Designing smart call forwarding

Creating a new type of product

Sebastian Karabeleski and Oscar Sigurdsson

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Designing **smart call forwarding**: *creating a new type of product*

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Authors:	Sebastian Karabeleski Oscar Sigurdsson	*dat12sk1@student.lu.se* *dat14osi@student.lu.se*
Examinator Lund University, Faculty of Engineering:	Joakim Eriksson	*joakim.eriksson@design.lth.se*
Supervisor Lund University, Faculty of Engineering:	Kirsten Rassmus-Gröhn	*kirre@certec.lth.se*
Supervisor Telavox AB:	Henrik Thorvinger Myad Tahajody	*henrik.thorvinger@telavox.com* *myad.tahajody@telavox.se*

Sammanfattning

Nya system skapar svårigheter då man inte kan använda redan etablerade metaforer, designer eller sätt att beskriva och prata om systemet. Detta arbetet ämnar att underlätta arbetet med sådana system genom att erbjuda designprinciper och metodiker för att jobba med dem och undersöka vilka svårigheter man behöver vara medveten om.

För att forma och testa nya designprinciper och metodiker så genomfördes ett projekt där ett system designades. Det som designades var ett molnbaserat växelsystem, som automatisk kopplar en ringare baserat på data i ett kalkylark. Datan matas in av en administratör som på så sätt enklare kan sätta upp och styra hur samtal ska vidarekopplas. När detta systemet designades så undersöktes kundernas behov och hur de beskrev sina behov samt så designades en mock-up och en fungerande prototyp implementerades. Under denna process så utvärderades designen av inspektioner och användartester.

Den största utmaningen under projektets gång var att få användaren att *förstå* produkten, vad produkten gör och nyttan med den. Detta var till stora delar på grund av svårigheterna i att hitta en bra metafor att använda samt att komma på termer och språk att beskriva systemet i. För att åtgärda detta så utvecklades och testades en ny metodik som kallades *söktest*. Det innebar att man låter användare söka på internet efter en lösning på ditt problem, medan man antecknar deras söktermer och tankar.

Det här arbetet utvärderar även hur det är att designa ett system med en tredjepartsprodukt som en del av användarupplevelsen. Framförallt så tyckte användarna att det var överraskande att byta från det egna systemet till tredje parten, detta orsakade förvirring och osäkerhet hos användarna. Därför så fann man att det var viktigt att tydligt och ofta informera användaren om framtida handlingar. En annan erfarenhet av vikt var att användandet av en tredje part gjorde det svårt att använda ”constraints”. Detta var till stort besvär för designen av användarupplevelsen och är något man bör tänka på när man väljer vilken tredje part man ska använda.

Abstract

One of the difficulties in designing new products is the absence of already tried metaphors, designs or ways to talk about the system. This thesis focuses on methods and practises one could potentially use when designing something new - and if there are any challenges one need to aware of as a designer of such a system.

In order to devise, and test, these practises and methods, an example system was designed. The system forwards calls based on data in a spreadsheet. The data in the spreadsheet is put there by an administrator. That way, forwarding calls based on their incoming number is made reachable. When designing this system, the authors investigated customer needs, investigated how the users described their needs, designed a mock-up and implemented a functioning prototype. During this process the design was evaluated through inspections and user tests.

The biggest challenge during the project was to *communicate the product* to the user which sets up the system. It was to communicate what the product does and the benefits with the product. Ultimately, it was hard finding an appropriate metaphor to use and to have terminology and labels which describe the system to the user well. To contest this difficulty, a new technique was developed and tested by the authors. The new technique, which was called a *search test*, let potential users search for a solution to the problem on the internet - while their choice of search-terms and comments were noted.

This paper also reviews designing with a third party as part of the user experience and the challenges that introduces. It was found that the users found it very surprising when the third party app was opened. Thus, it is very important to frequently and clearly inform the user of future behaviour. Another thing of importance was that using a third party disallowed the designers the use of constraints when the user was working in the third party application, this was found to be a severe hindrance and something to be mindful of when choosing which third party to use.

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Contents

Glossary

API Application programming interface. A set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.

CRM Customer Relationship Management. A system which is used log log information about a customer and it may include special features such as a soft phone or statistics analysis.

Flow The web-service provided by Telavox, which the prototype of this thesis is a part of.

GDPR The General Data Protection Regulation(GDPR) 2016/679 is a regulation in EU law on data protection and privacy for all individuals within the European Union and the European Economic Area. It also addresses the export of personal data outside the EU and EEA areas.

Jira Jira is a proprietary issue tracking product developed by Atlassian that allows bug tracking and agile project management. The product name is a truncation of Gojira, the Japanese word for Godzilla, which is a reference to a competitor, Bugzilla.

MVP Minimum Viable Product. The most independent and smallest product that can be released with the intention of receiving feedback from customers and following in that product's steps later on when the bigger products are developed and released.

PBX Private Branch Exchange. A telephone exchange or switching system that serves a private organization and performs concentration of central office lines or trunks to provide intercommunication between a large number of telephone stations in the organization.

ROI Return on investment. How much earnings, directly or indirectly you will earn back for making a certain investment.

UCD User-Centered Design. Technique where the needs and desires of the user is in focus when developing a product. See section 2.4.

1 Introduction

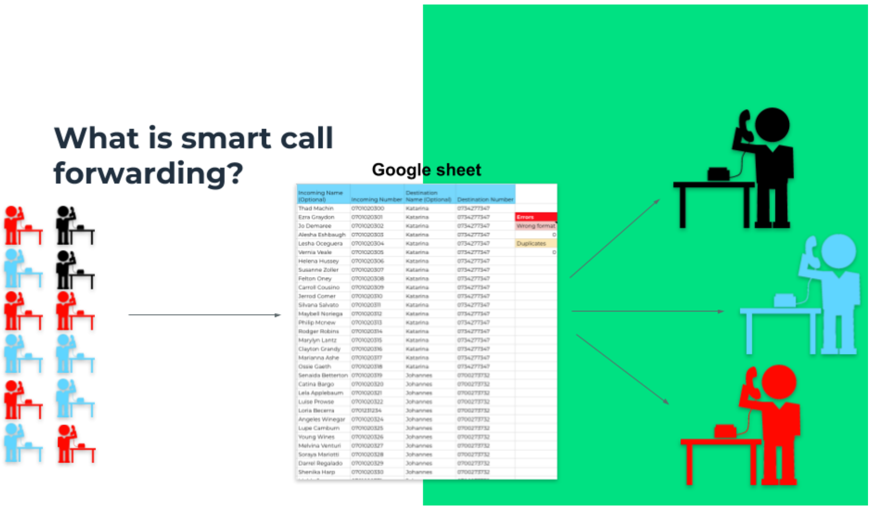
New products are designed all the time, everywhere, in every company. However, one seldom designs something completely *new* - everything new is more or less an evolution of something that came before. This means that, as a designer, one can make use of previously existing designs, principles and metaphors in order to inform design choices in the new product. There are, however, degrees of new. The first personal computer and the first smart phone are instances where the product does not work like any established, and marketable, product that has come before them. They released completely new types of functionality, and users can in those cases rely less on their previous experiences or previous knowledge of these kinds of systems. Before the ”desktop metaphor” was implemented for personal computers, users had to interact with a terminal - which is not that intuitive to use. The question is then: ”Are there any design techniques which are advantageous, when designing *new* systems - for which the user has no previous experience and a very general set of expectations?”.

In this thesis, the goal is to explore just that - if there are any design techniques and principles which may apply to specifically *new* technologies. In order to do this, an interface is to be designed for a cloud-based automatic routing system for telephony - something that has not been done on a commercial and wide market level before. Telavox, a developer of world-leading communications platforms with solutions for smart and efficient telephony, PBX, chat and much more[1], has previously developed the functionality for forwarding callers based on their incoming number. However, that project lacked an interface in which a customer is able to set the system up and modify its behaviour. In cooperation with Telavox, the authors will design the system, test it and document the challenges and potential solutions - to further the study of designing new types of products.

1.1 Automatic Routing

Automatic routing is, in essence, a way to redirect calls from one destination to another *automatically* - based on the callers telephone number. This system is intended to do so from a main company number to its employees. When a customer calls the company, the system checks if the calling number is in the database and, if it is, extracts were to route it. For example, if a real estate firm sets up this system, their customers could be routed directly to the correct agent when the customer calls the company main number. What the ”correct agent” is, is decided by the administrators of the system. It could be e.g. that every real estate agent's customer, when they call the firm, they get connected to their contact. The goal of this system is to save time and manpower, since one would no longer need someone dedicated to taking and redirecting calls, like a secretary. This system could also allow the company to present a more professional and streamlined experience for their customers.

The automatic routing system is controlled through the database, and it could be any kind of database. By allowing the administrator in the real estate firm to control the database, they can configure it to make it work the way they want it to.



Incoming Name (Optional)	Incoming Number	Destination Name (Optional)	Destination Number	
Thad Machin	0701020300	Katarina	0734277347	
Ezra Graydon	0701020301	Katarina	0734277347	Errors
Jo Demaree	0701020302	Katarina	0734277347	Wrong format
Alesha Eshbaugh	0701020303	Katarina	0734277347	0
Lesha Oceguera	0701020304	Katarina	0734277347	Duplicates
Vernia Veale	0701020305	Katarina	0734277347	0
Helena Hussey	0701020306	Katarina	0734277347	
Susanne Zoller	0701020307	Katarina	0734277347	
Felton Oney	0701020308	Katarina	0734277347	
Carroll Cousino	0701020309	Katarina	0734277347	
Jerrod Comer	0701020310	Katarina	0734277347	
Silvana Salvato	0701020311	Katarina	0734277347	
Maybell Noriega	0701020312	Katarina	0734277347	
Philip Mcnew	0701020313	Katarina	0734277347	
Rodger Robins	0701020314	Katarina	0734277347	
Marylyn Lantz	0701020315	Katarina	0734277347	
Clayton Grandy	0701020316	Katarina	0734277347	
Marianna Ashe	0701020317	Katarina	0734277347	
Ossie Gaeth	0701020318	Katarina	0734277347	
Senaida Betterton	0701020319	Johannes	0700273732	
Catina Bargo	0701020320	Johannes	0700273732	
Lela Applebaum	0701020321	Johannes	0700273732	
Luise Prowse	0701020322	Johannes	0700273732	
Loria Becerra	0701231234	Johannes	0700273732	
Angeles Winegar	0701020324	Johannes	0700273732	
Lupe Camburn	0701020325	Johannes	0700273732	
Young Wines	0701020326	Johannes	0700273732	
Melvina Venturi	0701020327	Johannes	0700273732	
Soraya Mariotti	0701020328	Johannes	0700273732	
Darrel Regalado	0701020329	Johannes	0700273732	
Shenika Harp	0701020330	Johannes	0700273732	

Figure 1.1: This image visualizes how smart call forwarding works. To the left are customers and to the right are the agents of those customers. The agents and customers are colour-coded, which means that the red customers are customers to the red agent. The customers all call the same number and then based on the database, in this case a spreadsheet, the customers are directed to the correct agent.

1.2 Background

In the spring of 2018, Atlasson and Hesslow, published a thesis[2] that made it possible to have automated routing using Google Sheets, a cloud based storage provider described in section 1.2.2. This solution enables a company to use a trusted third party as a host for the information needed to know where the call is getting routed to, in a format which is easy to communicate to a customer. Additionally, it would make it easy for small companies to use the automated routing, since a single person would be able to set it up and it would not require additional maintenance by Telavox. Automated routing should work like this: if a caller calls a main company line and, based on the callers incoming phone number, gets forwarded(or routed) to another specific number. What this can be used for is explored during the development of the product.

The problem is, there is nothing in place to make the system accessible to an end user yet. This is a completely new product on the market, a product without any given terminology or metaphor. There is no standard to create a product that has no comparison. How do you make somebody understand what something is, if it didn't previously exist?

Also, the person setting up the system in the end could be a small business owner, who does not necessarily have an IT department nor extensive computer experience. In order to make this solution into an usable and accessible system, the more precise needs of the users needs to be examined and the system will need to be adapted with usability in mind. What would this system need to do in order to satisfy the needs of the users and how would the system need to be designed in order to be usable for said users.

1.2.1 About Telavox AB

Telavox AB is a Swedish IT company in the telecom business, providing cloud based Private Branch Exchange(PBX)[1] solutions and mobile services for businesses. Their goal is to make simple enough for a small business owner to use but functional enough to satisfy larger company infrastructure. That is why they have customers in both market segments.

In 2003, the small start up company Telavox was founded by two students from Lund in Sweden, Viktor Karlsson and Fredrik Hedberg, and a management consultant, Marianne Wachtmeister. They had an idea to create a cloud based PBX service. Today the company has grown to a total of 25 offices in Sweden, Norway, Denmark, Finland and the UK. Telavox AB has over 240 employees and they are servicing over 250 000 users daily.

Flow

Telavox's main product is called *Flow.* Flow is an adjustable PBX solution with call and chat functionality, offering call forwarding from a local business number to a mobile. Flow also offers system for Telephone queues and for routing callers through your telephone system. Flow is usually interacted with through a web-app, which follows traditional material-ui[3] design patterns.

1.2.2 Google Sheets

Google Sheets is a free online spreadsheet app that lets users create and format spreadsheets and simultaneously work with other people.

Google has an open API[2], which makes it possible for developers to access proprietary software. Google's API for Sheets, specifically, manages actions one can do in a spreadsheet - for example CRUD[3] actions.

Since Google Sheets is so accessible, widely used, and has support to interact with the sheet via API calls over the internet, Telavox were interested in using the service with their new *automatic routing* feature. This would leave their customers with the freedom of using a third party spreadsheet application, to collaborate with their system.

[1] A private branch exchange is a telephone exchange or switching system that serves a private organization and performs concentration of of central office lines or trunks to provide intercommunication between a large number of telephone stations in the organization.

[2] Application programming interface - a set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.

[3] Create, Read, Update, Delete

1.3 Problem Statement & Purpose

The goal of this thesis is to explore designing a digital online product, specifically a automatic routing system.

This goal is realized through a process which leads to 3 Research Questions:

- Are there any design principles which apply specifically to designing *new* types of digital online products?
- What kind of issues does one need to be mindful of when designing a new type of digital online product?
- What are the challenges in designing a user experience with a third party integrated into it, specifically Google Sheets?

1.4 Related Work

This thesis is very much based on the work done by Atlasson and Hesslow[2], as mentioned previously. Their work contains the proof that third party cloud routing is viable and has an example technical solution. Their work also contains a use-case study and an example GUI that were used as a starting point for this thesis.

2 Theory

In this thesis we use several established practises and principles when collecting data and while designing the prototype. These practices and principles are explained here. Starting with data-gathering theory such as brainstorming and interviews, continuing with theory on design techniques and ending with theory on testing and inspections.

2.1 Brain writing

Brain writing is a silent and written generation of ideas by a group. Brainstorming as Osborns[4] describes it is, in contrast, normally an oral exercise. Brain writing is usually started with the team leader sharing the topic with the team, and team members individually writing down their ideas. This helps eliminate the anchoring bias and encourages everyone on the team to share their own ideas. It also gives everyone more time to think over their ideas, which is especially helpful for your introverted participants.

Brain writing is neither better, nor worse, than a typical brainstorming [5]. It does have the benefits of something like brain dumping, but has the shortcoming that critical evaluation is better done by objectiveness. To compensate for this shortcoming, one might discuss the ideas generated separately and possibly generate new ideas from those discussions.

2.2 Pain Points

Pain points are a way to talk about customer needs which is spread throughout start-ups and entrepreneurs [6, 7]. Shewan defines pain points as ”specific problem that prospective customers of your business are experiencing” and states that one may simplify it as simply problems [6]. Pain points are a way for primarily entrepreneurs to think in the terms of the consumer and to make sure that they understand the purpose of their product, instead of starting from what they wish to offer they start from what the product is meant to solve [7, 8].

By focusing on the pains when presenting the product to the user, one is also more able to present why the user would want to use it. This gives a product better chances to remain relevant for the consumers [9, 10]. in order to do this one has to also make sure that the pain point is something the customers care about and are invested in solving[7].

2.3 Semi-structured Interviews

Interviews are a qualitative way of gathering data focusing more on gathering a depth of data of subjective and exploratory data from a few sources rather than a quantity of measurable data. Semi-structured interviews are a subset of interview methods which combine structured questions and themes with the possibility to explore the answers of the interviewee [11, 12]. It is a well used method of data collection, especially in social sciences and anthropology from which the methods originated [13].

The quality of a semi-structured interview depends to a great deal on the interviewer [14]. There are therefore some criteria which is brought up by Hove and Anda [14] that frames what a good interviewer needs to do:

- Encourage the interviewees to talk freely.
- Ask relevant and insightful questions.
- Follow up and explore interesting topics.

Furthermore, Hove and Anda's research group has also in practise found several useful practises which contributes to better interviews, with point 1, 2, 4 and 6 reiterated by Horton et al [15]:

1. Use a tidy and well-organised process: schedule the appointments as early as possible and be flexible to changes.
2. Gain the trust of the subject: ensure confidentiality, explain your research motives, describe how the data will be applied and in which papers they are going to be used.
3. Be courteous at all times. Remember to thank the subjects for their contribution.
4. Be well prepared. Bring slides to the interview with the interviewee's name on, your research goals, a short presentation of the research institution you represent etc.
5. Take care with your appearance and make a good first impression. We have experience with two strategies; 1) dressing up to make a formal and serious impression, 2) dressing down to appear less threatening. A good rule of thumb is to dress at approximately the same level of smartness and formality as the interviewees. If the interview is conducted in the subjects' work place, it is beneficial to have an idea of the dress code in the company and adapt to it.
6. Allow the interviewees to view the questions in advance, so they can prepare for the interview.
7. Talk informally with the interviewees before or after the interviews to facilitate a friendly and relaxed atmosphere.
8. Use humour. This can contribute positively to the interview. Laughing together can create a more relaxed and open climate. However, humour and bonhomie must not be used excessively or in inappropriate situations, because it is important to project an image of gravitas and seriousness.

9. Be active and show interest by nodding, paying attention and asking follow-up questions.
10. Be careful not to argue or question the answers you get. The interviewee may become defensive and lose respect for you.

When it comes to collect the data many researchers hold taping as the method of choice in order to be able to transcribe it later and let the interviewer focus on the interview rather than on documenting what is being said. If the interviewee or the situation does not allow taping then manually written protocols suffice. In both cases Hove and Anda as well as Horton et al. recommend having two interviewers present and to divide the roles with one being responsible for asking the structured questions and the other focusing on probing with follow-up questions and observation.

2.4 User Centered Design

The term *User-centered design* was coined by Donald Norman and in 1986 became recognized in his and Stephen Drapers book *User Centered System Design; New Perspectives on Human-Computer Interaction*[16]. Since then the term has evolved and now represent techniques, processes and methods that starts with the end user's needs and abilities to the eventual implementation of the product [17].

UCD is described by six principles, in the ISO-standard 9241-210:2010 [18]:

1. The design is based upon an explicit understanding of users, tasks and environment
2. Users are involved throughout design and development
3. The design is driven and refined by user-centered evaluation
4. The process is iterative
5. The design addresses the whole user experience
6. The design team includes multidisciplinary skills and perspectives

2.4.1 Advantages with User-centered Design

By applying a user-centered design there is less time spent in redesigning the product, in later parts of the implementation. The product will be designed for its intended purpose in the right context. By involving the users from early on, information about needs, context and troubles can be revealed and influence the design in a way that would be hard to otherwise.

2.4.2 Disadvantages with User-centered Design

By involving the end users iteratively, the gathering of information about the user can make the design process more costly[19]. Although different competences can lead to more creative design solutions, competence may be required outside the primary development team - like representatives from marketing, or a usability specialist. It could also require a large amount of stakeholders, otherwise one runs the risk to develop a product aimed towards one specific user group, rather than bigger market segment [19].

2.4.3 Personas

Personas as presented by Cooper are detailed fictional users with goals and history which are made to represent an archetype of actual users[20, p. 82]. Personas are primarily defined by their goal and every persona used in a project has a different goal in interacting with the system being designed. These personas and goals are based on investigation of the users which is to make sure that they match potential real users.

When using personas one can use them to inform design decisions and help decide which tasks to prioritize. This methods allows the designers to keep the user in mind while not needing an actual user present [21]. It also helps the design team to focus on the actual goals of the user and prioritizing of those goals by selecting a primary persona as the most important one [22]. These effects lead to a design which is more user focused during the whole process even when users are not present, which leads to a design simpler to use for the users [22, 23].

2.5 Design Practises

2.5.1 Paper prototyping

Paper prototyping refers to the technique of, as the name suggests, creating a prototype of the user interface with or on paper. Paper prototypes can range from sketches of each screen to advanced tools, like Marvelapp [24], created to mimic the popular technique.

One big advantage with paper prototypes is that the user/test person does not focus on design choices like color, font or other aesthetic features, but on the labels and symbols that help the user know what to expect next. It is also inexpensive, both due to the material and due to the speed of which a prototype can be made - which makes the iterations rapid. It can be made before even a line of code has been written [17, p. 18-19]. The freedom of pencil and paper, unlike a software design tool, is that it facilitates new ideas and possibilities to experiment.

A big disadvantages of paper prototyping is that the gut reaction of the end user is hard to be replicated in paper prototypes. The user/tester presses whatever they wants in a test, and assumes it did it correctly. On the other hand, there's just no way to replicate the experience of using a digital product on paper, no matter how detailed it is [25, p. 275-283]. Paper prototypes require a great deal of imagination, which might not even match what the designer intends. In that case there will be inaccurate feedback.

2.5.2 Iterative Development

Iterative development is when one improves a design by making improvements in small steps and testing those steps along the way. The general idea is that a designer cannot design the perfect system instantly. Instead by testing more and in smaller steps the design gradually improves. It is cheaper to do big changes early and by testing iteratively one can find these problems early. Nielsen performed 4 case-studies to see the impact of this design technique and every iteration improved the usability scores by about 25% [26].

Another feature with iterative design is the fact that one starts to test as early as possible. The technique to start testing even before one has what could be called a prototype was dubbed pretotyping by Alberto Savoia in 2009 [27]. When one makes a pretotype it is with the intent to make sure that one can get user reactions and feedback even before one has made any kind of technology and the investment is still small. One tries to make something that can still create the feeling of using the final product. Savoia defines it as ”Pretotyping [pree-tow-tie-ping], verb: Testing the initial appeal and actual usage of a potential new product by simulating its core experience with the smallest possible investment of time and money.” [28].

2.6 Feature Fatigue

Feature Fatigue is when the amount of features of a product lessen the usability of the product. It is easy for a designer to add every feature which comes to mind and not realizing the usability costs of including that feature in the design. The term ”feature fatigue” was first coined by Thompson et al. and they describe the trade of between consumer interest in capability of the product and the usability of it [29]. In their studies they have found that consumer interest is correlated with the number of features, but usability has a negative correlation with the number of features. This was also the case when the users were tasked with designing their own package of features.

2.7 Usability Evaluation

Usability testing is essential in order to ensure that a product is usable by the customer and that flaws which limit usability are found [30–32]. There are several methods and techniques which are used when performing testing. They can mainly be divided into automatic, formal, empirical and informal methods [33]. The two types which are used during this project are the empirical and informal methods.

2.7.1 Empirical Methods

Empirical methods are the standard usability testing methods used in the industry. The different kinds of tests have different goals and are usually done at different stages of the design procedure. These methods are described by Rubin and Chisnell as Exploratory, Assessment, Validation and Comparison test [17, p. 28]. Exploratory tests are conducted early in the process with the purpose to map out the main design features and see if they work for the user. Assessment tests are more focused and are often conducted several times during the process in order to make sure that the design is on the right track and that no great errors are made during the process.

During validation tests the test leader interact as little with the test person as possible and tries to have the them as close to the actual use-case as possible in order to make sure that the design works as intended. [17, p. 30-38]. Comparison tests are done when one has two or more alternatives that one wishes to compare in order to decide in which direction to take the design.

When performing tests one will act as a test moderator. Rubin and Chisnell describes how one should act as a moderator and how to perform the tests [17]. They highlight that is is easy to affect the tester and one should therefore act in the same manner whether they perform the intended actions or not. One should also therefore be mindful of the pitch of one’s voice and body language so that one remains consistent. They also mention that users easily blame themselves if something goes wrong during the test and that one should therefore remind the user that all actions are useful to the test and that everything they do helps the designers understand how the system acts.

Finally Rubin and Chisnell brings up ”Think out loud” as an technique. It provides several advantages:

- One receives feedback on expectations and thought processes continually.
- One gets insight in how the participants come to do the actions that they do.
- One receives early clues as to why the participants come to a misunderstanding or confusion with the design.

They are however careful to mention that there are cases in which one should not use the technique such as when the action being performed is meant to be reflexive and automatic. Thinking out loud brings a mindfulness to the participant which may affect how they interact with the design. Some participants find the method unnatural and one should not in that case force the technique upon them, but rather prompt them for comments when one finds it appropriate.

System Usability Scale (SUS)

The system usability scale is a questionnaire designed to measure usability of a system. it was designed by John Brooke in order to have a questionnaire which is quick to fill in and gives a good overview of the usability of a system [34]. SUS features both positively based questions and negatively based questions in order to avoid users sticking to one side for every answer and to avoid acquiescence bias[35].

The SUS generates a single number which represents the systems overall usability. This score is calculated by taking the sum of the items' individual scores and multiplying them by 2.5. The unevenly numbered items generates a score by taking the scale's answer minus 1. The evenly numbered items score is 5 minus the scale's answer [34].

SUS has been widely used in the industry with the author claiming more than 1200 citations accumulated by 2013 [36]. This popularity has resulted in a great deal of material to validate the questionnaire and prove its reliability [37–39]. The same popularity also generates a lot of material for comparison between systems and Bangor, Kortum and Miller devised a rating system which made it possible to interpret the SUS-score into what is passable or excellent for most users [40]. They found that a SUS-score of 50 or lower was correlated with the evaluation ”unacceptable” and a score of 70 or more was ”acceptable” while the in-between was not clear one way or another, which can be used as a metric of good the system is doing in usability. When coding the results of the questionnaire one has to be mindful of errors due to the mix of negative and positive questions. Sauro and Lewis found that these are sources of error which do not affect the result significantly but still to be mindful off [41].

Evaluation through reaction cards

Benedek and Miner presented a method to evaluate and measure user reactions by having the user pick from a set of reaction cards as a method of evaluation [42]. Users pick five cards which represents their experience with the product and are afterwards asked to explain why they picked the cards they did.

Benedek and Miner explains that the greatest value of the method is not in the cards chosen but rather in the explanation the test persons give for choosing them. They also found that test person had a greater tendency to speak of negative experiences with the system which would indicate that the method therefore has less acquiescence bias. A tendency which is stronger when done on a ”good looking” prototype [43]. The method has seen some academic use [44–46], with Barnum and Palmer finding that the method helped with getting them to understand the user better and while not eliminating acquiescence bias, confirming the original authors claim of limiting it.

2.7.2 Informal Methods

Informal methods often takes the form of inspection. This usually takes the form of a professional inspecting the design and looking for flaws according to their experience or common practises and principles [33]. As with testing there are several methods which one can use in order to get different results from the inspection. One of the chief advantages with inspection is the lack of need of a user which usually means inspections are cheaper and can be carried out more often [33, 47]. The two most commonly used methods are heuristic evaluation and cognitive walk-through [48].

Heuristic Evaluation

Heuristic Evaluation was first brought into the common conscience by Molich and Nielsen [49]. The method is done by inspecting an interface and evaluating it according to a rule-set. They suggested a simplified rule-set in order to make the process easier to do properly while retaining the effectiveness of the inspection, which was as follows:

- Simple and natural dialogue
- Speak the user’s language
- Minimize user memory load
- Be consistent
- Provide feedback
- Provide clearly marked exits
- Provide shortcuts
- Good error messages
- Prevent errors

These heuristics were then developed further by Nielsen in order to improve explanatory power. The following improved heuristics has their base in a set of 249 usability problems which were analyzed by Nielsen in 1994 [50], and were suggested to be used as improved versions by Nielsen.

- **Visibility of system status -** The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
- **Match between system and the real world** The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
- **User control and freedom** Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
- **Consistency and standards** Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
- **Error prevention** Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.
- **Recognition rather than recall** Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
- **Flexibility and efficiency of use** Accelerators — unseen by the novice user — may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
- **Aesthetic and minimalist design** Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
- **Help users recognize, diagnose, and recover from errors** Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
- **Help and documentation** Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Heuristic Evaluation has been shown to be an very efficient method compared to costs [47], which has been its primary draw. The effectiveness of heuristic evaluation might be related to the skill of the ones doing the inspection [49]. This needs to be taken into account when one organizes an inspection with this method.

Cognitive Walk-through

Cognitive walk-through is a method designed to focus on the learn-ability of a system by focusing on cognitive processes. One determines the set of tasks that should be supported, then form initial goals which accomplish these tasks. During the walk-through one analyzes if and which interface items would prompt interaction from a user based on the current goal of the user and if the feedback would change the goal [51]. This is done by answering four questions presented by Wharton et. al [52].

1. Will the user try to achieve the right effect?
2. Will the user notice that the correct action is available?
3. Will the user associate the correct action with the effect that user is trying to achieve?
4. If the correct action is performed, will the user see that progress is being made toward the solution of the task?

Cognitive Walk-through has had success in the field [48] though the original format has been streamlined to be easier to use in software companies together with developers. Spencer presents some practises which makes the methods easier to use in real projects [53]. The new practises tackle the social issues of the method which can be experienced at a software company. Before the test the group discusses defensiveness and makes sure that all evaluators understand that the evaluation is when problems are identified, not solved. It should also be brought up that this is not the time to defend an existing solution or design a new one, one should simply take note of the problem and move on. Another change is to streamline the questions in order to make the process go quicker and smoother. This is done by working from these questions instead.

1. Will the user know what to do at this step?
2. If the user does the right thing, will they know that they did the right thing, and are making progress towards their goal?

These new questions take the first three of the old ones and reforms them into a single one which streamlines the process.

3 Phase 1 - Analyzing the end users and needs

To successfully develop a product, it is very important to understand the customer/end user. To deliver something usable, one has to understand customer needs, pains and problems to help ease or erase those problems. In this chapter, we initially present our brainstorming sessions to find the pain points in user situations and how we measured customer needs.

We also examined the terminology, by testing if users could find any existing solutions to the given problem our product is trying to solve. The trick was to *not* give any presumed terminology on our part. This test and its results are also presented in this chapter.

Finally, to summarize and represent *users* the system would cater to and those users needs, personas were constructed.

3.1 Brainstorming pain points

At Telavox they currently use *pain points* in order to analyze customer needs. Pain points are also a popular tool for entrepreneurs and designers of new products (see section 2.2). Together with the user focus of the method presented in theory it was deemed as a suitable method of tackling the users' needs.

3.1.1 Method

At first different pain-points - what problems the user is experiencing in their current situation - were brainstormed. The brainstorm and discussion was first made privately between us, the students. Before the brainstorm in order to understand the pains, material was gathered.

At Telavox, Jira [54] is used as the issue and project tracking system. In Jira, developers and customer advisors can present issues that they think should be fixed. In the system, four were found that related to the usage of the imagined design [55–58] and these were used as descriptions of user needs. Another major source was the master thesis done previously on the functionality of this very product by Atlasson and Hesslow [2].

After summarizing the material of what the problems and potential pain points are. We performed brainwriting to come up with functions which could solve the pains. Afterwards, a meeting with the supervisors of the project at Telavox to discuss the pain-points and potential functions was held. During the meeting, new pain points were brainstormed based from the ones we brought to the meeting. We also got a marketing and developing perspective of the features we were going to develop design for, which resulted in the functions being reduced to combinations of in- and out-parameters.

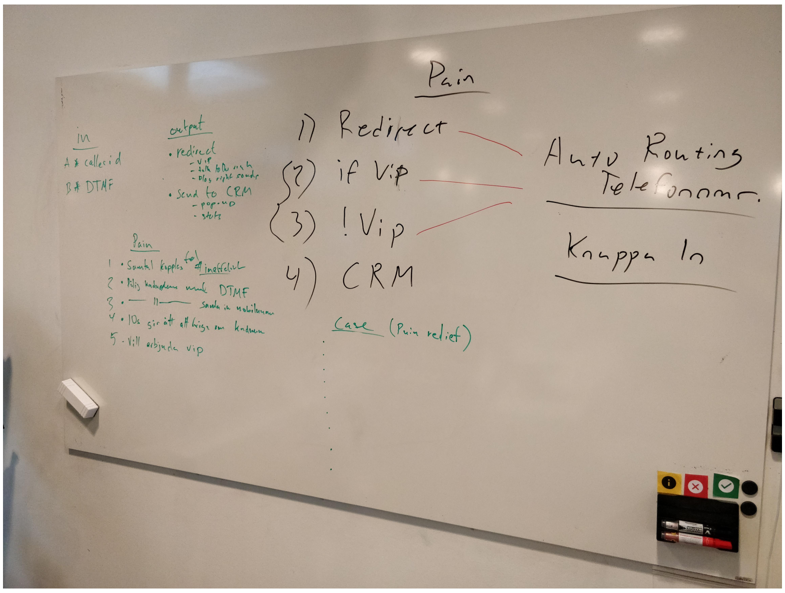


Figure 3.1: The sketch made during the brainstorm

After the discussions we came up with eight pain points we could provide pain relief with four functions for rerouting customers. Because the whiteboard is an early sketch was an early sketch, the names of functions on the whiteboard do not coincide with the ones used in this paper.

3.1.2 Result

Whilst discussing cases of usage and how the new functionality could solve, these pain points were the result from the study of the material:

1. The biggest pain point us was the problem of *Needing to answer calls not meant for you.* The reasons can be different:

    (a) Caller calls the wrong office, for any given reason.

    (b) Caller gets connected/forwarded wrongly

    Needing to answer calls not meant for you leads to lost time, inefficiency and irritation both on the part of the caller and the one answering.

2. Another possible pain point could be *the wish to offer exclusive service to your customers.*

3. From the callers perspective, it is troublesome to manually tap in a multi-digit code to get connected to the right end point. This is an example of bad customer experience.
4. Non-VIP customers calling a VIP exclusive support.

Four features on rerouting, or forwarding, people based on their incoming number were thought of before the meeting with the advisors. Here comes a list of, first, the name of the functions on the whiteboard (seen in Figure 3.1) and, following, the names we changed them to:

1. Redirect – Location routing. As the name suggests, this is routing based on the incomming callers' location. For example, the incoming caller is routed to the office in their city based on their number.
2. if Vip – VIP. A solution where only "special callers" get preferential treatment, and get connected to a separate VIP-service(with other open hours, shorter queues etc.)
3. !(not) Vip – Smart routing, a service to which the link to a spreadsheet where one could manually specify all the ways the incoming callers were routed. This functionality is very similar to the VIP solution, just with more options and less interactions within the application.
4. CRM – CRM. This feature was based on getting contact information and other notes, based on their Customer-relationship management systems. This feature got scrapped, since the scope of it was beyond this project.

The brainstorm with the supervisors did narrow and focused the concept of the end product. The input from multiple stakeholders was good for aligning more parties ideas of the end product. One idea emerged, that hadn't come up earlier, which was the alternative to send information about the call to a type of CRM(Customer-relationship management) system. It would result in interaction between our system and the customers CRM system and could result in e.g. a doctors office automatically showing a patient's journal, while the patient is calling. This was deemed beyond the scope of the thesis but the concept was worked with as data for the needs analysis.

The pain points, discovered during the brainstorming, were then discussed and presented like the following:

1. A call is routed to the wrong agent.
2. Does not want to have to ask the caller for the identification or customer number.
3. Manual entering of caller statistics into CRM or similar systems take time.
4. It is a hassle to collect phone numbers from clients.
5. Entering a number to navigate through a telephone menu is an annoyance for the caller.
6. There is a long line for caller support
7. Non-VIP call VIP-support, which these callers have not paid for.
8. Want to offer information to a certain customer even though they go to voicemail.

These pain-points are pains for both the customer and the caller since a pain for the caller is in extension a problem for the customer since they want to offer a good caller experience. Points 1 to 4 are about the customer having to do extra work or being interrupted in their own while points 5 to 8 are problems for the caller which reflects on the customer.

Then different functionalities were proposed to solve these pains. These functionalities were how to connect input and output. From a caller one may take their caller ID (most often number) or numbers which they enter during the call. One can use this to send data to systems or to redirect the call. These options combine in four different ways, four different **functions**:

1. The system takes the caller ID and redirects the caller based on rules for that caller.
2. The caller enters numbers which are forwarded to a CRM-system which can use that to log the caller or bring up a profile for the one taking the call.
3. The system forwards the calling number to a CRM system which is them able to log the call or to bring up a profile for the one taking the call.
4. The caller enters numbers and is redirected based on the entered numbers.

The functions were kept broad and general. The intention of defining these functions was to, in the next stage, measure the customer needs.

3.2 Measuring customer needs

Now that the reasons to create the system have been developed, one wonders - are these real pain points the costumers have? Will the system be used in the end at all? Is there a need for this system?

3.2.1 Method

To collect the data, customer advisors were contacted. To make the process as simple, efficient and so that it takes as little time as possible for the advisors, a questionnaire was formed and sent to them. The questionnaire was formed to answer how big the need of the product was. This was done by taking the resulting functions from the brainstorming and defining four cases:

1. The system takes the caller ID and redirects the caller based on rules for that caller.
2. The caller enters numbers which are forwarded to a CRM-system which can use that to log the caller or bring up a profile for the one taking the call.
3. The system forwards the calling number to a CRM system which is them able to log the call or to bring up a profile for the one taking the call.
4. The caller enters numbers and is redirected based on the entered numbers.

Then letting the advisors rank the functions and answer how many of their clients would want to use it. To get a comparable score total score between the functions' rankings, 4 points were given to highest priority, with 1 point lower for each descending rank.

3.2.2 Result

These functions were presented to the *customer advisors*, who were asked to rank them and to estimate who many of the current customers who could find the function useful. Results of the ranking are presented in table 3.1 and the results for estimated needs are presented in table 3.2.

Table 3.1: The first question - Ranking made by customer advisors, ranking which function they rather have

Function	Priority 1	Priority 2	Priority 3	Priority 4	Total Score
1	0	2	3	2	14
2	6	1	0	0	27
3	1	3	2	1	18
4	0	1	2	4	11

Table 3.2: Estimated number of customers which would find a use for the system

Function	None	<10%	10-30%	30-50%	>50%
1	1	1	1	2	2
2	0	0	5	0	2
3	0	1	3	0	3
4	0	2	2	1	2

In the first question, which is shown in table 3.1, function 2 (Sending caller input to CRM) comes out ahead with a big margin. In the second question it is unclear which one is ahead as there seem to be a usefulness to all of the proposed functionalities. The plan from the start of the project was to continue upon the work done by Atlasson and Hesslow [2], which would be to continue with function 1 (redirecting based on caller ID). While it wasn't ranked the highest the advisors were still of the opinion that it would be useful for a wide base of the customers, as seen in table 3.2. Function 2, which is the one ranked highest, is something which can be found in the industry - in companies which offer a package with telephony and CRM system combined.

Function 1 would potentially solve several of the pain points brought up during brainstorming. It could solve point 1 by routing the caller based on their number and thus route a client to the correct agent. It could route VIP clients to different telephone queues which have lower queue times, solving point 6. This could also solve point 7 by doing cleverer sorting of one's customers and in that way perhaps lower queue times. Finally, by directing certain clients to specific answering machines to give them information, one could solve point 8.

3.3 Product Discoverability and Terminology

Since automatic routing is a new feature for customers there was a need to find out which terminology would be used by the customers to describe and find the feature. In order to find which words would be used by a new customer to describe the system a test was devised.

3.3.1 Method

The test person was given a case in which they were a hairdresser out of 6 in a salon. The problem in the case was that the customers of each hairdresser would call the main number to the salon and nobody would know who it was for. They were then told to search for an solution in which the call was directed to the correct mobile phone depending on whose customer called. The goal of the test was to find what terms the test person used in the search engine to find the functionality. The result was then used as a baseline for labels and descriptions in the design. The detailed testplan can be found in appendix B.

During the test the test person was recorded and otherwise the test followed the recommendations of Rubin and Chisnell presented in theory (section 2.7.1). While the primary goal was to take note of the terms they used when they tried to describe the solution other things might come up which is of interest. 10 users took part in the test and were all students from engineering programs though in different fields.

3.3.2 Results

The search terms which the testers used during their search has been organized in categories with how many different testers used a search term from the category. This is presented in table 3.3 and one notes that the exchange and forwarding category are above the rest. This indicates that the users associate this issue and solution with telephone exchanges or some kind of forwarding service. From this the word forwarding was used to describe the functionality in the development of the prototype.

Some other notes taken during the tests were that 2 out of the 10 users described DTMF, the caller typing in numbers as the solution they searched for. 4 of the users expressed uncertainty in that what they searched for even existed and 4 also said that they would try to find a company working within telephony and try to ask them if they could provide a solution rather than searching extensively themselves. 2 of the testers described e-mail forwarding and said that they wanted something similar and therefore searched with the word *forwarding.*

Special note was taken from the description of email and telephone exchanges as this was how the users related to this new functionality. Another point of special interest was that 3 out of the testers also managed to find Telavox homepage without prior knowledge of it. That together with one of the most popular search-terms being ”telephone exchange” tell us that if someone was to search for this kind of functionality they could find themselves searching for it at Telavox.

Table 3.3: Result from product discoverability an terminology tests

Search Category	Users	Search Terms
Exchange	5	telefonväxel, automatisk telefonväxel
Forwarding	4	forward, koppla, phone call forwarding, koppla vidare, vidarekoppling
Sub-Numbers	2	undernummer, svarsgrupp
General	2	telefonsystem företag, telefon kopplad till flera nummer
Splitting	1	telefonsamtalsspridare, divide incoming phonecall, split to several recievers
Caller’s Input	1	voicebox choices, mutlichoice, call menu
Routing	1	routing
Switch	1	omkopplare

3.4 Personas

Personas were used as a means to talk about the different types of users that were kept in mind for the system. The personas also represent a result from the studies on the potential user’s needs.

3.4.1 Method

Three different kinds of personas were created to represent the different types of primary users which will mainly interact with the set-up of the system, which the interface is being designed for. The personas were primarily based on unstructured interviews with the supervisor at Telavox, about what type of users would use the system - divided into technical level and background knowledge. We also used the old reports from customer advisors[55–58] and the case-study done in Atlasson and Hesslows thesis[2]. These personas would then be used to guide the design process at the later stages.

3.4.2 Result

During the analysis of customer needs, a goal was to allow representation of different types of customers and customer needs as personas. Following are the personas developed at the end of phase 1.

Nils - Novice Small Business Owner of Nils Bilverkstad

Nils is a small business owner, but it is expanding. Last year he opened another garage, in a new city. He is still the main IT manager at his company, and he needs to install a phone system to distinguish customers of the respective garages. He is not a computer wizard, as he puts it himself, but he is used to the operating system Windows, daily uses Word, Excel and such tools. He is a new customer at Telavox and has never used their services before.

His goal is to install smart call forwarding, so that his mechanics do not have to answer unnecessary calls meant for other garages.

Hannah - Head of IT

Hannah went to an IT program in High School. Afterwards she started working as IT-support and helped fix computers, install operating systems and other pieces of software. She is now the Head of IT at a company.

Her goal is to install routing with a higher level of complexity. She needs to install different routing based on different rules, depending on agents, time of the day, holidays etc.

Adrian - Customer Advisor

Adrian has worked at Telavox for 4 years, as an advisor. He has back-end knowledge of the system. Adrian gets hundreds of calls every day about how he can support customers to set up their systems. He is used to the more creative solutions to certain specific problems.

His goal is to be able to quickly and efficiently solve requested problems of a customer.

4 Phase 2 - Mock up

During the second phase, the focus was on developing a pretotype which exemplifies how the needs of the customers can be satisfied in a usable system. The pretotype was developed and tested in iterations, starting with a simple mock-up made in a presentation tool which was made navigable through InVision.

Tests were conducted throughout the process in order to ensure the quality and usability of the final design. It was also done in order to learn lessons which applied to these kinds of systems and designs which to avoid. Therefore results of the tests are presented here.

The mock-up was developed through 3 iterations and underwent testing at the end of each of the iterations. After an iteration was completed the next one fixed issues revealed in the tests of the previous one and different designs were explored and new elements added.

4.1 Mock-up Prototype version 1

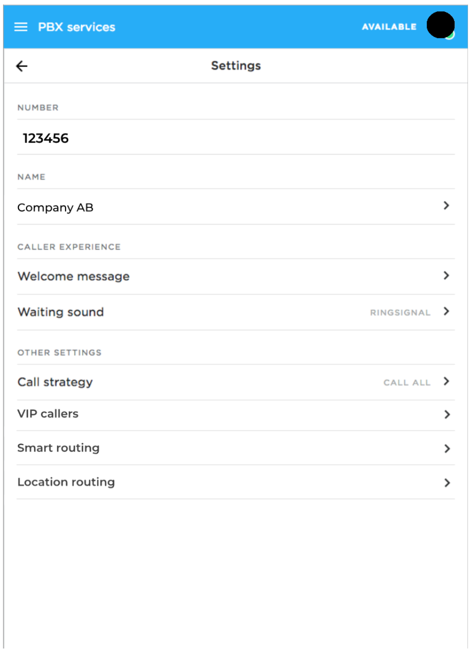
Initially, the Telavox systems were examined for a suitable location in their system to put the new functionality. Subsequently, a high fidelity paper prototype was created with that location in mind.

4.1.1 Method

The prototype was first sketched on paper, but the process was quickly migrated into the presentation tool Google Slides [59], since there the prototype would be easier to edit and also, the tool is free. The images were then inserted into a digital product design platform, InVision [60], which has the ability to link the pictures to one-another with clickable areas. This allowed the buttons to take the user between views and made the prototype navigable.

The prototype was tested using empirical tests, the test scenarios can be found in appendix C. The test person was encouraged to *think out loud.* One person acted as test leader, while the other acted as an observer with primary focus on where the users got lost or confused. In addition to observation notes the test was also video recorded. This round of tests was done on 5 students of a computer engineering program. The prototype was, in addition to testing, inspected by two professionals at Telavox with design and domain knowledge.

4.1.2 Result



PBX services AVAILABLE

Settings

NUMBER

123456

NAME

Company AB

CALLER EXPERIENCE

Welcome message

Waiting sound RINGSIGNAL

OTHER SETTINGS

Call strategy CALL ALL

VIP callers

Smart routing

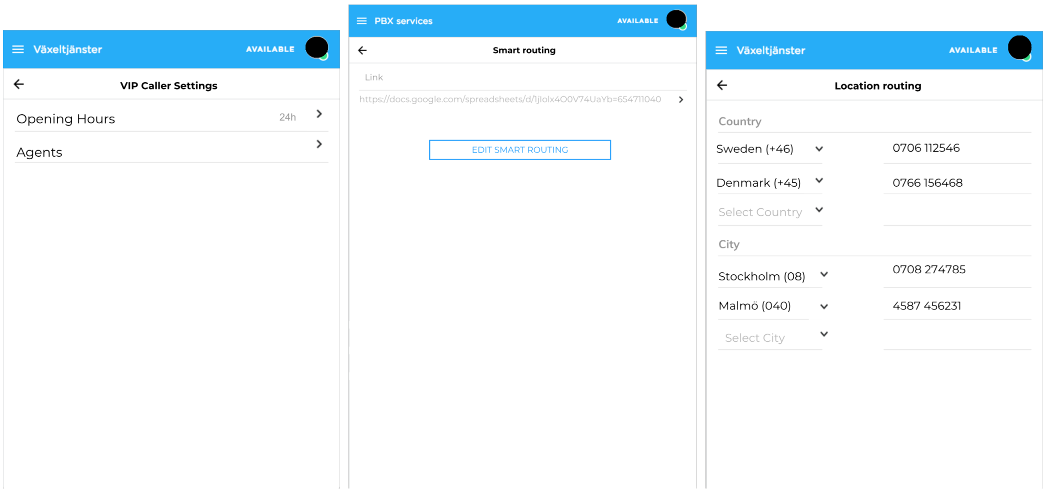
Location routing

Figure 4.1: The first screen of mock-up version 1, showing the settings menu of a queue

The first design was divided into three main functionalities: VIP callers, smart routing and location routing. These functionalities was presented as different options in the settings menu, as seen in figure 4.1. The other options on that screen are ones found in the Telavox system today. The **VIP callers** view has options for adding callers to the list of VIPs and setting in which one could set active hours and where to route them. One could either add VIPs one by one or set-up a google-sheet in order to manage the list through it. **Smart routing** was designed to only be usable through the google-sheet so the design was minimal with only place for a link and a button which takes one to set-up. When setting up, one was asked for three connections one wished to make. These connection were then placed in the spreadsheet in order to provide an example for how it was supposed to look and which fields the user were to use. At this point the design did not take sharing of the spreadsheet into consideration and thus users did not have to go through steps which they needed to at later iterations. **Location routing** had drop-down menus which one could use to select a country or region and a textfield next to it in order for the user to write where to route calls from than location to.

4.1.3 Test Results

During the user tests, two major issues were identified. Two of the users pressed ”call stategy” rather than one of the other options and none of the users had a clear idea what differentiated



Opening Hours 24h

Agents

Link

https://docs.google.com/spreadsheets/d/1jlolx4O0V74UaYb=654711040

Country

Sweden (+46)	0706 112546
Denmark (+45)	0766 156468
Select Country	

City

Stockholm (08)	0708 274785
Malmö (040)	4587 456231
Select City	

Figure 4.2: The views of the three different functions of the mock-up version 1

VIP- and smart routing, and when to use one or the other, even though they managed to choose the ”correct” functionality for each case. The users were also confused, and thought that they had made a mistake, when the app took them to the spreadsheet. Aside from the main issues the users were able to complete their tasks without any hindrance.

The inspections raised the question of why the functionality was divided into three different kinds, when smart routing could in theory do it all. The inspection arose suspicions that the user would need more, and earlier, indications that the goal is to get to a spreadsheet. Evidently, the user did not get the impression that what they were pressing was a link to a web-based spreadsheet.

4.2 Mock-up Prototype Version 2

Subsequent prototypes were developed in small iterations. New user-tests and inspections were conducted at the end of each iteration. The iterations based their changes on the result from testing the previous iteration.

4.2.1 Method

During this iteration, the spreadsheet created by Atlason and Hesslow [2], was used to conduct the test. It was developed into an intitial version which did not support all of the functions it needed.

This iteration was tested on 5 students *without* programming background. One reason for this to be done is for the possibility of receiving feedback about diverse design aspects. After the tests, to get a tangible and quantifiable result of how usable the system is, the test persons filled out a SUS(System Usability Scale) questionnaire(which was translated into Swedish by Malin Fabbri [61]). These answers were used to evaluate the state of the prototype and to compare with later parts of development.

After the second iteration of tests, an alternative to version 2 (designated version 2.5) of the prototype was developed in order to compare it to the original version 2.

4.2.2 Result

In version 2 of the mock-up, location routing and VIP routing was abandoned in favour of presenting a simpler and clearer view of smart routing. Call strategy was also renamed to queue distribution, in a hope that the users would have an easier time to differentiate between smart routing and the functionality of the ”call strategy”-menu(which is how callers are distributed between agents in a queue), this can be seen in figure 4.3.

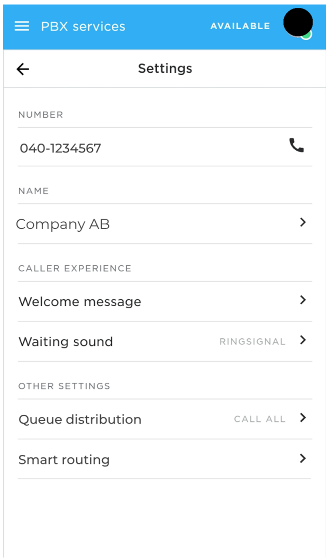

PBX services AVAILABLE
Settings
NUMBER
040-1234567
NAME
Company AB
CALLER EXPERIENCE
Welcome message
Waiting sound RINGSIGNAL
OTHER SETTINGS
Queue distribution CALL ALL
Smart routing

Figure 4.3: The settings menu in version 2

In the previous iteration, there were problems with testers wondering if something was wrong when they reached google-sheets. This iteration therefore included an introductory view which mentions google-sheets, which is only shown after one clicks on smart routing without having one set up. The view which follows is, in essence, the same as smart routing in the previous version, but with a explanatory text and a neater layout. Both of these can be seen in figure 4.4.

When one has pasted a link, a green finish button appears. This button makes the view transport to the smart routing page, as shown in figure 4.5.

Functionality for in-app interaction with the spreadsheet was added, making it possible to add, delete and search for connections with the application. The intent was to make day to day usage on the phone easier, since interacting with a spreadsheet is very cumbersome on the phone. The option of getting to the spreadsheet was still available, for those on desktop or simply interested in administrating via the spreadsheet.

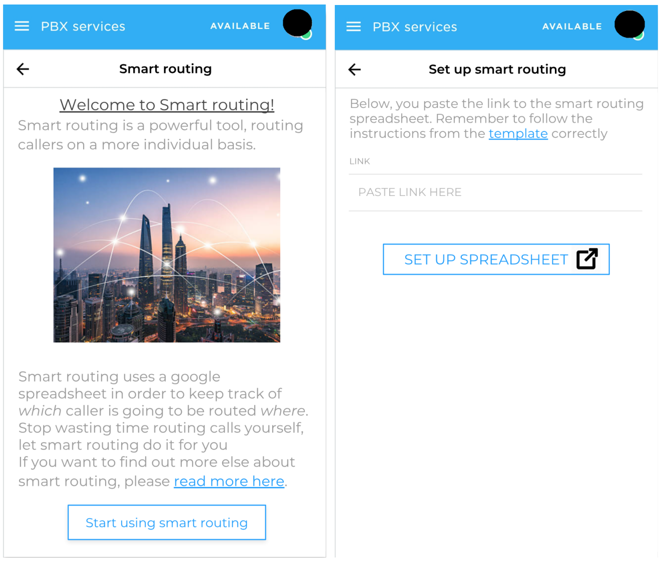
A spreadsheet template (found in appendix A) was designed with had instructions on how to get a share-able link to the right, which guides the user through the steps in google-sheets.

4.2.3 Test Results

This iteration of tests showed several positive experiences with the prototype:

- users now expect the spreadsheet and are not surprised when it comes up
- interaction through both the spreadsheet and the in-app functions worked smoothly
- users had little issues in completing the tasks and did so quickly
- users conceptualize what the sheet is used for when seeing it for the first time

First thing noticed was that 4 of 5 users still pressed the top-most button ”Queue distribution” (previously called Call strategy) instead of the intended ”Smart routing”. When the users were in the spreadsheet, they added the information in the correct cells. 4 out of 5 testers did not



PBX services AVAILABLE

Smart routing

Welcome to Smart routing!

Smart routing is a powerful tool, routing callers on a more individual basis.

Smart routing uses a google spreadsheet in order to keep track of *which* caller is going to be routed *where*. Stop wasting time routing calls yourself, let smart routing do it for you
If you want to find out more else about smart routing, please read more here.

Start using smart routing

PBX services AVAILABLE

Set up smart routing

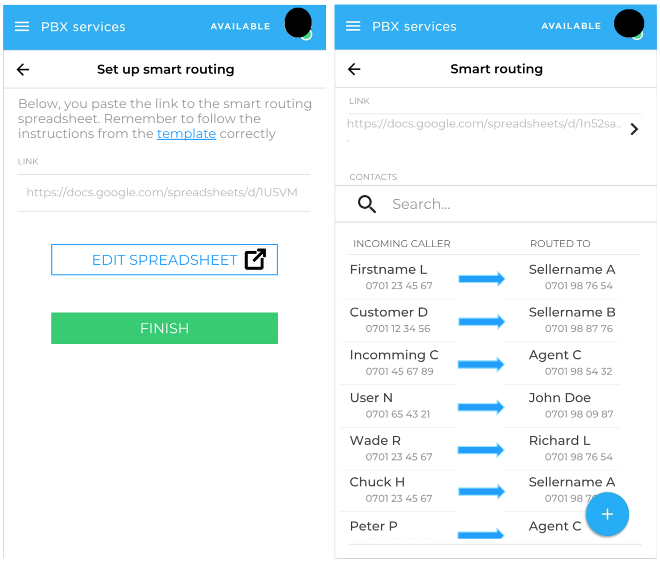
Below, you paste the link to the smart routing spreadsheet. Remember to follow the instructions from the template correctly

LINK

PASTE LINK HERE

SET UP SPREADSHEET

Figure 4.4: The introductory view and the following set up view in version 2



PBX services AVAILABLE

Set up smart routing

Below, you paste the link to the smart routing spreadsheet. Remember to follow the instructions from the template correctly

LINK

https://docs.google.com/spreadsheets/d/1U5VM

EDIT SPREADSHEET

FINISH

PBX services AVAILABLE

Smart routing

LINK

https://docs.google.com/spreadsheets/d/1n52sa..

CONTACTS

Search...

INCOMING CALLER	ROUTED TO
Firstname L 0701 23 45 67	Sellername A 0701 98 76 54
Customer D 0701 12 34 56	Sellername B 0701 98 87 76
Incomming C 0701 45 67 89	Agent C 0701 98 54 32
User N 0701 65 43 21	John Doe 0701 98 09 87
Wade R 0701 23 45 67	Richard L 0701 98 76 54
Chuck H 0701 23 45 67	Sellername A 0701 98 7
Peter P	Agent C

Figure 4.5: The main view of smart routing and the view for editing the link in versoin 2

find the instructions for set-up in the spreadsheet, since one has to scroll to the right in order to see them. The 2 users also reported that they found it awkward to find the share-able link and paste it into the application.

One of the major issues, which were new for this version, was that 2 out of the 5 testers were momentarily stunned when they arrived at the main smart routing view (figure 4.5), and took a little while before proceeding with their actions. All but one of the five also skipped past the introductory view without reading it.

Some general questions from testers were also noted:

- What happens if who the call is routed to does not answer?
- Could the application automatically fill in numbers when one fills in a name?

During inspection, the main view (figure 4.5) was thought of as messy and intimidating. The introductory view (figure 4.4) had too much text which did not help the users with the spreadsheet.

4.3 Mock-up prototype version 2.5

After the second iteration of tests, an alternative to version 2 (designated version 2.5) of the prototype was developed in order to compare it to the original version 2.

4.3.1 Method

The alternative version 2 had two main differences – a label change and a separation of the link and connections view. We noticed that the testers consistently chose the menu item ”Queue Distribution”, rather than the menu item we entered - ”Smart Routing”. For that reason, we decided to try to change the label ”Smart Routing” to be more in accordance with the testers' search queries and terminology in the search test found in section 3.3.2. The name of the functionality was then renamed to ”Smart Call Forwarding”.

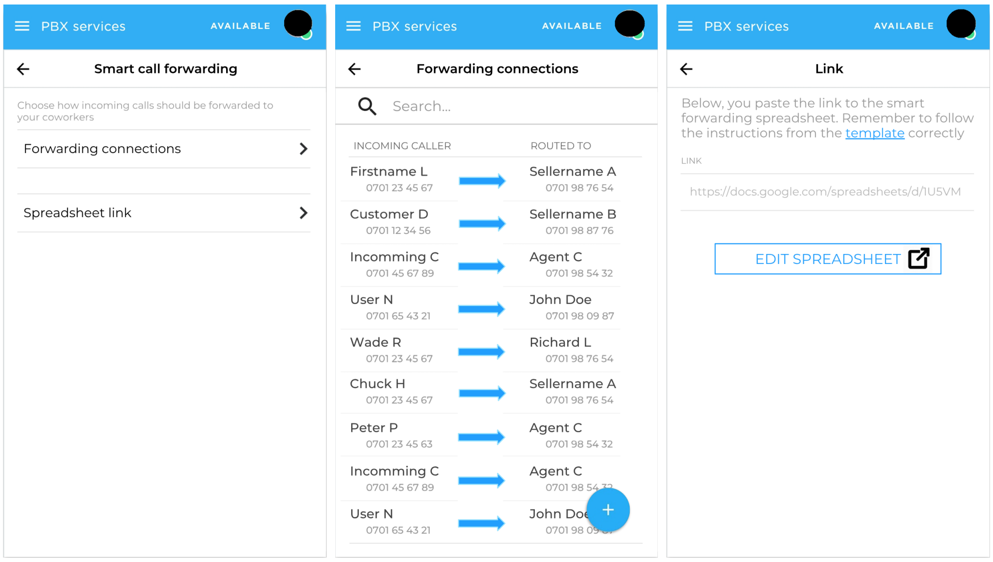
4.3.2 Result

The second change was done to reduce the overwhelmed feeling some testers were having when using the application. The ability to *edit the link* and the *list of connections* were separated into different views. To accommodate the two new views, the view to the left in figure 4.6 was introduced. From that view, one can navigate to the two separated functionalities, now called ”forwarding connections” (shown in the centre of figure 4.6) and ”Link” (shown to the right).

One need that emerged when changing the prototype was to have a ”Edit your connection”-view, where one can do basic CRUD[1]-actions. That view can bee seen to the left in Figure 4.8.

Also, just by just testing out the prototype internally, it became obvious that verification was needed for if a connection was added or deleted. The verification messages got a *toast*, also known as a snackbar, like appearance as seen in Figure 4.7. Another need that emerged from

[1] Create, Read, Update, Delete



PBX services AVAILABLE

Smart call forwarding

Choose how incoming calls should be forwarded to your coworkers

Forwarding connections

Spreadsheet link

PBX services AVAILABLE

Forwarding connections

Search...

INCOMING CALLER	ROUTED TO
Firstname L 0701 23 45 67	Sellername A 0701 98 76 54
Customer D 0701 12 34 56	Sellername B 0701 98 87 76
Incomming C 0701 45 67 89	Agent C 0701 98 54 32
User N 0701 65 43 21	John Doe 0701 98 09 87
Wade R 0701 23 45 67	Richard L 0701 98 76 54
Chuck H 0701 23 45 67	Sellername A 0701 98 76 54
Peter P 0701 23 45 63	Agent C 0701 98 54 32
Incomming C 0701 45 67 89	Agent C 0701 98 54 32
User N 0701 65 43 21	John Doe 0701 98 09 87

PBX services AVAILABLE

Link

Below, you paste the link to the smart forwarding spreadsheet. Remember to follow the instructions from the template correctly

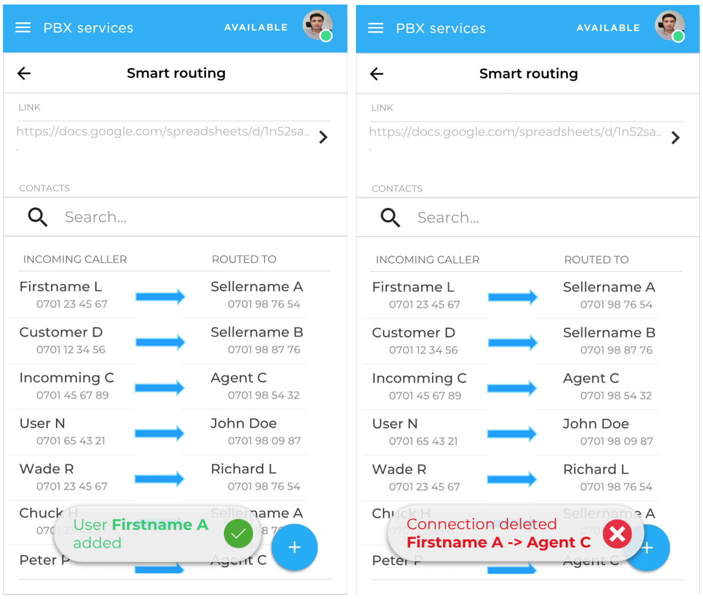
LINK

https://docs.google.com/spreadsheets/d/1U5VM

EDIT SPREADSHEET

Figure 4.6: The left frame is the new view which the user enters, after the spreadsheet is set up. The centre view shows the current connections, previously called the smart routing screen. To the right is the new link view

testing internally was the need of a confirmation dialog when deleting a connection, as in Figure 4.8.



PBX services AVAILABLE

Smart routing

LINK

https://docs.google.com/spreadsheets/d/1n52sa..

CONTACTS

Search...

INCOMING CALLER	ROUTED TO
Firstname L 0701 23 45 67	Sellername A 0701 98 76 54
Customer D 0701 12 34 56	Sellername B 0701 98 87 76
Incomming C 0701 45 67 89	Agent C 0701 98 54 32
User N 0701 65 43 21	John Doe 0701 98 09 87
Wade R 0701 23 45 67	Richard L 0701 98 76 54
Chuck H	Sellername A
Peter P	Agent C

User **Firstname A** added

PBX services AVAILABLE

Smart routing

LINK

https://docs.google.com/spreadsheets/d/1n52sa..

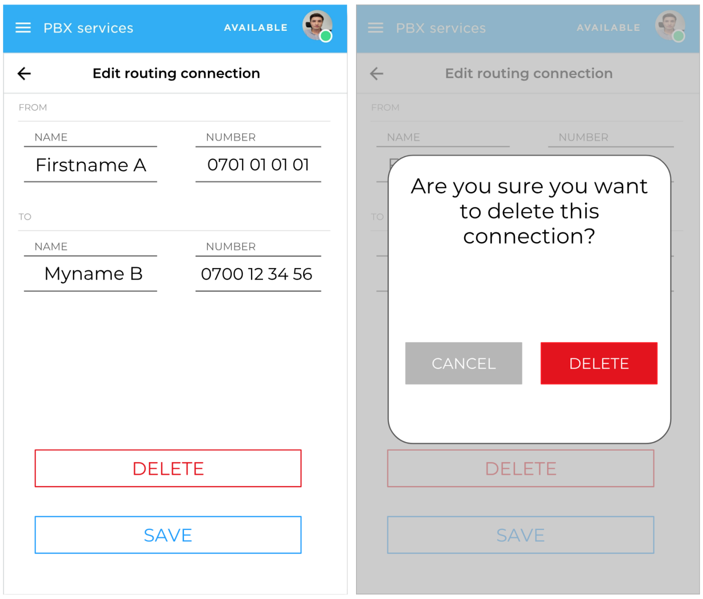
CONTACTS

Search...

INCOMING CALLER	ROUTED TO
Firstname L 0701 23 45 67	Sellername A 0701 98 76 54
Customer D 0701 12 34 56	Sellername B 0701 98 87 76
Incomming C 0701 45 67 89	Agent C 0701 98 54 32
User N 0701 65 43 21	John Doe 0701 98 09 87
Wade R 0701 23 45 67	Richard L 0701 98 76 54
Chuck H	Sellername A
Peter P	Agent C

Connection deleted
Firstname A -> Agent C

Figure 4.7: The ”User added” and ”User deleted” dialogues.



NAME: Firstname A
NUMBER: 0701 01 01 01

NAME: Myname B
NUMBER: 0700 12 34 56

Are you sure you want to delete this connection?

Figure 4.8: The image to the right represents the ”Edit connections”-view. The image to the left shows the dialog that appears if you press the ”Delete”-button.

4.3.3 Test Results

In this iteration of tests all testers pressed ”Smart Call Forwarding” rather than ”Queue Distribution”, though 2 of 7 weren’t confident when they chose the option. 3 of 7 users skipped past the introduction quickly and one thought they had pressed the wrong option when they read the introduction. None of the testers were stunned at any point of the test but rather went through it without significant pauses or contemplation. The testers were split in half between those who interacted in-app and those who manipulated the data through the sheet.

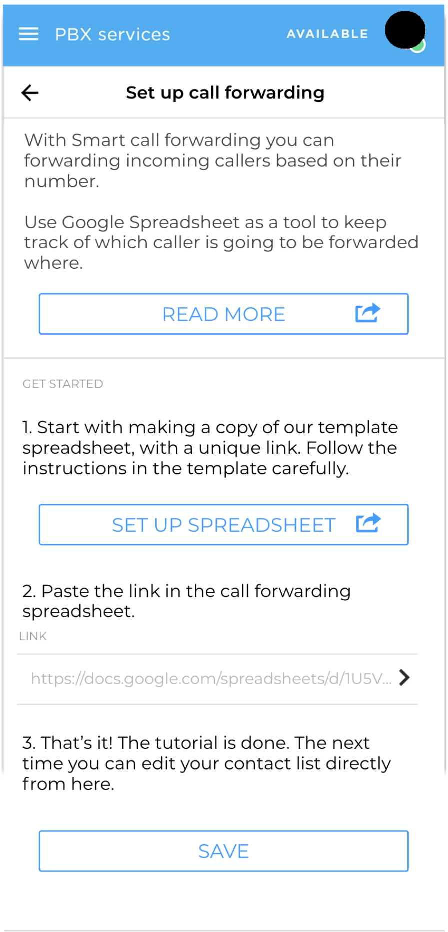
4.4 Prototype Version 3

During this iteration, design of the mobile instructions for setting up the google-sheet was initiated. This iteration of tests were the first in which the user actually performed the whole chain of setting up the system, giving us feedback about unforeseen difficulties. Due to the complexity of, and many steps it takes, setting up the system had not really been tested in previous iterations. It would have been more time consuming and would only be testing something that possibly is a fraction of a users interaction with the system.

This iteration was tested on 8 students with programming knowledge, to see how the users from the ”Hannah” persona would interact with the spreadsheet.

4.4.1 Result

The third version is an continuation of 2.5 as it was deemed to have the better test-results since the testers were less stunned in that version and seemed to go through the steps quicker and easier. The previous introduction view was changed to a new one without a picture and a more step by step structure to set up the spreadsheet, as seen in figure 4.9. The design was changed so that one always arrives at this view if one does not have a spreadsheet set up and one cannot press save and continue without the application being able to reach a spreadsheet. When pressing save with a functioning link one arrives in the left view shown in figure 4.6, as in the previous version.



With Smart call forwarding you can forwarding incoming callers based on their number.

Use Google Spreadsheet as a tool to keep track of which caller is going to be forwarded where.

1. Start with making a copy of our template spreadsheet, with a unique link. Follow the instructions in the template carefully.

2. Paste the link in the call forwarding spreadsheet.

3. That's it! The tutorial is done. The next time you can edit your contact list directly from here.

Figure 4.9: The new introduction for set-up in version 3

The spreadsheet was developed further to version 2 in this iteration. To enable it to be used as intended, a guide for set up on mobile was added at the top of the spreadsheet. The spreadsheet now contained the columns to add numbers and names for caller and destination, instructions for set-up on desktop and instructions for set-up on the mobile google sheets application, with specific design for android.

4.4.2 Mock-Up Version 3 Test Results

The big conclusion from this rounds of tests was that the set up through the spreadsheet was possible but difficult to do on mobile. All 8 of the testers reported issues interacting with Google Sheets mobile application or commented that it would be easier to do the tasks on a desktop. 3 of the 8 testers failed to complete the task correctly and missed a step necessary in the spreadsheet in order for the system to work. All but 2 testers completed the test smoothly without any hang-ups or confusion (even though it was erroneous in two cases) and thought the spreadsheet was a natural part of the procedure. This would indicate that the new introduction was an improvement.

Since the testers all came to the conclusion that google-sheets was hard to use on mobile it was decided at this point that the product would not support set up on mobile. Even though it is still possible to do for users who wish to, the users will be encouraged to do the set up on a desktop.

4.5 SUS-scores for Mock-Up

Version 2, 2.5 and 3 were evaluated with SUS-surveys in order to be able to compare them and to get a general idea of the state of usability of the prototype. Confidence intervals were calculated on the samples in order to better analyze the values generated by the SUS and to take into

Table 4.1: SUS answer statistics for the Mock-Up

Version	Participants' Scores								Mean	Standard Deviation	Confidence Interval
2	92.5	82.5	85	82.5	80	-	-	-	84.5	4.81	[78.5, 90.5]
2.5	77.5	77.5	90	95	92.5	55	90	-	82.5	13.99	[69.56, 95.44]
3	60	62.5	82.5	77.5	70	87.5	65	85	73.75	10.77	[64.74, 82.75]

account the low sample size. The lower end of the confidence intervals are above and close to 70 for version 2 and 2.5 which indicates an acceptable design according to SUS. In version 3, when the testers were to perform actions within the spreadsheet, the values fall a significant amount and are generally more spread.

There is one outlier in the answers for version 2.5, number 6 with a value of 55. It is more than one standard deviation bellow the rest. If it is removed from the sample mean, standard deviation and confidence interval changes to: 87.08, 7.65 and [79.05, 95.11] respectively, which would be very close to the interval for version 2, only slightly better. Number 6 did explicitly point out that the integration with google sheets was a source of confusion and thought that it could be better done. This is something which was also reported by the testers in the later test iteration for version 3, which might indicate that they are not an extreme outlier and the real mean of Version 2.5 is closer to the lower end of the interval.

5 Phase 3 - Functional prototype

During the development the authors took a great deal of help from the developers at Telavox which helped answer technical questions and to provide the current code of Flow to which the authors could add their designs. The structure and look was made intentionally to conform with the existing the design of Flow in order to achieve consistency. To evaluate the prototype, cognitive walkthrough, heuristic evaluation and usability testing was conducted in that order.

5.1 Developing the functional prototype

The functional prototype was developed in Javascript. In the project React[62], Redux[63], and Material UI[3] were the main major libraries in the current Telavox Flow web-app. The end product is intended to integrate seamlessly with the current Telavox Flow web-app, thus the prototype contained the rest of Telavox Flow Web-app - as well as the functionalities developed during the process of this thesis. The first iteration of the functional prototype was made to be as close as possible in functionality and look as the mock-up.

5.1.1 Development in Telavox Flow

When opening the Telavox Flow web-app, one is met by the ”PBX-view” with the first queue in the list marked.

During the development of the functional prototype, the development supervisor at Telavox informed us that the functionality was put in the wrong place. It is not supposed to be a setting for an individual queue, rather it should be a setting for something called Refers. Refers is the technical term used by Telavox to numbers, e.g. a company’s main line, that has the option *refer* calls depending on different conditions like: if the main number has open hours, a special answering message during closed hours, refer callers to different types of agents depending to the time of day, button selection and other types of features that could be expected.

After moving the app, what differs the *refers settings* from the queue settings is that there are not many options in the refers page (as seen in Figure 5.2). This makes it easier for the users to find the Smart call forwarding option.

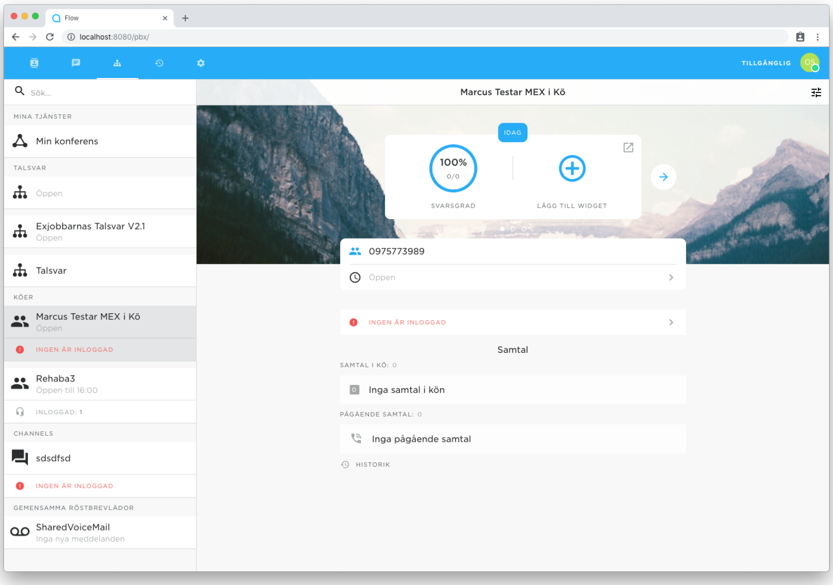


Figure 5.1: The first view of opening the Telavox Flow web-app

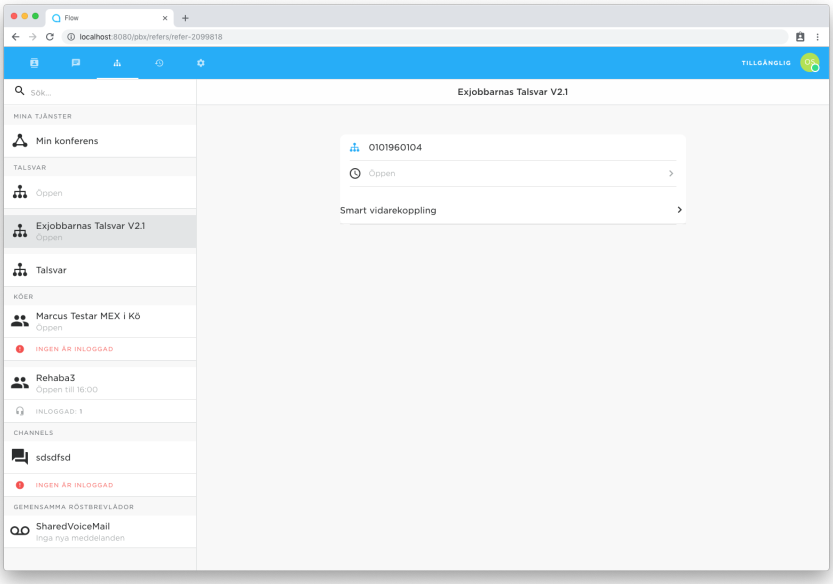
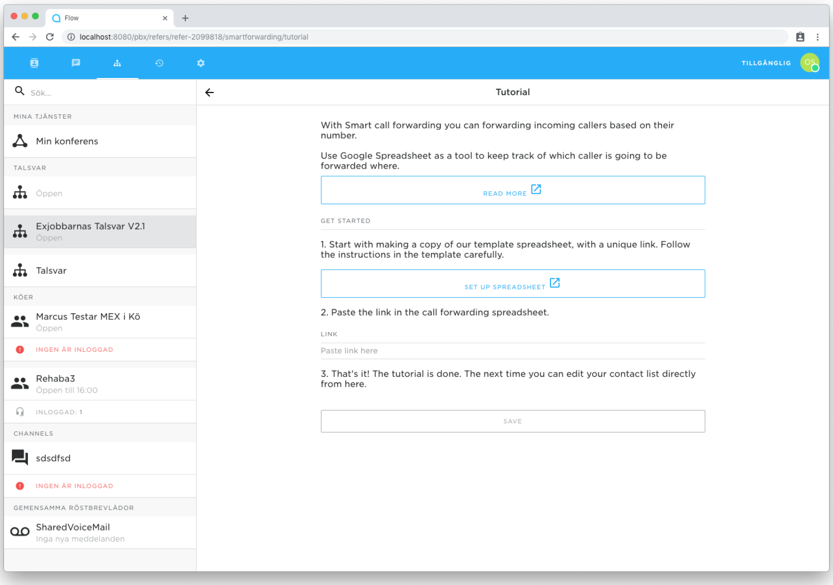


Figure 5.2: The first view of opening your Refer

The interface, as described earlier, is very similar to the mock ups done earlier. What distinguishes these images from the mock ups is that they are taken on a desktop environment, rather than the mobile-fist centered design.



With Smart call forwarding you can forwarding incoming callers based on their number.

Use Google Spreadsheet as a tool to keep track of which caller is going to be forwarded where.

1. Start with making a copy of our template spreadsheet, with a unique link. Follow the instructions in the template carefully.

2. Paste the link in the call forwarding spreadsheet.

3. That's it! The tutorial is done. The next time you can edit your contact list directly from here.

Figure 5.3: The tutorial window of the app

The tutorial, as seen in Figure 5.3, is pretty much the same. However, the need to validate the link emerged during the development. This did not show during the tests since the InvisionApp tests had pre-programmed linktext. Therefore, we added a loading animation and a message under the link text which informs the user whether the link to their sheet is valid or not(as seen in Figure 5.4).

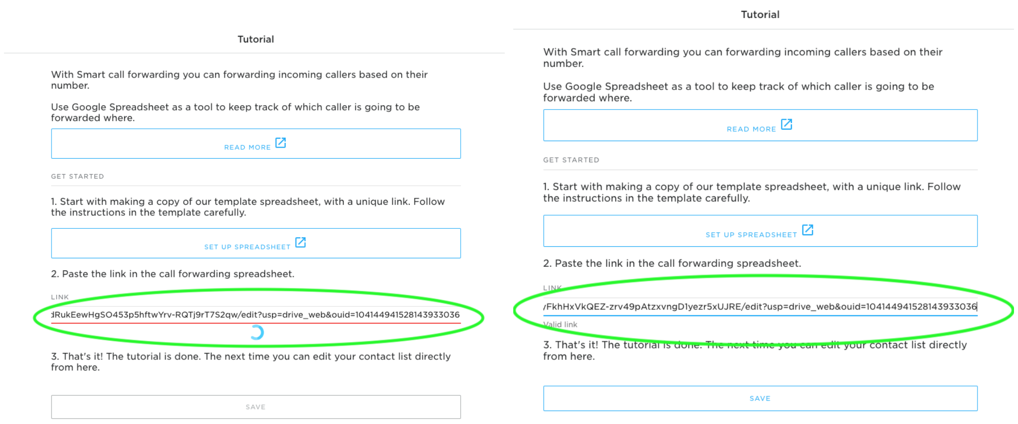
The figures 5.5, 5.6 and 5.7 show that we kept the design of the Mockups - just compare them to the figure 4.6 in the previous chapter.

One thing that differed were the ”Add” and ”Delete”-dialogs. Prevously, as seen in figure 4.7, they had a toast/snackbar look. When developing, to make it more uniform with the rest of the Telavox Flow interface, the verification dialogues got to look more like figure 4.8(see figures 5.8 and 5.9).

5.1.2 The Spreadsheet template

There was a lot time spent on developing the interaction with the spreadsheet, with scripts being written to facilitate interaction between Flow and the spreadsheet. The instructions of the spreadsheet was updated to be align with google's latest update and the instructions for mobile usage was removed. The spreadsheet in its current form can be found in figure 5.10.

To help the user find if they have made any mistakes with filling out the spreadsheet, some conditional formatting was added. Also, if the user writes numbers in the wrong format or it contains multiples of the same incoming number, there is an ”Errors” section where you can see the amount of errors. That way, the user at least knows that errors exists. Right now the spreadsheet checks if the numbers contain anything but letters, +, - or spaces and the cell turns red if it does. An example of how the errors might look can be seen in Figure 5.11.



Tutorial

With Smart call forwarding you can forwarding incoming callers based on their number.

Use Google Spreadsheet as a tool to keep track of which caller is going to be forwarded where.

1. Start with making a copy of our template spreadsheet, with a unique link. Follow the instructions in the template carefully.

2. Paste the link in the call forwarding spreadsheet.

LINK: dRukEewHgSO453p5hftwYrv-RQTj9rT7S2qw/edit?usp=drive_web&ouid=104144941528143933036

3. That's it! The tutorial is done. The next time you can edit your contact list directly from here.

Tutorial

With Smart call forwarding you can forwarding incoming callers based on their number.

Use Google Spreadsheet as a tool to keep track of which caller is going to be forwarded where.

1. Start with making a copy of our template spreadsheet, with a unique link. Follow the instructions in the template carefully.

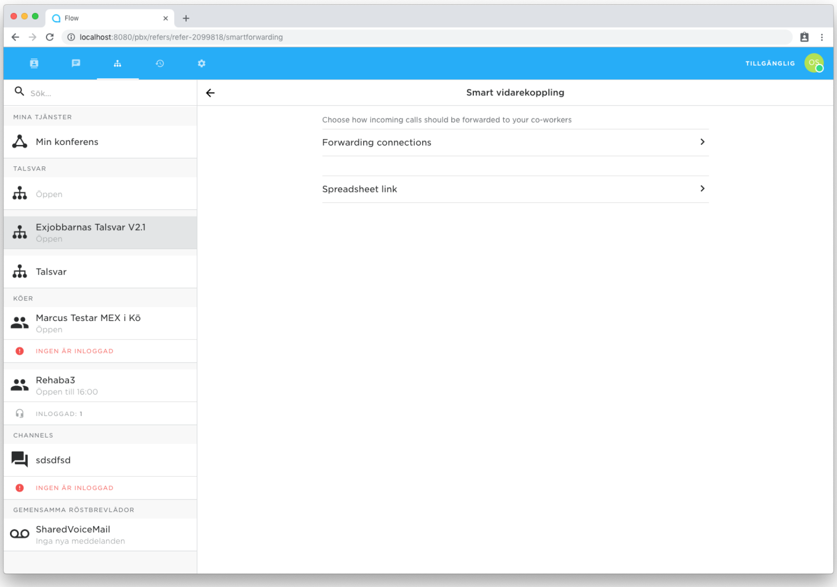
2. Paste the link in the call forwarding spreadsheet.

LINK: /FkhHxVkQEZ-zrv49pAtzxvngD1yezr5xUJRE/edit?usp=drive_web&ouid=104144941528143933036

Valid link

3. That's it! The tutorial is done. The next time you can edit your contact list directly from here.

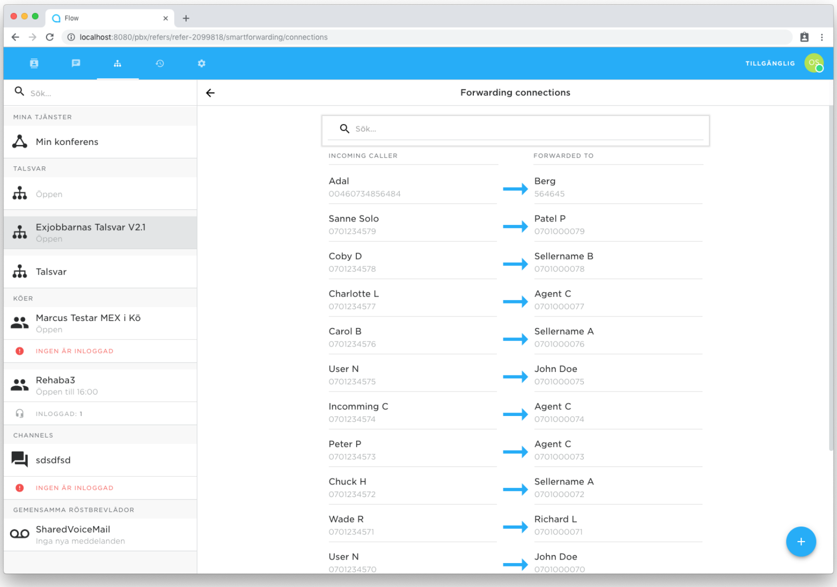
Figure 5.4: The tutorial window of the app. To the left, the app is loading to validate the link. To the right, the link is validated and the user can save the link to the system. This is also referred to as the introduction view



Smart vidarekoppling

Choose how incoming calls should be forwarded to your co-workers

Figure 5.5: The starting screen of the Smart Forwarding settings. Here, you can navigate to the Forwarding connections view and the view to edit the spreadsheet link

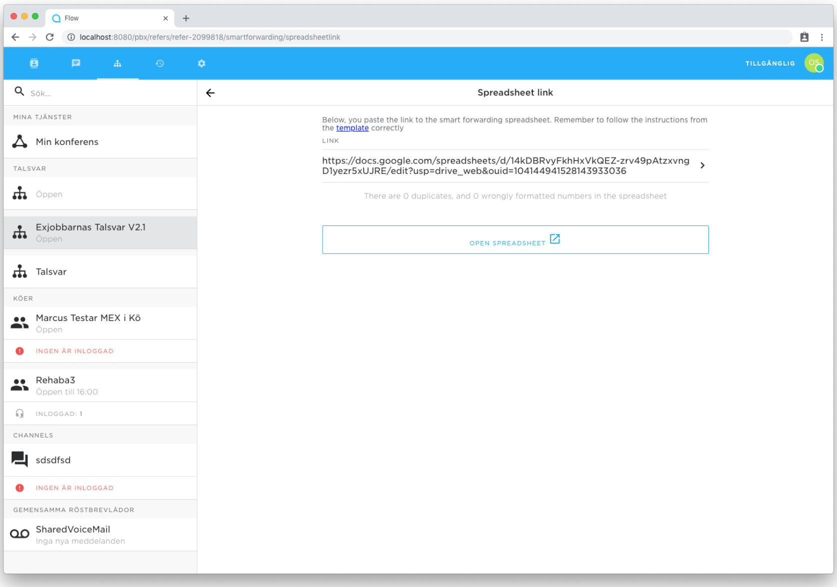


Forwarding connections

Sök...

INCOMING CALLER	FORWARDED TO
Adal 00460734856484	Berg 564645
Sanne Solo 0701234579	Patel P 0701000079
Coby D 0701234578	Sellername B 0701000078
Charlotte L 0701234577	Agent C 0701000077
Carol B 0701234576	Sellername A 0701000076
User N 0701234575	John Doe 0701000075
Incomming C 0701234574	Agent C 0701000074
Peter P 0701234573	Agent C 0701000073
Chuck H 0701234572	Sellername A 0701000072
Wade R 0701234571	Richard L 0701000071
User N 0701234570	John Doe 0701000070

Figure 5.6: The smart forwarding connections view. Here, a user can view and manipulate his/hers different smart forwarding connections



Spreadsheet link

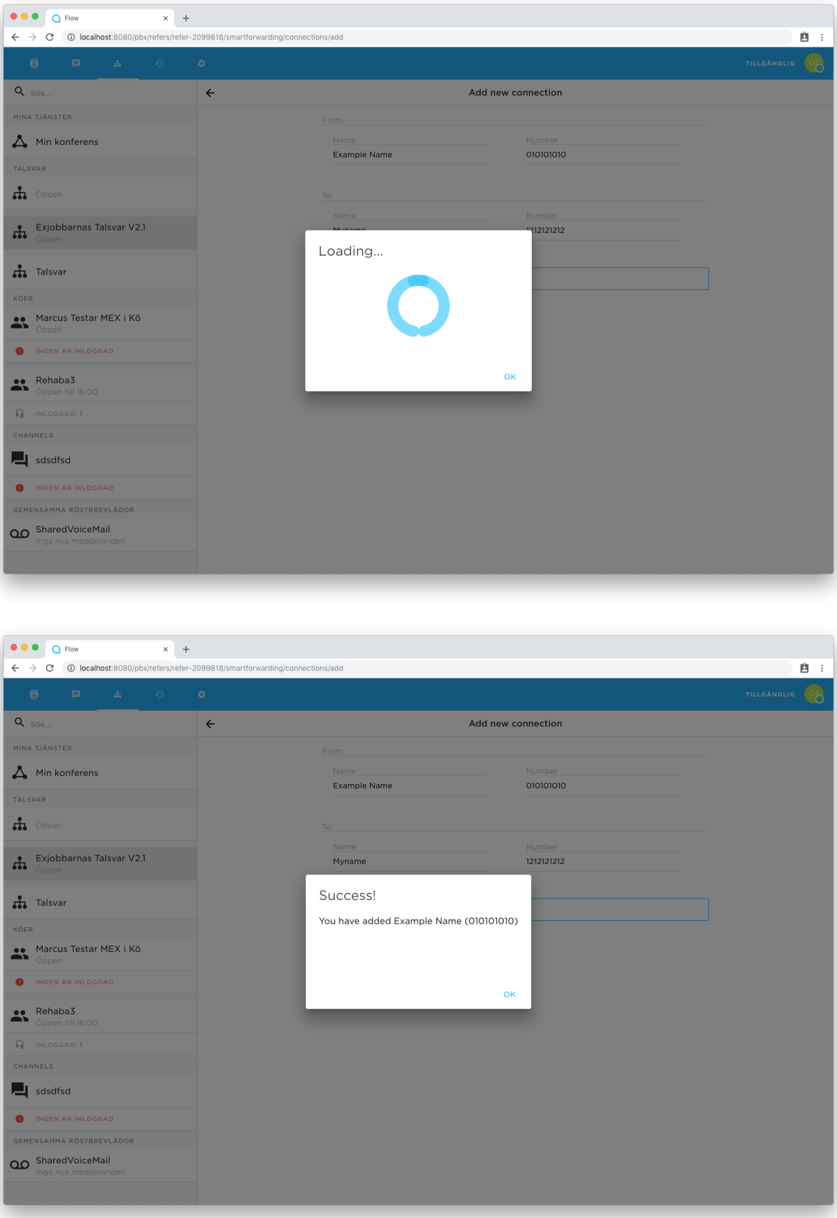
Below, you paste the link to the smart forwarding spreadsheet. Remember to follow the instructions from the template correctly

LINK

https://docs.google.com/spreadsheets/d/14kDBRvyFkhHxVkQEZ-zrv49pAtzxvng D1yezr5xUJRE/edit?usp=drive_web&ouid=104144941528143933036

There are 0 duplicates, and 0 wrongly formatted numbers in the spreadsheet

Figure 5.7: Spreadsheet link view. Here, a user can quickly open his/her spreadsheet and edit the link for the spreadsheet, if you want to change Smart Forwarding spreadsheet.



From

Name: Example Name

Number: 010101010

To

Name: Myname

Number: 1212121212

Loading...

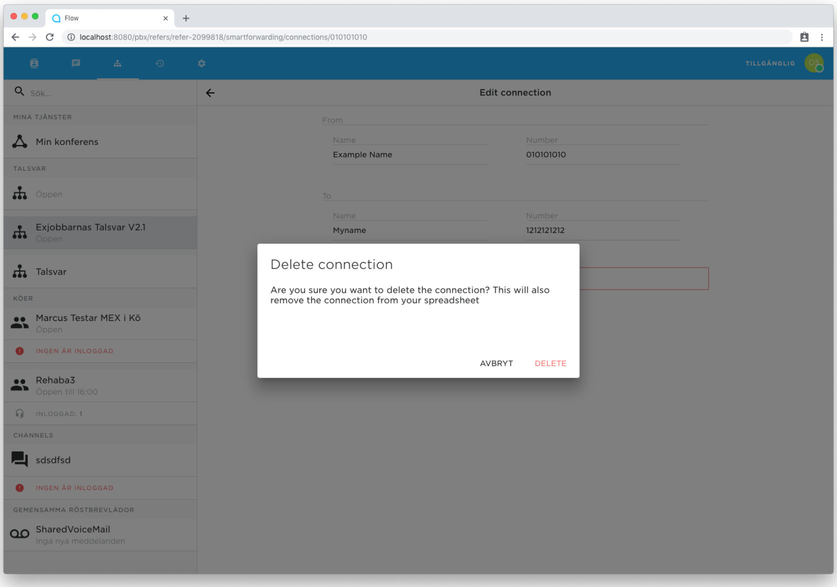
OK

Success!

You have added Example Name (010101010)

OK

Figure 5.8: The dialog window when adding a connection. The first image shows the loading screen and the second image is the success message, after successfully adding a connection.



From

Name: Example Name
Number: 010101010

To

Name: Myname
Number: 1212121212

Delete connection

Are you sure you want to delete the connection? This will also remove the connection from your spreadsheet

Figure 5.9: The dialog window after deleting a connection.

5.2 Usability inspections

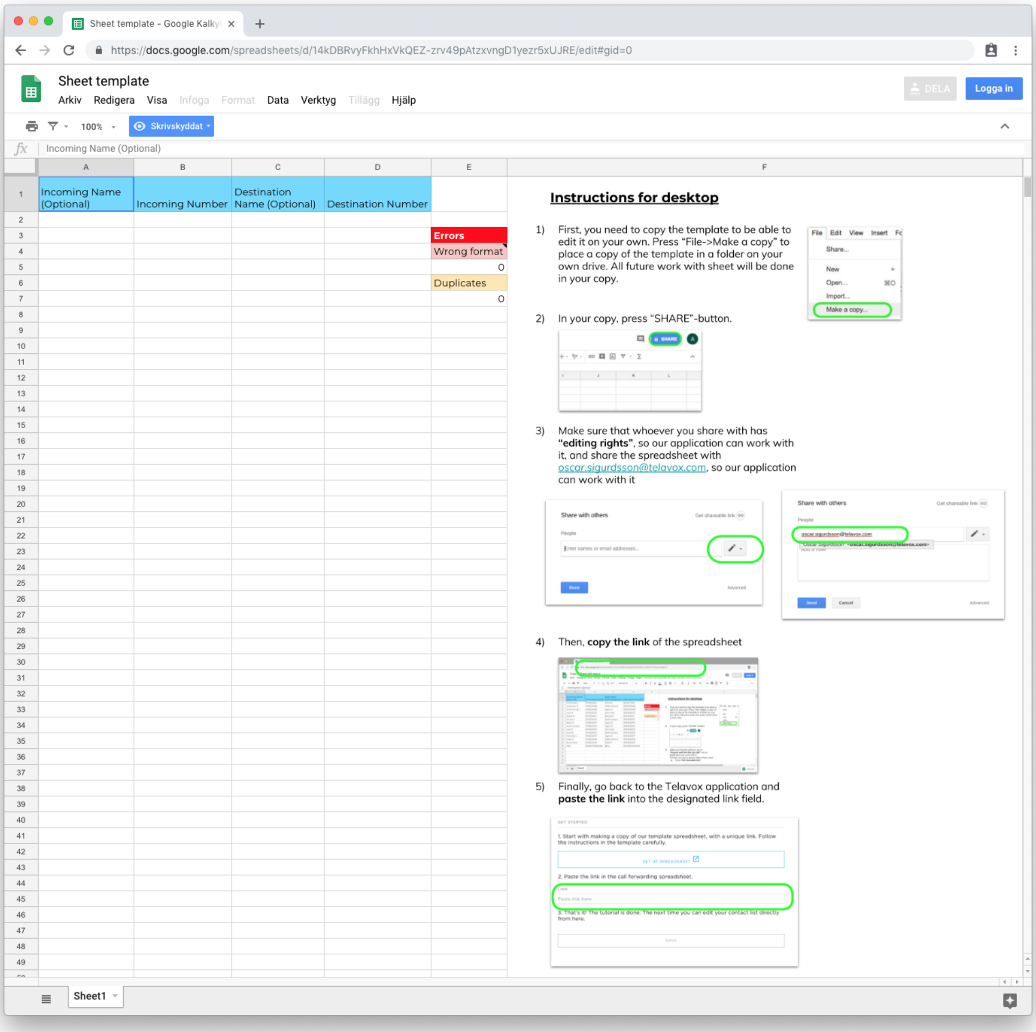
A cognitive walkthrough and a heuristic evaluation was conducted with the same two design students. The cognitive walkthrough was conducted first with heuristic evaluation conducted shortly after.

5.2.1 Method: Cognitive walkthrough

To perform the walkthrough, Spencer's streamlined version of a cognitive walkthrough was used - as described in section 2.7.2. Spenser's method involves identifying problems, rather than finding solutions, and to streamline the process as much as possible.

The goals of the system users was used by the two students as they performed the walkthrough. These are the goals the testing students were given:

1. Add all numbers from their own customer database to the system for the first time.
2. Add a single new number to the system, and connected to a specific forwarding connection.
3. Find out to whom a number is routed if a specific caller calls the system.
4. Find out if a specific number is connected to the system.
5. Remove a number from the system.
6. Change which Google-spreadsheet the system is connected to.



	A	B	C	D	E
1	Incoming Name (Optional)	Incoming Number	Destination Name (Optional)	Destination Number	
2					
3					Errors
4					Wrong format
5					0
6					Duplicates
7					0

Instructions for desktop

1) First, you need to copy the template to be able to edit it on your own. Press “File->Make a copy” to place a copy of the template in a folder on your own drive. All future work with sheet will be done in your copy.

2) In your copy, press “SHARE”-button.

3) Make sure that whoever you share with has **“editing rights”**, so our application can work with it, and share the spreadsheet with oscar.sigurdsson@telavox.com, so our application can work with it

4) Then, **copy the link** of the spreadsheet

5) Finally, go back to the Telavox application and **paste the link** into the designated link field.

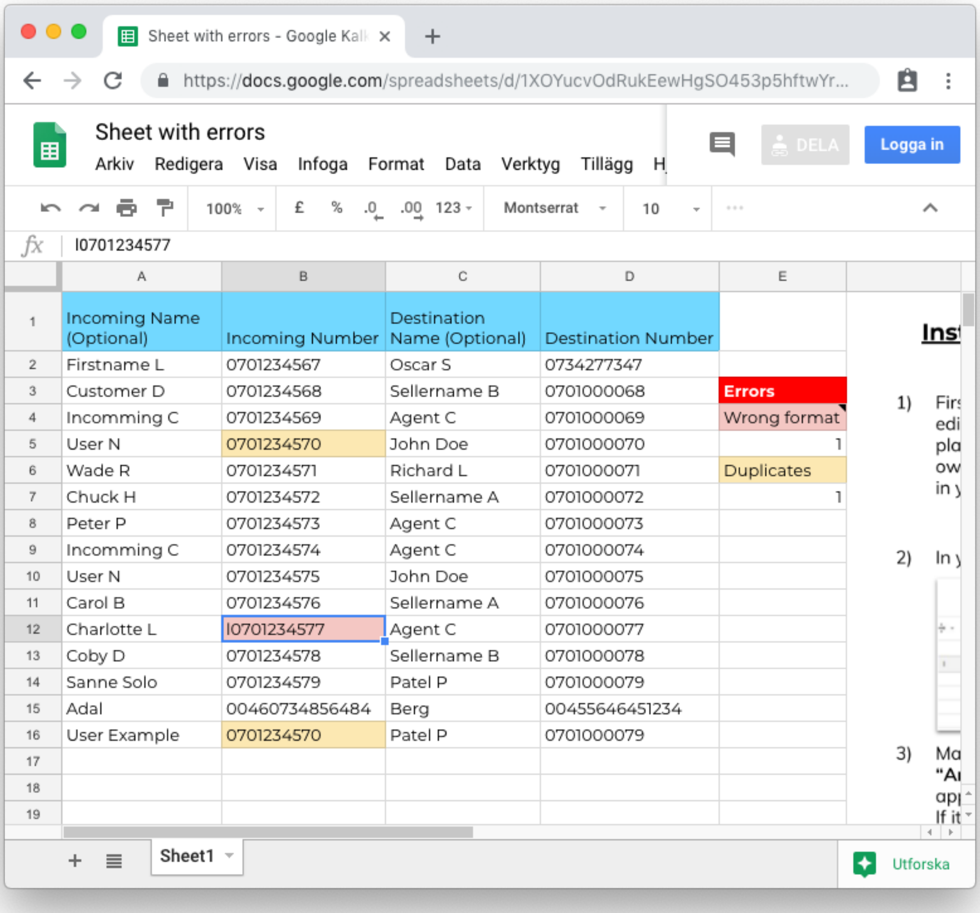
GET STARTED

1. Start with making a copy of our template spreadsheet, with a unique link. Follow the instructions in the template carefully.

2. Paste the link in the call forwarding spreadsheet.

3. That's it! The tutorial is done. The next time you can edit your contact list directly from here.

Figure 5.10: The template to how the spreadsheet should look. Notice the image with instructions how to copy the template and how to share it with the application.


Sheet with errors - Google Kalk
https://docs.google.com/spreadsheets/d/1XOYucvOdRukEewHgSO453p5hftwYr...
Sheet with errors
Arkiv Redigera Visa Infoga Format Data Verktyg Tillägg H
DELA
Logga in
100% £ % .0 .00 123 Montserrat 10
Inst
1) Firs edi pla ow in y
2) In y
3) Ma "Ai ap If it
Sheet1
Utforska

fx l0701234577

	A	B	C	D	E
1	Incoming Name (Optional)	Incoming Number	Destination Name (Optional)	Destination Number	
2	Firstname L	0701234567	Oscar S	0734277347	
3	Customer D	0701234568	Sellername B	0701000068	Errors
4	Incomming C	0701234569	Agent C	0701000069	Wrong format
5	User N	0701234570	John Doe	0701000070	1
6	Wade R	0701234571	Richard L	0701000071	Duplicates
7	Chuck H	0701234572	Sellername A	0701000072	1
8	Peter P	0701234573	Agent C	0701000073	
9	Incomming C	0701234574	Agent C	0701000074	
10	User N	0701234575	John Doe	0701000075	
11	Carol B	0701234576	Sellername A	0701000076	
12	Charlotte L	l0701234577	Agent C	0701000077	
13	Coby D	0701234578	Sellername B	0701000078	
14	Sanne Solo	0701234579	Patel P	0701000079	
15	Adal	00460734856484	Berg	00455646451234	
16	User Example	0701234570	Patel P	0701000079	
17					
18					
19					

Figure 5.11: An example of how the spreadsheet might look with errors.

5.2.2 Result: Cognitive Walkthrough

Hereby follows the points lifted during the cognitive walkthrough. All of the points are presented after its given goal, and later summarized at the end of this section.

The first goal included interaction with the, so called, tutorial view and the spreadsheet. The rest of the goals included interactions with the smart forwarding home page, the forwarding connections view and the spreadsheet link editing view.

Goal 1: Add all numbers from their own customer database to the system for the first time.

- It was easy to find which menu item to press to enter our system.
- Tutorial does not feel right until after one has read the description
- The ”Read more” button and ”Set-up spreadsheet” button is of the same size and colour which makes them feel of equally weight and of equal importance to click.
- In the spreadsheet, one might start to read the instructions or try to start editing the spreadsheet. However, both work as valid actions.
- When one has pasted the link of the spreadsheet into the program, the red colour underneath the link while it is loading might make the user think that something is wrong while it is only loading. The spinning circle animation might help alleviate this.
- The text area for writing links and the sub-headers are too similar and it is not clear that there is space for writing there.
- The user might also think that they did something wrong due to the time it takes for the program to validate the links.
- Save should light up more when one is able to press it to make sure that the user notices the change and know to press it.
- The buttons in general do not have enough contrast compared to the background and may be hard to notice.
- When one presses ”Save” in the tutorial, there should be more feedback that makes the user feel that they performed the correct action.

Goal 2: Add a single new number to the system, and connected to a specific forwarding connection.

- There are signifiers to press on both ”forwarding connections” and to go to the spreadsheet in order to add connections. Both are considered the correct action.
- The plus button, in forwarding connections, is too far down on the page and might be hard to find for the user. This will not be an issue on a mobile but on desktop this becomes an issue.
- When adding a connection in the application, one has to press outside of the text-area in order to activate the save-button. This might cause hesitation in the user in what to do next.

- When the user clicks on ”ok” one should go back to the list instead of the view for adding another connection, as this implies that the action was unsuccessful and is to be performed again.

Goal 3: Find out to whom a number is routed if a specific caller calls the system.

- Search is fast and responsive and is positioned where the user should expect.

Goal 4: Find out if a specific number is connected to the system.

- This goal should be done in the same way as the previous and the inspectors during the cognitive walkthrough imagined that users would also realize this

Goal 5: Remove a number from the system.

- The actions and feedback was clear.

However, when deleting a connection the inspectors came upon the option of editing and, while it was not a listed goal for the walkthrough, they came up with interesting points.

- When editing a contact, the system lacks feedback that the state has been saved.
- There should be a clear option of saving, and one for canceling the changes that should be made.

Goal 6: Change which Google-spreadsheet the system is connected to.

Here the same critique which was found in the tutorial section comes again.

- Validating the link is slow and may cause the user to worry that they have done something wrong unnecessarily.

Summary

There are a number of issues which have surfaced during the walkthrough. Error handling is slow which may cause usability issues with users doubting that everything works correctly. Buttons and headers are perhaps not distinct enough from either the background or from the help text within the link-area. This can be summarized as a style change may be needed overall. Some mobile first designs may cause usability issues on the desktop such as buttons being in the bottom right of the screen. Saving and changing data within the application does not provide enough feedback that the action was successful.

There are however a couple of positive notes from the walkthrough. The application supports data management from within the application and the spreadsheet, and both ways of completing the tasks are signified and equally available. After the tutorial, how to do the rest of the goals were clear. Additionally, the issues during the tutorial seem to be minor.

5.2.3 Method: Heuristics evaluation

The *heuristic evaluation* used the improved heuristics by Nielsen, described in section 2.7.2. The two students performed this evaluation directly after performing the cognitive walkthrough. During the evaluation, we found that we were short on time which means that the evaluation was not done as thoroughly as it should be done. The results from the heuristics evaluation is therefore somewhat meager.

5.2.4 Result: Heuristics Evaluation

As mentioned earlier the heuristics evaluation was short on time so the result are not as well done as it could be but here the issues that were gathered are presented.

1. **Visibility of system status.**
   - The loading circles are a good indicator of the system status.
   - Refresh in the forwarding connections view does not provide any feedback when it loads.
2. **Match between system and the real world.**
   - ”Forwarding connections” is a label which the user is unfamiliar with.
3. **User control and freedom.**
   - When one makes a change it is automatically saved without a means to cancel. This is true for both the data of the connections and for the spreadsheet link.
4. **Consistency and standards.**
   - The consistency within the application is good.
5. **Error prevention.**
   - There is no error prevention within the spreadsheet, but error messages are provided.
6. **Recognition rather than recall.**
   - The application is small and its features few. What is in it is clearly signified and nothing is hidden.
7. **Flexibility and efficiency of use.**
   - It would be a good idea to add functionality to add several numbers at once in the application.
   - Pressing ”Ok” when waiting for add confirmation is possible for those who are secure in what they do. ”Ok” should however get a different label in order to emphasize this use.
8. **Aesthetic and minimalist design.**
   - Buttons need a bigger font and sub-headers need a darker one. To make the important information clear.
   - The ”Read more” button in the tutorial is very prominent despite the fact that it is not a primary feature.

- The functionality to open the spreadsheet from the forwarding connections view is imagined as rarely needed.

9. **Help users recognize, diagnose, and recover from errors.**
    - When there is an error with the spreadsheet the program offers a clear description of the problem but no suggested solutions. It could be considered unnecessary to provide solutions due to the simplicity of the errors.
10. **Help and documentation.**
    - The instructions in the spreadsheet takes up a great deal of space and is only necessary once. One should be able to hide it when it is not needed anymore.

5.3 Usability Tests

Usability testing was done on a group of 18 people, consisting of 12 university students and 6 testers of various professions. 2 of the older testers and 9 of the students have extensive background of computer science, which comes with some technical expertise.

5.3.1 Method

As in previous usability tests, the testers were encouraged to **think aloud** and, after the test, were asked to fill out a SUS-form. In this *final* test iteration, the testers were also asked, in addition to the SUS-survey, to mark every word that described their experience from a list of 118 words presented by Benedek and Miner in [42], seen in Table 5.1. They were then asked to pick the 5 most central of the words and to discuss why they picked those 5.

After 14 of the tests were completed, a pattern became clear - link-sharing through Google Sheets was a difficult step for most. The prototype was changed to an alternative version in order to see if there was a change. In this alternative version Telavox was given access to the spreadsheet directly by the user instead of through a shareable link.

The four remaining tests were then done with the new version in order to see if the change made the sharing of the spreadsheet with Telavox easier to perform. The first 14 tests are therefore denoted group A and the last 4 are denoted group B. The SUS survey and and Reaction Cards result only contains the result from group A.

5.3.2 Result Group A: Test Observations

There were several behaviours and events which there were only a single instance of. One tester commented that it felt weird putting their data into a third party application. The same person also used the word contact book to describe the system at the end of the test, a metaphor used when designing the forwarding connections view. Another user suggested that being able to quickly add a number which ones searches for and cannot find would be neat. Another commented that they are unable to see which refer(queue) they are currently working in and imagined that would be an issue if they had several to manage. Two of the participants did not like the red error header in the spreadsheet, specifically that is was there even when there were no

Table 5.1: The complete set of 118 Product Reaction Card words presented by Benedek and Miner

Accessible
Advanced
Annoying
Appealing
Approachable
Attractive
Boring
Business-like
Busy
Calm
Clean
Clear
Collaborative
Comfortable
Compatible
Compelling
Complex
Comprehensive
Confident
Confusing
Connected
Consistent
Controllable
Convenient
Creative
Customizable
Cutting edge
Dated
Desirable
Difficult
Disconnected
Disruptive
Distracting
Dull
Easy to use
Effective
Efficient
Effortless
Empowering
Energetic
Engaging
Entertaining
Enthusiastic
Essential
Exceptional
Exciting
Expected
Familiar
Fast
Flexible
Fragile
Fresh
Friendly
Frustrating
Fun
Gets in the way
Hard to Use
Helpful
High quality
Impersonal
Impressive
Incomprehensible
Inconsistent
Ineffective
Innovative
Inspiring
Integrated
Intimidating
Intuitive
Inviting
Irrelevant
Low Maintenance
Meaningful
Motivating
Not Secure
Not Valuable
Novel
Old
Optimistic
Ordinary
Organized
Overbearing
Overwhelming
Patronizing
Personal
Poor quality
Powerful
Predictable
Professional
Relevant
Reliable
Responsive
Rigid
Satisfying
Secure
Simplistic
Slow
Sophisticated
Stable
Sterile
Stimulating
Straight Forward
Stressful
Time-consuming
Time-Saving
Too Technical
Trustworthy
Unapproachable
Unattractive
Uncontrollable
Unconventional
Understandable
Undesirable
Unpredictable
Unrefined
Usable
Useful
Valuable

errors and they felt that they had done something wrong when they had not. While these issues were only mentioned once or twice, they are still criticisms to take into consideration.

There were some issues, however, which were more reoccurring. These issues are listed in table 5.2. On a laptop screen, the plus-button becomes a lot harder to notice. In contrast, the plus-button was easily found on a mobile phone - which has a smaller screen. Having the testers actually add 200 contacts, unlike in the mock-up, meant they were handling large quantities of data. This resulted in requests for streamlined ways of entering several numbers all at once in Flow. Currently, there is verifying feedback after editing a smart forwarding connection - and in order to keep consistency with the rest of Flow, there is no save button in smart forwarding either. This caused confusion and uncertainty, and some participants did not think it was possible to edit the smart forwarding connections.

Technical issues were causing usability problems as well. For example: when one changes the spreadsheet, the Smart connection view does not automatically refresh. This caused the users to doubt if they actually performed the action correctly. Also, the add button does not highlight as clickable until one presses enter in, or changing focus from, the last textfield in the ”Add connection”-view. Error handling was not a part of the prototype until very end, and users wished to be able to see the error handling in Flow - as well as in the spreadsheet.

The most troublesome usability issues were related to setting up the system and, prominently, the spreadsheet's part of the process. When setting up the system, there were generally 3 kinds

Table 5.2: All usability problems which occurred for more than 2 participants

Usability Problem	Occurance
Refresh being slow causing confusion	9
Hassles at Set-up	8
Add being unavailable until one presses enter in the last field	6
Does not think of adding contacts in spreadsheet	5
Wants to see errors in Flow	5
Looks at the connections view to confirm spreadsheet operations	5
Becomes insecure due to lack of feedback when editing link or connection data	4
Have a hard time finding the +-button	3
Wishing to be able to do mass editing or adding in Flow	3

of users:

1. Those who found the instructions, read them carefully and managed to share their spreadsheet with Telavox. However, then did not think of to put the contacts directly into the spreadsheet. Instead, they searched within Flow for a way to insert the contacts. These people possibly lacked something telling them that they could edit the spreadsheet, or felt insecure in working with a tool they were uncomfortable with.
2. Those who tried to copy their own, personal, data directly into the template and did not notice that the template is *view-only* and therefore believed that things were not working as intended. Some of the these testers tried to request editing rights to the template.
3. Those who managed to find the instructions and copy their data correctly. Often, these testers added their data to their copied version of the template directly after making the copy - and then proceeding with the instructions.

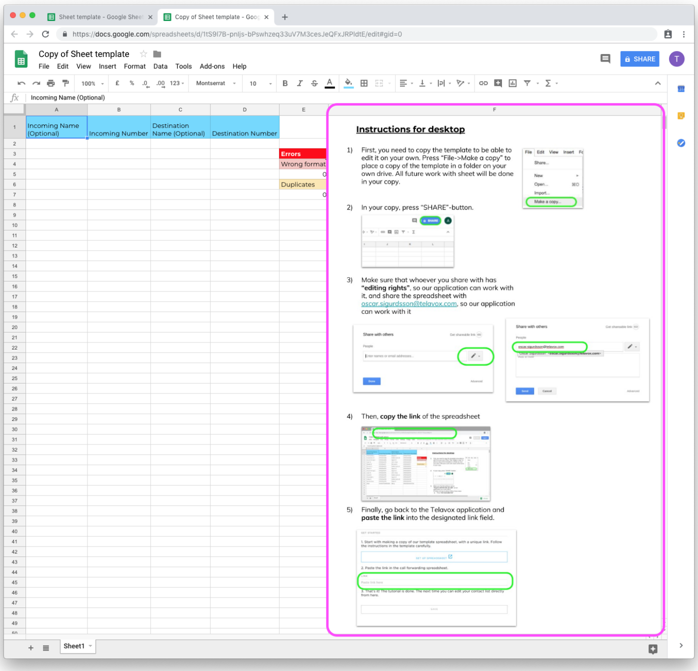
Testers of all three kinds still had hassles with the set-up, due to the written instructions being hidden behind the pop-up for *sharing* in Google Sheets - as can be seen in Figure 5.12. Subsequently, the participants had troubles to find the correct options due to not being able to read the instructions. Additionally, for participants without much experience in working with spreadsheets, managing 200 entries was cumbersome.

One case of special note - a tester reacted very strongly to the word *tutorial* during the set-up process, and therefore thought that the entire set-up had not been ”for real”. Up until that point, the tester had done very well, making the same steps as other testers. However, after this *reaction*, the participant tried to do another set-up. However this time, the participant was both frustrated and did not use the spreadsheet template. Also, the tester encountered several issues in the rest of the testing.

5.3.3 Result Group B: Test Observations

The main difference between group A and group B was the fact that for group A were instructed to use Google’s link sharing system, while group B were instructed to share editing rights with a specific Telavox account directly.

The process for group B seemed to be easier to perform in the tests. The biggest difference for



Incoming Name (Optional)	Incoming Number	Destination Name (Optional)	Destination Number

Errors

Wrong format 0

Duplicates 0

Instructions for desktop

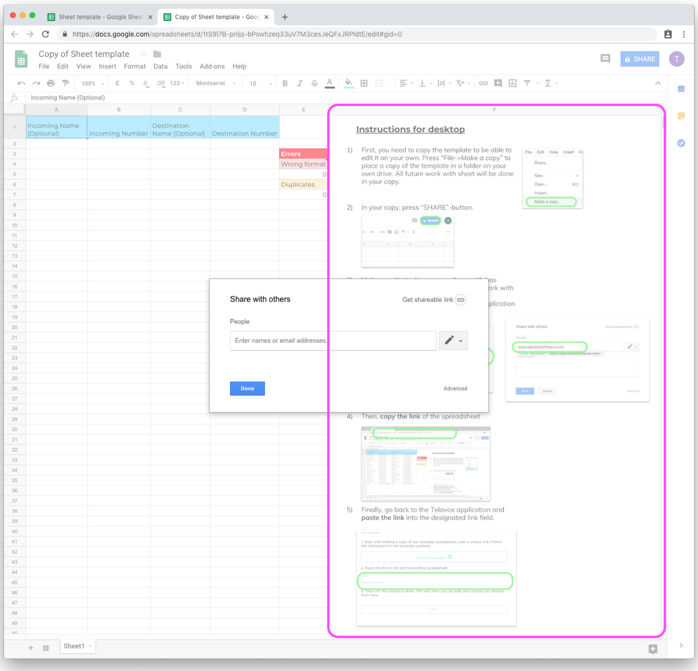
1) First, you need to copy the template to be able to edit it on your own. Press "File->Make a copy" to place a copy of the template in a folder on your own drive. All future work with sheet will be done in your copy.

2) In your copy, press "SHARE"-button.

3) Make sure that whoever you share with has **"editing rights"**, so our application can work with it, and share the spreadsheet with oscar.sigurdsson@telavox.com, so our application can work with it

4) Then, **copy the link** of the spreadsheet

5) Finally, go back to the Telavox application and **paste the link** into the designated link field.



Share with others

Get shareable link

People

Enter names or email addresses...

Done

Advanced

Figure 5.12: The template, focusing on the instructions. On the bottom image, it is harder to see the instructions because of the share pop-up window blocking the view

group B was that they did not have any issues and the test leader did not have to give any hints, during the sharing-of-the-spreadsheet process. This is heavily contrasted by 4 testers from group A, that had significant issues or errors with this part of the process. The result therefore seems to be that B's way of sharing is the preferable design.

5.3.4 Result: SUS survey

After the tests, group A completed a SUS-survey and the result is presented in figure 5.13. In the first row of table 5.3, the statistical analysis of the result is presented. A SUS score above a 70 is what usually constitutes a good user experience. In our confidence intervals, shown in figure 5.3, we can see that we do not always fulfill that goal with a sufficient certainty. There was, however, one **significant** outlier in the samples much like in the previous rounds of tests. The so called ”significant outlier” had a SUS score of 37.5. That score is close to 3 standard deviations from the average, which would signify the opinion of less than 1% of the most displeased theoretical users. Therefore, a new analysis was done *without* the 37.5 sample. The new analasys led to a SUS score, with a 99% confidence, of over 72 for all users - meaning that the product is considered good by users from a usability standpoint.

What differed ”the outlier”, with the SUS score of 37.5, was that the test-person reacted very strongly on the word ”tutorial”. The wording of *tutorial* alludes to a process where one just learns how the system works - without any real impact being made on the system. That was not the intent, but it led to the tester thinking that the entire set-up was done in vain. After the test, the tester expressed that it was a good product aside from the tutorial. What is fascinating was that the sentiment does echo the more positive testers, which also expressed that the set-up is the difficult part of the system. Both results are presented, but the authors are not sure in which value is the more legitimate one.

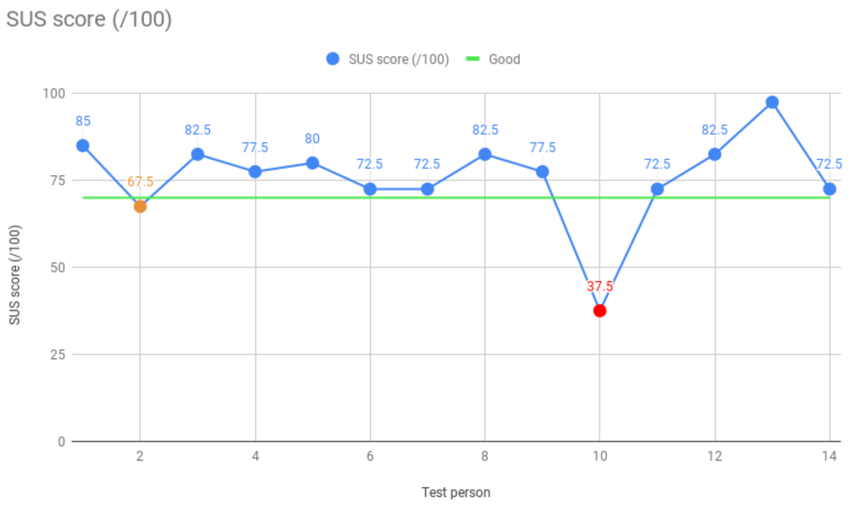


Figure 5.13: This image represents the SUS scores of the testers. There is a line, with the value of 70, marking the bound for what constitutes a good product

Table 5.3: The calculated statistics of the SUS result, the first row is the entire sample and the second row is without the 37.5 entry

	Average Score	Standard Deviation	95% Confidence Interval	99% Confidence Interval
Entire Group A	75.7	13.3	[68.1, 83.4]	[65.0, 86.4]
Without the 37.5 entry	78.7	7.75	[74.0, 83.3]	[72.1, 85.2]

5.3.5 Result: Microsoft reaction card evaluation

When scoring the words, a word was given 1 point if it was marked by a tester and 2 marks if it was also selected as one of the 5. In table 5.4 and in image 5.14, the scores are presented. Conspicuously, words like usable, understandable and useful are the mayor choices among the possible choices. One notable *negative* word is confusing, with at score of 5. The testers commented on that the initial set up with the Google spreadsheet was difficult and confusing, expressing frustrations regarding using the third party application.

Usable	15	Stable	5	Personal	2	Disconnected	0
Understandable	14	Familiar	5	Rigid	2	Disruptive	0
Useful	14	Comprehensive	4	Slow	2	Distracting	0
Time-saving	13	Consistent	4	Sophisticated	2	Dull	0
Convenient	12	Effortless	4	Sterile	2	Empowering	0
Easy to use	12	Fresh	4	Boring	1	Energetic	0
Clean	11	Powerful	4	Calm	1	Enthusiastic	0
Helpful	11	Valuable	4	Collaborative	1	Gets in the Way	0
Effective	10	Attractive	3	Customizable	1	Hard to Use	0
Low Maintenance	10	Comfortable	3	Cutting edge	1	Incomprehensible	0
Business-like	9	Compelling	3	Difficult	1	Inconsistent	0
Straight Forward	9	Creative	3	Engaging	1	Irrelevant	0
Friendly	8	Desirable	3	Essential	1	Motivating	0
Integrated	8	Expected	3	Exceptional	1	Not Valuable	0
Relevant	8	Frustrating	3	Exciting	1	Novel	0
Simplistic	8	Inviting	3	Fragile	1	Old	0
Organized	7	Reliable	3	Impersonal	1	Ordinary	0
Professional	7	Responsive	3	Impressive	1	Overbearing	0
Accessible	6	Satisfying	3	Ineffective	1	Overwhelming	0
Efficient	6	Unrefined	3	Optimistic	1	Poor quality	0
Meaningful	6	Controllable	2	Predictable	1	Stimulating	0
Trustworthy	6	Entertaining	2	Secure	1	Time-consuming	0
Intuitive	6	Fast	2	Stressful	1	Unapproachable	0
Appealing	5	Flexible	2	Too technical	1	Unattractive	0
Approachable	5	Fun	2	Advanced	0	Uncontrollable	0
Clear	5	High quality	2	Annoying	0	Unconventional	0
Compatible	5	Inspiring	2	Busy	0	Undesirable	0
Confusing	5	Intimidating	2	Complex	0	Unpredictable	0
Connected	5	Not Secure	2	Confident	0		
Innovative	5	Patronizing	2	Dated	0		

Table 5.4: This table represents the words chosen by the testers, when evaluating their experience with the application. To the left is the word, and to the right the number of times the testers chose it

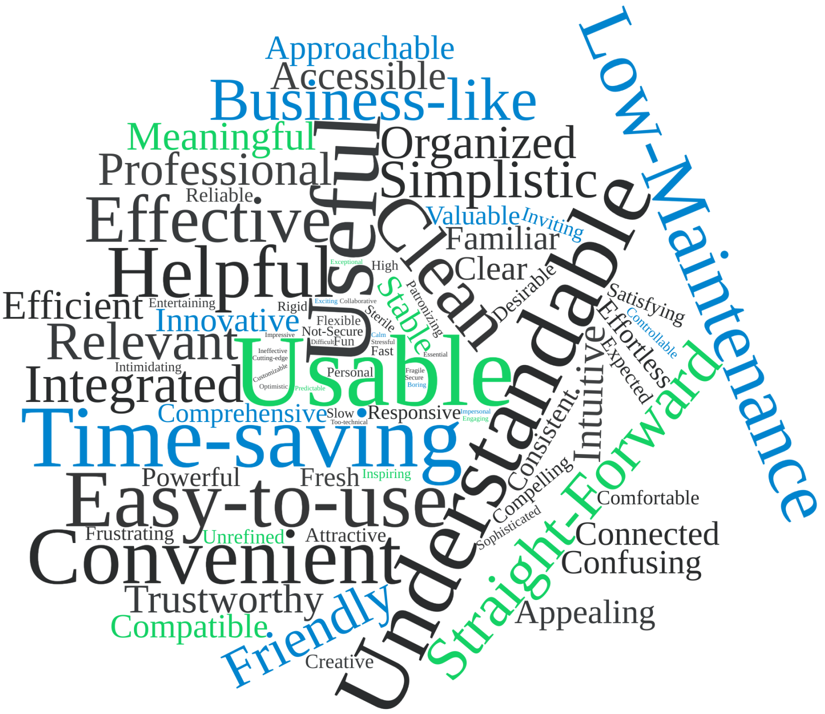


Figure 5.14: This image represents the words chosen by the testers, when evaluating their experience with the application. The larger the font, the more times the word was used

After users were asked to circle what they thought was the 5 most relevant words, they were asked why they had chosen the words they did. In table 5.5 one can see all the words which were encircled by more than 1 participant. All of the words which were selected by more than 1 were positive. However in their explanations 5 of the participants chose positive words such as usable, convenient and easy to use with the caveat: except for when doing the set-up. So while the whole system as a whole gives a good impression a significant part of the users do not like the set-up process.

Table 5.5: The most circled words during the reactioncard-test

Convenient	4	Business-like	2	Professional	2
Time-saving	4	Clean	2	Straight Forward	2
Usable	4	Effective	2	Trustworthy	2
Useful	4	Helpful	2	Understandable	2
Easy to use	3	Integrated	2		
Low Maintenance	3	Organized	2		

6 Discussion

6.1 Use of Design Techniques

The choice of design techniques impacts a lot of aspects in projects. It impacts the time it takes, what is tested and considered and the cost of the project. Hence, we will discuss the techniques used and which impact it might have had and what impact different techniques could have had.

6.1.1 User-centered Design

User-centered design, as described in section 2.4, is done in order to ensure that the design meets the correct needs and users. In this project, the goal was to utilize this design technique and make use of its advantages. There are however some principles which were not properly followed. While not a certain error source, it impacts the effectiveness of User-centered design.

Error sources

Firstly, the design does not address the complete user experience. The rest of the Telavox system is not evaluated in this project, but acts only the foundation of which the system is. The design mainly considers the new ”smart routing”, and the views surrounding its settings.

Secondly, the team of this project has consisted of two students with a very similar education in computer science and design. Sadly, that runs the risk to a lack of multidisciplinary skills and a lack of different perspectives.

Finally, the the testers involved were not necessarily the users of the proposed system, but rather somewhat representative. They consisted of friends and people close to the writers of this thesis. Although there was input from different age-groups and people of different disciplines, the test group ran the risk of being uniform in nature since a majority of the testers were students in the computer science program.

6.1.2 Paper Prototyping

In this project a proper paper prototyping step was not really done, as in writing prototypes on paper and testing them against users. This was due to the fact that editing the prototype with the presentation tool Google Slides easy, even easier than on paper. That aspect of having an iterative, easy to change, prototype covered by the early mock-ups.

Due to not having a lot of modules in our design, and the Telavox system already having an established design throughout the Flow app, we did not get any unwanted feedback regarding the color scheme or font choices - risks one runs when doing a high fidelity prototype. One risks this because, as Snyder writes in his book [25, p. 58]:

> “When something appears to be finished, minor flaws stand out an will catch the user’s attention. To put it another way, people will nitpick.”

Also, since we did not have infinite amount of time doing this thesis, we chose not to do too much in the low fidelity prototype. In our case, it was an advantage that the prototype looked very close to the real product. It made the users’ gut reaction easier to see and use as feedback.

However, by starting with a high fidelity prototype, the user would more likely focus on the details. This can be avoided by using paper prototyping. There were some design issues that were never caught during the testing - leading to the biggest changes being made to the design has come after speaking to the UX team at Telavox or when speaking to the supervisor from Lund University. For example, no test caught in the first mock-up that ”smart routing” and ”VIP-calling” were the same thing. However, the UX team at Telavox questioned why we had two different views that did the same thing. If given more time, it would possibly have been advantageous to have a lower fidelity prototype to get better feedback from our tests.

6.2 State of the Final Prototype

One of the biggest issues when designing this product was the lack of a clear metaphor[64] and terminology for the design. Because of this, a discoverability test was carried out where the participants were asked to search the web for a product that has the functionality of smart call forwarding (described in section 3.3). In the discoverability test, some described a wish to find something akin to an *email filter* or *email rules*. *Smart forwarding* works very much like an email rule which forwards based on who sent it, but instead of emails it is now callers. When designing the system however, email was not a very good inspiration for how to present the content. Contact organizers in smart-phones was a better fit, since the connections view presented a list of people. However, an arrow was put between the two numbers in order to represent the forwarding, a symbol taken from e-mail. No confusion regarding how to work with the connections view appeared - mostly thanks to the familiarity with a contact organizer.

Even though the usability score from the tests are good, the design is not finished and ready for release to the public. There are more changes to do. Currently, the prototype has succeeded in making Google Sheets a part of working with the product, aside from the set-up stage. Nonetheless, testers switch between working in the prototype and in Flow without issues - meaning a success regarding making the system a natural part of the established product of Flow. During the tests, the participants appreciated using the system and the potential it could bring. The issues remaining are first and foremost performing initial set-up with Google Sheets and that a lot has to be set-up **flawlessly** in the spreadsheet by the user in order for the system to work.

6.2.1 A Potential next Iteration

A next iteration would try to solve the issues with setting up the system. One alternative could be to introduce more thorough instructions, probably with a new step which encourages the user to enter their data into their copy of the template. That way, they would have confirmation of it working just by looking at connections. That would clarify understanding of how the system works and shows that one is allowed to edit the spreadsheet. Otherwise many of the issues with set-up are inherent to Google Sheets, e.g. users having a hard time noticing that the template is view-only, and therefore hard to solve without having to switch from Google Sheets as a cloud solution.

Aside from set-up, automatic updates of the connections list in Flow when the spreadsheet is edited is the next priority. This would give feedback for those changes within the spreadsheet, and less confusion on the part of the user. In somewhat the same vein, the errors which one can find within the spreadsheet should also be represented within Flow, so that all information which is present within the spreadsheet is also represented within Flow. This change would bring greater consistency and allow the user to use the more powerful search function within Flow to find the errors. As a final change, the sub-headers would need to be darker in order to differentiate them from the text area in which to write.

While there are many small issues to fix in addition to whats mentioned above, the last iteration of tests showed that the set-up is the main issue that needs to be streamlined and made easier, so it would be the primary focus.

6.2.2 Additional Features and Improvements

While the product is functional and, according to the last round of tests, usable, there are some additional features which would significantly improve the system. Due to this being a new product, there exists no established metaphor for it among the users and as such one has some flexibility in how it may be presented and thus which features the user may associate with it.

In this project the chosen metaphor has been the functionality of e-mail rules and filters presented in a contacts list. This is the assumption from which these features are designed.

Interaction with Call History

In e-mail clients, one can often add a rule by clicking on an e-mail and filter based on the sender or other information. This concept could be extrapolated to this system and one could imagine a system were it was possible to add data to the spreadsheet by interacting with the call history. This would have the added bonus of a simple way to get started with the system and gradually make oneself familiar with it.

Additional Rules

Extrapolating the metaphor with the e-mail rules and filters further, one could imagine additional rules which could be of use to the user. Routing a user based on their country- or areacode, could make more general rules within the same kind of system. One could even route users based on other parts of the number if, for example, a company has the same prefix to all of their numbers. This could be done by using a wildcard symbol in the spreadsheet. One would however need to have a better idea of how the system is being used in practise in order to ensure that this kind of functionality is something which will be used. Additionally, clear instructions of this possibility needs to be communicated to the user. Otherwise, it runs the risk of never being used.

Security

One improvement which could be implemented regardless of metaphor is an improvement in security. As of right now anyone can call the script which handles interaction with the google-spreadsheet, which makes it completely available as long as the attacker has the link. This is a problem which can be solved in the back-end, through proxy servers in a way which was suggested by Atlasson and Hesslow[2]. However, one has to examine how this affects the user experience. If there are other steps needed to be done in the web-client or in the spreadsheet by the user in order to enable a more secure solution.

6.2.3 Feature and Design Motivations

Due to feature fatigue[29] and the costs associated with developing a product, one needs to consider every added feature and to not let the amount of features get to high. The inability to remove a feature which is unnecessary might burden your system's usability and make all other features more cumbersome to use. The motivation behind including a feature is therefore of importance and should be considered for all new products. In this section, we explain why the following features were included in the final prototype.

Introduction: We found that when this functionality was described to the test persons, they did not imagine why a spreadsheet was necessary. The set up with the spreadsheet therefore came as a surprise for the first iteration of testers. In order to not surprise the user, the introduction view was added. It tells the user that they will store their data in a spreadsheet and that the *system* needs knowledge and a connection to said spreadsheet. After adding a tutorial, users perception of the spreadsheet went from ”strange” to a natural part of the system. The tutorial also serves the purpose of guiding the user through the first set up of the system.

Connections view: This was imagined as a way to provide feedback and confidence for the user in the system. Here the user can see their data represented in the application and thus make sure that the system reads it correctly. When users add an item to the spreadsheet it provides confirmation if that item then can be seen in the application itself. During testing, some users used this view as intended and went back to it frequently in order to confirm spreadsheet operations.

Connections manipulation: To enable a low-effort use on the mobile for the user who wants to continually update their data on their phone, or somebody in the Flow web app, the ability to edit connections was developed. The feature is also a convenience that users likely will expect, and miss if it is not present. Especially, if they can see the connections within the application, though this was never tested explicitly. It was however noted that testers manipulated the data without any hesitation and thought it as a natural part of the system. This indicates that the complexity cost of the feature is low.

Search/Filter: This allows the user to easier confirm that a specific number is in the spreadsheet. This goes together with manipulation in order be able to work with the spreadsheet and the data. We noticed a great need for confirmation, on the part of the user, and this gives sufficient feedback to confirm if changes have been exported to the system. Also, it is a feature that especially simplifies usage on a smart phone.

Splitting views: When users arrived at the connections view, they were often overwhelmed in the early iterations. The connections view contained both the forwarding connections as well as the link. Since all the information and possiblilties overwhelmed users, the two were therefore separated into different views. In following tests, none reported any kind of confusion upon arriving at the connections view. Tests have therefore indicated that the link and connections should not be in the same view - especially on a smaller screen. This is an example of keeping it simple and limiting the amount of information in a single view being necessary for a pleasant user experience.

Error message when checking link: To provide feedback on link input, an error message was implemented. If the user puts an erroneous link which either does not lead to a spreadsheet or is not editable by the system they get an error message. Otherwise, it can be very hard for the user to understand and discover what went wrong without proper feedback. In order to prevent frustration from the user, the program checks up front if the link is correct.

Error checking in spreadsheet: The spreadsheet has a script which checks the numbers' columns in order to make sure that they are numbers. This effect of the error would appear when the caller with that number calls and is not routed correctly. Also, the system does not support duplicate additions for forwarding an incoming number. Therefore, those are also counted as errors. By trying to check for these errors ahead of time, an error can be correctly dealt with before they cause the user any actual issues for the user.

6.3 Third Party Cloud

Designing through a third party creates additional constraints upon the design since some elements of the user experience are hard to control. The elements of the design which are related to the third party are discussed here.

6.3.1 The Choice of Third Party

This project used the work of Atlasson and Hesslow [2] as a basis when choosing a third party cloud storage. They considered Google Drive, Microsoft Azure (OneDrive) and Amazon S3 (AWS). In their analysis, Google Drive and Microsoft Azure was prefered over Amazon S3, since they had graphical user interfaces which a majority of customers would recognize and be able to use. Google Drive had the ability to use their web app service to create API's which one could call, which made implementing the functionality of the service easier. Google Drive also uses their own authentication system which enables users which already have a google account to use it.

This analysis is applicable to our own project and Google Drive was chosen for this project for the same reasons.

6.3.2 Design Solutions

The process of setting up the spreadsheet needs to be done in a very specific way for the system to work. Since the spreadsheet is part of a third party, one cannot use the common design technique of *constraints*[65, p. 125] in order to guide the user through the steps. The solution in this project was therefore to put detailed instructions directly into the spreadsheet. This is one of the major negative aspects of using a third party interface since one cannot affect the experience in the third party application a great deal.

The positive part of using Google Sheets was very apparent. It has, as previously mentioned, an open API - making it easy to develop custom commands for -, and a spreadsheet is a very good way to manipulate many data objects. It is easy to copy and paste 2000 cells from one's own spreadsheet into another, in comparison to manually having to input the (in this case) phone numbers one-by-one.

However, when working with the spreadsheet as the primary database, the users might not be convinced that editing the spreadsheet actually changes anything in the system as a whole. In order to provide feedback, a representation of the spreadsheet was designed in Flow. This allowed one to make changes and then observe the changes made in one's spreadsheet and vice versa to the app. Therefore, even though the spreadsheet displays the data, showing it in Flow allowed users to easier understand how their actions in the third party application affected the application.

6.3.3 Alternatives to Third Party Clouds

An alternative to using a third party cloud provider would be to provide similar functionality from within Flow. This would give the designers control to the entire user's experience and would make it possible to utilize constraints to limit the plethora of options within a spreadsheet.

This would however bring significant costs, since we would have to reinvent much of the functionality provided by Google Drive and Google Sheets. Also, one would have to introduce even more functionality to the user. By using Google Sheets, we also have powerful additional functionality for the more advanced users, who can e.g. utilize their knowledge of Google Sheets to set up their own scripts which update their data automatically. To add, most people working with a computer has some experience of interacting with a spreadsheet.

6.4 Designing Something New

The project went through several phases of testing. These tests resulted in new design-principles or other phenomenon which will be discussed and motivated to a greater degree bellow. Some design principles may be general and extracted any type of software product, while others are more specific for this project. These are in essence the lessons from the project which one is able to bring into other similar projects.

6.4.1 Prepare the User for the Unexpected

As noted in the first iteration of tests, described in section 4.1.3, users were confused and thought they had done something wrong when the application took them to the spreadsheet. The label they pressed on was ”set up smart routing” which was what they wanted to do and the function was discoverable. However, the users did not have the expectation that they would work in a spreadsheet and thus thought they had done something wrong.

This was solved by preparing the users and making sure that they knew that they would open another window, with a spreadsheet, before they pressed the button which took them there. When users were told ahead of time that they would work with a spreadsheet, the spreadsheet did not come as a surprise. It even seemed natural for the testers in the later iterations. This could be extrapolated to a more general principle when designing functionality with new processes or unfamiliar actions for the user. But future studies are needed to properly validate this.

6.4.2 Conveying Capabilities

Being able to convey what a product does is not just a marketing problem. Rather, if a user does not know what is available in the design then the product is unusable. During the early tests of the prototype, some participants reported feeling unsure of what the system does even after managing to set it up. Later, during the final tests, many participants picked words in the reaction card evaluation which highlighted the usefulness and purpose of the system, with **time-saving** being one of the more picked words. The test scenario changed so that they would have a larger quantity of customers and they saw the system in the context of the rest of Flow. Those additions may be what resulted in the users understanding the purpose of the system, after they had completed the tests. So while knowledge of the functions’ intent was not necessary to perform the actions to get the system working, it might be necessary in order to get a user to explore the functionality outside of a test environment. We do not have anything conclusive to tell what was the reason for the change between the early and late tests. It could simply be that the mock-up was insufficient to convey understanding of the system, and a more realistic situation in an actually working system was what made the difference. It is worth to keep in mind that this is a challenge for *any* new type of product, which will need justification for its existence to users.

6.4.3 Having Users Search

During the early tests, the participants were confused with the term ”smart routing”. No available technique was found to find a better term which would resonate better with the users among the literature. Therefore the *discoverability test* (described in section 3.3) was thought up and tested.

The label was then changed to *smart call forwarding* - in accordance with what the participants in the *discoverability test* searched for (as seen in section 3.3.2). After the change was made, it was much more natural for the participants to pick it when looking for the functionality. This was but one of many positive results from this test. What was not expected when the tests were initiated was that users would try to explain what they searched for. They described telephone exchanges, telephone queues and e-mail and these thoughts were later converted into metaphors for the system.

Another tertiary benefit of the test was what kind of companies resulted in the users searches for the functionality described in the test. The testers searched for telephone exchanges. Thus, some of them arrived at the Telavox's homepage and others ended up at other similar companies. This told us that the system fits with the image of the company and that it is something that would work well as an extension to the existing services.

The method of asking your users to search for the features you wish to design provides, in our experience, a great deal of information on what they expect and which terms they might use to describe your system. With this, you can confirm the relevance of the functionality, what metaphors the users use and what labels are appropriate to use in the system.

6.5 Ethical Aspects

In this section we discuss the different ethical aspects which are relevant for the project and in extension the product.

6.5.1 GDPR and Data Protection

The General Data Protection Regulation [66], or GDPR for short, is a recent regulation from the EU which has codified several practises which earlier only had been ethical concerns. The regulation was put in place to protect user data. It is primarily three subjects of the regulation which are relevant for *this* thesis work: consent, right to access and right to be forgotten.

GDPR mandates that a person must consent, and there must be a sufficient reason, for a company to be allowed to store data of them. For example, Telavox needs phone numbers in order to be able to provide their services. The consent is usually managed by the terms of services, whereby the customer agrees to share their data in order to acquire the services of the company. The company may only process the data in accordance with what the customer has consented to.

If a company stores data of a person, that person also has the right to access the data being stored and to ask for its deletion. This is the right to access and to be forgotten. With the proposed system, the database is made bare and for the customer to manipulate. The customer has full control of the sheet and can delete it at any time and can access it at any time, without having to contact the company. This makes it more transparent, towards the customer, what data the system has and makes it easier for the customer to remove any data which they do not want to share anymore.

On the other hand the current system and design puts the data in the hands of a third party. This system was designed with Google as that third party which have their own practises and policies to deal with GDPR and data protection. This means that the customer does not only have to give their consent to Televox, but to Google as well, in order to use the service. This also brings along the risks associated with trusting a third party and provides another venue of data breach.

6.6 Error Sources

In this section potential sources of error will be explained and analyzed in order to confirm or discuss the validity of the conclusions stated in this thesis.

6.6.1 User Representation

The major source of error in the need analysis is the limited exposure to real users. The difficulty in finding representative users to interview, meaning that a lot of the design is based on customer requests and expertise at Telavox, but not on any quantitative study. This is also one of the difficulties of a new system, there are not necessarily any established users of such a system. It is a good idea to figure out the user basis, making the design of the product to fit a persona.

This kind of error is also found in the testing of the prototype, as most testers were students at engineering programs. The intended users are at management levels in companies, which may or may not have an engineering degree. They are, however, most likely older and therefore have other ways of interacting with the system and different assumptions. This affects the feedback and observation on the usage of the prototype.

While the final tests are more representative than the earlier tests, they did contain a large number students due to the difficulty in finding test people for the project. A mitigating factor is that design inspection was used along with user tests, in order to get different kinds of feedback. This could partially cover for the issues faced in the user tests.

6.6.2 Number of Data-points

The user tests during the project was performed with 5 to 8 users for each iteration and inspections were carried out with 2 design experts. This is a low number of data-points, and a quirk in a few of the individuals runs a high risk of affecting the tests significantly. A mitigating factor is that the iterations of the prototype were similar to each other, and therefore tested old functionality at the same time as new. Therefore, the older and more core parts of the design has theoretically undergone testing by a large number of individuals. To draw a conclusion despite the low number of testers, statistical analysis was done on the SUS scores. The statistical analysis makes the assumption that the SUS-scores follows the normal distribution like most random numbers, which may also be a cause of error if SUS-scores do not.

6.7 Constraints

We needed to fit our project inside an already established product, the Telavox Flow system. Overwhelmingly, Telavox system has affected design choices regarding to colors, fonts and layout. One important fact to note, some design decisions, like the approach to editing the spreadsheet link, were only made in order to be consistent with behaviour with the rest of Flow.

This project has only worked with functionality and code which the user interacts with. For an analysis on the of developing the back-end functionality, one has to find related work - perhaps Atlasson and Hesslows report [2].

6.8 Future work

Here is described what potential research one could do based on this thesis. It primarily covers validation since the result of this thesis is presenting new principles and methods, which needs to be used by others.

6.8.1 Alternative Designs for Cloud-Based Automatic Routing

The project done in this thesis uses Google Sheets and Telavox's Flow in order to design the cloud-based automatic routing. Another project which has different outlooks and constraints would result in a very different design which would serve as a good comparison with this one. It would also serve to provide a wider base of design theory for designing with third party software as a part of the experience if other works also utilized that.

6.8.2 Testing Conclusions

This thesis tackles how to design a user experience for a new kind of system and in this case the system is for telephone routing. Alternative designs of new products in different markets would also be of use to help validate how generalizable the design techniques are. Other works trying the techniques proposed in this thesis and confirming or denying their worth are very much needed as a single project does not tell much of how useful they are.

7 Conclusion

Here we try to answer the three research questions stated in section 1.3. These conclusions are based on the experiences from the project and the tests done during it.

Are there any design principles which apply specifically to designing new types of digital online products?

During this project, one potential principle stood out as an general principle - and that is to ”Prepare the User for the Unexpected”. When encountering a new system, one may get nervous. The user does not, naturally, have any experience with this kind of system and will not know what to expect. Thus, one has to prepare the user by giving indications in the form of symbols or introductory text, so that they are not surprised when the program works as intended. This can be done by implementing an introductory message - explicitly pointing out the purpose and what the next step towards the end goal is. If there is an especially strange step from the users perspective, like leaving the app and opening another application, one should tell the user about it several times before they take that step.

What kind of issues does one need to be mindful of when designing a new type of digital online product?

During the project, primarily two issues surfaced when designing the new systems:

- There are no established terms and labels to use. What kind of terminology is logical to the end user?
- There is no metaphor to use for the design.

Both labels and metaphors were able to be gained directly from participants in the discoverablity test, described in section 3.3.1. Having the users come to their own conclusions and find the terminology for a system they thought was real, was very useful as a tool to help with these issues and for idea generation.

What are the challenges in designing specifically cloud-based automatic routing?

The greatest difficulty was designing with a third party service. The third party is part of the user experience, for better or worse. Unfortunately, it is difficult to design an experience beyond the choice of the third party. This project contains a design which uses Google Sheets, and the design has good usability scores in its current form, but it does have room to improve. The most glaring issues are to do with setting up, as several testers had issues with completing the set-up correctly in the current form.

Challenges earlier in the process was having the user understand the product and to not be overwhelmed with all the information at any one step. Both of these problems were dealt with in the final version. The second was mitigated by splitting up the information in different views and by using a desktop, rather than a phone. How the first problem was solved is still inconclusive, but it did help to have the arrow symbols and to give an introductory example of a possible usage of the product.

Bibliography

[1] About telavox. [Accessed: 2019-01-21]. [Online]. Available: https://www.telavox.com/en/about

[2] A. Atlason and P. Hesslow, “Samtalsstyrning i molnet [thesis],” Master’s thesis, LTH School of Engineering, Lund University, Helsingborg, Sweden, 6 2018.

[3] The worlds most popular react ui framework - material ui. [Accessed: 2018-11-12]. [Online]. Available: https://material-ui.com/

[4] A. Osborn, *Applied Imagination-Principles and Procedures of Creative Writing.* Read Books Ltd, 2013.

[5] A. B. VanGundy, “Brain writing for new product ideas: an alternative to brainstorming,” *Journal of Consumer Marketing*, vol. 1, no. 2, pp. 67–74, 1984.

[6] D. Shewan. Pain points: A guide to finding & solving your customers’ problems. [Accessed: 2018-12-04]. [Online]. Available: https://www.wordstream.com/blog/ws/2018/02/28/pain-points

[7] StartupYard. What’s a pain point? a guide for startups. [Accessed: 2018-12-04]. [Online]. Available: https://startupyard.com/whats-pain-point/

[8] J. Carter. What’s a pain point? [Accessed: 2018-12-04]. [Online]. Available: http://pointsandfigures.com/2012/04/27/whats-a-pain-point/

[9] S. Lee, “Pig (pain is good) strategy: Make customer centricity obsolete and start a resource revolution. imatchpoint limited,” *Hong Kong*, 2014.

[10] B. Wang, Y. Miao, H. Zhao, J. Jin, and Y. Chen, “A biclustering-based method for market segmentation using customer pain points,” *Engineering Applications of Artificial Intelligence*, vol. 47, pp. 101–109, 2016.

[11] T. J. Rapley, “The art (fulness) of open-ended interviewing: some considerations on analysing interviews,” *Qualitative research*, vol. 1, no. 3, pp. 303–323, 2001.

[12] A. Pathak and C. Intratat, “Use of semi-structured interviews to investigate teacher perceptions of student collaboration,” *Malaysian Journal of ELT Research*, vol. 8, no. 1, p. 10, 2016.

[13] N. K. Denzin and Y. S. Lincoln, *The Sage handbook of qualitative research.* Sage Publications Ltd, 2005.

[14] S. E. Hove and B. Anda, “Experiences from conducting semi-structured interviews in empirical software engineering research,” in *Software metrics, 2005. 11th ieee international symposium.* IEEE, 2005, pp. 10–pp.

[15] J. Horton, R. Macve, and G. Struyven, “Qualitative research: experiences in using semi-structured interviews,” in *The real life guide to accounting research.* Elsevier, 2004, pp. 339–357.

[16] D. A. Norman and S. W. Draper, *User Centered System Design; New Perspectives on Human-Computer Interaction.* Hillsdale, NJ, USA: L. Erlbaum Associates Inc., 1986.

[17] J. Rubin and D. Chisnell, *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests*, 2nd ed. Wiley Publishing, 2008.

[18] ISO, *Ergonomics of human system interaction-Part 210: Human-centred design for interactive systems*, International Organization for Standardization ISO 9241-210:2010, 2010.

[19] C. Abras, D. Maloney-Krichmar, and J. Preece, “User-centered design,” *Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications*, vol. 37, no. 4, pp. 445–456, 2004.

[20] A. Cooper, *The Inmates Are Running the Asylum: Why High Tech Products Drive Us Crazy and How to Restore the Sanity (2Nd Edition).* Pearson Higher Education, 2004.

[21] A. Blomquist and M. Arvola, “Personas in action: Ethnography in an interaction design team,” in *Proceedings of the Second Nordic Conference on Human-computer Interaction*, ser. NordiCHI ’02. New York, NY, USA: ACM, 2002, pp. 197–200. [Online]. Available: http://doi.acm.org/10.1145/572020.572044

[22] T. Miaskiewicz and K. A. Kozar, “Personas and user-centered design: How can personas benefit product design processes?” *Design Studies*, vol. 32, no. 5, pp. 417–430, 2011.

[23] F. Long, “Real or imaginary: The effectiveness of using personas in product design,” *Proceedings of the Irish Ergonomics Society Annual Conference*, vol. 14, pp. 1–10, 2009.

[24] Marvel. Marvel app. [Accessed: 2018-09-20]. [Online]. Available: https://marvelapp.com/

[25] C. Snyder, *Paper Prototyping. [Elektronisk resurs] : The fast and easy way to design and refine user interfaces.*, ser. Morgan Kaufmann series in interactive technologies. Burlington ; San Francisco, Calif. : Morgan Kaufmann, 2003, 2003. [Online]. Available: http://ludwig.lub.lu.se/login?url=http://search.ebscohost.com.ludwig.lub.lu.se/login.aspx?direct=true&db=cat01310a&AN=lovisa.004223753&site=eds-live&scope=site

[26] J. Nielsen, “Usability inspection methods,” in *Conference companion on Human factors in computing systems.* ACM, 1994, pp. 413–414.

[27] A. Savoia. Pretotyping.org. Accessed: 2018-11-20. [Online]. Available: http://www.pretotyping.org/

[28] A. Savoia, “Pretotype it,” *Make Sure You Are Building the Right It before You Build It Right*, 2011.

[29] D. V. Thompson, R. W. Hamilton, and R. T. Rust, “Feature fatigue: When product capabilities become too much of a good thing,” *Journal of marketing research*, vol. 42, no. 4, pp. 431–442, 2005.

[30] G. S. Bailey, "Iterative methodology and designer training in human-computer interface design," in *Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems*, ser. CHI '93. New York, NY, USA: ACM, 1993, pp. 198–205. [Online]. Available: http://doi.acm.org/10.1145/169059.169163

[31] H. Desurvire, J. Kondziela, and M. E. Atwood, "What is gained and lost when using methods other than empirical testing," in *Posters and Short Talks of the 1992 SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '92. New York, NY, USA: ACM, 1992, pp. 125–126. [Online]. Available: http://doi.acm.org/10.1145/1125021.1125115

[32] J. Nielsen and T. K. Landauer, "A mathematical model of the finding of usability problems," in *Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems*, ser. CHI '93. New York, NY, USA: ACM, 1993, pp. 206–213. [Online]. Available: http://doi.acm.org/10.1145/169059.169166

[33] J. Nielsen, "Usability inspection methods," in *Conference Companion on Human Factors in Computing Systems*, ser. CHI '94. New York, NY, USA: ACM, 1994, pp. 413–414. [Online]. Available: http://doi.acm.org/10.1145/259963.260531

[34] J. Brooke, "Sus - a quick and dirty usability scale," *Usability evaluation in industry*, vol. 189, no. 194, pp. 4–7, 1996.

[35] L. J. Cronbach, "Response sets and test validity," *Educational and psychological measurement*, vol. 6, no. 4, pp. 475–494, 1946.

[36] J. Brooke, "Sus: a retrospective," *Journal of usability studies*, vol. 8, no. 2, pp. 29–40, 2013.

[37] A. Bangor, P. T. Kortum, and J. T. Miller, "An empirical evaluation of the system usability scale," *Intl. Journal of Human–Computer Interaction*, vol. 24, no. 6, pp. 574–594, 2008.

[38] T. S. Tullis and J. N. Stetson, "A comparison of questionnaires for assessing website usability," in *Usability professional association conference*, vol. 1, 2004.

[39] J. R. Lewis and J. Sauro, "The factor structure of the system usability scale," in *International conference on human centered design*. Springer, 2009, pp. 94–103.

[40] A. Bangor, P. Kortum, and J. Miller, "Determining what individual sus scores mean: Adding an adjective rating scale," *Journal of usability studies*, vol. 4, no. 3, pp. 114–123, 2009.

[41] J. Sauro and J. R. Lewis, "When designing usability questionnaires, does it hurt to be positive?" in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 2011, pp. 2215–2224.

[42] J. Benedek and T. Miner, "Measuring desirability: New methods for evaluating desirability in a usability lab setting," *Proceedings of Usability Professionals Association*, vol. 2003, no. 8-12, p. 57, 2002.

[43] M. E. Wiklund, C. Thurrott, and J. S. Dumas, "Does the fidelity of software prototypes affect the perception of usability?" in *Proceedings of the Human Factors Society Annual Meeting*, vol. 36, no. 4. SAGE Publications Sage CA: Los Angeles, CA, 1992, pp. 399–403.

[44] M. Sharples, "Methods for evaluating mobile learning," *Researching mobile learning: Frameworks, tools and research designs*, pp. 17–39, 2009.

[45] H. Petrie and C. Harrison, "Measuring users' emotional reactions to websites," in *CHI'09 Extended Abstracts on Human Factors in Computing Systems*. ACM, 2009, pp. 3847–3852.

[46] C. M. Barnum and L. A. Palmer, “More than a feeling: understanding the desirability factor in user experience,” in *CHI’10 Extended Abstracts on Human Factors in Computing Systems*. ACM, 2010, pp. 4703–4716.

[47] R. Jeffries, J. R. Miller, C. Wharton, and K. Uyeda, “User interface evaluation in the real world: A comparison of four techniques,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI ’91. New York, NY, USA: ACM, 1991, pp. 119–124. [Online]. Available: http://doi.acm.org/10.1145/108844.108862

[48] T. Hollingsed and D. G. Novick, “Usability inspection methods after 15 years of research and practice,” in *Proceedings of the 25th Annual ACM International Conference on Design of Communication*, ser. SIGDOC ’07. New York, NY, USA: ACM, 2007, pp. 249–255. [Online]. Available: http://doi.acm.org/10.1145/1297144.1297200

[49] J. Nielsen and R. Molich, “Heuristic evaluation of user interfaces,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI ’90. New York, NY, USA: ACM, 1990, pp. 249–256. [Online]. Available: http://doi.acm.org/10.1145/97243.97281

[50] J. Nielsen, “Enhancing the explanatory power of usability heuristics,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI ’94. New York, NY, USA: ACM, 1994, pp. 152–158. [Online]. Available: http://doi.acm.org/10.1145/191666.191729

[51] P. G. Polson, C. Lewis, J. Rieman, and C. Wharton, “Cognitive walkthroughs: a method for theory-based evaluation of user interfaces,” *International Journal of man-machine studies*, vol. 36, no. 5, pp. 741–773, 1992.

[52] C. Wharton, J. Rieman, C. Lewis, and P. Polson, “The cognitive walkthrough method: A practitioner’s guide,” in *Usability Inspection Methods*, J. Nielsen and R. L. Mack, Eds. New York, NY, USA: John Wiley & Sons, Inc., 1994, ch. 5, pp. 105–140. [Online]. Available: http://dl.acm.org/citation.cfm?id=189200.189214

[53] R. Spencer, “The streamlined cognitive walkthrough method, working around social constraints encountered in a software development company,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI ’00. New York, NY, USA: ACM, 2000, pp. 353–359. [Online]. Available: http://doi.acm.org/10.1145/332040.332456

[54] Jira. Atlassian jira. [Accessed: 2019-01-20]. [Online]. Available: https://www.atlassian.com/software/jira

[55] Telavox, “Automatisk routing av inkommande samtal till rätt advisor,” [Jira]. Available: https://telavox.atlassian.net/browse/TEL-2509, 2016, [Accessed: 2018-08-14].

[56] Telavox, “Kunna knappa in tex personnummer i talsvar,” [Jira]. Available: https://telavox.atlassian.net/browse/TEL-1108, 2014, [Accessed: 2018-08-14].

[57] Telavox, “Set multiple pin codes in ivr to get access / variables,” [Jira]. Available: https://telavox.atlassian.net/browse/TEL-3588, 2014, [Accessed: 2018-08-14].

[58] Telavox, “Knappa in sitt telefonnr i talsvar,” [Jira]. Available: https://telavox.atlassian.net/browse/PAR-1573, 2014, [Accessed: 2018-08-14].

[59] G. LLC. Google slides. [Accessed: 2018-09-27]. [Online]. Available: https://www.google.com/slides/about/

[60] InVision. Invisionapp. [Accessed: 2018-09-14]. [Online]. Available: https://www.invisionapp.com/company

[61] M. Fabbri. Sus mätning – test av användbarheten av ett system som helhet. [Accessed: 2018-08-20]. [Online]. Available: https://malinfabbri.com/2013/03/26/sus-matning-test-av-anvandbarheten-av-ett-system-som-helhet/

[62] F. O. Source. React - a javascript library for building user interfaces. [Accessed: 2018-11-12]. [Online]. Available: https://reactjs.org/

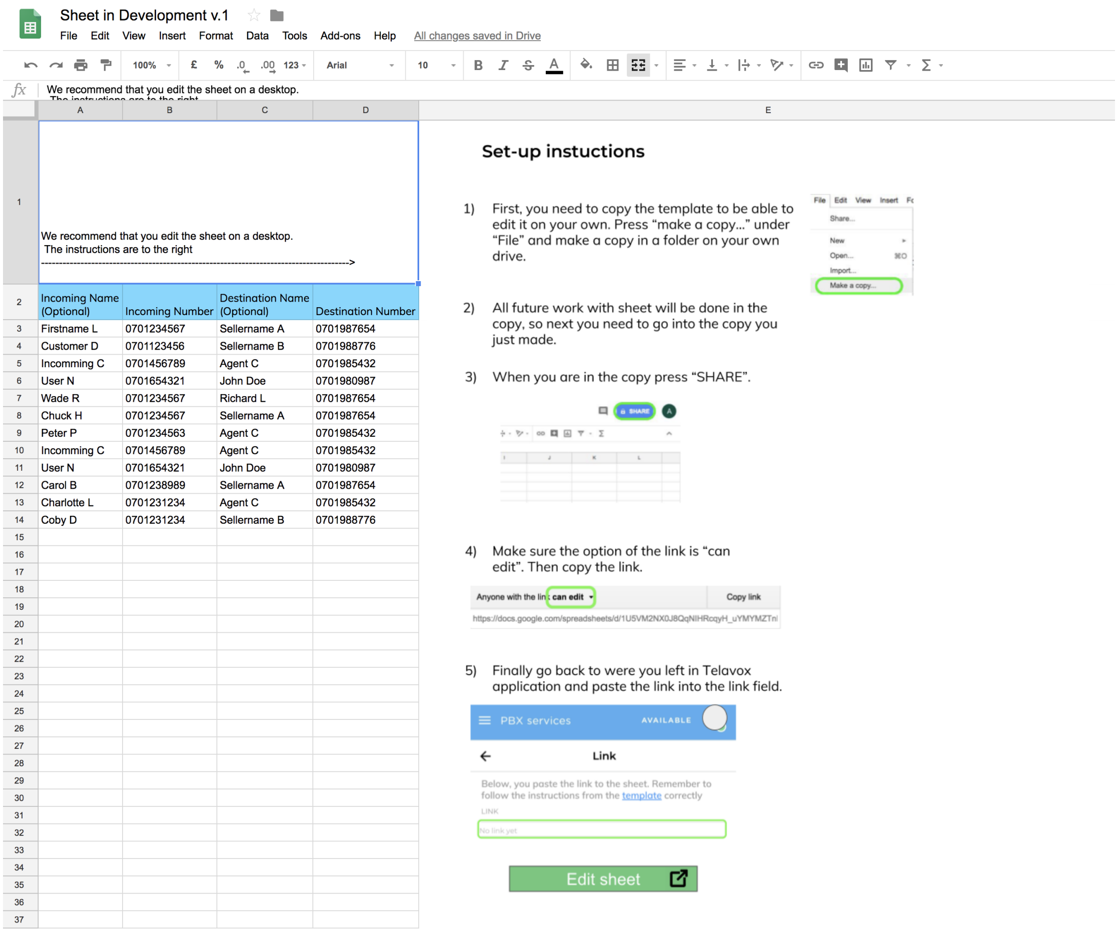
[63] D. Abramov. Read me - redux. [Accessed: 2018-11-12]. [Online]. Available: https://redux.js.org/

[64] J. Johnson and A. Henderson, "Conceptual models: begin by designing what to design," *interactions*, vol. 9, no. 1, pp. 25–32, 2002.

[65] D. Norman, *The design of everyday things: Revised and expanded edition.* Basic books, 2013.

[66] T. E. Parliament and the Council of the European Union. on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing directive 95/46/ec (general data protection regulation). [Accessed: 2018-08-20]. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1528874672298&uri=CELEX%3A32016R0679

A Spreadsheet Templates



Sheet in Development v.1
File Edit View Insert Format Data Tools Add-ons Help
All changes saved in Drive
100% £ % .0 .00 123 Arial 10 B I S A

We recommend that you edit the sheet on a desktop.
The instructions are to the right
--->

Incoming Name (Optional)	Incoming Number	Destination Name (Optional)	Destination Number
Firstname L	0701234567	Sellername A	0701987654
Customer D	0701123456	Sellername B	0701988776
Incomming C	0701456789	Agent C	0701985432
User N	0701654321	John Doe	0701980987
Wade R	0701234567	Richard L	0701987654
Chuck H	0701234567	Sellername A	0701987654
Peter P	0701234563	Agent C	0701985432
Incomming C	0701456789	Agent C	0701985432
User N	0701654321	John Doe	0701980987
Carol B	0701238989	Sellername A	0701987654
Charlotte L	0701231234	Agent C	0701985432
Coby D	0701231234	Sellername B	0701988776

Set-up instuctions

1) First, you need to copy the template to be able to edit it on your own. Press “make a copy...” under “File” and make a copy in a folder on your own drive.

2) All future work with sheet will be done in the copy, so next you need to go into the copy you just made.

3) When you are in the copy press “SHARE”.

4) Make sure the option of the link is “can edit”. Then copy the link.

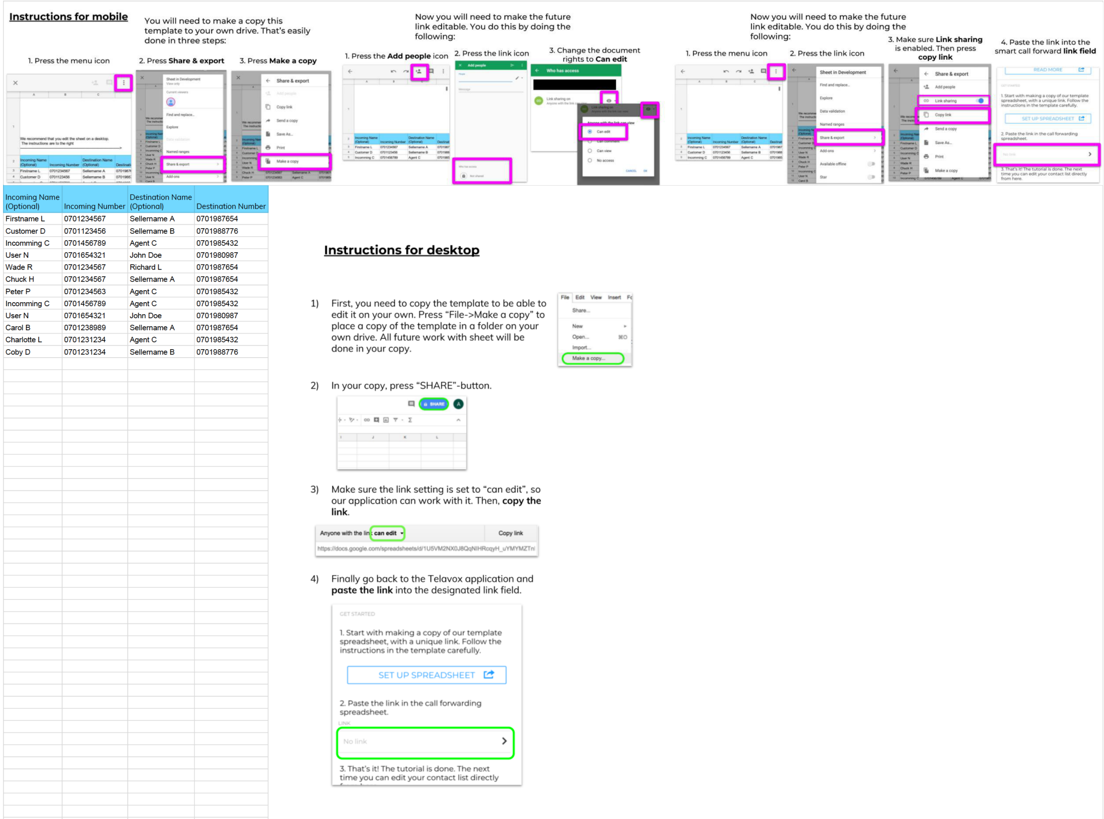
Anyone with the lin: can edit | Copy link
https://docs.google.com/spreadsheets/d/1U5VM2NX0J8QqNIHRcqyH_uYMYMZTnl

5) Finally go back to were you left in Telavox application and paste the link into the link field.

Below, you paste the link to the sheet. Remember to follow the instructions from the template correctly

LINK: No link yet

Figure A.1: The spreadsheet template version 1



Instructions for mobile

You will need to make a copy this template to your own drive. That's easily done in three steps:

1. Press the menu icon

2. Press **Share & export**

3. Press **Make a copy**

Now you will need to make the future link editable. You do this by doing the following:

1. Press the **Add people** icon

2. Press the link icon

3. Change the document rights to **Can edit**

Now you will need to make the future link editable. You do this by doing the following:

1. Press the menu icon

2. Press the link icon

3. Make sure **Link sharing** is enabled. Then press **copy link**

4. Paste the link into the smart call forward **link field**

Incoming Name (Optional)	Incoming Number	Destination Name (Optional)	Destination Number
Firstname L	0701234567	Sellername A	0701987654
Customer D	0701123456	Sellername B	0701988776
Incomming C	0701456789	Agent C	0701985432
User N	0701654321	John Doe	0701980987
Wade R	0701234567	Richard L	0701987654
Chuck H	0701234567	Sellername A	0701987654
Peter P	0701234563	Agent C	0701985432
Incomming C	0701456789	Agent C	0701985432
User N	0701654321	John Doe	0701980987
Carol B	0701238989	Sellername A	0701987654
Charlotte L	0701231234	Agent C	0701985432
Coby D	0701231234	Sellername B	0701988776

Instructions for desktop

1) First, you need to copy the template to be able to edit it on your own. Press "File->Make a copy" to place a copy of the template in a folder on your own drive. All future work with sheet will be done in your copy.

2) In your copy, press "SHARE"-button.

3) Make sure the link setting is set to "can edit", so our application can work with it. Then, **copy the link**.

Anyone with the lin can edit
Copy link
https://docs.google.com/spreadsheets/d/1U5VM2NX0J8QqNIHRcqyH_uYMYMZTnl

4) Finally go back to the Telavox application and **paste the link** into the designated link field.

GET STARTED

1. Start with making a copy of our template spreadsheet, with a unique link. Follow the instructions in the template carefully.

SET UP SPREADSHEET

2. Paste the link in the call forwarding spreadsheet.

LINK

No link

3. That's it! The tutorial is done. The next time you can edit your contact list directly

Figure A.2: The spreadsheet template version 2, which now includes instructions for set-up on mobile

B Test Plan for Search Test

B.1 Background

Due to the relatively new functionality of automatic call routing, there is no name established to the common man. There are a few services out there, which give it a different name. This is what is going to be tested.

B.2 Purpose

We want to figure out what the search queries are that the average man/woman would use to find this functionality. The purpose of our study is to make automatic call routing available for everyone, but how can be that when nobody knows how to find it.

B.3 Questions

1. What do people search for when trying to find the desired functionality?
2. What are the struggles with formulating the search query?

B.4 Test Tasks

Task	Subtasks	Data collected	Correctly finished when	Maximum time
Find the solution to the issue described in the case	1. Read the case 2. Sit by the computer 3. Google/search for an answer to the issue	Search queries Frustrations	One or more established services of “automatic call routing” is found and the test subject feels finished	5 minutes

B.5 Case

Du är en frisör av sex stycken frisörer på salongen Hairs R Us. Ni har ett huvudnummer som går till salongen. Ofta har frisörsalongens kunder en specifik frisör som de föredrar och därmed alltid bestämmer tid med. Problemet är att folk ringer huvudnumret och fel frisör svarar, vilket slösar tid. Du skulle vilja ha ett system där det ringer till rätt mobil när en kund ringer till huvudnumret.

Ditt mål är att söka på internet efter en produkt som löser problemet.

B.6 Selection of subjects

Number of of test subjects:	10-15 test subjects
Age:	18-50

Majority of test subjects will be in the ages 18-30. However, we do want at least 2 test subjects in a more advanced age to get a wider perspective.

B.7 Test leader and other roll distribution

Test leader(TL): Describe and brief the test subject about why they are doing the test.

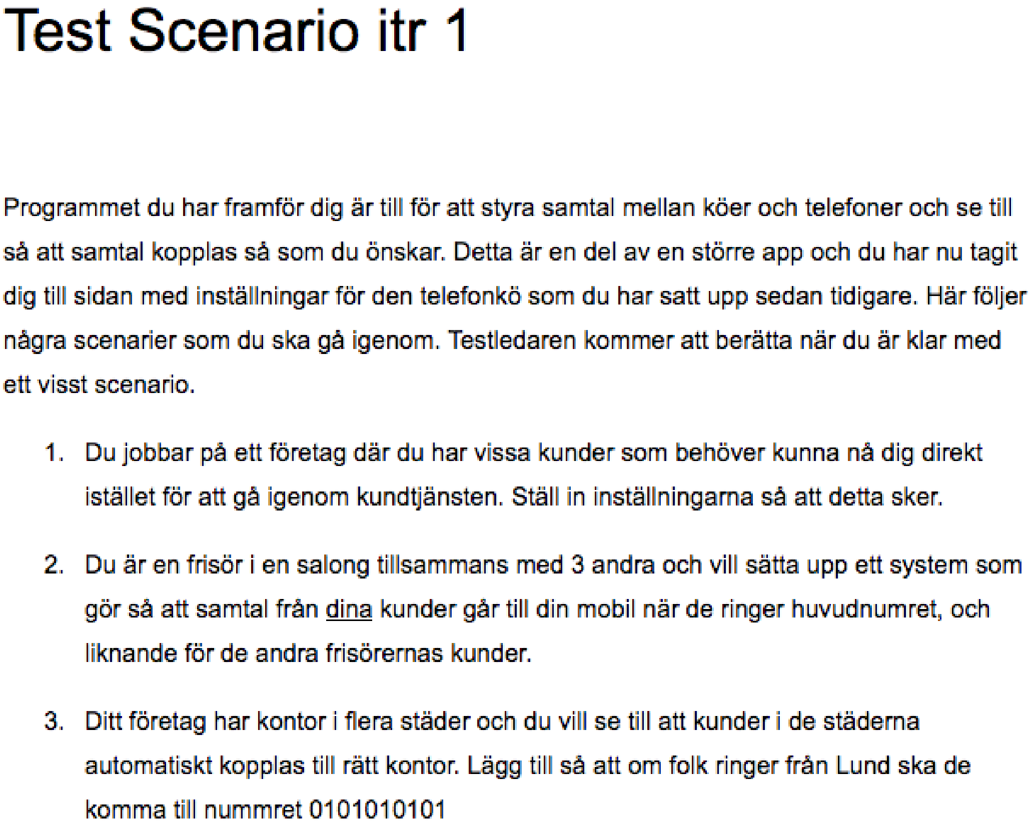
Secretary: Writes down discussions and thoughts the test subject has during the test. It also will write down possible frustrations and record the search queries.

Testperson(TP): The executor of the test. A hypothetical user.

B.8 Test environment/equipment

Both indoors and outdoors. It will be done on a laptop running a chrome web browser. The data collection will be done by recording the reactions, thoughts and search queries by notetaking and possible audio/video recordings.

C Test Scenarios

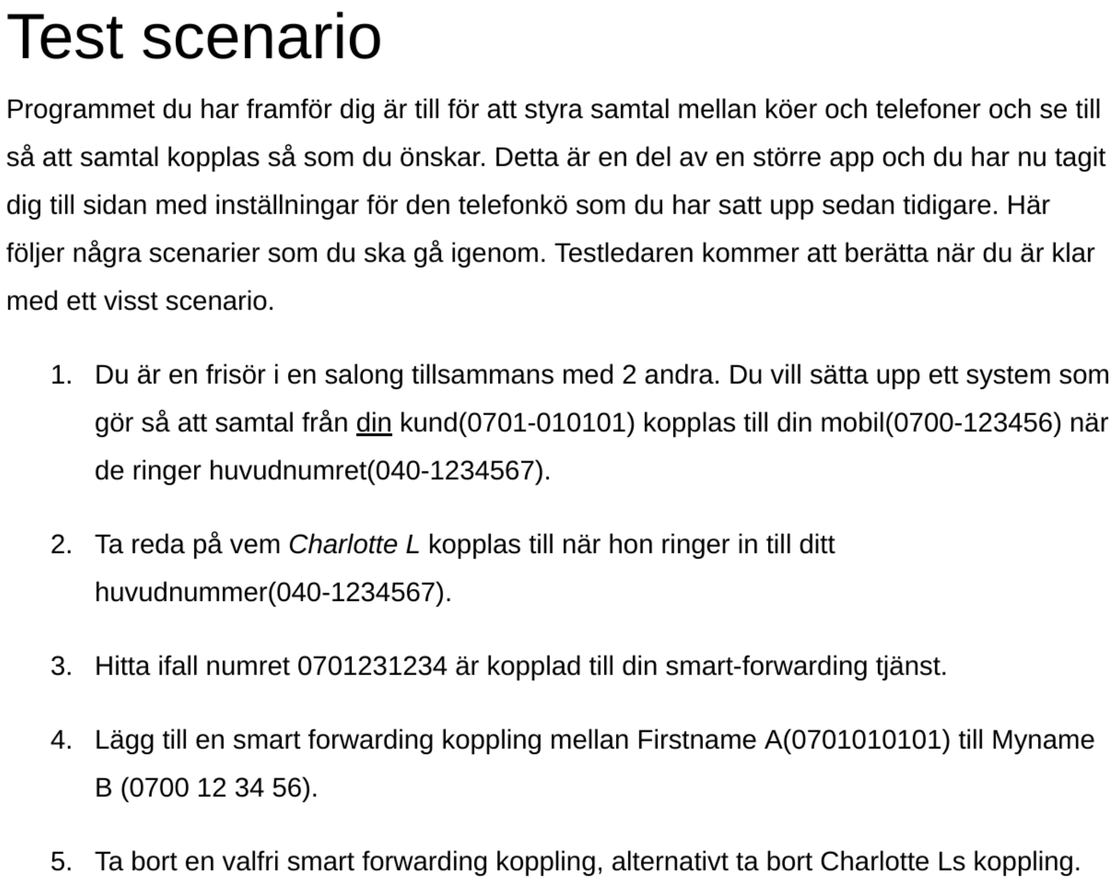


Test Scenario itr 1

Programmet du har framför dig är till för att styra samtal mellan köer och telefoner och se till så att samtal kopplas så som du önskar. Detta är en del av en större app och du har nu tagit dig till sidan med inställningar för den telefonkö som du har satt upp sedan tidigare. Här följer några scenarier som du ska gå igenom. Testledaren kommer att berätta när du är klar med ett visst scenario.

1. Du jobbar på ett företag där du har vissa kunder som behöver kunna nå dig direkt istället för att gå igenom kundtjänsten. Ställ in inställningarna så att detta sker.
2. Du är en frisör i en salong tillsammans med 3 andra och vill sätta upp ett system som gör så att samtal från dina kunder går till din mobil när de ringer huvudnumret, och liknande för de andra frisörernas kunder.
3. Ditt företag har kontor i flera städer och du vill se till att kunder i de städerna automatiskt kopplas till rätt kontor. Lägg till så att om folk ringer från Lund ska de komma till nummret 0101010101

Figure C.1: The test case for the prototype test of version 1

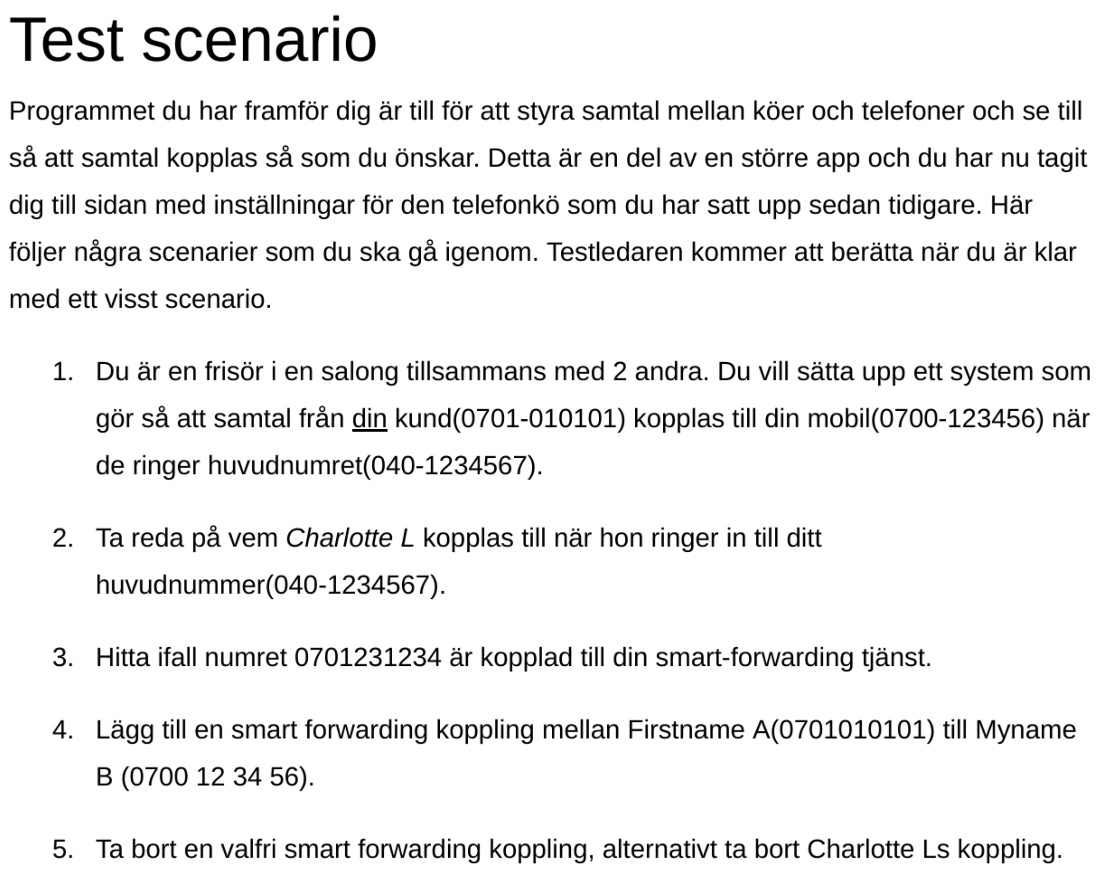


Test scenario

Programmet du har framför dig är till för att styra samtal mellan köer och telefoner och se till så att samtal kopplas så som du önskar. Detta är en del av en större app och du har nu tagit dig till sidan med inställningar för den telefonkö som du har satt upp sedan tidigare. Här följer några scenarier som du ska gå igenom. Testledaren kommer att berätta när du är klar med ett visst scenario.

1. Du är en frisör i en salong tillsammans med 2 andra. Du vill sätta upp ett system som gör så att samtal från din kund(0701-010101) kopplas till din mobil(0700-123456) när de ringer huvudnumret(040-1234567).
2. Ta reda på vem *Charlotte L* kopplas till när hon ringer in till ditt huvudnummer(040-1234567).
3. Hitta ifall numret 0701231234 är kopplad till din smart-forwarding tjänst.
4. Lägg till en smart forwarding koppling mellan Firstname A(0701010101) till Myname B (0700 12 34 56).
5. Ta bort en valfri smart forwarding koppling, alternativt ta bort Charlotte Ls koppling.

Figure C.2: The test case for the prototype test of version 2 and 2.5



Test scenario

Programmet du har framför dig är till för att styra samtal mellan köer och telefoner och se till så att samtal kopplas så som du önskar. Detta är en del av en större app och du har nu tagit dig till sidan med inställningar för den telefonkö som du har satt upp sedan tidigare. Här följer några scenarier som du ska gå igenom. Testledaren kommer att berätta när du är klar med ett visst scenario.

1. Du är en frisör i en salong tillsammans med 2 andra. Du vill sätta upp ett system som gör så att samtal från din kund(0701-010101) kopplas till din mobil(0700-123456) när de ringer huvudnumret(040-1234567).
2. Ta reda på vem *Charlotte L* kopplas till när hon ringer in till ditt huvudnummer(040-1234567).
3. Hitta ifall numret 0701231234 är kopplad till din smart-forwarding tjänst.
4. Lägg till en smart forwarding koppling mellan Firstname A(0701010101) till Myname B (0700 12 34 56).
5. Ta bort en valfri smart forwarding koppling, alternativt ta bort Charlotte Ls koppling.

Figure C.3: The test case for the prototype test of iteration 3