

Improving User Experience in Chat Tool by Implementing an Intuitive Search Feature

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MASTER THESIS



Improving User Experience in Chat Tool by Implementing an Intuitive Search Feature

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Abstract

In the current digital era different kinds of chat tools and communication platforms are used worldwide at many companies as a natural part of the work day. As the amount of chat conversations and messages increases, the degree of difficulty to find information sent previously rises. To tackle this difficulty, many of the leading communication platform providers have incorporated a search functionality to their chat tool.

This thesis was executed in collaboration with Telavox, a company providing a business communication platform. The goal was to help Telavox design a prototype of a possible search functionality incorporated into their chat tool. The chat tool is used both internally by the employees of the company and externally by their customers.

The aim in this project was to investigate how to create a user-friendly product which could satisfy the users' needs and to compare similar search experiences online to the chat tool search experience. To accomplish this, a user-centered design process was followed. To gather the necessary data needed to create prototypes a survey, focus group and literature study were conducted. The survey began the identification of the users needs and the focus group added to this with a competitive analysis through the heuristic evaluation principles. The literature study explored the current search functionality guidelines and previous findings on the user experience when interacting with search engine result pages.

The execution phase consisted of three prototyping iterations, one mid-fi and two hi-fi iterations. After each prototype was made, a number of end-users tested the prototype and then an evaluation was conducted to change and add requirements. The final prototype proved very promising, according to the evaluation of test results, and showed how great usability in a new feature can be accomplished through good adherence to the consistency of an already existing application as well as by following an iterative process where valuable lessons about the user needs can be learned along the way.

Keywords: User-Centered Design, User Experience, Telavox, Search in Chat, Search Experience

Sammanfattning

I den digitala era vi lever i idag har olika sorters chattverktyg och kommunikationsplattformar kommit att användas som en naturlig del av arbetsdagen på många företag. I takt med att antalet konversationer och meddelanden som skickats på dessa plattformar ökar blir det även svårare att hitta information bland det som har skickats vid en tidigare tidpunkt. För att lösa detta problem har många av de ledande kommunikationsplattformarna idag stöd för en sökfunktion i sina verktyg.

Detta examensarbete utfördes i samarbete med Telavox, ett företag som tillhandahåller en kommunikationsplattform för andra företag. Målet med detta arbete var att hjälpa Telavox utveckla en prototyp för att undersöka hur sökfunktionalitet skulle kunna designas och integreras i deras nuvarande chattverktyg. Chattverktyget används idag internt av Telavox egna anställda såväl som externt av företagets kunder.

Syftet med detta projekt var att skapa en användarvänlig produkt för att tillgodose alla användarnas behov samt att jämföra liknande sökupplevelser på nätet med sökupplevelsen i ett chattverktyg. För att åstadkomma detta tillämpades en användarcentrerad designprocess. Insamlingen av nödvändiga data för att kunna skapa prototyper skedde med hjälp av en enkät, en fokusgrupp samt en litteraturstudie. Enkäten inledde definieringen av användarbehov och fokusgruppen adderade värdefulla insikter om motsvarande konkurrenters verktyg genom att applicera principer från en heuristisk utvärdering. Litteraturstudien utforskade nuvarande riktlinjer för utformning av sökfunktionalitet på nätet och vad forskningen har kommit fram till angående användares interaktion med sökmotorers resultatsidor.

Utförandet av prototyper delades upp i tre på varandra följande iterationer varav en mid-fi iteration och två hi-fi iterationer. Efter det att varje prototyp var färdigställd testades den på ett antal slutanvändare, varpå en utvärdering av produkten kunde utföras och designkraven uppdateras. Den slutgiltiga prototypen visade sig vara mycket lovande, enligt utvärderingen av testresultat, och även hur god användbarhet i en ny funktion kan åstadkommas genom att hålla hög konsekvens med den redan existerande applikationen samt genom att följa en iterativ process där viktiga lärdomar om användarna kan dras under projektets gång.

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Chapter 1

Introduction

This chapter introduces the background to, and purpose of this master thesis. Apart from the purpose, this chapter discusses the research questions, scope, limitations and Telavox, the company that has enabled us to carry out this thesis. It will also present work that is related to the subject of our thesis and the contribution it will have to future work.

1.1 Background

As the world we all live in becomes increasingly digital with further technical advances and the Covid-19 pandemic forcing people to work from home, the need for online communication has never been bigger[20]. There are numerous different ways to communicate, from video-meetings and voice-calls to the popular chat tools, which will be the focus of this paper. Many of the big corporations such as Facebook¹ and Slack² offer some kind of communication solution that includes a chat tool and are widely used by billions of people worldwide. This thesis will be looking into Telavox's³ platform aimed at businesses looking for a unified communication solution.

Most chat tools today provide options for both direct messaging (one-on-one) and group chats which can lead to each user having a great deal of different conversations to keep track of. When the number of chat groups increases, the complexity does as well and it gets harder to find previously sent messages. A majority of platforms have support for some kind of search functionality to resolve this issue with some services offering advanced, customizable search experiences and others doing little more than matching free-text search queries. To help users of the Telavox chat in their daily work and improve their experience using the app, our goal is to implement an intuitive search feature based on previous research studying

¹<https://www.facebook.com/>

²<https://slack.com/>

³<https://telavox.com/>

search experience on the web, user experience analyses of comparable tools and investigation of user needs.

Throughout the design and implementation process the methods of user-centered design[37] and an iterative process will be used and combined to reach the desired result. This will lead to an early involvement of end users and going through several iterations in order to identify problems and areas of improvement early in the process.

1.2 Purpose & Research Questions

Chat is a core functionality for many of Telavox's users but information is easily lost between thousands of messages. We want to create a prototype for a search functionality, where users can search through messages using a number of different parameters and display matches in an intuitive way that is both easy to interpret and includes the relevant information that they were looking for. Our research questions are the following:

- Which search features are of value to the chat tool's users?
- How does the current literature regarding the user experience searching on the web translate to searching in Telavox's chat tool?
- How can the chat tool search experience be designed to be both intuitive and easy for the user to interpret?

1.3 Scope & Limitations

One limitation that was imposed on this thesis was that we could only recruit Telavox employees for the user studies. Enlisting users outside the organization would have broadened the user profile and perhaps included users not as intimately familiar with the Telavox application as its employees. The reason for not including said user group in our studies was for Telavox to withhold good relations with customers. Should a sought-after feature such as this one be hinted at, customers might expect it to roll out into production in the near future and be disappointed if it was not. Consequently, test participants and survey respondents were not selected randomly from the pool of end users which may introduce selection bias.

Furthermore, the users studied in this project possess greater knowledge about the application and its workings than any other end user due to their employee-employer relationship with Telavox. Therefore, they may have preconceived notions of how the search functionality ought to be designed, leading to a possibly closed mindset when presented with variant solutions.

Designing to accommodate for people with special needs using *universal design* [37] would be preferable in the long run but not considered in this process. Neither will the prototypes be adjusted to fit different screen sizes and media such as smartphones. Should the search functionality go live in the future, interfaces for these formats will of course be implemented as well but for the purpose of this thesis, responsive design was not deemed relevant.

In order to be able to focus on the research questions and to limit the complexity of this master thesis it was decided to not create a search function for the entire chat tool,

which would allow the users to search across multiple chat rooms through the same interface. Instead the goal was to create a prototype for searching in a specific chat conversation or chat room. On the same note it was determined to limit the scope to three iterations with the object to stay within the given time limit of 20 weeks.

1.4 Related Work & Contribution

Whether it be querying a search engine, finding keywords within an article or looking up a specific item in a web shop, search functionality is one often used feature on the web. Many studies have explored the various aspects of chat bots, but few articles have explored user-to-user chat tools specifically. Qin et al. [38] have written about a tool for conversation search in chats, by aggregating messages sent within the same limited time period but other than that, the literature leaves much to be explored. However, extensive work has been done covering the different aspects of search engine result pages (SERPs) [7, 2, 18, 34]. As the end user's goal in both cases is often to retrieve information, previous findings about how to structure SERPs in terms of number of results, result summaries and more, is still of relevance to this thesis.

1.4.1 User Experience with SERPs

A common sight on the web are the *ten blue links*, the standard interface shown to users upon querying a search engine. The ensuing scanning of search result links and enclosed summaries for information is what ultimately leads the user to select which result they deem most relevant for fulfilling their goal. According to Cutrell and Guan [7], the length of search result summaries can impact the success rate when trying to find a specific piece of information, regardless of its source. Meanwhile, the opposite was true for navigational tasks, i.e. when the goal was to find a specific website or page, test subjects were less likely to succeed in their task when summary lengths increased.

Conversely, another study investigating summary lengths instead found that although users much preferred longer summaries over shorter ones, neither accuracy in finding the correct information nor number of relevant matches increased when users were shown longer summaries [2]. These results indicate that information retrieval as well as user experience might be improved by displaying richer search result snippets. How well these findings translate to the messaging search experience has not yet been explored.

Not only is the result summary of importance to user experience, Kelly and Azzopardi [18] also discovered that the number of search results shown to the user at a time will impact how they perceived the search experience. When interacting with result pages showing 3, 6 or 10 matches, users reported the highest overall frustration, physical and mental load in the 10-results-per-page group in comparison to viewing 3 or 6 results. Although the differences were not statistically significant, these results are similar to the findings of Oulasvirta et al. [34] who described the paradox of choice in terms of search results. The paradox of choice states that facing an abundance of possible choices, people are more easily overwhelmed and less satisfied with the decision they end up making even though a greater selection seemingly allows them to optimize their choice [45]. Oulasvirta et al. [34] found that subjects exposed

to 6 search result were more satisfied and confident than subjects who were shown 24 results which indicates that the paradox holds true even for SERPs.

In light of these results, deciding how much of a message to show in a chat search as well as how many results to display per page could affect how the end users respond to the interface.

1.4.2 The Global Goals

The Sustainable Development Goals are a group of 17 global goals agreed upon by leaders of United Nations member countries ⁴. The 17 goals describe which environmental, economic and social problems the countries need to solve by 2030 in order to make the world a better place for all. The work done in this thesis aims to contribute towards goal number 8: "Decent Work and Economic Growth. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". More specifically, our work will hopefully aid businesses in creating a more productive and user-friendly work environment, to spur further financial growth and innovation.

1.5 Telavox

Telavox is a company focused on providing a business communication platform through Unified Communications as a Service (UCaaS), enabling their customers to manage all means of communication; such as telephony, messaging, contact center and meetings, through one application. By streamlining the communication process for organizations, Telavox aims to eliminate the need to use multiple different systems and the hassle of scaling up or down. The company was founded in 2002 and has since then acquired upwards of 15,000 customers ⁵.

In 2020 the company went through a rebranding journey where the name of their product Flow was changed to the Telavox application. This was done to fulfil their commitment to simplicity and hassle-free communication [23].

1.5.1 The Telavox application

The messaging functionality in the Telavox web application is one of the ways Telavox users can communicate within their organization. The Telavox app was launched in 2014 and provides, among other features, options for direct messaging (one-on-one) which can be seen in fig 1.1, group chats, creating posts (chat message that other users can like and comment on) and participating in public rooms. Public rooms are best described as topic-based group chats where members can discuss interests or share advice and information with one another.

A highly sought-after functionality that is missing today is to search for messages in a chat or public room. The only search functionality that currently exists is the possibility to perform the command CTRL+F and search among the 25 messages that are loaded at a time. Implementing a more intuitive search feature to chats would help users filter through

⁴<https://sdgs.un.org/goals>

⁵<https://telavox.com/about-telavox/>

information and retrieve old messages that would otherwise require scrolling through all subsequent conversations to find.

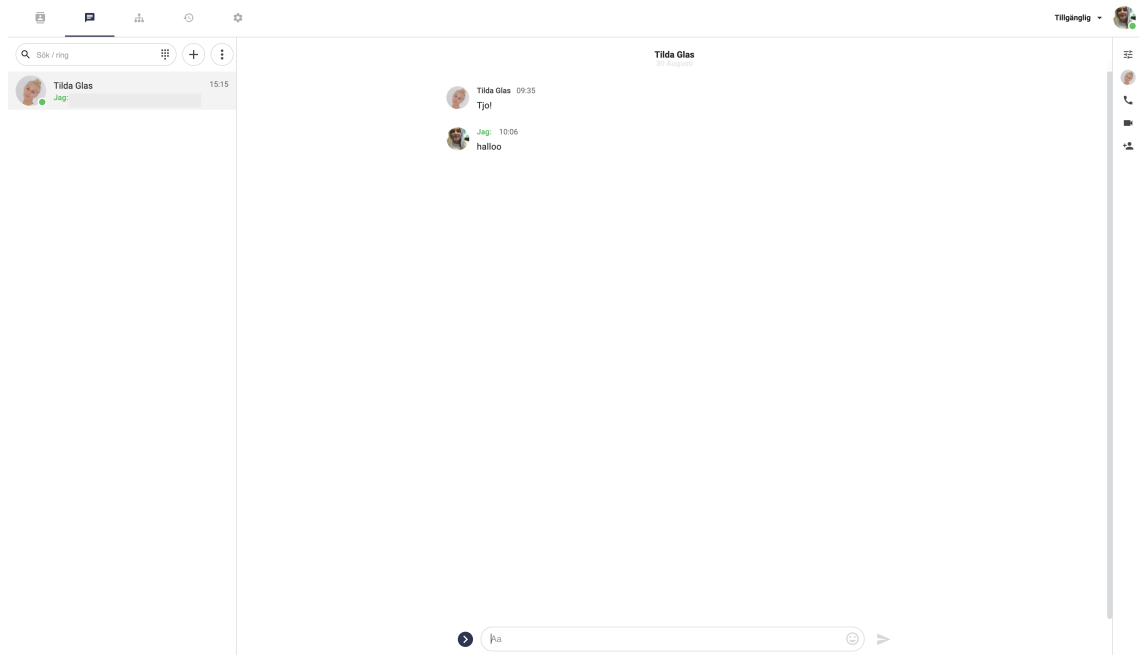


Figure 1.1: A one-on-one chat in the Telavox app.

Chapter 2

Theoretical background

In this chapter the concept of user-centered design and its design process is introduced. Then the procedures of the design process is further presented beginning with the data gathering through surveys, focus groups and competitive analysis. Next prototyping with low and high fidelity prototypes is discussed and lastly the evaluation phase including heuristic evaluation and the system usability scale.

2.1 User-Centered design

As early as 1985, Lewis and Gould [15] established three principles for designing with a focus on usability:

- Early focus on users and tasks
Before starting to work on any implementation it is important to identify who the users are. This can be done by finding out their characteristics regarding cognitive ability, their behaviors and their attitude. It can also be valuable to study these characteristics in the environment where the product will be used.
- Empirical measurement
In the beginning and throughout the design process, prototypes of the product should be made so that intended users can be observed and evaluated while using these prototypes. An introduction to the prototypes that are to be used in this study are presented in section 2.4.
- Iterative design
In order to find problems early in the development, an iterative design process needs to be deployed, the concept of which is explained in the next section.

These principles are now regarded as the basis of the user-centered design approach [37]. An approach where the user's activities and goals are the main driving forces for development and where all aspects of the user and the user's environment are considered.

2.1.1 The design process

With the aim to keep the user-centered approach, developers can be helped by having a tested design process to follow. According to Preece, Rogers and Sharp[37] there are four fundamental activities in user-centered design process:

1. Establish Requirements
2. Design alternatives
3. Develop prototypes
4. Evaluation

When it comes to performing the different activities listed above, a project founded by the European commission has published a document called User Study Guidelines(USG) [9] where a number of different techniques and approaches are presented. In order to establish the requirements and design alternatives, information needs to be gathered which can be done in various ways according to USG [9] and Preece, Rogers and Sharp [37]. Some examples are surveys, interviews, focus groups, studying documentation and exploration of similar products. It is wise to choose more than one method for the purpose of receiving a large amount of data to work with.

The third activity, development of prototypes, is great for visualizing ideas and exploring different alternatives together with the intended user. The complexity of a prototype can vary from a sketch on paper to a complex software implementation [37].

Lastly the developed prototype or product needs to be tested and evaluated to see if it reaches the requirements. If it doesn't fill the requirements or if new requirements have been found, the design process starts over at the first activity.

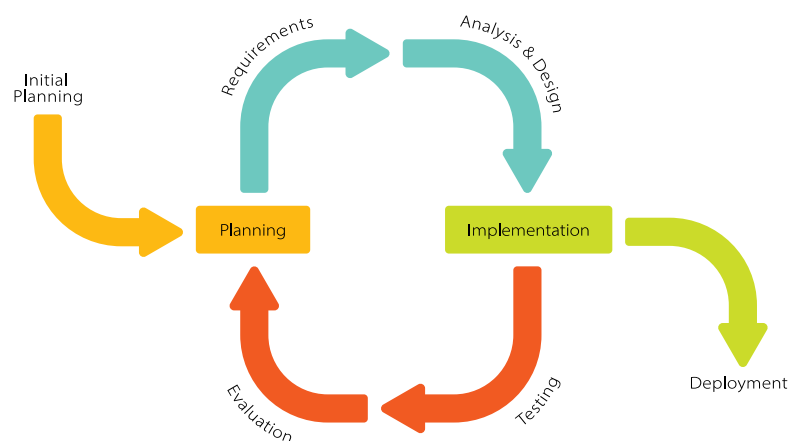


Figure 2.1: The iterative design process [52].

As presented in the previous section an iterative design process should be used to find and correct problems at an early stage. To have an iterative design process means to perform several iterations of the fundamental activities as seen in figure 2.1. After each sprint in the implementation, the product is tested and evaluated. When the evaluation is done it's time to go back to the planning phase in order to revise the requirements and redo the design.

After each iteration you get a product which fulfills an increasing number of requirements and has a more complete, efficient and satisfying user experience [37].

For this thesis, we aim to begin with an investigation and planning phase to analyse competitors, gather input from end users and study the already existing literature regarding search functionality on the web. After the initial phase, we will do a shorter iteration with a mid-fi prototype followed by two longer iterations developing, testing and evaluating hi-fi prototypes. The phases and progression of our design process is shown in figure 7.1.

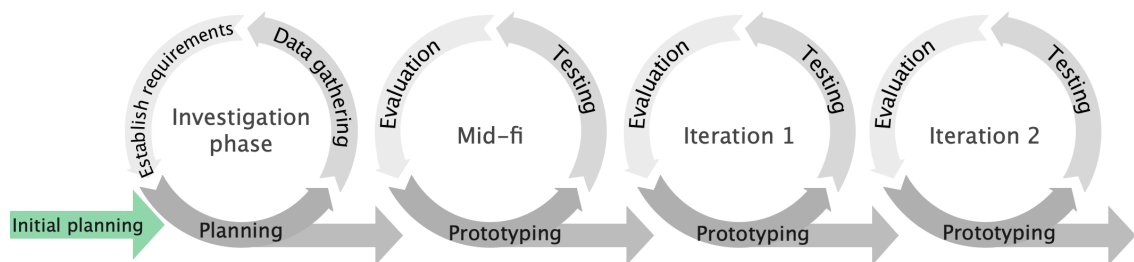


Figure 2.2: The four different phases of our design process.

2.1.2 User Experience

User experience is easy to interpret as the usability of a system or the user interface design, but these are only parts of the user experience. To try to understand what experts and professionals mean when they talk about user experience we start by looking at the definition provided by the International Standard Organisation (ISO). As stated in ISO 9241-210, user experience is the "user's perceptions and responses that result from the use and/or anticipated use of a system, product or service"[1] where the user's perception and responses includes a range of aspects. Preece, Rogers and Sharp [37] mention some of these aspects including usability, functionality, aesthetics, look and feel which together create an overall impression of the user experience.

So as to achieve a better understanding and a way to speak about the user experience of technology, UX pioneer Peter Morville has created the honeycomb of user experience, an optimized version of the honeycomb can be seen in figure 2.3. The honeycomb consists of seven facets which in turn can be divided into three categories: how users use, feel and think about the product [17].

The category regarding **use** includes the *accessibility*, *usability* and *findability* of the design. Morville [35] elaborates this by explaining that the design needs to be accessible for all people

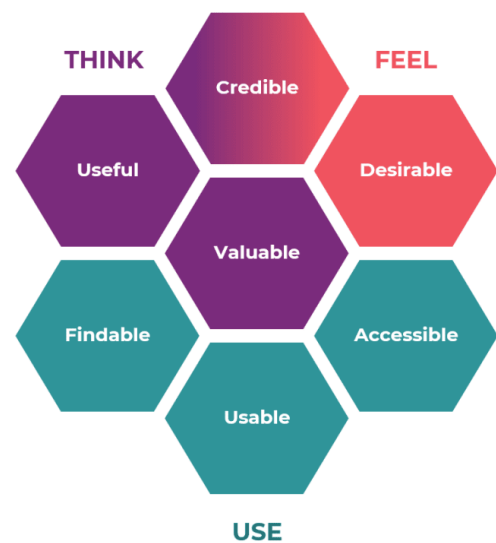


Figure 2.3: Katerina Karagianni's optimized version of Peter Morville's user experience honeycomb [17].

regardless of disabilities. Furthermore, it also needs to have great usability and be easy to navigate.

The two other categories, **think** and **feel** are more overlapping and could be harder to grasp. It is often quite obvious to understand that the product needs high usability but the developer also needs to ask: is the product *useful*? and does the product create *value*? Both these facets interrelate with how users think about the product. However, when it comes to the *credibility* it concerns both the mind and the emotion, does it feel credible? Lastly the *desirability* of a product relates only to the visual feel of the product which in short means how attractive it is.

All of the facets need to be evaluated and obtain a positive result for the system to provide a good user experience. A product could be very desirable but if it is hard to access or find, the users will not have a great experience of the product which could lead to frustration and ultimately, to the user abandoning the product.

2.2 Data gathering

Going back to the activities in the design process, especially the two first: establish requirements and design alternatives. Like mentioned before, data needs to be collected to be able to formulate the requirements and succeedingly, design alternatives. In this paper three methods of information gathering will be discussed and used. These are surveys, focus groups and research of similar products and guidelines.

2.2.1 Survey

Surveys or questionnaires are a reasonably cheap way to reach a big crowd and collect a large amount of data to start researching the given subject [9]. It may seem easy to design a survey but a lot of effort and time should be put into getting the formulations, order and number of questions correct to be able to draw substantiated conclusions. It is preferred to use an online survey because it leads to shorter response time, better anonymity and a faster way to collect and analyze the response data [9].

Regarding the structure of a survey, you often start with questions about basic demographic information, for example gender and age, as well as experience with a specific system. After that, questions that are more specific to the subject or the product being developed are asked. It is important to think about the ordering of the questions, make clear instructions and to make the survey no longer than it has to be [37].

Questionnaires can be both qualitative and quantitative depending on whether the questions are open-ended or close-ended [10]. A close-ended question could be a yes or no question, multiple choice questions or involve some kind of scale. One example is Likert scale questions where the respondents rate a statement from one extreme to the other and the responses are of a quantitative nature (e.g. 1-5). An example of an open-ended question is "Why did you choose your education?" which will produce a range of answers that are more qualitative.

2.2.2 Focus group

To complement a survey a focus group can be used to highlight problematic areas and get new perspectives on the subject [37]. The concept of a focus group can be described as having a group interview where one of the researchers acts as moderator and the participants discuss questions with each other. To get the best results, the participants should be intended or representative users of the product. Before the interview, all participants also need to receive and sign informed consent forms [9]. A good idea is to involve a big range of participants and divide them into different groups to discover all kinds of problems.

Focus groups could be used during the entire design process but often yields the best results in the beginning, when ideas are generated and possible angles of approach are discussed. A focus group can be compared with an open or semi-structured interview[9]. Like the name perhaps reveals, an open interview is an interview where the questions are open-ended (see section 2.2.1) and different topics rather than specific questions are discussed. A semi-structured interview includes both open- and close-ended questions, where neutral open-ended follow-up questions are often preferred [37].

2.2.3 Competitive analysis

When developing a product that already exists in some form on the market it can be wise to research similar products and pre-existing guidelines [37] as there is no need to reinvent the wheel. A so-called competitive analysis helps the developer determine strengths and weaknesses in the competitors' products and sets important benchmarks. There could be features that need a lot of man-hours to develop but aren't very appreciated or used by the customers and therefore can be down-prioritized in the process. Another advantage with competitive analysis is that the competitor has probably done a series of user tests already, which can be taken into account.

The competitive analysis is usually done by an expert or by having a group of users testing the competitors product and then giving their feedback [44]. To get a diverse but not overwhelming analysis, Schuber at Norman Nielsen Group [44] recommends to choose two to four competitors to analyse. Schuber also points out that the competitors need to be chosen wisely, pick the ones that are the most important competitors, have the best user experience or the most similar functionality.

2.3 Data analysis

After data has been gathered, for example with the methods described above, it is time to analyze the acquired data. This can be done both quantitatively and qualitatively depending on the type of data. Answers to close-ended questions can be analyzed in a quantitative manner and can be put together in charts and percentages[37].

Answers to open-ended questions are harder to analyze in a quantitative way with numbers and charts because the answers are often of different length and nuance. To interpret the answer to an open-ended question, more qualitative methods should be used where researchers manually or with some kind of sophisticated tool identify different themes [10].

2.3.1 Quantitative

For quantitative analysis a spreadsheet software is a tool of great importance because it generates methods for easy manipulation and graphic representation. By putting the data into correct columns in the spreadsheet software it is easy to create the graphic representation of choice. Bar charts, pie charts and scatter plots are popular ways of presenting quantitative data [37].

When doing a quantitative analysis different methods of statistics are used, the most basic being mean, median and mode. Mean summarizes all the data and divides the total sum by the number of data points, the median is the value in the middle when the data is sorted numerically and mode is the most frequently occurring value. Which value should be used depends on the data set. If extreme values are present in the data, calculating the mean is not preferred as it can give an unjust representation. In the case of extreme values it is better to calculate the mode or the median [11].

2.3.2 Qualitative

As previously stated, qualitative analysis needs to be used when the answers aren't close-ended. Preece, Rogers and Sharp [37] present three ways to conduct an easy qualitative analysis: identifying reoccurring themes and patterns, categorizing data and analyzing critical incidents.

A diverse set of techniques can be used to **identify reoccurring themes**, Rosala [39] writes about three methods: using software, journaling and creating some sort of affinity diagram where all three methods have their strengths and weaknesses. Using software creates a thorough analysis but is both time and money consuming while journaling is cheaper but can't be done as a collaborative task. The technique involving affinity diagrams is both cheap and open for collaboration but depending on the amount of data it can be hard to do it exhaustive.

Regardless which method is used the following steps should be adhered to when performing a thematic analysis [39]. After the data is collected, everyone in the team should read all data and then begin to **categorize** all the data entries to catch their essence. When all entries are categorized designers can begin to divide them into themes and iterate the process by revising the codes and themes until the whole team is satisfied.

2.4 Prototyping

The third step of the iterative design process is to develop prototypes. To allow for different interface ideas to be explored, tested and evaluated, system designers use a technique called prototyping. This tried-and-tested tool helps designers communicate their vision to end users in an interactive way as the prototypes emulate different parts of the thought-out interface, be it looks, functionality or navigation. Moreover, prototypes can be examined by system developers to determine the feasibility of a certain design, preventing (expensive) technical pit-falls later in the process [37].

2.4.1 Lo-Fi/Mid-Fi Prototyping

To support the iterative design process, the initial prototypes are often simplistically executed using analog materials such as paper drawings rather than highly functional digital prototypes [37]. Such prototypes are called low fidelity (lo-fi) and are never meant to be incorporated into the finished design. However, they are inexpensive as well as easy to create and modify and can thus be used to research possible design options without investing unnecessary time or resources [37].

Oftentimes, middle fidelity prototypes (mid-fi) incorporating digital elements are developed as a complement or instead of the lo-fi prototype. On the mid-fi level, prototypes are still rudimentary but slightly more advanced than their lo-fi counterparts [13]. An example could be a PowerPoint-based prototype which more closely resembles the actual interface but is still limited in terms of interactivity. When comparing paper-based and computer-based prototypes, Sefelin et al. found that although comments and remarks from test subjects didn't differ between the two, subjects preferred the computer-based prototypes [46].

2.4.2 Hi-Fi Prototyping

Once designers have a rough idea of the final interface, lo-fi prototypes are refined into high fidelity (hi-fi) prototypes. With hi-fi prototypes, users can experience the full functionality of the eventual product, its navigational features and how the system responds to user actions meaning that considerably more time is spent during development [37]. Hi-fi prototypes are often constructed in more advanced UX design tools such as Adobe XD, which offer the possibility to create a lifelike, clickable dummy but implements no actual functionality. As explained by Rudd et al. [41], hi-fi prototypes as described above can later be used as blueprint for programmers since they specify the system in its entirety.

Alternatively, developers can start working iteratively on a real implementation of the product instead of creating dummies. This technique is known as evolutionary prototyping. According to Davis [8], this requires the functional criteria to be well-known and established from the beginning of the project. By developing the basis for the system first, designers can then discover additional user needs to be covered in later iterations.

2.5 Usability Evaluation

Previous sections have outlined the initial phases of developing a user interface, from research to finished prototype. Circling back to the main objective of this process, there is yet one question to be answered: will end users be satisfied with the final product or not? Through a series of different usability tests measuring for example learning rate, ease of use, satisfaction and more, system developers get a better understanding of how well they have met their intended users' needs [37], hopefully answering that very question. Given the nature of the iterative design process, once user feedback has been collected the interface can be altered accordingly before the next iteration begins [37].

2.5.1 Usability Testing

Usability testing, or user testing, is often used as an umbrella term for any methods evaluating user interfaces. In this article, user testing will refer to the process of recruiting real or representative end users of a system which is a technique widely employed in the industry to conduct everything from complex, large-scale evaluations to less formal, smaller tests [40]. Rubin and Chisnell [40] explain how the main objective of user testing is to identify and mitigate poor usability in products by observing groups of representative users performing tasks through interactions with the interface.

2.5.2 Number of Usability Test Participants

Intuitively, one would think that testing a user interface thoroughly requires a big group of test subjects to exhaust all possible usability issues. Realistically, recruiting a large number of test participants can become extremely costly. Ranging from \$50 per subject in an unmoderated study (low estimate) to \$336 per subject in a moderated study (high estimate) [24], conducting extensive studies quickly becomes a considerable expense for small to medium companies. Whilst the body of work in this area is ample, the usability testing community is still divided as to how many test subjects constitute the perfect size group [32, 48, 14].

A study by Nielsen and Landauer [32] found that there is little to no use of recruiting more than 15 usability testers when evaluating a medium-large system, as the function of number of testers to problems found can be modeled as a Poisson process. Assuming that evaluations are done independently of one another, subjects are bound to find many of the same issues (the obvious ones), as well as a few more. Thus, the probability of the next participant uncovering a novel issue not yet brought to attention by any of the preceding testers becomes negligible as the number of testers grows. Nielsen [28] argues that using five participants per test and instead testing in several iterations is sufficient and even preferable when planning usability studies.

However, Nielsen's five-participants theory has been challenged by other colleagues in the field of usability testing for software development. When Faulkner [14] conducted a study where test subjects were randomly drafted into groups of five from a pool of 60 people in total, some groups were highly successful finding virtually all usability issues while other groups only managed to find around 55%. Failing to detect almost half of the problems is obviously a less-than-optimal outcome. Furthermore, Faulkner [14] showed how increasing test participant groups to 10 or 20 people simultaneously raised the lowest percentage of problem discoveries to 80% and 95% respectively. Faulkner's conclusions are supported by Spool et al. [49] who claim that the complexity of many websites today cannot be compared to that of systems back in the 1990's, when Nielsen's original studies were done.

2.5.3 Heuristic Evaluation

A naive way of performing a usability evaluation without representative end users would perhaps be to simply sit a usability expert down, let them go through the interface and make an educated judgement of the system's usability. Heuristic evaluation is in fact, very roughly, doing the above. However, to be able to reproduce the heuristic evaluations of a product in

an accurate manner there are frameworks of usability principles for evaluators to adhere to. Nielsen and Molich [25] has proposed such a set of nine principles for heuristic evaluations:

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help and documentation

The heuristic evaluation is carried out in two steps: an analysis phase where each evaluator goes through the interface alone to avoid bias, followed by a collaborative phase where evaluators' individual opinions are aggregated into one verdict [27]. It is recommended that evaluators spend between 1–2 hours and go through the interface at least twice, all the while assessing how well the design elements and navigational structure of the interface follow the heuristic guidelines [27].

Although Nielsen and Molich [33] present heuristic evaluations as a consequence of lack of resources to do empirical user testing, other studies both by Nielsen [26] and Jeffries et al. [16] have found heuristic evaluation to hold its own as a usability evaluation method by often uncovering more problems than user testing. Heuristic evaluations also tend to discover poorly designed elements more quickly, making them less time-consuming than user testing [22]. Even so, the same studies showed that user testing, although discovering fewer problems, accounted for more severe usability issues being brought to light [16, 22]. Thus, both methods could be seen as valuable, complementary and worthwhile input when evaluating product design.

2.5.4 System Usability Scale (SUS)

The System Usability Scale or SUS is a means of collecting quantitative, subjective user data about the general usability of a system through a collection of ten Likert scale questions (scored from 1-5) aimed at provoking "extreme" responses, either in agreement or disagreement [4]. The results can be expressed as a single score, ranging from 0–100. By using statements that don't elicit neutral or ambiguous responses, researchers can get a good understanding of the user's attitude towards the system. Moreover, the questionnaire is designed so that positive and negative statements appear in an alternate fashion, prompting the respondent to pay attention to which statement they are currently answering [4].

Since its inception, SUS has been widely used in the industry and proved itself a sturdy tool for usability evaluation. Bangor et al. [3] ascribe much of its success to four key attributes:

1. SUS is independent of the product's underlying technology, meaning many different systems can be tested
2. It's non-proprietary and therefore inexpensive to use
3. Both moderators and test subjects can grasp the SUS concept easily and quickly
4. By producing a single score, SUS facilitates communication across professions, so that different stakeholders can all understand and assess the results

While the fourth statement above is reasonable enough, the final SUS score remains non-descript as long as there is no grading system to relate it to. To address this, Bangor et al. [3] added an adjective rating to the usability scale, with the options being *Best imaginable*, *Excellent*, *Good*, *OK*, *Poor*, *Awful* and *Worst imaginable*. They found that *Good* to *Best imaginable* SUS scores ranged from approximately 70–100 while *OK* landed around 50 and finally, *Poor* to *Worst imaginable* systems scored between 50–25. Thus, Bangor et al.s [3] suggest that systems with scores below 70 are subject for further work and supervision while scores above 90 can be seen as signs of highly user-friendly systems.

Choosing a representative group of test subjects is also key to accurately measure the usability of a system when adopting the SUS methodology. Oftentimes, users that are new to a system tend to classify issues they encounter as more severe than experienced users do [19]. This suggests that mainly using novices could result in a SUS score that is more biased towards measuring learnability than usability [50]. However, other factors such as test subjects' age, educational level and type of participants were not statistically significant to SUS scores, according to a literature review by Vlachogianni and Tselios [51].

Chapter 3

Technical background

This chapter introduces similar search functionalities in other applications. The applications discussed are Facebook Messenger, Slack and Discord.

3.1 Similar Search Functionalities in Other Applications

As previously stated, the search feature central to this thesis is not a new one to messaging applications. Comparable applications with search-in-chat features include Facebook Messenger (commonly referred to as Messenger), Slack and Discord.

3.1.1 Messenger

Messenger was originally developed by Facebook and integrated with the Facebook application but has since 2011 been a standalone app where users can exchange messages, videos, images, create group chats and more¹. Currently, Messenger provides the user with two different options for searching in one-on-one conversations and group chats: the user can either search between different conversations and users (outlined with red to the left in figure 3.1) or search within one chat/group chat (outlined with blue to the right in figure 3.1), of which the latter is the intended purpose of the new Telavox application search as well.

¹https://en.wikipedia.org/wiki/Facebook_Messenger



Figure 3.1: The two different options for searching in Messenger

Figure 3.2 illustrates the search-within-a-chat in Messenger. Here, the user can lookup messages containing the keyword entered in the search field and matches are highlighted in the conversation pane below. No overview of matches is presented, except for the total number of results shown in the search field. Thus, the user has to traverse all matches chronologically from most recent to farthest back, in order to find the correct message or messages. Messenger offers no possibility to jump to a specific moment in time or to filter messages by sender when searching in group chats.

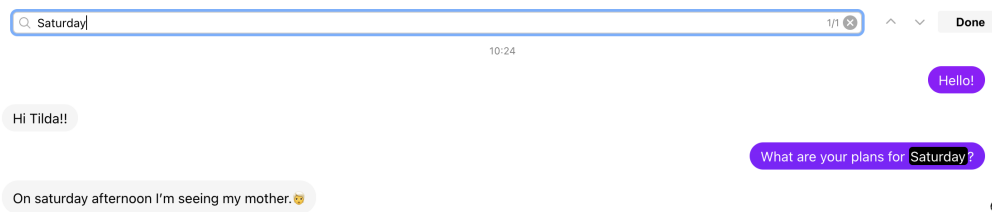


Figure 3.2: Searching for the keyword 'Saturday' within a one-on-one conversation in Messenger

3.1.2 Slack

Founded in 2013, Slack is a messaging service mainly aimed at formal organizations and businesses. Slack offers features such as direct messaging and *channels* which are either private or open for all members of the organization². According to a 2016 tweet by co-founder and CEO of Slack, Stewart Butterfield, the application's name originated as an acronym of the phrase "Searchable Log of All Conversation and Knowledge", implying that search functionality is integral to the very idea of Slack³.

To retrieve information in Slack, users can search within different channels, one-on-one conversations or the entire organization. Upon interacting with the search field, the user is presented with the available search parameters; *Messages*, *People*, *Channels* and *Files* followed by their most recent searches (see figure 3.3). To further fine-tune results, users can include modifiers such as quotation marks to search for exact phrases or temporal keywords like "during:" or "after:", to obtain results from within a given time period⁴.

Slack displays search results in a list view, as can be seen in figure 3.4, using tabs to group matches by the parameters *Messages*, *People*, *Channels* and *Files*. Clicking on a result leads the user to be redirected to that message, person, channel or file. Additionally, one can apply one or more of the available filters to exclude unwanted information. Selecting filters through the filter buttons will yield the same result as adding the corresponding modifiers.

²<https://slack.com/intl/en-se/help/articles/115004071768-What-is-Slack->

³<https://twitter.com/stewart/status/780906639301812225>

⁴<https://slack.com/intl/en-se/help/articles/202528808-Search-in-Slack>

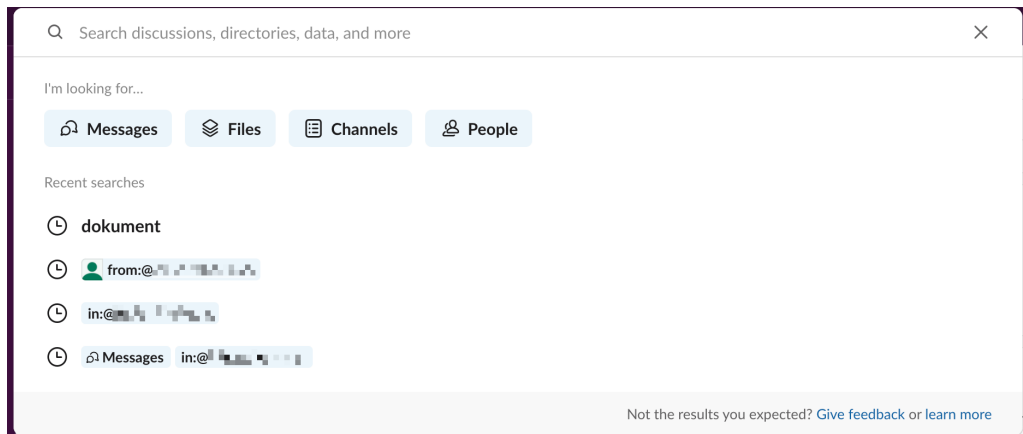


Figure 3.3: The user interface shown after clicking on the search field in Slack.

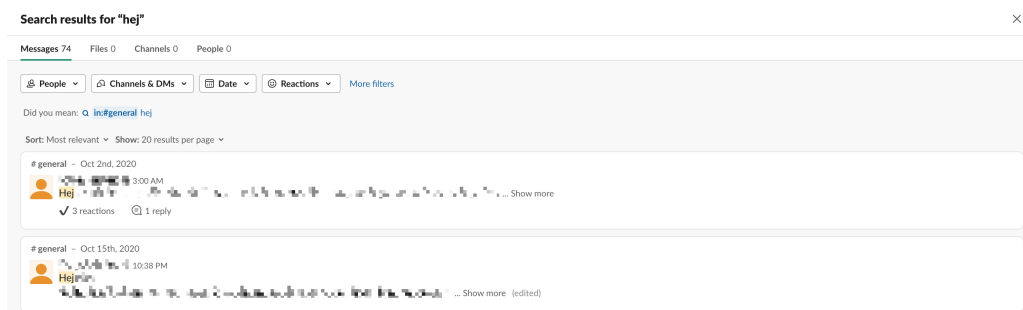


Figure 3.4: The user interface shown after entering the search query "Hej" in Slack.

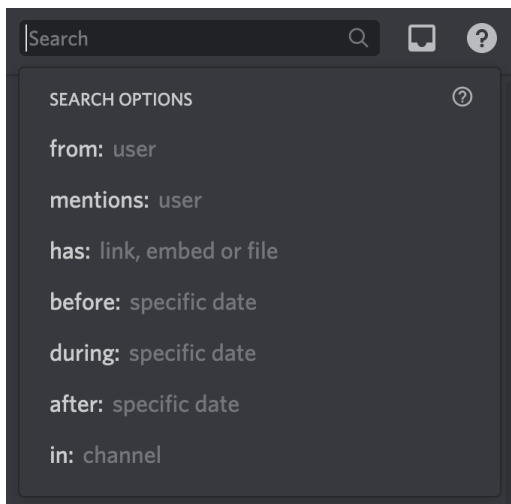
3.1.3 Discord

As a consequence of the growing online gaming community, Discord was launched in 2015 to enable easy communication between players whilst partaking in online games, through messaging, video and voice services ⁵. In the years since, and largely due to the COVID-19 pandemic, Discord has broadened its intended target group from "gamers" to the general population by decreasing gaming references within the app and continuing to enhance the voice and video chat features [6].

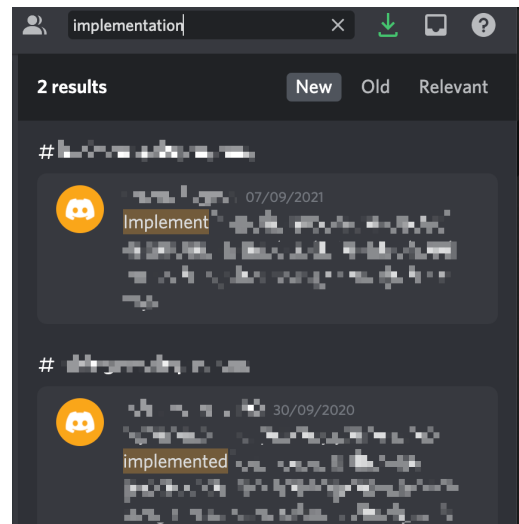
Much like Slack, Discord allows the user to communicate through open or closed groups (called servers) wherein channels for various topics can be created. Moreover, there is also support for direct messaging independent of servers or groups. Searching in Discord can either be done by server, looking up matches in the corresponding server's text channels or by one-on-one conversations. The dropdown in figure 3.5a lists the parameters with which searches can be performed. To summarize, results are fetched either by a match on free-text search, user who sent the message or is included in the message body, contents of the message, time period for the message or channel the message was sent in.

Upon entering a search query in Discord, results are displayed highlighted in the same dropdown, as can be seen in figure 3.5b. Derivatives of the query are also fetched, e.g. in figure

⁵<https://discord.com/company>



(a) The user interface shown after clicking on the search field in Discord.



(b) The search matches shown after entering the search query implementation

Figure 3.5: Discord's search-in-chat functionality

3.5b the words "implement" as well as "implemented" are interpreted as alternative results for "implementation". Once a user interacts with one of the matches, the corresponding channel the message was sent in will be shown to the left of the results pane, with the clicked on message highlighted.

Chapter 4

Investigation Phase

This chapter describes the first phase of the design process, the investigation phase, depicted in figure 4.1. During this phase the intended users are identified and the data needed to establish requirements for the prototypes and the product are gathered. The data is collected through a survey with real end users and researching the existing guidelines for search functionality. Lastly a competitive analysis is conducted using a focus group discussing the search functionality of competitors Facebook, Slack and Discord.

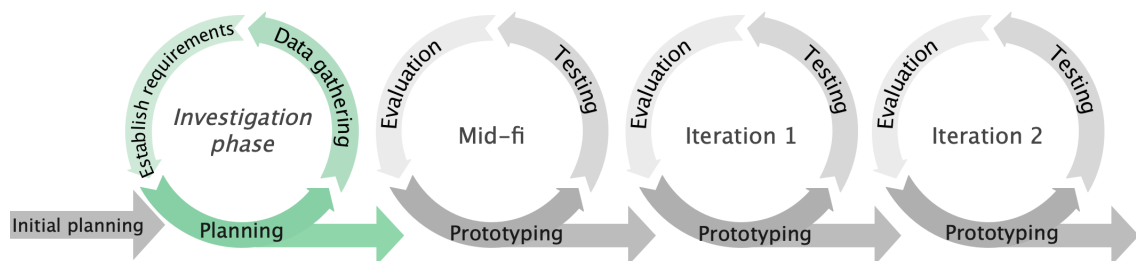


Figure 4.1: The current phase, investigation, in the design process is highlighted.

4.1 The users

According to the first principle of user-centered design it is of key importance to identify the intended user before starting any sort of implementation. This is also given by the name, user-centered, and it is hard to have the user in the center if the user isn't known. The job of finding the intended user started when we formulated the problem description; we want to improve the user experience in the Telavox chat tool. The chat tool is used both internally

by employees of Telavox and externally by their customers. The search functionality we are implementing will only be used and tested internally at this stage.

As a result of this, the intended users of our implementation are the employees of Telavox that are currently using the chat tool. Most employees are using the chat on a regular basis during their work day and rely on it to communicate with coworkers, especially these days when a lot of people are working from home. Regarding the user's knowledge and skills they have a comparatively high technical competence, most have some sort of academic education and a big portion of the users are developers themselves. Some of the users have been involved in producing parts of the chat and have worked with, for example, the user interface, software or testing.

Another important aspect of the users is that the majority have great experience of other chat tools and their search functionality which can entail both negative and positive consequences. If we can take advantage of these experiences we could find out early in the process what is worth focusing on and what is not. But it could on the other hand lead to the users having very high expectations and a preconceived idea of the product.

4.2 Survey

To gather more detailed information about the users and their opinions regarding search functionality in general, we sent out an online survey created with Google Forms (see Appendix A). Out of the company's 267 employees in Sweden (as of September 2021), we got a total of 100 responses.

The survey started off with two demographic questions asking the respondents about their age and gender. We chose to use an age interval of 10 years to not get too specific and risk to spoil the anonymity. On the question about age 97 respondents answered while 3 respondents didn't and on the question about gender all the respondents answered, the results can be seen in Figure 4.2.



(a) The survey respondents' age

(b) The survey respondents' gender

Figure 4.2: Pie charts showing the responses to the demographic questions.

To the question about gender almost a quarter of the survey participants answered female which correlates well to the gender division of the whole company. We could also see that a big majority of the participants(85.6%) were between 20 and 40 years of age.

In order to learn more about the respondents' knowledge of the app, they were then asked in which way or ways (if any) they had been involved in its development and for how long they have been using the chat functionality in the Telavox application. The majority of respondents, 57% had not been involved in the development at all. Among the employees that had been involved, 22% had worked on developing and/or testing the software and the remaining 21% had been part of other steps in the process such as formulating requirements and communicating with other stakeholders.

Most respondents had been using the app for 3 years or more, as shown in figure 4.3. Only 12% were relatively new to the app, having used it for less than a year. Thus, we can conclude that the participants in this survey are generally knowledgeable of the application and its workings.

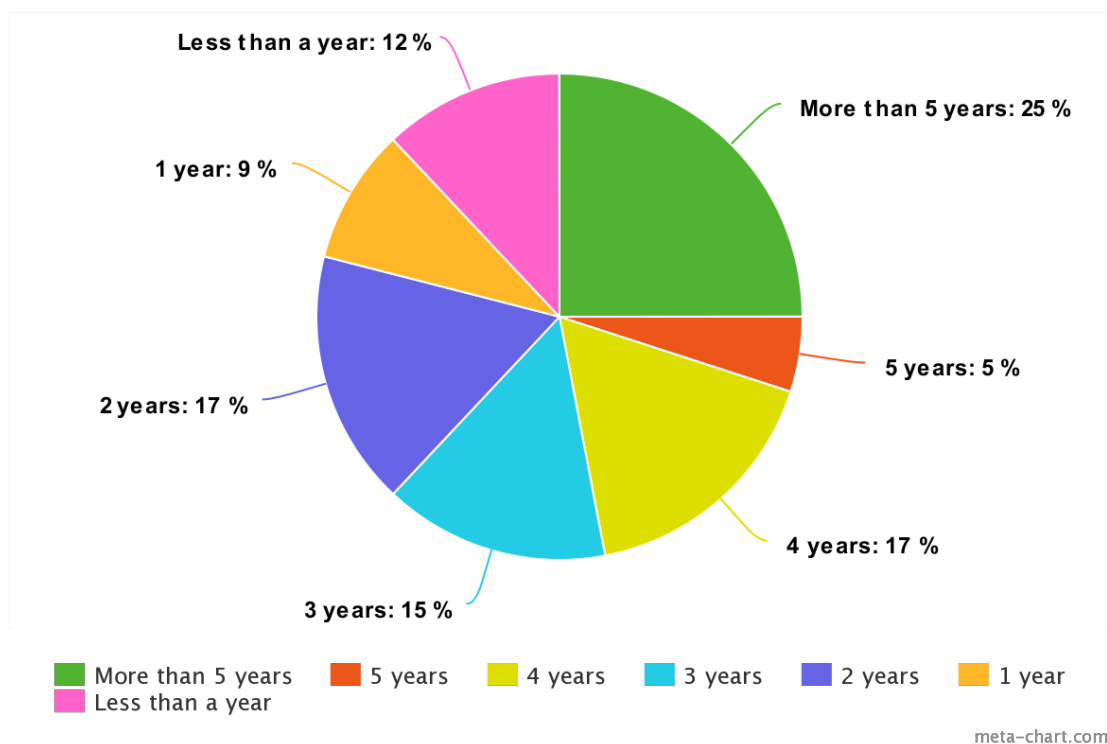
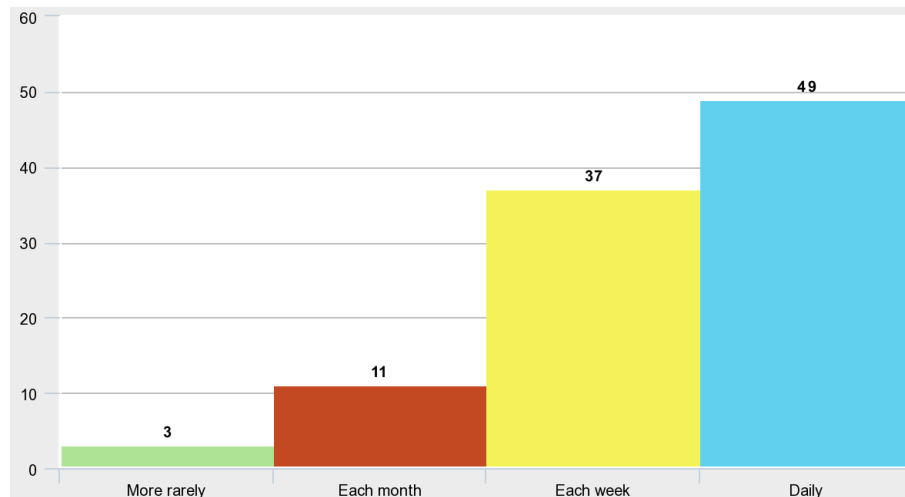
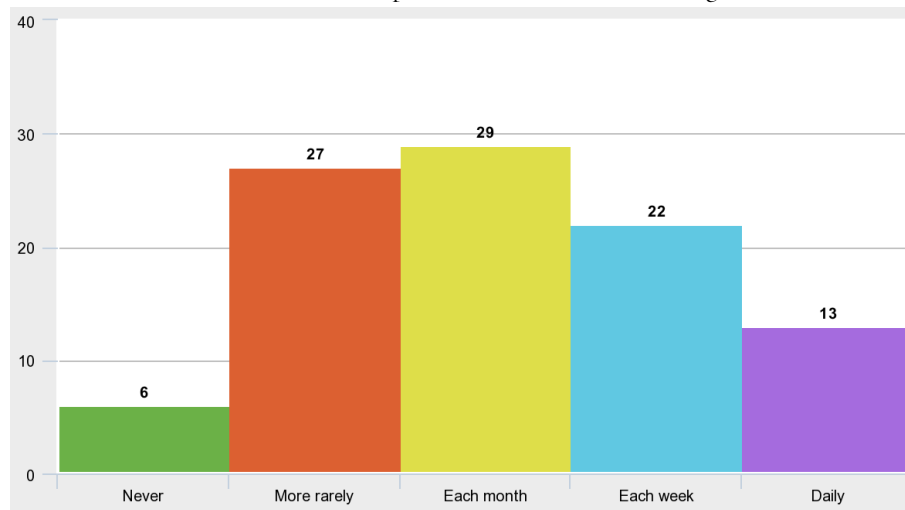


Figure 4.3: How long the survey respondents had been using the app

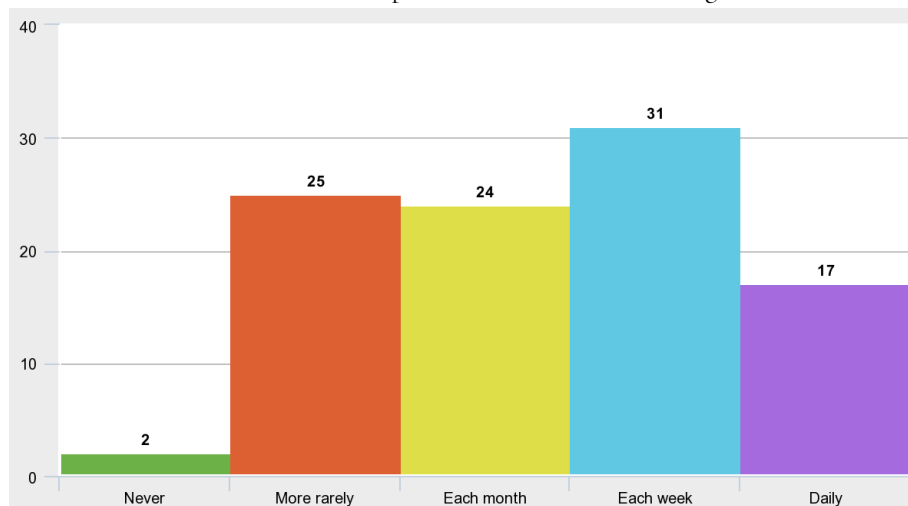
The survey then moved further with more specific questions about search functionality in general and the possible search functionality in the Telavox chat in particular. The first question asked how often, if ever, they would want to search in the chat if the option was currently available. Of the responses a large majority answered that they would use it often. More specifically, 47% claimed they would use it daily and 37% multiple times every week. Of the remaining 16%, 6% answered they would use it once a week, 9% several times each month and 1% some times each year. Nobody answered that they never would use the search functionality.



(a) How often the respondents would search using Text



(b) How often the respondents would search using Time



(c) How often the respondents would search using Person

Figure 4.4: Histograms over how often the participants would search using the different parameters

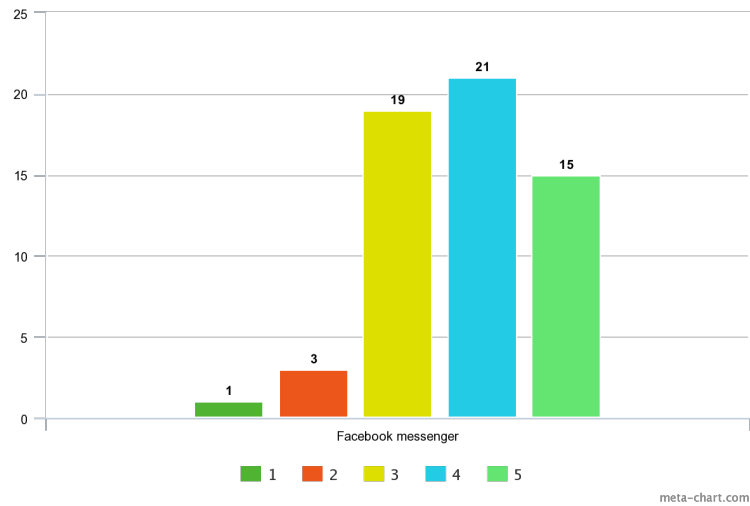
To start exploring research question one "*Which search features are of value to the chat tool's users?*" we used a multiple-choice grid with the question "If a search function existed today, how often would you have searched on the following parameters?". We gave three options to rate: Text in message, Time (Jump to specific time in chat) and Person (Get all messages a certain user has sent). The options were rated by choosing the alternative that was best suited ranging from **never** to **daily**. Figure 4.4 shows the results and we can see from the figure that searching for text in a message was rated as the parameter that would be used most frequently, 49% answered that they would use it daily and nobody answered that they never would use it. Between the parameters time and person it was more of an even race but 94% versus 98% answered that they would search for these parameters to some extent.

To get a more thorough analysis of the result the methods in quantitative analysis mean, median and mode were used. For figure 4.4a the most common option (mode) was "daily", the median was "each week" and if we graded the options from one to five with five being *daily* and one being *never* we get the mean 4.32. Continuing by doing the same calculations for the other two figures, for figure 4.4b both the mode and the median was "each month" and the mean was 3.0. Lastly for the figure 4.4c the mode was "each week", the median was "each month" and the mean was 3.33. From these numbers we could determine that the option the users considered the most useful was the option to search by text in the message, followed by the option to search on messages written by a specific person. The option to search for a specific time in the chat was the least popular but more than half of the participants answered that they would use it once a month or more often.

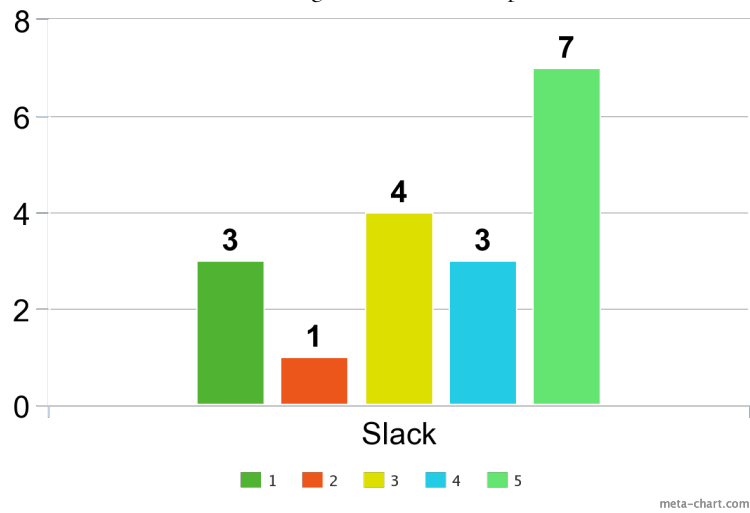
4.2.1 Assessment of Similar Applications

Search functionality is a well-known concept present in many other chat tools but not yet in the Telavox chat. Leveraging the fact that user data can be gathered from already existing applications, the second part of the survey consisted of a series of questions regarding the respondents' attitudes toward the search functionalities in Facebook Messenger (Messenger), Slack and Discord.

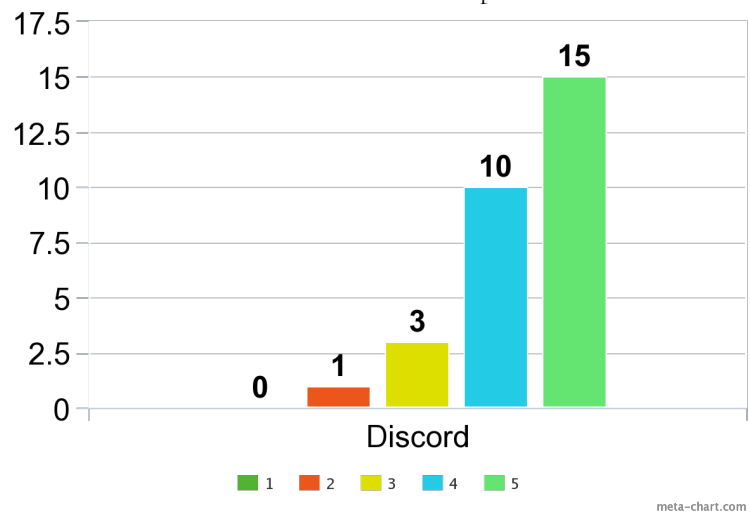
First the participants answered if they had used the specified search function or not. The data was then gathered through Likert scale questions where participants, if they had used the search feature in the above apps' chats, could rate how well that app fulfilled their search needs from one (Not at all) to five (Very well).



(a) How well Messenger fulfills the respondents' needs



(b) How well Slack fulfills the respondents' needs



(c) How well Discord fulfills the respondents' needs

Figure 4.5: Participants' opinions on the search features in Facebook Messenger, Slack and Discord.

Messenger's search feature was the most commonly used among our respondents, where 55% answered that they had used it. Regarding how well Messenger fulfilled its users' needs it received a mean score of 3.78 on the Likert scale and a mode value of 4, see figure 4.5a. Slack on the other hand (figure 4.5b, had been used by fewer respondents, 12%, and received a lower mean rating of 3.56 but a higher mode value of 5. Finally, the tool with the highest mean rating of 3.84 was Discord's search feature, which also had a mode value of 5, see figure 4.5c, where 29.6% of the participants had used Discord's search function.

After rating how well the different search features satisfy the users' needs we gave the respondents a chance to elaborate on their thoughts about the competitors' search functionalities in an open-ended free text answer. Messenger had the search functionality used by most of our respondents and was also the functionality which got the most nuanced answers. The qualitative analysis method of dividing the answers into categories was then used and two categories were identified: **good features** and **improvement possibilities**. Regarding good features the following list was put together:

- The search results show a good amount of information: sender, timestamp and context.
- Works OK given the amount of data it needs to search through.
- Simple to use.
- Possible to search far back in time/ chat history.
- Pleasant looking.

A couple of the participants highlighted the simplicity of the search function and the design when showing the search results. Concerning the improvement possibilities several people responded that the function is slow and has low findability, we composed this list of improvements:

- Troubles with loading all history.
- Slow.
- Too hard to find because it is hidden in a menu.
- Bad feedback when no results are found.
- No info on how far back it searches.
- Lacks intuitiveness when there's a lot of search results.
- Wants to be able to search for attached files.

As can be read from the lists there exists some opposing views when it comes to the intuitiveness of the search results and the loading time. This could be because some users are more forgiving when it comes to loading time and search relevancy than others. It could also be because the users have very contrasting amount of chat data saved which affects the search time and relevancy.

The search functions of Slack and Discord had, as mentioned previously, not been used by as many participants as Facebook Messenger which resulted in fewer free text answers and less information to analyse. The only things mentioned about Slack was that it has a good search functionality which searches in both channels and chats but that it is desired to be able to search for attached files. As for Discord a handful of users thought that this is the optimal search function and that it presents the search result in an intuitive way. Some users pointed out that the function was on the verge of being too complex and losing some intuitiveness.

4.2.2 Wanted Features and Additional Thoughts

On the last page of the survey, participants were asked whether they had any additional thoughts or wanted features concerning a search functionality feature in the Telavox application. There were almost 40 individual answers to these questions and while a third of them were well wishes and prompts to finish the development fast the other answers gave us a lot of good hints and directions. We decided to do an affinity diagram where we categorized the

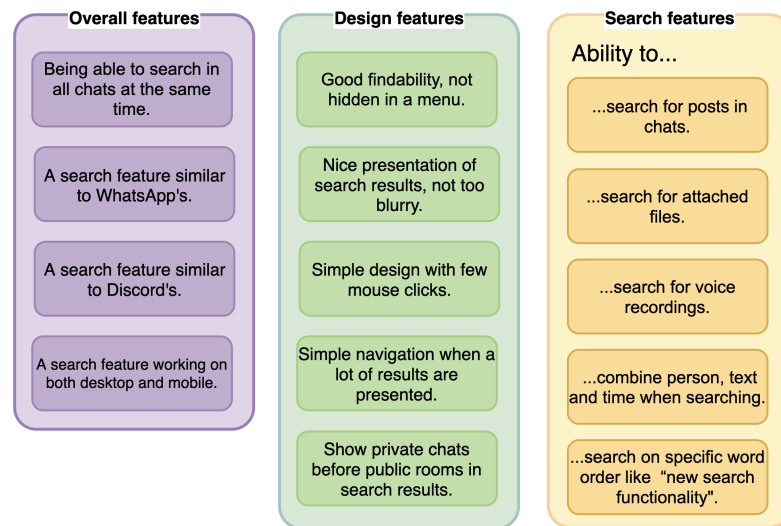


Figure 4.6: Affinity diagram showing the wanted features and thoughts concerning a possible search functionality.

answers and found three different themes/patterns. These were overall features, design features and search features. The affinity diagram is shown in figure 4.6 and contains 14 different entries that reoccurred in the answers. The three first items in the overall features column were answered by more than one respondent. Some of them simply said that they wanted the search functionality of WhatsApp or Discord without elaborating any further and many wanted the ability to search over all chat rooms and not just in a specific chat. One person pointed out that the functionality should work both on the desktop and the mobile application. Although these are all good suggestions and we can draw much inspiration from both WhatsApp and Discord, it may be a little out of scope depending on how the implementation phase goes along.

The wanted design features focused on simplicity, findability and the presentation of search results. It was pointed out once more that it is not desired to have the search function hidden in a menu like on Facebook Messengers mobile app. The wish for simplicity in both the navigation with few mouse clicks and when presenting the search results was expressed. One suggestion regarding the presentation of search results was to show private chats before public rooms which is connected with the ability to search in all chats at the same time and is a secondary feature at this time.

The last theme in the affinity diagram (figure 4.6) was the wanted search features where we got a lot of qualified suggestions. Survey participants suggested the ability to search on a specific word order and only get results with that exact word order, search for attached files, search for voice recordings and search for posts in chats. To search for attached files and

voice recordings could be too advanced for this thesis, especially voice recordings depending on whether the user means to search for the file name or the contents of the voice recording. Lastly, many respondents suggested some sort of search functionality where two or more parameters such as text, person and time worked in combination.

4.3 Focus group

A focus group discussion was conducted with five participants, all participants were engineering students and the gender division was one female and four males. Before starting the focus group all participants signed an informed consent form we created for the user study which can be seen as a whole in Appendix B. The focus group session began with a few open-ended questions aimed to explore the participants' thoughts and opinions on searching in a chat. After that the discussion proceeded with a competitive analysis. The competitive analysis was done in order to draw conclusions from already developed products and to learn from their pros and cons.

The focus group started off with the question **What characterizes a good search function?**. The group agreed that they wanted clear feedback and short loading time and that they would rather have a search function which gives good feedback, perhaps with a spinner, and is a little bit slower than the other way around. One person pointed out that the Facebook Messenger mobile app lacks both clear feedback and a short loading time which is quite unsatisfying.

The discussion then continued with the questions **How would you want the search results to be shown?** and the follow-up question **How much of the message should be shown in the search result?**. Everyone was of the opinion that the most recent search result should be showed first or at the top of a list with search results. Two of the participants wanted the search functionality to work like a filter where the chat component was removed to only show the found search results. The others did not agree with this, they instead wanted the search results to be shown next to the chat to be able to see the context in the chat. When it comes to showing context in form of the rest of the message in the search result one person thought that if the message was very long they didn't want to see the whole message in the search result. Another person didn't mind if the search results show the whole message even if it is long and a third person wanted to see both the message above and below as context.

The last questions before the competitive analysis was as follows **Which parameters would you want to search with?**. The group discussed that often when they use a search function in a chat they don't know the exact phrase they are searching for. To maximize their success rate they would like to be able to search on text, person, time, file and image. Some of the participants said that they could find it useful to search for a whole phrase while others never thought they would search in this way. The group came to the conclusion that it could be good to be able to search for two words combined but that only one person in the group has done this before.

In addition to these questions the participants estimated that they use a search function in a chat approximately one time every fourth month and that they are more likely to scroll in the chat to find a certain message.

Table 4.1: How well Messenger’s and Discord’s search functionalities follow Nielsen’s heuristic guidelines according to the focus group participants

Heuristics	Messenger	Discord
1. Visibility of system status	×	✓
2. Match between system and real world	✓*	✓
3. User control and freedom	✓*	✓*
4. Consistency and standards	✓	✓*
5. Error prevention	×	✓*
6. Recognition rather than recall	✓	✓
7. Flexibility and efficiency of use	×	✓
8. Aesthetic and minimalistic design	✓	✓*
9. Help users recognize, diagnose and recover from errors	×	✓*
10. Help and documentation	✓*	✓

4.3.1 Competitive Analysis

The participants were then asked to take their time to review Nielsen’s 10 heuristic guidelines [26] alone and then to discuss whether the search functionalities in Discord and Messenger follow these or not. All participants had access to a computer where they could access both of the Discord and Messenger apps, thus they could try out different scenarios to determine the app’s adherence to a certain usability heuristic. The results can be seen in table 4.1. The ✓ indicates that the corresponding usability heuristic was applicable to the application in question, ✓* indicates adherence but with reservations and lastly, × indicates failure to adhere to that heuristic.

The pros and cons of each app are discussed in the sections below but one user need that was not fulfilled in either one was alternative search query suggestions when the user has misspelled a word. This was commented on by focus group members during both discussions and many conveyed that this was a feature they would very much like to have.

Facebook Messenger

In a 2015 study comparing the usability of seven social networking sites, Messenger was the lowest rated among survey respondents in terms of search options when compared to the other six (Skype, Facebook, WhatsApp, Instagram, Twitter and Viber) [21]. The usability and functionality features of Messenger were overall the lowest rated in the study. These results support our findings with the focus group. When group members rated Discord and Messenger’s search features according to the usability heuristics, Messenger received more critique and fulfilled fewer heuristics than Discord.

Participants reported that Messenger was fairly easy to use as the app doesn’t provide much in terms of functionality and therefore is minimalistic and behaves as can be expected. However, when a search query yields a large number of results, finding the intended message becomes cumbersome as users have to go through all previous matches one by one. Moreover, the focus group all agreed that there was little to no feedback helping the users prevent or

diagnose errors, for example when no search matches are found. Neither were users informed of which search options were available in the app or the system status when clicking through results.

Discord

The focus group members were more positively inclined towards Discord's search functionality. As can be seen in table 4.1, Discord fulfilled all 10 usability heuristics, to some extent. Appreciated features in this app were the dropdown displaying search results, participants liked the overview of results as well as the ability to be redirected to a chosen message in the left pane whilst retaining search matches in the dropdown to the right. In addition, Discord's range of available search options matched the focus group users' needs, many had expressed frustration over not being able to search for specific people or dates in the Messenger app. One participant noted that when filtering search matches to fit within a time interval, the user can choose dates from a calendar instead of entering them manually. Considering the number of different date formats one could choose from, this prevents users from entering one that doesn't match the system specifications.

Nevertheless, there were still complaints about some aspects of the Discord search functionality. By offering plenty of options both in terms of result categories (matched people, messages, channels and more) and in terms of how to filter results, the participants were concerned that it might confuse some user groups. Although the participants in this study were highly proficient with computers in general and had been using Discord before, this can not be said for all other target groups. Furthermore, participants felt that some of the information and options shown in the search feature were redundant and had a negative impact on the app's aesthetics.

4.4 Search Functionality Guidelines

Russel-Rose and Tate [42] explain the standard model that users follow when retrieving information online as a process divided into four consecutive steps:

1. Problem identification
2. Formulating which information is sought
3. Formulating the search query
4. Evaluation of search matches

4.4.1 Displaying Results

This previous mentioned sequence of events is repeated until the desired information is found or the user simply gives up. Bridging the gap between the first executed search and successfully retrieving the intended data is therefore a key part of designing the search experience. Users are known to close in on their goal by following the *information scent*, words and phrases that are recognized as helpful for the task at hand, according to Pirolli and Card [36]. With

this in mind, web designers can guide the user by including subtle cues such as *hit highlighting* where search results corresponding to the user's query are highlighted or in bold font [42]. Examples of this are shown in figure 4.7.

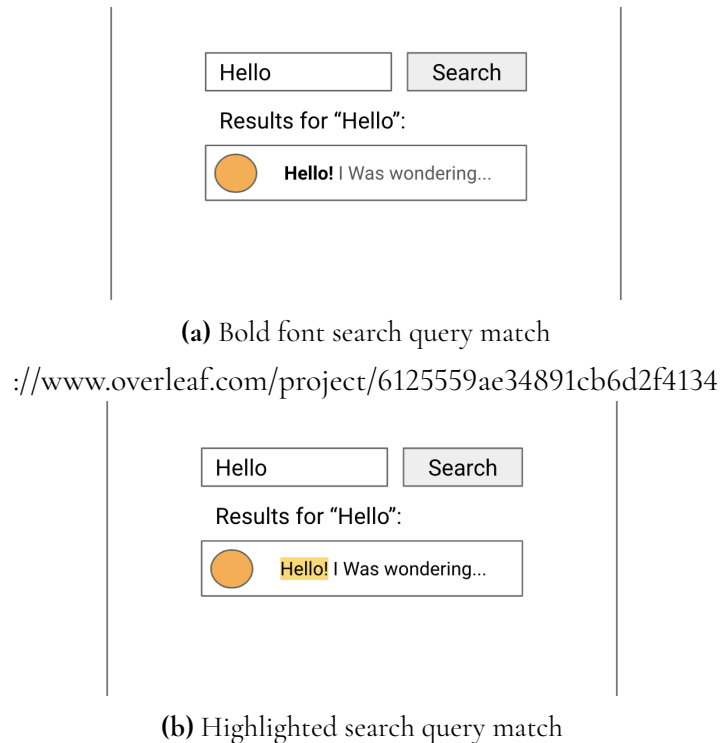


Figure 4.7: Hit highlights to increase information scent when searching for the word "Hello" in a made-up interface.

Dumais et al. compared seven different user interfaces in order to explore the importance of categories when presenting search results [12] and came to the conclusion that including category information decreased the search time significantly compared to presenting results in a plain list view. Users are able to more efficiently follow the information scent when results are clearly labeled [42]. In the experiment by Dumais et al., all interfaces containing category information outdid the plain list with regards to search time but the users experienced the least effort when being presented with search matches grouped by category. Though grouping chat messages by analysing text contents is out of scope for this thesis, relevant categories used when displaying query matches could be to group messages by user or type of match (e.g. plain message, post or file).

4.4.2 Designing the User Interface

Heinz et al. [43] has done research on where website users anticipate different elements to be located on the website and the search box is expected to be found in the upper right corner [5]. This expectation follows a phenomena known as the F-pattern, a concept many UX/UI designers are familiar with, that denotes the pattern in which users scan a text-based web page [47]. Users tend to scan the top of a page horizontally, from left to right and then progresses to do the same a bit further down the page but in a shorter movement [31]. Consequently,

the top right of a page is one of the first points to potentially grab a user's attention yielding high findability for any feature in that place.

Nielsen [29] argues that the search functionality should be simple and visible. Nielsen [29] further suggests that the search box should be an actual box and not a link because the web page users tend to scan the page instead of reading to save time and energy. The box itself ought to be big enough to include a whole search query of typical length to avoid scrolling inside the search box. Nielsen [29] also studied how likely the website visitors were to succeed with their search when reformulating their search term and found that the success rate decreased for each iteration. This study suggests that the search result should be optimized to maximize the success rate on the first search and to give good suggestions on search queries. Lastly, the study showed that the average query length was two words long and that is why advanced search shouldn't be offered if the visitor hasn't asked for it [29].

When it comes to the question about having several search boxes, Nielsen [29] on one hand strongly suggests to only have one search box for all search functionality on a website to keep the simplicity. But on the other hand Nielsen [30] admits that having two search boxes could be the right way to go in some cases. As can be seen in figure 1.1 the Telavox app already has a search field where you can search for users and numbers. If the search boxes do very different things like one searching on employees and one searching on documents the differences are sufficient for the user not to get perplexed, yet Nielsen [30] suggest that only one search box should be labeled "Search".

Chapter 5

Mid-fi prototyping

This chapter describes the second phase of the design process, the mid-fi prototyping phase, depicted in figure 5.1. During this phase the previously established requirements are used to create a mid-fi prototype. The prototype is then tested by eight end-users by letting them act out predetermined scenarios. Lastly an evaluation is made and the requirements and design choices are reconsidered.

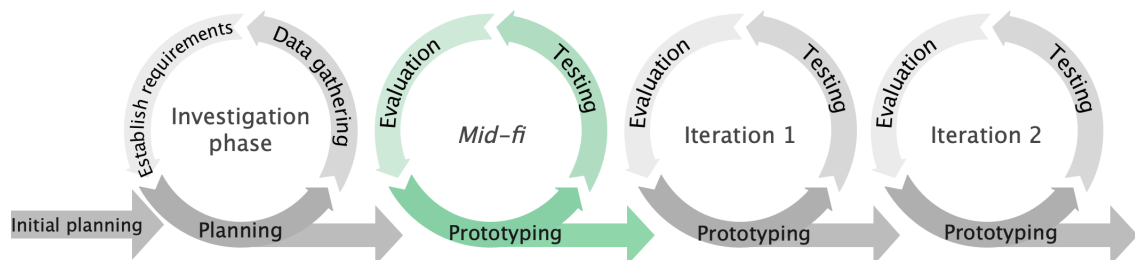


Figure 5.1: The current phase, mid-fi, in the design process is highlighted.

5.1 Mid-Fi

After gathering and analysing the data it was possible to establish some requirements and alternatives and continue to the third step of the design process, making prototypes. It was decided not to make a low fidelity prototype but instead focus on making a middle fidelity prototype using PowerPoint. A mid-fi prototype was chosen because studies have shown that testers prefer computer-based prototypes (see section 2.4.1) and also because it enabled the use of the existing interface as a starting point. Several different design suggestions were made based on the findings from the survey, competitive analysis and literature review. The differ-

Table 5.1: List over the test persons and their job title.

Person	Job Title
P1	Full-stack Developer
P2	Advisor for resellers
P3	Software Developer & Teamleader
P4	Project Manager, delivery to large companies
P5	Full-stack Developer
P6	App Developer
P7	Business Intelligence Developer
P8	Full-stack Developer

ences between the alternatives were the search function's placement, what happens when a user starts to search and how the search results are shown.

5.1.1 Participants

For these tests, we recruited a total of eight real end-users out of which were all Telavox employees but with different job descriptions, see table 5.1 below. Since usability experts have yet to come to an agreement as to whether five test subjects is sufficient for conducting user tests or not, safeguarding with a higher estimate seemed a sensible decision in this case. Just as in our survey study the gender division was two females and six males but when it comes to the ages six people were between 20 and 29 years old, one was between 30 and 39 and one was between 40 and 49.

To find voluntary participants a post was made in one of the largest public rooms belonging to Telavox's internal communication platform asking for help. The volunteers then went on to register themselves on an appropriate meeting time in a doodle¹ schedule created for the test session.

5.1.2 Test setup

The user tests were conducted both remotely and in-person at the Telavox office and the users got to sign a informed consent form beforehand, see Appendix B. During all test sessions, one of the authors acted as moderator while the other took notes.

Test subjects were assigned a search task comparable to a real-life situation: to find a message containing a specific word sent at a certain time in a one-on-one chat by navigating through the interface. Participants were asked to think aloud while clicking through the interface, including their reactions to system responses, the user interface and the ease of use performing their task. Collecting qualitative data such as success rate and time spent on the task did not seem relevant for these tests as most users are assumed to be familiar with search functionalities prior to participating in this test. Thus, gathering qualitative information such as ease of use, satisfaction with the experience as well as overall comments on the design suggestions was the main priority.

¹<https://doodle.com/>

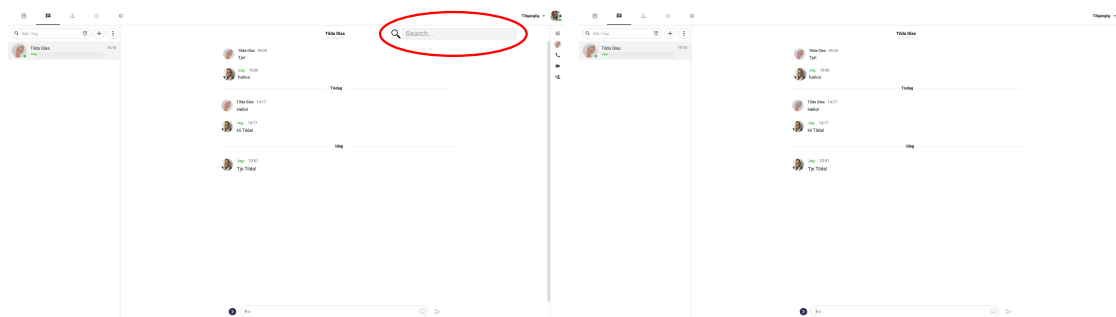
Before the real user tests were done, the setup was pilot-tested with another employee at Telavox. The pilot test made it clear that one of our design suggestions was redundant and could be removed from our proposals. It was also apparent that certain transitions between slides made the test confusing for the user. These issues could also be remedied before conducting the actual tests.

5.1.3 User Test Results

Regarding the placement of the search function, there are two principles that should be considered:

- Consistency with existing interface
- Expected placement

Two suggestions were made for the placement of the search box/search icon and these can be seen in figure 5.2. The first one (figure 5.2a) was placed in the top right corner of the current chat and was inspired by the research behind placement of search boxes(they should be placed in the upper right corner and be an actual search box) and by evaluating the placement of Discord's search box. The second suggestion (in figure 5.2b) was inspired by the existing interface of the Telavox application and by a comment made on the last question of the survey that read "maybe have it as an icon in the existing right sided menu". This solution would be more consistent with the current user interface.



(a) Search box in the top right corner of the chat. (b) Search icon in the right-aligned chat menu.

Figure 5.2: The two suggestions regarding the placement of the search box/icon.

Out of the four design suggestions, two showed the search bar in the upper right corner and two showed a magnifying glass icon in the side-panel to the right. The results from user tests suggested that although placing a search field in the upper right corner offered higher visibility, subjects could still locate the smaller icon in the side-panel within a matter of seconds. Seven out of eight testers expressed that this solution was more aesthetically pleasing, minimalistic and consistent with the current design. A few stated that the first option could be seen as more user-friendly in terms of findability but not to the extent that it was worth interfering with the interface as it is today. It was also pointed out that because the search functionality isn't the main function of the chat it doesn't make sense to give it this much space. One person even mentioned that the search bar would probably make the

user experience less satisfying because it removes important whitespace and makes the chat look more cluttered and messy.

We made three proposals on how the interface will react and show results when the user starts to search, see figure 5.3. Again, we considered two different approaches to this:

- The most appreciated functionalities from competitors
- Consistency with existing interface

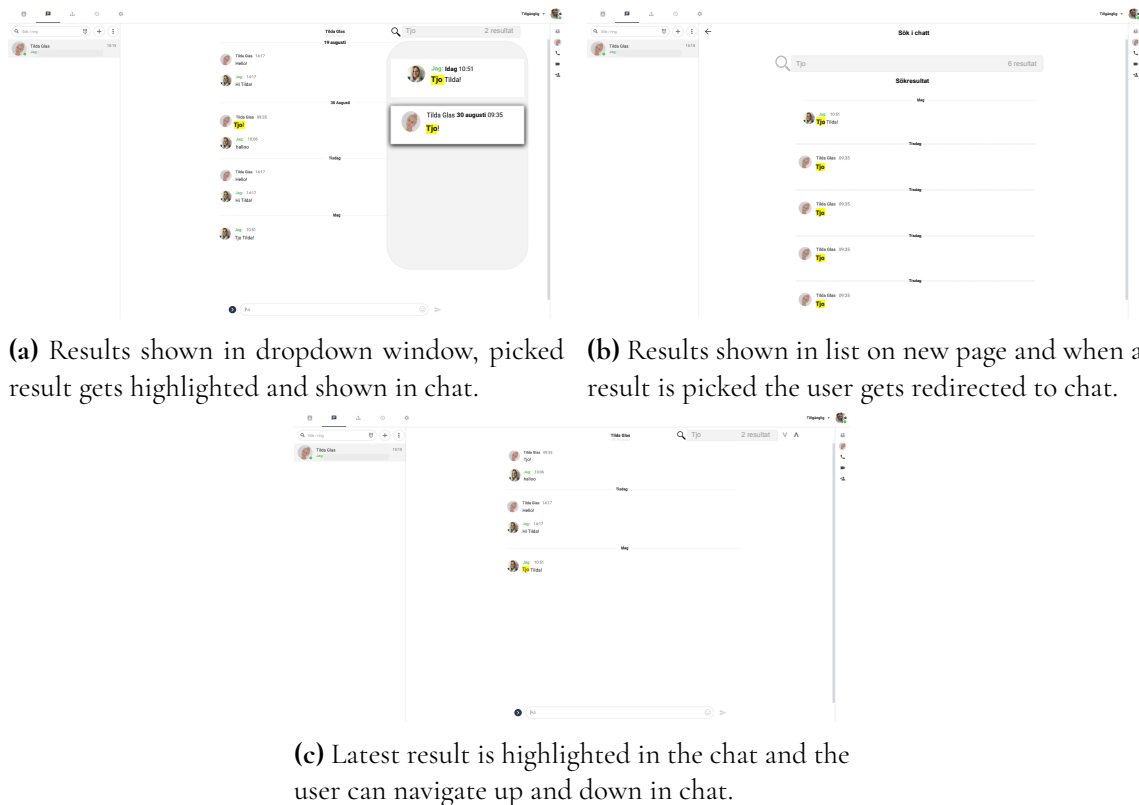


Figure 5.3: Suggestions on how to show the search results.

In figure 5.3a a dropdown is used when a search is initialized. This is similar to the way Discord’s search interface work, which many users find highly usable according to our pre-study. In the dropdown menu the results are displayed in a list, the picked result is highlighted and the chat relocates to the chosen message in the chat. How to keep consistency in this stage of the search experience is subject to ambiguity. One other suggestion in figure 5.3b was to reroute the user to a new page. This alternative is most in-line with how the existing chat features work in the right-aligned menu. The results are then shown in a list with the latest on top and then in descending order, if the user scrolls down more results are fetched. When the tester clicks on a search result the page redirects to the corresponding place in the chat and they can navigate back to the search results using an arrow in the left corner of the chat.

The last alternative, figure 5.3c, was to not show the results collected in a menu or on a new page but instead it would function more like CTRL-F where the user navigates through the results in the same pane as the original chat is shown. By executing search this way, the application instead stays consistent with how the other, already existing, search functionality

works. The latest result is automatically highlighted when the user presses enter and to navigate through the results two arrows can be pressed to move either up or down in the chat. In all of these suggestions the search phrase is highlighted in yellow and made bold in order to increase *information scent* [42].

The testers that had used the Telavox application for more than a year explained that in a previous version of the application the options in the sidebar did not redirect to a new page but instead just extended out from the right to the left. This was similar to our suggestions with the dropdown menu, figure 5.3a, and two of the testers thought that the dropdown should work like this extendable component instead to make it more consistent with the design and to be able to resize it easily. When there were only a few results, one person didn't like the space the dropdown took up beneath the search results and another tester thought each search result was too big. The majority of testers thought it was nice that the chat scrolls up to the chosen message and that they were able to see the chat at the same time as the search results, to get context for the results. One person said that they expected the search window to disappear when a result is picked while others wanted to close the window themselves when the correct result was found. Another tester had some issues with the way the results are shown with the most recent result at the top. This tester pointed out that chronologically this makes the most sense but because the chat works the other way around, with the most recent message at the bottom, it could be better to follow the existing design pattern.

The suggestion in figure 5.3b got both positive and negative comments from the test persons. They liked that it didn't interfere with the existing design, that the large search box was good when formulating long queries and that if there are a lot of results it would be easier to scroll through. More than half of the testers thought that they lost the chat context when being redirected to a new page and that if they just wanted a quick search it was too complicated with too many "clicks". It could also be a source of frustration to navigate back and forth when reaching an undesired result. Some of the testers got confused with the scope of the search in this design, they felt like they were searching through all chats and not just one. Hardly any of the testers discovered the arrow that allow users to move back to the search result page. Most of them said that they would click on the magnifying glass again to go back to the result page and expected it to remember the old query.

Almost all of the test persons expressed recognition when they saw the suggestion in figure 5.3c, either from searching in an IDE when programming or when searching for something in a document or on a website. One tester thought that this suggestions was the most reasonable and that it works like Facebook Messenger does while others didn't think it was user-friendly. There were several arguments for this not being user-friendly, for starters if there are a lot of search results it would require many "clicks" to reach the desired result. If there are numerous results the testers wanted to get a quick overview of them to confirm whether the wanted result even exists which is not possible with this design. The majority of the test subjects expressed that they liked this design the least. However, two testers said that they thought this design gives good context overview and saves space in the application.

At the end of every test session the participant was asked which design option they preferred the most and the results can be seen in table 5.2. Option one and option two both had the dropdown menu but option one had the search box while option two had the magnifying glass icon. Option three was the one with the CTRL + F search functionality and Option four opened a new page for search results. Only one person preferred the option with the search box and the same goes for option number three. Both option two and four were favorites

Table 5.2: Which design option test subjects liked the most

Person	Preferred option
P1	Option 2
P2	Option 1
P3	Option 2
P4	Option 4
P5	Option 3
P6	Option 4
P7	Option 2 & 4
P8	Option 2

among the participants and P7 thought that option two was better for a more light weight search while option four was better suited for a more advanced search.

The test subjects also provided us with some overall comments about our designs. Some of them inquired for the possibility to search on a date or a person and to search in all chats, the last of which is out of scope for this thesis. Most of the testers commented that they expected the search functionality to automatically start searching, without having to press enter, when a query is entered. One person suggested that the search page could open when pressing the shortcut CTRL + F and another that the search bar would appear when scrolling upwards in the chat.

5.1.4 Evaluation

After creating and analysing test results on the mid-fi prototype we decided to discuss our findings with a UX designer at Telavox who has been working with design of the chat tool. This was done to make sure that the design we were to develop would be coherent and not interfere with the current interface. We mainly discussed the options with the dropdown menu and the new search page, as they were the most preferred options from the testing.

When discussing the possibility to have the dropdown menu as an extendable component, as proposed by some of the testers, the designer explained that the Telavox design team had abandoned this approach some months ago because they thought it made the interface too cluttered at times. For example when the user is in a video conference and navigates to the chat, the video is still visible on the right side of the page and if a search is begun in a extendable component it would lead to having three components in a row from the right. We agreed that this could become too cluttered if the user was in a video conference and wanted to do a quick search for something.

The designer then proposed that we could do a kind of combination between option two and four by not going to a new page directly when pressing the search icon but rather show a search bar with a dropdown menu for suggestions and then move further to a new page when pressing enter. The dropdown component is already in use in other parts of the application, for example when choosing people to invite to a room, therefor it wouldn't interfere with the current interface. We decided to proceed with this flow of actions as it was the suggestion that was the most consistent with the results from the mid-fi testing and a combination of the suggestions we had already designed.

Main takeaways

The mid-fi prototype testing gave us many valuable insights to how we should move forward to create a hi-fi prototype. The following design choices were made from these insights:

- To remain consistent with the existing interface and to not take attention away from the main purpose of the tool - to chat with other users - it was decided to go forth with having the search icon in the right-aligned menu and to not have a fixed search box at all times. All but one of the test subjects favoured this choice and thought that even though findability is important, it shouldn't be displayed as one of the main functions. This would also help make the user interface more aesthetically pleasing.
- When a search has begun, by clicking on the search icon, the search box appears and the user can begin to enter the query, get suggestions and then move further to a new page for the search results. In this way we hope that users still feel that they have some context to the chat while the design remains consistent with the interface. We also want to make the flow easy to follow in order to prevent the users from feeling like the search functionality is too complex and requires an unnecessary amount of clicks.
- We decided to keep and further develop the features for displaying the results in the chat by highlighting the chosen search result, matched search terms and to allow the user to be redirected to a chosen search result by clicking on it.

Chapter 6

Hi-fi Prototyping Iteration 1

This chapter describes the third phase of the design process, the hi-fi prototyping phase one, shown in figure 6.1. To develop the first hi-fi prototype, results from the mid-fi and investigation phase are taken into consideration in order to fulfill the established user needs and preferences. The prototype is then tested by end users who are given representative search tasks to complete using the prototype. Lastly an evaluation is made using observations from the tests as well as a SUS score.

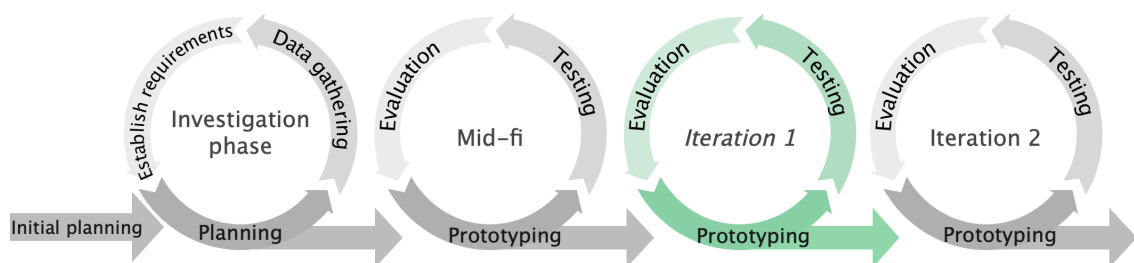


Figure 6.1: The current phase, iteration 1, in the design process is highlighted.

6.1 Hi-Fi prototyping

For the following iterations of this design process it was decided to apply the approach of evolutionary prototyping. In this way, instead of creating a high fidelity prototype without actual functionality, we aimed to implement an early version of the real product. This was decided because the basic functional criterias were well-known and highly testable in the real environment. The basic functional criteria were to, in an easy and intuitive way, search for previously written messages in one chat and display the search results in a way that gives the user a comprehensive overview of the results. Considering that the search functionality will

be integrated with an existing application, this gives us as designers a greater understanding of how the existing features and design patterns work, which will hopefully lead to a higher consistency and credibility of the finished prototype. We also thought that with this product it is easier to discover additional user needs when the user interacts with the real system, as all of our test users are familiar with the app since beforehand and therefore know how they expect it to work.

6.2 Iteration 1

The following two iterations started off with a prototyping phase and was followed by a testing and an evaluation phase. During iteration one the main focal points was the overall design of the search functionality and it's flow of actions. The main functionalities and design decisions that were implemented in this iteration were mostly based on findings from our literature study, focus group and mid-fi user tests but also took into account previous studies' results on how users interact with SERPs to see if these are applicable to a search-in-chat setting. The decisions were the following:

1. Possibility to search using two parameters; text and sender, either combined or separately. The decision was made to start off with these two parameters since results from the survey study showed that these were the ones users thought they would use most frequently. Not being able to search by sender was also identified as a source of frustration with Messenger's search functionality and thus frustration we wanted to avoid in our prototype.
2. Keeping the chat interface consistent and minimalistic by placing the search icon in the right-side menu. This was the option that was preferred by most user test participants and would also provide the search functionality with high findability which was highly prioritized by many users in the survey.
3. Placing the search field (that is opened by clicking the search icon) in the upper right-hand corner, following users expectations and previous experiences with search bars.
4. Showing search suggestions in a dropdown below the search field when users start typing, as this was a much appreciated search feature in Discord's application.
5. Displaying a list of search results instead of showing them one-by-one, as test subjects in the mid-fi testing as well as participants in the focus group expressed that they wanted to get a good overview of the results.
6. Making it possible for users to be redirected to the chat when clicking on one of the results as this was appreciated by mid-fi test participants.
7. Highlighting the matched search terms as well as the chosen search result (the one that the user wants to be redirected to) to increase the information scent.
8. Showing larger snippets (400 characters) of the matched messages to help users find the correct information. Most messages in this chat are shorter than the max length we chose to display and are thus shown in their entirety.

9. Possible decreasing mental load and frustration by limiting the number of search matches shown to six at a time.

6.2.1 Prototype

Below the different components of the prototype belonging to iteration one and their functionality are presented.

Initiating a search

From testing the mid-fi prototype we learned that most of the users were of the opinion that the search icon in the right-aligned menu was the way to go for finding the search functionality.

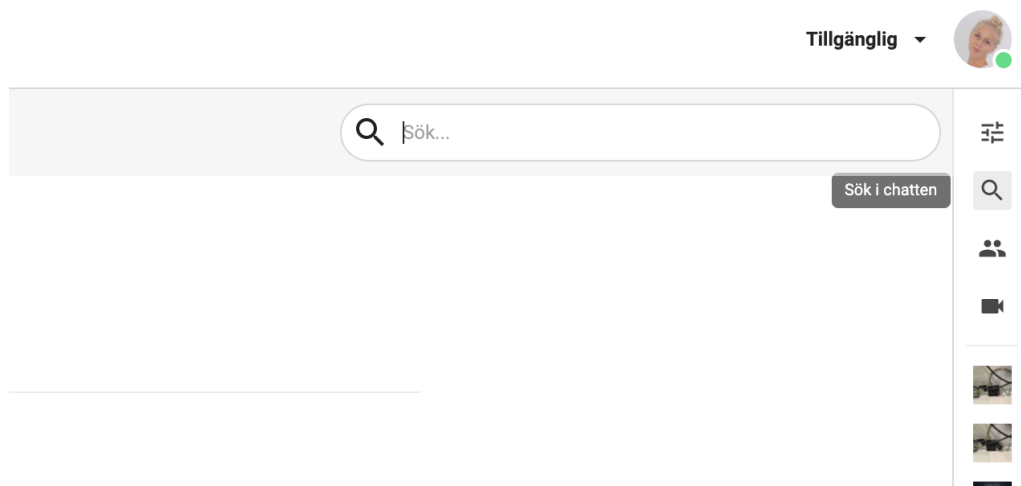


Figure 6.2: The search box appears when clicking on the search icon in the menu.

Figure 6.2 shows what happens when a user initiates a search by clicking the search icon, the magnifying glass, in the menu. When hovering over the search icon the user gets an explanation about what the icon button does, i.e. "Search in chat" and then when clicking on the icon a search bar appears as a header in the current conversation. In the text-field of the search bar the placeholder phrase "Search..." is shown to encourage the user to enter their own text and start a search query. If the user for some reason regrets their decision to search or has pressed the search icon by accident they can easily quit the search and hide the search bar by clicking on a 'X' located at the left side of the header or by clicking on the search icon in the menu again. The next time the user wants to search, the previously entered search query is removed and they can start the search from scratch.

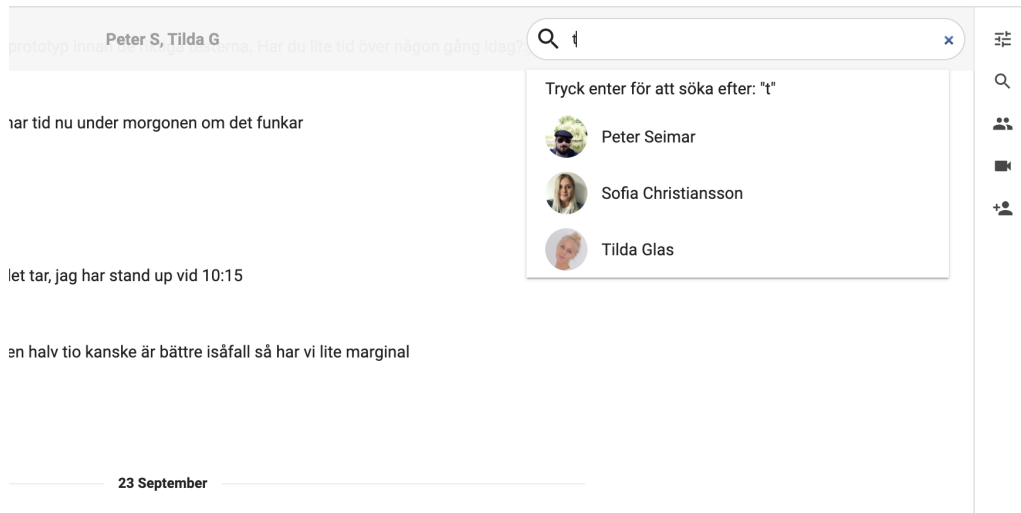


Figure 6.3: Dropdown when searching for a specific person

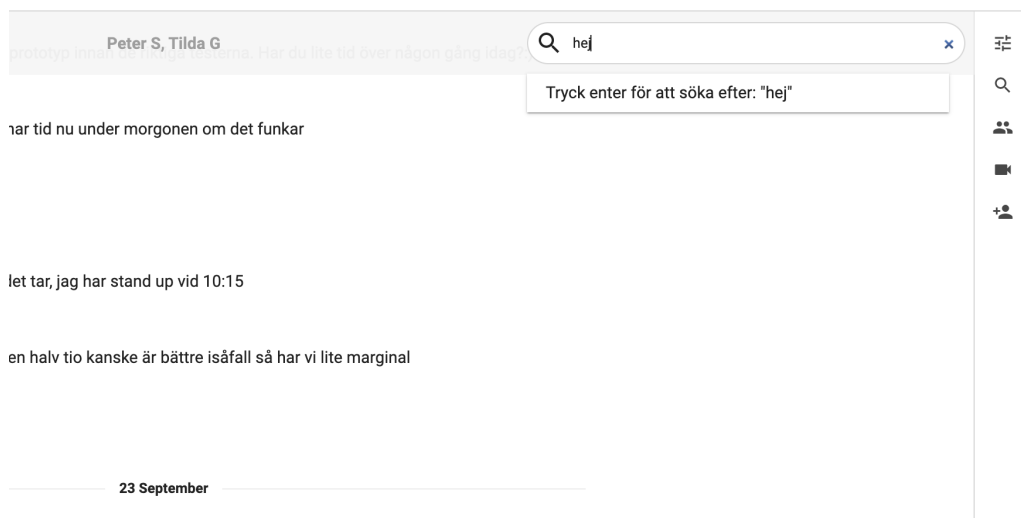


Figure 6.4: Dropdown when searching on free text.


Getting suggestions


Once a user starts typing in the search field, suggested people that they can search for are shown in a dropdown. Profiles shown in the dropdown are all members of that particular chat and are also filtered based on what the user has entered in the search field. In figure 6.3 the user has started typing 't' in the search box and the dropdown menu then shows all persons with a 't' in their name. If the user had continued to put in 'til' the dropdown would have shown the only matching person 'Tilda Glas'. Figure 6.4 shows what the dropdown looks like when the search query doesn't match any member of the chat and reads "Press enter to search for: "search query"".


To choose a person to search for and move on to the results, the user can either press the arrow down key until the wanted person is highlighted and then press enter, or use the mouse to click on the wanted person. If the user wants to search for the text put into the search box, even if it is a name, they simply press enter as stated in the dropdown. All of these actions redirect the user to a new page shown in different variations in figure 6.5 and 6.6.


Sökresultat för "Sofia Christiansson":


Q Sofia Christiansson X Sök...


 Sofia Christiansson 2021-10-12 14:03
Hej, Ja det hade varit skoj! :)

 Sofia Christiansson 2021-10-11 10:47
Ja det kanske är bäst att bara köra på måndagar så kan man planera lite inför veckan då.)

 Sofia Christiansson 2021-10-06 14:47
Hej! Tack för att du kolla upp det :) vi klarar oss nog ett tag till!

 Sofia Christiansson 2021-09-24 10:37
yes!

 Sofia Christiansson 2021-09-21 08:15
Tror inte det tar så lång tid men halv tio kanske är bättre isåfall så har vi lite marginal

 Sofia Christiansson 2021-09-21 08:13
Funkar klockan 10?.)


 Sofia Christiansson 2021-09-21 07:59
Hej Peter! Vi hade behövt pilottesta vår prototyp innan de riktiga testerna. Har du lite tid över någon gång idag?.)

Figure 6.5: Search results for a person search.

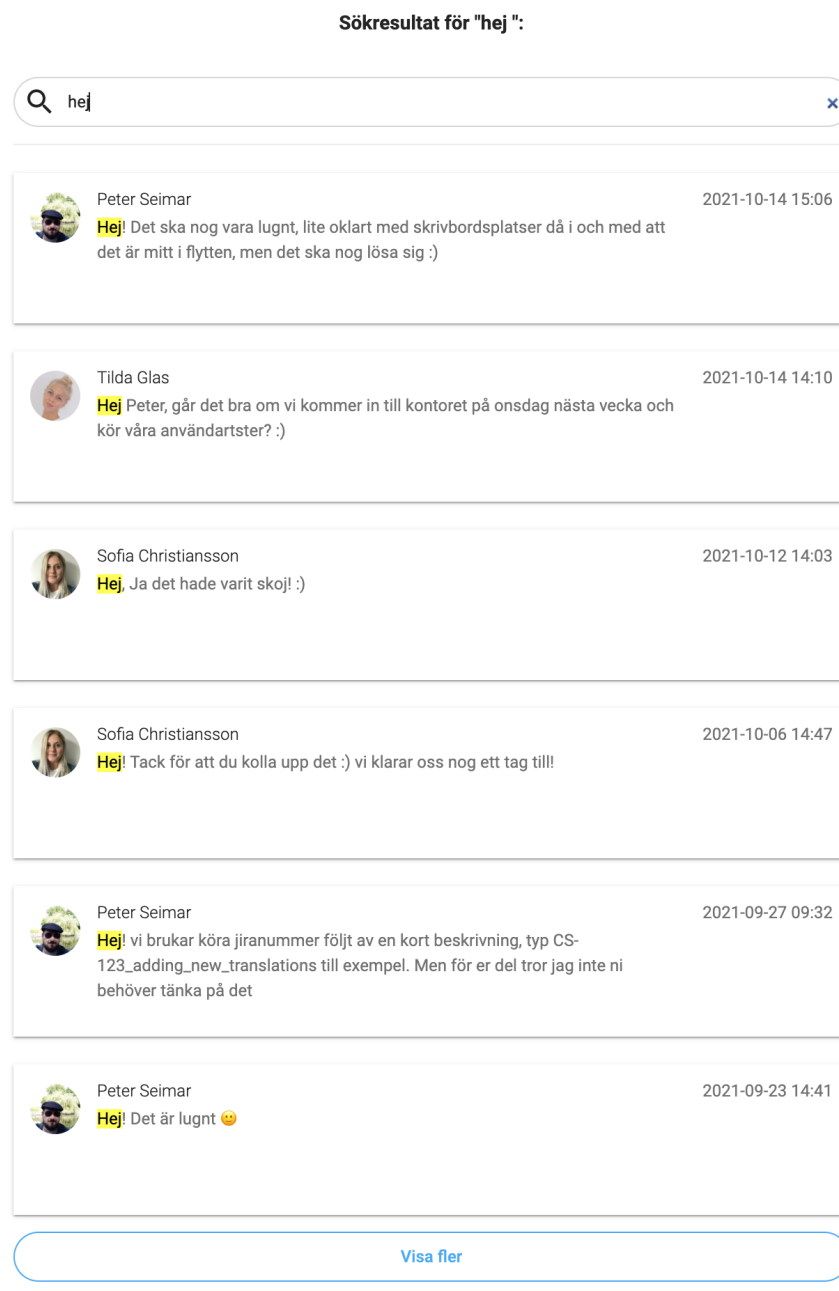


Figure 6.6: Search results for a text search.

Showing search results

At the top of the search results page the text "Search results for "search query/person"" is displayed and below is a new search box which contains the chosen search query/person. The search box is interactive which, in this case, means that if the search input is removed or changed the search results also change. In figure 6.5 the user has searched for one person in the chat and all of their chat messages are shown with the most recent messages at the top. In this figure they have also chosen to load more messages than the first six.

Figure 6.6 shows the result for searching on the word "hej" and as can be seen in the figure, "hej" is highlighted in each of the search results. In this prototype the search function only

searches through the last 25 messages sent and shows the results. If a user wants to search further back they can press the button at the bottom of the page in figure 6.6 and the next 25 messages are searched through. When loading more search results the new results appear below the already fetched results and this creates the scrollable window that can be seen in figure 6.5.

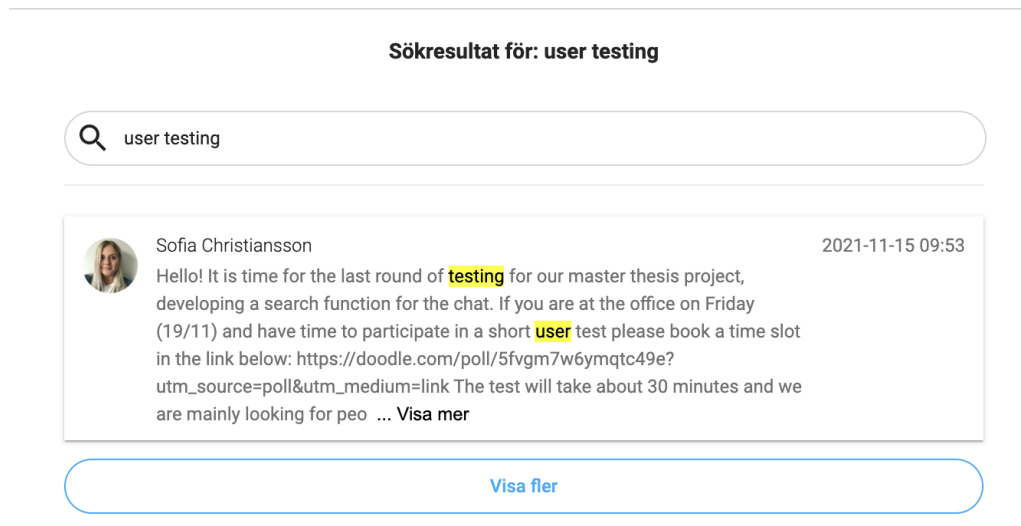


Figure 6.7: Search result page showing a matched post.

When users search for queries that match a post (which is a message that users can like and comment on), the search result is displayed as in figure 6.7. Since the contents of this message exceed the character limit of 400, a "Show more"-button is shown where the message text is cut off. Clicking this button will expand the search result container to show the full contents of the post text, whilst staying on the search results page. Posts also contain a descriptive title which are shown in the chat rooms but not in search results.



Figure 6.8: Search result page when no matches are found.

Lastly, search queries yielding no matches will be displayed as in figure 6.8, with the "Show more" button disabled and relabelled to read "No more results".

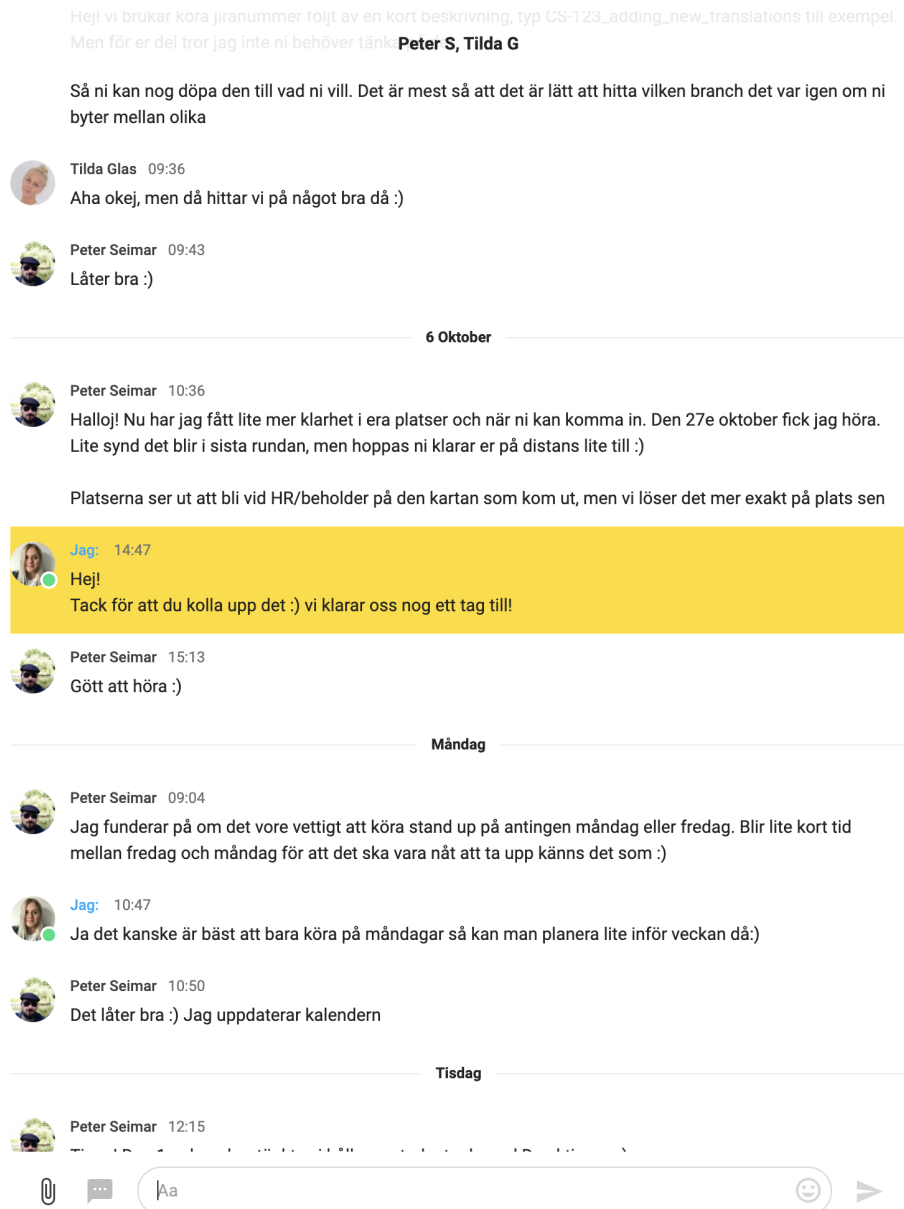


Figure 6.9: The user has chosen a result and gets navigated to this result.

Choosing a search result

The figure above, figure 6.9, displays what happens after choosing a specific search result, in this example the user has selected the third result from the top down. After clicking on the search result the user is redirected back to chat and the chat window scrolls up to the selected message which will then be highlighted for two seconds. If the user navigates back in the browser the search result page will be shown and the current search will be saved.

6.2.2 Testing

In order to evaluate the user experience of the search-in-chat prototype and to uncover any issues with the current version, the prototype was tested by five potential users through indi-

vidual user testing sessions. Prior to the test, all participants filled out an informed consent form shown in Appendix B.2. During the tests the test subjects got a set of tasks to complete and when they were done they got to fill out a system usability scale survey.

Participants

The participants were recruited the same way they were in the mid-fi test, by writing a post in one of the largest Telavox chat rooms and linking to a doodle schedule page. In the post it was specified that it was preferred that the test subjects hadn't participated in the previous test session and were able to participate in the test on site and not online. We wanted new participants to get new insights from people that weren't influenced by the previous prototype.

It was decided to only do the test on site and not online which limited the number of possible test persons. Even if this caused limitations we agreed that this would be an easier way to manage a test session with test subjects that weren't familiar with how to set up our working environment on their own computer. If we were to do the test online the users would have to clone the repository from git and configure the application to run locally on their own computer. This may be no big deal for a developer but for other people testing our app this would probably have been a major obstacle.

All five participants were male, we tried to get at least one female participant but unfortunately most of them still worked from home and due to the above described issue, remote testing was not an option. Two of the participants were between 20 and 29, one was between 30 and 39 and the two remaining were between 40 and 49 years old. Three of the test subjects were working as developers at Telavox, of the remaining two one worked as UX designer and the other worked as an advisor.

Test setup

For this iteration we formulated a set of user tasks for the test subject to complete, to let the user explore most of the major features of the search functionality. All tasks were meant to emulate real end user scenarios that might arise when using the Telavox application, although some were arguably a bit more far-fetched to be able to test edge cases such as looking up the last message in a chat. As the application and many of its chats are updated daily, participants were shown which specific chat they should perform the tasks in. In the first four scenarios, one of our own private chats that we knew the contents of was used. For the last scenario, the testers were redirected to a chat about product updates to complete the test. The test participants were asked to solve the following problems:

1. You are a master's thesis student working at Telavox and have forgotten which days your stand-up meetings are. Try to find this information using the search functionality.
2. You remember that Person X has mentioned how branches are usually named in GitHub, and that this had something to do with Jira, but you are unsure of how Person X phrased this. Find the message where Person X has mentioned this.
3. Imagine that you are Person X and that you're wondering whether it was Master's Thesis Student one or Master's Thesis Student two who asked about branch naming. How do you figure this out by using the search functionality?

4. You're feeling nostalgic and are curious to find out when Master's Thesis Student one wrote their first message in this chat, and what was in that message.
5. To your recollection, Person Y posted about a product update sometime around last Christmas and you wish to find out which features were changed in this update. Try to find Person Y's post about this.

Before doing the actual user testing, a pilot test was done to try out and possibly find issues with the user tasks and test set-up. This pilot test did not indicate any major problems, except for rephrasing some of the tasks in order to avoid confusion on the tester's behalf. The pilot test also made it obvious that test subjects perhaps weren't inclined to comment on the size and number of search results shown which lead us to add these follow-up questions after all tasks were completed:

1. What is your opinion on the search result snippet size?
2. What is your opinion on the number of search matches shown?

Results

The results will be presented with regards to testers' opinions of and experiences with our design choices, listed under section 6.2.

1. Firstly, all test participants appreciated being able to search both by text and by sender of the message. However, about half of the participants didn't realize that searching by sender was even an option at first and thus tried to search only using keywords. This was mainly an issue in the second task, the first task where we expected participants to search for a person and not only use keywords. By the time that the testers were completing the third task, most of them were comfortable with utilizing the search-by-sender functionality.
2. Placing the search icon in the right-aligned menu seemed to feel natural for the test participants as they all found the search functionality within a matter of seconds and no one commented that it felt out of place. One participant even said "I can't imagine it being placed anywhere else in the chat.". Another participant pointed out that he expected it to also be available in the settings menu since all of the other chat options in the right-side menu can be accessed from there.
3. The placement of the search field itself didn't raise any objections. Test subjects either didn't comment on it at all or simply said that it looked nice. These results indicate that our choice of placement felt in line with end users' expectations and/or intuition of where the search field should appear.
4. As explained in point (1) of this list, it took a couple of tasks for testers to even notice that a dropdown responding to their search input was shown below the search field. When they started using it, no one had any troubles whatsoever figuring out what was shown and how to find the person they wanted to search for. But some of the testers pointed out that they were missing a feature to search for a name by typing in free text, without having to pick a specific person from the dropdown. In this prototype the

search functionality only searched within the messages and not in the chat members' names when users had typed in their free text queries, which caused some confusion on the testers' side.

5. The highlighted search terms did not elicit any specific response from test subjects, possibly because this is such a normal feature and in general, people with computer experience expect their search matches to be emphasized in some way. Highlighting the clicked on results did however get a positive response from the testers. "Wow, this looks great!" and similar exclamations were made by several people. Since the scroll-to-result feature still suffered from a few bugs in this iteration we were unsure of whether to keep it or not but the user tests made it evident that this functionality was a must-have for end users.
6. Everyone in the usability tests thought that showing larger snippets of the messages was a great feature. They appreciated that a majority of messages were fully displayed so that they could easily read the entire message without having to click on anything else. In this prototype we had added a button to show more text if the message was longer than 400 characters (see figure 6.7). Almost none of the participants noticed this button and one said that they thought clicking on this button would lead them to the context in the chat which was why they choose not to click on it.
7. Limiting the number of search matches shown at a time was not as appreciated by test users as showing larger snippets. Four out of five testers wished to see more results at a time or at least didn't want to have to press a button to see more results. Three participants said that they would rather scroll down to the bottom of the page to load more search matches, than press the "Show more" button.

Other comments and suggestions from test users were to include some kind of sorting functionality, to either sort the search results by "Newest first" or "Oldest first". Several participants were a bit confused as to how results were sorted (which is currently from newest to oldest) but didn't express any specific preference in this matter, only that the option to sort would be helpful and could increase the current sorting's findability. This could have been affected by our selection of tasks, where some of the tasks were dependent on time (task 4 and 5). Another feature that was requested when performing these tasks was to include support for a functionality to search by time interval, such as a day or month, in order to facilitate search tasks where one remembers time period but not phrasing of the message.

Another issue that testers noted was the number of matches shown in one search. Since the current version only searches among the last 25 messages, users have to click "Show more" to load more messages into the search algorithm. This sometimes lead to only a couple of matches being shown at first, even when there were more matches to show from that query. In some cases, the user would not even have the option to load older messages, if there were no matches at all among the most recent 25. The reason for this unusual behaviour was the limited time period and scope for our first iteration.

6.2.3 Evaluation

After completing the test tasks, all participants filled out the survey with the system usability scale form shown in Appendix C. The collective system usability score was calculated to 83,

with individual scores ranging from 75 to 87.5, see figure 6.10 for details. According to the current research (see section 2.5.4) a good score is considered to be 70 and above and our result is well above. This means that our prototype is approved by the testers when it comes to the usability but it could be even closer to 100.

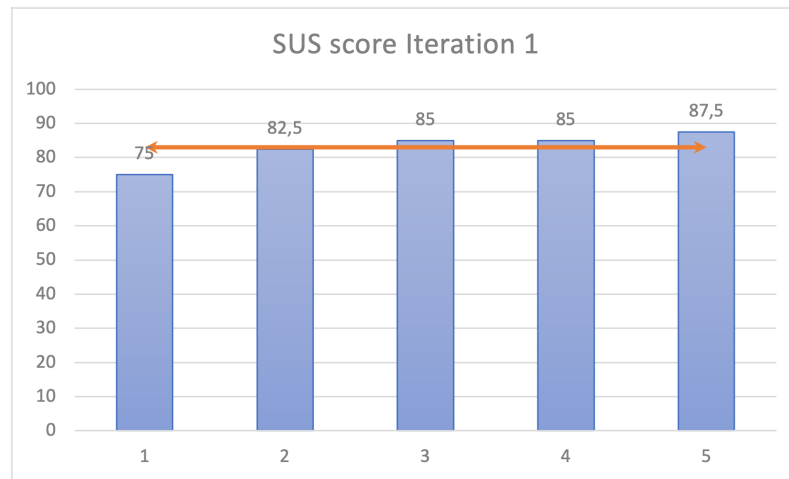


Figure 6.10: The individual SUS scores with the mean score of 83.

The statements that got the poorest scores in the SUS survey were statement five and six. The fifth statement was *I think that the different parts of the search functionality are well integrated.* and the sixth was *I think that it is too much inconsistency in the search functionality.* Both of these statements are interrelated with the already known insufficiency with this prototype, that it only searches through 25 messages at a time. This causes the scroll-to-result functionality to not be as fully integrated with the system because it only works if the search result is among the 25 latest messages. Besides that, it is the cause of the inconsistency when showing search results, which is explained above.

From the SUS form answers and the test sessions some conclusions could be derived about the user experience of this prototype. Regarding the use of the prototype, all participants gave the highest or second highest rating to the form statements regarding whether they found the search function easy to use and not troublesome. This displays good usability and findability which we aim to keep and further develop in the next prototype. Moving on to the think and feel of the prototype, all but one answered that they most likely would want to use the functionality regularly, showing that they would find it helpful in their work. The results for whether the participants felt safe in using the functionality showed that the majority (three people) gave it the second highest, one the highest and one the middle score. This in turn shows acceptable credibility, but all of the above could of course be improved to offer users an even better experience using the search functionality.

Main Takeaways

The user tests helped uncover various usability issues with the current version of the search functionality. Our main focus areas for the next iteration were deemed to be:

- Fixing the issues with the scroll-to-result functionality as this was one of the features

that received the most praise, even though it had not been fully completed. Testers valued the ability to see message context very highly.

- Adding support for searching by time interval. This feature was third on the list of wanted features from our user needs survey and from the user test results it became evident that searching by time would facilitate the search experience for chat users.
- Implementing a sorting function for how to display search results. This would both increase visibility of how messages are sorted from the get-go as well as assist users in finding the right information more quickly.
- Increase the findability of the "Show more"-button.
- Include a more stable implementation for loading and displaying older messages, to avoid the issues where no matches were shown even for queries that should give results.
- Showing more results than six at a time or making it easier to load older messages by scrolling instead of clicking a button, but keeping the length of the message snippets shown as this aided users in their search.

Chapter 7

Hi-fi Prototyping Iteration 2

This chapter describes the fourth and final phase of the design process, the last hi-fi prototyping phase, shown in figure 7.1. In iteration two, the main weaknesses from iteration one were to be mitigated, using results from the user tests and evaluation. Ensuing development, the prototype was then tested by end users one last time. These tests utilized the same method as in the previous chapter, giving exploratory search tasks for the users to complete. Observations from these tests were complemented by a SUS score along with a set of semi structured interview questions.

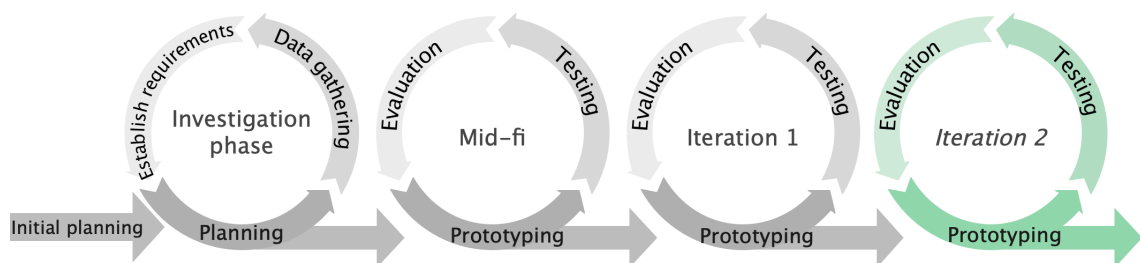


Figure 7.1: The current phase, iteration 2, in the design process is highlighted.

7.1 Iteration 2

From the evaluation of iteration one it could be concluded that the main flow of actions in our prototype was easy to understand and to navigate through. Many of the design choices were appreciated, such as the different search parameters, placement of the components making up the search functionality and the highlighting of search results. But the prototype also offered several areas of improvement and during this iteration focus was put on the following:

- Improving the consistency with the existing application by adding the possibility to

navigate to the search page from the general settings in each chat and not only from the sidebar settings. On the same note, contact names were displayed in bold text to stand out from the body of the message and post titles were included in search results in order to follow the design of the preexisting chat.

- Enhancing the usability of the search functionality by making it feasible to search by using a third parameter, time, and to make the text search parameter work on contact names and post titles too. This means that users will be able to search by time, sender, free text or any combination of those parameters.
- To create more value for the users and to get a more coherent design we made it possible to display images and gifs in the search results when searching for a specific contact's messages. Before, these messages were only depicted as a search result without any content.
- Fix the usability issues with the scroll-to-result functionality that was very well received by test users but did not always work as expected. The scroll-to-result functionality was extended to also work when the user has searched for a post and not only for messages.
- To help users understand the order of search results and to give them the option to customize their search result page, a time sorting function was added.
- Increase the findability of the "Show more"-button in search results exceeding the 400 character limit by making it blue and adding a down-pointing arrow to indicate that more message content can be shown below.
- Lastly our main focus: Implement a new endpoint in the application programming interface (API) where messages are fetched from the database, so that we can search through more than 25 messages at a time. This will be a compromise between system latency, as fetching more messages will take more time, but will also provide a more consistent search experience, where users will not be confused as to whether their search has yielded any matches or not. This feature will also include a timestamp below the last message found, to indicate how far back the search functionality has gone.

7.1.1 Prototype

Below the different components of the prototype belonging to the second iteration and their functionality is presented.

Initiating a search

When initiating a search the flow shown in the last iteration (figure 6.2) was kept and an additional path to reach the search results page was added. When clicking the icon above the magnifying glass in figure 6.2 the user reaches a chat setting page where all the possible chat actions can be reached. In this iteration a option to search in the chat was added to the settings page as circumscribed in red in figure 7.2. The added option was made to fit with the current interface and when clicked it redirects the user to an empty search result page.

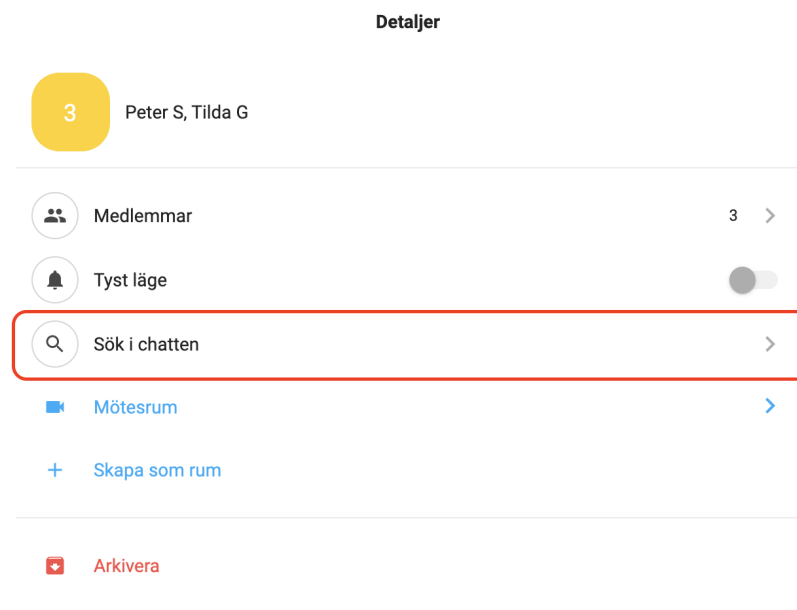


Figure 7.2: Option to search in chat added to chat settings.

Getting suggestions

One of the main requested features has been to add functionality to search by a specific time period to further customize one's search experience. In this iteration, we decided to include support for selecting a search time period by introducing a calendar option in the dropdown list, as shown in figure 7.3. This replaced the previous informative text prompting the user to press the enter key to begin their search. When the user chooses to click on this option, a calendar is displayed in the dropdown, showing the current year, month and today's date marked by a circle, see figure 7.4. The user can then navigate backwards and forward in time by clicking the left and right arrows, respectively. This interface was inspired by Discord's search-by-time functionality and chosen to avoid confusing users with different date formats and thereby hopefully preventing possible errors from occurring.

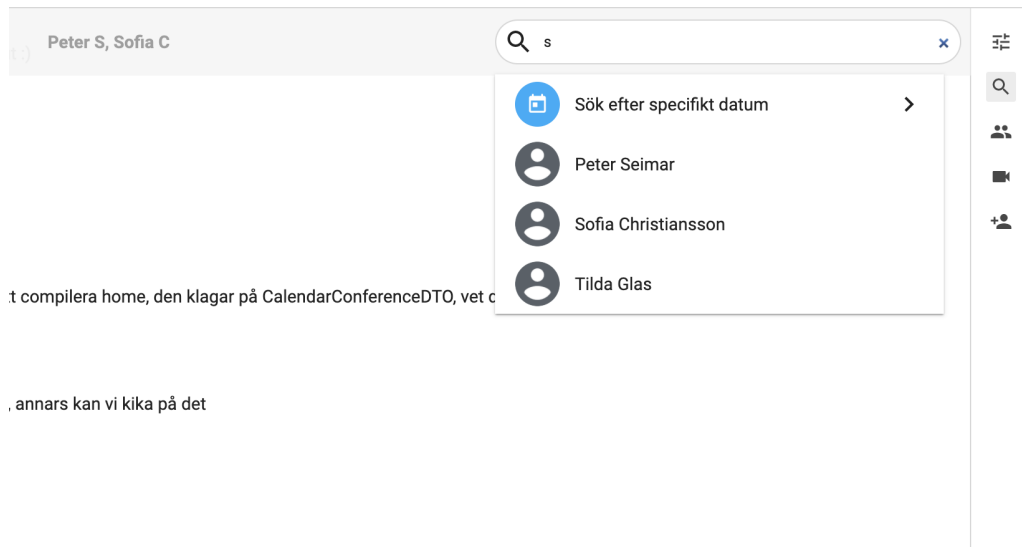


Figure 7.3: Possibility to search for a specific period of time in the dropdown list.

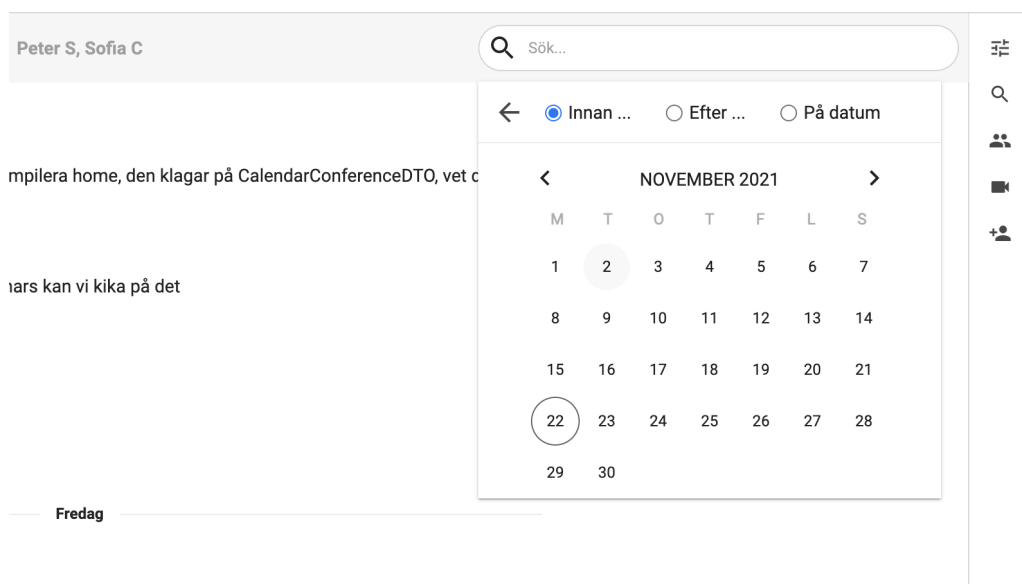


Figure 7.4: Calendar interface with different time period options.

Above the calendar itself, different search options for determining which period of time to search in are shown. These options include 'Before...', which will show all search matches before that date; 'After...' which will do the opposite and lastly 'On date', which will filter out all results except for messages sent on that exact day. Once the user clicks on a date in the calendar, the search functionality will immediately redirect the user to the results page, showing all results for the chosen time option applied to the clicked-on date, see figure 7.5.



Figure 7.5: Search results after selecting the 'Before date' option when using the search-by-time functionality.

Showing search results

In the first iteration, the consistency of the interface was interrupted by the varying number of search results shown for different chat rooms and search queries. This problem stemmed from the fact that the search algorithm could only find results among the last 25 messages and users had to click on the 'Show more' button repeatedly to retrieve more results. In this iteration, a dedicated search endpoint was added to the API, which allowed users to search among the last 500 messages instead. Using this endpoint, search matches will hopefully be more consistent across the application and not cause confusion when users enter queries that should show matches but nothing is displayed until 'Show more' has been clicked one or more times. To provide feedback for how far back matches have been retrieved, a timestamp for the 500th message has been added above the 'Show more' button, see figure 7.6.

Adding the new search endpoint also allowed users to view more results at a time without having to click on 'Show more', which was requested from the previous round of user tests as many users found that specific feature annoying.

Sökresultat för: spots testing

☰ Nya**st** först

Tilda Glas

2021-10-18 09:47

Thanks to everyone who has signed up for the usability **testing**! We have now filled all **spots**! 🙌🙏

Sofia Christiansson

2021-10-18 09:14

Hi! We still need to fill some **spots** for our usability **testing** on Wednesday, so if you are at the office and want to participate you can register at this link:
[https://doodle.com/poll/fq5aqmdkm7dusthh?
utm_source=poll&utm_medium=link](https://doodle.com/poll/fq5aqmdkm7dusthh?utm_source=poll&utm_medium=link) We appreciate all the help we can get!

Inga fler resultat efter 2021-04-22 kl 15:44

[Visa fler](#)


Figure 7.6: Search results for the last 500 messages when searching for terms 'testing' and 'spots', as well as the last match's timestamp.

Also visible in figure 7.6, right below the search field, is the sorting functionality. To address the initial confusion testers experienced regarding the sorting of results, a button to toggle the chronological sorting between newest-to-oldest and oldest-to-newest was implemented. In figure 7.6, the sorting is set to the default mode, which is showing the most recent messages at the top of the result list. This setting is labelled as "Newest first". Upon clicking the sorting button, the message list will be automatically updated to display the oldest matches first, switching the label to "Oldest first".

Sökresultat för: Sofia Christiansson

Sök...


☰ Nyst först



Sofia Christiansson

2021-10-18 09:14

Hi! We still need to fill some spots for our usability testing on Wednesday, so if you are at the office and want to participate you can register at this link:
[https://doodle.com/poll/fq5aqmdkm7dusthh?
utm_source=poll&utm_medium=link](https://doodle.com/poll/fq5aqmdkm7dusthh?utm_source=poll&utm_medium=link) We appreciate all the help we can get!



Sofia Christiansson

2021-09-20 09:24

Användartest av prototyp!

Hej! Vi söker nu mer input till vårt exjobb och behöver användare som vill testa några enkla prototyper vi har gjort för sökfunktionen till chatten. Om ni känner att ni har en halvtimme över på torsdag får ni gärna anmäla er på länken nedan. Testningen kan ske digitalt eller på plats beroende på vad du föredrar, ange för och efternamn när ni anmäler er så vi kan skicka ut en "Consent form" innan t

[▼ Visa mer](#)

Inga fler resultat efter 2021-08-06 kl 13:59

[Visa fler](#)

Figure 7.7: Search results showing both messages and posts when searching on user 'Sofia Christiansson'.

Figure 7.7 shows how posts versus regular messages are shown in the search result page, the result at the bottom is a post and the other is a message. In the previous iteration they looked the same and the post title was not shown which wasn't coherent with the existing interface. As can be seen in figure 7.7 the post title is shown above the post body separated by a thin divider and the title is in a different font and size compared with the body. In this case the post contains more than 400 letters and is condensed to only show 400 letters, if the user wants to see more they can expand the message by pressing the button "Show more". In this iteration the button is made more visible by changing the color, font size and adding the arrow icon. Figure 7.7 also shows how the users name is highlighted when showing search results for a specific user.

Choosing a search result

In the previous iteration the scroll-to-result functionality was very unstable and only worked in a few limited cases. By implementing the earlier mentioned endpoint it was possible to make the functionality substantially more robust. In this iteration the scroll-to-result works regardless of how many messages are currently loaded or which messages the user has chosen to scroll to. In the previous version the scroll only worked for messages and not for posts but in this iteration it works the same way for posts as for messages which is displayed in figure 7.8.

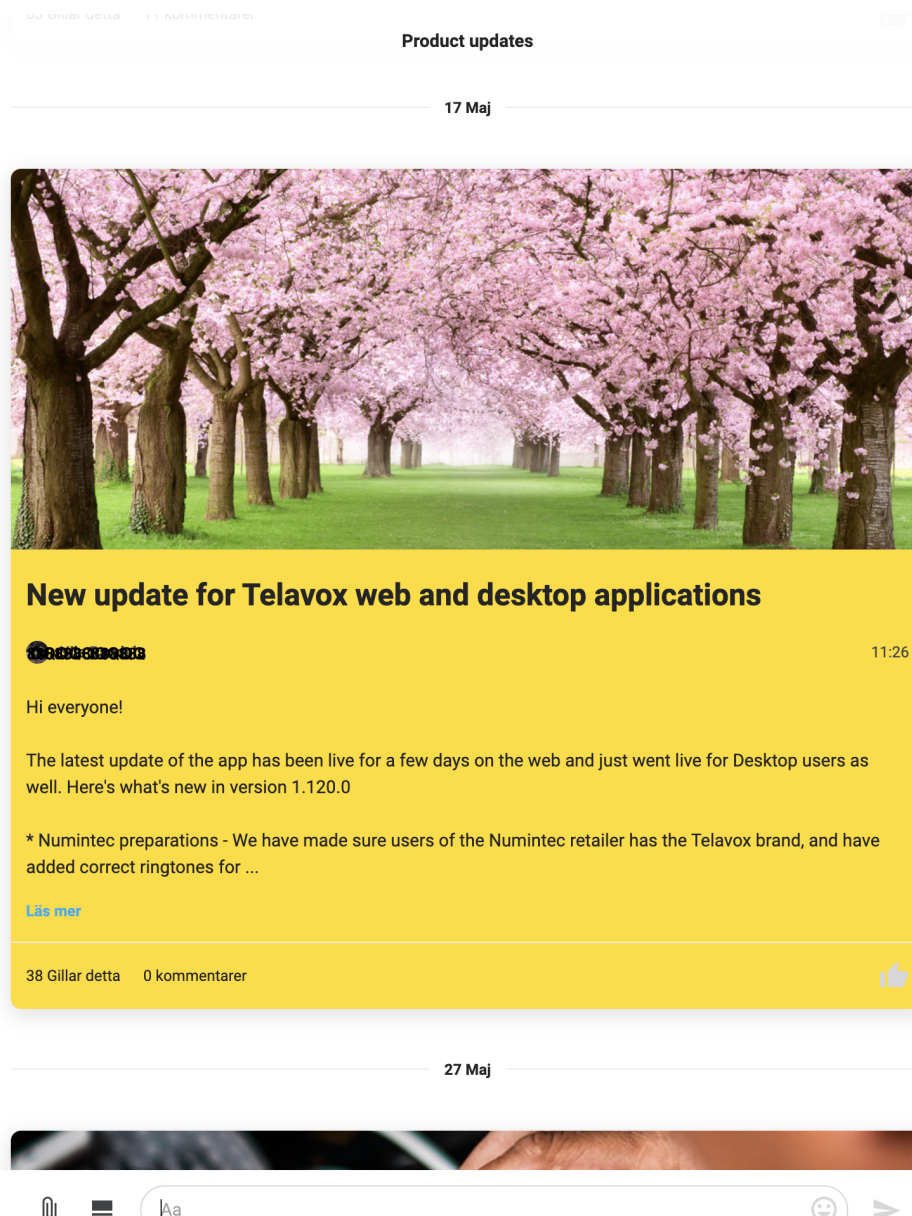


Figure 7.8: A post has been chosen as the selected search result and scrolled to.

7.1.2 Testing

Similarly to iteration 1, testing the second version of the hi-fi prototype was done with real end users, all employed by Telavox, and a pilot test was conducted before the real tests. The same procedure was followed, where all participants filled out an informed consent form (see Appendix B.2.) before the test. Once again, the test consisted of a set of tasks depicting fictional scenarios for the subjects to complete, followed by a SUS survey at the end. However, this time the user tests were followed by a few more semi-structured interview questions to collect as much user data as possible besides the tasks. One other change was to conduct tests through running the application locally, against a test database instead of the live version, as this iteration contained changes to the API that were not yet present in production.

Participants

Just as in the previous iterations a post was made in one of the larger chat rooms belonging to Telavox where a doodle schedule page was linked. In the post it was specified that persons from all departments, not only developers, that had not been participating in the previous test were welcome to take part in the user test session. It was decided to do this test in person and not online because it would be very difficult for the testers to interact with our interface over link. We figured it would be near impossible to have the testers running our interface on their own computer. This was because they would have to checkout our git branches and if their role at the company isn't as developers they wouldn't have access to the company's git repository.

For this test session it was easier to recruit testers, probably because almost all teams and departments at Telavox were back to working at the office again. The test group consisted of three women and five men, none of which had participated in the earlier prototype test sessions. Three testers were between the ages of 20 and 29, four testers were between 30 and 39 and one person was in the age group 40 to 49 years old. Exactly half of the test group, four people, were working at Telavox as software developers. The other half was working at other departments: UX design, Graphical design, team-lead for technical support and the sales department.

Test setup

The tasks in this round of user tests closely resembled those from the last time, with a few adjustments made to ensure participants could explore the new features added. During the previous tests some participants struggled with task 2 and 3, which were thus replaced with an entirely new task intended to fulfill the same purpose.

1. You are a master's thesis student working at Telavox and have forgotten which days your stand-up meetings are. Try to find this information using the search functionality.
2. You want to view all messages that Person X has written in this chat, please use the search functionality to do this. *After the participant has completed the first part:* You remember that Person X wrote something about survey(s), please find these messages.
3. You're feeling nostalgic and are curious to find out when Person Y wrote their first message in this chat, and what was in that message. *After the participant has completed the first part:* You now wish to get more context for this message, find out what Person Y responded to.
4. You now wish to display all product update posts before June 2021 and read about one of the updates that were made in May.

The semi structured interview questions each participant was given to answer were the following:

- What is your opinion on the number of search results that were displayed at a time and how they were displayed?
- Was there anything in the search functionality that surprised you or didn't work as you expected it to?

- Do you think the search functionality fulfills all of your search needs or is there anything missing?
- Do you have any other comments or thoughts?

Results

The intention for user testing the second iteration was to let participants explore the various search features that had been implemented, uncover any remaining usability issues and be able to evaluate the overall user experience. Results will be presented in the same way as in the previous iteration: firstly with regards to our main focus points, then with the addition of the answers to the semi structured interview questions and lastly the SUS scores.

- Adding possibility to search from the general settings page did not make much of a difference for the participants in this round of tests. All users were quick to find the search icon in the right-side menu and thus no one had to locate it in the general settings menu. We do however believe that not including it there would disturb the flow of the app as it would interrupt the pattern where all right-side menu options can be found through the general settings page. Other consistency improvements that were made, such as displaying search results more in line with how normal messages are displayed didn't elicit much of a response from testers either. This was expected though, as no participants in this round had tested the previous iteration.
- In general, the response to the search-by-time feature was very positive. All participants found the feature very quickly when asked to search for messages sent before a specific date (task 4), with the exception of one person who instead started to type in the date directly as text. When that person's attention was redirected to the calendar option in the dropdown list, they managed to complete the task without any further problems. Other than that, there was one aspect of the search-by-time feature that did raise some questions. As testers were asked to search for messages sent before June, it was not immediately apparent whether the right choice was to search for messages sent before May 31st or before June 1st. Although this choice didn't make a big difference for completing the task, there should still be one definitive way to anticipate the system's response to one's actions, thus the presentation of time options could unarguably be improved.

We did also notice an improvement with how easily testers were able to find messages sent by a specific person, as they could now type in that person's name without having to click on their avatar in the dropdown list. A majority of testers still used the option from the dropdown but this could be due to the fact that in all tasks where testers were asked to search for a specific person, they did so in a small group chat where all members could fit in the dropdown menu directly. In some of the bigger chat rooms, there can be hundreds of members meaning that users would have to scroll in the dropdown or start typing in the name of the person they're looking for before they can see them in the list. As a few of the testers started typing in names before noticing the avatars, we do believe that this feature will be of value to users in the future.

- Unfortunately, the inclusion of gifs and images in the search results could not be evaluated properly as no images are loaded into the test database, which was the one used for these tests. As this was not an integral part of the search experience, considering

how it isn't even possible to search for message attachments in the current implementation, we don't believe that the inability to view images will have made any significant impact on test subjects.

- Once again, users were appreciative of the scroll-to-result feature. Two testers even mentioned that they were "positively surprised" by this functionality. This being said, four out of eight testers expressed confusion as to whether results were even clickable in the first place implying that the findability of this feature could be increased. In the current version, results are slightly darkened when hovered over but nothing else suggests that they are clickable. Several participants suggested that the cursor should be switched from the usual arrow to a pointing hand when users hover over search results to indicate that the results are indeed clickable.

One tester strongly disagreed with the choice to highlight clicked-on search results and questioned why this was relevant. In their opinion, it made no sense to highlight the chosen result as no other search matches were highlighted when being redirected back to the chat. No other participants expressed any negative feelings towards this feature but rather left very positive feedback.

- All test participants were able to find the time sorting function when tasked with finding a sender's oldest message in the third test scenario. There was one suggestion to change the sorting icon to an arrow either pointing up or down, depending on which sorting option the user has chosen, which would improve the system's feedback on user actions.
- Since a new API endpoint had been implemented to retrieve a total of 500 messages at a time, the system's response times were negatively affected, as expected. It was difficult to tell which delays were dependent on the larger workload and which were due to the fact that we were running the application in a slower, local environment. Through testing, it was apparent however that users were confused when shown the "No more results" view as the application was loading messages. A few testers responded quickly to this, by starting to rewrite their queries before results were displayed. As messages are fetched within a few seconds, they quickly realized that entering another query was unnecessary but still found this behaviour disconcerting. One solution could be to show a "spinner", i.e. an animated loading interface which suggests to the user that the system is still working and prompts them to wait for the results.

Answers to the semi structured interview questions can be summarized as follows:

- *What is your opinion on the number of search results that were displayed at a time and how they were displayed?* Much like during the previous user tests, participants were divided on this question. Six testers liked the number of results displayed in the current version of the system, with no set limit, whereas two testers wished to see fewer results at a time. Concluding from two rounds of hi-fi tests, 77 % of end users do want to see as many results as possible which is a clear preference for the way search results are displayed as of this version. Other than that, the answers indicated that results were presented to users in an intuitive way that was easily recognizable from comparable search features in other web applications. No users thought that the text snippets shown in the results, which were up to 400 characters long, were too lengthy.

- *Was there anything in the search functionality that surprised you or didn't work as you expected it to?* A few testers expressed confusion regarding the user avatars shown in the drop-down when initiating a search. One person mentioned that it was not apparent what clicking an avatar would lead to, even if they could guess what the response would be. Considering how the first option, "Search by a specific date" is more instructive, the contrast between the two is perhaps too strong as there is no additional text informing the user how to search by sender. Except for the above issue, participants mostly reported that they were "positively surprised" by the search functionality features and that it worked better than they had expected. This response can possibly be attributed to the fact that all testers are longtime users of the application and have (as expressed during the interview) longed for this feature to be released.
- *Do you think the search functionality fulfills all of your search needs or is there something missing?* Four users wished for some way to tell how many search results had been found, to determine whether there is a need to further refine queries that yield many results. Another feature requested by two testers was to include a time-span search with the option to search for the period between two dates when using the search-by-time functionality. Lastly, two people wanted the search to be automatic, i.e. not having to press enter to initiate a new search. Apart from these wishes, other answers were only mentioned by one person and could be interpreted more as suggestions rather than actually crucial search features.
- *Do you have any other comments or thoughts?* This question was mostly met by positive feedback and requests for the search functionality to be released as soon as possible. Several testers also said that they hoped for the search functionality to be made global in the future, which means that users would have the possibility to search in all chats through one interface. The current version isolates the search to one chat or public room only, which limits users when they don't know in which chat to search for a certain piece of information.

7.1.3 Evaluation

After the test and the interview questions the participants filled out the survey with the system usability scale form shown in Appendix C, exactly the same as in hi-fi iteration one. The aggregated system usability score was compiled to 93 and the individual scores ranged from 80 to the maximum score of 100, see figure 7.9. In the previous iteration a score of 83 was obtained and as discussed before, a good score is above 70. This shows that the current prototype is well approved by testers and deemed as having a better usability than the earlier prototype. From the figures 6.10 and 7.9 it can be determined that all but one of the individual scores from iteration two were equal to or greater than the highest score from iteration one. Another factor that could be calculated from these figures is the median of both iterations which also increased by 10 points in iteration two. In iteration one the median was a SUS score of 85 and in iteration two 95.

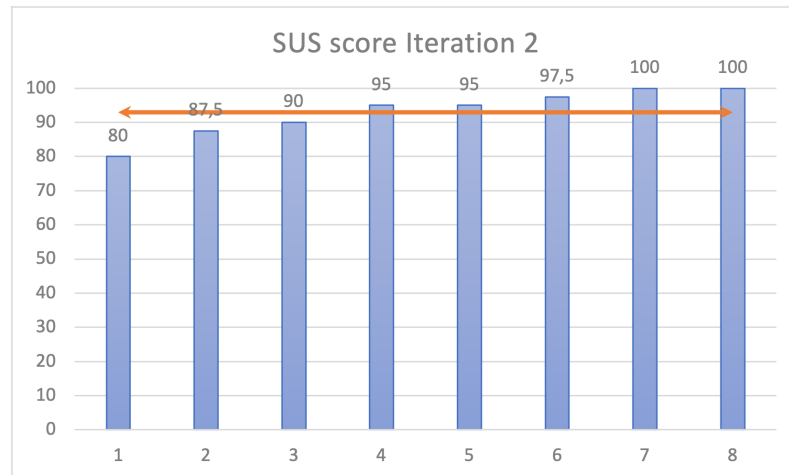


Figure 7.9: The individual SUS scores with the mean score of 93.

Four of the statements in the SUS form scored a little bit lower than the other ones but higher compared to the previous iteration. On these statements, three of the test subjects scored a four or a two when the others scored a five or a one. The first of these were *I think that the search functionality is too complex* which can relate to the different search parameters the users get to choose from. When speaking to test subjects during the different tests and from the survey results it can be concluded that the most used parameter is search by text. For the users that only want the search by text option, adding the other parameters could be perceived as a too complex functionality and not useful for the tester.

Of the remaining three statements, two were closely intertwined with the first one: *I think that the search functionality is easy to use* and *I think that most people would learn the search functionality quickly*. A correlation that could be determined was that the testers who put a lower score on the first statement put a lower score on one of these statements or in one case, on both. If a tester is of the opinion that the search functionality is a little bit too complex it makes sense that they also think that it could be difficult to learn or to use.

The last statement was *I think that the different parts of the search functionality is well integrated*. This got a lower score in previous iteration too but the score was definitely better in this iteration. As mentioned above one tester didn't like the highlighting in the scroll-to-result and thought that it bothered the search experience. Another tester thought that the ordering of the search result wasn't intuitive and some of the testers had trouble with understanding that the results were clickable. All of this could be reasons why some testers scored this statement lower than the other ones.

Regarding the different aspects of the search function's user experience some comments can be made. The majority of the testers expressed that they hoped for the search functionality to be incorporated into the real product and that they very recently had wished for this functionality to exist. This, together with a very high score on the first statement of the SUS (*I believe that I would use the search functionality regularly*) tells us that our search functionality seems to be useful and create value for the user.

The findability is higher than in the previous iteration but could still be even better according to the SUS score on the statements discussed above. Especially the trouble some had with understanding which components were clickable shows that there is still some improvement to be made. The credibility of this prototype seems to be very good, all of the

participants answered the highest score on the statement *I feel safe using the search functionality*. Lastly regarding the desirability it was harder to draw any conclusions but the majority of the testers said that they were pleasantly surprised by how nice it looked. The only bad comment regarding the desirability was the tester that disliked the highlighting in the scroll-to-result feature and thought it was a warning of some sort.

Main Takeaways

- To ensure that all of the main search functionality features can be easily discovered, search results need to appear clickable or users might miss the opportunity to be redirected to the context of a search match. Users have continuously, throughout the research done in this thesis, reported that context for their searches is among the most important of their search expectancies, as the ultimate goal of the search could be to find the answer to a question that was asked, or to view a discussion in its entirety. Once users found the scroll-to-search, they expressed their content with the functionality which proved to be one of the most appreciated features in the search interface.
- Although the main feedback on the search-by-time feature was positive and users seemed to have no trouble figuring out how to utilize it, improvements such as adding more time options than before/after/during and clarifying which exact dates are included or excluded in these searches should be made.
- Retrieving more messages than the original 25 reduced inconsistency when displaying results and provided test subjects with a more realistic notion of which results their search query had yielded. Even though a loading interface should be added to indicate that the search is underway, further work needs to be done in a production environment to find the true sweet spot for how many messages can be fetched at a time, without having too much of a negative impact on the user's patience.
- The results from this thesis indicate that users interacting with search-in-chat results pages wish to not be limited when viewing search matches, neither in number of messages shown nor length of message snippet displayed.
- The current version of the search feature seems to fulfill the most common user search needs to a satisfying extent. Users in this prototype are able to search by free text, including one or more words; any number of different senders; a specific date or alternatively, the time before or after a chosen date; and lastly, any combination of these parameters to get an even more precise search. As mentioned in the above results section, the response to the available features was highly positive and well in line with the expectations set in our initial user studies.

Chapter 8

Discussion

This section will discuss and evaluate each of the phases in the design process. Successful as well as less effective aspects of the process are lifted in order to understand strong points in the thesis or where results might have become less reliable. Design process activities will be motivated and evaluated based on circumstances and limitations, in order to understand which decisions have been helpful or disadvantageous to the research goals. Lastly, results from each respective iteration will be discussed and compared with each other to evaluate the process as a whole.

8.1 Investigation Phase

The objective of the investigation phase was to gather a substantial amount of data about the users, their needs, search functionality in general and chat search functionality in particular. The data was collected using several different methods including a survey where the end-users thoughts and needs were mapped out and a focus group concentrating on doing a competitive analysis using the heuristic evaluation principles. Lastly the existing search functionality guidelines were studied in order to lay a foundation to proceed from.

8.1.1 Survey

More than a third of the employees at Telavox responded to the survey and both the gender and age division among the respondents were representative for the company. The survey showed that a great amount of respondents had worked at Telavox for a long time which means that they have a lot of insight in how they want to use the chat tool. This was great for the thesis research purposes because the functionality was intended to be used by people who have to use the chat on a daily or weekly basis. However, it would have been great to ask customers outside the company as well to get a more diverse user group.

One aspect that could have influenced the responses was that a great amount of employees at Telavox have expressed that the search functionality is a very coveted feature. This may

have affected who chose to respond and what they responded. For example, when asked about which search parameters the respondents would like to use very few answered that they would never want to use a specific parameter when searching. This could have been influenced by the fact that the respondents indeed wanted a search functionality and therefore gave the survey a more positive answer. But this probably also led to the survey having a great deal of nuanced free text answers on the additional thoughts question and this provided valuable information about the user needs and wants.

Another point that affected the surveys result was the fact that few of the respondents had used the search functionality in Slack and Discord. This led to problems when trying to analyse the responses and made it difficult to draw any conclusions from these answers. Instead the main analysis of competitors was made in the focus group session.

8.1.2 Focus Group

The focus group session gave great insights about the liked and disliked features of the competitors' similar applications. Considering the time limit of an hour, it was decided to focus on the competitive analysis and to follow the principles of heuristic evaluation in order to get a structured discussion. This yielded a good result and during the session the participants quickly found elements they thought had less good design.

In the chosen group the participants had an above-average knowledge about technology much like the end users, this was to get the most accurate picture of the feelings towards the different applications. If the user group had been more diverse when it comes to their technology knowledge it would probably have been better to have recruited a more diverse group in this aspect. The participants differed from most of the end users in one regard, they estimated that they have the need to use a search function in a chat one time every fourth month. This could have affected the result because someone that don't feel much need for searching can have other demands on the search functionality.

In order to avoid moderator bias we tried to formulate the initial questions without adding our personal values and to further stick with principles of the heuristic evaluation and not interpret the discussions. This was possible to do because the chosen participants were all comfortable with speaking in a group and with letting others speak their mind. A consequence of this was that the discussion proceeded smoothly throughout the session and the moderator didn't have to intervene which minimized the risk of introducing bias. However, taking notes of spoken conversations always follows a selective process, where not everything that has been said can make it into the records. Nuances in statements may also have been lost during transcription, creating a gap between what participants have expressed and what they actually mean or feel.

8.1.3 Search Functionality Guidelines

It was hard to find relevant and reliable literature regarding the search functionality guidelines in a chat tool. Many of the sources found either discussed search functionality in a web shop or search engines. Because of this, quite a lot of time was spent combining and comparing different sources discussing search queries, general search functionality design and search result displaying. In retrospect this gave us many valuable hints and a solid base to work with in the prototypes. The placement of the search box and the highlighting that

were found in the literature were features which were appreciated by most testers during the different iterations.

8.2 Mid-fi Prototyping

To start off the developing phases, a mid-fi prototype in PowerPoint format was deemed the best possible approach. This decision was based on factors such as adequate knowledge of the pre-existing requirements, as search functionalities as a concept are well-known to most computer users, and the high availability to a subset of our target end user group. Moreover, the prototype was only designed to explore different "flows", rather than incorporate all possible features that had been outlined during the investigation phase. As the time set aside for this phase was only one week, this was most likely a sound decision. However, it also left us with a few blank spots going into the first hi-fi iteration, such as how to display search options.

Overall, the user testing went well, given the circumstances. The sessions that were conducted remotely did however lack in some aspects. Although users were instructed to think aloud, interact with the prototype the way they would a real website and explain their way of thinking, most testers disregarded this and went straight to clicking back and forth between the slides. Consequently, it was difficult to interpret which elements they would have interacted with in real life, and where issues would have arisen. One way to avoid this could have been to use a dedicated prototyping tool where users would be forced to click on the correct design elements to achieve their goal. This approach was considered as an alternative but ultimately not chosen due to time constraints. In hindsight, it would most likely have given us slightly more valuable insights than using a PowerPoint presentation did. Nevertheless, as the main goal of this phase was to understand which flow of actions felt most natural to users, the results obtained were definitely enough to continue our work.

8.3 Hi-fi Prototyping

As explained above, the general knowledge of our problem domain was considered high which led to the hi-fi prototypes to be implemented as a fully functional part of the application, in code. Another aspect that weighed into this decision was the nature of the task, where the ultimate goal of the search functionality was to integrate it into the already existing application. Had the prototype been implemented using other prototyping tools, the very feasibility of various search functionality features might have been compromised. Writing the prototype in code also gave us a chance to explore the general feel and established conventions in the application. Undoubtedly, implementing the search functionality using existing components and features of the app gave the finished prototypes a more true to life feel as well as increased overall consistency.

The trade-off in this case would be the amount of time spent on developing the prototypes which was certainly higher than if we had chosen a prototyping tool. Coding the prototype did lead to some bottlenecks, such as the scroll-to-result feature and retrieval of messages, which took much longer than expected to implement. Furthermore, there might have been search features and design choices that we failed to consider due to the limitations of the

current application and its workings. All things considered, developing a fully functional prototype still proved satisfactory to this thesis as all planned features could be completed and tested well within the time set aside for the hi-fi phases.

8.3.1 Hi-fi Prototype 1

For the first prototype, the aim was to include support for minimum requirements established in previous phases such as searching by free text and displaying matched results. Since this could be implemented fairly quickly, the decision was made to add the feature to search by sender and a first version for scroll-to-result. During development, inspiration was also taken from the competitive analysis to avoid usability issues with other applications, while simultaneously learning from their more successful aspects. A major focal point was also to explore which pre-existing design elements could be used, for reasons explained above. One drawback during this phase was that some conclusions drawn from the mid-fi user testing could not be carried out in the hi-fi prototype. After discussions with one of the UX designers at Telavox, it was apparent that frequently used features of the current application would be incompatible with the preferred design flow of the mid-fi prototype. Had the only objective of this thesis been to develop a freestanding search functionality this would not have been an issue but since application features are often added piece by piece as user needs are reevaluated, there has to be a compromise between different design aspects in order to make a coherent application.

A few issues that are worth noting regarding the usability testing in this phase are the following:

1. The number of test subjects amounted to the smallest acceptable group, five people, which meant that opinions on some topics varied greatly between participants.
2. The testers made up a comparably homogeneous group of all male employees working at the same company, out of which a majority (80 %) were developers.
3. Because the hi-fi prototype was implemented in code, it suffered from a few bugs which could be of distraction to the users when completing tasks.

Out of the problems described above, the first was mitigated by mainly considering opinions that were expressed by more than one tester. By doing so, helpful comments were possibly omitted from the main takeaways that were used as a guide for the next iteration. Nonetheless, choosing which suggestions to include or not out of the individually contributed ones was determined too volatile a process to go with, subject to bias and cherry picking from the authors' side. The small sample size may also have had an impact on the number of usability issues discovered. As has been explained in the theoretical part of this thesis, there is some evidence that suggests five participants may be far too few to uncover enough usability problems. Considering that participants made at least one unique comment each, including a larger group of test subjects would likely have been a better course of action, as this would have given us the opportunity to pick up on more trends.

Secondly, lacking diversity amongst testers may have affected the types of problems that users experienced when using the prototype. Needless to say, testers who have been using, or even developing, the application daily for several years are less likely to run into problems

(even with new features) than novice users are. Additionally, the fact that all testers were employed by the company behind the application being tested may have made them less critical than, for example, a customer actively paying for the product.

Lastly, all major bugs in the prototype were known to us beforehand, meaning that we could inform subjects of these issues in advance and ask them to disregard these specific problems when completing the assigned tasks. However, it was noticeable that the prototype didn't always behave and respond as expected, making it hard to tell how affected testers were when answering the SUS Scale survey for example. It should also be noted that having the prototype fully implemented in the real application may also have contributed positively to the participants' impression of the product, as it presumably looked more finished than another prototype would have, making users more receptive to accept the functionality as a valid part of the application. The final System Usability Scale score landed on 83, which places the prototype just below *Excellent* in the adjective rating system and well above the acceptable level, which is hopefully an indication that even though certain external factors might have dragged the number up or down, the first prototype still provided users with a satisfactory experience.

8.4 Hi-fi Prototype Iteration 2

The main focus when starting with the second prototype was to further improve the user experience with valuable insights gathered from the previous user test and to get rid of the unwanted bugs that affected the users during the test. Many of the bugs and usability issues derived from only being able to process 25 messages at a time and the goal of increasing this number to 500 was to improve consistency and overall usefulness of the search feature as users would be able to see a representative amount of search matches without having to click a button to load more messages. By also including sorting and search-by-time options, the prototype included support for all of the most frequently requested features from the user studies.

Thanks to a larger group of people being back at the office, the recruited test group was both bigger and more diverse than the previous iteration, with eight people in total, three of which were women and only half working as developers. This possibly helped resolve some of the issues brought up above, such as identifying trends among test subjects' opinions and comments.

When comparing the SUS scale results between the two iterations, there are two statements that stand out: *I think that the different parts of the search functionality are well integrated* and *I think that it is too much inconsistency in the search functionality* which both got low to average scores in the first iteration and almost exclusively high scores in the second. Considering that the deliberate intention in iteration two was to increase consistency and resolve bugs (which likely made the functionality feel poorly integrated), the problems and user needs identified in the previous round of testing are a good reflection of which aspects of the prototype failed to fulfill the usability statements. With an average SUS score of 93, which places the search functionality well into the *Excellent* category, we can definitely claim that the usability of the product was significantly improved between iterations and that the final prototype managed to fulfill the specified user needs.

8.5 Future Work

During all stages in this process where end-users have been able to give their opinions and suggestions one wish has continuously come up, the users want to be able to search through all their chats at the same time. It was decided early in the process that the scope for this thesis was to design a search functionality in one chat conversation and not across multiple. This decision was made in order to be able to focus on the research questions throughout the design process. For further development on this thesis it would be interesting to investigate how the conclusions in this thesis can be used when creating a prototype of the search functionality in the whole chat application. Many findings are probably applicable but the presentation of search results almost certainly needs to be changed in some way.

The same goes for designing for different screen sizes, some of the testers expressed that they almost never use the web application in full screen size. Also here the search result page probably needs to be redesigned in some way. A design challenge will be to find a balance between how small each result can be without losing important information.

In the user experience honeycomb (figure 2.3) one facet remains unexplored in this thesis, the accessibility. This was done deliberately, considering the time limit of 20 weeks and limited group of users to test the prototypes on. As an expansion to the discoveries in this thesis it would be interesting to use the principles of universal design [37] with the aim to improve the accessibility of the prototype.

Throughout this thesis research has been done about how to design the search experience in a chat tool but much remains unexplored. The prototype improved much in consistency and overall usability when the functionality to process 500 messages instead of 25 was added. But it is still a substantial limitation considering over 50 new messages are written in some chat rooms each day. To make a functionality that could be released to customers more work in fetching messages from the database needs to be done. The best possible outcome would be to find a way to search through all messages written in a chat conversation at the same time without compromising the user experience. When the search functionality has this capability further research about the SERP size and search result presentation can be made.

Chapter 9

Conclusion

This thesis has explored users' search behaviour on the web, specifically when using search in chat tools. The purpose of this study was to define a clear set of user needs when searching in the chat, to compare previous papers researching search behaviour on the web with the chat tool search experience and lastly to get a good understanding of how search results can be designed in order to fulfill the identified user needs. Findings from this work aiming to answer these questions are summarized below.

RQ1: Which search features are of value to the chat tool's users? Along every step of the design process, crucial requirements to satisfy user needs could be distinguished. The investigation phase helped outline the three major parameters that users wanted to search by: text consisting of one or more words, person/sender and time, in that order. The mid-fi phase made it clear that remaining consistent with the current graphical interface and conventions was of high importance to the tool's users, as well as being able to navigate to chosen search results. Lastly, the hi-fi iterations showed that providing an easy way to sort results and showing the total matches found would facilitate users' search experience even further.

RQ2: How does the current literature regarding the user experience searching on the web translate to searching in Telavox's chat tool? The findings in this thesis suggest that much like some evidence regarding the user experience when interacting with search engine results pages (SERPs), people searching in chat tools prefer longer search match summaries over shorter, reporting that this makes the information they are looking for easier to find as there is less need to click on results to validate that belief. Conversely, test users in this study were not negatively affected by viewing a larger number of results at a time, which is the opposite of what has been shown when users interact with SERPs displaying a large number of results per page. Therefore, we can conclude that the user experience browsing search results in a chat tool is in some aspects similar to that of interacting with SERPs and in some aspects not, though more research needs to be done on the subject.

RQ3: How can the chat tool search experience be designed to be both intuitive and easy for the user to interpret? The conclusions that can be drawn from the user studies and testing

results is that characteristics such as high findability and minimalist design minimizing the amount of clicks were highly valued by many users of the search functionality. In our design this was implemented by staying consistent with the Telavox application's existing design to make the search easy for users to discover and by updating search results whenever parameters were changed. Clearly showing which elements were clickable also proved to be important for letting users know which actions were currently available to them.

In comparison with other popular chat applications' search functionalities, feature-rich functionalities giving a good overview of results, such as Discord, was much preferred over simpler version such as Facebook Messenger. Finally, search functionality standards such as placing the search bar in the upper-hand right corner and increasing the information scent by highlighting matched terms and phrases proved intuitive and beneficial for guiding users through the interface.

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Appendices

Appendix A

Survey

A.1 Page 1

Hur gammal är du?

- under 20 år
- 20-30 år
- 31-40 år
- 41-50 år
- 51-60 år
- över 60 år

Vilket kön identifierar du dig som?

- Kvinna
- Man
- Ickebinär
- Annat alternativ
- Osäker
- Vill ej svara

Har du varit med och utvecklat någon del av Telavoxappen?

- Ja, delar av design (UX).
- Ja, jag har varit involverad som testare.
- Ja, utvecklat den (övriga delar).
- Ja, jag har varit med på annat sätt än ovanstående.
- Nej

- Annat...fritextsvar

Under hur lång tid skulle du uppskatta att du har använt chatten i Telavoxappen?

- Mindre än 1 år
 1 år
 2 år
 3 år
 4 år
 5 år
 Mer än 5 år

Hur ofta uppskattar du att du hade använt en sökfunktion i chatten om den funnits i dagsläget?

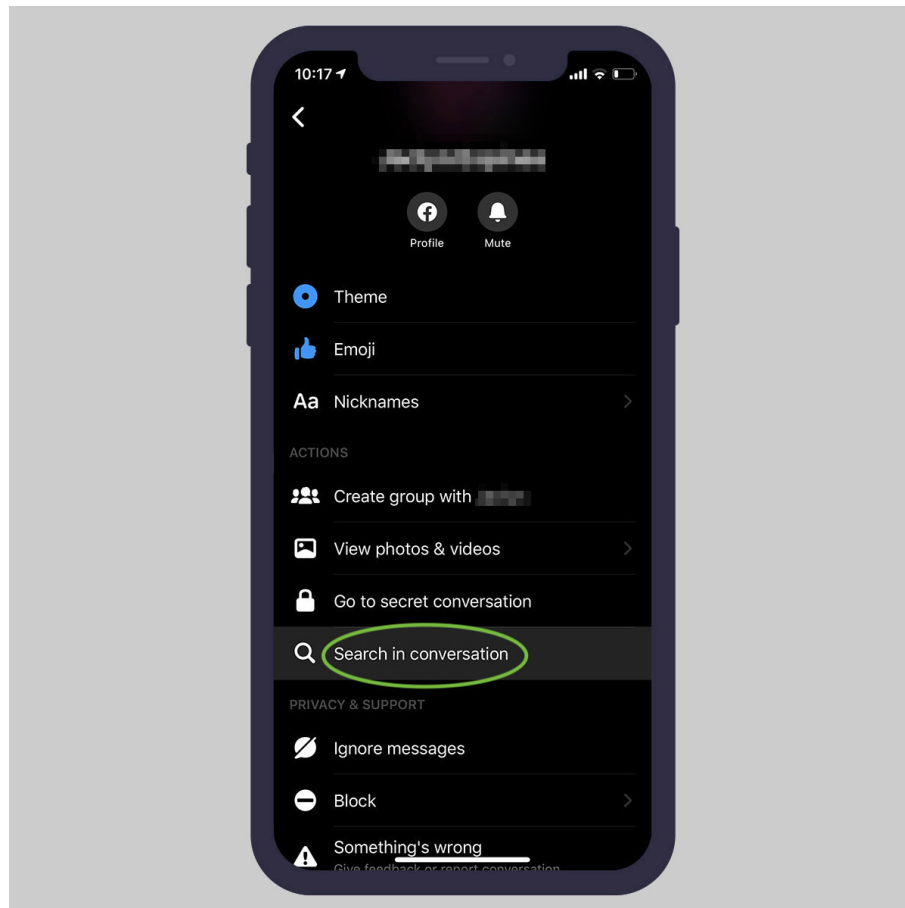
- Dagligen
 Flera gånger i veckan
 En gång i veckan
 Flera gånger i månaden
 En gång i månaden
 Någon gång om året
 Mer sällan
 Aldrig
 Vet ej

Om det funnits en sökfunktion idag, hur ofta hade du sökt med följande parametrar?

	<i>Aldrig</i>	<i>Mer sällan än svar je månad</i>	<i>Var je månad</i>	<i>Någon gång i veckan</i>	<i>Dagligen</i>
<i>Text i meddelandet</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Tid(Hoppa till en viss tidpunkt i chatten)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Person(Få upp alla meddelande en viss användare skrivit)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

A.2 Page 2-4

Funktionen för att söka i en konversation i Facebook Messenger:



Har du använt funktionen för att söka i en konversation eller gruppchatt i Facebook Messenger?

- Ja
- Nej
- Vet ej

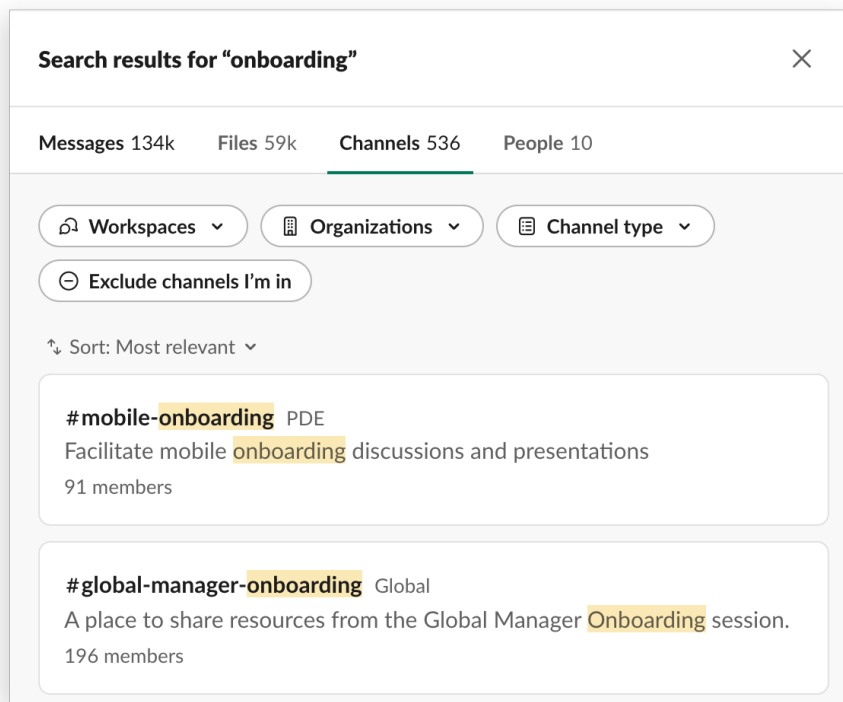
Om ja, hur väl tycker du att sökfunktionen i Facebook Messenger uppfyller dina behov?

- | | | | | | | |
|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------------|
| | 1 | 2 | 3 | 4 | 5 | |
| <i>Inte alls</i> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <i>Mycket väl</i> |

Har du några andra åsikter eller tankar om denna sökfunktion? (Valfritt)

Fritextsvar...

Funktionen för att söka i en konversation i Slack:



Har du använt funktionen för att söka i en konversation eller gruppchatt i Slack?

- Ja
- Nej
- Vet ej

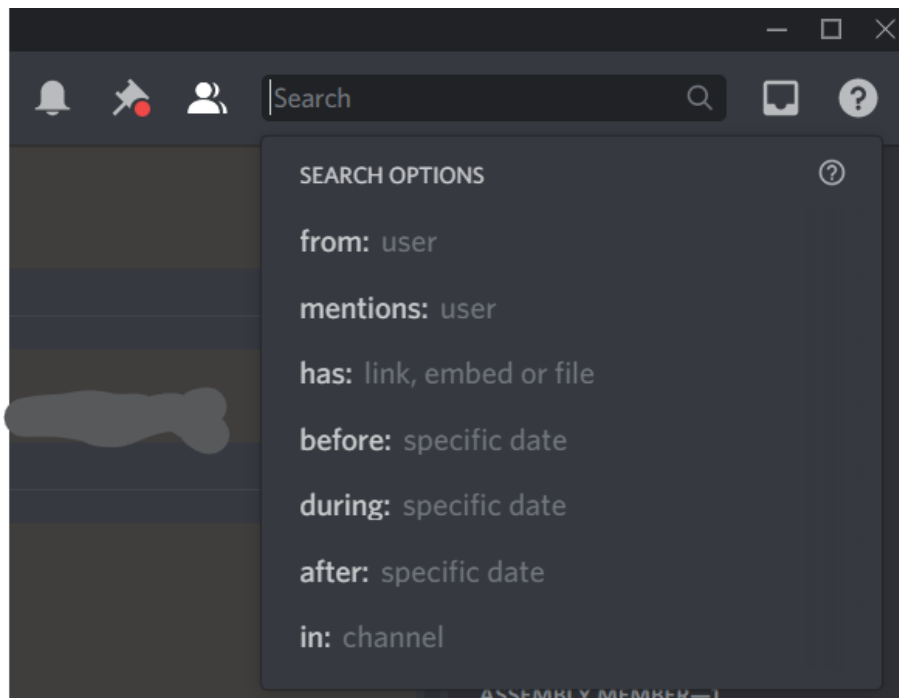
Om ja, hur väl tycker du att sökfunktionen i Slack uppfyller dina behov?

Inte alls 1 2 3 4 5 *Mycket väl*

Har du några andra åsikter eller tankar om denna sökfunktion? (Valfritt)

Fritextsvar...

Funktionen för att söka i en konversation i Discord:



Har du använt funktionen för att söka i en konversation eller gruppchatt i Discord?

- Ja
- Nej
- Vet ej

Om ja, hur väl tycker du att sökfunktionen i Discord uppfyller dina behov?

- | | | | | | | |
|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------------|
| | 1 | 2 | 3 | 4 | 5 | |
| <i>Inte alls</i> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <i>Mycket väl</i> |

Har du några andra åsikter eller tankar om denna sökfunktion? (Valfritt)

Fritextsvar...

A.3 Last Page

Har du några andra önskemål eller tankar om den kommande sökfunktionen till chatten i Telavoxappen? (Valfritt)

Fritextsvar...

Appendix B

Informed Consent Forms

B.1 Informed Consent Form Focus Group

Informed Consent

You are invited to participate in user studies and testing related to our master thesis at the Department of Design Sciences at LTH.

The purpose of our thesis is to create an intuitive search functionality for a chat tool provided by Telavox AB. Your participation will give us important information needed to create a user friendly function.

Your participation in this study is **completely voluntary** and you can at any given time choose to withdraw from the study without any explanation. It is okay to choose not to answer a question or participate in a discussion.

We will collect information about your opinions and experiences regarding search in chat in general as well as analysing the search functionality in Facebook Messenger, Slack and Discord. It will involve you testing different chat services and commenting your thoughts during the testing. The discussions and comments will be **documented in writing** and will also be **audio recorded**.

The notes and recordings will be treated as **confidential** and will only be handled by us, Sofia Christiansson and Tilda Glas, and possibly our supervisors at LTH and Telavox. Your comments/actions/discussion can be used in parts of our master thesis report and presentation but your information will be entirely **anonymized** and will not be able to be traced back to you.

The information gathered will be saved until we are done with our master thesis and then it will be deleted. If you at any time want your data to be **deleted** or if you have any **questions** about your participation, just contact us at:

so2877ch-s@student.lu.se or ti7462gl-s@student.lu.se

Please sign this document to show that you have been informed about and consent to the following:

- The purpose of the study and your participation.
- That the study is going to be documented in writing and audio recorded.
- That the participation is completely voluntary.
- How the information will be saved and used.

Place, Date:

Name:

Signature:

B.2 Informed Consent Form Testing

Informed Consent

You are invited to participate in user studies and testing related to our master thesis at the Department of Design Sciences at LTH.

The purpose of our thesis is to create an intuitive search functionality for a chat tool provided by Telavox AB. Your participation will give us important information needed to create a user friendly function.

Your participation in this study is **completely voluntary** and you can at any given time choose to withdraw from the study without any explanation. It is okay to choose not to answer a question or participate in a discussion.

We will collect information about your opinions and experiences regarding the prototypes we have created. The discussions and comments will be **documented in writing** and will also be **audio recorded**.

The notes and recordings will be treated as **confidential** and will only be handled by us, Sofia Christiansson and Tilda Glas, and possibly our supervisors at LTH and Telavox. Your comments/actions/discussion can be used in parts of our master thesis report and presentation but your information will be entirely **anonymized** and will not be able to be traced back to you.

The information gathered will be saved until we are done with our master thesis and will then be deleted. If you at any time want your data to be **deleted** or if you have any **questions** about your participation, contact us at:

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Please sign this document to show that you have been informed about and consent to the following:

- The purpose of the study and your participation.
- That the study is going to be documented in writing and audio recorded.
- That the participation is completely voluntary.
- How the information will be saved and used.

Place, Date:

Name:

Signature:

Appendix C

System Usability Scale Form

1. Jag tror att jag skulle vilja använda sökfunktionen regelbundet.

Håller inte alls med 1 2 3 4 5 *Håller helt med*
○ ○ ○ ○ ○

2. Jag tycker att sökfunktionen är onödigt komplex.

Håller inte alls med 1 2 3 4 5 *Håller helt med*
○ ○ ○ ○ ○

3. Jag tycker att sökfunktionen är enkel att använda.

Håller inte alls med 1 2 3 4 5 *Håller helt med*
○ ○ ○ ○ ○

4. Jag tror att jag behöver stöd av någon teknisk kunnig person för att kunna använda sökfunktionen.

Håller inte alls med 1 2 3 4 5 *Håller helt med*
○ ○ ○ ○ ○

5. Jag tycker att de olika delarna i sökfunktionen är välintegrerade.

Håller inte alls med 1 2 3 4 5 *Håller helt med*
○ ○ ○ ○ ○

6. Jag tycker att det är för mycket inkonsekvens i sökfunktionen.

Håller inte alls med 1 2 3 4 5 Håller helt med
○ ○ ○ ○ ○

7. Jag tror att de flesta snabbt skulle lära sig att använda sökfunktionen.

Håller inte alls med 1 2 3 4 5 Håller helt med
○ ○ ○ ○ ○

8. Jag tycker att sökfunktionen är besvärlig att använda.

Håller inte alls med 1 2 3 4 5 Håller helt med
○ ○ ○ ○ ○

9. Jag känner mig trygg i att använda sökfunktionen.

Håller inte alls med 1 2 3 4 5 Håller helt med
○ ○ ○ ○ ○

10. Jag kommer att behöva lära mig många nya saker innan jag bli produktiv med denna sökfunktion.

Håller inte alls med 1 2 3 4 5 Håller helt med
○ ○ ○ ○ ○

