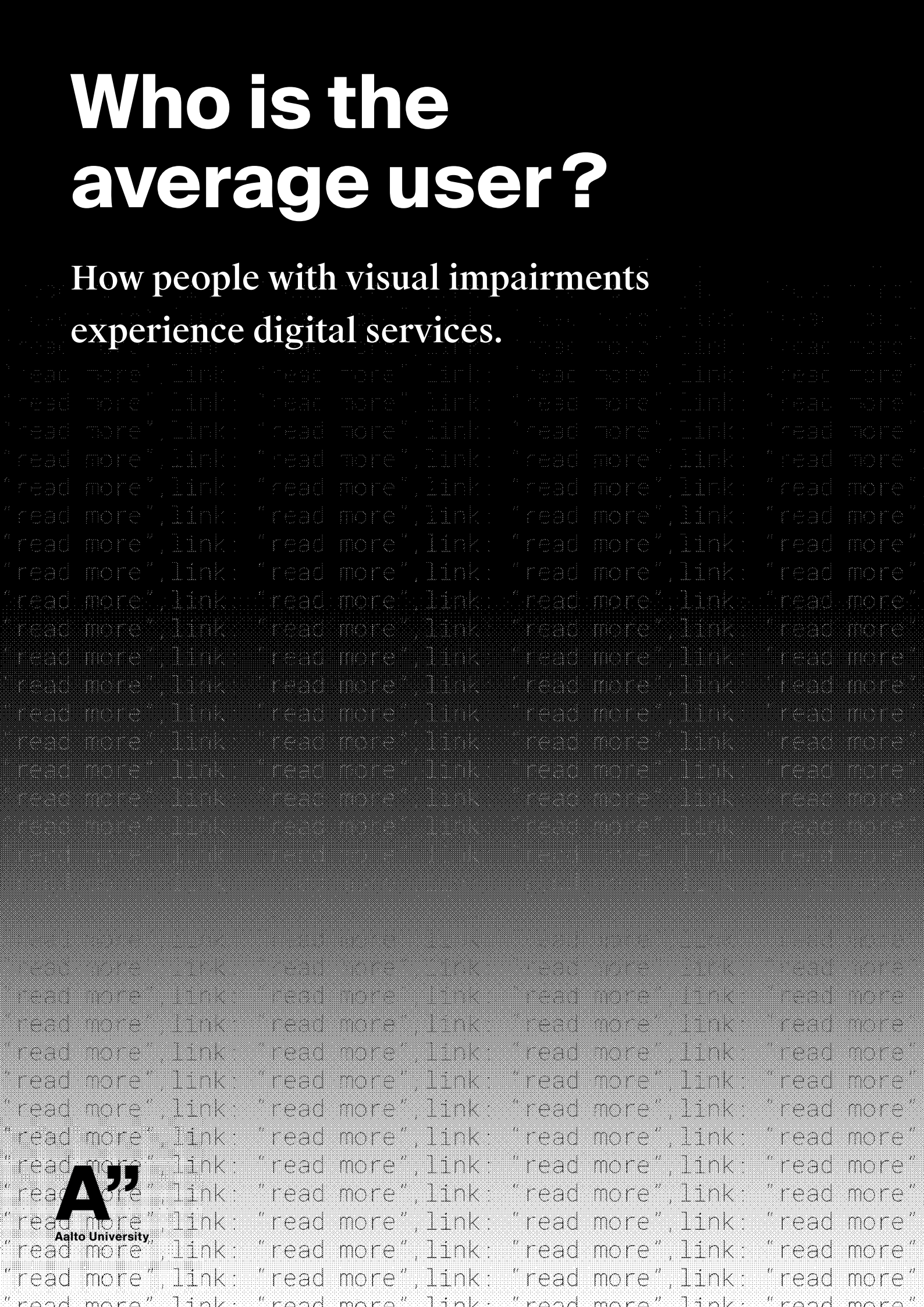
Who is the average user?

How people with visual impairments experience digital services.



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Abstract

This thesis investigates the connections between the process of designing digital services on the one hand and the personal accounts of five people with visual impairment who use digital services on the other. Design plays a significant role in causing or mitigating disability in society through the shape and function of products, services, and the built environment. To better understand how products and services cause disability, I analyse disability as a multifactorial phenomenon which emerges through the interplay of personal, social, and environmental factors.

I first review three models of disability from the field of disability studies, and, secondly, the design process through the review of inclusive design frameworks. Based on this analysis, I discuss how inclusive design frameworks fail to address the individual needs of people with impairments by generalising their challenges; and how the official interpretation of disability has developed into defining disability as a basic human experience.

This research follows a grounded theory approach which utilises the accounts of five people with visual impairment to discuss their ability to access digital content, and, the role of design and technology in mitigating disability. Based on their accounts, I argue that design can mitigate disability and, thus, increase the independence of people with impairments. Furthermore, concrete examples of their interaction with digital services will help to organise factors that cause a positive or negative user experience for people with visual impairment.

This thesis concludes with the suggestion of a new approach for designing inclusive products and services. This approach aims to consider the factors constituting the personal experience of accessibility, such as the use of assistive technology, the effects of physical impairments, and the availability of technology. Through this approach, designers can distinguish vulnerable user groups on a case-specific basis and, consequently, mitigate exclusion during the design process. In addition to improving the design process, this thesis argues that interacting with people with impairments, e.g., in the work environment, serves as an indispensable educative function to understand the requirements for building accessible products and services, and, thereby, develops an inclusive and diverse society.

Keywords Design, Disability Studies, User Experience, Accessibility, Service Design, Grounded Theory

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1. Introduction

In 2016 I visited the Finnish Federation of the Visually Impaired in Helsinki together with two other students for a course at the Media Department. This visit aimed to learn how design can accommodate people with visual impairments. At the time, Raisa, whom I would later interview for this thesis, introduced us to various assistive devices and the means people with visual impairment employ to perform daily tasks. During this project, I realised that designers focus too much on people benefitting from their products, but rarely on the people whom it excludes. However, considering the use of products and services by people with impairments can improve their versatility. Notably, digital technology enables designers to communicate the same message through various means of perception. For example, digital text can be printed, displayed on a screen, or translated to speech. Designers, therefore, have to consider the individual's preferences for perceiving digital content and ensure that each channel communicates the same information.

Two years later, now working as a designer at the digital consulting company Futurice, I was working on the design renewal for the largest Finnish evening newspaper, Ilta-Sanomat. Considering the upcoming European Accessibility Act, which requires public services to be accessible by people with impairments,[1] accessibility became an integral part of the project. Even though the EU directive would not immediately impact the newspaper, as it is a private company, the organisation wanted to improve the experience of the service for everyone. Remembering my encounter in 2016, I was motivated to take responsibility for this subject, and document the process in my thesis.

In the following months, we built an entirely new website together with a large team of developers and one additional designer. In the beginning, I organised a workshop together with my thesis advisor Anna Novius, to discuss the necessary steps for creating an accessible website. Afterwards, the development team focused on the technical accessibility, and the design team kept the layout accessible and spoke with the users. During the project, we had several follow-up discussions within the team to ensure the priority of accessibility-related improvements. The awareness and support from the project team and stakeholders, and our early focus on the topic enabled us to launch a highly accessible website. The final accessibility audit praised our efforts and only asked for small adjustments. This project showed that building inclusive websites does not require much additional development costs, but merely the awareness of all stakeholders.

In order to build an accessible website, everyone in the team needs to understand the reasons and consequences of accessibility, and their field-specific accessibility requirements. The requirements for designers, developers and content creators to build an accessible website are documented in the Web Content Accessibility Guidelines (WCAG)[2] by the World Wide Web Consortium (W3C).[3] However, a website can be perfectly accessible according to the WCAG but unusable by people with impairments. The lack of awareness of the lived reality of people with impairments, causes this ambivalence between technical accessibility and personal usability.

But how can the needs of people with impairments be communicated when every personal story differs? My approach was to ask people with impairments themselves. Enough books are written about accessibility, without a single quote from a person with impairments. Therefore, this thesis does not serve as a step-by step handbook to create an accessible website. Instead, it focuses on the accounts of five people with visual impairment.

1 (European accessibility act, n.d.)

2 (Web Content Accessibility Guidelines (WCAG) 2.0, n.d.)

3 (About W3C, n.d.)

Research objectives

I based the interview questions for these five people on my experience form the Ilta-Sanomat website renewal and an initial literature review from the field of design and disability studies. The results were four main topics which I discussed in individual sessions with the interviewees:

1. How can we design with - and for people with visual impairments?
2. How do people with visual impairment interact with digital content?
3. Is technology improving the independence of people with visual impairment?
4. Do people with visual impairment receive all the information they need?

Initially, I intended to use the interview results to contextualise our efforts to create an inclusive user experience for the Ilta-Sanomat website. However, during the analysis of the interview results, I realised that a mere documentation and validation of the project would not account for the versatility of the topics raised by the interviewees. Consequently, I adjusted the initial research objectives. Two broader topics emerged which form the main chapters of this thesis:

1. The online experience of people with visual impairment. This topic includes design-related challenges for accessing online services, and examples to illustrate positive and negative browsing experiences. In addition, I added the personal experience of people with visual impairment and the factors influencing the trustworthiness of a service to this section.
2. Can technology mitigate disability? This topic emerged from the combination of the initial second, third, and fourth topic. The influence of technology on the lives of people with visual impairment is connected with their independence and ability to access digital content, such as news. The initial fourth topic, about their ability to access information diminished during the analysis because the omnipresence of information through digital media, appears to yield enough information even without access to visual content.

The Content of this Thesis

I will start this thesis by discussing different concepts of disability from the field of disability studies and inclusive design frameworks. This section elaborates the various models used to define disability, and design theories devices during the last decades to accommodate people with disabilities in the design process. The second part of this thesis comprises the analysis of the interview results. This section will discuss, first, the design-related challenges people with visual impairments face when accessing digital services; and second, a broader discussion about whether or not technology can mitigate disability. To conclude this thesis, I will suggest a new design framework to account for the personal experience of accessibility of people with impairments. Finally, I will summarise the findings of the interview analysis in a comprehensive checklist.

Throughout this thesis, I aim to connect the concepts discussed in the literature review and the accounts of the five interviewees. The aim is to create a broad interdisciplinary understanding of the multifactorial phenomena of disability. Besides, this thesis aims to help designers and other stakeholders of digital products and services to emphasise with the challenges of people with visual impairments, and thereby, create an understanding for the reasons behind guidelines such as the WCAG. Ideally, this thesis will serve as a motivation to further examine the subject in the reader's respective field and, therefore, increase the sensitivity for the topic of accessibility.

2. Literature review

"I cannot go by ordinary bus,[…] [i]s that because I had polio 37 years ago,
or because the transport authority doesn't buy buses that will work for everybody?"[1]

1 ('Time Magazine Recognizes Adolf Ratzka as European Visionary', 1998)

2.1. What is disability?

Our definition of what is normal defines disability. Because normalcy creates the 'abnormal' and therefore, disabilities, consequently, disability can be seen as a product of a normative society. The terminology to describe disability is dependent on its historical and political context. Some terms assume a normative - ableist view of society which positions the abled-bodied individual at its centre. Thus, they tend to reduce a person to their bodily or cognitive disability. These terms neglect the circumstance that society and politics can be a more significant cause for disability than the body.

In the following chapter, I will discuss different terminology and models used to analyse and define disability in society.

2.1.1. Definition and terminology

In the International Classification of Functioning, Disability and Health (ICF), the World Health Organisation (WHO) defines disability as a "universal human experience".[2] Thereby, the WHO acknowledges disability as an experience independent from specific bodily or mental impairments. Instead of grouping people with disabilities apart from those without disabilities, everyone can be affected by a temporary or gradual loss of their bodily abilities. Thus, every person is more or less disabled at different times in their life.

The WHO further states that disability is an interplay between bodily and socially induced restrictions. It can neither be solely explained through a person's physical and cognitive abilities nor their social and environmental context. The ICF model, therefore, emphasises the interaction between bodily restrictions (impairments); the ability to execute activities; and the ability to participate in society. Therefore, disability is an interplay between environmental and physical factors. For example, if a person is unable to access public transport the cause can be physical or cognitive impairments, such as limited mobility or sight, or the inaccessibility of the public transport system itself can be the cause.

Previously people with physical or mental impairments were treated as a separate group, thus, "disability began where health ended".[3] The ICF contrasts this notion by removing the differentiation between disability and general health. The ICF sees itself as a "tool for measuring functioning in society, no matter what the reason for one's impairments"[4] rather than attempting to classify people as disabled or not. Through this definition, disability becomes part of mainstream society and a phenomenon which can affect anyone.

While the WHO describes guidelines for defining disability, Lennard J. Davis discusses disability in his book Enforcing Normalcy[5] as a phenomenon which emerged from our social and historical understanding of normalcy. He claims, that the term disability itself places too much importance on highlighting the inability in general, i.e. "any lack of ability – fiscal, physical, mental, legal".[6] The term, therefore, defines people by their inabilities, instead of acknowledging the social and political causes for disability. The term 'disability' has succeeded the older term 'handicapped' which was used to describe a gambling game for

2 *('WHO | International Classification of Functioning, Disability and Health (ICF)', n.d.)*
3 *Ibid.*
4 *Ibid.*
5 *(Davis, 1995)*
6 *Ibid.*

horse racing in which a superior horse would be handicapped to match an inferior horse in racing. Even though the term lost its connection to gambling, the idea "to link impairment to the notion of competition and unfair inability to compete"[7] persists. The more recent term 'differently-abled' has a broader meaning than 'disabled' and can be applied to anyone. Davis criticises the term for its broadness since every person is differently able in their skills and abilities and not merely through their bodily capacity. While rendering the term the most inclusive by its broad application, it diminishes the magnitude of physical and cognitive impairments compared to manual skills such as knitting and cooking.

When comparing the terms 'people with disabilities' and 'disabled people', Davis argues in favour of the former. He notes that "the former term implies a quality added to someone's personhood rather than the second term's reduction of the person to the disability".[8] Following the argumentation of Davis and the ICF, a person who experiences difficulties when executing specific tasks or participating in society caused by bodily impairments should not be characterised by their restriction.

As Davis describes, every term used in this context carries a long history that reflects changing social attitudes. Nevertheless, they are all "products of a society invested in denying the variability of the body"[9] since the need to segment people by their physical and cognitive ability persist. At present, we are facing changing social demands for individual self-determination. Thus, our society and terminology has to cater for more diverse individual needs instead of social segmentation. It is, therefore, possible that the perception of the terminology used in current literature and this thesis will be perceived as discriminatory in the future.

In this thesis, the phrase 'people with disabilities' is used to describe the phenomena of disability in its various forms and contexts. In contrast, the term 'impairment' or its specification 'visual impairment' are used for the physical cause of the disability, in our case mostly partial sightedness and blindness.

2.1.2. Models of disability

Different models are commonly used to describe disability. In 1989 Gillian Fulcher listed four discourses of disabilities in his book Disabling Policies?.[10] These models are the "medical, lay, charity and rights".[11] Tom Shakespeare[12] later challenged these models through the construction of the social model of disability. In the following section, we will focus on the most dominant medical and social model of disability.

The medical model of disability

The medical model postulates physical disability as an intrinsic bodily characteristic of a person: "A medical discourse is the source of the dominant and misleading image of disability as physical incapacity."[13] The medical model defines disability as a malady. By establishing disability in the realm of medical remediation and "through its language of body, patient, help, need, cure, rehabilitation, and its politics that the doctor knows best, [it] excludes a consumer discourse or language of rights, wants and integration

7 Ibid.
8 Ibid.
9 Ibid.
10 (Fulcher, 2015)
11 Ibid.
12 Shakespeare, Tom. The Social Model of Disability In: (Davis, 2013)
13 (Fulcher, 2015)

in mainstream social practices".[14] In order words, establishing disability in the therapeutical context withdraws the topic from a broader political and social dialogue. The model combines physical impairment and disability while emphasising the individual's condition. The most critical aspect of this model, however, is the withholding of political demands related to disability by the supremacy of medical institutions in political decision-making.

The social model of disability

In the 1970s, the group called Union of Physically Impaired Against Segregation (UPIAS) questioned the dominating medical discourse by stating that:

> "it is society which disables physically impaired people. Disability is something imposed on top of our impairments, by the way we are unnecessarily isolated and excluded from full participation in society. Disabled people are therefore an oppressed group in society".[15]

The social model, which emerged from the argumentation of the UPIAS, denies that physical impairment is the leading cause of disability. Instead, it regards disability as a consequence of social exclusion. In contrast to the medical model, the social model separates physical impairment, the restrictions imposed by the body; and disability which is according to the UPIAS, inflicted by a society built by- and for non-disabled people.

In 1975 Victor Finkelstein, a member of the UPIAS, published an essay to illustrate that "it should be possible to prove that other social groups can become disabled, in an imaginary society which took no account of their physical status".[16] In the essay, he describes a village solely inhabited by wheelchair users. Walking people living in the village have to bend in order to fit through doors and thus bruise themselves whenever using the buildings designed for wheelchair users. "Soon the wheelchair-user doctors, wheelchair-user psychiatrists, wheelchair-user social workers, etc., were involved in the problems of the able-bodied villagers"[17] and they devised special aids, such as helmets and knee-pads for the non-disabled disabled people to survive in the utopian village.

By placing people without disability in a society unfit for them, the story shows to which extend social integration and the built environment cause disability even to people without impairments. Following this argumentation, if our culture and architecture accommodates impaired people, we could resolve disability altogether.

Shakespeare criticises the UPIAS as too invested on wheelchair-users.[18] The causes for impairment are numerous and solving social integration for wheelchair-users will not improve the lives of people with cognitive or visual impairments. Consequently, Shakespeare asks "What would it mean to create a barrier free utopia for people with learning difficulties?".[19] Arguably, the ability to read and write are equally disabling than navigating space in a wheelchair. The social model proposes a complete opposition to the medical model, which, according to Shakespeare, can be seen as a complete rejection of medical prevention.[20] While the UPIAS with its vocal claims helped to evoke public attention for the issue of social discrimination of people with impairments, the narrow scope of the social model complicates a versatile analysis of disability.

14 Ibid.
15 (Davis, 2013)
16 (Finkelstein, 1975)
17 Ibid.
18 (Davis, 2013)
19 ibid.
20 ibid.

The Biopsychosocial model of disability

This duality of medical versus social model has lost its significance in the present disability discourse. Nowadays, disability is defined as an interplay between bodily impairments, environmental, and social factors. In the words of the WHO:

> "Disability is a complex phenomena that is both a problem at the level of a person's body, and a complex and primarily social phenomena. Disability is always an interaction between features of the person and features of the overall context in which the person lives".[21]

Medical treatment and guidance for the individual, combined with educational efforts to build accessible environments create inclusive societies. Both topics have to be considered as part of the same system because, "social and individual aspects are almost inextricable in the complexity of the lived experience of disability".[22]

To combine the personal, cultural, and environmental causes for disability, the WHO suggests a "better model of disability, […] one that synthesizes what is true in the medical and social models, without making the mistake each makes in reducing the whole, complex notion of disability to one of its aspects".[23] This "Biopsychosocial"[24] model positions disability in the intersection between health conditions and contextual factors. The first includes "diseases, disorders and injuries",[25] the latter incorporates environmental factors such as social attitudes and the built environment; and personal factors like coping styles, social background and education.[26] Dividing disability into variable blocks helps to accommodate the vast diversity of disabling factors. Through this model, it becomes easier to analyse and determine disabling factors and consequently, helps to improve inclusivity where it is most needed.

Conclusion

The interpretation of disability mirrors social attitudes and political motivations. Beginning with the introvert view of disability as a personal malfunction through the medical discourse; followed by the criticism of society as the sole cause of disability; concluding with the present interpretation of disability as a "universal human experience."[27] Disability should no longer be seen as characteristics of a group with specific bodily and cognitive impairments. Instead, disability is a shared experience in our culture and society. Or in the words of Davis: "Disability is not an object – a woman with a cane – but a social process that intimately involves everyone who has a body and lives in the world of the senses".[28]

We can observe a similar evolution of the definition of disability in the design discourse. While disability studies are invested in defining the social perception of disability, design frameworks aim to reflect the diversity of society in products, services, and the built environment. Therefore, I will elaborate in the next section how designers tried to accommodate people with disabilities into the design process.

21 ('WHO | International Classification of Functioning, Disability and Health (ICF)', n.d.)
22 (Shakespeare, n.d.)
23 ('WHO | International Classification of Functioning, Disability and Health (ICF)', n.d.)
24 ibid.
25 ibid.
26 ibid.
27 ibid.
28 (Davis, 1995)

2.2. Inclusive design frameworks

Over the last decades, various design frameworks have emerged to include people with disabilities in the design and production process. The most prominent concepts are the Universal Design, Accessible Design and Inclusive Design frameworks. Their common objective is to draw the attention of designers to vulnerable user groups. These concepts aim to include everyone in the design process independent from a person's abilities. The broad scope, however, has resulted in their criticism for being unachievable promises. More recent frameworks focus the design process on a small group of individuals for whom interacting with the product would be most challenging. Developing products for one extreme use case, enables designers to regard impairments as a driver of innovation instead of a restraint.

The following section will discuss the characteristics of these frameworks and approaches to implement them into the design process.

2.2.1. From mass production to Accessible Design

In the late 20th-century mass production process, designers regarded users as "'universal types' rather than individuals".[29] Coleman et al. sees this notion represented by the designer Henry Dreyfuss, who introduced the human scale to industrial design. Dreyfuss proposed an average scale of men and women to represent every user (Figure 1). Applying the average dimensions of a person to the shape of products, improved their ergonomic factors for a significant amount of people. People with impairments, however, did not benefit from these improvements. Consequently, "those who did not conform in terms of height, weight, cognitive or sensory capacity or physical strength became vulnerable to design exclusion".[30] Coleman elaborates, that, the exclusion of minorities from the mainstream design process generated the demand for products specially developed for people with 'special needs'. The comparably small user group for these products resulted in expensive small-scale productions. Coleman describes their quality and appearance as resemblant of "hospital aids and appliances [rather] than consumer-based products and services".[31] The treatment of people with disabilities as a 'special case' separate from the 'normal user' was exemplary for the design discourse of the mid-20th century. Instead of building products for a diverse society, designers preferred to mould society through an ideal, average archetype. The result was cheap, mass-produced goods for the majority and special aids for people with disabilities.

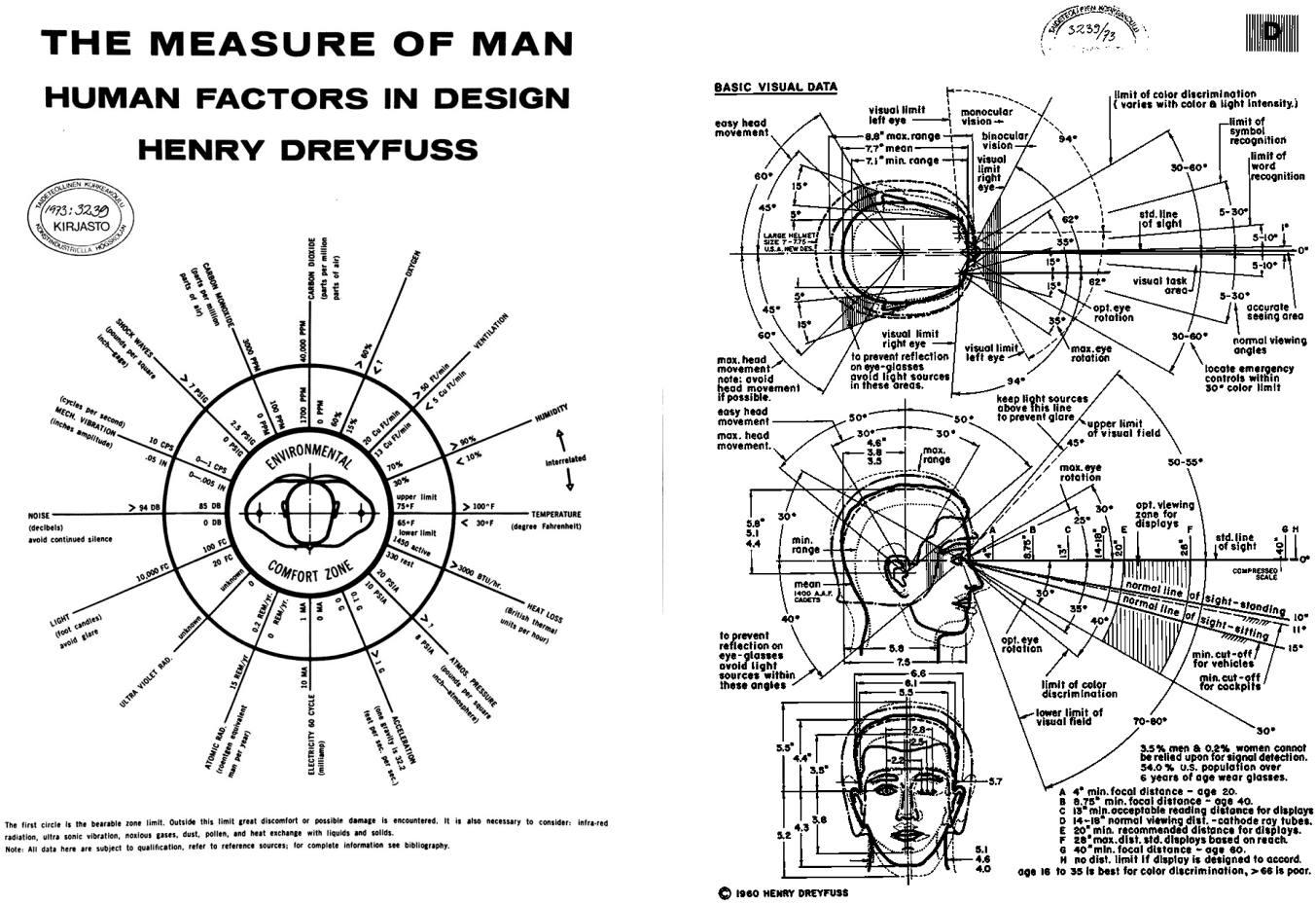
The following generation "rejected assumptions about dependency and exclusion due to age and disability, and insisted increasingly on equal rights in society and the marketplace".[32] Consequently, personal access to products and information became part of the design discussion. This demand correlates with the emergence of the concept of Accessible Design. The concept aims to render environments and products accessible to people with physical restrictions. Kalbag explains that Accessible Design is characterised by retrospectively rendering products or buildings accessible like a "building having a wheelchair ramp attached to its far side, as an afterthought".[33] Thus, Accessible Design does not challenge the Design process itself. Instead of finding ways to include people with disabilities into the design process, it regards

29 (Coleman et al., 2016)
30 ibid.
31 ibid.
32 ibid.
33 (Kalbag, 2017)

accessibility as an additional feature. The need to use, e.g. special entrances, creates new causes for stigmatisation.

We can, therefore, conclude that the use of buildings or products by a diverse society should be the foundation of the design process, not an added value.

Figure 1
Henry Dreyfus The measure of man. Illustrations of the human comfort zones and basic visual data.



Dreyfuss, H. (1967). The measure of man: Human factors in design (Rev. and expanded 2nd ed). Whitney Library of Design.

2.2.2. Universal Accessibility and Design for All

With increasing demands for inclusive services and to mitigate the exclusion of people with disabilities, "[a] new message was proclaimed: these groups were not special cases with special needs but people whose requirements should be considered and incorporated at every stage of the design process".[34] Thus, products had to be usable by everyone despite their physical or cognitive abilities. To meet this demand, policymakers and academic institutions devised the principles of "Universal Design"[35] in the United

34 (Coleman et al., 2016)

35 ('The Center for Universal Design—Universal Design Principles', n.d.)

States, and "Design for all"[36] in the European Union and Japan. The Center for Universal Design at the NC State University advised designers to consider "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design".[37] The Universal Design framework comprises seven principles to guide designers in their work: "1: Flexibility in Use, 2: Simple and Intuitive Use, 3: Perceptible Information, 4: Tolerance for Error, 5: Low Physical Effort, 6: Size and 7: Space for Approach and Use".[38]

The Design For All approach adds a social dimension to the operability of products. Anderberg cites the European Institute for Design and Disabilities (EIDD) to explain that Design for All "aims to enable all people to have equal opportunities to participate in every aspect of society. To achieve this, the built environment, everyday objects, services, culture and information – in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and responsive to evolving human diversity".[39] Design for All combines the promise for equal access to products and services with the demand for equal abilities to participate in society. However, it does not propose the concrete measures required for its achievement.

Both, Design for All and Universal Design assume an all-encompassing user group. Instead of separating people with disabilities from people without disabilities, it aims to serve everyone at once. This perspective, however, overlooks the diversity of individuals and evens out the personal needs of people with impairments. Consequently, Harper, acclaims in his article "Is there design-for-all?", that: "To create universal usability by designing for all involves making generalizations about users, and it is these exact generalizations that have led to so many users being excluded from the technological world in the first place".[40] Neither of the two concepts acknowledges the distinct differences of individuals. Grouping everyone into one all-inclusive user group, is therefore little better than treating people with disabilities separately. Therefore, Universal accessibility is an ideal state, which, when applied to the design process, can result in products and services which fit everyone a little but which nobody actually enjoys using.[41]

2.2.3. Design for Me

Universal design is unachievable because accessibility is a personal experience. Following a universal design approach, we can expect "a design which is hopefully reasonably ok on an average level, but which may not fit anyone perfectly".[42]

Designers should instead look at the individual user, especially those who are most likely to be excluded by the products or service. To create this interaction, Magnusson proposes the "design for me"[43] method. In this method, designers interact with one person of a vulnerable user group. This individual serves as an "extreme and inspiring case"[44] who challenges the product through the design process.

Magnusson exemplifies the method with the case of a girl who, after a brain injury, could merely move her finger. They built an assistive device for her to interact with her surroundings. The device was

36 (Pullin, 2009)
37 ('The Center for Universal Design—Universal Design Principles', n.d.)
38 ibid.
39 (Anderberg, 2006)
40 (Harper, 2007)
41 (Newell et al., 2011)
42 ibid.
43 ibid.
44 ibid.

developed in close iteration with the girl and later matured into a tool which benefited people with similar impairments. “In the process a design which really suits this person should be developed – and once a working design is reached this may then be extended to encompass more users”.[45] Design for Me, or Design for One, helps to develop a product with an outstanding user experience for a single person. In this case, the impairment of the girl challenged the team to develop a product for its most extreme use-case. Afterwards, the group of users can be extended. The initial restriction forces the team to focus on the user experience, which, after that, becomes the starting points for its growth. Notably, digital products benefit from the Design for Me method as the layout and structure of digital content can be adjusted to further adapt to the individual’s needs.[46]

To see people with impairments interact with products at an early stage of the design process, ensures its later accessibility. Harper thus, concludes, that universal usability is only possible by understanding the individual user through the application of the ‘design for me’ methodology.[47] Developing a perfect user experience for one person helps narrow and restrict the design process. It helps to focus on the subtleties of a person interacting with a products

2.2.4. The design process

Everyone is an expert in handling their everyday life. people with visual impairment, for example, are experts in using non-visual means to gain information. Pullin argues in his book “Design meets disability”,[48] that including people with visual impairment in the design process can mitigate the “oversight or […] misconception of an able-bodied design team”.[49] Design teams usually consist of people without disabilities and whose concept of accessibility is not based on real-life encounters. “The developer is typically not the user. As a designer or developer you cannot use yourself as a reference - you have to work very close to real users”.[50] To design products intended to suit more than the average user, they need to understand the reality of people with disabilities. Thus, designers need to see how people interact with their products, “it was not until engineers actually met older people and saw them trying to use their paper prototypes that they fully realised the challenges of designing for that group of people”.[51] The situation, Newell describes in the case of elderly people, can be applied to designing for people with disabilities. Gaining an understanding of a diverse user group is especially important for the accessibility of the final product.

People have different views on a product or service. Further, people with disabilities have particular restrictions which are challenging to combine with the needs of users without disability. Traditional user testing or user-panels can, therefore, be particularly challenging. Kalbag explains that users who are solely relying on keyboard control are unable to test visual prototypes, such as, simple click dummies.[52] Newell elaborates that people with cognitive disabilities or speech impairment can be unable to communicate their thoughts in user panel discussions.[53] The alternative could be the creation of a user panel which solely comprises people with disabilities. However, as we have already seen, the disability itself does not estab-

45 (Magnusson et al., 2018)
46 (Anderberg, 2006)
47 (Harper, 2007)
48 (Pullin, 2009)
49 (Pullin, 2009)
50 (Coleman et al., 2016)
51 (Newell et al., 2011)
52 (Kalbag, 2017)
53 (Newell et al., 2011)

lish a unifying factor to group users. People with different disabilities can have complementary needs, "e.g. floor texture can assist blind people but may cause problems for wheelchair users".[54] The range of impairments is too diverse for a single user group. Therefore, we can argue, that learning an individual's habits and environment can best serve an inclusive design process.

2.2.5. Conclusion

Inclusive design methods are "a logical response to changing social realities and an approach to design that places the user at the heart of the design process".[55] We can no longer build products and services to fit the average user. Instead, we need to accommodate everyone. Designers should, therefore, understand how people who are most likely to be otherwise excluded, interact with the products and services they build.

> "It is also about understanding that the less tangible human factors – identity, emotion, delight, self-expression – are common to us all, and that getting these right for users who are vulnerable to exclusion is an effective way of ensuring that what we design really does enhance life quality, simply and intuitively, for as many people as possible".[56]

Apart from the understanding of the user's context, the product itself has to be adaptable. It has to cater to diverse use-cases, e.g., a website should be usable with different devices and assistive technology.

Finally, we should become aware of the impact of design in society. According to Guffrey, "graphic communication, urban planning, and architecture […] weave social attitude into the very shape and texture of our built environment".[57] Products and services reflect the attitude of their designers. To design for human needs means to "remember the essential humanity of everyone interacting with our products and interfaces".[58] Focusing the attention to serve the needs of people helps "[u]nderstanding for whom we are designing acknowledges that we are not designing for everybody at once"[59]

54 ibid.
55 (Coleman et al., 2016)
56 ibid.
57 (Guffey, 2018)
58 (Kalbag, 2017)
59 (Pullin, 2009)

3. Research design methods

3.1 Research setup

The research connects academic concepts of disability and inclusive design methods, with the personal accounts of five people with visual impairment. This thesis follows a Grounded Theory[1] approach to best reflect the individual's accounts in the research result. The Grounded Theory method "is designed to encourage researchers' persistent interaction with their data, while remaining constantly involved with their emerging analyses".[2] A predefined hypothesis could have prevented valuable topics raised by the interviewees, from being reflected in the research. My intention was to reflect the results of open-ended interviews instead of evaluating predefined assumptions.

Consequently, the analysis emerged from the content of the interviews. I found the interviewees through the Finnish Federation of the Visually Impaired and associated Facebook groups. The scale of the interviews comprised five individuals whom each participated in a one-hour session. Afterwards I categorised sections of the manually transcribed recordings from the interviews. "Categorization is a major component of qualitative data analysis by which investigators attempt to group patterns observed in the data into meaningful units or categories".[3] I used software Atlas.ti[4] to perform this categorisation. Atlas.ti is a qualitative analysis software for documenting connections between and within documents. These connections were established by marking quotes with a manually defined set of tags. These codes, e.g., marked the relation between interview quotes and topics such as independence, social perception or positive browsing experiences.

These tags and their associated quotes were visualised through a network representation. Each research topic was documented in a separate network (Figure 2). Afterwards, I printed and connected the resulting four networks from the interview analysis and the additional two networks from the literature review (Figure 3-4) into one overview. The combined networks revealed a graphical overview of the entire research material. Through colour highlights and manual annotations, I identified categories to be summarised in chapters. Finally, I constructed the chapters based on this selection of quotes from the network (Figure 5).

1 (Bryant & Charmaz, 2007)
2 ibid.
3 ('Categorization', 2008)
4 (ATLAS.ti, n.d.)

Figure 2

Atlas.ti network overview

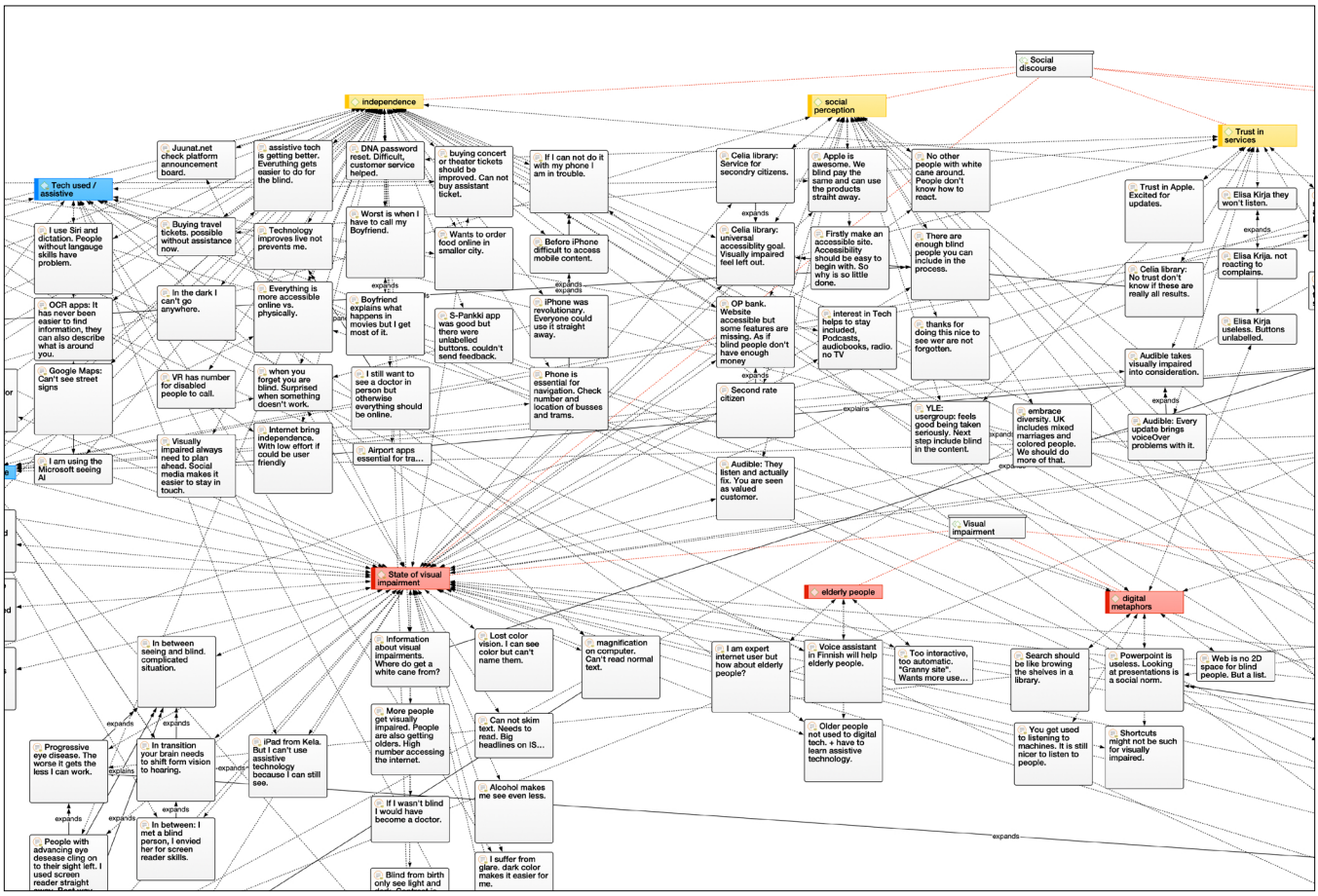


Figure 3

Annotated network with chapter highlights.

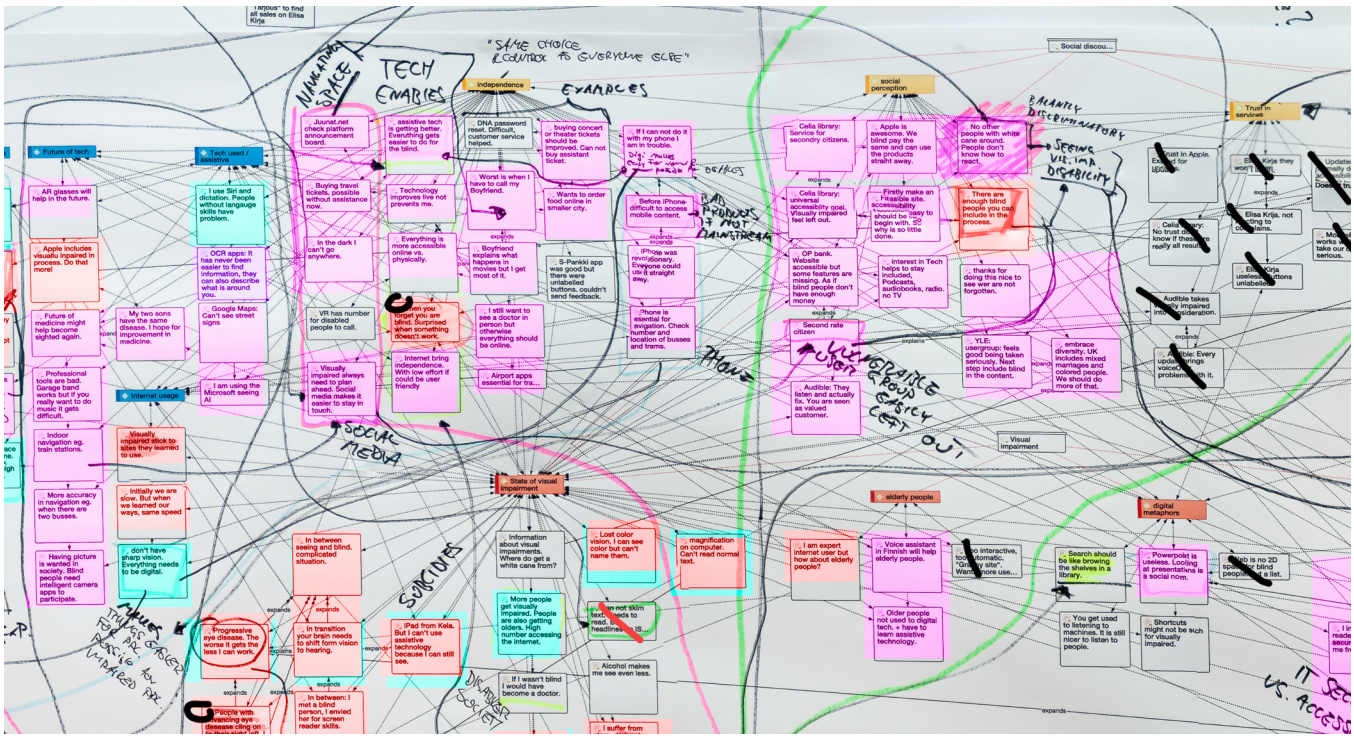


Figure 4

Overview of all six networks.

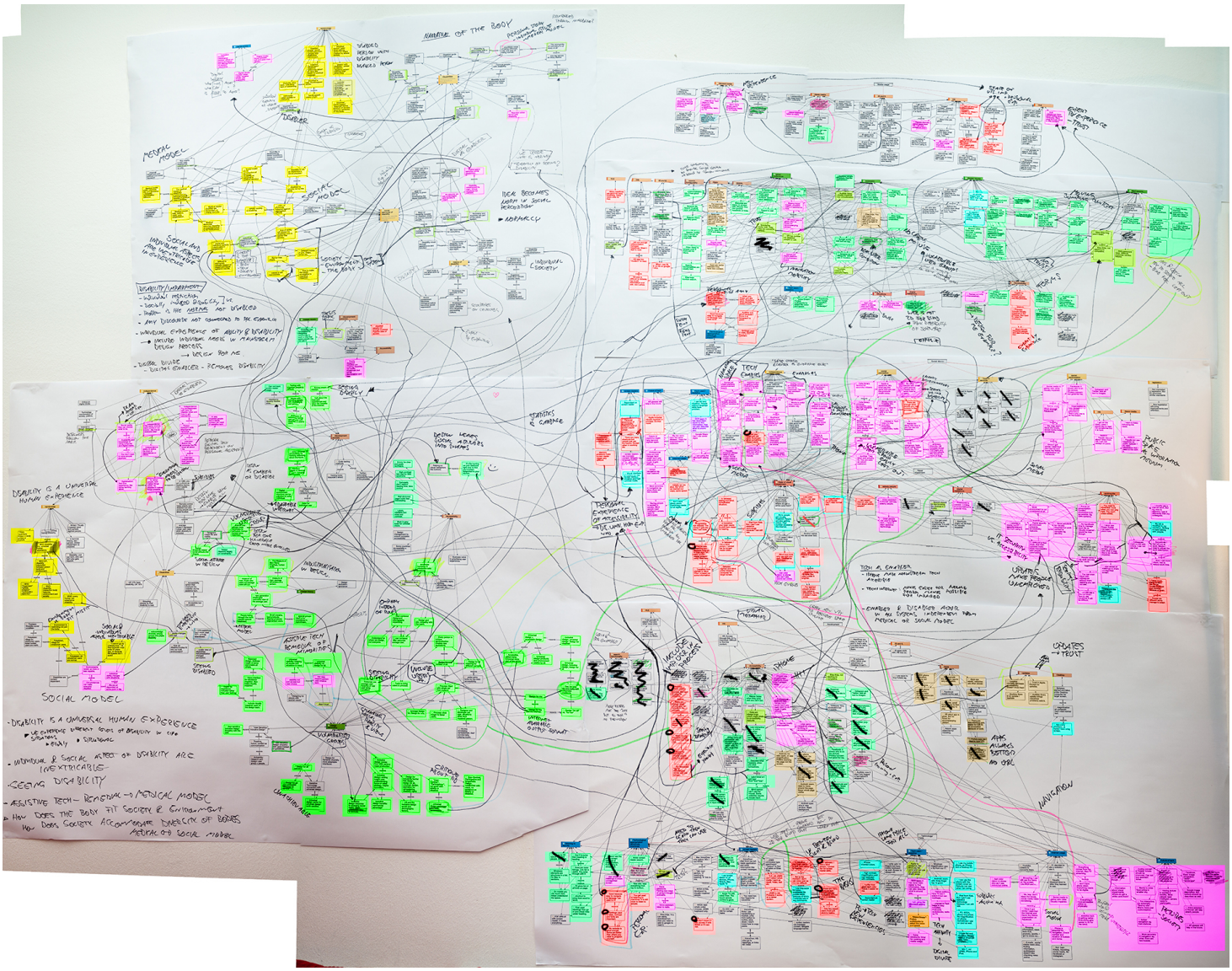
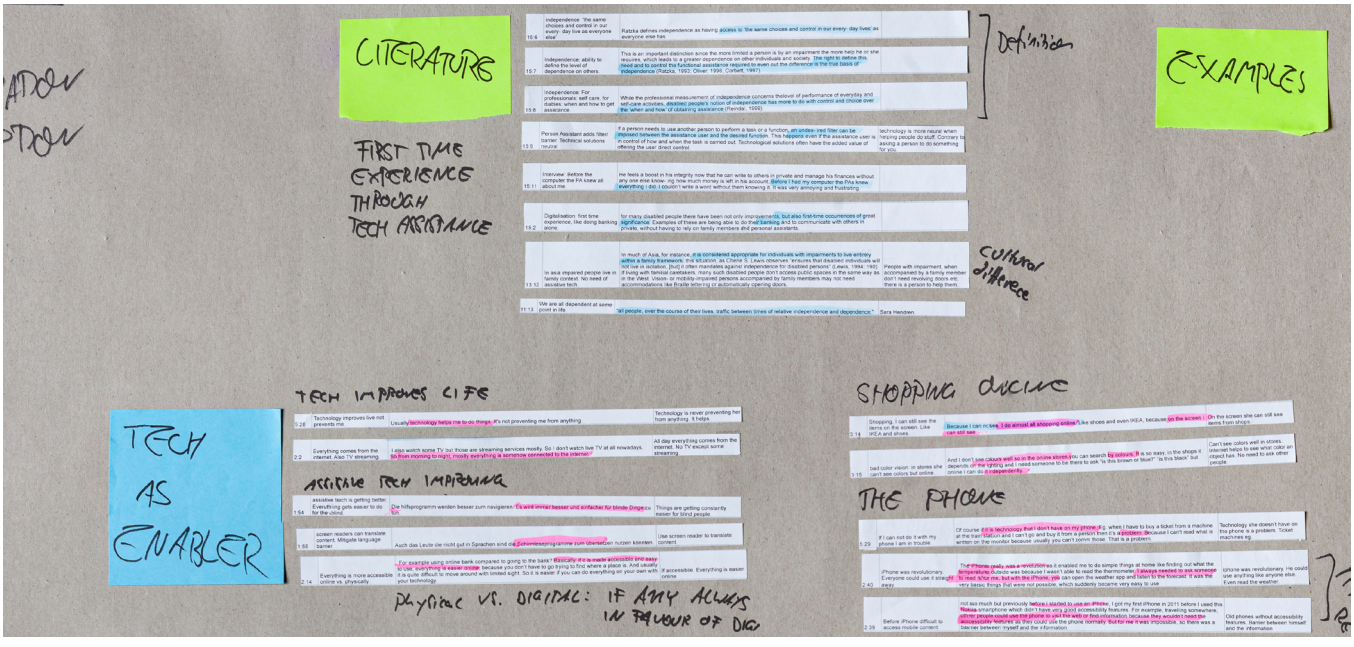


Figure 5

Quote arranged into chapters.



3.2. Introduction of the research participants

In August and September 2019, I conducted five interviews with people with various degrees of visual impairment. In the following section, I introduce these five participants and give an impression of how they access digital content. Except for Jonna, all the interviewees are affected by a genetic disorder of the eye called "Retinitis pigmentosa".[5] This genetic disorder causes a gradual decrease in peripheral vision and can lead to complete blindness. During the interviews, I asked about their online-experience, their usage of news media and, whether they feel that technology improves their independence.

Name	**Visual impairment**	**Assistive technology (Figure 6)**	**Occupation**	**Age**
Sini	Gradual loss of sights.	High-contrast mode and screen magnification.	System administrator	31
Mari	Gradual loss of sights.	High-contrast mode and screen magnification.	HR assistant	52
Raisa	Gradual loss of sights.	Screen reader, high contrast and screen magnificaiton.	International affairs assistant	43
Kimmo	Gradual loss of sights.	Screen reader, high contrast and screen magnificaiton.	Accessibility expert	52
Jonna	Blind since birth	Screen reader	Author, journalist, translator	41

Sini 31, is currently working full time in the banking industry. She says that she can no longer read texts but: "When I read a book, well I don't read books, but when I need to read a text, then I have the magnification". For working on her computer or phone, Sini uses the in-built magnification tools to increase the size of the content by 200%. Additionally, high contrast settings, which inverts the colours on a screen for a darker appearance, assist her to go by her daily work. During our discussion, Sini highlights obstacles related to accessibility in her work environment and when navigating the city.

Mari 52, who is working as HR assistant at a Finnish university, describes her stage of visual impairment as being in "the middle of a process. Coming from being a person with vision to becoming a person who can not see, it is a complicated situation at the moment". She explains that after her vision worsened: "I needed to drop some of my tasks like those that were dealing with excel and very small text". Similar to Sini, Mari is using the screen magnification and higher contrast on screens. Mari explains that she would like to learn using screen readers but "the brain doesn't learn how to use the devices through hearing when you can still see". She emphasises this phase of being in between sighted and blind as very stressful. Especially, as she finds it difficult and tiring to switch form visual to spoken interfaces.

5 *(Retinitis Pigmentosa | National Eye Institute, n.d.)*

Raisa 43, is working as an international affairs assistant at the Finnish Federation of the Visually Impaired. She is at a more advanced stage than Mari but also describes her condition as being "between using my sight and not using my sight, I still prefer my desktop so I can get an idea of the layout of a page or site when using the magnification. Also, I can still use a mouse to look around. On the other hand, my eyesight is not good enough to read anything anymore, just single words here and there". For the near future, Raisa explains she will be entirely relying on the screen reader. Currently, screen magnification and inverted colours help her getting a general understanding of the content she is hearing. Another reason for inverting colours on her screen is her sensitivity to glare, which means that: "the brightness hurts your eyes and makes it difficult to see, and strains your eyes". During our discussion, Raisa described challenges when accessing digital content with the screen reader and how they affected her experience of digital services.

Kimmo 52, is working for the accessibility consulting company Annanpura.

> "I can not see well, so any kind of visual interface would be useless for me. I use screen readers, voice inputs and dictation. I have the high contrast mode enabled when possible, so I get some understanding that there is something on the screen, but I can not consume any content in that way. So assistive technologies are very important to me".

Like Raisa, Kimmo uses the magnified content on his screen to get a better overview of its content. Through his work as an accessibility expert, and his interest in technology, he likes to try out new technology. "I use screen readers on the desktop computers, Windows and Mac, on phones, Android and IOS, on the Ipad, Apple Watch and AppleTV, that's about it. And I have these Amazon Echo devices, lots of them". For Kimmo, almost everything he does for entertainment and work is utilising digital content. During the interview, Kimmo explains common accessibility issues he encounters in his work in addition to general obstacles visually impaired, and blind people face in private and working life.

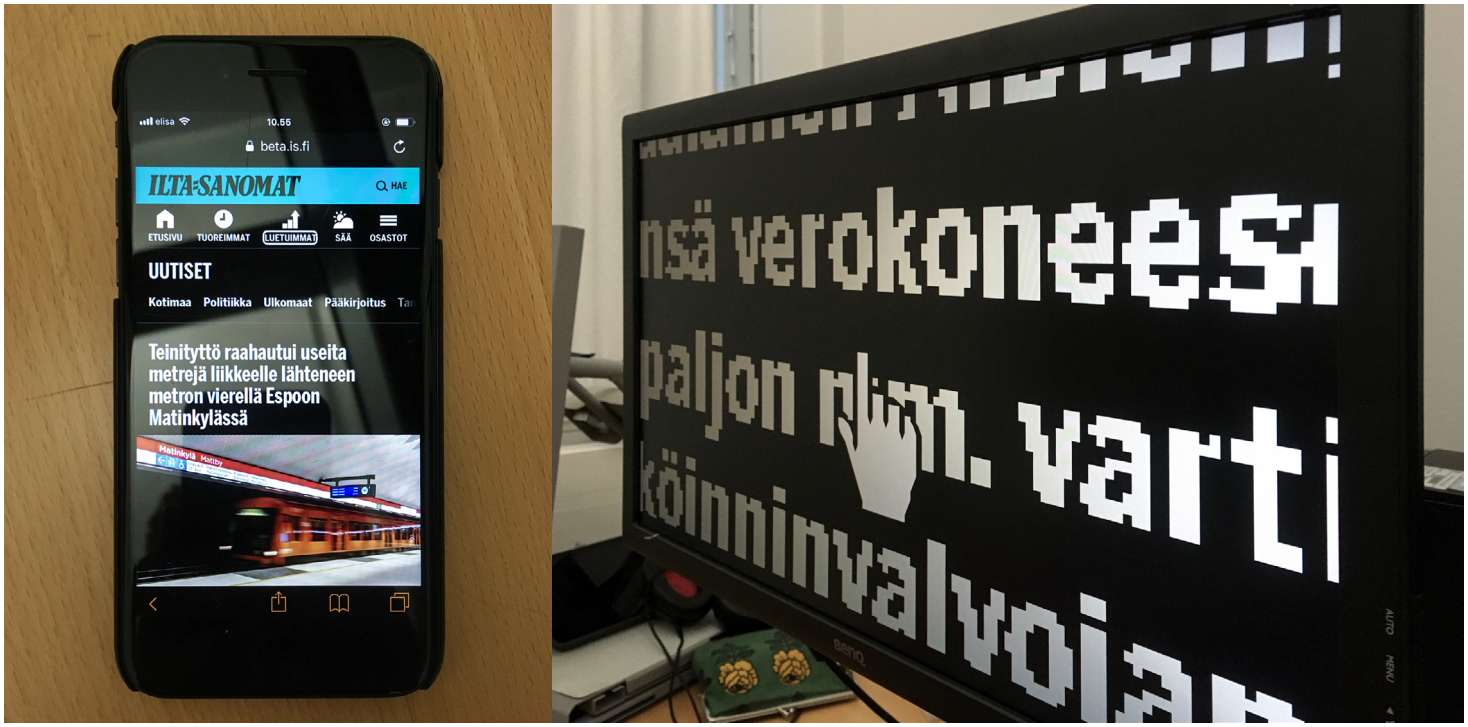
Jonna 41, is working as author, journalist and translator. She is blind since birth. In our interview, which we held in German, she explains

> "Ich kann ein bisschen hell und dunkel sehen also jetzt zum Beispiel sehe ich es ist hell. Aber wenn hier eine Kerze auf dem Tisch stehen würde könnte ich diese nicht sehen. Also Kontrast muss sein, aber sonst kann ich weder Farben noch Umrisse, also nichts sehen".

She can see slight differences in the levels of brightness, but otherwise, she can see neither colours nor shapes. Consequently, she is relying on a screen reader to access her computer and phone. She mentioned that her screen reader and computer are outdated, which is why she prefers using her iPhone. During the interview, she elaborates on her shortcuts to access non-accessible websites and how simple improvements could make her life much more comfortable.

Figure 6

Iphone with high-contrast mode and screen reader cursor,
and computer screen with high contrast mode and screen magnification.



4. Interview analysis

4.1. Online experience of people with visual impairment

The following sections discuss the online-experience of the interviewees. The first section explains how screen reader users browse the internet and which shortcuts they find useful to access digital content. The second section discusses the positive and negative browsing-experiences described during the interviews, and list issues design-related concerns. The third section will discuss the observation of trust related to online services. Websites with poor accessibility and dysfunctional feedback mechanisms can cause people with visual impairment to mistrust the given information. Therefore, the communication of the service provider forms an essential part of online accessibility. Finally, the chapter closes with an explanation of the personal experience of accessibility and the factors constituting the experienced accessibility of an online service.

4.1.1. Listening to layouts

For people without visual impairments, the internet is a predominantly visual medium. Most people understand webpages through their layout in which sections and visual cues, such as, colours, texts, and images, construct the information hierarchy. For people with lower vision, these cues need to be exaggerated through higher contrasts or larger font sizes. Blind people, on the other hand, have to translate visual elements to speech, which takes place through a voice synthesiser, the screen reader. As described in the previous section, Sini and Mari are using their sight to read digital content, although both of them rely on magnification and colour inversion for a better reading experience. Raisa and Kimmo, who can still discern shapes but no longer read texts, combine screen magnification and increased contrast with the screen reader. In this way, they can get a rough understanding of the layout while having its content read-out. Jonna, who can only see slight differences in brightness, has her screen switched off at all times and solely relies on the screen reader.

Some screen reader software is freely available or in the case of Apple products, built-in. Thus, anyone can try out a screen reader and use their device through hearing. Solely relying on screen readers, however, requires learning and practices. Therefore, trying a screen reader will now yield much insight into the performance of a website for people with visual impairment. People who use the reader daily develop their tricks and shortcuts to quickly accessing the content the desired content. Therefore, I will briefly summarise how Kimmo, Raisa and Jonna use their screen readers. These accounts will provide an initial understanding of spoken interfaces before discussing related challenges in later sections.

Every screen reader and operating-system works differently. The main features, however, stay the same across all platforms. With the screen reader, a person can listen to each element on a website, starting from top to bottom. Alternately, they can decide to listen only to the headlines or links of a page. For this reason, structured headlines starting from headline one are essential for screen reader users. After selecting a headline, e.g., headline two, the reader will recite the associated content. On computers, screen readers utilise the keyboard input of a user, but as we have seen in the case of Raisa and Kimmo, it is possible to combine keyboard shortcuts and mouse focus. In this case, the reader announces the element underneath the cursor. Many shortcuts exist to analyse the content displayed on a screen. With the right key combination, the screen reader even announces the colours of the texts. According to Kimmo and Raisa, most

people, however, solely use the basic functionalities, such as, accessing the list of headings and links, or searching a page for keywords.

On touchscreens, there are two possible ways to use the screen reader. Either the user swipes on the screen to listen to each element after each other, or alternatively, they can touch specific parts of the screen to hear the element underneath the finger. Through pre-defined gestures, the user can access different functionalities similar to the screen reader on the desktop, e.g., the list of headings and links.

The main difference between the screen reader on touch devices, and computers, is the possibility to access elements at their actual location on a touch screen. Instead of going through a list of elements, one can tap the top left corner of the screen to revert to the previous page. Especially on the Apple operating system, IOS, rigid layout guidelines enforce the consistent use of the back button the top left corner.

> "When you are thinking about the people who have been blind forever, they don't have a two dimensional understanding of a website. Because when you access a site with a screen reader, it is just a row of elements, one after another. They don't think of it as a two-dimensional space". (Kimmo)

Consequently, when a blind person accesses a website for the first time, they listen to the entire page from top to bottom to understand the arrangement of information on the website. Listening to a large website with several hundred links and headlines is a tedious process. On recurrent visits, however, they can go straight the headline indicating the desired section and thus, access its content. Once inside the right block of information, its content can be searched for links or keywords, through the search function of the screen reader or the list of links provided by it.

For sighted people, the outline of a button in connection with an adjacent text field may be sufficient to understand its destination. Screen readers, however, only announce that there is a link, and read the text of the button. As we have seen, screen reader users often access links or buttons through a list of all links on a page. In this case, the context of the link will be unknown to the user. A label, or Alt-Text, added to a link in the code of a website can, therefore, provide further context for screen reader users. This label can contain additional information about the destination of a button. If this extended description is missing, screen reader users will merely hear the link text which in many cases is 'click here' or 'show more'. Thus, the screen reader will announce 'This is a link, 'click here''. Kalbag describes this circumstance in her book "Accessibility for everyone" as: "It's like turning on your bedroom light only to find you've been teleported to your kitchen".[1] In other words, the link does not provide any information about its destination.

Consequently, screen reader users have to listen to endless recitations of 'click here' and 'see more', which may result in their abandonment of the page. After all, as Jonna notes, which sighted person would click a button without knowing where it leads? The example of the button or link exemplifies how designs relying on visual cues create confusion and annoyance for people using screen readers.

Jonna explains that she has developed her shortcuts to access "impossible" websites – sites with poor accessibility. She elaborates that the inbuilt search function of the screen reader can help mitigate confusing sites. For example, when she accesses the Elisa kirja service, she searches for the words 'Tarjous' (Engl.: sales) to get all items which are labelled to be in sales. Afterwards, she can jump through the results to browse all items currently on sales. Screen reader users often have to resolve to such shortcuts as too many sites are still too inconsiderate of screen reader users.

Accessing a website with a screen reader requires practice and, sometimes, the invention of tricks and shortcuts. Once people using the reader have learned to access a site, they can browse its content as fast as sighted users. Furthermore, they will keep using a service once they learned how to browse it and are understandably reluctant to learn new sites if not necessary.

1 (Kalbag, 2017)

In the future, computer vision will further improve the interpretation of visual content. Services like Facebook and Google already apply computer vision to interpret images. Other applications describe elements and sceneries through the phone camera. Until computers become more efficient in these tasks, however, services can enable their users to describe images. For example, Instagram and Twitter, allow users to enter descriptive Alt-Text for screen reader users manually. Despite these developments, designers and developers should be aware of the needs to provide alternative means to interpret visual content.

4.1.2. Examples and design challenges

When discussing web-services, we too often merely ask whether a service is accessible at all. Instead, during our interviews, we talked about particularly positive and negative browsing-experiences. In the best case, an accessible website will provide a positive browsing experience. However, as we will see, accessible websites can quickly become hazardous for people with visual impairment through simple updates. In the following, we will discuss some of these examples more in detail and summarise common factors.

Jonna says, Wikipedia is well made and enables for effortless browsing. Clear headlines help to jump between different sections to read specific parts of the page. The consistent layout, which stays similar on all sub-pages, further improves the orientation on the page. In the case of Amazon, Jonna points out the ease of using the search. The site allows to easily browse through search results without having to read the entire page. Again, the consistent layout and logical succession of headings improve the browsing experience. Raisa elaborates on the importance of the page structure through the website of the Finnish electronics store Verkkokauppa. The page is simple to browse because the navigation is located on the side of the screen. This layout provides clear a differentiation between the functional and content part of the page. The consistent layout also helps to stay oriented when moving deeper into the site or jumping between pages. Otherwise, the user needs to regain orientation for each new page, which is exceptionally cumbersome for people with visual impairment. These three examples already point towards the importance of a simple page as a predominant factor for a good browsing experience.

In addition to the page structure, the predictability of a page can improve the browsing experience. Jonna illustrates this circumstance through the Finnish sweets-shop website, Urjalanmakeistukku, which she describes as predictable and logic. When placing an item into the shopping cart, the website informs her about the action through a small banner. Furthermore, before removing an item, it requests the user to confirm the action through an overlay window. These additional confirmations enable Jonna to keep track of her shopping and improve the understanding of her interaction with the page. According to Jonna, this gives the user control over the usage of the site and makes it behave predictably.

Also for partially sighted people, like Mari and Sini, an intuitive page structure, that follows common design patterns is most comfortable to navigate. The page design should be “just ordinary, so it works, that you find the things in a place where your intuition says where it usually is, eg., the search and language settings in the corner”(Mari). When placing items in predictable positions, people do not have to scree the entire page to understand its structure but can, instead, focus on the content. Sini elaborates that:

> “In the past, you had the index always on the left side. Nowadays, in many sites, eg., of a restaurant, you might have a picture in the background, the menu somewhere and the links on top of the picture. It might be hard to read the text on top of the picture. I mean it is modern but it is harder to read”.(Sini)

Sini refers to the fact that presently webpages are less restricted in their layout as in the past. Modern web pages can behave like applications with complex functionalities, and without limitations to their layout. When considering people solely seeing websites through magnification, having to understand

varying positions of elements between every site becomes very tiring.

The intuitive placement of elements, however, is only helpful when their location does not change over time. Moving elements on a website can be a reason for people with visual impairment to abandon a site and never return. “When you open and then close something, and afterwards the site jumps back to the beginning, and you need to find where you were; those sites I immediately leave because it is too difficult”. Mari describes here the behaviour of a website which requires several steps to confirm a task. She elaborates that: “Especially at work we have webpage systems where whenever you accept it, and there are several buttons where you need to click, ok, ok, ok, and every time you need to scroll back to see what is going on”. The interviewees often mentioned the terms ‘jumping’ or ‘living’ to describe the interaction with a website. Jonna illustrates the challenge through the website of the German drug store Rossman. When searching for an item, the website starts showing results, even before the users finished typing. This fast interactivity of the page might ease the need to type for some users, but for people with visual impairment, fast changes in the content create confusion. The same holds for jumping menus. Sites that open the menu by merely hovering over the associated icon are challenging to navigate for people with visual impairment because the fast change in content and layout disorients users, and further, does not communicate the interaction enough for screen reader users.

Followed by the page structure and predictability, the length of the displayed information is essential to the browsing experience. “Basically for me, the more stuff there is on the page, the worse it is”(Kimmo). People with low vision cannot skim texts the same way sighter users can. “Usually when people look at the text they just skim it and ok because it just takes a few seconds. I can’t do that I have to actually read it”(Sini). Therefore, to understand the meaning of written content, people with low vision need more time. Sighted users merely skim through a feed or list of headlines and open the ones they find interesting. People with low vision, on the other hand, have to read through the headline word-by-word. Reading through a long list of superfluous, or otherwise unimportant information can become a depressing experience.

The search functionality of a webpage can help users for whom reading through the page content is challenging. People with visual impairment highly appreciate the ability to filter results, to narrow the outcomes. Pages, such as Amazon and Zalando, have a well-designed search, according to Mari. Zalando provides a large variety of filters while Amazon has perfected their search to the extent, that even people with visual impairment can rely on its results without the need for filters. Sighted people can skim search result lists through images or other visual cues, visually impaired users, however, have to rely on filters to, e.g., find items with a specific colour.

On the other hand, poor search functionality can cause mistrust in a website. The Finnish library service Celia was named as such a negative example by most interviewees. Weak filters and a need for clicking through multiple dialogues before finding relevant results were the leading causes for the criticism. Raisa compares her preferred way of using a search with a visit to a physical library:

> “What I loved about libraries and the service that I am using now is that I can select a genre like fiction and then go to ‘detective’, then to modern detective, and then I search the books that are longer than 8 hours, and finally, I can organise them by author and so on. That is basically like going to the library and browsing the shelves”(Raisa).

In contrast, the Celia service provides results which are connected in any way with the search term and prevents sufficient filtering of the content. Consequently, users get results which are unfitting to their search. The result is that people with visual impairment feel they are missing available content because items are not available to them through the search: “I don’t trust it because there is no way I can be sure that it found all the books with the topic I am interested in”(Raisa). A website can cause mistrust when sighted users have options to search content which are unavailable to people with visual impairment. We

will further illustrate this circumstance in a following section.

From these accounts, we can derive a list of topics which define the web-experience of people with visual impairment.

First, we should highlight the need for a predictable and straightforward layout with a clear differentiation between different types of content. The headings on a webpage should follow a consistent hierarchy because they are the main elements for screen reader users to navigate a page. Further, a clear separation between functional elements, such as the navigation or search, and the page content, enable people with visual impairment to focus on the content. Finally, the intuitive placement of elements, such as language settings or search prevents people with visual impairment from having to search for their location every time they visit a new website.

Second, the user should stay in control of their action. E.g., having to confirm the removal of an element from a shopping cart or being told when an element, helps people with visual impairment to stay informed about their actions.

Third, the interactivity of webpages can cause much confusion. When interacting confirming dialogues, the main content and layout should remain unchanged to help users maintain orientation on the page. Similarly, menus which open too quickly, e.g., by hovering over them with the cursor, or a search that provides results before the user has finished typing, result in disorientation. Blind have to either listen to the new elements and partially sighted users need to read them before being able to react on the changes. Therefore, the content should only change after the user asked for it to prevent wasting time listening to erroneously opened menus or search results.

Fourth, Partially sighted people cannot skim texts the same way as sighted users. Reading through long texts or elaborate headings, therefore, can become tiring. Consequently, texts should be written in a simple form to assist people with visual impairment in finding the content they want to spend time reading.

Finally, the search plays an essential role in the browsing experience of people with visual impairment. When building a library service, following the search pattern of a physical library, can provide a good starting point. While sighted users can rely on visual cues to further filter through search results, people with visual impairment require dedicated filters for this task. Poor search results can lead to mistrust into the entire service for not providing the same results as for sighted users.

Most of these challenges are the result of poor design. As Mari mentioned: “It is the small things that help me, like bigger fonts and text”(Mari). Readable texts or simple layouts are not merely an accessibility challenge. We can, therefore, conclude, that every internet user benefits from the mentioned improvements. Nevertheless, while being challenging for sighted users, they can exclude people with visual impairment from using a website.

4.1.3. Trusting digital services

In the previous section, we saw how inaccessible content creates mistrust. Websites have to provide equal access to its content. In the case of people with visual impairment and other user groups who are vulnerable to exclusion, this requires a particular sensitivity. Raisa illustrates this point by describing a case she encountered when accessing her online banking service. The website had a recently added pop-up window. Due to the insufficient accessibility of the window, she had difficulties in accessing her bank account. To report the mistake she tried using the feedback form, and when that proofed to be inaccessible, she called her bank. What would have been a simple obstacle for sighted people became a barrier to the complete service, for a screen reader user.

This example illustrates that when people with visual impairment fail to access an online service, they

can either try to report the issue through a feedback form or by calling the service provider. The reaction of the provider to these complaints can significantly influence the level of trustworthiness, people with visual impairment bestow in the service.

Raisa explains that, e.g., the audiobook service Audible take people with visual impairment seriously: “it feels that they listen and fix the problems you tell them about. You feel like a valued customer”(Raisa). Even though “every time they update their application, there are bugs related to voiceover”(Raisa). Despite the fact, that Audible is causing accessibility-related problems, Raisa trusts the service to take her accounts serious.

This example stands in contrast with the situation Jonna describes when talking about the audiobook service Elisa Kirja. She describes her relationship with the service as being in a constant battle with their customer service. According to Jonna, the company does not react to simple problems, such as unlabelled buttons, even after repeated complaints. Understandably, people with visual impairment feel excluded from a service, when neither their website is accessible by their devices, nor when their customer support ignores their feedback.

Besides, updates generally cause challenges related to accessibility. It appears that many services do not prioritise improvements to screen reader users before releasing an update. Therefore, Raisa avoids updating, at least before being sure it will not impede her experience: “Anytime there is an update I hesitate”(Raisa). It takes time and effort for people with visual impairment to get used to the appearance and functionality of a service. When updates change these known patterns and worsen the accessibility of a site, it is unsurprising, “that many people never update anything and just continue using Windows XP”(Kimmo).

Kimmo contrasts the fear of update with his excitement of updates released by Apple. “I have high trust in Apple, and I am excited when a new update is coming up. They normally have very useful new features”(Kimmo). Therefore, if improving a service would go hand in hand with improving accessibility, people with visual impairment could both benefit from updates and begin to trust that services are not ignoring their needs.

Consequently, building online services with the aim of a positive user experience for people with visual impairment does not stop at its release. Customer support and update cycles play an equally important role in the functioning inclusive web services.

4.1.4 The Personal Experience of Accessibility

The last chapter examined the diverse needs and challenges of people with visual impairment when accessing digital content. Most of these challenges were technical or related to the design of a website. However, it is equally important to understand the individual experience of accessibility. Sighted users, as well as people with visual impairment, have personal preferences towards websites and their functions. Further, a person’s choice to use a computer or phone impacts their experience of a website. Moreover, in the case of people with visual impairment, the availability of assistive devices and the knowledge of their usage plays an essential role in the experience of accessibility.

Kimmo even describes the knowledge of using a screen reader as “one of the many issues that make up the experience of accessibility”(Kimmo). Without the aid of visual cues, people with visual impairment have to remember the structure of a website through the announcements of a screen reader. Thus, “if you have memory problems, the screen reader becomes very difficult to use, even though the content might have been very easy to use otherwise”(Kimmo). Besides the knowledge of operating a screen reader, remembering its announcements poses an additional challenge. Likewise, partially sighted people need to

remember the content of a page because their screen magnification prevents them from seeing the entire page.

As described in an earlier chapter, screen readers are capable of interpreting every visual cue available to sighted users. Most people using screen readers, however, merely utilise its basic functionalities. Consequently, it becomes difficult to determine whether or not the site itself, the screen reader, or the user's knowledge of the screen reader, causes accessibility relates challenges. This circumstance becomes especially problematic when considering inexperienced or elderly people with visual impairment, for whom using the internet itself is already challenging.

The personal experience of accessibility improves once the use of a web service becomes a routine. "I don't think any websites are easy enough to use. Some of them are manageable, and some websites that I visit regularly become easy because you learn how to use them"(Kimmo). Kimmo here speaks about the need to learn a website before being able to use it. After accessing a site many times, people gradually get used to its features and flaws and thus become fast at accessing its content. All five interviewees mentioned the importance of getting used to a service. Compared to sighted users, people with visual impairment rarely visit new sites. Instead, they learn the sites they use.

Digital services have the responsibility to accommodate their users, instead of having them program themselves. Harper stresses this point in his article "Is there design-for-all?" by saying that: "Making software usable is not just about a utilitarian view of software use, it is also about the personal choice of the user".[2] People have different habits and devices to access digital services, the content of which, however, has to stay the same.

Helsingin Sanomat news-site as an example for the personal experience of accessibility

For the renewal project of the Ilta-Sanomat(IS) and Helsingin-Sanomat(HS) new sites, mentioned in the introduction, I asked the participants about their acquaintance with the service. The results illustrate the interchange of personal preference, experienced accessibility and web-accessibility.

"I tried to read HS at some point, but it was too modern, too plain. It was hard to distinguish the headlines"(Sini). For people with visual impairment, the ease of use in terms of readability is especially important when choosing a service they intend to use regularly. Sini describes the contrasts on the site as too weak, and the headlines challenging to read. The circumstance that partially sighted people cannot skim texts, but need to read it, requires short and descriptive headlines. Elaborate headlines, therefore, decrease the ease to use the service for partially sighted people. The headlines also cause irritation to Raisa, who perceives the 120 headlines announces by her screen reader as intimidating.

In contrast, Jonna prefers many headlines because it is easy to skip through them with a screen reader. The differing preference in the number of headlines in the case of Jonna and Raisa seems to be personal preference. Nevertheless, while sighted users only see a screen-full of headlines and images, screen reader users hear a list of all headlines on the page. Therefore, the amount of headlines can cause irritation for screen reader users.

Similar differences apply to the spoken content of the HS news site: "And here I say thanks to HS because now in longer articles you can listen to them. And some of them were read by the journalist, and that was a very nice experience. […] I usually listen to audiobooks and listening to articles read by a human, is very special"(Mari). For Mari, the spoken content relieves the need for reading longer articles. Raisa, on the other hand, explains that: "There is a synthesised speech that reads the articles. I haven't tried it because the default speed is normally too slow. I have voiceOver"(Raisa). Usually, people who are used to screen readers, speed-up the voice synthesiser, having to listen to voices at average speed, is, therefore,

2 (Harper, 2007)

often considered as too time-consuming for news-content. Therefore, Raisa, as well as Kimmo and Jonna, prefer using their voice synthesiser, while Mari enjoys the personal touch of the service.

Conclusion

The experienced accessibility of people with visual impairment is dependent on multiple factors. For the user perspective, these mainly consist of their experience with a service, the availability of assistive technology and their proficiency in using assistive devices. These factors can be extended by personal preferences, state of visual impairment and cognitive skills. Considering these various needs, and the service-side challenges we have discussed in this chapter, how can digital services achieve a good experience for people with visual impairment? Mari elaborates on this dilemma by saying that:

> "There are so many different vision impairments. Some people say that they need more light, and others say this is very bad for my eyes. But how do you put those different needs together? When you compromise, it is not good for anybody, so it is not easy"(Mari).

Improving the understanding of product teams about the ways people with visual impairment access services can ease this dilemma. "It would be nice if they could go and meet people with visual impairments so they can understand and see what is hard for them"(Jonna). Jonna mentions the example of Apple, which includes blind people in the development process. As a result, they test their products for accessibility before their release.

Another possibility is to put production teams into the situation of people with visual impairment. Therefore, Jonna suggests a mouse-less day for developers and designers. As blind people only use the keyboard to control their computer, this restriction can further the understanding of their situation.

Further, in addition to asking whether or not people with visual impairment can access an online service, we should aim for a positive experience. Kimmo elaborates that with a working setup of assistive devices and accessible services, he is surprised when other devices, which do not support screen readers do not work for him: "doesn't this thermometer have a screen reader?".

> "When you built the environment that works for you, it is shocking when things don't work in other environments. When a website is working fine, you forget that you are using a screen reader and that is always the best moment. You just use it and don't have to think about it. One example is when you want to send a feedback form because, e.g., there is a captcha where you need to type in the letters you see in an image. Then you get very disappointed and get reminded that you are blind"(Kimmo).

In a functioning environment, digital content can be fully accessible. Consequently, then the personal skill and the technical setup are proficient, we can follow the argumentation of Adam Alison, that, a "poorly designed Web site could be regarded as creating disability".[3]

3 20:10 (Adam & Kreps, 2006)

4.2. Can technology mitigate disability?

This chapter discusses the influence of technology on the independence of people with visual impairment. Assistive technology can improve social participation and integrate people with impairments to working life. However, social norms, IT security or miscommunication reduces their effectiveness.

The first part of the chapter elaborates on the meaning of independence in the context of people with disabilities. Afterwards, it will exemplify independence in the realm of digital service, through accounts from the interviews. Finally it closes, with an account on future improvements stated by the interviewees.

4.2.1. Introducing the concept of independence

Adolf Ratzka, the director of the Independent Living Institute, describes independence as having the same level of freedom to choose the time and means of receiving assistance as everyone else. “Independent Living means that we demand the same choices and control in our every-day lives that our non-disabled brothers and sisters, neighbors and friends take for granted”.[4] According to Ratzka, “Independent Living does not mean that we want to do everything by ourselves and do not need anybody or that we want to live in isolation”.[5] Moreover, instead of patronising people with disability, they should be enabled to live independently. People with disability are the experts of their requirements and should, therefore, be in charge of their own lives. “we need to show the solutions we want, need to be in charge of our lives, think and speak for ourselves - just as everybody else”.[6]

After all, people with disabilities are not the only people in need of assistance. Therefore, Hendren notes in her article “All Technology is Assistive”[7] that: “[a]ll people, over the course of their lives, traffic between times of relative independence and dependence”.[8]

Today, assistance is an interplay between personal and technological aid. We have earlier discussed how screen readers and voice control systems enable people with visual impairment to access digital media. In the past, people with visual impairment would have relied on personal assistance to perform tasks which they can now perform digitally. Anderberg, who interviewed people with mobility restrictions, quotes one participant on their experience with personal assistants (PAs): “Before I had my computer the PAs knew everything I did. I couldn’t write a word without them knowing it. It was very annoying and frustrating”.[9] Anderberg elaborates that even the most proficient assistant causes a filter on what their protégé says or writes. In contrast to a personal assistant, assistive technology constitutes a neutral aid for independent living.

In 1988 Radabaugh wrote in his report about “the Financing of Assistive Technology Devices and Services for Individuals with Disabilities”, that “[f]or Americans without disabilities, technology makes things easier. For Americans with disabilities, technology makes things possible”.[10] Radabaugh describes technology as enabling the independence of people with disabilities. Anderberg elaborates, that: ”for many

4 (A Personal Definition of Independent Living by Adolf Ratzka, n.d.)
5 ibid.
6 ibid.
7 (Hendren, 2014)
8 ibid.
9 (Anderberg & Jönsson, 2005)
10 (Disability (U.S.), 1993)

disabled people there have been not only improvements, but also first-time occurrences of great significance. Examples of these are being able to do their banking and to communicate with others in private, without having to rely on family members and personal assistants".[11]

Conclusively, independence describes the circumstance when people are in control of their need for assistance and, thus, can decide for which tasks they require assistance, without being patronised by caretakers. Technology has further improved independence by removing the need for personal assistance for various tasks.

How technology affects independence

In the case of people with visual impairment, technology has almost entirely replaced the personal assistant. Therefore, all interviewees perceive that technology is enhancing their independence. Sini confirmed this view by saying that: "usually technology helps me to do things. It's not preventing me from anything"(Sini). Nevertheless, unexpected challenges can impede this technologically mediated independence. Jonna explains that captchas (a text field asking the user to type letters from an image to proof that they are not a robot) on websites, for example, cause such effect. Whenever one appears on a site, she has to call her husband to help resolve the situation. She describes these situations as the worst experience. Given the fact that captchas are an unnecessary element in the first place, Jonna points out that with small improvements, her online experience could be even better, and consequently, people with visual impairment more independent.

Mari illustrates how digital services can mitigate physical challenges. When she buys furniture or clothes:

> "I don't see colours well so in the online stores you can search by colours. It is so easy because in the shops it depends on the lighting, and I need someone to be there to ask 'is this brown or blue?', 'is this black?' but online I can do it independently"(Mari).

The physical environment bears the most challenges for people with visual impairment. The possibility to purchase tickets, or handling bank transactions online, removes the need to navigate the city and interact with ticket or cash machines.

> "If it is made accessible and easy to use, everything is easier online because you don't have to go trying to find where a place is. And usually, it is quite difficult to move around with limited sight. So it is easier if you can do everything on your own with your technology"(Kimmo).

Sini exemplifies the challenges of operating technology by saying that

> "If I don't have on my phone, e.g. when I have to buy a ticket from a machine at the train station, and I can't buy it from a person, then I have a problem. I can't read what is written on the monitor because usually, you can't zoom in those machines. That is a problem"(Sini).

People with visual impairment rely on their setup of assistive settings or programs. Even if public machines were accessible, users would first need to learn how to operate their assistive features. Therefore, the smartphone and especially the iPhone plays a vital role in the development of assistive technology.

The iPhone was the first phone with an built-in screen reader. Thus, people with visual impairment could use all functionalities as sighted users without needing additional assistive programs. Kimmo exemplifies, what Anderberg called a "first-time occurrence"[12] he experiences with his first iPhone:

> "The iPhone really was a revolution as it enabled me to do simple things at home, like finding out what the temperature outside was because otherwise, I wasn't able to read the thermometer. I always needed to ask someone to read it for me, but with the iPhone, you can open the weather

11 (Anderberg & Jönsson, 2005)

12 ibid.

app and listen to the forecast. It was the very basic things that were not possible, which suddenly became very easy to use"(Kimmo).

Even though nowadays, most smartphones have inbuilt accessibility features, most interviewees prefer iPhones. Moreover, the Finnish health insurance provides people with visual impairment with iPhones as an assistive device. From these accounts, we can conclude that technology causes a significant improvement for the independence of people with visual impairment. Mainly, through the smartphone, they can conduct everyday tasks without the need for personal assistance.

Technological developments, such as, image recognition, which help to interpret digital content, can further improve the independence of people with visual impairment. With these applications "you can just point your phone at objects or grocery in the store, and it reads what kind of item it is. These kinds of things help very much for independence"(Kimmo). Alternately voice assistants can be employed to perform daily tasks through speech control. Kimmo uses the Amazon Echo voice assistant, for a multitude of tasks, from listening to the radio to cooking timers or controlling lights.

All in all, the voice interface helps him to control his home through speech. Kimmo elaborates that older people could benefit from voice assistants, once they become available for the Finnish language. Other than computers or touch devices, a natural language interface is more comfortable to operate. Without the need to learn new technology, people can ask the same questions they would pose to a human assistant, and thus, remove barriers for performing tasks online.

4.2.2. Social participation

Apart from being able to perform tasks independently, technology helps impaired people to foster social connection without having to leave the house. Visiting unknown places requires extensive preparation for people with visual impairment. Social media and other forms of online communication remove these needs. Sini explains how social media helped her find information about her condition through online groups and organisations: "Before I had no visually impaired friends, but now I know people whom I can ask". Sharing practices online prevents the institutionalisation of knowledge about disabilities.

The online environment yields the additional benefit of removing physical impairments from social interactions. Following Davis's argumentation, "Many disabilities are constructed through the sense of sight and can be deconstructed in virtually real locations that do not rely on sight".[13] Physical disabilities, such as visual impairments, indeed, become imperceptible in text-based conversations, such as email or text messengers.

While these examples illustrate the positive aspects of technology on social interactions, it can also reveal flaws in the social perception of disability. Raisa exemplifies this situation through her experience with the OP banking service. Even though significant parts of the site are accessible to her, some parts are either difficult or impossible to access. The customer support suggested using their separate, accessible site. However, as Raise elaborates:

> "when you go to the accessible site for people with visual impairment, they don't have all the same services. It feels like you can pay your bills, and check your account, but you can't, e.g., buy shares or put money into stocks. As if no blind person has money enough to do that"(Raisa).

Discrepancies between a service aimed for people with visual impairment, and one for 'normal' people, impede the independence of the former target group, and, thus, causes mistrust. Therefore, Raisa concludes: "it feels like you are considered a second rate citizen".

13 (Davis, 1995)

For people with disabilities need to be represented in everyday life, to feel and be included in mainstream society. “Around here I don’t see anyone else with a white cane. And I always get looks because I still can see them. I know they don’t mean bad, but it is just so rare, and they don’t know what to do. Should they go this way or help?”(Mari). Davis elaborates that appearance is constructing disability for the viewer.“Accompanying the gaze are a welter of powerful emotional responses. These responses can include horror, fear, pity, compassion, and avoidance”.[14]

Popular media could help familiarise people with the sight of people with disabilities. The Finnish broadcasting company YLE started to work together with people with various impairments to improve their services. Mari is part of these meetings and recounts that it was “really nice for me to hear from people with hearing impairments to hear what they have to say and what accessibility issues they have. And it was very nice to be heard and taken seriously”(Mari). Mari continues that the next step should be to include impaired people in their productions as actresses and actors and to include them into their program. People with impairments should be considered in all parts of a service and not merely for their ability to access services.

So far, we have seen how people with visual impairment access services and how technology improves their ability to collaborate and perform daily tasks. The examples in this section elaborated on the impact of social perception on digital services and content. In the next section, we will discuss challenges related to the work environment and the creation of content.

4.2.3. Working environment

Shopping websites or other commercial online services are improving in terms of their accessibility. In contrast, professional tools, e.g., for the production of media content, are mostly unusable for people with visual impairments. According to Kimmo, “the focus has been on consuming the content or receiving information, but […] If you want to create a website or blog, those tools are difficult to use. Content creation is one area that needs much improvement”(Kimmo). During our interview with Jonna, we discussed the difficulties involved in creating a YouTube video. To create a high-quality video, she would need to use equipment and software for video and audio editing before being able to publish her content. Unfortunately, the availability of accessible, professional tool seems to be scarce.

Additionally, while commercial websites are gradually becoming more accessible and the public sector is required to provide accessible services, the work environment stays unaffected from these improvements. Sini describes her situation at work as challenging:

> “they don’t consider accessibility at all. When we develop our systems, we don’t think about that. If it is an internal system, it is not considered at all. We make changes to systems which I am testing, and I tell them, when you take this feature away, it will make my life harder, but that is how it is”(Sini).

We have already discussed that minor changes in a website can render the complete service unusable for people with visual impairment. In the context of the work environment, updates can cause people with impairments to lose their employment.

> “It is a huge problem because people with visual impairment have already other difficulties in finding work. […] [and if] there is a big update to the tools in the work environment, which make them inaccessible, they are out of work because they can no longer use the tools they have previously used”(Kimmo).

14 (Davis, 1995)

People with visual impairment rely on their working tools to accommodate their needs. Consequently, updates resulting from a development process that neglects accessibility features create exclusion.

Whereas in private life, people with visual impairment can rely on their devices, workplaces require their employees to use shared systems in a more secure environment. Sini elaborates that the secure systems she is working with causes her screen settings to reset. While she uses an enlarged cursor in other programs, the secure systems remove these settings and force her to search for a tiny white cursor before she can start working with the program. “If I had to work every day with that system while doing the job you are supposed to do with it, I couldn’t do it because it would take so much energy just to find out where the mouse is going”(Sini).

In addition to technical challenges, the social interactions at the workplace can impose challenges. Sini explains the challenges of presenting digital content in meetings without being able to see the presentation. When presenting she either splits the screens to maintain magnification on the presenter’s screen or presents remotely from a larger screen at home. Similar to the perception of people with visual impairment, seeing magnified content on a screen appears to cause similar confusion for sighted observers.

On the other hand, participating in meetings yields fewer obstacles. “I managed ten years in this company without seeing any Powerpoint slides”(Sini). According to Sini, visual presentations are a routine of our visually dominated work culture. Even in one-on-one meetings and “though they know I can’t see anything, they are still presenting (slides). It is the social pressure that makes you look at the PowerPoint whenever there is one”(Sini). Though, after all “when people understood that I can’t see they explain more”(Sini).

Thus far, we have discussed meetings and software in working life. Additionally, Mari illustrates a challenging situation when collaborating with colleagues. In her work as an HR assistant of a University, she mainly works with E-mails. For their work, Mari and her colleagues use shared E-mail inboxes. However, her colleagues “mark things with colours and they don’t show on my screen because I use higher contrasts on my screen”(Mari). In this case, unchallenged working routines became an obstacle for Mari.

To improve their situation at work, sighted people need to understand the working context of their visually impaired colleagues.“Now people at work come up to my desk and start to see what I can’t or can do”(Sini). In the case of Sini, her screen is the only indication of her partial sightedness. Screen magnification, high contrast modes and other accessibility features alter the visual appearance of Sini’s screen. These differences in appearance, in Mari’s example, prevented her from seeing the labels on their shared inbox. The variability of software, while enabling their use for people with visual impairment, creates challenges for collaboration.

Unquestioned routines, IT security and updates, complicate the integration of people with visual impairment to working life. Moreover, without the experience of collaborating with people with visual impairment, sighted people will stay unaware of these challenges. This circumstance, as Kimmo mentioned, “keeps very qualified people from getting work”(Kimmo).

4.2.4. Future perspectives

At the end of the interviews, we discussed how future developments could mitigate visual impairments in the future. The most common topic raised by the interviewees was mobility and navigation. Sini, who has difficulties discerning the numbers on buses and trams, would benefit from a more precise live-locations service for public transport. Kimmo elaborates that he would like more in-door navigation, especially for train stations to find platforms.

Considering the advancement of technology, Kimmo sees great possibilities in augmented reality glasses. These glasses with a camera could translate the wearer’s environment to speech. He would like to

see the system read texts in his surrounding, e.g., posters or labels. The same technology for recognising images can ease the challenge of taking pictures for people with visual impairment. Once integrated into phones, the system can explain the elements visible in the picture to assist its users. Kimmo explains that: "everything is becoming more visual and sometimes you are expected to have photos"(Kimmo). The ability to take pictures or selfies without assistance would ease this demand. Following a similar idea, Jonna is hoping that browsers could recognise and describe the action of links and buttons on websites.

Addressing the poor accessibility of professional tools, Kimmo and Jonna would like to use professional tools for creating music and videos: "I also do music with my iPad, and even though Apple's garage band is excellent in terms of accessibility, all the third-party apps are never accessible. That would improve my personal life if that were different"(Kimmo).

Moreover, everyday processes could be further improved. For example, people with visual impairment can get a free ticket for a personal assistant when attending concerts. However, these assistant tickets are unavailable online. Mari elaborates that in the case of a popular concert, ordering tickets through the phone is slower which reduces her changes to obtain good seats.

From these accounts, a large variety of possible improvements emerges. From image recognition, indoor navigation to more user-friendly ticket shops, all these suggestion can help improve the independence of people with visual impairment. Nevertheless, we should not leave the task to build and develop an inclusive society to technological advancements. To improve the inclusion of people with visual impairment, they have to be enabled to create and publish their own content and be represented in mainstream media and the working environment. In other words, we need to recognise disability as "a social process that intimately involves everyone who has a body and lives in the world of the senses".[15]

15 (Davis, 1995)

5. Conclusion

In this section I will introduce a new design framework based on the results of this thesis. This model aims to increase the awareness of the factors that cause disability during the design process. Afterwards, I will conclude this thesis with a checklist to summarise the results of the interviews.

5.1. The Personal Experience Model

This thesis started with the statement that disability is a "universal human experience"[1] caused by the correlation of various disabling factors. The accounts of the interviewees further confirmed this interpretation. The interview analysis discussed how smartphones help people with visual impairment to perform everyday tasks without assistance. Moreover, screen readers, magnification tools and other assistive programs enable them to access digital services. In contrast, small alterations of websites, redundant updates and inconsiderate customer support exclude people with visual impairment and cause the feeling of being ignored and left out. These accounts exemplify that technology can remove and create disability.

To summarise our conclusions, I propose a new model to improve the inclusiveness of the design process. This "personal experience of accessibility model", is constructed through the factors that cause the inability to access a product or service. These factors, in regard to people with visual impairments, include:

1. The changing needs depending on the person's visual impairment, e.g., partial sightedness or blindness.
2. The person's previous experience with similar services.
3. The person's preferred means to access specific digital content, e.g., through their smartphone, computers or voice assistants.
4. The knowledge of assistive technology, e.g., screen readers and accessibility settings.

Based on the interview results, these four factors, mainly, constitute the personal experience of accessibility for people with visual impairment. Considering these four factors, designers can ask: is the product usable for a person who is blind, who uses a smartphone through a screen reader daily, and, does not have previous experience with a similar product?

Similar questions should be constructed for other vulnerable user groups, e.g., people with cognitive disabilities or deaf users. Besides, these factors depend on the design problem. Sound-based products will discern different disabling factors than online collaboration tools. First designers need to distinguish people who could be excluded from the use of a product. Afterwards, they can ask which factors disable the user from accessing a product and aim to address their removal through the design process.

This model, although based on merely five interviews, illustrates the need to examine the causes for disability for each project or case. Without the claim for universal usability, they can focus on the people who are most affected by exclusion through their product or service. Instead of design for everyone, designers understand which parts of their work cause exclusion and thus, can focus on the people most likely to be affected by it.

However, the interaction with people with disabilities, should not merely be encouraged to validate the usability of a service, but to drive innovation. By substituting the visual world through their hearing,

1 ('WHO | International Classification of Functioning, Disability and Health (ICF)', n.d.)

people with visual impairments are experts in a field which technological development is just beginning to discover. Therefore, people with disabilities are experts by experience and invaluable collaborators for building innovative products and services.

5.2. List of recommendations

The following list summarises the main concerns, challenges and ideas discussed in this thesis, sorted by chapters. This list does not provide a final checklist for building inclusive online services. Instead, it aims to show the diverse factors which enable or discourage people with visual impairment to access digital service.

Design related concerns that improve the browsing experience of people with visual impairment:

Consistent use of headlines

Screen reader users often access the content of a page through its headings. Consistent use of headings, starting from H1, therefore, helps screen reader users to quickly find the content they are looking for without having to listen to all elements on a website.

Good example: Wikipedia

Consistent layout on all pages and subpages

Gaining orientation on a website is more difficult without the aid of visual cues. If the structure of the website changes in sub-sequent pages, users have to regain orientation, which is even more difficult for people with visual impairment.

Good example: Wikipedia

Differentiation between content and function

When the functional parts of a website, e.g., navigational elements, are separated from the content, people using screen readers can skip faster to the content, and people using screen magnification can focus their view on the content section.

Good example: verkkokauppa.com

Predictable behaviour

Unforeseen transitions on a website cause confusion for people with visual impairment. These transitions include menus that open by merely hovering over an icon with the cursor, or predicting search results before the user has finished typing. Letting people confirm their action, e.g., to the remove an item from a shopping cart, helps users to stay in control of their interaction with the website.

Good example: urjalanmakeistukku.fi

Placing elements at an intuitive location

Following common design patterns for placing elements on a website helps people with visual impairment to find items, such as the search, or language settings, based on their previous experience.

Good example: The IOS back button is always located on the top left corner

Jumping layouts

Returning to a page after browsing a subpage should lead the user to the same position they left. When a site changes its scroll position after, e.g., confirming a dialogue, users need to reorient themselves to find their previous location. Especially for people with visual impairment, this "jumping" behaviour creates confusion and annoyance.

Amount of information on a site

Partially sighted people cannot skim texts. Consequently, reading texts takes more time and effort than for sighted users. A large quantity of elaborate titles is, therefore, particularly tiring, especially when the length of the title is irrelevant to understand its content.

Search

To prevent having to listen to the entire content of a website, people with visual impairment often rely on its search functionality. Additional filter to refine and sort the list of results gives them fast access to the requested content.

Examples: Zalando.com

Factors that improve or prevent people with visual impairment from trusting the content and reliability of digital services.

Search results

Arbitrary searcher results caused by a poor search or insufficient filters prevent people with visual impairment from accessing the same content as sighted users. While sighted users can browse content by sight or skim through large amounts of texts, people with visual impairment more often rely on the search functionality of a website.

Customer support

Insufficient accessibility of websites requires people with visual impairment to call customer support for assistance. If the service provider fails to react on these reports, people with impairments will feel marginalised and, thus, mistrust its ability to care for their needs.

Updates

Updates are often released without consideration of screen reader users. Therefore, newly released services or updates to operating systems and websites are mistrusted by screen reader users.

A selection of factors influencing the personal experience of accessibility

General accessibility

Technical and design-related challenges for accessing an online service.

Knowledge about assistive technology

Not every person with visual impairments is using assistive technology.

Updated system

Outdated screen readers and old operating systems running on slow computers reduce the accessibility of online services.

Cognitive skills

People with visual impairment have to remember more than sighted users. People using screen magnification only see a small portion of the entire page layout and, therefore, have to remember the rest of the content. Moreover, screen reader users need to remember the announcements of the reader to stay oriented on a website. Consequently, the ability to remember influences accessibility.

Experience with similar services

People with visual impairment need to learn a website before frequenting it. Previous experience with similar services can accelerate this learning process.

General user experience

General preferences affect every user. Therefore, they influence the personal experience of accessibility. These preferences include the length of a website or the person's preferred device for browsing and the user's general knowledge about digital technology.

Steps designers can take to make the design process more inclusive

Understand the variability of the user perspective and setup

Assistive aids like high contrast modes or screen magnification change the appearance of websites. These alterations should be considered during the design process to create adaptive designs which deliver the same content to all users.

Emphasise with the user

Putting oneself into the situation of people with impairments increases the understanding of accessibility. For example, a mouse-less day for designers would educate people in the lived reality of screen reader users.

Meet people with disabilities

Meeting people with disabilities removes most barriers between designers and users with a disability. Even meeting a few people increases the sensitivity towards the topic.

How technology mitigates disability and increases the independence of people with visual impairments

Everything is better digitally than physical

Navigating space is particularly challenging for people with low vision. Digital services enable the performance of daily tasks without having to go outside.

The user's setup

On their computer and phone, people with visual impairment can adjust the settings to best suit their needs. In contrast, ticket machines do not allow for adjustments. If they can perform a task with their own devices, digital technology enables their independence.

Social interaction online

Social media enables people with visual impairment to share information about their impairments. Consequently, they can exchange best-practices independently from medical institutions. Further, digital interaction removes visible impairments and can, therefore, reduce potential stigmatisation.

Professional tools and the working life – The most challenging areas for the inclusion of people with disabilities

Professional tools are not accessible

Creating content like publishing a blog, or editing audio and video require professional digital tools. Unlike many consumer websites, professional tools are commonly not accessible to people with visual impairment, e.g., through screen readers.

Work environment

Performing daily tasks in the work environment are challenging for people with impairments. Most of the tools in this context are not accessible.

IT security

Increased security standards for working tools can disable or reset the user's accessibility settings.

Working routines

PowerPoint presentations during meetings exclude people with visual impairment when their visual content is required to understand the context of the presentation.

Collaboration tools

Collaboration tools that use colour labels or other visual cues to communicate information are unusable by people who cannot discern colours.

Updates

Updates to the working tools which do not take accessibility into account can cause people with visual impairment to lose their job.

Future outlook, how can future development further mitigate disability?

Navigation

Indoor navigation and more precise live-location for public transport can improve the mobility of people with visual impairment.

AR glasses to describe surroundings

Augmented reality glasses which describe ones surrounding and read texts would help people with low vision to read, e.g., the labels of a product.

Taking pictures

If camera applications could more reliably describe the content of an image, people with visual impairment could take better pictures, e.g., to share on social media.

Create digital music

If professional tools, such as audio editing software was accessible, people with visual impairment could create high-quality media content.

Voice assistants

Especially for older adults with visual impairments, the advancements of voice assistants could improve their ability to interact with digital technology.

6. Discussion

The online experience of people with a visually impairment

This thesis discusses a multifactorial understanding of disability. These factors vary depending on the person and situation. In contrast, the design frameworks discussed in the beginning of this thesis, postulate a universal approach to accessibility instead of focusing on the personal experience of accessibility. Thereby, they mitigate the individual's challenges of interacting with a product through an all-encompassing definition of their users. Designing for All, in the end means to design for nobody in particular. In contrast, this thesis highlights the importance of discerning vulnerable user groups and the versatile needs of its individuals during the design process.

The results of this thesis, therefore, are more related to the Design for One framework. The Design for One framework initiates its process with one user and aims to build a product solely for their needs. In contrast, this thesis suggests exploring disabling factors related to a product or service. Afterwards, designers can collaborate with the people most affected by these factors.

The design frameworks have not mentioned the connection between the accessibility of a service and its perceived trustworthiness. This connection, however, is similar to the differentiation between 'normal' and 'special' users described in connection with the Accessible Design framework. Having to use a wheelchair ramp attached to the back of a house is similar to accessing a separate accessible website. This special treatment causes stigmatisation and the feeling of being a "secondary citizen"(Raisa) ant thus, part of a minority. Especially in the digital realm, providing different information for sighed and people with a visual impairment causes mistrust. When people with visual impairments perceive that specific content is unavailable to them, they feel excluded and, thus, mistrust the service. Therefore, I see parallels between the Accessible Design framework, which provides special means for people with disability to access a product, and the accounts of the interviewees related to the trustworthiness of a digital service.

Can technology mitigate disability?

The beginning of this thesis discussed two competing models of disability claiming that disability is either caused by bodily impairments or the environment. Following the accounts of the interviewees, smartphones and computers mitigate their physical impairment, e.g., by enabling them to perform specific tasks without having to leave the house. The same devices further reduces disabling factors caused by their environment, for example, through the live location of public transport vehicles. Therefore, technology mitigates disability, following the definition of the medial and social model of disability.

Digital technology, however, creates new disabling factors as we discussed in the section about the working environment. Working routines that derive from a visually dominated working culture create challenges for people with a visual impairment. Moreover, technology expands the factors which cause disability. For example, updates, forms or captchas renders services unusable for people with a visual impairment, and thus, creates disability.

However, in order to establish disability as a universal human experience, as postulated by the WHO, it should not be the aim to eliminate disability. Instead, people with disabilities need to be integrated into and represented by society. Learning about the skills and challenges of people with disabilities fosters the sensitivity needed for everyone to interact with a diverse society. Moreover, everyone is affected by disability at some point in their life. Therefore, learning how people with impairments handle everyday life serves as preparation for everyone.

Digital Divide

This thesis highlighted the benefits and drawbacks of technology for people with a visual impairment. However, this thesis has not discussed the consequences for people who do not have access to such technology. All five people interviewed for this thesis had access to smartphones and computers, as well as sufficient knowledge about assistive technology. This difference between people who have access to technology, and those who do not, is described in the concept of the "Digital Divide".[1]

The term describes the connection between economic income and the ability to afford the technology.[2] The increasing availability of smartphones with assistive functionalities diminished the challenge of the affordability. Moreover, the term has been criticised for its tendency "to equate access with simplistic views of availability of technology".[3] In reality, a steep learning curve causes more significant challenges for accessing assistive technology than affordability or availability. Considering that most people with a visual impairment are older adults who are less acquainted with technology, "[t]he grim reality is that disabled people, to a great extent, are on the have-not side of the digital divide".[4]

Without discussing the Digital Divide in detail, we should nevertheless consider the fact that the interviews used for this thesis were conducted with people who are currently working. Further, they have access to assistive technology and sufficient knowledge about its usage. In contrast, people who are less familiar with technology "for example, older people, if they didn't use digital technology before they can't learn it or they don't want to"(Kimmo). In other words, for older adults without previous experience of digital technologies, learning to use screen readers is extremely difficult or even impossible.

When discussing the independence of people with a visual impairment, we should, therefore, not assume that people use technology in their daily life. In this case, the improvements in digital services or assistive technology might only apply to a reasonably small group of people who are sufficient in using the required devices. Because "even when people have an impairment that could benefit from an assistive technology, we should never assume that they're using an assistive technology".[5]

Challenges of this research

Various disconnected academic disciplines discuss the phenomena of disability. This thesis draws its content from items published in the fields of disability studies, industrial design and human-computer interaction (HCI). Moreover, neither discipline has a long history in discussing the social phenomena of disability and its causes. Therefore, this thesis treats the phenomena of disability through an transdisciplinary approach.

Shortcomings of this thesis

The main conclusions of this thesis are based on the accounts of five individuals. The amount of interviewees is not representative to cover the diversity of people with visual impairments. Moreover, many people with a visual impairment are older adults or retirees, neither of whom were represented in the group of interviewees. Therefore, a broader scale of interviews is needed to draw more representative conclusions.

While conducting this research, I found many more interesting and related topics which I could not further elaborate in this thesis. For example, I excluded the connection between gender studies and

1 *(Adam & Kreps, 2006)*
2 *ibid.*
3 *ibid.*
4 *(Anderberg & Jönsson, 2005)*
5 *(Kalbag, 2017)*

disability studies, the discourse about the stigmatisation of people with disabilities and the evolution of the narrative of disability.

Future recommendations

Everyone has personal experiences of disability. These experiences are unrelated to whether or not a person has a physical or cognitive impairment. Therefore, it would be interesting to connect the personal experience of accessibility with the overall user experience of a service. One might ask, which factors of positive or negative user experience are connected to the personal experience of accessibility? Following the discussion in this thesis, many accessibility-related challenges are related to the general qualities of a product or service. Consequently, one should be able to interlink accessibility and user experience.

Besides, different products have varying disabling factors. Therefore, examples from the design practice could be analysed to discern patterns of these factors for specific genres of products or services. As a result, designers building new services or products could follow the patterns observed in a similar product.

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