IOT IN THE CITY

DATA AWARENESS AT STRATUMSEIND

Eindhoven University of Technology,
Bachelor College Major Industrial Design

DPB210 Project 2 Design
Transformative Practices for Social Inclusion
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INDEX

INTRODUCTION

The municipality of Eindhoven is always working on innovation and are working with new IoT technologies and sensors in public spaces, based on gathering and analyzing people's data to improve the quality of life in the city.

At Stratumseind, there is such a sensor network which gathers data to solve issues in daily lives like safety. As local government, Eindhoven has to ensure that use of technology and data in the public space is visible, transparent, open, secure and respects the privacy of individuals and communities, which means that it is anonymous at all time.
It is known that in Eindhoven a number of IoT / sensor networks in the public space work independently and are used by different parties and stakeholders. However, not everyone is aware of this sensor network and it has become clear that visualization and interaction with IoT in public spaces is a challenge. Especially, now privacy has become on of the main hot topics in the rapid digitizing world, think about The General Data Protection Regulation which is introduced in the EU in May 2018, (local) governments are looking for ways to implement new technologies in a transparent and democratic way. Therefore, as a leading municipality, Eindhoven wants to make it known and clear to everyone where the measuring equipment is located, what is measured and by whom, to ensure the public interest and stimulate innovation with the use of new technologies.

That is exactly where industrial design comes in. This report will show the design and research process during Project 2 Design. Our project gives three solutions to get people informed about the sensor network and to let them interact with their own data. Focusing on systemic change of the digitised everyday, we put industrial design into practice guided by our clients of the municipality of Eindhoven and Stratumseind Living Lab.
Project goal

PROJECT GOAL

As has been introduced, we have to find out what people need to know about sensors in the public space and to explore the best way to make it known. The main goal we want to achieve is to make all involved stakeholders at Stratumseind aware of the sensor network and the possibilities of data technology by help of social responsible design which could be implemented in the current challenging situation.
To reach the main goal our project needs to:

- Research what information stakeholders need, how to address the goal of the sensor network and how to engage with inhabitants and entrepreneurs to make them aware of sensors in public space.

- Implement findings in the city center of Eindhoven, preferably in a form of a working prototype.

- Suggest how different potential stakeholders (government, companies and inhabitants) can be brought together to discuss and to use the sensor equipment and the measurements / data from the public space and to give feedback to the sensor owners and the government.

- Reflect and relate with our clients' needs

- Explore directions the municipality could follow and to finally give advice about the opportunities.

The design could be found in a broad solution perspective including: a physical product, a new interface, an improved service offering, a new marketing message or even a new space feature.

Our concept(s) should localise, question and open up to make visible the invisible.

As industrial design students, we aim to develop ourselves in the following competencies:

USER & SOCIETY
By meeting societal value, stakeholder needs, interactiveness to create a user-centered concept which makes the network open and democratic.

TECHNOLOGY & REALIZATION
By learning the basics of how to work with IoT technology and using code to visualize sensor output to make visible the invisible.

MATH, DATA & COMPUTING
By learning how to work with sensor output (of a new programming language) and adapting it to useful information which can be used in our design prototype.

CREATIVITY & AESTHETICS
By making a house style and brand for the design concept in order to stimulate attractiveness and a clean communication of the concept

PROFESSIONAL SKILLS
By collaborating with a client for the first time and relate to their wants and needs. Furthermore, by integrating scientific research in the project and by presenting and pitching our project in reflection sessions with our coach and/or clients and at the Demo Day to the general public.

PROCESS

1. LITERATURE & CLIENT RESEARCH

The design research started of in the literature. We looked at the current problems the municipality experienced regarding awareness of the sensor network at Stratumseind and searched for approaches regarding use of data elsewhere. Therefore, research was done in the field of privacy laws and regulations in China, the USA and the European Union.
Furthermore, we used provided information of the municipality to understand their position and the position of Living Lab, to understand their wants and needs regarding innovation in IoT and their concerns around the image of being a Big Brother and to understand the position of external stakeholders, like Sorama and City Beacon, in the sensor network.
By positioning and framing this information we created an image of the system dynamics at Stratumseind, which stimulated us to envision and create the pressure cooker. After the first meeting with our clients, which had a delay, we reflected and adapted our concepts again to the new provided information.

2. USER RESEARCH

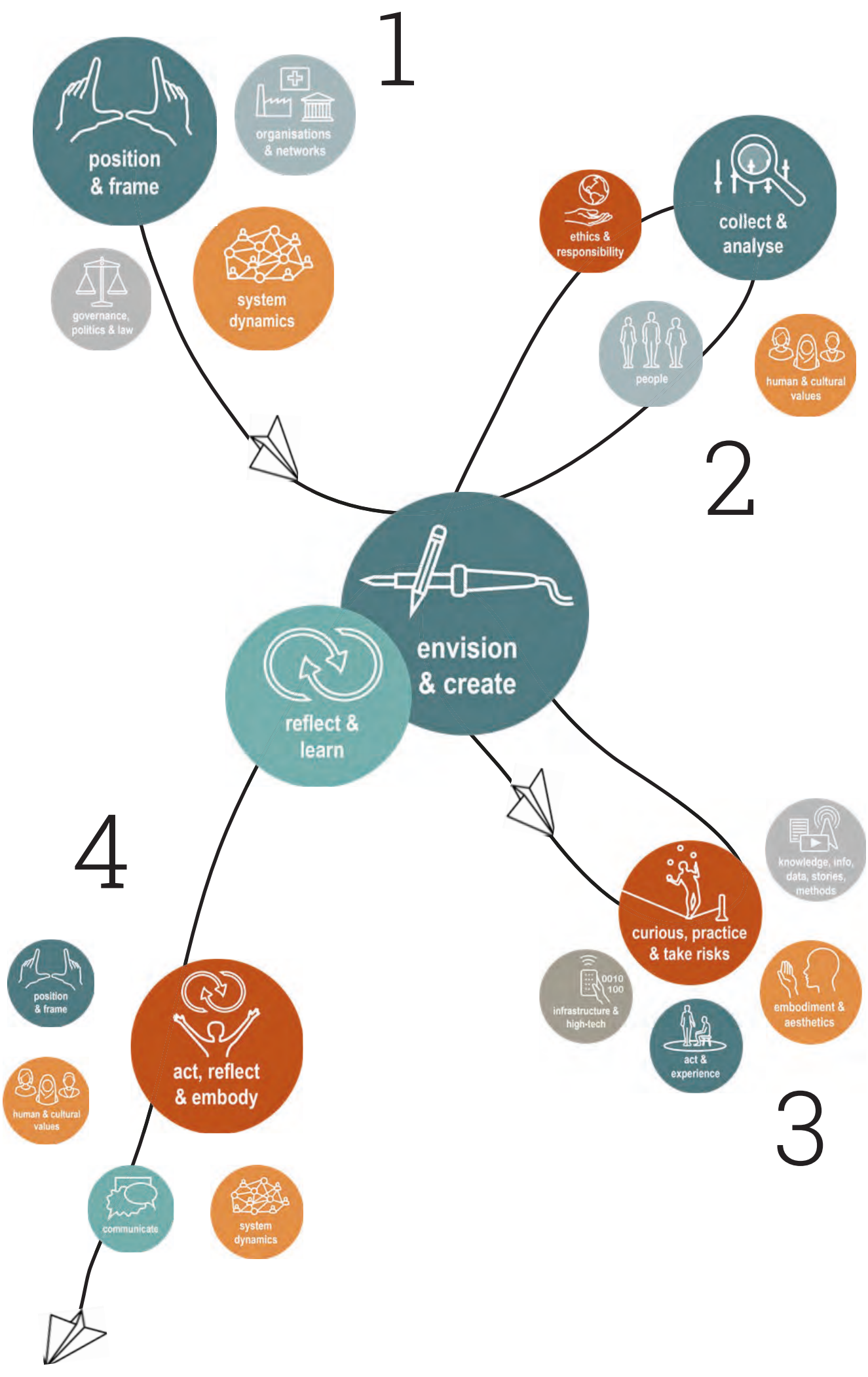
To understand which kind of people are involved in the system dynamics of Stratumseind and to understand their user needs and human and cultural values we collected and analysed user information by as well a quantitative test (online survey) as a qualitative test (interviews on the street). This information got analysed and transformed into personas. With these personas we could design with more responsibility and empathy for the actual user. Besides, it provided us new information to reflect and learn of our former ideas and ideate and conceptualize again.

3. MID-TERM GLOW CONCEPT REALIZATION

By co-reflecting with our coach, fellow students and our clients we choose one concept which could be tested on Glow. By first acting and experiencing our concept ourselves, this 'quick' deadline of Glow pushed us to take a risk and to search for guidance by external parties to use the sensor network infrastructure and to realize a high definition concept for a large audience. That gave us completely new insights in working with the sensor network and it generated ideas about as well weaknesses of the design as strengths of the design to reach our main project goal.

4. FINAL THREE CONCEPTS

Eventually, by reflecting on the Glow concept the municipality gained a lot of insight about a possible opportunity to create data awareness. This transformed into a new demand of questioning what other scenarios are possible. By looking back at source of the problem and by targeting the different potential stakeholders per persona and per attribute individually in using the sensor equipment, we could frame three different concepts which all aim to generate awareness, but all in a different way targeting a different user need. We worked out these concepts and created a solid communication to make our message clear and to highlight the societal relevance of our concepts. Eventually, we set up future implications as advisory material for further research and implementation of the concepts in daily life.


1
position & frame
organisations & networks
governance, politics & law
system dynamics
2
ethics & responsibility
collect & analyse
people
human & cultural values
envision & create
reflect & learn
3
knowledge, info, data, stories, methods
curious, practice & take risks
infrastructure & high-tech
embodiment & aesthetics
act & experience
4
position & frame
act, reflect & embody
human & cultural values
communicate
system dynamics

ITERATION 1

FIRST PERSON SCOPING

INTRODUCTION

What do we think as designers about the IoT sensor network on Stratumseind? What values play a role for us and how can this be used in design? This iteration is about exploring what the design problem is and questioning for ourselves what sort of directions design solutions could take from our own perspective.

GOAL

The goal of this iteration is to gather information and familiarize ourselves with the subject of IoT and the use of sensors in smart cities and to use this information to set a goal for our design to be able to make a first design. With a goal in mind different design options should be explored through our own experience to get a scope of design options, to choose one design option and detail it briefly. This allows for a basis to get the design process started and gauge whether the direction the design is taking is desired.

METHODS

To get a first impression on the subject we researched what could be found on the Internet on the theme IoT in general, sensors placed on Stratumseind and the additional security measures. This was then discussed in the group to get a more complete view on the subject.
Then to get a view of IoT in practice we visited a lecture called IoT and perception: a case study in Andorra by the MIT Media Lab where we learned about the use of IoT in Andorra. Next to this we contacted the Living Lab in Eindhoven to be able to get information on the exact situation of Stratumseind.
To determine the goal for our design we looked at the assignment (appendix 1) that was provided by our client, the , the Municipality of Eindhoven. With this goal in mind we brainstormed for ways to reach this goal through design, then grouping ideas by similarities and finally thinking of an idea for every group. This process with grouping allows us to get an overview and different design directions. Then to choose an idea we looked at which idea would be the most interesting to see on stratumseind with enough leads to data awareness.
In this iteration designing through first person has been chosen to get a grip on the subject and therefore be better able to ask others questions in other to design for them and understand their viewpoints in a later iteration.

RESULTS

LITERATURE RESEARCH

When having been assigned our project we had no inkling of an IoT network being present at Stratumseind and what IoT entails. Therefore we first decided to acquire knowledge on the subject.
From the literature research we learned that our project deals with the living lab in Eindhoven and the sensors it has placed on Stratumseind. Living Labs are locations where innovative solutions can be tested in real life settings. (Lanzing & Van der Sloot, 2017)
Next we learned that there are quite some articles and videos online that are very critical regarding privacy of the data collection by sensors and visitors not being aware of this. According to the data protection law people should be notified of being sensored as this data is used to try to change aggressive behaviour. (Saskia Naafs, The Guardian, 2018)

DECIDING UPON GOAL

The municipality of Eindhoven wants

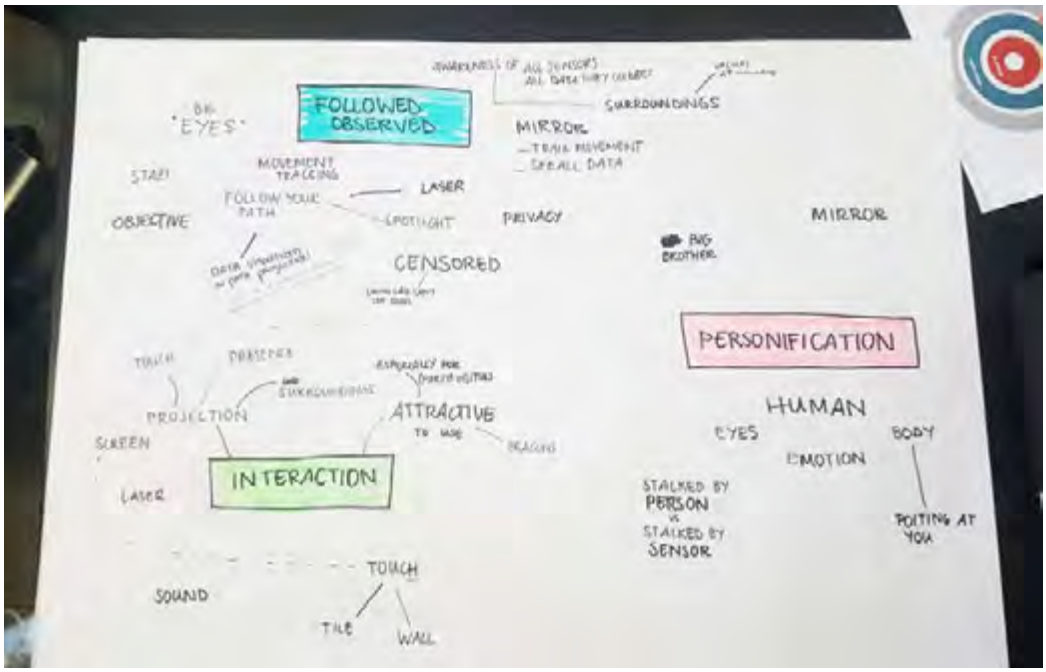
to be more open to its citizens and communicate to them what they are doing at Stratumseind with the living lab. However, when googling 'living lab Eindhoven' it can only be found that you are being measured by sensors and cameras to ensure safety. Very few articles explain what the sensors are and what they do exactly to ensure safety. Therefore in accordance with our assignment and own knowledge of the subject we decided that our goal would be to make the visitor of Stratumseind aware of the monitoring on Stratumseind and to make the collected data public for the visitor.

RESEARCH IN PRACTICE

Next to the literature research we went to a lecture called IoT and perception: a case study in Andorra by the MIT Media Lab where we learned about the use of IoT in Andorra. They made use of sensors in a school and made the children combine those with their emotions. This allowed for interesting conclusions like places in the city that were nice or weren't due to the collection of data through rating places with emotions in an app. Therefore the children were exploring the reality through data. What we mainly gained from this lecture is that it is important to design with meaning, it has to be relevant. It is important to not use IoT just because you can, but it should be there for a reason. Next to this it is important to start from a humane viewpoint when designing with IoT. and therefore take human emotions into consideration.

CONCEPTUALIZATION

After this information acquisition we sat together to brainstorm for design solutions to make Stratumseind visitors aware that they are being monitored and to make the data as a result of this monitoring public, as this is a requirement set by the municipality of Eindhoven. A mind map was made with making collected data public in the center. Themes of ideas that arose were visibility, safety, accessibility through gamification, urban installations and personification. These themes were then converted into three



categories in order to gain an overview. The categories were named followed/observed, interaction and personification. The category followed/observed is about direct awareness of something tracking you, which should lead to awareness of data. Interaction is about being able to play with collected data, so that awareness is created while having fun with your data so it has a purpose for the user directly. Personification is about making the digital based data collecting more humane and therefore more relatable for humans. This category was also inspired by the lecture IoT and perception. For each of these categories we again brainstormed to finally choose an idea that we thought would be the most interesting to see at Stratumseind, while it would also give enough awareness of being sensed by the sensors with data accumulation. The idea that fit this the best was 'follow your path'. We did not spend very long at choosing an idea, as this iteration is meant to be a pressure cooker and therefore a quick process to get this project started.
The concept 'follow your path' is a projector above the street, that projects a tracked path on the ground that a visitor of Stratumseind has walked. This path shows the data footprint of the visitor in terms of tags along the pad, with direct data information that has been collected. This way the visitor has the idea of being followed through the tracked path, while also seeing the actual data that results from walking through Stratumseind. We also thought this idea would be interesting as it is also part of the street's landscape due to the projection on the ground, and therefore not disturbing this landscape as could be the case when placing a physical object on the street. Also this design would reflect the nature of data, as both aren't tangible.

ITERATION 2

FROM BROAD TO NARROW

INTRODUCTION

By doing research and a pressure cooker as first iteration, we had a good foundation for the rest of this project. In this second iteration, we could start off with the actual focussing on the assignment, rather than doing research. After being introduced to our clients and the Living Lab, and having a first meeting with them, the assignment became more clear.
The focus of this second iteration will mostly be on the user. We have done multiple interviews and created a complete picture of the user we're designing for. This iteration will also focus on creating and selecting concepts. With all the gathered knowledge about the user, we are able to criticize the concepts and select the best ones. We will go from broad to specific. This iteration ends with the midterm presentation and our Glow installation.

GOAL

The main goal of this iteration is to choose a final concept that we could present on the midterm Demo day. In order to do this, we had to create an image of the user, which is our second goal. What is their knowledge on the sensor network already? What is their opinion about it and what kind of requirements should a product contain raise awareness amongst visitors? When we have answers to these questions, we can have a better look at the concepts and select the best out of them.

METHODS

So far, we have created a first concept according research and doing a pressure cooker. After having a first meeting with our clients, we got to know what the perspective of the municipality of Eindhoven is in this design case. Their main point is that they do not want to create a big brother is watching you atmosphere, they want to create the opposite and let everyone be able to access this data at all time.

The next step in the process was to do user research on the visitors at Stratumseind. For creating further concepts it was necessary to know what their knowledge and opinion was on the sensor network. We did this by using two methods; a qualitative online survey and a qualitative in-depth street interview. To position all the gathered user data, we categorized the interviews and created four personas.

After we had created a more concrete image of our user, it was time to start ideating and conceptualizing. We looked back at the already created concepts and came up with new ones. We critically reviewed each concept if it would fit with our user group. When only a few concepts were left, we reviewed each one with important requirements, that have been set based on values we have ourselves, and we ended up with a final concept.

In the next meeting with our client we discussed the concept. They were very enthusiastic, but we came to the conclusion that this could unfortunately not be realized for Glow. We discussed the opportunities of Stratumseind, and we had to create a new concept for Glow. After ideating, conceptualizing and a lot of prototyping, a final installation was realized rather quickly.

This iteration ends with the midterm presentation in which we presented our Glow-concept. Since it was an interac-

tive concept, visitors who came to see our stand could experience it. Seeing their reactions and hearing their responses was a great way of feedback, which definitely helped us in the next iteration.

RESULTS

USER RESEARCH

The first part of the research was sending an online survey, with quite superficial and quantitative questions to people in our surroundings. The purpose of this survey was to quickly find out how much people knew about the sensors. (appendix 4) From this we could conclude that only 36% knows of the presence of the sensors and that most people don't feel negative about it.

The second method was interviewing people on the street. (appendix 6, 7) This was a way more in-depth interview compared to the first one, and essential to our research. We created questions with the vision of the municipality in mind. The questions were more based on their opinion about the sensors and discussing if they feel like there is any use in it for them, and also what the role of the municipality should be in this sensor network awareness. We interviewed a very broad representation of

visitors, like young party visitors and elderly who are just passing through, foreign tourists and work related visitors. (appendix 8)

USER POSITIONING

The following step, after having done the user research, is to position the user and create personas. (appendix 9) We categorized the interviews and dug through them to see patterns. We looked with the qualitative research for the average visitor, and we ended up creating four personas. While there is, on average, a bigger amount of party-people on Stratumseind, we gave value to day-people as much as night visitors.

In each persona we discuss topics that are relevant and valuable for our

subject. The reason for visiting Stratumseind was described, as well as the technology knowledge, opinion about privacy and data awareness.

A small description of personas; Elizabeth, an elder woman that was walking through Stratumseind, she does not have an opinion about the sensors as long as it is used to create safety in the neighborhood. Lucas visits Stratumseind because his job is located near it, and he takes a walk through it frequently. He has very little knowledge about technology and does not seem to care about the sensors. Herman is a tourist visiting Eindhoven. With his job as an architect and designing public spaces, he thinks that privacy is very important, which is why he doubts if the sensors are a good thing. Britt is a young lady, that visits Stratumseind often to party. When she is going out, she isn't really thinking about the subject and doesn't pay attention to the sensors.

CONCEPTUALIZATION; LOOK AT EARLIER CONCEPTS

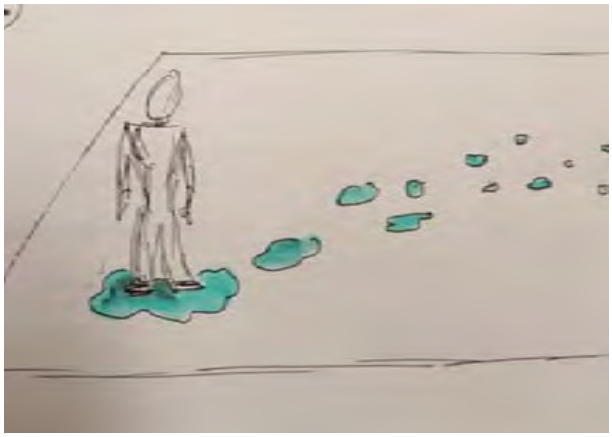
After we had created a more concrete image of our user, it was time to start ideating and conceptualizing. We looked back at the 17 concepts that were created in the first iteration. With the gathered user information, we also thought of new concepts. For each concept was discussed whether this would fit the personas or not, and if it would be a concept that we wanted to continue working on. Out of 17 concepts we saw potential in four specifically.
The Augmented reality frame, a frame placed on Stratumseind through which a visitor could see where sensors are located. The pressure cooker idea Follow your path in which the visitor would see a path of where they had walked.
An Installation that would immediately hit the eye, and would adapt itself to someone's behavior. The last potential concept was a Projected circle that would follow the visitor when walking down the street.

CONCEPTUALIZATION; NARROWING DOWN

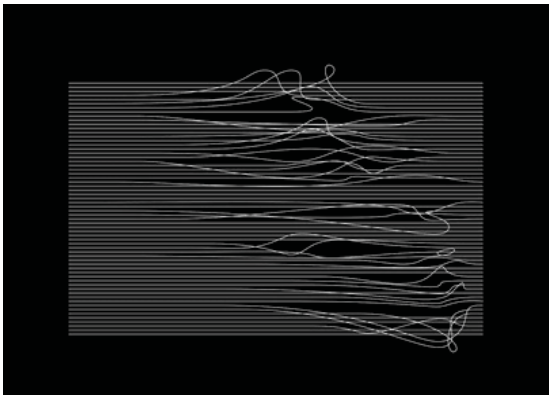
In the next meeting with our client and project coach, we proposed the four concepts and asked for their opinion and feedback. The main feedback was: make sure that you trigger people and engage with them, make sure that people interact with the system, take pictures with it and continue the discussion online.

The next step was to decide on a final concept, and this was done using a point system for important requirements. (appendix 10) These were awareness, engagement/trigger, safety, interactivity, practicality, informative and experience. The concept with the most points was the blob/drops concept. (appendix 11)

In this concept, a big projector will be placed above Stratumseind, which will be able to project down on the street. Everywhere the visitor goes, a blob projection will follow. Also tiny parts



of that blob will illustrate that parts are 'taken away from you', symbolizing data. Everyone that steps within the range of the projector will be detected and automatically participates. We chose this because it is very in your face, however it is not scary or creates a big brother is watching you vibe.



DESIGNING FOR GLOW

While this final concept was chosen, the practical opportunities for the Glow installation were discussed. The conclusion was that it was not going to be possible to place a projection above the street. A big installation with pillars

would be required for that, which was not possible within the small amount of time and budget. Also, the street would be crowded with Glow visitors, which makes it hard for the camera to detect individual persons and to project on the ground.
The client advised us to make use of 't Oude Lempke' which was an empty building on which we could project.

An ideation was done again for wall concepts, from which we chose to visualize the sound people made. (appendix 12, 13) We decided to create a 3D-data-landscape, called Wavescape. Each time a visitor walks by and makes a noise, this will be noticed by the sensor, which will display this on the projection. Also a text 'The street is listening' will appear, to let people think about it and start the discussion. (appendix 16)

INSTALLING FOR GLOW

There was a lot of work to be done, to actually realize the installation. We looked at the practicalities, such as where to get a big projector? From what place could we project? And also software issues like how could we connect the code to the sound sensor? We set up a plan of preparation including a list of contact which we needed in order to get technical support for the code and installation.

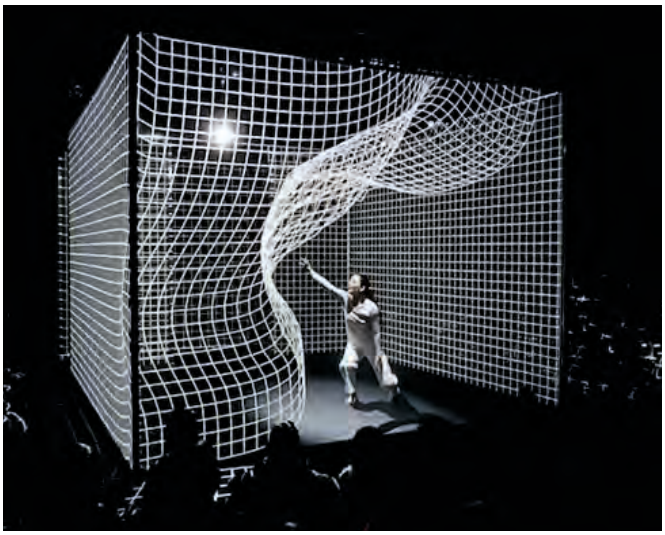
There was not much time so we worked hard to get everything arranged. Luckily, we did manage to create a code that worked. It still had a lot of bugs in it due to the big memory of the background processes of the API and the teamviewer application which was needed for access to the desktop of Living Lab. However, it functioned! (appendix 14)

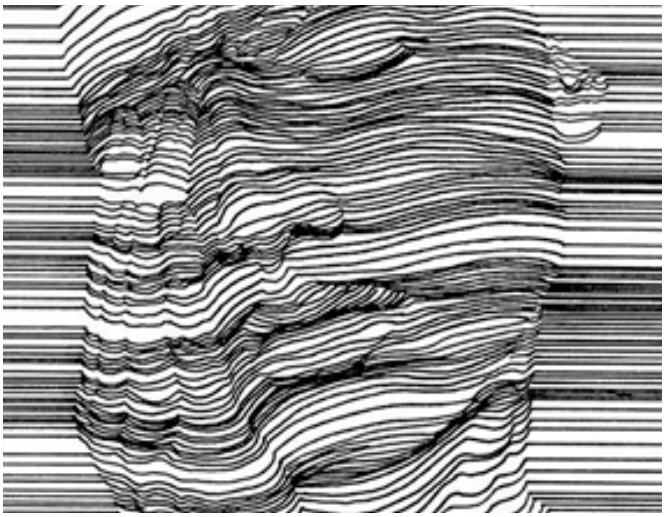
We were able to present our project on Glow, but not is the best condition. The code bugged and we had to restart it every few minutes, we were only able to project on the first floor instead of the ground floor and there was a lot of struggling with the equipment. Nevertheless, we did manage to show of

our projection! We learned that, even though we already prepared very well, more preparation was required. However, this was hard within the small amount of time we had.

MIDTERM PRESENTATION

We decided to show off our Glow concept during the midterm Demo day. (appendix 16, 17) A microphone and projector were connected to a laptop. We projected on the wall and people could experience it themselves. We received great feedback.We also created a process poster. (appendix 15)





ITERATION 3

FROM NARROW TO BROAD

INTRODUCTION

From specific to broad again. From this moment on, the focus was on revising and reflecting and integrating feedback of our Glow concept, both from our coaches as our clients, to lead our design project to a final stadium. We already showed that we could work out a reactive projection on a large scale, but how can we look back at the beginning and source of the problem and focus on targeting the different potential stakeholders which need to be brought together to discuss and to use the sensor equipment? What would be the main opportunities for the municipality to inform and create awareness underneath visitors? Is there just one scenario? The following iteration focusses on scoping, positioning and framing the different scenarios to envision and create concepts which focus on different persona's to specify possible directions the municipality of Eindhoven could go into.

GOAL

The goal of this iteration is to create three different directions with three different design concepts based on differences of stakeholders (e.g. personas), communication and experience techniques and practical and financial matters.

These three directions and corresponding concepts, with their pro's and con's, aim to envision and advise future interventions which the municipality can take to make the stakeholders aware of the sensor network.

METHODS

Reflect on midterm Glow project
In the first phase of this iteration we reflected on our mid-term design by taking into account feedback from our coaches and fellow students at the midterm Demo Day. Furthermore, we showed our mid-term results to our clients and also took their feedback into account. In general, the feedback was very positive and the projection was very triggering. For example, people wanted to have pictures, while they were standing in the projection, to post these on social media. (appendix 18) foto Lynne & Ayu) Points for improvement were also retrieved and reflected (appendix 18). The main three insights were the following:

- The threshold for interaction was to high

- It was not very personal

- The focus is too much on technology

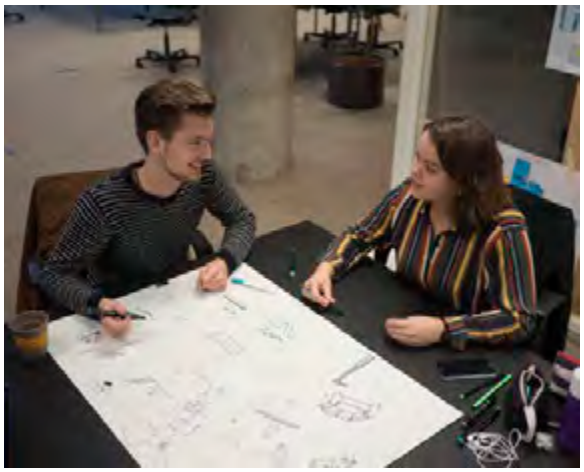
However, the municipality was very content about the execution of Wavescape and proposed to not invest more time in optimizing Wavescape, but prefered to scope the project bigger again to look at different directions they could follow based on differences of stakeholders (e.g. personas), exposure, setting (big event vs. everydaylife) and practical and financial matters. From here on the decision was made to develop potential conceptual directions with corresponding concept designs all highlighting different aspects of our project goal, instead of optimizing one design to high definition. Eventually, we set up a plan to work out three scenarios in a conceptual way aiming to envision and advise future interventions which the municipality could take to make the stakeholders aware of the sensor network.

SCOPING AND IDEATION

In the second phase of this iteration we looked back at our main project goal and at how to scope the design challenge. Therefore, we broadened the solution space again. Who are our stakeholders and how can we influence them? The solution could be a physical product, a new interface, an improved service offering, a new marketing message or even a new space feature. While all organizations and projects have constraints that dictate viable forms of solutions, err on the side of inviting varied solution possibilities. Considering that the assumed form of solution may not be the only or best one to achieve our goal. (Hasso Plattner Institute of Design at Stanford, 2016)

During the coach meeting with Caroline Hummels we got the feedback to ideate in three different directions, rather than solely for the personas. The directions that we defined were:

1) Visualization (reactive) -- Output of what is measured
2) Interactive -- Makes people play with and own their data
3) Informative -- Informs people more directly about the sensors on Stratumseind



The output of the ideation can be found in appendix 19.

DESIGN DECISION ANALYSIS

After the scoping and ideating phase, we went on analysing the concept directions using the three attributes: visualization, interaction and information. These attributes were chosen because of their importance in triggering people and their contribution to the main goal of creating awareness. We rated the attributes on the following:

VISUALIZATION:

- aesthetics
- data output communication

INTERACTION (Kiousis, 2002):

- complexity of choice available;
- effort that users must exert;
- responsiveness to the user
ease of adding information;
- facilitation of interpersonal communication

INFORMATION:

- extent of providing information
- stimulation of discussion
- pre-knowledge needed (taking into account all personas)

POSITIONING AND FRAMING CONCEPTS IN SOCIETAL AND USER CONTEXT

Using the results of the design decision analysis together with the wants and needs of our personas, we set up three directions based on the three main attributes. In these directions, we created concepts which are adapted to specific persona needs:

WAVESCAPE
Target group | General public (light art)
Exposure | Very big, but superficial
IoT awareness/informative | Intermediate
Event setting | GLOW (big events)

BLOB
Target group | All
Exposure | Big
IoT awareness/informative | Big (but superficial)
Event setting | GLOW (big events)

CITY BEACON EYE (interface application)
Target group | Socially engaged people
Exposure | Small-medium
IoT awareness/informative | Big
Event setting | Daily (permanent)

For each direction and corresponding concepts, we positioned and framed them in the societal context. In this way, we also took into account the exposure rate and practical and financial matters of each concept, such as the purchase of new materials, which can be important for the municipality to make decisions. (appendix 20)

ENVISION, SKETCH AND REALISE DESIGN PROTOTYPES

To act, reflect and embody the three concepts, we sketched them and realized them
using a microphone and processing for Wavescape, a Wizard of Oz-technique and processing for Blob and a mockup application for the City Beacon Eye.
For video material, we even tested the latest variant of Wavescape on Stratumseind again. (appendix 21)

PRESENTING AND COMMUNICATING CONCEPTS IN AN ATTRACTIVE MANNER

To present all three concepts in an attractive, clear and one-sided way we developed our own branding. (appendix 23) This was done to make the experience visible of invisible data and artificial intelligence, besides it shows the consistency of the goal of the three concepts despite their difference. We also brought this back in the design of the stand of the final Demo Day in which we made a square 'pillar of innovation' which showed the different concepts from different perspectives, but all leading to the same goal.
To communicate our concepts well, regarding the overview of differences and the implementation of each design in the city centre of Eindhoven, a video in which all three concepts are shown implemented in the environment in which it could be used by the municipality in the future. The storyboards can be found in appendix 24 and the video can be watched via the following link: https://youtu.be/S-mIZxe-gjU

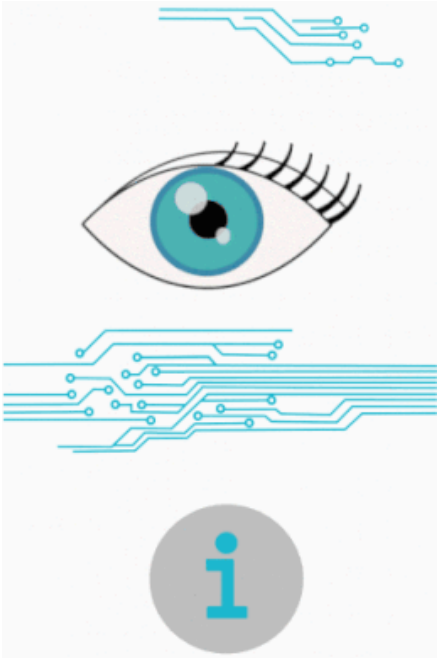
RESULTS

WAVESCAPE

BLOB

CITYBEACON EYE

(full app interace in appendix 25)



OVERALL RESULTS

In the end our process led us to the development of three concepts that aim at sensor awareness each in a different way. For each concept a prototype was made, and presented alongside a box made of four posters and a video on the demo day. On the front side of the box the project was explained including the video and on the remaining sides each concept was shown with their corresponding prototype.

WAVESCAPE

Wavescape shows a dynamic data landscape which represents each coordinate of sound intensity on a specific area at Stratumseind. The big projection covers a full facade and questions if the street is listening.

BLOB

Blob is an interactive projection which tracks movement and follows people who are passing by. Meanwhile, the ground under your feet is lighting up, bubbles are leading your attention to an information sign which explains the sensor network and his modalities at Stratumseind.

CITYBEACON EYE

The Citybeacon Eye is an infographic application which gives you the opportunity to explore the locations and usages of the sensor network at Stratumseind while using the interface of a Citybeacon. An eye follows you while walking on the street to grab your attention.

Pictures of the box set up with prototypes and posters can be found in appendix 26.

FUTURE IMPLICATIONS

This project has been executed with the municipality of Eindhoven. The municipality will actually want to realise something that can make Stratumseind visitors aware that they're being monitored. Before our project the municipality tried to make people aware with a sign, but very few people looked at it. To aid in creating awareness we recommend which of our concepts to use for what kind of purpose.

PEOPLE'S FAVOURITE

Out of a questionnaire (appendix 27) filled in by 27 people on the demo day, 66,7% said that their favourite concept is Blob. They liked how it was instantly grabbing their attention and immediately reacted to their movements. To make sure Blob is really the most favorited concept, more research would be needed. However if the municipality wants what users would like best, from the results of our questionnaire Blob is the best choice.

CHEAPEST TO REALIZE

When considering a budget, the cheapest concept to realize is Citybeacon Eye. The CItybeacons of which the screens are needed are already at Stratumseind, so the only thing that should be developed is the application. For the other concepts projectors and an installation on which the projector would be attached are needed

PREFERENCE OF EXPERIENCE OVER THEORY

In our society there are lots of external stimuli, if something is not interesting enough people will simply regard their attention elsewhere. For some people experiencing something will grab their attention more and understand more than when reading about something. Wavescape and Blob are both experienceable concepts. The user directly experiences what the sensors do: measure sound level for Wavescape and track your movements for Blob. From our interviews on Stratumseind we gleaned that a large group doesn't like to see direct data, which is direct information. Having something that's an experience rather than direct information could therefore satisfy this group of people.

GET THE MESSAGE

To make sure people understand what is presented to them, it is best to show information more directly as is the case with Citybeacon Eye. The other concepts are more vague in that sense and not all will understand the message they send. Blob does however also have an information sign, but it may not be clear for every person that the blobs lead them to the sign. Citybeacon Eye also has the eye animation at the start to attract attention, and the sensor information contains images and icons to make it more visually attractive for those that do not like to read.

All in all, all concepts have pros and cons. Concepts could also be combined to more fully satisfy the municipality's wishes.

CONCLUSIONS

At the start of this project we imagined a broad range of possible solutions to the problem of visitors of Stratumseind being unaware of data collection by sensors. However, we ended up with three solutions instead of one. Due to the municipality of Eindhoven wanting to see multiple directions they could head in we created three different concepts on different levels of information transmission. Having designed three concepts allowed us to look through different perspectives and therefore to broaden our view. This led to designs we otherwise wouldn't have considered and learning of what our users and client want, and not just what we as designers want. Our project is now a full decision range for the municipality, and has set a direction for them to head in.

Our main project goal was to to make all involved stakeholders at Stratumseind aware of the sensor network. We succeeded in creating three options for awareness for different types of people in terms of how they like to receive information. However, we didn't succeed at involving all stakeholders. Also entrepreneurs and bar owners have a vested interest in what happens at Stratumseind. We did not involve these stakeholders, which makes for a not fully completed goal. Nonetheless not involving them made for a more effective and simple design, as business interests are very different from those of users.

To make sure that the three solutions actually create more awareness, more research would be needed by placing the prototypes on Stratumseind for a longer period of time. Then observing and interviewing users would determine if they have actually become aware of the sensor network and what this means for the user.

To reach our main goal we had set the following subgoals:

research what information stakeholders need, how to address the goal of the sensor network and how to engage with inhabitants and entrepreneurs to make them aware of sensors in public space.

We have researched stakeholder needs through street interviews and creating personas based on them. Through these needs we learned how to address the sensor network and make the inhabitants aware. Entrepreneurs were omitted due to conflicting interests.

implement findings in the city center of Eindhoven, preferably in a form of a working prototype.

We have created three prototypes according to the wishes of Stratumseind visitors and the municipality. The prototypes would need some work to be fully operational, but do show what they should do.

suggest how different potential stakeholders (government, companies and inhabitants) can be brought together to discuss and to use the sensor equipment and the measurements / data from the public space and to give feedback to the sensor owners and the government.

Our current prototypes don't contain any feedback mechanism. What we counted on is that newspapers and visitors will post online about one of our ideas. This would then create an online discussion.

reflect and relate with our clients' needs

Through our bi-weekly meeting with our client we were informed with their needs and got feedback on whether our progress fit with their vision. Then during our process we reflected whether what the client wanted would also satisfy the goal and the needs of Stratumseind visitors.

explore directions the municipality could follow and to finally give advise about the opportunities.

Having produced three concepts adjusted to different groups of Stratumseind visitor, we were able to give the municipality advise on what direction to take for various purposes.

As designers we are expected to develop ourselves within five concepts. Within this projects we have made the following progress:

USER & SOCIETY
is been addressed in the research into societal value, stakeholder needs and UI/UX to create a design concept which makes the sensor network open and democratic.

TECHNOLOGY & REALIZATION
is been addressed in the realization of the concepts on Glow and the final Demo Day including assembling, programming (API access, data visualization) and projecting in collaboration with external parties like Sorama for technical guidance.

MATH, DATA & COMPUTING
is been addressed in using and adapting the sensor output of the IoT network on Stratumseind into a code for data visualization.

CREATIVITY & AESTHETICS
is been addressed in the visualization of the data and the branding communication of our concepts to the stakeholders.

PROFESSIONAL SKILLS
is been addressed in co-reflecting and collaborating with the client, working together with external parties for technical help and support and the communication concerning our concept branding.

All in all, we believe we have designed a strong set of options for the municipality to explore while having learned lots of new things about the design process. To fully complete this project a research is proposed in whether our prototypes could truly create awareness.

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REFLECTION NOA VAN DEN BRINK

Starting this project I felt like I had to prove my ability to do a design project as I barely passed project 1. Having made mistakes in planning and communication I wanted to make sure that this project I wouldn't make the same mistake twice. Therefore to get the basis right we documented every week in turns, so that when it would come to the report it would make the process a lot easier. Also clear schedules and deadlines were made in order to avoid confusion. This has helped me learn that keeping track of your process is essential to make a project succeed. To take this a step further I would like to keep track of my own personal progress next project as well.

Next to these administrative tasks, I also wanted to improve in the User & Society competency. Last project I got to do user tests, but no personal contact was had with the user before having a product. This project I wanted to be able to involve users more and translate their needs into a design. I got to do this through performing street interviews and then taking the surfaced demands into account when designing.

Another thing I have learned during this project is how actually implementing a design works. For Glow we worked hard on realizing our concept Wavescape by programming. As a group we were so focused on getting the program to work, that we didn't reflect on what impact it may when we actually got it placed on Stratumseind. This was however a learning point as I got to reflect on what went wrong and how this could be prevented in a following design. Fully trying to realize this concept has also helped me improve my Technology & Realization skills as I hadn't programmed a 3D output before. Next I learned that arranging and planning is a very important aspect of implementing a design. Not having planned beforehand where our projector should be caused the projection not to be at the place I would have wanted it to be. Arranging was needed in order to get necessary things like power to work.
Having done a full concept realization and a short pressure cooker, I learned how the design process works from quick conceptualization to actual concept realization. However, during this process I arrived at a final idea, without small prototypes to verify the core of the idea. For a next project it could help to create smaller prototypes first instead of fully realizing something as the main idea could also be verified with a smaller prototype. Although a fully realized prototype gets more detailed feedback, some basic problems could have already been solved through testing with a quicker prototype.

In the competency Business & Entrepreneurship, I learned how to deal with a client in the design process. Presenting our process to them has helped me get an insight on what a client may want to see, and how that's different from what a coach would like to see. Next I gained the skill of listening to feedback of a client, and reflecting on what of the feedback should be implemented in the design so to keep a balance of opinions from other stakeholders and therefore also be an advisor to our client in turn.

What I mainly contributed in this project is being a creative force in the ideation process due to coming up with lots of different ideas. I could come up with both realistic ideas, and very out of the box ideas that could then lead to more implementable ideas while keeping results from user research in mind. Also realization wise I have done quite some technology realization by programming and through that I was also partly responsible for the aesthetics as the programming produced a visual output.

REFLECTION

TEUN VAN ACKER

WHAT HAVE I LEARNED?

While I expected to be fully drained by IoT-technology with the user as side-object, this project showed me the opposite by highlighting user and society as driver of change. Although, I learned a lot about data technology and tough programming during this project, I mainly learned how to use this in an efficient way not being afraid asking for technical support. This project was my first project which didn't focus particularly on product design, but on design in all her varieties to reach a systemic change in which transformation is key and user and society are deeply involved.
During the design process I made some big steps in approaching concept development. Especially because due to the collaboration with the municipality, I for the first time in my studies designed in a real-life situation with the wants and needs of a client. Besides this brings a lot of responsibility, it also gave me the opportunity to develop the professional skill of relating, collaborating and co-reflecting with an external party in a design project. Working together with a client learned me to integrate specific needs and to look from another, more business-like, perspective to design.
This was very an interesting and valuable experience to me as it confirmed my future ambitions. Because I want to specialize in design management / design strategy with a focus on future and business thinking.
The societal relevance of this project, gave me the opportunity to develop the competency of User & Society on a next level. By for example doing interviews on the street and interfering on a hot topic, showing confronting pictures of the possibilities of sensor technology, you really triggered people to think about their ethics and values around technology. Something which is in my opinion a major breakthrough, since user research I did in beforehand retrieved more superficial information.
Of course not everything went completely well, like for example the execution of the Glow installation which could have been planned better. Though a design process sometimes has to go in different directions, and failure has a lot of value to reach success.

WHAT WAS MY ROLE IN THE TEAM AND HOW DID I CONTRIBUTE?

First of all, I'm really proud of our team. Because we were with three people, we all worked hard and all contributed to all major tasks. We already knew each other a little bit, so the team vibe was great. We divided tasks well and even started with giving each other team 'roles' (timekeeper, chairman and secretary) to keep the meetings as efficient as possible.
Regarding my role: I'm a protagonist, so I sometimes had a strong opinion and vision and wanted to take the lead when pitching and strategizing, but I always listened to the ideas and opinions of the others. Not only because I'm convinced that enriched the teamwork and creativity, but it also pushed me to do concessions with my perfectionism.
Eventually, I've developed myself in almost all competencies within this project, but especially on user and society, business and entrepreneurship and technology and realization. This all-round character can be found back in my professional identity.

So in conclusion this project gave me the opportunity to work with a client and to develop myself in design strategy for a digitized future in which human values take center stage.

REFLECTION RENATE VOSS

I learned from Project 1 that having a good documentation is very important to have. We decided in the beginning that each week, we should write a paragraph documentation. I kept track of this and made sure that everyone documented their assigned week.
It was very new to me to work with a client. Working with them was a constant reflective process. Creating ideas and concepts, discussing them with our clients and implement their feedback in order to improve. It was a great experience working with them, also because they seemed very satisfied with our performance.
Creating a product without the need of getting profit out of it was new to me. We did not have to take into account that the product would be attractive to buy.

This project was mainly USER & SOCIETY oriented, since creating awareness amongst users was our leading goal. Every decision that we made was based on how a user would respond to that, and what consequences to their behavior would be. I learned a lot by investigating the user. Trying to see patterns, categorizing characteristics and digging through interviews gave me a next level insight onto the user. This was useful during the whole process since we kept on referring to our personae.
While this project was not focused on BUSINESS & ENTREPRENEURSHIP, it still feel like I have learned a lot. It was for once good to not focus on a product in a commercial way. This was the opposite with project 1, which made this project innovative. It gave me the opportunity to look at a different side of design, social design.
Throughout our project, the competency TECHNOLOGY & REALIZATION was worked on often. To realize the Glow installation, get all the materials together and contact people to arrange everything. As well as for the Demo day, since our presentation required a lot of technology. I created a big part of the Blob-code from which I learned new insights regarding processing, and I made the visualization which represented the third concept.
Heading to the second half of our project, we knew that we were not going to have a physical product. We had to present our concepts through visualizations like video's, posters and apps. To make sure everything looked good and consistent, I created a branding (appendix) which focusses on CREATIVITY & AESTHETICS. We kept on using this through all our created visuals, this made it feel organized and structured atmosphere, even though we had three different concepts.
My role within the project was making sure that everyone kept making their assigned documentation of each week. During meetings I did a lot of visualization like sketching, mind mapping, but also creating posters and images.
Regarding group work, I am very satisfied with the group I had to work with. It was clear from the beginning that all of us were on the same level and very motivated to work on the project. There were not many discussions, however, when someone had something on their mind we could easily talk about this. Because of this good atmosphere, some meetings could have had more productivity. Towards the end, we noticed this and we tried to adjust ourselves to have more concentration. We had multiple week meetings and outside of that there was good communication.
I learned that it is very important to have good visual material when presenting. When all material looks organized, consistent and clear, people are more eager to listen to your presentation. Also, during the final Demo day, I learned that you can make your stand look attractive when you implement interaction and products that visitors can experience themselves.

Main skills that I have improved are visual designing, sketching, programming and doing user research.
Improvements for next time would be to, among keeping track of things that we do in a group, to also keep track of my own developments. If I do this and I think more about my personal development, I might find out more what kind of designer I want to become

APPENDIX

1. ASSIGNMENT OF THE MUNICIPALITY

EINDHOVEN

Municipality of Eindhoven	
Assignment	: To research the **needs and design solutions for interaction with Internet of Things (IoT sensors) in the city centre of Eindhoven**
Organization	: *[TU/e]*
Program	: Smart Society
Sector	: Strategy
Supervisors	: Guus Sluijter and Olha Bondarenko
Introduction	Do you want to conduct a design research at the lively dynamic city centre of Eindhoven? Learn more about Eindhoven and its residents, the Smart Society program and interesting projects about the use and impact of new technologies in public space? Please read our assignment below and get in touch! For more information or questions contact Olha Bondarenko (o.bondarenko@eindhoven.nl).
General information about Smart Society	Smart people living in an intelligent community 'Smart Society' is all about quality of life in the city. Individuals, companies and research institutions work together using innovative technologies to solve issues in their daily lives as well as major social issues in a smart way. In this process, new technologies are often used in public space, often based on gathering and analyzing people's data. As a local government, we need to ensure that use of technology and data in public space is visible, transparent, open, secure and respects privacy of individuals and communities. The processes and the results of data collection in public space should be easy to understand and to make use of for everybody: citizens, entrepreneurs, companies, academic and governmental organisations. Municipality of Eindhoven together with Amsterdam and other cities in the Netherlands work to bring people in control of digital public space just like they are in physical city.
General information about the assignment	To fulfil this role, the municipality of Eindhoven started - in cooperation with the Cadaster (National Real Estate Registry) - a pilot project to create a register for the fixed sensors in the public space, beginning at and around Strijpsweid area in Eindhoven. Strijpsweid is not only a famous area to go out for a beer on Friday night but also a well-known living laboratory for IoT and data solutions in the domain of public safety. Various partners cooperate on breal-through research topics, such as predictive policing or using smart lighting to de-escalate aggression. Although all projects are carefully evaluated for their impact on privacy, creating and making public a register of measuring equipment on the street contributes to ensuring transparency and stimulating cooperation around the digitalization of the public space. The sensor registry pilot at Strijpsweid is completed in June 2018 and produced the following results: ▪ A viewer and a register model based on a compiled metadata model; ▪ Visualization (www.sensorpilot.nl) of the viewer and the register model; ▪ Advisory report with conclusions and advice for a follow-up. As a next step, municipality of Eindhoven considers to extend this pilot to other areas of the city. It is known that in Eindhoven a number of IoT / sensor networks in the public space work independently and are used by different parties. However, during the pilot project it has become clear that visualization and interaction with IoT in public spaces is a challenge. As a municipality, we want to make it known and clear to everyone where the measuring equipment is located, what is measured and by whom, to ensure the public interest and stimulate innovation with the use of new technologies. Therefore our research question: what do people need to know about sensors in public space and what is the best way to make it known?

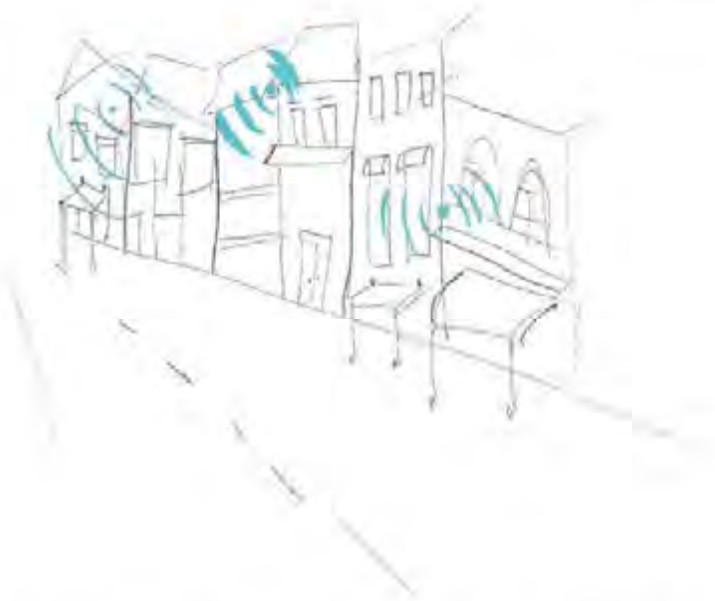
Goal of the assignment	General questions: how do you make the IoT and the sensor register known and interactive on a local scale? How do we engage with inhabitants and entrepreneurs to make them aware of sensors in public space and let them to use the best of it? To answer this question, we would like you to: ▪ Research the needs of different stakeholders (described below) with regard to the sensor register, IoT equipment and measurements in the public space of Eindhoven (beginning at Stratumseind). ▪ Figure out what the best way would be to make the inhabitants and visitors aware of the sensor equipment and measurements in the public space. What information do people need? How can they interact with it? Can people control the measurements in their environment and in what circumstances are they willing and able to do so? ▪ Implement your findings in the city center of Eindhoven, preferably in a form of a working prototype. ▪ Suggest how different potential stakeholders (government, companies and inhabitants) can be brought together to discuss and to use the sensor equipment and the measurements / data from the public space and to give feedback to the sensor owners and the government.
Specifics	▪ The stakeholder groups: inhabitants and visitors within the city centre (Stratumseind), relevant entrepreneurs, employees of the municipality of Eindhoven that work with the public space of Eindhoven. ▪ Make a schedule of activities and an action plan based on our input and conservations with your supervisors and other stakeholders. ▪ Define research approach, scope, methodology, time frame and results (in consultation with the supervisors). ▪ Provide feedback on a regular basis about the progress, and if necessary, report the changes that can influence decisions about the process or content of the assignment.
Results	▪ Report the findings on user needs in different stakeholder groups according to the goals of the assignment. ▪ Create design concepts or prototypes that make the sensor register interactive and known to the stakeholder groups (different equipment can be made available for testing purposes, for example, the Citybeacon on Stratumseind). ▪ Report with research results corresponding to the goals mentioned above and a description of the conducted research, including a follow up advice.
Time	▪ The project has to start before the end of 2018 ▪ The project can be scoped / split to incorporate a group assignment with different (sub)goals

2. CONCEPTS PROPOSED MUNICIPALITY

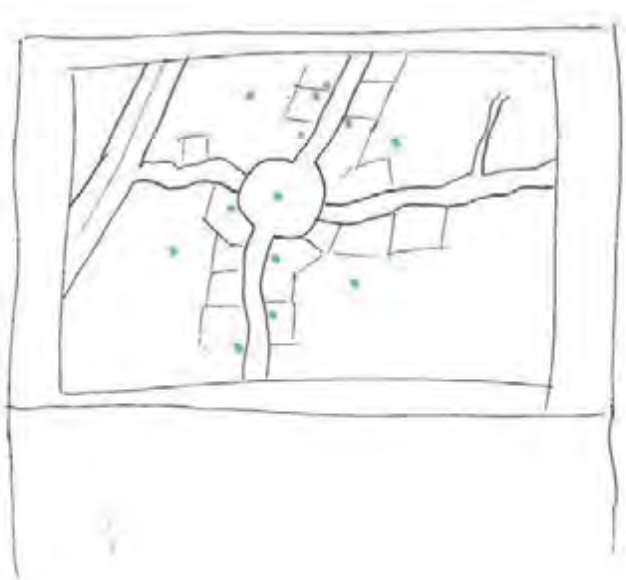
CONCEPT 1

Doel: Maak de aanwezigheid van de sensor zichtbaar

Concept: De sensoren zijn niet altijd direct zichtbaar, de camera's soms wel maar de geluidsdetectors niet. Maak de sensoren zichtbaar met licht/visuele effecten.



Dit concept kan gecombineerd worden met een sensor-plattegrond. Maak een sensor plattegrond van Stratumseind en weergeef deze op een scherm. Zodra je een sensor aanraakt geeft deze licht en kan je de informatie er van zien.



CONCEPT 2

Doel: De gebruiker ervan bewust maken dat er *op dit moment* gegevens worden gedetecteerd.

Concept: Er staat een scherm op Stratumseind, verbonden met een camera. Hierin wordt precies weergeven wat je ziet (als er iemand langs op loopt, zie je diegene meteen). Op het scherm wordt met licht duidelijk gemaakt waar de sensoren zitten. Een soort VR ervaring, maar dan toegankelijk voor iedereen, en er is geen telefoon nodig). Er zou een interactief element in gemaakt kunnen worden zoals, zodra je de sensor aanraakt gaat het licht aan/uit of veranderd de kleur.

CONCEPT 3

Doel: Laat de gebruiker zien hoe hij/zij wordt geregistreerd en hoe snel er data verzameld wordt.

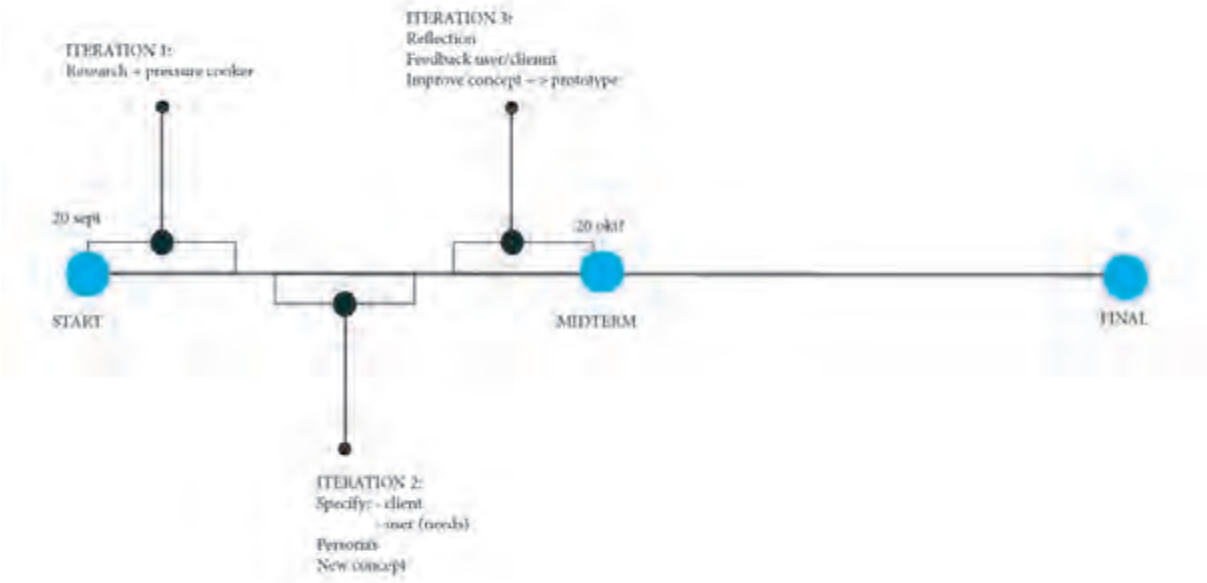
Concept: Door middel van een projector wordt het pad dat een gebruiker loopt weergeven. Zo krijg de gebruiker een gevoel dat hij/zij achtervolgd wordt en is het zichtbaar dat elke stap wordt geregistreerd. Ook, wanneer er op dat moment data beschikbaar is over de gebruiker, wordt dit weergeven en 'toegevoegd' aan het pad.

CONCEPT 4

Doel: In het groot de data op een visuele manier laten zien.

Concept: Grafiek projecteren door de straat. Interactief maken door het op de City Beacon bewerkbaar te maken / dat je een bepaalde lijn gegevens kunt selecteren.

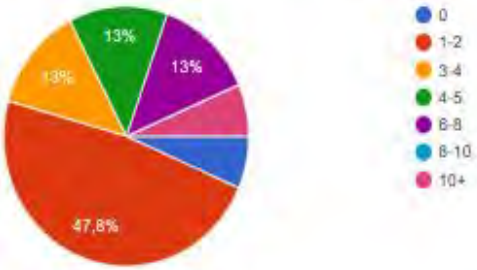
3. PLANNING BEFORE MIDTERM



4. ONLINE SURVEY

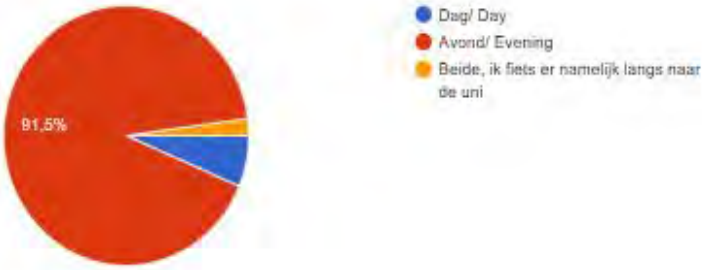
Hoe vaak bezoek je Stratumseind ongeveer in een maand?/ How often do you visit Stratumseind in a month?

46 reacties



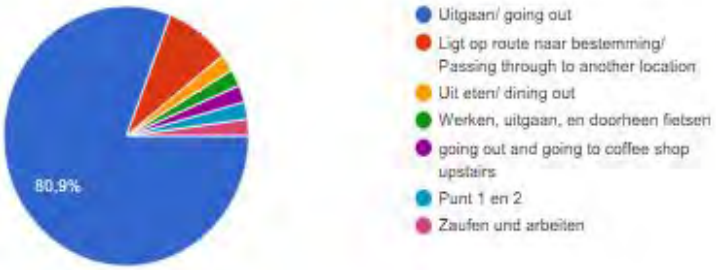
Bezoek je Stratumseind vooral overdag of in de avond? / Do you visit Stratumseind mostly during the day or in the evening?

47 reacties



Wat is de reden voor je bezoek aan Stratumseind/ What is the reason for your visit to Stratumsiend?

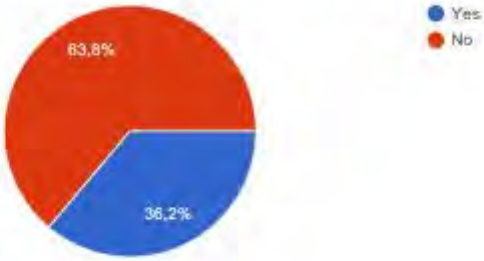
47 reacties



Sensors Stratumseind

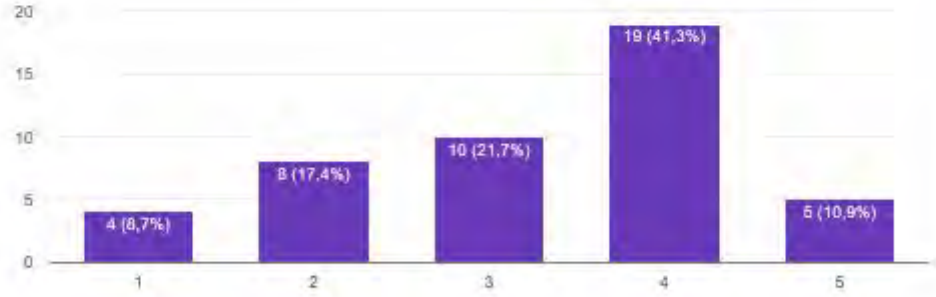
Wist je al van de sensoren op Stratumseind af? Did you already know about the sensors on Stratumseind?

47 reacties



Wat vind je van de sensoren op Stratumseind? How do you feel about the sensors on Stratumseind?

46 reacties



Wat voor data zou je graag willen zien die verzameld wordt door de sensoren, op het moment van je bezoek?/ What kind of data would you like to see that has been collected by the sensors, at the moment of visiting?

37 reacties

Wat voor data zou je graag willen zien die verzameld wordt door de sensoren, op het moment van je bezoek?/ What kind of data would you like to see that has been collected by the sensors, at the moment of visiting?

37 reacties

?

Nothing actually

Loud areas, places where aggressive behavior occurs. Places I should avoid really.

De invloed ervan

Agressieve dronken mensen

Crowd control

Feitjes over aantal mensen op bepaalde tijdstippen

Geen

Dat je veilig bent

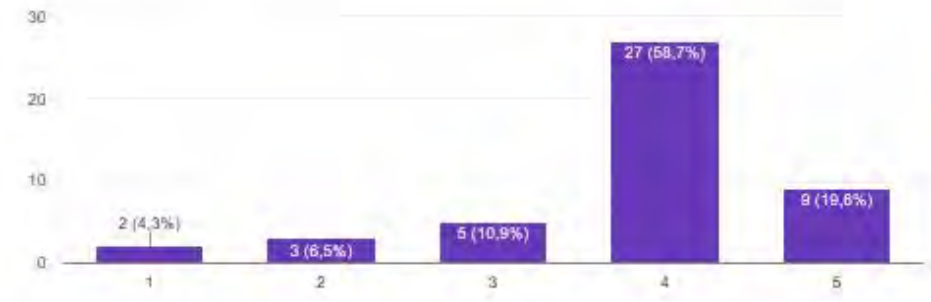
What places are busy.

Iets met veiligheid

age of visitors or sth interesting

Wat is uw ervaring in het algemeen met Stratumseind?/ How do you feel about Stratumseind in general?

46 reacties



5. FIRST MEETING LIVING LAB, TINUS, OLHA

- “It is known that in Eindhoven a number of IoT / sensor networks in the public space work independently and are used by different parties. However, during the pilot project it has become clear that visualization and interaction with IoT in public spaces is a challenge .”
    - So what exact research is already done regarding the experience of the visitors?
    - Do many people know that there are sensors at Stratumseind?
    - We have to design for awareness of the collected data, but in the positive, neutral or the negative way?
    - Who is doing the new UX for the city beacons?
- You want to bring people in control of digital public space, but do you therefore want to create a digital open platform or a physical interaction with IoT?
- What are relevant entrepreneurs regarding the stakeholders we have to involve in the project?
    - “Employees of the municipality of Eindhoven that work with the public space of Eindhoven” -> Police, the researchers like you?
    - Are the owners of the sensors/beacons involved in commercial targets?
- What is the vision of the municipality regarding privacy of data? Article of the Guardian was pretty critical, has it changed the way of working?
    - In what way do we have to deal with this during our project? Or can we work in freedom?
- In what way can we use the data that’s collected?
    - What do you measure at day? At night? And do we have to focus at day or night?
    - What do you now do with the collected data? Can stakeholders already use it for commercial goals?
    - Is it easy to integrate the output of these data in a prototype?
- Propose our concepts and receive feedback about the possibilities

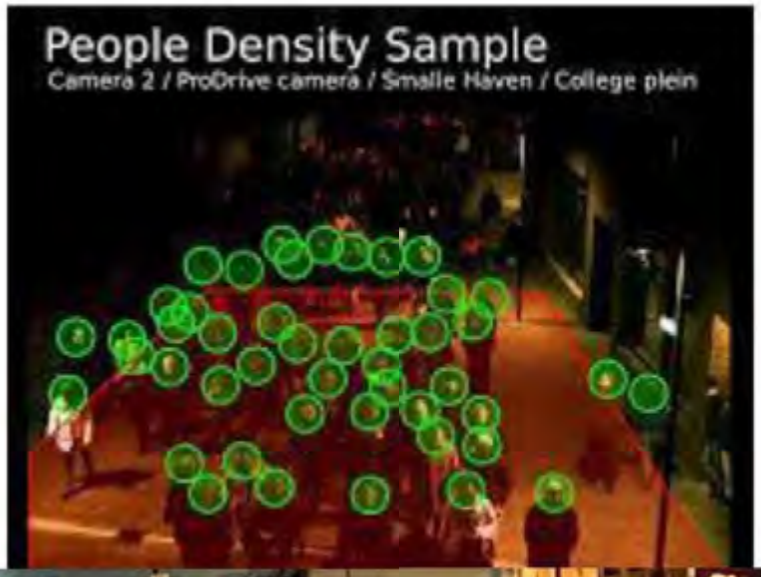
6. INTERVIEW QUESTIONS - QUALITATIVE INTERVIEW

- What is your age?
- How often do you visit Stratumseind a week/month?
- What is the reason of your visit?
- Can you describe a visit like that?
- What do you think of Stratumseind?
    - Why?
- Are there any points of improvement?
    - Why?

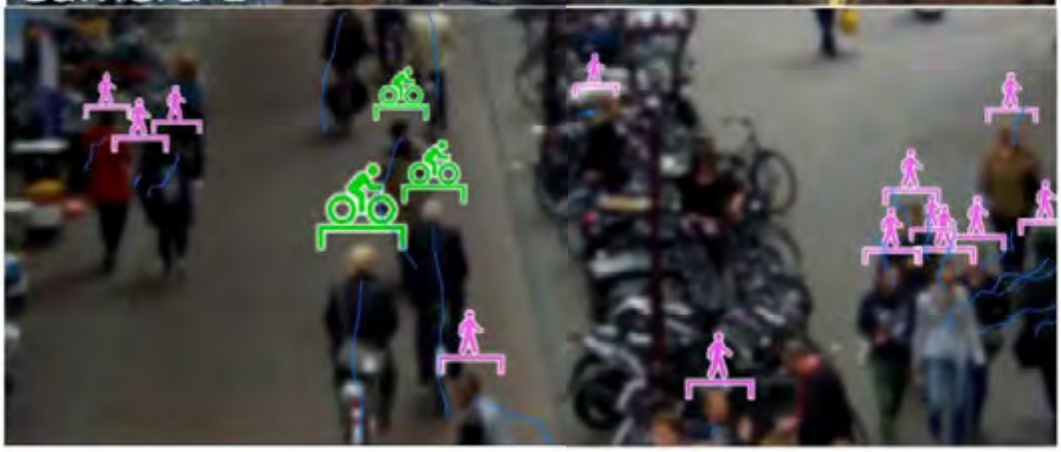
- **Explain sensor network Stratumseind**
- **Show pictures**

- Did you know about these sensors?
- What is your opinion about this? What do you think of it?
    - Why?
- What is good and what is not good about these sensors?
- Would you want to know what data these sensors collect?
    - What kind of data?
- Is there anything else you want to mention regarding this interview?

7. PICTURES INTERVIEW


People Density Sample
Camera 2 / ProDrive camera / Smalle Haven / College plein


Camera 1



8. INTERVIEWS TRANSCRIBED

Renate #1

1. Man, 50-55
2. About two times a month
3. I have a break from work, and I wanted to take a walk
4. I pass through it in the middle of the day
5. It's common for its partying, the cafés look messy and not coherent, but in general nothing negative
6. The organization of the buildings could be more neat, the colors of different pubs could be better aligned, the lightning could be better, but in general it's not necessary to change a lot.
7. No
8. It is fine (prima), I'm only taking a walk here
9. In general I feel good about these sensors
10. No I don't really care, *they* can know everything about me (but my pincode)

Renate #2

1. Woman, 30-40
2. About two times a year
3. I just had a job interview
4. I just walk through it
5. The street looks expired and neglected. The difference in facades could give character, but in this case it doesn't. The street doesn't seem very well maintained. (onderhouden) The color use isn't great and the ground seems dirty.
6. Fix the ground, add some green and/or plants thoughtfully. Give attention to the appearance.
7. Yes I do, I have immersed myself in the public space under which Eindhoven as well.
8. It is great that it can solve aggression problems and establishment. But it is also tensive because it is kind of and experiment. Ethical issues worry me the most. But in general I'd feel positive about the sensors.
9. – (kind of Q8)
10. For me as a civilian, I think it won't be very interesting for me. But for a designer it can be very interesting. It can also be a great tool for maintenance/enforcement (handhaving), and to start a conversation/discussion.

Renate #3

1. Woman, 71
2. Not very often
3. Stratumseind is in the middle of my house and the doctor so I just walk through it.
4. I like it when there aren't many people around
5. -
6. -
7. It is very good if it detects criminality. It is very important for safety reasons since there is a lot of activity going on here. Aggression is the worst. Privacy is also important but if you don't do anything wrong the sensors shouldn't be harmful. (*als je niks op je kerfstok hebt, heb je niks te vrezen*)
8. Q7
9. Q7
10. No, I don't have an interest in that. Maybe to protect my grandchildren, but the parents should have a role in that as well.

Noa #4

1. Woman, 27
2. Never as she has lived in Ireland before, but now has come to the Netherlands for work (she spoke Dutch though)
3. There was a job interview she was heading to
4. -
5. It looks fine, and the experience is good so far
6. I would like some more decorations on Stratumseind, but I understand those have to be cleared away again for the night life.
7. No
8. I think it's partly good and bad. It's good to minimize aggression and therefore have more safety. It's however a bit sensitive in the privacy area if things like faces could be recognized. For example with Facebook it's your own choice to be monitored as you choose to make a profile and agree to the terms of condition. Therefore walking on here without agreeing on the sensors feels a bit like spionage to me.
9. Q8
10. I am interested in that, it would be nice to see what the sensor register.

As in movement I'm not interested in who walks where, but it feels awkward to me to not know whether there are sensors here.

What I would like is an alert when there is a fight or something for safety. Statistics do not interest me at all.

Noa #5

1. Male, 26
2. I'm a tourist from Italy and I'm just here for 3 days. It's my first time here so I've also never been on Stratumseind before.
3. I'm passing through Stratumseind on my way to visit some friends nearby.
4. -
5. It feels easy and normal to walk through here. I like that there are also lots of younger people walking here, which makes it feel lively. It is really different here from Italy here and I like that.
6. No, this feels typically Dutch for me. A street like this is street art for me. It is nice to see something different like this than what I'm used to.
7. No
8. It is good for safety. If people do bad things it is registered. Less so for privacy, but it's 50/50 in my opinion.
9. -
10. No, I wouldn't need to see that
11. Eindhoven feels easier than Amsterdam as it's way less busy here.

Noa #6

1. Man and woman with a baby, around 30. The man has a job in the design world. (also mainly the man gave the answers)
2. They're sightseeing here as they are tourists from the UK.
3. Strolling through the streets for sightseeing
4. -
5. The buildings around here feel rather dated. For example the Hema feels rather ugly to me as it's just old brick. There is no sense of place or cohesion of some buildings.
6. The buildings could get a more cultural update, I like the older buildings with a history better.
7. No
8. I think it's great that this [sensor data collecting] is done.
9. The collection of data could allow for a better and more attractive environment. Also I think social behaviour can be influenced positively. Though the question i how much data would I be okay with being collected? So I think it's an interesting debate and I'm not sure where my limit is of data collection yet.
10. Yes, data about safety for younger people, elderly and women could help them search for safer areas. Also I would be interested about data of where you can park your bike or car, where is space left. In general I would like the data to be used to help people make decisions.

Noa #7

1. Male, 25
2. Tourist from Spain, so hasn't been to Stratumseind before
3. I'm here for work and free for a day. So walking around the city.
4. -
5. In the night it's very nice to have such a street.
6. -
7. No
8. It's more or less the same in Spain
9. Good against aggressiveness. I think security is good.
10. -

(Spoke little English so wasn't able to understand all questions)

Noa #8

1. Male, 26
2. Bar owner of Café Tracé on Stratumseind, so is there nearly every day.
3. Work
4. -
5. -
6. -
7. Yes, I know that it's good for the safety of the street
8. I think it would be good if people would know about the existence of the monitoring sensors. Entrepreneurs here on the street know about the sensors but the people that go out here at night don't. It can help to record crime that would otherwise have happened out of the sight of the police. Therefore it is good to reinforce safety.

For example speed cameras are instantly clear that they record your speed and everyone will adjust their speed limit because of these cameras. Therefore of the sensor here on Stratumseind it could also maybe be made clear what sensors do.

As a bar owner I don't have any cameras of my own, so It's good that there are cameras on the street that I could call upon if for example a window is broken by someone.

9. Good: Safety

And for privacy everything you do would otherwise also be seen by other people on the street as it is public. So it doesn't matter for me that sensors also see this.

10. Yes for the cameras if something is damaged. But I don't want to know how many people are here and go where. I don't want data to get people here, I just want to be the nicest bar and trust that people come here because of that. As long as my café is full.

Noa #9

1. Man and woman from enforcement, around 22
2. They come daily to Stratumseind, multiple times a day for their work.
3. Patrol, work
4. -
5. -
6. -
7. No, we didn't know about that
8. I think it's only good that the sensors are here for safety - Man
   I think it's rather intense(heftig) that they monitor us in that way- Woman
9. -
10. For work it's good to see this kind of data, as it could help us. Privately it doesn't matter to me as I don't care about that when I go out. - Man

    I would like to know that the sensors are there, but don't need to know exact data when going out. Showing how they work could be interesting though. - woman

11. Signs or something that show you're being monitored anonymously could also help.

Noa #10

1. Girl and a boy, around 13
2. We come here around once a month.
3. We're here today for a scouting came
4. -
5. We think it's kind of cozy here. During the night you have to watch out, but it isn't unsafe to us.
6. We would like more trash cans on the street.
7. No
8. We think it's pretty handy. There are already cameras almost everywhere, and these sensors are pretty similar. If it's anonymous data it's no problem to us that we're being monitored.
9. Q8
10. No we don't really need that. We don't think making people conscious of it is necessary as it is already happening around us almost everywhere. However it could be handy to show the sensors, as people will behave better when they know about them.

Teun #11

1. 34, (tourist from Poland)
2. This was the first time in Eindhoven and Stratum.
3. They were looking for coffee shop Upstairs.
4. -
5. It looks like a nice street.
6. -
7. No, we didn't know about that
8. I think it's pretty scary. I immediately think about Big Brother. I think people should know that they are getting tracked.
9. I think the sensors are not good, because I don't see the advantage of the output.
10. When I would go out I wouldn't be interested in which data is gathered. But make visible that the sensors are there. And focus on security, not on other stuff.
11. These sensors have advantages and disadvantages, but although you say all data is gathered anonymous, it doesn't feel like that.

Teun #12

1. 21 (HBO student)
2. They come to Stratumseind several times per month.
3. Going out and sometimes to get some food (when having a break at school).
4. -
5. There are good bars and cafe's, but during the day it looks dead.
6. There should be more decoration to create a better atmosphere.
7. No, we didn't know about that. We only knew that there were camera's.
8. Positive, I think it's good for the safety.
9. Negative is the superficial aspect of observing, because you cannot know how people feel or why they are behaving in a certain way.
10. I would not be interested in certain data, but I think you should make people aware of the sensors. Also to frighten people that they don't have to do forbidden stuff.
11. Signs or something for in the evening and maybe some game or interaction for during the day.

Teun #13

1. 69 (from Limburg, a day out with her husband)
2. This was the first time to Stratumseind
3. Visiting Eindhoven for a day out
4. -
5. I don't really have an opinion about it.
6. I think they should renovate the facades of the houses. Besides, they should remove all those flags and light signs.
7. No, I didn't know about that.
8. I thinks it's good when they will use the information in a useful way.
9. I don't have difficulties with being sensed.
10. I'm not afraid for my privacy, but I'm not certainly interested in something.
11. -

Teun #14

1. 17
2. Several times per month.
3. Passing route & going out
4. I drink alcohol and it's mostly after 12 when I'm here.
5. I think it's a nice street.
6. They should renovate the facades and they should focus more at day.
7. No
8. I think it's good, but I should be informed about it. Also the commercial purposes could be a good plan for the future. But only when the privacy is defended in a good way.
9. -
10. The privacy issue is pretty big, so you should be getting informed. But the density of people would be interesting data.
11. You could light up the sensors in an artsy way by pointing. I would love to see a product which plays with unconscious things instead of statistics or something

Teun #15

1. 28
2. I work at Thomas
3. I'm here daily for work and monthly for going out.
4. I'm coming here for 8 years already, so it's a routine.
5. I think its a good spot for youngsters.
6. During the week there's not many stuff to do.
7. I knew about the camera's and the sound sensors, but not about the density sensors and more advanced stuff.
8. I think it's only good if it stimulates the development of Stratumseind.
9. I'm personally not afraid of privacy issues.
10. I would not be really interested in those data and I think many people don't wan to see statistics when going out. But I think commercial purposes of those data would be cool for the street, but I'm also not sure if it has much value.
11. I don't have to be informed about it and I think people don't have to be informed about it.

Teun #16

1. 23 (& friends from Design Academy)
2. They come daily to Stratumseind, multiple times a day for their work at Calypso.
3. Normally for work, but sometimes for going out and to get drunk.
4. I'm not really into music at Stratumseind, but when I'm here it's always special because I'm mostly wasted.
5. There is a certain special atmosphere at night, especially when having alcohol.
6. There should be more variation in cafe's and bars. They should change the image of the street as pub street with all those crappy music.
7. No, we didn't know about that
8. Wow.. this is pretty scary. We had a lecture about science friction and this could work out very bad regarding privacy issues. Especially because here at Stratumseind drunken people get tracked and they are often not aware of their behaviour and that they are getting tracked.
9. I'm pretty afraid that these systems could be hacked by intelligence agencies and could be used for bad purposes. (like killer drones etc.). I'm not a believer in tracking. It's always about safety, but I think we forget about the privacy aspect.
10. I think the only data which would be interesting is non-personal stuff. So data which focuses on the environment or on the mass density etc.
11. Maybe you can make this subject more accessible to make a joke with the data.

9. PERSONAE

HERMANN SCHMIDT

AGE 35
GENDER MALE
LOCATION COLOGNE, GERMANY
JOB ARCHITECT
CHARACTER AMBITIOUS FAMILY MAN

PROFILE

He is an architecture, so he knows a lot about building sciences and urbanism. That is why he likes to drive around in his car and explore new places. About two times a year, he goes to the Netherlands to visit a city. Hermann is also a big lover of nature. Hiking, camping and other outdoor activities are his favorite besides exploring cities.

REASON FOR VISITING STRATUMSEIND

He's on a weekend trip to the Netherlands with his wife and daughter. They're here to visit museums, Strijp and just have a good time away from home. Today, they wanted to walk around in the city centre of Eindhoven, and visit some shops. They ended up walking through Stratumseind.

TECHNOLOGY KNOWLEDGE

For his job, Hermann has to work a lot with computers. That's why he knows how to handle a computer. He uses the internet frequently. Furthermore, he spends a lot of time on his smartphone, on which he communicates with his family and makes use of some convenient apps.

PRIVACY

He knows a lot about privacy. Designing a public space or a home environment requires a completely different level of privacy. He thinks privacy is a very important and valuable thing to have, especially in nowadays world where everything is being posted on the internet.

DATA AWARENESS

He is aware of the fact that almost every website requires you to log in or to share personal details. Sometimes this stops him from using the website. However, he does use Facebook to keep in touch with people he doesn't see often. He isn't aware of how much data some companies have.

LUCAS BERENDS

AGE	40
GENDER	MALE
LOCATION	VELDHOVEN, NETHERLANDS
JOB	RETAIL SALESMAN
CHARACTER	SOCIAL FRIENDLY MAN

PROFILE

He has recently started his new job in Eindhoven. Lucas likes to stay fit and does this for example by cycling to his work or taking a walk during his break. Furthermore, he is a very social person and therefore likes to hang out with friends often.

REASON FOR VISITING STRATUMSEIND

His job is located near to Stratumseind. For his job, he needs to sit all day long. That's why everyday he takes a walk during his break. About once a week, this route passes through Stratumseind.

TECHNOLOGY KNOWLEDGE

He has little bit of knowledge about technology. He knows how to work with a phone and the computer. Other than that he isn't very handy with more complex computer usage. He uses Facebook a lot on which he regularly posts messages.

PRIVACY

He has little knowledge about privacy. He has heard about the dangers of hackers, and that they can easily guess a password. However, he thinks that this won't happen to him. Besides that, his motto is: "They can know everything about me".

DATA AWARENESS

He has very little knowledge about what can happen with personal data. He uses Facebook a lot. Where possible, he logs in with his Facebook account on other websites. He knows that he shouldn't share personal details on the internet, but besides that, he posts almost everything.

BRITT DE BOER

21
FEMALE
STRIJP, EINDHOVEN
HBO STUDENT
PARTY ANIMAL

PROFILE

Britt is a open and social girl and besides she is a true party animal. She studies Applied Psychology at Fontys University of Applied Sciences and lives at a student house in Strijp. She is enjoying her student life and really values family and friends above her study. Besides, she plays hockey and often does sports at the gym. When she goes out she often drinks a lot of alcohol to have the best time.

REASON FOR VISITING STRATUMSEIND

Every Thursday night she is at Stratumseind and also at Tuesdays she's often there to have a drink at café La Route with her hockey team.

TECHNOLOGY KNOWLEDGE

Britt is known with the latest technologies regarding laptops, smartphones etcetera. She uses her smartphone a lot and she puts a lot of effort and time in social media.

PRIVACY

She isn't really busy with this subject. However, Britt believes privacy is important, but she trusts the government that laws will protect her. Though, she is willing to sacrifice privacy for extra safety.

DATA AWARENESS

Britt doesn't know anything about the sensors at Stratumseind. She is aware of the camera's, but when she's going out she doesn't pay attention to that.
Regarding the sensors, she wouldn't be interested in the data on Stratumseind, but she thinks that people should be aware of the sensors. Especially because people are drunk and not aware of their behaviour.

ELIZABETH VISSERS

AGE	66
GENDER	FEMALE
LOCATION	ROCHUSBUURT, EINDHOVEN
JOB	NONE, RETIRED
CHARACTER	CARING GRANDMOTHER

PROFILE

Elizabeth grew up in Eindhoven in a family of 6 children and now still lives there as she is very much a family person and likes to stay close to her family. Currently she is retired and therefore has the time to go for strolls outside in the city. She also really loves babysitting her grandchildren. So her daily activities include doing groceries, gossiping with friends, visiting family and going for a walk.

REASON FOR VISITING STRATUMSEIND

Her reason for visiting Stratumseind is passing through on one of her walks.

TECHNOLOGY KNOWLEDGE

Elizabeth doesn't know a lot about technology, but can use her laptop to send e-mails and uses her smartphone for whatsapp as she has to adapt to these times.

PRIVACY

She believes privacy is important, but thinks that if you do nothing wrong you also have nothing to fear. For her safety is so important that some amount of privacy can be sacrificed by for example surveillance cameras.

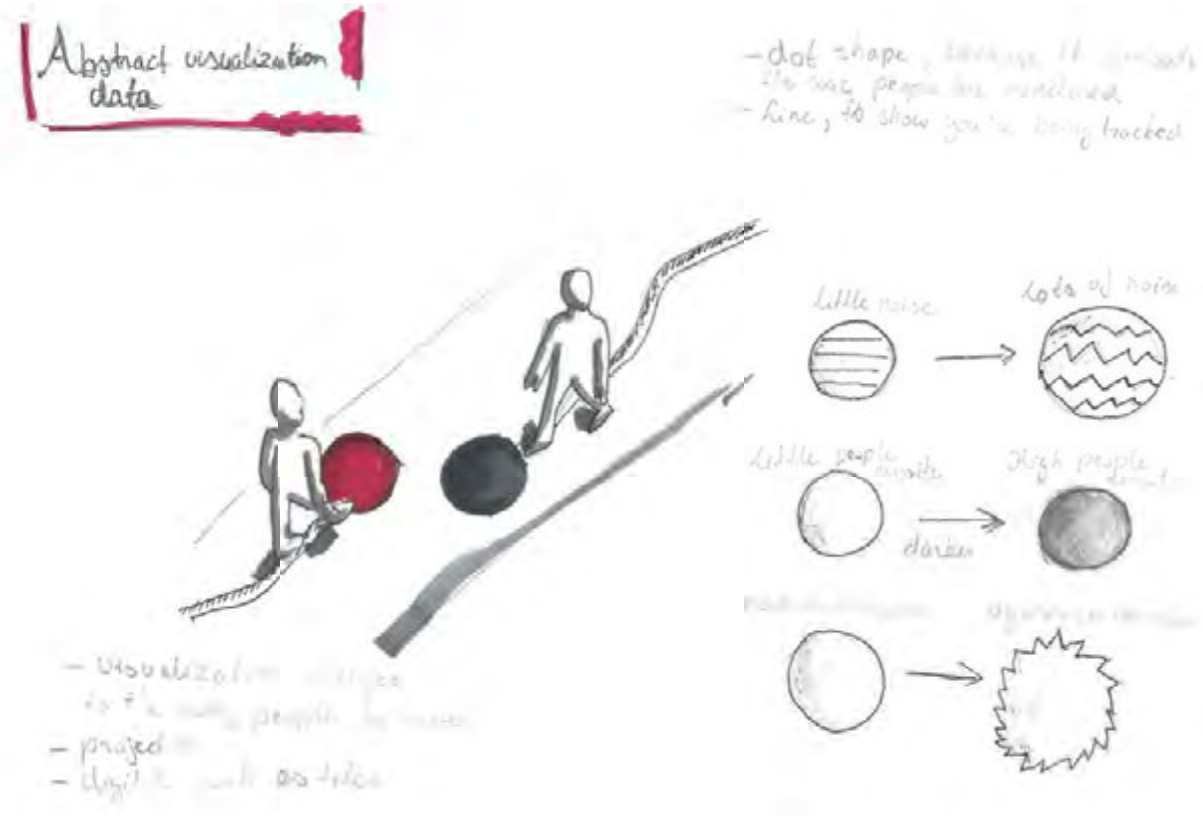
DATA AWARENESS

Elizabeth is aware that there are cameras everywhere in public spaces as she is used to this. She has however no knowledge of what can exactly be done with the information of sensors or what kind of sensors are out on Stratumseind, but believes that everything placed in public spaces is done for safety purposes.

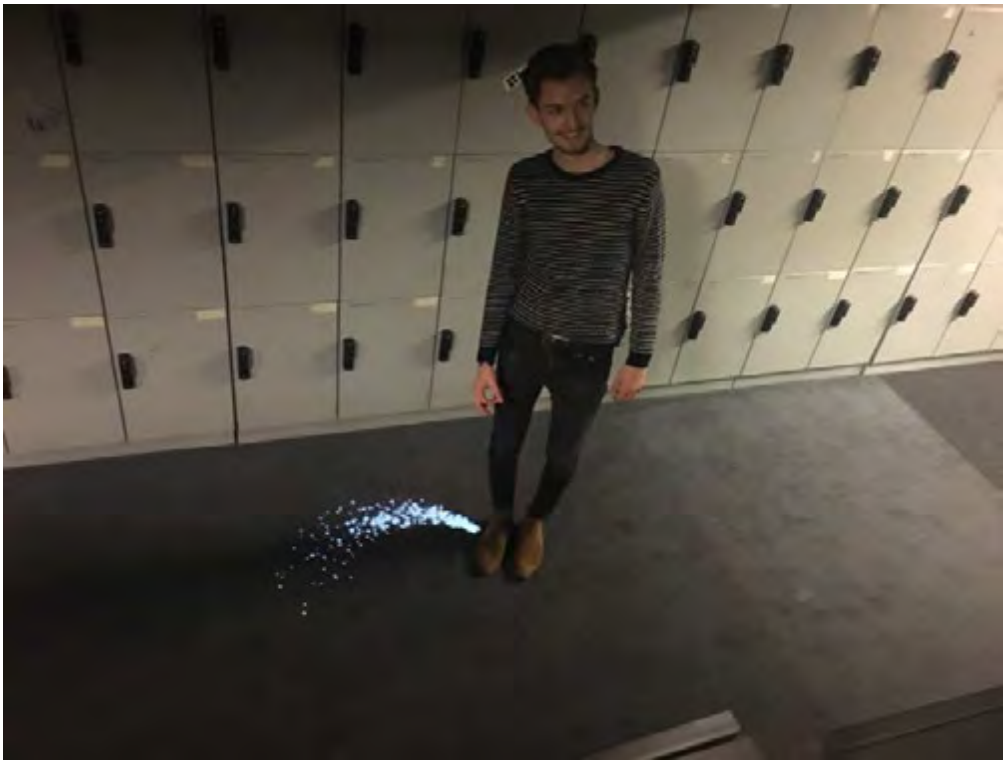
10. DESIGN DECISION MATRIX

concept/requirements	Engage/triggering	Safety	Awareness	Interactive	Practicality	Informative	Experience	Total
Angel wall	2.5	0	0	4	5	1	2	14,5
Shadow wall	3.5	0	2	4	3	1	4	17,5
Shadow ground	4	0	2	4	4	1	4	19
Starry ground / blob / drops	4.5	0	4	5	4	3	4	24,5
Footstep ground	5	0	4	5	4	2	3 (could be scary)	23
Circle and line, with changing circle due to data interaction	3.5	1	4	4	4	3	3	22,5
Shouting against wall with flowers & fish	3	0	2	4	3,5	1	4	17,5
Circle around a person's head to emphasize anonymity of data collection - wall projection	4	1	4	2	3,5	2,5	2	19
Infrared wall with small text with ‘make a picture with me’	4	0	3	2	2	5	2	18
Movement prediction	3	0	3	3	3,5	2	3	17,5

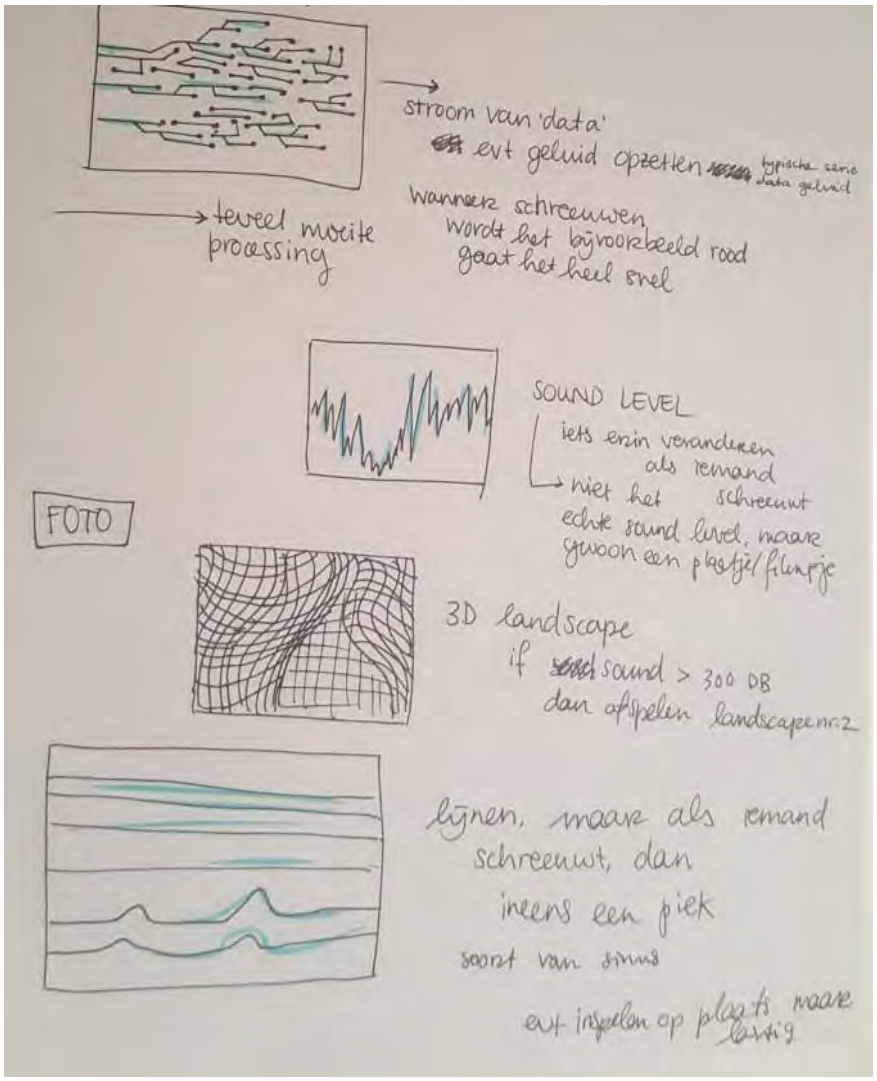
11. PRELIMINARY CHOSEN CONCEPT

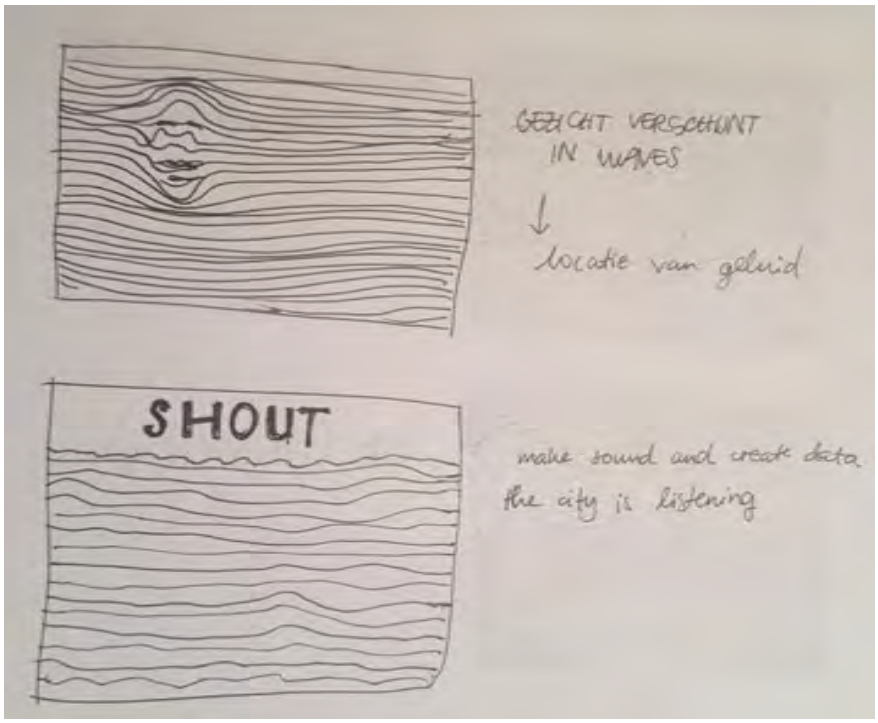


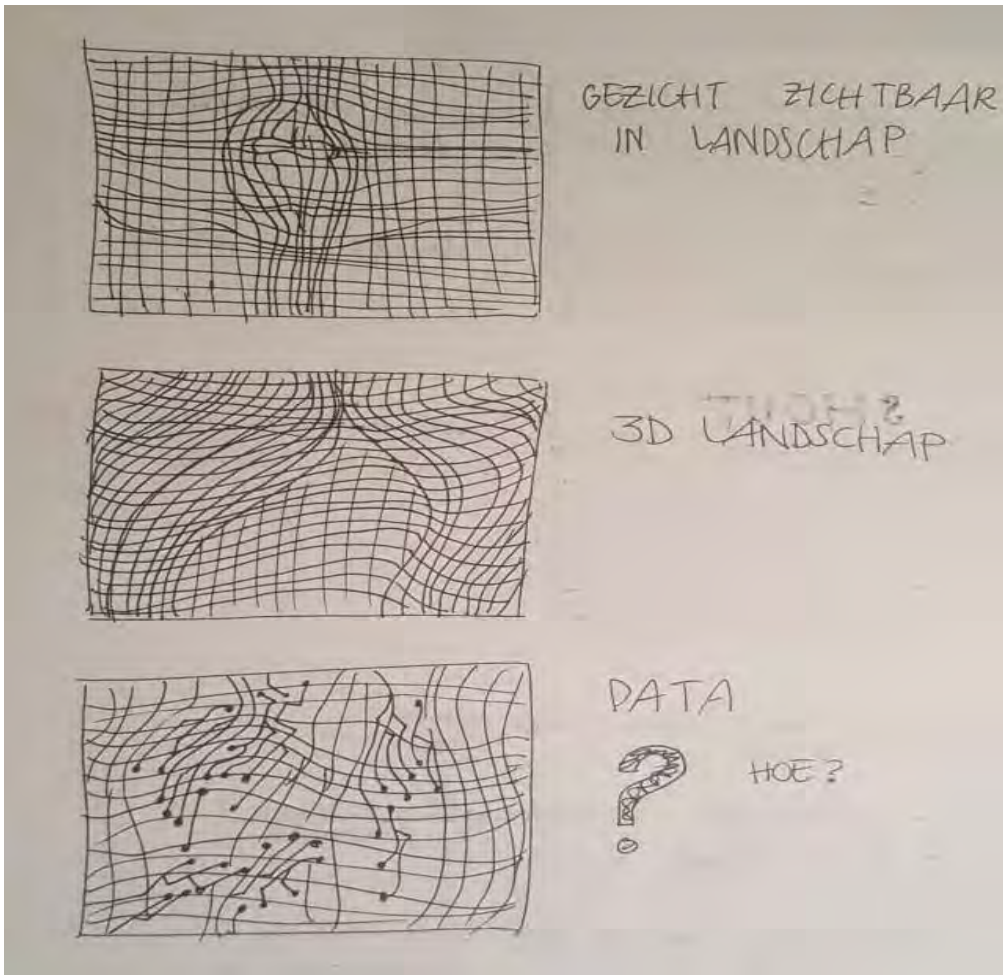
12. PHOTO'S EXPLORATION W ALL PROJECTION



12. GLOW VISUALIZATION EXPLORATION



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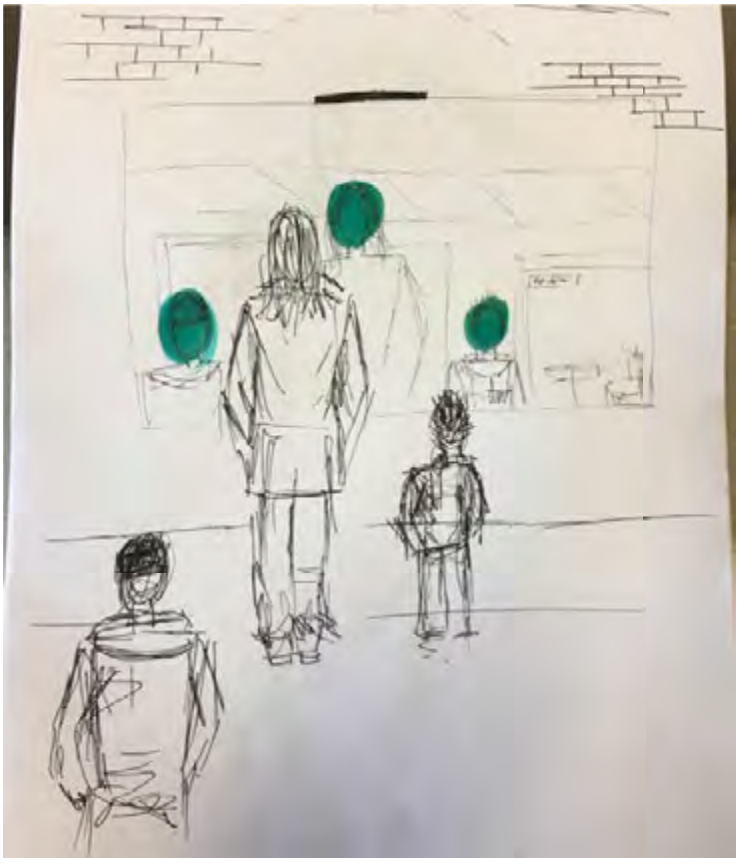
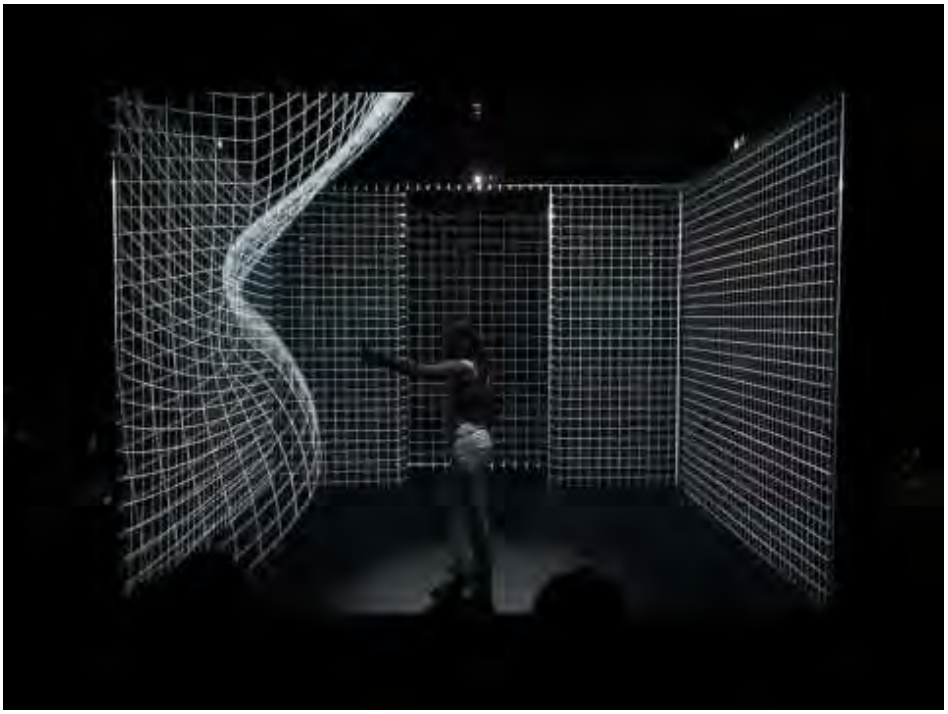
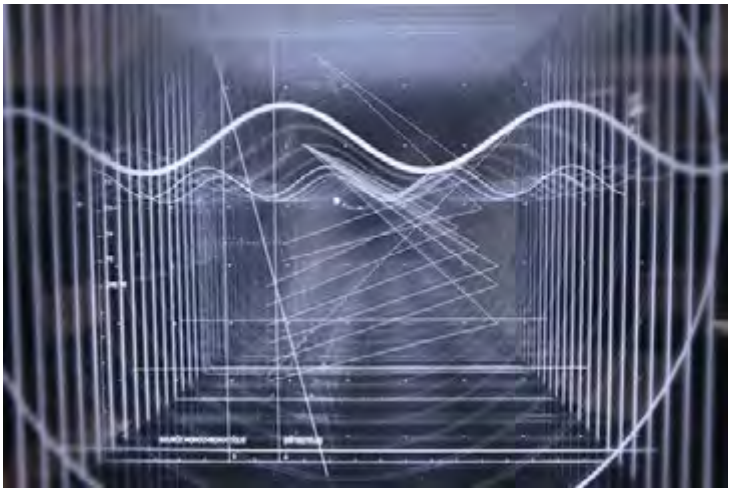
DATA
HOE?





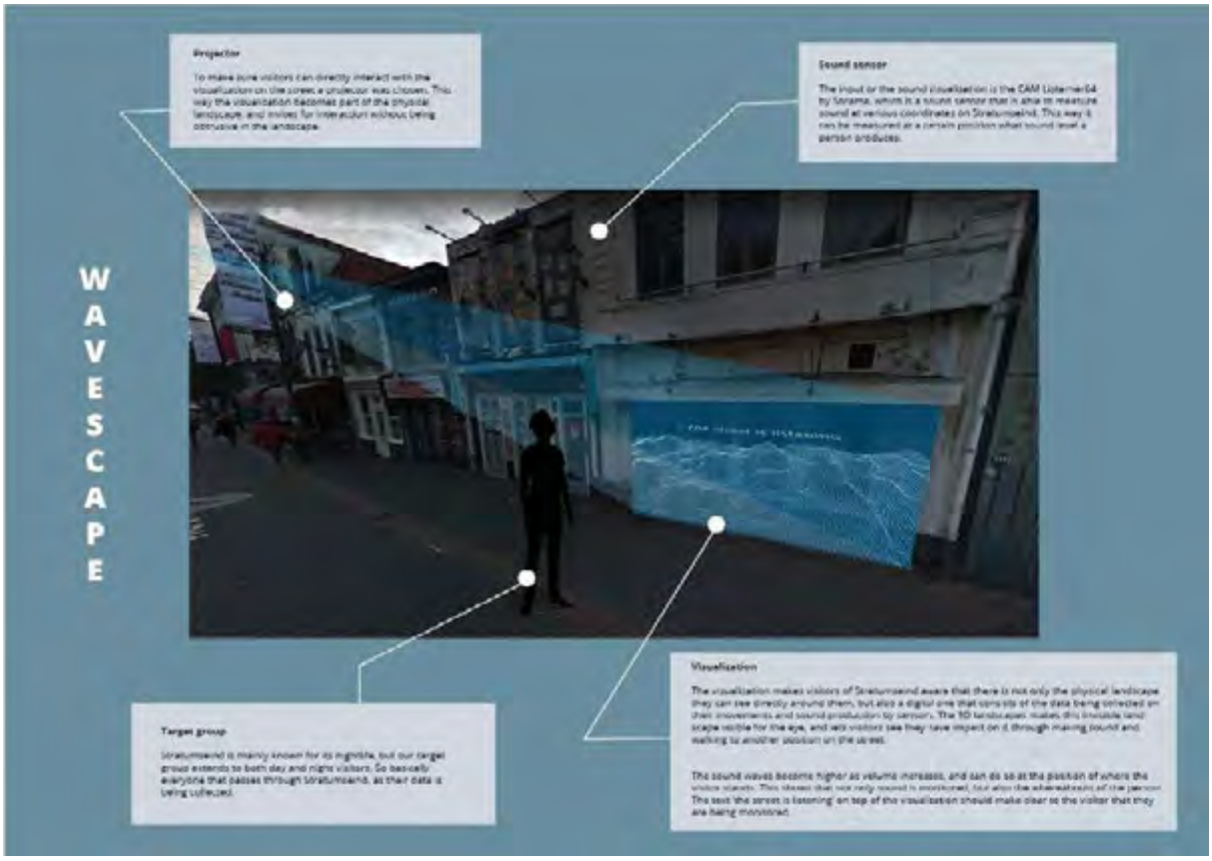


13. GLOW , BIG PROJECTOR TESTING AND INSTALLATION

14. GLOW INSTALLATION

15. MIDTERM PROCESS POSTER

16. MIDTERM CONCEPT POSTER



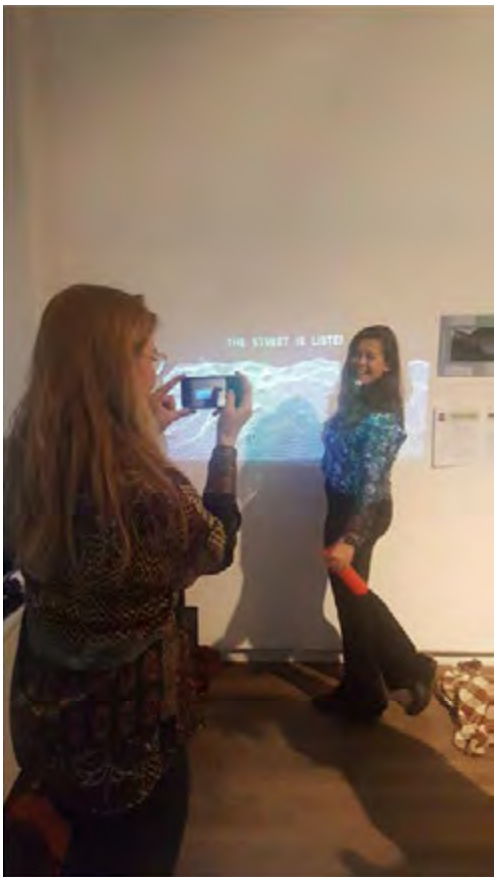
17. MIDTERM PRESENTATION

18. REFLECTION WAVESCAPE

The concept Wavescape was designed with the goal of Glow in mind. Therefore this iteration was working on realization, with our goal being achieved when we would have a projection to show at Glow.

The visualization showed the level of sound per coordinate, therefore being reactive to the sound people produced. This was good as a visualization of the fact that your sound level was being measured. On the other hand the visualization was just reactive, therefore not showing the complete scope of the sound data being recorded. Next to this an interactive visualization would have made the experience more rich, as just seeing sound input isn't as interesting to our users as actually getting to play with the data.

When having ideated about this concept, we wanted the projection to be on ground level of the old Lempke, so that people could take pictures with it and have it more visible for the user. However in reality we could only project from a balcony, which resulted in the projection being situated much higher up than anticipated. This caused visitors of Stratumseind not noticing the projection to not knowing they could influence it as it was too far away. If something is too far away, there is also an higher barrier of interacting. "Proximity would be the degree to which a respondent feels he/she is 'near' other subjects when engaging with the system from 'very far' to 'very close'[1]

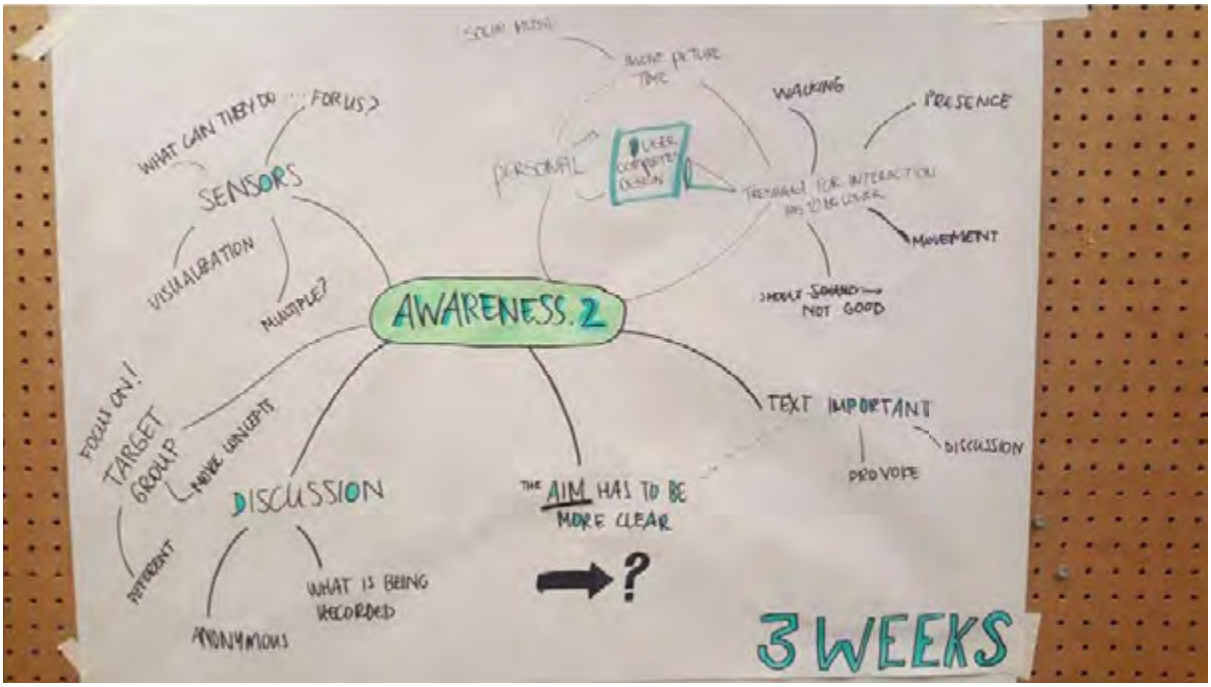


Next the question 'Is the street listening?' above the visualisation could have lead to thinking about whether you are being monitored, but as the projection was way too high up and mirrored, the question wasn't readable. Also after some feedback it could be argued whether a more provocative question could lead faster to discusion than this one.

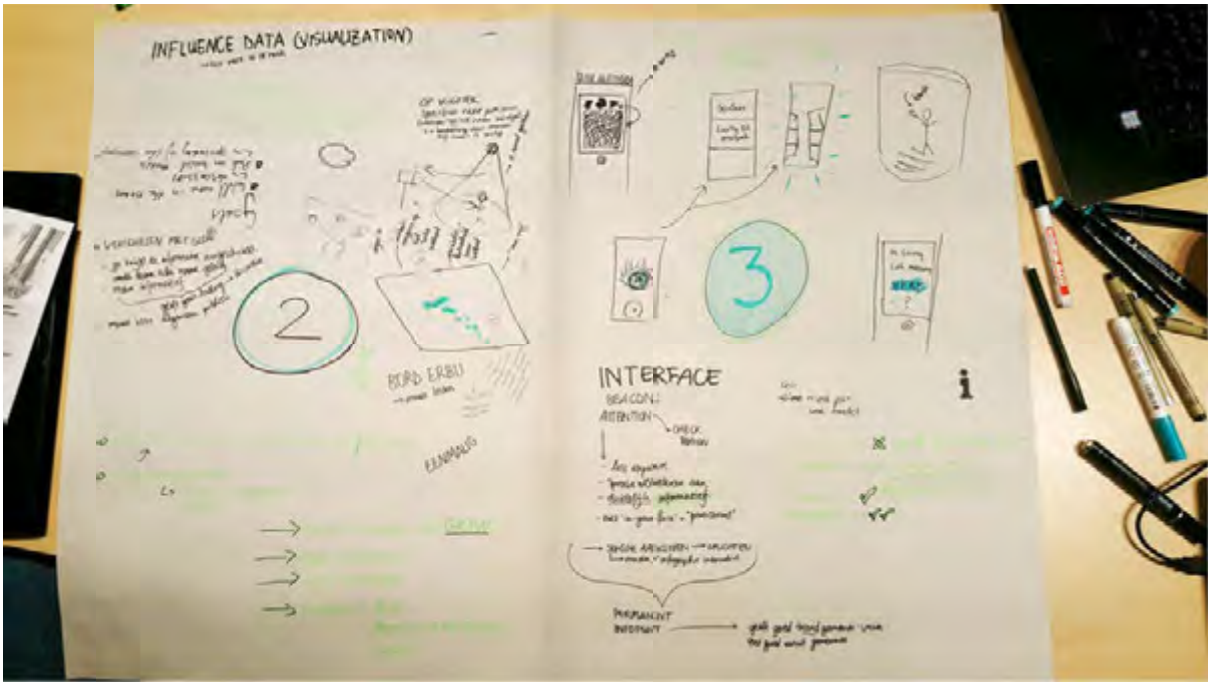
Lastly the threshold of shouting was too high. People weren't prone to make much higher sound levels than just talking, as shouting takes more effort and may be frowned upon by others. Therefore in a public space it didn't work to make people shoutd, so more regular activities should be taken into account as triggers for interaction to lower the threshold.

[1] Interactivity: a concept explanation, 2002 SAGE Publications London, Thousand Oaks, CA and New Delhi, New Media & Society Vol4(3):355–383 [1461–4448(200209)4:3,355–383;026203

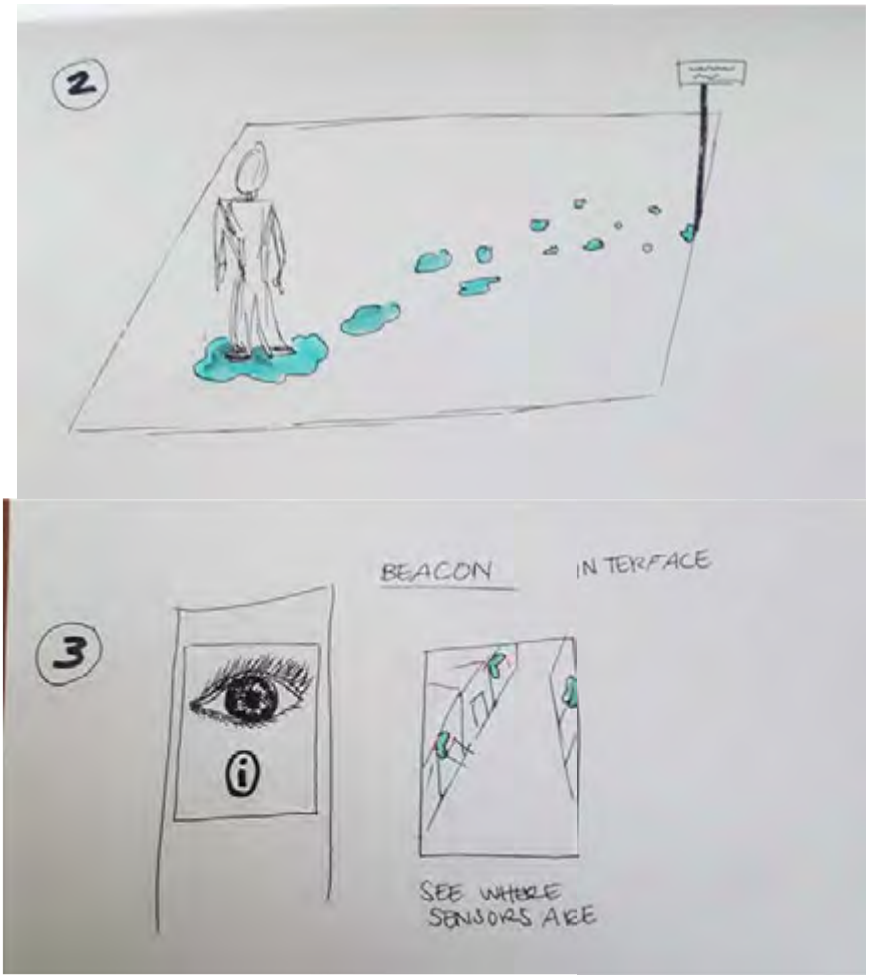
19. SCOPING AND IDEATION



20. POSITIONING AND FRAMING CONCEPTS IN SOCIETAL AND USER CONTEXT



21. SKETCHES AND PROTOTYPES




THE STREET IS LISENI NG

22. PROTOTYPE OF INFORMATION ON INFORMATION SIGN BLOB

SMART SOCIETY

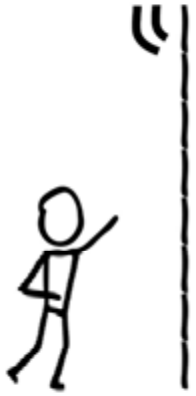
Eindhoven is always working on innovation and strives to create a **'SMART SOCIETY'**. We are working with new technologies and sensors in public spaces, based on gathering and analyzing people's data to improve the quality of life in the city. Right here at Stratumseind, we have a sensor network which gathers data to solve issues in daily lives like safety.

All data in public space is visible, transparent, open, secure and respects the privacy of individuals and communities, which means that it is anonymous all the time.

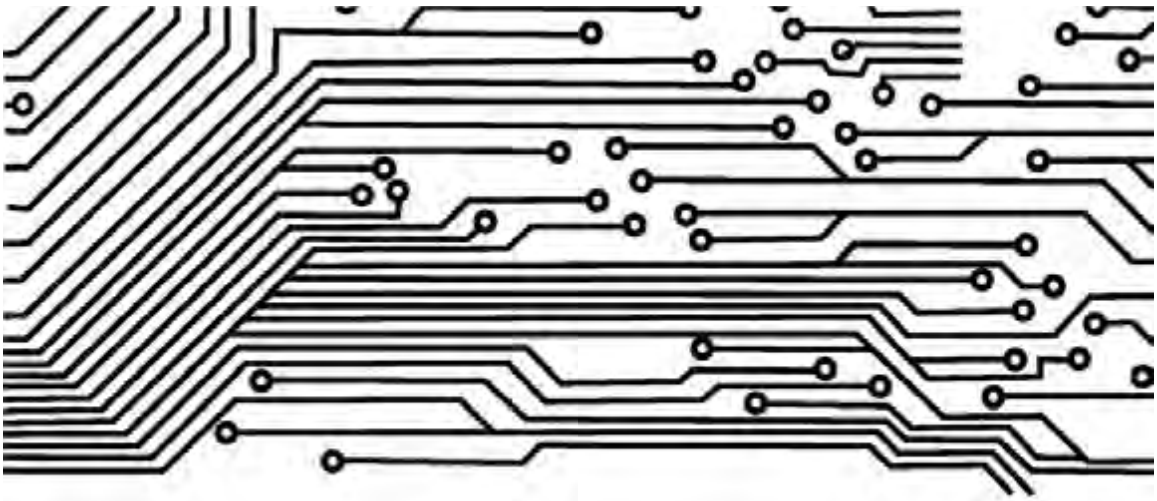
Want to know more? Visit **WWW.SENSORPILOT.NL**

What is your opinion about this innovation?

Leave your comment at
WWW.EINDHOVEN.NL/SENSORS.



23. BRANDING



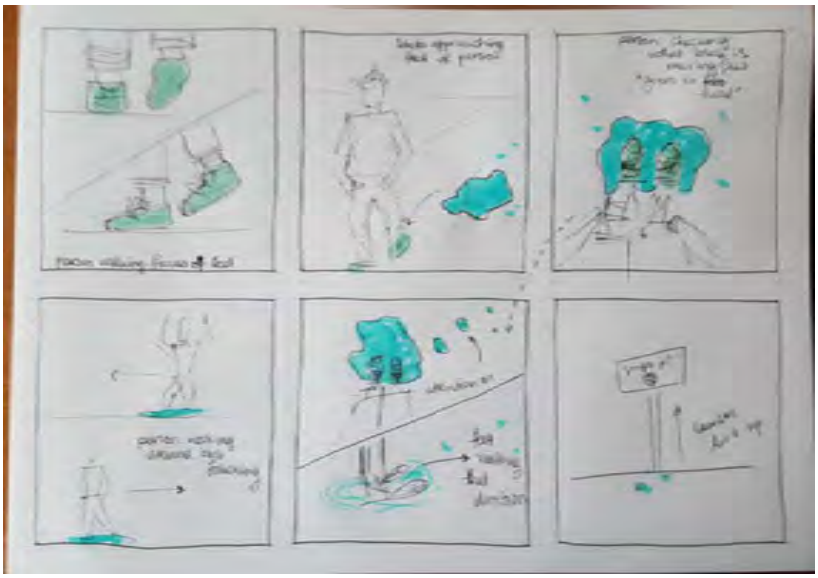
F28E39 83CDE1 1DB7CE 1F9AC5 1E7AB2 044A74

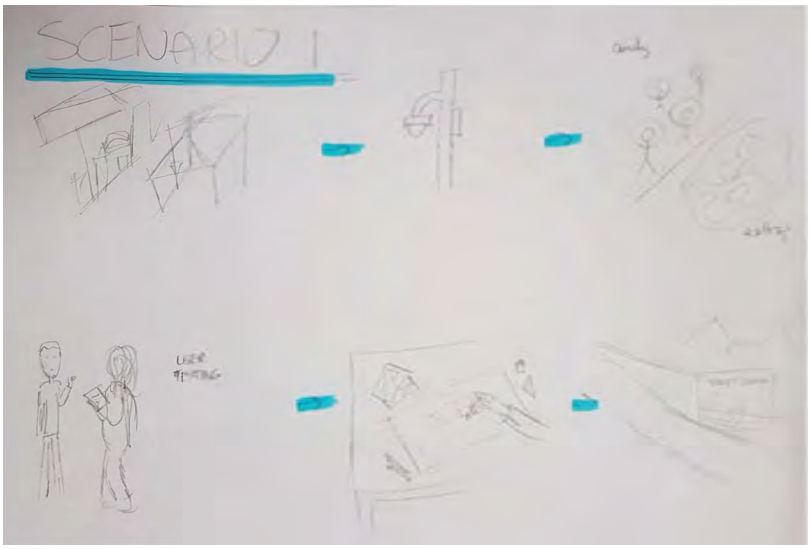
IBM PLEX MONO
IBM PLEX SANS
Medio
AEMSTEL

Intro font Nunito Sans light, 12pt

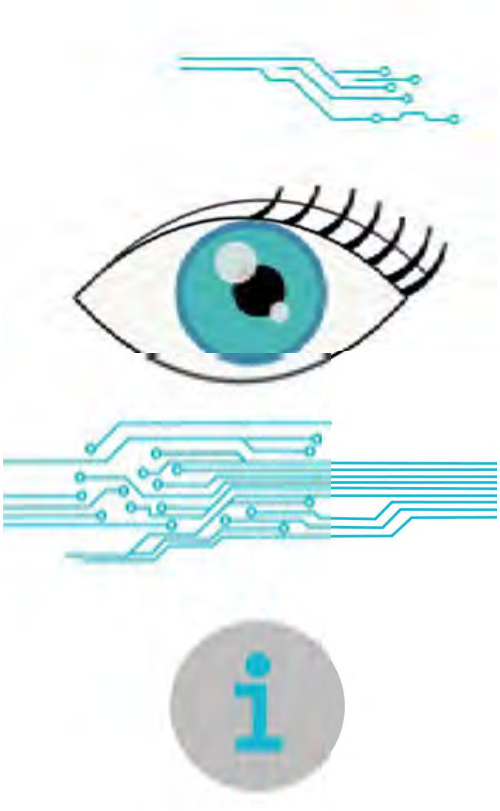
Quotes Nunito Sans bold, 14pt

24. SCENARIOS





25. CITBEACON EYE FULL INTERFACE

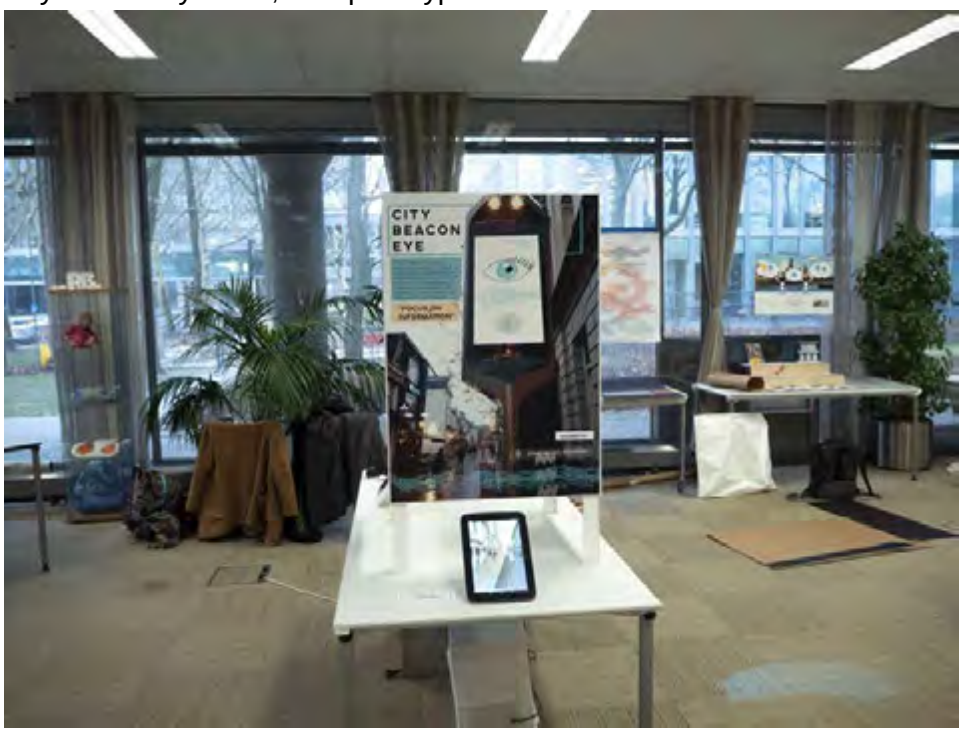


26. OVERALL RESULTS

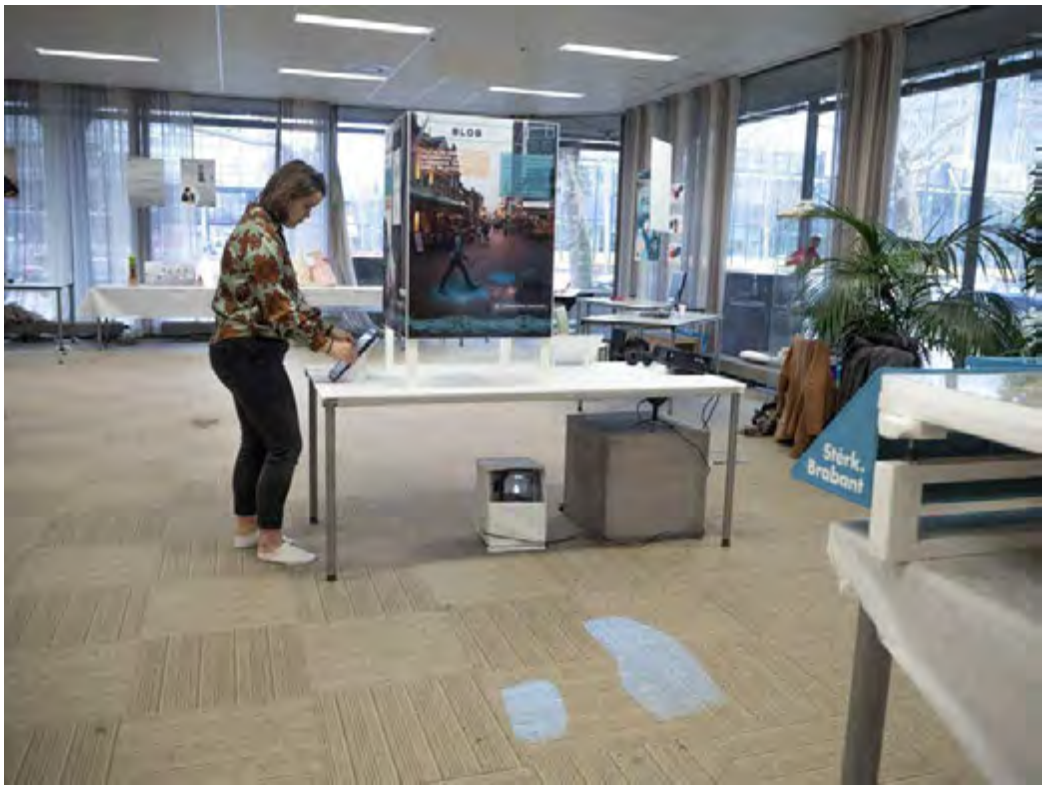
Set up demoday

Explanation side, which shows a video showcasing all three concepts and text to explain our project goal.

Citybeacon Eye side, with prototype that users can touch on a tablet



Blob side, which shows a projection prototype consisting of blobs that could follow the user by controlling it on the mobile phone.



Wavescape side, which shows a projection prototype that reacts to the sound level people produce

27. POSTERS

DATA AWARENESS ON STRATUMSEIND

INTERNET OF THINGS IN THE CITY

The municipality of Eindhoven is always working on innovation and are working with new IoT technologies and sensors in public spaces, based on gathering and analyzing people's data to improve the quality of life in the city. At Stratumseind, there is such a sensor network which gathers data to solve issues in daily lives like safety. All data in this public space is visible, transparent, open, secure and respects the privacy of individuals and communities, which means that it is anonymous at all time.

However, due to issues like privacy people should be aware of this. A pilot project made clear that visualization and interaction with IoT in public spaces is a challenge.

Our project gives three solutions to get people informed about the sensor network and to let them interact with their own data. The following video shows and explains the three scenarios:

THREE SCENARIOS

1 WAVESCAPE

Wavescape shows a dynamic data landscape which represents the heatmap of sound intensity on a specific area at Stratumseind. The big projection covers a full facade and questions if the street is listening.

2 BLOB

BLOB is an interactive projection which tracks movement and follows people who are passing by. Meanwhile, your feet are lighting up, bubbles are leading your attention to an information sign which explains the sensor network and his modalities at Stratumseind.

3 CITYBEACON EYE

The Citybeacon Eye is an infographic application which gives you the opportunity to explore the possibilities of the sensor network at Stratumseind while using the interface of a Citybeacon. The eye follows you while walking on the street.

INTERESTED?

Experience the concepts yourself and walk around this pillar of innovation.
Want to give feedback on our project? Fill in our questionnaire.


WAVESCAPE
Wavescape shows a dynamic data landscape which represents each coordinate of sound intensity on a specific area at Stratumseind. The big projection covers a full facade and questions if the street is listening.
"FOCUS ON EXPERIENCE, THOSE THAT WILL ALSO TAKE OWN INITIATIVE TO UNDERSTAND."
STRATUMSEIND, EINDHOVEN


BLOB
"FOCUS ON EXPERIENCE AND INFORMATION ABOUT THAT EXPERIENCE, THAT CAN NOT EASILY BE IGNORED"
BLOB is an interactive projection which tracks movement and follows people who are passing by. Meanwhile, your feet are lighting up, bubbles are leading your attention to an information sign which explains the sensor network and his modalities at Stratumseind.
STRATUMSEIND, EINDHOVEN

CITY BEACON EYE

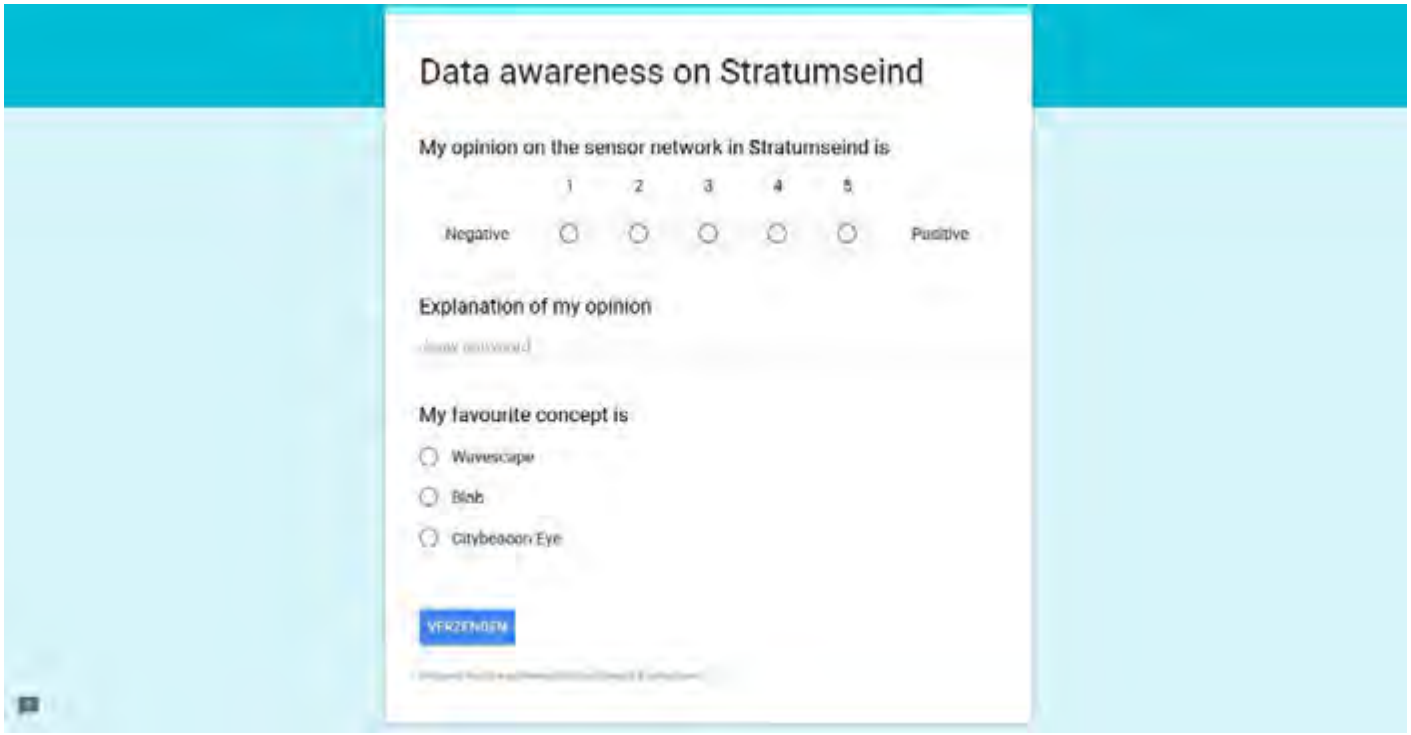
The Citybeacon Eye is an infographic application which gives you the opportunity to explore the possibilities of the sensor network at Stratumseind while using the interface of a Citybeacon. The eye follows you while walking on the street.

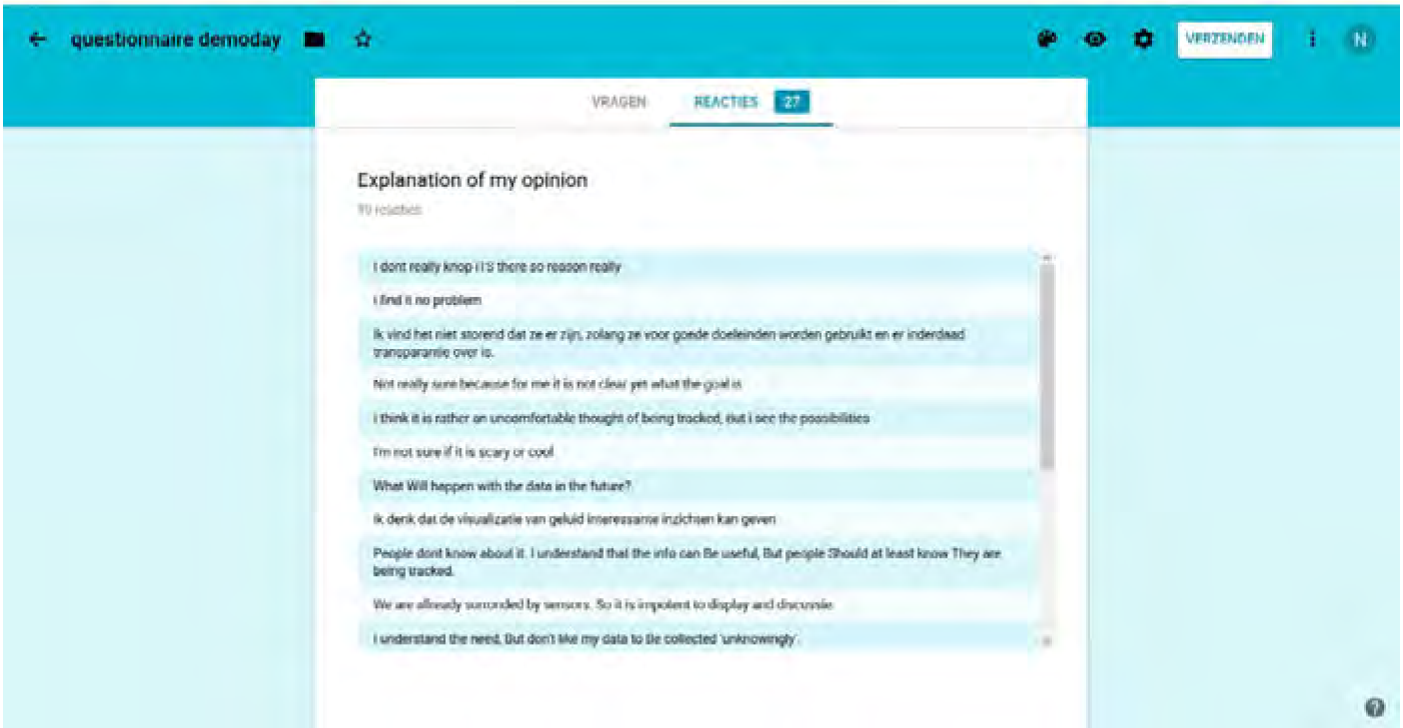
"FOCUS ON INFORMATION"

STRATUMSEIND, EINDHOVEN

27. FUTURE IMPLICATIONS

Questionnaire Demoday





questionnaire demoday
VERZENDEN
VRAGEN
REACTIES 27
Explanation of my opinion
I dont really knop I I S there so reason really
i find it no problem
Ik vind het niet storend dat ze er zijn, zolang ze voor goede doeleinden worden gebruikt en er inderdaad transparantie over is.
Not really sure because for me it is not clear yet what the goal is
i think it is rather an uncomfortable thought of being tracked, but i see the possibilities
I'm not sure if it is scary or cool
What Will heppen with the data in the future?
Ik denk dat de visualizatie van geluid interessante inzichten kan geven
People dont know about it. I understand that the info can Be useful, But people Should at least know They are being tracked.
We are allready surronded by sensors. So it is impotent to display and discussie.
I understand the need, But don't like my data to Be collected 'unknowingly'.

questionnaire demoday
VERZENDEN
VRAGEN
REACTIES 27
We are allready surronded by sensors. So it is impotent to display and discussie.
I understand the need, But don't like my data to Be collected 'unknowingly'.
My favourite concept is
27 reacties