

Adapting an In-Flight Entertainment system to include Older Users

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TACTEL



Adapting an In-Flight Entertainment system to include Older Users

by Anna Anderson and Siri Hallqvist



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Abstract

Every year, the average age of the population is increasing as people live longer and fewer children are born. With age, it is not uncommon for cognitive abilities to deteriorate, affecting the ability to learn new things and process new information. As digitalization continues, some people are left behind and thus experience difficulties in using the newly developed digital environments. This is a problem that creates a demand for a more inclusive design of digital products that is to be used by everyone, including older adults with reduced cognitive abilities.

This thesis aims to investigate how older adults are experiencing an existing In-Flight Entertainment system (IFE) and with that knowledge implement improvements in the design where problem areas have been found, resulting in a broadened system where older adults feel more comfortable. A thoroughly iterative design process, mainly inspired by Design Thinking, has been conducted with a user-centered design approach in mind. The project included amongst other things a literature study, empathizing with the users in the forms of interviews, surveys, workshops, and user tests to define the existing problems, and then creating different Lo-Fi prototypes with implemented improvements aimed at more testing with the target group.

The result is presented as a Hi-Fi prototype with solutions for the problem areas discovered, together with arguments for the various design decisions. Some improvements that have been implemented in the Hi-Fi prototype are fewer steps within the system that create greater transparency, clear scroll indicators when needed, and a design skeleton that gives the system consistency. Beyond that, an overall conclusion of this thesis was the importance of including end-users in the design process to prevent bias from taking place.

Keywords: older adults, in-flight entertainment system, inclusion

Sammanfattning

Varje år ökar befolkningens medelålder eftersom människor lever längre och färre barn föds. Med åldern är reducerade kognitiva förmågor inte ovanliga, vilket påverkar förmågan att lära sig nya saker och bearbeta information. I takt med att digitaliseringen fortsätter, upplever en del personer därmed svårigheter med att använda nyutvecklade digitala miljöer. Detta är ett problem som skapar efterfrågan på mer inkluderande design av digitala produkter som är tänkta kunna användas av alla, inklusive äldre vuxna med nedsatt kognitiv förmåga.

Detta examensarbete syftar till att undersöka hur äldre vuxna upplever ett befintligt In-Flight Entertainment system (IFE) och med den kunskapen implementera förbättringar av designen där problemområden har hittats, vilket resulterar i ett bredare system där äldre vuxna känner sig mer bekväma. Projektet har utförts som en iterativ process, inspirerad av Design Thinking, med ett användarcentrerat tänkande. Projektet omfattades bland annat av en litteraturstudie, kontakt med användarna i form av intervjuer, workshops och användartester för att kunna identifiera problem samt skapande av Lo-Fi-prototyper med implementerade förbättringar som syftar till fler tester med målgruppen.

Resultaten presenteras som en Hi-Fi-prototyp med förbättringar i de funna problemområdena, tillsammans med argument för de olika designbesluten. Några av de förbättringar som har implementerats i Hi-Fi-prototypen är färre steg i systemet vilket skapar större transparens, tydliga indikatorer på att man kan skrolla och ett designskelett som ger kontinuitet till systemet. Utöver detta är en övergripande slutsats av examensarbetet att det är viktigt att inkludera slutanvändarna i utformningsbesluten för att förhindra att fördomar påverkar.

Nyckelord: äldre användare, in-flight entertainment system, inkludering

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1 Introduction

1.1 Background

Today, many products and services take place beyond the visible, namely digitally. The digital transformation has contributed to opportunities in a completely different way than before in terms of, for example, social and cultural aspects.

While digitalization has made life easier for many older adults, if the digital development does not consider their aspects it can put obstacles in front of them. This regards both their reduced cognitive abilities and their approach when faced with something new. One example of this is the simple transition from buttons to touch screens. This change alone made it even harder for people with reduced abilities, such as visual impairment (Ricardo Shimosakai 2019), to use the applicable products which in turn, creates an exclusion in society that did not exist before. More and more regulations are being put in place around the world to address this digital exclusion. For example does organizations in the public sector need to have their websites and mobile applications compliant with the EU Web Accessibility Directive (Siteimprove 2023a). Therefore, it is important for companies that want to be at the forefront of digital products and services, to also be at the forefront of this topic. Making a company's product development process more thoughtful of its end-users gives them a competitive edge, which is very desirable and profitable.

Furthermore, to come up with an entirely new product today might be hard, as it probably already exists. Therefore, to include as many people as possible in the existing products could be considered a priority, which requires research and an understanding of who you are trying to include. The group of people you think feel excluded in one way, might actually feel excluded in

a completely different way, which could lead to erroneous developments due to presumptions that society gives. Therefore, an inclusive way of thinking should be adopted, and to bring the people that are supposed to use the digital products or services into the development process should be considered. Another important aspect related to this is how the inclusion of a product can be improved without having to develop a new design specific for a group of people. This is a problem in itself because you don't want anyone to feel left out or outed when entering for example a digital system (Devina 2020).

The digital transformation of the world is a constant subject to explore, as it continues to progress. At the same time, the population also gets older. In some countries, the average age of the population is increasing as people become older while the number of childbirths decreases. One example is Japan, the oldest population in the world, where 29.1% are over 65 years (Kyodo 2022). With age, certain abilities naturally decrease, which easily brings a risk of the older adults being a group in society that can be excluded when it comes to different areas. With digitalization taking place, this could mean a huge exclusion from society's side, where older adults cannot keep up with the digital environments. Therefore, an example of a group that is important to consider regarding this, to prevent the not so rare mistakes made by assumptions, is the older adults.

This project is a collaboration with the digital interaction agency Tactel, owned by Panasonic Avionics. They have the majority of their customers within the flight industry as they develop the systems on the screens in front of the passengers on long-haul flights. These systems are called *In-Flight Entertainment systems* (IFEs) and provide multiple features such as a map with an overview of where you are, various games, movies, music, etc. This is used for both entertaining purposes, and to provide information in a fast and efficient way (Akl, Gayraud and Berthou 2012), and these systems are the focus of this thesis.

The word "In-Flight Entertainment" has implied different things since the concept first started. In 1921, a silent movie was shown with a projector, in 1936 a piano lounge provided the entertainment, and as from 2007, high-definition displays are used to entertain the passengers (FDS Avionics Corp. 2023).

Today, when developing IFEs, and as technology develops rapidly, there are an incredible number of things that you can do. Despite that, due to the in-

creasing pressure for an inclusive thinking mentioned above, together with an aging population, there are still aspects left to study regarding how the design of these systems can be improved.

1.2 Purpose and Goals

Digital exclusion and the aging population are something that has led Tactel to see an increased demand for a more inclusive and usable system for people in the older age category. This forms the purpose of this master thesis, to study and investigate the problems that an swedish older adult experience with IFEs and come up with ideas on how to avoid or reduce these problems when designing the next IFEs. In this thesis, the definition of *older adults* is inspired by Czaja et al. (2019) who says that it is hard to put a number on it, but if forced it could be meant people age 65 and above.

The aim of this project is to broaden an existing system and include the aspects of older adults so that it benefits them in the same way as it does to anyone else. In writing this thesis, the hope is to help Tactel become a leading force within inclusive development of IFEs.

To develop an inclusive product, research is first to be made as older adults are not considered a homogeneous group of people. The result of the project will be a digital functional prototype that has been modified from the original system. Along with images of the resulting prototype, comments on the changes will also be made to contribute to a knowledge bank where the gap between older adults, digital exclusion and IFEs is patched up.

1.2.1 Research Questions

To sum up and clarify the purpose and goals of this thesis, five research questions were created.

- What are the difficulties for the older adults using the IFEs?
- What kind of design is preferred for the older adults to feel comfortable when using the IFEs?
- What types of features are valued for the older adults?
- How can this be implemented without the older adults feeling judged?

- If time allows, how much easier would it get by using the adapted design?

Based on the thesis' findings, the above research questions are to be answered at the end of this project.

1.2.2 Delimitations

Below are this project's delimitations listed.

- This project will be examining older adults from Sweden although the demand also comes from outside Sweden's borders
- Because of regulations regarding integrity, some functions will always be limited throughout the system
- Data from airline-customers will not be presented as it is not available
- This project will only examine the overall system, not any specific applications
- The testing will not be executed in a realistic environment
- Potential cultural differences between countries and continents will not be explored in this thesis

1.3 Project Setup

The first part of this thesis will be in collaboration with another thesis, named *Designing for Older Adults: A Usability Evaluation and Development of an In-Flight Entertainment System*, hereinafter referred to as *Usability Evaluation of an IFEs*, which will investigate the same issue. Therefore, much of the research in early stages will be made together with that project group to figure out the existing problem areas.

The second part is where the different problem areas have been demarcated and distributed between the project groups.

In addition to that, this project's preliminary setup and actual outcome can be found in a Gantt chart in Appendix A.1.

2 Theory

To be able to find and solve a problem like in this thesis, different approaches have been used to collect the necessary data. This project started with research through suitable articles and reports and asking employees with experience at Tactel to gain knowledge in relevant areas that would be used to build on.

2.1 Decreasing Abilities with Age

A person can have many abilities, for example one that relate to the use of numbers or for a person to be able to understand. Another skill is needed for a person to hear (Maker and Anuruthwong 2023). This section explains some, for this thesis, relevant skills and how they change with age.

2.1.1 Cognition

As we get older, the risk of developing age-related neurodegenerative diseases, such as Alzheimer's disease, which negatively affects cognitive ability, increases. The ability for the brain to learn, remember, take in and process new information is part of the cognitive ability. However, it is not necessarily a disease that impairs cognitive ability, as it also declines naturally with normal aging. Cumulative skills and memories of previously acquired knowledge peak at the age of 60 and then decline, while the ability to process new information steadily declines from the age of 20 (Murman 2015).

A person can also suffer from mild cognitive impairment, meaning for example, reduced orientation, memory loss, reduced problem-solving skills, and

difficulty in focusing (NEURO 2023). This is an example of how ageing can affect a person's cognition.

Furthermore, the word *disability* is often used when talking about skills and means that a person has limitations in their natural abilities. Disabilities can be divided into three categories: permanent, temporary, and situational. The stress and anxiety experienced by people who are afraid of flying is a situational disability, which can affect cognitive ability as the available attentional resources needed to process information decrease (Scott et al. 2015).

2.1.2 Vision

The ability to see what you are doing is a crucial part of how easy a product is to use, and this applies at any age. Especially when it comes to a screen that you have to navigate on. A design that easily and uninterruptedly gives you information, can be decisive whether a user will use the product or not. That said, it is very common for vision to deteriorate with age, including a decrease in contrast sensitivity and visual acuity decrease (Salvi, Akhtar and Currie 2023), which should be taken into account when designing for end-users today.

2.2 Design and Older Adults

As mentioned earlier, the world's population is getting older every year. Between 2015 to 2050, the number of people above the age of 60 is expected to almost double from 12% to 22% (World Health Organization 2022). Alongside the aging of the world population, there is also the drastic digitalization, which poses difficulties if not designed inclusively, as cognitive functions deteriorate with age (Murman 2015). Because of this, there are many older adults today who are struggling to keep up with the newly developed technology, which increases the risk of being digitally excluded (Alexopoulou 2022).

Digital development is different in different countries around the world. While Sweden's high rate of digitalization may give rise to problems of digital exclusion, this can also be seen as the older adults in Sweden being more tech-savvy than in other countries where they are not exposed to digital environments to the same extent. In Sweden, the general technical experience of an average

person is high, as Sweden was ranked fourth amongst European countries in the Digital Economy and Society Index (DESI) in 2022 (European Commission 2022). Therefore, if Swedish older adults experience problems with a digital product, it can be assumed that there is also a global demand for this.

2.2.1 Integration in the Process

To remove the digital exclusion of older adults from the usability of a product, the process must include their perspectives. When developing and designing with the goal of including older adults' aspects, there is a large number of misconceptions about how to design due to preconceived notions, such as that older adults are the problem as they are "incompetent" (Mannheim et al. 2019). This phenomenon is called *ageism* and is described as prejudices and discrimination against people because of their age (World Health Organization 2021), which can be prevented quite easily. By including the older adults in the research phase and other steps of a development process, the actual behavior can be studied and understood, and thus unique findings and results can then potentially prevent exclusion.

2.2.2 Relevant Findings for Digital Design

When designing a website or a digital product, some things to consider for this thesis are touch gestures, spacing, button size, text size, contrast, etc. Gao and Sun (2015) has studied these topics and the results showed that older adults prefer to click buttons, while younger adults prefer to use multiple fingers to manipulate the touchscreen. Polyuk (2023) agrees, saying that no more than two fingers should be required for an older adult to use the entire system. He also says that the font size should be kept above 16 px if possible and that the best scenario is if the older adults can choose the text size themselves.

Choosing the right font is also a subject of its own. There are many different aspects of what the used font should look like, which DeVos (2023) presents well. She writes that the letters used should be distinct and that a single letter should not blend in with itself. The terminals of the letter should be clear and the text should have sufficient contrast in the letterform.

2.2.2.1 Accessibility Design Guidelines

Accessibility focuses on giving all users equal opportunities to use the product, regardless of their varied abilities. This means that websites and other technologies should provide access to information for all people, which should be considered a basic human right. Studies have shown that websites that are accessible are more successful regarding for example search results, cost of maintenance and audience reach (World Wide Web Consortium 2018). A UX designer from Tactel, with experience within the area informed that common areas where accessibility is considered are both cognition and vision. However, accessibility mainly focuses on that the product can be used appropriately, which does not necessarily mean that the product contains the right value for the user. Nevertheless, it is important to think about such aspects also when, for example, extending a product.

To put this into practice, a technical standard guideline often used as a framework for web applications, called *Web Content Accessibility Guidelines* (WCAG), was developed in 2008 by the Accessibility Guidelines Working Group, part of the World Wide Web Consortium. Its purpose is to provide guidance on how to make an application accessible according to certain requirements. This standard contains so-called *success criteria* divided into three levels: A, AA, and AAA (World Wide Web Consortium 2023), where AAA has the highest accessibility requirements (Siteimprove 2023b). A WCAG standard that complies with the EU's Web Accessibility Directive for public sectors is the WCAG 2.1 AA standard, which has 13 different guidelines including the ability to resize text, minimum contrast values, and page titles (World Wide Web Consortium 2019). Later in this thesis, the WCAG 2.1 AA will be considered.

The 13 guidelines within WCAG 2.1 are as follows:

1. Text Alternatives
2. Time-Based Media
3. Adaptable
4. Distinguishable
5. Keyboard Accessible
6. Enough Time
7. Seizures and Physical Reactions
8. Navigable

9. Input Modalities
10. Readable
11. Predictable
12. Input Assistance
13. Compatible

2.3 Development of IFEs at Tactel

From our understanding *testing* is something Tactel finds very important. However, recruiting real users and setting up tests of prototypes at relevant stages within the process can be time-consuming and complicated. Tactel is continuously working on how to easier implement more testing during the whole development and design process for IFEs. Today, they work with testing in close collaboration with the customers. Sometimes the airlines also conduct their own user tests. The results from both help Tactel in their iterative work of the design to get a "proof of concept". The developers at Tactel do also test the system intrnally during all stages of a product development project.

A principal designer at Tactel stated that airlines tend to keep the system for at least six years once it is in operation, which means that it needs to be as up-to-date as possible during that time. Therefore, being able to test the system on end-users is a great way of validating the created design. As stated earlier, the aim is to insert more testing sessions with end-users to get proper feedback that can be used in the further process. Since testing has not been done with older adults in this project, to the necessary extent, this thesis needs to take that into account as well.

In addition, Tactel does research internally to stay at the forefront of the industry. These studies often run in parallel with the regular work and focus on areas that can be useful in the design of IFEs. Once completed, the studies are often presented to the entire design team at Tactel to share the collected data.

2.4 Design Terms

In this section, some design terms that are suitable to have knowledge about will be presented.

User interface (UI) design aims to ensure that the interface of a product contains the things that are needed for the user to know how to use it. A UI designer could work with different things, such as visual elements, interaction, or animation. This includes the layout and different elements of a website, which could be seen as the art of the product. It is the designers within UI that often creates prototypes, and therefore, when the interface has been approved and passed to the next step of the process, their work can be considered mostly done (Pendo 2023).

User experience (UX) is a common word when it comes to development processes. It is a broad concept that covers the process of adapting a product to users by empathizing with them considering for example user demographics and background, searching for what they really need and would value with their abilities (and limitations), and improving the art of the product thereafter. Therefore, the job of a UX designer is everything from researching users to coming up with improvements and then testing both prototypes and launched products with regards to the interaction between the user and the product, which is an iterative process (Pendo 2023).

User flow is a flow created by the choices a user makes going through an application or a website. This is a part that needs to be functional and easy, and should also be considered as a part of the design suggestions when developing a digital product that will be interacted with (Optimizely 2023). In this project when the word flow or user flow is mentioned, it refers to the way to navigate through the system and which pages are connected.

2.5 Product Development vs/and Interaction Design

When developing a product to be used by an end-user, the actual users and their interaction with the product should be taken into account. As previously described, there is a strong demand today for as many people as possible to be able to participate in the use of a product. Behavioral analysis is therefore to a large extent part of the development process, especially when there is little

or no data on the subject under investigation.

When examining the concepts and words "product development" and "interaction design", there seems to be a lot of confusion about whether there are boundaries between them and, if so, where they are drawn. Siang (2021) argues that the concept of interaction design is under the concept of UX design, and Kuzmenko (2021) writes that UI/UX design are critical components of the product development process. This is because no user would appreciate the product if their needs and aspects had not been considered in the design of the product. As the project team studied the concepts and theories of product development, it became apparent that interaction design is a relevant part of the product development process.

However, going further in the search on the perceptions of product development and design, Kuzmenko (2021) says that there are differences between product design and product development. Both aim to create a product and are considered subjects of engineering, and in the article, Kuzmenko (2021) further describes product design as the creative part, placing great emphasis on the functionality of the product. She notes that product design has a few sub-areas, including interaction design while product development involves the production of the product and bringing it to the market. In this context, product design, and thus interaction design, is described as an independent part separated from product development, which differs from the other sources.

Arvola (2014) points out that the terms (interaction design, UX, and more) can be seen as warring siblings, and that it depends on what you want to say, whom you are talking to, and what aspects of the process you want to highlight. In this work, the project group has chosen to go with the first description in this section, i.e. that interaction is considered an important part of product development and that it is important to include in all types of product development, including digital.

3 Process and Methods

This section describes the tools required to carry out this thesis, as well as the processes and methods used as sources of inspiration throughout the thesis. Last but not least, the specific approach to this particular work is presented.

3.1 Development Tools

The execution of this thesis required some tools during the process. These are described in this paragraph.

3.1.1 Miro

Miro is an online digital whiteboard where you can put in many different things, such as schedules, notes, and frames on which you can build a lot of the process. With this digital tool, you can also easily collaborate with others, which greatly simplifies the sharing and monitoring of the process.

In this project, this was used throughout the process to structure the work, as a platform for brainstorming and to create very simple concepts to test before further development.

3.1.2 Workshop Tactics Cards

To get inspiration when stuck or in need of guidance when holding different workshops in this thesis, the Workshop Tactics Cards created by Charles Burdett and David Hill were used. In this pack of cards, there are nine different

main genres to choose from, depending on where in the process you are: understand, technique, goals, session, ideas, frame, evaluate, discuss, and decide. Under these main genres, there are some examples of tasks that can be done to achieve the desired result, providing more clarity and clearer results.

3.1.3 Figma

Figma is a free UI-design collaboration tool that is useful when creating programs or systems that require graphic and visual design. It offers a digital environment easy to understand for designers to create a design for an application or website at an early or late stage of the design process without having to think about upcoming technical aspects, such as programming and marketing. This is very useful for showing a design that can be tested and then modified and improved before being passed on to the next stage of the development process. It can be used by several users at the same time, which is good when multiple people are working together toward a design.

3.2 Design Thinking

Design Thinking is a process that can be used to develop a solution to a problem in a user-focused way. It starts from the end-users needs and, unlike other methods, focuses on how users actually interact with and experience the product (Tuttle 2021). The specified process provides a framework to follow to, in this case, achieve a design solution that works best for the users in a target audience.

There is no single definition of this process as it can also be seen as more than just a development process, e.g. as a strategy or as a mindset (IDEO 2018). Therefore, it is important to define the approach to be used. In this project, Design Thinking was inspired by Plattner's vision, where the process includes five steps: Empathize, Define, Ideate, Prototype, and Test (Plattner 2010). These steps can be performed in parallel or iteratively, they do not have to be performed sequentially (Tuttle 2021). The different steps in the process will be described briefly below in subheadings, and a more detailed description of how the methods were implemented in this work can be found under the respective headings later in this report.

3.2.1 Empathize

Empathy and understanding are essential when designing a product with a human-focused approach, especially when the designer cannot relate to the problem to be solved. The first step of the design thinking process, with all assumptions and prejudices aside, is to investigate the user's needs and understand the problem. To get a broad insight and not just confirm your thoughts, some examples of approaches are to use observations, engagement, and open-ended interviews and conversations (Plattner 2010). In this thesis, the empathize step will be carried out by conducting *interviews* with a survey as a base, a *workshop*, and multiple *user tests*, which can be read more about in section 4.

3.2.2 Define

The second step of the Design Thinking process is to *define* the needs and key problems of the users within the target group, formulated as a problem statement or requirements specification. Defining the problem statement is an important step in the process and will help the team in later phases, by providing clarity and a clear goal to strive for. By analyzing and synthesizing the information gathered from the previous step, patterns and interesting results will be discovered (Plattner 2010). To develop a proper problem statement description based on the collected research from the previous step.

The methods used in this step in this project will be to first analyze the raw data acquired from Empathize by performing *How Might We* questions, and coding it by using a *Bottom-Up* approach. Then a *functional analysis* of the findings will be performed and used as a specification of requirements throughout the process. From the information regarding the participants of the tests, *personas* will be created to give a clear view of the people studied in this work. This can be found in more detail in section 5.

3.2.3 Ideate

In Design Thinking, *ideate* is the phase where ideas are generated by combining the understanding of the problem together with the knowledge of the people. It is very important to search for ideas widely and not only look at

obvious solutions or be too critical of early concepts. Later in the process, the best solution will be identified, but at this stage, the focus is on the generation of concepts (Plattner 2010). Two ideation techniques performed in this thesis are *brainstorming* and *sketching*. More in detail on how this will be conducted can be read in section 6.1 and section 7.

When working iteratively in the Design Thinking process, ideating does not have to, but can be part of the loop. Therefore, the basis for generating concepts can vary, whether it is based on the problem formulation from define or the analysis from user tests after a prototype is created.

3.2.4 Prototype

After creating concepts, it is time to start realizing the ideas by developing prototypes. This phase is performed in order to later be able to test the concepts on the users within the target group. Prototypes have different qualities depending on how far the process has progressed. If it is early in the process the prototype may contain only the necessary functions and might be created as sketches, for example. The prototype is then called *Low Fidelity Prototype* (Lo-Fi Prototype), which is flexible for design changes, and the creation phase does not take much time due to not having to focus on the technical part.

Otherwise, if it is later in the process and you have already tested the Lo-Fi prototype, you can make a more complex and realistic prototype. This prototype is then called *High Fidelity Prototype* (Hi-Fi Prototype), which is good for more realistic behaviors of users when testing the prototype (Pernice 2016).

In this thesis, the first iteration of prototyping, Lo-Fi prototyping, will involve putting together the various generated sub-concept from the previous ideation step, and can be read more about in section 6.2. Furthermore, the second iteration, the Hi-Fi prototyping, will be performed using the program *Figma*. All findings from the project will here be implemented into a final prototype together with thoroughly described design decisions which can be found in section 7.2.

3.2.5 Test

After creating prototypes, it is time to examine the result by testing it with the people for whom it is intended. By letting people in the target group interact with the model, without detailed explanations, it is possible to gain insights into improvements for further development, but there is also an opportunity to complement the information about the users and gain more empathy. A good way to conduct the test is to include several prototypes, allowing for comparison (Plattner 2010).

The Lo-Fi testing in this thesis is executed as a *qualitative and comparative usability test* which is useful when wanting to compare different design suggestions, read more on how this was conducted in section 6.3. Due to time limitations, there was no time to carry out Hi-Fi testing.

3.3 User-Centered Design

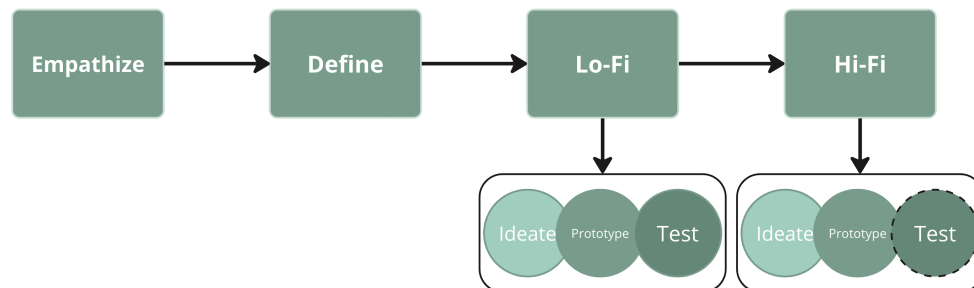
User-centered design (UCD) is an approach often used when developing a product to be used by a person in some way. Lowdermilk (2013) describes this methodology as a software design methodology that can be used by people involved in designing and developing products to be used by humans.

Furthermore, Lowdermilk (2013) also mentions the concept UX (earlier described in section 2.4), where he claims that if UCD is used, it can be assumed that it will improve the UX of the product, which describes the relationship between the two. This can be explained by the fact that UCD is built on findings that forms the basis of the chosen design, the design is therefore supported by the found data. UCD is also more than just design to be aesthetically beautiful, it can therefore be used to avoid costly mistakes within the development process (Lowdermilk 2013).

A recurring word when studying UCD is *Usability*, which in simple terms is a measurement of how easy a UI is to interact with by a user. This can be applied to applications or websites and can be tested by different methods such as usability testing (Usability First 2023). How this is applied in this thesis' process will be described later on.

3.4 The Adapted Approach for this Thesis

As there are many definitions for the different issues mentioned so far in this thesis, this section describes more precisely what applies to this particular study. Although it is based on the methodologies and other facts, there are some uncertainties regarding the boundaries of each area, and therefore a clarification is necessary.



This project's process is mainly based on inspiration from the process of Design Thinking, where empathize and define were executed first, and then two loops were conducted. The two loops, here named Lo-Fi and Hi-Fi, included ideate, prototype, and test. Though, considering the time frame of the project, the Hi-Fi testing would not be performed, so the result of this work aims to provide a good prototype that can be tested on in further work.

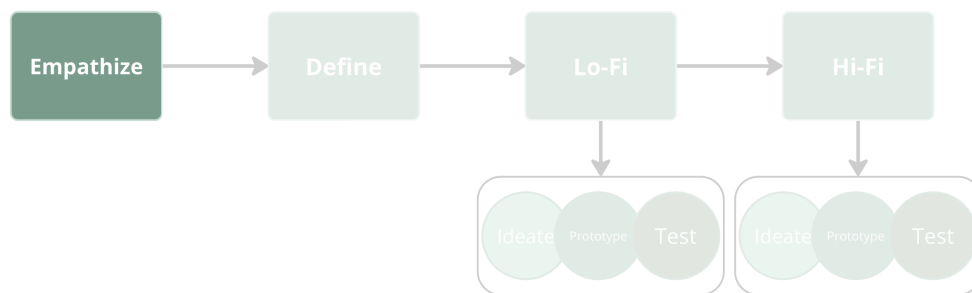
Furthermore, one approach considered was the accessibility design described briefly in section 2.2.2.1. This was considered too narrow of a concept that would not cover the scope of this project, as the goal was to broaden an existing product and not just focus on the technical aspects of it. Nevertheless, since this project aims to develop a better design for certain users, the methods performed within the steps of this process were performed with a User-Centered Design approach, and how they were adapted and conducted in this project is possible to read in more detail of in the following sections.

However, it should be mentioned that although Design Thinking and User-Centered Design are considered to be two different concepts, they have many similarities and are considered to be complementary when developing a design for a digital product or application (Nallan and Jaiswal 2019). Design Thinking, as previously described, tends to be a way of thinking rather than a methodology that can be followed when creating solutions, and therefore a meth-

odology such as UCD was considered appropriate when wanting to put the users of a product at the center of the design.

As no actual validated data in the area of older adults in combination with IFEs was provided to, or found by the project team for this thesis, the user studies needed to be relatively extensive to properly empathize with the users. All considerations in this work were made with the time constraint of 20 weeks in mind.

4 Empathize



This section provides an overview of how the first step of this project was performed by describing the various methods that were used for empathizing with the problem and users in order to gain a better understanding of the areas for improvement. This research part of the project was done in collaboration with the project team from *Usability Evaluation of an IFEs* and was carried out with an open mind in order to find as much relevant knowledge and as many different perspectives as possible.

4.1 Interviews with Flight Attendants

Complementing the previous literature research found in section 2, insights were also gained from project group *Usability Evaluation of an IFEs*, which conducted three interviews with flight attendants, aiming to acquire knowledge from their perspective. The interviews focused on getting to know the procedures and specific observations regarding older adults as passengers on flights, which was useful information for this project as well.

4.1.1 Interview Results

The takeaways from the interviews contained a lot of useful information. A common theme in the interviews was that older adults often show signs of stress when flying. There are different types of stress, for all people, such as being given too much information when boarding or when the fear of flying strikes, which can happen at any time during the flight.

The routines performed by the flight attendants are not very different for a person with the age of 20 versus a 70-year-old. There may be specific needs that a person requests, but this is done when the ticket is purchased, and for people with more severe disabilities.

It was also mentioned during the interviews that most passengers use the screen in front of them, regardless of their age. This is something that has changed drastically in recent years. Passengers are becoming more and more independent of the screen. The majority of the older adults like to keep track of the journey, i.e. the speed of the flight, the map, and the arrival time, which are available on the IFEs.

4.2 User Survey

To get a deeper understanding of the area and to get in touch with people who had real and relevant experience in this field, a survey was created and conducted orally. This part also aimed to get information about what would be of interest on a screen of this kind, so that those areas could be tested.

4.2.1 Preparation of User Survey

To find potential participants, different communities for older adults that are arranged by Malmö and Lund municipalities were contacted. These communities are called Träffpunkten and are located in different places but have the same purpose: to offer a meeting place and activities for pensioners and older adults.

Since the problem was not yet defined, and to ensure the right outcome of the survey, preparations were made that specified what the desired results would be. Then, the actual survey was created with the preparations in mind (see

appendix A.2), which was quite diversified in order to acquire a wider and more complex knowledge of the target group's experiences and backgrounds in aviation and IFEs.

This survey was conducted verbally with a participant and an interviewer in two communities located in Lund, on Arkivgatan, and Sankt Laurentiigatan. The interviewer was either a member from this thesis or the group of project *Usability Evaluation of an IFEs*, and had the mission to fill in the answers to the survey as well as note other interesting answers. The survey aimed to get as many answers as possible to get a broad insight in the target group, thus the participant was over 65 years old the data was collected and used in later steps. A secondary goal of the survey was to recruit participants for future workshops by getting their contact details in order to make contact at a later stage in the process.

4.2.2 User Survey Results

The survey got eleven responses, of which eight were women. All participants used a smartphone on a daily basis and all but one also had another digital product, such as a computer or a tablet at home. Five answered that they find today's digital services difficult to use, especially if there are multiple steps to perform and you have to remember them to get to the function you want. However, some of those who responded that today's digital tools were not difficult expressed that there is often an initial threshold to a service or application.

Nine out of eleven have flown with a screen in front of them at some point in their lives, and ten out of eleven would use the screen on their next flight. This audience is more interested in watching movies, listening to music, looking at the map, and reading about the destination on the screen, rather than playing any kind of game or reading a book or magazine on the screen, see figure 4.1.

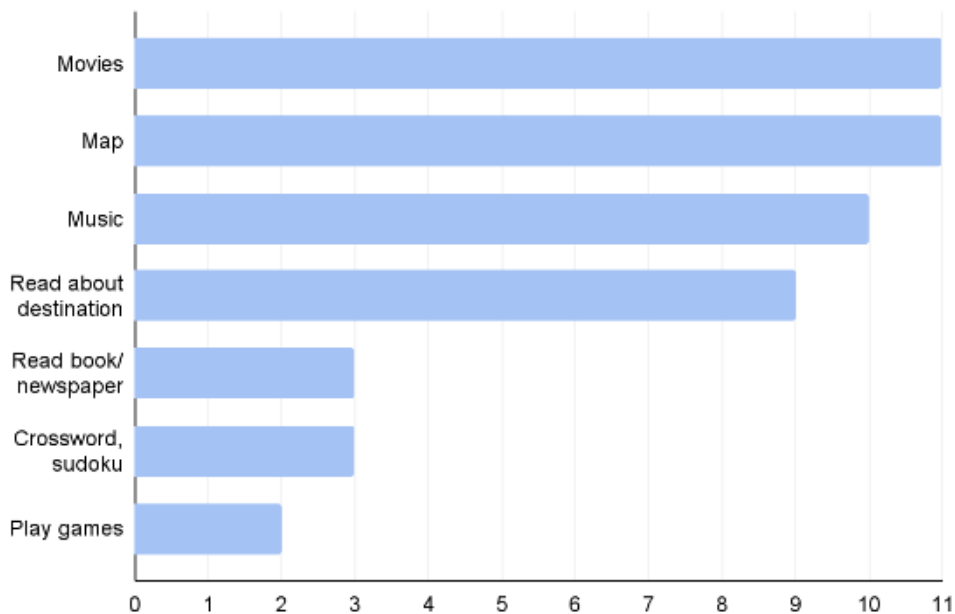


Figure 4.1: Answers to the question: "If the following content are available, what would you consider using?" Multiple answer was possible.

4.3 Workshop

To gain a broader knowledge in the field and to build a relationship with the participants to gain more insights into their experiences, a workshop was held at Träffpunkten in Husie, Malmö.

4.3.1 Preparation of Workshop

A well-composed and content-rich workshop requires preparation. With the Workshop Tactics card (see section 3.1.2) as inspiration, the workshop was prepared. It was to be held by both project teams, therefore all preparations were done together.

A very important aspect of the planning of the workshop was to make the participants feel comfortable and give them an open space to share their experiences. With this in mind, it was decided that the workshop would be presented in a playful way as a journey, which involved arriving at the airport, getting

to know each other and telling some things about their background, flying a long-haul flight where the IFEs would be introduced using tablets, and finally arriving at the destination and reflecting on the workshop.

The first activity of the workshop was called the "Ice Breaker" activity. The aim was to get the participants to open up and feel safe, but also to get information about their digital background and skills. It was conducted by posting different questions on a wall and having the participants answer the questions on separate post-it notes. The questions concerned the following:

- Age
- Former occupation
- Hobby
- Desired destination
- Digital product that I use the most
- Snacks that I will order on the plane
- What I will drink on the plane
- Pastimes during the flight
- If I don't understand the screen functions, I will...

The second activity of the workshop corresponded to the long-haul flight and consisted of a user test, which can be read more about in section 4.4. Each participant had to perform the user tests on a tablet with a default system installed. The user tests were planned to be carried out with one participant at a time in parallel between the two project teams for reasons of time efficiency.

The third and final activity was to sit down and reflect on the recent workshop together. Similarly to the first activity of the workshop, the participants were asked questions which they answered on separate post-it notes. The questions to reflect on in this activity were as follows:

- What is your feeling after using the screen?
- What would you like to use again?
- What have you learnt during this workshop?
- Describe the workshop using one word

4.3.2 Workshop Results

The workshop in Husie, Malmö, was conducted with four participants from Träffpunkten. The results of interest for this thesis regarded the second activity of the user test at the workshop, and are displayed as a part of the results of the user tests in section 4.4.2. The other received information, for example age, former occupation, hobby, and the answer to "If I don't understand the screen functions, I will...", was acquired by collecting and compiling the answers on the post-it notes and later used as inspirations when creating personas.

4.4 User Tests

To gain knowledge about the product usability level of the existing product in regards to older adults, a usability test inspired by Usability First (2023), here called user test, was prepared and conducted. This aims to see areas where usability can be improved, and thus also the UX of the product in general.

The user tests were performed both at the workshop at Träffpunkten Husie and at two different Träffpunkten in Lund, where older adults were willing to do the tests. Each test was conducted with one participant from the target group and two members of either this project team or the group of *Usability Evaluation of an IFEs* where one person was responsible for taking notes and starting to record the screen and the other presented the tasks from the manuscript. Between each test, a small five minutes discussion was conducted by the two members carrying the test to gather the thoughts and write down any potential observations or specific interesting findings. This was considered important since there sometimes might be unconscious problems found, that were beyond the questions.

That said, the user tests performed represented the flying part of the trip, where the participants had taken their seats on the plane, and started using the screen in front of them. On the screen, a default system presented in section 4.4.1 was tested by giving the participants different tasks to perform, so that the project teams would know where the difficulties of the target group occur hands on.

4.4.1 Preparation of User Test

Five different pages were selected for investigation and tasks were set to obtain as much information as possible about the potential problem areas. The tasks related to different parts of the system are described below along with a brief description of each page.

1. **Welcome Screen**, the first view of the screen where the passenger is welcomed to the plane and can see the seat number. The task here was simply to start using the system, intending to see how the user thinks initially. This page can be seen in figure 4.2.

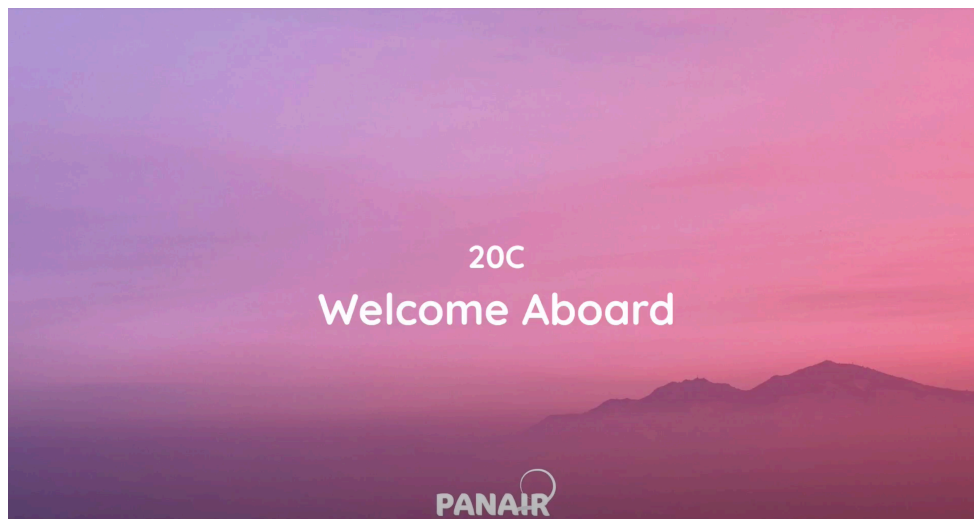


Figure 4.2: Original systems Welcome Screen

2. **Home**, the page found when entering the system. There is a bit of everything here, such as a login button, advertisements for things that can be bought, quick access to the map, etc. See the existing layout in figure 4.3, note that this is a scrollable page. The first task on this page was to explore and navigate around and answer questions. The purpose here was to hear initial thoughts and to see if it was understandable to find more on the screen by scrolling.

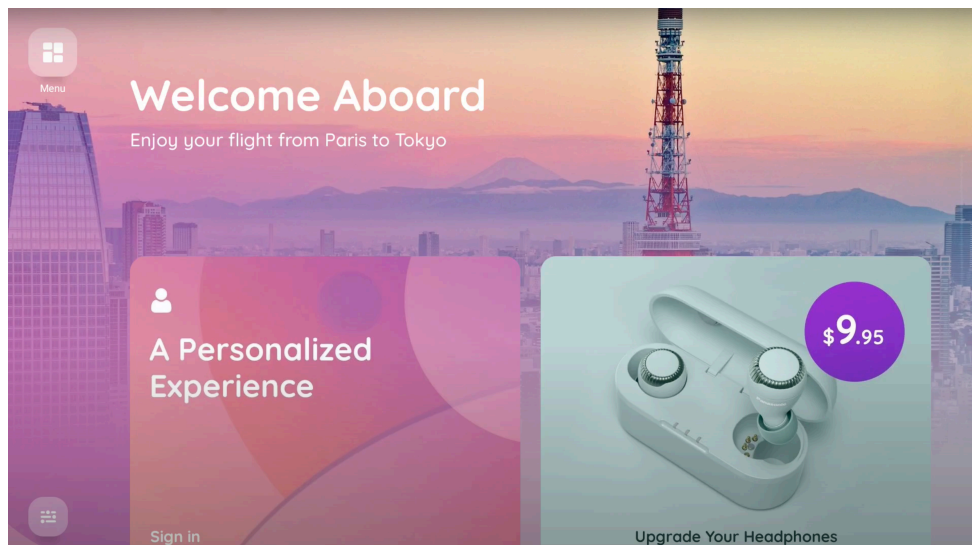


Figure 4.3: Original systems Home Page, which is scrollable

3. **Menu**, where it is possible to choose from many options, such as movies, games, shop, or information about the destination, see figure 4.4. The tasks on this page were to assess how understandable the layout is and to compare the menu and the home screen. The next task was to go back to the homepage and look for the timeline in order to find out the testers thoughts about it.

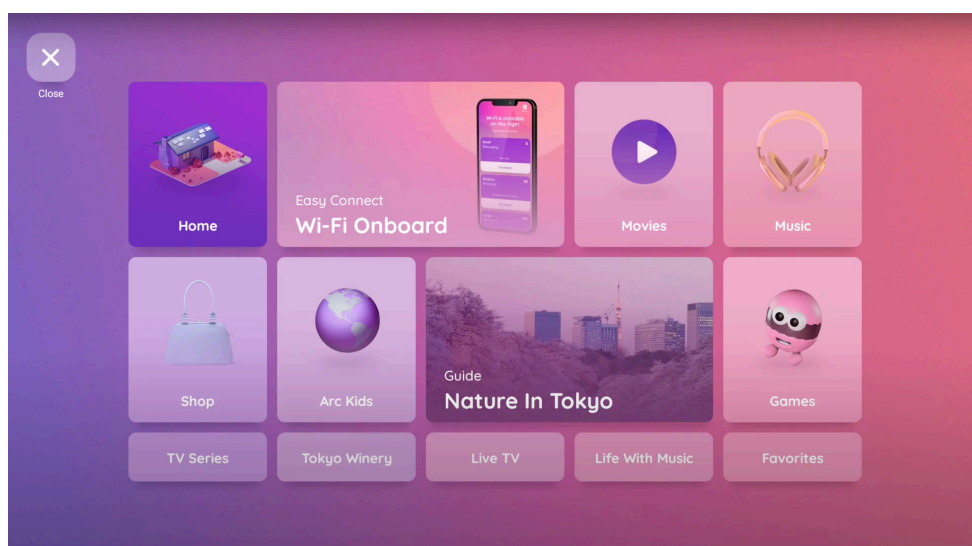


Figure 4.4: Original systems Menu

4. **Movies**, the page where you can choose different movies to watch in different genres, by scrolling both vertically and horizontally, and finding a shortcut to the shop for snacks, etc. This can be seen in figure 4.5 and figure 4.6. The task was to find a desired movie in the action genre, starting at the home screen, play it and then go back to the home screen and navigate to the map. The focus was to find out which path was imagined, via the menu or the home screen, and then whether it is understandable how to find more movies and different genres. Also which button is preferred to use of the menu and back button, to go to the home page, was examined.

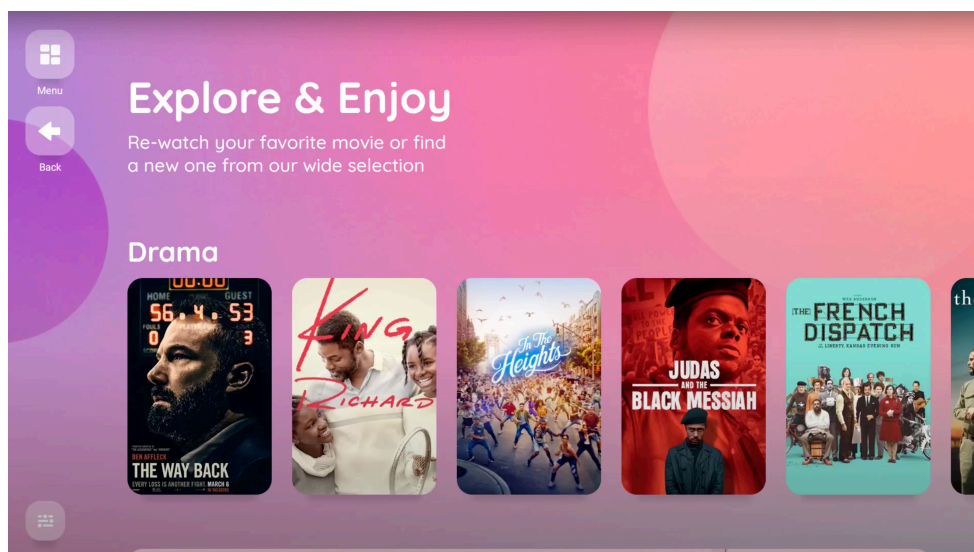


Figure 4.5: Original systems Initial Movie Page

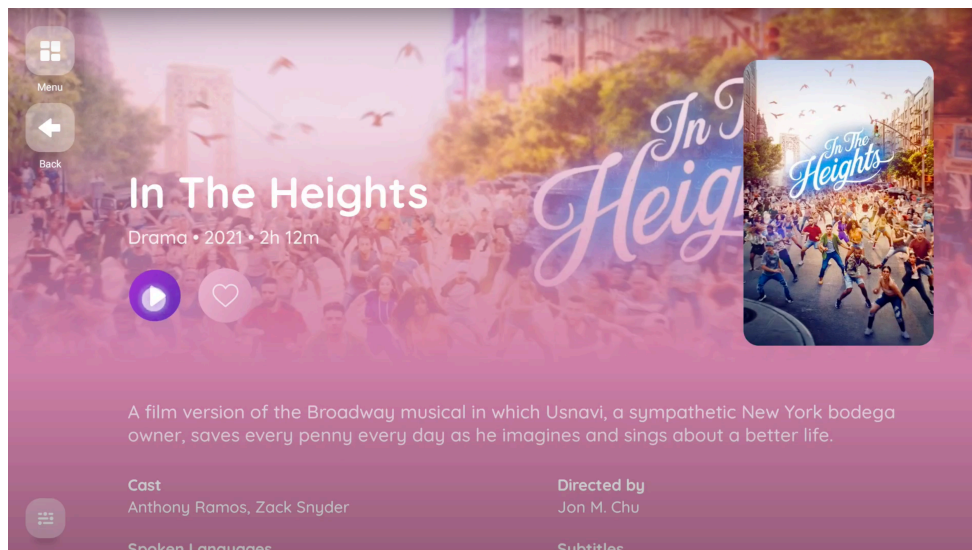


Figure 4.6: Original systems Movie Page, when a movie has been chosen

5. **Settings** and **Accessibility**, where accessibility is a button on the settings page where the questions were focused, see figure 4.7, figure 4.8 and figure 4.9. Starting at the home screen, the task was to enlarge the text size of the system. The intended outcome of this task was to find out which way they preferred to increase the size, where they would intend to find it, and what signals the word "accessibility" sends.

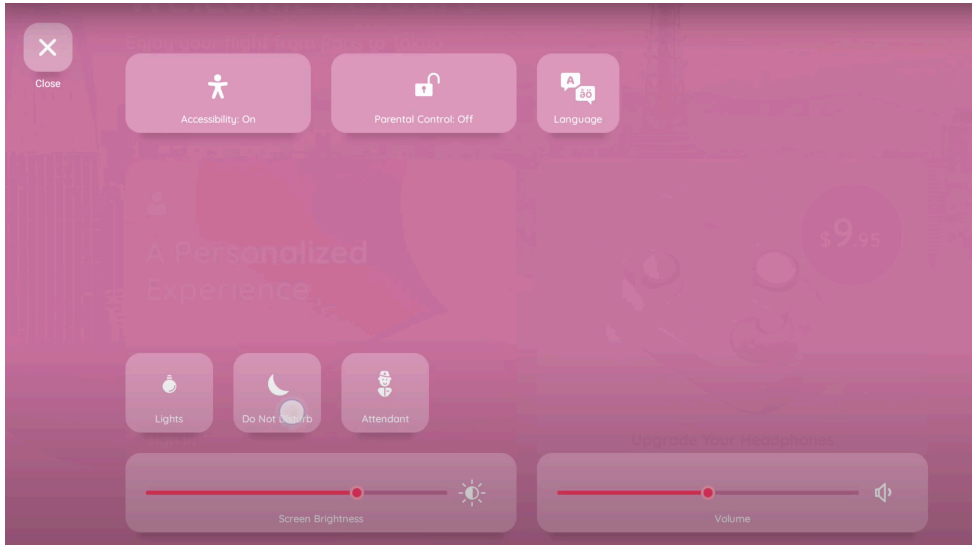


Figure 4.7: Original system's Settings Page

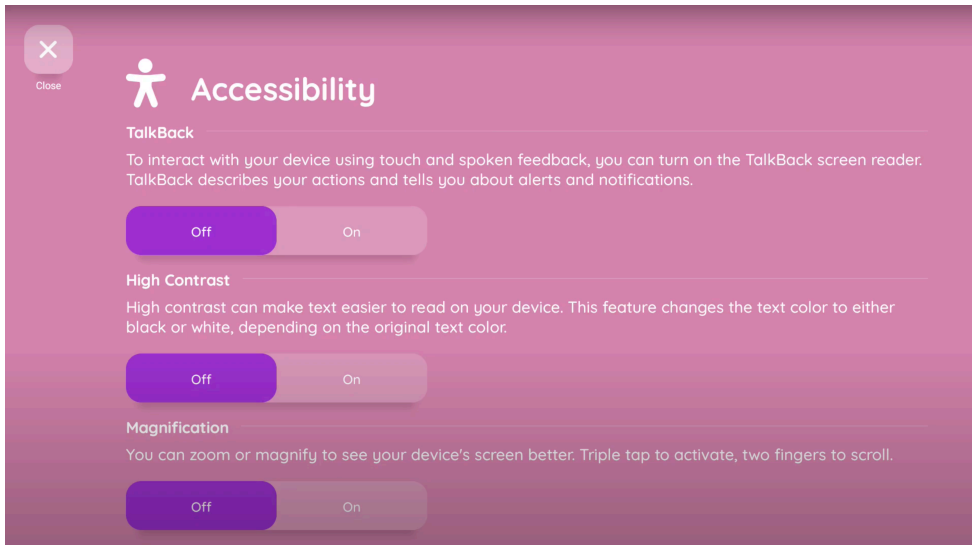


Figure 4.8: Original system's Accessibility Page. The accessibility button has been pressed on Settings Page

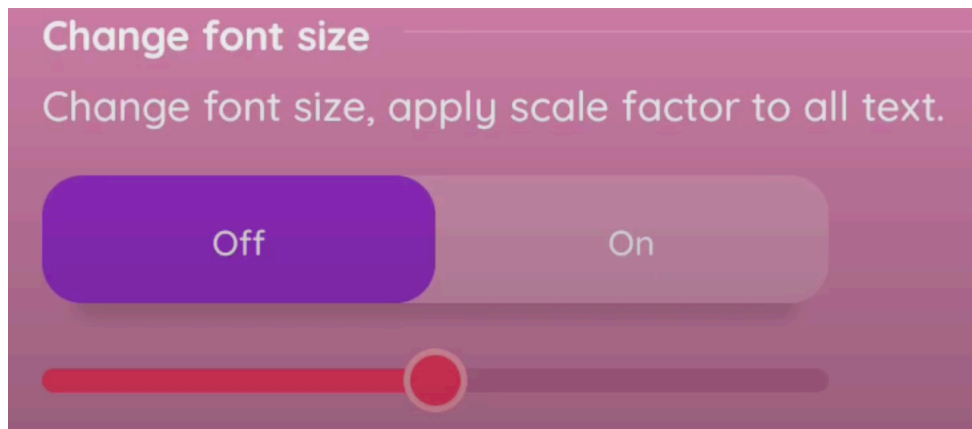


Figure 4.9: Original system's Accessibility page, font size feature

Before starting the tasks, the participants were always informed that there were no incorrect thoughts or actions, and if there was a difficulty, it was a problem with the product, not with the participant. The script that was followed can be found in Appendix A.3.

4.4.2 User Tests Results

The results from the user tests will be presented in two parts, they will be derived from: notes and recordings, but also as observations noted during the tests.

4.4.2.1 Notes and Recordings

All notes together with the recordings from the user tests were reviewed together by the two project teams. Due to the anonymity of the participants, only a recording of the audio and screen was done, not of the people performing the test. Based on this, some key insights from the user tests were noted:

- Start up - start screen
 - An indication that touching is possible is not necessary but can be helpful.
 - When the screen is presented in front, the information is read.

- Thoughts about home page
 - There is a struggle to understand that it is possible to scroll the page. The presented information is expected to be all information of the page.
 - The menu button is clear and many users find it and touches without guiding. Under the button it says "Menu".
 - Not many users use the "quick menu" at the bottom of the home screen.
 - Text with a capitalized initial letter followed by lowercase letters helps with reading because of the recognition of words
- If they enter "Sign in" page
 - It is mutual, for those users that found sign in, that no one wants to give away password.
- Menu page
 - Many participants thinks that the menu gives a good overview of the content.
- Difference between menu and homepage
 - Most users expresses that the menu is more clear and gives them a better overview than the home page
- Find the timeline
 - It is difficult to find and navigate to the timeline
 - The timeline is functional and useful
 - The timeline could increase in size and be more distinguishable
- Thoughts about the timeline
 - Recognizable symbol in combination with word(s) makes it understandable (cutlery + next)
- Movie page
 - Movies are almost always found through the menu (only one used the "quick menu" at home page)

- For most of users, it is understandable to swipe horizontal to find more movies. The genre-title is believed to be a button.
- Enlarge the text
 - Often the exclusion method is used to access settings
 - What is shown at the top of the page is read first and checked against the task
 - Tolerances for touch gestures must be "larger" as it is hard to be precise
 - Many people think that enlarging the text is under settings, not in next layer ("Accessibility")
- Accessibility - the word and the meaning
 - Accessibility is non accessible for the user group
 - Some users associate the symbol with children or toilet

All findings will be discussed and prioritized in a later step of the process. However, three interesting takeaways from this step were the difficulty to understand the possibility to scroll different pages, that the menu page was more clear and accessible than the home page, and that the settings and accessibility page were hard to grasp.

4.4.2.2 Observations

In addition to the key insights from the notes and the screen and audio recordings from the user tests, observations were made during the tests.

With user observations as part of the testing, some unexpected and expected behaviors of the target group could be collected and used to improve the usability and UX of the product (Gomoll and Nicol 1990). One observation was that a few people in the test group, often people with more experience with digital tools, could say that they knew what they were doing and did not need help. During the test later on, it turned out that they actually needed help finding different things, such as understanding that there was more to a page than what was shown.

Another observation that was interesting was that the attitude to using a flight screen on the next flight changed to a more positive mindset. Moreover, almost

all participants' first approach was to read from left to right and from top to bottom.

Finally, an observation was made about the "back" button. This button seemed to confuse the users as they got a bit lost when they pressed it. Most, therefore chose to click on the "Menu" button to go back instead, and another observation was that many users seemed to be a bit confused if told to go to a page that they had recently visited.

All these observations were chosen to be considered in further stages of the process.

4.5 Discussion of Empathize

At this stage of the process, there are a few things that should be taken into account and are good to know.

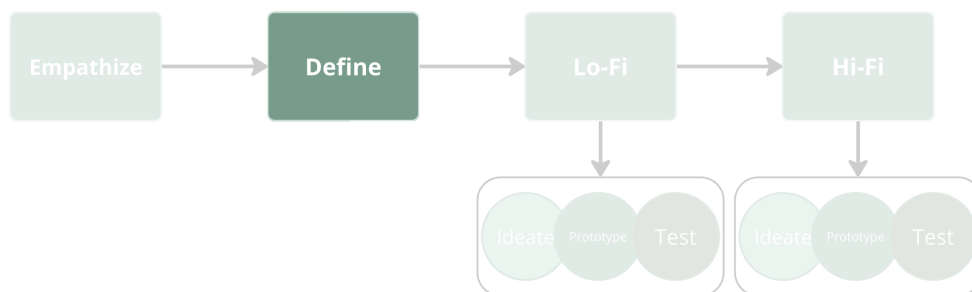
When conducting the user survey found in section 4.2, it should be considered that it was performed orally while the answers were recorded in writing as notes. These notes can be considered a potential source of error as the notes may contain bias, even if it was not intended. The same applies to the observations of the user tests. These were also noted from thoughts after the user test when a pattern or feeling could be spotted, which could mean a biased source.

From the survey, the participants from the target group answered that, among other things, they would probably use the map function on such a screen. Since this project aimed to focus on the functions that the target group had highlighted as something they would use, this test should have included the map feature. However, in order to display the map feature, the tablets needed to be connected to Tactel's private Wi-Fi which did not work as the tests were conducted in public places with respect to the target users, and therefore the map feature was not tested.

In addition, the results of the survey also emphasized the music function and the possibility to read information about the destination. The music page was similar to the movie page which was already being tested, so it did not seem relevant to test it twice. The destination information page was decided to be too little interaction with to be prioritized at this time.

Furthermore, before starting the user tests two pilot tests were carried out on two of the participants on Träffpunkten at St. Laurentiigatan in Lund. After these tests were performed, the approach was not changed, only a few questions were changed to be more open, and the outcome did not differ in any major way from the rest of the tests. Therefore, the data gathered from these two pilot tests were chosen to be added to the data bank as ordinary tests.

5 Define



This part of the project gathers all the data collected from the previous step to analyze them and identify the different problem areas that exist with the current solution. This was done to be able to know which areas to focus on both in general and between the different project teams so that they could take different directions later on in the project. Define was therefore partly executed together with the project team from *Usability Evaluation of an IFEs*, thus the project groups would have access to all user tests performed, and all other data. During this stage of the process, the different problem areas were identified, and thus the project teams divided the project and worked from then on separately.

5.1 Analysis of Data

To be able to understand and use the received data from the earlier step, different analysis methods were used to clarify the data.

5.1.1 How Might We Questions

How might we...? questions are open questions focusing on understanding which areas could be further explored and possibly improved. When applying this method, the aim is to understand that it is not just one correct answer at this stage, and in that matter, it is a great way to create a bridge between the raw data from the research and the later design process (Szerovay 2022).

This method was used to get a broader base and to support idea generation at a later stage. This was done by going through the findings and creating questions by first adding "How might we" and then formulating a question to solve each key insight. Then the questions with similarities were grouped into common themes.

The questions compiled using this method and their topics were as follows:

Sorting information

How might we...

- ...include content but avoid information overload?
- ...create a flow of the system that the users can comprehend?
- ...create a good structure of the system that is not confusing and which does not contain too much information?

Communicating idea

How might we...

- ...inform other designers of our insights from the user tests?

Inclusion - Engagement

How might we...

- ...make sure everybody gets access to all of the information and entertainment available?
- ...get older adults to want to engage with the screen?
- ...invite users to the system?

Mediate/Convey

How might we...

- ... choose by using icons or language to explain things?

Accessibility

How might we...

- ...include without excluding?
- ...include accessibility in an accessible and inclusive way?
- ...create a design that enables mistakes related to touch gestures?
- ...get older adults to know what they can do on the screen?

Functional Specification

How might we...

- ...get the users to clearly understand that there is a timeline?

Safety

How might we...

- ...get users to feel safe using the system?
- ...create a personal setting without demanding the user to give up info about themselves?

5.1.2 Coding Data

To ensure nothing was missed when the categorizing was done in section 5.1.1, and to capture every important aspect of the problems, the findings from the research were further analyzed by the project group in this thesis alone.

Coding is useful when having a lot of informative answers from interviews and other research methods, and wanting to translate the received data into numerical values, which is then called *codes*. There are two main different approaches for performing this type of coding of research data, where one focuses on **understanding** the received data by going through the data and finding the different themes (codes) and then categorizing the different answers into them. The other approach aims to **verify** by finding and creating themes (codes) from existing information and then verifying it by doing research which could be categorized into the different themes (Kumar 2011).

The first described approach is called *Bottom-Up* and was used as a source of inspiration when wanting to understand the problem and users. Therefore, the coding in this part of the process is inspired by that and included analyzing and stating common patterns as areas that could potentially be improved. The secondly described approach is called *Top Down*, which will be used later on in this project when different problem areas are to be verified (Olander 2023).

From the different tasks in the user tests, the information was already pre-grouped by the different pages of the system. Thereafter, the raw findings from the research were grouped into different themes. These themes were stated as problem areas that could potentially be looked into to be able to improve the system.

The themes found when further analyzing the data were as follows:

- Security
- Inclusion
- Promote
- Terminology
- Touch gestures
- Icons
- Information absorption
- Navigation flow
- Layout
- Functions

5.2 Functional Analysis

Based on the analysis of the data found in section 5.1.1 and section 5.1.2, a functional analysis was created to get a structured list that represents a *Specification of Requirements*. This is to be returned to further on, to check against the future created solutions, and it was done by the project group of this thesis alone, and not together with the project group in *Usability Evaluation of an IFEs*.

Functional analyses are often done as one of the last things in this step of the design process, to prepare for the ideation phase (Stiftelsen Svensk Industriedesign 2023), which is also applied in this case. In this step, it was chosen

not to include the aspects from the literature found in section 2 to reinforce and maintain the focus of this study: the direct perspective of the users. The requirements stated from the literature study will come in at a later stage and will then be explained more clearly.

5.2.1 Specification of Requirements

Figure 5.1 shows the list of requirements to which the future solutions should relate. The prioritizing of *required* and *desired* was done as a result of the earlier research and analyses. While demands that were considered required in this project were areas that were of interest for this thesis and would have a significant impact, the desired demands were areas that were considered would fall more into place if the required areas would be fixed first. The main rating is already fixed as the product was working for that purpose.

Verb	Noun	Rating	From
Prevent	Information Overflow	R	Interviews, User Tests
Facilitate	Navigation	R	Survey, User Tests
Invite	Everybody	R	Survey
Appear	Interesting	D	User Tests - Observation
Provide	Information	D	Survey
Clarify	Choices	R	Survey, User Tests
Offer	Customization	D	Company
Allow	Mistakes	D	User Tests
Decrease	Initial Threshold	R	Surveys
Provide	Safety	D	Survey, User Tests
Provide	Entertainment	M	Survey
Offer	Distraction	D	Interviews, Survey
Offer	Guidance	D	User Tests

R = Required, D = Desired, M = Main

Figure 5.1: Functional Analysis as a Specification of Requirements

5.3 Personas

As a way to identify which people the research and development are for, and to remember their needs and wishes throughout the process, personas can be created that can be seen as fictional characters based on the people within the target group (Lowdermilk 2013).

The personas were first done comprehensively with the project team from *Usability Evaluation of an IFEs*, and then modified and adapted to this project team's research and codings. The personas were based on the outcome of the survey (see section 4.2) and the workshop (see section 4.3), and although they are all older adults, which is our overall target group, some specific differences were highlighted. Besides the demographic information and personal characteristics, the technical and travel experiences of the users were brought into different personas.



Vivanne

Age: 87

Gender: Female

Former occupation: Nurse

Family: Lives by herself

Vivanne is satisfied with her life and wants to enjoy her long-time hobbies such as reading books and playing the piano, rather than trying new things. At home, Vivanne has a stationary computer used for emails and to search for information on the internet. She also owns two cell phones, one feature phone, and one smartphone. The smartphone she had to purchase to use "Mobilt BankId", to log in to her bank, and to buy bus tickets. She got help from others to install both features on her phone, and except for those functions, she exclusively uses the feature phone. Vivanne feels uncomfortable and anxious when experiencing stressful situations such as handling technical devices, and she solves this by moving on or asking someone close to her.



Margret

Age: 80

Gender: Female

Former occupation: Receptionist

Family: Lives by herself. Divorced, two grown up children and six grandkids

Margret is an active pensioner and a powerful lady who is confident in herself and is not afraid to speak her mind. In Margret's daily life, she uses a smartphone with many applications, a Chromecast, and an iPad. She has an interest in being up to date with today's technology and she feels confused when the technical device is not comprehensive for her. When she experiences stressful situations, she still wants to be independent and tries until she gets it. Margret is quite an extrovert person and therefore has many friends she meets for coffee or athletic activities. She also facetimes with her grandkids multiple times a week.



Rolf

Age: 70

Gender: Male

Former occupation: Engineer

Family: Wife lives at nursing home, one kid who lives far off

Rolf needs to come out and meet people since Rolf is an active and outgoing man who is caring about his peers. He visits his wife every day where they talk about life. If people imply that he is an older man, he easily gets frustrated and therefore, he tries to keep up the appearance that he is still technically skilled. Otherwise, he is overall pleased with his life and enjoys it fully as a humble man with an interest in learning new things. He uses his computer and smartphone daily but is a bit careful leaving his identification. He has some websites that he trusts and can log into. Rolf's friends describe him as calm, outgoing, and curious. When he is confused, he tends to get a bit stressed and wants to prove that he is not old, but he is still not angry or irritated.



Juliet

Age: 77

Gender: Female

Former occupation: PE teacher

Family: Lives with husband, both children and grandchildren lives abroad

Juliet and her husband travel once every other year to visit their children and grandchildren abroad. Juliet needs to meet her friends and get social interaction in her daily life. This results in, for example, meeting up and playing bridge with friends, or attending meeting places for older adults. She likes to be a part of a community. Juliet has a smartphone, which she uses to call her friends and family, but the text needs to be big so that she can read. When she does not understand a technical device, she comes across as a bit too proud to admit that she is having difficulties. Even though she thinks it would be fun to be more interested in new technology, she values her social life more and does not care much about learning new things.

5.4 Defining Problem Areas between Teams

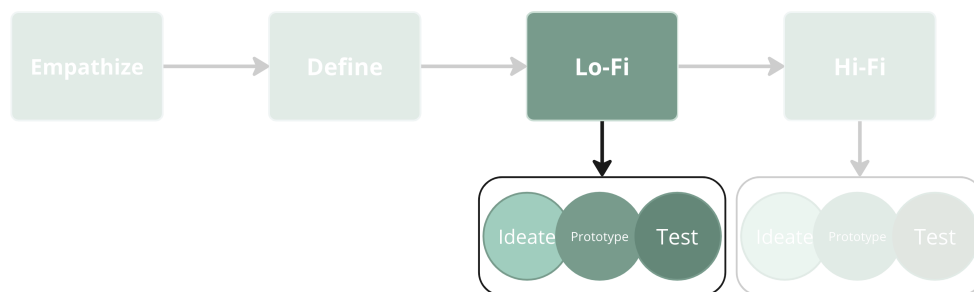
When the analysis of the research and the system was done, the various problem areas had been identified. To make a relevant and appropriate split of the work between the two project groups that had up until this point mostly worked together, a definition of the two problem areas was made at this stage. This resulted in two separate parts of the system: the *onboarding* part, including the pages between the *start screen* up until the *home screen* when the user has fully entered the system. The second part of the split can be called the *inside* of the system where the user has already onboarded onto the system.

Within the two different parts of the system, similar problems were found and explored. From now on, this thesis was performed on its own and was decided to move forward with the inside part of the system.

5.5 Discussion of Define

One thing that could be reflected on, and which would probably affect the results would be if different places of finding participants would be chosen. When conducting the research in the empathize phase, it was quite soon realized that it was a clear majority of women in the places that the participants came from, Träffpunkten. This was considered in the progression of this thesis since the work is mostly built on the findings from the research and was highlighted in this work through the creation of personas where three out of four personas are female, and one out of four is male. If this work is to be used in the real world, this must be taken into account as it does not necessarily correspond to reality. But for this thesis, the personas stated in section 5.3, were a good representation of participants of this process.

6 Lo-Fi



In this section, the *ideate*, *prototype* and *test*, implies for the creation of Lo-Fi concepts that were to be tested, to gain more insights into the target group regarding the created solution-focused layouts of the system.

6.1 Ideate

Ideate, as earlier mentioned, requires gathered data for the analyzers to brainstorm and generate different ideas for concepts, which later on can be implemented into prototypes. During this step, it is really important to have an open mind, even if the product itself already exists as in this case.

To integrate a UCD approach in this step, it is important for the people participating to think of how the comfortable aspects of the experience of the product can be improved, while still having the other principles, such as usability, in mind (Pascual 2016). This was considered moving forward in the ideation of the Lo-Fi prototypes.

6.1.1 Workshop at Tactel

To get inspiration for potential part-solutions from other designers, a workshop was held by the two project groups internally at Tactel, where 14 designers with experience within UX participated. This aimed to gain professional thoughts and ideas on the matter that could later on inspire the continued work, and was performed together with the project team from *Usability Evaluation of an IFEs*.

Since the brainstorming session would be based on previous steps of this process, the participants were first introduced to the research and findings that had been done by the two project teams. Two personas were then presented, since four personas would have taken too much time to go through because this event had to be kept to 30 minutes and no more, it was decided two personas was enough. However, these two personas represented a combination of the project's four personas and were to be used in this workshop for the designers to remember during the workshop, and for them to conduct the tasks with the right mindset. The main differences between the personas in this part of the process were that one of them was a bit younger, but still over 65, and more technically experienced, and the other was older and less technically experienced.

The workshop consisted of reading about personas and then drawing an idea for a solution in Miro for the given tasks. The tasks were as follows:

Task 1: Picture that **PERSONA** is facing the system for the first time. With the given information in mind, generate ideas for a suitable user flow. Reflect on how to engage and include the **PERSONA** in the system.

After ten minutes, the participants were asked to switch places in Miro and go to another person's previous work with the other persona. There the task was as follows:

Task 2: Continue building on the previous work. Generate ideas and solve the problem in which **PERSONA** is in focus and her needs and frustration are met.

Similarly to the workshop before, to get inspiration for the further work, some key takeaways were noted from this workshop and gathered in the following list:

Brainstormed Ideas from Internal Workshop at Tactel

- Content based on what has been chosen before (personalization)
- Narrow down the content of the home page, to "look for a movie" or "relax and listen to some music" only
- Place a navigation bar menu on the top of the landing page
- Have Menu as the landing page and then the Home page as an "Explore" page (like a feed)
- Important to make clear and "safe"
- Tell the user what the personalization does
- Should have big and easy options
- Language-specific content
- Popular and unpopular settings & Advanced settings separately
- No separate accessibility section
- Avoid scrolling
- Text-based options, only use icons if they help
- Scrolling indicator (if not scrolled at a certain time)
- "Do you need help?" button
- Tooltip (information button) next to each function
- Give feedback when pressing a button throughout the system
- Remove unnecessary information
- Bounce to show that there is more info on a page (or other options to show this, arrows, etc)
- Guide should come up the first time the user enters a function, this guide can easily be skipped by pressing "SKIP", or a button that is called "smart guide" and the first time the user enters the system, it shows a talk bubble where it says "click here if you want a guide of the page, I'm always here"
- Have the whole IFEs available to search for
- Guide: give a tour of the system and how to navigate through it, always have a "SKIP" button
- Step by Step choices are important

6.1.2 Brainstorming

In this stage, a brainstorming session for generation of different ideas were made by the project team of this thesis.

After the internal workshop at Tactel, inspirations were taken from the list of ideas while the main focus was on the list of requirements (see figure 5.1), which represented previous research well. Some feedback and inputs from the designers at Tactel were useful and were therefore considered, and some were not due to time efficiency. When the lists had been gone through, the concept generation process started by making another list of the overall areas that needed to be brainstormed by the project team. This list was as follows:

- General concepts of flow
- Concepts for individual pages
- Concepts for the skeleton layout on each page
- Gather concepts and create full user flow
- Look into personalization

The brainstorming session followed the order of the list, which as earlier stated had taken inspiration from the workshop at Tactel, but mainly focused on the previous research summed up in the specification of requirements. This was conducted by sketching the ideas in Miro to get an overview of the different ideas. Once the ideas came to an end at the specific topic, the team moved forward to the next subject. Sometimes, an idea on one topic led to new ideas on another issue, in other words, it was also an iterative brainstorming session to a certain degree. The skeleton layout of the system is in this thesis referred to as a layout with buttons, information, etc. that will always be available on a page. This is intended to contribute with structure to the system but needs to be verified with user tests. The last item, *Look into personalization*, was considering GDPR (General Data Protection Regulation), limited to the presets and settings page only. Other personalization features are referred to in future work. At the end of the session, inspiration was also drawn from ideas shared by the designers who participated in the workshop (see section 6.1.1), to put these in context.

6.2 Prototype

Entering this stage of the process, the ideation phase resulted in concept ideas that were not fully developed but provided inspiration for further developed Lo-Fi prototypes. The project team, therefore, started by going through the different ideas and referring to the research to come up with combinations that would cover the identified problems within each page, along with the overall flow of the system. The approach for validating the resulting concept choices was primarily to go through the concepts, with the acquired research and personas in mind, at the same time as the specification of requirements was gone through so that at least every demand rated as "required" in the requirement specification list would be considered.

Furthermore, during the creation of the Lo-Fi alternatives, it was decided that all concepts, including the original system, would be done quite basic in Miro, without color. This was because Lo-Fi concepts would otherwise never be as visually appealing as the already installed original system, which would not be a fair assessment. Therefore, this was decided to reduce the risk of the original being selected during the comparative test due to its more advanced design. To keep track of the original system it was chosen to represent *concept 1*, while the other created Lo-Fi concepts got to be subsequent.

From the brainstorming session, three main flows were decided to be of interest and therefore chosen to move forward with. These were implemented in concept 1, concept 2, and concept 3 and will be described in more detail for each of the following concepts.

As the different pages of the concepts would later be tested against each other, the presented concepts did not have to follow the same layout throughout the concept, which can be reflected upon. However, this was done to include as many ideas as possible and to have as clear a structure as possible for reference at a later stage.

6.2.1 Concept 1 - Original Translated into Miro Design

Although concept 1 corresponded to the original system, some modifications were made based on the research findings, which can be read more about in the following two paragraphs. When it comes to guidance, the original concept did not contain any and neither does the modified one.

6.2.1.1 Flow of Concept 1

The flow of concept 1, seen in figure 6.1, was almost ready as this concept represented the original system and was a relatively flat flow with few layers. To make the flow with even fewer layers, the "Home" page was removed as it was not considered useful during the first user tests. This resulted in the "Menu" page becoming the landing page, and thus the first entered page of the system since the home page was removed. The options in the menu were made as direct selections, e.g. "Movies", "Music" and "Games", so selecting any of these options would take you directly to that page, thus the same approach as to the previous original design.

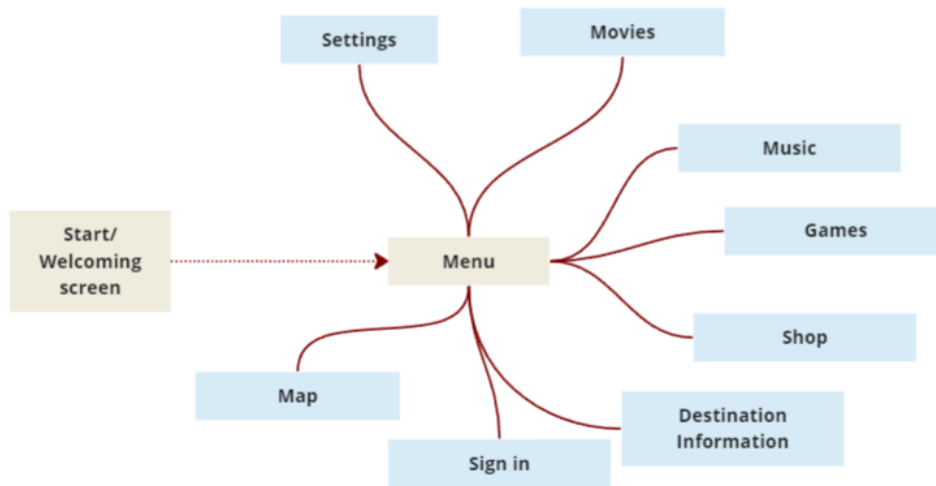


Figure 6.1: Flow of concept 1

6.2.1.2 Concept 1

The original system translated into a Miro design can be found in figure 6.2. In addition to this, which was not in the original system to begin with, were the scroll indicators on the "Movies" page. This was added to be tested against the other concepts of scroll indicators.

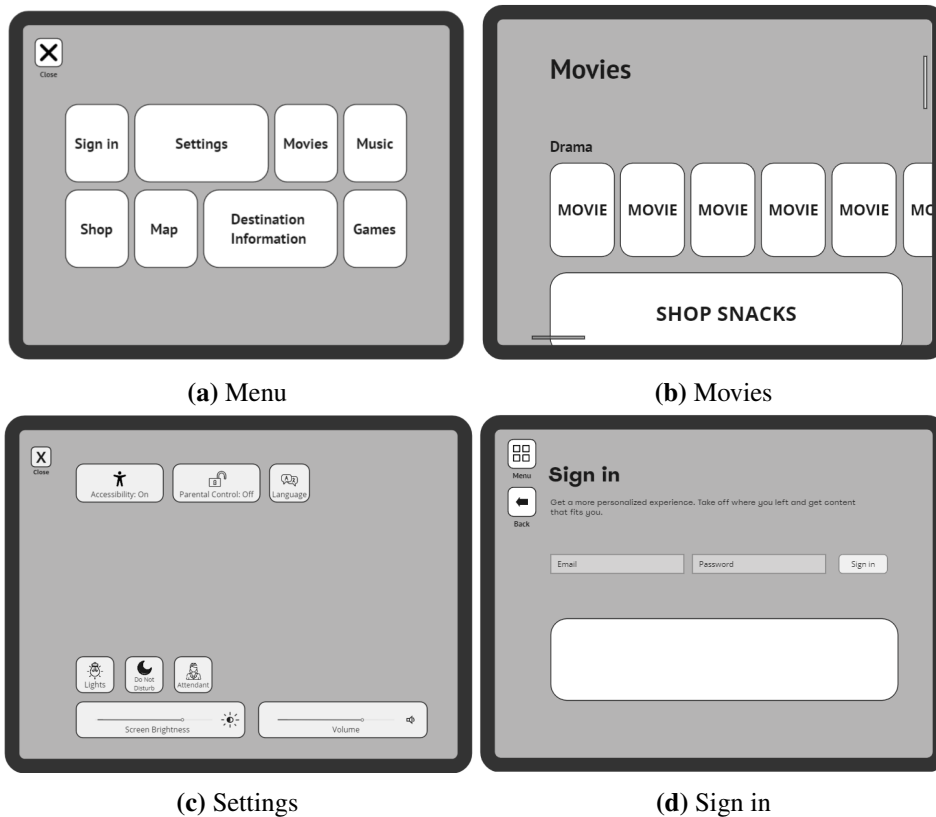


Figure 6.2: Concept 1 of Lo-Fi Prototypes, the modified original system

6.2.2 Concept 2

The first concept (see figure 6.3) created beside the modified original system was called *concept 2* which generally aimed to apply a simple layout with fewer options on pages, where the user instinctively would understand where they should go, and how to go about it.

6.2.2.1 Flow of Concept 2

The menu of the second concept would first show more general options such as "Media" and "My Trip", under which sub-genres would be. When selecting "Media", the next page would show "Movies", "Music", "Games" and "Podcast" which means that the flow of this system would mean more layers,

and thus more depth, to the system.

To test the flow of the system, other functions than the ones found in the research, regarding interesting features for the target group, did not matter in this case. Therefore the "Media" page was chosen to be tested, containing the page "Movies" that had previously been tested and problem areas been found.

The flow of concept 2 can be found in figure 6.3 below.

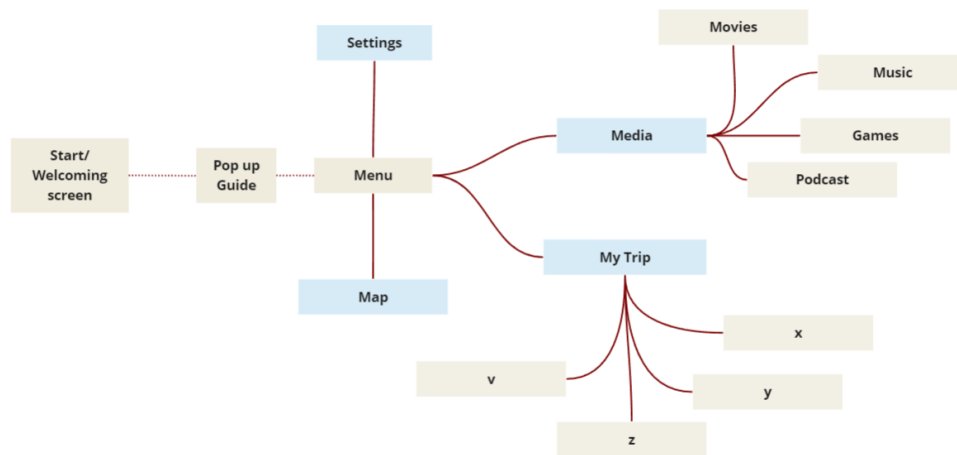


Figure 6.3: Flow of concept 2

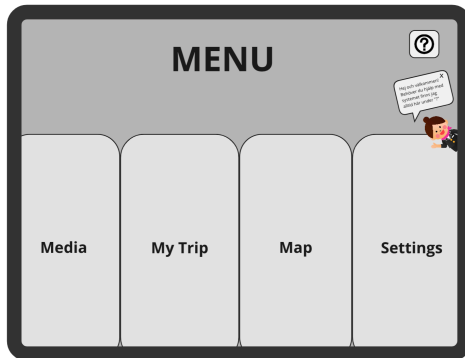
6.2.2.2 Guidance in Concept 2

The guidance implemented in concept 2 would be applied as a sort of mascot that would appear on the "Menu" when the system is first entered. This mascot would tell the user where to press if they would need help with the system, and this button would be available on any page of the system. If the help button was clicked, help would appear by highlighting and describing each function of the current page. This concept of guidance can be found in figure 6.4a.

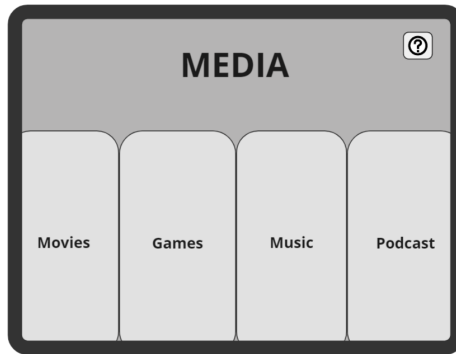
6.2.2.3 Concept 2

As described in the section on the flow of this concept (section 6.2.2.1), the menu focused on having as few choices as possible for the user to be able to look at the system without any stress about it, which can be found in figure 6.4b. The "Movie" page can be seen in figure 6.4c and was designed to have the different genres at the top of the page for the user to be able to see the different choices at all times. This would make the system more flat and informative about what can be done. It also aimed to test a vertical scrolling indication in the form of a hand and arrows showing scrolling direction, which would appear in five seconds if no interaction had been made with the screen in that time.

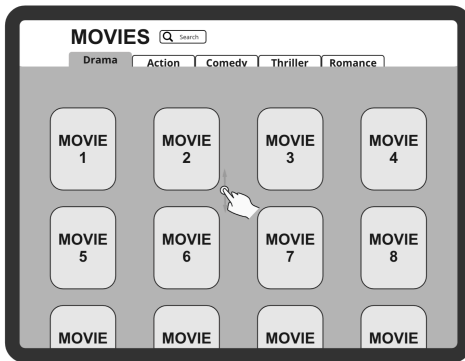
This concept's settings page aimed to have the "popular" (meaning often used) settings visible at the top, and have the other choices on the page in a structured way. The lower part would be flexible and monitored by the different choices selected above. In figure 6.4d, this page can be seen where the text size option is chosen but if for example language would be chosen, a choice of languages would come up instead of the three text sizes.



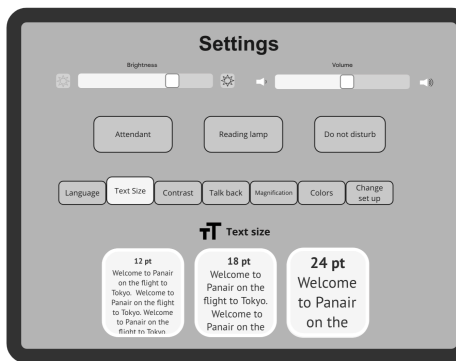
(a) Menu with pop up guide



(b) Media



(c) Movies



(d) Settings

Figure 6.4: Concept 2 of Lo-Fi Prototypes

6.2.3 Concept 3

This concept was called concept 3, and like concept 2, this also had a simple design. On the other hand, this concept required a little more interactional understanding on the part of the user.

6.2.3.1 Flow of Concept 3

In concept 3, the implemented flow seen in figure 6.5 was a mixture of the two previous flows aiming to test what the initial approach of the user would be. This concept would have needed more accessible interaction to test, but since the initial clarity of the system was looked for, this was chosen to be included after all.

Using the same argument as why "Movies" was chosen to be tested in concept 2, the "Movies" page was also selected here. The other functions would look similar and the scope needed to be limited at some point so that the tests would not take too long time.

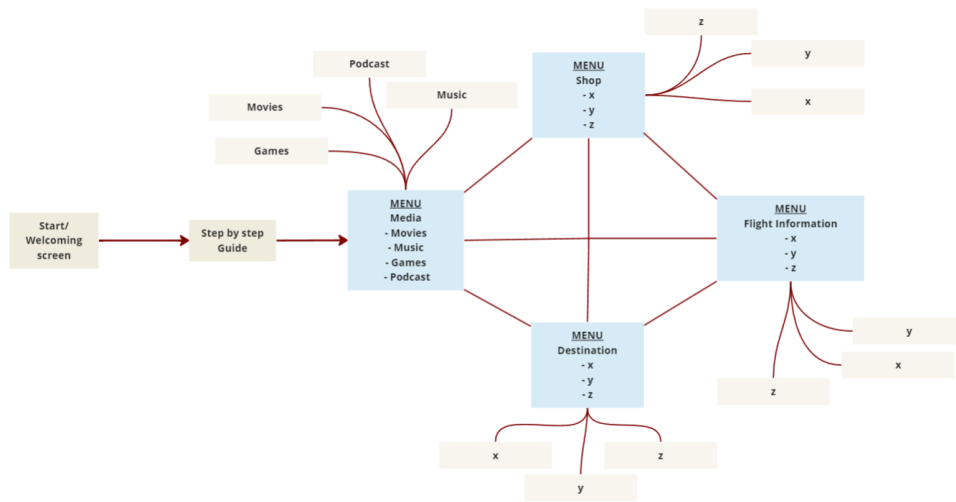


Figure 6.5: Flow of concept 3

6.2.3.2 Guidance in Concept 3

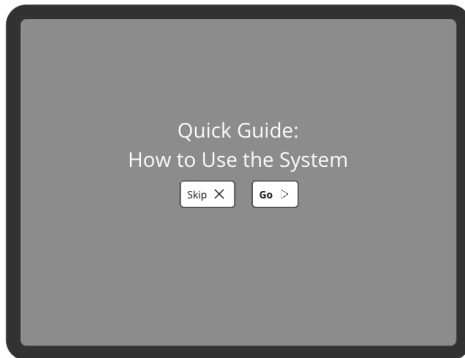
In concept 3 the guidance was implemented as a step-by-step guide that would start for the users at the beginning of the system, and which thus also had its flow. This was to introduce the user to the system and guide them through all available functions before they would enter the landing page. It was important that this guide could be skipped at any time as it was not enjoyed by all users beyond the target group, therefore a "Skip" button was added which would take the user to the landing page of the system. This concept can be seen in figure 6.6a, 6.6b, and 6.6c.

6.2.3.3 Concept 3

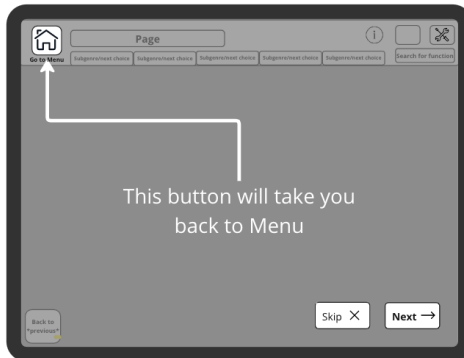
The "Menu" page (see figure 6.6d) of this concept was decided to have an unsymmetrical layout with an overall menu to the left and the sub-categories to that choice to the right. These sub-categories would change when the selection of the overall menu would change.

Furthermore, the "Movies" page can be found in figure 6.6e and contained horizontal scrolling which was here indicated by an arrow in the lower right corner along with an otherwise simple layout.

This concept's "Settings" page was similar to the one in concept 2, but with more focus on turning things on and off (see figure 6.6f). In this design, the highlighted buttons meant that they were on, and the others were off. The upper half of the page was the interactive part which would switch when another button was chosen at the top of the page.



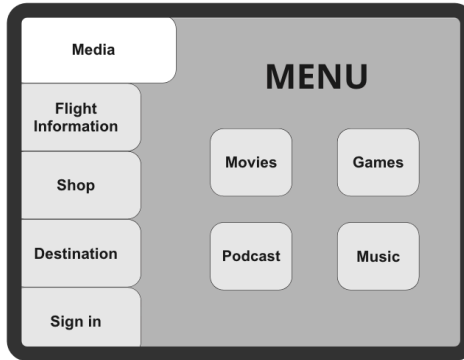
(a) Guide step 1 - pop up when entering system first time



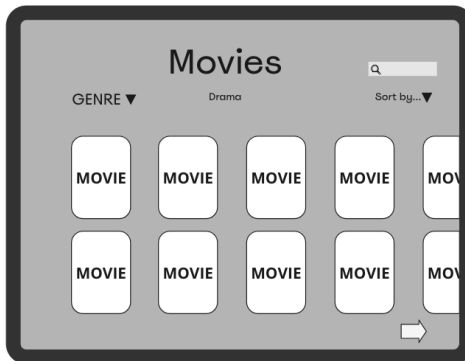
(b) Guide step 2 - When "Go" was pressed on step 1



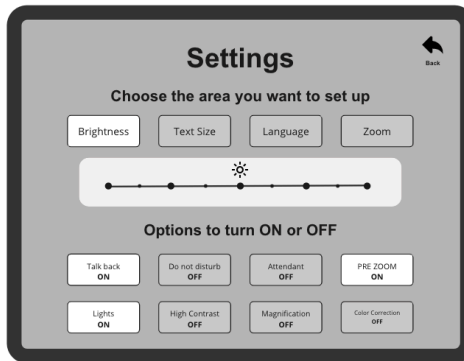
(c) Guide step 3 - When "Next" was pressed on step 2



(d) Menu



(e) Movies



(f) Settings

Figure 6.6: Concept 3 of Lo-Fi Prototypes

6.2.4 Skeleton of System

Skeleton means the things on the screen which are always available no matter which page is visited and should provide a structured feel with enough information, while not being overwhelming for the user.

The different concepts that were brought into further analysis from the ideation phase can be found in figure 6.7. Every alternative except alternative 3 would be in a fixed place on the screen at all times. Alternative 3 would be able to be hidden by clicking on the "hamburger" menu (three horizontal stripes) in the left upper corner.

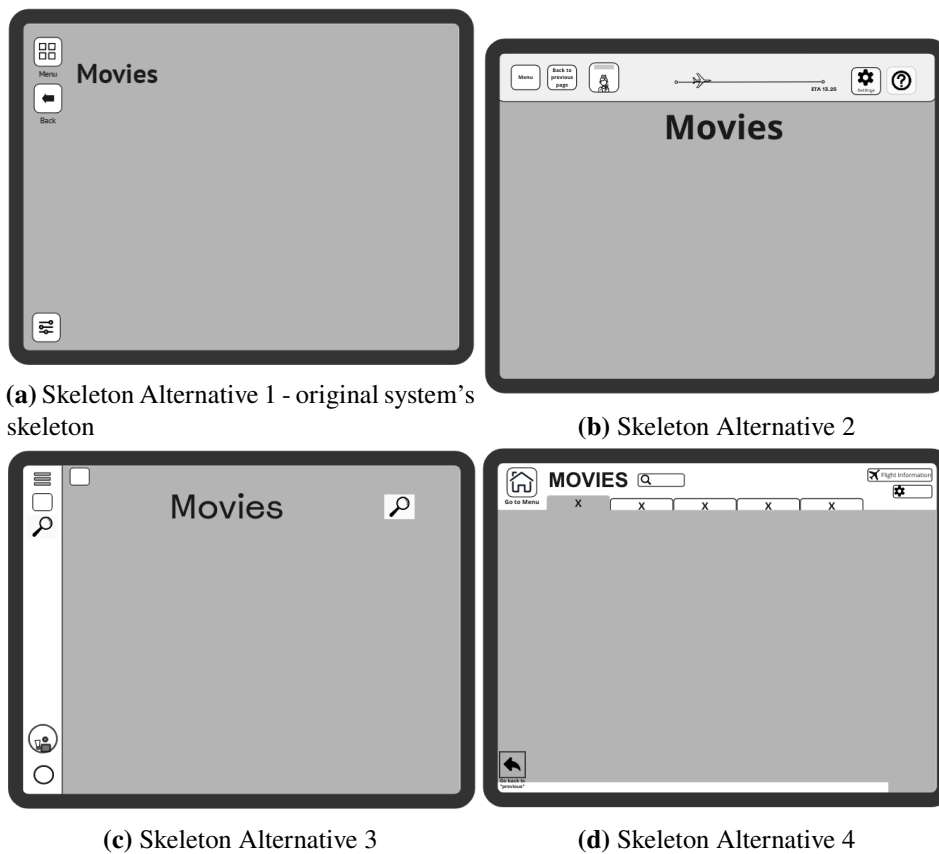


Figure 6.7: Concepts of system skeletons

6.3 Test

After the Lo-Fi prototypes had been created, it was time for testing the prototypes on users within the target group. Users that earlier had left their contact details were reached out to and asked to participate in another user test which resulted in seven people performing the test of the different Lo-Fi concepts.

This test was decided to be performed as a *qualitative and comparative usability test*, where task success, number of errors, and general feedback were taken under consideration and measured. This approach of a test is useful when wanting to compare the effectiveness and efficiency of multiple different design suggestions (Anderson 2023). Ross (2023) has written an article that includes a useful method for this purpose, which was used as inspiration for this test. He states that it can be useful to test many different designs early in the process, as it provides valuable information about what does or does not work with each design, and therefore the solutions that should be prioritized for implementation in the further process are screened.

6.3.1 Preparation of Lo-Fi Test

The planning of the test was performed with the specification of requirements in mind (see figure 5.1). It aimed to test all the required demands in the list, and some of the desired ones. The data from this test would provide a base for the project to move forward with when designing the Hi-Fi prototype which would then be able to consider more aspects.

The first task of the test was to go through every concept's "Menu" page and ask the same questions about each alternative. When every concept had been gone through, the moderator zoomed out on all three alternatives and asked comparative questions. This test method was then implemented for all other pages of the system that was tested as well.

One page that was added to the test was the sign-in page of the original system. Although the previous user tests had shown that the users would not want to log in to a system of this kind, questions regarding whether the user would feel safe signing in if the right information was given, were asked.

Furthermore, to find out which buttons and icons worked for the target group, the concepts developed from the brainstorming session were placed next to

each other, and the participants got to speak about their experience of them (see figure 6.8 and figure 6.9). This aimed to gain knowledge of what the target group was used to which could be used in future design.

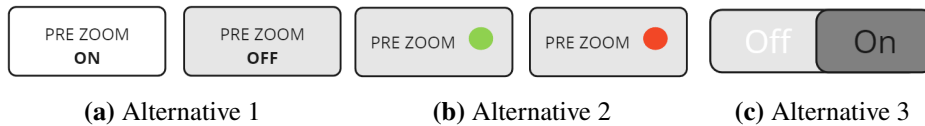


Figure 6.8: Three alternatives for buttons to activate

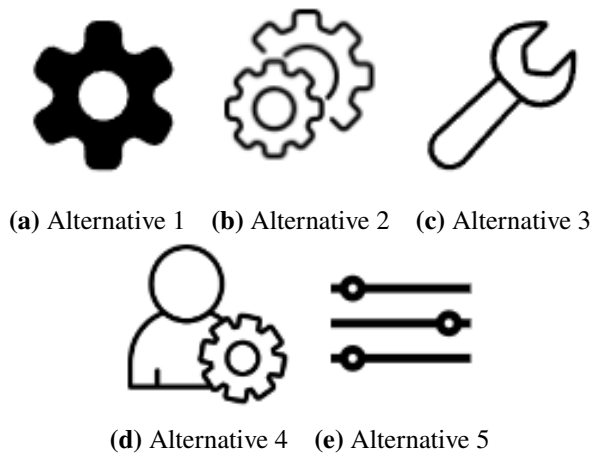


Figure 6.9: Five examples of icons for setting

The approach when conducting these tests was overall to get the participants to speak their minds at all times. To ensure the right outcome of data from these tests, a manuscript was created for a moderator of the project group to go through when walking the participant through the test, which can be found in appendix A.4. The other person on the project team that did not moderate during the tests took notes and was responsible for turning on the audio recording after the participants' approval. The desired outcome was to gain as much input from the target group's perspective as possible, which is why not two specific things are the same, which in turn resulted in a lot of different things being tested.

6.3.2 Lo-Fi Test Result

When the tests had been performed, the audio of the recordings was carefully listened through so that potential gaps in the notes would be filled in for every participant. All screen-specific notes were gathered, and the outcome was as follows.

Menu

The participants claim that alternative 2 was clean and simple due to the big buttons but at the same time meager. Some of the participants had difficulties fully understanding what the categories led to and expressed that there was not enough information or options. This was also a problem in alternative 3, although half of the participants said that they thought it was understandable, observations and analysis of their answers showed otherwise. The other half of the participants expressed that they were a bit confused with this alternative.

Alternative 1 was perceived as more clear due to more direct options, rather than headings like "Media" as in alternative 2. The direct options also increased the interest in what was possible to do on the IFEs. On the question *Is there any of the alternatives that speak to you?* an answer that fits in on most testers is *I think the second, just because they (the buttons) are so big. But I think that one (alternative 1) has more content, so it feels more interesting.*

Movie page

All participants understood it was possible to swipe horizontally on alternative 1 to find more movies thanks to the half-next movie at the right. Though, swiping vertically did not occur to anyone, whether the task was to find more movies or find other genres. First when the scrollbars were designated the thought came to their mind, but the participant's approach sometimes differed from the initial assumed thought. While the arrow in alternative 3 was the one most of the users understood best, alternative 2's scroll indication, represented as a hand within five seconds indicating the available scroll direction, differed a lot amongst the participants on how to use it, saying *If that one popped up, then I would have taken it, /.../ moved it to "Movie 2" and pressed with it.*

How to change genre and find more movies was quite clear on alternative 2 for the testers, and therefore this was the one they felt the most comfortable with. Alternative 3 was also clear, but the outcome showed not quite as much as for alternative 2.

Settings and Buttons

The content, buttons, and words at alternative 2 and 3 was quite clear while with alternative 1 there was some confusion. The words were in some cases hard to understand, non of the testers understood the word "Accessibility" although they got to know the word in Swedish after a while. Even though alternative 1 looked easy on the eye, some wished it contained more options, meanwhile, alternative 2 gave the initial feeling of messiness for some testers and they did not initially understand the connection between the white button, here "Text Size", and what was displayed under. This seemed more understandable in alternative 3, where all participants but one caught that the white buttons were activated.

When the different concepts of buttons were shown, red and green was good indicator for on/off, but the button that the most participants understood (four out of seven), and thus being clear is the white+on/grey+off switch, the one in Figure 6.8a.

Guide

A guide in general could be useful for the testers if they got stuck and if the guide was to be simple and easy to use. It was appreciated to have the opportunity to use the guide wherever in the system, like in alternative 2 in the form of a "?" (help) button. Though, some of the participants did not like that it was a mascot popping up and seemed stressed by it. It was noted that Alternative 3 had good guidance value, but contained too much unnecessary information for the users and that it had too many steps, *I don't want to know all this unnecessary information of the system* someone pointed out. This brought the participants to the skip button, saying that alternative 2 would be much better, and also better to receive current-page information to help with memory. Note, alternative 1 did not have any guide, thus the original system did not provide any.

Initially when asked how they wanted help if they had some problems with the screen, all but one said that they would ask their neighbor or a flight attendant. After introducing the guides, the majority of them seemed positive to instead try to use a guide for help.

Sign in

Almost all (six out of seven) participants were negatively tuned to signing in to the system, despite the presented benefits.

Skeleton and Icons

Things that the participants would like to be included in the skeleton was a

”Menu” button, while a ”Settings” button was desired. Alternative 1 looked simple since there were only three buttons, though the testers had trouble understanding the ”Settings” button. Everyone preferred to have the skeleton visible at all times and expressed that they otherwise would need to remember where everything was which made alternative 3 a bit too confusing for them. Both alternatives 2 and 4 contained useful and clear options, and the absolute majority saw the benefits of the timeline in alternative 2.

When asking the participants *which icon, for you, indicates settings?*, there was a definite response from all participants that the gear wheel (alternative 1) was the most correct indicative of a ”Settings” page.

6.3.3 Analysis of Lo-Fi Test Results

As earlier described in section 5.1.2, to analyze data it is useful to code it so that it can easily be overviewed when used. In this stage of the process, a lot of data regarding different pages and areas of the system had been gathered from the tests of the Lo-Fi concepts. This data needed to be structured and was therefore coded. This time, the so-called ”Top Down” approach of the coding was taken inspiration from, since the different themes (codes) had already been found. After all the key findings from the tests had been gathered under the accurate page of the system, presented in section 6.3.2, the specification of requirements (see section 5.2.1) was looked at again to check against the test results.

Based on the specification requirements and the Lo-Fi alternatives for each page of the system, a concept scoring matrix was created, see figure 6.10. The purpose of making a concept scoring matrix was to select one or more concepts for continued development (Ulrich and Eppinger 2012). Inspiration for the concept scoring matrix done in this stage of the process was taken from Ulrich & Eppinger’s approach. The selection criteria were there given weights based on their importance, here the criteria were the specification of requirements. When the concepts then had received their rating from the team, a weighted score was calculated and summed up to find out which concept got the most points (Ulrich and Eppinger 2012). Unlike Ulrich & Eppinger’s concept scoring matrix, there were no reference concepts chosen to get the middle point of 3 throughout, thus the possibility to give greater point differences was preferred to be used. The findings from the tests were both directly used, as well as sometimes interpreted by the project group, to score the dif-

ferent alternatives.

In the matrix in figure 6.10 the leftmost column presents the different specification requirements that were tested on each page, these were also weighted, where *required* (R) gave x1 and *desired* (D) gave x0.5 as the importance was prioritized here. The remaining columns represent the ratings and weighted scores for each option and page, based on the results of the tests. The different alternatives for each page can be found in section 6.2 and 6.3.1.

Specification Requirement	Weight	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Menu		Original		Alternative 2		Alternative 3			
Invite Everybody (R)	1	4	4	2	2	2	2	-	-
Clarify Choices (R)	1	5	5	3	3	2	2	-	-
Scores		9		5		4		-	
Movies		Original		Alternative 2		Alternative 3			
Facilitate Navigation (R)	1	1	1	4	4	4	4	-	-
Clarify Choices (R)	1	1	1	5	5	3	3	-	-
Scores		2		9		7		-	
Scroll indicator		Alternative 1		Alternative 2		Alternative 3			
Clarify Choices (R)	1	3	3	3	3	4	4	-	-
Scores		3		3		4		-	
Settings		Original		Alternative 2		Alternative 3			
Prevent Information Overload (R)	1	4	4	2	2	3	3	-	-
Clarify Choices (R)	1	2	2	3	3	5	5	-	-
Offer Customization (D)	0.5	3	1.5	3	1.5	3	1.5	-	-
Allow Mistakes (D)	0.5	3	1.5	4	2	4	2	-	-
Scores		9		8.5		11.5		-	
Guide		Original		Alternative 2		Alternative 3			
Offer Guidance (D)	0.5	-	-	3	1.5	3	1.5	-	-
Prevent Information Overload (R)	1	-	-	2	1	4	4	-	-
Scores		-		3.5		5.5		-	
Skeleton		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Provide Information (D)	0.5	1	0.5	4	2	3	1.5	4	2
Facilitate Navigation (R)	1	2	2	4	4	1	1	4	4
Scores		2.5		6		2.5		6	
Buttons		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Clarify Choices (R)	1	4	4	3	3	2	2	-	-
Scores		4		3		2		-	
Icons		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Clarify Choices (R)	1	5	5	2	2	1	1	1	1
Scores		5		2		1		1	

Figure 6.10: Concept scoring matrix

6.4 Discussion of Lo-Fi

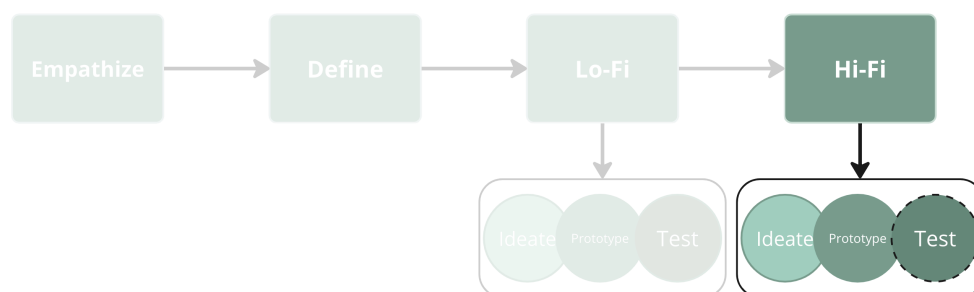
The participants that were contacted for the test of the Lo-Fi prototypes, came from the same communities, Träffpunkten, in Malmö and Lund, where the first user tests of the original system were conducted. This means that some of the participants of this test also tested the original system during the empathize stage of the process. This could be a potential source of error if they would have remembered the original system and therefore knew how to go about that system. However, the fact that the original system was both redesigned and the pages split up probably meant that the participants did not necessarily need to know that it was a system they had interacted with before (see section 4.4). This was also validated when no participant understood the vertical scrolling on the "Movies" page.

Furthermore, for the tests to match the research, the participants in this test needed to fall into one of the personas listed in section 5.3. Therefore, the participants were analyzed and matched with the personas and after the tests, all participants fell into at least one of the personas.

Another potential source of error was the interpretation of the participants' thoughts on the different alternatives. The audio from the tests was recorded and notes taken, but the translation from key sentences to a weighted value of the option compared to others had to be interpreted by the project team of this work to move forward. The interpretations made have been based entirely on the key sentences as unbiased as possible, but this should still be acknowledged.

During these tests, the created alternative flows were not explicitly tested due to the split of the pages. Some questions were planned to cover this issue as well as possible, like for example *would you rather have Movies, Music, Map, etc available from the start, or would you want to have general genres such as Media, My Trip, etc?*.

7 Hi-Fi



Once all steps within the Lo-Fi segment were completed and the findings from the tests had been analyzed, it resulted in a concept to move forward with. To be able to develop the final Hi-Fi prototype properly, and to further develop and refine the concept, the resulting Lo-Fi prototype was implemented in Figma. This interactive prototype could be called a *sub-Hi-Fi prototype*, where the alternatives were put into the right flow and the theme was inspired by the original system.

7.1 Ideate

At this stage, the existing interactive sub-Hi-Fi prototype still needed improvements before entirely being developed as a proposal to the company. Therefore, some expert inputs were acquired from supervisors and experts at Tactel, to gain a broader perspective of what is important to think about when designing in general.

Although the Lo-Fi tests did not examine the total "guide" experience, they tested whether the users would want a guide of some kind, and how it, in that case, should be applied to the system. An idea of what the guide should look like existed and was communicated to the participants of the tests, but a final concept of the guide also needed to be created. Therefore, in this stage, a concept of a guide page was developed based on the findings from the Lo-Fi tests where the users had said that they did not want unnecessary information. Since this was the first concept, it must naturally be tested.

7.1.1 First Inputs from Experts at Tactel

In a meeting with the supervisors at Tactel, the first sub-Hi-Fi version was presented together with the previously acquired research and arguments for the design decisions made. The supervisors then gave feedback, which was noted and taken into account when continuing the development of the sub-Hi-Fi prototype, these are described here.

The first matter that was discussed was the start screen, where they thought the seat number needed to be further described to avoid misunderstanding. Writing "Seat:" before the seat number, or similar, would prevent anyone from wondering what that number meant.

To make the prototype more realistic, and to be able to present the system credibly, an onboarding phase should be created even though it was not the focus of this project. This was requested by the company so they could see how the whole system would look like, and for potential tests in the future to be as realistic as possible.

Moreover, the supervisors had some thoughts about the applications that were available on the menu. The user survey (see section 4.2) showed that the top features that would be used by the target group were movies, music, map and to be able to read about the destination. The first sub-Hi-Fi prototype contained them, but not at the top. The supervisors argued that, if the older adults read from the top left to the bottom right, as the observations of the results showed, their favorite features should be at the top, the younger users will still find what they are looking for either way.

When presenting the guide of the system, which appeared when pressing the "?"-button in the navigation bar at the top of the page, information about the current page appeared. The supervisors then proposed adding a button that

said "Can't find what you are looking for?" or similar so that the user could search for things within the whole system. This was also taken into consideration moving forward.

After the meeting, the team internally brainstormed on potential solutions to the feedback if nothing concrete was suggested.

7.1.2 Brainstorming with Expert at Tactel

After the brainstormed solutions from section 7.1.1 had been implemented in the prototype, another meeting with an expert at Tactel was decided to be held. This was partly to get some direct inputs on a more developed system, but also to brainstorm some ideas of different areas which still needed to be figured out, with the gained knowledge as the base.

First the project team presented the findings and material from previous steps in the process, then a discussion on each page was conducted, where the expert together with the project team came up with ideas for further implementation. With the brainstorming discussion as inspiration, a list of ideas were made. This was as follows:

- Add something that would indicate that you can press on the home screen. This could be an icon of a clicking hand, or writing "press to start" or similar.
- The choice of which languages should be available will be decided by the airlines before installation. The languages should be written in the correct language, for example, "Swedish" should instead be "Svenska".
- The settings button "Attendant" might be confusing for the users, *what will happen if I turn on Attendant?*, and it should be accessible outside the settings page. The expert statement is to leave attendant as another subject, this is an ongoing project itself in parallel to this.
- Get rid of the square with the text "Click on an alternative above" in the upper part of the settings page. This might be confusing for the users and is unnecessary here.
- One solution for the settings page could be to just have buttons on the first page and when choosing a setting, a pop-up window appears with the right tools. This could also potentially add convenience to the sys-

tem as users may have already seen how it works on other pages, such as "Movies".

- The guide had too many bent arrows which made the page look messy and overwhelming. This could be changed to just highlight the described things and add a text with one arrow, or similarly. It must be more simple than the current solution.
- How would the "Can't find what you're looking for?"-page look like? What do other FAQ pages look like, take some inspiration from there. Perhaps: "Most recent..."? Maybe a pop-up similar to the movies page?

Similar to after the previous meeting with Experts at Tactel, section 7.1.1, the project group of this thesis discussed and generated ideas for further implementation on the concerned subjects.

7.2 Prototype

General Hi-Fi Design Decisions

In order to incorporate the requirements that the theory already states (see section 2), this section will describe how those aspects has been woven into this work.

The design of the Hi-Fi prototype was decided together with supervisors from Tactel to be inspired by the original tested system since the focus of this project was to broaden an already existing product, not to design a new one. The involvement of aspects regarding the accessibility design guidelines found in section 2.2.2.1 is described. To meet the criterias of WCAG 2.1 AA which requires a contrast ratio of 4.5:1 (3:1 for large text), the colors were set in other shades than in the original design. To fulfill the WCAG contrast criterion, the contrast needed to be checked in all ways, both the text against the button as well as the button towards the background. This was tested throughout the developing session with the help of a plugin in Figma, named *Stark*.

The font of the new system is *Nunito*, which meet the advice of a good digital font, described in section 2.2.2 and were quite similar to the original font. Throughout the system, the text always contains one capitalized first letter followed by lowercase letters to favor the readability aspect (found in section 4.4.2.1), and the text size is after a discussion with a design expert at Tactel

with an interpretation about the font size for WCAG 2.1 AA, decided to be at least 20px overall, and 24px for body text and 30px for button text, which also covers the findings in section 2.2.2. This aims at simplifying difficulties related to the potential visual impairment of the target group, see section 2.1.2.

This prototype has been created without assumptions due to its thorough integration of older adults in the design process. The reinforcements of the actual users' perspective, described in section 5.2, aiming to involve users to the extent that there is no ageism in this system. From the relevant findings regarding the touch gestures (see section 2.2.2), it has been made clear that the participants will not have to use more than two fingers, and the system can be used by just pressing buttons.

The structure of the system, the flow, was intended to be as flat as possible, meaning unnecessary layers of pages that would lead the user further away from the menu would be avoided. This aimed to prevent the users from getting lost or stuck in the system since they now do not have to remember as many steps as in the previous system, which the target group explicitly found difficult in the user survey and which was later validated from the tests of the system. The advantage of this is that the user can easily see where in the system they are and what options they now have which can be linked to the potential reduced cognitive ability, see section 2.1.1.

Futhermore, due to that the tests performed at Tactel during the process mentioned in section 8.1.4 has not yet included older adults, this prototype aims to be continuously tested by the company together with older users. More direct knowledge and insights from their perspectives are valuable for the end-product, and should be considered in the future.

Welcome screen and onboarding

The welcome screen is the first page of the system which is shown when the screen is turned on. After pressing the welcome screen, the onboarding process starts.

Since no user had issues with the original "Start" page, the Hi-Fi prototype "Start" page looks quite the same. The only difference is that the word *Seat* is added large, so no misconceptions would occur during the stressful period of boarding, and an icon that indicated that the user could touch the screen to get started appears and pulses after the safety briefing if not already touched (see figure 7.1).

Based on the expressed wishes of the company, an onboarding sequence is created to get a more realistic feeling of the system. This sequence includes, as seen in figure 7.2, one page with languages to choose between, to remove the language barrier, and a page with three options: "Sign-in", "Get Started" and "Kids Mode", with accompanying descriptions of what it means to choose a specific option which can be found in figure 7.3. Since the focus of the project was guidance/clarity within the system not including the on-boarding steps, these were not tested with the users and are therefore a proposal that needs to be looked further into by the company.

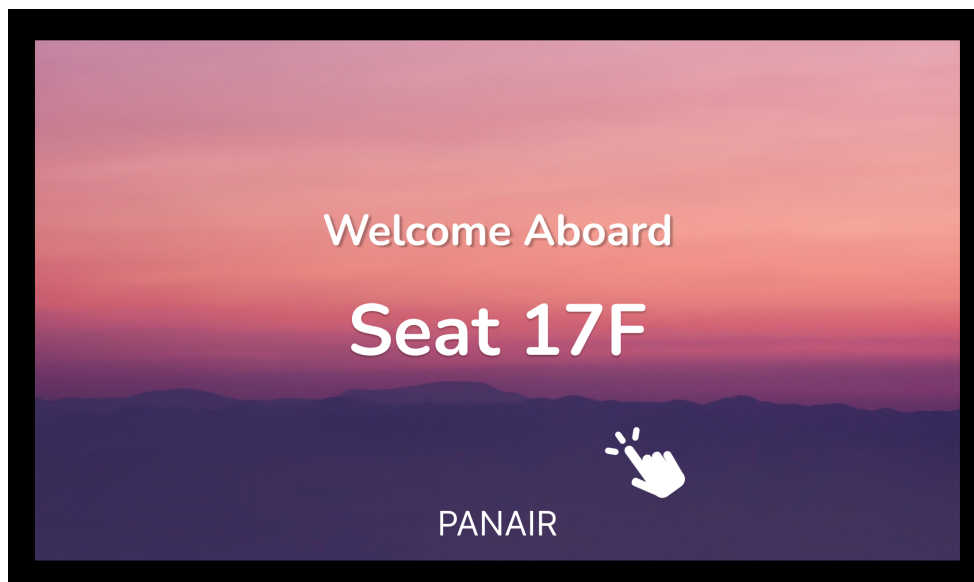


Figure 7.1: Welcome screen

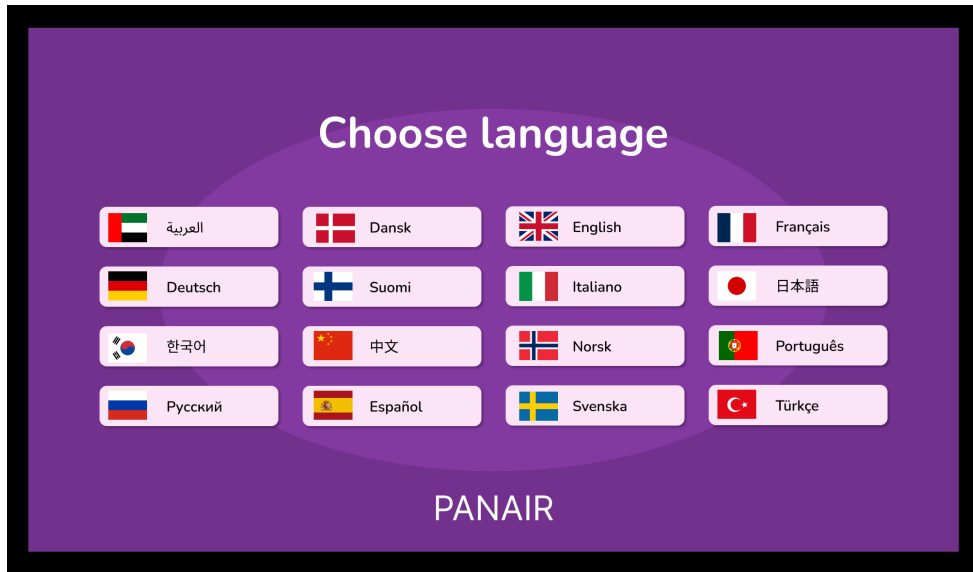


Figure 7.2: Onboarding 1 Choose Language

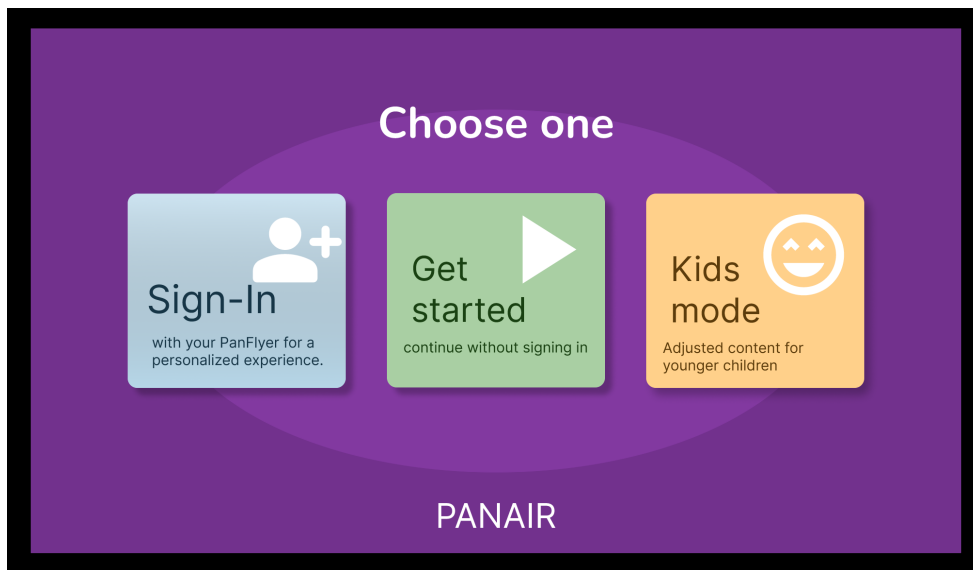


Figure 7.3: Onboarding 2 Choose option

Skeleton

This paragraph describes the skeleton of the system. To briefly describe it, it is what is consistent on the different pages, in other words, what is available regardless of where you are in the system.

One factor that makes navigating a system less complicated is consistency across all pages as this creates familiarity. The skeleton shown in figure 7.4 is a combination of the two alternatives that got the highest scores in the concept scoring, figure 6.10. It contains the required and desired features that emerged from the Lo-Fi tests; "Menu", "Settings", a timeline, and a Help/Guide. In this concept, the "Settings" icon is replaced by a gear wheel, based on the Lo-Fi test results in section 6.3.2. Due to all participants from the target group associating the gear wheel strongly with settings, it was decided that no clarifying word was needed for that icon, as it hoped to be sufficient for the icon itself. "Menu" and "Help" icons might not be used equally often in other digital environments, and these were therefore decided to have an aiding text below. This project tested "Settings" icons due to that it was found as a problem area of the original system in the user tests (see section 4.4.2), but to make the system properly, a similar investigation needs to be made for the other used icons in the future. The considerations made in this project came from key findings regarding icons and associated explanatory words, *Thoughts about the timeline* section 4.4.2.1.

A button that is no longer used in the prototype is the "Back" button. This was decided since the system now has a new structure that is not as deep as the previous one and thus would not need it. Also because the user tests of the original system in the empathize step showed that it contributed to confusion as they could sometimes get stuck in a loop, which was not desirable. When clicking on the timeline, the user gets transferred to the "Travel Information" page where for example a more elaborate timeline and other information about the journey can be found. This also needs further investigation.

The purpose of the tabs is to provide a good overview of where the user is in the system and to provide information about what other options are available on this page. This can for example be different genres of movies, see figure 7.6 The tabs may not be used on every page unless necessary, but when used, they, along with the rest of the skeleton, are likely to facilitate navigation in the system and clarify the possible options, both of which were required specifications of requirements.

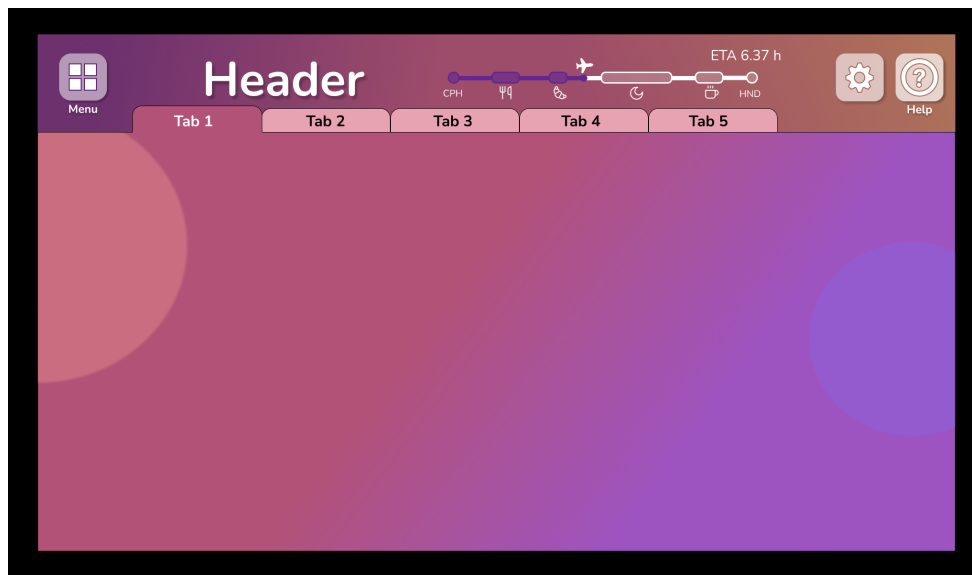


Figure 7.4: Skeleton for consistency through the system

Menu

The "Home" page (see figure 4.3) is removed because the users did not see its purpose and did not understand that there was more to the screen that would be accessed by scrolling. The first page visible when entering the system, called the landing page, is, therefore, the "Menu" page.

This "Menu" page (see figure 7.5) is similar to the original system's menu with the options centered in the middle as the first tests showed no problems with this type of layout, and the Lo-Fi tests confirmed this concept as many users found it to be interesting and the options to be more clear, which in turn directly applies to the desired specification requirements: "Appear Interesting" and "Clarify Choices". However, some features inside the menu have been replaced. The "Home" button is removed due to the "Home" page being gone, and replaced with "Travel Information", "Arc Kids", which is an internal name for the map feature at Tactel, is now "Map" instead. The placements of the features have been modified to be more advantageously for the target group of this project, which is more interested in the map, the information about the journey and destination, movies, and music, those options are placed at the top row based on the key finding about how they approach the screen, (see section 4.4.2).



Figure 7.5: Menu

Movie page

The movie page is where all the available movies can be found and played. Through the tabs from the skeleton, it will most certainly be easier to find and change genres than in the original system. An option to search for a movie is added from requests, then a keyboard and search field appear, see figure 7.7. The discovered problem regarding the difficulties to understand that the original systems page was scrollable to find more movies led to an arrow pointing downwards. Together with the half movies visible at the bottom of the screen, it is intended to indicate that there are more movies further down, and thus the page is scrollable. The idea with the arrow is partly for it to be an indicator, but also it is possible to press it and the page will then scroll down one row of movies. This solution came from a few of the participants during the Lo-Fi testing when asked how they would use the arrow, see section 6.3.2. The arrow will also start to pulsate to catch the eye if no scrolling has been done under a predetermined time.

The original systems preview of a movie was a whole new page. To be able to follow the approach of not having multiple layers nor a back button, the preview is now made as a pop-up instead. The user can now see the previous movie page in the background, and closes the pop-up by pushing the *close* or just outside the appeared window. The movie player is similar to the original

one since no big problems were discovered in that area.

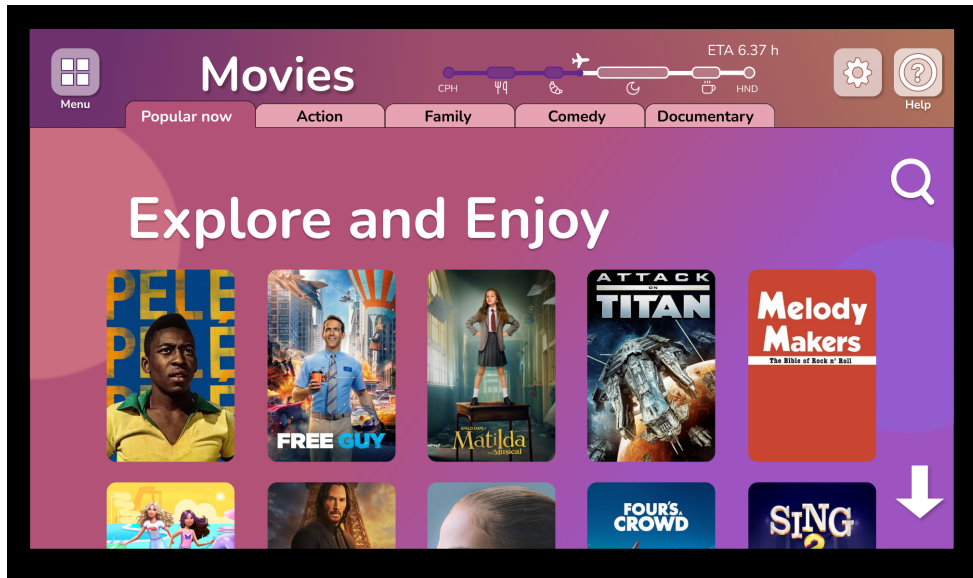


Figure 7.6: Movie page

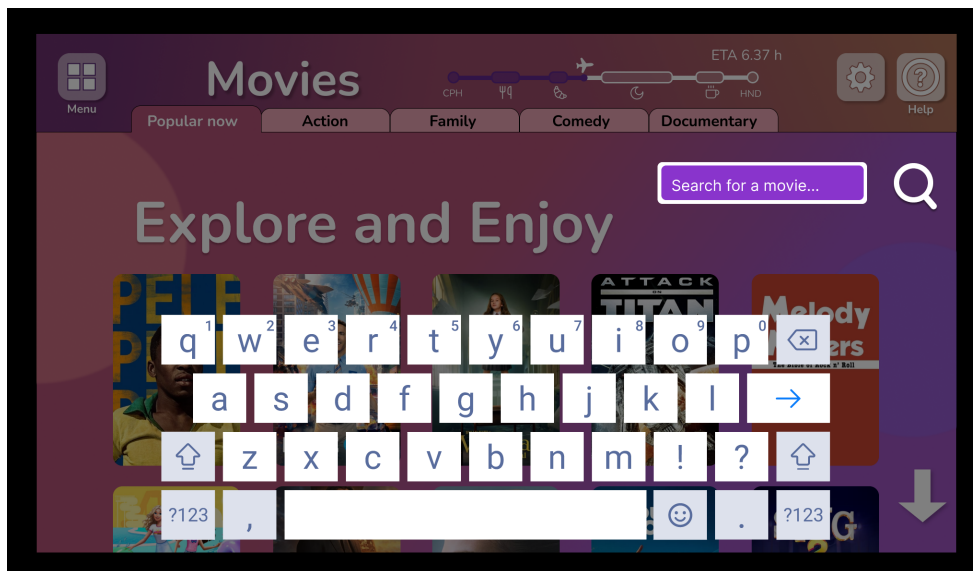


Figure 7.7: Movie page with the search function activated

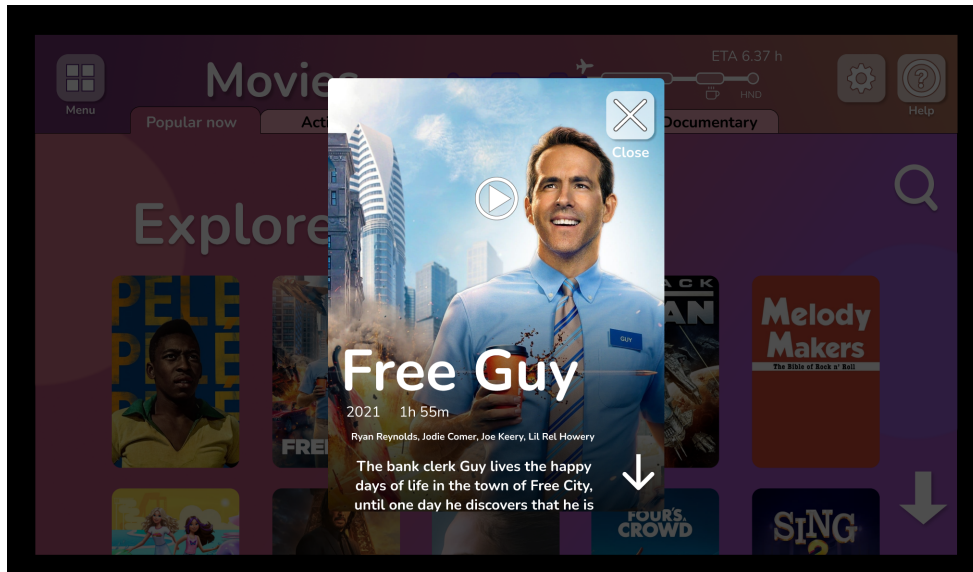


Figure 7.8: Preview window for chosen movie

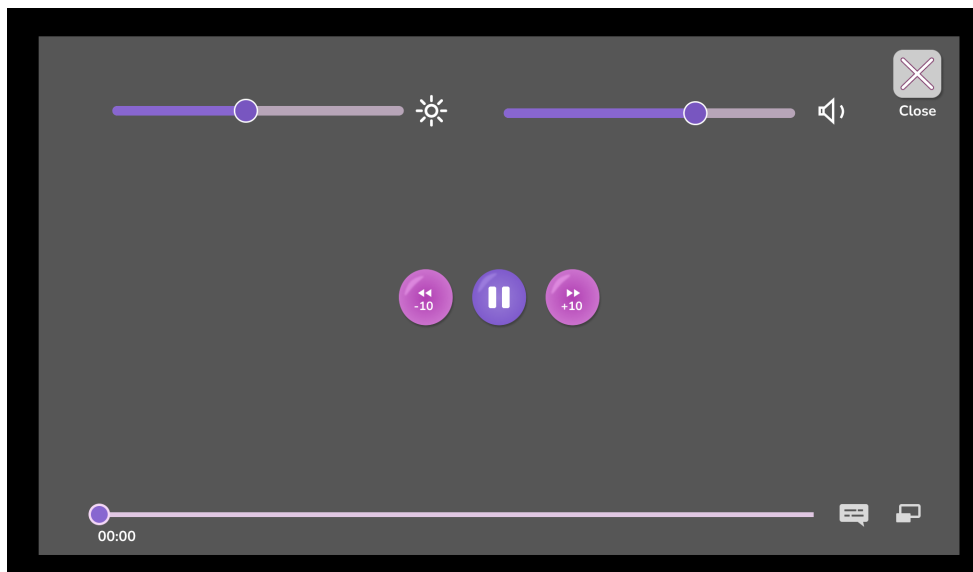


Figure 7.9: Movie player

Guide

A guide is available whenever the user needs help when using the system. The first time entering the system and reaching the "Menu" page, a pop-up appears

that shows where help can be found if needed (see figure 7.10). From the Lo-Fi tests it was found that a mascot should not be used (see section 6.3.2), and therefore it is represented as a text box in this prototype. The "Help" button is also based on the results of the Lo-Fi testing, where the users expressed a preference for always having access to guidance within the system.

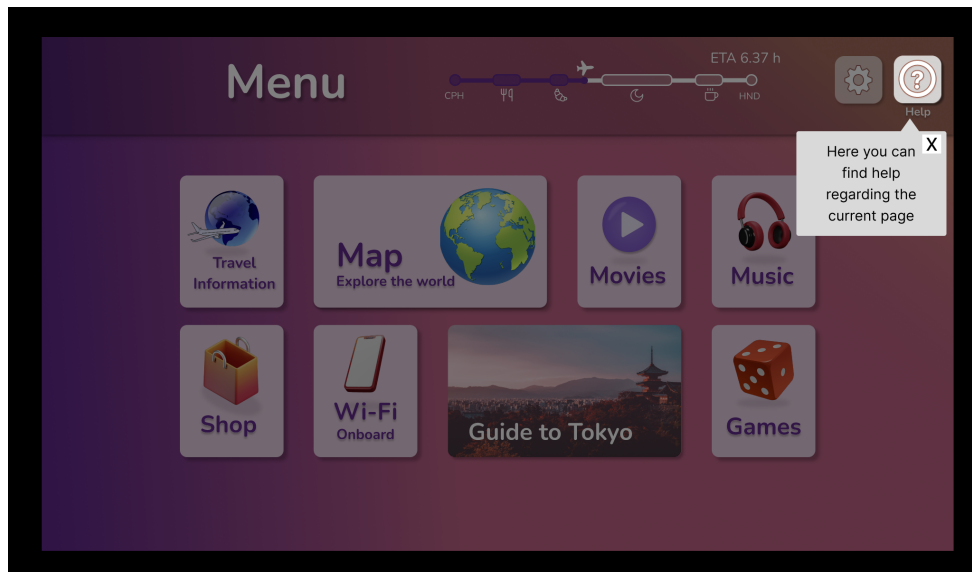


Figure 7.10: Pop-up first time when entering Menu page

In figure 7.11, an example of how the "Help" button can display help for the current page is shown. The important features are highlighted and have a related word or short sentence to describe what will happen if pressed. There is also a button that takes them to another help page if they did not find the help they wanted. This page will contain a list with the headline "Are you looking for ..." and items of suggestions on actions, a search field for other topics, and a button to call the flight attendant. The helping pages are not tested on users, it is only discussed with designers at Tactel, section 7.1.2, and therefore this needs more investigation.

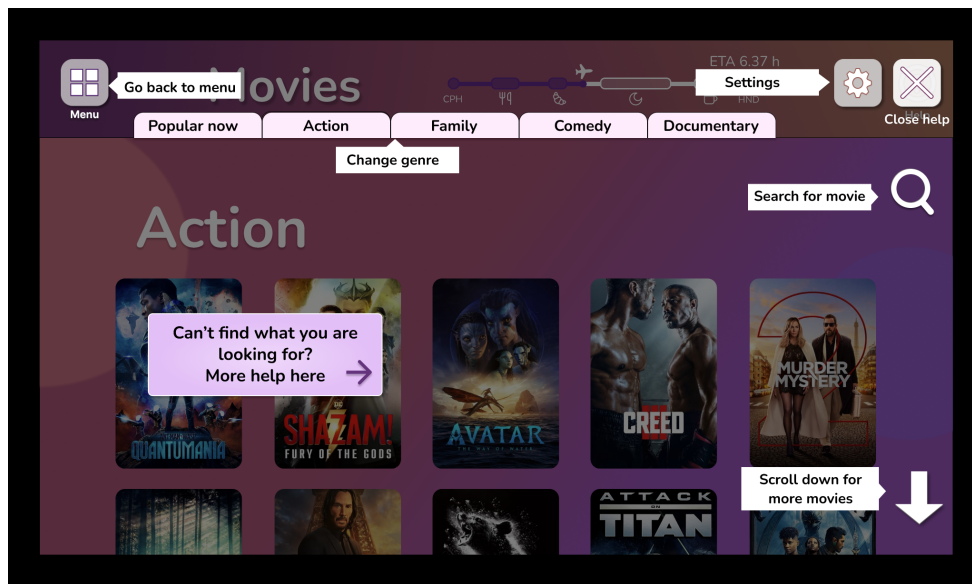


Figure 7.11: The help from the guide when at current movie page

Settings

If the user wants to change the system, they go to the settings page where they can find e.g. sound or screen settings. The "Settings" page has been completely redesigned to accommodate all options on one page. In the original, users had trouble understanding both the "Accessibility" icon and the word *Accessibility* and what it would contain, so this has been removed in this concept (see figure 7.12). Unlike the "Settings" page that was developed as a Lo-Fi concept and scored highest in the concept scoring matrix (see figure 6.10), the slider is now placed in a pop-up page instead aiming to make the primary page less cluttered (see figure 7.13). The placement of the content is based on which settings are predicted to be used most often and therefore should be most accessible and placed at the top. A header, telling the user that they are at the "Settings" page, which is also used in the other pages is added as well, and the menu, help, and timeline are also available here due to the skeleton. An alternative to this chosen concept would be if there is an interest in having the options more compartmentalized. Then there is a good opportunity to use the skeleton with tabs presented in section 7.4, which could then contain the different general settings such as "Audio", "Screen" etc.

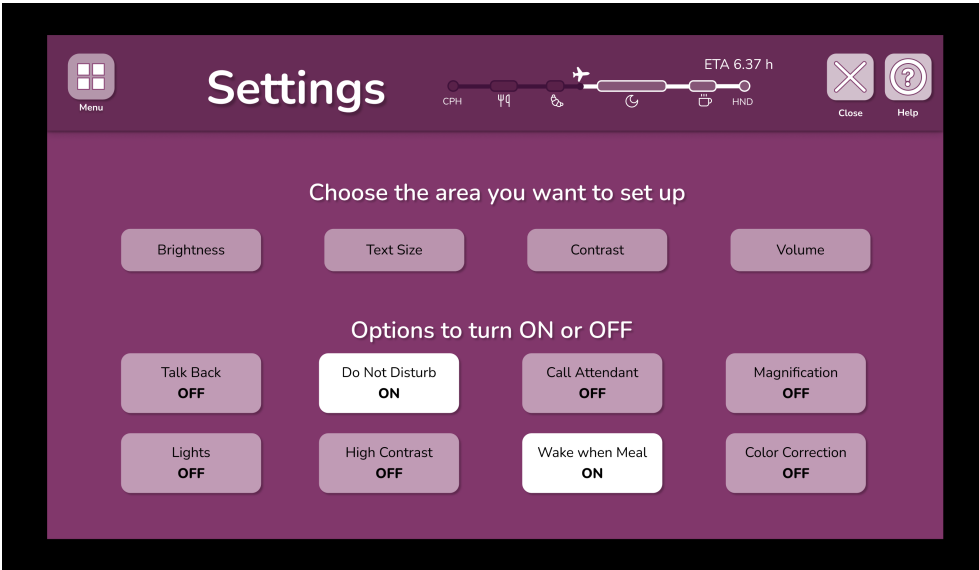


Figure 7.12: Settings page

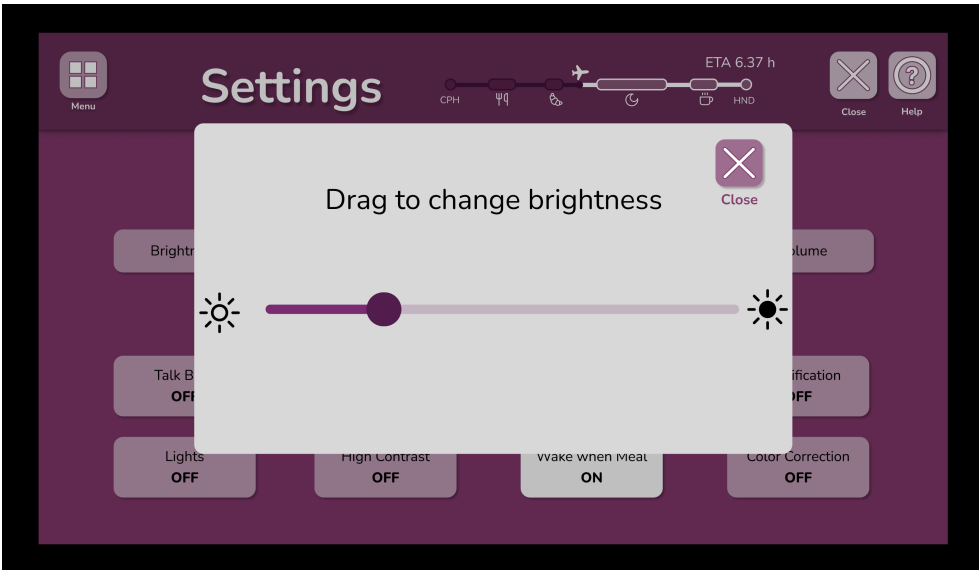


Figure 7.13: Settings page with pop up for brightness

8 Discussion

8.1 Reflections on Project

Throughout this thesis, some reflections has been made which will be discussed in this section.

8.1.1 Comments Overall

In this project, much work has proceeded according to plan. However, the time consumption of different steps was higher than expected, which resulted in fewer steps than predicted at the start. Examples of time-consuming steps in the process were getting participants for the different tests, which is why the last Hi-Fi test was excluded from this work to hand over as good and well-founded a prototype as possible to Tactel for future testing. Moreover, to be sure that the results of the tests would be useful, the project team had to prepare the tests to find suitable methods to analyze older adults, which required a lot of research. Another delaying part was the program used for Hi-Fi prototyping, Figma, which had not been used before by any of the members of the project team and therefore had to be learned.

Even though this thesis contributes with a result that matches the intended research questions, it was realized that some things could have been handled differently along the way, which might have affected the outcome of the thesis.

The user tests contributed to results that were used in the next step of the process. For example, the different Lo-Fi concepts were built upon research made in the beginning, with an emphasis on the first user tests of the original system. These Lo-Fi concepts were then tested on users within the target group, which

led to the final Hi-Fi prototype. The result from these tests was considered sufficient once a fairly saturated pattern of the older adults had been achieved, resulting in a total of nine tests (two of which were pilot tests) of the default system, and seven Lo-Fi tests. The low number of users per test was supported by Nielsen (2000), who states that it's better to spread the number of test participants over different tests, and who therefore recommends no more than five participants per test. Nevertheless, it cannot be ruled out that the results could have been different if the number of tests had been increased. Neither of the participants were not from the same community which automatically categorizes the group of participants as people who want to socialize and learn new things, therefore the outcome could be different if the tests would have been conducted on older people outside of Träffpunkten as well. In addition, some participants of the Lo-Fi tests had already tested the original system which could state a problem, but this matter has already been discussed in section 6.4.

Due to the time constraint of 20 weeks, some things were deprioritized to make room for other things that were considered more important. One thing was the features within the product, which was only explored in the first survey where the users were asked what they would like to do on a screen in a long-haul flight. Another matter that fell by the wayside, was the graphical design including which colors, etc. This was not tested as it was not found as a problem area during the tests, but the area of how to implement a reassuring and good visual design is a project in itself. Thus, it can be said that this work was aimed at building a functional prototype where how well users could complete the tasks rather than at the graphics were looked at.

Moreover, a Hi-Fi prototype practically could have been tested within this time, but then the quality of that prototype would have had to be compromised, and hasty design decisions would have been made as both gathering participants and preparing the test would have to be made. As previously mentioned, it was instead chosen to make the final Hi-Fi prototype as thoroughly and well-founded as possible to hand over at the end of the project.

A potential source of error that might affect the outcome of the tests, was the language of the systems. If this project would have been restarted, a system in Swedish would have been tested on people who speak Swedish, etc. which would have helped ensure that the language barrier would not affect any outcome, and which in the final Hi-Fi prototype has been solved by providing the system's language selection at the beginning of the system. This was not

something that was taken into consideration in any part of this work and would have to be investigated further for more accurate results. The default system only came with English as a language, and to make sure that the Lo-Fi prototypes were not just improved by changing the language to Swedish in the later tests, these were also chosen to be in English, but this should be considered in the future.

8.1.2 Reduced Abilities

From studying the different cognitive abilities of the participants, an over-represented ability that was reduced was short-term memory. From the surveys, it was shown that the users did not like to have systems where you can get lost, and findings from the user tests represented a large number of situations where the participant did not remember the last visited page. From this, it was concluded that users should not have to remember anything to perform a certain action on the screen which resulted in the guidance button being present on every page in the same place of the page. When pushing on it, everything on the screen you are on is described, and not anything else. Regarding the visual ability, it was validated that large buttons and spacing were important in the design. However, this became difficult to get the correct data of due to the tablets were not mounted at the correct distance from the user during tests. It is therefore referred to as a future study.

8.1.3 Older Adults in Design Process

The people in the target group who took part in the tests all thought it was great fun to be involved and that it was important for them to have a say. The tests provided information from their perspective, and it was soon realized that age is not a reasonable division of people, as the group of older people is a very broad and diverse group with different experiences and characteristics, and therefore the prevention of age discrimination must be considered, as the theory also stated. Diversification was a fact, everyone was different even if some had similar inclinations in some important areas for this project. These areas were focused on during the creation of the personas.

8.1.4 Development of IFEs at Tactel

This thesis started with a digital product that Tactel earlier brought and showed at trade fairs to promote against customers. This system was tested and improved with a user-centered approach by letting users from the target group test and give inputs, which provided grounded information from the people to be integrated into the product. The user tests, providing input from actual end-users, made every design decision reliable which circles back to the company, bringing satisfied customers. This thesis demonstrates that it does not have to be complicated to obtain the information looked for. Many older adults are more than willing to participate in a development process of this kind. By simply integrating them, their UX of the system will increase, and thus it contributes to Tactel being at the forefront of the industry.

The company had an idea of adding a *Simple Mode* aiming for the older adults to get a more simple and clean layout, similar to a *Kids Mode*. If a user chose this mode, the layout and settings on the page would change to another default. One problem that was found here during the first tests, was that none of the participants associated themselves with the word "Accessibility" which could be because they did not understand the word itself, or that they did not think of themselves as a person that need to simplify the system. To be sure if this would have been something to go on, new concepts need to be made and tested in the future without the language barrier.

8.2 Research Questions

In section 1.2 it was stated what the purpose and goals of this thesis were supposed to be. As stated before, some priorities had to be made, which led the project in another direction than thought. However, the research questions found in section 1.2.1 were to be answered by findings within this project.

R.Q.1: What are the difficulties for the target group using the IFEs?

From the literature study shown in the theoretical section 2, some difficulties with digital environments were found. For example, older adults like buttons and do not use more than two fingers when interacting with a screen. The text should also be quite large and distinctive to be readable for the users, the contrast should meet certain standards, and the phenomena of ageism (misinterpretations of what older people want in a design) should be prevented so the

user does not feel weird about the system. The difficulties found in the user tests for older adults with a system of this type was that it was perceived as something new with an initial threshold. As read in section 8.1.2, a person's cognitive ability is affected by age which was validated in the user tests where the reduced short-term memory affected the use of the system. This means that the users within the target group had problems with remembering in different steps, and therefore found it difficult to navigate through the multiple layers (or pages) of the system. The tests also showed that some icons easily could get misunderstood and therefore cause more confusion than guidance.

R.Q.2: What kind of design is preferred for the target group to feel comfortable when using the IFEs?

A design proposal, where findings from both user tests and from the other research studies are considered, has been developed in this thesis. Some design key points that are worth thinking of when designing a digital system where older adults are a part of the end-user group is that older adults often read from the top left corner to the right lower corner, like a book. They like information in the form of text but get confused or stressed when there is a lot of information at the same time. Therefore, it can be more comfortable not to have to learn new layouts depending on where in the system you are, so keeping it continuous and not adding too many layers (providing less depth in the system) is preferred since they do not want to have to remember every step they made either.

R.Q.3: What types of features are valued for the target group?

This subject was investigated in the first survey performed on potential users of the system, but not that extensively as the project took a turn and went in another direction. The survey showed that the features most people said they would use were movies, map + flight information, music and to be able to read about the destination. This needs to be further researched in the future.

R.Q.4: How can this be implemented without the target group feeling judged?

Older adults are not just a "group of people", they are a broad range of people with different personalities regarding various characteristics, which was shown during the test occasions. While some of the people fished out their smartphones and went on Instagram, others were much more technically shy. Either way, it should not have to be a choice to have a functioning and understandable system or not. Therefore, this thesis states that it is important to invite the users into the development procedure to get their opinion and inputs, before

making decisions from a "designer's perspective", even if you have a lot of experience within this particular field. This would promote ageism or other prejudices which should be kept outside the process.

When it comes to how to implement the findings from this thesis into an IFEs, it is recommended to do a broad product instead of a specific solution for the target group. Partly because some might feel that it is excluding itself to have to be "outed" that they need help, but also they may not associate themselves with the word "accessibility" or even "help", which was shown in the user tests.

R.Q.5: If time allows, how much easier would it get by using the adapted design?

During the process, as earlier mentioned, a choice was made together with the supervisor at LTH, which was to focus on submitting a well-functioning and founded design proposal as a final Hi-Fi prototype, instead of putting something together quickly and then testing it. With that said, this research question is to be further looked at in the future where the resulting prototype should be tested against users within the target group in the future.

8.3 Limitations

In this project, the gathered users within the target group were limited to Sweden as the project was carried out there. It should be considered that this problem is not only linked to Sweden, as the demand for this research comes from a non-Swedish customer of Tactel. A solution for this type of problem would contribute to improvements beyond Sweden's borders, hence the end-users cannot be linked to just one country, even if others are not analyzed in this thesis.

A meaningful and natural limitation of this thesis was naturally the time limit. 20 weeks is a long time, but if a subject is to first be researched and then a design improvement is to be made and tested, the time passes quickly. This time constraint affected much of the work which is further described in section 8.1.1.

8.4 Future

Areas that still need to be considered for the IFEs are the available languages which could affect the size of the area where the text should be, and some words might even be longer in one language than another. On the same theme, the selected icons might not mean the same or be as clear abroad as for Swedish users, so this needs to be taken under consideration and tested in the concerned country.

Another area worth considering is the ethical aspects of the information an airline has about its passengers. To contribute with a personalized system, one idea is for customers to be able to build their system which then accompanies them on all long-haul flights with that system. However, this would in turn probably be limited by regulations and might easily contribute to the customer feeling violated. But it is an interesting aspect that should be further looked into.

During the various user tests, the participants were not exposed to the right environment. This would have been both interesting and important, to be able to evaluate the solutions based on a situational stress condition where the cognitive ability decreases mentioned in section 2.1.1. This could proceed either by sending up testers on a plane, installing a test on existing screens in use, or a cheaper alternative could be Virtual Reality (VR) glasses, that could simulate a real environment which could contribute to more realistic results and measurements. The latter concept has been investigated by Tactel this spring as well by a master thesis done by two students from LTH which could be interesting to read before looking into this alternative.

In addition to what has already been mentioned, the results represent the aspects of older adults within Sweden's borders. In the future, the same research would be needed from international countries that are appropriate from Tactel's perspective. The final solution should be suitable for older adults from all relevant countries, and therefore there might exist other problem areas in other countries. As mentioned, Sweden is a highly technically savvy country (see section 2.2).

9 Conclusion

This thesis aimed to research and broaden an existing IFEs to bring the target group of older adults, into the mindset of designing such a system to increase their UX. Therefore, it started with researching previous work, getting the required knowledge about the approach at the company Tactel and understanding users within the target group along with testing together with them. The project also involved designing Lo-Fi concepts and performing qualitative comparative usability tests which gave the base for a Hi-Fi prototype which was continued to be developed in collaboration with supervisors and experts at Tactel, into the final result.

The outcome of this thesis landed in a design proposal made in Figma, where every design decision made, changed from the original design, is explained.

9.1 Contribution of Knowledge

As stated in section 2.2.2.1, regarding the 13 guidelines applicable to WCAG 2.1, both validation and additional recommendations have been understood during this project. Some aspects that have been validated for the target group of older adults are:

- Guideline 1 - *Text Alternatives*: having text alternatives for icons
- Guideline 3 - *Adaptable*: creation of a simpler layout
- Guideline 8 - *Navigable*: providing help and guidance throughout the system to facilitate the navigation and help them understand where in the system they are

- Guideline 10 - *Readable*: the information in a system must be understood both as text and icon

One aspect that this thesis recommends adding to, or even making as a 14th guideline to WCAG 2.1, is regarding guideline 7 - *Seizures and Physical Reactions*. In this project, several valuable findings have established the importance of not having too much information on a page. This, as should be prevented according to guideline 7, causes physical reactions in the form of stress which can be reduced by only having the necessary information in order to operate a system, but not more. Not least when the system is to be used in a potentially already stressful environment, by users that are likely to have a reduced cognitive ability. Therefore, an additional guideline or addition to the definition of guideline 7 regarding less but sufficient content is a recommendation.

A guideline that was shown to be of particular interest to the participants of this thesis, which is therefore recommended to emphasize the importance of in WCAG 2.1, is guideline 8 - *Navigable*. The final outcome of this work was built on the fact that the users should not be obliged to remember in order to use the system, and a potential solution for this is to provide direct and current help, and thoroughly provide information about where in the system they are.

9.2 Key Takeaways

Throughout this thesis, the problem formulation has been questioned, for example, people have wondered “Is this a problem worth solving?”. The main evidence provided by this work is that it is in fact that: a problem worth to be solved. Even though a UI can be simple for many people, the same UI might not be as simple for all older adults. Some participants of the tests were careful to point out that they did not want to be a burden to anyone and therefore had not tapped on one’s shoulder begging for help, which would in that case decrease the level of their UX. Most of the testers also expressed gratitude and that they appreciated being asked about their opinions, which promotes a sense of inclusion in the product. As mentioned in section 2.2, the population is getting older and therefore it is crucial to implement users of all ages and with all kinds of conditions into the developing process.

The project team gained a lot of experience and knowledge from this thesis.

First of all, it would have been good to narrow the scope of the project in the beginning, and then broaden the scope if time allowed later on. That way the project could have been more thorough and specific but at the same time the area this project ended up in would not have been investigated. Another gain of knowledge made from this thesis was that it is important to be flexible in the process. There is no correct way to proceed, but if there is a gut feeling exists or interest, this may lead to something bigger than expected. No matter what, you will come across different crossroads where you have to reflect on the previous process and back up the choice with arguments from there.

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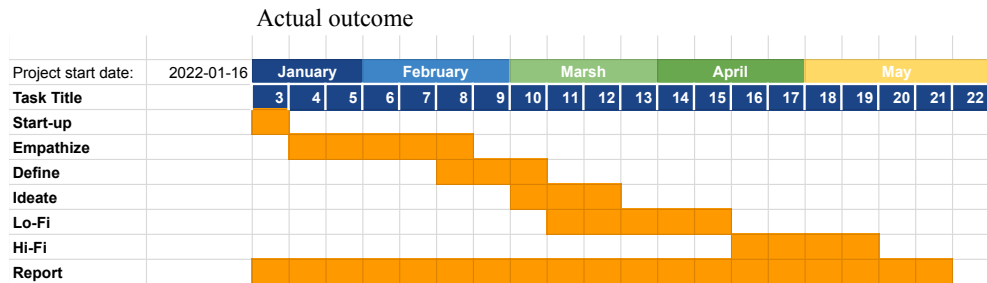
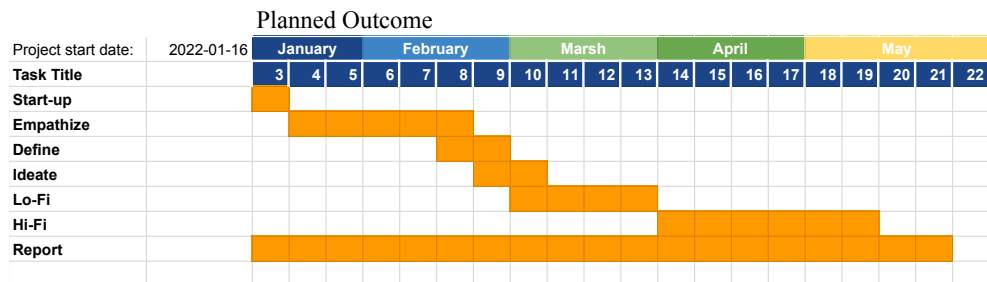
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A Appendices

A.1 Weekly Gantt Chart, planned and actual outcome



A.2 Survey Träffpunkten Lund

2023-02-15 09:25

Användarenkät

Användarenkät

Vi är fyra tjejer som läser till ingenjör vid Lunds tekniska högskola. Vi skriver just nu vårt sista arbete om hur användare upplever de digitala skärmar som sitter framför dig i stolryggen då du reser med flyg. Vi har en enkät med frågor angående detta och skulle vara tacksamma om du ville besvara dessa.

Tack på förhand.

Anna, Louise, Siri och Sara

Demografi

1. Kön

Mark only one oval.

Man

Kvinna

2. Ålder

3. Vilket var ditt tidigare yrke?

4. Anteckningar

Digital miljö

<https://docs.google.com/forms/d/1BgWo7Jzgi5EIFYoqjpsEQCgwKfatZDP1qqW8UoThTo/edit>

1/5

5. Använder du en telefon med touch-skärm?

Mark only one oval.

Ja

Nej

6. Använder du en dator eller en padda i vardagen?

Mark only one oval.

Ja

Nej

7. Vilka av följande saker använder du dig av i vardagen på mobil och dator?

Check all that apply.

Film/serie/tv tjänster (t.ex. Netflix, TV4play)

Musiktjänster (t.ex. Spotify)

Sociala Medier (t.ex. Facebook, Instagram)

Spel på mobiltelefonen/paddan/datorn

Låsa tidningen

Söka vårdhjälp (t.ex. 1177, Kry)

Kommunikation (t.ex. sms, ringa)

Inget utav de tidigare nämnda

Other: _____

8. Upplever du att dagens digitala tjänster är svåra att använda?

Mark only one oval.

Ja

Nej

Other: _____

9. Om ja, vad är det som känns svårt? Vad brukar du vilja ha hjälp med?

10. Anteckningar

Flygrelaterade frågor

11. Har du någon gång flugit med en skärm på stolsryggen framför dig?

Mark only one oval.

- Ja
- Nej
- Other: _____

12. Pondera att du ska sätta dig på ett långflyg (9 h), och du får reda på att det kommer finnas en skärm för underhållning, skulle du vara intresserad av att använda den?

Check all that apply.

- Ja
- Nej
- Other: _____

13. Om du svarade nej, hur går tankarna?

14. Om följande utbud finns på skärmen, vad hade du kunnat tänka dig att använda?

Check all that apply.

- Film
- Musik
- Läsa bok/tidning
- Spela spel
- Korsord/sudoku/liknande är detta spel?
- Kolla på kartan, hur långt det är kvar osv
- Läsa på om min destination

15. Vad hade du önskat fanns på en sådan skärm? (övrigt)

16. Hade du kunnat tänka dig vara med på användartester framöver i vårt projekt?
Lämna gärna namn, nummer och email-adress. Tack för din hjälp.

17. Anteckningar

This content is neither created nor endorsed by Google.

Google Forms

A.3 Manuscript for Workshop at Husie, Malmö

ANDRA AKTIVITETEN - IFE

Info som ska sägas innan vi börjar med skärmen

- Nu kommer vi ge er olika uppgifter som du ska få utföra, dock ska det sägas att det inte är något test.
- Viktigt är att du vet med er att du inte kan göra fel, om du inte klarar av uppgiften är det helt okej det med (det är fel på produkten och inte er).
- Har du några frågor under uppgiften är det bara att fråga.
- Tänk gärna högt - berätta om hur du tänker.

Skulle det vara okej att vi spelar in denna aktivitet? (ljud och skärm)

Inspelningen kommer endast användas som hjälp för oss att minnas och komplettera våra anteckningar.

Vi har nu tagit oss ombord på planet, alla har fått hjälp att hitta sin plats och flyget är uppe i luften.

Det är nu dags för första uppgiften.

Uppgift uppstart

Huvudfokus: Första tankar kring skärm, kolla hur de scollar, skillnad hem och meny skärm

Visar välkommen till seat xx.

Föreställ dig nu att du sitter i på din stol i flyget och detta är skärmen som sitter framför dig i sätet.

- Vad tänker du när du ser detta?
- Tror du att du kan hitta mer information, vad skulle du göra då?

Om du inte redan klickat så kan du få testa att göra det nu.

Hemskärmen visas. Se vad dom gör själva. Skrollar dom, läser dom?

- Vad tänker du om det du ser?
- Är det något som väcker ditt intresse?

Vänta

- Tror du att det finns mer av skärmen/sidan?

(Be dem att testa scrolla om de inte redan gjort det.)

- Får du känslan att man kan trycka på något?

Vänta

- Vad tror du att man kan göra om man tar sig in på menyn?

Du kan nu få testa att trycka dig in på menyn.

Klickar oss in på meny.

- Beskriv det du ser framför dig och vad kan du göra här?
- Hur känns denna sida jämfört med den hemskärmen vi tittade på nyss?
- Vad upplever du är skillnaden mellan föregående sida och denna sidan?

Uppgift - home page

Huvudfokus: Navigera sig på hemskärm, tidslinjens funktion. Tillbaka-funktion

Vi befinner oss på meny.

Ni vill se hur flygresan är upplagd tidsmässigt och har hört att det finns en tidslinje på hemskärmen där man kan se när nästa måltid är. Din uppgift blir nu att hitta tillbaka till hemskärmen och hitta till denna tidslinje.

Låta dem navigera själva, hjälpa till om det känns svårt.

- Beskriv vad du ser? Vad visar den dig?
- Kan det vara användbart? Är den tydlig? Kan den vara utformad på ett annat sätt, isf hur?
- Vad tycker du om funktionen tidslinjen?

Uppgift film

Huvudfokus: Testa att hitta film, vilken väg tar de för att hitta film, hur scrollar de

Vi vill nu titta på film, hur tänker du att vi ska gå tillväga? *Testa själv!*

Om dom inte letat utan bara tar första bästa; Vi skulle vilja se en film som heter **Matrix** och ligger under **kategorin action**. Din uppgift blir att hitta filmen och sätta igång den.

Filmen XX spelas. Om dom inte lyckas -> ta upp filmen åt dem.

Viktigt att börja spela filmen! Pausa innan nästa fråga:

- Hur var det att hitta till filmen?

Nu vill du kolla kartan som ligger på hemskärmen. Din uppgift blir alltså att navigera dig till hemskärmen och sedan öppna kartan som visar flygplanets resa.

- Hur var det att hitta tillbaka? (skala 1-10?)
- Låg detta där du hade velat att det skulle ligga?

Uppgift inställningar - accessibility

Huvudfokus: Accessibility -betydelse, utvärdera inställningssidan

- Vad skulle du göra om du upplever att texten är för liten på skärmen?
(Om de har en ide, låt dem testa själva! Annars lite guidning, nedan)

Alternativ; Pekar på inställningsikonen

- Vad tänker du att denna ikon betyder?
- Om dom trycker på den spontant --> vilken sida har du kommit till?

Om du inte redan tryckt, kan du få göra detta nu.

Inställningssidan visas.

- Vi skulle nu vilja ändra textstorleken, hur tänker du att vi ska göra det?

Om detta inte går, vägled dem till accessibility.

När dom har ändrat textstorleken:

- Hur kändes det att ändra textstorlek? Hur fungerade de två olika sätten som du kunde använda?
- Vad kan man göra på denna sida tänker du?
- Vad innebär ordet accessibility för dig?

Om de inte förstår, förklara att det betyder tillgänglighet och sen fråga.

- Vad för ord skulle du använda?

Avslut:

- Har du några sista tankar eller något du vill dela med dig av efter att ha testat skärmen?

Tack för att du ville vara med och testa skärmen. Du kan nu gå tillbaka till de andra så hämtar vi snart nästa person. (vänta 5 min)

A.4 Manuscript for Lo-Fi testing at Träffpunkten Husie and Arkivgatan

Hej,

Vad roligt att du ville komma tillbaka och testa vår prototyp idag.

Detta är ett användartest helt utifrån de insikterna och inputs vi fick av de förra användartesterna. Detta systemet är därför inte alls lika utvecklat och går till exempel inte att trycka på. Vi kommer istället gå igenom olika alternativ där vi tidigare sett lite problemområden och detta kommer göras tillsammans, du och jag.

Som vid det förra testet är scenariot att du sitter på ett flyg och har en skärm på ryggen av stolen framför dig. Det är inte ett "prov", så du kan alltså inte göra fel utan blir det fel så är det fel på designen av produkten. Viktigt är att du under hela tiden gärna får tänka högt, fråga frågor och försöka fokusera på det funktionella av det vi visar, alltså det du förstår och inte förstår, därmed inte det visuella och grafiska.

MENU

Vi kör igång, och vi börjar med meny-sidan.

Enbart alternativ 2, in-zoomad:

- Vad hade du gjort om du ville kolla på film?
- Media

Gå igenom alla 3 och fråga hur det upplevs, zooma ut och fråga:

- Är det något av alternativen som bjuder in dig mer än något annat?
- Är det något av alternativen som är tydligare än något annat?
 - Varför?
- Hade du helst haft övergripande genrer (t.ex. media) eller direkt från menyn kunna gå in på det du vill ha t.ex. filmer?
- Är det någonting du sett på dessa alternativ som du fastnade för?
 - Varför?

MOVIE

Nu vill du kolla på film och har tryckt dig vidare från menu och det ser ut något liknande så här:

Gå igenom koncept för koncept, fråga för varje koncept:

- Finns det fler filmer än dom du ser nu?
 - Vad är det som visar att det gör det?
 - Hur hade du gått tillväga för att se andra filmer än de som visas här?
 - Hur hade du bytt genre av film?

Visa alla koncept

- Är det något av alternativen som bjuder in dig mer?
- Är det något av alternativen som är tydligare än något annat?
 - Varför?
- Är det någonting du sett på dessa alternativ som du fastnade för?
 - Varför?

Touch Gestures:

- Är det någon av scroll indikationerna som tilltalar dig?

SETTINGS:

KVAR på movies

Nu ska vi undersöka möjligheten till att ändra textstorlek. Men innan vi gör det vill jag fråga en fråga:

- När tänker du att du behöver använda inställningar på en sådan här skärm?

Gå igenom alla alternativen och fråga för respektive alternativ:

- Är knapparna för små och/eller sitter de för tajt för att se ordentligt?

Koncept 2 och koncept 3:

- Kan du berätta vad för knappar som är tryckta på?

Knapp alternativen:

- Är det något av dessa alternativ som visar tydligt att det är en knapp som är på?
 - Vilka och varför?

Zoomar ut på alla tre settings sidorna:

- Om vi går tillbaka till de tre alternativen, tycker du att något alternativ är tydligare?
 - Varför?
- Är det någon information som du inte tycker passar in här?
- Är det någonting du sett på dessa alternativ som du fastnade för?
 - Varför?

GUIDE:

Allmän fråga innan börjar kolla på alternativen:

- Om du hade behövt hjälp med skärmen, hur hade du velat få hjälp först?

Visa båda alternativen efter varande och förklara dom, fråga sedan:

- Hade du nyttjat en guide för systemet?
 - Talar något av alternativen mer till dig än det andra?
- Vad tänker du ska hända om du trycker på "?" i koncept 2?
- Är det någonting du sett på dessa alternativ som du fastnade för?
 - Varför?

SIGN IN:

På detta system kan man logga in för att kunna ta del av vissa förmåner etc.

Visa sign in sidan och fråga sedan:

- Hade du velat kunna logga in i systemet med mail och lösenord (om du vet vad du får ut av det)?

SKELETON:

Innan något visas

Nu kommer vi visa några skärmar som är ganska tomma, men som ändå har lite saker på sig. Det som finns tillgängligt här är tänk att det ska finnas på alla sidor, såväl "movies"-sidan som på "sign in"-sidan.

- Finns det någonting du alltid vill ha tillgång till, oavsett vart i systemet du är?

Gå igenom alla koncept för sig och fråga hur de upplevs, sen fråga:

- Vill du alltid ha en synlig navigeringsbar eller vill du kunna klicka fram/scrolla fram den?
- Tycker du att någonting du hade velat veta saknas?
 - Vad?
- Är det någonting du sett på dessa alternativ som du fastnade för?
 - Varför?

Ikön alternativ:

- Är det någon eller några av dessa som du tycker betyder "inställningar"?