Msc thesis

Delft University of Technology

designing a positive white cane.

a future vision and design approach

student: Thijs te Velde

coach: Rebecca Price

chair: Pieter Desmet

I would like extend my special thanks to my chair Pieter Desmet and mentor Rebecca Price. Without your guidance and support, I would have never known I could pull this off. I would also like to thank Margot Scheltema for her generous advice and access to her private life. You were the big inspiration for this project and I thank you for that.

I would like to thank Renske, Ruth, Femke, Thijs, Aviva, Ernie, Robert, Robbert, Murat, Mustafa and all of the other kind people at Visio Den Haag for their help. Without the insights that you provided, this project would be nothing.

I would like to thank the gentlemen working at the PMB for their patience with me. Better safe than sorry.

I would like to thank Kaylee, Marjan, Leo, Heleen, Shay, Hidde, Sven, Stijn and everyone else that is close to me for keeping me sane-ish over the course of this project.

I would like to thank all of my friends at the faculty of Industrial Design Engineering for their inspiring work. Seeing you thrive and make both yourselves and the world better has been my driving force over the course of this project.

"I put down my robe, picked up my diploma,
Took hold of my sweetheart and away we did drive,
Straight for the hills, the black hills of Dakota,
Sure was glad to get out of there alive."
- Bob Dylan

Chapter i executive summary.

⠠⠉⠓⠁⠏⠞⠑⠗ ⠊ ⠑⠭⠑⠉⠥⠞⠊⠧⠑ ⠎⠥⠍⠍⠁⠗⠽.

Context & case

You are reading the report for a master's graduation project conducted at Delft University of Technology. This project is chaired by prof. dr. ir. Pieter Desmet and coached by dr. Rebecca Price. The project was initiated by Margot Scheltema, an influential Dutch commissioner with multiple companies. She initiated this project because she is suffering from retinitis pigmentosa, a progressive eye disease, and will soon have to walk using a white guiding cane. However, she finds this cane too stigmatising and is looking for a more positive white cane.

Research

In order to get insights into possible design directions for a positive white cane, extensive user research was conducted. This research was conducted in collaboration with Visio, an institution that helps the visually impaired that is based in Den Haag. With help from Visio, three auto-ethnographic studies were conducted, as well as one generative session and three observation studies. These observation studies were conducted by means of participant observation and gave insight into how cane walkers are trained, how the visually impaired interact with technology and how visually impaired people can be profoundly misunderstood by their environments. Independently, two observations of Margot Scheltema were conducted that gave insights into how the visually impaired are still able to live a rich life. Also, one generative session was conducted and two events were visited that include a trade fair and the Dutch retina day.

The research shows that the visually impaired face multiple problems on a daily basis. These problems include increased visibility due to (the effects of) visual impairment, loss of agency, difficulty communicating (the effects of) visual impairment and experiencing a negative self-image. Some attitudes towards assistive devices were also observed, and these are connecting the image of the assistive device to self-image, facing the reality of the situation, not letting the opinions of bystanders affect you and being concerned about the social effects of using specific assistive products. From these insights, four personas were created that can be places in certain situations in a journey map. These personas, combined with an extensive literature study and the journey map served as a basis to develop design proposals upon.

Design proposal

After some failed attempts to reaching a meaningful design proposal, a tool was created that allows concepts to be developed while keeping research front and center. The final concept consists of a modular cane that used contemporary technology to give the visually impaired an edge in developing their unique skills and add their insights to the world. It leverages positive aspects about being visually impaired and amplifies them, making them actionable. Three embodiments of this modular, open-ended design were developed and presented in scenarios. The aesthetics of the cane were designed in such a way that it shows the technological advances it makes use of, while still having a very striking and unique appearance. Combining the added benefits with this unique identity brings together multiple strategies that serve the purpose of de-stigmatising assistive products that were found in literature research.

Validation

The concept was validated using a stigmaticity test and a generative session at Visio using visually impaired participants. The session at Visio gave insights into what kind of data the visually impaired imagined to be generating, with whom they would want to share that and which degree of privacy they would prefer to be associated with which kind of data. The stigmaticity tests shed some light into the effect of the aesthetics of the positive white cane. In these tests, the dyadic distance between participants and a research confederate were measured and the amount of looks the research confederate received were recorded. It was found that, in the female research confederate, dyadic distance was significantly closer when wielding the positive white cane. This means that people were more comfortable getting closer to her than when she was wielding the current white cane. This was also the cane with the male research confederate, but less significantly so.

Conclusion

The results of this design project suggest that a positive white cane be made that combines advances in technology and a unique aesthetic that not only de-stigmatised the white cane but also brings meaningful new features to the visually impaired. These new features will allow them to become more connected, learn faster and contribute to society in a more direct manner. The data generated by this positive white cane would also serve researchers in their attempts to shape the world and make it more inclusive for everybody. Next steps that can be taken include the making of functional prototypes, holding joint workshops with both professionals working in the field of visual impairment, visually impaired users and government workers to explore the possibilities the positive white cane has to offer and many others. This project will exhibit at the Design United exhibition at Dutch Design week and I hope to make many connections there that could potentially allow me to develop this project further.

Chapter ii Introduction.

Project brief.

The project brief is to design a positive white cane. The classic white cane is a tool that has been used by visually impaired people for quite some time. For all intents and purposes, it works fine, but it also comes with the negative stigma that many assistive products come with. Through subtle social and psychological interactions between product, user and bystanders, negative stigma arrives surrounding the use of the product that makes its intended target group reluctant to use it, as it is not seen as matching their personal identity.

Project goals.

The master's graduation project is an interesting one because, next to delivering a good result to all relevant stakeholders and showing one's skill as a budding designer, it is also the last project in which the student is relatively free to set their own learning goals and work on them. Because of this, this section will be divided in two parts: project goals and learning goals.

The project goals are somewhat inherent in the project brief but have been elaborated on some more to also define the scope of the project. The first project goal is ***to execute extensive user research***. Because of the empathic nature of this project, understanding the user and being able to empathise with them will be key to producing a satisfying result. This project goal can also be defined as a learning goal as I would like to do these kinds of projects in my professional life and have to grow in these design methods in order to have a chance at getting into that industry. The sub-goals for this goal can be defined as gaining empathy and understanding for the target group and building a strong network of stakeholders.

The second project goal is ***to add to the body of research on assistive products and product stigma***. I would like this project to employ a research through design methodology (on which more can be read in section 1.1.4). This means that the outcome of this project will consist of research in the form of design artefacts. This has the implication that the resulting design concepts can be quite speculative, as long as the path towards them is clear and a discussing can be held about whether or not we want to go to a future that allows these products to exist. Whether this goal entails publishing a scientific article or not remains to be seen and is up to the project planning.

The third project goal is ***to take the first steps towards developing an interaction genre for the visually impaired***. Interaction genres are already well-established in GUIs (graphical user interfaces, for more, see section 1.1.3). Interactive products for the visually impaired are, as of now, mere adaptations on products meant for sighted users and do not make use of their particular skillset. I aim to develop an interaction framework during this project that leverages the skills of the visually impaired and allows them to interact with the products in their environment in a deep and expressive manner.

The learning goals both result from the nature of the graduation project as described above and emerge through reflection. The first of the learning goals is ***to deliver a graduation project that shows my design process to future employers***. I believe that, in design, process is everything. Through showing the connection between result and process in the design process, one can show capacity for reflection as well as designerly skills. In this project, I want to show that I am skilled at executing a user-centred design approach that combines with academic skills to deliver a future product-serivce-system that is based on real knowledge. I believe the design field to be growing more and more to interactive systems of products and users, and want to show through this project that I am fit to participate in the shape of design to come.

The second learning goal is ***to incorporate prototyping in the design process more***. I have always been a believer in the hands-on approach to designing and the notion of "thinking with the hands", but have so far failed to become skilled in it. In this project, I would like to involve different methods of prototyping during different phases and reflect on their use. I have previously been a very screen-based designer in that I did a lot of desk research, sketching and thinking but rarely went out into the field or thought using my hand. In this project, I would like to change that.

The third learning goal is ***to build and leverage an extensive network of stakeholders***. This project has great opportunity for that since it is initiated by Margot Scheltema, an influential woman in the Dutch finances circles. This is my first opportunity to engage multiple parties in my project and I intend to fully grasp it.

section 1: research.

Chapter 1.1 literature review.

⠠⠉⠓⠁⠏⠞⠑⠗ ⠼⠁⠲⠼⠁ ⠇⠊⠞⠑⠗⠁⠞⠥⠗⠑ ⠗⠑⠧⠊⠑⠺⠲

1.1.1 Literature review.

This literature review will present an academic framework on which this design project is built. It deals with multiple themes that all come together to form the context in which this project lives.

The first paragraph concerns assistive products and the stigma surrounding them. There exist many physical and mental disabilities in the world and just as many products to alleviate their effects. These assistive products can be used to help people live normal lives but also have many drawbacks. This causes there to be a low adoption rate (Scherer, 2015). There are, however ways to make assistive products appealing (De Barros, Duarte & Cruz, 2012). Stigma is a subject that is very much linked to assistive technology. The products we use have a definite effect on our perception of ourselves and others (Belk, 2002). Products can cause us to categorise others in certain groups or form expectations or certain attitudes. These attitudes towards users of certain products can be positive or negative. Consider for example your attitudes towards a person wearing an expensive Rolex wristwatch. Depending on one's predispositions towards these watches and the associations they carry, one could expect the wearer of this watch to be wealthy, cultured, appreciative of craftsmanship or annoyingly pompous. Assistive products like the white cane are mostly bearers of negative stigma (Vaes, 2014). This paragraph considers the causes of this negative stigma, how it can be assessed and how it can be changed through design.

The second paragraph describes specific deal considerations for the visually impaired. The visually impaired are a unique target group with unique needs that need to be taken into consideration when designing for them. Especially in the design of interactive connected products, which are as of now often screen-based (Van Campenhout et al., 2013). These screen-based devices mainly appeal to our cognitive skills and not our senses and motor skills (Djajadiningrat et al., 2004). This projects chooses the domain of tangible interaction as a valuable for visually impaired people because it "materialises the dematerialised" (Van Campenhout et al., 2013). This is especially important because this project deals a lot with connectivity. It also considers the principles of inclusive design to make the proposed design accessible for all kinds of visual impairment and skill.

The third paragraph talks about design research and ways to uncover latent user needs. It will outline various user research methods that have been employed during this project. Some of these methods draw from own experience (Ellis et al., 2011) while others try to get design insights straight from the users they will impact through observation and prototyping. Several methods that are made specifically for designing for and with visually impaired participants will also be discussed (Metatla et al., 2015).

The fourth paragraph deals with the technological and social trends that ultimately inform the future vision this project points toward.

1.1.2 Assistive products.

In Possessions and the Extended Self (Belk, 2002), Russel W. Belk tries to understand consumer behaviour by seeing our possessions as "part of ourselves". Belk identifies four stages in the functions of possessions in human development. To us, the most relevant are the third and fourth stages in which adolescents and adults use possessions to help manage their identities and the elderly use possessions to achieve a sense of continuity and preparation for death, respectively. Belk posits that the extended self is not "(...) seen to be limited to external objects and personal possessions, but also included persons, places and group possessions as well as such possessions as body parts and vital organs". It can be argued that Belk reasons from Cartesian body-mind dualism (a concept which will be relevant in the next section), but nevertheless shows how important possessions and products are to the construction of self. A especially interesting subset of products that have a particularly large impact on the construction of self-image are assistive products.

Assistive products are products that help disabled people - be it mentally or physically - cope with and in some instances even overcome their challenges. However, their use does not come without any drawbacks. In Assistive Technology use and Stigma (Scherer, 2015), Marcia Scherer focuses on the issue of stigma and its impact on assistive technology use. She identifies issues such as "family expectations of the AT (assistive technology), [and] viability resulting from use of AT in public settings (...)". The article also posits that stigma in assistive technology is a complex issue that stems from multiple issues, including but not limited to product aesthetics, gender and age appropriateness, social factors such as ability to acquire assistive technology, culture around disability and general device features and design. As an example, it has been found that "adolescents with disabilities tend to be more concerned with their appearance and projected image than older adults" (Scherer, 2015).

It is clear that stigma can be solved differently for each and every target group. In a study on low acceptance rates in children, researchers found more factors that can contribute to users rejecting assistive technology (Gori et al., 2016). These factors were found by analysing existing products for the visually impaired and include (i) invasiveness, (ii) high cognitive load, (iii) need for substantial training, (iv) poor performance, (v) lack of action perception link and (vi) lack of multi-sensory integration.

The two reasons that people are most reluctant to use assistive products are aesthetics and stigma (Barros, Duarte & Cruz, 2012). One way to increase acceptance rate in assistive products is to present them as consumer products. This has to do with both the aesthetics of the assistive products and the way they are presented. Research has shown that designing and presenting assistive products as consumer products increases their adoption rate (Barros, Duarte & Cruz, 2012). One way to present assistive products as consumer products is to develop a solid design language. The way this is approached in this project is using a six-step process, in which the design language is constructed by doing research, along with isolating and embodying themes and principes (Rheinfrank et al., 1986). If the assistive product developed in this project is not only aesthetic in terms of interaction, but also in form and materials, it will produce a better emotional experience and even work better (Desmet & Hekkert, 2007; Norman, 2003).

1.1.3 Design considerations.

Around the globe, researchers and designers are working to make the world and the products we use more accessible for people with disabilities. Since the release of Viktor Papanek's seminal work Design for the Real World, designers have been directing their effort more and more to helping those groups in society who actually need it (Papanek & Fuller, 1972). A quote from Papanek's book nicely illustrates his "10 percent-rule".

> *"Why this polemic? What is the answer? Not just for next year but for the future, and not just in one country but in the world. During the summer of 1968 I discovered a Finnish word dating back to medieval times. A word so obscure that many Finns have never even heard it. The word is kymmenykset. It means the same thing as the medieval church word tithe. A tithe was something one paid: the peasant would set aside 10 per cent of his crop for the poor, the rich man would give up 10 per cent of his income at the end of the year to feed those in need. Being designers, we don't have to pay money in the form of kymmenykset or a tithe. Being designers, we can pay by giving 10 per cent of our crop of ideas and talents to the 75 per cent of mankind in need."*

One look at the portfolios of globally influential design firms such as frog and IDEO shows that modern designers and design firms abide by this rule. Not only large design firms, but researchers are making an effort to make things easier for the per cent of mankind in need - among which are the visually impaired. In the next sections, we will consider some examples and try to learn from them. We will also outline some design considerations that can be taken into account to more meaningfully design for the visually impaired.

Researchers from the Italian National Research Council have developed a search engine interface for the blind (Leporini, Andronico & Buzzi, 2007). The reason they give for developing this specific application for the visually impaired is that "(...) the search and retrieval of information is important for everyone but it is crucial for people with disabilities, especially for the blind, who cannot access printed information." They present several limitations and downsides to the widespread use of screenreader and propose guidelines for better interface design, the most relevant of which is the use of sound cues. The rest of the guidelines concern the underlying structure and website architecture which affects the order in which certain items are read by the screenreader. A project done at the Department of Applied Computing at the University of Dundee, Scotland, offers a more interesting approach (Gregor, Newell & Zajicek, 2004). Using the principles of User Sensitive Inclusive Design (Newell & Gregor, 2000), they designed a web page that allows for dynamic diversity. This web page allowed for use by persons of various levels of visual impairment and computer skills. It was achieved by creating an adaptive webpage that can be configured to remedy the lack of representative user group and to accommodate for an incredibly diverse group of users. Voice support was added as well as the option to highlight and enlarge pieces of text. The researchers suggest that other aspects such as confidence and memory capacity should also be addressed by limiting the amount of available functionality, but allowing users to add additional facilities. Some more guidelines for User Sensitive Inclusive Design are to "(...) (1) determine common dimensions on which users can be mapped, (2) designing flexible interfaces, (3) present information most effectively to people with disabilities in various modalities and (4) design interfaces which do not require good memory and language capabilities" (Newell & Gregor, 2000).

In this project, user research attempted to follow the first guideline as laid out by Newell and Gregor. The second, third and fourth guidelines can be approached by using the principles of tangible interaction. Tangible interaction is an interaction framework that attempts to make the intangibility of digital and electronic devices tangible again. What started as an attempt to balance the rise of Virtual Reality by conceiving of computer-augmented environments (Wellner, Mackay & Gold, 1993), has become a full-blown research area, taking cues from fields such as ubiquitous computing and human-centred design (Ishii & Ullmer, 1997; Norman, 1988). Because one of the goals of this field is to return interaction design to a discipline that "... respect(s) all of man's skills: his cognitive, perceptual-motor and emotional skills" (Djajadiningrat et al., 2004), combined with the insight that simple daily life calls on a great deal of cognitive skill from visually impaired people, tangible interaction is deemed a promising framework in the design for the visually impaired. Some of the challenges embedded in this field, especially when talking about design for the visually impaired, is how to communicate the results of an action - in other words, how to present feedforward. In the design of tangible interactions during this project, the frogger framework by Wensveen, Djajadiningrat and Overbeeke will be used (Wensveen, Djajadiningrat & Overbeeke, 2014). This framework seems to based on work by Gorbet, who presents a framework of design principles for physical-digital objects (Gorbet, 1998). In traditional GUIs (graphical user interfaces), a set of interaction genres have already been established. Genres are "... a set of design conventions anticipating particular usage contexts with their own conventions" (Bellotti et al., 2002). The authors give examples such as the flashing cursor indicating that text can be typed. There are no such genres in tangible interaction yet, but one of the goals in this project is to develop such genres for the visually impaired.

As of now, all controls in electronic products look and feel roughly the same (Norman, 2013). That is why these controls are currently explained by textual information on screens. Obviously, this is not of much use to the visually impaired. As observed in the research done for this project, this results in a disjointed and dissatisfying interaction with current electronic products (see section 1.2.2). Norman's natural mapping principle could offer a solution, in which the way controls are laid out spatially explain their purpose. It does however not apply to design problems where there is abstract data involved that has no physical counterpart (Djajadiningrat et al., 2004). One can also use a semantic approach, in which the product's appearance and controls become signs (Krippendorff & Butter, 1984). This is more of a metaphorical approach and depends on the user's experience and knowledge. In their paper Tangible products: redressing the balance between appearance and action Djajadiningrat et al. propose a more direct approach, one that uses "... the sensory richness and action-potential of physical objects as carriers of meaning and interaction" (Djajadiningrat et al., 2004). The authors see a certain aesthetics of interaction in it, they are, in their words "... interested in not only the structural but also the affective aspects of affordance." In their mind, there are four aspects to aesthetic interaction. The third aesthetic element to interaction is the aforementioned aspect of skill. Well-designed interactive electronic products allow users to grow and learn whilst using the product (Djajadiningrat, Matthews & Stienstra, 2007). A study in two-handed input done by William Buxton and Brad A. Myers shows that the introduction of skill in the control of electronic products not only increases efficiency in use, but satisfaction as well (Buxton & Myers, 1986). Another thing that can increase efficiency in the addition of haptic feedback. Haptic feedback is unique because it "... supports two-way communications between humans and interactive systems, enabling bidirectional interaction between humans and their surroundings" (Hale & Stanney, 2004). Making the interaction more aesthetic will allow this product for the visually impaired to still experience this product on an aesthetic level (Desmet & Hekkert, 2004).

1.1.4 Design research.

In an empathic design project like this, research is a vital tool towards unstinting unique user needs and producing value. Several qualitative research methods were used in this project. The first tool that was used towards understanding the visually impaired user group was autoethnography. Autoethnography is a research methods that breaks with the traditional empirical methods and instead focuses on subjective experience. It is "… an approach to research and writing that seeks to describe and systematically analyse (graphy) personal experience (auto) in order to understand cultural experience (ethno)" (Ellis, Adams & Bochner, 2011). In order to get a more objective view, participant observation was used. For this, the book Qualitative Research Methods: A Data Collector's Field Guide was used (Mack et al., 2005).

In ideation, design research can be seen as a mix between thinking and doing, an approach that Christopher Frayling describes as research for design (Frayling, 1993). Frayling describes this practice of research as "… research where the end product is an artefact - where thinking is, so to speak, embodied in the artefact, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication". This approach treats the outcome of research, the design artefact, as the ultimate goal of the process. Another more applicable approach to research in design is research through design. This is a method that "… stressed design artefacts as outcomes that can transform the world from its current state to a preferred state. The artefacts produced in this type of research become design exemplars, providing an appropriate conduit for research findings to easily transfer to the HCI research and practice communities" (Zimmersman, Forlizzi & Evenson, 2007). In other words, a practice through which designers focus on making the right thing. In this process "… the final output of this activity is a concrete problem framing and articulation of the preferred state, and a series of artefacts - models, prototypes, products and documentation of the design process". Because of the nature of this project's ideation process (using a lot of empathy for a target group that has a profoundly different exerperience than the designer), a technique called informance design was considered. In informance design, designers can, through "… the use of performance techniques such as improvisation […] promotive multi-disciplinary, collaborative design work in ways that are as much visceral and experiential as intellectual and reflective" (Burns et al., 1994). A very nice example of how this can impact a design project for the better can be found in the paper Cardboard Computers: Mocking-it-up or Hands-on the Future (Ehn & Kyng, 1992). Another ideation tools that was used is called making for exploration (Frens & Hengeveld, 2013). This is a hands-on ideation approach that focuses on exploration and elaboration through actively engaging with materials. Through iterative prototyping, the designer generates insights during the design process. The prototypes that come out of this process are filters, consciously limited in scope to only research one aspect of the design (Lim, Stolterman & Tenenberg, 2008). In this stage, is it important that the designer engages with physical, preferably low-fidelity materials such as cardboard and foam. This is because the tools we use have the same fidelity as the insights that we need. As we move up in the design process, the fidelity of the problems we want to solve (such as an exact fillet of a product) increases, and so should our tools. A second reason for this low-fidelity, interactive prototyping is reflection. Time and time again, it has been found that physical making has a strong connection with cognition. As one team of researchers states it: "Successful product designs result from a series of "conversations with materials." Here, the "conversations" are interactions between the designers and the design medium - sketching on paper, shaping clay, building with foam core" (Hartmann et al., 2006). An inspiring application in the field of interaction design of this technique can be found in Rich Interaction: Integrating Form, Interaction and Function (Frens, 2006). Another reason is to train the creative body. With practice, designers can turn into craftsmen of designing interaction, becoming attuned to certain interaction qualities and moving certain parts of knowledge to their hands (Sennett, 2008).

The pictures on the adjacent page show representations of design approaches that were deemed interesting in research: designing though making.

1.1.5 Trends.

In Smart Cities in Europe, the researchers point to multiple characteristics of a smart city, six in total (Caragliu, Bo & Nijkamp, 2009). All are interesting, but three of these are especially important in the context of this project. First of all, the fact that smart cities are characterised by "... the utilisation of networked infrastructure to improve economic and political efficiency and enable social, cultural and urban development". This point places emphasis on connectivity and links it to growth. The second important point is "... a strong focus on the aim to achieve the social inclusion of various urban residents in public services." Connectivity and the use of connected products by groups on society that have been traditionally at a disadvantage could help them gain a comfortable role in society and still have a sense of belonging in it. This brings us two the third point, being "... profound attention to the role of social and relational capital in urban development. A smart city will be a city whose community has learned to learn, adapt and innovate". I see the visually impaired community as a good candidate for championing this role. Who else has learned to learn, adapt and innovate as well as them? A few key areas in which smart cities could be use have been described and identified (Zanella et al., 2014) but not much has been done yet in the field of using urban IoT and smart city technologies to improve accessibility and strengthen the role of the impaired in society. An interesting aspect in which smart city technologies and the visually impaired can link are in policy. As stated in one article, "... transformation from an ordinary (non-smart) city to a smart city also entails the interaction of technological components with political and institutional components" (Chourabi et al., 2012). The visually impaired community is a master of their own experience and could have direct impact on making cities accessible. This is also observed in observational research done during this project (see section 1.2.2). In order to help city planners design more accessible cities for the visually impaired, data is needed. In big data, three sources of data can be identified (Kitchin, 2014). These sources are directed, automated and volunteered. Directed data are gathered by surveillance and are already being collected on a large scale using for example CCTV or passport controls. Automated data consist all types of data that are generated by devices that are used - examples that can be given include payment history, internet search history and many more. Volunteered data is data that is voluntarily provided by the user of a product or system. Example of data are pictures that are uploaded to the internet or shared locations. One large critique on the development of smart cities is the risk of also creating a panoptic city (Kitchin, 2014), in which all aspects of citizens' lives are logged and processed. Some researchers propose that life-logging technologies forget the things they record (Doge & Kitchin, 2007).

There are difficulties in getting the visually impaired target group to participate in smart cities, however, and these lie in the digital divide. To cite Winberg and Bowers: "... the more widespread are innovations in computer interaction which require visual ability, the more visually impaired users are disenfranchised from leading edge technical developments" (Winberg & Bowers, 2004). As observed during observational studies of ICT-related training with the visually impaired, this group of people has to work very hard at gaining access to digital tools (see section 1.2.2). This is not a matter of Access Digital Divide (ADD), but of Social Digital Divide (SDD). This Social Digital Divide is explained by the skill levels people have when they using these digital tools (Hargittai, 2002). Kvasny even goes further and uses the words digital inequality to "... signify a shift and distinction in focus from access to use of information and technology" (Kvasny, 2002). Not being able to use the internet is problematic because of its widespread use in today's society. In the information age, the internet can be seen as a necessity for living. Letting some groups in society not utilise its benefits can set them back considerably, or in the words of Floridi: "... building an equitable information society for all is a historical opportunity we cannot afford to miss" (Floridi, 2001). Floridi offers a set of universal information ethics, which are based on the notion of allowing access to information for all and ensuring the quality and security of that information. A connected white cane that places itself within the network of the smart city will allow visually impaired users to interact with the Internet in ways that are more suited to their particular skills. To allow to collaboration with sighted users within this system (using a tangible interface), several design rules have to be abided by (Winberg, 2004). In order to allow for collaboration with graphical interface users, these tangible interfaces have to (i) provide access to the same functionalities as are available in the graphical interface, (ii) allow for exploration and manipulation of the system - this gives both user groups the same level of control over the system and allows the visually impaired user to explore all functionalities (iii) be coherent with the graphical interface. The visually impaired participant should also be able to have a meaningful contribution to the system (Winberg, 2006).

Assistive products and product stigma.

Reasons for low adoption:

1. invasiveness.
2. high cognitive load.
3. poor performance.
4. lack of perception-action link.
5. lack of multi-sensory integration.
6. aesthetics.
7. social stigma.

(Schrerer, 2015; Gori et al., 2016; Barros, Duarte & Cruz, 2012)

Possible solutions:

1. reshape meaning of product.
   - advances in technology.
   - identify product with user.
   - strengthen product (brand) identity.
2. empowering users.
   - additional features.
   - boost social skills.
   - boost group identity.
3. reshape context.
   - present as consumer good.
   - educational campaign.
4. better fit between user and (interaction) design.

(Vaes, 2014; Rheinfrank et al., 1986; Barros, Duarte & Cruz, 2012)

Effects:

1. improved aesthetic and emotional experience.
2. a better working product.
3. greater adoption rate.

(Desmet & Hekkert, 2007; Norman, 2003; Barros, Duarte & Cruz, 2012)

Design considerations.

Dynamic diversity:

1. modular design.
2. design for skill.
3. multimodality.

(Newe
Matthews & Stien

Multimodal interaction:

1. using sound cues.
2. tangible interaction.
   - genres.
   - perceptual-motor s
3. haptics.

(Leporini, Andronico & Buzzi
Wensveen, Djajadiningrat
Belotti

ell & Gregor, 2000; Djajadiningrat, stra, 2007; Buxton & Myers, 1986)

skills.

, 2007; Djajadiningrat et al., 2004; & Overbeeke, 2014; Gorbet, 1998; et al., 2002; Hale & Stanney, 2004)

Social and technological trends.

Smart cities:

1. connectivity.
2. social inclusion.
3. social and relational capital.
4. interaction between technology and politics.

(Caragliu, Bo & Nijkamp, 2009; Chourabi et al., 2012)

Big data:

1. multiple sources.
   - directed.
   - automated.
   - voltunteered.
2. ethics of forgetting.

(Kitchin, 2004; Doge & Kitchin, 2007)

Digital divide:

1. digital equality.
   - Access Digital Divide (ADD).
   - Social Digital Divide (SDD).
2. collaboration with sighted people.
   - access to same functionalities.
   - allow for exploration of system.
   - coherent with sighted GUI.

(Winberg & Bowers, 2004; Hargittai, 2002; Floridi, 2001; Kvasny, 2002; Winberg, 2006)

Chapter 1.2 user research.

1.2.1 User research.

As presented in both the introduction and literature review, user research is vital to the execution of this project. User research will not only allow us to uncover latent knowledge in the group we are designing for, but also to empathise with them. User research is also vital in the ideation phase, as concrete observations can be used to kickstart ideation. Generative sessions can also be rich sources of inspiration for ideation. This part of the graduation report will be structured as a report in itself. First, methods will be considered and the research results will be presented. Afterwards, conclusions will be presented and main insights. The timeline of research activities can be found on the facing page.

The research questions that were determined before starting research are the following:

1. What are the struggles visually impaired people face on a daily basis?
2. What are their issues towards assistive devices?

With these two specific research questions, it is hoped that a first steps towards a design can be taken. This design will both have a functional use for the visually impaired target group as well as be seen as favourable by them and the people surrounding them.

01-03-2019
autoethnography
at Visio

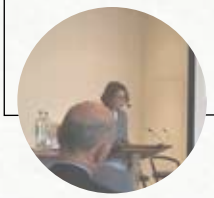
06-03-2019
autoethnography
in Delft

07-03-2019
observation
Margot Scheltema

20-03-2019
autoethnography
in Den Haag

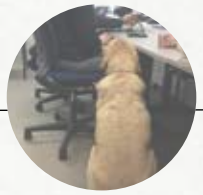
19-03-2019
autoethnography
in Leiden

16-03-2019
visit
ZieZo fair

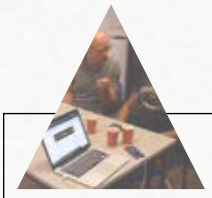


28-03-2019
observation
Margot Scheltema

02-04-2019
observation
cane training

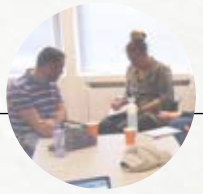


02-04-2019
observation
ICT training



17-04-2019
session
at Visio

12-04-2019
session
at TU Delft



02-04-2019
observation
social worker

22-06-2019
visit
Retinadag

autoethnography

observation

miscellaneous

1.2.2 Methods.

In this section the data collection methods used over the course of the research are described. While designing the research strategy, the principle of triangulation was used (Berg, 2001). By using a combination of different data collection methods, research subjects and researchers, the aim was to capture more rich data, and to avoid a one sided narrative.

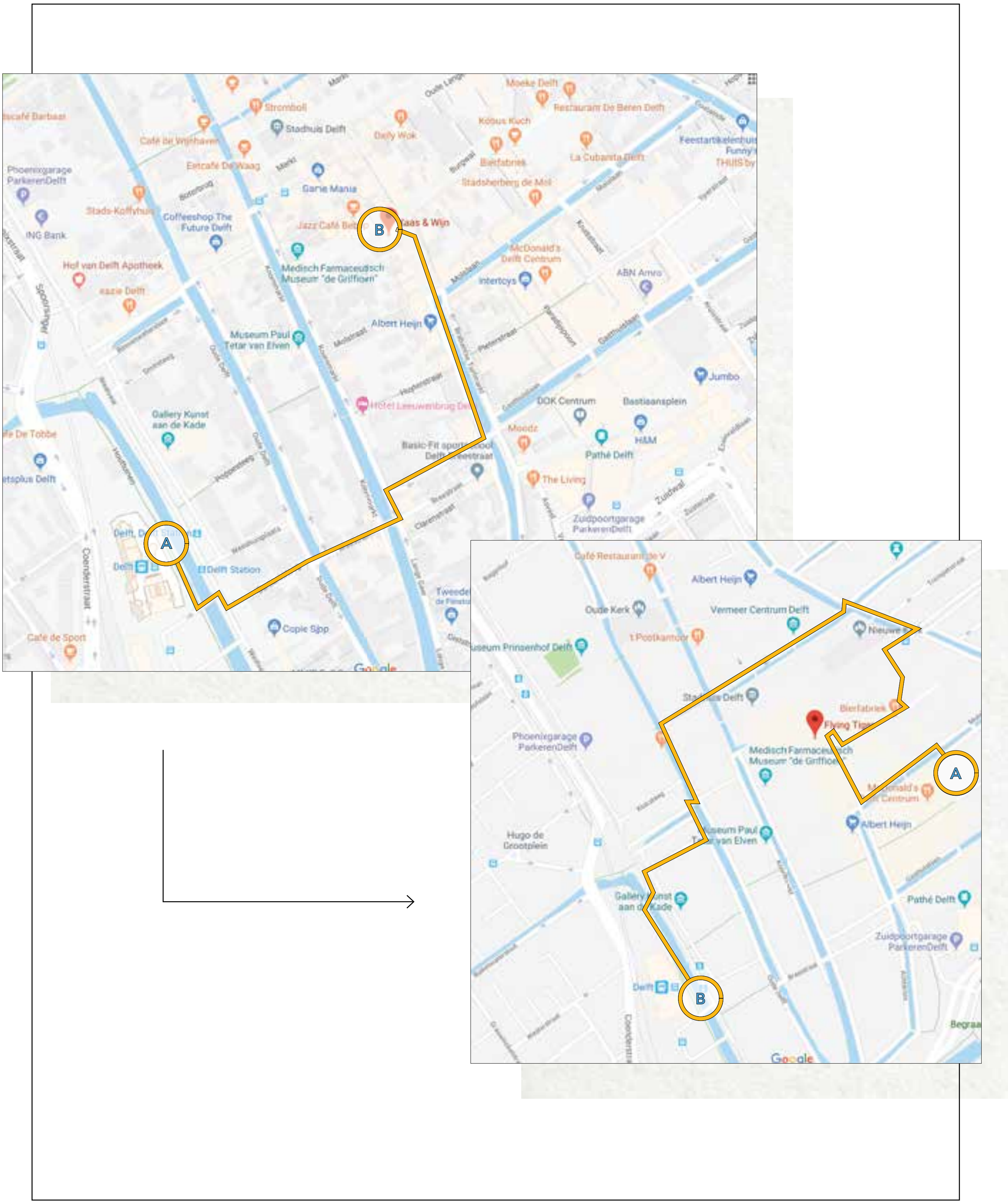
Autoethnography

As Wall (2006) puts it, autoethnography "allows the author to write in a highly personalized style, drawing on his or her experience to extend understanding about a societal phenomenon". As the subject of the study is highly personal and related to emotions and struggles, a similarly personal and sensitive method is needed, alongside the more traditional qualitative research technique of participant observation.
Autoethnography can take several different forms. In the course of this study autoethnographic texts were the product of the researchers reflections on fieldwork activities. In the creation of autoethnographic texts, researchers tell about their experiences in most cases using the first person. Aesthetic qualities of the text are also important to convey the experience to the readers (Ellis, Adams, & Bochner, 2011).
During this study, the two researchers experienced navigation with limited vision, and analysed this experience, thus creating their personal narratives. As the autoethnographies were created by two researchers, the differences between voices and narratives could be subjects of analysis as well. Using this kind of self-observation as a research tool had two main goals. Next to obtaining knowledge on the main research question, the secondary goal was to develop empathy towards the user group, which will aid the design phase and also the communication with users. Having this experience, and looking at it analytically can be a powerful tool in bridging the communication gap resulting from experiencing the world in a different way.
The two researchers took turns in wearing modified glasses. The glasses simulated retinitis pigmentosa, the same condition Margot Scheltema lives with. The second researcher observed the first researcher and also the reactions of the bystanders. The two participants in this study are Veronika Szabo and Thijs te Velde. They are both design researchers conducting their master's graduation project at Delft University of Technology. Features that set them apart from the general populations are their knowledge of design research and their stake in the project. These two participants were selected to allow them to both gain experience in conducting autoethnographic research and participant observation as well as gain insights useful to the graduation projects.

During the activity, audio recordings were taken and the researchers' observations were stated out loud for further processing. After each session, the researchers took quick notes on their most important observations and impressions. After each research activity was completed, both researchers expanded their notes by the help of the audio recording, and also created a text containing their personal narrative of the activity.
This method was used in three sessions. To obtain diverse observations, a variety of locations, times and activities were used. This way the researchers could also compare the experiences between cities and times of day to see if there is a lot of difference between, for example, a familiar or unfamiliar neighbourhood or between rush hour and a quiet morning hour.

In total, the tools used to perform these autoethnographic studies are the following:

- ***Glasses to simulate the effects of retinitis pigmentosa.*** We took a pair of sunglasses and neatly cut out blinds out of thick black paper. We then used a pin to create two small holes in the middle of these blinds to see out of. This simulates the effects of retinitis pigmentosa. We chose to simulate this specific type of visual impairment because one of the main stakeholders in the project suffers from this condition.
- ***Long cane.*** The kind people at Visio allowed us to borrow a used long cane. This particular cane is quite worn as it has been used in many a training but still functions and serves our purposes perfectly.
- ***Mobile phone for audio recording and taking pictures.*** Because we won't be able to record everything using writing when walking around town, we decided to use a mobile phone to record the majority of information.
- ***Field notebook and pen.*** We did, however, still carry around a notebook to note down particularly noteworthy observations.


A
B
Stromboli
Stadhuis Delft
Café de Wijnhaven
Eetcafé De Waag
Markt
Garie Mania
Phoenixgarage ParkerenDelft
ING Bank
Stads-Koffyhuis
Coffeeshop The Future Delft
Hof van Delft Apotheek
Kaas & Wijn
Medisch Farmaceutisch Museum "de Griffioen"
Museum Paul Tetar van Elven
Albert Heijn
Gallery Kunst aan de Kade
Delft Station
Copie Sjop
Café de Sport
Coenderstraat
Moeke Delft
Restaurant De Beren Delft
Kobus Kuch
Daily Wok
Bierfabriek
La Cubanita Delft
Stadsherberg de Mol
McDonald's Delft Centrum
Intertoys
ABN Amro
Jumbo
DOK Centrum
Bastiaansplein
H&M
Moodz
Pathé Delft
The Living
Zuidpoortgarage ParkerenDelft
Zuidwal
A
B
Albert Heijn
Oude Kerk
Vermeer Centrum Delft
't Postkantoor
Stadhuis Delft
Bierfabriek
Phoenixgarage ParkerenDelft
Medisch Farmaceutisch Museum "de Griffioen"
Hugo de Grootplein
Gallery Kunst aan de Kade
Pathé Delft
Zuidpoortgarage ParkerenDelft
Google

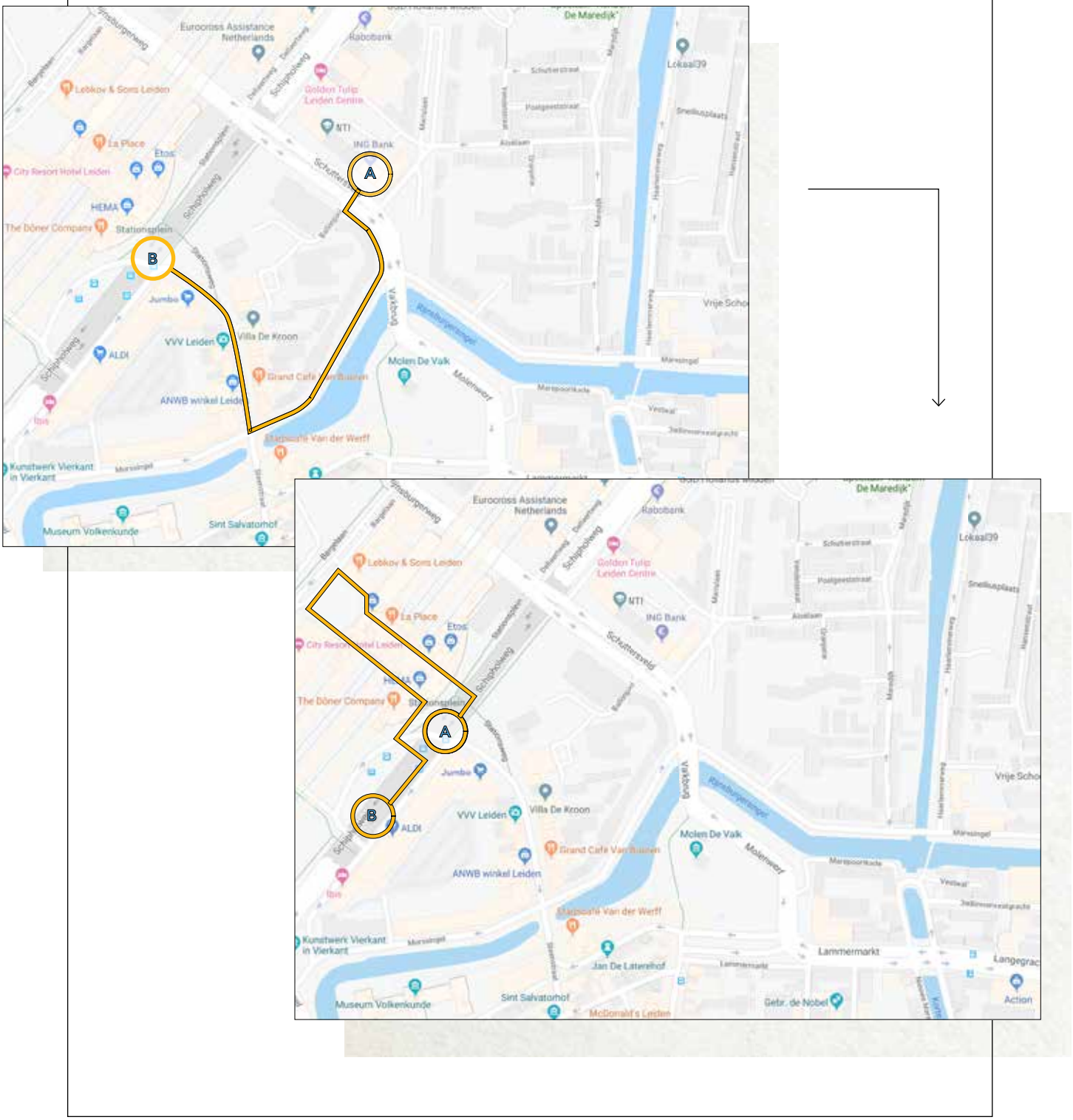
1. Autoethnography in Delft (06-03-2019).
To get familiar with the methods of participant observation and autoethnography, a pilot study was conducted in the city centre of Delft. The secondary goal of this study was to uncover problems that can emerge during execution of the methods, and improvement possibilities of the equipment used. The third and last goal was to get insights into the reaction surrounding visually impaired people and to gain empathy for this target group.
A detailed plan of the session can be found in appendix A. The session consisted of two parts, with a short break in between to switch roles and note down observations and switch roles. The map of the route can be seen in the figures on the adjacent page.
The time schedule for this first autoethnographic study was as follows:

- **11:00: Start of first part of the study** (Veronika guided, Thijs was visually impaired). During this first part of the study, Thijs was getting used to walking around using the modified glasses and cane, and Veronika was probing how much guidance is needed. Veronika and Thijs were also getting used to stating their experiences out loud, and making notes whenever anything noteworthy occurs.
- **11:00: Start walk from Delft central station to Kaas & Wijn** (Brabantse Turfmarkt). During this main part of the first round of study, Thijs noted observations about the visually impaired experience while Veronika noted observations about the reaction of bystanders to the presence of behaviour of a visually impaired person.
- **11:20: Arrive at Kaas & Wijn, buy sandwiches.** During this forced interaction with a bystander, Thijs was making observations about how it feels to execute mundane activities as visually impaired persons, while Veronika was making observations about the behaviour of the people in the store.
- **11:30: End of first part of the study, start of reflection.** Writing notes for narratives. After this, both researchers noted down other key observations while they were still fresh in their memories.
- **12:00: Start of second part of the study** (Thijs guided, Veronika was VI). This is when we change roles. This time around, Veronika will have to get used to walking with the modified glasses and the cane, while Thijs will have to get used to guiding and making observations at the same time.
- **12:00: Start walking back to the station.** The second leg of the study begins. The approach remains the same, the roles are reversed.
- **12:20: Buy notebooks at Flying Tiger** (Phoenixstraat). Another forced interaction with the environment and possible bystanders allowed both researchers to gain empathy for visually impaired people and observe the reactions of the environment to the presence of one.
- **12:30: End of second part of the study, start of reflection.** Writing notes for narratives. After this, we wrapped up the second part of the study and noted down additional observations for use in our personal narratives while they were still fresh in our memories.

2. Autoethnography in Leiden (19-03-2019).
The second instance of this research activity was conducted in Leiden, near the central station. The area around the central station was chosen because one goal of this activity was to find out how people would react to the presence of a visually impaired person in a busy environment. The presence of shops also provided an interesting opportunity to get more data on behaviour and feelings during daily interactions between bystanders and visually impaired people.
This session, similarly to the session in Delft, consisted of two parts, so that both researchers could experience both roles. The detailed plan of this activity can be found in the appendices. The map of the route taken can be seen in the figures on the adjectent page.

The time schedule for this second autoethnographic study was as follows:

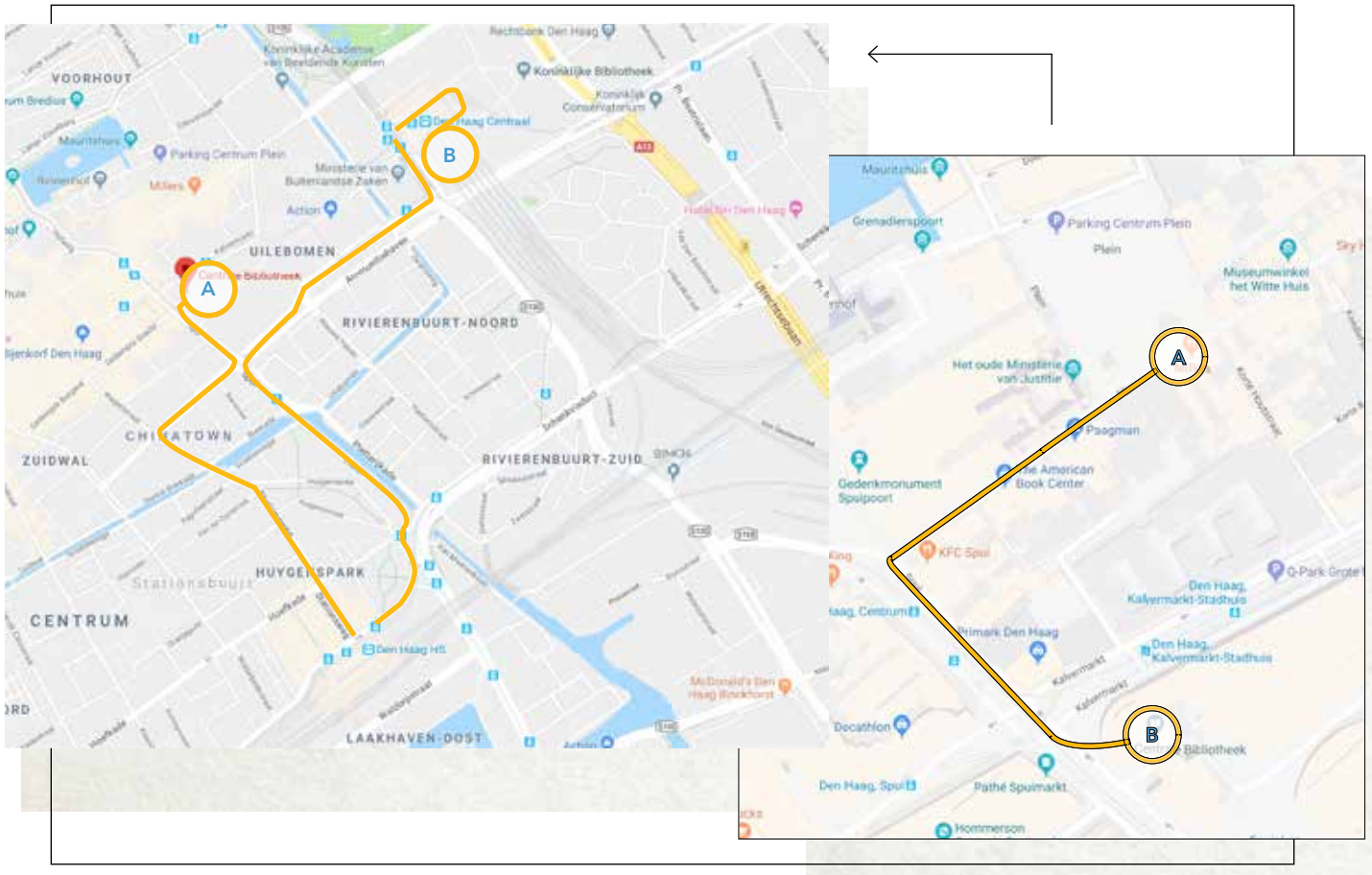
- **11:00: Start of first session.** (Veronika guided, Thijs was VI).
- **11:00: Start walk from ING** (Schuttersveld). in the direction of Leiden Central Station. Similarly to the pilot, Thijs was noting observations about experiencing the walk as VI, and Veronika was observing bystanders reactions.
- **11:20: Arrive at Leiden Centraal.** Enter the station. Entering Leiden Central Station created a possibility to experience navigating among rushing commuters. Differences in bystanders responses were probed, as compared to calmer situations during the pilot.
- **11:30: End of first study. Switching roles.** As opposed to the plan, the researchers switched roles and continued with the observation, as the timeframe available for the study became shorter due to unexpected circumstances.
- **11:30: Start of second session.** (Thijs will guide, Veronika will be VI). In the second part of the study, Veronika was noting observations about experiencing visual impairment, and Thijs was observing bystanders reactions.
- **11:35: Checking in at Leiden Centraal.** Checking in was chosen as an everyday activity that permits how the daily experience changes with retinitis pigmentosa.
- **11:40: Entering Lebkov and Sons.** The activity of buying sandwiches was chosen for this study. After entering, Veronika decided to purchase them at another store.
- **11:50: Buying a sandwich at AH to go.** At AH to Go, Veronika was buying a sandwich. The process of selecting the sandwich and also using the self checkout was observed.
- **11:55: Find the platform to board the train to the direction of Delft.** The last activity was to find the right platform at the train station. Navigation inside the stationand on the platform was observed.
- **12:00: End of second pilot and start of reflection.** Writing notes for personal narratives. After wrapping up the session, observations were noted down. Later, both researchers expanded the notes with the help of the audio recording, and completed their personal narratives about the experience.

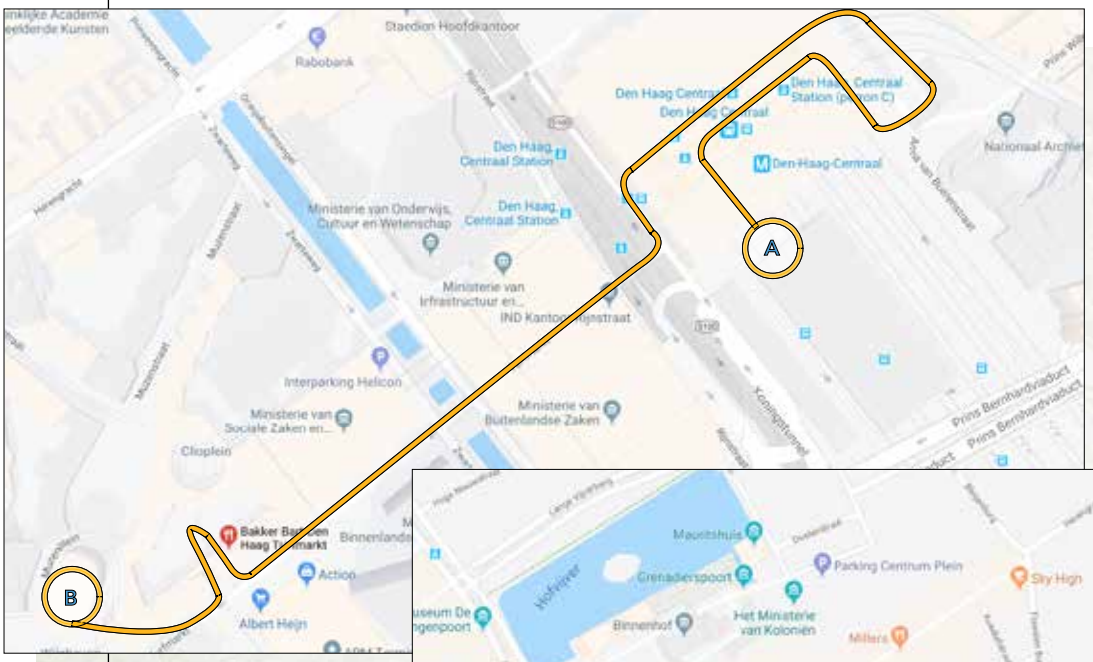

A
B
Eurocross Assistance Netherlands
Rabobank
De Maredijk
Lokaal39
Lebkov & Sons Leiden
Golden Tulip Leiden Centre
NTI
ING Bank
La Place
Etos
City Resort Hotel Leiden
HEMA
Stationsplein
The Döner Company
Jumbo
VVV Leiden
Villa De Kroon
ALDI
Grand Café Van Buuren
ANWB winkel Leiden
Molen De Valk
Kunstwerk Vierkant in Vierkant
Museum Volkenkunde
Sint Salvatorhof
Jan De Lateraalhof
Lammermarkt
Gebr. de Nobel
Action
McDonald's Leiden

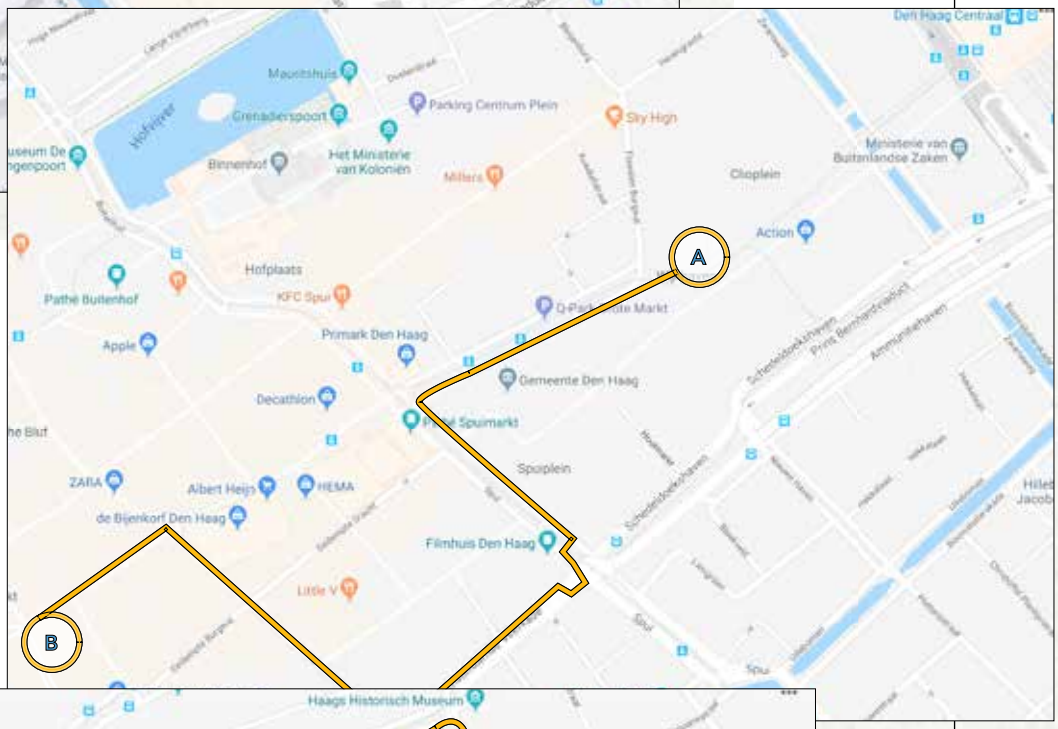
3. Autoethnography in Den Haag (20-03-2019).
The third instance of this research activity was conducted in Den Haag, in the city centre. This session was substantially longer than previous sessions and was designed to be as diverse as possible. Den Haag was familiar territory for one of the participants, but not for the other. A large amount of diverse activities were chosen to get insights into multiple aspects of daily life for visually impaired people.
This session consisted of four parts, each researcher taking up both the role of visually impaired and observer two times. In between the parts, small breaks were included to note down observations and insights. The exact routes and activities to include were decided during the course of the session, to experience a more natural way on navigation compared to the first two studies. This gave the researchers the possibility to react on unexpected situations.
The map of the route taken can be seen in the figures on the adjacent page.

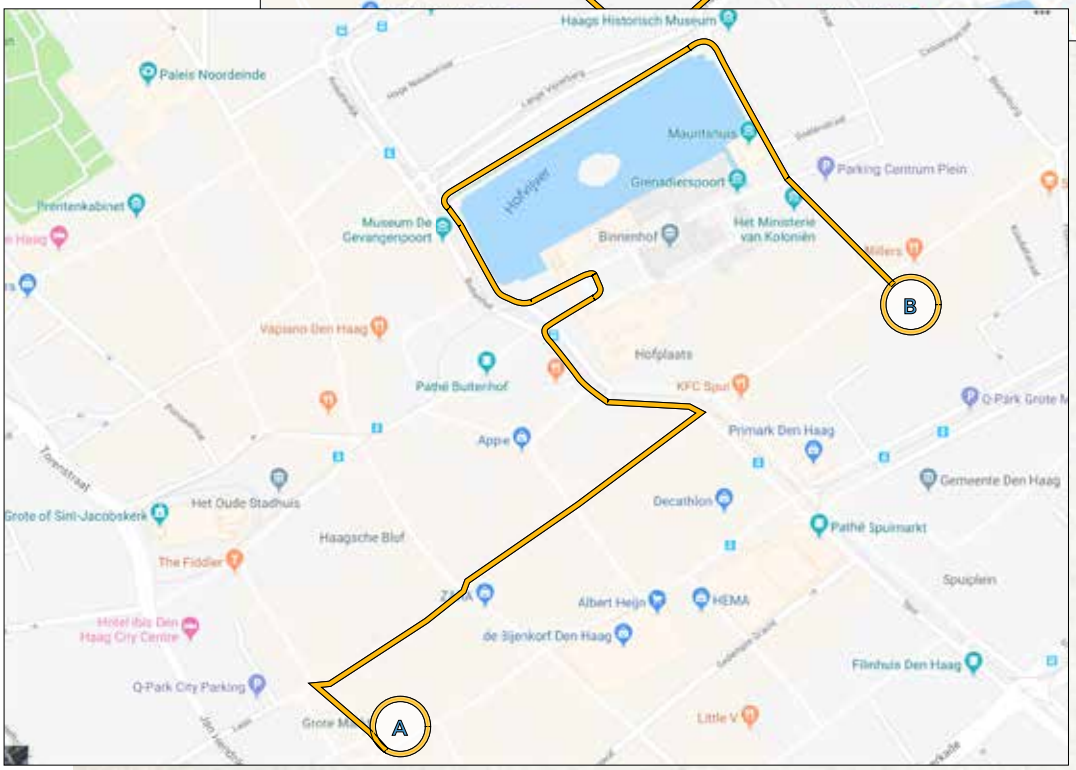
The time schedule for this first autoethnographic study was as follows:

- **8:20: Start of first session (**Thijs guided, Veronika was VI). Exiting Den Haag Centraal. Conversation with political activist. Walking to Bakker Bart (Turfmarkt). Enter Bakker Bart. Buying coffee. Walk to Wijnhaven.
- **8:50: End of first part of the study, start of reflection.** Writing notes for narratives.
- **9:00: Start of second part of the study** (Veronika guided, Thijs was VI). Walk from Wijnhaven to the Spuiplein. Cross the Spui at the Filmhuis. Turn to the Amsterdamse Veerkade. Walk to Grote Markt. Take a break. Write notes for narratives. Walk from the Grote Markt to the Binnenhof. Walk around the pond and to the Plein.
- **9:40: End of second part of the study, start of reflection.** Writing notes for narratives.
- **10:45: Start of third session (Thijs guided, Veronika was VI).** Walk from the Plein to the Centraal Bibliotheek. Break. Walk from the Centraal Bibliotheek to the HEMA. Entering the HEMA. Looking around. Exiting the HEMA. Walking to Den Haag HS.
- **11:05: End of third part of the study. Switching roles.**
- **11:10: Start of fourth part of the study** (Veronika guided, Thijs was VI). Walking to the tram stop. Waiting for the tram. Boarding the tram. Travel with tram to Den Haag Centraal. Get off the tram, walk inside the station.
- **11:30: End of fourth part of the study, start of reflection.** Writing notes for narratives.




Rabobank
Den Haag Centraal Station
Den Haag-Centraal
Ministerie van Onderwijs, Cultuur en Wetenschap
Ministerie van Infrastructuur en...
Interparking Helicon
Ministerie van Sociale Zaken en...
Ministerie van Buitenlandse Zaken
Cloplein
Actieo
Albert Heijn
A
B


Mauritshuis
Grenadierspoort
Parking Centrum Plein
Sky High
Het Ministerie van Koloniën
Binnenhof
Millers
Cloplein
Ministerie van Buitenlandse Zaken
Action
Hofplaats
Pathé Buitenhof
KFC Spui
Primark Den Haag
Apple
Decathlon
Gemeente Den Haag
Spuiplein
ZARA
Albert Heijn
HEMA
de Bijenkorf Den Haag
Filmhuis Den Haag
Little V
A
B


Haags Historisch Museum
Paleis Noordeinde
Mauritshuis
Grenadierspoort
Parking Centrum Plein
Prentenkabinet
Museum De Gevangenpoort
Binnenhof
Het Ministerie van Koloniën
Millers
Vapiano Den Haag
Hofplaats
Pathé Buitenhof
KFC Spui
Apple
Primark Den Haag
Gemeente Den Haag
Het Oude Stadhuis
Grote of Sint-Jacobskerk
Decathlon
Haagsche Bluf
Pathé Spuimarkt
The Fiddler
Spuiplein
Albert Heijn
HEMA
de Bijenkorf Den Haag
Filmhuis Den Haag
Q-Park City Parking
Little V
B
A

Observation of Margot Scheltema

Participant observation is one of the most common methods of qualitative research. As how people often perceive and report their behaviour can be contradicting how they actually believe, participant observation can be used to compare their reported and actual behaviours. Participant observation also serves the purpose of building a positive relationship with the important stakeholders of the project. (Mack, Woodsong, M. MacQueen, Guest, & Namey, 2005). It is important to note that participant observation is subjective in nature, therefore researchers need to be conscious of the difference between the observed phenomena and the interpretations made based on it.

While preparing the research strategy, shadowing was also considered as a method for data collection. As described by Quinlan (2008), the method is suitable to capture behaviours and opinions, and can provide answers to the why questions, and not only descriptive data. The downside of shadowing is that both the data collection and analysis requires considerable time and effort, and to reach the depth and richness of data the shadowing periods are typically longer (several weeks). Due to time constraints present in the graduation projects, the method of participant observation was used instead.

The participants in this research were the students Veronika Szabó and Thijs te Velde, as well as Margot Scheltema. Margot Scheltema is one of the initiators of the graduation projects Thijs and Veronika were working on and was thus chosen as suitable participant. Margot Scheltema is an accomplished commissioner that has served on the boards of multiple companies and has been suffering from progressive retinitis pigmentosa for multiple years now.

In the course of the observations she was accompanied by the researchers throughout her daily activities. In both studies, the goal was to both uncover difficulties in visually impaired persons' day-to-day interactions with the outside world, as well as get a sense of the culture in which Margot Scheltema moves. We perceive this culture as being very significant to achieving a meaningful design intervention.

During the activities researchers noted down their observations and interpretations, and asked questions to the participant to validate the assumptions made. These initial notes were expanded after the observations.

1. Observation in Rotterdam, Den Haag and Amsterdam (07-03-2019).

During this day the participant was observed during several activities. First she gave a tour in the Nederlands Fotomuseum in Rotterdam. After the tour the researchers accompanied her to her home in Den Haag, and to a reception in the Tropenmuseum in Amsterdam by public transport. In addition to the goals previously described, an additional goal for this study was to get to know Margot Scheltema personally and build a professional and friendly relationship with her. A detailed research plan can be found in the appendices.

2. Observation in Den Haag and Baarn (28-03-2019).

In this observation, the participant was observed during an hour-long drive to Baarn, where she was to give a presentation. This day was chosen because the participant expressed concern in giving the presentation because of several factors. Both parties thought that concern could offer an interesting day of observation. After giving this presentation, the participant was observed during the car drive back to her house. A detailed research plan can be found in the appendices.

The pictures on the adjacent page show Margot Scheltema during observations in both Rotterdam and Baarn.


Margot
Scheltema

Observation of various activities at Visio

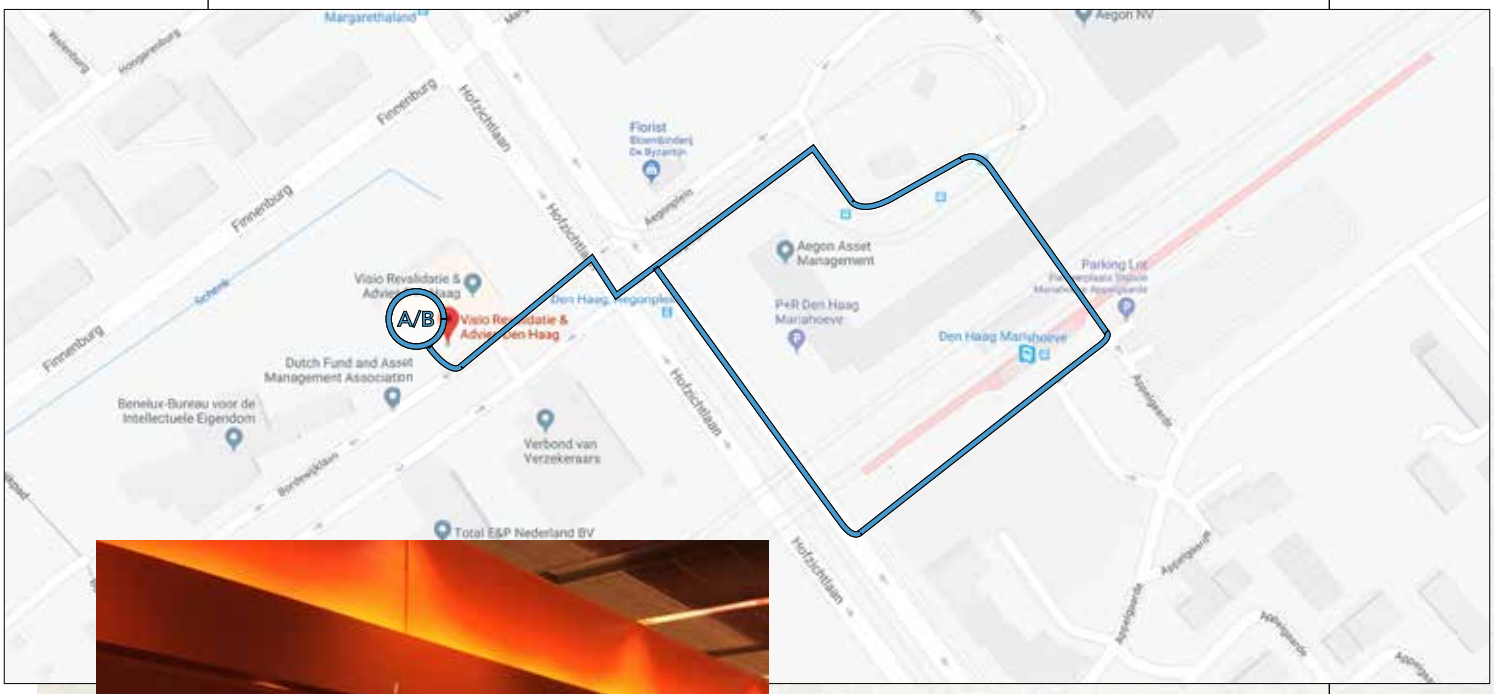
The researchers were invited to a full day of observation at Visio Den Haag. A schedule was prepared in which the various activities were indicated, but one of the clients ended up canceling later in the day. Another observation session was quickly arranged.

1. Observation of the training of a cane walker (02-04-2019).
In this session, the researchers observed the training of a completely blind cane-walker learning a specific route from the Visio location to the nearby station. This man had been learning how to use a cane for the last five years, so was moderately skilled in using it. The goal of this session was to uncover common problems visually impaired people have when learning how to use a cane, both practical problems relation to navigation as well as emotional problems relating to the social implications of using a cane. The observation notes can be found in the appendices.

2. Observation of an ICT-related training (02-04-2019).
During this activity the researchers observed an ICT training at the Visio facility. During the lesson the researchers were sitting near the client and the instructor, and were noting down observations. At times short questions were asked to the participant. After the lesson, a short interview was conducted with the instructor about the training observed and her experiences with ICT trainings in the past. The goal of this research was to find specific problems relating to visually impaired users and their interactions with (digital) products. The observation notes of both researchers can be found in the appendices.

3. Observation of a talk with a social worker (02-04-2019).
During this activity the researchers observed as a newly visually impaired person and their spouse having a meeting with a social worker. The main topics of conversation as well as the reactions and behaviour of the parties were noted down. No recording was made of the conversation out of respect to the personal nature of the conversation. The observation notes of both researchers can be found in the appendices.

The pictures on the adjacent page show two of the observed activities at Visio: a cane training and an ICT training.


A/B
Florist
Aegon Asset Management
P+R Den Haag Marshoeve
Den Haag Marshoeve
Parking Lot
Dutch Fund and Asset Management Association
Benelux-Bureau voor de Intellectuele Eigendom
Verbond van Verzekeraars
Total E&P Nederland BV
Hofzichtlaan
Finnenburg


Het kompas

Miscellaneous activities

Some miscellaneous activities were also executed that cannot be put in any other categories. These will be presented here.

1. Expert meeting at Visio Den Haag (01-03-2019).
To start the collaboration with the Visio expertise center, an initial meeting was held with the two researchers, the manager of the Visio Den Haag facility and two occupational therapists. Firstly, expectations were discussed along with opportunities to collaborate. During the meeting, one of the occupational therapists offered the opportunity to experience what it's like to be visually impaired, which the researchers gladly accepted. Several modified ski masks were tried on, starting completely blind, which simulate various visual impairments. This first experience was meant to be a starting point for subsequent autoethnographic studies. Personal narratives of the experience can be found in the appendices.

2. Visiting the ZieZo Beurs in Utrecht (16-03-2019).
In order to explore what is currently available for visually impaired users in the domain of mobility tools, the ZieZo Beurs was visited. The secondary goal of this activity was to build connections with possible stakeholders of the project. Firstly, the researchers explored the selection of exhibits. Their offering was assessed visually, to have an overview of the technology and visual style. The exhibitors of interest were selected, favouring the topics related to mobility and the booths who sported an original approach. During the course of the visit several discussions were hold to acquire more information on the projects and products exhibited. After the fair the researchers completed personal narratives on the visit, which can be seen in the appendices.

3. Visiting the Retinadag in Utrecht (22-06-2019).
The retina day in Utrecht was useful because it both provided some technical knowledge about retina diseases and how to combat them, as well as give insights towards how the afflicted deal with loss. Margot Scheltema was also present at this event.

The pictures on the adjacent page show an impression from both the Ziezo fair and the Retina day.

Generative sessions

To synsthesise and complement the findings through means of observation and autoethnography, a set of focus groups or generative sessions were held. These were used to contextualise the insights previously gathered and kickstart ideation.

1. Generative session at Delft University of Technology (17-04-2019).

The first generative session was meant to get a sense of which attributes are essential for products to show their users' identity. The session was carried out with four students, three being master's students at the Industrial Design Engineering department at Delft University of Technology, the other being a master's student at the Erasmus University Rotterdam. With the results from this session, the researchers hoped to find relevant parameters to produce designs with that could alter the identity assistive products for the visually impaired signal to bystanders. This was attempted by means of a few exercises.

The first exercise was both a means of introducing participants and getting them to think about product identity. Five bottles were placed on the central table around which participants were sitting and participants were asked to pick the bottle most appealing to them. They were then asked to introduced themselves and compare themselves to the bottle they picked. A discussion was then started to in which ways personal characteristics can present themselves in product attributes.

After this, the problem statement was more clearly defined by the group.

The second exercise was collage making. Participants were asked to make A4 collages using magazines that represent their personalities. Afterwards, the collages were slowly presented and a discussion was held on whether the message in the collages was congruent with the choice of bottle.

The third and last exercise consisted of making associative "flower" diagrams around the themes of "identity" and "elements of a product". These were then written down on post-its and clustered on flip-over sheets on the wall. All participants were given two dots, one to indicate the most feasible concept or aspect, the other to indicate the most novel one. The session was then wrapped up.

A detailed session planning can be found in the appendices.

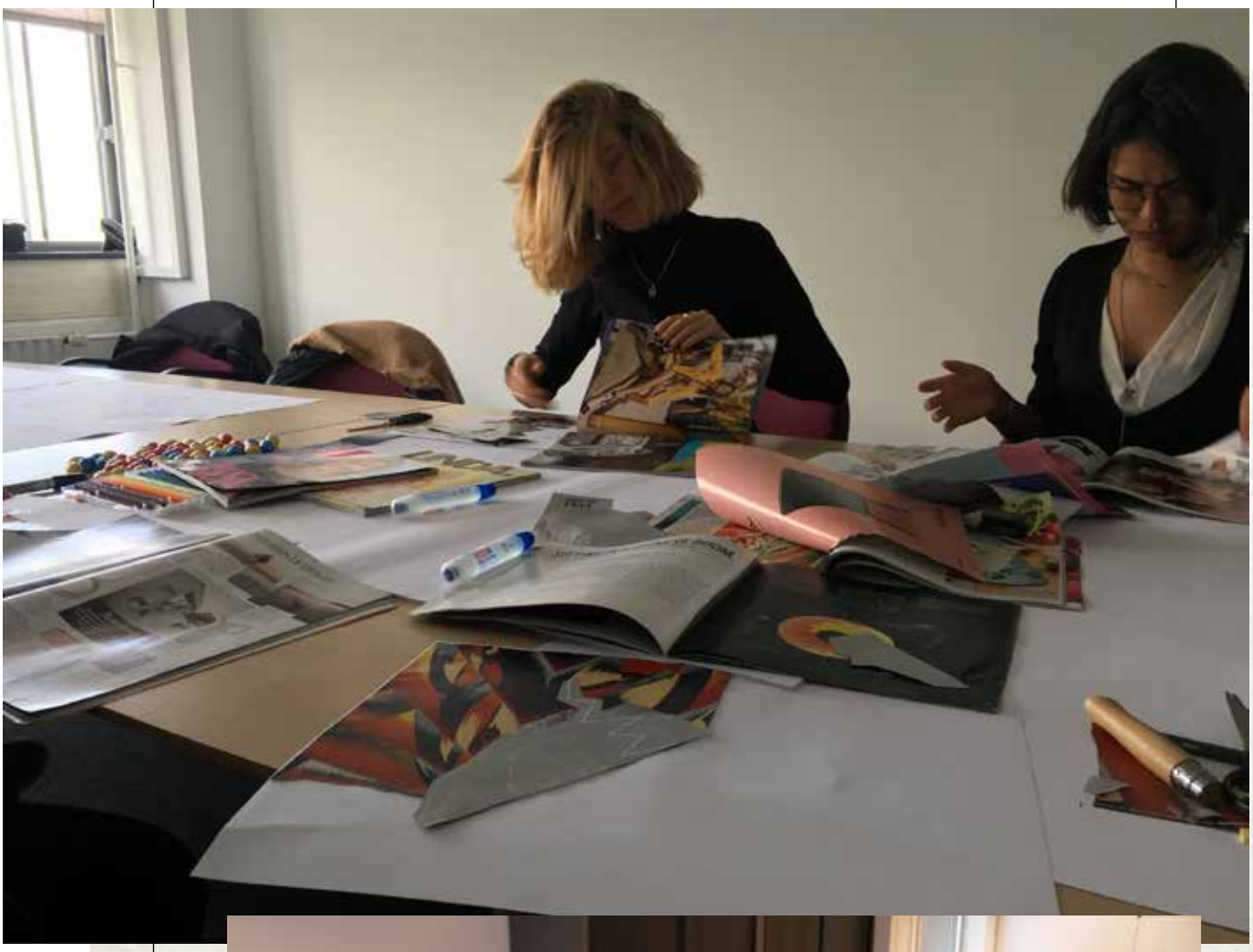
2. Generative session at Visio Den Haag (23-04-2019).

After the data collected previously was processed, the most insightful pieces of observations or narratives were selected by the researchers. The subjectively selected insights were then turned into GEMs. The GEMs were clustered by the researchers to identify the main themes.

To further explore the chosen directions, a generative session was carried out with visually impaired participants. When planning a generative session with visually impaired participants, a slightly modified approach is necessary. The majority of the commonly used creativity techniques build strongly on visuals stimuli and cues. There are a few examples on how to overcome this difficulty in literature.

Metatla, Bryan-Kinns, Stockman and Martin (2015) describe an iterative method consisting of several workshops with the same participants. The workshops are carried out using audio-haptic mock-ups, audio diaries and highly malleable prototypes. But, counterintuitively, the use of mock-ups and prototypes hindered the communication in the workshops, suggesting that replacing the focus of the prototyping methods from visual to haptic is not a sufficient solution. Sahib, Stockman, Tombros, & Metatla (2013) provided a participatory design approach that is built on using scenarios to simulate the user interaction, to engage VIP users at different points of the design process. This approach was used as a basis of the ideation in the generative session planned. Brock et al. (2016) included a locomotion trainer in the session to ease the communication, and a researcher to note down the ideas and group them in categories. They suggest to limit the number of participants to 5-8, in order to make it possible for the participants to identify the speakers based on voices. These guidelines were also considered when preparing the session plan. The detailed session planning can be found in the appendices.

The final generative session at Visio Den Haag was carried out with five visually impaired participants, as well as two Visio employees, one of which was a secretary, the other a general advice employee. Especially the presence of the general advice employee helped because she was able to steer conversation and filter out irrelevant directions in the group discussions. In the first part of the session, participants introduced themselves and an open discussion was started within the topic of assistive products for visually impaired. The topic was steered towards specific problems daily users face. These problems were to be used as primers in the second part of the sessions, which focused on solving specific problems in specific scenarios. Three scenarios were chosen, consisting of "at home", "having a drink with friends" and "talking a walk in town". Audio recordings were selected and played to aid in imagination. Participants were split up in three groups of two and were asked to come up with specific solutions to problems in these contexts. To aid creativity, no constraints were placed on the ideas by placing the context in the year 2050, where the government funds all assistive products for the visually impaired.



1.2.3 Results.

In this chapter, we will describe the results of the research activities separately. Key insights will be presented and discussed. The majority of insights were turned into GEM-cards for later analysis, all of which can be reviewed in the appendices.. A few observations and statements that were used as input for the GEM-cards will be presented in their relevant sections.

Autoethnography

The autoethnographic studies yielded results pertaining to the daily experience of visually impaired persons, as well as reactions of bystanders. These results were instrumental in gaining a better understanding of the effects of using assistive products and the stigma surrounding impairment in the public domain.

1. Autoethnography in Delft (06-03-2019).

The first autoethnographic study was intended to be a pilot study, used to get the researchers comfortable in using the methodologies of both autoethnography as well as participant observation. This goal was reached, and interesting initial insights into the visually impaired experience and reactions of bystanders were noted. One interesting result is that the researchers did not feel the same amount of exposure. This can be illustrated in the following two quotes from the personal narratives resulting from this study:

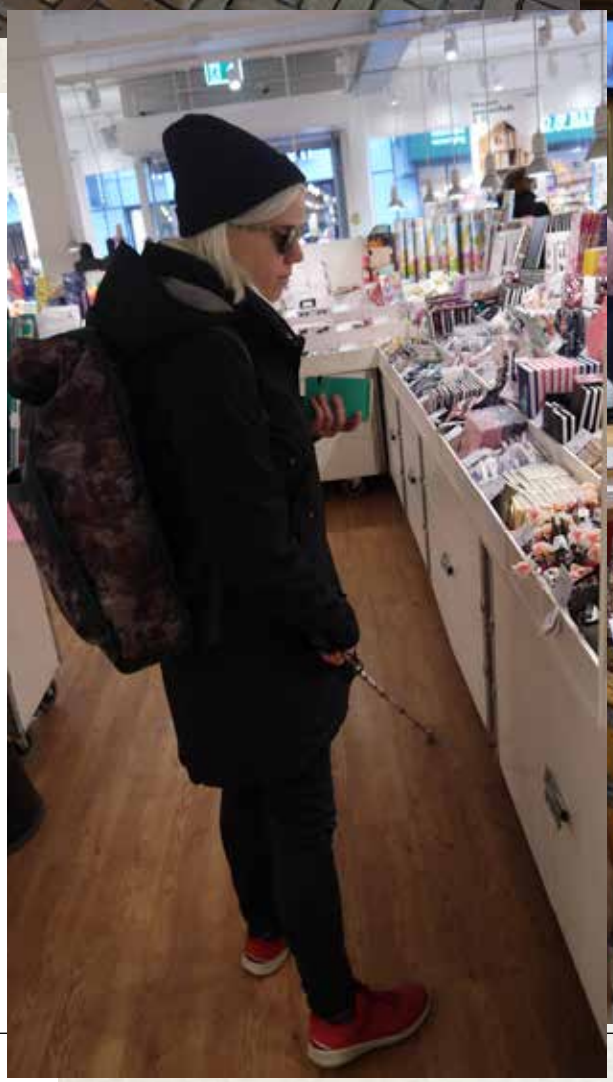
> *"From the moment I put on the glasses and started walking with the white cane, I felt like everybody was looking at me from the corner of my eyes and approaching me more carefully."*
>
> ---
>
> *"I noticed that people reacted on the cane and the glasses, but it didn't feel like they were staring. I was walking knowing that passers by will look out for me a bit more, this gave me a sense of safety."*

It was also found that bystanders react very differently to both researchers. Some bystanders did not seem to react to the presence of a visually impaired person at all, while other went out of their way to help. The following observation from the observation notes illustrates that nicely:

> *"A driver at a crossing near the central station stopped for us at a very large distance, signaling with headlights that we could cross."*
>
> ---
>
> *"In the cheese store I felt that the interaction was normal, and I didn't notice people staring at us or acting unnatural."*

These quotes and observations show that this first pilot study gave the researchers a nice first look into how bystanders react to the presence of visually impaired people, how that makes them feel and the interplay between bystanders' reactions and self-image of visually impaired persons.

The pictures on the adjacent page show the researchers engaging in various activities during autoethnography in Delft.



2. Autoetnography in Leiden (19-03-2019).
This study yielded results pertaining the the visually impaired experience in busy places, as well as small interaction to which visually impaired are subject on a daily basis. Various factors determining the reactions of bystanders in certain contexts were hinted at in the results. Some of these factors can be seen in the following quotes from the personal narratives and observation notes:

> *"The passers by didn't pay a lot of attention to us. Possibly they were in a hurry, they also saw that Thijs is not alone, or they just didn't care."*
>
> ---
>
> *"When I put on the goggles in Leiden I felt a little more insecure than in Delft. The people, environment and culture were new to me and I had a hard time anticipating how these people would react."*
>
> ---
>
> *"Everyone on the platform is glancing at Veronika. People are very aware of her presence. Maybe they notice it more because they are just waiting around and have nothing to do."*

This strengthens the belief the researchers gained during the last participant observation, which is that the interaction between environment, bystanders and visually impaired person is what determines the kind of stigma and degree of visibility in certain contexts. This can make certain day-to-day activities daunting for visually impaired people, as evidenced by this observation taken from the observation notes:

> *"Veronika punches in the wrong PIN-code, gets scared for a bit. People seem to be moving around us in quite a large circle. "*

Another key insight was that knowledge of a place does inform the confidence with which a visually impaired person moves about. This, in turn determines the reaction of bystanders to them. This phenomenon could also explain the previously found discrepancy between feelings of exposure between the researchers during the Delft study.

> *"When I put on the goggles in Leiden I felt a little more insecure than in Delft. The people, environment and culture were new to me and I had a hard time anticipating how these people would react."*

With these results, the researchers decided to focus their next autoethnographic study on forcing themselves to partake in more forced interactions.

The pictures on the adjacent page show the researchers engaging in various activities during autoethnography in Leiden.


TE KOOP
KOMPAS
071 523 42 75

3. Autoethnography in Den Haag (20-03-2019).
This extensive study yielded all kinds of results in the visually impaired experience and bystander reactions. This study also helped the researchers empathise with the experiences described by clients at Visio Den Haag, who also have to move throughout Den Haag on a daily basis.

Normal things can be alien when visually impaired. The researchers noticed that in an environment unknown to the visually impaired, confusion can quickly set in. This is illustrated by the following quote:

> *"When passing a group of people in front of the T-mobile shop, Thijs asks what they are doing there. They are employees waiting for their shift, but Thijs does not recognise them."*
>
> ---
>
> *"I asked Veronika if we could enter the Bijenkorf. When she told me it was closed and a man was still cleaning the floor, I felt a little ashamed that I did not see that."*
>
> ---
>
> *"We ended up walking behind two men talking loudly amongst themselves. One of them was wielding what looked like a stick that I supposed he must have found somewhere and was carrying home. They suddenly walked slower and moved out of their way and I could feel their eyes burning in the back of my head. They stopped talking when we passed, which felt threatening. I turned the corner and was relieved when they did not."*

In busy areas, sensory overload can quickly set in for visually impaired persons. Because they rely that much more on their other senses, they need them at all times in order to be able to navigate. Coupled with the unfamiliar environment one of the researchers found himself in, this provided some struggled during navigations as evidenced by the following observation:

> *"I felt my senses were overloaded, and conditions were swiftly changing. I felt that I couldn't keep up with it, and I just got tired of trying to. I wasn't feeling very much in control of the situation, so I mostly passively consented to the suggestions Thijs made. I was led by him through a crossing and I was feeling quite vulnerable."*

Face-to-face interaction can also be quite weird, as it is hard or impossible for visually impaired people to gauge the reactions of the people around them. This often makes them struggle in daily life. This helplessness can also cause bystanders to overreact to their struggles, offering help when not needed or doing other unpleasant things to them. These situations can be illustrated and put into context by the following quotes and observations:

> *"Veronika talked in a very low, almost trembling voice when ordering coffee. The lady serving the coffee acted completely normal."*
>
> *"Some ladies blocking the guidelines with their bikes apologised a lot. The ladies apologising to Veronika touched her on her shoulder while talking to her."*

The pictures on the adjacent page show the researcher engaging in various activities during autoethnography in The Hague.

Observation of Margot Scheltema

The observation studies with Margot Scheltema attempted to look into the culture surrounding one of the main target users of the project and the results reflect that. Along with insights into Margot Scheltema's culture, other daily problems facing visually impaired persons surfaced during these studies. The most valuable and relevant insights are those reflecting problems that occur below the surface, and play a part in the visually impaired person's construction of their new world.

1. Observation in Rotterdam, Den Haag and Amsterdam (07-03-2019).

During this observation, the researchers observed Margot Scheltema in different contexts, including a board room, museum and large-scale event. The results from this study were enlightening and told a lot about the culture in which Margot Scheltema lives, her daily trials and tribulations and underlying concerns. Some key insights about her environment, the people in it and the role it plays in the experience of her newfound visual impairment can be found in the following observations:

> *The room is very dynamic, with people moving about, meeting and mingling. Margot has difficulties recognising people in this dynamic atmosphere. It's hard for her to recognise faces in this dim environment.*
>
> ---
>
> *Women are also in formal clothing, but are more trendy. They show their individual style with their earrings and handbags.*
>
> ---
>
> *Margot remarks: "When I have to look for the button to call the elevator, I'm always happy when no-one's around".*

Trying to still be a part of this dynamic, cultured scene takes extra effort on the part of visually impaired people. A lot of tricks and adjustments are necessary in order to still be able to participate. These often go unseen but a few can be found in the following observations:

> *She only goes to stores where they already know her and her condition, as it is a hassle to explain it, and what kind of help she needs.*
>
> ---
>
> *"I ll just bluff if I don't recognise someone, it takes too long to explain" she said about the event later on.*
>
> ---
>
> *She decided to just walk around and then someone will recognise her. "I will just walk around and someone will recognise me."*

A lot of insights were also gained in the role specific environments can play in the experience of visually impaired persons. Due to them experiencing their surroundings in a very different way than sighted people, certain behaviour can seem out of place, as well.

> *At the reception she was first hesitant to mingle, she felt disoriented and overwhelmed by the crowd. " There are a few people I want to meet, but I don't see where they are."*
>
> ---
>
> *Margot bumps into a door and the bystanders get startled. One of the bystanders asks Margot if she's okay.*
>
> ---
>
> *A gentleman coming down the stairs, did not know what to do when Margot - who was going up the stairs - suddenly stopped walking up. He kept standing, waiting for Margot to pass.*

The pictures on the adjacent page show Margot Scheltema engaging in various activities during the observation in Amsterdam.

2.Observation in Den Haag and Baarn (28-03-2019).
This observation yielded a lot of insights into the behaviour of visually impaired persons when in the spotlight and the reaction of an audience on that. It is interesting to see that Margot can be very open about her impairment when necessary, and reserved about it otherwise.

Margot has trouble sitting down on her chair after the talk and almost falls down. Some people in the audience gasp or talk amongst each other after this.

Margot tells the technicians that she is visually impaired. She is not ashamed to talk about her impairment and mainly wants the talk to go well.

It showed the researchers what is necessary for visually impaired people to succeed in life and be a leader. It also gives insights into how bystanders react to these needs.

During the drive, Margot mostly takes the time to make calls and answer emails. Margot says during a call "I'm calling you now so you don't have to read about it in the newspaper." The talks on the phone during the drive are pretty serious in nature and large in scope.

Upon arrival, Margot is received by someone that guides her to the room downstairs carefully. The event's organisation is expecting her and does know of her visual impairment.

The first thing Margot does as part of her talk is announce her visual impairment.

Apart from these findings, some additional specific struggles in the daily life of visually impaired people were found that provide a richer picture of the visually impaired experience:

Margot: "I hate not knowing what the room will look like and what I will encounter."

Margot asks us to describe where a hot air balloon is, instead of pointing at it. People tend to point things out to Margot. This obviously doesn't work and she tells us so in a deliberate but slightly annoyed tone.

She would still like to do everything, but has no bucket list. "I sometimes do feel like my life is almost over."

The pictures on the adjacent page show Margot Scheltema engaging in various activities during the observation in Baarn.

Observations at Visio Den Haag.

These studies, that were executed over the course of a day at the Visio Den Haag location, were insightful because they provided insights into the great lengths visually impaired persons go to in order to be able to live a fulfilling life. These observations allowed us to better understand pain points with current (digital) products for visually impaired people, the great effort it takes to learn how to use assistive products effectively and social implications of impairment.

1. Observation of the training of a cane walker (02-04-2019).

This observation gave us insight into the elements that make navigation hard for the visually impaired. It also showed us just how much effort goes into learning to navigate a specific route. We also learned about how bystanders and the environment play a role in either discouraging or enabling mobility for the visually impaired. Some quotes are provided to illustrate these findings:

"

The bumpy road is hard for Jaap to walk on. He sometimes trips.

When asked whether people are more careful with him now: "Not all of them. Some people don't. Central Station sucks."

The traffic lights turn red way too quickly for Jaap to be able to comfortably pass.

While walking, Michelle tells Jaap what is on the square, and which of these things make a noise. Michelle notes that the fountain in the square is probably only working in the summer. Small differences in height can be very invasive when trying to walk straight.

Jaap tells us that learning this route to the bus really opens up options. He is going through this hardship in order to still be able to live a rich life in possibilities.

Jaap sighs after the first practice lap. "Now, now." It is exhausting for Jaap.

"

2. Observation of an ICT-related training (02-04-2019).

This observation exposed problems visually impaired users have with certain assistive technologies. Its results lay out the flaws inherent in speech- and gesture-based controls and the social difference between walking with a cane and a guide dog. Some quotes are provided to illustrate these findings:

"

Irene remarks that lists can take very long to go through. She is bored or annoyed with the entire process.

"It sometimes doesn't work, so most people do it the old way. There is some level of distrust towards newer technologies."

The keyboard consists of little keys that all feel the same. It is not designed for visually impaired, but for sighted users. However, many people use the keyboard because "typing things is better than dictating them, especially for emotional content."

"The cane seems very confronting, pointing people to facts they don't want to accept. When walking with a dog, people offer you help a lot quicker."

"

3. Observation of a talk with a social worker (02-04-2019).

Attending this conversation gave us great insight into the reactions of people close to a recently visually impaired person. It gave the researchers a lot of insight into misunderstandings that occur and the hard dilemmas that visually impaired people are faced with. Some quotes are provided to illustrate these findings:

"

Menno is working hard to get his old life back. He has used a viewing strategy training to get his driver's license back.

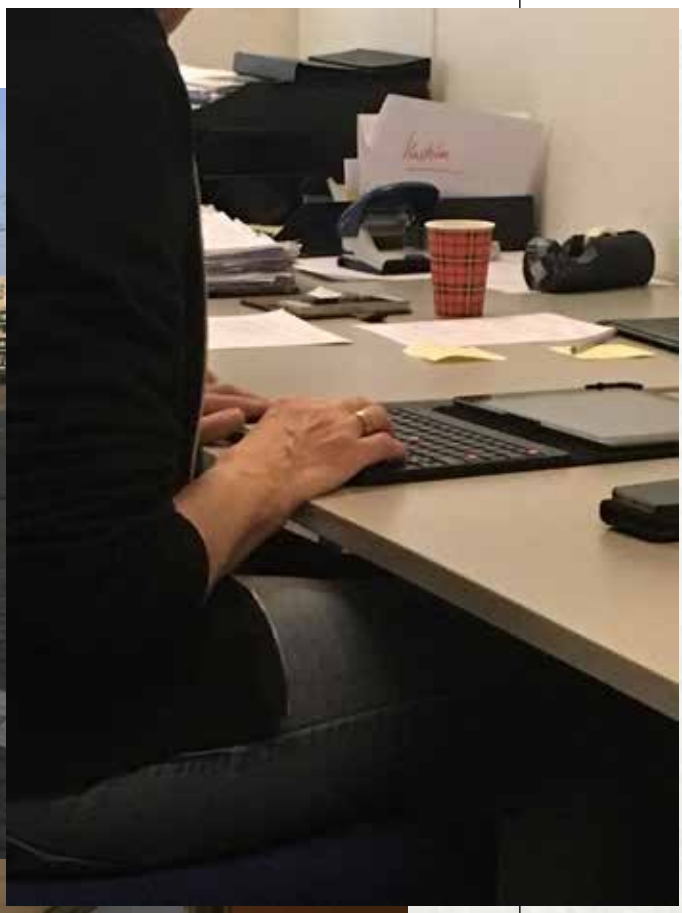
People in his surroundings have hard time understanding the implications of his condition, in what way can it cause problems. "You have bad vision? You just have to put on glasses."

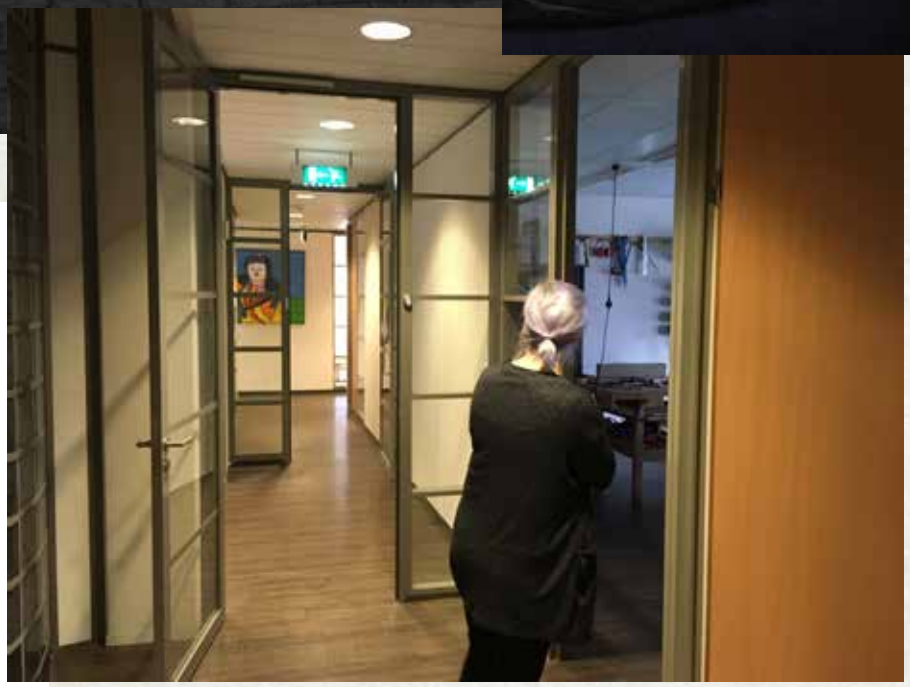
Menno: "You can't see anything about the impairment so that's the problem, really."

Ria is tired of explaining her husband's behaviour all of the time. "People keep asking me, why isn't he joining this time?" Ria: "We still try to do everything, but then a little bit adjusted." Menno: "While in fact, we can't."

Menno has the dilemma of going to a dance performance of her granddaughter. Menno: "These are dilemmas that people just don't get.

"





The pictures on this page show three of the activites that were observed at Visio Den Haag: a cane training, an ICT training and a talk with a social worker.

Miscellaneous activities

These two miscellaneous activities both served as starting points to greater parts of the design project.

1. Expert meeting at Visio Den Haag (01-03-2019).
The expert meeting at Visio allowed the researchers to structure their collaboration with the people at Visio, as well as get a first glimpse into what it is like to be visually impaired. This set the stage for subsequent autoethnographic research as well as build a relationship with the people at Visio Den Haag, which would prove instrumental in the further development of the project. To illustrate the experience during this study, we provide a few relevant quotes from the autobiographical narratives written by the researchers.

> *"Walking towards the elevator, we met another of Femke's co-workers, with whom it was hard to get a normal interaction. I felt a little bit awkward and just waved in all directions, making jokes to alleviate my own distress."*
>
> ---
>
> *"After arriving back to the Visio facility, I was relieved and exhausted. Being tense all the time needed a lot of effort."*

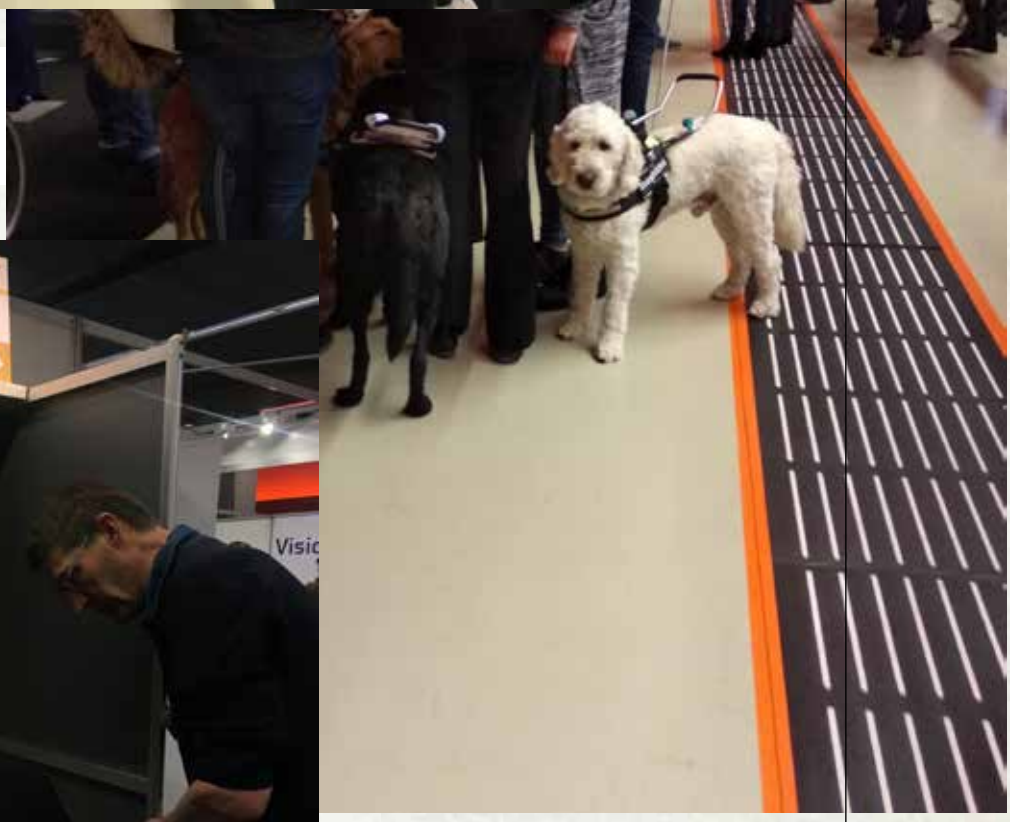
2. Visiting the ZieZo Beurs in Utrecht (16-03-2019).
Visiting this trade fair gave the researchers insights into the current state of assistive technology for the visually impaired. The researchers also met employees from Bartimeus and got insights into how visually impaired people still like to present themselves to the outside world. We also got to see visually impaired people interact with each other for the first time. This was very interesting to see and can be illustrated with the following quote from one of the reflections both researchers wrote:

> *We saw that VIPs who attend were in a positive mood, greeting each other. I don't suppose they meet so many fellow sufferers very often, and at this fair they were the "normal people", the sighted were the ones out of place.*

The second striking observation is that there are, next to technological advances, quite some efforts that help visually impaired people to integrate into society, as evidenced by the following quotes:

> *Another highlight was a voting booth, adapted for the visually impaired. I thought it was wonderful to see that there are efforts to give these people the means to participate in and put their mark on society.*
>
> ---
>
> *We encountered a booth from Bartiméus with an interestingly unusual approach: at the Oogverblindend Mooi workshops they help VIPs regain control over how they present themselves to the seeing society. This includes style and colour advising, make up, but also self presentation and body language. I did find it inspiring that they leapt over offering purely functional help, and are giving tools of self expression to their clients.*

The pictures on the adjacent page show people and dogs at the Visio trade show in Utrecht. A highlight is the voting booth for the visually impaired.




Ingang
Stembureau

Generative sessions

The two generative sessions were meant to kickstart ideation in this project. The insights gained in these sessions mainly dealt with concrete problems faced by visually impaired people, suggestions towards solutions and important aspects to take into account while work on solutions.

1. Generative session at Delft University of Technology (17-08-2019).

The first of the generative sessions was held at the university in Delft and was designed to explore in which ways products can express their users' identity to the outside world. Numerous ways to do this were found and were rated in terms of novelty and feasibility. The highest rated items in terms of feasibility were 'novel shape', 'geometrical shape' and 'embracing'. The most preferred items in terms of novelty were 'shows your capabilities', 'ethics' and 'the meaning and what it represents'. The session notes are in the appendices.

2. Generative session at Visio Den Haag (23-08-2019).

The generative session at Visio Den Haag was held with five visually impaired participants and two caretakers at Visio. The session was centred around common problems in using assistive technologies. The first part of the session was spent identifying these problems while the second part focused on creating novel concepts to solve these problems in a variety of contexts. The detailed session notes can be found in the appendices.
The issues raised during the session can be illustrated with the following quotes:

"

"One of the cons is that people see there's something wrong with your eyes, so you feel that you're being treated different. I could always see, I became blind in 2016, and you do notice definite difference coming from your environment."

"You do lose a lot of friends."

Murat (when the subject gets changed to going out in a busy bar): "Avoid." People agree.

"Sometimes I'm using my phone in public and that also makes people curious: "You're blind right? But you still have an iPhone!" Especially when the voice speed is fast, people are amazed you can use it. And then there's already a loss of a social barrier. "

"I once had dinner in a themed restaurant, and a magician got mad at me for not responding to his tricks. You experience things that are quite weird."

"You choose visibility, and the degree of visibility would be nice to be able to control."

"

Their relations with the cane can be illustrated with the quotes below:

"

"When someone walks with a cane, people won't talk to you that often, but a dog gives people a lead to make small talk with you. And that gives life a different colour."

"The cane is empty. It doesn't have any qualities that attract people."

"I don't often use my cane, because I see just enough to see the world around me react to my cane. And I don't have the need to be seen as dependent and pathetic."

"If there's a genuine interest in for example a guide dog or an iPhone, that breaks barriers. But you don't accomplish that with a white cane.

"I know I can carry a larger cane and the solution is there, but my emotions say that I'm not up for that yet."

"If you don't walk around using a white cane, the world will judge you as a sighted person. And that's what you'll have to deal with."

"

The pictures on the adjacent page show the participants engaging in various activities during the generative sessions.


D·E

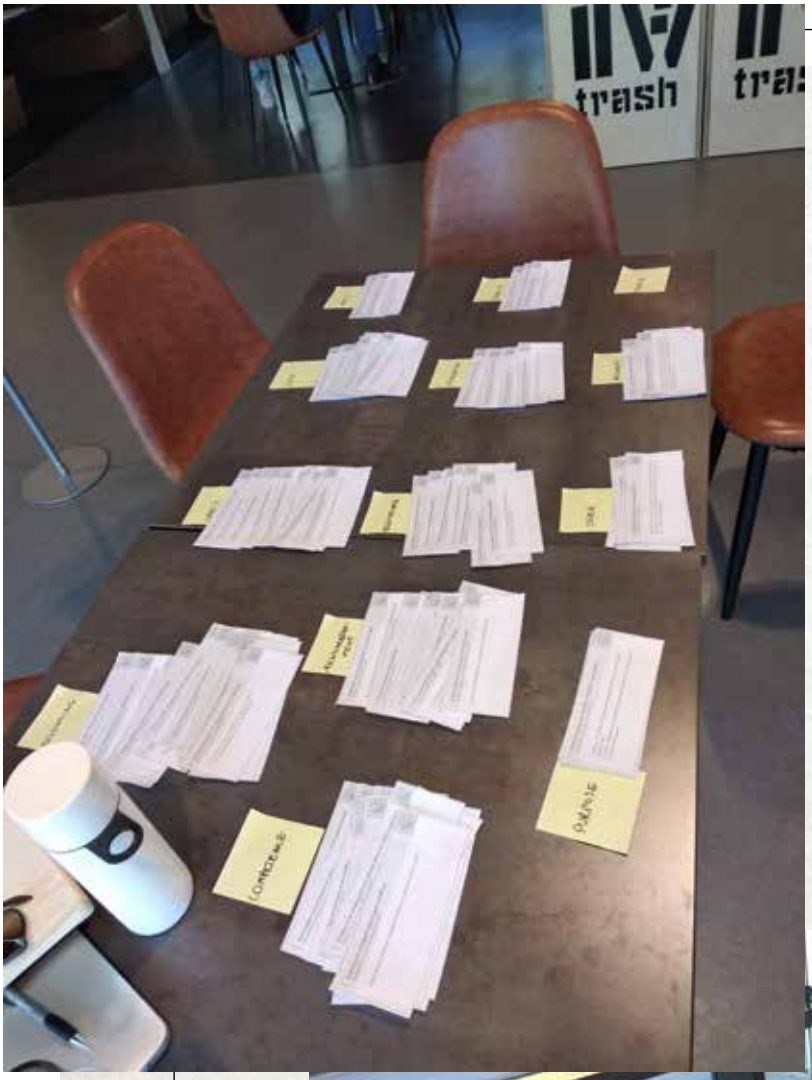
Chapter 1.3 analysis and results.

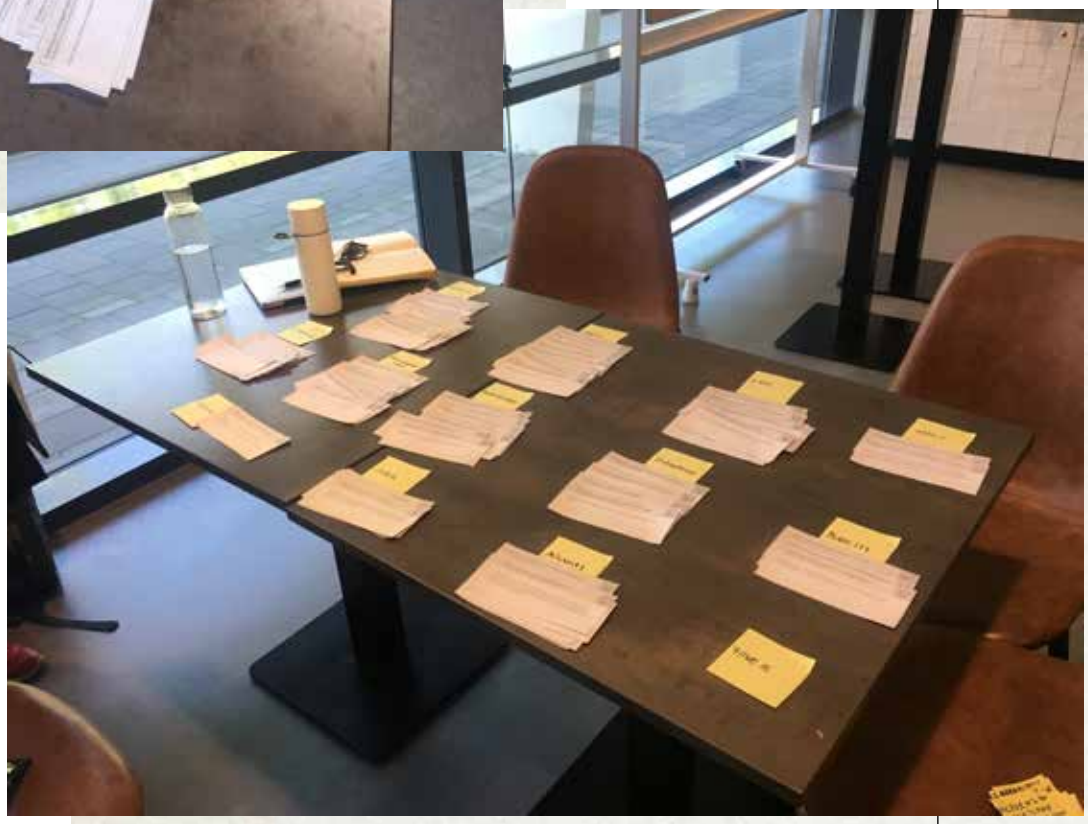
1.3.1 Clustering.

After the observation notes and autoethnographic texts were completed from research activities A-D, both researchers selected the most important insights and observation on subjective basis keeping in mind how much do they reveal about the main research question. From these valuable insights and observations GEM cards were created.
The GEM cards were clustered by the researchers to create a shared understanding about what is present in the data (see appendices). The main themes identified are in the following section.

As the result of the data analysis, several themes were identified. Some themes were formed from a higher number of GEMs, and some clusters only contained a few. This doesn't necessarily translate into a hierarchy among the themes. In this section each theme is described and illustrated with examples. Along with the clustering presented here, another clustering was done based on the Elementary Human Needs framework by Desmet and Fokkinga (2018) . However, no real results were gathered from this clustering, other than that all needs were represented in the data.

The pictures on the adjacent page show the clustering in various phases.


trash



1.3.2 Results.

The research activities outlined in this report and their results will ultimately be used in the context of a design graduation project. These research activities have had multiple results that will prove beneficial in the final design project. These beneficial results will be outlines in this section.

First of all, the clusters and GEM-cards that result from the analysis of data will help focus ideation during later stages of the design project. They can be used to construct concepts focusing on either one cluster, one GEM-card or the space in between clusters or GEM-cards, signifying untapped opportunity.

The research activities also helped the researchers form a solid network of stakeholders. This network consists of visually impaired stakeholders in various stages of their impairment, offering a rich dataset that touches multiple facets of the visually impaired experience. It also consists of trained professionals that help these visually impaired people reach their full potential, among which are professional mobility trainers and social workers.

This research phase also allowed us to empathise with the visually impaired target group more deeply. Experiencing both practical and social difficulties through autoethnography and talking to and observing actual visually impaired people in their daily routines will allow for more empathic design solutions and ultimately more added value.

The research questions we have set for ourselves at the start of the report have been answered. As a reminder, they were the following:

1. What are the struggles visually impaired people face when it comes to mobility?

2. What are their attitudes towards assistive devices (especially the white cane)? What other ways are in use to overcome them?

What are the struggles visually impaired people face?
To answer the first question, there are many. We have found such issues as sensory overload, having a tough time avoiding obstacles and people offering unnecessary help. Apart from the issue of mobility, we have found many social struggles in visually impaired people, such as having trouble explaining their impairment to bystanders and perceiving social stigma due to their impairment and its signifiers.

Increased visibility due to (effects of) impairment
Visually impaired people face a lot of issues executing mundane visually-oriented tasks. This can have great effects on both the enjoyment of life and the way visually impaired people present themselves to the outside world. This problem is illustrated by this quote:
Ines has a small amount of mascara in her hair. We assume she has a hard time maintaining her appearance. When asked about this, she she confirmed that choosing the right clothes became harder and shopping is not as much fun as it used to be.

These problems can cause visually impaired people to stand out from the general populace, drawing even more unwanted attention to themselves. The researchers regard this as a strong design direction, possibly offering great amounts of value. This extra level of visibility is supported by the following quote from an observation during one of the autoethnographic studies:

A man was looking at Veronika, noticed he caught my eye and then looked away all the way behind him. He proceeded to pretend like he was looking around at his surroundings with great interest.

VIPs can are oftentimes reminded of their increased visibility in public spaces:

One time, she walked outside with a cane and a child yelled she saw a blind woman. "That was very rude and confronting."

On a deeper level, this increased standing out leads to a reduced sense of belonging in many visually impaired people, causing them to lose their bonds with communities they were once tied to:

Rachid: "I think that, when you finally do walk with a cane, people will drop out." Bruce: "You don't fit in their image of you anymore." Bert: "It's also the fact that people don't know how to behave, themselves. So they might avoid you for that reason. Rachid: "It's new for them, as well."

Loss of agency

Visually impaired people experience a loss of agency in almost all facets of life. The most obvious example is their inability to, in most cases, go out in public by themselves. This is a mobility issue, as illustrated with the following quote.

She uses public transport as much as she can, but in the evening she is not able anymore. She travels a lot less than she used to.

But the loss of agency runs a lot deeper than that and can be way more subtle and, in some ways, more impactful than just mobility issues. Visual impairment can cause people to not only limit their mobility, but also avoid entire environments altogether. This can be illustrated with the following quotes and observations:

Jaap remarks that at the central station people are blocking the guideline, but their luggage there or stand on it. He is reluctant to go there.

When asked how he would deal with going to a crowded bar, Nick answers he would always "avoid it". The others in the room agree.

Another aspect to this loss of agency is the difficulty to ask for or receive assistance when a visually impaired person needs it. Many visually impaired people experience intrusive behaviour from bystanders that offer them help. Oftentimes, this is coupled by touching, tugging or other unwanted actions. On the other hand, asking for help can be embarrassing. This is a recurring problem that can be illustrated with the following data from the research:

Ines: "The worst thing about these kind of nights is asking for help in mundane tasks."

Difficulty communicating the (effects of) impairment

Some visually impaired people have a hard time communicating their impairments to the people close to them, causing all kinds of misunderstandings. This may be due to ignorance in the general population about the various kinds of visual impairment, or the impaired person's own inability to talk about their struggled. This can be nicely illustrated by the following interaction, taken during an observation of a talk between a newly visually impaired person and a social worker.

Menno has had a stroke and lost a part of his vision. This is called hemianopsia. His newfound visual impairment costs him a lot of energy and the company doctor doesn't recognise this. Neither does his brother. He is not very good at sharing concerns with friends.

Aviva: "When people see the words "visually impaired", they think it can be solved with glasses."
Menno: "You can't see anything about the impairment so that's the problem, really." Ria agreed, saying she is tired of explaining her husband's behaviour all of the time. "People keep asking me, why isn't he joining this time?"

Face-to-face communication can also become a challenge, as it is, for the sighted, heavily reliant on visual cues and nonverbal communication elements.

When ordering, I was completely incompetent in reading the situation. It wasn't a pleasant experience, I was extremely self conscious. I felt I was missing out on the reactions, the facial expressions. It was exhausting.

Having a negative or changed self-image because of the impairment

The impairment, the assistive products use to mediate it and the message they both send to the outside world can change the self-image of visually impaired people. Most visually impaired people get confronted with that on a regular basis. We would like to share this quote as an example:

One time, she walked outside with a cane and a child yelled she saw a blind woman. "That was very rude and confronting."

As was established in section 5.2.3, there are plenty of misunderstandings about visual impairments in the general populace. These misunderstandings can often have a large impact on visually impaired people. There are various coping strategies, the foremost being the use of humor to ease tension:

Lars: "You're not seen as being full. I have a button that says "visually impaired". One day someone walked up to me and said "I don't believe it. You don't look retarded." Literally."

Although it has affected him very much, Menno is very humorous about it all: "The bus (that disabled people use in Holland to go to work) has arrived and here I am!"

What are the attitudes towards assistive devices?
Through multiple observational studies and a generative session, several different attitudes towards the use and stigma surrounding assistive technology have been uncovered. These particular attitudes will form the base of personas to design for in the next steps of this project. Some attitudes here will be discussed and illustrated using quotes.

Connecting assistive products to self-image

As already discussed in the section above, impairment can greatly change one's self-image. Assistive products, often used by impaired people, play a big part in this change. Numerous points of evidence were found that indicate this is one of the main psychological aspects of using assistive products. Users often feel like they are seen by others as less capable, or in some occasions even less human. This sentiment is illustrated by the following quote:

Lars: "I don't often use my cane, because I see just enough to see the world around me react to my cane. And I don't have the need to be seen as dependent and pathetic."

This often causes visually impaired people to postpone the public use of assistive products such as white canes. Because the cane is a signifier that its user is visually impaired, making the step to using a cane is often seen as admitting to oneself that one is indeed visually impaired:

Lars: "I know I can carry a larger cane and the solution is there, but my emotions say that I'm not up for that yet." Ines remarks that "the white cane is stigmatising".

Peter: "As long as I can go without a cane, I won't. Reason one is that I see it as a step backwards in independence. That to me weighs more than the extra effort needed to get around."

As time goes by, some visually impaired do get over this dilemma:

Irene became visually impaired slowly and took twenty years to admit it to herself. "Walking with a cane is admitting. Eventually you have to, and you get over the fact that people see you differently."

Facing the reality of the situation

Some visually impaired people take the assistive products for what they are and use them regardless of the negative effect they might have. Most of these people became visually impaired due to an accident of rapidly progressing illness, causing them to not deal with the transition people other visually impaired people might face. They use their assistive products because they have to and often indicate that they were left with no other choice. This sentiment is echoed in the following quotes:

Jaap (when asked whether the pros outweigh the cons in using a cane): "I don't have a choice, I don't see anything."

Jaap: "For my self-image, I would not like everyone to see I am blind. But I am, I am someone with a double impairment. This is the way it'll have to be. If I don't use the cane, I won't be able to go outside."

Some assistive products for visually impaired people are designed with sighted people in mind, and have a layer of added functionality that makes them usable. Some people still use these products because they offer a lot of benefit, and put up with the discomfort of use. This is what we observed during an ICT training for the visually impaired:

Even the teacher doesn't know the answer when confusion arises whether they are in "rotor mode" or not. The teacher suggests rebooting the iPad.

A lot of people use the keyboard because the gestures don't always work as intended. The gestures are finnicky.

The teacher and Irene complain about updates changing shortcuts.

Not letting the opinions of bystanders affect you

Some visually impaired people are not affected by the reactions of bystanders to their impairment, and thus don't feel the stigma. Others have felt that stigma in the past, but are now so acclimatized to it that that they don't let it bother themselves any longer. Oftentimes, these are either individuals that were born visually impaired or have been so for a long amount of time. See the quotes for examples:

Bert: (when asked about whether he feels eyes on him when walking in public): "No, I'm over that. I don't feel it and I don't care." Robert F: "Do you still register that people look at your more?" Bert: "No, I'm preoccupied with my own route and my own thing."

Jaap: "If I try to hide it, I'm only kidding myself and spend unnecessary energy on other people's opinions."

Being concerned about the social effects of using specific assistive products

While the visually impaired people in section 5.3.1 are mostly concerned with their self-image due to using assistive products, this participant group is mainly concerned with their changing social roles due to their impairments. They worry that their use of certain assistive products limits their social interaction when out and about, and base their choices of and attitudes towards assistive products on that. We provide some quotes to provide some perspective on this attitude:

Bert: "If there's a genuine interest in for example a guide dog or an iPhone, that breaks barriers. But you don't accomplish that with a white cane. It's a dead object that signifies your impairment. They should have made the bands black instead because it's a black-and-white object."

"I walked into a restaurant with a cane a few times, and it instantly became quiet."

"When walking with a dog, people offer you help a lot quicker. They don't do that when you're using a cane."

Lars: "If you don't walk around using a white cane, the world will judge you as a sighted person. And that's what you'll have to deal with."

1.3.3 Personas

Apart from these answers to the research questions, a set of four personas was developed that could be used as starting points for ideation. The idea behind developing these personas was that they could be placed inside of a point in a journey map, and coupled with some quotes and observations from research. These rich situations would allow for empathic design. This concept was lated fleshed out into an ideation sheet or model which is described in section 2.1.

The personas were put on two observed axes. These axes are the following:

Experienced - novice:
This axis described for how long the persona has lived with their visual impairment. It has been observed that this oftentimes says something about their attitudes towards both the reactions of bystanders and their impairment itself. It does not detail the severity of the impairment, as visual impairment can be caused in a variety of ways both rapid and slow, such as accidents or progressive eye diseases.

Skeptical - embracing:
This axis described their attitude towards innovation in assistive technology. The personas on the skeptical side are not fully convinced the benefits of using the white cane weigh up to the negative effects it has on their lives. These people might be concerned about social stigma or might not at the stage in their acceptance process that allows them to use the white cane and admit to themselves that their lives have changed. The other side of this axis describes personas that are fully embracing of the white cane because it helps them live their day-to-day lives. As a byproduct of this, they are often not open to innovation in the realm of assistive devices as they see the white cane as being good enough.

These two axes divide the persona space into four quadrants, each holding one persona. These personas will be described here, along with some quotes from research that support their existence.

the hopeful champion.

Experienced & skeptical.
Involving themselves in all kinds of initiatives that better the lives of fellow visually impaired, the hopeful champion fully committed to making a change for the better. They are often open-minded and open for innovation, but deeply critical of the available assistive products. Though not always positive, they try to make the best of not only their own, but their peers' situations as well.

"I was walking down the street a while ago and saw a man walking with a cane using sonar to determine where a pole was. I was in awe."

"You're not seen as being full. I have a button that says "visually impaired". One day someone walked up to me and said "I don't believe it. You don't look retarded." Literally."

"When someone is handicapped, you're automatically being put in the category of unusable material. So apparently there's a lot wrong with you."

the stubborn warrior.

Novice & skeptical.

The stubborn warrior has a progressive eye disease resulting in gradually increasing visual impairment. Despite this, they still live their old life like they had always done. Over time, this takes more and more energy but the stubborn warrior is reluctant to use assistive technology. They want to feel independent and not to be seen as less than their fellow human beings.

"When somebody is handicapped, you're automatically being put in the category of unusable material. So apparently there's a lot wrong with you."

"I don't often use my cane, because I see just enough to see the world around me really to my cane. And I don't have the need to be seen as dependent and pathetic."

"I think that, when I do finally have to walk with a cane, people will drop out."

the industrious learner.

Novice & embracing.

The industrious learner has had to adapt their way of life dramatically due to rapid onset visual impairment. They are forced how to walk with a white cane from the get-go or face the risk of not being able to go outside any more. This makes the industrious learner a practical person that is willing to use any assistive technology as long as it gets the job done.

"You have to remember it all: a pole here, letterbox there… I'm now at the letterbox so in twenty meters there will be little pole on the left. It's exhausting."

"I'm also learning braille. Jut a few classes to pick it up again."

"I don't have a choice, I don't see anything."

the focused veteran.

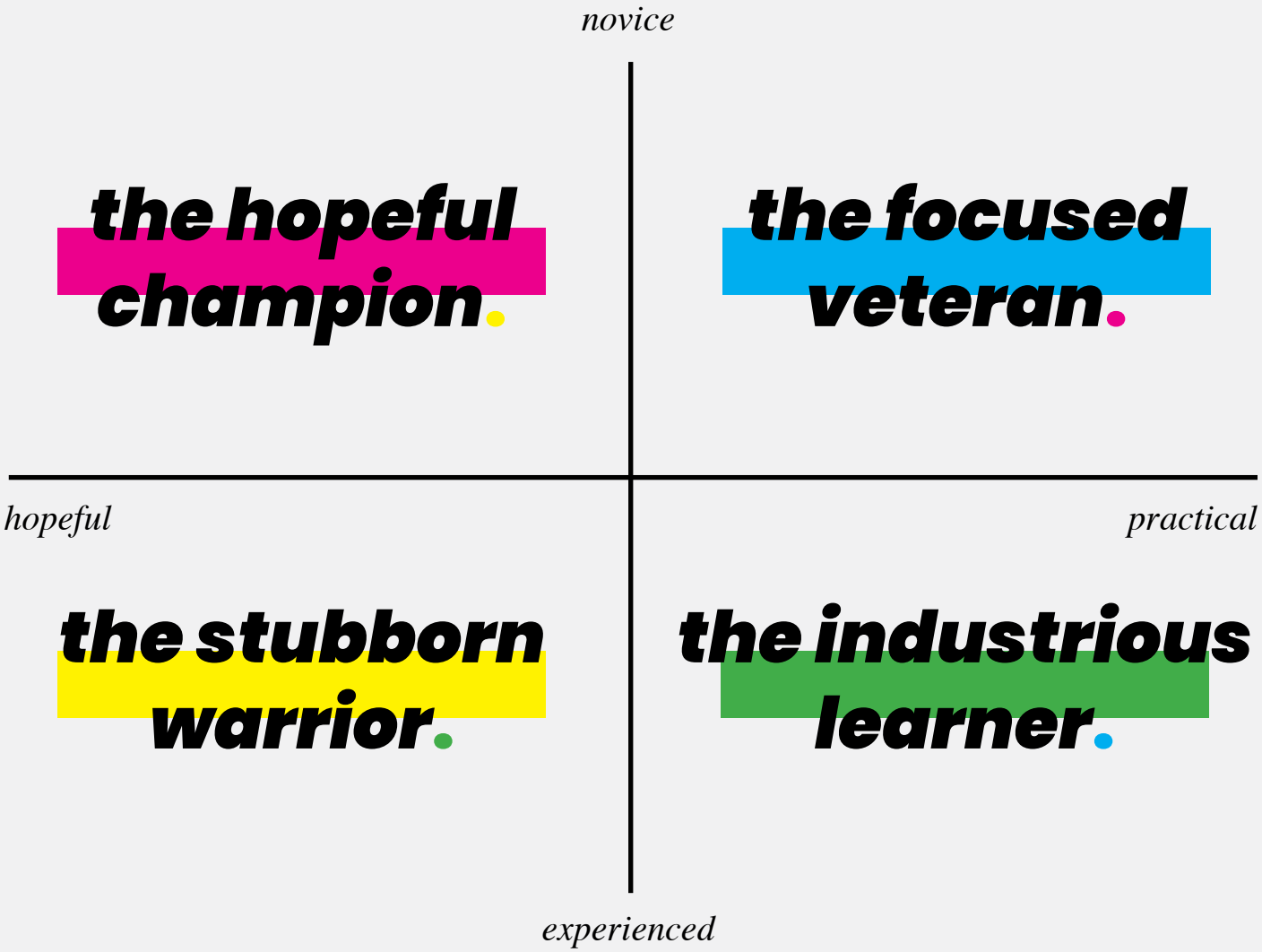
Experienced & embracing.

The focused veteran has been visually impaired in some shape or form for most of his or her life. They have gone through all the phases and have finally learned to accept their impairment for what it is. Social stigma associated with visual impairment and its signifiers does not really bother them as they are more so focused on navigation and their own goals.

"I don't feel staring eyes on me anymore. I'm preoccupied with my own route and doing my own thing."

"If I try to hide my impairment, I'm only kidding myself and spend unnecessary energy on other people's opinions."

"Eventually you have to [start using a cane] and you get over the fact that people see you differently."


novice
the hopeful champion.
the focused veteran.
hopeful
practical
the stubborn warrior.
the industrious learner.
experienced

From the generative session, a simple journey map was created that is comprised of three different situations. These situations will be described here and the associated problems will be presented. These situations will ultimately be used in the aforementioned ideation tool to keep focus during ideation.

At home
The location of the part in the journey speaks for itself. Visually impaired people encounter a variety of hardships at home, some of which will be illustrated here with quotes. Some of these quotes return in the ideation tool that was used in developing the final concepts.

"Things you drop on the floor are unable to be found, so goggles or your phone that tells you if you have to reach in some ways in order to grab it for you."

"Facial recognition for doorbells would be very nice."

"A lot of automatisation and making accessible for people that cannot see anymore [is desirable]. To make daily life easier."

In transit
Navigation is a big part of why life is exhausting for the visually impaired. Because the modern urban environment is not necessarily designed to keep the visually impaired in mind, a lot of training is needed to get around. Some of the challenged the visually impaired encountered are described in these quotes.

"The most important thing is learning how to use technology and learning to trust it."

"Contact with people will always be a point. You will always have to ask people for help."

"The cane might lead to unwanted help, that's something I want to avoid at all costs. That is my stage. I only use it in very busy streets when I otherwise run risks, that's when it has benefit to me."

Out and about
Visually impaired people like to go out just as much as any other person. However, it is a different experience for them in multiple ways. These experiences can be summed up with the following quotes.

"If you go to a cafe, you are the one having to adapt most of the time. Sometimes bad things happen like bumping into people, you can apologize in a nice, breezy way or annoyed way, and that makes all the difference. If you do that in a place you come often, they will often look out of you."

"The smart glasses came up again. You enter, the glasses tell you where there's a free spot, it reads the menu for your and helps you pay. On top of that, it helps you read the receipt, show you the road to the bathroom and call a taxi."

"I would like something that measures the decibel levels, finds places where there is an ideal sound level where you can talk. A lot of sounds hampers visually impaired persons in social interaction."

"Last time I met a friend in a bar I walked into a black hole and only had my phone to count on. A host that does that would be nice."

Chapter 1.4 first ideation.

1.4.1 The first set of concepts

Initially, a set of concepts was developed to be presented at the mid-term. These concepts will be presented here and afterwards a reflection will be provided on why these concepts were not deemed fully satisfactory by the graduation team.
As a starting point for these concepts, quotes and observations from research were used.


Press down
OR
multiple options
Simulate on phone (basic processing)
To-DO
Design badges
Print booklet
Create booklet
Spring
4 springs
push
push hole over
Sense anxiety with bio measurements
Guide meditation with soft haptics
Turn head of cane handle to indicate time
Soft haptics guide meditation
Time in braille

Memtic cane.
This cane comes from the idea that the fact that every cane looks the same reinforces its existence as a stigmatising product. One of Vaes' strategies for decreasing product stigmaticity is to develop a strong personal identity for the product itself (Vaes, 2014). This can be done by developing an ultrapersonalised product-service system that caters the look and feel of individual canes to the aesthetic preferences of its users. This system is envisioned to consist of the cane users, trainers, designers and manufacturers that all interact to produce personalised canes that the user can identify with. These canes will be produced by means of rapid prototyping to keep costs low and repairability high. The following quotes indicate a need for this type of solution:

"

"It's a dead object that signifies your impairment. They should have made the bands black instead because it's a black-and-white object."

"If there's a genuine interest in for example a guide dog or an iPhone, that breaks barriers. But you don't accomplish that with a white cane."

"I know I can carry a larger cane and the solution is there, but my emotions say that I'm not up for that yet."

"


LONE WOLF
NO CLUB
SKULLS OF SAHARA

Visual passport.
Visual impairment and its effects are often hard to explain to bystanders. People that have not gone through the hardship of visual impairment themselves find it in turn hard to empathise with those that have and don't often know how to deal with these hardships. This makes visually impaired people feel misunderstood. A visual passport might help the visually impaired explain their handicap better. This passport would contain basic information about the specific disease or impairment its carrier suffers from as well as more specific tips and tricks in dealing with these impairments. These specifics can be discovered during training or consultation with an organisation such as Visio. The visually impaired could also collect a set of badges after each round of training, showing to the outside world the amount of work that is necessary to live a rich life while being visually impaired.

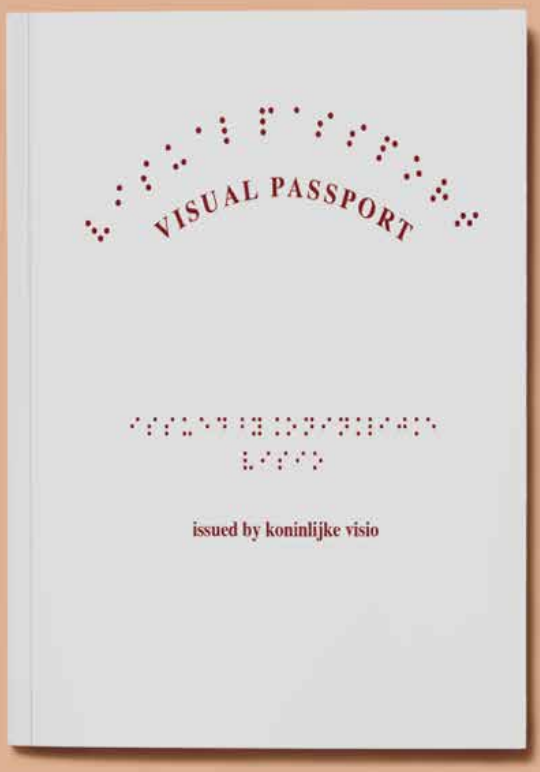
"

"If you don't walk around using a white cane, the world will judge you as a sighted person. And that's what you'll have to deal with."

"His newfound visual impairment costs him a lot of energy and the company doctor doesn't recognise this. Neither does his brother."

"When people see the words "visually impaired", they think it can be solved with glasses."

"


VISUAL PASSPORT
issued by koninlijke visio


name
te Velde
surnames
Thijs Kornelis
date of birth
18 APR/APR 1994
place of birth
Enschede
type of visual impairment
Maculadegeneration
1994
Ipsumes. Atem fugiae volores pelibus ev-
elitate vendae nost, corem eruntotate
a voloreperiam ditiatistio que dollenis
quae poreperum rerchillaut allandam
qui beateni hillaris ut ut et am, quiae
non ped que volo tore nus delit esse-
qui atest, sum eapla samus dentorio
cum quae evel int quias autatus et
et que dest aborerum quis et et, que
nectur arit aut rerferum fugit qui ut
expiab Ipid quae. Itatust volorestist,
quae esti ad qui
Pitest dolore
sustecat qui ut ab ipsuscies au-
tempe aut aut oditati untur? Quis
apictur malo tem inulpa dolo eaquiae
nullorerum, etluptas et esequat ut do-
loriam esti officia nisque voluptas evel
maximinum vent pliliorsedit quassit
aecessim endi aut voluptatur?

Guided meditation.
Being visually impaired causes people to experience frequent moments of stress throughout their day. Especially in the first stages of the the impairment, when its effects first become apparent, or early days of walking with canes, this anxiety and stress can cause a lot of self-doubt and exhaustion. Using smart technology, the cane's handle could measure stress levels and offer guided breathing whenever it's necessary. The cane could also learn which situations its user finds particularly stressful and respond proactively by indicating these moments of stress, potentially helping the user identify them. For this concept, the makers of the meditation app Headspace were contacted. They showed interest in the concept but commented that they were only looking for long-term research partnerships.

"
"A few wines will make this less intimidating", Margot says."

"When we encounter some traffic, Margot keeps checking by how much we are delayed. Margot: "We are getting close now." She says this out of nerves."

"When we encounter some traffic, Margot keeps checking by how much we are delayed. Margot: "We are getting close now." She says this out of nerves."
"

Margot's white cane.
After presenting the three concepts to Margot Scheltema, a combination of both the memetic cane and guided meditation was settled upon. The reasoning behind this combination is that Margot is postponing the use of the cane because of its stigmatising features. Walking around with a (in her own words) "fancy, stylish cane" would lower that degree of stigma and get her to walk around with the cane. She is interested in this as she does recognise the many benefits the white cane can offer. The guided meditation aspect was incorporated into the concept because Margot likes to operate on a very high level, going to board meeting at major firms and giving presentations all over the country. Because she is such a busy woman and is involved in multiple projects at any given time, she sometimes feels stress, especially with the added challenges her visual impairment brings. Since she already uses the Headspace application, the addition of the meditation feature seemed very beneficial to her.

"
"Margot remarks that "the white cane is stigmatising"."

"Margot says during a call "I'm calling you now so you don't have to read about it in the newspaper." "

"A gentleman recognises Margot: "Are you Margot Scheltema?"
"

Chapter 1.5 midterm and pivot.

1.5.1 Pivot

After the midterm, a project pivot was decided upon. The concepts that were presented were deemed not academically valuable and a clear link with research was missing. The graduation team decided to look into both social and technological trends that could, together with the research already executed in this project, lead to a more meaningful and relevant design challenge. Initial directions that were formulated during the mid-term evaluation included looking into the emergence of smart cities and the implications that could have for a connected white cane. This was the direction that was eventually decided upon and further literature research was done to understand the relevant factors more deeply. Those factors are described in section 1.1.5. Over the course of conceptualisation, it was also decided to make the connected white cane modular. One of the reasons for this is that during conceptualisation, it was found that there we so many distinct needs in the target group that a single solutions was impossible. By broadening the scope of the product to that of an ultra personalised product-served system (UPPSS, Nachtigall, 2016), a service can be built around a modular product that does not only allow for customisation in terms of functionality, but also allow for the creation of additional models by associated parties should the need arise.

Using Vaes' product intervention model for stigma (PIMS), we can find different design interventions that alleviate product stigmaticity (Vaes, 2014). An especially relevant one when talking about the concept of a connected white cane are reshaping the meaning of the product through advances in technology, integrating additional benefits and experiences in product use and in some ways, strengthening the institutional identity of the product. Through the application of a strong design language, the product can also have a strong individual identity which makes "(...) users wish to associate themselves with that product, and possibly value it as an extension of or addition to their personality". These strategies will be described in the sections below.

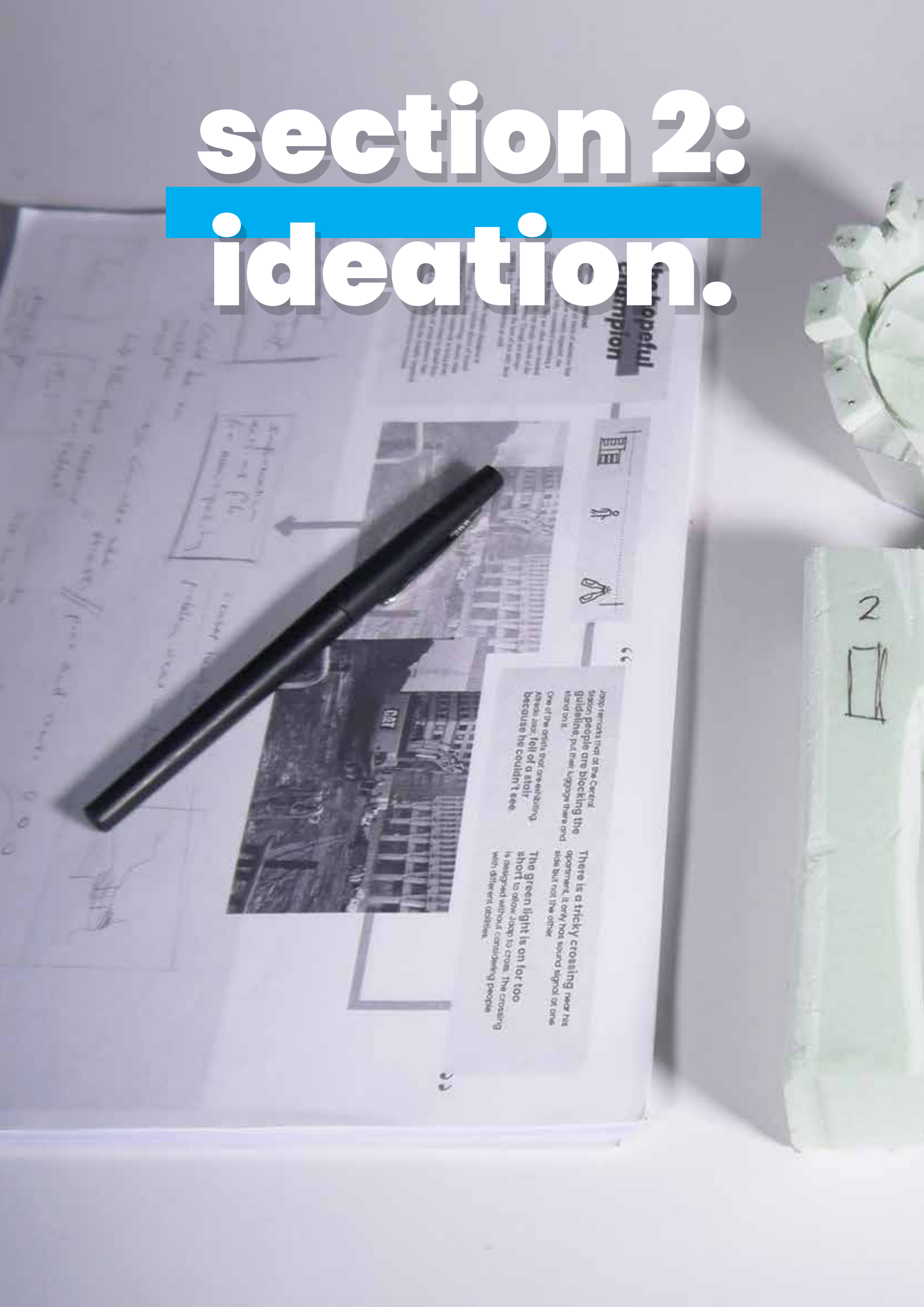
Integrating additional benefits and experiences in product use.
Connecting the white cane to the smart city and allowing the user to customise the white cane using functionalities that play off of that network will offer a wide variety of new functionalities. By going beyond the core functionality of the traditional white cane, the designer can "(... create product experiences that take the user away from its physical dependency of the product" (Vaes, 2014). These functionalities will decrease the product's stigma even more when recognised as useful by the general population - they will be appreciated as useful tools for society at large.

Reshaping the meaning of the product through advances in technology.
This strategy is more of a nuance of the one previously described. Through use of new technologies, a products functionality can be enhanced or altogether changes, thus changing the meaning of the product in society and alleviating stigma.

Strengthening the product's individual identity.
By placing the connected white cane in the context of an UPPSS, the cane's functionality cans be tailored to the user. This tailoring of the white cane would be done in accordance with the user's needs as discovered by both the visually impaired person and their trainers at an organisation like Visio. Although Vaes mainly talks about customisation in terms of aesthetics (Vaes, 2014), it is assumed that customisation in terms of functionality will also work to strengthen the bond between product and user. Using theory from Belk, effort put into the selection of a product increases product attachment as well (Belk, 1988). This effort will be exerted through the conversations between visually impaired user and trainers.

Strengthening the institutional identity of the product.
The effectiveness of this strategy is far-fetched in this context but could arise if implemented successfully and on a large scale. By creating a larger community around the use and manufacturing of the connected white cane and making the cane itself recognisable to the larger population, an institution is formed around it. Because of the positive aspects from which this institution is built (the perseverance, sense of community and unique skills inherent in visually impaired people), the products used by members of this institution will radiate these qualities as well. A strong design language is needed in this case as well. This design language will signal to the public that the products belong to this institution - in other words, make them iconic and recognisable.

section 2: ideation.



Chapter 2.1 second ideation.

2.1.1 A new concept

During this ideation phase, a tool was developed that would keep ideation more focused. This was deemed necessary as the previous ideation effort were not fully grounded in research. Due to the sheer volume of insights gathered from research, ideation was very chaotic and some order was needed to come up with meaningful concepts that had a link to real insights. The tool will be shown alongside some sketches before concretising the concepts in scenarios.

Holistic concept

The concept is built around a modular cane handle. This cane handle allows for up to three modules at a time, each of which has a different functionality based on the needs of the user and the locus on the product. The place on the handle also determines the loci of interaction and the semantic meaning this interaction holds. The configuration of the different modules will be determined by both the user of the connected cane and their trainers at an organisation like Visio. Next to the concept of this modular connected cane, design rules have been developed to allow for the development of a wide range of different modules. These design rules have been formalised in a form language. More about this form language can be read in section 2.2. By creating a network of involved stakeholders consisting of support organisations like Visio, champions from the visually impaired community, design studios and FabLabs, this concept can be expanded upon by creating new modules and investigating new socially relevant uses for the white cane. To further explain this concept, the core cane handle and its principles will first be described. Afterwards, three potential manifestations of this concept will be presented through a fictional visually impaired person and their personal cane.

The core handle

The core cane handle was designed to be comprised of three different modules while still maintaining both an ergonomic and recognisable form. Sketches were made investigating form, followed by a series of foam models. The foam models were created by cycling through intervals of intuitive creation, ergonomic testing and reflection. Possible loci of interaction were indicated on the foam models using a felt tip pen. The most suitable form of the core cane was selected and was developed into three different sizes conforming to the width of the human palm as described on Dined. A rudimentary connection system was developed as well, allowing the modular handle to be disassembled and changed on the spot. This concludes the development of the cane handle up to this point (more interactions will be made after the green light meeting). As seen in the pictures, the cane handle is divided in three modules that run along the length of the handle. These will from now on be referred to as “top module”, “middle module” and “bottom module”.

The pictures on the adjacent page show various stages in the design of the cane handle.


1
2
3
4
5


2


3

the hopeful champion.

Experienced & skeptical.
Involving themselves in all kinds of initiatives that better the lives of fellow visually impaired, the hopeful champion fully committed to making a change for the better. They are often open-minded and open for innovation, but deeply critical of the available assistive products. Though not always positive, they try to make the best of not only their own, but their peers' situations as well.

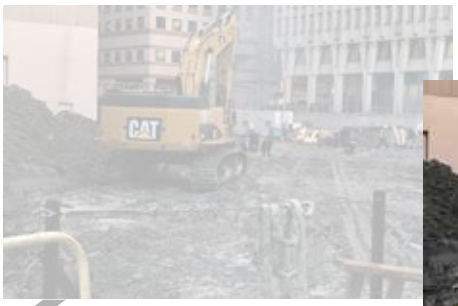
This concept allows the hopeful champion to use their white cane to indicate places of hazard and discomfort, like busy crossings, chaotic train stations and places where roadwork is being done. The connected system allows them to upload their findings straight to a team of urban planners, that can work in collaboration with the visually impaired community to make a better town for everyone.

Jaap remarks that at the Central Station **people are blocking the guideline**, put their luggage there and stand on it.

One of the artists that are exhibiting, Alfredo Jaar, **fell of a stair because he couldn't see**.

There is a tricky crossing near his apartment, it only has sound signal at one side but not the other.

The green light is on for too short to allow Jaap to cross. The crossing is designed without considering people with different abilities.



Possible solutions:

1. reshape meaning of product.
   advances in technology.
   identify product with user.
   strengthen product (brand) identity.
2. empowering users.
   additional features.
   boost social skills.
   boost group identity.
3. better fit between user and (interaction) design.

(Vaes, 2014; Rheinfrank et al., 1986; Barros, Duarte & Cruz, 2012)

Digital divide:

1. digital equality.
   Access Digital Divide (ADD).
   Social Digital Divide (SDD).
2. collaboration with sighted people.
   access to same functionalities.
   allow for exploration of system.
   coherent with sighted GUI.

(Winberg & Bowers, 2004; Hargittai, 2002; Floridi, 2001; Kvasny, 2002; Winberg, 2006)

The hopeful champion

"I have been blind for a number of years now, and have adjusted to my new way of life fairly well. Learning to live with my limitations, I have found that many of them are man-made. After developing a new sensitivity to my other senses, I have found many tricks to overcome these obstacles. Together with visually impaired peers, I have come up with solutions to them as well, but implementing these solutions is hard. There is just no easy or direct way to notify municipalities and other policy makers of inaccessibly features and a part of the visually impaired community is oblivious to the potential solutions, as well."

The concept that was developed for the hopeful champion allows them to contribute to their community by indicating less accessible spots in the urban environment to the local municipality. This is done by pointing the top module, which has a camera running along the length of the cane, in the direction of the situation to be reported. The user then turns the back module until the haptic vibration motors in the center module indicate that the user's location is recognised. The user then pushes the back module into the cane and uploads the coordinates of the undesirable situation to a map owned by the local municipality. The haptic vibration motors pulse to signal to the user that the action has been completed. This concept especially plays into the strategy of making the stigmatised product beneficial for society at large.

Stella is a 26 year old office worker that has been blind for the better part of her life. She goes to work every day and has learned to live with her impairment very well. Next to this, she is actively involved in the visually impaired community.

She walks from her home to her office every day. She needed to practice this route for a long time before being able to travel individually, but is now confident in doing so.

The only obstacle in the route is set of steps that are not indicated and are treacherous.

As suggested by her social worker at Visio, she starts walking with the positive what cane, which has been modified so she can notify the city municipality of any inaccessible areas.

She arrives at the treacherous steps again.

She points it towards the inaccessible area and slides the button up to activate the camera module.

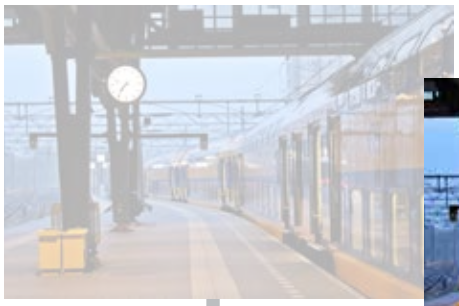
When she pressed bottom module, both a picture of the relevant area and the GPS coordinates are sent to the Delft municipality.

The municipality reviews this data and acts on it, making the city more accessible for all.

the industrious learner.

Novice & embracing.
The industrious learner has had to adapt their way of life dramatically due to rapid onset visual impairment. They are forced how to walk with a white cane from the get-go or face the risk of not being able to go outside any more. This makes the industrious learner a practical person that is willing to use any assistive technology as long as it gets the job done.

Because the stubborn warrior is fiercely independent, they encounter a lot of stress moments in their daily activities. With this concept, the stubborn warrior can indicate when they have stress and get help from more experienced VIPs. The cane can also sense these stress moments and offer guided breathing exercises.



You have to remember it all: a pole here, letterbox there... I'm not at the letterbox so in twenty meters there will be a little pole on the left, so that's exhausting.

I am a little bit of an illiterate when it comes to computers.

Remembering all the shortcuts will always be a problem. At least it is supposed to help against dementia!

I'm also learning braille. Just a few classes to **pick it up again**.

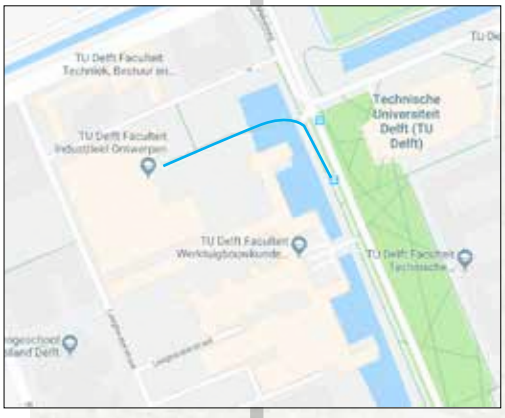
The industrious learner

"It's the end of the week again, which means my weekly cane training at Visio Den Haag is coming up again. I've been looking forward to it. Ever since I lost my eyesight five years ago, I have been feeling dependant on my surroundings. This is in stark contrast with my previous life, in which I worked at an advertising firm. I was training to run a marathon with co-workers when I suddenly felt an immense headache. Three months after, I had lost my entire eye-sight due to retinal detachment. The doctors said it could happen to anyone and that I was just unlucky. I had to say goodbye to my job and most of social life and because only a few close friends remain I have been dependent on caretakers. This unfortunate turn of events has not damaged my willpower, though. I started training with a white cane at Visio from day one because the only thing I want now is to have some of my independence back. Progress is slow though, as I can only do short training sessions once every two weeks. If only I could train on my own… I would do so every day."

The concept that was developed for the industrious learner allows them to train and practice walking certain routes autonomously. The top module contains a module that sends location signals to a cloud. These signals get compared to a map of the route previously decided on by the cane walker and trainer. The user of the cane is guided through the route using haptic vibrations in the middle module of the cane. These vibrations can go from left to right and front to back, simulating motion and gently guiding the user along the path. Warning signals can also be given to the user and are made by quick pulses of haptic vibrations. Using the bottom module, the user can indicate the amount of help that is desired by turning the cane's pommel. This opens or closes the module, semantically indicating the amount of help that is received through data streams. By pressing on the bottom module, places of interest are added to the user's personal route which can be discussed during training with the mobility therapists. The mobility therapist also receives data from the cane that manifests itself in maps. These maps can be used to discuss progress and potential pitfalls that cane walker might encounter.

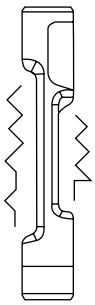
Ayla is 20 years old and a student at Delft University of Technology. After an accident, she has lost 90% of her eyesight and is now legally blind.

She has been training with a professional ergo-therapist once a week in order to be able to walk the route from the campus bus stop to the faculty of Industrial Design Engineering.



Her ergo-therapist at Visio explains to her the benefits of the positive white cane. He suggests a configuration that will allow her to train the route by herself every day.

Using haptic feedback, she begins regularly walking the route by herself.

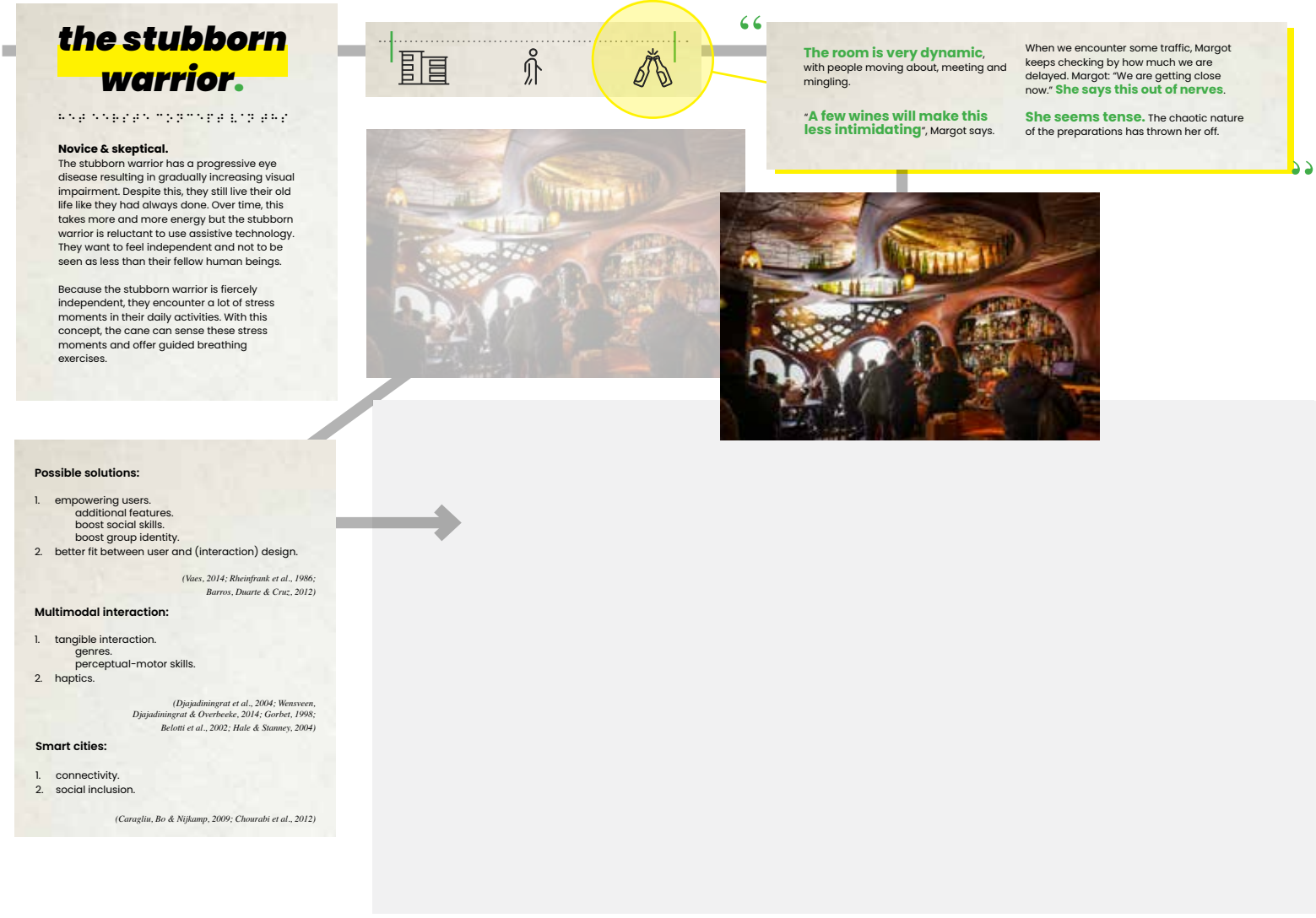


The cane handle employs different kinds of haptics that offer cues that have been decided upon together with the ergo-therapist.

When Ayla wants the positive white cane to track her data, she pushes up to activate the top module.

Ayla can turn the bottom module to determine the amount of data that is being shared within the system. She can also push it to indicate a place of interest.

Using the data, Ayla's ergo-therapist can give her more targeted feedback, allowing her to develop her cane technique in a more pleasant and efficient way.



The stubborn warrior

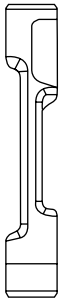
"I have been going blind slowly due to retinitis pigmentosa for a good number of years now. At first it was slow and I could live my old life. But now it's honestly getting harder and harder to stay independent. I have learned many tricks that still allow me to live my old life. I think that's because I'm unwilling to accept my future impairment and am frankly very scared for what the future may hold. I know I'm going to have to walk with a cane to continue living, but I'm afraid of what people will think when they see me walking down the street holding it, although living without it has been very stressful and exhausting. I did recently meet some fellow blind people through Visio and have started talking to them. Some of them have begon convincing me that trying the cane would be worthwhile, but it doesn't feel right to me yet…"

The concept that was developed for the stubborn warrior allows them to hide and show the white cane at will. This will help them to gradually get used to the white cane and its effect it has on both their perception of self and the reactions of bystanders through stigma. The top module includes motors that allows the white cane to fold into itself, turning less visible. This is controlled by the bottom module, that can be turned to increase or decrease the size of the cane and pressed to either fully retract or expand the cane, depending on the current mode. The middle module measures stress levels and offers guided breathing exercises when moments of stress arise. Both these moments of stress and the user's behaviour pertaining to either showing or hiding the cane are shared with the professional at an organisation like Visio. This will help the professional understand the specific fears and anxieties of their clients better and allow them to come up with more target exercises to overcome these hurdles.

Peter is a 25 year old man that has been going blind due to retinitis pigmentosa for some years now. He has been postponing the use of the white cane because he does not want to be seen as pitiful.

He has been having multiple discussions about this fact with his social worker at Visio. The social worker at Visio recommends Peter walks with the positive white cane. She says this will allow Peter to slowly get used to walking with the white cane out in public.

Peter tries walking in public with the positive white cane for the first time. He feels the eyes of people in his back. This makes him very anxious. The positive white cane senses this.



1010101

Peter synchronises his breath with the haptic feedback the cane provides, breathing together with it until his heart rate has slowed down.

Peter tries walking walking with the white cane more and more, closing the bottom module more and more to indicate to the system that he is in less need of help.

Peter has fully learned to let go of the fear of walking with a white cane in public. This has made him considerably more independent. Peter and his social worker at Visio can now discuss freely whenever moments of anxiety show up in the data.

Chapter 2.2 form language.

Form language and form trends are important in this product for the visually impaired for a multitude of reasons. The first reason is adoption. Through interviews, observations and focus groups it was discovered that many prospective cane users either postpone the adoption of the cane or forego it altogether. This has mainly to do with the stigma that these assistive products come with, a fact also observed by academics (1.1.1). Other research has pointed out ways to alleviate this aspect of stigma in assistive products. An affective way of doing is to present the product as a consumer good or to give the product its own distinctive (positive) identity apart from the user.

Another way is to reshape the meaning of the product. Form language can help doing that by presenting the users of the product as, for example, an early adopter of new technology (see section 1.1.1). Because stigma is not only generated by the product and the user, but by bystanders' reactions as well (for more information, see also section 1.1.1), the look of the product can affect the occurrence of stigma in products. In this section, some trends that are relevant in developing this product's form language are discusses. Most of these trends are not only aesthetic, but also functional, and have been chosen for this property. A fascinating relationship to interaction genre was also found, which will be presented in the next chapter.

Exaggerated afforances.

Affordance was discussed before in the literature review sections and all over this report because it is a very important concept in interaction design. Exaggerating affordances in ways such as adding colourful accents to handles, enlarging use cues and using very simple form to indicate affordance is an emerging aesthetic all by itself. Apart from this, it can help the impaired to interact with product in a more intuitive way.

It is however observed that exaggerated affordances can contribute to a more medical look. This is to be avoided if we intend to decrease the amount of stigma produced by our white cane. The Together Canes project by Lanzavecchia and Wai presents an exemplary application of this trend and manages to use it in a modern way without having the product feel like an assistive product.

Macro patterns.

Macro patterns is another recent trend in product design. Accenting entire surfaces with subtle repeating patterns does not only give a product a modern feeling, but could also be very valuable in the design for the visually impaired as it allows them to differentiate between different parts of products by touch. This trend is arguably started by Yves Behar's work on the Jawbone set of products.

Modular elements.

Another current trend in formgiving is modular design. Because the design proposal in this project is modular, it is logical that the form language would leverage that. As observed by examining this trend, it is important that all modular elements differ slightly in orientation, finish or colour as to produce a cohesive whole while still allowing the user to discern the different elements.

Images on next pages, by number:

Exaggerated afordances:
1. Dexcom G6 by Design Concepts
2.Stand by Judy Kong
3. Waytap by frogdesign
4. Adapticve controller by Microsoft
5. Together Canes by Lanzavecchia & Wai
6. Homehero by Jonas Damon

Modular elements:
1. PR/01 by Fabien Neuroy
2. Nurture by Yin Wang
3. Voice BLOX by Yang Gao
4. Fuego by Ammunition group
5. Elvie by Chiaro Technology
6. Krobo bench by Torbjorn Arfdal

Macro patterns:
1. Jet backpack by Tessel
2. Speaker + Microphone by Antoni Botev
3. NDM City Sock by Adidas
4. Hennesy XO bottle by Mark Newson
5. Vision Alpha by NONOBJECT
6. Digital Camera concept by Abidur Chowdhury
7. Jawbone bracelet by Yves Behar

Exaggerated afforances.

1

2

3

5

4

6

Modular elements.

1

2

3

4

5

6

Macro patterns.

1

2

3

4

5

6

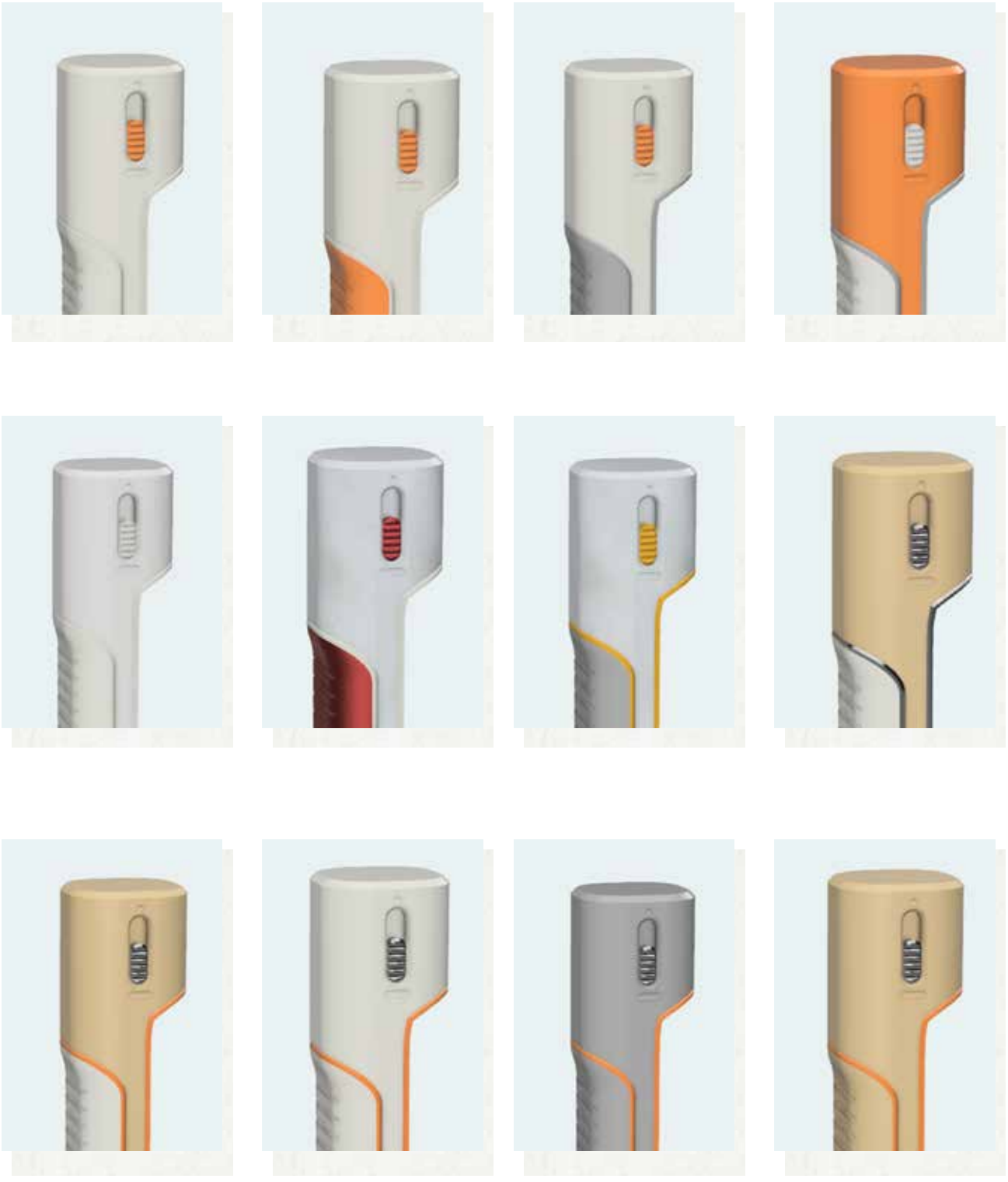
7

Chapter 2.3 colour studies.

⠠⠉⠓⠁⠏⠞⠑⠗ ⠼⠃⠲⠼⠉ ⠉⠕⠇⠕⠥⠗ ⠎⠞⠥⠙⠊⠑⠎

With the cane design finished, a high-definition prototype could be built with which user tests could be conducted. Before doing this, however, a colour scheme had to be decided on. A large number of renders were made to determine this colour scheme. These renders were subsequently shown 10 fellow students in total. These students were asked to rate the colour schemes relatives to the three characteristics ‘modern’, ‘high-tech’ and ‘unique’ on a scale from 0 to 5.

A cane that scores the highest on these three characteristics is not only assumed to embody a unique identity of its own, but also show that it offers features that go beyond the functioning of the current white cane. In other words, the colour scheme is meant to represent the technologically advanced nature of the cane while still showing a unique and personal identity. The colour schemes and their ratings can been in the figures on the next pages. The final colour scheme that was decided upon is highlighted.





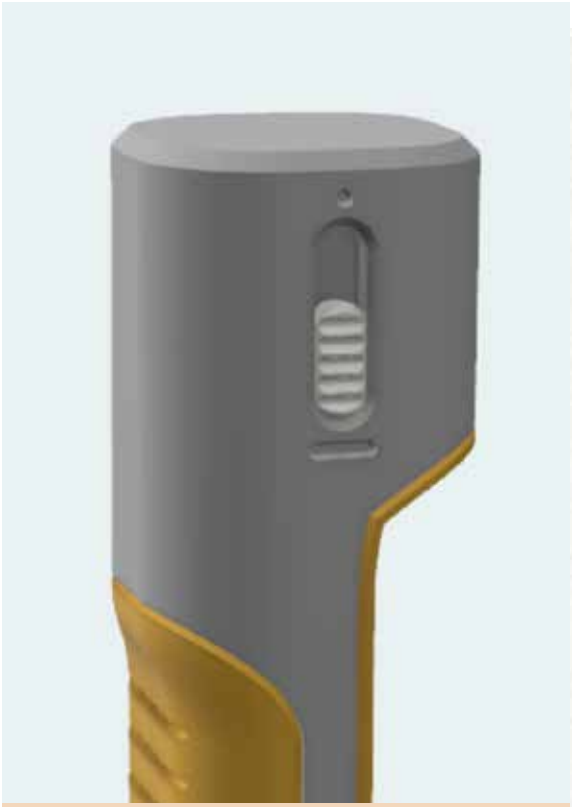









modern: 2
high-tech: 2
unique: 3



modern: 3
high-tech: 3
unique: 5

modern: 3
high-tech: 4
unique: 3

modern: 5
high-tech: 4
unique: 3

Chapter 2.4 prototyping.

⠠⠉⠓⠁⠏⠞⠑⠗ ⠼⠃⠲⠼⠙ ⠏⠗⠕⠞⠕⠞⠽⠏⠊⠝⠛⠲

The design that is highlighted was chosen for the final prototype. The prototype was made by 3D-printing the more complex parts and applying layers of spray plaster that could subsequently be sanded to give a smooth finish. The colours were applied by masking areas of the 3D-printed model and spay-painting on top of the spray plaster. The simpler parts of the cane were turned out of wood and aluminium on a lathe. The model was made in parts to ensure better portability. This was deemed important in carrying out the user tests.

The construction of the prototyped will be presented using a timeline of pictures with added descriptions on the following pages.

1. The general shape of the handle is investigated by making foam models.

2. The shape is 3D-modeled and printed. After testing, it is deemed suboptimal.

3. Some other shapes are investigated, as well as suitable cane materials.

4. The final cane design is modeled and set to the Ultimaker 2+ printer.

5. The cane parts are milled out of beechwood. Three parts are milled to allow for two bands.

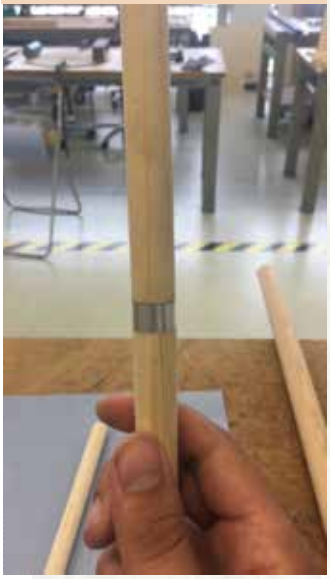
6. The wood is treated with beeswax to bring out the grain and make it more weather-resistant.

7. The core handle is done! It is then repeatedly treated with spray plaster and sanded for a smooth finish.

9. The rest of the parts are printed. This is done because it allows for more accurate painting later.

11. The rest of the handle is done. Time for assembly!

8. The indicator rings are milled out of aluminium. They also serve as connectors.



10. Parts of the handle are masked and the handle is spraypainted, giving a clean product line.

12. The finished prototype is complete and ready to be tested on it stigmatic properties. Here it is next to the current white cane.

section 3: validation.

Chapter 3.1 validation.

3.1.1 Validation.

In order to validate certain aspects of the design, a set of two validation tests were done. One of these validation tests served the purpose of proving the decreased stagmaticity of the positive white cane, while the other was conducted to validate the meaningfulness of data gathered by the positive white cane. These tests will be described in a methods section, results section and conclusions section.

3.1.2 Meaningful data.

To explore and test the meaningfulness of the multi-layered data gathered by the three concept canes, a session was set up at Visio. This session was meant to gather insights from professionals and visually impaired people in how this data could be meaningful in their relationships and how it might allow them to work together more effectively or pleasantly. The data gathered from this session would prove to be useful to nuance and provide meaning to the extensive amounts of data that could be gathered by a connected white cane.

Stimuli, setup and participants

The session was held at Visio in Den Haag, next to the Mariahoeve station on Wednesday August 14th and lasted from 14:00 until 16:00. The session was conducted in a room with a table in it around which all participants were sat. Some cookies were brought to enjoy during the break. A cellphone was brought to record audio of the session.

Five participants were gathered for the session. Three of these were visually impaired, one of these was a social worker from Visio and the last was the spouse of one of the visually impaired participants. Amongst the three visually impaired participants, two were legally blind. One of these had been legally blind for most of their lives, while the other lost their eyesight recently. The last visually impaired participant has a progressive disease in the intermediate stage. These three participants were selected to ensure a balance in visually impaired experience. This was taken into account to make the outcomes relevant for as large a target group as possible.

Method

At the start of the session, participants are welcomed and the intent and setup of the session is presented. Permission to record audio was gained. Afterwards, participants are asked to introduce themselves to each other. An icebreaker was not deemed necessary, as the last session at Visio showed that the people that make the effort to come to such a session are mostly motivated to share their opinions and are not scared to do so.

The bulk of the session consisted of a guided fantasy. The guided fantasy consists of three parts and is described as follows:

1. It is Wednesday morning. You leave your home, and start off on a familiar route. You walk a few minutes and listen to the sound of the traffic.

You arrive at a street crossing not far from your home. This is a place that you know very well. Stop here for a bit, and pay attention to the moment you stand still. What do you listen to? What do you do? What comes to your mind? What do you need to know to continue your route?

What would you like to share or receive from your companion? What is the difference in companions in terms of information sharing? What do you want to keep private? Why these types of information?

2. You continue your walk. You are entering an unfamiliar neighbourhood. What changes? Who are you accompanied by?

You arrive at a crossing. This place is new to you. Stop here for a bit, and pay attention to the moment. You are standing still. What do you listen to? What do you do? What comes to your mind? What do you need to know to continue your route? How can your companion help your in this? How is it different from before?

What information would you like to share or receive from your companion? What is the difference in companions in terms of information sharing? What do you want to keep private? Why these types of information?

3. Let's say you explore this new neighbourhood by yourself. How is this different from exploring it with a companion?

You arrive at a crossing. This place is new to you. Stop here for a bit, and pay attention to the moment. You are standing still. What do you listen to? What do you do? What comes to your mind? What do you need to know to continue your route? How is it different from before?

What information would you like to share or receive from your companion? What is the difference in companions in terms of information sharing? What do you want to keep private? Why these types of information?

A fifteen minute break took place after the guided fantasy, after which a half-hour plenary reflection was held. This reflection was meant to gain deeper insights into points that were discussed during the guided fantasy. After the plenary reflection, the session was wrapped up by having participants reflect on the insights once again and ranking the different takeaways from the session. After this, the session ended and participants were guided out of the Visio facility.

Results

Through a semi-open discussion that was structured using the three guided fantasies, several topics that have to do with data when being visually impaired emerged. These topics will be presented below and discussed.

Indicating danger

Participants remarked that some of the premier topics of information they wanted to know about and could not always get access to pertain to danger. Traffic flow is not always obvious and can be treacherous when navigating densely populated urban spaces. They would also like to be notified of obstacles that are close by, especially citing "amsterdammertjes", which are little poles that dot the urban landscape of Amsterdam and which they frequently run into.

Navigation

Navigation was also a key topic of information the participants wanted to know about. Particularly the topic of staying on-route was mentioned. Participants wanted to know if the direction they were facing in was the right one and if they were on track. However, this information is not always welcome, as visually impaired people get thought a personal navigation style by their ergotherapist. This suggests a certain flexibility in the information, and the fact that visually impaired people will not always take directions as gospel. This notion is reinforced by the following quote:

> *Peter: "In navigation, you have to find your own way. So the system should enable for that kind of flexibility".*

When to share

Some reasons to share data were mentioned by participants. While they couldn't find any reason to share data with just anyone that had access to the system, some occasions were identified as exceptions. They wanted to share information pertaining to danger, such as the one mentioned in that relevant section. They also wanted to share data when trying something new of difficult as they thought that could add to the body of knowledge in the visually impaired community.

Emotional data

Emotional data is data that the participants indicated they were only willing to share with people close to them. In nuancing this notion, however, the conclusion was reached that quantifying emotions should never be the goal, as that wouldn't help in reaching a higher level of understanding. Data with emotional qualities could lead to conversations instead, which will help to bring the visually impaired users and the people around them closer together. Also, emotional data was deemed useful to be recorded for oneself, as it could give insights into your own habits.

Information they would like to receive

Information visually impaired people would like to receive are on multiple levels. On one hand, there is the practical information that they don't have easy access to. On the other hand, there is information that is more hedonistic in nature. The more practical information pertains to things like the locations of curbs and slopes. Additional information that is practical in nature can be found in the section pertaining to practical information above.

The more hedonistic kind of information that they are interested in learning about mostly pertains to context. Visually impaired people find it hard to get a sense of the kind of environment they are navigating within. That is why they are interesting this kind of information. They would like to know the type of buildings in the neighbourhood, the people walking through the streets, the sights on vacation and may other less practical, but more emotive kinds of information. This notion is reinforced by the following quotes:

> *Ines: "I have an artist friend that's very visual. When I'm with her, she tells me what she sees and my surroundings come to life".*
>
> ---
>
> *Peter: "The world is changing. Hearing what surroundings that I remember fondly look like now would make me very happy".*
>
> ---
>
> *There has to be a balance between the two kinds of information that are gathered, though. While both types of information are very valuable, they each have their place. This notion is reinforced by the following quote:*
>
> ---
>
> *Jaap: "When I go to a new neighbourhood, I would love to hear about the general vibe there, and the kind of people walking around. When I just want to go to the store, I don't care about those kinds of things".*

Discussion

The most interesting thing to see is that a certain system of data can be found in which the emotional or hedonistic character of data can be plotted among an axis of level of desired privacy. Participants also mentioned that as they mastered their environment more, the need for practical data declined and the desire for more hedonistic data increased. This axis is called 'novelty' A representation of this can be seen in the figure below.

3.1.3 Dyadic distance.

This experiment was conducted to test whether stigmaticity is decreased in the positive white cane as opposed to the old white cane. This test is partly appropriated from Vaes (2014). Minor adjustments were made, these will be indicated where appropriate.

Stimuli, setup and participants

This experiment is carried out in six times, each time using different stimuli. Firstly, the experiment is carried out using both a male and female participant. This is done to mitigate the effect the participant's gender might have on the results. Both participants perform the experiments while not wielding a cane (this is the reference condition), wielding the traditional white cane and wielding the positive white cane.

The chosen location for the experiment is Delft central station, both because it is a very realistic situation for visually impaired to be in (they have to rely on public transit to get around) and because it offers a large amount of participants. Because the researcher had no access to a measurement device such as described by Vaes (Vaes, 2014) distance between research confederate and participants was measured by comparing it to objects from which the distance between research confederate and object was known. Notes were made, placing the participant between the objects and the research confederate using an observation template (see figure on adjacent page).

Due to the selection of the location, the set of participants is very diverse. A lot of people pass by Delft railway station on a daily basis, ranging in nationality, gender age and social background. The sample size in this experiment was 161. Passers-by had to meet a few qualifications in order to be considered a valid participant (Vaes, 2014):

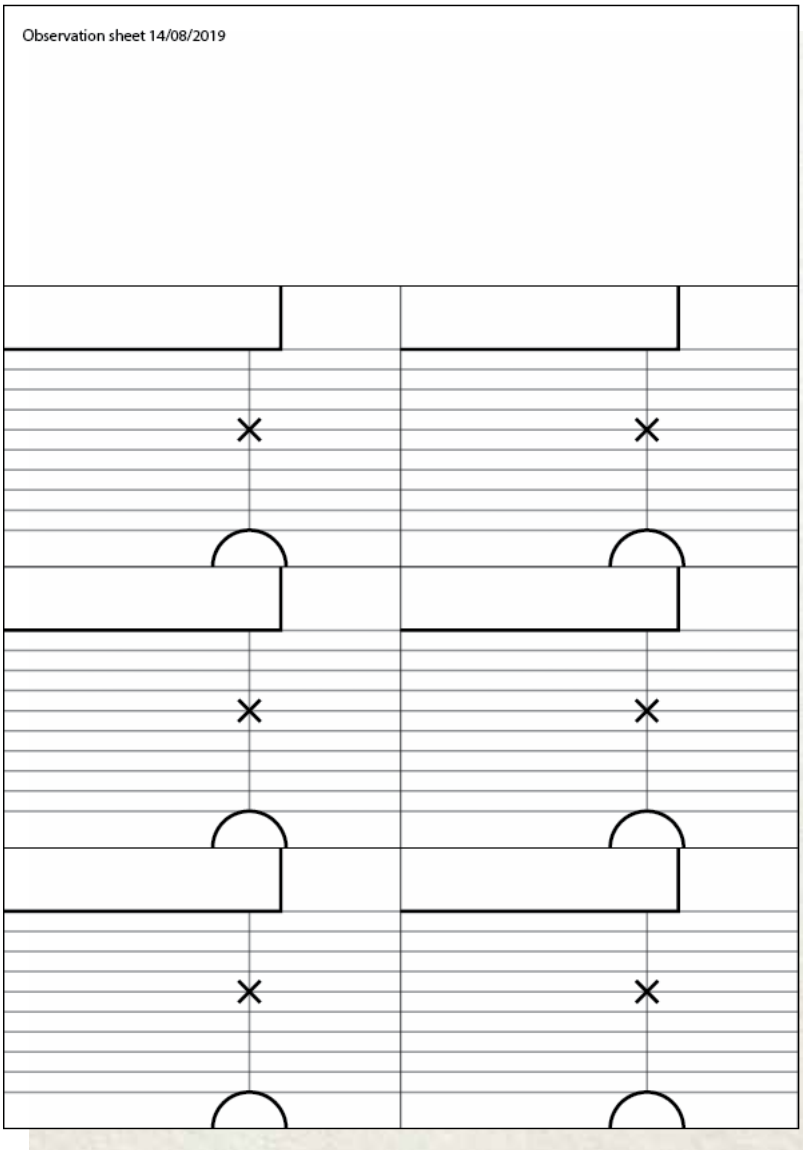
1. Because people behave differently in groups, only singular passers-by were considered as valid participants.
2. Passers-by who were accompanied by a pet were not considered as valid participants.
3. If passers-by were obstructed or otherwise hindered during the interactions, they did not count as valid participants. This also counts for passers-by engaging in focused activities such as listening to music or talking on the phone.
4. If passers-by walked in the reverse direction and were thus not facing the participant, they did not count as valid participants.

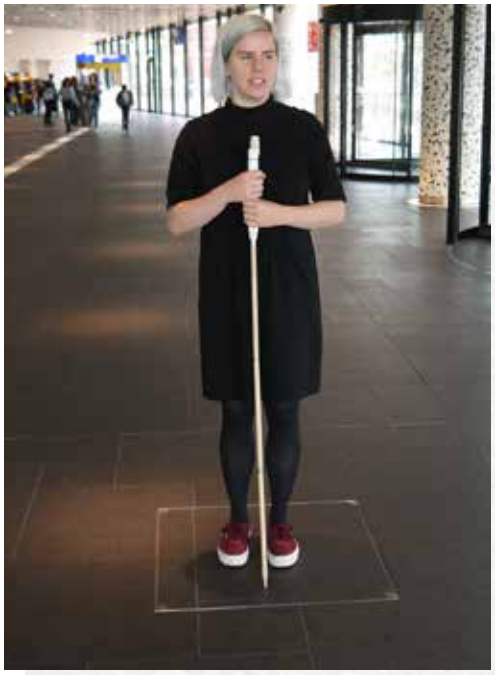
The variable measured in this experiment is called the dyadic distance, which is the distance between a "dyad". A dyad is a collection of two people, which is the smallest social unit. The dyadic distance can signify how comfortable people are with each other. Using theory by Hall, we can define certain distances as certain types of space (Hall, 1966). These spaces are the intimate space, personal space, social space and public space. Intimate space is the space utilised for embracing and touching, personal distance is used for interactions amongst good friends or family and social distance is used for interactions amongst acquaintances. Lastly, public distance is used for public speaking. Thus, we can conclude that the dyadic distance can tell us something about the relationship between two persons.

Next to this, the amount of times bystanders looked over their shoulders was also noted. The exact motivation of this response is unclear and can be explained by a multitude of factors including curiosity and aversion. Some interviews were held with bystanders looking over their shoulders to clarify their intentions.

This dyadic distance and staring behaviour of participants are measured by observing the behaviour of people passing by a research confederate without a cane, with the current cane and with the positive white cane. The walking and staring behaviour is registered in a notebook filled with observation templates. For the first 30 minutes, the behaviour of participants regarding the presence of the research confederate was noted without cane. The research confederate then switched to welding the current white cane. After 30 more minutes, the research confederate switched to wielding the positive white cane. The behaviour of participants regarding the presence of the research confederate wielding the positive white cane was also recorded for 30 minutes. After each round of observations, a short open-ended interview was conducted with the research confederate.

After this, the session ended and participants were guided out of the Visio facility.


Observation sheet 14/08/2019



Results

The hypothesis in this experiment is that the dyadic distance would increase when research confederates would wield either of the canes, with the dyadic distance being smaller while wielding the positive white cane. A secondary hypothesis is that the amount of looks would be greater in wielding the positive white cane than the current white cane. A hypothesis in terms of differences per gender was not established. We will discuss the results for the female and male confederates separately and then compare them.

Results for the female research confederate

The experiment measured an average dyadic distance of 0,60 meters for the female research confederate without any sort of cane. In the other two setups, the experiment measurements indicate an average dyadic distance of 1,38 meters for the current cane and 1,02 for the positive white cane. This theoretically indicates that individuals passing by a visually impaired person wielding the positive white cane are willing to enter into personal space which is a dyadic distance between 46 and 120 centimetres (Hall, 1966), which is the same personal space as the one that is entered when she is not wielding a cane.

Passers-by offered the female participants help on two separate occasions when wielding the current cane, and not once when wielding the positive white cane.

The amount of looks recorded during the experiment was 2 when wielding no cane, 9 when wielding the current cane and 6 while wielding the positive white cane. Because of sample sizes of 20, 29 and 28, respectively, no hard conclusions can be gathered from this data. The open-ended interviews can, however, shed some light on this.

> *Veronika (when asked about how she felt wielding the current white cane): "I did not feel out of place, but I did have the feeling that people were paying a lot more attention to me. Like they were looking out for me."*
>
> ---
>
> *Veronika (when asked about how she felt wielding the positive white cane): "I felt very out of place. I feel like when people would ask me what I was doing here, I wouldn't know what to tell them."*
>
> ---
>
> *Veronika (when told that she did get less looks when wielding the positive white cane): "Strange, it sure felt like people were staring at me a whole lot more."*

Results for the male research confederate

In this experiment, an average dyadic distance of 0,77 meters for the male research confederate without any sort of cane was measured. In the other two setups, the experiment measurements indicate an average dyadic distance of 1,17 meters for the current cane and 1,01 for the positive white cane. This again indicates that individuals passing by a visually impaired person wielding the positive white cane are willing to enter into personal space which is a dyadic distance between 46 and 120 centimetres (Hall, 1966), which is the same personal space as the one that is entered when she is not wielding a cane and using the current white cane. However, the distance measured when not using a cane is towards the lower end of personal space, while the other two dyadic distances are in the higher spectrum of personal space. Also, far more occasions of passers-by making a circle around the research confederate were observed in the situation looking at the white canes than at the station without the cane.

The amount of looks recorded during the experiment was 3 when wielding no cane, 9 when wielding the current cane and 7 while wielding the positive white cane. Because of sample sizes of 27, 31 and 32, respectively, no hard conclusions can be gathered from this data. The open-ended interviews can, however, again shed some light on this.

> *Sven (when asked about how he felt wielding the current white cane): "I think people just treated me as if I were blind. I did not particularly feel in the way, but did feel like I was cheating my surroundings - especially when that truly visually impaired man walked by."*
>
> ---
>
> *Sven (when asked about how he felt wielding the positive white cane): "I think people were mainly looking at me to determine what that stick in my hand was. I didn't feel any negativity."*

Comparison between male and female research confederate

There are some differences between both the data and reported experiences between the female and male research confederates. The differences will be listed here. Their relevance will be discussed the discussion.

- The dyadic distance between the female research confederate and passers-by when wielding the current white cane is larger than the dyadic distance observed with the male participant in the same situation.
- However, the dyadic distance when wielding the positive white cane was homogenous between female and male research confederates.
- The amount of looks in all situations did not differ between the female and male research confederates.
- When wielding the current cane, passers-by offered help to the female participants twice, while no passer-by did so for the male participant.
- The female research participant reported feeling much more insecure while wielding the positive white cane than the male participant.

Discussion

We can conclude that the difference in dyadic distance between the situations without wielding a cane and the situations in which a cane was present (be it current cane or positive white cane) is significant. In the female research confederate, the dyadic distance between the current cane situation and positive white cane is significant while it's not significant in the male confederate. This can be attributed to differences in how society treats males using assistive technology versus how society treats females using those same products. To be sure of this and to find a successful method of coping with this phenomenon, additional research will have to be carried out.

After deliberation with the female research confederate, the conclusion was reached that she felt more out of place because she thought passers-by might recognise the white cane for what it is and respond accordingly. She did not know how to respond to the reactions pertaining the positive white cane because she did not know how the passers-by interpreted the product. She indicated that she did not know whether the looks were out of curiosity, confusion or some other motivation unknown to her.

The chosen location of the train station could also be considered to be a pretty extreme case of a forced social situation. The location was chosen regardless because of its prominence in the experiment replicated from Vaes (Vaes, 2014). An objection to the selection of a train station could be the fact that commuters are in a hurry and might not have the same level of attention as in more general public life. The stationary position of the research confederate might also cause passers-by to treat them differently.

Chapter 3.2 conclusions.

Various hardships in the lives of visually impaired people have been found in the user research conducted over the course of this project. Some of these are due to the fact that visually impaired people rely on assistive products, which are heavily stigmatised. This jeopardises their position in society to such an extent that this social group can grow very isolated and experience a multitude of psychological problems. The user research in this project has shown various issues that visually impaired people face on a daily basis, as well as their attitudes towards the devices they have to rely on to overcome these hardships. There are multiple styles of coping with these hardships and the assistive products and each of these styles - which have been embodied into personas - require a different strategy in order to overcome some of their issues.

The functionalities in the three concepts outlined in this report are deemed to be fairly meaningful to their intended users within the visually impaired community. Especially the validation session at Visio has shown that there is a need for this kind of assistance and that the sharing of data pertaining to these functionalities is deemed to be meaningful.

Combined with this, the aesthetics of the positive white cane are also found to have an impact on stigmaticity. Especially in females, the modern, technological look of the proposed white cane seems to make people less weary of its wielder and makes passers-by avoid them to a lesser degree. While this effect is observed less in males remains a topic to be clarified by further research.

The project also shows promising avenues to pursue towards the development of an interaction genre for the visually impaired. It is a shame that the context of this project did not allow enough time for this facet of the project to be fully explored. Would an interaction genre for the visually impaired be developed in the future, it would bring much benefit to the relationship between visually impaired users and their products, which is currently poor because of the fact that products for the visually impaired are oftentimes nothing more than a finicky layer that is built on top of product that are designed for the seeing. This merely allows the visually impaired to make use of these products, instead of achieving mastery over them.

Chapter 3.3 recommendations.

While this project has made some steps towards understanding how to design for less stigmatising assistive products for the visually impaired, it gives no conclusive answers. In this chapter, some recommendatons will be given. Using these recommendations, the project can developed further in the future.

Allowing for selective sharing of data

The concepts as they are presented in this report do not allow their user to select the types of data they wish to be shared or kept private. This is, however, recognised as a valuable functionality in maintaining the privacy of all stakeholders. In the next iteration of the positive white cane, this functionality has priority. In developing this functionality, it will be important to determine the exact types of data that are being exchanged through the system. These types of data will then have be semantically represented in interactions that allow of prevent them from travelling between users. It is also important that this product functionally be designed in an open way to allow for the introduction of new types of data.

Prototyping the communications system between visually impaired users and others

Developing a rudimentary prototype that allows data to travel between visually impaired cane walkers and others in their social system will enable us to test certain hypotheses that are put forward in this project.. Iterative prototyping and testing of this system will also uncover nuances that can be made ints design that were not previously obvious.

Iterating on the physical design of the positive white cane and the proposed design language

Because only one iteration of the positive white cane was tested on its stigmatic effects, no definite conclusions can be made on the effectiveness of this particular design, other than that it performed differently than the current design. To optimise the design of the positive white cane, multiple iterations should be made that each emphasis one of three design language elements. This will give a more nuanced understanding of each of the design language elements and their role in product stigmaticity. Designing the cane's shape by varying these three parameters could also be an interesting way to bring out new features in the cane's design.

Identifying relevant new functionalities for the positive white cane

Defining relevant new functionalities for the white cane would expand the three concepts into more of a system and could bring the benefits of the positive white cane to a far wider user group. As found in research, the user group of visually impaired people is wildly diverse and no singular solution will ever solve the problem of designing a positive white cane. Since not all visually impaired people are concerned with the stigmaticity of the white cane, the visual redesign will work as a general solution. These users could, however, benefit from additional functionality, which is another strategy that is used to solve product stigmaticity.

Producing technology and production roadmaps

Talking to technologists and producing technology roadmaps with them would allow the development of the positive white cane to be more focused. By focusing on cutting-edge technology and anticipating both social and technological developments, the positive white cane could be made both more relevant and more feasible.

Chapter 3.4 reflections.

At the start of this project, I set myself six project goals. In this part of the reflection, I will discuss whether or not I achieved these goals and if these goals proved to be relevant in the context of this project. I will also reflect on how I can set myself goals for my future projects.

Execute extensive user research

I set this as a goal for myself because I foresee myself working as a designer with a strong research background. I also stated that this goal was deemed important for the project because I was unable to empathise with my visually impaired target group in the beginning. I think I have achieved this goal because everything that is done in this project is grounded in research. For example, the concepts are fully based on insights from user research and the aesthetics of the positive white cane are validated through experiments. I also learned a lot about my own design process whilst conducting this research; I learned how willing some people are to talk to you about their most private of problems - I also learned that some people embellish on their own experiences in order to please you as a researcher. This being the first time I took such a research-centric approach, I also found that I really like this approach to designing. It was a huge learning experience for me and I am grateful that I was able to execute it with the help of some amazing people.

Add to the body of research on assistive products and product stigma

At the start of this project, I wanted to have some scientific impact. I don't know if I fully achieved that as I have not talked to many academics about my work. However, a research group from Delft University of Technology was interested in my process and are talking about using my work in some form. In the end, I think I did not add much to the already existing knowledge on product stigma, but merely deepened it by making it more tangible. I think my example of the positive white cane can serve as a guideline or source of inspiration for future project dealing with assistive products and product stigma.

Develop an interaction genre for the visually impaired

Setting this goal was too ambitious of me. While I still feel it is a worthwhile pursuit to develop an interaction genre for the visually impaired, in the context of this project it was not possible. While I did give some suggestions for interaction paradigms that are a logical result of the proposed form language, and some prototypes were made and validated, a robust interaction genre had not been found. This is however a very interesting topic that I would love to work on in the future. Setting this goal is an example of me spreading my time thin over the course of a project, which I something I tend to do in every project. Letting this goal go was tough for me, but it did make me realise that good results can be reached when a project is more focused.

Deliver a graduation project that shows my design process to future employers

I think this project shows a good combination of various skills. It shows that I can do user research, develop shapes through form studies and tests, make relatively high quality prototypes and am able to reflect on both my growth and design process.

Incorporate prototyping in the design process more

I have always been a big believer in the notion that making is understanding. However, in the projects I had done until now, I had never really conducted a process in which making models and prototypes played a key role in making design decisions. In this project, I went all-out in making models to validate all kinds of assumptions. I have found it works tremendously for me and speeds up my decision-making significantly. From now on, I will incorporate model making into my process and lean on it as a powerful ideation and validation tool.

The design process

Overall, executing this project went relatively smooth. While there were some roadblocks, particularly in the analysis and ideation phases, I feel like the solid foundation of research that was laid down in the beginning phases of this project made the rest of the process relatively easy. One of the harder parts during this process for me was the transition from working with a research confederate to working alone. I really missed the daily interaction with another design student and the motivation we gave to one another. During the second part of the project, I got stuck on multiple occasions and found it hard to think laterally. I also found it harder to focus at times and had many a day where I was paralysed by the sheer amount of choices to make during the project and its boundless opportunities.

I also found it hard to not let myself get too beat up whenever the project was not going according to plan. This is due to the fact that I found it very hard to separate myself from the project. Because I got so involved in this project and excited about working on it, I took feedback very seriously and had a hard time approaching it more loosely. This made the project gradually less fun and I lost track of my self-care for a while. I am happy I can reflect on this phenomenon now that the project is nearing completion. I think it's dangerous for a designer to get so lost in a project that they forget themselves and their own needs, and it's something I will need to watch out for in the future.

Implications for design career

I think a project like this could fit well in the portfolios of companies like IDEO and frog, which are my dream companies to work at later on in my career. The fact that my project has been accepted to exhibit at the Design United exhibition at the Dutch Design Week makes me very proud and I am going to embrace it as a networking opportunity.

References.

Belk, R. W. (2002). Possessions and the Extended Self. Journal of Consumer Research, 15(2), 139. https://doi.org/10.1086/209154

Bellotti, V., Back, M., Edwards, W. K., Grinter, R. E., Henderson, A., & Lopes, C. (2002). Making sense of sensing systems. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems Changing Our World, Changing Ourselves - CHI '02, (1), 415. https://doi.org/10.1145/503376.503450

Bloom, P., & Veres, C. (1999). The perceived intentionality of groups. Cognition, 71(1), B1. https://doi.org/10.1016/S0010-0277(99)00014-1

Burns, C., Dishman, E., Verpiank, W., & Lassiter, B. (1994). Actors, hairdos & videotape: informance design, 119–120.

Buxton, W., & Myers, B. (2007). A study in two-handed input. ACM SIGCHI Bulletin, 17(4), 321–326. https://doi.org/10.1145/22339.22390

Caragliu, A., Bo, C. Del, & Nijkamp, P. (2009). Smart Cities in Europe Smart Cities in Europe. Proceedings of the 3rd Central European Conference in Regional Science, 0732(November), 45–59. https://doi.org/10.1080/10630732.2011.601117

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., … Scholl, H. J. (2012). Understanding smart cities: An integrative framework. Proceedings of the Annual Hawaii International Conference on System Sciences, 2289–2297. https://doi.org/10.1109/HICSS.2012.615

Desmet, P., & Hekkert, P. (2007). Framework of Product Experience, 1(1).

Djajadiningrat, T., Matthews, B., & Stienstra, M. (2007). Easy doesn't do it: Skill and expression in tangible aesthetics. Personal and Ubiquitous Computing, 11(8), 657–676. https://doi.org/10.1007/s00779-006-0137-9

Djajadiningrat, T., Wensveen, S., Frens, J., & Overbeeke, K. (2004). Tangible products: Redressing the balance between appearance and action. Personal and Ubiquitous Computing, 8(5), 294–309. https://doi.org/10.1007/s00779-004-0293-8

Dodge, M., & Kitchin, R. (2007). "Outlines of a world coming into existence": Pervasive computing and the ethics of forgetting. Environment and Planning B: Planning and Design, 34(3), 431–445. https://doi.org/10.1068/b32041t

Ehn, P., & Kyng, M. (1992). Cardboard Computers: Mocking-it-up or Hands-on the Future.

Ellis, C., Adams, T., & Bochner, A. (2011). Autoethnography : an overview Autoethnography : An Overview. Historical Social Research / Historische Sozialforschung, 36(4), 273–290. https://doi.org/10.1177/1077800405284363

Feijs, L. (2003). Design Science : Meaning , Action and Value. Proceedings of the 6th ADC, (October). Retrieved from http://www.idemployee.id.tue.nl/g.w.m.rauterberg/conferences/CD_doNotOpen/ADC/final_paper/185.pdf

Fernández-Hernández, I., Simón, J., Blasi, R., Payne, C., Miquel, T., & Boyero, J. P. (2014, April). The Galileo commercial service: current status and prospects. In Proceedings of the European navigation conference.

Floridi, L. (2002). Information ethics: an environmental approach to the digital divide. Philosophy in the Contemporary World, 9(1), 39-45.

Frayling, C. (1993). Research in art and design.

Frens, J., & Hengeveld, B. (2013). To make is to grasp. Consilience and Innovation in Design, (August), 1–8. Retrieved from http://purl.tue.nl/590447512073284.pdf

Gorbet, M. (1998). Beyond Input Devices: a New Conceptual Framework for the Design of Physical-Digital Objects. MSc. Media Arts and Science Thesis.

Gori, M., Cappagli, G., Tonelli, A., Baud-Bovy, G., & Finocchietti, S. (2016). Devices for visually impaired people: High technological devices with low user acceptance and no adaptability for children. Neuroscience and Biobehavioral Reviews, 69, 79–88. https://doi.org/10.1016/j.neubiorev.2016.06.043

Gregor, P., Newell, A. F., & Zajicek, M. (2004). Designing for dynamic diversity, 151. https://doi.org/10.1145/638249.638277

Hale, K. S., & Stanney, K. M. (2004). Design Guidelines from Human Physiological , and Neurological Foundations. Ieee Computer Graphics And Applications, 24(2), 33–39.

Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. First monday, 7(4).

Hartmann, B., Klemmer, S. R., Bernstein, M., Abdulla, L., Burr, B., Robinson-Mosher, A., & Gee, J. (2006, October). Reflective physical prototyping through integrated design, test, and analysis. In Proceedings of the 19th annual ACM symposium on User interface software and technology (pp. 299-308). ACM.

Hassenzahl, M., & Wessler, R. (2014). Capturing Design Space From a User Perspective : The Repertory Capturing Design Space From a User Perspective : The Repertory Grid Technique Revisited, (May). https://doi.org/10.1080/10447318.2000.9669070

Hummels, C., & Frens, J. (2009). The reflective transformative design process, 2655. https://doi.org/10.1145/1520340.1520376

Ishii, H., & Ullmer, B. (1997, March). Tangible bits: towards seamless interfaces between people, bits and atoms. In Proceedings of the ACM SIGCHI Conference on Human factors in computing systems (pp. 234-241). ACM.

Jensen, M. V., Buur, J., & Djajadiningrat, T. (2005). Designing the user actions in tangible interaction, 9. https://doi.org/10.1145/1094562.1094565

Keane, K., & Nisi, V. (2013). Experience Prototyping, 224–237. https://doi.org/10.4018/978-1-4666-4623-0.ch011
Kitchin, R. (2014). The real-time city? Big data and smart urbanism. GeoJournal, 79(1), 1–14. https://doi.org/10.1007/s10708-013-9516-8

Krippendorff K, Butter R (1984) Product semantics: exploring the symbolic qualities of form. Innovation. J Ind Des Soc Am 3(2):4-9

Kvasny, L. M. (2003). Problematizing the digital divide: Cultural and social reproduction in a community technology initiative.

Leporini, B., Andronico, P., & Buzzi, M. (2007). Designing search engine user interfaces for the visually impaired. ACM SIGCAPH Computers and the Physically Handicapped, (76), 17–18. https://doi.org/10.1145/1036401.1036409

Lim, Y. K., Stolterman, E., & Tenenberg, J. (2008). The anatomy of prototypes: Prototypes as filters, prototypes as manifestations of design ideas. ACM Transactions on Computer-Human Interaction (TOCHI), 15(2), 7.

Mack, N., Woodsong, C., M. MacQueen, K., Guest, G., & Namey, E. (2005). Qualitative Research Methods: A Data Collector's Field Guide chapter 2. In F. H. International (Ed.), Family Health International.

Mcgookin, D. K., & Brewster, S. A. (2006). SoundBar : Exploiting Multiple Views in Multimodal Graph Browsing, 189(October), 145–154.

McGookin, D., Robertson, E., & Brewster, S. (2010). Clutching at straws: using tangible interaction to provide non-visual access to graphs. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10), 1715–1724. Retrieved from http://dl.acm.org/citation.cfm?id=1753583

Metatla, O., Bryan-Kinns, N., Stockman, T., & Martin, F. (2015). Designing with and for people living with visual impairments: audio-tactile mock-ups, audio diaries and participatory prototyping. CoDesign, 11(1), 35–48. https://doi.org/10.1080/15710882.2015.1007877

MR, M., & RG, G. (2003). The hidden demand for participation in activities and travel by persons who are visually impaired. Journal of Visual Impairment & Blindness, 97(8), 475–488. Retrieved from http://libproxy1.nus.edu.sg/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=106726134&site=ehost-live

Nachtigall, T. (2016, September). Ultra personalization and textile thinking in interaction design. In Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct (pp. 958-961). ACM.

Newell, A. F., & Gregor, P. (2000, November). "User sensitive inclusive design"—in search of a new paradigm. In Proceedings on the 2000 conference on Universal Usability(pp. 39-44). ACM.

Norman, D. (2013). The design of everyday things: Revised and expanded edition. Basic books.

Norman, D. A. (2004). Emotional design: Why we love (or hate) everyday things. Basic Civitas Books.

Papanek, V., & Fuller, R. B. (1972). Design for the real world(p. 22). London: Thames and Hudson.

Rheinfrank, J. J., Evenson, S. K., Kresge, K. J., & Sanders, E. B.-N. (2012). On the Semiology of Object, Space and Behavior: The Design of Strategic Design Languages. Proceedings of the Human Factors Society Annual Meeting, 30(11), 1059–1062. https://doi.org/10.1177/154193128603001102

Scherer, M. (2015). Assistive technology use and stigma Assistive Technology Use and Stigma 1 Running Head : ASSISTIVE TECHNOLOGY USE AND STIGMA Assistive Technology Use and Stigma Phil Parette Illinois State University Marcia Scherer Institute for Matching Person and Techno, (September 2004).

Sennett, R. (2008). The craftsman. Yale University Press.
Vaes, K. (2014). Product Stigmaticity: Understanding, Measuring and Managing Product-Related Stigma. Retrieved from http://resolver.tudelft.nl/uuid:f8471a93-0a6e-42c2-96e4-162984ddf84c
Weiser, M. (1993). Ubiquitous computing. Computer, (10), 71-72.

Wellner, P., Mackay, W., & Gold, R. (1993). Computer-augmented environments: back to the real world. Communications of the ACM, 36(7), 24-27.

Wensveen, S. A., Djajadiningrat, J. P., & Overbeeke, C. J. (2004, August). Interaction frogger: a design framework to couple action and function through feedback and feedforward. In Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 177-184). ACM.

Wensveen, S. A., Djajadiningrat, J. P., & Overbeeke, C. J. (2004, August). Interaction frogger: a design framework to couple action and function through feedback and feedforward. In Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 177-184). ACM.

Winberg, F. (2004). Assembling the Senses : Towards the Design of Cooperative Interfaces for Visually Impaired Users.

Winberg, F. (2006). Supporting Cross-Modal Collaboration: Adding a Social Dimension to Accessibility, 102–110. https://doi.org/10.1007/11821731_10

Zanella, A., Bui, N., Castellani, A., Vangelista, L., & Zorzi, M. (2014). Internet of things for smart cities. IEEE Internet of Things Journal, 1(1), 22–32. https://doi.org/10.1109/JIOT.2014.2306328

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI, 493. https://doi.org/10.1145/1240624.1240704

Appendices.

⠠⠉⠓⠁⠏⠞⠑⠗ ⠞⠓⠗⠑⠑ ⠉⠕⠝⠞⠁⠊⠝⠎ ⠉⠕⠍⠏⠗⠑⠓⠑⠝⠎⠊⠧⠑ ⠍⠁⠞⠑⠗⠊⠁⠇ ⠞⠓⠁⠞ ⠎⠥⠏⠏⠕⠗⠞⠎ ⠞⠓⠑ ⠍⠁⠊⠝ ⠁⠗⠛⠥⠍⠑⠝⠞⠎ ⠕⠋ ⠞⠓⠊⠎ ⠞⠓⠑⠎⠊⠎⠲

Goal of study:
The goal of this autoethnographic study is to get familiar with *autoethnography* and *participant observation* as methods. Another goal is to uncover the possible problems that can emerge during engagement in these methods. These insights will improve the methods used in the eventual full study. The third and last goal is to get insights into the reaction surrounding visually impaired people and to gain empathy for this target group.

Methods:
The two participants in this study are Veronika Szabo and Thijs te Velde. They are both design researchers conducting their master's graduation project at Delft University of Technology. Features that set them apart from the general populations are their knowledge of design research and their stake in the project. These two participants were selected to allow them to both gain experience in conducting autoethnographic research and participant observation as well as gain insights useful to the graduation projects.

The tools used to perform this autoethnographic study are the following:

- *Glasses to simulate the effects of retinitis pigmentosa.*
  We took a pair of sunglasses and neatly cut out blinds out of thick black paper. We then used a pin to create two small holes in the middle of these blinds to see out of. This simulates the effects of retinitis pigmentosa. We chose to simulate this specific type of visual impairment because one of the main stakeholders in the project suffers from this condition.
- *Long cane.*
  The kind people at Visio allowed us to borrow a used long cane. This particular cane is quite worn as it has been used in many a training but still functions and serves our purposes perfectly.
- *Mobile phone for audio recording and taking pictures.*
  Because we won't be able to record everything using writing when walking around town, we decided to use a mobile phone to record the majority of information.
- *Field notebook and pen.*
  We did, however, still carry around a notebook to note down particularly noteworthy observations.

Two rounds of 30-minute studies will be done. In each study, one of the researcher will assume both the role of a guide and a participant observer. This researcher will keep an audio record of observed bystander behaviour by stating observations in the audio recorder out loud. The other researcher will be guided around town using a white cane and modified sunglasses that simulate the effects of retinitis pigmentosa (tunnel-vision). This participant will keep an audio record of autoethnographic information like observations, insecurities and feelings. Pictures will be taken at moments of interest, both for record and later analysis. Two schedules were decided on. They both consist of a walk and executing a mundane task. The two tasks decided on are to get some sandwiches withdraw money at an ATM. After the completion of the two rounds both researchers will complete their personal narratives based on their experience, the audio recordings and the notes made during the reflection. These narratives will be compared afterwards and both commonalities and differences will be noted down and discussed.

The schedule for both sessions is already defined and can be found in this section:

11:00: Start of first part of the study (Veronika will guide, Thijs will be VI).
During this first part of the study, Thijs will have to get used to walking around using the modified glasses and cane, and Veronika will have to probe how much guidance is needed. Veronika and Thijs will also have to get used to stating their experiences out loud, and making notes whenever anything noteworthy occurs.
11:00: Start walk from Delft central station to Kaas & Wijn (Brabantse Turfmarkt).
During this main part of the first round of study, Thijs notes observations about the visually impaired experience while Veronika notes observations about the reaction of bystanders to the presence of behaviour of a visually impaired person.
11:20: Arrive at Kaas & Wijn, buy sandwiches.
During this forced interaction with a bystander, Thijs will make observations about how it feels to execute mundane activities as a visually impaired persons, while Veronika will make observations about the behaviour of the people in the store.
11:30: End of first part of the study, start of reflection. Writing notes for narratives.
After this, both researchers note down other key observations while they are still fresh in their memories.
12:00: Start of second part of the study (Thijs will guide, Veronika will be VI).
This is when we change roles. This time around, Veronika will have to get used to walking with the modified glasses and the cane, while Thijs will have to get used to guiding and making observations at the same time.
12:00: Start walking back to the station.
The second leg of the study begins. The approach remains the same, the roles are reversed.
12:20: Withdraw money at the ING Bank (Phoenixstraat).
Another forced interaction with the environment and possible bystanders will allow us to both gain empathy for visually impaired people and observe the reactions of the environment to the presence of one.
12:30: End of second part of the study, start of reflection. Writing notes for narratives.
After this, we will wrap up the second part of the study and note down additional observations for use in our personal narratives while they are still fresh in our memories.

Personal narrative by Thijs

Prior to starting this experiment, I felt a little bit nervous about navigating the city, but especially going into the store. When I put on the glasses, I noticed I could still see quite well from my center vision. Enough to navigate on my own. This made me walk pretty confidently and comfortably. The cane was still very useful as I could still feel the ground in front of me and thus did not have to think that much about navigating curbs and slopes. Otherwise, this would have been very exhausting navigation. From the moment I put on the glasses and started walking with the white cane, I felt like everybody was looking at me from the corner of their eyes and approaching me more carefully. Right away, Veronika noted that a person on a bike took a larger path around me than usual. Walking to the cheese store was relatively easy, although I did feel like I was in people's way more so than in my seeing life. And to be fair, I did see a lot less. The outline of cyclists approaching was clear, but their faces and general appearance a blur. When entering the cheese store, I felt a moment of hesitance. I even asked Veronika if she would go inside for me in advance and announce our arrival. With a slightly pounding heart, I entered the store. When entering the store, which I had visited not long ago, I navigated confidently to the back of the store where they prepare the sandwiches. A lady asked us if she could help us. I stated I wanted a sandwich and my preferred cheese. She asked me whether I would want anything else with the sandwich. I felt like she was talking to me a in a childish voice, like you do to toddlers. I don't know if this was slightly true or if my mind was messing with me completely, but the effect was amplified in my mind due to my insecurity for sure. Another lady browsing the cheese store looked at me in wonder, or so I interpreted.

In general, I felt like bystanders were not observing me any more than usual, but were more aware of my presence. I also felt like I was tricking bystanders, as if me pretending to be blind was somehow unfair to them.

Personal narrative by Veronika

During the experiment I felt sometimes that I was in the way, like my guidance is not really needed, and I was hesitant to interfere with how Thijs was navigating. I had the impression that I was too close to be able to observe the situation well, and that also I am influencing the results too much. I had the feeling that I was looking at the people more than I usually do, and that it can feel intrusive.
Thijs was confident with walking in the city, but much more hesitant when he had to interact with someone ("I feel like I am tricking them"). This was especially apparent before entering the cheese store. He was very conscious of the happenings around us, he acted as a participant and an outsider at the same time.

I didn't see negative reactions from passers by, and there was only one cyclist who took a way too big detour around us.
I had the feeling that people were aware of us, but didn't make any unnecessary or exaggerated reaction.
In the cheese store I felt that the interaction was normal, and I didn't notice people staring at us or acting unnatural. I didn't notice any very strong reaction on our entering the shop.

Afterwards the cheese lady mentioned she acted differently as Thijs was not alone (had already a guide, so no need to offer too much help).

Observations. by Veronika

Observation	**Interpretation**	**Notes**
A cyclist made a large detour when passing us.	The cyclist didn't feel sure about what is a safe distance.	
The interaction at the cheese store was smooth.	It looked to me as a normal interaction, and I saw no staring people.	

Observations.

Observation	Interpretation	Notes
A man rolling a trash bin from his house across the street apologized for being in our way, quickly crossed and then stood still.	This man felt responsible to ensuring Veronika's safety and was unsure what to do about that next.	
A lady walking with a bike first looked at, then smiled at Veronika.	This lady was checking Veronika's safety and then felt happy to see she was doing well on her own.	
Employee no. 1 at Flying Tiger kept looking at Veronika.	She was checking to make sure Veronika could navigate the store, and assumed she would need help finding items.	**Interview:** She did not think much of it but kept her eye on her anyway. She observed her a bit more than she would observe other customers.
Employee no. 2 at Flying Tiger was looking around nervously, and not at Veronika, when helping her pay for her items.	She was looking around for help, or making sure another colleague was nearby in case she needed help.	**Interview:** She was a little bit nervous but wanted to help in small ways like holding the PIN-machine.
A couple entering the Flying Tiger when we were exiting quickly hopped into the store, keeping distance from Veronika and looked at me in a questioning way.	They did not want to be in the way and thus kept their distance. They looked at me for confirmation they were acting in the right way.	
A man on the way to the station took a very large distance from Veronika and looked at her intensely.	This man was scared Veronika would do something unpredictable.	
A car driver at a crossing near the central station stopped for us at a very large distance, signaling with headlights that we could cross.	This person wanted to make extremely sure we saw them, and make extreme precautions to not run Veronika over.	
People in general were looking Veronika in the eyes.	People in general were curious how Veronika navigated or wanted to make sure she was okay.	

Personal narrative by Veronika

I felt safe during the walk and the shopping, I didn't have the feeling of being exposed and looked at that Thijs mentioned after his blindfolded excursion. I noticed that people reacted on the cane and the glasses, but it didn't feel like they were staring. I was walking knowing that passers by will look out for me a bit more, this gave me a sense of safety. A few times I noticed people moving out of their way to let me pass on the street, but generally I felt I was more passive, I waited for everyone to pass and let the situations unfold, rather than actively reacting to the situation and people.

Entering the store was harder than expected. The sudden change in the light and environment conditions was hard to adapt to that quickly. Getting around was not that big of a problem, but I had an awkward feeling. I was anxious about looking around as I had the assumption that people generally don't distinguish between the different visual impairments and suppose everyone with a cane is totally blind, so they will notice me looking around and will think I am just acting as I was blind.

Before crossing the small bridge with the stairs, I was expecting that it will be kind of a challenge to cross, but it turned out to be much more simple than all the other crossings. I had to give the cane over to Thijs, as it was really getting in the way with walking on the stairs.

Only once had the feeling that someone reacted in an unexpected and exaggerated way: he looked like he was scared of me he avoided me in such manner. He took a big detour, he kind of went over to the other side of the road, and it really didn't feel necessary.

By the end of the experiment I felt that my neck was really tense, I suppose I was holding my head and shoulders in an unnatural way.
I had the feeling that the cane was more of a hindrance than help. It was occupying one of my hands, and kept getting stuck in the holes between the bricks and the pavement. It was also tiresome to swipe with it all the time, and the noise was annoying.
I also wasn't really using the information the cane provided, I was relying more on my eyes.

I felt that Thijs was offering me more guidance than I needed. He was for example taking my elbow at crossings, when I didn't feel it was necessary.

I felt that people were really considerate with me, and that I triggered stronger and more reactions from bystanders than Thijs, when he was in the VIP equipment.
Possible interpretation: gender? Or I was more hesitant in getting around?

Goal of study:
The goal of this participant observation is to get a clear picture of Margot's attitude to her visual impairment and the reactions/interactions/ of the participants in the activities we will partake in during the day. It is also first step towards mapping her context through the daily activities she undertakes. We will also observe the difficulties she encounters during these activities.

Methods:
The day during which we will observe Margot Scheltema's (change name) behaviour will consist of a morning activity and an afternoon activity. In the morning, we will pick her up from metro station Wilhelminaplein in Rotterdam and walk to the Nederlands Fotomuseum, where she will give a tour explaining what it's like to go to a museum while visually impaired. At 15:30, a reception will be held in the Tropenmuseum in Amsterdam. We will travel there by public transport. This will be an interesting event to observe as it will be a social one in a dimly lit context and Margot has expressed worries about that as she will have difficulties identifying people and navigating. The data will be mostly gained from participant observation, meaning we will pay close attention to details like what people say, body language and other meaningful interactions. We will especially pay attention to bystanders' behaviours and attitudes towards Margot's visual impairment, as well as Margot's behaviour and attitudes. We will also note down specifics in the environment that cause these attitudes and behaviours to occur. A complete list of points of interest can be found in the section below. Observation sheets will be produced that will be filled in rapidly right after observation. This will be done during the train ride home. After this, notes will be expanded on and a visual overview of key observations will be produced. An interview will be scheduled sometime after observation to discuss points of interest discovered during analysis.

For Margot:
Body language.
Way of navigation.
    Annoyances.
    Habits.
    Attitude.
Personal stories.
Statements.
Interactions with specific persons.

For bystanders:
Body language.
Attitudes.
Personal stories.
Statements.
Interactions with Margot.

For the surroundings:
Physical properties (light, material, layout).

Body language.
Attitudes.
Statements.

Tools:
Mobile phone for audio and video recording.
Field notebook.
Pen.
Consent forms.
Observation sheets.

At the Nederlands Fotomuseum.

Observation	Interpretation	Notes
During the first meeting, the people from Nederlands Fotomuseum ask Margot personal questions about how much she can see. Margot gives generalised answers such as “my eyes take longer to adjust to differences in lighting conditions”.	Margot feels uncomfortable talking about her visual impairment to people she has just met. She does seem to warm up after a while though.	
Margot remarks: “When I have to look for the button to call the elevator, I’m always happy when no-one’s around”.	Margot is self-conscious about her visual impairment and how that affects her behaviour.	When asked whether the same is true when using the cane, Margot wholeheartedly agrees.
Margot remarks: “I feel like I am living in some kind of parallel world”.	Margot feels like she experiences the world in a vastly different way.	
Margot bumps into a door and the bystanders get startled. One of the bystanders asks Margot if she’s okay.	The bystanders feel like they should have guided Margot more. Margot herself feels self-conscious about bumping into the door.	
Margot tells how she finds traveling with public transit uncomfortable. “I’ve had a few occasions where I sat next to the only other person in the bus.”	Margot finds it harder to act natural in social situations due to her limited vision.	
During the tour of the museum, the museum employees ask Margot if she can see every little aspect.	The museum employees want to make the museum more universally accessible.	I wonder if they are asking the right questions. What can they do for fully blind guests? Margot is only one specific case.
Museum guide points Margot the way.	The museum guide didn’t take into account Margot cannot see where she was pointing.	
Museum guide tells story about how one of the artists that are exhibiting, Alfredo	The museum has its issues in visibility, not only for people with visual	

Jaar, fell of a stair because he couldn't see.	impairment but people without 20/20 vision in general.	
Margot keeps bumping into people during the tour.	Margot finds it hard to judge distance.	
A gentleman coming down the stairs, did not know what to do when Margot - who was going up the stairs - suddenly stopped walking up. He kept standing, waiting for Margot to pass.	It is not visible that Margot is visually impaired. As such, she showed weird behaviour for a "sighted" person.	

On the way to the Tropenmuseum.

Observation	**Interpretation**	**Notes**
Margot remarks that "the white cane is stigmatising".	Margot worries about being more visibly visually impaired.	
Margot seems quiet on the bus.	She might be disoriented.	
A girl in the wheelchair on the bus became annoyed when people offered her all kinds of help when trying to board or disembark the bus. She did, however give me orders when I tried to help her.	This girl feels awkward when she gets unwanted attention because of her handicap. She does however know how people can help her and isn't afraid of telling so to bystanders.	
Margot's house is very orderly, classic and adorned. There are many paintings on the walls.	Margot clearly still cares about aesthetics, even though her vision deteriorates.	She did remark that she recently had more lights put in, in order to see better.

At the Tropenmuseum reception.

Observation	**Interpretation**	**Notes**
The snacks being served are very basic, among which cheese cubes, sausages and	The party wants to stay grounded. There is no grandeur.	

bapao.		
Margot remarks that she can “sort of discern people, but faces are a problem”.		
The room is very dynamic, with people moving about, meeting and mingling.	People here know each other and are eager to reconnect. The atmosphere is one of “see and be seen”.	Margot has difficulties recognising people in this dynamic atmosphere. It’s hard for her to recognise faces in this dim environment.
There are mostly older people attending, 60 and over.	This is an event for the Triodos employees that are higher up the ranks.	
Men are in formal clothing, mostly suits.	This is quite a formal event.	The researchers do not know if the men attending also wear these suits at work.
Women are also in formal clothing, but are more trendy. They show their individual style with their earrings and handbags.	The women try to show off their jewelry and handbags.	The researchers do not know if the women attending also bring this jewelry and these handbags at work. Margot wears a similar outfit to the one we had already seen her wearing, so the occasion may not be more special than normal.
The older people are sitting in the front, with younger people in the back. Friends of Marilou van Golstein-Brouwers are sitting in the front rows.	There is a strong hierarchy which is shown in the seating configuration.	
There are about 100-150 people attending the event. Most of them greet each other.	These people all know each other. Presumably they all work at Triodos bank or have worked with Marilou in the past.	
The event is hosted by a young businesswoman that has served in several boards and is introduced by the CFO of Triodos bank.	These people are well-connected.	
When introducing Marilou, a whole host of jobs is	Marilou has had a very broad career and has met	

discussed.	people all over the international scene.	
The night is hosted in English.	The crowd is international.	
A video message from a CEO in the USA is being player instead of the CEO attending.	Marilou has a large international network and many admirers (professionally).	
Some people are sitting alone.	Not everyone is part of this tightly-knit network.	
The people sitting alone are the only ones frequently using their mobile phone.	These people are less interested in the contents of the evening.	It could also be that these people that are sitting solo want to give themselves posture.
The topics discussed during the panel are mainly focusing on sustainable banking and inclusivity.	In Marilou's career, sustainable banking was a big topic.	It all seemed very circlejerk-y.
Margot called this a "laid back event".	This kind of event is quite normal when some board member retires.	
Quite some people arrive late.	These people try to squeeze this event in their schedule. They might not be too close to Marilou.	
Almost none of the men wear beards. The men that do, are younger.	A clean-cut image is appreciated at Triodos bank.	
The keynote speakers compliment amongst themselves a lot.	They know each other well, and want to show it to the audience.	It seems like a strategy to justify their position on stage, and a humblebrag.
The keynote speakers perform a lot of shoutouts to members of the audience.	The keynote speakers are well connected, and want to show it to the audience.	It seems like a strategy to justify their position on stage, and a humblebrag.
During the break, there is a musical performance by jazz singer Denise Jannah.	Jazz is both cultured and hip, and appeals to most everyone.	
Denise Jannah plays the songs "Nature Boy" and "What a Wonderful World".	These songs are selected to be in keeping with the ecological message of the entire event.	It seemed a little bit too congratulatory for my tastes.

Announcing the special guest of the night, the hostess makes a joke about the Prime Minister not showing up last time, but says this one is more special.	She builds up the tension for who the special guest is.	
Accompanied by security and the Mayor of Blaricum, Her Majesty Queen Maxima enters the room.	This Marilou must be something quite special for Maxima to show up.	
Everyone stands up, only to sit again when Maxima takes her seat.	These people are aware of the status the Queen holds.	
The Mayor gives Marilou a speech, praising her accomplishments.	Marilou has done impressive things on a national level for the Mayor of Blaricum to compliment her.	
Marilou gets knighted by the Queen.	Marilou has done some very impressive things on an international level.	Makes me wonder how many other people in this room got knighted.
The Queen notes that her "... husband signed this document with pleasure this morning".	Marilou is known at the Royal Court.	
Marilou gives a closing speech with a lot of shoutouts to the audience.	Marilou is thanking the people that helped her become who she is today.	She says she is overwhelmed with emotion, but does not show it.
Margot gets help down the stairs.	She asked someone to help her down the stairs.	She does not seem to be as ashamed of this as she would be using, for example a white cane.
Margot looks around in a disoriented way.	The room is too dynamic and dimly lit for her to see well.	
A wait offers Margot some snacks, Margot looks at him puzzledly.	Margot does not see the snacks the waiter offers her, and questions his motives.	This can be an uncomfortable situation for both parties involved.
Margot is touched by others for attention.	Others know of Margot's visual impairment.	Being touched all the time could increase confusion.
Margot walks very slowly	She is taking her time,	It can be awkward to

while looking for people.	making sure not to approach the wrong person.	recognise someone for the wrong person.
Margot asks us if we would join her on her tour around the room.	She feels like someone to help her find others would be useful.	Is she scared on her own?
There is no music during the reception.	This is an event for talking.	
The majority of the staff is coloured.	I don't want to make too many assumptions here.	
Margot gets led to the people she wants to meet by a friend.	People know of Margot's visual impairment and help her navigate.	
Margot frequently puts her hands above her eyes.	I assume this helps her see as it limits the light from above falling into her eyes.	It is a bit of misplaced action in this cramped, dimly lit room.
There are no smokers outside.	Smoking is frowned upon in this company.	
A part of the guests leave rather early.	Some of the attendees are not that close to Marilou and the core guests group and would rather go home.	
Among the gifts are jewelry, champagne and books.	Pretty standard gifts for this high-class audience.	
"A few wines will make this less intimidating", Margot says.	She needs some social lubricant in order to deal with situation.	
She wants to stay for ten more minutes after her car is supposed to pick her up.	Margot is having a good time and does not want to go home.	
The nuts are spooned on people's hands instead of people reaching for them inside of the bowl.	This is high society.	
Margot holds on to me when going down the stairs to her car.	Margot cannot walk down the stairs alone, as well as go home alone.	

Observation Notes 7 March

On the public transport

Observation	**Interpretation**	**Notes**
Margot says it is hard to adjust to changing light conditions, for example between two rooms, or between outside and in the underway/tunnel, when we are nearing the entrance to the underground		
She says doesn't feel embarrassed if she needs to explain the situation and ask for help (in the museum)	She doesn't feel embarrassed to talk about her condition	
She prefers to walk with someone to walking alone, therefore she makes sure that she won't visit a museum for example alone	Her condition requires a lot of planning on her side, and preparing for different situations	
Walking down the stairs is more challenging than walking down, and also she feels that there is a bigger risk when falling *"you cannot fall up on the stairs"*		
She had a bit of mascara in her hair	I assumed she starts to have problems with doing her makeup and getting dressed, she confirmed this when I asked about changes in getting dressed, choosing outfits and shoes. She said that her condition has an enormous effect in this area in her life, she no longer likes to shop for	

	clothes (she loved it before), it is hard to create an outfit, matching colours (tights)	
She only goes to stores where they already know her and her condition, as it is a hassle to explain it, and what kind of help she needs	It is hard to get it through to people what her condition implies, and what can she do herself, what is hard and what is not really possible	
She only wears heels now when she is sure she won't have to walk alone	She prepares for all the possible situations that can arise during the day, and dresses accordingly	
"I ll just bluff if I don't recognise someone, it takes too long to explain" she said about the event later on	She wants to avoid awkward situations that can arise as the effect of her vision problems	
It is easier to recognise people who she got to know before her vision problems	It is getting harder for her to store visual memories	
She sometimes ask for a list of guests, it makes recognising people easier, as she knows who to expect	She likes to be in control and prepared	
When on the bus she had a hard time noticing that someone offered a seat to her, the other lady had to repeat her offer several times, as Margot didn't see the gestures and the background noise level was high	when she enters the bus, she doesn't pay that much attention to the surroundings as she doesn't expect to notice things	
She had to install more light sources in her home	It is becoming difficult to navigate even at home	
She feels like she is in grey mist, it becomes worse with low light		

She uses public transport as much as she can, but in the evening she is not able anymore		
She travels a lot less than she used to		
She changed her flat shoes to heels when we stopped briefly in her home between the two events, as she knew already that we will accompany her on the whole event	She seizes every opportunity to dress up	
She mentioned she was slightly anxious about the event before, but she feels more safe now that she knows we'll be there to guide her (for example finding her seat, getting there, on the train station etc)		
She wants to avoid Amsterdam Centraal, as it is just too crowded	She prefers controlled situations	
She doesn't favor turning doors, and she prefers the type where she is the one pushing and not the automatic "*I like to be in control*"		

On the event/reception

The microphone was relatively low for most people	Looked unprofessional	

and they didn't adjust it between speakers		
People brought jewelry, cashmere, maybe books for gifts	The guests want to show their status	
People seemed wealthy, mostly well in age and white		
The waiters and personnel were mostly coloured people		
Before the event the catering was more refined confectionary, tea and coffee, after the event there were typical Dutch party food (cheese and sausage, vegetable sticks, bitterballen, beer, wine, juice, nuts, chicken steamed balls)		
She is immediately helped upon our arrival, we weren't even needed to guide her to the seat	People at the event are helpful and they look out for each other	
She was asking for help when going down the stairs from someone she knew	She started to feel more comfortable	
At the reception she was first hesitant to mingle, she felt disoriented and overwhelmed by the crowd *" There are a few people I want to meet, but I don't see where they are"*	She was overwhelmed by the crowd and started to worry	
She decided to just walk around and then someone will recognise her *"I will just walk around and someone will recognise me"*		Shortly after this happened, a lady took her by the elbow to say hello

She was helped by this lady to find the people she was looking for First they walked to the wrong man, as the lady didn't know im, and Margo didn't see if it was him or not		
She way enjoying herself, she wanted to stay longer than originally planned		
She used the heels of her shoes to feel the edge of the stairs when going down	She developed a set of tricks to navigate by other senses	

Notes for myself

- When testing the design it is helpful to have someone from the environment, to have their opinions/reactions; it can be helpful for the users to have a "picture" of the product
- Near Nijmegen there is a reintegration programme, they help people with readjusting to everyday tasks like cooking and looking after themselves (makeup, etc), and also there is a museum/exhibition about blind experience

Consent Form for Participant Observation 1

Please tick the appropriate boxes	Yes	No
Taking part in the study		
I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
I understand that taking part in the study involves being observed in both actions and attitude. The information will be recorded by taking written notes and pictures. These pictures will be recorded safely according to the GDPR rules and will be destroyed after 10 years.	□	□
Use of the information in the study		
I understand that information I provide will be used for one research project and two graduation projects at Delft University of Technology. It will be published in graduation reports that will be stored in the university's repository.	□	□
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the study team.	□	□
I agree that my information can be quoted in research outputs.	□	□
I agree that my real name can be used for quotes.	□	□
Future use and reuse of the information by others		
I give permission for the insights based on data that I provide to be archived in TU Delft repository so it can be used for future research and learning.	□	□

Signatures

_____	_____	_____
Margot Scheltema	Signature	Date
_____	_____	_____
Thijs te Velde	Signature	Date
_____	_____	_____
Veronika Szabó	Signature	Date

Study contact details for further information: Thijs te Velde, 06-40253899, t.k.tevelde@student.tudelft.nl

Reflection Ziezo fair Veronika

We tried to go to the ZieZo fair with an open mind. We didn't set too many observation goals, we were ready to take in what the fair has to offer. I also had a bit of doubt about how useful the event will be, as I had attended a different fair at the Jaarbeurs before, and that wasn't the most fruitful day.

When arriving at the fair I was pleasantly surprised about the general ambiance, as I was expecting a very commercial and crowded event, with little soul in it. The first impression the ZieZo was however a quite welcoming one. We saw that VIPs who attend were in a positive mood, greeting each other. I don't suppose they meet so many fellow sufferers very often, and at this fair they were the "normal people", the sighted were the ones out of place.

At first of course it was overwhelming, with the crowd and all the guide dogs attending. It was a challenge not to bump into someone, and I had a guilty feeling to be so much in the way. Guidelines were installed to the whole area, but it was hard to use them because of the cramped and narrow space between the booths.

A large share of the exhibiting companies were there with an offering of highly functional and functional looking assistive devices, such as loops, reading out devices, canes. Several organisations training guide dogs were also present. As it was just before the provincial elections, a device that permits the visually impaired was also on display.

We encountered a booth from Bartiméus with an interestingly unusual approach: at the Oogverblindend Mooi workshops they help VIPs regain control over how they present themselves to the seeing society. This includes style and colour advising, make up, but also self presentation and body language. I did find it inspiring that they leapt over offering purely functional help, and are giving tools of self expression to their clients.

We also made a few interesting discoveries at the NS booth. They told us that the conductors on trains undergo a training where they have to navigate on the train in modified goggles simulating visual impairment to build more empathy. It was a comforting feeling that they made the effort to have empathy with all the different people they can encounter in their work. Also interesting was that the NS sometimes receives complaints from people tripping over because of the guidelines and other features of the stations that are to assist the visually impaired train users.

At a stand selling everyday objects for visually impaired, we saw a few hidden gems. Among all the similarly looking loups and assistive devices some design objects were hiding. One was a tactile watch, that looked quite stylish, and a wall clock that I could imagine in a sleek and minimalist home. We also encountered a haptic printer to prepare educative materials for VI children. But generally the devices available had a more sterile and medical look, some were even scary, as they belonged more to a lab than to a home. I had the general feeling that they were designed with the assumption in mind that if you design for VIPs aesthetics doesn't matter.

Reflection Ziezo fair Thijs

My goals for attending the ZieZo fair was to uncover what is on the cutting edge of technology currently being developed for visually impaired users. I wanted to get a sense of the level of technology that is acceptable for these users. And lastly, I wanted to probe what the visual style and feel of the products currently being used is and to see where this can be improved. I also hoped to meet a variety of interesting people in order to include them in the project and build a solid network on which to build.

My expectations going into the fair were that there were indeed a lot of interesting people. I did not know how much access we could get to having long conversations with people in industry and how ready they would be to collaborate with us in our project. I expected the level of technology to run the gamut. Some products I expected to slightly improve quality of life with low-tech interventions, while others would be more technologically advanced. I expected, perhaps cynically so, that these high-tech products would be quite challenging to use for visually impaired users and, above all, be quite unattractive in design. I expected these products to have most of all a functional and quite medical look.

It was very exciting to see how much interest there was in our project from the people exhibiting at the fair. Most people were genuinely interested in meeting us and hearing that ‘bright students’ were devoting their energy in helping the visually impaired community. People were eager to hand us their business cards and asked to be kept up to date on our efforts. The products were indeed very much varied. The exhibits ranged from special vacations for visually impaired to high-tech zooming devices that VIPs can use to read. These, in turn, varied in size from handheld devices to desktop-sized proportions. The look of most of these products and devices was very clinical and functional, and the interfaces were designed in a very childish way - no regard for font or compositions, mostly consisting of rows of very large buttons in different primary colours.

The technological products on show were all meant for magnification. I did not see any innovation on any other product front, and a strong absence of white canes. This can indicate that there are opportunities, or can indicate that there is no need for innovation when it comes to white canes. The highlights of this fair to me were the Bartiméus initiative called Oogverblindend Mooi, which attempts to help VIPs in selecting outfits, applying makeup and in general caring for their appearance. I did see an adapted version of the white cane fit into this philosophy very well. Another highlight was a voting booth, adapted for the visually impaired. I thought it was wonderful to see that there are efforts to give these people the means to participate in and put their mark on society.

There is still a lot of innovation to be done and impact to be had on the visually impaired experience. The tools these people use have great effect on their day-to-day experience and these tools are being treated like machines more fit for a hospital than daily life. This has not been achieved so far and achieving this will make sure these products and their users are seen as more normal and fitting within society.

Observations by Veronika

Observation	Interpretation	Notes
Thijs moved less confidently than he did in Delft “I feel more exposed than last time. I don’t know where I am”	He didn’t know the terrain well.	
The passers by didn’t pay a lot of attention to us.	Possibly they were in a hurry, they also saw that Thijs is not alone, or they just didn’t care.	
Thijs asks Veronika if people are looking at him.	He is curious about the culture in Leiden and wants to compare it to Delft.	
Thijs is talking about topping up his OV card. “I am curious if anyone will offer me help”.	He is unsure how it will go. He is also a bit nervous about the situation.	
On the way to the station people are not moving out of our way.		
Thijs is asking about things we are passing.	He is disoriented, he wants to figure out where we are.	
A van is parked on the guideline in front of the station.		

Personal narrative

When I put on the goggles in Leiden I felt a little more insecure than in Delft. The people, environment and culture were new to me and I had a hard time anticipating how these people would react. Walking with the cane and glasses itself took a little getting used to again, and I didn’t remember being that visually impaired while walking in Delft. It felt like I could see a lot less here. We did not encounter a lot of people on the street, which was both pleasant and a dissapointment. The interesting part to me was to see whether people here would react differently than people in other towns. When walking across the canal, we finally encountered two people - a man standing in a doorway talking to a man blocking the curb with his bicycle. They seemed no to notice us when we approached. I expected the man

blocking the road with his bicycle to move away from me, but he did not. “The people here seem to be more rude”, I remarked. In some way, that made me feel more safe since they seemed to care a bit less. This made feel less observed than in Delft. Turning right and walking up to the station, I followed the guidelines. I walked more confidently here, knowing that I was not seen as an anomaly. People were walking on the guideline and did not move out of the way, though. Since I still had enough visual capacity to move out of people’s way actively, it did not bother me too much. I was debating whether people just didn’t care about allowing me to follow the guideline, didn’t see or were just plain ignorant. Neither of those three is very favourable. While I had walked here just a few hours before, the environment seemed alien to me and I could only make out the contours of the buildings. My annoyance reached a peak when a van was parked right across the guideline, as if to mock me. When we arrived at the station, people from GroenLinks were spreading pamphlets and harvesting votes. They did not approach me. Going inside the station to top up my OV-chipcard was nerve wracking as I did not see a thing. I was scared about people asking me if I needed help and me accepting their help. It feels treacherous to pretend to be blind.

Observations

Observation	Interpretation	Notes
Veronika has some issues finding her OV-chipcard.	It is a small object and her bag is full. It's also hard to both hold the cane and search your bag.	
Passing through the gate goes smoothly.	I expected some issues here, but it was smooth sailing.	
Some people in the station glance at Veronika from the corner of their eyes.		
Most people are too absorbed in their own thoughts to notice us.		
Veronika does not seem to see the entrance to Lebkov and Sons, even though it is quite clear.	Some factors could be that the facade is made out of glass. The door is huge, and it's weird that she misses it.	
Veronika seems scared to enter Lebkov and Sons.	It is a little bit crowded and a large, open space without any landmarks. It is also quite dimly lit.	
Veronika asks me what they sell at Lebkov and Sons, asks about the prices.	She is unable to see the wares clearly on display. The boards with the prices and sandwiches on them are places quite high up.	
Veronika quietly says she wants to leave.	She is a little nervous in this location.	The reason she gives is that it's a little pricey.
Checking in seems harder this time.	Veronika's eyes have had less time to adjust to the relatively low light levels in the station.	
Veronika is able to find the platform quite easily.	She has been here many times before.	I wonder if she would be be able to find the platform on her own in a station in which she is not that familiar.
The moment we enter the Albert Heijn To Go,	The layout of unclear, nothing is labeled,	

Veronika seems disoriented.	everything looks the same.	
People move out of Veronika's way.		
A man wanted to look on the same shelves as we were, but walked away.	He anticipated this might take some time and did not want to be rude and ask Veronika to move.	
People seem to be moving around us in quite a large circle.	This has been observed many times before. People don't want to be in our way and maybe anticipate unexpected behaviour. They might not know how to deal with visually impaired people.	
Veronika asks me what kind of sandwiches they sell.	The packages are the same and the light is more dim.	
Veronika looks at the sandwiches really closely.	She wants to know the contents of the package.	She feels a bit awkward about touching every sandwich. She feels like she is not making an informed choice.
Veronika can't tell where the self-checkout is.	It is not clearly marked.	
Veronika can't find her card.	The entire action of paying feels chaotic and stressful.	
Veronika punches in the wrong PIN-code, gets scared for a bit.	She feels anxious losing abilities that were so common to her.	
People hear Veronika approaching and move out of their way.	They are aware of her disability and comply.	
People standing on the guideline move out of their way.	The guideline was opening like the sea to Moses. It was quite touching.	
Everyone on the platform is glancing at Veronika.	People are very aware of her presence. Maybe they notice it more because they are just waiting around and have nothing to do.	

I am also getting glances.	I’m getting checks on whether I am caring for Veronika right.	

Personal narrative by Veronika

After we switched the glasses, first I needed to check in the station. I was a bit afraid of checking in and out, but it was surprisingly smooth. I had had a bit of problem with finding my OV card. I had to switch between the weekday and weekend cards. My weekend card was at the back of the phone, where I usually keep my other card. The weekday one was in my pocket. When entering the station I got disoriented for moment, as the light was lower than outside, and I needed time to adjust. First I didn't see a thing. Walking in Leiden Centraal was very easy for me, as I know the station quite well. I was walking much more confidently than I did in Delft (a city I don't know very well), and I was less hesitant.
When we left the station on the other side, I was much more disoriented. This was the side of the station that I don't really use often, so I wasn't sure where the things were. I wanted to buy food, as I was heading to Rotterdam, and I knew that I need to eat something before. But the sandwich place at that side of the station was unfamiliar to me. I didn't even know where the entrance was, and it was hard to find it in the modified glasses. We entered the place, I had to ask Thijs about the price range and selection of sandwiches. I found it too pricey, so we exited the place. It was an awkward feeling. We went to the AH to go instead, as I kind of knew what they sell. But when entering, it wasn't that easy to select a sandwich. I had to take the sandwiches off the shelves to check the label, but in the end I just asked Thijs to help with it. When I payed for the sandwich I was very happy with my choice of banks, as my card is bright orange, so it was easy to find it in my card holder. But when I tried to pay, the machine said I had to type my pin code in. It was quite hard to operate the self cassa, as I could read nothing on the user interface/buttons, so I didn't know what to press.
We entered the station again, and I was reminded of how a VIP was checking in and was feeling for the gate to open with her hand a few days before. I didn't see if the gate opened either. But I decided not to extend my hand, as I had the sandwich in one and the cane in the other, so I already had my hands full.
We used the escalator to go up to the platform. Seeing the people moving away from my way, opening the guideline gave a satisfying feeling. I felt that the cane has the power to grant me passage on the train platform. People who were looking at their phones heard the noise of the cane swiping on the guideline, and moved away as well. I walked past the Kiosk, and just waited for my train. We talked about being vulnerable and exposed. I didn't really feel it at that moment, but Thijs said he experienced it when he walked with the cane.

Walking around in Den Haag was immediately terrifying to me. When putting on the glasses, the noise of the city became hard to deal with. Walking past busy traffic, construction sites and numerous people in bicycles zooming past me, navigating on my own became increasingly hard. Veronika tried to give me a sense of place by naming the buildings we were walking past, but they all sounded unfamiliar to me - and looked the same. Walking through the city felt a little sinister, the high rise buildings to my sides looming over me. Because I could only discern shapes and the buildings around were columnated white, it felt like walking around ancient Rome. When we came to a turn, we had to traverse under a small overpass or tunnel. I completely lost my sight here, and had to just keep walking to the light with no idea of the surface I was walking on. I felt anxious to cross because of the audio overload and the many inputs around me. Cyclists didn't stop when I tried to cross and I was happy to have Veronika there. When walking through a more quiet street, I could finally catch a little bit of my breath. We ended up walking behind two men talking loudly amongst themselves. One of them was wielding what looked like a stick that I supposed he must have found somewhere and was carrying home. They suddenly walked slower and moved out of their way and I could feel their eyes burning in the back of my head. They stopped talking when we passed, which felt threatening. I turned the corner and was relieved when they did not. Veronika told me that those men were garbage collectors, and suddenly the stick made sense. Walking through this new street I started to notice groups of people waiting outside stores. I suddenly realised that it was still early in the morning and that these people were waiting for work. This thought came and went quickly and pretty soon I asked Veronika if we could enter the Bijenkorf. When she told me it was closed and a man was still cleaning the floor, I felt a little ashamed that I did not see that. We turned the corner and I suddenly felt the relief of recognising where I was. This was the point that I decided to stop my first round of walking because I was mentally very exhausted.

My second round of walking for the day was quite a long route. We started at the Grote Markt, after a short break and decided to head to the library to compare and document notes. Walking the street to the Spui was no challenge as by now I had grown accustomed to walking with the modified glasses and cane again. This street was not that busy and mostly consisted of stores, whose brands I could recognise easily enough, though I could not discern the contents of most of the posters on the windows. We passed some groups of people waiting until they could enter their places of work and I felt looked at by some of these groups. When we reached the library we, or rather Veronika, discovered it was closed.

I took the glasses and cane from Veronika. Walking in this neighbourhood was easy for me as I had already observed previously that the residents here did not pay us any mind. Approaching Den Haag Hollands Spoor was stressful though, since there was lot of traffic and the crossing were unclear. People seemed to be in a hurry and did not stop to let us pass. Veronika had to help me cross but once we reached the broader pedestrian street I felt more at ease. I knew we were going to Hollands Spoor to take the tram and as we approached the tram station I felt a knot form in my stomach. Taking the tram was a scary thought as I expected it to be cramped and dark, a rollercoaster. To reach the tram station, we had to cross the tram tracks thrice. There were people all around and trams passing us multiple times. It was chaotic and the lack of overview and sense of when and where to cross made me feel glad to have Veronika there. I could read the board showing the

departure time of the trams vaguely, if I really focused my eye on it. The six minute wait seemed like an eternity and I tried to make it passable by making stupid jokes. Going into the tram was hard because I could reason where the entrance should be, but judging where to enter the tram and how high I had to step was impossible. I leapt into the tram just to be sure I got in. The next challenge was to find where to check in my OV-chipcard. Because I had rode these trams before, I knew where to put my card but I could imagine this being hard for completely blind persons. I stumbled towards somewhere where I could stand securely, which was no easy feat because three ladies with prams were fighting for spots and I almost tripped multiple times. The tram started moving and I felt very claustrophobic. The people in the tram looked like shades because of the low light conditions and my inability to discern their faces. I became quiet. On the outside I smiled and looked serene, but my heart was pounding in my chest and I wanted to get out as soon as I could. The tram twisted and turned and I felt like I was on a ghostly amusement park ride, but with nothing amusing to it. A long way before our stop at Centraal, I tried to see where the exits were and where to check out, so that everything went smoothly. At every turn, I said “here we are”, only to be disappointed at the next turn. The ride seemed to take forever. When finally exiting the tram, I hesitantly stumbled out of it, trying to check out with my OV-chipcard on the wrong side (attempting to use a pole for that purpose). I found myself in the middle of a crowd. Veronika had to help me through this crowd because it was stifling. We walked through the station following the guidelines, people did not move away. We exited through the back and I removed the glasses. I was exhausted.

Observations.

Observation	Interpretation	Notes
When they see Veronika coming, people in the station move away from the guideline.	They know what the guideline is for and they can hear Veronika approaching.	They were already paying attention because it was crowded.
Almost all of the people passing us glanced at Veronika from the corner of their eyes, then looked at me.	People are more worried about her, then confirming with me whether I helped her sufficiently.	
A lady from D66 asked Veronika if she was going to vote.	She wanted Veronika to feel included. And wanted her vote.	
A man was looking at Veronika, caught my eyes and then looked away completely.	This man was ashamed to be caught looking, so pretended like he was looking around very interestedly.	
A man jumped off of the guideline when he saw us approaching as if it was hot lava.	He was scared to trip Veronika, or to be hit by the cane.	
Veronika needed my arm when going under the dark overpass.	She could not see due to the change in light and needed my guidance. It was also very busy under the overpass so she was frightened.	
The people in the staton were very hurried.	It's rush hour in The Hague, people are gonna be busy.	
Some ladies blocking the guidelines with their bikes apologised a lot.	They wanted to show they were not hindering Veronika on purpose.	
The ladies apologising to Veronika touched her on her shoulder while talking to her.	Maybe they felt Veronika would be startled by their voices if they didn't touch.	Veronika hated this.
Veronika seemed disoriented in the bakery.	It was darker in there and a lot of movement.	
People enjoying coffee in	She didn't stand out. She	

the bakery did not look at or notice Veronika that much.	was also more quiet, which could be a reason.	
Veronika could not see where the cash register was.	It was lit more than the rest of the store so should be more visible. Apparently, it wasn't enough.	
Veronika had a hard time finding where to stand in line.	There were people all around, and the line was clearly defined.	Maybe it was hard to judge their orientation?
Veronika talked in a very low, almost trembling voice when ordering coffee.	Veronika was scared to order coffee.	
The lady serving the coffee acted completely normal.	She apparently was used for blind people to order coffee at her bar.	

Observations by Veronika

Observation	**Interpretation**	**Notes**
Thijs said he doesn't know the way to HS	He is not as confident as he would be in a familiar setting	
Thijs said he can't see a thing	The light conditions are worse than the day before, also the high buildings block lot of the morning light and have long shadows	
Thijs remarks there is a lot of noise and he feels that his senses are a bit overloaded "I kind of understand what they meant at Visio with audio overload"		We are walking next to a construction sight, also the area is quite busy
We are more looked at than in Delft	It can be several things: more people in general, Thijs is less confident and also it is a very different city	
A girl passes us on a bike, looks at us for a long time	She is puzzled or concerned about Thijs	
"I feel like I'm walking in ancient Rome"	He feels he is not in the same reality, a bit alienated	High white buildings (library, city hall, construction of the Spuiforum)
He remembers Leiden was more inviting		
Guiding requires more effort than in Delft or Leiden	There is more traffic, more complicated crossings	
Thijs remarks that it is more scary as he is unfamiliar there	The overload of senses makes it really hard to navigate in a busy environment, knowing the way do help a lot	
Veronika tries to give Thijs cues in the navigation by naming the buildings, but is doesnt help him	as Thijs is not really familiar with the city it only adds to the information overload already created by all the audio, so he is not happy about this	

Thijs remarks that he doesn't see at all under the bridge		
We remarked that there is no audio feedback at the traffic light when we were crossing, but in reality there was, it was just so much noise that we didn't hear it	Audio overload is very real	In front of the filmhuis
Thijs is curious if we are looked at, but most bystanders are just hurrying to work/school, their business		
Cyclists don't stop for us at the crossings	We are ignored or we are too hesitant, so they are not sure if we want to cross	
Thijs remarked that the car stopped for us way farther than necessary at the crossing	The driver was unsure about our trajectory, he didn't want to risk hitting us or we are getting more hesitant	
We pass a pair who collect the garbage from the pavement. They stop their work and wait for us to pass until they resume	They are afraid that they would bother us if they continue or we might bump into them. It seemed a bit overly considerate	
Thijs remarked that this walk is exhausting	We are facing more complicated situations, it required a lot of effort to navigate	
Thijs starts to act proactive in asking for help at crossing and navigating	Veronika didn't provide enough guidance from this point or he is getting tired and needs more guidance than before	
Passers by and cyclists don't stop they make rounds/walk around us	they are aware of us but they are confident they can pass us safely	
Thijs is asking about the busyness of the street		there are mostly horeca vans on the street, not many passers by, shops and places are mostly closed

break @ Grote Markt		
When passing a group of people in front of the T-mobile Thijs asks what they are doing there. they are waiting for their shift	He didn't see the details (company logo on uniform, etc.) therefore he hed no explanation for the fact that a small group of people are standing in an empty shopping street	
Thijs needs a lot of help at the crossing.	He doesn't realise if we finished crossing or not, that's why he is hesitant	
When entering the Binnenhof, Thijs remarks he doesn't see a thing	We go through a small tunnel	
A group of schoolchildren pass us. They don't react to us	They don't find the sight of a blind/VIP person unusual. They are more interested in their peers	
When on the promenade a girl looks at Thijs for a long time	She is concerned/interested	
Veronika warns Thijs of the horse droppings on the path.	Possibly it is hard to notice these kind of things lying on the path for VIPs	
An older lady smiles at Thijs while passing	She was encouraging us	
An older guy passed us on a scooter. He came close to us, didn't make a detour	He didn't notice or didn't care	

Observation	Interpretation	Notes
We joke about already smelling rookworst, and thus knowing there is a HEMA nearby.	I don't know if we are getting more accustomed to our other senses, but we joke about it.	
Veronika is uncomfortable asking directions.	She does not want to randomly approach people on the street.	She thinks the test will be about language instead of visual impairment.
Thijs gives a lot of directions when crossing the road.	He wants Veronika to be safe. It is however a little too much.	
Thijs wants Veronika to wait and let a tram pass way in advance.	See above.	
Thijs gives a lot of information about the surroundings while crossing.	He wants to involve Veronika and the navigation as much as possible.	It is questionable how much Veronika can actually do with all of this information.
A stopping car stops at a very great distance to let us pass.	The car wants us to be safe and show he takes care with us.	
Veronika sees the HEMA before Thijs.	The hema is well indicated.	
The entrance to the HEMA is observed by Veronika as just a black area.		
Veronika doesn't see if the entrance is a turning door or sliding door.	Even though it is well lit and obvious to me, she doesn't see it.	
Two girls waited for us to pass.	They did not slip by us as they would normally do but gave us plenty of room.	
Veronika has no problem going up the escalator.		
Veronika can't see much, even though the HEMA is very well lit.		
Veronika has to look intently too find the balloon ("F").	The labels all look alike.	It helps that the balloons are ordered alphabetically.

The cane makes no noticeable sound in the floor of HEMA.		This causes less people to notice Veronika.
Veronika does not want to eat and walk so decided against eating.		
A lady almost runs us over with her stroller and gets startled.	Her reaction seems exaggerated because she almost “ran over a blind person”.	
Exiting the HEMA is easier for Veronika because she is “walking towards the light”.		
There is a lot of noise in the city around us, making Veronika disoriented.	There are no specific sounds to be discerned, making it harder to navigate.	
Veronika remarks that “here, navigating takes more effort”.	She means it is busier and louder here, making it harder to focus on getting around.	
She does however, remark that “I’m more confident here than in Delft, I really don’t know that city”.	These two things seem to contradict each other.	
People in this neighbourhood seem to pay us no mind.		It’s interesting to research the different reaction to people with disabilities amongst various demographics.
Veronika recognises the neighbourhood we are in.	She can still see enough to recognise a general ambiance and layout of a neighbourhood.	

Observations by Veronika
(Audio: Veronika 2 & Thijs 3, from 21:30)

Observation	**Interpretation**	**Notes**
Thijs remarked that he needs some adjusting again	He doesn't feel very confident in the glasses	
Thijs feels the area is busier than it really is		
Passers by casually look at us and look away	They consider us as a normal sight	
Crossing needs a lot of concentration	The area is not well adjusted to VIP needs, there is no guideline for example	
Thijs remarks several times that he is disoriented	he is disoriented	
Thijs remarks he is concerned about the tram ride	He is unsure about what to expect	
Thijs is annoyed by the noise	The noise level hinders his ability to navigate	
Thijs remarks getting to the tram stop is scary		we are crossing several tracks, trams cross tracks and it is generally quite busy
Thijs remarks waiting for the tram seems longer in the glasses than it usually does		
People in the tram stop don't react to us	The tramstop is not crowded, and many people are waiting for the other trams	
Thijs doesn't see where the door to the tram is	It lacks the sufficient contrast or the light conditions are too bad	
Thijs doesn't see the check in terminal	When stepping in the tram it is suddenly darker	
Thijs remarks "I don't see a thing"	He feels disoriented	
Veronika needs to guide	He has difficulties orienting	

Thijs to find the handles	on the tram, he doesn't see where the handles are	
Thijs makes a joke about the name of the tram station	He tries to lift the mood a bit, as he is anxious	Bierkade station
People generally react less about Thijs on the tram than on the street. They don't try to move farther from us or let us pass	They just try to squeeze themselves inside, and they don't mind the cane and the goggles	
Thijs is asking about which side will we get off	He is concerned about the getting off, he wants to prepare himself in advance	
When stepping out, Thijs is disoriented		
When moving on the guideline we have to wait for people to move from the guideline	It is in the middle of the day, people have a slower pace than in the the morning. They just take their time	
Thijs remarks he feels exhausted	It requires considerable effort to navigate in busy situations	
Thijs wanders off the guideline, and needs help finding it again	He is tired and it makes navigating harder	
The guideline leads through a door that is not working, but Thijs cannot read the sign about it		

Walking in Den Haag Centraal was not that stressful to me, even though I didn't see very well. I was following the guideline, and looking out only for if the people to move away from it. When we exited the station at the quieter side, a political activist lady was asking me if I'll vote, and she said she hoped that I'll vote for the party she was an activist for. I also noticed that it was really hard to navigate when lights change. When there was shadow on the ground, I couldn't see at all. I even needed to ask Thijs to take my arm and guide me, as I became completely disoriented. I also experienced that it is much harder for me to navigate in a smaller space, so when entering a store, or when inside the station the space wasn't that open I lost the ability to navigate. I also had trouble around entrances and exits. I noticed that navigating in Den Haag was harder than it was in Leiden or Delft, as there is much more traffic and more complicated crossings and situations. People are much more in a hurry, I didn't feel that I can rely on the bystanders' awareness of my conditions. High rise buildings also make it more difficult to navigate, as they block a lot of light.
When we wanted to buy coffee, I felt a bit lost. I didn't even know if the places are open or not, and I had no idea where to go. I wasn't just able to look around, look at the coffee places and decide if they look welcoming or sympathetic. I could only rely on Thijs's assessment of coffee places. When we entered the cafe, I didn't see at all what was going on. I couldn't see the layout of the place, I didn't see where the people are, if they are in the line of they are there at all. When ordering, I was completely incompetent in reading the situation. I wasn't aware of the distances, if the lady was looking at me or not, if she is close or far away, so I couldn't adjust my voice. It wasn't a pleasant experience, I was extremely self conscious. I felt I was missing out on the reactions, the facial expression. It was an exhausting experience. I felt my senses were overloaded, and conditions were swiftly changing. I felt that I couldn't keep up with it, and I just got tired of trying to.

After switching, we decided to go to the Hema to buy some food. I wasn't feeling very much in control of the situation, so I mostly passively consented to the suggestions Thijs made. I was led by him through a crossing and I was feeling quite vulnerable. I had no means to assess the situation, I wasn't aware if I am crossing at the right place, or if I got to the other side yet. I managed easily to get to the HEMA from the crossing. Thijs suggested that we got something to eat at the ground floor, but I really didn't favour the idea. I am not fond of eating and walking at the same time, and without seeing properly the idea only became less appealing. We walked around the HEMA and it didn't prove to be particularly challenging. I was only feeling a bit of aimlessness, as we were only walking around for the purpose of walking around. After exiting the HEMA, we started off to the direction of the HS. Thijs remarked that I don't get looked at that much as have been in Delft for example. As I was thinking about it, I noticed that I am walking much more confidently as I know the area and I had a goal in mind. So I wasn't that hesitant, I was just following the route to the Hollands Spoor. It gave me confidence that I am aware of the surroundings so well. It didn't require that much effort to navigate, I started to enjoy the walking much more.

Observation Baarn

Observation	Interpretation	Notes
Margot calls extensively with her gardener about her yearly ‘plant plan’.	She cares a lot about the aesthetics of her house and her garden.	
During the drive, Margot mostly takes the time to make calls and answer emails.	This is time for business. She cannot afford to make extensive small talk during the drive.	
Margot says during a call “I’m calling you now so you don’t have to read about it in the newspaper.”	The talks on the phone during the drive are pretty serious in nature and large in scope.	
Margot: “The worst about these kinds of nights is to ask for help in mundane tasks.”	She feels a bit embarrassed about asking for help in public situations.	
Margot: “I hate not knowing what the room will look like and what I will encounter.”	When she can prepare, the night becomes easier.	
When we encounter some traffic, Margot keeps checking by how much we are delayed.	She is nervous about the talk and wants to make sure to be there ahead of time.	
Margot: “We are getting close now.”	She says this out of nerves.	
During one call, Margot gets a little pushy: “Hurried is not good, quick is good.”	She means business. She sounds disappointed in her colleague.	
Margot: “I still greatly enjoy travelling, but like to stay in one place now. Learning a new hotel room every night is exhausting.”	Her visual impairment is limiting in some sense.	
Upon arrival, Margot is received by someone that guides her to the room downstairs carefully.	The event’s organisation is expecting her and does know of her visual impairment.	
Margot tells the technicians that she is visually impaired.	She is not ashamed about telling them, and wants the talk to go well.	

The room is dimly lit, not enough light for Margot to read her talk.	The event's organisers are not fully aware of Margot's needs.	
The technicians help her come up with solutions.		
Margot seems tense.	The chaotic nature of the preparations has thrown her off.	
After deliberation, Margot agrees that a handheld microphone should do fine.	She is making concessions, seems annoyed at the organisation.	
When I return, the technicians are outfitting her with a headset.	She did in the end get what she wanted.	
A gentleman recognises Margot: "Are you Margot Scheltema?"	Margot is well-known in these circles.	
Two men standing next to me are talking about their day and name dropping a lot.	This is a networking event, and these men are flexing their muscles at each other.	Most people here seem to know each other by some degree - there is even a matchmaking app.
The first thing Margot does as part of her talk is announce her visual impairment.	She wants to add explanation for any unexpected things that might happen.	
During the talk, Margot bumps into a chair behind her.		
There is a certain palpable awkwardness in the room after this.	People don't associate this kind of clumsy behaviour with classy, elegant women like Margot.	
Margot gets handed a bottle of champagne after the talk, this goes pretty smoothly. She does look startled.	She often has trouble with people reaching out their hands or reaching her things, so she is weary for these kinds of situations.	
Margot has trouble sitting down on her chair after the talk and almost falls down.	She did not see the chair against the carpet and was 'winging it'.	

Some people in the audience gasp or talk amongst each other after this.	It is quite unexpected that someone almost falls down at such a professional and semi-formal event.	Almost looks like gossiping.
Margot talks to people at the drink after.	Everything seems really normal and people	
A lady is showing Margot tricks on LinkedIn on her small iPhone.	She is not aware Margot is unable to see these kinds of small things on a small screen.	
Margot acts excited about this.	She does not want to embarrass the lady.	
She stays a bit longer than anticipated.	She's having fun!	
Back in the car, Margot jokingly suggests I make shoes with sensors that help her find her chair.	The entire ordeal shook her up a little bit. She would rather avoid situations like this in the future.	
She goes back to work in the car.	There's always enough work for Margot.	
The atmosphere does seem a lot more loose, she jokes with Theo (the driver).	She did have a nicer afternoon than expected.	
Margot plays a game of WordFeud.		
Margot asks us to describe where a hot air balloon is, instead of pointing at it.	People tend to point things out to Margot. This obviously doesn't work and she tells us so in a deliberate but slightly annoyed tone.	
She would still like to do everything, but has no bucket list. "I sometimes do feel like my life is almost over."	Retinitis Pigmentosa is slowly limiting her world and she is pessimistic about that.	She does go to a lot events for work still. What would be the point of that if life is almost over?

Observation	Interpretation	Notes
Michelle gives Jaap the direction to the door by pointing his cane.		
Jaap uses the cane to probe his surroundings very carefully.	He is a little unsure about where he is, or is practicing good technique.	
Jaap follows the guideline flawlessly.	Guidelines are useful.	
Jaap has some trouble with a pole and orientation - he steps to the wrong side of the pole.	With round objects, it is hard to gauge where you are using the cane.	
Jaap is here to learn a very specific route from his house to the bus station at Den Haag Mariahoeve.	Navigating takes a lot of practice and a lot of remembrance.	
The bumpy road is hard for Jaap to walk on. He sometimes trips.	Small differences in height can be very invasive when trying to walk straight.	
When arriving at the crossing, cars drive more slowly when they see Jaap.	They are careful, maybe they don't want to startle him.	
Another visually impaired person with a cane walks over the crossing towards us. The cyclists that are approaching are visibly confused.	Dealing with one VIP on the road is hard enough, let alone two.	
Jaap meets Seb, the visually impaired man approaching. They recognise each other, make jokes and are friendly.	The two men already know each other, maybe from Visio. They are friendly because they might be going through the same.	Everyone at Visio seemed very friendly.
When asked whether people are more careful with him now: "Not all of them. Some people don't. Central Station sucks."	He seemed kind of bitter about it.	
He uses his hearing		

carefully to navigate.		
The traffic lights turn red way too quickly for Jaap to be able to comfortably pass.	City planners don't take these people's needs into account as much.	This can make him and other VIPs feel more "in the way".
A man on a bike stops for us at great distance.		
When asked if it would help if he visited this place before he became visually impaired: "Yes, it would certainly help. But I didn't."	He seemed to find the question irrelevant and wanted to focus on the situation at hand.	
Jaap is sceptical of a way for him to be as visible to the outside world in a nicer way: "What, with lights, a horn or electrocution?"		
Jaap doesn't know whether he liked being more visible with the white cane: "It's a little bit of a double-edged sword, isn't it?"	He has a love-hate relationship with his daily tool.	Surely this can be improved.
Jaap tells us that learning this route to the bus really opens up options.	He is going through this hardship in order to still be able to live a rich life in possibilities.	
Jaap sighs after the first practice lap. "Now, now."	It is exhausting for Jaap.	

observations of the cane-using training of Jaap with Michelle

Observation	Interpretation	Notes
Michelle first tells Jaap that they will look for the bench, and Jaap will look for the bench (still inside Visio building)	He first has to know what will happen	
Jaap has a prosthetic leg, so he has “double handicap”		
He lives in social housing	He has low/no income	
He started to learn to use the cane in 2015	It takes a long time to learn to use the cane efficiently	
He uses a telescopic cane with a rolling end. It is a light cane, but a bit hard to fix the joints		
Michelle tells Jaap what will they do in the lesson, which route will they take		
Michelle uses the cane that Jaap holds in his hand to show the direction of the exit	He can feel directions with the cane handle	
Jaap finds it hard to use a turning door		
Jaap strongly relies on the edges and the guideline to keep direction	His sense of directions is poor	
Jaap keeps checking if the guideline is turning		
Jaap manages to find the pole with the button at the crossing, but he needs help to find the direction he needs to take to cross after he pushed the button	It is hard for him to sense and keep directions. He lost the direction when he was pushing the button, and he got disoriented.	
Jaap meets another man walking with the cane. They know each other. The man cheers him on with the	Jaap seems happy about the support of his peer.	

training.		
Jaap has difficulty walking straight at the crossing. There is no guideline.	He need s a guideline to keep walking straight	
Michelle warns us not to block the sight of Jaap with the cane, so that the cyclists and the cars would see him		
The tram rails are an extra barrier, as the cane can get stuck		
The green light is too short for Jaap to cross	The crossing is designed without considering people with different abilities	
Jaap remarks that at the Centraal Station people are blocking the guideline, put their luggage there and stand on it	He is reluctant to go there	
He only walks alone if he knows the way already		
There is a tricky crossing near his apartment, it only has sound signal at one side but not the other	It is confusing that the two sides of the same crossing use a different system to inform people	
While walking, Michelle tells Jaap what is on the square, and which of these things make a noise		
Michelle notes that the fountain in the square is probably only working in the summer	Jaap needs to know the seasonal differences of sound sources to be able to navigate year round	
Jaap needs to practice the bus stop for getting on and getting off separately		
Michelle shows Jaap the longer and the shorter route to get to the bus stop	It is good to have the possibility to choose	
From time to time Michelle		

asks Jaap if he still knows where he is		
Michelle gives Jaap different cues in navigation: the sound sources, the shades of a building		

Observation	Interpretation	Notes
During the last time, Irene learned how to use e-mail.	This is not her first class.	
The voice application using the iPad uses a lot of shortcuts.	Of course it is hard and expensive to design a more suitable interface, but there must be a better way.	There is a map of shortcuts on the wall, presumably for the teacher to remember them.
Teacher and Irene complain about updates changing shortcuts.	The designers of this particular application don't take this into account.	
Irene remarks that lists can take very long to go through.	She is bored or annoyed with the entire process.	
They use Siri a lot, but only for basic commands like opening applications.	Maybe Siri is too prone to mistakes to use it reliably.	A few mistakes with Siri do happen over the course of the class.
The iPhone and iPad are operated in a different way.	This makes it so VIPs need double the training.	
"The rotor function moves the focus to a different part of the screen."	A lot of technical terms that are not intuitive. They use visual memes for description.	
"It sometimes doesn't work, so most people do it the old way."	There is some level of distrust towards newer technologies.	It might just be that they don't work well enough.
Irene remarks that "(...) it is true that you have to remember a lot, but you can do it by ear if you know the basic commands."	She is optimistic about the capabilities of the system, or isn't able to imagine any other way that might be smoother.	
The voice commands use a lot of technical terms.	This is not intuitive to learn.	The terms are also very visually oriented.
There are a lot of sensitive gestures necessary to go through lists.	These are prone to failure and thus annoyance.	The VIPs have to rotate a dial they don't even see. This makes no sense.
The class is pretty chaotic, as the teacher, Irene and voice application are all talking.	While it is an informal class, it seems badly organised.	

The teacher explains a lot of concepts in skeuomorphic terms.	This might help the VIP make a mental image that is useful in use.	Does this differ between people that have gone blind and people born blind?
Irene is able to use the iPhone very effectively and rapidly through gestures.	She has learned to use it through a lot of practice and is competent in doing so.	
The keyboard consists of little keys that all feel the same.	It is not designed for visually impaired, but for sighted users.	
A lot of people use the keyboard because the gestures don't always work as intended.	It is the best of the two mediocre options.	
"Typing things is better than dictating them, especially for emotional content."	She doesn't want others to know her personal stories. Dictating is public.	
"Using this technology is mentally very tiring."	Listening to the voice and remembering the gestures is mentally taxing.	
"I have started to hate that lady (the voice)!"	She hears the voice all day, every day.	It is a jarring, robotic voice.
"I am a little bit of an illiterate when it comes to computers."	It is harder for VIPs to really get to know computers and learn how they work.	
"Using this technology with the voice application can cause audio overload."	Listening to the voice on her phone and the sounds around her is auditory overstimulation.	
"Remembering all the shortcuts will always be a problem. At least it is supposed to help against dementia!"	She doesn't see a better solution than the current one. She is humorous about this, however.	
Teacher to Irene: "You're there… listen a little longer the next time."	The teacher tells Irene to be patient, even though they both know it takes a long time to go through lists.	There are a lot of lists.
The keys on the keyboard are indistinguishable without proper training.	Not designed with visually impaired users in mind.	

The teacher and Irene make sarcastic jokes to each other about the application.	They both know it doesn't work optimally.	It's weird that the teacher participates in this, it's not fully encouraging.
Explaining the shortcuts is a long and arduous process.	They are hard to remember.	There are a lot of technical terms and explanations of which key was which again.
They mimic and make fun of the generated voice the application uses.	They both find the voice annoying and repetitive.	They have inside jokes about it.
Even the teacher doesn't know the answer when confusion arises whether they are in "rotor mode" or not. The teacher suggests rebooting the iPad.	The application still has bugs. Sometimes the best solution is to just shut off the device.	
"I'm also learning braille. Just a few classes to pick it up again."	Irene does continue to develop herself to try to live a full life.	
Irene became visually impaired slowly and took twenty years to admit it to herself. "Walking with a cane is admitting."	It was hard for her to come to terms with her disability.	
"Eventually you have to, and you get over the fact that people see you differently."	This kind of shuts down utopian thinking. Do they really accept there are no better options?	
"When using a cane, people don't dare to talk to you anymore."	Maybe the reason is that they don't know how to approach VIPs.	
One time, she walked outside with a cane and a child yelled she saw a blind woman. "That was very rude and confronting."	This is an aspect of being visible that might not be that beneficial.	
"The cane seems very confronting, pointing people to facts they don't want to accept."		She means that sighted people come to terms with their own abilities - and some lack of it.
"When walking with a dog, people offer you help a lot quicker."		I don't know why this is.

“They don’t do that when you use a cane.”		
“I walked into a restaurant with a cane a few times, and it instantly became quiet.”	This is stigma at its most immediate.	

ICT training with Eva and Irene

Observation	Interpretation	Notes
the training is about using the iPad with voice over		
Eva remarks “you can be robbed if you walk with the cane. They don’t want to use it because of that”	The cane can make you more vulnerable	
Lights are dimmed in the room, so that the client will feel more at ease		
The client (Irene) is already skilled in using voiceover on her iPhone		
It can be challenging to find time to practice for the lessons		
Software updates can be hard to handle. Especially if it changes the page/app layout or structure	They only learn the actual version of the apps, practice that layout	
Irene is practicing to use the mailing on the iPad		She already has experience with mailing on the iPhone. This is a bit different, as the layout is not the same
Irene is told about the layout of the mailing application, and which parts are left, right, etc	This requires a lot of mental effort, memorizing	
She is told where to zoom on the page, and where to click		
Some features don’t work all the time, they need to prepare for it.		
sometimes the iPad and the iPhone both respond to the	Irene cannot be sure that the right device will respond	

voice command, which can be confusing	to her command. This adds to her mental load.	
Irene is interested in how to open attachments		
the voiceover is giving information on the mail you select		
the voiceover keeps updating you in which mailbox you are	This is useful, especially for beginners. For Irene, this is sometimes not needed, and she only listens to the first second. This repeating few second of voiceover only adds to the her noise load	
navigation between folders in the drive can get time consuming		
learning the hotkeys makes the use quicker		
Irene uses her iPhone with black screen she is navigating in her emails quickly and confidently	She only needs the touchpad functionality of the touchscreen	
while using a keyboard she doesn't have to worry about accidentally zooming in or out, or turning the screen		
Irene uses both typing and dictation when messaging. Some words are easier to say, some are to type		
Typing gives her a sense of privacy, she cannot be overheard		
Irene always listens back to the text before sending	she wants to check if she typed/dictated it the way she wanted	
when listening to the voiceover sometimes the pronunciation is off, it makes it harder to understand or		

unpleasant to use		
Irene talks about learning to touch type	She doesn't feel confident with her typing abilities	
She believes she uses the computer for similar things as seeing people		
Irene doesn't have many photos on her phone	Photos are not accessible to her	
She is yet to use audio memos, but she is interested		
she wears an earplug, plugged in to one ear when using a phone in public	she doesn't want to be overheard or stand out	
navigation with a phone is hard, she has a dog in one hand and the phone in the other		
It is annoying for her to listen to the phone all the time.	It is overloading her senses.	
the iPad keyboard is small, she has to pay extra attention to the gaps between keys		
accepting your limits is harder when you are visually impaired. you can always say to yourself: I can still do this. But if you are blind, it is easier to accept - Irene remarks		
it consumes a lot of energy to walk with the cane, it is much easier with the dog, Irene remarks		
the reactions of people are different if you enter with a cane or with a dog, Irene remarks		

Irene is a bit puzzled about dealing with photos	She is curious about them, but has no means to deal with them.	

After the ICT lesson, with Eva

Observation	**Interpretation**	**Notes**
Standard cursus is 10 lessons+intake, usually it is not enough		
about apps: not all of them are usable with voiceover, some lacks the appropriate design		When developing apps, some companies do not take VIPs into consideration. Sometimes not even big companies and banks. Visio can help with advising.
revalidation: to teach clients how to build up their lives again, how to work, how to be independent		
sometimes they have to quit their previous occupation, and they might receive some pension from the government		This can be slow and needs a lot of paperwork.
Visio helps clients to change careers if necessary		This is sometimes needed if the previous occupation is to reliant on vision.
Eva also gives advice to the clients and provides support, but from time to time she advises them to seek the help of a psychologist (also a service provided by Visio)	For some clients it is easier if they can talk to someone outside of the family. They feel they can confide in Eva, they are not afraid of the consequences.	
Group sessions can help with coping, by providing experiences, advice, tricks from people in struggling with similar problems. this can make you stronger - Eva says		

they also do sessions with family members and friends, to help them understand each other and what the condition implies more		
Eva sends voice recorded materials to the clients to help them practice. A lot of the times it is easier with a separate voice recorder, as using the voice memo app and navigation on the same device can be confusing. Other materials can be emails and booklets. It depends on the vision level and the client.		
The content of the classes depend on the client needs and also on their previous experience with technology and ability to learn new things.		
Eva gives also lessons to people with dementia. In this case first there are a couple of trial lessons to determine if the client is still capable of learning.		

Observation	Interpretation	Notes
Menno has had a stroke and lost a part of his vision. This is called hemianopsia.		He has lost the left side of his vision.
He has used a viewing strategy training to get his driver's license back.	Menno is working hard to get his old life back.	
His newfound visual impairment costs him a lot of energy and the company doctor doesn't recognise this.	There is a lot of misunderstanding is his surroundings about the full extent of his disability.	
Neither does his brother.	Even within family.	
When he gets misunderstood, he goes "on the barricade".	Menno gets angry when people think he can do more.	He might have trouble dealing with expectations and emotions.
He scored too high on the capability test done at Visio, because he tried extra hard.	Sometimes, visual impairment is not visible.	
Aviva: "You tried too hard."	VIPs might want to prove to themselves that they are still capable of performing daily tasks normally.	
Menno: "Yeah, I was happy that the day was over."	Tasks are mentally draining for him.	
Aviva: "I think I did not exaggerate in my report."	She is serious about the situation and was written down what she feels is right.	Aviva wrote a report to the company doctor explaining the severity.
Ria: "Maybe when you called him very visually impaired."	Ria finds it hard to come to terms with her husband's visual impairment, and tries to play it down.	
Aviva: "When people see the words "visually impaired", they think it can be solved with glasses."	Most people only come to action or change their opinion when you emphasize the severity of the visual impairment.	
Menno has worked at a bakery for forty years, but	This is painful for him.	This is a manual job consisting of a lot of

soon has to leave due to his disability.		checking.
Aviva: “It will be exit bakery. Be prepared for the end of your working life.”	Aviva is very realistic to Menno and doesn’t want to get his hopes up.	
Aviva: “Maybe we can find you some suitable volunteering work.” To which Ria agrees.	It is important for Menno to still contribute to society.	Ria seems to be very involved in the conversation, maybe more so than Menno on some points.
Menno is sitting back comfortably, resting his head on his hand.	He is present in the situation, but also kind of averse to it.	
Menno makes a lot of annoyed, militant points. He seems angry.	He has become bitter by the entire affair.	He always seems to be on the defensive. Can also be side effect over overstimulation caused by brain damage.
Aviva: “Maybe we have to give you a job below your level, which you might not want. See this as an exploration.”	Aviva tries to encourage Menno not to wallow, but to try new, out-of-the-box things.	
Menno gets upset by noises and crowding.	This is a side effect from his stroke.	He previously complained about a lawn mower outside.
Menno is very humorous about it all: “The bus has arrived and here I am!”		Menno is referring to the bus with which disabled interns arrive at the bakery.
Menno is 64 years old, they are talking about early retirement.		
Menno: “I’m just going to try driving, small bits first. We will see.”	He is optimistic about getting his drivers license back and the possibilities that offers.	
Menno and Ria seem very happy about getting Mennos’ drivers license back.		It opens up a lot of options, of course they are happy.
Aviva will make Menno a visual passport to combat	Menno has trouble explaining his condition to	The visual passport consist of certain things he can and

ignorance amongst people around him.	people himself.	cannot do or see.
Menno: “You can’t see anything about the impairment so that’s the problem, really.”	Menno tries to reason and see the ignorance from the other’s point of view.	
Menno and Ria have a busy schedule visiting a lot of doctors and hospitals.	They are working hard ensuring Menno is healthy and comes out of it right. They are in it together.	
Last week, they talked about processing and coping.	This is important in the process.	I don’t know if it is more important for Menno or a standard part of the process.
Menno said he is good at actively tackling his issues, avoiding them and giving himself comforting thoughts.	He still has some willpower in him and tries to go on as normally as possible.	
He is not very good at sharing concerns with friends.	He seems to be very down-to-earth about his condition, and finds it unnecessary to bother others with it.	
Menno: “That guy lives very far away and we don’t see him that often.”	Menno avoids talking about his new impairment with some people.	He doesn’t want to bother others with his ailments.
Menno and Ria have joined group therapy - Oog Voor Elkaar.	They look to others for help and understanding.	
Ria: “It’s nice to see that some aspects of this all are the same across people.”	Sharing the pain with other spouses of visually impaired gives Ria solace.	
Aviva: “You will both have to learn to cope with changing patterns of behaviour.”	She is realistic about what the couple will need to do, and the work it will take.	She seems very kind while saying this, and knowledgeable.
Ria is tired of explaining her husband’s behaviour all of the time. “People keep asking me, why isn’t he joining this time?”	She says this in an annoyed tone, like she can’t understand why others don’t get it.	
Menno: “These are	Menno agrees with her. This	The dilemma is whether he

dilemmas that people just don't get."	fact saddens him, too.	is going to see his granddaughter's ballet.
Ria: "We still try to do everything, but then a little bit adjusted."	She is realistic about the situation, and optimistic.	They both seem very down-to-earth.
Menno: "While in fact, we can't."	Menno seems less optimistic.	

Interacting normally is hard when visually impaired.

Visio self-experience 01-03-2019

“Walking towards the elevator, we met another of Femke’s co-workers, with whom it was hard to get a normal interaction. I felt a little bit awkward and just waved in all directions, making jokes to alleviate my own distress.” - Thijs

Interacting normally is hard when visually impaired.

Visio self-experience 01-03-2019

“Walking towards the elevator, we met another of Femke’s co-workers, with whom it was hard to get a normal interaction. I felt a little bit awkward and just waved in all directions, making jokes to alleviate my own distress.” - Thijs

Interacting normally is hard when visually impaired.

Visio self-experience 01-03-2019

“Walking towards the elevator, we met another of Femke’s co-workers, with whom it was hard to get a normal interaction. I felt a little bit awkward and just waved in all directions, making jokes to alleviate my own distress.” - Thijs

Interacting normally is hard when visually impaired.

Visio self-experience 01-03-2019

“Walking towards the elevator, we met another of Femke’s co-workers, with whom it was hard to get a normal interaction. I felt a little bit awkward and just waved in all directions, making jokes to alleviate my own distress.” - Thijs

Visual impairment sets you apart from the world.

Visio self-experience 01-03-2019

"I noticed that, when blind, I felt 'locked into' my own body and experienced the outside world like a series of random events happening to me." - Thijs

Safety is derived from mastering all senses.

Visio self-experience 01-03-2019

"Without the feeling of directions and space I was afraid and unsure, and I was really dependent on my guide to be able to get out of the building. I was moving slowly and unsure, my muscles were tense, I had an elevated heart rate ands the feeling of I had to be prepared for an attack or a fall." - Veronika

Safety is derived from mastering all senses.

Visio self-experience 01-03-2019

"Without the feeling of directions and space I was afraid and unsure, and I was really dependent on my guide to be able to get out of the building. I was moving slowly and unsure, my muscles were tense, I had an elevated heart rate ands the feeling of I had to be prepared for an attack or a fall." - Veronika

Visually impaired persons can be more self-conscious.

Autoethnography in Delft 06-03-2019

"I felt like everybody was looking at me from the corner of their eyes and approaching me more carefully." - Thijs

Visually impaired persons sometimes avoid contact.

Autoethnography in Delft 06-03-2019

"When entering the cheese store, I felt a moment of hesitance. I even asked Veronika if she would go inside for me in advance and announce our arrival." - Thijs

VIPs can interpret things negatively.

Autoethnography in Delft 06-03-2019

"I felt like she (the lady in the sandwich shop) was talking to me in a childish voice, like you do to toddlers." - Thijs.

VIPs are often alienated less than they think they are.

Autoethnography in Delft 06-03-2019

"In the cheese store I felt that the interaction was normal, and I didn't notice people staring at us or acting unnatural." - Veronika

Bystanders can feel responsible for a VIP's safety.

Autoethnography in Delft 06-03-2019

A man rolling a trash bin from his house across the street apologized for being in our way, quickly crossed and then stood still.

Some types of help are necesarry, while others are too much.

Autoethnography in Delft 06-03-2019

1. Employee no. 1 at Flying Tiger kept looking at Veronika.
2. Employee no. 2 was looking around nervously, and not at Veronika, when helping her pay for her items. She wanted to help in small ways like holding the PIN-machine.

VIPs can look very vulnerable to the outside world.

Autoethnography in Delft 06-03-2019

A car driver at a crossing near the central station stopped for us at a very large distance, signaling with headlights that we could cross.

VIPs understimate their own abilities.

Autoethnography in Delft 06-03-2019

"Before crossing the small bridge with the stairs, I was expecting that it will be kind of challenge to cross, but it turned out to be much more simple than all the other crossings." - Veronika

Help can be unnecessary and invading.

Autoethnography in Delft 06-03-2019

"I felt that Thijs was offering me more guidance than I needed. HE was for example taking my elbow at crossings, while I didn't feel it was necessary." - Veronika

VIPs have trouble maintaining their appearance.

Participant observation with Margot Scheltema 07-03-2019

Margot has a bit of mascara in her hair. We assume she has a hard time maintaining her appearance. When asked this, she confirmed that choosing the right clothes becomes harder and shopping is a lot less fun than it used to be.

VIPs sometimes do not feel ashamed asking for help.

Participant observation with Margot Scheltema 07-03-2019

1. Margot says she is not embarrassed if she needs to ask for help in a musum.
2. Margot asks for help getting down stairs.

VIPs do very much still care about their appearance.

Participant observation with Margot Scheltema 07-03-2019

At her home, Margot takes the time to change from flat shoes into heels.

VIPs have more to take into account when dressing.

Participant observation with Margot Scheltema 07-03-2019

Margot says she only wears high heels when she's sure she doesn't have to walk alone.

It can be difficult to talk about your visual impairment.

Participant observation with Margot Scheltema 07-03-2019

During the meeting at the Nederlands Fotomuseum, Margot has trouble giving exact answers to the personal questions she is being asked. She gives generalised answers, instead.

VIPs can be ashamed of behaviour due to visual impairment.

Participant observation with Margot Scheltema 07-03-2019

Margot remarks that "*Sometimes, when fumbling for the elevator button, I'm happy that no one is around.*"

VIPs can be ashamed of products due to visual impairment.

Participant observation with Margot Scheltema 07-03-2019

Margot says that the cane is a clear indicator of visual impairment and is very "handicapping" and stigmatizing.

Bystanders can overreact to VIPs' struggles.

Participant observation with Margot Scheltema 07-03-2019

Margot walks into a door at which point the people giving the tour at the Nederlands Fotomuseum get startled and ask if she needs help. She was completely fine.

Non-visible impairments confuse bystanders.

Participant observation with Margot Scheltema 07-03-2019

A gentleman coming down the stairs at the Nederlands Fotomuseum did not know what to do when Margot - who was coming up the stairs - suddenly stopped walking up. He kept standing, waiting for Margot to pass with a confused look on his face.

People attract unawanted attention because of impairment.

Participant observation with Margot Scheltema 07-03-2019

A girl in a wheelchair on the bus became annoyed when people offered her all kinds of help when trying to help or disembark the bus. She did, however, give me clear instructions when I tried to help her.

VIPs still care a whole lot about aesthetics.

Participant observation with Margot Scheltema 07-03-2019

Margot's house is very orderly, classic and adorned. There are many paintings on the wall.

Women in Margot's social circle care about aesthetics.

Participant observation with Margot Scheltema 07-03-2019

Women are also in formal clothing, but are more trendy. They show they individual style with their earrings and handbags.

Staying in control takes a lot of planning from VIPS.

Participant observation with Margot Scheltema 07-03-2019

She prefers to walk with someone to walking alone, therefore she makes sure that she won't visit a museum for example alone.

Indicating the amount of help needed to others is hard.

Participant observation with Margot Scheltema 07-03-2019

She only goes to stores where they already know her and her condition, as it is a hassle to explain it, and what kind of help she needs.

Explaining your condition again and again is cumbersome.

Participant observation with Margot Scheltema 07-03-2019

“I ll just bluff if I don’t recognise someone. It takes too long to explain everything to them .”

Creativity is needed to manage as a VIP.

Participant observation with Margot Scheltema 07-03-2019

1. Margot decided to just walk around. Someone will recognise her: “I will just walk around and someone will recognise me.”
2. She used the heels of her shoes to feel the edge of the stairs when going down .

VIPs can have the feeling of living in a different world.

Participant observation with Margot Scheltema 07-03-2019

Margot remarks: “I feel like I am living in some kind of parallel world”.

People will feel they can touch VIPs more easily.

Participant observation with Margot Scheltema 07-03-2019

At the reception, Margot is touched by others for attention.

People will feel they can touch VIPs more easily.

Participant observation with Margot Scheltema 07-03-2019

At the reception, Margot is touched by others for attention.

There is a large variety of products and services for VIPs.

Visiting the ZieZo fair 16-03

The exhibits ranged from special vacations for visually impaired to high-tech zooming devices that VIPs can use to read.

There is little to no innovation when it comes to white canes.

Visiting the ZieZo fair 16-03

"We did not see any innovation on any other product front, and a strong absence of white canes. This can indicate that there are opportunities, or can indicate that there is no need for innovation when it comes to white canes." - Thijs

There are some efforts that allow VIPs to participate in society.

Visiting the ZieZo fair 16-03

"Another highlight was a voting booth, adapted for the visually impaired. I thought it was wonderful to see that there are efforts to give these people the means to participate in and put their mark on society." - Thijs

Being amongst other VIPs can be a safe space.

Visiting the ZieZo fair 16-03

"We saw that VIPs who attend were in a positive mood, greeting each other. I don't suppose they meet so many fellow sufferers very often, and at this fair they were the "normal people", the sighted were the ones out of place." - Veronika

Products and services concerning VIPs expression have impact.

Visiting the ZieZo fair 16-03

"(...) this includes style and colour advising, make up, but also self presentation and body language. I did find it inspiring that they leapt over offering purely functional help, and are giving tools of self expression to their clients." - Veronika

Impending social interaction can be scary.

Autoethnography in Leiden 19-03

"I was scared about people asking me if I needed help and me accepting their help." - Thijs.

The amount you are being watched varies tremendously.

Autoethnography in Leiden 19-03

Most people are too absorbed in their own thoughts to notice us.

The amount you are being watched varies tremendously.

Autoethnography in Leiden 19-03

Most people are too absorbed in their own thoughts to notice us.

Some tasks seem daunting for VIPs.

Autoethnography in Leiden 19-03

Veronika seems scared to enter Lebkov and Sons. It is a little bit crowded and a large, open space without any landmarks. It is also quite dimly lit.

People stare at VIPs more when they have nothing to do.

Autoethnography in Leiden 19-03

People are very aware of her presence. Maybe they notice it more because they are just waiting around and have nothing to do. I am also getting glances.

Lack of consideration concerning guidelines can be frustrating.

Autoethnography in Leiden 19-03

1. A van is parked on the guideline in front of the station.
2. *"My annoyance reached a peak when a van was parked right across the guideline, as if to mock me."* - Thijs

Using the cane while you still have vision can feel like cheating.

Autoethnography in Leiden 19-03

"I was scared about people asking me if I needed help and me accepting their help. It feels treacherous and unfair to pretend to be blind." - Thijs

Feelings of incompetence arise in the simplest of situations.

Autoethnography in Leiden 19-03

She feels a bit awkward about touching every sandwich. She feels like she is not making an informed choice.

Being a VIP changes your priorities in surprising ways.

Autoethnography in Leiden 19-03

"When I payed for the sandwich I was very happy with my choice of banks, as my card is bright orange, so it was easy to find it in my card holder." - Veronika

People are sometimes ashamed to stare at VIPs.

Autoethnography in Den Haag 20-03

A man was looking at Veronika, noticed he caught my eye and then looked away all the way behind him. He procedeed to pretend like he was looking around at his surroundings with great interest.

People sometimes touch VIPs when they talk to them.

Autoethnography in Den Haag 20-03

The ladies that stood on the guideline touched Veronika on the shoulder when talking to her. Veronika found this annoying as touch is very personal.

Confidence affects how visible VIPs are.

Autoethnography in Den Haag 20-03

We looked at more than in Delft. Thijs is less confident because it is a very different city.

There can be too much information in navigation.

Autoethnography in Den Haag 20-03

Veronika tries to give Thijs cues in the navigation by naming the buildings, but it doesn't help him. As Thijs is not really familiar with the city it only adds to the information overload already created by all the audio, so he is not happy about this.

When VIPs need help, they will often ask for it.

Autoethnography in Den Haag 20-03

Thijs starts to act proactive in asking for help at crossings. Veronika didn't provide enough guidance or he is getting tired and needs more guidance than before.

VIPs often are concerned about certain activities in advance.

Autoethnography in Den Haag 20-03

Thijs remarks he is concerned about the tram ride - he is unsure about what to expect.

Anxiety in VIPs is not always shown to the outside world.

Autoethnography in Den Haag 20-03

People generally reacted less to Thijs on the tram than on the street. They don't try to move farther from us or let us pass. They just try to squeeze themselves inside, and they don't mind the cane and goggles.

Disability to read body language makes communication harder.

Autoethnography in Den Haag 20-03

"I was completely incompetent in reading the situation. I wasn't aware of the distances, if the lady was looking at me or not, if she is close or far away. [...] I was extremely self-conscious." - Veronika.

Confidence in VIPs makes navigating more enjoyable.

Autoethnography in Den Haag 20-03

"[...] I wasn't that hesitant, I was just following the route to Hollands Spoor. It gave me confidence that I am aware of the surroundings so well. It didn't require that much effort to navigate, I started to enjoy the walking much more." - Veronika.

VIPs can feel preyed upon due to bystander behaviour.

Autoethnography in Den Haag 20-03

"They suddenly walked slower and moved out of their way and I could feel their eyes burning in the back of my head. They stopped talking when we passed, which felt threatening." - Thijs.

Knowing the culture of their surroundings puts VIPs at ease.

Autoethnography in Den Haag 20-03

"Walking in this neighbourhood was easy for me as I had already observed previously that the residents here did not pay us any particular mind." - Thijs.

Distress is not always visible in VIPs.

Autoethnography in Den Haag 20-03

"I became quiet. On the outside I smiled and looked serene, but my heart was pounding in my chest and I wanted to get out as soon as I could. The tram twisted and turned and I felt like I was on a ghostly amusement park ride, but with nothing amusing to it." - Thijs.

A lot of the times, you don't control the situation.

Autoethnography in Den Haag 20-03

The ladies apologising to Veronika touched her on her shoulder while talking to her. Maybe they felt Veronika would be startled by their voices if they didn't touch.

Overstimulation of the senses hinders navigation for VIPs.

Autoethnography in Den Haag 20-03

Thijs remarks there is a lot of noise and he feels that his senses are a bit overloaded. "I kind of understand what they meant at Visio with audio overload."

Everyday phenomena can be puzzling to VIPs.

Autoethnography in Den Haag 20-03

When passing a group of people in front of a store Thijs asks what are they doing in the street at that time. They are actually waiting for their shift to begin, they work there.

A big part of the perceived stigma is only in our head.

Autoethnography in Den Haag 20-03

Passers by casually look at us and look away. They consider us a normal sight.

It is hard to get sufficient information to make choices.

Autoethnography in Den Haag 20-03

"I wasn't just able to look around, look at the coffee places and decide if they look welcoming or sympathetic. I could only rely on Thijs's assessment of coffee places." - Veronika

VIPs still care about the aeshtetics of their surroundings.

Participant observation with Margot Scheltema 28-03

Margot calls extensively with her gardener about her yearly 'plant plan'.

VIPs can be relucatant to ask for help in mundane tasks.

Participant observation with Margot Scheltema 28-03

Margot: "The worst about these kinds of nights is to ask for help in mundane tasks."

VIPs are always limited in some way or the other.

Participant observation with Margot Scheltema 28-03

Margot: “I still greatly enjoy travelling, but like to stay in one place now. Learning a new hotel room every night is exhausting.”

Being forward about the impairment depends on the occasion.

Participant observation with Margot Scheltema 28-03

1. Margot tells the technicians that she is visually impaired. She is not ashamed about telling them, and wants the talk to go well.
2. The first thing Margot does as part of her talk is announce her visual impairment. She wants to add explanation for any unexpected things that might happen.

Showing impairment can make bystanders uncomfortable.

Participant observation with Margot Scheltema 28-03

There is a certain palpable awkwardness in the room after Margot bumps into a chair in the middle of her talk.

VIPs can sometimes run into unpredictable obstacles.

Participant observation with Margot Scheltema 28-03

Margot has trouble sitting down on her chair after the talk and almost falls down. She did not see the chair against the carpet and was ‘winging it’.

VIPs want to avoid uncomfortable situations.

Participant observation with Margot Scheltema 28-03

Back in the car, Margot jokingly suggests I make shoes with sensors that help me find her chair. The entire ordeal shook her up a little bit.

Repeated errors in bystanders can annoy VIPs.

Participant observation with Margot Scheltema 28-03

Margot asks us to describe where a hot air balloon is, instead of pointing at it. She asks us so in a deliberate but slightly annoyed tone.

It takes a lot of physical and mental effort for VIPs to navigate.

Observation at Visio Den Haag 02-04-2019

Jaap is here to learn a very specific route from his house to the bus station at Den Haag Mariahoeve.

There is plenty of friendliness and recognition between VIPs.

Observation at Visio Den Haag 02-04-2019

Jaap meets Seb, the visually impaired man approaching. They recognise each other, make jokes and are friendly. Jaap seems happy about the support of his peer.

VIPs can feel hostility from bystanders' negligent behaviour.

Observation at Visio Den Haag 02-04-2019

When asked whether people are more careful with him now: "Not all of them. Some people don't. Central Station sucks." He seemed kind of bitter about it.

The design of an environment can make VIPs feel "in the way".

Observation at Visio Den Haag 02-04-2019

The traffic lights turn red way too quickly for Jaap to be able to comfortably pass.

Being more visible is necesarry, but doesn't feel great.

Observation at Visio Den Haag 02-04-2019

Jaap doesn't know whether he liked being more visible with the white cane: "It's a little bit of a double-edged sword, isn't it?"

VIPs are often challenged financially due to their impairment.

Observation at Visio Den Haag 02-04-2019

Jaap tells us that he has been forced to live in social housing.

VIPs have to work hard to be able to live a full life.

Observation at Visio Den Haag 02-04-2019

Jaap tells us that learning this route to the bus really opens up options. He is going through this hardship in order to still be able to live a rich life in possibilities.

Learning to navigate takes years of effort.

Observation at Visio Den Haag 02-04-2019

Jaap tells us that he started to learn to use the cane in 2015.

Certain environments can make VIPs reluctant to go there.

Observation at Visio Den Haag 02-04-2019

Jaap remarks that at the Centraal Station people are blocking the guideline, put their luggage there and stand on it. He is reluctant to go there.

VIPs can be subject to the changing seasons more than others.

Observation at Visio Den Haag 02-04-2019

Michelle notes that the fountain in the square is probably only working in the summer. Jaap needs to know the seasonal differences of sound sources to be able to navigate year-round.

Having a choice in navigation is nice.

Observation at Visio Den Haag 02-04-2019

Michelle shows Jaap the longer and the shorter route to get to the bus stop.

Using technology takes a lot of remembrance for VIPs.

Observation at Visio Den Haag 02-04-2019

1. The voice application for using the iPad uses a lot of shortcuts.
2. Irene remarks that "(...) it is true that you have to remember a lot, but you can do it by ear if you know the basic commands."
3. "Using this technology is mentally very tiring."

Using technology is tedious for VIPs.

Observation at Visio Den Haag 02-04-2019

1. Irene remarks that lists can take very long to go through.
2. Teacher to Irene: "You're there… listen a little longer the next time."

Technology developed for VIPs doesn't work ideally.

Observation at Visio Den Haag 02-04-2019

1. A few mistakes with Siri do happen over the course of the class.
2. There are a lot of sensitive gestures necessary to go through lists. These are prone to failure and thus annoyance.

Generated voices can become very annoying with daily use.

Observation at Visio Den Haag 02-04-2019

1. “I have started to hate that lady (the voice)!”
2. They mimic and make fun of the generated voice the application uses.

The voice application uses a lot of technical terms.

Observation at Visio Den Haag 02-04-2019

“The rotor function moves the focus to a different part of the screen.”

VIPs and their trainers are sceptical of new technologies.

Observation at Visio Den Haag 02-04-2019

“It sometimes doesn’t work, so most people do it the old way.”

VIPs use tools that were initially designed for sighted users.

Observation at Visio Den Haag 02-04-2019

1. The keyboard consists of little keys that all feel the same.
2. The keys on the keyboard are indistinguishable without proper training.

Voice control is a public interaction.

Observation at Visio Den Haag 02-04-2019

1. “Typing things is better than dictating them, especially for emotional content.”
2. Typing gives her a sense of privacy, she cannot be overheard.

Voice control can lead to auditory overstimulation.

Observation at Visio Den Haag 02-04-2019

It is annoying for her to listen to the phone all the time. It is overloading her senses.

Using a white cane can make you vulnerable.

Observation at Visio Den Haag 02-04-2019

Eva remarks that “(...) you can be robbed if you walk with the cane. They don’t want to use it because of that.”

Software updates can be very inconvenient to VIPs.

Observation at Visio Den Haag 02-04-2019

Software updates can be hard to handle. Especially if it changes the layout or structure of an application. They only learn the actual version of the apps, practice that layout.

VIPs can become very skilled in their own ways.

Observation at Visio Den Haag 02-04-2019

Irene uses her iPhone with black screen she is navigating in her emails quickly and confidently. She only needs the touchpad functionality of the touchscreen.

Using voice control can cause VIPs to stand out.

Observation at Visio Den Haag 02-04-2019

“I wear an earplug, plugged in to one ear when using a phone in public.“ She doesn’t want to be overheard or stand out.

Acceptance runs the gamut between degrees of sight.

Observation at Visio Den Haag 02-04-2019

“Accepting your limits is harder when you are visually impaired. you can always say to yourself: I can still do this. But if you are blind, it is easier to accept.”

People know assistive technology doesn’t work properly.

Observation at Visio Den Haag 02-04-2019

The teacher and Irene make sarcastic jokes to each other about the application. They both know it doesn’t work optimally.

Using the voice control app can be finicky.

Observation at Visio Den Haag 02-04-2019

There are a lot of sensitive gestures necessary to go through lists.

Using a cane has a definite social effect.

Observation at Visio Den Haag 02-04-2019

1. “When using a cane, people don’t dare to talk to you anymore.”
2. “I walked into a restaurant with a cane a few times, and it instantly became quiet.”

Social stigma is different between using a dog and a cane.

Observation at Visio Den Haag 02-04-2019

1. “The reactions of people are different if you enter with a cane or with a dog”, Irene remarks.
2. “It consumes a lot of energy to walk with the cane, it is much easier with the dog.”

Some VIPs work hard to get their old life back.

Observation at Visio Den Haag 02-04-2019

Menno has used a viewing strategy training to get his driver’s license back.

VIPs surroundings sometimes misunderstand the struggle.

Observation at Visio Den Haag 02-04-2019

His newfound visual impairment costs him a lot of energy and the company doctor doesn't recognise this. Neither does his brother.

Misunderstanding can cause VIPs to get angry.

Observation at Visio Den Haag 02-04-2019

When he gets misunderstood, Menno goes "on the barricade".

VIPs might want to prove to themselves that they can function.

Observation at Visio Den Haag 02-04-2019

He scored too high on the capability test done at Visio, because he tried extra hard. Aviva: "You tried too hard." Menno: "Yeah, I was happy that the day was over."

Being spouse to a VIP is an emotional experience.

Observation at Visio Den Haag 02-04-2019

Ria finds it hard to come to terms with her husband's visual impairment, and tries to play it down.

The words “visually impaired” might not have enough impact.

Observation at Visio Den Haag 02-04-2019

Aviva: “When people see the words “visually impaired”, they think it can be solved with glasses.”
Most people only come to action or change their opinion when you emphasize the severity of the visual impairment.

When impaired, your environment might let you down.

Observation at Visio Den Haag 02-04-2019

Menno has worked at a bakery for forty years, but soon has to leave due to his disability.
This is painful for him.

When arranging your new life, you have to be realistic.

Observation at Visio Den Haag 02-04-2019

1. Aviva: “It will be exit bakery. Be prepared for the end of your working life.”
2. Aviva: “Maybe we can find you some suitable volunteering work.”
To which Ria agrees.

A spouse can be a very significant support unit.

Observation at Visio Den Haag 02-04-2019

Ria seems to be very involved in the conversation, maybe more so than Menno on some points.

Visual impairment can make people very negative.

Observation at Visio Den Haag 02-04-2019

1. Menno has become bitter by the entire affair.
2. He always seems to be on the defensive.

Visual impairment can be hard to explain.

Observation at Visio Den Haag 02-04-2019

Aviva will make Menno a visual passport to combat ignorance amongst people around him. The visual passport consist of certain things he can and cannot do or see.

VIPs do reason from sighted people's points of view.

Observation at Visio Den Haag 02-04-2019

Menno: "You can't see anything about the impairment so that's the problem, really."

VIPs do reason from sighted people's points of view.

Observation at Visio Den Haag 02-04-2019

Menno: "You can't see anything about the impairment so that's the problem, really."

Misunderstandings can hurt caregivers, too.

Observation at Visio Den Haag 02-04-2019

Ria is tired of explaining her husband's behaviour all of the time. "People keep asking me, why isn't he joining this time?"

Visual impairment can cause disagreement in families.

Observation at Visio Den Haag 02-04-2019

Ria: "We still try to do everything, but then a little bit adjusted."
Menno: "While in fact, we can't."

Visual impairment often leads to tough dilemmas.

Observation at Visio Den Haag 02-04-2019

Menno has the dilemma of going to a dance performance of his granddaughter, or keeping his energy up.

Stigma test

V w/0	V cane 1	V cane 2	S w/o	S cane 1	S cane 2
0,2	0,0	1,5	0,0	1,0	0,5
0,5	1,5	0,75	1,0	1,0	2,0
0,75	1,5	1,5	0,33	1,75	0,75
0,2	1,5	1,0	0,33	1,25	1,0
0,5	1,25	1,0	0,25	1,25	0,075
0,2	1,25	1,25	1,25	0,75	1,0
0,0	1,25	1,5	0,75	1,0	1,25
0,0	1,5	0,75	1,75	0,75	1,0
0,5	2,0	1,0	1,0	1,75	0,25
0,33	1,0	1,0	1,25	1,0	1,0
0,5	1,5	1,5	1,5	1,25	0,5
0,75	0,75	1,5	1,0	1,25	1,0
0,33	1,0	1,0	1,0	1,75	1,25
1,5	1,75	1,25	1,0	0,75	1,5
2,0	1,75	1,0	0,75	2,0	1,75
2,5	1,75	0,75	0,75	2,25	1,25
0,2	2,0	0,5	0,25	1,0	0,75
0,2	2,0	0,33	1,0	0,25	0,75
0,2	1,5	1,0	0,25	0,5	0,25
	2,0	1,5	1,0	1,25	0,5
	1,0	0,5	0,5	2,0	0,75
	2,0	0,75	1,25	2,25	1,75
	1,5	1,0	0,33	1,0	1,0
	1,25	1,0	0,5	0,75	1,0
	1,5	1,0	1,0	1,0	1,0
	0,5	0,75	0,0	1,0	1,75
	0,75	1,0		1,0	0,25
	1,25			1,0	1,5
				1,0	1,0
				0,5	2,0
					1,0
0,597894736842105	1,375	1,02148148148148	0,768846153846154	1,16666666666667	1,01048387096774
2	9	6	3	9	7
Veronika	0,60		**Sven**	0,77	
	1,38			1,17	
	1,02			1,01