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Föregående

Nästa

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Tryck på den här symbolen för att få en förklaring av funktionaliteten.

# Designing for Continued Use of Digital Interfaces

Guidelines for Designing a Selection Mechanism Used in a Multi-Layered Interface to Aid Continued Use of Digital Interfaces Targeting Digital Seniors

Master's thesis in Computer science and engineering

Rebecca Finne and Lisa Larsson



MASTER'S THESIS 2020

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Guidelines for Designing a Selection Mechanism Used in a  
Multi-Layered Interface to Aid Continued Use of Digital Interfaces  
Targeting Digital Seniors

Rebecca Finne and Lisa Larsson



UNIVERSITY OF  
GOTHENBURG

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Gothenburg, Sweden 2020

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Cover: Example screen from the final prototype.

Typeset in L<sup>A</sup>T<sub>E</sub>X  
Gothenburg, Sweden 2020



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## Abstract

Technology is more and more becoming part of today's society and having a digital device and access to the internet is today a requirement to not be excluded from society. However, using a digital product is not as easy when growing older since physical and cognitive skills are decreasing with age. To help older adults continue using their social media a research group has started a project where they are exploring the possibility of using a technique called multi-layered design. This technique divides the functionality of an interface into different layers making it possible to remove unnecessary features for certain users and by that make an interface easier to use.

As a part of this project, we have researched how to best implement a selection mechanism that decides which layer in the multi-layered design is best suited for each user. The final result has been found by conducting interviews, researching literature, and creating a questionnaire. A final prototype with seven functionality groups containing layers was created and tested. The prototype is a wizard where the user answers questions and depending on their answers they get a customized Facebook interface. The user tests showed that the participants liked the concept and they said that they were likely to use something similar if it were to be implemented by Facebook.

Based on the findings from the user tests, eight guidelines were created. These can be seen as guidance when designing a selection mechanism for multi-layered interfaces to help digital seniors to continue to use a computer program.

However, further testing by a long-term study is needed to see how the seniors would interact with the prototype in the wild and how their reactions to the layers are when having a chance to use Facebook as they usually do.

Keywords: multi-layered interface, digital seniors, adaptable interface, selection mechanism, Facebook.



## Acknowledgements

We would like to thank the digital seniors research group who has helped us greatly by giving us access to their research and by implementing our design of the prototype.

Secondly, we also want to thank all of the amazing seniors that have participated in the interviews, user tests, and answered the questionnaire. It has been truly interesting to listen to all of your stories.

We also like to thank Lisa Holtz, Peter Lindblom, and Åsa Dahlgren who have helped us come in contact with seniors and provided us with a room to conduct the interviews.

Finally, we would like to thank our supervisor Olof Torgersson for providing his expertise and support throughout the process.

Rebecca Finne, Gothenburg, June 2020

Lisa Larsson, Gothenburg, June 2020



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# 1

## Introduction

Technology and social media is an important part of today's society as more and more things become digital. If a person cannot access the internet, that increases the risk of being excluded from society [7]. For example, a lot of advertisements on television, radio, and newspaper refer the audience to see more information on their website, but what if some from the audience do not have access to the internet? These people are excluded from that information. Moreover, it is also common that banks, for example, are offering exclusive services online and some are even taking an extra fee for performing the service offline. With this in mind, it is very important to make sure all members of society can use and have access to this technology.

The development of technology has been going on for a long time and as the personal computer has been around for about 35 years, a lot of early adopters to computers are getting old. These early adopters will be called *digital seniors* from now on. When aging, several physical and cognitive skills decrease, for example, the fine motor-skills [8]. On top of the decreased skills, older people might also suffer from age-related diseases such as strokes or dementia, which decreases the person's cognitive and/or physical skills even more. This can create problems for digital seniors when interacting with digital interfaces, such as computers, tablets, and smartphones [8]. It also results in a longer completion time when performing tasks than younger users [9] and it is more likely that they become frustrated when they cannot use their computer as they always have done.

It is known that social interactions are important for older adults to avoid a cognitive decline and it has also been indicated that technology use and especially social media use gives similar cognitive benefit as face to face social interactions [10]. So, having an older person use technology and social media can help them maintain their cognitive skills while aging.

There is a technique to gradually teach users how to use a system by beginning with an interface with basic functionality and then introducing new functionality over-time. This technique is called multi-layered (ML) interfaces and has been proven successful in on-boarding elders to software systems and reduce their task performance time [9]. The use of ML interfaces is beneficial for the user since they can learn the system at their own pace and spend time at a layer as long as they want.

A research group at Chalmers University of Technology and the University of Gothenburg is currently investigating how ML interfaces can be used by digital seniors to

help them continue to use their social media. The idea behind their research is to create layers, by applying the idea of ML interfaces in a reversed way, to make it possible to scale down functionality for users who do not utilize everything and thereby make the interface less cluttered. This thesis is in collaboration with this research group, which from now on will be called *the digital seniors research group*.

### 1.1 Problem Description

There is a big cognitive benefit with social interactions, both face-to-face and online, and at the same time, as they grow older, a lot of digital seniors are getting trouble using digital devices that can help them carry on with social interactions. To help older adults continue using social media, the digital seniors research group believes that ML interfaces can help to remove unnecessary features and therefore make it less cluttered and easier to use.

One subject that is discussed within ML interfaces is how to change layer in a good way. Some suggest an adaptive design where the interface changes itself without the involvement of the user, but this has the downside of users being confused by the changing interface and even if prompted with the change users find it distracting [1]. Instead, an adaptable interface where the user themselves can change the interface is preferred [1][11]. However, having the extra complexity of choosing a layer can be overwhelming, especially for novice users. Therefore, in this project, a third way of changing the interface, which can be seen as a combination of adaptive and adaptable, will be researched. This third way we will call a “Selection Mechanism”.

### 1.2 Research Question

With the benefits and knowledge from multi-layered interfaces we will focus on the research question:

*What should be considered when designing a selection mechanism for multi-layered interfaces to help digital seniors continue to use a digital interface?*

### 1.3 Aim

The aim of this project is to investigate how a system might adapt to a digital senior’s declining abilities. This will be done by literature studies, user studies where we will learn about the elders’ needs and problems, and prototyping. We will create a selection mechanism and layers for a multi-layered adaptive interface for digital seniors and show by our prototypes what it might look like. The selection mechanism is responsible for deciding what level, in the ML interface, the user will utilize. The ML interface in this project will not be used to introduce a user to a new program, instead, it will be a tool to remove unwanted features to simplify the interface of the program. This could be seen as a reversed use of an ML interface. The main

goal is then to create guidelines for designing a selection mechanism in this type of ML interface, based on our findings from the prototypes.

The wanted long term effect of the project is to have industry implementing our findings and be inspired by the prototypes and guidelines, so that digital seniors will benefit from this study.

### **1.4 Limitations and Delimitations**

We have decided to use the social media network Facebook's website for laptops and desktops without touch interaction as the main platform for this research. That means that user research and prototypes will be centered around that, and the reason for this is that it is more practical for us when creating and testing prototypes. The project will focus on the selection mechanism, which functionality should be on each layer, and general user experience. The prototype will only affect the news-feed page on Facebook and not include the entire website, due to time constraints. We will also not include any long term study on how our findings affect the digital seniors.





# 2

## Background

This chapter will provide some useful studies that have been conducted within the area and other related background information that is important for this project.

### 2.1 Related Work

A lot of research has been conducted about how to design for elderly people, such as Hawthorn [12] who researched how to design a tutorial, by using a simplified interface, to learn older people the file management system Windows Explorer. All 25 participants, aged 60 to 88, had tried and failed in learning Windows Explorer before and by doing the tutorial the participants got more confident in using the system. After the tutorial, the participants were asked to do a few exercises in Windows Explorer, including navigate through the directory tree, make new files, delete files and rename files. The result of the exercises showed that 48% of the participants succeeded with only 0-2 trivial errors, where the errors were solved immediately without any help. The writers conclude that a simplified version can help some elders to learn complex systems since almost half of the participants in this study succeeded with something they had not managed before.

Another study within the topic was conducted by Leung et al. [9] who used ML interface to gradually teach elders to use a contact book on a mobile phone. In this study older adults, aged 65-81 years, were taught how to use a contacts book in the mobile phone and perform a few basic tasks, either on a full functionality interface or a reduced functionality interface. After a 30 minutes break the participants were asked to do the same tasks again and after that, they were asked to do a few advanced tasks as well. All the tasks were followed by a semi-structured interview. The result showed that for the basic tasks the older participants were faster with the ML interface than the full functionality interface and for the advanced tasks the participants performed the same regardless of the interface. A conclusion from the study was that the ML interface benefits the learning of an interface and the participants performed the tasks in fewer steps.

The focus of these studies has mainly been on older people learning to use interfaces rather than on the continued usage of a product. Even though the focus is on different things, the result of these studies can still be relevant for this research.

### 2.2 Elders and Social Media

The stereotypical older user might not be using social media. However, some older adults use social media more frequently than a group of teenagers [13]. Moreover, the computer and internet use for seniors over 65 increased from 15% to 32% between 2001 and 2006 in the US [14] and in 2016 this number was 64% [15]. Also, in 2019, 40% of seniors over 65 in the US used social media [16].

One study investigating older adults' use of blogs as a social media concluded four different reasons why they chose to have a blog [17]. The first reason is that they can develop their identity from adulthood to older adulthood, for example being a grandparent or retiree. The second reason is that they can express themselves in their own way, since other social media is, according to them, superficial and that they cannot talk about deeper subjects, as they can on their blog. Another reason is that it gives them a meaningful purpose during retirement, for example keeping up with regular posts and posting meaningful texts that can help others. The last reason is that it provides a social platform and gives social interactions.

There are four main motivators for older citizens' use of the social media network Facebook [18]. These motivators are social bonding such as staying connected with family and friends, social bridging such as interacting with groups and events, curiosity, and responding to family member requests.

Two factors have been identified that need to be fulfilled in a social media network for older adults [19]. The first factor is that a social media network should be designed to support and maintain family relationships, which is similar to the motivators above. The second factor is that privacy settings should be simple and easy to understand and also default to be more private.

# 3

## Theory

In this chapter important concepts and issues related to aging, design patterns, multi-layered design and other design techniques that might be relevant for this study will be presented and explained.

### 3.1 Benefits for Elders When Using Computers

To use computers and social media has been proven to be beneficial for older people. One benefit is connectedness [20]. More than 30% of the participants in a study made by Gatto and Tak [20] said that a favorite activity on the internet was to use e-mail to talk to others and connect. Connecting over the internet is a good way to keep relationships as it gets harder to maintain relationships when getting older [10]. This is both because of the death of friends and spouses and physical declines that makes it harder for elders to go somewhere and meet. These factors decrease both the quantity and the quality of relations for the elders. Therefore, social media interactions can increase the life quality for an older adult.

Another benefit with computers and social media is the feeling of satisfaction [20]. The participants, in the study by Gatto and Tak [20], mentioned that they felt satisfied with their learning which increased their confidence, self-worth, and self-esteem. They were also satisfied with the information available on the internet, both how much information was available, how quick and easy it was to access, and how updated it was. A third benefit mentioned by the study is the activities they could perform online. Some of these activities were financial services, entertainment, shopping, and travel arrangements.

Loneliness is impacting the overall health of all people, but especially for the elders, as they have more difficulty keeping social connections [10]. This is problematic since it has been shown that social interactions can help elders to slow down cognitive decrease and dementia [21]. However, the overall computer use will help an older person's cognitive functions [14], and a study by Quinn [10] shows an indication that connecting over social media gives the same social benefits as social interactions in real life. This study was conducted for four weeks giving 47 older adults with little social media experience lectures about social media a few times a week. The participants were encouraged to use social media outside of the classroom and the participants' cognitive skills were tested before, during, and after the study. The result showed an indication of cognitive benefit, but more research is needed

to prove that the improvements really came from using social media and were not caused by any other factors.

## 3.2 Problems Related to Aging and Using Computers

What type of aging symptoms a person gets is very individual [8], however, they can be divided into four types [13]. The types are: chronological aging, biological aging, psychological aging, and social aging. Chronological aging is the correlation between a human's behavior, psyche, physiology, and sociality changes. Biological aging is the change to the human body when cell replication is decreasing. Psychological aging is the changes to sense, perception, and cognition when a person ages and social aging is how a person's relations and roles change to friends and family when aging.

A lot of the problems that occur when aging affect the person's ability to interact with digital interfaces and creates barriers. The problems will be divided into physical problems, cognitive problems, and mistrust.

### 3.2.1 Physical Problems

The physical problems are a part of the biological aging, and the problems connected to using interfaces are impaired eyesight, fine motor skills deterioration, reduced hearing [8], and ailments such as arthritis [22, 23]. For a person, the impaired eyesight can lead to that person not being able to see the interface well enough to use the system [8]. This problem goes beyond the text being too small since the user can have a bad enough eyesight that both images and text are hard to see. Therefore, the understanding of the interface will be affected and it will lead to increased time to perform tasks and also to understand the purpose and the information of the interface.

The fine motor skills deterioration gives problems for users when interacting with an interface using a mouse, keyboard, or touch [8]. The interaction with keyboard and mouse is often more difficult than touch interaction since the connection between the physical movement and the digital movement can be hard for this type of user. Mouse interaction also relies on smaller hand movements than touch interaction, which can be hard for older users. Also, some gestures like dragging and double-clicking are harder to perform [8] as well as two-hand-gestures on a tabletop [13].

Reduced hearing is also a physical problem when interacting with digital interfaces [23], even though hearing is not a very big part [8]. But sound can be an important part of indicating success or failure and it is also important to hear when using text-to-speech interfaces.

Another physical problem is pain [20, 23]. Older adults can get stiff necks if us-

ing the computer for a longer period of time and their hands can be too stiff to use a mouse.

### 3.2.2 Cognitive Problems

The cognitive problems are related to psychological aging and the most common cognitive problems connected to using digital interfaces are attention, working memory, and long-term memory [8]. All these three are overlapping [24], but will be presented separately.

Attention is a common problem when getting older and can give problems when using more complex interfaces. There are a few types of attention, for example, selective attention, the ability to focus on stimuli and disregard other stimuli that are irrelevant, and divided attention, to process two or more tasks/information at the same time [24]. In general researchers agree that selective attention decreases by age, however, it is debated whether this is also true for divided attention [25, 24]. Divided attention problems seem to occur among elders when the tasks are complex, but not for simpler tasks. However, it is debated what the cause of the problems is. The first theory is that the divided attention has been deteriorated and that the simpler tasks are trained and done automatically. The second theory is that the tasks are being too complex [25]. So, in the end, the problem is usually not to keep focus for a longer period of time [24].

Working memory is the process of holding items in the short term memory and at the same time process these items, for example, repeating a few digits backward [24]. This also includes common everyday tasks like problem-solving and decision making. Working memory is also something that is getting worse when aging [24]. The big problem with reduced working memory is that together with reduced attention older people have a harder time remembering how to do a chain of actions to complete a task, especially if the chain is more than three actions long [8]. This raises a lot of frustration among the elders since they have to work really hard to learn how to perform a task and have difficulties keeping up with instructions [20]. This is especially a problem when an interface is changing its design a lot.

The long term memory is used when remembering information that is stored for longer than 60 seconds [25], and is, for example, present when completing a chain of actions to perform a task [8]. When the long term memory is getting worse a user has a harder time performing a chain of actions without getting help with what to do next [8]. It also takes longer time for elders to learn how to perform a task than a younger age group [13].

### 3.2.3 Mistrust

In a study conducted by [23], mistrust was shown to be the second biggest reason why older people avoid using the internet. It can also make them avoid certain activities on the internet due to fear of, for example, identity theft, viruses, or

the consequences of giving out credit card information online [20]. They are also insecure about how trustworthy the information is that they find on the internet [20]. However, some degree of mistrust can be good as it creates caution, especially in settings where there can be a lot of disinformation, such as when looking for health information on the internet [26]. [26] suggests one possible explanation for the mistrust as the fact that older people find it difficult to assess how credible an online source is and therefore adopts a general scepticism.

## 3.3 Already Existing Solutions When Designing for Older People

There are already several existing solutions and guidelines for designing for seniors. For example, the National Institute on Aging and the National Library of Medicine have created guidelines for how to design for older internet users [27]. These guidelines include tips on three areas: designing readable text, presenting information, and navigation. It is important to follow existing guidelines as it has been shown to increase the success rate on tasks for the users on sites using them [28]. Below a few solutions to the challenges that were found regarding older people's interactions with digital interfaces will be presented.

### 3.3.1 Interface and Control Design

The controls in an interface are all elements that a user interacts with, for example, text inputs, buttons, and links. The most important thing when designing the controls, especially for an older user group, is to follow standards that are established within font, color, and sizes [8]. For example, using high contrast between text and background [29], where the best being black text on white background [30]. The importance to follow these standards is also highlighted in the guidelines presented by [27]. One example of this is to have a consistent layout regarding design, icons and navigation buttons. Further, it is important to make the controls intuitive, for example, buttons and links that perform an action should be accompanied by an icon that visually represents the action [8], and the way the user interacts with the controls should be a single mouse click [27]. In addition to this, it is also important to not have any distracting visual stimuli, which could be avoided by, for example, having a plain background in the interface [29].

Dodd, Athauda, and Adam also states that giving the user constant feedback, both on success and error, will make the older users more comfortable and they learn better how different inputs affect the system [8].

### 3.3.2 Input Controls

Overall, touch input makes older users perform better and the performance time is not increasing as much when aging compared to input with mouse and keyboard, where performance times are increasing drastically when a user ages [8]. One reason

for this might be that seniors have issues applying the right amount of force when clicking the buttons on the mouse, which lead to more errors selecting the right target [31]. Therefore, it is argued that touch interfaces are preferable when designing for older users [8].

Another input type is voice commands, which can be used if the user is incapable of physically using the interface [8]. It is also found that voice input-to-text is preferable instead of inputting text with a touch keyboard since the error rates are high and they are often considered to be too object-dense [8]. One thing that should be considered when designing speech based interfaces is that older people might have issues with articulation as well as slower speech with more pauses [25].

One input type that is recommended for motion-impaired users is eye-gaze input [8]. It tracks the user's eye motions and translates it into actions. The performance time for eye-gaze input is in general faster than input with mouse and keyboard, but it is worse than touch input. But the performance of eye tracking depends a lot on the quality of the device and it is not as accurate since the eye is never completely still [32]. Therefore it is only recommended for motion-impaired users [8].

### 3.3.3 Text and Language

To make an interface more intuitive the type of language displayed on digital interfaces is an important part that can be improved. Most digital interfaces are usually using jargon, for example tag and hashtag, which a lot of elders are not familiar with [8]. This is a challenge for a lot of elders, since they do not understand the instructions they are given [20]. The reason for using jargon is to have a more standardized language for all digital interfaces, but instead of help, it is a barrier for many older users that do not understand the jargon [8]. Instead, the language should be simple, familiar and use the active voice [27].

Another thing that can be done to make the text easier to read and understand is to divide long texts into smaller sections [27]. Text areas can also be narrowed to increase reading speed and retention of information compared to a wider text area [33] [12].

Another solution to make an interface more intuitive is to have short plain messages and display the available options. For example elders like the prompt “‘Would you like to deposit or withdraw money?’, rather than ‘Would you like to perform a credit or debit transfer?’” [34], since the user gets a plain question with clear options. Also, when most older users are prompted with a choice they prefer to choose between default values instead of entering an exact value [8], but these default values should only be used when the input data is imprecise, otherwise, the number of options would be too large [34]. An example of good default values to choose from are times such as 9 am, 3 pm and 7 pm [34].

#### 3.3.4 Cognitive Evaluation

To make sure the developed interface will work for users with cognitive deterioration a method for cognitive evaluation can be used, for example, cognitive walkthrough that is mentioned in section 4.5.3 [8]. This is to make sure the interface is intuitive and usable. Also, to make sure the interface is usable for older users, they can be invited to perform the evaluation. The importance of usability testing when designing websites for seniors is also highlighted by [28].

### 3.4 Multi-layered Interfaces

Multi-layered (ML) interfaces is a technique that removes functionality from an interface to help a user learn the basics of a system before adding more advanced functionality to the interface [9]. This is done by having different layers, for example, a first-user layer where the basic functionality is, a few intermediate-user layers, and a full functionality layer for advanced users. The ML interfaces are successful because they put fewer demands on a user's working memory. They can be compared to learning to do karate, a novice karate practitioner does not start practice on the black belt level [1]. Instead, the novice practitioner starts with no belt and work their way up. It is the same idea with multi-layered design, work your way up by learning the basics of an interface first.

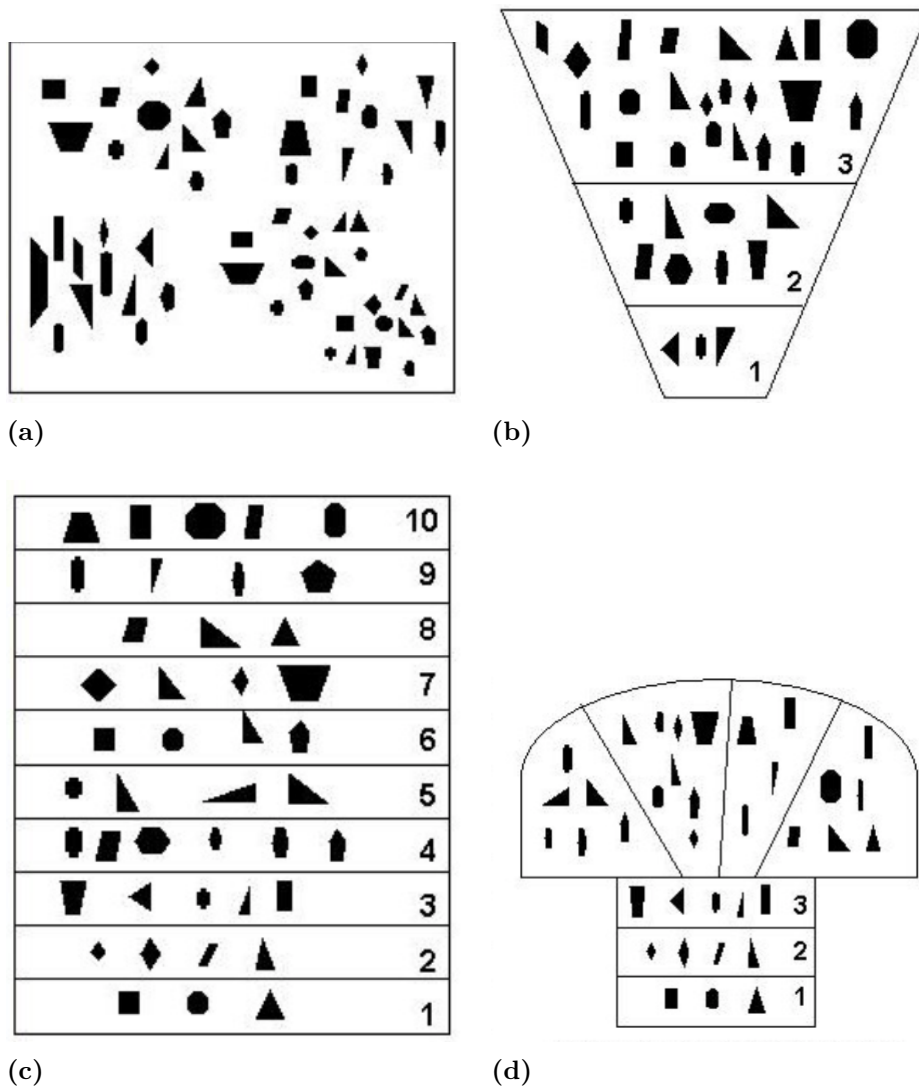
Clark and Matthews [35] suggests that ML interfaces can be divided into two subcategories, feature layers and mixed layers. Feature layers are layers that consists of one single category of functionality and within a feature group there can be several layers. Mixed layers are defined as adding some new functionality from all types of functionality groups to each layer. Mixed layers can have the downside that if a user is advanced in one feature it is impossible to avoid to have an uncluttered interface, since the user needs to use the full functionality layer [35].

The difference between the two subcategories is that with mixed layers the designer assumes which dissimilar features that are equally difficult [35]. While with feature layers, the designer only needs to decide which functionality within a specific feature group is more advanced than the other functionality within that group.

#### 3.4.1 Creating a Layer Structure

There are a few different ways of structuring the layers in an ML interface [1]. One way is to start with a few functionalities in a base layer, and then add roughly the same number of additional functionalities with each new layer, see Fig. 3.1 (c). However, this can be limiting according to some designers. Instead, an approach with less layers can be used, where the number of functionalities that are added increases with each layer, see Fig. 3.1 (b). A third version is to have a few thin layers building up the foundation followed by a few layers on the same level with different contents, which forms a mushroom like layer structure where the user can get a more personalized layer, see Fig. 3.1 (d).



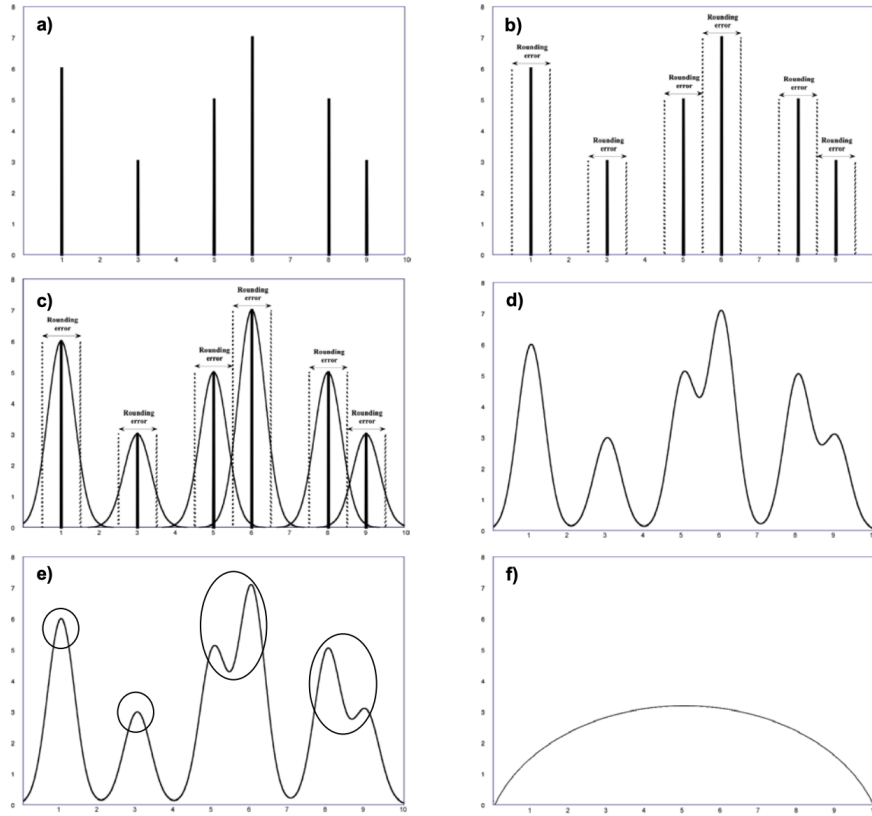


**Figure 3.1:** Different structures of multi-layered design, (a) a regular interface, (b) expanding multi-layered design, (c) multi-layered design, (d) multi-layered mushroom [1] (used with permission)

There is an approach to decide which level of functionality should be on which layer and which layer structure to have. This approach is done in three phases where the first phase is called identification [2]. In the identification phase data is collected. There is no special method for how the data should be collected, but it is preferable to collect quantitative data and use some sort of scale on how good the user is with a certain functionality.

The next phase is called categorization and in this phase a radar diagram for the data is created, where each axis is a feature or category and the scale on the axes is the level of knowledge within that feature, see Fig. 3.3 a) [2]. In that radar diagram one of the colored lines represents one participant from the collected data. A line

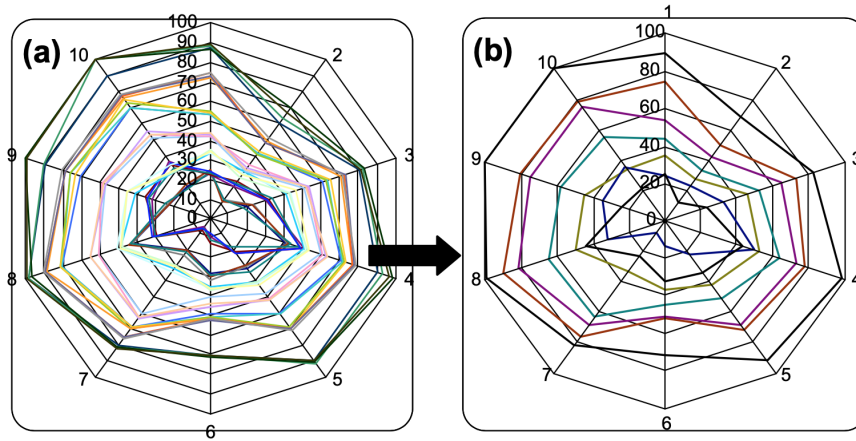
chart for each functionality is also created, where the y-axis represent the number of participants and the x-axis represent the scale. From the line chart it is then possible to find the user groups, i.e. where a lot of users end up at the same point on the scale. This is done by sketching normal distribution curves, where each line in the line chart is the top of the normal distribution curve, see Fig. 3.2 for illustration. Each peak in this now curved chart is a user group. However, if there is a small peak next to a larger peak these two groups are combined into one user group.



**Figure 3.2:** The process of finding user groups [2] (used with permission)

The designer can then find these user groups in the radar diagram and combine all these answers into one average answer, see Fig. 3.3 [2]. Each average line is a potential layer. When the radar diagram is done the designer can look at the different types of layer structures, see Fig. 3.1 and see what structure would be most applicable in their case. If the radar diagram looks like it does in Fig. 3.3 a “regular” ML design can probably be used, see Fig. 3.1 b). However, if the radar diagram is very pointy the mushroom like structure is probably the best way to go, since the radar diagram shows that the users are specialized in one or a few features. If the jump between each user group grows bigger for each step an expanding multi-layered design structure is more suitable since each potential layer advances the user more and more. To help decide if the regular multi-layered structure or the expanding multi-layered structure should be used the designer can calculate the area of the groups in the radar diagram. If the difference in area between user groups

are the same a regular multi-layered structure should be used, and if the difference in area is growing bigger between each step an expanding multi-layered structure should be used.



**Figure 3.3:** An example of a radar diagram showing all data in (a) which is translated to average data for each user group (b) [2] (used with permission)

The last step of creating layers is to translate the diagrams into the real world [2]. To do this each feature within each category has to be ranked from easy to advanced to see which layer is suitable for that feature.

### 3.4.2 Adaptive vs. Adaptable Interfaces

An ML interface can be changed in two different ways, adaptive and adaptable [36]. The main difference between these two ways is that with adaptable interfaces the user is changing the interface and with adaptive interfaces the system is changing the interface based on the user's actions and tasks.

An adaptive interface does not need any extended knowledge by the user, all knowledge on how to adapt is located within the system [36]. This means that the user does not have to put any extra effort into the system, but since the adaptive interface will change, the user can have a hard time getting familiar with the interface and have a feeling of losing control as the interface changes. Even when the user is asked to approve a change of the interface before it occurs, they still perceive it as distracting [1].

An adaptable interface adds a bit more complexity to the system since it needs to contain a way for the user to change the interface. This means that the user needs a little more knowledge about the system to be able to adapt it, which can be overwhelming for some users [1]. This will, on the other hand, lead to a feeling of control [36] and the user can adapt a system to him- or herself in a predictable way which, according to [1], is strongly preferred over an adaptive interface. One common way of changing an ML interface in an adaptable way is to have a slider



**Figure 3.4:** An example of a slider for layer selection in an adaptable ML interface [1] (used with permission)

that is always visible on the screen, where the user can select a layer. An example of such a slider can be seen in figure 3.4.

## 3.5 Adaptive User Interfaces

There are two types of adaptive graphical user interfaces (GUIs): spatial and graphical. These two types that can be used either individually or combined [37].

### 3.5.1 Spatial Adaptive User Interfaces

Spatial adaptive GUIs change the placement of items in the interface, for example by having the most frequently used items appear at a more convenient location in order to decrease navigation time and also reduce visual search time [37]. However, it has been shown that the navigation time that is gained by placing an item at a more convenient location is usually lost in practice as the user has to take time to adapt to this new location [37, 38]. It has also been shown that spatial consistency results in higher user satisfaction [37]. Because of this, spatial adaptive GUIs are generally only helpful when the number of steps to reach a specific item is greatly reduced [37].

### 3.5.2 Graphical Adaptive User Interfaces

Graphical Adaptive GUIs change the appearance of items in a GUI, for example by changing their background color, to draw the users attention to them in order to reduce visual search time [37]. Two techniques used for this are StencilMaps

and EphemeralMaps. Both techniques keep the placement of the items at the same position as in the original interface to have spatial consistency.

A StencilMap uses a dark semitransparent overlay that is put on top of the interface on everything except the chosen subset items, which will then appear more prominently to the user [39]. With an EphemeralMap, on the other hand, the items in the subsets are shown first and then the other items on the interface are gradually faded in [39] [37].

These two techniques are good for different things. The EphemeralMap is better for learning the interface long term and the StencilMap is better in the moment but does not support learning as well as EphemeralMap. An explanation to this is given by [39], stating that when using a StencilMap the user does not use the full UI and therefore they do not learn the positions of the subset elements in relation to the other elements that are not part of the subset. In comparison, when using an EphemeralMap the user sees all elements, even those that are not in the subset, and therefore learns the position of the subset elements in relation to all others.

## 3.6 Design Patterns

Design patterns are tools that describe the best practices of interface design [40]. They give a structure of an interface but are not too specific, so there is room for creativity. Below, a few relevant design patterns are described.

### 3.6.1 Wizard

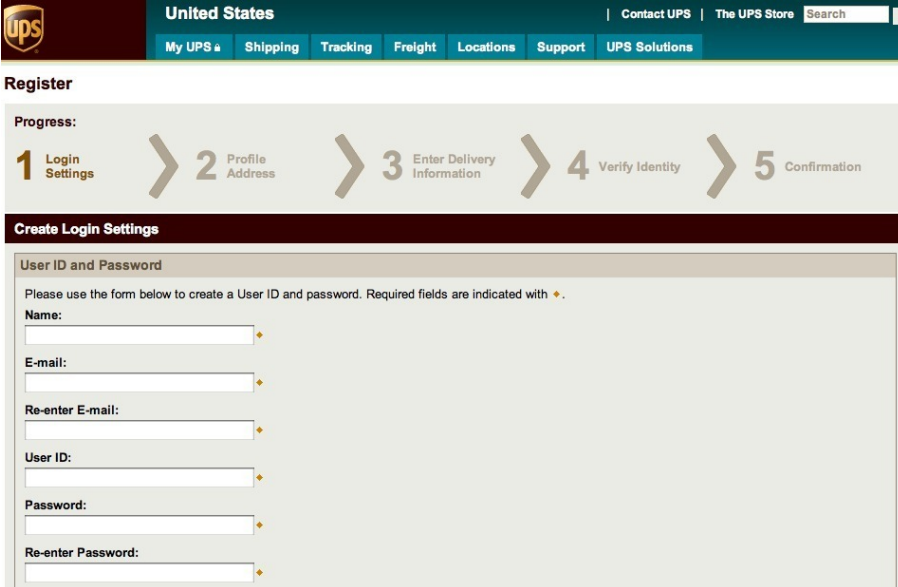
A wizard [40, pp.54-58] is a design pattern that leads the user through a longer task or tasks that need to be performed in a specific order [40]. It is common to use a wizard when installing computer software and Microsoft uses a wizard when importing data into Excel, for example. Another example can be seen in iPhones, where the users are presented with a short wizard when setting up the phone, before they can start using it for the first time. The wizard helps the user focus only on the task in front of them and when done the user can move on to the next task [40]. According to [41] there are only a few cases where the wizard design pattern is appropriate. Two examples of appropriate cases mentioned are initial setup of hardware devices and online survey interfaces consisting of a set of questions.

The drawback with the wizard pattern is that a user needs to be willing to give away the control and advanced users might feel limited by this [40]. However, the reason to use a wizard is that it is simplifying the task at hand and the user, therefore, does not have to put a lot of effort into the task. On the other hand, [40] states that the need for a wizard may indicate that the task is too long and too complicated instead. Users might also feel interrogated by a wizard and the large amount of questions it asks [41].

When designing a wizard the tasks need to be broken down into groups, it is bene-

ficial if each group has similar tasks or choices [40]. By breaking down the task into smaller chunks, the task seems less intimidating to the user [41]. The hard thing about the wizard pattern is to balance the size of the groups and the number of steps, too few steps or too many steps is not optimal, and at the same time, it is not good to have too much information in each group [40]. According to [42], the number of groups should typically lie between three and ten. It is also important to follow the mental model of the user [42], meaning how the user thinks the system will work [43]. One way to help form their mental model of the application is to use a progress indicator that clearly states the steps needed to complete the wizard [44].

The groups can be divided into pages and the user can go between them by “Back” and “Next” buttons [40]. The groups can also be present on the same page and use one of the following patterns: titled sections, responsive disclosure or responsive enabling.

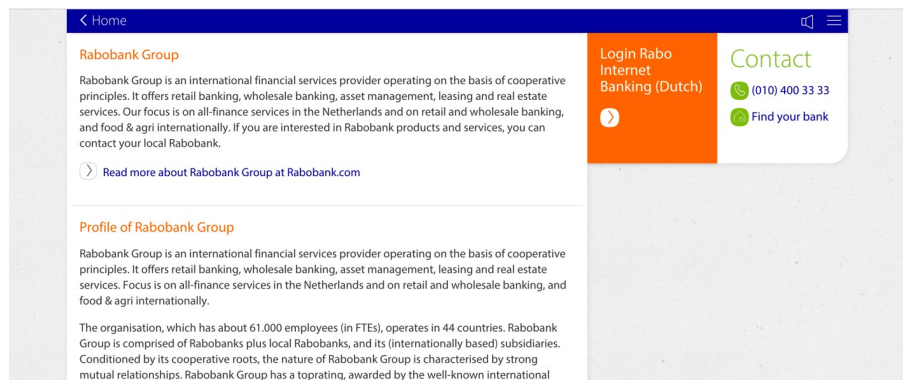


The image shows a screenshot of the UPS website's registration wizard. At the top, there is a navigation bar with the UPS logo, "United States", and links for "Contact UPS", "The UPS Store", and a search bar. Below this is a secondary navigation bar with links for "My UPS", "Shipping", "Tracking", "Freight", "Locations", "Support", and "UPS Solutions". The main heading is "Register". Below the heading is a progress bar with five steps: 1. Login Settings (active), 2. Profile Address, 3. Enter Delivery Information, 4. Verify Identity, and 5. Confirmation. Below the progress bar is a section titled "Create Login Settings". This section contains a form with the following fields: "Name:", "E-mail:", "Re-enter E-mail:", "User ID:", "Password:", and "Re-enter Password:". Each field has a small orange diamond icon next to it, indicating that these fields are required.

**Figure 3.5:** One example of how a wizard could look like. From [3], CC BY-NC-SA 2.5 DK

#### 3.6.2 Titled Sections

The titled sections pattern [40, pp.152-155] divides one page into sections by using titles and is good to use when a lot of information is displayed on one page [40]. This helps the user scan the page fast to find information. One important design aspect when implementing titled sections is to make the titles stand out. Other design decisions that help the pattern be clear is to use white space between sections and make contrasts in color between background and section.



**Figure 3.6:** One example of how a titled section can look like [4]

### 3.6.3 Responsive Disclosure

The responsive disclosure pattern [40, pp.179-182] starts with a minimal interface and by doing choices and tasks the interface shows more and more functionality [40]. The pattern is good to make the user understand the choices and what they affect since the interface expands in front of the user. It is also easy to go back and make changes since everything will be on the same page.

One important thing when designing for this pattern is to keep the controls for previous steps on the page, so the user easily can go back and change a choice [40]. Since the interface is built up in front of the user it does not have to progress linearly, instead, the interface can look different depending on the user's choices. For example, in a webshop, if the user says that the billing address is the same as the shipping address, the second address input will not be shown.

### 3.6.4 Responsive Enabling

It is called responsive enabling when an interface has an initial state where most things are disabled and the user unlocks more of the interface by doing tasks and choices [40, pp.182-185]. The pattern is well accompanied with the wizard pattern when the designer does not want the user to go page by page, but at the same time wants a stable interface that does not change after each step, as in responsive disclosure. On the other hand, if there is a complex task the interface may look cluttered or bad with all input controls, and in that case the responsive disclosure pattern might be preferred instead. However, a good thing about the pattern is that it also helps the user to form a mental model by allowing the user to directly see the effect of a choice and since parts of the interface are disabled the user is prevented from making severe errors.

One thing to think about when designing an interface that is using the responsive enabling pattern is to only disable what really needs to be disabled [40]. If more choices than needed are disabled the user can feel limited and annoyed instead of helped. Another thing to think about when designing with this pattern is to whenever possible place disabled functionality close to the choice that will make

### 3. Theory

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them enabled. This helps the user understand the connection between the choice and the disabled items.



# 4

## Methodology

In this chapter, several methods for the design process will be described and compared.

### 4.1 The Iterative Design Process

The importance of having an iterative design process and that it is a good way of working to understand complex problems are mentioned by a lot of authors, for example, Friis Dam and Stang Teo [5], Hartson and Pyla [45], and Preece, Rogers, and Sharp [46]. All of these authors are mentioning how the design process is an iterative process with a few stages. However, all authors are naming these stages a little bit differently. Therefore, in this section the process defined by [5] will be explained, however any of the processes could have been followed.

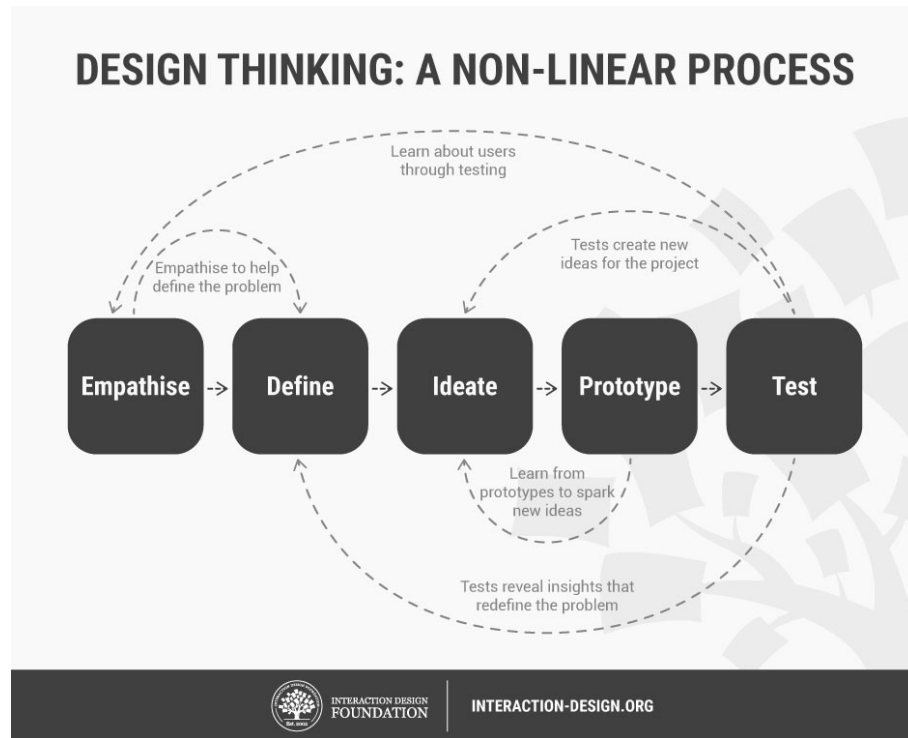
Friis Dam and Stang Teo [5] defines five stages that are visited iteratively. The process helps the designer to understand and tackle the problem in a human-centric way. The five stages are empathize, define (the problem), ideate, prototype, and test.

The empathize stage is the first step and the focus in this step is to get an understanding of the problem to solve. To do this it is a good idea to consult with experts within the area to understand their problems, motivations, and experiences. For the designer to gain empathy for the target users is an important part of the design process, since it decreases the involvement of the designer's own assumptions and it increases the focus on the user's actual needs.

The data gathered in the empathize step is used in the second step to define the problem. The data is analyzed and core problems are defined. The problems should be defined as problem statements and from this, the designers can start to think about features that can solve the problems, which leads to the ideation step.

In the ideation step, it is important to come up with a lot of ideas, that can later be narrowed down to the best solutions to the problem. An important aspect of the ideation step is to allow everyone to think freely and come with crazy ideas.

Low- and high fidelity prototypes can then be created and have a possible solution implemented in the prototype. Each prototype can be tested by someone in the design team to early eliminate the prototypes that are not good enough. In



**Figure 4.1:** A representation of the design process, from [5]

an iterative design process, the test step is mostly to understand if the problem is solved or if other problems need to be addressed and to see if the prototype needs to be redesigned.

It is important to remember that the five steps are, in real life, not followed from start to finish. Instead, it gives a general idea of the steps in a design process. Usually, the design process jumps between all steps since new knowledge from one step changes the problem definition, for example. The process is represented in figure 4.1.

## 4.2 Data Collection

Data gathering is used in the first phases of a design process, often called exploratory research [47, p.84]. Data collection can also be used in the evaluation step to get data on how the prototype is perceived.

### 4.2.1 Interviews

An interview is a method for collecting self-report data. It is mainly used for qualitative data, but it can also be used to collect quantitative data [47]. The main advantages of using interviews are that the interviewer can ask follow-up questions and that the interviewee has greater freedom to explain their thoughts and give more in-depth answers, compared to for example a survey. However, some aspects that have to be considered are that interviews are very time consuming, both to

perform and to later transcribe and analyze [48]. The interviewer also has to be careful not to ask leading questions or only listen for what they want to hear in the answers [48]. There are also several types of interviews that should be considered: individual-, group-, structured-, semi-structured-, and unstructured interviews.

Individual interviews and group interviews [48, p.67, p.75] both have their advantages and disadvantages. A group interview can be a good way to start a discussion and one participant might say something that triggers a memory for someone else, which brings up things that might have been missed in an individual interview [47]. However, having multiple people talking might make it difficult to record the interview in a good way [48]. Even with a tape recorder, it might be difficult to distinguish the voices of all the participants. In group interviews there is also a risk of some people dominating the conversation and that the opinions of some people that do not feel as comfortable speaking out might not be heard. The risk of this happening increases with a larger group, and preferably, the size should be less than ten people [48].

Interviews can also be either structured, semi-structured, or unstructured [46, pp.268-270]. A structured interview has a closed set of questions which makes it both easier to analyze and to account for how much time it will take to perform the interview, compared to an unstructured interview where a single question can vary in time depending on which interviewee is answering the question [47]. However, the closed set of questions also makes the interviewer less able to explore the answers on a deeper level or to explore other thoughts that might come up during the interview. An unstructured interview, on the other hand, gives more freedom to the interviewer for this type of exploration to get a deep understanding of the topic and gives the possibility for interviewees to mention issues that researchers have not thought about [46]. However, it requires that the interviewer also guides the interview to make sure that all topics of interest are covered [47]. If the interviews are conducted for exploratory reasons, an unstructured interview is often preferable over a structured interview [47]. A structured interview is better than an unstructured interview, for example, when several researchers are doing the same interview and need to follow the script [49]. Since a semi-structured interview is a combination of a structured- and unstructured interview, it can be used to obtain a mix of the advantages of both methods.

### 4.2.2 Recording Interviews

Recording an interview is an essential part since most researchers cannot recall details from an interview without a recording [50]. The recording also helps with the analysis afterward. Some common ways of recording are photographs, audio recording, video recording, or taking notes, and often multiple of these methods are combined [46]. Three common approaches to this are: notes together with photographs, audio together with photographs, and video. If audio- or video recording is chosen it is preferred to have a backup recorder just in case something happens with the first one [50].

Notes combined with photographs is perhaps the least intrusive approach [46]. On the other hand, it might be difficult for the interviewer to take notes during the interview as it might be distracting to do that and at the same time listen and move the interview forward. However, this might be solved by having a second researcher who is responsible for note-taking. Notes are preferably written by hand rather than a laptop since that is more flexible and might feel less intrusive for the interviewee. When taking notes one also has to be careful so that they are not biased. Photographs are used as a way to help the researchers' memory of the interview later.

A combination of audio and photographs is another common approach [46]. Just like when combined with notes, the photographs are used to help the researchers' memories. An audio recording might be helpful for the researcher so that they can give their full attention to the interview itself. However, during a group interview, it might be difficult to distinguish the voices of all the participants. Another downside with audio recording is the amount of time it takes to transcribe the interview afterward. In general, a one hour long interview takes between three to six hours to transcribe [51, 48].

Using video will capture a lot of information such as body language and tone of voice [46]. However, it might feel intrusive for the participants and they might change their behavior due to the knowledge that they are being filmed. As with audio recording, a video takes a long time to transcribe as well [51].

If using audio or video recordings it is important to make sure the quality is good, as any background noise can affect the quality of the recording [52]. It is also in this case suggested to take a few notes during the interview to make sure all questions are covered and it works as a backup if the recording malfunctioned [51].

### 4.2.3 Questionnaire

Questionnaires [47, p.172] are a good method for collecting a lot of data in a short time and if the obtained sample is large enough, it can be analyzed statistically [47]. It is similar to an interview in the sense that the questions can be open- or closed-ended, but when the questionnaire is made it can involve users from remote places which gives a larger data sample [46]. Even though a large amount of data can be collected it is not as in-depth as the data collected from an unstructured interview, but it can be used together with other methods to get a deeper understanding [46]. For example, a few interviews can be backed up with a questionnaire answered by many users.

A downside with questionnaires is that there is no possibility for follow-up questions on interesting answers or clarifications. It should also be considered that the data collected in a questionnaire is self-reported, which means that it might not be completely accurate [47]. There are a few reasons why self-reported data might not always be accurate, for example, a participant does not have to be honest and par-

ticipants might not use a rating scale in the same way, a 9 in a 10 point scale might not mean the same thing for all participants [53]. The questions for a questionnaire are also harder to produce since they need to be very clear [46]. This is because the interviewer cannot be there to explain the questions if needed.

#### 4.2.4 Observation

Observation [47, p.120] is an exploratory method to collect information about an area that is relatively unknown to the researcher [47]. It can be done, for example, when evaluating a prototype or in the field when the participant performs day to day tasks to get more knowledge of their everyday life [46, p.287]. One advantage of using the observation method over, for example, interviews or questionnaires is that observations do not collect self-report data, which might make it more reliable. It can also give more insights than an interview would do [46]. However, a downside with an observation is that it will give a lot of data and a lot of that data is likely irrelevant. Another downside is that the data is not as in-depth as the data from an interview and as a researcher, you might want to ask follow-up questions to understand the thought process behind the participants' actions. This might be solved with a follow-up interview, but that is time-consuming, as described in section 4.2.1. There might also be some ethical considerations to take into account if the participants are unaware that they are being observed, if doing the observations in the field.

#### 4.2.5 Diary Studies

Diary studies [47, p.66] is a good method for exploratory research to gain a better understanding of a user group over time, where the time period can be from a few days to several months [54]. Usually, the method only requires a small sample of participants to find common themes and patterns [47]. To make it easier for the participants to create diary entries the researcher should give clear instructions for how the diary should be filled in and possibly also add a few examples, as long as the examples are not biased [54]. It is also beneficial to keep contact with the participants during the study to keep them motivated. Before the study starts the research question should be defined, since the design of the diary study relies heavily on the research question [55]. Another thing to decide before the study starts is if the diary entries are about the present or entered in retrospect.

Compared to an interview, diary entries can be written just as a critical incident has happened and is still fresh in memory, but during an interview a few weeks later they might not have as clear memory of what happened [47]. However, a diary study requires a bigger investment from the participants as it is performed over an extended period of time. Therefore, it is good to put more effort into the recruitment process to make sure the recruited participants will follow through with the study [54].

### 4.2.6 Love Letter and Breakup Letter

The love letter and the breakup letter [47, p.114] are two methods for exploratory research and are good methods to use in a group dynamic such as a group interview [47]. They also provide a personal insight into the participants' experiences with a product. When performing these methods the participants should not spend more than ten minutes writing the letters, to avoid them overthinking the content. It is also important that the participants read their letters out loud, as the tone of voice and their expressions together with the content gives a better understanding of how they feel than just the text alone [47]. However, some participants might feel that these methods are difficult as they do not feel comfortable writing these types of letters and reading them out loud.

## 4.3 Analyzing data

Analyzing data is done both after the research phase and the evaluation phase since a lot of data is usually gathered in these types of sessions. When analyzing data, methods for discovering themes are often used, this is called *thematic analysis* [46]. A theme is described as something important in the data that relates to the study goal, which is often a pattern or a topic. Below, two kinds of analysis methods are described.

### 4.3.1 Affinity Diagram

Affinity diagramming [47, p.12] is a method for generating themes from qualitative data, collected from user tests or interviews, for example [47]. With this method, common issues and patterns among users can be found [45]. The method is based on clustering post-it notes together and creating a hierarchy of the groups to find interesting patterns [46]. The method can also be used to organize a large amount of data [56].

When doing an affinity diagramming session the clustering of observations is done inductively, meaning that there are no predefined groups that the notes are divided into, but rather that the groups emerge during the process of clustering similar notes together [47]. This approach can, therefore, give rise to themes that the researchers had not previously thought about. It is also possible to give each participant a different color post-it note, so the researchers can see how common a theme or pattern is [47].

It is also a method that takes a lot of time, as the qualitative data from one interview would typically result in 50-100 sticky notes with observations [47]. The main time-consuming parts of the method are to extract the observations from the data, to write them down on the notes, and to group the notes. Even though extracting observations is time-consuming, time is saved when using this method by not having a group of researchers discussing several hundred pieces of unorganized data [56]. When planing an affinity diagram session, 100 notes will approximately be the work

one person can do in a day [47].

### 4.3.2 Content analysis

Content analysis is a method where codes are assigned to data items that have been extracted from qualitative data, collected during, for example, an interview [47]. These codes can then be used to find common themes in the data. There are two main approaches to content analysis [47, p.40], inductive- and deductive content analysis. The inductive approach means that the codes and categories emerge during the analysis of the data, just like in affinity diagram, while deductive means that the codes and categories are predefined before the analysis begins [47]. In general the inductive approach is taken when doing a thematic analysis and the deductive approach is taken when categorizing data [46]. The method can be used either to identify themes and patterns in the data, similar to an affinity diagram, but it can also be used to get a quantitative result, which could be in the form of occurrences of for example words, phrases, or concepts [47]. For larger sets of data, content analysis can also be performed using software [47].

## 4.4 Ideation

Ideation methods are used to develop new ideas and think creatively, it is also a part of the iterative design process [45]. When choosing the ideation method it is important to choose a method that suits the team and the type of ideas that you want to generate [57].

### 4.4.1 Skewing

Skewing [58] is an ideation method that looks at an already existing artifact's properties and changes some of them. This will generate a new version or a completely new artifact. Skewing can be very useful when re-designing something.

### 4.4.2 Parallel Prototyping

To explore several different designs the method parallel prototyping [47, p.122] can be used. The main idea with parallel prototyping is to try out several designs and avoid being attached to one design, that in the end might not be optimal [47]. When comparing several prototypes next to each other it is harder for the designer to get defensive about one particular design and it will become easier for newer designers to view their designs as separate from themselves.

It has been shown that by conducting parallel prototyping the designs are made with better quality and are more diverse [59]. Groups that are designing in parallel are also outperforming the groups creating one single design [60].

In a parallel prototyping session, designers should be encouraged to design a few different prototypes, however, more than five different prototypes are not necessary

[61]. When the designs are done they should be tested by users and each user can test two or three designs since more designs will tire the user and they will not see the difference between the prototypes. It is also important to alternate which design is tested first since the users are only fresh once and will use knowledge from the first attempt in their second and third attempts. After the test session the best parts from the different prototypes can be merged into one refined prototype that can be iterated on further.

### 4.4.3 Brainstorming

The base of brainstorming is to build on each other's ideas and from there form new ideas and a session should be a safe place where participants are encouraged to come up with wild ideas and no ideas should be critiqued [62]. It is also encouraged to include a lot of different people with a wide range of experiences [46].

A downside with brainstorming is that there is a possibility that not all participants feel comfortable throwing out ideas [62]. This can be because the participants are simply shy or having trouble expressing their ideas.

## 4.5 Evaluation

Evaluation of design suggestions and prototypes is an important step when it comes to creating a digital product, and it is important to do evaluations early in the design process to avoid costly fixes or getting a bad reputation when the product is commercialized [45]. It is also important before releasing a product to get an indication if the user group will actually like the product, which is suitable done by an evaluation session [46]. The concept of user experience and usability is not per se measurable, but it is possible to get an indication depending on errors and time to complete tasks [45]. Different data gathering methods can also be used to get indications on the users' satisfaction, for example, methods like questionnaire and interviews [45].

The amount of participants that should be participating in an evaluation is a debated topic [63]. Some say that five participants are the "magic number" that will find 80% of the usability problems in a qualitative evaluation [64, 65]. This is because using five participants is shown to give the best ratio of benefit and cost with a few exceptions regarding eye tracking evaluations and statistical evaluations, for example [66]. Among 83 case studies with a varying amount of participants it was seen that there was a very small correlation of finding more problems with more participants, but the correlation is so small that it is not worth the extra cost of having more than five participants. Others argue that five participants are not enough to reach 80% of all usability issues [63]. For example, a study with four different websites was made and after five usability tests, only 35% of the usability problems were found [67].

Before conducting an evaluation session the type of evaluation has to be decided.



There are two types of evaluations called formative- and summative evaluation [45]. A formative evaluation collects qualitative data to locate UX problems in the design. A summative evaluation is when the designer collects quantitative data to check the quality of the design, for example, the number of errors the test person performed. The summative evaluation is usually based on the formative evaluation, to control that the UX problems found in the formative evaluation are fixed.

There are a lot of different methods that can be used to evaluate an interface. Some methods are formative and some are summative. Below, some methods and techniques, which can sometimes be used together, will be explained and compared.

#### **4.5.1 Critical Incidents**

A critical incident [45, p.436-437]; [47, p.50] is a notable event that happens when a participant is evaluating a product [45, 47]. It is a very common technique that a lot of researchers use, however, some researchers make their own adjustments of the method for it to fit their study [68]. Identifying critical incidents is the most important collection of qualitative data in a formative evaluation [45]. Often the event occurs when the actual outcome of the interface is not the same as the outcome expected by the user [47]. The incidents can be found in several different ways and it can be both negative and positive. It can be shown by a shrug of the shoulders or an error in the task performance. In general, it is easier for an experienced facilitator to find the not obvious incidents, for example, a shrug of the shoulders, and then follow up on the incident. A less experienced facilitator mostly focuses on the obvious errors the participant does.

#### **4.5.2 Think-aloud Protocol**

The think-aloud protocol [47, p.180] is a very common method when evaluating a design [47]. In general, there are two types of think-aloud protocols, the current and the retrospective. The current protocol is most common and is when the participant talks while performing the task. The retrospective protocol is when the participant is doing the tasks in silence while being filmed and after the evaluation, the participant looks back on the film and tells the facilitator what they thought while performing the tasks by using the video as a reminder.

The main reason to use the think-aloud protocol is that the majority of qualitative data is hidden in the participant's head [45]. It is a very effective method to understand the users' motivations and reasons behind their actions. The technique is also effective in finding the emotional impact of a prototype.

Thinking-aloud might come naturally for some participants but not for all, therefore it is important that the facilitator reminds the participant to talk while performing the tasks [45]. For some participants, it might be so hard to talk and perform tasks at the same time, that the evaluation has to be adapted for them. This adaption can be to take breaks between each task performed and talk about the thoughts

then or use the retrospective protocol. Some participants can also ask questions in terms of “What will happen if I press this button?”, then the facilitator can ask encouraging questions like “What do you think will happen?”. These encouraging questions make the participants think for themselves and it is also a natural way to get the participant to tell their thoughts.

### 4.5.3 Design Walkthroughs

A method that is very quick and easy to conduct is design walkthrough [45, p.469-470]. It is especially good to use in the early stages of the design process to find problems the user might encounter early on. A few examples of design walkthroughs are cognitive walkthrough [47, p.32] and stakeholder walkthrough [47, p.168], which can be used for many different types of systems [46].

A stakeholder walkthrough is done in a group with stakeholders, end-users, and designers, where one person in the group is assigned the role of leader. The leader goes over different scenarios and explains what the user will do and the expected outcome [45]. The rest of the group discusses each step and how it works in the flow and tries to find potential problems.

A cognitive walkthrough is often used with “walk-up-to” systems, like an ATM [47]. The difference between stakeholder walkthrough and cognitive walkthrough is that cognitive walkthrough only uses one expert within the field. The expert goes through the design and at each step answers a few yes or no questions. If the answer to a question is no, a problem with the design is found.

There are a few extensions of the cognitive walkthrough method, for example, extended cognitive walkthrough [69], enhanced cognitive walkthrough [70] and cognitive walkthrough for the web [71]. Extended cognitive walkthrough is like the original cognitive walkthrough but with more questions to answer at each step [69]. Enhanced cognitive walkthrough has two sets of questions that are answered depending on which type of task that is performed [70]. The answer to the questions is a number between 1-5 depending on how severe the problem is, where one means *Very small chance of success*, two means *Small chance of success*, three means *Impossible to decide if success or not*, four means *Probably successful* and five means *A very good chance of success*. Each problem is also categorized in a problem type. There is also an analyzing framework accompanied with this method, where the problems and problem types are summarized in different types of matrices. Lastly, cognitive walkthrough for the web which largely focuses on the text on a website [71].

### 4.5.4 Heuristic Evaluation

Heuristic evaluation [72] is an evaluation method to find usability faults. It is conducted by a usability expert that looks at the interface and evaluates it while guided by design principles known as heuristics [46]. The heuristics are originally based

on Nielsen and Molich's 10 rules of thumb and Ben Shneiderman's 8 golden rules [72]. However, today the designer is encouraged to create their own heuristics to get heuristics specified to their product since the rules of thumb and the golden rules are too general [72]. This method is good to make evaluators focus on certain areas and find problems with specific elements that effect the overall usability. However, some downsides with the method are that if the designer decides on the wrong heuristics critical problems might be overlooked and the method is also time consuming.



# 5

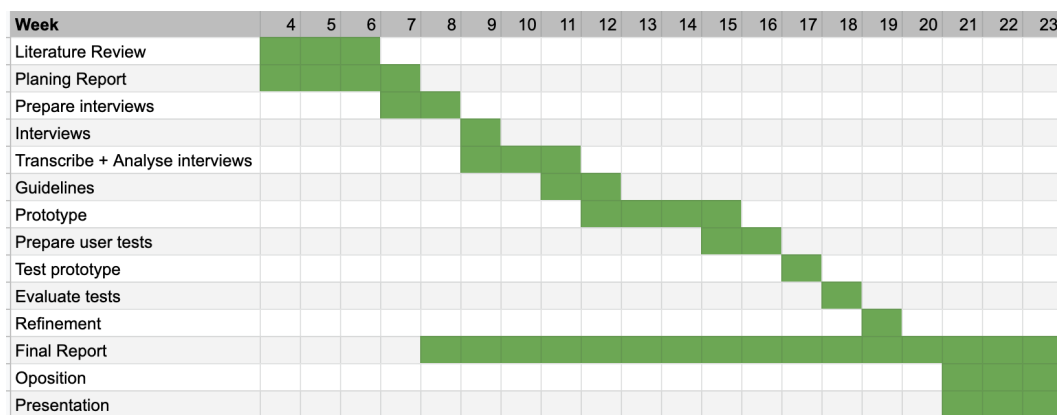
## Planning

In this project, we will start with a literature study to see what types of studies that have already been conducted, then we will use different methods to understand the user group, build a prototype and later on evaluate the prototype. For understanding our user group we will conduct semi-structured interviews with one user at the time. The focus of the interviews will be to understand the habits of the users and what they struggle with when using Facebook.

When conducting the interviews we will record the audio together with photos and then transcribe the interviews. When all interviews are transcribed the interviews will be analyzed by using content analysis and/or affinity diagramming as described in section 4.3. The summarized analysis will be the foundation for guidelines that will act as a base when we build prototypes.

When the prototypes are done we will evaluate them on our user group. Using the methods think-aloud protocol and taking notes of critical incidents. After the evaluation, the prototypes will be refined according to the received feedback.

To make sure we will have time to do everything described above, a time-plan has been created and can be seen in figure 5.1. The original time-plan created in the proposal can be seen below as well. The difference between the two time-plans is that the first one is a lot briefer and focuses more on guidelines, which was removed as the main goal around the second week of the project since the focus shifted from ML-design as a whole to the creation of layers and the selection mechanism.



**Figure 5.1:** The time-plan for the project represented in a gantt chart

The original time-plan created before the start of the project:

- Week 1-4 - Literature research, write planning report, look into research and evaluation methods.
- Week 5-10 - User research and make guidelines.
- Week 11-13 - Create a prototype with help from guidelines.
- Week 14 - Evaluate prototype.
- Week 15-16 - Revise guidelines
- Week 17-20 - Write the report, prepare the presentation and prepare opposition.

# 6

## Execution and Process

The project has followed an iterative design process described in section 4.1. The project started with a first empathize phase including a literature study, grouping Facebook functionality, a Facebook analysis, and interviews. This was followed by a define phase where an affinity diagram was created based on the interviews. After this, a questionnaire was made as a part of a second empathize phase. Then the ideation and prototype phase began where layers, questions, and a design to the selection mechanism were created. During this phase, an extra interview was held as well as a third empathize phase. The prototype was then tested in the test phase, and the result from the user tests was a foundation to the guidelines.

This chapter will describe our process in a chronological order. It will mention the methods and frameworks used and the reason for it and describe the result from each step.

### 6.1 Literature Study and Preparations

During the first weeks of the project, a lot of reading was conducted. The topics that were covered are presented in the Theory and Methodology sections. The relevant papers were found by accessing the EndNote-library created by the Digital Seniors research group and also additional papers and books were used. The research group, digital seniors, had already made some interviews before this project, so before conducting the interviews the transcripts from the earlier interviews were studied. This was to get some prior understanding and also make sure the new interviews did not cover the exact same topics.

The preparations that needed to be done were finding people to interview and participate in usability tests, find somewhere to perform the interviews and borrow equipment for it. This part of the work consisted of a lot of emailing, mainly to different organizations and libraries, and also creating a poster advertising for participants that one of the contact persons put up in the buildings where they work.

### 6.2 Grouping Functionality

When planning the interviews we realized that we wanted to ask exactly which functionality was used by the interviewee. So, therefore, all functionality of Facebook

was listed. The listed functionality was also categorized into groups of usage areas based on what might be used together. This was made based on our assumptions and the idea with this was to get a foundation for when deciding which functionality should be in which layer in our prototype later in the project and to get a better understanding of the existing Facebook functionality. The groupings can be seen in the list below.

Base functionality:

- Search function
- Settings

Group 1 - groups and pages:

- Groups
- Pages

Group 2 - Facebook suggestions:

- Friend suggestions
- Suggestions in news feed

Group 3 - Groups:

- Groups
- Buy and sell groups
- Marketplace
- Write posts in groups

Group 4 - Shop:

- Marketplace
- Offers
- Buy and sell groups
- Recent ad activity

Group 5 - Categorize things yourself:

- Friend lists
- Save post

Group 6 - New acquaintances and keep contact:

- Events
- Groups
- Friend suggestions
- Messenger

Group 7 - See previous activity:

- Recent ad activity
- Memories

Group 8 - Charity and spread love:



- Fundraisers
- Crisis response
- Birthdays

### Group 9 - Content creator:

- Write posts
- Check in
- Tag friends
- Add emotion/activity
- Add photo or video or text
- Change background on post
- Add GIF
- Send live
- Change post privacy
- Write on friends' wall (for example Birthdays)
- Video party
- Create story

### Group 10 - Content consumer:

- Read posts
- Comment
- Like/Reactions
- Watch stories
- Videos on watch

### Group 11 - Entertainment:

- Games
- Videos on watch
- Gaming videos

### Group 12 - Help:

- Quick help
- Recommendations

### Group 13 - Jobs:

- Jobs

### Things probably no one wants:

- Advertisement
- Oculus
- Weather
- Shortcut for language

## 6.3 Analyzing Facebook

To better understand the existing problems with Facebook, an analysis was made during week eight and nine. The chosen method to do this was Enhanced Cognitive Walkthrough, described in section 4.5.3. The method was one of the suggested methods from the supervisor and after reading about it we decided to choose it over other methods like heuristic evaluation, cognitive walkthrough for the web and extended cognitive walkthrough. The enhanced cognitive walkthrough was judged to be the better of the methods for our type of analysis since it analyzed the task for each substep, but also as a whole and had a pre-decided set of questions to answer for each step in the analysis. Instead of heuristic evaluation where the questions or principles had to be decided by the evaluators before the evaluation and if the wrong principles are chosen critical usability problems can be overlooked.

The reason for not using cognitive walkthrough for the web was because of the focus on the text, titles and links on the website, since we wanted to incorporate other aspects as well. Extended cognitive walkthrough was not chosen because it gave a very flat result, only yes or no answers to the questions. It did also not provide an analysis framework as enhanced cognitive walkthrough did. Extended cognitive walkthrough does not have that many sources as well, which made it a bit unreliable.

The tasks that we decided to investigate in the walkthrough are presented below in table 6.1. The task importance is a number between one and five, where one is the most important task. The task importance were decided based on our reasoning and assumptions.

| Number | Task                                   | Task Importance |
|--------|--|-----------------|
| 1      | Create a post                          | 2               |
| 2      | Go to Marketplace                      | 5               |
| 3      | Attend an event through the news feed  | 3               |
| 4      | Look at a notification                 | 1               |
| 5      | Check in at a place                    | 4               |
| 6      | Add a story                            | 4               |
| 7      | Congratulate someone on their birthday | 3               |
| 8      | Comment on a post of a friend          | 1               |
| 9      | React to a post                        | 1               |
| 10     | Go to your profile                     | 2               |
| 11     | Write “Hello” to someone on messenger  | 4               |

**Table 6.1:** Tasks and task importance

The analysis was carried out individually by each of us and our results were then combined to obtain an average for each value. The original matrices with the individual values can be found in appendix B.2. The average results are presented in five different matrices.

The first matrix, matrix A, is a summary of task importance and problem seriousness and indicates the interface's general condition [70], seen i Fig. 6.1. The scale for problem seriousness and task importance indicates how serious a problem is and how important a task is, where, number 1 indicates the most serious problems and the most important task. The cells in the matrix show how many occurrences there are for each combination of problem seriousness and task importance. The blue area in matrix A highlights the most serious problems as there is both high task importance and high problem seriousness, indicating serious problems in important tasks which might prevent intended use [70]. The yellow cells highlights areas with many issues, but of less important character.

|                 | Problem seriousness |     |     |     |
|-----------------|---------------------|-----|-----|-----|
| Task importance | 1                   | 2   | 3   | 4   |
| 1               | 0,5                 | 2   | 8,5 | 8   |
| 2               | 0                   | 0   | 1,5 | 3   |
| 3               | 0,5                 | 2   | 7   | 12  |
| 4               | 0                   | 1,5 | 10  | 7   |
| 5               | 1                   | 0,5 | 0,5 | 2,5 |

**Figure 6.1:** Matrix A: Task importance vs. problem seriousness

Matrix B shows a summary of problem type and problem seriousness and indicates what the overall problems with the interface are [70], see Fig. 6.2. In this matrix the blue area shows the problem type with the most problems and the yellow cells highlight where the larger amount of serious problems are. The problems have been categorized into six different types [70]. *U* are problems related to the user and their knowledge and previous experience. *H*, which is hidden functionality or functionality without indications on how to use it. *S*, which are steps within operations or functionality that the user has to take in an unnatural order. *T* are issues related to text and icons where the placement, appearance, or context are unclear or easily misinterpreted. *P* contains problems where the physical demands, such as motor skills or speed, from the interface on the user might be too high. *F* encompasses issues where the system does not give sufficient feedback on the users actions.

The third matrix, matrix C, seen in Fig. 6.3, shows a summary of problem type and task importance. Here, the yellow cells indicate which problems that are most important to take care of [70].

Matrix D, see Fig. 6.4, shows task number versus problem seriousness and indicates which tasks that have many serious problems [70]. The blue line shows the task that has the most problems and the yellow cells show the tasks with most serious problems.

Fig. 6.5 shows the last matrix, matrix E. This matrix summarizes what type of

|              | Problem seriousness |     |      |     |
|--------------|---------------------|-----|------|-----|
| Problem type | 1                   | 2   | 3    | 4   |
| U            | 0                   | 2   | 11   | 9   |
| H            | 0,5                 | 2   | 3    | 5,5 |
| S            | 0,5                 | 0,5 | 1    | 0,5 |
| T            | 1                   | 2   | 11,5 | 9   |
| P            | 0                   | 0   | 3,5  | 8,5 |
| F            | 0                   | 0   | 1    | 1   |

Figure 6.2: Matrix B: Problem type vs. problem seriousness

|              | Task importance |     |     |      |     |
|--------------|-----------------|-----|-----|------|-----|
| Problem type | 1               | 2   | 3   | 4    | 5   |
| U            | 7,5             | 1   | 7   | 5    | 1,5 |
| H            | 8,5             | 0   | 2,5 | 0    | 0   |
| S            | 0               | 0   | 2   | 0    | 0,5 |
| T            | 1               | 3   | 7   | 10,5 | 2   |
| P            | 4,5             | 0,5 | 4   | 2,5  | 0,5 |
| F            | 0               | 0   | 1   | 1    | 0   |

Figure 6.3: Matrix C: Problem type vs. task importance

|             | Problem seriousness |     |     |     |
|-------------|---------------------|-----|-----|-----|
| Task number | 1                   | 2   | 3   | 4   |
| 1           | 0                   | 0   | 0,5 | 1,5 |
| 2           | 1                   | 0,5 | 0,5 | 2,5 |
| 3           | 0,5                 | 2   | 6   | 7   |
| 4           | 0                   | 0   | 1   | 2   |
| 5           | 0                   | 0   | 2   | 2   |
| 6           | 0                   | 0,5 | 2,5 | 3   |
| 7           | 0                   | 0   | 1   | 5   |
| 8           | 0,5                 | 1   | 1,5 | 2,5 |
| 9           | 0                   | 1   | 6   | 3,5 |
| 10          | 0                   | 0   | 1   | 1,5 |
| 11          | 0                   | 1   | 5,5 | 2   |

Figure 6.4: Matrix D: task number vs. problem seriousness

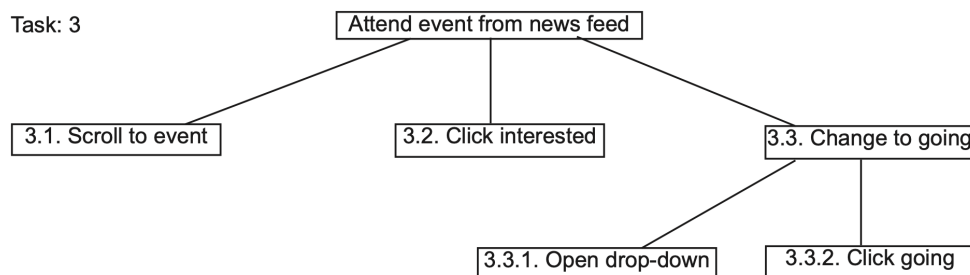
problems each task has [70].

These results tell us that the interface is not in a perfect condition and that there are parts that can be improved. The main type of issues that Facebook experiences in the interface are connected to text and icons, however, the most important tasks mainly have issues regarding the user's knowledge and experience, hidden functionality and the physical demands the interface puts on the user. The task that experiences the highest number of issues is *setting "Going" on an event in the feed*, which also together with *going to Marketplace* and *commenting on a post from a friend* are the three tasks with the most serious problems out of the eleven tasks that were tested, which can all be seen in table 6.1.

| Task number | Problem type |     |     |     |     |   |
|-------------|--------------|-----|-----|-----|-----|---|
|             | U            | H   | S   | T   | P   | F |
| 1           | 0,5          | 0   | 0   | 1   | 0,5 | 0 |
| 2           | 1,5          | 0   | 0,5 | 2   | 0,5 | 0 |
| 3           | 6,5          | 2,5 | 2   | 4   | 1,5 | 1 |
| 4           | 0,5          | 0,5 | 0   | 0,5 | 2   | 0 |
| 5           | 1            | 0   | 0   | 2   | 1   | 0 |
| 6           | 1,5          | 0   | 0   | 3   | 0,5 | 1 |
| 7           | 0,5          | 0   | 0   | 3   | 2,5 | 0 |
| 8           | 3            | 2,5 | 0   | 0   | 1   | 0 |
| 9           | 4,5          | 5,5 | 0   | 0,5 | 1,5 | 0 |
| 10          | 0,5          | 0   | 0   | 2   | 0   | 0 |
| 11          | 2            | 0   | 0   | 5,5 | 1   | 0 |

**Figure 6.5:** Matrix E: Task number vs. problem type

In the task of *setting “Going” on an event in the feed*, the sequence of the sub tasks was not obvious. In the sequence, the user has to first click “Interested” and then open a drop-down menu to click “Going”, see Fig. 6.6. This is a strange sequence and when the user changes from “Interested” to “Going” there is not a lot of feedback, only the text on the button changes, which can be difficult to notice if the user does not know what they are looking for.



**Figure 6.6:** Task tree for setting “Going” on an event

The task *going to Marketplace* turned out to be problematic for several reasons. The name “Marketplace” is in English and an older user with less knowledge of English might not understand from the name what it is. This might not be a problem if the button had other visual elements to aid the users’ understanding, however, the icon on the button was also not very clear and it was not obvious that it symbolized a place for buying and selling things, see Fig. 6.7.



**Figure 6.7:** A picture of the marketplace icon (screenshot from [6])

The third task that was problematic was *commenting on a post from a friend*. In this task the user is supposed to write some text and then press Enter to post the comment. However, there is no indication for the user that they have to press Enter when they are done, and to someone with less computer experience this might not be obvious.

There are also some unclear problems that were found as well. The reason that they are unclear is because the problem seriousness is often on a three or four, which means “Impossible to decide if success or not” and “Probably successful” [70]. One of the reoccurring problems found was that buttons were too small to click for the older users, but this is impossible to say for certain that this is a problem as it is only based on our assumptions and not a test made with actual older users. Matrix B (Fig. 6.2) also shows that the problems related to physical demands are all on a three or a four in problem seriousness, which indicates a potential problem, but we can not be sure that this will be an issue for actual users.

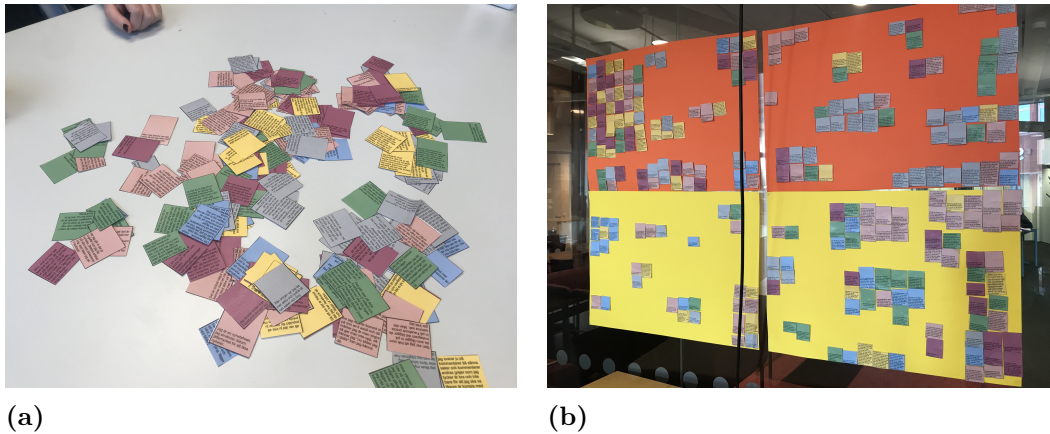
### 6.4 Interviewing the User Group

To get an in-depth understanding of the user group, interviews, in a semi-structured manner, were conducted during week nine. In total six interviews were conducted and each interview lasted for about 30 to 50 minutes. All interviewees were between 67-80 years old and had had a Facebook account for several years. As all participants were from Sweden, the interviews were conducted in Swedish and all quotes from the interviews mentioned in this report are therefore translated to English. All interviews were also video recorded by two cameras, one recording the participants’ face and upper body to be able to look back on their body language and facial expressions, and one recording on the participants’ digital device, so we could look back and see what they showed us.

The earlier interviews made by the digital seniors research group was focusing more on how the participants used their electronic devices in general. Our interviews worked more in-depth with Facebook and we asked about specific functionalities on Facebook. The interview questions can be found in appendix C.1, however, the script was not followed from start to finish since it was a semi-structured interview. For example, follow-up questions were asked and the order of the questions was not always followed since the participant sometimes mentioned things that were connected to a question that was meant to be asked later.

#### 6.4.1 Affinity Diagramming

To get an overview of what was said in the interviews we extracted interesting quotes from the interviews and created an affinity diagram. The version of affinity diagramming where each participant has their own color of the post-it notes was used. This was to see if one theme or group consisted of only one interviewee, or if several of them had said something within the same theme. This is mainly why we chose affinity diagramming over other methods.



**Figure 6.8:** The affinity diagram notes and on the wall

### 6.4.2 Affinity Diagram Result

The affinity diagramming resulted in 32 groups which emerged into seven themes. The groups and themes are shown in table 6.2.

The participants did not, in general, have any major issues. Some of them complained about a few usability issue, for example, the order of comments on a post was not always in chronological order, which made it hard to follow a conversation.

**Interview person 2:** *Yes, to follow a feed of comments can be a problem, because they are not always in sequence.*

**Rebecca:** *No, right*

**Interview person 2:** *Eeh... so if I say like this, that I am following a feed, then I see that someone posted this 7 hours ago, and there is a new and it shows that that was posted 10 hours ago. And I have a hard time following the thread. I cannot see who said it first.*

They also expressed that they really liked Facebook and how Facebook made them connect to old friends again. However, their view on Facebook was a little bit different, three of them mentioned that they like to share interesting posts on topics that need attention or are educational, while one interviewee said: *“I do not see Facebook as a source of information, I see it more as social, instead of calling and have contact with my siblings and friends and so on”*

Four of them expressed concern about privacy and two of them mentioned the expression *“Big brother is watching you”*. Because of the privacy concerns, the participants used different strategies to feel safer. Some of them did not post anything on their wall, at least not personal content. One barely read their news feed because they were afraid Facebook would see what kind of content they liked to look at.

**Rebecca:** *When you read posts, do you usually like and comment a lot then?*

| Groups  | Themes   |
|---|----------|
| Content creator<br>Games<br>Messenger<br>Content consumer<br>Save content<br>Power user tweaks<br>Response on own content           | Activity |
| Youth is busy<br>Age related issues<br>Complaints<br>Requests<br>Ignorance<br>Fear  | Issues   |
| Privacy<br>Caution<br>Big brother is watching   | Security |
| Spreading knowledge<br>The digital society<br>Stay in touch and make contact  | Society  |
| Personal background<br>No fear<br>Routines<br>Personal attributes<br>Learning and help  | User     |
| View on Facebook<br>Fun with Facebook<br>Facebook vs. other<br>Facebook now and then<br>Ascertainment<br>Facebook is time consuming | Analysis |
| Internet except Facebook<br>Distancing from technology  | Other    |

**Table 6.2:** Groups and themes extracted from the affinity diagram

***Interview person 6:** No, no, I have learnt that, if I even read, because then this eye sees that I... Now she has been there, she is interested in this and then you get a lot of similar information and that bothers me.*

One of the participants felt a great fear of doing the wrong thing and mess something up, while others when we asked them felt more confident and did not hesitate to try out new functionality. Another thing that two of the participants mentioned were that the youth and people younger to the participant were both busy and lived hectic lives. Because of this the participants felt that they cannot ask for help as often as some of them would like to. For example, one person we interviewed said:



**Interview person 1:** *And then I notice that when I ask my children they become a little bit annoyed, because they have more elders around them, they do not like that you always come and ask too much.*

Another interviewee said the following about the youth:

**Lisa:** *If you need to ask someone for help about something on Facebook, do you have anyone you would ask then?*

**Interview person 3:** *Yes I would ask my daughter I think, mmh she is around the age of 45 and yes know most of this... but on the other hand, you are so busy around the age of 45 and have children.*

One finding that was a little surprising to us was that one participant looked a lot on how much response they got from their uploads. They mentioned that a picture where they write about what is in the picture gives more likes compared to a picture with no description.

One of the participants also expressed an annoyance towards younger people. They said that our society is really excluding towards older adults and “youth fixated”.

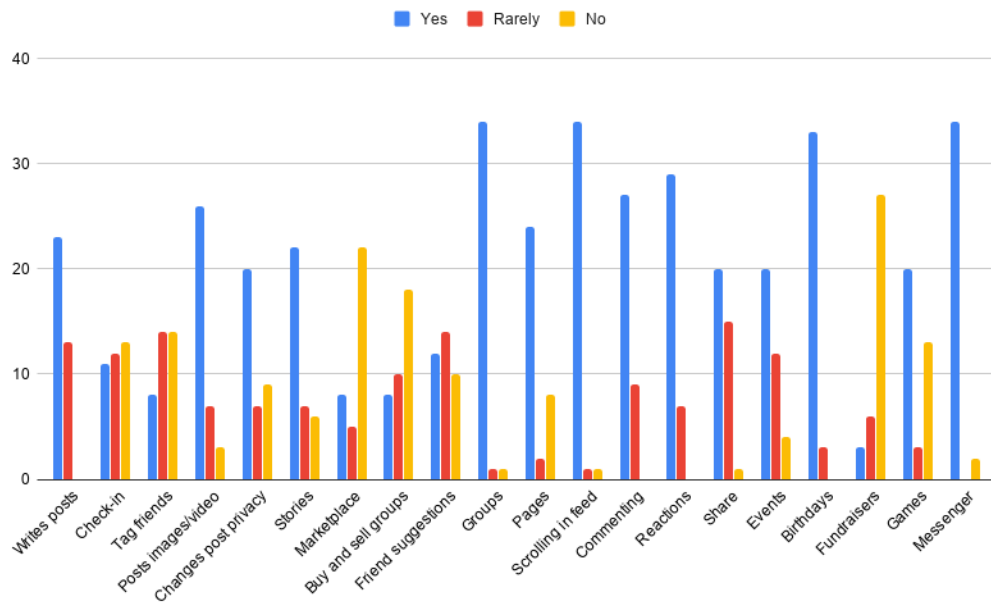
**Interview person 1:** *Even if I retire, my brain is still working and I am still a pretty functional citizen. It does not go one night and suddenly you are slow and I think that this is important to think about when meeting older adults in different contexts. [...] As soon as you turn 65 you get a label in your forehead, it is us and them, and it is according to me very youth fixated in our country. And we are a huge group and our group only gets bigger and bigger.*

## 6.5 Questionnaire

To get more statistical data a questionnaire was made with questions regarding which functionality on Facebook the participants used. Each question had the answers “Yes”, “No”, “Rarely”, and “I do not know”. The instructions for the answer “Rarely” was that it should be answered if the participant had used the functionality at some point and could imagine using it again, but not often enough to answer “Yes”. The answer “I do not know” was answered if the user did not understand which functionality we meant. The questionnaire was distributed in several groups on Facebook and to one organization.

### 6.5.1 Questionnaire Result

In total 37 answers was recorded, but one participant was under 65 years old and was therefore removed from the data. The final result can be seen in Fig. 6.9



**Figure 6.9:** Result of the questionnaire

From the questionnaire, a radar diagram was also created by adding the number of answers from “Yes” and “Rarely” together. Each axis in the diagram represents one question from the questionnaire, which corresponds to one functionality, and the numbers on the axis represent the percentage of respondents that answered “Yes” or “Rarely”. The radar diagram can be seen in Fig. 6.10.

The radar diagram idea was inspired by Gustavsson Christiernin’s [2] process of deciding layers, described in section 3.4.1. However, we did not collect data using a scale based on the users knowledge of the different functionalities. Instead, the percentage of respondents utilizing the feature was used.

## 6.6 Layer Creation

From the findings from previous steps we started to create a base-layer and then different feature layers, which are described below.

### 6.6.1 Base-layer

To decide on the base-layer we started to look at our radar diagram. We saw that a few of the features had 94-100% of the respondents answering “Yes” or “Rarely”. These eight features formed the start of the simplest layer, the base-layer. Later on, we also added “Crisis response” since it might not be an often-used function, but if a crisis would occur we decided that it would be good to always have it available. In total, nine features were added to the base layer and the features are presented in the list below:

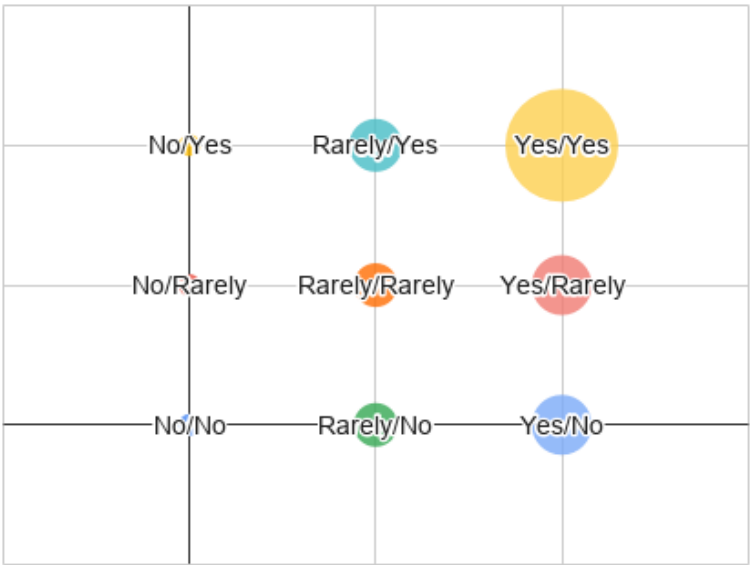


**Figure 6.10:** Radar diagram based on the questionnaire results

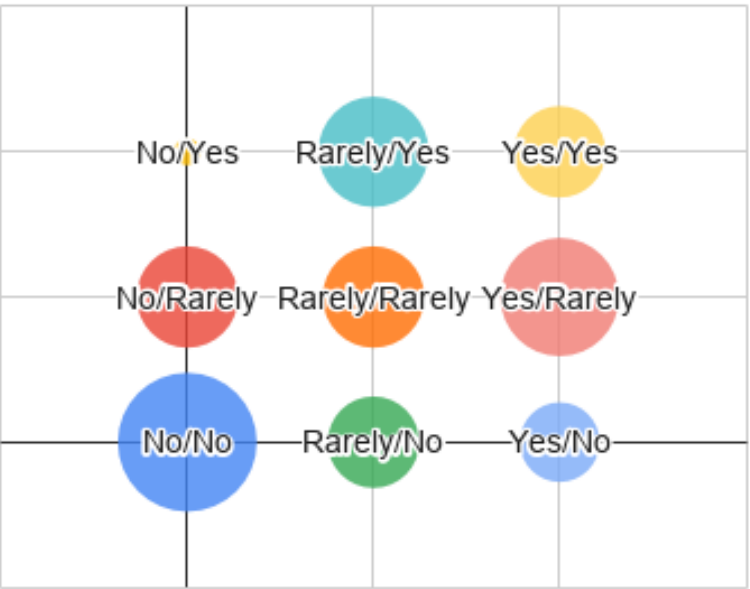
- Write posts (only text)
- Messenger
- Birthdays
- Share
- Reactions
- Commenting
- Scrolling in news feed
- Groups
- Crisis response

### 6.6.2 Feature Layers

When the base-layer was decided we tried to see correlations between different features, for example, see if a person used a certain feature they would also always use one of the others. The first attempt to see this was to make bubble charts to compare two features. The axes in these bubble charts represented a feature and the axes went from “No” to “Rarely” and “Yes”, see Fig. 6.12 and Fig. 6.11.



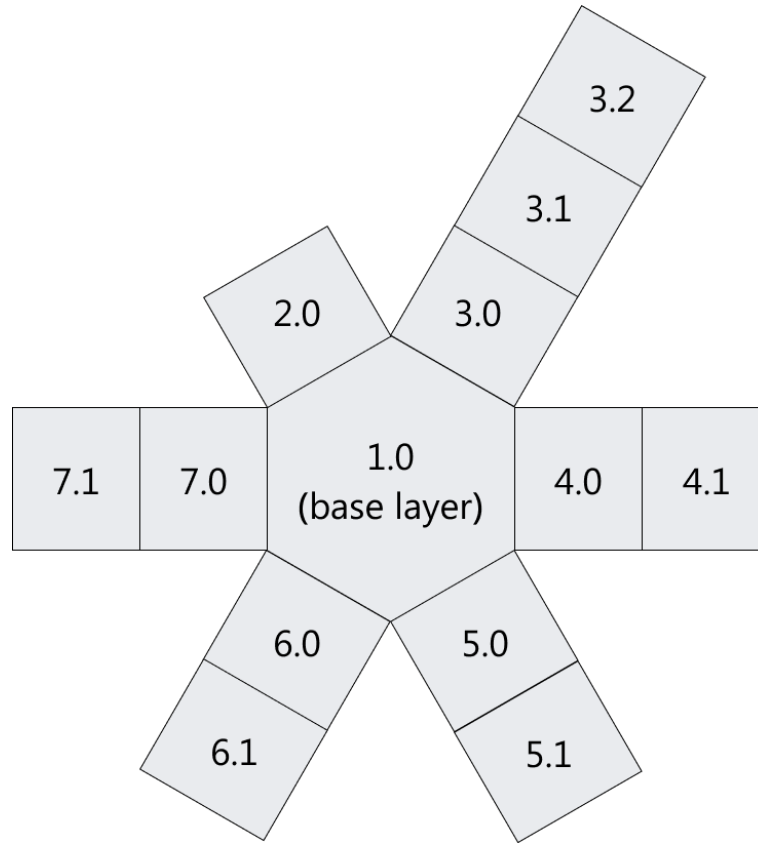
**Figure 6.11:** Bubble chart comparing stories and adding image or video to a post



**Figure 6.12:** Bubble chart comparing tag friends and check in

The idea was to find correlations, for example, if the bubbles “Yes/Yes”, “Yes/Rarely”, and “Rarely/Yes” were the biggest those features would be used by the same users. However, we found some issues with this approach, for example, if feature A is very popular and feature B is not as popular, but is always used together with feature A, the bubbles “Yes/Yes” and “Yes/No” would be the biggest, and the correlation will be hard to see. Furthermore, most of the diagrams showed that the answers were spread out and the only correlation we could see was stories and adding pictures or video to posts, see Fig. 6.11, but that might be because they are both popular features that many respondents use.

Since we could not, from the data, find any correlations it was decided that we would go with feature layers, described in section 3.4. The idea was to keep the base-layer, and from that layer each feature-group would grow its own set of layers, visually represented in Fig. 6.13.

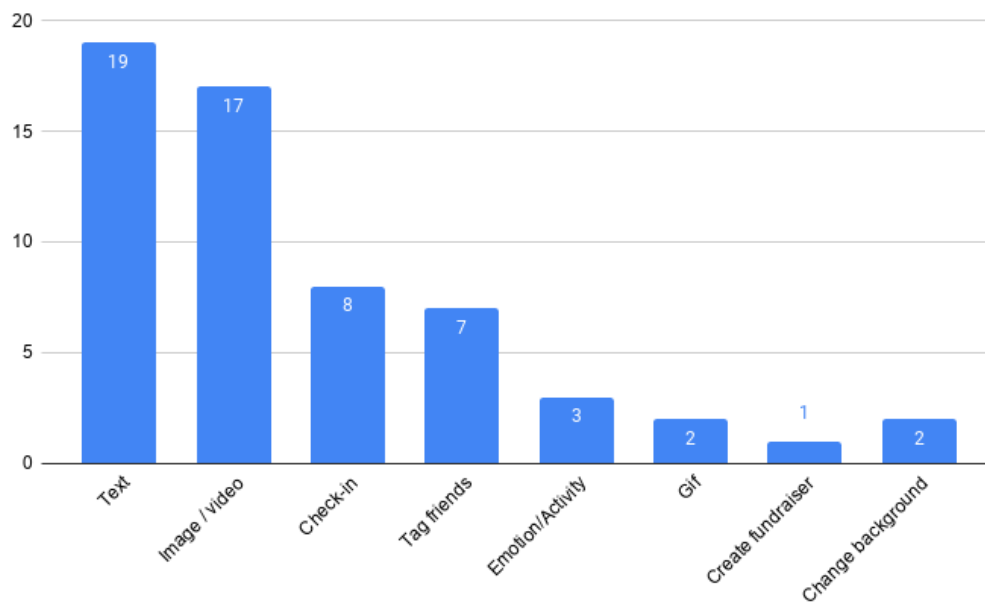


**Figure 6.13:** Visual representation of the layer structure

To decide on the different feature-groups we went back to the grouping of Facebook features we did in the beginning of the project, see section 6.2. The first clear functionality-group we found was “Content creator”. We listed all functionality that was related to creating content associated with posts and we went on Facebook to see which functionality older users utilized the most, see Fig. 6.14 for result. This was done by looking at 20 older users’ profiles and noting what functionality was used in their posts. The users were semi-randomly selected from the members list of a Facebook group for seniors. Only members who had public profiles were chosen.

With help from the data in Fig. 6.14, three layers within the content creator functionality-group were formed, which can be seen as layer 3.0, 3.1, and 3.2 in table 6.3. These were based on how many of the users utilized each functionality. Other layers were created from our groupings of Facebook functionality and resulted in the layers also presented in table 6.3.

Layer 2 is about user privacy. Layer 4 represents a “suggestions” layer, both sugges-



**Figure 6.14:** Functionality used in posts by 20 semi-randomly selected senior users on Facebook

tions from Facebook and from friends. The fifth layer is a “content consumer” layer which decides in general what extra things should be in the users’ news feed, and in the more advanced layer, the possibility to customize their news feed. Layer 6 is related to economy with buy and sell, jobs and fundraisers. The final layer, layer 7, is about games.

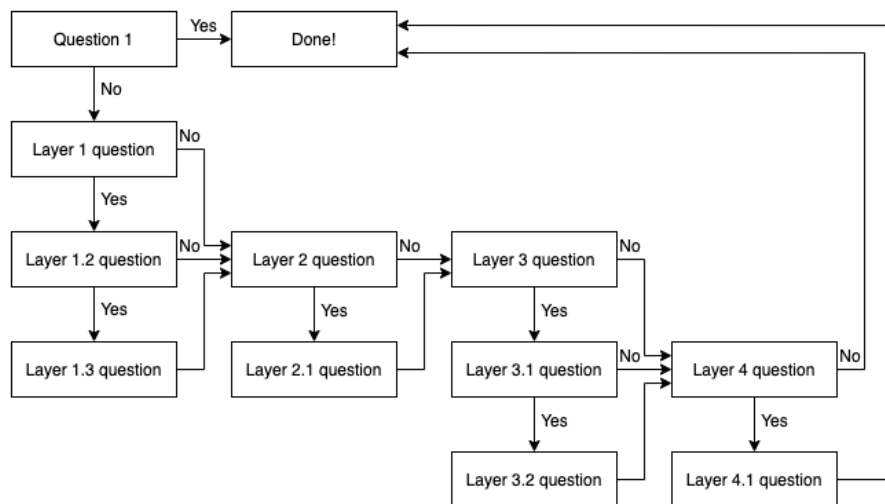
## 6.7 Selection Mechanism

When the layers were done we started looking at the design and content of the selection mechanism. The first things we decided was that the selection mechanism is used to select which layer the user should have in their Facebook interface. This mechanism consists of a wizard containing questions about what functionality the user utilizes on Facebook, and is displayed to the user as they enter the Facebook website. Once they have gone through the wizard it is not shown to the user again, unless they choose to redo it. The reason for using a wizard is that it is an easy and pedagogical way to make a user perform several tasks in a certain order.

### 6.7.1 Questions

The questions were designed by looking at the layers that were defined in the previous step. The initial idea was to create one question for each layer or sub-layer with yes and no answers and depending on the answer the user would answer another question within the same group of layers or move on to the next layer group, as a type of responsive disclosure but not on the same page, described in section 3.6.3, see Fig. 6.15 for a visual representation. The idea was to have a different page for each

question to not make the interface cluttered and make sure no scrolling is needed. However, this approach would result in at least twelve questions and pages, and the total number of questions or groups of questions in a wizard should, according to what was found out during the literature study, be kept between three and ten. It was therefore decided to create one question for each layer branch and having the sub-layers in that branch forming the answer alternatives as statements instead of just having plain “yes” or “no” answers, see Fig. 6.16. This approach, from now on referred to as *version 1*, managed to decrease the number of questions, and thereby the number of pages, to seven but still obtaining the same information from the user as the previous approach would have done. One example of such a question can be seen in the box below and Appendix F shows a complete list of all the questions.

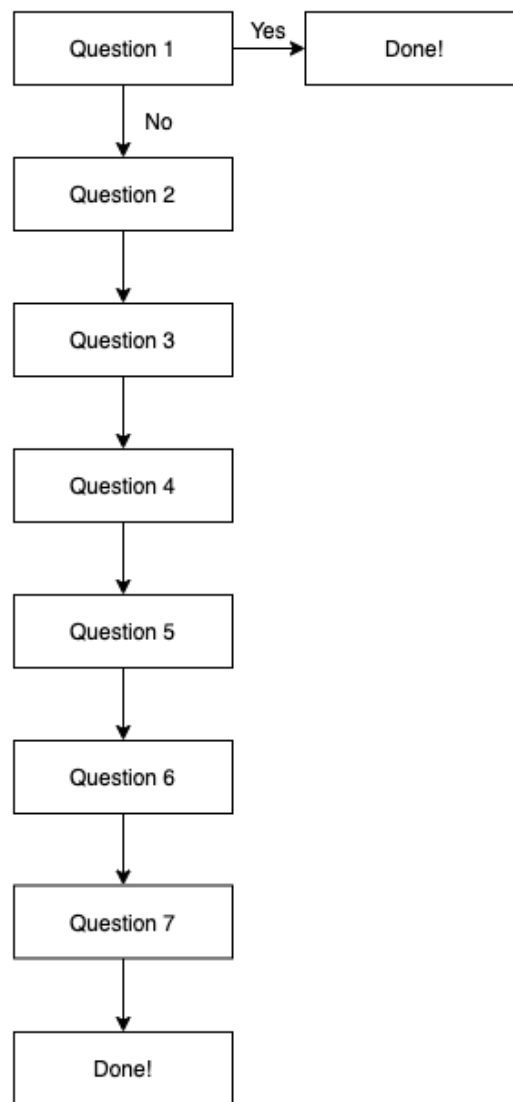


**Figure 6.15:** First version of the wizard flow chart

*Which statement suits you best?*

- (a) *Sometimes I publish my own posts where I add a picture or video.*
- (b) *Same as above, but sometimes I tag the friends I'm with or check in to the places I visit.*
- (c) *Same as above, but sometimes I ask for recommendations, add an emotion/activity, add a GIF or create a fundraiser.*
- (d) *I only want to write posts with text or no posts at all.*

One downside with the version 1 approach is that each statement contains multiple functionalities and if the user only uses some of it, they might be uncertain on what answer to select. Because of this and other advantages of creating multiple prototypes, mentioned in section 4.4.2, we decided to use parallel prototyping, and create a second set of questions, from now on referred to as *version 2*. In version 2 the functionality in each layer is listed and the user ticks the boxes for what functionality they use. The result of this wizard will instead show all the ticked functionality and remove everything else. Therefore the pre-defined layer structure



**Figure 6.16:** Final version of the wizard flow chart

that was defined for version 1 is not used in this version except for the base layer which is always there independent of what boxes the user ticks. To tick off exactly which functionality to have on Facebook might be less confusing for the user, but this results in more statements for the user to consider and there is a risk that they might tire or get bored. However, the functionality to tick off is divided into the same feature groups as the layer structure and each feature group has its own page, therefore it is still within the recommended range of three to ten questions or groups of questions.

### 6.7.2 Wizard

A wizard was designed for both sets of questions defined in the previous step and the basic layout was the same for the two versions, see Fig. 6.17 and Fig. 6.18. A progress indicator was used to give the user an overview of where they were in the



wizard and how much they had left. To make it easier for the user to understand what functionality is referred, tooltips were added to the wizard so that when the user hovers some of the words in the questions, an image of the functionality appears, see Fig. 6.19. In version 1, all words that can be hovered are written in bold to make it easier for the user to distinguish them. In version 2, the words are not written in bold as the entire answer alternatives can be hovered. The progress indicator has been placed at the left side of the window, rather than placing it at the top or bottom, to narrow the text area for the questions as this improves reading speed and retention of information which was described in section 3.3.3. Other guidelines mentioned in section 3.3 were also followed, such as avoiding visual distractions, having a plain background, and using black text on white background. When designing the wizard we have also had the problems discovered during the Facebook analysis in mind. For example, we made the buttons bigger and the sequence of tasks is linear and straight forward.

Even though radio buttons and checkboxes are rather small and could be a problem for the users due to a decrease in the fine motor skills, we decided to include that anyway. The reason for this is that we wanted the interface to follow standard input controls and we did not want to make the interface too simplistic and risk offending the users. Instead, we decided that the entire text area of the alternative is clickable, so in the end the hit area for each alternative is rather big. Another approach that was discussed was to have the alternatives as big buttons that would light up when chosen, but this was disregarded as we thought it would look too easy and “childish”.

**Figure 6.17:** Version 1 of the wizard.

In the beginning, we had an idea to use either a stencilMap or ephemeralMaps on the Facebook interface after the wizard is completed. However, we did not follow through with this for two reasons. The first reason is that this prototype is not

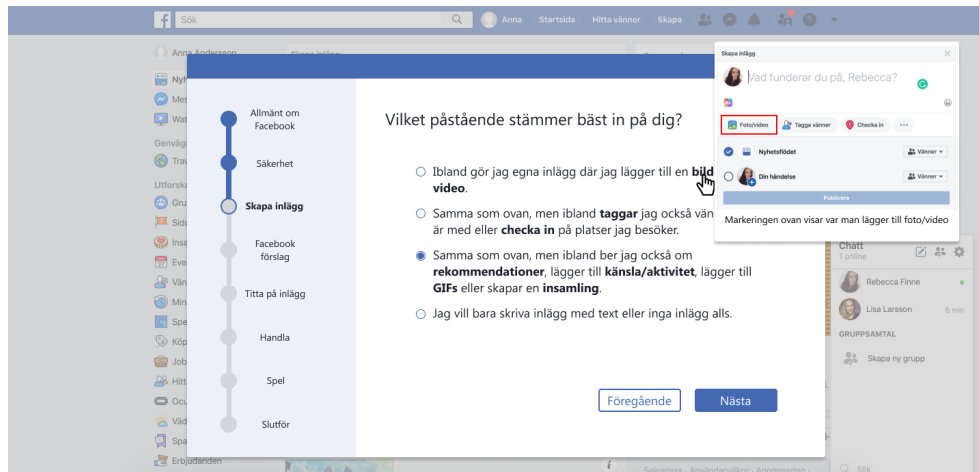
**Figure 6.18:** Version 2 of the wizard.

intended to teach the user an interface as both `stencilMap` and `ephemeralMaps` are meant to do. Instead, this is to help continued use of an interface the user already knows. We did also create a suggestion on how it could look to have a `stencilMap` for the base layer, see Fig. 6.20. However, this was not aesthetically appealing and felt cluttered, and is the second reason why we chose not to use any of those maps in our design.

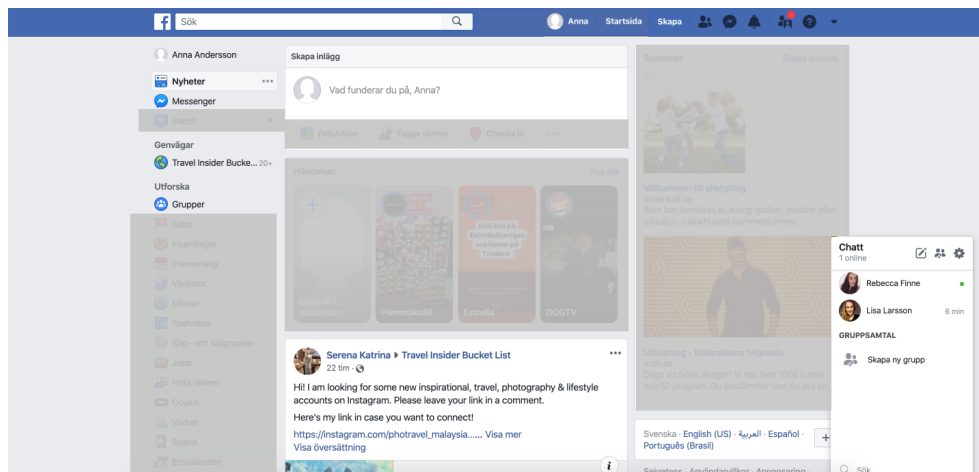
## 6.8 Extra Interview

Two weeks after we had conducted the interviews, we were contacted by a person who had suffered from a stroke. Despite it being late in our process, we decided to perform an extra interview with this person as she fitted well with our intended user group and we had not previously been able to get in contact with someone who could give us a better insight into how a stroke might influence Facebook usage. Since this was after our other interviews, we decided to do this interview over email by sending some questions for her to answer in written format. We also decided to not ask about specific features, and instead more general about her Facebook use and how that was related to her health problems since the layers were already created, so exactly what she used on Facebook was not relevant.

The most interesting findings from the email conversation were that the person lives in Florida, but her family lives elsewhere and therefore they are using a Facebook group to communicate, especially during hurricane season, to know they are all okay. The person is because of the stroke paralyzed on her left side of the body, and therefore type on the keyboard using only one finger. She also told us that different Facebook groups helped her see if someone is feeling down and needs help. For example, she found one girl who had written in a group that she was going to



**Figure 6.19:** The design of the tooltip feature, where a user can hover the functionality described in the wizard to get a visual representation of it.



**Figure 6.20:** The Facebook interface base layer using a stencilMap.

commit suicide. The interviewee and a few others from the same Facebook group had then searched for family or friends of the girl and could, therefore, prevent the suicide. Finally, the person also mentions that since she cannot go outside, Facebook has replaced her social life and is therefore very important to her. Unfortunately, since this interview was conducted at such a late stage in the process, it was not possible to apply any changes to the prototypes.

## 6.9 Prototype Implementation

A research engineer from the digital seniors research group offered to implement our prototypes and since that would be more time efficient for us we accepted the offer. The research engineer started to implement version 1 of our design as a Google

Chrome<sup>1</sup> extension, which later extended to Firefox<sup>2</sup> as well. After a few meetings over Zoom<sup>3</sup>, the first prototype was done for us to give feedback on. This procedure was repeated a few times until the prototype behaved as we wanted it to.

When version 1 of the prototype was done, version 2 of the prototype was implemented following the same procedure, the research engineer implemented a prototype, which we gave feedback on and this was repeated a few times.

### 6.10 Usability Tests

To see if the idea was good according to our target group a few formative usability tests were conducted. A formative approach was selected since we wanted to see what the participants thought about the concept and we were not interested in finding, for example, the amount of errors or time to complete a task.

In total five tests were conducted and the participants were the same as for the interviews except for one that did not have a computer and was therefore not able to participate.

#### 6.10.1 Changes Due to COVID-19

Due to the COVID-19 virus, we had to change our plans for conducting the user tests. The original idea was to meet with the participants in real life and give them one of our computers to try the prototype and afterward ask some follow up questions. Instead, the usability tests had to be conducted online over Skype and Zoom, and the participants had to themselves install the prototype on their computers and share their screen while trying out the prototype.

#### 6.10.2 Preparations

To prepare for the usability tests we created a number of guides for how to install the prototype, both for Firefox and Chrome and how to share the screen in Zoom and Skype<sup>4</sup>. See Appendix H for an example of one of these guides. The follow-up questions were also created and a general outline over how a test would be conducted was also made.

#### 6.10.3 Execution of Usability Tests

The general outline of the test was to give a brief introduction to the prototype, what was expected of the participants during the test and introduce a consent form for them to agree to. When that was done we helped them start a screen sharing and installing our prototype if they had not done that beforehand. Then it was

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<sup>1</sup><https://www.google.se/intl/sv/chrome/>

<sup>2</sup><https://www.mozilla.org/sv-SE/firefox/new//>

<sup>3</sup><https://zoom.us/>

<sup>4</sup><https://www.skype.com/>

time to try out the prototype. Three of the participants started trying version 1 and then version 2 and two of the participants started trying version 2 and then version 1. This was to eliminate the risk that they would become tired or get more comfortable when trying the wizard a second time or use the knowledge from the first round the second time, and that it would affect the result. After they had tried a version, we asked a few questions about what they thought about the new interface, if any functionality that they used were missing and if they thought they would use it if a similar product was released to simplify their Facebook interface. When the participant had tried both versions we also asked which one they preferred and why.

Overall the user tests went well, even though they were conducted online. Only one participant had managed to install the prototype prior to our meeting, but to help the participants install the prototype while screen sharing was not a big issue.

#### **6.10.4 Usability Test Result**

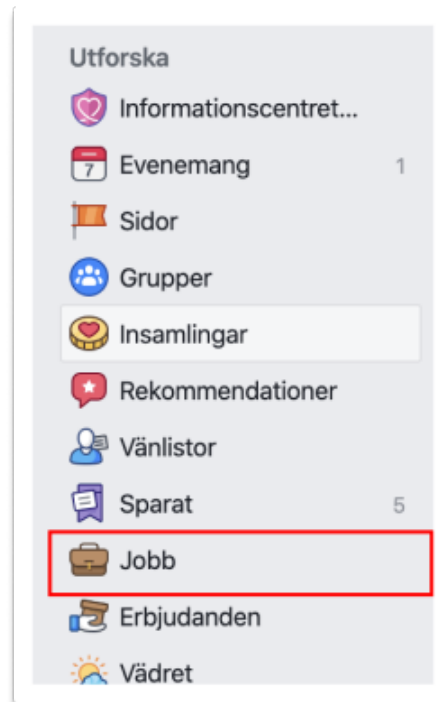
In general, most of the participants were positive to the concept. However, one stated that it was more for beginners and not for experienced Facebook users as the participant themselves. Another participant was also positive to the idea, but also said that this concept limits the development of Facebook usage and the participant will not learn new things if using this type of simplified interface.

Many of the participants thought it was fun to do the wizard and that it was easy and quick to answer. Some said that it could have been more questions as well. They also thought it was fun since they learned about new functionality they did not know existed before. However, not all of the participants saw a change in their interface, this was mostly those who answered that they used a lot of functionality and therefore not a lot of items were removed from the interface.

##### **6.10.4.1 Tooltips**

The biggest issue that arose during the tests was the tooltip feature, see Fig. 6.19. Only one of the participants found the tooltips by themselves, the other participants were asked afterward if they saw the tooltips. Many of the participants had accidentally hovered over the words or phrases that activated the tooltips, but they said they did either not notice or thought they broke the prototype somehow when the tooltips appeared. After getting the tooltips explained, the participants said that they did not get enough information out of the tooltips. Instead, they would prefer to have an explanatory text accompanied by the picture.

Another issue with the tooltip pictures was the size of the images. Some of them were too small for the participants to see properly and in some cases, it caused more confusion than help. The most problematic pictures were those showing the “Explore” section on the left side of Facebook, see Fig. 6.21. These pictures included a lot of items and since the size of the image was small the items in the picture were also small and difficult to see.



**Figure 6.21:** One of the more problematic tooltip images.

### 6.10.4.2 Version 1

Almost all (two of the participants could see benefits with both versions) participants preferred the version 1 prototype since it gave a better context, which made it easier to understand the questions and consequently easier to answer them. However, one issue with version 1 that arose was that a few participants thought it was hard to choose the right answer for them. Some participants said they used some functionality in an alternative, but not all, and instead picked the alternative above since they used all functionality in that alternative. They would rather have more alternatives to make it easier to choose an answer that suited them better.

Most participants liked that the last alternative in version 1 existed, which was “I’m not interested in any of the above”. However, one participant did not like the phrasing of it, they stated that they might not use the functionality because they do not know the functionality exists, but now wants to try it out and therefore they are interested in the functionality. The participant continued saying that in that case, none of the alternatives would suit them.

### 6.10.4.3 Version 2

According to a few participants version 2 was better in the sense that it showed more functionality. But in general, it was harder to understand and all of the participants asked us about what at least a few functionalities were. The most common questions we got were about “Suggestions in feed”, “Friend lists”, “Change background in post”, “Pages” and “GIFs”.

#### 6.10.4.4 Comparisons Version 1 and Version 2

We saw some indications of confusion between checkboxes and radio buttons. Many participants did not understand that more than one checkbox could be chosen and those who started with version 2 often tried to click more than one radio button. Some also did not understand that they could move on in the wizard without clicking any checkbox in version 2. Instead they wanted a checkbox that said “None of the above” or similar. However, the confusion between checkboxes and radiobuttons was never a problem in the first version the participants tried, no matter if it was version 1 or version 2, and the confusion was likely caused by going from one way of doing it to the other.

Furthermore, we noted that many of the participants answered that they used less functionality in version 1 than in version 2, probably because the participants chose the alternatives where they used all functionality in version 1. It was also found in the tests that the participants mostly needed explanations to words in version 2 since the words did not give enough context as the statements in version 1.

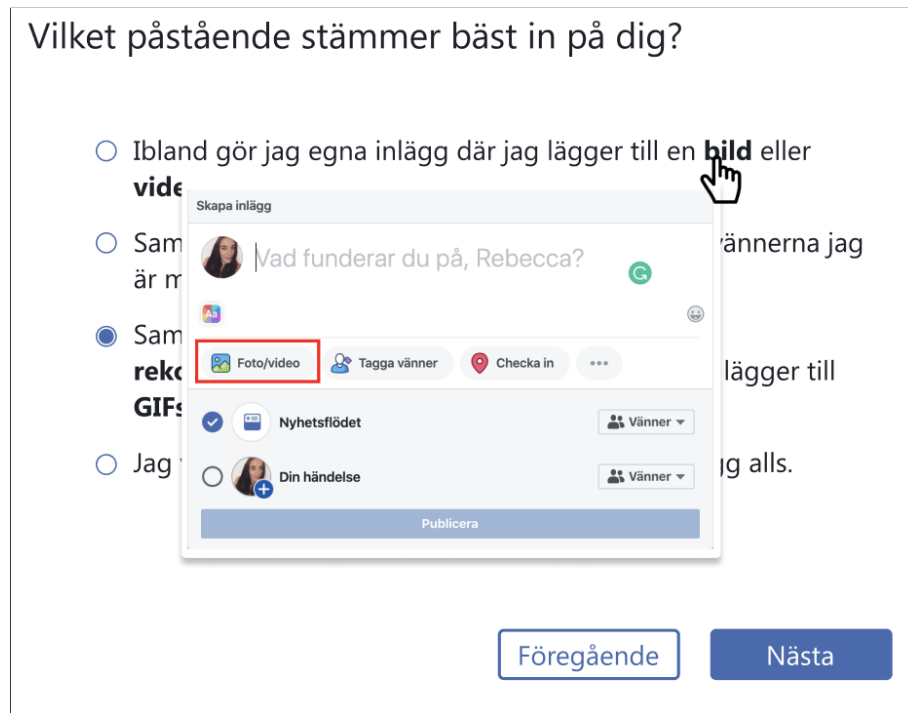
## 6.11 Refinement of Prototype

Based on the results from the user tests, the prototype was refined. The first decision was to scrap the second version of the prototype, the one that had checkboxes for each functionality instead of statements. This was an easy decision as none of the test persons said that they preferred that version over the other. Refinements made in version 1 concerned the tooltips, which were renamed to *the help feature*, the wizard questions and the layers. This refined final prototype has not and will not be tested by users in this project due to time constraints.

### 6.11.1 The Help Feature

The tooltip-like help panels that appeared for the user as they hovered over certain words in the questions, see Fig. 6.22, was thoroughly refined. We realized that this needed improvement as it was both difficult for the participants in the user tests to find and understand, and also did not provide the information that they had hoped. Even though many of the participants expressed dislike for this feature, many of them were initially pleased when we told them about it, as they needed help in understanding the different features that were mentioned in the questions. This lead us to believe that they liked the idea, but not the implementation, of the help feature.

The first issue that had to be tackled was that only one of the participants found the help feature on their own. This was solved by adding information-icons in the questions in order to catch the users’ attention. It was also a way to make the interface intuitive by having the action represented by an icon, as described in section 3.3.1. Several mockup versions of this were made in order to find one design where the word and icon stood out, but without the page feeling too cluttered. We decided on a version with the information-icon placed directly after each of the words that



**Figure 6.22:** Original version of the tooltip-like help feature.

had an explanation available, see Fig. 6.23, which were previously only written in bold. One suggestion that was not picked was to have the information icons within parentheses to make them stand out more, which was abandoned because it felt too cluttered, see Fig. 6.24. Another suggestion was to have the information icons at the very end of each statement instead, see Fig. 6.25, and pressing one of those icons would then show explanations to all of the highlighted functionality in that statement in the help panel. Even though the design of the question area for the last suggestion looked cleaner, we did not pick that design because the help area would then be cramped with too much information, as it would have to contain explanations to several different functionalities rather than just one at a time.

Other issues with the help feature were that the images were too small and that it felt cluttered and irritating when they appeared. Some of the participants also expressed that the images did not provide the help that they wanted. These issues were solved by adding a dedicated help area in the wizard, containing an explanatory text together with larger images, see Fig. 6.26.

### 6.11.2 Wizard Questions





Although the participants said that they liked the way the questions were formulated as statements in the wizard, there was still room for some minor improvements. As some of the participants found it difficult to decide which statements suited them the most, the title text on questions three to seven was rephrased from “Which statement suits you best?” to “Choose the statement that covers as much as possible of the functionality you use”. The last alternative on questions three to seven



Vilket påstående stämmer bäst in på dig?

- ☐ Ibland gör jag egna inlägg där jag lägger till en **bild eller video** .
- ☐ Samma som ovan, men ibland **taggar**  jag också vännerna jag är med eller **checka in**  på platser jag besöker.
- ☒ Samma som ovan, men ibland ber jag också om **rekommendationer** , lägger till **känsla/aktivitet** , lägger till **GIFs**  eller skapar en **insamling** .
- ☐ Jag vill bara skriva inlägg med text eller inga inlägg alls.

**Figure 6.23:** The information icons that were added to the wizard during the refinement.

☒ Samma som ovan, men ibland ber jag också om **rekommendationer** () , lägger till **känsla/aktivitet** () , lägger till **GIFs** () eller skapar en **insamling** ().

**Figure 6.24:** A mockup version where the information icons are placed within parentheses, which was not used in the final prototype.

were also changed to “I don’t do anything of the above”, as we realized that they were all different, but expressing the same thing, and that it would probably be easier for the user if they were all formulated the same way.

Even though several of the participants suggested that the wizard could be longer and contain more questions, we decided not to add any more questions to it. The reasoning behind this decision was that our prototype only focuses on one small part of the Facebook website right now, but the end goal is to cover the entire website with all its functionality. Because of this, we did not want to add more questions to this part as the full version would have a significant increase in the number of questions to be able to cover all functionality on the website. A complete list of the revised version of the questions can be seen in Appendix E.

### 6.11.3 Layers

As we didn’t feel that it was possible for the participants to give any feedback about the layers, we decided to not do any dramatic changes to them. The only thing we

- Samma som ovan, men ibland ber jag också om **rekommendationer**, lägger till **känsla/aktivitet**, lägger till **GIFs** eller skapar en **insamling**. ⓘ

**Figure 6.25:** A mockup version where the information icons are placed at the end of each statement, which was not used in the final prototype.

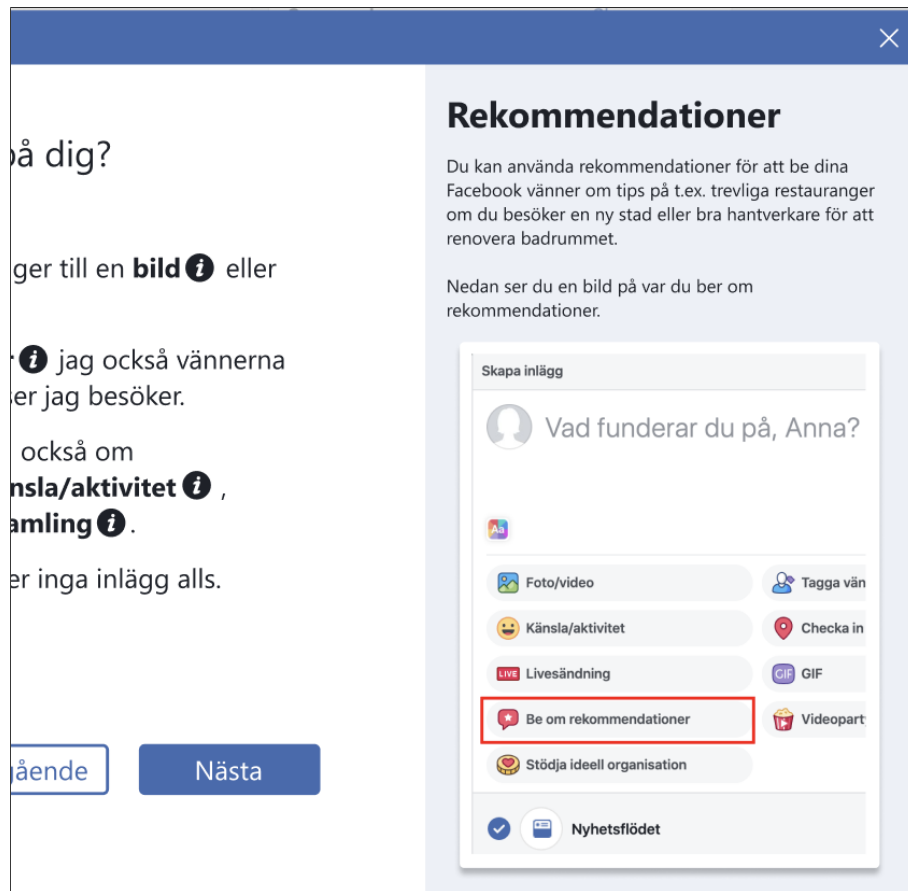
changed was that we removed the button to visit your profile located in the sidebar, as there already is an almost identical button located in the top bar, see Fig. 6.27.

## 6.12 Creating Guidelines

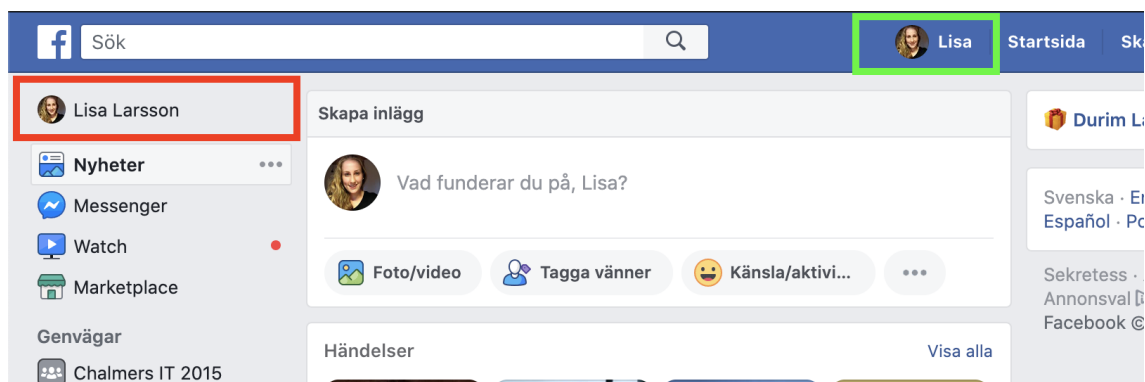
Based on the findings from the usability tests, eight guidelines were created. To create them we looked at the problems discovered in the user tests, interviews and literature, and from that formed appropriate guidelines. The guidelines are meant to work as a rule of thumb when designing a selection mechanism for digital interfaces used by digital seniors, and are presented in the list below.

- Consider Using a Wizard
- Make it Easy to Find Information
- Present Information in a Context
- Minimize the Use of Different Input Controls
- Clear Relationship Between Action and Effect
- Use a Feature Layer Structure
- Consider Showing the Selection Mechanism Regularly
- Remember that Older Adults have Different Abilities

Four guidelines are based on the findings from the user tests, for example, the guideline, “Minimize the Use of Different Input Controls”. It was created because of the confusion between checkboxes and radio buttons, as discussed in section 6.10.4.4. We saw a pattern that those who started with version 1 later had trouble with checkboxes and those who started with version 2 later had trouble with radio buttons. Since the participants became confused when the second input type was introduced we concluded that it is best to stick to only one input type in the selection mechanism.



**Figure 6.26:** The help panel that was added to the wizard during the refinement.



**Figure 6.27:** The two buttons for accessing your profile on Facebook. The left button, marked with a red square, was removed completely from the interface during the refinement and the one in the top bar, marked with a green square, was kept (screenshot from [6])

|                           |  |
|---------------------------|--|
| Layer 1.0<br>(base layer) | Write posts (only text)<br>Messenger<br>Birthdays<br>Share<br>Reactions<br>Commenting<br>Scrolling in news feed<br>Groups<br>Crisis response                             |
| Layer 2.0                 | Change post privacy<br>Friend lists  |
| Layer 3.0                 | Post image or video<br>Stories<br>Memories   |
| Layer 3.1                 | Check in<br>Tag friends  |
| Layer 3.2                 | Change background on post<br>Add feeling or activity<br>Add GIF<br>Create fundraiser<br>Ask for recommendations<br>Send live video                                       |
| Layer 4.0                 | Friend suggestions<br>Suggestions in news feed<br>Game suggestions (in the side bar/chat bar)  |
| Layer 4.1                 | Recommendations  |
| Layer 5.0                 | Events<br>Pages<br>Memories  |
| Layer 5.1                 | Hide post<br>Hide all posts from group/people/pages<br>Snooze group/people/pages posts<br>Turn on notification for a post<br>Report post<br>Save post<br>Videos on Watch |
| Layer 6.0                 | Marketplace<br>Buy and sell groups<br>Fundraisers  |
| Layer 6.1                 | Recent ad activity<br>Offers<br>Jobs   |
| Layer 7.0                 | Games  |
| Layer 7.1                 | Gaming videos  |

**Table 6.3:** Describes the functionality contained in each layer

# 7

## Results

The result of this project is a final prototype consisting of the selection mechanism accompanied by layers and a set of guidelines on what to consider when creating a selection mechanism. In this chapter, the prototype and the guidelines will be presented.

### 7.1 Final Prototype - The Selection Mechanism

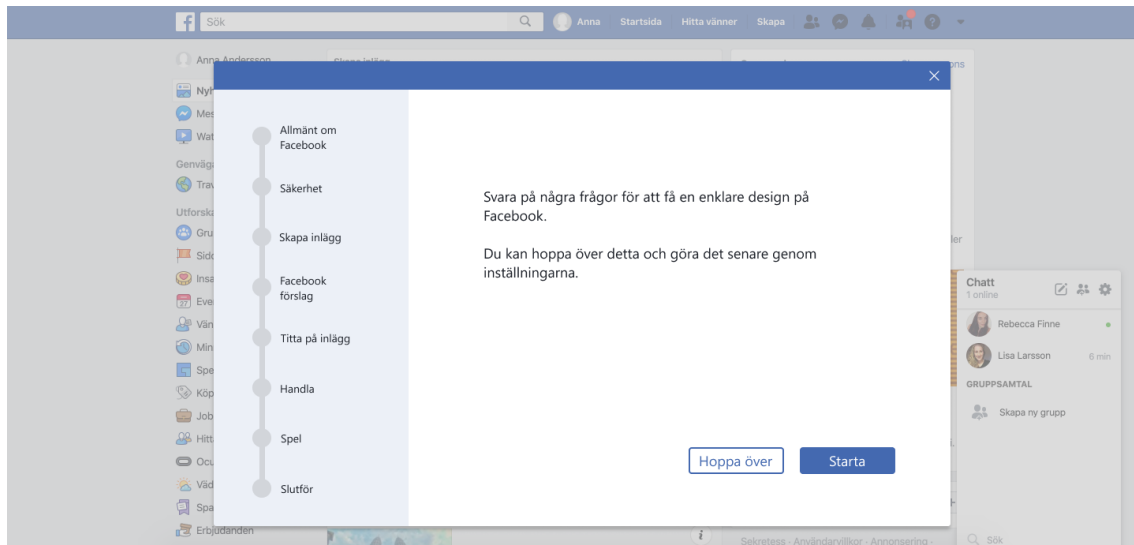
After considering the comments from the usability test and refining the design accordingly, the final prototype was created. The prototype is a wizard that is presented as a dialog on top of Facebook. The wizard is used as a selection mechanism with the purpose of selecting a suitable layer for the user from the layer structure that has also been created together with the selection mechanism. Facebook users utilize the wizard once to get a customised Facebook interface based on their answers. It is possible to retake the wizard if the user is not happy with the result.

Fig. 7.1 shows the first screen of the wizard. The left side consists of a progress indicator which gives an overview of the wizard and where the user is. The sections to be completed are “General about Facebook”, “Security”, “Create post”, “Facebook Suggestions”, “Look at posts”, “Shopping”, and “Games”. A final section “Finish” is also present for the user to confirm the change of Facebook.

The text in the middle says:

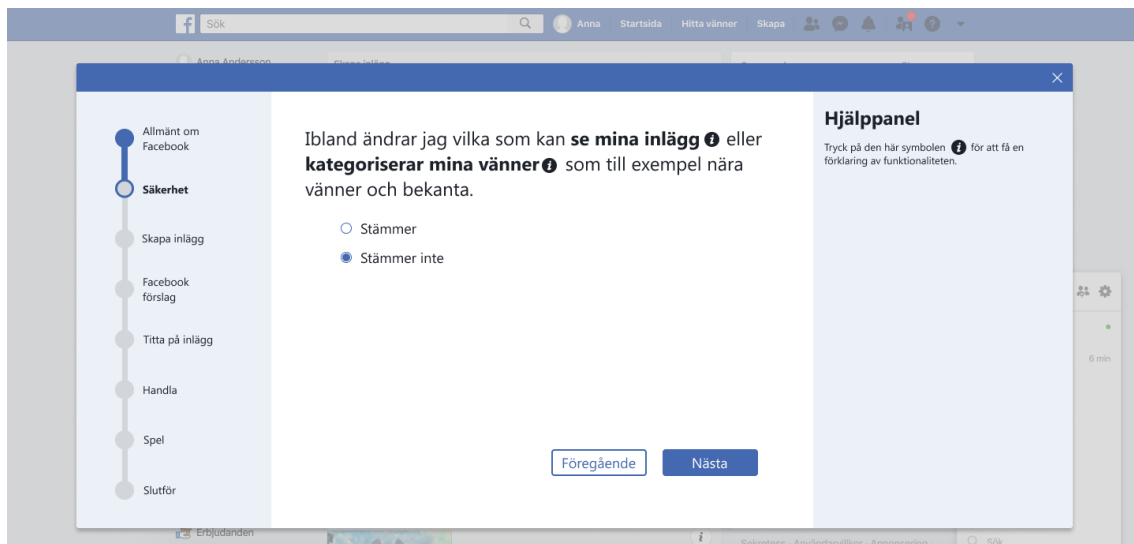
*Answer a few questions to get an easier Facebook design.  
You can skip this and do it later through the settings.*

The user can click on the white button to skip the wizard or click on the blue button that says “Start” to continue with the wizard. When the start button is clicked the width of the wizard will expand to make room for a “help panel”, seen in Fig. 7.2. The help panel will act as a help to the user if they do not know the meaning of one of the bolded words in a question or alternative. The user can then click on the information icon behind the word to get information about it in the help panel, see Fig. 7.3 for an example. If the user has not yet clicked on an information icon the help panel will look like in Fig. 7.2, which says:



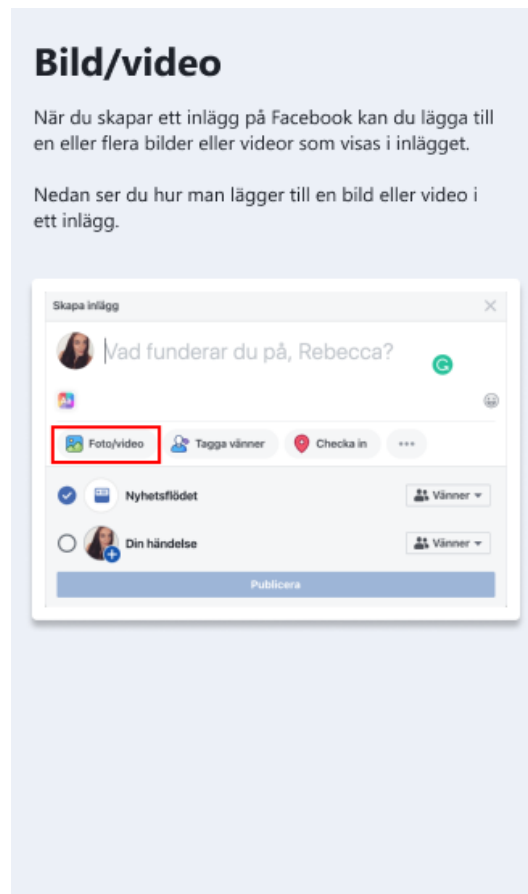
**Figure 7.1:** The starting screen of the selection mechanism.

*Click on this icon [information icon] to get an explanation of the functionality.*



**Figure 7.2:** The second question in the wizard.

The first two questions the user will answer in the wizard are two statements where the user answers “Correct” or “Not correct”, Fig. 7.2. In the other questions, the user selects the statement that covers as much functionality as possible that they use. For example question 3:



**Figure 7.3:** An example of information displayed in the help panel.

*Choose the statement that covers as much as possible of the functionality you use.*

- (a) *Sometimes I publish my own posts where I add a picture or video.*
- (b) *Same as above, but sometimes I tag the friends I'm with, or check in to the places I visit.*
- (c) *Same as above, but sometimes I change the background on a post, add an emotion/activity, or add GIFs.*
- (d) *I only want to write posts with text or no posts at all.*

If the user only *adds a picture or video* to a post, the user should choose alternative a). If the user utilizes the features *adding a picture or video* and *check in* to a post alternative b) should be chosen, even though the user does not *tag friends*.

The user goes on with the wizard by clicking on the blue button which says “Next” and the user can always go back and change their answers by clicking on the white button which says “Previous”. When all questions are answered the user comes to the final screen in the wizard, see Fig. 7.4. In this screen the text in the middle says:

*Click on “Finish” to get an easier design on Facebook.  
You can always reset Facebook or redo the questions through the settings.*

The white button says “Previous” and the blue button says “Finish”. When the

## 7. Results

user clicks on “Finish” the wizard disappears and a loading screen appears that says “Updates Facebook based on your wishes”. In the background, the user can see some items on the Facebook interface disappearing, see Fig. 7.5. When the loading screen is finished the user will have an updated Facebook interface.

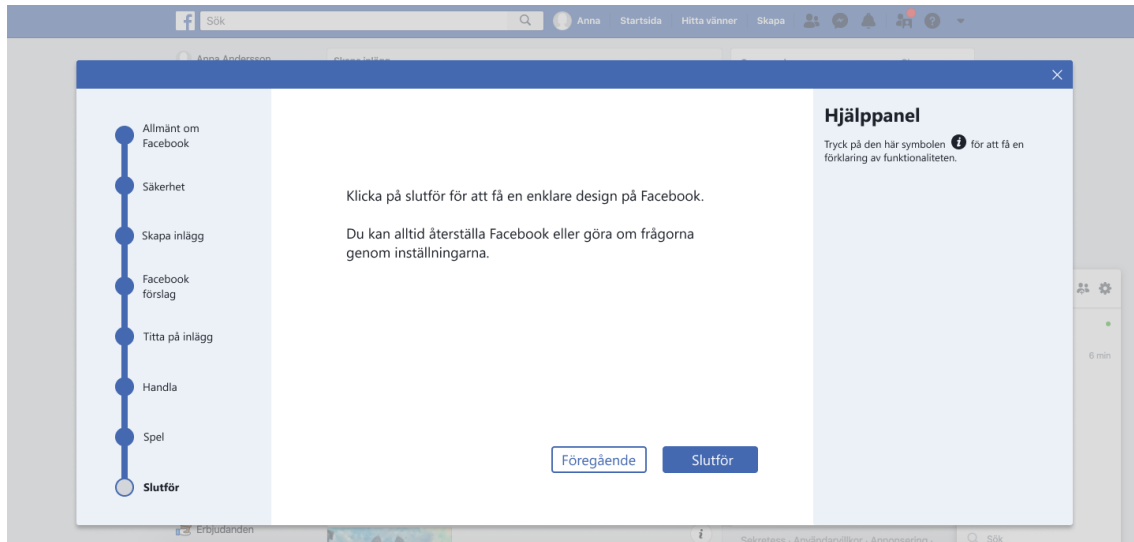


Figure 7.4: The final screen of the wizard.

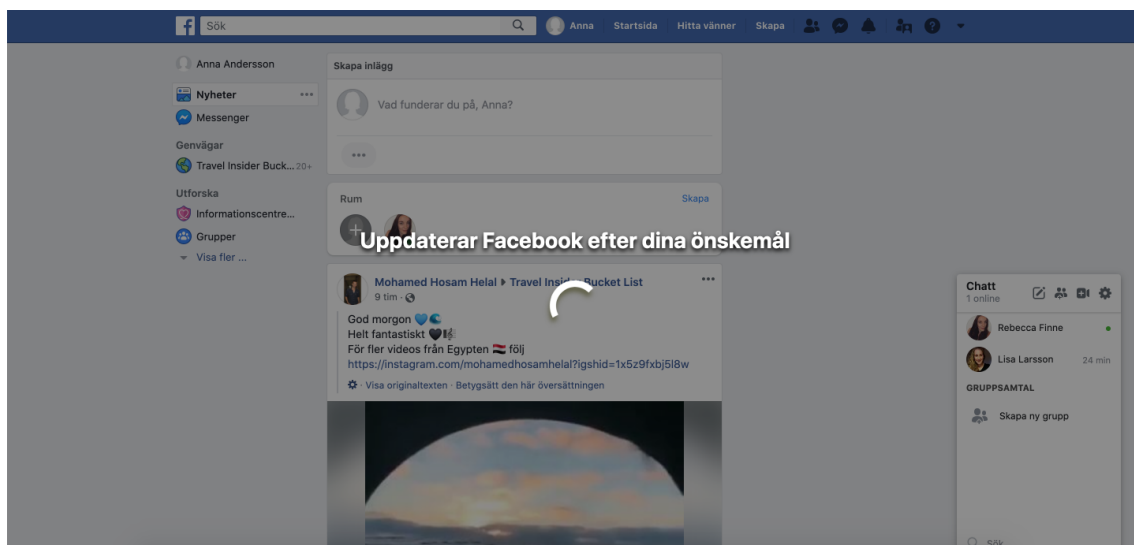


Figure 7.5: The loading screen that is displayed after finishing the wizard.

## 7.2 Guidelines

In total, eight guidelines were created based upon the result of the user tests. The purpose of these guidelines are to be used when designing a selection mechanism for digital interfaces used by digital seniors. They are presented below together with an explanation and motivation why these guidelines are appropriate.



### 7.2.1 Consider Using a Wizard

*Use a wizard as a part of the selection mechanism.*

All participants were positive to the concept during the user tests, no participants had any issues going through the wizard, and some participants also mentioned that it was an easy process to go through the wizard. This, therefore, shows an indication that using a wizard might be a good option.

A wizard is also a common design pattern with a several benefits, for example, helping the user to keep the focus on the task at hand, as presented in section 3.6.1. Another reason why the wizard pattern is a good choice is that one of the occasions when a wizard is appropriate is in an online survey with a set of questions, which this concept is. A drawback mentioned in the theory section about wizards is that advanced users might feel limited by a wizard, which should be kept in mind when designing it.

### 7.2.2 Make it Easy to Find Information

*Do not hide where to find more information.*

In the first version of the prototype, we hid further explanations under a tooltip function, which showed a picture of the feature when hovered. Since this feature was hard to find for the older adults we instead suggest giving a clear indication of how to find more information overall about things in the wizard, but especially for the features mentioned in the questions. This can be done by, for example, having an information icon and a dedicated space for the information itself. To use an information icon together with a text also follows one of the existing guidelines regarding design for older adults, presented in section 3.3.1.

Furthermore, older adults will have a harder time processing new information, as mentioned in section 3.2.2. Therefore the information presented to the user should be static on the screen until the user chooses not to see the information anymore, so that they have time to take in the new information.

### 7.2.3 Present Information in a Context

*Put information within a sentence so the user gets a better understanding.*

From the user tests, we found out that the participants understood the features better when they were put in a context. They did not ask as much what a feature meant and, therefore, it should be considered to put information and features in a sentence rather than trying to keep it as short and concise as possible when designing the questions. An example of how to use the feature can also be added if it will add value.

As presented in section 3.3.3 information should be presented in a clear and familiar way, and the text should also include a simple language. By presenting different

features in a context the text is becoming more clear, familiar, and simple since a single feature name might not be in the users' vocabulary, but when put in the context of use it is possible to understand what the feature is.

### 7.2.4 Minimize the Use of Different Input Controls

*Do not mix similar input controls in the wizard.*

When comparing the two versions of the first prototype the participants were confused about the difference between radio buttons and checkboxes. Therefore, we suggest not mixing the two or any other input controls that are similar to each other, instead, only one type of input control should be used, if possible.

This guideline goes hand in hand with the guideline about “consistent layout” presented in section 3.3.1. By using a consistent layout they mention design, icons, and navigation buttons, however, they do not mention anything about input controls. Therefore, this guideline is needed as a complement to the existing guideline about “consistent layout”.

### 7.2.5 Clear relationship between action and effect

*Do not let the user be unsure what actions caused a change in the interface.*

During the user tests, a lot of participants accidentally hovered over the tooltips implemented in the first prototype. When doing this they did not say anything about it and when we asked afterward they said that they thought they broke something when the tooltips appeared and had therefore ignored it. Because of this, we suggest having to perform a clear action before changing the interface in any way, by for example, a mouse click, as mentioned in section 3.3.1.

### 7.2.6 Use a Feature Layer Structure

*Allow the user to be more advanced in certain areas.*

Even though the layers could not be tested properly we still recommend using feature layers. Backed-up by the theory from [35] presented in section 3.4 we believe that feature layers are good to allow the user to be an expert in one area, but a novice user in other areas without having to use a full-functionality interface. This was also seen in the interviews. All participants used Facebook in very different ways, and some were very advanced in a certain area but had no experience in another area.

### 7.2.7 Consider Showing the Selection Mechanism Regularly

*Allow the user to remove or add functionality to their interface on a regular basis.*

A person is continuously aging, so it can be argued that after a while a user might need to remove more functionality from an interface. It can also be possible that a

user has learned more about digital interfaces and wants to add more functionality to their interface. Therefore, we suggest showing the selection mechanism regularly, for example, once a year. It is also important to not show it too often since if the interface is changing too frequently it will be hard for the user to familiarize with the interface again after a change, as mentioned in section 3.4.2.

### **7.2.8 Remember that Older Adults have Different Abilities**

*Do not design an interface that is too easy, not all adults are beginners.*

In the interviews, one participant said that they were annoyed that as soon as you turn 65 you will be seen as a stupid elderly that do not know anything about digital devices. [13] also states that older adults are often portrayed in a negative light and mostly seen as a burden. However, this is not the case, all the participants that we met were very talented and did not fulfill the negative stereotypical elder. Therefore, we suggest to design a clear and easy selection mechanism, but not too easy that it will offend the user.



# 8

## Discussion

In the discussion we will go through the steps of the process and discuss different things that could have affected the result of this project. We will also discuss our results from the test of the prototype, ethical issues, and future work.

### 8.1 Credibility of User Data

Finding users within our target group has been a hard process. When a few candidates were found that could meet for interviews we realized that all of them were still pretty young and healthy. Some of them had only been retired for a few years and therefore, there might be a slight bias in our data, from the interviews and the usability tests, and probably from the questionnaire as well. It is not surprising that the more healthy seniors want to participate in an interview, while others, with more health problems, might not want or are not able to participate.

The result from our interviews showed that in general the seniors do not have any problems. The few problems they have are due to lack of knowledge more than physical demands. However, if we had found more participants who had had more age related health issues the result could have been a lot different.

Another part that can be biased is that those who participated in the interviews had a lot of knowledge about Facebook and had had Facebook for many years. It is possible that the users that have had Facebook for only a few years are insecure about their knowledge, and do not want to participate in interviews or studies.

### 8.2 Process

In this section, we will discuss some steps in our process. Some topics that are covered are: what could have been done better, what could have been done differently with more time, and if some steps were unnecessary.

#### 8.2.1 Difference in Planning and Execution

At the beginning of this project, a brief time-plan was created. The time-plan was followed to a great extent, however, there were a few changes during the execution of the project. The first thing that was added to our process was the grouping of

Facebook functionality and the Facebook analysis. This was suggested by our supervisor and therefore added to get a better understanding of Facebook and to get an overview of Facebook's exact functionality.

The second thing that changed was how the interviews were recorded. The initial idea was to record only the audio and take some photos to remember better. However, after researching interview techniques more we decided to go with two video recordings instead. One recording was filming the participant to record their body language and facial expressions, and the second recording was filming their device where they showed Facebook during the interview.

After the interviews, we were, according to our planning, supposed to create guidelines. However, the interviews did not provide a good enough foundation to generate these guidelines, instead, we decided to make a questionnaire and a prototype first. This way we would have more foundation to base the guidelines on. The questionnaire was added as a complement to the interviews to find out statistically which features were the most popular and it, therefore, helped to design the layers.

Except for the things mentioned above our process followed the time-plan. The interviews and user tests were conducted week 9 and week 17 as planned and other internal deadlines were met as well.

### 8.2.2 Facebook Analysis

One of the problems found in the analysis was that a lot of the buttons seemed rather small. However, this problem was not raised during the interviews as a problem, but as discussed in section 8.1 the interview participants were among the healthier spectrum of seniors. Therefore, the buttons might be a problem among users with worse motor skills for example, but that was not raised in the later interview with the person who had had a stroke either. So in conclusion, the buttons might not be a problem.

Since the focus of our work has been on creating a selection mechanism and not change the looks of Facebook itself the analysis has not helped in that process. However, this analysis was made before we decided to focus on only the selection mechanism. Because the focus of the project shifted the Facebook analysis was not as important anymore since it was outside of the scope of this project to fix the problems we found. But we had the problems in mind when designing the selection mechanism so that similar mistakes would not be made.

### 8.2.3 Creation of Layers

Creating the base layer for the layer structure was straight forward since we could look at the radar diagram created from the questionnaire and see which functionalities were the most popular. Creating the rest of the layers, however, was not as straight forward as the base layer. One attempt at creating layers was by using

the bubble charts, which did not provide the help that we thought as we found it difficult to see the correlations. This method could be slightly better with more data points, to be able to form clearer correlations between features. But, we do not recommend this method, even with more data points since it is hard to interpret the diagram, and the probability of finding a correlation this way is pretty low.

In the end, the layers were created by grouping functionality that would fit together. Examples of two of these groups are creating a post and games. Then the features within the functionality group were sorted from most used to less used. This was mostly done by reasoning and discussion. However, for a larger scope or a larger time frame, this could be decided by more user research, for example, observing users to see which features are used together and which features only the experts use. However, this was not possible in our time frame, but can be part of future work.

#### **8.2.4 Changes due to COVID-19**

Due to the COVID-19 pandemic during the spring of 2020, a few changes in the process were made. One example is how the user tests were conducted, as explained in section 6.10.1. Another change is that this project was, to a large extent, conducted remotely. A consequence of this is that no proper ideation session was conducted and no rough sketches were made. Instead, the ideas were discussed and the “sketches” were made in Figma<sup>1</sup>, which resulted in them being quite high fidelity. The risk of doing this is that not all possible ideas are explored and some great ideas could, therefore, be missed. However, it is impossible to say if the prototype would have looked different if a proper ideation session with sketching had been performed.

#### **8.2.5 Implementation of the Prototype**

Towards the end of the project, we got the prototype implemented as an extension to Google Chrome and Firefox. However, according to “good” design practice, a prototype should not be implemented before shown to users to avoid costly fixes. We are aware of this, but in this case, it was more time-efficient to have a third person implement the prototype than having us create a clickable prototype in Figma.

There are also other benefits to this. One benefit is that due to COVID-19 it was not possible to test the prototype face-to-face with our participants, and therefore not possible to test a paper prototype. Another benefit with an implemented prototype is that the participants can interact for real with the prototype and not with pictures, and it was also possible for them to see and interact with their resulting Facebook interface.

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<sup>1</sup>[www.figma.com](http://www.figma.com)

### 8.2.6 User Test

Overall, the user tests were helpful and gave valuable insights to how the prototype could be improved, and later, what should be considered in the guidelines. However, there are some things regarding the user tests that we would like to discuss further.

The fact that the user tests were performed remotely over Skype and Zoom, instead of face-to-face which was the original plan, might have affected the results slightly. The users might not have been comfortable communicating this way and they might have felt stress over having to install things on their personal computer. However, we do not believe that this had significant negative effects on the results, since no larger obstacles occurred. It might even be that the impact was positive as the users were at home in their natural environment and on their own computer, which made the setting more realistic.

Another thing we realized during the user tests was that it was difficult for the participants to pinpoint the changes made to the UI after finishing the wizard. No one of the participants could mention anything they used which was missing in the interface, and they also claimed that they used everything that was left. Of course, the point of the prototype is to remove everything that the user does not use, and keep the things that they do use. However, when the same participants tried the other version of the prototype, the resulting interface looked slightly different to the previous version in most cases, but the participants still claimed that they used everything in the interface and that nothing was missing that they regularly used. One possible explanation to this is that it might have been difficult for the participants to notice the changes in the interface during such a short time. This made it difficult to evaluate the layers of functionality in the prototype, and user tests where the participants got to use the new interface for a longer period of time would therefore be a better way to evaluate this.

## 8.3 The Final Result

The final design is a wizard with seven questions that relate to Facebook's news feed page and a set of guidelines. In this section, the prototype and the guidelines will be discussed.

### 8.3.1 Prototype

The final design of the wizard focuses on the news feed page on Facebook. However, since there is a lot more on Facebook than the news feed page a lot more questions are needed to determine layers for Facebook as a whole. Therefore, this approach might not be the best for more complex and big systems, which might be in the most need of a multi-layered structure. Even though many of the participants expressed that the wizard could have been longer with more questions, it is difficult to say how many questions would be too much for them. It is also difficult to say how many more questions would have to be added if the prototype was expanded to include



the entire website.

To be able to have a wizard with fewer questions, each question needs to contain a lot more features. This might be possible if a lot more research is made in advance. With more data points it is possible to be more certain about correlations that might exist between features, and from the correlations be able to ask better questions and cover more features in each question.

One of our guidelines states that it should be considered to show the selection mechanism regularly, for example, once a year. It might be possible to have fewer questions in the following years by not letting the user answer questions about features they have already removed from the interface. Another approach is to ask completely different questions every year, by, for example, starting with the news feed page and our questions and in the second year ask questions about, for example, group settings. So, in the long run, the interface will become more and more adapted to the user.

Another approach to cover the whole Facebook with as few questions as possible could be a merge between the questions already implemented and the approach discussed in section 6.7.1. The approach where a user answers a question for layer 3.0, for example, and if utilizing that functionality the user answers a question for layer 3.1, but if not utilizing the functionality in layer 3.0 the user, instead, answers the question for layer 4.0 immediately. The merge would mean using the current questions and if a user chooses an alternative containing a more complex feature, for example, pages, the user gets a follow-up question to understand in which way the user utilizes this feature. For example, if the user has created their own page.

This merge would have the benefit of collecting a lot of information in the basic questions (the ones already implemented) and the dynamic benefit of responsive disclosure. This approach would also help cover all functionality on Facebook without adding too many questions.

Another approach to determine which layer is optimal for a user is to use machine learning to track what the user is doing on Facebook, and make the interface adaptive instead. However, if this approach is implemented it is important to not change the interface too often since users think that is annoying, see section 3.4 for more information about that.

One other thing that we are not considering in the prototype is that there is a lot to do on Facebook and a lot of these things are possible to perform in several different ways, for example, go to your profile page and create a fundraiser. One way to make the interface less cluttered is to make sure there is only one way to perform each action. However, we do not know at this point which way of doing things is the most used and it might cause a lot of confusion for the user if the way they are doing it is removed. It could be possible to add a question about this in the wizard to know what way to keep.

### 8.3.2 Guidelines

The guidelines are generalized and could work for any system and not just Facebook, and should therefore also be applicable to other devices, such as tablets, even though we only tested using laptops and desktops. They are also in a state where they can be used and it would be beneficial to use them together with other guidelines, for example, how to design a wizard and designing for older adults. However, they are still at the first draft, therefore, further iterations and research should be conducted, to make them better and possibly a few more could be added.

One guideline that is not based on the findings from the user tests is the guideline “Use a feature layer structure”. It is not based on the user tests since we could not test the layers properly, as discussed in section 8.2.6. However, we still believe that our layer structure is good and that it is a benefit to use feature layers instead of mixed layers in this case since it is not very common to be an expert in all areas, as mentioned in section 3.4. This is also strengthened from our usability tests where, for example, one participant had a lot of knowledge about groups as the person was an administrator for one, but did not know that it was possible to play games on Facebook. So, in conclusion, we recommend using feature layers since the literature and the user tests back this up, but we are also encouraging further testing to be even more certain about this.

Another guideline that we were not able to investigate in our user tests is “Consider showing the selection mechanism regularly”. This is based on literature, but it would be beneficial to investigate further, for example, how often the selection mechanism should be shown to the user. That could be investigated by performing a longitudinal study.

## 8.4 Ethical Issues

The most concerning ethical issue that was present during this project was the personal information our participants have shared during interviews and usability tests. However, we were clear with what was needed from them, and during the interviews, all participants signed two copies of a consent form, so they were able to take one copy home to study afterwards if they wanted to. In this consent form, it was stated that all data collected would be transcribed and anonymized, meaning that their names, other names they mentioned, and other things that could show their identity would be removed or changed.

When conducting the usability tests it was not possible to get a signed copy of a consent form, due to the Covid-19 virus. Instead, the participants got a consent form over email before the meeting and during the meeting, their consent was recorded.

There is one thing in the interview consent form that does not apply anymore though. In the interview consent form, it is stated that the original video of the

interview will be stored on Google Drive, however, due to technical limitations, the original recordings are instead stored on Box.com. The participants are not aware this, but none of them showed any concern about their recordings for the usability test being stored on Box.com, as the consent form was updated between the interviews and the user tests. So they most likely do not see it as a problem storing the interviews on Box.com either. However, it is an ethical problem that we did not follow through our part of the consent form.

Another ethical issue that was taken into account during this project was that all participants were older adults and might not have the stamina as a young adult. Therefore, we took into consideration the speed and length of the interviews and usability tests. None of the meetings lasted for longer than an hour and we took it slow and explained everything, so the participants would not get stressed. None of the participants showed any signs of fatigue at the end of any meeting, so in conclusion, the length and pace of the meetings were good.

Due to current circumstances of Covid-19 and the fact that our user group is a high risk group for this virus, we have been careful not to expose our participants for any risks. This has been done by not meeting them after the initial interviews, which were performed before the virus started spreading seriously in Sweden.

We do not see any ethical issues with the concept itself, however, if our prototype would get commercialized there will be an ethical problem towards Facebook. This prototype is removing advertisements on Facebook, which hinders Facebook from making money. However, this project is more a proof of concept and is not aimed to become commercialized.

## 8.5 Future Work

This project is only scratching the surface of what can be done with multi-layered design to help with the continued use of digital products, such as Facebook. Therefore, there is a lot of future research that can be conducted and this section will cover a few of those areas.

First of all, more iterations with our final prototype would be good to polish it further and see what the users think of our solution with the help panel. It is also important to do a longer study where a few users can try out the prototype for a longer time, to see how they use it and for them to be able to further explore which features are removed and how they feel about that.

Facebook has also, during this spring, started rolling out a new version of Facebook for the web. The functionality of the new Facebook is similar to the older version, but it looks quite different. So, to make it work for the new version it is necessary to change the pictures in the help panel to match the new look. It could also be good during this rollout period to have two versions of the prototype, for the old and new Facebook respectively.

At some point when this research is more established it would be ideal if companies started using this concept by building it into the existing websites and not have it as web extensions. This would be beneficial since everyone except one of our participants did not manage to install the prototype. The social media companies could for example activate this concept when the users hit a certain age, or the user could activate the concept themselves through the settings or similar.

Lastly, there is also an opportunity to explore the possibility of an adaptive interface so the user does not have to fill in anything to get an adjusted interface. Adaptive interfaces have been known to be quite annoying for the user, but we still think that it is important to research how it would work in this purpose to, in the end, be able to decide if an adaptable or adaptive interface works best.

# 9

## Conclusion

The digital seniors research group has started a project where they explore the possibility of using multi layered design to help a continued usage of digital products when getting older. As a part of this project we have explored how to make a selection mechanism that decides which layer in that multi layered interface each user should be on, and by that answer the research question:

*What should be considered when designing a selection mechanism for multi-layered interfaces to help digital seniors continue to use a digital interface?*

The process to answer this question has included a literature study, interviews, an analysis, and a questionnaire. From that a prototype accompanied by a layer structure containing seven feature groups, and a set of eight guidelines were created. The prototype is a wizard that the user goes through and answers questions about what features they use.

A first version of the prototype was tested with a positive response and from the tests we learned a few things. These things include that the questions should put the functionality in a context, and tooltips with only a picture is not enough information to understand what feature is mentioned if the user does not know about it already. Tooltips are not optimal since the user will not always know that they exist or where to hover, therefore, in the final version of the prototype a static information box was implemented, that contains clear instructions on how to get more information.

The layers themselves have not been tested since the most reliable result will come from a long-term study, which is not possible with our time frame. However, having feature layers made it easier to structure the questions around each feature branch and are therefore recommended.

By considering the findings from the user tests eight guidelines were created to answer the research question:

**Consider Using a Wizard** - Use a wizard as a part of the selection mechanism.

**Make it Easy to Find Information** - Do not hide where to find more information.

**Present Information in a Context** - Put information within a sentence so the user gets a better understanding.

**Minimize the Use of Different Input Controls** - Do not mix similar input controls.

**Clear relationship between action and effect** - Do not let the user be unsure what actions caused a change in the interface.

**Use a Feature Layer Structure** - Allow the user to be more advanced in certain areas.

**Consider Showing the Selection Mechanism Regularly** - Allow the user to remove or add functionality to their interface on a regular basis.

**Remember that Older Adults have Different Abilities** - Do not design an interface that is too easy, not all adults are beginners.

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# A

## Groups of Facebook Functionality

Base functionality:

- Search function
- Settings

Group 1 - groups and pages:

- Groups
- Pages

Group 2 - Facebook suggestions:

- Friend suggestions
- Suggestions in news feed

Group 3 - Groups:

- Groups
- Buy and sell groups
- Marketplace
- Write posts in groups

Group 4 - Shop:

- Marketplace
- Offers
- Buy and sell groups
- Recent ad activity

Group 5 - Categorize things yourself:

- Friend lists
- Save post

Group 6 - New acquaintances and keep contact:

- Events
- Groups
- Friend suggestions
- Messenger

Group 7 - See previous activity:

- Recent ad activity
- Memories

Group 8 - Charity and spread love:

- Fundraisers
- Crisis response
- Birthdays

Group 9 - Content creator:

- Write posts
- Check in

## A. Groups of Facebook Functionality

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- Tag friends
- Add emotion/activity
- Add photo or video or text
- Change background on post
- Add GIF
- Send live
- Change post privacy
- Write on friends' wall (for example Birthdays)
- Video party
- Create story

### Group 10 - Content consumer:

- Read posts
- Comment
- Like/Reactions
- Watch stories
- Videos on watch

### Group 11 - Entertainment:

- Games
- Videos on watch
- Gaming videos

### Group 12 - Help:

- Quick help
- Recommendations

### Group 13 - Jobs:

- Jobs

### Things probably no one wants:

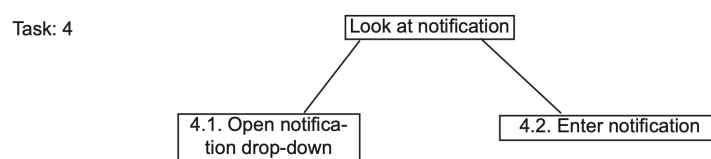
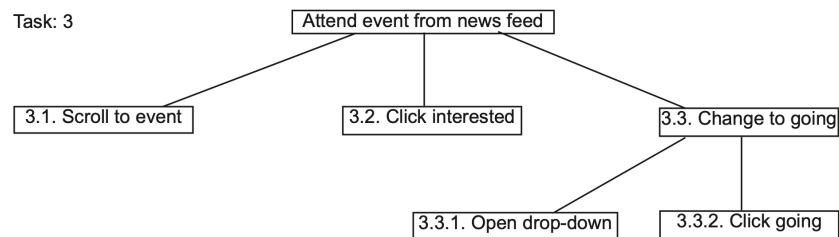
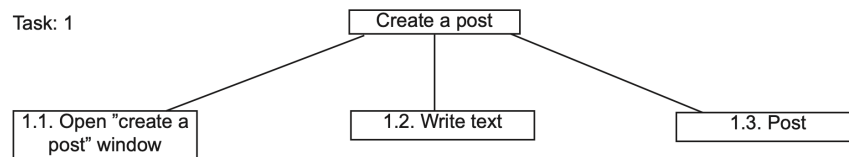
- Advertisement
- Oculus
- Weather
- Shortcut for language

# B

## Facebook Analysis

### B.1 Preparations

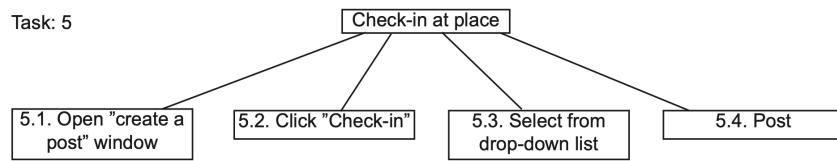
#### B.1.1 Task Flow Trees



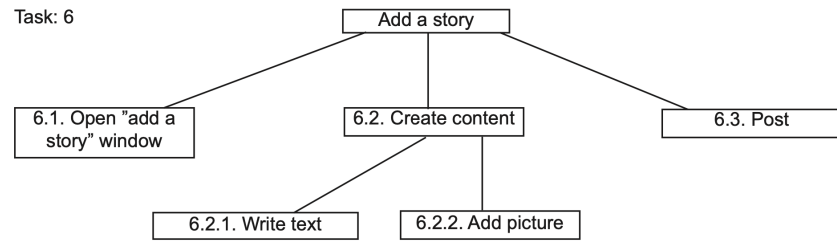
## B. Facebook Analysis

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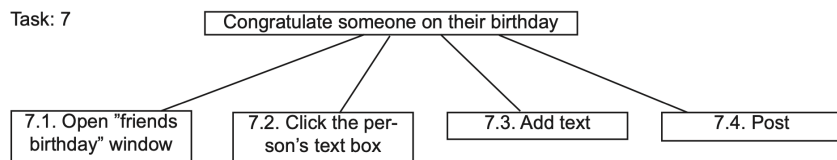
Task: 5



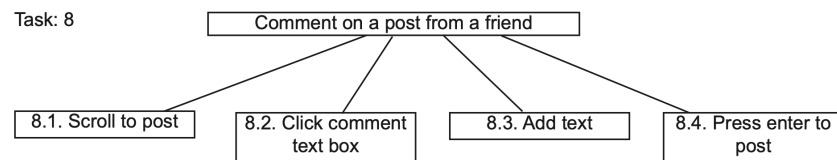
Task: 6



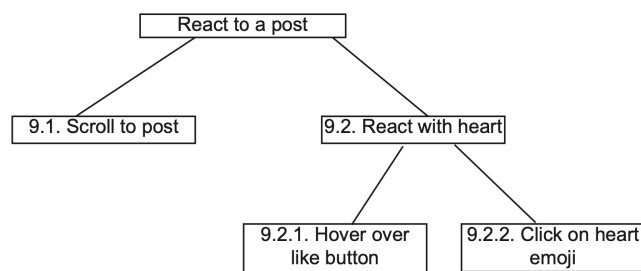
Task: 7



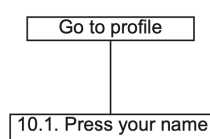
Task: 8



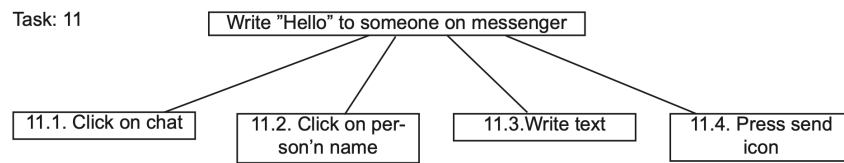
Task: 9



Task: 10







### B.1.2 Description of Interface Changes

1. **Create post** - upper part of the news feed shows the create post text box. When that is clicked a smaller window with more details is opened, the text field is marked by default so the user can just start typing. When the user has typed something the post button is enabled (it is disabled until the user adds something). When clicked post or the cross to go out of the create post window the window is closed.
2. **Go to Marketplace** - Click the Marketplace-button in the left menu on the screen.
3. **Attend an event through the news feed** - Events can appear in the news feed and they usually have picture and a grey bar at the bottom with information about the event (name, time, date etc). A button "interested" is also on the grey banner. When the interested button is pressed the star symbol is changed to a check mark and a arrow appears on the right side of the button, if clicked again a drop down menu then appears with the options "Going", "Interested" (which is chosen), "can't go" and it is also possible to change who can see that you are going. If "Going" is clicked the drop down closes and "interested" is Changed to "Going".
4. **Look at a notification** - Press the bell-icon in the top right corner. Press one of the notifications that show up in the drop-down menu.
5. **Check-in at a place** - Press the create a post text box in the upper part of the news feed. Press the Check in-button and select a location from the drop down-menu. Press the Post-button.
6. **Add a story** - The add story is located below the create post area. When clicked it looks exactly as when creating a regular post.
7. **Congratulate someone on their birthday** - Press the "birthday box" in the upper right corner. Press the text box for the person you want to congratulate. Write some text. Press Post-button.
8. **Comment on a post of a friend** - On posts from friends the comment section is open and the text box can be clicked and start producing text. To post the user needs to press enter on the keyboard, there is no send button. When enter is pressed the text box is emptied and the comment is added to the comment section.
9. **React to post** - Each post has a comment, like and share button. To react to a post the user needs to hover over the like button and then an extra section on the post with different reactions animations. When clicked the like button is highlighted on the post.
10. **Go to your profile** - On the top of the interface the user's name has a button and if that is clicked the user change cite and end up on their profile page.

11. **Write “Hello” to someone on messenger** - In the right bottom corner there is a chat box that says “chat” and how many friends are online. if clicked a list of active friends are shown. If a friend is clicked a chat window next to the list is opened. The text field is activated and the user can just start typing. To send the “send” icon is clicked (or enter).

### B.1.3 Specification of the User and use Situation

**User:** The user is over 65 years old and has used Facebook for a few years, and has some computer experience in general. The user is retired and has interests that they have more time to pursue.

**Use situation:** At home or at a public space with internet (since laptop or desktop computer). Used to keep contact with friends and family, read posts, maybe create a post and buy and sell things.

## B.2 Result Matrices

Matrices by Rebecca:

| Matrix A: Task importance vs Problem seriousness |                     |   |    |    |
|--|---------------------|---|----|----|
|  | Problem seriousness |   |    |    |
| Task importance                                  | 1                   | 2 | 3  | 4  |
| 1  | 1                   | 3 | 14 | 7  |
| 2  | 0                   | 0 | 0  | 2  |
| 3  | 0                   | 3 | 8  | 10 |
| 4  | 0                   | 3 | 8  | 8  |
| 5  | 0                   | 0 | 0  | 2  |
|  | 1                   | 9 | 30 | 29 |

| Matrix B: Problem type vs Problem seriousness |                     |    |    |    |
|---|---------------------|----|----|----|
|   | Problem seriousness |    |    |    |
| Problem type                                  | 1                   | 2  | 3  | 4  |
| U   | 0                   | 2  | 17 | 10 |
| H   | 1                   | 3  | 5  | 5  |
| S   | 0                   | 1  | 2  | 0  |
| T   | 0                   | 4  | 5  | 8  |
| P   | 0                   | 0  | 6  | 6  |
| F   | 0                   | 0  | 2  | 2  |
|   | 1                   | 10 | 37 | 31 |

| Matrix C: Problem type vs Task importance |                 |   |   |   |   |
|---|-----------------|---|---|---|---|
|   | Task importance |   |   |   |   |
| Problem type                              | 1               | 2 | 3 | 4 | 5 |
| U   | 10              | 1 | 8 | 8 | 2 |
| H   | 11              | 0 | 3 | 0 | 0 |
| S   | 0               | 0 | 3 | 0 | 0 |
| T   | 1               | 1 | 7 | 8 | 0 |
| P   | 8               | 0 | 2 | 2 | 0 |
| F   | 0               | 0 | 2 | 2 | 0 |

| Matrix D: Task number vs Problem seriousness |                     |   |    |   |
|--|---------------------|---|----|---|
|  | Problem seriousness |   |    |   |
| Task number                                  | 1                   | 2 | 3  | 4 |
| 1  | 0                   | 0 | 0  | 1 |
| 2  | 0                   | 0 | 0  | 2 |
| 3  | 0                   | 3 | 8  | 6 |
| 4  | 0                   | 0 | 2  | 3 |
| 5  | 0                   | 0 | 2  | 2 |
| 6  | 0                   | 1 | 3  | 5 |
| 7  | 0                   | 0 | 0  | 4 |
| 8  | 1                   | 1 | 2  | 3 |
| 9  | 0                   | 2 | 10 | 1 |
| 10   | 0                   | 0 | 0  | 1 |
| 11   | 0                   | 2 | 3  | 1 |

| Matrix E: Task number vs Problem type |              |   |   |   |   |   |
|---------------------------------------|--------------|---|---|---|---|---|
|                                       | Problem type |   |   |   |   |   |
| Task number                           | U            | H | S | T | P | F |
| 1                                     | 0            | 0 | 0 | 1 | 0 | 0 |
| 2                                     | 2            | 0 | 0 | 0 | 0 | 0 |
| 3                                     | 7            | 3 | 3 | 6 | 0 | 2 |
| 4                                     | 1            | 1 | 0 | 1 | 3 | 0 |
| 5                                     | 2            | 0 | 0 | 1 | 1 | 0 |
| 6                                     | 3            | 0 | 0 | 4 | 0 | 2 |
| 7                                     | 1            | 0 | 0 | 1 | 2 | 0 |
| 8                                     | 4            | 3 | 0 | 0 | 2 | 0 |
| 9                                     | 6            | 7 | 0 | 0 | 3 | 0 |
| 10                                    | 1            | 0 | 0 | 0 | 0 | 0 |
| 11                                    | 2            | 0 | 0 | 3 | 1 | 0 |

Matrices by Lisa:

| Matrix A: Task importance vs Problem seriousness |                     |   |    |    |
|--|---------------------|---|----|----|
|  | Problem seriousness |   |    |    |
| Task importance                                  | 1                   | 2 | 3  | 4  |
| 1  | 0                   | 1 | 3  | 9  |
| 2  | 0                   | 0 | 3  | 4  |
| 3  | 1                   | 1 | 6  | 14 |
| 4  | 0                   | 0 | 12 | 6  |
| 5  | 2                   | 1 | 1  | 3  |

| Matrix B: Problem type vs Problem seriousness |                     |   |    |    |
|---|---------------------|---|----|----|
|   | Problem seriousness |   |    |    |
| Problem type                                  | 1                   | 2 | 3  | 4  |
| U   | 0                   | 2 | 5  | 8  |
| H   | 0                   | 1 | 1  | 6  |
| S   | 1                   | 0 | 0  | 1  |
| T   | 2                   | 0 | 18 | 10 |
| P   | 0                   | 0 | 1  | 11 |
| F   | 0                   | 0 | 0  | 0  |

| Matrix C: Problem type vs Task importance |                 |   |   |    |   |
|---|-----------------|---|---|----|---|
|   | Task importance |   |   |    |   |
| Problem type                              | 1               | 2 | 3 | 4  | 5 |
| U   | 5               | 1 | 6 | 2  | 1 |
| H   | 6               | 0 | 2 | 0  | 0 |
| S   | 0               | 0 | 1 | 0  | 1 |
| T   | 1               | 5 | 7 | 13 | 4 |
| P   | 1               | 1 | 6 | 3  | 1 |
| F   | 0               | 0 | 0 | 0  | 0 |

| Matrix D: Task number vs Problem seriousness |                     |   |   |   |
|--|---------------------|---|---|---|
|  | Problem seriousness |   |   |   |
| Task number                                  | 1                   | 2 | 3 | 4 |
| 1  | 0                   | 0 | 1 | 2 |
| 2  | 2                   | 1 | 1 | 3 |
| 3  | 1                   | 1 | 4 | 8 |
| 4  | 0                   | 0 | 0 | 1 |
| 5  | 0                   | 0 | 2 | 2 |
| 6  | 0                   | 0 | 2 | 1 |
| 7  | 0                   | 0 | 2 | 6 |
| 8  | 0                   | 1 | 1 | 2 |
| 9  | 0                   | 0 | 2 | 6 |
| 10   | 0                   | 0 | 2 | 2 |
| 11   | 0                   | 0 | 8 | 3 |

| Matrix E: Task number vs Problem type |              |   |   |   |   |   |  |  |
|---------------------------------------|--------------|---|---|---|---|---|--|--|
|                                       | Problem type |   |   |   |   |   |  |  |
| Task number                           | U            | H | S | T | P | F |  |  |
| 1                                     | 1            | 0 | 0 | 1 | 1 | 0 |  |  |
| 2                                     | 1            | 0 | 1 | 4 | 1 | 0 |  |  |
| 3                                     | 6            | 2 | 1 | 2 | 3 | 0 |  |  |
| 4                                     | 0            | 0 | 0 | 0 | 1 | 0 |  |  |
| 5                                     | 0            | 0 | 0 | 3 | 1 | 0 |  |  |
| 6                                     | 0            | 0 | 0 | 2 | 1 | 0 |  |  |
| 7                                     | 0            | 0 | 0 | 5 | 3 | 0 |  |  |
| 8                                     | 2            | 2 | 0 | 0 | 0 | 0 |  |  |
| 9                                     | 3            | 4 | 0 | 1 | 0 | 0 |  |  |
| 10                                    | 0            | 0 | 0 | 4 | 0 | 0 |  |  |
| 11                                    | 2            | 0 | 0 | 8 | 1 | 0 |  |  |



# C

## Interview Questions

### C.1 Interview Questions for First Round

1. Tell us a little bit about yourself. For example, earlier jobs, when you started using computers, hobbies, what you are doing now.
2. How old are you?
3. Do you have any health issues that affect your usage of computer, tablet, or smartphone?
4. How often do you use Facebook?
5. What are you doing on Facebook?
  - Ask if they can show how they do it.
  - Ask about specific functionalities.
  - Is there any reason why you are not using functionality XXX?
  - If you want to find new friends on Facebook, how do you do it?
6. Is there anything you think are annoying or in the way on Facebook?
7. Is there something you have done but are not able to anymore? Not only on Facebook.
8. Is there something you want to do but cannot? Not only on Facebook.
9. How do you get help if there is something that you cannot do on Facebook?
10. For how long have you had Facebook?
11. Are you using any functionality on Facebook that we have not talked about yet?
12. Is there something you want to add that we have not talked about?

### C.2 Interview Questions Round Two

1. Do you want to tell us short about your background? For example, what you have worked with and when you started using computers and for what?
2. How old are you?
3. For how long have you had Facebook and how often do you use it?
4. Do you want to tell us about how your stroke has affected your usage of computers? What has become harder and how do you work around it?
5. You mentioned in your email that Facebook has helped you, do you want to tell us more about that?
6. What do you usually do on Facebook?
7. Is there anything more you think could be interesting for us to know that you want to add?





# D

## Questionnaire Questions

1. How old are you?
2. Do you create your own posts?
  - If “Yes” or “Rarely”:
    - (a) Do you check in where you are?
    - (b) Do you tag the friends you are with?
    - (c) Do you add image or video to your post?
    - (d) Do you change who can see your posts?
3. Are you making your own Stories or watch others?
4. Are you using Marketplace?
5. Are you using buy and sell groups?
6. Are you adding new friends by the Facebook friend suggestions?
7. Are you using groups?
8. Are you using pages?
9. Are you scrolling in the your news feed?
10. Are you commenting on others posts?
11. Are you reacting to others posts?
12. Are you sharing others posts?
13. Are you using events?
14. Are you using birthdays?
15. Are you using fundraisers in combination with birthdays?
16. Are you playing games?
17. Are you using messenger (chat)?
18. Are you using anything else on Facebook that we have not asked about?



# E

## Wizard Questions - Refined Version

*I like Facebook as it is and don't want anything to change.*

- (a) *Correct*
- (b) *Not correct*

*Sometimes I change who will see my posts or categorize my friends as for example, close friends and acquainted.*

- (a) *Correct*
- (b) *Not correct*

*Choose the statement that covers as much as possible of the functionality you use.*

- (a) *Sometimes I publish my own posts where I add a picture or video.*
- (b) *Same as above, but sometimes I tag the friends I'm with or check in to the places I visit.*
- (c) *Same as above, but sometimes I change the background of the post, add an emotion/activity, or add a GIF.*
- (d) *I only want to write posts with text or no posts at all.*

*Choose the statement that covers as much as possible of the functionality you use.*

- (a) *Sometimes I look at the suggestions Facebook gives me, for example, friends, recommended posts, or games.*
- (b) *Same as above, but sometimes I ask or give recommendations.*
- (c) *I don't do anything of the above.*

*Choose the statement that covers as much as possible of the functionality you use.*

- (a) *Sometimes I scroll in my feed and see what different organizations and companies post, show interest in events, or look at memories.*
- (b) *Same as above, but sometimes I want to hide posts that annoys me, save posts or put on notifications for a specific post.*
- (c) *I don't do anything of the above.*

*Choose the statement that covers as much as possible of the functionality you use.*

- (a) *Sometimes I want to sell and buy things on Facebook or contribute to fundraisers.*
- (b) *Same as above, but sometimes I want to look at my recent ads, my offers, or search for job ads.*

(c) *I don't do anything of the above.*

*Choose the statement that covers as much as possible of the functionality you use.*

(a) *Sometimes I play games on Facebook.*

(b) *Same as above, but sometimes I want to look at game videos on Facebook as well.*

(c) *I don't do anything of the above.*

# F

## Wizard Questions - Original Version

*I like Facebook as it is and don't want anything to change.*

- (a) *Correct*
- (b) *Not correct*

*Sometimes I change who will see my posts or categorize my friends as for example, close friends and acquainted.*

- (a) *Correct*
- (b) *Not correct*

*Which statement suits you best?*

- (a) *Sometimes I publish my own posts where I add a picture or video.*
- (b) *Same as above, but sometimes I tag the friends I'm with or check in to the places I visit.*
- (c) *Same as above, but sometimes I ask for recommendations, add an emotion/activity, add a GIF, or create a fundraiser.*
- (d) *I only want to write posts with text or no posts at all.*

*Which statement suits you best?*

- (a) *Sometimes I look at the suggestions Facebook gives me, for example, friends, recommended posts or games.*
- (b) *Same as above, but sometimes I ask or give recommendations.*
- (c) *None of the above suits me.*

*Which statement suits you best?*

- (a) *Sometimes I scroll in my feed and see what different organizations and companies post, show interest in events or look at memories.*
- (b) *Same as above, but sometimes I want to hide posts that annoys me, save posts or put on notifications for a specific post.*
- (c) *None of the above suits me.*

*Which statement suits you best?*

- (a) *Sometimes I want to sell and buy things on Facebook or contribute to fundraisers.*
- (b) *Same as above, but sometimes I want to look at my recent ads, my offers, or search for job ads.*

(c) *I don't want to do any of the above.*

*Which statement suits you best?*

(a) *Sometimes I play games on Facebook.*

(b) *Same as above, but sometimes I want to look at game videos on Facebook as well.*

(c) *I'm not interested in games on Facebook.*

# G

## Help Panel Text

**See my posts** - When you create a post on Facebook you can change who can see your post, e.g. friends, the public or only you.

Below you can see where you change who can see your posts.

**Categorization of friends** - Categorization of friends can be used to group your Facebook friends into different groups, e.g. close friends, acquaintances or family. This can then be used to for instance easier control who can see your posts.

Below you can see a picture on where you find the categorizations, also called friend lists.

**Picture or video** - When you create a post on Facebook you can add one or more pictures or videos that will appear in the post.

Below you can see how you add a picture or video to a post.

**Tag** - You can let your friends see who you are with by tagging these persons in a post. If you, for example, have lunch with your daughter you can tag her name in the post and your friends can see that it is her you are with.

Below you can see a picture of where you tag people.

**Check in** - You can check in at different places to let your friends know where you are when you write a post.

Below you can see a picture of where you check in.

**Change background** - On your posts you can change the background color.

Below you can see a picture of where you change the background.

**Feeling/Activity** - You can add a feeling or activity to a post to mediate clearer how you feel or what you are doing.

Below you can see a picture of where you add a feeling or activity.

**GIF** - A GIF is a kind of moving picture that you can add to your posts.

Below you can see a picture of where you click to add a GIF.

**Friend suggestions** - Sometimes Facebook gives you suggestions of people that you might know and asks if you want to add them as friends.

Below you can see a picture of how a suggestion might look like.

**Recommended posts** - Sometimes it can pop-up posts in your feed that Facebook think that you might be interested in.

Below you can see a example of how that kind of post can look like.

**Game suggestions** - You can sometimes get suggestions on games that your friends are playing on Facebook and that you also can start to play.

Below you can see a picture on how these suggestions can look like.

**Recommendations** - You can use recommendations to ask your Facebook friends about tips for e.g. nice restaurants if you are visiting a new city or a good craftsman that can renovate your bathroom.

Below you can see a picture on where you can find yours and other recommendations.

**Feed** - The feed is the news feed where posts from your friends appear.

Below you can see a picture on an example of a feed.

**Organisations and companies** - Organizations and companies can have pages that you can go and like and then see posts that they do in your feed.

Below you can see a picture on an example of a post from the company Göteborgs-Posten.

**Events** - Everyone can create an event on Facebook and then invited can indicate to the host if they are coming or not.

Below you can see a picture on where you can find events.

**Memories** - With memories you can see what you did the exact same day for a few years ago.

Below you can see a picture on a shared memory.

**Hide a post** - If you see a post in your feed that you do not want to see you can choose to hide the post. You do this by click on the three dots in the right corner of the post and then choose "Hide post".

Below you can see a picture on how you find Hide post.

**Save a post** - If you see a post in your feed that you want to look back on later you can save the post. You do this by click on the three dots in the right corner of the post and then choose "Save post".

Below you can see a picture on how you find Save post.

**Turn on notifications** - If you see a post in your feed and you want to follow the comments you can enable notifications for this post. You do this by click on the three dots in the right corner of the post and then choose "Turn on notification for this post".

Below you can see a picture on how you find Turn on notifications.

**Buy and sell** - You can buy and sell things through Facebook, both by "Buy and



sell groups” and on “Marketplace” which is like Facebook’s own version of Blocket. You can add own ads or respond to others’ ads.

Below you can see a picture on how you find buy and sell groups, Marketplace and an example on how an ad can look like.

**Fundraisers** - You can collect money for different causes by creating a fundraiser or donate to friends’ fundraisers.

Below you can see a picture on how a fundraiser looks like in the feed.

**Recent ad activity** - If you have clicked on any ad on Facebook then you can find the most recent ads you have looked at by going to “Recent ad activity”.

Below you can see a picture on how where you can find recent ad activities.

**Offers** - By going to offers you find companies that have a sale or other rebates and offers.

Below you can see a picture on how where you can find offers.

**Job ads** - Facebook has a page where companies can put job ads. You can go there if you are searching for a new job.

Below you can see a picture on how where you can find job ads.

**Games** - You can play games on Facebook. An example on a common Facebook game is “Quiz planet”.

Below you can see a picture on how where you can find games.

**Gaming video** - You can watch when others play games through gaming videos. The ones who are playing often talk and explains what they are doing.

Below you can see a picture on how where you can find gaming videos.



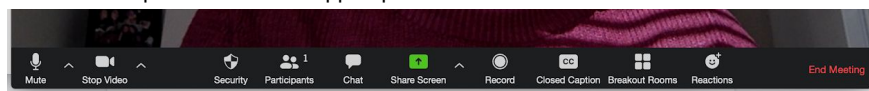


# H

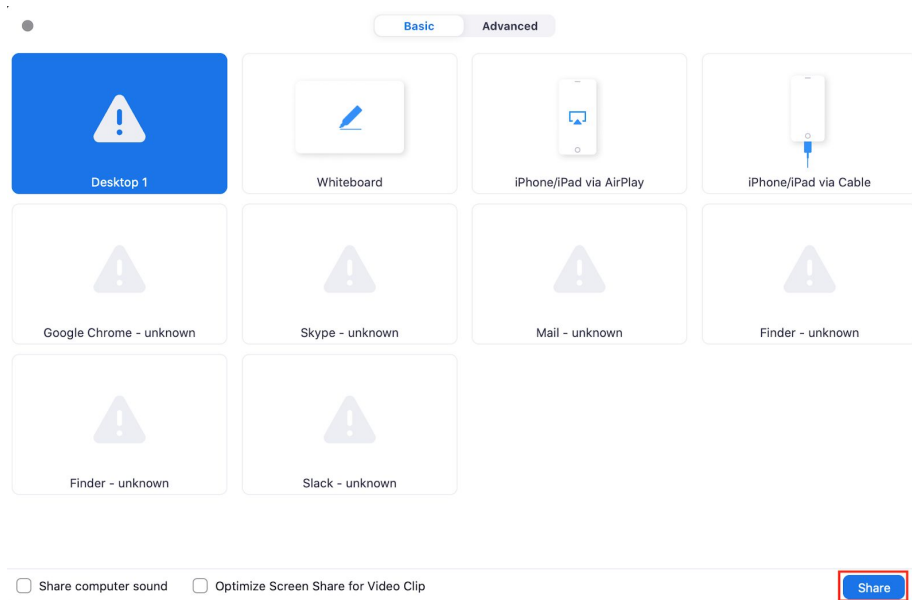
## Guide to Share Screen in Zoom

Detta är en guide för Mac, men borde gå att följa om man har Windows också. Kontrollerna i Zoom ser i alla fall likadana ut.

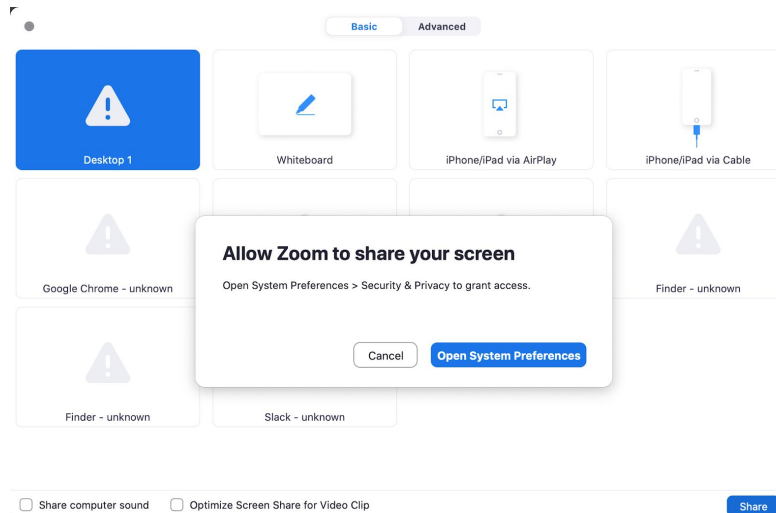
1. Klicka på dela skärm knappen på nedre delen av skärmen.



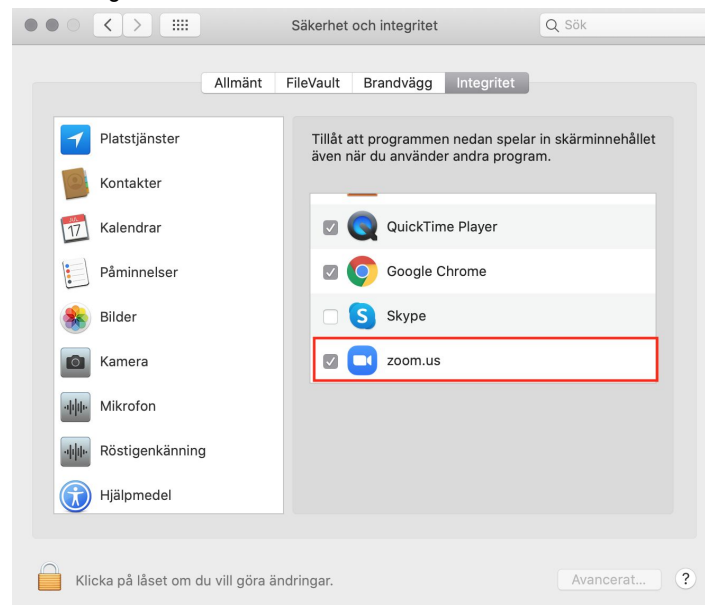
2. Klicka på den skärm du vill dela, antagligen din webbläsare, genom att markera rätt ruta som visas på bilden nedan, och klicka sedan på "Share"-knappen.



3. Är det första gången du delar skärm på Zoom kommer du behöva ändra dina inställningar lite, klicka på "Open system preferences"-knappen.



4. I inställningarna får du klicka i rutan för zoom.us



5. När du klickat i zoom.us kommer en ruta som säger att du behöver starta om zoom klicka på "avsluta nu"



6. Öppna gå sedan med i mötet igen och genomför steg 1 och 2 igen.
7. Klart!