. Is the maintenance information helping the user to be prepared for the maintenance?
 3. Do the participants understand the meaning of the light icon(water, beans and coffee grounds) on the coffee machine?

Research questiona about general usability and experience

- 3. Do the participants understand the icons, text and interactions provided by the machine.**
 1. Do they understand the different functionalities (drinks, clean and settings)?
 2. Do they understand the icons meanings? (Maintenance, functionalities, customization)
 3. Do participants understand the wording of the interface? (customization + explanation, maintenance + explanation) and did people use the extra information when needed?
- 4. Do the participants experience the product as a luxurious product (interface & machine)?**

Appendix 4. Detailed explanation of test procedure

Script

The script is used as a guide through the user test. The script has to be followed during the tests, to make sure all the participants go through the same test procedure, the results will be more reliable.

Introduction (5 min)

The participant is introduced to the procedure. To make sure the participant understands the setup and the goal of the test. To make the user feel at ease.

Welcome the tester. Thank you for participating.

Please sit down.

- Introduce team:
 - Host Guide you through the test.
 - Note taker Take notes
 - Assistant Wizard of ozzing.

PRACTICALITIES

- **Recording (video and photo)**
These recording materials will only be used for the research on the Philips Saeco during the UXAD course.
- **Consent form**
Please sign the consent form we have sent you. You volunteer as a participant, video and photo material, sharing.
- The test will take about 60 min.

THE REDESIGN

Gathering basic information

- **short interview** → to get insight in you as a participant about your coffee habits and knowledge.

Prototype

- **Usability of the redesign** prototype.
- We are using an **ipad** to represent a **touch screen display and two physical buttons**. The machine does not function with this prototype, so don't expect any coffee. Try to imagine it.
- Scrolling interactions don't work

THE TEST

Explain procedure

- 3 scenarios → you will then do the tasks.
- There is no wrong answer, as we are testing the redesign and not you.
- Think aloud.

- Questions? → ask them

Interview (5 min)

First we will do a short interview to get insight into the participant and its knowledge of coffee and coffee machines. These answers are filled in into a Google Forms to keep the answers on the same place.

Goal Get insight into our participants (general, coffee machines and coffee knowledge).

General

- Gender:
 - M/F
- What is your age?
- What is your nationality?
- Activity , student ?
- How does your household look like? Student house? Alone/studio.

Coffee

- How much coffee do you drink?
- How often do you make coffee at home? And at what moments do you do this? Why on this specific moment?
- What is your knowledge on coffee?
 - expert/beginner/moderate?
- With what coffee machines do you usually prepare coffee?
 - Show list of coffee machines
- What is your expectation of a fully automatic coffee machine?

First impression (<5 min)

The first impression of the participant is gathered about the machine and its interface. There is no interaction yet. The redesign is shown as a rendering on a poster.

Goal Get an impression of the first thoughts about the aesthetics of the machine.

- What is your first impression of this product? You can look at the interface and the machine itself.

It is important to not interrupt the test. So these questions can help to not guide the participant too much, but still, try to get insight into the problem.

Helpful questions for during the test

- You look a bit lost, can you maybe explain why?
- What do you think caused this to happen?
- What is causing this problem?

System usability scale (5 min)

The System Usability Scale (SUS) is a 10 item Likert scale questionnaire to measure the usability of a product or service. With the SUS the usability of the coffee machine is checked. The participant is asked to rate the 10 questions from strongly disagree to strongly agree.

System usability scale

Strongly agree Strongly disagree

Question	1	2	3	4	5
1. I think that I would like to use this system frequently.					
2. I found the system unnecessarily complex.					
3. I thought the system was easy to use.					
4. I think that I would need the support of a technical person to be able to use this system.					
5. I found the various functions in this system were well integrated.					
6. I thought there was too much inconsistency in this system.					
7. I would imagine that most people would learn to use this system very quickly.					
8. I found the system very cumbersome to use.					
9. I felt very confident using the system.					
10. I needed to learn a lot of things before I could get going with this system.					

When the results are gathered:

- The best way to interpret your results involves "normalizing" the scores to produce a percentile ranking.
- The participant's scores for each question are converted to a new number, added together and then multiplied by 2.5 to convert the original scores of 0-40 to 0-100. Though the scores are 0-100, these are not percentages and should be considered only in terms of their percentile ranking.
- Based on research, a SUS score above a 68 would be considered above average and anything below 68 is below average.

Interview (5 min)

The interview at the end of the user test is used to find in depth information about the usability problems and opportunities.

- Can you describe the experience you had with the machine? What went wrong and what went right? And why?
- Did you understand when you were able to brew your coffee?
- What did you think about the maintenance information?
 - Icons on the containers
 - The maintenance indicator
 - The maintenance information + overview
- What did you think about the aesthetic look of the machine?
- Did you have any difficulties with the icons provided on the machine?
 - Coffee selection
 - Menu structures / functionalities
 - Customization
 - Profile section
 - Maintenance
- Did you have any difficulties with the information provided on the machine?
 - Maintenance
 - Customization
 - Waiting time
 - Functionalities
- If you have to compare the machine from a Volkswagen to a Bentley (choose from these cars)

Appendix 5. Test setup

Room setup

To have a fluent test it is important to think about the setup of the room. This is important to gather data the right way, but also to make the participants feel comfortable during the tests and to make them imagine the right setting. Figure A3.1 shows the setup of the room which will be explained in detail.

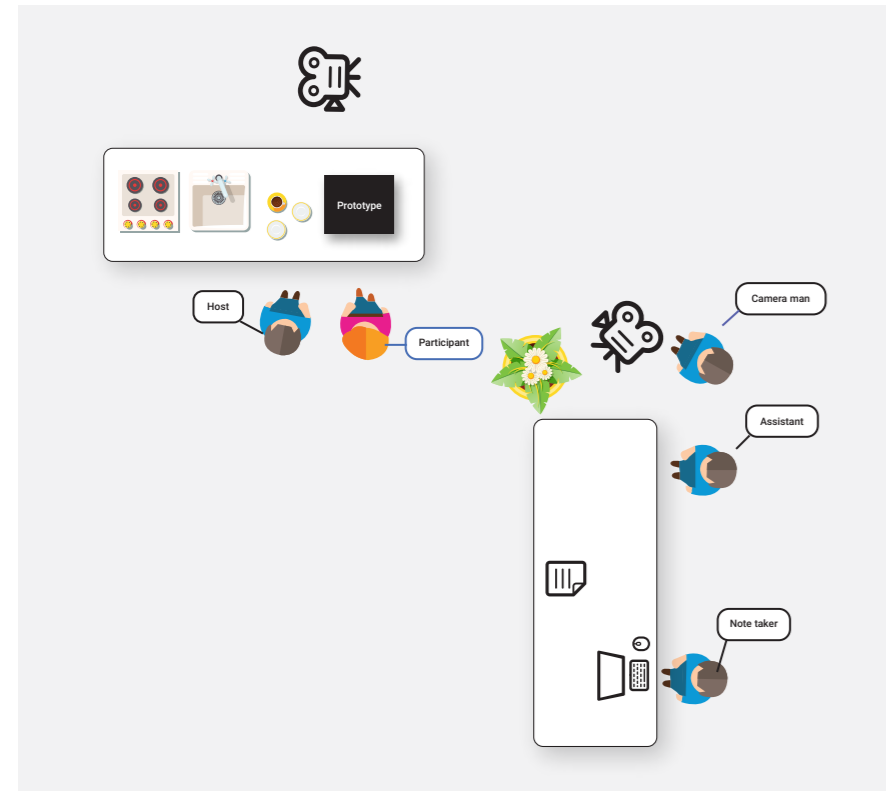


Figure A3.1

Convenient to gathering data

The data from the user tests is gathered in different ways. The table on the right is used to start the test, sign the consent form, to do the interviews before and after the actual test and to fill in the System Usability Scale. The user tests, with the three scenarios are done at the table on the top. To record the user tests two cameras are set up. One to capture the facial expressions and body language of the participant and one to capture the interactions with the coffee machine.

Make testers feel comfortable

To make sure the participants feel comfortable the complete user test is divided over two tables. The welcoming, consent form and interviews are done at the right table while being seated to create a relaxed environment. here the participant can take a snack if wanted.

Help testers to imagine the setting

To make the participant imagine the setting of the test, a kitchen layout has been replicated to help the participant imagine the normal setting where the machine is used. A plant is added to the setting of the room to dress the room and to separate the note-taker and assistant from the testing.

Appendix 5. Test setup

Roles and positions



Host	Gijs	Serve as a host during the whole test, introduce all the tasks and host all the test, also introduce the participants, take the consent form and interviews.
Assistant	Marieke & Gu	The assistants will operate some parts of the prototype from a distance(wizard of oz). (The lights on the container will be turned on and off from a distance, and some screens of the interface need to be controlled from a distance)
Camera-man	Liangyi	Make video recordings of the test. Upload the data on the drive as soon as possible after the test.
Note taker	Alessia	Takes notes during the test. A note-taking form is provided to make the note-taking easier to do and to interpret.

Figure A3.2 Roles and role division during the usability test

Appendix 5. Test setup

Participants recruitment

Participants requirements

To get results from the user test that represent the target group, it is important to test with this target group.

At least two participants that represent the target group are wanted for the test.

In total a group of 8 participants is required.

Total testers >=8

Tester from target group >=2

- People with a day job
- Age between 30-50 years old
- Likes high-end products
- Likes to drink coffee
- The participant is from one of the targeted countries (the Netherlands, Poland, USA, China, Germany)

For the other testers:

- Can be both male and female.
- Has experience interacting with touch screens.
- Drinks at least one cup of coffee a day.

Appendix 6. Note-taking form

	Good	Bad
Turn on machine		
Button		
Experience		
(General)		
Coffee selection		
Grid		
Icons		
(General)		
Overview of coffee		
½ cups		
Coffee picture		
Customization		
Profile		
(General)		
Customization		
Icons		
Text		
Extra information		
Bars		
Profiles		
(General)		
Brewing		
Progress bar		
(General)		
Maintenance		
Maintenance indicator		

Maintenance overview		
Maintenance icons on machine		
Doing the maintenance		
(General)		

Appendix 7. Detailed description of the tasks

Tasks (20 min)

Scenario 1 - Explore the functionalities of the machine. (5 min)

Maintenance status: 3 cups available.

"You just bought the machine and did not yet try it out. Explore the functionalities of the machine. When you think you have a clear idea of the machine you can stop." (The machine is turned off)

Task 1.1 - Turn on the machine

Turn on the machine to start the test, participant can experience the start up

Task 1.2 - Explore the functionalities.

The participant can look through the system a little bit.

1.3 - Turn off machine

After a while the machine turns off automatically, or you can press the

Test goal

- See how a first-time user operates the machine.
- See whether people understand the interface of the machine at first time use
- See whether people understand the icons and text that are provided at first time use.
- Find out what the person expresses about the aesthetics.

Maintenance

When the drink is prepared, there is water left for 3 more drinks.

! Maintenance indicator pops up. Water left for 3 more drinks.

"The machine will turn off automatically"

[machine is turned off by the assistant]

Scenario 2 - Make an espresso with customized taste and (create your own profile)

Maintenance status: 3 cups available.

"Sunday afternoon: You are going to make an espresso for yourself, you like your espresso a bit larger with a strong taste. You would like to drink this espresso more often, for example in the morning before going to work."

Depending whether the maintenance is done, this still needs to happen.

Task 2.1 - Turn on machine

The participant can explore the process of making a drink. He/she can choose to save the drink to a profile.

Task 2.2 - Prepare the espresso from the profile section

The participant can select his/her own profile to get the favourite espresso as fast as possible.

Test goal

- See whether people can quickly and easily prepare their preferred drink using the profiles.

"You will go to the living room to drink your espresso. The machine will turn off automatically"

[machine is turned off by the assistant]

Scenario 3 - Make an espresso and a cappuccino (10 min)

Maintenance status: 2 cups available.

"A friend (teammember) is visiting you, he would like to drink a cappuccino and you would like to have your favourite espresso. First serve your friend and then serve yourself. Imagine "teammember" is your friend."

Task 3.1 - Turn on machine

The participant can explore the process of making a drink. He/she can choose to save the drink to a profile.

Task 3.2 - Prepare the cappuccino and save it

Go through all of the steps to prepare the drink.

! After the brewing → Maintenance message on top of the screen. "Water left for 1 more drinks"

When the water tank is pulled out → maintenance overview pops up.

Task 3.3 - Prepare the coffee

Go through all of the steps to prepare the drink.

! after the brewing → Maintenance message pops up. "Water needs to be refilled"

When the water tank is pulled out → maintenance overview pops up.

Test goal

- See whether the maintenance (information and the activity) is disturbing the participant.
- See whether people can easily save their preferred drink.
- See whether people understand the interface of the machine
- See whether people understand the icons and text that are provided

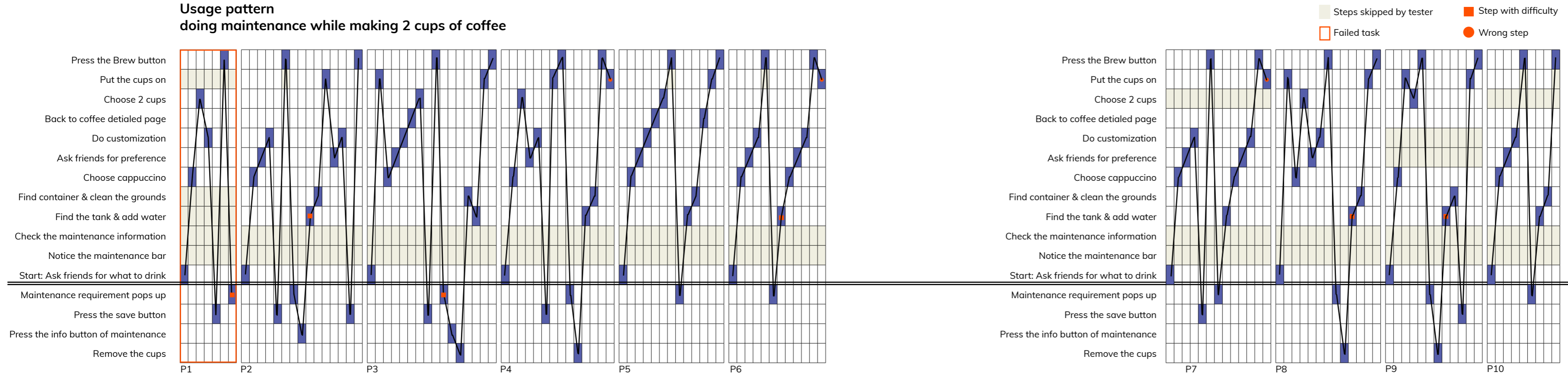
"The machine will turn off automatically"

[the machine is turned off by the assistant]

Appendix 8. Usage pattern

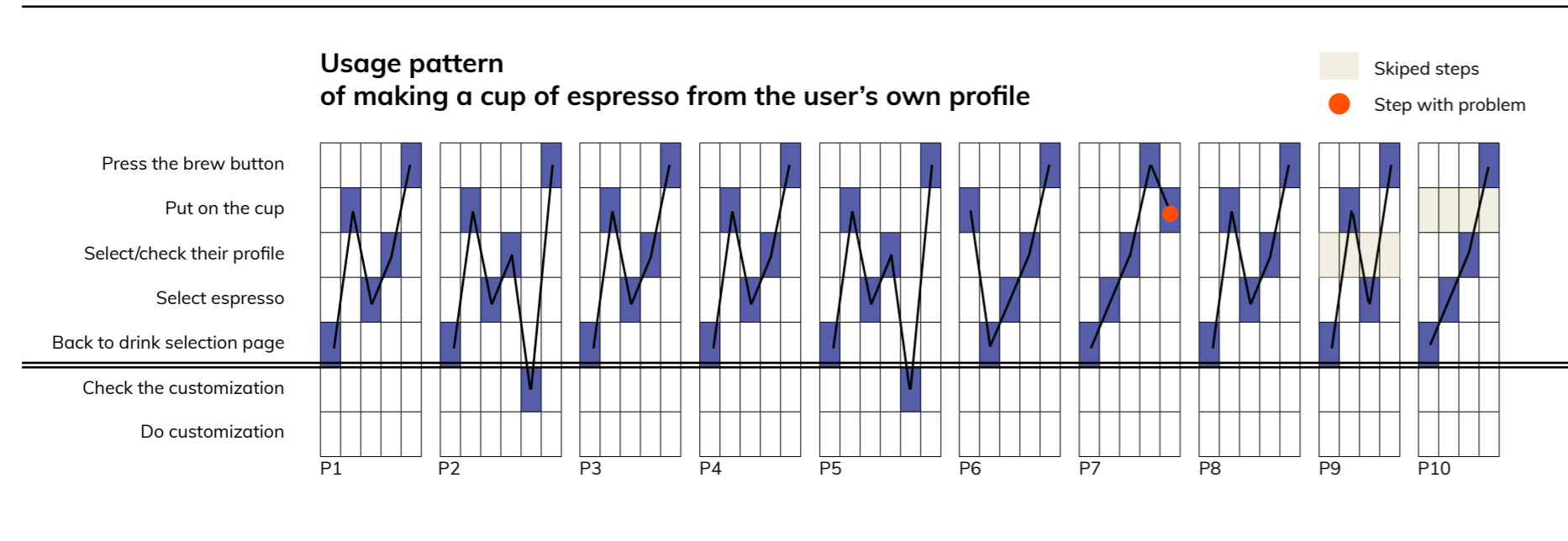
Doing maintenance while making 2 cups of coffee

Usage pattern
doing maintenance while making 2 cups of coffee



Appendix 8. Usage pattern

Make a cup of espresso from profile



Appendix 9. Raw data of system usability scale

Participant number: 1		System usability scale				
Question	1	2	3	4	5	
1. I think that I would like to use this system frequently.					✓	
2. I found the system unnecessarily complex.		✓				
3. I thought the system was easy to use.			✓	✓		
4. I think that I would need the support of a technical person to be able to use this system.	✓					
5. I found the various functions in this system were well integrated.			✓			
6. I thought there was too much inconsistency in this system.	✓					
7. I would imagine that most people would learn to use this system very quickly.					✓	
8. I found the system very cumbersome to use.	✓					
9. I felt very confident using the system.				✓		
10. I needed to learn a lot of things before I could get going with this system.	✓					

$27 \cdot 2,5 = 54 + 13,5 = 67,5$

Participant number: 2		System usability scale				
Question	1	2	3	4	5	
1. I think that I would like to use this system frequently.					✓	
2. I found the system unnecessarily complex.		✓				
3. I thought the system was easy to use.				✓		
4. I think that I would need the support of a technical person to be able to use this system.	✓					
5. I found the various functions in this system were well integrated.				✓		
6. I thought there was too much inconsistency in this system.			✓			
7. I would imagine that most people would learn to use this system very quickly.				✓		
8. I found the system very cumbersome to use.		✗		✓		
9. I felt very confident using the system.				✓		
10. I needed to learn a lot of things before I could get going with this system.		✓				

$33 \cdot 2,5 = 66 + 16,5 = 82,5$

Appendix 9. Raw data of system usability scale

Participant number: 3

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.				✓	
2. I found the system unnecessarily complex.		✓			
3. I thought the system was easy to use.				✓	
4. I think that I would need the support of a technical person to be able to use this system.	✓				
5. I found the various functions in this system were well integrated.				✓	
6. I thought there was too much inconsistency in this system.	✓				
7. I would imagine that most people would learn to use this system very quickly.				✓	
8. I found the system very cumbersome to use.	✓				
9. I felt very confident using the system.			✓		
10. I needed to learn a lot of things before I could get going with this system.	✓				

$25 \times 2,5 = 63,5$

Participant number: 4

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.			✗		
2. I found the system unnecessarily complex.	✗				
3. I thought the system was easy to use.					✗
4. I think that I would need the support of a technical person to be able to use this system.	✗				
5. I found the various functions in this system were well integrated.					✗
6. I thought there was too much inconsistency in this system.		✗			
7. I would imagine that most people would learn to use this system very quickly.					✗
8. I found the system very cumbersome to use.	✗				
9. I felt very confident using the system.				✗	
10. I needed to learn a lot of things before I could get going with this system.	✗				

$28 \times 2,5 = 70$

Participant number: 5

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.					✓
2. I found the system unnecessarily complex.		✓		✓	
3. I thought the system was easy to use.				✓	
4. I think that I would need the support of a technical person to be able to use this system.	✓				
5. I found the various functions in this system were well integrated.					✓
6. I thought there was too much inconsistency in this system.	✓				
7. I would imagine that most people would learn to use this system very quickly.				✓	
8. I found the system very cumbersome to use.	✓				
9. I felt very confident using the system.					✓
10. I needed to learn a lot of things before I could get going with this system.		✓			

$30 \times 2,5 = 75$

Participant number: 6

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.				✗	
2. I found the system unnecessarily complex.				✗	
3. I thought the system was easy to use.			✗		
4. I think that I would need the support of a technical person to be able to use this system.	✗				
5. I found the various functions in this system were well integrated.					✗
6. I thought there was too much inconsistency in this system.				✗	
7. I would imagine that most people would learn to use this system very quickly.				✗	
8. I found the system very cumbersome to use.			✗		
9. I felt very confident using the system.					✗
10. I needed to learn a lot of things before I could get going with this system.		✗			

Appendix 9. Raw data of system usability scale

Participant number: 7

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.					✓
2. I found the system unnecessarily complex.			✓		
3. I thought the system was easy to use.				✓	
4. I think that I would need the support of a technical person to be able to use this system.	✓				
5. I found the various functions in this system were well integrated.				✓	
6. I thought there was too much inconsistency in this system.	✓				
7. I would imagine that most people would learn to use this system very quickly.					✓
8. I found the system very cumbersome to use.	✓				
9. I felt very confident using the system.				✓	
10. I needed to learn a lot of things before I could get going with this system.	✓				

Participant number: 8

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.				α	
2. I found the system unnecessarily complex.			X		
3. I thought the system was easy to use.				X	
4. I think that I would need the support of a technical person to be able to use this system.			α		
5. I found the various functions in this system were well integrated.				X	
6. I thought there was too much inconsistency in this system.		X			
7. I would imagine that most people would learn to use this system very quickly.				X	
8. I found the system very cumbersome to use.		α			
9. I felt very confident using the system.					X
10. I needed to learn a lot of things before I could get going with this system.				α	

Participant number: 9

System usability scale

Question	Strongly disagree			Strongly agree	
	1	2	3	4	5
1. I think that I would like to use this system frequently.			X		
2. I found the system unnecessarily complex.				α	
3. I thought the system was easy to use.			α		
4. I think that I would need the support of a technical person to be able to use this system.		X			
5. I found the various functions in this system were well integrated.				α	
6. I thought there was too much inconsistency in this system.	X				
7. I would imagine that most people would learn to use this system very quickly.			X		
8. I found the system very cumbersome to use.		α			
9. I felt very confident using the system.			α		
10. I needed to learn a lot of things before I could get going with this system.		X			

strongly agree. 3300 (10)

System usability scale

Question	Strongly agree					Strongly disagree				
	1	2	3	4	5	1	2	3	4	5
1. I think that I would like to use this system frequently.		o		X						
2. I found the system unnecessarily complex.					o					
3. I thought the system was easy to use.		o								
4. I think that I would need the support of a technical person to be able to use this system.										o
5. I found the various functions in this system were well integrated.		o								
6. I thought there was too much inconsistency in this system.										o
7. I would imagine that most people would learn to use this system very quickly.		o								
8. I found the system very cumbersome to use.										o
9. I felt very confident using the system.		o								
10. I needed to learn a lot of things before I could get going with this system.										o

When the results are gathered:

- The best way to interpret your results involves "normalizing" the scores to produce a percentile ranking.
- The participant's scores for each question are converted to a new number, added together and then multiplied by 2.5 to convert the original scores of 0-40 to 0-