History Meets Future: The Use of Mobile Technology to Influence the User Experience in Museums

Master's Thesis

Espen A. Nordenhaug

October 3, 2011
Halden, Norway


Østfold University College
Mobile Applications Group

Abstract

Keywords: Mobile Applications, Location Aware Systems, QR-codes, Open Source Code, jQuery Mobile

This thesis describes an exploratory study of the impact of the use of mobile phones as a tool for distribution of personalized location-based information as well as interaction with the content during a visit to a museum. By combining media such as desktop computers with smart phones and the solving of tasks, the thesis aims to measure how mobile technology can influence the user experience of a visit to a museum.

It does so by evaluating a prototype designed for Østfoldmuseene[1]. The design targets pupils in a local high school, and aims to involve the users in three stages. Prior to the physical visit to the museum, teachers will pull out data from a project website and use it in their lecturing. During the visit the pupils will use mobile phones as tools for exploring the museum. The mobile phones are used to distribute location-based content by scanning QR-codes, to solve tasks and to collect data, which in turn is uploaded to a project website. After the visit, the pupils will access the collected data and process it in the classroom.

The concept has been tested by pupils, teachers and museum staff.

Keywords: Location Aware Systems, Mobile Phones, QR-codes, Open Source Code

[1] An organization of museums in Norway

Acknowledgements

I wish to thank my supervisor Harald Holone at Østfold Univeristy College for his interest and guidance in the work with this thesis. His efforts have been invaluable. Thank you for your patience and flexibility.

I am also grateful for the support, effort and initiative shown by my colleagues at Østfold-museene. In particular I wish to thank Fredrikstad Museum for showing interest in the concept and for the hours of work you have spent producing content for the implementation of the prototype. The prototype and evaluation could not have been implemented without their work. I also wish to direct a special thank you to Hege Hauge Tofte at Østfoldmuseene for taking part throughout the process and for showing great dedication and interest in the concept. They have all been remarkable.

I must not forget to show my appreciation to teacher Hege Glad and her pupils at Kvernhuset ungdomsskole. This thesis could not have been completed without their participation.

Lastly I wish to thank Marion Eriksrød, not only for taking part in the production of the mock-up videos, but for all of her support throughout the work with the thesis.

Table of Contents

Chapter 1

Introduction

The availability and spreading of information has drastically changed with the widespread use of the Internet. Traditionally, multimedia content has been presented through desktop services. However, with the development of new mobile devices and high speed network mobile access, content can also be viewed away from the desktop. Information is becoming available *any time* and *any where*. Hence, information about the context can also be presented based on geographical location.

A large majority of the population use mobile phones on a daily basis. It is a device that is brought along everywhere at all times. This can change the way we percept and interpret the surroundings. It allows us to combine the physical presence at a distinct location with virtual elements that can be specifically fitted to that particular location. It also makes it possible to interact with the physical surroundings, record content and save it for future reference and use. These characteristics make the mobile phone a valuable asset in the entertainment, information and education fields.

1.1 Motivation

At the time being, I am involved with a project at Østfoldmuseene[1] - an organization of local museums located in the south east of Norway. The projected is funded by Kulturrådet[2], and aims to take use of digital technologies in the process of providing visitors new methods of interacting with the exhibitions, as well as engaging and involving (new) visitor groups. The museum has expressed a desire to direct activity to the use of mobile phones as tools for distributing digital content to the visitors. In particular, Østfoldmuseene would like to focus these efforts to target youths in local

[1] http://ostfoldmuseene.no

[2] The Norwegian center for archives, libraries and museums, formerly known as ABM-utvikling

schools, as they are the next generation of visitors.

Østfoldmuseene is divided into eight divisions, and their locations are widely scattered around the county. Many of the exhibitions and locations consist of open air areas and buildings, which have several stories connected to them. These stories are difficult to distribute, first and foremost because most of them are geographically connected to an outdoor arena. On the other hand, the stories connected to an indoor setting can presently only be accessed during the presence of museum staff within the opening hours.

Albeit still a somewhat young and unexplored territory, the use of mobile phones to distribute multimedia content has become very widespread in use. The technology has been adapted and applied to a wide range of activities.

The use of mobile technology as a tool for communicating multimedia content has become very widespread. Even so in the museum industry. Handheld devices such as audio guides have been used as tools for distributing content for decades. As the so called smartphones have gained large shares of the mobile phone market over the last years, independent developers have been able to create user experiences distributed to the visitor's personal device. However, the mobile technology, particularly in the fields of museums, is relatively young and unexplored. The design approaches have thus far been somewhat empirical, assuming designer are familiar with the problem field. However, as Kjeldskov states[27], "given the youth of the research field, this can hardly be true".

In many cases, the use of mobile devices has so far mainly been a process of transferring content from one platform to the other. Hence, the recipient of the information takes on a passive role. Mobile phones have built in functionality which allows interacting, recording, storing uploading and sharing information on the Internet. In addition, as mobile phones are personal belongings, content could also be personally tailored. The use of these assets may influence the experience of a museum visit and quite possibly pass the visitor on to a more active role.

1.2 Research Objectives

This thesis aims to test whether or not the mobile phone, in combination with other platforms and media, can be used as an asset for promoting and adding value to the user experience of a museum visit by taking use of a wide range of medias. It attempts to contextualize and personalize the content. It measures the potential of using the technology for this purpose by undertaking evaluations on a prototyped mobile application design. The design is based on input from the

stakeholders, whom are teachers and pupils in a local high school as well as the museum itself. These stakeholders also serve as testers and evaluators.

The work in this thesis focuses mainly on the evaluation of user experiences using mobile phones as a tool not only for distributing information, but also for actively involving visitors at the museum. It does so in an on site concrete experiment, using a selection of pupils in a local high school as evaluators to measure the experience and value of a visit to Isegran Museum[3] with the use of a proposed design of a mobile application. It compares this approach to more traditional visits, where mobile phones are not used. It attempts to measure to what degree the mobile phone may serve as a tool for influencing, possibly enhancing, the user experience of the visit itself.

The proposed design consists of a project website containing resources used by teachers to prepare the pupils for the visit to the museum. The project website also contains a wide range of selectable tasks which can be input to the mobile application. On site, the pupils access the application and receive content which is specific to the location. The entire design has been tested, but it is the mobile application that has been undergoing detailed evaluation, focusing primarily on the pupils' response.

Through research, prototyping and evaluation the following research question will be focused on:

- How can a mobile application influence the user experience in a visit to a museum?

Secondary relevant research questions are:

1. How does technology affect the user experience?
2. How does the solving of tasks (using technology) affect the user experience?
3. How can technology influence the personalization of the content distributed to the users?

By observing user behavior and performing interview sessions, it is possible to measure how the use of the prototype affects the user experience.

1.3 Method

The concept described in this thesis has evolved throughout the work with it, taking on an explorative approach. This process has been incremental using several rounds of iteration before ending

[3] A branch of Fredrikstad Museum, located at the Isegran Penisula in Fredrikstad Town

up as a working prototype tested in a real life setting, involving potential end users throughout the design.

The below mentioned methods have been used in the process:

- Identification of research objectives.
- Literature and case studies.
- Development of mock-up videos.
- Implementation of a high-fidelity prototype.
- Field test and interview - Testing the prototype on real representative users.
- Discussion of findings and future work.

1.4 Deliverables

The results and findings from the thesis will be backed up by the following deliverables:

- A pilot prototype mobile design.
- A pilot prototype website including downloadable resources and selectable tasks which can be implemented in the mobile application and solved on site at the museum. The website also displays content generated by the users.
- Sound recordings of the evaluation interview.
- Mock-up videos describing a user scenario.

The expected research contributions are:

- User experiences with mobile phones as a tool for digital storytelling and the solving of tasks in a museological setting.
- An outline of the viability of the concept and proposals for future work.

1.5 Scope

The implemented application is merely a tool for testing and measuring the effect the use of a mobile application may have on the user experience of a visit to the museum. It aims to compare the experience of a visit to the museum with and without the use of a mobile application, and outline the potential such technology may have on the visit itself.

Hence, the implementation must only be considered a prototype, and may lack certain functionality and content. It is, however, a fully functioning and testable high fidelity prototype. The prototype is not a commercial software product, and the performance investigation is undertaken by an exploratory approach. Therefore, the design merely serves as a tool for investigating the research objective.

The designed prototype consists of several parts, and attempts to involve the users prior to the visit, during the visit and after the visit. However, the scope of the project is limited to the testing of the user experience during the visit itself. It does not conduct user tests on the planning involved prior to the visit, and does not measure the effects after the visit. It does however focus attention to the concept as a whole during an interview conducted with all stakeholders present. It would be highly interesting to investigate how the use of mobile technology could have more long term effects by looking at the effects on learning, production and contribution. However, that is beyond the scope of this thesis.

1.6 Outline

Background

Chapter two gives a description of the problem case. It outlines the research approach, the stakeholders and their expectations and incentive for using such an application. This is based on interviews conducted with the stakeholders. The background chapter also outlines similar applied designs. Finally, the chapter gives an introduction to the technology, as well as a comparison of native and web-based development.

Design Method

Chapter three gives a description of the design process and the methods used.

Prototype

Chapter four gives a detailed description of the implementation of the prototype.

Research Approach

Chapter five describes the methods used to evaluate the prototype. The evaluation consists of field testing and a following interview session. The observations made during the research were recorded.

Results

Chapter six presents the observations made during the field testing of the prototype. Moreover, it makes interpretations where necessary.

Discussion

Chapter seven presents a discussion based on the findings of the evaluation.

Conclusion

Chapter eight concludes the thesis and makes suggestions on potential further work.

Chapter 2

Background

From the last decade of the 20th century, mobile phones have become increasingly widespread in use. The development of these devices has boosted, and over the last few years they have become highly technologically advanced. Mobile phones are no longer only used for making calls and sending or receiving text messages. High speed mobile Internet access through either wireless Internet or 3G[1] and 4G[2], combined with dedicated fully functioning built-in web browsers provide users with instant access to online services.

This gives access to content containing large amounts of data, even at remote geographical locations. It is only over the last few years that advanced smartphones have become widespread in use and publicly available to the masses.

As mobile phones now are adapting the characteristics of traditional desktop services, they are becoming highly interesting assets in creating new users experiences. Mobile devices dispose characteristics that make them quite unique. The most obvious qualites being that they are in fact highly *mobile* and they are *personal* - They are brought along everywhere. This makes it possible to present location-aware personalized content to the users. More interestingly, the physical presence at a geographical location can be combined with a digital experience distinct to that location.

On the other hand, one might argue that location-aware information, presented on a mobile device has been practiced (particularly in the museological world) for decades. While portable audio guides, PDAs etc. certainly have been used in this industry, these devices are quite simple. They have merely been used as tools for displaying content that has been transferred from another platform and are generally only suitable for one-way communication. Hence, mobile phones have

[1] International Mobile Telecommunications-2000 (IMT–2000), more commonly known as 3rd Generation

[2] The fourth generation of cellular wireless standards

certain characteristics that make them highly interesting assets in creating freedom of choice as well as interactivity and user participation.

The remainder of this chapter will first give a description of the case and the problem field. It will then identify the stakeholders involved in the project, also outlining their expectations and reasons for taking part in the research. Furthermore, an outline of existing practices and designs in the industry will be presented, followed by a description of Human-Computer Interaction with a focus on mobile devices. The chapter will also present suitable content and developer tools needed to conduct a field test.

2.1 Case Description

As of May 2010 I have been involved in a project anchored at Østfoldmuseene. By taking use of digital tools and media, the museums are attempting to target a broader group of people. There is a significant interest in exploring mobile phones as tools for digital storytelling. Above all there is a will to involve youths and pupils in local schools in this project.

Østfoldmuseene consists of eight divisions of museums, scattered around the county of Østfold. One of these museums is Isegran Museum which is located at Isegran Island in Fredrikstad, and is part of Fredrikstad Museum. This museum has shown dedication to exploring the potential of mobile technology.

At the outdoor part of the museum there is an activity trail which mainly is used for organized tours aimed at local school classes. At certain points of the trail, a costumed actor presents historical information which is relevant to the location. In the words of the museum staff, this approach seldom manages to engage the visitors. They are simply passive consumers of information, and do not actively take part in the experience. Moreover, the process of involving actors is both time consuming and costly, and is not flexible in regards to when the actor is available and the content he is presenting.

The museum believes that mobile phones, as tools for telling stories as well as for the solving of tasks, may assist in driving the pupils to play a more active role in the experience of the visit. By doing so, there will be a stronger value of paying the museum a visit. By taking use of mobile technology, information will be available at any given time and the content will be far more adjustable providing more freedom of choice to the end users.

However, there has been undertaken little research on the matter, and it is difficult to predict whether or not this approach could be fruitful.

2.2 Stakeholders

In the above mentioned user case, there are three stakeholders: the teachers, the pupils and the museum. They all have different purposes for using a mobile application in a visit to the museum. The teachers use it as an approach to *teach*, the pupils use it as an approach to *learn* and the museum use it as an approach to *involve* the visitors by conveying local history.

On the other hand, all stakeholders will expect the introduction of technology to bring added value to the museum visit.

The main target group is the group of pupils. However, the system must also target teachers and staff at the museum. Teachers are responsible for preparing the pupils for the visit to the museum. They are also responsible for selecting content. The museum staff are on the other hand responsible for providing teachers and pupils with appropriate content.

By interviewing all three stakeholders, the following information has been collected and used as valuable input in the design process.

2.2.1 The Museum

The foundation of the project is based on a vision from the museum itself, stating that they believe mobile technology can be used as an asset and tool in attracting the attention of (new) visitors. Isegran Museum has been selected as a pilot project. The project will be extended to include several other locations at the museum in the future.

Traditionally a class of 20 to 30 pupils visit the museums as a group. The pupils are generally not prepared for the visit and are quite often passive recipients of a monologue presented by the staff at the museum. Having spent time at the museum, they return to the school and seemingly forget about the visit.

In such a scenario, there is not much purpose in visiting a museum. The approach requires a fair amount of planning and co-ordination between the teachers and museum staff and is a time consuming process. The content during the visit can hardly be modified and adjusted to taylor the needs of the visitors. This approach has limited value to the pupils, the teachers and the museum.

From the museum's standpoint, they believe mobile phone technology can be used for:

- Providing visitors supplementary relevant (digital) content, in addition to the existing exhibitions. This is particularly interesting in the open air exhibits.
- Extending the opening hours of the open air areas of the museums by making digital content

available. By doing so, one can provide more freedom of choice of content as well as time.

- Providing a cost-efficient approach to dynamic distribution of digital content.
- Attracting new visitors. There is a strong emphasis on involving and engaging youngsters and in particular schools.
- Allowing the visitors to take on a more active role, by letting them interact with the content. By solving tasks and creating content themselves, it is believed that one can turn the visitor from a passive recipient of information into an active participant. This will add an element of value to the time spent at the museums, which in turn will result in a closer sense of relationship to the local history.
- Providing personalized content during the visit by allowing the visitors to taylor the content prior to the visit.
- Encouraging communication and collaboration between the group of pupils.
- Encouraging and promoting creation of own works.

2.2.2 The Teachers

Teachers are pledged to the curriculum and are not able to spend significant resources on teaching that does not relate to it. As a consequence of this, using the applied design must require a minimal amount of effort from the teachers and must be easy to use.

Teachers expect to use mobile technology as a resource for teaching. Digital competence, local history, reading and interpreting maps and language skills are areas of the curriculum which are particularly relevant to the content.

Perhaps more importantly, the teachers expect technology to provide more flexibility and control. They would like to be able to freely decide *when* to pay the museum a visit, and *what* to experience during the visit. Hence, they expect a possibility of personalizing and tailoring the entire visit so that it suits their needs.

2.2.3 The Pupils

The pupils expect the introduction of the mobile application to provide more freedom. They would like to be in charge and pay an active role during the visit. Moreover they expect to have fun and be able to work together in order to gain knowledge.

2.3 Relevant Content

The content for the prototype has been developed in close collaboration with expert staff at the museum. Whereas the content itself is not in the core interest area of the work with this thesis, it is essential for the implementation of a high fidelity prototype. Hence, quite a significant amount of resources has been spent on developing and modifying suitable content.

Figure 2.1: On the set of the recording of footage for the short story from the 1700s at Isegran

The staff at the museum has produced five manuscripts[3] for five short stories based on historical events from five different centuries. Each story is connected to a certain area at the open air museum at Isegran and has a historical character linked to it. The stories are:

- The 1200s - An unknown female talks about ”Alv Erlingsson”[4].
- The 1600s - A priest talks about the sinking of the ship ”Lossen”[5].
- The 1700s - Commander Niels Christian Hals looks back at the events of the 1700s[6].
- The 1800s - ”Dina Bing” talks about the usage of the island during the 1800s[7].

[3]The manuscripts can be found in Appendix A
[4]http://www.youtube.com/watch?v=zp9kYvLjYus
[5]http://www.youtube.com/watch?v=WRbwhn8uV-A
[6]http://www.youtube.com/watch?v=3oFPp1$_W vbA$
[7]http://www.youtube.com/watch?v=nZKqUETFijM

- The 1900s - Boatbuilder ”Alf Larsen” talks about the success of the Regatta boats built at the island during the 1900s[8].

The stories were recorded to video as museum staff acted out the roles of the characters. The footage was then edited into five separate stories using Adobe After Effects[9] and Apple Final Cut Pro[10], to be included in the mobile application. In addition, museum staff authored five sets of tasks that were to be published on the website along with short summaries of the key events of each century[11].

2.4 Related Applications

The museum industry has been using handheld digital devices in their distribution of content for a number of years. One of the most widespread uses of such technology is the audio guided tours. These tours typically take use of a handheld device such as a PDA and a set of headphones to provide audio-based information about the context as a supplement to the visual experience. This allows visitors to explore the museum on their own. While this may be an useful asset to for instance foreign language speakers, it leaves the visitor as a passive consumer of information with a somewhat limited amount of freedom of choice. However, with the development of new technology, many institutions have been taking use of a number of other portable devices and technologies in a wide area ranging from entertainment to learning, production and collaboration.

Some of these will be presented in the following sections.

2.4.1 Using Portable Devices For Learning Purposes And Collaboration

Li-Der Cho et al.[4] at the National Central University of Taiwan have developed a proposed portable tour guide system for PDAs which is both context-aware and location-aware. The purpose of the system is to provide vivid and comprehensive multimedia content to the end user, adding to the physical exhibits in the museum. An interesting additional feature is the embedding of a ”learning activities system” which provides collaborative activity modules for educational exercises.

Drammens Museum, Sørlandets kunstmuseum and Lillehammer kunstmuseum are three art galleries in Norway taking part in a pilot project[26] using iPods as a tool for the visitors not only to

[8] http://www.youtube.com/watch?v=4L$_c lhnf - CQ$

[9] http://www.adobe.com/products/aftereffects.html

[10] http://www.apple.com/finalcutpro/

[11] The survey of the content and the responsible parties can be found in Appendix B

receive information about the exhibits, but also to generate their own content. The project targets youths in Norwegian schools. The iPods are used to distribute music and short narrative stories about the exhibits. Furthermore, the iPods allow the pupils to record short video clips on site focusing on certain topics. The three involved museums claim iPods can be used to involve students. However, in order to succeed one has to work closely with the teacher and make sure the students do not use it solely as an audio guide.

2.4.2 Location-Aware Systems

Schmidt-Belz et al.[29] presents location-based mobile tourist services. The main functionality of the design is recommendation of tourist attractions based on personal interests and the proximity of the attractions. Hence, the system touches on two very interesting characteristics, those being location-based content and personalization of content.

Cheverst et al.[3] have developed GUIDE - an electronic tourist guide which has been installed for use in Lancaster. The system combines mobile technologies with wireless access and provides tourists with information tailored to their personal and environmental contexts.

2.4.3 Extending The Museum Visit

Semper and Spasojevic[30] describe the development of "The Electronic Guidebook", anchored at the Exploratorum Museum in San Fransisco. Visitors carry wirelessly connected portable devices giving them opportunities for exploration, sharing, context, analytical tools, background and suggestions for related experiences. The devices can assist extend the museum visit. Prior to the visit the system orients the visitors about the exhibits. After the visit it gives them opportunities to reflect and explore related ideas.

Sherri Hsi et al. [11] describe the development of The "eXspot" design, a project linked to the "Electronic Guidebook". A visitor entering the museum receives an RF Tag that is brought along and allows her to receive information about specific exhibits. Furthermore the visitor would collect data along the way. Once the visitor returns home, she may access and retrieve the information collected at a personalized website which has been keyed to the RFID[12]. Hence, the museum visit is extended, also providing personalized content to the visitor.

[12]Radio Frequency Identification - http://en.wikipedia.org/wiki/Radio-frequency$_i dentification$

2.4.4 Augmented Reality

Mohring et al.[23] presents an augmented reality system on a consumer mobile phone. Augmented Reality uses markers to render and project 3D graphics into a live video stream on a consumer mobile phone. This technology has been implemented in several commercial projects over last years. For instance, Gule Sider[13], one of Norway's largest telephone directories, has developed a commercial iPhone application using Augmented Reality to place virtual elements on top of a live video stream through the built-in camera in order to provide road directions to the users.

2.5 HCI

Human-Computer Interaction (HCI) is a discipline covering a vast range of topics. In the context of a mobile application, it can be understood as the interaction between the people using it and the design itself. HCI has been summarized in short as: "A discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them"[8].

There are two particularly important aspects to a design: (1) How usable it is, and (2) How the user feels when using it. Designing with the user in mind will provide better functioning design.

2.5.1 Paradigms of HCI

Historically HCI has been practiced by a two set paradigm. The first paradigm attempts to optimize the ergonomic fit between man and machine. The second takes on a more theoretical approach, focusing on how the human mind works while using the computer. Hence it pays interest to the way the user interacts and communicates with the computer. Harrison, Senger and Tatar[9] introduce yet another paradigm shifting the attention to a more social setting - How can the design be used in a social setting in a real physical world, and to which degree is the user satisfied when using it?

All of the paradigms are equally important and valid when designing applications both for the mobile platform and desktop/laptop computers.

2.5.2 HCI-related issues

The following sections will direct focus to some of the HCI-related issues in designing for mobile phones.

[13] http://www.youtube.com/watch?v=4jnGY6qFPxg

Availability

An obvious strength when developing for the mobile platform is availability. Mobile phones are today part of our daily life. In 2006, the Norwegian Post and Telecommunication Service reported 4,97 million mobile subscriptions in a country of 4,66 million citizens[1]. According to Netcom, one of the leading mobile telecom operators in Norway, 9 out of 10 mobile phones sold in the first half of 2011 were smartphones[2].

Fit

The fit of the device influences the overall user experience. The user should feel comfortable using it. This is challenging as the hardware has some obvious limitations. Mobile phones are usually used in challenging settings and conditions. In an outdoor arena - light, rain and wind are factors which will influence the visibility and audibility of the content presented. However, mobile phone displays are designed for outdoor use in relatively harsh weather conditions, and they are fitted ergonomically to the hand of the user. By using headphones, one may also cope with the challenges of communication by use of audio.

Localization and Distribution

One of the most evident characteristics of a mobile phone is that it is in fact *mobile*. It can be brought along anywhere. Hence, presenting location-aware information to the users has been made possible through several technologies. Hence it is fair to assume that the users will expect to be able to access relevant content which is specific to their whereabouts with relative ease.

Interaction

Some interface developers tend to transfer workstation environments to the mobile platform. However, the nature of these two platforms are in fact very different. The mobile phone is only a fraction of the size of a desktop computer and the tasks performed on the two are seldom similar. Thus it is important to realize that developing for mobile devices is indeed quite different.

The lack of an input device, such as a full size keyboard or a mouse, makes traditional interaction with the device impossible. Hence efforts should be directed in limiting the amount of required user input.

Coping with the challenges of bad light conditions, poor speakers and a presence of ambient noise, designers should make use of contrasting colors and make sure sound quality is as good

as possible. Users should be encouraged to use headphones when necessary. In traditional color theory, there is a strong contrast between warm and cool colors. Use of descriptive icons in buttons, descriptive images and large touch-sensitive areas are other measures which may assist to a successful design.

2.6 Platforms

There are a wide variety of mobile phone manufacturers available on the consumer market. The mobile phones can be classified in two categories - contemporary basic feature phones and the so called smartphones. Albeit the feature phones being able to run stand alone applications, smartphones are generally able to run more advanced applications based on a specific platform. Smartphones run operating systems which provide a platform for application development[14].

The feature phones still dominate the mobile market. According to a report conducted by the NPD[15], feature phones represented 72 percent of handset sales in the USA in 2009[20]. However, according to studies, smartphones is the fastest growing segment in the market[15].

Smartphone Subscribers
3 Month Average Ending Jan. 2010 vs. 3 Month Average Ending Jan. 2009
Total EU5 (UK, DE, FR, ES and IT), Age 13+
Source: comScore MobiLens

	Smartphone Subscribers (000)		
	Jan-09	**Jan-10**	**% Change**
EU5	*38,994*	*51,623*	*32%*
U.K.	6,525	11,109	70%
France	4,842	7,140	48%
Germany	6,309	8,429	34%
Spain	7,809	9,907	27%
Italy	13,510	15,037	11%

Figure 2.2: Statistics of number of smartphone subscriptions in Western Europe from January 2009 to January 2010[7]

In the UK alone, there was a 70 percent increase in the number of smartphone subscribers only from January 2009 to January 2010.

As such devices are equipped with more powerful processors and memory as well as larger screens and resolution, they are more fitted for rich multimedia user experiences. More importantly,

[14] http://en.wikipedia.org/wiki/Smartphone
[15] A global provider of consumer and retail market research information

these devices are integrated with fully functional web browsers, which allow the deployment of user friendly applications.

Operating System	2nd Quarter 2010 Units	2nd Quarter 2010 Market Shares	2nd Quarter 2009 Units	2nd Quarter2 2009 Market Shares
Symbian	25,386.8	41.2	20,880.8	51.0
Research In Motion (RIM)	11,228.8	18.2	7,782.2	19.0
Android	10,606.1	17.2	755.9	1.8
iOS	8,743.0	14.2	5,325.0	13.0
Microsoft Windows Mobile	3,096.4	5.0	3,829.7	9.3
Linux	1,503.1	2.4	1,901.1	4.6
Other OSs	1,084.8	1.8	497.1	1.2
Total	**61,649.1**	**100**	**40,971.8**	**100**

Figure 2.3: Worldwide Smartphone Sales to End Users by Operating System in the second quarter of 2010 (Thousands of Units)[14]

The table above illustrates the major parties in the worldwide smartphone market. The Symbian operating system still dominates the market, but the Android OS increased its market shares by more than 15 percent in one quarter of 2010. Research In Motion (RIM) maintains a strong position in the US market, as it is used on the Blackberry phones. Referencing these statistics, there are several platforms controlling a continuously growing market.

2.7 Native and Web Applications

Mobile phones run on a number of different operating systems, and are programmed using various programming languages. Developing applications using native programming languages make those applications exclusive to that particular platform. As a result of this, developers must create several versions of the same application in order to support the vast number of different platforms.

However, there are alternative approaches to native application development. As these devices can access the Internet in a fully integrated web browser, it is possible to develop web-based applications using open standard development tools and frameworks. Both of these approaches to application development have advantages and disadvantages. The figure below outlines the main pros and cons of both approaches.

In addition to these characteristics, Thomas Claburn[**?**] argues that native applications are more

NATIVE APPLICATIONS	WEB-BASED APPLICATIONS
+ Access to all device features + Access to users through the marketplaces + Certain features will be able offline	+ Any device with can access the Internet through a webkit browser will be able to access the application + Does not need to be distributed through marketplaces + Does not have to participate in developer programs + Uses open standards that are easy to implement
- Will only run on the single platform/device it has been developed for - Device manufacturers may not approve the application for distribution - Device manufacturer may claim shares of the profit it potentially generates.	- Cannot easily access built-in device features such as motion detection, camera and GPS

Figure 2.4: Pros and cons of native and web-based applications

likely to have access to new mobile device capabilities before web-based applications do because the manufacturers provide access to APIs before these reach the public. Furthermore he argues that file storage for web-based applications is limited and that monetization works well through applications stores.

On the other hand, Claburn presents valid argumentation supporting web-based development. Many of the major manufacturers are now making commitments to HTML5 development, among them Microsoft (Windows 8) and Apple. In an open letter to Adobe, titled ”Thoughts on Flash”, co-founder and chairman of Apple Steve Jobs states that ”New open standards created in the mobile era, such as HTML5, will win on mobile devices (and PCs too)”[17]. Albeit marketplaces being a powerful asset in distributing applications, these demand revenue. Selling applications through the iTunes App Store or the Android Market will cost the author 30 percent revenue. Web-based distribution is cost-free. In addition, the web has fewer patent predators while developers who create native applications do so at their own risk.

Claburn concludes the argumentation stating ”The winners (of mobile application development)

will be those who, through their due diligence, choose the right technology for the task at hand"[6].

2.7.1 Native Development

This section will give a short summary of some of the major players and programming languages in the market and the requirements for developing application for the platforms.

Apple iOS

When the Apple iPhone was released in 2007, it was an immediate success and set the course for a new generation taking use of haptic technology with its multi-touch screen. Apple has invited third parties to develop applications for the iPhone by distributing a collection of development tools through the iOS SDK.[16] These tools include Xcode which is the complete development environment, a simulator, instruments and an Interface Builder.[13]

Developing applications for the iPhone/iPad requires the use of an Apple Mac and familiarity with the Objective-C language. Cocoa gives access to a collection of APIs[17]. Developers must sign up for the Developer Program[18].

Android

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Applications are written in the Java programming language. As Apple, Android has released an SDK which may be downloaded by developers. The Android SDK tools compile the code and data into an Android package.

Symbian

Symbian is the operating system used by Nokia's smartphones. However, Nokia has announced that they will migrate away from Symbian to Windows[28].

Symbian OS is written in C++, and this is therefore regarded as its primary programming language. C++ offers the greatest access to the Symbian OS APIs, and being the native OS language, the best performance in memory use and execution speed. Alternative development languages are Python, Adobe Flash or Java ME.

[16] Software Development Kit

[17] Application Programming Interface- A set of data structures, protocols, routines and tools for accessing software applications

[18] http://developer.apple.com/programs/ios/

RIM

RIM[19] develop and design Blackberry phones. Developing applications for the Blackberry platform requires the use of Java. To develop Java-based applications for BlackBerry smartphones, one may use the Eclipse environment or the BlackBerry Java Development Environment[12].

Windows Mobile

Windows Mobile applications are developed using Visual Studio and .NET. Mobile applications are written similarly to desktop applications. However, a downloadable SDK is needed to access API header and library files needed to access Windows Mobile functionality[22].

2.7.2 Web-based Development

With the introduction of technology such as HTML5, CSS3 and Javascript libraries, developers are now able to create applications with advanced graphics, typography, animations, transitions and advanced functionality all inside a browser without the use of any plug-ins. The technology has the ability to deliver components like audio and video, as well as local storage for saving data offline.

A vast majority of the default browsers used by the major mobile phone vendors support this technology. Therefore, developers may build rich applications able to run simply by accessing the built-in browser on the phone taking use of open standard technology. The following section will briefly describe some of the frameworks that take use of this technology and helps building applications and mobile friendly sites uncomplicated.

jQuery Mobile

jQuery Mobile[20] is a powerful touch-optimized web framework for smartphones and tablets. The jQuery Mobile framework is built on jQuery and jQuery UI Foundations, and allows developer to design a single customized application that will run on all popular[21] smartphone and tablet platforms[19].

The jQuery Mobile framework provides tools to build dynamic touch interfaces. Among these tools are layouts, form controls and User Interface widgets[22]

[19] Research in Motion
[20] http://jquerymobile.com
[21] A list of supported platforms can be found at http://jquerymobile.com/gbs/
[22] A list of demos of the framework can be found at http://jquerymobile.com/demos/1.0b3/

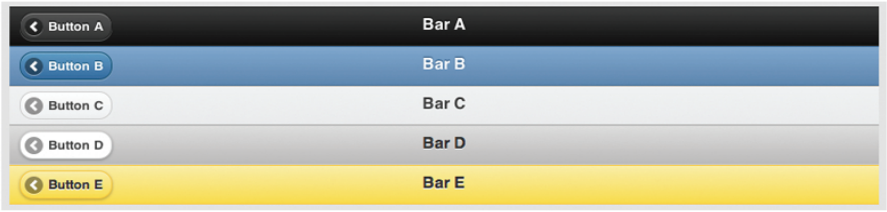

Figure 2.5: A screenshot of the list styles and button styles of the jQuery Mobile framework

Using the jQuery Mobile framework in combination with HTML5 is fairly simple. By referencing the library, one may simply target classes in the markup.

Sencha Touch

As with jQuery Mobile, Sencha Touch[23] is a built to leverage HTML5, CSS3 and Javascript on touch screens inside the browser.[24] The framework has support for iOS and Android, as well as BlackBerry.

jQTouch

jQTouch[25] is a jQuery plug-in for mobile development on touch-based screens. It supports native webkit animations, swipe detection, extensions etc..

Corona

Corona is a development tool for the iPhone, iPad and Android. It is produced by Ansca, and the Corona SDK allows developers to create cross-platform applications that have access to APIs that other frameworks do not. Corona executable binaries are fully Objective-C/C++.

Developing in Corona uses the Lua scripting language. It has a good amount of market adoption in the development community. Lua syntax can be compared to languages such as JavaScript or ActionScript 3[21].

[23] http://www.sencha.com/products/touch/
[24] A list of deoms of the framework can be found at http://www.sencha.com/products/touch/demos/
[25] http://jqtouch.com/

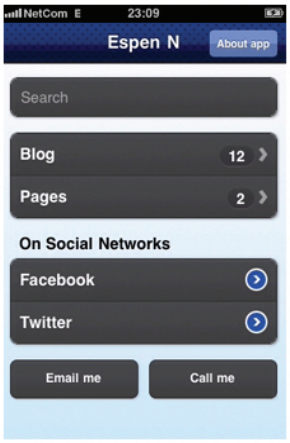

Figure 2.6: The figure shows an exploratory approach to building mobile friendly designs using the jQTouch framework.

WPtouch-Pro

WPtouch Pro[26] is a plug-in for Wordpress allowing developers to create tablet and mobile optimized designs. However, WPtouch Pro's primary purpose is to detect supported devices and displaying a mobile-friendly version of an exisiting website built with Wordpress. Hence, it is a tool for presenting content dependent on the device of access rather than a dedicated mobile development tool.

Wrapping Applications

One may build applications for the mobile phone using HTML and Javascript and at a later point in time turn these applications native. Services like PhoneGap[27] and Appcelerator Titanium[28] translate web-based applications and make them perform and look like they were authored in Objective-C or Java.

2.8 Location Determination

One of the most interesting features of a mobile phone is the ability to determine the geographical location of the device. This has opened up a whole range of possibilities of combining presenting

[26] http://www.bravenewcode.com/store/plugins/wptouch-pro/
[27] http://www.phonegap.com/
[28] http://www.appcelerator.com

content based on geographic location.

2.8.1 GPS

One of the most widespread use of technologies in location-aware design is the GPS[29]. Most smartphones come with a built in GPS-receiver which is able to determine a fairly accurate position. The position can be displayed on a map or trigger an event connected to a specific position.

The GPS on a mobile phone is part of the native operating system environment and in order to exploit it's functionality access to the built-in functionality is needed. However, HTML5 also supports Geolocation by GPS directly in the (supported) browser.

2.8.2 RFID

In addition to Geolocation by GPS technology, there are other approaches that do not take coordinates into account. RFID[30] is a technology that makes the passing and storing of data possible through radio waves. By attaching an electronic tag to objects, a reader may identify or track that object.

2.8.3 QR Codes

Another interesting technology is QR[31] Codes, a two-dimensional barcode which originally was designed for the automotive industry in 1994. The technology was initially used to track car parts in vehicle manufacturing. However, QR Codes have been adapted by the mobile technology, and is widely used in marketing. Codes appear in magazines, on signs, on buses and on business cards.

These codes can store information which prompts users to receive text, add a contact to their device, or compose an e-mail or text message. More interestingly the codes are also able to load URLs, automatically opening a predefined website in the mobile phone browser.

QR codes can be generated using a wide range of online services, both free and paid versions. Some mobile phones are shipped with natively installed QR readers. However, there are free downloadable QR reader applications available for all the major smartphone vendors.

[29] Global Positioning System
[30] Radio Frequency Identification
[31] Quick Response

Chapter 3

Design Method

In order to be able to investigate the research objectives, a prototype has been developed and utilized. The prototype is merely used as a tool to measure the effects mobile technology combined with the solving of tasks has on a visit to the museum.

This chapter will describe the methods used in the design process. It will not describe the implementation of the prototype in detail, as this is discussed in the next chapter.

The design is based on literature and case studies of developer frameworks as well as on the feedback collected from the stakeholders through several iterations of prototyping. Mock-ups have been presented to the stakeholders, varying from user scenario videos to demo frameworks and high fidelity working prototypes.

3.1 Methodology

The development and implementation of the prototype requires a design approach that is flexible and able to handle frequent as well as late changes during the implementation. As there are several primary stakeholders involved in this project, the inclusion of these throughout the design process has been essential. However, some of the initial design choices and technical considerations have been made prior to involving the end users. These choices include native versus web-based application development and content management.

The design process consists of three main phases, (1) Production and adaption of the identified content (2) Implementation of content in prototypes using the identified developer frameworks (3) Evaluation of the design by the stakeholders.

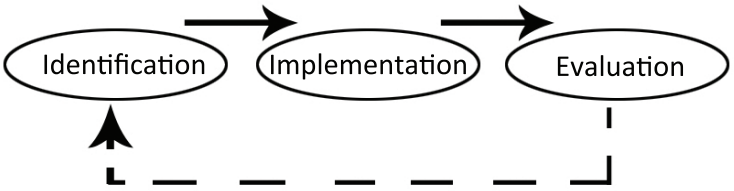

Figure 3.1: The design process divided into three phases including iteration (the dashed line)

3.1.1 Interaction Design Models

There are many approaches to interaction design. Many of these approaches have been attempted standardized in various life-cycle models. In many ways, the Waterfall Model may be directly applied to this particular design process. The design is fairly straight forward and quite limited in scope. It focuses on progressive steps, involving some iteration. However, the time spent on each iteration is quite limited.

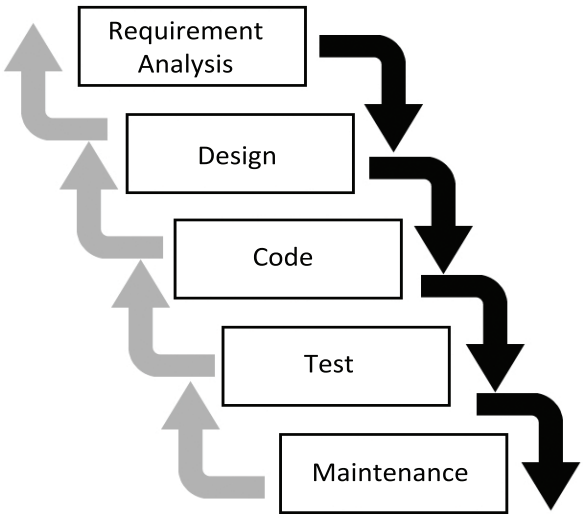

Figure 3.2: The Waterfall Model introduced in 1970 by Winstond Royce. The light opaque arrows illustrate iteration between the stages.

On the other hand, the Waterfall Model does not take the end-user into consideration, and is not considered suitable for end-user applications. The consideration of the users is essential to this particular design. These characteristics are more typical for for instance the Spiral Model or the Dynamic Systems Development Method[10].

Perhaps more suitable are the Prototype-Based Models. The design relies heavily on a trial-and-error methods. The advantages of such a model include the following[10]:

- Easy for users to give feedback
- Reduced development time and cost
- Involvement of the user in the development process

These are characteristics that are quite obvious for this particular design process. The design comes to life through a process of exploring different frameworks and designs by presenting prototypes at different levels. This is a quite useful approach to designing, as the stakeholders get a vivid impression of both design and functionality. However, when presenting a prototype one must be careful so that it is not viewed as a final product which may lead to insufficient analysis.

In total, there were three meetings with all three stakeholders present. The first meeting was spent presenting the general concept as well as a mock-up video describing a user scenario. The feedback collected from the stakeholders was used to implement a simplified proposed design which was presented at the second meeting along with another mock-up video describing the technical functionality of the design. The feedback collected from this meeting was used for one last iteration of the implementation of the design. Finally, representatives from all three primary stakeholders met at Isegran Museum for an on site real life testing and evaluation of the design.

3.2 Recruiting Partners

The design process consisted of a number of iterations and may be identified as an explorative approach based on trial and error. An explorative design process is similar to other iterative and incremental development processes[16]: One must understand what to make, implement, and test, and then evaluate the results from this testing. After evaluation, one has hopefully reached a higher level of understanding which allows the making of a better prototype to be created and further tested.

One important aspect of such an approach is to involve real and representative users. These users will contribute in the process of improving and optimizing the design.

The involvement of a teacher was essential for the collaborative efforts of a school class and the museum. Hence, it was necessary to attract the interest of a local school. By distributing a summary[1] of the ideas behind the project, including a user scenario, the project was pitched to Kari

[1]The summary can be found at http://mobilformidling.no/isegran/outline.pdf

Agerup who is in charge of *Den kulturelle skolesekken*[2] which is an approach to offering pupils a cultural supplement to the curriculum. Many of these projects are hosted at Østfoldmuseene.

She expressed enthusiasm about the concept, and helped get in touch with Hege Glad, a teacher at Kvernhuset ungdomsskole. Hege Glad established a group of nine of her 10th grade pupils, aged 15 to 16 years old. These pupils were handpicked by the teacher, with representatives from both genders - four girls and five boys. There was no acquaintance between the pupils and the museum staff what so ever. This group has served as the primary stakeholders and testers.

[2] http://denkulturelleskolesekken.no/

Chapter 4

Prototype

This chapter will present the implementation of the prototype. It will first provide a user scenario in order to establish an overview of how it can be used. Next it will give an overview of the system as a whole described as the structure of the design. Furthermore, it will describe how the content was implemented both at the back-end and the front-end.

4.1 Scenario

Upon pitching the project to potential teachers, a user scenario was developed in order to portray the core usage and functionality. The purpose of the scenario was to clearly and simply show the relationships the user(s) will have with the system. The scenario was developed using Harold Laswell's guidelines for communication - "Who says what in which channel, to whom, with which effect"[5].

We are familiar with scenarios from our early childhood through children's stories. As Jack Carroll states, referenced by Matt Jones and Gary Marsden, "Scenarios are stories. They are stories about people and their activities"[18]. These short stories can be highly useful in outlining the participants setting, goals and objectives and their actions and events.

The following scenario describes the hows, whens, whys and whos.

Rita is a teacher at Greåker high school. She teaches a wide range of subjects, among other geography, history, biology and Norwegian. She has been looking at alternative methods of teaching in order to involve and increase engagement amongst her students. However, she has found it troublesome to adapt her methods of teaching to the wide range of subjects. She is also aware that her pupils are at different intellectual levels.

Rita is informed about the project at Isegran, where the pupils use mobile phones as tools for exploring the area and the solving of tasks at the museum. The project encourages an extended visit to the museum and is split into three phases (1) Prior to the visit (2) During the visit and (3) After the visit. The project web portal includes a database of downloadable resources divided into centuries of historic origin. These resources may be used in the preparation for the visit to the museum. Each century also has a range of predefined tasks that can be selected or unselected in a form. The form allows her to input her own tasks. By accessing the website she is able to taylor the content of a mobile web application which may be accessed during the time spent at the museum.

By taking use of mobile phones, the pupils may access more information and solve a range of tasks during the visit to the museum. When they return to the classroom, they have collected information and data which is to be used to produce their own works.

Rita learns that the system quite easily can accommodate her needs. She can alter and adapt the content so that it fits the curriculum. She downloads sources from the website and uses them to taylor her own educational program. She then adds her own content.

Rita has now collected information that covers much of the curriculum, but still feels something is lacking. By contacting staff at the museum through the website, she is able to elaborate on the content.

She uses the form to select which tasks she would like to be displayed in the mobile application. She also adds a few of her own tasks and fills out the date of the planned visit. The form is sent to the staff at the museum, whom input the tasks and a video presentation of the century in a designated area of the mobile application framework. The following day she holds a lecture for her pupils and informs them of the visit to the museum.

At the museum, the pupils are divided into groups equipped with a smartphone. Each group selects a story belonging to a century they would like to explore. One group approaches the mill and is presented with a video short story told by Mr. Vik, the lumberjack. The pupils are given tasks to be solved. One task is to take photographs of the big iron door leading into the vault. As soon as the picture is taken, the pupils upload it to the project website by sending it to a predefined address.

As the groups finish their assignments, they gather and go back to the classroom. By taking use of the collected data at Isegran, they are now able to create their own short stories. However, some students would like to elaborate on their stories. They get in touch with staff at the museum through the website to obtain more information.

The scenario was developed as a manuscript and later turned into a mock-up video[1]. In addition,

[1]The video can be seen at http://nordenhaug.com/master/content/teachers-scenario-video-presentation/

Figure 4.1: Screenshots from the mock-up video describing the user scenario

a video giving rather detailed instructions on how to use the design[2] has been developed.

4.2 Structure of the Design

As we can see from the described scenario, the design aims to involve the users in three different phases in time. By adding two additional phases to the visit itself, the design accommodates use prior to the visit, during the visit and after the visit.

Whereas the core interest area of the research is in the imparting of information by taking use of mobile technology during the visit to the museum itself, the entire design will be described below. However, there has been focused more detail to the mobile application design.

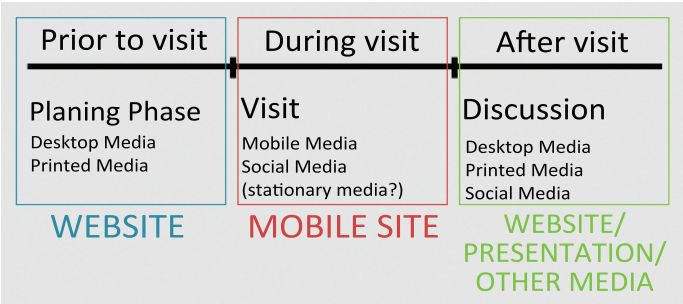

Figure 4.2: Extended visit to the museum. The visitors are engaged prior to the visit, during the visit and after the visit using different medias

In the initial phase, the teachers or the pupils themselves access a project website[3] to gather relevant information necessary to prepare for the visit to the museum. This information is divided into areas of the website, sorted by the century it belongs to. The website is also used for selecting content and tasks to be displayed inside the mobile application. The tasks are selected by filling out a form consisting of checkboxes. The users are able to add their own tasks by entering them in a textbox. Once the form is sent, museum staff assist in inputting the tasks into the mobile application.

[2]The video can be seen at the project website http://mobilformidling.no/isegran/informasjon/
[3]http://mobilformidling.no/isegran

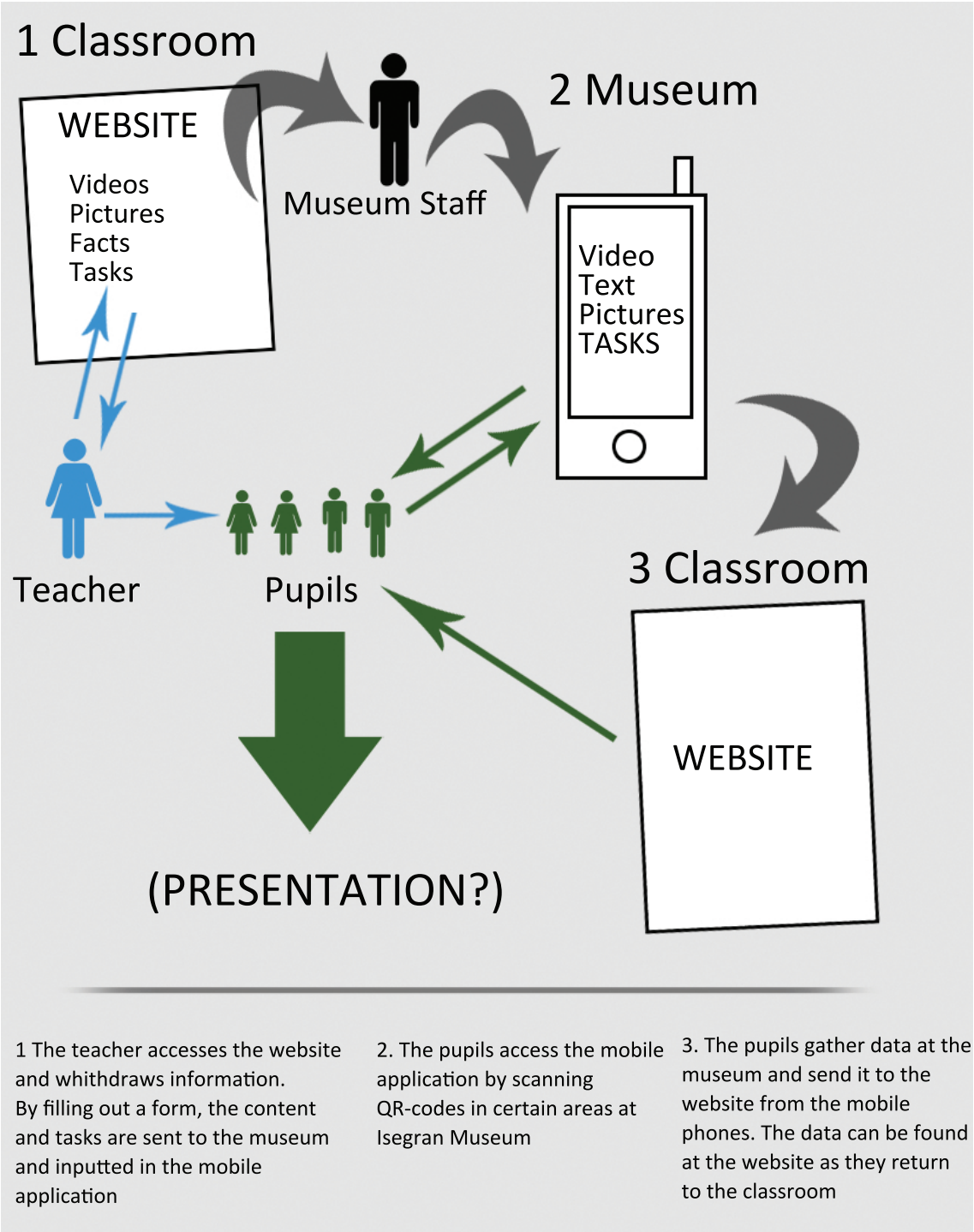

Figure 4.3: The simplified figure shows the functionality of the design

These tasks now become available through a dedicated area of the mobile design[4] when the pupils scan QR-codes with their phones at the museum.

The accessed information is specific to a certain location at the museum where they are situated. This information may consist of snippets of text, images and videos as well as the selected tasks. These tasks are mainly solved by using the built-in features of the mobile phones, and involve collecting data, taking pictures, recording video, checking in to social media etc. All data is gathered and brought back home either by storing it on the mobile phone or by sending it to the project website. Furthermore, the data can be accessed at designated areas of the project website once the pupils return to the classroom. The collected data serve as a foundation to treat and handle for a presentation or lecture to follow held by the pupils themselves.

4.3 Content Management

Both the website and the mobile application require easy administration as they are to be maintained and updated by museum staff who have a quite limited technological knowledge. Hence, the content must be managed by a CMS.[5] A self hosted installation of Wordpress[6] was chosen for several reasons:

- It can be applied at the back end of both the mobile application and the project website.
- It is free of charge.
- It is built on open source code and is very flexible. Independent developers contribute with a wide range of extensions and plug-ins which add to the functionality.
- Staff at the museum are familiar with the functionality and the back-end graphical user. interface as it is used on a daily basis on the Østfoldmuseene website
- Personal knowledge and competence of Wordpress development.

Wordpress has been installed on two separate sub domains. Each of the installations control the content on the project website and the mobile application. Two different themes were developed and optimized for their purposes. As Wordpress states, ”WordPress themes are files that work together

[4] http://mobilformidling.no/isegranmobil

[5] Content Management System

[6] Wordpress is distributed both as an online blog platform as well as a downloadable package containing a developer kit. http://www.wordpress.org

to create the design and functionality of a WordPress site. Each theme may be different, offering many choices for site owners to take advantage of in order to instantly change their website look"[7] Wordpress runs on PHP and stores information in MySQL-databases. By logging in, administrators use a Graphical User Interface to input information which can be assigned to the front-end design.

4.4 Prior to the Visit

The website serves as the main source for resources and content related to Isegran Museum and is used prior to visiting the museum. It is built with the teachers in mind, as they are the primary target group. Looking at the interview committed on the teacher, keywords are simplicity and efficiency. It must be easy to find information about the functionality of the project as well as the resources.

Hence, the website is divided into sections. The main sections the teachers will need to access are instructions of use as well as the resources. Instructions to teachers are provided both as text and as a video screencast.

The resources are divided into sections based on the century the content belongs to. As described in the background chapter, the content is divided into five different centuries. Having produced a short narrative video story for each of the centuries, these have been uploaded to YouTube, and embedded into each of the sections.

These resources are available through an expandable tab located on the left hand side of the website at all times. Through the resource center, teachers may download general information about the island as well as content specific to a century. At each of the century pages there are two columns. The left column provides information about that particular century. The main source of information is short video stories for each century. The right column contains tasks. The tasks are selectable by check marking them in a form. The form is also used to provide the name of the teacher, the name of the school, the date the school plans their visit to the museum as well as a field where the teacher may provide his or her own defined tasks.

Once the form is filled out, it is sent by e-mail to representatives at the museum. The tasks are plotted into the mobile application by accessing the Content Management System.

[7] http://codex.wordpress.org/

Figure 4.4: Screenshots from the website.

4.5 During the Visit

During the visit, the pupils interact with the content by using mobile phones. The design has been developed using the jQuery Mobile framework, as it was able to produce many of the design features necessary to develop a high fidelity prototype. The following section gives a description of the mobile design.

4.5.1 Selecting a Development Framework

As we have learned, there are advantages and disadvantages to both native and web-based development. However, looking at the core of the research objectives, web-based development was the only plausible option. Learning native programming languages is far beyond the scope of this thesis, and is not necessary in order to be able to research the problem field. The design does not need to be available offline, nor does it need to be downloadable from the marketplaces. On the contrary, the personalized dynamic content is dependent on accessing and downloading information online. The users do however need to access certain device features such as the camera and the e-mail application, but for the sake of keeping things simple these are accessed outside the design.

Reasons for choosing web-based development tools may be summarized as follows:

- The design must be able to run on a number of different platforms. As we have learned, mobile web-based applications and sites are accessible by all devices[8] with webkit browsers. This includes almost all smart phones. As native development requires knowledge of a wide range of native programming languages, such as Objective-C, Python and Android, it is outside the scope of this paper

- There is no need to distribute the design through the marketplaces. However, if found necessary, web-based applications can be ”wrapped” and converted to native apps through services such as Appcelerator Titatium[9]

- The design does not depend on in-application access to device features in order to support the required functionality

- It must be possible to manage and administrate the content of the design through a graphical user interface.

One of the advantages of web-based mobile design is removing the need of software development skills. However pure CSS[10] is not able to imitate the behavior of native applications alone. There is a selection of developer tools, mainly based on Javascript, that may be used to assist this process. A handful of these frameworks were explored and tested before deciding which of these to implement in the design.

The design progressed through several stages, exploring a handful of those frameworks available. These frameworks are mainly based on the Javascript library jQuery[11] which gives access to AJAX, which can be used to replicate those transitions and effects which are distinguishing for the native applications. In combination with HTML5 and CSS3, it is possible to create powerful web-based applications and websites which behave similarly to those that are developed using native developer frameworks. Some of the frameworks that were explored include Sencha Touch[12], jQ-Touch[13], jQuery Mobile[14] and WPtouch Pro[15]. The latter is not a traditional developer framework, but rather a plug-in developed to turn regular websites into mobile friendly sites.

[8] A list of default browsers used on various devices can be found at http://en.wikipedia.org/wiki/Mobile_browser
[9] http://www.appcelerator.com/
[10] Cascading Style Sheets
[11] http://jquery.com/
[12] http://www.sencha.com/
[13] http://jqtouch.com/
[14] http://www.jquerymobile.com
[15] http://www.bravenewcode.com/store/plugins/wptouch-pro/

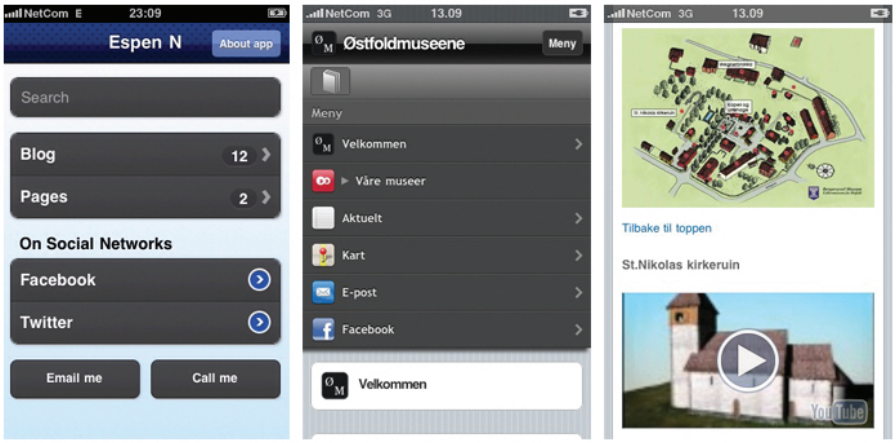

Figure 4.5: Screenshots of the exploratory approach of frameworks. The one the left using jQTouch, the two on the right using WPtouch Pro

Design Iterations

The mobile application is the in the core of the prototype design and the pupils were involved in two separate evaluation sessions during the design process. These sessions were held at the school, with representatives from the museum and the teacher present in addition to the pupils. The sessions were used to collect feedback on the proposed design. The feedback served as the foundation to commit iterations on the design and helped decide which framework was the most suitable for the development of the prototype.

Initially, the concept was introduced by presenting a low-fidelity mock-up video prototype. This is an approach to describing concepts which can be very fruitful. The purpose of this session was not to collect feedback on a designed prototype, but rather to present the concept and receive general feedback on it. However, the pupils expressed trouble understanding the idea. They needed to be able to visualize a scenario in order to be able to understand the concept. The mock-up video did not succeed in doing so.

Prior to the second session, an improved mock-up video going further into the details was prepared. The video describes a user scenario[16] from a teacher's perspective, also outlining how the design may be used by the pupils. Spending time and resources on the development of such a video seemed inevitable as it was important to collect constructive feedback on the concept. The footage in the video shows a teacher accessing the website, adding the content and tasks to the mobile application as well as a description of how it can be used in the field. This proved to be a far more

[16]http://nordenhaug.com/master/content/teachers-scenario-video-presentation/

effective method of conveying the concept, as they were able to relate to it and understand the idea.

For the same reason, a working prototype was installed using WPtouch. The prototype was limited in functionality and content, but was used to present a structure of elements. It was presented on an iPhone and passed around the group of pupils. The observations made during this session indicated that the pupils are familiar with haptic devices in general, and touch screen mobile phones in particular. They were able to navigate within the proposed design without assistance. However, they suggested the design was overly complex. The design must be intuitive and easy to navigate, requiring little effort and few steps from the user-side.

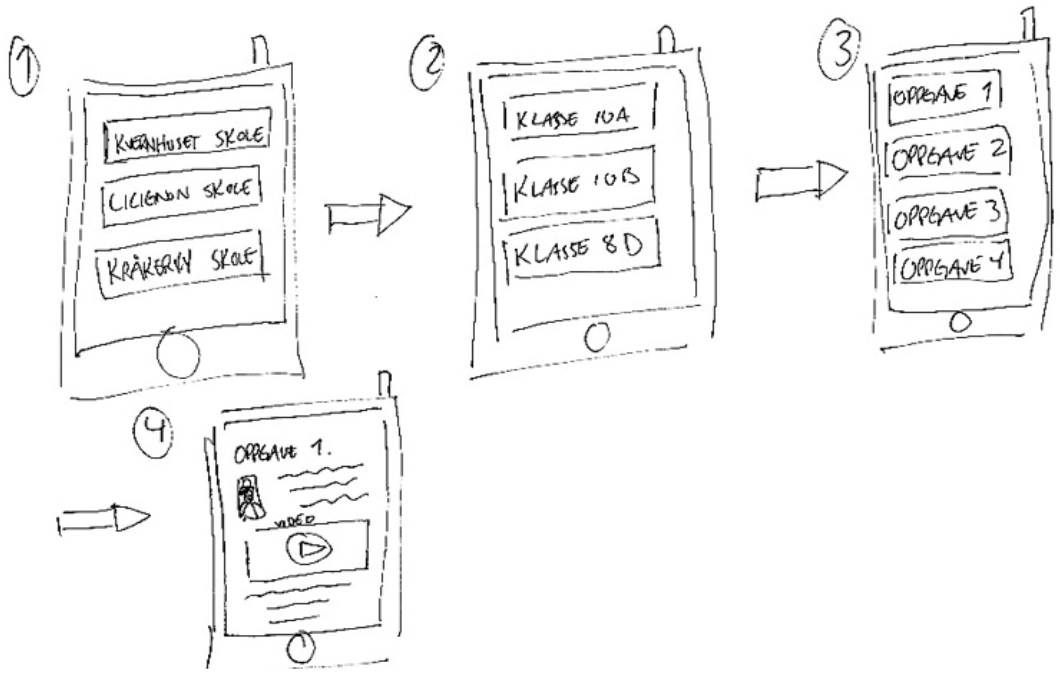

Figure 4.6: The sketch shows a proposed design developed by the pupils during the second session.

Final Implementation

Collected feedback during the second interview suggested simplicity through minimalism. The pupils suggested a clean user interface, leaving out any unnecessary elements.

Having explored several of the mobile development frameworks, jQuery Mobile, in combination with HTML5 and CSS was found to be able to produce a design and functionality very similar to what the pupils outlined during the initial meetings.

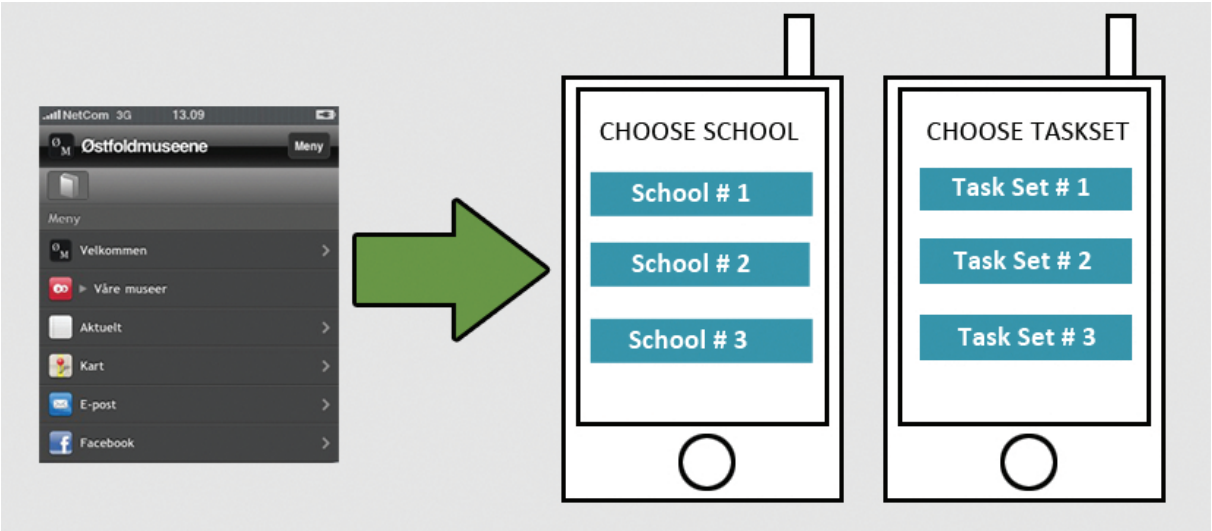

Figure 4.7: The left hand screenshot shows the presented low-fidelity prototype. The right hand sketch shows the pupils' proposed design

The jQuery Mobile library is made available through the jQuery website and may be referenced inside an HTML or PHP document quite easily:

```
<link rel="stylesheet" href="http://code.jquery.com/mobile/1.0a2/jquery.mobile
-1.0a2.min.css" />
<script src="http://code.jquery.com/jquery-1.4.4.min.js"></script>
<script src="http://code.jquery.com/mobile/1.0a2/jquery.mobile-1.0a2.min.js">
</script>
<meta name="apple-mobile-web-app-capable" content="yes" />}
```

Furthermore, using HTML5 data classes, themes, filters etc. referenced in the jQuery Mobile stylesheet, one is able to very easily imitate the behavior of native designs:

```
<div data-role="content">
<ul data-role="listview" data-theme="b" data-filter="true"
data-counttheme="c">
<?php if( have_posts() ) : while( have_posts() ) : the_post(); ?>
<li>
<?php the_post_thumbnail(); ?>
<h2>
<a href="<?php the_permalink(); ?>" data-transition="slidedown">
<?php the_title(); ?></a>
<span class="ui-li-count"> <?php comments_number(0, 1, ' '); ?> </span>
</h2>
```

```
<article> <?php echo the_excerpt(); ?> </article>
</li>
<?php endwhile; endif; ?>
</ul>
</div>
```

The snippet above uses PHP to grab all posts from Wordpress and display them in a list of buttons each containing the excerpt from the post as well as the featured image set for that particular post. These buttons are clickable by touching them with a finger, bringing the user to the content of that post.

The design has been tested on a range of devices from different vendors[17], displaying satisfactory on all of them.

As we can see in figure 4.6, the pupils suggested a clean interface taking use of large buttons leaving only the necessary items. They suggested an hierarchical structure, first selecting the school they belong to, then their class, and finally the century they would like to explore. For the sake of the functionality of the prototype, only the two last levels of the hierarchy were needed to implement.

4.5.2 Aesthetics

As Microsoft advice in their general guidelines in developing for mobile phones[18], all unnecessary menu items should be excluded. Furthermore Microsoft suggests large buttons and descriptive labels along with supporting icons. The use of contrasting font and background color makes it easier to view the screen in bright light. As we can see from the figure below, the buttons also display a descriptive title as well as a short excerpt of the content of the post. All buttons are blue with white text. Within the post, the background is white with a contrasting black text.

When tapping the video, it loads in full screen and thus takes use of the entire space available. Once playback is complete, the video closes down and returns back to the content.

4.5.3 Determining Location

In small displays, the use of hierarchical menus can help strategically structure the navigation[18]. By providing a listing of all the sub posts on the main page, all the content is accessible by the push of a button. However, this step forces the user to determine their geographic location themselves. Moreover, the user has to launch the browser application and manually enter the URL in order to get to the menu items. This requires unnecessary effort.

[17] Apple iPhone 3G and 4, HTC Desire and Desire HD

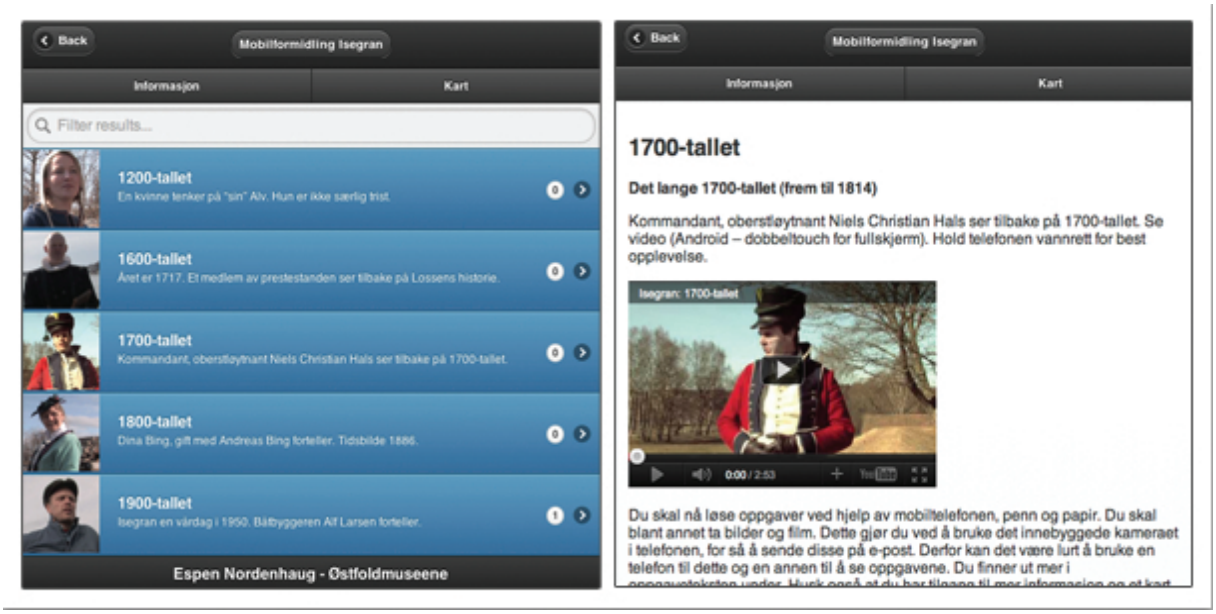

Figure 4.8: Screenshots from the design. The left hand side shows the list of content. The right hand side shows the content within the 1700s post.

Certain areas of Isegran island are connected with the stories belonging to each of the posts in the design. Hence, the content is dependent on location and the user should be able to access only the content that is relevant to that area. QR codes is an effective and efficient solution to the challenge of presenting location-aware content. Placing unique QR codes pointing to unique URLs on posters, hanging them in location-specific areas of the island, makes it possible to point the users to the relevant content. Once the QR code is scanned by the built-in camera on the phone, the browser is launched and loads the URL. It is worth noting that the scanning of QR codes requires the installation of a third party application able to read QR codes on some devices.[18]

4.5.4 Maps and Instructions

While QR codes are able to point the user to the relevant content, they are not built in with the design and do not communicate with it. They are simply shortcuts to the content and can not determine the physical geolocation. Hence, they are not able to inform the user where they can be found.

To cope with the challenge, a map has been placed at the entrance of the museum pointing out the location of the posters. The mobile application design also contains two static pages in addition to the dynamic posts. These two pages are ”Map” and ”Instructions”. These two tabs are located

[18] Some vendors distribute QR readers natively

Figure 4.9: The content is inputted using Wordpress in the back-end system and pushed to the front-end displayed on mobile devices using HTML, CSS, PHP and jQuery Mobile for transitions and effects. QR-codes are placed at certain spots at the museum which gives the users access to the content related to that particular spot.

Figure 4.10: Posters with QR-codes have been placed at six locations on the island. These codes point the web-browser to the post of that particular location

above the content are available at all times browsing the design. The map gives a graphical overview of the location of the QR codes whereas the instructions gives practical information to the user. The latter is used to provide instruction for the sending of images and videos to the project website.

Google Maps[19] provide a service that allows users to embed segments of maps along with custom placed markers. These maps are layered and allow panning and zooming. However, the mapping service did not provide a satisfactory level of detail of the island. There are buildings, roads and paths that are not visible in the mapping segments. Hence, a custom map was constructed and saved as an image file inside the ”Map” page of the design.

4.5.5 Storing Content

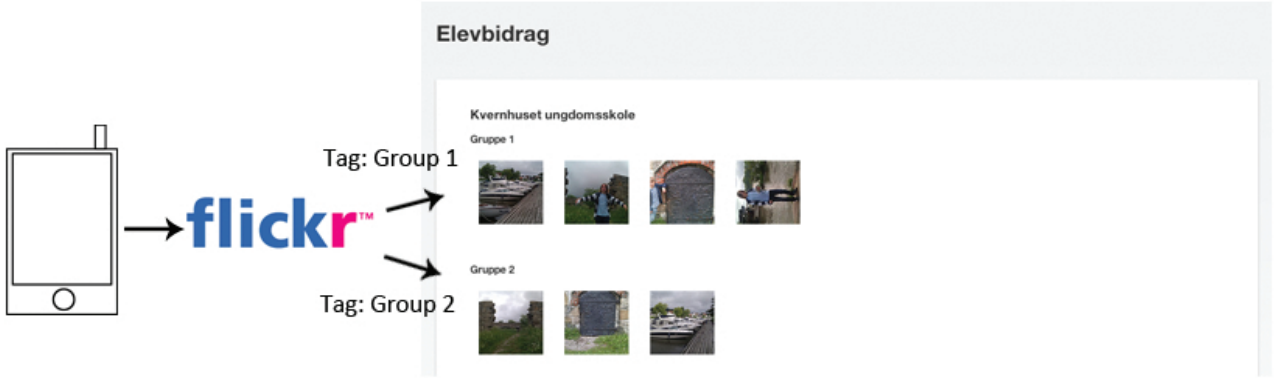

Figure 4.11: Media tagged ”Group 1” and ”Group 2” uploaded to Flickr from the phones and displayed on the website

Some of the tasks in the design ask the pupils to record media, intended for use in further work as they return to the classroom. Hence, this media must be possible to access at a later point in time. The jQuery Mobile framework does not give access to the built-in features of the mobile phone. As a consequence of this, the prototype design does not support these features and they must be accessed outside the application.

As media is recorded, it is automatically stored to the mobile phone. While this may be sufficient in some cases, it does not allow the publishing and shearing of media. For the sake of keeping things simple, an account has been set up at Flickr[20]. This account has an e-mail address linked to it, in

[19] http://maps.google.com
[20] http://www.flickr.com

which it is possible to send photos and videos. Once the photos have been sent to the address, they will also appear at the project website. By assigning tags to the subject of the e-mail, the media will be placed in sections appropriate for that specific media.

4.6 After the Visit

As the pupils return to the classroom, they access a dedicated section of the website containing the media they uploaded from the phones. The media may be downloaded and used for further processing.

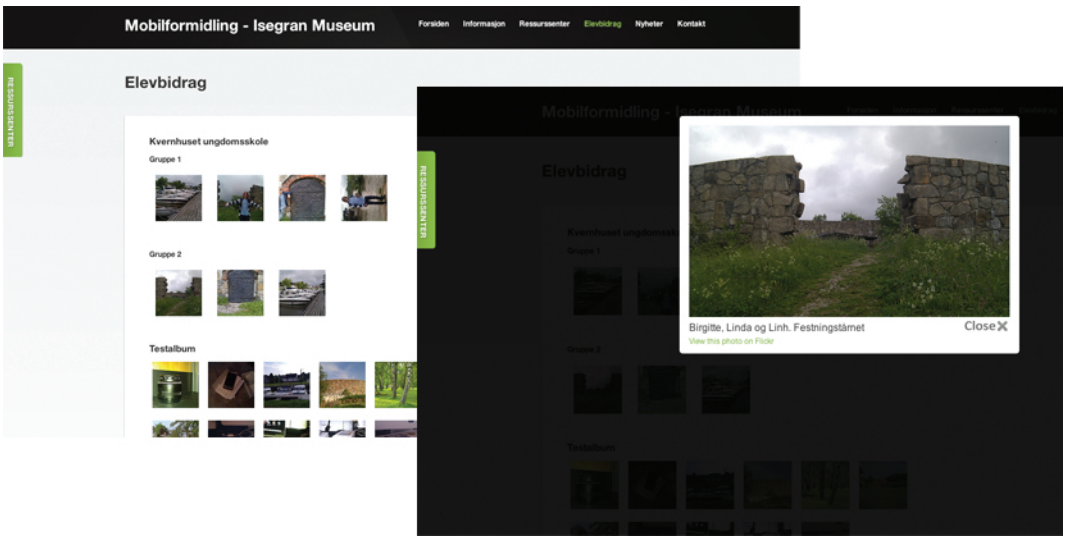

Figure 4.12: The contributions uploaded by the pupils are hosted at Flickr and displayed at the project website.

The media files are hosted at Flickr and displayed in sections based on their school and group number. The contributions uploaded are shared publicly and may be downloaded for further processing and may for instance be used in preparing a presentation.

Chapter 5

Research Approach

The research objective of this thesis is to investigate the influence the use of mobile technology combined with the solving of tasks has on the overall user experience of a visit to a local museum. A field test where real representative users have been involved in testing and evaluation has been conducted. The evaluation is based on the collected data through the field testing in an on-site experiment at Isegran Museum. The field test was followed by an interview session where representatives from all stakeholder parties were present.

The prototype allows testing of distribution of location-based personalized multimedia content, the solving of on-site tasks as well as interaction with the system by uploading content to the project website. The outlined design also consists of phases connected to before the visit and after the visit. However, the field testing limits itself to the evaluation of the mobile prototype itself. Hence, the results gathered from the evaluation may only be used in evaluating the design of the mobile application.

This chapter discusses the testing. First, it describes the evaluation methods applied. It then gives a practical description of the preparations prior to the carrying out. The next chapter will present the actually carrying out of the evaluation as well as the findings.

5.1 Evalutation Method

Due to limitations of both time, resources and finances, the evaluation method is based on the theory of a simplified user testing. Jakob Nielsen suggests a group of five evaluators is a sufficient amount for performing user tests, claiming a larger number will only produce the same results[25]

Furthermore, Nielsen suggests three rules for a simple user testing[24]:

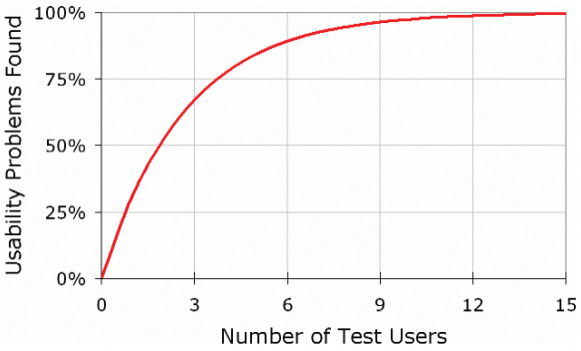

Figure 5.1: The design process divided into three phases including iteration (the dashed line)

1. Get representative users
2. Ask the to perform representative tasks with the design
3. Shut up and let the users do the talking

The evaluation session was two-folded. The first part was a field test, where the pupils were invited to test the prototype in a real life setting at the museum. The purpose of the field test was to gather representative users and have them perform representative tasks with the design.

The second part was an interview conducted after the field testing in a meeting room at the museum. The interview provides valuable data which may be used to go further into the evaluation. During the interview, the users were encouraged to speak freely in a so-called think-aloud technique[18], similar to a session of brainstorming. The aim of the session was to produce independent, sincere and spontaneous reactions. However, in order to be able to direct the conversation to the right topics, a list of questions had been prepared. These questions can be found in Appendix D. During this session, two additional observers representing the museum were present.

5.2 Recording Observations

Performing user tests and evaluations can be highly valuable if observations are recorded thoroughly. The observations serve as the foundation to answer the research objectives. The results and experience gained during the work with this paper will serve as a foundation in further development and improvement of the design, which ultimately may lead to a full implementation of the concept, the feedback is of high value. It will assist in the process of outlining methods of transferring the

concept and design to other similar projects at the other museums in the organization. The collected feedback serves as the foundation for the following discussion in the next chapter

According to Marshden and Jones[18], the main question to ask one self is *what* it is that needs to be recorded. The evaluation takes place in two very different environments. The field test takes place out in the field in a challenging setting outdoors using a somewhat unfamiliar prototype. The second session is an interview shaped as a conversation between the stakeholders, which takes place in a controlled environment indoors in a meeting room.

During the first session, the observations of user reactions, behavior and communication is the primary source of empirical data. Hence, a solid approach may be the to record video footage. Such footage will help capture communication, body language and visual expressions. However, capturing and editing video is a tedious and challenging effort. Moreover it might feel intrusive on the testers. Field notes have been considered sufficient for the purpose of the field test. Field notes are valuable data because they allow the researcher to record the observation of user behavior, communication and emotional state while using the design. Hence, what the researcher sees and hears as well as how the researcher is behaving and how he is being treated should be paid careful attention to.

During the interview, the important data is the feedback on the field test. Hence, the empirical data is the conversation. The interview session has been recorded using a digital sound recorder placed in the center of a table in the meeting room where it was conducted. The sound recordings have later been transcribed.[1]

5.3 Analyzing Data

The sound recordings and field notes are rich data which need to be analyzed. However, when dealing with large amounts of information, there is a recognized risk of ”drowning in data”. Ways to cope with this is to (1) Analyze the data as it is gathered, and (2) Ask key questions about the data. By topicalizing data, it is easier to outline categories and context. Hence, keywords and terms may be highlighted and used to get an overview of important aspects of the rich data.

Silverman[31] suggests the following questions to kick-start an anaysis:

- Articulation: What are the main units in your data and how do they relate to one another?
- Definition: What categories are used by the people you are studying? We do not want to

[1]The transcript can be found at http://mobilformidling.no/isegranmobil/transcript.rft

begin with our own categories at the outset.

- Hows and Whats: What are the contexts and consequences of your subjects' categories?

- Troubles: How do difficulties in the field provide further research topics?

  By looking at the interviews, one is able to attach answers to certain categories. Respondents' answers may belong to several topics. By topicalizing, the main focus areas and their relation becomes more evident.

Figure 5.2: Having analyzed the collected data, the main topics were put into keywords and topicalized.

The main topics covered in the evaluation related to the research objectives have served in outlining the findings. These topics are presented in the next chapter.

5.4 Preparing the Field Test

Prior to conducting the field test, the testing had to be planned in detail. There were representatives from all three stakeholders involved, serving different roles. All stakeholders were on a tight schedule. To be able to conduct the testing, equipment had to be set up and brought out in the field. Posters had to be placed at the correct locations of the museum. A detailed tentative plan[2] for the test day was prepared and distributed to the stakeholders in advance. The plan outlines a definition of the theme of the evaluation, the participants roles and responsibilities, the required equipment and a schedule explaining the timeframes and the arenas where the activities take place.

Storyboards[3] were developed to assist in the process of carefully planning the field test. The storyboards describe the activities, the areas where they take place, the people involved and the timeframes.

5.4.1 Participants and Roles

The testers used were the same pupils involved in the process of designing the prototype. They were accompanied by their teacher as well as a representative from the museum, whom served as observers representing each of the stakeholders.

5.4.2 Equipment

A few days before the field test, posters for each of the centuries were placed around Isegran island. Each of the posters has it's own unique QR code printed, containing a link to the URL of the content it represents. The posters were laminated and attached to objects on the island.

Furthermore, free QR readers[4] were installed on a total of four mobile phones. The phones used for the testing were three HTC Desire and one HTC Desire HD. All of the phones run on the Android operating system and were equipped with SIM-cards. The SIM-cards were needed in order to access the Internet.

Testing of the prototype required the testers to use some of the native features of the mobile phones, thus leaving the prototype when solving the tasks. To be able to send media to Flickr,

[2]The document can be found at http://mobilformidling.no/isegran/eksperimentdesign.pdf
[3]The storyboards can be found in Appendix C
[4]Barcode Scanner

the pupils had to attach the photos to an e-mail, give the e-mail a subject and send it to a pre-defined address. In addition to adding the address to the instructions within the mobile application, it was printed along with short instructions on small pieces of paper.

Other necessary equipment included:

- Four sets of headphones
- A Zoom H4 digital audio recorder
- Two umbrellas, in case of rain or bright sunlight
- Notepads
- Pens
- Snacks

5.4.3 Content and Tasks

For the purpose of the field test, only a limited amount of content and tasks was added to the mobile application[5]. This was considered a sufficient amount in order to be able to perform the test at a satisfactory level.

The content included a short video of the history of the 1700s at the island presented by Lieutenant Colonel Niels Christian Hals, acted out by a member of the staff at the museum. Furthermore, three representative tasks were added.

1. Check in to Isegran at Facebook. Make sure you ”tag” the people you are there with.
2. The soldier in the video clip mentions several places and buildings located at the island. Locate ”The round fortress tower”, ”The deep end”, as well as ”The iron door”. Take a snapshot of each of the objects using the built-in camera. Attach the images to an e-mail message (using Gmail) and send it to press12many@photos.flickr.com. You must also assign tags to the photo by adding ”tags: yourgroupnumber” in the Subject of the e-mail. For instance, if you are in group 1, your e-mail subject should read ”tags: group1”. By doing so, the photos will be displayed at the right spot in the Contributions on the project website. (Note, a map defining the locations of the objects was attached underneath the task).

[5] http://mobilformidling.no/isegranmobil//isegranmobil/uncategorized/1700-tallet-2/

3. The video from the 1700s informs you about the mills at the island. These mills provide flour which was given as nutrition to the soldiers. Have a look at the painting by Mathias Blumenthal (1748). Locate the mill at the island and approach it. Write a short manuscript about the impact the water around Isegran has on the island. Keep the mills and military defense in mind. Pick a pupil and record him while he reads the manuscript.

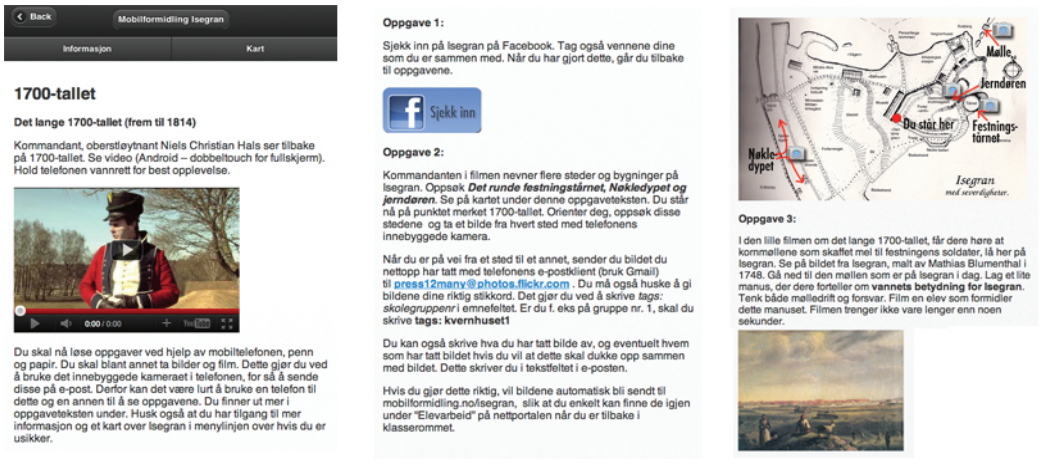

Figure 5.3: For the purpose of the field test, a limited amount of tasks were added to the prototype. They were accessed by scrolling down on the touch screen.

These tasks are of diverse nature, and allow testing several aspects of the design. The first task focuses on sharing through social media. A button linking to the check-in of Facebook was placed below the task. The second task directs focus to orientation, map interpretation and the collection of data. A map defining the locations of the objects was attached below the task. Lastly, the third task directs focus to the combining of traditional media with technology. An image of the painting described in the task was attached below it.

5.4.4 Executing Pre-Testing

Prior to involving the stakeholders in the field testing, a pre-test was conducted using an independent non-representative user. The test was carried out at the museum using the same equipment and accessing the same content as had been implemented for the field test. The test person had a limited technological insight and no knowledge about the island or it's history. The observations were not recorded. Hence the purpose of the pre-test was not to perform an evaluative session, but rather to run through the planned field testing unveiling potential

technological and task-related challenges. This would also help establish an overview of the time spent at each task.

The feedback collected from the test person was used to make minor changes to the design. One of the tasks was substituted with another, due to the fact that it proved to be impossible to solve without any previous knowledge about the area.

Chapter 6

Results

This chapter will give an overview of the data collected during the testing and the following interview. The testers involved in the evaluation were the same pupils who had contributed to the design process of the prototype. This group originally consisted of ten 10th graders, aged 15-16 years old. Both genders were represented. However, during the test, the group was reduced to six pupils, four girls and two boys, in order to be able to observe them.

6.1 Carrying Out the Field Test

The teacher, the pupils and a representative from the museum arrived at Isegran island on the morning of June 14, 2011. The participants were given a short introduction where the schedule of the day was outlined. This was supposed to be followed by a narrative act performed by an actor at the museum. The purpose of this was to observe the reactions of the pupils while they were taking part in a traditional way of visiting a museum, comparing it to the visit taking use of technology and the solving of tasks. However, the same morning the actor had reported he was not able to make it. Albeit a disappointment, all the pupils had previously participated in similar traditional visits to the museum. Hence, as their reactions could not be observed, there had to be directed more focus to the comparison during the following interview session.

We made our way to the location of the poster containing the information about the 1700s. The six pupils were divided into two groups. The groups were given two mobile phones and sets of headphones each. They were also handed the small piece of note paper giving

instructions on where to send their recorded media. The paper had the QR code printed, in case the groups needed to access the application again.

Figure 6.1: The testers scanned QR codes printed on a poster in order to access the video.

The groups were directed to launch the QR reader and scan the code. As there were six testers and only four mobile phones, some of the participants had to share the device. From this point in time, I merely made observations not interacting with the pupils unless approached. The teacher as well as a representative from the museum were also present observing the test.

Having watched the video, the two groups started browsing the tasks. As both groups disposed two phones, they were advised to use one of the phones to solve the tasks while using the other one to navigate within the application. This was to avoid having to launch the application in between the intervals of each of the tasks, as the tasks required the users to access some of the native features of the phones, thus closing the application. However, one of the groups seemed to prefer to use one device throughout the testing. They quickly figured out that the application could be accessed by launching the built-in Internet browser on the phone, as soon as it had been loaded the first time. In general, the pupils seemed to be very familiar with the operation of smartphones. However, the level of experience and insight in the technology did vary within the group and the ones more skilled seemed to take charge operating the phones.

6.1.1 Task 1

The first task asked the pupils to check in to Isegran on Facebook by clicking the check-in button below the task. The button directed them to the Facebook login, using their profile. This

lead to a short discussion about who should log in. Having logged in, Facebook suggested Isegran as the location to check in to. The task was completed by both groups with quite ease. However, as the application is loaded within the web browser, they had now browsed outside of it. Using just the one device, they exited the web browser, launched the QR reader again and scanned the code on the poster.

Figure 6.2: The testers were given small notes of paper with instructions on how to upload media to Flickr. The QR code on the note provided a link to the application.

6.1.2 Task 2

The second task asked the pupils to locate certain areas of the island and take photographs of objects located in those areas. To solve the task, the pupils needed to reference the map which was provided below the task. The map gives an overview of the island, indicating where the objects are located.

Figure 6.3: The testers in one of the groups discussing where the objects are located on the island.

The solving of this task raised a few minor issues. Initially the groups discussed where the objects might be located. The two groups then headed in different directions. Following one of the groups, they had no difficulties finding the round fortress tower and the iron door. They headed towards Nøkledypet[1] and were able to locate the area. However, they did not seem to be able to determine what to photograph as they did not have the necessary previous grounding. One of the testers expressed this by stating:

> ”What is Nøkledypet? There is nothing here. Just grass and water. What are we supposed to photograph?”

Both groups needed to consult the teacher in order to figure out what to photograph.

The two groups had chosen different approaches to sending the photographs to Flickr. One group collected all photos and sent them as a batch. The other group sent them individually, as they were walking around the island. This group complained about the tedious process:

> ”This is annoying. I have to type so much in order to send the photos, and I can’t hit the right buttons on the touch screen.”

However, as she was sending the second photo, she burst out:

> ”Oh! The e-mail client remembers the address I just sent to.”

As she had previously entered the e-mail address, the e-mail client automatically suggested the address as she was typing it in.

6.1.3 Task 3

The third task asked the pupils to write a short manuscript about the water around Isegran, and which role they believe it might have played for the island over the years. Furthermore, they were asked to read the manuscript as one of their peers filmed them.

At this point in time, both groups had reached the area around the mill. As in the case of the previous task, this task proved to require certain knowledge about the history of the island. However, after consulting their teacher, both groups were able to produce a short manuscript.

The pupils were confident performing in front of the camera.

[1] The neck of water between the island and the mainland

Figure 6.4: The pupils developed short manuscripts and read them while peers recorded them.

6.2 Carrying Out the Interview

Having finished the field testing, an interview session took place in a meeting room at the museum. The initial participants were joined by two additional observers from the museum staff. The purpose of the interview was to discuss the experience gathered during the field test, focusing on the research questions[2]

During the session, representatives from all stakeholders participated actively in the conversation, letting them speak freely.

6.3 Findings

Using mobile phones at the museum to access information about the area was new to each and all of the pupils. None of them had previously solved task on site at a museum. Hence, the introduction of both of these elements independently was also new to them.

Using narrative videos as a method of telling stories is not so different from a traditional visit where an actor performs on site. One of the pupils compared this way of telling stories to a traditional way of visiting the museum:

> ”It is pretty much the same. The video told a story about the area where we were located. The actor presented a description about the area and it’s history. It is quite similar to a traditional visit where a person is physically present telling a story.”

Hence the introduction of the mobile application as a replacement for the traditional narrative act does not by itself influence the user experience much at the museum. However, the use

[2]The list of questions can be found in Appendix D. The transcript of the session can be found at http://mobilformidling.no/isegranmobil/transcript.rtf

of technology combined with the solving of tasks may be used to change the way the visitors interact with the museum.

In general, the main topics of the discussion that took place during the interview may be divided into two categories - The *possibilities* that emerge as mobile technology is introduced, and the *assumptions* and *qualifications* needed to take use of it.

6.3.1 Independence, Flexibility and Availability

One of the topics mentioned quite frequently during the session was the introduction of the element of independence, freedom and flexibility at different levels. The pupil elaborates on his statement about narrative videos and the fact that they are not so different from a traditional visit saying:

> "...On the other hand, we had a much stronger feeling of freedom. You can check out the areas you feel like, and pick what areas you would like to visit, and in which order. Things like that. You are in control."

The pupil claims that the use of mobile phones on site could provide more freedom of choice. The technology provides an approach to the content of the museum which allows the visitors to be more selective in what they would like to experience when they are at the museum.

One of the museum staff brings up another quite interesting observation:

> "What has been designed is in fact a system for teachers, where they (beforehand) can plan and select the content which is to be presented during the visit. It makes it possible for the teachers to make changes to the tasks, suggest new tasks and in addition remove or add the tasks he or she feels are relevant for the pupils that particular day. In my opinion that is a real improvement compared to traditional visits to a museum. You know, an employee at the museum would probably ask the pupils certain questions in order to engage in a discussion or promote reflection, right? That would be a discussion about the topic you had been invited to learn about. However, in this case the teacher would have a lot more freedom of choice in the selection of the questions or tasks that are brought up."

She touches on an interesting point. Not only does the introduction of the concept provide more freedom of choice at the museum, it allows the parties involved to select the content of

the entire visit prior to the actual visit. It allows teachers to input the content based on the curriculum or field of interest. In fact, it even allows the teacher to personalize content and make it unique.

6.3.2 Effectiveness, Efficiency and Capacity

During the initial interview with the teachers, they stressed that in order to take use of a concept like this, there would have to be a limited amount of effort involved on their side. This becomes quite evident during the interview session, as the museum staff bring the issue up:

> ”Let us turn things around. What you witnessed during the video you watched, was in fact nothing more than a small part of a guided tour which could have been presented just as well without the use of mobile phones. As much as we would like to give guided tours, the problem is that the museum does not have the capacity...”

The teacher replies:

> ”Not to speak of the teacher’s capacity. In my opinion it is not even an option. That is what is so great about this. Without this concept I would have to pay the museum three visits, splitting the class into groups of people, and I would have to organize and make appointments with the museum. That is pricy and very time consuming. I am not in a position to spend time on that.”
>
> ”I believe this (concept) will generate more visitors to Isegran and more focus on Isegran in the education. Simply because there are usually so many thresholds that must be bypassed, considering the logistics and taking kids out on a trip. And this is what we as teachers would refer to as ”a class on a can” - you just open it, and there it is.”

The museum staff pick up on the discussion:

> ”No that is exactly our experience as well. There is too much of a hassle, and too much organizing involved. (We are) not flexible enough, in reference to time and the people involved.”

As is becoming evident from the conversation, both parties have limited time, resources and capacity available. Logistics seems to be a problem. However, using the project website to plan and implement the content to the visit, there is less organizing involved and less time spent. In fact, the teacher suggests giving the museum visit as a homework assignment encouraging the pupils to visit the museum during the afternoon or over the weekend:

> ”I can picture myself giving this as a homework. You know, the pupils go on their own, solve the tasks and upload it to the website.”

Such an approach would require a fair amount of planning and work prior to the visit. As became quite evident during the field test, the pupils were unable to solve some of the tasks as they did not have the required knowledge. However, this is merely a question about providing the necessary training and selecting appropriate content from the teacher’s side.

6.3.3 Collaboration

The task implemented in the prototype for the purpose of the field testing encouraged the testers to work as a team. Each of the two groups consisted of three members, sharing two phones. One of the groups decided to use one phone throughout the solving of the tasks.

The pupils claimed sharing a device was not a problem. By appointing operators who served as group leaders, they were able to solve the task in collaborative efforts. In fact, they do not believe the tasks could be solved working individually. One of the pupils stated:

> ”You need to be at least two in order for this to work out”.

Another pupil added to the discussion:

> ”It is a lot more fun if you work together with your peers. If you collaborate.”

> ”It helps generate a good debate and discussion.”

Furthermore the teacher believes using the concept in the context could influence the bonding of the pupils. Whereas there has not been directed any efforts to the research of effects on ”fun” and learning in the work with this paper, it is an interesting observation. The mobile phone has some obvious limitations in a small screen size and poor performing speakers.

As one of the pupils suggests there could be up to six persons sharing a phone, there is a unanimous protest from the rest of the group:

> ”No! That is too many! It would be difficult to watch and read. Three persons would be just perfect.”

The group of pupils involved with the testing of the prototype had been handpicked by the teacher, and are among the brightest in the class. They encountered few difficulties in carrying out the field test. However, during the interview some of the pupils expressed that a certain level of technological understanding is required. One of the pupils stated:

> I think most (of the pupils) would understand how to use it if the teacher would give short instructions. I am sure it would not be a problem”

This initiated a discussion on the technology as one of the other pupils replied:

> ”You do need to install an application reading the QR codes though.”

A third pupil stated:

> ”I am not so good with mobile phones and technology. I did not really understand that you were supposed to use the camera to scan the codes. I think I would have needed to have some sort of instructions on how to use it. You know, just like a short bullet list or something like that. But as soon as we had scanned the codes everything was fine. Then everything worked and I had no trouble completing the tasks.”

Considering these statements and looking at the field notes, the ones more technically experienced are likely to take charge operating the phones. Hence, the composition of the groups may be an important factor to consider in order to be able to implement a well functioning concept. The teacher stressed this, as she insisted it would be the teachers' responsibility to compose the groups wisely. In order to be able to solve the tasks, the pupils will need a good foundation of knowledge prior to the visit, and they will need a certain level of technological understanding:

> ”Randomly assigning people to groups like I sometimes do would not be a good idea in this case. There are pupils at different levels with different abilities. But

> I am sure it would not be a problem. I would say the composition of groups is absolutely essential".

6.3.4 Motivation and Effort

During the field testing, the pupils worked well together completing the tasks with a very limited amount of assistance from the teacher. This, according to the teacher, is due to the fact that they are focused on solving the tasks, using a device for a short period of time with a purpose:

> "This is how the pupils work. I believe there should be a limited amount of tasks to solve on site. If the teacher constructs good groups, I think they will very determined and dedicated to the tasks. If I were to hand out sheets of paper and ask them to answer questions.. I mean, I would be picking up sheets of paper afterwards. This however, is very focused. They would be focusing on collecting the required data in order to be able to present something to the class afterwards."

One of the pupils confirms this by stating:

> "Yes that is motivating! We do not want to return to the classroom and stand up in front of our classmates and have nothing to present."

Hence, perhaps it is the combination of the tasks themselves, the mobile phone as the media of distribution of the tasks and the purpose of collecting the data needed to present their findings that motivates and makes the pupils focus.

6.3.5 Side Effects

A positive side effect of making content available on mobile phones is the possibility of involving other visitors and potential by passers as well. The museum staff have reflected on the issue, stating:

> "I believe this could be quite a lot of fun for others as well, not just the pupils. What about people who pass by? There are a lot of people around here. They use the island for recreation. So when they see the poster, do you think it would be an

> exciting supplement to the Sunday walking trip at Isegran? Is this something you would take use of in your spare time with your friends?"

The pupils do not think it would appeal to them outside of the school setting, as they believe one needs to have a certain interest in history:

> "No I do not think so. Not everyone has an interest in history. However, if I were here with my family, I might use it."

The teacher, on the other hand, was quite convinced it would appeal to others as well:

> "I am sure people would love to be able to watch videos on their phones. I have colleagues coming in to Fredrikstad, and I have friends visiting from abroad... I would be very proud if I could take them out to Isegran and show them short narrative videos in an authentic environment. This is where the history has taken place."

Chapter 7

Discussion

This chapter will review the findings from the field test and the interview in relation to the research question. The stakeholders' hypotheses for the concept were outlined in Chapter 2. They expected the concept to provide more flexibility, a higher level of freedom and control of the content and allow the pupils to play a more active role during the visit.

The primary research question of the thesis is:

- How can a mobile application influence the user experience in a visit to a museum?

Using mobile phones as tools to replace the traditional guided tours at museum solely because technology makes it possible has no purpose. As the pupils clearly stated during the interview, the use of videos to tell narrative stories is simply no more than a transferring of the same content from one platform to the other. This does not influence the user experience in itself, and will not necessarily represent an improvement. On the contrary, providing a guided tour with real actors may make far stronger and more vivid impressions. Actors have the ability to engage in a dialogue with the visitors. The actors are real people who can be seen, heard and are able to take part in a conversation.

However, as desirable a scenario where the visitors meet real actors might be, it is hardly realistic to provide this as a regular service. Using mobile phones to present narrative videos may be a good alternative after all. Nevertheless, there are also other possibilities emerging with the introduction of mobile technology.

7.1 Making The Visit More Flexible

Using mobile phones on site at the museum makes content available regardless of opening hours and the presence of museum staff. The visitors use their own mobile phones to receive information. While at the museum, the visitors will have more freedom of choice as they may explore areas independently, at their own pace and in the their preferred order. This correlates well to the initial expectations outlined by the pupils.

7.2 Coping With Capacity-related Issues

According to both the teacher and the museum staff, one of the greatest challenges of involving school classes in visits to the museum is the lack of capacity at both ends. On the museum side, there is simply not enough capacity to offer guided tours on a regular basis to school classes. The teacher claimed the execution of a traditional museum visit involves so much planning and organizing it becomes difficult to go through with. In addition, it may be challenging to organize large groups on field trips which quite possibly makes it necessary to split the classes into several groups and make repeated field trips.

Hence the lack of capacity and efficiency is a problem in traditional field trips to museums. The use of the concept could, on the other hand, significantly reduce the amount of organizing needed. No appointments will have to be made with the museum, and by accessing the website all the resources needed to prepare the pupils for the visit will be available. During the visit, the pupils will use their own phones to explore the area.

The teacher made an interesting suggestion during the interview which helps shed light on the influence a mobile application could have on the way pupils visit museums. Whereas the pupils depend on the presence of museum staff in a traditional visit, the use of this concept could in fact be given as a homework assignment, she suggested.

7.3 Personalizing Content

As the teachers outlined during the initial interview sessions, they have certain fields they are pledge to stick to in the curriculum. Moreover, the fields of interest may not be constant. There are different approaches to teaching, and the pupils have different interests and skills.

Hence it should be possible to adjust the content of the visit and arrange it according to the needs of the users. This can hardly be accomplished in a traditional museum setting, where the content is mostly very static.

By providing resources, content and tasks publicly on a website, the teachers are given the possibility of implementing and adjusting the content of the museum visit to suit his or her needs. The teacher simply fills out a form, selecting tasks from a list or formulating her own and sends them to the museum staff.

As the content is selected by the teacher, it could be implemented into a dedicated section of the mobile application which can be accessed on site by scanning QR codes. Hence the content is unique to a particular visitor and to the particular location. It makes it possible to adjust the amount of content implemented, the level of difficulty of the tasks and a planning of the time spent at the museum. This certainly requires effort from the teacher, but it allows her to personalize the content that is distributed on site.

7.3.1 Promoting Motivation and Collaboration

According to the pupils, it was rather the introduction of the solving of tasks than the technology that made the experience during the field test different to that of a more traditional visit to the museum. Furthermore, they pointed out that the tasks could not have been solved without the use of technology. While this is true, it is important to take note of the fact that the tasks were in fact designed to be solved by the use of technological features of the phone. Hence, it could most likely be possible to distribute and solve other tasks without the use of the features of a mobile phone.

Even so, this would require the use of several medias as opposed to using only the mobile phone throughout the visit. In the experience of the teacher and the pupils, field trips quite often become very unorganized and unfocused. Solely using a mobile phone to solve tasks may help in keeping the pupils focused and determined. The mobile phone as a media may allow them to work effectively in collaborative efforts in teams, which in turn is benecial for the acquisition of knowledge. Furthermore, it may help motivate them to collect the necessary data in order to be able to present their findings in the classroom. As the pupils state, the nature of the arrangement makes it motivating and fruitful. They play an active part during the entire visit, solving tasks which serve as data to further process and present to the their classmates. This helps keep them motivated.

However, the contents and tasks distributed will have a strong effect on the overall experience. Hence it may just as well be the nature of the content and tasks they solve on site which makes the approach interesting, not necessarily the use of technology in itself.

7.3.2 Attracting Other Visitors

Isegran Museum is an open air museum which is frequently used for recreational purposes. Hence, all visitors do not necessarily seek out the area with the purpose of visiting the museum. Nevertheless, they are a potential audience. The museum staff have reflected on the issue and believe narrative videos could be distributed to their mobile phones.

As the designed application is passive, in the sense that the user has to activate it by scanning a QR code, this will probably only appeal to the potential visitors who are genuinely interested in the history of the area.

7.4 Assumptions And Limitations To The Concept

In order for the concept to provide a user experience at a satisfactory level, some assumptions will have to be made.

The designed prototype has some quite obvious weaknesses in the sense that it is somewhat difficult to operate. Whereas some of the testers claimed they had no difficulties operating the mobile application, others expressed trouble scanning the QR codes and uploading the media using the e-mail client. Hence, it becomes apparent that there are differences in the technical insight of the pupils, and careful attention must be paid to the composition of competence within the groups of participants. One must therefore assume that teachers are motivated and able to foresee such problem fields. As the teacher claimed during the interview, the composition of groups is a decisive factor. The concept will not be feasible unless the groups of pupils have the required insight.

The technological challenges may be present due to the design of the prototype and it's usability. By for instance building in functionality in the application such as the uploading of media one can quite possibly make it more usable. This has however not been in the core interest area of this thesis.

As experienced during the field test, not all tasks were possible to solve without the necessary knowledge. As the concept does not include interacting with a human being on site, there is no possibility of asking for assistance on site. Hence it must be assumed that the necessary training has been given before the visit to the museum.

The distribution of multimedia content and the interaction requires the use of a smartphone. During the interview, the pupils estimated that close to eight out of ten of the pupils in their class dispose a smartphone able to display the application. Hence, perhaps accessibility is not a problem if one assumes the pupils work together in groups. In addition, there is a cost involved when downloading content to the phones in areas where there is no wireless Internet access. Quite interestingly the pupils did not seem to be affected by this, and expressed they would be willing to cover potential costs connected with the usage of the application.

By implementing a content management system at the back-end of the mobile application, it is possible for the service provider (the museum) to manage the content with a very limited amount of technical competence. However, the system is vulnerable in the sense that technical challenges surpassing the content administration requires a certain level of competence.

7.5 Summary of the Discussion

The main findings may be summarized as follows:

The distribution of narrative videos by mobile phones does not by itself influence the user experience. It is simply a transferring of content from one platform to another. Traditional museum guiding will most likely provide a superior user experience, as a real life actor will be able to communicate with the visitors. However, the feedback collected during the testing indicates that the concept as a whole, including the introduction of the solving of tasks, does influence the user experience of the visit turning the pupils from passive recipients of information to playing an active role.

Furthermore, the findings indicate that the introduction of the concept can be used to improve efficiency and flexibility for all parties involved. In combination with task solving, it assists in the promotion of collaborative efforts. The availability of content may also attract the attention of potential by passers. Perhaps more interestingly, by giving the teachers the possibility to provide their own content and tasks through the use of the project website, one is able to

implement personalized content. This content can be connected to a specific area by using QR codes.

Chapter 8

Conclusion

This thesis has investigated the influence a designed system has on the user experience in a visit to a local museum. It focuses particular interest to the effects of the introduction of mobile technology and the solving of tasks. The concept targets pupils and teachers in a local high school providing personalized location-aware content.

The thesis takes on an explorative approach. A prototype has been designed and implemented in order to be able to research the topic. The prototype consists of a project website and a mobile application. The website is used by teachers to input content into the mobile application. It is also used to host content generated by the pupils on site. The mobile application is used to present content and tasks on site at the museum.

The stakeholders have been involved throughout the design process and the evaluation of the prototype. The results are based on the feedback collected during a field test using the prototype and a following interview.

8.1 Claimed Results

The work with this thesis has shown that it is possible to distribute personalized location-based content to smartphones exclusively using open standard developer tools such as HTML, CSS, and Javascript. QR codes have been used to determine the location of the users.

The feedback collected during field testing was very encouraging, indicating the concept may

influence the user experience of a visit to the museum. The implementation of tasks distributed by the mobile application may assist in the process of motivating and turning the visitors from passive recipients of information to active partakers, also encouraging collaborative efforts. Hence it is not the use of the mobile application in itself that influences the user experience. However, the use of technology influences flexibility and efficiency on both the service provider end and the user end. It also makes it possible to personalize content.

8.2 Claimed Contributions

The contributions of this thesis are:

- A working prototype for the concept, consisting of the project website including downloadable resources and tasks sets, as well as a mobile application where the tasks along with other content is accessible.
- Experiences from the use of the concept with 10th grade pupils, a teacher and museum staff in an on-site field test.
- Examples of user generated content on the project website.

8.3 Future Possibilities and Improvements

The prototype designed in the work with this thesis is fully functioning and usable. However, there has been directed little efforts to usability issues. By incorporating certain features in the mobile application, such as access to the built-in camera and the possibility of uploading media to the project website, the usability could be highly improved. It would also be interesting to investigate possibilities of confirming geolocation more seamlessly, for instance by integrating a QR reader or taking use of GPS-technology.

The thesis does not research the long term effects of using the concept as a part of the education. It would be highly interesting to measure how the use affects learning, collaboration and production.

As this thesis is being written, there is ongoing work with the extension of the the concept to other target groups and other museums within Østfoldmuseene. Borgarsyssel Museum will

soon offer their visitors access to videos, images and text using the same developer frameworks. Moss by- og industimuseum are planning the development of a similar design, offering foreign-speaking visitors access to information about the exhibits. Kultur- og naturreise[1] is a project taking use of the same technologies as the concept developed in this thesis. However, they have also incorporated the use of Augmented Reality. AR describes the projection of virtual elements in the real environment on the screen, thus using the camera to combine the two. This is an interesting technology which could also be implemented in the concept in future work.

[1] http://kulturognaturreise.wordpress.com/about/

References

[1] Aftenposten. Fem millioner mobiler i norge. http://forbruker.no/digital/nyheter/mobil/article1557046.ece, 2006.

[2] Aftenposten. 9 av 10 solgte mobiler er en smarttelefon. http://www.aftenposten.no/forbruker/digital/nyheter/mobil/article4085155.ece, 2011.

[3] K. Cheverst, N. Davies, K. Mitchell, A. Friday, and C. Efstratiou. Developing a context-aware electronic tourist guide: some issues and experiences. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 17–24. ACM, 2000.

[4] L.D. Chou, C.C. Lee, M.Y. Lee, and C.Y. Chang. A tour guide system for mobile learning in museums. 2004.

[5] Louise Harder Fischer Marie Christensen. *Udvikling af multimedier*, volume 2. Ny Teknisk Forlag, 2006.

[6] Thomas Claburn. Web vs. native development: There's no winner. http://www.informationweek.com/news/development/web/231500197, 2011.

[7] Comscore. Uk leads european countries in smartphone adoption with 70 percent growth in past 12 monthsr. http://www.informationweek.com/news/development/web/231500197, 2010.

[8] Association for Computing Machinery. Special Interest Group on Computer-Human Interaction. Curriculum Development Group. *ACM SIGCHI Curricula for Human-computer Interaction*. ACM, 1992.

[9] S. Harrison, D. Tatar, and P. Sengers. The three paradigms of hci. In *Alt. Chi. Session at the SIGCHI Conference on Human Factors in Computing Systems San Jose, California, USA*. Citeseer, 2007.

[10] S.G. Heim. The resonant interface: Hci foundations for interaction design. 2008.

[11] S. Hsi, R. Semper, W. Brunette, A. Rea, and G. Borriello. exspot: A wireless rfid transceiver for recording and extending museum visits. In *Proceedings of Ubi-Comp*. Citeseer, 2004.

[12] Research in Motion Limited. Java application development tools. `http://us.blackberry.com/developers/javaappdev/devtools.jsp`, 2011.

[13] Appple Inc. ios developer program. `http://developer.apple.com/programs/ios/develop.html`, 2011.

[14] Gartner Inc. Gartner says worldwide mobile device sales grew 13.8 percent in second quarter of 2010, but competition drove prices downe. `http://www.gartner.com/it/page.jsp?id=1421013`, 2010.

[15] InformationWeek. Android phones steal market share. `http://www.informationweek.com/news/224201881`, 2010.

[16] Y. Rogers J. Preece and H. Sharp. *Interaction Design - Beyond Human-Computer Interaction*. John Wiley and Sons, 2002.

[17] Steven Jobs. Thoughts on flash. `http://www.apple.com/hotnews/thoughts-on-flash/`, 2010.

[18] Matt Jones and Gary Marsden. *Mobile Interaction Design*. John Wiley Sons Ltd, 2006.

[19] The jQuery Project. jquery mobile framework. `http://jquerymobile.com/`, 2011.

[20] NPD Group Ltd. Feature phones comprise overwhelming majority of mobile phone sales in q2 2009n. `https://www.npd.com/press/releases/press_090819.html`, 2009.

[21] Lua. About lua. `http://www.lua.org/about.html`, 2011.

[22] Microsoft. Getting started with windows mobile application development.

[23] M. Mohring, C. Lessig, and O. Bimber. Video see-through ar on consumer cell-phones. In *Proceedings of the 3rd IEEE/ACM International Symposium on Mixed and Augmented Reality*, pages 252–253. IEEE Computer Society, 2004.

[24] Jakob Nielsen. Recruiting test participants for usability studies recruiting test participants for usability studies recruiting test participants for usability studies. `http://www.useit.com/alertbox/20030120.html`, 2011.

[25] Jakob Nielsen. Why you only need to test with 5 users. http://www.useit.com/alertbox/20030120.html, 2011.

[26] S. Norendal. Pedagogisk med ipod. *Museumsnytt*, pages 4–5, 2010.

[27] D. Raptis, N. Tselios, and N. Avouris. Context-based design of mobile applications for museums: a survey of existing practices. In *Proceedings of the 7th international conference on Human computer interaction with mobile devices & services*, pages 153–160. ACM, 2005.

[28] Thomas Ricker. Rip: Symbian. http://www.engadget.com/2011/02/11/rip-symbian/, 2011.

[29] B. Schmidt-Belz, H. Laamanen, S. Poslad, and A. Zipf. Location-based mobile tourist services-first user experiences. *Information and communication technologies in tourism*, pages 115–123, 2003.

[30] R. Semper and M. Spasojevic. The electronic guidebook: using portable devices and a wireless web-based network to extend the museum experience. In *Proceedings of Museums and the Web Conference, Boston, MA*. Citeseer, 2002.

[31] D. Silverman. *Doing qualitative research: A practical handbook*. Sage Publications Ltd, 2005.

List of Figures

Appendix A

Survey of Content

A.1 Content

UTGANGSPUNKT:

Oppdeling fordelt på århundre. I første omgang:

- 1200-tallet
- 1700-tallet
- 1800-tallet
- 1900-tallet

Pr. århundre:

- En stk. videosnutt à maks to minutter (Basert på manus à 200 ord) Knyttet opp mot oppgavesettene.
- Oppgavesett, for bruk i mobilapplikasjonen, til hvert av århundrene (Mange nok oppgaver til at elevene bruker cirka èn time ute på Isegran)
- En samling ressurser og materiell – som kan publiseres på nett. Disse skal lærere kunne laste ned for å bruke i undervisningen, før besøket.

Ansvar for råmanus 1200-tallet: Trond Ansvar for råmanus 1700- tallet: Werner/Elisabeth Ansvar for råmanus 1800-tallet: Hege St. Langvik Ansvar for råmanus 1900-tallet: Tove

Thøgersen Ansvar for å ferdigstille disse små manuskriptene: Elisabeth (m/bistand av Hege Hauge Tofte) Ansvar for å legge ut en samling ressurser og materiell, til alle århundrene: Tove, Hege og Trond.

(Elisabeth har opprettet en mappe under Fellesområdet M:, der Espen kan gå inn og hente stoffet dere legger ut. M:/Avdelinger/Fredrikstad/Formidling/Mobil formidling – Isegran

NB: I denne mappen finner dere også en oversikt som Tove har satt sammen – over kildemateriale og historiske karakterer.

Ansvar for å lage oppgavesett: Elisabeth (m/bistand av Hege Hauge Tofte) Ansvar for videosnuttene: (Hege Hauge Tofte er veldig velkommen disse to dagene) Espen filmer – og tar seg av det tekniske. Trond og Christine gjør opplesningene Elisabeth sørger for at fire stykk historiske kostymer er på plass Christine kjøper inn mat og drikke/Elisabeth serverer

Til de som skal lage små manus à 200 ord:

Sikkert lurt å ta gangspunkt i De annalibus Isegrani – Hendt på Isegran 1287 – 1997 ,

Men: trekk gjerne inn relevant informasjon fra andre kilder.

Manus danner utgangspunktet for videosnuttene. Så forsøk å la èn historisk karakter være fortellerstemmen til ditt århundre – om mulig. NB: Dette skal ikke være en dramatisering, men et menneske/en representant for sitt århundre – som formidler historien. (En opplesning/foredrag av en representant – i tidsriktig drakt.)

Forsøk å ha samlingen med ressurser i bakhodet når dere lager manus. Dette er stoff som lærerne har hatt tilgang til i forkant. (Det er bare fint om elevene hører det samme stoffet MANGE ganger, på litt forskjellige måter.)

Tidsrom: Uke 9 28/2 – 6/3

Uke 10 7/3 – 13/3

Uke 11 13/3 – 20/3

Uke 12 21/3 – 27/3

Utarbeide råmanus -Trond

-Werner/Eli.

-Hege St.L.

-Tove

x Deadline:

Mail til Elisabeth og Hege H. Tofte – senest fredag 6/3.

Lage ressursbank -Tove

-Hege St. L.

-Trond

x x Deadline:

Lagt inn i mappe senest fredag 13/3

Ferdigstille manus -Elisabeth

-Hege H.T.

x Deadline:

senest fredag 13/3

Filmseanse -Espen

-Trond

-Christine

-Elisabeth

-Hege H.T.

x Mandag + tirsdag

Lage oppgaver -Elisabeth

-Hege H.T

x x Deadline:

Fredag 27/3

A.2 Manuscripts

A.2.1 1200s

Midt i dette århundrede ble Alv Erlingsson født. Kong Magnus Lagabøtes tremenning. Selv ble han både baron og jarl. (Her på Isegran satt han opp et lite borganlegg. Eller var det

på Valdisholm da?.....) Alv spilte en viktig rolle under kaperkrigen. Det nordtyske Landefredsforbundet drev jo handel med Norge, men ble så altfor store. Den norske kronen startet da kaperkrig. Da Landefredsforbundet mobiliserte sine flåtestyrker førte det til fredsslutning etter forhandlinger. Men Norge måtte betale krigserstatning til de tyske handelsbyene. Statskassen var tom – og Alv dro av gårde til England, på vegne av den norske kronen, og lånte omtrent 400 kg. Sølvmynter. Denne sølvskatten så man ikke mere til. (Ser litt lur ut) Det ble etter hvert ugreit mellom Alv og kongehuset. I 1287 seilte han til Oslo og angrep kongsgården. Hertug Håkon var ikke i byen, men Alv fikk satt Oslo i brann. Borgherren i Oslo, Herr Hallkjell Ogmundsson Krøkedans, ble tatt til fange. Han ble tatt med da Alv og hans menn seilte tilbake til Borgarsyssel. Der ble han "kastet inn" i et fangehull på Isegran. Kong Eirik - Prestehater lyste da Alv fredløs - og invaderte Borgarsyssel. Alv kom seg unna, men året 1290 ble Alv gjenkjent og fanget ved kysten av Skåne. I Helsingborg ventet han på sin dødsdag. – og slik forløp denne: På steile og hjul ble armene flettet inn mellom eikene i hjulet, og hender og føtter ble bundet fast. Bøddelen knuste så leddene i Alvs kropp. Til slutt ble ryggmargen knekket, og brystet ble slått inn med en stor slegge.

Trekke på skuldrene/ evt: Der fikk han der – for å inngi seg med svenske tøsen!

Epilog: Alv han er i Norge Land født, Han lyster der intet at være. Han har vel femten herreder i Leen – Han kan sig deraff nære. Fordi treder Alv både steile og hjul – så høyt over Ørsund.

A.2.2 1600s

Den 30. mai 1685 kom kong Christian den 5. til Fredrikstad. Kongen var da også innom Isegran – og det var byens forsvar og ikke minst orlogsverftet han var mest interessert i. Under besøket på Isegran, ga kongen muntlig ordre om at verftet skulle legges ned! Nybygging av fartøyer skulle opphøre, – og fregattene skulle overføres til København! Dette kunne en eneveldig konge bestemme – uten så mye som et pennestrøk. På Isegran denne dagen, så nok også kongen fregatten Lossen . Byggingen av fregatten startet i 1684, og det var en prektig båt - nesten 30 meters lengde – og sju og en halv meters bredde. Lossen kom på sitt første tokt i 1686, under kommando av Løytnant Jens Jensen Dall fra Båhus. Under kappseilas seilte Lossen "overmaade vel". Og stor fart var viktig – både ved angrep, og for å kunne unnslippe fienden. En stor del av Lossens tjeneste var å beskytte konvoier, og å holde våre farvann rene for svenske kapere. For noen dager siden, den 22. desember 1717, la Lossen ut

på konvoi fra Staværn. Det skulle hentes høy og korn hjem til magasinene her i Norge. Det var et forferdelig uvær – og konvoien ble splittet. På selveste julaften var været slik at "ingen Menneske kunne Regere seg". Og Lossen klarte ikke å redde seg inn i Oslofjorden - vest for Søsterøyene. Fregatten ble drevet over flere grunner, og master og baugspryd gikk over bord. Til sist sank fregatten i den lille bukta Stolen på Vesterøy. Av de 109 som var om bord - avled halvdelen av mannskapet. Jeg lyser fred over deres minne.

Epilog: 1963 ble Lossen gjenfunnet etter nesten 250 år på havets bunn.

A.2.3 1700s

"- Jeg fikk ordre om å sende bort kanonene som hadde stått på Isegran. Ordren kom i juli 1814. Men bare få uker senere ankom svenskene til Fredrikstad. Den arme byen ble bombardert og jeg så ingen annen mulighet enn å overgi hele festningen.

Øya Isegran hadde en ærerik fortid. På begynnelsen av 1700-tallet, da Den store nordiske krig herjet, brukte selveste admiral Peter Wessel Tordenskiold den som flåtebase. Her lå det runde festningstårnet fra salige general Cicignons tid.

Selv om det nok ble noen rolige år på øya etter krigen, dukket det opp grandiose planer om å gjøre Fredrikstad til en av rikets største festninger. Det var i 1730-årene. Pengene strakk nok ikke helt til, men på Isegran ble det allikevel bygget et nytt fort, en tørr grav og et glacis. Alt sto klart i 1742 og dette skulle holde fienden på avstand. For øya var viktig for festningen. Her lå jo kornmøllene som skaffet mel til festningens soldater.

Borte ved Nøkledypet lå også en gammel kirkegård for soldatene. Den ble flyttet bort fra øya i 1741, for det behøvdes mer plass. En ny kirkegård ble anlagt nede på Vaterland, hvor den lå til enda mer plass behøvdes etter Tyttebærkrigen i 1788.

Det gamle tårnet ble ikke mye brukt på 1700-tallet. Vi hadde jo fortet som skulle beskytte oss. Faktisk ble store deler av tårnmuren revet ned i 1812 og stenen brukt annetsteds i byen. Men fortet lå der... og svenskene kom fra Kråkerøy... hadde jeg bare hatt de kanonene den skjebnesvangre dagen i 1814."

A.2.4 1800s

"Isegran, ja jeg har jo nesten aldri vært der men jeg ser jo ofte over på trelasten som ligger stablet. Vet du at min manns fars far engang eide møller der ute? Han hadde store, fine

møller men da han døde så ble de solgt. Det har vært dårlig med mølledrift der ute de senere årene. Etter at de svenske styrkene forlot Isegran i 1815, så ble det i grunnen slutt med hele mølledriften, og de forfalt sterkt. Og til slutt så var de bare å rive, men lenge var det jo ingen som turte det da, på grunn av den historien om at den som rev møllene vil omkomme. Det har vært mange som har eid områdene der de gamle møllene var, men noen mølledrift ble det aldri mer, selv om Søren Wiese visstnok søkte om å bygge både dampsag og dampmølle der en gang. Øya brukes nå mer til trelastopplag enn mølledrift likevel. Men det er jo et flott område da, og så lett å bygge der. Hele grunnmuren til havnevesenets skur kunne de jo bygge av sten fra det gamle tårnet som sto der. Nå brukes jo nesten hele øya til trelasttomter. Både min svoger Halvor Bjørneby og min mann, Andreas Bing, har trelasttomter der. Og prambyggeriet er jo til stor nytte for alle som driver med trelast her i byen. Min manns kusk, Adolf Olsen, bor i det gule huset på Isegran. Det er nylig blitt omgjort til 4-manns bolig. Han har også et lite gårdsbruk og mange dyr. Låven hans er rett ved den gamle kirkegården som lå der."

A.2.5 1900s

I dag skal Elisabeth og Beauty sjøsettes og skipes. Krana på brygga er klargjort for løftet. Endelig er de ferdige, og Appelgren sjøl og kona står allerede på brygga og tar båten sin i øyensyn. Begge skinner og er så blanke og fine! Vi båtbyggerne er også ganske fornøyde.

Kanskje denne Elisabeth gjør det like bra som den vi bygde i 1924. Den vant OL i Le Havre det året – og det gjorde at Aas fikk litt av et navn som regattabåtkonstruktør, skal jeg si deg!

IOD'en – som han konstruerte i 1936 har det blitt storproduksjon av! Bare i 1937 leverte vi 26 stykk til Amerika!

. . . og vi båtbyggerne er blitt sabla flinke til å pusse – vi pusser både "framlengs og baklengs" – da går det jo dobbelt så fort. . .

I Minemagasinet produseres det på løpende bånd – hemmeligheten som Aas har tatt patent på er at til forskjell fra meterbåter så kan bordgangene på IOD'en masseproduseres - det er enormt tidsbesparende! Den gangen en båtbygger stjal med seg dette patentet til Son ble det bråk skal jeg fortelle deg – rettsak og greier – Aas vant den saken ja!

Epilog - i dag dupper en 6m og en IOD ved museumsbrygga og Isegran er friareal – i Minehallen hvor båtene den gang ble produsert er det nå maritime utstillinger, ringen er sluttet!

Appendix B

Progress Plan

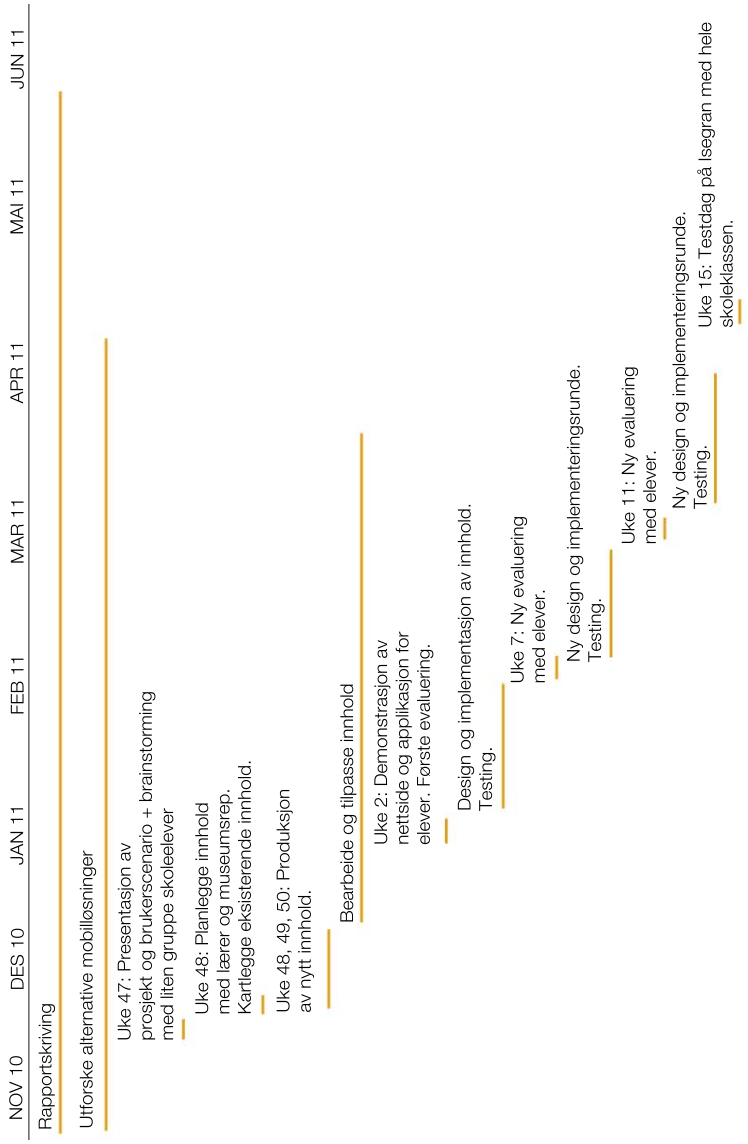

Figure B.1: The progress of the project was put to paper in order to establish an overview of the stakeholders and time frames. The number of iterations after evaluations with the stakeholders was adjusted to three

Appendix C

Storyboard

Figure C.1: Planning of the field test

Appendix D

Field Testing Question Set

QUESTIONS DIRECTED TO PUPILS

1. How do you experience this way of visiting the museum compared to the traditional way?
2. What was fun? Instructive and informative? Interesting? Engaging? Exciting? Challening?
3. How did you cooperate?
4. How do you use technology in your daily lives?
5. How did you experience the use of video? Did the video give you a sufficient amount of information?
6. How did you interpret the tasks you were given?
7. How did the technology work out? And what could have been done to improve it?
8. Could this project have been realized without the use of a mobile phone? If so, how would it affect the user experience?
9. How can you use the data you have collected?

QUESTIONS DIRECTED TO THE TEACHER

1. How do you experience the concept?
2. How was it different from a traditional way of visiting a museum?

3. How was it different from a traditional class in school?
4. How did it affect the way the pupils work?
5. Is it the technology or the tasks that makes this way of visiting a museum different?
6. Could this have been done without the use of a mobile phone?
7. Did the technology perform at a satisfactory level?
8. Did the tasks given relate to the curriculum at satisfactory level? Did they engage the pupils?