

Final report User-Centered Design

Group I1 - Elena Dagg, Max Rijpert, Boy de Wit, Anika Kok



Design case brief

Design something that helps drivers to save energy (fuel/electricity) while driving. The solution needs to, at least:

- Inform people about their usage
- Persuade people to improve their performance

Part 1: Data gathering

1.1 Goal of the data gathering and description of the target group (max. 100 words)

The three goals of the data gathering is to find out:

1. The type of drivers the participants are;
2. If participants are aware of their fuel/energy consumption and if they would want to change their behaviour to drive more sustainable ;
3. How participants think they can save fuel/energy while driving.

Our intended user group is:

People who drive longer distances regularly. The car type (electric/ combustion engine) and the age of the users does not matter.

Word Count: 76

1.2 A list of 10 interview open questions used in the final interview

1. Can you tell something about yourself as a driver?
2. What habits do you have while driving?
3. Why do you drive the way you do?
4. Why do you drive regularly?
5. What does distract you while driving?
6. What distances do you drive?
7. What do you think of sustainability/energy saving trend?
8. How energy efficient do you think you are currently when it comes to driving?
9. What would help or stimulate you to save more energy while driving?
10. How would you want to be provided with information regarding your energy usage?

Extra questions:

1. How often do you drive?
2. For how long have you been driving regularly?
3. How do you know when to change the gear?
4. What is your behavior towards the maximum speed limit and why?
5. How much would you pay for the product?

Number of questions: 10

Number of extra questions asked in the interview: 5

1.3 The informed consent form & the completed ERB form

Subject Consent Form

DDB200 design case – group I1

User centered design - design|case

- I have been given information and I understand what this research is about. I was also able to ask questions. My questions have been answered to my satisfaction. I had enough time to decide whether to participate.
- I know that participation is voluntary. I know that I may decide at any time not to participate after all or to withdraw from the study. I do not need to give a reason for this.
- I know that some people can access my data. These people are Anika Kok, Elena Dagg, Max Ripert, Boy de Wit.
- I consent to gathering and usage of my data for scientific publication and additional research on my data.
- I consent to my data being stored at the research location for another 5 years after this study.

I want to participate in this study.

Name of study subject:

Signature:

Date: __ / __ / __

I hereby declare that I have fully informed this study subject about this study.

If information comes to light during the course of the study that could affect the study subject's consent, I will inform him/her of this in a timely fashion.

Name of investigator (or his/her representative):

Signature:

Date: / /

Ethical Review Form

(Version 27.06.2019)

This Ethical Review Form should be completed for every research study that involves human participants or personally identifiable data and should be submitted before potential participants are approached to take part in the research study.

Part 1: General Study Information

1	Project title and project number	DDB200 design case – group I1
2	Researcher name and email	Anika Kok, Elena Dagg, Max Rijpert, Boy de Wit
3	Supervisor(s)	Daniël Tetteroo
4	Faculty/department	Industrial Design
5	Research location	Technical University of Eindhoven
6	Research period (start/end date)	28-11-2019 until 14-01-2020
7	Funding agency	No funding needed
8	[If Applicable] Study is part of an educational course with code:	DDB200
9	[If Applicable] Proposal already approved by external Ethical Review Board: Add name, date of approval, and contact details of the ERB	
10	Short description of the research question	How can we help drivers to save energy (fuel/electricity) while driving?
11	Description of the research method	Short interview
12	Description of the research population, exclusion criteria	The researchers will select participants from their network, that are older than 18 years and drive a car regularly.
13	Description of the measurements and/or stimuli/treatments	The interview will consist of open questions and questions that can be answered with a that can be answered with a number on a scale of 1 to 10.
14	Number of participants	Approximately 8
15	Explain why the research is socially important. What benefits and harm to society may result from the study?	The research will contribute in the design process of a new product that will help save energy, thus improving sustainability.
16	Describe the way participants will be recruited	Participants will be recruited by the researchers by inviting them to join in person or via email.
17	Provide a brief statement of the risks you expect for the participants or others involved in the research or educational activity and explain. Take into consideration any personal data you may gather and privacy issues.	There are no expected risks for the participants or others. A consent form will be signed prior to the user test to gain permission to store the collected data.

Part 2: Checklist for Minimal Risk

		Yes	No
1	Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. children, people with learning difficulties, patients, people receiving counselling, people living in care or nursing homes, people recruited through self-help groups)		✓

Ethical Review Form

2	Are the participants, outside the context of the research, in a dependent or subordinate position to the investigator (such as own children or own students)?	✓
3	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people in non-public places)	✓
4	Will the study involve actively deceiving the participants? (e.g. will participants be deliberately falsely informed, will information be withheld from them or will they be misled in such a way that they are likely to object or show unease when debriefed about the study)	✓
5	Will the study involve discussion or collection of personal data? (e.g. name, address, phone number, email address, IP address, BSN number, location data) or will the study collect and store videos, pictures, or other identifiable data of human subjects?. Please check the FAQ's on the intranet . If yes: please follow the procedure . Make sure you perform a Data Protection Impact Assessment (DPIA) and make a Data Management Plan if necessary and let the data steward check it. Please attach these documents with this form (see part 5; enclosures)	✓
6	Will participants be asked to discuss or report sexual experiences, religion, alcohol or drug use, or suicidal thoughts, or other topics that are highly personal or intimate?	✓
7	Will participating in the research be burdensome? (e.g. requiring participants to wear a device 24/7 for several weeks, to fill in questionnaires for hours, to travel long distances to a research location, to be interviewed multiple times)?	✓
8	May the research procedure cause harm or discomfort to the participant in any way? (e.g. causing pain or more than mild discomfort, stress, anxiety or by administering drinks, foods, drugs)	✓
9	Will blood or other (bio)samples be obtained from participants (e.g. also external imaging of the body)?	✓
10	Will financial inducement (other than reasonable expenses and compensation for time) be offered to participants?	✓
11	Will the experiment involve the use of physical devices that are not 'CE' certified?	✓

Important:

If you answered all questions with "no", you can skip parts 3 - 4 and go directly to part 5. Check which documents you need to enclose and continue with signature and submission.

If you answered one or more questions with "yes", please continue with parts 3 – 5.

Part 3: Study Procedures and Sample Size Justification

1	Elaborate on all boxes answered with "yes" in part 2. Describe how you safeguard any potential risk for the research participant.	
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Ethical Review Form

2	Describe and justify the number of participants you need for this research or educational activity. Also justify the number of observations you need, taking into account the risks and benefits	
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Part 4: Data and Privacy Statement

1	Explain whether your data are completely anonymous, or if they will be de-identified (pseudonymized or anonymized) and explain how.	
2	Who will have access to the data?	
3	Will you store personal information that will allow participants to be identified from their data? See VSNU draft .	<input type="checkbox"/> No <input type="checkbox"/> Yes, and I declare I will follow the general data protection regulation (GDPR).
4	Will you share de-identified data (e.g., upon publication in a public repository)?	<input type="checkbox"/> No <input type="checkbox"/> Yes, and I will inform participants about how their data will be shared, and ask consent to share their data. I will, to the best of my knowledge and ability, make sure the data do not contain information that can identify participants.

Part 5: Closures and Signatures

1	Enclosures (tick if applicable): <input checked="" type="checkbox"/> Informed consent form; <input type="checkbox"/> Informed consent form for other agencies when the research is conducted at a location (such as a school); <input type="checkbox"/> Text used for ads (to find participants); <input type="checkbox"/> Text used for debriefings; <input type="checkbox"/> Approval other research ethics committee; <input type="checkbox"/> The survey the participants need to complete, or a description of other measurements; <input type="checkbox"/> Any other information which might be relevant for decision making by ERB; <input type="checkbox"/> Data Protection Impact Assessment checked by the privacy officer	
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Ethical Review Form

<input type="checkbox"/> Data Management Plan checked by a data steward	
<p>2 Signature(s)</p> <p>Signature(s) of researcher(s) Date:</p> <p>Signature research supervisor (if applicable) Date:</p>	<p>28-11-2019</p>    

1.4 Overview of the participants' demographics (max. 150 words)

The eight participants from these interviews drive regularly. Most of the participants drive long distances, mostly for work or for other reasons. The participants have different types of cars. Some of the cars are expensive and not energy efficient while other participants have a smaller, more sustainable car. The ages of the participants vary from 20 to 59.

Word Count: 58

1.5 The selective transcripts of the gathered data (max. 300 words)

"I drive to work every day because there is no public transport."

"I drive almost everyday. I have to drive a lot for my job as well so I believe I'm pretty experienced."

"I usually drive a little bit over the speed limit yes. Because most of the times it just feels to slow on certain roads."

"On the highway 20 km/h to fast is a penalty of 35€ where I live. So most of the times I drive the speed limit and a bit more, but never more than 20km/h over the speed limit."

"Depends on the situation. If there is a possibility, I drive faster."

"I consume a lot of fuel, the main reason for this is my car... I got an old Jeep and it literally uses fuel as if it's nothing. "

"Very efficient, because I'm always trying to be very aware of it. I drive an electric car and always really pay attention to how much energy I use while driving, even though I don't use fuel."

"Saving the environment would be a reason for me to save more energy while driving. It is really important for me."

"It would probably be money. I don't really care about the environment that much."

"Ah, definitely saving money. I get most of the fuel consumption back from my work, however less fuel means less expenses."

"Cows. "Laughs" No but actually I get distracted by nice landscapes or a nice sunrise/sunset. But nothing inside the car distracts me. I can have a conversation, sing a long music or call someone. Only if I have to concentrate on finding the way I cannot do anything else while driving."

"Not really anything that I know off... Maybe when I select a new song on my phone."

Word Count: 298

Part 2: Data analysis and Personas

2.1 Process description of your data analysis (how you conducted the analysis) (max. 200 words)

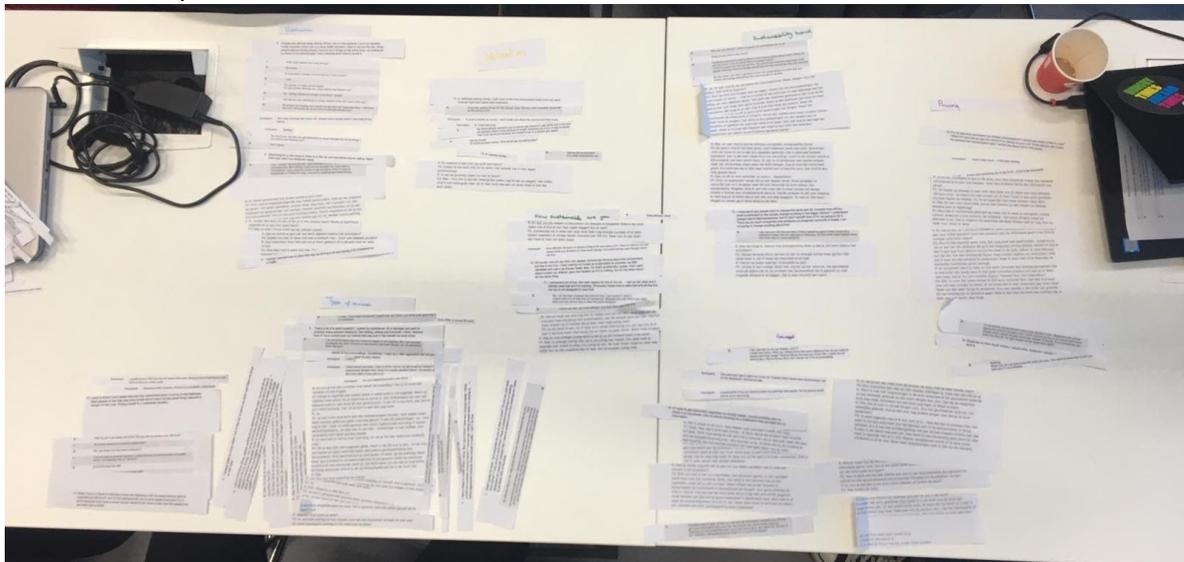
The analysis has been done by making selective transcripts which were briefly discussed within the project group. After the short discussion of the results, all of the statements from the selective transcripts were categorised. This was done by printing out the transcripts and cutting out every single answer given to the interview questions. The individual statements were then categorised and discussed with the group, after which the categories were reviewed and altered if necessary.

Word Count: 74

2.2.a Overview of results (e.g. affinity diagram, list of themes)

The results were grouped in the following categories/ themes:

- Motivation
- Distraction
- Type of driver
- How sustainable are you
- Sustainability trend
- Pricing
- Concept



2.2.b Overview of conclusions (interpretation of results relevant for personas and design case) (max. 250 words)

From the interviews can be concluded that most participants focus on the road as much as possible and don't get distracted. Driving in a sustainable way is important to half of the participants. The other half of the participants isn't that invested in sustainability and saving energy.

Participants note that driving on itself is not good for the environment unless you drive an electric car which most participants don't. Most cars that participants drive use a lot of fuel. However, this isn't triggering the participants to buy a car that is better for the environment.

Most of the participants pay attention to their way of driving and are making sure that this is as sustainably as possible. Some of the participants however, are not taking the environment into account and are therefore not actively trying to drive eco-friendly.

The participants would pay money to buy a product that helps them drive more efficient, as long as the product eventually helps save money. Some participants would invest more than others, as some wouldn't want to spend that much.

The type of car that is driven influences the way of driving. For instance: participants are more calm and paying more attention in a smaller car. They are a more confident in a bigger car.

Word Count: 212

2.3 Two different and complementing personas, based on suggested templates, attractively presented (graphical design, readability) on one A4 page each, and relevant to the design case.

Personal Profile

- Emma just started working and is at the start of her career.
- She drives the old car of her parents because buying a new car is too expensive.
- In her free time she loves to hike and spend time outside in nature.
- She is very open-minded and likes traveling to new places.
- She lives a healthy, vegan lifestyle and tries to be sustainable.
- On the weekend she drives to her hometown to visit family and friends.

Goals, needs, and requirements

- She values social activity and wants to spend as much time with her boyfriend and other friends. This could be by having drinks or doing something fun on the weekend.
- She wants to keep working on her career and improve her skills. She wants to promote within 3 years.
- Emma is very conscious of her impact on the environment and wants to decrease this impact as much as possible.

A day in the life

Emma loves to wake up early so she can take her time getting ready for the day. She takes a shower and prepares breakfast. Her boyfriend carpoles with her so she drops him off at his work. Then she continues to drive to her own office.

The drive takes about 45 minutes so she likes to listen to the radio. She focusses on traffic but does get distracted sometimes by nice landscapes or a beautiful sunrise/sunset.

Emma is a calm driver that doesn't feel the need to rush or be annoyed at other drivers unless they really do something stupid or dangerous.

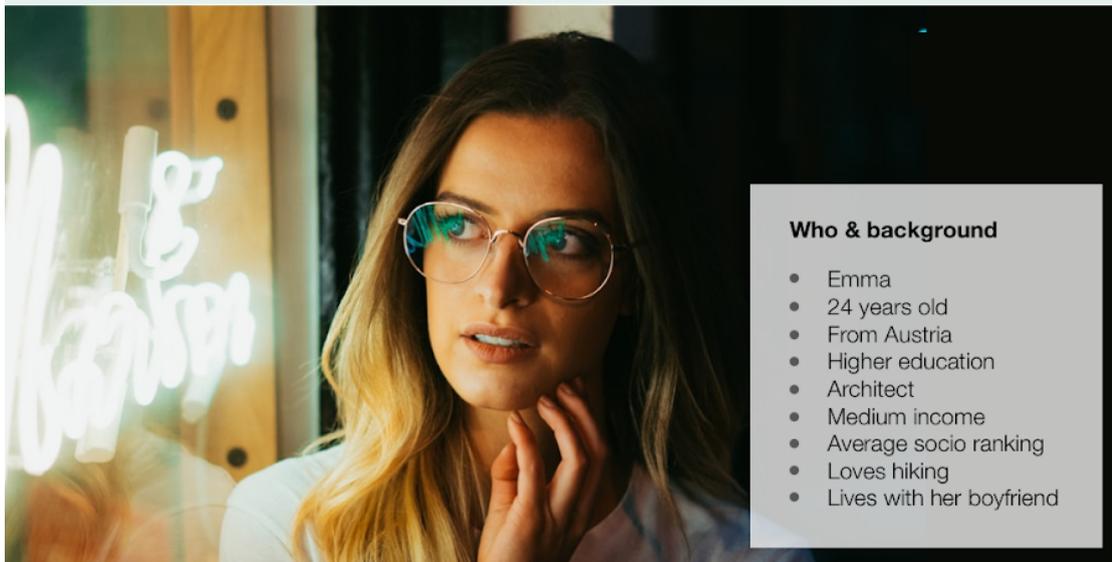
She is always very busy at work. She has meetings and designs new buildings. Speaking to clients is also a big part of her job.

At lunch time, she likes to go for a walk while eating her food. She leaves the office at around 7pm and drives home. Her boyfriend already left his workplace and went home using public transport.

In the evening, Emma likes to cook a nice meal so she can enjoy this together with her partner. After dinner she likes to watch tv or go out to have a drink in the city with friends.

She likes to meet family and friends on the weekends so she uses her car to visit them. She dislikes the old car because it uses a lot of fuel. That is why she is saving for a new, possibly even electric car. This way her impact on the environment decreases, which is something Emma cares about a lot.

Image reference: Photo by Fezbot2000 on Unsplash - https://unsplash.com/photos/pqYPRPHE_8



Who & background

- Emma
- 24 years old
- From Austria
- Higher education
- Architect
- Medium income
- Average socio ranking
- Loves hiking
- Lives with her boyfriend

Personal Profile

- A trustworthy and loving mother.
- Loves to spend time with family.
- Drives a lot for work but does not care about the fuel consumption, because she values time more.
- Drives a Mercedes car and goes flat out on the no-limit highways.
- When she is driving she doesn't fully concentrate on the road and is multitasking behind the wheel, like calling or singing to songs on the radio.
- She is easily distracted while driving.

Goals, needs, and requirements

- She values time over saving money, especially when it comes to driving. She gets her fuel expenses back from her company.
- She wants to make a career even though she is a little older and mostly focussed on being a good mother.
- Patrice needs strict time management, otherwise she will get in trouble either at work, or something will go wrong in her household.

A day in the life

In the morning she makes breakfast for her husband and her children. After breakfast she brings the youngest two sons to school and afterwards drives to her work. She loves to drive to work because this is the only time of the day where she is alone. She likes to sing songs on the radio and tends to turn on the radio a bit too loud. Patrice drives a Mercedes that slurps gasoline like if it's nothing. When she drives to work she avoids roads with speed limits because she likes to go flat out on the highway. In the car she always feels like she is in a hurry and drives relatively aggressive towards other drivers. Although she knows that driving high speeds is dangerous, she wants to save time by driving and accelerating fast. The sportive car and engine help her in achieving this.

After a work day from 9am to 5pm Patrice drives back home. She calls her husband in the car to ask if there are still groceries that need to be taken care of. She has the same ritual almost every weekday. If her tank is running low she will take the most convenient gas station and refill her tank. Even if the gas station is on the highway, she doesn't care about the price of gas. Her company composite the expenses while driving.

Normally when she comes back home, the family eats together and on Mondays and Wednesdays she brings her kids to football practice in the car. After an hour or 2 she picks them up again, takes a shower at home and watch some News with her husband. She falls asleep around 11PM to be fresh the next morning to start the whole process all over again the next morning.

Image reference: Photo by LinkedIn Sales Navigator on Unsplash - <https://unsplash.com/photos/wS73LE0GnKs>

Who & background

- Patrice
- 47 years old
- Has a PhD in economics
- Manager at a wealthy company
- Workaholic
- Mother of 3 sons
- True family person
- Likes being active and sport
- Not into technical stuff
- Loves reading and coffee



2.4 Brief reflection on the personas in which you indicate the relation to the data and the analysis (max. 300 words)

We created two personas that have characteristics that were established from the interviews with our target group.

One of the personas, Emma, 24, is very focused on sustainability and being eco-friendly. However, she just started working which is why her financial situation doesn't allow her to make all the choices and changes she would like to make. This persona is based on the findings from the interview, that half of the participants are aware of the importance of sustainability and would change behavior for the environment. Furthermore, saving money was mentioned as motivating by many of the interviewees.

The other persona named Patrice is a little older and in a very different stage of life. She is a mother of three and has a good job. Money is not an issue in her situation but yet she is not concerned with sustainability.

The Persona Patrice represents the other half of our participants - people who do not care or would not change their behavior for the environment. Her age also refers to the analysis of our gathered data - the subjects above 30 did not mention the money as a motivation for more sustainable driving.

Besides the mentioned relations between our personas and the data from the interviews, we also incorporated our selected target group that was logically also reflected in our participants of experienced drivers who use their car frequently.

Word Count: 231

Part 3: Concept development

3.1 A (max!) one-page description of your selected design concept, including

- **A scenario (see section 11.5.2 of the book)**
- **A storyboard (see section 12.2.3 of the book)**

Scenario:

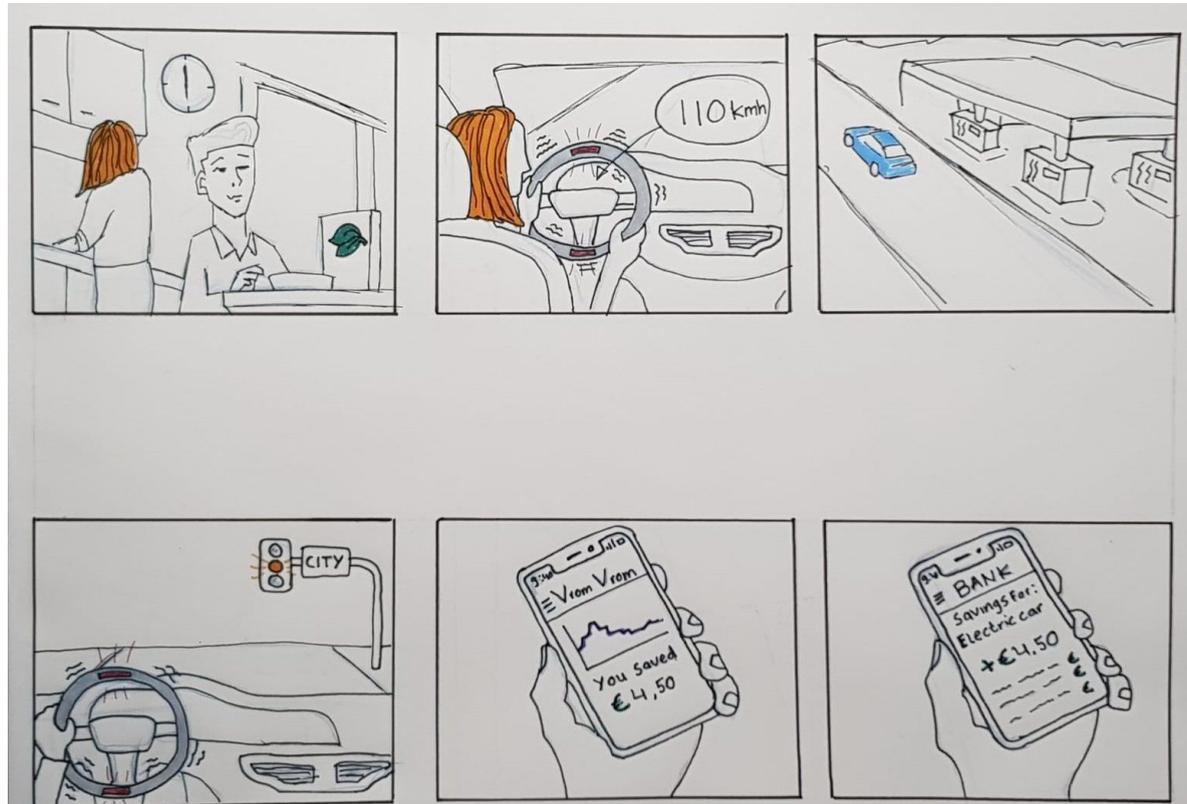
It is 6 am in the morning. Emma is preparing breakfast for her and her boyfriend in the kitchen using only fairtrade and local products. Later on, Emma and her boyfriend are sitting in the car, carpooling to work. Emma is driving and is using the new VromVrom – steering wheel. She is talking to her boyfriend and accidentally accelerates over 110 km/h. The Vrom Vrom steering wheel is turning red and vibrates softly to remind her to drive slower, which is more sustainable. Before reaching the city, they are passing by a gas station. They do not have to stop to get new fuel, because they are driving really energy efficient with the help of Vrom Vrom.

When entering the city, the Vrom Vrom steering wheel switches to city mode and helps Emma drive efficient. Vrom Vrom does this by indicating that Emma is driving too fast, considering the fact that there is an orange traffic light about to turn red ahead.

After Emma and her boyfriend arrive at work, Emma checks the VromVrom App on her phone. In this app she gets all the information about her driving habits and also how much money she saved this morning by driving sustainable. She can also retrieve information on how to drive more efficient and sustainable.

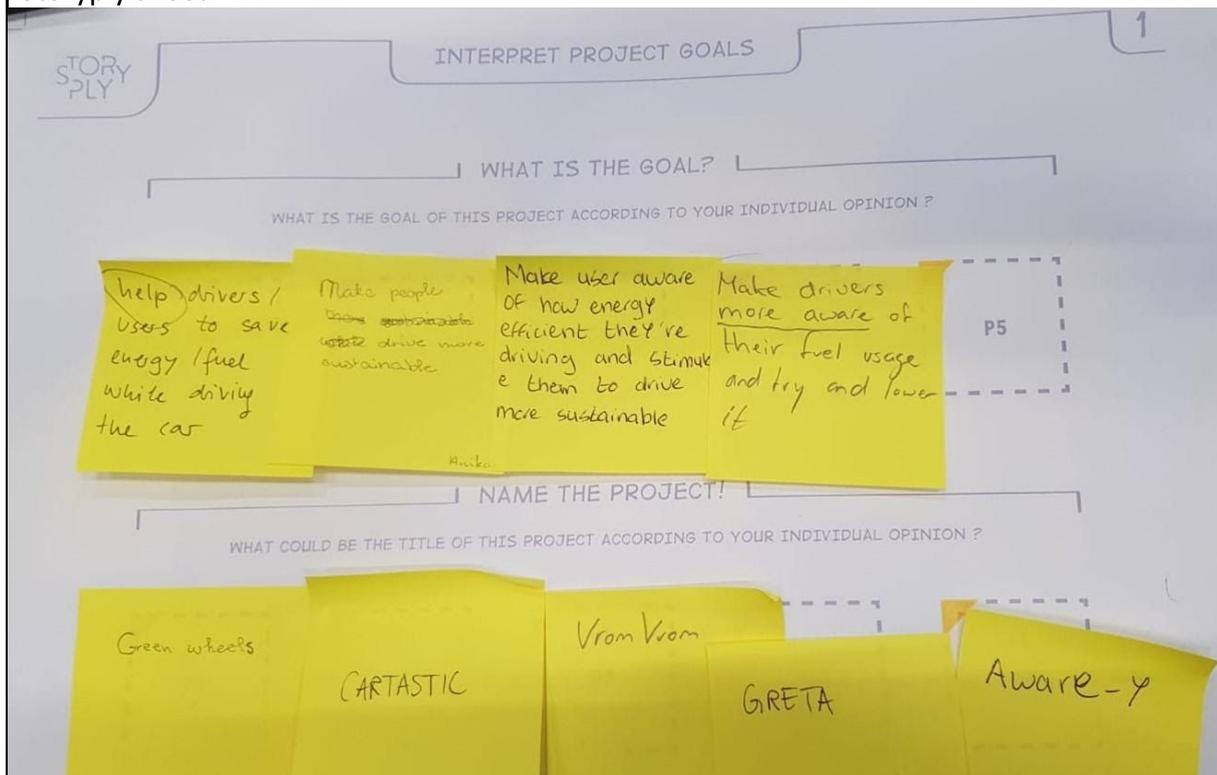
Emma switches to her banking app and puts the amount of money she saved by driving sustainably on to her savings account. She does this because she is saving up to buy a new electric car that would help her to be even more eco-friendly.

Storyboard:



3.2 Scans or pictures of all 7 Storyply sheets

Storyply sheet 1:



Storyply sheet 2:

STORY PLY **CAST YOUR CHARACTERS** 3

MAIN CHARACTER
GIVE A FACE, A NAME, AGE, OCCUPATION AND LOCATION TO YOUR CHARACTER.

	Emma	24
	Architect	Austria

GENERAL MOTIVATIONS
DISCUSS ABOUT WHAT DRIVES THIS CHARACTER?
WHAT KEEPS HIM/HER UP IN THE MORNING?

family is important

Career

she wants to have an impact on the world and change it to a better place

SUPPORTING CHARACTERS
WHO ARE THE PEOPLE AROUND THE CHARACTER WITH AN INFLUENCE OVER THE EXPERIENCE?

Emma's Boy friend

Family & Friends

BOSS

DISCUSS ABOUT THE CHARACTERS' VULNERABILITIES.
WHAT KEEPS HIM/HER UP IN THE NIGHT?

Work Stress

conflict between her resources/and her beliefs

Maintaining relationship to boyfriend & family & friends

Well Being of family and friends

being judged for your beliefs → maybe even being bullied

while being stressed at work and wanting to be sustainable

Storyply sheet 3:

STORY PLY **CATEGORIZE STORY ELEMENTS** 2

passengers

Driver

instructor

Car

Blue motion

employe

Other drivers

De VromVrom

Smartphone

Highway

City

Parking lot

Gas Station

Storyply sheet 4:

CONTEXTUALIZE EXPERIENCE

IMAGINE THE SETTING WHERE THE EXPERIENCE WILL TAKE PLACE AS VIVIDLY AS YOU CAN
BY ASKING THE FOLLOWING QUESTIONS

7 am in the morning before work
January 2020
Winter

7 am in the morning

gas station
+ stranger
+ boyfriend
+ cashier

gas station is just outside of the city center
country road

boyfriend
+ stranger
+ cashier

WHAT IS AROUND?

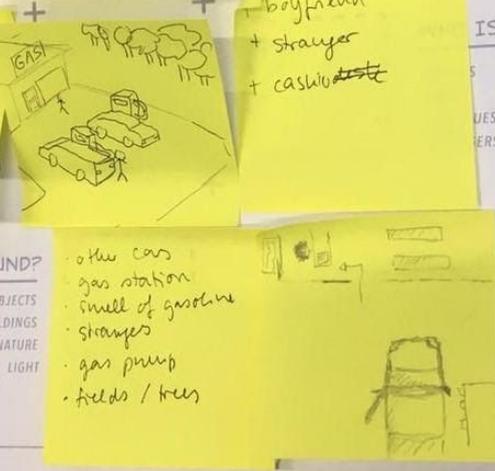
OBJECTS
BUILDINGS
NATURE
LIGHT

- other cars
- gas station
- smell of gasoline
- strangers
- gas pump
- fields / trees

HERE IS

IS INVOLVED?

UES
ERS



The image shows a storyboarding sheet with several yellow sticky notes and hand-drawn sketches. The top sticky note describes the time and season: '7 am in the morning before work, January 2020, Winter'. Another sticky note lists characters: 'boyfriend, + stranger, + cashier'. A third sticky note describes the location: 'gas station is just outside of the city center, country road'. A fourth sticky note lists environmental details under 'WHAT IS AROUND?': 'other cars, gas station, smell of gasoline, strangers, gas pump, fields / trees'. There are two sketches: one of a gas station with a car and a person, and another of a car. The sheet has sections for 'CONTEXTUALIZE EXPERIENCE' and 'WHAT IS AROUND?' with sub-sections for 'OBJECTS', 'BUILDINGS', 'NATURE', and 'LIGHT'. There are also partially visible sections for 'HERE IS' and 'IS INVOLVED?'.

Storyply sheet 5:

STORYPLY IDENTIFY THE CONFLICT 5

DESCRIBE THE EXISTING EXPERIENCE. START WITH A PROBABLE EVENT THAT SETS THE EXPERIENCE INTO MOTION.

PRIMARY VALUE
NAME

SECONDARY VALUE
NAME

1. This is Emma with her boyfriend Harold. She's 24 and tries to live as sustainable as possible.

2. Emma at home in her kitchen. Prepares breakfast for her and her boyfriend. Using fairtrade coffee and local ingredients. *Breakfast is ready babe!*

3. Noticing that the car is out of fuel again. They realise how quick this happens and that it's bad for the environment.

4. Emma and her boyfriend pull over to get fuel.

5. Emma at the cash desk trying to pay. Does not have enough money to pay. and thinks about how often she needs to fill the tank and how not sustainable that is. *AGAIN! I have to make this in a minute. 60.0€ CASH DISK*

Storyply sheet 6:

STORYPLY MAKE YOUR PROPOSAL 7

IMAGINE A MORE DESIRABLE ALTERNATIVE THAT SUGGESTS A BETTER EXPERIENCE.

PRIMARY VALUE
NAME

SECONDARY VALUE
NAME

1. This is Emma with her boyfriend Harold. She's 24 years old and tries to live as sustainable as possible.

2. Emma at home in her kitchen preparing breakfast for her and her boyfriend. Using fairtrade coffee and local ingredients. *Breakfast is ready babe!*

3. Harold is asking if they need gas but they agree so sustainable that they don't need to.

4. Emma and her boyfriend drive past the gas station.

5. Emma is checking savings and sees that she has already saved 35% of her dream car. *Electric Dream car. 35% You've already saved! 10500€ of 30.000€*

https://www.designstool.com/storyply
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Storyply sheet 7:

STORYPLY

CAPTURE IDEAS

9

MAKE A QUICK SKETCH OF THE IDEA AND WRITE A ONE SENTENCE DESCRIPTION BELOW FOR QUICK RECOLLECTION OF THE IDEAS AND DISCUSSIONS IN THE FUTURE.



An app that tells you how much fuel you can save and how to do this. This should be used after driving.



Creating a heads up display by using your phone. The display provides you with information and warns you when you use too much fuel.



as feedback in the steering wheel

Feedback on fuel usage

Eventual money being saved displayed on dashboard screen





fuel consumption cheap
↓
not okay

THE END OF EACH SESSION.

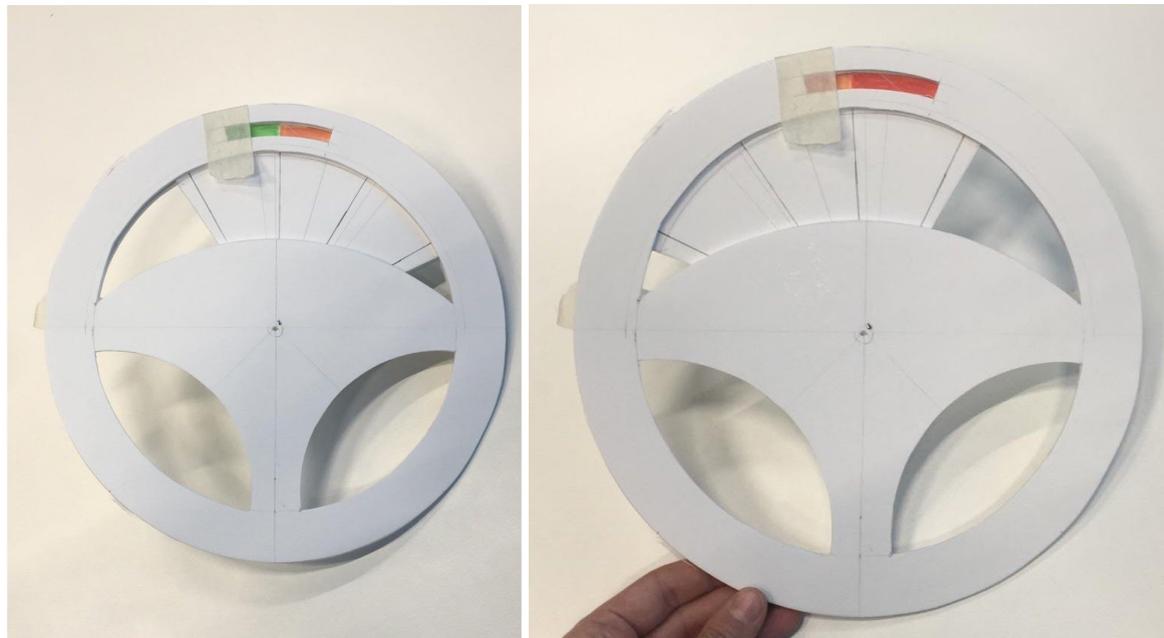
Part 4: Prototyping (max. 600 words)

4.1 A description of the low-fidelity prototype you made for your user evaluation including one or more pictures.

Our final concept involves a combination of an app where you have an overview of your driving behavior and a steering wheel that gives you feedback while driving. For the user test, we decided to test the steering wheel part of the full concept.

Therefore we made a low-fidelity prototype out of cardboard that acts as a steering wheel. In the upper part of the steering wheel, there is a scale that goes from green, to orange, to red. To simulate the vibration of the steering wheel, a phone was taped to the back of the prototype. This phone was equipped with a vibration app that could be used to test how people react to that feedback.

Word count: 117



4.2 List at least three usability goals (see page 19) and at least three user experience goals (see page 22) that you implemented in your low-fidelity prototype. Motivate why these are relevant for your concept and motivate how these goals are implemented in the prototype.

Usability goal 1: **Good utility**

Our product is meant to lower the fuel/energy consumption while driving. The steering wheel is designed to make you aware of your speed, so you can lower it if necessary. With the vibration and green, orange and red light, we strive to give enough feedback to the driver while keeping it safe and practical.

Not only will you save money on fuel/energy, you will also be more eco-friendly.

Usability goal 2: Learnability

We want our concept to be very easy to understand and learn so that people who drive could just buy this product and use it without having to put time and effort into learning how to use the product.

With our prototype, we will test if the user understands what the feedback he gets means and how he would react to it. While we simulate the driving the researcher will change the color and give feedback in the form of vibrations according to the situations in the simulation.

Usability goal 3: Effectiveness

The overall goal of the concept is to make driving more sustainable. If our product/ concept is not effective we would fail to reach our target group of people who have to go to work by car but want to be more sustainable.

The low-fi prototype will be part of a simulation. While participating we ask the tester to “think out loud” and tell us what he is doing and thinking. By using this method we can see if the user changes his driving after the feedback we give him.

User experience goal 1: Motivating

The main idea behind our concept is to make people drive more sustainable. Thus, we want to test if the user experience is motivating. If not, people probably would not drive more sustainable with our product.

With our prototype, the participant can experience our concept. This experience could give a good indication of the effects of the product, allowing us to assess how motivating our product is.

User experience goal 2: Helpful

We want to make it easier for the user to drive sustainable. Therefore we need to test if our idea is actually helpful.

By experiencing giving the user the experience we can get information by observing and after the test asking how helpful the test was.

User experience goal 3: Challenging

We want to change the challenge from “who is the fastest?” and “can I be faster than my navigation system says?” to “who drives the most sustainable?”. Therefore we want to challenge people with trying to always stay in the green area of the scale and try to not give any negative feedback on their driving.

With testing the experience we want to see if the users actually try to avoid the red on the scale and the vibration or if they do not care and it is not bothering them.

Part 5: User evaluation

5.1 An evaluation plan describing the goals, method and measures for the evaluation

a) Purpose and goals (max. 50 words)

The purpose of this test is to evaluate the concept of Vrom Vrom and the design of the corresponding prototype with potential users out of the target group. Our goal is to get feedback on the current state of the concept and design so that both could be improved.

Word count: 49

b) Research questions (list only, max. 6)

1. Does the product have a good utility?
2. Is it easy to learn how to use the product?
3. Is the product effective?
4. Is the product motivating?
5. Is the product helpful?
6. Is the product challenging?

c) Participant characteristics (max. 50 words)

Participants of this user evaluation should be between 18 and 65 years old and drive regularly. This could be daily but participants that drive once a week would also suit the target group. The type of car the participants drive is not relevant in our research.

Word count: 46

d) Methods (max. 150 words)

The user evaluation consisted of a simulation using the prototype and a questionnaire. The participants were first given a short introduction which didn't include any information on the concept but did include an explanation of the simulation. Participants were asked to think out loud and describe what they thought was happening and why it was happening. This way, we could test if users understood the feedback given to them.



After the participants filled in the consent form of the usertest, the simulation started. In this simulation, the user was holding the prototype and looking at a screen with a video. This video showed the view that a driver has while driving a car. While the video was playing, the participant got feedback in the form

of color and vibration in the steering wheel. After the simulation including the prototype, participants filled in the System Usability Scale [1] questionnaire.

Word count: 148

e) Task list (describe 1 task in full, name titles of any additional tasks)

The participants were only given one task: Imagine you are driving in a car with this steering wheel. The researcher then asked: "Can you tell me what you think is happening and why you think this is happening?" The participants then had to interact with the steering wheel while watching the video. During this simulation, the participants were asked to think out loud.

f) Equipment and logistics (max. 50 words)

This user test required the following:

- ERB form
- Consent form
- Low-fidelity prototype including a phone to provide vibration
- Video to simulate the driving
- Device to play the video on
- Questionnaire > System Usability Scale

Word count: 33

g) Measures (list only)

Think out loud method:

- Evaluation of the comments made by participants during the test.
- Evaluation of the observations made by the researchers.

Questionnaire:

- Evaluation of the given answers ranging from strongly agree to strongly disagree.

h) Analysis methods (max. 100 words)

We analysed our data by making notes of the remarks that participants made. We then discussed these with the project group. We also used the System Usability Scale which can then be interpreted by converting the scores by doing the following:

- For the odd numbered questions, subtract 1 from the score.
- For the even numbered questions, subtract their value from 5.
- Take these new values which you have found, and add up the total score. Then multiply this by 2.5.

The final result of this formula is not a percentage but does give a good sense of the score.

Word count: 100

5.2 Overview of the participant's demographics (max. 150 words)

This user evaluation included 8 participants of which seven have a Dutch nationality and one has a French nationality. The participants of this research all drive in a car regularly. The cars driven by the participants differ from old to new and vary from low-end to high-end. The average age of the participants is 45 and all of the participants have an average affinity with technology.

Word count: 66

5.3 The informed consent form used

Subject Consent Form

DDB200 design case – group I1

Usertest Vrom Vrom

- I have been given information and I understand what this research is about. I was also able to ask questions. My questions have been answered to my satisfaction. I had enough time to decide whether to participate.
- I know that participation is voluntary. I know that I may decide at any time not to participate after all or to withdraw from the study. I do not need to give a reason for this.
- I know that some people can access my data. These people are Anika Kok, Elena Dagg, Max Rijpert, Boy de Wit.
- I consent to gathering and usage of my data for scientific publication and additional research on my data.
- I consent the researchers to make and use:
 - Photographs
 - Videos
 - Audio recordings
- I consent to my data being stored at the research location for another 5 years after this study.

I want to participate in this study.

Name of study subject:

Signature:

Date: __ / __ / __

I hereby declare that I have fully informed this study subject about this study.

If information comes to light during the course of the study that could affect the study subject's consent, I will inform him/her of this in a timely fashion.

Name of investigator (or his/her representative):

Signature:

Date: __ / __ / __

Ethical Review Form

(Version 27.06.2019)

This Ethical Review Form should be completed for every research study that involves human participants or personally identifiable data and should be submitted before potential participants are approached to take part in the research study.

Part 1: General Study Information

1	Project title and project number	DDB200 design case – group I1
2	Researcher name and email	Anika Kok, Elena Dagg, Max Rijpert, Boy de Wit
3	Supervisor(s)	Daniël Tetteroo
4	Faculty/department	Industrial Design
5	Research location	Technical University of Eindhoven
6	Research period (start/end date)	01-01-2020 until 31-01-2020
7	Funding agency	No funding needed
8	[If Applicable] Study is part of an educational course with code:	DDB200
9	[If Applicable] Proposal already approved by external Ethical Review Board: Add name, date of approval, and contact details of the ERB	
10	Short description of the research question	How can we help drivers to save energy (fuel/electricity) while driving?
11	Description of the research method	Usertest with questionnaire
12	Description of the research population, exclusion criteria	The researchers will select participants from their network, that are older than 18 years and drive a car regularly.
13	Description of the measurements and/or stimuli/treatments	System usability scale questionnaire
14	Number of participants	Eight participants
15	Explain why the research is socially important. What benefits and harm to society may result from the study?	The research will contribute in the design process of a new product that will help save energy, thus improving sustainability.
16	Describe the way participants will be recruited	Participants will be recruited by the researchers by inviting them to join in person or via email.
17	Provide a brief statement of the risks you expect for the participants or others involved in the research or educational activity and explain. Take into consideration any personal data you may gather and privacy issues.	There are no expected risks for the participants or others. A consent form will be signed prior to the user test to gain permission to store the collected data.

Part 2: Checklist for Minimal Risk

		Yes	No
1	Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. children, people with learning difficulties, patients, people receiving counselling, people living in care or nursing homes, people recruited through self-help groups)		✓

Ethical Review Form

2	Are the participants, outside the context of the research, in a dependent or subordinate position to the investigator (such as own children or own students)?	✓
3	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people in non-public places)	✓
4	Will the study involve actively deceiving the participants? (e.g. will participants be deliberately falsely informed, will information be withheld from them or will they be misled in such a way that they are likely to object or show unease when debriefed about the study)	✓
5	Will the study involve discussion or collection of personal data? (e.g. name, address, phone number, email address, IP address, BSN number, location data) or will the study collect and store videos, pictures, or other identifiable data of human subjects?. Please check the FAQ's on the intranet . If yes: please follow the procedure . Make sure you perform a Data Protection Impact Assessment (DPIA) and make a Data Management Plan if necessary and let the data steward check it. Please attach these documents with this form (see part 5; enclosures)	✓
6	Will participants be asked to discuss or report sexual experiences, religion, alcohol or drug use, or suicidal thoughts, or other topics that are highly personal or intimate?	✓
7	Will participating in the research be burdensome? (e.g. requiring participants to wear a device 24/7 for several weeks, to fill in questionnaires for hours, to travel long distances to a research location, to be interviewed multiple times)?	✓
8	May the research procedure cause harm or discomfort to the participant in any way? (e.g. causing pain or more than mild discomfort, stress, anxiety or by administering drinks, foods, drugs)	✓
9	Will blood or other (bio)samples be obtained from participants (e.g. also external imaging of the body)?	✓
10	Will financial inducement (other than reasonable expenses and compensation for time) be offered to participants?	✓
11	Will the experiment involve the use of physical devices that are not 'CE' certified?	✓
<p>Important: If you answered all questions with "no", you can skip parts 3 - 4 and go directly to part 5. Check which documents you need to enclose and continue with signature and submission.</p> <p>If you answered one or more questions with "yes", please continue with parts 3 – 5.</p>		
Part 3: Study Procedures and Sample Size Justification		
1	Elaborate on all boxes answered with "yes" in part 2. Describe how you safeguard any potential risk for the research participant.	

Ethical Review Form

2	Describe and justify the number of participants you need for this research or educational activity. Also justify the number of observations you need, taking into account the risks and benefits	
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Part 4: Data and Privacy Statement

1	Explain whether your data are completely anonymous, or if they will be de-identified (pseudonymized or anonymized) and explain how.	
2	Who will have access to the data?	
3	Will you store personal information that will allow participants to be identified from their data? See VSNU draft .	<input type="checkbox"/> No <input type="checkbox"/> Yes, and I declare I will follow the general data protection regulation (GDPR).
4	Will you share de-identified data (e.g., upon publication in a public repository)?	<input type="checkbox"/> No <input type="checkbox"/> Yes, and I will inform participants about how their data will be shared, and ask consent to share their data. I will, to the best of my knowledge and ability, make sure the data do not contain information that can identify participants.

Part 5: Closures and Signatures

1	Enclosures (tick if applicable): <input checked="" type="checkbox"/> Informed consent form; <input type="checkbox"/> Informed consent form for other agencies when the research is conducted at a location (such as a school); <input type="checkbox"/> Text used for ads (to find participants); <input type="checkbox"/> Text used for debriefings; <input type="checkbox"/> Approval other research ethics committee; <input type="checkbox"/> The survey the participants need to complete, or a description of other measurements; <input type="checkbox"/> Any other information which might be relevant for decision making by ERB; <input type="checkbox"/> Data Protection Impact Assessment checked by the privacy officer	
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Ethical Review Form

	<input type="checkbox"/> Data Management Plan checked by a data steward	
2	Signature(s) Signature(s) of researcher(s) Date: Signature research supervisor (if applicable) Date:	21-01-2020    

5.4 A clear and concise description of the evaluation results (max. 300 words)

- Use basic statistic methods in the analysis of quantitative data
- Use proper visualizations for quantitative data
- Use selective quotes for qualitative data

The purpose of the product was clearly understood fairly soon by all users. All participants understood why the feedback that was being given and responded to this.

“Oh I think this means I am driving too fast right now. Because I am driving 50 in a city”

One individual didn't catch the red 'light' used on the steering wheel to indicate going too fast, but understood when the wheel vibrated. For all other users, it was clear that the light turning red indicated that the user was driving over the speed limit, and that the vibration alerted them after taking too long to adjust the speed. Multiple users mentioned that the vibration of the steering wheel would help them to focus on the road and less on their dashboard if they would own the product, because they would not have to look down constantly to get the feedback.

“Oh it even vibrates. I am taking too long to adjust the speed”

The product is useful and effective because participants stated that the feedback is useful and helps them to drive correctly. They would change their behaviour according to the feedback they receive. The product also motivates the drivers to drive sustainably by challenging them to stay in the green zone that is indicated on the steering wheel.

“So it is good when the color is green?”

The final score of the System Usability Scale that was used as a questionnaire is 81,25. This means that our product scored very high and is received very positively by the participants of the user evaluation. This can be concluded because the average System Usability Scale score is 68. A score below 68 is perceived bad, while a score higher than 80 is very good.

Word count: 292

5.5 The questionnaire(s) used

References

1. System Usability Scale (SUS) | Usability.gov. (n.d.). Retrieved from <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

Appendices

Full selective transcripts of the interviews:

- *Interview 1*
- *Interview 2*
- *Interview 3*
- *Interview 4*
- *Interview 5*
- *Interview 6*
- *Interview 7*
- *Interview 8*

Link to video used in user evaluation

- *User evaluation simulation video*

Filled in System Usability Scale questionnaire

- *Questionnaire 1*
- *Questionnaire 2*
- *Questionnaire 3*
- *Questionnaire 4*
- *Questionnaire 5*
- *Questionnaire 6*
- *Questionnaire 7*
- *Questionnaire 8*

Interview 1:

R: In which age category are you? 17-23 or 24-30?

P1: 17-23

R: For how long have you been driving regularly?

P1: I have had driving lessons since I was 17, so actually from that moment.

R: And constant or ...

P1: Yes with ups and downs. It is now because I live in a student home that I drive less by car because the car is at my home, but if I need it, then I take the car. So it's ups and downs.

R: And can you tell me something about yourself as a driver?

P1: It actually depends on which car I actually drive. Because we have two cars at home that I mainly drive. A Volkswagen Up, a somewhat smaller car and an Audi Q5, a larger car. In the UP you are in such a small car.

R: Yes

P1: Yes then you really have to follow all traffic rules, drive very well because people will not give you priority. In that Q5, on the other hand. Yes ... How do you say that ... There is

always a kind of built-in priority in a certain way. Yes, then I am ... a presence in traffic. Then my driving style changes a bit.

R: So that is when you are talking about priority. And when you talk about speed?

P1: Oh yes, that is about the same. Because in the Q5 you can do something ... It is nicer to drive faster because it has much better sound damping, for example. So with that driving on the highway is much more fun and better. But in terms of speed in built-up areas, it is always just the maximum speed or something below, because yes, it makes no sense to exceed that.

R: Okay.

P1: To make it very specific.

R: And what habits do you have while you are driving?

P1: Um, especially impatience to fellow drivers. If the traffic light turns green, don't pull up immediately, stay put, that frustrates me. Traffic slowing down, having to wait for roundabouts, or for a bus, for example. That is really annoying. Especially impatience and if you drive the Audi then it is also a bit of ego with me. A little bit of macho behavior.

R: Okay so that also differs per car.

P1: Yes

R: Okay. Why?

P1: Yes that's just a bigger, more expensive car. I'm 22, pretty young. Yes then there is a certain feeling involved. In the Up it is just ... Is a very decent car, but it is just a slightly different feeling when you drive it.

R: And that impatience, where does that come from?

P1: Yes that's normal. That is really completely because of my character. That's normal. I am a fairly impatient person, especially when it comes to things in traffic. That's how I am on my bike too.

R: Okay, and how regularly do you drive?

P1: Yes, let's say 4 to 8 times a month. Something like that.

R: Yes okay. What distracts you when you are in traffic? Are you distracted at all when you are driving?

P1: Not that often. Focus must remain on traffic.

R: Okay. And what distances do you usually travel?

P1: It is often somewhat larger distances. Really when you have to go somewhere. So yes say 50 km something like that. Or yes if I have to be in Eindhoven it is all a bit less ..

Usually I need the car if I really have to go somewhere. So yes, say 50km +

R: Okay, and what do you think of the energy efficiency, sustainability trend?

P1: I like it very much with cars, because everyone has a car. Maybe even two and if you use it daily. It is all fossil fuel. Then that is a mega source of pollution. For example, air in the cities also gets very bad. There are now a number of streets in Eindhoven where there are signs about pollution. So I think that trend is very good. If at all if you look at hybrid cars or electric cars. I think that is a very good trend.

R: Okay, and this is very specific on cars ... How about more in general?

P1: Ehm. Yes in general it depends a bit. Separating waste is of course also one of those things that naturally comes with it. That sustainability thingy. I don't do it myself, but that's more because it's too much trouble in a student home, I think. Furthermore, with food I try to make sure that I don't throw it away unnecessarily. Too many things and things like that and I almost always ride my bike.

R: Okay and how energy efficient do you think you're in the car right now?

P1: Not very energy efficient. Die Up is quite sustainable by nature. So you don't have to do much to be eco-friendly there. The Audi uses fuel quite a lot because of my driving style too because of my impatience so I am not very energy efficient with that.

R: And what would help you to be more energy efficient in the car?

P1: Yes, because it is specifically my driving style in the Audi, the Audi itself should be more sustainable. Or an electric car. Yes, because the Up has such a thing... What is it called? Smart function. With that you can see exactly .. On the dashboard there is such a thing and with that you can see exactly how sustainable you drive. I think that is completely crazy. There is such a meter on the dashboard on which you can see how eco-friendly you drive. I think that's called Blue Motion Drive or something. And then the engine also turns off, for example, when you are at the traffic light and stuff. I think that is completely crazy. I find that completely annoying. No, I don't like that at all. It is nice to look at but then you are far too distracted when looking at that dashboard than you are actually busy with the traffic. So I don't think that's a good thing.

R: Because it's distracting.

P1: Yes, because you have to keep focus off the street.

R: Okay and does that have anything to do with the fact that .. Yes, you are very concerned with sustainability on one hand, and not really on the other hand. Would it have more impact on you if you were more involved in that?

P1: Yes, I think so. If I would be actively involved with that, I would also be more involved with it in the Audi and pay more attention to it.

R: So that in your dashboard is completely crazy. Suppose we want to give you information about, for example, energy-efficient driving. Do you have an idea how that could be improved?

P1: Then I would integrate it into the heads-up display. Then the dashboard is projected at the bottom of the windshield. You could incorporate it in there because you are still looking straight ahead and you are still looking at the street. On the road. You could then incorporate it in there. Then it is certainly much less distracting.

R: That's only in the car. Any ideas for outside the car? Do not have to.

P1: Pooh. No, that is really a hard one ... I think that it is very difficult for you as a student to be 100% involved, because the products that you also get are therefore organic products. Slightly more expensive and so on. I think that it is very difficult for you as a student to work on it except to use the bicycle a lot.

R: Yes and your example is in the car. So my next question would be how much you would pay for it. For a product that you would give that information ...

P1: Oh heads up display is very nice. So I would certainly pay for that. 120 euros or so. Yes I don't care. I have been in a car once with a heads up display. So. I really don't want anything else but ehm.

R: Okay. And what kind of information would come up on that heads up display except about your driving behavior?

P1: Well what I currently know is what I know is navigation, cruise control, adaptive cruise control, the speed .. All those things are already on it. I think it is Blue Motion that is not on it as far as I know.

Interview 2

R: Are you in the age category 51 to 60?

P2: Yes

R: Okay. And for how long have you been driving regularly?

P2: Yes then I have to dig into my memory but I think I was 19 when I got my driver's license and since then I have driven a lot.

R: Okay. And can you tell me something about yourself as a driver? What type of driver are you?

P2: I think I am pretty relaxed. I can absorb quite a lot while driving and I am as constant as possible in terms of driving style, but very occasionally I can get a bit angry when other road users do stupid things.

R: Okay. And what habits do you have while driving?

P2: Focus on traffic and driving.

R: Furthermore, specific things that ...

P2: Listening to music. In other words, listen to the radio.

R: Why do you drive the way you do?

P2: I like that and I tell myself that it saves fuel and that it is also pleasant for fellow passengers to ride along.

R: Okay and how often do you drive exactly?

P2: Every day.

R: And which distances are involved?

P2: That is very variable but ehm .. I think I think for a moment ... I think I drive four to five hundred kilometers a week.

R: Okay. And why do you drive so often or regularly?

P2: Well first of all because of my health that I actually do everything by car. And secondly because I like to drive. Visit my family. Visit friends. And occasionally help my friend to drive some trailers from A to B.

R: Okay and are you sometimes distracted while driving?

P2: Rarely or not. I don't know what you mean by ... Being distracted by what?

R: Well maybe because of something happening around you or in the car with the radio or something.

P2: No, it doesn't bother me. I can separate that very well. The moment I have to concentrate more than I hear nothing at all around me.

R: Yes. And what do you think of the trend of sustainability. Taking better care of the environment. What do you think of that?

P2: I am not against that in itself. Only the changes that one makes or desires are.... I doubt whether that really contributes as much to the environment as people all think. As a private individual, you also have to have the money that is involved in being sustainable. Companies know that and take it into account. I understand that and I think that is justified. But as a private person I think you are sometimes really forced into things. Take the environmental zone in Utrecht as an example. If you have an older car. Older Diesel I have to say. You are therefore forced to purchase something else or simply not to go into the city anymore. Well I think that goes very far. You know, I understand those steps, but you can't force everyone to participate in this way.

R: No, I understand that. Okay and how energy efficient do you think you are while driving?

P2: Given the car I drive, I am not that energy efficient but given my driving style I think I almost get the maximum out of it.

R: Okay and on what basis do you conclude that?

P2: Because I have a calm driving style, pay attention to the usage, the average usage during the ride. And try to cover as much distance as possible with the fuel I use. That is really a sport for me.

R: And why is that really a sport for you?

P2: Because I like doing it. It saves me money.

R: Is that the biggest reason to do that?

P2: No ... Well it is an important reason, let me put it that way. I also think the environment is important, but I really want to do something about it.

R: And what would help or encourage you to save energy while driving a car, even though you say so a lot already?

P2: On Thursday I will take another step by making it even more energy-efficient by tuning, so that I use less diesel per 100 km. I can't do more than that or I have to not use the car.

R: Okay so you can't do more. And suppose you are not driving very sustainable and we want to give you information about how you can do that better. How would you like to receive that information?

P2: Well I think it's a bit of a mix of documentation so just in writing and then combined with maybe movies to see the effects.

R: And would you like that in the car or outside the car?

P2: No outside the car.

R: And when you talk about the inside of the car. Do you have ideas about that?

P2: Well maybe something that is visible on my display, more than it already is. Because I have some applications in the car that I can see the average consumption and actual consumption and things like that. That maybe you encourage even more to do it even more or better.

R: Okay so you can already see some things. So that average consumption, the actual use. Can you also see other things that you can think of now?

P2: I actually don't know if I can see if I ... No, I can't see that anyway because I drive a machine so it decides for itself whether it changes gear up or down so I cannot necessarily influence the changing gear behavior other than that I put it in manual. Then I have to do it manually and then I actually do not know whether my display shows whether I should switch gear yes or no. But I don't have more applications at the moment.

R: And suppose you should or would like to purchase such a product, how much would you want to pay for it? For a product that gives you information about how you can drive a more fuel-efficient car?

P2: Well I actually have no idea. That may cost some money. I think there are those plugs that you plug into the contra plug connector and that you can then read in an app how you do it in the car. Only I think that this should not be a distracting factor while driving. Or yes. That is nice to analyze afterwards, but I don't know if you can capture the actual moments properly.

R: And specific? Because you have not actually mentioned an amount in concrete terms? It is of course also difficult because I don't have a specific product to show you, but you would buy such a plug. How much would count for?

P2: For that tuning I pay 225 euros including VAT. I am willing to drive more economically. I expect that I have to drive three quarters of a year to earn it back. So a bit in that order of magnitude, up to that amount I am willing to go. Provided that I can really notice that I also gain money with that.

R: Do you have anything else that you would like to tell me what I can include in the results?

P2: Ehm well that you have to take care when giving advice. In the past people talked about modern driving, I don't know exactly what they called it, but that is also more

sustainable driving. Only if you apply that, for example, abroad in, for example, the mountains. Then you completely go wrong. So I do think that the information you receive or that you have to give it fairly can be applied in the Netherlands where everything is flat or where the circumstances are like that. But you have to be careful with that to ensure that people really apply it consistently.

Interview 3:

Interviewer: Ok, so in which age range are you? (showing age ranges)

Participant: In range A

Interviewer: For how long have you been driving regularly?

Participant: 2 years

Interviewer: Can you tell something about yourself as a driver? What type of driver are you? How experienced?

Participant: I drive almost everyday. I have to drive a lot for my job as well so I believe I'm pretty experienced. Besides that I think I'm a pretty obedient driver. I let people pass when they have right of way and so on.

Interviewer: What habits do you have while driving?

Participant: I don't really know... I guess I just try to always pay attention to my surroundings and be aware of everything.

Interviewer: Why do you drive the way you drive?

Participant: Because I think that's the safest way for me to drive.

Interviewer: How often do you drive?

Participant: Almost everyday.

Interviewer: Why do you drive regularly?

Participant: Mostly to drive to the gym. Otherwise just for work.

Interviewer: What distracts you while driving?

Participant: Not really anything that I know off... Maybe when I quickly select a new song on my phone.

Interviewer: What distances do you drive?

Participant: Usually just to the gym... Around 10 minutes driving. If I have to drive for work it's usually a lot more.

Interviewer: What do you think of sustainability/energy saving trend?

Participant: I don't really know... I don't really give it much attention.

Interviewer: How energy efficient do you think you are currently when it comes to driving?

Participant: I mostly drive fairly normal. Sometimes I accelerate a bit, but mostly fairly normal I think.

Interviewer: How do you know when to change the gear?

Participant: When I get around 2-3 thousand rpms, I usually shift gears.

Interviewer: What is your behavior towards the maximum speed limit?

Participant: I usually drive a little bit over the speed limit yeah. Because most of the times it just feels to slow on certain roads.

Interviewer: What would help or stimulate you to save more energy while driving? Money? Saving the environment?

Participant: It would probably be money. I don't really care about the environment that much.

Interviewer: How would you want to be provided with information regarding your energy usage?

Participant: I would prefer if my car would provide me with that information. On my phone would just be more distracting.

Interviewer: How much money would you pay for the product?

Participant: I don't really know... Preferably nothing.

Interview 4:

Interviewer: Ok, so in which age range are you? (showing age ranges)

Participant: In range D

Interviewer: For how long have you been driving regularly?

Participant: Since 1988, so around 30 years

Interviewer: Can you tell something about yourself as a driver? What type of driver are you? How experienced?

Participant: I'm very experienced and a calm driver.

Interviewer: What habits do you have while driving?

Participant: Not any that I know of.

Interviewer: Why do you drive the way you drive?

Participant: Because that's the way I prefer to drive.

Interviewer: How often do you drive?

Participant: Every day. At least 3 times a week 200 kilometers for work, and sometimes more than 800 when going on vacation.

Interviewer: Why do you drive regularly?

Participant: Because I work in Amsterdam and I live in Breda.

Interviewer: What distracts you while driving?

Participant: Nothing.

Interviewer: What distances do you drive?

Participant: Around 200 kilometers a day.

Interviewer: What do you think of sustainability/energy saving trend?

Participant: I think it's a good trend.

Interviewer: How energy efficient do you think you are currently when it comes to driving?

Participant: Very efficient, because I'm always trying to be very aware of it. I drive an electric car and always really pay attention to how much energy I use while driving, even though I don't use fuel.

Interviewer: How do you know when to change the gear?

Participant: Yes, preferably at low rpm's. But since I drive electric I don't really need to change gears.

Interviewer: What is your behavior towards the maximum speed limit?

Participant: Depends on the situation. If there is a possibility, I drive faster.

Interviewer: What would help or stimulate you to save more energy while driving? Money? Saving the environment?

Participant: If I could save time.

Interviewer: How would you want to be provided with information regarding your energy usage?

Participant: The same way I get it right now in my car. A graph which shows how much energy I use on the dashboard. And also an app.

Interviewer: How much money would you pay for the product?

Participant: It may cost something, but it has to be... it has to be reasonable.

Interview 5:

1. E (51-70)
2. I got my driver license when I turned 18. I have been driving regularly for about 30 years now.
3. I am a conscious driver, always putting all my attention to the road. I try to put all my attention into my driving. You never know how other people will drive and it is best to imagine everyone being either drunk or not paying attention. You can easily adapt to other people when you imagine them not knowing what they're doing. ... I consider myself to be an experienced driver, I know how to react to most situations in traffic.
4. I always listen to music when I am in the car. It calms me down and helps me focus on the road.
5. I guess I learned how to drive this way by driving a lot and having a lot of experience in traffic.
6. I drive at least 5 days a week to my work.
7. For work.
8. People who call me while driving. When I am on the highway I put it on speaker mode, however when I am in a busy traffic situation I tend to cancel the call. When people call me during driving I have to do 2 things at the same time, not putting all my focus in my driving style. I don't like that and I tend to avoid it.
9. I drive from Margraten to Eindhoven so that's about 190km every day.
10. I understand why people want to change the world and all, however how will my small contribution to this society change anything in the bigger picture? I understand change has to start somewhere, but if I don't benefit from it I'm not going to do it. There are so much companies that produces un-imaginary amounts of waste, I am not going to change anything about that.
11. I consume a lot of fuel, the main reason for this is my car... I got an old Jeep and it literally uses fuel as if it's nothing. Of course I know how to save fuel and all that but my car is not designed to save fuel.
12. You can hear the RPM go up, when it reaches a certain frequency I change gear.
13. I tend to drive 5 km/h faster than the max speed limit when it comes to the highways. Most people on the high way drive to fast and if I don't do the same thing I become a danger on the road. Putting myself in a vulnerable situation.
14. A, definitely saving money. I get most of the fuel consumption back from my work, however less fuel means less expenses.
15. I guess through sound feedback? Or a small display like a TomTom. Sometimes when I am listening to music in the car, the most annoying thing to happen is the Navigation System telling me what to do, NO I WANT TO LISTEN TO THIS SONG.
16. Depends on how much money I would save, however I would say less than 100 euro's.

Interview 6:

1. D. (41-50)
2. I have been driving since I was a teenager. We always drove in a car in the backyard of my aunt. So I would say about 32 years and on the road for about 28 years.
3. I consider myself to be a decent driver. I know how to react to others and I am always aware of my surroundings. Sometimes I might be a little aggressive but not placing other people in danger by any means.

4. I like to listen to music when I drive. But I don't think I have any unusual habits. "What would you consider unusual habits?" I would say calling people while I'm driving or being aggressive towards other people in traffic, I don't do that.
5. That's a bit of a weird question, I guess by experience. As a teenager we used to practice these extreme situations, like drifting, sliding and burnouts. I think I learned how to have control over my vehicle this way and it has benefited me ever since.
6. I drive my family when we go out or visit other family. And I drive to Bonn or Rotterdam twice a week for work. I would say not very often.
7. Well I guess for work. "Is it essential for you to drive to work? Or can you also work from home?" I only drive to work when I have to present something in a meeting, otherwise we videocall. Despite this I have to present a lot in the meetings so I have to be there 75% of the time.
8. Searching for a new song to listen to in the car and handsfree phone calling. Apart from that I won't be distracted easily.
9. Well to work it of course depends if I have to go to Rotterdam or to Bonn, I would say somewhere between 120 and 190 km to work and the same back. So that's 200 and 400 km. However when I drive my family it's not more than 20km.
10. Of course I should say that I am always consciously thinking about the environment, but this is not true. I tried making my house as sustainable as possible, we filter rainwater and use it as shower water later. So that's ecofriendly I guess. And I can't stand it when my children open the heaters as if it is nothing, but on the other hand I do the same thing.
11. I drive an automatic car, so when it comes to shifting gears I can't control that. But I am not constantly accelerating like a maniac, so I think I am pretty energy efficient in my car. I do like to put the AC on a comfortable temperature, especially in the winter period, otherwise my hands would freeze off.
12. As I said, I drive an automatic so I don't have to change gears. But in a normal car I just listen to the engine and when it gets loud you should shift gears. You can also feel when you have to change gears in a normal car.
13. When I drive to Bonn in Germany there are highways with no speed limit so tend to drive almost 200 km/h. And in the Netherlands I try to drive speed limit plus 3 to 5 km/h because they have a small margin where if you drive a little over the speed limit you won't get a ticket.
14. A. saving money.
15. If I were to get information regarding my energy usage, I would probably want to check it on my phone. Like my phone sending me a notification that provides me my information.
16. For an app that calculates my energy consumption? I would say make it free to use? "What if it was not an app but more of a device in your car" If this device can make my general fuel consumption less I would say about 50 to 150 euros.

Interview 7:

Interviewer (I):	How old are you?
	a. 17-23
	b. 24-30
	c. 31-40
	d. 41-50

	e. 51-60 f. 61-70
Subject (S):	A
I:	For how long have you been driving actively?
S:	3 years
I:	Can you tell something about yourself as a driver? What type of driver are you?
S:	I do not drive faster than the maximum speed on the highway. But I get annoyed by people who drive 70 km/h on the country road even though you are allowed to drive 100 km/h.
I:	How experienced are you as a driver?
S:	I would say that I am very experienced, because I drive every day.
I:	What habits do you have while driving?
S:	What do you mean with habits?
I:	What do you do while driving with respects to the driving itself and other things you do while being in the car (for example: talking, checking your phone etc.)
S:	Most of the times I listen to music on the radio, sometimes on the phone. But most of the times just radio.
I:	Why do you drive the way you do?
S:	I do not exceed the speed limit on the highway because I feel like you do not have the full control when you drive 200 km/h. But on the country road I most of the times drive exactly the speed maximum because I need to get somewhere on time. I do not like overtaking because I am always afraid that I am not fast enough etc.
I:	How often do you drive?
S:	I drive to work every day, because there is no public transport.
I:	What does distract you while driving?
S:	What do you mean?
I:	Do you get distracted by something happening outside of the car or insides? That influences your attention on driving?
S:	Cow. "Laughs" No but actually I get distracted by nice landscapes or a nice sunrise/sunset. But nothing inside the car distracts me. I can have a conversation, sing a long the music or call someone. Only if I have to concentrate on finding the way I cannot do anything else while driving.

I:	So, would you say that you get distracted by visual changes but not by things you hear or are listening too?
S:	Yes, I agree.
I:	What distances do you drive?
S:	60 km per day, it is about 90 mins. 45 min to work and 45 min back.
I:	What do you think of sustainability/energy saving trend?
S:	I think it is really important and it is important that we actually act sustainable.
I:	How energy efficient do you think you are currently when it comes to driving?
S:	I would say that I am quite efficient. One tank filling lasts pretty long.
I:	How do you know when to change the gear?
S:	It depends on the car and is different for every car. I can hear it and look at the rotation speed.
I:	So would you say you pay attention to when you have to change the gear?
S:	Yes of course.
I:	What is your behavior towards the maximum speed limit?
S:	I am not sure. On the one hand I think it would be good if there would be a maximum speed limit on highways in Germany. On the other hand statistic show that there are not more accidents.
I:	And your personal behavior?
S:	I do not drive that fast on the highway.
I:	What would help or stimulate you to save more energy while driving? a. Saving money b. Saving the environment
S:	Saving the environment It is really important for me.
I:	Do you think other things would motivate you even more? For example benefits, if you saved energy?
S:	Of course, getting things for free always helps. But my main motivation would still be the environment.
I:	How would you want to be provided with information regarding you energy usage?
S:	Probably over an app. Where you can see all information. Actually you already get most information from your car. But maybe you could have a pop-up

	message on the screen that tells you if you use a lot or very little fuel. Similar to the "Attention, temperature underneath 3 C it could be slippery.
I:	How much would you pay for the product?
S:	To be honest, at the moment and in the situation I am.. Because I am just an apprentice and do not earn a lot I think I would not buy it. If I would earn more money and it would actually save fuel, maybe 70 Euros, if it is something you build into the car. An app should not be expensive right?
	More about the concept specifically
I:	What is your first response to this concept?
S:	I really like the idea of changing the challenge to who saves the most energy instead of who is the fastest. Furthermore I think it is important to raise awareness about sustainability and the energy usage while driving.
I:	If you would be able to improve the concept right now, what would you change?
S:	I think it would be really good if you would build it into the car. In my opinion it would be even better than an app.
 <u>Interview 8:</u> 	
Interviewer(I):	How old are you? a. 17-23 b. 24-30 c. 31-40 d. 41-50 e. 51-60 f. 61-70
Subject (S):	b
I:	For how long have you been driving actively?
S:	Since I have been 17.
I:	17? That means...(pause).. for 7 years.
S:	Yes, exactly. 4+3 "laughs"
I:	Can you tell something about yourself as a driver? What type of driver are you?
S:	I am a calm person, I do not loose control often while driving. I would say I am a chilled driver. I do not take it that serious.
I:	So do you mean that you are a calm and confident and safe. Or do you mean you do not take it serious?
S:	No, No I mean the first one.

I:	How experienced are you as a driver?
S:	I mean, I have been driving for 7 years now. So I think I can drive quite good and I am confident.
I:	What habits do you have while driving? I mean while driving in respect to driving and what do you do besides driving.
S:	No, I will not say that now.
I:	No, I mean, if you listen to the radio while driving?
S:	Yes of course, I always listen to music.
I:	Anything else?
S:	I also eat while driving?
I:	And habits in respect to driving? For example, I have a problem with stop and go.
S:	No, I am a normal driver.
I:	Why do you drive the way you do?
S:	What kind of questions are that? I think it is just a habit, isn't it?
I:	How often do you drive?
S:	At the moment not that often anymore. But the last 3 years, 2 times per week, 200km. By the way, are you also taking notes or what?
I:	Only a few, that is why I am recording you as I told you.
S:	Ah, okay.
I:	What does distract you while driving?
S:	My phone.
I:	Is it because it makes a sound and you check it then?
S:	"nods"
I:	No worries, the data will be treated So your phone distracts you, does talking also distract you?
S:	No. "Joking" please do not talk to the driver "laughs".
I:	And are you also distracted by things outside of the car? Like a nice sky?
S:	Of course I am looking, but I would not say that I am dreaming away. I still know that I am driving the car at the moment and pay attention to it.
I:	What do you think of sustainability/energy saving trend?
S:	Why are you asking? I think it is good, but sometimes too much.

I:	What do you think is too much?
S:	Suddenly everyone is talking about it and making stress about it and I think it is way too much. I do not know how to express myself... I think it is good, but live and let live. You cannot tell everyone especially older people that they have to change everything and that everything they did was bad.
I:	So you mean, you are in general in favor for sustainability but think that you should not change everything from one moment to another.
I:	How energy efficient do you think you are currently when it comes to driving?
S:	Quite efficient I think.
I:	How do you know when to change the gear?
S:	I hear/feel it.
I:	So you pay attention to driving in the right gear?
S:	Yes of course, otherwise it hurts.
I:	What is your behavior towards the maximum speed limit?
S:	With my car I can sadly only drive 160 and with my father's car 190 km/h .
I:	And when there is a maximum speed limit?
S:	No, you know I do not want to discuss it.
I:	I do not mean a general maximum speed limit but sometimes there are speed limits – for example 100 or 130 km/h.
S:	20 km/h to fast are 35€.
I:	So you do not want to pay more than 35€?
S:	You know what they say: The speed limit is more like an orientation.
I:	What would help or stimulate you to save more energy while driving? <ul style="list-style-type: none"> a. Saving money b. Saving the environment c. Other benefits d.
S:	Saving money Of course to save money. Who would say something else?
I:	Do you think other benefits, for example, payback would motivate you even more?
S:	My friend always wanted to go to special gas stations to get points and in the end we probably spend more because of longer distances we drove. It was so stupid how much we drove because we needed to go to a special gas station .
I:	So you do not think something else would motivate you even more?

S:	No, I do not even compare the price for fuel. I just pump if I need to. I never paid a lot of attention on saving fuel. Because you only drive if you need to drive and you are too lazy to take the public transport.
I:	How would you want to be provided with information regarding you energy usage?
S:	I think I look at it before buying a car, that I buy a car that uses less fuel.
I:	And while driving?
S:	I can see that on my car display, can't I? I mean you know, when you always drive the same distance how do you want to reduce your fuel usage? Saving fuel by the way you drive? No, I really do not want to do it. My ex-fiance did it, but I would not. It is so exhausting.
I:	How much would you pay for the product?
S:	You cannot..? What do you mean? If there was something you can put in your car?
I:	It does not matter how it looks like yet. Just in general?
S:	Nothing. When you do not even know for what you pay. You need to know how much you safe and if it is profitable.

User evaluation simulation video



YouTube link: <https://youtu.be/ehwsOD6KrKM>

Questionnaire 1

System usability scale - Vrom Vrom

1. Ik denk dat ik dit systeem graag frequent zou gebruiken.
2. Ik vond het systeem onnodig complex.
3. Ik vond het systeem makkelijk te gebruiken.
4. Ik denk dat ik de steun van een technisch persoon nodig heb om dit systeem te kunnen gebruiken.
5. Ik vond dat de verschillende functies in dit systeem goed geïntegreerd waren.
6. Ik vind dat er teveel inconsistentie is in dit systeem.
7. Ik denk dat de meeste mensen snel zouden leren hoe ze dit systeem kunnen gebruiken.
8. Ik vond het systeem erg omslachtig om te gebruiken.
9. Ik voelde me erg zelfverzekerd terwijl ik het systeem gebruikte.
10. Ik moest veel dingen leren voordat ik met dit systeem aan de slag kon.

Niet mee eens

Mee eens

	1	2	3	4	5
			X		
		X			
			X		
X					
			X		
			X		
			X		
			X		X
			X		
			X		
			X		

Questionnaire 2

System usability scale - Vrom Vrom

1. Ik denk dat ik dit systeem graag frequent zou gebruiken.
2. Ik vond het systeem onnodig complex.
3. Ik vond het systeem makkelijk te gebruiken.
4. Ik denk dat ik de steun van een technisch persoon nodig heb om dit systeem te kunnen gebruiken.
5. Ik vond dat de verschillende functies in dit systeem goed geïntegreerd waren.
6. Ik vind dat er teveel inconsistentie is in dit systeem.
7. Ik denk dat de meeste mensen snel zouden leren hoe ze dit systeem kunnen gebruiken.
8. Ik vond het systeem erg omslachtig om te gebruiken.
9. Ik voelde me erg zelfverzekerd terwijl ik het systeem gebruikte.
10. Ik moest veel dingen leren voordat ik met dit systeem aan de slag kon.

Niet mee eens

Mee eens

	1	2	3	4	5
				X	
X					
					X
X					
				X	
X					X
				X	
X					
X					

Questionnaire 3

System usability scale - Vrom Vrom

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.

<i>Strongly disagree</i>			<i>Strongly agree</i>	
1	2	3	4	5
			X	
X				
				X
X				
			X	
X				
				X
X				
			X	
		X		

Questionnaire 4

System usability scale - Vrom Vrom

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.

<i>Strongly disagree</i>			<i>Strongly agree</i>	
1	2	3	4	5
	X			
X				
				X
X				
		X		
	X			
				X
			X	
		X		
X				

Questionnaire 5

System usability scale - Vrom Vrom

1. Ik denk dat ik dit systeem graag frequent zou gebruiken.
2. Ik vond het systeem onnodig complex.
3. Ik vond het systeem makkelijk te gebruiken.
4. Ik denk dat ik de steun van een technisch persoon nodig heb om dit systeem te kunnen gebruiken.
5. Ik vond dat de verschillende functies in dit systeem goed geïntegreerd waren.
6. Ik vind dat er teveel inconsistentie is in dit systeem.
7. Ik denk dat de meeste mensen snel zouden leren hoe ze dit systeem kunnen gebruiken.
8. Ik vond het systeem erg omslachtig om te gebruiken.
9. Ik voelde me erg zelfverzekerd terwijl ik het systeem gebruikte.
10. Ik moest veel dingen leren voordat ik met dit systeem aan de slag kon.

Niet mee eens Mee eens

	1	2	3	4	5
			X		
X					
					X
X					
				X	
	X				
					X
X					
		X			
X					

Questionnaire 6

System usability scale - Vrom Vrom

1. Ik denk dat ik dit systeem graag frequent zou gebruiken.
2. Ik vond het systeem onnodig complex.
3. Ik vond het systeem makkelijk te gebruiken.
4. Ik denk dat ik de steun van een technisch persoon nodig heb om dit systeem te kunnen gebruiken.
5. Ik vond dat de verschillende functies in dit systeem goed geïntegreerd waren.
6. Ik vind dat er teveel inconsistentie is in dit systeem.
7. Ik denk dat de meeste mensen snel zouden leren hoe ze dit systeem kunnen gebruiken.
8. Ik vond het systeem erg omslachtig om te gebruiken.
9. Ik voelde me erg zelfverzekerd terwijl ik het systeem gebruikte.
10. Ik moest veel dingen leren voordat ik met dit systeem aan de slag kon.

Niet mee eens Mee eens

	1	2	3	4	5
				✓	
✓					
					✓
		✓			
					✓
✓					
					✓
✓					
					✓
✓					

Questionnaire 7

System usability scale - Vrom Vrom

1. Ik denk dat ik dit systeem graag frequent zou gebruiken.
2. Ik vond het systeem onnodig complex.
3. Ik vond het systeem makkelijk te gebruiken.
4. Ik denk dat ik de steun van een technisch persoon nodig heb om dit systeem te kunnen gebruiken.
5. Ik vond dat de verschillende functies in dit systeem goed geïntegreerd waren.
6. Ik vind dat er teveel inconsistentie is in dit systeem.
7. Ik denk dat de meeste mensen snel zouden leren hoe ze dit systeem kunnen gebruiken.
8. Ik vond het systeem erg omslachtig om te gebruiken.
9. Ik voelde me erg zelfverzekerd terwijl ik het systeem gebruikte.
10. Ik moest veel dingen leren voordat ik met dit systeem aan de slag kon.

Niet mee eens Mee eens

	1	2	3	4	5
			X		
		X			
			X		
X					
			X		
			X		
					X
			X		
			X		
			X		

Questionnaire 8

System usability scale - Vrom Vrom

1. Ik denk dat ik dit systeem graag frequent zou gebruiken.
2. Ik vond het systeem onnodig complex.
3. Ik vond het systeem makkelijk te gebruiken.
4. Ik denk dat ik de steun van een technisch persoon nodig heb om dit systeem te kunnen gebruiken.
5. Ik vond dat de verschillende functies in dit systeem goed geïntegreerd waren.
6. Ik vind dat er teveel inconsistentie is in dit systeem.
7. Ik denk dat de meeste mensen snel zouden leren hoe ze dit systeem kunnen gebruiken.
8. Ik vond het systeem erg omslachtig om te gebruiken.
9. Ik voelde me erg zelfverzekerd terwijl ik het systeem gebruikte.
10. Ik moest veel dingen leren voordat ik met dit systeem aan de slag kon.

Niet mee eens Mee eens

	1	2	3	4	5
				X	
X					
					X
X				X	
X					
					X
X				X	
X					