MASTER THESIS

MOBILE IDENTITY VERIFICATION AMONGST OLDER ADULTS: A USER EXPERIENCE STUDY ON THE READID READY APPLICATION

MIREL NIJHUIS
12TH OF JULY 2021

INDUSTRIAL DESIGN ENGINEERING
HUMAN TECHNOLOGY RELATIONS
UNIVERSITY OF TWENTE

SUPERVISOR:
DR. IR. DEGER OZKARAMANLI

EXTERNAL SUPERVISOR:
DR. IR. FEI LIU

DPM 1827

ACKNOWLEDGEMENTS

First of all, I would like to thank my supervisor from InnoValor, Fei Liu, and my UT supervisor, Deger Özkaramanlı, for guiding me through this project. Even during Covid-19, I was always able to meet with you and ask for your help if needed. I really appreciate the time that you both have invested in my Graduation Thesis, and therefore also my development as a person.

Secondly, I would like to thank Jesse van der Scheer and Olga Kulyk for their guidance throughout my project on behalf of InnoValor. Your UX expertise helped me a lot when I needed just that extra bit of help during my research.

Next to this, I want to thank all of the participants of the expert interviews, user research and online intervews for their willingness to help me in my research.

Lastly, I would like to thank my family and friends for their support. Even in these unusual times, you were always there for me.

SUMMARY

Modern everyday technologies and widespread usage of mobile phones enables society to make use of mobile applications on a daily basis. Over the past few years, Near Field Communication (NFC) has been integrated into a number of these applications. One of the possibilities that this newly found technology enables is the remote identity verification of an individual without having to visit the relevant organization. InnoValor develops the mobile identity verification technology called ReadID. The ReadID Ready application checks the authenticity of an identity document with the use of one's smartphone, verifying one's identity remotely on behalf of ReadID's customer.

A good product is one that has the capacity to be accessible for all kinds of users. Especially when a new kind of technology is brought onto the market, designing in an inclusive manner is sometimes forgotten. In this Graduation Thesis, a scenario-based design methodology in combination with dilemma-driven design is used to execute a user experience study on the ReadID Ready application. Desk research and expert interviews serve as a first exploration into the target group, older adults. In an extensive user research, the usability challenges older adults experience when they make use of ReadID Ready are uncovered. The needs of the target group in regards to inclusive design are mapped out, as well as the dilemmas that arise while older adults use the ReadID Ready application.

In the design phase of the Thesis, dilemmas function as an exploration space for design opportunities. Possible designs are generated for specific steps in the user journey of the ReadID Ready application. Online user tests with older adults evaluate the generated prototypes. In the end, a final recommendation is made to enhance the user experience of the ReadID Ready application for older adults.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

eIDAS: The electronic IDentification, Authentication and trust Services (eIDAS) is the commonly used name for the EU regulation on electronic identification and trust services for electronic transactions.

iProov: In the last step of the ReadID Ready app, iProov software is used to check the genuine presence of the user. This technology belongs to the company iProov and is integrated in the ReadID Ready app.

ISO: International Organization for Standardization (ISO) is a nongovernmental organization that comprises standards bodies.

NFC: Near Field Communication (NFC) technology allows users to exchange digital content, and connect electronic devices with a touch. NFC transmissions are short range (from a touch to a few centimetres) and require the devices to be in close proximity.

MRZ: The Machine-Readable Zone (MRZ) is a codified element of identity documents. An MRZ facilitates easier automated scanning of basic personal details of the document holder, such as their full name, document number, nationality, date of birth, and the document expiration date. An MRZ can be found on the photo page of any international passport, as well as on many types of ID cards, residence permits etc.

OCR: Optical character recognition (OCR) is the electronic conversation of images of types, written or printed text into machine-encoded text.

QR-code: A quick response code (QR-code), is a type of barcode that can be read easily by a digital device and which stores information as a series of pixels in a square-shaped grid.

SaaS: Software as a service (SaaS) is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted.

SDK: A software development kit (SDK) is a set of software development tools that allows the creation of applications for a certain software framework or system. To put it simply, an SDK is a tool box that often includes APIs, pieces of code, or other rules for developing software. SDK's enable developers to help them easily integrate with their services.

UX: User experience (UX) is the interaction and experience users have with a product or service.

1. INTRODUCTION

This Industrial Design Engineering Graduation Thesis is conducted externally on behalf of the company InnoValor. In this first chapter the company, the goal of this Thesis, and research question will be introduced.

1.1 NFC based identity verification: ReadID

Modern everyday technologies and widespread usage of mobile phones enables society to make use of mobile applications on a daily basis. Over the past few years, Near Field Communication (NFC) has been integrated into a number of these applications. Using one's phone to pay contactless in a supermarket or café has become the most normal thing in the world. NFC is a radio frequency based technology, that allows short-range communications between NFC devices and smart cards allowing transactions within a range of up to 10cm (Finžgar & Trebar, 2011; Madlmayr et al., 2008). This contactless technology enables many current solutions in access control, payment and transport. The technology provides a range of benefits in terms of time savings and process optimization (Madlmayr et al., 2008). Next to this, it is suitable for a variety of industries, is standard based, enables secure transmissions of data, and has capabilities to support secure applications on mobile phones (Finžgar & Trebar, 2011).

One of the possibilities that this newly found technology enables is personal identity verification over a distance, without having to visit the relevant organization. InnoValor develops the mobile identity verification technology called ReadID. ReadID reads data from the chips within passports, ID documents, and drivers licenses. The authenticity of a document is checked with the embedded NFC reader from one's smartphone. ReadID is a technology provider enabling various customers verify the identity of their end-users. Examples of important customers of the ReadID application are: Rabobank, ING, the UK government and the Dutch police.

The current ReadID products consists of:

1. ReadID SaaS: For the SaaS version the customer-side runs as a Software Development Kit (SDK) in the app of the customer, sending the information the SDK read from the chip to the server side, where it is verified (figure 1.1). This SDK version is integrated by the customer in their own application.

2. ReadID Ready: ReadID Ready is a ready-to-use identity verification app suitable for online use cases, meaning that this application is already available in the app store (figure 1.2). ReadID Ready is a version of ReadID SaaS but with a configurable app, ready for use. Within the ReadID product range, ReadID Ready can be seen as the application that forms the base of the product line. The ReadID Ready application will be explained in more deatil in section 1.1.1.

3. ReadID Client only: In the client-only version, ReadID runs on the smartphone only, without a server. The verification is thus done on the smartphone, and therefore can only be used for trusted devices. Typical uses cases are border control, police forces or public transport.

1.1.1 The ReadID Ready application

ReadID Ready is a ready-to-use identity verification app, making remote identity verification possible from one's home. InnoValor's customer makes use of the ReadID Ready app, in order to verify the users identity (ReadID Ready, n.d.). The app is linked to the customers processes and website, without having to implement their own app. The app communicates with the ReadID SaaS server to do the verification, making it suitable for self-service in which users have the ReadID Ready app on their own phone.

Figure 1.1: Rabo identificeren app (SaaS)

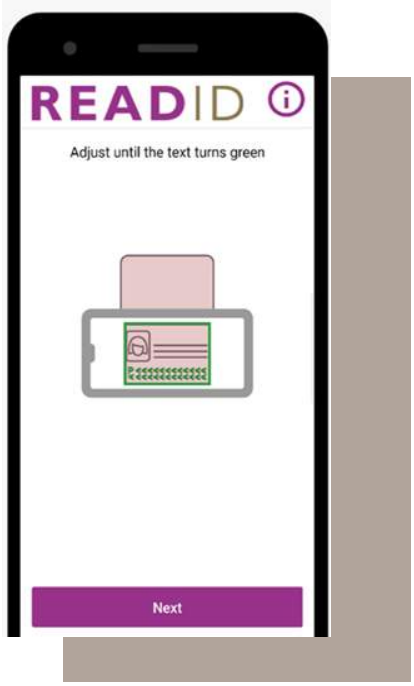


Figure 1.2: ReadID Ready application

The ReadID Ready application consists out of a series of steps that the user needs to conduct in order to verify their identity. What happens before and after the usage of the application is completely depend on ReadID's customer, the organization that needs to verify the users. Users will go through the following steps in the verification process:

1. *Receive a verification request:* First, potential users will receive a request on behalf of the customer in order to verify themselves. This can be in the form of an e-mail, letter or mobile URL. Often, an instruction webpage will provide the user with the necessary instructions on how to go through the verification process.
2. *Installation of the app:* Users are requested to download the app on a suitable smartphone with NFC reader. This app is available in the App store (iOS), as well as the Play store (Android). Users will first take a look at the start screen, where it is stated that they need an identity document.
3. *QR-code:* In the request, a QR-code can be found. The user needs to scan this code in order to proceed in the environment from the customer.
4. *Scan:* The user needs to scan the MRZ (Machine Readable Zone) on their identity document with their camera.
5. *Read:* In order to read the data present in the chip from the identity document, the user has to hold his document against their phone. The NFC reader should be able to catch the signal, therefore chip should has to make contact with the NFC reader.
6. *Face (dependent on customer)*: The user is asked to scan their face with the front-camera of their smartphone in order to verify that they are indeed the person on the identity document. Whether this step is implemented is dependent on the wishes from the customer.
7. *Confirmation:* Once the steps have been executed correctly, a confirmation is shown to the user. This confirmation includes their personal data. Their identity is now verified and they will proceed further is the online environment from the customer.

The ReadID Ready application and it's user journey will be explained in more detail in Chapter 3 of the Thesis.

Figure 1.3: Short explanation video about the ReadID Ready app

1.1.2 Problem statement

ReadID is a modern and innovative service, available on the consumer market for a couple of years now. As the technology used is new, input that is required from the user is also unique and different from other mobile applications. ReadID's product portfolio grows as well as the variety of use-cases, therefore new types of users come into the picture. A good product is one that has the capacity to be used by all kinds of users, regardless of age, sex, cultural background or interests. Especially when a new kind of technology is brought onto the market, designing inclusively can be tough. A consequence of this could be that certain kinds of users are marginalized unintentionally. The user experience of a product plays a key role in this process. It is therefore the designers aim with this research to examine what the optimal user experience from ReadID would look like and how this can be implemented in the current product range. The focus in this Thesis will lie on the ReadID Ready application.

1.2 Company brief

InnoValor is focused on advisory services as well as on software development (see figure 1.4). The advisory part focuses on digital innovation. Where ReadID is mainly focused on software development. Software is developed and implemented in the different ReadID applications. As this Thesis is conducted within the ReadID branch of the organization, the advisory department will not be further addressed in this research.

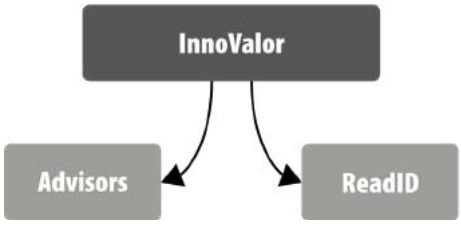


Figure 1.4: Company structure InnoValor

1.2.1 Stakeholders in the identity verification process

Before the actual research phase of the Thesis will start, it is critical to map out the stakeholders involved in the process and their relation to the ReadID Ready application. ReadID uses a business-to-business model, meaning that they provide services and sell products to other companies. These companies or organizations will be addressed as customers. ReadID Ready can be used by customers from various sectors. These sectors can be grouped into five different categories (see figure 1.5):

1. Banking
2. Trust service providers
3. Governments
4. Mortgages
5. Insurance companies

Customers are able to use the ReadID technology for online identity verification by integrating it in their own process. This can be done in a variety of ways depending on the wishes and needs of the customer. ReadID Ready is in this case a ready-to-use white label mobile application for identity verification. ReadID Ready can be linked to the process and the website or a mobile application of the customer without having to implement their own mobile application.

Another stakeholder involved in this process is the end user. The user needs to verify their identity on behalf of the customer by downloading and using the ReadID Ready mobile application. The user is able to use their own phone, making it a complete self-service. The Ready app communicates the data of the user with a trusted server for verification.

A total of three direct stakeholders are involved in the usage of the ReadID Ready application(see figure 1.6):
1. *ReadID Ready:* Supplier of the identity verification technology.
2. *Customer:* The organization or company that makes use of ReadID Ready for mobile identity verification.
3. *User:* Person that needs to verify their identity on behalf of the customer.

Apart from the direct stakeholders involved in ReadID's process, indirect stakeholders are also involved. Whether and which indirect stakeholders are participating is dependent on the use case.

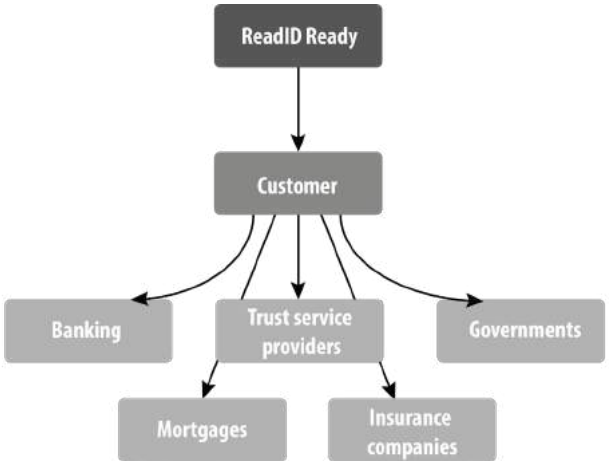


Figure 1.5: Customer segments Innovalor

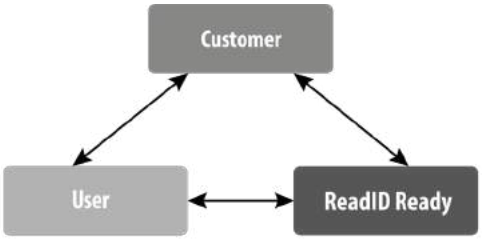


Figure 1.6: Direct stakeholders ReadID Ready

1.3 Project focus

For this research, the focus will be placed on the ReadID Ready app. ReadID Ready is especially developed for customers that want to integrate the technology in a short span of time, and they do not need to develop their own application. The reason for this is that the ReadID SaaS application is an SDK, that needs to be implemented by the customer themselves. They can adjust the steps and settings depending on their personal use case. ReadID client-only is used by professional users, which is also not within the scope of this research, this will be described next.

The ReadID Ready app has two types of users:
1. *One-time users:* Users have to download the application in order to verify their identity for an organization. An example of such an organization could be a bank or insurance company. The application is only used once, often without prior knowledge.
2. *Professional users:* The ReadID Ready application is used daily by a professional. The user needs to verify an identity of a person, by reading their identity document such as passport, identity card or driving license. An example of such a professional could be a police offices or a border force control officer. In this case the ReadID Ready application is part of the professionals working equipment and is used multiple times a day, with prior knowledge on how to use the app.

The first user group, one-time users, will be addressed in this research. This group entails everyone that has to be able to verify their identity: every citizen in possession of an identity document. This is by far the largest target group of ReadID Ready. The

application is only used once, without prior knowledge. This means that the required actions within the app are novel to most first-time users; scanning your identity document with a camera, reading the identity document with a phone by holding the document against the phone. Professional users already know how to use the app, because they use it multiple times a day. They do not need to be guided through this process anymore, and therefore fall out of the scope for this project.

A good product is one that has the capacity to be accessible for all kinds of users. Especially when a new kind of technology is brought onto the market, designing in an inclusive manner is often forgotten. A consequence of this could be that certain kinds of users are marginalized unintentionally. In case of the ReadID Ready application these could for example be people with minimal knowledge of technology, elderly or people with an impairment.

1.3.1 Target group

The target group chosen for this research are adults aged between 55 and 75 years old. They can be classified as the older generation of adults or be seen as the 'baby boomer' generation born between 1946-1965. This target group was determined by means of expert interviews within InnoValor (see section 2.2). The adults are independent and rather active in life, meaning that they have the drive to do a lot by themselves. They are either still working or have been retired. Besides this, they live independently, with or without their partner and are in no need of help for nursing yet. One of the benefits of using generational categorizations is for tracking a cohort through time (Griffen, 2015), professionals use data in order to determine the best ways to reach consumer groups.

Figure 1.7: Older adults aged 55 - 75

1.3.2 Research question

Above information leads to the following research question for this Graduation Thesis:

What are the current challenges that older adults experience when using the ReadID Ready app? How can this be enhanced in regards to user experience and inclusive design?

Sub-questions:

1. How does the target group stand in relation to digital services (Chapter 2)?
2. What is the current user flow of the ReadID Ready app? (Chapter 3)
3. What is the current status of the ReadID Ready app in regard to universal accessibility standards (Chapter 3)?
4. What usability challenges arise when older adults use the ReadID Ready app? (Chapter 4)
5. What are the needs of the target group in regards to inclusive design? Which dilemmas arise when older adults make use of the ReadID Ready app? (Chapter 4)
6. What design opportunities do dilemmas inspire? (Chapter 5)
7. What are the redesign possibilities that enhance the usability and experience of the ReadID Ready app for older adults? (Chapter 6)

1.4 Methodology

During this research, a human centered design methodology is used in order to explore how to enhance the user experience of ReadID Ready application. Within this methodology, dilemma-driven design and scenario-based design will play a key role:

Figure 1.8: Dilemma-driven design

Dilemma-driven design

Personal dilemmas are inspiring phenomena, which can stimulate design creativity and reflection on users' goals and values (Ozkaramanli et al., 2020). Dilemmas can be seen as the experience of having to make a choice between two mutually exclusive alternative options. This allows the designer to gain a better understanding into the personal conflicts that the user experiences while designing a service. An example of such a dilemma could be: I want to stay healthy and in shape vs I want to eat what I like and enjoy eating.

Figure 1.9: Scenario-based design

Scenario-based design

Scenario-based design is a methodology that supports designers and design teams in their creative and reflective activities by providing an explicit means to explore the future use of a product or a certain technology (Bont et al., 2013). Scenarios are rich descriptions of use situations containing one or more actors, their goals, the 'product', the context in which the use situation is taking place, the actions an actor takes and the events he or she has to deal with during their actions (Bont et al., 2013). Scenario-based design is a universal term for techniques that make the use of either a product or service explicit (Bont et al., 2013). Different scenario types can be distinguished with regard to their content. Anggreeni and van der Voort (2008) developed a scenario use roadmap to establish understanding on different scenario uses and how they fit in a scenario-based product design process.

1.4.1 Research approach

This Thesis consist out of a variety of sections. The brown section is focused on uncovering explorative scenarios and actual practice scenarios, whereas the grey section explores the possibilities in regards to future practice scenarios (Anggreeni, 2010):

- *Explorative scenarios* generate in this case awareness on the current possibilities and obstacles that users face when they interact with the ReadID Ready application.
- *Actual practice scenarios* will capture the current challenging situations that older adults face when they interact with the ReadID Ready app.
- *Future practice scenarios* will function as a design space in which potential solutions are examined and investigated.

The conclusion includes a reflection on the overall process of the Thesis. Figure 1.10 below shows the overview of the various chapters of this research.

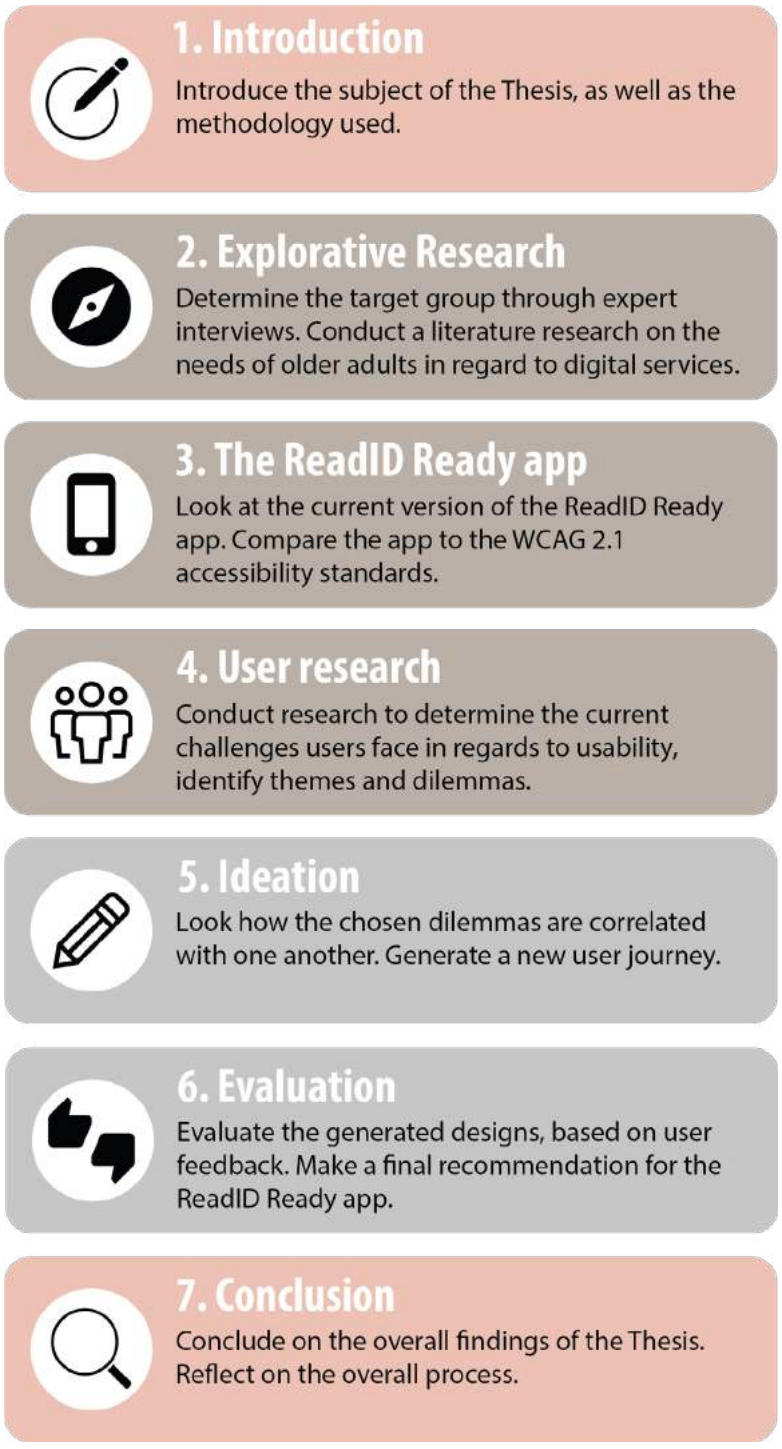
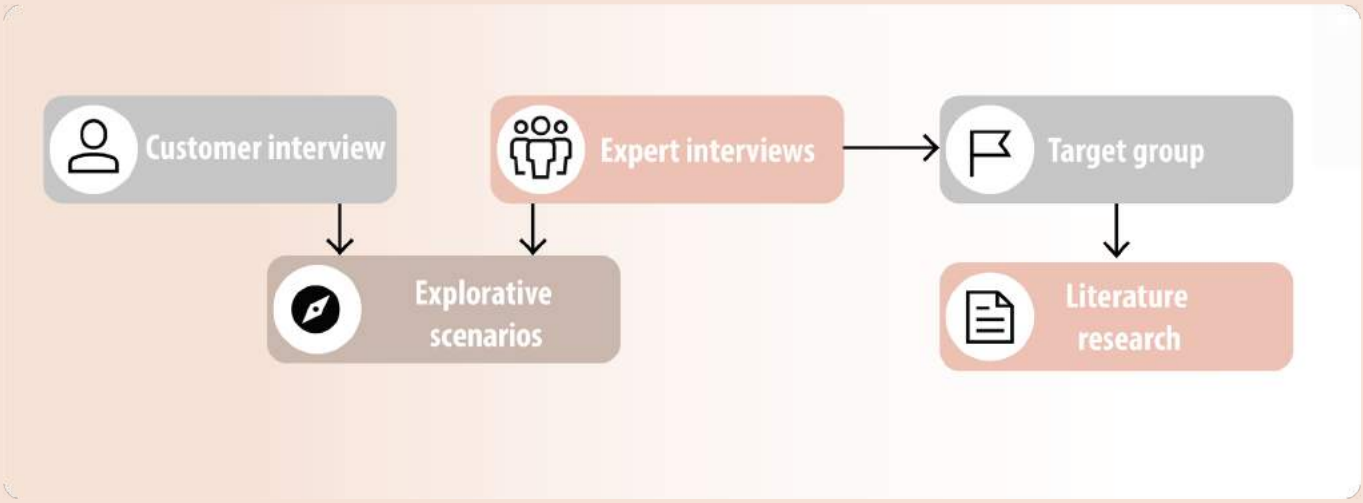


Figure 1.10: Overview Thesis

2. EXPLORATION

The aim of this second chapter is to conduct a desk research. Talking to one's stakeholders is of major importance in a human-centered design approach. Expert interviews were conducted by the researcher to decide upon a target group. Next to this an interview with one of the customers from ReadID was held. The knowledge from stakeholders will be synthesized into a small number of focused explorative scenarios (Anggreeni, 2010). Explorative scenarios generate in this case awareness on the current possibilities and obstacles that users face when they interact with the ReadID Ready application. Hereafter, literature research will reveal how the target group interacts with online services and what matters to them. Thus answering the first sub-question: *"How does the target group stand in relation to digital services?"*



2.1 Inclusive design and accessibility

For this Master Thesis it is of major importance to understand the target group, as well as what the terms inclusive design and accessibility entail. A human-centered design approach is used, in which the end-user plays a central role in the whole design process of a product. Prior to determining a target group, literature research is conducted on these different design terms. The correlation between these terms is mapped out, as well as how they vary from each other.

Inclusive design

First of all, it is important to define what inclusive design entails. Users will experience a variety of emotions while they interact with a product or service (Seminar, 2011), also referred to as the 'user experience (UX)'. These feelings can be both positive and negative. Inclusive design tries to include the user needs of those who are often left out in a design process. A variety of definitions can be found for the term 'inclusive design'. Waller et al. (2013, p.299) define inclusive design as: *"An understanding of customer diversity to the design of mainstream products, in order to better satisfy the needs of more people and deliver success."* According to Waller et al. (2013), setting up an inclusive design strategy requires the understanding of the diversity within a population. As well as a response to this diversity with informed design decisions.

Shalamova (2019, p.2), on the other hand, defines an inclusive product or a service as: *"A product or service that must reach the widest possible audience, address a full range of human capabilities and neurodiversity, and ultimately empower people across the globe to participate in global conversations, enable them to lead more independent lives, and diminish social and cultural inequalities."* The ground for inclusive design is based on the fast pace of technology adoption across the globe (Shalamova, 2019).

In this Thesis, the definition of Waller et al. (2013) is used to define the term inclusive design. People of different ages, capabilities, social and cultural backgrounds have a diverse range of needs and desires which a designer must take into account. Designing inclusively does not always make sure that a product or service addresses the needs of an entire population. Specialist solutions are sometimes required for people who experience severe difficulties when interacting with a certain technology (Hosking et al., 2010; Waller et al., 2013), see figure 2.1. Inclusive design guides the designer and helps to design an appropriate response suitable to the diversity within the population, until the point where specialist products are required.

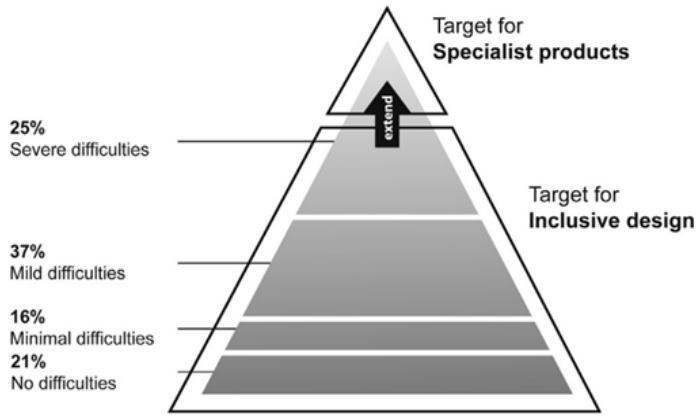


Figure 2.1: Population Pyramid for inclusive designers. (Hosking et al., 2010; Waller et al., 2013)

The difference between accessible and inclusive design

In the context of product design, making things simple is a challenging task (Waller et al., 2013). A designer needs a clear and distinct vision of who the target group is, and what functionality these users need. Inclusive UX design also incorporates design for accessibility (Shalamova, 2019). Shalamova (2019, p.3) argues that: *"Accessibility usually refers to making special considerations for people with disabilities."* Hutter & Lawrence (2018, p.22) also confirm this in their research: *"the concept of accessible design asks us to specifically consider the needs of people with disabilities."* These two terms are thus very closely related and some might view them as the same, even though they are not. This difference will be explained.

Accessible design considers making an equivalent experience in a space for those with disabilities often through adjustments like for example captions and keyboard navigation. For online service design this often entails following different standards for accessibility which include guidelines for keyboard navigation, screen readers (Kirkpatrick et al., 2018) etc. A universal accessibility standard is known as WCAG (Kirkpatrick et al., 2018). These WCAG guidelines are based on a total of four principles: perceivability, operability, understandability and being robust. Inclusive design is on the other hand, a more extensive approach to all kinds of users. Focusing on needs, perspectives and behaviors, rather than solely looking at specific disabilities. Inclusive design is thus a kind of approach or philosophy, while design for accessibility entails a set of specific design principles and focuses more on the overall outcome (Shalamova, 2019) (see figure 2.2).

Within this Thesis, designing for the target group using an inclusive, human-centered design approach will be the main goal. Inclusive design is needed to take care of the full range of human diversity. Where accessibility focuses on taking into consideration differing abilities between people. Inclusive design thus incorporates differing perspectives, including also people with disabilities, into the process.

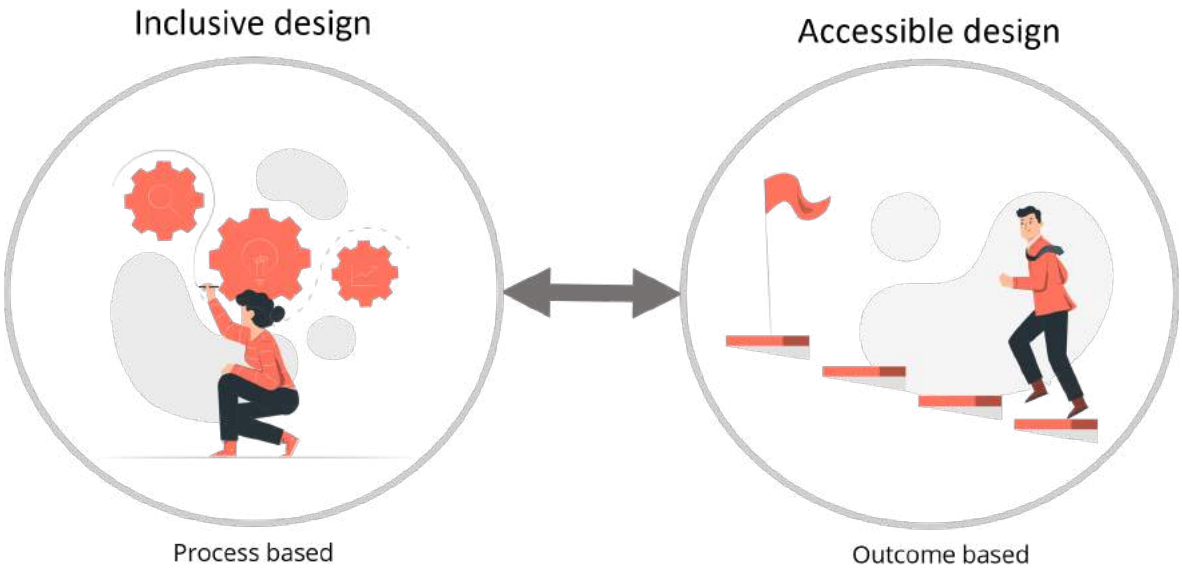


Figure 2.2: Inclusive versus accessible design

2.2 Expert Interviews

Semi-structured expert interviews were conducted with InnoValor's employees. The goal for conducting the expert interviews was to determine a target group for this Graduation Thesis; what user groups find it difficult to interact with the ReadID Ready application? And which user group can be used as a target for this Thesis? Next to this, a set of explorative scenarios has been set up. These scenarios generate awareness on the current possibilities and obstacles that general users face when they interact with the ReadID Ready application.

2.2.1 Procedure and format

The interviews are conducted over the platform Microsoft Teams, as it is not necessary to meet in person and working from home is still the norm (December 2020). This is due to the COVID-19 situation in the Netherlands. Before starting the interview, the participant was informed about the goal of the research and the fact that he or she could stop the interview at any moment via a consent form (Appendix A). Next to this, they were informed about the fact that the researcher would like to audio-record the interview, but only if permission is given by the participant via the consent form. The participants are questioned during the interview about their function and the goal of ReadID. Furthermore, they are asked about the different customers and users. Based on these findings the final target group for this research is determined, as well as the final study objective. Interviews are determined to last for about 30 – 45 minutes, depending on the progress of the conversation. The interviews will be conducted in either Dutch or English, depending on the mother tongue from the participant.

Participants

Employees who stand in close relation to the ReadID customers are interviewed. They are part of the sales and customer services team. Participants were asked to participate in an online interview and via e-mail.

Questions

The questions asked during the interview can be found in Appendix A. The sequence of these questions is based on the interview flow as suggested by Baxter et al. (2015). The interviews are semi-structured, follow-up questions can be asked depending on the expertise of the person and the course of the interview.

2.2.2 Analysis

A total of six interviews were conducted with the employees from Innovalor. All of the participants gave consent for their attendance in the interview, as well as the permission to record the complete conversation. All of the interviews are transcribed and printed in order to conduct an thematic analysis. This is a method for identifying, analyzing and reporting patterns or themes within data (Boyatzis, 1998). A theme is in this case an important finding in the data in relation to the goal of the research. It represents some level of patterned response or meaning within the data set (Braun & Clarke, 2006). During the analysis, a form of descriptive coding (Miles et al., 2013) (Saldana, 2009) is used. A descriptive code assigns labels to data to summarize in a word or short phrase, most often a noun, the basic topic of a passage of qualitative data. For example the sentence: *"I walked one block away, there was a MC Donalds, Kruidvat and Albert Heijn across the street."*, would be summarized with the term *"Businesses"*. These codes eventually provide an inventory of topics for indexing and categorizing. In all of the six interviews, the codes are categorized into themes using sticky notes, this is done per participant. Hereafter, all of these themes are categorized together in one big scheme to be able to provide the end results.

2.2.3 Results

The following results were found during the thematic analysis of the expert interviews. The goal for executing these interviews was to define a final target group for this Master Thesis. Also, the benefits and obstacles users and customers face are identified. First, InnoValor and its success factors in general are specified, hereafter the customers and users of the ReadID software are addressed. In the end, potential user groups that could benefit from this research are discussed.

At the start of the interviews, participants were questioned about ReadID's main goal and success factors. The following factors were found to be most important for ReadID's market position (figure 2.3):

1. The urgency to handle processes online as much as possible has never been so high. Society cannot function anymore without being online. Standardization of physical to online operations is therefore necessary. Next to this, privacy regulations are becoming more strict. Internationally, this means that InnoValor has to comply to the ISO 27001 and ISO 27701 standard of privacy protection (Naden, n.d.). InnoValor's ISO/IEC 27001 makes sure that there is an appropriate Information Security Management System (ISMS) in place (Certifications, n.d.). The ISO/IEC 27701 certificate proves that InnoValor has all the required security and privacy controls in place to securely process personal data as a controller as well as a processor. Without these certifications, InnoValor would not be allowed to operate on the consumer market.
2. NFC is a relative new technology on the consumer market. Almost everyone has an NFC reader in their mobile phone. This new technology enables new opportunities, such as payments without a bankcard. ReadID is the first one on the market to make use of the NFC technology in this particular way, and has been adapted by big companies and organizations within the Netherlands.

Identity verification was originally conducted physically in person at an organization. Relevant documents would be taken from the user in order to be copied or scanned. This is not the case anymore, identity verification is mostly done online. Companies and organizations in particular sectors are obligated by the government to verify the identity of their customers. Whether NFC technology can be used to verify a user is dependent on the country of origin. The Netherlands is a so called 'NFC friendly country', meaning that NFC chips are present in one or more identity documents distributed by the Dutch government. Other NFC friendly countries are often located in the United Kingdom, Scandinavia and Oceania. In addition, the main goal and function of the company play a key role in their decision to choose for either NFC technology or OCR (visual) technology. OCR technology takes longer, is more expensive and has a relative low conversion rate. An OCR solution does however have the preference if lots of documents without NFC chip will be used or the goal of the customer is not in line with the NFC compatibility.

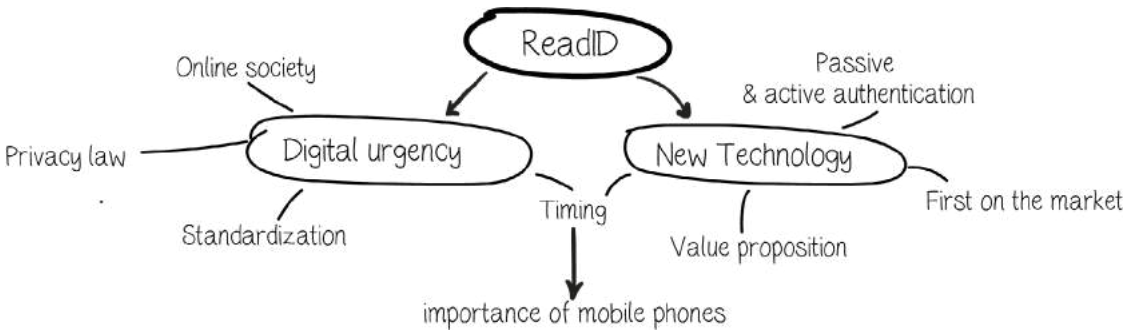


Figure 2.3: Factors of influence for ReadID from a company perspective

ReadID Customers
The following benefits are according to InnoValor's employees experienced by the customers of ReadID (figure 2.4). On one side there is the reliability of the application. It is cheap, as no employees are needed for checking the documents, and has a high conversion rate. The application is simple and at the same time safe, fraud is not possible. Furthermore, the application offers remote identity verification on a trusted server. This server is recognized with an electronic IDentification, Authentication and trust Services (eIDAS) certification (Certifications, n.d.), that is renewed every year. No human mistakes can be made, morphed pictures or information on the document will not pass through the server. The verification is real-time and ensures a fast response, allowing new opportunities for different customers. The flexibility in the range of products allows customers to choose the version of the application that suits them best; ReadID Ready is convenient for companies or organizations that are rather small, want to be online within a few weeks or do not have their own team of developers.

Possible obstacles that the customer can face when they want to integrate a ReadID product in their service, is the fact that they need more personal information than is given on the document. This adds additional steps in the process. Also, not being located in an NFC friendly country or a country where NFC smartphones are only available to a small part of the population can generate difficulties.

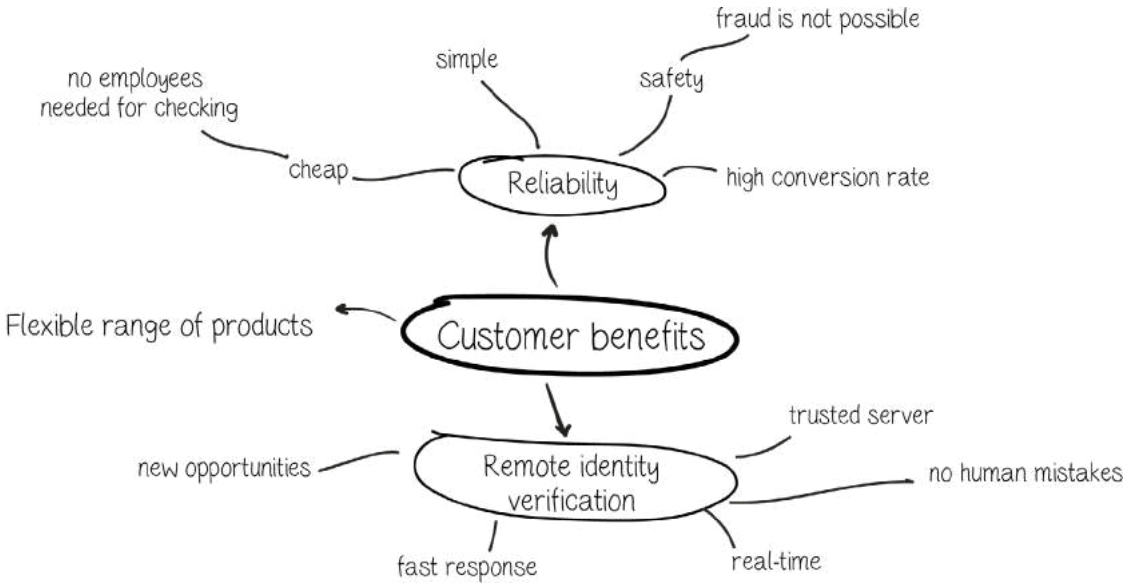


Figure 2.4: Customer benefits ReadID, from a company perspective.

ReadID users
When looking at the users of the application, remote identity verification currently suits the wishes of the population best (figure 2.5). Users are able to conduct the process anywhere, at any time on a smartphone; there is no need to leave the house physically. A favorable situation in our busy lives, yet also needed and pleasant in the current COVID-19 pandemic (December 2020). Users will receive an immediate confirmation, without having to wait. Besides this, the users benefit in a way of convenience. The application is simple to use, it consists steps where animations play a key role when it comes to guidance. Fraud is impossible, which guarantees a high safety standard. The user is in control. When used for a first time often the novelty effect occurs, a wow factor in response to the quick and new process.

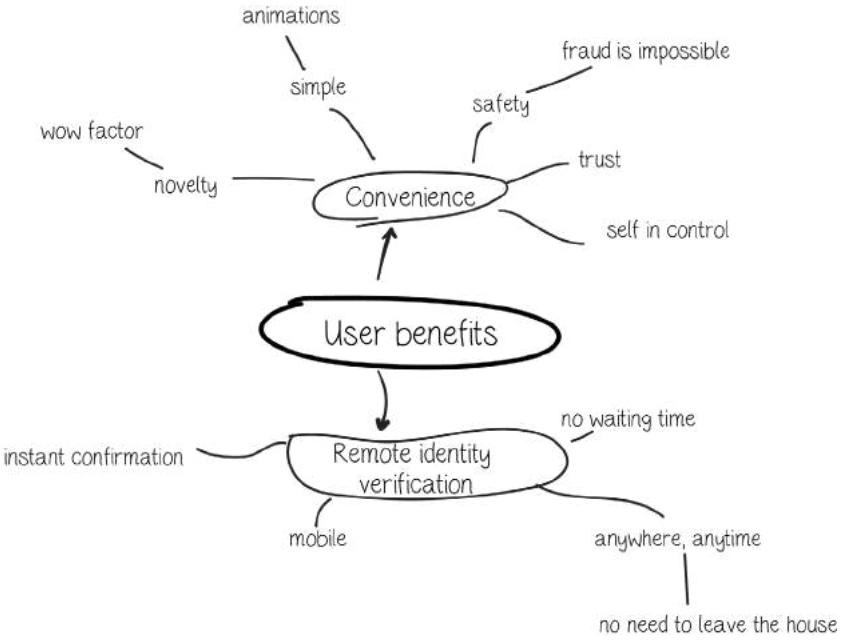


Figure 2.5: User benefits ReadID from a company perspective.

Two major aspects that need to be taken into account are the urgency and type of motivation for the user. What is their goal when trying to complete the process? Let's sketch two simple use cases, use case A and use case B. In use case A, the user is asked to verify her identity at the bank in order to get a mortgage for her newly bought house. In use case B, the user needs to verify his identity at the insurance company where he has been a member for over 7 years. The insurance company needs to check whether his personal information in their system is still up to date. These explorative scenarios can be found in figure 2.6 and Appendix B. The motivation would in this case be much higher in case A, whereas in use case B the motivation is possibly there, but in a less urgent manner.

Obstacles that can arise for users when they want to complete this type of process are not having an NFC smartphone or document. There could also be a hesitance for installing the application, as it is might be an unknown technology, and therefore lacking a certain type of trust. Different expectations might arise when installing the application, or clicking on the next button without reading the instructions. Holding the smartphone against the document is often the hardest part of the process.

Participants specified three different user groups that have presumably more difficulty in using the ReadID application:

1. *Older Adults*

By far the most mentioned group are the older adults. Some participants considered 40+ people already as an older generation, whereas others saw people aged 65+ as the elderly. These users do often not keep up with all the newly found technologies available nowadays. Usage of new technologies can therefore be difficult and sometimes harder to understand for this group. They might not know about the existence of NFC and might therefore prefer the traditional way of identity verification. They are however often more patient than youngsters, who are often in a rush.

2. *Digital illiterates*

Digital illiterates are users who have difficulty to find certain types of information through digital platforms. They often have a low IQ or a lower type of education. This makes it more difficult for them to function within our digital society.

3. *People with an impairment*

The last type of user that was mentioned a few times are users with an impairment. This can be either visual, auditory or in a variety of other ways. Such a kind of impairment can give a disadvantage to the user, as certain functions and actions of the application might not suit the user's needs.

Figure 2.6: Explorative Scenario A: Computer to app flow (Web2app flow)

2.2.4 Discussion and conclusion

The goal of these interviews was to identify a user group that has a bigger difficulty in understanding the ReadID Ready application.

The results indicate that ReadID's current success factors rely heavily on the nowadays digital urgency within our society, as well as the newly used NFC technology. Customers often choose to use ReadID because of its convenience, just as the option to verify a user's identity remotely without being physically present. Restrictions for implementing this software are the urgency to be located in an NFC friendly country and the limited amount of information present on identity documents. Users make use of the application because of its reliability, fast response and the option to verify oneself from a distance. They do however sometimes not know what is meant with NFC technology, or do not know the organization resulting in a hesitance for using the application.

In the end, three user groups that have more difficulty using this application were identified. Older adults, digital illiterates and people with an impairment could benefit from a more extensive research into their needs and wishes when using the ReadID Ready application. The final target group will now be defined.

Older adults

Older adults aged between 55 and 75 years old have been chosen as the target group for this Thesis. The reason for selecting this particular target group is the fact that it was by far the most mentioned group in the expert interviews. Participants usually mentioned this group first when asked about possible difficulties for certain user groups. In users tests organized by the ReadID team in which the researcher assisted, older adults also tended to have more difficulties when completing the process in comparison with youngsters. People aged 55 – 75 encompass 25% of the Dutch population (CBS StatLine, n.d.), improving the user experience of the application can in that sense help a big part of society.

Digital illiterates, elderly aged 75+ years old, and people with an impairment are excluded in this research partly because of the fact that older adults encompass a big majority in Dutch society. Next to this, these other groups are often in need of help of a caretaker. This caretaker frequently handles the essential necessities, such as an verification process, which was also confirmed in the interviews.

Limitations of the studies

As the participants of the interviews all have a specific function in the company, this needs to be taken into consideration. Sales employees have a greater insight in selling areas compared to customer service employees who have a bigger affinity with the actual functioning of the application. A possible bias can therefore be the result in answering specific questions. The second bias within these expert interviews is the fact that InnoValor's employees are in many cases font of the software, as they work with it every day. Benefits are exaggerated more in comparison to obstacles. The researcher tried to be as objective as possible in terms of analyzing the interviews and tried to take into account the different functions of the participants, as well as the fact that they work within the company.

2.3 Talking to one of ReadID Ready's customers

In order to generate a better view on the usage of the ReadID Ready app, it is important to talk with all of the stakeholders. Expert interviews within InnoValor have already revealed insights from a company's point of view. Besides this, it is important to talk to the customers from ReadID as well. The aim here was to talk to more stakeholders who stand in close contact with older adults as their end users, the researcher reached out to multiple customers. Yet in the end, only one interview was held. A semi-structured interview has been conducted with a customer from ReadID who has a lot of older adults as end-users.

Integrating the ReadID app; a customer perspective

At the start of the interview, the reason for integrating the ReadID Ready app into the customer's use-case was discussed. The process for identifying a particular group of older adults included a lot of paperwork, which was quite tiring for both the user and the customer. On top of this, this process had to be conducted again over a certain period of time. Introducing the ReadID Ready application meant that a lot of time was saved for the customer, as there would be less paperwork. The customer's organization was not big enough to have their own team of developers who could produce such an app. As the technology itself has already been produced for ReadID Ready, outsourcing the software development was therefore a big advantage. Next to this, there was no need to travel to the office for the employees with this technology, which is preferred in times of Covid-19. It can be confirmed from behind one's laptop that an individual has identified oneself.

One of the bigger obstacles in integrating the application within the organization was the fact that they were really careful when it comes to the privacy of their users. For the employees it was kind of a dilemma to start using the new technology, they suddenly had to get used to a new way of working. Some of them wanted to stick to the old, well-known way. Switching to another way of working can cause some resistance. Lastly, ReadID is ISO 27001/27701 and eIDAS certified (Certifications, n.d.), still the certification was a barrier for the customer. They wanted to be sure that ReadID did not violate the privacy concerns of their users. This caused the application to be launched later than planned.

User benefits and obstacles; a customer perspective

In the second part of the interview, attention was paid to the older users of the application. In the opinion from the customer, there are several benefits for users of the application. ReadID Ready is the so called 'digital officer at home', there is no need to travel anymore to a physical location. Travelling takes in general more time for older adults, in these Covid-19 times it is good that they do not need to go outside of their homes. Overall, the application is easy to use and serves the user in a more comfortable way; there is no paperwork anymore. Additionally, older adults can ask others for help in finishing the process. If they are too insecure to start the process or do not have a compatible smartphone, an acquittance can guide them.

The usage of the app is a new phenomenon for older adults. Having no compatible smartphone or not being confident in oneself to start the new process are possible obstacles that the user can face (see the explorative scenario in figure 2.7). In some cases, users do not possess an NFC document. This does however not occur that often, as most Dutch citizens possess at least one document with an NFC chip.

The overall usability problems that were found by the customer were downloading the wrong app, as there are in fact two ReadID applications available in the App/Play store. And not having enough/too much light intensity for the MRZ scan to

work, meaning that the MRZ code is not readable for the camera of one's phone.

In the explorative scenario below, two different storylines with the same obstacle are explored; having no compatible phone. In sequence A, the user is not able to complete the process whereas in sequence B, she is able to complete the process with help from an acquaintance. This shows that not having a NFC compatible phone can on the one hand sometimes be overcome by relying on others, whereas in some instances it cannot.

Figure 2.7: Explorative scenario C, having no compatible smartphone

In the end

According to the customer from ReadID, communication is key for older adults to understand the verification process. You should not give the user too much information, yet enough for them to understand why they are asked to conduct this procedure and the different steps. As restricting older adults in their choice can cause them a lot of frustration, an organization should in the beginning you still provide them with both choices; the old way and new way. After a few years, one could start thinking about getting rid of the old process.

2.4 Older adults in a digital world

The population in our world is ageing; in 2018, people aged 55 years or older accounted for almost one third, 32,8%, of the total European Union population (Strandell & Wolff, 2019). In the Netherlands, people aged 55 – 75 encompass 25% of the Dutch population (CBS StatLine, n.d.). Baltes and Lindenberger (1997) argue that ageing is one of the key drivers of ability variation. Hence, as the population gets older, the number of people with functional difficulties is consequently growing. The needs of this growing group are large, especially in the ICT area (Persson et al., 2015). Previous generations seemingly accepted that difficulties with products were expected with ageing. Nevertheless, the baby boomer generation is less likely to tolerate products that are difficult to use (Rogers, 2009). Specifically technology products that are needed for essential services, as Rogers (2009, p.25) states: *"It's a mistake to view the boomers as a generation whose technology habits will remain fixed going forward....In fact, baby boomers have a dynamic, thoughtful and ever-changing relationship with new technology, viewing the world ahead with great enthusiasm and just a touch of caution."* Every design decision has the potential to include or exclude customers. Including the great diversity of users in a design is a challenge, but not impossible.

For this Master Thesis it is of major importance to understand the target group, as well as what inclusive design entails for this group. Therefore, the target group and their relationship to technology will be explained by looking into different aspects that influence older adults; viewing behavior, aesthetical appearance and a decline in physical and mental functions. Next to this, motivation and trust are found to be of major influence for older adults while interacting with a digital service. Lastly, a user experience model is generated in which all the different user-stages are provided.

The baby-boom generation

People of different ages, capabilities, social and cultural backgrounds have a diverse range of needs, desires and preferences. Baby boomers, born between 1946-1965, have a unique relationship with technology (Obal & Kunz, 2013; Rogers, 2009). The special thing about these older adults is the fact that they are often in the midpoint of life's cycles. Some of them still live with their children at home and might be working full-time, whereas others are retired and already waved their children goodbye. They grew up without and with technology (Obal & Kunz, 2013; Rogers, 2009); they were young adults when the first PCs appeared, and were the early adopters of that era. Nevertheless, they still know a time with almost no technology, were the Dutch television only had three public broadcast channels and entertainment channels would only be in German. Alwin & McCammon (2007) and Sullivan et al. (2009) suggest that generational differences in attitudes and worldview typically originate from different experiences of major events in the younger years of childhood (figure 2.8). The experience that technologies provided in these childhoods were significantly different for older adults in comparison with other generations, for example Millennials (people born between 1977 – 1990) (Djamasbi et al., 2011).

It is often said that older adults learn about technology from their children, and this assumption is confirmed by Rogers (2009) and Griffen (2015) in their studies. Once they have learnt a new technology, they will actively share it with their peers. They, however, blame manufacturers for creating unnecessary complexity. In several analyses (Greying Gadgets, n.d.; Waller et al., 2013) it has become clear that products can now offer more features at a relatively low incremental cost. Shalamova (2019, p.300) states that: *"Indeed, companies can easily fall into the trap of competing in the 'feature race', trying to provide ever more features to keep one step ahead of the competition."* Yet, this does not always result in an optimal experience for the user, due to more interface complexity and the reduction is size of controls, symbols and text. It is the main reason of frustration for 57 percent of the baby-boomers (Greying Gadgets, n.d.). Older adults want to see their own values back in new technologies, which is sometimes not the case.

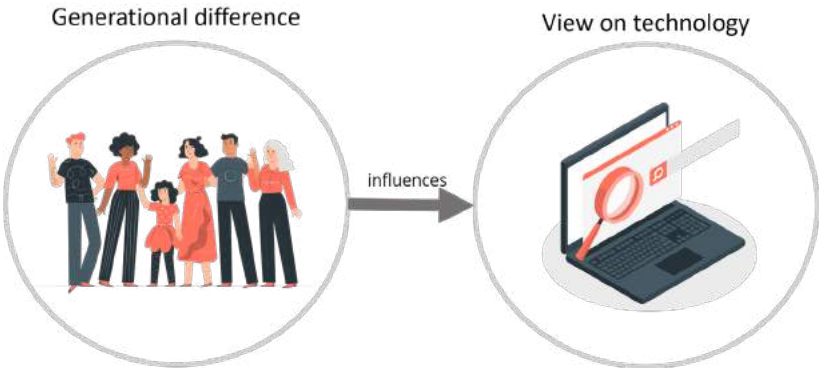


Figure 2.8: Influence of age on technology

Communicating the right amount of information

How a person looks at an interface, also known as the viewing behaviour, determines how successful information is communicated to a user. Guiding users is of key importance in a user interface (D. E. Chisnell et al., 2006; Djamasbi et al., 2011). This is dependent on the elements present on a webpage such as text and images, as well as size and locations of elements. Users often first scan images on a webpage and after this start reading the text (Faraday, 2000). In addition, large elements in a user interface tend to be perceived as more important than smaller items (Faraday, 2000). Likewise, elements on the top of a webpage are seen as more valuable. A clustered interface, unclear usage of elements or unfamiliar items may distract, confuse or frustrate older adults (D. Chisnell & Redish, 2005). Especially websites that are densely packed with information are difficult to read (D. Chisnell & Redish, 2005).

Moreover, the aesthetic appeal of a user interface affects the user experience (D. Chisnell & Redish, 2005; Djamasbi et al., 2011). Effective visual design depends on the context of the user, just like the context of the interface (D. E. Chisnell et al., 2006). Visual aids can reduce both the need for complex descriptions and the cognitive effort required to understand these descriptions (Harwood et al., 2012). An inviting design can be meaningful in attracting new users. Even if a webpage has big usability issues, users are more likely to forgive these flaws if the site is aesthetically appealing (Lindgaard & Dudek, 2002). In a visual engaging service, a user will ultimately have a better trust (Karvonen, 2000). For baby boomers the viewing behaviour and aesthetic appeal of an online service can be influenced by their age, resulting in weakened motoric and psychological skills.

Both the physical and mental functions decline when one ages. Sensory organs experience reduced sensitivity, with slower coordination, attention span and reaction time. In regards to the usage of a tablet device, the area's most relevant for decline are vision, dexterity, touch and cognition (Griffen, 2015); the decline in vision constrains the ability to read information on screen or differentiate certain colours, such as blues, greens, and violets. A weakened eye-hand coordination, can sometimes make the use of a computer mouse frustrating, luckily touch-screen devices help in minimizing this frustration (Harwood et al., 2012). In comparison with younger generations, older adults experience a reduced speed when communicating (Delello & Mcwhorter, 2017). A decline in mental acuity (Delello & Mcwhorter, 2017) and a weakening cognition (Gazzaley, n.d.) makes older adults slower at ignoring irrelevant information, this can impact their ability to navigate through for example a website and complete tasks in an efficient way. Commercial organizations often do not take into consideration the user with minor ability losses, such as those that commonly occur with ageing. This is due to the fact that minor ability losses are often not severe enough to acquire extra attention, even though it may cause significant difficulties when interacting with products. Inclusive design can in this case help to incorporate these users.

Looking back at the population pyramid for inclusive designers (figure 2.1). It can be argued that older adults who experience some kind of functional decline, are most likely to fall into one of the last three categories(Hosking et al., 2010); mild, minimal or no difficulties (figure 2.9). Minimal difficulties include a an impairment that does overall not limit one's employment or daily life. Individuals in this case have often more than one daily task which they find hard to conduct, due to a particular decline or impairment. Severe difficulties impact an individual's daily life, and therefore fall out of scope for this target group.

Please note that not everybody will experience these functional declines (D. Chisnell & Redish, 2005); one does not always have a poor eyesight, problems with their motor control or a cognitive loss. All of our bodies are different and can react in a different way, literature shows how the majority of the overall population will decline in function when they age.

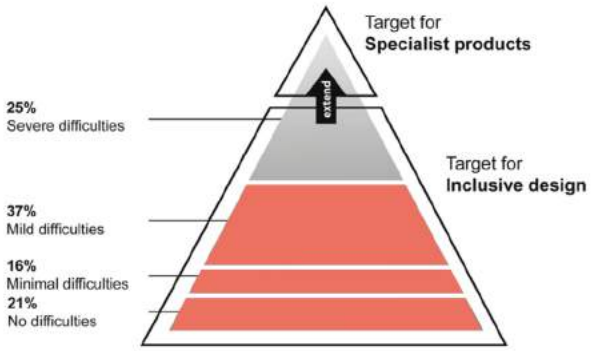


Figure 2.9: Older adults on the inclusive design pyramid

In an interesting research from Djamasbi et al. (2011), baby boomers and generation Yers (born between 1977 – 1990) were compared with one another when looking at different kinds of webpages. Younger users had less tolerance for lots of elements on the screen in comparison with the older users. Even though the baby boomers had a longer attention-span and fixation count, they both preferred images over large amounts of text. This can be explained due to the fact that younger users typically have a shorter attention span, and are more prone to boredom (Djamasbi et al., 2011). Djamasbi et al. (2011) did however not take into account the physical and mental decline of the older generation in their results, this could have supported their results and might have explained some of their findings. See figure 2.10 for the overall relationship on interface design.

The different features and elements present on a user interface, as well as the aesthetic appeal can be reviewed in regards to accessibility by having a look at the WCAG guidelines (Kirkpatrick et al., 2018).

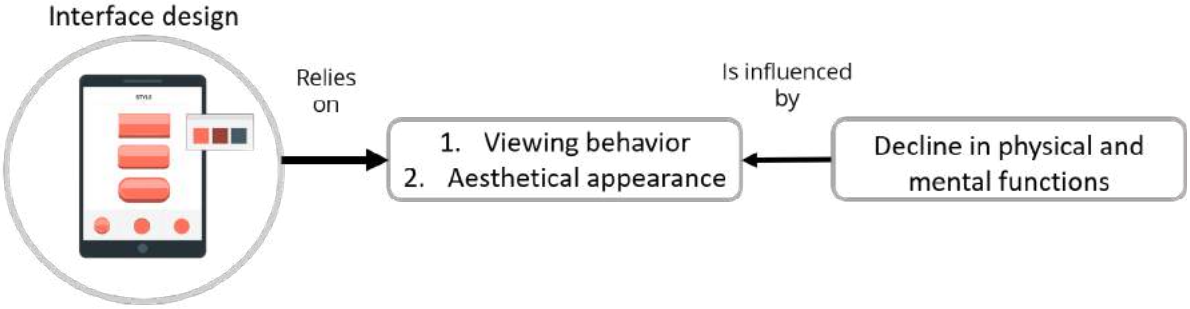


Figure 2.10: Relationship interface design

Using a digital service

Older adults tend to take into account special considerations when they use a digital service. The first important fact to consider is the users motivation (Djamasbi et al., 2011; Yang & Jolly, 2008), which was also confirmed by the participants from the expert interviews. An example of a motivation driven concern is the usage of contactless payment in the Netherlands. This has doubled in 2020 by people aged 65+ (DeNederlandscheBank, n.d.). In October 2020 this was 58% of the transactions, when in fact this was in the beginning 2020 was only 27%. Due to the Covid-19 pandemic, consumers do not want to come in physical contact with the cashier. The average consumer now pays 67% of their purchases contactless (DeNederlandscheBank, n.d.). There is an urgency and therefore the motivation to adapt oneself to perform an action in a different way.

Secondly, trust is a crucial determinant of a user's intention to use a digital service in terms of privacy (Obal & Kunz, 2013; Ozturk et al., 2017). The development of trust in digital technology really differs between generations, especially the information privacy present in an interface is of great value for baby boomers (Obal & Kunz, 2013; Rogers, 2009). Baby boomers look for cues of privacy before they begin transacting with an digital service (Obal & Kunz, 2013). In a study conducted by Ozturk et al. (2017, p. 2040-2041), the NFC mobile payment technology in a restaurant was evaluated: *"The findings demonstrate that privacy concern was significantly associated with users' behavioral intentions as they believe that using NFC mobile payment technology could lead them to loss of their privacy. These findings show that customers are more likely to use NFC-MP technology when they believe that it is useful and makes the payment process easy."* Referring back to one's motivation to use a digital service, in this research it was confirmed that compatibility has the strongest impact on the intent to engage in an NFC based technology, meaning that one will make use of the technology if it aligns with their goals and lifestyle (Ozturk et al., 2017).

These two pillars are connected with one another (figure 2.11), showing the general assumption an older adult has of a platform before the actual usage. In an analysis from Lin et al. (2013) a three-stage theoretical model of consumer trust wat created that clearly shows the connection of both trust (perceived risk) and motivation (perceived benefit) for a user. This model is based on two frameworks, the first one being the extended valence framework (Lin et al., 2013; Peter & Tarpey, Sr., 1975). The extended valence framework incorporates perceived risk and benefit, the two aspects that influence one's decision making process the most. The second framework used by Lin et al. (2013) is the IS (information systems) expectation confirmation theory; before consumers make use of a product, specific expectations are formed (Bhattacherjee, 2001). Expectations and performance are compared to one another in order to measure the perceived usefulness and confirmation, leading to the overall satisfaction of a service.

One's perceived user experience of a product or service is formed over a time-span (Seminar, 2011). Seminar (2011, p. 8) argues in his whitepaper that: *"People can have an indirect experience before their first encounter through expectations formed from existing experience of related technologies, brand, advertisements, presentations, demonstrations, or others' opinions. Similarly, indirect experience extends after usage, for example, through reflection on previous usage, or through changes in people's appraisals of use."* The time-span of one's perceived user experience can be divided into different stages: pre-usage, during usage, after usage and over time (Lin et al., 2013; Seminar, 2011). The last one would not be applicable for the ReadID Ready application, as this Thesis has a focus on one-time users.

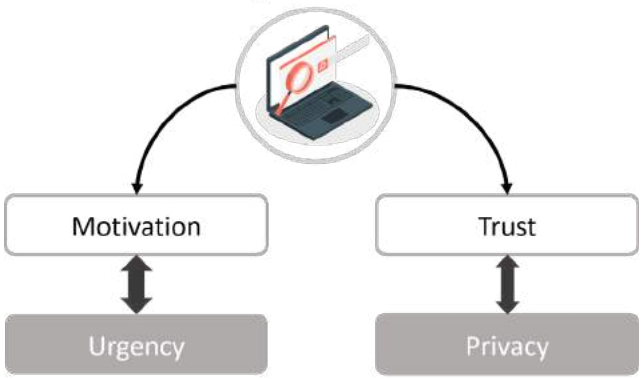


Figure 2.11: Considerations before usage of a digital service

The model from Lin et al. (2013) has been extended for this Thesis by the researcher in combination with the different time periods from Seminar (2011) as depicted in figure 2.12. It clearly shows the different stages a user goes through when interacting with a product, system or service; the pre-usage stage, usage stage and post-usage stage. In the pre-usage stage, the two factors that influence one's assumptions about a product or service are the perceived benefit, as well as the perceived risk by the user. During the usage stage the actual product or service is used. In the post-usage stage the perceived usefulness and user confirmation lead to the actual satisfaction the user perceived during the interaction, also known as the overall user experience.

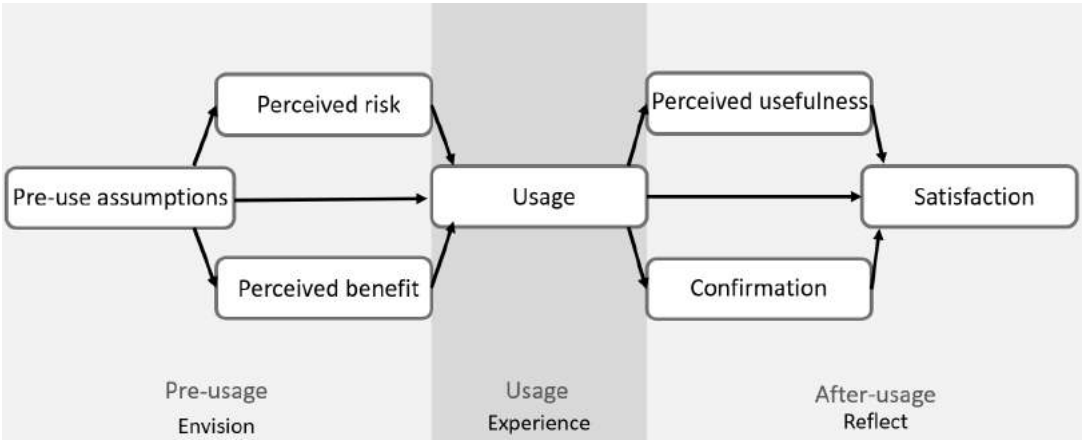


Figure 2.12: Three stage extended user experience model(Lin et al., 2013) (Seminar, 2011)

Discussion and conclusion
In conclusion, this literature research gave a clear insight in the way inclusive design is connected with older adults and their user experience of digital services. From the generated insights, considerations that need to be taken into account during the user research could be set-up, see figure 2.13 below.

The baby-boom generation grew up in a time with almost no available technology, yet as young starters in the office the first PCs became available on the market, making them the early adopters of that era. These generational characteristics often cause a *difference in attitude* towards technology. Older adults often tend to fall in the 'feature race' trap from companies, which causes the application to surpass the values from this age group.

Communicating the right amount of information to the target group plays a key role in the process of inclusive design. Both the *viewing behaviour and aesthetic appeal* from an online product or service determine how well a message is received by the user. Guiding the user with the right elements is of major importance, though at the same time very tough. An appealing design can invite older adults to make use of a service, giving off a welcoming feeling. *The physical and mental conditions of an individual decline as one ages.* This means that the baby-boom generation most certainly experiences one or more weakened functional difficulties.

Before older adults make use of a digital service, two influential factors are always taken into consideration; the users *motivation* to make use of a platform and *the trust* they have before starting the interaction. For baby boomers, trust in directly related to the perceived privacy. As the ReadID Ready app involves one's personal data, concerns beforehand can have a huge influence on one's opinion. Other possible concerns should therefore be examined as well.

The user-experience model (figure 2.12) clearly shows the different phases one has to through in order to know the actual satisfaction (user experience). As this model is informing and at the same time simple to understand and integrate, it will be used in the remainder of the Thesis as a guideline.

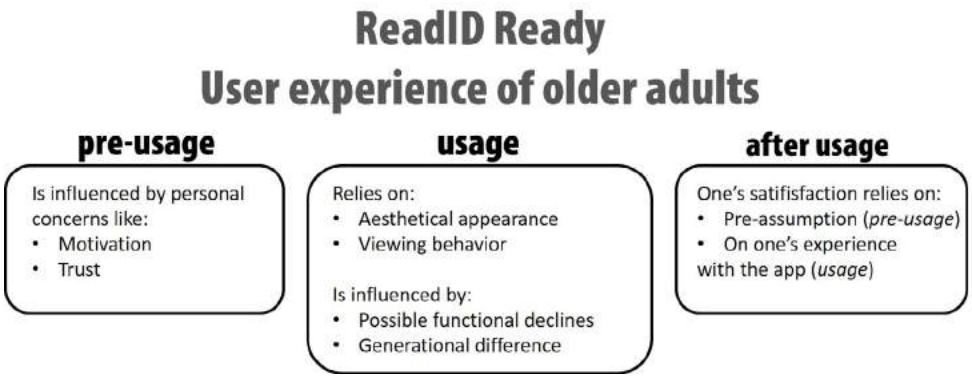
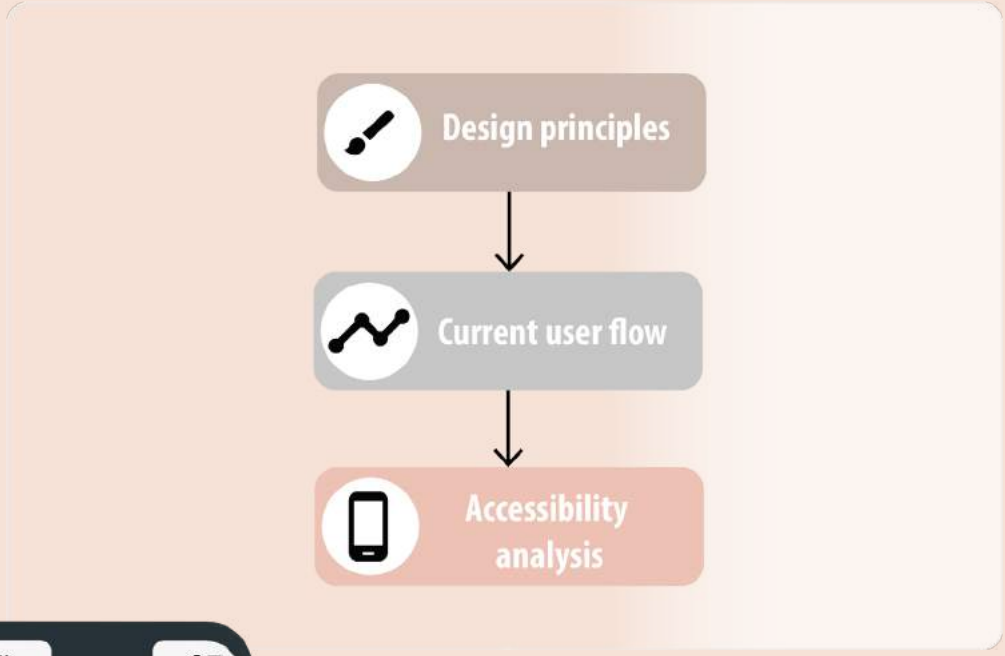
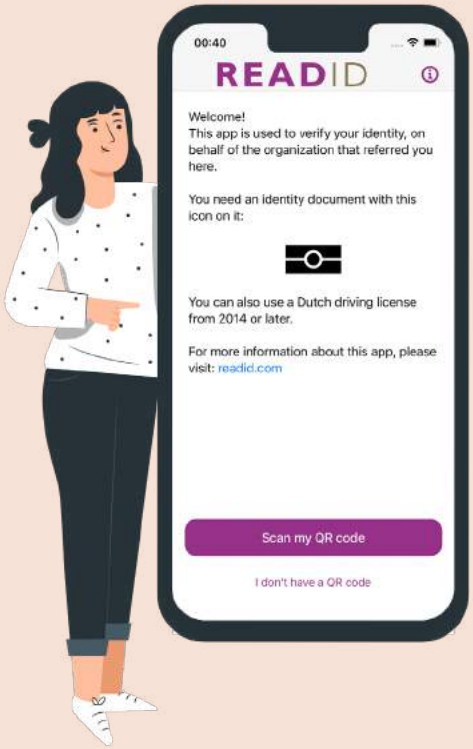


Figure 2.13: Factors of influence for the user research

3. THE READID READY APPLICATION

In the third chapter of the Thesis, the current design principles and the user-flow of the ReadID Ready application are explained. Literature research suggests that the current interface design can already be evaluated in terms of accessibility according to the WCAG 2.1 guidelines (Kirkpatrick et al., 2018). Therefore an accessibility analysis is conducted on the ReadID Ready application that answers sub-question 3 of this research; "*What is the current status of the ReadID Ready app in regard to universal accessibility standards?*" This resulted in a set of explorative scenarios about obstacles users might face while interacting with the ReadID Ready app.





3.1 Design principles

The current ReadID Ready application is built around a set of design principles. These principles explain the user flow of the ReadID Ready application, and where set-up by InnoValor in their UX whitepaper (Wegdam & Claas, n.d.).

1. Instructions: show, don't tell

ReadID Ready adopted the principle to demonstrate the interactions as much as possible, rather than describing them. ReadID uses animations and illustrations as user instructions.

Implementation: Animations

- When showing an animation, limited text is showed. ReadID states that it is hard for users to provide attention to both.
- Show the animation twice, then proceed automatically.
- Provide a button to proceed for quick users.
- Read: proceed automatically when a document is detected.

2. Help: only when needed

Information overload easily occurs, therefore ReadID tries to avoid confusing the user with too much information. One simple instruction is provided before the user needs to perform an action.

Implementation: Help carrousel

ReadID implemented a help carrousel during the NFC read step. The most likely solution is showed first in this carrousel. The sequence is based on priority.

3. Guidance: as custom as possible

Different identity documents require different interactions. This also applies to the various types of smartphones, where NFC antennas are placed on different places. An antenna placed at the top of the phone requires a different reading interaction than an antenna placed in the middle of the phone. iPhones are easier to read than Android telephones, as the antennas are always placed at the top of the back side of the telephone.

Implementation: custom flows

ReadID provides custom flows for each type of identity document; either a passport, identity card or driver's license can be used. Also the type of steering system is taken into account, Android and iOS steered phones differ slightly in the instructions given.

3.2 The ReadID Ready Application

The user flow within an application is the path taken by a user on a website or application to complete a task. The ReadID Ready application takes the user through an identity verification process in a set of steps, these steps are depicted in figure 3.1:

1. *Installation of the app:* The user downloads the app, they will be guided by instructions from the customers online environment (see section 3.2.1).
2. *Start of the verification:* After the app is download, the user has to scan a QR-code in order to start a secure session in which the app communicates with the ReadID server(see section 3.2.2).
3. *Perform scan:* The user is required to make a photo scan of his document, read the data from the chip and make a face scan using the selfie camera. (see section 3.2.3).
4. *Prresent results(process data):* After completing the verification process, the user receives a confirmation on the result screen. The data is send to the ReadID server to be retrieved, interpreted and processed further by the customer (see section 3.2.4).

These steps will be explained more extensively in the following sections.

What happens before and after the usage of the ReadID Ready app depends entirely on the process of the customer. The application is integrated within their process and therefore relies on their intention. In the following sections the different steps taken in the user flow will be explained more extensively. Screenshots from the different steps in the app can be found in Appendix C (Made using a Samsung Galaxy 8 Android smartphone)

Figure 3.1: Steps ReadID Ready

3.2.1 Installation of the app

The customer will ask the user to download the ReadID Ready application for the verification process (figure 3.2). The app is available on both IOS and Android, making them downloadable in the App store and Play store. The instructions are provided in one or more of the following ways:

- Provide an URL link to install the app. **(desktop + mobile)**
- Provide a QR-code with a link to install the app. **(desktop)**
- Provide Play/App store buttons with a link to the store. **(mobile)**
- Provide a description to manually find the app in the Play/App store. **(desktop + mobile)**
- Send an URL via SMS, Whatsapp or something similar. **(desktop)**
- Provide an explanation or static QR-code via a letter. **(post)**

Figure 3.2: User flow app download

3.2.2 Start of the verification

Once the application has been downloaded from either the App Store or Play Store, the user is able to continue the process within the ReadID Ready mobile app (figure 3.3). After being welcomed on the start screen, the user is required to scan the QR-code provided by the customer. If the user does not see a QR-code, the application will refer the user back to the (mobile) website or a start application of the customer. The user will have the option to get to know more about the application by clicking on the information symbol in the right upper corner (see appendix B).

There is also the possibility for the user to start the userflow from a mobile website (or app), referred to as the mobile2app flow. In the mobile to app flow, the user has to click on an activation link to start a personal session within the Ready app. This link replaces the QR-code. The main scope for this Thesis lies however on the web2app flow, this is the flow in which the user starts the verification process from their computer. The web2app flow is used by the huge majority of ReadID's customers. Taking into consideration the mobile2app flow as well would be too much to take on by one person and is therefore considered out of scope for this Thesis.

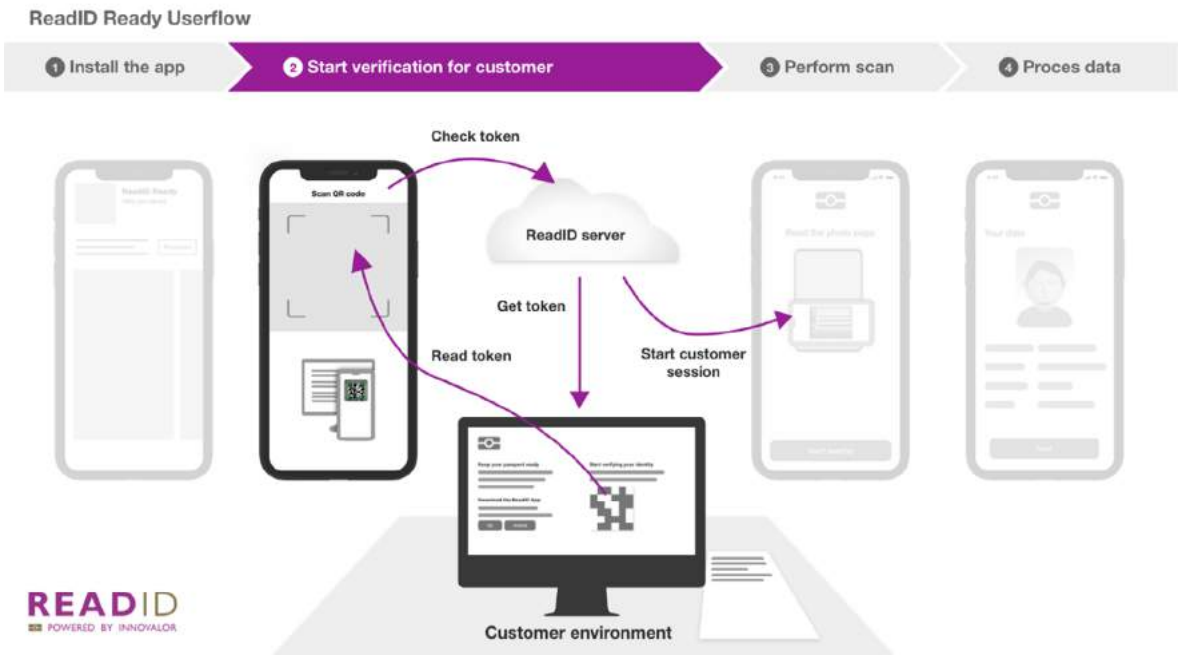


Figure 3.3: User flow QR-code

3.2.3. Perform scan (figure 3.4)

Scan

After scanning the QR-code, the user chooses which type of identity document they will use in the process. The user needs to scan the chosen identity document with the camera in order to read the Machine Readable Zone (MRZ). This step is needed to get access to the NFC chip and extract data from the identity document. This MRZ is either placed on the front or back of the identity document. By making use of explanatory animations, instructions on how to place the document and camera are provided. After two repetitions of the animation, the application will automatically proceed to the MRZ camera view. A 'next' button gives the user the choice to immediately proceed to the MRZ camera view. Within this step there is the fallback possibility of typing the code manually instead of scanning the document with the camera.

Read

After completing the MRZ scan, the user is directed to the NFC read step. First, an explanatory animation is shown that tells the user how to scan NFC chip with the identity document. This animation is shown two times before automatically proceeding. The user has the option to continue by clicking the 'next' button. If the NFC reader from the smartphone does not sense any NFC chip nearby a help carrousel is displayed. This carrousel provides tips on how to read the document. If the NFC chip is detected by the smartphone, a progress bar shows the current status of the scan. After completion, the user will proceed to the next step.

Face

Based on the preference of the customer, iProov[1] is integrated in the ReadID Ready process. This is the last step in the verification process after the NFC scan. The user is asked to scan their face using the front camera of the smartphone. The animation shows that the user needs to align their face inside the oval. Also the camera needs to be kept still during the scan. Once the scan is completed, the user will proceed to the last step.

1 Please note that the face verification step uses the product from iProov. This means that the process itself cannot be changed.

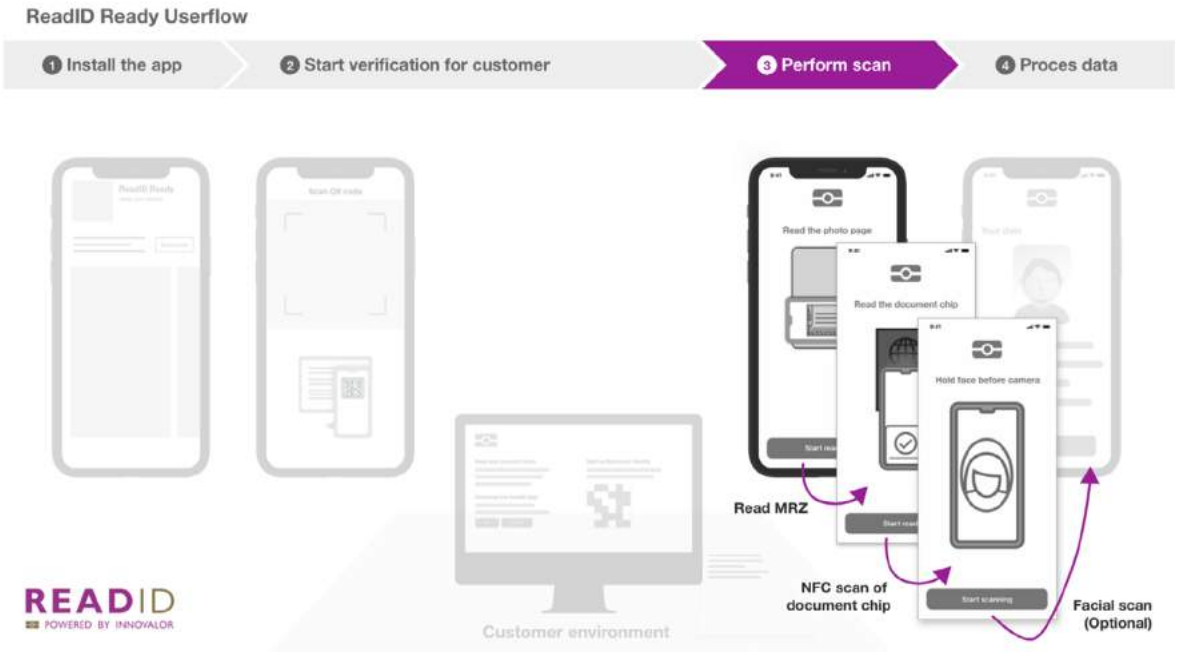


Figure 3.4: User flow perform scan

3.2.4 Present results

The verification process has now been executed. The user will receive a confirmation with their document details and photo (figure 3.5). The application can now be closed and removed.

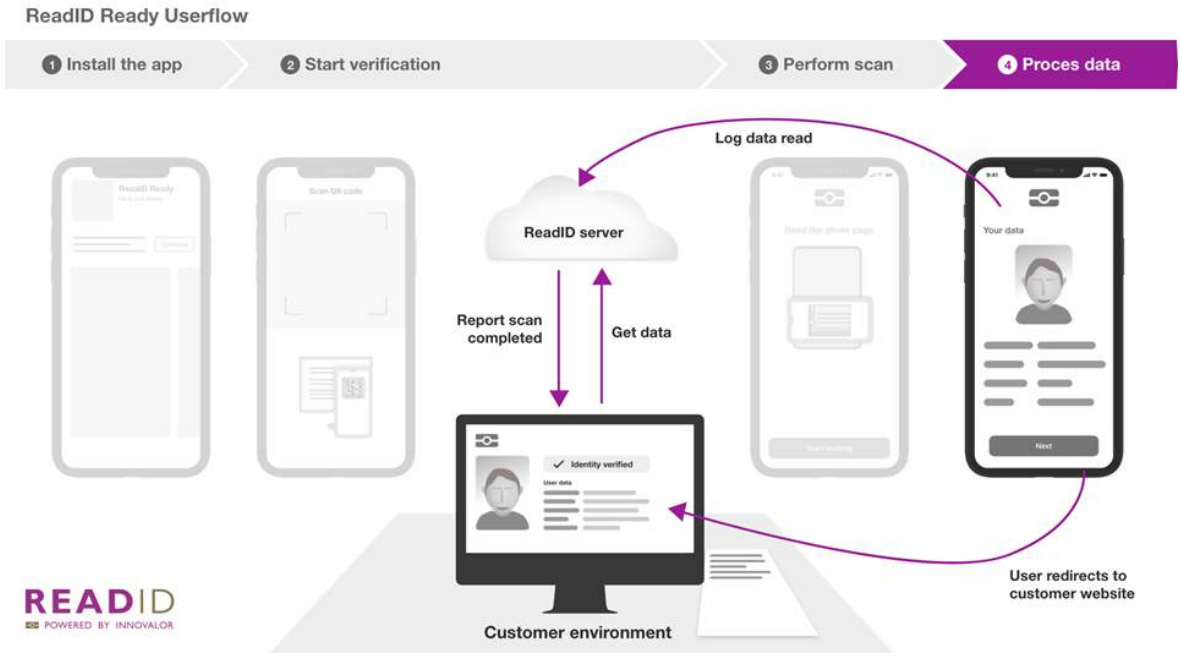


Figure 3.5: User flow confirmation

3.3 Accessibility analysis

Inclusive design and accessibility are closely related with one another. According to the literature research from section 2.4, accessible design is focused on a set of design principles, whereas inclusive design entails the overall design approach one takes when designing a product (Shalamova, 2019). The most widely accepted standard in this area are the W3C WCAG guidelines, adopted as an ISO/IEC International Standard (ISO/IEC 405000:2012) (Fuglerud, 2014). These guidelines stand in relation to the communicated information of a mobile app, making an accessibility analysis of the ReadID Ready application a logical next step. Explorative examples of obstacles users might face while interacting with the ReadID Ready app will be visualized.

The WCAG documents explain how to make web content more accessible to people with disabilities (Kirkpatrick et al., 2018). In this case web content refers to the information on a web page or web application, including:

- Natural information such as text, images and sounds
- Code or markup that defines structure, presentation etc.

These guidelines can also be applied to mobile web apps, native apps and hybrids apps when taking into account special considerations (Patch et al., 2015). In the European Union, all the official websites of the EU institutes should follow the WCAG 2.0 guidelines, where the top-level pages confirm to level AA (Web Accessibility Policy | European Union, n.d.).
In this section of the chapter, the current accessibility status of the ReadID Ready app is examined based on the WCAG 2.1 guidelines. This is newest set of guidelines, updated from WCAG 2.0. The WCAG guidelines are divided over four principles that provide the foundation for accessibility (Kirkpatrick et al., 2018):

1. **Perceivable:** Information and user interface components must be presentable to users in ways they can perceive. Content should make sense.
2. **Operable:** User interface components and navigation must be operable. A user should be able to navigate through an application easily.
3. **Understandable:** Information and the operation of user interface must be understandable. The language used should be easy and not complex.
4. **Robust:** Content must be robust enough that it can be interpreted by a wide variety of user agents, including assistive technologies.

The WCAG 2.1 guidelines are categorized into three different levels (Kirkpatrick et al., 2018):

1. *Level A:* The lowest and easiest level of conformance to obtain. This is the minimum level of accessibility and does not enhance a wide accessibility range for a variety of situations.
2. *Level AA:* The mid-range and most common level of conformance to obtain. This is the recommended accessibility standard for applications and online services.
3. *Level AAA:* The highest and hardest level of conformance to obtain. It is however not recommended to strive for full AAA compliance as it is not possible to satisfy all level AAA criteria. Yet trying to obtain this level in some elements is recommended.

The researcher decided to not put a focus on the levels of accessibility (A, AA, AAA), these levels are meant to indicate what guidelines to tackle first, but should not be used as a literal scoring guide. Especially the higher levels (AA and AAA) depend heavily on the purpose of an online service. One could for example try to comply with sub-criteria **3.1.6 Pronunciation** (Kirkpatrick et al., 2018); *"A mechanism is available for identifying specific pronunciation of words where meaning of the words, in context, is ambiguous without knowing the pronunciation."* But this is not applicable to the ReadID Ready application. Putting a focus on these levels is therefore out of the scope of this research.

3.3.1. Analysis

The accessibility analysis of the ReadID Ready app (version 3.76.6) is conducted on an Android 8.0 steered Huawei P20 lite device, using a passport. The four principles each have their own subset of guidelines. During the analysis, each guideline is tested in order to see if it complies with the sub-criterion. The WCAG 2.1 accessibility guidelines are a set of instructions, rather than a set of requirements. The goal and function of the application determine whether certain guidelines are met, and in what manner. Each guideline is information intended to advise designers and developers, meaning that it does not need to be followed very strictly. This is also taken into consideration during this analysis.

3.3.2. Results

In appendix D, the complete table with guidelines and sub-criteria can be found. Whether the application complies with the criteria is indicated with either a pass or a fail, sometimes certain criteria were not applicable due to the goal and function of the ReadID Ready application. In this section, the most important findings per principle are explained. The extra accessibility considerations for mobile applications are addressed as well. Explorative examples of obstacles users might face while interacting with the ReadID Ready app are visualized.

Principle 1: Perceivable

Information and user interface components must be presentable to users in ways they can perceive. Content should make sense.

- *Non-text content:* ReadID Ready makes use of a lot of non-text content, which is often preferred by older adults according to the literature research (Karvonen, 2000) (Faraday, 2000). There are however not many text alternatives present. Bits of text are shown besides the animations but these are additions, rather than non-text content. This means that there are no alternatives provided for the animations. If the user does not understand the animation, they will most likely get stuck in the process (figure 3.6).
- *Adaptation and distinction:* The steps are presented in a meaningful sequence, and the usage of colour is distinguishable. The application cannot be turned into landscape mode, as portrait is the standard.

Mobile accessibility considerations

- *Small screen size:* The small screen size is taken into consideration, as this application is designed to be used on a smartphone. The amount of information present in the application is kept at a minimum.
- *Zoom/magnification:* Text size can be adjusted by the preference of the user in the smartphone settings. It is not able to change the size of the font in the application itself. When the zoom function of the smartphone is used, text is still clearly readable.
- *Contrast:* The minimum contrast level is acquired. The ratio between the purple and white color is 6.73.

Figure 3.6: Explorative obstacle 1, non-text content.

Principle 2: Operable
User interface components and navigation must be operable. A user should be able to navigate through an application easily.

- *Time:* The application provides the user with enough time to complete actions, as there is no time limit. There is no option for the user to pause, stop or hide the animations and carrousel.
- *Authentication:* If the user leaves the application in the middle of the process, the personal information is lost. Hence, this is essential for the privacy protection. Users are warned about the inactivity of the QR code for 30 minutes, but not the loss of their progress.
- *Flashes:* In the face step, flashes are present that appear more than three times in a second. According to the guidelines, this can cause physical reactions. Some kind of warning should be given to the user.
- *Navigation:* The user will immediately step into the verification process, meaning that he or she is not distracted by other functions. However, various screens within the Ready mobile app do not have titles or step indications, thus the user does not know how far he or she is in the process. Nowhere is mentioned why suddenly new kind of animations are shown, possibly resulting in an older adult not knowing how to proceed or what to do (see figure 3.7). Extensive titles would not make sense to use, as this only causes more confusion for the user. Simple titles or descriptions could nonetheless be used.

Mobile accessibility considerations
- *Touch target size and spacing:* The bigger elements present in the application such as the 'next' buttons are at least 9mm x 9mm high. This is however sometimes not the case for smaller elements, such as the 'I' button.
- *Touchscreen gestures and placing buttons where they are easy to access*: The used touchscreen gestures are currently very simple, users only have to click on the next button at the bottom of the screen to continue in the process. The manual input needed can however be harder to understand for the user, as this is often a process that has not been done before.

Figure 3.7: Explorative obstacle 2, navigation.

Principle 3: Understandable
Information and the operation of user interface must be understandable. The language used should be easy and not complex.

- *Use of language:* Content is written in clear and simple English and Dutch. No abbreviations are used except for the term NFC. What the term NFC exactly means can be found in the more information section. If the user wants to get to know more about the ReadID application, before starting the process they are redirected to the English ReadID website. This website is not available in Dutch, which can be hard for older adults to understand. The ReadID FAQ page is however available in Dutch, with some Dutch instructions on how to use the app. This would not be the first place where the user would look for more information on the ReadID Ready app and its instructions.
- *Prediction:* Before the start of a task, users are advised on how to conduct the task and in what manner with the help of animations. No navigational system such as a menu is present in the application. The outlines of the pages and its elements are consistent, making it easy to navigate through the steps.
- *Error identification:* In all of the steps, suggestions are given to prevent the user from making mistakes. Subsequently, a confirmation is presented in the end, where all the gathered information is shown. During the scan step, the suggestion for manual input is given. Similarly, the read step makes use of the help carrousel. The fact that the help carrousel gives tips to the users is however not clear (see figure 3.8). If the NFC chip loses connection with the identity document, the message 'lost connection' is shown. This can confuse the user as it is not always known what type of connection is meant.

Mobile accessibility considerations
- *Changing screen orientation*: It is not possible to change the screen orientation of the application. The default setting is portrait. For the usage of the camera of the MRZ scan, the orientation is in landscape. Whereas in the face step the front-camera is positioned in portrait.

- *Consistent layout:* A consistent layout is present in the application. The default settings are kept the same throughout the verification process. Operable elements that perform a particular action are always the same and all of the elements have another function.
- *Indication that elements are actionable:* Elements that trigger a change in the application, can be clearly distinguished from static elements such as the animations and short text descriptions. Also the elements are positioned in a consistent way.
- *Provide instructions for custom touchscreen and device manipulation gestures:* As user input is required with physical documents, animations are shown that explain the desired action. There are however not much text alternatives present.

Figure 3.8: Explorative obstacle 3, error identification

Principle 4: Robust
Content must be robust enough so that it can be interpreted by a wide variety of user agents, including assistive technologies.

Sub-criteria in this section had a focus on the programming language of the application, meaning that this section is aimed more at developers of an application and therefore sometimes out of the scope for this research.

Mobile accessibility considerations
- *Provide easy methods for data entry:* Data entry is only possible in one specific way by the user performing the required actions in a right manner. No manual text input on a keyboard is needed from the user.
- *Support the characteristic properties of the platform:* It is possible for the users to adjust the font size of the application by themselves in the settings of the device. Horizontal scrolling does not occur, vertical scrolling one or two times. The zoom function is available when turned on by the user in their own settings.

3.3.3 Discussion and conclusion

In conclusion, this analysis gave a first insight on the current accessibility status of the ReadID Ready application. In terms of **perceivability,** the ReadID Ready application scores really well on visualizing information. Visualizations always have the preference over big chunks of text. There are however almost no non-text alternatives present, except for short descriptions of text. If an animation is not understood by an older adult, these descriptions will not suffice in explaining the correct message towards the user. In most of the use cases, the manual input and actions needed from the user to finish the process are new, making them harder to understand.

The ReadID website is available in English, only the FAQ page is available in Dutch. Understanding the English website can be hard for older adults, who do not speak the English language fluently. It is of course not possible to translate the language of the ReadID website for every country in which ReadID is used. Nonetheless, since the majority of ReadID's customers are located in the Netherlands, translating the entire website to Dutch would be a good suggestion.

The second principle, **operability,** demonstrates a correlation between navigation of the application and headers used. Once the user starts the verification process in the application, they are not distracted by too many features or functions; the steps that need to be taken are the center of attention. Nevertheless, one does not know where thet are situated in the process nor the amount of steps that need to be taken. No headers, titles, descriptions or numbers are used to indicate this.

Information present on a user interface has to be **understandable.** Error prevention plays in this principle a key role. In all the steps, the application suggests how to overcome a variety of challenges. In the NFC step, ReadID uses a help carrousel. It is made clear in no manner that this carrousel is shown to help the user, causing possible confusion for older adults as to why new animations are suddenly shown.

With regard to **robustness**, the ReadID application only provides one way of data entry. On the one hand it limits the possibilities for older adults to provide the customer with the needed information. Yet on the other hand, it is not easy to integrate because of security and technology restrictions.

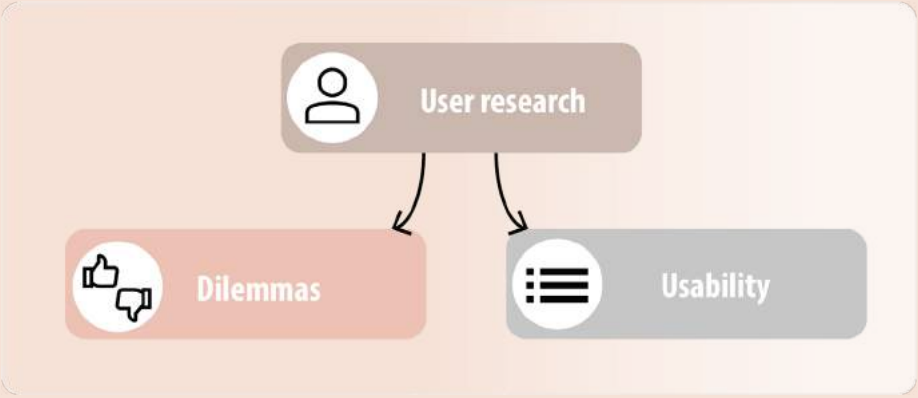
The data suggests that in terms of accessibility the ReadID Ready application can take into account some considerations for older adults. It is however too soon to state whether these forethoughts actually need to be integrated in the application. User research with the target group should either confirm or contradict these findings. At the end of the user research chapter in section 4.6.1, the accessibility analysis is compared to the overall usability findings of the user research. This will result in design specifications for the Ideation phase of the project.

Limitations in the study

This analysis is conducted by only one person, conducting the exact same analysis with more than one person could have let to more insights. Also, the interpretation of certain WCAG 2.1 guidelines can depend on someone's individual opinion. The researcher tried to stay as objective as possible when conducting this analysis and always reviewed a variety of examples of each criteria before inspecting the actual ReadID Ready application.

4. USER RESEARCH

Designing revolves around the user, it is therefore of key importance to talk to one's target group. Within this chapter, the ReadID Ready application will be reviewed in practice. An extensive user research with the target group is conducted, actual practice scenarios (Anggreeni, 2010) will capture the current challenging situations that older adults face when interacting with the ReadID Ready app. The following sub-questions are answered in this section: *What usability challenges arise when older adults use the ReadID Ready app? What are the needs of the target group in regards to inclusive design and which dilemmas arise when older adults make use of the ReadID Ready app?* In the end, dilemmas that baby-boomers experience are identified. These dilemmas will function as a design space for the remainder of the Thesis.



4.1 Objective

Time to start talking to the users! In order to generate a complete picture of the user experience for older adults, the most important step in the research phase of this Thesis is to talk and test the application with the target group. The objective for this user research is to:

1. **Gain insight in user concerns and dilemmas:** What are the concerns and dilemmas that older adults experience whilst interacting with the ReadID Ready app?
2. **Difficulties:** What usability issues arise when older adults interact with the ReadID Ready app?

Actual practice scenarios (Anggreeni & van der Voort, 2008) are developed, in which the problems that older adults face when they interact with the ReadID Ready application are framed. This allows the researcher to identify user needs for a potential solution space.

4.2 Participants

Older adults aged between 55 – 75 years old participated in the user interviews. According to Nielsen & Landauer (1993), you need to test an application with at least five users in order to find almost all of the usability problems. The goal for the researcher was therefore to recruit at least N=5 participants, with a maximum of N=10. In the end, a total of 8 participants were recruited through the researcher's social circle and InnoValor's employees. A plan was written for both physical interviews and remote interviews. All of the participants agreed to a physical meeting, taking into consideration the current Covid-19 regulations at that time (March 2021). The interviews were conducted at either the InnoValor office or in a home setting.

A total of eight interviews were conducted with older adults aged between 55 – 75 years old. With the youngest participant being 55 years old and the oldest one 68 years old, the mean age was 63. The researcher reached out to two possible participants in the age range of 70 to 75 years old as well. Unfortunately, both of them emphasized that they would normally not conduct such a process, as someone else in charge of these matters and therefore did not want to participate. In appendix E the data of the participants can be found, including type of phone and documents used.

4.2.1 Ethical approval

The Ethics Committee from the Faculty of Engineering Technology of the UT has given approval for conducting the user research. Permission was given based on a variety of documents that had to be submitted (Appendix E).

4.3 Set-up of the user research

The user research sessions are set-up by means of a 3 step approach, this set-up has been finalized by means of a pilot-test. A simplified script of this set-up can be found in appendix E.

1. Sensitization

Sensitizing is often used to trigger, encourage and motivate participants to think and reflect about a certain topic (Visser et al., 2005). A sensitization booklet was created for the participants to get familiar with the topics 'identity verification' and 'remote identity verification'. This booklet consists of three exercises in which the user can explore their personal context to the topics (see appendix E). A week before the meeting between the participant and researcher would take place, this sensitization booklet was sent.

Answering questions with an open mindset is not something older adults do often, and it therefore might take them some time to be able to do so. In the sensitizing booklet, questions are asked in such a way that they are very open and allow the participant to generate an answer from their own experience. At the same time, it is clearly instructed what is expected from the participant by means of small examples. The following exercises are present in the sensitizing booklet:

1. *Warming-up:* Participants are asked to fill in a word web and write down what comes to mind when they think about the topic 'identity verification' and also 'remote identity verification'.
2. *Personal identity verification:* What are the personal experiences from participants with identity verificication, both physically and remotely? They will provide at least two examples, from which one has to do with remote identity verification.
3. *The experience:* How did the participants experience the times that they had to verify their identity? Which feelings occurred to them and why? In this step, visualizations from the Emotion Measurement Instrument (Blythe & Monk, 2018; Desmet, 2019), also addressed in this section as 'PrEmo', are shown to the participant. These emotions consist of 7 positive and 7 negative emotions from which the participants will make a choice and further explain themselves.

Once the interview between the researcher and participant begins, the first step is going through the different exercises of the filled-in sensitizing booklet as means of a reflection and introduction into the topic of 'remote identity verification'. The interview is recorded via audio. Afterwards, this reflection will serve as an input for the researcher to question the participant about the concerns, considerations and values he or she goes through before actually deciding to verify oneself remotely. What is important for the user to consider before starting the verification process? Where does the user pay attention to and why? Which matters, values and concerns play a key role in starting this process?

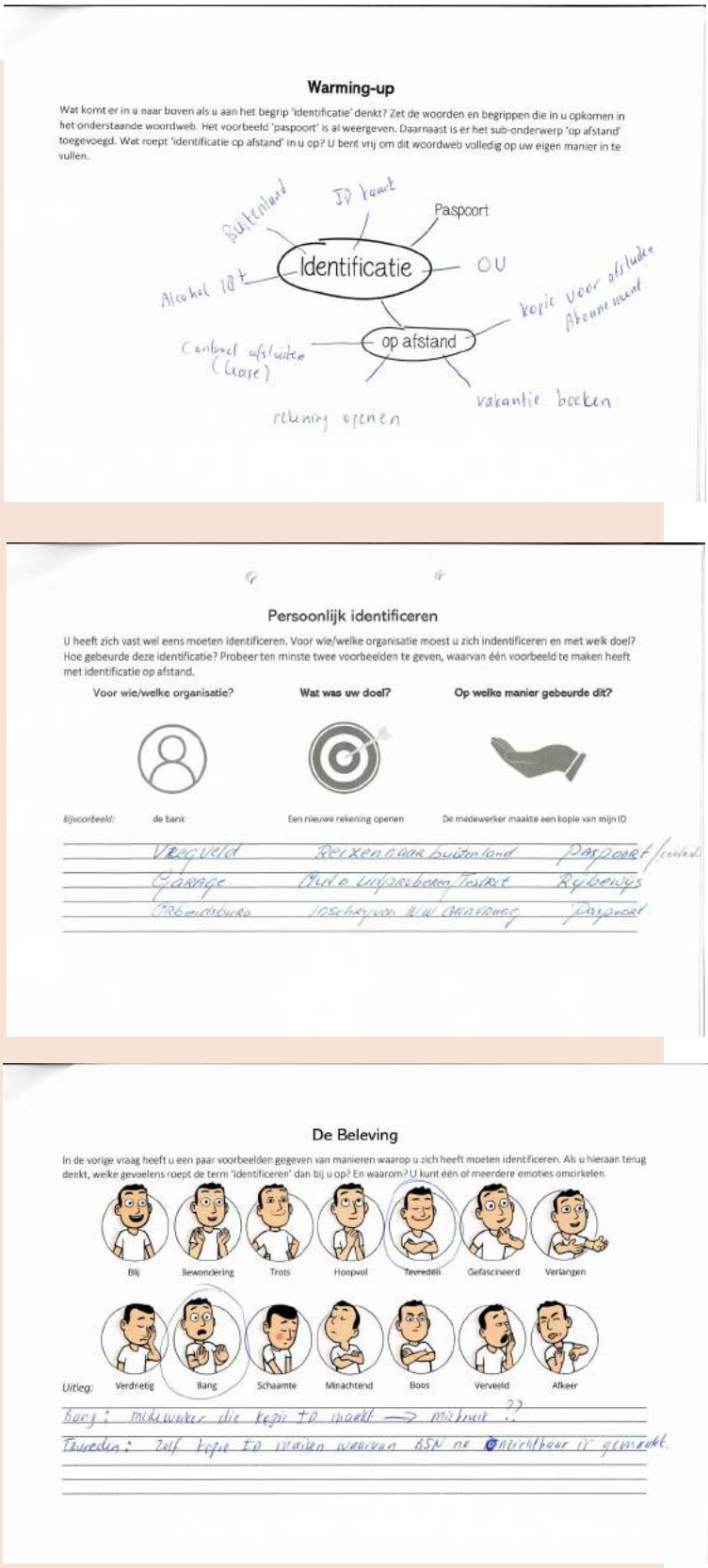


Figure 4.1: Exercises booklet
See also appendix E.

Understandable, open-ended questions will help the participant to clearly formulate answers on the pre-usage experience.

2. Using the ReadID Ready application

Now the time has come for the participant to actually start using the application. First, a scenario is given to the participant, this scenario describes the situation as to why the user needs to verify their identity; the participant will soon stop working, but in order to be able to receive a pension, a last step has to be conducted. The user needs to identify oneself for the pension insurer called 'Innova'. The scenario can be found in appendix E. By giving a scenario, the participant can relate to the story and imagine beign part of such a process.

Subsequently, the participant is introduced once again to the PrEmo cards. PrEmo measures distinct emotions and combinations of emotions but does not require the participant to extensively verbalize these emotions (Blythe & Monk, 2018) (Desmet & Wassink, n.d.). This tool is used as a trigger for the participants to express their feelings throughout the verification process in the post-usage interview. The choice has been made to show the cards before the app usage, so that the participant can already get used to the idea of using this tool. Instead of the 14 emotions, the researcher decided to only show the participants 8 emotions (figure 4.2), based on feedback in the first two participant interviews. Participants thought that chossing from a set of 14 emotions was too much, and too time consuming.

Figure 4.2: PrEmo cards (Desmet & Wassink, n.d.)

Now that the reason for verifying one's identity is made clear, a laptop with an instruction webpage is presented to the participant. This webpage is meant to guide the user through the complete process, and is based on the current example webpage InnoValor presents to its customers (appendix E). From now on, it is up to the participant to finish the verification process (figure 4.3). Participants are asked to make use of their own mobile phone and are provided an alternative phone if theirs is not compatible with the ReadID Ready application. Next to this, the participant is given the choice to use either their own identity document or borrow one from the researcher. If the participants own identity document is used, the Face step is also included in the verification process. If not, the Face step is not included in the process since this would cause an error. The researcher would have to interfere, which is not in line with the normal user experience and the Covid-19 guidelines at that time would also violated.

The participant is asked to talk aloud during the app usage, sharing the thoughts and the actions that are performed. The researcher now functions as an observer and makes notes on an observation form. She will not help or guide the user in the process, only when there is no other possibility and the participant really gets stuck after some time.

Once completed, the researcher will talk with the participants about all the steps taken in this process in the post-usage interview. Each step is addressed during this post-usage session by means of questioninh. The participant is asked to use the PrEmo cards This is done in order to gain as much input from the user as possible. Question are asked like: *"How did the completion of the step go? How did you feel when performing this action? What went well and what was difficult for you?"*

Figure 4.3: Setting participants

3. A creative brainstorm
Before the usage of the application, the participants were questioned about what matters to them in an identity verification process. The concerns, values and standards that the participants find valuable and meaningful were written down by the researcher. After the participant has finished the verification process, there will be a 10 minute break. During this break, the researcher writes down these different values and standards on sticky notes. These notes are put in front of the participant on the table.

After the break, the participant is introduced to the new exercise; the goal is to determine what the ideal remote identity verification process would look like for the participant. The researcher will try to answer this question together with the participants by discussing the different descriptions on the sticky notes. Example questions could be: *"Why is the feeling of trust important to you? How is this generated and why?"*. As the ReadID Ready application has now been used, it is anticipated that the participants can give more complete and in-depth answers than before using the app. This exercise is conducted one-on-one or with two participants at the same time. Some of the participants are in fact a couple, which makes completing this last step more interesting together as insights and opinions can be shared with one another. The participants are provided with a small toolkit for them to express their ideas: a mini-whiteboard, sticky notes, screenshots of the popular apps, pen and paper (figure 4.4).

Figure 4.4: Setting Creative Brainstorm

4.4 Analysis

The eight interviews resulted in set of qualitative data, consisting of: eight sensitization booklets, around 14+ hours of audio recording, sticky-notes from the creative session and eight observation forms.

A thematic analysis in conducted on this set of data, which is a method for identifying, analyzing and reporting patterns or themes within data (Boyatzis, 1998). Please refer to section 2.2.2 of this Thesis for a more elaborate explanation on a thematic analysis. Quotes are extacted from the interviews in order to identify theme's and sub-themes by means of relation mapping. These theme's will guide the researcher in formulating a variety of dilemma's which the user experiences in the ReadID Ready process. Next to this, the overall usability of the ReadID Ready application is determined during the usage stage. The difficulties that older adults experienced are mapped out and compared with one another.

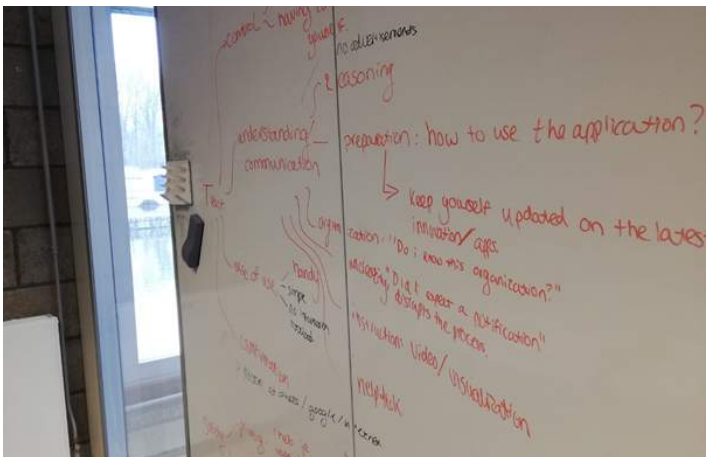


Figure 4.5: Snapshot thematic analysis

4.5 Identified Themes

The first goal for this user research was to determine which concerns and matters are important for older adults during the user experience. Themes are divided in the different stages of the user experience.

Pre-usage

The leading emotions in the pre-usage stage are trust and safety have a look at figure 4.6 and 4.7). Enough trust must be generated in order to convince the user to start using the application. This goes hand in hand with the feeling of being safe; one's personal information such as their name, place of residence, document number and BSN number are obtained. If this is not secure, the user's data might fall in the hands of the wrong person. The feeling of trust generates the feeling of safety and vice versa.

How is the feeling of both trust and safety generated? Different sub-themes that play a key role in answering this question will be explained.

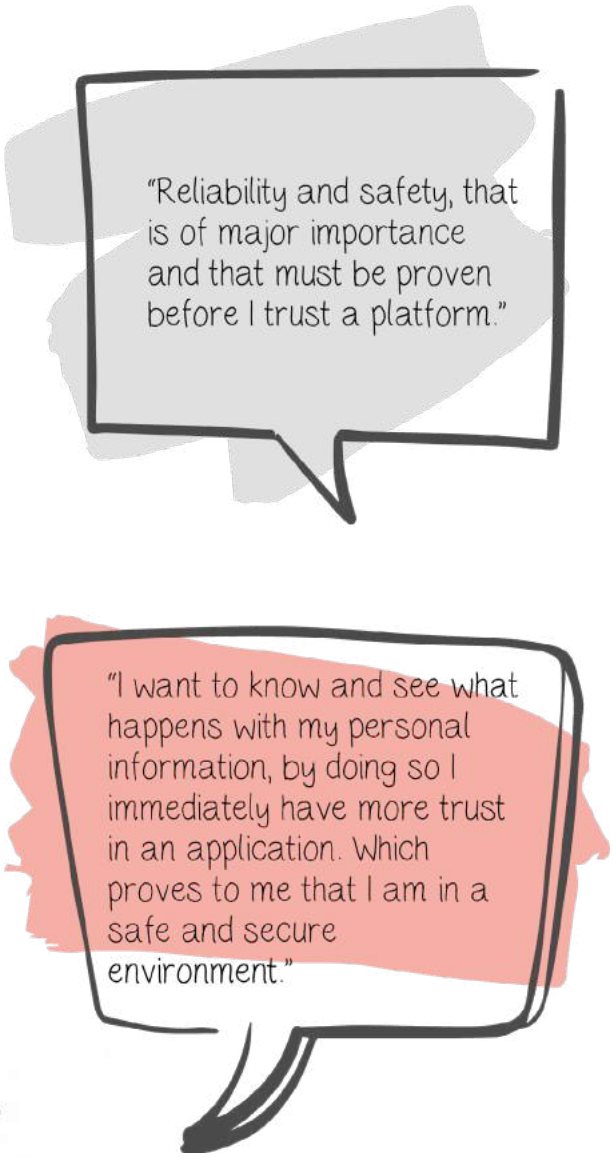


Figure 4.6: Participants emphasize their opinion on safety and trust.

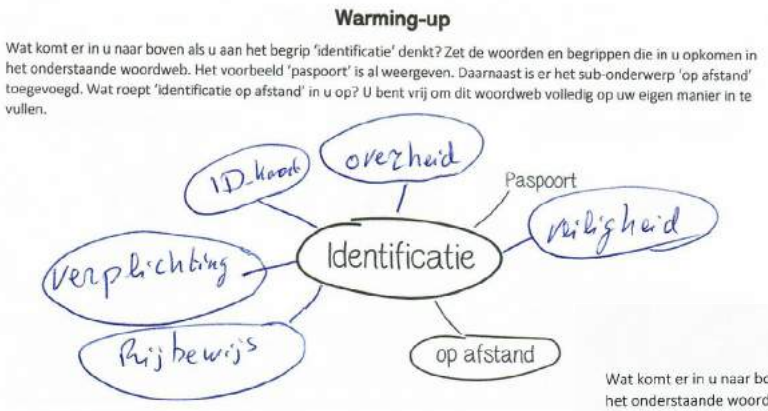
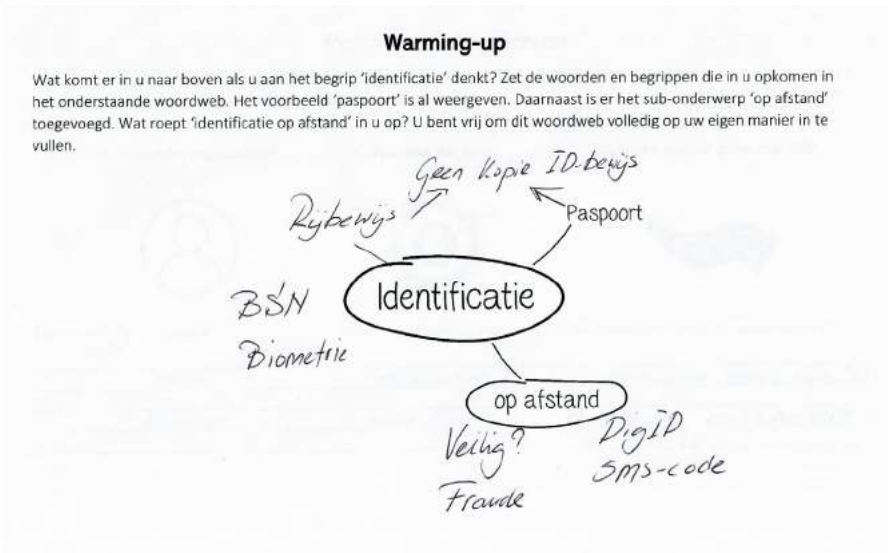


Figure 4.7: In the first assignment, some participants already emphasized the importance of safety for them.



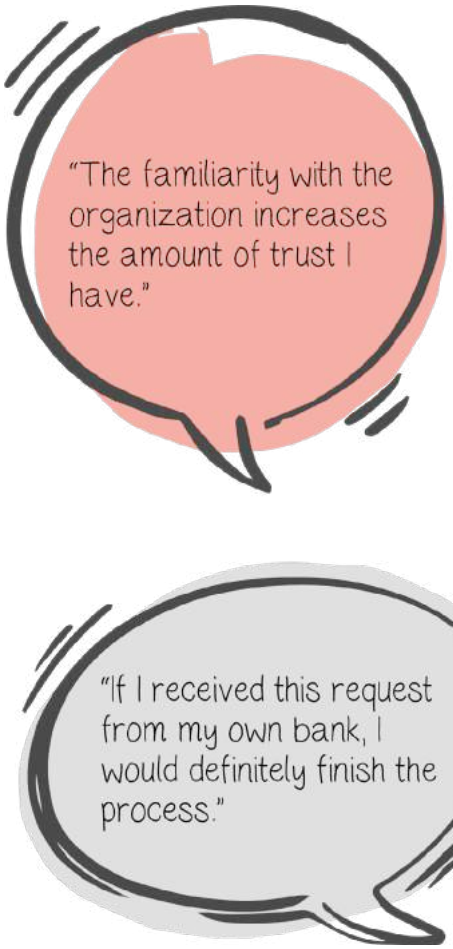


Figure 4.8: Familiarity plays a key role

Secondly, the way how the request is explained towards the user has an impact. The reason for verifying one's identity has to be made clear and meaningful (figure 4.9). Was the user informed in a correct manner? This can for example be done by sending a letter or e-mail. Participants emphasized the fact that they would like to receive more than one notification about this in advance. The language used should be in one's mother tongue and clearly written. In case the goal or information send is confusing, the user's mindset will immediately go into an alarming state. Fear of fraud is a reason for this, as explained in the next section.

1. Understanding of what is expected, by means of communication

If a user is requested to finish an identity verification process it is of major importance for the user to understand why this procedure needs to be carried out, and in what way. Communication is leading in the formation of one's expectation and view.

First of all, the company or organization requesting the user to verify themselves gives a first impression. Participants want this organization to be well-known and familiar to them (figure 4.8), take for example a bank or insurance company. If this organization is not known, small and unfamiliar to the user, such a request would

Figure 4.9: Explaining the reason in a clear way helps users understand.

Lastly, the possibility to receive help or guidance throughout the process is of crucial influence for older adults (figure 4.10). Is there some kind of instruction available for the user to read? This can be achieved in a variety of forms, e.g. in an e-mail, letter, webpage, visualization or a video. Additionally, the opportunity to asks questions if needed is essential in the opinion of older adults e.g. in the form of a helpdesk, chatbot, FAQ's or acquaintances.

Precise and straightforward communication results in the feeling of **assurance, confidence and clarity**. Whereas vague or incomplete transmission of information produces **insecurity, fear and confusion.**

Figure 4.10: Users want to be able to ask questions

Figure 4.11: Being careful online

2. Protection of personal data in our digital society

Digitalization has made its impact during the 21st century, it is impossible to ignore and one has to get adjusted to it. Baby-boomers did not grow up with all this new technology. Older adults are often afraid to lose their privacy because of this digitalization. As it is a new and novel process.

Messages of data leaks are all over the media. Older adults are frightened to lose their personal data because of this. A few of the participants were involved in these data leaks as well, sometimes even losing money or needing to block their credit-card. The government, banks and insurance companies try to warn the older adults for phishing emails users by means of advertisements and messaging (figure 4.11). Therefore, the majority of the participants try to look for some kind of indication of vague messaging or untrustworthy information.

The fact that it is becoming almost impossible for older adults to catch up with all the technological developments nowadays makes them sometimes feel **insecure and worried.** While, the thought of their personal data being hacked results in being more **careful, anxious, fear** (figure 4.12) and sometimes even **anger.** This sometimes **motivates** them to try and keep up bit with the new possibilities through the news and media.

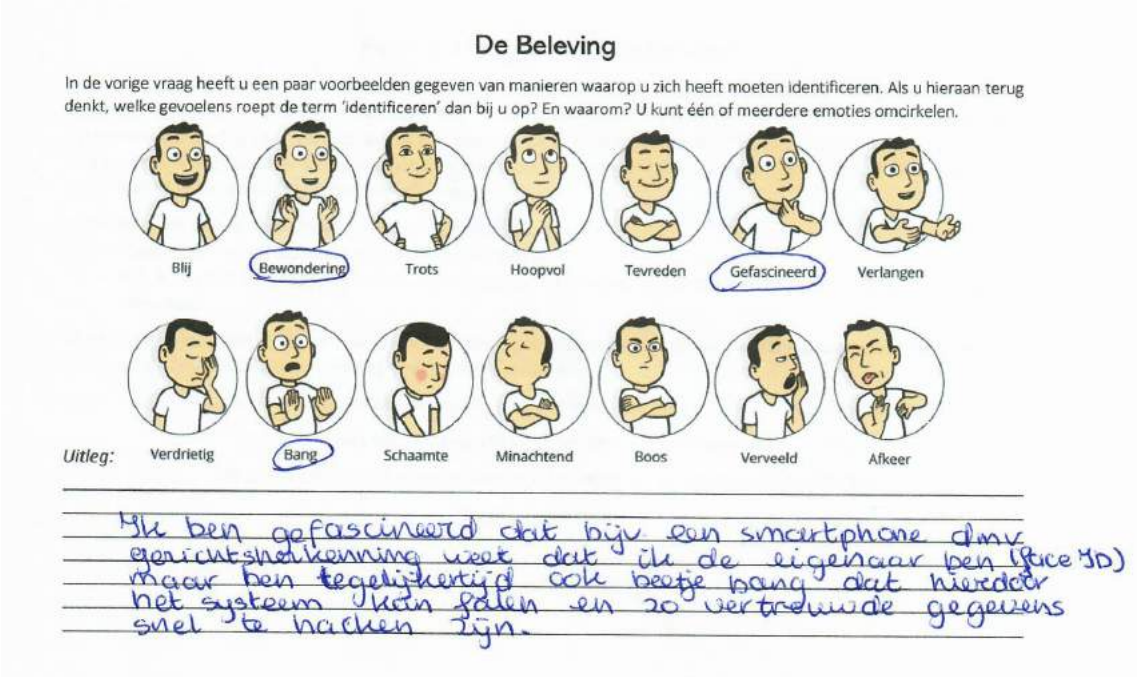


Figure 4.12: Fascinated and scared at the same time because of data usage

3. Control
Who is in control during the verification process? This can either be oneself or someone else, for example an employee from an organization or acquaintance. In the beginning of the 2000's it was considered completely normal that someone else had the control in an identity verification process. This is not the case anymore; the majority of the participants has experienced some kind of self-control through for example DigiD or KopieID.

One's preference is in the case for older adults undecided (figure 4.13), as this completely relies on the person themselves. Some participants felt more secure about the overall process if they were self in control. Positive emotions evoked by being in control are **confidence** in oneself, **curiosity** and **freedom.** Negative feelings that can arise are being **unconfident, uncomfortable** and **frightened.**

Others are more used to the physical way of verifying oneself and would also choose this option if given the choice. Users have in that case more **confidence** in the traditional way, which gives them a **secure** feeling as well as the belief of **belonging**. **Boredom** can occur as an unfavorable side-effect.

Figure 4.13: Differences in opinion about control

A lot of participants gave in the sensitization booklet the example of having negative experiences with hotels and travel agencies (figure 4.14). As they often take one's identity document with them, where the user is not able to see what happens and this gives them the feeling that they **do not have control at all** anymore.

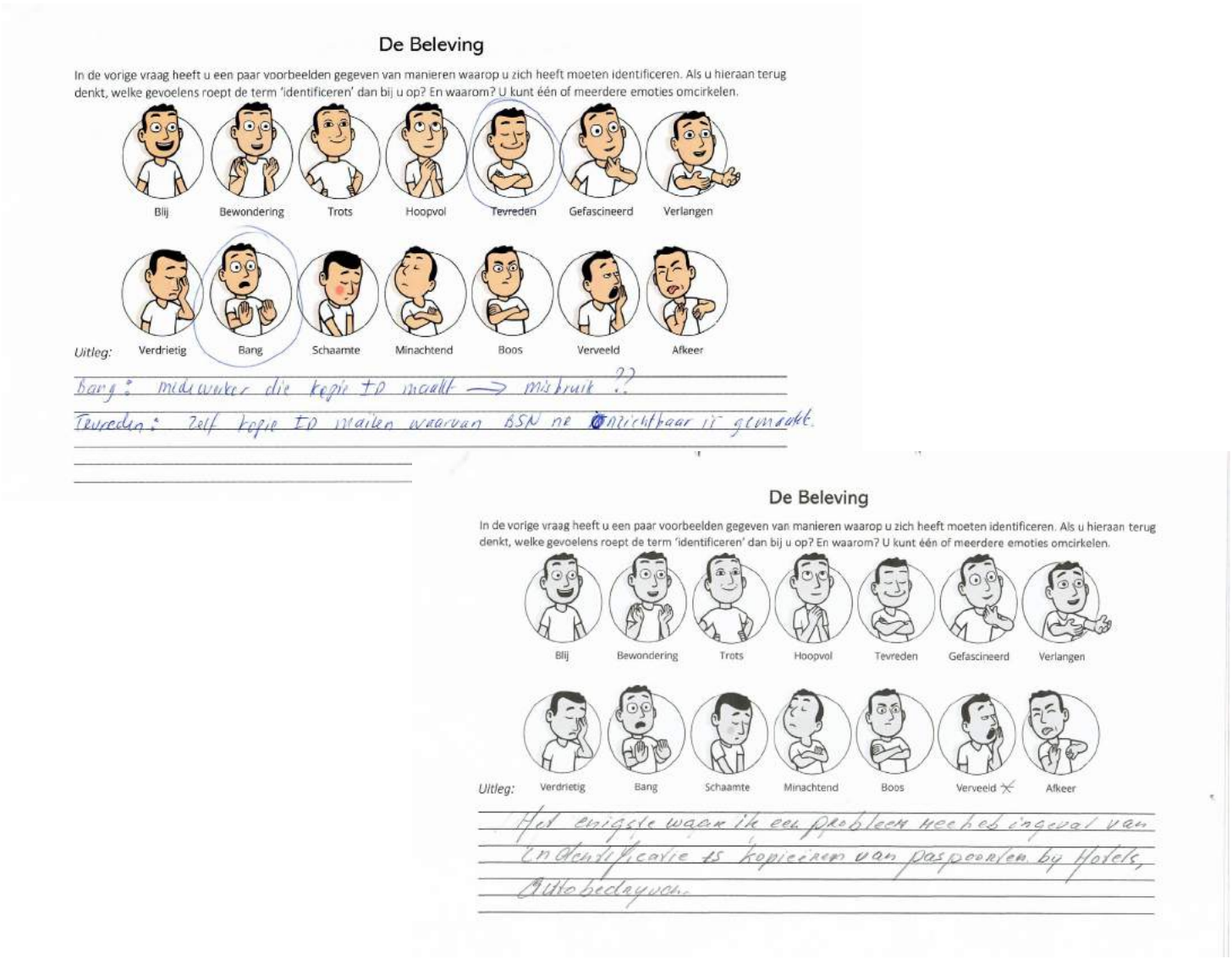


Figure 4.14: Someone else who makes a copie is sometimes perceived as scary.

When the user is given the choice of using a remote verification option or physical process, their preference will mostly rely on their knowledge of the technology, desire for human contact and one's confidence in trying out something new.

4. Travel

Travelling from one location to another has to fit in one's schedule and is therefore taken into consideration by the user as well. If the organization is rather closely located, for example in the center of the village of where the user lives, this has a positive influence. Nowadays banks and big companies are however mostly located in cities, and not so much in villages (figure 4.15). A consequence can be that the user needs to travel over a longer distance, which is not appreciated that much. Since the travel time would be bigger than the actual time that the verification process takes. If the overall travel time is rather time consuming, users often see this as a **nuisance,** which sometimes results in the feeling of **irritation.** If not, participants are rather **neutral** and **benign** about leaving their house for a short amount of time.

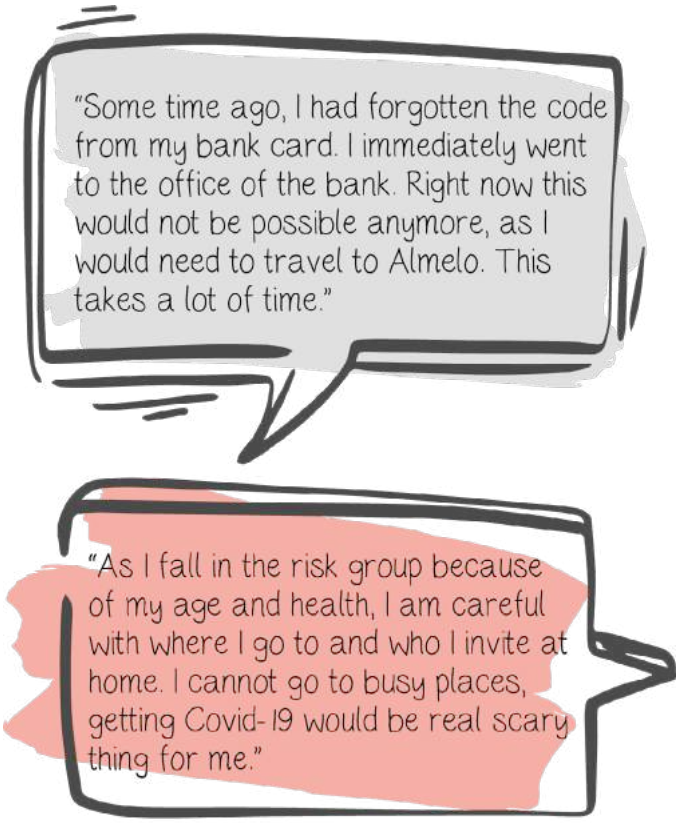


Figure 4.15: Travelling has its consequences

Besides this, the current circumstances (April 2021) with the Covid-19 virus have a big influence on how society functions. Older adults fall into the risk group, and need to be extra **careful** in order to protect themselves (figure 4.15). Leaving one's home can therefore be a boundary. Staying in one's own environment gives older adults the feeling of **security and protection**, as their health is not in danger. Of course, staying in your own environment can also be preferred if a person is more introvert or has a rather busy schedule.

A summary of the found themes and sub-themes of the pre-usage stage can be seen in figure 4.16.

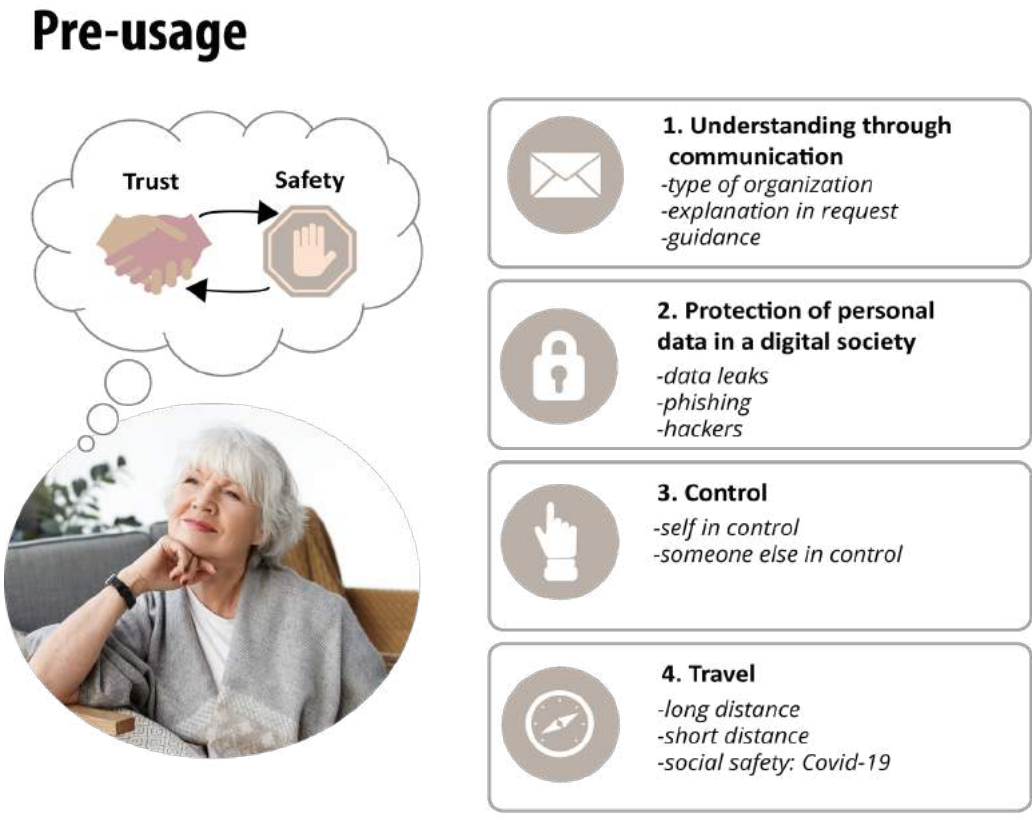


Figure 4.16: Themes pre-usage stage

Usage

Once the participant has decided to use the ReadID Ready app, the user has generated enough trust in the new innovation and believes their safety is in good hands. Participants were mostly focused on completing the actions during the usage phase, and not so much to the trust and safety aspect anymore. Only if explicitly asked about these matters, participants would voice their opinion. Once this boundary has been crossed in the pre-usage stage, the trust versus safety issue is not likely to appear again.

1. Ease of use

Older adults want the application to be easy to use (see figure 4.17). User-friendliness is an important matter for them as they are sometimes slower in understanding how an application works. Explanations should be concise and simple to get. There should not be an overload of information. Furthermore, they expect this application to be faster and less time consuming than going physically to a bank. Finishing the process without too much trouble will lead to a **satisfied** feeling. If the process is perceived to be too difficult, **dissatisfaction** will be the result.

Figure 4.17: New applications should be easy to use.

Figure 4.18: Some participants take their time, whilst other try to finish everything fast.

Figure 4.19: Some participants will first try out gestures which they are used to.

2. Time

During the usage of the application, a factor that would always come up is time (figure 4.18). Some users would take time to read through the explanations provided. Sometimes participants even wanted to know more about the process than the application or webpage provided to them. In that case, the user would surf on the internet in order to find out more about the ReadID application. If users choose to take their time for the overall process, they feel in **control.** This gives them more **certainty** and the feeling of being **precise. Boredom or disinterest** might as well arise.

On the other hand, the user could try to finish the process as fast as possible. Explanations would often not been read completely or even skipped. Finishing such a process is in this case often perceived as 'something I still need to do'. Older adults trying to quickly complete everything, often have the **confidence** that everything will be fine. Whenever this is not the case, **stress** and **worry** can turn up.

3. Input, actions and gestures

During the different steps that the user needs to take, new and unknown actions are requested. Using an identification document in combination with a phone is a new phenomenon, this impacts the way users interact with the application. Some users would first try to use gestures and interactions that are familiar to them (figure 4.19), whereas others would immediately follow the instructions from the application. Creating the link in one's head and actually starting to perform a required action is hard to do, especially if a phone is only used for the most necessary things. Using basic, universal gestures gives the user the feeling of **confidence** as it is a habit. Whereas trying out new actions and ways of input helps them to require more **knowledge** and **talent,** but can be **stressful** and **anxious** at the same time.

In figure 4.20, the identified themes of the usage stage are summarized.

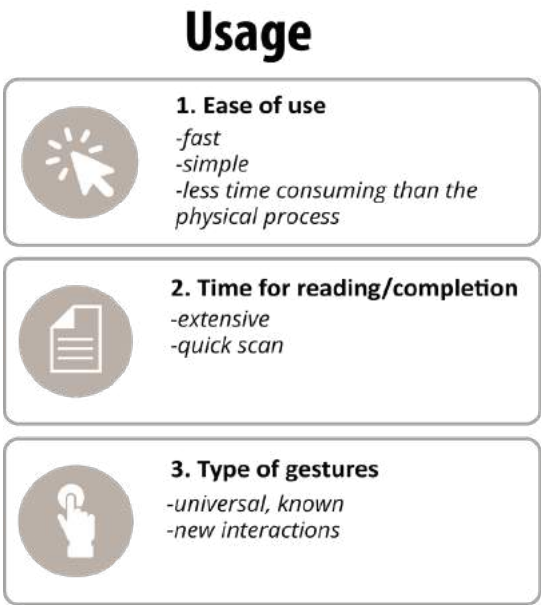


Figure 4.20: Themes usage stage

4.6 Usability challenges

The usability of a product or design is a measure on how well a specific user in a specific context can use this product to achieve a defined goal effectively, and efficiently while enjoying the experience. In order to answer the second goal of this user research, namely uncovering the usability challenges that arise during the usage of the application, the overall findings are summarized.

Installation of the app

The first step in the usage of the application was for the participants to read the Innova webpage on the laptop (4.21). The only background information provided to them was via the user scenario presented to them and the webpage. Half of the participants emphasized that *they expected a more extensive explanation* from the organization, stating precisely for what reason they personal information would be used. One could argue that this has more to do with the pre-usage stage than the actual usage of the application. A second thing that came up during the webpage reading was the fact that several participants pointed out that they find it difficult *to switch between two digital devices*, in this case a smartphone and laptop. Furthermore, the participants would either decide to take their time and *read the instructions extensively or go through it rather quickly*. Throughout the complete process half of the participants paid rather much time on trying to read the instructions, whereas the other half did not.

Next up is the app download, 3 out of 8 participants managed to easily find and download the app. Half of the participants *spelled the name wrong or decided to only input part of the name*. If only 'ReadID' is typed in the search bar, the ReadID NFC Demo app will appear as a first search result (see figure 4.22). If 'Ready' is inserted, the app cannot be found. This resulted in two participants downloading the wrong application, in their opinion there were *too many options to choose from.* Two participants first tried to download the app on the laptop, as they thought that the App/Play store can also be used here, it was not specifically mentioned on the dummy website that this has to be performed on their smartphone. Lastly, two participants searched within the web browser of their phone for the application instead of in the app store, these participants needed to get help from the researcher in downloading the app. Two participants explicitly mentioned to the researcher during the process that they were already **afraid** to get stuck before trying anything.

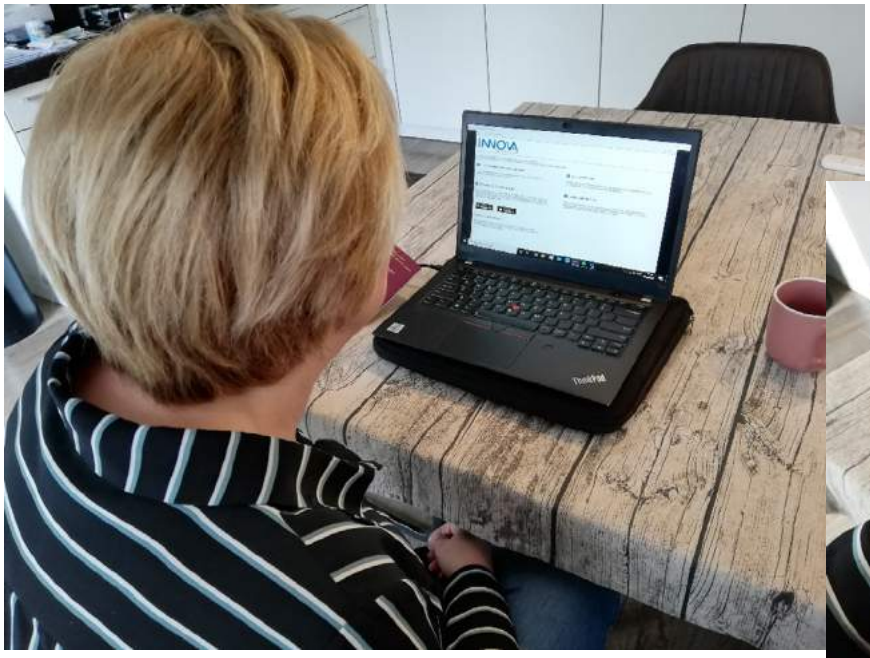


Figure 4.21: Webpage reading

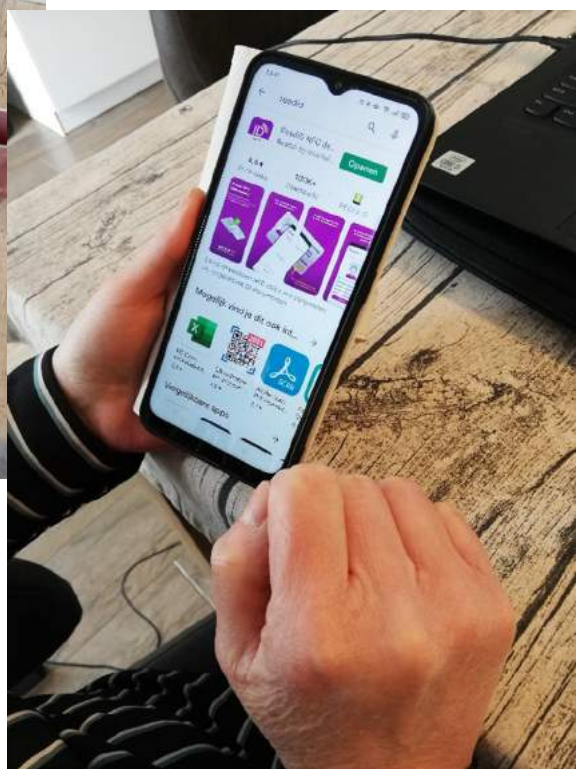


Figure 4.22: : NFC Demo app appears if typed in 'ReadID'

Start of the identity verification

Once the user has downloaded the app, the first thing they will see is the start screen (see figure 4.23). Again, whether the participants would read the information present on here is up to them. What was quite surprising is the fact that *none of the participants felt like clicking on the website link or the 'more information' section through the 'I' button*. It is of course not expected from the user to do this, but not one participant clicking here is remarkable. When questioned about this in the after-usage interview, reasons for not clicking on here is the fact that they did not notice the 'i'. Some thought it was part of the logo, others did not feel like they needed help at that point. Two participants instead used Google or looked into the settings of their phone to find out what the term 'NFC' means. This phenomenon can also be explained due to the fact that the two buttons at the bottom of the page are inviting to click on immediately, and go onto the next step of scanning the QR code.

The scan of the QR-code went well for the majority of the participants. Once a user thought she had already finished the step because of the check mark icon present in the animation and one of the users pointed the selfie camera towards the QR code. One of the participants in this step did everything exactly as was required, when she finished the step *she expected some kind of confirmation or interference when going to the next step*. She therefore thought that she did something wrong.

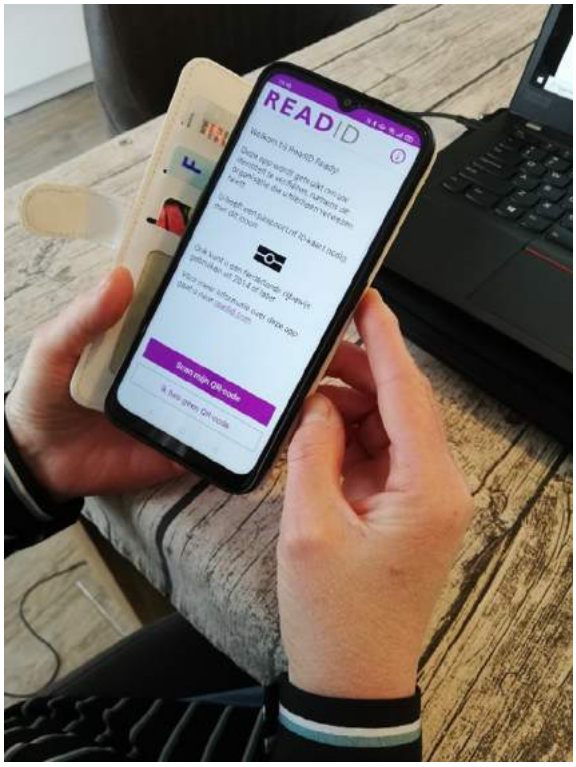


Figure 4.23: Startscreen ReadID Ready

Performing the scan
After scanning the QR-code, it is time to actually start performing actions with the identity document. First, the participants had to scan the MRZ code by holding the phone in landscape mode and positioning the camera in the right position. For half of the participants this step was easy to figure out. The other half took some more time. *Three of the participants actually first held their phone in portrait mode* (see figure 4.24), as this is usually how they take pictures with their camera. These participants often started conducting an action while the animation was still playing. The passport is a rather big document, which makes it harder to position the front page. *Two of the participants experienced this problem and would sometimes make use of objects* like a coffee cup to avoid the passport from flipping back. In the end, two of the participants received help from the researcher; once the researcher would hold the passport in place and the other time the user would conduct the right action but the system malfunctioned. Once again, a participant would be confused in this step as to whether he was finished or not after he completed step correctly.

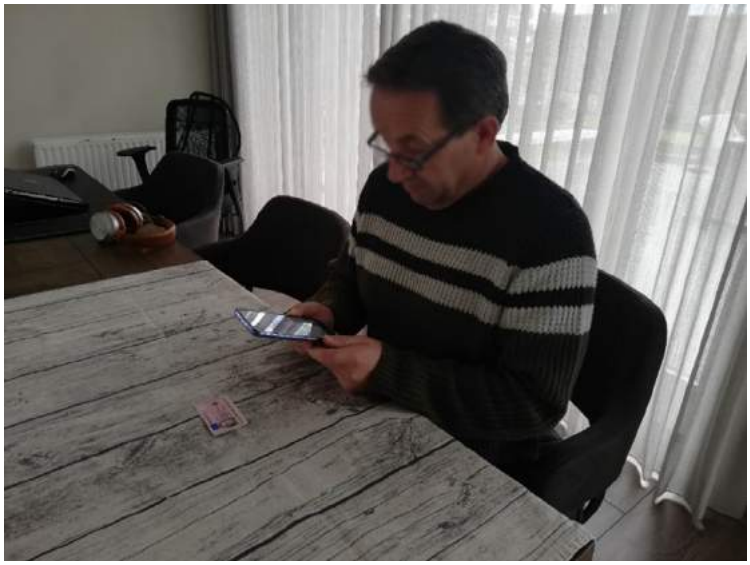


Figure 4.24: Holding the phone in portrait position

The read step, in which the user needs to hold their identity document against the phone in order to be able to read the NFC chip, *was definitely the hardest action for the participants to take* (figure 4.25). Only two of the participants managed to conduct this step without encountering the help carrousel. Often, *users do not hold their document still or take it from their phone once a connection is made*. Two of the participants first kept their document at a distance. In fact, half of the participants had the opinion that the animations shown in the help carrousel go too fast and might even contain too much advice, *resulting into an information overload for the user*. *Also the reason for seeing these help animations shown continuously is not understood clearly*. In this step, two participants were not sure as to whether they finished the step and would wait a while to see what happened. At last, four participants needed help from the researcher to finish this step. Emotions that participants experienced here were mostly **confusion, irritation** and sometimes even **anger** if it did not work as they anticipated.

A total of five participants conducted the face step, only one of the participants experienced a problem here. He would first keep the identity document against his phone for too long, and hereafter the system did not recognize him because he kept on his glasses during the scan.

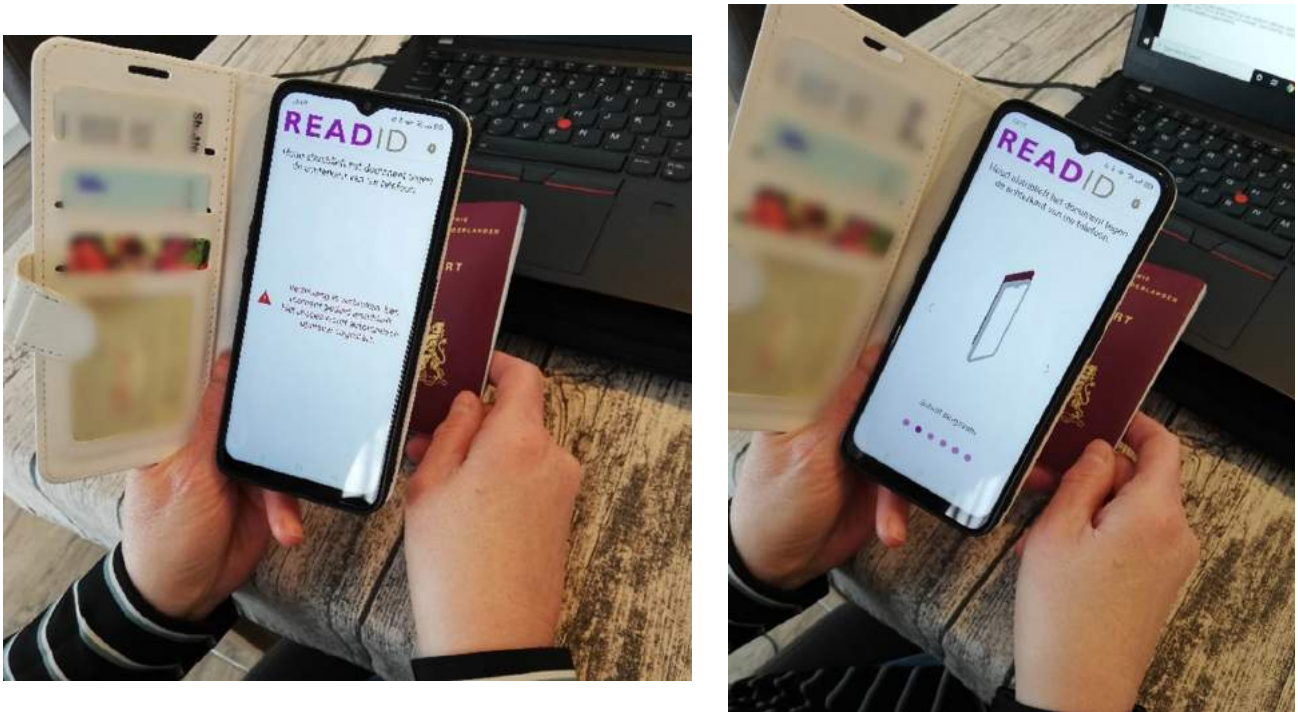


Figure 4.25: Error message and help carrousel

Present results
Once the participants completed the required actions, a confirmation screen with the document details from the user is shown after which the data will be send to the customer. All of the participants *appreciated the fact that this screen was shown to them*, as this shows that they have completed the process in a correct manner. Four from them clearly encountered the **wow-effect**, they were really amazed by the possibilities that the application has. Emotions that often occurred in this step were **satisfaction, fascination, being proud, happy** and finding the usage of the application **funny.**

After-usage
So what was the general opinion from the participants about the ReadID Ready application? Overall, the participants thought that the application was easy to use, and they would use the application again if a big organization would request them to do so. According to the participants, the threshold to make use of the application again is lower if you know how to use it. When first using the application, users are still a bit doubtful as to which actions they need to perform, this faded away after the first usage. Two from the participants still liked the traditional way better, such as physically meeting someone or using KopieID. When explicitly asked whether they had enough trust in this application, seven of them agreed. This was not specified by the participants themselves, which can be explained due to the fact that they do not think about this trust-safety issue anymore once they took the decision to make use of the application. The majority suggested the researcher to provide them with more background information before using the application.

4.6.1 Discussion

In Chapter 3, an accessibility analysis has been conducted using the WCAG 2.1 guidelines. At the end of this analysis, different findings were summarized for the ReadID Ready app. Accessibility guidelines address possible discriminatory aspects for users with disabilities (Shalamova, 2019) (Hutter & Lawrence, 2018). Therefore, integrating these accessibility requirements can actually improve the usability for all users, with the target group in this case being older adults. In addition, the WCAG 2.1 guidelines also include information on visual elements that influence the viewing behavior and aesthetical appearance of a service, which was important to consider according to the literature research (section 2.4). Comparing these findings with the usability results of the user research can provide insights for possible improvements in the ReadID Ready app.

Textual content: At the moment, visuals in the form of animations explain the actions that the users need to do throughout the application. This is great, as visuals are often preferred over big chucks of text. There is however not much non-text content is present. In case the user does not understand the animation, the text does not suffice in explaining the desired actions. Increasing the amount of textual information present would however not be suggested. Nevertheless, the textual information present in the application can in a lot of cases be fine-tuned. Texts shown with the animations is in some instances not concrete enough. Take for example the following Dutch descriptions:

1. *"Houd uw identiteitsbewijs tegen uw telefoon. Beweeg niet tijdens het lezen."* ***Could be changed to****: "Houd uw ID tegen uw telefoon. Beweeg uw telefoon en ID niet tijdens het uitlezen."*

One of the participants became quite irritated after she kept on dragging her driver's license over the back of her phone. She thought she needed to only keep her phone still and not the driver's license because of this description.

2. *"Open de foto pagina. Verschuif tot de tekst groen wordt".* ***Could be changed into:*** *"Open de foto pagina. Verplaats uw mobiel tot de tekst groen wordt."*

One of the participants thought at first that he needed to move his identity document instead of his phone in a certain direction.

Navigation/feedback: Throughout the different steps of the ReadID Ready application, participants of the user test were continuously wondering whether they finished a step or were already at the next step. It is not known were one is situated, there is currently no interference between the steps. No headers, titles, descriptions or numbers are used to indicate this. An element or screen should be added to overcome this problem, this could for example be in the form of a progress bar or step indication.

Touch target size and spacing: None of the participants clicked on the more information section of the start screen. Users often thought that the 'I' was part of the ReadID logo, and did not find it tempting to click on. According to the accessibility guidelines this 'I' button is not big enough. Adjusting this in a certain way and making it more prominent could to invite the user more to also have a look at this section of the application.

Error identification: For the participants, the read step was definitely the most difficult to understand. The NFC help carrousel was hard to figure out, its purpose was not completely clear and user often experienced an overload of information. It is not made clear to the users that these animations are shown to help them. Changing the NFC help

Limitations in the study
In the set-up of the user research, it is difficult to get a good picture of one's motivational influence and functional decline. Both these factors came up in the literature research. As participants are beforehand already aware of the fact that they will use an application, they know what is expected from them and this is not the case in a normal setting. The influence of one's motivation is therefore hard to determine. Still, in the desk research (expert interviews and literature research) this was found to have a major effect as well and it believed to be of importance. Measuring one's functional decline would include another type of research with the users, more focused on timing and functional gestures. Nevertheless, some of the participants emphasized the fact that they are often slower in conducting these types of actions than the younger generation (e.g. their sons and daughters). Functional decline is considered to be influential as well.

The choice to restrict the amount of PrEmo cards to 8 instead of 14 is questionable and can cause a bias in the studies. This might limit the emotional output of the participants during the post-usage talk. The researcher did not question the participants directly about what they believed to be the most meaningful emotions.

4.7 Dilemmas

Based on the identified themes of the user research, dilemmas (actual practice scenarios) can be generated. Dilemmas are in fact choices the user has to make, where one cannot have two desirable alternatives at the same time (Ozkaramanli et al., 2018). An example of this can be wanting to relax in bed, whilst at the same time wanting to arrive on time for work. Dilemma-driven design offers a framework to capture emotional conflicts, providing insight in challenges users are facing during decision making processes and prioritization of conflicting goals. Therefore, the framework of dilemma-driven design as proposed by Ozkaramanli et al. (2017) has been applied to translate these themes into dilemmas (figure 4.26). A total of five dilemmas have been identified for both the pre-usage and usage stage, the overview of the underlying frameworks can be found in Appendix F. All of these dilemmas summarize in fact the user research findings, and could thus be used as a design input for the Ideation phase of this project.

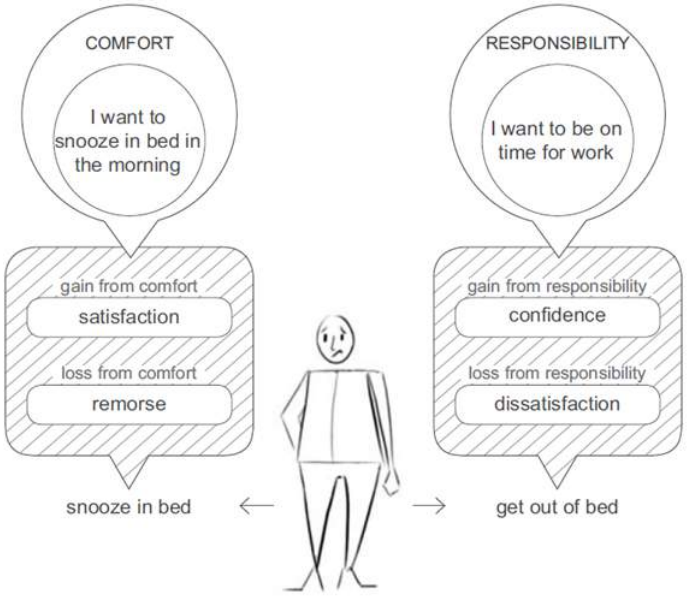


Figure 4.26: Dilemma framework as proposed by Ozkaramanli et al. (2017)

Dilemma 1: Novelty versus Trust in tradition
Once the user has been requested to verify their identity using a new and unknown process, they are in fact asked to **trust** a process which they do not know (figure 4.27). Older adults want to finish the request send on behalf of the organization, but have never done this before, this makes them more *hesitant.* Using the remote verification process lets the user become more **inventive and resourceful.** This can on the other hand also result in **stress and anxiety for the unknown.** Choosing a more traditional option gives them more **confidence and certainty,** whereas they can also feel **bored.**

Figure 4.27: Dilemma Novelty versus Trust in tradition (pre-usage)

Dilemma 2: Social safety versus Human-contact
Because of the Covid-19 virus, people that fall into the risk group need to be extra careful. Older adults are more vulnerable. If users have the possibility to verify their identity through different options, a variety of choices can be made (figure 4.28). Staying home in a known environment gives the user the **assurance** of being safe. This can however also be really **boring and lonely**, as one will stay in its own bubble and have limited access to the outside world. The preference for human-contact can therefore also be bigger. Meeting an employee in person gives one the feeling of **belonging and confidence** in finishing the process. **Worry** might however arise, if a lot of people are present in the building. More introvert users favor being alone over human-contact as well.

Figure 4.28: Dilemma Social-safety versus Human-contact

Dilemma 3: Independence versus Guidance
The following dilemma is applicable in both the pre-usage and usage stage (figure 4.29). **Trust** in oneself plays a key role in this dilemma. Finishing the verification process independently and taking matters in one's own hands gives the user **more knowledge,** as well as the capability to be more **inventive. Stress and anxiety** can be a side effect if something unexpected happens and the user does not know what to do. When the user is guided throughout the process, they can fall back upon someone or a system, this generates the feeling of **assurance** and **confidence**. **Distrust** can arise, if the person or help system provides the user with an unexpected response or answer.

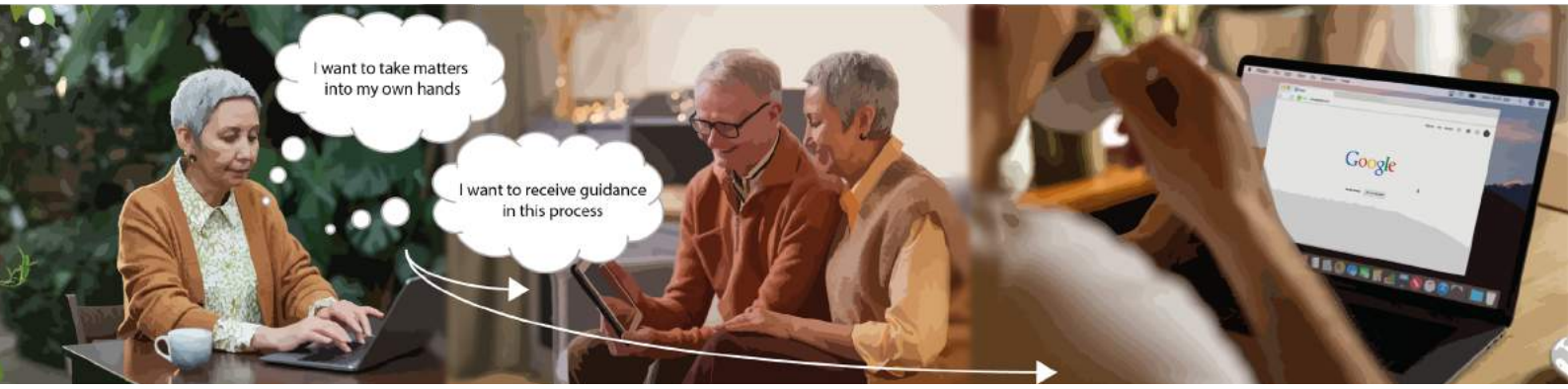


Figure 4.29: Dilemma Independence versus Guidance

Dilemma 4: Control versus Time-efficiency
Users want to be in control of what happens to their personal data and know what is going on. They can therefore take their time to finish the verification process, and read the instructions attentively (figure 4.30). Being in control results in the feeling of **certainty and precision**. As it takes longer to finish the verification process, **disinterest** might occur as well as **boredom**. Going through the steps fast, results in more time for oneself. Users here are often **confident** that everything will work out. However if trouble arises, the unpleasant feelings of **stress** and being **worried** will occur.

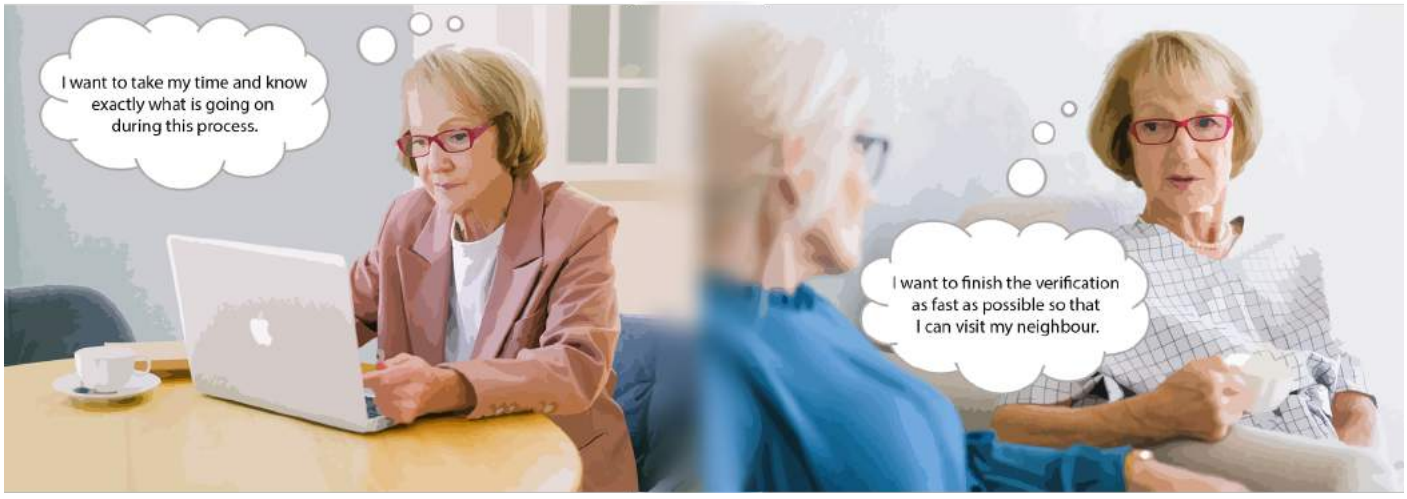


Figure 4.30: Dilemma Control versus Time-efficiency

Dilemma 5: Novelty versus Trust in tradition
The last dilemma is again called Novelty verus Trust in tradition, but can now be placed inside the usage stage (figure 4.31). During the completion of the ReadID Ready process, users are asked to perform actions that are new. Older adults can either choose to make of use known gestures, which they would normally use. This gives the user a **confident and comfortable** feeling, but will most likely result in **irritation** once the system gives an error message. Following the instructions and performing the actions as they are requested by the application is needed. Users willing to try out new actions and gestures with their phone, will require new **knowledge and talent** while completing the required actions. **Stress** can nonetheless occur if the performed action does not work.

Figure 4.31: Novelty versus Trust in Tradition

4.7.1 Choosing a design-worthy dilemma
The five dilemmas that have been identified in the user research can all generate as an input for the next phase of the project, the Ideation phase. Putting a focus on all of these dilemmas is however out of the scope for this Thesis, therefore the most design-worthy dilemmas will be selected.

Desmet et al. (2017) categorized the common considerations for choosing a design-worthy dilemma under three themes; *relevance, inspiration and meaningful formulation.* The three main themes cover a total of seven key qualities for choosing a design-worthy dilemma, which are intended to frame a space for reflection and discussion (Desmet et al., 2017):
1. Addresses the key challenge given in the design brief
2. Applies to the majority of potential users
3. Has direct impact on the subjective well-being of potential users
4. Is one in which design might play a role
5. Involves surprising elements
6. Seldom involves strictly opposing choices
7. Is abstract enough to be inspiring, but also concrete enough to give direction.

The five identified dilemmas have been compared to one another according to these qualities. The following table (4.1) functioned as a set of considerations that the researcher could take into account, rather than a literal scoring guide:

Quality	D1	D2	D3	D4	D5
Key challenge	X		X	X	X
Applicable to most users	X	X	X	X	X
Impact on well-being		X	X		
Design is relevant	X		X	X	X
Surprising or unexpected		X			X
Seldom involves strictly opposing choices			X	X	X
Inspiring, but concrete enough to give direction	X		X	X	

Table 4.1: Five dilemmas comparison

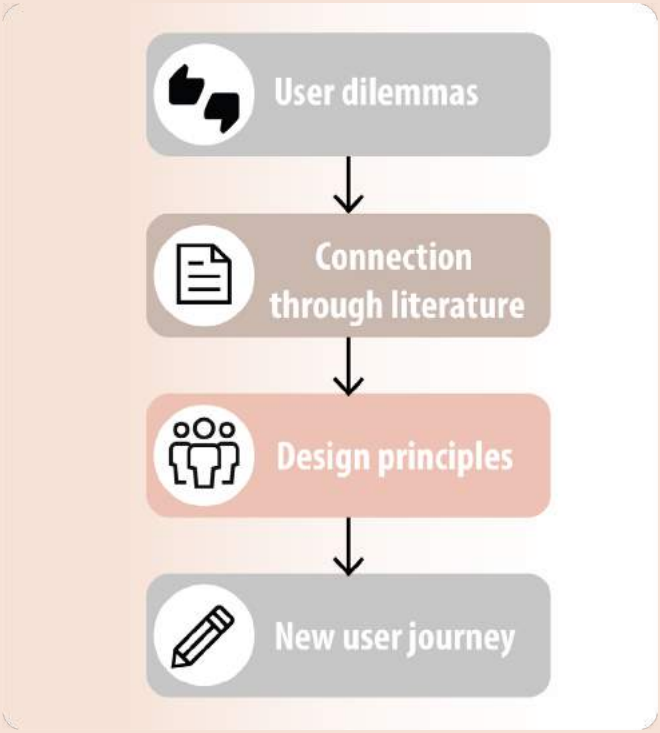
The found insights are interesting and fascinating to consider; in the pre-usage stage, strictly opposing choices occur in both dilemma 1 and 2. The choice would often be: *"Do I want to use the application or do I want to use a different way of verifying my identity?"*. The second dilemma does not cover the key challenge of this project, and can therefore already be rejected. The fifth dilemma is not concrete enough to provide the designer with a good design direction, which is one of the main considerations for proceeding in this project, and can therefore also be rejected.

The three chosen dilemmas for the ideation phase are:
1. *Novelty versus trust in tradition (pre-usage)*
2. *Independence versus guidance (pre-usage and usage)*
3. *Control versus time efficiency (usage)*

For the researcher, it was of major importance that in all of these three dilemmas design is relevant; they are all inspiring but still concrete enough to provide direction. Next to this, the main challenge for this Thesis is covered and the dilemmas are applicable to most of the users. One could argue that above dilemmas contain two different aspects, one for the pre-usage stage and one for the usage stage. It was chosen to proceed with both of these stages as they play a big role in the overall user experience for older adults. Eliminating one over the other would in the vision of the researcher be a loss for this Thesis.

5. IDEATION

The aim of this chapter is to generate future practice scenarios (Anggreeni & van der Voort, 2008), in which potential solutions are examined and investigated. Sub-question 6 of this Thesis is answered: *"What design opportunities do dilemmas inspire?"*. Solutions are based on the insights generated from the user research. First, the connection between the chosen dilemmas is framed by means of a small literature research. These findings are translated into design principles for a new user journey. In the end, design suggestions are made for ReadID Ready.



5.1 Formulating concrete design questions.

The chosen dilemmas for the Ideation stage are:
Dilemma 1: Novelty versus Trust in Tradition *(pre-usage figure 4.26)*
Dilemma 3: Independence versus Guidance *(pre-usage and usage, figure 4.28)*
Dilemma 4: Control versus Time efficiency *(usage, figure 4.29)*

The three chosen dilemmas will function as an input for the ideation phase. It is necessary to gain a deeper and clearer understanding in the relationship between the three chosen dilemmas. Which ingredients connect these dilemmas and can help in designing? Two components are explored with academic literature: self-efficacy and flow. By doing so, more inspiration is generated for the designer and common focus points are mapped out. Self-efficacy is all about overcoming the mental obstacle of starting a new process independently, being dependend on the amount of trust a user has in oneself (see section 4.7 - dilemma 3). It is mostly related to the dilemmas of Novelty vs Trust in Tradition and Independence vs Guidance. Flow stands for getting completely occupied into an activity. It is related to both the dilemma of Independence vs Guidance and Control vs Time-efficiency;

5.1.1 Exploring the dilemmas through academic literature

Self-efficacy

First of all, self-efficacy and its influence on older adults is explored. Self-efficacy can be defined as: *"the belief in one's own competences in face of impediments (Lippke, 2017, p.4713)."* Or in other words, one's belief to succeed in a specific situation. According to the self-efficacy theory by Bandura (1977), people who belief they can perform well are more likely to view difficult tasks as a challenge to master, instead of avoiding this task (see figure 5.1). Whereas people with a lower self-efficacy view demanding challenges as a threat, and would most likely try to prevent doing so. Users who have already performed a certain behavior have the highest level of self-efficacy (Lippke, 2017). In the case of the ReadID Ready application this does not apply, as they are in fact one-time users.

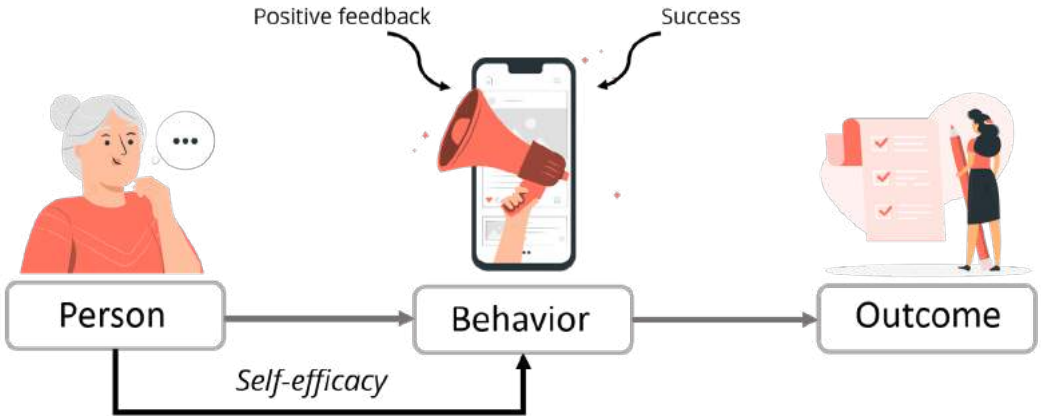


Figure 5.1: Extended relationship self-efficacy (Bandura, 1977)

Self-efficacy and usage of technology have a connection with one another; Czaja et al. (2006) found that older adults and sometimes even middle-aged adults have a lower self-efficacy with respect to using technology than younger adults. People with a lower self-efficacy are less likely to use technology in general. Self-efficacy expectations are steered by one's ability to perform the required behaviour, and the persons confidence in being able to use these abilities (Lippke, 2017). Ageism can lead to a reduction in self-efficacy amongst older adults (McDonough, 2016), especially if they internalize the negative view society has on their technology usage. When you try to teach older adults a new kind of technology, Czaja et al. (2006, p.348) state that: *"it is critical to ensure that*

older people receive encouraging feedback during training and experience some level of success. Interface design is also important in this regard". This is also confirmed by Nap et al. (2013), system designers should according to them implement affective support in the form of positive feedback messages. Providing users with positive outcome expectancies and by developing support that increases coping, older adults are likely to be encouraged. Clear feedback can thus increase one's self-efficacy, and encompass the user with a positive feeling. The technology should allow the user to experience success, which helps them to generate more confidence in their own abilities.

Self-efficacy plays in this research a key role in overcoming the **novelty** versus **trust in tradtion** dilemma, as well as trying to finish a process **independently.** Based on academic literature, it can be stated that by providing older users with clear outcome expectancies can be of huge influence in this case. Additionally, positive feedback encourages older adults to complete the process, and assures them that they are doing well. Support within the design itself should also not be forgotten, as this **guides** users throughout the complete process. Hence, these considerations will in the end effect the behavior and outcome of older users.

Flow

Secondly, the concept of flow is analyzed. Flow is the mental state in which a person is fully immersed into an activity. Nakamura & Csikszentmihalyi (2009, p.195) also name this: *"the experience of complete absorption in the present moment"*. In the flow zone, the user experiences a happy feeling and feels motivated to continue in the process, getting older adults into this mental state is therefore crucial. Coming into the flow happens when there is a complete balance between how challenging a task is (difficulty) and a person's level of skill at the given task (ability) (see figure 5.2). This balance is however easily disturbed (Nakamura & Csikszentmihalyi, 2009). When challenges exceed skills, the user can become anxious. If skills exceeds challenges, a person's first relaxes but becomes easily bored. Both of these feelings appear in the resulting dilemma frameworks of Chapter 4 (appendix F), and can be overcome by understanding the flow theory.

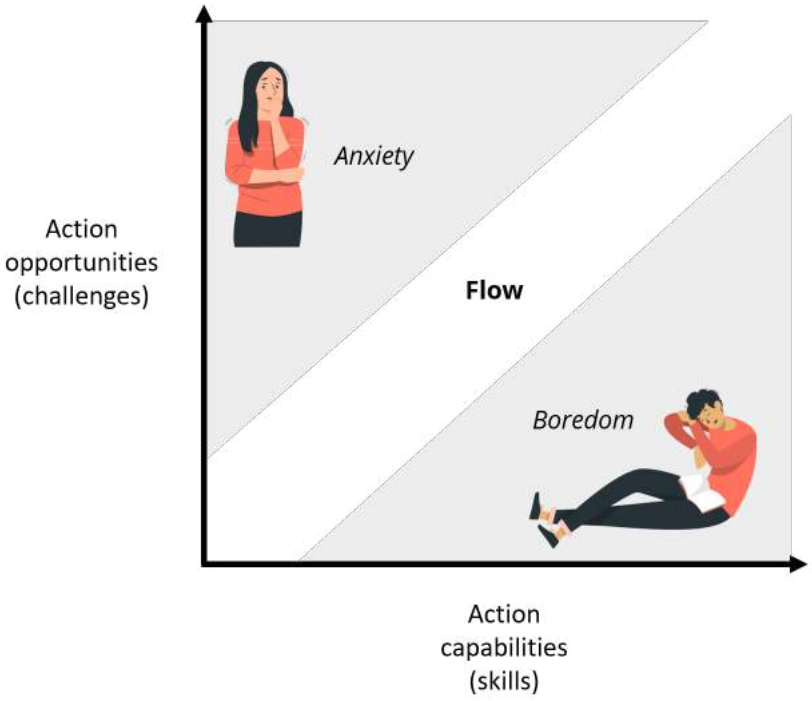


Figure 5.2: Flow theory (Nakamura & Csikszentmihalyi,

There are in fact eight dimensions through which the optimal flow experience can be found (Vann & Tawfik, 2018) (Kiili, 2005) (Csikszentmihalyi, 1997) (Mahnke, 2014) :

1. *Clear goals and immediate feedback:* Allow users to know what is expected from them, let them obtain immediate response on their performance. Clear goals are also essential in letting the user achieve sufficient motivation to fulfill a given task.
2. *There is a balance between challenge and skill:* The task asked from the user should be engaging, being comparable to the skills they possess. The user is not overwhelmed by for example design- or learning requirements.
3. *Sense of control:* The user is able to control the task in such a way that makes the activity relevant to learn. The user is in control of the process, without being fully aware of this; they are in a full state of relaxation, without being worried.
4. *Merging of action and awareness:* The user is completely occupied in an action or task. For user experience design this means that the interface design should allow the user to learn in a fluent manner.
5. *Transformation of time:* The user is not aware of the time anymore. Therefore the time can either go really fast or really slow.
6. *Complete concentration:* The user is able to get into a state of complete concentration. In terms of UX design, the interface should balance design features that allow the user to progress in their learning journey, while at the same time limiting distracting information that can interrupt the users attention. Eye movement distances can be reduced through for example a clear hierarchy. Important elements are provided at high levels in the structure of for example websites.
7. *Loss of self-consciousness:* Users become so engaged in a task that they lose the awareness of everything else.
8. *Self-rewarding experience:* Goals are clearly defined and easy to be achieved, making the completion of the task rewarding for the user. There is an immediate return on one's investment.

Mahnke (2014) conducted a study on users online shopping experiences using the flow theory, according to him, it is of key importance to maintain the users motivation, continuous progress towards an existing goal must be shown to the user. Next to this, user should be inspired to pursue new goals throughout the process, by tackling one's curiosity.Taking into account these dimensions whilst ideating can provide the researcher with more guidance as how to design for this particular age group and to get them into the desired mental state.

Ensuring a continuous flow within an application generates a pleasant experience for the user, therefore a balance between opportunities and challenges should be found for the senior user. This is needed for older adults to become **more independent**, while still **enough support** is given in case they need it. The actions required by the user to perform should not exceed the users capabilities. By means of step-wise approach, concise instructions and explaining visuals enough **guidance** has to be generated for the older user. By doing so, the user is more likely to feel in **control** of the process. This should however be conducted in a **time-efficient manner.**

5.1.2 Formulating concrete design questions

Based on the selected dilemmas and explored academic literature, the essence of the dilemmas can be found by formulating two design questions. One for the pre-usage stage, which is focused on addressing this specific age group. As well as one for the usage stage, where the focus will lie on the design of the application:

1. **Pre-usage:** *"In what way can older adults become more comfortable to start using ReadID Ready and at the same time feel guided throughout the process?"*

This first design question aims to help customers in addressing this particular age group. InnoValor tries to advice its customers in the best way possible, as they are responsible for guiding the users throughout the complete process. The customer is in charge of everything besides the app.

2. **Usage:** *"In what way can you guide older adults so that they can complete the ReadID process independently and give them the feeling of being control, while at the same time keeping the process time-efficient?"*

The second design question stands in direct relation with the user, being applicable to the app itself. It is Innovalor's responsibility to design the app in such a way that the user experience is as optimal as possible. Adjustments made within the application have a direct influence on the user.

Resolving dilemmas

There are three different approaches as to how one can design with dilemmas (Ozkaramanli et al., 2016):

1. *Resolve:* The aim here is to redesign an existing product or service in such a way that conflicting concerns can be simultaneously fulfilled.
2. *Moderate:* One can also moderate a dilemma by explicitly prioritizing one concern over the other.
3. *Trigger:* It is also possible to trigger a dilemma, meaning that attention is drawn to the concerns to create awareness.

Triggering a dilemma as a means of a solution was found to be inappropriate for this Thesis, the actual dilemmas of the older adults would not be properly addressed. The first and second approach are used to generate new design ideas.

5.2 Designing for an existing product

What differs in this Thesis, is the fact that there is already a product from InnoValor on the consumer market. This Ideation phase is not intended to come up with a completely new product. On the contrary, the researcher needs to find out how the existing product can be improved.

When it comes to development of new features and ideas for the ReadID Ready flow, certain considerations have to be kept in mind by the designer. Especially the back-end of the application should be compatible with new app ideas. Therefore the researcher has to take into consideration certain concerns whilst designing. In order to be sure that the proposed designs for the interface of the ReadID Ready app are implementable, close contact was sought with the developers from ReadID.

It is helpful to first simply explain how the back-end of the ReadID Ready app is constructed. Information for the functioning of the app is namely derived from two different sources:

1. **ReadID Ready**
2. **ReadID UI SDK**

An SDK or so called 'Software Development Kit' brings together a group of tools that enables the programming of mobile application. The ReadID UI SDK is used as a base for all of the products from ReadID, including ReadID SaaS.

So how is the ReadID Ready app constructed?
The start and the end screens are one the back-end fetched from the ReadID Ready app itself. The screens and technology needed for the MRZ scan, NFC chip read and Face scan are retrieved from a different source, the ReadID UI SDK. This means that changes made in these designs will also affect all other apps linked to this SDK; not only customers from ReadID Ready will experience these adjustments, but also customers from ReadID SaaS, have a look at figure 5.3.

Considerations that need to be taken into account whilst designing:

- What happens before and after the usage of the application is entirely up to the customer from ReadID. Designs made for the pre-usage stage are meant as a guidance for the customer, rather than a real implementation.
- It is not possible to change the sequence of the steps in the application. E.g. performing the face scan before the MRZ scan.
- It is not possible to change how the user needs to perform certain interactions. The user has to use the identity document and phone in the same manner.
- Changes in the design that will affect the ReadID UI SDK, have to be compatible with all other apps connected to this SDK.

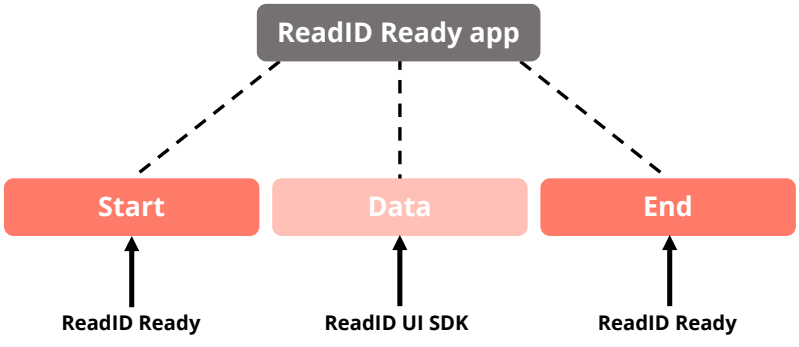


Figure 5.3: Backend Readid Ready

5.3 Design scope

As the ideation phase revolves around the already existing ReadID Ready app, specific steps within the current user flow are enhanced. One could also decide to make a complete new concept from scratch, instead the researcher found that by enhancing specific steps in the user flow can have the most impact. This gives room to generate design improvements to properly tackle the dilemmas and are feasible, in the end providing the most value for the user.

Based on the user research conducted in the previous chapter, the choice has been made to focus the design on the following steps in the verification process:

1. Instruction page
2. The start screen of the app
3. The overall feedback throughout the steps of the app

Instruction page

At the moment, there is not a clear example instruction page available that can be used by customer support to advice customers on how to instruct users. The current webpage (figure 5.4), is mainly used in demos with potential customers from ReadID, but lacks the right information and design elements that should be used. This webpage did not provide participants with enough advice and instructions on how to start the online verification process.

Start screen

The current start screen from the ReadID Ready app (figure 5.11), is rather simple without much information present. Participants stated that they would like to know more about the overall process before they start, this could for example be integrated into an instruction page. It is however not granted that this is also implemented by the customer. Therefore, it is wise to also show some extra information in the start screen of the app. Besides this, the more information section could not be found within the current design, making users who want to know more use Google in stead of this section.

Feedback in the app

Older adults in general thought that the animation instructions throughout the app were clear. There is however no feedback present within these steps on how the user is doing. So if a user would conduct a task in the right manner, they would automatically proceed to the next step without any feedback.

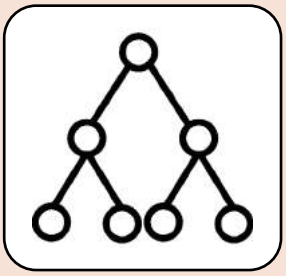
For these steps, two different design options are presented. Meaning that two different design suggestions are made for each step. Design principles are generated to come up with these proposals. Why would one make use of design principles? Design principles determine the context in which a design is created. They provide a clear framework in which the most important wishes and needs of users, the organization and technology are recorded. By doing so, the desired user experience becomes clear for everyone. In these design principles, the dilemma's and its connection to one another are integrated by incorporating theory from section 5.1.

5.3.1 Design principles

Designs made in the Ideation phase of this project are based on 4 design principles:

1. Transparent: be informative

Information is presented in an arrangement that implies importance, as well as transparency. By doing so, both visual and textual information is received by the user in the way it is intended. Using a hierarchy can for example make complex amounts of information more simple for the user to understand. The flow theory states that clear goals should be present for the user to know what is expected from them, the design should therefore be easy to understand. This enables the user to be in control of the flow, as the tasks and the end goal are made completely clear.



2. Flexible: provide options

Information will be presented in a concise and flexible manner. Users are not overwhelmed by an information overload. Options are provided, users can decide for themselves to look at specific sections of the interface or not. The user should be allowed to come into a state of complete concentration (flow theory), meaning that there should be a balance and satisfying arrangement between design elements. By doing so, a merging of one's action and awareness will occur, making the user completely occupied by the task.

3. Essential but specific guidance

Users will obtain necessary guidance throughout the process. More in-depth information can be acquired, this is encouraged by means of a visual attractive layout. Ensuring older adults with enough guidance is key to a better self-efficacy; actions should be presented in such a way that it is clear how these are performed and what is expected from the user. The flow theory also suggests this, actions and awareness should become merged, users should be able to learn in a fluent manner by means of design. Features will support the users learning progress, while limiting unneeded and distracting information, eventually leading to a balance between challenge and skill.

4. Positive feedback

One of the main concerns that came out of the user research was the lack of feedback throughout the steps in the application. The self-efficacy of older adults is higher when there is sufficient positive feedback present, this encourages the user and assures them, eventually leading to a positive outcome expectancy. Immediate feedback is key according to the flow theory as well, an instantaneous response tells the user how the task is going. This results in a self-rewarding experience for the user, as there is an immediate return on one's investment.

5.4 Designs

The new designs for the ReadID Ready app are focused on three specific elements in the user flow: the instruction page, start screen and feedback throughout the application. The design principles were used as an input to generate these prototypes. Frequently occuring usability challenges were also taken into consideration by means of accessibility improvements (section 4.6.1). Two future practice scenarios on these designs can be found in Appendix G.

Instruction page

The approach here is to actually *resolve* the dilemmas in the pre-usage stage by designing a webpage that will function as an example for customers. The two proposed designs are rather simple, while being quite informative. The main goal here was to keep it concise, yet insightful.

- A short introduction on remote identity verification is provided to the user.
- It is stated what is needed for the mobile verification process and what can be done if the user does not have a compatible smartphone.
- The steps that the user has to go through are visualized by means of pictures and a short text. This prepares the user on what is going to come before they have even started the ReadID Ready process.
- Lastly, extra guidance is provided to the user in the form of FAQ. This is simple but effective as this can easily be achieved. No physical employee is needed for this form of guidance.

The difference between instruction page A and instruction page B is the way how the steps are presented. Page A (figure 5.6) makes use of a carrousel, which the user can click through (provide options), whereas page B (figure 5.8) makes use of a time-line (hierarchy).

In the future practice scenario A (Appendix G) the user finds enough trust in the new application by reading the instruction page.

The current version of the example instruction page can be seen below. This is shown to potential customers to introduce them to the app:

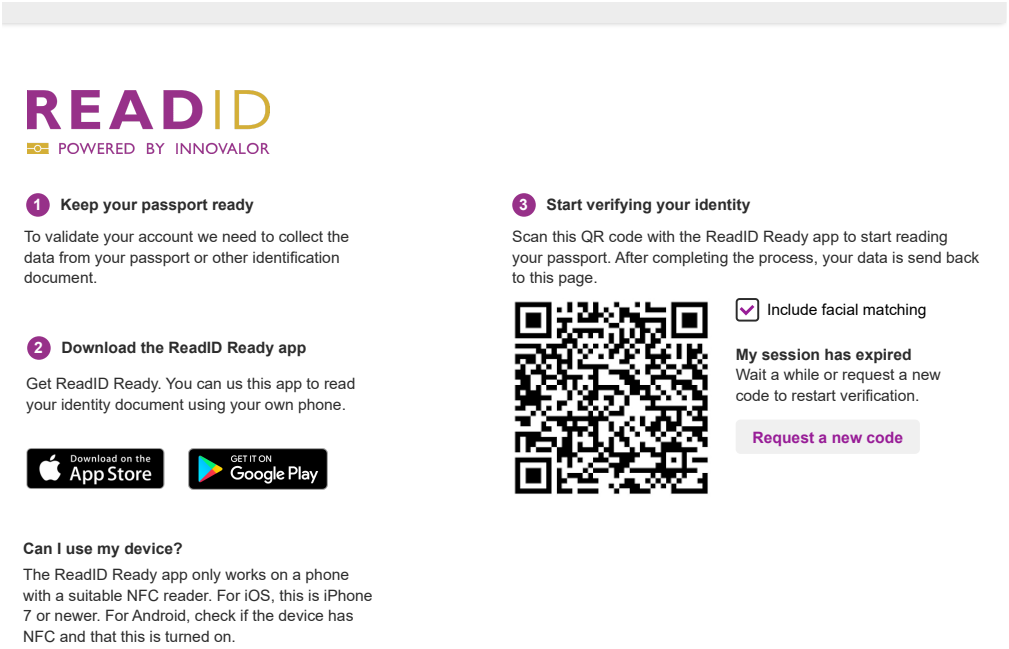
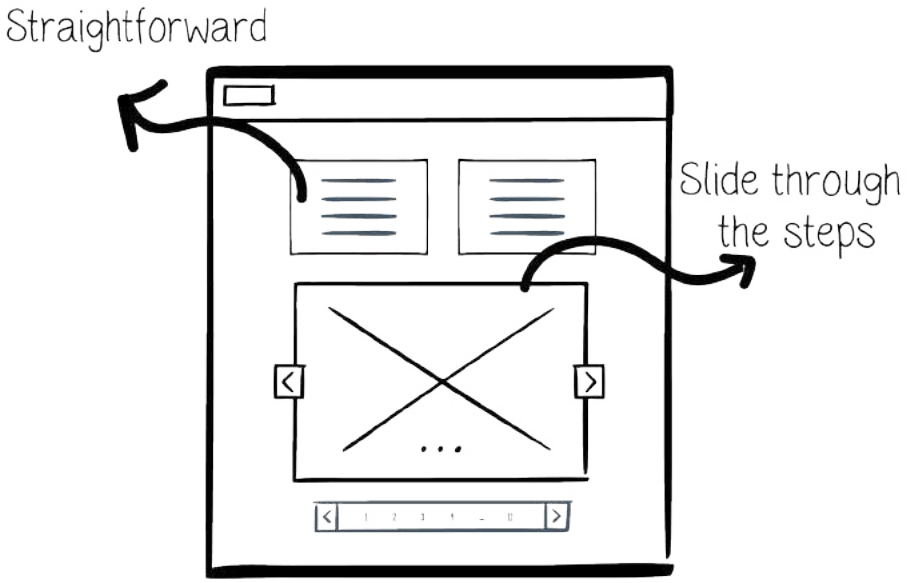


Figure 5.4: Current instruction page shown to ReadID customers

Sketch Design A

Figure 5.5: Sketch instruction page design A



Design A

Figure 5.6: Instruction page design A

READID

Verifieer uw identiteit

Via de ReadID Ready app

Wilt u namens NAAM uw identiteit verifieren? Op deze pagina leggen wij u uit hoe dit moet via uw mobiel. Verder kunt u onderaan de pagina de veelgestelde vragen vinden.

Wat heeft u nodig?

1. Een geldig paspoort, ID kaart of rijbewijs.
2. Een geschikte smartphone:

-iOS: iPhone 7 of nieuwer.
-Android: met het een besturingssysteem van 5.0 of hoger.

Heeft u geen geschikte smartphone?

U kunt altijd een smartphone van iemand lenen die wel aan deze voorwaarden voldoet. Op welk apparaat u de identificatie uitvoert maakt niks uit.

Hoe werkt het?

1 **Pak uw telefoon en document**

Houd uw identiteitsdocument en telefoon bij de hand

2 **Downl**

Download de ReadID Ready
App store (iOS) of Play store

ID READY

Veelgestelde vragen

1	Hoe werkt de ReadID Ready app?
2	Waarom moet ik ReadID Ready gebruiken?
3	Wat gebeurt er met mijn persoonlijke data?
4	Ik heb geen QR code, wat nu?

READID

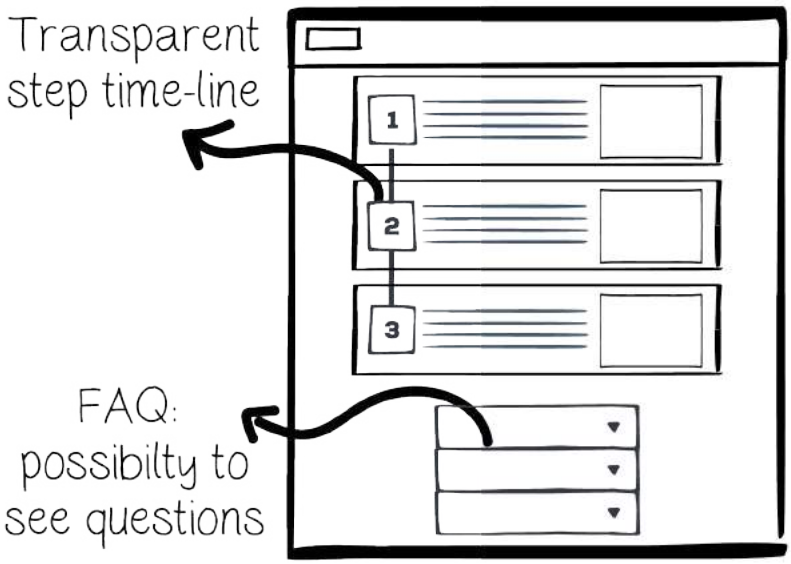


Figure 5.7: Sketch Instruction page design B

Design B

READID

Verifieer uw identiteit

Via de ReadID Ready app

Wilt u namens NAAM uw identiteit verifieren? Op deze pagina leggen wij u uit hoe dit moet via uw mobiel. Verder kunt u onderaan de pagina de veelgestelde vragen vinden.

Wat heeft u nodig?

1. Een geldig paspoort, ID kaart of rijbewijs.
2. Een geschikte smartphone:
-iOS: iPhone 7 of nieuwer.
-Android: met het een besturingssysteem van 5.0 of hoger.

Heeft u geen geschikte smartphone?

U kunt altijd een smartphone van iemand lenen die wel aan deze voorwaarden voldoet. Op welk apparaat u de identificatie uitvoert maakt niks uit.

Hoe werkt het?

1 **Pak uw telefoon en document**

Houd uw identiteitsdocument en telefoon bij de hand.

2 **Download de app**

Download de ReadID Ready app op uw telefoon via de App store (iOS) of Play Store (Android).

READY · GET IT ON Google Play · Download on the App Store

3 **QR-code**

Scan de QR-code die u heeft ontvangen met uw mobiel.

4 **Scan**

Scan uw identiteitsdocument door uw camera op het document te richten.

5 **Lees**

Houd uw telefoon tegen het document aan om deze uit te lezen. Hierna bent u klaar en ontvangt u een bevestiging.

Veelgestelde vragen

1. Hoe werkt de ReadID Ready app?
2. Waarom moet ik ReadID Ready gebruiken?
3. Wat gebeurt er met mijn persoonlijke data?
4. Ik heb geen QR code, wat nu?

READID

Figure 5.8: Instruction page design B

Start screen
The current version of the Start screen can be seen in figure 5.11. Older adults are triggered to click through the start screen rather fast because of the 'scan my QR code' CTA at the bottom of the screen. Additionally, participants of the user research did not feel like looking at the 'more information' section because the icon used is rather small and not inviting to look at.

The two proposed designs are transparent, while providing essential guidance:
- Two visual images are added on the welcome screen, that show both a passport and ID card with the NFC logo.
- A 'start' button is integrated instead of the 'QR-code' button. An extra screen is added after the start screen, which shows the 'QR' code buttons (Appendix H)
- The 'more information' section is made more prominent in the form of a CTA at the bottom of the screen underneath the 'start' button.
- An extra section is added which shows the steps that the users will take during the verification process. This prepares the user for the actions they are required to perform. The steps are explained quite briefly, with visual images.

The difference between the two designs is the fact that in start screen A (figure 5.10) users can decide for themselves at which sections they want to have a look, *resolving* the dilemma. Whereas in start screen B(figure 5.13) the user will automatically view the 'step' section before they can proceed, priotitizing guidance and control over time-effiency aspect, thus *moderating* the dilemma. It is believed older adults would benefit from this extra step section.

In the future practice scenario B (Appendix G) the user finds enough trust in herself by receiving guidance and positive feedback throughout the usage of the application to conduct the process independently.

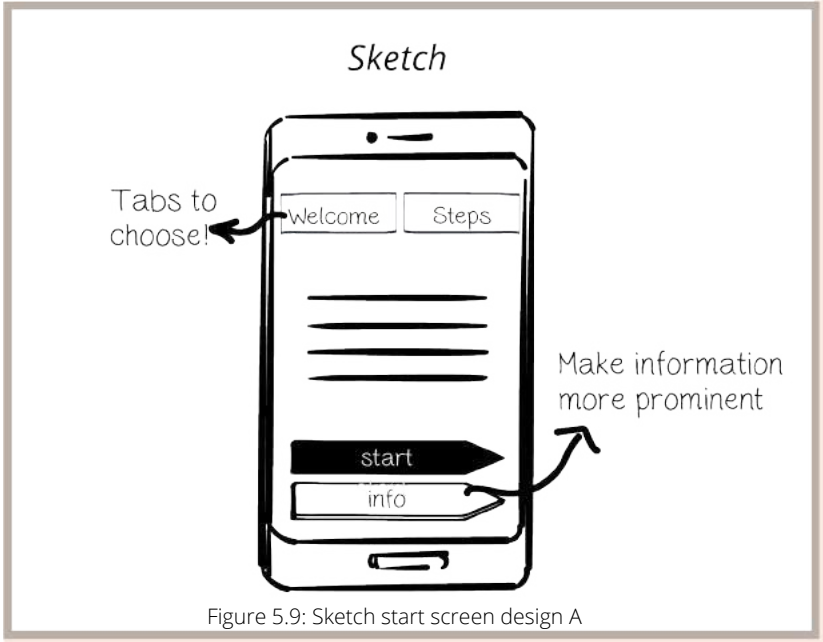


Figure 5.9: Sketch start screen design A

Start screen Current Design

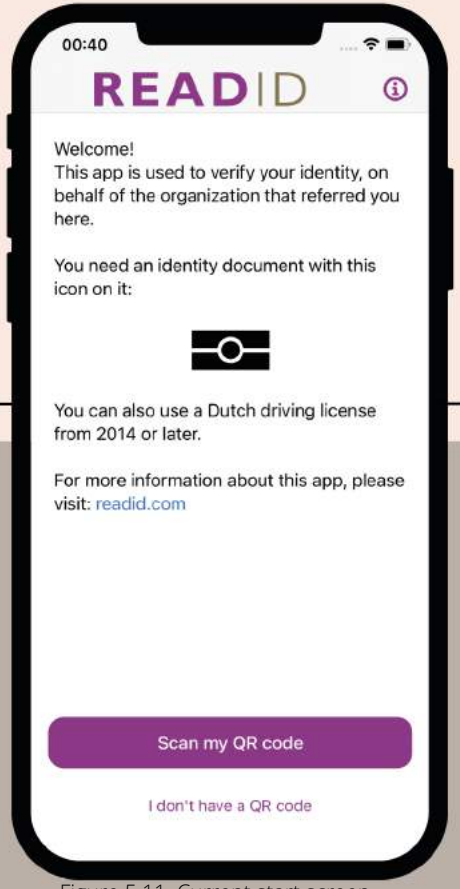


Figure 5.11: Current start screen

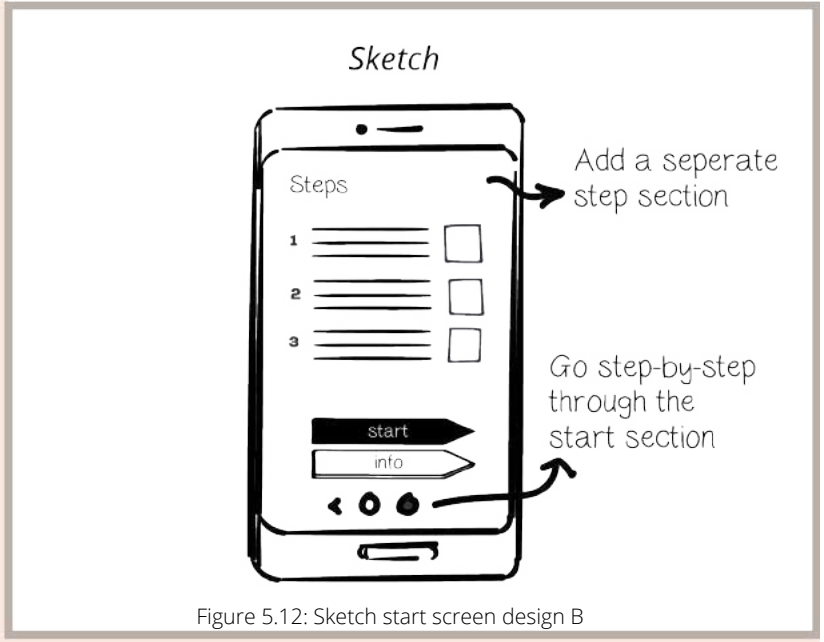


Figure 5.12: Sketch start screen design B

Design A

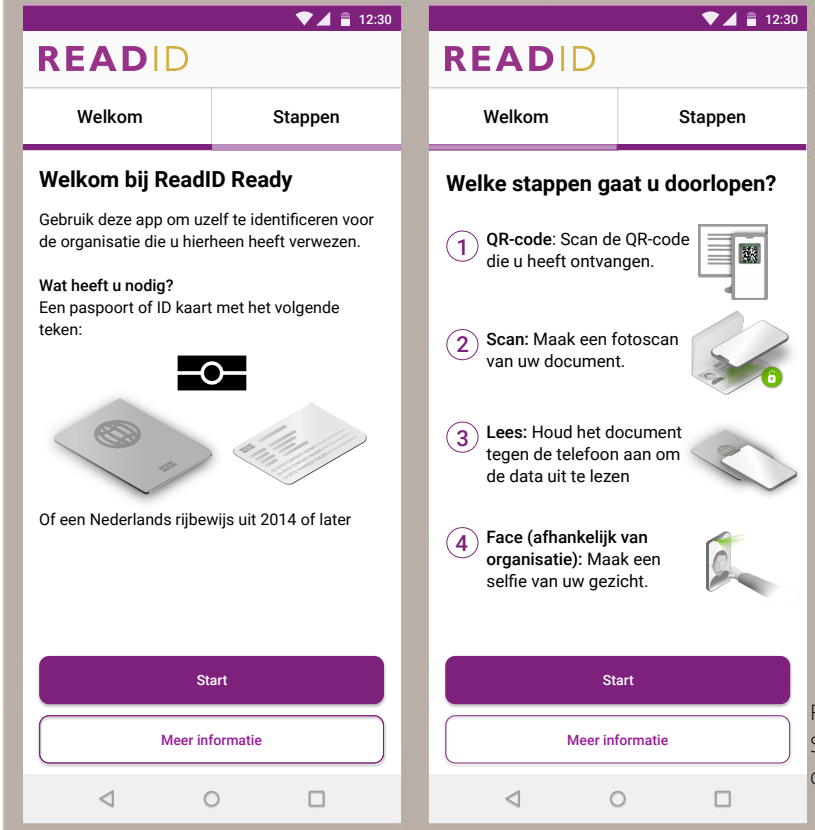


Figure 5.10: Start screen design A

Design B

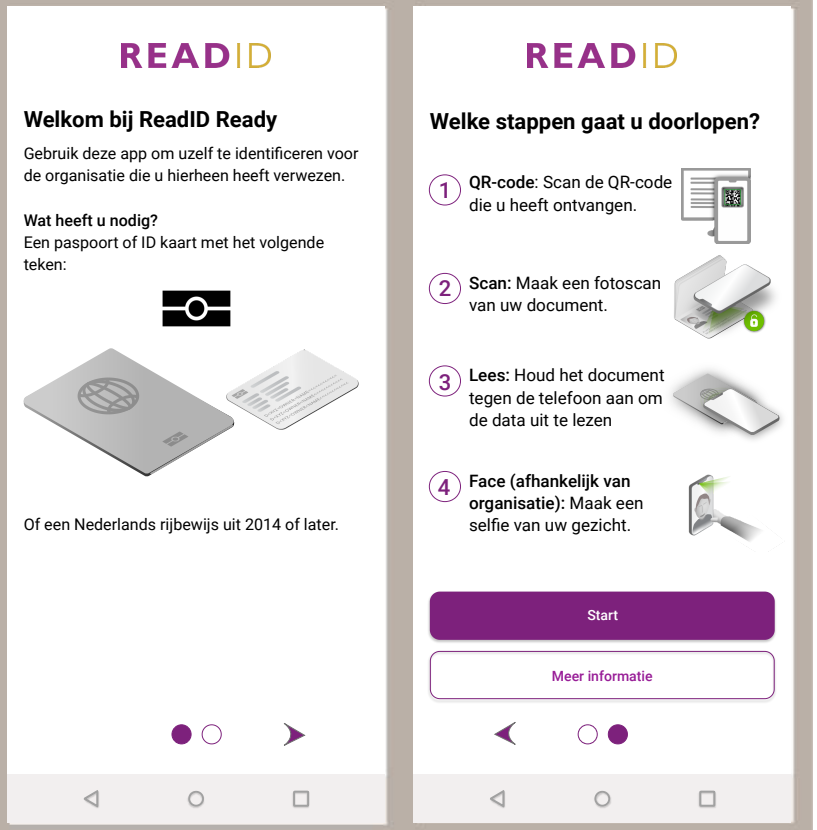


Figure 5.13: Start screen design B

Feedback in the app
While trying to integrate more feedback in the app, a major consideration had to be made; changes made throughout the QR-code, Scan, Read and Face step should be suitable for all applications connected to the ReadID UI SDK. So how would this be possible?

Firstly, step animations are not accompanied by any headers or titles right now, this is a first step in showing the user where they are located throughout the process (appendix H). Just as looking how to improve the current textual descriptions (see evaluation section 6.6.2).

How can extra feedback in between the steps be integrated? An extra screen will show how the user is doing (figure 5.15), providing them with positive feedback. More attention is paid to the guidance and control aspect of the app for older adults rather than time-efficiency, thus *moderating* the dilemma. Three different versions for a possible feedback screen have been generated:

- In feedback screen 1, an automatically generated checkmark shows the user that the step was conducted correctly.
- In feedback screen 2, a pop-up screen can be seen, with a short textual description. In order to proceed the users would have to tap the 'next' button.
- In feedback screen 3, an automatic feedback message tells the user that a step is finished. A progress bar shows the user how far they are in the process, and how many steps they still need to conduct. A progress bar can be integrated, according to developers, but would however be a lot of work.

The NFC carrousel is difficult to understand for older adults. One will come across this carrousel if you do not conduct the read step correctly. The chip in the document needs to make a connection with the NFC reader in one's phone. Changing this carrousel would be a major project on its own, still an interference before proceeding to this carrousel can be given (figure 5.16). A short feedback message on 'tips and tricks' can already make a big difference for older adults, letting them know that new tips on how to conduct this step in a correct manner are shown.

- In NFC feedback screen 1, an automatically generated message on tips and tricks is shown to the users.
- In NFC feedback screen 2, a pop-up screen on tips and tricks is shown to the user. They will have to tap on the 'tips' button in order to proceed.

Feedback screens in between the steps

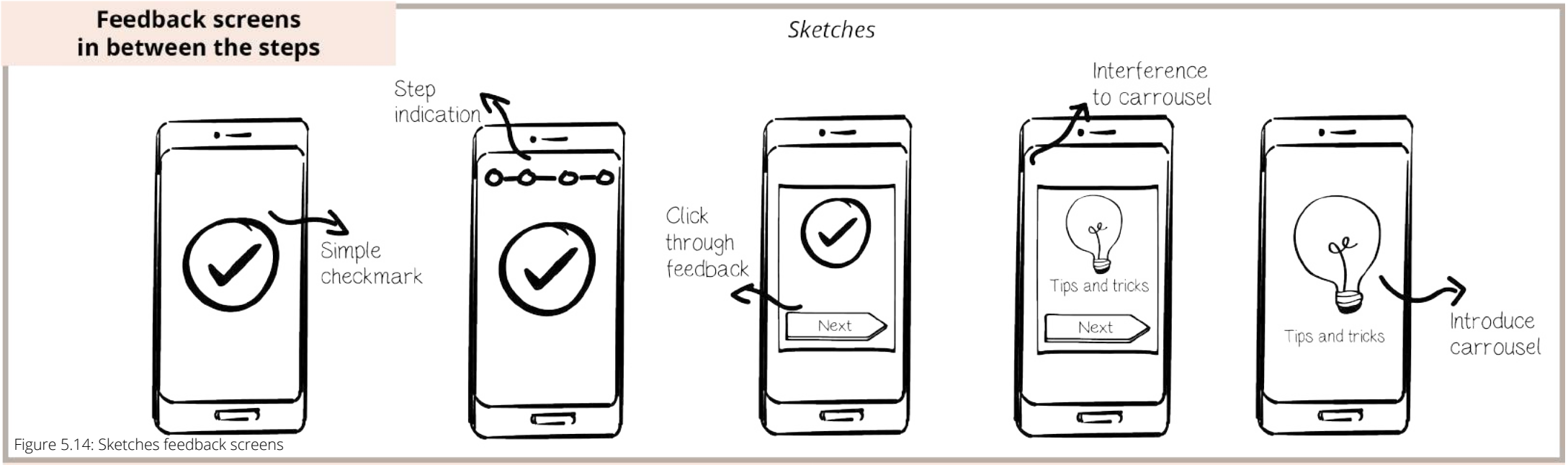


Figure 5.14: Sketches feedback screens

Feedback screen 1, 2, 3

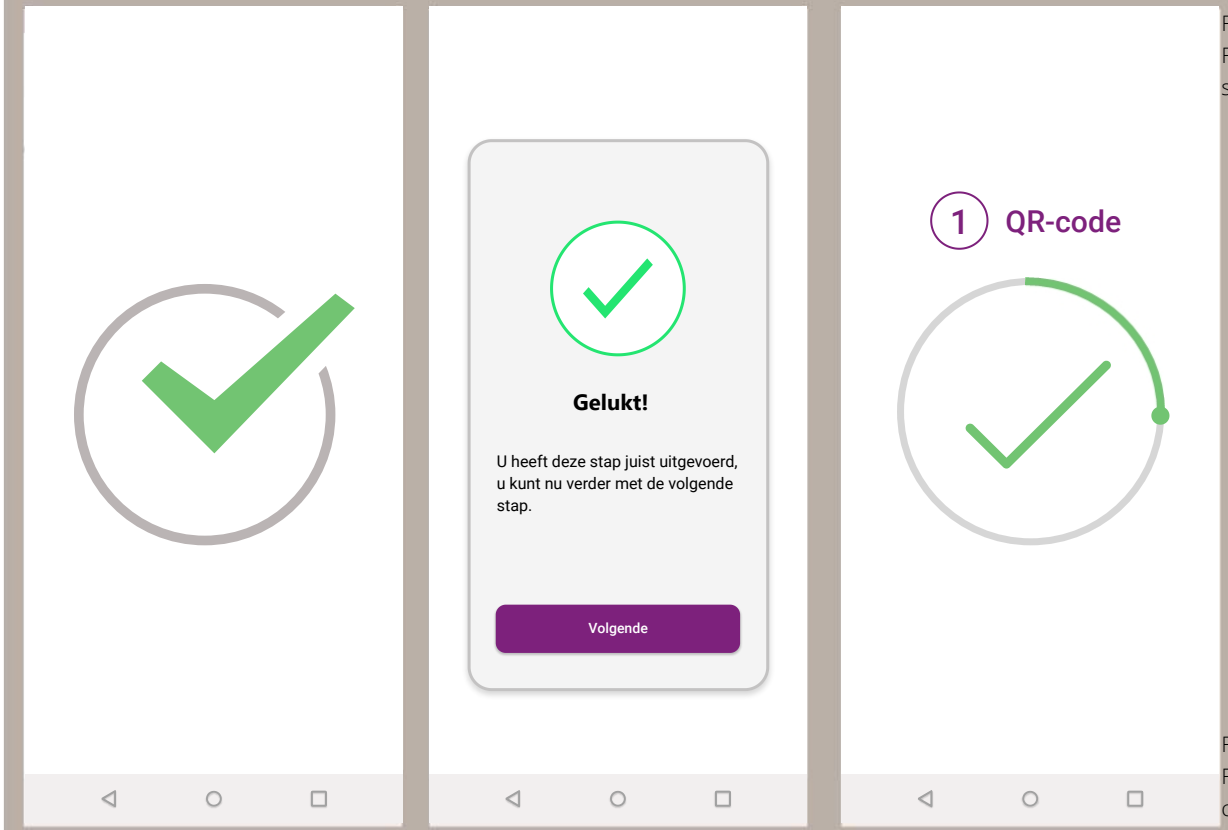


Figure 5.15: Feedback screens

Feedback NFC carrousel

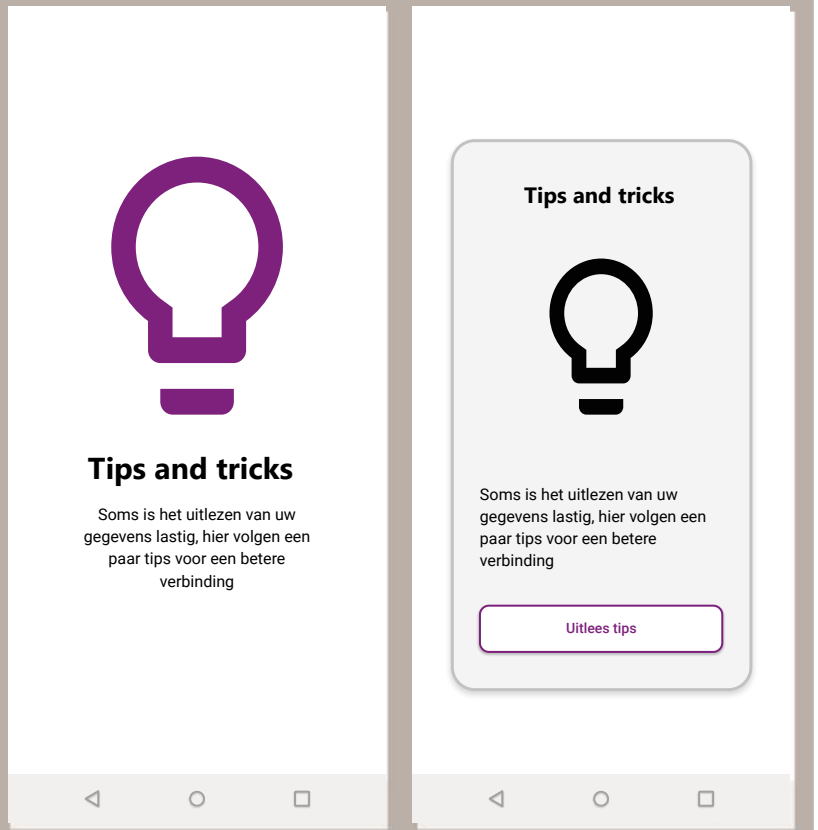
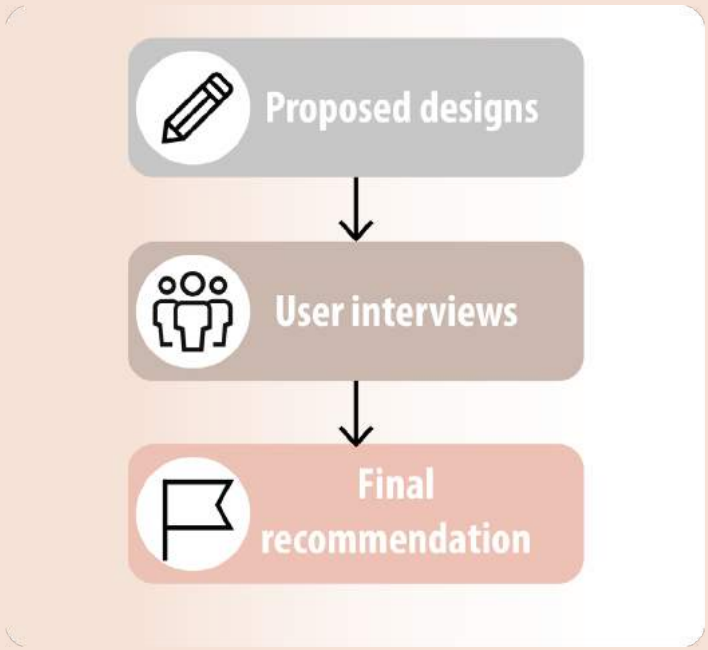
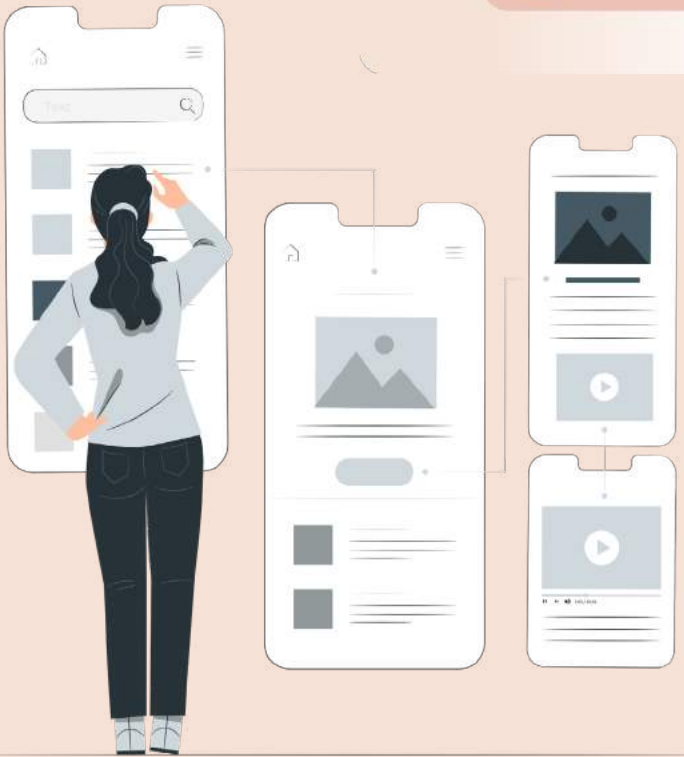


Figure 5.16: Feedback NFC carrousel

6. EVALUATION

The goal of this Chapter in is to examine the designs that have been generated in the ideation phase of the project: *"What are the redesign possibilities that enhance the usability and user experience of the ReadID Ready app for older adults?"*. To start off, online user tests will tell how older adults feel about the proposed designs. Detailed prototypes will reveal how older adults make sense of the proposed solution. this is done by means of a 'walk-through' session. User opinions and thoughts are summarized and mapped out. Hereafter, a final recommendation for the overall user experience of the ReadID Ready app for older adults is made.





6.1 Objective

The objective of the online user interviews is:

1. To examine whether the designs created in the ideation phase make users feel prepared to start the ReadID Ready process. What makes older adults feel prepared when they start the identity verification process? And which elements contribute to this?
2. To evaluate the different designs. What are the advantages and disadvantages of the proposed designs? And are there any particular preferences when it comes to a design or specific element?
3. To assess the overall information present. What is the proper amount information to show to older adults without annoying them?

Detailed prototypes that have been developed in the ideation phase are used to walk the user through the different steps of the user flow. The online user tests are meant as a first exploration on the proposed designs.

6.2 Participants

A total of six participants that fit within the target group took part in the user tests. The youngest participant was 54 years old, and the oldest one 67 years old (see also Appendix I). These were recruited via the social circle of the researcher. A plan was written for both a physical and remote setting. Two participants agreed on a physical meeting in a home setting, whereas four of the participants were questioned online via Microsoft Teams.

6.2.1 Ethical approval

The Ethics Committee from the Faculty of Engineering Technology of the UT has given approval for conducting the user tests.Permission was given based on a variety of documents that had to be submitted (Appendix I).

6.3 Set-up of the user tests

User tests were set-up by means of a 3 step approach, this approach has been finalized with a pilot interview. The researcher tried to work according to the principle of *observe, discuss, opinion*. First *observe* what the participant is doing, *discuss* particular choices and design elements, and lastly ask them *to voice their opinion* in relation to the design. A simplified script can be found in appendix I.

1. Instruction

At first, the researcher introduces herself and the topic of her Graduation Thesis. Participants are given a scenario through which they are introduced into a certain setting (Appendix I). This scenario is more or less the same as the one used in the user research; the participant has to verify their identity in order to receive their pension. They have received a link to an instruction page, the participant is either given the link of design A or B (figure 5.6 and figure 5.8). A task is given: they have to look at the instruction page and see if they are able to download the existing app via the Play/ App store. Participants are asked to talk aloud, sharing their thoughts on what they are doing and why (figure 6.1). The researcher will observe the participants and write down observations on a form. The interview is recorded through audio as well.

Once the participant is finished, they will talk about the overall interaction with the instruction page. Did the participant feel prepared for the verification process? Why? How many steps did the process consist of? And what did the participant do first?

Afterwards, the participant gets to take a look at the second design of the instruction page. If the participant first looked at design A, they will now look at design B and vice versa. The researcher and participant talk about the usage of this webpage. In the end, the participant is asked about differences in elements, in particular the variation between the carrousel and timeline function.

2. Start screen

The second step within the user test is for the participant to explore a new version of the ReadID Ready start screen. The participant is either given design A (figure 5.10) or design B (figure 5.13). The question *"How would you proceed?"* is asked. The researcher tries to see what the participant would do in a normal situation (see figure 6.1). Key here is to observe on which elements the participant puts a focus. Do they look at the 'steps' or 'more information' section? Why do they make certain choices? Once finished, a conversation between the participant and researcher will take place in which certain choices, feelings and opinions are shared.

Secondly, the other design is presented to the participant. Once again the participant is asked to interact with the prototype. The researcher and participant will talk about particular interactions within the design and possible shortcomings. Subsequently the designs are compared to one another. What elements enhance a design and which do not? Do participants prefer one prototype over the other? Or would a combination of certain elements be a good solution? And what about the amount of information shown?

3. Feedback within the app

The steps in the identity verification process are enhanced using more feedback. In order to evaluate the different designs, a demo of the process as is shown to the user. Next to this, a demo with more feedback throughout the screens is shown. By doing so, participants understand the envisioned change of the feedback and how this is going to be implemented. Three different feedback screens are shown to the participant (figure 5.15). The participant is asked to have a look at each one of them and voice their opinion. Afterwards, the researcher and participants will talk about the different elements present on the interface to see if there are particular advantages and disadvantages in the three designs, as well as the amount of information presented.

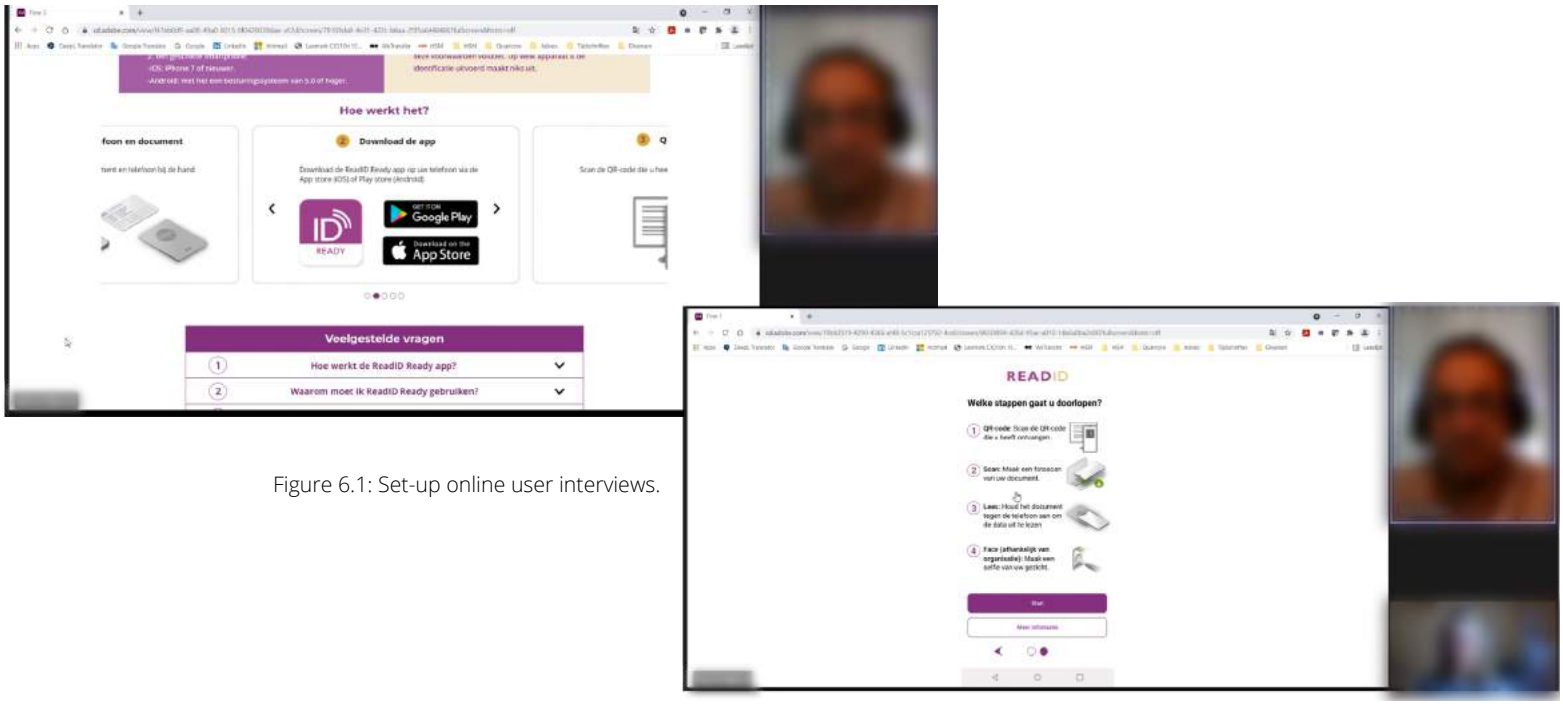


Figure 6.1: Set-up online user interviews.

6.4 Results

The online user tests resulted in a set of 6 observation forms and 6 hours of audio recording. These have been analyzed by the researcher in order to sketch a general picture of the opinions from the participants.

Instruction

How a person looks at an online interface, also known as the viewing behavior, determines how successful information is communicated to a user. The first thing users (5 out of 6) would often do once they were asked to interact with the instruction page is reading the introduction of the page, as well as what they needed in order to proceed in the verification process. One half would read everything carefully, whereas the other half read through it rather quickly. Most attention was paid to the 'how it works' section by all of the participants. Half of the participants (3 out of 6) actually read one of the FAQ questions, the others emphasized that they would only take a look here if they got stuck in the process. One participant did not notice this section at all.

Starting the verification process

The bigger part of the participants (4 out of 6) felt prepared to start the verification process, whereas two participants were quite **unsure** to start this process. Even though an instruction page was provided, interacting with a digital device to complete an important process made them feel **worried**. After reading the webpage, three participants could tell the researcher the amount of steps in the process.
Five from the participants managed to download the ReadID Ready app on their phone. Four managed to download the app rather quickly, whereas one needed a bit more time to find the right tools on her phone for the download. One participant had never downloaded an application on a mobile phone before, and would only use his phone for calling and texting. It was therefore unknown to him what certain terms like 'Play/App store' meant, making it almost impossible for him to understand what he had to do.

Design elements

Participants appreciated the step-section; they found the explanations of the steps straight to the point and clear to understand (4 out of 6). Especially the fact that a lot of visuals where present, made it easier for users (5 out of 6) to understand what they needed to do.

The big difference between design A and B, is how the steps are presented to the user. In design A, the steps are presented in a click-through carrousel. Though in design B, the exact same information is shown in a vertical timeline, where no clicking is needed. Half of the participants did not notice that they could actually click on the arrows of the carrousel to view the next set of steps (figure 6.2), therefore **missing out on important information in a real-life situation.**

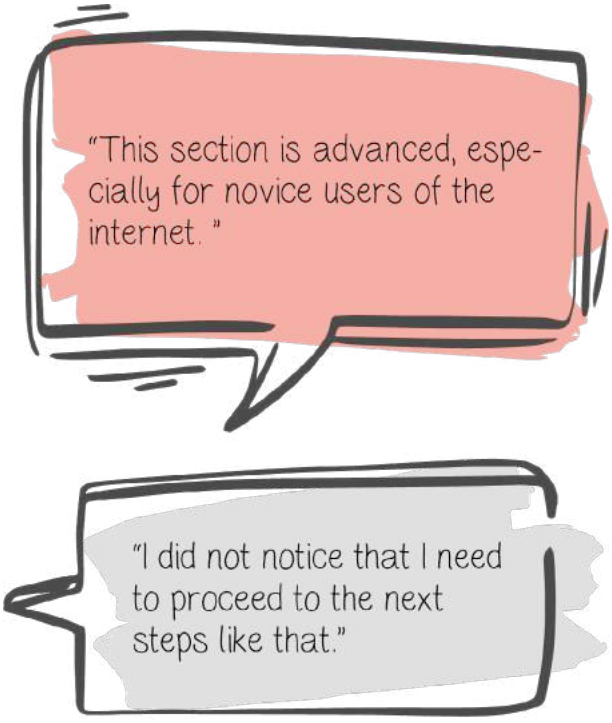


Figure 6.2: Interacting with Prototype A

Accordingly, the 'timeline' of design B was in fact understood by all participants. In their opinion, you see everything at once (figure 6.3), making it clear that you need to scroll down in order to see the next step (5 out of 6). Scrolling from the top to the bottom of the page felt natural for this age group. The fact that the timeline actually took over a big part of the webpage did not bother them. Clicking feels like a bigger threshold, whereas scrolling feels like a natural thing to do while interacting with a webpage.

What half of the participants actually missed in both versions of the webpage, is a phone number to call in case they are in need for help, providing users only with a FAQ section might therefore not be enough.

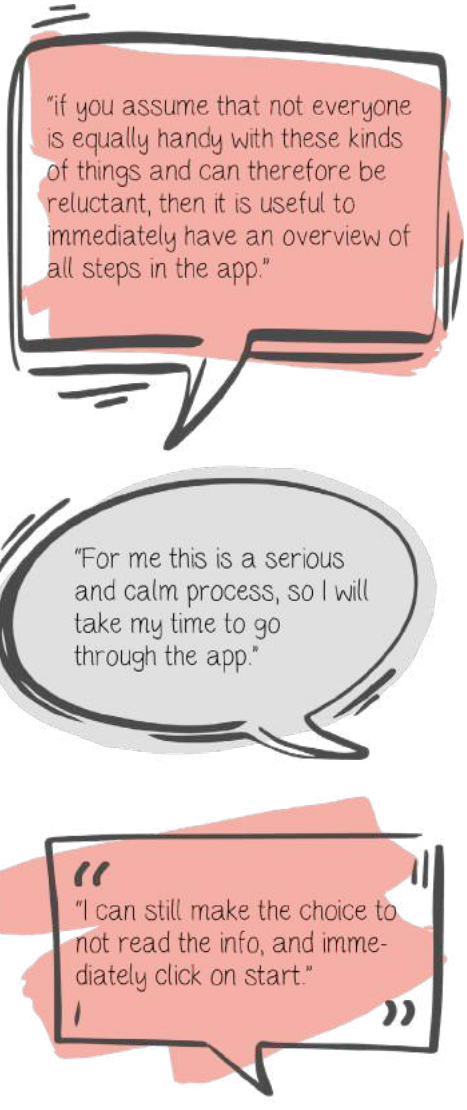


Figure 6.4: Participants inspecting design B

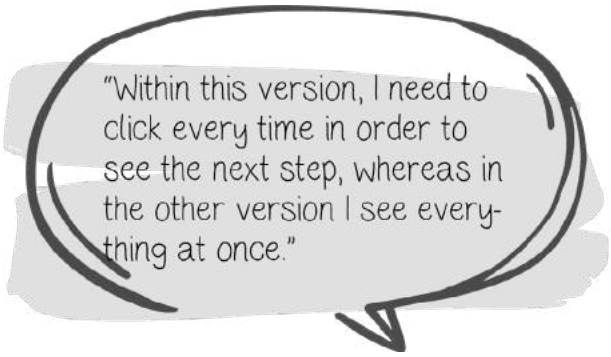


Figure 6.3: Inspecting the different elements of instruction page.

Start screen

Half of the participants read the information on the start screens quite extensively, whereas the others went through it quite quickly. How participants interacted with the start screen, depended heavily on the prototype which they used. For design A, participants were immediately drawn to the 'start' section (4 out of 6). Two participants clicked on the 'steps' section here. Half of the participants did not notice the 'steps' section, a reason for this is the fact that they (3 out of 6) read from top to bottom and therefore more often look at the bottom of the screen. Next to this, 'steps' did not capture their attention as it is not portrayed in for example a different color, whereas the 'start' button does.

In design B, participants have to encounter the step page before they can proceed in the verification process and see the 'start' button. The majority of the participants (5 out of 6) immediately knew that they had to click or swipe in order to proceed, swiping feels like a natural movement on the phone for older adults. Was this extra section bothering? Not at all, as looking at the steps actually made it extra clear for the participants (5 out of 6) what was expected from them and what they had to do.

Two participants emphasized that even though it is extra information to read, you would normally also take your time to finish a process, and if you do not want to read the info you can just skip it (see the last two quotes of figure 6.4).

Again, the steps here were perceived as easy to read and concise. Participants liked the fact that they saw visual images again, this appeals more to them than big chucks of text.

The more information section was noticed by the majority of participants (5 out of 6), but only one participant clicked here. As a reason for this participants argued that they would only look here if something was really unclear for them, which was not the case at that time.

Feedback
As stated earlier, a demo of the steps without additional feedback, and a demo with additional feedback was presented to the participants. Five from the participants thought that having additional feedback would be beneficial for the user experience, whereas one participant thought that the original ReadID application is clear enough. Three versions of a feedback screen were shown to the participants (see also figure 5.15). It became immediately clear that the most simplistic version (screen 1) with a checkmark was too basic and therefore meaningless for all participants. In two cases even causing **confusion** and **frustration** as it lacks information in the opinion from the participants.

Within the second feedback screen, all participants preferred the fact that you have to click in order to proceed in overall process. This makes them feel **in control** of the process, instead of it being a nuisance. Participants did not think that the amount of text on the screen was too much (5 out of 6). Although, one participant emphasized that there might be too much textual information present here.

The third feedback screen was perceived as useful as well, the usage of the title and step-indication made participants understand better at which step they are located (4 out of 6). Two participants did not think a timeline would be necessarily needed (2 out of 6).

In fact, four participants suggested that they would like to see different elements from screen 2 and 3 together in one design. Clicking gives users the feeling of being **in control** (figure 6.5), and a moment of rest if needed. A step indication gives **the feeling of assurance and confirmation** due to the timeline.

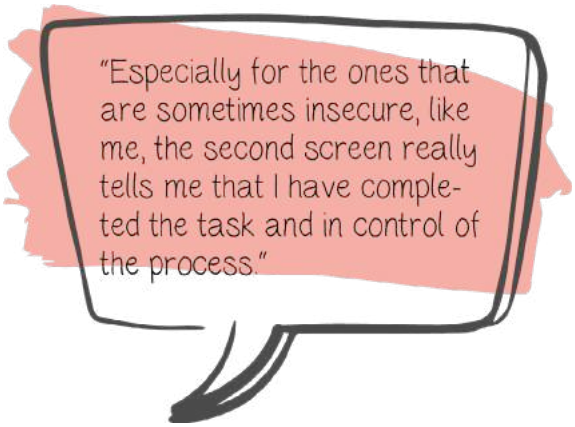


Figure 6.5: Staying in control through clicking.

6.5 Conclusion

Taking into consideration the objective of the online user tests, it can be argued that the generated prototypes from the ideation phase show a great potential to enhance the user experience from older adults in the ReadID Ready app.

Providing older adults with a clear overview of what is expected from them, as well as the steps that they need to take in the overall process will provide the majority of the users with more assurance, confidence and trust in oneself to finish the process independently. How the information is presented does however have a big influence on the overall user experience. Older adults tend to favor scrolling on a webpage over clicking. Whilst on the smartphone swiping is also perceived as a natural gesture. Information is scanned from top to bottom, elements that are positioned in a different matter are therefore easily overlooked. Highlighting important matters plays a key role here; the usage of numbers and bullet points raises more awareness to older adults. Next to this, visuals images can provide them with an immediate explanation.

The addition of the extra information did not seem to bother this target group. On the contrary, elements that have an added value for them in the process are appreciated. Participants argued that the information presented was simple and straightforward. If big chunks of text and unnecessary visual elements were shown to the users, this would have been a different story. At the moment, certain visual aids like the timeline helped the users in understanding the steps which they needed conduct in the remote verification process. Although others were less successful, like the carrousel and the 'steps' tab; these were sometimes difficult to understand for participants or easily overlooked. When feedback is provided to the older user, it should be meaningful and at the same time give them control over the process. A simple checkmark on an empty screen does not satisfy their needs, they expect a screen which tells them their progress as well as a clear 'success' message.

Looking back at the design principles of section 5.3.1, it can be stated that these have been of great value for the way the different designs have been set-up. Design principle 1, 3 and 4 have worked out pretty well. Design principle 2, did however not seem to be preferred by this age group. Both instruction screen A and start screen A provided the user with the option to look at different sections by their own choice. Even so, older adults find it easier to just receive all information immediately. Nonetheless, information should still be presented in a concise and flexible manner; not letting users be overwhelmed by an information load. With the latter still being incorporated, this design principle could be changed into: Unified; provide purpose. Meaning that every bit of information should be part of a greater whole and contribute in a positive manner to the process. There should be no isolated features or outliers.

In the next section of this Thesis, the found insights will be processed in order to come up with a final recommendation for the ReadID Ready application.

Limitations in the evaluation interviews

Evaluation interviews were mainly held online due to Covid-19. Even though the results were really insightful, a real-life interview is believed to be different. Talking to a person in real life might make the participant more comfortable in sharing their thoughts. This can allow a participant to tell just that 'little bit more'. Small remarks and suggestions might not have been told because of the online setting. These small bits of information could have had an influence in the final recommendation of the Thesis.

6.6 Final recommendation

Based on the findings from the online user interviews, a final recommendation is made for the user journey of the ReadID Ready application.

6.6.1 Pre-usage

Example message

Before older adults feel comfortable to start the identity verification process, the feeling of both trust and safety has to be ensured to them. A structured and simple message should be send to the user with the request to verify one's identity, an example of such a message can be seen in figure 6.6. This could be shown to potential customers of ReadID Ready.

Example instruction page

Additionally, a straightforward and transparent example instruction page is needed (figure 6.7). Feedback in the user interviews revealed that scrolling through a page feels more natural for the older user. Next to this, providing a phone number for customer support is highly recommended, users always have someone to fall back on, giving them more assurance.

A instruction guide has been generated, which can be shown to new customers of ReadID Ready (Appendix J). This guide helps customers in the first stage of setting up the user flow for their users, keeping in mind the needs of older adults. It includes both the example message and instruction page.

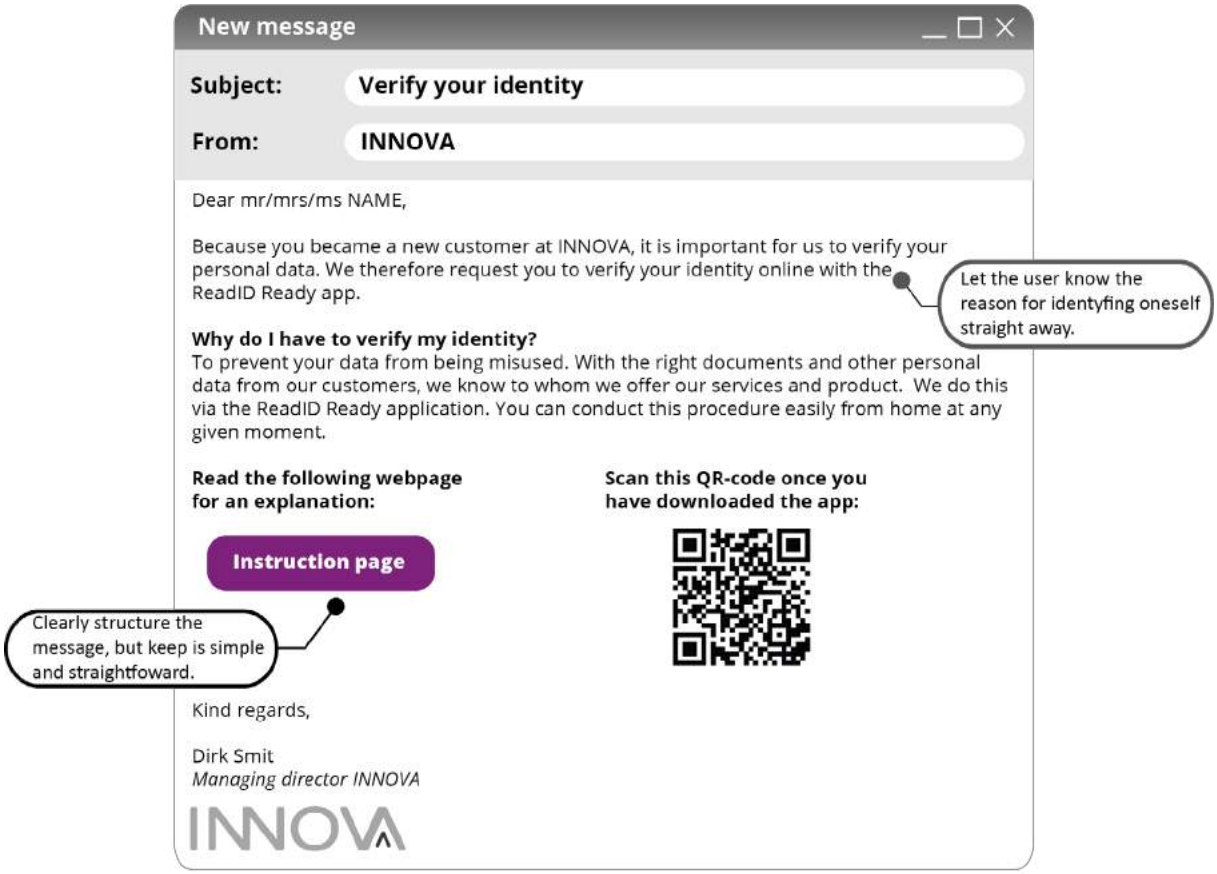


Figure 6.6: Example message

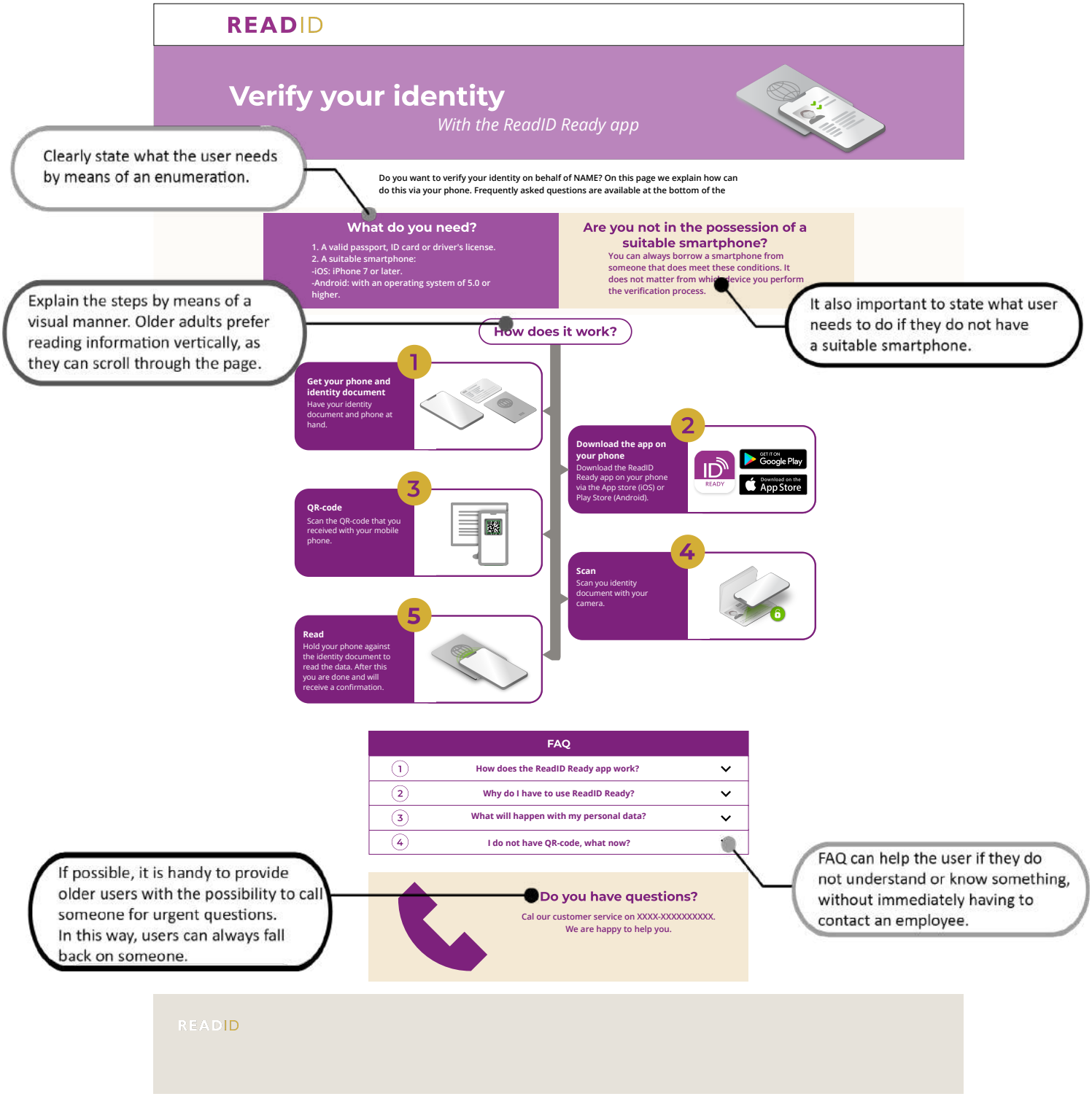


Figure 6.7: Example instruction page

6.6.2 Usage

Start

A new start screen has the potential to provide more guidance to older adults at the beginning of using the app(figure 6.8). The design of this screen shows besides a general introduction, all of the steps that the user needs to go through in order to complete the process. By providing this extra step of guidance, the older user knows better what to expect. While the app is loading, a so called 'splash screen' is shown with the logo of ReadID:

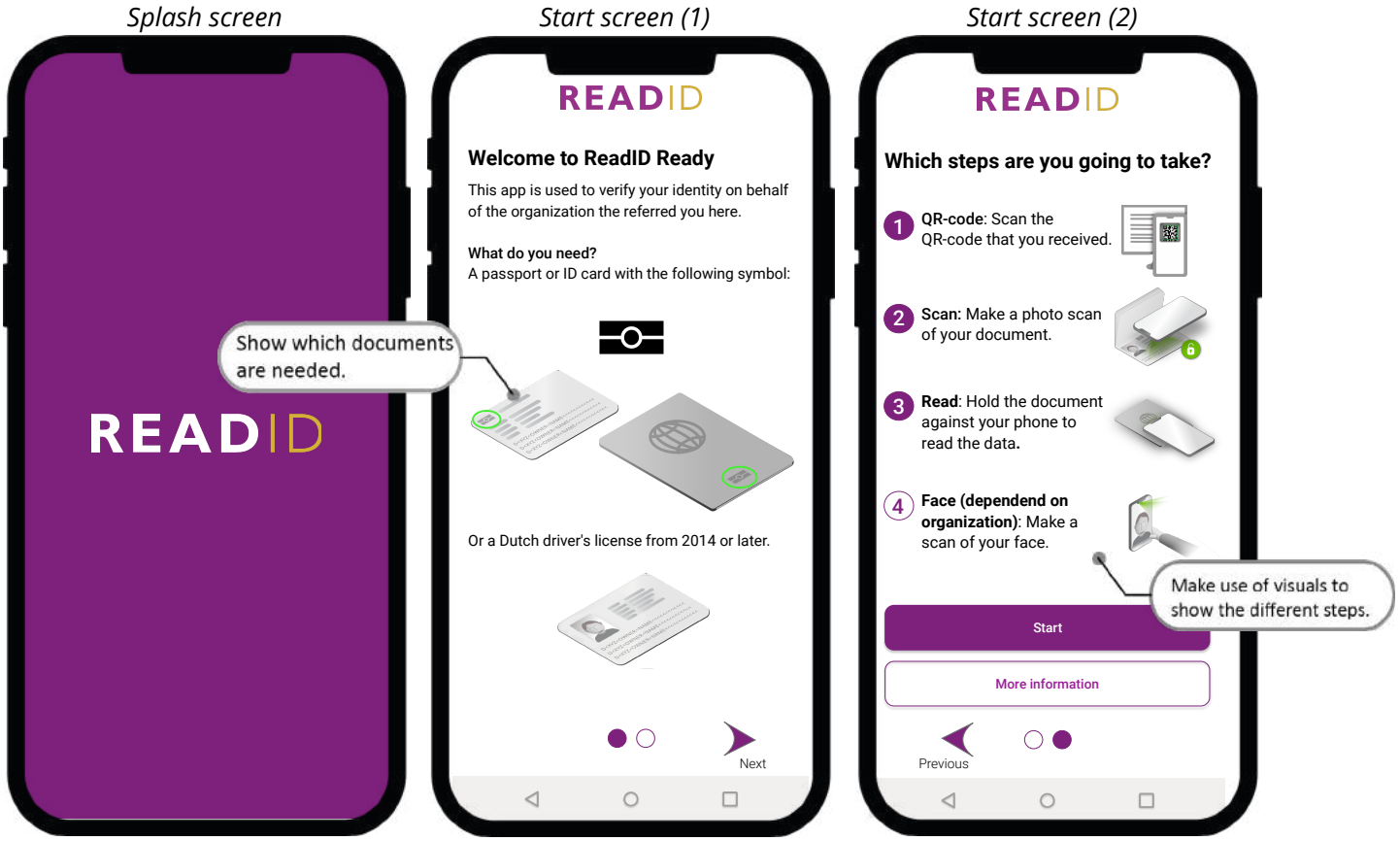


Figure 6.8: Start of the ReadID Ready app

Headers and textual descriptions

By using headers and new textual descriptions, more information is provided to the user. This is essential when they do not understand the animation. The sentences are shown one after another while the animation is playing. Have a look at figure 6.9 for the new screen of the QR-code and Read step. A complete overview of the current texts and new proposals can be found in Appendix J.

Feedback screens

In order to provide the older adult with more positive feedback in the app, feedback screens have to be integrated in between the different steps. Older adults have to click on the 'next' button to proceed, giving them control over this screen. A solution that can be quickly implemented by InnoValor is option 1. However in the long-term, it is strongly advised to also add a progress bar on this screen, as this gives users a better idea of where they are located in the app as shown in option 2. Likewise, a 'tips and tricks' screen tells the users that they will start looking at tips for completing the read step. See figure 6.10 on the next page for these designs.

The integration of numbers before titles is harder to implement because of the ReadID UI SDK, these could therefore also be implemented in the long-term.

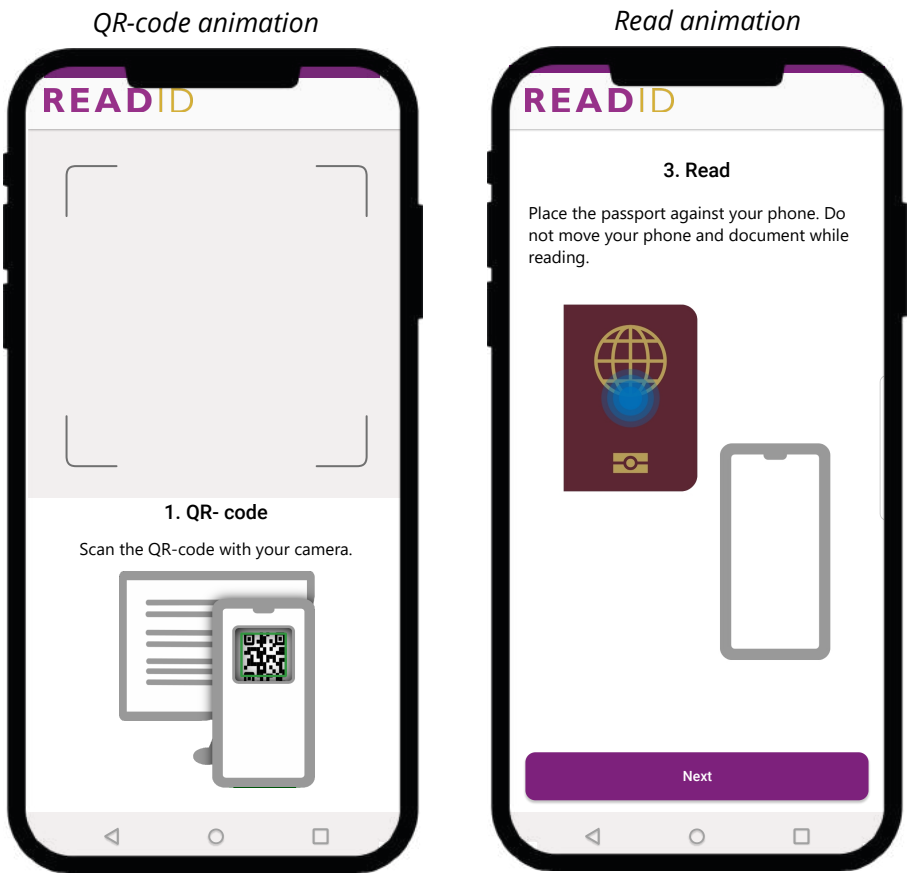


Figure 6.9: Using headers and new textual descriptions

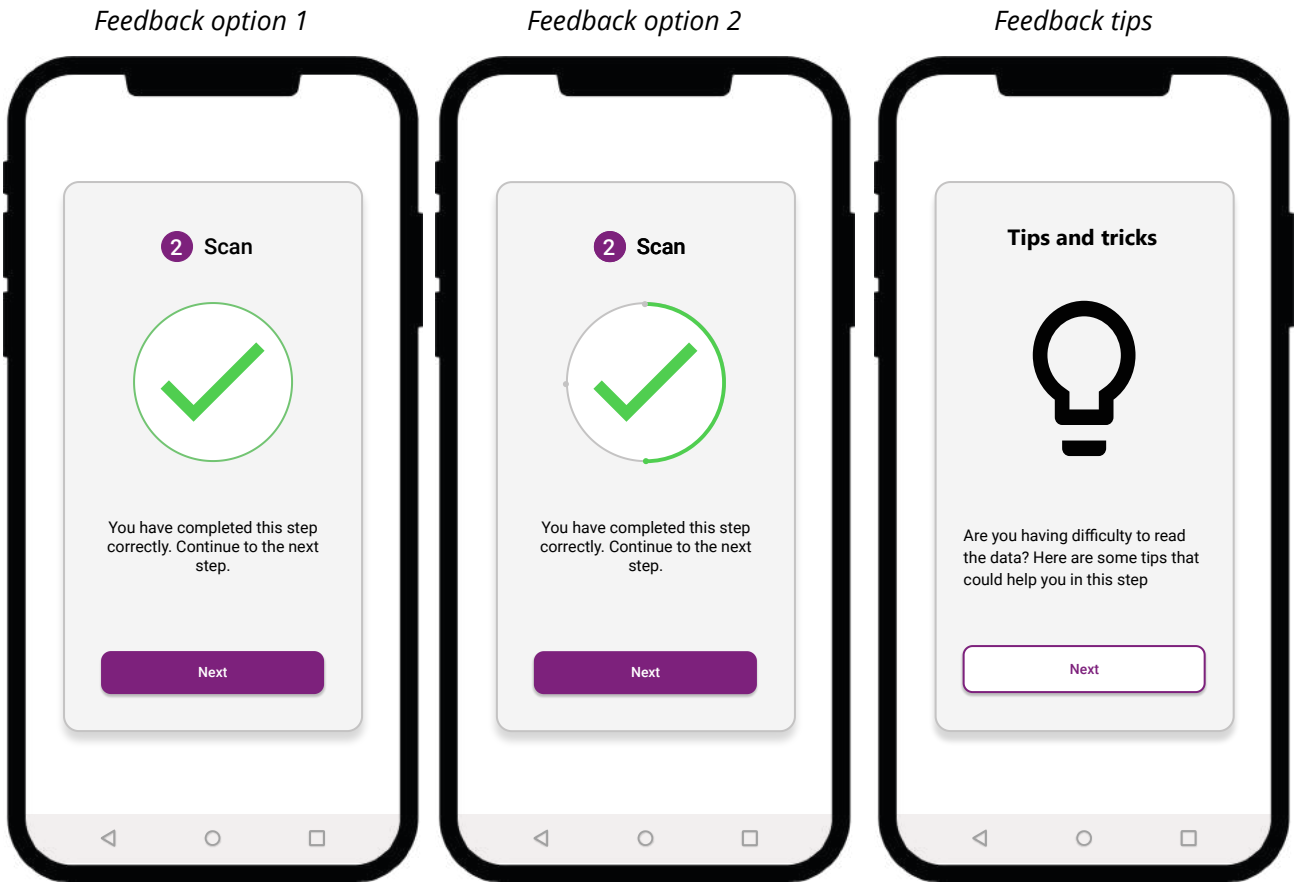
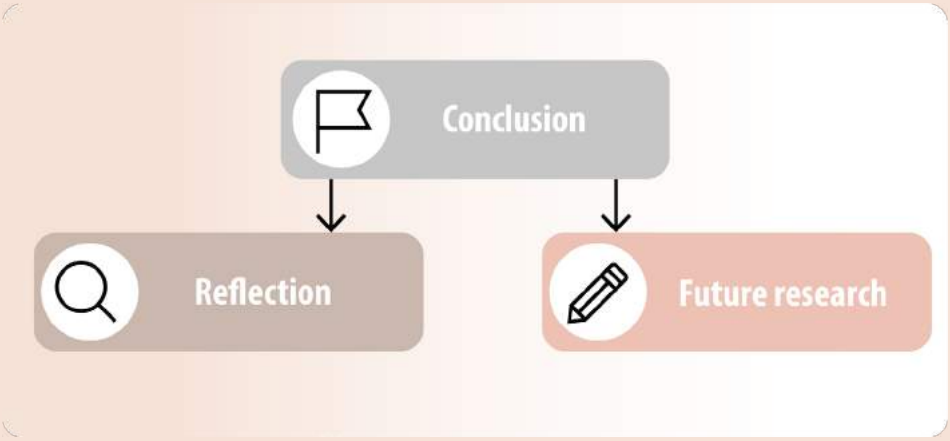


Figure 6.10: Positive feedback screens

7. CONCLUSION

We have come to the end of this research, it is time to look back. A short conclusion on the overall outcome will be given. Hereafter, a reflection on the process and future recommendations will be mapped out.



7.1 Conclusion

The aim of this Graduation Thesis was to generate a design which supports older adults in identity verification over a distance, with the main research question being: *"What are the current challenges that older adults experience when using the ReadID Ready app? How can this be enhanced in regards to user experience and inclusive design?* In an iterative approach, using a scenario-based design methodology in combination with dilemma-driven design, this question has been answered. Desk research generated the first insights into the benefits and obstacles older adults face while interacting with the ReadID Ready app. In an extensive user research, usability challenges, as well as dilemmas were uncovered that could be used as a design space.

During the ideation phase of this Thesis, two designs questions guided the researcher in coming up with the final concept, with the first one being: *"In what way can older adults become more comfortable to start using ReadID Ready and at the same time feel guided throughout the process?"* An example webpage gives customers of ReadID Ready the possibility to set-up an intuitive instruction for their users, preparing them for the download of the app and the steps they will soon encounter in the verification process. This makes users more trustworthy of the process, overcoming the novelty versus trust in tradition dilemma.

The second design question was formulated as follows: *"In what way can you guide older adults so that they can complete the ReadID process independently and give them the feeling of being control, while at the same time keeping the process time-efficient?"* More guidance at the start of the app, as well as more positive feedback during the steps in the app will tell the user what is expected from them, and show them their progress. It is believed that by making using this guidance, older adults will be more comfortable in conducting the verification process independently. At the same time, the feeling of being in control is perceived by the user, while not being too time consuming .

7.2 Reflection

It is important to take the time to reflect on the overall process and how this worked out in the end. As this is my personal reflection, I will write in the 'I' form, this makes it more personal for me.

In November 2020, I had started a new and final adventure in my life as a student, my Graduation Thesis. In my Bachelors I made the choice to conduct my Thesis externally, as I enjoyed getting to know the working culture of a company. It was an obvious choice for me to do this in my Masters as well. I was happy when I found an external company that was willing to hire me as a graduate student in times of Covid-19. And guess what? They actually had an actual product that was already available on the consumer market on which I could work!

At the start of my Thesis, I tried to find a suitable methodology that I could use as a guidance throughout the research. As there was already a working product at hand, I was not sure as to what would be a suitable approach. Eventually, the choice was made to make use of a scenario-based design approach in combination with dilemma-driven design.

Scenario-based design & dilemma-driven design

Using scenario-based design in this research allowed me, as a designer, to research my target group in a human-centred, inclusive manner. At the start of the Thesis, explorative scenarios gave an insight into the current possibilities and obstacles that users faced while interacting with the ReadID Ready application. Especially the explorative obstacles older adults might face (Chapter 3), formed a good baseline for the user research. Therefore, the current user story of an older adult using the ReadID Ready app could partly be understood, before even talking to actual users.

The extensive user research with my target group lead to a variety of dilemmas which could be used as an space for idea generation in the remainder of the Thesis. Once every now and then, I would ask myself the question: *"What is the exact difference between dilemma-driven design and scenario based design?"* Dilemmas are according to my point of view, user scenarios as well, whilst being focused on one specific decision. The user's decision can have a major impact on what happens next. Dilemmas capture the decision making process of older adults. This directly influences the overall user experience one has with the ReadID Ready app; dilemmas involve personal concerns, emotions and an individual's train of thought. Eventually bridging the gap between found insights and design possibilities.

During the ideation phase of this project future practice scenarios tried to answer the set of chosen dilemmas. For me, it was at the beginning hard to come up with these future practice scenarios, as these do not involve a completely new concept. By means of a 'walkthrough' session users could voice their opinion on the overall usability of the designs. These eventually determined the final concept details. To be honest, I first thought that this evaluation would only have limited value for the project; I already talked with my users right? And I found so many insights! Would that not be enough? The contrary seemed to be true, different design elements were preferred by the participants than I expected. The ones I preferred did not meet the standards from my target group .

I managed to catch the thoughts and feelings of my target group more deeply than I expected, resulting in a clear design base for the Thesis. Scenario-based design encompasses great variety of techniques that one could use to design, this 'great variety' was sometimes frustrating as well. Once every two or three weeks I got stuck for a few days in my decision making process, as there were so many different directions that I could take and there was no one who would tell me what to do. This is, looking back, part of a designers job! Eventually making me become more independent as a designer, but also as a person. In the end, I can say that I have grown from 'just a student' to a real 'human-centered designer' by working with this kind of methodology.

Working on an existing product

What differentiates this Graduation Thesis from other cases I have worked on, is the fact that there is already a product out there on the consumer market. In University, most of the times one would work on an open-ended case, where the aim was to design a product from scratch. For me, working on an existing product meant that I could have a big impact if some of my suggested designs would actually be integrated, making me extra motivated. It was however, also a different way from working than I am used to. Reviewing the actual product with older adults was a big part of the research phase, and meant having to rethink certain design methodologies. It was sometimes difficult for me to combine looking into the current app, whilst also exploring my target group. I believe that with the help from my supervisors, the methodology worked out better than expected.

In the ideation phase of the project, a major consideration that I took into account was the fact that I wanted my designs to be easily implementable, as this can immediately have an impact on the overall user experience of older adults. This did however mean that I had to stay in close contact with the developers from ReadID, and that I needed to understand the back-end of the app thoroughly. One could argue that not coming up with a completely new concept of the app might have limited the overall outcome of the Thesis. Based on the different conversations I had with a variety of employees of InnoValor, I can say that identity verification comes with a lot of privacy and technical matters that have to be taken into consideration before it complies with the right regulations. Meaning that a new concept would have most likely lacked in that sense.

Being able to make a direct impact is for me as a designer, of great added value, as I want to guide older users in this digital world.

Graduating in times of Covid-19
The last 1.5 years of my time as a student at the University of Twente have been unusual. Due to Covid-19, I had to suddenly follow all of my subjects online from home. This also meant that I had to do most of my Graduation Thesis over a distance. Sometimes this was tough, I am a person who likes being around others, talking face to face to a person feels so much more natural for me than via my laptop screen. In a normal situation, a graduate student would go to the office to work on her research, but also talk every now and then with other employees. I missed this social aspect a lot. Fortunately, my supervisors were willing to meet with me online on a regular basis, I could always email if I had any questions or got stuck. For this I am grateful, as these small kinds of gestures really helped me moving forward.

Besides this, the boundary to reach my target group for user research possibilities felt extra tough. I would often think: *"We are currently in a lockdown, older adults are extra vulnerable. They have got numerous other things to think about during these times than my research right?*" The contrary turned out to be true. Luckily employees from InnoValor and people from within my social circle were willing to help me out a lot. Via via, I had the possibility to reach out to my target group, and gain lots of insights.

7.2.1 Limitations in the research
No research is perfect, certain limitations in the project may have influenced the results or choices could have been made differently.

Customer interviews
In the explorative research of this project, the aim was to talk to several customers of ReadID Ready. Unfortunately, I did not succeed in getting in touch with enough customers who stand in close relation with my target group. It would have been of added value to talk to more customers for my explorative research.

User research
In the set-up of the user research, the PrEmo tool (Desmet & Wassink, n.d.) was used as a means of trigger. The main goal for this tool was to let participants be able to express their emotions more clearly, by making use of different visuals. Based on feedback of participants, I decided to limit these visualizations to 8 emotions instead of 14. Participants thought that the amount of cards to look at was too big, and therefore too time consuming. In stead of selecting this set of emotions by myself, it would have been better to ask participants directly which emotions were the most suitable to continue with.

Another aspect that could not be reviewed in the user research thoroughly is how motivation plays a role in the users decision making process. Academic literature and expert interviews revealed early on that one's motivation can have a big influence on the overall verification process. As the user research was not a real-life setting, the influence of one's motivation was hard to determine. Participants received indeed a scenario of a setting as to why they needed to verify their identity, still they were already aware of the fact that they were indeed going to use the app.

Online evaluation interviews
Evaluation interviews were mainly held online due to Covid-19. Even though the results were really insightful, a real-life interview is believed to be different. Talking to somebody in person feels more natural, and in that sense might have allowed some of the participants to tell just that little bit more. These small remarks could have had an influence in the final recommendation of the Thesis.

7.3 Future research

In this last section of the Thesis, some recommendations for future research are made.

User testing

In Chapter 6 of this project, different designs have been evaluated by means of online user interviews. It is important to test the final concept of the application as well. A good way to continue with this, is by doing an A/B test. Two versions of the app, with one being the final concept and one being the current version of the app, will be compared to one another. Version A will be given to one group of participants and version B will be given to the other group of participants. By doing so, you can see which one performs better than the other. From my point of view, this performance should not be assed only based on the time it takes to finish the verification process, but also take into account factors like the feedback from the participants, their feelings and the overall content. Hereafter, the final iteration of the design can be made and as such be implemented into the current user flow.

Other user groups

The research has been focused on one specific target group, namely older adults aged between 55 – 75 years old, also known as the baby-boom generation. The ReadID Ready app is however used by all people who need to be able to verify their identity; everyone who is in the possession of an identity document. A follow up research could also take into consideration the opinion from other age groups. Does the final concept fulfill their needs? Or do they maybe have some other suggestions that could be integrated as well? User interviews with different age groups can be organized. The set-up of these interviews can be more or less the same as the user research, with the new version of the concept being tested. If needed, a new iteration can be made that suits the needs of all different age groups.

NFC help carrousel

If users are not able to make a connection with the NFC reader in the read step, a carrousel with a variety of animations is shown. These animations are meant to help the user in understanding what they need to do. The sudden interface change does however not makes sense to the user, as well as why they are suddenly seeing these animations. Looking into another way of portraying these animations and tips is therefore one of the recommendations for future research. This step in the process is perceived as the most difficult to perform, showing the carrousel in a more guiding manner can be of huge influence, and therefore make a big impact if done correctly.

REFERENCES

Alwin, D. F., & McCammon, R. J. (2007). Rethinking Generations. Research in Human Development, 4(3–4), 219–237. https://doi.org/10.1080/15427600701663072

Anggreeni, I. (2010). Making use of scenarios : supporting scenario use in product design [University of Twente]. https://doi.org/10.3990/1.9789036530873

Anggreeni, I., & van der Voort, M. C. (2008). Tracing the Scenarios in Scenario-Based Product Design: A Study to Understand Scenario Generation. Design Principles & Practices, 2(4), 123–135.

Baltes, P. B., & Lindenberger, U. (1997). Psychology and Aging Emergence of a Powerful Connection Between Sensory and Cognitive Functions Across the Adult Life Span: A New Window to the Study of Cognitive Aging? In Psychological Association, Inc (Vol. 12, Issue 1).

Bandura, A. (1977). Self-efficacy: Toward a Unifying Theory of Behavioral Change. Psychological Review, 84(2), 191–215. https://doi.org/10.1007/978-3-319-75361-4

Baxter, K., Courage, C., & Caine, K. (2015). Understanding your Users: A Practical Guide to User Research Methods. Elsevier. https://doi.org/10.1016/c2013-0-13611-2

Bech, H. P. (2017). TBK Consult: When too much low hanging fruit is a warning sign. https://tbkconsult.com/much-low-hanging-fruit-warning-signal/

Bhattacherjee, A. (2001). An empirical analysis of the antecedents of electronic commerce service continuance. Decision Support Systems, 32(2), 201–214. https://doi.org/10.1016/S0167-9236(01)00111-7

Blythe, M., & Monk, A. (2018). Funology 2: From Usability to Enjoyment. https://doi.org/10.1007/978-3-319-68213-6_4

Bont, C. de, Smulders, F., Voort, M. C. van der, Schifferstein, R., & Ouden, E. den. (2013). Advanced Design Methods for succesful innovation. Design United. https://research.utwente.nl/en/publications/advanced-design-methods-for-succesful-innovation

Boyatzis, R. (1998). Transforming Qualitative Information: Thematic Analysis and Code Development. https://www.researchgate.net/publication/242364922_Transforming_Qualitative_Information_Thematic_Analysis_and_Code_Development

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

CBS StatLine. (n.d.). Retrieved January 6, 2021, from https://opendata.cbs.nl/statline/#/CBS/nl/dataset/7461BEV/table?fromstatweb

Certifications. (n.d.). Retrieved June 22, 2021, from https://www.readid.com/certifications

Chisnell, D. E., Redish, J. C., & Lee, A. (2006). New heuristics for understanding older adults as web users. Technical Communication, 53(1), 39–59.

Chisnell, D., & Redish, J. (2005). Designing web sites for older adults: Expert review of usability for older adults at 50 web sites. Washington, 2(4), 479–492. http://roncastle.com/downloads/AARP-50Sites.pdf

Csikszentmihalyi, M. (1997). Finding flow: the psychology of engagement with everyday life. Choice Reviews Online, 35(03), 35-1828-35–1828. https://doi.org/10.5860/choice.35-1828

Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). Psychology and Aging, 21(2), 333–352. https://doi.org/10.1037/0882-7974.21.2.333

Delello, J. A., & Mcwhorter, R. R. (2017). Reducing the Digital Divide: Connecting Older Adults to iPad Technology. Journal of Applied Gerontology, 36(1), 3–28. https://doi.org/10.1177/0733464815589985

DeNederlandscheBank. (n.d.). DNBulletin: Opmars contactloos betalen in coronatijd - De Nederlandsche Bank. 2020. Retrieved January 11, 2021, from https://www.dnb.nl/nieuws/nieuwsoverzicht-en-archief/dnbulletin-2020/dnb391390.jsp

Desmet, P. (2019). PrEmo card set: Male version. Delft University of Technology. https://diopd.org/premo/

Desmet, P., Ozkaramanli, D., & Özcan, E. (2017). Is this a design-worthy dilemma? Identifying relevant and inspiring concern conflicts as input for user-centred design. J. of Design Research, 15(1), 17. https://doi.org/10.1504/jdr.2017.10005351

Desmet, P., & Wassink, P. (n.d.). Premo (Emotion Measurement Instrument). Retrieved June 22, 2021, from https://diopd.org/premo/

Djamasbi, S., Siegel, M., Skorinko, J., & Tullis, T. (2011). Online viewing and aesthetic preferences of generation y and the baby boom generation: Testing user web site experience through eye tracking. International Journal of Electronic Commerce, 15(4), 121–158. https://doi.org/10.2753/JEC1086-4415150404

Faraday, P. (2000). Visually Critiquing Web Pages (pp. 155–166). Springer, Vienna. https://doi.org/10.1007/978-3-7091-6771-7_17

Finžgar, L., & Trebar, M. (2011). Use of NFC and QR code identification in an electronic ticket system for public transport. 2011 International Conference on Software, Telecommunications and Computer Networks, SoftCOM 2011. https://ieeexplore.ieee.org/abstract/document/6064445

Fuglerud, K. S. (2014). The challenge of simplicity vs. complexity in universal design. https://doi.org/10.13140/2.1.4471.5844

Gazzaley, A. (n.d.). The Aging Brain: At the Crossroads of Attention and Memory User Experience Magazine. Retrieved January 11, 2021, from https://uxpamagazine.org/the-aging-brain-at-the-crossroads-of-attention-and-memory/

Greying Gadgets: How Older Americans Use Tech. (n.d.). Retrieved January 7, 2021, from https://www.radioworld.com/news-and-business/39greying39-gadgets-how-older-americans-use-tech

Griffen, L. L. (2015). Touch-screen tablet navigation and older adults : An investigation into the perceptions and opinions of baby boomers on long , scrolling home pages and the " hamburger icon " by Linda Litchfield Griffen A thesis submitted to the graduate faculty in partia.

Harwood, J., Leibowitz, K., Lin, M.-C., Morrow, D. G., Rucker, N. L., & Savundranayagam, M. Y. (2012). Communicating with older adults, an evidence-based review of what really works.

Hosking, I., Waller, S., & Clarkson, P. J. (2010). It is normal to be different: Applying inclusive design in industry. Interacting with Computers, 22(6), 496–501. https://doi.org/10.1016/j.intcom.2010.08.004

Hutter, L., & Lawrence, H. M. (2018). Promoting Inclusive and Accessible Design in Usability Testing: A Teaching Case with Users Who Are Deaf.

Karvonen, K. (2000). The beauty of simplicity. Proceedings of the Conference on Universal Usability, 85–90. https://doi.org/10.1145/355460.355478

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. Internet and Higher Education, 8(1), 13–24. https://doi.org/10.1016/j.iheduc.2004.12.001

Kirkpatrick, A., O'Connor, J., Campbell, A., & Cooper, M. (2018). Web Content Accessibility Guidelines (WCAG) 2.1. https://www.w3.org/TR/WCAG21/

Lin, J., Wang, B., Wang, N., & Lu, Y. (2013). Understanding the evolution of consumer trust in mobile commerce: a longitudinal study. https://doi.org/10.1007/s10799-013-0172-y

Lindgaard, G., & Dudek, C. (2002). User Satisfaction, Aesthetics and Usability. 231–246. https://doi.org/10.1007/978-0-387-35610-5_16

Lippke, S. (2017). Self-efficacy. In Encyclopedia of Personality and Individual Differences. https://doi.org/10.1007/978-3-319-28099-8_307-1

Madlmayr, G., Kleebauer, P., Langer, J., & Scharinger, J. (2008). Secure communication between web browsers and NFC targets by the example of an e-ticketing system. Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 5183 LNCS, 1–10. https://doi.org/10.1007/978-3-540-85717-4_1

Mahnke, R. (2014). Designing flow experience on the web: A grounded theory of online shopping flow. Proceedings of the Annual Hawaii International Conference on System Sciences, January, 3015–3024. https://doi.org/10.1109/HICSS.2014.376

McDonough, C. C. (2016). The Effect of Ageism on the Digital Divide Among Older Adults. Gerontology & Geriatric Medicine, 2(1), 1–7. https://doi.org/10.24966/ggm-8662/100008

Miles, M. B., Huberman, M. A., & Saldana, J. (2013). Qualitative Data Analysis: A Methods Sourcebook (3rd ed.).
Naden, C. (n.d.). ISO - Tackling privacy information management head on. Retrieved June 22, 2021, from https://www.iso.org/news/ref2419.html

Nakamura, J., & Csikszentmihalyi, M. (2009). Flow Theory and Research. In The Oxford Handbook of Positive Psychology (2nd edn) (pp. 195–206).

Nap, H. H., Greef, H. P. De, & Bouwhuis, D. G. (2013). Self-efficacy support in senior computer interaction. International Journal of Cognitive Performance Support, 1(1), 27. https://doi.org/10.1504/ijcps.2013.053553

Nielsen, J., & Landauer, J. (1993). A mathematical model of finding the usability problem. Proceedings of the CHI 93 proceedings of the Interact conference on human factors in computing systems. Proceedings of ACM INTERCHI'93 Conference, 206–213. http://delivery.acm.org/10.1145/170000/169166/p206-nielsen.pdf

Obal, M., & Kunz, W. (2013). Trust development in e-services: A cohort analysis of Millennials and Baby Boomers. Journal of Service Management, 24(1), 45–63. https://doi.org/10.1108/09564231311304189

Oiacono, E. T., Watson, R. T., & Goodhue, D. L. (2002). WebQual: A measure of Web site quality. In K. Evans and L. Scheer (eds.). Proceedings of Marketing Educators' Conference: Marketing Theory and Applications, 432–437.

Ozkaramanli, D., Desmet, P. M. A., & Özcan, E. (2016). Beyond Resolving Dilemmas: Three Design Directions for Addressing Intrapersonal Concern Conflicts. 32(3), 78–91. https://doi.org/10.1162/DESI

Ozkaramanli, D., Desmet, P. M. A., & Özcan, E. (2018). From teatime cookies to rain-pants: resolving dilemmas through design using concerns at three abstraction levels. International Journal of Design Creativity and Innovation, 6(3–4), 169–184. https://doi.org/10.1080/21650349.2017.1381042

Ozkaramanli, D., Desmet, P. M. A., & Özcan, E. (2020). From Discovery to Application: What to Expect when Designing with Dilemmas. Revista Diseña, 17, 58–83. https://doi.org/10.7764/disena.17.58-83

Ozkaramanli, D., Özcan, E., & Desmet, P. (2017). Long-Term Goals or Immediate Desires? Introducing a Toolset for Designing with Self-Control Dilemmas. Design Journal, 20(2), 219–238. https://doi.org/10.1080/14606925.2017.1272831

Ozturk, A. B., Bilgihan, A., Salehi-Esfahani, S., & Hua, N. (2017). Understanding the mobile payment technology acceptance based on valence theory: A case of restaurant transactions. International Journal of Contemporary Hospitality Management, 29(8), 2027–2049. https://doi.org/10.1108/IJCHM-04-2016-0192

Patch, K., Spellman, J., & Wahlbin, K. (2015). Mobile Accessibility: How WCAG 2.0 and Other W3C/WAI Guidelines Apply to Mobile. https://www.w3.org/TR/mobile-accessibility-mapping/

Persson, H., Åhman, H., Yngling, A. A., & Gulliksen, J. (2015). Universal design, inclusive design, accessible design, design for all: different concepts—one goal? On the concept of accessibility—historical, methodological and philosophical aspects. Universal Access in the Information Society, 14(4), 505–526. https://doi.org/10.1007/s10209-014-0358-z

Peter, J. P., & Tarpey, Sr., L. X. (1975). A Comparative Analysis of Three Consumer Decision Strategies. Journal of Consumer Research, 2(1), 29. https://doi.org/10.1086/208613

ReadID Ready. (n.d.). Retrieved June 4, 2021, from https://readid.com/products/ReadID-Ready

Rogers, M. (2009). Boomers and Technology: An Extended Conversation. World Future Review, October.

Saldana, J. (2009). The Coding Manual for Qualitative Researchers.

Seminar, D. (2011). User Experience White Paper. Seminar, 1–12. http://www.allaboutux.org/files/UX-WhitePaper.pdf

Shalamova, N. (2019). Beyond cultural dimensions: Digital inclusion in global UX. Shalamova, Nadya. https://doi.org/10.1145/3328020.3353923

Strandell, H., & Wolff, P. (2019). Ageing Europe: Looking at the lives of older people in the EU. In Bmj. https://doi.org/10.1136/bmj.315.7115.1103

Sullivan, S. E., Forret, M. L., Carraher, S. M., & Mainiero, L. A. (2009). Using the Kaleidoscope Career Model to Examine Generational Differences in Work Attitudes. In Career Development International (Vol. 14, Issue 3). https://digitalcommons.fairfield.edu/business-facultypubs

Vann, S. W., & Tawfik, A. A. (2018). Flow Theory and Learning Experience Design in Gamified Learning Environments. 1–17.

Visser, F. S., Stappers, P. J., van der Lugt, R., & Sanders, E. B.-N. (2005). Contextmapping: experiences from practice. CoDesign, 1(2), 119–149. https://doi.org/10.1080/15710880500135987

Waller, S., Bradley, M., Hosking, I., & Clarkson, P. J. (2013). Making the case for inclusive design. https://doi.org/10.1016/j.apergo.2013.03.012

Web accessibility policy | European Union. (n.d.). Retrieved January 18, 2021, from https://europa.eu/european-union/abouteuropa/accessibility_en

Wegdam, M., & Claas, L. (n.d.). ReadID UX overview.

Yang, K., & Jolly, L. D. (2008). Age cohort analysis in adoption of mobile data services: Gen Xers versus baby boomers. Journal of Consumer Marketing, 25(5), 272–280. https://doi.org/10.1108/07363760810890507

Appendix A: Expert interviews

Interview questions Expert Interviews Innovalor
Ice breaker
General introduction. Who am I? What do I study?

Introduction
Intro into the subject, user experience of the ReadID Ready application. Focus on inclusive user experience design, meaning that the design of the application is accessible for everyone. Also for people who do not use technology that much, elderly etc. The main goals of the interviews for me is to gain an insight into the customers and users of the ReadID software. And ultimately define a more concrete user group that I will be researching. Consent form?

Can you tell me a bit about yourself?
What is your current job at Innovalor? What does this job entail? How did you become part of Innovalor?
What are your daily tasks? How do you conduct these tasks?
Questions Maarten: Why did you start the ReadID department? What was the motivation behind it?
What is the success of ReadID?

Key questions
In what way do you stand in contact with the customers?
In what way do you stand in contact with the users of the ReadID applications?
What is the goal of ReadID Ready?
What are, according to you, the reasons why customers choose to make use of the ReadID (Ready) application?
Can you share an interesting use case with me?
What are the benefits for the users to make use of the ReadID software?
What are, according to you, the problems that customers of the ReadID Ready application face most often? Can you tell me a bit more about these problems/ examples?
What are, according to you, the problems that users of the ReadID Ready application face most often? Can you tell me a bit more about these problems/examples?
Are these problems linked to a specific target group? E.g. elderly, people who do not use technology that often, people with an impairment.
Do you receive specific questions about the usability or accessibility of ReadID?
Where do you expect ReadID Ready to go in the future? How can other user groups benefit from ReadID Ready?
Why would potential customers decide not to use ReadID or go to another company? Consideration? Usability/Accessibility? Target group?

Summary
Considering everything that we've talked about today, what's the one thing that's most important to you?

Wrap-up
Is there anything that we did not talk about yet that you would like to add to this conversation? Things that come to mind?
Do you have tips or suggestions regarding my research?
Thank you for your time and help. This is really the starting phase of the project, around March/April I will conduct a mid-term presentation for the company. If you are available and curious about the information that I gathered at that time, please feel free to join!

Information Sheet Internal Interviews Innovalor
The purpose of this research is for the researcher Mirel Nijhuis to gain a better understanding and insight in ReadID's customers and users, specifically the benefits and obstacles they face when using the ReadID software. Talking with Innovalor's employees will provide the researcher a better and broader insight into the subject, from a variety of perspectives.

The participant is free to stop the interview at any given moment, without having to give a reason. The participant is also free to not answer a question. Personal data is gathered from the participant in regards to their function within Innovalor. All the data given in the interview is strictly confidential and shall only be used for the research. Before the start of the interview, the participant is given the opportunity to ask questions.

Since conversations always go quite fast, the researcher would like to record the interview in order to transcribe everything. This is only done in consent with the participant. The video is converted to an audio file, that is stored on the Innovalor laptop of the researcher. If you do not wish to be video recorded, you can also turn of the camera during the conversation. The audio recordings will be removed after completion of the Master assignment, this will be in July 2021.

If you have any questions or complaints about this research, please contact Mirel Nijhuis.
E-mail: XXXXX
Phone: XXXXX

Consent form Internal Expert Interviews Innovalor
You will be given a copy of this informed consent form

Please mark the appropriate boxes with the Word highlight tool
Taking part in the study

	Yes	No
I have read and understood the study information provided on the information sheet.	O	O
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	O	O
I understand that taking part in the study involves an audio/ video-recorded interview and give permission for this.	O	O

Signatures

Name participant: Signature:

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting

Name researcher: Signature:

Appendix B: Explorative Scenario

1

John is surfing on his phone after a long working day. He suddenly receives a notification from his insurance company.

2

His insurance company, Bilo, asks John to verify his idenitity to check if his personal details are still valid. John had a long day and decides to do this the next week.

3

About a week later he starts the verification process from his smartphone.

4

John clicks on the link for the application download.

5

The application states that if John wants to verifiy his identity via his moble phone, he needs to click on the activation link.

6

John clicks on the activation link and can start with the activation link.

A few minutes later.....

7

See use case A for the user interaction between John and the ReadID Ready application numbers 6 - 10.

8

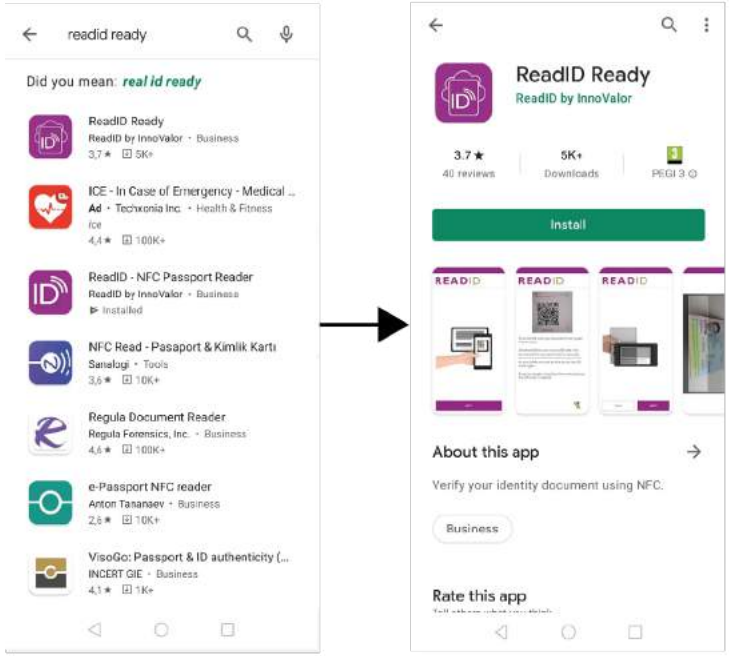
John receives the confirmation and is happy that he finished the verification process.

9

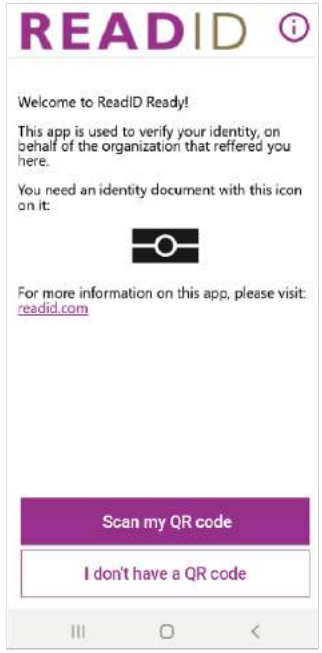
John now finally has time to sit back en relax at the start of his well deserved weekend.

Appendix C: The ReadID Ready app

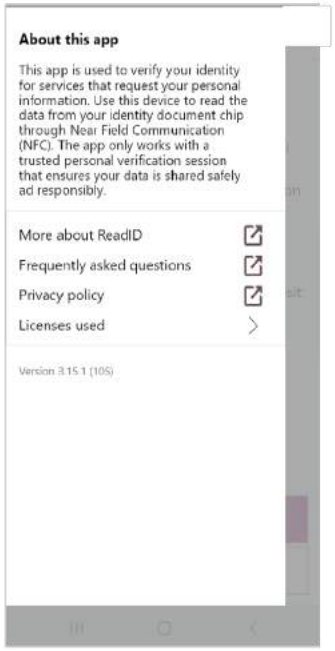
Download



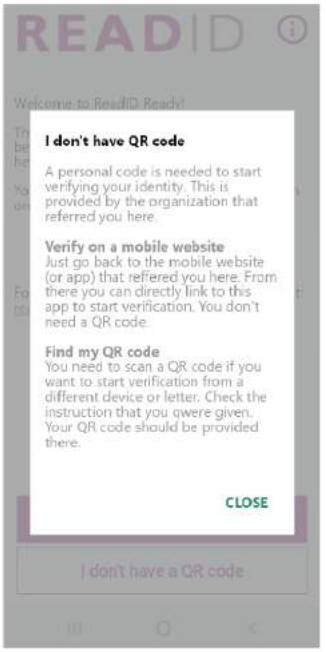
Start screen



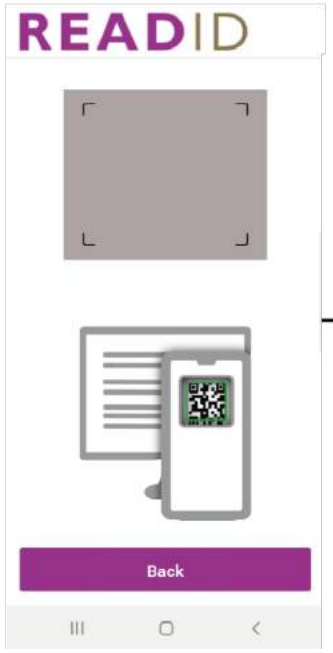
About



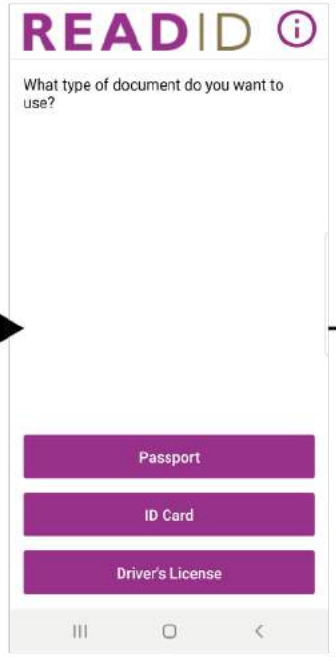
No QR code



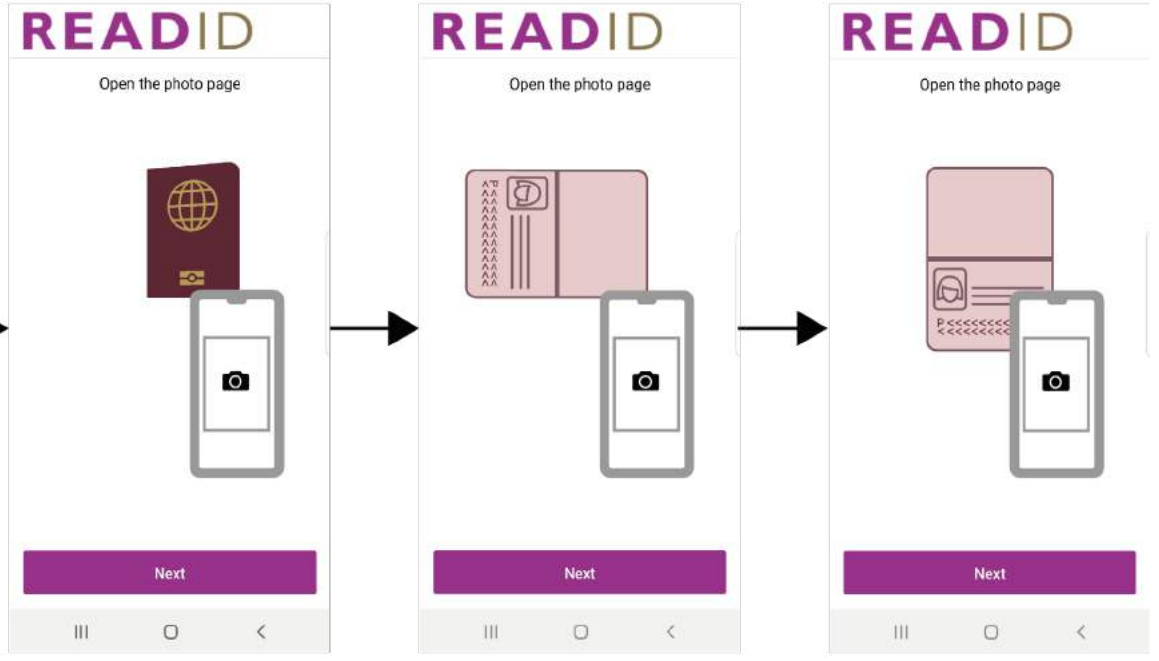
QR code scan



Document Choice

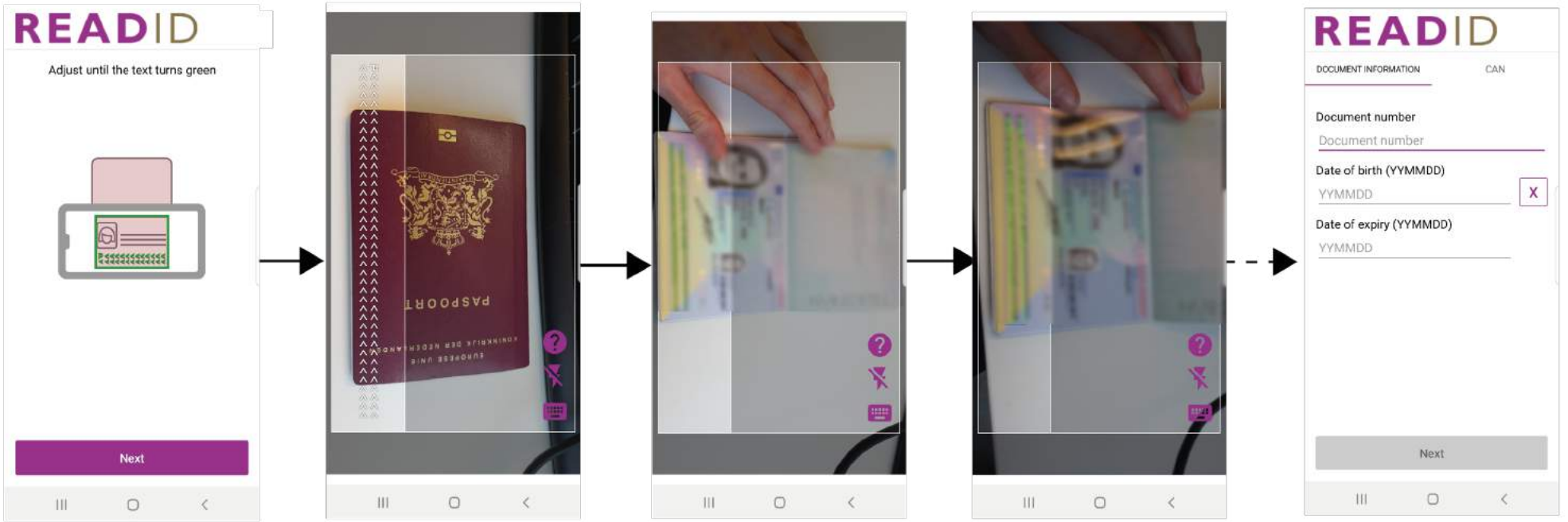


Explanatory animation MRZ



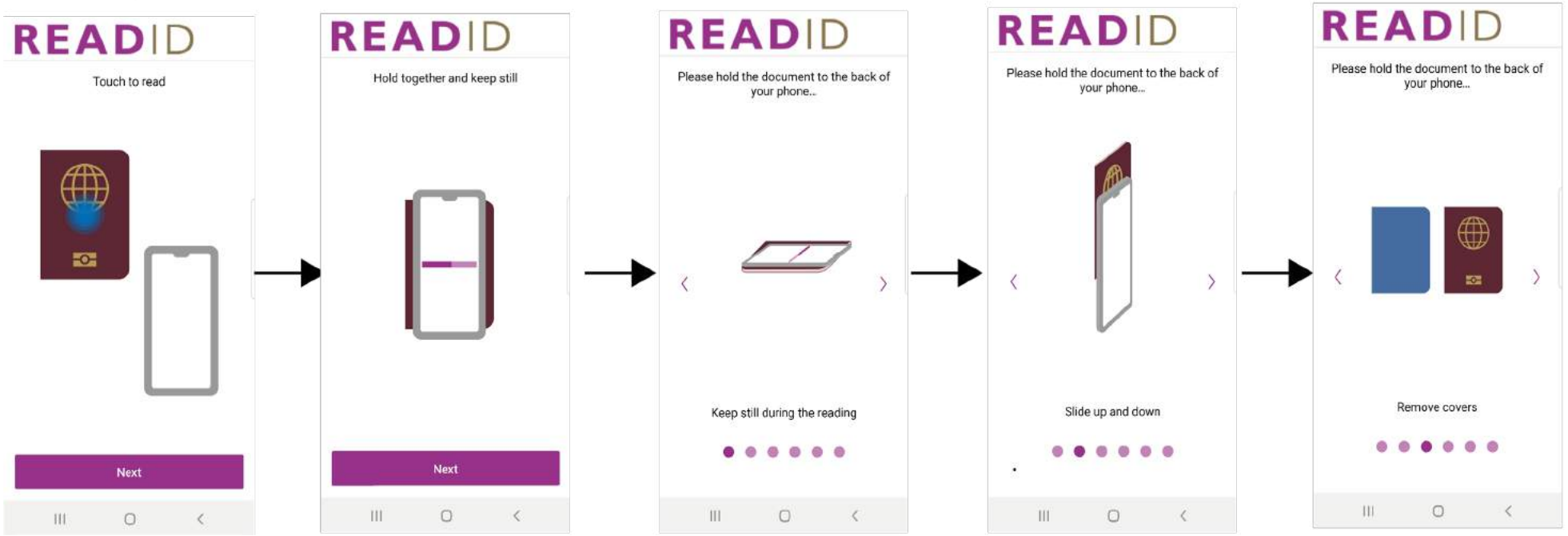
MRZ scan

Optional manual input

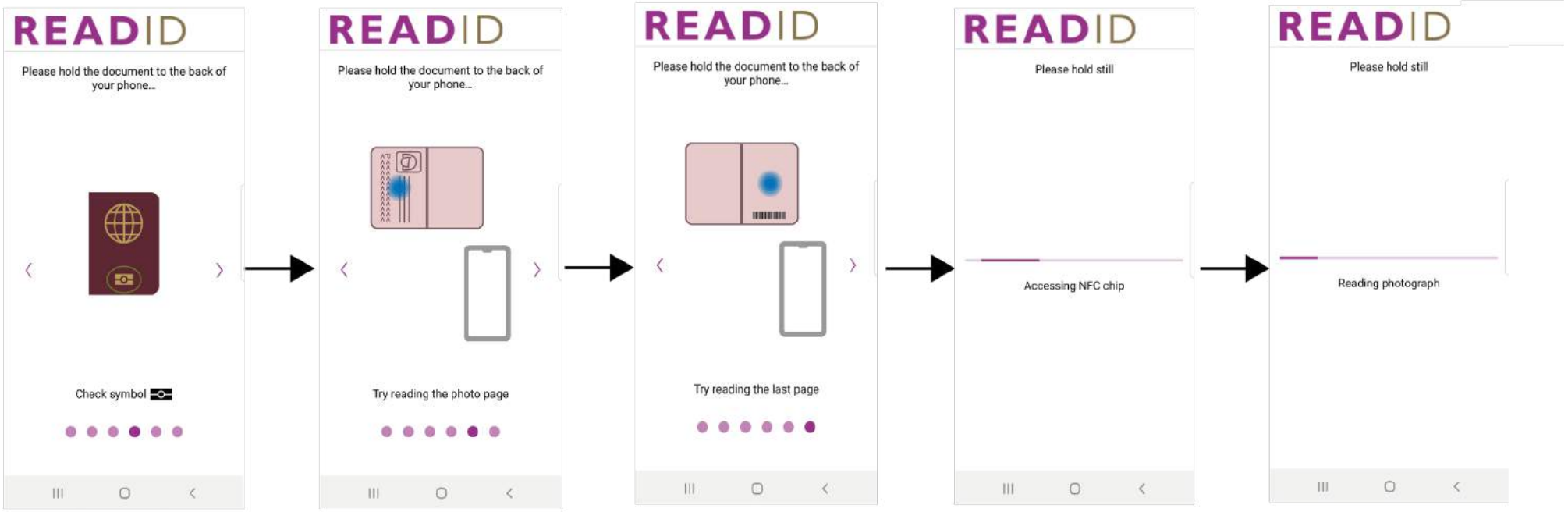


Explanatory animation NFC

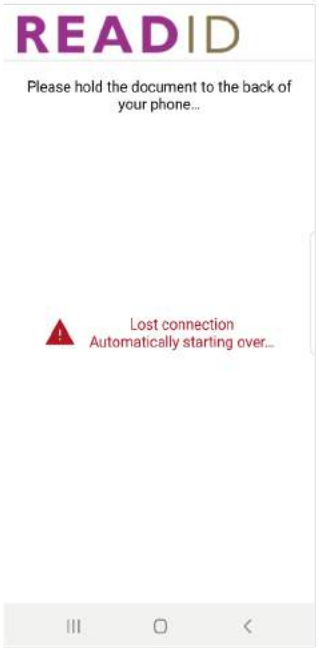
NFC Help carrousel



NFC Scan

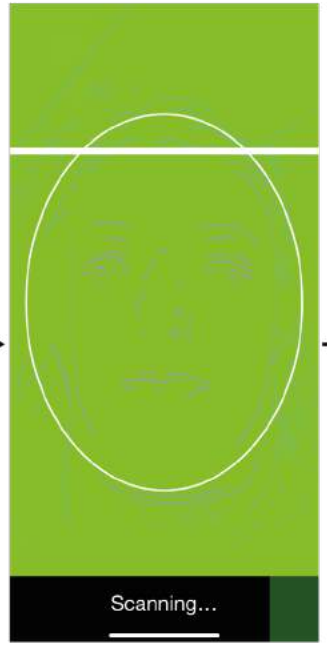


Lost connection

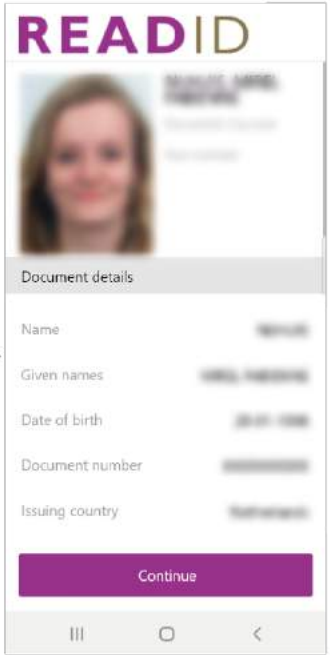


Explanatory animation iProov

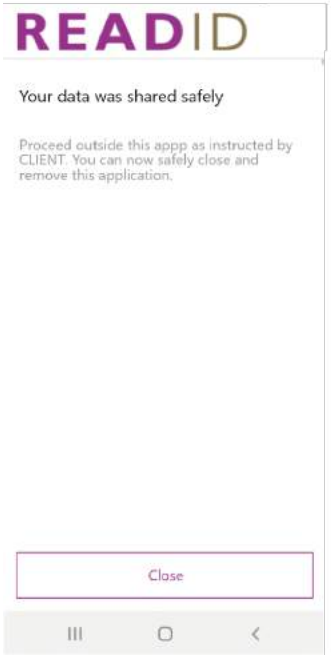
Face scan



Result



Confirmation



Appendix D: WCAG Comparison

Principle	Guideline	Goal	Criterion	Level	Name	Success	Fail	Not applicable	Comment
Perceivable	**1.1**	**Non-text content:** Provide text alternatives for any non-text content so that it can be changed into other forms people need.	1.1.1	A	Non-text Content		X		No text alternatives are present
	1.2	**Time-based media:** Provide alternatives for time-based media.	1.2.1	A	Audio-only and Video-only(Pre-recorded		X		No alternative is provided for the animations.
			1.2.2	A	Captions			X	
			1.2.3	A	Audio Description or Media Alternative		X		Small texts are represented but do not cover the complete context that is shown in the animation. The descriptions are additions, rather than full descriptions.
			As level A is not met, the follow-up criteria for level AA and AAA will not be addressed.						
	1.3	**Adaptable:** Create content that can be presented in different ways without losing information or structure.	1.3.1	A	Info and Relationships		X		Only partly available in text.
			1.3.2	A	Meaningful sequence	X			
			1.3.3	A	Sensory characteristics	X			
			1.3.4	AA	Orientation		X		The application cannot be turned to landscape mode. In the MRZ scan the landscape orientation is essential, just as in the portrait orientation of iProov**.**
			1.3.5	AA	Identify input purpose		X		The text available besides the animations is not sufficient enough.
			As level AA is not met, criterion 1.3.6 will also not be met						
	1.4	**Distinguishable:** Make it easier for users to see and hear content including separating foreground from background.	1.4.1	A	Use of color	X			The ‘I’ icon could be adressed better on the homepage.
			1.4.2	A	Audio control			X	

			1.4.3	AA	Contrast	X			
			1.4.4	AA	Resize text Level	X			
			1.4.5	AA	Images of text		X		The text available besides the animations is not sufficient enough.
			1.4.6	AAA	Contrast (enhanced)		X		The purple-white ratio is too low.
			1.4.7	AAA	Low or no background audio			X	
			1.4.8	AAA	Visual presentation		X		No mechanism is available.
			1.4.9	AAA	Images of text (no exception)		X		Images of text are used as a means of explanation.
			1.4.10	AA	Reflow	X			
			1.4.11	AA	Non-text contrast	X			
			1.4.12	AA	Text spacing	X			
			1.4.13	AA	Content on hover or focus			X	
Operable	**2.1**	**Keyboard accessible**	Will not be taken into consideration as the main function of this application depends on actions that do not require a keyboard.						
	2.2	**Enough time:** Provide the users enough time to read and use content	2.2.1	A	Timing adjustable	X			
			2.2.2	A	Pause, stop, hide		X		There is no option for the user to control the animations or carrousel
			2.2.3	AAA	No timing	X			
			2.2.4	AAA	Interruptions			X	
			2.2.5	AAA	Re-authenticating		X		No, but this is essential for the privacy information. When the user stops using the application throughout the process. His or her QR code will be invalid for 30 minutes due to security reasons**.**
			2.2.6	AAA	Time-outs		X		You are warned about the inactivity of the QR code, but not about the loss of their progress within the steps.
	2.3	**Seizure and physical reactions:** Do not design content in a way that is known to cause seizures or physical reactions.	2.3.1	A			X		Without taking into consideration iProov ReadID Ready would meet this criterion. iProov does however use flashes that flash more than 3 times in a second.

			2.3.2	AAA	Three flashes		X		See 2.3.1
			2.3.3	AAA	Animation from interactions		X		Animations are essential for this application to function, this is however not necessary.
	2.4	**Navigable:** Provide ways to help users navigate, find content, and determine where they are.	2.4.1	A	Bypass blocks	X			Ass this is an mobile application, the user immediately goes to the main content needed.
			2.4.2	A	Page titled		X		The app pages do not have titles. This might not be needed for this application. 'MRZ scan' would mean nothing to a one time user as they do not know what MRZ entails. This is also not needed, as it would slow down the process. More simple titles could however be used.
			2.4.3	A	Focus order	X			
			2.4.4	A	Link purpose	X			
			2.4.5	AA	Multiple ways	X			The page is the result of a process.
			2.4.6	AA	Headings and labels	X			Not often used, but if they are used, for example during the manual input in the MRZ step. It is clear what needs to be filled in.
			2.4.7	AA	Focus visible	X			
			2.4.8	AAA	Location level		X		No, the user does not know how far in the process he or she is.
			2.4.9	AAA	Link Purpose	X			Not much links are used, except in the information section where it is formatted in a clear way.
			2.4.10	AAA	Section headings			X	
	2.5	**Input modalities:** Make it easier for users to operate functionality through various inputs beyond keyboard.	2.5.1	A	Pointer gestures			X	
			2.5.2	A	Pointer cancellation	X			Up and down events are in this case the next steps in the application. Going deeper in the application is done by clicking through the steps on the purple buttons. The back button of the telephone allows the user to go back in the process to the earlier steps.

			2.5.3	A	Label in name level	X			
			2.5.4	A	Motion Actuation	X			It is in this case essential for the functioning of the application.
			2.5.5	AAA	Target size		X		
			2.5.6	AAA	Concurrent input systems	X			Input modalities are restricted as the application would otherwise not function in the right way.
Understandable	**3.1**	**Readable:** Make text content readable and understandable.	3.1.1	A	Language of Page	X			
			3.1.2	AA	Language of parts	X			
			3.1.3	AAA	Unusual words			X	
			3.1.4	AAA	Abbreviations	X			The only abbreviation used is NFC, this can be looked up in the more information section.
			3.1.5	AAA	Reading level			X	
			3.1.6	AAA	Pronunciation			X	
	3.2	**Predictable:** Make Web pages appear and operate in predictable ways.	3.2.1	A	On Focus	X			
			3.2.2	A	On Input	X			Before starting with a task, users are advised on how to conduct the tasks.
			3.2.3	AA	Consistent Navigation			X	There is not really a navigational system present in this application. Yet the outlines of all the pages are the same, making it easy to navigate through the steps.
			3.2.4	AA	Consistent Identification	X			
			3.2.5	AAA	Change on request		X		
	3.3	**Input assistance:** Help users avoid and correct mistakes.	3.3.1	A	Error Identification	X			
			3.3.2	A	Labels or instructions	X			On the start screen, the user can get more information on the ReadID steps, the ReadID website is however only available in English and not in Dutch! Only the FAQ page is available in Dutch.

			3.3.3	AA	Error suggestion	X			In the MRZ scan, there is a suggestion for manual input. In the NFC step is goes to the help carrousel. If the NFC loses connection with the NFC chip, it says lost connection which can be hard to understand for the user.
			3.3.4	AA	Error prevention	X			If in the MRZ information will be provided manually but in the wrong way, the user will be guided back to this step in the NFC step. He is asked to check the input data again. A confirmation is shown in the end of the verfication, users are however not allowed to make adjustments as this is not secure.
			3.3.5	AAA	Help		X		No, users cannot go to the information page anymore. In case of the help carrousel, it is often not clear that these are help steps.
			3.3.6	AAA	Error prevention (all)	X			See 3.3.4
Robust	Criteria in this section have a focus on the programming language of the application, meaning that this section is aimed more at developers and therefore out of the scope for this research.								

Appendix E: User research

Participants

Participant	Gender	Age	iOS or Android?	Own phone or borrowed phone?	Own document or borrowed document?	Type of document	Comment
1	M	58	Android	Own	Own	ID card	
2	F	55	Android	Own	Own	Passport	
3	F	62	iOS	Borrowed Android phone once download completed	Borrowed	Driver's license	Used iPhone 6, which has an NFC reader. Therefore assumed that it was compatible and did not contact the researcher beforehand.
4	M	63	iOS	Own	Borrowed	Passport	
5	F	66	iOS	Borrowed Android phone once download completed	Own	Driver's license	Used iPhone 6, which has an NFC reader. Therefore assumed that it was compatible and did not contact the researcher beforehand.
6	M	65	Android	Own	Own	Driver's license	
7	M	68	iOS	Borrowed iOS phone	Own	Passport	Uses iPhone 6 as well
8	F	66	Android	Own	Borrowed	ID card	

Sensitization booklet

Laat ik mij even voorstellen!

Mijn naam is Mirel Nijhuis en ik ben op dit moment bezig met de laatste fase van mijn studie Industrieel Ontwerpen aan de Universiteit Twente. Ik hou ervan om te sporten en ben meermaals per week op de ijsbaan in Enschede te vinden. Naast sporten vind ik het leuk creatief bezig te zijn en spreek ik regelmatig met vrienden af om iets gezelligs te ondernemen. In september 2019 ben ik met mijn master Industrieel Ontwerpen begonnen aan de UT. Op dit moment ben ik bezig met mijn afstudeerscriptie. Deze mag ik uitvoeren bij het bedrijf Innovalor in Enschede, hier bouwen zij aan de applicatie ReadID waar ik de gebruikerservaring aan het onderzoeken ben. Hierover later meer.

Wat houdt dit gebruikersonderzoek precies in?

Ik waardeer het erg dat u aan mijn onderzoek mee wil werken. Het onderzoek zal bestaan uit twee fases, allereerst zal ik u wat korte vragen stellen ter voorbereiding op ons interview. Deze vragen staan in dit boekje vermeld en zal ongeveer 15-20 minuten duren om in te vullen. Doe dit vooral op uw eigen manier, er bestaan geen goede of foute antwoorden. In de tweede stap zullen wij met elkaar spreken over de applicatie waar ik momenteel onderzoek naar doe. Voordat u aan de eerste fase begint, ontvang ik graag uw toestemming om aan dit onderzoek mee te doen in verband met de privacy wet. Alle resultaten van dit onderzoek zijn volledig anoniem en zullen als zodanig behandeld worden. Wanneer het onderzoek is afgerond, in juli van dit jaar, zullen alle resultaten worden vernietigd. Ik kijk ernaar uit om u te ontmoeten, op een coronaproof manier natuurlijk!

Toestemmingsformulier met betrekking tot deelname

Het doel van dit interview is voor de onderzoeker, Mirel Nijhuis, om een beter inzicht in de gebruikerservaring van de ReadID Ready applicatie te krijgen. Door met verschillende deelnemers te praten en ze de applicatie te laten gebruiken, kan dit doel worden gerealiseerd.

De deelnemer is vrij om het onderzoek op elk gewenst moment te stoppen, zonder opgaaf van reden. Ook is de deelnemer vrij om specifieke vragen niet te beantwoorden. Persoonlijke gegevens van de deelnemer die verzameld worden zijn de leeftijd, het geslacht en de desbtreffende mening over de applicatie. Al deze gegevens zijn strikt vetrouwelijk en worden alleen gebruikt voor het onderzoek. Voor de aanvang van het onderzoek krijgt de deelnemer de gelegenheid om vragen te stellen via e-mail, telefoon of een persoonlijk gesprek.

Omdat gesprekken snel gaan, zou de onderzoeker het fijn vinden om het gesprek via audio op te mogen nemen zodat zij het interview kan analyseren. Dit gebeurd echter alleen met toestemming van de deelnemer. Het interview zal worden opgeslagen op de laptop van de onderzoeker en na het beëindigen van haar scriptie worden verwijderd in juli 2021.

De deelnemer wordt verzocht gebruik te maken van de ReadID Ready applicatie, hiervoor moet hij of zij een identificatiedocument gebruiken. Wanneer er een fysieke afspraak gepland is, dan is het ook mogelijk voor de deelnemer om een identiteitsdocument van Mirel te gebruiken mocht de deelnemer dit fijner vinden. Wanneer een eigen identiteitsdocument wordt gebruikt, dan zullen de gegevens kort (2 à 3 dagen) worden opgeslagen op een trusted server, waarna ze weer verwijderd zullen worden.

Kruis alstublieft aan wat voor u van toepassing is	**Ja**	**Nee**
Ik geeft de onderzoeker toestemming om het interview via audio op te nemen	○	○
Ik vind het geen probleem om mijn eigen document te gebruiken voor dit onderzoek. Zo niet, dan is dit ook geen probleem en heel erg begrijpelijk. U kunt dan een identiteitsdocument lenen.	○	○

Handtekening deelnemer: **Handtekening onderzoeker:**

Tijd om uzelf voor te stellen!

Wat is uw naam? _____

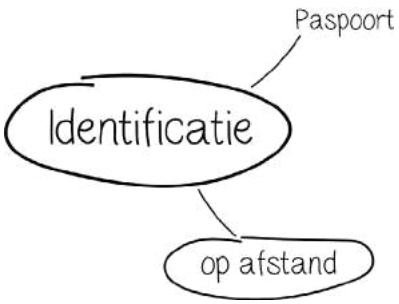
Wat is uw leeftijd? _____

Wat is uw geslacht?

- ○ Vrouw
- ○ Man
- ○ Anders

Warming-up

Wat komt er in u naar boven als u aan het begrip ‘identificatie’ denkt? Zet de woorden en begrippen die in u opkomen in het onderstaande woordweb. Het voorbeeld ‘paspoort’ is al weergeven. Daarnaast is er het sub-onderwerp ‘op afstand’ toegevoegd. Wat roept ‘identificatie op afstand’ in u op? U bent vrij om dit woordweb volledig op uw eigen manier in te vullen.



Persoonlijk identificeren

U heeft zich vast wel eens moeten identificeren. Voor wie/welke organisatie moest u zich indentificeren en met welk doel? Hoe gebeurde deze identificatie? Probeer ten minste twee voorbeelden te geven, waarvan één voorbeeld te maken heeft met identificatie op afstand.

Voor wie/welke organisatie?	**Wat was uw doel?**	**Op welke manier gebeurde dit?**
		
Bijvoorbeeld: de bank	Een nieuwe rekening openen	De medewerker maakte een kopie van mijn ID

_____
_____
_____
_____
_____
_____
_____

De Beleving

In de vorige vraag heeft u een paar voorbeelden gegeven van manieren waarop u zich heeft moeten identificeren. Als u hieraan terug denkt, welke gevoelens roept de term 'identificeren' dan bij u op? En waarom? U kunt één of meerdere emoties omcirkelen.

Uitleg:

_____
_____
_____
_____
_____
_____
_____

Fase 2: Het gebruikersinterview

We zijn aangekomen bij het volgende onderdeel van dit onderzoek, namelijk het interview waarbij u de applicatie zult gaan gebruiken, dit interview zal ongeveer een uur duren. De onderzoeker zal u hiervoor contacten om een afspraak te maken. Bij dit interview heeft u een smartphone met NFC scanner nodig. Deze is geïntegreerd in het overgrote deel van de smartphones. Mocht u echter een smartphone gebruiken die al wat ouder is (5+ jaren), dan kunt u voor de zekerheid checken of hij voldoet aan de volgende specificaties:

- Android: Met een besturingssysteem van Android 5.0 of hoger.
- iPhone: De iPhone 7 en de daaropvolgende toestellen.
- Heb ik een NFC lezer? Dit staat aangegeven binnen de instellingen van uw telefoon, even Googlen geeft ook snel antwoord.

Mocht u niet beschikken over een smartphone met deze specificaties en het interview wordt fysiek gehouden, dan kunt u eventueel de Android smartphone van de onderzoeker gebruiken.

Verder heeft u een geldig paspoort, id-kaart of rijbewijs nodig. Mocht u het geen probleem vinden om deze te gebruiken.

Vergeet niet om deze vragen uit te printen en mee te nemen.

Dit boekje zal namelijk gebruikt worden in het interview om de app te introduceren.

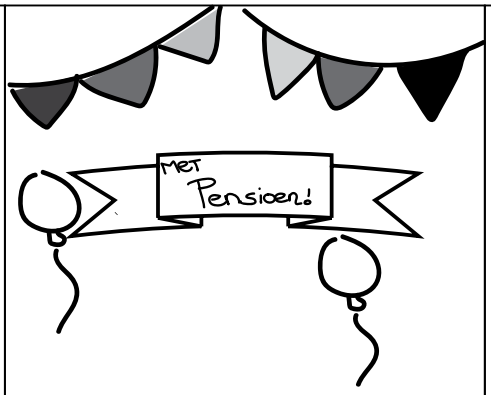
Tot op het interview!

Simplified script

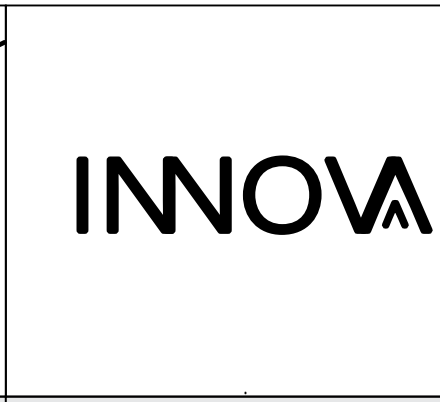
Action	Duration	Checklist
1. Reflection sensitizing	10-20 min	Send participants a week in advance the sensitization booklet. Interview: Introduce myself and tell a bit more about myself and the research Pre-usage interview: Ask participants questions about the sensitization booklet. What experiences do they have with verification of their identity? What is important for them prior to verifying their identity? What is needed? - Sensitizing booklet participant - Scenario A & B - Script - Audio-recorder
2. Using the ReadID Ready app	30 – 40 min	Introduce the participant to the given task, namely identifying oneself. What is needed? -Emotion cards -Observation form -Laptop with startscreen and QR code Post-uage interview: Go with the participants through the different steps once again. Ask questions about the steps. How did they experience the different steps? What went well? What went wrong? How did they feel about this? What is needed? -Screenshots app -Script -Emotion cards
Break	5 minutes	Write down all of the considerations from the user on sticky notes
3. Creative brainstorm	15 – 20 minutes	Introduce the participant to the brainstorming task, and explain clearly that I am going to help. Go through the different subjects on the sticky notes. Why is this important to them? When do they trust an organization? How is this related to their personal believes? What is needed? -sticky notes -paper cards -drawing tools

Scenario

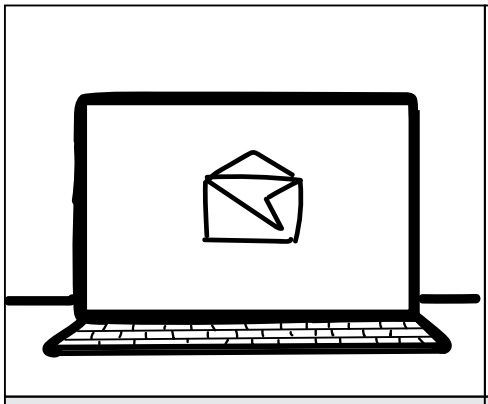
Na bijna 40 jaar op kantoor te hebben gewerkt voor de kost is het dan eindelijk zover, tijd voor je welverdiende pensioen!



Volgende maand is het tijd om je werkgever vaarwel te zeggen! Na al die jaren hard gewerkt te hebben heb je een aardig pensioen weten op te bouwen.



Maar voordat je je pensioen maandelijks op je bankrekening gestort gaat krijgen, moet je je identificeren bij je verzekeraar genaamd Innova.

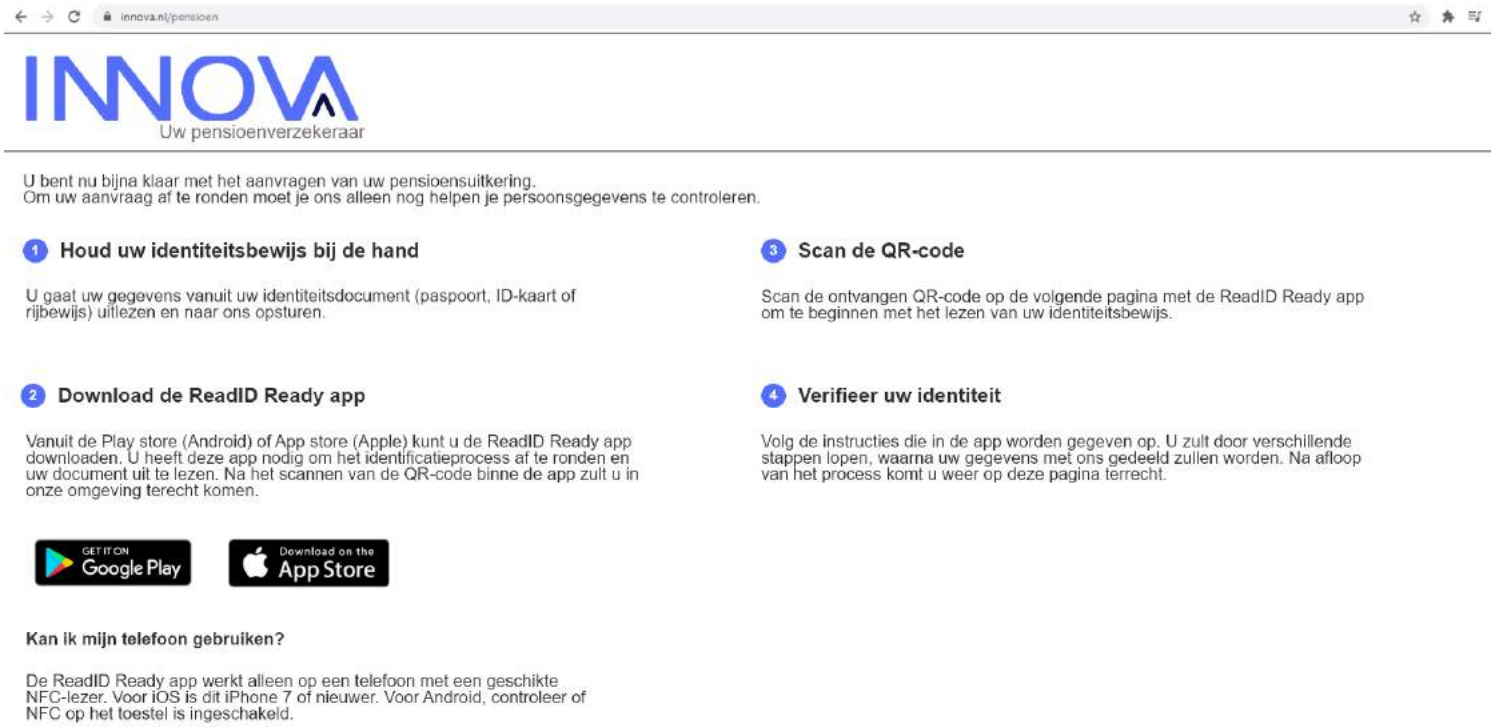


In een e-mail afkomstig van Innova staan de verschillende mogelijkheden vermeld voor het identificatie process.

Je oog valt op de 'thuis identificatie' optie.
Sinds kort heeft Innova namelijk een applicatie uitgebracht waarmee je het process op afstand kan voltooien.

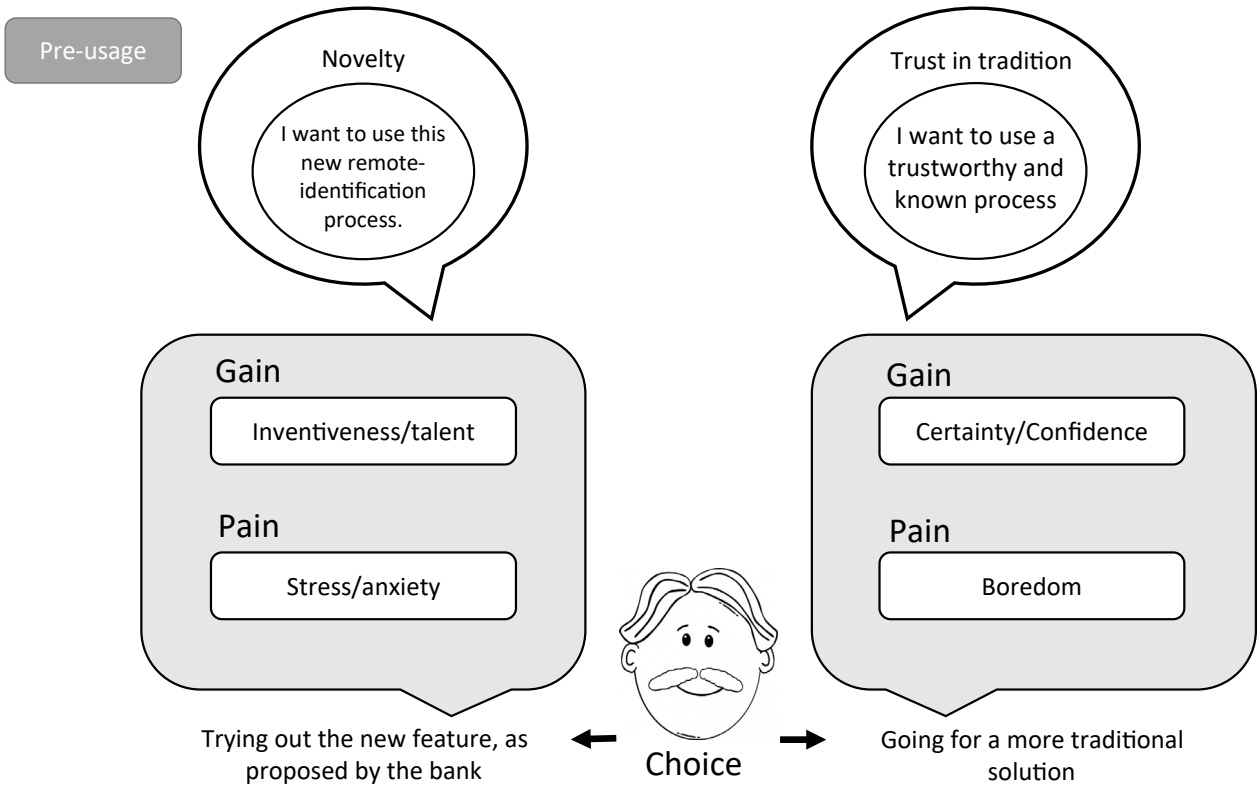
Je kunt dit process gemakkelijk thuis uitvoeren, zonder naar hun kantoor te hoeven komen.
Je besluit deze nieuwe functie te gaan gebruiken.

Example webpage

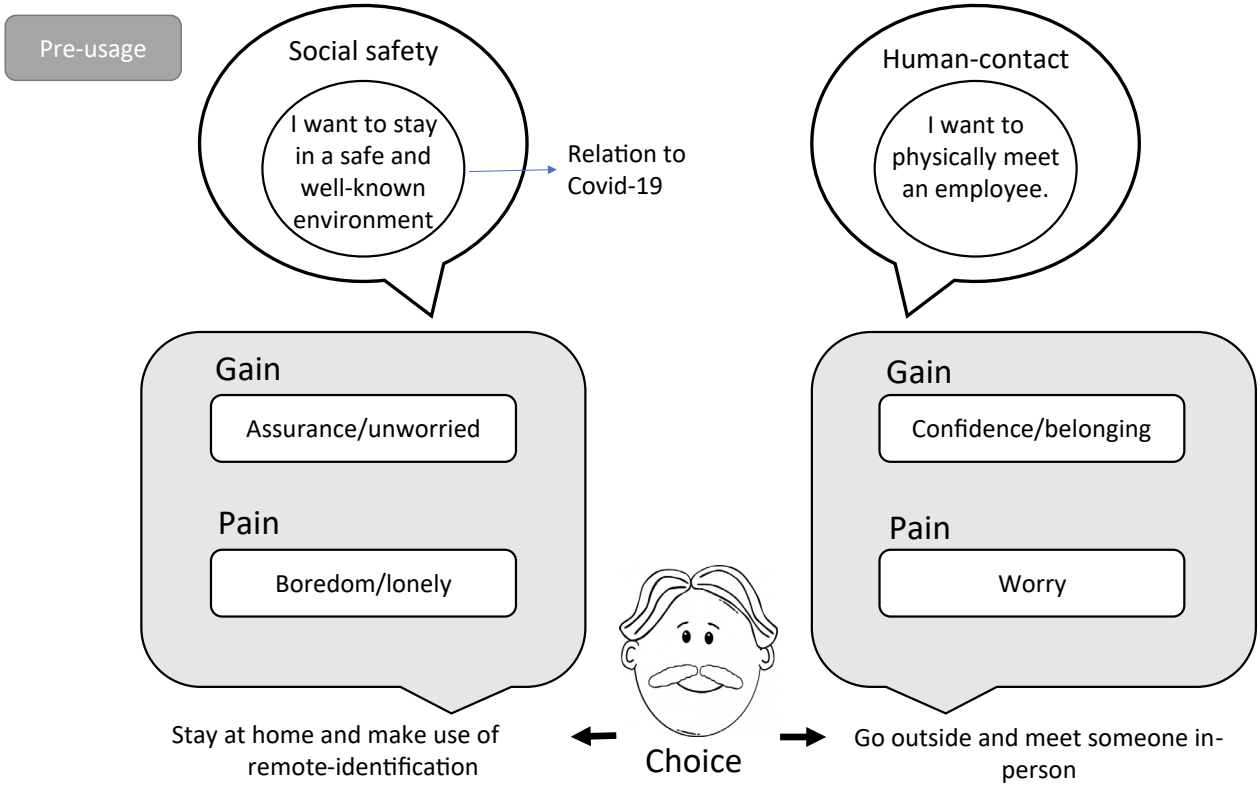


Appendix F: Dilemma framework

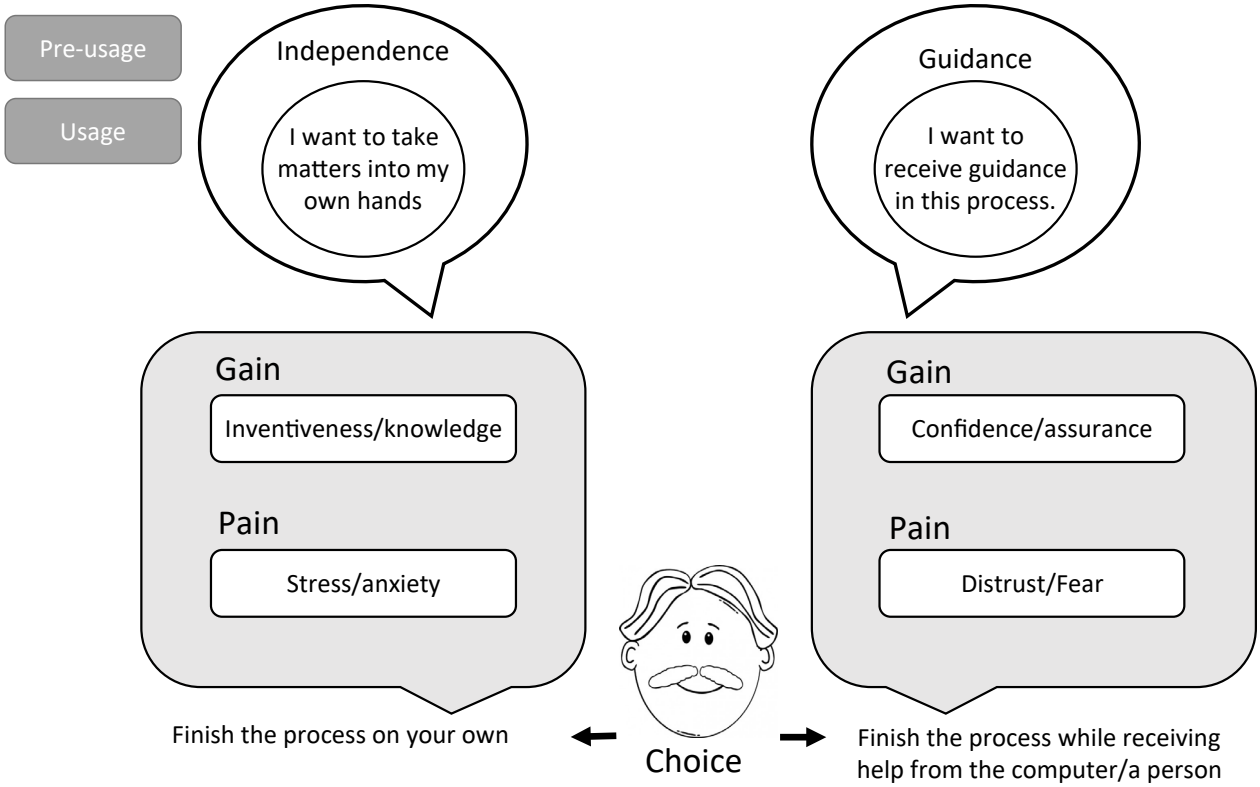
Dilemma 1: Novelty vs Trust in tradidtion



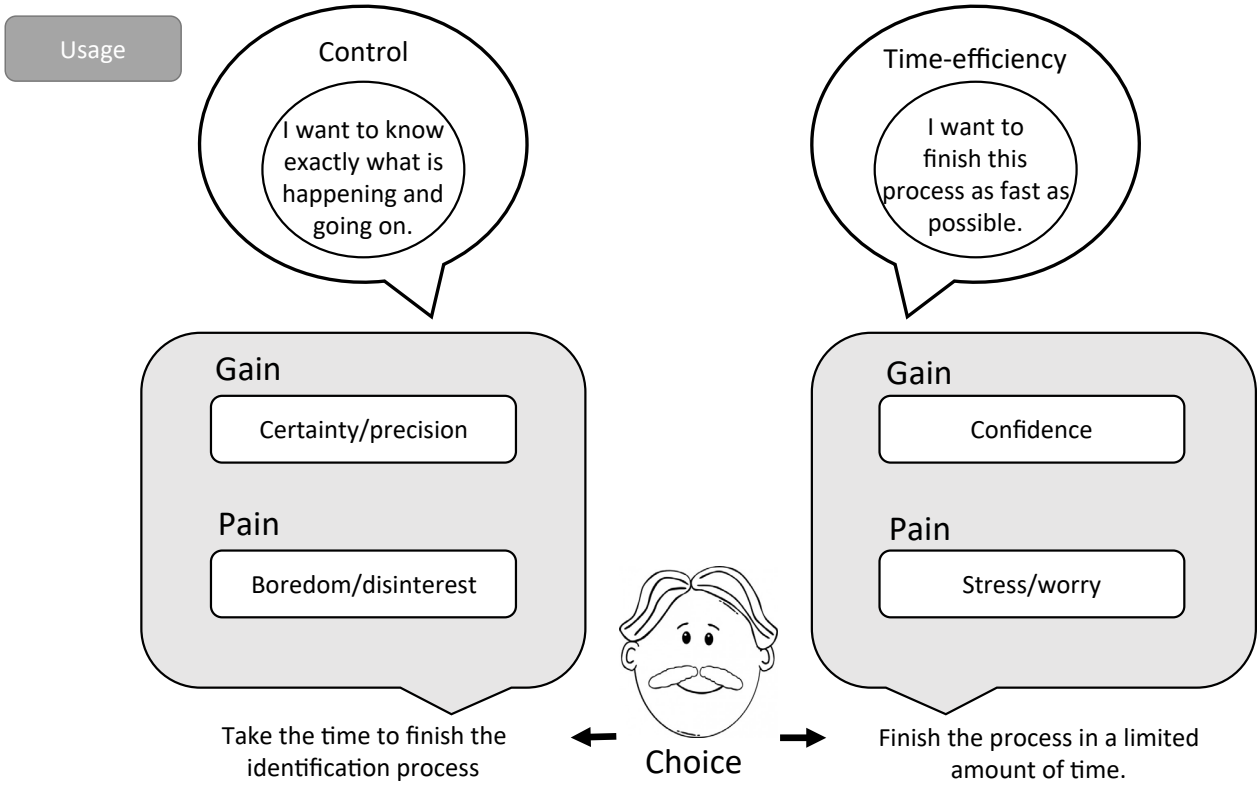
Dilemma 2: Social safety vs Human-contact



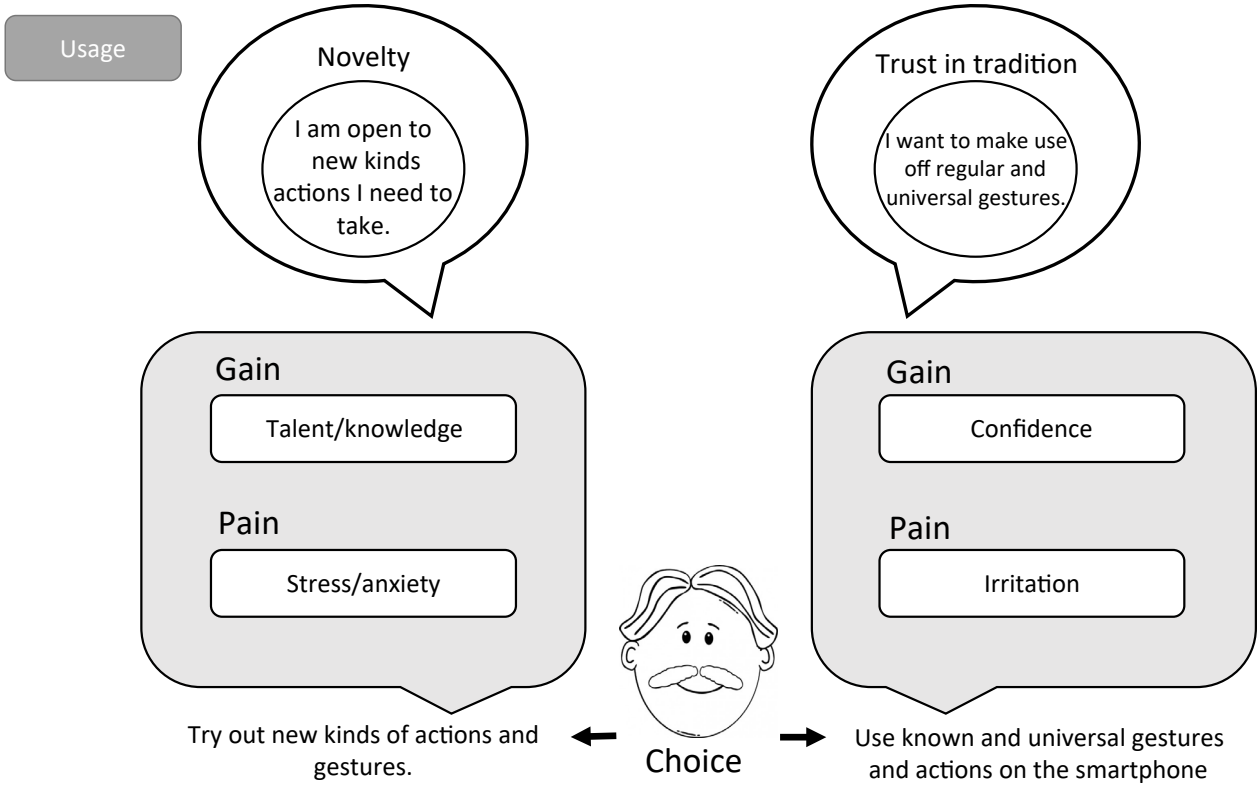
Dilemma 3: Independence vs Guidance



Dilemma 4: Control vs Time-efficiency



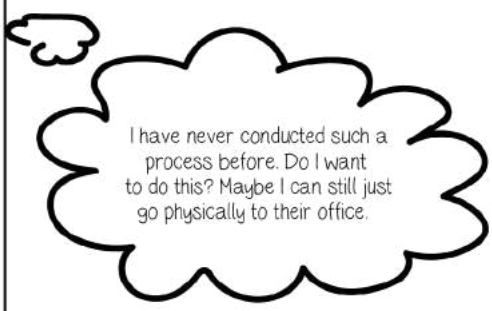
Dilemma 5: Novelty vs Trust in tradition



Appendix G: Future practice scenarios

Future practice scenario A:
Instruction page

Last week, Ben received the request from his insurance company to re-verify his identity. As it is weekend Ben now has time to conduct the request.



Verifying himself on an app is a new experience for Ben. He is not sure whether he wants to do this. He intitally thinks that going to their office would be a better solution.

In the e-mail a link to an instruction page is available. Ben decides to look for more information through this link.

On the instruction page, it is clearly stated why Ben needs to do this and with which steps. In the FAQ, he also reads why doing it remotely is safe and secure.

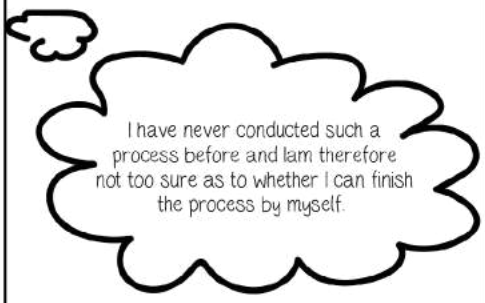
After reading the complete webage, Ben changes his mind. He thinks conducting it on his phone is a suitable option as well. He therefore decides to download the app.

Ben downloads the app and completes the verification process on his phone. He does not need to travel to the insurance company. This actually saves him a lot of time.

Ben completes the process and does not need to go physically to the insurance company.

Future practice scenario B:
Startscreen and feedback

Betty is sitting at home, trying to verify her idenity with the ReadID Ready app with her mobile phone for her bank. She just downloaded the app, but she is a bit insecure about herself.

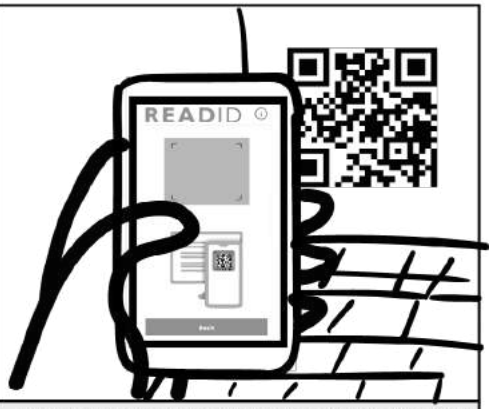


She wonders if she would be able to conduct the process independently, as this is new for her. There was no clear instruction available, only a small text in the email.

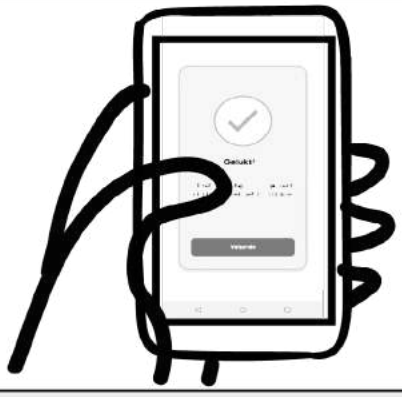
She first takes a look at the start screen to see what she needs in order to proceed in the ReadID Ready process. She quickly grabs her passport.

She sees that there is also a 'steps' section available in the app. She clicks on it and sees the different steps that she will have to conduct in order to finish the process.

Betty is happy and a bit surprised that this overview is present. It guides her through the process.



Betty scans the QR-code with her phone. She has never done this before. And is therefore a bit hesitant at first.



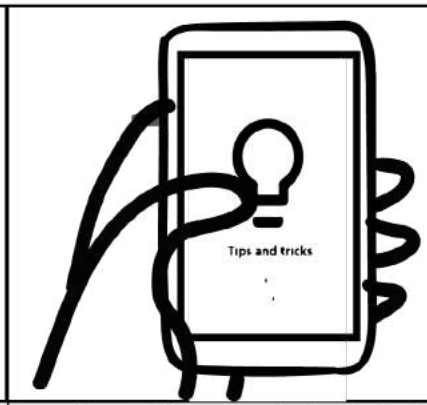
A pop-up screen suddenly appears. It tells Betty that she conducted the step in the correct manner.

Betty gains more confidence in oneself, she believes the other steps should be possible to conduct as well.

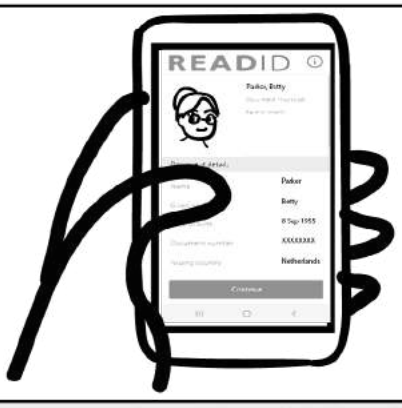
Betty conducts the scan step.
She receives a feedback message here as well.
Now she proceeds to the Read step.

Betty conducts the scan step succesfully.

When Betty keeps her passport against the phone, no signal is made. This confuses her. She did everything in the correctly, she thought.



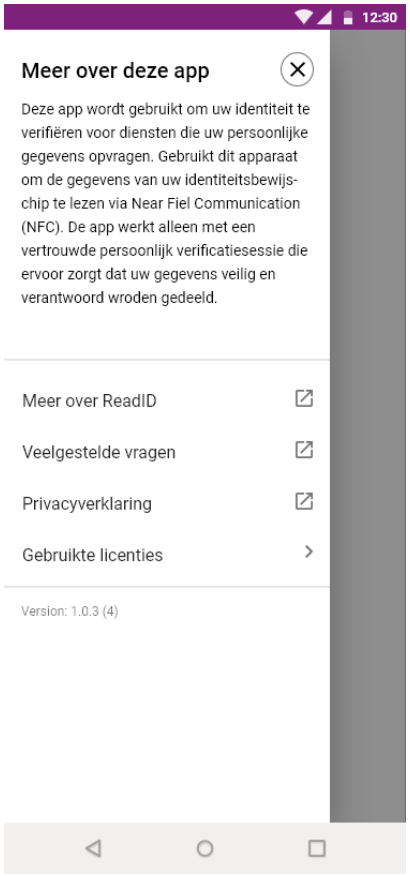
She received the message that tips and tricks will be shown to her. Helping her in completing the step. She nows knows how to hold her passport and finishes the step.



Betty receives a confirmation. She has now finished the verification process. She is really happy that she was able to do everything by herself and did not need to ask her daughter for help.

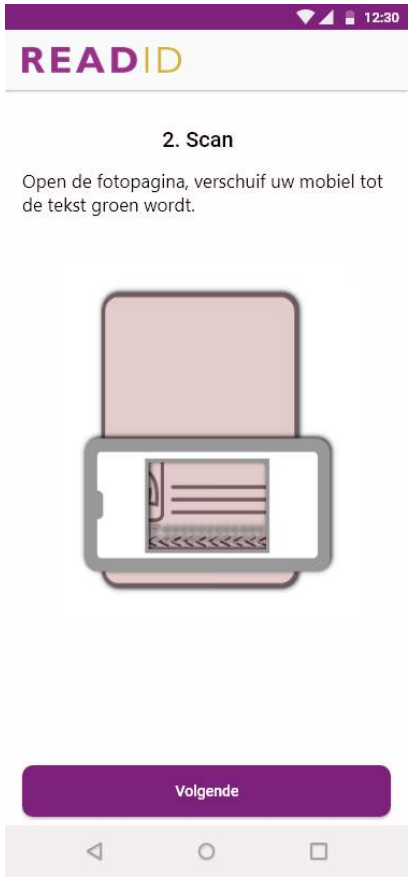
Appendix H: Designs ideation

More info section



Extra QR screen

Usage of headers and titles



Appendix I: Evaluation Interviews

Participants

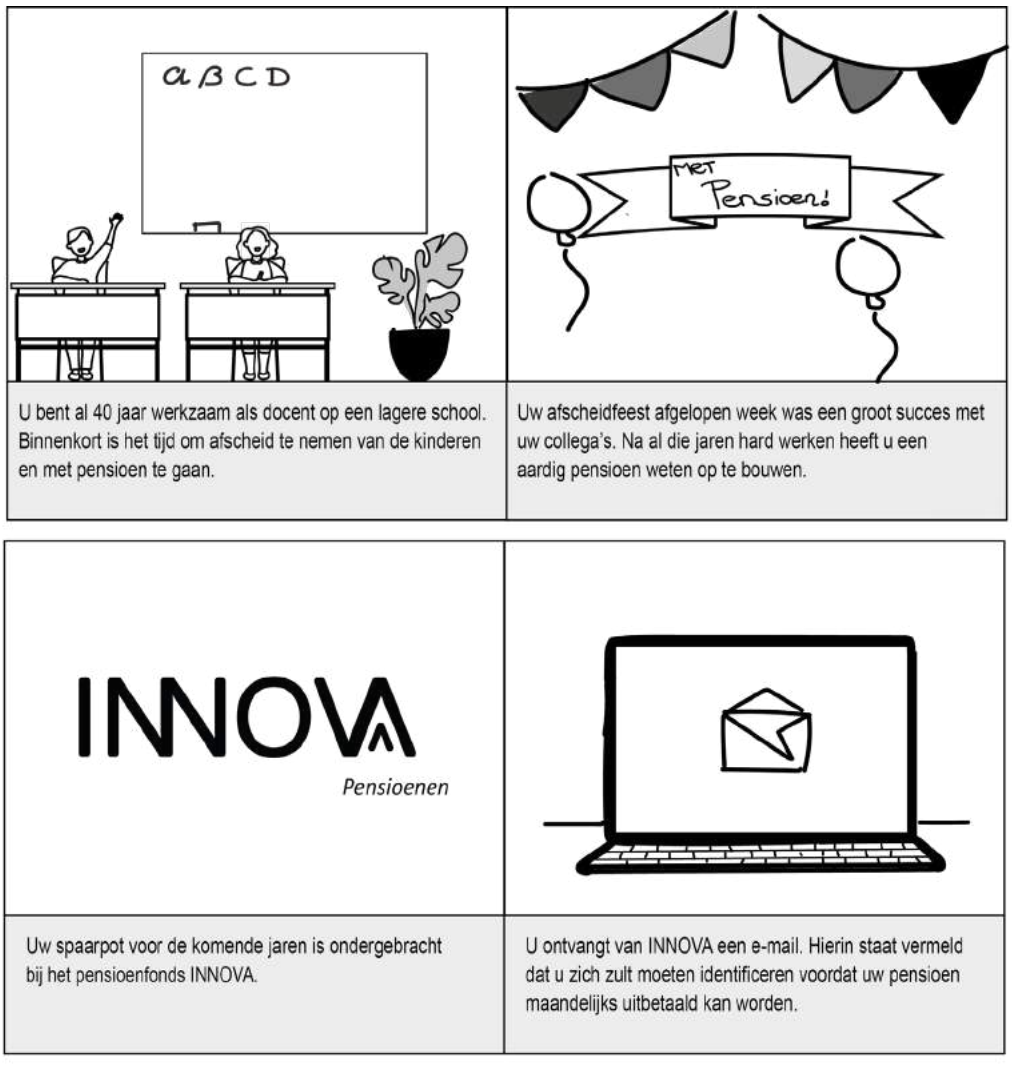
Participant	Age	Gender
1	66	Female
2	67	Male
3	60	Female
4	59	Male
5	54	Female
6	54	Female

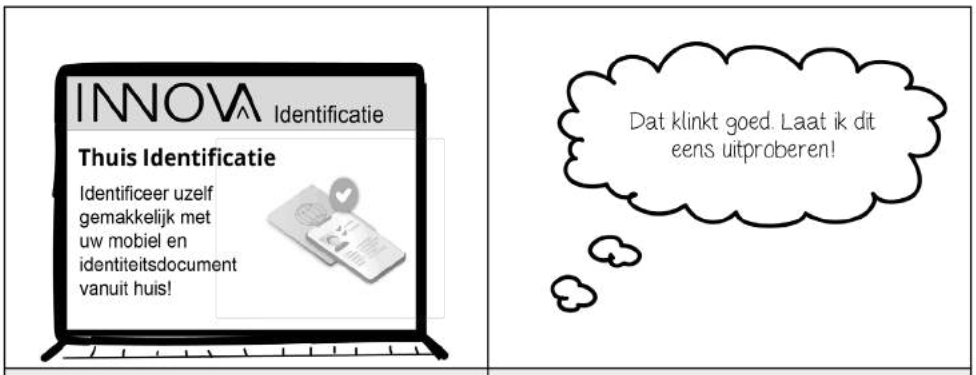
Simplified script

Action	Duration	Checklist
1. Reflection sensitizing	10-20 min	Send participants a week in advance the sensitization booklet. Interview: Introduce myself and tell a bit more about myself and the research Pre-usage interview: Ask participants questions about the sensitization booklet. What experiences do they have with verification of their identity? What is important for them prior to verifying their identity? What is needed? - Sensitizing booklet participant - Scenario A & B - Script - Audio-recorder
2. Using the ReadID Ready app	30 – 40 min	Introduce the participant to the given task, namely identifying oneself. What is needed? -Emotion cards -Observation form -Laptop with startscreen and QR code Post-uage interview: Go with the participants through the different steps once again. Ask questions about the steps. How did they experience the different steps? What went well? What went wrong? How did they feel about this? What is needed? -Screenshots app -Script -Emotion cards

Break	5 minutes	Write down all of the considerations from the user on sticky notes
3. Creative brainstorm	15 – 20 minutes	Introduce the participant to the brainstorming task, and explain clearly that I am going to help. Go through the different subjects on the sticky notes. Why is this important to them? When do they trust an organization? How is this related to their personal believes? What is needed? -sticky notes -paper cards -drawing tools

Scenario





Uw oog valt op de thuisidentificatie optie, hiermee kunt u namelijk via uw mobiel het process afronden.

Een groot pluspunt voor u aan deze optie is dat u uw huis niet hoeft te verlaten. Daarom besluit u om deze optie uit te proberen.

U ontvangt een link naar een webpagina waar wordt uitgelegd wat u moet doen om de identificatie op afstand te voltooien.

Consent

Toestemmingsformulier met betrekking tot deelname

Het doel van dit interview is voor de onderzoeker, Mirel Nijhuis, om een goed inzicht te krijgen in haar ontwerpen voor de ReadID Ready applicatie. Het online interview zal ongeveer 45 minuten duren.

De deelnemer is vrij om het onderzoek op elk gewenst moment te stoppen, zonder opgaaf van reden. Ook is de deelnemer vrij om specifieke vragen niet te beantwoorden. Persoonlijke gegevens van de deelnemer die verzameld worden zijn diens leeftijd en diens mening over de ontwerpen. Al deze gegevens zijn strikt vetrouwelijk en worden alleen gebruikt voor het onderzoek.

Omdat gesprekken snel gaan, zou de onderzoeker het fijn vinden om het gesprek via audio op te mogen nemen zodat zij het interview kan analyseren. Dit gebeurd echter alleen met toestemming van de deelnemer. Het interview zal worden opgeslagen op de laptop van de onderzoeker en na het beëindigen van haar scriptie worden verwijderd in juli 2021.

Kruis alstublieft aan wat voor u van toepassing is	**Ja**	**Nee**
Ik heb bovenstaande informatie gelezen en doe graag mee aan het onderzoek	○	○
Ik geef de onderzoeker toestemming om het gesprek via audio op te nemen.	○	○

Handtekening deelnemer: **Handtekening onderzoeker:**

Appendix J: Final recommendation

Textual descriptions NL

Animation	Huidige tekst NL	Voorstel NL
QR - code	Geen	Richt uw mobiel/camera op de QR-code
MRZ - Passport	Open de fotopagina	Open de fotopagina van uw paspoort
MRZ - ID Card	Draai om naar achterkant	Draai uw ID-kaart om naar de achterkant
MRZ - Driver's license	Houd de voorkant naar boven	Houd de voorkant van uw rijbewijs naar boven
MRZ - general	Verschuif tot de tekst groen wordt	Richt de camera op uw document (rijbwijs/paspoort/ID-kaart). Verplaats uw mobiel tot de tekst groen wordt.
NFC - Passport	Houd het identiteitsbewijs tegen uw telefoon. Beweeg niet tijdens het lezen.	Houd het paspoort tegen uw telefoon aan. Beweeg uw paspoort en telefoon niet tijdens het uitlezen.
NFC - ID card	Houd het identiteitsbewijs tegen uw telefoon. Beweeg niet tijdens het lezen.	Houd uw ID-kaart tegen uw telefoon aan. Beweeg uw ID-kaart en telefoon niet tijdens het uitlezen.
NFC - Driver's license	Houd het identiteitsbewijs tegen uw telefoon. Beweeg niet tijdens het lezen.	Houd uw rijbewijs tegen uw telefoon aan. Beweeg uw rijbewijs niet tijdens het uitlezen.
NFC - Carrousel		
Passport	Houd het paspoort tegen de telefoon. Houd de telefoon stil	"
	Schuif langzaam	"
	Verwijder hoesjes	Verwijder hoesjes van uw mobiel en paspoort.
	Controleer symbool 'icoon'	Controleer of u het volgende symbool kunt vinden/ Kijk of u het volgende symbool kunt vinden.
	Probeer de fotopagina	Probeer uw telefoon tegen de fotopagina aan te houden.
	Probeer de laatste pagina	Probeer uw telefoon tegen de laatste pagina aan te houden.
ID Card	Houd de identieitskaart tegen de telefoon. Houd de telefoon stil	Houd het identiteitsbewijs tegen uw telefoon. Houd de telefoon stil. --> opeens kaart ipv bewijs, gebruik 1 term.
	Schuif langzaam	"
	Controleer symbool 'icoon'	Controleer of u het volgende symbool kunt vinden/ Kijk of u het volgende symbool kunt vinden/

Driver's license	Houd het rijbewijs tegen de telefoon. Houd de telefoon stil	"
	Schuif langzaam	"
iProov	Houd uw gezicht in het ovaal	"
	Beweeg niet tijdens de scan	Beweeg niet tijdens de scan. Er zullen lichtflitsen verschijnen.

Textual descriptions EN

Animation	Current text EN	Proposal text EN
QR - code	None	Scan the QR-code with your camera.
MRZ - Passport	Open to the photo page **(I do not believe this is grammaticaly correct)**.	Open the photo page of your passsport.
MRZ - ID Card	Rotate to the back.	Rotate your ID card to the back.
MRZ - Driver's license	Keep the front facing up.	Keep the front of your license facing up.
MRZ - general	Adjust until the text turns green.	Aim your camera at your document (passport/ID card/ driver's license). Move/Adjust the position of your phone until the text turns green.
NFC - Passport	Place the identity document against your phone. Do not move while reading.	Place the passport against your phone. Do not move your phone and document while reading.
NFC - ID card	Place the identity document against your phone. Do not move while reading.	Place the ID card against your phone. Do not move your phone and document while reading.
NFC - Driver's license	Place the identity document against your phone. Do not move while reading.	Place te driver's license against your phone. Do not move your phone and document while reading.
NFC - Carrousel		
Passport	Keep the passport and phone close to each other. Keep still during reading.	Keep the passport and phone against each other. Do not move them while reading.
	Slide up and down slowly until progressing dots **(also not grammaticaly correct)**	Slide up and down until the dots shows progress.
	Remove the cover.	Remove the cover from your phone and passport.
	Check for the symbol.	Check if you can find the following symbol/Look if you can find the following symbol.
	Try reading the photo page.	Try holding your phone against the photo page.
	Try reading the inner back page.	Try holding your phone against the inner back page.

ID Card	Keep the ID card and phone close to each other. Keep still during reading.	Keep the ID card and phone against each other. Do not move them while reading.
	Check for the symbol.	Check if you can find the following symbol/Look if you can find the following symbol.
	Slide up and down	"
Driver's license	Keep the driver's license and phone close to each other. Keep still during reading.	Keep the driver's license and phone against each other. Do not move them while reading.
	Slide up and down	"
iProov	Align your face inside the oval.	"
	Keep still during the scan.	Keep your head still during the scan. Flashes will appear.

Instruction booklet customers ReadID:

INTRODUCING READID READY TO OLDER USERS

The following guidelines are intended to introduce ReadID Ready to older adults. Digitalization can be difficult for this target group, so good guidance in this process is important. In addition, the privacy aspect can play a major role in this. What should you as an organization take into account? Here we list the most important guidelines:

01

Let the user know that they need to verify their identity by sending an understandable request:
This can be done in a variety of ways, e.g. via e-mail or post. Write in the mother tongue of the user. A short notification in advance can be really imporant for this target group.

New message

Subject: **Verify your identity**

From: **INNOVA**

Dear mr/mrs/ms NAME,

Because you became a new customer at INNOVA, it is important for us to verify your personal data. We therefore request you to verify your identity online with the ReadID Ready app.

Let the user know the reason for identyfing oneself straight away.

Why do I have to verify my identity?
To prevent your data from being misused. With the right documents and other personal data from our customers, we know to whom we offer our services and product. We do this via the ReadID Ready application. You can conduct this procedure easily from home at any given moment.

Read the following webpage for an explanation:

Instruction page

Scan this QR-code once you have downloaded the app:

Clearly structure the message, but keep is simple and straightfoward.

Kind regards,

Dirk Smit
Managing director INNOVA

INNOVA

02

Make is possible for the user to take a look at an instruction via a webpage:
An e-mail alone is often not enough for an older adult. It is important to explain the process clearly. Visual information plays a key role in this.

03

Give users extra guidance when they need it:
When a user does not understand something, they will look for additional information. Normally this information is located at the end of a webpage.

READID

Verify your identity

With the ReadID Ready app

Clearly state what the user needs by means of an enumeration.

Do you want to verify your identity on behalf of NAME? On this page we explain how can do this via your phone. Frequently asked questions are available at the bottom of the

What do you need?

1. A valid passport, ID card or driver's license.
2. A suitable smartphone:
-iOS: iPhone 7 or later.
-Android: with an operating system of 5.0 or [illegible]er.

Are you not in the possession of a suitable smartphone?

You can always borrow a smartphone from someone that does meet these conditions. It does not matter from which device you perform the verification process.

Explain the steps by means of a visual manner. Older adults prefer reading information vertically, as they can scroll through the page.

It also important to state what user needs to do if they do not have a suitable smartphone.

How does it work?

1 **Get your phone and identity document**
Have your identity document and phone at hand.

2 **Download the app on your phone**
Download the ReadID Ready app on your phone via the App store (iOS) or Play Store (Android).

3 **QR-code**
Scan the QR-code that you received with your mobile phone.

4 **Scan**
Scan you identity document with your camera.

5 **Read**
Hold your phone against the identity document to read the data. After this you are done and will receive a confirmation.

FAQ

1. How does the ReadID Ready app work?
2. Why do I have to use ReadID Ready?
3. What will happen with my personal data?
4. I do not have QR-code, what now?

FAQ can help the user if they do not understand or know something, without immediately having to contact an employee.

If possible, it is handy to provide older users with the possibility to call someone for urgent questions. In this way, users can always fall back on someone.

Do you have questions?

Cal our customer service on XXXX-XXXXXXXXX.
We are happy to help you.

READID