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Storytelling of Norwegian mountain farming.

Through a milkmaids perspective, focusing on a user centred design approach, exploring AR and Audio as technology.

Master's thesis in Master in interaction design (MIXD)
Supervisor: Ole Edward Wattne
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Faculty of Architecture and Design
Department of Design

Abstract

Purpose & limitations: This master thesis is based on the rurAllure project, where the purpose is to attract pilgrimage visitors to nearby museums and other important attractions along the trip. The main user group that has been explored during this project is mainly Norwegian pilgrimage travellers in the age group between 30 and 69 years of age. The research question for the master thesis is: *How to tell the story of Norwegian mountain farming through a milkmaids perspective, focusing on a user centred design approach, exploring AR and Audio as technology?* The implications of the study are mainly the narrative aspect of mountain farming.

Research methods: Research methods that are used to explore the research question are practice based research by design, double diamond design process, literature review, questionnaire, interviews, personas, storyboards, user scenarios, focus groups, low and high fidelity prototypes, and user testing.

Findings: Some of the key findings from our study are: 26.8% of the people we sent the questionnaire to said that they were very interested in using a storytelling application and often the travellers travel alone or with friends or family. And many of the users main focus is to not use technology during the walk. The main goal of pilgrimage travellers during their walk is to be in the now, de-stress and be in contact with themself. Many of the participants we talked to wanted to experience history along the walk. Some of the participants highlighted that the cultural pilgrimage travellers were interested in a package deal when travelling. Multiple of the participants were overall positive to the use of AR and audio during the walk, and especially liked the idea to get notifications when arriving at an interesting site for heritage or mountain farming and wanted the app to be part of the rurAllure application. Some of the feedback from the user testing was that the application could be nice also for a younger user group such as children in school or kindergarten. There was also feedback given about the application could be used for mediations of restaurants, cafés, hotels and other places that are of interest for the pilgrimage traveller to give a “package deal” where all functionality is in one “place”.

Prototype: These findings resulted in a tangible prototype application, where the use of both AR and audio as a way of telling the story of the mountain farm was discussed in focus groups and further usability tested. The application both uses the camera for finding the real aspect in the world and adds new virtual figures and voices through 3D animated figures and sound.

Value: The project gives information about the user group and their needs and use of a storytelling application. The information is valuable for the rurAllure project and gives an important basis for exploring the need of the application from a museum point of view. Some important aspects to explore further is a younger user group, and the use of the application as a teaching tool for elementary school and teachers for teaching the history and methods of Norwegian mountain farming. It is also an idea to explore the use of AR as part of including users that have physical health challenges or deficiencies to make it possible to visit actual museums.

Keywords: *Norwegian mountain farming, augmented reality, AR, audio, sound, user centred design, interaction design, storytelling, narratives, practice based research by design, double diamond, milkmaid, dairymaid, freehold, package deal, cultural pilgrim, 3D, three-dimensional.*

Sammendrag

Formål & begrensninger: Denne masteroppgaven er basert på rurAllure prosjektet, hvor formålet er å tiltrekke pilegrimsbesøkende til nærliggende museer og andre viktige attraksjoner langs turen. Hovedbrukergruppen som har blitt utforsket under dette prosjektet er i hovedsak norske pilegrimsreisende i aldersgruppen mellom 30 og 69 år. Forskningsspørsmålet for masteroppgaven er: *Hvordan fortelle historien om norsk seterdrift gjennom øynene til en budeie, med fokus på et brukersentrert design, ved å utforske utvidet virkelighet og lyd som teknologi?* Begrensningen av studien er hovedsakelig det narrative aspektet ved seterdrift.

Forskningsmetoder: Forskningsmetoder som brukes for å utforske forskningsspørsmålet er praksisbasert forskning ved design, dobbel diamant designprosess, litteraturgjennomgang, spørreskjema, intervjuer, personas, storyboards, brukerscenarier, fokusgrupper, lav og høy fidelity prototyper, og brukertesting.

Hovedfunn: Noen av de viktigste funnene fra vår studie er: 26,8 % av personene vi sendte spørreskjemaet til sa at de var veldig interessert i å bruke en historiefortellingsapplikasjon og ofte reiser de alene eller sammen med venner eller familie. Mange av brukernes hovedfokus er å ikke bruke teknologi under turen. Hovedmålet til pilegrimsreisende under vandring er å være i nået, stresse ned og være i kontakt med seg selv. Mange av deltakerne vi snakket med ønsket å oppleve historien underveis. Noen av deltakerne fremhevet at de kulturelle pilegrimsreisende var interesserte i en pakkeløsning når de reiste. Noen av deltakerne var generelt positive til bruken av AR og lyd under vandringen, og likte spesielt ideen om å få varsler når de ankom et interessant sted for kulturarv eller seterdrift og ønsket at appen skulle være en del av rurAllure applikasjonen. Noen av tilbakemeldingene fra brukertesting var at applikasjonen kunne være fin også for en yngre brukergruppe som skole- eller barnehagebarn. Det ble også gitt tilbakemeldinger om at applikasjonen kunne brukes til formidling av restauranter, kafeer, hoteller og andre steder som er av interesse for pilegrimsreisende for å gi en "pakkeløsning" der all funksjonalitet er på et "sted".

Prototype: Disse funnene resulterte i en prototype-applikasjon, der bruken av både AR og lyd som en måte å fortelle historien om seteren ble diskutert i fokusgrupper og ytterligere brukertestet. Applikasjonen bruker kameraet for å vise den virkelige verden og legge til virtuelle figurer og stemmer gjennom 3D-animerte figurer og lyd.

Verdi: Prosjektet gir informasjon om brukergruppen og deres behov, og bruk av en historiefortellingsapplikasjon. Informasjonen er verdifull for rurAllure prosjektet og gir et viktig grunnlag for å utforske behovet for en applikasjon fra et museums synspunkt. Noen viktige aspekter å utforske videre er en yngre brukergruppe, og bruken av applikasjonen som et undervisningsverktøy for grunnskolen og lærere for å undervise i norsk seterdriftshistorie og -metoder. Det er også en idé å utforske bruken av AR som en del av det å inkludere brukere som har en fysisk funksjonsnedsettelse for at de skal kunne besøke fysiske museer.

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1.0 Introduction

1.1 Background

This master project is based on the rurAllure project where the focus is: “Promotion of rural museums and heritage sites in the vicinity of European pilgrimage routes” (rurAllure, n.d.).

There is an economic gain within the pilgrimage routes because it is a valuable and significant economic and political asset in Europe (rurAllure, n.d.). Therefore the rurAllure project is a big economic opportunity (rurAllure, n.d.). According to statistics from Jansson (2021), 857 persons travelled one pilgrimage trip in Norway 2021, in 2019 the same number was 2971 people, which means it is a user group with many opportunities to explore. The reason for the decreasing numbers in 2021 are likely due to the covid pandemic, but we don't know the whole background, therefore the numbers from 2019 are the more reliable numbers.

Today there is one weak point with the pilgrimage routes, often the people that walk the pilgrimage routes don't stop by other important places such as museums and other heritage sites (rurAllure, n.d.). One of the goals of the project is to make it easier for the pilgrim to do a detour and visit other nearby places, cultural- or historical sites, or towns along the pilgrimage route (rurAllure, n.d.).

To reach the goal, the rurAllure project focuses on designing, and testing different technological tools, and promotional strategies to generate economic activity (rurAllure, n.d.).

The concept consists of different institutions such as museums, libraries, or natural heritage sites that would have a positive gain of getting visitors from the pilgrimage routes (rurAllure, n.d.). These institutions are working together to create multimedia content that will be offered to the pilgrimage travellers before, during and after their travel (rurAllure, n.d.).

The rurAllure solution will consist of a cultural heritage knowledge base in connection to third party resources such as Wikipedia (rurAllure, n.d.). Further it is a co creation of content and narratives for the pilgrimage guide, to produce a shared digital exhibition (rurAllure, n.d.).

With the background in the rurAllure project and the challenge of attracting pilgrim travellers to nearby heritage sites such as Skibladner, Stiftelsen Lillehammer museum Maihaugen, and Mjøsmuseet AS the project group wanted to explore the use of narratives to engage travellers to visit other places on the pilgrim route to Trondheim through Lillehammer.

1.2 Motivation

After gathering some inspiration about different topics, the project group found Norwegian mountain farming from the past as an interesting topic to work with. Stiftelsen Lillehammer museum Maihaugen also has an exhibition of the Øy garden mountain farm and other smaller mountain farms in which the project group has gotten some of the inspiration from. Creating a design prototype for telling the story of the mountain farming, might contribute to more visitors to Maihaugen and therefore also be a contribution to the rurAllure project.

Another point of view is that Norwegian mountain farming is a big part of Norwegian heritage and the pilgrim travellers that travel the pilgrimage route through the mountains might walk past different mountain farms. Creating a way of presenting the history in the field of interaction design might contribute to increasing interest around the Norwegian heritage and make the travellers take time to experience the culture and history along the way.

1.3 Limitations

The focus of this master thesis is based on narrative communication rather than the aspect of attracting the travellers to nearby sites in the pilgrimage route. Even though the narrative aspect can be conveyed to the travellers before and during the pilgrimage travels, the exploration of attracting users to the museum are work for the future. Our goal is instead to focus on the narrative perspective, and how this

information could be conveyed to the users in an engaging way through interaction design and the use of technology.

The narrative perspective that the project aims to investigate is the mountain farming and the history told through the eyes of the milkmaid. The technology that is focused on is the use of augmented reality and audio as part of a user centred design approach in the field of interaction design. AR is implemented using both audio and camera functionality displaying three-dimensional characters and elements in the prototype.

1.2.1 Research question

Based on the limitations described above, the research question for the project is:

Main objective

How to tell the story of Norwegian mountain farming through a milkmaids perspective, focusing on a user centred design approach, exploring augmented reality and audio as technology?

1.2.2 User group

The user group that is chosen is firstly based on numbers found from Nidaros Pilegrimsgård from 2019 and 2020 (Neraas, 2020), through a questionnaire sent out to the target group and through interviews conducted with experienced pilgrims.

One of the main findings from the interviews was that there are two types of pilgrimage travellers, where one are long travelling pilgrims and the other group are the cultural pilgrim travellers. It was further problematized that the long travelling pilgrim did not take the time to visit museums and similar places. Based on these findings the chosen user group for the project are cultural pilgrim travellers that are Norwegian residents in the age between 30 and 69 years old.

The results from the Nidaros Pilegrimsgård and the questionnaire can be found in [3.1 Findings from questionnaire and Nidaros Pilegrimsgård statistics](#).

1.3 Definitions and explanations

1.3.1 Narratives

According to the Norwegian encyclopaedia, the word narrative means history and springs from the latin word *narrāre*, which means to tell a story (Andersen, 2022).

The same meaning is also supported by Oxford English Dictionary, which states that narrative means recounting or telling a story (Oxford University Press, 2023).

Narratives can be used in different settings, but are often used to tell a story about oneself, a group or about the society as a whole (Andersen, 2022). Throughout the project, narratives and storytelling are used for describing the same meaning.

1.3.2 About Norwegian mountain farming

According to Dybdahl (2023) Norwegian mountain farming (seterdrift) is an area used for grazing during the summer. The goal of the mountain farming was to utilise all available resources (Norsk Folkemuseum, n.d.). The Norwegian name Seter comes from Norse Setr which meant place of residence (Dybdahl, 2023). The work in the Norwegian mountain farms was traditionally done by a budeie in Norwegian or a freehold/milkmaid/dairymaid in English (Dybdahl, 2023). The freeholds often were the wife at the farm or the oldest daughter (Dybdahl, 2023). It was not unusual to hire a milkmaid to do the work in the summer (Dybdahl, 2023). The words freehold, milkmaid and dairymaid have the same meaning in this project and are used interchangeably throughout the document.

The tasks on the mountain farm were usually tied to milking of cows, churn butter and to curd cheese. Carrying water and washing cups and dirty dishes was also part of the daily work (Dybdahl, 2023). Often also the younger children on the farm went together with the dairymaid to look after the animals on the mountain farm (Dybdahl, 2023).



Figure 1. Illustration of a mountain farm. Made with Midjourney (n.d.).

1.3.4 User centred design approach

As part of the master thesis, the user centred design approach is used. This means according to Baxter et al. (2015) that there is a focus on the end user in the development cycle, and that the product is built to suit the user, and not demanding the user to fit the product (Baxter et al., 2015). The user centred design approach is accomplished by using different processes, that includes the end users (Baxter et al., 2015). The double diamond design process also puts the user in focus at an early stage (Design Council, 2019).

Often there is a focus on three principles in the user centred design approach (Baxter et al., 2015):

1. Early focus on users and tasks
2. Empirical measurement of product usage

3. Iterative design

1.3.5 Words and translations

There are some words in this project that are difficult to translate from Norwegian into English without the loss of context, below translations for these words are listed. There are also some abbreviations of words in the project, these are listed below with their normal form or meaning.

| English | Norwegian |
|----------------------------------|------------------|
| Milkmaid, freehold or dairymaid: | Budeie. |
| Mountain farm: | Seter. |
| Mountain farming: | Seterdrift. |

| Abbreviation | Normal form/Meaning |
|---------------------|--------------------------------|
| 3D: | Three-dimensional |
| AR: | Augmented reality |
| EWK: | Extent of world knowledge |
| GPS: | Global positioning system |
| MR: | Mixed reality |
| WPS: | Wi-Fi based positioning system |

1.3.6 Augmented reality and audio

By augmented reality or also referred to as AR, the project group means three-dimensional figures, elements or characters that work with the surrounding world to give the users of the prototype more information than the real world could on its own. For this the camera on the mobile phone is used. The augmented reality definition from Kishino & Milgram states that the environment which is real, is supplemented by virtual graphical elements (Kishino & Milgram, 1994). To explain the meaning of augmented reality it is also possible to look at Gillis' explanation (2022); AR blends information from the real world where the user is, with information from digital information at the same time (Gillis, 2022). With augmented reality it is possible to either change what the user is experiencing or to add information to what the user sees, feels or hears (Gillis, 2022).

Kishino & Milgram (1994) also introduces the term mixed reality. This is shown as a scale visualising a continuum from the real environment to fully virtual reality in the figure below (p. 3). Kishino & Milgram (1994) further explains that the term real, are objects that have an objective existence (p. 6). It is further an image that has some luminosity at the location where it appears to be located (Kishino & Milgram, 1994, p. 7).

Virtual objects are objects that exist in the essence or effect and they are elements that are not displayed with luminosity in the environment where it appears (Kishino & Milgram, 1994, p. 7). This brings the augmented reality in the middle left side of the continuum, where augmented reality both displays parts of the real world and a virtual world or virtual elements.

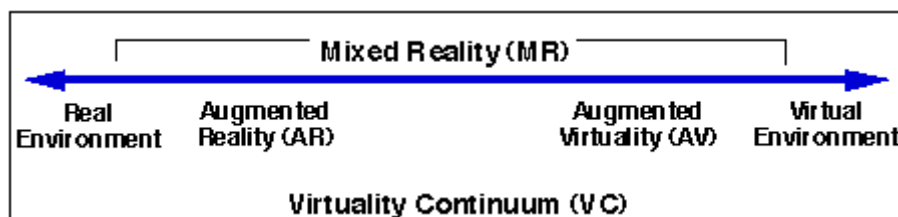


Figure 2. Displaying where AR are on the mixed reality scale (Kishino & Milgram, 1994, p. 3).

Another scale used by Kishino & Milgram (1994) is the extent of world knowledge, where on the left side the full real world is displayed and on the right side the fully modelled world is displayed (Kishino & Milgram, 1994, p. 9).



Figure 3. Displaying the extent of world knowledge (Kishino & Milgram, 1994, p. 9).

In the project groups prototype there have been used both a mix of the real world environment and virtual, where the users are given the opportunity to see the milkmaid directly into the real environment they are in through the phone of the camera. In this way the combination for virtual reality and real environments are

mixed together as Kishino & Milgram (1994) mentioned in their study on mixed reality. Audio is also included by the project group in the augmented reality, and gives the user sounds and speech attached to the action done by the three-dimensional elements in the prototype.

1.4 Tools

The group has used multiple programs, tools and assets in the project to help both with the prototyping and the teamwork, the way these are utilised and how they have helped the project group are listed and described below.

Adobe Aero



The tool Adobe Aero has been used to make a high fidelity prototype of how the augmented reality function in the application could look. Adobe Aero has been a fun and useful tool to learn. The logo is sourced from the Adobe Aero website (2023).

Adobe InDesign



For the mood images from the low- and high- fidelity prototypes, Adobe InDesign has been utilised. Adobe InDesign is a tool which is helpful for making graphics of how things can look on multiple devices or in different settings. The logo has been sourced from the Adobe InDesign website (2023).

Adobe Photoshop



Adobe Photoshop has been utilised to edit images and graphical elements used in the project. Especially the image from Midjourney have gone through smaller adjustments. Photoshop has also been used to make the logo for the project's application. The logo is sourced from the Adobe Photoshop website (2023).

Apple iMovie



To create the overall video of the high fidelity prototype Apple iMovie was used to clip and edit the video and to add textual descriptions into the video. The logo has been sourced from the Apple iMovie website (2023).



Autodesk Maya

To make three-dimensional design elements for the augmented reality experience Autodesk Maya has been used. This tool is utilised especially for modelling 3D elements from scratch, but also to make changes on existing 3D objects found in Rigmodels library. The logo is sourced from the Autodesk Maya website (2023).



Blackmagic Design DaVinci Resolve

To clip and edit the video for the augmented reality experience in the prototype interface, Blackmagic Design DaVinci Resolve was used. The tool DaVinci Resolve has been useful for both cropping-, editing- and clipping the video, but also in making the audio better. The logo has been sourced from the Blackmagic Design website (2023).



Facebook Meta Messenger

The project group has communicated mainly using Facebook Messenger. This tool has been of use in both textual-, audio- and video communication. Facebook Messenger has been used on a daily basis by the project group members. The logo is sourced from the Facebook Meta Messenger website (2023).



Figma

For both the low fidelity prototype and the high fidelity prototype Figma has been utilised by the project group. This has been done to learn Figma better by the members, who have more experience in using Adobe XD from earlier projects. The logo has been sourced from the Figma website (n.d.).



Google Docs

To co-write on the project, Google Documents has been used. Google Documents has given the project group a valuable opportunity to also get feedback from the supervisor straight into the document. Planning, user testing and note taking have also been done using Google Documents. The logo is sourced from the Google Docs website (n.d.).



Google Sheets

For the planning of the progress Google Spreadsheets has been used to make a time schedule of when the different phases of the project were due. Google Spreadsheets has helped the project group keep on track in the project. The logo has been sourced from the Google Sheets website (n.d.).



Icon Set

The icons used in the high fidelity prototype have been sourced from the Figma plugin 3D Icon Set. These icons have given the project group a more three-dimensional way of displaying the icons and fits the project well with the three-dimensional theme. The logo is sourced from the Figma plug in 3D Icon Set (n.d.).



Microsoft Teams

For most of the interviews and some internal group meetings, Microsoft Teams has been used. This has given the project group the possibility of seeing the participants and to speak with them. The logo has been sourced from the Microsoft Teams website (n.d.).



Midjourney

The artificial intelligence text to image generator Midjourney has been used to make the illustration of the mountain farm in the project paper. This tool is a great way of making an image of what one wants quickly and easily. The logo is sourced from the Midjourney website (n.d.).



Miro

Miro has been used to make personas and scenarios, for creating affinity diagrams and for brainstorming throughout the project. This tool has been great for teamwork and doodling along the time schedule in the project. The logo has been sourced from the Miro website (2023).



Nettskjema

The website Nettskjema has been used throughout the project for both questionnaires and to record and store audio in a secure way to fulfil the requirements from SIKT. The logo is sourced from the Nettskjema website (n.d.).



Rigmodels

For the three-dimensional character of the dairymaid and the cauldron Rigmodels has been used to find free to use three-dimensional models. This has helped the project group save time in the three-dimensional design modelling stage. The logo has been sourced from the Rigmodels website (2022).



Stark

Stark is used as a plug in Figma, to test if the contrasts are following the WCAG 2.1 requirements. Stark is a tool for testing accessibility and universal design. The logo is sourced from the Stark website (2023).



Storyboard That

Storyboard That is a useful website for creating cartoons or to make storyboards. The project group members have used Storyboard That to make the storyboards in the project. The logo has been sourced from the Storyboard That website (2023).



Trello

To keep on track with the assignments attached to the project, Trello has been used by the project group. Trello has helped with listing and crossing out assignments that have been finished. The logo is sourced from the Trello website (2023).

1.5 Reporting to SIKT and ethical guidelines

As part of ethical research practice, the group got an approval by Norwegian agency for shared services in education and research (*Sikt – Kunnskapssektorens tjenesteleverandør*, n.d.). The reporting included an allowance to gather a written consent form from the participants according to the law. This consent form also followed the guidelines from Leedy & Ormrod (2021) which describes that participants in a study should have the rights to withdraw from the study at any time (Leedy & Ormrod, 2021). The consent form should also include a brief description of the nature and the goals of the study, a description of what the participation will involve in terms of duration and activities, and a guarantee to the respondents that their data will remain confidential and anonymous (Leedy & Ormrod, 2021).

In this project we have followed (*Sikt – Kunnskapssektorens tjenesteleverandør*, n.d.) standard templates for consent form and the consent is conducted digitally through e-mail. Further the reporting to (*Sikt – Kunnskapssektorens tjenesteleverandør*, n.d.) also consists of the allowance to store data from audio recordings from the interviews that have been carried out.

The informants were also given information at the start of the sessions about their rights to withdraw from the project at any moment, and that their information was stored anonymously.

The audio recordings were stored in Nettskjema, where only the members of the group had the access. The recordings are deleted after the project is done on the 16th of June. For recording the group used the application from Nettskjema to do the recordings and no personal data was stored or saved in any other places.

The attachment of the consent form can be found in 7.9 Consent form.

2.0 Methods & theories

2.1 Practice based research through design

Design research evolved around the 1960's, and went from a technical perspective to a problem solving process and a process of reflection in action (Shannon, 2013, p. 27). Barab & Squire (2004) referenced in Shannon (2013) also emphasises the importance of the positive aspect of a series of approaches instead of the single approach view, which allows for flexibility in the research design (p. 27). Where a systematic evaluation of the research phases or iterations contributes to theory building (Shannon, 2013, p. 27).

This project is based on research through design. This means that design activities are used as a formative role in the generation of knowledge (Stappers & Giaccardi, n.d.). The process includes the development of a prototype or artefact that plays a central role in the knowledge generating process (Stappers & Giaccardi, n.d.). Also Sevaldson (2010) states that research by design emphasises the insider perspective as an approach that relates to real life contexts. Sevaldson (2010) also considers research by design as an explorative, generative and innovative aspect in systematic research (Sevaldson, 2010, p. 11). He further states that the knowledge forms a basis for new communicable knowledge that is only found within design practice (Sevaldson, 2010, p. 8).

Schön (referenced in Höök & Löwgren, 2012) states that design as a reflective practice is tied to design learning as a reflective practice (p. 4). Schön (1991) writes: “In a good process of design, this conversation with the situation is reflective” (p. 79). In this case the designer reflects on the construction of the problem, or phenomenon (Schön, 1991, p. 79). This is what Schön (1991) describes as reflection in action. His view is based on the criticism of instrumental problem solving and its strictness of scientific theory and technique (Schön, 1991).

The figure below shows how design and research can be used to generate new knowledge (Stappers & Giaccardi, n.d.).

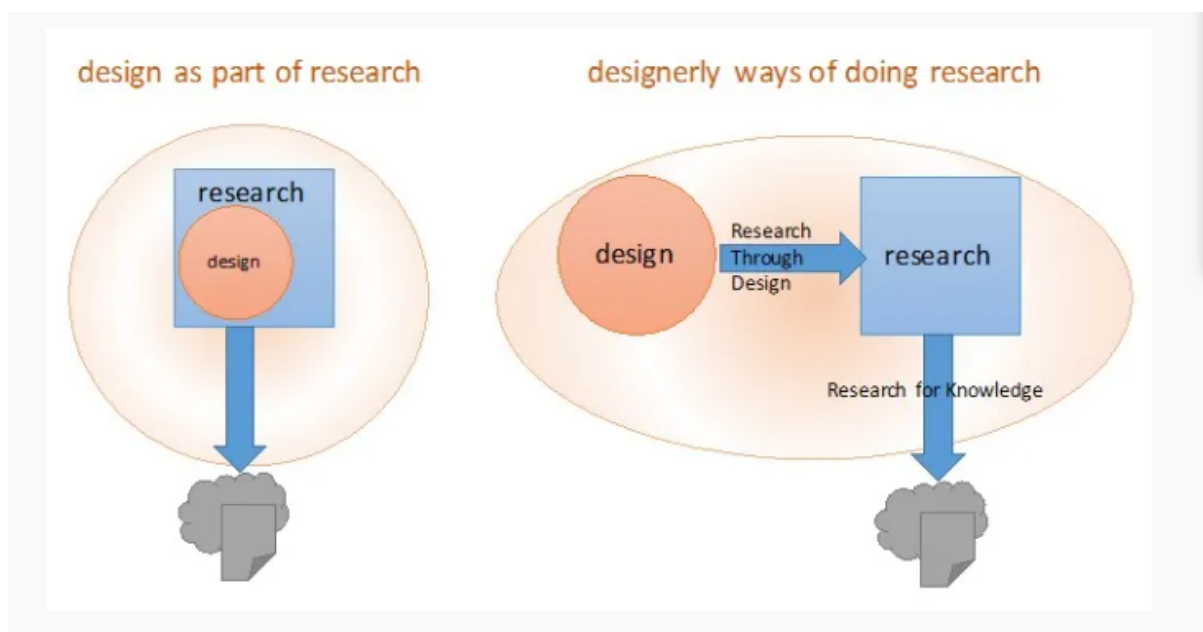


Figure 4. Design and research (Stappers & Giaccardi, n.d.).

Andersson (2020) also emphasises the importance of research by design. Especially the importance of the human factor, and the participation while the product is in use (Andersson, 2020, p.18). Andersson (2020) writes about possible ways to reach this goal by using visualisations, creating design, enquiring stakeholders, validating and by self examining (Andersson, 2020, p. 25).

2.1.1 Design process

For the design process in this project the Double Diamond framework from Design Council (2019) has been followed. The Double Diamond offers a clear, comprehensive and visual description of the design process. The process consists of

two different processes or diamonds which helps the designer to study the phenomenon more widely and focused. This is also referred to as convergent and divergent thinking (Design Council, 2019). The process is not intended to be linear but rather iterative, going back and forward between the different stages (Design Council, 2019).

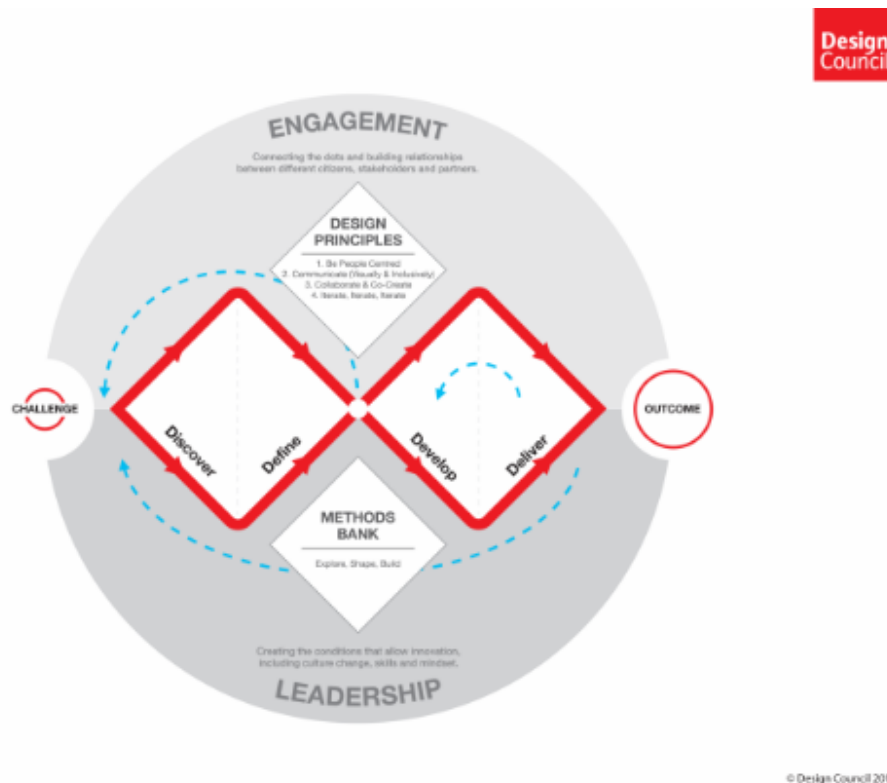


Figure 5. Displaying the double design process (Design Council, 2019).

The different stages in the divergent and convergent diamonds involve these different phases (Design Council, 2019):

Discover: The goal is to understand the problem and it focuses on gathering insight, both with the user and in the domain. In this stage the research on existing studies and scientific papers are a baseline for going forward with the next stages in the process (Design Council, 2019).

Define: The goal is to define the challenge in more concrete ways, to support the development and delivering phases (Design Council, 2019).

Develop: The goal is to create different solutions to the problem found in the earlier stages and to seek inspiration (Design Council, 2019).

Deliver: The goal is to test the different solutions and throw away those that do not fit and improve those that will (Design Council, 2019).

2.2 Qualitative versus quantitative methods

In this project the main methods used are qualitative methods. Qualitative methods are often used according to Leedy & Ormrod (2021) to describe, explore, build theory, and often consist of a smaller sample size. There is often an acknowledgement of the information being subjective and therefore also might be biased in some way (Leedy & Ormrod, 2021, p. 113). Qualitative research is often also more changing, where the interpretations are developing along the way (Leedy & Ormrod, 2021, p. 113).

While quantitative methods aim to test theory, confirm and validate, and to predict based on the data (Leedy & Ormrod, 2021, p. 113). The main goal for this kind of method is to generalise the findings to the population (Leedy & Ormrod, 2021, p. 113).

As the nature of this project is more of the explorative category and the intent has been to explore the user group and their needs, goals and feelings towards Norwegian mountain farming through AR technology along the pilgrimage travels, most of the methods that has been used, such as part of the survey, interviews, focus groups and user testing are qualitative in their nature.

2.3 Literature review and benchmarking studies

As part of methods used in this project a thorough literature review on the topics narratives and audio, storytelling and augmented reality, and emotional design are reviewed. The research questions that formed the basis for the search were:

- What does research say about narratives and use of audio?
- What does research say about storytelling and the use of augmented reality?

The research search engines that were used were Oria, Google Scholar and Web of Science. The different topics that were searched for was:

- Narratives and audio
- Narratives and audio in interaction design
- Audio and emotional design
- Emotional design and learning
- Audio used in museums
- Narrative storytelling augmented reality AR
- Narrative storytelling augmented reality
- Narrative history design augmented Reality
- Narrative history design AR
- Storytelling augmented reality

For the searches of audio and narratives the search results were based between the years 2015 until today.

| Title: | Topic: | Link: | Citations: | Year: | Search engine: |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------|----------------|
| Audio-based narratives for the trenches of World War I: Intertwining stories, places and interaction for an evocative experience | Visitor aware personalized multi pont auditory narrative system. Interaction with sound and NFC cards in a belt like device | https://www.sciencedirect.com/science/article/pii/S1071581915001251 | 15 | 2016 | Web of science |
| Engagement in video and audio narratives: contrasting self report and physiological | Narratives, contributors feeling of engagement and physiological | https://www.proquest.com/docview/2421632322?pq-origsite=prim&parentSess | 9 | 2020 | Web of science |

| | | | | | |
|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---|------|----------------|
| measures | responses. | ionId=Ow373vMa%2F1Op6mSsHMqIUlmIUNEGk4ii2SAI%2BZgbob0%3D | | | |
| Emotional Engagement for Human-Computer Interaction in Exhibition Design | Emotional design with use of metaphors, and design process in exhibitions | https://link.springer.com/chapter/10.1007/978-3-319-20901-2_51 | 1 | 2015 | Web of science |
| Emotional Design in Multimedia Learning: Systematic Review | Review of 20 projects and the use of emotional design. | https://link.springer.com/chapter/10.1007/978-3-030-89735-2_19 | 1 | 2021 | Web of science |
| Materialising contexts: virtual soundscapes for real-world exploration | Interaction with sound installation national museum in Bradbord | https://doi.org/10.1007/s00779-020-01405-3 | 2 | 2021 | Web of science |
| Sounding the Museum: A Shared Reflection on the Chou Hayda (What is this?) Intervention at the National Museum of Beirut | Engaging participants, using questions and recording of participants thoughts. | https://doi.org/10.1111/cura.12312 | 1 | 2019 | Oria |

Table 1. Literature search table Audio & Emotional design.

For the literature searches for augmented reality and storytelling the search results were based between the year 2014 till today.

| Title: | Topic: | Link: | Citations: | Year: | Search engine: |
|-----------|---------|-----------------------------------------------|------------|-------|----------------|
| Augmented | How the | https://doi.org | 31 | 2015 | Google |

| | | | | | |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----|------|----------------|
| Reality and Storytelling in heritage application in public gardens: Caloust Gulbenkian Foundation Garden. | project has used augmented reality to tell stories in a public garden. | g/10.1109/DigitalHeritage.2015.7413891 | | | Scholar |
| Augmented Reality Storytelling – Narrative Design and Reconstruction of a Historical Event in situ. | The project used augmented reality to tell the story of D-day in the second world war. | https://doi.org/10.3991/ijim.v13i12.11560 | 30 | 2019 | Google Scholar |
| Designing interactive narratives for mobile augmented reality. | Paper about how augmented reality on mobile phones can give users more information. | https://doi.org/10.1007/s10586-014-0354-3 | 47 | 2014 | Google Scholar |
| Snapchat's augmented reality brand culture: sponsored filters and lenses as digital piecework. | Paper about how augmented reality can be used in marketing in Snapchat etc. | https://doi.org/10.1080/10304312.2020.1827370 | 29 | 2020 | Google Scholar |

Table 2. Literature search table augmented reality & storytelling.

2.4 Research on the Norwegian mountain farming

To gather inspiration and information about the mountain farming the project group visited the Stiftelsen Lillehammer museum Maihaugen, to see the mountain farms that are located there. Further the project group searched for information in the (*DigitaltMuseum*, n.d.), watched different Youtube videos, television channels and encyclopaedias to gather information on the topic.

Topics that were of interest was:

- How was the experience with working on the mountain farming?
- The milkmaid's story.
- Poems & lyrics.
- The historical perspective.
- Objects and tools.
- Norwegian folklore.

2.5 Questionnaire - user group

To gain more information about the user group and to narrow down the target audience the group conducted a questionnaire. The questionnaire consisted of six questions, in which one question was an open ended qualitative question, one question was multiple choice, two were single choice questions and two were questions based on interval scales from 0-10, where the value of 0 was not interesting and 10 was very interesting. The advantage of using interval scales is that there are equal units of measurement and the zero point is established arbitrarily. It is also possible to do more in depth statistical analysis that is not possible with nominal or ordinal data (Leedy & Ormrod, 2021).

The questions asked was:

- What is your age? (single choice)
- What is your experience with the use of AR? (open ended question)
- How interested would you be in using a history application about mountain farming on mobile devices? (scale from 0-10)
- How interested would you be in visiting one or more museums along the way to the pilgrimage goal? (scale from 0-10)
- Who are you travelling with? (multiple choice)
- Are you planning to go on a pilgrimage trip this year? (single choice)

The questionnaire was sent to four different channels in Facebook:

| <u>Name of Facebook group:</u> | <u>Number of members:</u> |
|-----------------------------------|---------------------------|
| ● Hiking along Gudbrandsdalsleden | 704 members |
| ● Pilegrimsleden | 7193 members |
| ● Pilegrim | 3184 members |
| ● Pilegrim på Selja | 444 members |

The reason why the questionnaire was sent to these groups was to reach the target group for the project. In these channels there were between 7000 and 10 000 members all together, which was an opportunity for us to gain insight in the early stages of the project in a fast way. Some of the members can of course be members in multiple groups, this has not been checked - therefore the number of members is written in approximately numbers. The results from the first distribution gave first only 27 respondents, which the project group considered to be too few respondents. Therefore the project group redistributed the questionnaire.

There are some positive and some challenging aspects of using a questionnaire as a method. First of all, the return rate may be low, and the people that respond to the questionnaire might not be representative of the sample (Leedy & Ormrod, 2021). This further means that the results might not be possible to say something about the understanding of other people than the respondents (Leedy & Ormrod, 2021).

The non response bias might occur where the ones responding and those that do not are different in significant ways, this might cause the answers to not be representative for the opinions in the intended population (Bordens & Abbott, 2011). In the project questionnaire, it might be that people that are more interested in mountain farming have responded than people that aren't that interested in the topic. With conducting the survey in this way, we don't know much about the persons that are responding or not responding, and we cannot say for sure that the data are representative. When using a questionnaire it is more likely that the participants might have misunderstood the questions (Leedy & Ormrod, 2021). Also the non random sample technique is not the one with the highest reliability or external validity in the research design. With reliability it means the ability to measure the same results each time (Leedy & Ormrod, 2021). With internal validity it means the ability to draw conclusions on cause and effects (Leedy & Ormrod, 2021). To gain a more

reliable sample and sample size a true randomised method should be used (Bordens & Abbott, 2011).

On the positive side the questionnaire generates quick responses, and can be used as a starting point for further investigations. It is also positive in ways that the participants can be fully anonymous, the participants might therefore also be more truthful in their responses (Leedy & Ormrod, 2021).

2.5.1 Redistributed questionnaire

As part of increasing the reliability and validity of the research, the questionnaires were redistributed in the Facebook groups mentioned both above and below to gain more responses from the user group. In this way the number of respondents increased from 27 to 56. The higher the number of respondents there are, the more the representativity of the study increases.

The questionnaires were again posted in the same four Facebook groups as before, to reach the target group:

- Hiking along Gudbrandsdalsleden
- Pilegrimsleden
- Pilegrim
- Pilegrim på Selja

2.6 Interviews

As part of gathering insight about the users' preferences and feelings around the topic, the project group conducted six interviews with persons between 25 and 70 years of age, four women and two men, who all had a lot of experience with pilgrimage walks.

The group also performed an informal interview with employees from the Stiftelsen Lillehammer museum Maihaugen about topics such as technology at Maihaugen museum, ideas and thoughts around the use of AR, and about the user group that are interested in Norwegian mountain farming.

Qualitative research aims to answer questions that are related to events that have happened, or that are occurring in natural settings (Leedy & Ormrod, 2021). Interviews are positive to use in exploration phases, to get more insight into a phenomenon where there exists little or no studies (Leedy & Ormrod, 2021). Interviews can also help to uncover key problems, obstacles or challenges within the phenomenon (Leedy & Ormrod, 2021).

As part of preparing for the interview, an interview guide consisting of 15 questions were prepared. The main goal of the interview was to gather insight about the users experiences on the pilgrimage travels. The different topics that were asked were about the person's experience, and challenges when travelling on a pilgrimage trip, their experience with technology before, during and after the trip and their experience with museum visits. The project group also explored the user's experience with the use of AR. The questions were open ended, because the project group wanted the respondents to talk as freely as possible.

The interview was a semi structured interview, where some follow up questions were also asked during the interview. During the interview all respondents were asked the same questions from the interview guide. The positive aspect of using a more structured interview is that the answers are more comparable when doing analysis (Malt & Grønmo, 2023). Also in a semi structured interview the researcher may follow the standard questions with one or more tailored questions to get more clarifications or to probe a person's reasoning (Leedy & Ormrod, 2021).

The interviews were carried out either digital with Microsoft Teams or with mobile phone interviews. One of the group members was the facilitator and interviewer, and the other person was responsible for taking notes, observing and recording the sound through Nettskjema. The advantage of conducting the interviews this way, is that the interviewer can focus mainly on following the conversation and following up with questions. While the observator can pick up body language or tone of voice in which the interviewer might not pick up on.

The results from the interviews were later used to create personas, scenarios and storyboards and to gain insight for creating a prototype based on the user's needs.

The interview guide can be found in attachments [7.2 Interview guide](#) and the results can be found in [3.3 Results from interviews and thematic analysis](#).

2.6.1 Recruiting of informants

When recruiting informants for the project, the group contacted different pilgrimage centres in Norway and asked if they knew about persons in the user group that would be interested in participating in an interview. In this way the snowball sampling was used (Julia, 2023). The sample technique is called this because the sample group grows like a rolling snowball, in this way the sample is not randomised and not all of the members of the population have the same possibility to attend the study (Julia, 2023). The project group also sent out information and requests for participants in the different Facebook groups where we also sent out the questionnaire. The project group also contacted Stiftelsen Lillehammer museum Maihaugen, and DNT. In this way we got informants that had experience with pilgrimage trips and that were in our user group. Many of the participants were also familiar with the rurAllure project. The snowball sampling technique is often used when it is difficult to find participants for the study, the benefits of this sampling technique is that it takes less time in planning and sampling (Julia, 2023).

This way of recruiting participants might lead to confirmation bias and therefore might affect the validity of the findings. This means that the persons responding to the recruiting might be more interested in the topic than others in the user group (Junge, 2022).

2.6.2 Thematic analysis

For analysing of the interviews a thematic analysis of the transcribed data was conducted. A thematic analysis is according to Rosala (2022) from Nielsen Norman Group a systematic method of breaking down and organising rich data from qualitative research by tagging individual observations with appropriate codes to find significant themes (Rosala, 2022).

The figure below shows how the process is divided into six different steps (Rosala, 2022):

1. Gather all data
2. Read all data
3. Code the text based on what it is about
4. Create new codes
5. Take a break
6. Evaluate the themes

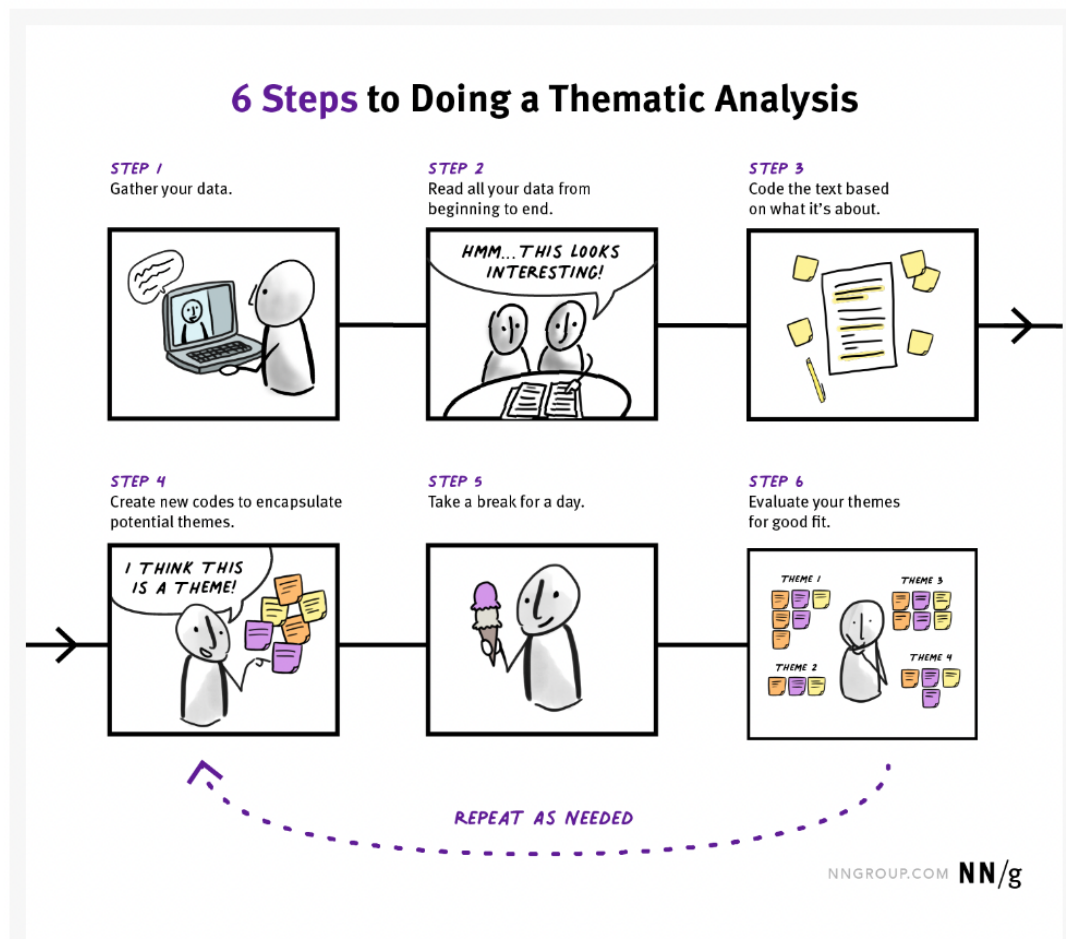


Figure 6. Displays how thematic analysis works (Rosala, 2022).

For analysing the data that were conducted, the tagging functionality in Google Docs was used. The topics found there were further put into Miro in an affinity diagram. The purpose of this was to gather, group and find patterns throughout the interviews. Affinity diagrams are often used to analyse data material quickly, where similar items are grouped together to find or identify themes or trends in the data (Baxter et al., 2015).

Codes the project group used in Norwegian:

Kulturvandrerene ▾ Pakkeløsning ▾ Domkirkeodden ▾ rurAllure ▾ Langvandrerene ▾
 Formidling av kulturhistorie ▾ Formidling av kulturhistorie ▾ Indre og ytre motiver ▾
 God mat og drikke ▾ Kirker ▾ Restituere ▾ Bli kjent med andre ▾ Godt vær ▾
 Minske stress ▾ Mobil til planlegging ▾ Lite fokus på mobil ▾ App som veiguide ▾
 App som veiguide ▾ Fysisk og mentalt krevende ▾ Utfordrende-slitene ▾
 Gå med venner ▾ Gå med kollegaer ▾ To mil om dagen ▾
 Irritasjon på bruk av teknologi ▾ Bruke app til å lære om historie ▾
 God informasjon om app ▾ Audio guide ▾ GPS ▾ Mitt interessefelt ▾ Hviledag ▾
 Lære mer ▾ Hamarguiden ▾ Bruke fantasien ▾ Positivt for unge ▾ Gå i Spania ▾
 Mosjon ▾ Være tilstede ▾ Museer ▾ Kultur og historie ▾ Gå alene ▾
 Kontakt via sosiale medier ▾ Overnattingsplass ▾ Mobil i flymodus ▾ Ta bilder ▾
 Bli kjent med brukeren ▾ inspirasjon ▾ Opplevelser ▾ Gå sakte ▾ Landbruk ▾
 Byggverk og arkitektur ▾ Kapasitet ▾ Kostnadsnivå ▾
 Ikke planlegge, men gjøre det som faller inn ▾ Internett til planlegging ▾
 Bruk av AR undeerveis, unngå store avstikkere ▾
 AR er fremtidsrettet, pdd.prematurt ifht. brukeren. ▾ Friluftsliv ▾ Notatblokk ▾
 Refleksjon ▾ Infrastruktur ▾ Dårlig vær ▾ Skremmende med nye ting ▾
 Høy terskel ▾ Gå med kjæreste ▾ Snapchat ▾ Gå med få personer ▾
 Lite AR erfaring ▾ Opptatt av grunnbehovene ▾ Pilegrimsleden.no ▾ AR er gøy ▾
 Teknologi som terskel ▾ App for språk ▾ Voice of Norway ▾ Filtrering på emne ▾
 Lære om plassen ▾ Bygdehistorie ▾ AR bra der det ikke er bemanning ▾
 Knytte seg på rurAllure aksene ▾ Få aktørene langs leden til å kommunisere ▾
 rurAllure app ▾ Påvirket av venner ▾ Åndelig ▾ Gå med ektefelle ▾ Nysgjerrig ▾
 Personlig vekst ▾ Utfordrende-vondter ▾ God på planlegging ▾ Stille og rolig ▾
 Markert sti ▾ Planlegge med bøker ▾ Uten digitale hjelpemidler ▾
 Ikke bruke mobil ▾ Skrive for hånd ▾ Til nød kontakt ved telefon ▾ Fotograferer ▾
 Fine steder ▾ Vise/dele med venner ▾ Få informasjon ▾ Ikke forstyrrende ▾
 Hyggelig ▾ Lyd tilleggsinformasjon ▾ Lykkelig ▾ Dyrehold ▾ Seterlivet ▾
 Hardt arbeid ▾ Kortvandrerene ▾ Pil.leden mer tilgjengelig ▾ Drømming ▾

Based on these codes some overall themes emerged from the data:

1) About the pilgrimage trip in general:

1. The main goal of persons walking pilgrimage tours is to de-stress, and be in the now.
2. Challenge the physical form.
3. People to travel with
4. What the pilgrimage wants to experience on the trip.
5. What does a pilgrim traveller need?
6. How to plan the trip.

7. Challenges during the trip
8. Package deal

B) About technology:

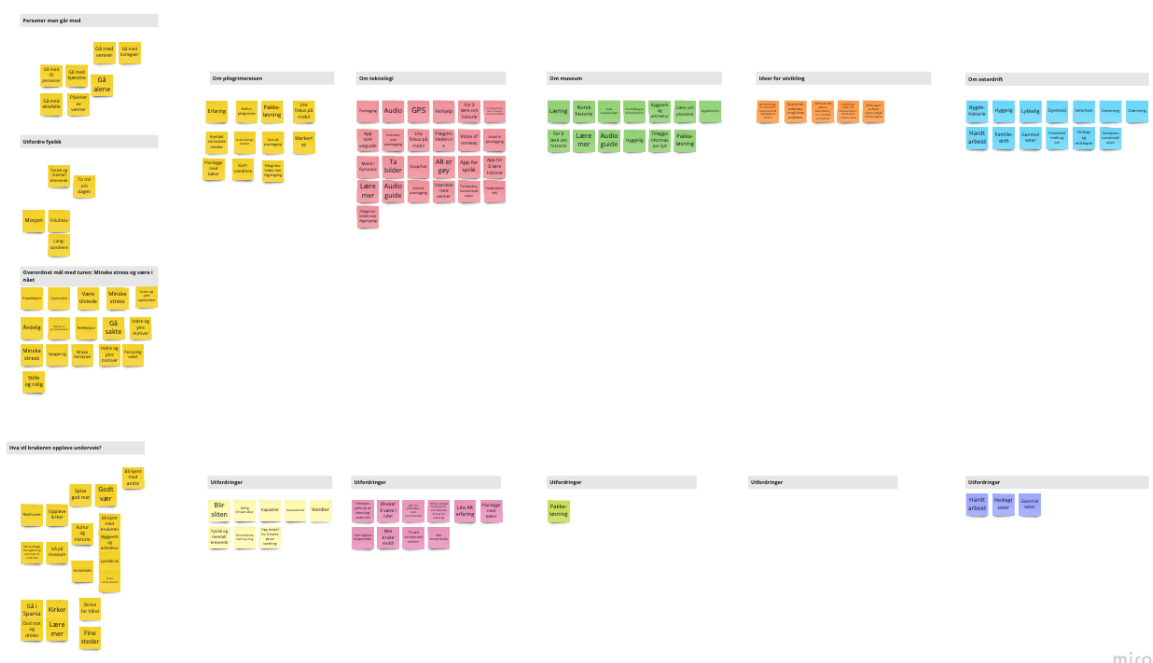
1. Planning
2. App as wayfinder
3. To learn about history
4. Take pictures
5. Focus on not using technology
6. Challenges with the use of technology

C) About museums:

1. Learning

D) Ideas for development

E) About Norwegian mountain farming



miro

Figure 7. Shows how the affinity diagram was made and the different codes were gathered into different themes.

Om pilegrimsreisen

| | | | | |
|------------------------------------------------------|-----------------------|---------------------------------|----------------------------|------------------------|
| Indre og ytre opplevelser | Kultur-pilegrimen | Pakkeløsning | Fysisk og mentalt krevende | Bli kjent med andre |
| Minske stress | Være tilstede | Spise god mat | Godt vær | To mil om dagen |
| Restituere | Oppleve kirker | Gå med venner | Gå med kollegaer | Bli kjent med brukeren |
| Inspirasjon | Opplevelser | Kultur og historie | Gå sakte | Byggverk og arkitektur |
| Ikke planlegge men gjøre ting selv man vil underveis | Gå på museum | Mosjon | Friluftsliv | Landbruk |
| Lite fokus på mobil | Indre og ytre motiver | Notatblokk | Refleksjon | Se på infrastruktur |
| Gå med få personer | Gå med kjæreste | Oppstart av gruppe/aktivitet | Langvandrere | Erfaring |
| Gå i Spania | Kirker | Gå alene | Kontakt via sosiale medier | Overnattingsplasser |
| God mat og drikke | Lære mer | Påvirket av venner | Indre og ytre motiver | Åndelig |
| Gå med ektefelle | Nysgjerrig | Bruke fantasien | Stille og rolig | Personlig vekst |
| Minske stress | God på planlegging | Markert sti | Planlegge med bøker | Skrive for hånd |
| Fine steder | Kortvandrere | Pilegrimsleden mer tilgjengelig | | |

Utfordringer

| | | | | |
|----------------------------|-------------------------|-----------------------------------------|----------------|---------|
| Blir sliten | Dårlig infrastruktur | Kapasitet | Konstruksjonsv | Vondter |
| Fysisk og mentalt krevende | Skremmende med nye åreg | Høy terskel for å starte på en vandring | | |

Om teknologi

| | | | | | |
|---------------------------------|---------------------------|---------------------|----------------------|------------------------------|-----------------------------------------------|
| Planlegging | Audio | GPS | Veihjelp | For å lære om historie | Interesser busk eller vandrer stier/overvåket |
| App som veiguide | Internett som planlegging | Lite fokus på mobil | Pilegrim sleden.no | Voice of norway | Mobil til planlegging |
| Mobil i flymodus | Ta bilder | Snapchat | AR er gøy | App for språk | App for å lære historie |
| Lære mer | Audio guide | God på planlegging | Vise/dele med venner | Tankeplass kunstinstallasjon | Inspirasjon tek |
| Pilegrimsleden mer tilgjengelig | | | | | |

Utfordringer

| | | | | | |
|-------------------------------------------|----------------------|----------------------------------|-------------------------------------------------------------|------------------|---------------------|
| Irritasjon på bruk av teknologi underveis | Ønsker å være i nået | ÅG - er premissar, men fremtiden | Ofte en tanke for personer som ikke kan så mye om teknologi | Lite AR erfaring | Planlegge med bøker |
| Uten digitale hjelpemidler | Ikke bruke mobil | Til nød kontakt ved telefon | Ikke forstyrrende | | |

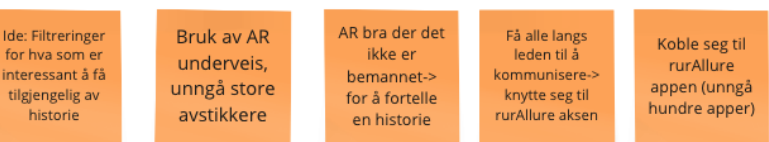
Om seterdrift



Utfordringer



Ideer for utvikling



Om museum



Figure 8. Shows a closer view of the affinity diagram.

The thematic analysis method gave the project group a clear way to compartmentalise the different themes gained from the interviews. The results are described in detail in [3.3 Results from interviews and thematic analysis](#).

2.7 Personas, scenarios and storyboards

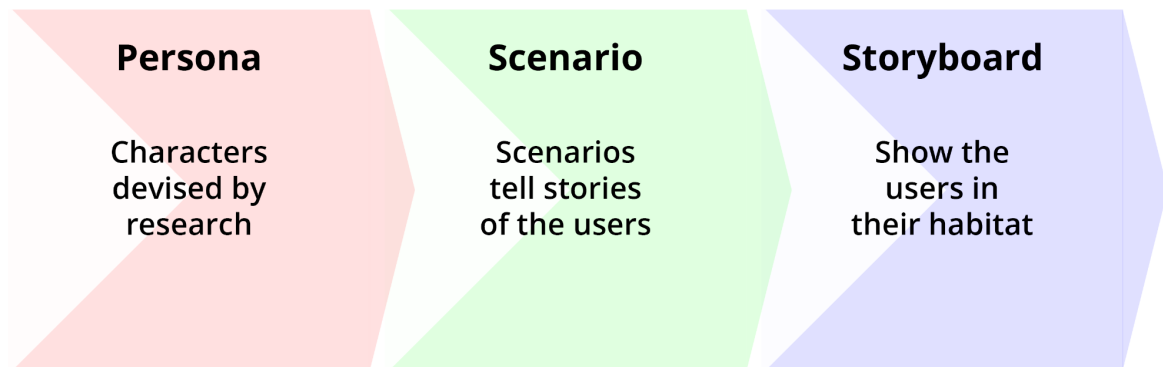


Figure 9. Displaying the connection of persona, scenario and storyboard.

This project utilises personas, scenarios and storyboards to tell the user stories and to explain who the users are. Personas are characters that are devised by research of the possible users of the augmented reality application in the project (Dam & Siang, 2022). This activity makes it easier to understand the users goals, tasks, needs and behaviours (Dam & Siang, 2022).

Scenarios are made to tell stories about the possible users of the service or product in question (Salazar, 2021). These stories help in the idea generation phase of the design process (Salazar, 2021). The scenarios are based on the personas that came from the research on the users, this gives extra information of how the users would or could act (Salazar, 2021).

Storyboards have been used extensively in tv and movie production for many years (Briggs et al., 2021). The storyboards are like a comic strip, following what the users do in certain situations (Briggs et al., 2021). These comics can show the users in their habitat which affects both why and how the users do what they do in certain

circumstances (Briggs et al., 2021). The storyboards in the project are based on both the personas and the scenarios earlier made.

The results of the personas, scenarios and storyboards can be viewed in chapter [3.4 User definition through personas, scenarios and storyboards](#).

2.8 Prototyping and design

As part of the development phase in the double diamond process the prototyping is the focus (Sharp et al., 2019). This is an iterative process where feedback is used to do changes as a circular process, involving users and prototypes (Sharp et al., 2019). Prototypes provide a concrete manifestation of an idea, which allows the designer to communicate the idea with users and stakeholders (Sharp et al., 2019).

A prototype can exist in many forms, such as paper, flat screen design or interactive look alike prototype. The goal of the prototype is to answer questions, and support designers in choosing between alternatives (Sharp et al., 2019). It might have different purposes such as user testing, clarifying requirements, or to check the design direction (Sharp et al., 2019).

Prototypes are often divided into low and high fidelity prototypes. Where low fidelity is more flat screen, often not looking like the final product and does not provide the same functionality (Sharp et al., 2019). The low fidelity prototype is quick, cheap and easy to make, which supports the exploration of different designs and ideas (Sharp et al., 2019).

High fidelity prototypes on the other side looks more like a final product and usually provides more functionality, and are also often possible to interact with in the same way as it is intended to work (Sharp et al., 2019). In this project both low- and high fidelity are used as a basis for exploring and gaining more insights about how the user would use the product.



Figure 10. Displaying illustrations of the low fidelity prototype.

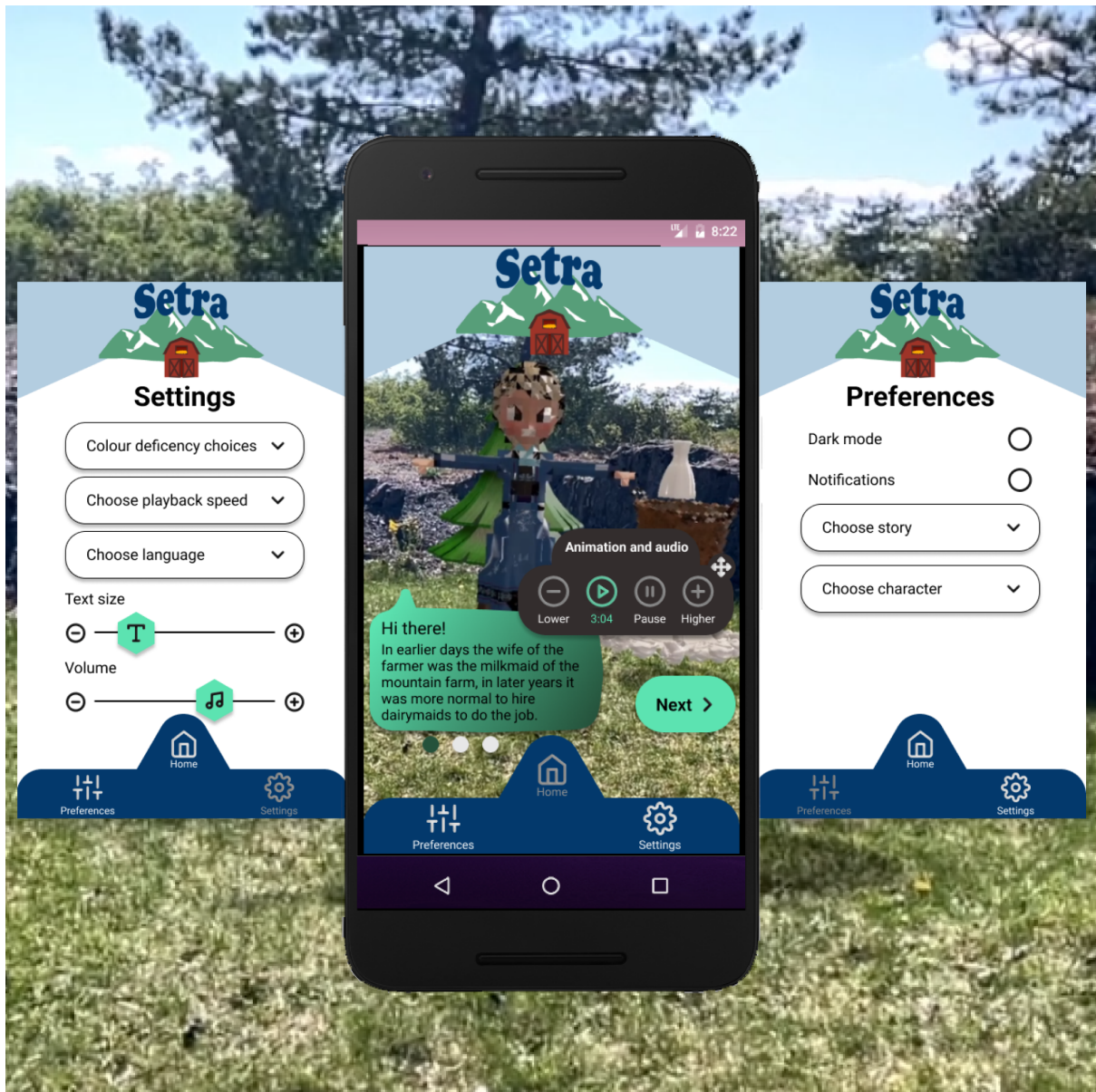


Figure 11. Displaying illustrations of the high fidelity prototype.

The results from the prototype designs are in chapter [3.5 Results from prototyping and design](#).

2.9 Focus group - low fidelity prototype

The way focus groups are structured are informal, and are a way of exploring the participants feelings and what they need when testing a prototype (Nielsen, 1993, p. 214). During the discussions there should be a moderator present who is responsible for focusing the group's theme of discussion (Nielsen, 1993, p. 214). The time spent discussing in the focus group should be around two hours in total (Nielsen, 1993, p. 214).

The moderator in the focus group has planned and made questions in advance of the session, and should steer the discussion back on track if the conversation turns far away from the theme in question (Nielsen, 1993, p. 214). The participants should feel that the discussions and the session are flowing freely (Nielsen, 1993, p. 214). The focus group method has an advantage in observation, as the moderator can read the situations, body language and reactions (Nielsen, 1993, p. 214). The moderator should ensure that all of the participants in the focus group get the opportunity to speak their mind and to discuss (Nielsen, 1993, p. 215).

Steve Krug (2014) states that focus groups are positive for determining what your audience wants, needs and likes in the abstract phase of the product creation (Krug, 2014, p. 113). Focus groups are positive to use when testing an idea and to see if it makes sense, and to learn about how the users feel about the product (Krug, 2014, p. 113).

According to Baxter et al. (2015) the number of participants in a focus group should be between five and ten (Baxter et al., 2015, p. 340), these numbers are supported by Krug (2014, p. 113). Nielsen (1993) on the other hand states that the number of participants should be between six and nine (Nielsen, 1993, p. 214).

The project group followed the mentioned number of test participants in a focus group as Baxter et al. (2015) writes about in the book "*A practical guide to user research methods. Understanding your users.*" (Baxter et al., 2015, p. 340). Krug also supports the number of participants in the book "*Don't make me think*" (Krug, 2014, p. 113). Five participants participated in the focus group, and the testing was conducted in a living room around a circular dining table. There were no disturbances such as a television or music present for the testing. All of the participants tested the low fidelity prototype on their mobile phone. The participants were of a diverse set of personalities and of different ages, all of the five testers were inside the project's target group.



Figure 12. Displaying illustrations of the low fidelity prototype.

The preplanned questions for the focus group were influenced by some of the questions listed by Baxter in the book *“A practical guide to user research methods. Understanding your users”* (Baxter et al., 2015, p. 342-343);

- Users likes and dislikes, advantages or disadvantages (Baxter et al., 2015, p. 342-343).
- Users desired outcomes or goals (Baxter et al., 2015, p. 342-343).
- Users reaction, opinions, concerns, or attitude toward a new product (Baxter et al., 2015, p. 342-343).
- Desired outcomes for new project (Baxter et al., 2015, p. 342-343).

The questions we discussed in the focus group were:

- What feelings and thoughts did this prototype give you?
- What did you like?
- What did you dislike?
- How did you expect the prototype to work?
- How did you experience the information?
- What was the goal for the use of the prototype?
- Do you see any advantages or disadvantages with the prototype?
- How do you envision using the prototype?

2.9.1 Recruiting of participants - Focus groups

The recruitment of participants was done through e-mail to earlier interviewed participants in the project. The focus group had five participants, where one of the group members was moderator and one was observer, taking notes and giving follow up questions when or if needed.

The results from the focus group discussions can be viewed in chapter [3.6.1 Focus group - Low fidelity prototypes](#).

2.9.2 Affinity diagram - Focus group

As with the interview, the group used an affinity diagram to group all the different topics and to get a clearer overview of the key results. The figures below show how the project group worked with the data from the focus groups by creating affinity diagrams. Read more about the use of affinity diagrams in chapter [2.6.2 Thematic analysis](#).

| Hvilke følelser og tanker gav denne prototypen dere? | | Hva likte dere? | Hva mislikte dere? | |
|------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------|
| Nasjonalromantisk, Norsk | Landlig følelse, tilbake til gamle dager | Morsom måte å fremvise informasjon på. Også for barn. Fint at det var mulig å kunne tilpasse så mye. Fin måte å lære om gammel norsk historie. | Likte budeien, fikk lyst til å vite mer | Ønsker det mer naturtro. Skulle gjerne visst mer. |
| Koselig følelse | Koselig, gammeldags | Gøy med historien om smørlaging. Lett forståelig app. | Likte at man møtte Budeien | Budeien var ikke gammeldags nok Mer naturtro, korrekt |
| | Forbindelse med melkesjokolade, oppskrift på Norsk | | Tydlig å se hvor jeg kan trykke | dark mode, ikke noe for meg. |

| Hvilke mål hadde dere for bruken av prototypen? | Ser dere noen fordeler eller ulemper med prototypen? | Hvordan ser dere for dere å bruke prototypen? | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------|
| Hvordan den kan hjelpe meg på veien og gi meg informasjon når jeg går forbi flotte steder. Fint å bruke til å lære barna ting jeg ikke kan så mye om selv. | Interessant å vite mer om seterdrift | Må være en balansegang mellom bruk av teknologien og å få med det rundt meg på tur. Kanskje man kan ha forskjellige nivåer så man kan få opp historier basert på det. (lite, medium og mye informasjon) | Fint med preferanser og innstillinger | Brukt mye, spesielt for å lære barna, for tips og råd for hva jeg kan gjøre underveis. | Bruke i undervisning, touchfri skjerm på museum |
| Hvordan lage smør, lære om seterdrift, fint å velge tema og historie | Lære om gammel historie | Det var enkelt for personer uten mye teknisk kompetanse | Godt forklarer knapper, store knapper. | Skolebruk og undervisning | for å lære om seterdrift, lære on the go. |
| | Lære noe | | Treffer det norske godt | | Lære å lage smør, |



Figure 13. Displaying focus group affinity diagrams.

2.10 User testing - high fidelity prototype

To user test a prototype with actual users is the primary user testing method, and is according to Nielsen irreplaceable (Nielsen, 1993, p. 165). Testing with the users gives qualitative information directly of the usage and the problems the users come across in a system interface or prototype (Nielsen, 1993, p. 165).

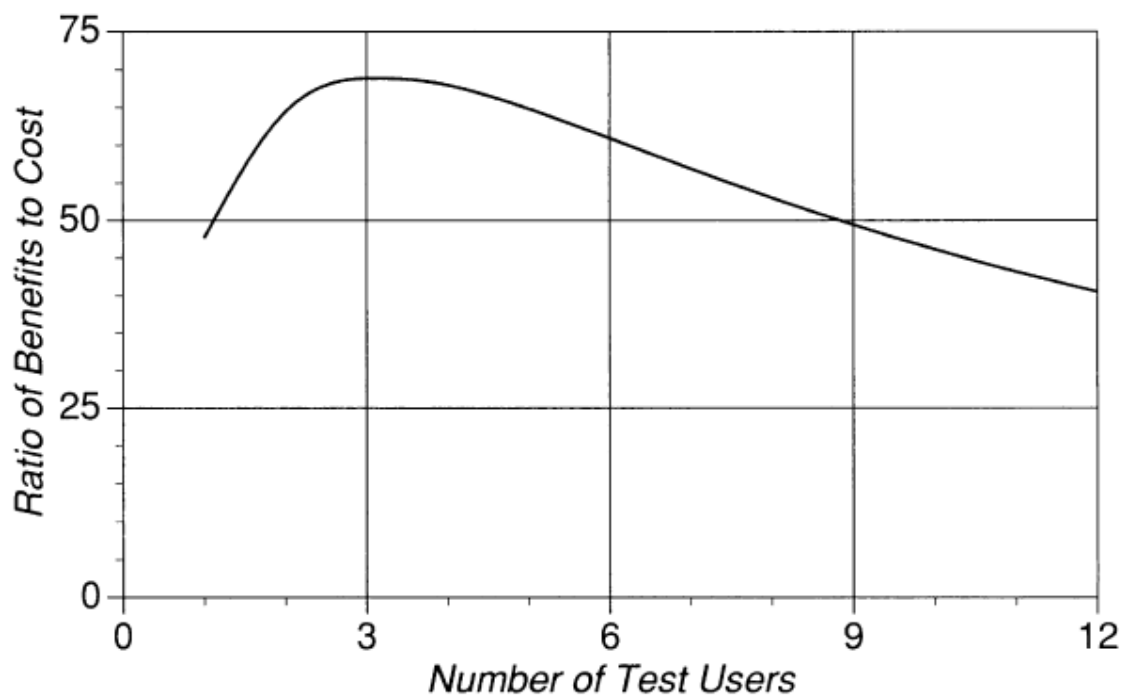


Figure 14. Displaying the cost versus benefit ratio from Nielsen (Nielsen, 1993, p. 174).

As the figure above shows, the benefits of the number of user testers stops finding new usability problems at the number of three to five test participants (Nielsen, 1993, p. 173). This figure is based on a medium sized project by Jakob Nielsen (Nielsen, 1993, p. 174).

The user testing accompanied by the “think aloud” method could be one of the most valuable methods of testing usability (Nielsen, 1993, p. 195). This helps the designers understand the users in a unique way as the users continuously express what they are thinking when navigating a systems interface (Nielsen, 1993, p. 195). The “think aloud” method shows how the users decipher and understand the interface in question (Nielsen, 1993, p. 195). This is a unique way of identifying where the user's understanding of the system interface deviates from what the designers wanted (Andrews Paulsen et al., 2002).

In user testing one participant at a time tests the system interface in question through tasks given, and gives feedback both in body language and in speech (Krug,

2014, p. 113). The designers can therefore spot and understand what things in the design frustrates or confuses the users (Krug, 2014, p. 113). Steve Krug says it in a good way: “Testing reminds you that not everyone thinks the way you do, knows what you know, and uses the web the way you do.” (Krug, 2014, p. 114).

Qualitative testing of a prototype identifies problems and possible opportunities for improving the design to help the users (Boyle et al., 2017, p. 53). Qualitative feedback should be open, where the user has the possibility of expressing themselves in detail (Boyle et al., 2017, p. 54). The qualitative information is also based on interviews and observations (Boyle et al., 2017, p. 54).

The main goal of the user testing was to gain feedback on usability and the concept of using AR with camera and sound in an outdoor situation, in a context that was similar to the context during a pilgrimage walk. The user testing was done with one group member as a facilitator and one group member that worked as an observer and notetaker.

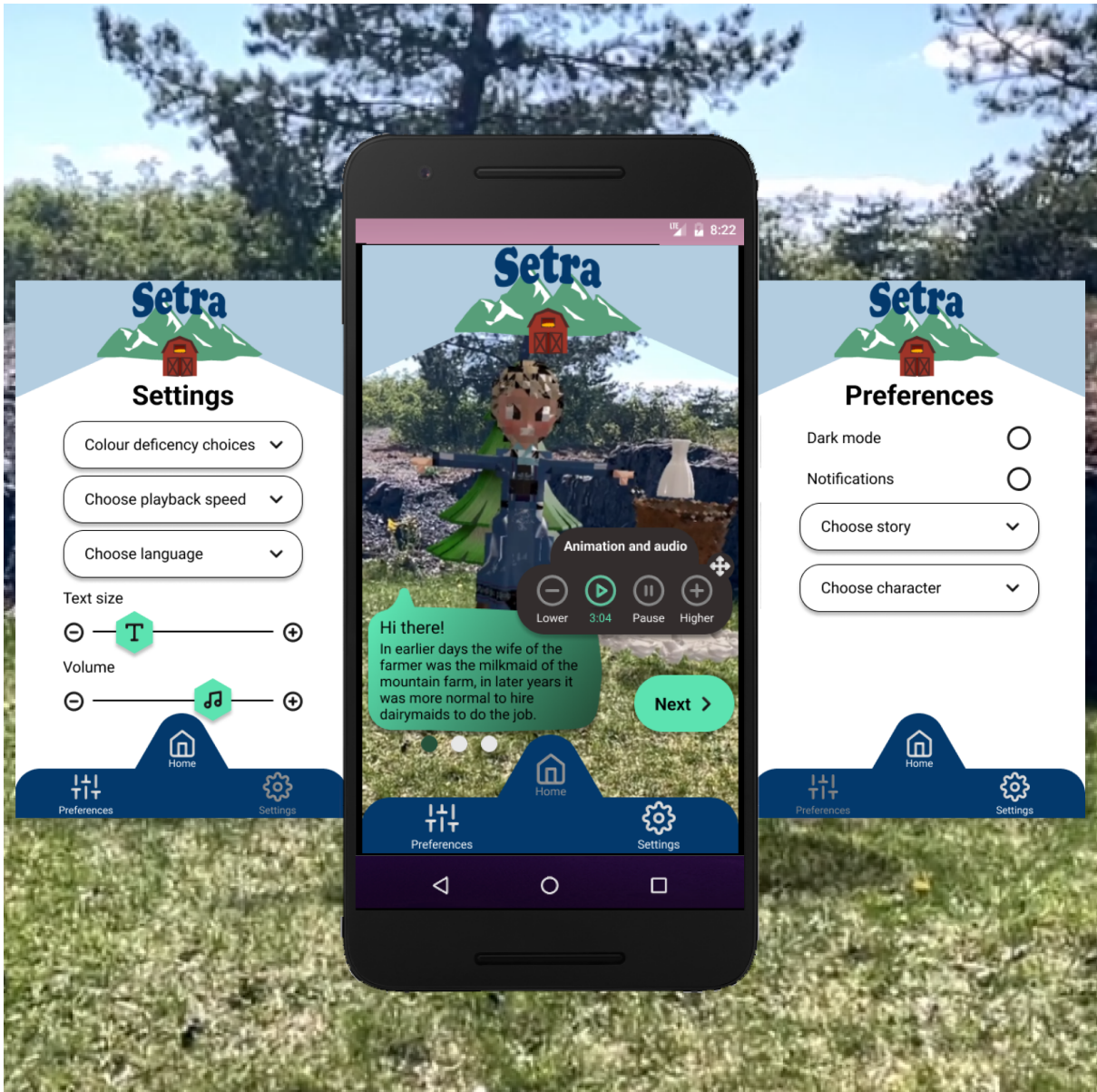


Figure 15. Displaying illustrations of the high fidelity prototype.

The tasks that were given during the user testing was:

1. Play the AR and sound.
2. Experience the history without AR and audio- click next to read more
3. Pretend you are playing the animation and audio and put it on pause.
4. Go to settings and choose desired settings.
5. Choose language in settings.
6. Go to preferences and choose desired preferences.
7. Choose dark mode in preferences.
8. Choose character in preferences.

2.10.1 Retrospective probing

Directly after user testing retrospective probing can be utilised by asking the users questions about the experience they had with an system interface immediately after completing a series of tasks, while the experience is still fresh (Andrews Paulsen et al., 2002). The user's responses highlight problems or concerns in the system (Andrews Paulsen et al., 2002).

The method of retrospective probing could be either open ended- or close ended questions (Andrews Paulsen et al., 2002). The open ended questions give the participant the opportunity to express themselves freely about the interface in question (Andrews Paulsen et al., 2002). Close ended questions on the other hand searches for answers like yes and no, and is not inviting the participant in giving detailed feedback (Andrews Paulsen et al., 2002). In the retrospective interview the project group used open ended questions, to get the user to speak as freely as possible.

The retrospective probing method is effective as it gains fresh feedback and responses from the user's experience navigating the system interface in question (Andrews Paulsen et al., 2002).

The interview consisted of the following questions:

- How did you experience the prototype?
- Tell me about what was challenging?
- How do you vision using this type of app?
- What do you think about the use of augmented reality?
- What did you think about the use of sound and text?

See the results from the retrospective probing in chapter [3.6.2.1 Retrospective probing](#).

2.10.2 Recruiting of test participants

The project group recruited participants for the user testing by contacting some of the participants that had been interviewed in the insight phase. In this way the

project group were assured that the participants had knowledge and insight about the pilgrimage walks. This way of recruiting can lead to biases with the answers from the participants. It might for instance be that the participants don't want to state their real opinion and are afraid of hurting, or because of interpersonal elements. So even though the project group did put weight on the importance of giving constructive feedback and the importance of creating a user friendly prototype based on the feedback it might not be the case that the participants are truly honest in the setting. One way this method could have been challenged could have been to do a distributed user test, where the participants did the user test when no one was watching and could give feedback in writing. In this way the project group might again have lost some other important information such as body language and tone of voice, and other important observations during the user test.

2.10.3 Implementation of user testing

The user test was done outside, in an environment close to the participants. The reason for this was to make it easy for the participants, and to have a context that would be more realistic due to the outside situation. The participants had different times scheduled for when to user test, this was done so that the participants would not help or influence each other in any way.

To create an even better contextual situation the project group could have visited Stiftelsen Lillehammer museum Maihaugen and done Gerilja testing, but as the project group could not get in touch with the employees there in time the decision was to do the testing in this way.

The project group first gave the user information about their right to withdraw from the test and from the project at any time, their rights to ask questions, and the importance of giving constructive feedback. Then the users were given instructions for tasks to do with the prototype. One of the members in the project group was the facilitator, giving the tasks and asking follow up questions, and one was an observer, taking notes. After finishing the tasks in the user test, the follow up questions for the retrospective probing were asked.

The user testing was done with five participants, and matches the participant number as Jakob Nielsen states in the book “*Usability Engineering*” (Nielsen, 1993, p. 173). The user testing was done with the participants doing the tasks on their mobile phone, with two different prototypes - one with the augmented reality storytelling experience and one with the high fidelity prototype application interface.

3.0 Results

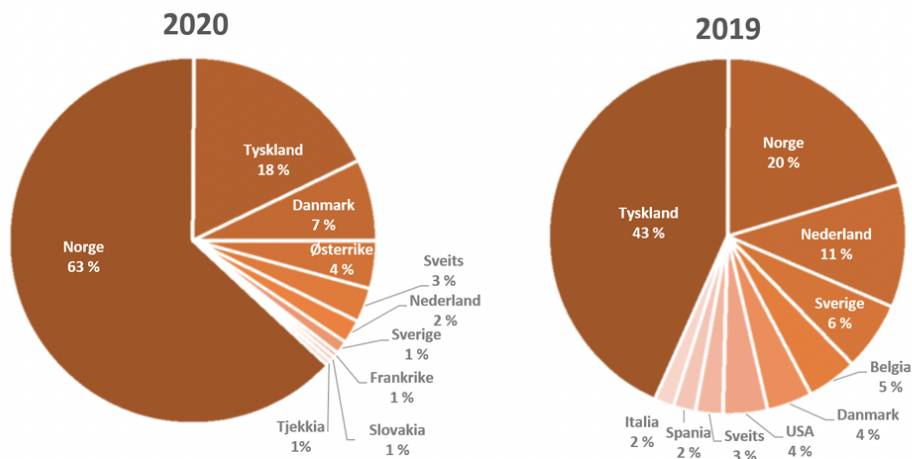
3.1 Findings from questionnaire and Nidaros Pilegrimsgård statistics

According to Nidaros Pilegrimsgard statistics the age group that uses the Gudbrandsdal pilgrim tracks are mostly in the group of 50 years old to 69 years old (Neraas, 2020). This data is similar to the numbers that were gathered from the questionnaire sent to the different Facebook groups. But as stated in statistics from the Nidaros Pilegrimsgard there was an increase in younger travellers in the age group 16 to 21 years old. Which might indicate that the pilgrim travels also is an activity for the younger age groups (Neraas, 2020). This is on the other side not a trend the project group sees in the dataset, where only one person reported to be in the age between 21 and 29 years old and zero reported being between 18 and 20 years old.

As can be seen also from Nidaros Pilegrimsgard statistics there are more women than men travelling, approximately 57% females and 43% males in 2020. In figure 17 below we can also see that there is a bigger traffic on the Gudbrandsdalsleden than the other routes (Neraas, 2020). Further one can see that most travellers were from Norway during the pandemic in 2020, but that in 2019 it was mostly travellers from Germany (Neraas, 2020).

A critical aspect with the data representation from Nidaros Pilegrimsgard is that not all travellers are passing Trondheim and Nidaros Pilegrimsgard, many travellers also end their route at Nidarosdomen and are therefore not counted in the statistics.

Nasjonalitet – Figur 1



Figur 1 - 2020: N = 449, 2019: N = 1465

Figure 16. Showing nationality of the travellers along the Gudbrandsdalsleden (Neraas, 2020).

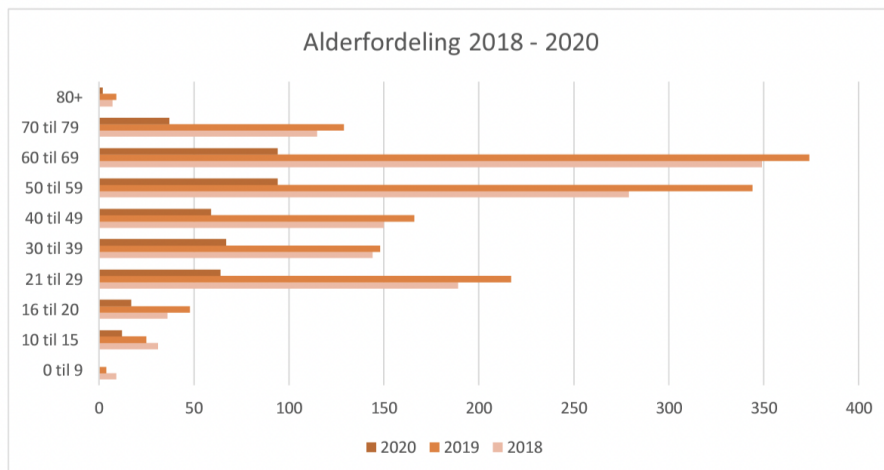


Figure 17. Showing age distribution from 2018 to 2020 (Neraas, 2020).

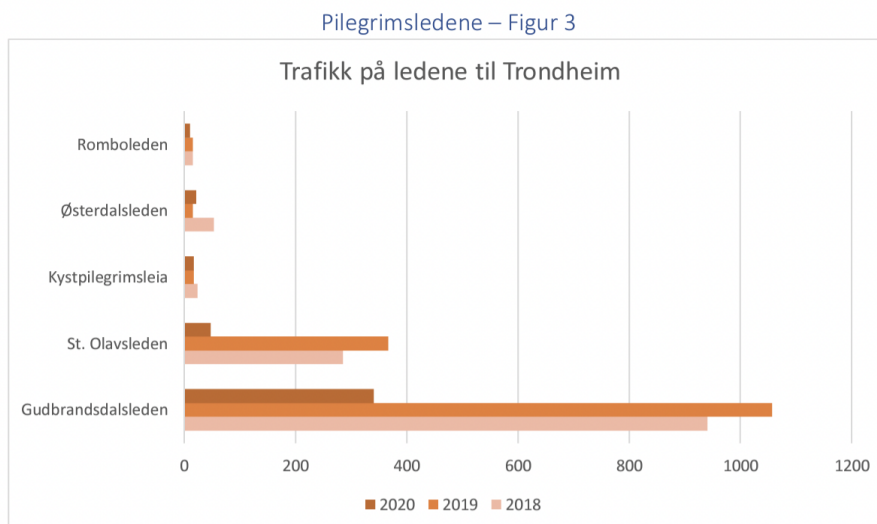


Figure 18. Showing the traffic at the Gudbrandsdalsleden from 2018 to 2020 (Neraas, 2020).

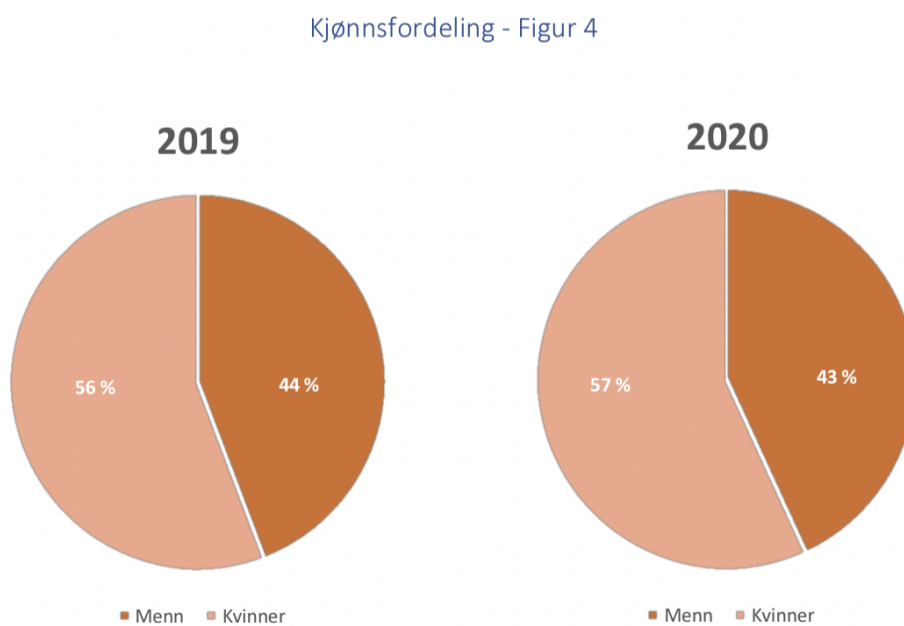


Figure 19. Showing the distribution of males and females in 2019 and 2020 (Neraas, 2020).

After redistributing the questionnaire the project group got 56 answers, and the age group that had the highest representativity was the age group 50-59 years old and 60-69 years, representing 58.9% of the participants. As also can be seen there were not any reported answers from the age group 18-20 years.

Hva er alderen din? ^

Antall svar: 56

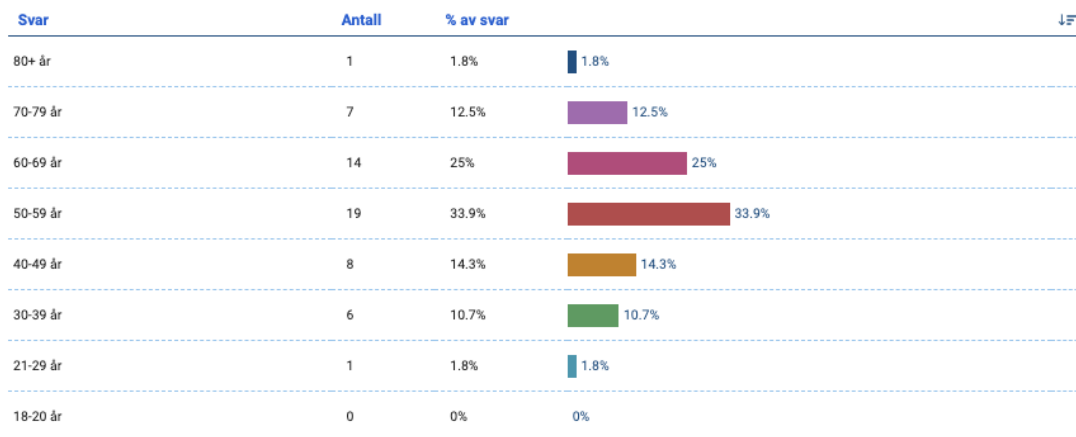


Figure 20. Showing the answers from the participants about age.

On the question “what is your experience with AR?” There were most responses about persons reporting that they had little or nothing experience with using the technology. Two persons mentioned that they had used it in accordance with museum visits such as in the British museum or “Voice of Norway”. Others reported that they had used it with Snapchat, Pokemon Go, and social media. Some reported their experience as positive and some reported the functionality as more of a gimmick or as a distraction.

26.8% of the participants answered that they would be very interested (10 on the scale 0-10) in using a storytelling application about mountain farming on mobile devices. 7.1% answered that they would not be interested (0 on the scale 0-10). 16.1% answered that they would be indifferent about it (5 on the scale 0-10). The percentage of participants from 5 to 10 on the scale were 58.9% of the participants, and from 0 - 5 on the scale there were 41.1%. This might indicate that the participants are divided in their interest in using an application for this type of experience. Still we see a higher response of people responding 10 on the scale than in the other categories. The mean score was 6.27, which might indicate a higher likelihood in the users being more interested than not interested in using this

type of application.

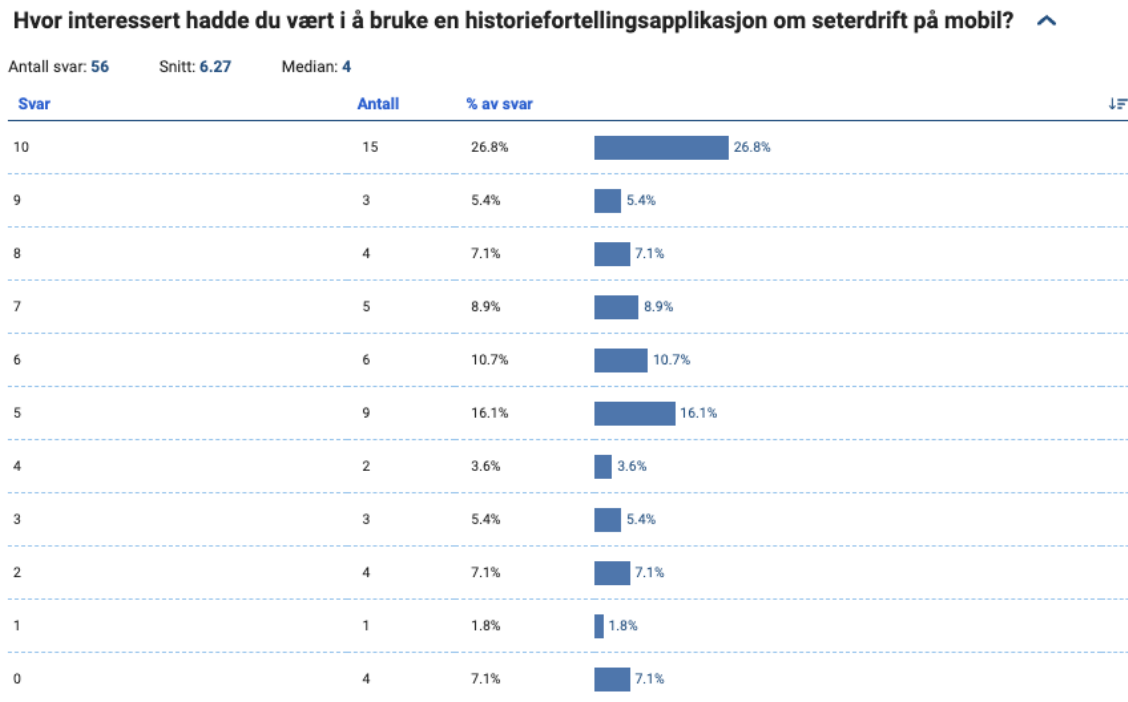


Figure 21. Showing the answers from the participants on how interested they would be in using a history application about mountain farming on the mobile phone.

In the question “How interested would you be in visiting one or more museums on the way to the goal of the pilgrimage route?” 23.2% answered that they were very interested (10 on the scale 0-10) 16.1 % answered 9, and 21.4% answered 8. There were 10.8% answering below 5 on the scale and 5.4% that answered that they were indifferent about it (5 on the scale). This gives a mean score of 7.46 on the scale, which might indicate that the user group is more positive to go to museum visits.

Hvor interessert hadde du vært i å besøke et eller flere museum på veien til pilegrimsmålet? ^

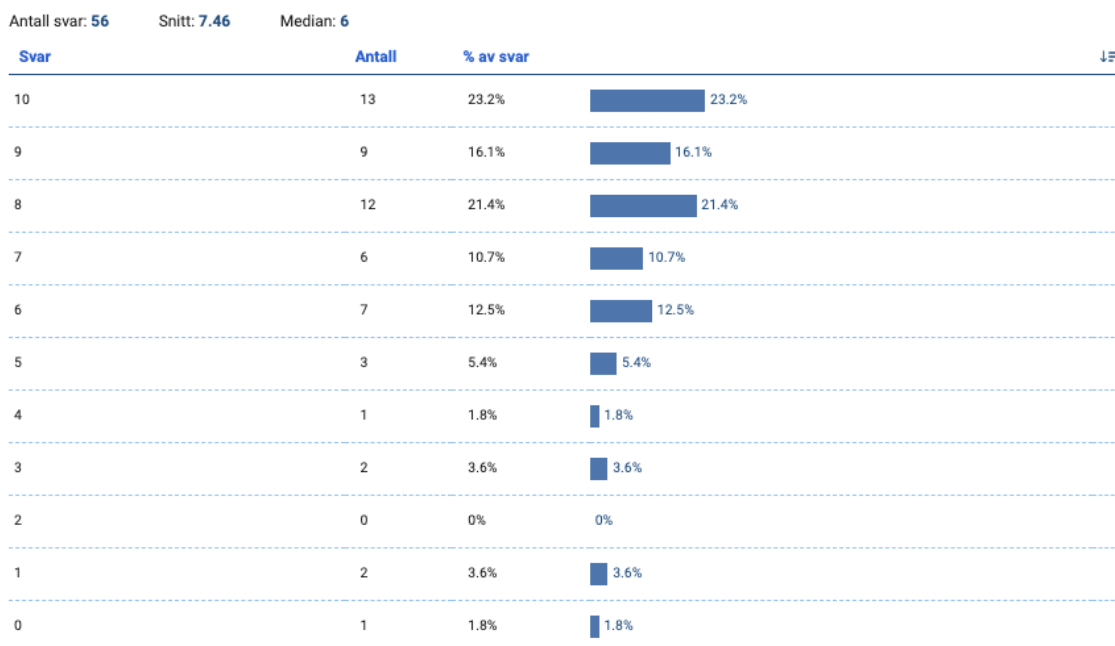


Figure 22. Showing the result of how interested the participants would be in visiting museums.

On the question about who they travel with, there were 43 answers. 48.8% answered that they are travelling alone, 51.2% answering that they are travelling with friends and 14% reporting that they are travelling with their own children. Further 16.3% reported travelling with their boyfriend/girlfriend/husband/wife/partner.

Hvem reiser du med på pilegrimsreisen? ^

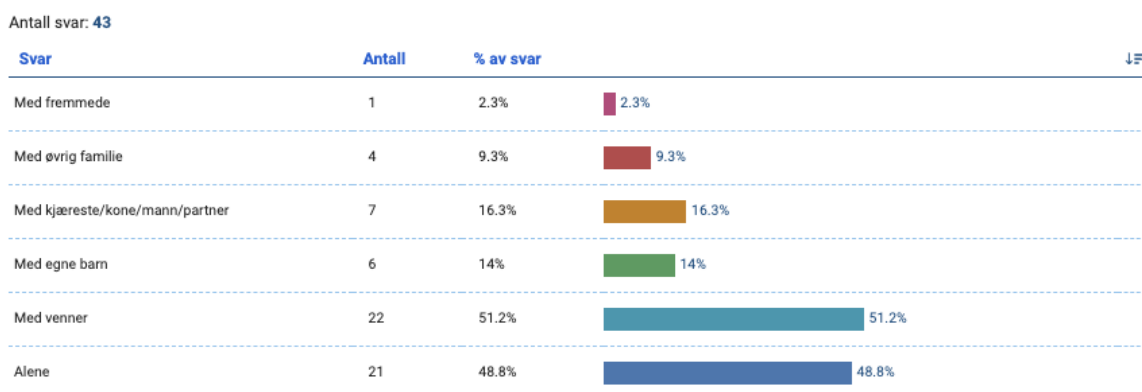


Figure 23. Showing results of who the participants usually travels with.

On the last question about plans on going on a pilgrimage trip this year, 69.6% answered yes, 17.9% answered no and 12.1% answered that they don't know, or that they may be travelling.

3.2 Research results

3.2.1 Literature review - use of audio in narratives

The results from the literature review on use of audio in narratives, shows a wide spread of use of audio in narrative communication.

Marshall et al. (2016) writes that information is not the only or most important factor that impacts the way in which designers should think about digital interaction with heritage (p. 1). They base these findings on museum studies which emphasises the revisiting of the information centric approach of cultural heritage. Which emphasises the importance of visitors being in contact with objects and places, this offers multiple possibly conflicting voices and leaves the act of interpretation to the visitors' existing knowledge (Marshall et al., 2016).

Sound is also known for evoking emotions, and is often used in films for this purpose (Marshall et al., 2016). Also Cliffe et al. (2021) states that sound has the potential to give exhibitions emotional power and to generate different perspectives (Cliffe et al., 2021, p. 1-2).

Auditory experience offers a powerful tool for both telling a story and creating an alternative experience for the user (Marshall et al., 2016). In their design they used human voice to convey information, trigger empathy and to stimulate interpretations (Marshall et al., 2016).

Zhang et.al. (2015) have researched the emotional aspect of design in exhibitions (Zhang et al., 2015). One way they emphasise that emotions can be used in interface design is to use metaphors. The metaphors could influence people to jump into the historical, cultural, and emotional knowledge (Zhang et al., 2015). In Rodrigues & Silva (2022) project they found clear evidence that emotional design has positive implications for learning outcomes (Rodrigues & Silva, 2022).

In the review of Marshall et al. (2016) they found different ways of using sound in different projects: They found that using sound when the participant is close or far away, when the user stays still, as reaction to movement, the use of ambient sound,

sound through headphones, eavesdropping on others to increase the social aspects, instructions to engage with the tangible elements, audio snippets in interaction with material tokens, natural sound and direct sound (p. 3-4).

Some interesting findings from Marshall et.al. (2016) was that the perspective of the participants needed to walk while using the audio, it contributed to giving the users a sense of being there, and when reaching the different destinations it increased the feeling of excitement in the users (Marshall et al., 2016). When multiple senses are being used, such as smell of the place, sight and sound, it contributes to increasing the emotional affective level (Marshall et al., 2016). The focus on personalisation for accommodating different needs also contributed to engagement for the users (Marshall et al., 2016). Most of the users were in groups and it was important to experiment with design that was not hindering social interaction and the enjoyment of sharing the experience (Marshall et al., 2016).

In Marshall et.al. (2016) study a belt with different cards and pockets where used, the pocket where the card was, affected what personalised way of audio the user heard (poem, order of the day, my dear wife, and women in the war). An audio lantern was placed near each of the sites, and connected to the belt with bluetooth (Marshall et al., 2016). They did a field trial and observed how people reacted and behaved at the narrative points and gained feedback (Marshall et al., 2016).

Richardson et al. (2020) investigated to the extent of how audio or visual medium affected self reported physiologically measured engagement with the narrative (p. 1). They found that stronger physiological responses were recorded for auditory stories other than video. Even though the participant self-reported greater involvement with watching video. The reasons behind this might be that when listening to a story is a more active process of co-creation, and that this imaginative process in the listeners mind is detectable (Richardson et al., 2020).

Nikolarakis et al. (2022) writes about how storytelling techniques and gamification often is used to increase the positive user experience in many mobile guide apps. Further the primary delivery is audio narratives, which often is accompanied by multimedia content such as images, video or animations and AR. The downside of

these findings is the social aspect of using these applications (Nikolarakis et al., 2022). In their study they used gamification and audio to create a museum guide.

Cliffe et.al (2021) aims to investigate the potentials of using audio augmented reality installation to promote visitors exploration and engagement with physical museum and gallery based artefacts together with digital audio archive material (Cliffe et al., 2021).

In the Cliffe et.al. (2021) project they used headphones connected to smartphones and an application. The application records the distance and orientation of the listener, and plays sound based on these. The figure below describes how the system architecture of their prototype was built (Cliffe et al., 2021).

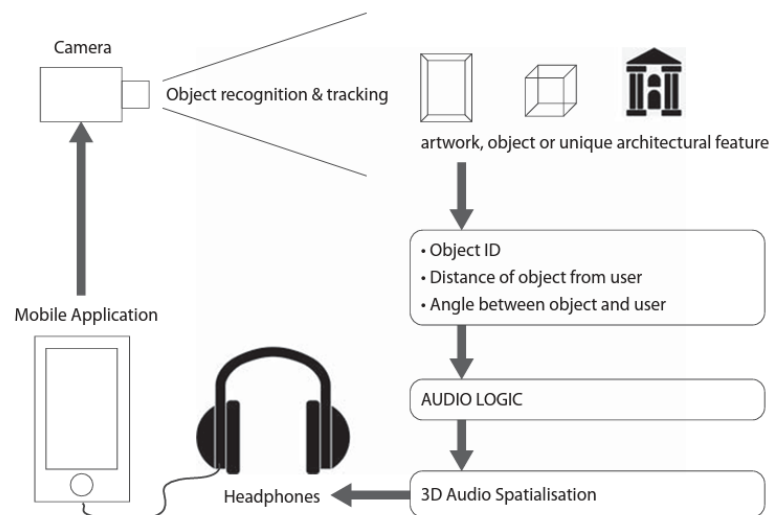


Figure 24. Shows how the system architecture of Cliffe et al. (2021) are used (p. 4).

The below figure shows how Cliffe et.al. (2021) used movement to influence the content the user was hearing (Cliffe et al., 2021) .

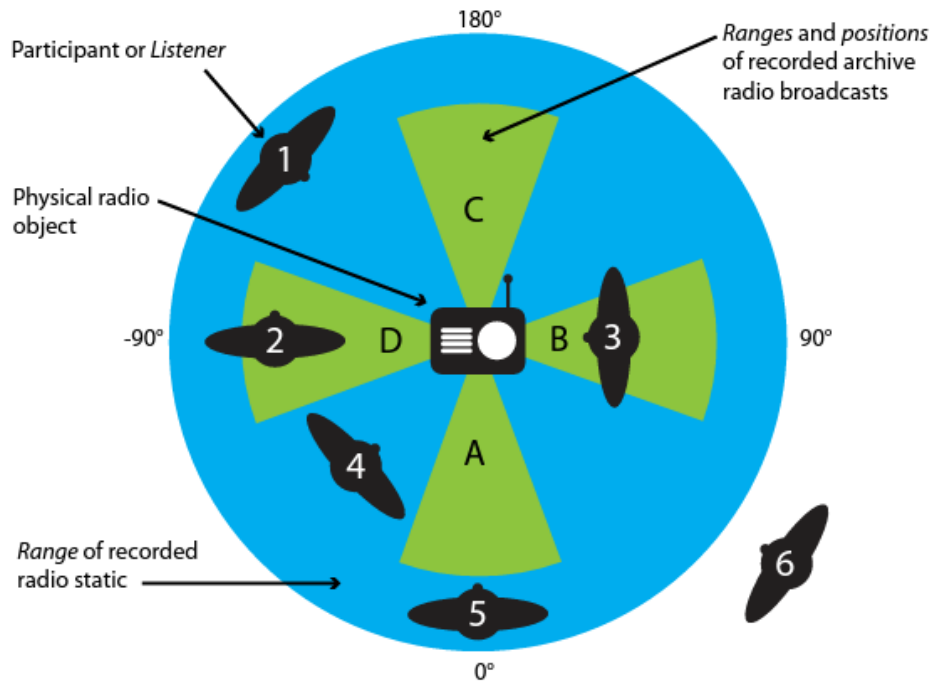


Figure 25. Shows the audio interaction design in the LISTEN project (Cliffe et al., 2021, p. 6).

Findings from the participants in the Cliffe et.al. (2021) project suggested that the user found it interesting or fascinating, and commented on the warm sound and that it was interesting to use new technology to tell about old objects. Others mentioned that the use of bodily movements made them think of how it is to tune a radio (Cliffe et al., 2021, p. 8). One of the participants also wanted a textual description of the sound (Cliffe et al., 2021, p. 8). Their conclusion from the project was that the users would engage with this approach (Cliffe et al., 2021, p. 8).

The LISTEN project includes a personalised and interactive location based audio experience based on adaptive system model (Zimmermann & Lorenz's referenced in Cliffe et al., 2021, p. 2). Also this project uses tracking of aspects of the users behaviour to personalise the audio experience. To hear the sound the user uses customised headphones and uses different techniques such as attractor sound to suggest nearby artworks to the visitor that may be of interest with the use of spatially audio prompts (Cliffe et al., 2021, p. 2). The project differs from the regular sounds in museums with the interactive element of movement and proximity (Cliffe et al., 2021, p. 2).

Seidenari et al. (2021) both used camera and speech detection to maintain the social interaction with other visitors (Seidenari et.al. referenced in Cliffe et al., 2021, p. 3).

Abi Khalil's (2019) project gives another view on how participants can be included into the history: They used voices from visitors to the National Museum of Beirut. The visitors spoke to, for and about the objects from the past, and it contributed to revealing fragments of the present (Abi Khalil et al., 2019, p. 1). The project was based on participatory social art practice (Abi Khalil et al., 2019, p. 1). The objects were presented with a question, making the participants reflect upon the question and the thematic from their lives and Lebanon's current social and political reality (Abi Khalil et al., 2019, p. 1). The results reflect upon a myriad of voices by the participants for visitors to listen to (Abi Khalil et al., 2019, p. 1).

(Estefanía, 2021) conducted a case study on different heritage narratives, he found eight different applications that used sound walks as a method for telling stories and narratives. All the eight case studies were locative by using audio files triggered by proximity to specific GPS coordinates through the use of mobile devices (Estefanía, 2021, p. 9). In this way the participants were both a listener and an observer.

3.2.2 Literature review - use of augmented reality and storytelling

As earlier described in this project, narratives can be described as a way of telling a story (storytelling). And as defined further up in the paper, augmented reality is working with the real world around the user to give them more information than what the real environment could alone. The full definitions of narratives and of augmented reality can be viewed in the chapters [1.3.6 Augmented reality and audio](#) and [1.3.1 Narratives](#).

Augmented reality has been used extensively in later years in mobile phone games like Pokemon Go and Harry Potter: Wizards Unite (Klebo-Espe, 2021). Pokemon Go has been especially popular (Klebo-Espe, 2021). Also other applications use AR, Snapchat for one has been using augmented reality for several years (Carah & Hawker, 2020). Users of Snapchat mainly take pictures of themselves and add filters

and/or other graphical elements to these images or videos and send it to their friends (Carah & Hawker, 2020).

Liestøl (2019) has used storytelling and augmented reality in mobile phones to tell the story of the attack on Omaha Beach on D-Day (Liestøl, 2019). Liestøl (2019) talks about the possibility of using AR to make complex animations and rich graphical representations for today's phones and tablets as the processing power is greater than before (Liestøl, 2019). Earlier, augmented reality storytelling had been mainly done on static surroundings such as cultural or historical sites using for example audio, text or video (Liestøl, 2019).

In the representation of the attack on Omaha Beach on D-Day in augmented reality there was used an indirect method (Liestøl, 2019). Liestøl (2019) describes this as a way of providing the users with a virtual perspective on their mobile phone or tablet screen using the camera of the device while the users are on location and are seeing the real sites with their eyes (Liestøl, 2019). This also mixes in the now and then time perspective of the site (Liestøl, 2019). This can be viewed in the figure below.



Figure 26. Virtual and real perspective of a Omaha Beach site (Liestøl, 2019).

Augmented reality has the possibility of providing an unique storytelling perspective in the physical world at a site or a location (Nam, 2014). With the use of a mobile phone, AR can turn real world elements into story subjects with extra context and help the user's imagination (Nam, 2014).

Furthermore Nam (2014) has found that it is normal for existing augmented reality applications to have ready made content and elements, and offer little or no interaction to further engage or activate the users (Nam, 2014).

When looking at this project, there is a similar mobile phone application about stories of trolls in Norway (Erikstein-Midtbø & Helle, 2019). This mobile phone application is about getting the users out on hikes to experience the stories about trolls and the accompanying graphics (Erikstein-Midtbø & Helle, 2019). The application, called Hidden, has been of inspiration in the project group.



Figure 27. AR image of Trolls fighting in the Norwegian mountains (Hidden, n.d.).

Research done by Figueiredo et al. (2015), states that with the usage of GPS (Global Positioning System), WPS (Wi-Fi Based Positioning System) or infrared both outside and inside, mobile phone applications can use the geographical position together with augmented reality (Figueiredo et al., 2015). The studies undergone by Figueiredo et al. (2015) concerns the history and nature combined with AR technology in the Garden of the Calouste Gulbenkian Foundation in Lisbon (Figueiredo et al., 2015).

Furthermore the history of the garden gives a new experience when it is coupled up with mobile phone AR application technology as the visualisation and the interactivity gives the users a different exploration option (Figueiredo et al., 2015). In the research done by Figueiredo et al. (2015) the project used the Aurasma application (Figueiredo et al., 2015).

3.2.3 Research on mountain farming and the dairymaids work

As earlier mentioned, mountain farming has been a way of life for Norwegian farmers for many hundred years, maybe even thousand of years (Dybdahl, 2023). It has predominantly been the dairymaids job and responsibility to run the mountain farm (Dybdahl, 2021). Traditionally there were more than one type of mountain farm; some of the farms were close to the main farm and others were high up in the mountains (Dybdahl, 2023). Some main farms also had multiple mountain farms (Visit Norway, n.d.). The mountain farms were an important way for the farmers to use all the grazing areas available (Visit Norway, n.d.).

In earlier days the wife of the farmer was the milkmaid of the mountain farm, in later years it was more normal to hire dairymaids to do the job in the summer (Dybdahl, 2021). The work the milkmaid did on the mountain farm was attached to the cows and goats, and meant hand milking and churning of butter (Dybdahl, 2021). In other words, the dairymaid had the responsibility of the mountain farm (Dybdahl, 2021). The milkmaid often worked and lived on the mountain farm from June and until the end of August (Visit Norway, n.d.).

Most of the time the milkmaids spent on the farm was accompanied by hard and physical work, and often in small, smoke-filled rooms with warm cooking stoves (Dybdahl, 2021). This is in stark contrast to the way the dairymaids have been portrayed by painters and foreign tourists for many years (Dybdahl, 2021).



Figure 28. Illustration of dairymaids from Tidemand (Dybdahl, 2021).

The smallest children that could not work, also lived on the mountain farms with their moms that worked as dairymaids during the summer (Dybdahl, 2021). The older children often had to help out as shepherds for the cows and goats, and often spent the whole day out with the animals as they were grazing (Dybdahl, 2021).

Today there is a smaller amount of mountain farms that produces milk and churns butter (Dybdahl, 2023). Visit Norway states that the number of functioning mountain farms today are around 700 farms (Visit Norway, n.d.). The total number of mountain farms in Norway has receded a lot since the start of the 1900's (Dybdahl, 2023). Visit Norway writes that there were about 100 000 mountain farms at the most in Norway (Visit Norway, n.d.). Some of the mountain farms have been destroyed through the years due to rock slides and avalanches, and others have been abandoned because of predatory animals (Stensgaard, 2017). Especially bears (Stensgaard, 2017).

There are mountain farms nowadays that are more used as cabins, hotels or other leisurely activities (Stensgaard, 2017). Using the mountain farms as retreats and vacation spots gives the possibility of being close to animals, going hiking and to experience the place the food originates from (Visit Norway, n.d.). Some mountain

farms also give the guests the opportunity to learn and to join in on milking the animals, feeding the animals, churning cheese or to do activities in the mountains (Visit Norway, n.d.). Some mountain farms have cafés or shops where guests can experience traditional food made at the mountain farms (Visit Norway, n.d.). This has contributed to Norwegian mountain tourism for many years and has contributed to shaping the Norwegian cultural landscape.

3.2.4 Research on existing storytelling technology gained through interviews

Through both the interviews and the questionnaire the project group gained feedback about an existing application for mobile phones called Voice of Norway. This is an application that is focusing on audio and augmented reality holograms in storytelling of culture, history and attractions (Voice of Norway, n.d.). The Voice of Norway application has played approximately 280 000 audio stories by April 2023 (Voice of Norway, n.d.).

Voice of Norway's audio guide tells stories about the sites users visit (Voice of Norway, n.d.). The augmented reality hologram shows the users extended information about the sites the users visit (Voice of Norway, n.d.). For example a 3D model of a viking ship that is buried several metres below the surface (Voice of Norway, n.d.).



Figure 29. Shows the Voice of Norway application (Voice of Norway, n.d.).

Another existing application gained through feedback from the interviews undergone are KuGo, which is an augmented reality app which teleports the user to a mountain farm at three different museums; Domkirkeodden in Hamar, The bygdemuseum in Tynset and Glomdalsmuseet in Elverum (Anno Museum AS, n.d.). The KuGo augmented reality experience is about solving assignments during the exploration of the museums (Anno Museum AS, n.d.). From the information and the trailer video found, this application seems to be made for kids.



Figure 30. Displays an image from the KuGo application (Anno Museum AS, n.d.).

3.3 Results from interviews and thematic analysis

3.3.1 Interviews from pilgrimage travellers

The project group has conducted seven interviews to gain insight in the project. Six of the participants were experienced pilgrims and have helped in understanding the possible pilgrim users and their needs in the prototype. One of the participants also had extensive knowledge of mountain farming in general and its history.

The insight gained from the participants are thematically divided into five categories which again is divided into subcategories. These can be seen in detail below.

A) About the pilgrimage trip:

1. *The main goal of persons walking pilgrimage tours is to de-stress, and be in the now.*

All of the participants had similar goals with walking the pilgrimage trail. They all had a goal to de-stress, become more in contact with themselves, to be present, to experience internal and external experiences, experience their spirituality, and personal growth. A participant mentioned that he/she feels more fulfilled after walking a pilgrimage trip.

One of the participants said that he/she got concerned with the fundamental needs such as food, and sleep and therefore forgot other problems and challenges that he/she experiences in their daily life. Another said that he/she gets more practical and worries more about where to sleep every night than other things. One of the participants mentioned the saying: eat, walk, sleep, as the fundamental needs during the walk.

Others also mentioned the curiosity of walking and seeing what is around the next corner as a positive part of the pilgrimage walk. Some participants also mentioned the interest of old history both in buildings and in nature along the way.

2. Challenge the physical form.

All the participants mentioned that they walk to challenge the physical form and to feel how the body handles the walk. One participant also said that he/she is a sports pilgrimage and is walking for overall exercising. It was also said that the pilgrimage walk is both physically and mentally challenging, this is also part of the travellers goal with the trip.

3. People to travel with

The participants reported travelling with different people on the trip. Some wanted to travel alone to get to know more people, some travelled with their husband/wife/girlfriend/boyfriend, some travelled

with friends or colleagues. One of the participants mentioned that he/she would not like to travel with many people and the maximum would be with one other person.

4. *What the pilgrims/participants want to experience on the trip.*

What the participants wanted to explore during the walk was similar. One of the main things was to experience history, culture, historic places, museums, cathedrals, old buildings, castles, and churches during the walk. Other things that were mentioned were archeology, agriculture, meeting other people, enjoying nature, and heritage.

Two participants also mentioned that they like to take notes, to reflect upon the walk. One of the participants mentioned that he/she uses this as a source on looking back on the experience and to use reflection later.

5. *What does a pilgrim traveller need?*

Most of the participants mentioned that they wanted good weather, good food, and a place to sleep during the trip. It was also mentioned that they would need to rest between their walks.

6. *How to plan the trip.*

Most of the participants said that they used the internet to plan the trip in advance, one person said he/she used a book. Another person said he/she likes to book 2-3 first nights before the walk starts and that he/she booked the rest of the nights along the trip.

7. *Challenges during the trip*

The challenges that were mentioned were that the travellers get tired, that it is physically and mentally challenging, pain in different places in

the body, chafing, bad infrastructure, capacity, finding a place to sleep, bad weather, wrong packing and high cost level.

One of the participants mentioned that he/she experiences that many that haven't walked a pilgrimage walk yet experiences it as a bit scary to start on a pilgrimage walk and meant that the threshold was high for the inexperienced to start.

8. Package deal

Some of the respondents mentioned that there is a need for a package deal for the cultural pilgrimage tourists. Where sleeping, cultural offers, food, information and museums are all in one package. One of the respondents highlights that the travellers want a comfortable trip without too much to carry. Another highlights that the cultural pilgrimage travel wants the whole package of good food, and experience.

B) About technology:

1. Planning

Most of the respondents said that they use the internet or their mobile phone as part of the planning of the trip and sleeping during the walk. Some mentioned pilegrimsleden.no and the map on their website for planning the trip. One person also mentioned that he/she uses the packing list on the same website for planning what to bring to the trip. One of the respondents also reported that he/she did not use any form of digital tools to plan, and rather used books.

Some of the respondents also mentioned that they use the phone as planning for the next days during the trip. One person mentions that he/she does this in the evening when he/she has arrived at the resting place.

2. App as wayfinder

Some of the participants said they used GPS on the mobile to follow the route. Some also said they only used it if they had to go off the pilgrimage route to find the way back. Others said that the pilgrimage route often is well marked and therefore they don't need to follow such a digital map to follow the route. One person mentions that he/she downloads the map on the phone but prefers to ask other travellers about the way if he/she gets unsure about the route.

3. To learn about history

Overall findings from the respondents showed that most of the participants had little or no experience with the use of AR. Still the participants were positive about the use of an app for learning about history. One person mentions AR as a fun and entertaining element. Another respondent mentioned the use of audio as part of the coastal pilgrimage walks and the use of the application "Voice of Norway". Others were positive about the use of audio as part of museum visits, and that it is easier to get the history through audio so that he/she did not need to read everything.

One participant said that he would use an app for learning about places that he/she walked past during the walk, but that it could not be too often, then it would be disturbing.

4. Take pictures

Some of the respondents mentioned that they use their phone for taking pictures of nice places, historical places and other important and nice attractions during the walk. It was also mentioned that the photos were used for sharing with family and friends and for use as a memory for later.

5. *Focus on not using technology.*

One of the main goals for the participants during the pilgrimage walk is to destress and focus on the now, most of the participants also mentioned that they try to not use their mobile phone during the walk, they try to use it as little as possible, some puts it in flight mode, and some use it only in emergencies. One of the respondents also mentioned that he/she could get annoyed if the walk partner used the mobile phone for stating how much time was left to the goal. One also used the pilgrimage walk for decreasing the phone addiction and the need to check the mobile multiple times during the day. The person stated that it was thought provoking to see how much time he/she uses on the mobile phone during a regular day. On the other hand some of the respondents also said that they knew that other pilgrimage travellers used their mobile phone more during the trip than themselves.

6. *Challenges with the use of technology*

One of the participants mentioned some challenges with the use of technology, that there is a threshold for parts of the pilgrimage travellers that aren't that familiar with the use of technology. One person also mentioned that the use of AR might be a bit premature as the user group on museums often are elderly people that don't know that much about technology or families with children where they don't have the capacity to use such technology. The person also said it could be a positive element for the future where the elderly generation would become more used to technology and the possibilities it encounters.

C) About museums:

1. *Learning*

Most of the respondents reported that they would go to museums during the walk. The goal for them exploring museums was to learn

about different topics such as Norwegian history, cultural history, architecture and buildings, learn about different places, and rural history.

There was also interest shown by the respondents in using both audio and AR as part of the experience of learning new knowledge as part of the museum visit.

D) Ideas for development

One respondent mentions that it would be nice to have the app or the AR experience as part of the walk, so that the traveller doesn't need to take a detour to the museum, but can write it down for later that the history was interesting and that a trip to the museum later could be a positive experience.

Another respondent mentioned that it would be positive to integrate the project into the rurAllure application so that the user would not need to have hundreds of applications on their phone. The person mentioned the idea of having a type of filter for what places or history that would be positive to learn more about or experience during the walk and that the traveller gets notified about it during the walk.

One person also mentioned that AR is great to use in places where there is little or no staff during the season and highlighted that it is great that the person can hear the history of that place based on knowledge and facts rather than from a person that has a summer job and maybe doesn't know the history in the place that well.

One of the participants also had an idea for the different companies, cultural life, and stakeholders along the pilgrimage walk could communicate on the same axes.

E) About Norwegian mountain farming

One of the participants also had experience with Norwegian mountain farming and therefore had some insights about feelings and the experience of being part of it. The feelings the respondent connected to Norwegian mountain farming was happiness, dreaming and joy. He/she also mentioned the hard work and the manual labour. The main goal was to produce cheese, milk and dairy products.

3.3.2 Interview with employees at Stiftelsen Lillehammer museum, Maihaugen

Some of the key takeaways from the interview with employees of Stiftelsen Lillehammer museum Maihaugen museum was that they thought that the user group for the main visitors for the Norwegian mountain farming was people in the age group from 50 years and often men that are interested in cultural history, farms, and outdoor life. A tourist group called "kulturisten" They also said that there were not that many visitors due to the Norwegian mountain farm requiring more walking and the location being away from the main street at the museum.

The respondents also thought that there is a balance in using technology as part of the experience of visiting a museum, it is important that it is not a disturbing element, and should support the experience in a positive way. They also mentioned that it should be very available and easy and engaging to use. The participants mentioned that there is an ambivalence between going with the face into the screen and to enrich with real smells and historical buildings.

The technology they are using today at Stiftelsen Lillehammer museum Maihaugen is simple screens, videos, with buttons or with sensors, audio installations and sensors. The respondents also mentioned that they use "digitalt kulturpunkt" together with QR codes. Before the strategy of using "digitalt kulturpunkt" was to attract visitors, but this is a view they are moving more and more away from and the thoughts around what is a visit is changing. A visit might be through playing a video in the personal home for example. The respondents mentioned that the digital statistics of the use of the "digitalt kulturpunkt" is that it is not used a lot at the

museum but more from people's laptops at home. One possible reason for this the participants mentioned was that people might not want to use technology during a museum visit and want more the analogue and realistic feeling of the history.

The respondents also mentioned that they use social media with videos to deep dive into specific parts of the history.

Their thoughts around AR was that it would be nice to use for school classes, and to support the possibility for the visitors to explore the museum on their own because of capacity. The important aspect of using AR, the respondents mentioned, was to tell the story of the people that have lived there, through their eyes and from their perspectives, because it is the people that bring life to the history. The participants also thought that AR can make the experience of the Norwegian mountain farm more available and accessible without the visitors actually walking there, and might also attract the visitors to walk the way up to the mountain farm.

3.4 User definition through personas, scenarios and storyboards

During the process of creating personas, three main characteristics emerged based on the interviews and questionnaire.

1. One user group travels alone (primary persona).
2. One user group travels with their girlfriend, boyfriend or with a friend, friends, colleagues or a colleague (primary persona).
3. One user group travels with their children (secondary persona).

Primary Persona

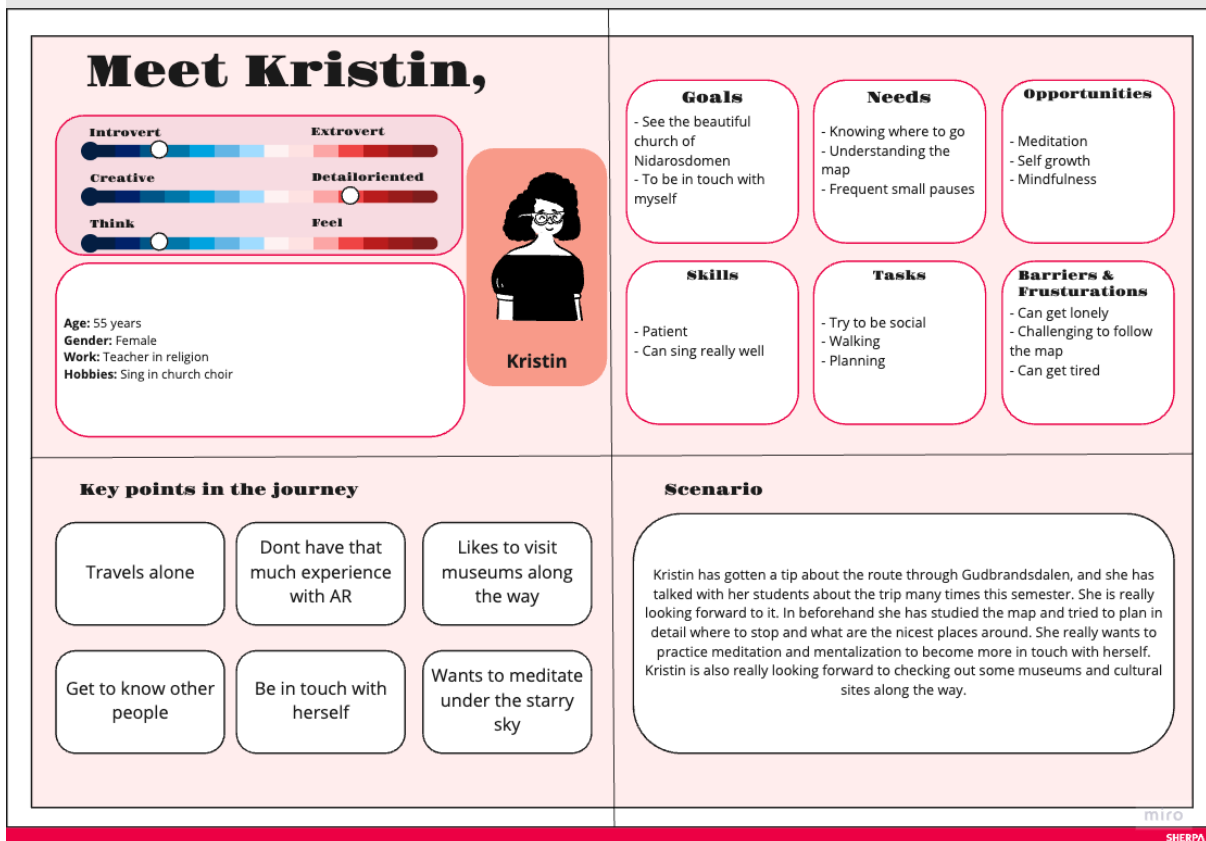


Figure 31. Shows the primary persona Kristin and her scenario.

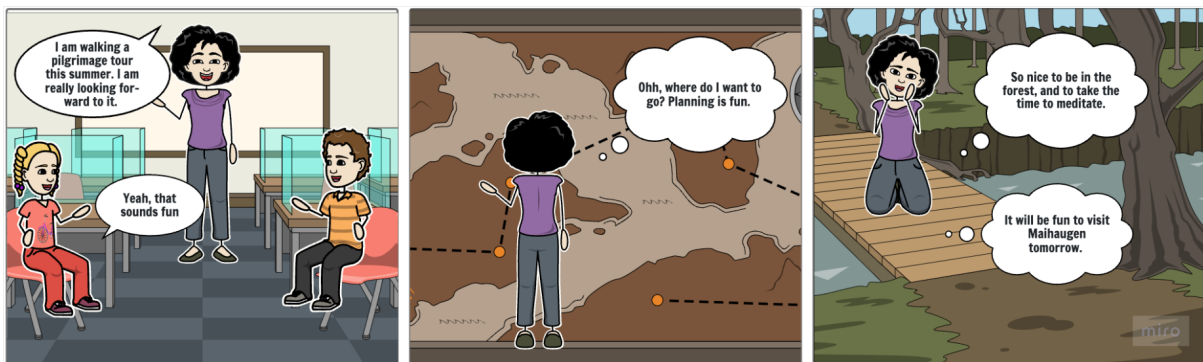


Figure 32. Shows the storyboard for the primary persona Kristin.

Primary Persona

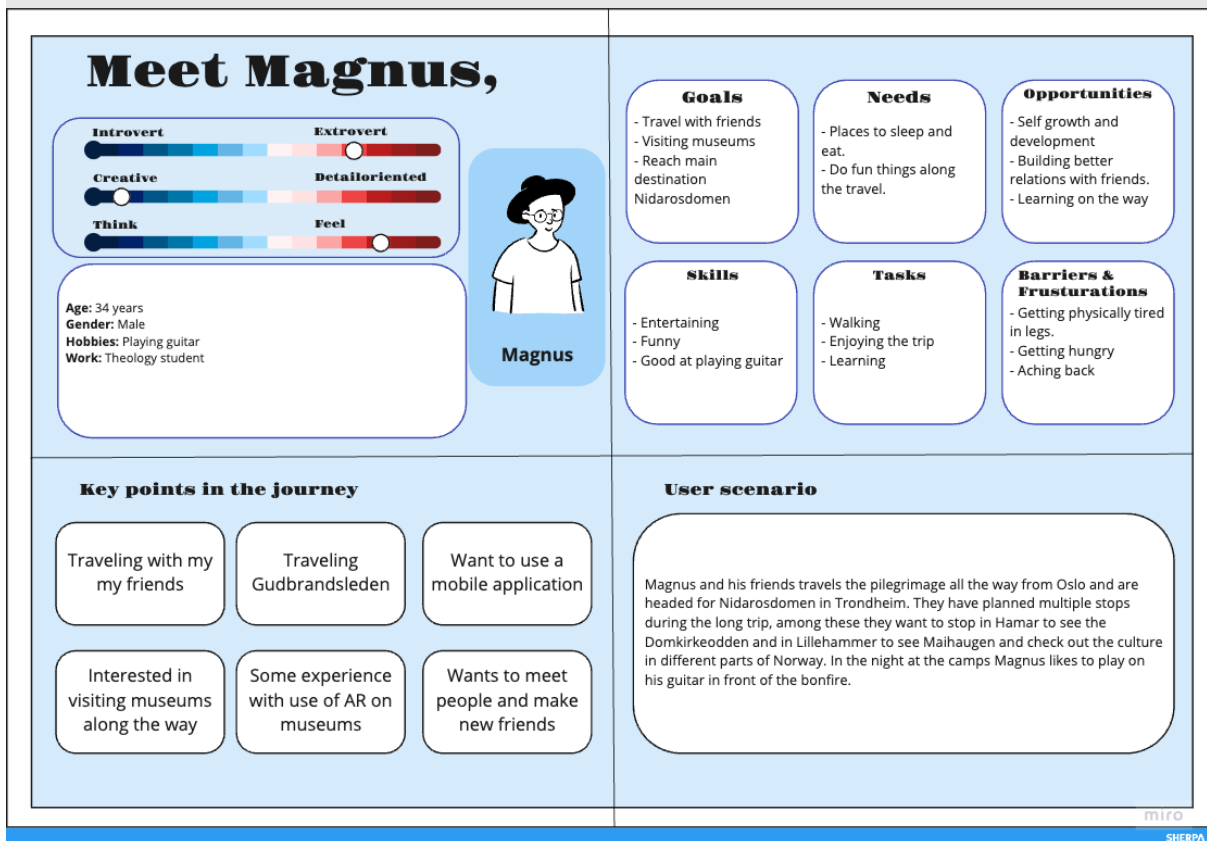


Figure 33. Shows the second primary persona Magnus and his scenario.



Figure 34. Shows the storyboard for the primary persona Magnus.

Secondary Persona

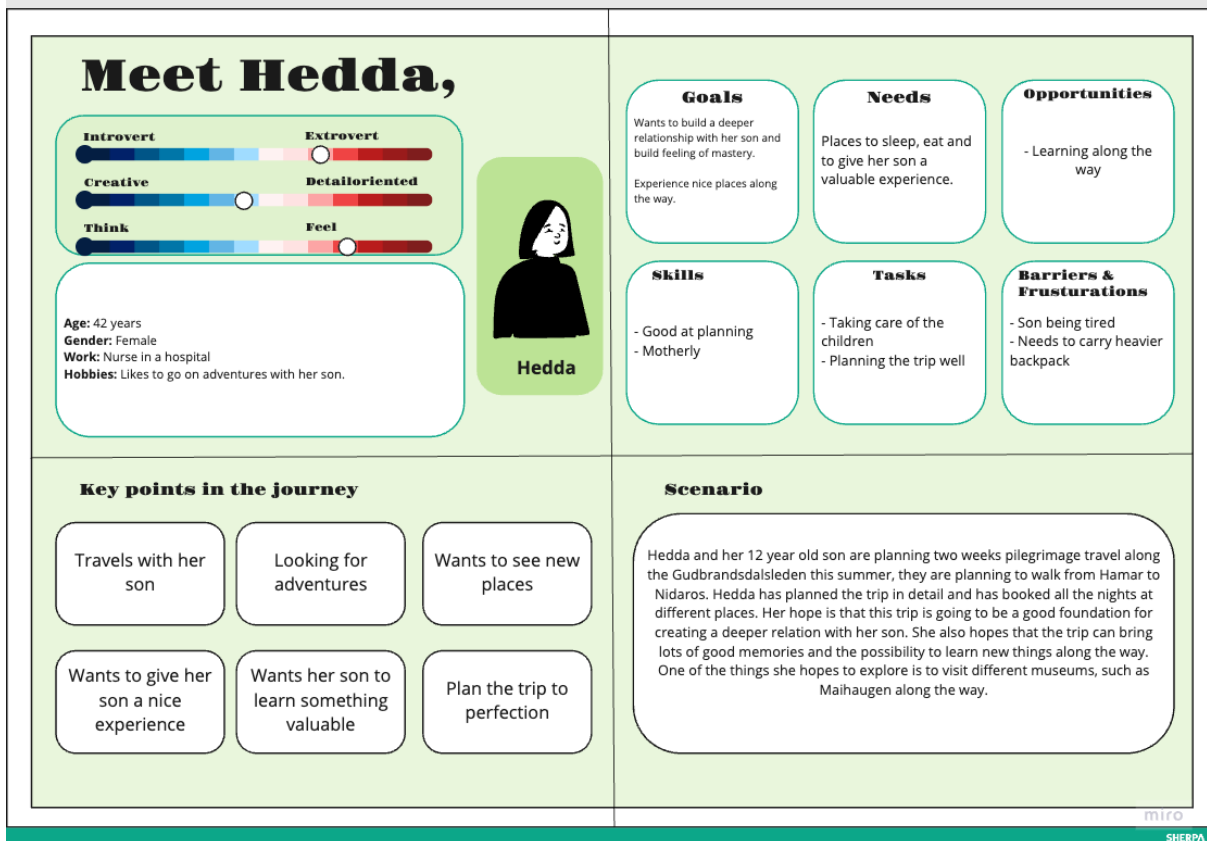


Figure 35. Shows persona and scenario for the secondary persona Hedda.



Figure 36. Shows the storyboard for the secondary persona Hedda and her son.

3.5 Results from prototyping and design

3.5.1 Use of augmented reality and audio

The idea of the prototype was to use a mix of the real world and the virtual world. This is by using the camera function of the phone to display the real place in the

museum, or on the mountain farm in which the pilgrimage walks by. The idea is that the user will get a notification when he or she walks past a historical place for a mountain farm or at the place of the museum using GPS tracking. When the user is at the mountain farm in the real world, then the user can use his or her mobile camera to visually add the virtual figure into the real world.

The prototype also consists of a storytelling voiceover and realistic nature sounds from how it was in the past. The goal is to evoke the emotions in the users, and to put the user into how it was to be on a mountain farm in the past to enhance the learning outcome. Findings from the literature review also supports that when multiple senses are being used it increases the emotional affective levels (Marshall et al., 2016).

3.5.2 Description of functionality

This chapter describes all the different functionality with screenshots of the functionality in the high fidelity prototype.

Text

In addition to the sound, and virtual animated figures the application also has a textual display of the history that the milkmaid is telling. In this way the applications are more accessible for users that have hearing disabilities. This is also based on feedback in the study from Cliffe et al. (2021), where the users were missing a textual description to the sound.

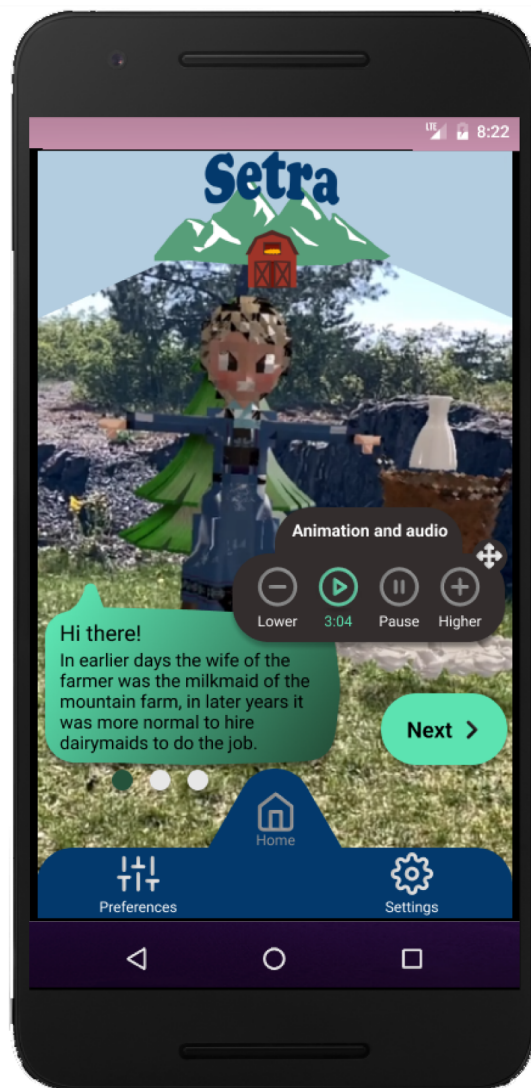


Figure 37. Shows the textual description in the prototype.

Play sound and animation on and off

During the animation and sound, it can be played and paused from the same page as the AR and sound is located in the application. There is also the possibility of turning the sound higher or lower.

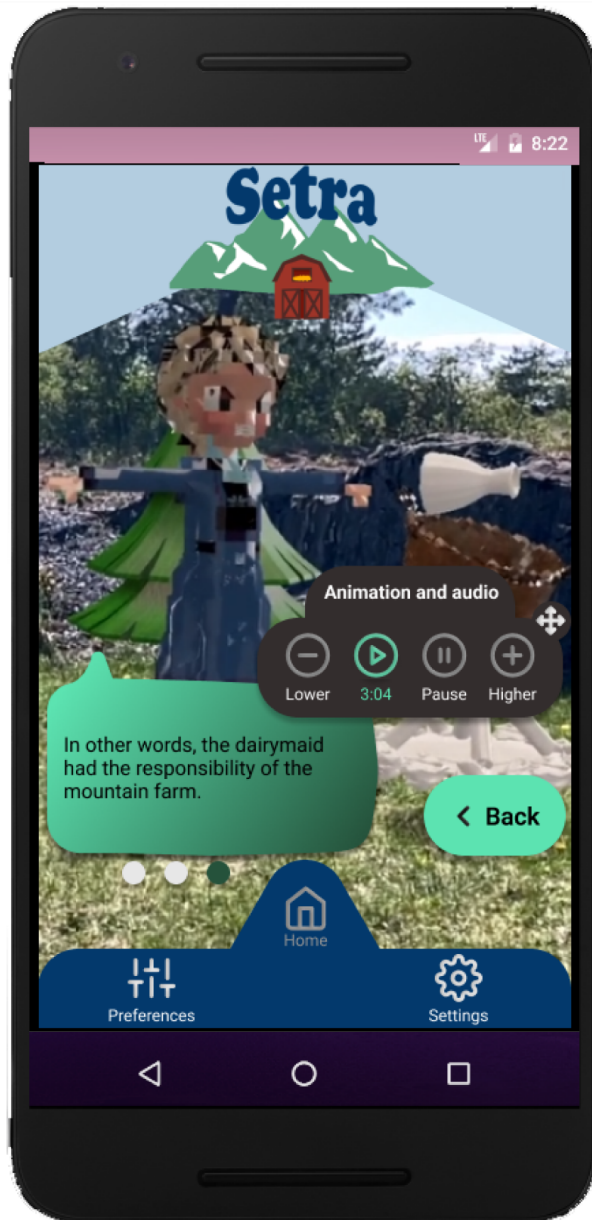


Figure 38. Shows the play and pause buttons in the prototype.

Settings

In the settings page the user can choose different settings to choose from. It has especially been thought of the use in a universal and accessible design point of view, making it possible for the user to choose between different colour deficiency types, if

the users want to change the language or the speed of the animation and sound. There is also the possibility of choosing text size and increasing or decreasing the volume for the users.

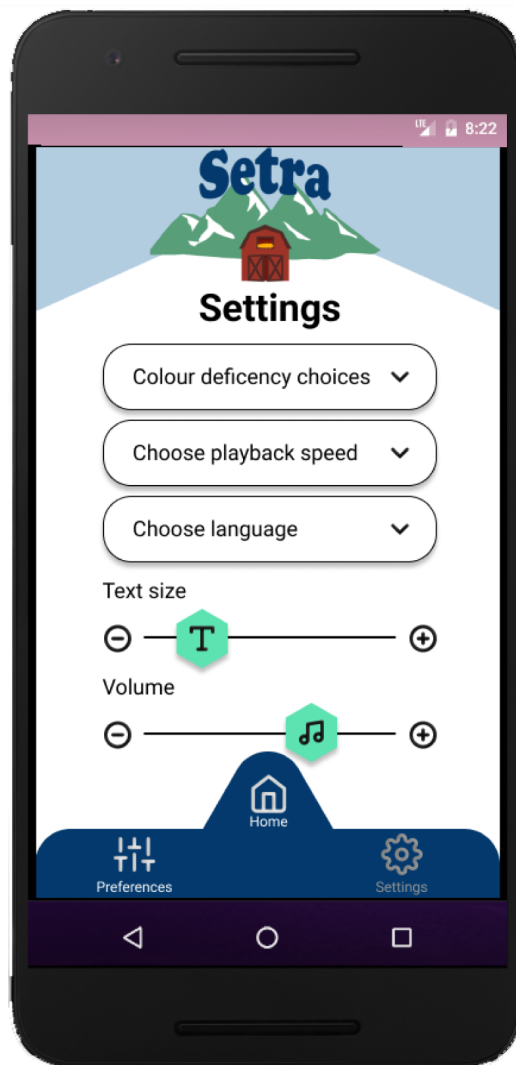


Figure 39. Shows the settings page in the prototype.

Preferences

In the preferences the user can choose dark mode, to have the notifications turned on or off, which story they would like for the animation and sound, and choose which character to tell the story. Personalisation is a topic that was highlighted in the

literature review as an important factor for making it into a customizable experience. Marshall et al. (2016) also indicates that it increases the engagement of the users to have the ability to personalise the experience.

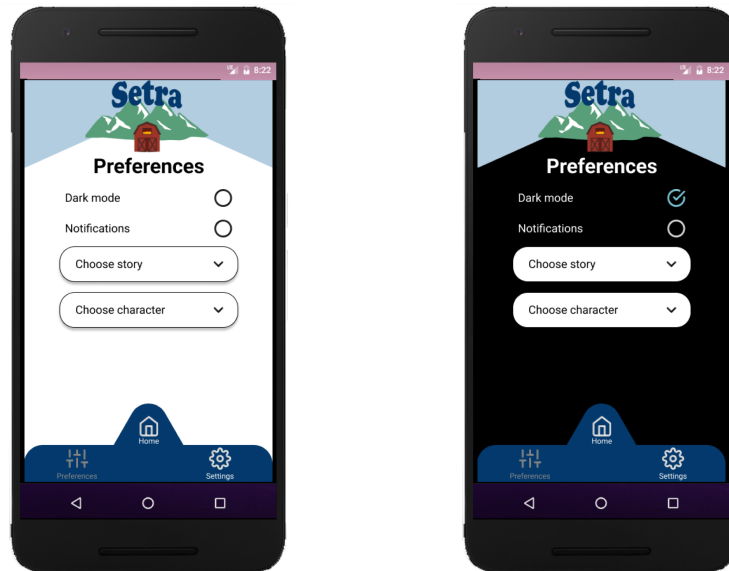


Figure 40. Shows the preferences in the prototype.

3.5.3 Links to prototypes

- [Low fidelity prototype in Figma](#)
- [High fidelity prototype in Figma](#)
- [Link to the augmented reality experience and sound in Adobe Aero](#) (needs to be opened on an Apple iPhone, the project group could not open it on Android devices)
- [Link to video of high fidelity prototype](#)

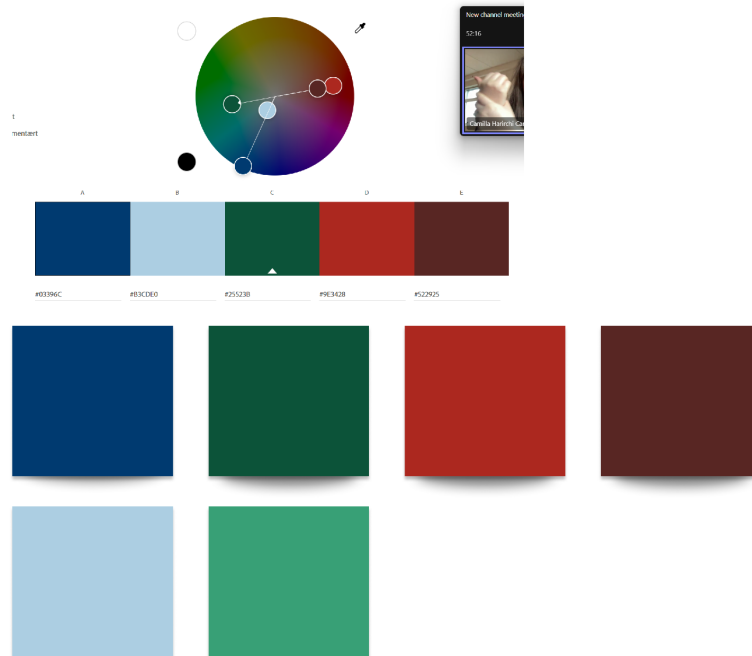
3.5.4 Colour inspiration

The colours are inspired by the traditional Norwegian mountain farms, with the colours red, green and blue. The colours in the project have been sourced through the images in the figure of the collage below. The colours green and blue are

complementary colours to the red shade in the project. This can also be viewed in the figure below.

The mixture of the colours red and green can be a nuisance for users with colour vision deficiency. The American Optometric Association states that the most usual colour vision deficiency is the red versus green colours (n.d.). Red-green colour vision deficiency users can see the colours, although it could be harder for them to see the difference (American Optometric Association, n.d.). This also depends on what shade of red and green the colours are (American Optometric Association, n.d.). Therefore it has been thought of not mixing them in the user interface, and not conveying information with only using colours.

Colours



Collage



Figure 41. Displays the colours and the collage in the project.

As this is in the early stages of prototyping the colours that are used are not WCAG 2.1 compliant. But this is something that would be needed to change if the application were to be developed. According to [utilsynet \(n.d.\)](#) the requirements for applications in the public sector in Norway have to follow the requirements of WCAG 2.1 with the contrast for text on background to be minimum 4.5:1.

The different places where the project group should change the contrast is in the speech bubbles which only gives a contrast of 2.86:1 on the darkest green.

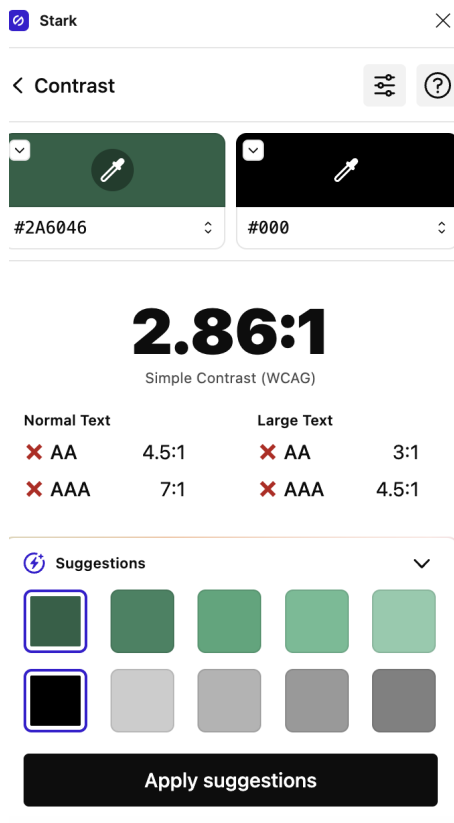


Figure 42. Displays the contrast of the black against the darkest green colour in Stark.

Also when elements are chosen in the navigation menu the disabled functionality doesn't have enough contrast with only 3.83:1 between the grey and the blue background. This can be viewed in the figure below.

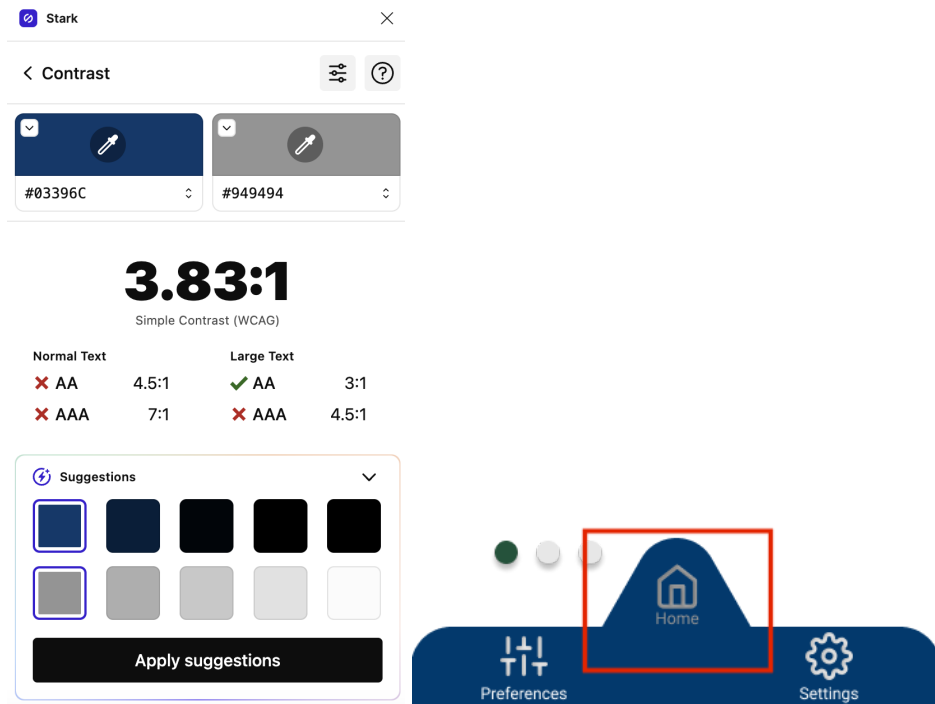


Figure 43. Displays the contrast of the grey against the darkest blue colour in Stark.

The play and pause section also does not meet the requirements. With 3.66:1 regarding the light grey against the black background, and 1.6:1 on the light green tone against the black background.

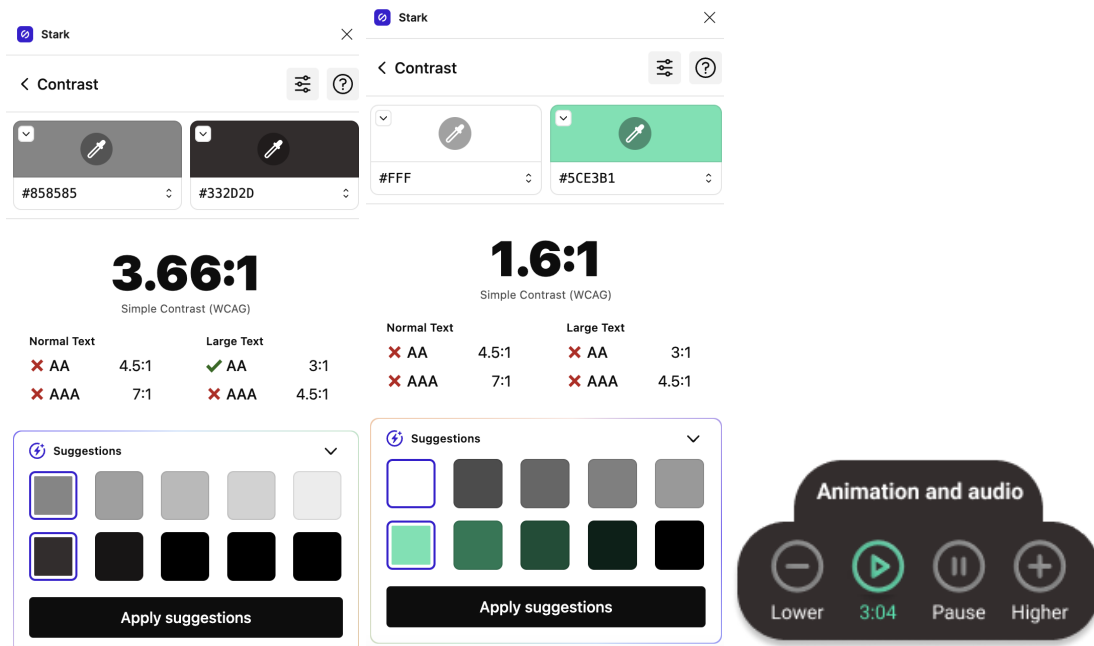


Figure 44. Displays the contrast of the grey and green against the black colour in Stark.

3.5.5 Logo



Figure 45. Showing the first iteration of the logo to the left and the second iteration of the logo to the right.

The logo for the prototype has been made on the background of the colours sourced from the collage. The colours in the second iteration of the logo give good contrast and are easier to see than the logo in the first iteration. The elements of mountain and farm symbolises the mountain farm, with the Norwegian wording for mountain farm “*Setra*” in writing at the top. The colours are mixed with both red and green, this could be a problem regarding colour vision deficiency for some users. Although the colours are of different tones. In the second iteration of the logo to the right in figure 45, the green tones are lighter, while the red shades are darker, which gives an increase in contrast.

3.5.6 Graphic profile

A graphic profile has been made in the project to display the colours chosen, what typography and how the buttons are to be laid out. Graphic profiles are a way of visualising the identity and personality of an organisation or business (Bly, n.d.). The graphic profile of the Setra augmented reality application prototype has not been made to be a fully fledged graphic profile as this is not a graphic design course or topic, but made to showcase how it could look. The figure can be viewed below.

Typography

Profile font - Cooper Black
System font - Open Sans

Open Sans

Setra

Setra

Setra

ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅ
abcdefghijklmnopqrstuvwxyzæøå
1 2 3 4 5 6 7 8 9 0

Cooper Black

Setra

A B C D E F G H I J K L M N O P Q R S T U
V W X Y Z Æ Ø Å
a b c d e f g h i j k l m n o p q r s t u
v w x y z æ ø å 1 2 3 4 5 6 7 8 9 0

Colour palette

The colour palette are made to inspire and give a feeling of the mountain farms colours.



RGB:
3 57 108



RGB:
37 82 59



RGB:
82 41 37



RGB:
179 205 224



RGB:
87 158 121



RGB:
158 52 40

Logo

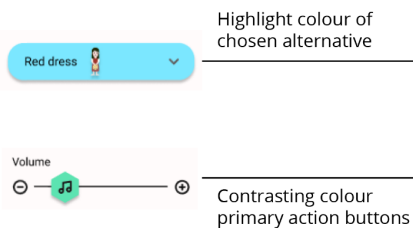
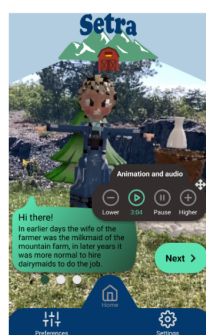


Figure 46. Graphic profile of the Setra AR application prototype.

3.5.7 Low fidelity prototype

For the colours in the low fidelity prototypes buttons and other elements, the project group made a collage to find colours matching the mountain farming topic. The greens and the reds were extracted using the colour picker tool in Adobe Photoshop from these images. The lighter shades were picked using Adobes colour wheel, to find matching and complimentary colours which fitted well together. The primary action button colour was chosen to be the lighter green tone, as it is visually easy to see. This can also be viewed in the figures both above and below.



Figure 47. Displaying illustrations of low fidelity prototype screenshots.

The audio and animation playback elements were based on the research found in the literature and studies mentioned in chapter [3.2 Research results](#).

The three-dimensional character of the dairymaid was inspired by the Voice of Norway application (Voice of Norway, n.d.). The three-dimensional elements are also used in multiple of the other products or studies looked at in the research phase of the project, for example Pokemon Go, Harry Potter: Wizards Unite, the Hidden app and the Omaha Beach on D-Day augmented reality experience. Especially the Hidden application and the Omaha Beach on D-Day augmented reality experience

uses three-dimensional characters and elements to their advantages to tell the story at hand.

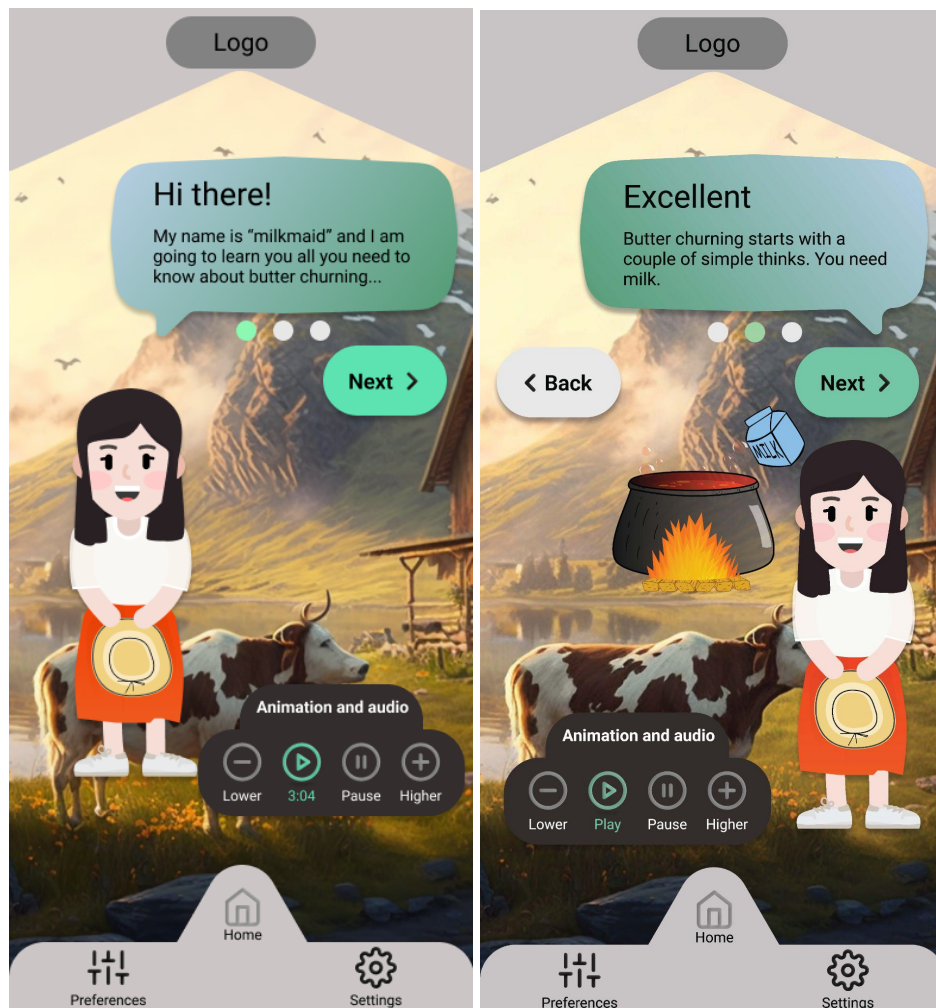


Figure 48. Showing the home page with the storymode of the low fidelity prototype.

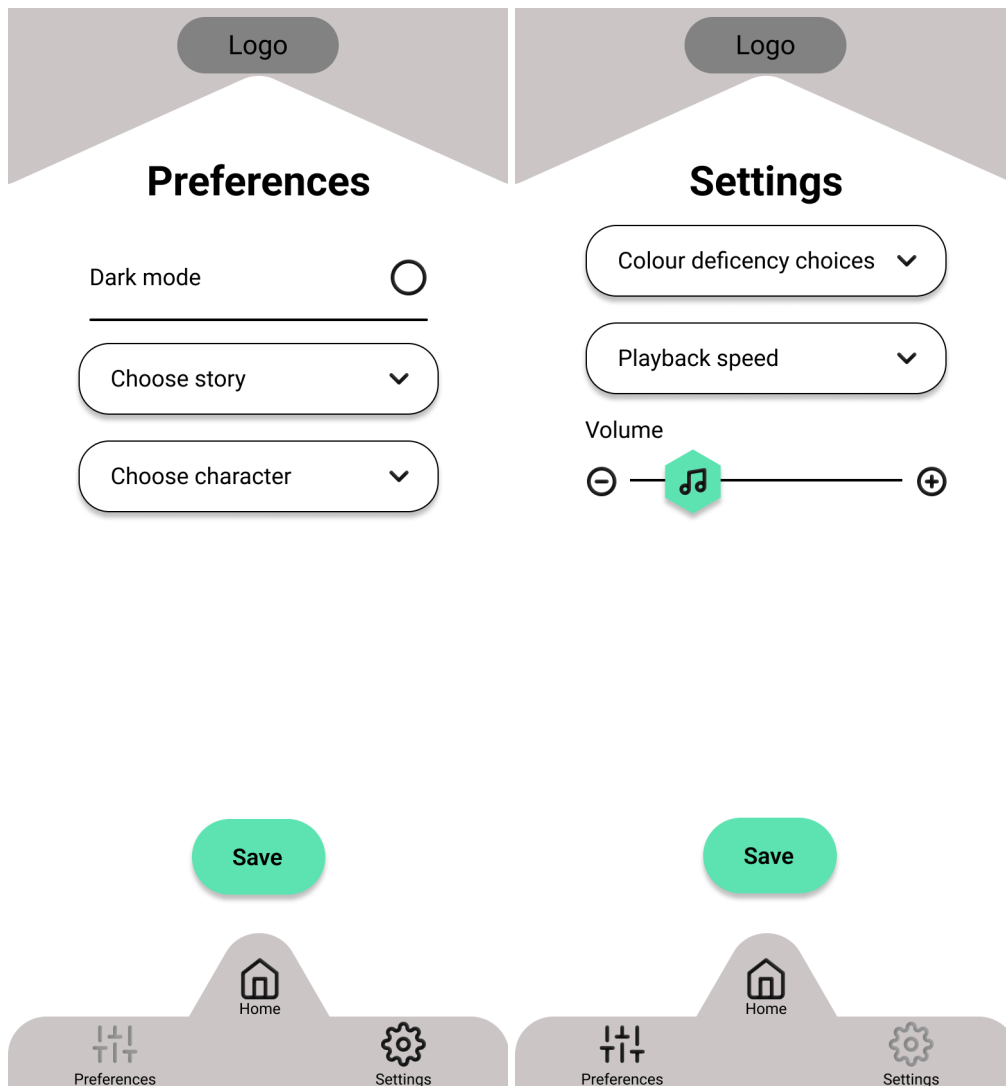


Figure 49. Displaying the preferences and the settings page of the low fidelity prototype.

3.5.8 High fidelity prototype

From the literature research, feedback found from the interviews and also feedback gained in the focus group multiple elements has been taken into consideration and implemented in the high fidelity prototype. Especially important was to integrate emotional design, to gain an emotional response in the users when using the prototype. This to enhance the effect of learning the story about the mountain farms. Read more about emotional design in chapter [3.2.1 Literature review - use of audio in narratives](#).

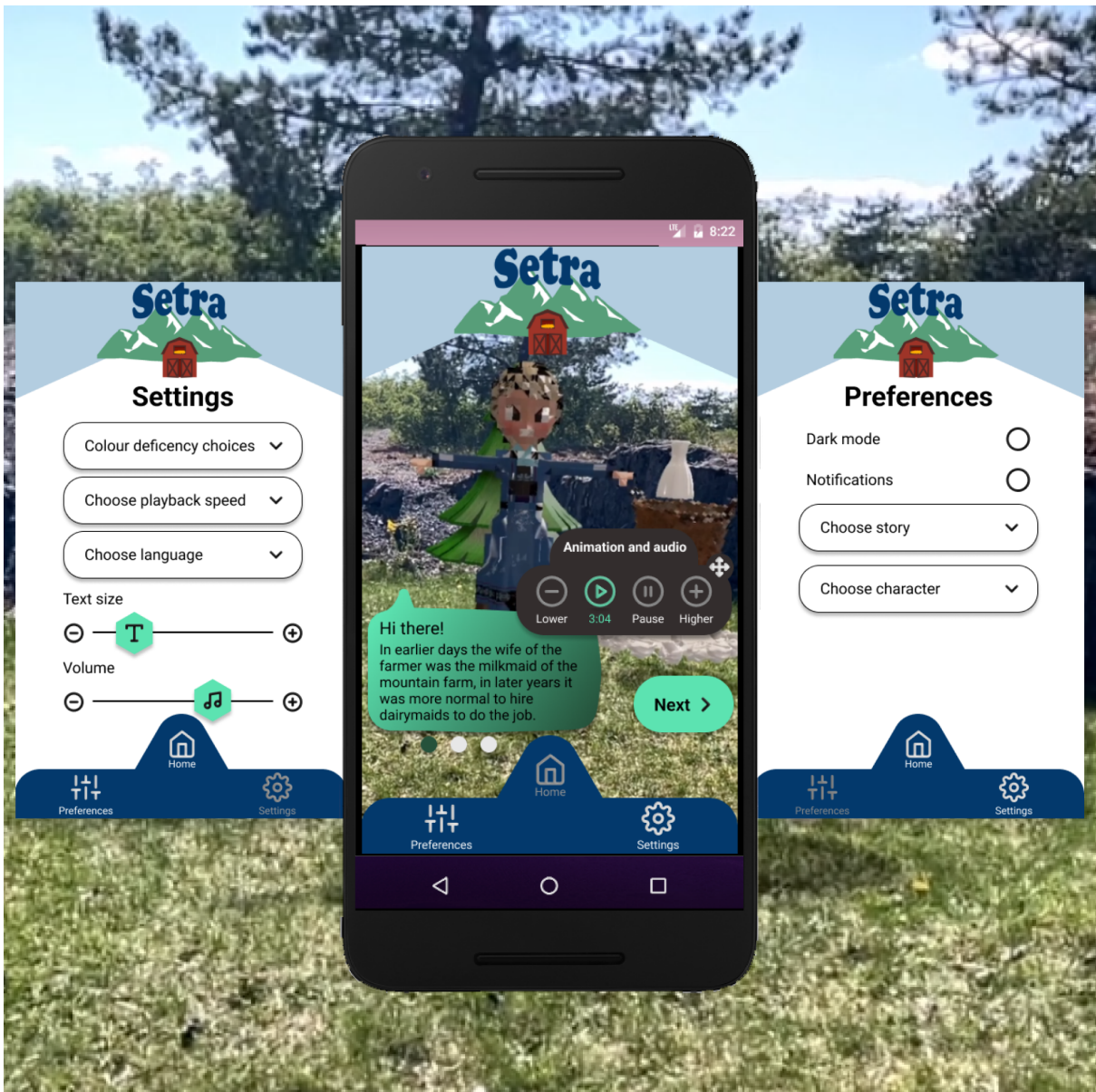


Figure 50. Displaying illustrations of high fidelity prototype screenshots.

The aspects from the literature, such as the use of sound by using the human voice as storyteller, and nature sounds, such as the cow moan, and the milk being poured were added as audio to the prototype. Further the prototype uses metaphors, such as the milkmaid, a pot, the milk and the audio sounds to bring the user into the situation.

The feedback from the focus group regarding the universal design and the accessibility aspects were taken into account. Especially the possibility of changing the size of the text in the prototype were of focus for the project group. There was

also other feedback gained by the discussion with the focus group about the low fidelity prototype's possibility to choose language and to visualise that the audio and playback section could be moveable.

The figures of the milkmaid and the accompanying campfire, milk bottle and cauldron also got a makeover as the feedback from the focus group mentioned this being too cartoonish in the low fidelity prototype.

From the interviews the project group got feedback about the notifications, and wanted it to be implemented with the possibility of turning it off or on. The users also wanted a possibility of filtering what kind of story they wanted to hear in the integration with the rurAllure application. This is research that needs to be done for the future, to find out what other historical aspects that would be beneficial and wanted from the user's perspective. In the prototype we have added the possibility to choose different kinds of perspectives for the mountain farming, but the idea could be extended in different ways by adding different historical eras in Norwegian history, or adding local folklore in the different regions that the pilgrimage walks by. The participants also wanted notifications during the trip about places they passed by during the pilgrimage walk. This is also something that would need to be created and tested with the rurAllure application in the future.

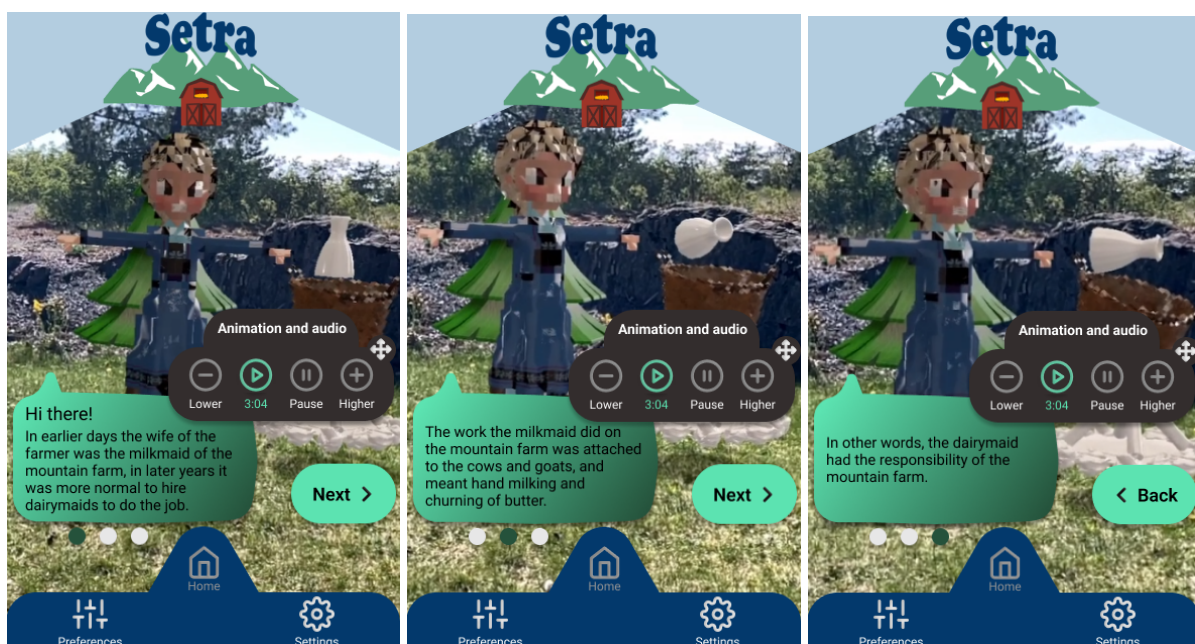


Figure 51. Displaying the home page with the storymode of the high fidelity prototype.

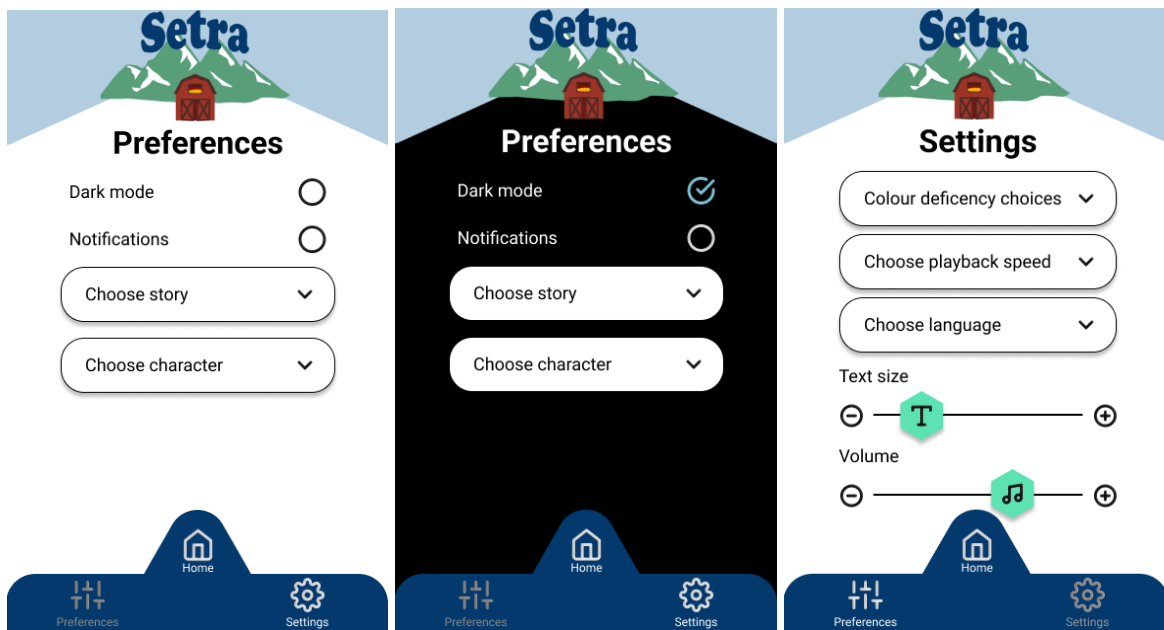


Figure 52. Showing the preferences and the settings page of the high fidelity prototype.

3.6 Results - User feedback on prototypes

3.6.1 Focus group - Low fidelity prototype

In the first of the questions discussed in the focus group, regarding what feelings and thoughts they gained from the low fidelity prototype there were a couple of responses that recurred; especially the feedback regarding the feelings about the prototype. All of the five testers agreed that the design gave them a romantic, old fashioned, cosy, rural and giving a generally good feeling. One of the testers mentioned that the design was like “a recipe” in what is typical Norwegian, especially the background.

During the discussions regarding the second topic which was about what the testers liked in the low fidelity prototype the project group gained feedback about the participants being curious of the story and wanted to know more about it. There was also feedback regarding the navigation; a couple of the testers agreed on the navigation being easy to use and to understand. One of the testers also liked the colours in the speech bubbles.

In the third question which was about what the participants in the focus group disliked about the low fidelity prototype there was feedback regarding the milk and the cauldron over the fire being too cartoonish and not fitting in with the look and feel of the prototype. There was also feedback regarding the milkmaid in the application, one of the participants wanted the dairymaid to be more old fashioned.

When the fourth question regarding how the focus group expected the prototype to work came up, the focus group discussed the fact that they were curious and expected to learn about what the prototype wanted to tell. Two of the participants also wanted a map of where to find AR stories in the museum. The same two participants wanted a map to see where they were in relation to the pilgrim route.

The fifth question discussed by the focus group regarded how they experienced the information, there was a consensus by the participants about the prototype being interesting, that the prototype held a good amount of information and that it also was short and concise. The focus group also came with universal design feedback such as the possibility to change the size of the text, to change how light the screen is and that the user could change language.

When it came to the sixth question discussed in the focus group, which regarded the goals they had for the use of the prototype, the feedback was quite similar; it was interesting to understand- and to learn more about mountain farming, a topic none of the participants had much experience with.

In the seventh question regarding pros and cons seen by the focus group about the prototype there was an agreement surrounding the layout of the prototype, it was too big to fit the screens of the participants mobile phones. One of the participants talked about notifications, and not wanting too much of these. Three of the participants agreed on the prototype being user friendly and easy to understand, and that it was positive that the project focused on the universal design aspect of the prototype. One participant mentioned that the audio and playback section could be moveable.

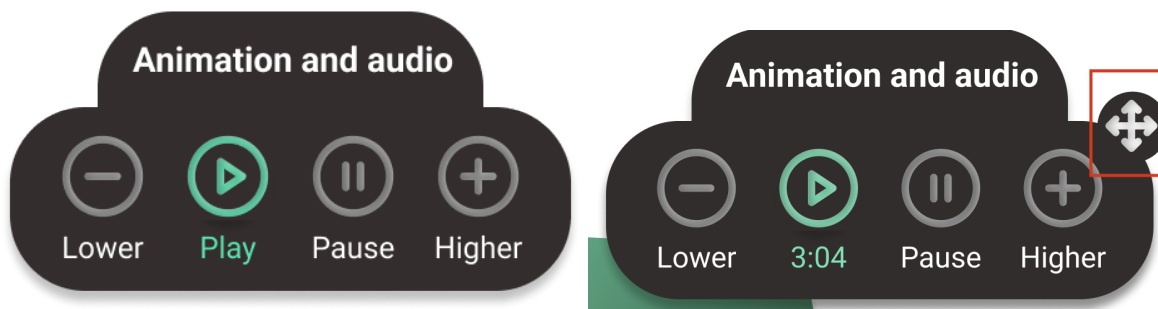


Figure 53. Illustrations with the changes in the playback element that were implemented based on the feedback.

The last question which regarded how the focus groups participants wanted to use the prototype, it was discussed that it could be used in education, at schools and in museums. Multiple participants were also mentioning that the prototype fitted the usage by kids. Two of the participants in the focus group mentioned that the prototype could be featured in a standalone screen at a museum. There was also feedback from one participant regarding the prototype being used on the go.

3.6.2 User testing - High fidelity prototype

The feedback regarding the tasks in the user testing was, according to the participants, easy to perform, and through observations none of the five participants had any major issues performing the tasks given by the project group.

Although it was not observed any major challenges with using the high fidelity prototype, one of the testers struggled a bit with finding the play button on the home page. This is something that has to be looked further at by the project group and might be due to too little contrast. Another participant mentions that there should be a back button on the second part of the written history speech bubbles. The same user tester also wants the text size and audio volume settings to be slideable. This was also something that was supposed to happen, but the project group could not find a way to prototype in Figma.

Some of the testers also commented on the animation and quality of the three-dimensional characters and elements to be lagging and of poor quality. This is of course something that the project group knows of, and are due to issues with the

software Adobe Aero. The 3D models are not of this low quality when displayed in Autodesk Maya. Also since this is not the final prototype, the effort in creating a perfect 3D figure in this stage of the design was not what we aimed to test or focus on. Instead we wanted to test more of the concept and if the user flow in the product made sense for the user. The three-dimensional character as it should have looked can be viewed in the figure below.



Figure 54. The three-dimensional character of the milkmaid (Rigmodels, 2022).

3.6.2.1 Retrospective probing

One key finding from the feedback gained in the retrospective probing, was that the participants thought that the prototype could be valuable for teaching school children and for use at museums.

One of the participants wondered why there was a preferences button, and thought that it could be under settings to save space in the interface of the prototype. This is something that has to be studied further by the project group. The same tester wanted to know more about other stuff on the travels, where to go and what to do for example. This is something that rurAllure can take into account in their studies to create an application as a “package deal”, where everything the pilgrimage needs is gathered in one place.

When looking at the first question regarding how the participants experienced the usage of the prototype there was mostly feedback on the user friendly nature of the prototype. Multiple user testers mentioned that the prototype was easy to use, easy to understand and easy to see where to navigate. There was also feedback regarding the informativeness of the prototype, and that the story was easy to understand.

In the second question, regarding what the participants found challenging or difficult in the prototype, there was feedback from one of the user testers regarding the play button and that it was difficult to see. The participant mentioned that the play button also could have a textual description below the icon such as “play”, and maybe the information about where the users are in the timeline of the animation could be placed above the button.

The third question in the retrospective probing was about how the participants would use an application like this. The project got a lot of different feedback regarding locations for where the application could be used, such as on mountain farms, at schools for children, in kindergartens, at museums, places where historical events have happened or at vacation in for example London.

As for the fourth question, which regarded what the participants thought about the usage of augmented reality the feedback was positive. The user testers found augmented reality used like this to be both fun, instructive and exciting at the same time. Some of the participants commented on the augmented reality storytelling experience being easy to understand when listening to the story and watching the animation at the same time. One participant also called the AR experience attractive. On the other hand there was one participant that felt like the experience of the poor three-dimensional elements and animations gave a lesser feeling of how it could be. The same participant commented that augmented reality should give a better feeling on how it was.

In the fifth and final question regarding the usage of both audio and text in the prototype the project group got feedback from the user testers about the implications for those who have forgotten their glasses and are still able to follow the story with audio. The participants also commented on it being positive that users with poor hearing also could follow the story reading the text. One participant also mentioned that it was positive that the users could read if there is too much noise and disturbances, and that there is a possibility of listening when the user wants. One of the participants mentioned that the sounds from the cows could be somewhat disturbing, this is something that the project group has to look at further. The same tester commented on the possibility of having the opportunity to choose spoken language to learn a new language. This is also an interesting angle for the project group.

4.0 Discussion

The discussion part of the project has been divided into four main areas to make it more clear what is being discussed in each part. The areas that are being discussed are the methods, the user group, the relevance and what should be done in the future regarding work.

4.1 Methods

As part of the discussion a critical look into the methods are of importance. Both the interviews and the focus group did not have that many participants. And the findings

might have been different with more participants. For instance; Nielsen states that a focus group should have between six and nine participants (Nielsen, 1993, p. 214). On the other hand both Baxter et al. (Baxter et al., 2015, p. 340) and Krug (Krug, 2014, p. 113) states that the number of focus group participants should be between five and ten. The project had five focus group testers, and are therefore inside the wanted number of participants. On the other side it could also be positive to have done several focus groups at different times to also compare the results from each focus group.

Another aspect is the similarity of those taken part in the study, the project might have gained different results if the users were more spread both in characteristics such as personality and place of living. Even though there was a spread in the age of the participants who gave feedback in the project, we could have been more thorough by using a more randomised sampling technique for choosing participants. This would also have contributed to better validity and reliability of the study. However, according to Jakob Nielsen there are always issues of reliability and validity when it comes to testing (Nielsen, 1993, p. 165).

There are also some respondent biases to take into account when interpreting the results. There are some steps that could have lifted the validity and reliability of the study. The group could also have done a deeper analysis of the distributed survey, exploring numerical correlation between age for instance and the feelings about the use of AR. Also a distribution model of the respondents could have been used to see if there was a normal distribution of the answers from the participants. The advantage of checking if there is a normal distribution is to see where most of the population lies within which portion of the curve (Leedy & Ormrod, 2021, p. 347). And to see the percentage of participants that stand out.

But as the goal of this project was to explore the use of AR technology and the narratives of mountain farming, a more qualitative and explorative direction of methods has been used and emphasised.

Furthermore, since the study is mainly based on qualitative feedback which does not predict the behaviour of the users in the future, our findings might not give any clear

results which can be used for predicting the needs of this application of the users in the future. This could have been different if also quantitative feedback were looked at.

It is also possible that a different design method or design process would have given a different result, both with the use of different underlying methods for understanding the users and in total. There are multiple design methods or design processes who are quite alike. The double diamond design process can look like the design thinking method, although the design thinking method could have given a different result. The project group could also have used different methods such as A/B testing, card sorting, or statistical analysis, which might have given a different result.

4.2 User group

Another aspect to discuss is how the prototype and the concept meets the user groups needs and wishes. Many of the users from the interview said they don't want to use technology or to use technology as little as possible during their pilgrimage walk. One of the participants also mentioned that the concept of AR and an application for museums are a bit premature. That the idea and concept might be more realistic in the future years, with a new generation “elderly” that are more used to technology. It might be that the interest in using technology along a pilgrimage walk would increase in interest in the future. Although multiple of the participants in the interviews were interested in visiting museums, cultural- and historical sites.

Further we don't know much about other user groups' motivation or need for this type of technology. As many of the participants mentioned, the concept and idea might meet a younger user group as kids and families. It might be used more as a fun and gamified way of learning Norwegian history in primary schools for instance.

Therefore the exploration to widen the user group is something that would need to be explored, before a final version or analysis of this kind of application would bring more useful value. The value of the prototype might also have a great transfer value for the mentioned possible user group, and could be a positive basis for the rurAllure project to extend the user group also for their future application.

Another aspect is that insight from the interviews and the questionnaire, shows that the focus on being social and talking with other travellers are of importance during a pilgrimage walk. Therefore the use of mobile and AR technology might go two ways, it might lead to less social interactions or it can lead to more social interactions with the need for showing and talking about what is seen on the screen. Ways of improving this aspect through the technology might be to give tasks, discussions or similar in the application to engage the users to discuss and solve the tasks together.

Also technology might feel interrupting for the user group that we have explored in this project, as mentioned in the results from the interviews, the overall goal for the pilgrimage walkers is to find themselves, destress and be in the now. This goal is in many cases thought of as the opposite of using a mobile application. Results from the interview with a museum shows that also the goal for visitors for the museum often are to be in the now, and experience what the museum has to offer. This is a challenging aspect of the need and use of this application. To explore different ways, places and user groups is therefore of importance to meet the users' needs for this application.

4.3 Relevance

The idea of the application can be implemented by cooperation actors in the rurAllure project, such as Stiftelsen Lillehammer museum Maihaugen, Domkirkeodden, and the Norsk Folkemuseum in Oslo. It can also be implemented as part of the rurAllure app, to make it available for all travellers.

It can also be used both under visits at museums and before, during and after the pilgrimage walks. It can be used in the exploration phase when the user is exploring which trips to go for and what to experience during the walk. It can be used during the walk when the person walks past different historical places and mountain farms during the walk. The application can be used on the specific museums to give the visitors more in depth knowledge about the historical places in the museum.

Other museums have also used different applications for a similar purpose, of telling a story to the users during the museum visits, such as the Voice of Norway and

KuGo applications. Which both have served these museums with a valuable user experience for their users. Also foreign museums, cultural- and historical places such as the augmented reality experience of the attack on Omaha Beach on D-Day and the Garden of the Calouste Gulbenkian Foundation in Lisbon have been valuable for the users. This shows that there is a valuable experience for the users of augmented reality in cultural- and historical settings.

As one of the participants also mentioned, the prototype application can also be used by other user groups such as people in nursing homes, that because of health can't walk or visit museums. In this case it contributes to making the experience more accessible for people with different challenges. This was also an aspect which was emphasised during the interview with employees at Stiftelsen Lillehammer museum Maihaugen, that the experience of visiting a museum is changing, and that visiting the museum from one's own home is part of this new way of thinking. This could be a great way of building the experience for a bigger audience, such as blind users, people with hearing disabilities, children in hospital or elderly people in care centres.

4.4 Future Work

For future work for the project, a possibility of implementing the prototype into the rurAllure application would be beneficial. This is also a functionality that was mentioned from the participants during the interviews. In this way the pilgrimage users would not need to use other applications than the rurAllure application. In this way the historical AR and historical experience could be tied to the wayfinding in the rurAllure application and it would serve as a whole package, where the user would find everything they need in the rurAllure application “in one place”. It could have been a part of the settings functionality where the user could switch on and off the historical notifications and choose what kind of history they would want as part of the settings for the integration of the application. In this way the user could also personalise what perspective they would want the story to be told from, for instance it could be only music, through a character such as the milkmaid, through poems, or through a more historical perspective.

In the high fidelity prototype the users have the opportunity to choose preferences and by this become engaged and activated through personalisation. The engagement and activation by personalisation is supported by studies done by Nam (2014). This could be further developed by having more personalisation such as the tone of the voice of the storyteller, types of games, quizzes and fonts.

Also as seen in the literature review, the idea of exploring gamification in the application, might be beneficial, especially if the application could be used with school children in the future. Gamification can be used to engage the users more and to create a basis for a bigger learning outcome for the users. Because of the nature of this study and its limitations, this has not yet been explored. Other applications that utilise the use of gamification in augmented reality are Pokemon Go, Snapchat, Harry Potter: Wizards Unite, KuGo and the Norwegian pole hunting (Stolpejakten). The pole hunting is based on the idea of finding poles located in the centrally of the different municipalities, where the goal is to activate people in different age groups (Stolpejakten, n.d.). It would be beneficial to do a thorough study of how this is done and the value it brings to their users.

Also the idea in this project could be extended to also meet other historical information and experience, for instance for known farms, places, and statues along the pilgrimage walk. In this way the historical aspect would be covered more in depth in all areas. It could for instance also give information about the different museums, cafés, restaurants, cultural places, and other sites that would be beneficial for the user to experience.

It was also mentioned during the focus group that changing the lightness of the screen directly in the application was wanted. This is functionality that exists in most mobile phones today and are therefore not integrated as part of the prototype, but could be work for the future to make the application more accessible for all users. The dark mode alternative in the prototype is also a part of this. Dark mode reduces the fatigue associated with seeing (Bruder et al., 2019). Bruder et al. also shows in their studies that dark mode display devices increased the visual acuity (Bruder et al., 2019). The same studies show that the participants favoured the dark mode (Bruder et al., 2019).

For the future the project group can also experiment more with different colour choices, to especially meet the WCAG 2.1 AA standards. One of the participants during the user testing had challenges finding the play button, this might be due to lack of contrast. This is also shown by the testing in the Stark WCAG 2.1 plugin. The project group should also look further into the colour vision deficiency issue, especially in the use of red and green in the logo. It is important to create more realistic AR figures and animations and test this with a younger user group.

The three-dimensional elements and characters were originally of a better quality than what is viewed in the high fidelity prototype. This is due to issues connected to the Adobe Aero program and the low quality it renders to the augmented reality “world”. This is also something that some of the user testers have commented on and agreed on. This is something that has to be looked at before the next iteration of the prototype. It might be a program that is better suited for rendering good quality augmented reality than Adobe Aero.

At last the user group also would want to do more design iterations, using eye tracking to gather quantitative data. Eye tracking could be a great way of understanding what the users looked at and how long they looked at it during the augmented reality experience, and to understand what the project group must focus on further in the prototyping iteration. The user group also would want to do more user testing, with more users. This could for instance be done at the Stiftelsen Lillehammer museum Maihaugen and other historical museums which exhibit mountain farms as part of their exhibitions.

5.0 Conclusion

In this project the information from research, questionnaire, interviews, focus groups and user testing has been wired together to create a prototype that extends the rurAllure project and the goal of attracting pilgrimage travellers to museums during the pilgrimage walk.

Our main goal was to answer our research question: *How to tell the story of Norwegian mountain farming through a milkmaids perspective, focusing on a user centred design approach, exploring augmented reality and audio as technology?*

In exploring the users needs the main goal of the user group seemed clear, it was to be in the now and destress. They wanting to use the mobile phone as little as possible during the pilgrimage walk served as a dilemma for the project. Still when asked about using an application during the museum visits most of the users were positive to the idea.

To answer the research question the group has explored different ways of using augmented reality, both as sound effects and by using animation in Adobe Aero. These technologies have further been implemented into a functional high fidelity prototype focusing on the users needs, created in Figma.

During the focus groups and user tests the feedback from the participants were mostly positive. Which serves as a positive ground for exploring the app for a wider user group and the exploration of integrating the user experience into the rurAllure application in the future.

To sum it all up, the results from this project have given us a lot of interesting findings, but some questions and work are still left unanswered and should be looked at further. It can furthermore be concluded that our study surrounding augmented reality both in audio and in three-dimensional graphical elements and storytelling in culture and historical places should be explored further.

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7.0 Attachments

7.1 Report from questionnaire on user group.

7.2 Interview guide

7.3 Transcribed and tagged interviews with pilgrimage travellers

7.4 Affinity diagram

Link to Miro board:

https://miro.com/app/board/uXjVPoLI1-E=?share_link_id=497120643932

7.5 Notes from interview with Stiftelsen Lillehammer Museum, Maihaugen

7.6 Focus group topics and feedback

7.7 Setup and feedback from user testing

7.8 Roadmap

7.9 Consent form

7.10 Folder of illustrations and images from the project



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