



**UNIVERSITY OF BERGEN**

Faculty of Social Sciences

Department of Information Science and Media Studies

**MASTER THESIS**

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**HistorieVandring: Local History Through a  
Location-based App**

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## **Abstract**

In today's society, where there are rather few areas, of everyday life where technology is, there are still some areas that lag behind in this development. One of these is the area of local history, an area found all over the world. The most common way of exploring local history is through books, written by local historical societies. Few of these books are digitalized or furthered developed in any way. Although there are some good examples of this type of information being digitalized and given a new presentation form, even in Norway, there are few that use location-based technology, and AR-functionality.

This thesis carries out research to see if using a local history book content with an app that uses the two technologies location-based technology and AR-technology can give users a living experience of local history. To do this a two-step process will be followed. First a mobile app will be developed, and then the app will be evaluated it in a real life environment. The book used as a content source contains local history from Bjørnsund, an old fishing village at the coast of Møre and Romsdal. The prototype for the app has both the locals and also tourists as a potential user group.

The prototype of the app had a development process consisting of three cycles, where each cycle consisted of a design and development phase followed by a user testing. After each cycle the prototype was improved with findings in the user test and further developed. At the end of the process there was a final evaluation of the app at Bjørnsund.

The results from the user testings and the evaluation show that the people who tested the app were very open to this new form of experiencing local history, and were also exited to get a chance to see what it was like. There were some concerns that adding AR to the app would complicate the easiness of the user friendliness of the app. Other than that there were only positive feedbacks on this new way of displaying the history, showing that there is a market for this kind of application including this technology, in Norway.

## Preface

*I would like to express some gratitude to some of the people who helped me the most during my work with this thesis.*

*My supervisor Barbara Wasson, supported my project from the first day and motivated me to make it the best as could be. She especially helped me through the final days before finishing with some crucial feedback and advise.*

*I would also like to thank my parents for supporting me through my work with this thesis. Especially my father for allowing me to use his book as a source for my data and for all the phone calls answering questions about Bjørnsund. I also thank him for passing along the love of history to me.*

*Last I would like to give big thanks my boyfriend Stian, for the patience and all the help during this thesis. Especially for helping me stay positive throughout the work and for being there when I needed someone to discuss problems with the work.*

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## 1. Introduction

In today's world with all this technology available to almost everybody, there are still some areas that have not come as far in making use of technology. One of these areas is local history, where some of it is partly digitalized, but the largest part is not. Among what is not digitalized are books that contain information about small villages around our country. The books contain information about houses, their owners, and the families living there for several generations. This information is often gathered by local historians and written down. Given the technological developments of today there is so much more that can be done. Digitalizing it and exploring new ways of sharing it with the people is the future.

In this thesis I have chosen to develop an app that uses some of this historical information. The goal is to see what can be done with the information and also if people are interested in exploring the information in a new way. I chose to use location-based technology and also explore AR technology to see how they can be used to share local history. The information used is historic pictures and written information about the houses and their owners in a small community in western Norway.

### 1.1.Bjørnsund

Along the coast of Norway, including Møre and Romsdal, there are many islands that used to be old fishing villages. The book being used as a source for historical data contains information about the fishing village Bjørnsund on the west coast of Norway, as seen in figure 1. Bjørnsund is a group of four islands and is a part of Fræna municipality in the county of Møre and Romsdal. The islands lie in the coastline Hustadvika, which is known as one of the most dangerous parts of the Norwegian coast and for its very hard weather. Many ships over the years have been shipwrecked there. The coastline is also a shipping lane between the two towns Molde and Kristiansund



Figure 1 Bjørnsund marked on a map of Norway.

and has been so for many hundred years. Bjørnsund is located about 40 kilometers from Molde. You can get there by driving 45 minutes to Harøysund and then take the boat to Bjørnsund, a boat ride of approximately 30 minutes; the distance can be seen in figure 2.

Bjørnsund is an old vacated fishing village, which today is mostly used for vacation homes by those who have roots there, but there are also others who have vacation homes here. The island group comprises four main islands: Norde, Søndre, Hammerøya and Moøya. Between three of the islands there is a connecting pier, and the last one has to be reached by boat from the others, as shown in figure 3. Moøya, the island furthest out has a lighthouse, which has been there since 1871 and has been a very important guiding point for the ship traffic passing



Figure 2 The distance between Molde and Bjørnsund.



Figure 3 An overview of the islands at Bjørnsund. Photo: Øyvind Leren

Hustadvika. An early picture of Moøya, see figure 4, show the lighthouse, which today is automated and has no lighthouse keepers living there. It is now protected by Norwegian law. The view from Nordre to Moøya can be seen in figure 5.

At most 600 people lived in the fishing village. This was in the time after the Second World War. In 1968 a contested decision was made by the authorities, which was based on a claim made by the people living on Bjørnsund. The claim consisted of an improvement in the infrastructure on the islands including, water supply from the main land, a renovation of the harbor with a new quay and lighting and a bridge between Hammerøya and Nordre. This would cost the authorities quite a lot of money. When the case was up for hearing in the municipal, it was passed on to the County and then further on and ended up as a State's decision, where it was decided to rather give the people living on Bjørnsund a settling-in grant for them to move and establish themselves on the Mainland. The depopulation on

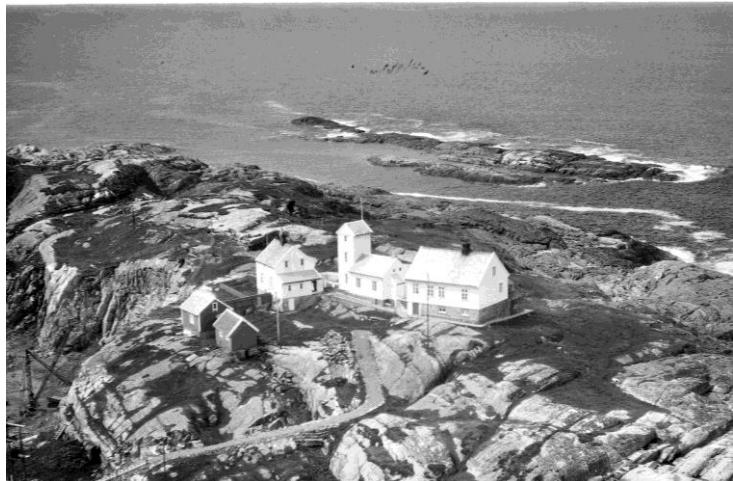


Figure 4 A old picture of the lighthouse on Moøya.



Figure 5 The lighthouse on Moøya. Photo: Anne Sofie Hammerøy

the island started shortly after. This also led to the post office and local store closing. After that there was only a little store held open some weeks in the summer by a shop-keeper from the mainland. In 1971 there was only one man left still living on Bjørnsund, and he lived there alone until he was over 80 years old, all year around even in the hard and cold winters. Today there are a lot of caring people working together to preserve the fishing village and its history. There are neighborhood associations, a sports team and so on working to take care of the buildings, the chapel and the communal areas. They also arrange activities in the summer when the islands are filled with people and they are full of life again.

The chapel on Nordre Bjørnsund towers over the island at the highest point, giving a beautiful view over the island and the ocean beyond, as can be seen in figure 6. The chapel was built in 1907 and got its clock tower in 1951. The chapel has always had a large signification to the people on Bjørnsund and still has today. There have been all sorts of gathering there over time, both happy and sad. It is still in use for services in the summer, weddings, baptisms, and also an annual bazaar. It is also well taken care of, and had a restoration both on the inside and outside around its 100-year anniversary.



**Figure 6 The chapel towers the highest point on the island. Photo: Anne Sofie Hammerøy.**

There are several monuments spread around on Bjørnsund, on Nordre Bjørnsund there are two, the polar bear "Isbjørnen" and the lady "Damå". Both of these monuments was made and given as a gift to the people on Bjørnsund by the sculptor Steinar Sandvig. He was the son of the known Norwegian museum-man Anders Sandvig, who opened a

famous museum, “De Sandvigske Samlinger” on Maihaugen in the town Lillehammer in Norway. Anders Sandvig came from a small village on the mainland not far from Bjørnsund. The reason for Steinars Sandvigs strong connection to Bjørnsund was several. His aunt, Anders Sandvigs sister married the trader Oliver Olsen on Nordre Bjørnsund and moved there. His grandparents, Anders parents also moved to the island in their old age. Steinars Sandvig himself lived on the island in periods and ran a dentist office there. All of this gave him a special connection to Bjørnsund and might have been the reason for him to make sculptures. (Hammerøy, 2009)



**Figure 7 "Isbjørnen" is looking out over the sea. Photo: Anne Sofie Hammerøy**

Isbjørnen is placed on an outer hill “Tomashaugen” looking out over the sea, as seen in figure 7. It is a memorial monument for the seamen who lost their lives at sea from 1850 to 1950 and it has a plate with 35 names on it; there are also the names of three men who lost their lives during the Second World War. The fact that the monument is of a polar bear is likely not a random choice, since the sculptor knew about the legend of a polar bear who came drifting on an ice flake and swam ashore on Bjørnsund. It is said that this is what gave the name to the islands. In 1907 Steinars father Anders Sandvig wrote an



**Figure 8 Isbjørnen at its unveiling in 1951.**

article in the local newspaper Romsdals Budstikke, where he expressed the need for a memorial monument for all the fishermen lost at sea in the local area and also that the monument should be placed on an island furthers out to sea. This can be assumed as one of the reasons that his son, Steinar made this sculpture and placed it on the island he knew very well Bjørnsund. The monument was unveiled the 21 of July in 1951, see figure 8, by the brother of the sculptor, Anders Uchermann Sandvig. (Hammerøy, 2009)

“Damå”, another monument on Nordre Bjørnsund, is of a lonesome lady sitting on

the inside of the island looking out over the mainland and the mountains. See figure 9 for a picture of Damå” when it was new. This is the second of two sculptures made and given to the people by Steinar Sandvig. The sculpture was in place about 1954, about 2-3 years after the bear was unveiled.

While making the sculpture Sandvik had a 12 year old girl from Bjørnsund model for him, and there are several stories about what and who the sculp-

tor had in mind when he made this young lady “Damå”. One of them is that Sandvigs had his own daughter who died young in mind, and another tells that he had the local wom-



Figure 9 A picture of Damå.



Figure 10 Damå looking out over the main land and the mountains. Photo: Anne Sofie Hammerøy

an Gurine Rasmusdatter in mind when making the sculpture. Gurine, who lived from 1834 to 1912, was a woman who had quite a lot of sorrow in her life. It is said that she was one of the most tried woman living in the islands at the west coast of Norway. She lost both her father, her husband, and two sons at sea. From the stairs of her house she could look out to the place where she lost them. She gave birth to 9 children, but unfortunately only one girl grew up to adult age. Sadly also she died before her mother. It is told that "Damå" sits on the inside of the island looking in to the main land and the mountain, away from the sea who took all of her loved ones. (Hammerøy, 2009) You can see Damå in the lower right part of figure 10, sitting on the inside of the island.

## **1.2.Motivation**

After I decided to work on developing a mobile app with historic content in my thesis, it fell natural for me to choose Bjørnsund as the historic place from which to use historical data. There are two reasons for working with a history app. The first it is my connection and love for history and for the island Bjørnsund, and the second is the desire to further evolve my developing skills in mobile applications.

During my bachelor degree I had two semesters where I worked for an IT-company as part of my degree. There I got the chance to work with different developing assignments for the company. This gave me an insight into what it would be like to work as a developer for an occupation. Having this opportunity to see what it was like made me realize how much I liked doing developing work. This is the reason I wanted to further develop my skills and also see if I could make something that can contribute to the local history in small places. Also exploring new technologies that I have not worked with before is also exciting.

Ever since I was a child I have spent a lot of time on Bjørnsund; it is the island where my father was born and raised and where his family lived until the 1960s. It is a beautiful island that holds a special place in my heart. It is not so far away from where I myself was born and raised, but it is amazing to think and learn about what a totally different community it was when my father lived there, and his ancestors before him. To learn about this history is very fun for me, especially learning it from my father, who has so much knowledge about it. My whole life my father has been very interested in history and has been learning as much as he can about it, particular about Bjørnsund. He also

wrote a book with historical information about the island on which he grew up. It was many years of work to collect all of this information and it has a huge historic value for the local area and people with connections to the island. I have the impression that it is quite normal, especially in our country, to have these kinds of books, collecting the history from small places and villages. It is a very important job to do this work and document the history. It is also important to do it while the people who lived and experienced it firsthand are still alive. Being raised with a father who has this much passion for history has also contributed to my love for history. When traveling around the world I love visit museums and historical sites seeing what each place has to offer. There is always something new to learn and see. Thanks to this interest in history I wanted to incorporate this in my Master thesis and work on new ways of showing this to people. I wanted to see how new technology can help to preserve this information and make it available for new generations.

## 1.2. Research Questions

### Guided research question:

- How can location-based and AR functionality be used to create a living experience of local history.

### In order to answer this question I will do these two tasks:

1. A mobile app will be developed
2. The app will be field tested to determine the user experience with the app.

## 1.4. Thesis Contents

Chapter 2 reviews previous research in this field. The literature review then comes in chapter 3, with the following chapters, 4, 5, 6 covering the development and the user testings. Chapter 7 and 8 are a discussion, of results and the conclusion.

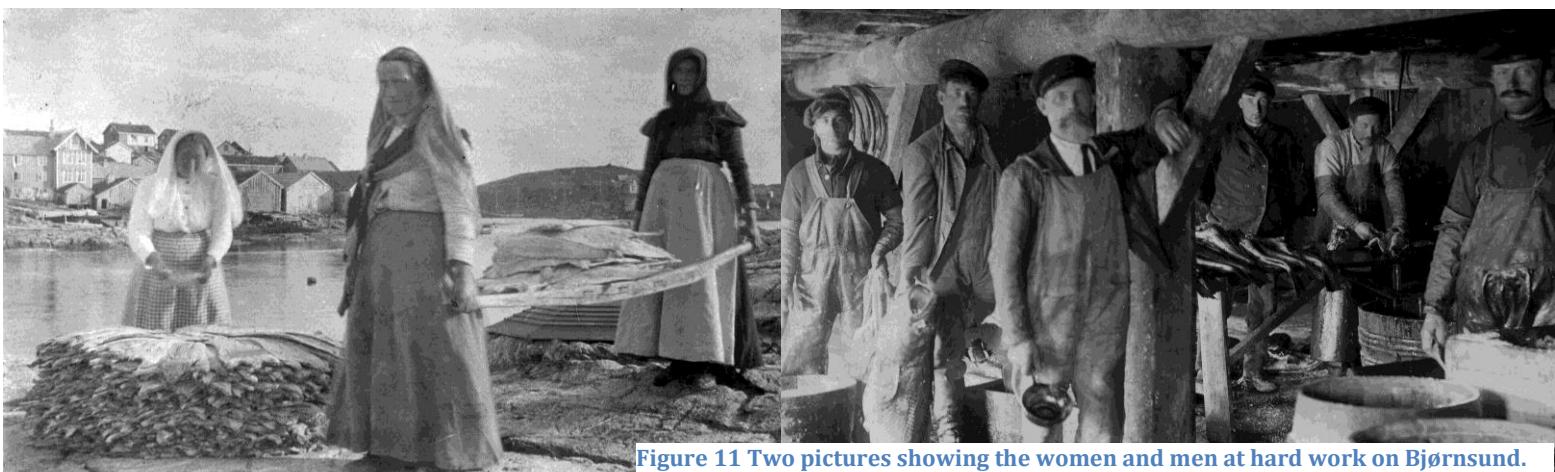


Figure 11 Two pictures showing the women and men at hard work on Bjørnsund.

## 2. Literature Review

This chapter review relevant literature for this research. This includes the history of it and also some similar work and research done using these technologies in the field.

### 2.1. Technologies for mobile tourism apps

The two mayor technologies used in this thesis are location based technology /GPS and Augmented Reality (AR). They are what elevate the app beyond an app that shows text and pictures. Many tourist / history apps use these technologies.

#### 2.1.1. Location-Based Technology

Location based technology makes it possible to show the user the information that is relevant to the location where she/ he is at the moment. The Global Positioning System (GPS) is probably the most known for providing positioning data. The official name is NAVSTAR Global Positioning System, and it has its origin in 1973 from the American army. The first operational GPS satellite was launched in 1978, and the 24-satellite constellation was completed in 1993. In the first period it was mainly used for military purposes, but in the 80s the system became available for civil use (Höllerer & Feiner, 2001). The GPS-system works all over the world, all the time, in any kind of weather, as long as the signal is not blocked by anything such as house walls or mountains. The system is available and free to use for everybody.

There was already some computer systems et al. using this technology in the early 90s. For example, Loomis (Höllerer & Feiner, 2001) and colleagues developed a GPS-based outdoor system to present navigational assistance to the visually impaired with spatial audio overlays (developed at the University of California, Santa Barbara). In the late 90s Feiner and colleagues (Feiner et al., 1997) developed a system called The Columbia Touring Machine. This was an early



Figure 9.1 Mobile AR restaurant guide. (a) User with MARS backpack, looking at a restaurant. (b) Annotated view of restaurant, imaged through the head-worn display.

Figure 12 An early version of The Columbia Touring Machine.  
From Chapter Nine Mobile Augmented Reality in the book *Telegeoinformatics: Location-Based Computing and Services* by Tobias H. Höllerer & Steven K. Feiner.

prototype of an outdoor Mobile Augmented Reality System (MARS) that presents 3D graphical tour guide information to campus visitors, registered with the buildings and artifacts the visitor sees (Höllerer & Feiner, 2001). This is much like the systems we strive for today, which can give us information about what we see around us, using the GPS to get location data from the user. Back in the 90s the equipment was still large compared to what is available today. A picture of the early version of The Columbia Touring Machine can be seen in figure 12, showing that even if the system was mobile, it might not be so small and practical. As we can see there is a laptop that is worn as a backpack, a number of instruments connected to it and a head worn piece. Today we can get the same information on a small screen on a mobile phone.

## GPS coordinates and Map Datum

The GPS signal on a mobile phone works in the way that it receives position data from several sources. These are *GPS* technology, positioning via *WLAN*, and *Cell-ID* based positioning. Combined these give the best position available of the smartphone. If all three are not available however, it is possible to only use one of them, though it can take a while longer to get the position. The GPS gives an accuracy location up to 5 to 10 meters and it takes several seconds to minutes to determine the position. It also had limited functionality, for instance inside stone / concrete buildings. The WLAN location is accurate up to 30 to 50 meters and for this method to work it requires a connection to a wireless hotspot. Cell based location information is available as long as the smartphone has a network signal, but only has an accuracy of several hundred meters. On an Android phone you have the opportunity to set how you want the phone to retrieve the location information, see figure 13. You can choose if you only want to use the GPS or also use a wireless network and the cell based location. These different options use different battery power on a smartphone, which today can be a problem with the large



Figure 13 A screenshot from the Samsung phone used in development & testing showing the different localization options.

screens using a lot of power when in use. So if the phone was being used in a remote place with no opportunity for charging, it might not be wise to use all three of them, but to set it to the battery saving mode (von Watzdorf & Michahelles, 2010).

A location on the surface of the earth is represented by a latitude and longitude value. The actual value obtained for latitude and longitude is dependent on the particular datum used, because it is the datum that provides the origin and orientation of latitude and longitude lines. The most used datum in the world is the World Geodetic System of 1984 (WGS84) (Payne, Scarbrough, Jernigan, & Zlatkov, 2009). When you receive a position from a GPS it is always in the WGS84-format, if not otherwise informed. This is also the case with GPS positions received from a smartphone. The numbers you get is the latitude and longitude, which describes how far you are away from the reference point in that particular map datum. The numbers you get on a smartphone are in decimal form, but they can also be calculated into Degrees ( $^{\circ}$ ), Minutes ('), and Seconds ("'). Under is an example of a GPS position for Bjørnsund in three different formats:

- **Decimal Degrees:**  
62.89146974 - 6.82658932
- **Degrees ( $^{\circ}$ ) - Minutes (')** **WGS84 format:**  
Latitude N62 $^{\circ}$ 53.4881844  
Longitude E6 $^{\circ}$ 49.5953592
- **Degrees ( $^{\circ}$ ) - Minutes ('') - Seconds ('')** **WGS84 format:**  
Latitude N62 $^{\circ}$ 53'29.291064"  
Longitude E6 $^{\circ}$ 49'35.721552"

To make sure that the numbers you are working with are correct it is very important that you work in the same reference frame. When comparing positions for instance, that both positions are in the same format, such as in the WGS84 reference frame. Otherwise, the positions will not make any sense.

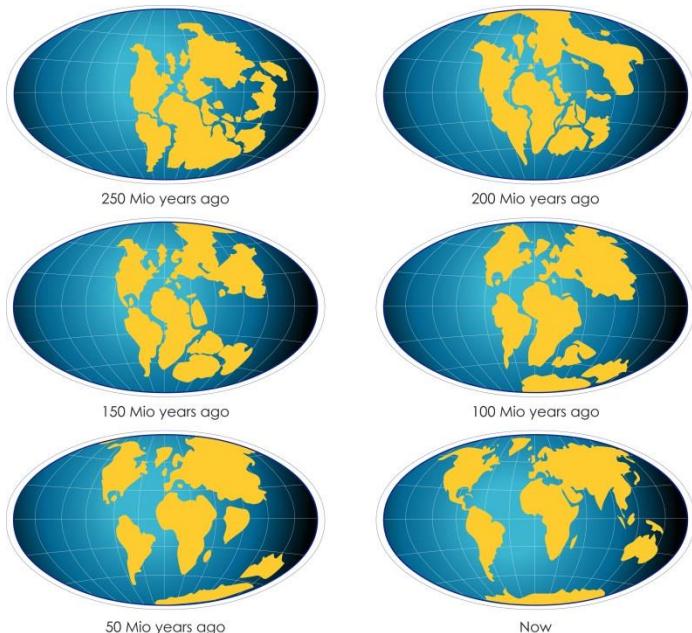
After talking to Narve Schipper Kjørsvik<sup>1</sup> who is a Dr. Scient in the field of satellite geodesy, it became clear that there are several things that need to be taken into consideration when working with geographical coordinates. This is because of the fundamental problem of the continental drift, see figure 14, which is the movement of the earth's continents relative to each other. If working with high accuracy this needs to be taken into consideration. For example the North American continent moves a few centimeter a

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<sup>1</sup> An acquaintance from Bjørnsund

year in relation to the European continent; this will make the position of an object “almost” constant in regards to the continent you are on, changing with the same amount of centimeters as the continent moves. The position however, will not be “almost” constant in regards to a global coordinate system, such as the WGS84. Thus the reference system needs to have a time stamp attached to the position if you work with very high accuracy. The reference frame used to retrieve the positions from Bjørnsund is the EUref89, a Norwegian reference frame that uses the physical coordinates from the GRS89, which are practically identical with the WGS84 frame. All the positions in the EUref89 system are calculated back to the

1.1.1989, by using a model for the continental drift. This means that if you are measuring relatively between two points, you don't need to take this into consideration because both points have moved just as much. But when taking the position of a house on Bjørnsund using a map with the EUref89, this point will be in the position that the house had on the continent, back in 1989. When comparing this to the position of the user, it is important to remember that there is a difference of the continental drift of 26 years, which needs to be taken into consideration. Dr. Kjørsvik did a calculation that showed the difference for Bjørnsund from 1.1.1989 until 1.1.2015 to be about 40 centimeters in eastern direction and about 50 centimeters in northerly direction. This is beneath the expected horizontal accuracy that is expected from a GPS signal under good conditions, which is about 2 meters. The 2 meters are considered a standard deviation. This means that there is an option to choose to ignore these centimeters in difference or all the positions of the houses can be adjusted with 40 cm east and 50 cm north before putting them in the app. Since an average house is over 10 meters long and 5-10 meters wide these 40 and 50 cm will not make any difference, if the position of the house is taken in the middle of it. Thus there will be no need to adjust the latitude and longitude before using it in the app, although it is important to be aware of this (Kjørsvik, 2015).



**Figure 14 A picture showing the continental drift.**

## 2.1.2. Augmented Reality

*Augmented Reality system - a system that combines real and computer-generated information in a real environment, interactively and in real time, and aligns virtual objects with physical ones.* (Höllerer & Feiner, 2001, p. 2)

The term Augmented Reality first came about in the early 1990s. It was first used by two researchers working at Boing Corporation, Tom Caudell and David Mizell. They used the term in 1992 about a proposed solution of overlaying computer presented material on top of the real world as augmented reality. The technology would be used to simplify the process of conveying wiring instructions for aircraft assembly for construction workers. Eventually the term was accepted as the standard for referring to overlaying computer-presented material on top of the real world.

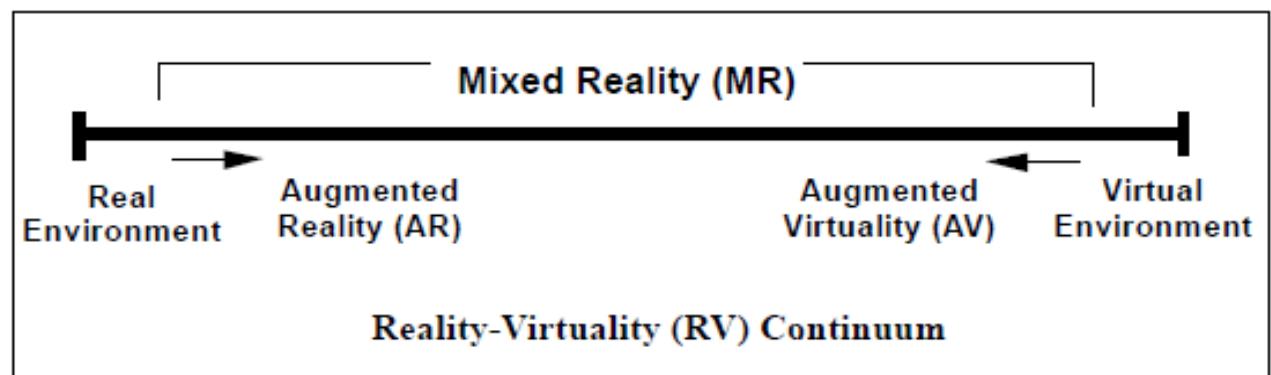


Figure 15 A simplified representation of a Reality-Virtuality (RV) Continuum.  
From "Augmented Reality: A class of displays on the reality-virtuality continuum" by Paul Milgram, Haruo Takemura, Akira Utsumi, Fumio Kishino, 1994.

Augmented Reality (AR) is a subfield of the broader concept of mixed reality (MR), see figure 15. One definition of a generic Mixed Reality environment is one in which real world and virtual world objects are presented together within a single display. AR is related to the concept of Virtual Reality (VR), but they differ in some ways and as seen in the figure 2 they are on different sides of the scale with respect to the real and a virtual environment. While VR creates an artificial world, AR only add to the already exiting world of the user. AR adds to the users experience by using the senses of the user, most common is the vision scene. It supplements the real world, rather than creating an entirely artificial environment. The physical object in the individual's surroundings become the backdrop and target for computer-generated annotations. To make a mobile Augmented Reality application there are several different technologies

necessary, global tracking technologies, wireless communication, location-based computing (LBC) and services (LBS), and wearable computing if the app is for a wearable piece (Milgram, Takemura, Utsumi, & Kishino, 1994).

The first mention of an activity similar to the Augmented Reality we are familiar with today is found in the book “The Master Key” from 1901. Lyman Frank Baum (1856-1919) writes about a pair of spectacles that adds a letter in the forehead of all the people seen through them, showing what type of person it is (good, evil, wise etc.)<sup>2</sup> The author most likely never imagined that this would be a possibility a hundred years later, but today this could be a realistic device (e.g. using Google Glasses technology), given that you could group people into categories of types. AR technology was already in use in the late 1960s, see figure 16, “...when Ivan Sutherland (an American computer scientist) and some colleagues used it to build a mechanically tracked 3D see-through head-worn display, through which the wearer could see computer-generated information mixed with physical objects, such as signs on a laboratory wall” (Höllerer & Feiner, 2001, p. 2). After this there were more and more projects using this new and evolving technology, and it is still in further development today, with perhaps the most known being Google Glasses.

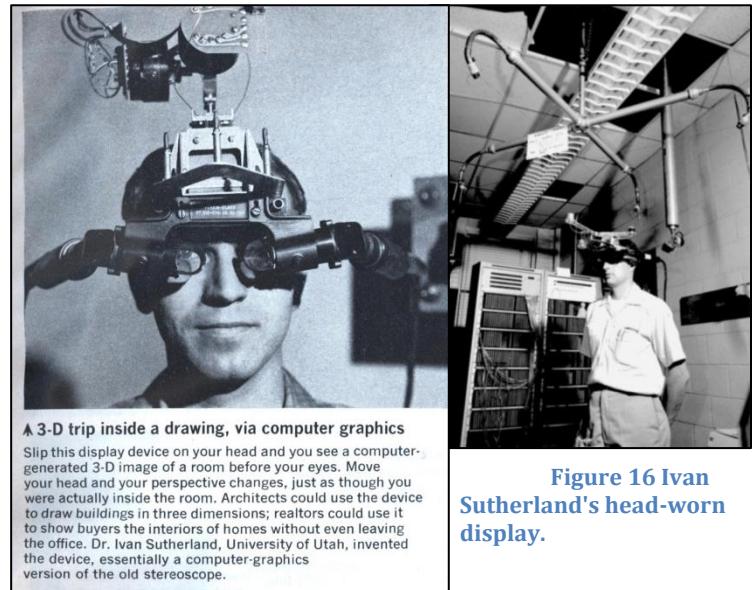


Figure 16 Ivan Sutherland's head-worn display.

There are several different ways of displaying the AR to the user, some of these are showing AR in a head-mounted piece, in eyeglasses, using Head-Up Display (Google Glasses) or an Eye Tap, seeing it on a handheld device or Spatial AR using digital projectors to display graphical information onto physical objects. There are also new ways of using this technology in development, for instance in contact lenses.

Today the AR technology is being used more and more as wearable computing. This is a technology that became popular in the 1990s, but even earlier in the 1980s the

<sup>2</sup> [http://en.wikipedia.org/wiki/The\\_Master\\_Key\\_\(novel\)](http://en.wikipedia.org/wiki/The_Master_Key_(novel))

Sony Walkman made the way for mobile devices. In the 90s came the laptops small enough to take with you, and this field only continued a huge development towards today when there is rather few things you cannot take with you. The AR technology is being more used in everyday apps that users all over the world can download; also in tourist and history apps.

## **2.2.Modern use of technology in the tourist and museum industry**

Traveling and tourism have been a part of our culture for hundreds of years. It has not always been as important for the traveler to know as much about the destination as is normal today. Previously you could not go online and discover different destinations, book your own ticket and search for information about what you could do when arrived at the destination. In today's society there are websites and apps available to provide information to travelers in all stages of travelling. The travel process in its whole has been separated in to three different stages: *planning* phase, the *touring* phase and the *reminiscing* phase (Watson, Akselsen, Monod, & Pitt, 2004).

- The *planning* phase is where the tourists, prior to the trip, collect information about the destination. This is done by visiting websites or tourist offices.
- The *touring* phase is the period where the tourist is visiting sites, wandering around museums, attending a festival, and so forth. During this phase, the tourist needs location-based information services to inform them about the tourist attractions within their environment.
- The *reminiscing* phase arises after the trip is over and the tourist has come home again. On returning from a trip, travelers recall the highlights and often share these with relatives and friends. Also, they might want to comment in an online service on places they have visited.

Watson et al. (2004) argue that in these three phases of the travel process an information system could be useful. A standard data model that would be a standard for tourism sites is proposed. Since most states, provinces, and governments have their own official tourism sites they would be potential hosts of a standard data model. This data model would be a pre-defined data model that would contain the same information on all sites. A model like this could benefit the tourism industry and be an entry point for the tourist's information search. It would make it easier for the tourist to find what they

are looking for and they could expect to find the same information on all these sites (Watson, Akselsen, Monod, & Pitt, 2004).

The amount of information available to the tourist on the Internet is also a problem today. A quick search in the google search engine for "new york tourist" gives 189.000.000 hits, see figure 17. This is an astonishing amount of hits, that one could not possibly read. To find the best information for your individual needs is a lot of work for a tourist. The top results are often the ones paid for by the publisher; then come the ones with the most clicks, but the right information for you might not be what is the most viewed by others. According to Watson et al. (2004) there are three fundamental problems with current tourism information systems. *First* there is an overwhelming mélange of tourist information through which tourists have to sift and winnow. They confront too many Web sites and can easily spend too much time searching for useful information. *Second*, there is little use of information technology to support tourists when they are touring. *Third*, experiences gained during a trip are not easily shared and reminiscing is rarely supported (Watson, Akselsen, Monod, & Pitt, 2004).

The search for information by tourists used to be more intense before arrival at the destination than during the travelling period. This is the time where tourists decide upon whether to travel to the destination and make preliminary decisions regarding what to do once there. However, there is a growing recognition of the role of information search during travel. For an independent traveler search for information tends to be an ongoing task, with tourists actively searching for information. (Peres, Correia, & Moital, 2011). This shows that the need for tourists to find information when on site at the attraction is there and can be improved by using location-based technology.

The traditional way of entertaining a tourist would be through either guided tours, brochures, maps or other physical things they could look at and get information from. Some sites provide audio through earphones where the tourists can get information about what they are looking at. It would be the same in a museum where there most typically are text information placed next to the object you are looking at and also audio and videos is used in some museums.

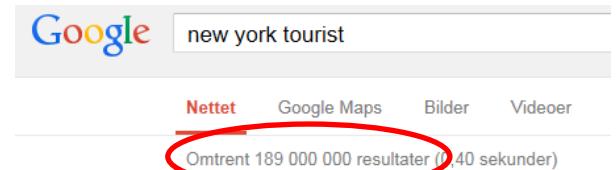


Figure 17 The amount of hits for "new york tourist" google search.

## 2.2.1.Tourist Apps

The modern-day ways of supporting tourist has become more and more technological. One of these technological solutions is apps directed towards the tourists. There are all sorts of apps available, both for when planning the trip, when traveling, and also when they have arrived and go out to tourist destinations. If you for instance go into app store on your smartphone, there is an own section for traveling, see figure 18, where you can get help to find traveling destinations, accommodation, and attractions to visit when you have made it to your destination. Most of these apps might be made for the larger and most popular destinations in the world, but hopefully it will become more and more normal to have these kinds of opportunities available for tourists in smaller and remote places in the future.

One example of an app such as this is the old fashion guidebook you would buy before visiting a place and carrying it around with you, see figure 19. It would have a map in it, maybe even a fold out one and also all the information you



Figure 18 The old guidebook vs. the new one.



Figure 19 An overview of the travel section in the app store.



would need to know about the place you were visiting. Today you instead can buy an app with all the same content for your smartphone. Not only is it space saving in your luggage but it is also easier to search and find for something you are looking for in the app.

### 2.2.1.Museums

It is not only during the traveling and discovering of a city's where technology has become more common, there are already some examples of the use of modern technology in the world of museums and such. It is becoming more and more normal for a museum to have some sort of technological solution implemented to their expeditions. These might be QR-codes that take the visitor to a website to show some additional content about the exhibition, see figure 20. It could also be videos showing a virtual reality (VR) or similar next to the object. This is a good way to introduce the visitor to some additional content.

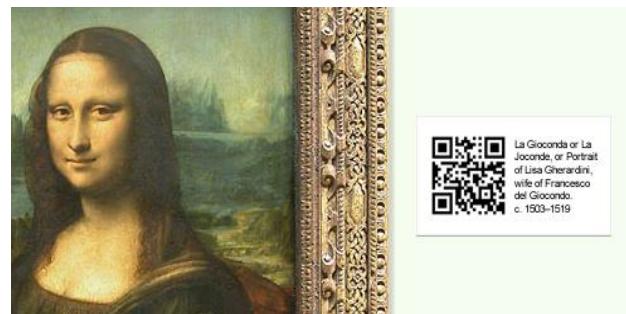


Figure 20 A QR-code next to the Mona Lisa painting that hangs in the Louvre museum. From <http://uqr.me/2013/02/qr-codes-in-museums/>

In 2014 there were more than 55.000 museums in over 202 countries around the world (International Council of Museums), 2014. These museums show a lot of history, but there is also a great deal of history around the world that is not shown in a museum. For example history from small remote places in the world might not be cover in a museum. Digitalizing the history and using it in an app, as a mobile tour guide, would be one way to show this local history. How accepting tourists are to this new art of mobile guides have been researched. While mobile apps are still an emerging technology, it is regarded as very promising (Peres, Correia, & Moital, 2011). Thus this is a positive direction to go in to order to include more of the untouched history we have all over the world. This was also evident when looking at the app store. Although there were not hundreds of apps in the travel category, there were many. Peres et al., (2011) refers to these apps as mobile electronic tourist guides (METG).

Some of the benefits mentioned about METG the are "*The high levels of mobility and access to interactive information in real time are perhaps the greatest benefits of METG. Consequently, the tourist is better equipped to maximise the time spent in*

*the destination. This is achieved by avoiding travelling to the tourist office every time new information is required, by not having to wait for the information and, above all, through accessing information anywhere and anytime.”* (Peres, Correia, & Moital, 2011, p. 121)

The benefit of not having to travel to the tourist office, if there is one in small remote places is also a benefit. This means that making an app with this kind of information available to tourist visiting these places could drastically increase the number of tourist attractions with information available to the tourists all over the world. Another benefit to the METG that is giving the tourist the opportunity to avoid spending time looking for information gives them more time do other activities at the tourist place and might just increase the amount of time they spend there. This would only benefit these small remote places that might not have many tourists.

The traditional way for a tourist to use a travel app is to download it before they leave on their trip. This gives the tourist the opportunity to play around in the app for a while and get to know it. If there is a location-based technology showing the content in the app however, this will limit what the user can see before they actually are in a close range of the attraction. According to Peres et al., (2011) “*...there is a growing recognition of the role of information search during travel. In a recent study, Nishimura et al. (2007) suggested that for independent travelers information search tends to be an ongoing task, with tourists externally searching for information actively*” (Peres, Correia, & Moital, 2011, p. 124). With the growing amount of tourist looking for information when actually at their destination, a mobile app using location-based technology would be a good a good solution. If there were to be apps showing content from small remote places, for instance along the coast of Norway, they would need a different advertising model than apps for the larger cities. Since there is a growing possibility for getting the tourists attention to the app while they are on the travel, it would need advertisement in the local areas. This would make it the local areas job to promote the apps with local tourist information. For example if a tourist traveled to Fræna Kommune, in Møre og Romsdal, it would be good to promote the app when the user is in the county, and even more so when they arrive in the same municipality. This would increase the chances for tourist not already knowing about a place like this to find out and visit it. By having tourist use these kinds of apps and with the developments in mobile technologies, it would be much

easier for local governments and tourist offices to disseminate information regarding the destination in a more up-to-date and interactive way (Peres, Correia, & Moital, 2011). This would result in more correct information and decreasing misunderstandings for the tourist.

A tourist using an app with location-based technology to show historical content can evaluate the experience in three different forms; *functional*, *psychosocial* and *relational*. The *functional* dimension refers to the availability of the system anytime and anywhere and is closely related to efficiency provided by access to information while on the move. The *psychosocial* dimension includes issues such as security and privacy, while the *relational* dimension involves evaluating the opportunities for communication with other individuals (Peres, Correia, & Moital, 2011). The usefulness of a Mobile Electronic Tour Guide is determined by its *functionality* and *quality*. Generally speaking, functionality involves availability, trust and presentation, whereas quality is associated with quality, ease of use and currentness (Peres, Correia, & Moital, 2011). This means that it is important for an app like this to work without problem when the user needs it and also that the content is well presented. It is also important that the user interface is user-friendly and easy to use and that the app is current, both with the information and presentation. It also needs to have a quality feel to it to impress the user. When it comes to how the tourist feels about using the METG, research has found that the stronger the tourist's intention to use METG on a trip, the more likely they are to use them (Peres et al., 2011; Cao and Mokhtarian, 2005). Therefore, behavioral intention can be regarded as a surrogate measure of the tourists' acceptance of METG (Peres, Correia, & Moital, 2011; Cao and Mokhtarian, 2005).

With over 55.000 museums in the world there are still a small number of them using the newest technology available. The traditional way to display the exhibition in a museum is still the most used. But there are some places that have embraced the new technology and new ways of showing history to the visitors. One of these places is The Foundation of the Hellenic World (FHW), which is found in Greece. This non-profit organization is working on preserving and disseminating Hellenic culture, historical memory and tradition through the creative use of state-of the-art multimedia and technology. To this purpose it uses the best of contemporary museum theory, developments in computer science and audiovisual media for interactive exhibits. In their cultural cen-

ter they have developed a variety of interactive and educational virtual experiences, offered to the visitors to discover, learn and explore. There are approximately five hundred people, mostly students, who visit the two VR exhibits daily. This is quite a large number of visitors and it gives a good chance to get feedback on the installation. A virtual environment like the one shown in figure 21 can provide rewarding aesthetic and learning experiences that would otherwise be difficult to obtain. In the virtual experience you can take a virtual journey to the ancient city of Miletus and the reconstruction of the Temple of Zeus at Olympia. There is also a series of educational virtual reality programs related to the exhibition. This educational bit includes tasks for the visitor to perform, the first one was about the 4000 year old Hellenic costume, and there is also an Olympic pottery puzzle for the visitor to complete. Having this educational part of the experience is a new way to use this technology to involve the visitors even more. This can again lead to enlarge the learning experience and a more engaging and fun visit. Still, there is a high cost and restrictive format to these installations, but it is still worth investing in it, as it adds value and experience that is not obtained in other ways. *"The potential to transcend the physical location of the built environment and the growing educative role of the museum juxtaposed with commercial pressure has lead museums to consider virtual reality as a necessary component in the arsenal of tools to educate, entertain and dazzle"* (Gaitatzes, Christopoulos, & Roussou, 2001, p. 107).



Figure 1: Children exploring heritage sites on an Immersadesk™

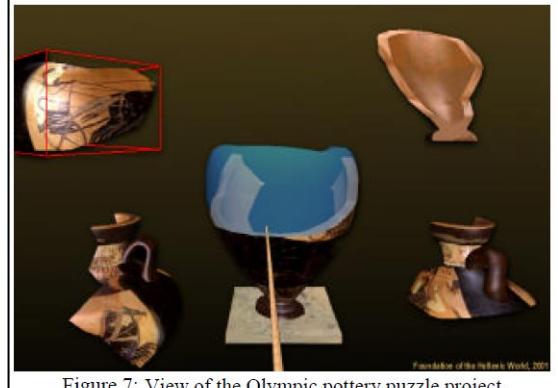


Figure 7: View of the Olympic pottery puzzle project.

**Figure 21 Some pictures form the VR exhibition by The Foundation of the Hellenic World.**  
*From "Reviving the past: Cultural Heritage meets Virtual Reality" by Gaitatzes, Christopoulos, & Roussou, 2001*

Another example of new technology being used in the tourism industry is AntarcticAR (Lee, Dünser, Nassani, & Billinghurst, 2013), a mobile outdoor Augmented Reality (AR) application that provides a virtual tour of Antarctica. The most common use of AR in mobile application takes place in the user's real world and adds content and experi-

ence to it. AntarcticAR on the other hand takes the user to a place far from their reality; it gives them the opportunity to get a virtual tour and experience Antarctica. Users can visit places of interest in the Antarctica or follow historic expeditions to the South Pole, as seen in figure 22. Virtual Reality (VR) technology allows users to travel within a simulated environment and a virtual tour gives an opportunity to visit places that are remote in space and time. In the earlier stages of the AR technology the system required a significant amount of hardware that the users had to carry, however mobile phones and tables have now become

powerful enough to run AR applications. This also gives the possibility to make AR-apps available for use in consumer market instead of the customer having to travel to the facility hosting the AR-application. In the beginning AR applications showed the users geolocated information such as icons and text labels overlaid on the real world, but today they are capable of visualizing 3D models registered in the real world (Lee, Dünser, Nassani, & Billinghurst, 2013; G. A. Lee, A. Dünser, S. Kim, and M. Billinghurst, 2012).

AntarcticaAR is a mix between an AR system and a VR system because it replaces significant portions of the real world with visual content. The app uses a semi-transparent white surface that is overlaid on the real ground to simulate ice and the horizon is bounded by white mountains creating a visual representation of Antarctica as seen in figure 23. Apart from the ice and the

mountains the user can see the real world as is where the user stands (Lee, Dünser, Nassani, & Billinghurst, 2013). When the app was tested by the public at the NZ IceFest fes-

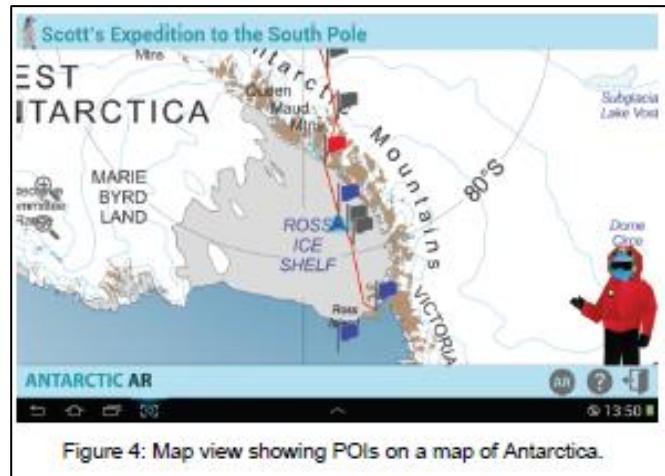


Figure 22 A picture from the AntarcticaAR-app. From Lee, Dünser, Nassani, & Billinghurst, 2013.



Figure 23 A screenshot from the AntarcticaAR showing the overlay at the bottom and the real world on the top. From Lee, Dünser, Nassani, & Billinghurst, 2013.

tival the response was very good, which shows that there is a potential market for these kinds of technology used in apps.

## 2.3.Similar projects and apps

There are a handful of tourism apps available, several of them in Norway, that are similar to the app made in this thesis. A few of these are introduced below.

- **Ålesund Brenner**

Ålesund Brenner is a Norwegian app that tells the story of one of the most known fires in Norway that took place in the city Ålesund on the west coast of Norway in 1904. This app lets the user relive the fire where 850 houses burned to the ground. The app guides the user to eight different places in the city and tells how that particular place got damaged through pictures, videos and text, see figure 24 (Ålesund Brenner, 2014). The app was developed by the local newspaper "Sunnmørsposten". This is a great example of how you can take local history and make it more accessible, interesting and give it a more modern presentation for the user. The editor of the paper said "*-This should be useful in the history teaching in schools*" (Sunnmørsposten, 2014).

- **Historypin**

Historypin, launched in 2011, was made by the not-for-profit company Shift. It can be used both as an app and a website. The app contains worldwide history in the form of pictures and text. The organization themselves say that the app "*was created to help people to come together from across different generations, cultures and places, around the history of their families and neighborhoods, improving personal relations and building stronger communities.*" (Historypin).

Historypin has won several awards for this project for history and technology, showing



Figure 24 Some pictures from the app "Ålesund Brenner".

that it is a good way to modernize the presentation of history. The app makes historical pictures from the whole world available to the user. The app works in the way that the user opens a map, where they can see small pictures placed on the map where there are photos to be seen. When you click on one of the pictures a new site opens that contains an overview of all the pictures available for that location. You can then click on one of them to see it in a bigger scale and also read the text. What is the most unique about Historypin is its AR functionality; there is an opportunity to get the picture as an overlay in the camera view, so that you can see through it, as seen in the example in figure 25. This gives the user an opportunity to compare the old picture to the current site.

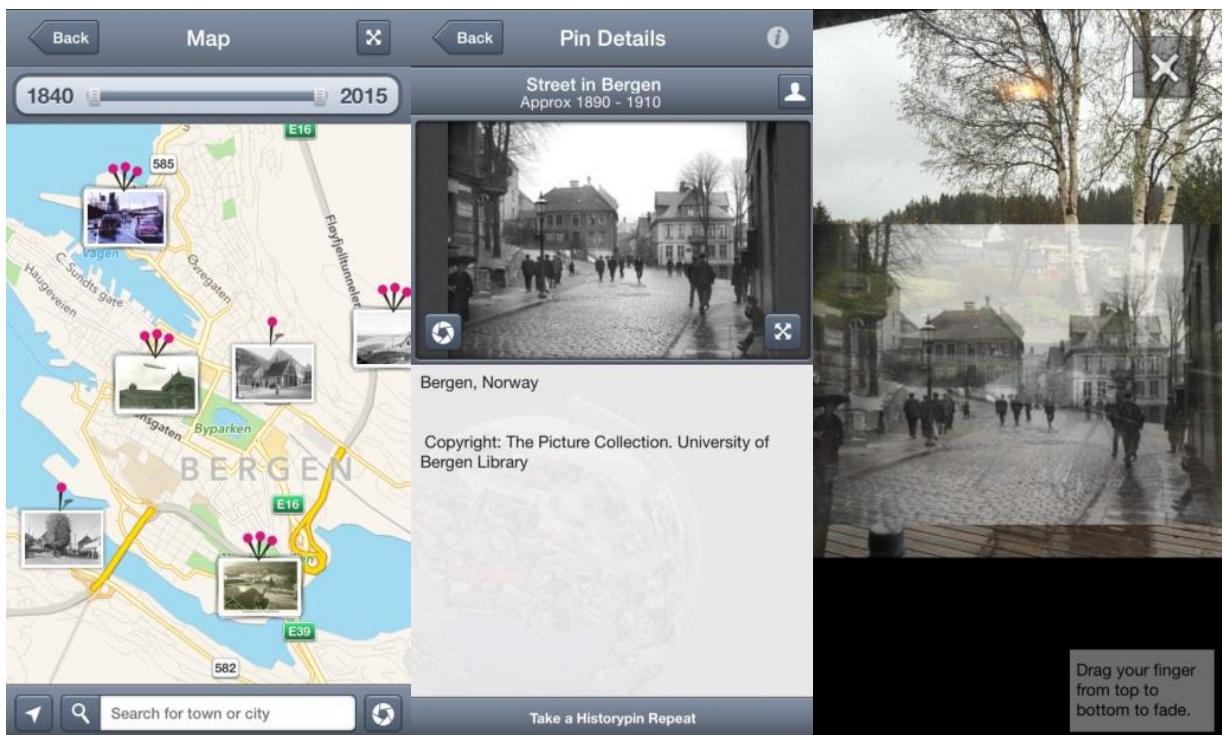


Figure 25 Some picture from the Historypin-app.

- **Valg 1814**

Valg 1814 is an app made by the Riksantikvar (Directorate of Cultural Heritage) in Norway and it shows the details about the very first election that was held in the country in 1814. This election gave the country its constitutional law and our national day the 17. May. The members who attended this meeting were chosen through several rounds of elections held in the congregations around the country. There were a different number of participants from each place, depending on its size. The app contains information about the representatives from each congregation and their way through all the round of

elections leading them this well-known meeting at Eidsvoll. The app shows the user a map, as seen in figure 26, with all the election churches and the representatives from the church. There is also a possibility to see the power of attorney the representative had with them to the election at Eidsvoll, both the original and its transcription. These powers of attorney are on the UNESCOs register of Norway's document legacy. This shows that it is also possible for the authorities to share some of their historic documents with the people of Norway in a modern and digitalized way.

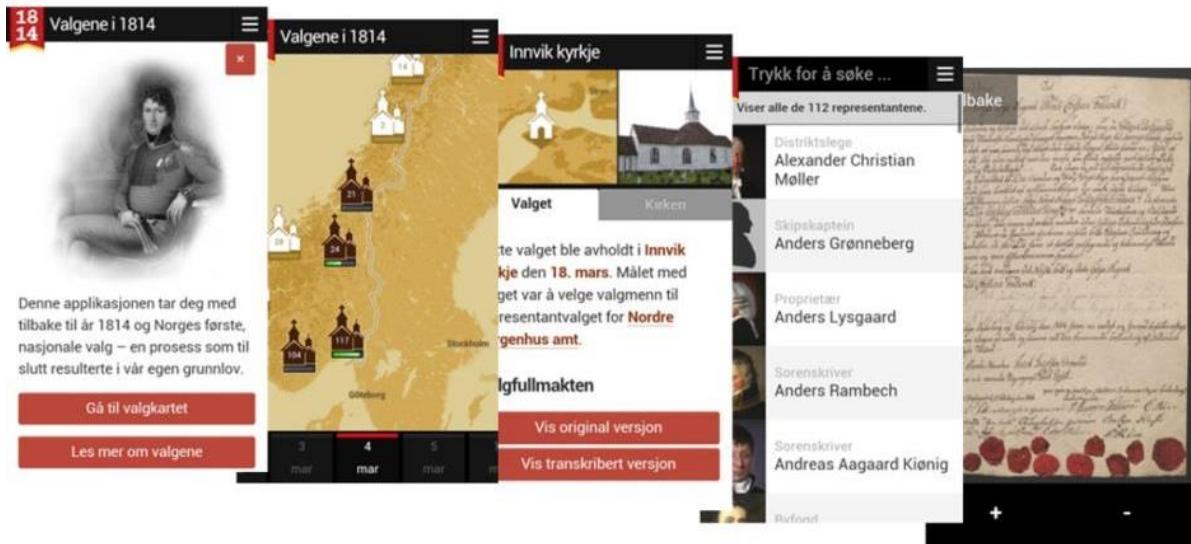


Figure 26 Some pictures showing the app Valg 1814.

- **Dingate Bergen**

Dingate Bergen is an app that shows historic details about some of the most historic parts of Bergen such as Bryggen and Vågsbunnen. The user can look at old pictures of houses and also compare them to how they look today, as seen in figure 27. There is also some information available about the people and families that lived in the houses. A collection of some of the sculptures in the city, museums, and churches are also available to the user. This is a Norwegian app developed with funding from the Norwegian government. On their website they mention that both in middle school and high school is meant that the students use digital resources in the history subject and they have an own page for school activities using this app. This is a very good way for young people to see a new and modern form of discovering history, both local and worldwide history.



Figure 27 Some pictures from the app dingate Bergen.

- **Premierløitnant Bielke**

Premierløitnant Bielke is a location-based learning game developed as part of a PhD thesis at the University of Bergen. The game is developed using SILO, a two-layered technological infrastructure for authoring and playing location-based games. This game uses local history from Premierløitnant Bielke's diary, a man who was in Bergen in the 1800s and also history from discussions with the City 73 Inspectorate for the Protection of Ancient Buildings (Byantikvaren i Bergen in Norwegian). The main

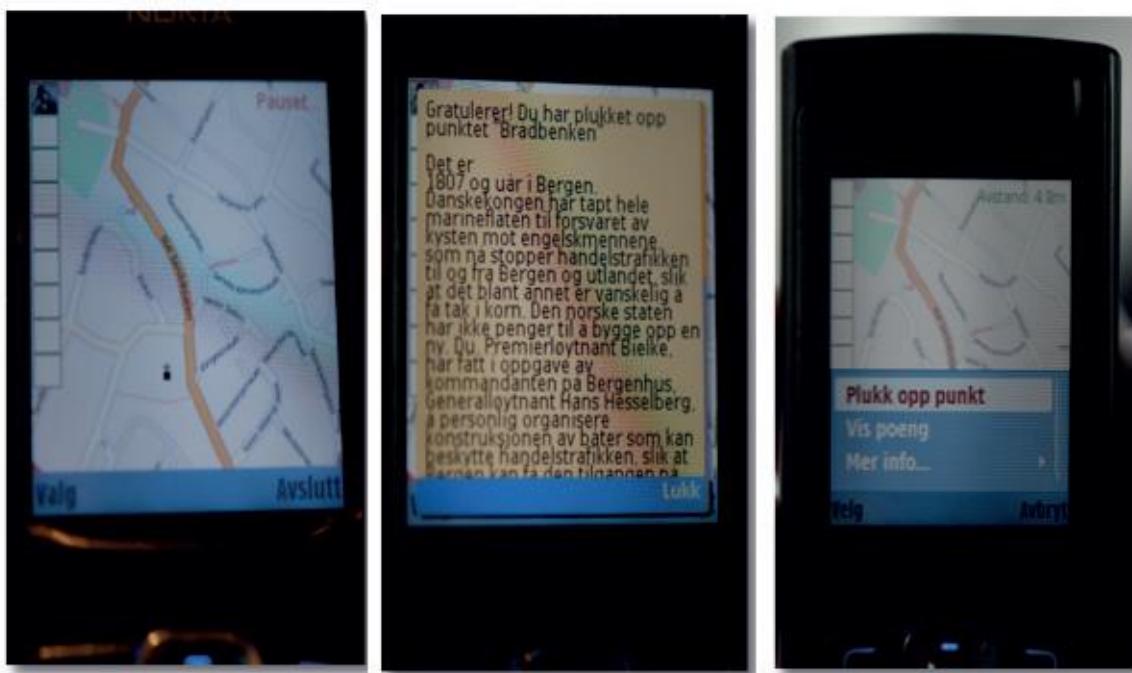


Figure 28 Some pictures from the location-based game Premierløitnant Bielke.

idea behind the game is to combine the locations that were relevant for the production of gunboats in Sandviken, Bergen, with a storyline, or set of quests, about the same locations in the form of a game to potentially provide an immersive and novel way of learning history (Wake, 2013). The goal for the player is to find locations relevant for the production of gunboats in the Bergen town area of Sandviken in the early 1800s. The game has several different locations which the user has to play thorough to solve the game. The first location the player has to find is the residence of the historical figure of the commandant of Bergenhus, General Lieutenant Hans Hesselberg, where they will receive the drawings for the boat and then continuing the game from there, as seen in figure 28.

All five mobile apps above showing historic content are good examples of what can be done with digitalizing and modernizing historical information. This can be good both for the tourist user group, but also for locals that are interested in history or schools in the local area.

## **2.4. Summary**

This chapter contains information about the different technologies intended for use in this thesis; the two main technologies are the AR technology and the location-based technology. There is also a section about the use of GPS-locations with high accuracy, another section about earlier work done using these technologies and a section about the use of the technologies in the tourism industry and the museum world. At the end of the chapter there is an overview of some of the apps available using these technologies.

### **3. Research methods**

The research is guided by the research question: *How can location-based and AR functionality be used to create a living experience of local history.* To answer this question an app will be developed that contains the materials from a local history book from a small fishing village on the coast of Norway. Several user testings will be undertaken during the development process, and the final prototype will be evaluated on location in the village. This chapter describes the research methods used to carry out the research.

#### **3.1. Development Methods Used**

Several different methods are used to support decision making, and develop and gather data from the user testings, and evaluation. When developing the app there will be used a development method called *the prototype method*. The *QOC* method is used to help decision making during the development process. Questionnaires, interviews, and think out loud are used during the user testing and evaluation phases.

##### **3.1.1. Prototype Model**

The development method called *prototyping* is used to develop the app. The word prototype can be described in many different ways. Two of them include:

*“A prototype is a model of a system or part of a system that will be developed. Its purpose is to demonstrate system features and to improve communication between the user and developer....”* (Doke, 1990, p. 172)

Sprague and McNurlin (1987) defined a *prototype* as “*an iterative process of creating quickly and inexpensively live and working models to test out requirements and assumption*”. (Peter M Ogedebe, 2012; Sprague & McNurlin 1987)

In simpler words a prototype is a physical model of a system or part of a system that intends to show the user how the system will work when completed. When using the prototyping method there are several stages in the process. Including: analysis, design, developing, implementation and design stages. These iterative stages are repeated until the final product is reached, see figure 29. You start with an analysis of what is needed, and then design and implement the system before testing. The test results are used to modify the analysis and design model and create a revised system prototype. The prototype is gradually modified until a satisfactory implementation is produced

(Oates, 2006).

Some of the advantages of prototyping are that it is not necessary to fully understand a problem before exploring tentative solutions (Oates, 2006). Another advantage is that it might be reassuring to the researcher to have a tangible implemented system fairly early on, even if it needs some modification. This is in contrast to, for instance, the waterfall model where you only reach the implementation stage on the end of the research period (Oates, 2006).

Oates also mentions that if you choose to work with the prototype model it is important that you make it clear in the report you write how the implemented solution emerged from repeated cycles of analyses, design and implementation and that there is a thought through design rational.

A prototype can be made in several different ways (Doke, 1990). He surveyed a number of large companies to give feedback on whether they used prototyping and if so, how they did the prototyping in their company. The result from this survey concluded in four different types of prototype methodologies: Illustrative, Simulated, Functional and Evolutionary, see figure 30. They each have different ways to show the user how the resulting system will operate and do its assigned tasks.

### ***Illustrative prototyping***

This way of making a prototype is carried out by using representative screens and reports to show the user how the system will work. It is a non-iterative process with the goal to en-

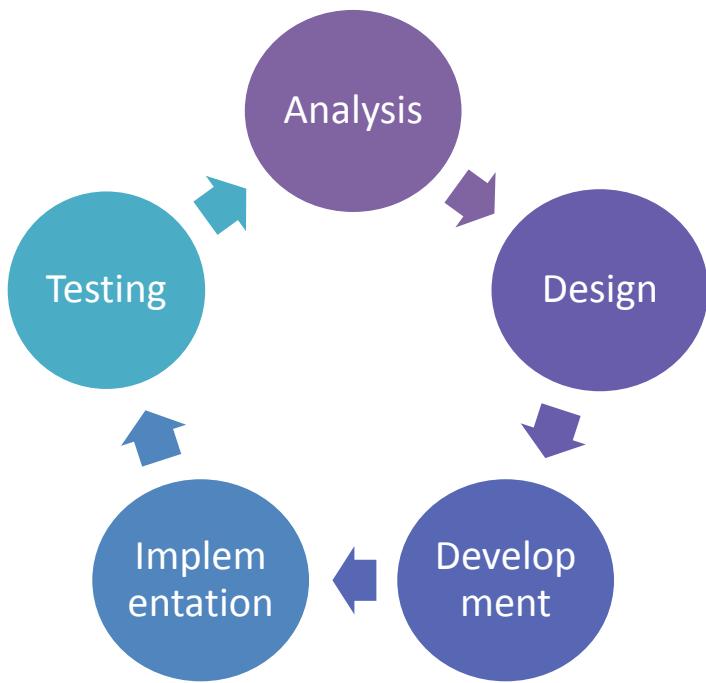


Figure 29 The prototyping process.

Table 2  
Prototyping Methodology Characteristics.

Methodology	Process	TLC Relationship	Use Data-base	Model Produced
1. Illustrative	sequential	supplements	no	disposable
2. Simulated	iterative	supplements	no	disposable
3. Functional	iterative	supplements	yes	disposable
4. Evolutionary	iterative or sequential	supplements or replaces	yes	operational

Figure 30 A table from the article by E. Reed Doke with the overview of the four prototyping methodologies.

hance the communication between the user and developer during the requirements definition and design phase. This method has little or no interaction.

### ***Simulated prototyping***

This prototyping method is carried out by making models that act as if they were part of the desired system. This is an iterative process because the models can be remade and enhanced, but in the end they can also be disposed of. This method supplements the requirements definition and design phase of the traditional system development life cycle (TLC). The models made here appear to function like part of the system but simulate the interaction with a database.

### ***Functional prototyping***

This prototyping method develops models that interact with a database but represent a more complete set of system functions. This makes the model able to replace large parts of the design phase in the TLC. They are still seen as disposable models because they typically lack the operational efficiency and completeness of a working system.

### ***Evolutionary prototyping***

This prototyping method is used to produce a real operational system. The models made here are not disposable and either uses a sequential process producing multiple models or an iterative approach that repeatedly refines a single method. These methods tend to replace the TCL entirely and these techniques are more appropriate for systems whose requirements are poorly defined.

All these four prototyping methodologies were being used in the 1980 and even earlier, so they are not new development methodologies at all. They are also still very much in use today although some may be named differently but the work they perform are still the same.

Evolutionary prototyping is used in this research because an app will be developed that also will be part of a final system that can be used afterwards. The prototyping cycle will be repeated three times before the final evaluation of the app. There will be three design and development periods and three implementations and user testings, see Figure 31. The first cycle focuses on the design of the app and the appearance of the pic-

tures followed by the first user testing. The results of the user testing will feed into the second cycle of app development where some reel content will be added. The second

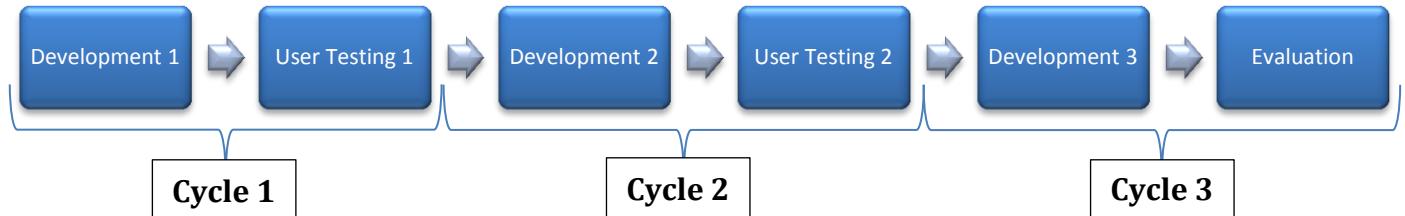


Figure 31 The evolutionary process of the Bjørnsundsapp.

user testing will have a focus on the material in the app, the text information about the houses and the pictures. Based on this feedback the last development cycle will be used to improve errors and do some last fixes to the app before the final evaluation of the app in a real-life setting.

Both the user testings use potential users who will give some valuable feedback. Oates (2006) writes that there is no need to fully understand the problem before starting to explore solutions to it, and this thesis explores solutions.

### 3.1.2.QOC

Question Option Criteria (QOC), is a decision-making tool that helps make and documents decisions in the development process. In the article MacLean, Young, Bellotti, & Moran (1991) talk about design rationale, which they describe as “A design rationale is a representation for explicitly documenting the reasoning and argumentation that make sense of a specific artifact” (p. 203). The reason that design rationale is so important in a design and development process is that it helps the designer show why the decisions made about the design were made. A product needs to be understood by many people both the ones making the product, the ones selling the product, those servicing it and the customers using the product. To help all of these people understand the product and its design, the developer can use a tool to show what options were available and why certain ones were chosen. Design Space Analysis (DSA) places an artifact in a space of possibilities and seeks to explain why the particular artifact was chosen from these possibilities. DSA “creates an explicit representation of a structured space of design alternatives and the considerations for choosing among them – different choices in the design space resulting in different possible artifacts.” (MacLean, Young, Bellotti, & Mo-

ran, 1991, p. 203). They write that an artifact is understood by the relationship it has to plausible alternative artifacts.

One way to create a Design Space Analysis is to use the QOC method, which displays the most basic concepts of DSA. As mentioned earlier this is a tool to help the designer make decisions and to document how they were made.

**Q** – Questions: which pose key issues for structuring the space of alternatives

**O** – Options: which are possible alternative answers to the Question

**C** – Criteria: which are the bases for evaluating and choosing among the Options.

**A** – Assessments: whether an Option supports or challenges the Criteria.

To use the QOC there is first identified a question, see figure 32. For example “which platform should be used?” Then identify some options, such as iOS Apple, Android or Web-based. Based on these options there are set some criteria for this options to try and meet, such as “known programming language shorter development time”, “possibility for testing in live environment (mobile) and “Free to develop”. Based on these options there will be drawn lines from the option to the criteria, using either a solid line or a dashed line. The solid line shows that it is a positive assessment and supports the criteria while the dashed line is a negative assessment and does not support the criteria. The option that only has positive / solid lines connected to the criteria is the solution that is the best and will be chosen, such as Android in figure 32.

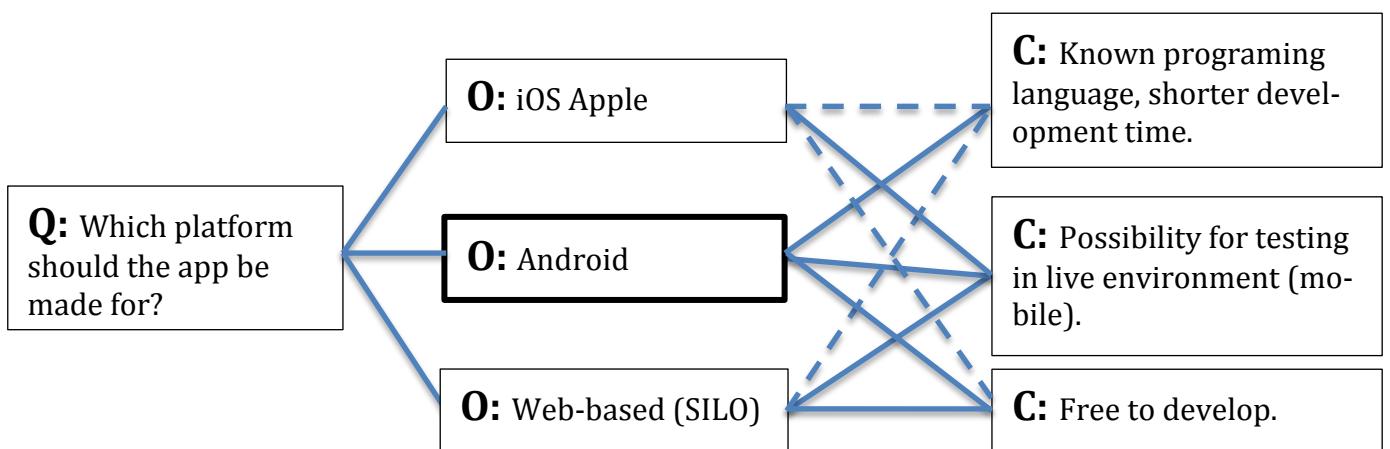


Figure 32 QOC example on choosing the operating system for the app.

### **3.1.3.Sketching**

Sketching is often defined as a tool to help designers put to paper the ideas they have in their mind. Sketching then becomes a useful way in which form, appearance, and character of artifacts that are as yet intangible may be transferred from the designer's mind onto some lasting medium. Sketching can also involve reading and interpreting the sketch, explaining it and eventually rephrasing it. Sketching is hence not simply an externalization of ideas already in the designer's mind, but on the contrary a way of shaping new ideas (Fallman, 2003).

There are several different ways to do sketching, with the most traditional being with pen and paper. In the later years it has also become more and more common to use computer programs made for sketching. Both of these methods will be in the design process. First a hand drawing on a piece of paper will be produced and afterwards a program called Pencil will be used to make a more professional sketch. The sketch will show how the app and its working are envisaged.

## **3.2.Data Gathering**

The data gathering will be carried out in several different ways. Among the data that will be collected is feedback during the development process, both regarding the design and user functionality of the app. Furthermore data from a final evaluation of the app and its use in the local history area will be collected. The methods to be used in the data collection are reviewed below.

### **3.2.1.User Testing**

User testing can be done in many different ways; you can have a paper based model, a semi-working model, or a real life prototype. A real life prototype will be developed in this thesis.

During development an app will be tested with potential users. The user test will focus on the different functions and will be followed by a questionnaire. This will be carried out during each development cycle but each of the user testing will have a different focuses.

In the first two user tests there will be approximately five testers, as the Heuristic Evaluation rules (Nilsen & Molich, 1990) suggest this. They performed a number of heu-

ristic evaluations where they researched the conclusion that with one to five evaluators the number of usability results grows rapidly, but reaches the point of diminishing returns around the point of ten evaluators (Nielsen & Molich, Heuristic Evaluation Of User Interfaces, 1990).

The thinking aloud method will also be used. This is a method where the testers speak Aloud what they are thinking during the testing. Nielsen (1993) described this method, *"In a thinking aloud test, you ask test participants to use the system while continuously thinking out loud — that is, simply verbalizing their thoughts as they move through the user interface."* (Nielsen, Thinking Aloud: The #1 Usability Tool , 2012). During both of the two user tests the users will be asked to try and remember to verbally show what they are thinking and what problems/ errors they run into. These will be audio recorded or written down.

### **3.2.2.Questionnaire**

A questionnaire is a pre-defined set of questions, assembled in a pre-determined order. Respondents are asked to answer the question, thus providing the researcher with data that can be analyzed and interpreted (Oates, 2006). There will be in total three different questionnaires during the process. Two of them will be given in the development cycles and the final one at the end of the process, as part of the evaluation of the app. This final one will be more comprehensive than the two previous ones. The two first questionnaires will be a mix between a self-administered and a research-administered questionnaire, since I most likely will be present but I will let the testers answer the questions themselves and I will be available to answer any questions the tester have regarding the questionnaire. The last questionnaire will be a self-administered one, where the questionnaire is handed out to the testers after they have tried out the app. Then they will fill out the form by themselves and give it back to me after they are done.

It is important to try and make sure that the questions will generate data about the concept being studied (Oates, 2006). In the two first questionnaires there will be approximately five open questions, while in the questionnaire for the final evaluation there will be between ten to fifteen questions, both open and closed questions. There will also be a mix of factual data and opinions gathered in the evaluation questionnaire.

The questionnaires will provide valuable feedback to the development of the app.

### **3.2.3.Interview**

Interviewing the testers of the app will also be a part of the evaluation stage of the development process. Approximately five of the testers in the evaluating stage will be interviewed. The reason for having these additional interviews after a tester has filled out the questionnaire is to get some more details about their experience with the app. It will give an option to explore emotion, experiences or feelings that cannot easily be observed or described via pre-defined questionnaire responses (Oates, 2006).

The interviews will be semi-structured following an interview guide. It is not clear if testers will be interviewed individually or in a group. This will depend on the situation on the evaluation day and on the time schedule of the interview objects. The interviews give the tester a chance to say more about the experience they had with the app then they took time to write down.

### **3.3.Summary of work**

During this thesis several research and development methods will be used. The *prototype methodology*, with user testing at three different times during the development will be used. In the development process the two methods *QOC* and *sketching* will be used make design and functionality decisions. The two first user testing will include the tester trying out the app while using the *think aloud method*, before filling out a small *questionnaire*. Based on the recommendation in the *heuristic evaluation method*, five testers will be used during the two first cycles of testing. For the final evaluation of the app approximately ten to fifteen testers will be used. They will answer a larger *questionnaire* and an *interview/group interview* will be conducted at the end of the evaluation process.

## 4. First Iteration - Design and Development

This chapter describes the first of three development cycles, as seen in figure 33.

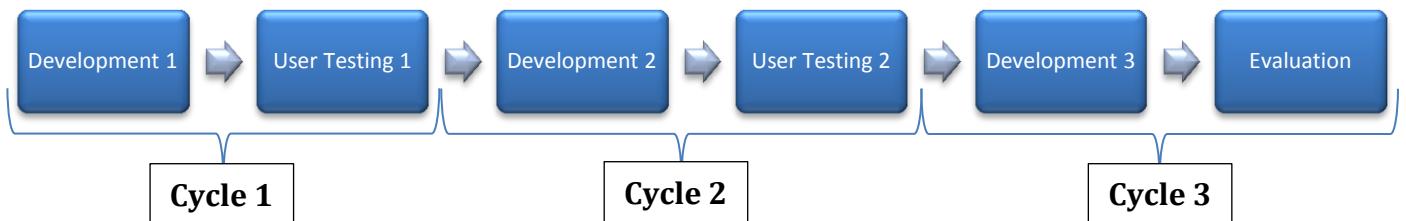


Figure 33 The development process.

The development process consists of three cycles, each containing a design and development phase and a user testing, see figure 34. The cycles all build on each other, where the first version of the prototype developed in cycle 1 will be further developed and improved in cycle 2 and 3, based on feedbacks from the user testings. The first two development stages are followed by user testings, and the third with an evaluation of the final prototype.

The first cycle has its main focus on the user interface of the app, where functionality and ease of use are important factors. The second cycle has its main focus on the content of the app and also how the AR function is perceived by the users. Here it will be important to find an appropriate amount of text to show the users at each point of interest. Also how the users experience the AR-function in the app and how they want to be made aware of the AR-option will be important. In the third cycle the focus will be on finalizing the app making it ready for the final evaluation.

This first stage documented in this chapter consists of design and development phase

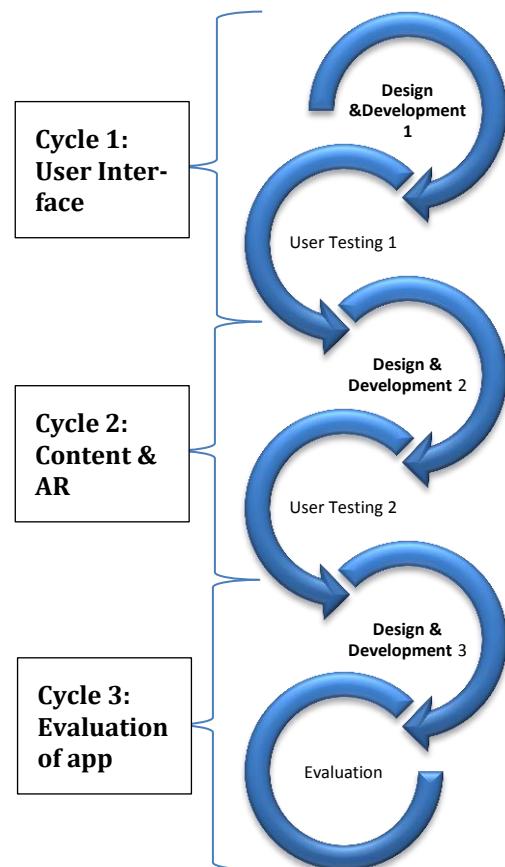


Figure 34 The development process of the app.

leading to the first prototype of the app. The chapter begins with some information about the service available today.

#### 4.1. Current service

The current service available with the same historic information today is found in the book "Bygdebok for Fræna, Gard og Slekt 1" published by the author Arve Hammerøy in 2009, see figure 35. The book consists of over 750 pages of local history; information about Bjørnsunds history, the dialect spoken, local fishing grounds and also local nicknames of known sites around the islands. There are also facts about important points in the history of the islands and the way of living throughout the times. A complete register of all the island's land and title numbers, including all the existing information about the houses, their owners and residents. A lot of old pictures, both of the houses and life on the islands, can also be found in the book. At the end of the book there is a complete register of all the names mentioned in the book, making it easy to look up a person and finding the right place in the book with information about them.

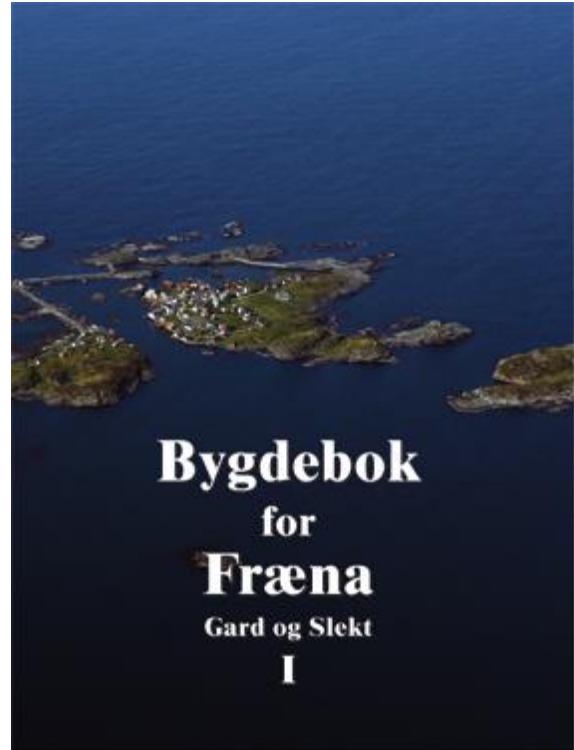


Figure 35 The cover of the book used as source in the app.

A digital version of this book does not exist today, only the hard-cover edition, and there are no plans to digitalize the book as of now, leaving people having to flip through the pages to find what they are looking for. Using the book outside might not be a good option either so having the content, or at least some of it in an app, could be a clever way of having the data available when out walking around the islands. Having the option to view the photos and get some general information of the houses could help people to gain more knowledge of the island and potentially their own history.

## **4.2.Prototype 1: Design & development**

This section describes the development process, system requirements, design decisions, and the development leading to the first version of the prototype.

### **4.2.1.System requirements**

The system requirements of the app were based on the two technologies to be used in the app; location-based and AR-technology. The two technologies were chosen based on not having many existing apps with both technologies. When searching for it there was found some apps using the location-based technology and some using the AR-function, but few using both the location-based and the AR-technology together. Combining these two technologies in an app about local history led to these requirements:

- A map showing the position to the user in regards to the points of interest on the island, updating the position when the user moves around.
- Showing several different types of interest points on the island; the houses, the monuments and the light house. Using text and picture to provide historic information to the user.
- An option to compare the house as is today to a picture of how it use to be, by using the AR-function and adding the old picture as a layer in the camera view.

To achieve these requirements the two technologies will be used alongside content from the book, “Bygdebok for Fræna, Gard og Slekt 1” (Hammerøy, 2009).

### **4.2.2.Platform Choice**

Before starting the development process there were some main decisions that needed to be made, the largest one being the platform on which to develop. First there needed to be made a decision on whether to develop the app myself or using SILO, a program developed in a PhD project at the department for making location-based games. This could be used and adapted to this project. SILO had been used to make a game using location-based positioning. The location-based functionality in SILO could be used to make an app and add the location of the houses and showing information and pictures. I was given access to the program code of SILO and the website where the games are made. Both options were given a lot of consideration, but in the end the decision fell on developing the app from scratch myself. The reason for this was that there was a bigger possibility for understanding how the technologies function when imple-

menting them in an app myself, having the opportunity to shape the app from scratch, and also that there would be a larger learning experience this way.

When this first and biggest decision of the project was made, the next decision that needed to be made was which operation system to make the app for, since making an app for several systems would take too much time. The choice was between making an app for Android or iPhone. To help make the decision the QOC method, see chapter 3.1.2, with a QOC-diagram was used, see Figure 36. This QOC-diagram includes both the SILO alternative and the option for iPhone and Android. The option fell on developing an app for Android, with the conclusive option being the knowledge of the programming language beforehand. This decision was made even though the developer is an iPhone-user. This was not a problem when having two borrowed android phones available for live testing. I also used the QOC-method underway on some of the design challenges, see Appendix A.

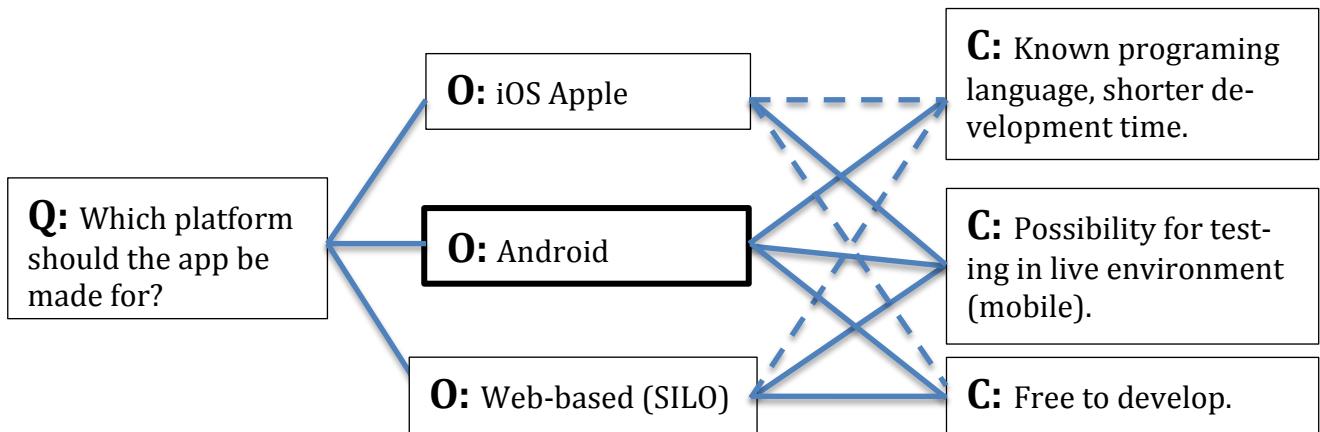


Figure 36 QOC example on choosing the operating system for the app.

When developing for Android the programming language Java was used with the program Android Studio. This is a free license program made for app development for Android and was fairly easy to learn and use. For testing out the app during development an emulator was used in the beginning, but later on when the GPS-locations were needed, the two borrowed Android phones were used to do the testing. The phones were a HTC Sense and a Samsung Galaxy S3, giving the chance to experience the app in different version of the Android operating system and also in two different screen sizes, as seen in figure 37 on the next page.

#### 4.2.3.Sketching Designs

The first stage of the development process was carried out by drawing some sketches of the design of the app. These were of how the app had been imaged when working on the idea for this thesis. They were first made by hand drawing and then using the sketching program, Pencil, which is an open-source GUI prototyping tool, available for all platforms. The program uses built-in shape collections to make mockups. The result of the sketching is displayed in the figure 38.

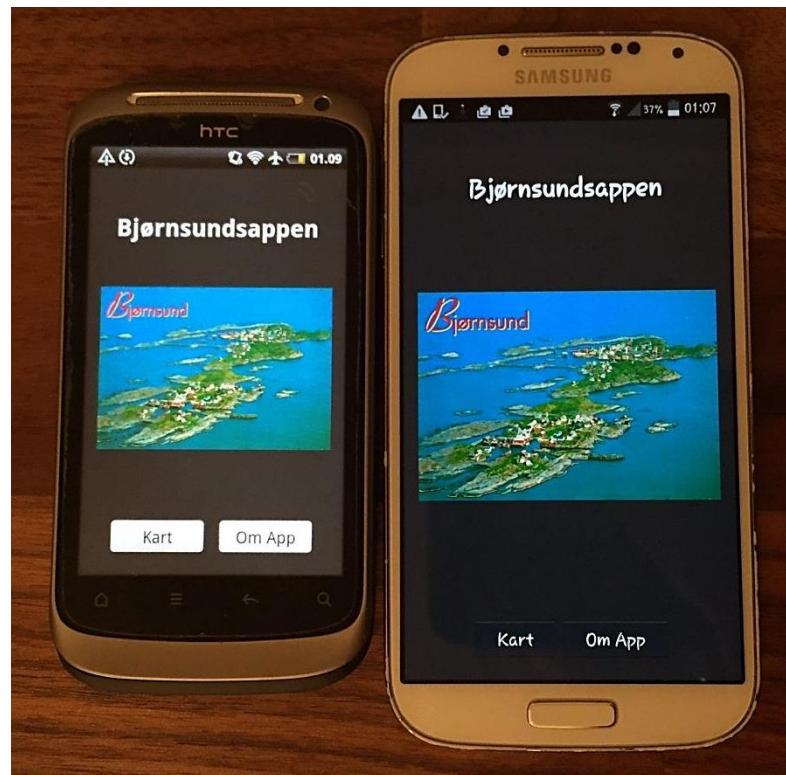


Figure 37 The two phones used during testing of the app.

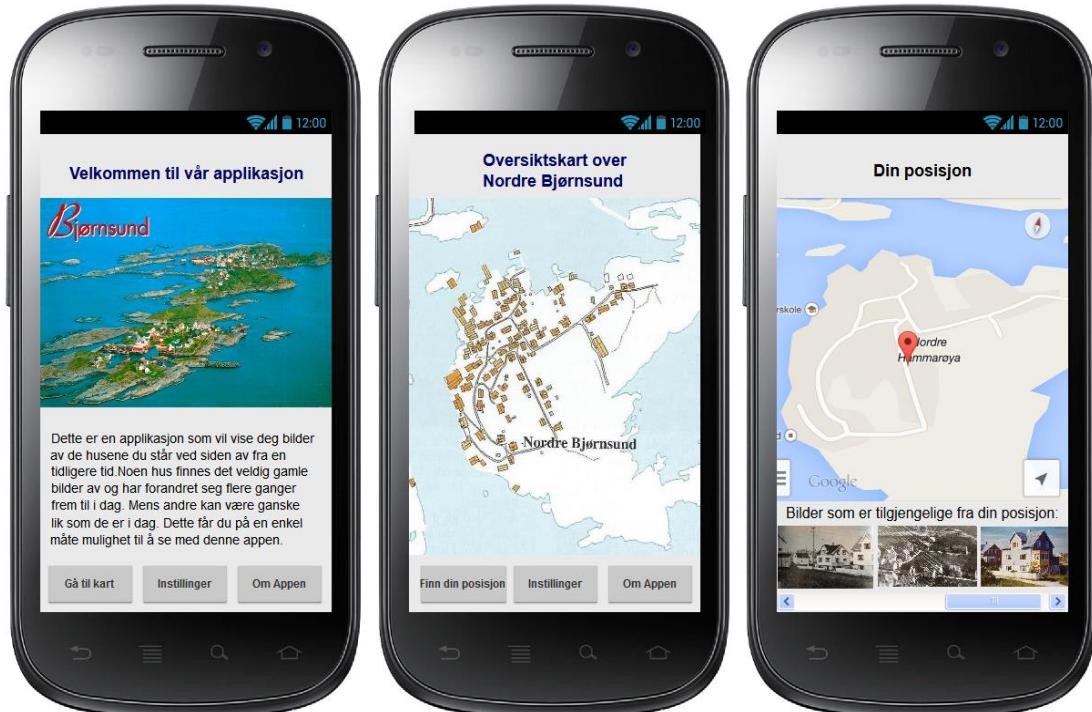


Figure 38 The sketch made early in the development process.

Based on this sketch the design in the prototype was developed. When drawing the sketch and adding the user interface, it made it easier to get an understanding of what would work well in the interface and what would have to be done in a different manner. The sketch was also a help when the development started with already having an idea of what elements was needed in the interface.

#### **4.2.4.Design and development**

The first prototype of the app began with making the app from scratch based on the sketches made earlier in the research process. The first version of the prototype was developed in Java in Android Studio. It started with adding and designing all the necessary windows and their elements. There are a total of three different windows in the app; the home screen, the about page and the map page. Functionality of the windows and the elements was next, such as the buttons in each page. Content was added to the about page and working on getting the right amount of text necessary for the user to know about the app. Also in this first prototype the google map was added to the map page, displaying the map and zooming into the user's position. Then the location-based technology was added showing the user's position and updating it when the user moved around. There were some adjustments that needed to be made to location technology during the further development.

The three different pages, the home page, the map and also the about page, can be seen in figure 39. The home page consists of a headline, one picture of Bjørnsund and also two buttons. The button "Kart" takes the user in to the map page and the second button "Om App" takes the user into the "about" page. On the "about" page there is a head line, some text and a picture of Bjørnsund. The text gives information about what the app contains, how it works and also that it is a prototype developed as part of a Master thesis. The map page contains the google map that in the next cycle will be developed to show the points of interest. At this stage the map starts searching for the user's positions when entered, and it gives a message at the bottom of the screen about the status of this feature. It first lets the user know it is searching for a position, and then it gives a new message when the position is retrieved.

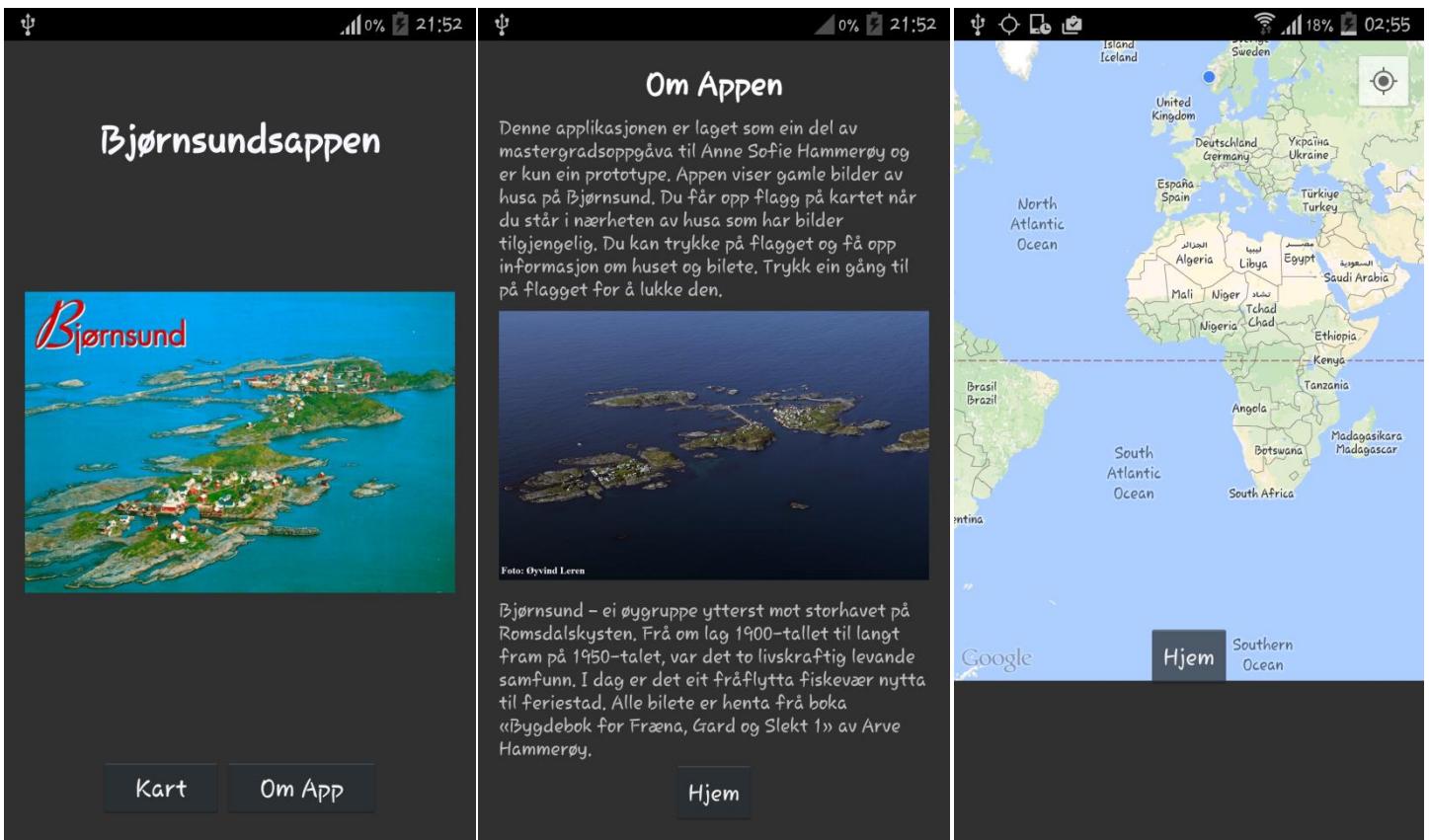


Figure 39 Screenshots of the first prototype of Bjørnsundsappen.

There were also added the function of showing the pictures of the house. There were two different ways of displaying the pictures, see figure 40, one was in a gridview in its own area below the map that would contain the picture available for the house and the other one was on the map a small icon next to the flag, marking the house location.



Figure 40 Two examples displaying the two different ways to show the pictures of the houses.

Examples of both were made to be used in the first user testing, in order to get some feedback on which is preferred.

### **4.3.The first user testing**

The first user testing was conducted at the University of Bergen with five invited testers. The focus in this user test was the design and user-friendliness of the app, and there were some predefined points that would be the topic of the test. The testers tried out the app while using the think aloud protocol method and at end answered a questionnaire.

#### **4.3.1.Participants**

To help test the app in this first user test five people were invited to help with the conduction. Four of the testers were fellow students and one acquaintance from outside University. On the day on the test, one person was sick, resulting in four people completing the user test. As seen in table 1, three of the testers were female and one male. There were 3 skilled testers in the area of information science and one being an average smartphone user. They were all in the age between 20 – 30 years old, giving a young test group for the first user testing.

<b>Number of tester</b>	<b>Skilled / not skilled</b>	<b>Sex</b>
4	3 skilled / 1 not skilled	3 Female, 1 Male

**Table 1 Details about the tester in the first user testing.**

#### **4.3.2.The test**

The test was executed by having the testers, one by one, come and trying the app and also giving some feedback. Each test took about half an hour. Each tester was given a smartphone with the app. The concept of the app was explained to the tester, including what they could expect at this stage of the development. A problem that had not been anticipated that day was that the phone could not update the GPS-signal, most likely due to the test location at the University. The location was a brick building that blocks the GPS signal. The testers tried the different functions in the app and made comments and came with feedback, which were both written down and recorded. At the end of the testing each of the testers also replied to the questionnaire. The questionnaire, see Appendix B was about general impression of the app and also the design.

### 4.3.3.Data Collection

Gathering data during the testing was done in three different ways; observation, think aloud which was digitally recorded, and questionnaire. Before the test started the tester was asked if it was okay that the session was recorded. While the tester tried out the app they were asked to speak aloud what they were thinking about how the app was to use, to give insight into their thoughts when using the different elements in the app. Throughout the test the test-holder observed the testers when using the app, to see if there were any obvious problems with the use. At the end of the user test the testers were asked to fill out the questionnaire. They were also asked an oral question in addition to the questionnaire, about how they preferred the pictures to be shown, after they had seen both examples in the app. Several of the testers used the opportunity to switch between them and seeing the difference while answering.

### 4.3.4.Results

Despite some of the problems with the GPS-signal good feedback was given. As the focus was on the design and interface the GPS-problem was not crucial for conducting test at this stage. Some of these problems identified by the four testers include:

- **Home-buttons in the app.**

On all of the screens in the app there have been used home buttons, which returns the user to the home/ start-screen. iPhone users are used to a home button in iPhone-apps, but android users may feel that they are in the way. This because on the iPhone there is only one button which takes the user all the way out of the app and to the main screen on the smartphone, see figure 41. On an android smartphone there are three/ four buttons (depending on the model), where one of them takes you one step back in the app, see figure 41. This would replace the action that



Figure 41 An iPhone with the button that takes you to the home-screen and an Android-phone with the back-button on the bottom.

the home-button in the app does. All the testers were asked if they felt the buttons were necessary or if they were in the way. Three of the four testers were iPhone-users, and the forth an android user. The feedback was the same from all the iPhone users; they felt that the home-button was necessary and did not know that they could use the “back”-button on the phone. The one android user did not feel that it was necessary, but it was not in the way either. The conclusion was to keep the “Home”-buttons in the app.

- **How to display the pictures**

Feedback on how the users wanted to see the pictures that were available for each house was important. Two different ways to display the pictures could be seen by the testers. One of them was on the map in the same place as the house, and the second was at the bottom of the screen in its own area. The last option might make it a bit easier to notice and gives a cleaner design. After seeing both versions, the testers were asked which they preferred. The testers all preferred the second option where the pictures were in their own area, as seen in figure 42.



Figure 42 The chosen options for displaying pictures in the app.

- **“About” the app page**

The “about” page can be accessed from the start page, on this page some information about the app, the place Bjørnsund and its history is displayed, as seen in figure 43. There is also some information about how to use the app. This is an optional page for the users to view and feedback about if it should be obligatory for the user to see was desired and also on what they would expect from a page like this. A question that was not on the questionnaire was asked all the testers to hear their thoughts on this; what thoughts they got from seeing the “about” page, if it was boring, interesting etc. and if it was necessary to have a page like this at all on the app. The feedback was that some felt it was nice to have the opportunity to read such a

page, while some felt it not so interesting and would probably not open it at all. Thus it was decided to keep the page, but not force the user in on it the first time they used the app.

#### 4.4. Implications for the Prototype

Following the first user test and the result from it, there were a number of changes to be made to the prototype. A decision to keep the home buttons was made, based on some of the tester expressing the need for it and one not feeling the need but not minding it in the app either. The decision about what way of displaying the pictures of the houses was also made, having most of the tester preferring the version using the gridview beneath the map. This gives a cleaner and more structured interface. The last change that needs to be made was regarding the “about” page; based on the feedback from the testers that most of them wanted it to be an option to have in the app, but not that they automatically were sent into the page on their first use of the app.

The result of the first user test was useful and gave answers to all of the questions about the interface.



Figure 43 The about page in the app. The text is in Norwegian.

## **5. Second Iteration – improving the prototype**

This chapter talks about the implementation made to the second version of the prototype, based on the results from the first round of user testing. The second user testing will also be discussed. The focus in this user testing was the content of the app and the use of AR in the app.

### **5.1. Second Design & Development cycle**

The second prototype was improved based on the results and feedback received from the first user testing, and on new design decisions based on the content. The results from the first user testing formed the bases for this further design and development. It started with implementing the improvements based on the result and then the further development to add new functionality related to content.

The improvements made based on the first user testing result were the decision to keep the home buttons on all the screens in the app. The testers from the first user test gave an impression that these were needed to navigate out from the current site and back to the start page, even though there is an own button for this on android phones. The second improvement made was how to display the pictures available for each house. The results from the users showed that using a gridview in the bottom of the screen below the map gave a more clean and structured interface. This method was kept in the app, while the other option was removed. The final improvement was the decision to keep the “about” page in the app, but not to force the user to enter it the first time the app was in use; thus, it is kept as an optional page for the user to view.

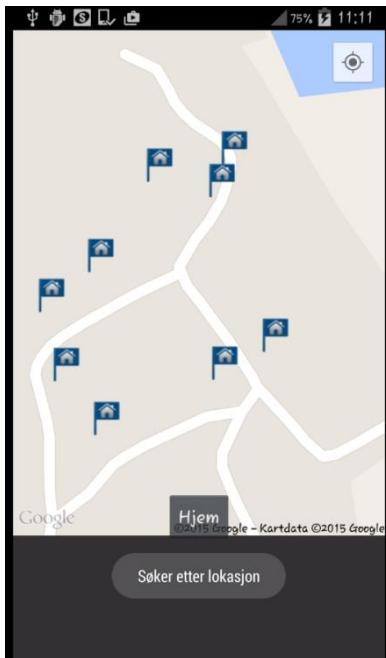
Further development on the app was made by adding the information about all the points of interests on the island. Such as the different houses, the “Isbjørnen” monument, the “Damå” monument and also the lighthouse. The position of the houses were collected from the online map<sup>3</sup> by Kartverket, where you had the opportunity to choose which map datum to use when extraction a GPS-location. The one used was EUref89. The information was added by having a function in the code to read a text-fil, see figure 44, with all the information to be displayed. The information two-dimensional array in the code, where the name, title number, the latitude and longitude and the text was kept.

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<sup>3</sup> <http://www.norgeskart.no/?sok=Bj%C3%88rnsund#13/84885/7000025/+hits>

**Figure 45** The text-file containing all the information about the points of interest.

When the user enters the map page, the app immediately starts searching for the user's position. Once this is found it runs through the array, using the GPS-location to compare the distance between the position of the user and of the points of interests. If the distance is beneath a set distance limit, the points within the limit are shown on the map with a flag, see figure 45. The limits were set to 50 meters on the houses, 500 m on the lighthouse, giving the user an option to see it from Nordre Bjørnsund and not having to walk out to the island the lighthouse is on, the limit of "Damå" was set to 250 m, making it available from the closest road, and the limit on "Isbjørnen" was set to 200 meters. When the user presses a flag, an info- window with the information about the interest point is shown and the pictures available are shown in miniature size in the gridview at the bottom of the screen. An example of this and also the original information found in the source book can be seen in figure 46 and 47. As seen on the two first of the original pages on this house from the book, the rest can be seen in Appendix C, there is a lot of information available, and only some of it is used in the app at this stage. The name, land number, the pictures and also a summary of some of the text information is used in the app.



**Figure 445** The points of interest within reach.

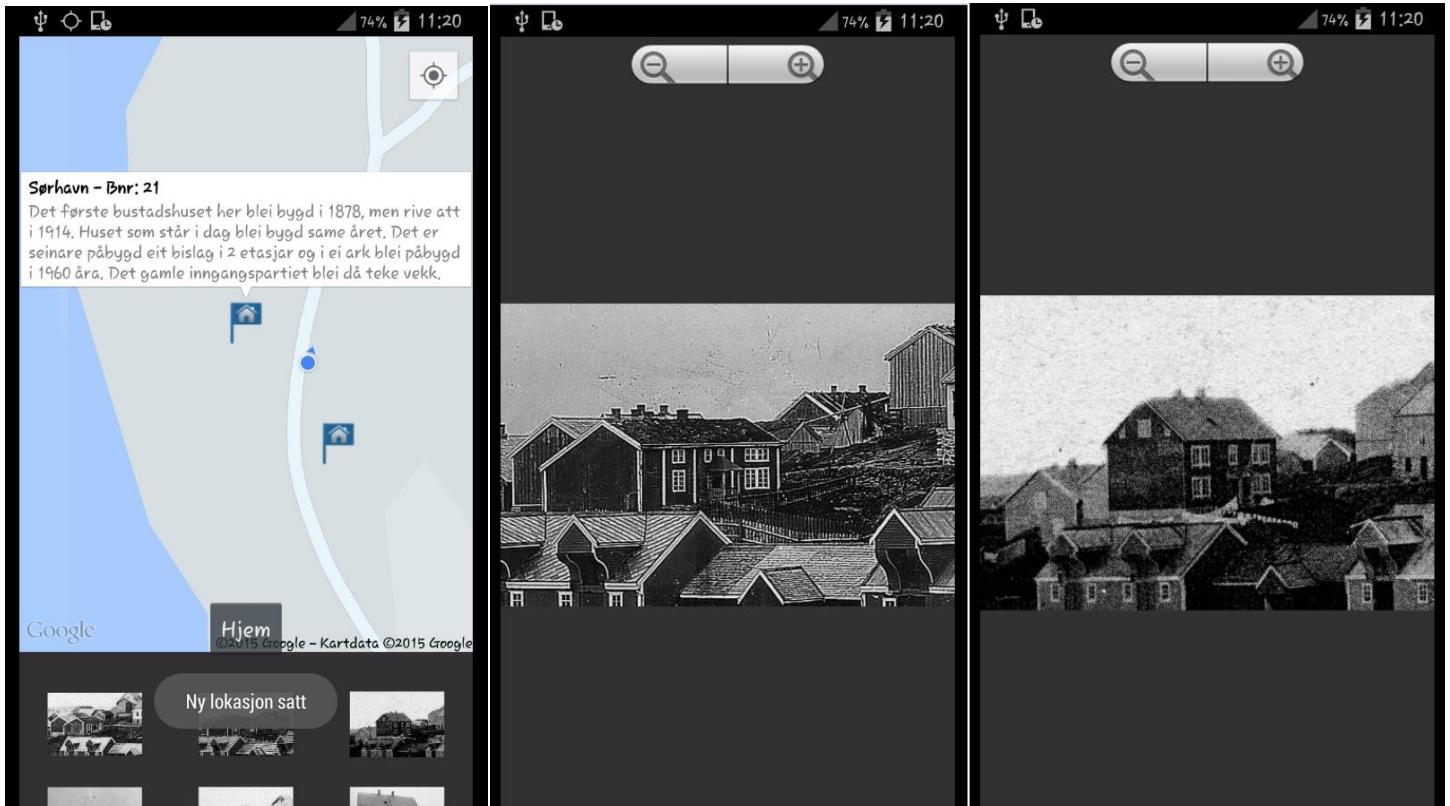


Figure 46 Screenshots from the house Sørhavn.

## Sørhavn, bnr. 21

Ut frå bnr. I den 1/11 1889

### Skyld

Frå 1889: 5 øre.

### Frådelt

Frådelt: 1987: 441,1 m<sup>2</sup> til bnr. 123.

### Plassering

Eigedomen ligg på vestsida av Nordre Bjørnsund på «Rør'n». Eigar hadde rett til fiskeberg på Rundholmen.

### Bygningar i dag

Eit våningshus oppsett i 1914 av pløgd tømmer. Det har 2 etasjar og loft. På nordsida er det påbygd eit bislag i 2 etasjar. Huset er tekt med skiferstein. På framsida blei det kring 1960 påbygd ei ark like høg som huset. Det gamle inngangspartiet blei då teke bort. Eit uthus med skrātak av bølgjeblekk. Det innneheld vedhus og wc.

### Tidlegare bygningar

Eit våningshus av tømmer med torvetak oppsett i 1878. Det var 19 alen langt, 11 alen breitt og 5 1/2 alen høgt. Det inneholdt 2 stuer, kjøkken og gang og sperreløft. I kjøkkenet var det skorsteinspipe og i stuene kakkelomn. Til nordre langvegg var det tilbygd ei sval. Nokre år seinare blei det bygd ei sval til vestre endevegg som blei innreidd til kammers.

Dette huset blei rive i 1914 for å gje plass til eit nytt våningshus.

I 1892 blei det nedafor huset oppsett eit naust med ein steinmur framføre. Ved sidan av ein treplattning med ein frittståande heiseinnretning (vinnje). Naustet blei rive i 1912, og det blei oppsett ei brygge i 2 etasjar på same tomta. Bryggja er fleire gonger påbygd. Ho er frådelt og har bnr. 123.

### Brukbarar

Iver Andreas Sæmundsen (Iver Andreas på Rør'en) f. 1/10 1853 på Nordre Bjørnsund, d. 30/4 1887, son til Sæmund Andersen og Lovise



Våningshuset til Sigurd Skarsbø på Rør'en som blei bygd i 1914. Foto: Ivar Hallsteinsen.



Jon Edvard Paulsen (Jon på Rør'en f. 1867 kona Siri Anna Olsdt. f. 1850 og dottera Inger Anna f. 1891.

Marie Augustiniusdt. (sjå bnr. 22). Han omkom saman med broren Adolf og Johan Eriksen Groven, dei hadde vore ute på Ersgrynne og sett line. Dei skulle segle inn sundet mellom småskjera ved Knubben og inn ytste Buasundet. Sundet bratt igjen og båten, torsingen til Iver Andreas, bratt full. Fjerdemann om bord, Johan Johansen (på Rør'en) berga seg i land på eit av småskjera. Gift 7/7 1877 med Siri Anna Olsdt. Dale f. 25/5 1850, d. 27/3 1921 av hjartelamming i Molde, d. til Ole Knutsen og Kristi Pedersdt. Dale i Frana, gnr. 48, bnr. 5. Ho gift 2. gong 17/5 1891 med Jon Edvard Paulsen (Jon på Rør'en) f. 22/9 1867 på Håset i Frana, d. 14/7 1963 i Molde, son til Paul Ingebrigtsen og Ingeborg Jonsdt. Haaseth (Håset) (sjå Frana bind III, side 195).

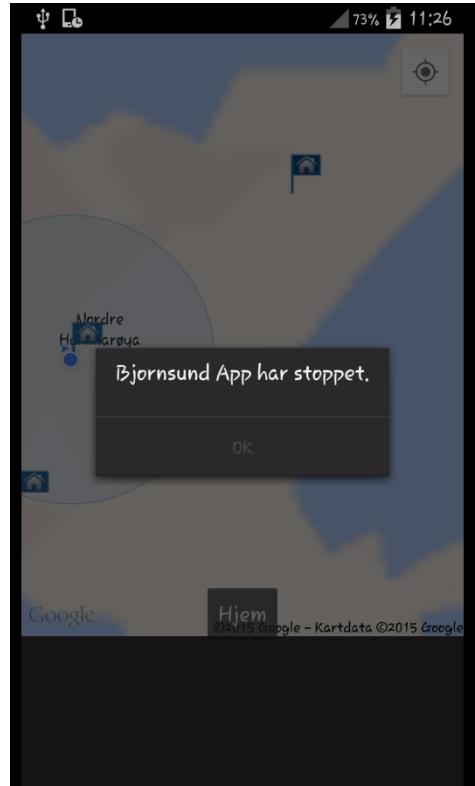
Dei flytta i 1916 til Molde der dei busette seg på Øvre Bekkevold.

Iver Andreas Sæmundsen fekk festeseddel 23/7 1880.

Siri Anna Olsdt. fekk skjøte på eigedommen den 15/8 1891 for 200 kr.

Figure 47 The two first pages in the book with information of the house Sørhavn..

The AR-function was also scheduled to be added during this development cycle. Research about how this was done, was started and some good sources were found. Unfortunately at this point in the development, an unforeseen problem occurred, putting the development of the AR-function on hold. This was a memory problem, as a result of the distributed heap-size being filled up. This happened every time a point of interest was opened and the pictures were entered to full size. After one to two pictures the app would terminate and give an error message that it had stopped, a screenshot of this error can be seen in figure 48. The app could not handle all the large images the user wanted to see. This was a major problem preventing the user to use the app for more than about 10 seconds after opening a full size picture. It was also very irritating having to enter the app from the beginning several times when viewing more than one house. Several solutions were tried to solve this problem, one being to put some of the largest tasks in the code into separate threads. By the time the second user test was planned, the memory problem had not yet been solved. This resulted in not having an own AR-function to show the users in the test, and having to find another solution for this part of the user test.



**Figure 48** The error-message showing before the app terminated.

## 5.2.The second user testing

The focus on second user testing was on content in the app, the information and picture of the houses, and also the AR-functionality. This test, same as the first user test, was performed in Bergen. With the app using location-based technology to determine whether to show the points of interest or not, and those points being at Bjørnsund, this was a problem. The solution of this was to make a new text-file, with the GPS-positions changed to Bergen and have the app use that file during the test. Eight houses were chosen and given positions around the University buildings here in Bergen. This would give

the testers the opportunity to test the position update function, which makes the houses pop up when the user is close enough, in meters, from the house position.

### 5.2.1.Participants

To help with this user test the same fellow students and friends were asked to participate. Three of the same from the first user test had the time to help, and two new ones were asked, resulting in a total of five testers for this test. There were 3 female and 2 male in this test, 2 skilled in information science and 3 being an average smartphone user, see Table 2. The latter being what is anticipated to be a normal user for the app. In this test there were more of less skilled / normal users testing the app. The age of the testers spread from 24 – 65, giving a perspective of an “older” user as well.

Number of tester	Skilled / not skilled	Sex
5	2 skilled / 3 not skilled	3 Female, 2 Male

Table 2 Details about the testers in the second user test.

### 5.2.2.The test

As mention earlier the test was held in Bergen, in the area around the University. Each of the testers was handed an android smartphone with the app on and given a short summary of where the app was in regards to the development and what functions worked. Then they each walked around viewing the different houses that they found on the map, with the test holder walking alongside them. The users gave feedback underway and also at the end of the test with the questionnaire. The duration of the test was about 30 minutes, depending on how long each tester wanted to walk around using the app. The memory problem was first explained to the tester at the first appearance of it in the app. Thankfully everybody worked around the problem and also showed great patience with it, but this problem added to the time the test lasted and making it more stressful for the user to test out the app. The user tested the map, how the app updated the position, the size of design elements and also the amount of text on the houses. Due to the AR-function not being completed, another solution was used to get some feedback on this topic. Each of the testers was shown a picture of how AR-functionality worked in another app and also given an explanation of how it would work in the Bjørnsundsapp. Even though the best solution had been to have a functional AR in the app, this solution at least gave some data to base the next development phase on.

### **5.2.3.Data Collection**

The data gathering in this second user test was done by the same three methods as in the first user test. This was observation of the user, recording of their think aloud and a questionnaire at the end of the test. Before starting the test the user was asked if they agreed to the session being recorded. The tester was also asked to speak aloud what they were thinking while trying out the different functions in the app, giving a better understanding for possible obstacles for the user, also errors found and observations they had of the app. The test holder also observed the tester while using the app, the see what was stressful to use and what seemed to work, both in regards to the interface and the functionality in the app. At the end of the user test each of the tester was asked to answer a questionnaire, see Appendix D, containing five questions about the total experience of the app, problems and errors, the content of the app; if there was too much/little text and pictures and if it was presented in a okay way. There were also two questions about the AR-function, if the tester felt that it should be included in the app and also how they would want it presented to the user. An additional question was asked to the user while they were trying out the app and watching the photos; if they would like to have a zooming option on the pictures. This gave them the option to answered while using the app and getting to feel if they felt in necessary.

The GPS-signal worked just fine on this user test, in contrast to the first user test where this was a problem. The only bug in the app was with the memory problem, appearing after viewing a few pictures of a house.

### **5.2.4.Results**

Despite the memory issue creating problems, good feedback was retrieved from the testers. With the focus in this user test being on the content in the app and the AR-functionality, these are some of the results based on the feedback from the testers.

- **Text in the info window**

When you are within 50 meters of a house, a flag pops up on the map. You can then click on the flag and an info window with information about the house is shown, as seen in figure 49. At the top of the window the name of the house and the title number is shown, and below is a text with information on the specific house. Feedback from the testers about the amount of information/ text in the info window was that it should not exceed the amount in the window of the houses “Butikken” and “Fyret”, which are two of the houses with the most text. This gave sort of a model to compare to when writing the texts.



Figure 49 The info window in the app.

- **Pictures**

The display of pictures in the app was a key point in this user testing. In particular, feedback about the size, the number of pictures and the zooming option was collected. At this point zooming was only a possibility and the test results show that the users felt this was a good feature to have in the app. There was a different amount of pictures on the test houses in the test app in Bergen, giving the tester something to compare to when answering this question. The testers gave an impression that they felt that more than 6 pictures would be too many and 6 and under was enough for each of the houses.

As seen in figure 50, “Fyret” has 6 or



Figure 50 An example of the amount of pictures on a house.

more pictures, requiring the user to scroll down in the gridview to see the lower ones and to also check how many there are.

- **Augmented Reality**

It had been an idea from the beginning that Augmented Reality might add a nice functionality to the app. It would be used to see a picture as an overlay through the camera view. But by the time the second user testing was carried out, however, the development was behind schedule as problems with other areas of the app had taken more time than anticipated. Therefore in order to show the users how an AR feature would work, they were shown a picture of what AR would look like with an old photo in the camera view.

Figure 51 shows how this was introduced to the



Figure 51 An AR picture I used to show this feature to the testers.  
<http://infosthetics.com/archives/historypin.jpg>

testers along with explaining how this would be implemented in the app and how it would work. Most of the testers thought this was a nice feature, but 4 of 5 felt it would not be necessary for this app. As the testers felt that the main focus should be on the text and pictures. They also meant that this feature might make the already easy user interface of the app more difficult, taking away some of the positive sides of the app; being easy to use for everybody. This feedback was surprising.

### 5.3.Implications of prototype

Following the second user test and the results it gave some improvements were made to the prototype.

- **Zooming-button**

When the idea of having a zooming button shown when the picture was in full size was presented to the testers, they all expressed a need/ want for having this possibility in the app. The button adds the function to zoom in and out of

the pictures of the house, giving a opting to focus in on details in the picture and studding it more closely. Given that all of the testers felt this was a good element to add the prototype, this was an easy decision to make.

- **Text amount in the info window**

After getting feedback from the testes on the amount of text they felt were enough about each house, a limit of words was used to prevent the texts from being too long. One on the eight test houses used in Bergen, "Fyret" was the one of all the houses with the largest amount of text. The tester gave this example as the limit of the amount of text felling sufficient to reed on a mobile screen. This made the job of editing the texts for the third and final prototype easier.

- **AR-function**

The result from questions about having the AR-function in the app, was very surprising. Beforehand it was anticipated that the users, especially the younger ones, would like this feature in the app. The oldest of the tester was actually the only one eager for this function to be added to the app. This was the opposite of what the developer had believed to happen prior to the test. Having 4 of 5 expressing concerns that this feature would take away focus from the pictures and texts of the houses. Some mentioned it to be a fun feature, but that they probably would not use it if available. This resulted in the developer being in doubt of whether or not to include it in the app. At the end a decision was made to down prioritize this function in the app, at least until the memory problem was resolved and then seeing if there was enough time to finish it.

All these implications were added to the third prototype, which was the one evaluated on Bjørnsund by users with a connection to the islands.

## **6. Third Iteration – Finalizing and Evaluating the Prototype**

This chapter tells about the last and final step in the development cycle, consisting of a final development phase and the final evaluation of the app. The last development period focused on implementing the edits from the second user testing and also on finalizing and getting the app ready for the evaluation. The evaluation was carried out over the Easter. Because this is one of the times during the year, except the summer holiday, when there is most people on Bjørnsund. Giving that the thesis is done before the summer, the Easter was the second best alternative, with the highest chance of the most participants. The third prototype is the final one and is used in the final evaluation of the app.

### **6.1.Third development cycle**

The start of the third and final development phase consisted on editing the current prototype with the implications from the second user testing. First the zooming button was added in the full size imageview, after full support from the testers in the second user testing. This gave the user the option to zoom in and out when seeing the image in full size and focusing on details in the pictures. The second implementation was the alteration of the texts about the houses, on checking if they were within the limit set by feedback from the second user test. The third implementation was the decision to put the development of the AR-function on hold, until the memory problem was solved. The main issue with the third cycle was to fix the memory problem before the evaluation, as this destroyed the experience of the app and the continuity of its use.

Then further development of the prototype was started, the first that was done was reducing the size of all the pictures even more then already done, to see if this could help solve the memory problem. Then all the texts were gone over, with the help of the author of the source book (Hammerøy, 2009) to check the historic details and correct eventual errors, this to improve the quality of the information given by the app. Due to the limited of time between the second user testing an evaluation, this was the shortest of the three development phases, there was limited of time for further development. Most of the time was spend on improving errors and problems that came to attention during the user testings. There was also a main focus on solving the memory problem, trying to have a fully functional app for the evaluation. Luckily this problem was solved a

few days before the evaluation was planned. This gave a much better prototype to show the testers, instead of a prototype that continually terminated during use. This would have made the experience of the app much worse than it needed to be.

Despite the wish to finish the AR-function, there was just not enough time left before the evaluation to finish this part. Then the decision to leave the questions about this functionality out of the questionnaire was made. The reason for this was that it seemed as a bad solution to use the same tactic as used in the second user test; to show a picture of AR and explain how this feature works. There were too many people, with very different backgrounds and likelihood for understanding this and giving worthy answers to the question, without having tried the feature for themselves. This was a hard decision to have to make in regard to the research, but it seemed the most reasonable in this case, where the probability of the tester getting confused being very high.

The final version of the prototype had a total of 25 flags on the map, 22 of these are houses and the 3 other are landmarks, the lighthouse, "Isbjørnen" and "Damå", see figure 52. The points of interest chosen to be used in the prototype were those in the book with most old pictures, and also those with the most historic importance to

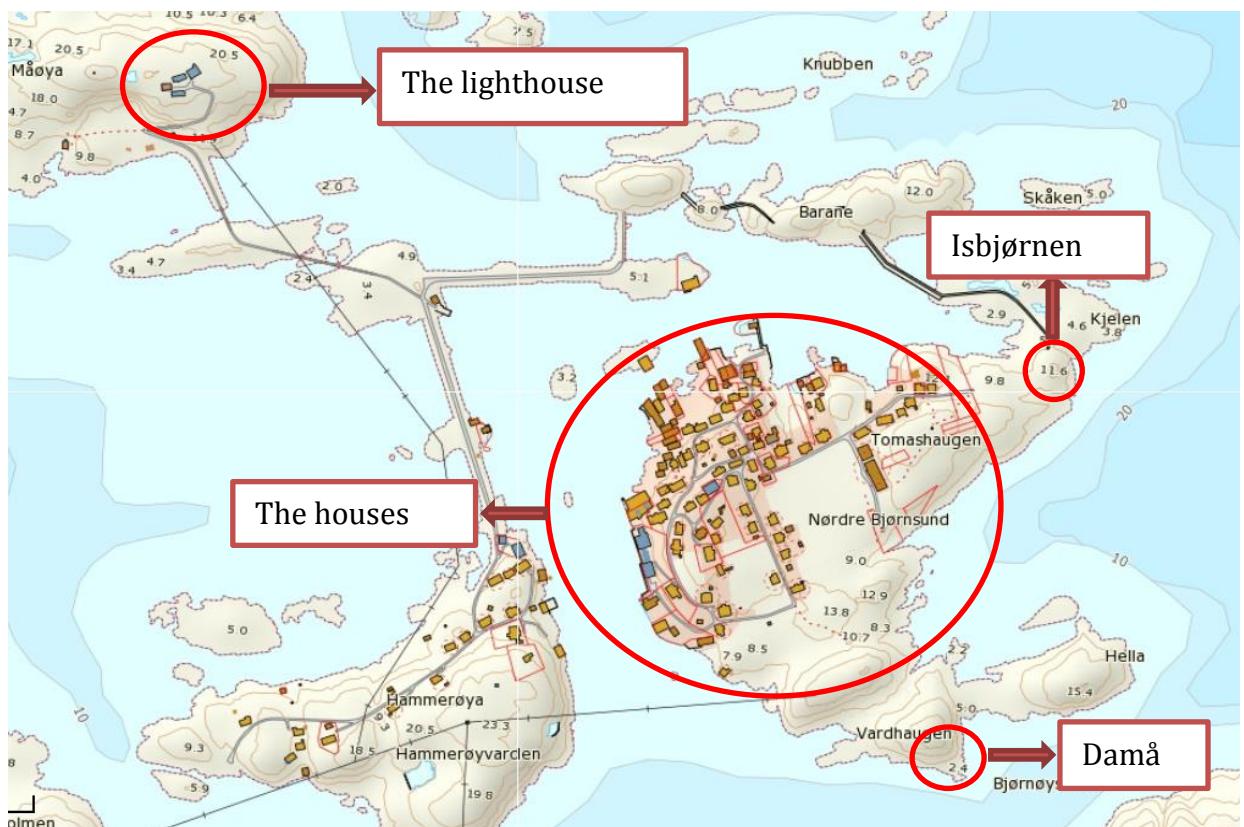


Figure 52 The placements of the points of interest on Bjørnsund.

Bjørnsund. This would give the user the most valuable information and also the best possible impression of the potential of the app. All the photos were borrowed from the book “Bygdebok for Fræna, Gard og Slekt 1” (Hammerøy, 2009).

Due to the size of the islands and that all the testers had been to Bjørnsund before, there was no risk that anybody would get lost. Figure 53 shows the main roads on the island, marked in red. There are limited of options on where to go. All the flags are

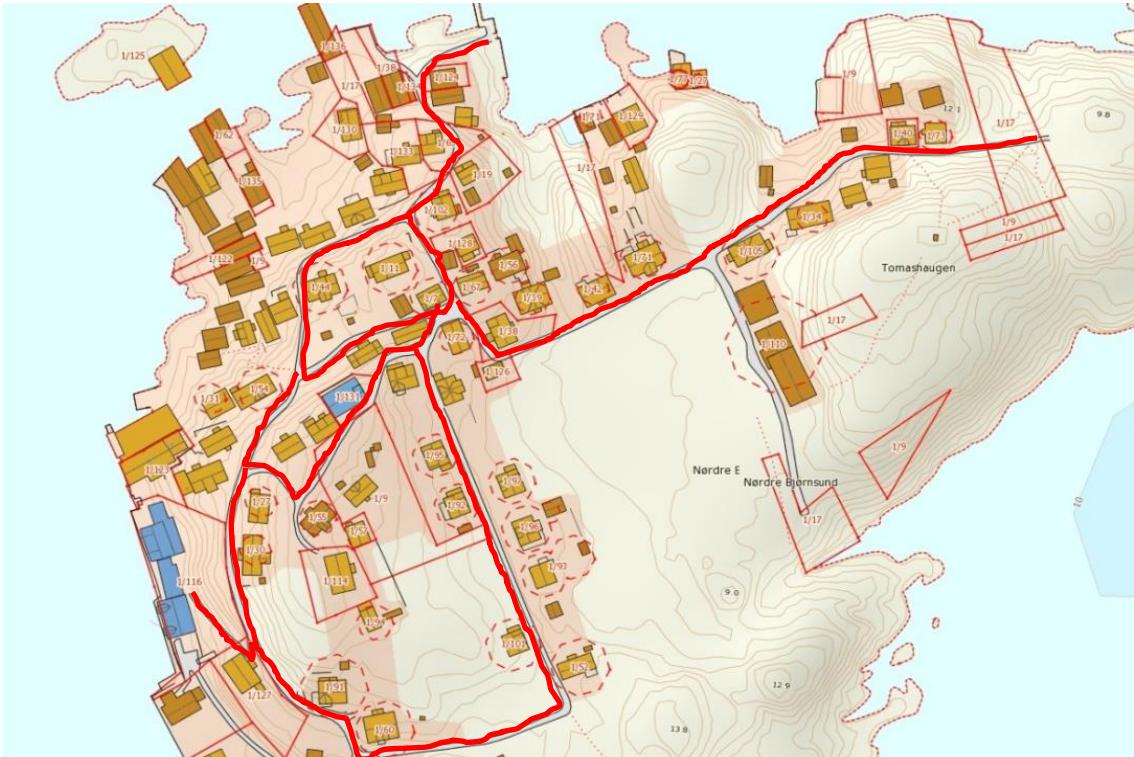


Figure 53 The main roads on Nordre Bjørnsund marked in red.

by the main road except three of them. This is the lighthouse which is on its own island and the monuments “Isbjørnen” and “Damå”. You can see the placement of these in figure 52. Because of the placement of these flag in the map and the lighthouse being a bit far away from the island, the limit the user had to be near the lighthouse to get it up on the map was upped to a distance of 500 meters, see figure 54 of the lighthouse being view from Hammerøya. There were also set special limits to the two monuments “Isbjørnen” and “Damå”, they got limits of 200 meters

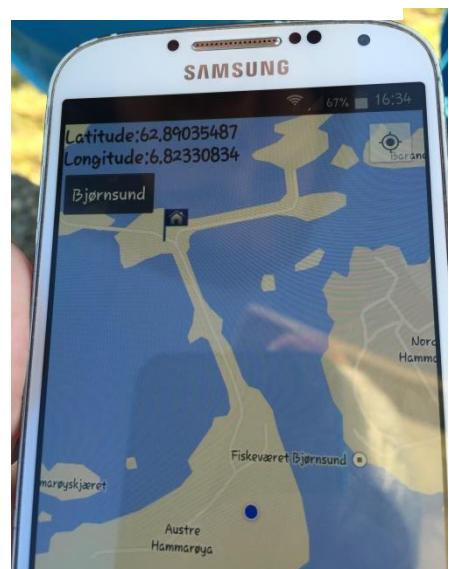


Figure 54 The lighthouse seen from the island Hammerøya. Showing that the limit is large enough.

and 250 meters. The limit to "Damå" was set a little higher so that you could get the flag up on the map from the closest main road. The rest of the houses had a limit of 50 meters.

Shortly before the evaluation of the prototype, the developer was a weekend on Bjørnsund, testing out the app in its native setting. This was a good possibility to check how the location-based functionality worked and if the updating happened fast enough. Also to check if everything worked as it should on both phones, see figure 55. There was also one person in the travel company trying out the app, giving some feedback. This was some useful days to have before conducting the evaluation.

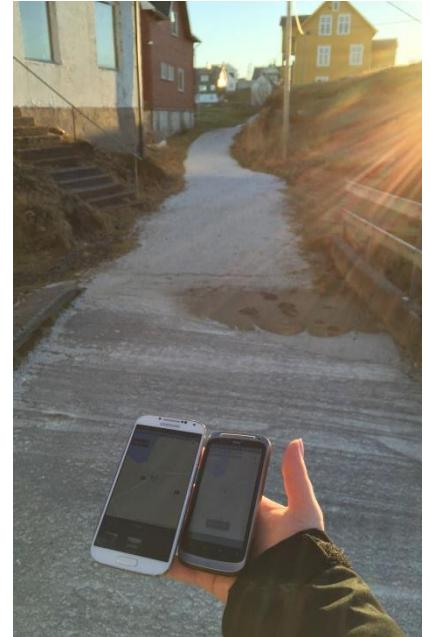


Figure 55 Testing on both phones prior the evaluation.

## 6.2.Evaluation of the prototype

The evaluation process was split into two parts. In the first part there were five participants who tested the app and answered the question form. In the second part, that was conducted a few days later, there were another eleven testers doing the same. This resolved in a good amount of feedback from this evaluation. The focus in this evaluation was on several areas, such as the user interface and the content of the app and also how easy the app was in use.

As mentioned earlier the evaluation was conducted on Nordre Bjørnsund in the Easter of 2015. People who were on Bjørnsund in the Easter, was asked to test out the app and answer the questionnaire. Some were asked beforehand, but most were found on the day of the evaluation. This worked out very well, with getting a total of 16 people to try out the app.

### 6.2.1.Participants

There were 16 participants in the evaluation. The participants were found among my family and from others being at Bjørnsund at the days of evaluation. There was nothing decided beforehand on who the testers would be, there would just be made an effort to try and get testers who were in different age groups and of different sex. There was also a hope that there might be some tourist on the island in the Easter, but unfortunate-

ly there were none. It might have been a bit too early in the season for this. This would have given a tourist view of the app also, which would have been nice to have to compare to in the research.

From the questionnaire, some demographic information was retrieved from the contestants in the evaluation. The information were about sex, age, knowledge of Bjørnsund, knowledge about the source book and also if the contestant had lived on the island before. In the total of 16 testers there were 9 men and 7 females, see figure 56. This was a good division between the sexes, giving both male and female views of the app.

The testers were also divided into five different age groups; below 16, from 16 to 25, from 25 to 35, from 35 to 50 and older than 50, see figure 57. Here there were some spread, all but one tester was in the groups from 25 years and up. The largest group with six testers was the group with the highest age, from 50 years and older. This is the age group where the people who lived on Bjørnsund when they were young would be in, resulting in this group, most likely having the most knowledge about Bjørnsund. There were no testers below the age of 16 and only one beneath 25 year. It would of course have been better to have some in all of the groups, but still 16 testers is a good number.

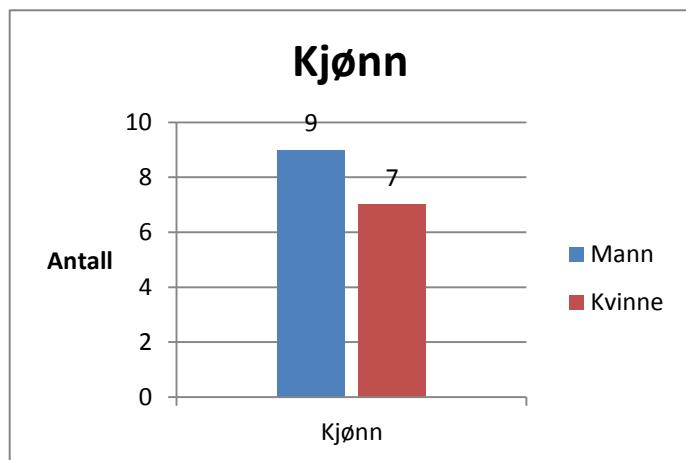


Figure 56 The division of sex among the testers.

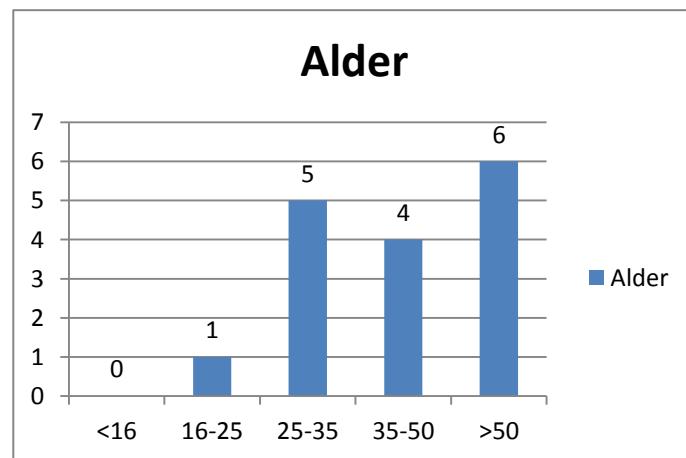


Figure 57 The different ages of the testers.

Whether or not the tester had previous knowledge to Bjørnsund was also important to know in regards to the research. Of the 16 tester there was one checking of the tourist box in the questionnaire, see figure 58. The rest checked off for being known to the islands. This is not an optimal result, given that there is not a lot of data to use

when researching the use of this app for tourist purpose. To have gotten more tourists to test out the app, the evaluation would have to be held in the summertime.

If the tester had lived on Bjørnsund was also one of the data retrieved from the questionnaire, see figure 59. The result here was that 2 of the 16 testers had previously been a resident on the islands, leaving 14 of them not having lived there before. This is also an interesting fact to have, with gaining the thoughts of the people who know the island the best of all. They might have insights to an app like this that other users don't.

The last demographic detailed retrieved about the testers were if they had knowledge to the source book or not. This would give them knowledge to the information found in the app.

Here 9 testers answered "yes" and 7 answered "to some extent" and none of the testers answering "no", see figure 60. This means that all of the testers already have some knowledge of the content that is shown in the app. Having had someone not familiar to the content would

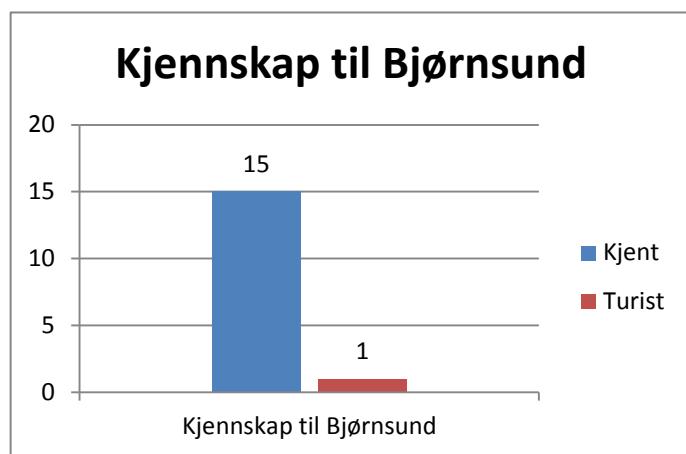


Figure 59 The graph showing the testers knowledge of Bjørnsund.

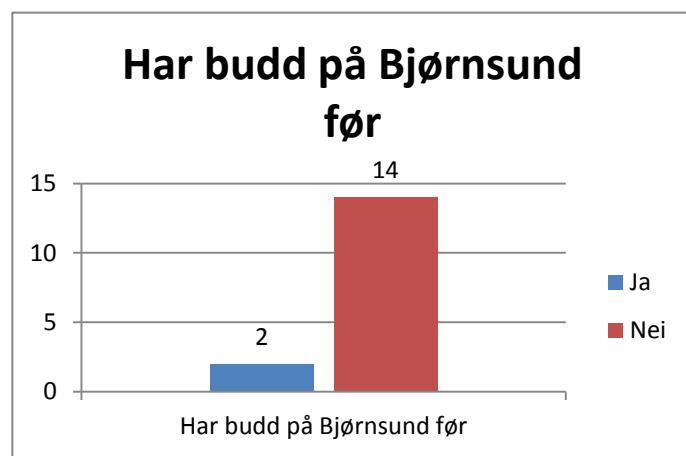


Figure 58 A graph of having lived on Bjørnsund or not.

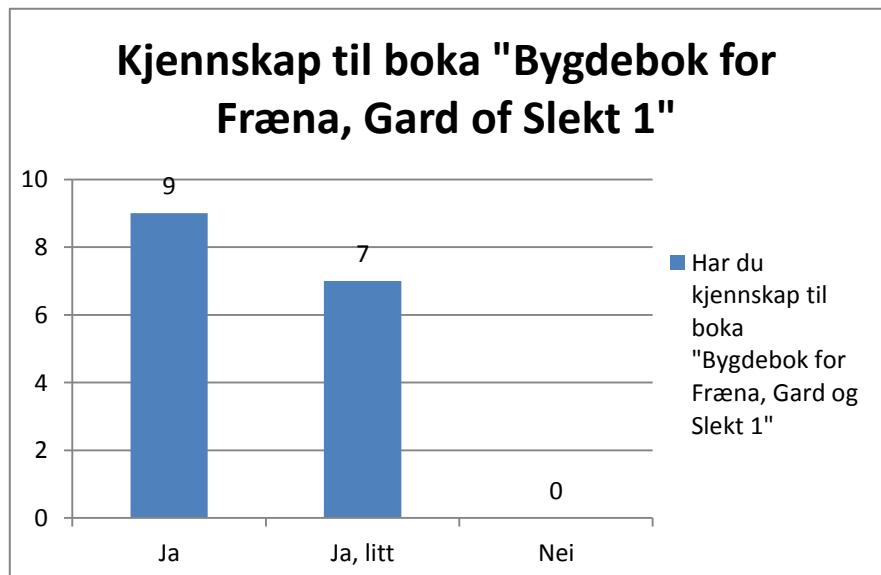


Figure 60 A graph showing the knowledge to the source book.

also be good in a research perspective.

Given all this information about the testers in the evaluation, it is safe to say that they are all well known to the islands comparing them to a tourist. Having had some of both would have been the best solution in regards to the research. But getting 16 people to test out the app is a great result for being on a remote island, mostly used for vacation.

### **6.2.2. Conducting the evaluation**

The conduction of the evaluation was done by having one and one person testing the app. First the job of finding people was done, by just walking around the island and asking people to be a part of the evaluation of the app. Explain to them that it was a part of a master thesis and that the results would be used in a research. An explanation of how the app worked and its basic function was also given to everybody, making it easier for them to use it during the test. If they had any questions they were also answered prior to them trying the app.

Then the tester was given the phone and told to walk around the island for as long as wanted and then to come back to answer a question form at the end. I personally followed some of the testers around both to observe them using the app and also if they had any questions underway. This seemed to be a good way of performing the evaluation. When the tester felt he / she had tried out the app a sufficient amount of time, he / she gave back the phone and answer the questionnaire, before the testing was finished. Since there were two phones available to test on, some of the testers walked around the island trying out the app together and after answering each of their own questionnaires. Some pictures from the evaluation can be seen in figure 61.

There were no major problems during the testing, except for one of the GPS-positions being wrong. This was fixed in a minute and then the house was on the right place in the map. Other than that everything went as planned and the amount of testers was fulfilled, giving a successful evaluation of the prototype.



**Figure 61 Some of the testers out walking around using the app.**

### 6.2.3.Data gathering

During the evaluation there were gathered data in three different ways. The main method was the questionnaire that all the testers answered after having tried the app around the island. Then some of the testers were asked to take part in a group interview. There were also made observations of some of the testers while out walking and using the app. Combined they gave a lot of knowledge about the experience of the app in use.

#### 6.2.3.1. Questionnaire

A questionnaire was handed out to all the testers to answer after having tried the app out on Bjørnsund. The questionnaire contains 12 questions about the app, see Appendix E. The first five are questions gathering demographical data from the tester, these questions have checkboxes where the user crosses off the right one for them. These five questions are:

- Sex: Male / Female
- What is your age: (five checkboxes with different ages)
- What is your knowledge of Bjørnsund: Tourist / Known
- Have you lived on Bjørnsund before: Yes / No
- Do you have knowledge about the book “Bygdebok for Fræna, Gard og slekt 1”: Yes / Yes, some / No

These questions were asked to gain some basic information of the user, before he / she gave the answers of their experience of the app. The next three questions were about the user experience of the app, the user interface and also about the content of the app:

- What impression did you get from Bjørnsundappen, was it easy to use? (etc. hard or easy in use, could not use it)
- Is there something you are missing/ disliked in the user interface of the app
- Is there something you are missing / disliked about the content of the app

These questions were asked to gain some information about what the user experience was for the user. If there were any problems they ran into while trying it out. And if it was something they were missing in the app, both in the user interface or with the content. The three next questions are regarding the learning experience, the potential of the app to help preserve the history on Bjørnsund and if the user would use an app like this if it available.

- Did you learn something while using the app, for instance something new you did not know before.
- Do you feel the app could help preserve the history of Bjørnsund.
- Would you use an app like this if you were a tourist in this place or another

These three questions were asked to get information about the learning experience the user had while trying out the app and if he / she learned something while using it. The potential the app have to help preserve the history of a place like this and also if the user could imagine to use this kind of apps while being a tourist in Bjørnsund or somewhere else.

At the end of the questionnaire there was an open question about the total impression of the app, with several blank lines for the user to writes as much a wanted. This was done to give the user a chance to give feedback they felt were not a topic in the other question or if they had something else they would like to point out. The questionnaire worked as it should and gathered the data required to do the research on the app.

#### **6.2.3.2. Group interview**

Another method used to gather data was a group interview held on the last day of testing. Five of the testers were asked to participate and share their thoughts of the experience using the app. Everybody sat around a table, and the developer lead the interview. It was an open interview with a free discussion, where the users could speak their

mind. Certain topics were brought up by the developer to start a discussion and hear what the users felt and thoughts on the subject.

Some of the topics build on the questions from the questionnaire and were asked to get a more rich answer from the tester. There were also topics that came from the users and the discussion spread from this. It was a freely interview so this was no problem, it could only be seen an opportunity to get additional feedback on the app and its potential. The group interview was also a possibility to get some feedback on the AR-function originally meant to be included in the app. The topic was raised about the users feeling and thought on this technology and how it would be to have it in the app. It was also asked if any of them had heard about or tried the technology before or seen it in another app / program.

The interview lasted a little over half an hour giving a lot of additional information to use in the research.

#### **6.2.3.3. Observation**

During the evaluation some of the testers were observed during their time walking around the island using the app. This was done on five of the testers and gave some additional information about how the app was in use. This also gave the developer a chance to observe the different elements in the user interface and see how they were in use by a potential user of the app.

The observations were done with both men and women, young and old, to see the difference in how they used the app. It also gave information on how they reacted to the different functions in the app and also how they handled the location-based technology with a constantly updating position. The understanding of a map and where you are in the map at a given time was also an interesting fact to observe, where it was very apparent who was used to a map and not.

When walking around observing the users it also gave them a chance to ask questions they had while using the app, both about how to use the app and the content of it.

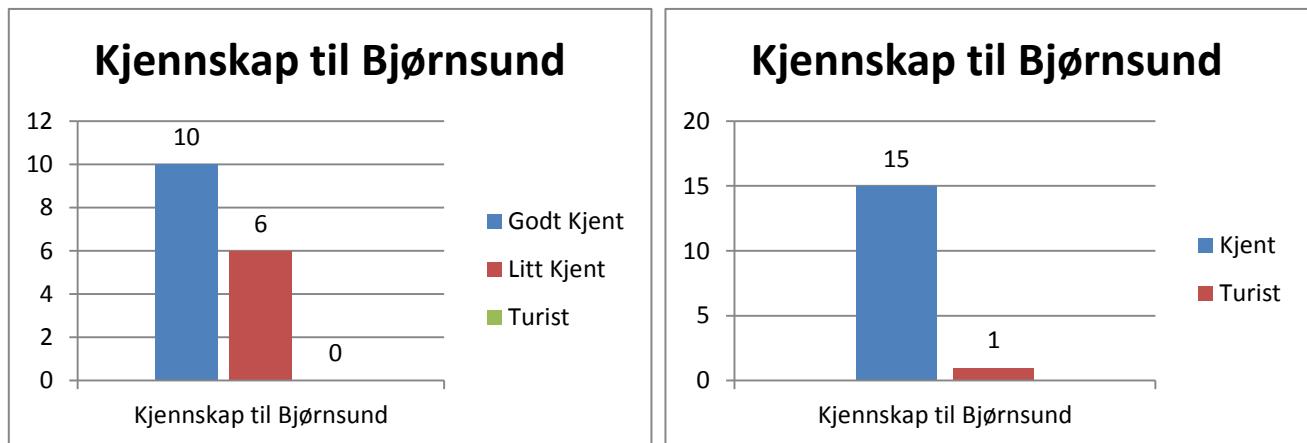
## **6.3.Results**

The results from the evaluation, both from the question forms, observations, the group interview and feedback form people gave a lot of positive response from the testers. I got the impression that they all thought it was fun to get this new perspective of all the historical data that exists about Bjørnsund. There was of course no feedback about the AR-function that was missing, due to the decision to leave it out of the questionnaire. Although getting some feedback in the group interview on this topic, added some data on this subject.

### **6.3.1.The questionnaire**

The questionnaire, which was handed out contained 12 questions for them to answer after using the app. The first five questions were as mentioned demographical questions about the tester and their previous knowledge. The last seven were question about the app, general impression, the user interface, the contents and overall impression. The answers on the last seven of the questions can be seen in the Appendix F.

After going through all the answers from the question form, it seemed that all of the questions worked and gave the result intended, except for one. This was the question about the person's knowledge of Bjørnsund prior to the test. What was meant to be pointed out with this question was how much knowledge the user had before getting additional information from the app. The amount of knowledge the user have before using the app can alter the experience of the app, for instance if they find it boring, interesting or very educational. In this question there were two answering options for the user to choose from; "Known" and "Tourist". These options gave no possibility to be a place in between, such as a person who have been on the island a couple of times before or have relative on the island. There should maybe have been another option of being "a bit know". If so the results from the questionnaire might have looked a bit different. Since the developer knew all of the testers and also how well they knew Bjørnsund, a new graph was made, showing how the result could have been, if there were a third option on this question. The result of the new graph compared to the old can be seen in figure 62.



**Figure 62 The old and the new representation of the "how well known" data.**

Changing data like this after collected might be considering manipulating the data. But there was nothing taken away from the results, it was just presented in a new way. This new graph will not be used in the research; it was only made to show how the results might have looked and also the importance of formulating a question and the options the right way.

The rest of the questions all gave valuable data. The five demographic questions, except the one just mentioned, gave a good presentation of who the users were and their knowledge of the content in the app beforehand. The next seven questions also gave valuable feedback. The user interface was well accepted, and was said to be easy to use. The content of the app also got good feedback, giving a good learning experience. There were some ideas of additional content that could be added and further development and improvement of the app, see next section.

All of the testers answered that an app like this could help preserve the history of Bjørnsund and they all answered that they would use an app like this on Bjørnsund or somewhere else if available. This results in a good evaluation of the app and a positive experience for the testers having tested the app on Bjørnsund.

### 6.3.2.The observation

The observation resulted in a few points that were taken extra notice to. One of them were how used the person was to using a smartphone, as it was very apparent from observation when one of the users was not so used to this. This was seen when he/she struggled with the basic function of the app, like pushing the buttons and understanding where they were in the app. Also how to zoom into the map and moving it

around to the flags available was a problem for an unexperienced smartphone user. This might lead to a not optimal experience of the app, due to using extra effort to view the information available.

Another observation made was how used people were to using a map on the smartphone. It was observed that some struggled with the map, moving it around and also rotating it to get it the right way according the users own position, making it easier to understand where you are on the map. Some also struggled to understand where the houses were according to the flags on the map. It was apparent that the more knowledge the user was with using a map, the easier this was in the app and also made it more fun for the user to walk around the island discovering flags with information.

It was also observed that some of the elder testers using the app struggled a bit more adapting to its way of use then the younger tester. This was not a totally unexpected observation.

All in all it was an informative experience to observe real users testing the app and its functionality, giving a better understanding of the importance of an easy and manageable user interface and the technology used in the app.

### **6.3.3.The group interview**

The results from the group interview were additional information adding to the answers gotten from the questionnaire. More detailed information on how the app was to use and if there were any problems they ran into. All of the testers interviewed found the app easy to use and had no negative criticism about it. They only had some questions about if it was possible to add additional content to the app. Some ideas were mentioned about what could improve the app, like a name register of the people having lived I the houses and also a search function of the houses.

The most interesting result from the group interview was the part where the AR-function was discussed. None of the tester had used a function like that before and only one of them had seen a program with it in use. Most of them were a bit skeptical to this function, worrying about if it would be too hard to use. It was also mention as a worry that this function would destroy the impression they had gotten of how easy the app was to learn and use and also take the focus away for the content already in the app. This

feedback was a bit surprising to hear, both from the older ones and the young ones. This was much of the same worries mentioned from the testers in the second user testing.

#### **6.4.Implications for the prototype**

Some of the points that were mentioned by the tester were that some felt that it was a bit hard to orientate themselves in the map. The map that was used was a standard google map. I thought that this would be the best solution, since most people today use this map, either on a computer or a smart phone. The reason people are struggling, I think, is because they in general have little experience with using a map. By watching some of the testers use the app this became clear. This is not really a problem the developer can do something with. Here the user just has to practice using a map and orientating themselves. Of course there can be some helping advice in the app and also some guiding the first time the app is in use.

Some of the ideas by the testers about additional functions to the app were; a list over previous people living in each house, and a search function of the houses and names of owners. Another was a register of the houses and a function to select a house on the list and then there would be placed a flag on the map where the house is, making it easier to find. There was also a suggestion of having a register of today's owner and add a function that would allow the user to search up a person and having a house on the island and then the app would show the user the route to their house.

All of these ideas are of course valid and can be some ideas for further development of the application.

Some screenshots of the last version of the prototype can be seen in Appendix G.

## **7. Discussion**

This chapter will discuss the results from the user testings and the evaluation of the app. What they show and how they can be interpreted. There will also be a section about what could have been done differently and troubles experienced during this research work. The discussion is focused on the research question: "How can location-based and AR functionality be used to create a living experience of local history".

### **7.1.The development of a local history app**

To get an answer to the guiding research question the first step was to develop an app that contained historic information. During this research the development was split into three phases. Each of the phases focusing on different area of the app. The first phase had its focus on the user interface and the placing of elements in the interface. The second had its focus on the content the app gave the user and also on the possibility of using AR.

During the first development period the time was spent on setting up the app from scratch and also adding the user interface. Due to no experience by the developer with use of google map and location based technology, it took some time to get this up and running as intended. No major problem accrued in this phase, just some thoughts about placement of the elements in the interface. Also the way of displaying the content to the user was under question and would be addressed in the user testing following this first phase of development.

The second phase focused on the content of the app; how the information was displayed to the user and also the usefulness of the information. There was also a focus on getting to know the users opinion about using AR-functionality in the app. In this phase of development there occurred a problem that would follow the development to the point right before the evaluation. A memory problem, causing the app to terminate itself and making the user enter it from the beginning. The problem was caused by the large pictures taking up all the heap-size the app had gotten distributed from the smartphones operating system. The problem first came about shortly before the second user testing and many attempts to try and fix the problem had still not worked and the problem still was occurring during the testing. This also took away from time to develop the AR-functionality.

Based on the results from the second testing, the third phase of development had its main focus on correcting problems the user had brought to the developers attention. Fixing the memory problem was also a main priority, to get the app to work properly before the evaluation. Unfortunately this meant putting the AR-functionality aside while fixing this. When the time was getting close to the evaluation of the app, the developer realized that there was not enough time to properly add the AR-functionality to the app. An option was to just try and explain and show pictures of the feature to the tester and then have them answer questions about it in the questionnaire. However the decision was made to drop it from the evaluation, because it might cause the testers confusion when not getting to try it out for themselves.

When evaluating the development process it is apparent that the development should have started some weeks earlier and also been structured a bit different. Due to the lack of experience in developing apps, it was not so easy to set a timeframe for the different stages. It might have been an idea to have a start phase where the base of the app was developed and first then starting on the development phases with a following user tests. This might have given a more structured development and also time to finish developing the AR-functionality. It might also have given cleaner developing phases and better user testings.

## **7.2.The user testings of Bjørnsundappen**

To help understand the usefulness of an app like this the app was field tested to determine the user experience of the app. This gave some answers to whether or not this could be a beneficial way of displaying this type of historic content. The testing phases were divided into three, two user testings during the development and finally an evaluation of the app at the end of the process.

In the first user testing the main point of interest was to get feedback on the user interface of the app. There were some design elements that had several different options of design and also placing in the interface. Getting feedback on this from the tester was a requirement to make the app as user-friendly as possible. One problem occurring during the first testing was that the test was held inside of the University building, where it turned out there was no GPS-signal on the phone. This should of course have been tested prior to the testing and then the test could have been done outside or in another place with

GPS-signal available. There was also a bug in the app at the time, resulting in the user having to press two times on a button for it to work. This was of course not optimal for the testing but the testers were made aware of the problem and worked around it during the testing. Other than that the first user testing went well and it concluded in some good advice on the user interface.

The second user testing had its focus on the content of the app and also the AR-functionality in the app. Due to the fact that the points of interest (the houses with information) were located on Bjørnsund, they would not show up when the app was tested in Bergen. This would not give users much to test except the basic functionality of the app. So 8 houses from Bjørnsund were added with a GPS-location around the University area. This gave the users a chance to test the app in the way it would work in its native environment on Bjørnsund. They would also get to test how well the location-based technology works and if it updated the positions fast enough. It was before this user test that the memory problem arose. It was then decided to put priority on this problem instead of continuing developing the AR-functionality. Even so the problem was not fixed by the time the second user test was carried out. This was very unfortunate, but also with this problem the users were informed about it and they worked around it entering the map again when the app terminated. Since the AR part of the app had to be put on hold, there was no such functionality in the app to have the users test. Instead they were given a description and shown a picture of how it would be. They were also shown an example from the app Historypin, where such a functionality is included. This thankfully gave the feedback needed in this user test. Even though the result was surprising it also gave very interesting feedback. Thanks to the positive attitude of the testers the feedback from the test was very helpful for the last part of developing.

### **7.3.The Evaluation of Bjørnsundsappen**

The evaluation went ahead without any major problems. The testing was divided into three different days, due to people being at Bjørnsund at different times. After the first day of testing there was a small error in the text window that the users had discovered. This was caused by using a hyphen as the splitter in the programming code. When the program read the file with the information about the houses and split each line into several fields it sometimes did not get all the text in the last field. This was caused by the error of using a hyphen instead of a semicolon as a splitter. Whenever there were a hy-

phen used in the text field about the house the program would split the text at the first hyphen instead of showing all of the text. An example of this error can be seen in figure 63. The text line read by the program is the following:

*"Norhavn;7;62.89277638;6.82746812;Dette er det første huset som blei bygd ovanfor "Været". I 1854 og i 1862 blei Nordre Bjørnsund råka av to sjøskadar der sjøen sopte bort over tjue hus, uthus og naust. Etter det byrja folket byggje husa sine lengre frå sjøen. "Gammle-Kristian" var den første som sette opp hus her i 1863."*

This ends up been split into the name of the house (Norhavn), the title number (7), the GPS-location (62.89277638;6.82746812) and then the text field. It is in the last field that the error occurs, with the name "*Gammle-Kristian*", here the app would originally cut the text after "*Gammle*". This would look strange to the user, with just the word "*Gammle*" at the end of the text. After the split sign was changed to a semicolon and the text file was altered, everything worked fine.

Other than this error there were no problems during the evaluation phase. The

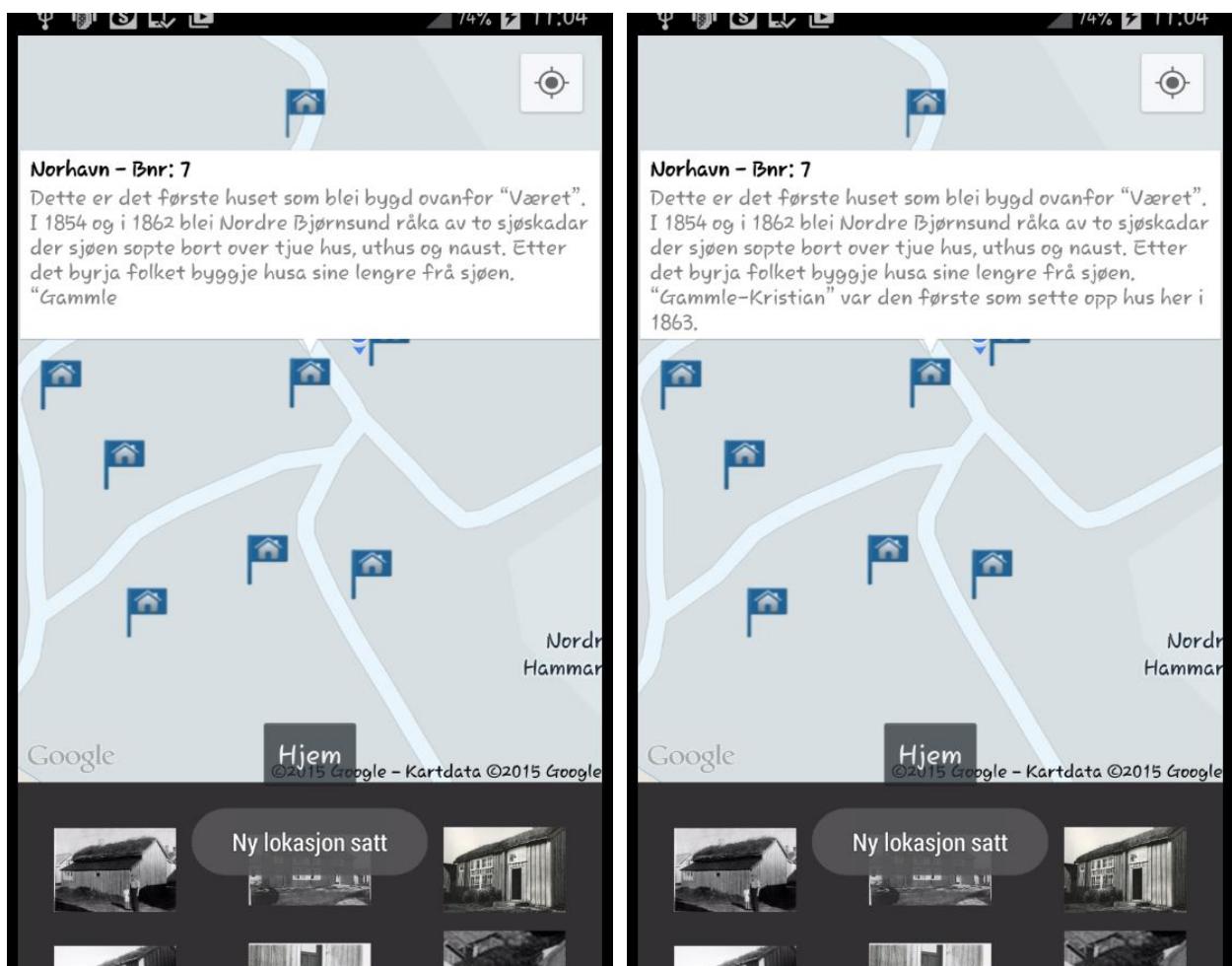
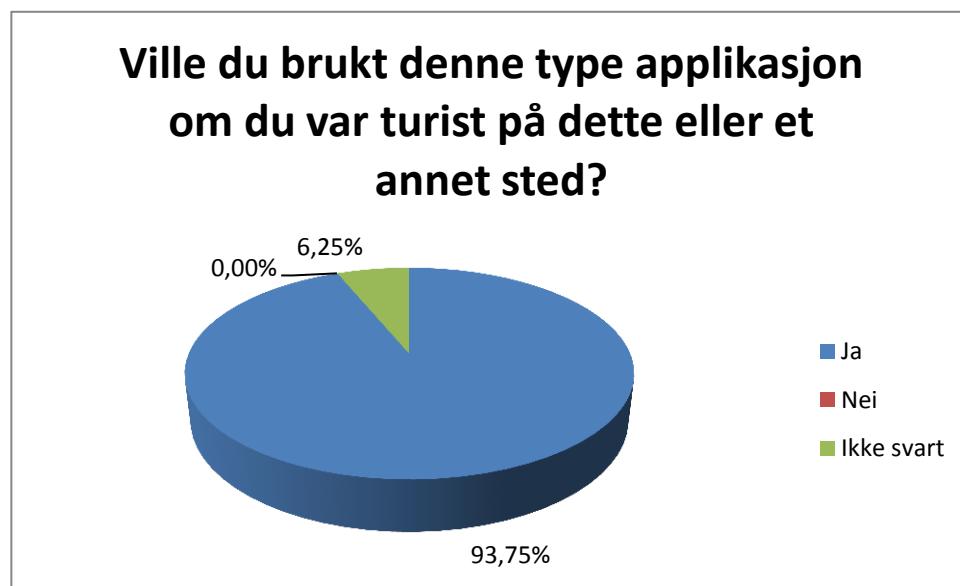


Figure 63 A example of the hyphen error in the code.

memory problem had finally been fixed a few days prior to the evaluation. When the solution finally was found it was a quick fix, but many alternatives were tried out before finding the one that took the memory problem away. This helps raise the total impression of the app massively. During the second user test, which had the memory problem the testers got a bit tired of this problem and gave the impression that this ruined the experience to some extent. There might also be a chance that the evaluators would have given up trying the app if it kept terminating and they many times during the evaluation had to enter if from scratch. This would most likely have given the app bad reviews on the questionnaire.

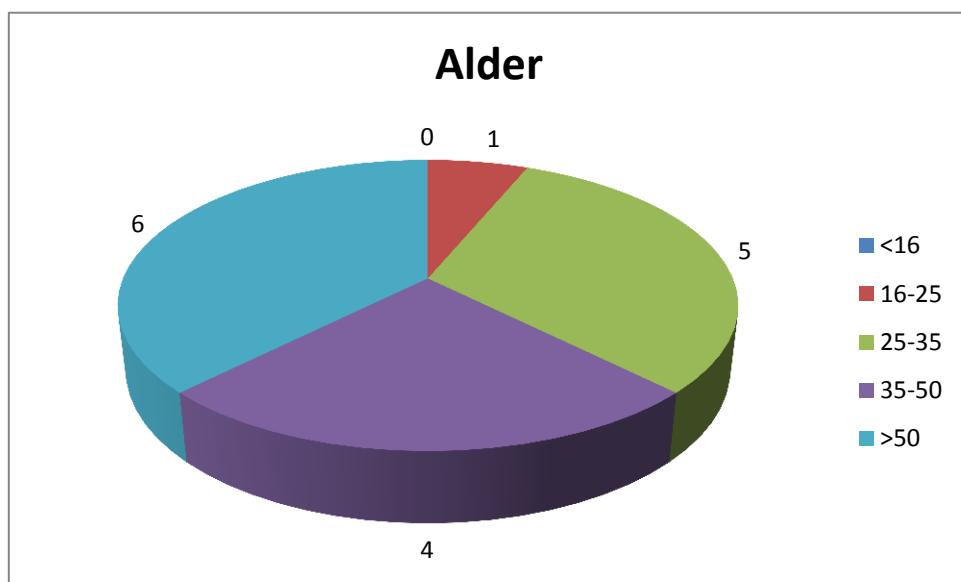
There were 16 evaluators testing the Bjørnsundapp. This is a very good number, specially thinking about that the evaluation was held during the Easter time on Bjørnsund. If there was to be a higher number the evaluation would have to be held in the midst of summer. Based on the results on the question about if the user would use an app like this on Bjørnsund or in another place it can be interpreted that the users liked the app. Figure 64 shows that 93,75 % of the testers said they would. This equals 15 of 16 of the evaluators that said they would use an app like this if available. The last one of



**Figure 64 A graph showing how many would use an app like this if available.**  
the 16 had not answered the second page of the questionnaire, so the number might have been 100% if they had.

The spread in the relation of men and women who participated in the evaluation was close to equal, 7 women and 9 men. This gives a good understanding of both women and men's experience of the app. There was no way to predetermine this beforehand, due to the fact that it had to be taken on the fly, after seeing who was on the island at the time of the evaluation.

When it comes to the age of the contestants there was also some spread here and almost all were 25 years and older, with only one person being less than 25 years. As seen in figure 65 the largest group those from 50 years and up, and then the second largest group was those in the 25-35 age group. Also this, as with the sexes, was not possible to predetermine beforehand. Although there might have been a chance to anticipate that the largest group would be the eldest one, because this is the generation that was born and grew up on Bjørnsund and also are the ones owning most of the houses on the islands now. Most have taken over their family home and this also results in them being there the most. Then comes the second and third largest groups, which mostly consists of the children of the natives on Bjørnsund and also their partners / family. There are also some that have bought a house on Bjørnsund that have no special relation to the islands, they are mostly in the age group 35 -50. Having so few below 25 evaluating the app is a simple result who was on Bjørnsund at Easter.



**Figure 65 A graph showing the age of the contestants in the evaluation.**

## **7.4.The AR-functionality in the app**

The AR-function of the app was unfortunately not finished in time for the evaluation at Easter. Right up to just a few days before the evaluation was to take place, the memory problem was still troubling the performance of the app. This was a very unfortunate problem that took up very much of last part of developing time. This had totally thrown off the planned schedule of development and caused the AR-functionality not to be done in time for the evaluation. The decision to prioritize fixing the memory problem before the AR- functionality was not just based on the developer's meanings, but also the feedback from user test number 2. In that test all the testers had mentioned this as a problem they experienced with the app and that should be fixed before the evaluation. This fact combined with the high percentage of users not feeling that need for AR in the app gave the reason to prioritize the memory problem before AR. Now after the development and evaluation is over, this seemed to be a reasonable choice, since having an app with a memory problem and a half working AR-functionality would most likely just had confused the users in the evaluation and also drawn the total impression of the app down.

During the second user test the testers where shown an example of AR-functionality and asked a question about the need for this in the app and if they would use it if available. An astonishing 80 % (4 of 5) of the testers said that they did not feel it necessary to have this in the app, and also gave concern about this ruining the "easiness" of the app in use. Some of them were not sure if they even would use it if available and some were concerned that it would be too mucky on a small screen. This was an unexpected response from the users of the app, due to the fact that it was anticipated that this would be received as a new and fun technology to add to the app. Based on these feedback the AR-functionality was prioritized as lower than the memory problem. Had that problem gotten solved faster, there might have been enough time to finish the development of the AR-functionality for the evaluation.

The AR-functionality was also a topic during the group interview. The AR-function from the app Historypin was shown to the interviewees and a discussion was started on this topic. Also here there were mostly feelings that this was not a necessary function. Some said it seemed fun but that the main focus should be on the photos and the text. Others felt it would be too hard to use for everybody unlike the rest of the app

that everybody could use with little to no practice. One person felt this would add to the app and should be added to those that had the right photos for it.

The feedback from both the second user testing and the group interview were mostly not in favor of the AR-function. This might be because the users did not get to test out a function like this for themselves. None of them had used a function like this in an app before, some had heard of it but none were very familiar with it.

Deciding to prioritize having fully working prototype, and putting the AR on hold is supported by (Peres, Correia, & Moital, 2011) where they explained that *"...the usefulness of a Mobile Electronic Tour Guide is determined by its functionality and quality. Generally speaking, functionality involves availability, trust and presentation, whereas quality is associated with quality, ease of use and currentness. This means that it is important for an app like this to work without problem when the user needs it and also that the content is well presented. It is also important that the user interface is user-friendly and easy to use and that the app is current, both with the information and presentation. It also needs to have a quality feel to it to impress the user."* Making the decision to have a prototype working without error (the memory problem) and having an app that was easy to use and having a clean and well working user interface was important to raise the total impression given to the tester in the evaluation. Most of the testers asked about the AR-function were worried that it would ruin the impression the app gave of being very easy to use and handle. So it would have been very important to implement the AR-function in a way that did not destroy the impression of the app, making it easy to use.

## **7.5. Local history book as a source**

The book used as a source for the data in the app is a local history book written by a man with his roots from Bjørnsund, "Bygdebok for Fræna, Gard og Slekt 1". The information used from the book is text information about the houses and also old pictures of them. It made the information search about the houses much easier and shortened the process a lot. The book had all the information needed except for the GPS-location of the houses. Having access to a book like this is almost a necessity when making an app like this. If the developer was to gather all the information from different sources or even by having to talk to each of the owners of the house, this would have required a much long-

er developing time. A book like this has all of this already and is a great source for an app containing this kind of information.

All over Norway there are local history societies that gather information and write such books every year; there is most likely one in all the municipals in our country publishing a large amount of books with this topic. Had it not been for all of these people with this interest for local history, there would be a lot of lost information for us today. Using these books to create a new presentation of this data could be very helpful in getting the younger generations interested in their own local history. It could also make it easier for people to get to know their own history and ancestors. It could also help ease the access to the information when you are traveling around small places in Norway or other places in the world.

## **7.6.Areas of use for Bjørnsundappen**

The primary use for this app has been for locals and also tourists visiting Bjørnsund to get to know the island and the houses there in a new and more detailed way; it is a way they would not be able to experience without buying the history book and sitting down reading it. There is so much information that could potentially be put into an app like this. Not just information about the houses, but about the people living in them, the boats that had their home port on the islands and also local fishing sites to mention some additional information. This could be fun for tourist to see and get a more personal connection to the island, instead of just being able to experience what you can see by walking around. It could also be a good tool for those with roots at the island to walk around seeing the houses related to their family and reading information about it.

Another use for this app that was mentioned at an unofficial trial of the app, was that the local authority could have an app like this at hand. At the department of technical services, in Fræna Kommune they receive applications to build or change something on a house at Bjørnsund. The island has a zoning protecting their historic value, and there is building protection on the houses keeping people from changing the house in a way not similar to the original building. The person testing the app mentioned that it would be handy for the caseworkers to have this app, to look at the old pictures of the houses and also read about the changes already made to it. This way they could more easily make the right decision about the application. According to a source at Fræna

Kommune there is no system or record with this information available to them today, they only have a system showing pictures of how the houses lo today. They also use the same book used as a source in this thesis. Sometimes the applications also get passed on to the County conservator to make the decisions. This tool would also be of good use for him/ her. Here the AR-function could also be off use, if the case worker were on the site and wanted to compare an old picture to the house as is today. This is a good use of an app like this for a completely different target group.

This app has the potential to be used by several different user groups and in different settings. The original idea was for the people on Bjørnsund to have a digital source of some of the information from the book “Bygdebok for Fræna, Gard og Slekt 1”, but there is also a great potential to make it interesting for tourist visiting the island, both Norwegian and foreign. This would require a version of the app in English, but this is not an impossible task. Also the idea for use of the app by local authorities show there can be more user areas than thought of by the developer.

## **7.7. Summary of the research project**

This chapter have discussed how location-based and AR functionality can be used to create a living experience of local history.

This can be done by giving people the opportunity to relive their own history using a smartphone, with the relevant content on. The location-based technology would make the information shown relevant to the user by only giving the content of that particular GPS-position the user is near. While the AR-function gives the option to see and fell the changes made to a house or a street “live” in their camera view. This would make the experience of seeing / reading local history relevant to an individual much more living and available for that person. Experiencing the content of a local history book in a new and different way, by having it with you while walking around the historic site gives a much more living experience of it, then sitting indoors reading a book.

## **8. Conclusion**

This chapter concludes by summarizing the thesis, identifying limitations and weaknesses and identifies further work.

### **8.1.Thesis summary**

This thesis describes the development of a local history app. The app is developed both for locals in the community with an interest or a connection to the island and also for tourists visiting with an interest to get a more eventful visit, with access to valuable historic information. The app was developed and evaluated by potential users as a two-step process to demonstrate how location-based and AR functionality can be used to create a living experience of local history.

There were a total of three development periods and three user testings, with the last one being the evaluation of the app. The development period lasted for about 4-5 months, starting in early December with the first stage of programming and being finished in the star of April with the evaluation of the app on Bjørnsund.

The results showed that very few of the people testing the app have used or seen an app like this before. All that answered the question about if they would want to use an app like this said yes, giving a very strong indication that there is a market for this kind of apps and for the interest in local history. A larger part of the testers said that they learned something new, while those with the most knowledge of the history beforehand appreciated the refreshment of it. The user interface was given good feedback, concluding that it was made easy enough for everyone to use, regardless of previous experience with similar apps. It was evident by observing some of the testers use the app, who of them was used to smartphones and had used a map on a mobile beforehand. Not surprisingly the youth were the ones who learned to use the app fastest, and some of the more elderly were the ones struggling the most using the app. Also people who are not used to orientating themselves on maps may struggle a bit to comprehend where the houses are according to themselves in the map. There were a few errors in the Google map, for example one of the roads on Bjørnsund where missing on the map. This may also have caused some extra confusion for the users. The content of the app was also given good reviews by the tester. There were some commenting on additional in-

formation they would like to have in the app, such as more information about the previous owner of each house and also a register of the current owners of the houses.

## **8.2. Research Contributions**

The contribution from this research is mainly in confirming that there is a market for digitalizing and providing a new way to display local history using an app. Confirming that using location-based technology gives the user a more lively experience with having only the relevant content showing up on the screen, limiting the work the user has to perform to get information. There was also an idea of using an app like this for local authorities when considering building applications for zoning areas that came as a suggestion from one of the testers of the app.

The result from the user testing gave some surprising feedback on using AR-technology in an app like this. Beforehand the thought were that the users would find the technology new, fun and also interesting to try out. The result on the other hand showed that most of the users did not feel it necessary to have this in the app and were not sure if they would use it if available.

## **8.3. Limitations and Weaknesses**

The limitations occurring during this thesis arose around the development phase. The two main limitations were the development time and also development experience. This was what stood in the way of fully completing the prototype to the system requirements. Having an unforeseen problem with memory problems caused by a large amount of pictures, threw the time schedule off and resulted in not having enough time to implement the AR-technology into the app prior to the evaluation. With no option to postpone the evaluation there was nothing else to do but evaluate the app without AR. There was no point in implementing the AR-function only halfway and risk it not fully functioning. There was also an unforeseen problem during the first user testing, where the phone could not update the GPS-signal. This turned out to be because of the material the University building is made off, blocking the GPS-signal. Luckily this test was not dependent of the GPS-position to be completed. Other than this the rest of the prototype worked as planned.

The experience of the developer prior to this thesis was limited in app developing and this combined with unforeseen problem is the main reason for the prototype not fully being completed. Two completely new technologies were being developed with, giving a large chance of problems underway. It might have been wise to have started the development a few weeks earlier, giving some more time to develop and maybe completing all system requirements.

#### **8.4.Further work with Bjørnsundsappen**

The research done in this thesis can be continued by first completing the app including the AR-functionality. Then a new evaluation should be done, to get a confirmation on users view on AR in mobile apps. Content from another location could be added and testing the app there to see if the results and interests from people are the same. It might also be wise to do a user testing during the main season on Bjørnsund in July. This would give more testers and also raise the chances of having tourists test the app. This would help get some research answers on how an app like this would be perceived by the tourist user group.

It might also be interesting to have a cooperation with the technical services at the Department of Plan, Building and Fire in Fræna Kommune. They could have a trial period using the app and see if this helped them in making better decisions on the building applications for houses with building protection. This could be a study building on the work done in the thesis and using the same app, with some alterations for that particular purpose.

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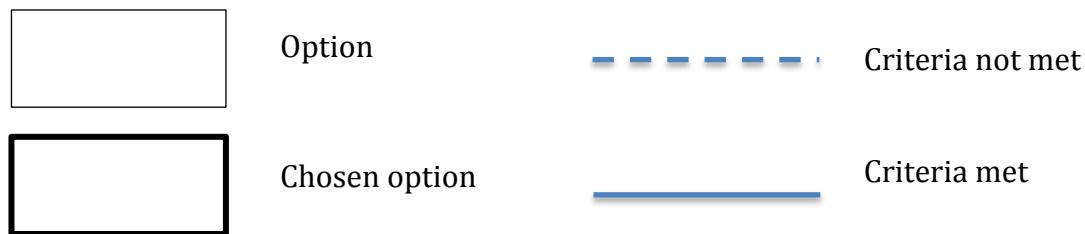
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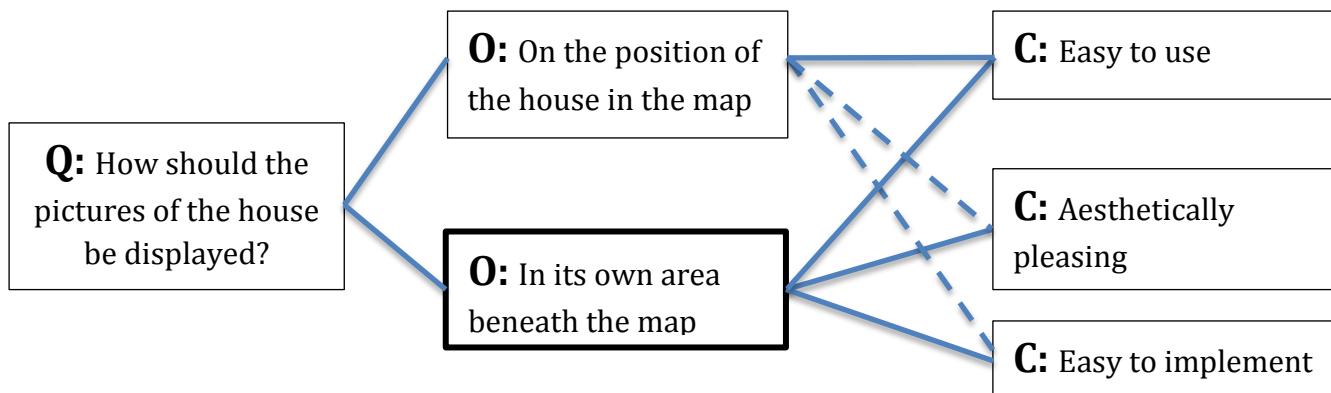
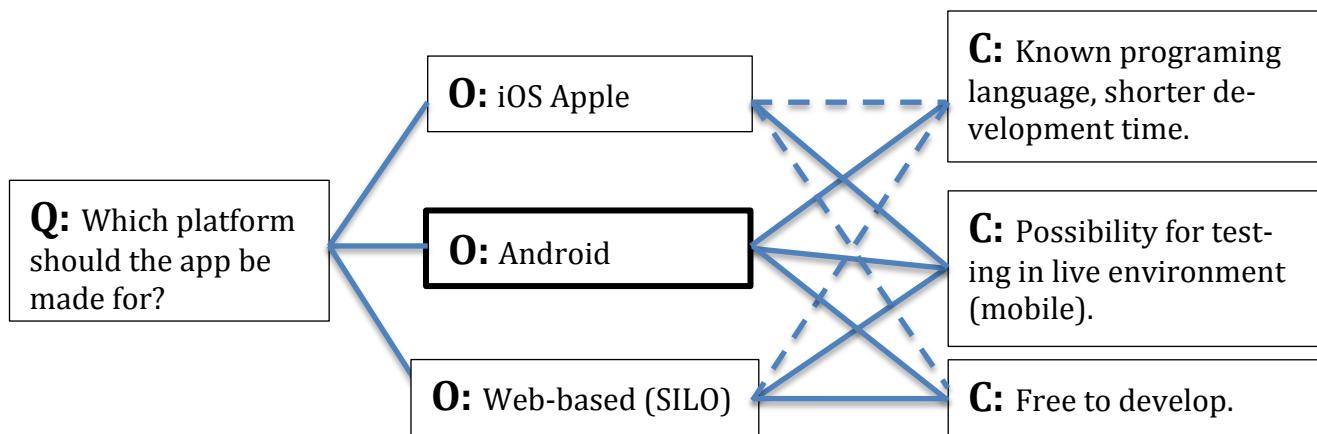
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## Appendix A – QOC diagrams



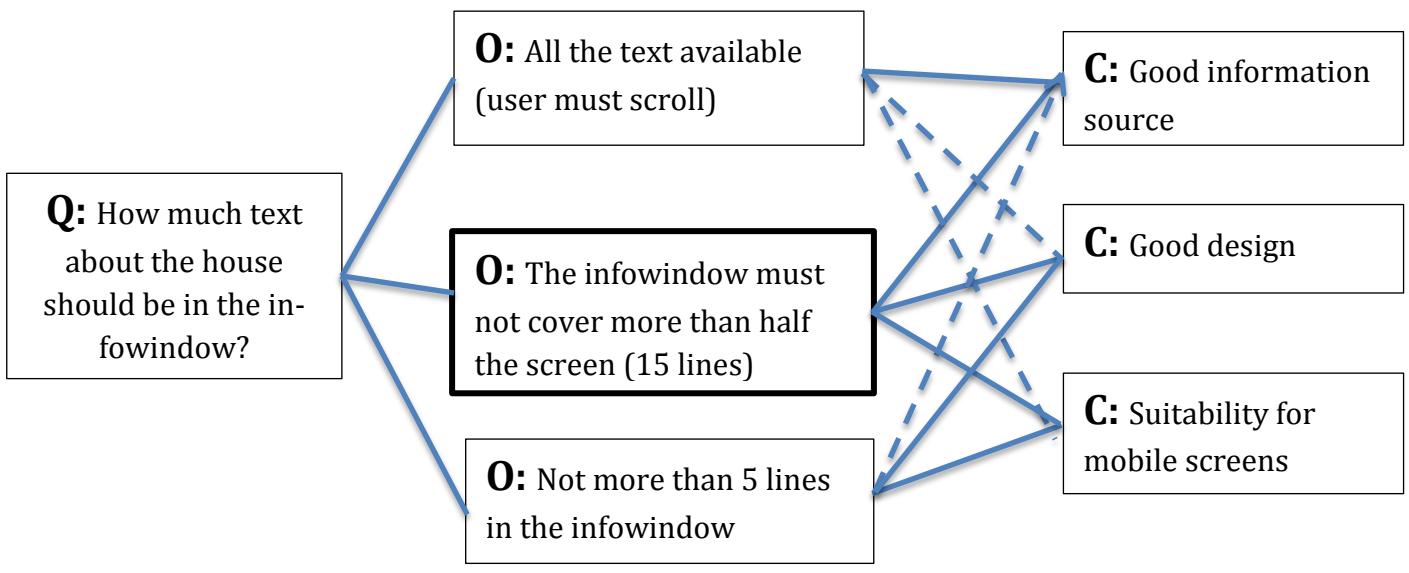
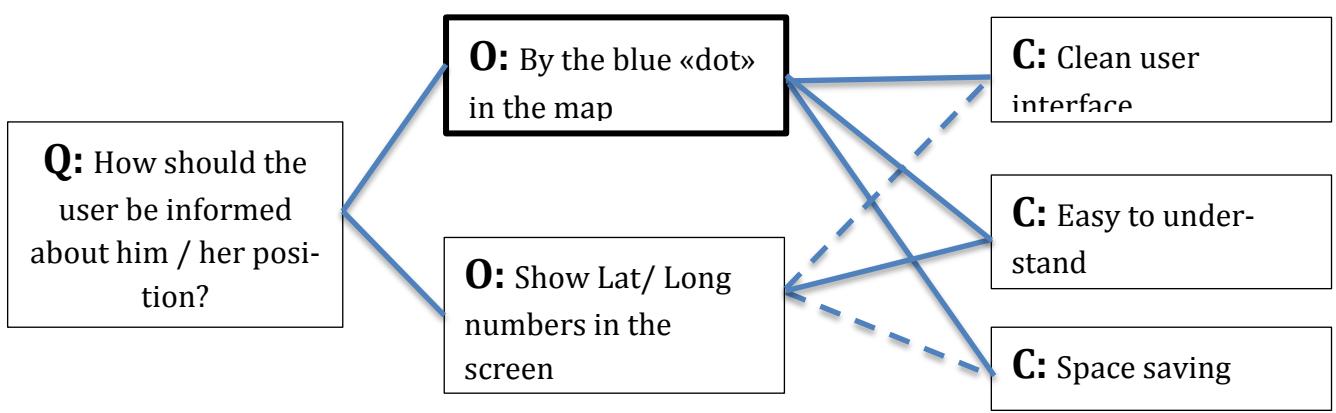
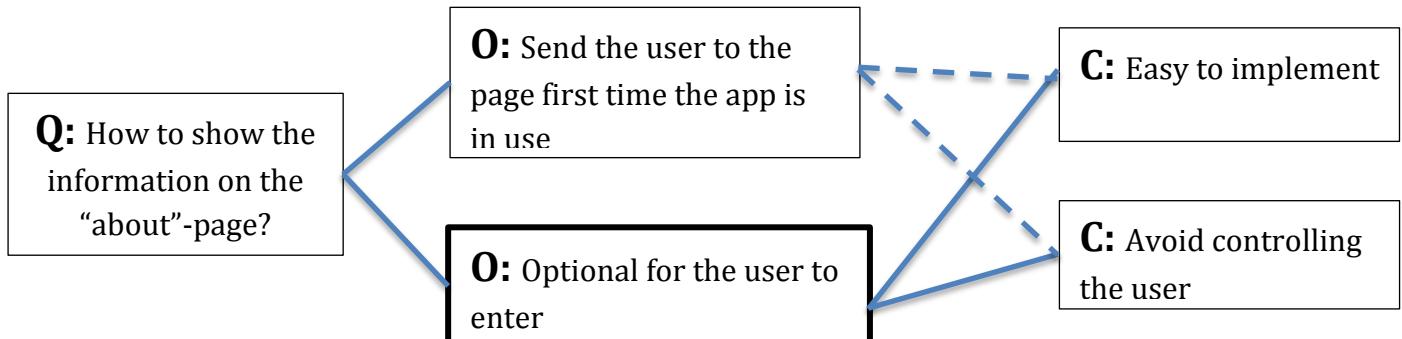
### Question      Option      Criteria

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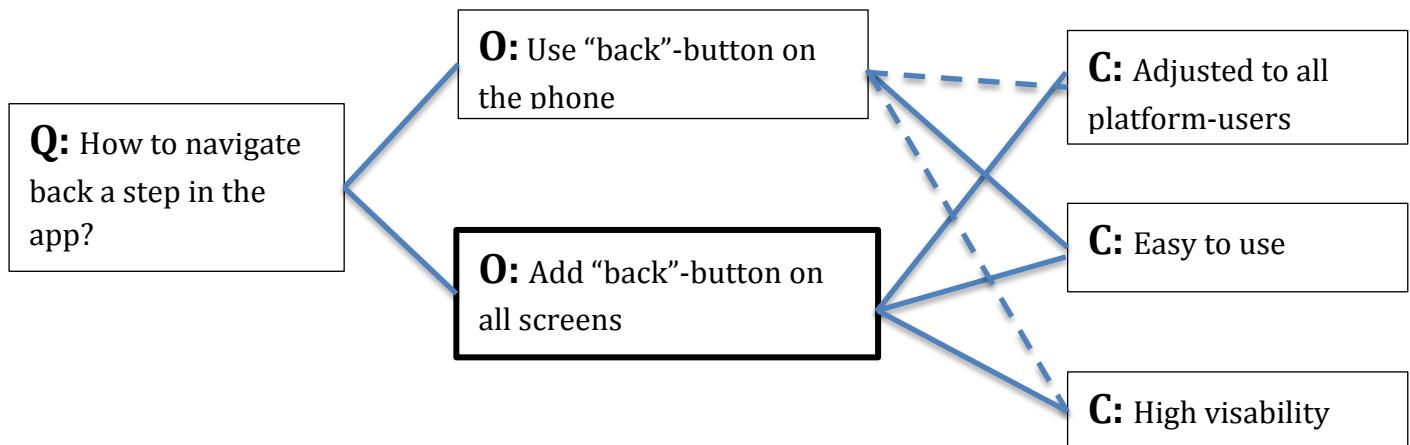
# Question      Option      Criteria

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# Question      Option      Criteria

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## **Appendix B – Questionnaire First User Test**

### **Spørsmål til testerne – Brukertest 1:**

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1. Føler du det er nødvendig med «Hjem-knapp» innpå appen i tillegg til den på selve telefonen?
2. Merker du noen tydelige feil/ problemer med brukergrensesnittet?
3. Er grensesnittet greit å forstå?
4. Ønsker du informasjon om din egen posisjon I skjermbildet (Lat,Long)?

## Appendix C – Original sides from the source book

### Sørhavn, bnr. 21

Ut frå bnr. I den 1/11 1889

#### Skyld

Frå 1889: 5 øre.

#### Frådelt

Frådelt: 1987: 441,1 m<sup>2</sup> til bnr. 123.

#### Plassering

Eigedomen ligg på vestsida av Nordre Bjørnsund på «Rør'n».

Eigaren hadde rett til fiskeberg på Rundholmen.

#### Bygningar i dag

Eit våningshus oppsett i 1914 av pløgd tømmer. Det har 2 etasjar og loft. På nordsida er det påbygd eit bislag i 2 etasjar. Huset er tekt med skiferstein. På framsida blei det kring 1960 påbygd ei ark like høg som huset. Det gamle inngangspartiet blei då teke bort.

Eit uthus med skråtak av bølgjeblekk. Det innheld vedhus og wc.

#### Tidlegare bygningar

Eit våningshus av tømmer med torvetak oppsett i 1878. Det var 19 alen langt, 11 alen breitt og 5 1/2 alen høgt. Det innehold 2 stuer, kjøkken og gang og sperreløft. I kjøkkenet var det skorsteinspipe og i stua kakkelomn. Til nordre langvegg var det tilbygd ei sval. Nokre år seinare blei det bygd ei sval til vestre endevegg som blei innreidd til kammers.

Dette huset blei rive i 1914 for å gje plass til eit nytt våningshus.

I 1892 blei det nedafor huset oppsett eit naust med ein steinmur framføre. Ved sidan av ein treplatting med ein frittståande heiseinnretning (vinnje). Naustet blei rive i 1912, og det blei oppsett ei brygge i 2 etasjar på same tomta. Bryggja er fleire gonger påbygd. Ho er frådelt og har bnr. 123.

#### Brukarrar

Iver Andreas Sæmundsen (Iver Andreas på Røren) f. 1/10 1853 på Nordre Bjørnsund, d. 30/4 1887, son til Sæmund Andersen og Lovise



Våningshuset til Sigurd Skarsbø på Røren som blei bygd i 1914. Foto: Ivar Hallsteinsen.



Jon Edvard Paulsen (Jon på Røren f. 1867 kona Siri Anna Olsdt. f. 1850 og dottera Inger Anna f. 1891.

Marie Augustiniusdt. (sjå bnr. 22). Han omkom saman med broren Adolf og Johan Eriksen Groven, dei hadde vore ute på Ersgrynne og sett line. Dei skulle segle inn sundet mellom småskjæra ved Knubben og inn ytste Buasundet. Sundet braut igjen og båten, toringen til Iver Andreas, braut full. Fjerdeemann om bord, Johan Johansen (på Røren) berga seg i land på eit av småskjæra. Gift 7/7 1877 med *Siri Anna Olsdt. Dale* f. 25/5 1850, d. 27/3 1921 av hjartelamming i Molde, dt. til Ole Knutsen og Kristi Pedersdt. Dale i Fræna, gnr. 48, bnr. 5. Ho gift 2. gong 17/5 1891 med *Jon Edvard Paulsen (Jon på Rør'n)* f. 22/9 1867 på Håset i Fræna, d. 14/7 1963 i Molde, son til Paul Ingebrigtsen og Ingeborg Jonsdt. Haaseth (Håset) (sjå Fræna bind III, side 195).

Dei flytta i 1916 til Molde der dei busette seg på Øvre Bekkevold.

Iver Andreas Sæmundsen fekk festeseddel 23/7 1880.

Siri Anna Olsdt. fekk skjøte på eigedomene den 15/8 1891 for 200 kr.

Tenarar 1891: Jon Edvart Paulsen Haaseth f. 22/9 1867 i Fræna, tyende, (sjå same bnr.). (sjå Fræna bind III, side 195).

Born i 1. ekteskap:

- a) Sanna Lovise f. 10/1 1880, d. 6/10 1895 av hjernebetennelse.
- b) Karoline f. 6/11 1883, d. 15/11 1964 på Hoem, gift 29/5 1904 med Peder Rasmussen Hoem (på Rosten) f. 27/2 1881, d. 18/2 1957, son til Rasmus Andreasen og Helge Eliasdt. Hoem, gnr. 28, bnr. 4. Dei busette seg på Hoem indre.

Born i 2. ekteskap:

- c) Inger Anna f. 22/8 1891, d. 6/2 1979, gift 4/11 1913 med Edvard Eriksen Holen, f. 28/3 1876 på Holen i Fræna, d. 13/12 1949 i Molde, son til Erik Knutsen og Karen Edwardsdt. Holen, gnr. 59, bnr. 3. Dei busette seg i Molde.

*Knut Sigurd Knutsen Skarsbø* f. 24/11 1890 på Skarsbø i Fræna, d. 3/3 1986 i Molde, son til Knut Knutsen Skarsbø og Hanna Olsdt., gnr. 73, bnr. 3. Gift 1/12 1916 med *Margrete Olsdt. Hustad*. f. 9/4 1895 på Hustad, d. 29/11 1977 i Molde, dt. til Ole Jørgensen og Abel Markusdt. Hustad, gnr. 91, bnr. 14. Dei budde først på bnr. 55. Dei flytta i 1962 til Molde.

Sigurd kom til Bjørnsund i 1906-7. Han var handelsbetjent hjå onkelen Oliver. Sigurd byrja med eige fiskemottak i 1918. Margrethe var tenestejente hjå Oliver i 1916.

Born:

- a) Karstein f. 7/4 1917, d. 23/8 2008, neste brukar.
- b) Anna f. 7/6 1919, gift 21/6 1942 med Rudolf Rasmussen f. 1/9 1919, d. 5/4 2004 i Molde, son til Rasmus Andreas og Anna Rasmussen, Nordre Bjørnsund. Dei busette seg på bnr. 39.
- c) Oskar f. 1/8 1921, seinare brukar.
- d) Håkon f. 7/10 1923, gift 6/6 1948 med Reidun Johansen f. 6/12 1922, d. 18/3 2000, dt. til Johan Ludvig og Synnøve Johansen (sjå bnr. 71). Dei busette seg i Molde
- e) Solveig f. 15/7 1927, gift 1955 med Arne



*Knut Sigurd Skarsbø* f. 1890 og *Margrethe Olsdt.* f. 1895 og borna frå v: Anna f. 1919, Håkon f. 1923, Karstein f. 1917 og Oskar f. 1921.

- Stokke f. 1929. Dei busette seg i Trondheim, seinare i Oslo.
- f) Oliver f. 10/10 1929, gift med Nanett Lenox f. 2/2 1927 i Sydney, Australia. Oliver reiste i 1954 med båten "Jenco" til New Zealand og vidare derifrå til Australia der han busette seg i Sydney.
- g) Sigurd f. 18/8 1933, gift 23/6 1962 med Bodil Myhr f. 14/5 1939 i Statsbygd. Dei busette seg i Trondheim, seinare i Ålesund og Molde.

*Karstein Skarsbø* f. 17/4 1917 på Nordre Bjørnsund, d. 23/8 2008, son til forrige brukar, gift 27/6 1948 i Hustad kyrkje med *Elsif Ashjørg Gule* f. 5/6 1920 i Askevågen på Male i Hustad, d. 20/1 2007, dt. til Birger Alfred Nilsen og Ane Serine Ingebrigtsdt. Gule, Askevåg, Hustad, gnr. 94, bnr. 35. Dei flytta i 1971 til Elnesvågen.

Karstein Skarsbø fekk auksjonsskjøte på eigedomen den 7/4 1925 for 12000 kr.

Born:

- a) Sigmund Magne f. 4/8 1949, gift 24/6 1972 med Anne Lise Farstad f. 25/6 1948, dt. til Arthur og Anny Farstad, Nordre Bjørnsund (sjå bnr. 40). Dei busette seg på Moen i Fræna. Dei er skilde. Han gifta seg 2. gong 1987 med Maureen Mahoney frå Aberdeen, Skottland. Dei busette seg i Aberdeen. Dei er skilde. No sambu med Solveig Helseth f. 19/7 1951 i Bud, dt. til Jakob og Hanna Helseth, Bud. Dei busette seg i Bud.
- b) Bernt Arild f. 6/2 1952, gift 13/7 1990 med Anita Johansen f. 19/7 1959, dt. til Lyder og Inger Marie Johansen, Elnesvågen. Dei busette seg i Molde.
- c) Kirsten Elisabeth f. 7/5 1953, gift 21/11 1970 med Bjørn Terje Moen f. 15/10 1944, son til Asbjørn Albertsen og Minda E. Moen på Sylte i Fræna, gnr. 56, bnr. 33. Dei busette seg i Molde.
- d) Anne Margrethe f. 18/3 1956, gift med Ola Sletnes. Dei busette seg i Molde. Dei er seinare skilde.

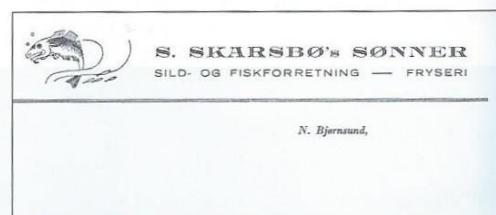
*Oskar Skarsbø* f. 1/8 1921 på Nordre Bjørnsund, d. 11/6 1998, bror til forrige brukar, gift 30/4 1960 med *Kjellaug Nesje* f. 15/6 1931, dt. til Rolf Nesje og Judith Julshavn (sjå gnr.2, bnr.1). Oskar og familien flytta i 1971 til Elnesvågen og busette seg der.

Born:

- a) Terje f. 2/11 1960, gift 16/11 2001 med Nina Janne Eriksen f. 17/9 1968 i Ålesund. Dei bur i Elnesvågen.
- b) Odd f. 7/12 1962, sambu med Torill Jørgensen f. 12/4 1969, frå Sandblåst.
- c) Leif Kristian f. 17/10 1964, gift med Karin Hansen f. 2/9 1965 i Skedsmo. Dei busette seg i Elnesvågen, seinare på Gule. Dei er seinare skilde.

*Fræna kommune* fekk skjøte på eigedomen den 10/5 1976 for 180000 kr.

*Åndalsnes Jeger og Fiskeforening* fekk skjøte på eigedomen den 11/5 1977 for 35000 kr



Faximile av brevark frå firma *S. Skarsbø's sønner*.

### Innsitjarar

*Albert Martin Madsen* f. 27/2 1885 på Hammerøya, d. 28/9 1918 av spanskesjuka, son til Mads Andreas Andersen og Sigrid Andersdt. Hammerø, gift 1917 med *Anna Ovidia Olsdt. Lunde* f. 30/7 1887 frå Tysnes, dt. til gbr. Ole Olsen og kone Anne Johannesdt. Lunde, Tysnes i Hordaland. Albert var ei tid i Amerika, men kom attende. Ho flytta tilbake til heimplassen etter at Albert døydde.

Born:

- a) Aslaug f. 12/8 1918 på Nordre Bjørnsund, d. 3/12 1971 på Tysnes, gift med Henrik Grimsland.



Anna Ovidia Olsdt. f. 1887 enkja etter Albert Martin Madsen og dottera Aslaug f. 1918.

Peder Madsen f. 25/2 1884 på Hammerøya, d. 23/7 1916. Han omkom ved drukning i Sunndalsfjorden. Son til Mads Andreas Andersen og Sigrid Andersdt. Hammerø. Gift med Anna Elise Ødegaard f. 16/6 1886 i Kristiansund, d. 13/10 1940. Peder var skreddar og dei budde ei tid i Kristiansund. Dei flytta til Sunndalen i 1914 kor dei budde på garden Sande. Anna blei oppattgift med Egil Berg f. 1/3 1892, d. 4/11 1971. Dei budde på Sunndalsøra.

Born:

- Sigrid Marie f. 6/10 1912 i Kristiansund, d. 6/2 1991, gift med Peder Jensen f. 12/5 1918, d. 10/2 1982. Dei busette seg på Sunndalsøra.
- Miriam Irene (Mimmi) f. 23/4 1916 i Sunndalen, d. 2/3 1992. (Ho blei adoptert av Andreas og Ollianna Mathisen, sjå bnr. 57).

Adolf Knutsen Dalhaug f. 11/2 1894 på Nordre Bjørnsund, d. 20/5 1964 i Ålesund, son til

Knut Andreas Andreassen og Ingeborg Anna Paulsdt. Dalhaug (sjå bnr. 19), gift 20/8 1916 med *Emma Beate Olufsdt. Melsæter* f. 29/8 1894, d. 28/4 1980 i Ålesund, dt. til Oluf Olsen Melsæter og Karen Anna Knutsdt. Nordre Bjørnsund (sjå bnr. 19). Dei 2 eldste borna vart fødde medan dei budde her. Dei busette seg på bnr. 9.

*Leif Edgar Thoresen* f. 5/9 1892, d. 18/3 1922 av tuberkulose, son til Karl Theodor Thoresen og Ragnhild Thoresen Bjørgen (sjå bnr. 2), gift 10/7 1920 med *Borghild Johansen* f. 29/5 1899, d. 24/1 1982, dt. til Johan og Karoline Johansen (sjå bnr. 31). Dei budde her frå 1921. Borghild gifta seg oppatt 22/3 1933 med *Nikolai Gornitshni* f. 24/10 1888 i Russland, son til Peter og Ekaterina, d. 30/11 1955 av hjarteslag. Dei busette seg på bnr. 52. (Sjå meir om familien der).

Born i 1. ekteskap:

- Edgar Reidar Kaare f. 6/3 1921, d. 14/5 1945 på Vestnes pleieheim av tuberkulose. Leif Edgar var assistent ved Bjørnsund fyr på Moøya. Borghild budde seinare på bnr. 35.

*Iver Bernhard Lauritsen* f. 11/4 1896 på Nordre Bjørnsund, d. 5/8 1977 på Aukra, son til Johan Laurits Iversen og Beret Anna Olsdt. (sjå bnr. 20), gift 5/12 1920 med *Jenny Lovise Johansdt.* f. 6/2 1901, d. 4/2 1992 på Aukra, dt. til Johan Johansen og Karoline Larsdt. (sjå bnr. 31). Dei busette seg på bnr. 20.

*Hans Jakob Bruun*, f. 18/7 1886, d. 30/5 1965 på Aukra, gift med *Olga Johanne Knudsdt.* f. 19/1 1895, d. 1/6 1981 på Aukra, dt. til Knut Andreas Pedersen og Malene Gundersdt. Hoksnes på Eikrem, Aukra (sjå bygdebok for Aukra, bind III, side 37).

Born:

- Karsten Arnold f. 2/9 1920 på N. Bjørnsund, gift med Dagmar Helene Nesse f. 14/10 1925, dt. til Daniel Hansen og Hanna Hansdt. Nesse på Horrem (sjå bygdebok for Aukra, bind I, side 349). Dei busette seg på Horrem (sjå bygdebok for Aukra, bind I, side 363).



Hans Jakob Bruun f. 1886.

Hans Jakob var mannskap på «Jarl». Han budde og ei tid hjå Peder Bendiksen på bnr. 6, han var då mannskap på Peder sin båt.

Sverre Olsen Haukås f. 3/2 1900 på Nordre Bjørnsund, d. 6/1 1957 i Molde, son til Ole Andreas Asmundsen Haukås og Siri Anna Hansdts. (sjå bnr. 26). Gift 2/3 1924 med *Emma Kristine Løvik* f. 24/7 1904 på Aukra, d. 28/08 1993 i Molde, dt. til Hans Andreas Kristiansen Løvik og Karen Emilie Paulsdt. Oterhals, Løvik på Aukra (sjå bygdebok for Aukra, bind II, side 345). Dei busette seg på bnr. 80.

Johan Bernhard Bendiksen Hustad f. 27/9 1899 på Malefeten i Hustad, lærar, d. 13/9 1953, son til Bendik Bendiksen og Elen Ingebrigtsen Malefeten, bnr. 93, bnr. 1. Han busette seg på bnr. 55.

*Oluffa Gjerp Bertheusen* f. 20/5 1901 i Valberg i Lofoten, d. 17/12 1976 på Orkanger, dt. til Andreas Gjerp og Sofie Benjaminsdt.

Born:

a) Elisabeth f. 22/7 1926.

Oluffa gjekk jordmorskule i Bergen og var deretter jordmor i Mehann i Finnmark fram til ho, i 1932, blei tilsett på Bjørnsund. Ho var tilsett til 1936 då ho flytta til Vik i Flatanger. Ei yngre syster av Oluffa, Camilla Gjerp, budde og ei tid hjå dei på Bjørnsund. Ho blei seinare gift på Sunnmøre.

*Ole Kristiansen Kvalvik* f. 24/3 1904 i Kristiansund, d. 24/4 1941 son til Kristian Martin Olsen og Ragna Birgitte Olsdt. Kvalvik på Tornes nedre (sjå Fræna bind II, side 472). Han var skipper og omkom ved ei ulukke om bord i ein båt. Gift 23/7 1938 med jordmor *Sigrid Hoemsnes* f. 23/8 1907, d. 17/12 1998, dt. til Mathias Hansen og Inger Anna Abrahamsdt. Hoemsnes på Løset (sjå Fræna bind III, side 98 – 99). Ho gift 2.gong 24/7 1949 med *Trygve Rasmussen* f. 5/11 1909, d. 13/8 1965 på Aukra, son til Olaus Tomas og Martha Rasmussen, Nordre Bjørnsund (sjå bnr. 42). Dei flytta i 1949 til Røssøyvågen på Aukra og busette seg der.

*Rudolf Rasmussen* f. 1/9 1919 på Nordre Bjørnsund, d. 5/4 2004 i Molde, son til Rasmus

Andreas Rasmussen og Anna Emilie Pedersdt., Nordre Bjørnsund (sjå bnr. 39), gift 21/6 1942 med *Anna Skarsbø* f. 7/6 1919, dt. til Sigurd og Margrethe Skarsbø (sjå same bnr.)

Born:

a) Solbjørg Margrethe f. 16/9 1942.

b) Anne Reidun f. 15/11 1943.

c) Rudolf f. 2/10 1945.

Rudolf og familien busette seg på bnr. 39 og er omtala der.

Noregs Sildesalgslag (Storsildlaget) hadde ordrekontor her ein del år.

## **Appendix D – Questionnaire Second User Test**

### **Spørsmål til testerne – Brukertest 2:**

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1. Hvordan oppleves appen i sin helhet?
2. Merker du noen tydelige feil/ problemer med appen?
3. Hvordan oppleves innholdet? (for mye/ lite, feil presentert)
4. Synes du det bør være AR inkludert?
5. Hvordan ville du presentert det?

## **Appendix E – Questionnaire Evaluation**

# **Spørreskjema om Bjørnsundsapp**

1. Kjønn: Mann  Kvinn
2. Hva er din alder:  <16  16-25  25-35  35-50  >50
3. Hvilken kjennskap har du til Bjørnsund  Turist  Kjent
4. Har du bodd på Bjørnsund før?   Nei
5. Har du kjennskap til boka «Bygdebok for Fræna, Gard og Slekt 1» med informasjon om Bjørnsund, husene og familiene som har bodd her?  
 Ja  Ja, litt  Nei
6. Hvilket inntrykk fikk du av Bjørnsundsappen, var den grei i bruk?  
(feks. Vanskelig eller lett i bruk, fikk ikke til å bruke den)  
\_\_\_\_\_  
\_\_\_\_\_

7. Er det noe du savner/ mislikte i brukergrensesnittet til appen?

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8. Er det noe du savner/ mislikte med innholdet i appen?

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9. Lærte du noe av å bruke appen, feks. noe nytt du ikke viste fra før?

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10. Føler du at appen kan ha en hensikt til å være med på å bevare historien til Bjørnsund?

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11. Ville du brukt denne type applikasjon om du var turist på dette eller et annet sted?

Ja       Nei

12. Hva er ditt samlede inntrykk:

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## **Appendix F – Answers Questionnaire Evaluation**

- 6. Hvilket inntrykk fikk du av Bjørnsundsappen, var den grei i bruk?**  
**(feks. Vanskelig eller lett i bruk, fikk ikke til å bruke den)**
- Den var enkel å bruke, lett forståelig.
  - Synes den var lett å bruke.
  - Enkel i bruk og meget informativ.
  - Ja den var grei å bruke.
  - Veldig lett og oversiktlig.
  - Enkel i bruk, men krever litt kjennskap til Bjørnsund fra før. (Namn på hus etc.)
  - Lett i bruk
  - Lett å bruke og svært informativt. Svært godt billed materiell.
  - Appen var lett i bruk, oversiktig kart og nye historiske bilder.
  - Enkel og informativ.
  - Lett.
  - Enkelt å bruke.
  - Den var lett å bruke – lett å lese og forstå
  - Enkel å bruke. Litt vanskelig å orientere seg i kartet (se hvor jeg er, kart vs. placering)
  - Appen virker veldig bra. Lærer fort hvordan du bruker den og det er en morsom måte å gå rundt på øyen.
  - Forholdsvis lett å bruke. Kunne kanskje være et mer nøyaktig kart enn det som er brukt.
- 7. Er det noe du savner/ mislikte i brukergrensesnittet til appen?**
- Nei
  - Nei
  - Nei
  - Nei
  - Brukervennlig app som er enkel å finne frem i.
  - Nei
  - «tilbake» eller «lukk»-symbol ved fullskjermvisning av bilder. «lokasjonsboble» dekker tidvis bildeserie i nedre skjerm. (søker lokasjon lenge). Flyfoto/ streetview / satellittbilde «under» kart.

- Opplevde appen lett å bruke og orientere seg i. En app som kan brukes av de fleste uten spesielle tekniske ferdigheter.
- Database med søkefunksjon på navn.
- Egen fane/ «rullgardin» e.l. med oversikt over alle eiendommer/ huseiere. Ved å markere navnet ville huset bli markert med et flagg e.l. i kartet.
- Kartet kunne vist en større omkrets/ avstand fra der en sto med markerte hus.
- Musikk ☺ Voice.
- Nei
- Hadde vært greit å kunne velge satellitt view, enklere å orientere seg.
- Synes alle hus og severdigheter skulle vært synlig i appen hele tiden. Da kunne jeg funnet en ting jeg ville sett og planlagt ruten dit. Nå må jeg være i nærheten for å se det. Symbolet på hus og severdigheter skulle vært forskjellige.
- At det kom opp avstand til et annet objekt hele tiden. Oppdaterte seg for sent. Litt vanskelig å se «hvor en er henn».

#### **8. Er det noe du savner/ mislikte med innholdet i appen?**

- Nei
- Nei
- Nei
- Nei
- Deler av teksten mangler på noen av husenes informasjonstekst.
- Kanskje bilde av huset i nyare tid «først» slik at ein veit ein er på rett plass.
- Bildetekst med info (årstall etc.), markerte severdigheter på kart (isbjørn etc.) med annet symbol
- Er bare positiv til innhold i appen, men håper den kan videreutvikles i samme retning som den allerede er etablert f.eks. informasjon om flere bygninger.
- Noe mer tekst på hvert bruksnummer.
- Navn på huseier, i tillegg til stedsnavn og bruksnr.
- Oversikt over huseiere med kobling til «flaggene»
- Nei.
- Kunne markeringa av der du er no ha ei skarp farge så det ikkje var tvil kovar du var?
- Det bør lages fleire typer tegn. Hustegn ok, men bør ha eget for severdigheter / monument.

- Med tanke på at appen kanskje skal brukes andre plasser så skulle det ha vært mulig å trykke på noe du vil se og deretter få opp ruten du skal gå.
- Det burde innledningsvis være et register som forklarte sammenhengen mellom br.nr og bruksnamn og dagen eier eller namn på huset i daglig tale. Kunne være bilde av noen av de eldste eierne på bruket.

**9. Lærte du noe av å bruke appen, feks. noe nytt du ikke viste fra før?**

- Ikke annet enn at jeg har sett bilder som jeg ikke har sett før.
- Fikk se bilder av husene jeg ikke har sett før.
- Ja, artig å lese om husa og fam. Som har holdt til i dei.
- Ja, fikk informasjon om husene som jeg ikke viste.
- JA! For en som ikke vet så alt for mye om Bjørnsunds historie fra før, er dette en lærerik app. Fint med bilder.
- Ja, mykje nyttig informasjon.
- Ja
- Ja, jeg fikk ny informasjon og repetisjon av allerede etablert kunnskap.
- Det var mange ting jeg ikke visste fra før, og det var mange bilder som var ukjent.
- Oppdatert historiekunnskap.
- Interessant billedmateriale som var delvis nytt. Oppfriskning av historiekunnskap.
- Ja.
- Ja – utan tvil mange gode opplevelser.
- Ja, lærte noe både fra tekst og biler.
- Ser hvordan husene og eller hvordan det så ut på Bjørnsund. Artig å lese historiene om de forskjellige husene.
- Som innfødt bjørnsunding kjenner jeg til historia omkring de fleste hus. Man blir oppdatert på historien hvis man bruker den.

**10. Føler du at appen kan ha en hensikt til å være med på å bevare historien til Bjørnsund?**

- Det kan den absolutt.
- Helt klart.
- -

- Ja det kan dei. Kjekt å lese om husa og se bilder av hvordan det var før og interessant.
- Ja.
- Heilt klart.
- Definitivt
- I aller høyeste grad. Den vil også bidra til økt interesse om Bjørnsund historikk.
- Med mer tekst til hvert bruksnummer vil denne appen absolutt bidra til å bevare historien til Bj.sund.
- Ja!
- Ja, absolutt.
- Ja.
- Ja ein kan både innhente historie og bevare historie.
- Ja. Enkelt å bruke for alle aldersgrupper også barn / ungdom. Fin måte å lære om historien på.
- Helt klart. Med tanke på at alle bruker smart telefoner og hvis prisen ikke blir så høy. Kan og bli populær i f.eks. en storby.
- Ja, helt klart. Både for de som er kjent og de som ikke er det. Hvis man bruker den får man en stadig repetisjon.

**11. Ville du brukt denne type applikasjon om du var turist på dette eller et annet sted?**

Ja       Nei

JA: 15 Nei: 0

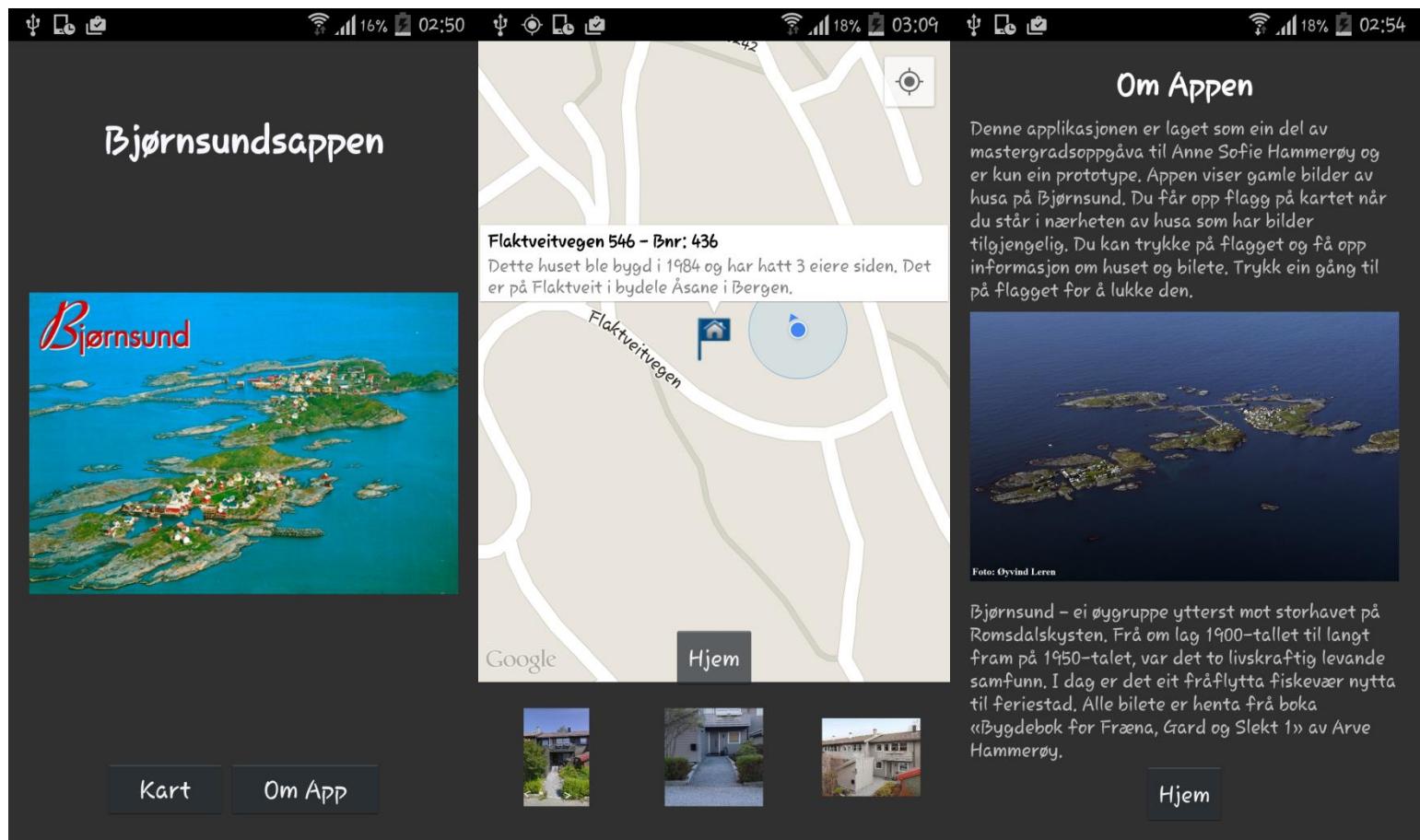
**12. Hva er ditt samlede inntrykk:**

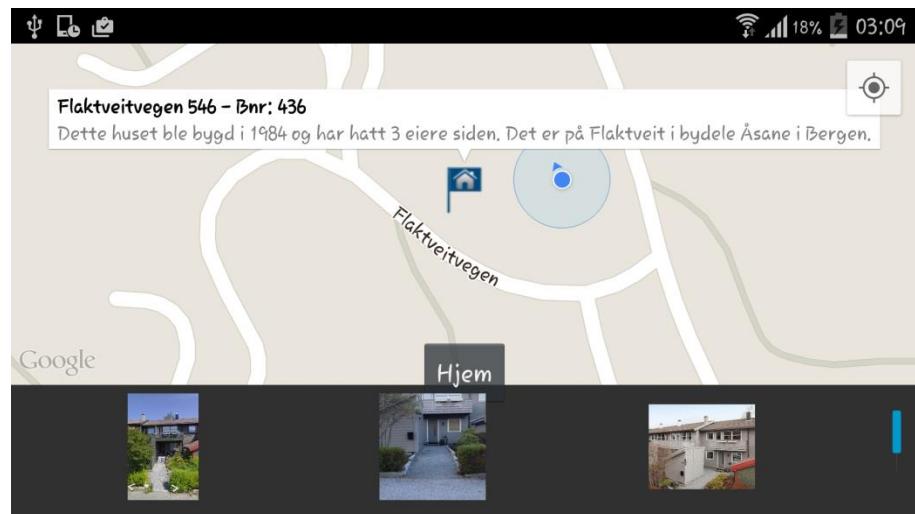
- En grei app med mange bilder og mye tekst for hvert hus. Mye historie og informasjon samlet lett tilgjengelig for alle.
- Fin app som jeg virkelig kunne ha tenkt meg. Et konsept jeg liker veldig godt.
- -
- Veldig bra. Fint å kunne bruke et slikt hjelpemiddel for å lese historie om husa på Bjørnsund.
- Lærerik og informativ app som er enkel å bruke. Et pluss at der er bilder av husene. Bør imidlertid ordne opp i tekstsrubrikken, slik at hele teksten kommer med.
- Veldig bra, likte prototypen godt.

- Funksjonell, enkel i bruk. Noe begrenset informasjon og enkelte forbedringsmuligheter i grensesnittet.
- Svært positiv. Håper den kan, etter hvert gjøres tilgjengelig for allmenheten. Tror dette er en apptype som også kan danne mal for andre samfunn i vårt langstrakte land. En type app mange ville like å ha tilgang til.
- En veldig nyttig app om kan brukes mange steder. For øygruppa Bjørnsund ville andre opplysninger som rutebåttider, bevertning, arrangement, fiskeplasser og turløyper være nyttig.
- Spesielt flott med alle bildene!
- Interessant app som kan finpusset noe. God reklame for Bjørnsund!
- Nice!
- Om du er kjent frå før er dette ein flott måte å hente meir historie på. Er du turist og veit lite om øyane, må dette være ein utmerket måte å smale informasjon om plassen frå tidligare, hente dagens historie og finne frem til «det spesielle» som er merket på kartet! Bjørnsundsappen må være «midt i blinken» for alle!
- Veldig bra laget. Men noen småjusteringer (som beskrevet i tidligere svar) tror jeg dette blir veldig bra og et fint læremiddel både for kjente og turister. Fint tiltak for å bevare historien til Bjørnsund.
- Appen har et utrolig potensiale. Hvis den blir utviklet med tanke på en storby og kanskje med ferdig ruter som du valgte etter hva du liker å se. Synes appen fungerer kjempebra på Bjørnsund og håper den kommer for salg. Kanskje på iOS og? ☺
- Et flott verktøy både for kjente og ukjente. Gjennom tekster får man en orientering om historien (det kunne være mere, gjerne om de som har bodd i huset). Bilde av huset (objektet) fra flere tidsperioder og fra flere vinkler er fint. Det kunne være fint med bilde av noen av de som har bodd der. En slik er fremtidsrettet og stimulere til å gå rundt å se og bli kjent. Noe å satse på.

## Appendix G – Screenshots of the prototype

Screenshots from the Samsung Galaxy S3:





### Screenshots from the HTC Sense:

