Empathy tools as a way to universally designed ICT solutions?

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Preface

This project started out of curiosity for combining theatre techniques and interaction design. I have a background in amateur theatre and have experienced the dedication actors have in shaping and making their characters come to life. Actors are professional empathy builders for the characters they are representing, and empathy is considered an important factor in design for the user experience. After realising that theatre techniques would be impractical and unrealistic to implement in ICT projects, I moved my interest over to Universal Design of ICT and how empathy can be a driving force for ICT professionals to make inclusive and barrier-free ICT solutions.

I would like to thank my supervisor Jo Herstad for all the enthusiasm and help he has given me, and for always believing in my project, even when I have had doubts myself. I also want to thank Diana Saplacan for giving me advice and help during the project!

I would also like to thank the informants who have used their valuable time to meet with me and to contribute to this project in their own way.

And last but not least, I want to thank all the people who have read and critiqued my thesis.
Chapter 1

Introduction

Internet and communication technology (ICT) has great potential in giving more people the opportunity to participate in society and be more autonomous despite their background or abilities. That is, if these ICT solutions are developed in an accessible way. But how would developers know if, for example, a website is accessible for a person with arthritis or for a blind person? Can simulations of impairments be a useful approach to make sure a solution is universally designed? And can the experience of functional impairments be a way to get interested in and learn about Universal Design, user diversity and to learn how to recognise barriers?

1.1 The story of Sven

Imagine the following fictive scenario: Sven is from Sweden, but has recently moved to Norway because of work. During his stay he has come across Norwegians from different parts of Norway, all using words that are unfamiliar to him. Most Norwegians can not expect Sven to understand these words, so they intuitively adapt their communication style when speaking to him. Sven, on his side, can not expect Norwegians

Accessibility on the web is defined by W3C as enabling people with disabilities to use the web (Sandnes 2011, p. 27)
he meets to speak Swedish to him and he also has to adapt by using words Norwegians understand. This mutual understanding comes from Sven interacting with Norwegians and from Norwegians empathy with Sven as a foreigner. If this was a one-way conversation, Norwegians would not know that Sven had troubles understanding them, and Sven would have a harder time living in Norway.

At the same time, ICT developers can not expect every user to have the same functional capabilities as themselves. Using simulations they can get a sense of which barriers the solution might have and figure out how to remove them.

1.2 Background

ICT is integrated in nearly all parts of modern society. In Norway, the use of digital public services has increased by 235% from 2010 to 2015 (Kommunal- og Moderniseringsdepartementet 2016). 92% of Norwegian citizens had access to the Internet in 2011 and 79% used it daily. In 2015 97% of Norwegians had access to the Internet and 90% used it daily. In three years, time spent on the Internet has increased from 112 minutes (in 2013) to 140 minutes (in 2016) per person on average (SSB 2017). However, there are large differences when it comes to age. 44% of the group between 75 - 79 years report not using the Internet and only 4% say they have good skills in using the Internet. "Digital natives" (young people grown up using digital devices) can also struggle when an unclear language is used in the digital sphere (Kommunal- og Moderniseringsdepartementet 2016, p. 40).

Most Norwegians are online all the time and expect instant access to information and services. It is therefore important that ICT services are designed and built in a way that does not exclude people. Autonomy, equality and inclusion are all important aspects to keep in mind when we
are moving towards a more digital society. Recognising the fact that ICT is an integrated part of the society, being able to take part in the information society is a prerequisite to fully take part of society as a whole. Inclusive ICT is needed for this to happen (Fuglerud and Sloan 2013).

Universal Design is a concept, a tool and a political strategy with the intent to include most people of society regardless of functional abilities, age or education. The intent is not to make separate or "special solutions", but to make the same solution accessible and usable by the largest amount of users.

There has been an increased awareness and interest in Universal Design of ICT in Norway the last couple of years (Begnum 2017). Awards such as Doga’s (Design and Architecture Norway) “Innovation price for Universal Design” are awarded to ICT solutions who has “made Norway a more including and open society” (Grafill 2017). Norway has legislated that all new solutions aimed at the general public must be Universal Designed and all existing solutions must be Universal Designed by 2021 (The Equality and Anti-Discrimination Act 2018). However, in a report by Difi checking the status of Universal Design of both private and public ICT solutions in Norway, 54% of public and 49% of private solutions were measured as being Universal Designed with scores ranging from 18 to 79 percent (Difi 2015).

1.3 Motivation

Adherence to requirements and standards is a frequently used approach to Universal Design (Fuglerud and Sloan 2013). While this is often a precondition, it does not solve the whole problem. For example: conformance to WCAG 2.0 guidelines can only solve around half of the

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2English: Agency for Public Management and eGovernment, Norwegian: Direktoratet for forvaltning og IKT.
issues experienced by visually impaired users (Fuglerud and Sloan 2013). Fuglerud suggests that the requirements are used as a part of a human-centered design (HCD) process³, where the design is based on an explicit understanding of the end-users’ task and environment, the user should be in the mind during all parts of the project and evaluation on real users is conducted in an iterative process.

However, Fuglerud and Sloan (2013) also states that in practise, user-involvement of people with disabilities is not practised. This might be because of:

- Budget and time constraints.
- It can be difficult to gain access to representative users.
- Designers can be afraid of accidentally offending people with disabilities.

Time is money, and user involvement can be costly especially when it comes to involvement of people with disabilities (Bai et al. 2017). As a response, ICT professionals might use self-observational techniques where the design of the ICT solution is primarily based on themselves as potential users (occasionally asking for feedback from their peers) (Cardoso and Clarkson 2012). Self-observation techniques are cheap, quick, practical and can be implemented in any stage of the development process (Cardoso and Clarkson 2012). This can exclude people with different capabilities than the designer / developer, which is both unethical, illegal and limits the marketable potential of the end product. People who experience disabilities in the real world can also be the ones who can benefit most by using ICT services. Retrofitting Universal Design into a finished product can be difficult, expensive and consume

³Also called User-Centered Design (UCD). Human is used to show that it also addresses stakeholders other than the end-users.
unnecessary development time than it would do if Universal Design was considered from the start (Wentz et al. 2011).

1.3.1 Empowering developers

The focus of this thesis is frontend developers working on ICT solutions, which I from now on will just refer to as "developers".

The reason for this is that it is often up to frontend developers if the ICT solutions are Universal Designed or not, especially when it comes to semantic code. In the evaluation of Difi (2015), code related accessibility errors was found to be most common. For example: wrong use of heading tags or missing alternative text for images and visualisations are both code-related issue.

Freire et al. (2008) says accessibility has been a very important issue in web development, but that there is a lack of knowledge among developers on which techniques should be used to make websites accessible. They suggests teaching developers how individuals use assistive technologies and show them how a target user struggles with their solutions.

1.3.2 Personal motivation

My personal motivation to conduct this research comes from an empathy for groups of people who are not always heard. My mother has worked with cultural activity for people with mental and physical impairments, and has let me participate in her work since I was a child. Aside my studies, I have worked as a social worker with people with autism. With my background I would say that I have empathy for people with different backgrounds and abilities, and would like to make the world a little more inclusive.

Accessibility on the web is defined by W3C as enabling people with disabilities to use the web (Sandnes 2011, p. 27).
1.4 Research Questions

The goal of this research is to figure out what role simulations of capability loss can have in the world of ICT, from education to professional ICT development. Simulations can be used to alter a person’s functional abilities to replicate some aspects of different kinds of impairments (lack of hearing, vision, motor, dexterity) by using software or devices.

As self-observational design techniques are not optimal, and budget/time constraints are said to limit the possibilities of including people with disabilities in ICT projects, can the use of impairment simulators support user diversity? My thesis aim to answer the following research questions:

1. *In which way can simulators be used to support user diversity?*
2. *In which way can simulations be used in ICT education?*

By user diversity, I mean the consideration of people with a different set of abilities, background, needs and functional requirements. The aim of user-centered design methodology is to encourage professionals to move out of their comfort zone and empathise with people with different background and abilities than themselves (Cardoso and Clarkson 2012). Can simulation tool do this? And what are the dangers by using simulators?

I also want to look at the role simulation tools can have in ICT projects and in learning about Universal Design and accessibility.

Courses related to Universal Design and accessibility are only available at some education programmes for soon-to-be ICT professionals. and they are almost always elective courses (Jordan and Vanderheiden 2010). Can simulations be used in ICT education to teach empathy?
Chapter 2

Case

This thesis has been related to two different projects; MediaLT’s "Stable Test Sites" and "UDFeed" at the University of Oslo.

2.1 MediaLT

MediaLT is a Norwegian company concerned with making the web accessible for most people. Their slogan is "Humans are different - and new technology should consider that!". They provide training in Universal Design and they evaluate and comes with suggestions on websites regarding Universal Design principles and implementation.

2.1.1 Stable Test Sites

MediaLT’s project "Stable test sites" came together after Difi in 2016 wanted an overview of how reliable automated evaluation tools are for measuring WCAG 2.0 success criterion. They found out that one way to measure this was to find inaccessible websites and see if the automated test tools would react on the errors. They soon found out that this was a tedious job, and that it would be much smarter to make their own inaccessible websites that could measure the WCAG 2.0 success criterion.
The test sites are intended to validate automatic testing tools and make it easier to manually recognise accessibility issues.

My project is only vaguely connected to "Stable test sites". MediaLT’s focus on the developers and to make developing accessible ICT solutions easier to achieve in practise inspired me. I chose to focus less on automatic evaluation tools, but more on how the developers can recognise accessibility issues manually through the use of simulators.

2.2 UDFeed

UDFeed is concerned with both learning and facilitation of Universal Design in higher education. The main goal is to focus on feedback from students. Formal evaluations are commonly used to improve upon higher education courses, but this project is concerned with how this feedback can come sooner during the course itself.

My project is also concerned with how developers learns about universal design, and that’s where the link to UDFeed lies. One of my research questions is related to in which way simulations can be used in education and learning about universal design and accessibility.

ICT solutions used in education should be accessible, and from January 2018 it is governed by law.
Chapter 3

Theory

3.1 User Experience

User experience is the subjective experience that people have of interacting with a product, solution, or service (Nordbø 2017). Being subjective, the experience of the artefact differs when different people are using it. User experience is not concerned with the technicalities of a solution, but what happens when people use it (Garrett 2010).

3.1.1 Human-Computer Interaction (HCI) and Interaction Design

HCI is an academic field with roots to ergonomics, industrial design and biomechanics (Bakke in Nordbø 2017). One of the earliest mentions of the term “HCI” was in 1976 in a research paper about office automation (Carlisle 1976). Carlisle problemised the trend of integrating technology into the workspace without acknowledging how people within the organisation do their work and how human beings function and socialise:

Too many computer-based systems have already been designed on the

1 Artefact refers to “any object made by human beings” (Dictionary.com Unabridged' 2018)
basis of technological breakthroughs and innovations which were insensitive to the limit on man’s rationality and the social needs that must be satisfied within organizational structures.

[emphasis added] (Carlisle 1976, p. 2).

Carlisle thought the implementation of computers in the workplace was backwards. The focus was on hardware and software, not on how people work or function.

Interaction Design can be regarded as the industrial adaptation of HCI research. Interaction design is concerned with the practical design of products with the ultimate goal of supporting people (end users) in their everyday and working lives (Rogers et al. 2011). Interaction designers think of who the artefact should be used by, how it is used and in which context the usage are anticipated to happen (Rogers et al. 2011). Both HCI and Interaction Design is concerned with understanding people and how they use ICT solutions and how the user experience can be improved in existing solutions or intact/integrated in future solutions.

Usability

Usability is a central term in HCI and interaction design. Usability is the extent to whether a product is usable or not. It is often measured in how well a product supports users in achieving specific goals by considering effectiveness, efficiency and satisfaction (Petrie and Bevan 2013). Effectiveness refers to how well the system does what it is suppose to do (Rogers et al. 2011). Efficiency is how well and quickly a user can perform a task once it is learned (Jakob Nielsen 2012).

Accessibility

Accessibility is defined in ISO 9241-171 as "the usability of a product, service, environment or facility for people with the widest range of
capabilities” (Petrie and Bevan 2013, p. 3). In this definition, accessibility can be seen as a subset of usability with the inclusion of people with the widest range of capabilities.

3.2 Universal Design

Universal Design means to design or accommodate the main solution so that the general functions of the undertaking can be used by as many people possible, regardless of disability (Likestillings- og diskrimineringsloven 2018).

Miljøverndepartementet (2007, p. 7) has conceptualised Universal Design as:

*Universal design is a strategic approach to planning and design of products and environments in a fashion that promotes an inclusive society that ensures full equality and participation for all.*

This strategic view on Universal Design is located at the *macro level* of Universal Design focusing on the broad concept of human, legislation and social justice (Lid 2013). Included here is the Equality and Discrimination act. According to this legislation, new ICT-solutions that are aimed at the general public must be universally designed from 1. Juli 2011. Existing solutions must be universally designed by 1. January 2021 (Likestillings- og diskrimineringsloven 2018). The law was revised 01. January 2018 and now includes a focus on higher education.

At the *meso level*, technical standards such as Web Content Accessibility Guidelines (WCAG) 2.0 is used to measure whether a solution is within the legal requirements at the makro level (Lid 2013). As noted in the Introduction chapter (see Section 1.3), adherence to requirements and standards is a frequently used approach to Universal Design (Fuglerud and Sloan 2013). It is at the meso level this is happening, and the
regulation following the Equality and Discrimination Act (Forskrift om universell utforming av informasjons- og kommunikasjonsteknologiske (IKT)-løsninger - Lovdata[2018]) includes WCAG 2.0 as the standard to evaluate whether solutions coincide with the regulation or not, and therefore, whether the solution is following the Equality and Discrimination act.

Fuglerud and Sloan (2013) argues that a user-centered design should be followed with inclusion of real users in with diverse needs and abilities. This happens at the the micro level. Individual experiences are used to inform if the design is usable and accessible (Lid 2013).

The layered levels of thinking about Universal Design makes it easier to grasp Universal Design and to separate between roles that can make inclusion of a diverse user group, including disabled people, happen.

3.2.1 Models of disabilities

The medical model views disability as within a persons’ medical condition and bodily function (Lid 2013). The focus is on the person and their inability to function in society because of their disability. In the social model, society is the one disabling the individual and environmental factors has the attention (Lid 2013). Finally, in the relational model these two previous models are combined and the disability happens in the interplay between them. The relational model is adapted by Difi (2016) when they explain the benefits of Universal Design to ICT professionals and is referred to as the Gap Model (Lid 2013) (see Figure 3.1 for an illustration).

2Disabled people is the preferred term British English (Rogers et al. 2011). This thesis is written in British English.

3And others, but Difi has a special focus on providing resources for ICT professionals.
It is in this gap that barriers can emerge and as a result, people can be excluded. According to Begnum (2017) "it is a social responsibility to ensure that different physical and psychological abilities are taken into consideration and barriers are removed and diminished". Physical and psychological abilities can be reflected back to Lid (2013)'s micro level to take in the consideration of peoples individual abilities and experiences.

### 3.2.2 Teaching Universal Design

Courses in accessibility and Universal Design for ICT are only offered at some universities and are almost always electives (Jordan and Vanderheiden 2010). If the class is elective, it means that many students are not going to come across Universal Design in their education programme. Eika and Evelyn (2017) calls this type of teaching Universal Design "module based". The "integrated model" of teaching is when Universal Design
Theory

is an integrated part of the whole curriculum. For example: if the students are developing websites, accessibility should be integrated automatically in the solution, because the students are used to take accessibility in consideration. Rughiniş and Rughiniş (2014) call this "Framing through Mainstreaming" where the act of making accessible ICT solutions becomes a routine.

Rughiniş and Rughiniş (2014) builds up to this layer (the Framing through Mainstreaming layer), by arguing that students need to learn the arguments for why they and others should focus on Universal Design. They call this the "web of arguments" and it contains arguments to *why* accessibility and Universal Design is important (ethics, social responsibility, legality). The arguments can make it clear for students why they should care about Universal Design and can also give them arguments they can use when they later might face objections from team members and leaders. Other claims that can be made is that Universal Design is governed by law and that in learning how to accommodate for it, the students can stand out from the competition of other students by showing that they are directly useful as job candidates after graduation. Impaired situations is also a claim that can be made, shifting the attention from people with impairments to situations that everyone might face (stress, sunshine glare on a screen).
At the *empathy* layer, students have direct contact with disabled people, and learns how they use technology. The direct contact can be coupled with the student’s own experiments with using assistive technology (Rughiniş and Rughiniş 2014).

### 3.2.3 Sympathy, empathy, compassion?

Sympathy, empathy and compassion are all related concepts, and are often confused with each other (Jeffrey 2016). Sympathy means in Greek exactly what compassion means in Latin (Comte-Sponville [2002] p. 103), so it is not weird that they are used interchangeable. The definition and differentiation of these words can make it easier to understand the meanings behind them, and make it easier to recognise when or if these concepts are in effect. Comte-Sponville (2002) notes that *sympathy* “is an emotional participation in the feelings of others”. To have sympathy means to feel along with another person. Jeffrey (2016) says that "sympathy is an emotion caused by the realisation that something bad
has happened to another person”. Sympathy is therefore something with negative connotations and can even be close to feeling pity or sorry for another person (Jeffrey [2016]).

Pity has even worse connotations: “pity only increases the quantity of suffering in the world” (Comte-Sponville [2002], p. 106). As described by Spinoza (in Comte-Sponville [2002]): “it follows that a man who lives according to the dictates of reason, strives, so far as he can, not to be touched by pity”. Spinoza means by this that a reasonable human being does not care about being affected by pity. As Comte-Sponville (2002) puts it "Pity is a sadness" and "love and generosity, not pity, should drive us to help our fellowmen".

Alain (referred to in Comte-Sponville [2002]) notes that feeling pity is better than being insensitive, cruel or egoistic "in an unjust or completely unreflective person, pity is better than brutish insensitivity", but it is clear that both theorists means that feeling pity about another person is not something to strive towards.

Compassion

Compassion is defined by Chochinov (in Jeffrey [2016]) as "a deep awareness of the suffering of another coupled with the wish to relieve it" [own italics]. Compassion differentiates from sympathy by highlighting engagement and commitment to relieve suffering.

Empathy

Empathy is by Jeffrey (2016) thought to be different from both compassion and sympathy as it is a "skilled response". This means that one can develop the skill of empathy while "teaching compassion seems counterintuitive". Mattelmäki and Batterbee (in Wright and McCarthy [2008], p. 2) highlights the need for design empathy when we move from
"designing for practical functions to designing for personal experiences and private contexts". This means that in order to design for peoples experience, one must have a clear understanding of people, not just technical functionality. Design empathy is here understood as the importance of a personal understanding, taking other peoples perspective and understanding users "as people with feelings rather than test subjects" (Wright and McCarthy 2008, p. 2).

Buchenau and Suri (2000) also has this view that empathy is an important factor in designing for people, but takes it one step further by coining the term "experience prototyping" as a way to understand, explore or communicate what it might be like to engage with the artefact that is being designed. These tools / prototypes makes it possible to experience an artefact by oneself, rather than witnessing someone else experiencing it. In this way it differentiates with the user-centered design use of prototyping tools, where the goal is usually to measure performance and reactions of real users (Rogers et al. 2011). Experience prototyping is meant to be a an attitude to design, moving the focus away from the artefact and towards the experience of another person (Buchenau and Suri 2000). Information about the user can be internalised easier if it is experienced, and it is easier to grasp issues and challenges and feel greater empathy towards the people who will be affected by design decisions and their lived experiences.

3.3 Simulations

Ranchhod et al. (2014) says that simulations are a simplified model of reality structured as a system with clear variables and dynamic relationships. Dynamic refers to the system being modifiable through movement or interaction and that it provides real-time feedback. This gives room for experiential learning by letting the users explore real-life
problems and situations.

Simulations are simplified and incomplete representations of reality, meaning they have a level of abstraction. The level of abstraction determines the degree of learning the system can offer. The system should be simplified enough to be easy to use and realistic enough to be meaningful for the learner.

Ranchhod et al. (2014) also compares simulation and games and says that simulation games that provide the best grounds for learning puts the user in a "flow state" with high focus, engagement, motivation and immersion. He says this can be compared to "intrinsic motivation".

According to Cardoso and Clarkson (2012), in the field of inclusive / Universal Design simulations refer to the use of physical restrainers that enables a person to feel the effects different types of capability-losses might have on a person. Cardoso and Clarkson (2012) uses the term "capability-loss simulator" instead of impairment simulator or disability simulator. Capability-loss refers to the effect an impairment has on bodily functions, for example loss of sight or loss of strength in hands. The aim is to alter the wearers’ experience of their environment to show how everyday products often disregard (and hence disable) a large number of users, due to a lack of consideration of their capacities.

### 3.3.1 What can be simulated?

Cardoso and Clarkson (2012) considers realism, comprehensiveness and representativeness as factors that can be used to evaluate simulators.

### 3.3.2 Critique on using simulations

French (1992) is critical to the use of impairment simulators to bring positive attitudinal changes towards disabled people. She says that such simulation exercises at first seems like a good idea, but that they are often
Table 3.1: Vision simulator

<table>
<thead>
<tr>
<th></th>
<th>Low fidelity</th>
<th>Mid fidelity</th>
<th>High fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simulator</strong></td>
<td>Blindfold</td>
<td>Yellow coloured spectacles</td>
<td>VINE simulation glasses</td>
</tr>
<tr>
<td><strong>Simulating</strong></td>
<td>Total blindness</td>
<td>Change in colour vision associated with cataracts</td>
<td>Peripheral and central vision loss</td>
</tr>
</tbody>
</table>

Table 3.2: Hearing simulator

<table>
<thead>
<tr>
<th></th>
<th>Low fidelity</th>
<th>Mid fidelity</th>
<th>High fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simulator</strong></td>
<td>Foam earplugs</td>
<td>Headphones playing music or white noise</td>
<td>Noice-cancelling head-phones</td>
</tr>
<tr>
<td><strong>Simulating</strong></td>
<td>Reduced ability to hear loud noises</td>
<td>Reduced ability to perceive different sound levels</td>
<td>Reduced ability to perceive low-frequency continuous sounds</td>
</tr>
</tbody>
</table>

harmful and counter-intuitive. She points to one study where student nurses spent a day in a wheelchair and felt a lack of self-esteem and feeling sexually unattractive.

French (1992) says that by depriving able-bodied people of one of their senses will definitely provide difficulties and fear, and that able-bodied people know that they can "go back" to their able-bodied status.

Simulation exercises can also provide false impressions that disabled people are heroic and superhuman for managing their lives living with a disability. This can lead to very damaging and direct the focus on the disabled person rather than the society and hostile environment they face.

Young (2014) also reports on this view some people have. She has been given awards just for being "brave" as she is in a wheelchair. She says that this is objectifying disabled people, as non-disabled people tend to think "Well, however bad my life is, it could be worse. I could be that person.". She calls this "inspirational porn".

Riccobono (2018) says that simulations of impairments can be effective,
Table 3.3: Dexterity simulator

<table>
<thead>
<tr>
<th></th>
<th>Low fidelity</th>
<th>Mid fidelity</th>
<th>High fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>Winter gloves</td>
<td>Wearing different layers of</td>
<td>Gloves with velcro-like fabric inside</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rubber gloves</td>
<td></td>
</tr>
<tr>
<td>Simulating</td>
<td>Reduced dexterity and</td>
<td>Reduced dexterity related to</td>
<td>Discomfort caused by &quot;needles&quot; digging into</td>
</tr>
<tr>
<td></td>
<td>tactile loss</td>
<td>arthritis</td>
<td>hand</td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

but only if it is used the right way. If used incorrectly, simulation exercises can do more harm than good. He illustrates his point by an example:

Ask a newly blindfolded person to travel the streets so she comes to understand the value of traffic sounds, and her predominant emotion will be fear.

This fear comes out of the newly blindfolded person temporary experience of loosing one of his main senses, without knowing how a blind person crosses the street. But if that newly blindfolded person has observed how a blind person crosses a streets using a cane, and seeing how the environment can be changed to his particular way of manoeuvring and understanding how he uses his cane (what it can and cannot detect) it becomes clear what alterations to the environment can be done in order for him to cross the street.

Humourising disability

French ([1992](#)) claims that disability simulations can appear funny to some people, as it is the response some people might have during simulation exercises.

*People undergoing simulation exercises do not appear to perceive themselves as disabled, but rather as the participants of a funny game, like "blind man’s buff.*
This response can be very offensive to disabled people and taken as mockery.

### 3.4 Existing solutions

In this section I present some tools that I have come across that aims at simulating impairments.

#### 3.4.1 Cambridge University Capability loss simulation toolkit

To provide a way to empathise with people having different disabilities, Cambridge University has developed a set of simulation tools they call "Capability loss simulation". The simulation toolset consists of glasses and software that simulates vision impairments and gloves which simulates fine motor-impairments (such as arthritis).

**Impairment simulation software**

The impairment simulation software makes it possible to simulate hearing and vision impairments. It includes a set of example pictures and audio files. The software simulates four levels of hearing loss, and several visual impairments and conditions. It is also possible to import pictures into the software, but they have to be of a specific file type.
Cambridge simulation glasses

In the same toolkit as the Impairment simulation software is the "Cambridge simulation glasses" which are meant to simulate vision loss. The glasses makes the vision of the user more blurry, and can provide a way of experiencing how a person with vision loss might experience an interface. The glasses comes in packages of five or 30 pieces, and are meant to be used on top of each other to provide three different levels of vision loss impairment.

3.4.2 NoCoffee browser extension

NoCoffee is a simulator which can be used to simulate different vision impairments. It works by adding a filter on top of the content of the
browser interface. The user of the simulator can adjust different settings such as degrees of blurring, ghosting, different types of color blindness etc.

Figure 3.4: The Chrome extension "NoCoffee" simulates different vision impairments by adding a filter on the screen.

The maker of the simulator has posted some thoughts on limitations of the simulator (NoCoffee – Vision Simulator for Chrome 2013):

• The simulations are not medically/scientifically accurate.

• The simulations of partial visual fields cannot follow your eyes.

• Settings are not linked to statistics and can be hard to relate to

• The simulator only works in Chrome
3.4.3 Funkify browser extension

This simulator is personas based, meaning that each setting is based on an imaginative person who has a certain impairment: "Blurry Blanca" has blurry vision, "Dyslexia Dani" has dyslexia and "Color Carl" is color blind. The simulator has eight different profiles, all portraying different kinds of impairments.

Figure 3.5: The Chrome extension "Funkify" simulates different vision impairments and showcases them using personas. Selected are "Tunnel Toby" simulating tunnel vision. The tunnel vision follows the mouse.

The simulator is created by usability and accessibility experts in Sweden and financed by The Swedish Post and Telecom Authority (Funkify.org n.d.).

The simulator provides statistics on how many people are effected on most of the disability personas.
Figure 3.6: Statistics are provided to quantify how many people are affected by each impairment.

In figure 3.6, the persona "Blurry Bianca" is selected. The user of the simulator is provided information that around 4% of the population has a vision impairment and that 60% uses glasses or contact lenses.
Chapter 4

Methods and activities

In this chapter I present how I have conducted the project, my research paradigm, how I have gotten in touch with informants and how I have analysed my data. I have only used qualitative data collection methods.

This has been an exploratory study, meaning that the goal was not to end up with a solution or product, but to explore the area of Universal Design of ICT with a special interest on frontend developers and simulation tools.

4.1 Casting the net

After the initial meeting with MediaLT I started exploring the area by conducting an interview with a developer that I knew had a special interest and knowledge on Universal Design and web accessibility. He sent me further on my journey towards a community organised on a closed Facebook group

\footnote{The Facebook group is called “Universal Design of websites and ICT - Best Practises” [my own translation].} for Universal Design enthusiasts (with a special attention on technology and web accessibility). The community has also
organised themselves on Meetup. I participated at two meetups, and it was at one of these meetups I got in touch with a second expert (see Expert interview with researcher).

4.2 Research paradigm

Assumptions on which methods to use and how to conduct research is based on philosophical paradigms Myers (n.d.). Orlikowski and Baroudi (in Myers (n.d.)) suggests four categories for conducting qualitative research; positivist, interpretive and critical. The choice of paradigm reflects the researchers epistemology and is the "glasses" a researcher wears while conducting, analysing and reporting research.

Originally I thought my research would be conducted using the critical paradigm, as Universal Design has had the role of giving a "voice to the oppressed" and to be social emancipatory (N.D'souza 2001). However, my research fits more in line with the interpretive paradigm which assumes that access to reality is through social constructions.

4.3 Focus Group

Focus groups are simply a gathering of people who can discuss experiences and thoughts about specific topics with a researcher and each other Crang and Cook (2007, p. 90). These groups can sometimes have contradictory views, which can be a good thing. Contradictory and competing views can enable "spaces of resistance" where collective knowledge generation can happen (Crang and Cook 2007, p. 90).

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2Meetup.com is a website for organising events in special interest groups. The Meetup relevant here is called "Universal Design & Digital Inclusion" and can be found here: https://www.meetup.com/Universell-utforming-og-digital-inkludering/

3Epistemology is the assumptions on what knowledge is and how it is obtained Myers (n.d.).
To enable more participants to argue or discuss and reflect over a given topic can be valuable, both for the participants and for the researcher. The probability for whether these spaces of resistance can occur, relies on the group dynamic. It can be an advantage to recruit people who know each other if the goal is to study this group in particular. However, according to Crang and Cook (2007), recruiting strangers can facilitate the discussion to be more like the one they might have with strangers and encourage shy participants to be engaged in the conversation if less shy members "break the ice".

Whether the group is homogeneous or heterogeneous regarding gender can also impact the group dynamic and discussion in the focus group. Men have a tendency to "speak to the crowd" while women tend to break into one-on-one conversations which are lost to the group as a whole (Crang and Cook 2007, p. 92).

4.4 Interviews

Interviews are usually categorised as unstructured, structured and semi-structured (Fontana and Frey 1994 in Rogers et al. 2011). The choice of interview type depends on the research question and the goal of the interview.

4.4.1 Expert interviews

According to Meuser and Nagel, expert interviews can be an effective method of inquiry because an expert can be seen as "surrogates for a wider circle of players" (Meuser and Nagel 2009, p. 2). Especially in the exploratory phase of a project, expert interviews can be an efficient point of entry into the research area and can provide clues on where to go for further inquiry.
Methods and activities

An expert is someone who has expert knowledge of a subject and is distinguished from someone with "everyday knowledge and common-sense knowledge" (Meuser and Nagel 2009, p. 18). Who is identified as an expert is up to the researcher’s judgement (Meuser and Nagel 2009).

Experts can inherit experiences, insider knowledge and domain knowledge about a subject. Experts can also be motivated to provide the researcher with knowledge to "make a difference" about the area of research or be motivated out of professional curiosity (Meuser and Nagel 2009).

Theoretical sampling

Theoretical sampling refers to the act of deciding who should be a part of the research. This involves thinking about the research aim and to figure out from which perspectives the research should be tackled. Different groups of people will have different perspectives on the same topic and can therefore provide the researcher with different thoughts, ideas and views on the subject being researched on.

I have interviewed two experts in this project, one which has competence and experience on working with Universal Design and accessibility and who also has been teaching other developers about these topics. This expert could give me an introduction in how Universal Design is viewed and dealt with in "the real world" of ICT.

The other expert I have interviewed has done research on Universal Design and could give me the research perspective. Research on Universal Design involves a different view than implementation and design in practise.

4.5 Simulators

Following are description of each simulators I have used in this project:

29
Elderly Ellen

In the Elderly Ellen personae (see figure 4.1), simulates shaking by moving the mouse randomly around 2x2 cm on the screen. This can make it hard to click on things on the web. Elderly Ellen also simulates acuity loss by applying a filter in the CSS code so the website has a blurry effect. This can make it hard to see if the artefact has low contrasts between elements.

Keyboard Kim on Norwegian.no

This personae does not use a mouse, so the simulator takes the mouse pointer away and the user of the simulator is not able to click on things.
The user is therefore forced to use the webpage with keyboard-navigation, which can be hard for amateurs. See 4.2.

Dyslexia Dan

Figure 4.3: Dyslexia Dan (screenshot by me)

Dyslexia Dan (Figure 4.3) simulates how it might be like for a person with dyslexia to use the web. The words shuffle around randomly making it hard to read long texts.
NoCoffee Vision Simulator

NoCoffee simulator can simulate many visual impairments such as ghosting, glare, contrast loss, cataract, nystagmus. The settings can be adjusted from 0 to 100.

Figure 4.4: NoCoffee (screenshot by me)
Cambridge Simulation Glasses

Cambridge Simulation Glasses can be used with other glasses on and simulates acuity loss and contrast loss. Being mobile and wearable, they can be used on any artefact.

4.6 Activities

To understand the universe of Universal Design of ICT solutions, I have talked to domain experts, participated at Universal Design relevant gatherings and talked to some developers. Following is an overview of activities I have conducted and an explanation of each activity:

4.6.1 Meeting with MediaLT

The meeting took place at MediaLT’s office. MediaLT said that the background for the project "Stable testsites" was that while automatic evaluation tools can give helpful feedback to the developers, they
sometimes give incorrect feedback, and that they had noticed that some errors were present even though the site was accessible. Another motivation was that WCAG says what needs to be achieved, but not how, and that around half of the WCAG success criterion can be tested with validators. Stable test sites aims at making it easier to manually recognise errors that validators tend to miss, and to make developers aware of which validators they should use (and which not to use) and to have clear indicators of faults with each validator.

The test sites are also meant to be a domain MediaLT can use to test new versions of automatic evaluation tools.

### 4.6.2 Focus group with recent graduated developers

The focus group was held by fellow students of mine in relation to a course at the University of Oslo. It was held 03.10.2017. I did not hold the focus
The aim of the focus group was to look at the views and knowledge inexperienced developers had on Universal Design, and how an ICT solution might support them in learning more about the subject. I wanted to get a better understanding of the views developers has on the subject of Universal Design and to get ideas on where I might steer the thesis.

Seven participants participated in the workshop. Most of the participants were working as front-end developers, one was studying programming, and one was looking for a job as a backend-developer. All of the participants who were developers were at junior level, meaning they did not have many years of professional experience. One participant was working as Staffing Manager, and had to consider Universal Design when he accepted projects. All the participants had a bachelor degree in informatics, except one that was still studying informatics.

The participants were contacts of the students who held the focus group. Some were previous classmates of two of the focus group-holders.

One person took notes and no recording was made. In the notes, the participants’ quotes were not separated, so it is impossible to state which of the participants said what.

4.6.3 Interview with UD Enthusiast

An expert semi-structured interview was held at a café in Oslo city centre 16.11.2017. The expert interview was held in relation to the course "INF5261 - Development of mobile information systems" by me and my two group members project in that course. The project had the same theme as this thesis (programmers relation to Universal Design of ICT), and the information uncovered in this interview is therefore relevant to this thesis as well. We were three researchers and one participant present during the interview.
The enthusiast has been involved with many ICT projects, has been teaching Universal Design and accessibility to his colleagues and at a university in Norway.

**Interview guide**

The interview was based on an interview guide we had prepared in advance. The interview guide was designed with inspiration from Nordbø (2017). The interview guide consisted of:

<table>
<thead>
<tr>
<th>Part</th>
<th>Themes discussed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Presenting us and the aim of the interview. Signing consent form.</td>
</tr>
<tr>
<td>Main Part</td>
<td>Learning, Practising, Whip or carrot, Impairment simulation</td>
</tr>
<tr>
<td>Solutions</td>
<td>Discussing possible solutions</td>
</tr>
<tr>
<td>Rounding off</td>
<td>Asking if the participant had any additional comments or questions</td>
</tr>
</tbody>
</table>

**4.6.4 Meetup 1 - How can developers and testers contribute more to accessibility evaluations?**

To meet Universal Design enthusiast and to get a glimpse on how the culture is within this community, I went to a meetup organised by the Facebook group "Universal Design - best practises" 29.11.2017. I was invited to this group by the UD enthusiast mentioned in 4.6.3. The topic for this meetup was for Norwegian Computing Center, NR, to present results from a science project were conducting trying to figure

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4Solutions that were related to the course this interview was a part of.
out what developers and testers (people concerned with accessibility evaluation of websites and apps) thinks about different ways of doing accessibility evaluations, and which evaluation method is more cost / beneficial and can uncover most accessibility problems. Figure 4.6 is from the meetup.

Figure 4.6: Picture from the Meetup taken by me.

The statement they made as motivation to conduct the research:

• Few developers and testers has competence in Universal Design, and carries out user testing or accessibility testing in software development.

• Familiarizing with standards and tools needed for accessibility evaluation can be time-consuming.

• Navigating existing literature on UD can be time-consuming.
4.6.5 Universal design experience conference

I went to a conference organised by Bufdir on 07.11.2017 to get a better understanding of Universal Design and how other fields (not related ICT) talk about this topic. I heard talks by architects, project managers and others who all had the same goal: to create a more inclusive society.

4.6.6 Expert interview with researcher

Through the Universal Design community, I came in touch with a person who has a background as a backend-developer and now works as a researcher with special interest in Universal Design. I conducted a semi-structured interview 25.01.2018 with him using the following interview guide (table 4.3):

Table 4.3: Interview Guide - Universal Design researcher

<table>
<thead>
<tr>
<th>Part</th>
<th>Themes discussed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Presenting myself and the aim of the interview. Signing consent form.</td>
</tr>
<tr>
<td>Main Part</td>
<td>When he was made aware of Universal Design and learning about Universal Design, research, biggest challenge for e-inclusion, WCAG 2.0, whip or carrot</td>
</tr>
<tr>
<td>Rounding off</td>
<td>Asking if the participant had any additional comments or questions</td>
</tr>
</tbody>
</table>

4.6.7 Interview with developer

A developer in my social network was recruited to this study because I know he had recently graduated from NTNU and also recently started

5Norwegian: Barne-, ungdoms- og famildirektoratet. English: The Norwegian Directorate for Children, Youth and Family Affairs
working as a frontend consultant. I wanted to know what students at NTNU learned about Universal Design and if they focus on Universal Design in the projects he had been involved with in his job. I arranged for a combined interview and exploration of different simulators. This combination can be seen as similar to the contextual inquiry method of interaction design where the researcher observes and interviews a participant in the context of the user.

4.6.8 Meetup 2 - how to teach accessibility to colleagues

The second meetup I went to had the theme "How to run accessibility workshops for development teams". The meetup was held by employees in Finn, Norways number one marketplace and was held as a test-run before they were having a talk at CSUN (Assistive Technology Conference). Finn has had great results in running workshops which both teaches the participants how to make accessible ICT solutions and evaluates their own solutions at the same time. I observed the meetup and took notes. The slides used on the meetup can be accessed here: https://www.slideshare.net/twidero/teach-colleagues-accessibility-csun-atc-2018.

4.6.9 Workshop with developers

I contacted a consultancy firm I have a relation to and asked if I could conduct interviews on five developers that were not familiar with Universal Design. They provided me contact details on four developers and I sent them a link to Doodle, a tool for organising meetings. After everyone had responded to the Doodle, I saw that four of the developers worked on the same location, so we organised a time to meet. I did not have the chance to meet with the last person.

The workshop was conducted together with another researcher from
the University of Oslo. She took notes and asked questions

Participants

Participants in the workshop were three developers who worked on two different internal apps. The participants were two men and one woman. The woman had some experience with Universal Design in projects. All the participants had heard about Universal Design during their education.

Initial interview

The first part of the workshop consisted of questions from an interview guide with the following themes:

- Relation to Universal Design
- Training in accessibility or Universal Design (workplace / education)
- Practical use of Universal Design in projects

Testing simulators

The second part consisted of testing out simulators on websites. I asked them to download two browser extensions (NoCoffee and Funkify) and to use Cambridge Simulation Glasses and gave them tasks to perform. I used both websites I knew had accessibility problems and websites that I knew were quite accessible. All the tests were made on the participants own computer to hinder unfamiliarity with the equipment.

The tasks I gave them:

- As Elderly Ellen
  - Enter sas.no and find a ticket from Oslo to Bergen 21 - 29 April 2018. Figure out how many minutes the trip takes.
• As Keyboard Kim
  – Enter Norwegian.no and find a ticket from Oslo to Bergen 21 - 29 april 2018. Figure out how many minutes the trip takes.

• With the Cambridge glasses
  – Try to find Gucci Glasses and sort them from low to high prize.
Cambridge Glasses
In one participant is trying to use Finn.no while wearing three Cambridge Glasses which simulates acuity and contrast loss. The participants took of their glasses, but optimally they would keep them on so as not to see worse as a person with "normal" eyesight (Goodman-deane et al. 2008). However, this workshop was to get a feeling of each tool and to get the participants reactions and opinions on them, not to evaluate an interface to find accessibility and usability issues.

Between testing each simulation tool, the researchers asked questions regarding the experience - what they felt, how testing the interface was using different tools and which tool they preferred or did not prefer to use.

Concepts

In the third part of the workshop, the goal was to come up with ideas or concepts that could make it easier for developers to make Universal Designed solutions. This part was inspired by Cornish et al. (2017) which held a participatory design workshop trying to find appropriate tools for graphic designers to design for diversity.

Based on Cornish et al. (2017) I had prepared some concepts on ways to make it easier to make Universal Designed ICT solutions. This was to "help prevent participants from fixating on one particular tool type" (Cornish et al. 2017, p. 59). The concepts I presented were: a "Universal Design assistant ala Microsoft’s Clipper" that shows accessibility errors, gives recommendations and can be implemented in the development environment. The other concept was a Virtual Reality concept that simulates a situation (that is relevant to the environment that the solution is intended to be used in). I presented these concepts briefly and we discussed them. Unfortunately, this part didn’t go as I had hoped, and no new concepts were developed. The concepts I presented acted more as conversation prompts reflecting on how to integrate accessibility testing
Methods and activities

in the developers’ work environments.

4.7 Research ethics

All of the participants in the study has been de-identified. They have been given pseudonyms to protect their identity and privacy. I could have chosen to refer to the participants as for example "participant A from first interview", but I chose to give them pseudonyms for a sake of clarity and to make it easier for me to discuss the findings.

Table 4.4: Pseudonyms

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Activity and Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lars</td>
<td>Expert interview with researcher 4.6.6</td>
</tr>
<tr>
<td>Stian</td>
<td>Interview with UD Enthusiast 4.6.3</td>
</tr>
<tr>
<td>Karl</td>
<td>Interview with developer 4.6.3</td>
</tr>
<tr>
<td>Lisa</td>
<td>Workshop with developers 4.6.9</td>
</tr>
<tr>
<td>Olav</td>
<td>Workshop with developers 4.6.9</td>
</tr>
<tr>
<td>Bernt</td>
<td>Workshop with developers 4.6.9</td>
</tr>
</tbody>
</table>

4.7.1 Informed consent form

Prior to the activities "Interview with UD Enthusiast 4.6.3", "Expert interview with researcher 4.6.6" and "Interview with developer 4.6.6", an informed consent form was sent out to the participants a day before before the activity took place. The reason for this was to give the participants a chance to read through the form before they signed to prevent them from signing up for something they were not familiar with.
4.7.2 Recordings and storage of data

Activity [Interview with UD Enthusiast (4.6.3)] was recorded by another researcher using note taking. The main reason for this was that we did not have an approval from NSD at the moment, so we could not record by using a microphone.

Since this project has been affiliated with UDFeed which already has an approval from NSD, this project is covered under the same agreement. Activities [4.6.6, 4.6.7 and 4.6.9] were recorded using a digital recording device. I chose to record the activities because it made me freer to focus on the interviewee instead of taking notes. Note-scribbling can be very disturbing and disrupt what could be a normal conversation (Crang and Cook 2007).

4.8 Analysis

I have conducted a thematic analysis Braun et al. (2008) of the interviews [Interview with UD Enthusiast (see Section 4.6.3), Interview with developer (see Section 4.6.7), Expert interview with researcher (see Section 4.6.6) and the Workshop with developers (see Section 4.6.9)].

I started off by familiarising myself with the data by transcribing the audio files for the activities that was audio recorded. [Interview with UD Enthusiast] and [Expert interview with researcher] was also translated to English (from Norwegian) to get further into the data. I developed open codes for each interview, and put them into themes. After that I tried to figure out which quotes from the codes were most relevant to my research question. After some time, I reread the interviews to see if there were any themes / ideas I had overlooked or that I would recognise better the second read-through.
Chapter 5

Results

5.1 Education

Jens mentions that it is a problem that developers are not getting familiar with accessibility during their education:

*What might be a challenge is the people who are measuring this, they might not have been familiar with it in their education, and there is a lot of interpretation in this, and it is a benefit if it is a part of the education. If you are a newly educated developer, and you have to think about the requirements of WCAG - and you have not any, at least very little about it in the education - the threshold to engage can be very high. And with empathy: why are we doing this? It can seem more like a trouble than a reward.*

The threshold to engage can high because it can be overwhelming and developers might not see the point.

One of the participants felt his education was lacking a focus on Universal Design, and that this could help him in his work as a developer. He states:

*If you are going to have it as a part of the education, it should come early on. If you don’t have it at the start, we will have
the same situation we are in today where we design something first, then add Universal Design at the end.

The participant requested a focus on Universal Design from the start and had experienced that Universal Design is often an afterthought in ICT projects.

Another participant said:

Yes, it can be good to have it in the back of our heads from the start so it isn’t something that is done the week before you hand in a project.

An introduction at the start of the IT-education can help making it intuitive for developers and designers to use in projects from the start, rather than just something you include at the end of the project.

Karl, the developer I interviewed (see section 4.6.7) said he first heard of Universal Design by signing up for an elective course called "Design Thinking". He said in his programme (civil engineering / computer science) the only mandatory course which relates to user-centred design is a course called HCI.

Yes, everyone had to have the so-called “human-computer interaction”, but I think it’s a challenge itself in, at least in my experience, many people didn’t seem to understand why you would make a user interface that was good at all. So I imagine that Universal Design wasn’t included in this course at all.

Karl says that this HCI-subject had "traditional empathy" as he puts it, where the focus was on usability, not specifically towards extreme users. He says most of his fellow students didn’t seem to understand the usability part, and he seemed to imply that there was a challenge in itself to get them to understand that they should consider users when making ICT solutions, let alone considering people with disabilities.
5.2 Reactions to simulations

In the workshop, when the participants were asked to use Color Carl in Funkify, Lisa responded "everyone looks sick" and "that sucks". An example of Color Carl is shown in Figure 5.1.

When using Dyslexia Dan, Olav said "That is extreme. Is this average dyslexia or is this a little extreme?". Lisa said "But can we do something about that? The editors are the one in charge of writing the text, right?" and "maybe you can have shorter titles, divide the text up and things like that?". An example
Results

Figure 5.2: Screen shot of Funkify’s Dyslexia Dan applied to an article on vg.no of Dyslexia Dan is shown in Figure 5.2.

They immediately considered the accuracy of the simulator, whether they had the responsibility of fixing the issue they were facing and how they could potentially fix them.

Karl also considered the accuracy of the simulators, and assumed they were based on real numbers.

I think this [Funkify] can be very good at setting some mechanisms on in peoples heads that make them think twice. I especially liked the old simulator, and the colour blindness simulator, that the statistics are there. Not that I need it, I’m not the one that needs to be convinced, but I need to convince others. Just that it’s there and that it says it’s one in twenty [statistics on user coverage].

Karl acknowledges that simulations combined with statistics can aid his work on convincing others on why Universal Design and accessibility
is important.

Remarks like "wow" and "shit!" were also common when the participants used the simulators (both in the workshop and in the interview with Karl), which can be seen as an indicator that this was a new and eye-opening experience for them.

Using the Cambridge Glasses, Olav said it was frustrating that he had to move closer to the screen to see the text. Bernt said "It isn’t that frustrating, you can just lean closer to the screen".

Interviewer two asked "What do you think about being in this situation, to use this every day, struggle with these feelings when you’re using an ICT system?"

Olav: I wouldn’t probably have bothered

Bernt: No, skipped it all.

Olav: I would get someone else to do it for me.

The participants felt the task was too hard to do when they used the Cambridge Glasses. Instead of considering making the solution more visually accessible or considering the use of magnifiers or other assistive technologies that can help making the life of vision impaired more autonomous, they would resort in giving up and letting someone else help them, if they were in that situation. This response might come because of the negative framing of the question. If the question was more in line of "How could you as a developer or designer of an ICT system help yourself so you don’t have to be frustrated or helpless using the system?" the response might have been different and the participants might look at the system as the disabling factor, not the lack of vision in the user.
5.3 From party speeches to actions

In the experience conference (see 4.6.5) it was mentioned that a visionary view on Universal Design can prohibit the evolution of the discipline, and that the focus should instead be on concrete examples. Universal design must move from something you talk about in “party speeches” to something that happens in practise. For me this means that we should move the focus on how Universal Design is achieved in practise, not why it is important. Providing ICT professionals with tools that can help them consider a diversity of end-user and make ICT solutions more accessible, is one way to realise this goal.

5.3.1 The importance of enthusiasts

Stian said that some developers learns about Universal Design and accessibility in ICT projects, but that it relies heavily on having an enthusiast on the team that knows about it and is willing to share his / her knowledge to the rest of the team. Lars has also seen the importance of enthusiasts in ICT projects:

(...) we have seen that if you have one enthusiast that can make sure you always have some focus on it if you forget about it in a project or in a company.

Lars also mentioned an enthusiast who had struggled with convincing his management to focus on Universal Design from the start rather than retrofitting in the late stages of the projects. The enthusiast had gone so far as to organise three projects which were quite similar and he instructed one of them to focus on Universal Design from the start, and the others to not focus on it. The project which focused on it from the start used 15% less money then the project that had to retrofit implementation of Universal Design. The enthusiast did this so he could get hard numbers to
show the management why early focus on Universal Design is important.

Karl could be considered to be an enthusiast. Karl had gotten interested in Universal Design through a student project where one of his project members had vision impairment:

We were doing a project with The Norwegian Library of Talking Books and Braille, and I had a team member who had vision impairments. So it was random that she was in my class, but I remember that it was interesting to hear her talking about Universal Design.

When he later started working as a developer, he noticed that a user interface he was working on had low contrast and bad keyboard access. He noticed it had bad contrast by doing informal tests on his own.

If I think something has low contrast, I try to squint. That’s in emergencies, not something that is a part of my development flow. It is often an OK indication that... I mean this is a trick I use myself. It is more about empathy than WCAG. I also look away and back and see if I can navigate quickly. I think, for example that to have two tables under each other that is styled exactly the same is annoying. Then I actually have to read the headlines. I’m a bit impatient actually.

Karl had also used colour contrast checkers to see if the UI was within the WCAG requirements. Karl obviously cared about accessibility but had no real tool for measuring the solutions he worked on. He used squinting and other self-thought techniques to evaluate the user interface. Karl also noticed a lack of support for keyboard navigation as he himself uses mostly the keyboard to navigate computers and websites.

One of the things that annoyed me most was lack of support for keyboard navigation. When I as a developer has to test the site many
times daily, it is annoying to use the mouse all the time. For me, it is an expert problem, there are no users that has this problem.

If the ICT solution is fully accessible with keyboard, this creates a better and easier work flow for Karl. The lack of keyboard accessibility becomes a problem for him, as he can’t work as fast as he is used to.

Karl notified his team that the solution had accessibility issues and referred to WCAG and the regulations.

The design language was too based on grayscales. I thought it had too low contrast to be a usable website, even for normal people. And referring to WCAG was almost like a tool to get my way. But it wasn’t taken serious, or fixed.

Karl noticed that the system was not accessible, notified the team and pointed out who could fix it, used WCAG to support his argument. Karl did not experience that the issues were taken seriously.
Chapter 6

Discussion

In this chapter I discuss my results in light of theories. The research questions are used to guide the discussion.

6.1 In which way can simulators be used to support user diversity?

6.1.1 Move developers out of comfort zone

ICT professionals have a tendency to use self-observation techniques when designing, developing and evaluating solutions. The aim of user-centred design methodology is to encourage professionals to move out of their comfort zone and empathise with people with different background and abilities than themselves (Cardoso and Clarkson 2012).

When the developers in my study used the simulators, they seemed to react with surprise. They reported feeling frustrated and annoyed by the difficulties they faced by conducting tasks they normally would have no problem conducting.

The developers seemed to use the simulations as "experience prototypes" as coined by Buchenau and Suri (2000). The developers seemed to have empathetic reactions to the use of the simulators. They reported
feeling frustrated, they referred to themselves when they expressed themselves and they considered how they could fix the problems the person they were simulating were facing. For example in regards to the dyslexia simulator (Funkify’s Dyslexia Dan): "But can we do something about that? Maybe you can have shorter titles, divide the text up and things like that?".

6.1.2 Developing a dialogue about disabilities through simulations

When the participants in the workshop used the simulators, they sometimes responded with sympathy and pitiness towards the personas that were simulated. They also said they felt frustrated when they lost control over the mouse pointer (using Elderly Ellen). When using the Cambridge Glasses, they said they felt helpless and that they would ask for help from others. This can indicate that simulators can be used to uncover views on disabilities and to discuss them.

Expressing sympathy towards someone is caused by realising that something bad has happened to a person (Jeffrey 2016). This is in line with a more medical view on disabilities, the charity model, which sees disability as something a person is undeserving and where the disabled is in need of help (Begnum 2016). Rather than dismantling stereotypes and barriers, this can potentially work against what disability activists have been fighting for over many decades, namely social emancipation and against a medical, individualistic view on disabilities (French 1992). Disabled people does not want to be taken care of or looked down at.

Uncovering such views can be a risiko when it comes to confidentiality: "A participant is asked to explore his or her thoughts and feelings on disability (...) that admission could be used against the participant in another context (...)" (Kiger and Kiger 2007). If a participant was unaware that such feelings or thoughts could be uncovered, this could be
dangerous. Kiger and Kiger (2007) suggests to always make it clear that people can quit and withdraw from the simulation activity.

### 6.1.3 Empowering developers

The workshop participants said that when they negotiate with the customer about what the ICT project should encompass, they as consultants had to focus on Universal Design, or it won’t be a part of the project. My results indicates that while there is a will to make accessible ICT solutions, some developers lacks tools to communicate accessibility errors to others. Some external factors such as time and budget constraints (which are typically the main excuse for not focusing on Universal Design) can be overcome if the implications of ICT solutions for a diverse set of users can be communicated from enthusiasts to stakeholders effectively. Simulators could be a way for developers to visually show stakeholders barriers in a solution.

Karl was eager to fix accessibility issues in the system he was working on, and he used informal tests to validate if the system was accessible. When Karl used the different simulators, he immediately recognised some accessibility and usability issues in the websites we tested. He also said that he would share the simulation tools I had shown him, and a few months later he asked where he could purchase the Cambridge Glasses, because he had convinced other people in his company that they could be used in ICT projects to make accessible solutions. For Karl, the tools I showed him was valuable for him as he could use them to convince others in his workplace to focus more on accessibility and Universal Design.

He had used WCAG requirements as tools without any luck, and he had used self-thought evaluation techniques. A good simulation tool that is calibrated could potentially help Karl and other developers.
6.2 In which way can simulators be used in ICT education?

Simulations can be used in the empathy part of Rughiniş and Rughiniş (2014) model for teaching accessible design. Ribu (2010) says that there is an attitude of scepticism and resistance towards Universal Design in the industry coming from lack of knowledge and the idea that catering to Universal Design will lead to added cost.

These attitudes can be changed by implementing the "web of arguments" Rughiniş and Rughiniş (2014) in which ICT students get a "knowledge bank" [my own figure of speech] they can use if they face negative views amongst stakeholders. I would also like to point out that Rughiniş and Rughiniş (2014) model can be used to make students Universal Design enthusiasts as Stian mentioned:

(...) we have seen that if you have one enthusiast that can make sure you always have some focus on it if you forget about it in a project or in a company.

6.2.1 Early vs. late

As two participants from the initial focus group said, it can be smart to have Universal Design in the education system from the start rather than at the end.

Participant: If you are going to have it as a part of the education, it should come early on. If you don’t have it at the start, we will have the same situation we are in today where we design something first, then add Universal Design at the end.

Participant: Yes, it can be good to have it in the back of our heads from the start so it isn’t something that is done the week before you hand in a project.
This can happen if Universal Design integrated in all courses and it is routinised as suggested by Buchenau and Suri (2000) and Eika and Evelyn (2017).

6.2.2  Active learning

If we draw the story of Sven from section 1.1 a little further and say that the output from the simulations works as a conversational partner telling the developer how a system can be experienced by people having impairments, one could argue that learning can happen at the fifth level in the ICAP-framework interactive. In this level, knowledge is generated via a dialogue and new and innovative ideas and perspectives can emerge (Chi and Wylie 2014). The developer notices barriers in the artefact by using simulators. This is different from passive learning where the developer reads about accessibility or listens to a lecture.
Chapter 7

Conclusions

I have in this project tried to find out how developers relate to Universal Design and simulation tools, and how simulations can be used to support user diversity in ICT projects. I have also related the use of simulations in ICT education. The background of this project was that ICT professionals tend to use self-observation techniques when designing and developing ICT solutions. This can hinder the solution from being accessible and universally designed. Budget and time constraints can also hinder projects from including real users in the design and development process.

I noticed that developers in my study had strong reactions when they used the simulators. Can this be because of unfamiliarity and surprise? The developers often referred to the experience as "frustrating", but this can again be because of unfamiliarity with how the simulation tool worked. They could also be surprised when they discovered how disabled people might use a computer. I would like to think that simulations can at least create a discussion on what the disabling factor is, and to make some developers reflect that over people with other abilities and requirements than themselves, that they should also be able participate fully in society.

Simulations can be used the wrong ways too, and make the participant be left with a wrong idea of how (in)capable a person with a certain impairment might be to do a task. Simulation participants may also feel
unwell uncovering private feelings and thoughts, which can be considered harmful, but which they do not want others to know about. Clear instructions from the person / lecturer facilitating the simulation activity is important.

### 7.1 Future work

Here I present some thoughts about approaches that I found interesting, yet not managed to pursue due to time constraints.

#### 7.1.1 Measure empathy

It would be interesting to see whether the use of simulations can actually build empathy. My results show that simulations can expose some views through the reactions the participants had while using different simulators, but it would be interesting to measure this in a more reliable way.

#### 7.1.2 Medical and social simulators

I have thought of the fact that some simulators tend to be designed to simulate medical conditions (NoCoffee, Cambridge Software Simulator, Blindesforbundets Synssimulator etc.). It’s interesting, as some of the medical-leaning simulators seem to be harder to use, as they require the user to tweak and measure themselves, while for example Funkify (which also simulates situated impairments) and Cambridge Glasses are easy to use and easy to learn.

#### 7.1.3 Develop software overlay

I initially wanted to build a software simulator that could overlay a computer interface - all apps and everything that happens on it. This could
make the simulations usable in other applications than the browser, such as prototyping tools, 3D modeling software etc.
Appendices
Appendix A

Interview guide - UD Enthusiast

4.6.3
Intervju med Universell Utforming-entusiast

Intervjugeide for intervju med UU-entusiast

16.11.2017

Introduksjon og bakgrunn

Presentere informert samtykke-skjema. Gi personen tid til å lese gjennom, og ta med penn!

“Vi er tre studenter som har et skoleprosjekt om Universell Utforming og hvordan vi kan hjelpe utviklere å lære om og praktisere dette. Prosjektet er i samarbeid med MediaLT.”

- Informer om tidsbruk, en time
- Informér om at en tar notater, og to stiller spørsmål
- Spør om alder, kjønn og stillingstittel

Hoveddel

Opplæring

- Når ble du oppmerksom på Universell Utforming?
- Vi har snakket med noen utviklere, og veldig få har vært borti Universell Utforming i løpet av studiet sitt, hvertfall i praktisk grad. Hvordan lærer dere om UU i ditt byrå?

Praktisering

- Hvordan jobber dere med Universell Utforming i ditt byrå?
  - Innsikt
  - Prototyping
  - Evaluering
- Hvordan jobber utviklere med Universell Utforming hos dere?

Supplerende
Hva synes du om denne måten å jobbe på?

Pisk eller gulrot

- Synes du diskriminerings- og tilgjengelighetsloven har hjulpet med å gjøre IKT i Norge mer tilgjengelig?
- Synes du bøtelegging er rett vei å gå?
- Hva ville vært den ultimate måten å sikre at flere IKT-løsninger er tilgjengelige for flest mulig?

Simulering

- Dere har en del empativverktøy i ditt byrå. Hvordan brukes dette i praksis? Har dere sett noen effekt?

Mulige løsninger

- Ville digital simulering av funksjonsnedsettelser vært en måte å sørge for at en løsning er tilgjengelig underveis som utviklere og designere jobber på en løsning?
  - Ikke som erstatning, men som supplering
- Vi jobber med en løsning som skal hjelpe utviklere å jobbe med universell utforming og wcag suksesskriterier. Ideen er et oppslagsverk hvor visuelle eksempler på suksesskriterier og kodesnutter til hvordan de oppnås i ulike språk. Hva synes du om denne ideen?

Avrunding

- Har du noe å tilføye?

“Takk for tiden din! Vi setter stor pris på at du tok deg tid til å snakke med oss.”

Supplerende spørsmål

- Kommer du på et prinsipp eller suksesskriterie innenfor UU som ofte blir oversett i digitale løsninger?
Appendix B

Consent form - UD Enthusiast
Informert samtykke

Bakgrunn
Dette intervjuet er en del av en masteroppgave på Universitet i Oslo som ser på universell utforming og bruk av digitale simulatorer. Jeg ønsker å finne ut om simulatorer kan være et verktøy for holdningsendring hos profesjonelle som jobber med IT-løsninger, primært frontend-utviklere. Jeg ønsker også å se om simulatorer kan hjelpe frontend-utviklere i jobben deres i å lage universelle løsninger.

Mål
Målet med intervjuet er å lære litt fra ditt arbeid med testverktøy og utviklere. Jeg er interessert i det dere har gjort, hva dere har lært og dine tanker om universell utforming og hvordan man får et mer inkluderende digitalt samfunn.

Hva innebærer deltagelse i dette intervjuet?
Dette intervjuet er et semistrukturert ekspertintervju, som betyr at jeg intervjuer mennesker med spesiell domenekunnskap om Universell Utforming og WCAG (ekspert) ved hjelp av en intervjuguide. Intervjuguiden blir ikke fulgt slavisk, og jeg kan velge å gå nærmere inn på enkelte spørsmål hvis jeg synes det virker interessant og hensiktsmessig. Jeg kan også velge å ikke stille enkelte spørsmål på grunn av tidsmessige hensyn eller som følge av at spørsmålet har blitt belyst på andre måter.

Personlige data som navn, arbeidsplass eller lignende informasjon som kan bli brukt til å identifisere deg som person, vil ikke bli notert eller avslørt før, under eller i etterkant av intervjuet. Alder og kjønn samt stillingstittel vil bli notert og brukt i studiet.

Hva skjer med informasjonen?
Personlige data som nevnt over vil bli anonymisert når informasjonen blir tatt vare på. Du har til enhver tid retten til å bli gitt en kopi av informasjonen vi tar vare på.

Informasjonen gitt i dette intervjuet kan bli brukt i en rapport i faget 5261 på Universitet i Oslo og som data for en masteroppgave på samme universitet.

Frivillig deltakelse
Deltagelse i dette intervjuet er frivillig, noe som vil si at du bestemmer fritt om du vil delta eller ikke, og har til enhver tid muligheten til å avbryte intervjuet uten å oppgi grunn.
Kontaktinformasjon
Hvis du sitter igjen med spørsmål i etterkant av intervjuet, kan disse stilles før intervjuet startes, eller henvendes til arrangørene av intervjuet på e-post:

Gard Olsen
gard.olsen2009@gmail.com

David Puente
davidop@ifi.uio.no

Markus Sørem
markusjs@ifi.uio.no

Informert samtykke
Jeg bekrefter at jeg har lest og forstått informasjonen tilknyttet dette intervjuet og ønsker å delta.

__________________________________________  ____________________________________
(Intervjedeltakers signatur, dato)           (Intervjuers signatur, dato)
Appendix C

Interview guide - Researcher 4.6.6
**Intervju med forsker**

*Intervjuguide for intervju med forsker på universell utforming og tilgjengelighet*

25.01.2018

**Introduksjon og bakgrunn**

Presentere informert samtykke-skjema. Gi personen tid til å lese gjennom, og ta med penn!

“Jeg skriver masteroppgave om universell utforming og hvordan front-end utviklere relaterer seg til dette temaet. Jeg prøver å finne ut om digital simulering av funksjonsnedsettelser eventuelt kan endre holdningen utviklere har til personer med nedsatt funksjonsevne, og å gjøre det lettere å forholde seg til tilgjengelighetskrav.”

- Informér om tidsbruk, rundt én time
- Informér om at jeg tar opp lyd
- Spør om alder og kjønn

**Hoveddel**

**Oppmerksomhet og læring om Universell Utforming**

- Når ble du oppmerksom på Universell Utforming?
- Vil du si at diskriminerings- og tilgjengelighetsloven har gjort at du har fokusert mer på universell utforming?

**Forskning**

- Der dere jobber har dere forsket en del på universell utforming og inkludering. Hva vil du si er den største utfordringen eller barrieren for et inkluderende e-samfunn?
- WCAG 2.0 er standarden for å evaluere digitale løsninger i Norge. Hva synes du om denne standarden?
- Kan du fortelle litt om forskningsprosjektet som har pågått i 2017 og som dere presenterte på UU-Meetupen i November?
Sendte dere ut testene til alle 94 personene, eller var alle testene personlig?
Når blir rapporten klar?

**Pisk eller gulrot**

- Synes du diskriminerings- og tilgjengelighetsloven har hjulpet med å gjøre IKT i Norge mer tilgjengelig?
- Hva ville vært den ultimate måten å sikre at flere IKT-løsninger er tilgjengelige for flest mulig?

**Simulering**

- Siden mitt fokus er på simulering av funksjonsnedsettelser, som dere har som en av testmetodene i forskningsprosjektet deres, lurer jeg på litt om ditt forhold til dette?
  - Hva slags simulert verktøy virker best?
  - Cambridge-briller- var mest populær som metode for testing. Hva kan dette komme av? Er det fordi det forutsetter minst bakgrunnskunnskaper? Er det fordi det er en uvant opplevelse, eller en aha-opplevelse?
  - Si litt om din mening om empativerktøy og nyttigheten av dette i arbeidet med IT-løsninger. Kan det bidra til en holdningsendring?

**Avrunding**

- Har du noe å tilføye?

"Takk for tiden din! Jeg setter stor pris på at du tok deg tid til å snakke med meg."

**Supplerende spørsmål**

- Kommer du på et prinsipp eller suksesskriterie innenfor UU som ofte blir oversett i digitale løsninger?
Appendix D

Consent form - Researcher
Informert samtykke

Deltakelse i prosjektet
"Fra sympati til empati med simulatorer?"

Bakgrunn og formål

Dette intervjuet er en del av en masteroppgave på Institutt for Informatikk på Universitet i Oslo som ser på universell utforming og bruk av digitale simulatorer. Jeg ønsker å finne ut om simulatorer kan være et verktøy for holdningsendring hos profesjonelle som jobber med IT-løsninger, primært frontend-utviklere. Jeg ønsker også å se om simulatorer kan hjelpe frontend-utviklere i jobben deres i å lage universelle løsninger.

Du er utvalgt på grunn av din interesse og ditt arbeid med universell utforming.

Mål

Målet med intervjuet er å lære litt fra ditt arbeid med testverktøy og utviklere. Jeg er interessert i det dere har gjort, hva dere har lært og dine tanker om universell utforming og hvordan man får et mer inkluderende digitalt samfunn.

Hva innebærer deltakelse i studien?

Dette intervjuet er et semistrukturert ekspertintervju, som betyr at jeg intervjuer mennesker med spesiell domenekunnskap om universell utforming (ekspert) ved hjelp av en intervjuguide. Intervjuguiden blir ikke fulgt slavisk, og jeg kan velge å gå nærmere inn på enkelte spørsmål hvis jeg synes det virker interessant og hensiktsmessig. Jeg kan også velge å ikke stille enkelte spørsmål på grunn av tidsmessige hensyn eller som følge av at spørsmålet har blitt belyst på andre måter.

Jeg tar opp intervjuet ved bruk av en diktafon. Lydbåndet blir kun brukt for å slippe å ta notater og for å få en bedre flyt på intervjuet.

Personlige data som navn, arbeidsplass eller lignende informasjon som kan bli brukt til å identifisere deg som person, vil bli anonymisert sånn at det ikke er mulig å knytte de tilbake til deg.
Hva skjer med informasjonen om deg?
Alle personopplysninger vil bli behandlet konfidentielt. Personen som gjennomfører intervjuet er den eneste som vil ha tilgang til lydklippet. Lydklippet blir kun brukt til transkripsjon av innholdet.


Prosjektet skal etter planen avsluttes 02. mai 2018. Etter denne datoen vil lydklippet bli tatt vare på i to måneder for deretter å slettes.

Frivillig deltakelse
Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn.

Dersom du har spørsmål til studien, i forkant eller etterkant av intervjuet, ta kontakt med meg Markus J. Sørem tlf: 40554504 eller min veileder Jo Herstad tlf: 91560563.

Studien er en del av et prosjekt på Universitet i Oslo som er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å delta

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(Signert av prosjektdeltaker, dato)
Appendix E

Interview guide - Single
developer 4.6.7
Intervju med utvikler

Intervjugeide for intervju med systemutvikler
01.02.2018

Introduksjon og bakgrunn

Presentere informert samtykke-skjema. Gi personen tid til å lese gjennom, og ta med penn!

“Jeg skriver masteroppgave om universell utforming og hvordan primært front-end utviklere relaterer seg til dette temaet. Jeg prøver å finne ut om digital simulering av funksjonsnedsettelser eventuelt kan endre holdningen utviklere har til personer med nedsatt funksjonsevne, og å gjøre det lettere å forholde seg til tilgjengelighetskrav.”

- Informér om tidsbruk, rundt én time
- Informér om at jeg tar opp lyd
- Spør om alder og kjønn
- Spør om stillingstittel og utdanning
  - Spør om informant er frontend / backend eller hvilken type utvikler han er

Hoveddel

Oppmerksomhet og læring om Universell Utforming

- Har du hørt om universell utforming av IKT-løsninger før?
- Når ble du eventuelt oppmerksom på universell utforming?
- Har du hatt om det i utdanningen din?
- Har dere hatt intern kursing om temaet?
- Har du hatt om brukeropplevelse eller interaksjonsdesign i utdanningen din?
  - Kursing om dette intern?

Holdninger og praktisering

- Tenker du på sluttbrukeren når du lager en løsning? Tenker du på opplevelsen de kan ha?
● Hvem sørger for at brukeropplevelsen er intakt i prosjektene du har jobbet i?
  ○ Har det vært noe fokus på tilgjengelighet? WCAG?
● Har du noen gang sett noen bruke en løsning du har laget? Hvordan var den
  opplevelsen?

Simulering
● Har du noen gang brukt simuleringssverktøy når det kommer til arbeid med
  universell utforming?
  ○ Hvordan var denne opplevelsen?
  ○ Har det endret synet ditt på mennesker med nedsatte funksjonsevner og
    deres mulighet til å benytte seg av IKT-løsninger?
● Hva er eventuelt grunnen til at du ikke har det?

Testing med simulering

Last ned Funkify for Chrome i meny - more tools - extensions - Get more extensions

Funkify

Som Keyboard Kim

● Gå inn på www.norwegian.no og finn en billett fra Oslo til Tromsø 25. januar
  2019.
● Velg ungdomsbillett med koden “UNDER26”.
● Hva koster billetten?

Som Elderly Ellen

● Gå inn på www.sas.no
● Finn en billett fra Oslo til Bergen 21. mars til 03. april og med en voksne. Hvor
  lang tid tar turen?

Som Peripheral Pierre

● Gå inn på www.finn.no og finn en snøscooter. Prøv å kjøp den andre som kommer
  som alternativ.

Og til slutt som Keyboard Kim igjen.

● Gå inn på www.sas.no
● Finn en billett fra Oslo til Bergen 02. februar til 21. Mars
Cambridge Glasses

- Gå inn på [www.finn.no](http://www.finn.no)
- Søk etter “iPhone x”
- Sorter på pris lav-til-høy
- Hvordan hadde du funnet en faktisk telefon og ikke et deksel?
- Hint:
  - Sorter på pris fra 8000

Hvis vi har tid:

*Synssimulator på smarttelefon og NoCoffee chrome extension*

Om bruken av simulatorer

- Hva synes du om denne måten å teste et brukergrensesnitt på?
- Hadde du brukt denne metoden hvis du jobbet med en løsning som skulle være tilgjengelig?
  - Hva kan en slik simulator eventuelt bestå av?
  - Krav til en optimal simulator?

Avrunding

- Har du noe å tilføye?

“Takk for tiden din! Jeg setter stor pris på at du tok deg tid til å snakke med meg.”
Appendix F

Consent form - Single developer

4.6.7
Informert samtykke
Deltakelse i prosjektet
"Fra sympati til empati med simulatorer?"

Bakgrunn og formål

Dette intervjuet er en del av en masteroppgave på Institutt for Informatikk på Universitet i Oslo som ser på universell utforming og bruk av digitale simulatorer. Jeg ønsker å finne ut om simulatorer kan være et verktøy for holdningsendring hos profesjonelle som jobber med IT-løsninger, primært frontend-utviklere. Jeg ønsker også å se om simulatorer kan hjelpe frontend-utviklere i jobben deres i å lage universelle løsninger.

Du er utvalgt til å delta i studiet basert på din stilling og det faktum at du er nyutdannet og relativt ny i rollen som IT-konsulent gjør det mulig å se på holdninger og antagelser om universell utforming og bruk av simulatorer.

Mål

Målet med intervjuet er å lære om din kjennskap til og holdninger til universell utforming og brukermedvirkning i arbeid med IKT-løsninger. Jeg ønsker også å observere din bruk av ulike simuleringsverktøy, både digitale og analoge, i en fiktiv gjennomgang av et brukergrensesnitt hvor du blir spurtt å innta en rolle med funksjonsnedsettelser og utføre oppgaver (scenarier). Etter, eller underveis i gjennomgangen, kommer jeg til å stille deg spørsmål knyttet til din opplevelse av bruken av simuleringsverktøyene.

Hva innebærer deltakelse i studien?

Første del av intervjuet er semistrukturert, som vil si at jeg intervjuer deg ved hjelp av en intervjuguide med spørsmål jeg har forberedt. Intervjuguiden blir ikke fulgt slavisk, og jeg kan velge å gå nærmere inn på enkelte spørsmål hvis jeg synes det virker interessant og hensiktsmessig. Jeg kan også velge å ikke stille enkelte spørsmål på grunn av tidsmessige hensyn eller som følge av at spørsmålet har blitt belyst på andre måter. Andre del av intervjuet er en gjennomgang av et brukergrensesnitt med bruk av ulike simuleringsverktøy.
**Tredje del** av intervjuet er semistrukturert og har som formål å se på om disse verktøyene kan være nyttig for deg og andre utviklere som jobber med IKT-løsninger som er lovpålagt å følge kravene fra Forskrift om universell utforming av informasjons- og kommunikasjonsteknologiske (IKT)-løsninger.

**Jeg tar opp intervjuet ved bruk av en diktafon.** Lydfilen blir kun brukt for å slippe å ta notater og for å få en bedre flyt på intervjuet. **Personlige data** som navn, arbeidsplass eller lignende informasjon som kan bli brukt til å identifisere deg som person, vil bli uidentifiserbare sånn at det ikke er mulig å knytte de tilbake til deg.

**Hva skjer med informasjonen om deg?**


Prosjektet skal etter planen avsluttes 02. mai 2018. Etter denne datoen vil lydklippet bli tatt vare på i to måneder før deretter å slettes.

**Frivillig deltagelse**

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn.

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Studien er en del av et prosjekt på Universitetet i Oslo som er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

**Samtykke til deltagelse i studien**

Jeg har mottatt informasjon om studien, og er villig til å delta

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(Signert av prosjektdeltaker, dato)
Appendix G

Task set - Single developer 4.6.7
Testing med simuleringsverktøy

**Funkify**

Last ned Funkify for Chrome i meny - more tools - extensions - Get more extensions

Som **Keyboard Kim**

- Velg ungdomsbillett med koden “UNDER26”.
- Hva koster billetten?

Som **Elderly Ellen**

- Gå inn på [www.sas.no](http://www.sas.no)
- Finn en billett fra Oslo til Bergen 21. mars til 03. april og med en voksne. Hvor lang tid tar turen?

Som **Peripheral Pierre**

- Gå inn på [www.finn.no](http://www.finn.no) og finn en snøscooter. Prøv å kjøp den andre som kommer som alternativ.

Og til slutt som Keyboard Kim igjen.

- Gå inn på [www.sas.no](http://www.sas.no)
- Finn en billett fra Oslo til Bergen 02. februar til 21. Mars

**Cambridge Glasses**

- Gå inn på [www.finn.no](http://www.finn.no)
- Søk etter “iPhone x”
- Sorter på pris lav-til-høy
- Hvordan hadde du fundet en faktisk telefon og ikke et deksel?
- Hint:
  - Sorter på pris fra 8000

Hvis vi har tid:

**Synssimulator på smarttelefon og NoCoffee chrome extension**
Appendix H

Plan - Workshop 4.6.9
Plan workshop 22. mars 2018

- Mål: finne ut hvordan utviklere forholder seg til universell utforming og simulatorverktøy.
- Tid: 60 minutter.

5 min Introduksjon.
- Velkommen.
- Informert samtykke-skjema
- Informere om at lyd blir tatt opp
- Informere om hva som kommer til å skje
  - Teste ut simuleringsverktøy
  - Se hva utviklerne synes om det
  - Diskutere konsepter

15 min Erfaring med Universell Utforming

- Har du hørt om universell utforming av IKT-løsninger før?
- Når ble du eventuelt oppmerksom på universell utforming?
- Har du hatt om det i utdanningen din?
- Har dere hatt intern kursing om temaet?
- Har du hatt om brukeropplevelse eller interaksjonsdesign i utdanningen din? Kursing om dette intern?
- * Hvem sørger for at brukeropplevelsen er intakt i prosjektene du har jobbet i?
- Hvem sørger for å møte kravene i prosjektene du har jobbet på?
  - Enthusiast? Prosjektleder?
  - Har det vært noe fokus på tilgjengelighet? WCAG?

5 min per oppgave

Funkify

Chrome: Last ned browser-extension på bit.do/funkfunk

Som Elderly Ellen
- Gå inn på sas.no
  - Oppdater siden hvis Funkify slutter å fungere
- Finne en SAS-billet fra Oslo til Bergen
  - 21 - 29 april
- Hvor lang tid tar flyturen (i minutter)?

Som Keyboard Kim
- www.sas.no
- Oslo - Bergen
  - 21 - 29. april
Spørsmål om opplevelsen

**Med Cambridge-briller**

- Gå inn på www.finn.no
- Søk etter en Gucci Solbriller.
- Sorter på pris høy/lav.

5 Etter man har brukt hver simulator

- Hva synes du om denne måten å teste et brukergrensesnitt?
- Hvorfor / hvorfor ikke hadde du brukt denne metoden for å teste et brukergrensesnitt på?
  - Fordeler / ulemper
- Hva følte du når du brukte Elderly Ellen?
- Hvordan ville du løst dette problemet teknisk?

**Konsepter**

![Image of Microsoft Word document with a color contrast picker]

Color contrast picker
Appendix H

Consent form - Workshop 4.6.9
Informert samtykke
Deltakelse i prosjektet
"Fra sympati til empati med simulatorer?"

Bakgrunn og formål
Denne workshoppen er en del av en masteroppgave på Institutt for Informatikk på Universitetet i Oslo som ser på universell utforming og bruk av simulatorer. Jeg ønsker å finne ut om simulatorer kan være et verktøy for holdningsendring hos profesjonelle som jobber med IT-løsninger, primært frontend-utviklere. Jeg ønsker også å se om simulatorer kan hjelpe frontend-utviklere i jobben deres i å lage universelle løsninger.

Du er utvalgt til å delta i studiet basert på din stilling som IT-konsulent.

Mål
Målet med intervjuet er å lære om din kjenndskap til og holdninger til universell utforming og brukermedvirkning i arbeid med IKT-løsninger. Jeg ønsker også å observere din bruk av ulike simuleringsverktøy, både digitale og analoge, i en fiktiv gjennomgang av et brukergrensesnitt hvor du blir spurt å innta en rolle med funksjonsnedsettelser og utføre oppgaver (scenarier). Etter, eller underveis i gjennomgangen, kommer jeg til å stille deg spørsmål knyttet til din opplevelse av bruken av simuleringsverktøyene.

Hva innebærer deltagelse i studien?
Første del av workshoppen handler om å kartlegge holdninger knyttet til universell utforming og tilgjengelige IT-løsninger. Spørsamlede som blir stilt er forberedt i en intervjuguide. Intervjuguiden blir ikke fulgt slavisk, og jeg kan velge å gå nærmere inn på enkelte spørsmål hvis jeg synes det virker interessant og hensiktsmessig. Jeg kan også velge å ikke stille enkelte spørsmål på grunn av tidsmessige hensyn eller som følge av at spørsåte har blitt belyst på andre måter.

Andre del av intervjuet er en gjennomgang av et brukergrensesnitt med bruk av ulike simuleringsverktøy.
Tredje del av intervjuet har som formål å se på om disse verktøyene kan være nyttig for deg og andre utviklere som jobber med IKT-løsninger som er lovpålagt å følge kravene fra Forskrift om universell utforming av informasjons- og kommunikasjonsteknologiske (IKT)-løsninger.

Jeg tar opp intervjuet ved bruk av en diktafon. Lydfilen blir kun brukt for å slippe å ta notater og for å få en bedre flyt på intervjuet. Personlige data som navn, arbeidsplass eller lignende informasjon som kan bli brukt til å identifisere deg som person, vil bli uidentifiserbare sånn at det ikke er mulig å knytte de tilbake til deg.

Hva skjer med informasjonen om deg?


Prosjektet skal etter planen avsluttes 02. mai 2018. Etter denne datoen vil lydklippet bli tatt vare på i to måneder for deretter å slettes.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn.

Dersom du har spørsomål til studien, i forkant eller etterkant av intervjuet, ta kontakt med Markus J. Sørem tlf: 40554504, Diana Saplacan: dianasa@ifi.uio.no eller Jo Herstad tlf: 91560563.

Prosjektet er en del av et større prosjekt på Universitet i Oslo som er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å delta

______________________________________________________________
(Signert av prosjektdeltaker, dato)
Bibliography


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Rughiniş, C. & Rughiniş, R. (2014). ‘In my shoes’ interaction sandbox for a quest of accessible design: Teaching sighted students accessible design for blind people. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 8513 LNCS(PART 1), 64–74. doi:10.1007/978-3-319-07437-5_7


Young, S. (2014). I’m not your inspiration, thank you very much. Retrieved April 22, 2018, from [https://www.ted.com/talks/stella_young_i_m_not_your_inspiration_thank_youvery_much](https://www.ted.com/talks/stella_young_i_m_not_your_inspiration_thank_youvery_much)