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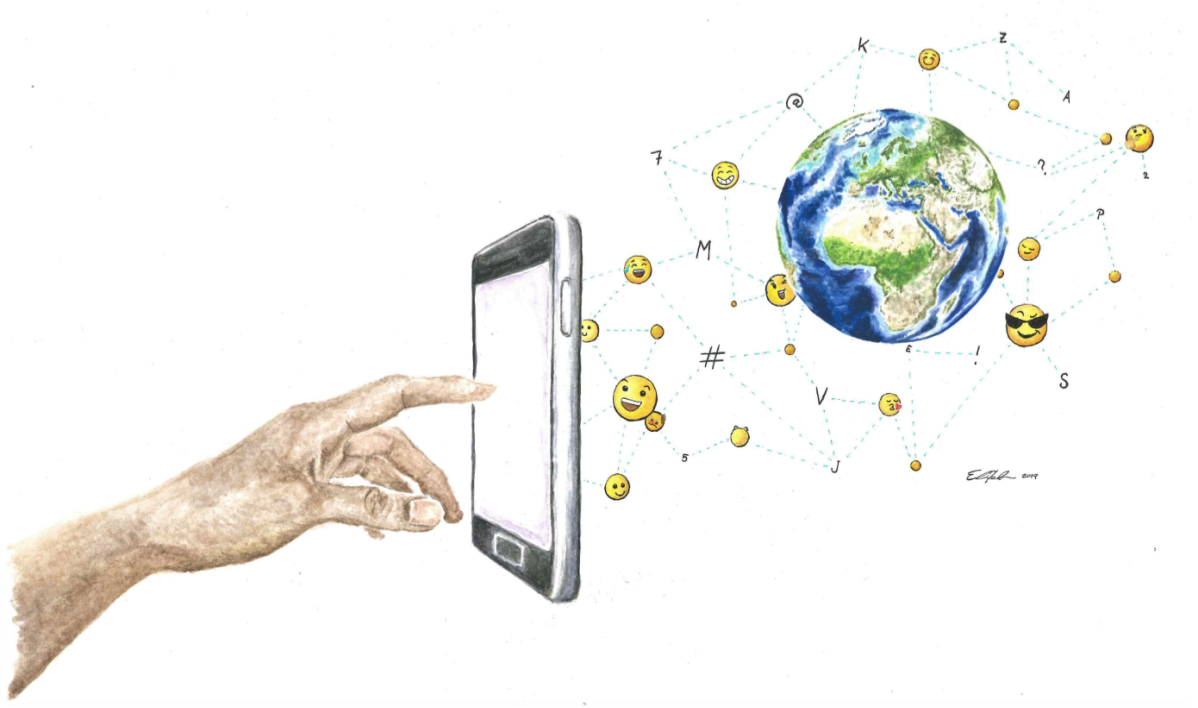

How can remote communication be made more accessible to people with communication disabilities?

An online focus group study with support persons to people with communication disabilities in need of augmentative and alternative communication (AAC)

Master's thesis in Biomedical Engineering

Elin Johansson

Department of Electrical Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2019

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Abstract

The human being is by nature a social creature for whom communication is a vital factor for survival. The core meaning of communication is the sharing of information and ideas between individuals. Over the last decade, remote communication via the Internet has become a prerequisite for taking an active part of the developing digital society. Although this is a beneficial evolution in many ways, it does not apply to everyone. People with different disabilities affecting ability to read and write, difficulties with understanding others, and limited motor skills or speech might find mainstream remote communication and technology problematic.

Augmentative and alternative communication (AAC) refers to all types of communication apart from talking. AAC-systems can be used to help persons with the above mentioned difficulties in their communication.

The objective of this work was to investigate how remote communication technology can be improved for people with communication disabilities.

An asynchronous online focus group study was conducted where support persons of individuals with communicative disabilities in need of AAC participated. They were invited to discuss three overarching topics regarding remote communication issues for the target group during four weeks. Data analysis was then conducted on the obtained transcripts using the systematic text condensation (STC) method.

The results from the online focus group indicated that adaptations of remote communication technology could be made regarding the graphical interface, physical design and function. The abundance of setting options and disturbing notifications was brought up as problematic. Proposed solutions were a system of organising settings in levels based on the users' cognitive abilities and a notification centre where notifications would be collected. A wish for larger buttons on devices and a more accessible design was expressed by the participants. A more seamless integration between assistive and standard technology was also mentioned as an important aspect when developing remote communication.

Conclusively, current technology for remote communication needs to be improved to be more accessible for more people regardless of functional variation or abilities.

Keywords: remote communication, communication disabilities, online focus group, augmentative and alternative communication (AAC), systematic text condensation (STC)

Acknowledgements

My personal motivation for doing this work originates from the strong belief that everyone should have equal opportunity to make their voice heard. I also wanted to do a work focused on how technology could be used as a complement to human abilities such as communication.

I would like to thank everyone who has supported me while doing this thesis. My supervisors for their continuous support and encouragement. My examiner for being understanding and willing to adapt the examination to my needs. My opponent who has helped improving this report. Everyone at MedTech West who provided a place for me to work with this thesis. The study participants, whose contribution was a key component in this work.

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Elin Johansson, Gothenburg, June 2019

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Introduction

Over the last decade, remote communication via the Internet has become a prerequisite for being able to take an active part in the modern society. As of 2018, 94 % of the Swedish population were estimated to use Internet although 98 % had Internet access at home [1]. Social networking and booking health care appointments are examples of things that are now mainly carried out by remote communication. It is in many ways a beneficial evolution in how we communicate, but does it include everyone? The simple answer to this question is probably no.

The statistics of Internet usage from 2018 [1], gives an indication of the importance of being able to engage in the digital world. However, these statistics does not completely reflect upon how many people might be excluded due to inability to handle the technology.

For example, older generations tend to not have the same capabilities to learn about and use new technology. Out of the estimated 1.1 million people of the Swedish adult population who do not use the Internet daily, the majority are of age 76 or older [2]. However, age is not the only factor that matters when it comes to utilise remote communication technology. People with different disabilities, such as inability to read and write, difficulties with understanding others, insufficient motor skills or limited speech may also find mainstream remote communication and technology problematic to use.

1.1 Communication

The term communication is derived from the Latin word *communis*, which has the applied meaning of common ground of understanding [3]. There are several definitions of communication, simply phrased as the exchange of information between one another. For the human being, the ability to communicate is compulsive and key for human relations. The foundation for human relations is mutual understanding which can not be achieved without communication.

Communication is undoubtedly necessary for the human being and can be considered a human right. In the Universal Declaration of Human Rights (UDHR) established by the United Nations in 1948, article 19 is most often regarded to highlight com-

munication rights in terms of freedom of opinion and expression [4, 5].

> Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers [4].

The ability to communicate is central for many articles of the UDHR despite not being explicitly mentioned [5], for example the right to work under favourable conditions (article 23) or the right to an education (article 26).

1.1.1 Communication technology

Communication technology will in this work be referred to as either standard or assistive.

- **Standard technology:** technology generally used in everyday life, for example smartphones, tablets, TV, laptop, telephone (including applications)
- **Assistive technology:** technology used in addition to standard technology to facilitate everyday life, for example speech synthesis, symbol language (Bliss, Widgit symbols) , voice control

Usage of standard technology often requires ability to read and write, functional speech ability and cognitive understanding. For people with communicative and cognitive disabilities, usage of standard technology for remote communication tends to be difficult. In order to gain knowledge of how to develop remote communication technology to better meet the needs of these people, more research is required.

1.1.2 Augumentative and alternative communication

Augmentative and alternative communication (AAC) is a term including all types of communication other than talking [6]. AAC can be unaided (facial expressions, body or sign language) or aided (a device or some sort of tool is used). It is *augmentative* if used as a supplement to existing speech and *alternative* if used as a replacement for non-existing or non-functional speech [7]. AAC systems are often a combination of several methods designed at individual level involving both standard and assistive technology [8].

There are different reasons for a person to be in need of AAC. The person can have problems expressing themselves, understanding others or both [9]. Autism, acquired brain injury, severe speech- and language impairment, cerebral palsy (CP), amyotrophic lateral sclerosis (ALS) and multiple sclerosis (MS) are examples of medical conditions that can affect the ability to communicate [10].

1.2 Background for this work

This project is a study on remote communication technology for people with communicative difficulties in need of ACC and relates to M. Buchholz doctoral thesis *Let's stay in touch! Remote communication for people with communicative and cognitive disabilities* [11]. This project was also conducted in collaboration with Dart and one of their projects CallforAll.

Dart − centre for assistive technology and augmentative and alternative communication − is organised under the Department of Neurology, Psychiatry and Habilitation of Sahlgrenska University in Gothenburg and works with AAC, communication rights and accessibility for children, adolescents and adults [12]. Dart participates in AllAgeHub, a collaboration platform for research, development and innovation that promotes accessible housing and assistive technology services [13]. The vision of AllAgeHub is to ensure that all people can live independent and safe lives regardless of disability or age. This work was formulated by the AllAgeHub partners Chalmers University of Technology, Dart, and the University of Borås.

The objective of the CallforAll project is to develop a solution for making video call communication easier for people using special programs with, for example, symbols as text support or speech synthesis [14]. With the video call program CallforAll proposes, it should be possible to have a direct connection for the speech synthesis eliminating the need for the sound to go out in the room first [15] and thereby improving the sound quality. Symbols with related texts from the user's own AAC program will be possible to send to the communication partner via the proposed video call program. This program should also allow for independent handling and usage of all features and have support for alternative ways of control.

In Buchholz's doctoral thesis, four papers were included where the forth one describes a study by Buchholz, Holmgren and Ferm [8]. In this paper, suggestions on how remote communication could be developed to better meet the needs of persons with communicative and cognitive difficulties were presented. The selection of which of these suggestions to include in this project was based on their suitability to propose solutions to the problems they described.

Ultimately, three topics assembled from the included suggestions were selected to be further investigated in this project. Below are the problem descriptions for each of the three topics presented.

1.2.1 User interface

The user interface is in this context referred to as the graphical user interface in smartphones, tablets and computers − the link between the user and the technical unit in question. In other words, what can be seen and interacted with on the screen. Accessibility to the unit in terms of buttons and physical design is also covered by

this definition.

People with communication difficulties have brought up some issues regarding the user interface in previous research [8]. Currently there are various different alternative settings in modern communication technology to facilitate for special needs, so called accessibility functions. For example, the text can be enlarged, the grid for app placements can be adjusted so fewer icons are seen at each screen, speech synthesis, hot key functions, spoken password etc. [16].

Hence, the largest issue with user interface is maybe not a lack of alternative settings, rather the abundance of them, which makes it difficult to know which ones are suitable for each individual.

1.2.2 Use of symbols and emojis

The use of emojis has become a natural part of the contemporary written communication. Today there are approximately 3000 different emojis in Unicode Standard with the newest release in June 2018 [17]. People with communication disabilities have expressed it as a problem not being able to use their own symbol supports together with emojis in a simple way [8]. Currently no application has supported access for both emojis and symbols.

Difficulties with choosing which emoji to use and when have also been stated as an issue and the meaning can be difficult to understand [8]. Different operating systems and platforms render their symbols differently, hence they might not look the same for the sender as for the receiver making the understanding of them even more difficult. Nevertheless, usage of emojis is relevant for these persons since emojis are familiar to the public and easy to access.

1.2.3 Video calls

The understanding of remote communication can be made easier with video calls since it is more similar to a physical conversation [8]. It gives direct feedback, allows non-verbal communication such as sign language, gestures and facial expressions. Video calls can also facilitate remote communication for people who find it difficult to read and write.

However, today there is no appropriate technology for people with communication disabilities which supports the use of symbols, speech synthesis, video and text. All of which are features important to people with communication difficulties [18]. Among the alternatives being offered, low quality of sound transmission or equipment lacking some or all of the mentioned supporting features are limiting factors. Consequently, many people with communication disabilities cannot use the technology for remote communication independently despite wanting to or potentially being in need of it.

1.2.4 Aim

The aim of this project is to investigate how remote communication technology can be better adapted for people with communication disabilities in need of AAC. In a broader view, the aim is to contribute to making digital communication available and compatible for even more people.

1.2.5 Specification of issue under investigation

How can current technology for remote communication be better adapted for people with communication disabilities?

How can integration between standard and assistive technology be improved for remote communication to better meet the needs people with communication disabilities?

What information needs to be presented to stakeholders (e.g. technology industry, politicians, general public,...) to increase awareness and facilitate development in this area?

1.2.6 Limitation

Possible developments of remote communication supports will mainly regard standard technology. Due to the relatively short time duration of this project, the objective will not be to present functional solutions ready for application but rather to draft and evaluate possible ideas on how to develop current technology.

2

Theory

This chapter introduces the basics of the focus group method and its online version which was used in this project. Advantages and disadvantages with the online focus group method will be presented and in what regards this variation is different to the regular focus group method. Methods for data analysis are also introduced in this chapter.

2.1 The focus group method

The focus group method can be defined as group discussions around a certain topic where interaction between participants is central, shifting the power from the researcher to the participants [19]. It is a qualitative research method where the generated knowledge is a result from common experiences focusing on the collective understanding arising from the discussion.

The main objective with the focus group method is to gain a better understanding for how people think or feel about a certain topic and gather their opinions [20]. Hence, it is imperative to create a comfortable and open-minded environment for the participants to share their opinions without fear of being judged.

The group size is important for the discussions to work. The aim is to have a small enough group to ensure everyone gets a chance to share their insights, but large enough to obtain a diversity of contributions within the discussion [20]. Typically groups consist of five to eight participants for focus groups.

2.2 Online focus groups

In the late 1990s, Peter J. Murray published an article about virtual focus groups stating that it could potentially be a useful future research method [21]. Now about two decades later, qualitative online data collection methods are mainstream, a probable response to the increased popularity of the Internet [22]. The concept and objective are the same as for a traditional focus group but without physical meetings.

Online focus group discussions can be conducted synchronously or asynchronously [23]. Synchronous focus groups are conducted in real-time requiring all participants to be active at the same time. Asynchronous focus groups are more comparable to a discussion board or forum where participants are free to decide when to be active.

When conducting focus groups online and in an asynchronous manner, the group size has the potential to be larger to include a wider range of experiences [23]. A larger group can also contribute to longer discussions when participants can reply directly to specific comments in form of threads [22]. On the contrary, if the group is too large, moderation can be difficult and the role of the moderator might be less efficient.

Furthermore, a smaller group can be beneficial since it may create a more comfortable environment for the participants to open up [23]. A risk with having a too small of a group is that the interest for participating may fade away rather fast [22].

Some advantages with online focus groups are mentioned by Reisner et al. [22]. A text based online format eliminates both the need for a physical meeting place and transcription. Hence, time and cost are reduced while data accuracy is improved. It is also possible to obtain a more diverse group from a much larger geographical area.

The anonymity the online environment offers can be both advantageous and disadvantageous. On one hand, it might be easier to reach people who are unwilling to partake in face-to-face settings [22] and participants may feel more comfortable to share first-hand experiences and open up more about sensitive topics [24]. On the other, there is an equal risk that participants feel more comfortable expressing negativity within the group when their responses cannot be traced back to them. Another aspect which has raised concerns is the lack of face-to-face interaction in an online focus group [22]. This may lead to misunderstandings caused by the limitation of expressing nonverbal signals.

In terms of data quality, Woodyatt, Finneran and Stephenson [24] concluded that although the format of the collected data differed between the traditional focus group method and the online settings, the content was virtually the same.

2.3 Methods for data analysis

There are several methods for analysing the results from focus groups. The main goal and key characteristics of three commonly used methods, focus group analysis, content analysis and systematic text condensation (STC) will be presented here. The STC method was chosen for this study and therefore a more detailed description of the steps in this method will also be provided.

The focus group analysis and content analysis is only mentioned to show there are several methods to perform the data analysis.

2.3.1 Focus group analysis

Focus group studies often generates a large quantity of data which can be difficult to overview [19]. It is thus important to let the objective of the study determine the analysis process. Data must be viewed in its context to make the meaning of the material clear. Hence, raw data should be used for as long as possible.

The focus group analysis is a systematic, sequential and continuing process [20]. The analysis begins already at the planning stage of the study with regards to formulating questions and anticipating what answers might be given. After the study is concluded, all raw data should be processed to gain an overview of the whole material [19]. The material is processed multiple times and themes identifying relevant information are picked out.

Next step is to systematically place the raw data in themed categories with the purpose of creating categories that correspond to the meaning of the content [19]. Before interpreting the data, a descriptive summary of each category should be written. The collective understanding which has formed during the discussion should be the foundation for how the data should be interpreted.

2.3.2 Content analysis

Content analysis is one of many methods for analysing textual data [25]. The data can be in form of printed text, verbal communication or in electronic format obtained from open-ended survey questions, interviews, focus groups, to mention a few. The content analysis method is a systematic and objective process to make valid conclusions from the data in order to describe and quantify the studied phenomenon [26].

The purpose of content analysis is to take intentions, context, meanings and consequences of the data into account to classify the text as categories representing similar meanings [26, 25]. Moreover, the overall goal of this method is to "provide knowledge and understanding of the phenomenon under study" [26].

2.3.3 Systematic text condensation

Systematic text condensation (STC) is a qualitative method developed by Kirsti Malterud [27]. The method is inspired by Amedeo Giorgi's principles of psychological phenomenological analysis [28].

STC is a thematic analysis method [28] which by focusing on identifying patterned meanings of the data, aims to provide answers to the research questions being asked [29]. The STC method is an appropriate method for novices in the field of textual analysis since the four steps are simple and rigid [28]. It also suites well for limited

amounts of data which counteracts the potential risks with losing information by fragmentation of the text, making it easier to maintain an overview of the material.

The four main steps

There are four main steps of the STC analysis [28, 27], which are displayed in Figure 2.1.

Figure 2.1: Steps of analysis in systematic text condensation

The first step is to establish an overview of the material by reading all data [28]. With a general impression of the data, *preliminary themes*, which are starting points for organising data, should be identified. At this stage, the themes do not constitute the results.

The next step is the coding process in which data elements, so called *meaning units*, are identified and organised [28]. Meaning units are text fragments containing information about the research questions. The objective is then to introduce codes which are used as labels for sorting the meaning units into code groups. A code is a short statement describing what is important about the meaning unit.

Condensation of the material is carried out in the third step of analysis. This means one should reduce the content of the organised meaning units into *condensates*, one for each code group [28]. The condensates are fictitious quotations written with the intention to represent the perspective of the participants. Condensates are therefore written in first-person format and should include every meaning unit in the code group.

The fourth and final step of STC analysis is the synthesis of descriptions and concepts to clarify the research questions [28]. Condensates are re-written into analytic texts in third-person format to emphasise the interpretation of the data. These analytic texts are then given appropriate headings describing their core content. Categories are placed into final themes and provide the final results of the analysis.

It is important to validate the synthesised result, ensuring the original context is still reflected upon correctly. Validation is done by going through the full transcript again searching for data that might contradict the interpretations and conclusions.

3

Methods

In this chapter, the study design, procedure and conduction of the data analysis will be presented. The intentions with the material the participants were provided with will be explained. Ethical considerations for this work will also be highlighted.

3.1 Study design

The study was conducted as qualitative web-based discussions, following the basic concept of the focus group method to involve people with personal expertise within the field of alternative communication to gain a broader insight into what the real needs are for people with communication disabilities.

The focus group method was suitable for collecting the type of data this study is based on. A web-based format was chosen so that the discussions could be active for a longer period and in an asynchronous manner. Hence allowing the participants to take part of the discussion when it suited them best.

3.1.1 Target group and selection of study participants

The target group of this study were people with communicative disabilities in need of AAC. However, for this type of study it was determined too difficult for persons of the target group to participate themselves. The study required the participants to be able to read, write and understand how to access and use the platform. Another reason was that persons of the target group might not have enough experience with remote communication to be able to discuss how it can be improved [30].

Instead this study considered support persons to people within the target group as suitable participants. A support person is here defined as someone who helps out in the daily life, such as a family member or a personal assistant. Support persons have valuable insight in how for instance remote communication is being used in the daily life and what aspects of it which might cause problems [30].

Inclusion criteria for participating in the study:

- Support persons to one or multiple persons with communicative disabilities in need of AAC
- Able to understand Swedish (read and write)
- Age 18+

A month before the study started, possible participants were contacted via e-mail from Dart where a short introduction of the study was provided in form of a brief information letter. If the person replied with interest, more thorough information was sent together with an informed consent form to fill in. All contact with the participants during the recruitment process was handled by Dart. A total of 25 persons were contacted and nine replied with interest in taking part in the study.

3.2 Procedure

There are several factors to account for when conducting an online focus group study. In this section, the procedure from planning and preparation stage to evaluation of the study will be described.

3.2.1 Planning and preparations

This work focused on suggestions from a paper by Buchholz, Holmgren and Ferm [8] related to standard technology. These where initially grouped into four topics with potential of being included in this study. In the list below are the primary selection of topics.

- Make tablets and smartphones more accessible for persons with cognitive problems and limited literacy; facilitate user interface to make it easier to use
- Find a way to combine emojis with the symbols/images available in the user's aids and provide explanations of the meaning in a suitable manner. Also make it easier to choose which emoji, symbol or image to use
- Message history to allow for the user to go back and check so they have understood or remembered what has been discussed
- Video call services which are more adapted to other communication supports

The first point was developed into the topic *User Interface*, the second point was developed into *Use of symbols and emojis*. The third point in the list regarding message history was excluded since it was not sufficient to have as a separate discussion topic. The fourth point suited well to include the CallforAll product proposal and was named *Video calls*.

The key questions were formulated to correspond to the research questions in Section 1.2.5 but adapted for each topic. The first question was about how standard technology could be adapted to include functions present in aids to facilitate for the target group. The second question was regarding suggestions on how the integration could be improved between standard and assistive technology. The third question was about the most important aspects product developers and designers should have in mind to make it easier for the target group when new products are developed.

For all three topics, a PowerPoint presentation was created to give the participants more information before starting the discussion. Each presentation included a brief introduction of the problem followed by a few fictional cases to further illustrate the issues.

3.2.2 Material for the focus group

Participants were presented with material about each discussion topic with the intention to inspire discussion. This material included a brief problem description followed by a few cases to further illustrate the problems. When suited, a suggested solution was also presented. The complete presentations presented to the participants can be seen in Appendix A.

User interface

The material for the first topic about user interface did not explicitly include a predefined solution to a problem. The intention here was rather to encourage discussion about presented problems and collectively define suggestions for possible solutions.

Four cases were presented to the participants to exemplify issues in the daily life. All cases, for all three topics, are fictional and were made up based on information presented in the doctoral thesis [11] used as primary reference for this study and personal experiences. They are shown below.

> **Erik**
>
> It is difficult for me to understand when things happen without a clear reason. A typical example is notifications and pop-up windows which appears on the screen even though I haven't done anything. When that happens, and I don't understand why, I get stressed and don't dare to continue.

> **Birgitta**
>
> I think it is difficult when I must use several devices or applications to complete one single task. It gets confusing and I easily get lost in what I am doing. Additionally, it is so easy to press the wrong thing and then it gets even more difficult to keep track of what I'm supposed to do. Then, I just want to start over but that can also feel hard sometimes.

Sonja

I struggle with remembering things, for example passwords, user names and other codes. This causes problems when I want to get a new application, a mobile phone or laptop since there are so many settings that needs to be handled before I can start using it. If the design differs from what I'm used to it becomes even more difficult. I would like it to be easier, so I could choose for myself what I want and not need so much help.

Per

I always use speech synthesis to write and read messages. It is a great help for me, but I sometimes find it hard to hear. I would like to raise the volume more. Sometimes I don't understand what is said even though I can hear, the pronunciation is bad.

Use of symbols and emojis

For the second topic concerning the use of symbols and emojis, the following three cases were presented for this topic.

Josef

There are so many different types to choose from, how am I supposed to know which one is best to use and when? It often takes such a long time for me to choose that I just get frustrated and end up not choosing any of them. I wish there were fewer, so it would be easier to choose.

Ida

I am afraid to use emojis because I think it is difficult to understand what they mean. I don't want there to be misunderstandings. My friends often use emojis, I would like to be able to do that as well without worrying about making mistakes.

Anton

I use symbols to communicate. It works well but I would like to use my symbols in my mobile phone or tablet and that it should be just as accessible as emojis. It also would be good if I could use both my symbols and emojis together.

As a suggested solution under this topic, a sketch of an app proposal was also presented to the participants. The app was thought to function as a complementary keyboard where all symbols and images are collected in one library together with regular emojis. Ideally it should be possible to respond to all kinds of written messages and also write new ones with this application.

The home screen of the proposed app is illustrated in Figure 3.1. A larger field for writing the message is designed to make it easier to see. Below the writing field is a

fixed panel with options to get text read by speech synthesis, a shortcut to contacts and a send button. The name of the recipient is always visible while writing with the possibility to add a picture of that person.

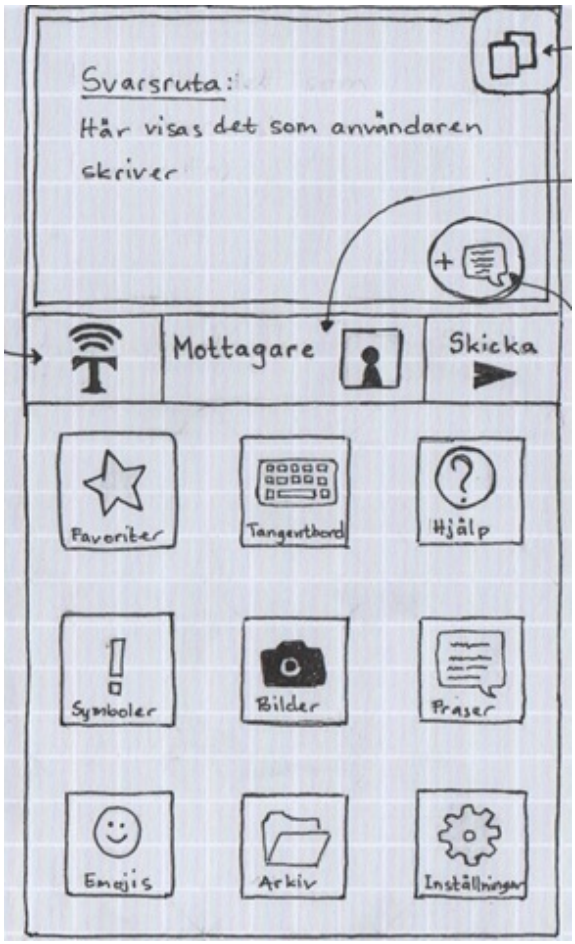

Figure 3.1: Sketch of the home screen for the app presented to the participants. Function of the buttons row by row, left to right: Favourites, Keyboard, Help, Symbols (i.e. Bilss, Widgit, etc...), Images, Phrases, Emojis, Archive, Settings.

To minimise the risk of pressing the wrong button, this design has larger spacing and also larger buttons. Every function within the app is illustrated with a symbol.

Video calls

The material for the third topic on video calls introduced the Dart research project CallforAll with a summary of their product proposal together with two cases.

> **Julia**
>
> I write with a communication program with speech synthesis as a complement to my own speech. When I call my friends, I often use Facetime. It feels better than a regular phone call since I can complement the use of my communication

program with facial expressions, gestures and signs. It is frustrating though that it's difficult for the person I'm talking with to hear what my speech synthesis is saying. In the end it just annoys us both. It becomes an even greater problem if the person I'm talking with also uses speech synthesis.

Ellen

I like video calls because we can see each other. It feels more like a real-life conversation. I understand what other people are saying to me, but I need to use AAC supports to express myself. I use a communication program with symbols and speech synthesis when I speak and write, but it does not work together with the video call services I have tried. It would be good with a service that can offer video calls with speech synthesis and writing with symbols, so I could be more independent in my communication.

3.2.3 Platform

The choice of platform to use for the study was crucial. To make sure the participants felt comfortable and safe to share information, the platform needed to fulfil several criteria, regarding security and data integrity, functionality and usability. Thus, six platforms (Microsoft Teams, SUNET Connect, Canvas, Zoom, FocusGroupIt and Slack) were evaluated following a list of features to determine which would be the most suitable for the purpose of this study. A summary of these features can be seen in Table 3.1.

The list of features to use when assessing and comparing different platforms were derived from three fundamental criteria:

- The participants must feel safe to participate and share information
- The participants must understand how to use the platform
- The platform must enable asynchronous discussions

Additionally, features such as mobile access, maximum group sizes, cost and file sharing were also determined to be of interest. The FocusGroupIt platform was determined to be the best choice offering the most of the desired features and sufficient security.

Table 3.1: Comparative table for choosing best suitable platform. Note that fields only containing a dash indicate the information was not found.

	Microsoft Teams	SUNET Connect	Canvas	Zoom	FocusGroupIt	Slack
Allow asynchronous activity	Yes	No	Yes	A host must be online to keep the room open	Yes	Yes
Chatroom	Yes	Yes	Yes	Yes	Possible to send private replies to moderator	Possible to send Direct Messages
Discussion threads	Yes	No	Yes	No	Yes	Yes
Mobile access	iOS, Android	-	iOS, Android (App)	iOS, Android (App)	Mobile access to webpage	iOS, Android (App)
Invite as gusts	Yes	Yes, (link)	CID is required	Yes, (link)	Yes, (link)	Yes (link)
Share files within discussions	Yes	Yes	Yes	Yes	Yes	Yes
Number of participants/groups	Max 300	-	-	Max 100	Unlimited	Unlimited
Username/ Anonymity	You are linked to your email	Username	CID	Username	Username/ Anonymity	Username
Language (used by platform interface)	-	English	Swedish	English	Swedish	English
Cost to use as administer	Free with Chalmers licence	Free	Free	Free	Plus: $49/group (ca 455 SEK) Pro: $99/group (ca 920 SEK)	Free
The information will not be further spread or sold	-	-	No, agreement (PUBA) with supplier – secrecy, security etc. in conjunction with regular university education	-	No	-

Table 3.1: (Continued)

	Microsoft Teams	SUNET Connect	Canvas	Zoom	FocusGroupIt	Slack
Possibility to download discussions	-	-	Can be done manually (copy + paste)	Possible to save chat to txt. files	Yes, to Excel and PDF	-
Storage of information from discussions	-	-	Server within EU, on Amazon Web Services (cloud service)	-	Heroku (cloud service) Amazon Web Service (cloud service)	-
Storage of personal data (name, e-mail, ...)	-	-	Server within EU, on Amazon Web Services (cloud service)	-	Server within EU, on Amazon Web Services (cloud service)	-
Platform owner	Microsoft	-	Instructure Inc.	Zoom, USA	FocusGroupIt LLC, USA	Slack Technologies, Inc. USA
Comment:	Unable to access with Chalmers login	Requires Flash Based on Adobe Connect	Need to create course	Not possible to see previous chat history if login occurs later	Have all desired functions but not free to use. Possibility to do test run for free.	More adapted for project planning

3.2.4 Start-up online study

A few days before sending out invitations to the participants to join the focus group, the group was created on the FocusGroupIt platform. As a first question, the participants had to give their informed consent by actively marking "Yes" to the question in order to continue. By doing so, they confirmed the information sent out to them was reviewed and understood. A second topic was created where documents with information about the study were uploaded and also offered a space for asking questions about the practicalities of the study.

On the platform, four tabs were created for each topic. The first tab presented the topic with brief instructions on how to respond and additional information to read through before answering the questions. This tab was titled "Information". The participants were asked to write if they had read the additional information here.

The remaining three tabs presented the key questions, titled "Question 1", "Question 2" and "Question 3". Hence, each question had its own separate discussion thread. This system was chosen to make it easier for the participants to keep track of which question they were discussing.

The first topic of discussion was presented from the start so participants could begin as soon as they had signed in.

With three different topics, the appropriate time frame was set to three to four weeks with opportunity to keep the platform open for later responses. Participants were also given the chance to send in comments via regular paper mail to Dart if the information was of a more sensitive nature.

3.2.5 Focus group moderator

The role of the moderator has been indicated to have possible influence on the outcome of generated data, both for regular and online focus groups [24]. The author of this thesis was also the moderator for the online focus group.

Follow up questions were therefore not asked until at least two replies to the same question had been given. When a discussion had begun to form, additional follow up questions were asked to keep the discussion alive. As the discussion progressed the other two topics were presented a few days apart. At times when there were low activity in the discussions, a reminder email was sent out to the participants to elicit more discussion in the group.

Other considerations included the risk of losing data, which was minimised by having the transcripts of the discussions downloaded and stored on an external hard-drive once every day throughout the study.

3.2.6 Evaluation of participation

After the data collection ended it was of interest to find out how the participants had experienced being a part of an online focus group study. Thus, an evaluation of participation topic was published on the platform with private settings so participants could not see each others answers. Depending on the answers, more specific follow up questions were asked individually.

3.3 Data analysis

For this study it was concluded that systematic text condensation (STC) would be the most suitable method for the data analysis. It does not require huge amounts of data or prior experience with text analysis. Furthermore, the main focus of the analysis was to highlight the participants' views and opinions on the topic.

In Figure 3.2 is the implementation of the method shown.

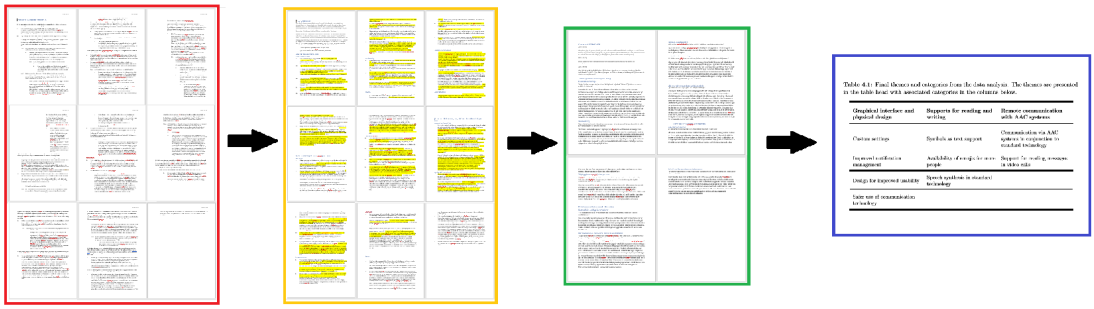

Figure 3.2: Overview of the text analysis process.

Since the discussions in this study where already divided into three topics, (*User interface, Use of symbols and emojis* and *Video calls*), it was natural to start the analysis with the same division as preliminary themes.

The second step of the analysis were more time consuming than the first and had to be repeated several times. Not focusing on the preliminary themes, the whole material was read through once more and meaning units were marked in yellow, see second box in Figure 3.2. To begin with the coding process, all marked sections were moved to a new document and sorted by content. Each group of meaning units were then labelled with short but descriptive codes.

In the condensation step, each code group was written into condensates as described in Section 2.3.3. One example of a condensate is seen below.

> I think it is an important feature to be able to see the messages in a conversation style where all messages are shown in chronological order and clearly stated who has written what. This is something that certain special program

> lack today and messages are instead shown as individual events. This makes it difficult to keep in mind what has been discussed. It is valuable to be able to go back and check what previous conversations have been about.

In the fourth step, analytic text were written and placed under suitable theme and category. A table with final themes and categories were then compiled to provide an overview of the results, see the fourth box in Figure 3.2. Lastly, the whole transcript was read once more to validate the results.

3.4 Ethical considerations

When conducting any kind of research, it is important to know what ethical considerations must be taken into account. Informed consent is generally a requirement for all research where subjects can be identified [31].

In this study, the informed consent form sent out to potential participants included information about the procedure and topic of the study, what they were expected to do, what information would be collected and how that information would be treated. It also included what possible risks and consequences participation in the study could entail, how the results would be published, who where responsible for the study and that participation is voluntary and the participant at any time can choose to withdraw. In case of withdrawal, the participant is not required to state reasons why.

The aspect of online security was also important for this study. It has already been mentioned regarding choice of platform, the importance of providing a safe and comfortable environment for the participants to share information. Hence, on the FocusGroupIt platform, a General Data Protection Regulation (GDPR) form had to be filled in and all participants had to give their consent in order to continue registration to the platform.

When it comes to the data collection and analysis, aspects such as risks of misrepresentation and misinterpretation becomes relevant [31]. In this study, misrepresentation could occur due to the fact that participants are representing the actual target group or at a later stage when analysing the collected data.

The risk of misinterpretation of the data is more likely if the researcher conducts the data analysis alone [31]. Therefore it is recommended for novice researchers to be closely supervised during the process of analysis.

As a part of the CallforAll project, this project was also ethically approved by the regional ethical review board in Gothenburg (Ref. No. 2018-05-17/180-18).

4

Results

This chapter begins with showing the outcome of the participation in the focus group study and then the results from the data analysis will be presented.

4.1 Participation in the study

Out of the nine persons who had replied with interest, only five participants joined the focus group online and gave their informed consent. The activity in the study over time can be seen in Figure 4.1.

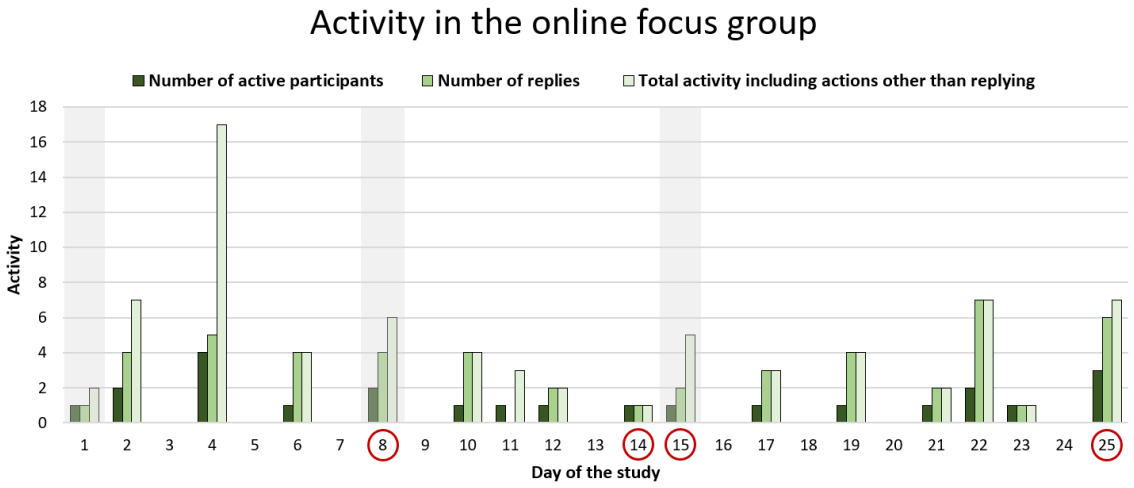

Figure 4.1: Diagram showing the activity in the online focus group over time. Note that the start of the time line indicates when the first person joined the group but invitations were sent about one week before. Shading indicates when new material was published in the focus group. Encircled days indicates when reminder e-mails were sent to the participants.

Initially three participants were active and answered the published questions to the first topic. However, they did not comment on each others responses making it more of an interview than a discussion. After the first week the activity decreased and only one participant continued to respond regularly. The last week after sending out a few reminders two participants came back and responded to some of the questions. A short discussion was also achieved for the first topic.

Ultimately, two participants did not respond to any of the questions within the discussion topics, two were active in the beginning and the end and only one during the whole study.

Regarding the evaluation of the experience of participating in the online focus group study, only one participant responded. This person thought it was a very positive experience and overall that everything had worked well. The questions were however perceived as difficult and demanded careful thought and reflection in order to answer. When asked about the time frame and frequency of new material, this was considered appropriate.

4.2 Results of the data analysis

The analysis yielded three final themes, *Graphical interface and physical design*, *Supports for reading and writing* and *Remote communication with AAC systems*. Each theme consists of categories which describe different aspects within the theme. An overview of the final themes and their categories is seen in Table 4.1. Each category in the text, includes a quote from the focus group transcript.

Table 4.1: Final themes and categories from the data analysis. The themes are presented in the table head with associated categories in the columns below.

Graphical interface and physical design	**Supports for reading and writing**	**Remote communication with AAC systems**
Customised settings	Symbols as text support	Communication via AAC systems in conjunction to standard technology
Improved notification management	Speech synthesis in standard technology	Support for reading messages in video calls
Design for improved usability	Availability of emojis for more people	
Safer use of communication technology		

4.2.1 Graphical interface and physical design

A prerequisite for using remote communication is to be able to manage the technology. The device must in itself be possible to handle and what can be seen on the screen needs to be understood. Improvements can be made in this regard and the participants have discussed a few suggestions.

Customised settings

The participants wished for an alternative way to manage settings in standard technology. They suggested a system of profile levels to organise settings based on the cognitive ability of the user. For example, the first level could be adapted for users with severe cognitive disabilities having settings at the most basic level and supported with larger text, illustrative symbols and speech synthesis. A higher level could be adapted for users who do not have issues with understanding the technology but might need settings for hearing or visual impairments.

> *Simple, logical, consistent functions. Option to remove "bothering" functions and just keep the most important ones.*

Another suggestion was to provide guides as an accessibility feature. Within the guide, the user would be asked questions about themselves and how they use their technology and based on their answers, the program would help the user find the right setting options.

Improved notification management

Pop-up windows and similar notifications were expressed as potentially being the most problematic feature by the participants. It was described as confusing for persons who have difficulties reading both the notification message and the action alternatives which could also induce anxiety. The participants wished for a function to minimise the occurrence of these notifications to only appear when absolutely necessary, in case of severe errors in the system for example. A proposed solution was to collect all notifications in a notification centre. The user could then choose a time to go through the notifications with someone helping them with interpretation and appropriate action.

> *In general, basically all notifications should be collected in a notification centre so one can choose to go in there regularly and go through the notifications.*

Design for improved usability

Regarding the physical design of new standard technology, participants did not see modern designs favourable for the persons within the target group. It becomes difficult to handle a device with tiny, hidden buttons and flat battery hatches. Preferably new models should have buttons that are easy to press, large and visibly placed. Hatches to batteries should have a notch or similar so they can be opened even if the user would have limited motor skills.

> *We have a Notebook which is so difficult to open that we need to place the charger cord between the screen and the keyboard when closing it to make it possible to open the next time.*

When it comes to charging the devices it was asserted to be easiest to use charging plates where the device is simply placed on the plate. Docking stations for charging were also claimed to be an easier alternative than using ordinary plug-in chargers.

Safer use of communication technology

The participants viewed the target group as vulnerable due to their dependence on other people when it comes to their use of technology. Therefore they claimed the safety aspects of using communication technology as important.

> *[...] these persons are often in a very vulnerable position*

In a discussion about password management it was concluded that fingerprint identification and facial recognition were possible options to limit the number of people having access to personal codes. Additionally, user names and passwords can be difficult to remember. One participant had however experience of it being difficult to know the appropriate amount of pressure when using fingerprint to unlock the device. Instead another app for identification on an external device was suggested. Another safety aspect brought up by the participants was the option to limit the group of people who could contact the user in advance. They claimed it should not be possible to be contacted by everyone.

4.2.2 Supports for reading and writing

Many persons within the target group have difficulties with reading or writing independently but much of the communication today is in written format. Therefore it is important to provide text support of different kinds.

Symbols as text support

The participants described the use of symbols as text support as an important aid for the target group. As reading and writing independently is a common problem within the target group, symbols complementing the text would offer a chance to learn the meaning of the text. It would also be valuable if AAC users had the opportunity to send text messages with symbols.

Furthermore, it would be necessary to have a complete and robust vocabulary of symbols compiled for each individual. The symbols need to have a predefined meaning written in text in conjunction to the symbol with the possibility to have it read with speech synthesis.

> *A possibility for AAC users to text with symbols is very helpful.*

More programs for smaller devices, such as smartphones and tablets, on the Swedish market was also expressed as a wish by some of the participants.

Speech synthesis in standard technology

Participants suggested all standard programs should provide the possibility to get text read by speech synthesis. Many persons of the target group find it difficult to read, talk or write with letters without some kind of support. Speech synthesis was therefore considered imperative.

> *All regular standard apps should have the option to get things read by speech synthesis.*

Availability of emojis for more people

Emojis are now a familiar addition to written communication and the participants stated emojis have become more important for persons among the target group as well. They want an equal opportunity to complement their writing with emojis to further express themselves.

> *Emojis can never replace symbols in a communication program, but just as for regular "writers", emojis are a complement for expression of e.g. a mood or spice up the message with that "something extra".*

In order to facilitate the availability and use of emojis, participants proposed they should be provided with explanations so their meaning becomes clearer. It would also be easier if they could be standardised so emojis look the same regardless of device, program or operative system.

The app proposal for use of symbols and emojis in standard technology, see Section 3.2.2, was met by positive responses from the participants. They agreed with it being beneficial to have access to both symbols and emojis within the same support. However, emojis should be separated from the symbols in the support program.

4.2.3 Remote communication with AAC systems

Being in need of AAC should not limit the ability to utilise remote communication. The participants shared their suggestions on how AAC systems could be improved for use in conjunction to standard technology.

Communication via AAC systems in conjunction to standard technology

The participants described the difficulty of having to change programs to complete a single task when communicating with both standard technology and AAC systems. Thus, it was claimed important to improve the communication between AAC systems and standard technology.

The best solution was according to the participants if remote communication was a default feature in communication aids. Another solution could be to include shortcuts to the assistive programs within the standard programs. This is a feature that is already available for other standard applications, for example in the Message-application in iPhone where shortcuts are displayed in a panel above the keyboard. The participants mean it should not be difficult to include an option to add own shortcuts in a similar manner.

> *That our AAC apps can communicate with standard apps in a more simple way [...] there should be buttons to add in the apps the AAC user utilises.*

The participants also brought up the value of being able to go back and check in the message history to remember what the conversation was about or confirm information has been interpreted correctly. There are some communication programs today lacking this ability and instead shows the messages as independent events, i.e. each message must be opened and read separately as in old mobile phones. Hence, a history where the messages are stored in chronological order and clearly shows who each message is written by should, according to the participants, be a standard feature in all communication programs.

> *An important feature is that the messages should be shown in a conversation feed, just as in ordinary mobile phones.*

Support for reading messages in video calls

Regarding video calls, participants thought it would be useful to have a window in commercial video call programs such as Skype or Facetime where written messages could be read with or without symbol support with the possibility to get the text read by speech synthesis. The participants also believed it would be an improvement if the AAC solution could be connected directly to the video call program. In such a case, the direct connection should provide a better sound quality of the speech synthesis.

> *It would be good of course if both variants were offered; read [by speech synthesis] and/or written messages, integrated in the video call.*

4.3 Suggestions for development of remote communication

To contextualise the obtained results, consider the perspective of the fictional characters and how they could benefit from the given suggestions. Possible solutions for each case are presented in Table 4.2.

Table 4.2: Suggestions for the fictional characters from the presented cases based on the obtained results of the study

Name	Described issue	Suggestion for improvement
Erik	Pop-up windows and notifications	Notification centre, function to minimise notifications to the absolute necessary
Birgitta	Several devices or applications for one single task, easy to press wrong	Include shortcut to assistive programs in standard programs. Have default feature for remote communication within the communication aid.
Sonja	Remember passwords and other codes	Facial recognition or fingerprint identification
Per	Unsatisfactory sound quality of speech synthesis	Direct connection to eliminate the need for the sound to go out in the room first
Josef	Difficult to choose which emoji to use and when	Proposed keyboard app for use of emojis and symbols
Ida	Difficult to understand the meaning of the emojis	Proposed keyboard app for use of emojis and symbols
Anton	Wants to use symbols and emojis together	Proposed keyboard app for use of emojis and symbols
Julia	Sound quality of speech synthesis in video calls	Message window for written messages with or without symbols in the video call service. CallforAll product proposal.
Ellen	Wants to use symbols in video calls	Message window for written messages with or without symbols in the video call service. CallforAll product proposal.

The participants proposed a notification centre where all notifications should be collected instead of appearing on the screen unpredictably. This solution could for instance help Erik.

Sonja described how she found it difficult to remember passwords and other codes. In her case, facial recognition or finger print identification could be useful options.

The problem of having to change devices or applications to complete one single task was described in Birgitta's case. This problem was also highlighted by the participants regarding remote communication. Therefore the participants claimed improved integration between AAC systems and standard technology as important. One suggestion given by the participants for solving this problem was to have a default feature for remote communication within the communication aid, hence eliminating the need for switching between programs. Another suggestion was to include shortcuts to the assistive programs in standard programs, making it easier to change program.

Both Ida and Josef expressed their worries regarding emojis and that they would like to use emojis more. In this case, the proposed app in Section 3.2.2 could be a possible solution. The app is thought to include explanations of each emoji with the option to have the explanation read by speech synthesis. To make it easier to choose, the app should offer a larger layout where fewer emojis or symbols are visible on each panel. There is also an option to archive emojis which the user does not use or add frequently used emojis to favourites. The app could also benefit Anton, who expressed a wish to use both symbols and emojis together.

Julia and Ellen describe problems when it comes to video calls and AAC systems. The participants stated it would be useful to include a message window in commercial video call services, such as Skype or Facetime, making it possible to write messages with or without symbol support and to have the text read by speech synthesis.

Speech synthesis in all standard programs was a suggestion given by the participants. A solution to improve the sound quality, which was described as a problem by both Per and Julia, could then be a direct connection between the AAC system to the communication program proposed by the participants.

5

Discussion

The aim of this work was to investigate how remote communication could be developed to better meet the needs of people with communicative disabilities in need of AAC. An online focus group was conducted with support persons as participants in order to gain their insight about how remote communication works in the daily life of the persons they support.

This chapter will present a two-parted discussion. In the first part, the results from the data analysis and what suggestions have been obtained for future development of remote communication technology will be discussed. The second part will discuss the methodology of this study and evaluate its suitability for this kind of research.

5.1 Results of the data analysis

The discussion of the results is structured according to the research questions of this work. Starting with how remote communication technology could be adapted for the target group. Then continuing with how integration between assistive and standard technology can be improved. And lastly, a discussion regarding what information stakeholders need to be presented with to facilitate development of remote communication.

5.1.1 Adaptation of remote communication

The first question this work aimed to answer was about how current technology for remote communication could be adapted to better suit the target group. Based on the results of the study, adaptations could be made regarding the physical design, the graphical interface and the function of the devices.

Graphical interface

The participants claimed pop-up windows and similar notifications as problematic and suggested all notifications should be collected in a notification centre. Such a

solution could make the device easier to use and remove some anxiety in connection to not knowing how to deal with unclear notifications. Another suggestion to the same problem brought up by the participants was to have a function which could minimise the occurrence of such notifications to only appear in case of severe errors in the system for instance.

The benefit of minimising the occurrence of notifications could be that it removes distractions which helps the user to focus. The definition of what is important to be notified about is however not the same for everyone. By having a general function that removes notifications it could introduce a new problem for some users who could miss alerts which are important to them. It would therefore be preferable if one could choose which of the notifications should be inactivated.

In standard technology today there is a function, Do not disturb, which inactivates notifications such as text messages, e-mails, news etc. This is a function which personally is frequently used, especially when studying or during the night. A similar function might be what the participants are asking for.

Alternatively, the support person could be chosen to receive the notifications instead. Problems with this alternative however could be if the support person supports several individuals and receiving notifications from multiple other persons might increase stress and affect the well being of the support person. It is also a question of what kind of notifications are considered. Is it mostly text messages, e-mails and other "social alerts", then having the support person notified instead might be considered a violation of privacy or integrity which is not the desired outcome.

Mentioned in the dissertation by Buchholz [11], self-determination and privacy regarding use of remote communication have been considered important for building confidence and independent communication. Thus, it might not be optimal for the support person to receive the users notifications.

An abundance of setting options were also asserted as an issue by the participants who wished for an easier way to manage settings in standard technology. Their suggestion was to provide a system of organising settings in profile levels based on the cognitive ability of the user. With this system, it would be easier to find relevant settings for each individual.

Practically, it can be discussed how this solution could be designed. With the possibility to do manual adjustments at an individual level, it might be sufficient to offer two or three levels. The first level could be adapted for persons with severe cognitive disabilities, as suggested by the participants. The second level could be slightly adapted for minor cognitive disabilities or other types of limitations such as visual or hearing impairments. Lastly, the third level would be the standard settings without any adaptations.

In the process of creating these levels, program developers should collaborate with support persons to find appropriate divisions.

Physical design

Physical design was also mentioned by the participants as a problem now with the modern trends of making new models thinner and with small buttons. Modern design of that kind does not show considerations to the fact that not everyone have the physical ability to handle such a device. Needs of the target group described by the participants in this matter was large, visible buttons on the device that are both easy to find and to press. Larger buttons could also apply to the graphic design where a larger grid might be useful. This result falls in line with previous research which also concluded new devices should have access options besides a touchscreen [8].

A more accessible design of some new models could be beneficial for people outside of the target group as well. It is not restricted to only this target group.

Hatches for batteries should have a more accessible design, making it easier to open even with limited motor skills. The same problem was addressed for charging options of the devices. A regular plug-in charger was claimed to be difficult and as alternatives the participants suggested wireless charging plates or docking stations.

5.1.2 Compatibility between standard and assistive technology

The second question this work aimed to answer was about how the compatibility between standard and assistive technology could be improved to better meet the needs of the target group. In order to answer this question, the needs must first be defined.

The target group for this study was defined as persons with communicative disabilities in need of AAC, including a broad spectrum of difficulties at different levels. Moreover, this target group is not homogeneous and therefore it is practically impossible to come up with solutions that will work for the whole target group.

Difficulties with reading and writing independently is however a difficulty many persons within the target group share. Alternatives include symbol support and speech synthesis, both for listening to text and as a support when writing.

Importance of speech synthesis

Regarding speech synthesis it was claimed as imperative by the participants who wanted speech synthesis as an option in all standard programs. Not brought up explicitly by the participants were the drawbacks of speech synthesis. Potential problems with speech synthesis was on the other hand described in the fictional cases for Per and Julia, see Table 4.2. These cases describe issues with volume and pronunciation resulting in unsatisfactory sound quality of the speech synthesis, both

in general and in video calls. The same issues were also described in an article by Buchholz, Mattsson Müller and Ferm [32].

One aspect of speech synthesis is that it might not be as private as regular written communication in the sense of other people being able to hear if headphones are not used. This could be a limiting factor in where the user feel comfortable to use remote communication and it could also be perceived as disturbing to the surroundings. Especially if the sound quality requires a high volume in order to hear. If the user wears headphones, high volume could be uncomfortable and over time also have negative effects on hearing.

Regarding the quality of the sound, CallforAll proposed a direct connection between speech synthesis and their video call program to eliminate the need for the sound to first go through the air and being picked up by a microphone. This direct connection would then provide a better sound quality and thereby a higher volume might not be necessary. Hence also be more comfortable to use with headphones yielding more private communication and less disturbance to surroundings.

In the context of symbols as text support, one participant expressed a wish for more communication programs using symbols on the Swedish market available for smaller devices such as smartphones and tablets. Although not being brought up in the context of speech synthesis, striving to compile a more developed and nuanced range for speech synthesis in Swedish could be useful.

A personal reflection is that since everyone is different, there should be many different voices to choose from as well as different accents and languages. From the perspective of blending in, it might feel more comfortable for a person in the south of Sweden to have a speech synthesis speaking with a southern accent. In some cases it might also be important what gender the voice is identified as.

Symbols as text support

Continuing the discussion on symbols as text support, the participants thought it would be valuable if AAC users had the possibility to send text messages with symbols. As many persons among the target group use symbols as text support, it would facilitate independent communication and ways to express themselves if they had the opportunity to send symbols in text messages.

The participants also described the relatively new and growing interest within the target group of using emojis as a complement in the written language. Interpreted as the largest issue was to understand the meaning of the emojis. This was described in previous research by Buchholz, Holmgren and Ferm [8] where a feature which presented the meaning of the emoji orally prior to sending it or while reading was suggested. In this study it was also mentioned by the participants that emojis should be standardised to look the same regardless of device, program or operative system.

With all emojis now available it might be difficult to find one single meaning to

everyone. The meaning of an emoji can also be completely different depending on both context and which population is regarded, i.e. nationality, generation, etc. In a friends group some emojis might have meanings only known within that group of people. The intended meaning of the designer might not be the same as perceived by the public.

Nevertheless, general meanings could be easier to find for the standard faces expressing different emotions, and it is most likely for these an explanation would be helpful. In terms of standardising the emojis, this could be beneficial for everyone

Integration of assistive and standard technology

The participants also pointed out the difficulties with inadequate integration of AAC and standard technology, resulting in the need of changing programs to complete a single task when using both standard technology and AAC systems. It would, according to the participants, be preferable if remote communication was a default feature in all communication aids. Or if standard programs had shortcuts to assistive programs, which would make the switching of programs easier and more seamless.

Just as mentioned by the participants, the function of shortcuts are an existing function but only for standard programs thus far. An example is the panel above the keyboard in the iPhone text message app where some shortcuts to other applications are found. A similar function is also available in the Samsung text message app if pressing the paperclip symbol next to the writing field. Programs for writing with symbols, such as WidgitGo, could be examples of programs that users might want to add shortcuts to. Considering there is a technical feasibility to implement this solution, it should not be too difficult to accomplish.

5.1.3 Information to stakeholders

The third question this work aimed to answer was what information needs to be presented to stakeholders to increase awareness and facilitate development in the area of remote communication. The stakeholders in mind was, to mention a few, the technology industry, politicians and the general public.

Safety using communication technology

One important aspect according to the participants was the safety of using communication technology. The participants discussed alternative ways of unlocking the devices or to login to different applications and programs. Facial recognition and fingerprint identification were mentioned as useful alternatives, limiting the number of people who have access to personal codes. Usernames and passwords can also be difficult to remember.

Another safety aspect highlighted by the participants was the option to, in advance, limit the group of people who would be able to contact the user as it should not be possible to be contacted by anyone. To this statement, no clear motivation was given and can therefore only be discussed here.

Anyone who has a phone or uses the Internet is at risk of being exposed to fraud. Seen from this perspective, the target group could be more likely to not understand if someone else is dishonest or be able to distinguish what is true or not on the Internet. This could be one reason to why the participants claimed it should not be possible to be contacted by everyone. If the option was given in advance to create a group of known persons who can contact the user, the risk of being a victim of fraud would decrease or ideally be eliminated.

There is one safety aspect the participants did not mention in this study but was discussed in the dissertation by Buchholz [11], namely the possibility to use remote communication to call for help. This could possibly be one of the most important things remote communication could be used for. In case of emergency it could be a matter of life or death, but it is also important for self confidence and independence.

Accessible standard solutions

One answer was given by one of the participants: "We need more apps which can be used by more people rather than having everything prescribed as aids." In general, this is something worth having in mind not only regarding applications.

Adaptations that make it easier for the target group can also be helpful in general. One example is symbol support, both in communication technology and in the physical world, which can be helpful for everyone. If going to another country with a different language, symbols and images makes it possible to understand more than if only text were provided. Images and symbols also help when learning a new language regardless of cognitive and communicative abilities.

Another example is the function of having text read by speech synthesis. This is not only helpful for the target group, but also for persons with visual impairments. Nevertheless, this is also a function that can be helpful for everyone.

A function which some communication programs lack today was said by the participants to be the possibility to see one's message history. In most standard communication programs or applications, message history or feeds are a conventional way to display conversations.

A personal view on communication disabilities is that it does not solely depend on the person with the diagnosis or difficulty. Communication is an interplay between at least two parties. Hence, if the other party is not aware of what might be difficult for someone else, it becomes much harder for them to be understanding and in that way facilitate the communication.

To address this, it is important to increase awareness about different ways of communications, both at an industry level and among the general public. One solution is to use so called "communication guides" (swe: *kommunikationspass*). This a book where the person has written down how communication works best for them and what both parties can think about to make the communication work better. When meeting a new person it is easy to show them the guide. It can also be tiresome to over and over explain oneself to every new person.

5.2 The online focus group method

The focus group method is well known and frequently used in various fields of research. However, online focus groups is relatively new and this study is the first time it has been done in relation to Dart.

5.2.1 Choice of platform

One of the key features for the platform was the ability to allow asynchronous activity. As can be seen in Table 3.1 in the Methods section, SUNET Connect did not fulfil this criterion. It was included as an option based on the relation to the Adobe Connect platform which Woodyatt, Finneran and Stephenson used for their online focus groups described in [24]. Their focus groups were however conducted in real-time which this platform seemed to be designed for. Moreover, the user interface was a bit difficult to understand and it was perceived a drawback not being able to answer specific comments in a thread, only in a chat.

Zoom was tested during a one-day trial within the project group. Although being promising at first, several drawbacks were discovered during this trial. Asynchronous discussion over a longer period was not possible since a host was required to be active to keep the discussion room open. Another major drawback was that participants joining the chat later than the opening of the discussion could not see any chat history. Nor was the chat saved automatically when logging out.

Usability and understanding how to use the platform was also an important factor for evaluation. In that regard, Slack was questioned as a fitting choice. Slack was not tested explicitly apart from watching video tutorials [33, 34, 35] and reading on their website. Previous experiences within the project group indicated there could be problems following a discussion using this platform. It was also difficult to find information about where and how the data were to be handled.

Microsoft Teams was recommended by the Chalmers IT-support. This platform possessed many of the desired features, however there were problems with accessing the service. Another concern was the data integrity and possibility to keep the participants anonymous.

As the new learning platform on Chalmers, Canvas could have been easily accessed. On the other hand, a course had be created to use the platform and all participants would need to get personal Chalmers identifications (CIDs).

The last option tested was FocusGroupIt which is a web-service designed for conducting online focus groups. It seemed to have all the desired features for this study and a two-week free test run was performed within the project group. During this trial, the different functions were assessed and determined suitable.

By not fulfilling the asynchronous criterion, both SUNET Connect and Zoom were ruled out as viable options for this study. Based on user friendliness, Slack was excluded. Microsoft Teams was eliminated from the alternatives since it could not be accessed.

Ultimately FocusGroupIt was the chosen platform to use for this study using the Plus group settings. Although being the only non-free platform, this was the alternative containing most of the wanted features as well as being user friendly. With the Plus group settings it was determined to be safe enough regarding data and personal information integrity. Canvas was ruled out as it did not appear to be a better alternative than FocusGroupIt.

5.2.2 Role as moderator

The role of the moderator has been indicated to have possible influence on the outcome of generated data, both for regular and online focus groups [24]. It was important to find an appropriate level in how frequently the moderator intervenes in the discussions. A moderator who asks questions too often might cause the participants to only provide answers rather than forming discussions [21, 22]. On the other hand, a moderator should make sure the discussions are kept alive and must therefore be flexible in when it is suitable to mediate.

The impression of the moderator was also important for how the participants would respond. For this study it was thought as a benefit for the moderator to add a profile picture to create a more welcoming impression.

Taking on the role as a moderator was a new experience and the online format worked much better than it would have in a regular focus group setting. Moderation was not a difficult part of this work apart from occasionally not knowing how to respond in the best way. In hindsight, maybe more follow up questions could have been asked to ensure each statement given by the participants was properly motivated.

5.2.3 Participation in the study

As shown in Figure 4.1, the number of active participants in the study was lower than hoped for. There are many possible explanations to why the participation in the study was only about 50 %. Two of the participants reached out during the last week informing of unexpected events preventing them from being as active as they would have liked to. Two participants did not write anything apart from the informed consent without giving their reasons. One possibility could be time optimism and procrastination, "I'll do that later..." and then forgetting or running out of time.

It could also be that the questions seemed too difficult, resulting in not knowing what to respond being the inhibiting cause. Reading between the lines, it could have been indicated that some felt they did not have the same level of knowledge to be able to respond as well as already posted replies. This could also be concluded from the fact that the total activity in general was higher than posted replies shown in Figure 4.1.

For this study it was decided to run with one potentially larger group rather than having two smaller groups in parallel. It would have been more work both with leading two groups and later performing the data analysis. Group interaction was also taken into account and for that reason it was not seen favourable to separate the participants.

Furthermore, it can be discussed whether or not it was sufficient to only have five participants in the group. If all of them had been active throughout the whole study, then five participants would probably be enough. In this case however, discussion was not formed until the end and then just briefly.

Also worth mentioning is the fact that nine persons showed interest but only five ended up joining the study. One could ask why only five decided to join, or turn the question around and ask what made these five join the study.

One possibility could be that the period between first information about the study and the starting point were too long. Since this was an online study, there were no logistic issues to solve or finding a time when everyone could be available. Thus, giving potential participants one month before starting the study could be one reason for the nearly half reduction of participants ultimately joining the study. Many are living busy lives and without reminders or strong motivation, it is easy to forget.

On the other hand, five persons did join the group despite having to wait for a month to receive new information which might be an indication of more motivation to participate.

5.2.4 Strengths and limitations of the study

This study was conducted as an online focus group. The online environment have the benefit of not requiring a meeting at a specific time or place. Hence, it provides the opportunity to reach participants who would find it difficult to participate if another method was used. The focus group method is also an appropriate method when the objective is to collect information from a group.

Regarding the data analysis, the online format provides already written transcripts which eliminates the need of transcription, thus saving both time and reducing work load.

Having the target group being represented by support persons can both be seen as a strength and a possible limitation. Since it can be difficult for persons from the target group to participate themselves in this kind of research, turning to the support persons might be the best option to gain insight about the topic. It can also be easier for the support person to see and reflect upon what aspects work and what can be improved regarding remote communication.

On the other hand, it is not guaranteed that the support person knows the user well enough to be able to voice this persons needs. This is thus a limitation, or weakness of not being able to present the questions directly to the target group.

A difficulty with the study was to formulate questions for the participants to discuss. Since the intention was to inspire discussion, the questions should not have yes or no answers. It was also a challenge to find an appropriate level in language that made the questions easy to understand but without being "too explanatory".

In this study, the participants were provided with a fair amount of information and material to inspire them to discuss. This can be seen as strength but it could also be the opposite in terms of potentially limiting their own line of thinking.

Specifically for this study, the time frame and the small number of participants can be viewed as limitations. Although it was discussed previously that potential participants were given too long time before the study begun, more time could have been useful for planning and preparations.

Only one participant responded to the evaluation regarding the participation in the online focus group study, which is not enough to draw any conclusions. Nevertheless, this participant expressed taking part in this study as a positive experience and that the study in general had worked well.

6

Conclusion

The objective in this work was to investigate how technology for remote communication can be developed to better meet the needs of people with communication disabilities in need of AAC. The results imply that adaptations can be made regarding standard and assistive technology and in terms of graphical interface, physical design and functionality of the devices. More specifically, this work provides input on issues with notification management, speech synthesis and use of symbols and emojis.

Regarding the method, online focus groups have great potential for this kind of research. More time for planning and preparations is however recommended. In this case when there was a rather small amount of data, the STC method was suitable for the data analysis. If studies are conducted where the amount of collected data becomes much larger, maybe a different analysis method should be used instead.

Conclusively, considering communication as a human right and the importance of remote communication in today's society, current technology for remote communication needs to be improved to be more accessible for more people regardless of functional variation or abilities.

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A

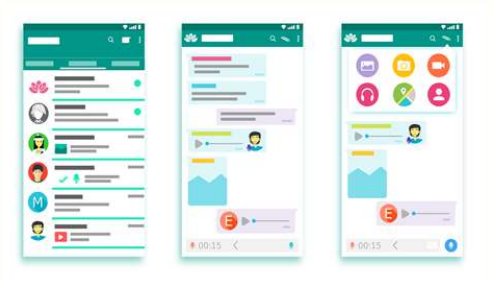
Focus group topic presentations

The following appendix contains the three presentations presented to the participants prior to the discussions. The presentations include problem descriptions, illustrative cases and suggested solutions with the intention to introduce the topics as well as inspire discussion.

All text and figures/illustrations is original material produced by the author within the frame of this master thesis unless otherwise indicated.

Användargränssnitt

Definition:
I det här sammanhanget till det grafiska användargränssnittet i smartphones, plattor och datorer. Länken mellan användaren och den tekniska enhet det gäller. Med andra ord det som syns på skärmen. Åtkomst till enheten i from av knappar och fysisk design inkluderas också i definitionen.



Problemformulering

För personer med kommunikativa svårigheter och i behov av AKK-teknik har en del problem med användargränssnitt lyfts fram i tidigare forskning. Det finns i nuläget många olika alternativa inställningar i modern kommunikationsteknik (smartphones och surfplattor) för att underlätta vid särskilda behov, så kallade tillgänglighetsfunktioner. Exempelvis kan texten göras större, rutnätet för appar kan göras större så att färre appar syns på varje panel/skärm, talsyntes, guidad åtkomst, kortkommandon, säg lösenord m.fl.

Det största problemet med användargränssnitt är kanske därför inte brist på alternativa inställningar utan snarare att det finns för många och det blir svårt att veta vilka som passar just för en själv.

Några exempel på vad som kan skapa svårigheter gällande användargränssnitt beskrivs här med citat från fiktiva personer.

Sonja

Jag har svårigheter med att komma ihåg saker, t.ex. inloggningsuppgifter som lösenord, användarnamn och koder. Därför blir det problem när jag vill skaffa en ny applikation, mobil eller dator eftersom det är så många inställningar som behöver göras innan jag kan använda den. Om designen skiljer sig från det jag är van vid blir det ännu svårare. Jag skulle vilja att det var enklare, så jag själv kan välja vad jag vill ha och inte behöva så mycket hjälp.

Per

Jag använder alltid talsyntes för att skriva och läsa meddelanden. Det är en stor hjälp för mig, men jag tycker att det är svårt ibland att höra. Jag skulle vilja höja volymen mer. Ibland förstår jag inte vad som sägs även om jag hör, uttalet är dåligt.

Birgitta

Jag tycker det är svårt när jag måste använda mig av flera olika enheter eller applikationer för att göra en sak. Det blir rörigt och jag tappar lätt bort mig. Jag har också lätt för att trycka fel och då blir det ännu svårare att hålla koll på vad det är jag ska göra. Då vill jag bara börja om från början men även det kan kännas svårt ibland.

Erik

Det är svårt för mig att förstå när saker händer utan en tydlig anledning. Ett typiskt exempel är notiser och pop-up fönster som dyker upp på skärmen utan att jag har gjort något. När det händer och jag inte förstår varför blir jag stressad och vågar inte fortsätta.

Användning av symboler och emojis

Målgruppen: personer med kommunikationssvårigheter i behov av AKK

Problemformulering

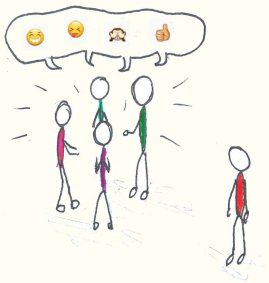
Användning av emojis har blivit en naturlig del av den samtida skriftliga kommunikationen. Det finns i nuläget uppskattningsvis 3000 olika emojis i Unicode Standard där de nyaste emojisarna släpptes i juni 2018 [1]. För personer i målgruppen har det uttryckts som ett problem att inte kunna använda de egna hjälpmedelssymbolerna tillsammans med emojis på ett smidigt sätt. I nuläget finns det ingen bra applikation som stödjer åtkomst till båda och.

Det har också uttryckts vara svårt att välja vilken emoji som ska användas när och att betydelsen av dem kan vara svår att förstå. Olika plattformar/operativsystem renderar symboler olika så det är inte säkert att det du skickar kommer se likadant ut hos mottagaren, vilket också kan bidra till svårare förståelse.

Användning av emojis känns dock relevant för målgruppen eftersom de är vanligt förekommande hos allmänheten och lätt tillgängliga.

1. https://emojipedia.org/faq/#how-many

Ida

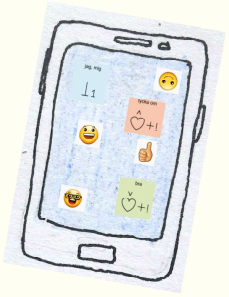


Jag är rädd för att använda emojis eftersom jag har svårt att förstå vad de betyder. Vill inte att det ska bli missförstånd. Mina vänner använder ofta emojis, jag vill också kunna göra det utan att vara orolig för att det ska bli fel.

Josef

Det finns så många olika att välja mellan, hur ska jag veta vilken som är bäst att använda och när? Oftast tar det så lång tid för mig att välja att jag bara blir frustrerad och tillslut inte väljer någon alls. Jag önskar att det fanns färre så det blir lättare att välja.

Anton



Jag använder mig av symboler för att kommunicera. Det fungerar bra men jag vill kunna använda mina symboler i min mobil eller surfplatta och att de ska vara lika lättillgängliga som emojis. Det vore också bra om jag kunde blanda mina symboler med emojis.

Lösningsförslag – app

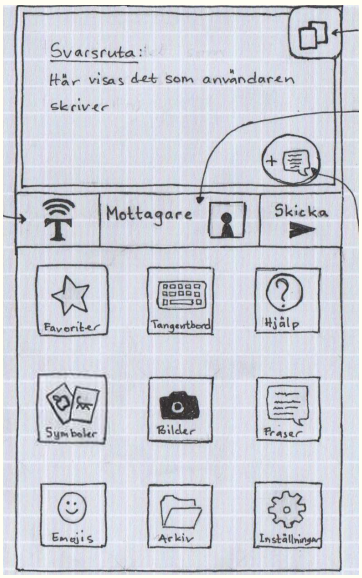
En idé är att ta fram en tangentbords-app där de symboler och bilder som användaren är van vid att använda finns i ett gemensamt bibliotek med vanliga emojis.

Tanken är att appen ska fungera som ett tillägg till det vanliga tangentbordet. Det ska gå att svara på alla typer av skriftliga meddelanden och skriva nya.

Hemskärm

Svarsruta: här visas det som användaren skriver.

Tryck för att få texten i rutan ovan uppläst.



Tryck här för att växla mellan Svarsrutan och mottaget meddelande.

Tryck för att komma till Kontakter och välja mottagare (nytt meddelande). Annars visas vem som ska svaras.

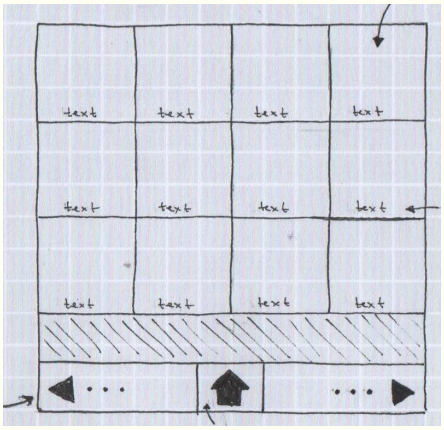
Tryck för att spara skrivet meddelande som färdig fras i ”Fraser”.

Hemskärm

- En större svarsruta att skriva meddelanden i – enklare att se
- Stöd för uppläst text och symboler för att illustrera funktioner
- Genväg till kontakter, mottagarens namn syns medan man skriver med möjlighet att lägga till bild
- Större avstånd mellan knapparna för att minska risken att trycka fel
- Svarsrutan och panelen under (läs upp text, mottagare, skicka) syns alltid

Favoriter

Symbolruta:
Tryck för att välja symbol
Håll in för alternativ:
- ta bort från ”Favoriter” ( )
- Läs upp förklaring ( )



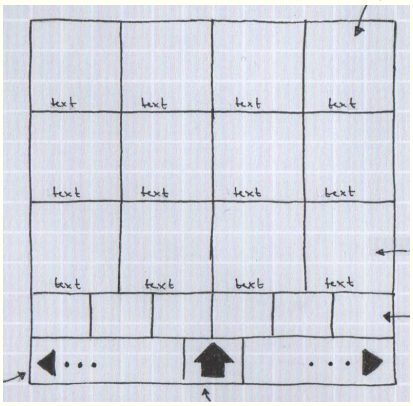
Symbol förklarad i text

Bläddra mellan flera paneler

Hemknapp – tryck för att komma tillbaka till hemskärmen

Symboler och emojis

Symbolruta:
Tryck för att välja symbol
Håll in för alternativ:
- lägg till som favorit (+)
- Läs upp förklaring ( )
- Arkivera (+)



Symbol förklarad i text

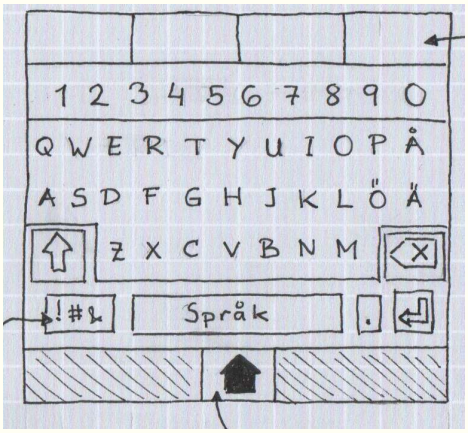
Kategorier

Bläddra mellan flera paneler

Hemknapp – tryck för att komma tillbaka till hemskärmen

Tangentbord

- Tangentbordet är baserat på Samsung (Android)
- Layouten är större och en hemknapp finns för att enkelt komma tillbaka till hemskärmen



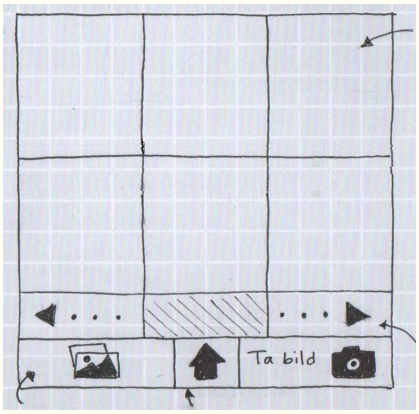
Ordprediktion – här visas förslag på ord

Tryck för att byta till specialsymboler

Hemknapp – tryck för att komma tillbaka till hemskärmen

Bilder

- Funktion att ta bilder eller välja från galleri
- Här visas bilder som lagts till i appens bibliotek. ”Galleri” syftar på enhetens standardgalleri



Bildruta:
Tryck för att välja
Håll in för alternativ:
- Ta bort bild (🗑)

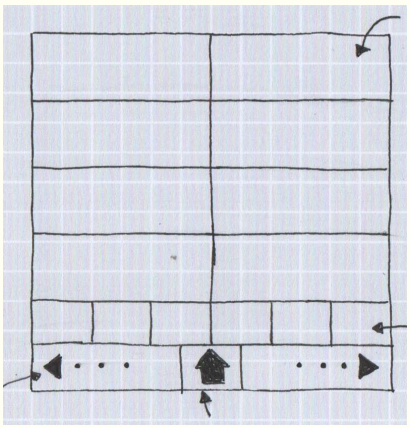
Bläddra bland flera paneler

Hämta bild från Galleri

Hemknapp – tryck för att komma tillbaka till Hemskärmen

Fraser

- Här kan användaren spara fraser som ofta används.
- Förslagsvis kan några standardfraser redan finnas här för att enklare komma igång.



Arkiv, Hjälp, Inställningar

- **Arkiv:** tanken är att de symboler/emojis som inte används kan arkiveras istället för att tas bort helt.
- **Hjälp:** Leder till hjälptexter om hur appen fungerar. Möjligen länk till demofilm. Kan också inkludera kontaktuppgifter till utgivare om det uppstår problem eller vid frågor.
- **Inställningar:** Några möjliga inställningar
  - Ändra storlek av layout
  - Anpassa färger
  - Ändra ordning av knappar på hemskärmen
  - Välj antal symboler/panel som ska visas

Videosamtal
Produktförslag från CallforAll

Målgruppen: personer med kommunikationssvårigheter i behov av AKK

Image from CallforAll project

Problemformulering

Förståelse av fjärrkommunikation kan underlättas med hjälp av videosamtal eftersom det är mer likt fysiska samtal. Det ger direkt återkoppling, tillåter ickeverbal kommunikation t.ex. teckenspråk, gester och ansiktsuttryck. Dessutom underlättar det för personer som har svårt för att läsa och skriva.

Dock finns i nuläget ingen lämplig teknik för *målgruppen* som har stöd för användning av symboler, talsyntes, video och text. Bland de alternativ som ges är låg kvalitet av ljudöverföring eller att utrustningen inte har de stöd som behövs begränsande faktorer. Resultatet blir att många av personerna i målgruppen inte kan använda tekniken för fjärrkommunikation trots att de kanske skulle vilja eller vara i behov av det.

Julia

Jag skriver med ett kommunikationsprogram med talsyntes för att komplettera mitt tal. När jag ringer till mina vänner använder jag Facetime. Det känns bättre än att ringa som vanligt eftersom jag kan komplettera användningen av mitt kommunikationsprogram med ansiktsuttryck, gester och tecken. Det som känns frustrerande är att det är svårt för den jag talar med att höra vad min talsyntes säger vilket tillslut blir irriterande för oss båda. Det blir ett ännu större problem om den jag pratar med också använder talsyntes.

Ellen

Jag tycker om videosamtal eftersom vi kan se varandra. Det känns mer som ett vanligt samtal då. Jag förstår vad andra säger till mig men själv måste jag ha hjälpmedel för att uttrycka mig. Jag använder ett kommunikationsprogram med symboler och talsyntes när jag talar och skriver men det fungerar inte tillsammans med de videosamtalstjänster jag har testat. Det hade varit bra med en tjänst som kan erbjuda videosamtal med talsyntes och symbolskrift så jag kan bli mer självständig i min kommunikation.

Lösningsförslag

Forskningsprojektet CallforAll jobbar med är att utveckla en redan befintlig kommunikationsplattform för att göra fjärrkommunikation möjlig för personer med komplexa kommunikationsbehov.

Mål: möjliggöra videosamtal i Windowsmiljö (på AKK-plattform), förenkla användarupplevelsen, textanvändare ska kunna ringa självständigt

Antaganden: textanvändare utan eller med del av tal, använder talsyntes i sin AKK-plattform, talsyntesen går att koppla direkt till produkten utan att behöva gå ut i rummet, plattformen är Windows-baserad, användarna nyttjar olika styrsätt/inmatningsenheter

En sammanfattande presentation av produkten ges nedan.

Viktiga funktioner

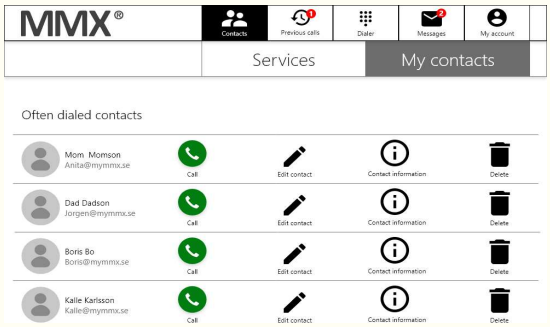
Till skillnad från andra videosamtalstjänster är det möjligt att:

- Skicka talsyntesen direkt utan att ljudet behöver gå ut i rummet först
- Skicka symboler med tillhörande text från eget AKK-program till mottagaren
- Tillåter självständig hantering och användande av alla funktioner samt stöd för alternativa styrsätt

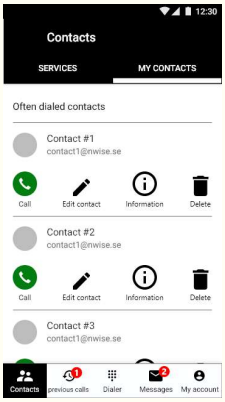
Kontakter

Kontaktbilder kan läggas till för att tydliggöra vilka det är.

Alternativen som kan göras för respektive kontakt är samlade i en lista bredvid kontakten.



Layout för Android surfplatta



Layout för Android mobil

Images the from CallforAll project

Ringa

Det går att ringa upp på olika sätt: via knappsatsen/tangentbordet, via kontakter eller tidigare samtal. Samtalet kan ske via text/video/tal

De inbyggda tangentborden för *123* och *ABC* ska innehålla endast de tecknen som kommer användas. I *123* är det alla siffror 0-9 samt @ och . (punkt). I *ABC* ska alla bokstäver A-Ö samt @ och . (punkt) finnas med.

Layout för Android mobil

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Tidigare samtal

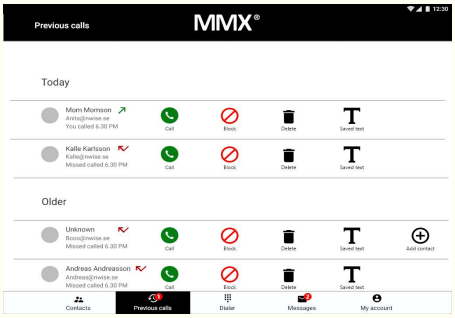
Funktioner:

Senast ringda läggs först i listan

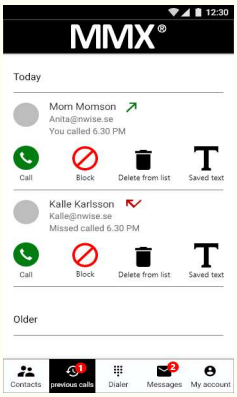
Kan ringa upp direkt

Blockera nummer eller ta bort från listan

Går att se konversationer (saved text)



Layout för Android surfplatta



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Meddelanden

Det går att både ta emot och lämna meddelanden på olika sätt (via text/video/tal).

Mottagna meddelanden är indelade i *Nya (osedda) meddelanden* och *Gamla (sedda) meddelanden*

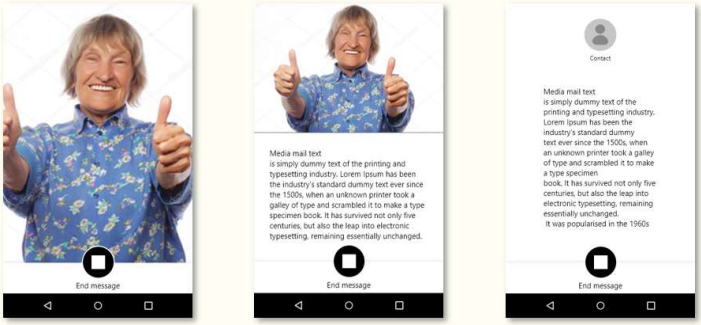
Knappen för att se meddelande ser olika ut beroende på vilken typ av meddelande det är.

Layout för Android surfplatta

Image from the CallforAll project

Meddelanden

Användaren tittar på ett mottaget meddelande. (Video, video + text, text)



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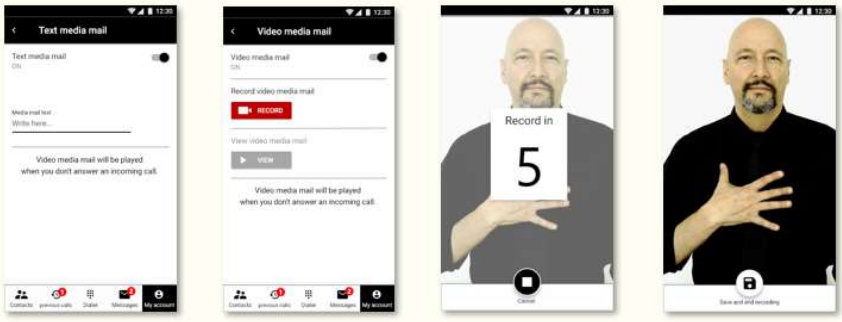
Automatsvar

Automatiska svarsmeddelanden för när användaren inte svarar kan spelas in.



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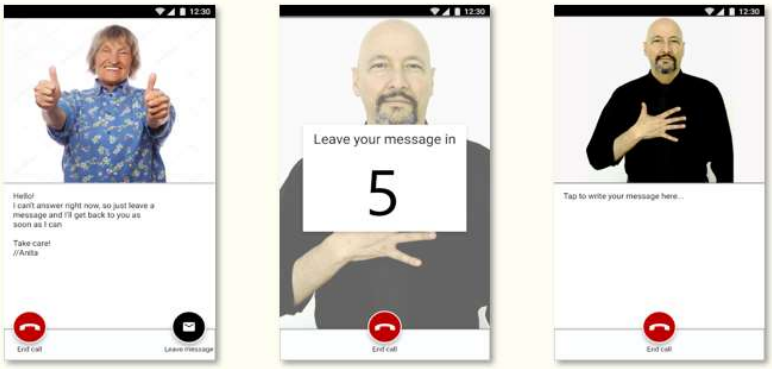
När mottagaren inte svarar

Meddelanden i både text och video kan även spelas in ifall mottagaren inte svarar.



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Inställningsmöjligheter

- Anpassa valmöjligheten på sortens samtal innan samtalet rings (ljud, mikrofon, video, text PÅ/AV)
- Ändra storlek av text
- Fördelning på skärmen, t.ex. välja var textfältet ska vara under ett samtal (till vänster, höger, över eller under videobilderna)
- Bestämma vilken typ notifikationer som användaren ska kunna få och på vilket sätt
- Välja färg på både textruta och text under samtal
- Endast ha inställningsalternativ som användaren själv förstår och kan/borde ändra