Design Project

IC1007 Human-Computer Interaction

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Grupp B3

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Abstract

COVID-19 has affected the whole world, especially people over 70 years of age. This report examines how the situation has affected elderly with the purpose of producing a screen-based interactive product that can help elderly with their situation during the COVID-19 pandemic. To gather as much information as possible regarding how the user groups lives have been affected by COVID-19 restrictions, the group decided that conducting interviews would be most effective. The main goal was to, through the gathered data, gain a comprehensive understanding on how the current COVID-19 situation has affected the user group's living situation.

Through the data gathered from the interviews, usability requirements were established. Based on these requirements, five design ideas were developed. At last, the digital-bingo idea was chosen. All group members agreed upon the idea meeting the usability requirements with highest importance rank. A paper prototype was developed and reviewed by people belonging to our user target group. Based on the response gathered from the first test round, a digital prototype was developed. This was done in a collaborative product design platform called Mockplus. Lastly, the digital prototype was tested in accordance with the usability testing procedure.

Table of contents

1. Introduction

Human-computer interaction (HCI) is a multidisciplinary field of study. HCI is focused on the design and use of computer technology, mainly the interfaces between users and computers.[1] For this project, the main objective is to go through the whole user-centered cycle and experience the many uncertainties and possibilities that may occur during the course of work.

The project theme regards how the COVID-19 situation has affected certain user groups. The user group that was assigned to this group were elderly users, referring to people over 70 years of age. The aim of the project is to produce a well-functioning digital prototype with the purpose of helping elderly with their situation during the COVID-19 pandemic. The purpose of this report is to document the design process, which methods were used and justifications for the design decisions.

Section 2 demonstrates the methods used for data gathering, usability requirements, design ideas, paper prototype, digital prototype and usability testing and test plan. Section 3 presents the results from the interviews and the final prototype. Section 4 consists of the discussion and section 5 is the conclusion part.

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[1] Human Computer Interaction (unknown date), *Interaction Design Foundation*, https://www.interaction-design.org/literature/topics/human-computer-interaction

2. Methods

Throughout the course, the group had to use different design methods taught, one being the "four basic activities of interaction design". The first phase of this method was to discover the requirements for the interactive product. This was performed by gathering data from interviews with participants in the desired age group of 70 years old or older, and then analysing this data. This phase is demonstrated in sections 2.1 to 2.3.

In the second phase, ideas based on the analysed data were proposed in order to meet the requirements. These requirements were formed from the data. Using the concept of conceptual design, conceptual models for the product were produced, outlining what elderly people are able to do with the product and what concepts were needed in order to understand how to interact with it. This phase is demonstrated in section 2.4.

During the third phase, which is the phase of prototyping, different ways were looked upon of how to gain feedback from users regarding the groups ideas. This was done by making use of a certain common method within the user-centered design process, that is, the method of paper prototyping. This phase is demonstrated in sections 2.5 and 2.6.

After a digital prototype had been created based on the groups paper prototype, it was time for the final phase in the "four basic activities for interaction design", which was the evaluation phase. The evaluation phase is accounted for in section 3.3.[2]

2.1 Defining Users

There were many discussions regarding which subgroup of users in the assigned target group a product should be made for. People over 70 years old could be subdivided into several groups since there is a big variation of people in this group. For this design project, a central part to keep in mind was that there is a great division amongst elderly over 70 years concerning the extent of usage of digital tools (mobile phones, tablets, computers). This limitation implied that the target group for this design project had to be limited to a certain subgroup amongst people over 70 years of age.

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[2] Sharp, Rogers & Preece (2019), p. 50.

It was concluded that the HCI solution in this project should aim at elderly above the age of 70 that are fairly acquainted with digital tools.

2.2 Plan for Data Gathering

Gathering data enables the establishment of requirements and design evaluation. It was concluded that in order to gather as much information as possible, and at the same time be able to identify the greatest user needs, the most fitting method for data gathering was to conduct interviews.

The main goal was to, through the gathered data, gain a comprehensive understanding on how the current COVID-19 situation has affected the user group's living situation. Taken into account that the design was intended to be user-centered, a core part of the data gathering was to enable the establishment of the user's needs.

With regard to the current COVID-19 situation and the fact that the user group consisted of people who are at a higher risk for severe illness, there were some struggles initially on how to conduct interviews with enough participants that would make a sufficient representation for the entire user group. Because of the limitation of not being able to conduct physical interviews with the chosen participants, it was concluded that the interviews were going to be conducted through an online solution, such as a video-call in Zoom or FaceTime, or simply via telephone calls.

The interviews were semi-structured, meaning a list of questions were prepared which the interviewer did not have to strictly follow. Instead, the interviewer asked open-ended questions to allow a discussion with the interviewee and follow-up questions when suitable.[3] Five interviews were made through telephone calls. Before each interview started, the interviewer explained the purpose of the interview, how long the interview would take and the interviewee's right to withdraw at any time. The interviewee was also made aware that the data collected would be kept confidential between the group members of this project and the examiners of the HCI course at KTH. If the interviewee agreed to the terms, the interview could continue. During the interviews, the interviewer took notes of what was said.

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[3] Lecture - Interviews. KTH: course IC1007 Human-computer interaction.

2.3 Usability Requirements

Usability requirements describe what the user needs or wants from a system.[4] The answers collected from the interviews were analyzed and compiled in order to formulate the usability requirements. Below are descriptions of the four usability requirements that were formulated based on the data collected.

Usability Requirements:

1. **Socializing with other users**: Users should be able to socialize with others with the help of their electronic devices.
2. **Engaging in activities with other users**: The system should offer the users some kind of entertaining activity, such as bingo, that incorporates social activities.
3. **Activities should be scheduled**: The user should be able to join a scheduled activity.
4. **Receiving help with everyday chores**: The user should be able to contact others and offer a helping hand for those in need.
5. **The design should be simple**: The system should be easy to understand and navigate, with all functions being easy to access and clearly indicated with text and buttons.

Not every requirement was deemed to be equally important. The final design idea prioritized requirements 1, 2 and 5 since these three requirements were the most reflective of the most pressing issues found through the interviews.

2.4 Design Ideas

After the requirements had been formulated, brainstorming sessions were held where design ideas were suggested and discussed. Lastly, five different design ideas had been formulated. Each design idea was to some extent based on the agreed upon requirements and on the feedback provided by the elderly that had been interviewed. The five ideas are listed below:

1. **A digital book circle**: A service that offers book tips once a week. At the end of each week, users can come together in a digital video meeting and discuss the book with each other. A digital book circle would keep the elderly busy with a recurring activity and would serve as a means to socialize with other people.

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[4] Lecture - Requirements. KTH: course IC1007 Human-computer interaction.

2. **An online chat application or website**: A service that connects two different users with each other so that they can talk and write with one another. Users can set their interests so that it connects with someone with the same interests. The user should also be able to set its location, so that a match is established with someone who lives nearby. This feature would allow users to make friends that they can then meet physically once the pandemic is over.

3. **An activity application**: An application that arranges activities between the user and people that live in their area. Users choose activities they are interested in, such as "take a walk" or "play kubb" and are then paired with other nearby users who have chosen the same activities. Users who are paired can then chat and vote for the time during the day when the activity should be performed.

4. **A get-help-with-chores application**: An application or service where the elderly can get help with their everyday chores. There could be categories such as "buy groceries", "retrieve letters from the post office" or "walk the dog". After an elederly user picks a category, he or she is connected with someone who has signed up to help with those chores. This idea does not necessarily solve the problem of loneliness (the biggest problem as per the interviews), but is a solution to other issues that many elderly face during the current situation.

5. **An online bingo game application**: An application that allows users to play bingo with each other online. Users can join a server with a set number of other players, play bingo with them and chat using their microphones and cameras. A social game application such as this provides users with entertainment and a way to socialize, both with their friends and with strangers.

Ultimately, the online bingo game application was chosen for the project. After discussions within the project team, this idea was determined to contain the best elements for counteracting the most widespread issue experienced by the user group: loneliness, and at the same time providing users with entertainment.

2.5 Paper Prototype

With the game application idea decided upon, the next step in the design process was the creation of a paper prototype. This type of low-fidelity (low level of detail and functionality) physical prototype is useful for demonstrative purposes, enabling quick and efficient testing

of design ideas. Paper prototyping is commonly used in the design of products, games and websites.[5] Since erasing and re-doing work is significantly easier to do digitally than physically, sample designs and design suggestions for the paper prototype were first sketched digitally in Adobe XD. Because our user group was the elderly above the age of 70, it was agreed that the design should be as simple, easy-to-understand and user-friendly as possible. With the initial design agreed upon, the paper prototype was created using mixed media paper, colored pencils and scissors. The resulting prototype was made up of nine cards, each representing a screen or pop-up intended to be implemented in the application.

The paper prototype was tested by other students and by two people in our intended user group. Since the design was intentionally simple, only a small number of problems were encountered in the tests. The biggest issue encountered was that navigating the prototype itself was slightly difficult since it lacked animations. Additionally, the paper prototype lacked functionality that would have been impossible to implement in this format. Most notably, it was not possible to actually play bingo, the main function of the application.

The most impactful suggestion was to change the orientation of the game from horizontal to vertical and to include more than a single row of bingo tiles, making the game more similar to real bingo. Minor suggestions from the users included a chat option and that the names of users should be saved after they have typed them for the first time. Though there were mute and camera controls included in the bingo rooms themselves in the prototype, one suggestion was that they should also appear before joining a room, as in the video conferencing programme Zoom. These suggestions were taken into consideration during the creation of the later digital prototype.

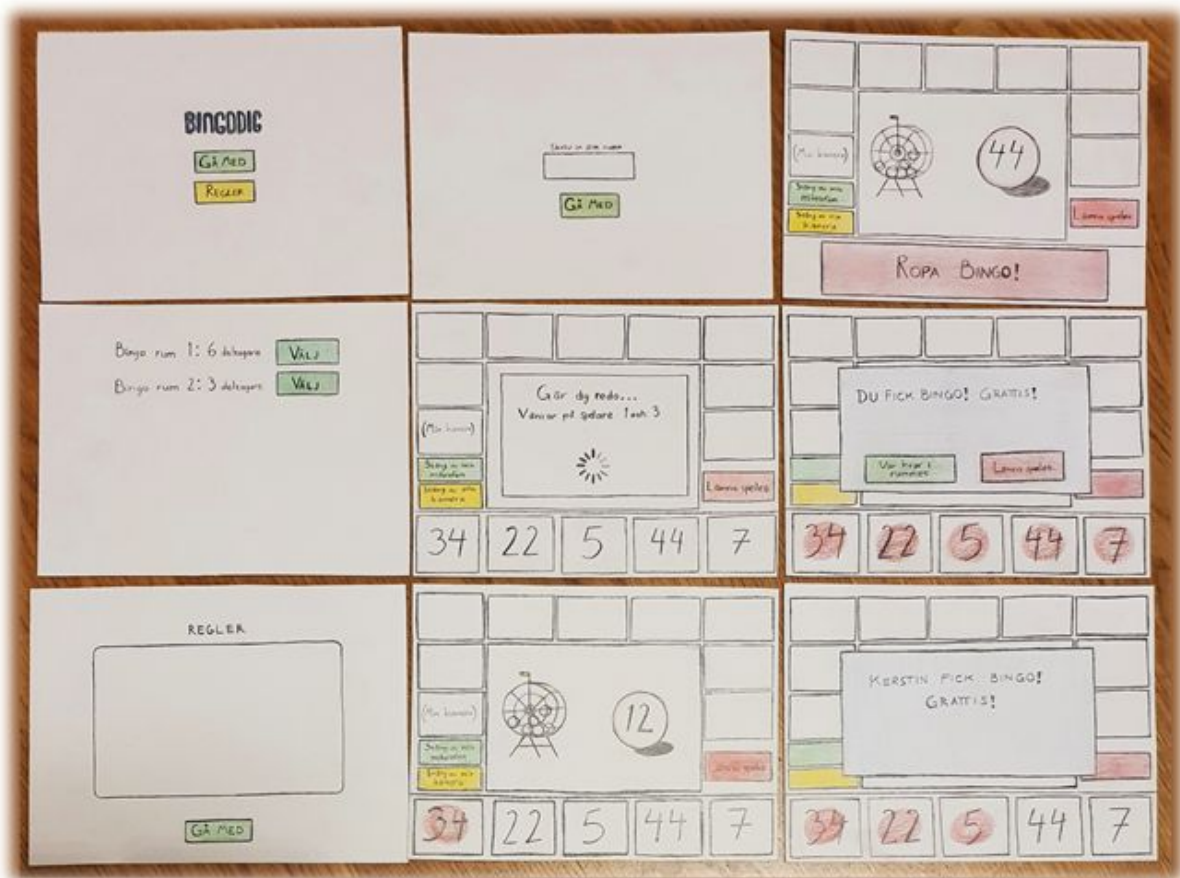[5] Sharp, Rogers & Preece (2019), p. 431–432.

Figure 1: Photograph of the finished paper prototype

2.6 Digital Prototype

With the testing of the low-fidelity paper prototype complete, the next step of the design process was to create a high-fidelity digital prototype. High-fidelity prototypes have more functionality than low-fidelity prototypes, such as paper prototypes, and are more similar to the intended final product.[6] The digital prototype was created using Mockplus, a collaborative product design platform, since it allowed the team to work together on designing the prototype and had a built-in preview function, useful for testing.

The overall design that had been used in the paper prototype was overhauled during the work on the digital prototype. There were several design changes made that were based on the feedback received during user tests with the paper prototype. Changes implemented included the orientation being changed to vertical, more bingo rows being added and the addition of the ability to save your username. One suggestion that was ignored was the possibility of

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[6] Sharp, Rogers & Preece (2019), p. 428.

speaking or chatting to just one other user. Two important reasons led to this idea being discarded. Firstly, implementing this feature would make the overall design of the app more crowded and complex, going against the decision to keep it as simple as possible. Secondly, communicating with just a single user was determined to be missing the point of the application, specifically designed to be a social experience. If users in a bingo room spoke just with each other in some way, other players might feel left out, which would be an effect directly opposing the goals of the project. Instead of a chat function, the ability to react with emojis was added to the prototype. This was in order to meet the desire to react without having to talk.

2.7 Usability Testing and Test Plan

With an initial version of the digital prototype completed, the next phase in the design process was usability testing. As the name implies, usability tests are controlled tests aimed at determining how usable a product is. The primary goal of a usability test is to see whether the designed product successfully allows users to successfully complete the tasks that the product was designed for. In order to test and see if the users can complete the tasks, a central element of usability testing is collecting data on how well users perform on predefined tasks and in predefined scenarios.[7] A test plan was created in order to perform the usability tests as efficiently as possible. This test plan is included in its entirety below:

Test Plan
Purpose of the study
The goal of the usability tests is to test if the bingo game is sufficiently usable by the user group, people over the age of 70. To test this, it is important to ensure that every step and function of the application is understandable and easy to use.
How many users will be involved?
Usability tests will be conducted on elderly relatives of the project team and on some of their acquaintances, amounting to seven testers.

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[7] Sharp, Rogers & Preece (2019), p. 524.

How will the data be collected?
Interviews will be carried out over Zoom. Users will test the prototype on their own computers and screen-share what they are doing in the Zoom meeting. As per the "think aloud"-technique, users are encouraged to describe what they are doing and think out loud, with members of the project team noting down what they say and experience. After the test is complete, post-testing interviews will be conducted with the testers.

Content of testing
The tests will amount to testers having to work through a series of tasks and scenarios. *Tasks for users***:** Join a bingo room, see users inside a room, mark bingo tiles while in a game, react with emojis, turn microphone on/off, turn camera on/off, leave the room, adjust the volume *Scenarios***:** Congratulate another player on getting a bingo, stay in the room when they get a bingo *Method of prompting feedback***:** Think-aloud technique.

Distribution of roles within the team
These are the planned roles of all team members during the testing and interview process: ● *Benjamin*: Interviewer. ● *Larisa*: Takes notes during the interview and post-interview process. ● *Mustafa*: Observes technical difficulties during tests. ● *Sara*: Takes notes during the interview and post-interview process. ● *Sebastian*: Team leader; responsible for overseeing the process, the team and for arranging the interviews.

Plan of post-testing interviews with users
Users will be asked questions during the testing process. After they are done, post-testing interviews will be conducted. Post-testing interviews will likely vary considerably from tester to tester, since the experiences of different people are likely to be different, but there are a handful of prepared standard questions: - On a scale from 1-10, with 1 being "very difficult" and 10 being "very easy", how easy/difficult was it to navigate through the digital prototype? - Was there anything in particular that you liked with the digital prototype? - Was there anything in particular that was extra difficult to understand when navigating through the digital prototype? - Do you think that a game like this, especially the social features, could decrease feelings of isolation and loneliness?

As with the previous sets of interviews, interviewees were informed by the interviewers of the purpose of the test, how long it was expected to take and their right to withdraw at any time. They were also made aware that any data collected during the testing and subsequent post-testing interview would be kept confidential between the project team and the examiners of the HCI course at KTH.

In addition to taking notes and asking questions during the tests, the overall learnability and ease of use of the functions in the prototype was also measured through how long each task and scenario took to complete and noting down if any errors were made.

3. Results

3.1 Digital Prototype

As mentioned in section 2.6, the digital prototype was developed in Mockplus. This platform facilitated the implementation of all the desired functions for the bingo game. It was also very easy for all group members to participate in the design since everyone had access to the prototype and it was updated in real time. The prototype created in Mockplus was interactive which made it very easy to conduct user-tests.
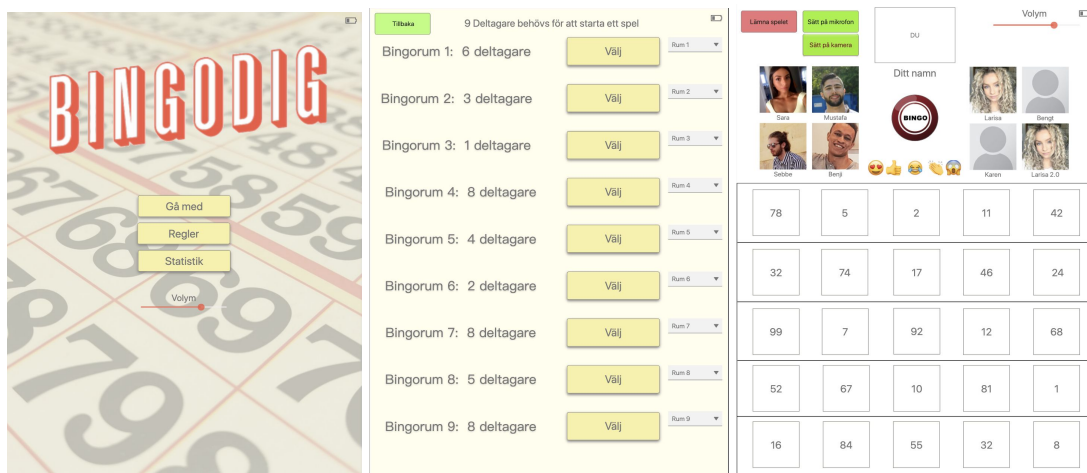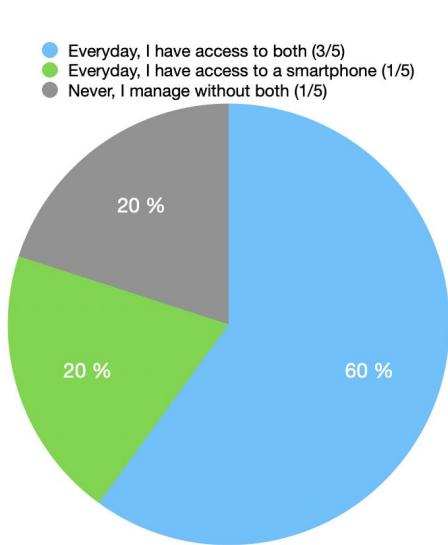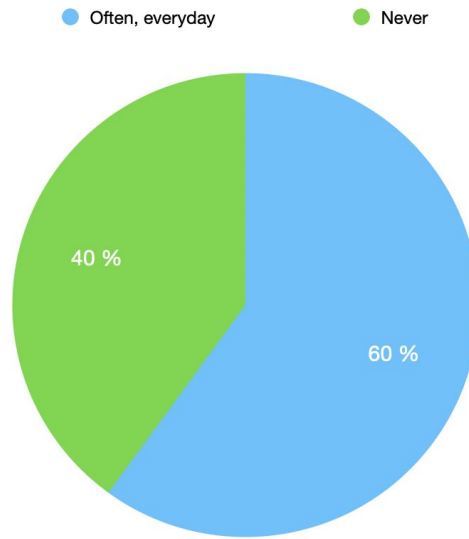

Figure 2: Screenshots of the finished digital prototype
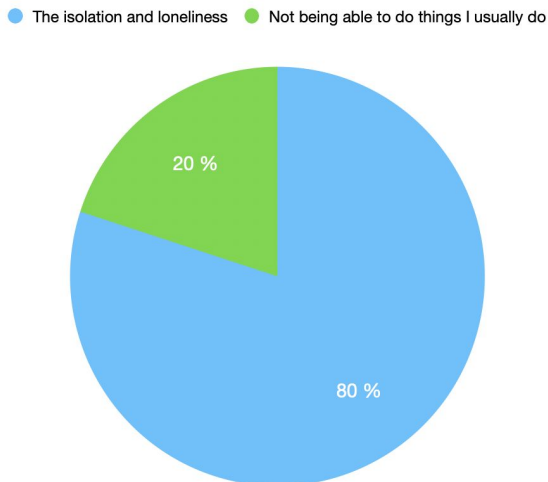
3.2 Interview Answers

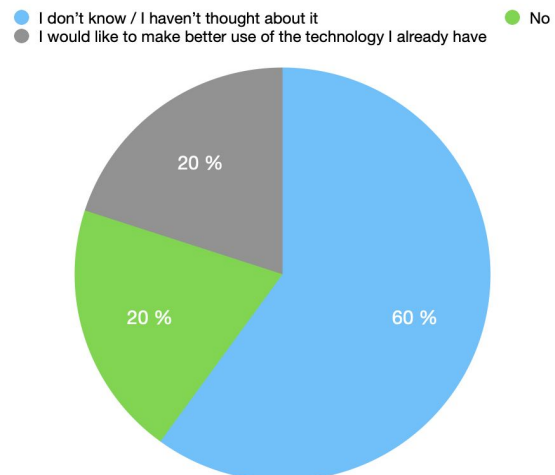Below are key interview answers represented in circle diagrams.

● Everyday, I have access to both (3/5)
● Everyday, I have access to a smartphone (1/5)
● Never, I manage without both (1/5)

20 %

20 %

60 %

How often would you say that you have
access to a smartphone or a tablet?

● Often, everyday   ● Never

40 %

60 %

To what extent are you using these
devices?

● The isolation and loneliness   ● Not being able to do things I usually do

20 %

80 %

What do you think is the most difficult
aspect of the current situation?

● I don't know / I haven't thought about it   ● No
● I would like to make better use of the technology I already have

20 %

20 %

60 %

Do you wish you had access to any
entertainment channels?

Figure 3: Circle diagrams of key interview answers

3.3 Results of Usability Testing

According to the users that tested the digital prototype, the final product was easy to navigate. Positive feedback was received regarding the implementation of reaction-emojis. The change of one to five rows of bingo tiles was also well received, with testers commenting that it now felt more like real bingo.

A suggestion offered was that the application should provide users with more clear instructions. They suggested that first-time users could be put through a guide or tutorial before starting the game for the first time. Additionally, some testers thought that the "rules" button could be changed to "rules and instructions" to make it more clear that instructions are also included on the "rules" page. These design changes were not implemented due to a lack of time.

4. Discussion

After working on the project, it is certain that it has been an insightful and interesting experience of what the design process of a product looks like. Initially, the design proposal that the group had been given was the idea to create a digital prototype with the purpose of aiding people over the age of 70 with the difficulty they were facing during the on-going COVID-19 pandemic.

The first problem regarding finding a way of conducting the interviews without putting the participants in any danger, considering the fact that people above the age of 70 are in the risk group of developing severe symptoms from the COVID-19 virus. At the time of planning the interviews it was forbidden to visit elderly homes, while going up to elderly strangers on the streets was seen as inappropriate and unnecessary. Therefore, the best resolution was to phone call people in the age group that the group members personally knew, mainly family members or other relatives. While this solution slightly decreased the variation of participants with different backgrounds and ways of living, it was a decision that had to be made in order to guarantee everyone's safety, including the group members.

Because of the limitations regarding the interviewing procedure, only five users from the target user group were interviewed. Obviously, concerning the low number of interviewees, the data gathered risks not being representative enough for the entire user group. It was therefore difficult to analyze the results in terms of formulating the usability requirements, aiming to represent the majority of the target users.

During the collective brainstorming everyone had a positive and open-minded attitude. However, only a few ideas were brought to light, and the group could have done a better job at uplifting the golden rule of brainstorming, which is that quantity is preferable over quality and that proposing many ideas usually leads to finding great ideas.

Less time could have been spent coloring the paper prototype and making it aesthetically pleasing. After all, the main goal of the method was to use a cheap and quick way to identify problems in the early stages of the design process through usability testing, rather than

creating a high-fidelity prototype which would have been done for an almost finalized product.

Based on the feedback given from the usability testing, there was room for implementing further changes such as an introductory guide for the first-time user. This would certainly increase the usability and learnability of the product, but because of the lack of time, there simply were no further changes made than already mentioned.

While there in hindsight could have been more improvements added to the finalized digital prototype, the overall consensus from the user tests inclined that the group had designed an accessible product with high usability. Ultimately, the product was supposed to be suitable for people within an age group where a large majority is not as technically experienced compared to younger generations. Therefore, while evaluating the prototype before finalization, some features deemed unnecessary by the group were removed in order to make it easy to use.

5. Conclusion

Throughout this course, working with the course literature and by attending all tutoring sessions, a fully functional prototype was completed. Because of COVID-19 there were restrictions and guidelines that we were forced to follow, which gave an insight on how working with people can be, without physically meeting them. As expected, there are potential expansions to the idea. In this project we learned that working with a digital app is a "never ending" process in terms of there always being something left to improve. That is the challenge with an interactive process.