

Master's thesis

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# Prototyping an Interactive Social Platform for Elderly Using Smartphones

Master's thesis in Master in Interaction Design

Supervisor: Anders-Petter Andersson

June 2020

NTNU  
Norwegian University of Science and Technology  
Faculty of Architecture and Design  
Department of Design



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## Abstract

There are a great number of elderlies using home-based services according to data from SSB. The data display a clear shift in the industry - moving elderly home and providing the necessary nursing, services and help at home. There exist several tools to monitor and secure physical health for elderly at home. However, social health is also important. We need to combat issues such as social isolation and depressiveness.

This paper aims to create an interactive prototype that enables elderly to socialize on an online platform with their smartphones. To create a specialized online platform, interviews are performed as a method to gather preferences and data to begin an iterative, user-based design process. Finalizing with a digitally interactive prototype.

This is where the development of new assistive technology to help elderly be independent plays an important role. A concerning proportion of elderly are lonely and lack social contact. This is likely to lead to a growing need for assistive technologies. In this project, an interface is designed where elderly and their relatives and contacts can interact and plan social activities.

The study will investigate the social circumstances of elderly and their application of technology in their daily life by interviewing participants in a Senior center. Resulting in designing a digital prototype specialized for elderly people.

## Sammendrag

Mange eldre har tilgang til hjemmebaserte tjenester i vårt samfunn i dag. Dette er et ledd i en offentlig styrt strategi om at eldre skal få tilrettelagte ytelser, pleie og rehabiliteringstjenester i eget hjem. Det eksisterer flere verktøy for å overvåke og sikre ulike helseytelser for eldre som bor hjemme. Mellommenneskelig kontakt og relasjoner er også viktig for å bekjempe problemer som isolasjon og depresjon. Her vil utviklingen av ny teknologi kunne hjelpe mange eldre. Med tanke på et stadig økende antall eldre i samfunnet, og et tilsvarende behov for hjelpemidler som gi selvstendighet i hverdagen og bedre funksjonsevne, vil det være viktig at man *også* ser på tiltak og hjelpemidler som kan gi bedre livskvalitet.

Målsettingen i denne masteroppgaven er å lage en prototype som vil være anvendelig for eldre som ønsker å sosialisere seg over nettet ved bruk av smarttelefoner. Intervju er benyttet som metode for å få fram eldre sine preferanser, erfaringer og ønsker med hensyn til teknologisk kommunikasjon i hverdagen. På bakgrunn av datagrunnlaget er det utviklet en digital interaktiv prototype spesialisert for eldre.

## Preface

I wish to thank my supervisor, Associate Professor, Ph.D. Anders-Petter Andersson, who has played an important role in this thesis. His advice and feedback have been great from start to finish. I would also like to thank my mother, for her motivation and support.

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## Abbreviations

UCD	User Centered Design
SSB	Statistisk Sentralbyrå / Statistics Norway
PDF	Portable Document Format

## 1 Introduction

Our population will see a major increase of elderly people in society in the next 40 years (Ministry of Health and Care Services 2018, World Health Organization 2018). By 2060 there will be twice as many people in their 70's (Ministry of Health and Care Services 2018). A chunk of this population is known as the baby boomer generation, born after the war, that will hit old age at around the same time. A big concern is the housing and caretaking of this generation. There simply is not enough room in the current retirement homes for everyone, and there may be a shortage of "warm hands" – nursing staff – to look after the old and frail. We also know that a growing elderly population is not necessarily understood as healthier aging. It will probably involve several "healthy" years along with "sick" years (Manton 1997). Furthermore, it is a political goal that the elderly should live if possible, in their own homes (Ministry of Health and Care Services 2018). To save resources and provide better service, the health sector is implementing new services to provide the same assistance for the elderly capable of living at home, as for them living at caretaking facilities.

This project is within welfare technology that focuses on the wellbeing, safety, user-experience, and life quality of elderly living at home. There are several challenges that rise when developing a product for this user-segment. The most obvious concern is the health condition of the individual, which luckily, we have seen a great advancement in the last years. As *Internet of Things* being a hot topic when developing smart homes, laying out the base for many health applications providing safety and surveillance at home. There are already pilot projects from the Norwegian health sector specializing in providing a safe living for elderly at home, monitoring health values and installing e-locks (Ministry of Health and Care Services 2018).

There are a lot of ground covered already in preparing for elderly living at home. Even though we can provide a safe living, there is also the importance of quality of life, where this project comes into play. People need socialization throughout a lifespan. Facilitation of interpersonal contact is a major goal in developing social tools for the elderly. It promotes social interaction with a personal network which is important for mental health. Getting old can be a challenge in maintaining good mental health and living alone can create loneliness and isolation (Barnes et al 2004, Cornwell and Waite 2009, Garber et al 2010). This project aims to create a window to the social society for elderly, who for whatever reason, have limited opportunity for social interaction in everyday life. However, it is finding place online, and hopefully contribute for maintaining interaction on daily basis with their next-of-kin.

## 1.1 Problem description: Elderly Social Challenges

There are statistics that should not be neglected; a large portion of the elderly are lonely being isolated in their living quarters (Ayalon 2018). Between 1994-2013 we see a rise in nurse- and care services at home, while a portion of this are patients with several health problems (Ministry of Health and Care Services 2018). Mental health represents an important part of these statistics since it's a health problem where we can preemptively help the patient. It is also a challenging area, as symptoms of struggles with mental health can be subtle and hard to spot even for professionals' caretakers (Ministry of Health and Care Services 2018).

Recent research has pointed out that technological adaptations is a positive choice for supporting independent living at home for the elderly (Bailey et al 2019). However, it also acknowledges that there are deeper challenges attached. Cognitive decline, sensory loss and reduced health are among these (Arlinger 2009, Alfakir et al 2015, Cornwell 2009, Haanes et al 2014, Haanes et al 2015). We also know that increased morbidity and disability inhibit people from interacting with their social environment (Ayalon 2018). On the other hand, commonly held perceptions and assumptions about older people and ageing pose serious challenges to developing adequate social responses to our population ageing (Officer et al 2020).

## 1.2 Research Questions: Interaction and Social Networks

### **What are older people's experiences with electronic application and utilities?**

Before this project can start developing a prototype for elderly, their capabilities to interact with a prototype must be established. Looking into user trends of the elderly population and through real life interaction in an interview, this project can establish an understanding of the generation's knowledge and experience with electronics.

### **How can new technology be designed to meet older people's need for social contact?**

It is necessary to research issues such as loneliness and isolation, looking into the digital and real-life social networks of elderly. Formulating an extended understanding through interviews of how the current elderly generation interact digital social platforms.

## 1.3 Justification, Motivation and Benefits

Justification for this field of research is mentioned in the National Health and Hospital Plan 2020-2023 that is provided by the Ministry of Health and Care Services in Norway. Throughout the report there are several mentions of the incorporation of technology to assist elderly. More specifically it suggests that the government is to take advantages in the development in technology in mental health. Depending on the needs, that might be highly related to the finished result of this project. The finished result of this project can contribute to the field of mental health, as social contact can be a component of alleviating loneliness and isolation.

*"- Develop better mental health services. The services meet the population's total need for mental health services in a sustainable manner. The patients receive the services they need at the most appropriate and efficient level. Further development will prioritize improving the quality of the mental health services. Key factors include better distribution of responsibilities between primary and specialist mental health services, collaboration, and taking advantage of the possibilities provided by use of technology." – National Health and Hospital Plan 2020-2030*

*"The proportion of elderly people aged 67 years and over is expected to raise from 14% today to 22% in 2060. Among the very oldest, the increase will be even stronger. People at  $\geq 80$  years will make up 12% of the population in 2100, compared to 4% today. More seniors in the society will increase the expenses of care services" Meld.St.29 (2016-2017) page 152*

*"An increased in financial expenses for care services will have consequences for the public health service. The consumption of health services among 70-year-olds is about twice as high as among 40-year-olds. Then, the need and consumption of services grows with increasing age." Meld.St.29 (2016-2017) page 152*

#### 1.4 Planned Contributions

In a few years, the proportion of elderly people in the society will increase. The need for various rehabilitation services, medical assistance and health services will also increase. Most seniors will probably receive these benefits at home in the future. The need for contact with relatives and friends will be present. Although personal meetings are usually preferred, the use of technological solutions could be an important supplement. The project will investigate what competence and pre-understanding older people have for using technological solutions, and develop a model based on their feedback.

This study results in a working digital prototype and a documented process of the development. That would be the first step in achieving the benefits encompassed by this project. By envisioning a finished product and its results, we would hopefully achieve several contributions:

- Documented development of a digital prototype designed for elderly
- Complete an interactive prototype
- Increasing awareness regarding elderly care in the field of interaction design

#### 1.5 Participants from Senior Center

The participants were recruited from a Senior center in Oslo. A written request was made to the general manager at the center. Information about the study and its purpose was enclosed to the email and was encouraged to be made available to potential informants.

Inclusion criteria:

Age  $\geq 65$  years

At Least minor understanding of online communication

Be willing to participate in a topic interview

## 1.6 Chapter Summary

The introduction is the fundamental start of the thesis. *1.1 Problem Description* described the problem of which the thesis contributes to solving. The base of why progression in this field of work is necessary have been justified, considering relevance for previous and future issues in *1.3 Justification, Motivation and Benefits*. How this thesis will contribute to progression in solving previously mentioned health and social issues, has been listed in *1.4 Planned Contributions*. The criteria set for participating in giving feedback have been defined in *1.5 Participants*.



## 2 Research Field and Related Work

### 2.1 Social Interaction and Mental Health

Social interaction and mental health have a strong connection. We will look at the determining factors of the elderly's social environment and resources. To determine the outline of the research and define where there are gaps in knowledge that are necessary to explore.

*«Social isolation has long been known as a key trigger for mental illness, while supportive relationships with friends, family and neighbors are beneficial to the mental health of individuals and the population.»* (Economic and Social Research Council 2019)

Looking at Cornwell & Waite's work from 2009, there is an established link between perceived social support and elderly's wellbeing (Cornwell & Waite 2009). Many reports attempt take a closer look into where the determining factors of these issues derive from. Social network and interaction are very often a part of the research, however it can be intricate, as relationship status, quality and frequency of social interaction is a part of this equation. Having a huge social network does not necessarily cure or prevent loneliness. A permanent solution is hard, and this report only aims to boost the social aspect of the elderly life. Which is established, overall – to be a contributing factor in lowering the frequency of loneliness and depression.

Family plays an important role as the center of our social network. Even more so for elderly as professional work dwindle with age.

*«Those receiving support from their family members may feel a greater sense of self-worth, and this enhanced self-esteem may be a psychological resource, encouraging optimism, positive affect, and better mental health»* (Symister & Friend 2003).

The results of the studies also bring up another important subject. If the internet usage is centered around health problems, it can be associated to increased risks of depression. Luckily, we see positive effects from communication between close friends and family through social media.

Practical activities based partly on increasing social interaction are emphasized in many elderly institutions. Social interaction has a link to mental health, and lack of social interaction increases the risk of issues with mental health. Therefore, it is important to focus on social interaction with methods developed for the elderly. This is a topic that needs more attention (Galek & Sandvoll 2020).

### 2.2 Teaching IT to Elderly

New generations being born are born into a world where IT is implemented into their daily life and develop a habit of using it, learning an understanding of interfaces and how to use software tools from an early age. Teaching these tools to elderly that do not already have experience in using similar tools can be challenging, however it's highly beneficial.

*"Well funded studies go to show that use of technology strengthens social support, social contact, life quality and well-being among elderly"* (Gabarron, Hoas and Johnsen 2017, s. 13)

In the later years, we have seen a rise in the use of social media applications. A concern whether it's "healthy" or not have been an ongoing discussion. People connect, contact and interact with a seemingly endless number of friends online. Raising some concern is the study that show us that there is a link between loneliness and the time spent on social media. Nevertheless, the causation of the loneliness is not determined. Perhaps the case is that lonely people simply spend more time on social media. The study does not prove that social media is the reasoning of people feeling lonely. A well-documented argument against the use of social media that have seen a lot of media attention (Pantic, Damjanovic & Todorovic 2012).

Many might think that if you can interact with your friends online then you will not have real life social interaction on the same basis as a non-user. Online interactions cannot replace all the facets of real life, such as facial expressions and the intricacies of emotions. Nevertheless, online contact can probably influence well-being. The use of social media to communicate within the family and keep up with already close friends is associated with a decline in depression (Bessiere, Pressman & Kiesler 2010).

### 2.3 Elderly's Challenges

There are plenty of data to prove that isolation and depressiveness are frequent among elderly (Barnes et al 2004, Cornwell and Waite 2009). Retirement and elderly homes often offer physical and social activities to combat social isolation. However, implementing IT into these methods are the next step, unlocking new ways for significant others cooperating and creating a better living for the elderly. With new resources and possibilities, arise new challenges. The concept of social interaction through a computer or tablet can be a challenging concept to grasp with little to no experience. Cognitive dissonance and dementia are prominent diagnosis especially when becoming older. There are as it stands no permanent solutions or cures to these diagnoses. However, research and methods/tools to alleviate symptoms exists.

### 2.4 The Coming Elderly Generation

*"The elderly population over 67 years of age are approximated to increase from 14 today to 22 percent in 2060. The eldest population have a greater increased growth. Portion of elderly over 80 years of age will make constitute 12 percent of the population by 2100, in regard to 4 percent today. More elderly leads to an increase burden of care." (Long-term Perspectives on the Norwegian Economy 2017)*

Grasping the changes and challenges that society will meet with an increase of elderly population are already planned out in *Long-term Perspectives on the Norwegian Economy 2017*. The economic aspect of a large generation entering old age can seem daunting for society. As we see in the report, the numbers are not in our advantage. Pointed out in the report there is no room for the use of welfare technology to alleviate traditional health services.

*"New technological solutions are also a precondition for better and more sustainable social services in the future. Welfare technology may make public health care more efficient and improve our ability to tackle the increased demand for social services from*

*an aging population.” (Long Term perspective on the Norwegian Economy 2017 – A Summary of Main Points)*

## 2.5 Technology Designed for the Elderly

Providing technological products to connect the elderly socially to their family is not entirely new. There are already several products on the market that have seen success with different approaches. Several products that have received funding, which is promising as it shows that the market confirms the need for these types of products (Kavlifondet 2017). With already established similar products on the market, they serve as a great source for comparing and inspiration for design.

### 2.5.1 WeCare

An application that serves as a communication platform for caretakers, family and a targeted elderly. It can be accessed by caretakers to plan a visit, which is available to be viewed by other users assigned to the elderly. A communication page where all users can talk about their visits or other activities.

### 2.5.2 KOMP

Designed like an old TV, elderly living at home can interact with new technology with old methods. Simple on/off function, and an old frequency dial to control. The medium is easy to understand for an older generation that had already are used to old TVs, and family that are used to smartphones can use those to video call and send messages that display on the TV. KOMP target users are stated on their website not being able to use smartphones and tablets.

## 2.6 Chapter Summary

This chapter continue from *1 Introduction* by outlining the research field of the thesis. In *2.1. Social Interaction and Mental Health* the link between social interaction and mental health have been established. *2.2 Teaching IT to Elderly* establish that technology is used as a tool to increase social interaction and mental health. *2.3 Elderly’s Challenges* explain some of the challenges of using technology to amplify social interaction for mental health between elderly. *2.4 The Coming Elderly Generation* reference sources from the Norwegian government accentuate the importance and future development of the elderly population. *2.5 Technology Designed for the Elderly* describe some of the existing products on the market that help in resolving the issues of this thesis.

## 3 Interaction Design for Social Health

The different types of products we use in our everyday life are vast. An essential part in completing our tasks are how we interact with these products, ranging from the phone we use to call up a colleague to the books we read to learn. Interaction design focus on amplifying the positive experience (such as: joy, ease-of-use, intuitive learning, compatibility) in interacting with products, while decreasing negative experiences (such as: constrained use, hard requirements, long training).

Interaction Design will assist in the first research question; What are older people's experiences with electronic application and utilities? Designing a prototype that an older generation can understand and fluently interact with, through working with the user. It also assists in the second research question; How can new technology be designed to meet older people's need for social contact? As Interaction Design includes methods that can identify the user's goals and design that solves the user's task.

There are several development frameworks that have roots in Interaction Design such as User Centered Design, Human Computer Interaction and Human Centered Design. For designing the prototype in this project will use a User Centered Design approach. UCD enhance design revolving around the user of the product and the task at hand, an important action for the National Health and Hospital plan 2020-2030 is to include the user in their own treatment. UCD is a framework that work intently to create a solution tailored to the user and with this framework it may empower the user in their task.

### 3.1 User Centered Design

The philosophy behind the approach for designing products with focus on the user is a user centered approach (Gould and Lewis 1986). There are alternative models for UCD, however they all build upon the originally three key principles defined by Gould and Lewis:

#### 3.1.1 Early Focus on Users and Tasks

*"First, designers must understand who the users will be. This understanding is arrived at in part by directly studying their cognitive, behavioral, anthropometric, and attitudinal characteristics, and in part by studying the nature of the work expected to be accomplished."* (Gould and Lewis 1986)

In the beginning of developing ideas, the perspective of the designer must be from the user looking into how to improve their tasks, by providing a tool designed for their situation. Instead of the opposite which would be finding users that can incorporate existing technology into their tasks. This includes taking the user behavior, characteristics, and workplace into account in the design. If an action is easily performed by pressing a button, it might not be optimal if the users are used to switches.

### 3.1.2 Empirical Measurement

*"Second, early in the development process, intended users should actually use simulations and prototypes to carry out real work, and their performance and reactions should be observed, recorded and analyzed."* (Gould and Lewis 1986)

Confirming prototypes functionality with the intended user and measuring this empirically. The empirical measurement takes basis in the 4.7 Requirements, 3.2 Usability Goals and 3.3 User Experience Goals set earlier in the project.

### 3.1.3 Iterative Design

*"Third, when problems are found in user testing, as they will be, they must be fixed. This means design must be iterative: There must be a cycle of design, test and measure, and redesign, repeated as often as necessary."* (Gould and Lewis 1986)

Completing the cycle of the project is the iterative approach, all the established design, including requirements are subject to change as the designer interacts with users and is given feedback on prototypes.

5.2.2 Heuristic Evaluations provided feedback on the usability, related to the first research question. While the 5.2.1 Formative Evaluation performed during the process were to continually uphold the social aspect in the designs and provide for the second research question.

## 3.2 Usability Goals

These goals are set for interaction with the product. The products usability should aspire to fulfill these goals as much as possible. During the development process of the product the designer should assess the usability of the product and compare them with measurable usability goals. The products usability is assessed through formulating a detailed question targeting individual goals, regarding the product. For example, Effectiveness: Is the hair comb able to brush through the hair? Does the foldable comb collapse as it intended? How many strokes before the hair is combed? Furthermore utilizing these usability goals can assist in a good experience for an any user segment, if the user is not able to complete their task because of a hindrance in interacting with the prototype, a user will not be able to proceed to fulfill any task or perhaps find another solution.

**Effectiveness:** Is the product successful in producing intended result?

**Efficiency:** Is the product performing its tasks with ease? How much work is required to reach desired result?

**Safety:** Is the user at risk when using the product?

**Utility:** Is the user provided with the necessary functionalities to complete their task in their preferred way? Alternative tools provide more utility.

**Learnability:** How much time is required for learning to operate the product? Is it possible to use it without an introduction?

**Memorability:** Is the user forced to relearn the product when used infrequently, if so, is it easy to get back into again?

These are general goals in creating a good interactive product. In this project it has an especially important influence on the design choices, as the users are a specific generation and has a distinct level of experience (See 4.6 Based Personas). Looking at the section of socialization and activity the plan in "A full life – all your life" by Ministry of Health and Care Services (2018), it also exist a correlation between these usability goals and their listed challenges, an description of how these usability goals will inform design choices to reach social health goals follows.

- Families who are less exhausted, and who can provide more stable care for their loved ones.

Effectiveness of the prototype would be to fulfill social contact in a network around an older person, being efficient in its workings would be to alleviate the workload of maintaining a social network, where family are an important resource.

- The target group is older persons over the age of 65, living at home or in institutions. This is a target group with different capacities and significant differences in their needs and wishes.

Several goals would contribute to this goal, different capacities may require different learnability and memorability. Different utilities provided to the user would also extend the range of needs able to be fulfilled.

### 3.3 User Experience Goals

In the previous section, *3.2 Usability Goals* provide the foundation of the users experience when interacting with the product. The user experience goals expand on this concept, designing a good experience is not simply fulfilling the usability goals, as the user can experience a tutorial of a product as a hassle, even though the usability is well designed. These goals serve to satisfy the subjective user perspective. Much like the usability goals, the user experience goals also aim to enhance social contact for elderly (1.2 Research Questions: Interaction and Social Networks).

### 3.4 Design Principles

These are general principles to have in mind when designing for the user experience. Perfect fulfillment of every aspect of these principles are practically impossible, they serve as mental guidelines that aids the thinking process and decision-making for the designer. There are several principles to follow, the most common are the following: Findability, Visibility, Feedback, Constraints, Consistency, Affordance. (Rogers, Sharp & Pearce, 2011)

There is a degree of redundancy of mentioning many more principles, as the previously mentioned principles description already covers guidelines that are to some degree specified more for other disciplines.

As the design principles are defined, we need to look back at the research question as the social health are the main factor in influencing how to use these principles. First and foremost, the prototype must be specifically designed for an older user segment.

**Findability:** The action of locating an item through several menus, searching/exploring for new functions, or going through previously posted content to find a specific post. The actions all go under findability, if the procedure of finding desired items feels logical and easy the findability is good.

**Visibility:** Conveying to the user what the function of a button is, simply by the icon displayed on the button. Being able to see the current actions relevant to the user at certain points in time is good visibility, not being forced to search for functions through extended menus or scrolling further down.

**Feedback:** Information to confirm what the results of actions are. When sending a text message on your phone, there are; Visual, audio, and verbal queues letting the user know the message is sent. Poor feedback in this example would be if the iPhone did not color its texts, (Blue for internet or green for cellular) letting the user know if it was sent using the internet or cellular data.

**Constraints:** Limiting the available options in certain intervals of the process can be helpful to the user. This can be achieved through greying out buttons that are not relevant, or locking features where requirements are not met. Sending a mail without a registered email would be pointless. The constraints are in place to limit human errors.

**Consistency:** It is important to consider the patterns that develop when using different elements to indicate information to the user. If icons are applied to buttons to display their function, this practice should be applied to all the buttons.

**Affordance:** The physical actions of which one is aware, interactions one can have with the object should be comprehensible through intuition. Buttons on the keyboard afford pressing down, there is no handle to grab or room for them to be moved sideways.

### 3.5 Designing for Elderly

There are guidelines for how to meet the market of elderly regarding interaction design. It includes specialized design accommodating for specific requirements and optimizing practical design. Mobile phones are one of our most popular technological tools at the age of 75-79 in 2018. Statistics shows that 47% of elderly people own a smartphone, more and more people adapting to use it as a part of their daily life (SSB 2018). This project chooses a platform that is already being utilized by the user segment, setting up for a better learnability as the user is already familiar with interacting with the platform (3.2 Usability Goals). In *2.2 Teaching IT to Elderly* I explored the social benefits of socializing online, combining this with my background in IT, choosing a smartphone as a platform that has a vast amount of help and tools online provides a great opportunity.

### 3.6 Accessible Design

Accessible Design is a term to describe design that includes users that may have unique requirements for the product. For elderly there are several cognitive and physical challenges to be addressed. Identifying the impairments that come with age is done in several studies (Alfakir 2015, Arlinger et al 2009, Davis & Davis 2009, Fratiglioni et al 2000, Garber et al 2010). This is also considered exclusively when designing for mobile applications. By mapping visual and physical problems the user might have before

interacting with the prototype, the design and methods can be prepared accordingly. There are also existing tools and solutions the prototype might draw inspiration from (1.2 Research Questions: Interaction and Social Networks.) A part of growing old is some of the challenges we are going to investigate. Sadly, there is also a social stigma related to these challenges, asking others to repeat themselves or misinterpretation can be tiresome. The prototype is looking to design solutions that ease the use of the interaction to hopefully circumvent some of the problems leading to such stigma, often referred to as ageism (Officer et al 2020). Reasoning to understand these challenges is to better the design, good interaction working as a prerequisite and facilitation of social interaction. An important aspect of the research questions.

### 3.6.1 Physical Challenges of Ageing

In the following section we will investigate some of the physical challenges that relate to ageing and ageism. It is important to understand some of the condition's elderly can develop, as it affects their visual ability. For example, an elderly that has impaired vision might have certain challenges in observing the design on a digital screen. Icons might be too small, colors can be hard to tell apart or blurry shapes might blend two buttons together. This ties into understanding the interactive capabilities of the elderly user segment, which is a part of answering the first research question *1.2 Research Question: Interaction and Social Networks*.

There are multiple age-related eyesight impairments, either one is born with impaired vision or develop it throughout life. Firstly, Wet or Dry Age-related Macular Degeneration (AMD) can cause visual distortions, decreased color distinction and generally blurred vision. An impairment that see higher representation in the age of 50 plus, in most cases being dry AMD and loss of reading vision due to damage to the accumulation of high amounts of drusen in the cell layer in the eye (Haanes 2014, Haanes 2015, Wang, Mitchell & Smith 2000).

Cataracts is also very common, affecting 70% of elderly over 70 years (Blindeforbundet, 2020). Mainly caused by age, the eye lens stiffens, yellowing and less transparent resulting in foggy vision, nearsightedness, and sensitivity to strong lights. There are other eye problems that develop with age such as presbyopia (Loss of nearsighted/reading sight) and increase/decrease of nearsighted and farsighted, often solved with different types of visual aids.

AMD and cataracts are important parts of ageism where accessible design can introduce interesting solutions. There are an array of tools and measures taken in accessible design to alleviate the visual impairments. Assistive tools are implemented in modern software and mobile phones, such as: Settings for accessibility (Fonts, contrast, and text size), Magnifying glass and text to speech (Reads selected text).

Colorblindness is not an exclusively age-related problem, one out of six is born with reduced color perception. As the heredity is on the X-chromosome, we see a higher representation of men. Reduced color perception is widespread and should always be considered when choosing a color palette and color combinations.

There are several types of color blindness, categorizing the troubles with perceiving different parts of the color spectrum. Mostly is distinguishing red-green and blue-yellow the most common.



There are several ways of accommodating for colorblind users, adding alternative colorblind mode is a popular solution for electronics, as there is colorblind mode also supplied with the firmware with many phones.

### 3.6.2 Cognitive Challenges of Ageing

Introducing new technology and products to a user segment includes teaching a new set of skills and a basic understanding of how to operate the product. The elderly generations have limited experience with computer science compared to the coming generations due to their age. It is a cognitive task to learn how to use a new application, the ability to learn new information and apply it to the subject at hand is named fluid cognitive ability. Crystallized cognitive ability is applying stored and previously taught knowledge.

"Some aspects of memory are stable with normal aging, but there are consistent declines in new learning abilities with increasing age and some decline in retrieval of newly learned material. Immediate or "sensory memory" is stable with age, but tests that require subjects to exceed normal primary storage capacity (e.g., six to seven items) are more difficult for older adults. "(Murman 2015)

However, the stereotype view on aging is no challenged. Scientific studies have emphasized on many factors associated with age, as well-being and social network, are major protective factors against the effects of age (Lupien and Wan 2004). It is assumed that an increased attention on the ageing population may have changed people's beliefs and prejudices about elderly individuals. The term "successful ageing" has made its entry into popular and scientific literature (Lupien and Wan 2004). It is encouraged that we should discuss age in a broader perspective, and the ageing process in a more positive way, from a biological, psychological, and psychosocial perspective (Lupien and Wan 2004).

### 3.7 Chapter Summary

This chapter describes the framework chosen to design a prototype in the field of Interaction Design *3.1 User Centered Design*. The UCD process focus early on the user included in the research, empirical measurement is used to iteratively design a prototype. *3.2 Usability Goals*, *3.3 User Experience Goals* and *3.4 Design Principles* describes different concepts that guide the designer decision making and accentuation of design aspects. *3.5 Designing for Elderly* source statistics of elderly, detailing how I can choose a platform for elderly to prototype on. Reasoning for how they link to the challenges of elderly are described in *3.6 Accessible Design*. Those sections go in-depth regarding several social and intractability issues the prototype faces.

## 4 Methods: Fidelity, Interviews and Based Personas

Creating a product for a user is not simply asking them what they need and want. It is a simple question that is hard to answer. If they are handed a product to try, they might quite quickly find errors or missing features. A product goes through several prototype iterations, removing/adding features with each iteration based on informed opinions. This leads into the several following methods; User-testing, Prototyping and User research. First, there are already lots of information to be gathered around elderly, IT, and a specialized design for said user segment. Luckily, there is lots of research in this area, so this thesis will continue researching and apply what has been discussed in previous chapters.

Prototyping explores both parts of our research questions for the thesis regarding good usability and users' social network. At the starting point is where the biggest and most exploration is done, creating a quick, simple, and cheap prototype does not slow down development despite big changes being implemented. It is beneficial for this prototype as the different design alternatives can practically explore social functions and interactive interfaces and evaluate what works during the process.

### 4.1 Low-Fidelity

Existing methods that are available to use here are almost endless. Many are based on paper, cardboard with the use of cutting and drawing to illustrate certain parts of the product. Often are concepts like how the user can interact with the functionality of the product or a step-by-step process of tasks to reach desired result illustrated with low-fidelity prototypes. Several methods will be employed for this product. Every prototype does not necessarily need to be tested with user, as it is time consuming and the prototype is too simple. To start off this prototype, sketches are created to organize the tasks and process of the product for the designer to get a rough idea of the products functionality. Again, low-fidelity are to develop concepts and can be too bizarre for users to grasp (Bergman and Haitani 2000). A storyboard illustrates which steps the user would complete for the task at hand. Say for example leaving a comment on a Facebook thread, a storyboard would indicate who are involved, how they are involved and what they do. Simple methods like sketching and storyboarding for this prototype creates a new perspective from a textual description, potentially emphasizing new challenges *1.2 Research Questions: Interaction and Social Networks*.

### 4.2 User Testing

The process goes to more in-depth from there on out, exploring different aspects of designing the product such as physical placement and design concepts. Conceptual design outlines a variety of issues such as user interaction and product interface.

The intention of prototyping are not the iterations created, but rather the feedback that users can provide based on them.

Prototyping as a research methodology already implements user-testing as a central piece of development. In prototyping the ideas and expectations created through research, they can be manifested in a way user can interact with early versions of the product and give important feedback. The developer also gets the chance to guide and

potentially discuss different concepts of the product, further exploring the expectations of functions and usage. Through interviewing users, this project may acquire important information about user trends and perhaps issues related to social health. Seeing the user's reactions, opinions, expectations and perhaps a practical interaction with a smartphone. Through talking with the user, one can openly reflect on user's experience. (1.2 Research Questions: Interaction and Social Network)

### 4.3 High-Fidelity

Nearing in on the end of the process, continuing with prototyping methods in High-Fidelity closes in the prototypes in on a final product. All the knowledge and experience gathered on the product up until so far will be condensed into the decision making of the final prototype. The goal of the high-fidelity prototype is simulating a final working product as close as possible. Presenting a fully interactive prototype, giving a proper user experience. Also, here in the end, the implementation of user feedback is important to look at the start and end point of the prototype in comparison. User testing and receiving feedback on the final prototype will provide necessary information on the expectations played out in the beginning. To follow the user's habits and meet their experience, based on this project theory (3.6 Accessible Design) and feedback (5.6 Interviews), an interactive digital interface is produced.

### 4.4 Tools and Utilities

Assisting in the design process, putting the theory into practice while sketching several sketches and the designing of the electronic prototype is all dependent on these tools. The level of experience required for using the tools is not high, even Justinmind Prototyper as the most advanced application.

#### 4.4.1 Justinmind Prototyper

The program is a free download from their websites, currently version 8.7.0 for this project. It allows creating an interactive design for mobile and web platforms, and devices with different screen formats. The website is a big resource for learning to use the program, and the process is very similar to adobe programs. A built-in guide for learning alongside testing of the program, and the website working as a resource for more advanced features and come with a big library of free-to-use designs. The program has well rounded options when beginning prototyping electronic prototypes, allowing me to learn during development.

#### 4.4.2 Balsamiq Wireframes

Developing the wireframes on paper is simply too hard for my drawing skill, it will become inaccurate and does not communicate UI spacing well. The electronic wireframes are easy to handle, the Balsamiq Wireframes are easy to get started with through the browser. It is a web browser application that provide several tools for wireframes.

#### 4.4.3 Paper Sketches

The sketching process starts often on paper. It allows for minimal requirements and hastily sketching out several ideas. My experience with sketches and drawing in general is only for practical applications, such as developing ideas and as a storage. There is need for electronic sketches when going into details as my paper sketches is limited by my skill in sketching. The Balsamiq Wireframes is an online website that provides simple sketching tools in the browser and serve as a great transition for sketches into wireframes.

#### 4.5 Interview

By performing an interview, requirements can be derived from gathered user data. An important step for the prototype to be developed based on actual user experience.

Preparation for the interview includes the research of the topic, formulating reliable questions that can provide useful information beyond what is researchable. After all preparations had been made, an inquiry was sent along with information about the study, to the Senior center. Time and place were planned through email in correspondence with staff at the center. Having determined a suitable date for all implied persons, the interview was set up with the IT group that had their activity and training at the center. All interviews were set up the same day. A review of the study, the topic and research question were held in plenary. This served as at great warm up, and many elderlies had questions regarding their phone, pc etc. Coincidentally this gave greater perspective to the topic and provided the interviewer useful insight into what understanding, and problems older people have regarding new technology.

After the introduction was finished, the staff provided the meeting room for the interviews in a calmer setting. Elderly who had confirmed their participation in the study consisted of people who were trained in technology and had different experiences. Each interview took 30-40 minutes, starting with information regarding anonymity, use of the study, subject information, and legal issues. The introductory information all included in the interview guide. All the interviewees were agreeing to the terms and wished to participate.

To get going in the interview the first couple of questions was to establish the level of the experience the interviewee had with phones and technology in general. Terminology and questions should fit the knowledge of the interviewee. This serves the purpose of creating a fluid conversation and as a warm-up. Proceeding from the point on the interviews was all very different. Structurally, notes and written transcription became important to organize the information. Key notes were written during the interviews to not hinder the flow of the interviews. A more extensive transcription was written immediately after the interviews ended. The core of all the interviews boiled down to experiences with social applications and their interactions, the interviewees had usually most to share about their personal experiences. When the interviewee had fully explored the question and subject to the extent it was useful for the interview, the pre-written guide served its purpose to guide the interviewer to another topic. The most controversial topic where some of the interviewees had strong opinions was on personal data and safety, saving this to the end of the interview before the cool-off questions. However, there was no tension in the interviews. Lastly the interviews ended with the interviewer thanking for the participation and their time. After the interviews was

officially ended, several of the participants had questions regarding phones, recommendations, and applications. Their requests were fulfilled, farewells were said with the staff and the process was over.

#### 4.5.1 Unstructured Interview

The formulation of questions asked in an unstructured interview are open ended, in that sense the interviewee is free to talk about their opinions and experiences regarding the question. This provides the interviewer insight into subjects that may not have been thought out before the interview, with the discovery of new points of interest the interview can explore these tangents with follow up questions. When the tangents have been thoroughly examined or are no longer relevant to the interview, the interviewer can return to pre-written questions continuing the interview (Robson 2002, Rogers, Sharp & Preece, 2011).

The unstructured interview is method of data gathering, providing a broad insight into the user habits and preferences. As the method is employed in the low-fidelity phase of the project, before establishing the requirements. The method of unstructured interviewing fits an open-minded exploration of ideas.

#### 4.5.2 Interview Guide

There are limited research focusing on skills, knowledge, and experiences held by elderly people on new technology. The current questionnaire was constructed based on previous research and experiences from friends and family. Health professionals in my own family was consulted. Options and preferences were taken into consideration. Two pilot surveys were carried out on and reviewed prior to the finalization of the present questionnaire version. The questionnaire began with a presentation of the objective of the project, and were divided into the following sections: 1) Interview goals, 2) Electronic social interaction 3) Idea exploration and feedback 4) Cool off

As it was declared in the introduction of the proceedings of the interviews (10.2 Interview Guide) The interviews performed as data gathering has legal issues regarding the anonymity of participants to consider, as there are guidelines one need to follow for some cases of research. However, for this feedback on the product, there is no need for personal information which does not ensue the need to register for NSD according to the guidelines. The interview method did not include biometrics or indirectly identifiable background information.

#### 4.6 Based Personas

The based personas are created out of the research and intended user for the product. Included in the personas are common challenges elderly have with smartphones, such as coloring, icon/text size et cetera 3.6.1 *Physical Challenges of Ageing*. These factors that influence the user's perception and interaction with the product is considered when developing their personality traits and background, as an attempt to replicate distinct users. Differentiation of these based personas reflects a wider pool of users with these traits. Managing requirements throughout the design process become less of a challenge with personalities to represent them.

## **Persona #1**

**Name:** Petter Halvorsen

**Age:** 70

**Residence:** Single living at home

**Occupation:** Retired Pilot

**Hobbies:** Reading and bicycling

Petter has retired from a long career of piloting and have taken on many private contracts to abroad companies, being one of the older pilots he contributed with many years of experience and teachings for the new generation of pilots. In the aviation career he has gone through multiple hand-eye coordination tests and followed the technological advances in the plane cabin. Despite being physically and mentally strong at the age of 70, the time for his career has reached its due. As his reactions are slowing down and vision is becoming weaker. He has set his sight on being more involved in the lives of his family. His two daughters are in their twenties are living in other parts of Norway. They come over for visits back to their father in the holidays and every other weekends. Every time they come over, they teach him about the newest advances in communication, so he can keep up with their daily life. Petter is however skeptical to these digital tools, as he worries about security.

Petter's friend from work has together with Petter many miles together on the bicycle, they complete new tracks each time they meet up, as their goal is to complete all the tracks over 10 miles on Strava in their hometown. The numbers of tracks multiply faster than they can complete them, however both Petter and his friend still like the challenge they have set for themselves.

## **Scenario #1**

Petter has never been a frequent user of social media, even though he has a Facebook profile. There simply was nothing of interest to browse through and did not find the other functions of Facebook to any use. His two daughters were visiting him this weekend and recommended he should try out another social media platform for families and close friends. Petter is interested in being more involved and updated on the daily lives of his daughters, as the distance between them made this a challenge. He downloaded the app on his tablet and was introduced to some of the functions over the weekend. With their departure Petter posted a picture of his bike to their family hub on the application, and within a couple of minutes he received a reply of his daughters on the train station. The upcoming week Petter and his daughters shared small and important moments of their daily life with each other. It only took Petter 10 minutes of his time a couple times a day to stay updated and share daily activities. Beginning with sharing a picture of his bike and replying to his daughters a couple of times through text posts, Petter developed an understanding of the app on his own. The application became an important part of his communication with his family, as whenever they met there was many comments to be made about the stories they had shared on the application. Integrating his family into his daily schedule daily communication, the challenge of living far apart became less of a concern. Petter felt secure using the application to communicate, as he could easily manage control over his account and content.

## **Scenario #2**

As an avid cyclist Petter sent his daughter's many pictures of the great landscapes which was appreciated, but the pictures of beautiful bicycles he saw standing around, not so much. With some of the friends from work Petter introduced them into a new hub for on the application where they could share all their bike related thoughts and photos. Petter's old colleagues picked up fast on the application as they had been posting some pictures on Facebook earlier, but it never really caught on as there was never much response. With the new hub between the friends they shared their newfound cycling routes and always posted on the end of a successful trip. The hub grew together with their social circle of cyclists, with several comments and posts each day.

## **Persona #2**

**Name:** Gina Karlsson

**Age:** 66

**Residence:** Living together in an apartment with husband

**Occupation:** Retired nurse

**Hobbies:** Reading and knitting

Gina have been retired for one year from being a nurse in 40 years. She is starting to settle down in her new daily life. Finding new hobbies like reading and picking up older ones like knitting from her teenage years. She visits the library a couple times a week to replace the books she is done reading for the week. She has joined a book club arranged in between some friends she met while browsing for books in the library. They all read the same book and hold meetings at the end of the week to talk about it over dinner. With her husband of 69 years of age, Gina takes a walk in the afternoon every day to the local park where they watch pets play, people working out on the outdoor gym and general people watching. Gina usually brings her camera to these walks. As younger she was taught a lot about birdwatching and always found them fascinating. In case there are some rare sightings, she was prepared to snap some great pictures. Her photo album at home have been growing rapidly the last year, and she has even had the time to frame the best photos.

## **Scenario #1**

On Fridays when the week is ending, Gina and her friends meet up at one of their houses which have been a problem in some weeks when people are unable to meet. The meetings are held regardless how many can attend. There has been some talk about the option to extend the meetings to alternative dates. Since they do not have a shared platform on which they can suggest and agree to a date, this has proved to be difficult. Gina have some experience with an application where they can message each other within the group, she proceeds to invite the others to download the application. After they have all downloaded the application, they share suggested dates. In their group they introduce their perspective on books they have read since last time.

## **Scenario #2**



Gina uses the application to discuss some of the pictures she has uploaded to her platform for her friends. She finds it cumbersome to write out long messages when she is on the move, therefore she sometimes waits until she gets home or a place to settle down before she answers. After writing a complete reply to her friends, she waits until tomorrow for a reply.

## 4.7 Requirements

In the beginning of the development process the requirements are based on previous research and products in the field of study. As the details of the prototype are not defined, nor has the research for this prototype been completed, the first set of requirements is subject to change. *"Establishing requirements is itself an iterative activity in which the sub activities inform and refine one another"* (Rogers, Sharp & Preece 2011).

The first set of requirements specifies the functional requirements of the prototype. Usually it describes the tasks a user can complete with the prototype. This set aims to facilitate social interaction. The second set of requirements specifies the non-functional requirements, which describes features such as quality, service, and accessibility. This set aims to create good usability. Covering the usability and social aspect of *1.2 Research Questions: Interaction and Social Network*.

The first set of requirements are based on *4.6 Based Personas* and *3.6 Accessible Design*. Both sets of requirements have been expanded upon during development, based on *5.2.1 Formative Evaluation* and *5.2.2 Heuristic Evaluation*.

### 4.7.1 Functional Requirements

Users can interact with each other socially on the prototype

Users can have both invest short or long time for a social interaction on the prototype

### 4.7.2 Non-functional Requirements

The interface accommodates for motoric challenges

The interface accommodates for poor vision

Users can manage their social network on the prototype

## 4.8 Methods Chapter Summary

The stages of the prototype are listed firstly *4.1 Low-Fidelity* *4.2 User Testing* and *4.3 High Fidelity*. These methods contribute to the development of the prototype in their own regards, beginning with exploration and ending with an interactive prototype based on target user. The tools to accomplish this are listed in *4.4 Tools and Utilities*, informing the decision making in the design alternatives is the *4.5 Interview*. These user characteristics are condensed into *4.6 Based Personas* and *4.7 Requirements*, to easily operate the information during development.

## 5 Prototype Development

Throughout the development all the methods described in the study will be applied to refine the prototype for each iteration. First iterations will use low-fidelity methods, sketches, and wireframes. Applying the information acquired through research and interview to develop several designs and iterations which finally culminates to our final prototype. In between the iterations, methods from interaction design examine the pros and cons of each design.

### 5.1 First Iteration

The first sketches in paper format is based off the based personas and former research produced in this paper. The established requirements set for the prototype is included in every design. It is the combination of the requirements and research that will create differentiation in several sketches. The alternative designs that come out of different sketches are important to explore different concepts before settling on specifics and deciding what is an optimal solution (Roberts 2009, s330). These first set of sketches are conceptual designs, sketching different interactions users can have with the product, attempting to provide different solutions to the requirements. This include concepts such as functionality, organizational composition, technologies, and interaction.

#### 5.1.1 Design Alternative #1 Kretser

Asking around in the elderly center made it clear that the elderly had experience with social platforms such as Facebook and Twitter, it was a mixed opinion. Some common points brought up when I discussed Facebook, were the vast amount of superficial functionality on the page. On the other hand, they did like how they could read what their friends had on their minds. With Kretser I am focusing simply on the posts of the users. The first design alternative focuses on a classical approach to social media, with an endless scroll featuring text and media posts. The intentions with this design are to use something that already exist to see how it can be made with interaction and usability in focus. Kretser caters for based personas such as Gina, that have time to explore content. There is no word count restrictions, video, comments, and pictures are all included. It opens the possibility to engage in longer descriptions and replies.

A post is separated graphically by rectangles displaying the option to comment in the button of each post. Scrolling can be handled with the up/down buttons on the corners of the screen, a "top" button bringing the user to the start of the page, and settings featured in the button left. Much like you see in web-browsers which have been around longer than navigating using touch screens, re-using old functionality elderly might be familiar with *3.2 Usability Goals*.

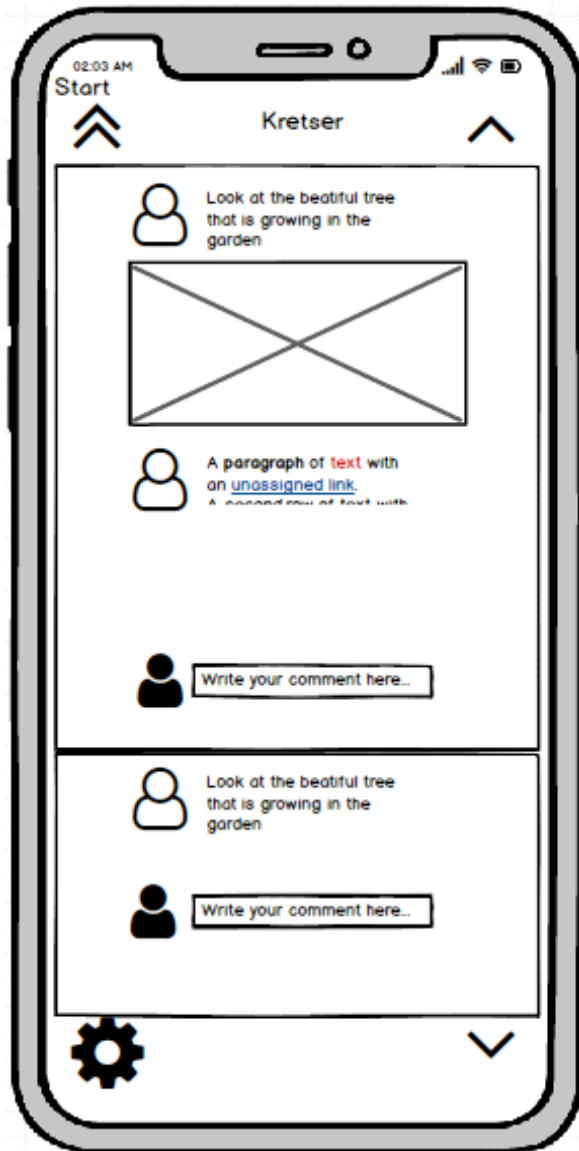


Figure 1: Kretser #1

Clicking the double arrow top left brings the user to the top of the page, the function of creating an own post is always on the top of the page. This were added as a functionality for users that might have trouble navigating to the top fast, after scrolling far down. Media can be added to the post such as pictures and video going along a textual description.

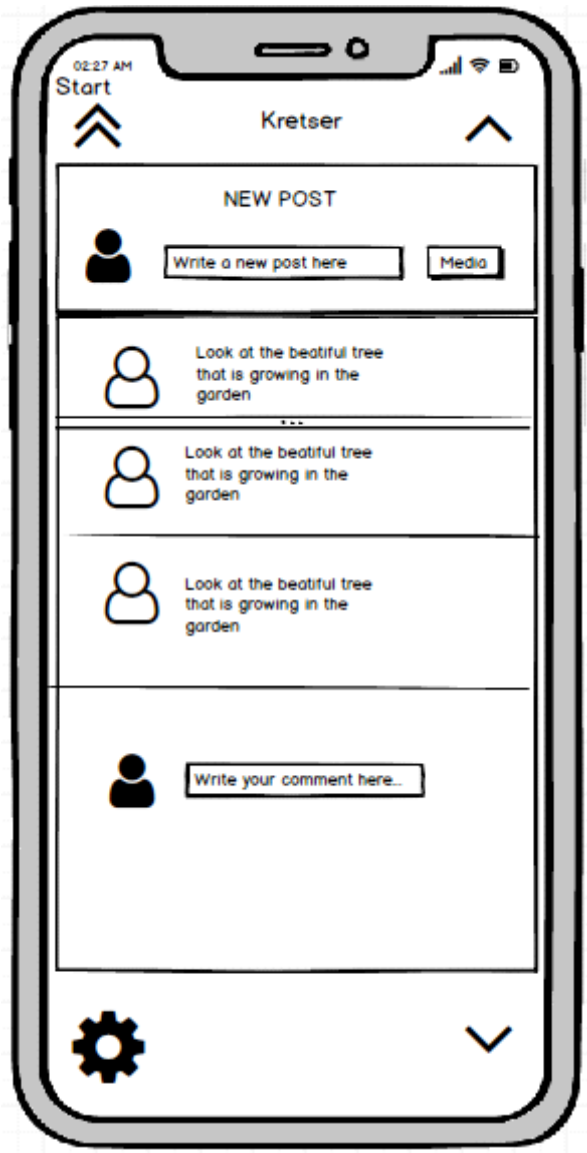


Figure 2: Kretser #2

In the button left settings are to add users to their network including them on their page. A simple search and add page, also would the user find the option to accept incoming requests.



Figure 3: Kretser #3

A simple function to search a user's name and send an invitation. Their profile picture is displayed next to their name to distinguish duplicate names. Also, the list of incoming invitations is listed beneath, a timer for an invitations can sort out unwanted invitations to avoid a massive list.

#### 5.1.2 Design Alternative #2 Gallery

The second design alternative is oriented around taking pictures and communicating through non-textual format, a preference that was discovered in the interviews, the ability to send a simple reply would now be possible for Gina. Replacing the traditional functions of leaving comments, the users can react to media with emoticons. As this application would be more fitting for users that do not prefer to text out comments due to it being hard or time consuming. A simple reaction with emotes or calling contacts through the family tab. This results in very little clutter on the screen, leaving more room for expanded icons, and room for the pictures (3.2 Usability Goals). Clicking the picture should bring up a full screen version in case there's landscape pictures or other reasons full screen would be preferred. On the right side of the picture is the possibility of bookmarking the picture, saving it for later viewing in the gallery. The home indicated by coloring, is the current location of the first sketch, with an endless scroll through posts and media. This is an more nontraditional approach to social communication (1.2 Research Question: Interaction and Social Network) as it is only based on media and emoticons, its design leans more towards having rapid updates and alleviating the users of writing out long comments. (3.2 Usability goals)

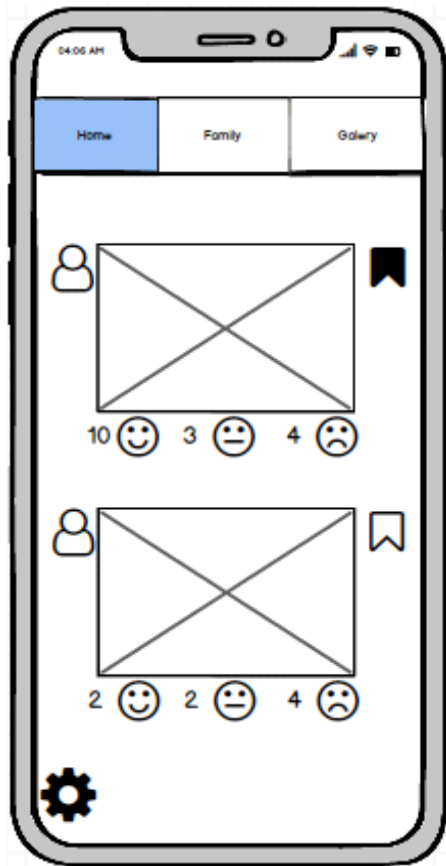


Figure 4: Gallery #1

In the family tab the user will find a list of their added contacts. Here the user can go through new posted pictures sorted like the Home screen or call the user by clicking the phone icon.

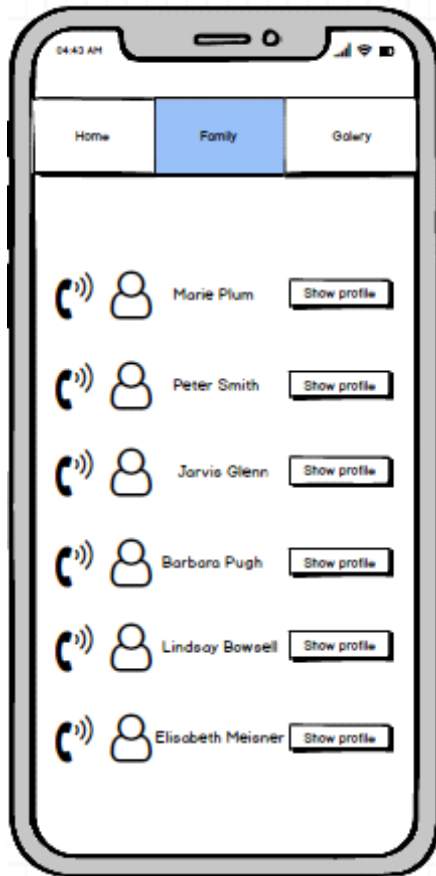


Figure 5: Gallery #2

The bookmarked pictures are placed in the Gallery tab, here the user can shift through bookmarked pictures, sorted by date posted.

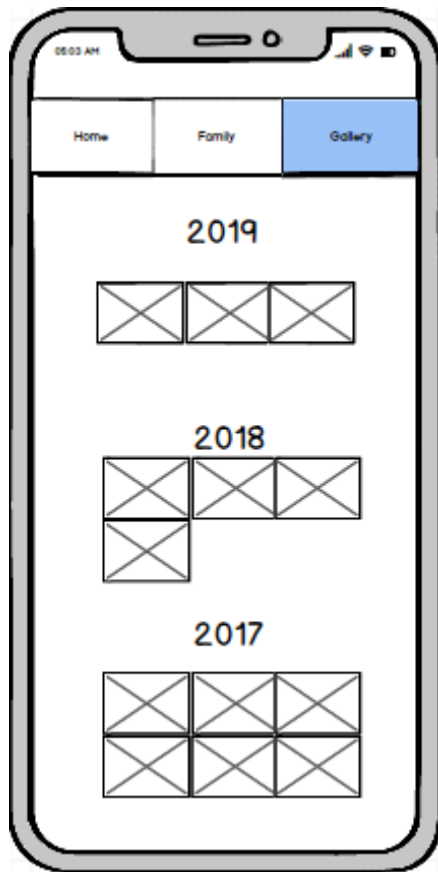


Figure 6: Gallery #3

### 5.1.3 Design Alternative #3 Calendar

The last design solution was made with connecting family through an online planner tool, a private calendar that include contacts to participate in suggesting activities and accepting invitations. Users can create and plan out their day in collaboration with family, a useful tool for both of my based personalities Gina and Petter. The calendar tab includes a week-by-week schedule of the months. The number of plans distinguished by coloring. The goal of an online planner is to facilitate social meetings and being a planner for healthcare personal (1.3 Justification, Motivation and Benefits).



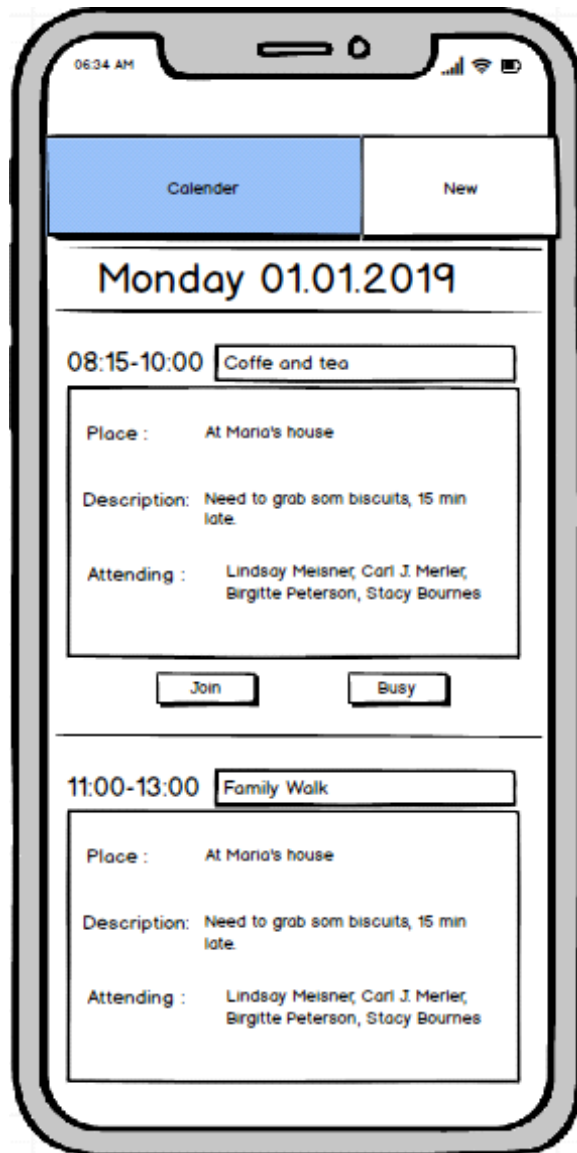


Figure 7: Calendar #1

Choosing a specific date split the day into times based on the invitations received, options include accepting the invitation or declining. Information regarding who else is attending, place and a basic description is displayed. Gina would be able to respond simply by pressing join/busy for each of the invitations. I am going for a low maintenance design when attending to the invites, the user simply must accept or reject the invitations.

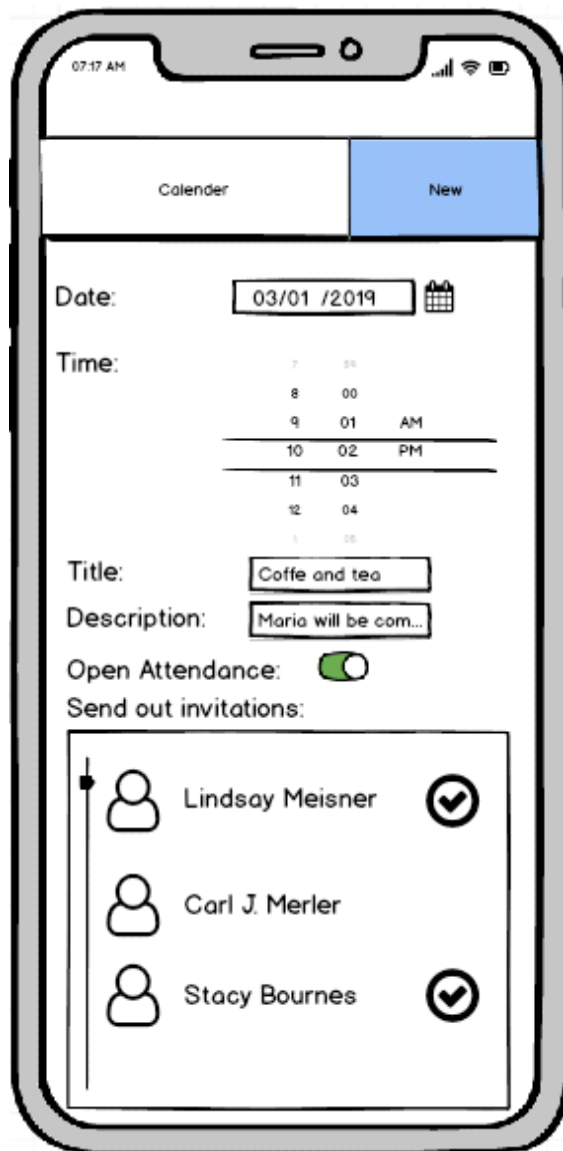


Figure 8: Calendar #2

The titled tab on the top of the sketch reads new to create a new event, information regarding the event is filled out by the user. Open attendance would make anyone available to sign up to the event, such as a picnic or a walk into town. Alternatively, the user can pick whoever is receiving the invitation. This tab is more detailed, but not mandatory to learn by older users to keep track of plans and signing up for other events. A planner tool like this would hopefully alleviate planning for the social network of an elderly.

### 5.1.4 First Iteration Summary

Before I continue with the second iteration, a short summary of the experience and results of the first iteration is necessary.

#### Design alternative: **Kretser**

Kretser turned out very much like a sketched version of Twitter or Facebook. I believe the goal for Kretser should focus more on a clean and simple interface, the content of what the users have on their minds could be enhanced. Not so much who they are, as having an online profile did not seem interesting to the users, as security and personal data was a concern. Separating all the settings into another page is a step in the right direction.

#### Design alternative: **Gallery**

I find the gallery design alternative an innovative approach to a social platform, a simple sharing of pictures or other media where users would be able to upload in a hurry. As writing text to accompany the pictures is not an option it might feel limiting to users that want to go more in-depth with their online interactions. Designing the application to look clean and easy to use seems like an easy task, as the interactions are rather simple. It also has the challenge of managing users, just as Kretser. Saving and creating your own online gallery of friends and family is a sought-after feature based of the interviews.

#### Design alternative: **Calendar**

With the last design I wanted to create something more regarding physical meetings. The concept of the user potentially only being required to respond to invitations seems like a great feature. Further, it was very hard to innovate the design, especially the screen for creating an event. The nature process requires the creator to make many decisions. It does facilitate physical interaction, which is great, however that is currently the only interaction it has besides replying to and sending invitations.

## 5.2 Second Iteration

The second iteration was designed in Justinmind Prototyper. The placeholder icons and buttons has been replaced with custom made and material from the free library. Some rudimentary navigation through the pages are added, and functionality as menus stick with scrolling of the page. As this iteration is used within the same environment as the last prototype will be designed in, it is shaping up to look more like a finished prototype. However, still limited by its lack of completion. Reviewing the second iteration a general formative evaluation and a heuristic evaluation is used to evaluate the screens of the interface.

### 5.2.1 Formative Evaluation

The completion of a second iteration of the prototypes begins a formative evaluation of the designs (Rogers, Sharp & Preece, 2011). The motive of evaluating half-way through the prototype development process is to make sure the original requirements set for the product stay true, and the current development are on the correct course for the based personas. This is to inform the continuation and decision making in choosing designs to develop further.

### 5.2.2 Heuristic Evaluation

The method heuristic evaluation can be performed intermediately in the process of development on prototypes to evaluate usability, a specific object or user experience. An individual evaluator can perform a heuristic evaluation, though he would lack a diverse perspective of the heuristics.

The first step in performing a heuristic evaluation as a singular evaluator is inspecting the user habits and environment (Wilson 2014), referring to based personas that originate from the interviews and product competitors as source of information regarding users and environment. Secondly the list of usability goals serves as aid in evaluating the prototypes, while they are not being completed orderly in the review, they remain as guidelines or points of concern for the evaluation. As the heuristics serves as aid in the review, the review might be also categorized as an expert review (Wilson 2014). For this heuristic evaluation the expert works with elderly on a daily basis assisting with hearing aids, and have published papers in the field of ageism, qualifying them as an intermediate communicator on behalf of elderly (Rogers, Sharp & Preece 2011).

**Effectiveness:** Is the product successful in producing intended result?

**Efficiency:** Is the product performing its tasks with ease? How much work is required to reach desired result?

**Safety:** Is the user at risk when using the product?

**Utility:** Is the user provided with the necessary functionalities to complete their task in their preferred way? Alternative tools provide more utility.

**Learnability:** How much time is required for learning to operate the product? Is it possible to use it without an introduction?

**Memorability:** Is the user forced to relearn the product when used infrequently, if so, is it easy to get back into again?

### 5.2.3 Review Structure

All the alternative designs are divided into screens of which the heuristic evaluation is oriented around. Each of the screens are reviewed individually. Meeting the usability goals is high priority for the prototype, though requirements and considering the based personas is just as important, the formative evaluation serves to ensure these are preserved and documented. As the design alternatives varies their approach to fulfilling the user's characteristics, the summary of a formative review is found in the end of the evaluation.

### 5.2.4 Heuristic Evaluation: Kretser

#### Screen: **Home**

The scrolling using the buttons on the bottom and top of the page feels according to the expert unintuitive, as the user would have to put the phone down to place fingers in the correct position, when the phone is laying down the scrolling function also increasingly easier.

The visual design of the application is pleasing in the eyes of the expert, with light colors and a thin framework centralizing each post. As there is little interaction on the home screen, the objects that are indeed interactable is easy to spot.

Writing a new post is very much like creating a new comment, simply adding text and/or media. The placing on the top of the page make it easy to spot and should have the same color every time for memorability.

The content and intentions behind the cogwheel are unknown for the expert, a description or an example of content could guide the expert into exploring options for the application. Users also might have troubles pressing wrong buttons, opening a new menu with many settings can be frightening.

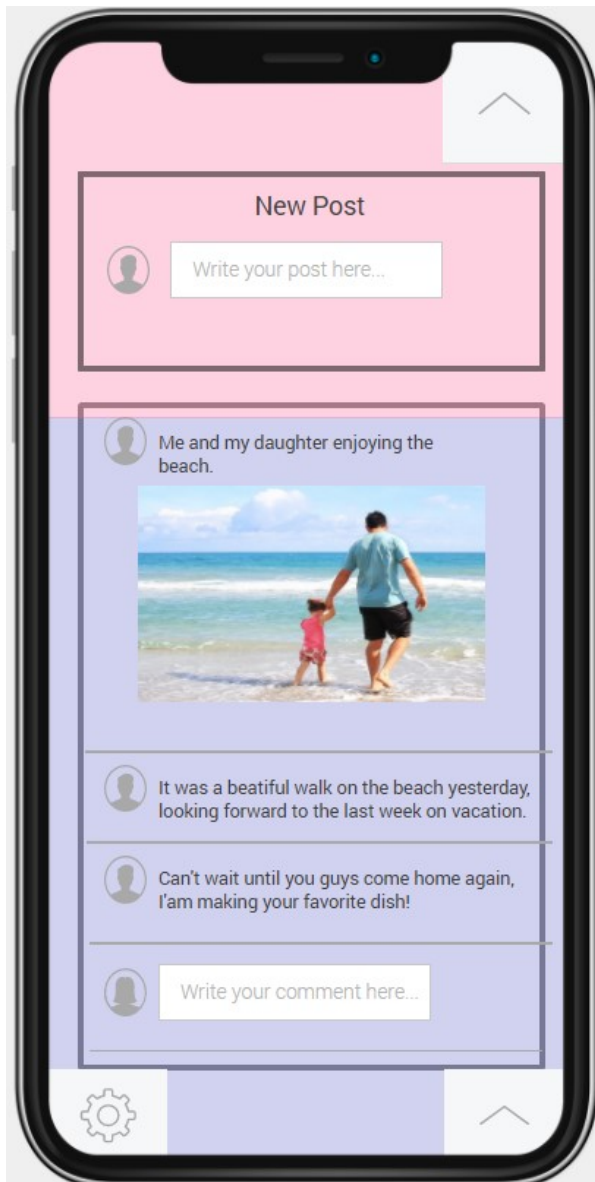


Figure 9: Kretser Home

### Screen: **Search**

The search for user screen would have to include a confirmation screen when accepting incoming and outgoing invitations. Also, an "already added" feature to avoid duplicates.

If there is an invitation the user does not want to add, a button to ignore the request and remove from the list of invitation is necessary as the list will naturally grow over time. Optionally blocking users.

Another potential problem is if the users contacts grow very large, their page would become less personal. Comments would be from unknown persons.

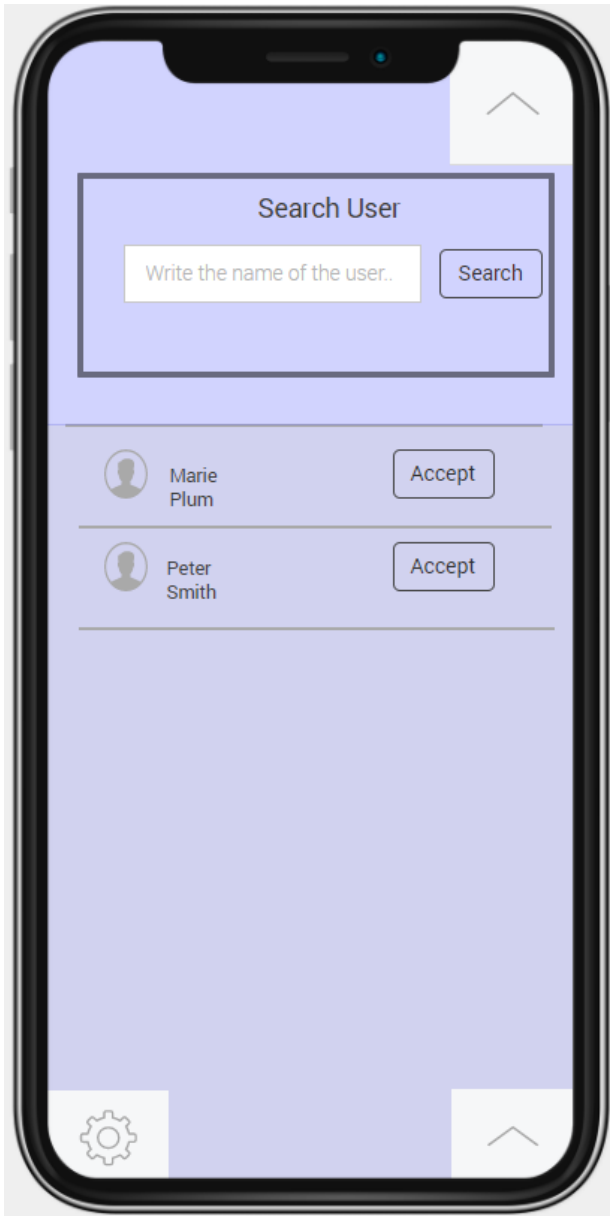


Figure 10: Kretser Search

#### 5.2.5 Formative Review: Kretser

The design alternative Kretser somewhat struggle to facilitate social interaction, the possibilities to update and communicate socially are present. Beyond the concept of responding and creating posts, there is nothing the design alternative do to encourage the user in actively participating in the activity.

#### 5.2.6 Heuristic Evaluation: Gallery

##### Screen: **Home**

First of is the coloring more pleasing for low lights viewing environment, the subtle contrast in shading is enough to make the posts distinct enough as there is little content and clutter in each post. Simple coloring of the emotions makes it easy to understand the

emotion behind the different reactions, without much knowledge in the use of the icons a user can understand their meaning.

The bookmarking functionality is the same icons for many other applications but carry little meaning for different user segments. Even using an android bookmark for an android software would not necessarily convey its proper functionality. A custom-made icon with a text would help.

Reacting in different emotions is rather limited, and the idea that it promotes communication in another tab can be confusing as it is redundant to the already existing contact list users have been creating contacts in. The functionality of importing the contact list into the application to create a network can be beneficial and saving the user in creating additional lists of contacts.

Saving and posting new pictures through an enclosed social circle also serving as a cloud-based gallery is an enticing idea to the expert, as the user get a common interest in sharing pictures with family and friends. It is also shared amongst devices, saving the troubles of managing devices and cloud settings.

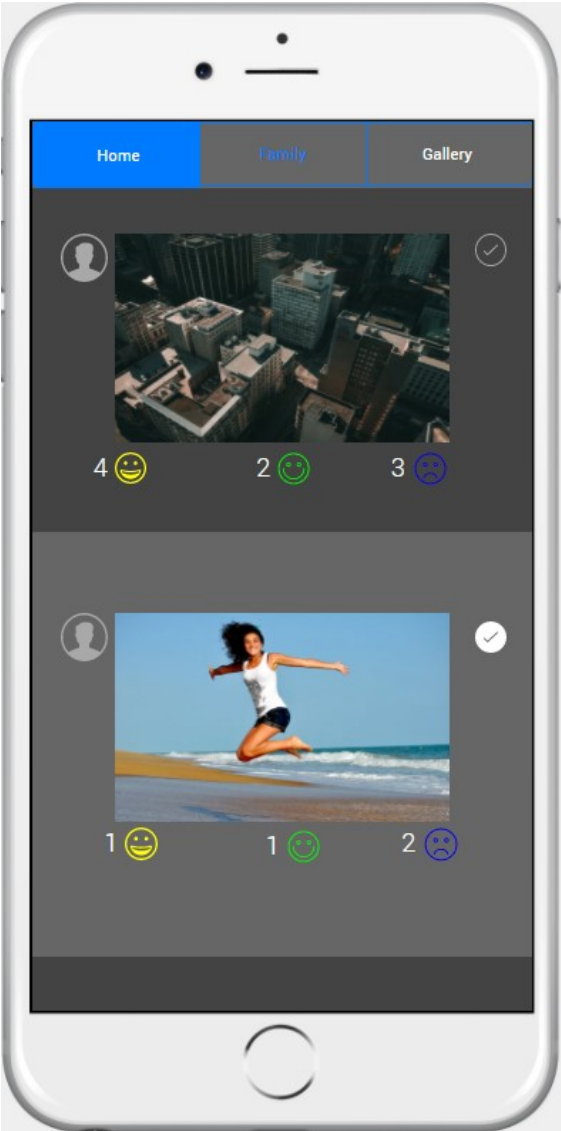


Figure 11: Gallery Home



## Screen: **Family**

Managing other contacts and creating new posts is much like the first alternative high on usability. Without too many options and buttons to interact with it become little room to do unintended actions. The intentions behind the list of contacts might be unclear to users, having a duplicate of the phonebook is also redundant for calling.

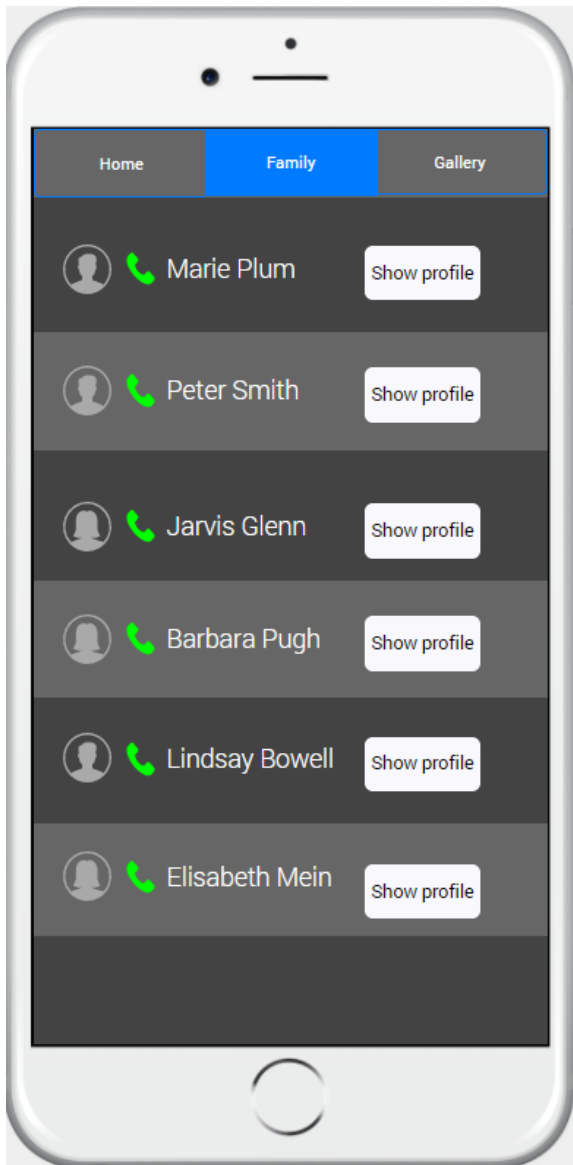


Figure 12: Gallery Family

## Screen: **Gallery**

Saving pictures long term and easily sharing them with different members on a public platform is great, several of the users was managing media on their phones, and in different instances lost older pictures due to new hardware.

### Formative Review

The design alternative is a simpler approach to communication, replacing the function of text with emoticons and the option to call users on the contact list. The gallery is an

incentive to users capturing pictures and sharing them with contacts, also functioning as a cloud-based album. The concept of creating a library of pictures would be great for based persona Gina.

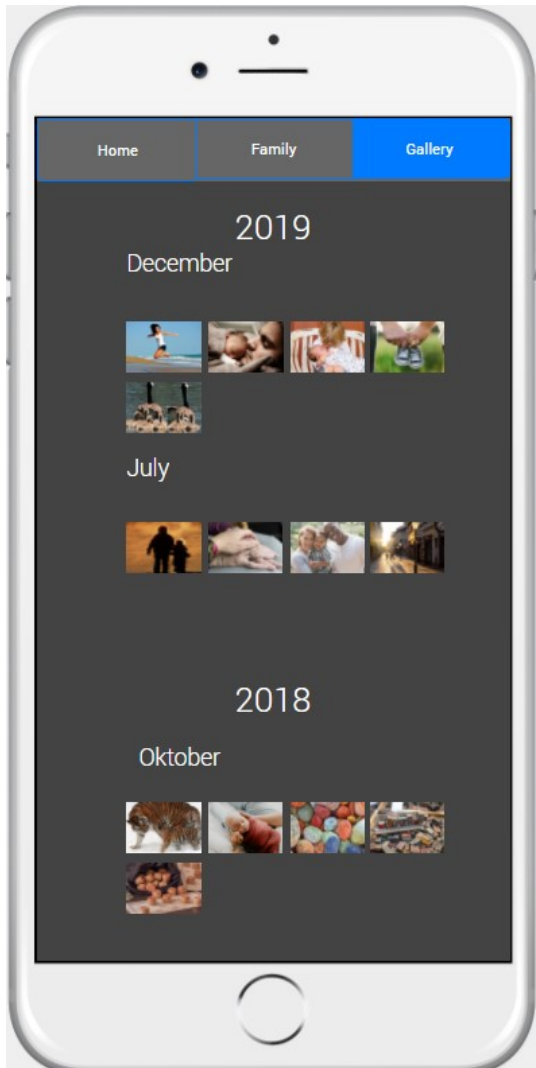


Figure 13: Gallery Library

### 5.2.7 Heuristic Evaluation: Calendar

#### Screen: **Calendar**

Communication is limited as the only communication is happening through the reply in attendance. As it might inspire physical attendance, it is little actual social communication within the application, serving more of a tool rather than recreational use.

The coloring in the first calendar is a common and modern format of planning. There is no way of telling which days invitations has been received.

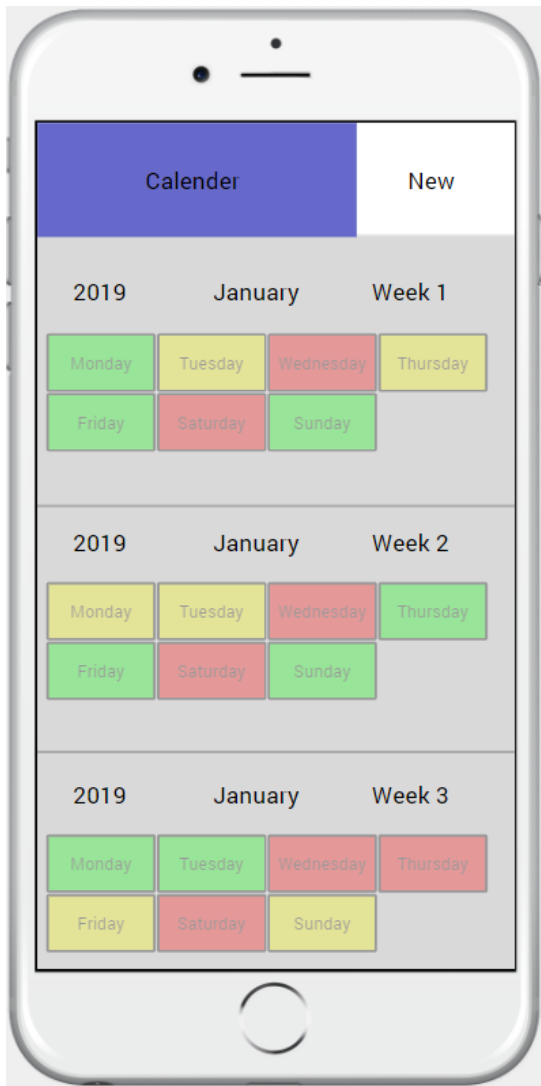


Figure 14: Calendar Home

Screen: **Date**

A visual queue to notify if the event is accepted or pending and dampening the saturation of the buttons as if the event is accepted the buttons serves less purpose, except if there has been change of plans.

The formatting of symbols in text is not working as intended.

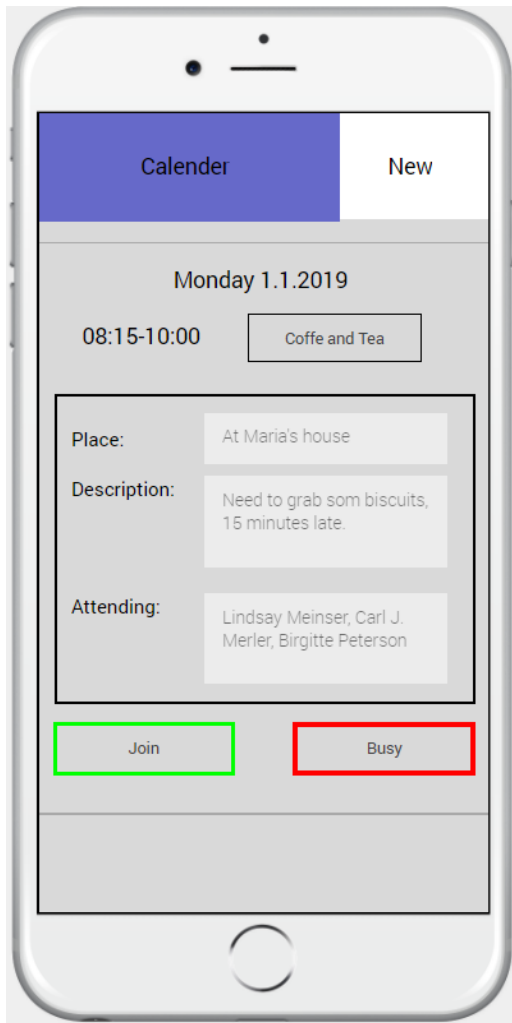


Figure 15: Calendar Date

#### Screen: **New**

The collection of time and date in a single function and selection frees up space for other content. Having an open attendance event, functionally equivalent to inviting everyone on the friends list. Inviting all on the list is visually more descriptive of what it is.

Creating new events to invite family over would probably be easier to do over phone, suggesting other times or plan specific details regarding an invitation is rather limited in a format like this.

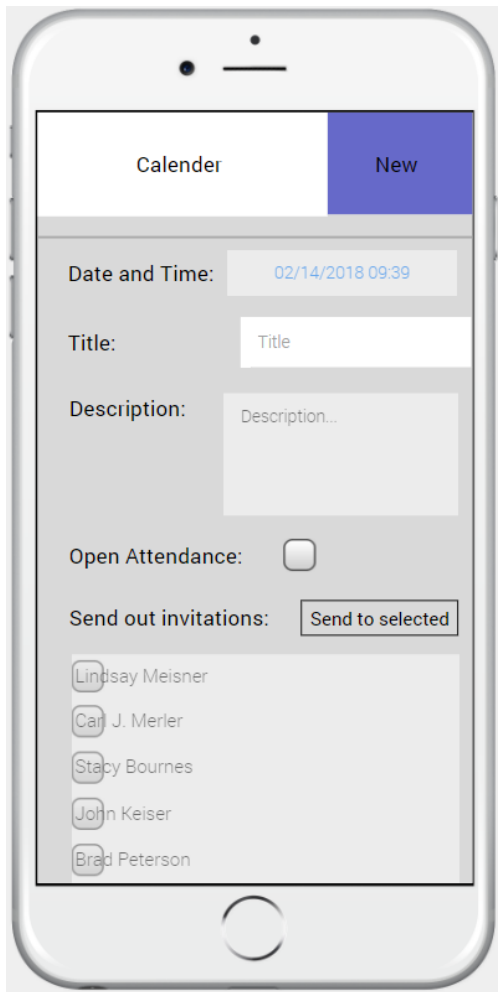


Figure 16: Calendar New

#### 5.2.8 Formative Review: Calendar

The calendar is a great way to simplify planning between users, the concept of increasing social activity through social planning is a good alternative, however the execution is poor as users would have to go through an form to set up an 1 hour visit. If there is no reply from other users, a phone call would be having to be made, and results in too much time investment for simple events.

## 5.3 Third Iteration

Three design alternatives has been progressed and reviewed in second iteration, for the third iteration of designs, the strengths from each of the design alternatives will be narrowed down to a singular prototype and cutting heuristics problems that were found in the evaluation. The potential for each of the alternatives has been explored, developing each alternative even more would be wasting time as they become less malleable with extended design and weaknesses in the design alternatives would ultimately be cut from the final design. Based on the design alternatives, a third iteration combining the best of each alternative.

### 5.3.1 Final prototype

The third iteration and final prototype starts with reviewing the formative evaluations of the design alternatives. The design alternatives have different solutions to achieving the requirements, and the reviews show in what regard their solutions accomplish this. The final prototype is the selection of the best solutions put together based on the formative evaluation. There is a varying extent of which the solution is able to be integrated into the design in an efficient manner, some redesign of the original solution is required, therefore the new design will not replicate the original design alternatives completely.

The problems identified in the heuristic's evaluation is based on the screens analyzed, which is subject to carry over to the last prototype. Therefore, the screens and its problems about usability is redesigned to avoid replicating the problems of the design alternatives. The new design is drawn from scratch on paper, working on the navigation and how the different functionalities would combine to form a single working system. The different problems of the design alternatives are addressed in appropriate progression of the new design, by the name of Connection.

### 5.3.2 Connection: Network screen

There were several problems that came from the feature of having contacts and friends, managing each instance of contact/friend is a set-up requiring many buttons and an extended interface. By the user's initiative they can join networks based on a unique ID, one action to connect with a select group of people. In the regard that users are not able to individually manage their contacts like in the previous design, in this decision increasing the design constraints prioritizing efficiency over utility. Also influencing this decision were the heuristic evaluation feedback regarding the cogwheel in *5.2.4 Heuristic Evaluation: Kretser*, removing the icon and integrating management of contacts into the design.

The design of the background to go with in the final prototype is the various color palette of the previous design alternative, a functionality to distinguish each of the posts is applied to relate to the groups of users (Social network) in the final prototype. Increasing the consistency of the design, as each post and network can easily be identified by their background color.

After implementing the network system, there was still needed to have a degree of settings to the networks. The functionality to leave and join networks led to the creation of a new screen where the user can both create and join a network.

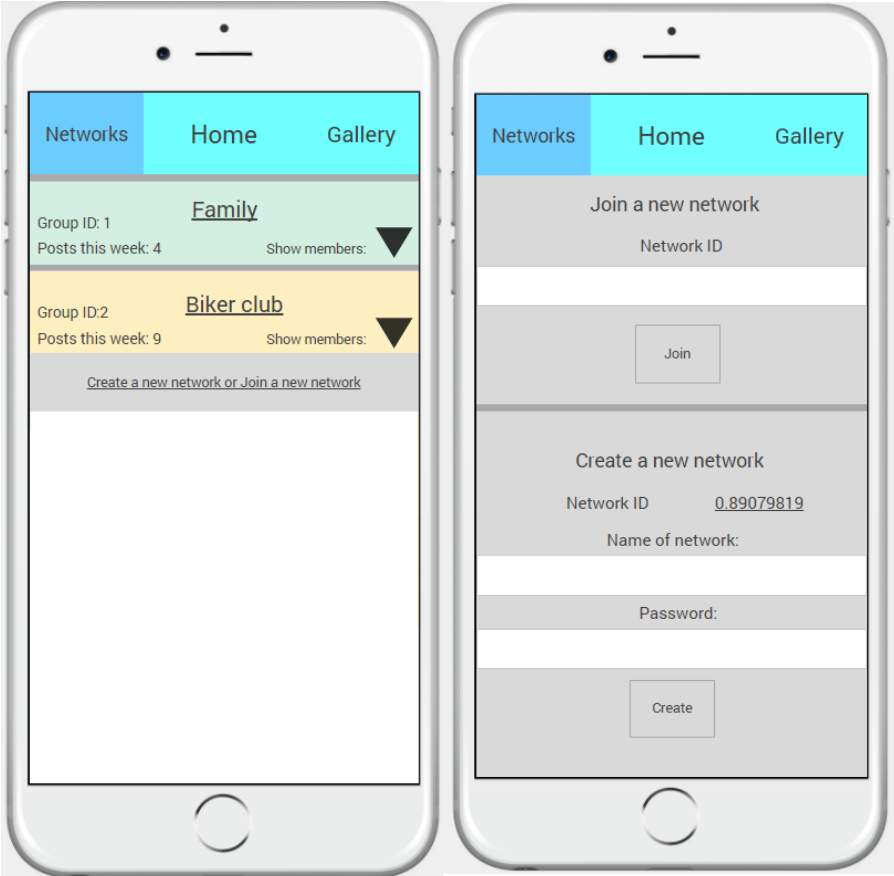


Figure 17: Connection Networks

Figure 18: Connection Network Settings

### 5.3.3 Connection: Home screen

The home screen is very much kept like the previous iteration Kretser with added details on the comments and posts, and a white field for each comment, as the background color may reduce readability. The profile icons are replaced with sample pictures, for higher fidelity. The comment section had a button added, a comment is now posted on the press of the button "Send". Making a new post had its color removed to avoid any confusion of which network it was posted to, attempting to improve consistency as the feedback acknowledged in *5.2.4 Heuristic Evaluation: Kretser*.



Figure 19: Connection Home



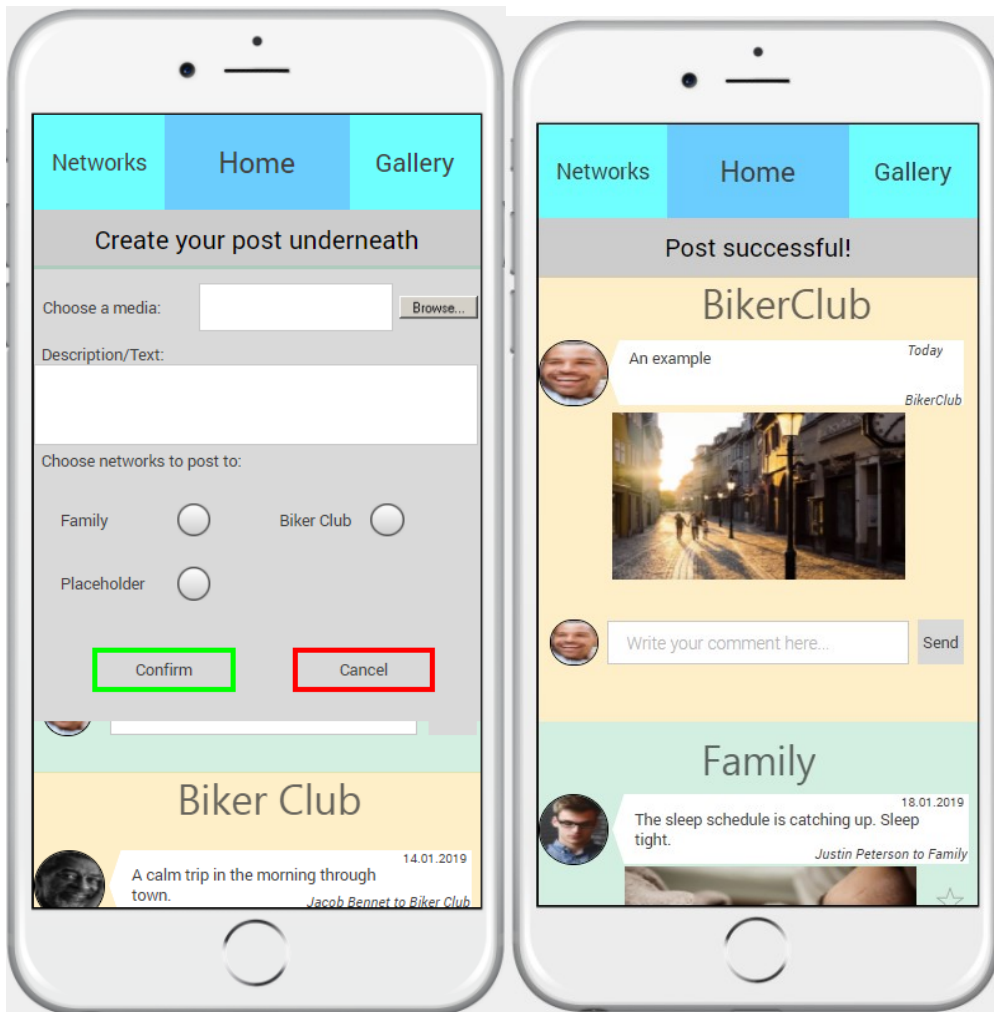


Figure 20: Connection Home New Post

Figure 21: Connection Home Post Success

#### 5.3.4 Connection: Gallery screen

The most likeness from previous iterations of the gallery design alternative we see the gallery library mostly untouched as it seemed to be intuitive and still very much remain consistent even though changes have been to other parts of the prototype. I kept the dark coloring based on the positive feedback of *5.2.6 Heuristic Evaluation: Gallery*, as there is no use to categorize by color in this screen, the dark background seems like the better alternative. Also, the icon picture for adding pictures to the gallery has been changed, as the star is a common icon to represent favoriting content.

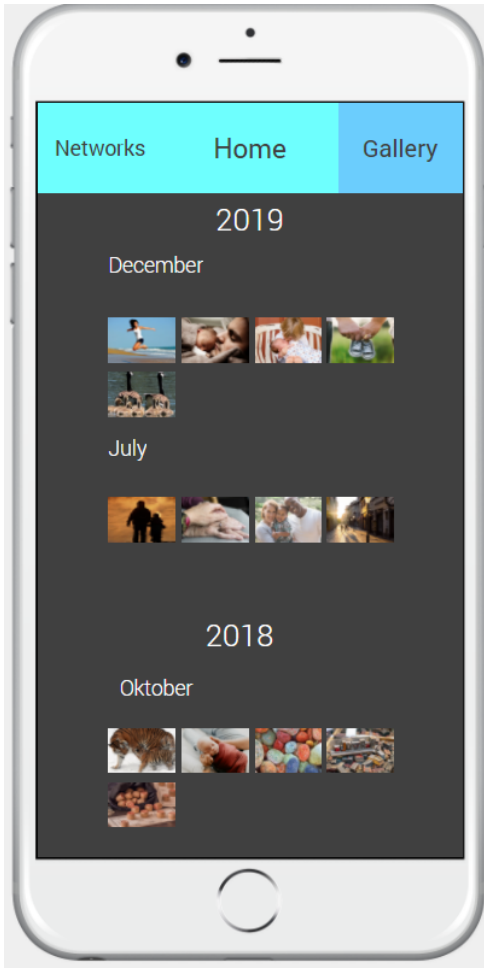


Figure 22: Connection Gallery

## 6 Results of final iteration

### 6.1 Design Case Studies

The design case studies select problems based on relative tasks of the users, looking on current solutions that exist on the market today, and describing the prototype's approach developed in this project in comparison. When looking at this project approach to the task of the case study, it will include the thought process behind the decisions that led its design. Any relative factors regarding the decision making of the design will be included in the description of the solution.

#### **Problem #1**

Facilitation of social interaction online in between a social network. User would like to use the application to have a social interaction online.

Alternative: WeCare

Oriented around family social communicating and meet-up. The application WeCare (2.5.1 WeCare) centers the family attention around a single user – the elderly. The other users serve the role as social caretakers regarding the application. The content that is posted on the platform is highly influenced by the user's activities, though it is also influenced by the platform capabilities. There are little facilitation of sharing stories or communicating beyond planning meetings.

Prototype: Connection

The prototype of this project is focused on establishing networks based on the affiliation of the user. Maintaining a personal interest in their communication, as the users of the network is confirmed to have a shared personal interest. A new post regarding a daily activity can be shared to one or several networks based on their affiliations. Families might not be interested in hobbies such as bicycling. Maybe it would yield more social interaction from a "bicycle club" as an example network.

#### **Problem #2**

Expanding and managing your social network online. User have talked with a friend which they would like to interact with online.

Alternative: KOMP

Much like the description of WeCare, KOMP is oriented around organizing the social network around the elderly. Receiving a message from a friend would require the friend to be a part of the user's network on the application. The elderly is not able to add another person to their network. That would require someone that already is part of the network to add the friend. They would have to make an account and get in contact with a family member that will approve their credentials. A barrier that are in place to ensure

the elderly is not able to add unwanted people in their network, potentially experienced as a hindrance in solving the problem.

Prototype: Connection

Connection intend to simplify organizing an online network. The networks in the prototype are designed to represent real life networks. Meeting people in real life often leads to an introduction to a person's social network, Connection attempt to replicate this as users added to a social network joins a social network online. The new friend would have to have the identification and password of the social network provided by the user to join their social network.

## 6.2 Answering Research Questions

### **What are older people's experiences with electronic application and utilities?**

Research plus personal reflection led to choosing the prototype being an application for smartphones. Choosing a platform that is convenient for designing prototypes for, due to alternatives for tools and utilities. It was partly my reasoning in the beginning *3.5 Designing for Elderly*. It was strengthened during the *10.1 Transcription of Interviews* as it became apparent that elderly themselves used smartphones but had several struggles with their usage. There is a large amount of elderly using smartphones as explored in *3.5 Designing for Elderly*. The platform is also highly accessible for the project as there exists specialized tools for developing a prototype for smartphones *4.4 Tools and Utilities*. The functionality of the technology is to connect the elderly socially to primarily their family and friends, including the benefit of connecting with new people which benefits are explained in *2.1 Social interaction and mental health* and *2.2 Teaching IT to elderly*.

### **How can new technology be designed to meet older people's need for social contact?**

The chapter *2. Research Field and Related Work* heavily focuses on establishing the relationship between social health issues and technological solutions, such as social media. Looking into the alternative solutions that is related. Such as the successes of alternative solutions in chapter *2.5.1 WeCare* and *2.5.2 KOMP* this project is inspired by their positive aspects. For instance, the social bond in families healthy influence on social health in *2.1 Social Interaction and Mental health*.

The prototype has gone through several iterations in *5 Prototype development* to ensure the concepts of the research are implemented in a successful manner. Early in the development the interview on the elderly center in *4.5 Interview* produced the foundation for the requirements to ensure the concepts fits the users' needs and habits. The *4.6 Based Personas* incorporated user characteristics regarding social habits and needs derived from *4.5 Interview*, furthermore, condensed early in the process before first iteration in *4.7.2 Non-Functional Requirements*. *5.2.1 Formative Evaluation* focused on designing for social contact, an important resource for decision making during the development of *5.3 Third Iteration*.

## 7. Discussion

### 7.1 Discussion on Theoretical Framework

Many elderly people enjoy independent and fulfilled lives despite reduced health and poor mobility. Through the last decades, home adaptations and technical installations has been offered to elderly living in their homes. The purpose has been to require help and support necessary to live safely and securely at home throughout a lifespan. This technical equipment is provided through NAV Hjelpemiddelsentral, and free of charge for all citizen in Norway. The rich variety/assortment of technical equipment available are mainly directed vision and hearing impairment, cognitive impairment, and reduced mobility. This will facilitate independence and self-reliance when age leads to physical and cognitive impairment, and sensory loss. As most people will experience when reaching high age. Even if technical equipment and support are important in everyday life, it does not necessarily involve and promote the participation of other people. Social contact is important for quality of life. By making use of a platform that is currently used by the population at large, one can achieve and optimize a platform for social interaction. This is where the current digital prototype platform has its justification and meets a need.

Elderly people are often referred to as being a homogeneous group. They are not. Given that people develop differently over the years, their references, knowledge, experiences, and interests also differ. Consequently, it might be greater differences between people between 60 and 100 years than people between 1 and 40 years. And we would not assume that people between 1-40 years have the same kind of needs, would we? Age is not sufficient to determine people's skills and preferences. Therefore, the development of technological solutions must be based on different functional levels. There must be flexible solutions that can be adapted to user's needs. It must be considered that many seniors will probably not have the same technical insight into technological solutions as younger people have. They might not have achieved and adapted to IT competence through growing up, education and working life. This makes their experiences inadequate. Additionally, they have more difficulties to adapt to the rapid changes that are constantly evolving in the technological field. Development of this digital platform has considered the different preconditions of the elderly.

### 7.2 Methods Discussion

#### 7.2.1 Interview Discussion

The interviews were performed in an elderly center, during the visit there was an IT learning class available for elderly to participate in. At the elderly center that day it is safe to assume that it was a larger representation of elderly interested in using phones and computers. It is possible that this subconsciously affected my observations of the elderly and their technological capabilities, it is important for the data that all types of users are represented in the thesis. This partly affected who was interviewed as I intended to include elderly that had participated in the IT class, and those who were there on a regular visit.

The raw data produced during the interviews are interviewees notes, that were detailed further procedurally after completing each interview. Recording by video or voice would in this case provide a better documentation of the interviews in general, as those

methods of capturing raw data is arguably more objective in nature. Writing notes are subject to be influenced by my interpretation or bias when transcribed to notes.

The unstructured interview method allowed me as interviewer to explore the reasoning behind answers given, minimizing potential error in interpreting answers. To enrich the interview experience if the answers were short, the participant were inquired to show how they performed different tasks, this worked well for the older participants to make detail their answers further (Rogers, Sharp & Preece, 2011). This also allowed me as interviewer to confirm my understanding of the replies.

In the last interview *10.1.3 Third Interview* answers were short and quick; the participant did not seem interested in explaining further even though follow-up question were asked and did not show interest in exploring issues using a phone. When the issue of security of personal information, the participant had a lot to talk about. During the interview I knew the participant had a bus to catch at later point, which might have occupied their thoughts even though they were initially showed interest in participating and agreed on the length of the interview.

It became clear that performing the interview as an unstructured interview. The format is more alike a normal conversation made the participants more at ease. Revealing characteristics through stories, in contrast to the short answers given when asked the initial questions. The participants that had the opportunity to get to know me prior to performing the interview, had much longer replies and made a clear attempt to provide examples. This became a crucial insight into the daily life and context of their daily social habits, providing me with an understanding of *1.2 Research Questions: Interaction and Social Networks*, beyond and complementary to reading statistics/research articles.

Lastly is the concern of upholding anonymity of participants in the interviews performed in this thesis. By not using recording software to log the interviews and transcribing the interviews, simply by handwritten notes during and after the interviews. I as interviewer have a responsibility of making sure their answers could not be traced back and identify participants. Based Personas were helpful in simplifying referring to the participants into condensed user characteristics (Rogers, Sharp & Preece, 2011).

### *7.2.2 Formative Evaluation Discussion*

The first method used to review the design alternatives during the development process was a formative evaluation. It considers how the design incorporate requirements and based personas. At the stage of the second iteration, the design alternatives had the fidelity to be able to communicate the use of its basic functions. It might have been a missed opportunity to not include users at this stage of the process. Alternatively, I could have used a method such as an interview with the prototype as an artefact, or a controlled experiment where user was given a task to complete within the design. The decision boiled down to I pushing to continue with the development, choosing formative evaluation. A method that require little resources to perform.

Many of my personal expectations of the user were refuted during the interview. This might have been replicated if another method with user involvement was performed instead, potentially missing influence on the design alternatives.

### 7.2.3 Heuristic Evaluation Discussion

The second method performed after the development of the second iteration tests the usability guided by a list of heuristics, performed by an expert that has experience from working with the users. The expert might have a good understanding of the user, their challenges, and behaviors. Feedback is however to a degree dependent on understanding the concept of heuristics, during the evaluation the expert seemed to understand the activity, but not experienced specifically in interaction design or usability testing. Potentially lessening the quality of feedback provided. On the other hand, it might influence the feedback to be more genuine and not replying what I as an author would like to hear, only based on their user expertise.

### 7.3 User Centered Design Process Discussion

Choosing UCD as the framework to layout the process and approach of the development seemed fitting as the theory had a clear intention of who the user was going to be. The current and coming social health situation for elderly have been thoroughly examined (1.3 Justification, Motivation and Benefits). A clear definition of the user behavior is important to define introductory in the UCD process; Parameters such as cognitive, behavioral, anthropomorphic, attitudinal characteristics define the user (Rogers, Sharp & Preece, 2011). Introductory the definition the elderly in general might be a broad definition, however in the nature of the prototype, broadness and inclusiveness is a that exact goal (Economic and Social Research Council, 2019). Designing for a narrow user segment of the elderly were my first intentions, those who were isolated at home and lacked social network. Throughout the design process, it became clear that not only is it counterintuitive to design a social application for elderly while potentially limiting the social network, but elderly would like to socialize with people of other ages as well. Ideally people of all ages would like to use the prototype, even though the usability is for elderly. The goal should be to facilitate socializing between elderly, a preventative measure - nurturing existing social networks *2.1 Social Interaction and Mental Health*. Towards the end, it influenced the final iteration as I moved away from second iteration Calendar, rather to design a good experience for all users in an elderly's social network.

The completion of the interviews marks the beginning of the development, establishing requirements and based personas was the first steps. Performing the interview early on in the process became obvious after the fact that it was highly beneficial, inspiring and an eye-opening experience in regard to expectations of what the user was capable of, expanding on my understanding of the user characteristics. Introducing an empirical impact early in the beginning of the UCD process *3.1.2 Empirical Measurement*.

Next step was to develop design alternatives. There is a vast amount of social applications to draw inspiration and technologies from. Designing a unique solution was for me personally hard due to it being seemingly an abundance of available applications for social communication. Even though it might be a creative achievement to innovate an entirely new concept, the first conceptual designs for this thesis should be plain to see are like current products on the market. Even though I intentionally attempted in several designs to deviate from the stereotypical interface of a social platform, realizing it is not strictly necessary or a realistic personal goal. Optionally, I can expand/modify existing designs (Rogers, Sharp & Preece, 2011).

This was also made clearer after the interviews that the elderly already has a well-established interaction with digital social communication on a regular basis. It is not necessary to fix something that is not broken. Even though the functionalities were highly regarded by the user, there were several issues raised by the user, implying there was room for improvement at least for them as individuals.

The first iterations were all sketched out many times before they went into the wireframes. This was to decide on unique conceptual designs for each of the design alternatives. Sketching the conceptual designs on paper allowed for rapid development of several different ideas, culminating into three wireframes in Balsamiq. The design alternatives made in Balsamiq was this point simply a barebone interface of the functionality of the technologies. Doing a poor job of communicating the concept *4.1 Low-Fidelity* a simple description of the intention of the design accompanied the illustrations, ending the first iterations in a summary of current thoughts on development. Balsamiq was sufficient in supplying the designs with a personal understanding of concepts and fidelity of a low-fidelity stage.

Second iteration required another tool to design higher fidelity iterations. Learning Justinmind Prototyper at this point in the process felt natural as a beginner's experience were able to cover the required fidelity. The second iteration of design alternatives progressed to detail a further number of functionalities than the conceptual designs, an intermediate stage for the third iteration of practical design. The second iteration were able to communicate intractability and its own unique approach to already familiar technologies, according to the heuristic evaluations. However, the heuristic evaluations still revealed several usability issues with the design. The higher fidelity iteration presented some issues during the evaluation such as errors in the functionality of the design, and the limited interaction was unexpected to the evaluator. Even though the limits of the design alternatives interaction were declared with the evaluator prior to the activity, it seemed to be disruptive, as it became a usability issue for the evaluator rather than a result of an incomplete prototype.

The intentions of having a formative review in addition to the heuristic evaluation was to connect the social issues of the second research question, as the heuristic evaluation covers the concern for the first research question of usability. The formative review provided an ongoing feedback of the designs in concern of the previously raised social issues *2.1 Social Interaction and Mental Health*. In their own approach the designs seemed to me as an evaluator to improve social communication, resulting in a facilitation of social health.

The second iterations of design alternatives were also the first step of the iterative process. Revisions of the first design alternatives were made to the interface, progressively more impactful changes were made for the third iteration, moving to the highest fidelity of the prototype. The third and final iteration of the prototype put the functionalities of Justinmind Prototyper to the test, as it became apparent that its functionality were at its limits. A time-consuming effort compared to the other iterations; the result of the final iteration was able to include the evaluations desired level of intractability into the prototypes functions. Working iteratively throughout development worked well with the feedbacks, as it provided new insight into my design choices, affecting how I used *3.3 User Experience Goals* and *3.4 Design Principles*.

The third iteration used the evaluation of the second iterations design alternatives, merging in a single design. Where the optimal parts of each design were included to the



degree it was practical. Second design alternative; Calendar, where cut due to it being too many functions included on the platform *10.1.2 Second Interview*. Making any conclusive claims regarding if this final iteration completes the UCD process is challenging, as it lacks a summative evaluation of the usability. The Design Case Studies puts the prototype into perspective how it has a unique approach to traditional social platforms, though actual user feedback of the final iteration would be preferable.

## 8 Conclusion

### 8.1 Challenges

Development are based on a sample of elderlies' current level of technological understanding. The next generations will potentially have a better understanding of technology, as the use of smartphones in the elderly segment are rising. The adult generation ageing, transitioning to who we know as elderly, use smartphones in a larger degree. Potentially obscuring the reasoning behind design choices made in this thesis, the next generation of elders will have probably had different relationship to smartphones, as their usage of smartphones are larger (SSB, 2020).

It is safe to state that involving experts and users to a larger degree in this thesis would be beneficial and a potential positive influence on the design choices (Cheng and Mustafa, 2014). Even though feedback could be challenging, or perhaps even impossible to solve within limited time, it still gives an important insight to the user segment, which is important to document and discuss.

A potential challenge worth mentioning is that the covid-19 pandemic did not impede with completing this thesis. Luckily, the methods requiring involvement of elderly were concluded. Intentions were to include elderly in the summative methods of the results, as a substitute a non-user method were chosen.

### 8.2 Opportunities

The result of this thesis is a documented process of development of a digitally interactive prototype specialized for the elderly. This could potentially contribute to improve social contact and participation in the elderly and connect people across generations. We know that there is a growing need for technological solution that will make it easier for elderly to socialize, and to prevent social isolation and loneliness.

I would be pleased if the documentation and content of the thesis are an opportunity for others to draw inspiration from. The need for technological solutions adapted to the elderly will raise in the future. I personally would be interested in a development of the final prototype. In Norway exists several entrepreneurial organizations that provide resources for ideas such as this. The next step is to explore these opportunities.

### 8.3 Conclusion

Firstly, will the results produced by the thesis be summarized according to *2.5 Planned Contributions*. The list defines the practical work done in this thesis; in this chapter we will see what fulfills these contributions. Moreover *6.1 design case studies* display how these results can be utilized in a real-world situation.

- Documented work on a digital prototype designed for elderly

This thesis serves as proof of a documentation of development on a digital prototype. Accompanied by pictures throughout in *5. Prototype Development*, and in *10.3 Additional Final Prototype Screens*. In *6.2 Answering Research Questions* it describes how it were especially designed for elderly.

- Provide an assistive tool for social contact for the elderly

Several methods throughout ensure that the product are an assistive tool for elderly, with basis of the 4.5 *Interview* and the several heuristic evaluations, the prototype is designed to facilitate social contact for elderly.

- Increasing awareness regarding elderly care in the field of interaction design

With the publication of this thesis to the database NTNUopen, this thesis hopefully provides a contribution to the field of "successful ageing" (Bailey et al 2019). I would be pleased if this could inspire other researcher and students to develop functional solutions for the elderly in the future.

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## 10 Appendix

### 10.1 Transcription of Interviews

The notes are a condensed version of the answers during the interviews. Questions and framework of the interviews differs between each interview, which is the reason to a loose structure of the notes. (4.5.1 Unstructured interviews)

#### 10.1.1 First Interview

First answer:

Depends on what the situation calls for, if the purpose of messaging were not a time-sensitive matter and could be condensed into around 50 words length, I will usually simply text and wait for response later. Calling and receiving calls are also an efficient way of communicating where the subject matter required a response at the time of calling, where the calls does not last long. I also have longer phone calls to friends and family that are more recreational in nature as they are to catch up on what has been happening in their lives since last time we have talked. Texting and calling are both done daily. For the longer phone calls, I prefer to be able to allocate some time for a longer conversation, and shorter ones happen more on the fly while I am preoccupied with other activities at the same time.

Second answer:

I have lately been using the phone to administer personal banking, such as paying bills and investigate spending, using the dedicated bank application. I began learning about paying bills online from friends, though had some challenges in understanding how. (She proceeds to tell the story of how she went to the post office to learn from them how, as they were locally available) After some time using the application on my own I got the hang of it. Now I have a better understanding of using applications on my smartphone and the computer.

Third answer:

Mostly use the base functions of the phone such as messaging and calling; however, I have been learning more about other applications and uses with time. It was hard in the beginning as it were a new concept to me. After trying on my own several times, it has become second nature to me. I have been learning from other people of my family and they have been teaching me. Teaching have been in my experience easy as they have been quick to learn, my husband which are at my age and the younger family members.

Fourth answer:

It has remained the same mostly. The internet provider Get have been pushing me to provide an email address, which I do not wish to give them. I do not like the fact that I must provide them with personal information.

Fifth answer:

Mostly the battery time of my phone is such a short duration, as I am almost required to charge it daily. I charge my phone every night, so the battery does not deplete during the day.

Sixth answer:



At this point I find using a phone in general is necessary to uphold my social network to some degree, I do meet people and find this to be the most social encounter compared to digitally. I find there is some problems in typing on the phone, especially in correcting and editing the text. I must focus on typing out my messages and do like writing longer texts as well as larger ones. I am very positive in the technological possibilities smartphones provide such as them being web based, potentially resulting in me saving money on phone bills.

#### 10.1.2 Second Interview

First answer:

I talk with people on a regular basis and are open to speak with people for a longer duration if I find pleasurable. I only use messaging for short messages, as I find it more as a practical application.

Second answer:

I have a Facebook account where I were introduced to the social platforms, now I only use it for non-personal messages. I read some of the posts others have, but do not interact much with it as it is not personally interesting. I also find it riddled with advertisements and superficial content.

Third answer:

Do not use the tools available through applications, because I have not taken the time out of the day to learn how to. Do see the value in using applications such as ruter.no to check transportation options and arrivals. Wish to learn more. Started with using the base applications such as messaging and calling, as there were so many other uses, I have started to learn more with time.

Fourth answer:

Actively try to learn more regarding using the different tools that are available on social media. At this point I simply know of some of the functions such as the chat and creating events, though my experience is limited. When I comes to communicating online, I usually wish to talk to one person at a time, I do not enjoy the idea of speaking to a public crowd of readers.

Fifth answer:

I have some troubles when I use my phone, as it sometimes registers my presses two times. Find it to some degree an annoyance to use. Personally, I love to read about that which interest me both online and in books.

#### 10.1.3 Third Interview

First answer:

Started using the phone for the social applications such as messaging and calling, it has become a more practical tool to relay messages. I use it daily, though I try to not be indulged too much in it. I am busy person.

Second answer:

I do not usually use applications on my phone, sometimes I do use the popular applications such as router and messaging. I do not use the phone to chit-chat about my day to others.

Third answer:

Was not hard to learn how to use the different applications, I have a good understanding.

Fourth answer:

I started using social applications such as Facebook, though it stops there. I do not use my real name on it as I am conscious about computer safety and personal information. Those I do communicate with online know that it is me they are talking to; it is not necessary to provide more information.

Fifth answer:

I read in the news a lot about personal information being used as material sold to companies to make personal adverts, so I keep my online profile to bare minimum.

Sixth answer:

I do not use my phone for social contact, it is simply a tool for me to communicate regarding plans and other activities.

## 10.2 Interview Guide

Interview goals:

- What applications do elderly use to socialize on their phone?
- What are the user challenges for elderly operating a phone?
- What kind of social relations does elderly have through their phone?

Interview information:

- Anonymous information, no trail of identifying information regarding participants.
- Informal interview, feel free to further explore questions and talk about related experiences.

Intro:

Elderly living at home increases, products supporting a living at home situation both in health and supportive measures making this a more viable option for many. This project aims to create a social application for elderly to communicate with friends and family through phone and tablet. This interview aims to explore user experience.

Electronic social interaction

1.

How do you usually contact others? mail, phone, message

Do you write/talk a lot when you firstly communicate, or short and dense?

How often to you usually speak/write using your phone?

2.

What kind of applications and utilities do you use on your phone? What for do you use communication applications for?

3.

How did you get started in using internet for communication? Was it hard?

Have you ever tried teaching others?

4.

How is your experience and interaction with social applications changed over time?

5.

What is some of your concerns/challenges with using your phone?

6.

How is the smartphone in your experience? (Digital interfaces)

#### Idea exploration and feedback

1.

What kind of experience do you have with forums and internal social groups?

2.

Hvilke funksjoner fra dagens sosiale applikasjoner er interessante eller noe du bruker?

3.

#### Cool-off

1.

Is there something you would like to add to the interview?

2.

Is there any questions or topics you would like to talk or ask about?

10.3 Additional Final Prototype Screens

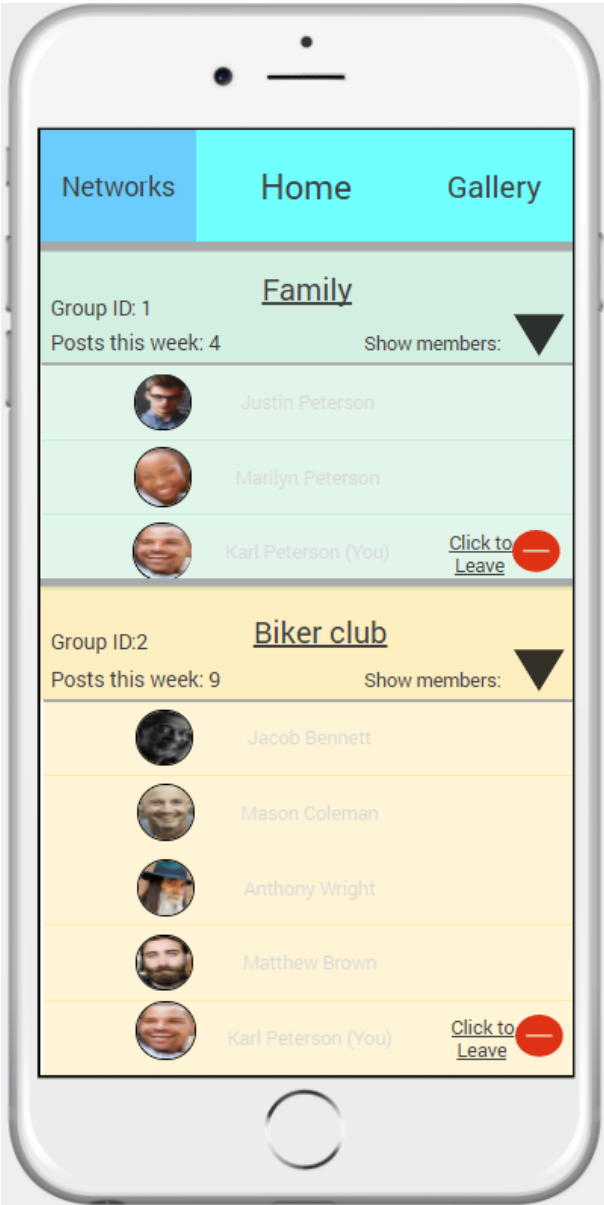


Figure 23: Open Menu

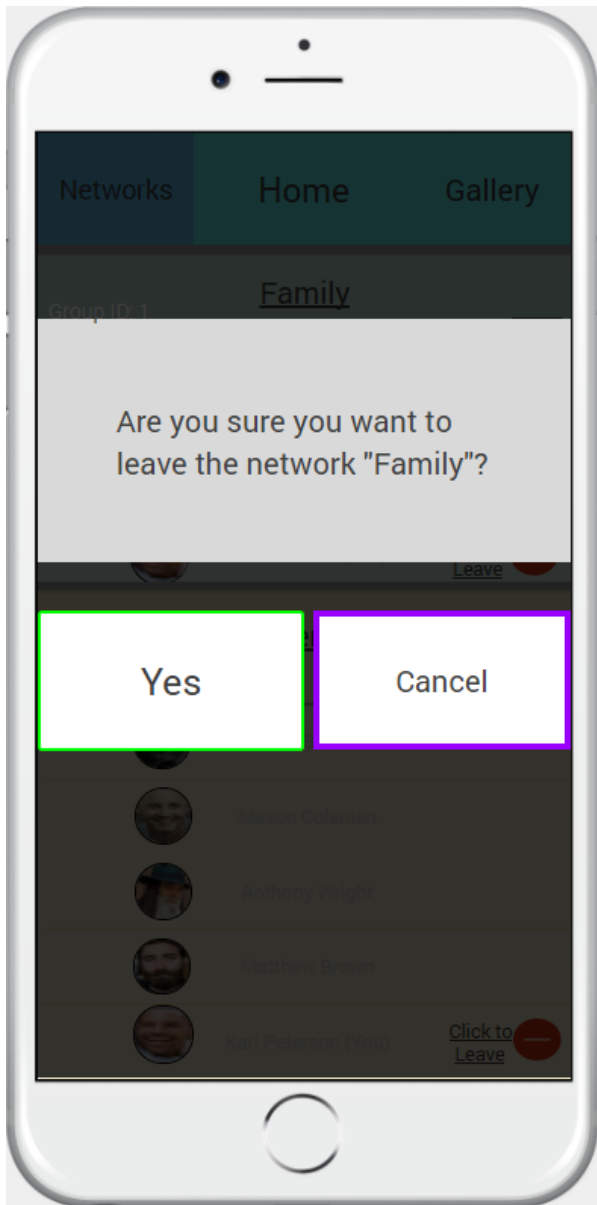


Figure 24: Leaving Family

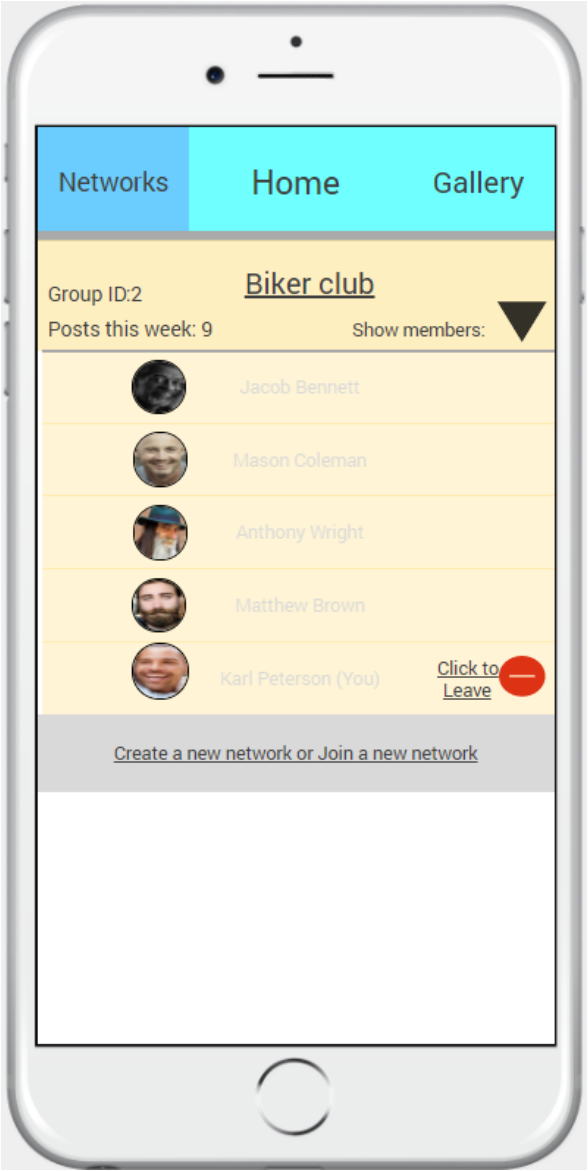


Figure 25: Left Family

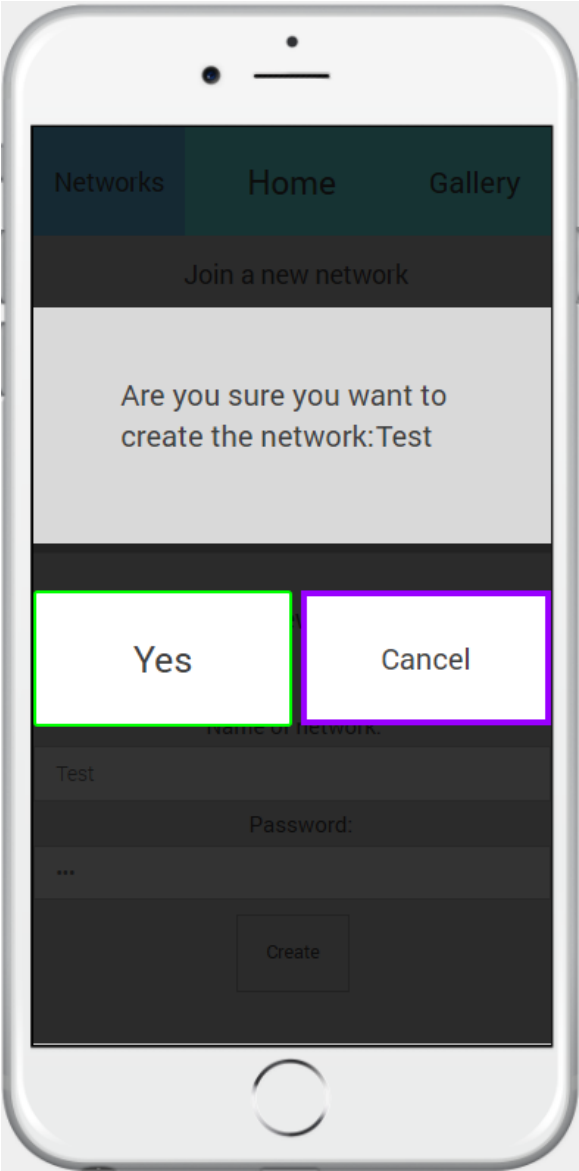


Figure 26:Joining Test



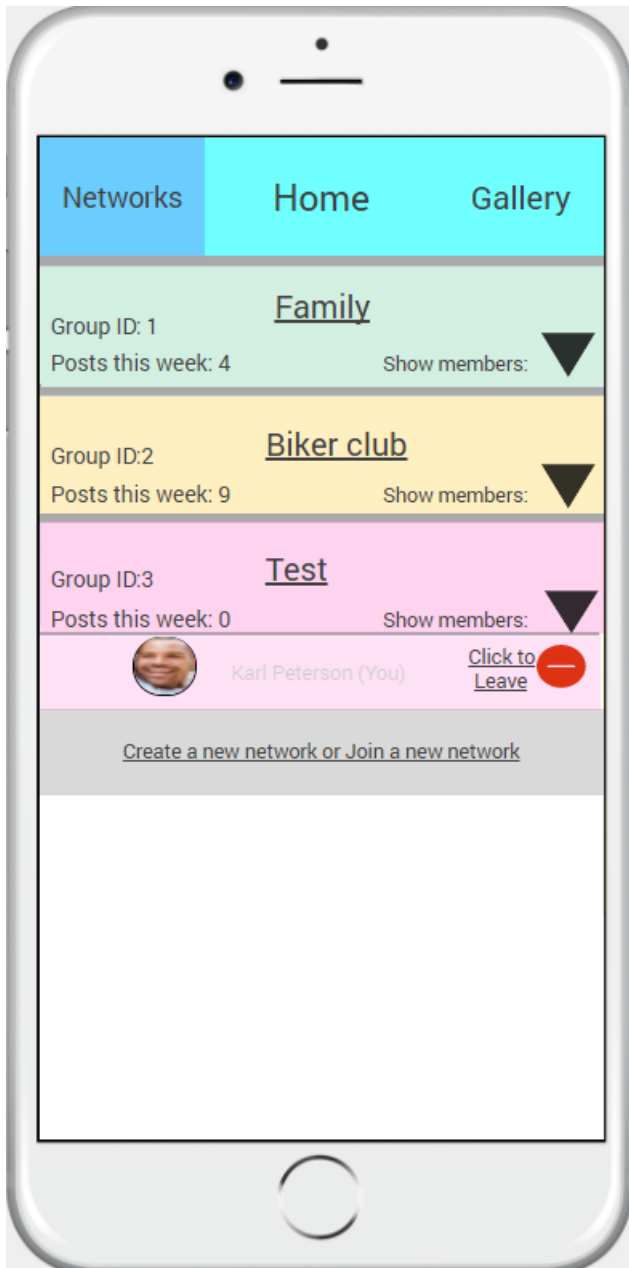


Figure 27:Joined Test

