UiO : Department of Informatics
University of Oslo

Using Bluetooth beacons in a museum

An exploratory study with proximity-based technology

Jon-Robert Skårberg and Kjetil Sletten

Master's Thesis Spring 2016

Abstract

The goal of this master thesis is to discover how Bluetooth beacons affect user experience in a museum setting, specifically for museum visitors and staff. Two applications were developed; one of which was highly automatic and required an active screen to work, and one that was less automatic and worked when the phone was inactive.

A high degree of automation was found not to be desirable, as users express a greater loss of control. This can be somewhat remedied by good feedback, but the highest degree of automation should not always be the goal, even though users express that they like the application doing a lot of the work for them. An application that requires users to use it at all times intensifies the feeling users already have of being in a 'bubble', which leads to a sense of isolation. An application using beacons should thus work as a supplement and not as the main source of information.

Keywords: ***beacons, Bluetooth, proximity based technology, mental models, feedback, context, context awareness, ubiquitous computing, museum***

Acknowledgements

We first started the work on this thesis in the fall of 2014, with a few brainstorming sessions and an initial meeting with our supervisor, Jo Herstad at the Department of Informatics at the University of Oslo. The project has taken many twists and turns since then, but thanks to the continual support and feedback from Jo, we have always moved forward towards the eventual final product. We are very grateful for his help.

A big thanks goes to Anita Woll, PhD candidate at the Department of Informatics for her continual enthusiasm and work as a contact with Rambøll, Statsbygg and Nasjonalmuseet, especially with getting access to testing facilities.

We also wish to thank Jahn-Fredrik Sjøvik, head of the ICT department at Nasjonalmuseet, for his help with getting us insight in the field of museum technology.

We wish to thank the participants in the tests, the workshop, and Associate Professor Palmyre Pierroux for their participation. Their input has been highly appreciated.

For the fruitful discussions and conversations with our friends and fellow students at IFI, we are very grateful.

Finally, we would like to thank our partners, friends and family for their support.

Oslo, May 2016
Kjetil Sletten and Jon-Robert Skårberg

Contents

1 Introduction **1**

1.1 Motivation 1
1.2 Field overview 3
1.3 Beacons 4
1.4 Research questions 5
1.5 Target groups 7
1.6 Methods 8
1.7 Structure 10

2 Theory **13**

2.1 Technology 14
2.1.1 Proximity based technology 14
2.1.2 Beacons 18
2.1.3 Bluetooth Low Energy 26
2.2 User experience 26
2.2.1 What affects user experience 27
2.2.2 Interaction 29
2.2.3 User interfaces 31
2.2.4 Mobile screens 33
2.2.5 Mental models 34
2.2.6 Feedback 35
2.3 Context 40
2.3.1 Properties of context 41
2.3.2 Position 42
2.3.3 Users and understanding of context 44

2.3.4 Context awareness and ubiquitous computing 45
2.3.5 Context aware communication 46
2.3.6 Context and user experience 49
2.3.7 Interaction with computers in museums 50

3 Methodology **55**
3.1 Research methodology 55
3.2 Methods 57
3.2.1 Workshop 58
3.2.2 User testing 61
3.2.3 Interviews 64
3.2.4 Prototyping 66
3.3 Analysis 70
3.3.1 Validity 72
3.3.2 Critique of our methods 73

4 Case **77**
4.1 Stakeholders 77
4.2 The new National Museum 78
4.3 Mellomstasjonen 78

5 Findings **81**
5.1 Testing 81
5.1.1 Findings from the first test 82
5.1.2 Findings from the second test 86
5.2 Workshop 90
5.3 Expert interview 95

6 Discussion **99**
6.1 First research question 99
6.2 Second research question 105
6.3 Third research question 115

7 Conclusion **121**

Bibliography **129**

A Code **133**

B Scenarios **135**

C Informed consent form **139**

D Transcriptions **143**
D.1 Transcript of first test #1 143
D.2 Transcript of first test #2 152
D.3 Transcript of workshop 156
D.4 Transcript of expert interview 173

E Screenshots of applications **185**
E.1 Screenshots of the first application 185
E.2 Screenshots of the second application 185

F Photos of Mellomstasjonen **191**

List of Figures

1.1 The new National Museum at Vestbanen in Oslo, Norway (Kleihues & Schuwerk, 2015) 2

2.1 QR code representing: “Beacons are cool!” 17
2.2 Shipping off the Eddystone Lighthouse (Melbye, 2009) 19
2.3 Estimote beacon (Nalder, 2014) 20
2.4 Apple’s iBeacon 22
2.5 ’User experience honeycomb’, (Morville, 2004) 28
2.6 Conceptual Model, (D. A. Norman, 2001, p. 16) 36
2.7 A classification of feedback 37
2.8 Context-aware communication dimensions 48
2.9 A simple look at the traditional relationship between user and computer 51
2.10 The traditional relationship between user and computer, with the addition of context 52
2.11 The complex relationships in a context, with user, smartphone and artwork 52
2.12 The complex relationships in a context, with user, smartphone, artwork and beacon 53

3.1 A printed image of Madonna hanging on a wall, with a beacon underneath 63
3.2 A view of the top floor of Mellomstasjonen 65
3.3 An overview of nearby artworks in the first application 68
3.4 An overview of nearby artworks in the second application 71

4.1 Sculpture from the first floor of Mellomstasjonen 79
4.2 A view of the top floor of Mellomstasjonen 80

6.1 Our applications - context acquisition 108
6.2 Making the user aware of beacons 112
6.3 A beacon-zone 113
6.4 Overlapping Zones 116
6.5 Number of beacons 117
6.6 Zones and artworks 118

E.1 An overview of nearby artworks in the first application 186
E.2 An example of what it looks like to users when the application discovers that it is close to an artwork 187
E.3 Information about a piece of art in the second application 188
E.4 A notification on the main screen 189
E.5 A notification 190

F.1 A collage describing the development of the area of the new museum 192
F.2 Interactive exhibition; users can take photos 192
F.3 Interactive exhibition; users can create new artworks 193

List of Tables

2.1 Our hierarchy of beacons 22

3.1 DECIDE-framework 58
3.2 Validity Procedures 72

Chapter 1

Introduction

One of the ways the user experience in museums can be enhanced, is through the use of technology. Whether it is through the use of familiar technologies such as audio guides, conventional information screens or ticket machines, or revolutionary technology we are still unable to imagine, technology contributes to the user experience in one way or another. We position ourselves somewhere in the middle, exploring technology that is still fairly new and unused, especially in the context of museums.

Many museum visitors now carry a smart device with them - usually a smartphone, and this provides new opportunities for personalization and interaction between user and museum. There is a potential for e.g. moving from common, shared screens and analogue information text to smartphones, and for bridging the gap between the physical and digital world. But, with the field of proximity based technology developing at a rapid pace, what is cutting edge today may be outdated tomorrow.

1.1 Motivation

With the rise of Internet of Things (IoT) and the cheap hardware that comes with that, we felt that the beacon technology was a natural choice to explore. Proximity-based technology is quite common in Norway, however our understanding is that there are not many people that actually use it. There are NFC bank terminals available, but not many stores has activated that functionality. Why is

Figure 1.1: The new National Museum at Vestbanen in Oslo, Norway (Kleihues & Schuwerk, 2015)

that? Does the people not understand the technology? How would users perceive the - to them - unfamiliar beacon technology? We want the beacon technology to succeed, but our feeling is that some new technologies in Norway are pushed onto the user without understanding the users need. We therefore wish to understand the technology and its impact *before* it is potentially widespread.

Proximity-based technologies, IoT and more specifically beacons, are on the rise. Big players like Apple and Google has already invested a great deal of effort into the beacon technology, in order to achieve better location and proximity experience for users, and to provide new opportunities for developers, businesses and organizations.

Our personal interest in this beacons has indeed helped us explore the different possibilities that arise with the use of beacons in a museum setting, and we feel that the use of beacons in museums is a perfect example of displaying the technology - a public domain with different types of users. By developing our own prototypes, testing the functionality of beacons has proved to be fruitful in improving our abilities in the development field but also in user-testing.

1.2 Field overview

This thesis mainly revolve around the technology of *beacons*, which can be described as small devices broadcasting their identities using Bluetooth Low Energy (also known as BLE or Bluetooth Smart). These devices have several uses, the two most popular being broadcasting commercial content and determining user location.

There are no current ad-hoc (specialized solution) infrastructure that provides the same possibilities, with low-cost devices that can be placed "anywhere". There are however several alternative to beacons when it comes to determine user location, facilitating indoor positioning and navigation. The combination of WiFi and triangulation algorithms makes it possible to determine position quite accurately, and when combined with navigation algorithms and floor plans it can also be used for indoor navigation. Amongst the other relevant technologies we can mention NFC and QR-codes, able of determining the user's current context. GPS is no good indoors because it relies on satellites, and the reception strength is not good enough indoors.

Key terms

Below is a short explanation of the most important concepts of this thesis. Most concepts will, with the exception of user/visitor, be thoroughly explained in chapter 2 and later used for discussion in chapter 6.

Beacons A beacon is a small device that broadcasts Bluetooth signals. The broadcast consists of different layers of identification that can accessed by application on Bluetooth-enabled devices, with a potential additional payload of information given that the chosen protocol supports it. The term *beacons* will be used both for the devices themselves, as well as the beacon technology itself.

Proximity based technology Proximity based technology is technology that has a fixed location, has a mode of data transfer, and has a limited area in which it can communicate with other entities.

Feedback Feedback is returning information to the user after an action is performed by the user, regarding what has been done and what the task accomplished. In this thesis feedback is closely related to *automation*, actions happening without users expressively asking for them to be performed.

Context Context is any information that can be considered relevant to or characteristic of the situation in which an entity find itself. Context is not limited to location or position, and things like people, time of day and weather can be considered part of the context as long as it is deemed relevant to the entity in question.

User and visitor The words *user* and *visitor* (and occasionally museum visitor) will be used interchangeably in this thesis, as the museum visitors are also the users of the applications and technologies described. We do acknowledge the differences between the two, but decide to treat them as equals. With regards to user testing and the workshop, the word *participant* is also used as an alternative to user and visitor, in order to separate the participants of the workshop and the museum visitors they are discussing.

1.3 Beacons

Beacons are small devices that emits Bluetooth signals that can be used to identify that specific beacon. What the signal is comprised of can differ depending on which protocol is being used, but will always contain three different 'layers' of identification, such as UUID, major and minor, allowing easy grouping of beacons. The two most widely used protocols, and the two mentioned in this thesis, are iBeacon and Eddystone. Beacons are intended to be stationary in relation to the object or entity it is related to, and are normally mounted onto walls or in other fixed positions. The beacons can still be placed on/in moving objects, such as buses and subway trains. This thesis focuses on the use of this technology in museums specifically. Thus, below we present different beacon use cases relevant to this, both from the point of view of the uses as well as the museum staff.

Use-cases for beacons from both a museum staff view and a user view are presented below. And, as this thesis focuses on the use of this technology in museums, the use-cases are all related to use in museums.

Beacons and museum staff Examples of ways beacons can be used by museum staff are, amongst others, the following:

- Use of position logging of museum visitors to identify popular and unpopular exhibitions
- Understand movement patterns of visitors and better facilitate effective movement of visitors
- Provide more personalized and interactive information to users

Beacons and users Use-cases for users in museums includes:

- Receive personalized information, for example in your own language
- Pay the entrance fee to the museum without having to stand in line to buy tickets
- Find information about nearby artworks with little required effort

Elaboration of selected use-cases are presented in section 2.1.2

1.4 Research questions

The overall research goal is to discover how beacons affect user experience in a museum setting, specifically for museum visitors as well as museum employees. However, this is such a comprehensive topic that we would not be able to answer it in a satisfying manner in a Master's thesis. We have, therefore, narrowed our research down to three research questions, each playing an important part in the user experience of beacons in museums. These research questions are:

1. ***What are the user concerns regarding the use of proximity based technologies with smartphones in a museum?***

   The introduction of beacons to museums requires an increased use of smartphones in order to exploit the technology. And, contrary to what the situation is today with proximity based devices such as audio guides, beacons intended use is for smartphones. We wish to understand which concerns users has regarding the proximity based technology that the beacon technology is, in a museum setting.

2. ***How does feedback affect users' understanding of proximity based technology?***

   A new technology requires use of feedback in order to help users understand the technology, but how and when that feedback should be presented to the users is somewhat difficult to determine. Current concepts in a museum requires the user to know which room they are situated in, and with beacons the users are introduced to the concept of beacon zones.

   Our goal is to understand how feedback affects how users understand the technology and how this affects the user experience for the museum visitors.

3. ***What are the technical challenges of using beacons in a museum?***

   Currently beacons are mostly used for commercial purposes, providing a new mode for stores to promote their goods. A few museums have installed beacons in their exhibition areas, but as the technology is relatively new and not widely used, not much information about this is publicly available.

   The museum studied in our case, the new National Museum in Oslo, is going to be very large, and will require a large number of beacons to cover the exhibition areas, which vary in both size, shape and content. What kind of challenges this presents to developer is currently unknown, and we wish to find the answer to this.

1.5 Target groups

This study is intended primarily for those that are interested in beacons and technology in museums, due to our interest in and choice of technology. As the new National Museum is such an essential part of the project, entities regarding the building project are also amongst the target groups. The main target groups for this thesis are:

The National Museum The new National Museum in Oslo, Norway, is currently under construction (see fig. 1.1), and the already existing National Museum organization will be the users of the new museum, see section 4.1. The National Museum will have some interest in this thesis because they are currently looking into the possibility of installing and using beacons in the new museum. The National Museum reached out specifically to master students at the Department of informatics at the University of Oslo, for which this thesis is written. They asked for someone to explore this technology for them, which suited us well.

Rambøll and Statsbygg Statsbygg is the building contractor for the new National Museum, and Rambøll is their technical advisor. (see section 4.1). In order to advise the contractors to obtain the right equipment and relevant infrastructure, this thesis will guide the consultants regarding the new National Museum's needs. As technology consultants and building contractors, they both have to acknowledge the challenges of beacons if they eventually decide to utilize them.

Those interested in technology use in museums According to our contacts in the technology department of the National Museum, there is a large milieu of museums that are interested in new technology and businesses that supply them. And, because the new museum is a large prestige project of national character, it is required to meet the needs of the future and not just the present.

Those interested in beacons and proximity sensitive technology As the Bluetooth beacon technology is fairly new - e.g. iBeacons were introduced in 2013 and Bluetooth Low Energy in 2010 - we propose that all possible usage possibilities of the technology have not yet been discovered. Despite that our way of utilizing

beacons already has been tried by others, we believe our attempt at doing it will have positive contributions for future attempts. Ideally, it can be used in the future to improve development of both similar and new ways of usage.

Mediascapes During our research we talked to Associate Professor Palmyre Pierroux, see section 5.3 and appendix D, who was in the making of a new research project, Mediascapes[1]. This thesis investigates similar themes as in the coming project as Mediascapes.

1.6 Methods

Our focus is on qualitative data, collected through interviews, user testing/observation and a workshop. In our opinion our research questions can not be answered by quantitative data alone, and although it could have given certain clues towards answering the research questions, we believe we can learn a lot more by focusing on qualitative data instead, as this thesis seeks to understand the phenomena of beacons rather than getting the numbers.

The data was collected through user testing and observation, interviews and a workshop. As beacons are not that widely used, we also developed two applications to provide the participants with a proper "beacon experience".

Two high-fidelity prototypes have been developed. The prototypes are intended to give users a representative experience of beacons, which makes the applications behaving properly as a "beacon-application" a key requirement. In addition to giving users experience with the technology, we encouraged them to speak out loud and voice their thoughts while performing the tasks they were instructed to perform. This was done for two reasons; for us to learn how users think while using the technology, and to use as starting points for discussion and conversation with users.

In the first round of tests, interviews were conducted directly after users had completed a small set of tasks meant to introduce them to the technology and what it does. The interviews were semi-structured, and based on the experiences and observations that were made during the completion of the test. The interviews

[1] http://www.uv.uio.no/iped/english/research/projects/mediascapes/

focused on what the users thought about the technology, and included a conversation about the present and the future of beacons. We did not wish to restrain the interviewees very much, as we realized that it was not always obvious what we were looking for. A detour can sometimes lead to interesting discussion.

The second round of testing took place in Mellomstasjonen, a visitor center for the new National Museum. This did not include interviews, but rather informal conversations and discussion, as well as observation.

In addition to post-test interviews, we have conducted an expert interview with Palmyre Pierroux. The goal of this expert interview was to discuss our findings with an expert that holds expertise in the field of technology use in museums. We compared our findings with findings from academic articles written by Pierroux, and used this as a starting point for discussion.

The workshop, or focus group, was done with four fellow master students as participants, in addition to us (the authors). The participants included one participant that had completed the first test, and three that had not. Our hope was that the different setting compared to the post-test interviews, with six people discussing scenarios rather than one participant at a time being interviewed, would be fruitful. Our goal is for the workshop was for it not feel like an interview, but rather as a discussion between equals.

Challenges regarding the writing of this thesis

There have been a few challenges we have faced when writing this thesis, and their impact on the final result should be acknowledged. Below, each challenge is described.

Writing in English We are native Norwegian speakers, and all interviews, workshops etc. have been conducted in Norwegian. When translating quotations from Norwegian to English, some of the meaning of words and phrases might have been lost in translation.

Working in pair Working in pair makes good communication a necessity, as well as an equal distribution of work. We each have our strengths and preferences when it comes to what work each of us would like to do. We have both participated

in all stages of writing this thesis, including development of both applications. But, as is only natural, the contribution from each of us has not been 50-50 on every part of the project.

Another advantage of working together is that has been easier to stay aware of our influence over the process and results. Having someone to discuss with at all times, has ensured a greater focus on how our believes and thoughts have affected the process and results.

Consistent phrasing This thesis was written over a time span of one and a half year, and both the project scope and our domain knowledge has developed through several iterations. This makes consistent phrasing challenging, as this too changes with change in scope and knowledge.

1.7 Structure

Chapter 2 - Theory

This chapter begins with a look at some of the technologies relevant to this Master's thesis; technologies that fit within the *proximity based technology*-term. This is to introduce the reader to the types of technologies that share similarities with the main technology chosen for this study - beacons, and to avoid a too narrow scope of comparison. The chapter then moves on to a thorough look at beacons, with a particular focus on the technology. After this is the topic of user experience (UX), with sub-topics such as interaction, interfaces, mental models and feedback. The chapter ends with a look at context, context awareness and how context affects user experience.

Chapter 3 - Methodology

The content of this chapter has already been briefly presented in section 1.6. It begins with a description of the research methodology, followed by a description of the methods used; workshop, user testing, interviews and prototyping. The chapter ends with an analysis of the chosen research methods, with a focus on validity and critique of methods.

Chapter 4 - Case

This chapter begins with a description of stakeholders in this project, followed by information about the new National Museum and the Mellomstasjonen visitor center, in which we have conducted the second round of testing.

Chapter 5 - Findings

This chapter contains the relevant findings that was made by conducting the methods described in chapter 3. The findings from the tests are presented first, with findings from the first test first, followed by findings from the second test. Findings are further grouped together thematically. We then present findings made in the workshop and in the expert interview, presented separately.

Chapter 6 - Discussion

Chapter 6 contains discussion of the research questions from section 1.4, using theory from chapter 2 and findings from chapter 5.

Chapter 7 - Conclusion

This chapter sets of with a summary of the thesis and the research questions, structured in the same order as chapter 2. The chapter ends with our thoughts about possible future work within the field.

Chapter 2

Theory

In this chapter the theory we build our thesis upon is presented. It is later used in combination with the findings in chapter 5 to produce the discussion in chapter 6. It is structured in the following way:

- *Technology*
  - *Proximity based technologies*
  - *Bluetooth*
- *User experience*
  - *How interaction with technology affects the relationship between user and device*
  - *Mental models*
  - *Feedback*
- *Context*
  - *Properties of context*
  - *Users and their understanding of context*
  - *Context awareness and ubiquitous computing*
  - *Context and user experience*

These topics will be elaborated below, in the above mentioned order.

2.1 Technology

This section is used to present technologies relevant to this project. We introduce the term *proximity based technology*, and explain what it is and what its implications are. After this we present different types of proximity based technologies, before turning to the proximity based technology this thesis is mainly concerned about; *beacons*. The beacon technology is thoroughly explained, and use-cases are presented, both from a system-design and user perspective. The section ends with a review of the Bluetooth technology, with particular focus on the properties that can affect how users see it and how it can be utilized in the prototypes made in this project.

2.1.1 Proximity based technology

The term *proximity based technology* is a term that is used in this thesis to describe technologies that fulfill the following criteria:

- Has a fixed location (being permanently attached to a movable object is in this context considered as having a fixed location)
- Has some sort of data transmission possibility, either digital or analog
- Has a limited area in which it can communicate with other entities

The term *proximity based technology* is used in this thesis for technologies that has *all* these three properties.

There are several technologies that fulfill all criteria for making them proximity based technologies. Due to a lack of communication with the satellites that make up the Global Positioning System (GPS), it is rarely sufficient indoors and thus it is not a good candidate for use in an indoor museum. Beacons are the proximity based technology that concerns this project the most, but alternatives covered in this section are:

- NFC
- WiFi
- Barcodes

- QR-codes
- Infrared

These proximity based technologies are not the only alternatives, but the ones the authors believe are the most feasible to use in a museum setting. Grouping the technologies together like this should give a decent introduction to what the authors believe the concept of proximity based technologies entails.

NFC

Near Field Communication (NFC) is a protocol for communication between two devices. NFC requires the devices to be close to each other in order to communicate; "within a few centimeters"[1]. NFC is part of the Radio Frequency Identification (RFID)[2] technology family. The NFC technology itself *can* transfer large amounts of data, but it will do so slowly (at a maximum of 424 kbit/s) (Ding, 2009). If there is a need for transferring larger amounts of data, NFC is able to establish a Bluetooth connection, given that both devices are Bluetooth enabled, and can transfer the data more quickly using that connection.

NFC can be used as an alternative to beacons by placing NFC tags near artworks to provide information about the art, or to establish the position of the user and do another action based on that. Either way would require users to position their smartphone close to the NFC device to communicate.

Wi-Fi

Wi-Fi - is a wireless network connection, capable of quite good speed (more than 100 mbit/s in some cases)[3]. In addition to providing Internet access to users, Wi-Fi can be used to determine the position of users using triangulation. This is a somewhat intricate process, but can be summarized as using the measured signal strength from several Wi-Fi emitters to calculate position[4].

[1] http://www.techradar.com/news/phone-and-communications/what-is-nfc-and-why-is-it-in-your-phone-948410

[2] http://www.rfidjournal.com/articles/view?392

[3] http://ccm.net/faq/298-what-is-wifi-and-how-does-it-work

[4] http://stackoverflow.com/questions/16485370/wifi-position-triangulation

If there are enough Wi-Fi emitters, it can be possible to get such a fine grained location so that e.g. the closest artwork to the smartphone used can be determined. When combined with maps of the building and the exact position of Wi-Fi emitters, it would also be possible to provide both determination of position and navigation.

Barcodes

The traditional barcode is familiar to most modern people, being printed on the packaging of products in stores. A barcode is a series of parallel lines, which by varying width of the lines and spaces between them makes it possible to use it to represent data[5]. More elaborate barcodes also exist, using different shapes than parallel lines A well-known example of this is QR-codes, which are described below.

The most familiar use of barcodes is where the cashier at a store scans the barcode using a device attached to the register system, and the system creates a recite based on the objects it has scanned. The system here used by a cashier, uses the barcodes to identify which product the store sells that it is currently scanning, but it can also be used to identify other entities such as artworks in a museum (Albert Manning, 1999).

When equipped with the correct hardware and software, a phone is able to read barcodes. The code is scanned using a camera, the result is analyzed, and the system can then use the analyzed result to perform an appropriate action[6]. As an alternative to beacons, barcodes would work in pretty much the same way as NFC, requiring an active scan from users. The difference is that it is completely analogue on the code's end of the transaction, unlike NFC.

Quick Response (QR) code

A Quick Response Code (QR code) is a kind of barcode, explained above, suggestively mostly used for representing URLs and redirecting browsers to them See fig. 2.1 for an example of a QR code. Information is represented by squares

[5]http://www.barcoding.com/information/barcode_history.shtml

[6]http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=1366183&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D1366183

in different sizes and positions, and combined they can represent strings of text of different lengths. The longer the string is, the more complex the QR code is and the harder it is to scan. An application (or alternative capable software) is then used to scan the QR code and perform the associated action[7].

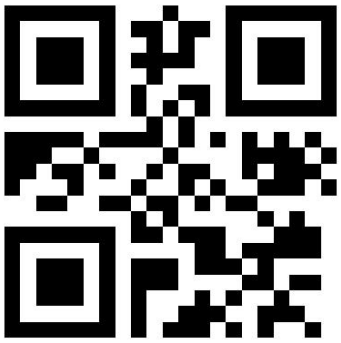

Figure 2.1: QR code representing: "Beacons are cool!"

Infrared

Infrared (IR) is invisible to the naked human eye, and consists of waves that are longer than those of light visible to humans. The name comes from infrared waves being outside of the red edge of the visible spectrum (Nagabhushana, 2009). Infrared may be familiar for users of remote controllers for TVs, decoders etc. Many remote controls use infrared to communicate with the device they control, and this requires a direct line of sight between the remote control and the device. Data is transferred by turning the infrared signal on and of at a rapid pace, and the receiver of the signals interprets this sequence[8] and performs an appropriate action based on the interpretation.

In museums, infrared can be used both to acquire position and to control actions. If a visitor carries a device capable of *receiving and interpreting* IR signals, the device can deliver information to the visitor when it receives data from a sender via IR. The modes of delivery depends on the capabilities and properties of the device. If the visitor has a device capable of *transmitting* IR signals, he

[7] http://www.qrcode.com/en/about/

[8] http://www.madsci.org/posts/archives/nov2001/1005591590.Eg.r.html

can use it to activate interactive exhibitions and thus may have a greater sense of control over the exhibitions than visitors do in a 'normal' exhibition.

Object recognition

Object recognition (also known as image recognition) is to use software capable of interpreting images taken with the camera of a device, and then perform an action depending on which objects the software identified in the images and what it is programmed to do with it[9]. Object recognition does, when compared to the abovementioned technologies, lack an element of complexity in that it does not compress data before 'transmitting' it to the device that is interpreting it. It does, however, make up for it by requiring far more extensive interpretation by the system than the previous technologies.

Whereas QR-codes, barcodes, IR and its likes encode and decode based on set rules, image recognition software must be 'intelligent' enough to interpret what it 'sees', and we are not yet in a situation where it works flawlessly[10].

2.1.2 Beacons

Beacons are small devices consisting of a low-powered unit that broadcasts its identification (and potential additional information) using Bluetooth, much like the lighthouse emits light to signal passing boats about dangerous areas or pathways. And, much like the lighthouse, the Bluetooth beacon can be used as a *guide*; helping shoppers, tourists and blind people to navigate to a location or advertise about a product. Figure 2.3 is such a Bluetooth beacon, from Estimote which is one of the major beacon producers.

The Bluetooth beacon is a rather new technology that enables communication with the context of the user's device (which is usually a smartphone). Put differently; beacons can make smartphones able to know about the context it is part of. The concept of beacons (in this use context) has been around for some

[9] http://www.cse.usf.edu/~r1k/MachineVisionBook/MachineVision.files/MachineVision_Chapter15.pdf

[10] http://www.popularmechanics.com/technology/a14116/microsoft-image-recognition-outperforms-humans/

Figure 2.2: Shipping off the Eddystone Lighthouse (Melbye, 2009)

years[11]. The CoolTown project from HP adopted the use of URLs for each device, and each device was connected to the Internet (Pradhan, 2000). During the recent years, Bluetooth beacons have increased in numbers and several vendors are designing new and improved chipsets and devices for the new "context world".

There are two distinct sides of beacon use; the one of the facilitator (or system administrator), and that of the user. Below follows our interpretation of the most important key points for beacon use for facilitators and system administrators:

1. Setup an bluetooth-enabled device in the real world.

2. Make it visible to everyone, providing context and positioning for your application.

3. Engage the users.

[11]https://www.fastcodesign.com/3034830/ideo-thinks-estimotes-bluetooth-nearables-could-be-a-game-changer

For the user, with the assumption that the application utilizing the beacons is already installed, these basic steps apply:

1. Walk around the physical world, with Bluetooth turned on.
2. Receive a notification about nearby offer, information about an entity.
3. The user chooses to interact with the notification.

Figure 2.3: Estimote beacon (Nalder, 2014)

Beacons provide indoor-positioning in an ad-hoc manner, and has the possibility of being more accurate with less effort from system administrators than the current solutions that exits today, such as Wi-Fi based positioning apps like Mazemap[12]. With beacons, there are no need to log in to the building's Wi-Fi, and there is no need for know the user's absolute position (in the world) since the context is determined dynamically by the closest beacon. Because it is not possible to receive GPS-signals indoors, the beacons provides a cheap way to deploy indoor-positioning.

Beacons provide relevant context for the user - when the user needs it. This context can be taken advantage of either by selling products in the store or for example help the visual impaired, which are the main usage areas as of 2016.

Major developers are involved in the development of the beacon technology. Apple and Google are both developing standards for beacons, the iBeacon and

[12]http://www.mazemap.com/

Eddystone protocols respectively. Some beacons are able to use both protocols, but only one at a time. There are also alternatives to these two protocols, but the ones mentioned here are really the leading choices for beacon producers. These protocols are described more in detail later in this section.

Functions

An application that uses beacons has two ways of interacting with beacons: **ranging** and **monitoring**. These are described below.

Ranging Works only in the foreground, i.e. the screen has to be on and active in order to work. When the phone is ranging, it scans after nearby beacons and retrieves an array of the nearby beacons based on their approximate distance (sorted by estimated distance from phone to beacon, with the closest beacon first). It needs to be clarified that ranging currently does work in the background on native Android applications, but not in e.g. an HTML/Javascript application or on Apple devices. However, this is discouraged due to increased drainage of the battery.

Monitoring Works by determining if the device has entered or exited a beacon's coverage area. When the phone is monitoring, it is listening for incoming Bluetooth packets, which is done in the background either with the screen turned on or off.

iBeacon

iBeacon (fig. 2.4) is a protocol developed by Apple, introduced in 2013. Devices that use this protocol broadcast an advertisement package that uses the following format: an iBeacon *prefix*, a *UUID* variable and a pair of identifying variables; *major* and *minor* (Cavallini, 2014).

The UUID is used to distinguish large groups of beacons, and the UUID the same for all beacons you own (you can use several UUIDs in the same application). The major and minor are used to further identify the iBeacon. The iBeacons are arranged in a hierarchical manner, illustrated with example beacons in table 2.1.

The iBeacon operates with no data payload except for its own identity. This message/broadcast is emitted repeatedly. It can e.g. broadcast a package every 20

Figure 2.4: Apple's iBeacon

ID	UUID	Major	Minor
4FDJ	f7826da6-4fa2-4e98-8024-bc5b71e0893e	1	1
8PSG	f7826da6-4fa2-4e98-8024-bc5b71e0893e	1	2
YP8U	f7826da6-4fa2-4e98-8024-bc5b71e0893e	1	3
FqWM	f7826da6-4fa2-4e98-8024-bc5b71e0893e	1	4
e3yq	f7826da6-4fa2-4e98-8024-bc5b71e0893e	1	5

Table 2.1: Our hierarchy of beacons

milliseconds, which gives high accuracy and low response times for applications that use that beacon, but the beacon battery is drained quite fast. Or, it can for example broadcast every 10 seconds (10000 milliseconds), which makes detection slower but the battery lasts significantly longer.

iBeacons can provide three types or degrees of proximity (Cavallini, 2014):

- **Immediate** (Less than 50 centimeters away)
- **Near** (Approximately between 50 centimeters and 2-5 meters away)
- **Far** (More or less between 2-5 meters and 30-50 meters depending on walls, the beacon output power and other factors)

These distances are very sensitive to effects of its surroundings, and are very much approximate.

Eddystone

Eddystone is a new protocol developed by Google, introduced in July 2015, that defines a Bluetooth Low Energy message format for proximity messages [13]. It is named after the iconic Eddystone lighthouse (fig. 2.2).

Eddystone's goals is to work on the most popular platforms; Android and iOS, working with existing BLE hardware profiles and flexible architecture to develop new frame types, compliant with the Bluetooth Core Specification. The protocol currently consists of three different types of frames; Eddystone-UID, Eddystone-URL and Eddystone-TLM. These are described below.

Eddystone-UID: Broadcasts a unique 16-byte Beacons ID; consisting of a 10-byte namespace ID and a 6-byte instance ID. The namespace ID functions as a group identifier, while the instance ID functions as a identifier within a group. It is similar to the UUID, major and minor of iBeacon.

[13] https://github.com/google/eddystone

Eddystone-URL: Broadcasts an URL. Makes it possible for any client to access that URL, whether you have installed an application to access it or not (requires a compatible device with Android 6.0 Marsmallow or newer). The Eddystone-URL forms the backbone of the Physical Web, which tries to enable effortless discovery of web-content surrounding the user.

Eddystone-TLM: The *telemetry*-frame is used to monitoring the health of the beacons that you own. The beacon can also monitor different sensors, for example if it is raining, the beacon can trigger an event to remind the person to bring an umbrella.

Physical Web

When using iBeacons, there is a need for an application if the beacon is to serve its purpose. Eddystone and Physical Web [14] tries to abolish this:

> *People should be able to walk up to any smart device - a vending machine, a poster, a toy, a bus stop, a rental car - and not have to download an app first. Everything should be just a tap away. ('The Physical Web', 2015)*

The goal of the Physical Web is to remove the need of having the users install an application for each individual company that supplies the public with beacons, or for companies and organizations that use them. An application for every beacon type and use is just not very practical.

The Physical Web works with the Eddystone protocol, and works by finding nearby URLs. Somewhat ironically, you have to install an application in order to show nearby URLs. However, there are plans for Android to work this into the operating system in the future. Plans for iOS are currently unknown.

Use cases

There are several different use cases for this new technology. Some use cases have already been adequately fulfilled by other technologies, but beacons can

[14] http://google.github.io/physical-web/

provide an improved solution for these cases, mostly because it may make increased automation and context use faster and easier. Below are different usage areas described. Some specific scenarios can also be found in section 3.2.1.

Museums One might say that museums are the perfect use case for beacons, as it makes sense to provide context for each object within the museum. Beacons are able to trigger events when the visitors are near an artwork, and users can receive more information about the artworks on their smartphones. The museum can receive more information about the movement patterns of visitors, and can use this information to e.g. understand which exhibits are popular and which are not so popular, or which routes visitors prefer to take through the exhibitions.

Museums can also make it possible to change the way visitors interact with the different objects in the museum. For school children there are ways of *gamifying* the experience; "Collect two more items from the Munch-exhibit to level up". For adults there can be audio guides that triggers on beacons placed near each artwork, and use this to provide an highly automatic audio tour to users.

Beacons can also make it possible to provide to indoor positioning for users - "where is the nearest bathroom", "where is the exit" etc. When having an infrastructure of indoor positioning, there are many possibilities of further building new functionality on top of that layer.

Retail Perhaps the first use of beacons, embedding beacons in a store makes it possible to provide coupons or other events to shoppers when they walk by said store. "Come inside and get a 10% discount on our delicious coffee".

A different approach is to integrate beacons with the store's existing application - given that it has one. If the user has an item on a wish-list, or has looked at an item or expressed interest in it, the application can guide the user to that item inside the store.

Indoor navigation The Wayfindr project [15] uses beacons to help blind people navigate the London Underground using their smartphones. It is a project currently under development. It is developed in cooperation with the Royal London Society for Blind People (RLSB). The application helps users find their way

[15] http://www.rlsb.org.uk/tech-hub/wayfindr

around the rather complex London Underground stations, and aids them in living independent lives and getting around town on their own. This technology can, of course, also be used by the seeing.

2.1.3 Bluetooth Low Energy

Using Bluetooth for beacons, it enables a more ad-hoc way of discovering proximity sensors. It is not limited to absolute positions, as GPS is. The underlying technology of beacons is Bluetooth. The first iteration of Bluetooth was developed by Nokia in 1994 and was designed as a short ranged technology. There is, however, some devices that can broadcast packages at range of approximately 100 meters. This may vary due to different objects blocking the signal (Holm, 2015).

The type of Bluetooth that is used in beacons and to communicate with them is Bluetooth Low Energy [16], which is an iteration of the existing Bluetooth technology. It was released in 2010, as an answer to the rise of devices that needed lower power consumption, but still operate at the same range and capabilities as the original Bluetooth. Examples of such devices are smart watches, fitness devices, beacons, and Point-of-Sale terminals. These devices are small and needs to preserve their battery, and thus the need for Bluetooth Low Energy is imminent.

2.2 User experience

This section explores the concept of *user experience*, by looking firstly at what it is and what affects it. The section focuses on user experience with regards to the use of smartphones, both separately and in the context of a museum, and explores the effects of different types of interfaces and interaction on user experience, with a focus on smartphones.

The term *user experience* (UX) is broad and not only used in the context of information systems. When used broadly, it encompasses several different aspects of interaction between entities. Nielsen and Norman (2014) describes user experience in the following way:

[16] https://www.bluetooth.com/what-is-bluetooth-technology/bluetooth-technology-basics/low-energy

> *"User experience" encompasses all aspects of the end-user's interaction with the company, its services, and its products.[...]True user experience goes far beyond giving customers what they say they want, or providing checklist features. In order to achieve high-quality user experience in a company's offerings there must be a seamless merging of the services of multiple disciplines, including engineering, marketing, graphical and industrial design, and interface design.* (Nielsen & Norman, 2014)

Nielsen and Norman further explains that to provide a good user experience to users, the user experience needs to "*meet the exact needs of the customer, without fuss or bother*".

> *'User Experience', often abbreviated 'UX', is the quality of experience a person has when interacting with a specific design.* (Knemeyer & Svoboda, 2006)

The definition of Knemeyer and Svoboda adds the concept of *design* into user experience. To further specify: the design of the companies, services and products end-users interacts with in the definition of Nielsen and Norman. It is worth noticing that the *user experience* term is used beyond the scope of human-computer interaction, both by Knemeyer and Svoboda, and Nielsen and Norman.

When the UX term is used in a context of smartphones in museums such as this project, we see that perhaps it is of little interest to establish a narrowed use of UX. As we will later see in section 2.3, the *context* term that is key to understand the research questions also encompasses a wide array of influence forces, just as UX does.

2.2.1 What affects user experience

Humans do not always experience things in the same way, and there will always be a certain degree of disagreement and having different perceptions of things. Despite this, there are certain ways of making an experience of use that will be pleasing to most of us. Morville lists seven requirements for good usability, and illustrates them in a "User experience honeycomb", see fig. 2.5. And, although

Morville seems to be mainly interested in development of websites, principles should be transferable to e.g. smartphone applications as they are quite general.

Figure 2.5: 'User experience honeycomb', (Morville, 2004)

The requirements by Morville for creating a valuable user experience are:

- Useful: The contend needs to be original and allow the user to perform a task he or she needs to do.
- Usable: The site must be easy to use.
- Desirable: It must be easy on the eyes and visually pleasing.
- Findable: Content needs to be easy to locate and navigate between.
- Accessible: User groups such as the visually impaired and the deaf must be able to use the site and access the content.
- Credible: The site must portray information in such a way that users trust both the site itself, how it works and what information is to be found there.

- Valuable: Must deliver value to those financing the solution, either by "advancing the mission" for non-profits, or contributing financially for for-profits.

Factors such as interaction styles and interfaces can potentially have a big impact on most of these requirements, which is why these topics are covered next.

2.2.2 Interaction

Interaction and *interactivity* are widely used words in the context of user experience. In order to understand the concept of interaction, it is useful to be able to divide it into smaller parts. Preece, Sharp, and Rogers (2015) describe four different *styles of interaction*. These four styles are as follows:

- Instructing
- Conversing
- Manipulating
- Exploring

These four interaction styles will be described below, based on the words of Preece et al. (2015).

Instructing interaction

This interaction style can be used to describe situations where users gets their tasks done by telling the system what to do. Examples used by Preece et al. (2015) includes giving instructions to print a file or instructions to tell the user what time it is. A benefit of instructing interaction is that it is quick and efficient, a useful property for actions that needs to be performed frequently.

Conversing interaction

Conversing interaction refers to the idea of perceiving the system as somewhat of a conversation partner, by having a system that reacts in a way one might expect from a human being. The presence of two-way communication is what differs it from instructing interaction. Examples used by Preece et al. (2015) includes the way users use search engines, where the user asks a question and the search engine returns a list of (potential) answers. The main benefit is that the interaction is familiar to the users - you are acting like you are conversing with another human being.

Manipulating interaction

Preece et al. (2015) define this as "*manipulating objects and capital[izing] on user's knowledge of how they do so in the physical world*". In manipulating interaction, objects remains visible while being manipulated, and the achieved results are immediately visible. An example of manipulating interaction is moving a file by dragging and dropping it in another location, while using a familier operating system such as Windows. Benefits include rapid learning for beginners, increased work speed for experienced users, and empowering users - making them feel in control.

Exploring interaction

Exploring interaction is explained by Preece et al. (2015) as "*users moving through virtual or physical environments*". Examples includes moving through virtual buildings, 'meeting up' with other virtual explorers in games, and using virtual reality devices such as the Oculus Rift[17]. Allowing users to immerse themselves in environments that are normally unreachable for them are one of the potential benefits, and making it easier to envision not yet built architecture is another.

[17] https://www.oculus.com/

2.2.3 User interfaces

We now have a way of categorizing the different types of user interaction. The interaction types will, however, have different properties when they are used on different types of user interfaces. In earlier days, interaction between humans and systems were more or less exclusively instructing, with the user using a keyboard or other buttons to instruct the system.

A user interface that relies solely on the use of the command line can be called a *command-line interface* (CLI)[18]. Command lines have several advantages, such as rapid and effective use for experienced users, and a low need for processing power. The main downside with command lines is that it is difficult to use for inexperienced users, having a large number of commands users need to learn before feeling comfortable with the interface. Another problem is that users can have a hard time grasping what is going on inside the computer.

In the 1970's, Xerox introduced personal computers that represented big leaps in the direction of today's modern interfaces, such as the introduction of the *desktop metaphor* [19]. The desktop metaphor makes it easier for the user to understand what is happening, by relating actions to concepts already familiar to users. Actions such as clicking a file, dragging it to the bin and releasing it there is quite easy for the user to understand. Although it is not *literally* a bin, the concept is similar enough for it to hold a value for the user.

Today the choices of user interfaces are greater. Three types of user interfaces will be described below; graphical user interface (GUI), tangible user interfaces (TUI) and natural user interface (NUI).

Graphical user interface

A graphical user interface (GUI) is the section of a graphical system that handles communication between the user and the system (Brookshear, 2008). The GUI term includes systems like a traditional computer with a screen controlled by mouse and keyboard, and more "all-in-one" touchscreen devices such as smartphones. It must be noted that the GUI does not encompass the *entire* devices, just the communication between user and system.

[18] https://technet.microsoft.com/en-us/library/bb490954.aspx

[19] http://www.ethanhein.com/wp/2009/the-desktop-metaphor-is-like-so-five-minutes-ago/

A key component of a GUI is the window manager, controlling the different parts of the screen and allocating the parts to different programs. The principle of manipulating interaction is also a key identifier in GUIs. The previously mentioned desktop metaphor is quite normal to use in GUIs.

Tangible user interface

> [...] *Tangible user interfaces give physical form to digital information, employing physical artifacts both as representations and controls for computational media.* (Ullmer & Ishii, 2000)

Ullmer and Ishii (2000) claims that the physical representation in TUIs is what separates it from more traditional user interfaces - with a clear reference to GUIs - is the physical representation. In a GUI the controlling devices can be replaced by different devices with the same abilities, but in a TUI the system is controlled by *representation of the objects themselves*. A mouse and keyboard holds little representational significance themselves, but in an example used by Ullmer and Ishii (2000) where small models of buildings is placed on a workbench to explore wind flow between structures, the models holds a great deal more representational significance for users such as city planners.

Natural user interface

> *Traditional GUI interaction models are flat, planar, and two-dimensional [...] In contrast, in a touch NUI interaction, models go beyond a simple plane to provide depth, encourage immersion and make objects appear to have volume or take on real-word three-dimensional (3-D) behaviors so people can navigate spatially in all dimensions.* (Wigdor & Wixon, 2011)

Wigdor and Wixon claims the word *natural* in this context refers to the way users *interact with* and *feel towards* the 'tangible', rather than the *tangible itself* being a natural interface.

The Xbox Kinect[20] is an example of a tool to provide NUIs to users. Although the environments produced for the Kinect are not always visually impressive (and

[20] https://en.wikipedia.org/wiki/Kinect

neither do they need to be in order to be NUIs), the focus is on the way users interact with the environment. This harmonizes with Wigdor and Wixon's claims that natural and intuitive interaction is a key property of the TUI.

2.2.4 Mobile screens

We can safely assume that a majority of smartphone users has a smartphone with touch screen. In total almost 97% of smartphones sold in the second quarter of 2015 used either Android or iOS as its operating system[21] - operating systems that are designed for the use of touch screens[22].

Siegenthaler, Bochud, Wurtz, Schmid, and Bergamin (2012) lists four things to consider when designing with UX in mind for touch screens, both for pleasing the users and for evaluating how pleased the users are:

- Navigational structure should be adapted to the type of user interface.
- Users past experience with touch screens should be considered.
- When evaluating input technologies with short tasks, setting a time limit for each task ensures that participants get to attempt all of the tasks.
- Alternative technologies, such as touch vs. physical buttons, can be evaluated for usability even when newer models of the products may soon be released.

Whether or not these considerations are met when designing an application, will inevitably affect the user experience.

Heads-down phenomenon

The *heads-down phenomenon* is the phenomenon of small handheld screens, such as the screens in smartphones, taking much of the focus of the user, in such a way that he fails to notice his surroundings (Lyons, 2008). Lyons describes users feeling isolated both from the museum experience and from their company, because

[21] http://www.idc.com/prodserv/smartphone-os-market-share.jsp

[22] https://developer.apple.com/library/ios/documentation/UserExperience/Conceptual/MobileHIG/InteractivityInput.html

uf this effect. When using handheld screens, users have a *tendency to stare fixedly at a handheld device for long periods* and *a lack of awareness of the surrounding context* (Lyons, 2008). Furthermore, Lyons suggests that visually complex interfaces will lead the users to spend more time looking at their smartphones, and shifting their attention to and between artworks less frequently, than when such a personal interface is not available.

2.2.5 Mental models

There are ways of getting your users to instantly know what they should do when they're looking at the current system. This may be through the use of metaphors, i.e old diskette used for *save* or a picture of a house to go *home* in a web browser, or through other concepts familiar to users.

D. A. Norman (1983) defines a mental model as a *naturally evolving model*. He elaborates that the mental model matures after interaction with the system, i.e. evolves through learning. D. A. Norman further writes that there are four different things that needs to be taken into account when thinking about mental models:

- The target system
- The conceptual model of that target system
- The user's mental model of the target system
- The scientist's conceptualization of the mental model

The *target system* is the system the person is using, and the designers may have developed a conceptual model for that system. The *conceptual model*, made by system designers, is to ensure that the target system is being properly represented, being accurate and complete. The user's *mental model* is constantly under development; users may get different input on how to interact with the system, thus the mental model is developing. Other factors may also constrain the mental model, such as the user's technical background or previous experience with similar systems. The *scientist's conceptualization* of a mental model is the scientist's interpretation of that particular mental model (D. A. Norman, 1983). Mental models, conceptual models and metaphors will be further described below.

Mental model A mental model is how a user perceive and understand the target system either before or during the use of the target system. The model represents a person's ability to think how the system works. The model is unstable and will likely change throughout different interactions with other users or their own use of the system. The model is built on-the-fly and is based on earlier experiences and the user's own perception of the system (Davidson, Dove, & Weltz, 1999).

Conceptual models The purpose of conceptual models is to provide an accurate representation of the target system. The model is built by designers in order to express the concepts in an orderly fashion, and it functions as a tool for understanding the use of a new system. The designer's assignment when developing conceptual models is to communicate the target system to the user, and it is therefore important to analyze the user in order to know the audience.

The user's mental model is developed through the interaction with the target system. The target system then corresponds with the appropriate feedback when the user interacts with the system. The designer has a set of assumptions of the user model, and if the target system is not clear, i.e not issuing the right feedback, the user will end up with the wrong mental model (D. A. Norman, 2001). A conceptual model should thus take into consideration what kinds of mental models users can and should end up with. Figure 2.6 explains the conceptual model.

Metaphors the users' mental model can vary from person to person. By representing concrete and familiar ideas to users, the metaphor serve its purpose of visualizing the conceptual model of the designer. Either by using e.g. a *thrash can* on the *desktop* or by simulating motions on different objects on a screen.

2.2.6 Feedback

Feedback is defined by D. A. Norman (2001) as *sending back to the user information about what action has actually been done, what result has been accomplished*. D. A. Norman compares it with talking to someone without hearing your own voice or drawing a picture with invisible ink, in both cases there would be no feedback. He continues with the example of the early days of the telephone. The designers of the telephone were concerned about the right amount of feedback

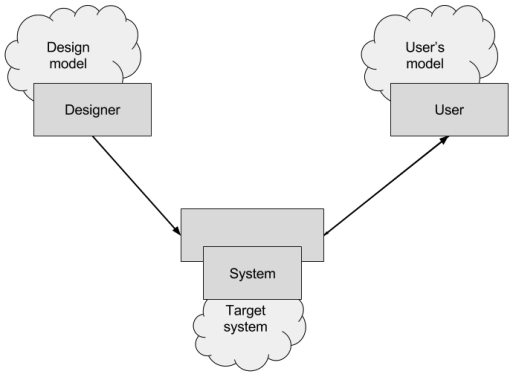

Figure 2.6: Conceptual Model, (D. A. Norman, 2001, p. 16)

in their current system., and the buttons provided tactile feedback, as well as a tone in the earpiece for each push. The callers voice was also heard in their own earpiece to control how loud they were talking. In these days, according to D. A. Norman, there are new designs with far more powerful and new functionality with the added price of greater complexity, some of which has less feedback.

Renaud and Cooper (2000) states that feedback should have two desirable features; *immediate feedback* and *archival feedback*. Immediate feedback consists of informing the user about the current system state and explaining the unusual occurrences and errors. The user should also feel that he/she is in control, and an action should not make the user doubt what is going on. Archival feedback is a way of helping the user remember things (Renaud & Cooper, 2000). Figure 2.7 illustrates how a classification of the nature of feedback is constructed.

Automation

In his paper, D. A. Norman (1990) also address the problem with automation. However, he emphasizes that the problem with automation is not the automation itself, but the lack of proper *feedback* to the users.

Norman studies three different cases where automation has escalated into an serious situation, e.g. not notifying the captain and crew of an aircraft that the autopilot had compensated for the weight imbalance caused by a fuel leak.

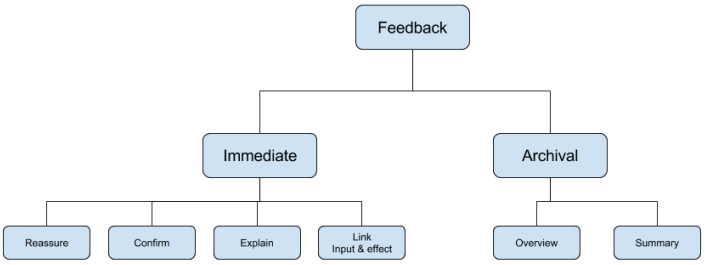

Figure 2.7: A classification of feedback

D. A. Norman continues with explaining the concept of a *feedback-loop*, meaning that the system has a desired state it wishes to fulfill. If there was an error in the system, the human behind the control panel could perform additional error corrections. With the move of towards higher degrees of automation, operators simply monitored the system. Whereas the human using the not-very automatic system could be considered as "being in the loop", the user monitoring the automatic system is more "out of the loop". The different cases that Norman presents, states that there were no issues regarding automation as the problem, but rater a "... lack of continual feedback and interaction".

He further states that presenting feedback appropriately is a difficult task. The balance of many and few notifications to the user can pose problems, both to the user and the system. *Overuse of alarms* (D. A. Norman, 1990) is a example of giving too much feedback to the user, resulting in people ignoring the problems that occur.

Norman explains that without the proper use of feedback the users are out of the loop, and therefore not able to know properly if an action or a problem has occurred. The *mental models* that the users visions are therefore not properly formed since the system image does not provide with satisfactory feedback.

Eco-feedback

With the current advancements in ubiquitous computing there is a need for change in behavior on how we as people interact with the different technologies. In order to understand how this behavior is changing, we need to understand how users

can get the correct feedback from the correct context, and how people act based on this feedback. In the coming section we explore the concept of *eco-feedback* and how people could change their behavior to react to their environment/context/surroundings. We illustrate with three different studies that have explored this topic.

Froehlich, Findlater, and Landay (2010) defines eco-feedback technology as a technology that provides feedback on individual or group behaviors with a goal of reducing environmental impact, based on the hypothesis that most people lack awareness and understanding on how their actions affect the environment. Froehlich et al. continues that the eco-feedback can be seen as an extension of research in *persuasive technology* (technology intended to change attitude or behavior of users) and the research goes back over 40 years ago with the research in environmental psychology. The last few years have however sparked the interest of eco-feedback technologies both within the HCI and Ubiquitous Computing domain, which have built systems regarding energy consumption, water usage, transportation and waste disposal practices (Froehlich et al., 2010).

In Froehlich et al. (2010), Strengers (2011), He, Greenberg, and Huang (2010) there is a push towards behavior change in people's everyday life and understanding how eco-feedback can help the users towards pro-environmental behavior. However, as He et al. (2010) states, there is no "one-size-fits-all" technology for all users, as because there are different people with different interests, the technology cannot provide the same feedback for everyone. He et al. (2010) apply the *Transtheoretical Model* (TTM) for behavior change, which stems back to health psychology (e.g addiction studies), whereas the Froehlich et al. (2010) looks into environmental psychology.

Froehlich et al. (2010) explains that in the TTM the person move through stages of behavior change, e.g. when trying to quit smoking: when trying to change behavior regarding the environment, different persons might not necessary move through the same stages as in the TTM. Froehlich et al. addresses their concern of using the TTM since the goal of eco-feedback is to change the behavior, not to stop entirely of using energy. If a person gets eco-feedback regarding excessive use of hot water, he will naturally not stop showering all together, but reduce the use of hot water. However, Froehlich et al. state that behavior change literature provides a rich corpus of behavior change techniques and should be in-

vestigated further.

Strengers (2011) studies different households that have taken use of systems that provide eco-feedback. The testers are people with an already established interest of pro-environmental change. The systems issued eco-feedback regarding water and energy usage. Strengers concludes that the system used in the paper remains limited in scope and potential audience, appealing only to those already interested in saving energy and water. A need for focusing on everyday life through ethnographically studies with households that dominate consumption in the home in contrast to the already interested in eco-feedback.

He et al. (2010) investigates the possible outcomes of different feedback-mechanisms facilitated by their own motivational frameworks. They use an imaginary energy user - *Mary*, and exemplify with a scenario. The scenario is iterated through its framework based on the TTM of behavioral change. Each stage is illustrated with a goal, a rationale and an example. Each example presents a way of displaying each stage with different feedback-methods in order to change the energy user's view towards proenvironmental impact.

Froehlich et al. (2010) compares different studies regarding the eco-feedback environment. Froehlich et al. presents two different views of models for pro-environmental behavior; *rational choice models* and *norm-activation models*. Rational choice models are the behavior driven by self-interest, and norm-activation models tends to be used by researchers who views pro-social motives as important aspects (Froehlich et al., 2010). Froehlich et al. (2010) stresses the importance of these models for HCI-designers, as they are needed in order to understand the behavior of their users. Eco-feedback to the already pro-environmental people are not necessary of importance to the skeptics of environmental change in behavior. Froehlich et al. (2010) explains;

> *Eco-feedback designers, whether conscious of it or not, imbue their designs with some theory of human behavior. [...] However, how the technology presents this information is fundamentally based on how the designer believes humans behave and react. It is important, then, to begin questioning and exposing the theories used in eco-feedback designs and, when possible, to relate them back to work in environmental psychology.* (Froehlich et al., 2010, p. 2001)

Each article stresses the point of understanding behaviors of different users and how the HCI-designer should utilize the different methods and frameworks that are available from earlier studies in both environmental- and health psychology with regards to behavior change. The rise of ubiquitous computing allows for cheaper and smaller hardware into both the home and public sphere. The authors of the previously mentioned articles state that HCI-designers should look into new studies with focus on eco-feedback to explore how they could change behavior of people in sake of a better environment. The different methods that are within the HCI-scope provides a better understanding of how and why users interact and/or change their behavior.

2.3 Context

Context is an elusive term. You might have an instinctive feeling about what it means and what it comprises, but most people do not have a concrete definition. Several suggestions have been made, all with their benefits, but let us start with the one by Abowd et al. (1999):

> *Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves.*(Abowd et al., 1999)

When analyzing the words of Abowd et al. (1999), we find that the *entity* is the central essential part of context. Without an entity, there is no context. In the case of this project, entities may be e.g. rooms, museums, artworks, smartphones etc. All these entities are in contexts.

Everything that affects the entity is part of its context. Abowd et al. (1999) states: "*If a piece of information can be used to characterize the situation of a participant in an interaction, then that information is context*". However, whether or not a specific piece of information can characterize the situation of an entity is very much up for discussion. As an example, let's take a look at a person looking at a painting hanging in a museum. One might argue that the interaction between

the person and the painting would be the same whether the gallery is in Oslo or Beijing and that the surroundings of the gallery is not part of the context. But, one might also argue that the culture that surrounds the gallery will very much affect the relationship between the person and the painting, affecting how the person experiences the painting, and thus the surroundings should be considered part of the context.

> *If a piece of information can be used to characterize the situation of a participant in an interaction, then that information is context.* -(Abowd et al., 1999)

Chen and Kotz (2000) has an alternate definition, which is quite similar to that of Abowd et al. (1999). However it brings more attention to the user;

> *Context is the set of environmental states and settings that either determines an application's behavior or in which an application event occurs and is interesting to the user.* - (Chen & Kotz, 2000)

However, whether or not a specific piece of information can characterize the situation or be interesting to the user is very much up for questioning. As an example, let's take a look at a person looking at a painting in a museum. One might argue that the interaction between the person and the painting would be the same whether the gallery is in Oslo or Beijing and that thus the surroundings of the gallery is not part of the context. But, one might also argue that the culture that surrounds the gallery will very much affect the relationship between the person and the painting and therefore the situation, and thus the surroundings should be considered part of the context.

As the reader can observe, one might argue that pretty much everything is part of every context, if one takes the time to do so. To use context as a part of a study therefore requires constraints and limitations, as well as focus on what is important and what is not.

2.3.1 Properties of context

The scope chosen for this thesis makes it natural to focus mostly on *position* as a part of the context, but it is important to understand that there are other properties

to context as well. Schmidt, Beigl, and Gellersen (1999) elaborates on the topic, with a focus on time and sensor data as part of context. And, although the article was written in 1999 and is now somewhat technologically outdated and what he calls *wearable computing* may now also be said about smartphones and other technologies we might not regard as *wearables* now, but he still makes some sound arguments.

> *A few key observations can be derived from the analysis of work on context-aware mobile computing. [...] the use of location is dominant but often in approximation of a more general context, for instance guide tours establish the surrounding context indirectly based on location sensing. Third, sensors can be employed to advance context-awareness beyond location-awareness, but obtained context tends to be either of low abstraction (e.g. noise level, temperature,...) or carefully crafted for specific applications (e.g. user's level of attention).* - (Schmidt et al., 1999)

2.3.2 Position

For the purpose of this thesis, we believe *position* is a key factor of understanding context and how context affects the situation of the user. By *position* and *positioning*, we mean the process of determining where you are, both *relative to other entities* as well as *absolute position* within a building, city, country etc.

Knowing where you are - outdoors

Throughout the history of the modern human, people have discovered more and more accurate ways of determining their position in the areas that surrounds them. Our ancient ancestors used knowledge of the stars in the sky and recognition of the landmarks that surrounded them in order to find their way home after hunting, and sea captains could use technologies such as the sextant[23] to determine their position in open water.

Today we have the Global Positioning System (GPS) to help us determine where we are in the world, and it is able to determine a very accurate position

[23] http://www.pbs.org/wgbh/nova/shackleton/navigate/escapeworks.html

when there is a clear line of sight between the GPS device and the satellites. In addition to GPS, one can also determine ones absolute position by for example using maps and compass.

Knowing where you are - indoors

As has been previously stated in this chapter, GPS does not work well indoors. It might actually not work at all, if there is no contact between the user's device and the GPS satellites. To determine indoor position, the position within the building or structure, we need a different strategy. In a building such as a museum or a shopping mall there are usually floor plans available, either as a brochure, a map on the wall, or both. The stationary map usually tells the user where he or she is right now, and makes it easier to understand where in the building you are and how to get to the other parts of the building. A brochure you can carry with you lacks this immediate information about where you are, but if the map is good it should not be very hard to work out where you are.

Some technologies can be helpful in providing indoor position recognition services to visitors, as has been explained in the technology section in this chapter. But, has we have established, context encompasses more than just the entity's position in the world or in a building.

Relative position and context

Knowing where an entity is in relation to other entities can also help decide if this is a part of the context or not. If you arrange a game night with your friends, you probably don't need to know where you are in relation to the approaching thunderstorm. But, if you decide to go for a swim outdoors instead, you should really know about that thunderstorm. Knowing the position of the nearest toilet or not when you are looking at a painting in a gallery does not affect the interaction between person and painting. But, if the painting next to the one being watched has something to do with the one that is being watched, the position of that painting might affect the context of the paintint that is being watched.

2.3.3 Users and understanding of context

How do one determine what "*is considered relevant to the interaction between a user and an application*"(Abowd et al., 1999)? We all have different experiences, education and interests, and will observe in different ways. If go it this direction with regards to the definition of Davidson et al. (1999), context is *relative to each person*. This makes *context* even more complex. Schmidt et al., 1999 introduces two approaches for acquisition of context from a system's point of view;

> *The first is based on smart environments that provide an infrastructure for obtaining context and for providing context to mobile applications. [...] The second approach is to embed sensors in ultra-mobile devices to acquire context related to the physical environment with the obvious advantage of not having to rely on infrastructure, and to be applicable in any environment.* - (Schmidt et al., 1999)

As an attempt to move our focus of context acquisition towards how *users understand context*, we take a look at the process of *understanding where you are*. This includes a simplified view on context, which as we know by now involves more than position, but let's choose to ignore that for a while and look at Montello and Sas (2006) and the role of context acquisition in a wayfinding process:

> *A fundamental information requirement of wayfinding is that travelers are aware of their location relative to their destination, and to other places or objects [..]. That is, they must be oriented.* - (Montello & Sas, 2006)

Although Montello and Sas (2006) are mainly concerned with what they call *wayfinding*, they acknowledge the steps of the travel process of *orientation*. This might be quite transferable to what one might call *acquiring context* or *context acquisition*. In the process of orientation the traveler doesn't need to know everything about the location he or she is currently in; they merely need to acquire enough information so that they can continue on towards their destination. Acquiring context can be seen in a similar way; there is no need in acquiring knowledge of everything in the surroundings, but just that which is relevant for the situation.

We end this section with an attempt at defining *acquiring context* for further use in this thesis:

> **Context acquisition**: *The process of determining and acquiring relevant knowledge of entities considered relevant to the interaction between person and object*

2.3.4 Context awareness and ubiquitous computing

We have now established what context is, and what the process of acquiring it is. Now we will look at *context awareness*. Let us return to Abowd et al., and how they define context awareness ;

> *A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task.* (Abowd et al., 1999)

Chen and Kotz (2000) splits context awareness into two separate parts;

> ***Active context awareness**: an application automatically adapts to discovered context, by changing the application's behavior.*
> ***Passive context awareness**: an application presents the new or updated context to an interested user or makes the context persistent for the user to retrieve later.*

From these definitions, we can draw a few conclusions about the nature of context aware systems:

- The information a context aware system provides to its users changes depending on the circumstances.
- The provided information is relevant to the situation of the user.
- Information may or may not be preserved for the user for when the user is no longer in the context in which the information was presented to the user.

Ubiquitous computing

Context awareness is closely linked with *ubiquitous computing* and the *Internet of Things*. Ubiquitous computing is the term used for the ever more present computers, using the term *computer* in a wide sense. Smartphones, microwaves, tablets, information boards at a bus stop, the smart watch on your wrist - these are all computers. When we look at computers this way, it is quite clear that computers are indeed *ubiquitous*.

Internet of Things

When computers are ubiquitous, the possible uses of them sharply increases when they can talk to each other. Perhaps the most familiar mode of communication between computers is the Internet. With the advances that has been done in technology in recent years, connecting a device to the Internet is neither hard nor expensive, allowing for increased functionality without a massive increase in price. When the price and size of small computers has decreased as well, fitting "things" with computers is very feasible. Connecting all these *things* to the Internet, which previously consisted of more "traditional" computers, is what transforms it into the *Internet of Things*.

2.3.5 Context aware communication

Interaction between humans is what we may traditionally think of when the word *communication* is mentioned. For the purpose of this thesis, however, we believe communication should be included in the topic of context and context awareness, because the way information is mediated to the user can affect user experience. This section explore the role context and context awareness plays in communication.

Schilit, Hilbert, and Trevor (2002) defines *context-aware communication* as "*...the class of applications that apply knowledge of people's context to reduce communication barriers*". For applications that provide such context, a two-dimensional space is proposed where the dimensions are *communication action* and *context acquisition*, as seen in fig. 2.8. Communication action means what action is required for communication to happen, and if that is an autonomous

or manual action. Context acquisition is how the context is acquired, manual or autonomous, i.e have people entered their context by themselves or has a computer system acquired this for the user.

Schilit et al. describes different systems that adopts five different types of context-aware communications; routing, addressing, messaging, providing caller awareness, and screening. Each of these systems is categorized based on their level of autonomy with respect to their context acquisition and communication action:

Routing Schilit et al. (2002) describe a phone system that is able to automatically route the phone call based on the user's context. The first iteration of the system required the user to log into the phone where they were situated. Different ring tones were used to distinguish different user that were logged in the same phone. The second iteration required the users to to wear an active badge, enabling the system to detect whether the user was in that specific room.

The system was designed to aid the receptionist in order to track down people and then manually track down calls. Later a proof of concept was developed to allow the system to automatically route calls. However, this system lacked human judgment to track down people, thus leading to faulty routing. Schilit et al. (2002) states that *when the automation increased, the intelligence of the system decreased.*

Addressing Addressing in context-aware communication is to determine which people should be included in the conversation based on their context. Schilit et al. (2002) describes a mailing-list that is context-aware. The system sends messages to people that is situated within a given location. This makes it possible not to spam users that are not applicable to said message.

Messaging With messaging the goal is to provide the right information at the right time. If the user is a is within a specific location, the user is notified and can inspect the relevant text or audio item. Schilit et al. (2002) place these kind of applications within the automation scale for both context acquisition and communication action. The MIT's Active Messenger that is described in the article priorities the email messages that the user receive and provides with contextual

messages for the device the user is nearest. The messages is prioritized by using the user's calendar, contacts, and email

Providing awareness Systems that provide awareness helps users to see what state their recipient is currently in, thus checking if the user is available for communication. Facebook[24] does this by providing a cell phone icon in their chat. Other examples included of providing users with messages if the printer is out of paper or whether a colleague has been at work today.

Screening Call screening includes the different contexts that the recipient is currently in, such as whether the user is alone at home or is at work. By enabling screening to the users, the caller can choose whether it is an appropriate time to call.

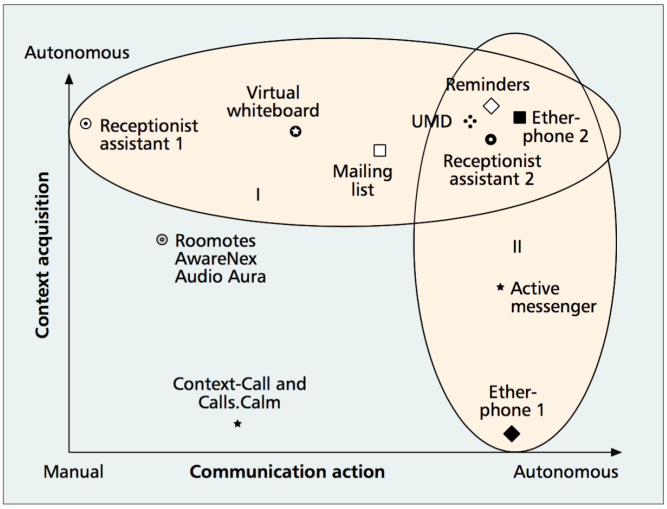

Figure 2.8: Context-aware communication dimensions

Figure 2.8 has the different systems that are described into their respective categories. For example; "Receptionist assistant #1" has the user's context automatically acquired but requires a receptionist to forward the call - hence the manual communication action.

[24]https://www.facebook.com

The cost of autonomy

Schilit et al. concludes that an increase of autonomy of both communication actions and context acquisition is much desirable, however it may come with a cost. With context acquisition becoming fully autonomous the user may feel that their privacy is violated. With communication actions becoming autonomous the users may notice a reduction in common sense. Schilit et al. continues with five points to consider when a context-aware communications system is designed:

- **Improving relevance:** Decide when the communication is relevant
- **Minimizing disruption:** When should the system notify?
- **Improving awareness:** Provide awareness for the user so the user can make a intelligent decision.
- **Reducing overload:** Filter out communications that don't apply for the current context
- **Selecting channels:** Which device should be used? When the person is using the computer, should the phone ring as well.

However, even if all these points are covered, Schilit et al. (2002) emphasize that it's difficult to tell which context is useful for the user and how the different sensors can provide with this information.

2.3.6 Context and user experience

In section 2.2, we established some things that can affect how users experience an application. When context and context awareness is also taken into account, we need to expand upon the topic of UX.

Revisiting the four interaction styles, the *conversing* style applies when context matters in a system. Although the context itself does not speak with the user, it acts in a way that is expected from the point of the user, and this may thus be regarded as a form of conversation. It is not instructing, as it requires an action from the user other than just telling the system directly what to do in order to get the desired information.

Context awareness very much also is a part of the *exploring* interaction style; *users moving through virtual or physical environments* (Preece et al., 2015). The environments users move through are very much physical, but with the addition of context awareness this environment can also be combined with virtual enhancements.

In addition to location based context, context aware applications also change depending on what the user is *doing*. When we take another look at the *user experience honeycomb* by Peter Morville (Figure 2.5), we observe that an application that give the user relevant information based on both position and action, there is a real possibility to fulfill several of the requirements Morville believes makes up a good user experience.

Schmidt et al., 1999 states two ways what he call *ultra-mobile computing* can benefit from context awareness: reacting to to changes in the environment and adapting accordingly, and improvement of the user interface. The second way is perhaps the most immediately visible to users, although adapting to changes in the environment as previously stated also definitely has its uses.

2.3.7 Interaction with computers in museums

The complexity of relationships between users and other entities increases with every entity added to the 'pool' of relationships. This sections looks at the increasingly complex relationships between user and computer, both through developing technology and by change of location. We begin off with a look at the traditional use of stationary computers, and end with the context of the applications developed in this project. This section is thus intended to help readers understand the specific context of this project, and is thus not very transferable to other contexts. The different stages are:

- The traditional relationship between user and computer. Consists of user and computer (fig. 2.9)
- The traditional relationship, with the addition of context. Consists of user, computer and context (fig. 2.10)
- A more complex relationship, where an artwork is added to the pool of relationships. Consists of user, smartphone, artwork and context (fig. 2.11)

- An even more complex relationship, where beacons comes in as a fourth entity. Consists of user, smartphone, artwork, context and a beacon (fig. 2.12)

Traditional relationship between user and computer

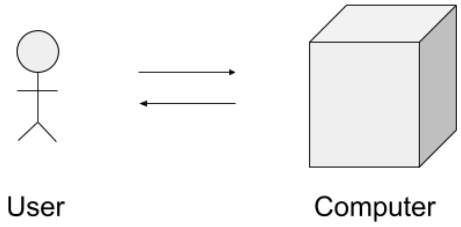

Figure 2.9: A simple look at the traditional relationship between user and computer

This section refers to fig. 2.9. By referring to this as a 'traditional' relationship, we in this case mean that the relationship is like the one you find when a user is using a stationary computer, in for example an office or at home. Neither the user nor the computer is directly affected by the surroundings (except physical effects on the user such as e.g. temperature, of course), and given that the computer is connected to the Internet if that is required for the tasks that are to be executed. The relationship between user and computer is mutual; the user gives his instructions to the computer, and the computer returns feedback.

Traditional relationship, with context

By adding *context* to the traditional relationship described above, the total relationship gains complexity (see fig. 2.10). Such a relationship is relevant for example in a museum, where a stationary computer of some sort is used to control parts of the exhibition, such as activating mechanisms. The user now not only receives feedback from the computer, but also from the context he find himself in.

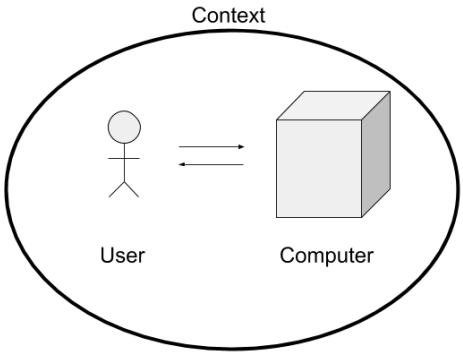

Figure 2.10: The traditional relationship between user and computer, with the addition of context

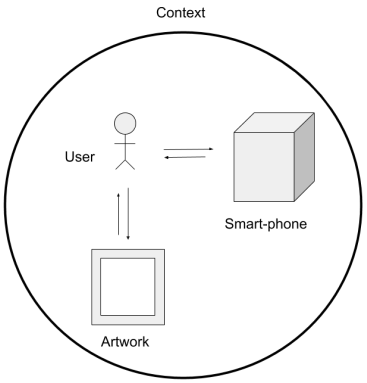

Figure 2.11: The complex relationships in a context, with user, smartphone and artwork

Relationships with smartphone and artwork

This relationship (fig. 2.11) is not all that different from the previous relationship, but has one distinct difference: the computer is now portable and personal, i.e a smartphone. As a result of this, the smartphone can be used in several different contexts in stead of always finding itself in the same fixed position. This means that the smartphone and not only the user needs to communicate with the context, in order to understand where it is and behave accordingly. This can, however, be difficult when it has no way of determining the context, and can thus not easily provide context relevant information to users.

In this figure the artwork is also displayed as a separate entity from the context to illustrate its importance compared to the rest of the surroundings, but it can just as well still be regarded as one with the rest of the context.

User, smartphone, artwork and beacon

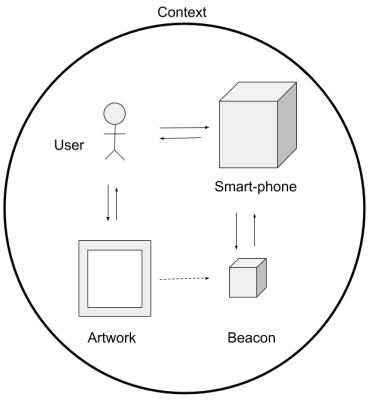

Figure 2.12: The complex relationships in a context, with user, smartphone, artwork and beacon

When beacons are added to the already quite complex mix of relationships, the way the smartphone interacts with its surroundings change (fig. 2.12). Users do not interact directly with beacons, but rather through their phones. Beacons provides an easy way for smartphones to acquire context, and gives applications a greater opportunity to provide context relevant information. The link between

context and beacon is here illustrated by a dashed arrow, but can, as in the previous relationship illustration, be seen as communication from the context to the beacon. What we mean by this, is that each beacon (or groups of beacons) represents a specific context, even though it is not aware of that. It simply broadcasts its identity, but when the smartphone combines its knowledge of beacons and its context, it can determine more accurately than before the properties of that particular context.

Chapter 3

Methodology

This chapter describes the methodology and methods that have been used in this thesis, as well as why these methods are appropriate for this research. We have performed a qualitative case study, and the following methods have been used in this thesis:

- *Workshop*
- *User testing*
- *Interviews*
- *Prototyping*

These methods will be presented in this chapter, after the methodology, and then followed by an analysis of the mentioned methods.

3.1 Research methodology

There are different approaches on how to tackle a new subject of research, the most common being *quantitative research* and *qualitative research*. This thesis is the latter. Quantitative research seeks to find solid numbers on measurable characteristics, which requires a large number of research participants to become valid

research. Common methods for quantitative research includes objective measurements based on analysis of data through polls, questionnaires and surveys. Golafshani (2003) states that this allows the researcher to familiarize with the problem or a concept to be tested and perhaps generate a hypothesis to be tested. Golafshani continues that a quantitative researcher may prepare a list of behaviors to be checked by the observer using a *predetermined scale* as an instrument in his/her research. Our thesis does not seek to measure anything, but rather explore in what way beacons affect the museum experience, a predetermined scale of behavior with a quantitative research question such as ‘*How much better or worse does the use of beacons [in a certain way] make the museum experience for [a specific type of use]*”, would make our research dramatically different and we would no be able to answer the same research questions.

Qualitative research goes in-depth and has the potential to describe peoples thoughts and actions, beyond just documenting them. Common qualitative research methods include interviews, observation, workshops/focus groups. There are several different approaches to qualitative research, but they all include one or more of these in one form or another. Golafshani (2003) defines qualitiative research as “*any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification*” and continues with “... *findings arrived from real-world settings where the phenomenon of interest unfold naturally*”.

To reiterate, we do not want to measure anything. Research regarding a new technology requires an understanding of the phenomenons it affects, and by having a predetermined scale of measurement on the user’s behavior, this would be difficult. In addition, we believe it could be difficult to obtain valuable research participants. Beacons are not an established technology, we therefore believe it would be more useful for us to ask questions along the research and - perhaps equally important - answer any questions the participants may have.

This thesis can be characterized as an interpretive study, and thus finds itself within the *interpretivist paradigm*. The world, within the study, only appears through social constructions (Myers & Avison, 1997). For our study, these social constructions will be shed light upon by the methods explained in section 3.2. The research will be affected by the different opinions stated by the participants as well as our own understanding of the user’s perception of the technology.

A positivist paradigm is not preferable for this kind of study, as this requires a "system" which is objectively given. It is difficult to replicate the results since the visitors that have participated can have different opinions on the subject. According to Myers and Avison (1997) positivist paradigms is used when a theory is being tested. We are however not interested in hypothesis testing as we are more interested in the depth of the phenomena; how beacons affect user experience in a museum setting.

Flyvbjerg (2006) describes a *case* as a "*detailed examination of a single example*" and can be used in the preliminary stages as a pilot methods. Stake (2005) explains a case as a "*specific, unique closed system*". Our closed system will be the visitors in a museum, more specifically the visitors that test proximity-based technology in a museum, see chapter 4.

Stake (2005) identifies three different types of case study; *intrinsic case study*, *instrumental case study* and *multiple case study*. This thesis uses the intrinsic case study, as the scope chosen affects the results. If the scope had been different, such as research in a different museum, the results could have been different. There are, however, definitely also parts of instrumental case study that applies to this project, as we are also interested in the topic outside of the new National Museum itself. So, perhaps it would be the most correct to say that it is a *combination of intrinsic and instrumental* case study.

3.2 Methods

In order to gain understanding from a user perspective, we supervised a *workshop* with potential visitors and users to the new museum. Additionally, *user testing* was conducted in two iterations; testing the first application with fellow students, and testing the second application with real museum visitors in a museum setting. The first test was conducted with a Meteor/HTML5-application, and the second user test in the museum was conducted with an Android-application. Participants in the first test was fellow students, and participants in the second test was museum visitors. During all tests we observed the interaction between the users and the technology. We also answered questions that the testers had during the tests. After the first test we conducted a *post-test interview* with the participants. We also conducted an expert-interview with Associate Professor Palmyre Pierroux, in

addition to a workshop with fellow informatics students. Both applications used for the tests have been developed by us. All these methods will be discussed in the following sections.

3.2.1 Workshop

The method we call *workshop* in this thesis is very similar to what can be called *focus group*. As we believe neither has a distinct definition that really separates them from each other, and as the differences between them are not that big, we have decided not to separate them and treat them both under the term *workshop*. The term *focus group* might thus also apply.

The overall goal of conducting a workshop was to provide a better understanding of proximity-based technology as seen from an user's perspective. See appendix D.3 for full transcript of workshop.

The DECIDE-framework (Preece et al., 2015) consists of six steps to plan and evaluate workshops (see table 3.1).

Determine	The goals to be addressed in the workshop
Explore	The questions that is to be answered
Choose	The techniques and paradigms that are suitable for the questions
Identify	The practical issues such as selecting candidates
Decide	How to deal with ethical issues
Evaluate	Interpret the data

Table 3.1: DECIDE-framework

How we approached each of the steps in DECIDE will be described below. Note: every step below was done before the conduction of the workshop, and is thus written in future tense. The 'Evaluate' step was performed after the worshop was conducted, and the results can be found in section 5.2.

Determine We want to collect data on what people think about the beacon technology, with a special emphasis on positive and negative aspects.

Explore On this step we differed somewhat from the guide. Questions to be answered are not easily defined in our case, as we have a more exploratory perspective than perhaps most workshops.

Choose We provide five scenarios to the participants, as a starting point for discussion. The scenarios vary in types and *personas*, written so that the participants can relate. The scenarios will be dealt with one by one, with a moderator reading the scenario out loud to the group, and then starting the discussion by asking for their first reactions to the scenario. We ask explicitly for both positive and negative aspects. When all the scenarios are discussed, we end off with a discussion about the use of mobile devices in museums.

Identify Practical issues are identified, and concerns such as selecting participants is one of the main concerns. We are conducting a workshop with fellow students, and that might lead to biased answers but it might also lead to increased conversation. They all share an interest of technology and system development. Another concern is whether the participants could relate to the scenarios that were presented or not. The concerns are further addressed in section 3.3.2.

Decide We will maintain the anonymity of the participants, and not reveal information that can identify them.

Evaluate The results of the workshops will not easily be reproduced by others, and is subject to qualitative interpretation. This low degree of reliability and verifiability require thorough supplementary work by us, and the workshop is fully transcribed (see appendix D.3 for full transcripts). Potential biases needs to be assessed, so that we are aware of them when interpreting the data, see section 3.3.2.

Scenarios used in workshop

The scenarios are designed as neutrally as possible, to try to avoid any biases. We have tried to make the scenarios as self explanatory as possible, to avoid any potentially biased comments or explanations from us when further explaining them

if that is required. There are five scenarios, and they are all described in brief below. For the full text of each scenario, please see appendix B (in Norwegian).

Scenario 1 - Museum tracking Describes how a museum worker and the museum may benefit from tracking visitors, by making the museum able to better accommodate visitors and make changes that are mutually beneficial. The scenario does not provide obvious and explicit benefits for visitors, other than improved possibilities for the museum to arrange exhibitions in a more suitable way for visitors.

Scenario 2 - Museum information Describes an Austrian tourist visiting the museum, who speaks some English but no Norwegian. As the new National Museum has little information on the walls, she is able to get the information she wants about the pieces of art in German by simply unlocking her phone and the information is automatically presented to her on the screen.

Scenario 3 - Payment A family visiting the museum are able to skip the line by buying tickets with a smartphone after receiving a notification. When approaching the turnstile, the family is automatically granted admission, without needing to show their tickets to anyone.

Scenario 4 - Gamification A school class is visiting the museum, and they play a game using an application. The pupils are competing to visit the most zones of the museum and answering the most questions correctly, and in the end a winning team is declared.

Scenario 5 - Positioning and navigation A visually impaired woman likes to visit museums, but she finds it hard to navigate spaces in which she has never been before. She has a smartphone she is able to control with her voice and large icons on the screen she is able to see, and when she wishes to go somewhere in the museum, she can click on the appropriate icon on the screen. The directions are then given to her directly in her ear using an earpiece.

3.2.2 User testing

During this thesis we have applied the method of *user testing* or usability testing, terms we use interchangeably. Affairs (2013) defines usability testing as a way of testing participants with a set of tasks while observers watch, listen and take notes. The overall goal of usability testing is to identify usability problems and collect data that can help the designer at a later stage in development. We also used user testing to understand the interaction between users and technology, thus expanding on the traditional purpose of user testing. During the usability tests that was performed, we encouraged the user to think aloud while we observed and helped with minor obstacles and questions users might have.

We wanted to test the two different functions that beacons provide; *ranging* and *monitoring*. The two different applications have therefore separated these two functions. The first test had ranging as its only function and the second test used only monitoring.

The tests also differ in the way beacons are being deployed. In the first test there is a beacon for each artwork in the test. In the second test there are an beacon for each floor in the museum. The latter resulting in fewer beacons needed.

The first application is highly automatic and autonomous, while the second application leaves more of the decisions and work to the users.

Both tests will be described below, before a more in-depth description of each application.

The first test

The first test had three purposes; contributing to answering our research questions, provide feedback for further development and researching the function of *ranging*. The test was conducted twice, with one fellow student performing the test each time.

The first test was divided into two parts: performing predefined tasks using an application developed by us, followed by a post-test interview. The set of tasks were meant to introduce users to beacons, as the technology is rarely used in Norway, and the main data set we used for analysis comes from the post-test interviews. That being said, valuable information that came up during the tests by observation is naturally valuable data to us.

Participants were first required to sign an informed consent form (which can be found in appendix C), and once it was signed we began recording audio. The audio was recorded until the post-test interview was finished, and was later transcribed and can be found in appendix D.1 and appendix D.2

Participants were then introduced to the application, and were given a short explanation of the tasks they were going to perform. After installing the application on their own phones, the participants were instructed to stand in a particular starting spot, and then to open the application. Instructions about the tasks were then given out orally, and they were encouraged to think out loud and ask questions as they performed the tasks. Tasks were mainly in the form of "walk to the 'Skrik' painting and read the information associated with it". An example of how this looked like can be found in fig. 3.1.

As the tasks were performed, we observed and made note of what needed to improve for future versions of the application. During this test we were not actively participating, only observing the actions that the users performed and answered questions they asked us. We also asked the participants questions as they were performing tasks if there was anything we were interested in there and then.

The post-test interview took place directly after the set of tasks was completed. The interviews were unstructured, with no specific question or topic decided. But, despite being unstructured, we made sure we did not wander too far from the topic of beacons, context and museums. As the participants were technologically competent and had at least some knowledge of beacons, we were also able to discuss more technical aspects of the application with the participants. Additional information about the interviews can be found in section 3.2.3.

The second test

This test of the second application was conducted at Mellomstasjonen[1], further described in section 4.3 (also see fig. 3.1). The test was done during regular opening hours, from 12 to 16 on a Saturday afternoon. Due to heavy rain the number of visitors at Mellomstasjonen was not overwhelming, which was great to us as we had all the space and observation possibilities we needed.

[1] http://www.nasjonalmuseet.no/no/besok_oss/visningssteder/Mellomstasjonen

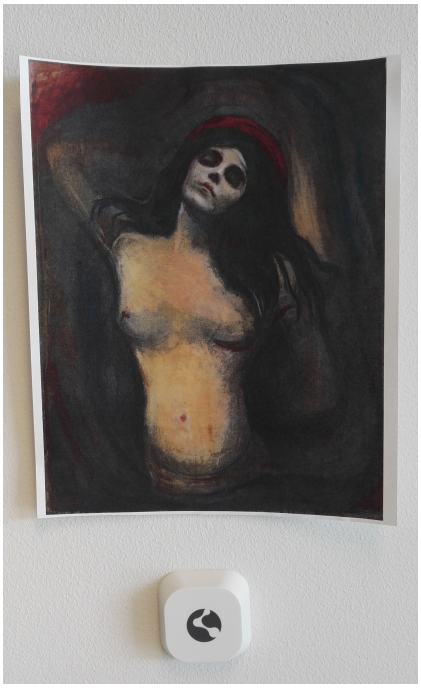

Figure 3.1: A printed image of Madonna hanging on a wall, with a beacon underneath

Beacons were carefully positioned around the building, that consists of three floors. The intention was to place the beacons so that each floor was covered, and because of the layout of the building the first and third floor had two beacons, and the second floor had one beacon.

The visitors that came to the museum, were already in a "museum-state-of-mind", meaning that they were not invited to conduct a test, or in any way informed of the test before they came to Mellomstasjonen. Their intention was to visit the visitor center to look at art and the building process of the new museum, while our goal was to test our application museum visitors.

Indications we had gotten from our workshop (see section 5.2) suggested that beacons should be used as a supplementary service, and thus this test treated the application in this manner. A small introduction about the technology was presented to users, because they had little or no knowledge about beacons. The visitors were instructed to walk around the museum as usual, and if they wanted to obtain more information about a particular artwork they could use the application. Users were encouraged to use the application at least once on each floor. The application provided just basic information that was retrieved from the museum's website[2]. Most of this information was *not* provided by the signs associated with the artwork, which was a mean of justifying the need of the application to users.

We were carefully observing the testers and providing with help and answers as necessary. We engaged in conversation and discussion with participants both during and after their rounds around Mellomstasjonen, eager to listen to their opinion. One of us mainly engaged in discussion, while the other was mainly engaged with note taking.

3.2.3 Interviews

Interviews provided a superb opportunity to get well inside the thoughts and minds of the participants involved in our research. We got to spend some one-on-one (or rather two-on-one) time with interesting people with interesting thoughts and thought processes. Two types of interviews have been conducted: *post-test interviews* after users have tested our application, and an *expert interview*. The interviews were semi-structured.

[2]http://samling.nasjonalmuseet.no

Figure 3.2: A view of the top floor of Mellomstasjonen

Semi-structured interview

In a semi-structured interview the questions have been determined before the interview (Crang & Cook, 2007). And, even though our questions were not strictly formulated before the interviews, we still characterize our interviews as semi-structured. This is because many of our discussion topics were narrow enough so that they almost certainly needed to be introduced with a question and would not arise naturally. We tried to keep the questions non leading as much as possible, to not affect those that were interviewed.

We recorded audio of all interview, and transcribed them afterwards. We avoided taking notes during interviews, as our previous experiences with conducting interviews leads us to believe that it creates a barrier between us and the interview subject.

Expert interview

An interview with Associated Professor Palmyre Pierroux was conducted. She is the author of articles such as 'Communication interrupted: Textual practices and digital interactives in art museums' and 'Gamifying the Museum: A Case for Teaching for Games Based Learning', which positions themselves in themes similar to that of this thesis. She is also heavily involved in projects regarding learning in museums and the role technology plays in learning, and she was recommended

as a potential contact by our supervisor.

The expert interview was conducted at a later stage in the thesis, thus the findings from the workshop and the first test were discussed in combination with the two aforementioned articles by Pierroux. The interview had an open structure, and both the technology and her own findings in the field were discussed.

3.2.4 Prototyping

Walker, Takayama, and Landay (2002) define a prototype as a outline for the final version of a product, e.g. a web-page or an application. Its intention is to formulate ideas and intentions of the design through an fast and inexpensive way and is then tested on users to further iterate on the design. A prototype varies from the very inexpensive prototype with paper, through to fully functional applications; *low-fidelity* and *high-fidelity* prototypes respectively. During this thesis we have developed two high fidelity prototypes that both use the iBeacon technology. We chose to develop high fidelity prototypes because we expected to get better feedback on a properly representative use of the beacon technology. Prototyping also provided valuable information for ourselves with regards to the development process when using beacons.

By doing our own development, we gained a better understanding of how beacons work. The first application used HTML5 and Javascript through the Meteor framework, and utilized the *ranging* function. The second application used the Android technology, and utilized the *monitoring* function.

Meteor Meteor is a framework for creating applications with Javascript, HTML and CSS. It makes it easy to prototype applications for both Android, iOS and the Web. In addition to catering to several platforms, it is easy both to add new packages and functionality, as well as hosting the application.

Android Android is a well known operating system mainly used for smartphones and tablets. The application we developed for Android was developed in Android Studio, using Java. It is a fairly simple application, with a heavy reliance on the AltBeacon[3] library to communicate with beacons.

[3]https://github.com/AltBeacon/android-beacon-library

The first application

The process of developing prototypes began with an intent to show users a realistic beacon application. The focus of this thesis is not primarily on the technical aspects of beacons, so the application is fairly simple. Additional screenshots of the application can be found in appendix E.1. The main principles of the first application is:

- If you stand close enough to a piece of art, information about this specific piece of art will be displayed on the mobile screen.
- Everything should be automatic, and require as little effort from the user as possible.
- Has a complete reliance on the user to move to specific artworks to find relevant information about it.
- Should provide feedback to us as developers to improve the application.

The three different degrees of proximity determined by iBeacons (far, near and immediate, see section 2.1.2) were believed by us to be a great asset for the user. These proximity degrees are solely used by the ranging function. When the user is standing in a room with beacons - or in any other location for that matter, as long as it is not close to beacons used in the application - i.e not close to an artwork, a list of the artworks covered by the application is displayed in the application (see fig. 3.3). When the user moves closer to the art and is within the *immediate proximity*, i.e a little less than 1 meter away, a photo of the art and relevant information is displayed. When moving a away, the user must press the 'back' key to exit the information, and move to a new piece of art. The phone must remain active the whole time.

A list of the artworks in the zone is displayed to the user. The user can not click on the objects in the application, but has to move close to the physical object in order to receive information. The decision was made in order to fully utilize the different proximities and encourage the user to walk to each artwork.

Our initial assumptions about the NFC technology was that it requires too much effort from the user to perform their task. More automation for the user was

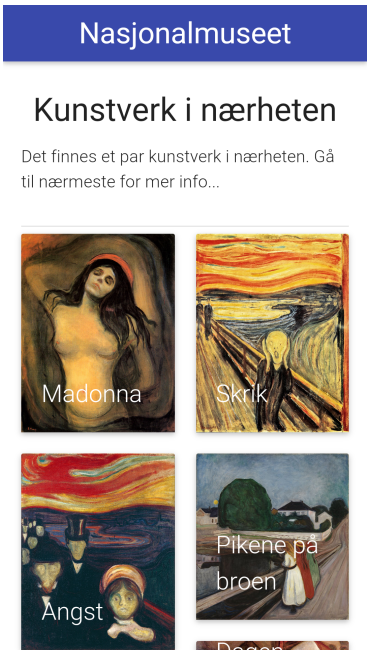

Figure 3.3: An overview of nearby artworks in the first application

therefore a focus during the development of this application. The problem with both HTML/Web applications as well as the ranging function, is that it requires the phone to be active in order to work. Determining the proximity of beacons is therefore problematic. In other words, we faced difficulties when trying to make it completely automatic. Additional screenshots of the application can be found in appendix E.1.

The second application

Using the results from the first test and the workshop, described more elaborately in chapter 5, we saw the need for improvements to provide better experience for the user. We revised the principles from the first applications and came up with some new ones:

- The user must be more in control of the application, which means less automation.

- Using the *near* proximity - and the other proximities - is unreliable and should be avoided. It should therefore avoid them and use *monitoring* instead of ranging.
- The application should be regarded as an additional service for further reading and exploration, and not the main source of information.
- The application should be passive, i.e. scan for beacons in the background and be ready and in the right context whenever the user wants to use it.

Each of these principles are further described below. See fig. 3.4 for an example of a list of artworks in the second application. Additional screenshots of the application can be found in appendix E.2.

User control In order to give users a greater sense of control of the application, it has a lesser degree of automation than the first application. This means that no artwork is opened in the application if the user does not click on it in the application, even if he is standing close to it. This is to prevent the wrong artwork to be displayed, as the artwork you are currently exploring isn't always the one you are standing the closest to. As a consequence of this, the user is displayed a list of the artworks in close proximity, and can then choose the item of interest.

Use the monitoring function The application uses the *monitoring* function instead of the ranging. This means that we are merely concerned with whether or not the user is within the range of a beacon (or group of beacons). If several groups of beacons are in the area, it would then be determined which beacon is closest in relation to the user's position.

Supplementary service The first test revealed that the application came somewhat in the way of the museum experience, and that the focus of the users was too much directed towards the screen instead of the artworks. The first test and review of literature also revealed that users primarily wanted analogue text, and then use digital resources to dig deeper down into pieces of art they find especially interesting, and to better see connections between the pieces.

Passive scanning Users want a supplementary service, and they need to feel like they are in control. To cater to both these wishes while at the same time making the application fast and easy enough that users want to use it, the application scans for beacons and prepares information in the background, while the users walk around the museum. When a beacon area is entered, the user receives a notification that, when clicked on, opens a list of art in the area. In addition, when the list is opened via the application, it automatically goes to the correct collection of art.

Universal design in applications

Universal design is designing in such a way that most people are able to use it[4]. This means designing in such a way that e.g. the visually impaired and those with cognitive difficulties should be able to use the functions of the design. In buildings this includes for example wheelchair accessibility and avoiding potential dangers for the visually impaired. In an ICT system, it means designing in a way that allows the previously mentioned groups, as well other groups with special needs, to access the functionality of the system.

We are very aware of the importance of universal design, and of the fact that both private and public ICT projects must follow the guidelines set by the Norwegian Agency for Public Management and eGovernment (DIFI)[5]. But, because of the exploratory nature of our project, and because the applications we developed in themselves are not the important part in our research but merely a vessel for collecting information, we decided not to follow the guidelines for universal design. The prototypes we created will also not be used for other purposes than these two tests.

3.3 Analysis

According to Creswell and Miller (2000) there are many various frameworks of establishing a qualitative research as credible, however Creswell and Miller states that many of these presentations "*provides little guidance as to why one procedure might be selected for use by researchers over other procedures.*" Creswell

[4]http://uu.difi.no/kva-er-universell-utforming#definsjon
[5]http://uu.difi.no/

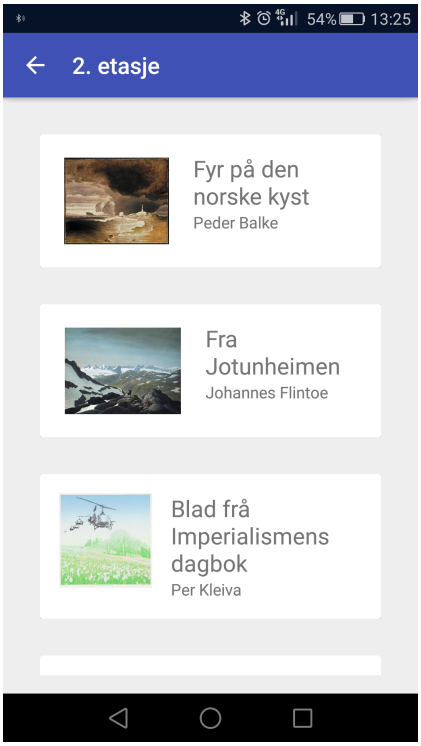

Figure 3.4: An overview of nearby artworks in the second application

and Miller continues with their own framework regarding the choice of validity procedures and states that the choice of methods is regulated by two perspectives; the *lens* researchers choose to validate their studies and *researchers' paradigm* assumptions. The framework consists of nine different types of validity procedures, all shown in table 3.2.

Paradigm assumption/ Lens	**Positivist Paradigm**	**Interpretive Paradigm**	**Critical Paradigm**
Lens of the Researcher	Triangulation	Disconfirming evidence	Researcher reflexivity
Lens of Study Participants	Member checking	Prolonged engagement in the field	Collaboration
Lens of People External to the Study	The audit trail	Thick, rich description	Peer debriefing

Table 3.2: Validity Procedures

3.3.1 Validity

As mentioned in section 3.1, our assumption for the paradigm lies within the interpretive paradigm. During this study we have adopted the use of both lenses of the researcher and the participants. Although the framework proposed in 'Determining validity in qualitative inquiry' suggests that the procedures for establishing validity with regards to the interpretive paradigm should use the *Disconfirming evidence* and *Prolonged engagement in the field*, we have adopted several of the other procedures to ensure validity in our thesis, such as *triangulation* and *researcher reflexivity*. Below are the procedures that we adopted during this thesis.

Triangulation Triangulation is a validity procedure where the researcher search for multiple different sources of information to form themes or categories in a study (Creswell & Miller, 2000). During this research we have applied many methods, such as interviews, workshops and user testing, to gain different perspectives within scope of this thesis. Each of the methods we used had similarities with each other, but different enough so that we could iterate our process through each method.

Disconfirming evidence Disconfirming evidence is closely related to triangulation. The themes are established, and at a later stage the evidence are negated by going through the data to see whether there are inconsistencies with the theme (Creswell & Miller, 2000). Our thesis adopted this procedure by going through the transcripts of interviews and workshop as well as our own notes during the tests.

Researchers reflexivity This procedure involves self-disclosing their own assumptions beliefs, and biases (Creswell & Miller, 2000), which we have done at all stages by being aware of our influence on the process and results.

3.3.2 Critique of our methods

Below are a few reflections regarding our use of the methods used in this thesis.

Workshop

The group dynamics in a workshop can be challenging. In order to have an active and engaging conversation, we invited fellow IT students that had a somewhat equal experience and understanding of the technology. The downside of choosing fellow students or acquaintances is that a bias towards the researcher may come into view. However, we didn't feel this was a problem for our goal of the workshop.

We wanted to avoid the Hawthorne effect (Fox, Brennan, & Chasen, 2008) by joining the conversation, but also to steer the conversation on the (to us) right path path. It can be challenging being both moderator and researcher when trying to ask the right questions with regards to the thesis. In any case, we had to steer the conversation in a direction that was beneficial of us and our research. This was also mentioned by one of the participants as a potential problem.

User testing

The biggest problem of using user testing is the tests themselves. The users were aware of this 'just' being a test, some of them not always taking it too seriously, and thus their behavior and opinions were reflected by that. Adopting observation

during the tests also made the Hawthorne effect appear, especially in the first test. We tried to avoid this during the second test by letting the testers roam more freely and observe them at a greater distance and with less focus on it being a test.

The location of the test is also an important factor to gain fruitful results. During the first test we simulated a museum environment by printing out artworks and placing beacons besides each of them. The second test was situated at Mellomstasjonen, see section 4.3. This was a real museum setting with actual guides and visitors that had the intention of visiting a museum. These participants seemed to be better suited for testing, both because they were actual museum visitors and because they did not have such a big focus on it being a test.

Regarding researchers reflexivity, we were aware of our assumptions beforehand and we somewhat underestimated the testers ability to perform the test in a satisfactory manner before the test.

Observation

During user testing some of the test participants had some problems with getting started with using the application. We chose to help them, so they could get a faster start and a better understanding of the technology rather than getting stuck with technicalities. Some might object that the test participants should have solved the problem on their own, and the help and explanations did not help the testers understand the technology. However, with beacons being a fairly new technology, our understanding was that it was better to establish a gray-box testing rather than a black-box[6].

Interviews

A downside of interviews is a potential difficulty to understand the difference between what participants *say* and what they *actually do or mean*. However, since we pair the interviews with participant observation and are able to observe the participants' actions, we believe the risk has been reduced. There is also always a risk of misinterpretation, which we believe has been reduced by conducting semi/unstructured interviews and being two interviewers.

[6]http://searchsoftwarequality.techtarget.com/definition/gray-box

Prototyping

Developing prototypes can be difficult with regards to the different users that are involved in this thesis. Because of time issues, a polished application with regards to performance and other non-functional requirements has at times been given less priority. These days, people will probably have higher standards in how they perceive a new application, given that there are some magnificent looking applications out there. To avoid 'repulsing' users, it has still received quite a bit of focus from us.

Chapter 4

Case

In this chapter we present the different stakeholders for this master thesis. After a presentation of stakeholders that were not mentioned as target groups in section 1.5, the chapter contains a more elaborate description of the new National Museum than the one found in section 1.5, as it is of such a big importance to our project. The chapter ends with a description of the Mellomstasjonen visitor centre, in which the second user test took place.

4.1 Stakeholders

There are several different stakeholders in this project - people or organizations that have an interest in our work and the results. The most important stakeholders have been described in section 1.5 as target groups. In this section, additional stakeholders are described.

The Ministry of Culture The Norwegian Ministry of Culture is the contracting entity of the new National Museum in Oslo, Norway, and their main assignment is to specify the requirements for the project.

Kleihues + Schuwerk Kleihues + Schuwerk is the architect for the project. The firm won the competition for the project i 2009-2010. As architects of such a large prestige project, we can assume the company is interested in the building giving the best possible experience to its visitors.

4.2 The new National Museum

Today, the National Museum in Oslo, Norway, is divided and located in several locations. The museum moves from these venues and into the new National Museum in 2020. This means there will be several different types of exhibitions within the same building, with exhibitions one today might find in museums such as The National Gallery, The Museum of Contemporary Art and the Museum of Decorative Arts and Design.

The new National Museum's goal is to be perceived as a highly profiled culture-building and give Norway a much more prominent international position within visual art. The building will be equipped with the latest technology, such as high capacity Wi-Fi.

As previously mentioned, the National Museum of Art, Architecture and Design will move in to the new museum. They are responsible for the new and old requirements for the new museum, thus ensuring the visitor's need.

We have gotten in touch with a new group within the National Museum organization called DigiLab, that research how technology can influence the museum's work in the future. How can technology change the way the museum approach the audience and how can technology be used in the new museum? These are some of the questions that are being explored in the DigiLab. Together with TellArt, the DigiLab has reflected on such topics through workshops and a choice of different technologies, trying to understand how they can influence the coming work for the museum.

TellArt is a consulting firm that specializes in how one can connect the physical world with the digital. Through strategy planning and concept development they make new designs and prototypes.

Rambøll's assignment is to find out how the user's needs can be fulfilled and how this is implemented. Some of the assignments of Rambøll includes determining what kind of equipment that is needed within the new museum.

4.3 Mellomstasjonen

Mellomstasjonen is situated in the old terminus area for westbound railroads from Oslo ("Vestbanen"). Mellomstasjoen is a visitor center created by the National

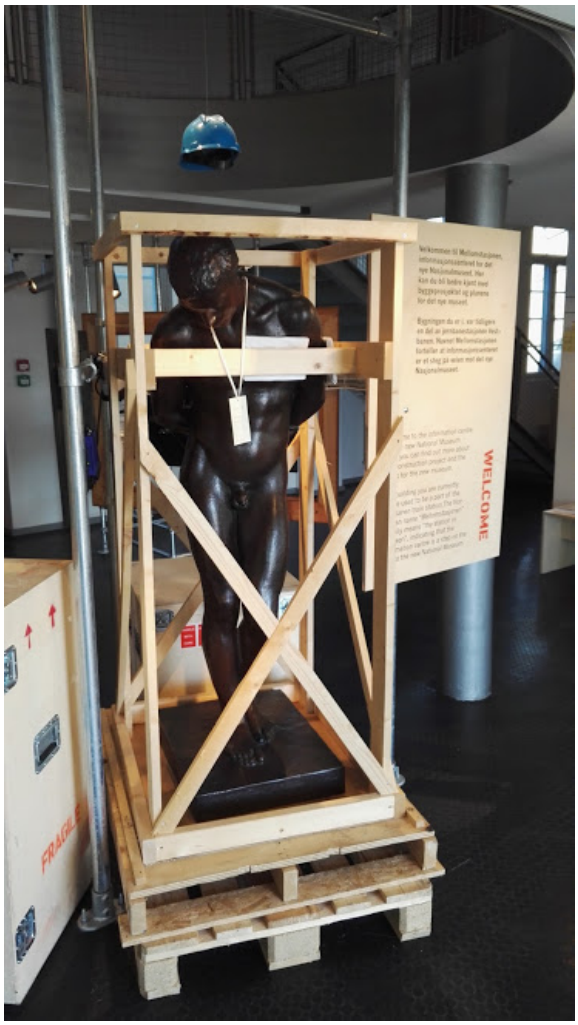

Figure 4.1: Sculpture from the first floor of Mellomstasjonen

Museum. With the new National Museum being constructed right next door, it is an excellent location for showcasing models of the new museum, material examples and artwork, intended to give visitors a greater feeling of what the new museum will eventually be like when it is finished. Mellomstasjonen has three floors that are quite open (fig. 4.2), resulting in very good conditions for beacons.

Mellomstasjonen is open every Saturday from 12 to 16, and the admission is free. It is located on Aker Brygge in central downtown Oslo, and is a bustling area popular with both tourists and locals on sunny days. This makes the potential visitor numbers quite great, but Mellomstasjoen is quite small and seeing all that it has to offer is done quite quickly.

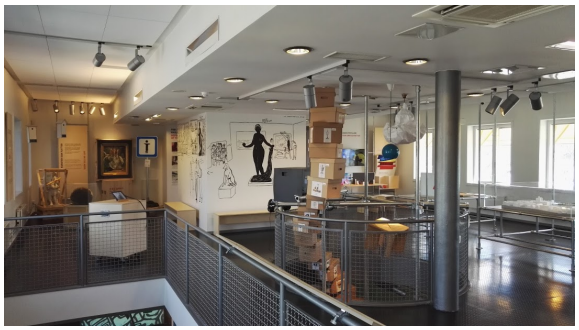

Figure 4.2: A view of the top floor of Mellomstasjonen

Exhibitions in the visitor center range from pictures and texts depicting the development of the area the new museum is being built in, artworks (fig. 4.1), and interactive objects with varying degrees of digital content. Additional photos of Mellomstasjonen can be found in appendix F, and it can also be spotted in fig. 1.1 where it is in the leftmost light yellow building in the middle of the picture.

Chapter 5

Findings

This chapter presents the findings we have made by conducting the methods described in chapter 3. It is structured in the following way:

- *User testing*
  - *Findings from the first test*
  - *Findings from the second test in Mellomstasjonen*
- *Workshop*
- *Expert interview*

These topics will be covered below, in that order.

5.1 Testing

Findings from the both tests are presented thematically rather than chronologically. Quotations are presented when believed relevant. All dialogue was originally in Norwegian, and was also transcribed in Norwegian. Snippets of the conversation used as quotations have therefore been translated to English, and some information may have been lost in translation.

5.1.1 Findings from the first test

The findings in this section includes topics such as;

- Automation
- Divided attention
- Required effort
- Bluetooth issues
- Other technical issues and test feedback

We have tried to separate the topics below, but as some of the topics are affected by the others, some sections will necessarily be somewhat similar to each other. For specification of how the tests and interviews were conducted, see section 3.2.2 and section 3.2.3. For full transcripts of both completions of this test, please see appendix D.1 and appendix D.2.

Automation

There was a clear opinion amongst the participants that having to navigate less in an application to find information was a good thing, but at the same time the users signalized decrease in the feeling of being in control.

> *It was very nice not having to press anything if I needed the information. But it was kinda like; with a back button and then I saw another picture across the hall, and then it was like: why can't I just have that information? Is it even interesting to me to walk over and look at that picture, or should I just walk in the opposite direction?*

This participant liked not having to press many buttons, but found not being able to choose any other pieces of art than the he you are standing close to to be a major flaw.

This participant also experienced the application not behaving the way he wanted it to do, and he did not always understand what was going on. He tried clicking on the artworks in the list of artworks the application told him were

nearby, but did not get any response. The application just did nothing when he clicked on the artworks, and gave him no feedback regarding what the click achieved. This participant also repeatedly clicked on the back button native to Android several times when trying to exit the information about the artwork he was standing close to, but the application did not behave the way he wanted to. What the participant did not know, was that the application did actually exit for a brief moment, but displayed the information again faster than the participant was able to perceive.

Both participants also voiced concerns about the application being too slow, and because of a lack of feedback they did not know what was going on. Were they standing close enough to the beacons? Has the application crashed? Is something else wrong? They believed this lack of feedback further strengthened their feeling of not being in control.

> *It would be nice to have the possibility of having it read to you. To press "read this for me please". And then you have a super sexy voice to read it to you.*

The participants again saw a potential in the application to do action automatically for them, in this case read selected information out loud. This would be quite similar to today's audio guides, but possibly with less effort required from the user.

Divided attention

Participants found themselves devoting their attention more to their smartphones than to the artworks. There was a difference in whether or not the participants were interested in the textual information provided to them by the application, which then also affected the time they spent watching the artworks. This varied with both user and artwork, as there was a difference in interest regarding particular paintings and associated information.

The participants also believed the time spent using their phones in the museum, with regards to acquiring information, would be affected by the amount of information available to them *without* using the application (i.e. analog text on the wall/display). They believed they would not use the application very much if the

information available in the application was available to them without having to use it. Regarding the amount of time being spent using the phone in the museum:

> *If there were no posters on the wall at all, then I think I would be walking around with the phone all the time. Possibly.*

In addition to concerns about the divided attention, one participant believed that older persons would have problems using the application. Not only because not all of them have smartphones, but also because they would not understand how it works. They would then be "left out" of the *universe of information* users can find in the app, and this further emphasizes the need for this application to be a supplement to the regular analogue experience and not the main source of information.

Required effort

Besides the participants having some humorous concerns regarding us installing our application on their private smartphones - "*you are not stealing my information, are you?*", remarks were made regarding the somewhat cumbersome nature of installing applications. Despite this being a fairly simple process in itself, they were reluctant to download a new application for "everything", unless it provided them with something they valued and could not get in any other way. Regarding downloading an application if the download process was simple, an whether or not the participant was willing to install it:

> *I don't think I would, I don't really think so. Not if there were signs around, but if the signs were lousy and I knew I could get good info on my phone if I downloaded the app.*

One participant referred to a recent visit to a museum, as an example of technology use that he felt was required too much effort from the user to provide him with satisfaction.

> *"Oh, where was it? MoMA I think, in New York - a museum I went to this year. They had - it might not have been there. You could borrow iPhones I think, they had loads of those and they cost 5$ to*

> *borrow, and they had a little thingy on the tip that was a scanner or something. I might not have been on the tip, but you could scan anyway. It probably wasn't RFID and it wasn't QR, but there were tiny holes in the wall - i don't really know what they did, sent out light perhaps, I have no idea. And then I got information on the phone like you have, but it was kind of cumbersome."*

In reference to the previous quote from the participant who wished to be able to read about an artwork without having to walk over to it, it is also a question of required effort. In addition to feeling uses had that it was the app and not them that were in charge, the task of physically having to move their bodies over to the artwork was seen by one participant as a big obstacle. The fact that he also had to move *away* from the artwork to close the information about it and go back to the list of nearby artworks, was not positively received. When asked whether a list of click-able nearby artworks was preferable to the current solution, he confirmed.

> *When I go to the museum, I walk around and... I want to look at everything, but most of it is... Most of it. Some of it I just take a look at and walk on.*

Bluetooth issues

Issues related to Bluetooth was first and foremost regarding turning Bluetooth on in the first place. None of the test participants had Bluetooth activated in their smartphones at all times, and were reluctant to turn it on even for specific purposes. When discussing experiences with Bluetooth:

> *I don't trust it 100%, because suddenly it does something I don't want it to do."* - Participant
>
> *Is your Bluetooth always on?* - Interviewer
>
> *No, now it is turned on, but it's really never turned on. Now it's on because of the test, but I turned it off yesterday because it started to malfunction a bit. I turned it on because I wanted to test my app a bit yesterday.* - Participant [referring to the development of his own application].

One participant also also pondered upon the qualities of Bluetooth. Just as the other participant, he did not turn on Bluetooth unless it had a specific purpose, but he never really experienced circumstances where he actually turned on the Bluetooth. And, even if he buys the small Bluetooth speaker he wants to buy, he is certain he will turn Bluetooth on and off every time he wants to use the speaker.

Other technical issues

We made findings regarding technical issues and the execution of the test itself. These findings were mainly results of observations made by us. Issues such as having to stand close to artwork to access information, application being so slow it confused users and made them think it did not work, a lack of feedback, e.g. with regards to the status of Bluetooth on the device, were all made and were addressed in the section regarding development of the second application; section 3.2.4.

5.1.2 Findings from the second test

Findings from the second test in Mellomstasjonen includes topics such as:

- The relationship between user and device
- The supplementary nature of the application
- Feedback
- Understanding of beacons and beacon zones
- Levels of granularity
- Technical aspects of beacons

These topics will we covered below, in that order.

Relationship between user and device

The relationship between the user and his smartphone was something that interested the users when we engaged in discussion with them, but we saw a clear distinction between the different groups of users. Out of the groups that used our application that day, two were there because they were involved in our project in one way or another and wanted to test the application. We experienced that they were far more interested in the fact that they were spending a lot of time looking at their phones, and what they experienced as less time looking at the art. We saw a clear distinction with regards to this subject with the other groups, those that did not know about the test before they arrived, who seemed both less worried and interested in this topic than the first mentioned two groups. We ascribe this to the mentality the participants came in with; those that were there for testing and those that were there to look at the building process of the new museum and the art in Mellomstasjonen.

While not ignoring the opinions of those that were there to test our application, we are mainly interested in those that were not. As the purpose of doing the test in Mellomstasjonen was to gain experience of beacons in a real setting with real visitors, we focus mainly on how the "real" visitors experience the application, and those people were either positive or neutral towards increased use of smartphones. There was a widespread notion of this being something unavoidable and a natural part of the evolution, and they were not negative towards using their own devices in a museum. On the contrary, they saw it as positive if it meant not having to borrow or lend devices.

Application as a supplement

We were curious to see that the visitors seemed to immediately acknowledge the application as a supplement to the information provided to visitors by analogue text adjacent to the different artworks. And, even though little effort was made by us to write the texts used in the application ourselves, participants on their own initiative showed signs of actually reading and learning from the texts. A prime example of this is a particular painting that was the first item being cataloged by the National Museum, something that visitors could read in the application but not in the text provided by the museum.

One group of testers consisted of a mother and a child, and in this case we observed the application taking a larger role in their experience than in most of the other cases. At times the way they treated the application was very different than what we had expected, almost using it as a "treasure hunt"; "*see this painting? Let's see if we can find it!*". This engaged the child, who was approximately 11-12 years old, for a little while. This "hunt" for the artworks in the application has links to what another test group spoke to us about; they were interested in a function where you could tell the application which piece of art you are interested in, and then it would take you to it.

There were raised some concerns about the application possibly excluding and discriminating against some groups of people, especially the elderly, whom they believed would not be able to use it. There were clear opinions amongst some of the groups, that all information provided by the application should be available by other means as well. But, there was also the previously mentioned notion that "*this is the future*" and that it is "unavoidable".

At least one of the groups showed signs of learning by using the app, by displaying knowledge of an artwork that was only available through the app. They could, of course, have learned the facts before they came to the museum, but they explained that they had learned this by using the app to learn more about this particular artwork of interest.

Feedback

First and foremost, we got clear feedback regarding notification sounds; there should be none. Even though there was only two devices running our application that day, the notification sound was deemed annoying by the participants. The feedback with the notification itself was more interesting, when it came to helping users understand the different zones. This will be further described in the next section - *Understanding of beacons and zones*.

There was some confusion regarding how the application worked when users first started it, so there seems to be a need for more information than what was provided on the starting screen of the application. All participants needed additional information given by us orally in order to get started with using the application.

Understanding of beacons and zones

Even though they had only been given a quick introduction to what beacons are, the participating visitors all, with some exceptions explained later, seemed to understand how they worked and what they should expect from them.

Users understood that when they received a new notification, they had walked into a new zone and should expect new artworks to be displayed in the application. And, even though there was a few hick-ups with regards to beacon zones overlapping, users seemed to trust the application when it told them they had entered a new zone, and ignored it when they knew they had not. Although users expressed concern regarding the use of notifications being potentially annoying, it seemed like users gained more understanding of the application and its notifications after a period of use.

We did not introduce users to zones and the range of beacons, but rather kept to familiar terms such as the metaphor; floor. We never explained that there were several beacons on each floor, and the users never asked. There was also no expressed expectation from users that there would be different zones on the same floor.

Levels of granularity

As previously mentioned, there was sometimes a mismatch between how users expected the application to work and how it actually worked. There seemed to be an expectation that the content or information structure in the application would change when users moved around on the same floor, despite them not expecting a notification about entering a new zone and the fact that they could already access information about all artworks on that floor. One user explained that it is a lot of work to scroll through all artworks on that specific floor to find the one you are interested in, and that it would be nice if they were ordered by proximity to the user. The same group of users seemed to find having to scroll the lists of artworks particularly tedious.

Technical aspects

There were some technical aspects that may have affected user satisfaction. The signal strength of the beacons surprised us by reaching much further than we

expected it to do, and users sometimes received notifications from beacons we assumed would be too far away for their signals to reach users in that location. Broadcast strength of most of the beacons therefore had to be lowered significantly during the test. The beacons also interfered with each other when there was a clear line of sight between the floors (which there are at some points in the building), and beacons had to be moved as an attempt to avoid this. These two measures reduced the overall errors that the application generated.

5.2 Workshop

The findings presented in this section are grouped together regardless of which scenario was being discussed when the findings were made. Topics that are covered includes:

- Tracking of museum visitors
- What kind of information users could want from a beacon utilizing application
- Potential exclusion of the elderly
- Worries about Bluetooth and applications
- Beacons and gamification
- Use of smartphones in museums

These topics will be covered in the aforementioned order. A full transcript of the workshop (in Norwegian) can be found in appendix D.3

Tracking of museum visitors

Different aspects of tracking, i.e. knowing the position and movement of specific museum visitors, were discussed with regard to several of the scenarios. The workshop participants find tracking potentially very useful for the museum, and they believe that it has a lot of potential.

> *[...] they [the museum] have the opportunity to see what people like; they can see how many that are going one place compared to another. That means something, in a way. That it has been more appealing. Or that it is well liked.*

Opinions are more divided when discussing tracking from a users point of view. While the aspect of helping the museum improving their services is generally viewed positively, concerns are raised about user privacy. They also believe that visitors would generally be positive to contribute when they are reassured that it is completely anonymous and cannot be linked to their person.

> *[...] concerning people being monitored or tracked. That should be clearly stated. And the challenge I see is that beacons are not that well known.*

The other participants somewhat disagree with this, arguing that users don't necessarily needs to know what beacons are.

> *Can't you just say that it is basically GPS tracking, so that they understand it better?*

Whether the technology tracking their movements is beacons or something else, seems to perhaps not matter that much. What does matter, is that users are expressively informed about the tracking, and that they should have a way to opt out of the tracking.

Information types

Participants seemed to see a lot of potential in beacons, and often imagined possible uses for beacons other than the ones explicitly mentioned in the scenarios. One of those possibilities was the possibility of getting information about where there are the most and the fewest visitors at all times.

> *I have a suggestion. I don't often visit museums, but if I do it's because I'm keen to see an exhibition. If there are an insane amount of people at that exhibition, but there is another exhibition I can see, then I might want to see that one first [the exhibition with the least people]. It might give somewhat misleading results if lots of people does that.*

This suggestion receives mixed response from the other participants. They argue that if an exhibition doesn't have many visitors, it might mean that it's just not that good and that you might not want to see it even if there are few people there. The participants are reluctant to the thought of sending visitors to exhibitions with few spectators if that proves to be the case. They do, however, take into consideration that the low attendance also may be due too poor directions and signage, and that suggestions of where to go in that case might be in order. Suggestions in this case can also be beneficial to the museum staff, both to direct visitors to exhibitions they believe visitors would be interested in, and to uncover where signage might be poor.

The participants see a potential in beacons for customized information to each visitor, especially when it comes to audio and information in several languages. There are negative attitudes towards borrowing or renting devices from museums in the group, and they are all positive to using their own devices. They seem to all prefer to use their own devices if they are given the opportunity to do so.

Beacons and the elderly

A recurring topic is what the participants perceive as an exclusion of the elderly. There is a perception that there is a majority - or at least a large part - of the elderly amongst those that go to museums. Referring to a conversation about giving consent to the museum collecting data via an application, thinking that elderly people will just say "no":

> *I also thought about what I said about older people might being excluded. That's not good. Because then they only get the opinions of a certain kind of people.*

In addition to the perception that the elderly just don't want to use the technology, there is also concerns that they do not have access to the required technology (i.e. smartphones). It is not seen as a major issue, but just serves to underline the opinion amongst the participants that an application in this case must be an additional/supplementary service and not the main mode of obtaining information.

Bluetooth and application worries

> *If they [the visitors] go to a museum, you have to use five minutes to download an application. Perhaps not many people do that. Or, some special people might.* - A participant
>
> *Give them coffee. "Download the app, get a coffee"* - Another participant

Despite the somewhat jokingly nature of the last remark, you do *need to give the users "coffee"*. By this, the participant means an incentive for visitors to download the application. One participant suggests that this threshold will be easier to overcome with marketing directed towards possible users.

When introduced by us to the concept of Eddystone, making the use of beacons without a dedicated application possible as described in section 2.1.2, opinions turn a bit more positive.

> *Then it is easier, then there just needs to be a sign outside. Considering it being the National Museum, it's in the capitol, people are in on this... this "technologization" of everyday life. [..] As long as people knows and consequently turns on Bluetooth themselves at their own choice.*

One participant is also worried that especially tourists may be low on device battery, and thus the notion that some of the participants have about Bluetooth using a lot of battery makes them more reluctant to use the application. One or more charging stations in the museum may be able to remedy this.

Games using beacons

The gamification aspect of beacons in museum is a topic that engaged the participants when presentet with the scenario.

> *I think this was really positive. I would have loved this if I was a kid. And even if you might end up running around and being more interested in getting points and stuff, you learn that way. It's better*

> *than following a guide and giggling in the back row and... and they get a bit of freedom as well.* - A participant
>
> *Following a guide like [another participant] says is just boring. So, even if you run through and might not catch a lot of info, I think... yes. So I think that freedom is a lot more...* - A second participant
>
> *And, if you get exercises you will learn something, because you need to find the answer to the puzzles.* - A third participant

Although some participants believe there would be a lot of running around, and perhaps also a lot of noise from playing the game, the other participants does not seem to react negatively to this.

> *[School kids playing games] might lead to chaos. Like, I think whichever grade... if you have a children's school there, there will be chaos. Perhaps more people show up, but that can also be negative, because there may be a bit chaotic and people may be more interested in the game and not the art.*

All participants agree that a game will steal focus from the art.

> *But I feel that grade of negativity is, kinda, very small relative to the positives.*

The game proposed in the scenario is intended for school children, for example from the age of 10 to 16, but the participants suggests that a game of this nature may also be interesting to adults as well, given that the tasks are exiting enough.

> *[..]if you come up with exiting questions that appeals to us, it would be really fun to do it like... at parties, at birthday parties and the likes. We go to the National Museum, and then we play a game there. Then you have something to do. Like shuffleboard. It's not that fun, but you do it because you need something to do. Then you can go there and like... They have heard that they have a cool app that...*

Use of smartphones in museums

The participants do consider the use of smartphones as somewhat of an obstacle for sociality between visitors, because users may find themselves in a "bubble". But, on the other hand, they recognize that people will use their phones anyway. They also see that even though having an application, in their opinion, encourages increased smartphone use, it is an additional service and will probably often not be used because the information provided in analogue text often is enough to "quench the thirst" for information.

5.3 Expert interview

The interview with Palmyre Pierroux, associate professor at the faculty of Educational Sciences at the University of Oslo, took place in a meeting room near her office. The topics that was covered were, amongst others;

- How sociality affects user experience
- Automation
- Controlling the actions of users
- Comparing groups and individuals with regards to user experience
- Using context to understand relationships between artworks

These topics will be covered below, in that order. A full transcription of the interview can be found in appendix D.4 (in Norwegian).

Pierroux also stressed the importance of *content* and how it affects how users experience and use the application. As we have made the choice of not using content and information types a key part of this project, this has been toned down in this section when compared to the transcript. We believe that the selection and structure of content is a job for curators, which we are not.

Sociality and user experience

Pierroux's work often revolve around sociality, and we discussed how the information itself and the information structure affects sociality. She explains that the *information content* plays a role in the information. She explained:

> *[...] Content plays a role in the interaction. Because, if it requires more reading, or you walk around with headphones or if there is video. That has an effect.*

Content and information types also has an effect on sociality and interaction between visitors:

> *If you have context as a focus, then there is a big difference if you are looking at the individuals interaction with the artwork [...] When we have done studies on the visitors to the National Museum, they were really surprised that most visitors, in the period we studied, in pairs or groups of three - not individuals and older ladies such as myself. And they have quite a few tourists as well.*

Pierroux then went on to explain that we had to make a choice regarding our master thesis - whether to look at inter-person interaction or solely on interaction between human and technology, as this is a very important distinction. As the reader hopefully has understood, we went with the latter.

Automation

An interesting example from the London Science Museum regarding automation was presented by Pierroux. She explained that visitors at this museum get an identity card, that tracks their movements when they walk around and use the card to interact with artworks. We were under the impression that requiring this much effort from the users was an unfortunate thing that should be avoided, but she believed that sometimes it was, as a matter of fact, the opposite.

> *You need to remember that visitors have different needs and interests, and families for example, to have an activity where they can walk around with the kids, talk about things and do things...[..] So to not*

> *have just one type of museum visitor in mind... you know. There are many different types and needs. Motivations.*

The topic of requiring active actions from users is also very relevant when it comes to gamification. We discussed her article 'Gamifying the Museum: A Case for Teaching for Games Based Learning' (Sanchez & Pierroux, 2015), in which interaction between users and the exhibition was encouraged by the use of a game. The game requires users to interact with the exhibitions in order to complete it, and to dig deep into the material.

Controlling users

We were somewhat worried that if users are to use their own devices in the museum, they might "wander off" into all that the Internet has to offer, which we felt largely negative towards. Pierroux directly contradicted this, by pointing out that the users are human beings and that we should not try to control them. If they want to wander off they should be both able and allowed to do that.

> *You cannot control, people will do that [check Facebook] anyway. That's what these guys [some people working with museum technology] don't understand. They cannot control this, the museum. They bring technologies and media and apps and cameras. They cannot be controlled. Then you need to think: "Okay, this is what the landscape looks like"*

Pierroux believed that making an unique experience for the users should be the main goal, making something the user *wants* to use rather than *has* to use.

Context and relationship

Context aware applications could be beneficial for discovering connections between artworks, Pierroux believes.

> *The work the curators do with regards to how different artworks are placed in a room isn't a coincidence, right. It is pretty thought through. They have a story they would like to tell, or visual connections they*

> *expect - as experts - that other people to make also. And that is very rarely visible for non-experts. E.g. when you are in the Munch room and see a figure here, and recognize the same figure on the other side of the room, but another, you know, theme. Some might pick that up and some might not.[..]And they believe visitors to do that when they make these exhibitions.*

Using the application to make the work of curators more visible, is in other words something that may be a good idea. She explained that she had had that thought herself a while ago as well. Both motivation and knowledge differs from the expert that a curator is to that of a "normal" visitor, and making the formers knowledge visible may be of value to the latter.

Chapter 6

Discussion

In this chapter, the findings from chapter 5 will be discussed with use of the theory from chapter 2, in order to answer the research questions from section 1.4.

As a reminder, let us revisit the research questions. They are:

1. ***What are the user concerns regarding the use of proximity based technologies with smartphones in a museum?***
2. ***How does feedback affect users' understanding of proximity based technology?***
3. ***What are the technical challenges of using beacons in a museum?***

For an explanation of each question, please see section 1.4. Each research question will be discussed separately, but there are similarities especially between research questions 1 and 2. The discussion of these two will therefore also share some similarities. Research questions may both be referenced to by its text and by its number; see list above for both. For further explanation of each research question, see section 1.4.

6.1 First research question

What are the user concerns regarding the use of proximity based technologies with smartphones in a museum?

This question is discussed thematically through smartphones and interaction styles, interfaces, divided attention, and user worries.

Smartphones and interaction styles

The introduction of the smartphone, a small device with a touch screen users carry around with them at most times, changes the interaction between user and artwork. The interaction between user and smartphone is arguably comprised of several of the interaction types described by Preece et al. (2015) in section 2.2.2. We now explore how the interaction between user and smartphone fits into each category we believe fits and how this affects the experience of users, by looking at the *conversing* and *exploring* interaction styles.

Conversing interaction

We consider the movement of users in order to obtain information as a form of non-verbal communication between user and system. The nature of the conversing interaction style is that the system reacts to input from the user in a way one might expect from a human being (Preece et al., 2015). In order to react in an expected way, the system both needs to understand what the user expects and *provide feedback* to the user to tell him what it is doing.

Especially in the first test there was a substantial lack of feedback from the application to the users, which made the users confused. The application did not act how the users expected, and thus did not adhere to the principles of a conversation, as we can see for instance in this situation: *"why can't I just have that information? Is it even interesting to me to walk over and look at that picture, or should I just walk in the opposite direction?"*. There were also situations where pressing buttons did not do what the users expected, and there was some apparent confusion in the conversation between user and smartphone.

Exploring interaction

Moving through the physical environment that is the museum in order to access information that is otherwise unreachable, can be considered exploring interaction (Preece et al., 2015). We see a clear link between exploring interaction and

how users understand the different zones and granularity of beacons, and this will therefore be discussed more later in conjunction with these topics in the *second research question*. There is also a clear link between exploring interaction and NUIs.

Smartphones and user interfaces

Amongst the three interface styles described in section 2.2.3, graphical user interface (GUI) and natural user interface (NUI) are applicable to this project; GUI because the user interface used in a smartphone is a GUI, and NUI because of the spatial navigation of users.

GUI

A GUI depends on familiarity and usability to be pleasing to users (Brookshear, 2008). It needs to adhere to the guidelines of Morville (2004), but the GUI itself cannot fulfill all these requirements on its own. It requires the programs running on the smartphone to fulfill the requirements as well, such as the launchers[1] and applications like the prototypes made for this master project. From this we conclude that the GUI is not only made up of the screen and its features, but also the programs that creates interaction with users.

During the duration of the tests, we saw results particularly linked to Morvilles' *usable* requirement. We saw examples, especially in the first prototype, that users found usability lacking. Users were confused and did not understand what was going on or what was required from them as users. And, as they also did not always understand what to do in order to obtain the information they desired and at times even believed the application had crashed because there was no feedback as to what was going on, we can safely say that the usability of this application was poor, partially due to low familiarity with the GUI.

After learning quite a few lessons, the second prototype had greater usability. We draw this conclusion as there was less feedback from users regarding things they did not understand, except the occasional confusion in the beginning. So,

[1] http://www.androidcentral.com/android-z-what-launcher

even though usability was improved, some confusion remained and dampened the usability.

Users displayed signs of finding the application useful, despite not saying it directly. In the first test in Mellomstasjonen, with real users, at least one of the groups told us a fact that was only found in the application and not in the museum itself (that a particular painting was the first cataloged by the museum), and that it was an interesting fact.

NUI

We believe there are strong ties between the relationships that can be seen in figs. 2.9 to 2.12 in section 2.3.7, and natural user interfaces - NUIs. As the key concept of a NUI is to feel natural to use for its users (Wigdor & Wixon, 2011), we believe that not much can be more natural to museum visitors than to walk around the actual museum and look at art while at the same time recieving information based on these movements.

After a bit of experience with the applications, especially the participants in the second test at Mellomstasjonen displayed signs of adapting the technology and using it independently. As we made sure not to encourage continual use but informed that we would rather the visitors use it when they wanted to, it seems like users adapted the intended behaviour of activating the app when they wanted additional information, expecting that it would be easy to access information relevant to their position. We believe this is comparable to expecting information about artworks in the form of text on a plaque etc. when you are not using a proximity based app. This movement and behaviour of users, is why we propose the entire museum in this context can be seen as a NUI.

Divided attention

The workshop participants considered the use of smartphones as an obstacle for sociality between users, but recognized the fact that museum visitors are going to do want they want to do anyways. Palmyre Pierroux agreed with this statement, stressing the fact that museum visitors are adults and should be treated as such (at least the main group of users concerned to us).

The participants believed users might find themselves in a "bubble" with increased smartphone use, perhaps drawing upon their own experiences in relateable settings in which the use of a smartphone has hindered sociality. We ascribe the 'bubble' described by users to the *heads down-effect* (Lyons, 2008). Pierroux countered this by stating that creating an unique experience for the users - an experience fulfilling the requirements of Morville (2004) - should be the main priority. The main priority should be to create an application people want to use, not force them to use it over another application.

During the first test, the participants were quite concerned with their smartphones and all the attention it got from them. So were also the visitors at Mellomstasjonen that were there to test the application, but this interestingly did not apply to the museum visitors that did not know that we were there before they arrived. These museum visitors treated the smartphone and the application as much more of a supplement than the other users that were much more focused on the 'testing' aspect. So, because of this observed difference between the users just based on what we believe is the mentality they came into the test with, we cannot draw solid conclusions on whether users treat the application as the supplementary service it is intended as or not.

User worries concerning application and smartphone

The users had a few worries regarding the use of proximity based applications, concerns that will affect the *honeycomb requirements* of Morville (2004). In addition to some of the faults in the prototypes, faults that can be remedied quite easily, some concerns are more serious and harder to remedy. The worries we consider the most important is discussed below.

Bluetooth concerns

Despite the lowered energy needs of later iterations of the Bluetooth and BLE technology, described in section 2.1.3, users still see Bluetooth as an energy demanding technology. They also do not completely trust the technology, seemingly due to previous experiences where the technology proved unstable. A technology users do not trust to work when they want it to, certainly decreases both the usability, desirability and credibility of an application which uses it.

The distrust of Bluetooth the users displays, explains why they seemingly tend to keep Bluetooth turned off when not using it. This might change if they have a Bluetooth device they use often, such as a speaker. Having to manually turn Bluetooth on and off to use the application requires additional effort from the user, but on the other hand it gives the users greater control of a technology they do not completely trust.

Downloading an application

Users express their concerns regarding having to download an app to use what the beacons can offer. In order for them to feel the need to download an app to be used only in one particular museum, the application would have to offer them an experience or a benefit they would not have gotten in another way, or make it substantially more convenient for them. As the former directly contradicts the expressed wish for an application to be supplementary and that the information must be able in another form as well, we believe going down the path of making the application convenient for user is the correct choice.

> *I don't think I would [download an app for a particular museum], I don't really think so. Not if there were signs around, but if the signs were lousy and I knew I could get good info on my phone if I downloaded the app.*

And, despite being informed that the new National Museum will have a very good free WiFi connection, the inconvenience of downloading an app still worries them.

> *If they [the visitors] go to a museum, you have to use five minutes to download an application. Perhaps not many people do that. Or, some special people might.*

As the Eddystone protocol is very new and not known to those that are not interested in beacons, the participants in our research had not heard of it. When told that it - combined with new updates of Android and perhaps also iOS - removes the need for applications, they were more positive as it required less effort from them as users.

Content and information types

As has been pointed out repeatedly throughout this thesis, we are not curators or information architects, and content and information types has not been part of our focus. But, as results from both the workshop and the interview with Pierroux indicated, the *content types* or *information types* themselves has a big effect on the user experience, with regards to what the content types offers to users.

We also need to remember that an application, no matter how well-made and nice-looking, will most likely not appeal to a 30-year-old if it was made for a 7-year-old. Likewise an app created for personalized audio tours will not appeal to users looking for a game to play in the museum together with their friends or kids. The information types will not only affect how users feel when using the app, but also whether or not they download it at all. If it does not offer anything users desires, it is unlikely that it will be downloaded.

6.2 Second research question

How does feedback affect users' understanding of proximity based technology?

We intend to answer this question by first exploring the topic of *mental models* and how participants in particularly the first and second test created these mental models. The discussion then moves on to the topic of *automation*, in which especially *user control* and *feedback* are key terms. The discussion of this question ends with a look at context awareness in the light of both mental models and automation.

Mental models

Beacons, being a fairly new and rare technology, requires users to build upon their past similar experiences to understand what to expect from the new technology. We expect most users to have at least some experience with the technologies from section 2.1.1, such as WiFi and infrared, and that perhaps similarities is seen by users between these and beacons, either consciously or subconsciously. This understanding of the beacon technology through using knowledge of similar technologies, is called *metaphor* usage.

Beacons have already used a metaphor to describe the technology. The name implies that the technology are emitting something, just like other beacons such as a lighthouse (fig. 2.2). The icon for Apple's protocol, fig. 2.4, also implies that something is being emitted, mostly since it resembles a lighthouse, but also have similar traits to icons of other proximity based technologies such as NFC, Wi-Fi and RFID.

There might be differences in what users expect to happen when for example clicking on an icon in an application - the *target system*, and what the creators of the application intended to happen when clicking the icon. This difference in expectation is due to what D. A. Norman (1983) *mental models* and the difference in these.

> *It was very nice not having to press anything if I needed the information. But it was kinda like; with a back button and then I saw another picture across the hall, and then it was like: why can't I just have that information? Is it even interesting to me to walk over and look at that picture, or should I just walk in the opposite direction?*

This situation from the first test is an example of a user experiencing a different behavior from the system than he is getting, and an example of mental models being different in users and developers. We, as the developers of the application, knows how it works and what to expect from it, but the users do not. But, despite the difference in expectation and reality, we observe that the users' understanding of how the technology works increases with experience. This confirms what D. A. Norman (1983) claims; *"the user's mental model is constantly under development"*.

From observing participants in the second test, we saw that despite being told that information was based on which floor the users were currently at, there was an expectation that the information displayed should change with regards to user proximity to each artwork as well. As seen in fig. 2.6, the target system (our application) was not clear and consistent, which shows that despite understanding the broad strokes of how beacons work, some users do not completely grasp it. The mismatch in mental models were mainly due to the expectation from users that the application used in the museum was able to detect which painting was closest to the user., which it was not.

For the second application we used the metaphor of *floor*, such as "1. floor", for use in the notifications and when describing the technology to users. We could also have said: *"You have connected with beacon #1"*, but this might not have meant anything to the user. The use of floors when the application acquired the context, we believed helped the users of understanding the technology, as they received proper feedback when they were moving up and down the floors.

Automation

One of the major differences between the first and the second application developed in this project, is how much the applications do automatically. The first application had a *high degree of automation*, and the second application had a *low degree of automation*.

Schilit et al. (2002) claims that the intelligence of the system decrease as long as the degree of automation goes up. As shown in the example of Schilit et al. (2002) (see fig. 2.8); when there is less interaction with the user, the program draws a higher number of erroneous conclusions. And, as a result, the program suffers from a lack of both human reasoning and thoughts. According to D. A. Norman (1990), it is not the automation itself that is the problem but the lack of feedback, as users are not aware of the current state of the system.

In fig. 6.1 we described our applications in regards to the graph of Schilit et al. (2002) regarding context acquisition and communication action. Both applications have a high degree of autonomous context acquisition, but thy differ in how the further action is done. In the first test, all of the information was displayed automatically in regards to where the user was positioned relatively to the artwork, by using the *ranging* function. The second test acquired the context automatically using of the *monitoring* function, but the user was made aware of the change of context by an notification, and could retrieve the information at a later stage. From our findings in section 5.1.1, the user expressed that the lack of control in the fist application was troublesome. We observed from the second test that the users seemed to be in much greater control of the application and interacted with both the artworks in the museum and with the application.

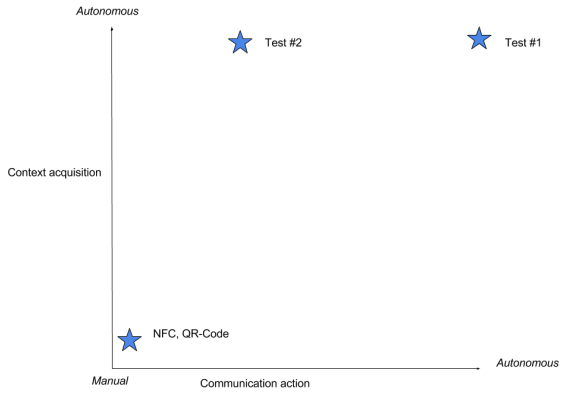

Figure 6.1: Our applications - context acquisition

High degree of automation

Let us return to the quote earlier in this discussion, regarding the application in the first test not behaving as the user expected it to do. This application did pretty much everything automatically, something we as its developers expected would be a great asset to the application. We were, however, proven wrong when users quite often did not understand what was going on. There were occasions at which users even believed that the application had crashed, because it did not tell the user anything about what it was currently doing. So, despite doing exactly what it was programmed to do, the mismatch of expected and actual behaviour created confusion and thus lowered user satisfaction (Morville, 2004).

An application with much automation thus requires frequent and good feedback. But, it also decreases the required effort from users. If done in such a way that users feel satisfied and understand what is going on in the application, an highly automatic application can still provide a feeling of being in control given that the feedback is adequate. And if the users understand how it works, having a mental model that matches the reality, this certainly helps. Users agreed that a system that requires less action from the user, for example less navigation in menus to find what they are looking for, is desirable. But, for example the lack of a functioning back button in the first application was a cause of frustration for users as the application did not behave the way they wanted it to and they did not know why.

Despite the negative effects of automation experienced by users in the first test, they still liked the fact that the application did a lot of the work automatically. There is no clear explanation in our findings as to why this is, but perhaps it is because users see a potential in the technology. Or, it's simply because users like having relevant information served to them. Either way, a highly automatic system needs to serve relevant information in a way that is expected and understood by its users.

The interview with Palmyre Pierroux makes it clear that increased automation, even with proper feedback, is not always the most desired solution though. Pierroux pointed out that when parents visit museums with their children, an increased degree of required actions can be desirable in order to engage children - and the family in its entirety. From this we can conclude that increased automation is not always desirable and needs to fit the purpose of the application.

Lower degree of automation

Users seemed to feel more in control when using the second application. After familiarizing with the technology, users of this application moved around much more freely than the users in the first test. Without underestimating the effect of the museum and the interesting artworks and activities it can offer as well as the Hawthorne effect, we as observers believe there was a greater degree of trust from users towards the application when the users had a greater degree of control; they were *in the loop* (D. A. Norman, 1990). We base this claim off, amongst others, an observation made in the second test, where users showed proof of learning information that was nowhere else than the application. These users used the application on their own initiative, with no other pressure from us than an encouragement to use the application at least once on each floor, but found it good enough to use several times on each floor. This was especially interesting given that we had spent very little time on the architecture of the information itself, as we are not curators.

The consequence of the lower degree of automation, is that users has to do more of the work themselves. In the second test, we received some comments regarding the fact that users having to manually find artworks themselves in the list of artworks was tedious, especially when the list was long. This naturally

lowers the findability and usability properties, which lowers the overall quality of use (Morville, 2004).

After familiarizing with the technology, users of the less automatic application in the second test moved around much more freely than the users of the more automatic first application. But, we can not underestimate the effect of the museum having a lot more interesting artworks and activities to offer than the surroundings of the first test.

Again, as Pierroux pointed out in the interview, there are times where a low degree of automation is preferable. When involving children, who might not have an extensive use of mental models and metaphors to use, less automation a good thing. As her work is mainly related to learning in museum, we can assume that her opinion of this is also related to learning.

Feedback

Closely related to automation, is feedback. As we have previously seen, especially the first application had some serious communication difficulties with the users as it did not inform the users about what it was doing. The application did for example not tell the user if it had discovered a beacon, and only told the user this by automatically providing information when standing very close to the artwork. If no information would show up when the user expected it, there was no way of knowing whether it was due to no beacon being positioned at that artwork, not standing close enough to the artwork, Bluetooth being off, the application freezing etc. It was, by all means, severely lacking in feedback.

The first application was designed to retrieve all the information about artworks automatically, and its intention was to relieve the user from having to give any user input. D. A. Norman clearly states the importance of a *feedback-loop*. He continues with the desired state of the system and how a person can fix it by being "*in the loop*" (D. A. Norman, 1990).

> *Without appropriate feedback, people are indeed out of the loop: they may not know if their requests have been received, if the actions are being performed properly, or if problems are occurring. Feedback is also essential for learning, both of tasks, and also of the way that*

> *the system responds to the wide variety of situations it will encounter. (D. A. Norman, 1990, p. 142)*

For the first test, the participants were *out of the loop* because the feedback loop did not reflect the actual state of the system - hence the confusion felt by the users. The users were also not aware of the context of being acquired by the application, as it happened automatically with little or no feedback to users.

After the first test, we shifted our focus somewhat regarding how feedback should be presented to and interpreted by the user. As previously mentioned the users were out of the feedback loop in the first application, and at first we thought that the problem was the automation itself but it was really inadequate use feedback that was the culprit. Figure 2.7 illustrates the classification of the nature of feedback, and Renaud and Cooper (2000) argues for the need for both immediate and archival feedback, as is also mentioned by D. A. Norman (1990):

> *Feedback is essential because equipment does fail and because unexpected events do arise. In fact, in any complex tasks or environment, one should always expect unexpected events: what is unexpected is the type of event that will occur. Human operators need to cope with these situations, and this why the feedback and 'conversation' is required.* (D. A. Norman, 1990, p. 144)

In the second test we focused on getting the users to become more aware of their context (see section 6.2) by providing immediate feedback solely in the form of a notification, given to the user when he was in the proximity of a beacon. The user was thus informed about the system state. In contrast to the first test, we made the invisible boundaries of beacon proximity aware to the users in the second application. By making it easier for users to understand things, as is the intention of archival feedback, we made the notifications with both pictures illustrating a Bluetooth-icon and an icon of an artwork being present, see fig. 6.2.

In the second test (see section 5.1.2), the users experienced an *overuse of alarms* (D. A. Norman, 1990), as the application created an notification each time they walked in a beacon zone, see fig. 6.3. This was a result of *overlapping beacons*, which was created because of the improper use of the txPower setting and unfortunate positioning of the individual beacons. After a small adjustment

(a) Bluetooth Beacon found

(b) Artworks found

Figure 6.2: Making the user aware of beacons

(i.e moving the beacons and adjusting the txPower setting), the users received mostly correct notifications and gained trust in the application.

The feedback that was provided in the second test proved to be a better solution for users regarding how they understood the technology, as there was less confusion regarding what was happening, and as users were interacting with both artworks and the application.

Eco-feedback

Although the focus of this thesis does not fall into the category of environmental change, there are some similarities between the topics in section 2.2.6 and the findings we made; a behavioral change for the users. A new technology such as beacons requires changes in behavior in order to use it as it was intended to, and to understand how system design change based on the user's different needs.

Froehlich et al. (2010) explain that eco-feedback can be seen as a persuasive technology, meaning that users get feedback about their current consumption of energy or water usage, and change their behavior with regards to pro-environmental change. This also applies to the use of beacons in a museum setting; the users can get feedback that is relevant for their current context and change

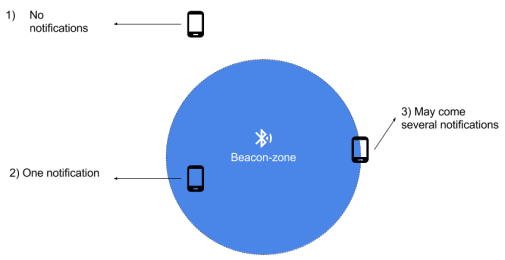

Figure 6.3: A beacon-zone

how they interact with the artworks. We saw this during our second test (see section 5.1.2), when the mother and her child used the application as a "treasure hunt" in order to find the nearby artworks in contrast to regular interaction (i.e. walking around seeing the artworks sequentially) with the artworks in the museum.

He et al. (2010) states that there are no *one-fits-all* solution for providing feedback to different users of the system. This applies in a museum environment as well; there are many different people with different backgrounds that visit a museum, with other expectations different than what was actually experienced.

The corpus of eco-feedback provides a nuanced view of how different feedback can facilitate change for the different users. By providing feedback with an intention to change the behavior of users, both museum visitors and museum employees can get a better user experience.

Context awareness

According to Abowd et al. (1999), "*a system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task*". The applications used in our tests were indeed context aware, and being more specific the first application was *active context aware* and the second application was *passive context aware* (Chen & Kotz, 2000). We believe that a passive approach is better way to approach beacons in a museum-setting.

The passiveness in the second test allowed the user to retrieve the information at a later stage in contrast to the first test where the user had to pay attention to the screen when they approached the artwork.

During the second test, see section 3.2.4, the users were aware of the changes in the system state when moving around the different floors. The application issued an notification whenever the user moved into an area with beacon coverage different than the one the user was previously in (or if it was previously not in a beacon zone at all). The context acquisition happened automatically and the actions performed by users were happening semi-automatically, allowing them to choose artworks at will without having to stand next to them - in contrast to the first test where both context acquisition and the action performed happened completely automatically, see fig. 6.1.

The different communications systems that were introduced by Schilit et al. (2002) had properties that we think are important for a context aware system., such as how the system acquires the context and which action is performed after the context is acquired. The most important categories for proximity based technologies for a museum setting based on our opinion is; *messaging* and *providing awareness*. Messaging is quite important in a context like a museum. The user has to obtain the right information based on their current whereabouts, like the current artwork. However, since the context is a museum the system should know that sound is a disturbance. The system should then be able to just provide awareness so that further action can be done later.

We are moving towards *ubiquitous computing* ant the *Internet of Things* (see section 2.3.4). During our talk with Palmyre, there was an indication that most curators had a vision when they were setting up their exhibitions, but the vision was often lost to visitors. With the use of Internet of Things (i.e beacons) and ubiquitous computing there are new ways of making these links much more apparent for the user, thus making the users more aware of its surroundings based on their current context.

> *. . . It is pretty thought through. They [curators] have a story they would like to tell, or visual connections they expect - as experts - that other people to make also. And that is very rarely visible for non-experts. E.g. when you are in the Munch room and see a figure*

here, and recognize the same figure on the other side of the room, but another, you know, theme.

6.3 Third research question

What are the technical challenges of using beacons in a museum?

This question is answered through discussing topics such as context acquisition, beacon battery life, Bluetooth, overlapping beacons and privacy. The topics are discussed below, in that order.

Context acquisition

In order to receive *accurate notifications* for the user, we had to adjust how often the application was scanning for beacons. By accurate notifications, we mean the way Preece et al. (2015) states a way of exploring the environment and being aware of the current context based on its current entities. According to Abowd et al. (1999), an entity is an essential part of context, and for the second test the floor and the artworks were all entities. The adjustment was necessary because the user is usually not spending more than 5 minutes (which is the default time between each scan for beacons) on each artwork/zone. Adjusting the scan period would probably result in higher battery consumption for the application, but we have not tested how much this affects the battery life of smartphones.

Beacon battery life

The beacons were advertised to have a battery life of approximately 3 years. We had to change the battery in all beacons after one to one and a half year. We could have used beacons that used an external power source, but this would however defeat the purpose of the ad-hoc manner of beacons.

Bluetooth

Another challenge of using beacons is that Bluetooth has to be turned on in order to communicate with beacons and obtain the context for the user. Users also per-

ceives Bluetooth as draining the battery in their smartphones. Bluetooth has been around since 1994 so many people have already established their current perception of that technology, but as D. A. Norman (1983) defines a *mental model* as a "naturally evolving model", this can change after a period of use. We already see a shift in this thought pattern with the more common use of wireless headphones and similar wearable technologies, which use Bluetooth. Aislelabs (2014a) have conducted a thorough report on the drainage of batteries in phones with the use of beacons. They conclude that; "*newer handsets are optimized for Bluetooth LE and iBeacons and battery impact is minimal even under high stress conditions*". In another report from Aislelabs it is concluded that newer chipsets both from Apple and Android are highly optimized for Bluetooth Low Energy (Aislelabs, 2014b).

Overlapping beacons

The beacon has two ways of adjusting how its packet is emitted; either by adjusting the *txPower*, i.e signal strength, or its *advertising interval*. The txPower was initially set to 3 (-12 dBm), but this resulted in many overlapping zones, which was troublesome in the second test. We felt that the variable for txPower was quite vague, and we had to test it manually to see the effect, see fig. 6.3. During our tests there were some problems that occurred that we did not think of beforehand. Beacons were placed close together, and this resulted in some faulty discoveries of beacons and notifications for the testers, see fig. 6.4. This was resolved by adjusting the txPower for each individual beacon.

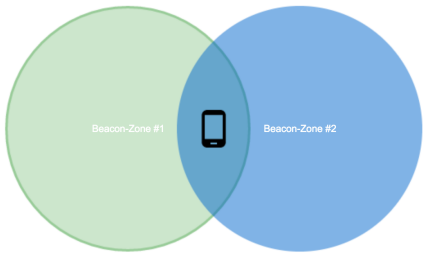

Figure 6.4: Overlapping Zones

We used at most 5 beacons in our tests, and the adjustment of these beacons was a rather trivial task to perform. However, when the beacons are placed in a museum, there will have to be a lot more than 5 beacons. The blue line in fig. 6.5 displays the number of beacons needed if all artworks has a beacon associated with it. The red line shows the required number of beacons if each beacon serves for example four artworks. No matter how many artworks each beacon covers, it could be difficult to keep track of all beacons in a museum. It will be necessary to manually test all the beacons at e.g. the new National Museum to ensure that each individual beacon is properly set up, which would require many hours of work given its size.

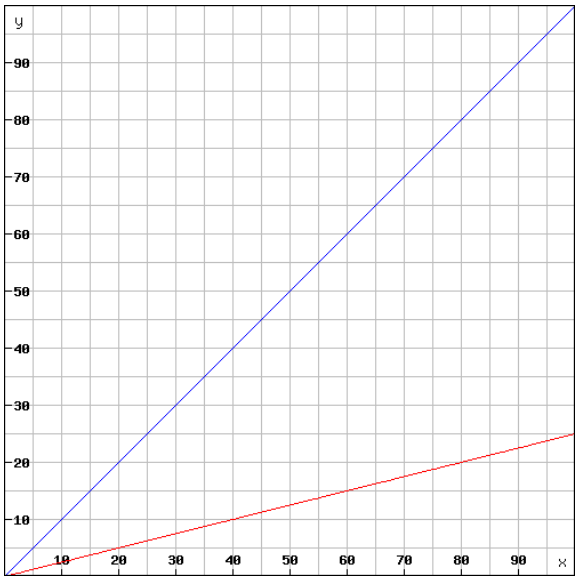

Figure 6.5: Number of beacons

The first test had a beacon associated with each artwork. This lead to very accurate context acquisition for each artwork, however we suggest that it is not scalable for an entire museum, ref. fig. 6.5. Figure 6.6 displays our implementation of the second test, resulting in fewer beacons required, but a slightly lower accuracy of context acquisition. If we were to use the same approach in the second test as in the first, we would probably have needed somewhere along the lines of 20 beacons, if not more.

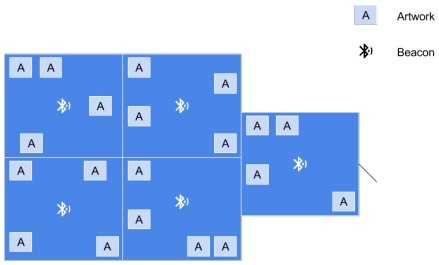

Figure 6.6: Zones and artworks

Ranging vs. monitoring

We tested the two functions for beacons in the tests; one in each test, see section 3.2.2.

The *ranging* function worked as intended; the user walked nearby the artwork and received information about the artwork automatically. This resulted in too much automation and lack of *user control*. The users also expressed concerns regarding using their phones too much, i.e. less interaction with the artworks in the museum. Since the information was triggered when the users were in *immediate* proximity (<50 cm), the user had to stand very close to the artwork in order to receive information. Imagine 100 people trying to receive information less than 50 cm from the *Mona Lisa*... We could have used the *near* proximity, but this would resulted in more erroneous discovery of beacons as the artworks were very close to each other, as it is in most museums. The artwork you are standing the closest to might not be the one you are actually watching right now.

The *monitoring* function worked much better in a museum setting, and it also lowers the need of beacons, see fig. 6.5. The monitoring function provides the ability for the user to receive notifications in the background in contrast to the ranging function that requires the screen to remain active and turned on in order to work. The users can then choose if they want to check the information or interact with the artwork. This gives the user more control than if this happens automatically.

Privacy

Although privacy is an important aspect when considering using beacons, this is not within our scope. We will however mention a few "problems" that might occur with beacons, now right towards the end of the discussion.

The privacy issues that occurs with iBeacons is linked to the permissions set by the applications. The only thing an iBeacon is capable of doing is sending out advertising messages. The beacons are by no means able to e.g.:

- Receive anything
- Report on other clients
- Transmit a message other than its ID and the payload it is programmed to broadcast
- Get GPS coordinates
- Collect information without permission

As for Eddystone, the privacy concern is slightly more difficult. Because the design is set to integrate with the operating system, surrounding beacons may be detected whether you have an application using them or not. When the user has discovered an Eddystone beacon the information may be transferred to Google to further improve Google's services. On Google's own platform page [2], developers are encouraged to respect the privacy of users, and honor the users request to delete their data.

[2]https://developers.google.com/beacons/overview

Chapter 7

Conclusion

The goal of this master thesis is to discover how beacons affect user experience in a museum setting, specifically for users. It is done by researching three research questions, that focuses on the effect of smartphones in museums, user understanding of proximity based technology, and the technical changes of beacon use in museums, respectively.

The theoretical groundwork revolves around the topics of beacons and other proximity based technologies, user experience, and context.

We have developed two prototypes, one with a high degree of automation tested on fellow students, and one with a lower degree of automation tested in a real museum settings with museum visitors. A workshop has been conducted, as well as an expert interview. We have used findings and theory to discuss the research questions.

An conclusion of each research question is described below.

Research question 1

What are the user concerns regarding the use of proximity based technologies with smartphones in a museum?

Users are generally not very concerned about smartphones taking too much attention away from artworks when in a museum. Users see the increased use of smartphones in museums as a natural development. Although recognizing that it

can hinder sociality, the 'bubble' users may find them selves in might be unavoidable. There are indications that this, known as the *heads-down phenomenon* is less prominent in a normal user setting, as we saw a big difference between users with a *test mentality* and users that did not know beforehand that they were going to test an application. We saw that regular museum visitors treated the application as the supplementary service it was intended as, and kept their phones inactive when not using the app.

Users have some negative perceptions towards the applications, especially concerning the Bluetooth technology using a lot of battery, as well as having to download an application just for use in a museum. With Bluetooth now consuming much less battery than it used to, it could be a matter of time before user perceptions reflects this. And, with the introduction of Eddystone, which may make beacon utilizing applications redundant all together, the negative perspectives on applications themselves can possibly also be remedied in the near future.

Research question 2

How does feedback affect users' understanding of proximity based technology?

The second research question falls within the field of users' understanding of proximity based technology, specifically with regards to feedback. The use of feedback was differentiated with the two applications; the first application had little feedback of substantial value for the user whereas the second application had more feedback that gave the user a larger sense of control.

Our mental model differed from the user's mental model in the first application. The users experienced the inadequate use of feedback to be problematic, which lead to a lack of user control. The first application was also lacking in use of metaphors, which can be of help when users are trying to understand the technology, particularly a new technology with which they have little or no experience. The second application was using metaphors, thus helping the users of understanding the technology better. The use of the metaphor regarding floors, helped the users to see that the application was working, as they were situated at the floor the application was notifying them about. They could thus see with their own eyes that the notification they received matched their observation about the reality. The overall mental models, with the designers and the users mental

models, were far better aligned in the second application, as the target system issued feedback as intended. This resulted in users using the application more independently and confidently.

The users of the first application saw the potential in getting information automatically, but after observing the test it raised several issues regarding the understanding of the technology as well as interaction with the artworks. A higher degree of automation may look good on paper, but the users were not grasping the concept of the technology when they were interacting with a fully automatic solution. The second application acquired the context automatically, but the users were in control of choosing whether they wanted to interact with the feedback provided by the application.

The only feedback that was provided in the first application was a change of screen content when the users were within the proximity of a beacon paired with an artwork. Because the distance from beacon to smartphone is a quite rough estimate, the results varied. The user did not receive any feedback during this interaction, leading to guesswork how they should approach the artwork and how close to the beacons users had to stand in order for anything to happen in the application. The second application had feedback implemented in the form of notifications, thus making the user more aware of its surroundings and how the proximity based technology worked.

Both applications acquired context automatically in a seamless matter, but the first application did not make the user aware of its change of state other than the content changing the screen. This resulted in users having to actively look at the screen, changing their focus from the artworks to the phone, in contrast to the second application where the users could choose to interact with the feedback or not. This resulted in users interacting with both the application and the artworks, and seemed to interact more with the artworks and less with the smartphone when comparing with the first application.

Developers of an application that use proximity based technologies in a museum need to look into how they issue feedback to the user, as it is essential for learning the technology. How that feedback is presented to users is also of importance. Using metaphors helps the user understand if/how their goal is achieved. The application should do this automatically as users prefer not having to do much to get the information they are interested in, however there is a balance of how

much automation that can be performed before users start feeling that they are not in control of the application. If the users do not feel like they are in control, they are likely to dismiss the technology. A way of avoiding this, is by making the users more aware of their surroundings when using the application.

Research question 3

What are the technical challenges of using beacons in a museum?

The third research question investigates the technical aspects of using beacons and what challenges that arise when using it within a museum.

In order to demonstrate the value of beacons, the time between scanning had to be lowered to achieve faster context acquisition. The adjustment was necessary since the users were walking around the museum, and the scanning needed to happen in the background when the phone was not being used. The time interval between each time the application scans for beacons needs to be small, even though this might lead to increased battery usage for the handsets using the application. And, despite this possibly being a negative effect, this is necessary in order to provide a user experience that corresponds with how the users are walking around the museum, as they don't always spend a lot of time at each artwork.

Battery life for the beacons themselves was a bigger inconvenience than expected. Even though we had just five beacons, their batteries seemed to drain at the most inconvenient of times. And, even though one can take steps towards extending battery life, and the time it takes to change one battery, it will have implications on functionality from a system administrator's point of view. It is thus our suggestion that stationary and permanent beacons should be permanently connected to a source of electricity if possible, especially in the context of a museum where the required number of beacons most likely is large. This may defeat the purpose of beacons and their ad-hoc manner, but imagine the costs of maintenance to check each beacon in a large museum such as the new National Museum. Eddystone can help this work with its telemetry frame, but it still requires a lot of resources.

The case of overlapping beacons is indeed a big challenge because it can limit the user experience for the visitors, as many beacons situated in the same room can lead to interferences, which results in displaying the wrong artworks for the

visitor. The manual adjusting of the txPower was indeed a cumbersome task, trivial for our case but in a real museum setting it requires manual testing for each room in order to provide good user experience for the visitors.

Our testing suggests that *monitoring* (beacons covering a room etc.) is preferred over *ranging* (one beacon for each artwork) in a setting such as ours. It lowers the required number of beacons. The high degree of automation users experienced when the beacons were using ranging, lowered their sense of control over the application.

Another very important distinction is that when using ranging, the screen has to be active in order for it to work, whereas monitoring can be performed in the background and notify users of e.g. entering new beacon zones. Requiring the screen to be active at all times is a breach of what users want, given that they want a supplementary service. We believe the monitoring function facilitates this a whole lot better.

All-in-all there are some challenges that may cause a problem when facilitating beacons in a museum, but the cost of achieving context based on the users' proximity has proved to be of great value, in particular when curators can display their intention of the exhibition based on the users' position.

Future work

Our thoughts about future work are many and varied, and are mostly the result of thoughts about what we would have liked to researched if we had more time, if we had gone in a different direction with the project, etc. Below, some of these thoughts are described.

Feedback in proximity based technologies As proximity based technologies, and perhaps especially beacons and its likes, are not that widely used in museums today, we believe there is potential for more research regarding feedback. There are questions related to the number and frequency of notifications to users, as well as the nature of the notifications themselves.

There is also potential for research regarding feedback other than by notifications, for example regarding how to best help users understand how the applica-

tions work, and perhaps even more important *how much* users need to understand of what is going on in order for them to have a satisfactory experience.

Content and information types in proximity based technologies We don't have much experience regarding content types, information types and information architecture and the consequences of these, but we believe there is a potential for research regarding this when it comes to use in proximity based technologies. Several potential uses were proposed and discussed by and with participants during the research, but we only tested the one (where content itself was not a focus). It would have been interesting to see how the different types of information would work together with a context based technology.

Possible usage areas for beacons At the beginning of the project, we discussed possible areas of use for beacons. Beacons are now currently mostly used for commercial purposes, with a few museums and a pilot project in the London Subway also trying the technology. Several of our early applications for beacons was in public transport, but we are sure there are other areas of use that we have not thought about. And, with beacons being a versatile technology, we believe there are areas of use that has not yet been discovered and/or tried..

Beacons on a large scale Another possible direction this thesis could have taken, was exploring the topic of using beacons on a large scale. We believe that using a large number of beacons would not only be hard to deploy, but also to maintain. We believe that beacons used on such a large scale requires development of brand new management tools, which would also be an interesting topic of research.

Use of beacons over time As mentioned earlier in the thesis, all our five beacons emptied their battery within one to one and a half year from the time of acquisition. When having a larger number of beacons this is something that can really take a big chuck of time to maintain, and it should be researched what the alternatives to the 'traditional' beacons we used are. Alternatives could be the kind of beacons we used attached to the power grid, beacons with better battery capacity, significantly less frequent broadcast emitting etc.

Using Eddystone beacons as infrastructure Using the Eddystone protocol for the beacons enables a new way of interacting with beacons from the facilitators side. There are no need for an application to be installed and it could easily be integrated with Google's own infrastructure. The Eddystone protocol are a new way of thinking of how beacons should bridge the gap between the physical and digital world.

Comparing beacons with similar technologies in a similar context It could be interesting to see a comparison between beacons and e.g. Wi-Fi in a museum, where both technologies provide the same usability to users. The experience should be possible to make very similar using both technologies, but a look at the amount of work needed to make it so would be interesting. Are some of the alternative technologies easier to deploy in order to provide the functionality and user experience we had with our applications?

Bibliography

Abowd, G. D., Dey, A. K., Brown, P. J., Davies, N., Smith, M., & Steggles, P. (1999). Towards a better understanding of context and context-awareness, 304–307.

Affairs, A. S. f. P. (2013, November 13). Usability testing. Retrieved April 30, 2016, from http://www.usability.gov/how-to-and-tools/methods/usability-testing.html

Aislelabs. (2014a). iBeacon and bluetooth battery drain report [Aislelabs]. Retrieved February 11, 2015, from http://www.aislelabs.com/reports/ibeacon-battery-phones/

Aislelabs. (2014b). iBeacon battery drain on apple vs android: a technical report [Aislelabs]. Retrieved February 11, 2015, from http://www.aislelabs.com/reports/ibeacon-battery-drain-iphones/

Albert Manning, W. (1999). Automated systems in museums: the use of bar code technology in collections management. *Museum Management and Curatorship*, *18*(1), 3–18.

Brookshear, J. G. (2008, January). *Computer Science: An Overview* (10 edition). Boston, M.A.; Harlow: Pearson.

Cavallini, A. (2014). Ibeacon bible 2.0.

Chen, G., Kotz, D. et al. (2000). *A survey of context-aware mobile computing research*. Technical Report TR2000-381, Dept. of Computer Science, Dartmouth College.

Crang, M. & Cook, I. (2007). *Doing ethnographies*. Sage.

Creswell, J. W. & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice*, *39*(3), 124–130.

Davidson, M. J., Dove, L., & Weltz, J. (1999). Mental models and usability. *Cognative Psychology*, *404*.

Ding, J. (2009). *Advances in network management*. CRC Press. Retrieved from https://books.google.no/books?id=JOSUimXOoGMC

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative inquiry*, *12*(2), 219–245.

Fox, N. S., Brennan, J. S., & Chasen, S. T. (2008, December). Clinical estimation of fetal weight and the hawthorne effect. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *141*(2), 111–114. doi:10.1016/j.ejogrb.2008.07.023

Froehlich, J., Findlater, L., & Landay, J. (2010). The design of eco-feedback technology. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 1999–2008). ACM.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, *8*(4), 597–606.

He, H. A., Greenberg, S., & Huang, E. M. (2010). One size does not fit all: applying the transtheoretical model to energy feedback technology design. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 927–936). ACM.

Holm, R. K. (2015, June 1). Nexans tracking system. an indoor positioning system using bluetooth low energy. Retrieved April 7, 2016, from http://www.ub.uit.no/munin/handle/10037/7953

Kleihues & Schuwerk. (2015). Det nye nasjonalmuseet på vestbanen. Retrieved November 15, 2015, from http://www.nasjonalmuseet.no/filestore/Om_Nasjonalmuseet/Visningssteder/Nye_Nasjonalmuseet/NasjMusRadhusetMedB-16-922.jpg

Knemeyer, D. & Svoboda, E. (2006). User experience–ux. *Retrieved*, *5*(01), 2008.

Lyons, L. B. (2008). *Designing for the cooperative use of multi-user, multi-device museum exhibits*. ProQuest.

Melbye, V. (2009). Shipping off the eddystone lighthouse. Retrieved January 22, 2015, from https://commons.wikimedia.org/wiki/File:Vilhelm_Melbye_(attrib.)_-_Shipping_off_the_Eddystone_Lighthouse.jpg

Montello, D. R. & Sas, C. (2006). Human factors of wayfinding in navigation.

Morville, P. (2004). User experience design. http://semanticstudios.com/user_experience_design/. Accessed: 2016-04-19.

Myers, M. D. & Avison, D. (1997). Qualitative research in information systems. *Management Information Systems Quarterly*, *21*, 241–242.

Nagabhushana, S. (2009). Object recognition. In *Computer vision and image processing* (Chap. 8, pp. 459–488). New Age International Pvt Ltd Publishers.

Nalder, J. (2014). Beacons by jnxyz.education. Retrieved May 3, 2016, from https://www.flickr.com/photos/jnxyz/13570805343/

Nielsen, J. & Norman, D. (2014). The definition of user experience. *nngroup,[Online]. Available: http://www. nngroup. com/articles/definition-user-experience/.[Accessed 6 April 2014]*.

Norman, D. A. (1983). Some observations on mental models. *Mental models*, *7*(112), 7–14.

Norman, D. A. (1990). The'problem'with automation: inappropriate feedback and interaction, not'over-automation'. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *327*(1241), 585–593.

Norman, D. A. (2001). *The design of everyday things: revised and expanded edition*. Basic books.

The Physical Web. (2015). Retrieved October 10, 2016, from https://google.github.io/physical-web/

Pierroux, P. [P] & Ludvigsen, S. (2013). Communication interrupted: textual practices and digital interactives in art museums. *The connected museum: Social media and museum communication*, 153–176.

Pradhan, S. (2000, December 1). Semantic location. *Personal Technologies*, *4*(4), 213–216. doi:10.1007/BF02391560

Preece, J., Sharp, H., & Rogers, Y. (2015). *Interaction design: beyond human-computer interaction*. Wiley. Retrieved from https://books.google.no/books?id=n0h9CAAAQBAJ

Renaud, K. & Cooper, R. (2000). Feedback in human-computer interaction-characteristics and recommendations. *South African Computer Journal*, *26*, 105–114.

Sanchez, E. & Pierroux, P. [Palmyre]. (2015). Gamifying the museum: a case for teaching for games based learning.

Schilit, B., Hilbert, D., & Trevor, J. (2002, October). Context-aware communication. *IEEE Wireless Communications*, *9*(5), 46–54. doi:10.1109/MWC.2002.1043853

Schmidt, A., Beigl, M., & Gellersen, H.-W. (1999). There is more to context than location. *Computers & Graphics*, *23*(6), 893–901.

Siegenthaler, E., Bochud, Y., Wurtz, P., Schmid, L., & Bergamin, P. (2012). The effects of touch screen technology on the usability of e-reading devices. *Journal of Usability Studies*, *7*(3), 94–104.

Stake, R. (2005). Qualitative case studies. *The Sage handbook of qualitative research*, 443–466.

Strengers, Y. A. (2011). Designing eco-feedback systems for everyday life. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 2135–2144). ACM.

Ullmer, B. & Ishii, H. (2000). Emerging frameworks for tangible user interfaces. *IBM systems journal*, *39*(3.4), 915–931.

Walker, M., Takayama, L., & Landay, J. A. (2002). High-fidelity or low-fidelity, paper or computer? choosing attributes when testing web prototypes. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 46, *5*, pp. 661–665). SAGE Publications.

Wigdor, D. & Wixon, D. (2011). *Brave nui world: designing natural user interfaces for touch and gesture*. Elsevier Science. Retrieved from https://books.google.no/books?id=ID0L0EI79-YC

Appendix A

Code

The application developed with Meteor for the first test can be found at **https://bitbucket.org/kjesle/beacons-test**.

The application developed in Android for the second test can be found at **https://bitbucket.org/kjesle/visitor-centre/**. Note: please download the 'displayContent' branch.

Appendix B

Scenarios

Scenario 1 - Museumstracking

Bjørg jobber på Nasjonalmuseet, og har ansvar for utstillingene som er på museet. Det er mange forskjellige utstillinger i museet, og det kan være vanskelig å vite hvilke som er de mest populære.

Bjørg har muligheten til å sjekke hvem som har vært på de forskjellige utstillingene og hvilke ruter de har tatt. Dette gjør det mulig for Bjørg å sjekke hvilke utstillinger som er mest populære. De andre i personalet har da også mulighet til å sjekke ut hvilke utstillinger som trenger en forandring, eller som det må bli tydeligere hvordan man kommer seg til.

Scenario 2 - Museumsinformasjon

Paula kommer fra Østerrike, og er i Oslo og Norge for første gang. Hun snakker litt engelsk, men ikke særlig godt. Tysk er hennes morsmål. Hun er i Oslo i et par dager som en del av en rundtur i Norge, og ønsker å få med seg kunstverkene i Nasjonalmuseet.

Det nye nasjonalmuseet har minimalt med informasjon på veggene. Ikke noe av informasjonen er på tysk, men Paula får en notifikasjon på mobilen sin at hun kan få informasjon om kunstverk på sitt eget språk. Hun velger å motta informasjon på tysk, og tar opp mobilen sin når hun står foran et kunstverk hun ønsker å vite mer om. Da står informasjonen om kunstverket på skjermen allerede, og hun kan lese den informasjonen hun ønsker.

Scenario 3 - Museumsbetaling

Petter og Hilde er på besøk med barna sine i Oslo. Petter og Hilde har tatt kollektivtransport og betalte sine billetter med mobilen. De bestemmer seg for å ta en spontan tur innom Nasjonalmuseet, da de får en notifikasjon om tilgjengelige billetter når de går forbi.

Petter velger å kjøpe alle billettene direkte fra mobilen når de står på gaten rett foran Nasjonalmuseet. Når de går inn i inngangspartiet ser de at det er lang kø for å komme inn, men Petter ser at man kan spasere rett inn om man allerede har kjøpt billett ved bruk av mobil. Når Petter går nærme "luken" kommer det opp på en skjerm at det er 4 stk som har "lov" til å komme inn.

Scenario 4 - Gamification

Mathias er sammen med sin klasse på Nasjonalmuseet. Alle har med sin egen mobil og de har på forhånd lastet ned Nasjonalmuseets egen app, etter oppfordring fra læreren sin. Etter at guiden på Nasjonalmuseet har sagt sitt, får skoleelevene i oppgave å følge spillet.

Mathias følger rutene som er satt av spillet, hvor oppgavene er på å besøke flest soner, som er satt av applikasjonen. Etter Mathias har vært i en sone får han en oppgave han må løse for den sonen. På slutten av besøket samles alle elevene for å sjekke hvem som har fått den beste scoren.

Scenario 5 - Posisjonering og navigering

Thea er en kunstinteressert dame på 32 år, som er svaksynt.. Til tross for at hun ikke lenger er i stand til å se kunsten så godt, liker hun å rusle rundt og føle på stemningen på museet. Hun er ikke i stand til å se skiltene i museet uansett hvor store de er, og synes det kan være vanskelig å komme seg rundt på steder hun ikke befinner seg på til vanlig. Det er vanskelig for henne å se skjermen på mobiltelefonen sin, men hun har skaffet seg store ikoner og bokstaver, samt har lært seg å styre de mest essensielle funksjonene med stemmen.

Thea har vært på Nasjonalmuseet mange ganger, men på det nye Nasjonalmuseet har hun aldri vært. For å finne frem til favorittbildene sine kan hun bruke Nasjonalmuseets app, der hun kan trykke på en knapp og så si hvilket maleri hun

ønsker å se. Hun får så veibeskrivelsen rett i øreproppene hun har på seg, som guider henne hele veien. Når hun er ferdig med å se på kunstverkenene, blir hun fortalt hvordan hun kommer seg til for eksempel utgangen eller cafeen.

Appendix C

Informed consent form

Samtykkeerklæring for deltakelse i intervju

Vi er Kjetil Sletten og Jon-Robert Skårberg. Vi er masterstudenter ved Institutt for informatikk ved Universitetet i Oslo, og tilhører studieprogrammet *design, bruk, interaksjon*. Vår veileder er Jo Herstad, mail: johe@ifi.uio.no, tlf: 91560563.

Vår masteroppgave omhandler forståelse av og syn på teknologien beacons/iBeacons, sett fra en brukers ståsted.

I intervjuet ønsker vi å snakke om hvordan kontekstteknologi, mobiltelefoner og annen teknologi påvirker bruksopplevelsen fra brukernes ståsted i et museum. Vi ønsker også diskutere emner fra artikkelen *Communication Interrupted: Textual Practices and Digital Interactivties in Art Museums*.

Frivillig deltakelse
Deltakelse i intervjuet er helt frivillig, og du kan trekke deg når som helst. Det blir gjort lydopptak av hele intervjuet, og det kan bli tatt notater. Du kan når som helst trekke tilbake informasjon som er gitt av deg under intervjuet.

Vi ber deg skrive under på at du har lest og forstått informasjonen over, og på at du ønsker å delta.

Samtykke
Jeg har lest og forstått informasjonen over, og gir mitt samtykke til å delta i workshopen.

_____	_____
Sted og dato	Signatur

Samtykkeerklæring for deltakelse i workshop

Vi er Kjetil Sletten og Jon-Robert Skårberg. Vi er masterstudenter ved Institutt for informatikk ved Universitetet i Oslo, og tilhører studieprogrammet *design, bruk, interaksjon*. Vår veileder er Jo Herstad, mail: johe@ifi.uio.no, tlf: 91560563.

Vår masteroppgave omhandler forståelse av og syn på teknologien beacons/iBeacons, sett fra en brukers ståsted.

Workshopen består av å diskutere en gruppe scenarier i mindre grupper, for så å diskutere disse i plenum etterpå. Vi ønsker å bygge et kunnskapsgrunnlag av diskusjonene som vi kan bygge vår teori på i masteroppgaven.

Frivillig deltakelse
Deltakelse i denne workshopen er helt frivillig, og du kan trekke deg når som helst. Det blir gjort lydopptak av hele workshopen, både under diskusjon i grupper og i plenum. Det vil potensielt bli gjort notater under workshopen. Du kan når som helst trekke tilbake informasjon som er gitt av deg under workshopen.

Anonymisering
Dialog vil bli transkribert og anonymisert, og det vil ikke være mulig å tilbakeføre informasjon til deg. Ingen andre enn vi, de to tidligere nevnte masterstudentene, vil vite hvem som har deltatt i workshopen.

Vi ber deg skrive under på at du har lest og forstått informasjonen over, og på at du ønsker å delta.

Samtykke
Jeg har lest og forstått informasjonen over, og gir mitt samtykke til å delta i workshopen.

_____	_____
Sted og dato	Signatur

Appendix D

Transcriptions

D.1 Transcript of first test #1

Kjetil: Den der tilbakemeldingen kan vi ta etterpå, men det er bare for når testen er ferdig.

Participant: Okei

Kjetil: Så da er det bare å starte og tenke høyt og forklare hva du ser

Participant: Okei

Kjetil: Ja, så tanken er da at du er på museum, du skal.. Participant: Ja, sett... sett kontekst for meg.

Kjetil: Ja, okei. Du er på Nasjonalmuseet, du kommer inn i en sone hvor det er Munch som regjerer, du vil finne ut mer info om bildene men det er ikke noen tittel på bildene

Participant: Jeg er veldig fan av Munch, da.

Kjetil: Ja, det er bra.

Participant: Men jeg kan ikke tittelen da, for jeg er ikke så fan.

Kjetil: Så, det du vil, du vil ha litt mer ekstra info og du har fått et tips om at det finnes en app for dette, og din oppgave er å teste appen og finne ut hvordan brukeropplevelsen for beacons er. Go!

Participant: Da trykker jeg på "neste", siden det var den grønne pilen. Kunstverkene... Oi, det er tre stykk. Her ser jeg tittelen også, tror jeg. Gå til nærmeste for mer info. Der seg jeg et rett forran meg, vet ikke om det er Madonna?

Participant: Det skjer ikke noe når jeg trykker tilbake, jeg bare står og venter, jeg trykker. Masse. Vet ikke hva som skjer. Har jeg nett? Trenger jeg nett? Nei, nei, Madonna, det er ingen informasjon.

Jon-Robert Har du på Bluetooth?

Participant: Nei...

Alle: [Alle ler]

Jon-Robert Det burde vi kanskje sagt!

Kjetil: Det burde vi sagt, ja.

Participant: Okei, nå, nå får jeg til.

Jon-Robert Fint det er pilottest!

Kjetil: Da tar vi en reset av testen, vi går tilbake. Jeg begynte å lure nå, hva som faktisk hadde skjedd

Participant: Burde kanskje få tilbakemelding på atte...

Kjetil: [Lager spole-tilbake-lyder]

Jon-Robert Vi kunne jo lagt inn en sjekk på det

Participant: Ja. Det kunne dere.

Jon-Robert Det kan vi gjøre

Participant: Okei, nå, nå, nå, kan du bekrefte at Bluetooth-tingen er markert?

Kjetil: Bluetooth er på [sier det ekstra tydelig rett i mikrofonen]

Participant: Sånn at, jeg ser Madonna...

Kjetil: Engage!

Participant: Engage. Jeg engager Madonna i kunstverk. Nei... Okei. Nå kan jeg få mer informasjon om Madonna. Jeg snakker til telefonen min[?]2:44 , men det gikk heller ikke.

Kjetil: Kan hende at du må resette appen

Participant: Okei, da prøver vi

Mer snakk om å restarte appen fra 2:48 til 3:15

Participant: Bluetooth er aktivert, og jeg trykker på neste. Oi, der dukka det opp.

Kjetil: Da var den rett på.

Participant: Ja, den bare "smeeck". Madonna er et maleri av Edvard M U N C H. Det finnes fem versjoner av maleriet. Det tror jeg ingenting på, for det står bare ett her. Alle malt i perioden 1894 til 1895, og alle med olje på lerretet. På lerret,

jeg beklager. Okei, da, det er greit. Da går vi tilbake-knappen, og så... virker ingenting så vi bare, vi bare går til neste. Jeg ser ett i hjørnet der.

Kjetil: Okei

Participant: Og dette er et ganske... flott bilde. Appen viser meg en tom skjerm, uten informasjon. 3:57

K. Okei, hmm... Det var jo litt rart.

Participant: Så... jeg vet ikke hva dette bildet heter. Der! kom det, når jeg trykket på tilbake

Kjetil: Ja...

Participant: Angst, det var litt det jeg følte når det bare... Tenkte bare "shit"[?] 4:15

Participant: Ehm... Det er laget av Edvard Munch det og. Det er fornuftig. Jeg er fornøyd. La oss... det var ett bilde til, så jeg.

Kjetil: Ja

Participant: Og det skal hete Skrik. Oi, der, den teksten var for mye for området

Kjetil: Ja

Jon-Robert Ja, det har vi fiksa. I den nye versjonen.

Kjetil: Ja, du har det ja

Participant: Sweet. Dette er et av de mest berømte bildene, og jeg har sett det før faktisk.

Kjetil: Ja

Participant: Jeg har ikke skreket til det da. Hallooo! [later som han roper] Ja... Nå trykker jeg tilbake, og det skjedde ingenting.

Kjetil: Nei

M. Er det... det er alle kunstverkene jeg kunne se?

Kjetil: Det er alt du kunne se

Participant: Ja

Kjetil: I denne verden

Participant: Ja, og appen sier at det er bare tre stykker, så da tror jeg på appen.

Kjetil: Ja

Kjetil: Men, ja. Jeg glemte jo egentlig å si at vi hadde sånn... om du går tilbake dit sånn

Participant: Nå gikk vi tilbake

Kjetil: Så ser du den feedback-knappen

Participant: Det er knapp med feedback skrevet på. Kan trykke på den.

Kjetil: Ja

Participant: Nå trykket jeg på den. Oi! Hvor vanskelig var det å navigere til kunstobjektet? Eh...

Kjetil: Det var egentlig bare det. Men

Jon-Robert Vi tar ikke vare på det, så... da brydde vi oss ikke så mye om det nå.

Participant: Nei. Jeg vet ikke

Jon-Robert: Ikke helt ferdig

Participant: Jeg skjønner ikke helt spørsmålet heller liksom, for hvor vanskelig... Jeg så jo kunstverkene når jeg kom inn i bygget

Kjetil: Ja, okei, ehm. Hvor vanskelig

Participant: Så...

Jon-Robert Var det å få opp info, kanskje?

Kjetil: Ja

Jon-Robert Mm

Participant: Eh

Kjetil: På en måte, hvor vanskelig var den interaksjonen mellom beaconsene for å få det inn på mobilen, da 5:45

Participant: Ja, det var litt forvirrende at det var en sånn tilbakeknapp, og så gjorde han ingenting når jeg var nærme

Jon-Robert Mm

Kjetil: Ja

Participant: ... greiene.

Kjetil: Ja

Jon-Robert Og at du ikke fikk opp beskjed om Bluetooth og kanskje?

Participant: Ja, det var forvirrende i starten, og jeg bare skjønte ingenting.

Jon-Robert Mm

Participant: Har stort sett ikke på bluetooth. 5:56

Kjetil: Ja

Jon-Robert Nei

Participant: Burde jo kommet opp sånn "denne appen vil bruke bluetooth"

Kjetil: Ja

Participant: Eller...

Jon-Robert Mm

Kjetil: Det er absolutt sant

Participant: Og der når jeg kom bort dit, så viste ingen ting seg før jeg trykket på den, så jeg vet ikke helt hva det var for noe.

Kjetil: Nei, tror kanskje ikke den hadde lastet ned bilde, tror jeg

Jon-Robert Nei, den har ikke jeg sett før

Participant: Ah, men det var ikke infoen heller da

Kjetil: Infoen?

Participant: Altså, det var kun det...

Kjetil: Ja, sånn ja, ja, stemmer det

Jon-Robert Mm

Participant: Det var ingenting annet. Så kanskje den bare trengte å oppdatere

Kjetil: Ja

Jon-Robert Mm

Participant: Ja. Ja.

Kjetil: Men da kan vi jo egentlig avslutte testen. 6:26

Kjetil: Vi lurte på bare en liten sån samtale og da.

Participant: Ja, jeg sette meg på andre siden her og

Kjetil: Ja, sånn at det blir hierarkisk riktig og sånn, vi er testerne og du er testobjektet

Participant: Men, ja. Hva er poenget med at den er i fullskjerm?

Kjetil: Nei, bare... Det var et eller annet

Participant: Okei, jeg bare...

Kjetil: Tok den, tok den at den skulle være i fullskjerm, jeg.

Participant: Ja

Kjetil: Bare for testen sin del

Participant: Ja, okei. Det er jo fornuftig da. Jeg vet ikke jeg. Hørtes veldig rart ut for å være ærlig

Alle: [ler]

Kjetil: Ja, okei, ja, men bare... Ja, så jeg hørte... du har jo ikke på bluetooth i det hele tatt

Participant: Nei, aldri.

Jon-Robert Hvorfor ikke det?

Participant: Jeg har ingen tjenester eller devicer som trenger bluetooth per i dag.

Kjetil: Nei

Jon-Robert Nei

Participant: Jeg har tenkt å kjøpe meg en sånn der en høytaler veit du som går på bluetooth, men den er ikke kjøpt inn enda.

Jon-Robert Nei

Kjetil: Men hvis du kjøper den høyttaleren, er det noe du... liksom kommer du til å ha bluetooth på hele tiden?

Participant: Nei

Kjetil: Nei

Participant: Det gjør jeg ikke.

Kjetil: Nei, så du liksom bare... du skrur den av og på når du bruker den

Participant: Ja

Kjetil: Ja. Eh... ja. Eh... men... hvilke... kunne du... kunne du liksom sett for deg... si hvis du er i et museum da

Participant: Ja

Kjetil: Og de spør deg: du må huske å skru på bluetooth på... for å bruke denne appen, hadde du

Participant: Ja da hadde jeg satt det på, hvis jeg, hvis jeg fant det, hvis jeg syntes det var bra å bruke appen liksom

Jon-Robert Mm

Participant: Hvis jeg hadde hatt nytte av det. Hvis appen var ubrukelig

Kjetil: Ja

Participant: Så hadde jeg jo bare ignorert det

Kjetil: Ja

Jon-Robert Mm

Participant: Men da hadde jeg jo ikke brukt appen i det hele tatt, så det er jo irrelevant om jeg hadde bluetooth på eller ikke 8:05

Kjetil: Ja. Hva synes du om liksom når du først, på en måte, for å få komme inn til beaconen, for å få liksom den interaksjonen, for å komme og få mer info, hva synes du om det?

Participant: Ehm. Jeg følte jeg så mer på telefonen enn på bildet. 8:21

Kjetil: Ja

Jon-Robert Mm

Participant: Men jeg har jo sett bildene før på en måte, og dette er jo bare ark som henger på veggen

Kjetil: Ja, det er jo det

Jon-Robert Mm

Participant: Så det er jo ikke... det er jo ikke som om jeg er i en mer reell... Da tror jeg at jeg sett mer på greiene, og så bare sett rett ned på telefonen for

Kjetil: Ja

Participant: ... info.

Kjetil: Ja

Participant: Muligens

Kjetil: Men... du... du, har du vært mye på museum i det siste, liksom? Har du...

Participant: Ikke, ikke i det siste.

Kjetil: Nei

Participant: Det er en liten stund siden jeg har gjort sist

Kjetil: Og da har du vel kanskje ikke mobilen oppe

Participant: Nei, jeg har telefonen i lomma. Eller av, hele turen, stort sett

Kjetil: Ja

Participant: Med mindre jeg tar snaps

Kjetil: Ja, det er jo viktig å...

Participant: En ting som skjer

Kjetil: ... viktig å dokumentere ting

Participant: Ja, for... for... ja. Det gode.

Kjetil: Ja. Ehm.

Et lite avbrudd i intervjuet fra 9:03 til 9:16

Kjetil: Sånn med tanke på... ja, ehm, med tanke på... jo, syntes du det var tydelig når liksom... hva syntes du om... du har jo sett beacons før, men... sånn...

Participant: Jeg nikker.

Kjetil: Ja

Alle: [Ler]

Kjetil: Men sånn, hva synes du om den biten... altså...

Participant: Det var veldig greit at jeg slapp å trykke på noe liksom, hvis jeg trengte informasjonen

Kjetil: Ja

Participant: Men det var litt sånn, med en sånn tilbakeknapp og så så jeg et sånt annet bilde sånn over gangen, egentlig 9:54

Kjetil: Ja

Participant: Og da var det sånn, hvorfor kan jeg ikke bare få informasjon der, er det interessant for meg i det hele tatt å gå bort og se på det bildet

Kjetil: Ja

Jon-Robert Mm

Participant: Eller skal jeg bare gå den andre veien

Kjetil: Mm

Jon-Robert Og du trykka jo også veldig mye på tilbake uten at det gjorde det du hadde lyst til

Kjetil: Ja

Jon-Robert Det var veldig tydelig at du hadde lyst til å gå tilbake, men du...

Participant: Skjønte ingen ting!

Jon-Robert ... uten at den gjorde det. Nei.

Participant: Men det var en knapp.

Kjetil: Ja

Jon-Robert Mm

Kjetil: Grunnen til at det skjedde er egentlig bare fordi du var i området til den beaconen

Participant: Ja

Jon-Robert Mm

Participant: Nei, jeg skjønte...

Jon-Robert Den forsvant, og så kom den tilbake igjen fortere enn du kunne se det

Participant: Ah, ja

Kjetil: Det var egentlig bare det som skjedde. Så det er jo en limitation da.

Participant: Mm

Jon-Robert Så det er jo noe..

Kjetil: Men det her er jo noe vi på en måte... vi har testet ut den der... avstands-måleren til beacons

Participant: Mm

Kjetil: Og... i teorien kunne vi brukt en annen måte, hvor vi har ett beacon i taken, så slapp vi...

Participant: Du peker i taket nå

Kjetil: Ja, jeg peker i... Jeg peker i taket! Eh... du kunne hatt en beacon i taket da, sånn at du får inn hele sonen da, så hvis du hadde for eksempel vært her, så kunne vi gjort sånn som du gjorde da

Participant: Mm

Kjetil: Fordi du syntes det var... hva synes du om den løsningen kontra...

Participant: Du, jeg har ingen, ingen erfaring med det, jeg vet ikke

Kjetil: Nei, nei men nå spør jeg deg litt hypotetisk da

Participant: Åja, skal jeg liksom... tenke?

Kjetil: Ja, du skal tenke. Hva, altså, i stedet for å ha en beacon for hvert kunstverk, og bare ha ett hvor bare du...

Jon-Robert Mm

Kjetil: ...nå kan jeg trykke på den, kontra enn å gå til selve kunstobjektet da, for å få mer informasjon

Jon-Robert Så det krever jo da en aktiv handling av deg på mobilen...

Participant: Ja

Jon-Robert ...fremfor en fysisk handling som å navigere da

Participant: Når jeg går på museet, så går jeg jo rundt og, jeg vil jo se på alt, men det meste er... det meste. Det er noe av det bare ser jeg på og så går jeg videre. 11:25

Jon-Robert Mm

Kjetil: Mm

Participant: Mens andre ting tar jeg og leser på, men... ehm... det er ikke alltid jeg leser liksom, av og til er det bare fint å bare...

Jon-Robert Men du, det er sjeldent du leser om noe du ikke faktisk går og ser på?

Participant: Eh...

Jon-Robert Eller? Eller leser du før for å se om det er noe du har lyst til å se på?

Participant: Hm... Jaaa... 11:47 Det er liksom, jeg pleier ikke å lese så mye av det som står... jeg pleier som oftest bare å skumlese gjennom tekst...

Kjetil: Mm

Participant: ... som oftest.
Jon-Robert Mm
Participant: Og da er det bare... okei, det var helt rart.
Kjetil: Ja
Participant: Og så leser du mer nøye.
Jon-Robert Mm
Participant: For det var sånn: whaat?
Kjetil: Ja
Jon-Robert Mm
Participant: Eh...
Kjetil: Men... du vil liksom ikke... trykket... du vil tro du ikke kom til å trykke på noe da, i og med at du kanskje bare skummer igjennom.
Participant: Jeg veit ikke jeg
Kjetil: Siden du bare...
Participant: Det er liksom... jeg liker å trykke på ting.

D.2 Transcript of first test #2

#0:0:3.5# Fordi bluetooth i bilen er noen ganger superstress, slik som i går skulle jeg hente pappa og skulle gi bilen tilbake til han og i det jeg gikk ut av bilen tok jeg en samtale til en venn, men så hørte jeg ingenting og jeg så at mobilen hadde "svart" fordi telefonen begynte å telle. Hva faen var det som skjedde? Så kom jeg på at pappa hadde samtalen på i bilen da. #0:0:45.5#

#0:0:45.5# Det samme har skjedd før da jeg har sittet utenfor i mamma og pappa sitt hus [i bilen], bort fra dem. Så sitter pappa i telefonen inne, så skrur jeg på bilen så plutselig får jeg telefonsamtalen til pappa i bilen og pluteslig hører jeg broren min fra ingenting. #0:1:8.7#

#0:1:5.4# Kjetil: Så du har litt dårlige erfaringer med bluetooth? #0:1:10.1#

#0:1:10.1# Nja, nei, jeg stoler ikke helt 100

#0:1:17.3# Kjetil: Er bluetoothen din alltid på? #0:1:20.2#

Nei, nå nå er den på, men den er egentlig aldri på. Nå er den på pga. av testen, men jeg skrudde den av i går fordi det begynte å klikke littegrann. Eller jeg skrudde den av på siden jeg skulle teste litt med appen min i går. #0:1:38.1#

#0:1:38.1# Kjetil: Vanligvis er bluetooth av? #0:1:39.3#

Vanligvis er bluetooth av, men siden jeg har begynt å utvikle denne appen[krever bluetooth] da har bluetooth alltid vært på. Hvis jeg skal ha lange bilturer setter jeg på bluetooth - hvis jeg kjører da. #0:1:55.0#

#0:1:52.8# Kjetil: For musikken sin del? #0:1:52.8#

Nei, for telefonsamtaler hvis noen ringer meg. For musikk bruker jeg AUX. Ellers bruker jeg ikke bluetooth "at all", jeg vet ikke hvorfor egentlig. Jeg har ikke noe sånn godt forhold til sånn, hvis det er snakk om sånn bluetooth headset. Jeg føler det bare aldri kommer til å funke. Jeg stoler ikke på det. Trådløs ting, egentlig "in general". Sånn trådløs headset og sånn jeg er ikke... Det er kanskje bluetooth alltid? #0:2:21.5#

#0:2:58.3# Kjetil: Hva tenker du om beacons kontra NFC i et museum? #0:2:58.3#

Å ja, hvor var det? Moma tror jeg, i New York - et museum jeg var på i år. Så hadde de, det var kanskje ikke der. Du fikk låne iPhones tror jeg, de hadde masse sånne og det kosta $5 å låne, så hadde de på seg sånn liten greie [iPhonesene] på tuppen som var en scanner eller noe slikt. Kanskje det ikke var på tuppen, men i hvertfall du kunne scanne. Det var vel ikke RFID og det var ikke QR, men det var noen sånne bittesmå hull i veggen - jeg vet ikke helt hva de gjorde, sendte ut noen lys eller, hakke peiling. Og da kom det info opp på mobilen slik som dere har, men jeg synes det var litt sånn tiltak. #0:3:52.6#

#0:3:48.4# Jon-Robert: Kanskje det var sånn infrarød, sånn typ fjernkontroll. #0:3:53.0#

Ja, det var sikkert det. #0:3:53.2# #0:3:53.6#

#0:3:53.6# Kjetil: Men det var på en måte samme prinsipp? #0:3:55.6#

Ja, det var samme prinsipp, men jeg synes det var litt tiltak og dra opp den og gå bort til den. #0:4:0.3#

#0:4:0.3# Kjetil: Gikk du slik som du gikk her #0:4:8.0#

Nja, du hadde den rundt halsen, i sånn typisk du har kort på jobb. Og så hadde du med øreplugger så du hadde lyd også. Så kunne du "beepe", så kunne du spille av lyd. #0:4:19.8#

#0:4:19.8# Hva synes, da du var i New York om å låne en slik device? #0:4:28.8#

Jeg synes det var litt kult, fordi jeg hadde aldri sett det før, men jeg tror at det var litt tiltak å gjøre det (låne bort enhetene). Jeg tror det er bedre enn å laste ned en app til hvert satans museum du skal gå i. Så tror jeg det er mye mer diggere å låne en device. Gitt at den fungerer ordentlig da. For hvis det begynner å skje noe

dritt med den devicen og du får slike feilmeldinger så har du ikke peiling på hva du skal gjøre. #0:4:55.2#

#0:4:52.7# Kjetil: Allerede her nå så var det jo problemer med å få inn applikasjonen på din mobil. #0:4:56.3#

Ja, det og egentlig. Installere apps, er jo skummelt. #0:4:58.9#

#0:4:58.9# Kjetil: Det som er mulig da, er jo ved inngangen at brukeren får muligheten tilå laste ned applikasjonen ved bruk av en notifikasjon #0:5:6.3#

Ja, en link liksom? #0:5:8.4#

#0:5:11.8# Ja, egentlig litt slik som jeg prøvde da med Dropbox, men så gikk jo ikke det da. Men da hadde det vært en link til Google Play da [i museum] #0:5:16.8# #0:5:19.9#

#0:5:21.4# Kjetil: Hadde du fortsatt vært villig til å laste ned appen da? #0:5:23.7#

Jeg tror ikke jeg hadde det, eh, hvis, jeg tror egentlig ikke det. Ikke hvis det var skilt rundt omkring, men hvis skiltene var elendige og jeg visste at jeg kunne få god info på mobilen hvis jeg lastet ned appen #0:5:42.2#

#0:5:42.2# Kjetil: Hva er god info for deg da? #0:5:43.6#

Hvis skiltene bare var titlene og... Det var et slikt Leonardo DaVinci-museum i Milan. Og der var det mange kule ting, ikke sant. Mange gadgets, og der har jeg lyst på litt mer info enn bare hva det heter og når det ble laget. #0:6:13.1#

#0:6:9.5# Ja, var ikke du med på Aker Brygge [Besøksmuseum for Nasjonalmuseeet] Der var det bare titler iaf. Og hvem som hadde laget det. #0:6:13.3# #0:6:16.0#

Det er altfor lite synes jeg, hvis det hadde vært alt. Hadde jeg nok lastet ned applikasjonen, for å få mer informasjon, tror jeg. Hvis ikke det var et lite "shitty" museum, som i bakhagen til Jon-Robert [ikke lastet ned app].... Og når det er sånn "narrating" da. Det hjelper jo mye. Hvis det ikke hadde vært essensielt, hadde jeg nok ikke lastet den ned. #0:6:47.0#

#0:6:47.0# Jon-Robert: Hvis du hadde fått opp den infoen der, hadde det vært enda bedre om du hadde fått den infoen i øret? #0:6:59.3#

Ikke nødvendigvis. Jeg er veldig inkonsitent om jeg liker det eller ikke. Av og til har jeg bare lyst til å scanne gjennom og se at dette er dritkjedelig og ikke har lyst til å lese mer. #0:7:10.8#

#0:7:7.8# Kjetil: Leste du det som sto på testen? #0:7:7.8#

Nei, det kunne for alt jeg visste stå: “LOL, Torkjel du er teit”. Så jeg vet ikke jeg. Nei, jeg leste ikke det. Jeg regnet egentlig med at det sto “Lorem ipsum”?#0:7:20.8#

#0:7:19.9# Kjetil: Ja, det var Wikipedia. #0:7:21.5#

#0:7:27.2# Kjetil: Men hvis du tenker på det formatet som sto der da. Så var det jo masse tekst. Hadde det vært bedre med en plass hvor du kunne trykke deg videre [aggregere] på mer informasjon? Hvordan hadde du vært villig til å faktisk lese det som var der? I det hele tatt, er det lese du vil gjøre på et museum? #0:7:55.9#

Jeg tror det. Det hadde vært digg å ha muligheten til å ha noen som leser det opp for deg. Og trykke; “Read this for me please”. Så får du en supersexy stemme til å lese for deg, men det er jo diggest hvis det er - hvis det står en del så er det godt med gode overskrifter; Her står det om X og her står det om Y, så hvis du for eksempel [museumsbesøker] driter i kunsterens liv. Så kan du hoppe over dette, for så å scrolle ned til bildets komposisjon - hvis det er det du synes er interressant. Jeg vet ikke om det er så nyttig med så mye interaktivitet. Kanskje for barn, men jeg vet ikke hva det skulle vært på sånne malerier. Det kunne kanskje vært; “Trykk her for å endre fargen på bakgrunnen. Så ser du blå farge på denne bakgrunnen i stedet for rød.” #0:9:18.1#

#0:9:24.4# Jon-Robert: Hvordan er det du ser for deg at det fungerer? Når du nærmer deg [kunstverket], hvordan er det du forventer, hvordan du forstår at det skjer? Er det magi? #0:9:40.7#

#0:9:40.7# Kjetil: F.eks. Når du var der [ved et kunstverk], så sa du at du var litt redd for at den ikke kom opp [informasjon]. Hvorfor var du redd for det? #0:9:52.1#

Det tok for lang tid, men . . . [avbrutt av mobilen]. . . #0:11:28.9#

#0:11:30.2# Kjetil: Har du noen andre tanker om beacons nå, nå har jo du jobbet litt med det, men nå som du faktisk har prøvd det ut i praktisk. I forhold til hva du tenkte før. #0:11:43.3#

Det tok litt tid, men jeg vet ikke helt om det er et reelt problem, for det eneste jeg sitter er jo å venter på popup [informasjonen skal komme opp]. For det er jo det som er oppgaven min. #0:12:2.2#

#0:12:2.2# Jon-Robert: Men det du sa var jo at egentlig så hadde du kanskje tatt den opp hvis det hadde vært noe mer du ville lese mer om. Ikke gå rundt med

mobilen. #0:12:9.9#

Ja, muligens. Men hvis det hadde vært slik at det ikke var noen plakater på i det hele tatt. Så tror jeg at jeg hadde gått rundt med mobilen hele tiden. Muligens. #0:12:34.4#

#0:12:26.4# Kjetil: På det nye Nasjonalmuseet skal det egentlig være veldig lite. Jon-Robert: Så lite som mulig. #0:12:33.7#

Sånn at gamle folk ikke "får lov" til å være der. #0:12:34.6#

#0:12:38.4# Kjetil: Ja, det var egentlig slik jeg også tenkte. Det blir sikkert enda verre når de må bruke mobil også [de eldre]. #0:12:44.1#

Det er jo litt rart. Pappa hadde sikkert slitt.... Hva var det jeg sa, jo... Hvis jeg for eksempel hadde tasset rundt med den scanneren i hånda eller hvor hen jeg har den og så går jeg og ser på et maleri så har det ikke noe å si om det tar 2-3 sekunder, for du ser jo ofte litt på maleriet først. Jeg regner med at det står tittelen på maleriet står ved siden av. Du ser jo (kanskje) på det først, før du ser på mobilen. Men det hadde vært digg om den kanskje scannet hele tiden [scanner etter beacons]. Sånn at den scanner nå da, selv om den hadde vært lukket. #0:13:45.5#

#0:13:36.7# Kjetil: Det er egentlig sånn den skal fungere, men vi ville fokusere når du var med den [brukte applikasjonen]. I nye Android som kommer ut [er ute nå for visse telefoner], så skal det bli veldig integrert med beacons. Sånn at du har det i bakgrunnen hele tiden. Så bruker man [Google] sånne Eddystone beacons [annen protokoll] og da slipper man å ha apper. De bare broadcaster URL'er. #0:14:50.4#

D.3 Transcript of workshop

Scenario 1 #0:0:2.5# Kjetil: Så du synes det er noe negativt om man trackes da #0:0:17.4#

#0:0:17.4# Person#1: Hvis det er frivillig synes jeg det er negativt, men om man ikke vet det, så er det litt dumt at folk vet hvor du har vært da. #0:0:22.8#

#0:0:22.8# Kjetil: Men det vi prøvde å legge fram da, er at det er til Bjørg sin, som en museumansatt, de som har ansvar for museumutstillingene, de skal på en måte gjøre utstillingene bedre og gjøre det mer tydligere da. Hvis det bare er til dette formålet, synes du det er greit da? #0:0:44.7#

#0:0:44.7# Person#1: Ja, da synes jeg det er veldig bra. Da har du muligheten til å se hva etterspørselen er da. Hvis en utstilling er mer attraktiv enn den andre, kan de tenke [museumsansatte]; den ligger kanskje bedre eller der har vi gjort noe morsomt eller kan på en måte vite det da. At dette slår an [hos publikum] og dette slår ikke an. Det er jo på en måte positivt. #0:1:11.4#

#0:1:11.4# Kjetil: Hva tenker du om det? #0:1:11.4#

#0:1:12.6# Person#2: Men må ikke folk være på utstillingen for å vite om de må dra til den? Og du er ikke overalt? #0:1:19.7#

#0:1:20.6# Kjetil: Slik som vi tenkte det i det scenarioet [Scenario 1]; De som jobber der, vet jo ikke alltid hvor publikum drar. For i det nye Nasjonalmuseet så er mange utstillinger overalt fordi det er et svært bygg. Det kan være at noen folk drar til utstilling A, men flesteparten drar til utstilling B. #0:1:41.9#

#0:1:41.2# Person#2: De drar ikke overalt lissom. #0:1:41.2#

#0:1:43.4# Person#1: Det er jo slikt på Teknisk museum også, så har man jo sånne forskjellige biter man kan dra til. #0:1:50.5#

#0:1:50.5# Person#3: Det virker som en god idé for de som jobber på museet. De får en oversikt over hvor folk går og ikke går. Da kan de plassere ting litt mer strategisk. #0:1:58.7#

#0:1:58.7# Person#1: Jeg tror også det er positivt for folk som kommer og ser. De kanskje er ikke så kunstinterresert, men er litt nyskjerrig på det. Så kan man se hva som andre har likt. Så hvis man ikke har peiling, i stedet for å gå ut å vandre og kanskje ikke få en positiv opplevelse fra det. Så kan man gå dit det er populært. #0:2:18.5#

#0:2:16.8# Kjetil: "Andre som deg gikk denne veien" For eksempel. #0:2:20.7#

#0:2:20.7# *Det humres* #0:2:20.7#

#0:2:20.7# Person#2: Ja, men det er kult det da. #0:2:22.8#

#0:2:22.8# Person#1: Eller kanskje folk med forskjellige interesser da... Det er liksom slik når man løper da, så har man forskjellige apper som tracker forskjellige ruter i nabolaget ditt. Der er det jo forskjellige spesifikasjoner; her er det høydeforskjell eller her er det langt eller kort. Du kan velge preferanser da. #0:2:44.7#

#0:2:44.7# Kjetil: "Her er det veldig mange bilder, her er det veldig mange skulpturer. Så du velger på en måte den ruta utifra dine preferanser #0:2:51.4#

#0:2:51.4# Person#1: Eller Oslo, dette er fra Europa [Bilder, skulpturer] #0:2:56.1#

#0:2:59.3# Person#4: Jeg har et innspill. Jeg er ikke så veldig ofte på museum, men hvis jeg er det så hvis jeg er keen på å se en utsilling, så er det sinnsykt mye folk på den utsillingen, men det er en annen utstillingen jeg kan se på, så vil jeg kanskje se på den utstillingen først [den med minst folk]. Da vil det kanskje gi litt misvisende resultat hvis det er mange som gjør det. #0:3:31.3#

#0:3:31.3# Kjetil: Fordi de velger den først i stedet for? #0:3:31.3#

#0:3:34.3# Person#4: Ja, fordi de velger den de vil se sist i stedet for da. Siden da er det kanskje ikke så mange folk der. #0:3:38.7#

#0:3:38.7# Person#2: Men det trenger jo ikke å bety at utstillingen er noe spesielt god. Men at sånn dere sier da, at den er nærme eller at den ligger godt til eller bare at de har reklamert den jævlig bra. Så det kan jo hende at utstillingen egentlig bare er skit. Men det bare har vært masse reklame på Tv liksom. Så er det en utstilling på hjørne som ingen går til. #0:3:58.4#

#0:3:58.4# Kjetil: Det er jo også litt det vi tenkte på da, at den [en upopulær utstilling] kanskje trenger bedre skilting. Det kan jo være mange faktorer som spiller inn der. Det kan jo være en indikator på at det er ikke mange som drar til utstilling A. Som kanskje vi [museumsansatte] må gjøre noe med. Så da kan Bjørg i dette scenarioet da, gjøre noe med dette. Eller de museumsansatte. #0:4:23.0#

#0:4:23.7# Person#2: De vet jo ofte om de har reklamert noe eller om de ikke har reklamert noe. Hva de har gjort forskjellig. Ja, det er sant. #0:4:30.8#

#0:4:30.8# Kjetil: Hva synes dere er det mest positive blandt dette scenarioet? #0:4:35.1#

#0:4:35.1# Person#2: For dem? Person#1: For de ansatte liksom? #0:4:37.9#

#0:4:37.9# Kjetil: For selve Bjørg og de ansatte. #0:4:43.0#

#0:4:43.0# Person#1: Det er jo det at de har muligheten til å se hva folk liker, at de kan se hvor mange som drar til et sted i forhold til et annet. Det betyr jo noe på en måte. At det har vært mer appellerende. Eller at det er likt. Og det har jo mye med trender å gjøre i samfunnet og da, det er ikke bare med hva jeg liker. Plutselig er det et kjempeinterresant museum [utstilling]. “Oi, her var det veldig kult med kongefamilien da”, men det var fordi at de hadde 25-års jubileum. Så det er jo også positivt at de kan tracke interressen [blandt folk]. #0:5:20.1#

#0:5:20.1# Person#4: Og at kunsterne får vite antall visninger. #0:5:26.6#

#0:5:26.6# Person#2: Betalt per antall visninger slik som Spotify. #0:5:31.8#

#0:5:31.8# Kjetil: Hva vil dere si er det mest positive for de besøkende da? Gir det noe i det hele tatt til de besøkende? #0:5:37.5#

#0:5:39.4# Person#2: Akkurat her så gir det kanskje ikke noe direkte da med mindre man får tilgang til den besøksdataen. Hvis man besøker forskjellige greier. Men man får det indirekte ved at museumet blir sikkert bedre hvis de kan tilpasse utstillingene sine utifra det. Så indirekte blir sikkert museumet bedre. #0:5:54.8#

#0:5:55.1# Kjetil: Negative. Hva er det mest negative for de ansatte i dette scenarioet? Eller for scenarioet da. Du nevnte jo tidlig i starten at du var litt usikker. #0:6:11.2#

#0:6:11.2# Person#1: Ja, det med at folk er klar over at de blir overvåket da eller tracket. At det burde komme tydelig fram. Og den utfordringen jeg ser er at beacons i seg selv ikke er så kjent. Så de må gjøre en kampanje og markedsføre det på en måte før de starter for å få noe nytte ut av det. Men hvis vi later som om det har skjedd, at folk vet hva det er. Så føler jeg at det er positivt og slikt. Man ser det jo bare mer og mer med trening og med restauranter, så hvorfor ikke museum. #0:6:48.1#

#0:6:48.1# Kjetil: Det du sier der er jo veldig essensielt i vår oppgave, fordi det er veldig få som vet hva beacons er egentlig; på samme måte som NFC-betaling. Hvor mange er det egentlig som bruker det? Så det er på en måte det å få den kampanjen ut da. #0:7:0.5#

#0:7:0.5# Person#1: Det ser jeg som den største utfordringen, men hvis det er på plass så tror jeg egentlig det bare er positivt. Annet enn at folk må ha smarttelefon da. #0:7:13.7#

#0:7:13.7# Person#2: Det har de fleste da, har de ikke? Men er det egentlig viktig at de skal vite at det er beacons liksom? Og at det er bluetooth? Kan man ikke bare si at det basically er GPS-tracking. Slik at de forstår det bedre. #0:7:29.0#

#0:7:29.0# Person#3: Men de må jo allerede ha lastet ned den appen. Hvis de kommer til et museum så må du bruke 5 min på å laste ned en applikasjon. Det er jo ikke sikkert at det er så mange som gjør det. Eller noen spesielle gjør kanskje det. #0:7:36.7#

#0:7:36.7# Person#4: Gi dem kaffe. “Last ned appen, så får du en kaffe” #0:7:43.1#

#0:7:43.1# Person#1: Det finnes jo flere måter å markesføre det før de kommer til museumet. Hvis de markedfører det før, men er det ikke en del universiteter som har indoors-tracking da? Hva er det de bruker? Bruker de beacons? #0:7:56.3#

#0:7:56.3# Jon-Robert: På NTNU bruker de WIFI #0:8:0.3#

#0:8:0.3# Person#1: Å!? Harvard og NTNU er det vel de eneste jeg har hørt om som gjør det, kanskje. #0:8:11.3#

#0:8:11.3# Kjetil: Men hvis vi tar et lite sidestep da. Det har kommet noe nytt som heter Eddystone beacons, som er laget av Google. Og da trenger du ikke å laste ned en applikasjon i det hele tatt. Hva tenker dere om det? For da skal det være integrert i operativsystemet. #0:8:23.5#

#0:8:23.5# Person#1: Men du må slå på bluetooth på telefonen din? #0:8:24.4#

#0:8:24.7# Kjetil: Ja, du må slå på bluetooth på. #0:8:25.4#

#0:8:25.4# Person#1: Men da synes jeg det er lettere, da kan det bare være et skilt utenfor. Med tanke på at det er Nasjonalmuseet, det er i hovedstaden, folk er med på denne teknologien - folk er med på denne teknologiseringen av hverdagen. Det blir det bare mer og mer av. Så da føler jeg at det... så lenge folk vet og konsekvent slår på bluetooth selv og velger det selv. Noen er jo litt eldre mennesker og er kanskje ikke så interressert i det og tenker; "Nei nei". Så kan de velge å ikke gjøre det. #0:9:1.2#

#0:9:1.2# Person#3: Jeg tenker jo at det kanskje er en del folk som er litt skeptiske til å dele slik informasjon, men hvis du klarer å snu det til at de også får noe igjen for det. Og at det ikke bare er for å hjelpe museet, men at det også skjer noe bra for de da [besøkende til museet]. #0:9:15.7#

#0:9:15.7# Person#1: Så tenkte jeg også på det jeg sa med at eldre kanskje blir ekskludert. Det blir kanskje litt dumt. For da får de bare meningen til en viss type folk. #0:9:25.7#

#0:9:23.9# Person#4: Det er gamlinger som kan kunst. #0:9:27.1#

#0:9:27.1# * Det skrattes enighet * #0:9:27.1#

#0:9:30.2# Person#1: Men det jo det som Person#3 sier, må gjøre det til noe positivt. De fleste er jo sikkert med på det. Kan ikke skjønne hvorfor; "Nei, det har jeg ikke lyst til" [Streng tone]. At det er ytterst få #0:9:40.3#

#0:9:40.3# Person#2: Det er jo ikke noe insentiv i det scenarioet der til å skru på bluetooth, annet... Det er akkurat det samme som at du skal huke av; "Ja, send

brukerdata når du innstallller Google Chrome f.eks. #0:9:48.9#

#0:9:48.9# Kjetil: Det er faktisk akkurat det samme. #0:9:51.5#

#0:9:51.5# Person#1: Det er jo ikke navn som det er knyttet til. #0:9:56.7#

#0:9:56.7# Person#2: Det er vel helt anonymt, eller det er vel nødvendigvis ikke det? #0:9:59.7#

#0:9:59.7# Kjetil: Slik som jeg tenker det nå, så er det jo det. #0:10:4.1#

#0:10:4.1# Person#2: Man trenger jo ikke å logge nødvendigvis hvem som var der, men bare at noen var der. Men det vet jo ikke folk. #0:10:13.1#

#0:10:13.1# Kjetil: Det er vel ikke helt lov heller. Sånn datalov... #0:10:21.1#

SCENARIO 2 #0:11:20.9#

#0:11:20.9# Person#2: Da er det sånn at du må ha en app igjen med bluetooth og da har hun et insentiv til å ha på bluetooth. #0:11:24.5#

#0:11:24.5# Kjetil: Hva tenker dere sånn ved første tanke? Hva tenker du Person#2? #0:11:30.9#

#0:11:30.9# Person#2: Det var min første tanke! Jeg tenker egentlig at det er ganske sweet. Men da må hun igjen laste ned en app. #0:11:48.6#

#0:11:48.1# Kjetil: Ta også se litt bort i fra det da. Bare anta at hun har gjort det, eller at det bare er integrert i operativsystemet. #0:11:56.6#

#0:11:55.0# Person#4: Da er det bare positivt da. Jeg var faktisk på Picasso-museet i Barcelona. Da delte de ut noe med øreproppper, så når du kom til bilde så ble det lest om bildet høyt for dem da. #0:12:17.7#

#0:12:16.8# Kjetil: Og de måtte ikke scanne noe? #0:12:18.1#

#0:12:18.1# Person#4: Nei, jeg tror ikke det. Jeg prøvde det ikke selv, men jeg så folk sto med de greiene foran bildene og det kan jo replace den appen da. At du også kan få informasjon gjennom øret med en eller annen device. Låne en device fra museet. Og du kan gjøre det sammen med mobilen om du foretrekker det. Få med gamlinger også. #0:12:43.0#

#0:12:43.0# Person#2: Jeg har vært borti en del sånn låne-device-shit også. Jeg synes det er dritirriterende. #0:12:46.8#

#0:12:46.8# Person#3: Jeg også! #0:12:47.6#

#0:12:47.6# Person#2: Også koster det...og noen steder må du gi depositum og andre steder må du betale, noen steder er det gratis. Jeg synes det bare... Det verste stedet jeg husker var sånn svær, det var en iPhone. Sånn svær kasse, ikke sånn svær kasse, men ble nesten 50

#0:13:21.7# Jon-Robert: Så det er fordel at du kan bruke din egen enhet da? #0:13:22.9#

#0:13:22.9# Person#2: Ja, jeg vil påstå det. Men det kan bli litt skummelt, nå er vi jo på det å ha app igjen da. Det er ikke så jævlig kult når du er på et museum i en by så er det jo ikke kult å laste ned en app hver gang du skal inn på et museum. #0:13:40.4#

#0:13:40.4# Person#3: Men jeg synes noen ganger at de der du får utdelt sånn at du må trykke på en knapp så skipper man på en måte videre. Og da må du jo hele tiden høre hvor du er hen. Det er jo så tiltak #0:13:49.7#

#0:13:49.7# Kjetil: Når du gjør det her da [i scenarioet] så vil du på en måte unngå det da. Når du kommer i rommet så er du på en måte på rikitg spor da. #0:13:57.4#

#0:13:57.4# Person#3: Det høres jo veldig praktisk ut da. Så slipper du å låne sånn device som en million andre turister har tafset på før. Jeg føler at de er så skitne og ekle [utlånsdevicene]. Og øreproppene har ørevoks i seg og slikt, jeg synes det er litt ekkelt. #0:14:10.2#

#0:14:10.2# Kjetil: Ja, det er sant. På samme måte med øreppropper på fly. De var jo resirkulert. De var jo brukt før... Men tanken med det her er jo at turister kan komme da og få informasjon med en gang - uten å gjøre noe mer hokus pokus enn å bare starte opp appen. #0:14:45.8#

#0:14:44.3# Person#2: Så slipper du at det står masse informasjon på 40 forskjellige språk på en plakat ved siden av. #0:14:51.9#

#0:14:51.9# Jeg synes det er bra som en tilleggstjeneste. At du ikke ekskluderer norsk og engelsk - at det er der, men i tillegg kan du ha det [Forskjellige språk på mobilen]. Og så har jeg notert at det ekskluderer de som ikke har smarttelefon. Og det var jo dere inne på at dere kan låne noe, da bør kanskje noe slikt utstyr være tilgjengelig, slik at man har muligheten. For det er ikke bare det å bare laste ned en app. Det kan jo være at en turist har en del ting på mobilen fra før, og man har kanskje litt lite batteri. Så har man ikke lyst til å bruke det der. Så da må man kanskje innføre ladestasjoner på museet. #0:15:35.1#

#0:15:48.5# Kjetil: Beacons er jo en teknologi som ikke bruker så mye strøm for din egen del, bluetooth er jo på uansett - altså som regel. Sånn sett vil jo det ekskludere de eldre, men det er jo bra det du sier at det er en tilleggstjeneste. For hvis det hadde vært utelukkende bruk av beacons så ville det jo ikke vært så mange

som hadde brukt det. Først og fremst er det jo litt eldre folk som er på museum, eller nå tar jeg jo tall ut fra lufta da. Eller vil man tro det? #0:16:22.1#

#0:16:20.9# Person#2: Nei, det vil jeg ikke tro. #0:16:25.4#

#0:16:25.4# Jon-Robert: Nå er jo dette om turister også da, så da er det jo ikke utelukkende at det er eldre folk. #0:16:28.5#

#0:16:28.5# Person#1: Jeg tror det er vanlig folk også jeg. #0:16:31.1#

#0:16:31.1# Person#2: Man hva definerer dere som eldre folk? #0:16:33.8#

#0:16:33.8# Person#3: 67 år og oppover. #0:16:39.2#

#0:16:39.2# Person#2: Men jeg kjenner flere av de som.. nå er jo pappa steingammel da, han er jo i den aldersgruppen. Alle vennene hans er jo into-den teknologi. #0:16:47.6#

#0:16:47.6# Person#3: Men det er ikke alle. #0:16:56.9#

#0:16:56.9# Person#1: Men jeg ser ikke det som et problem, at dette kommer til å hindre at dette kommer til å bli vellykket. Men det er et hensyn man må ta da. At ikke alle er med på den bølgen, men ikke ekskluderer de heller da. #0:17:11.8#

#0:17:11.8# Person#2: Jeg tror ikke alle eldre hater all teknologien var poenget mitt egentlig. #0:17:19.4#

#0:17:19.4# Kjetil: Men det mest positive, hva vil det være Person#3? #0:17:23.2# #0:17:34.7#

#0:17:34.7# Person#3: Det er jo det at du slipper å ha alt displayed på veggen hele tiden. At du kan få det på ditt eget språk. Uten å måtte plage alle andre med det. #0:17:43.0#

#0:17:43.0# Person#2: Eller på en skjerm, det er jo noen som har det. Ved vært kunstverk så er det en skjerm. Så skal den være så sykt fancy med touch, så fungerer den aldri. På Storo feks. da klarer jeg aldri, for du skal dra til siden for å komme til ny etasje, men den fungerer jo aldri. Så er menyen helt jævlig. Det er jo mulig det også for å få flere språk, men jeg er ikke så veldig fan av de. #0:18:7.0#

#0:18:7.0# Person#3: Og hvis det er mange folk, så kan ikke alle stå på den samtidig. #0:18:13.5#

#0:18:13.5# Kjetil: Og det mest negative var at det var litt ekskluderende da? #0:18:17.5#

#0:18:17.5# *Enighet blandt alle* #0:18:17.5#

#0:18:19.6# Person#1: Jeg har skrevet: Positivt: Gjør info mer tilgjengelig #0:18:34.6#

Scenario 3

#0:20:18.5# Person#4: Hva hvis det er 40 stk på trikken som billett, så tror de at de kommer til å slippe køen, men så er det ikke noe kø i billettluka, men det skapes en stor kø i den andre rekka. #0:20:33.6#

#0:20:33.6# Person#1: Det er jo ikke kø for å komme inn i et museum da. #0:20:33.6#

#0:20:39.6# Person#4: Det må jo sikkert være en kar som skal se på billetten. #0:20:41.0#

#0:20:41.0# Person#1: Det tar jo kortere tid det da. #0:20:42.7#

#0:20:42.7# Jon-Robert: Her skal du slippe å vise fram billetten. Den skal gjenkjenne deg når du kommer til luken. Det skal ikke være slik at du skal vise den til noen. #0:20:52.3#

#0:20:52.7# Person#2: Men hvordan da? Det åpnes en port? #0:20:54.3#

#0:20:54.3# Kjetil: Det står... Det kommer en skjerm der, hvor det står at 4 stk har lov til å komme inn. #0:21:6.8#

#0:21:6.8# Jon-Robert: Evt. kan man gjøre slik man gjør i skiheiser da. Der hvor man slipper inn en og en. Det er en mulighet. Det vil uansett gå fortere enn en billettluke, vil jeg tippe. #0:21:16.1#

#0:21:16.1# Person#2: men du sa Person#4, at man skulle kjøpe det på trikken? #0:21:21.6#

#0:21:21.6# Person#4: Ja, eller jeg vet ikke hvor lang rekkevidde det er. #0:21:21.7#

#0:21:21.7# Person#2: Det var jo utenfor. Så du ser jo om det er evig mye kø. Eller ikke. #0:21:28.1#

#0:21:28.1# Person#3: men da tenker jeg at det er det samme problemet at man ekskluderer de som ikke har appen. For da står alle de gamle i kø og venter i en evighet og de unge; "YES, nå går vi inn!". #0:21:40.2#

#0:21:40.2# Person#2: Da får de "Learn the hard way" at de må catche opp [med teknologien]. #0:21:45.9#

#0:21:47.2# Person#1: Det minsker jo kanskje køen i billetluken da, i stedet for at alle går dit. Så det er jo egentlig fordel for alle. #0:21:56.0#

#0:21:56.0# Kjetil: Hva tenker dere om en slags, dette kan jo brukes til mangt da. Bare at det står en beacon utenfor inngangen. F.eks kino, tbane og andre ting. Så kan du på en måte bare få en slags notifikasjon. Hva tenker dere om den betalingsløsningen, at dere er i nærheten så kan dere betale. #0:22:25.0#

#0:22:25.0# Person#4: Chillern det. #0:22:27.1#

#0:22:27.1# Person#1: Synes det er veldig positivt, gjør det veldig enkelt. Jo enklere det er, jo oftere gjør folk det. Og hvis man ikke vet om stedet så kan man gå rundt i byen og få tilbud om ting man kan gjøre da. Da tenker jeg utenfor museum da. Hvis alle kinoer hadde hatt det, så er det jo litt deilig. #0:22:47.6#

#0:22:47.6# Person#2: Det kan jo bli litt slitsomt etter hvert da. Notifikasjon på notifikasjon. #0:22:50.7#

#0:22:50.7# Person#1: Da kan du jo bare slå det av. #0:22:53.5#

#0:22:54.9# Person#3: Du kan velge typer for hva du vil ha. #0:22:59.5#

Kjetil: Ja, kan jo kanskje... "jeg vil bare få tilbud fra klesbutikker", eller bare fra kino eller museum eller sånne ting da.

Person#1: Ja sånn, attraksjoner. Det er jo kjempepositivt hvis man er i en by, spontant reiser til en eller annen random by og så bare... "hva skal vi finne på her?", og så er det kanskje en litt ukjent by, og så har du beacons og så kan du sette på "jeg vil ha attraksjoner" eller ting å gjøre, og så kan du få liksom bare gå rundt i nærheten av der du er da. Det er jo dødspositivt. Jeg hadde sikkert gjort mye mer enn det jeg gjør nå.

Kjetil: Og når man er i en annen by også så får man på sitt språk.

Person#3: Det er nice.

Person#2: Jeg var på sånn tur i sommer hvor jeg lasta ned en app som het "here", sånn "her", hvis du har hørt om den?

Kjetil: Ja

Person#2: Den tror jeg brukte WiFi, muligens. Eller GPS. Hvor det var sånn at hver gang du gikk et nytt sted, så fikk du liksom informasjon om at "ah, nå er du på Reichsmuseum (?) i Amsterdam", eller, "her kan du gjøre det og det" liksom.

Person#1: Kult!

Person#3: Jaa!

Person#2: Eller nå er du på Fruendamflyplassen(?), her er det og det. Det er jo egentlig ganske kult. Det ble litt irriterende etter hvert, når jeg var et eller annet sånt random sted som... bare var.

Kjetil: Så litt for mange notifikasjoner?

Person#2: Ja, nei, det var ikke så veldig mye, men plutselig fikk jeg bare... ja, så jeg brydde meg ikke så veldig om hva jeg kunne gjøre på en eller annen sånn shitty liten flyplass et eller annet sted. 24:15 Men, men, ja. Ja, nei, det var kult sånn in general. Jeg likte det ganske godt.

Kjetil: Ja, så det, så det positive med det her er jo at de gjør det litt enklere, sa dere. Og det negative var på en måte at det var igjen ekskluderende.24:31

Prat om "gamliser" og bollespising.

Neste scenario, Jon-Robert leser [scenario 4] 25:27 - 26:02 Person#4: Kan jeg bare spørre hvor gamle skal disse elevene være?

Kjetil: Typ ungdomsskolen da.

Person#2: De kommer jo bare til å løpe gjennom da

En liten diskusjon om at ikke alle skoleelever har smarttelefon, men man kommer frem til at det alltids er nok elever med smarttelefon til at man kan slå seg sammen i grupper der minst én på gruppa har smarttelefon.

26:44 Person#1: Jeg synes det her var kjempepositivt jeg. Jeg hadde digga det her hvis jeg var barn liksom. Og selv om man kanskje ender opp med å løpe rundt og være mer opptatt av det å få poeng og sånn da, så lærer man jo på den veien. Det er bedre det enn å følge etter en guide og bare sitte og fnise med de bakerste og... og så få de litt også den friheten da.

Person#4: Kids hater jo å dra på museum, egentlig.

Person#2: Ikke teknisk museum!

Samtale om at Teknisk museum er dritbra fra 27:08 til 27:23

Person#2: Å følge etter en guide som hun sier er bare dritkjedelig. Så selv om du kommer til å løpe gjennom og kanskje ikke få med deg så mye, så tror jeg... ja. Så jeg tror den friheten er mye mer. . .

Jon-Robert: Lærer mer enn ikke noe også kanskje da. I og med at du får oppgaver underveis.

Person#3: Og hvis du får oppgaver så lærer du jo et eller annet, for du må finne svaret på oppgavene.

Person#2 forteller om en skoledag der han hadde mye frihet fra 27:39 til 28:11 Videre er det en samtale om andre interessante skoledager deltakerne har hatt frem til 28:54

Kjetil: Hvis vi tenker litt ut ifra det scenarioet da, men å bruke det på eldre folk da, for eksempel... ja, oss kanskje? Er det fortsatt positivt?

Person#2: Jaja

Person#1: Spørs litt på oppgavene da. Hvis det er liksom... da kan man kanskje velge mellom forskjellige typer oppgaver eller at oppgavene er veldig sånn... straight forward. Det må ikke bli for lett heller da, på en måte. Da kan man jo like gjerne ikke gjøre det.

Person#4: Grinding...

Kjetil: Sånn vanskelighetsgrad, liksom? Du velger sånn liksom "hva er din alder?", og så...29:29

Person#2: Ja, jeg vet egentlig ikke hvor interessant det hadde vært, egentlig. Nei, når jeg tenker meg om, for oss. Eller for meg.

Kjetil: Eller for eldre igjen der da? For 40-åringer og oppover?

Person#1: Nei, det tror jeg ikke... 29:38

Jon-Robert: Er dere interessert i å bare... hvis det ikke hadde vært noen oppgaver da, bare se hvor du har vært? Person#2: Ja, det kunne kanskje vært kult, kanskje. Eller, eller, veien jeg har gått kanskje. Kunne vært litt morsomt å se på i fem sekunder og så få en liten chuckle.

Jon-Robert: Det gir deg ikke så mye, men du har fremdeles kyst til å ta en liten titt.

Person#2: Det er en sånn funfact liksom, kanskje.

Person#1: Hvis det hadde vært veldig intuitivt, nei innovativt skulle jeg si, og bare gjort det her til noe helt annet med et sånt spill, så... for det at jeg klarer ikke å se for meg det fordi jeg forbinder det med da jeg var barn. Men hvis du kommer med noen morsomme spørsmål som appellerer til oss, så hadde det jo vært dødsgøy å kunne gjøre det i sånn... på fest, på bursdagsfester og sånn. Vi drar på nasjonalmuseet, og så har vi en lek der. Så har man en ting å gjøre da. Sånn som shuffleboard da. Det er ikke så gøy, men man går og gjør det fordi man må ha noe å gjøre. SÅ kan man dra dit og liksom... Ja, de har hørt at de har en kul app som... 30:33

Samtale om hvor dritkult Teknisk museum er frem til 31:14

Person#3: Jeg tenker sånn, at på museum så kunne det vært litt sånn som escape the room, har dere hørt om det?

Person#1: Ja, det er akkurat det jeg tenkte!

Person#3: Det er skikkelig gøy, for da får du liksom et mysterie du skal løse, og du skal prøve å komme deg ut.31:26

Person#1: Det var faktisk akkurat det jeg tenkte på da jeg sa... hvis de liksom gjør det til noe...

Samtale om escape the room frem til 31:53

Person#1: Men det hadde vært kjempekult da, løse et mysterie liksom, hvem har stjålet maleriet. Eller hvilket maleri er stjålet. Og så er det et maleri som ikke er der eller noe. Og så blir du sendt rundt og liksom... [...] Det appellerer jo til oss. Da kunne man gjort det som en sånn... "ja, vi drar til nasjonalmuseet, så ser vi..."

Person#3: Se om vi er smarte nok til å løse det 32:11

Samtale om at det var en kul idé frem til 32:38

Person#2: Det kan jo være litt irriterende for andre om folk blir sånn evig gira da, og blir sånn "æææw" og begynner å løpe rundt.

Person#1: Nei, du. . .

Person#2: Det kan jo det. Jo, men ikke... Jeg tror kanskje ikke du hadde gjort det, men... kids.

[Alle snakker i munnen på hverandre] Person#2: Ja, men det kan jo hende det blir dritirriterende, jeg vet ikke jeg. Kjetil: Men det scenarioet her er nesten utelukkende bare positivt da.

Person#2 og Person#4: Ja

Kjetil: Men hvis det skulle vært noe negativt med det, da er det at det ikke appellerer til alle da?

Person#2: For min del at folk hadde blitt litt sånn bråkete, gira.

Person#1: At det kanskje fører til kaos da. Altså, jeg tror at uansett hvilken klasse... hvis du tar en barneskole der så blir det kaos liksom. Kanskje flere kommer, men at det kanskje også kan være negativt da, fordi det kan bli litt kaos og at folk er mer opptatt av spillet og ikke kunsten.33:29

Kjetil: Ja, at du setter litt fokus vekk fra selve opplevelsen med kunsten, men blir heller en opplevelse av spillet.

Alle er enige

Person#2: Og hvis det hadde prøvd alt for hardt å være jævlig kule, sånn jævla ungdommelige.

Person#1: Men jeg føler den negativitetsgraden er på en måte veldig liten i forhold til det positive.

Person#2: Ja, det er jeg helt enig i. Det er bare sånn sidenote.

Person#1: Jeg tror ikke det er så mange som drar på museum fra før. Jeg tror man må ha litt lyst. Jeg kunne sikkert gjort det, men jeg har sikkert mange venner som bare "æh, what, nei, det kunne jeg ikke gjort". Så da... Så jeg tror liksom at hvis de og kunne vært med så er det bare utelukkende positivt.

Person#2: Jeg er enig.

Person#1: Next! 34:06

Jon-Robert leser neste scenario, scenario 5, frem til 35:11 Folk ler av scenarioet, av at hun kan se på mobilen og ikke skiltene, samt at hun har et favorittbilde.

Person#4: Kan jeg spørre om en ting bare? Har dere tenkt å... på den appen, at man også kan få informasjonen lest opp i øret eller?

Jon-Robert: For det scenarioet har ihvertfall, har vi tenkt det.

Person#4: Ikke bare at man får beskjed om hvor man skal gå når man er ferdig liksom...

Kjetil: Det er liksom en slags...

Person#4: Det er begge deler

Det blir forklart at i tillegg til å fortelle deg hvor du er og hvordan du kommer deg dit du vil, er det informasjon om kunstverkene du kan få lest opp. 36:09

Person#2: Men ser hun nok til å liksom guide seg fra et rom til et annet, eller det det sånn at hun må bli fortalt hvor mange steg hun skal ta?

Kjetil: Vi tenkte egentlig bare at hun var svaksynt. Jeg vet ikke hvor stor grad... Her følger en liten diskusjon om svaksynte og hva de kan klare selv, frem til 36:32

Kjetil: Så, hva er dine første tanker om det, Person#4? Du som liksom har brukt litt av av den…

Person#4: Jeg brukte det ikke selv da, men jeg synes det er bra dere tar høyde for at folk som er litt svaksynte også kan ha glede av denne appen. Og museet da, siden man sikkert ikke vanligvis stikker på museum hvis man er blind, eller hvis hun ikke får sett bildene. Hvis hun får lest opp litt info og kjenne på stemningen ved hjelp av den appen, så er det jo helt strålende. 37:05

Person#2: Jeg synes at det å få veibeskrivelse er litt kult. Fordi, hvis det er... det blir et svært museum, blir det ikke det a? Med etasjer og gudene veit. Det kan

jo hende det blir helt umulig å guide seg rundt i det. Det er noen museer som er helt jævlige å finne veien i. Det kan være ganske sweet. 37:22

Kjetil: Så det her blir jo... scenario 1 og scenario 5 er på en måte litt det samme, da får du... I scenario 1 så hadde du liksom... ga du ikke noe til dem, men de... de liksom... går litt hånd i hånd da. Så... men... er det... hva tenker dere er negativt med dette? Er det noe negativt med dette?

Person#1: Nei. Det inkluderer de alle fleste, og det er bare kjempebra. Inkluderer alle sammen. Bra det.37:57

Person#1: Så kan jeg ta av meg brillene og kose meg med det.

Folk ler

Person#4: Hva om du er døv og blind a?

Jon-Robert: Da rusler du vel kanskje ikke alene rundt på museum... 38:10

Liten samtale om døve og blinde, Helen "Ann" Keller blir diskutert frem til 38:36

Kjetil: Nei, men... noe mer å si om det scenarioet? Det er liksom...

Person#2: Nei... er det noe negativt om det liksom? Vet ikke...

Person#1: Kanskje at hun må gå og snakke til mobilen sin

Kjetil: Det er ikke sikkert de gjør det heller, vet ikke

Person#1: Nei, jo, jo, de kan bruke sånn voiceover, at det får lest opp og at de trykker og så sier den "textmessage", "read text message"

Person#4: Det kan kanskje plage henne litt da, hvis den.. hva heter den appen på iphone der som gjør det du sier holdte jeg på å si.

Flere: Siri 39:12 Person#1: Den appen! [ler]

Person#4: For den er jo helt på bærtur. Hvis jeg ber om et program for eksempel, eller spille en sang på spotify

Person#1: "Do you want to call mom?"

Person#4: Så plutselig ringer den til en eller annen idiot. Det er kanskje litt pinlig hvis man driver og snakker til den appen og så bare forstår den ikke hva du sier og så bare... og så er det masse folk rundt deg og så bare... "jeg gir opp".

Person#1: Nei, det tåler vi ass.

Person#2: Men hvis du som svaksynt har en sånn... da har du sikkert noe tools ekstra og da er du jo sikkert jævla vandt til å bruke det.

Kjetil: Og med beacons så skal du jo egentlig bare, når hun kommer inn: "nå er det en ny sone, *pling*!", og så bare "her er disse bildene, bla bla bla", og så "fortell meg mer om dette"

Person#2: Får det jo sikkert inn i øret også, ikke på høyttaler. Er jo sikkert ikke erkedick mot de andre rundt...40:01

Snakker om at man har snakket ganske lenge nå, og starter på det siste temaet som er mobilbruk i museer.

Jon-Robert: Vi har jo hatt noen intervjuer, og da er det noen som mener at det blir litt mye mobilbruk. De fra Nasjonalmuseet snakker også om det at de vil ikke at man skal bare gå rundt og se på skjermen, de vil jo at man skal se på bildene. Hva tenker dere om det? Hva mener dere er... hvor går grensa for hvor det er for mye telefonbruk? Har dere noen tanker om det?

Person#2: I museet, eller generelt?

Jon-Robert: I museet. Hvor begynner det å stjele for mye oppmerksomhet fra bildene? 40:44

Person#3: Jeg ser for meg at grunnet til at de har sånne lyd-ting i veldig mange museer allerede er jo fordi at man da kan høre og se samtidig. Når man har det på telefonen må du jo lese, og da må man jo lese og da må man jo konsentrere deg om å lese det du ser på. 40:55

Person#2: Og terskelen er sikkert mye lavere for å begynne å gjøre andre ting hvis du allerede sitter på telefonen liksom. Hvis du får en melding på facebook eller melding generelt, så er det sikkert mye lettere å lese den når du sitter med mobilen der liksom. 41:09

Person#4: Og når noen som ikke bruker mobilen kommer inn i museet og ser at alle bruker mobilen og så bare "ah, da får vel jeg gjøre det samme".

Person#1: Nei, det er jo vanskelig å si hvor grensa går da. Jeg tror det... det å finne veien til utstillingene er jo positivt, for da er du jo så forvirra og det å få en liksom en... hvis du er forvirret da, å få en guide der er jo bra, men kanskje når du kommer til bildene at informasjonen er på... er der da. At du finner informasjonen ved utstillingen. Det vil jo da minske det, men det vil jo ta bort mye av det vi har snakket om om informasjon og sånne itng da, som også kan være positivt. Men jeg synes det er vanskelig. 41:54

Person#3: En annen ting jeg tenkte på er jo det med det sosiale; at hvis du ikke går og ser på en skjerm eller ikke hører på noe, så på en måte interagerer du med

bildene men også med de du er med kanskje og snakker og diskuterer, og det gjør du kanskje ikke så mye hvis du har et opplegg du følger på telefonen da.

Kjetil: Nei, det er sant. Og det er jo... selv om det er liksom... det er jo en sosial ting å gå på museum også. Man gjør jo det... som regel så gjør man vel ikke det alene vel?

Person#2: Det er ganske mange som gjør det, tror jeg 42:17

Snakker om at det å gå på museum godt er noe man kan gjøre alene, frem til 42:39

Person#1: Så tror jeg uansett at det er mange som er... altså, det er... det er flere som bruker telefonen sin mye uansett, for det er ... på en måte... det får man kanskje ikke gjort noe med da, selv om her oppmuntrer man jo til mer bruk. Den andre bruken vil jo alltid være der. Får man en snapchat og man er veldig på telefonen så vil man være på telefonen uansett da.

Person#2: Men hvis man bare bruker det for eksempel til å få opp informasjon om det kunstverket man står nærme da, så bruker du egentlig ikke telefonen noe mer enn når du bare står og ser på kunstverket og skal lese da. Sånn som vanlig da, å lese en plansje som står ved siden av liksom. Regner jeg med da. 43:23

Jon-Robert: Så lenge det ikke er sånn som du sa i stad, at du forsvinner ned i Facebook og...

Person#2: Ja, så lenge du ikke gjør det. Men du må jo ikke bruke den til å guide deg rundt og liksom... du må jo ikke bruke den til alt det der. Du må jo ikke gå rundt sånn og liksom...

Kjetil: Du må ikke bruke det i det heletatt

Person#2: ...finne ut hvor faen det er du skal. Nei, du må ikke bruke det i det hele tatt heller. 43:39

Person#1: Hvis du har informasjonen på norsk og engelsk så vil jo de fleste, i hvertfall i Norge, bruke det da tror jeg og lese det, og du er jo på museum for en grunn tenker jeg. Det at utlendinger kan kanskje bruke det til å få det på sitt eget språk, det er på en måte noe annet da, enn at alle skal gjøre det. At det er der informasjonen ligger. Det føler jeg at, det har jo ikke dere sagt heller, at det skal være det, men der er kanskje også... ikke dra den så langt liksom. 44:11 Ha den tradisjonelle... se på bilde, lese om bilde. Eller ha noe som forteller om...

Person#4: Fikk en nydelig idé. Du kan ha en funksjon som heter autoavspilling. Hvis du står stille foran et bilde i sånn tre-fire sekunder da, så kan du ha

mobilen i lomma med en propp i øret ditt, så hvis mobilen eller appen registrerer at du står stille i noen sekunder foran et bilde så begynner den bare å lese opp for deg den informasjonen du ellers kunne lest da. Så slipper du å drive og fikle og...

Kjetil: Ja, at den bare kommer automatisk når du står ved det

Person#1: Ja, at du hører og har den øreproppen da, dine egne.

Person#2: Det må være ganske presist da, det kan bli ganske irriterende etter hvert. Eller ihvertfall hvis du er...

Person#4: Ja, men da slår du den jo bare av

Person#2: Eller hvis du er i et stort rom da, så...

Person#1: Med handsfree

Kjetil: Ja, sånn skikkelig douche på museum

Alle ler 45:06

Person#2: Men hvis du er i et stort rom da, liker å tasse rundt mens du hører på den greia da og så plutselig kommer du for nærme et annet kunstverk og så...

Person#4: Ja, men hvis du må stå stille og så må det liksom være...

Snakker om det å stå stille og demonstrerer

Workshopen avsluttes med at Person#2 mener at vi ikke har funnet noen negative sider i workshopen, mens Person#1 og Kjetil sier at jo - det har vi.

D.4 Transcript of expert interview

#0:0:16.9# Kjetil: Som sagt så skal vi jobbe med beacons og samarbeider med de i Rambøll #0:0:24.9#

#0:0:24.9# Palmyre: Rambøll, det var de design, de er et designfirma, ikke sant. #0:0:28.3#

#0:0:28.3# Kjetil: Nei, de er et slags konsulentfirma, både på teknologi og de hjelper Statsbygg. De dekker de kravene som er satt av det tekniske. Hva som må til med rør, hvor de skal plasseres utifra arkitekenes behov #0:0:49.8#

#0:0:49.8# Palmyre: Så typ infrastruktur. #0:0:53.4#

#0:0:53.4# Kjetil: Ja. #0:0:54.9#

#0:0:53.9# Palmyre: Men det er kjempeviktig, for det er et stort spørsmål, ikke sant. #0:1:0.1#

#0:0:57.3# Kjetil: For når vi snakket med de, hadde de noen krav fra arkitekten om at for eksempel at det skulle være veldig lite skilt i det nye Nasjonalmuseet.

Fordi arkitekten ville ikke ha mange skilt, det skulle visst være så nøkternt og minimalistisk som mulig. De må samtykke etter sånne krav osv. #0:1:35.6#

#0:1:30.2# Kjetil: Men uansett, vi samarbeider med de litt og så har vi vært med Jahn-Fredrik. Og vi har fått en oppgave da at vi skal jobbe med beacons og utvikle på en måte en... vi har hatt en test på beacons og det har jo 2 sånne modus på beacons du har: "ranging", som har på en måte da har du, jo nærmere du kommer objektet så får du opp en slags melding. Du må gå nærme, så det blir mer aktivt. Så har du monitoring, som er på en måte hvis du er i den sonen #0:2:10.4#

#0:2:10.4# Jon-Robert: Så hovedspørsmålet blir at vi skal se på hvordan det påvirker bruksopplevelsen. #0:2:17.8#

#0:2:17.8# Palmyre: Hvordan da? #0:2:18.6#

#0:2:19.5# Jon-Robert: Det med konteksten, bevege seg inn og ut av de sonene for eksempel. Hvordan det påvirker brukernes opplevelser. #0:2:26.5#

#0:2:26.5# Palmyre: Fordi "monitoring", kan brukes til å [mumbling...] Så hvordan ser dere for dere at monitorings funksjon fungerer i... #0:2:35.0#

#0:2:35.0# Kjetil: Vi hadde jo en test med "ranging". Og da fant vi veldig fort ut at da må jo brukeren, da må skjermen være på, og da må brukeren gå veldig sånn [holder telefonen foran ansiktet]. Det fant vi jo tidlig ut, vi tenkte ikke på det når vi utviklet testen, da fant vi ut at monitoring er bedre fordi da kan det være i bakgrunnen og så kan brukeren kanskje få en notifikasjon: "Nå er du i den sonen, disse kunstverkene er i nærheten og slike ting. Det er en bedre vei å gå sånn sett. #0:3:15.9#

#0:3:15.9# Kjetil: Så har vi hatt en slags workshop med forskjellige aktører som kan være mulige besøkende. #0:3:27.3#

#0:3:24.8# Palmyre: Hva slags deltakere? #0:3:29.0#

#0:3:29.0# Kjetil: Bare studenter, med forskjellige bakgrunner. #0:3:31.7#

#0:3:31.7# Palmyre: En slags future technology workshop? #0:3:32.6#

#0:3:32.6# Kjetil: Ja, eller fokusgruppe da. #0:3:36.3#

#0:3:36.3# Kjetil: Og da kom det fram til at for at dette skal være en teknologi som skal tas i bruk på et museum så burde det være mer supplemerende #0:3:51.0#

#0:3:51.0# Jon-Robert: Det fant vi jo også ut i testen at det ble veldig mye "se-på-skjermer" og veldig lite se på kunsten. Det så vi også at du har skrevet. #0:3:59.9#

#0:4:1.9# Palmyre: Ja, det er en gammel studie. Så om dere har sett [usikker på hva hun sier: heaton von lenz - studie]. Det er den mest siterte. Det var på den tiden mobiltelefonen begynte å bli smarte - ikke så veldig smarte, men litt. Så var det den "heads-down"- fenomenet. Som han fanget ved bruk av videoopptak, og det var i 2001, tror jeg. Det er en kjent studie som dere kan sitere. Jeg vet ikke hvor mye dere skal se på museumsteknologi-litteratur, men det er en del ting som kan være relevant og koble inn. Og det er absolutt en som er relevant. #0:4:43.5#

#0:4:43.5# Kjetil: Så vi fant jo tidlig ut at det her kan vi ikke gjøre, så da tenker vi mer at vi må jo på en måte koblet den fysiske verdenen med den digitale. Det er i hvertfall det vi ser teknologien går fremover. Så vi tenker å ha en ny test på det besøkssenteret på Aker Brygge. Det er et mini-museum, så skal vi ha en ny test der om et par uker. Og da skal vi teste da på en måte at folk faktisk ser på kunstverket og ikke bare mobilen. #0:5:28.8#

#0:5:28.8# Palmyre: Så det som jeg hører dere sier, at dette med dere undersøker. Har dere formulert en problemstilling? #0:5:36.4#

#0:5:36.4# Kjetil: Ja, vi tenker om beacons bedrer bruksopplevelsen og da med underspørsmål som for eksempel: ... sånn med tanke på, hva heter det? [Ser til Jon-Robert] #0:5:59.6#

#0:5:59.6# Palmyre: Push vs monitoring? #0:6:1.1#

#0:6:1.1# Kjetil: Ja, altså vi tenker mer på om brukeren vet at de er i en sone, for eksempel en beacon-sone. Med tanke på feedback. Og at de ikke snakker sammen eller ser på kunstverket, at oppmerksomheten blir rettet mer mot mobilen. Det var jo det vi så i de initielle testene våres, at oppmerksomheten ble mer rettet mot mobilen enn mot selve kunstobjektene. #0:6:38.1#

#0:6:38.1# Palmyre: Så dere utforsker ikke et tredje alternativ; en type innholdsleveranse. #0:6:42.0#

#0:6:40.9# Kjetil: Nei. #0:6:40.9#

#0:6:41.9# Palmyre: Ok, så det er mer å se på den modellen. Og hva tenker dere når det gjelder innholdet. Fordi jeg tenker, det kan ofte i informatikk... Er dere opptatt av hvordan selve innholdet blir designet for disse opplevelsene? #0:7:13.8#

#0:7:13.8# Kjetil: Vi tenkte det først. Vi i hvertfall i den Communication Interrupted [art. skrevet av Palmyre], der formulerer du i hvertfall at innholdet

skal bli designet bra, men kuratorene vil ikke alltid endre seg på det. Så vi tenker ikke helt at det er den veien vi skal gå. #0:7:34.7#

#0:7:34.7# Palmyre: Nei, sikkert ikke for en masteroppgave sikkert. Men jeg tenker hvordan dere skal håndtere dataen dere samler inn. Fordi det må redegjøres på en måte, hvordan de beslutninger for innhold ble tatt, ikke sant. Om det er mye lesning, er det med video, kombinert med det pedagodiske opplegg, får de stille spørsmål som involverer andre. Det har mye og si tenker jeg, på hvordan dere i alle fall skal håndtere den biten av analysen. #0:8:21.7#

#0:8:21.7# Kjetil: Jeg tenkte mer sånn med kontekst, hvor viktig er kontekst for brukeren når du er ovenfor et kunstverk. Vi har sett mer på det som et viktig felt for vår masteroppgave. Og design på hvordan teksten blir presentert er på en måte ikke vårt scope. #0:8:46.7#

#0:8:46.3# Palmyre: Men dere må håndtere på en måte i analysen, i alle fall gjøre rede for akkurat det der. Og hvordan innholdet kan ha en rolle i interaksjonen. Fordi om det krever mer lesning, eller går med hodetelefoner eller om det er video feks [innhold på mobilen]. Det har noe og si, så dere må håndtere det, men om det gjelder kontekst, så vet dere sikkert at museumforskning fokuserer på den sosiale konteksten, at de fleste besøker museumer med venner eller familie. Og det spørs om dere har en modell om en individ-besøkende eller er dere åpne for det eller? Er det et empirisk åpent spørsmål for dere, når dere går ned til Nasjonalmuseets besøkssenter og bare ser hvem som kommer? #0:9:50.3#

#0:9:50.3# Kjetil: Vi har vel ikke tenkt så mye på det, men vi har vel sett mest på den individuelle brukeren da. Men det er kanskje bedre å se på det med en sosial kontekst ja. #0:10:7.2#

#0:10:7.2# Palmyre: Fordi om man har kontekst som fokus, da er det ganske stor forskjell om man ser på individets interaksjon med kunstverket. Nasjonalmuseet har en del hypoteser om deres besøkende som egentlig ikke stemmer med virkeligheten. Da vi har gjort studier på de besøkende på Najsonalmuseet, var de kjempeoverrasket at de fleste som besøkte, i den perioden vi studerte, i par eller grupper på tre - ikke individer og ikke eldre damer som meg, men det var ganske mange unge mennesker. Og det var i en periode hvor det var VM i ski, så det var en del turister også. Og de har en del turister. Så de har ikke gjort nok studier på besøkende for å vite hvem de faktisk forholder seg til. Når det er sagt, så har de en veldig klar idé om at det er individer som meg, eller som går

sammen med en annen eldre dame eller en eldre mann og vi bare rusler rundt og ikke har noe med teknologi å gjøre. Og ingenting skal forstyrre vår opplevelse av kunstverket - hverken tekst eller skilter. De prøver å komme bort fra den idéen, men det preger fremdeles. Jeg tenker når dere skal gjøre en studie som profilerer ny teknologier og ny tekning, men samtidig opplever som relevant for museet, strategisk sett er det smart for dere. Så kunne dere ta et valg og si; "Ok, da ser vi på disse individene - det er en måte. Individets opplevelse av teknologien i møte med kunstverket, da må dere skille ut andre besøkende. Om dere er opptatt av; hvem er det som faktisk, mer åpent utforskende [litt usikker her]. Hvem er det som kommer til Nasjonalmuseet besøkssenter, så tenker jeg sikkert at det er en del turister, de er ofte i par eller grupper. Så dere kunne velge en annen type gruppe eller... Det spørs om hvordan dere håndterer det empirisk, for å stille den problemstillingen dere har. Det kan hende at dere kunne gjøre en observasjon uten å bruke applikasjonen, fordi dere skal bruke en app tenker jeg? #0:13:3.2#

#0:13:3.2# Kjetil: Ja, vi har laget en app på den første testen [ranging], men gått litt vekk fra den, da den stjal for mye fokus. Og nå skal vi på en måte, tanken er da: Når de kommer inn i et rom, hvis for eksempel dette her er en beaconsone [peker rundt i det rommet vi sitter i], så skal de få en slags notifikasjon og så kan de velge selv om de skal se på den eller så kan de velge å ignorere den. I hverfall med ranging var det veldig mye automatikk når man gikk bort dit [kunstverket] så kom det opp automatisk og man fikk den brukerkontrollen da. Når man på den måten bare kommer inn og får en notifikasjon, kan brukeren selv velge om han vil se på skiltene eller de kan aggregere videre på mer informasjon på mobilen og lære videre sånn sett da. Så det er tanken da. #0:13:56.4#

#0:13:56.4# Palmyre: Ja, det er jo veldig fornuftig. Interrsant problemstilling, det er sikkert vært forskning på det også. Da kan dere bare se på om det blir brukt om det er noen forskjeller på bruk mellom grupper og individ. Om dere fant ut at feks individer hadde mer tid og kanskje bruker det mer. #0:14:29.2#

#0:14:29.2# Kjetil: Ja, men i den Communication Interrupted så skrev du noe om kontekstavhengig teknologi, så lurte vi om det er noe du har jobbet med lignende teknologier? At du sjekker på en måte hvor brukeren er og har du jobbet med noen sånne lignende teknologier? #0:14:53.9#

#0:14:53.9# Palmyre: Du tenker med den infrastrukturen som er sensitiv på den måten som beacons? #0:14:59.8#

#0:14:59.8# Kjetil: Ja. #0:14:59.8#

#0:14:59.8# Palmyre: Vi gjorde noen eksperimenter for lenge siden, men det var før beaconsteknologi hadde kommet så langt. Det som jeg synes er mest interessant med beacon-teknologi og den type infrastruktur er å kombinere forskjellige typer data. Det er det vi skal se på Mediascape-prosjektet. #0:15:19.6#

#0:15:19.6# Kjetil: For det er et ganske nytt prosjekt? #0:15:23.1#

#0:15:23.1# Palmyre: Ja, og sånn indoor-positioningsystems er ikke så veldig stabilt enda, det fungerer ikke så bra, men det kommer. Og så er det ganske mye informasjon som man kan få ved bruk av mobile-tracking. Så det er to gode artikler om "State of the art mobile tracking" i museer. Hvordan disse systemene kan brukes for å følge besøkende bevegelser - eller i alle fall noen bevegelser eller stoppesteder. #0:15:49.8#

#0:15:49.8# Jon-Robert: Det var jo også Jahn-Fredrik veldig opptatt av, akkurat det der. #0:15:55.4#

#0:15:55.4# Palmyre: Ja, jeg tror jeg har nevnt det for han :) For det er en del av Physitracker, som ikke er utviklet enda, men kommer. Jeg tenker at om du kombinerer observasjoner, som dere kommer til å få masse nytt og interessant allerede og se på hva de faktisk gjør, men å kombinere det også med en større type datainnsamling angående ulike forskjellige besøkstyper. Hvem er de besøkende også deres bevegelser.... #0:16:30.8#

#0:16:30.8# [Avbrutt av telefon] #0:16:30.8#

#0:16:46.5# Palmyre: Jo, så det... men vi har ikke kommet så langt. Jeg tenker det at å håndtere, man kan kalle det "Big Data", men det er ganske mange forskjellige nivåer av anonymitet og godkjenning når man driver med tracking. Og om at det er knyttet opp mot identitet, ikke sant vs. større mønstre. Så det å kombinere forskjellig type data, designe studier er det viktigste. Museene trenes opp i å tenke; "Hva er det vi ønsker å finne ut" som kan være nyttig for hvordan vi tenker på designet av utstillinger. Hvem er besøkerne, hvordan bruker de det, de ressursene vi gir dem, hvor mye tid bruker de. Hva slags traffic-flow, men også hvor de spennende interaksjonene blandt de besøkende for de ulike kunstverkene. #0:17:42.1#

#0:17:42.1# Kjetil: For dette er noe vi har diskuterte i workshopen, vi har gitt de et scenario og de har på en måte vært veldig positive til dette når intensjonene til museet er gode, at de skal gjøre utstillingene bedre. Så er jo det privacy-concerns

at folk skal trackes og sånne ting. Jeg var jo også på en presentasjon med Datatilsynet, om selve beacons og da var det i teorien gjøre mye av det bare at du gir conscent til appen. Sånn når man installerer appen, har du muligheten til å gi det. Det er jo mange folk som ikke vet hvordan teknologien fungerer, og det kan jo være veldig problematisk. #0:18:40.9#

#0:18:40.9# Palmyre: Ja, og vanligvis i museumsforskning så er det sånn opt-out løsning som er mest typisk for da er det ofte videoopptak. Da er det ikke anonymisert lenger. Men å gjøre observasjoner uten å ta bilder, da har vi håndtert... Datatilsynet har godkjent at vi har noe sånt [peker på samtykkeskjema] ved inngangen. At det er observatører som sitter, de tar ikke bilder, men noterer forskjellige typer interaksjoner, og hvor det skjer. Så er det spørsmål, jeg har ikke gått inn i den problemstillingen når man tracker, skal man bruke opt-in eller opt-out eller kan man bare regne med mobilen. Det er forskjellige nivåer og funksjoner hva dataen kan si noe om. Så tenker jeg at museene selv må trenes opp på hva de ønsker å finne ut, stille gode spørsmål og hypoteser og designe noen studier og si; "Vi trenger den type data og exit-surveys. Så for eksempel om de vil funne ut om folk leser tekst og spørsmål fra museene.

20:10 Palmyre: Om de lager skilt som dere kaller etiketter, eller tekst, leser de... det er masse tid som går inn i designet av disse tekstene, og så ønsker de å finne ut om besøkende leste dem og forstod. Leste teksten og er det noe vi skulle skrive teksten mot? En type... you know - om du finner ut at kvinner på en viss alder leser teksten men menn ofte ikke gjør det, eller, you know... Så kan de gjøre noen endringer i tekst. You know, så sånne ting. Så de er veldig opptatt av å se om folk leser tekst, og så også gjør de noen observasjoner, også data, og så kan de ved utgangen av det rommet spørre om "kan jeg stille deg noen spørsmål", "hvorfor leste du ikke den teksten" eller sånne ting. Så det samme med forskjellige typer data.

Palmyre: Ja, men dette med mobil-app, så... så er det ganske mange studier som har blitt gjort der. Men det betyr ikke at det er interessant uansett. Jeg bare tenker at det kan være noe å se på grupperinger, det er en viktig del av konteksten. Er det grupper eller individer som... hvordan de skiller seg ut. I bruk. Og så har du det tidsaspektet, hvor mye tid bruker de for å...

Kjetil: Ja.

Palmyre: Og andre typer kriterier.21:43 Hvor langt de gikk, kanskje i appen,

sånn log-data.

Kjetil: Eller hvor lenge de er på selve... tingen.

Palmyre: Så kan du prøve å fange opp om det er noe... de ser opp på kunstverk mer etter hvert, you know, det er kanskje noe der. Så kanskje de hører på ganske mye til å begynne med, og så... eller ser på, og så bruker de mer tid i etterkant, you know, så det er ganske små mikrointeraksjoner som er vanskelige å fange opp.

Kjetil: Ja. Vi lekte jo med en idé, sånn... hvis for eksempel han personen er veldig ofte her da, eller veldig lenge her, at i ettertid så får han en mail av noe slag da. Sånn - siden du var her så lenge så får du en mail på Munch-maleriene da. Sånn at du kan etterarbeide besøket.22:38

Palmyre: Ja, det er ganske... Det kan enten være litt creepy fordi de lurer på hvorfor du vet det, men ofte er det slik at du kan legge igjen en e-post eller klikke en type concent, hvor du får tilsendt mer informasjon i etterkant. Det er mange forskjellige måter det gjøres. I London science museum så får de et kort, identitetskort, og den tracker deg når du går rundt og engasjerer... you know, trykker på forskjellige interactions.23:12

Kjetil: Ja, for det er her vi føler at, for å gjøre det... det er ikke mange som på en måte... det er en... det som er bra med beacons sånn sett, er jo at det er... det er en passiv generering av data om deg på en måte, når du går rundt da. Du slipper på en måte å gjøre det, det skjer mye automatisk, mens med for eksempel sånne RFID-kort eller NFC og sånn, så må du alltid... og da vil du jo skape den at du må gjøre noe med den hele tiden da.23:41

Palmyre: Ja, men du må huske på at besøkende har forskjellige behov og interesser, og familier for eksempel, som besøker, det å ha en aktivitet som de kan gå rundt med barna og snakke om ting og gjøre ting er veldig... The Tratency institute of art(?)23:58 har for eksempel, you know, can you find... så for eksempel, du kan se et lite bilde og kan du gå rundt og se på malerier og se om du kan kjenne den igjen, og... Så det å ikke bare ha én museumsbesøkende i... you know. Det er mange forskjellige typer og behov. Motivasjoner. 24:19

Kjetil: Jeg tror jeg leste fra den, det var noe med den gamification, jeg så en publikasjon, det var nå før jul, var det ikke?

Palmyre: Ja

Kjetil: Og da var det på en måte, virket som de ble mer opptatt av selve spillet enn det å faktisk se på kunstverkene da.

Palmyre: Det var ikke testet med brukere.

Kjetil: Okei, det var ikke det nei

Palmyre: Det var bare design informatikk-studenter som designet det.

Kjetil: Okei

Palmyre: Så det... men det var noe som vi sa at de må passe seg for, for det de gjorde i den designen som var litt smart, tenker jeg, var... først hadde de et spill, der de lekte og drepte alt og ikke... you know. Og så måtte de... shift gears, og gå over til en annen type modus. Og, interagere med utstillinger på en annen måte for å samle inn informasjon for å bygge det opp igjen. Så det tok hensyn til både den, sånn... dette er et spill og ikke, you know, som kan spilles hvor som helst. Og så brukeren videre i og gå dypere inn i utstillingene. Så du må tenke gjennom, you know, om det er ønske.25:30

Palmyre: Men... jo, jeg tenker at det... du får en del interessant data sikkert fra museer ved å bare se på hvem er det som... Har dere tenkt på å kanskje stille spørsmål, I mean, gjøre some survey etterpå?

Jon-Robert Vi har jo hatt etter pilottestene, da har vi hatt det.

Kjetil: Som post-intervju, på en måte. Etter testene, hva de føler og sånne ting, og... synes egentlig det har funket ganske bra.

Palmyre: Ja, fordi du får den, du får... I mean, får dem til å snakke er en veldig rik type data.26:10 Det kan hende du trenger ikke å gjøre det med alle, men kanskje et utvalg.

Kjetil: Ja, det er det vi på en måte har gjort med de testene. Og vi fant ut, noe som han sa som ikke vi hadde tenkt på med den første testen da, med ranging, var jo at... Du har tre modus med beacons, du har near, far og immediate. Immediate er kanskje sånn to til tredve cm da. Og, near er på en måte...

Palmyre: Du kan ikke komme så nær det kunstverket.

Kjetil: Det betyr jo, som han sa da, at du skal få informasjon om det kunstverket som står der, så må du stå veldig nærme. Men hva med alle andre som er i museumet som bruker den samme appen? Da må de også stå veldig nærme. Og for eksempel Mona-Lisa da, som har... du kan kanskje ikke stå rett nærme den. Så vi har egentlig lagt den ranging-biten av beacons ganske død da. I hvertfall med tanke på museumskontekst, med at folk skal få mer informasjon om kunstverket.27:15

Palmyre: Det som jeg synes kunne være... jeg har ikke tenkt på dette på en stund nå, men... det arbeidet som kuratorene legger inn i hvordan forskjellige kunstverk er plassert i et rom er ikke tilfeldig, ikke sant.27:35 Det er ganske gjennomtenkt. De har en historie de vil gjerne fortelle, eller visuelle koblinger som de forventer, som eksperter, at andre også skal gjøre disse koblingene. Og det er veldig sjelden synlig for non-experts. Så for eksempel om du er i Munch-salen og du ser en skikkelse her, og kjenner at det er samme skikkelse på motsatte vegg, men et annet, you know, tema. Noen plukker det opp og kanskje noe andre ikke gjør det. Og så ikke skal du kunne mestre alt i et rom, men ta det med til neste rom og så huske tilbake og "hva var det når som jeg kan"... "Det uttrykket ligner på det jeg så for to rom siden og 40 kunstverk siden", ikke sant. Og de aner, de tror, at besøkende gjør det når de lager disse utstillingene.28:29 Om man tenker å kombinere en type design eller innhold som synliggjør kuratorens holdninger, så blir ikke kun.. You know, we talked... høydepunkter eller (??). Men, har en type narrative som er kuratorens narrative også kan gjøre disse koblinger, så kan du velge mellom forskjellige, det kan være en type tur og så kan det være en annen type tur, you know.

Kjetil: Det virker som om kuratorens mentale modell er noe helt annet fra hva besøkerens mentale modell er.

Palmyre: Ja, nei, ikke kun det mentale, men også motivasjoner og kunnskap og...29:12 Så, det er alltid den gap-en mellom ekspert og ikke-ekspert, ikke sant. Så, den informasjonen når de kommer i nærheten kan tenke kan være enkeltopplevelse av kunstverk, men det kan også være en, you know, en måte å synliggjøre koblinger som ikke er synlig ellers.

Kjetil: Ja, det er et godt poeng.29:38

Palmyre: Så det er masse forskning om dette her. Ja.

Palmyre: Men jeg vil i alle fall tenke at dere utvikler to eller tre spørsmål på en iPad som kan kanskje til og med om du trenger concent du kan bare trykke på og gjøre litt sånn survey med... kanskje basert på de første erfaringene dere har hatt, noen spørsmål som du tror kommer til å...

Kjetil: Ja, det hadde vi jo faktisk i den første appen. Sånn, når du var ferdig med testen så fikk du sånn...

Palmyre: Svarte folk på den?

Kjetil: Jaja.

Palmyre: Nei, men, spennende, jeg gleder meg til å se hva dere har funnet ut og spørsmålet igjen... forskningsspørsmålet igjen?

Her følger diskusjon om forskningsspørsmålet, der man blir enige om at "hvordan opplevelsen påvirkes" er bedre enn "hvordan opplevelsen forbedres", da sistnevnte krever solid sammenligningsmateriale vi ikke har noen intensjon om å innhente.

31:38 Her snakker Palmyre om artikler hun vil sende oss om mobile tracking og en nettside med mange artikler om museumsteknologi

33:20 Kjetil: Men i det prosjektet som dere skal ha nå, skal dere bruke beacons i det?

Palmyre: Ja, jeg tror det. Men det blir i forbindelse med utprøvinger i forbindelse med hvordan man opplever arkitektur. Og da er det forskjellige typer, det er tema med digital... "woren digitale artifakter"(?) som arkitekter... Det er veldig lite brukt i formidling, eller utstillinger, så potensialet der... Så hele den digitale formidlingen av arkitektur er et av temaene. Et annet tema ser på visitor studies og hvordan de kan se på å kombinere forskjellige typer data som jeg var innom. Og så var det andre typer... med crowdsourcing og citizen science. [mumling]

Kjetil: Ja

Palmyre: Så det er ikke fokus på kun teknologien, men jeg tenker at det blir en del. Og hvor mye jeg skal egentlig... jeg jobbet ganske mye med mobiltelefon i både postdok-en min og et prosjekt etterpå, og så har jeg gått litt bort fra mobilteknologien, så jeg er litt usikker for det er så mye som skjer hele tiden.

Kjetil: Hva er det man skal fokusere på

Palmyre: Ja... Og det er mye forskning som gjøres ellers, på det temaet, så jeg vet ikke hvor mye vi skal inn i app-verden nå. 34:56 Men det er kjempeviktig, fordi det er, som audio-tours er 70 år gammel teknologi, ikke sant.

Kjetil: Et problem som vi ser da, er på en måte når man bruker egne mobiler da, vil jo på en måte terskelen være veldig lav for at du... når er jeg på mobilen, hvorfor kan jeg ikke bare sjekke Facebook samtidig? Den stjeler fokus sånn sett da.35:24

Palmyre: Ja, men... det... Man kan ikke kontrollere, folk gjør det uansett. Det er det som disse ikke skjønner. De kan ikke kontrollere dette, museet. De har med seg teknologier og medier og apper og kameraer. De kan ikke kontrolleres. Da må du tenke: "okei, dette er hvordan landskapet ser ut".35:40 Hvordan kan vi gå inn og, you know, skape noe unik opplevelser på dette stedet? Så når jeg drar på

MoMa eller andre, jeg laster alltid ned appen men jeg bruker det ikke så ofte. Men av og til kan det hende at jeg, you know, jeg er litt sånn forskningsinteressert i det også. Men da er det WiFi around the museum, so if you can go online, why not? Why shouldn't you want to check your facebook if you want to? Jeg synes den ideen at man skal kontrollere er litt sånn... "How old are you?!?"

Kjetil: Nei, for når vi satt og liksom tenkte det ut, så tenkte vi bare sånn... Det fokuset blir alltid stjelt bort da, så det... Prøve å unngå det på et vis. Men det er jo sant, man kan jo ikke kontrollere folk.

Palmyre: Nei, og det kan være WiFi uansett.36:26

Palmyre viser frem Museums on the Web-nettsiden, og at det å se på artiklene om beacons er et godt utgangspunkt for å gjøre en review av state of the art.

Intervjuet blir så avsluttet med lykkeønskninger.

Appendix E

Screenshots of applications

Tenkte at her kan vi legge til de bilder vi tenker at man kanskje kan ha lyst til å ta en titt på, men som ikke trengs direkte i teksten. Eksempelbilde:

E.1 Screenshots of the first application

E.2 Screenshots of the second application

Figure E.1: An overview of nearby artworks in the first application

Figure E.2: An example of what it looks like to users when the application discovers that it is close to an artwork

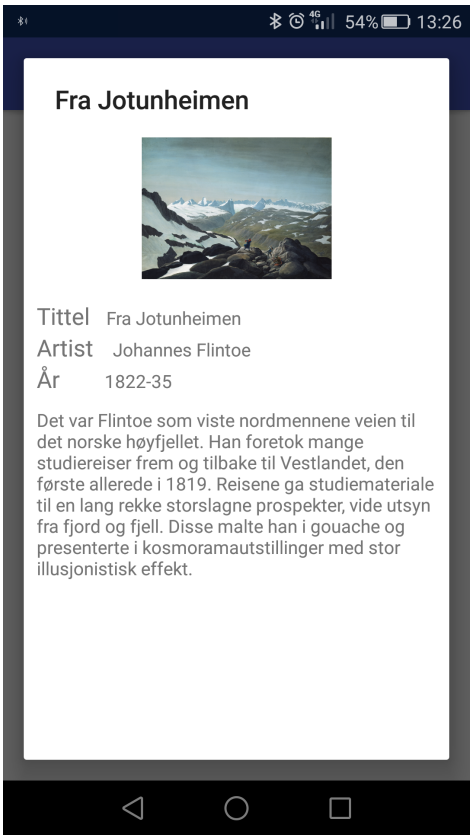

Figure E.3: Information about a piece of art in the second application

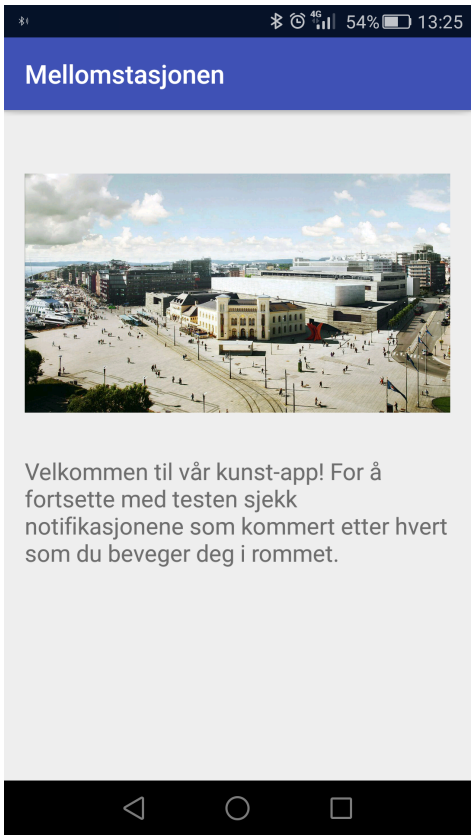

Figure E.4: A notification on the main screen

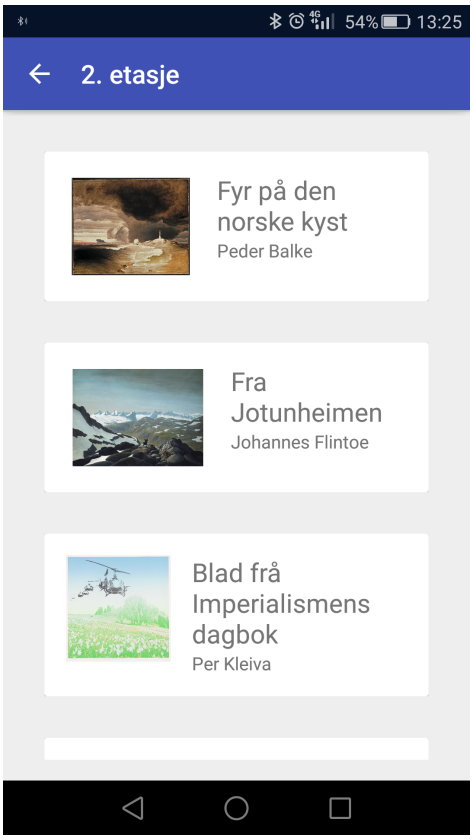

Figure E.5: A notification

Appendix F

Photos of Mellomstasjonen

Figure F.1: A collage describing the development of the area of the new museum

Figure F.2: Interactive exhibition; users can take photos

Figure F.3: Interactive exhibition; users can create new artworks