

# Design IoT Supported User Interventions for Sustainable Washing Usage

## Appendix



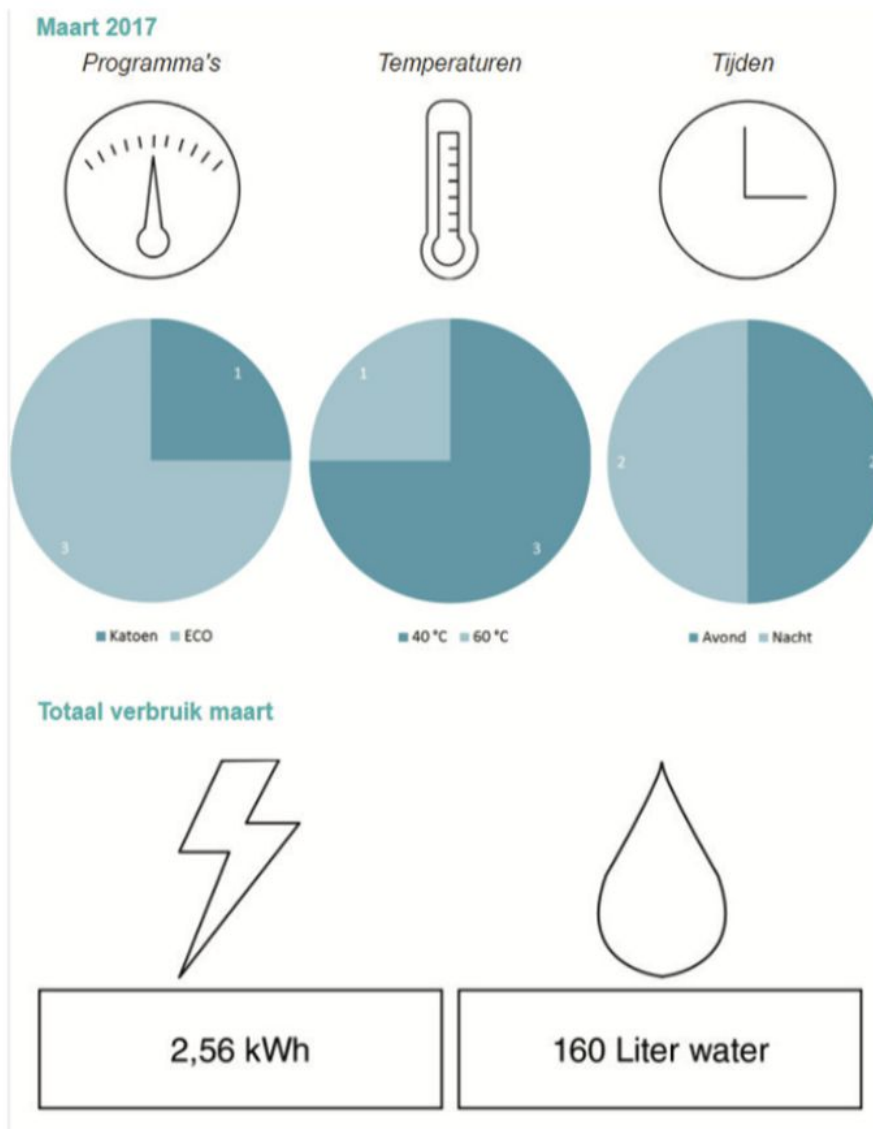
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## Table of Content

<b>Table of Content</b>	<b>1</b>
<b>Appendix 1: Project Brief</b>	<b>2</b>
<b>Appendix 2: HOMIE's Old Version Intervention Emails</b>	<b>9</b>
<b>Appendix 3: User Interview Questions</b>	<b>14</b>
<b>Appendix 4: User Interview Scripts</b>	<b>16</b>
<b>Appendix 5: Concept Iteration</b>	<b>27</b>
<b>Appendix 6: Two Concepts Evaluation Form</b>	<b>38</b>
<b>Appendix 7: HOMIE Lifestyle Wireframes 1.0</b>	<b>39</b>
<b>Appendix 8: User Test 1.0 Plan</b>	<b>43</b>
<b>Appendix 9: User Test 2.0 Plan</b>	<b>47</b>
<b>Appendix 10: User Test 2.0 Evaluation Forms</b>	<b>53</b>
<b>Appendix 11: User Test 2.0 Participants Scripts</b>	<b>57</b>

## Appendix 2: HOMIE's Old Version Intervention Emails

First month



### 2. Efficiënt wassen

We zien dat je al gebruik gemaakt hebt van het ECO-wasprogramma, goed bezig! *Het ECO programma kan namelijk tot 23% van de gebruikte energie besparen bij een 40 °C was.* Dit komt doordat het ECO-programma niet gebruik maakt van hogere temperaturen, maar van langere inwerktijden om een effectieve wassessie te garanderen. Hierdoor kan de machine energie besparen bij het opwarmen van het water.

Wassen op koudere temperaturen kan aanzienlijk schelen in het energieverbruik van de wasmachine. Wist je dat je met ons koude wasprogramma nog eens *25% kan besparen ten opzichte van een 30 °C was?*

## Second month

### 1. Wasgedrag van afgelopen maand

De volgende informatie is gebaseerd op onze data van de 4 wassen die je gedraaid hebt in de maand maart. Ter vergelijking staat je wasdata van de voorgaande maand eronder:

#### Maart 2017

Programma's



■ Synthetics ■ Wol ■ ECO

Temperaturen



■ 30°C ■ 40°C ■ 60°C

Tijden



■ Ochtend ■ Middag ■ Avond ■ Nacht

#### Februari 2017

Programma's



■ Synthetics ■ ECO ■ Katoen

Temperaturen



■ 30°C ■ 40°C ■ 60°C

Tijden



■ Ochtend ■ Middag ■ Avond ■ Nacht

#### Totaal verbruik maart



2,28 kWh



164 Liter water

### 2. Efficiënt wassen

We zien dat je al gebruik hebt gemaakt van het ECO-wasprogramma, goed bezig! Het ECO programma kan namelijk tot 23% van de gebruikte energie besparen bij een 40 °C was. Dit komt doordat het ECO-programma niet gebruik maakt van hogere temperaturen, maar van langere inwerktijden om een effectieve wassessie te garanderen. Hierdoor kan de machine energie besparen bij het opwarmen van het water.

Wassen op koudere temperaturen kan aanzienlijk schelen in het energieverbruik van de wasmachine. Wist je dat een 30 °C was al 25% goedkoper is in energieverbruik dan een 40 °C was, en dat je met ons koude wasprogramma nog eens 25% kan besparen ten opzichte van een 30 °C was?

## Third month

### A. Gemiddelde gebruiker

Hieronder tonen we een kort overzicht van jouw waarden, én de waarden die gelden voor een gemiddeld Nederlands gezin van vier personen, gevolgd door een uitgebreider overzicht van jouw wasinformatie:

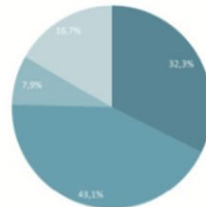
#### Jouw data

14 wasbeurten/maand	31 wasbeurten/maand
7,17 kWh energie	14,5 kWh energie
475 Liter water	1548 Liter water



30°C  
40°C  
60°C

#### Gemiddeld 4-persoonsgezin



30°C  
40°C  
50°C  
60°C

### B. Programma



Vaker het ECO-programma gebruikt

#### Vorige maand

#### Deze maand



30 min ECO Katoen



30 min ECO

### C. Temperatuur



warmer wassen gestegen

#### Vorige maand

#### Deze maand



30°C 40°C



30°C 40°C 60°C

### D. Tijden



niet 's nachts gewassen

#### Vorige maand

#### Deze maand



Ochtend Middag Avond Nacht



Ochtend Middag Avond Nacht

## 2. Wasgedrag van afgelopen maand

De volgende informatie is gebaseerd op onze data van de was die je gedraaid hebt in maart.

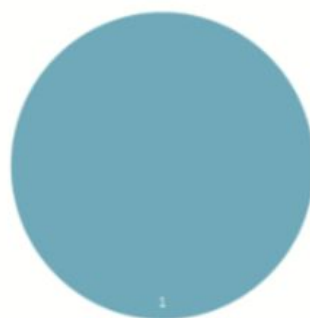
Hieronder tonen we een kort overzicht van jouw waarden, én de waarden die gelden voor een gemiddeld Nederlands huishouden van 1 persoon. We zien hier dat je vergeleken met een gemiddeld 1-persoons huishouden minder wassen hebt gedraaid, en vaker op een lage temperatuur wast. Heel goed!

### Jouw data

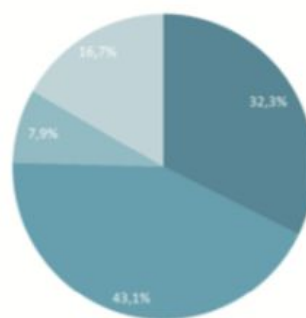
1 wasbeurt/maand
0,66 kWh energie
62 Liter water

### Gemiddeld 1-persoonshuishouden

11 wasbeurten/maand
14,5 kWh energie
480 Liter water



40°C



30°C  
40°C  
50°C  
60°C

### E. Totaal verbruik

Ook hebben we een overzicht gemaakt van jouw totale water- en energieverbruik:



7,17 kWh  
(meer dan 2x zoveel  
als vorige maand)



475 Liter water  
(32% meer dan  
vorige maand)

## Jouw meest gebruikte programma

Om je inzicht te geven in de wassen die je draait, hebben we hier wat informatie over jouw meest gebruikte wasprogramma:



0,66 kWh

62 L water

3:14 uur

Ter vergelijking, een lagere temperatuur heeft de volgende waarden:



0,35 kWh

44 L water

2:51 uur

## Appendix 3: User Interview Questions

### 1. Introduction

- a. Introduce myself, HOMIE

Hi my name Yihan, currently I am the graduation student involved in HOMIE project to make a more sustainable washing machine, thanks for your help in advance, your answers will be really helpful for my research.

- b. Explain general idea and purpose of the interview. There are no wrong answers all responses are good.
- c. Would you mind if I record the interview? and take some pictures? Ensure confidentiality

### 2. Basic Information

- a. Age
- b. Occupation
- c. How many people live with you? Who are they?
- d. Who usually in charge of washing?
- e. How long have you been using HOMIE washing machine?

### 3. Landary Process

- a. Could you describe the usual process that you go through when you wash your clothes?
- b. What motivates you to do the laundry?
- c. How often do you do laundry? (Do you have a schedule for it?)
- d. What do you care most about the landry?(cleaness, speed, cost...)
- e. What to achieve, what to avoid?
- f. Sorting
  - i. How do you sort different types of clothes?
  - ii. Why in that way?
- g. Filling
  - i. How do you fill in the washing machine?
  - ii. Do you know you have the full load in every wash? What if you can't make the full load? Do you care about that? Will that change your plan?
- h. Program choosing
  - i. Is this interface easy for you to understand?
  - ii. How do you choose program?
  - iii. What are your top 3 concerns when choose the program? (time, effect, load, material...)
  - iv. How do you decide which temperature to choose?
  - v. What do you think of ECO mode? How often do you use ECO mode?
- i. Detergent
  - i. What type of detergent do you use? Why that one?
  - ii. How much do you use every time? How do you know it's a proper amount or not?

### 4. Sustainable behavior

- a. To what extent do you normally think about the environmental impact of washing?



- b. How did this change since you wash with HOMIE machine?
- c. How do you think of HOMIE's monthly email that reporting your washing behavior? Does it impact on your behavior? Why?(\*\*\*\*\*Intervention emails show)
- d. What feedback do you expect HOMIE gives to you in the mail?
- e. Have you ever think of doing landary in a more sustainable way? Why or why not?
- f. Do you feel that the interface of the washing machine has told you enough information on whether you're doing sustainable laundry or not? What feedback do you think you need when interact with the machine?
- g. What other sustainable habits do you have? Why do you have those habits?

That's it. Thank you so much for the help!

## Appendix 4: User Interview Scripts

### Participant 1

#### 1. Basic Information

- a. Age  
33years old
- b. Occupation  
works in administration
- c. How many people live with you? Who are they?  
lives with husband and a 2 year old child.
- d. Who usually in charge of washing?  
Cindy does, because her husband doesn't like to and there should be someone do it.
- e. How long have you been using HOMIE washing machine?  
More than 1 year

#### 2. Landary Process

- a. Could you describe the usual process that you go through when you wash your clothes?
  - Throw them into washing basket until it's full
  - Sort clothes by light and dark colors
  - Then put into shopping bag
  - Fill them in the washing machine(Usually put the whole bag in, the volume is okay)
  - Select 30/30 program
  - Set time delay, 4hours usually
  - Put detergent based on the instruction on the bottle
  - Leave home
- b. What motivates you to do the laundry?  
Husband hates to do.  
Clean the clothes.
- c. How often do you do laundry? (Do you have a schedule for it?)  
Wait to landary bin is full
- d. What do you care most about the landry?(cleaness, speed, cost...)  
**Cleaness**
- e. What to avoid?  
Not really, already seperate the color, should be no problem
- f. Sorting
  - i. How do you sort different types of clothes?  
Based on color, light and black, wash child's clothes together with adults
  - ii. Why in that way?
- g. Filling
  - i. How do you fill in the washing machine?  
Using a shopping bag, ful is okay  
Towels do less
  - ii. Do you know you have the full load in every wash? What if you can't make the full load? Do you care about that? Will that change your plan?  
Always full load, tricks to the washing machine. :)  
**To reduce the times of washing**

- h. Program choosing (\*\*\*\*\*Interface show)
  - i. Is this interface easy for you to understand?  
Very clear
  - ii. How do you choose program?  
**30/30, because it's fast**  
Washing machine is on, she is not at home. 11:00-11:30. Because she has met a problem poll out the water, whole bathroom was flooded with water. Then she would like to run the washing machine as shorter as possible when she is not at home
  - iii. What are your top 3 concerns when choose the program? (time, effect, load, material...)  
How long it takes
  - iv. How do you decide which temperature to choose?  
The lowest most, but for 30/30 is automatically 30, don't touch the button anymore
  - v. What do you think of ECO mode? How often do you use ECO mode?  
Using it on Sunday, she can monitor it all the time, then she dares to use it for a longer time
- i. Detergent
  - i. What type of detergent do you use? Why that one?  
Cup on the top of bottle, **no indication on the washing machine**
  - ii. How much do you use every time? How do you know it's a proper amount or not?  
Based on the experience, it's clean and smells good, then should in a right volume

### 3. Sustainable behavior

- a. To what extent do you normally think about the environmental impact of washing?  
**Not really, it uses a lot of water anyway.**  
**Why not? This is just a small thing, if it's make standard eco, then she will use. 30/30 No eco indication for that function.**
- b. How did this change since you wash with HOMIE machine?  
Do the short cold program, at home use ECO
- c. How do you think of HOMIE's monthly email that reporting your washing behavior? Does it impact on your behavior? Why?(\*\*\*\*\*Intervention emails show)  
Very good to be conscious on how your washing behave. **Doesn't really have impact. 2-3wash/week, not too much in the situation that laundry is necessary.**
- d. What feedback do you expect HOMIE gives to you in the mail?  
No, they are clear, like the clear overview
- e. Have you ever think of doing landary in a more sustainable way? Why or why not?  
Yes, it's avaiable and use normal time, sure.  
Previous experience restricts.
- f. Do you feel that the interface of the washing machine has told you enough information on whether you're doing sustainable laundry or not? What feedback do you think you need when interact with the machine?  
Indicator where set on.  
**Better to see the energy and water consumption.**

No others.

- g. What other sustainable habits do you have? Why do you have those habits?  
Using candles in the winter before turning on the heating system to save the energy.

Motivation: like the candles, make the room cozy.

**Behavior comes from the preference**

About the information on the website

It's clear, they have very clear picture on how it works Can't link to the router Get in touch by email ,quickly reacted within one hour

#### Participant 2 (Roamer/Millennail)

##### 1. Basic Information

- a. Age  
29 years old
- b. Occupation  
Works in development finance, for emerging area.  
Investing Africa  
**Be sustainable in his work and his life**
- c. How many people live with you? Who are they?  
Lives with girlfriend.
- d. Who usually in charge of washing?  
Most on weekend , put clothes in the bin.  
He has white shirts, so white washing  
She does the color washing.  
Before girlfriend moves in he doesn't sort.
- e. How long have you been using HOMIE washing machine?  
Almost 1 year, from June/July 2017

Reason to get HOMIE:

- 1) Don't want to own the machine because he lives only a short term
- 2) Cheaper since he washes 1/week compare to the monthly rent one.  
But now considering change because girlfriend came...

##### 2. Laundry Process

- a. Could you describe the usual process that you go through when you wash your clothes?
  - Throw them into washing basket until weekend
  - Sort clothes by light and dark colors
  - Then put into shopping bag
  - Fill them in the washing machine(Usually put the whole bag in, the volume is okay)
  - Select 30/30 program
  - Set time delay, 4hours usually
  - Put detergent based on the instruction on the bottle
  - Leave home
- b. What motivates you to do the laundry?  
Husband hates to do.

- Clean the clothes.
- c. How often do you do laundry? (Do you have a schedule for it?)  
Clothes every weekend, Sheet every other week
  - d. What do you care most about the laundry?(cleaness, speed, cost...)  
**Cleaness**
  - e. What to avoid?  
Not really, already seperate the color, should be no problem
  - f. Sorting
    - i. How do you sort different types of clothes?  
Based on color, light and black, wash child's clothes together with adults
    - ii. Why in that way?
  - g. Filling
    - i. How do you fill in the washing machine?  
Just put in
    - ii. Do you know you have the full load in every wash? What if you can't make the full load? Do you care about that? Will that change your plan?  
Not everytime full loaded, 2 people also need seperate colors  
Usually medium high.  
Try to put as possible. But not that much clothes.
  - h. Program choosing (\*\*\*\*\*Interface show)
    - i. Is this interface easy for you to understand?  
Very clear
    - ii. How do you choose program?  
**Usually Cotton 40 degrees,**  
**Sometime in a hurry, choose the "Quick" function.**  
30/30 never occurs to them  
Have tried Wool/Handwash, because cleaning sweaters. **For the type of clothes he put in**  
Washing machine is on, she is not at home. 11:00-11:30. Because she has met a problem poll out the water, whole bathroom was flood with water. Then she would like to run the washing machine as shorter as possible when she is not at home
    - iii. What are your top 3 concerns when choose the program? (time, effect, load, material...)  
Cleanness/effect without damaging the clothes  
Time takes  
Amount of water and electricity
    - iv. How do you decide which temperature to choose?  
The lowest most, but for 30/30 is automatically 30, don't touch the button anymore
    - v. What do you think of ECO mode? How often do you use ECO mode?  
Using it on Sunday, she can monitor it all the time, then she dares to use it for a longer time
  - i. Detergent
    - i. What type of detergent do you use? Why that one?  
Cup on the top of bottle, **no indication on the washing machine**

- ii. How much do you use every time? How do you know it's a proper amount or not?  
Based on the experience, it's clean and smells good, then should in a right volume

### 3. Sustainable behavior

- a. To what extent do you normally think about the environmental impact of washing?

**Not really, it uses a lot of water anyway.**

**Why not? This is just a small thing, if it's make standard eco, then she will use. 30/30 No eco indication for that function.**

**Energy label is very important.**

**Since he has chosen HOMIE washing machine, he thinks he already achieved the sustainable life, and don't know whether one setting can have a big difference on sustainability**

- b. How did this change since you wash with HOMIE machine?  
Do the short cold program, at home use ECO
- c. How do you think of HOMIE's monthly email that reporting your washing behavior? Does it impact on your behavior? Why?(\*\*\*\*\*Intervention emails show)

**Good to know, don't think really impact on the washing patterns**

**Doesn't tell how you can do better. One step forward is missing.**

**Need is the primary thing, they don't use extra.**

**But the frequency is good. Monthly**

- d. What feedback do you expect HOMIE gives to you in the mail?  
-
- e. Have you ever think of doing landary in a more sustainable way? Why or why not?  
-
- f. Do you feel that the interface of the washing machine has told you enough information on whether you're doing sustainable laundry or not? What feedback do you think you need when interact with the machine?  
**It doesn't say anything about ecological. You have to guess which program option is the most sustainable.**  
Labels are in Dutch....

- g. What other sustainable habits do you have? Why do you have those habits?  
Turn off the light when he leaves  
Consciou about using heating. Make sure to save energy as much as they can.  
Dishwasher powder.

Girlfriend wants to buy a color change shower based on the water consumption.

**Will be really happy if their sustainable behavior can be appraised.**

**Share the email with girlfriend to compare. Think that can change their behaviors**

1. Basic Information

- a. Age  
24 years old
- b. Occupation  
6 months Internship in UX design in Norway
- c. How many people live with you? Who are they?  
Lives with 3 roommates.
- d. Who usually in charge of washing?  
Herself
- e. How long have you been using HOMIE washing machine?

-.

2. Landary Process

- a. Could you describe the usual process that you go through when you wash your clothes?
  - Throw them into washing basket until weekend
  - Sort clothes by light and dark colors
  - Fill them in the washing machine, **will try to make it full by searching other clothes if the clothes is not enough,**
  - Select settings that the roommate tells,
  - Put detergent follow the instinct
  -
- b. What motivates you to do the laundry?  
To clean the clothes
- c. How often do you do laundry? (Do you have a schedule for it?)  
Clothes every weekend, Sheet follow the instinct
- d. What do you care most about the landry?(cleaness, speed, cost...)  
**Cleaness, cost**  
What to avoid?  
Not really, already seperate the color, should be no problem
- e. Sorting
  - i. How do you sort different types of clothes?  
Based on color, light and black, wash child's clothes together with adults
  - ii. Why in that way?
- f. Filling
  - i. How do you fill in the washing machine?  
Just put in
  - ii. Do you know you have the full load in every wash? What if you can't make the full load? Do you care about that? Will that change your plan?  
-
- g. Program choosing (\*\*\*\*\*Interface show)
  - i. Is this interface easy for you to understand?  
Very clear
  - ii. How do you choose program?  
**Usually the basic settings, because that works and don't want to explore new functions**  
**For the type and price of clothes she puts in**

- iii. What are your top 3 concerns when choose the program? (time, effect, load, material...)
  - Cleanness/effect without damaging the clothes
  - Time
  - Cost
- iv. How do you decide which temperature to choose?
  - Usually use default setting, don't really care about the temperature
- v. What do you think of ECO mode? How often do you use ECO mode?
  - No idea, never use it. Current programs work well so there is no need to try
- h. Detergent
  - i. What type of detergent do you use? Why that one?
    - Follow the instinct, **no indication on the washing machine**
  - ii. How much do you use every time? How do you know it's a proper amount or not?
    - Based on the experience, it's clean and smells good, then should in a right volume

### 3. Sustainable behavior

- a. To what extent do you normally think about the environmental impact of washing?
  - She thinks washing is a necessary thing in her life, so no matter how it influences the environment, it's inevitable. **And she feels that herself can't have too much impact, only the group can have impact**
- b. How did this change since you wash with HOMIE machine?
  -
- c. How do you think of HOMIE's monthly email that reporting your washing behavior? Does it impact on your behavior? Why?(\*\*\*\*\*Intervention emails show)
  -
- d. What feedback do you expect HOMIE gives to you in the mail?
  -
- e. Have you ever think of doing landary in a more sustainable way? Why or why not?
  - Yes, if those settings can **ensure the washing effect** and positively impact environment, she is willing to try.
- f. Do you feel that the interface of the washing machine has told you enough information on whether you're doing sustainable laundry or not? What feedback do you think you need when interact with the machine?
  - No, maybe some suggestions and default settings, which she can take that action with little effort**
- g. What other sustainable habits do you have? Why do you have those habits?
  -

### Participant 4 (Millennial)

#### 1. Basic Information

- a. Age
  - 24 years old
- b. Occupation



Design master student

- c. How many people live with you? Who are they?  
Lives alone.
- d. Who usually in charge of washing?  
Herself
- e. How long have you been using HOMIE washing machine?

2. Landary Process

- a. Could you describe the usual process that you go through when you wash your clothes?
  - Sort clothes by light and dark colors
  - Fill them in the washing machine, **will try to make it full by searching other clothes if the clothes is not enough,**
  - Put detergent, she uses the liquid detergent in the small package, one time use one
  - Select settings based on the material of clothes, clothes usually 30 degrees, sheet and towels will use 90 degree for the hygiene
- b. What motivates you to do the laundry?  
To clean the clothes
- c. How often do you do laundry? (Do you have a schedule for it?)  
Clothes every weekend, Sheet follow the instinct
- d. What do you care most about the landry?(cleaness, speed, cost...)  
**Cleaness, whether it will do harm to clothes or not**  
What to avoid?  
Clothes not being damaged
- e. Sorting
  - i. How do you sort different types of clothes?  
Based on color, light and black,  
Why in that way?
- f. Filling
  - i. How do you fill in the washing machine?  
Just put in
  - ii. Do you know you have the full load in every wash? What if you can't make the full load? Do you care about that? Will that change your plan?  
Not sure. Then try to find other clothes to wash together, but won't always full filling
- g. Program choosing (\*\*\*\*\*Interface show)
  - i. Is this interface easy for you to understand?  
Very clear
  - ii. How do you choose program?  
**Choose based on clothes types and materials. If the clothes are delicate, then she will choose low temperature and low spin, or even really wash by hand**
  - iii. What are your top 3 concerns when choose the program? (time, effect, load, material...)  
Cleanness/effect without damaging the clothes
  - iv. How do you decide which temperature to choose?

- According to clothes material
- v. What do you think of ECO mode? How often do you use ECO mode?  
No idea, never use it. Don't trust the wash effect of clothes. Current programs work well so there is no need to try.
  - h. Detergent
    - i. What type of detergent do you use? Why that one?  
Use the detergent pod
    - ii. How much do you use every time? How do you know it's a proper amount or not?  
One for one time

### 3. Sustainable behavior

- a. To what extent do you normally think about the environmental impact of washing?  
She thinks washing is a necessary thing in her life, so no matter how it influences the environment, it's inevitable. **And she feels that herself can't have too much impact, only the group can have impact**
- b. How did this change since you wash with HOMIE machine?  
-
- c. How do you think of HOMIE's monthly email that reporting your washing behavior? Does it impact on your behavior? Why?(\*\*\*\*\*Intervention emails show)  
-
- d. What feedback do you expect HOMIE gives to you in the mail?  
-
- e. Have you ever think of doing landary in a more sustainable way? Why or why not?  
Yes, if those settings can **ensure the washing effect** and positively impact environment, she is willing to try.
- f. Do you feel that the interface of the washing machine has told you enough information on whether you're doing sustainable laundry or not? What feedback do you think you need when interact with the machine?  
**No, maybe some suggestions and default settings, which she can take that action with little effort**
- g. What other sustainable habits do you have? Why do you have those habits?  
-

### Participant 5 (Roamer)

#### 4. Basic Information

- a. Age  
24 years old
- b. Occupation  
Design master student
- c. How many people live with you? Who are they?  
Lives with other 4 roommates.
- d. Who usually in charge of washing?  
Herself
- e. How long have you been using HOMIE washing machine?  
-

#### 5. Landary Process

- a. Could you describe the usual process that you go through when you wash your clothes?
  - Sort clothes by light and dark colors
  - Fill them in the washing machine, **will try to make it full because it pays every time and the price is not cheap**
  - Put detergent, she uses the liquid detergent pod, one time use one
  - Select settings based on the material and color of clothes, if the clothes are color, she would like to choose a lower temperature in case of color fade. But it's cotton, then she would choose a higher temperature to ensure the cleanliness.
- b. What motivates you to do the laundry?  
To clean the clothes, make the clothes smell good
- c. How often do you do laundry? (Do you have a schedule for it?)  
Once a week
- d. What do you care most about the laundry?(cleaness, speed, cost...)
 

**Cleaness,**  
**Cost**  
**Impact on environment**  
What to avoid?  
Clothes not being damaged
- e. Sorting
  - i. How do you sort different types of clothes?  
Based on color, light and black,  
Why in that way?
- f. Filling
  - i. How do you fill in the washing machine?  
Just put in
  - ii. Do you know you have the full load in every wash? What if you can't make the full load? Do you care about that? Will that change your plan?  
Not sure. Then try to find other clothes to wash together, but won't always full filling
- g. Program choosing (\*\*\*\*\*Interface show)
  - i. Is this interface easy for you to understand?  
Very clear
  - ii. How do you choose program?  
**Choose based on clothes colors and materials. If the clothes are delicate, then she will choose low temperature and low spin**
  - iii. What are your top 3 concerns when choose the program? (time, effect, load, material...)  
Cleanness/effect without damaging the clothes
  - iv. How do you decide which temperature to choose?  
Clothes color and material
  - v. What do you think of ECO mode? How often do you use ECO mode?  
No idea, never use it.
  - Detergent
  - vi. What type of detergent do you use? Why that one?

- Use the detergent pod
- vii. How much do you use every time? How do you know it's a proper amount or not?  
One for one time

6. Sustainable behavior

- a. To what extent do you normally think about the environmental impact of washing?  
She thinks sometime, so she will try to wash more clothes at one time to decrease the washing times. But washing is a necessary thing and **there is no big difference between her different choices.**
- b. How did this change since you wash with HOMIE machine?  
-
- c. How do you think of HOMIE's monthly email that reporting your washing behavior? Does it impact on your behavior? Why?(\*\*\*\*\*Intervention emails show)  
-
- d. What feedback do you expect HOMIE gives to you in the mail?  
-
- e. Have you ever think of doing landary in a more sustainable way? Why or why not?  
Yes, if she can **feel the impact she creates** through the sustainable actions, she would like to behave more sustainable.
- f. Do you feel that the interface of the washing machine has told you enough information on whether you're doing sustainable laundry or not? What feedback do you think you need when interact with the machine?  
**No, it says nothing related to that topic. Maybe the comparison with others can stimulate her to behave better since it's a shame to waste energy and water if others all do well.**
- g. What other sustainable habits do you have? Why do you have those habits?

## Appendix 5: Concept Iteration

### Concept 1.1: Smart Assistant

**Intro:** This concept considers most of the IoT capabilities on the monitor, control and optimization levels, also using the Eco-feedback strategy. Using the load sensor, data and instant computing ability to enable real-time feedback and tailored washing suggestions. It's a technology-based solution.

#### Features:

- **Account identification and most used settings:** users can log in their account on the machine interface to check their washing history, in some cases, they can select directly and easily the setting which they use many times.
- **Real-time load indication and detergent suggestion:** users can know what is the proper weight and amount of detergent
- **Tailored washing recommendation:** the machine gives suggestion on program, temperature and spin speed based on the user input, make the laundry accurate and no waste.
- **ECO Mode as a primary recommendation:** the system will show the ECO mode primarily if the washing effect is similar to increase the usage of ECO mode.
- **Delay-washing suggestion:** inspect on the energy price and remind users of washing in a non-peak time to protect environment indirectly.

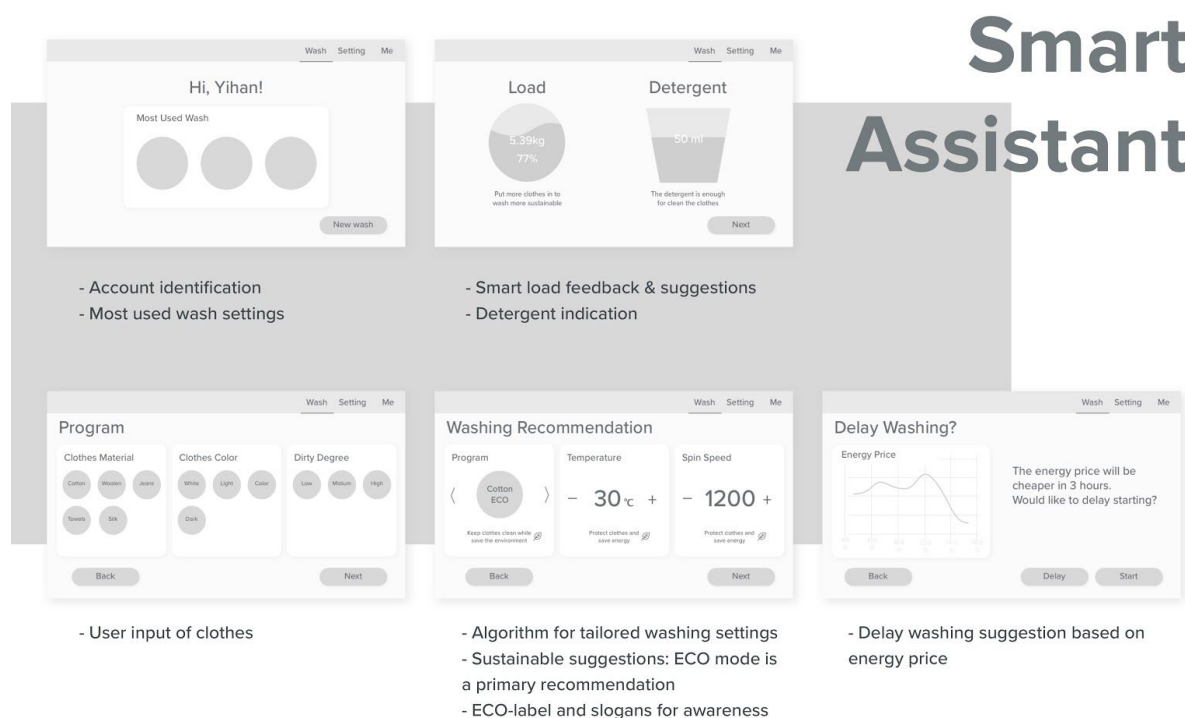


Figure #: Concept 1.1: smart assistant

## Concept 1.2: Feedback and Guidance

**Intro:** Mainly using the Eco-information and Eco-feedback strategies, this concept focuses on explaining the laundry process more in the sustainable aspect by telling the user the impact and the price of their choice, to raise user's awareness of sustainability during the laundry. Users receive the information but they can still decide on the behavior.

### **Features:**

- **Real-time load indication and detergent suggestion:** users can know what is the proper weight and amount of detergent.
- **Program introduction and ECO-index:** users can see the description of each program and their washing effect, also the ECO-index will be shown to help the user make the decision.
- **ECO-mode as a default setting:** in the program choosing phase the ECO mode will be defaulted chosen.
- **Price label of the temperature:** since HOMIE defines the washing cost based on the temperature the user select, therefore showing the price of each temperature can encourage the user to choose a lower temperature.

# Feedback & Guidance

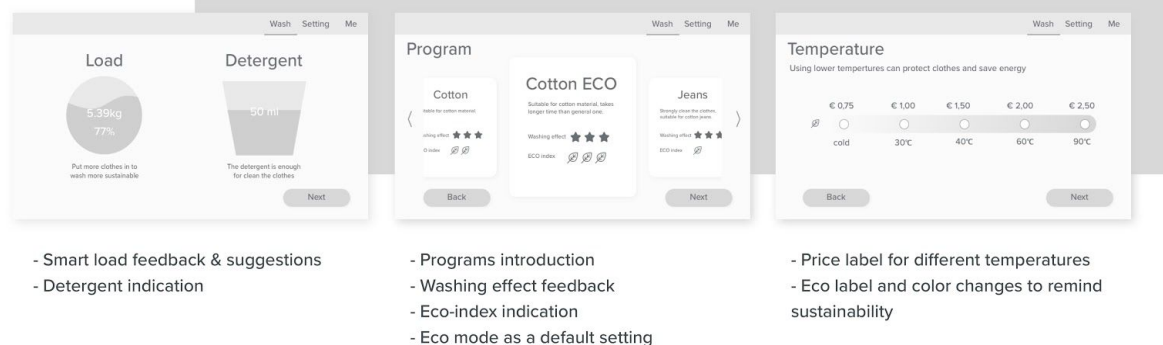


Figure #: Concept 1.2: feedback and guidance

### Concept 1.3: Community Power

**Intro:** The third concept extends the power of community in the laundry process, through the real-time feedback on the comparison of similar user groups to encourage sustainable washing. The user will see the sustainable ranking of their decision among the similar user group after they have finished an eco washing, they can gain the green score based on their sustainable level and the sustainable identity will level up by accumulating the eco washes to encourage a long-term engagement.

#### **Features:**

- **Real-time load indication and detergent suggestion:** users can know what is the proper weight and amount of detergent.
- **Sustainable ranking in the similar user group:** user can see how much people they can beat in the aspect of sustainability in the different choice of programs and temperatures.
- **Behavior appraisal and suggestions on improving**
- **Sustainable identity in the community:** user's identity will level up if they keep on behaving sustainably

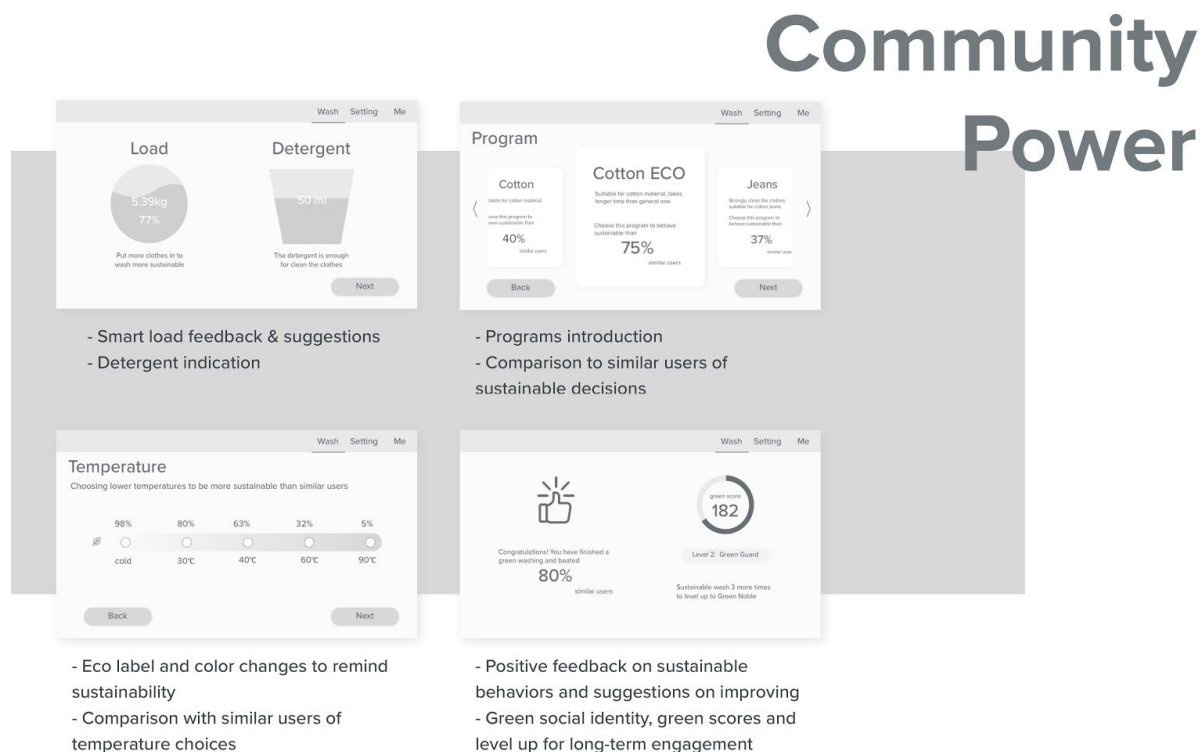


Figure #: Concept 1.3: community power

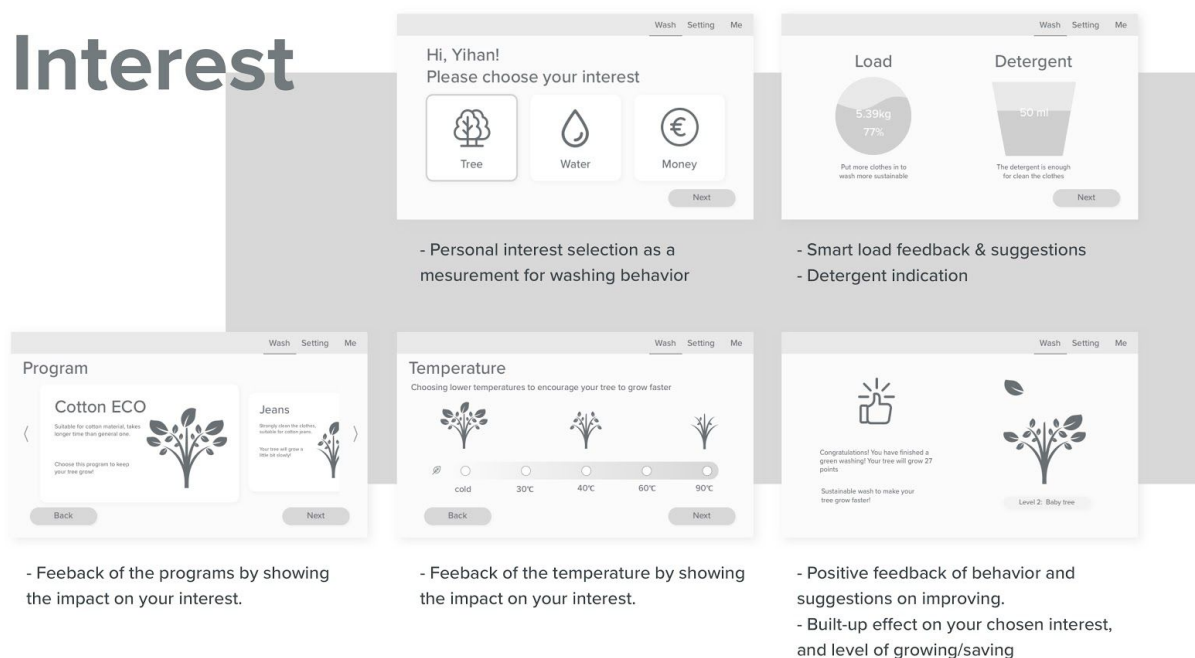
### Concept 1.4: Personalized Interest

**Intro:** This last concept is more like a gamification concept which asks user's interest at first, then will show the impact of user's choices in the way of their interest. For example, if the user chooses the tree as his interest, then every time he can see how his choice of program/temperature will impact on the growth of his tree. When his sustainable score reaches a level the tree will grow up to next stage.

#### **Features:**

- **Personalized interest as the measurement:** different user has different concerns so that the same trigger can't work for everyone. In this concept, the user chooses the interest to measure the washing impact of the program and temperature they choose
- **Real-time load indication and detergent suggestion:** users can know what is the proper weight and amount of detergent.
- **Long term saving:** the user can see the accumulation of the sustainable behavior in the way of their interest, which can let them see their impact.

# Personalized Interest





#### Four Concepts Evaluation: Pros and Cons

An evaluation based on the requirements and wishes is made for comparing each concept's pros and cons to seek for the future possibility. The pros and cons mainly address in IoT capability, sustainable strategy and user experience level.

##### Concept 1: Smart Assistant

###### Pros:

- Make use of most of IoT capabilities
- Effortless and intuitive in user experience
- Solve the user problem like lacking knowledge of the program, the technology assists in user decision making

###### Cons:

- Not really raise the awareness of the sustainability of users
- The interaction limits in visual level
- The sustainable intervention strategy limits in Eco-feedback and Eco-information

##### Concept 2: Feedback and Guidance

###### Pros:

- Feedback and guidance on laundry process
- Good use of Eco-index to let user know their impact of different choices

###### Cons:

- The feedback is general
- The guidance does not work for diverse users
- Limited IoT capability involves
- The sustainable intervention strategy limits in Eco-feedback, and Eco-information

##### Concept 3: Community Power

###### Pros:

- The green scores and the level-up mechanism to stimulate eco-behavior
- Social comparison can encourage the use to compete

###### Cons:

- The community data is doubtful due to the user numbers are not high in the database
- Easy to lose interest over time since the incentives are missing in the current chain
- May lead to an opposite result because some users tend to follow others
- Limited IoT capability involves

##### Concept 4: Personalized Interest

###### Pros:

- Meet with diverse users needs and desires, and create exclusive meaning to different user
- Keep attracting users since they can see the long term saving

###### Cons:

- It can be complex in user experience
- It has the risk of encouraging unsustainable behavior since users want to gain the incentives fast
- Limited IoT capability involves

#### Key Insights for Future Concept

Based on the evaluations of the initial concepts, key insights are gained to formulate future concepts:

- Personalization can be a good direction but need to dig out what is meaningful for users
- Initial concepts focus mainly on the visual level, it lacks other senses which can fulfill the interactions
- The IoT capabilities need to be implemented more
- Keep users feel interesting in long-term in the meantime prevent them from behaving unsustainably to achieve the goals.

#### 1.1.1. Two Refined Concept Directions

Based on the Pros and Cons of previous four concepts, new insights from the creative session and extra research, two concept directions are refined, developed and fast evaluated with potential users.

##### Concept Direction 2.1 : Personalized Meaning

The first refined concept is a more user-centered concept in which washing information is shown in the way that is meaningful to users, then users decide on how to behave based on that information.

Building the concept on the base of "Personalized Interest" from the initial concepts, this time the concept is fulfilled with more IoT capabilities and adjusted to be more meaningful to users. Compared to the first version, the new concept starting from learning user's habit, then the incentives and punishments are calculated by comparing with their own habit. The habit is updating as the washing happen, users can see a better personal behavior in the way that is meaningful to them. Three main interests result from the user research are tree growing, money saving and sustainable scores gaining. Figure # show the process of different interests.

Tree:

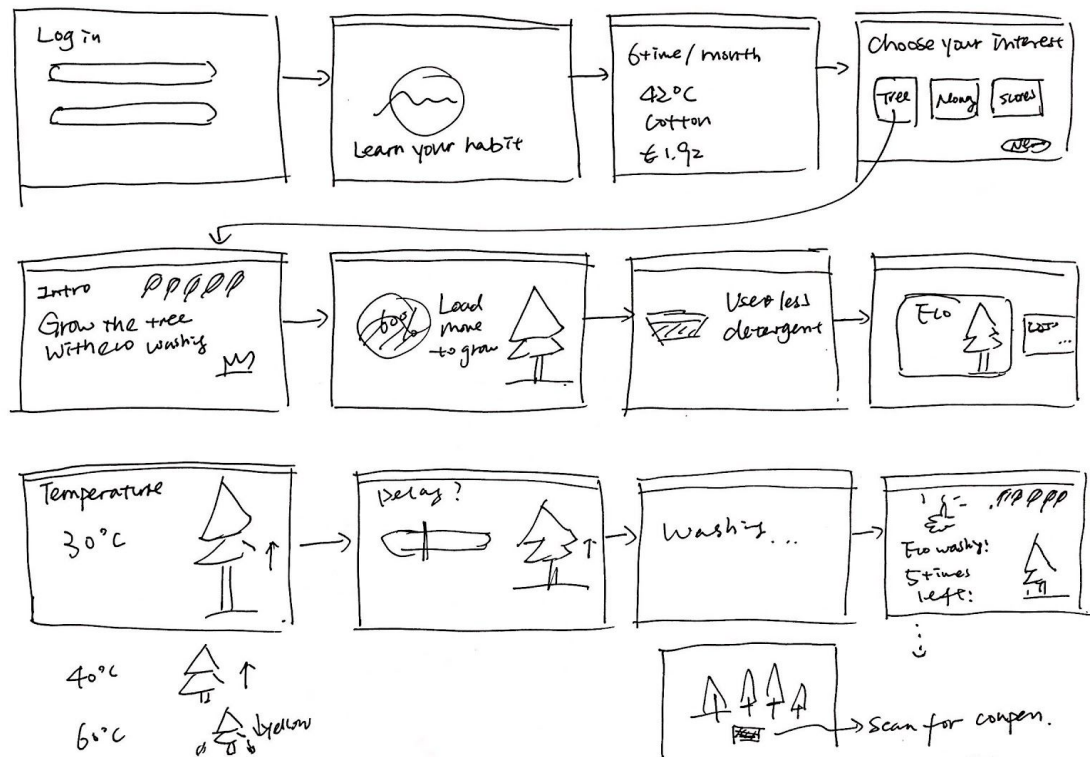


Figure #: Concept 2.1.1: Personalized Meaning-tree

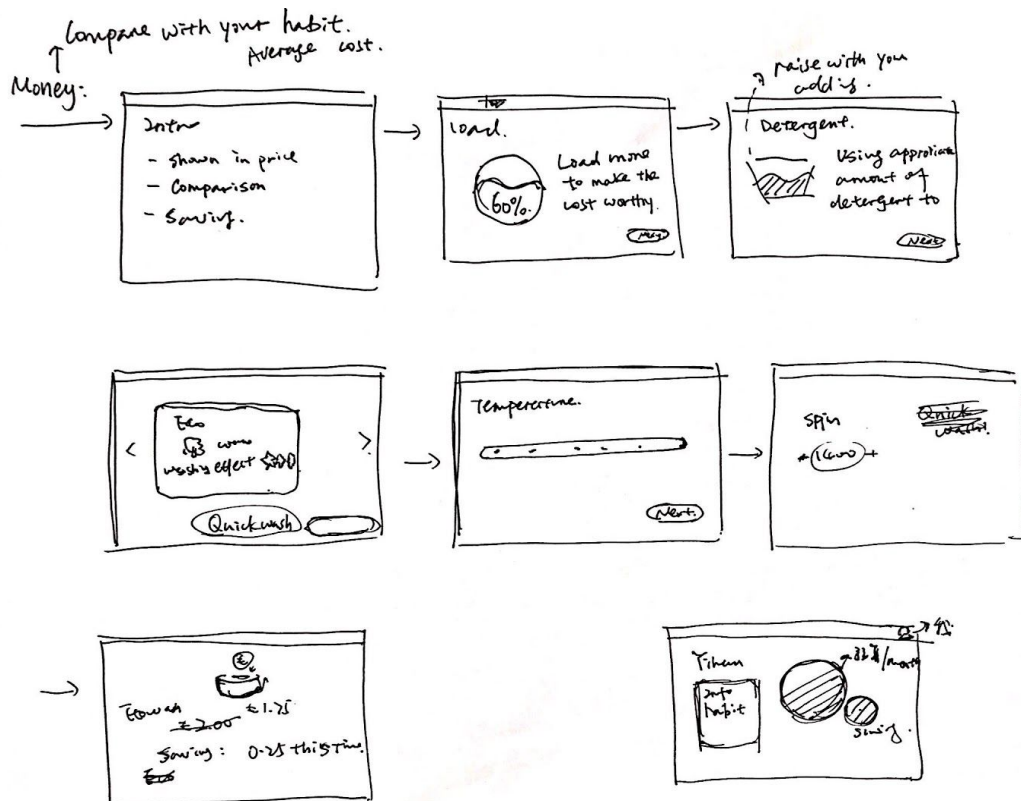


Figure #: Concept 2.1.1: Personalized Meaning-money

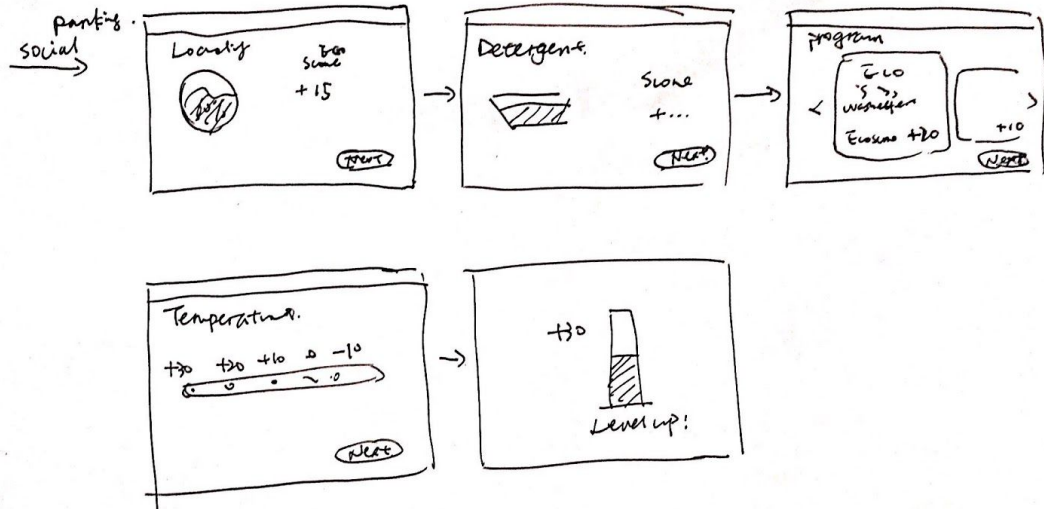


Figure #: Concept 2.1.1: Personalized Meaning-sustainable scores

According to the literature on persuasive design and considering the design wishes, a new direction called “trouble maker” is also thought to seek more inspirations. In this direction, the intervention is designed to create interaction trouble in diverse senses to users if they don’t behave sustainably. Figure # shows some directions, such as the machine sings awful songs if users make the unsustainable choice, keep asking the user if they would like to make the unsustainable decision, etc.

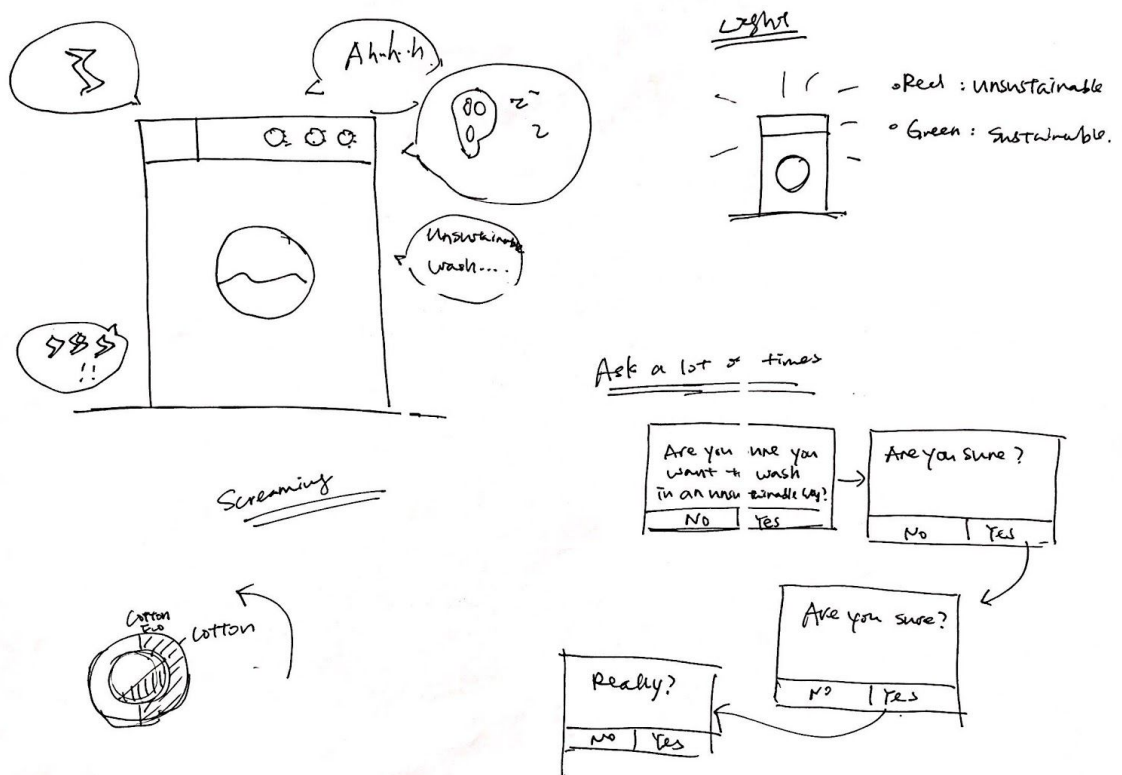


Figure #: Concept 2.1.2: User-centered-trouble maker

### Concept direction 2.2 : HOMIE Smart Butler

The second concept is a developed version of the smart assistant but in a clever and more futuristic way. It enables IoT capabilities in optimization and automation level, gives the user the most appropriate and sustainable recommendation by detecting what users have put in the machine with the RFID technology(nxp-rfid.com), in that case, the machine makes most decisions, users only need to load the clothes in, then can wash sustainably without changing their behavior.

Insights from the creative sessions tell that people are always pursuing a simple and natural way to interact with the product, therefore in this concept, two ways are taken into account, one is the visual screen, showing the process, Figure #.

Washing process — Visual.

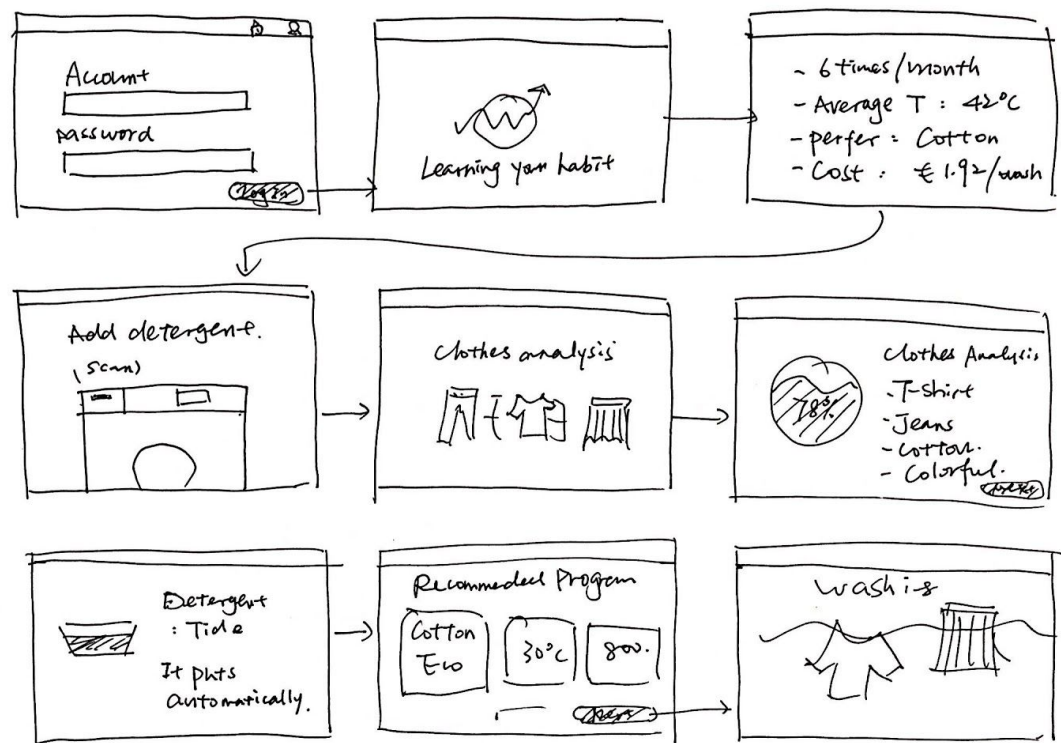


Figure #: Concept 2.2.1: Product-centered-visual

The other one is voice interaction, it's selected since the voice is one of the most natural interactions that human has every day. In the design, the machine tells the user about their washing habits and washing settings, the user speaks to answer and give the instruction, the light on the washing machine changes the color to indicate machine's status. To achieve that function, the washing machine interface is adjusted with a light and a speaker. Figure # shows the interaction:

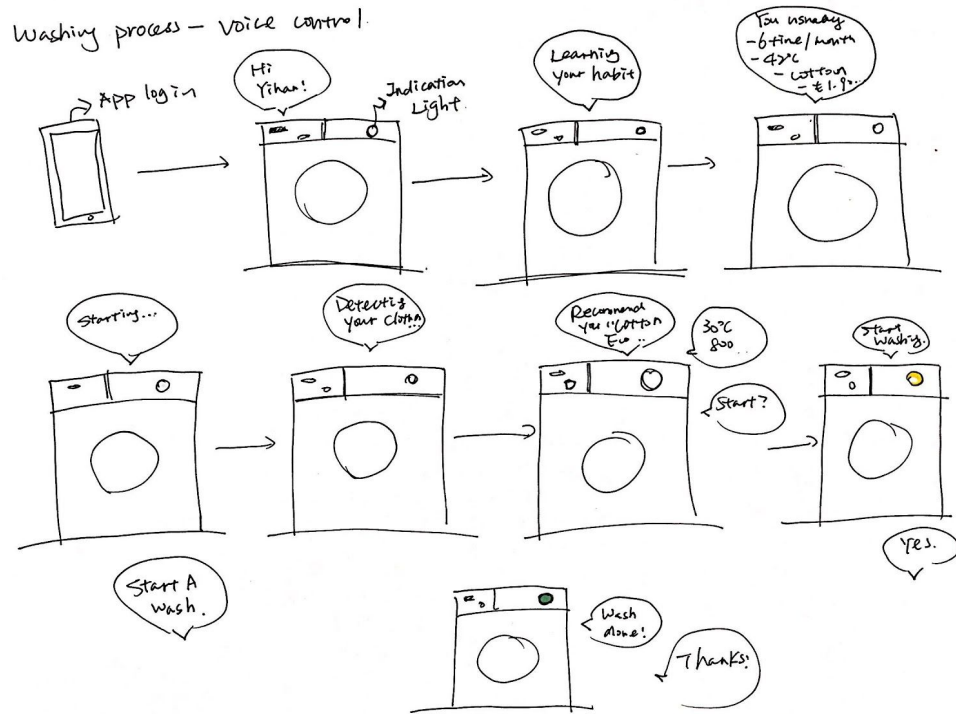


Figure #: Concept 2.2.2: Product-centered-voice

### Evaluation of Concepts

The evaluation focus on two concepts, one the personalized meaning, and the other one is the smart butler-visual. The troublemaker and the voice interaction were evaluated during the design process and result showed a low acceptance.

It was performed on paper with 5 Msc Design students. The user experience and the sustainable impact were two main aspects to discuss. During the evaluation they also give some comments on concepts directions. Evaluation form can be found in Appendix #.

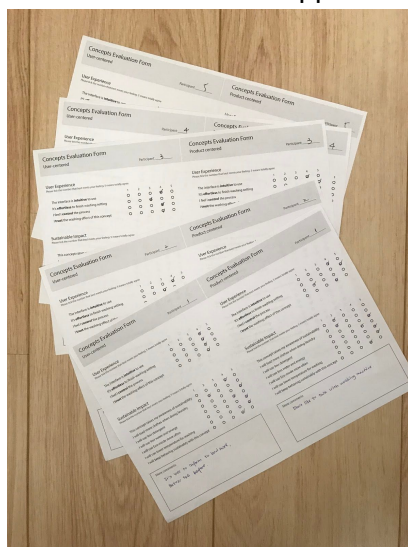


Figure #: Concepts evaluation forms

	User Experience(20)	Sustainable impact(35)
Personalized Meaning	15.2	26.6
HOMIE Smart Butler_Visual	15.2	23.4

Table #: Evaluation result for concepts

The scores are the average score of 5 participants of the sum of all questions in each section. The full score for UX part is 20, for the sustainable impact is 35.

From the evaluation result, it indicates that the user experience of both concept directions is the same (15.2/20). However for the personalized meaning concept, it can be a little bit complex and takes longer time for users since more information is added and the setting process is prolonged. As for the smart butler concept, the participants like the simplicity but they feel losing the control, they still want to make the decision themselves.

In the sustainable impact aspect, the personalized meaning concept gains more scores than the smart butler one (26.6 : 23.4). The reason that the smart butler concept is low is users are not aware of sustainability during the laundry, the machine makes the decision instead. That works better in the personalized meaning concept, users have more self-reflection on their behavior and improve with their actions, they like the personalization idea since it meets their desires. Nonetheless, some participants mentioned that the concept can't really increase their loading since they have already loaded the clothes for washing. So the loading intervention should appear before the washing settings. Moreover, some users say they doubt about the long-term engagement since the coupon is not that attractive to all of them.

It worth a mention that for the troublemaker concept, participants are attracted by the interesting interaction at the beginning, and they would change the behavior. However, they also mention that it's risky to apply that direction since it can cause the abusing or user's giving up easily. Hence it can be used on a micro level and be treated more cautiously to a positive impact on UX.

### Conclusions

Based on the result analysis, new insights for a future concept come as follows:

- Combine the self-reflection effect of personalized meaning concept and the smartness of smart butler concept to create a new experience based on the personalization.
- Adding interesting micro interaction to the concept to raise user's interests.
- Consider the laundry process, it would be better to inform the user what is a good amount of clothes for loading in advance.
- The incentives for long-term engagement can also be personalized to keep the user absorbed.

## Appendix 6: Two Concepts Evaluation Form

### User Experience

Please tick the number that best meets your feeling. 5 means totally agree

	1	2	3	4	5
The interface is <b>intuitive</b> to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's <b>effortless</b> to finish washing setting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel I <b>control</b> the process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I <b>trust</b> the washing effect of this concept	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Sustainable Impact

Please tick the number that best meets your feeling. 5 means totally agree

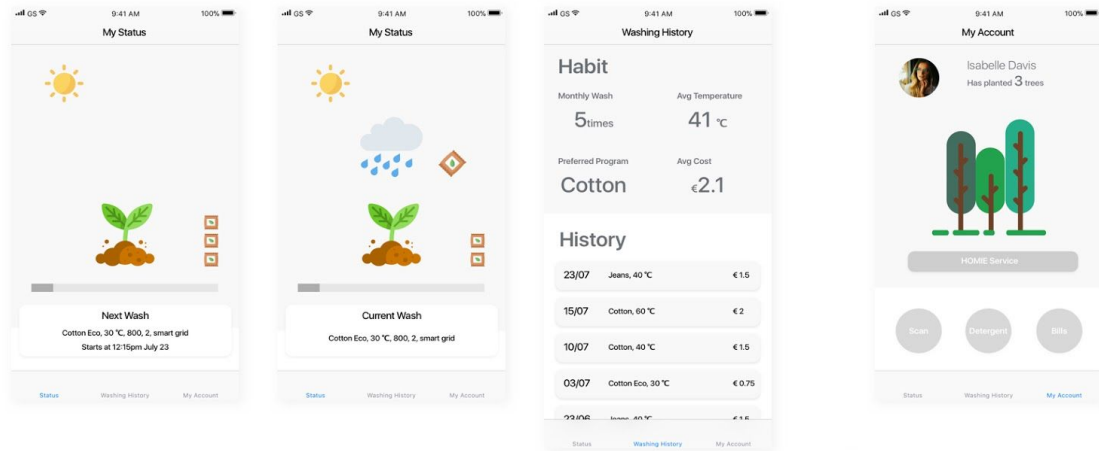
	1	2	3	4	5
This concept raises my awareness of sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will load more clothes when doing laundry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use less detergent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use less water and energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use Eco-mode more often	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use lower temperature for washing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will keep behaving sustainably with this concept	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

More comments



## Appendix 7: HOMIE Lifestyle Wireframes 1.0

### HOMIE App



Check the washing status and washing schedule

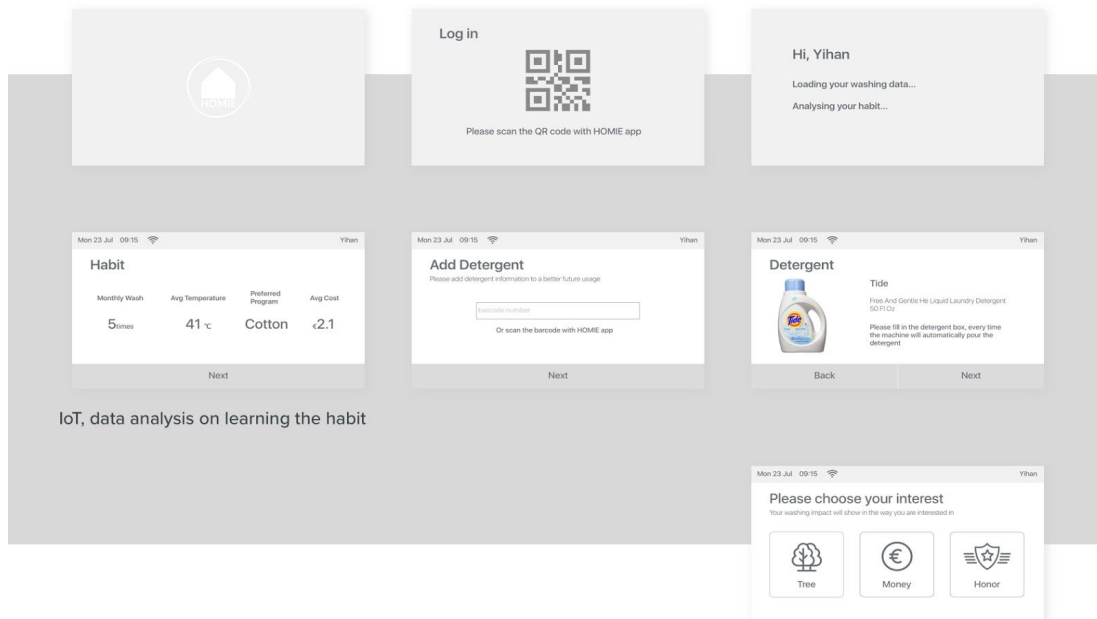
Washing habit and washing history

Check personal “forest”, “saving bank” and “medals”, goes to future personal service

Using tools

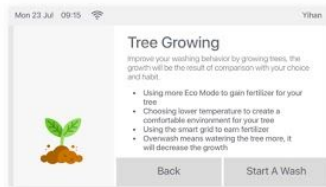
### Washing machine

#### Log in



IoT, data analysis on learning the habit

## Tree Growing



### Start A Wash

Please put your clothes in the machine, using HOME bag can help in full load.

The machine is detecting your clothes...

The machine is recommending a program for you...

The machine will put the detergent automatically...

The machine will detect your clothes and recommend program for you.

Also based on your detergent it will put the detergent automatically



Using Eco mode entails getting 2 bags of fertilizer

The temperature means the sun for your tree, the higher, the bigger.

When the temperature you choose is higher than your habit, the tree will knock the screen to remind you.

0 °C



30 °C



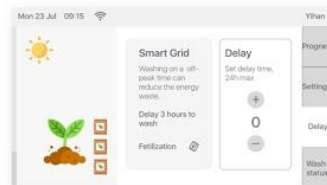
40 °C



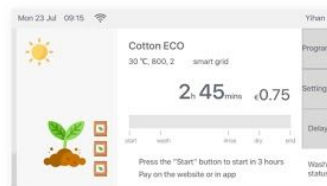
60 °C



90 °C



Choosing smart grid entails getting 1 bag of fertilizer



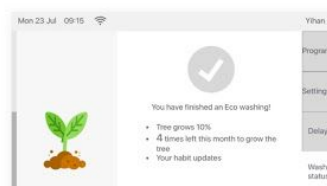
If your washing times exceeds your habit, the water will flood the tree, the tree is risky



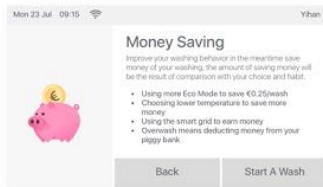
When the machine is working, the cloud will water the tree.

After an eco wash your tree will grow, you can see the growth bar

Your monthly left washing times will be reminded, to prevent you wash more to make the tree grow



## Money Saving



### Start A Wash

Please put your clothes in the machine, using HOME bag can help in full load.

The machine is detecting your clothes...

The machine is recommending a program for you....

The machine will put the detergent automatically...

The machine will detect your clothes and recommend program for you.

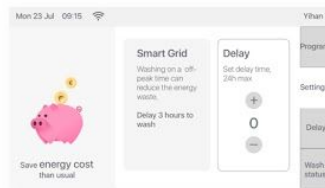
Also based on your detergent it will put the detergent automatically

During the process the piggy bank will jump up and down to let you hear the sound of coins, to give you the feeling of your money

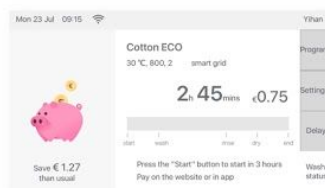


Using Eco mode can save 0.25 euro every time. Showing the percentage to increase the sense of saving money

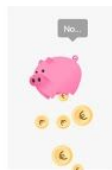
The temperature directly relates to the cost, so choosing a lower can save more money compared to the habit, otherwise the coins drop out



Choosing smart grid entails saving energy cost

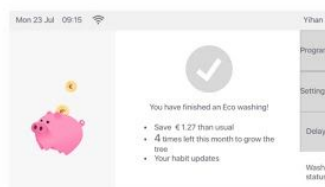


If your washing times exceeds your habit, the piggy bank will drop out money

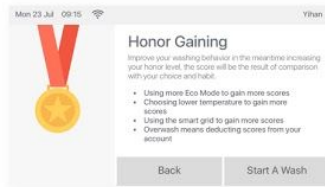


When the machine is working, the piggy bank will jump occasionally

After an eco wash your piggy bank will save money, you can see the amount Your monthly left washing times will be reminded, to prevent you wash more



## Honor Gaining



### Start A Wash

Please put your clothes in the machine, using HOME bag can help in full load.

The machine is detecting your clothes...

The machine is recommending a program for you....

The machine will put the detergent automatically...

The machine will detect your clothes and recommend program for you.

Also based on your detergent it will put the detergent automatically



Using Eco mode can gain extra scores

If the temperature you choose is lower than your habit, you will gain scores based on the temperature, otherwise you lose scores

0 °C



30 °C



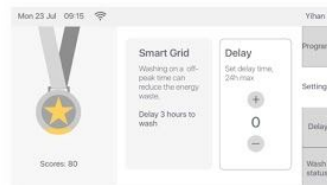
40 °C



60 °C

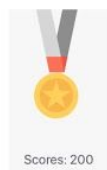
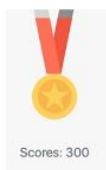


90 °C



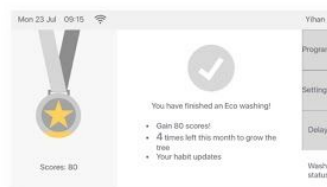
Choosing smart grid will gain some scores and color your medal

If your washing times exceeds your habit, it will deduct 100 scores from your account



After an eco wash you will color part of your medal, and gain scores based on your choice

Your monthly left washing times will be reminded, to prevent you wash more



## Appendix 8: User Test 1.0 Plan

HOMIE is a spinout who sells the smart washing machine free, but only ask the user to pay of each use, the every time price is based on the washing temperature the user chooses. For the project, HOMIE is looking for a intervention that could stimulate a sustainable washing behavior.

The aim of the user test is to evaluate the user experience and the impact on stimulating sustainable washing behavior of the concept: HOMIE Lifestyle.

### Research Goal

“What is the usability of the concept?”

“To what extent can the concept stimulates sustainable washing behavior?”

### Test Set-up

#### Forms:

- Consent form
- Pre-interview questionnaire
- Concept evaluation form(SUS, sustainable impact scale)

#### Devices:

- Prototype(iphone 6 Plus)
- Recorder
- Camera

### Planning

August 14th, 14:00 - 15:00

August 14th, 15:00 - 16:00

August 14th, 16:00 - 17:00

August 15th, 14:00 - 15:00

August 15th, 15:00 - 16:00

### Participants

The participants of the pilot test are two supervisors of the project.

Characteristic for the participant:

- Potential user of HOMIE washing machine
- Employees from HOMIE
- Spread in age, gender

### Test Procedure

The user test consists of the pre-test briefing and a questionnaire about former experience with washing in general, the main test as the principal part and finally the post-test with an interview and evaluation forms.

#### Pre test procedure(3mins)

Explain test set-up

- Welcome
- Purpose of the test

- Planning
- Consent form

### Pre Test Interview(7mins)

Ask the participants some basic questions about their washing experience to gain insight in their previous washing habits and sustainable knowledge.

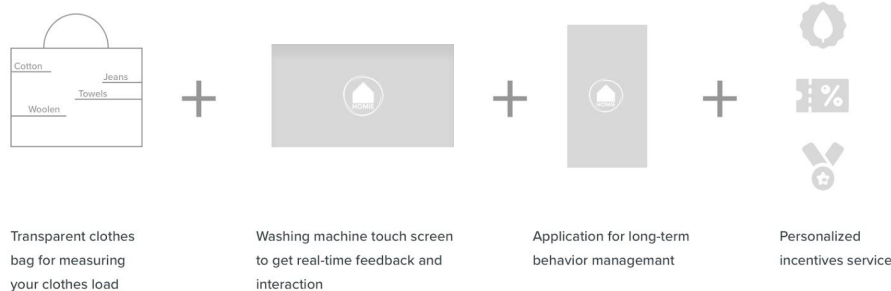
1. Can you tell me about your age and your profession?
2. Do you have the experience of HOMIE pay-per-use washing machine? How do you think of the service?
3. How often do you do the laundry?
4. What are your usual washing settings?(load, detergent, program, temperature, etc.)
5. Do you have the knowledge of the sustainable washing?
6. What is your attitude to the sustainable washing?Why?
7. Do you do a sustainable washing? Why?

### Use Case: Finish the washing setting with the washing machine interface(15mins)

HOMIE Lifestyle is a concept that combines different components to stimulate sustainable user behavior. Four parts are in, the HOMIE to measure how much clothes to load, the washing machine interface, the HOMIE app, and the long-term incentives.

The idea is to compare your washing setting choices with your washing habit, show your impact in the way that you have interested in. Therefore, the more you improve your behavior, the faster you grow the tree, or save the money, or win more medals. And after that, you can get personalized incentives from HOMIE.

#### HOMIE Lifestyle



### Goal

- Discover the current problems of redesign prototype in terms of usability.
- Find out what can be improved to stimulate sustainable washing behavior.

### Method

#### Thinking aloud

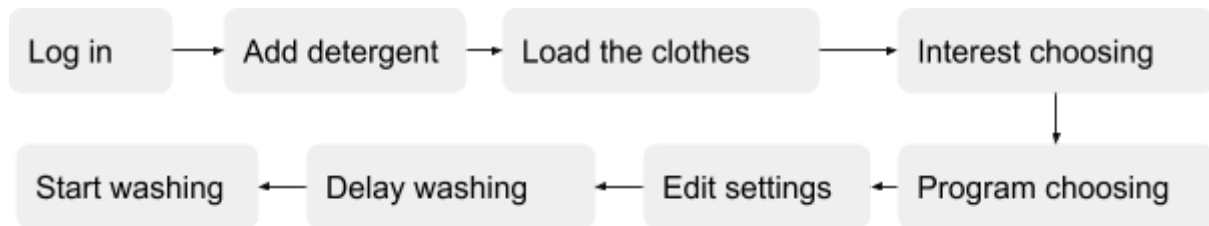
Please tell me while performing the tasks what you will do and what you think? This way I can follow your actions and understand what you are doing. Please also do notice me once you start or finish a task.

### Introduction(3mins)

Imagine this is the washing machine at your home, now it's the time for you to wash the clothes(clothes pics), please use the interface prototype to finish the washing settings.

If you don't understand something, or if you get stuck, you can try to find a solution yourself using the given tools. If that doesn't work you can always ask me.

### Task (7mins)



### Observation/Interview points

- Full load or not?
- The program they choose
- The temperature they choose
- Smart grid/not
- Will they try to cheat with the system
- Which story line they choose

### Post test interview(5mins)

Ask the participant questions about how the test went and their experience with the HOMIE Lifestyle. The first questions are open and address the overall experience of the usage. The second part of the interview makes use of the system usability scale(SUS) and sustainable impact scale to narrow the overall impressions down to a numerical rating on certain aspects.

### Open answer interview

- How do you feel about the interface?
- What was the the worst problem you encountered?
- What was the best thing you encountered?
- Will this interface stimulate you to behave more sustainable in the laundry process?
- Think of 5 years later, to what extent will you still interested in this intervention?(1-5)How to keep you be interested in?

### SUS | System Usability Scale

*1 to 5 scale from strongly disagree to strongly agree*

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 inconvenient 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

### **Sustainable Impact Scale**

*1 to 5 scale from strongly disagree to strongly agree*

1. This concept raises my awareness of laundry sustainability
2. I will load more clothes when doing the laundry
3. I will use less water and energy
4. I will use Eco mode more often
5. I will use a lower temperature for washing
6. I will keep behaving sustainably with the concept

### **End of Test**

This is the end of the test

- Thank the participant for their time and effort, give them small gifts

After the participant has left the room it is time to shortly review the session and prepare the setting for the next session.



## Appendix 9: User Test 2.0 Plan

HOMIE is a spinoff who sells the smart washing machine free, but only ask the user to pay of each use, the every time price is based on the washing temperature and programs the user chooses. For the project, HOMIE is looking for an intervention that could stimulate a sustainable washing behavior.

The aim of the user test is to evaluate the user experience and the impact on stimulating sustainable washing behavior of the concept: HOMIE Lifestyle.

### Research Goal

“What is the ux of the concept?”

“To what extent can the concept stimulates sustainable washing behavior?”(short and long)

“How do different features impact on sustianable washing behavior?”

### Test Set-up

#### Forms:

- Consent form
- Pre-interview questionnaire
- Concept evaluation forms(SUS, sustainable impact scale, feature impact)

#### Devices:

- Prototype(ipad mini, iphone 7)
- Audio Recorder(Iphone 6, mac)
- Camera

### Participants

The participants of the test are potential users who meet with the personas and the employees from HOMIE. It's anticipated 7 users and 2 employees can participant the test.

### Planning

September 4th- September 9th, every test lasts for 40 minutes

- 04/09 Tuesday, 13:00-13:40 , Thomas A. Edison
- 04/09 Tuesday, 15:00-15:40, Thomas A. Edison
- 04/09 Tuesday, 17:00-17:40, Thomas A. Edison
- 06/09 Thursday, 10:00-10:40, HOMIE
- 06/09 Thursday, 15:00-15:40, Thomas A. Edison
- 06/09 Thursday, 18:00-18:40, John Kennedy
- 07/09 Friday, 14:00-14:40, Thomas A. Edison
- 08/09 Saturday, 14:00-14:40, Thomas A. Edison
- 08/09 Saturday, 16:00-16:40, My Home
- 09/09 Sunday, 9:00-9:40, My Home

# Test Procedure

The user test consists of the pre-test briefing and a questionnaire about former experience with washing in general, the main test as the principal part and finally the post-test with an interview and evaluation forms.

## Pre test procedure(3 mins)

Explain test set-up

→ Welcome

- ◆ *“Welcome to my test, I am Yihan, the master student of IDE. My topic is design the intervention to encourage people to use the washing machine in a more sustainable way. Thanks a lot for participating! ~”*

→ Purpose of the test

- ◆ *“I designed the intervention, and the purpose of this test is to evaluate the effect of it, and see how to improve in the future.”*

→ Planning

- ◆ *“There will be three main parts of the test,  
First, a pre-test interview which we talk about your former laundry experience and understanding of sustainable washing,  
Then you can try the prototype and finish some small tasks  
At last there will be a post-test interview which you can share more your opinions of the design, and evaluate it with some forms”*

→ Consent form

- ◆ *“Here is the consent form, it declares that your test will be recorded in audio and photos, but all the recordings will only used by research and won't be shared in any other purpose, you can read it and sign it.”*

→ Introduce HOMIE

- ◆ *“HOMIE is a spin-off who provides the smart washing machine to customers, different from the general companies, they deliver and install the washing machine free, the customer only to pay for every wash.*

*The price of each washing is based on the program and the temperature they choose. HOMIE collect your washing data like the time, the program, the temperature, etc, and then record your washing habit.”*

## Pre Test Interview(7mins)

Ask the participants some basic questions about their washing experience to gain insight in their previous washing habits and sustainable knowledge.

1. Can you tell me about your age and your profession?
2. Do you have the experience of HOMIE pay-per-use washing machine? How do you think of the service?
3. How often do you do the laundry?
4. What are your usual washing settings?(load, detergent, program, temperature, etc.)
5. What is your comprehension of the sustainable washing?
6. What is your attitude to the sustainable washing?Why?
7. Do you do a sustainable washing? Why?

## Test(20 mins)

### Concept Introduction (3mins)

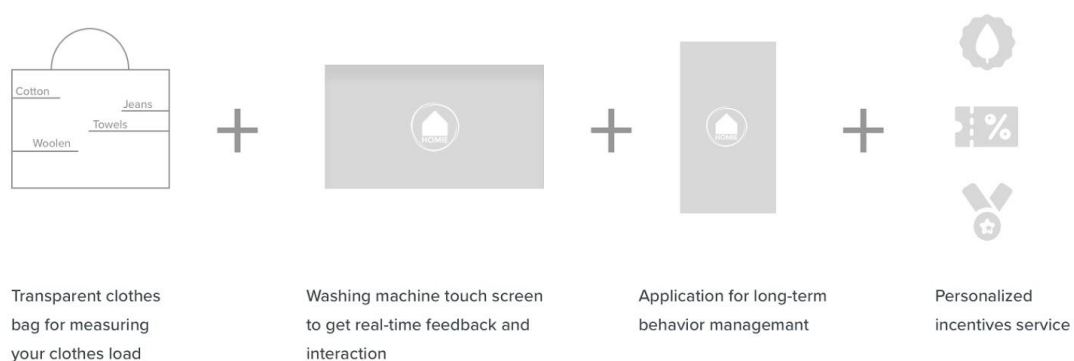
HOMIE Lifestyle is a concept that combines different components to stimulate sustainable user behavior.

There are four main components:

the HOMIE washing bag to measure how much clothes to load, the washing machine interface, the HOMIE app, and the real awards offered by HOMIE.

The idea is more like a game. It compares your every time washing setting choices with Dutch average of the similar group, and shows your choice impact in the way that is meaningful to you. Therefore, the more sustainable your choices are, the more benefits you gain. And after a period of time's accumulation, you can get the real personalized awards from HOMIE.

### HOMIE Lifestyle



## Method

### Thinking aloud

Please tell me while performing the tasks what you will do and what you think? This way I can follow your actions and understand what you are doing. Please also do notice me once you start or finish a task.

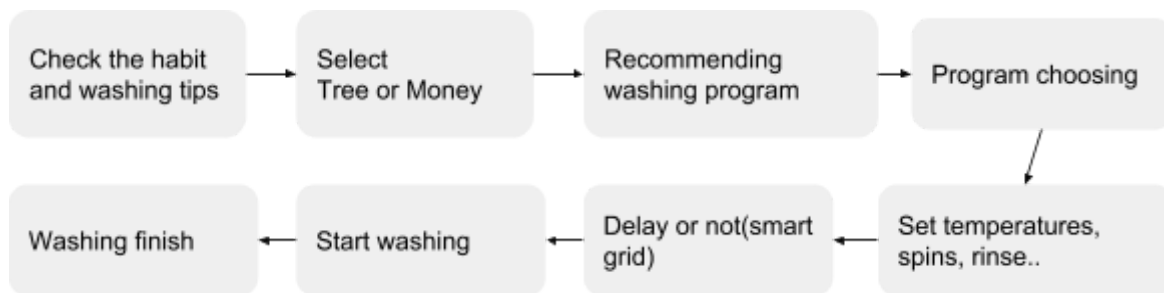
### Use case 1(10 mins)

This is the washing machine at your home, it is a smart washing machine which can detect your clothes, recommend program to you, and put the detergent and water automatically based on your clothes.

Imagine you are the old user of HOMIE, which means you already have some data in the database, but it's your first time to use this system. Today it's the time for you to wash the clothes(clothes pics), and you have already logged in. Please use the interface prototype to finish the washing settings.

If you don't understand something, or if you get stuck, you can always ask me.

### Task 1



#### Observation/Interview points

- Full load or not?
- Which story line they choose
- The program they choose
- The temperature they choose
- Smart grid/not
- Will they try to cheat with the system

### Use case 2 (5 mins)

Imagine you have used the system for some time, please use the HOMIE app to check the habit changes and your game updates.

#### Observation/Interview points

- Can they find the right page?
- How do they think of the contents?
- What can keep them interested in the intervention?
- Will they would like to try another game?

## Post test interview(12 mins)

Ask the participant questions about how the test went and their experience with the HOMIE Lifestyle. The first questions are open and address the overall experience of the usage. The second part of the interview makes use of the system usability scale(SUS) and sustainable impact scale to narrow the overall impressions down to a numerical rating on certain aspects.

### Open answer interview

- What is your overall impression with the concept(bag, interface and app)?
- What do you like or dislike?
- Will this concept motivate you to behave more sustainable in the laundry process?
- What feature/functions of the concept impact most on encouraging you to behave sustainably?
- Think of 3 years later, to what extent will you still interested in this intervention(1-5)? Why?

## Evaluation Forms

### SUS | System Usability Scale

*1 to 5 scale from strongly disagree to strongly agree*

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 inconvenient 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

### Sustainable Impact Scale

*1 to 5 scale from strongly disagree to strongly agree*

1. This concept raises my awareness of laundry sustainability
2. I will load more clothes when doing the laundry
3. I will use less water and energy

4. I will use Eco mode more often
5. I will use a lower temperature for washing
6. I will keep behaving sustainably with the concept

#### Intervention Features Impact

*1 to 5 scale from strongly disagree to strongly agree*

To what extent does each feature impact on your sustainable behavior changing?

1. HOMIE bag to measure the load
2. Social comparison and tailored washing advice
3. Real-time sustainable feedback of choices
4. Personalized meaningful sustainable information display
5. The personalized game updates(plant trees successfully, save more money)
6. The real long-term sustainable wash incentives
7. The over washing punishment in the game
8. Program recommendation(more on Eco mode)
9. Smart grid recommendation
10. Automatically putting the detergent

#### End of Test

This is the end of the test

Thank the participant for their time and effort, give them small gifts

After the participant has left the room it is time to shortly review the session and prepare the setting for the next session.

## Appendix 10: User Test 2.0 Evaluation Forms

### SUS

HOMIE Lifestyle

Participant \_\_\_\_\_

### System Usability Scale(SUS)

Please tick the number that best meets your feeling. 5 means strongly *agree*

- |  | strongly<br><i>disagree</i> |                          |                          |                          | strongly<br><i>agree</i> |
|--|-----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|  | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|  | 1                           | 2                        | 3                        | 4                        | 5                        |
| 1. I think that I would like to use this system frequently                                   | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. I found the system unnecessarily complex  | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. I thought the system was easy to use  | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. I think that I would need the support of a technical person to be able to use this system | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. I found the various functions in this system were well integrated                         | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. I thought there was too much inconsistency in this system                                 | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. I would imagine that most people would learn to use this system very quickly              | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. I found the system very inconvenient to use   | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. I felt very confident using the system  | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. I needed to learn a lot of things before I could get going with this system              | <input type="checkbox"/>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Sustainable Impact Scale

Please tick the number that best meets your feeling. 5 means strongly *agree*

	1	2	3	4	5
This concept raises my awareness of laundry sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will load more clothes when doing laundry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use less water and energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use Eco-mode more often	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will use a lower temperature for washing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will keep behaving sustainably with this concept	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

More comments



## Intervention Features Impact

To what extent does each feature impact on your sustainable behavior ?

Please tick the number that best meets your feeling. 5 means **strongly impacted**

	1	2	3	4	5
HOMIE bag to measure the load	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Social comparison and tailored washing advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Real-time sustainable feedback of choices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
---	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------



Personalized meaningful sustainable information display	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
---	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------



The personalized game updates(plant trees successfully, save more money)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
--	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

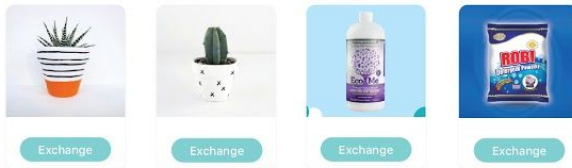


### My Medals



## HOMIE Lifestyle

The real long-term sustainable wash incentives



1 2 3 4 5

☐ ☐ ☐ ☐ ☐

The over washing punishment in the game



☐ ☐ ☐ ☐ ☐

Program recommendation(more on Eco mode)



☐ ☐ ☐ ☐ ☐

Smart grid recommendation



☐ ☐ ☐ ☐ ☐

Automatically putting the detergent



☐ ☐ ☐ ☐ ☐

## Appendix 11: User Test 2.0 Participants Scripts

### P1:

"It's so cute!"(the tree)

"If I don't have time pressure I will choose the normal one"(cotton eco)

"That will trigger me, If I am not in a rush I will be influenced by the information"(tree)

"I will focus on more of my bills, if it's higher than the average, I will go back to check what is wrong for my habit, and maybe change something"(app-history)

"If I know who I am competing with, for example, my friends or my family"

"I think the awards are interesting, it will trigger my intention"

"The forest is cute, it's an added benefit, but it won't be the main trigger. But it can be the minor thing I want to make fun of the programme. Collecting different kinds of plants here, it will be interesting to have more changes."

"For the most washing machine, they have the deep learning curve. But for this one, you can see the priority of the information, and make it cartoonish, so it's more friendly, it's more like a person guiding you, talking to you about your behavior. So it's more humanized."

"It reduces the stress of first using, it's quite friendly"

"I think it's nice."

"There is a gap to push me behave sustainably, but this intervention can guide me to do so."

"Comparison, animation"

"The animation helps to understand what are the right behaviors I need to approach."

"Animation gives more details later"

"3 years, I will care more about the things like how much energy I can save"

"I will be interested in getting the same seed as I plant the virtual one"

"Unlocking is more interesting than planting by me, it sets the goal for me"

"You bring the real world to the digital world"

### P2:

"If I am in a hurry, I won't use Eco mode"

"3 hours and 4 hours seems a waste, I feel it takes more energy"

"Just choosing between the cold and 30, it(tree) does make me feel a little bit guilty when I choose 30."

"It's nice to see the average cost goes down"

"I really like the arrows, it clearly indicates how my behavior is improved"

"568L seems a large amount of water, but I can't feel it. Maybe just tell me how many baths I can take with this amount of water."

"I like the pie chart"

"I like the idea behind it, like play a game, and also you can choose to play the tree game or the money saving."

"I do like the awards part"

"Glad to see how I compare with other people"

"I like to see how much water I am using."

"Every time the season starts, I will come back and see it." (3 years later)

**P3:**

"If I know there is a money choice, I will go directly to that without thinking whether planting a tree or not."

"The tree can talk more things on guiding me"

"Here in the money part, it tells how much I am saving, that's good!"

"I like the piggy bank, especially seeing money goes in haha."

"It's happy to see how much money I save in total, and if I can see the increase, that would give me more sense of achievement"

"I think here the arrows, show the comparison with myself is good, I can see my sustainability."

**HOMIE Employee:**

"I think my child or other families who have children will like the tree very much"

"The interface is clear"

"The way of showing sustainable information is good"

"Maybe for the long-term, the user can unlock different trees which are more and more precious."

"It's good to connect the sustainable behavior with saving money, for me I think it motivates a lot."

"For the long term, the system can learn your habit and finish settings automatically, which is simple to wash."

**P4:**

"Oh wo, that's brilliant!"(Putting detergent automatically)

"Wo, I think it's good, that you realize wo, maybe I should think about my habits, it also gives you pleasure if you see you are lower"(Habit page)

"Also to see the data here, I have to say, I never go to HOMIE website unless top up my credits, it's not really tangible."

"Yeah, I think it's a nice addition"

"Choosing Eco mode can give fertilizers to my tree... why not use it? It's good for both my tree and the environment."

"That's really nice you have the color schemes, you can see that's really bad, that is really convincing."

"I will also choose to save my money for energy"

"It's good you have the instant price related"

"This is nice that it shows the process"(washing)

"That's really nice! With HOMIE, you can always over draw the account. But this is something that really concrete, telling you okay this the number of washes you should do."

"I think your concept is really brilliant, to show the user real-time impact of their choices rather than at the end of month"

"I have to say, the competitors, the ranking for me really drive, trying to go up."

"Easy to follow, easy to understand what is happening."

"It encourages to make more sustainable choices"  
"Being able to visually see what kind of effect your choices have. "  
"Seasonality is beautiful, it's a good idea"

**P5:**

"I would sort the clothes based on the material"  
"Planting the tree looks interesting"  
"The name of the program tells me it's a sustainable choice"  
"Nice to get the fertilizer!"  
"I choose a lower temperature because I don't wanna my tree live in a bad environment, I am responsible for taking care of it."  
"Smart grid depends on my schedule, if you can tell me in advance, that's better"  
"Wo, it's cool!"  
"I like the medals! I feel proud of having them. Can I share them with my friends?"  
"Awards are appealing, but before it the medal encourage me"  
"What about it learning my habit after serial times, and then the process becomes simple?"  
"I focus more on reducing the consumption"  
"Can I have different pot plants? I would like to collect them."  
"The tree is like a partner of me, we grow better together."  
"When I grow more trees, will there come many animals?"

**P6**

"Nice to see the sustainable related information, which I never see before"  
"I need to improve my behavior!"(see the consumption)  
"No benefits for cotton, eh, I will choose eco, for my tree and for cheaper"  
"I will put in cold, to take care of my tree"  
"Compare to other washing machine, this one is more fun, and you feel you are doing something good."  
"Next time I will also choose the sustainable wash, so that I can earn the medal"  
"I like the idea to exchange for the real plants, I feel I really grow the tree!"  
"For me, the real awards are the strongest factor to motivate me to behave sustainably. But it also depends on what they are. But I like the plants here, and would like to see they can really grow up."  
"The forest is a build-up thing, I can see my outcomes, which make feel the sense of achievement"  
"I don't think the process is complex."  
"You got more informed about your behavior, it helps in build the relationship with your washing machine."  
"I will keep on planting the tree, I want to make my own forest!"

**P7**

"The process is very intuitive to me, I don't feel any complexity."

"No benefits for other programs, so I will choose cotton eco."  
 "It's convenient for me to select, and the tree makes it easier because it tells me what to do"  
 "I think there are some relationships between the tree and my clothes."  
 "I would like to see my tree grow better"  
 "I like the awards(plants) here because it is similar to the tree idea"  
 "It makes the washing clothes more fun than before"  
 "I like the washing "buddy" tree, feel the tree is accompanying"  
 "The tree grows on the moment when I am doing the decision, it influences my decision"  
 "Will this systems moving to another washing machine?"  
 "It is an accumulated effect, with time goes by I will feel the sense of achievement become stronger."  
 "I would like to design my forest, so I want to choose the tree to plant, I like this idea."

## P8

"The red part appeals me"(social comparison)  
 "The interface is clean, I like the style"  
 "Link the money to sustainability, I am strongly motivated"  
 "I see 40 degrees is much more expensive, 30 looks like the best choice"  
 "The pig is hinting me to use a lower temperature"  
 "In the emotional aspect, the pig's facial expression influence on my decision, it also tells me what is the right thing to do."  
 "The medal is interesting for me, it's like a game, can give me the sense of achievement"  
 "I want to put the clothes as much as possible, but the bag sometimes will limit my clothes, maybe you can set the minimal volume."  
 "Seeing I'm saving money can always encourage me to behave better."

## P9

"I really feel guilty to see I consume so much!"  
 "The machine recommends on Eco mode, okay I will trust it, it's the expert on washing"  
 "The weather(cold) is better, so I would like to choose it, for caring my tree."  
 "I like to see the arrows, it shows I am doing well"  
 "I like the forest!"  
 "I am looking forward to different types of medals"  
 "Unlocking way motivates me at the beginning, later I can design my forest, that is good for me."